Glass Thickness in Insulating Glass Units

Introduction

During service, insulating glass units must resist a variety of influences, remaining in situ and performing satisfactorily throughout their lifespan. Glass is subject to live loads, the scale of which will depend upon the building use and where the unit is installed. The glass thickness will vary in relation to the glass type, final dimensions and anticipated service loads.

Typically, wind, snow, barrier loads and environmental factors are considered, as well as any manufacturing limitations during glass processing. The wind, snow and barrier loads may be readily considered by calculation to ensure that the glass is of sufficient thickness to suit the use of the building and its design.

Environmental factors, primarily barometric pressure and cavity gas temperature, also affect the choice of glass thickness and the minimum recommended cavity width of insulating glass units.

Description

When insulating glass units are manufactured, the panes of glass are relatively flat and separated by a spacer profile around the perimeter edges. A quantity of gas or air is hermetically sealed within the unit cavity.

The nature of insulating glass units necessitates a sufficiently good seal to minimise the amount of water vapour that passes through the seal into the cavity, resulting in the formation of condensation inside the unit, since when this occurs the unit is deemed to have failed. The seal should also minimise the passage of any other gas from leaving the unit cavity.

Consequently, there are two separate effects that can produce distortions and stress in the glass.

Atmospheric Pressure

Atmospheric pressure changes continuously as high and low pressure weather systems move across the country. The variation in pressure commonly ranges from 950 mbar for deep low pressure and 1030 mbar for high pressure.

An insulating glass unit is sealed at the particular pressure on the day of manufacture. As the pressure outside the insulating glass unit changes, an imbalance occurs between the internal cavity pressure and the pressure outside.

Where the glass is relatively stiff in relation to the dimensions of the pane, for instance as with smaller sizes of units, the pressure differential generates stress in the glass. This stress, sustained for the duration of a particular weather system that generated the pressure differential, may be sufficient, in a few cases, to cause fracture of the glass.

The risk of glass breakage can be increased if the perimeter edge seal is itself a rigid material, since this tends to stiffen the glass, although breakages occasionally occur in units with more flexible seals under extreme conditions.

If the glass is relatively flexible, as in larger units, the pressure imbalance causes deflection of the glass panes, and both panes tend to bow either inward or outward depending on the prevailing pressure difference. The edges of the panes are held in position by the edge seal and are unable to move so the unit becomes either dished

or bowed respectively and reflections viewed in the glass will become distorted.

Changes in Temperature

After the insulating glass unit has been installed, the temperature of the glass panes and the gas inside the cavity will continuously change. This results from variations in the ambient external temperature and the effects of solar radiation which, if present, will heat the glass and gas inside the unit.

The effect of temperature increase on the gas is to increase the gas volume and pressure, the opposite occurs when the temperature falls. The unit was sealed at a particular temperature, so any variation from that temperature will change the volume and pressure of the gas in the cavity resulting in bowing or dishing similar to the effect of changing atmospheric pressure.

Glass Thickness

Since both the barometric pressure and temperature of the cavity vary in accordance with local weather conditions and the time of day, the glass in the insulating glass unit moves continuously.

In large units, with relatively narrow cavity widths, certain weather conditions may result in the glass panes touching in the centre area.

The result is a reduction in the thermal efficiency of the unit and undesirable optical effects known as Newton's rings. In extreme cases, if strong gusts of wind occur when the panes are touching, this will result in abrasions on the inside surfaces of the unit, manifesting as permanent white translucent patches.

In order to limit the risk of panes touching, certain minimum cavity widths, combined with maximum pane dimensions are recommended, please see the following two tables for guidance.

Laminated Glass

Annealed Laminated Glass Units (1 pane or more)				
Thickness (mm)	Cavity Width (mm)	Maximum Dimensions (mm)		Maximum Area (M^2)
		Square	Rectangle	
6	12,14,16,18,20	1400 x 1400	1400 x 2500	3.5
8	12,14,16,18,20	2250 x 2250	2250 x 3350	7.2
10	12,14,16,18,20	2500 x 2500	2500 x 4200	10.5
12	12,14,16,18,20	2700 x 2700	2700 x 4500	10*

Toughened Glass

Toughened Glass Units (both panes)				
Thickness (mm)	Cavity Width (mm)	Maximum Dimensions (mm)		Maximum Area (M^2)
		Square	Rectangle	
4	12,14,16,18,20	1400 x 1400	1400 x 2400	3.35
6	12,14,16,18,20	2100 x 2100	2100 x 3500	7.35
8	12,14,16,18,20	2250 x 2250	2250 x 4200	9.45
10	12,14,16,18,20	2700 x 2700	2700 x 4500	12*
12	12,14,16,18,20	2700 x 2700	2700 x 4500	10*

* IG unit size limited by maximum weight 600Kg

The glass thickness for each project should be determined in line with the environmental factors, prior to confirming suitability for live loads and acoustic performance.

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