

## **Thermally Toughened Glass: Flatness and Roller Wave Distortion according to European Standard EN 12150-1**

By the very nature of the toughening process, it is not possible to obtain a product as flat as annealed glass (not toughened). The difference depends on the nominal thickness, the glass size and the ratio between the dimensions. Therefore a distortion known as overall bow can occur. There are two kinds of bow (see Figure 1):

- overall or general bow
- local bow

NOTE 1: Overall bow can, in general, be accommodated by the framing system.

NOTE 2: Local bow needs to be allowed for in the glazing materials and the weather seals. For special requirements the manufacturers should be consulted.

### **Measurement of overall bow**

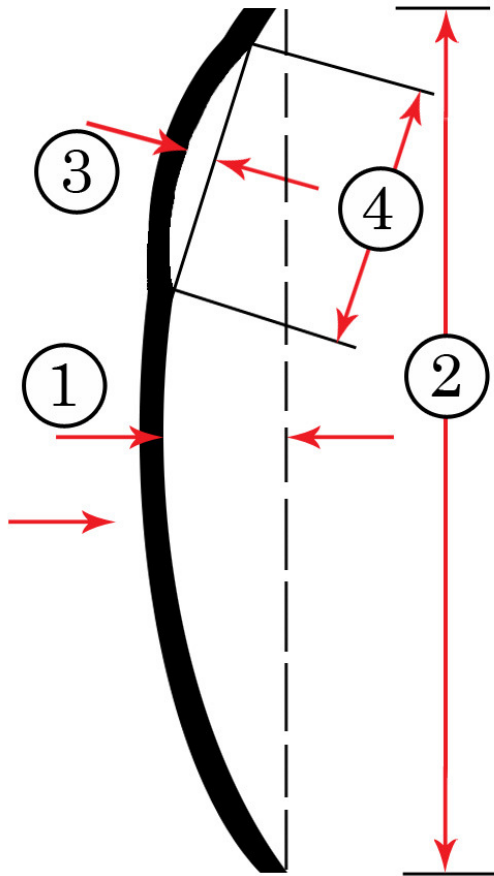
The pane of glass shall be placed in a vertical position and supported on its longer side by two load bearing blocks at the quarter points. The deformation shall be measured along the edges of the glass and along the diagonals, as the maximum distance between a straight metal ruler, or a stretched wire, and the concave surface of the glass. The measurement should be done at room temperature. The value for the bow is then expressed as the deformation, in millimeters, divided by the measured length of the edge of the glass, or diagonal, in millimeters, as appropriate.

### **Measurement of local bow**

Local bow can occur over relatively short distances on the edges of the glass. Local bow shall be measured over a limited length of 300mm by using a straight ruler, or a stretched wire, parallel to the edge at a distance of 25 mm from the edge of the glass (see Figure 1). Local bow is expressed as millimeters / 300 mm length.

For patterned glass, local bow shall be determined by using a straight ruler resting on the high points of the pattern and measuring to a high point of the pattern.

The maximum allowable values for the bow and local bow for glass are given in Table 1.



- (1) deformation for calculating overall bow
- (2) B or H, or diagonal length
- (3) local bow
- (4) 300mm length

**Figure 1: Representation of overall and local bow**

**Table 1: Maximum values for overall and local bow**

Type of Glass	Maximum values according to Standard EN 12150-1	
	Overall bow	Local bow
Float to EN 572-2	0.003 mm / mm	0.5mm / 300mm
Other	0.004 mm / mm	0.5mm / 300mm

**Roller wave** distortion is the periodic wave imparted to glass during heat treatment. It is measured by the industry in peak-to-valley distance. The customer perceives roller waves as optical distortion in reflection or transmission in the finished window. Roller wave distortion is the transition of flat glass into a lens. The severity of the lens radius defines the lens power of the curved glass and therefore the optical distortion in the resultant glass. Roller wave occurs when glass is heat-treated in a horizontal furnace – the glass surface becomes distorted when hot glass (its temperature close to the softening point) comes in contact with ceramic rollers during the heating process. Consequently, in the process of glass hardening it is not possible to produce glass perfectly flat as opposed to annealed glass (not toughened). Deviation from rectilinearity depends on the glass type, glass thickness, coatings, furnace temperature, atmospheric temperature and ambient humidity.

**Roller pick-up** – glass which is thicker than 8mm can show signs of small imprints in the surface called “roller pick-up”.

When placing orders for architectural glass, the customer would be well advised to take into account the “roller wave distortion” and specify the orientation of the glass in the tempering furnace.

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