

## Channel Shaped Glass: Thermally Toughened Soda Lime Silicate Channel Shaped Safety Glass

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#### Introduction

This part of the GGF Data Sheet 4.6 series gives extra information, over and above GGF Data Sheet 4.6.1 on thermally toughened soda lime silicate channel shaped safety glass.

#### 1. Scope

This GGF Data Sheet concentrated on the specifics of thermally toughened soda lime silicate channel shaped safety glass.

#### 2. Definitions and Descriptions

For the purpose of this GGF Data Sheet the definition contained within GGF Data Sheet 4.6.1 and the following apply: -

##### 2.1. Thermally toughened soda lime silicate channel shaped safety glass

A soda lime silicate channel shaped glass within which a permanent surface compressive stress has been induced by a controlled heating and cooling process in order to give it greatly increased resistance to mechanical and thermal stress and prescribed fragmentation characteristics

NOTE: The mechanical properties, i.e. thermal durability and profile bending strength, and safety properties, i.e. fragmentation characteristics,

are generated by the level of surface compression. These properties do not depend on the size of the channel shaped glass

##### 2.2. Opaque thermally toughened soda lime silicate safety glass

This is a thermally toughened soda lime silicate safety glass that has had a ceramic frit fired into the surface during the toughening process.

##### 2.3. Heat soaked thermally toughened soda lime silicate channel shaped safety glass

This is thermally toughened soda lime silicate channel shaped safety glass that undergoes a heat soaking process to reduce the presence of critical inclusions.

##### 2.3.1. Heat soaking process

This is defined within the standard for flat heat soaked thermally toughened soda lime silicate safety glass.

NOTE: The applicable standard is EN 14179-1

#### 3. Safety performance

##### 3.1 General

This is reproduced from the introduction to EN 15683-1

*"Thermally toughened soda lime silicate channel shaped safety glass has a safer breakage behaviour when compared with annealed glass."*

##### 3.2 Fracture characteristics (reproduced from EN 15683-1; clause 5)

*"In the event of breakage, thermally toughened soda lime silicate channel shaped safety glass fractures into numerous small pieces, the edges of which are generally blunt."*

NOTE: "Fragmentation in service does not always correspond to that described in Clause 8, due to restraint from fixing or due to the cause of fracture."



### 3.3 Impact safety performance

NOTE: It may be possible for thermally toughened soda lime silicate channel shaped safety glass to be tested in general accordance with BS EN 12600 as part of a screen or system. Please consult the manufacturer or supplier for more information.

This is because channel shaped glass is not a flat glass nor can it be manufactured to the required test specimen dimensions.

## 4. Dimensional Requirements

### 4.1 Method of measurement

The detail for measurement of the following: -

- width, B,
- height of flange, d,
- length, H.
- thickness, c,
- flange deviation, z, and
- squareness of cut, q.

are given in GGF Data Sheet 4.6.1

### 4.2 Tolerances

The tolerances on the dimensions referred to in 4.1 are given in GGF Data Sheet 4.6.1.

## 5. Flatness

### 5.1 General

By the very nature of the toughening process, it is not possible to obtain a product as flat as the annealed channel shaped glass from which it was manufactured. The difference depends on the nominal thickness, the web and flange dimensions and the length. Therefore, a distortion known as 'overall bow' may occur (see figure 1).

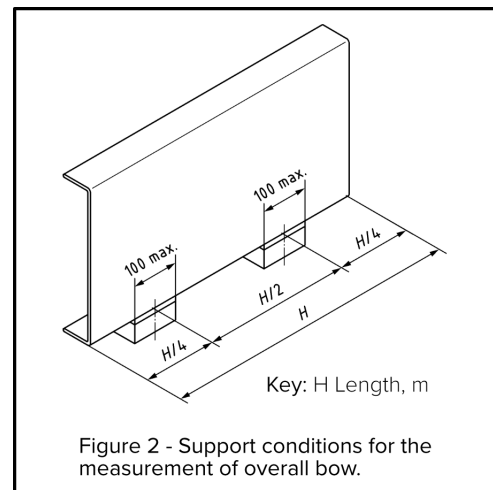
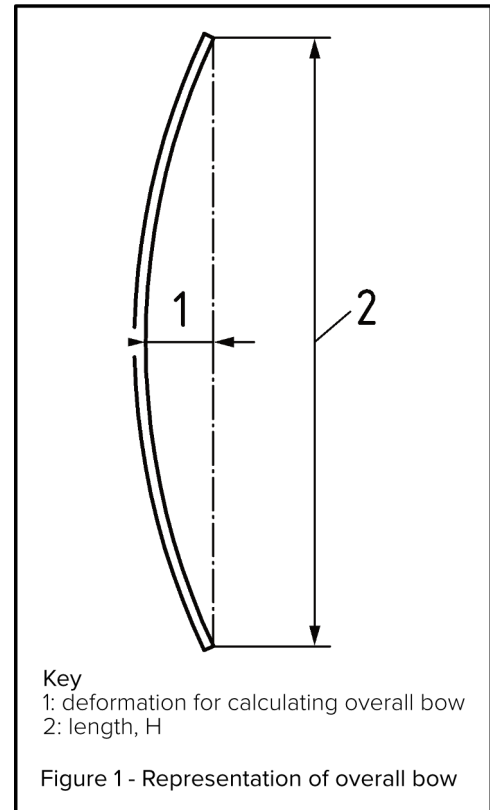
NOTE Overall bow can, in general, be accommodated by the framing system.

### 5.2. Measurement of overall bow

The pane of glass shall be placed in a horizontal position on its side on a flange supported by two load bearing blocks at the quarter points (see Figure 2).

The deformation shall be measured along the middle axis of the web between the cut edges of the channel shaped glass as the maximum distance between a straight metal ruler, or a stretched wire, and the concave surface of the channel shaped glass (see Figure 1).

The value for the bow is then expressed as the deformation, in millimetres, divided by the measured length of the channel shaped glass in metres.



The measurement shall be carried out at ambient temperature.

### 5.3 Limitation on overall bow

The maximum allowable values for the overall bow, when measured according to 5.2, shall not exceed 4mm/m.

6. Edge working of channel shaped glass before toughening

WARNING — THERMALLY TOUGHENED SODA LIME SILICATE CHANNEL SHAPED SAFETY GLASS SHALL NOT BE CUT, SAWED, DRILLED OR EDGE WORKED AFTER TOUGHENING.

The cut edges have to be edge worked prior to toughening.

The simplest type of edge working is the arrised edge (see Figure 3).

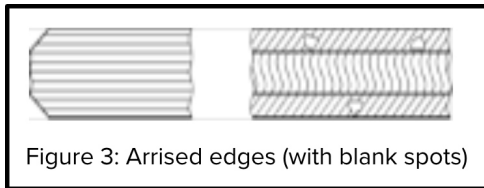


Figure 3: Arrised edges (with blank spots)

7. Appearance / Characteristics

7.1 Appearance [Visual faults]

7.1.1 Determination

These shall be determined under the viewing conditions given in GGF Data Sheet 4.6.1

7.1.2 Acceptance level

Bubbles, ream, scratches or inclusions visible in the conditions defined in GGF Data Sheet 4.6.1 are not allowed.

7.2 Characteristics [Optical]

7.2.1 Optical distortion

While the hot glass is in contact with the rollers during the toughening process, a surface distortion is produced by a reduction in surface flatness, known as 'roller wave'.

Roller wave is generally noticed in reflection.

The web can show signs of small imprints in the surface ('roller pick-up')

7.2.2 Anisotropy (iridescence)

The toughening process produces areas of different stress in the cross section of the glass. These areas of stress produce a bi-refracting effect in the glass, which is visible in polarised light.

When thermally toughened soda lime silicate channel shaped safety glass is viewed in polarised light, the areas of stress show up as coloured zones, sometimes known as 'leopard spots'.

Polarised light occurs in normal daylight. The amount of

polarised light depends on the weather and the angle of the sun. The bi-refracting effect is more noticeable either at a glancing angle or through polarised spectacles.

8. Harmonised standards for CE marking

All of the product standards referred to in this document have a part that covers the requirements for application of the CE marking. These parts are as follows: -

- EN 15683-2: Glass in building – *Thermally toughened soda lime silicate channel shaped safety glass – Part 2: Product standard*

ANNEX A Fragmentation: test methodology and assessment

A.1 General

The fragmentation test determines whether the glass breaks in the manner prescribed for a thermally toughened soda lime silicate channel shaped safety glass.

A.2 Dimensions and number of test specimens

The length (H) of the test specimens shall be 2100 mm. The width is determined by the glass type. The test specimen shall be taped on the external surface to stop the fragments separating but still allowing the specimen to expand when fragmented. Five specimens shall be tested.

A.3 Test procedure

The test specimen is placed web side down on a flat surface. Each test specimen shall be impacted, using a pointed steel tool, at a position 13 mm in from the cut edge of the test specimen at the mid-point of that edge, until breakage occurs (see Figure A1).

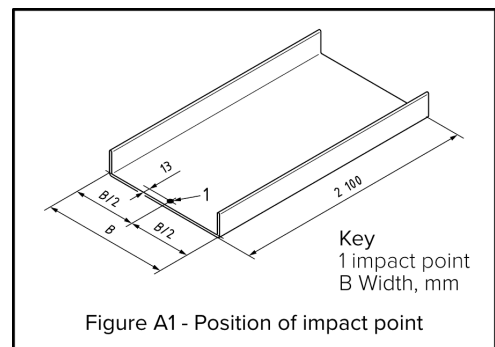


Figure A1 - Position of impact point

Examples of steel tools are a hammer of about 75 g mass, a spring loaded centre punch, or other similar appliance with a hardened point. The radius of curvature of the point should be approximately 0.2 mm.

NOTE The fragmentation characteristics of glass are unaffected by temperatures between -50 °C and +100 °C.

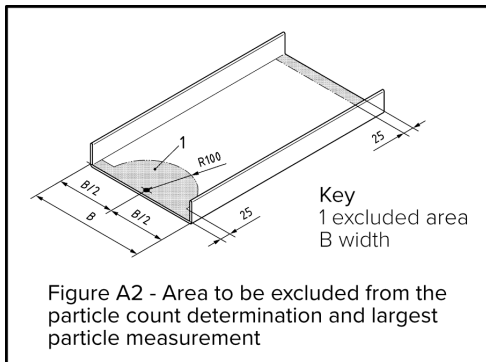
The test specimen shall be laid flat on a table without any mechanical constraint. In order to prevent scattering of the

fragments, the specimen shall be simply held at the edges, e.g. by a small frame, adhesive tape etc., so that the fragments remain interlocked after breakage yet extension of the specimen is not hindered.

**A.4 Assessment of fragmentation**

The particle count and measuring of the dimensions of the largest particle shall be made between 4 min to 5 min after fracture.

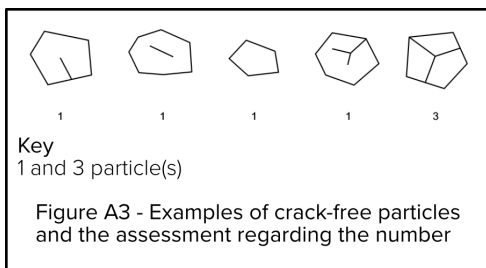
An area of radius 100 mm, centred on the impact point, and a border of 25 mm, round the cut edge of the test specimen together with the flanges (see Figure A2), shall be excluded from the assessment.



The particle count shall be made in the region of coarsest fracture (the aim being to obtain the minimum value).

The particle count shall be made by placing a mask of (50 ± 1) mm × (50 ± 1) mm on the test piece.

The number of crack-free particles within the mask shall be counted. A particle is 'crack-free' if it does not contain any cracks, which run from one edge to another (see Figure A3).



In the particle count, all particles wholly contained within the area of the mask shall be counted as one particle each and all the particles, which are partially within the mask shall be counted as 1/2 particle each

**A.5 Minimum values from the particle count**

In order to classify a glass as a thermally toughened soda lime silicate channel shaped safety glass, the particle count of each test specimen shall not be less than 40.

**A.6 Selection of the longest particle**

The longest particle shall be chosen from the body of the test specimen. It shall not be in the excluded area (see A.4 and Figure A.2).

**A.7 Maximum length of longest particle**

In order to classify the glass as thermally toughened soda lime silicate channel shaped safety glass, the length of the longest particle shall not exceed 100 mm.

**Bibliography**

EN 12600: 2002 – *Glass in building – Pendulum test – Impact test method and classification for flat glass*

EN 14179-1: *Glass in building – Heat soaked thermally toughened soda lime silicate safety glass –Part 1: Definition and description*

EN 15683-1: 2013 *Glass in building – Thermally toughened soda lime silicate channel shaped safety glass –Part 1: Definition and description*

EN 15683-2: *Glass in building – Thermally toughened soda lime silicate channel shaped safety glass – Part 2: Product standard*

Data Sheet 4.6.1: *Channel Shaped Glass: Generalities – Definitions, Terminology, Properties*

Data Sheet 4.6.5: *Channel Shaped Glass - Glazing and performance of Channel Shaped Glass*