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TNO report

TQS-RAP-08-3475/gge

PFG Building Glass
EN12150: Thermally toughened soda lime silicate safety glass
Float
(4 mm)

Date	January 21, 2008
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Project number	E07.0820
Number of pages	8 (incl. appendices)
Number of appendices	

Contents

1 Introduction

GGF Wintech on behalf of PFG Building Glass has subcontracted to TNO Quality Services BV the mechanical strength measurement testing part of the performance assessment of *thermally toughened soda lime silicate safety glass as defined in EN12150-1.*

According to EN12150-2:2004 'Evaluation of conformity' an initial type testing of a thermally toughened glass product is aimed to establish if a product conforms to the definition of thermally toughened soda lime silicate safety glass.
An initial type testing concerns the product aspects, as listed below:

1. Mechanical strength measurements in accordance with EN12150 (EN1288-3)
2. Fragmentation test in accordance with EN12150

The product description shall be added to this initial type test report by the manufacturer. It was to the manufacturer's responsibility that the samples delivered for initial type test are representative to the production and normal production deviations were included in the delivered test samples.

If any deviation of applied materials/process/machines is encountered (and a so-called major change), re-type testing or additional tests may be required. This decision and responsibility belongs to the manufacturer. The product description is the lead for determining the window of these rules.

The following paragraphs describe the tests and the results.

2 Experimental

2.1 Producer of the test samples

Production plant of the samples ***: PFG Building Glass***
Sampling date ***: August 2007***

Under responsibility of:
PFG Building Glass
Industry Road, New Era
Springs
South Africa

2.2 Product description

Product:	Float
Nominal thickness:	4 mm
Dimensions of tested glass specimens:	1100 x 360 mm
Number of test specimens:	5 (5 samples per thickness) for fragmentation 10 (10 samples per thickness) EN1288-3

2.3 Tests

The executed type test consists of the following test:
- Mechanical strength measurement in accordance with EN12150 (EN1288-3)
- Fragmentation test in accordance with EN12150

The test samples are assumed to be float glass according to EN572 and manufactured in accordance of EN12150. The mechanical strength measurement requires a minimum of 10 samples and the fragmentation test requires 5 samples of a dimension of 360 by 1100 mm. The samples are tested according the requirements of EN12150 taking into account samples distribution schemes as specified in EN12150.

2.3.1 Mechanical strength measurement

The value of mechanical strength can only be given as a statistical value associated with a particular probability of breakage and with a particular type of loading. The mechanical strength values apply to quasi-static loading of the 95% confidence interval.

Type of glass	Values for mechanical strength (N/mm^2)
Float: Clear, Tinted and Coated	120
Enamelled float	75
Patterned glass and drawn sheet	90

The test is executed according EN1288 Part 3: Test with specimen supported at two points (four point bending).

2.3.2 Fragmentation test

The fragmentation test determines whether the glass breaks in the manner prescribed for a thermally toughened soda lime silicate safety glass. Each test specimen was impacted, using a pointed steel tool, at the prescribed position of the EN12150-1. Then, via a hammer and centre punch the glass is broken. In order to prevent scattering of the fragments the specimen is positioned in a frame. The frame is about 3-4 mm larger than the test specimen. The fragments remain interlocked after breakage yet extension of the specimen is not hindered. Between 4 and 5 minutes of the impact and within 1 minute the particle count has been done. The particle count is executed the region of coarsest fracture and outside the so-called excluded area like defined in the EN12150-1. The following table defines the minimal amount of the crack free within the mask of this assessment of 50 by 50 mm.

- 3 mm float shall result in minimal 15 particles.
- 4 mm up to and including 12 mm float shall result in minimal 40 particles.
- 15 mm up to and including 19 mm shall result in minimal 30 particles.

The following photos are examples of an assessment:

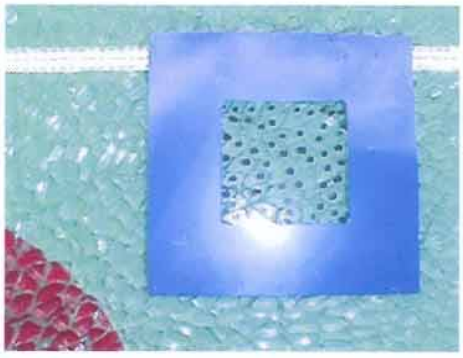

Photo 1: Typical example passing the requirements

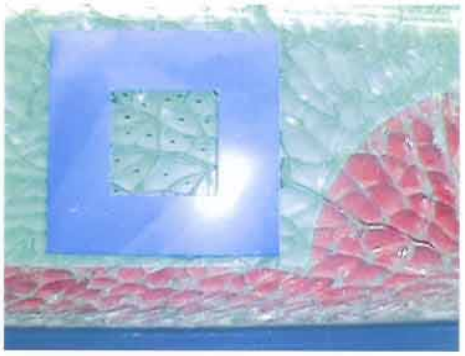

Photo 2: typical example failing the requirements

3 Results

3.1 General

The thicknesses of the tested samples were carried out using a calliper:

- TNO identification number: A15060
- Calibration certificate: GMER-RVA-040341
- Calibration valid until October 2007.
- Function check with NKO calibrated samples: Mitutoyo Cerablock, No. 41900402.
- Calibration certificate of the reference standards: 20200479AR.06
- Calibration valid until September 2007

3.2 Fragmentation test

The fragmentation test was carried out using:

- Fragmentation frame: A91259
- Centre punch: A91178
- Hammer: A91258
- Calliper: A15060

In the following table the results are given:

Limit values table: Fragmentation test EN12150	
Thickness [mm]	4
Minimum allowed number of particle within the gauge (25 cm^2)	40
Maximum allowed length of het longest particle after fragmentation (in mm)	100
Test Specimen 1	"4"
Number of fragments within the gauge (25 cm^2)	68
length of the longest particle in the body of the test specimen after fragm.	22
Assesment between 4 and 5 minutes [Y/N]	y
Test Specimen 2	"4"
Number of fragments within the gauge (25 cm^2)	83
length of the longest particle in the body of the test specimen after fragm.	22
Assesment between 4 and 5 minutes [Y/N]	y
Test Specimen 3	"4"
Number of fragments within the gauge (25 cm^2)	57
length of the longest particle in the body of the test specimen after fragm.	21
Assesment between 4 and 5 minutes [Y/N]	4
Test Specimen 4	"4"
Number of fragments within the gauge (25 cm^2)	74
length of the longest particle in the body of the test specimen after fragm.	16
Assesment between 4 and 5 minutes [Y/N]	y
Test Specimen 5	"4"
Number of fragments within the gauge (25 cm^2)	68
length of the longest particle in the body of the test specimen after fragm.	19
Assesment between 4 and 5 minutes [Y/N]	y
Evaluation of Conformity	"4"
The mimimum required number of fragments is not exceeded	OK
The maximum allowed length of het longest particle is not exceeded	OK

The conclusion is that the tested thicknesses are ***passing*** the requirements of the fragmentation test.

3.3 Bending strength

The bending test was carried out using:

- Calliper: A15060
- Four point bending tester: A91301
    - Calibration certificate: 04N155-B
        - MTS Hydraulic Power Unit Control: 0070090241
        - MTS 25 kN tester: 0070090243
        - MTS 407 Controller: 0070090192

In the following table the results are given:

Sample number	no layer facing upwards ↑ or downwards ↓	Thickness (mm)	Length (mm)	Width (mm)	Max. Force (N)	Mech.strength (N/mm^2)	Breakage between rollers [Yes/No]	Time to breakage (s)
4 mm	NA	3,80	1100	360	706	167,8	Yes	66
4 mm	NA	3,90	1100	360	706	159,4	Yes	66
4 mm	NA	3,80	1100	360	649	154,7	Yes	59
4 mm	NA	3,90	1100	360	659	149,1	Yes	61
4 mm	NA	3,90	1100	360	710	160,3	Yes	65
4 mm	NA	3,90	1100	360	659	149,1	Yes	60
4 mm	NA	3,90	1100	360	683	154,4	Yes	62
4 mm	NA	3,80	1100	360	696	165,5	Yes	64
4 mm	NA	3,90	1100	360	666	150,7	Yes	62
4 mm	NA	3,90	1100	360	659	149,1	Yes	61

4 Signature

Eindhoven, January 2008

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BU Glass

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