

GGF Recommendations for Adhesive Backed Polymeric Film Applied to Glass in the Overhead Position for Containment of Glass in the Event of Failure: Test Method

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Forward

This document clarifies the recommendations concerning the use of adhesive backed polymeric film applied to glass in the overhead position for the containment of glass in the event of failure. It is the second of two documents, the first of which describes the different types of adhesive backed polymeric films and containment systems (see also GGF Datasheet 5.18.4) and gives guidance on their selection.

The testing must be carried out by an independent test laboratory such as the GGF test facility.

1. Scope

This document describes a test method for adhesive backed polymeric film and containment systems used on non-vertical overhead glazing. The aim is to evaluate the reduction of risk in the event of glass failure. It is based upon a load uniformly applied to a horizontal test piece.

2. Definitions and Description

2.1 See GGF Datasheet 5.18.3 "GGF Recommendations for Adhesive Backed Polymeric Film Applied to Glass: Definitions, Descriptions and Components".

3. Test Conditions

3.1 The following minimum conditions must be met:

- The film has been installed for at least the cure times indicated in Table I (but see section 3.2)
- Water condensation is not present on the film surface during cure or during the test
- Test room temperature is 20 ± 5 °C

Table I: Minimum recommended periods required for curing before testing for containment in the event of glass failure

Film thickness, t	Minimum cure time for testing
$t \leq 100 \mu$	≥ 30 days
$100 < t \leq 200$	≥ 60 days
$200 < t \leq 300$	≥ 90 days
$t > 300$	100+ days [†]

[†] The manufacturer will provide the minimum time period required.

3.2 The periods in Table I may need to be adjusted for certain films e.g. combined solar control-safety films. Where favourable environmental conditions exist, containment testing may be performed earlier than the cure periods recommended at the discretion of the manufacturer or installer.

4. Test Equipment

4.1 General Equipment:

- Thermally toughened sodium silicate safety glass, in accordance with BS EN 12150, 10 ± 0.3 mm x 2500 ± 5 mm x 1500 ± 5 mm (nominal mass: ~94 kg)
- Standard mild steel frame with a rubber gasket for retaining the toughened glass with 19 ± 2 mm edge cover, representing a normal dry glazing system (Figure 1), or
- For bolted systems a subframe containing the bolts at the appropriate positions shall be used
- Steel supporting frame of sufficient robustness to securely hold the glazing / frame (section 4.2) in a horizontal position at 800 ± 100 mm above the ground
- White witness sheet of ≥ 3000 mm x 2000 mm dimensions (card or thick paper are suitable)
- Sand for adding load to glazing (400 kg in 10 kg sacks is suitable)
- Centre punch
- 1200 mm spirit level
- Tape measure
- Mechanical lifting apparatus
- Calibrated micrometer
- Digital camera

Note: Due to the weight of the toughened glass, the frame and support frame, they must be transported and positioned by mechanical means.



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4.2 Glazing

The glass may be held in place in a variety of ways; for the purposes of this test method, two systems are defined:

4.2.1 A mild steel frame with rubber gasket and sufficient dimensions, including return, for the installation of the toughened glass pane and a containment system. The frame may provide either two or four edged support for the toughened glass.

4.2.2 A bolted system using bolts at each of the four corners.

4.2.3 A system of securing the mild steel frame (section 4.2.1) or the bolts (section 4.2.2) to the steel supporting frame (section 4.1) is also required, e.g. scissor clamps or bolts.

5. Principles of Test

5.1 The test allows a safety film and containment system applied to glass to be tested. There are three levels of test (see Table 2).

5.2 A serviceable imposed uniform load of 100 kg is used as an equivalent to snow loading for the UK. An imposed uniform load of 400 kg is used as an equivalent to snow loading plus intermittent wind loading for the UK. This simulates a 'worst case' situation where the glass fails, a snow loading is present, and an intermittent wind loading occurs.

5.3 The self weight, snow loading, and snow loading plus intermittent wind loading tests are carried out consecutively on the same test piece.

6. Test Setup

The test piece is made from the toughened glass pane, the safety film, and the containment system.

6.1 Safety Film

Install the safety film to the toughened glass according to the manufacturer's recommendations and leave to cure in well ventilated conditions and for the appropriate times (section 3). Ensure the film will not be held within the rebate of the steel frame if this frame is to be used; the film edge shall be installed to within 1 mm +0.0 / -0.5 mm inside the sight line of the frame. If bolts are to be used the safety film shall be installed to within 1 mm +0.0 / -0.5 mm of all glass edges including the bolt holes.

6.2 Securing the Glass

Install the toughened glass + safety film into the steel frame or attach the bolts (section 4) to the corner holes in the toughened glass + safety film, with edge cover of 19 ± 2 mm.

Note: If the film is installed after glazing, ensure that the appropriate tolerances and cure time are met. (Section 5.1)

6.3 Containment System

6.3.1 Install the containment system according to the manufacturer's recommendations. For some containment systems, particularly the structural silicone and batten bar systems, the gaskets may need to be positioned so that the containment system can be installed correctly.

6.3.2 For adhesively fixed batten bar containment systems, ensure the batten bar has a suitable cross section profile and is installed so that one flat surface contacts the safety film and one flat surface contacts the frame; the batten bar is normally a simple L shaped profile but other profiles can be used.

6.3.3 For adhesively fixed batten bar containment systems, the batten bar should have a minimum of 12 mm contact with both the frame and safety film; normally the width of contact is 25 mm.

6.3.4 For all batten bar containment systems, the batten bar should not extend past the frame.

6.3.5 For structural silicone glazing, the width of contact between the silicone and the safety film and between the silicone and the support frame shall be ≥ 10 mm; the cross section shall be triangular.

6.3.6 For a 4 edged support system, the containment system must be applied to at least the two long edges; normally the containment system is applied to all four edges.

6.3.7 For a 2 edged support system, the containment system must be applied to the two long edges.

6.3.8 Leave the completed test piece for the time recommended by the manufacturer for the containment system to reach full performance. Condition the test piece at 20 ± 5 °C for at least 24 hours immediately prior to test.

Note: For example, structural silicone systems normally take longer than batten bar systems to reach full performance.

6.4 Place the witness sheet underneath the support frame on the floor level with the centre of the witness sheet approximately where the centre of the installed test piece will be, and secure to the floor.

6.5 Positioning the Test Piece

6.5.1 Ensure that when installed upon the supporting frame, the test piece will be held horizontally and at 800 ± 100 mm from floor level. Ensure that no obstructions



are present beneath or immediately around the support system.

6.5.2 The test piece shall be positioned with the safety film side facing downwards. Lift the test piece into position by mechanical means and attach it securely to the steel support frame.

Note: Do not allow any part of your body to pass underneath the test piece during or after installation to avoid injury in case the test piece is accidentally dropped. Likewise, ensure that other people present are not exposed to this risk.

6.5.3 Ensure the toughened glass pane is $\leq 5^\circ$ from horizontal in both longitudinal and transverse directions as given in sections 6.5.4 to 6.5.5.

6.5.4 When using the steel frame, place the spirit level midway along a long dimension on the frame holding the toughened glass, and check that this is horizontal to $\leq 5^\circ$ adjusting if necessary; repeat for the other long dimension then the two short dimensions. Make a final check on all four sides to ensure that no movement away from horizontal has occurred during the levelling process.

6.5.5 When using a bolted system, place the spirit level midway between and in line with two corner bolts along a long dimension and check that this is horizontal to $\leq 5^\circ$ adjusting if necessary; repeat for the other long dimension then the two shorter dimensions. Make a final check on all four sides to ensure that no movement away from horizontal has occurred during the levelling process.

Note: In the case of bow due to self weight, the spirit level may need to be placed on a straight edge spanning from bolt to bolt.

6.6 Sweep the witness sheet clean of any debris prior to the test using a long handled broom.

Note: The witness sheet may be re-used for subsequent tests if it has no or only minor damage.

6.7 Check that the temperature in the test room is $20 \pm 5^\circ\text{C}$.

7. Test Method

7.1 In order to fully describe the test piece, take sufficient digital photographs immediately prior to commencement of the test to clearly show the safety film, the type of containment system used, and the method(s) of installation of both the safety film and the containment system within the test piece. Take additional digital photographs during each stage of the test and at test completion to clearly show the reaction

of the structure to the loading and any debris that has fallen onto the witness sheet.

7.2 Break the toughened glass using a centre punch on the unfilmed side of the glass immediately adjacent to the centre of one of the long edges.

7.3 Leave the test piece for ten minutes after fragmentation.

Note: If the fragmentation does not show the required pattern as in BS EN 12150 Part 1, the test shall be terminated and a new test piece used.

7.4 Self weight – 72 hour test

Note: If the manufacturer wishes to claim a Class B, then the requirements of Class A can be ignored (proceed to section 7.5).

7.4.1 When using the steel frame, note any glass fragments that have separated from the test piece and passed through the safety film and/or containment system and have fallen onto the witness sheet.

7.4.2 When using bolted systems, also note any glass fragments that have separated from the edges of the toughened glass and fallen onto the witness sheet.

7.4.3 Note any minor and major detachments of the safety film from the containment system and any minor and major detachments of the containment system from the frame.

Minor detachment is defined as

-For framed systems: a length of separation ≤ 125 mm

-For bolted systems, any separation by \leq one quarter of the circumference of the containment system around the bolt

Major detachment is defined as:

-For framed systems, a length of separation > 125 mm

-For bolted systems, separation by $>$ one quarter of the circumference of the containment system around the bolt

7.4.4 If glass fragments have passed through the safety film and/or the containment system and fallen onto the witness sheet (section 7.4.1), have separated from the glass edges of bolted systems and fallen onto the witness sheet (section 7.4.2), or more than two minor detachments and / or any major detachments are present (section 7.4.3), stop the test and record a failure for the imposed load.

7.4.5 Maintain the test piece in position for 72 hours and repeat evaluation every 24 hours, sweeping the witness



sheet clean (section 6.6) after each evaluation (sections 7.4.1 to 7.4.4).

7.4.6 If the test piece passes the test (section 9), then proceed to 7.5.

7.5 Snow Load – 72 hour test

7.5.1 If the self load test is omitted, follow the procedure in 7.1 to 7.3.

7.5.2 Uniformly position 10 x 10 kg sand bags (= 100 kg) over the broken pane to give a total loading of ~194 kg, and leave for 10 minutes.

7.5.3 Repeat 7.4.1 to 7.4.5.

7.5.4 If the test piece passes the 72 hour snow loading test, testing may be extended for snow load plus intermittent wind load (section 7.6).

Note: Do not allow any part of your body to pass underneath the test piece during the test to avoid injury in case the test piece fails. Likewise, ensure that other people present are not exposed to this risk.

7.6 Snow Load plus Intermittent Wind Load Test – 30 second test

7.6.1 Uniformly position 30 x 10 kg sand bags (= 300 kg) over the broken pane plus the 100 kg of sand bags from the snow load test to give a total loading of ~494 kg, and leave for 30 seconds.

7.6.2 Repeat 7.4.1 to 7.4.4.

7.7 Film characterisation: Obtain a small piece of the safety film and measure its thickness in microns using a calibrated micrometer. Ensure that no contaminants are present to affect correct thickness measurement.

8. Test Evaluation

8.1 The test piece shall exhibit a fragmentation pattern (sections 7.2 and 7.3) that meets clauses 8.5 and 8.7 of BS EN 12150 Part 1.

8.2 For any type of containment system, no glass fragments passing through the safety film and/or containment system are permitted.

8.3 For bolted systems, no separation of glass fragments at the edges is permitted.

8.4 No more than 2 minor detachments are permitted in the test piece; if two minor detachments are present they must be separated by at least 125 mm. No major detachments are permitted.

9. Classification

9.1 Fragmentation

If the test piece does not exhibit the fragmentation pattern in accordance with BS EN 12150-1, no classification is possible.

9.2 Self Weight

If, after testing according to sections 7.1 to 7.4.6, the test piece meets the criteria in 8.2 to 8.4 it is classified as A.

9.3 Snow Load

If, after testing according to sections 7.1 to 7.3 and 7.5, the test piece meets the criteria in 8.2 to 8.4 it is classified as B.

9.4 Snow Load plus Intermittent Wind Load

If, after testing according to sections 7.1-7.3, 7.5 and 7.6, the test piece meets the criteria in 8.2-8.4 it is classified as C.

9.5 Weather Tightness

If the test piece is a framed system, and if the test piece meets the criteria in section 8.2 but with no detachments as defined in section 7.4.3, it is further classified as WT.

Note: WT can be applied to any of the three classes, e.g. A/WT.

Table 2: Loading type and classification

Loading	Class
Self weight	A
Self weight plus snow load	B
Self weight plus snow load plus intermittent window load	C

10. Test Report

The test report shall include the following:

- Date and time of commencement of the test
- Details of the test laboratory (name, address, etc.)
- Person(s) performing the test
- Temperature of the test area
- Description of the test piece (section 5) including a full description of the containment system type, safety film type and, if available, product code, manufacturer and installer
- Film thickness in microns
- Digital photographs of the test piece clearly showing the safety film, the type of containment system, and the reaction of the structure to the loading (section 7.1)
- Confirmation that the test piece has been conditioned for at least 24 hours at 20 ± 5 °C prior to test and that the test piece was $\leq 5^\circ$ from horizontal
- Installation dates of the film and containment system
- Observations made during the tests (section 7)
- If the test was terminated part way through, the date and time of test termination and the reason(s) for termination



- Classification A, B or C and, if applicable, WT (section 9)
- Deviations from the test method and an explanation of why they were done

11. Certificate of Conformity

A certificate of conformity shall be issued by the GGF on proof of production of a suitable test report.

12. References

GGF Datasheets:

5.18.3 “GGF Recommendations for Adhesive Backed Polymeric Film Applied to Glass: Definitions, Descriptions and Components”.

5.18.4 “GGF Recommendations for Adhesive Backed Polymeric Film Applied to Glass in the Overhead Position for Containment of Glass in the Event of Failure: Types of Systems and Precautions in Use”

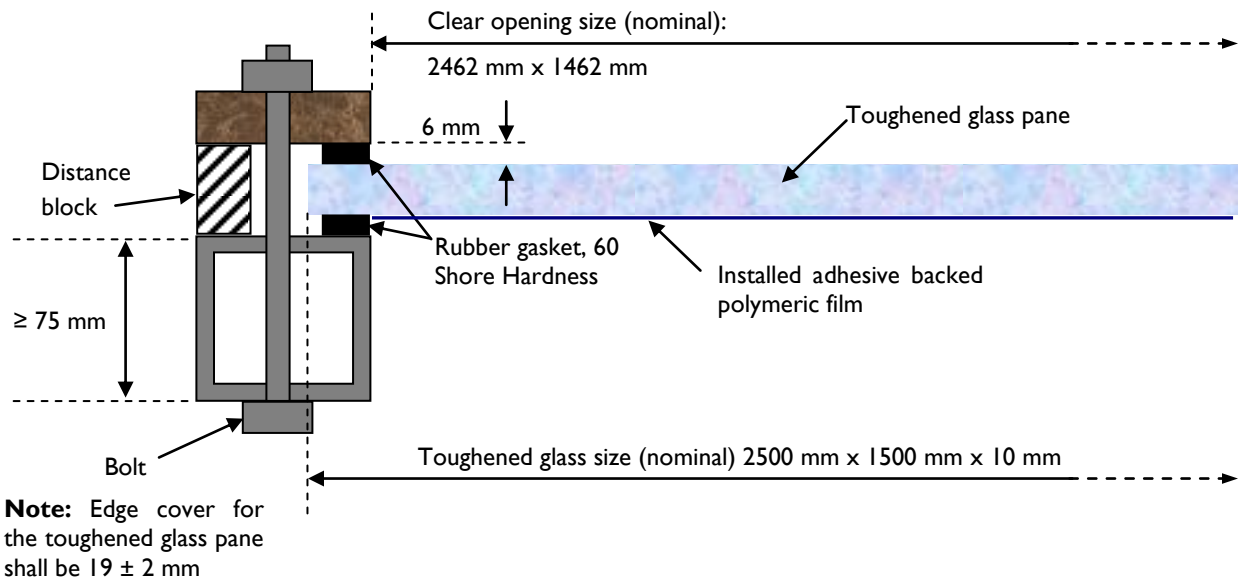


Figure I: Example of suitable glazing frame for containment testing

