BS EN 15755-1:2014

BSI Standards Publication

Glass in building — Adhesive backed polymeric filmed glass

Part 1: Definitions and requirements

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/520/4, Properties and glazing methods.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Glas im Bauwesen - Glas mit selbstklebender Polymerfolie - Teil 1: Begriffe und Anforderungen

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 15755-1:2014) has been prepared by Technical Committee CEN/TC 129 “Glass in building”, the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2015, and conflicting national standards shall be withdrawn at the latest by February 2015.

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Introduction

Adhesive backed polymeric filmed glass is glass which has had its properties and performance modified by the application of adhesive backed polymeric film.

There are a number of different types of films that are manufactured to modify specific properties of glass, including: solar energy transmittance, visible light transmittance, emissivity, Ultra Violet transmittance, privacy, appearance, impact behaviour, security, electromagnetic frequency (EMF) attenuation, and surface protection.

1 Scope

This European Standard defines the characteristics, properties and classification of adhesive backed polymeric filmed glass, i.e. glass product that has had an adhesive backed polymeric film applied, for use in buildings. The adhesive backed polymeric film is based on biaxially oriented polyester film as defined in EN 15752-1. This applies to both site and factory applications.

This European Standard does not apply to adhesive backed polymeric films manufactured using polyvinylchloride (PVC).

Other requirements, not specified in this standard, may apply to adhesive backed polymeric filmed glass that is incorporated into assemblies, e.g. laminated glass or insulating glass units. The additional requirements are specified in the appropriate product standard. Adhesive backed polymeric filmed glass, in this case, does not lose its mechanical or thermal characteristics.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 356, *Glass in building - Security glazing - Testing and classification of resistance against manual attack*

EN 410, *Glass in building - Determination of luminous and solar characteristics of glazing*

EN 572-1, *Glass in building - Basic soda lime silicate glass products - Part 1: Definitions and general physical and mechanical properties*

EN 572-2, *Glass in building - Basic soda lime silicate glass products - Part 2: Float glass*

EN 572-7, *Glass in building - Basic soda lime silicate glass products - Part 7: Wired or unwired channel shaped glass*

EN 673, *Glass in building - Determination of thermal transmittance (U value) - Calculation method*

EN 1063, *Glass in building - Security glazing - Testing and classification of resistance against bullet attack*

EN 12600, *Glass in building - Pendulum test - Impact test method and classification for flat glass*

EN 12898, *Glass in building - Determination of the emissivity*

EN 15752-1:2014, *Adhesive backed polymeric film – Definitions and description*

EN 50147-1, *Anechoic chambers - Part 1: Shield attenuation measurement*

EN ISO 8510-2, *Adhesives - Peel test for a flexible-bonded-to-rigid test specimen assembly - Part 2: 180 degree peel (ISO 8510-2)*

ISO 16933, *Glass in building — Explosion-resistant security glazing — Test and classification for arena air-blast loading*

CIE 13.3:1995, *Method of Measuring and Specifying Colour Rendering Properties of Light Sources*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 15752-1:2014 and the following apply.

3.1
adhesive backed polymeric filmed glass
glass substrate (see Clause 4) to which has been applied an adhesive backed polymeric film as defined in EN 15752-1 in order to modify one or more of its properties

3.2
release liner
disposable layer designed to protect the adhesive coating prior to installation

3.3
dry lamination
installation of an adhesive backed polymeric film by removal of the release liner and direct lamination to the glass substrate surface without using water-based solutions

Note 1 to entry: Dry lamination is normally done using machinery incorporating a roller system within a clean room.

3.4
wet lamination
installation of an adhesive backed polymeric film by removal of the release liner, wetting the exposed adhesive with a water-detergent solution, and lamination to the substrate surface

3.5
general appearance defects
these are either visual or optical faults caused by the film or by its application

Note 1 to entry: These are defined in 3.5.1 to 3.5 19

3.5.1
uniformity defect
slight visible variation in colour, in reflection or transmission, within an adhesive backed polymeric filmed glass pane or from pane to pane

3.5.2
stain
defect in the filmed glass larger than a punctual defect, often irregularly shaped, partially of mottled structure

3.5.3
punctual defect
punctual disturbance of the visual transparency whilst looking through the glass and of the visual reflectance looking at the glass

Note 1 to entry: Spots, pinholes, gels and particulates are types of punctual defect.

3.5.3.1
spot
defect that commonly looks dark against the surrounding film area, when viewed in transmission

3.5.3.2
pinhole
punctual void in one or more film layers that normally contrasts clear relative to the surrounding film area when viewed in transmission

3.5.3.3
scratch
variety of linear score marks, whose visibility depend on their length, depth, width, position and arrangements

3.5.4
cluster
accumulation of very small defects giving the impression of a stain

3.5.5
gel
a visible variation in the adhesive caused by additional polymerisation within the adhesive or by coagulation seen as a point of distortion

3.5.6
distortion
disturbing visible variation in optical sharpness of objects viewed through the adhesive backed polymeric filmed glass

3.5.7
distortion line
disturbing visible variation seen as a line in optical sharpness of objects viewed through the adhesive backed polymeric filmed glass

3.5.8
air bubble
pocket of air trapped between the adhesive backed polymeric film and the glass substrate

3.5.9
water bubble
pocket of trapped installation solution between the adhesive backed polymeric film and the glass substrate

3.5.10
particulate contamination
particulate trapped between the adhesive backed polymeric film and the glass substrate

3.5.11
haze
light that is scattered upon passing through the adhesive backed polymeric filmed glass that produces a misty field of vision when objects are viewed through the adhesive backed polymeric filmed glass

3.5.12
non-uniform colour appearance
visible variation in colour, in reflection or transmission, within an adhesive backed polymeric filmed glass

Note 1 to entry: Slight variations are not considered a defect.

Note 2 to entry: Slight colour differences may exist when joining two or more pieces of film on a large pane of glass.

3.5.13
peeling
separation of the adhesive backed polymeric film from the glass

3.5.14
delamination
separation of the polymeric layers in the adhesive backed polymeric film

3.5.15
iridescence
visible effect due to film construction consisting of rainbow-like, luminous or gleaming colours that change colour and intensity with viewing position

Note 1 to entry: Iridescence is not a defect.

3.5.16
demetallisation
partial or complete loss of one or more of the metal layers within the adhesive backed polymeric film

3.5.17
surface impression
localised or repeating pattern of indentations in the adhesive backed polymeric film visible as a non-uniformity

3.5.18
crease
line in the adhesive backed polymeric film caused by folding the film during manufacture or installation

3.5.19
edge defect
serrations and cuts caused by incorrect trimming of the adhesive backed polymeric film during installation

4 Glass substrate

The following types of glass products, in accordance with appropriate ENs, can be used as substrates for adhesive backed polymeric filmed glass:

Basic soda lime silicate glass products	EN 572–1 to 8
Special basic products - Borosilicate glasses	EN 1748–1-1
Special basic products - Glass ceramics	EN 1748–2-1
Special basic products - Alkaline earth silicate glass	EN 14178–1
Silvered float glass	EN 1036–1
Thermally toughened soda lime silicate safety glass	EN 12150–1
Heat strengthened soda lime silicate glass	EN 1863–1
Chemically strengthened soda lime silicate glass	EN 12337–1
Heat soaked thermally toughened soda lime silicate safety glass	EN 14179–1
Thermally toughened borosilicate safety glass	EN 13024–1
Thermally toughened alkaline earth silicate safety glass	EN 14321–1
Laminated and laminated safety glass	EN ISO 12543-2, −3
Coated glass	EN 1096–1
Basic alumino silicate glass products	prEN 15681–1
Heat soaked thermally toughened alkaline earth silicate safety glass	prEN 15682–1
Thermally toughened U channel soda lime silicate safety glass	prEN 15683–1

NOTE Application of adhesive backed polymeric film to the coated surface of coated glass is not recommended.

5 Product definitions

5.1 General

The performance of adhesive backed polymeric filmed glass is a composite of the properties of the glass substrate and the characteristics of the adhesive backed polymeric film as defined in EN 15752-1. Depending upon the type of film one or more of the properties of the glass substrate will be modified.

Where a test standard is specified, adhesive backed polymeric filmed glass shall be tested and characterized using clear, monolithic, uncoated float glass of nominal thickness of 4 mm as the substrate, unless otherwise specified in this standard. The adhesive backed polymeric film shall be applied to the glass substrate according to the original manufacturer's recommendations. The glass shall be soda lime silicate and shall be in accordance with EN 572-1 and EN 572-2. One or more tests may be conducted on glass meeting these requirements but with a different thickness; these tests shall only be accepted if the same tests have been completed and reported in accordance with this standard for 4 mm thick glass. Adhesive backed polymeric film test specimens shall be representative of normal production material.

Measurement of the properties of test specimens shall be made after the cure time has elapsed. Cure time requirements may be obtained from the original manufacturer of the adhesive backed polymeric film.

The installation method shall be representative of the normal method used to install the adhesive backed polymeric film to the glass substrate.

5.2 Solar control

The purpose of applying adhesive backed polymeric solar control film to a glass substrate is the modification of the spectrophotometric properties of the glass substrate to which it has been applied. The properties shall be determined and reported in accordance with EN 410. If desired, the solar-optical characteristics may also be reported as percentages, except for the general colour rendering index and shading coefficient; percentage values shall not be used in isolation from the decimal values.

Optional characteristics derived from EN 410 data, such as glare reduction, may be determined as described in EN 15752-1. These derived characteristics shall not be used in isolation and EN 410 values shall take precedence.

NOTE 1 The short wave shading coefficient and the long wave shading coefficient may be determined from the calculated EN 410 data.

NOTE 2 The contribution of the rear side of the pane of adhesive backed polymeric filmed glass is included.

5.3 Safety

The purpose of applying adhesive backed polymeric safety film to a glass substrate is the modification of the breakage characteristics of the glass substrate to which it has been applied. The testing and classification shall be in accordance with EN 12600.

NOTE 1 The application of adhesive backed polymeric safety film to a glass substrate that has a mode of breakage (A), i.e. annealed glass, as defined in EN 12600, will be the modification of the mode of breakage to (B), i.e. laminated glass, as defined in EN 12600.

NOTE 2 The application of adhesive backed polymeric safety film to a glass substrate that has a mode of breakage (B), i.e. laminated glass, as defined in EN 12600, will not change the existing mode of breakage.

NOTE 3 The application of adhesive backed polymeric safety film to a glass substrate that has a mode of breakage (C), i.e. toughened glass, as defined in EN 12600, will be the modification of the mode of breakage to (B), i.e. laminated glass, as defined in EN 12600.

5.4 Security

5.4.1 General

The purpose of applying adhesive backed polymeric security film to a glass substrate is the modification of the shatter properties, impact behaviour and resistance to attack of the glass substrate to which it has been applied.

5.4.2 Resistance to manual attack

The purpose of applying adhesive backed polymeric security film to a glass substrate is to modify the resistance against manual attack. The testing and classification shall be in accordance with EN 356.

NOTE 1 This modification could be the transformation of a glass substrate with no penetration resistance into one with penetration resistance.

NOTE 2 This modification could be the transformation of a glass substrate with a level of penetration resistance into one with a higher performance.

5.4.3 Resistance to explosive pressure

The purpose of applying adhesive backed polymeric security film to a glass substrate is to modify its resistance to explosive pressure.

Testing adhesive backed polymeric security filmed glass for performance against explosive pressure can use a hazard ranking test standard such as ISO 16933 or equivalent. Adhesive backed polymeric security filmed glass tested to ISO 16933 shall be classified to a minimum of Class EXV45(E). Hazard ranking testing may use 6 mm monolithic float glass as the substrate.

NOTE 1 This modification could be the transformation of a glass substrate with no resistance to explosive pressure into one with resistance to explosive pressure.

NOTE 2 This modification could be the transformation of a glass substrate with a level of resistance to explosive pressure into one with a higher performance.

Other hazard ranking test standards that are essentially identical to ISO 16933 in test procedure may be used, but care should be taken to ensure that the appropriate number of test pieces is used to allow comparison of test results with ISO 16933.

5.4.4 Resistance to ballistic attack

The purpose of applying adhesive backed polymeric security film to a glass substrate is to modify the resistance to ballistic attack of the glass substrate. The testing and classification shall be in accordance with EN 1063.

NOTE 1 This modification could be the transformation of a glass substrate that exhibits splintering, i.e. class S in accordance with EN 1063, to one that does not exhibit splintering, i.e. class NS in accordance with EN 1063.

NOTE 2 This modification could enable a glass substrate with a level of resistance to ballistic attack to be transformed into one with a higher performance.

In some circumstances other substrates than 4 mm monolithic float glass may be used, for example adhesive backed polymeric security film applied to a glass substrate that exhibits splintering, i.e. class S, to modify it to class NS.

5.5 RFI/EMI shielding

The purpose of applying an adhesive backed polymeric RFI/EMI shielding film to a glass substrate is to attenuate transmittance of electro-magnetic frequencies, i.e. for the purpose of improving the electrical isolation between the inside/outside of a room from the outer/inner electromagnetic environment. The testing and classification shall be in accordance with EN 50147-1.

5.6 Anti-graffiti

The purpose of applying an adhesive backed polymeric anti-graffiti film to a glass substrate is to give a level of protection to a glass substrate's surface against one or more of the following: scratching, etching, spray-painting, writing or similar defacing actions.

NOTE Adhesive backed polymeric anti-graffiti film can be regarded as a sacrificial product.

5.7 Decorative

The purpose of applying an adhesive backed polymeric decorative film to a glass substrate is to alter the appearance of the glass substrate.

5.8 Low emissivity

The purpose of applying an adhesive backed polymeric low emissivity film to a glass substrate is to reduce the emissivity of the glass substrate. The normal emissivity shall be determined in accordance with EN 12898.

The normal emissivity of any adhesive backed polymeric film installed to surface 1 of glazing systems may be taken as 0,89. The European Standard for calculating U values, EN 673, does not account for modification of U values by a low emissivity coating on surface 1 of the glazing.

5.9 Ultraviolet reduction

The purpose of applying an adhesive backed polymeric Ultra Violet reducing film to a glass substrate is to reduce the transmittance of Ultra Violet light to no more than 0,0010 when determined in accordance with EN 410. EN 410 requires values to be given as decimals to two places. However, the UV transmittance shall be given to four decimal places in order to distinguish between these products and non-specialist films.

5.10 Privacy

The purpose of applying an adhesive backed polymeric privacy film to a glass substrate is to reduce vision through the glass substrate.

6 Determination of the durability of adhesive backed polymeric filmed glass

6.1 General

The durability of adhesive backed polymeric filmed glass is a combination of the durability of the adhesive backed polymeric film (as defined in EN 15752-1), the glass substrate surface, and the application of the adhesive backed polymeric film (see Annex A).

NOTE The durability of the adhesive backed polymeric film (see EN 15752–1) will have been determined on applicable glass substrates.

6.2 Humidity test

6.2.1 Principle

This test is designed to assess the durability of the adhesion of the adhesive backed polymeric film to the glass product.

NOTE This test method is not aimed at checking the type of performance (see Clause 5) of the adhesive backed polymeric filmed glass.

The purpose of this test is to determine whether the filmed glass will withstand the effects of humidity in the atmosphere over an extended period of time without its adhesion becoming substantially altered. The effects of the humidity test to be judged are peeling, bubbling, delaminating and discolouring.

6.2.2 Size and number of test specimens

The test and reference specimens shall not be smaller than 300 mm x 100 mm. There shall be three test specimens and three reference specimens.

The glass substrate shall be 4 mm float glass in accordance with EN 572-1, EN 572-2.

The reference specimens shall be stored inside a room at a temperature of 23 °C ± 5 °C and at a Relative Humidity of 50 % ± 5 % without exposure to sunlight or similar sources of energy.

6.2.3 Preparation of adhesive backed polymeric filmed glass specimens

The adhesive backed polymeric film shall be installed onto the glass substrate and allowed to cure according to the manufacturer’s installation guidelines.

6.2.4 Cleaning of filmed glass specimens

The prepared and cured specimens shall be cleaned prior to test according to manufacturers' recommendations.

6.2.5 Conditioning of test specimens

Condition the three test specimens at 23 °C ± 5 °C and 50 % ± 5 % Relative Humidity for 24 h prior to test.

6.2.6 Test procedure – Test without condensation

Put the three test specimens vertically into a climate chamber and keep the temperature within the limits of 50 °C ± 2 °C and the relative humidity within the limits of (80 ± 5) % for two weeks. Adequate spacing between the test specimens shall be provided.

The test specimens shall then be stored at the same conditions as the reference specimens for 72 h after removal from the climate chamber allowing sufficient spacing around all test specimens to allow any residual water to evaporate.

The reference and test specimens shall be cleaned on both film and glass sides according to the manufacturer’s recommendations.

6.2.7 Visual Inspection

Inspect and compare the test and reference specimens at a distance of 50 cm in front of a white diffuse background in natural daylight or under artificial sky as defined in 7.2.2 but not direct sunlight. During the

inspection, the angle between the normal to the surface of the filmed glass specimen and the light beam proceeding to the eyes of the observer shall not exceed 30°.

6.2.8 Determination of adhesion using peel test

The 180° adhesive peel strength for all test specimens shall be determined in accordance with EN ISO 8510-2 using a 25 mm wide strip and 300 mm / minute peel rate. The results shall be given as the force in Newtons for the 25 mm wide strip, i.e. in N / 25 mm.

Average the values obtained for the three reference specimens; similarly average the values obtained for the three test specimens. The results shall be given as force in Newtons for the 25 mm wide strip, i.e. in N / 25 mm.

6.2.9 Assessment of results

Visual: Record the number and extent of the faults occurring in the filmed glass (peeling, bubbling, delaminating or discolouring) for each test specimen. Disregard all faults within 15 mm of an original edge or 10 mm from any crack in the glass.

Adhesion: compare the average values of reference and test specimens.

6.2.10 Acceptance criteria

Visual: no peeling, bubbling or delaminating is allowed on the surface of the test specimens. No discolouring is allowed when comparing the test and reference specimens.

Adhesion: the average peel adhesion for the test specimens shall be not less than 75 % of that for the reference specimens.

6.2.11 Test report

The test report shall include the following information:

— The name and address of the test laboratory;

— Reference to this European Standard;

— Identification of the adhesive backed polymeric film (film reference and classification in accordance with EN 15752-1);

— Identification of the glass substrate (type and thickness);

— The number of test and reference specimens used in the test;

— The date of installation of the adhesive backed polymeric film to the glass substrate;

— The test date;

— All test results for all test specimens from the visual inspection;

— All test results for all test specimens from the adhesion test;

— Comments (if any).

Deviations from the requirements of this standard and / or deviations from EN ISO 8510-2 are not permitted.

7 Appearance

7.1 General

The appearance of adhesive backed polymeric filmed glass is affected by defects that are:

— specific to the glass substrate (see appropriate standard as given in Clause 4);

— specific to the adhesive backed polymeric film;

— specific to the installation process.

If a defect specific to the glass substrate is more visible because of the adhesive backed polymeric film, it shall be treated as an adhesive backed polymeric filmed glass defect.

7.2 Detection of defects

7.2.1 General

The defects are detected visually by an observation of the adhesive backed polymeric filmed glass in transmission and/or reflection. An artificial sky or daylight may be used as the source of illumination. Inspection is to be made only on fully cured specimens.

7.2.2 Artificial sky

The artificial sky is a plane emitting diffuse light with a uniform brightness and a general colouring index R_a calculated following CIE 13.3:1995 guide with a value higher than 70. It is obtained by using a light source whose correlated colour temperature is in the range between 4 000 K and 6 000 K. In front of the arrangement of light sources is a light scattering panel, which is without spectral selectivity. The illuminance level on the glass surface shall be between 400 lx and 20 000 lx.

7.2.3 Daylight illumination

Daylight illumination is a uniform overcast sky, without direct sunlight.

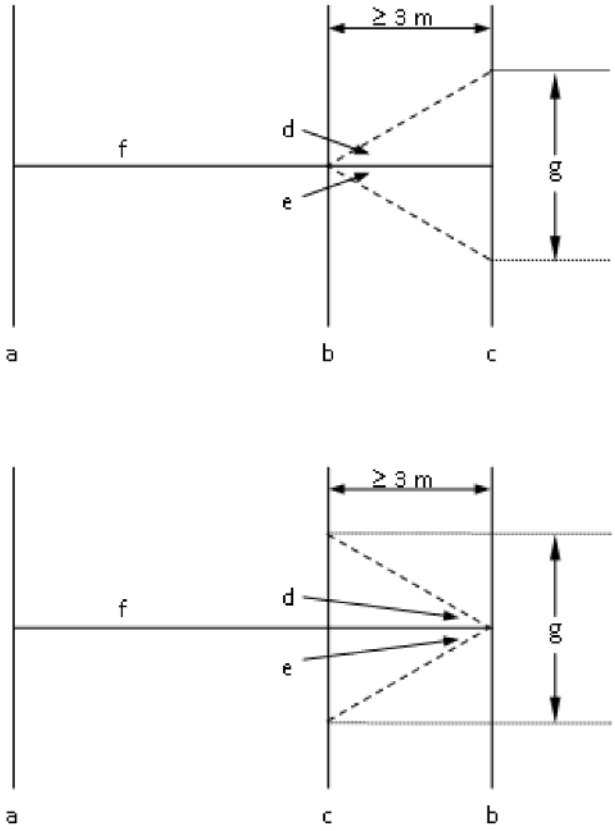
7.3 Conditions of examination

7.3.1 General

Adhesive backed polymeric filmed glass may be examined in stock size plates or in finished sizes ready for installation. The examination may be undertaken in the factory or on site when glazed. The examination shall be made after the adhesive backed polymeric film has cured according to the manufacturer's guidelines.

The pane of adhesive backed polymeric filmed glass being examined shall be viewed from a minimum distance of 3 m. The examination of the adhesive backed polymeric filmed glass in reflection shall be performed by the observer looking at the side that will be the outside of the glazing. The examination of the adhesive backed polymeric filmed glass in transmission is performed by the observer looking at the side that will be the inside of the glazing. During the examination the angle between the normal to the surface of the adhesive backed polymeric filmed glass and the light beam proceeding to the eyes of the observer after reflection or transmission by the adhesive backed polymeric filmed glass shall not exceed 30° (Figure 1).

For panes of adhesive backed polymeric filmed glass in finished sizes ready to be installed both the main area and an edge area of the pane shall be examined (Figure 2). Each examination will take ≤ 20 s.

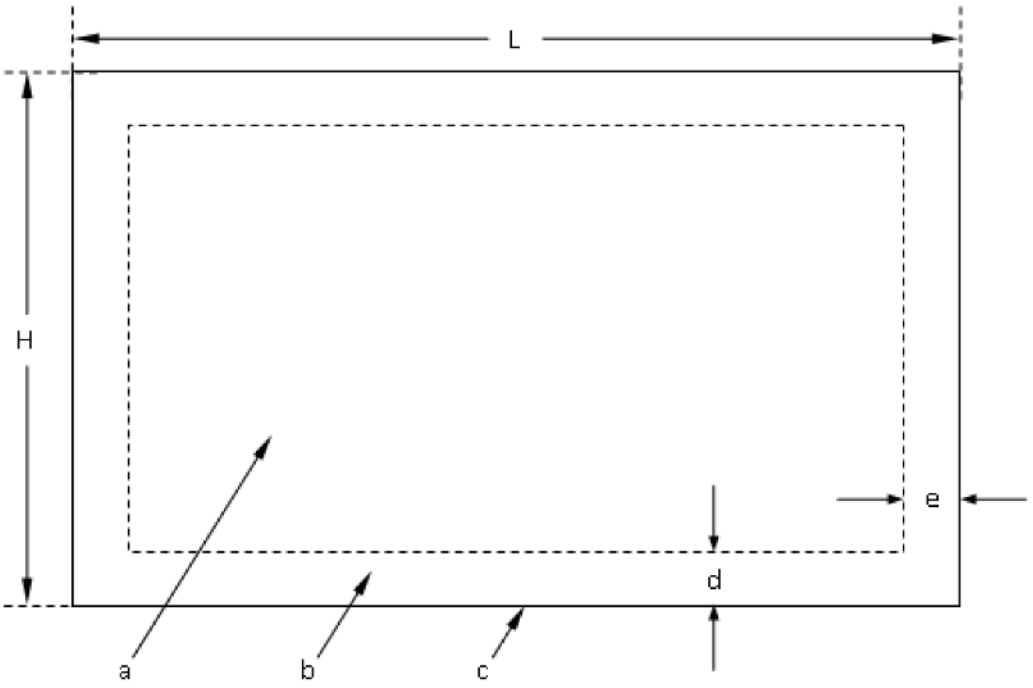


Key

Figure 1a	Transmission
Figure 1b	Reflection
a	illumination source
b	filmed glass sample
c	observer position along line c
d	30°
e	30°
f	centre line
g	limits of observer position

NOTE This system of observation is similar to that used for coated glass.

Figure 1 - Schematic diagram of examination procedure for adhesive backed polymeric filmed glass



Key

a main area

b edge area

c sight line of glazing

d 5 % of H, minimum 20 mm

e 5 % of L, minimum 20 mm

Figure 2 - Areas to be examined on filmed glass

7.3.2 Glass substrate defects

When examined under the conditions given in 7.3.1 any defects as defined in the European Standard for the given substrate shall not be taken into account.

7.3.3 Adhesive backed polymeric film defects

Under the conditions of examination given in 7.3.1 note the following defects:

7.3.3.1 Gels

Note and measure the number of gels relative to the size of the pane. If any clusters are found their position relative to the main area (Figure 2) shall be determined.

7.3.3.2 Distortion

Note any variations that are visually disturbing.

7.3.3.3 Distortion lines

Note any distortion lines that are visually disturbing. Determine whether or not they are in the main area (Figure 2) and measure their length.

7.3.3.4 Non-uniform colour appearance

Note any non-uniform colour appearance that is visually disturbing.

NOTE Slight colour differences may exist when joining two or more pieces of film on a large pane of glass. This is not a defect. The effect can be eliminated in most cases by using the same edge of the film at the join.

7.3.3.5 Haze

Note any areas of haze; this examination shall be after the period of time required for cure as defined in the manufacturer's instructions.

7.3.3.6 Spots

Note and measure any spots that are visually disturbing.

7.3.3.7 Scratches

Note and measure any scratches that are visually disturbing.

7.3.3.8 Pinholes

Note and measure any pinholes that are visually disturbing.

7.3.3.9 Delamination

Note any separation of the layers in the adhesive backed polymeric film.

7.3.3.10 Iridescence

Iridescence, a consequence of film construction, is not a defect.

7.3.3.11 Demetallisation

Note any demetallisation present.

7.3.3.12 Surface impressions

Note any surface impressions that are visually disturbing.

7.3.3.13 Scratch or abrasion resistant coating failure

Note any separation of the surface scratch or abrasion resistant coating from the body of the film.

7.3.4 Adhesive backed polymeric film installation defects

7.3.4.1 General

NOTE Examination for installation defects is normally made after the period of time required for cure as defined in the manufacturer's instructions. In some circumstances, the defect may be obvious prior to full cure.

In order to ensure correct cure, adhesive backed polymeric film applied to glass substrates using wet lamination techniques shall be stored and positioned correctly. In particular, the adhesive backed polymeric filmed glass shall not be enclosed or shielded by any structure that could prevent water evaporating away from the film or prevent correct cure; adequate ventilation and temperature shall be maintained. Where adhesive backed polymeric filmed glass is positioned as part of the external glazing of a building, the windows

shall have a direct, open and permanent view to the sky without external or mid-pane blinds shielding the film during the curing period. Condensation shall not collect on the surface or around the edges of the film.

7.3.4.2 Air bubbles

Note any air bubbles that are present.

7.3.4.3 Water bubbles

Note any water bubbles that are present after the defined cure period.

NOTE In some circumstances, such as cold weather, cure time may be prolonged and water bubbles may persist for longer than normally expected; this is not a defect.

7.3.4.4 Particulate contamination

Note and measure any particulates that are visually disturbing. If any clusters are found, their position relative to the main area (see Figure 2) shall be determined.

7.3.4.5 Haze

Note any areas of haze; this examination shall be after the period of time required for cure as defined in as defined in the manufacturer's instructions.

7.3.4.6 Scratches

Note and measure any scratches that are visually disturbing.

7.3.4.7 Peeling

Note any separation of the adhesive backed polymeric film from the glass substrate.

7.3.4.8 Creasing

Note any creases present.

7.3.4.9 Edge defects

Note any edge defects that are present.

7.4 Acceptance criteria for adhesive backed polymeric filmed glass defects

The acceptance criteria for defects in adhesive backed polymeric filmed glass, as defined in Clause 3, and examined in accordance with 7.3 are given in Table 1.

Table 1 - Acceptance criteria for defects in adhesive backed polymeric filmed glass

Defect type	Acceptance criteria				
Point defects					
Gels, particulates and pinholes					
Size of defect, d, in mm	≤ 1,0	1,0 < d ≤ 3,0			
Size of pane area, A, in m^2	For all sizes	A ≤ 1	1 < A ≤ 2	2 < A ≤ 8	A > 8
Number of permissible defects	No limit, however no accumulation of defects allowed	1	2	1 / m^2	1,2 / m^2
Spots, gels, particulates and pinholes ≥ 3,0 mm are not permitted					
Other defects					
Glass substrate defects					
Glass substrate	According to the appropriate product standard				
Adhesive backed polymeric film defects					
	Main Area	Edge Area			
Distortion	Allowed if not visually disturbing	Allowed if not visually disturbing			
Distortion lines	Not allowed	Not allowed			
Non-uniform colour appearance	Not allowed	Not allowed			
Surface scratches on filmed side, > 25 mm	Not allowed	Allowed but local density shall not be visually disturbing			
Surface scratches on filmed side, ≤ 25 mm	Not allowed	Allowed but local density shall not be visually disturbing			
Delamination	Not allowed	Not allowed			
Iridescence	Allowed	Allowed			
Demetallisation	Not allowed	Not allowed			
Surface impressions	Allowed if not visually disturbing	Allowed if not visually disturbing			
Scratch or abrasion resistant coating failure	Not allowed	Not allowed			
Installation defects					
Air bubbles	Not allowed	Not allowed			
Water bubbles (after cure period)	Not allowed	Not allowed			
Haze (after cure period)	Allowed if not visually disturbing	Allowed if not visually disturbing			
Surface scratches on film side, > 25 mm	Not allowed	Allowed but local density shall not be visually disturbing			
Surface scratches on film side, ≤ 25 mm	Not allowed	Allowed but local density shall not be visually disturbing			
Peeling	Not allowed	Not allowed			
Creasing	Not allowed	Not allowed			

Edge defects	Not allowed	Not allowed
NOTE: For adhesive backed polymeric films that are not scratch resistant, as demonstrated by 7.4 of EN 15752-1:2014, the acceptance criteria for scratches do not apply to these films.		
Examination shall be made after the adhesive backed polymeric film has cured according to the manufacturer's guidelines.		

8 Product information

8.1 General

The manufacturer of the adhesive backed polymeric film shall supply information on the properties of the adhesive backed polymeric filmed glass and appropriate instructions on installation, care and cleaning of the adhesive backed polymeric film.

Annex A
(informative)

Guidelines for installation of adhesive backed polymeric film

A.1 General

The following is a general guide to installation of adhesive backed polymeric film; special techniques exist for the installation of specific films such as thick safety/security films and external films. If there is any doubt about any part of correct installation procedure the adhesive backed polymeric film manufacturer should be consulted for guidance. Specialist films often require special installation methods; it is recommended that the installer always verify correct installation procedures for any specialist or premium adhesive backed polymeric film product prior to installation.

NOTE These guidelines are not intended to cover all possible installation situations.

A.2 Wet lamination

A.2.1 General

Wet lamination is often carried out on site with existing glazing. This standard therefore includes on-site lamination of adhesive backed polymeric film to existing glazing.

A.2.2 General Points

Ensure the film to be installed is the correct type, as specified on the worksheet.

Ensure that a full set of clean and well-maintained installation equipment is available and are as recommended by the adhesive backed polymeric film manufacturer.

Clear waste, etc. safely away as soon as it is made, especially parts of knife blades.

It is preferable to work in good daylight conditions but not in direct sunlight.

Installation should not be carried out when the temperature of the glass surface could cause the installation solution to freeze.

Pre-cutting the film to approximate size may be appropriate depending upon the project; pre-cut film shall be stored and handled correctly to avoid damage.

Externally applied film may be edge sealed with a suitable material such as neutral cure, high adhesion, external grade silicone.

A.2.3 Installation

A.2.3.1 Prepare for the installation

1) Normally, the film's machine edge (or a suitable straight cut edge) is used to match the film edge to the visible top edge of the glazing as in Figure A.1, with a maximum of three edges to trim. It is preferable to trim only one (the bottom) or two (bottom and one side) edges. The excess film to be trimmed should be

between 10 mm and 15 mm. Safety films ≥ 200 microns are normally pre-cut to exactly fit the size and shape of the visible glazing area, with a small edge gap.

2) Prepare solutions of glass cleaning and installation concentrates according to the adhesive backed polymeric film manufacturer's recommendations.

3) Unless the film has been pre-cut, prepare the correct size and shape of film for installation allowing sufficient film for trimming where needed.

4) Check and ensure that all necessary health and safety requirements are complied with.

5) Wipe any dust, dirt, cobwebs, etc. from the glazing, frame and gaskets using a soft brush.

A.2.3.2 Clean the glazing

6) Spray the glazing surface with the cleaning solution and wipe the gaskets thoroughly with lint free absorbent wipe.

7) If the glazing has silicone sealant around the perimeter, or the gaskets are degraded, or there is reason to suspect non-visible glass contamination, the glass surface – especially the perimeter area – shall be thoroughly cleaned to avoid lifting or peeling of the film from the glass surface.

8) Spray the glass surface and gaskets with the cleaning solution. Check that blade scraping will not damage the glass and, if acceptable, blade scrape the glass surface thoroughly using a suitable glass scraper; if glass damage is possible then do not blade scrape but scrub the glass surface twice, using a non-scratching pad. Take care to avoid damaging the frame, gaskets, etc. with sharp blades. Wipe the gaskets thoroughly with lint free absorbent wipe.

9) Re-spray the glazing with the cleaning solution working from top to bottom.

10) Ensure all gaskets are thoroughly free of moisture by using the lint free absorbent wipe. Dry all surrounding frames, paying special attention to the top edge to make sure no water drips onto or down the glass surface. Ensure that no fibres from the wipe are left behind on the gasket, glass, frame, etc.

11) Squeegee the window dry using a suitable window cleaner's type squeegee - work from top to bottom of the window. The first squeegee action shall be parallel to and along the top edge, drying the top gasket and frame with lint free absorbent wipe at the same time. Angle the squeegee so that water flows downwards. If the squeegee is removed from the glass surface, dry the blade before placing it on the glass again.

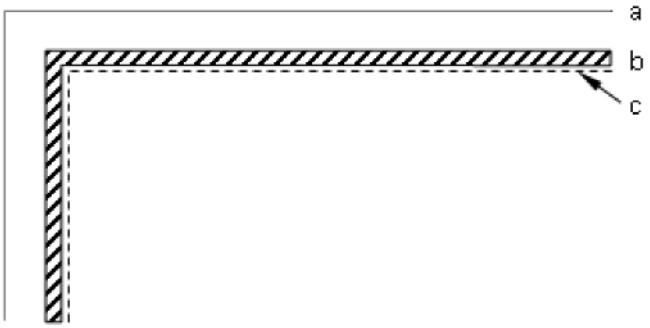
12) Immediately re-spray the glass surface using a fine spray of installation solution sufficient to cover the whole glass surface without the water running down the glazing. If the glazing is in direct sunlight it may be necessary to use more concentrate in the solution and/or use more solution on the glass surface. Do not get water in the gaskets, especially the top edge. It is essential that the glass surface does not become dry – high levels of contamination can result.

It is recommended that where possible the installer should avoid installing the adhesive backed polymeric film in direct sunlight. This will create easier working conditions for the installer and help to avoid drying out of the glass surface during adhesive backed polymeric film installation.

A.2.3.3 Install the adhesive backed polymeric film to the glazing

13) Spray both sides of the film with the installation solution and remove the release liner, spraying the adhesive during this removal. Before touching the adhesive, spray your fingers so that finger marks are not left on the film. Keep the film taut to avoid damaging the film.

14) If needed to keep the glass surface wet, gently re-spray with installation solution. Keeping the adhesive backed polymeric film taut, lift it up to the correct height to match the sight line at the top edge of the glazing. Slowly bring the film (adhesive side) to the glazing, matching the top and other edges that are not being trimmed. Position it by sliding into place – only a slight adjustment should be needed – with an edge gap of approximately 0.5 mm (slightly larger gap may be needed for uneven frame margins). The film shall not touch the gaskets, frame components, etc. See Figure A.1. When applied to structural glazing, the film shall not come into contact with the structural seal.



Key

a edge of glazing hidden in frame rebate

b gasket

c edge of adhesive backed polymeric film

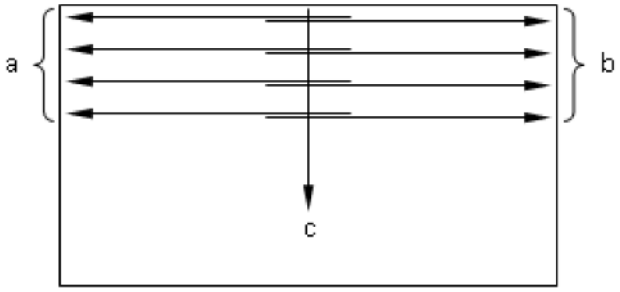
Figure A.1 - Diagram of gap between edge of adhesive backed polymeric film and sight line of glazing

A.2.3.4 Squeegee the film – first procedure

15) Spray the film surface with a fine spray of installation solution.

16) Use a heavy duty squeegee for all films thicker than 50 microns and a softer squeegee for all other films for the first squeegee process; angle the blade so that water flows down the window. Always push the blade rather than pull it across the film / glass surface for all squeegee operations used to remove water from behind the film. Squeegee pressure should be as high as possible without causing personal injury, and without damaging the glazing and / or frame and / or film.

17) Holding the film on the glazing, place the squeegee at the top edge of the film (Figure A.2) and firmly squeegee the film parallel to the top edge. Work down the window for about a metre keeping the squeegee parallel to the top edge. Keep about 20 mm away from edges wherever there is excess film to trim off.



Key

a squeegee first

b squeegee second

c optional squeegee

Work from top to bottom of the glazing

Figure A.2 - Beginning the squeegee process

18) Work to the bottom of the pane, squeegeeing out to each side alternately, keeping about 20 mm from the excess film, and overlapping the squeegee strokes by half the width of the blade. The squeegee blade should be angled so that residual water flows downwards.

NOTE This process will need to be adapted according to window shape and size; the aim is to move water out to the sides and/or down so that the water travels the shortest distance during the squeegee process.

A.2.3.5 Trim the film

19) Using a sharp stainless steel blade and a suitable trim guide, trim the film. Where a vertical edge needs trimming, start from the top. Always trim away from corners to avoid scratching the glass surface. Change the blade regularly. The edge gap should be approximately 0.5 mm without the film touching the gaskets, frame margins, etc.

A.2.3.6 Finish the squeegee process – second procedure

20) Lightly spray the 20 mm border and squeegee around the edge of the film pushing towards but not into the gaskets. Use the same squeegee as described above.

21) Dry the gaskets carefully with lint free absorbent wipe.

22) Re-squeegee the film firmly using a heavy duty squeegee with exactly the same technique and pattern as above. This step should normally be repeated for sputtered films and safety / security films.

23) Using a suitable hard card type squeegee and lint free absorbent wipe thoroughly squeegee around all four edges of the panel. This means wrapping the hard card squeegee in four thicknesses of the lint free absorbent wipe and firmly squeegeeing the 100-150 mm perimeter of the film.

A.2.3.7 Housekeeping

24) Clear away all waste including trimmed film pieces and release liner. Take particular care to clear away any blades or parts of blades.

A.2.3.8 Safety films ≥ 200µ

25) For safety films ≥ 200µ total nominal thickness it is necessary to use the following method.

25.1) Use a heavy duty squeegee and good pressure during squeegeeing. Overlap each squeegee stroke by 2/3 (only 1/3 of the squeegee blade squeegeeing a new area of film) so that each section of film has more squeegee treatment. Ensure the blade is angled so that water flows downwards.

25.2) Use sufficient pressure to squeegee the whole film, overlapping the squeegee strokes by at least half the width of the squeegee blade. Ensure the blade is angled to remove water from between the film and the glass, as described above. Repeat twice.

25.3) Check the installation and re-squeegee as in 25.1 and 25.2 if any water bubbles still remain.

25.4) For safety/security films ≥ 200µ the first squeegee process, using a heavy duty squeegee, shall be done with sufficient pressure on the squeegee and as quickly as possible (taking into account health and safety to avoid personal injury and / or glazing damage and / or frame damage and / or film damage). The film shall be thoroughly squeegeed at least twice more and may need squeegeeing with a hard card wrapped in four thicknesses of lint free absorbent wipe to squeegee the whole area of the installed film.

25.5) Films ≥ 200 microns thick usually need to be cut to exact shape and size rather that to approximate size – consult the adhesive backed polymeric film manufacturer.

25.6) Carry out all other steps as in the sections above, particularly ensuring good bonding of the adhesive around the perimeter of the window.

A.3 Dry installation

Dry installation can only be done for adhesive backed polymeric film that uses pressure sensitive adhesives. It is carried out using specialist equipment consisting of the minimum following elements:

1. Cleaning facility for the glass sheets.

2. Roller to carry bulk rolls of adhesive backed polymeric film.

3. Roller to carry used release liner (the wind-up roller).

4. Roller system to feed the adhesive backed polymeric film through the machine to the point where the film meets the glass sheet.

5. Roller system to remove the release liner from the adhesive backed polymeric film and to carry it to the wind-up roller.

6. Horizontal (or otherwise) roller system to feed sheets of flat glass to the point where the sheets meet the adhesive backed polymeric film.

7. Rollers to firmly press the adhesive side of the adhesive backed polymeric film onto the glass sheet. These rollers may be heated to facilitate faster bonding of the adhesive backed polymeric film to the glass.

8. Knives to cut the adhesive backed polymeric film at the edges of the glass sheet.

9. Stacking and storage system for finished adhesive backed polymeric filmed glass sheets.

Adhesive backed polymeric filmed glass shall be handled with care to avoid damage to the film. Lifting devices such as suction pads should be used on the non-treated side of the filmed glass sheet.

Annex B
(informative)

Film to glass compatibility and thermal stress

Thermal stress in glass depends upon several factors, including glass type, glass quality, especially edge quality, and environmental conditions. Edge quality is one of the most important factors and is the primary cause of many thermal stress failures of glass panes.

Tints in the glass and metal or other glass coatings will increase the absorption of solar energy by the glazing system, and hence the thermal stress placed on the glass. Adhesive backed polymeric film can also introduce tints to the glazing as well as metal or other coatings; these tints and coatings will also increase the absorption of solar energy by the glazing system, and hence the thermal stress.

However, the majority of adhesive backed polymeric films will have no effect whatsoever on the existing glass product. Glass types where adhesive backed polymeric film will not cause a breakage risk include heat strengthened glass, thermally toughened safety glass, heat soaked thermally toughened safety glass, laminated glass/laminated safety glass manufactured from ‘thermally treated glass, ‘frameless’ glazing, i.e. bolt fixed thermally treated glass or structural sealant glazing, and glass products made from such components.

Only annealed glass has any significant risk of thermal stress breakage; this risk is low but not zero without application of adhesive backed polymeric film. Application of adhesive backed polymeric film to annealed glass, done in accordance with manufacturers’ thermal stress compatibility guidelines, ensures that this risk remains low for glass complying with relevant standards and in good undamaged condition.

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