



CROSSLEY
CONSULT

Glazing Inspection Project Stardust, Deansgate, Manchester

Assessment of installed glass and proposed film
calculations

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Introduction

Crossley Consult Limited (CCL) were instructed by ISG Group to assess the glass specifications and solar, optical, thermal performance values used at this building for a range of glass types. Solar heat gain has been the main focus in the recent history of occupation and is driving the film proposals discussed in this report. The inspection was undertaken on 23 November 2022. CCL are a glass consultancy specialising in glazing for commercial and residential applications. Richard Kells of CCL has over 35 years' experience examining glass, assessing glass faults and undertaking calculations, see appendix 1.

1 As built glass specification

The upper floors were constructed to provide office accommodation and incorporate the following insulating glass units in the vision areas which were manufactured in 2002.

Outer pane 8mm clear float glass, Planilux by Saint Gobain in annealed form.

Cavity 16mm

Inner pane 8.8mm annealed laminated low emissivity glass, Planitherm Futur N, by Saint Gobain.

The measurements obtained during this inspection were consistent with the expected product performance of this glass type.

Whilst some areas of the South elevation on levels 7 & 8 have an additional inner secondary glazed pane and captured blind, the basic optical performance of this specification is still being provided as follows:

Light transmittance	75%
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Light reflectance	11%
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Total solar heat transmittance (g value)	58%
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For comparison purposes later in this report the long wavelength shading coefficient for this specification has been calculated as 0.17.

CCL can confirm that with such an extensive glazed area and low performance glass type overheating of the office space is extremely likely and it is not surprising to hear elevated temperatures are possible during full sun conditions.

2 First remedial film application

An internal (unknown source) dark film has been applied to the inner glass pane along levels 7 & 8 in an attempt to mitigate the solar gains in this area. CCL used a SpectrILight 3 spectrophotometer to

obtain values of colour, transmitted and reflected light for the units installed, which can be compared with the data of the as built specification, as follows:

	As built	With internal film
Light transmittance	75%	36%
Light reflectance	11%	10%
Total solar heat transmittance (g value)	58%	52%
Long wavelength shading coefficient	0.17	0.42

The importance of the long wavelength shading coefficient figure is significant for building service engineers. The increase following application of the internal film shows that it is simply heating up the inner glass and re-radiating energy, at a longer wavelength, into the office space. Planitherm Futur N is designed to reflect long wavelength infra-red, which is further compounding the problem of overall heat gain. In converting the shorter wavelengths of a typical solar spectrum the film and coating combination is providing a potentially worse situation than that experienced on other levels of the building.

During this inspection CCL noted the increased temperature of the inner pane experienced in the low sunshine conditions typical in November. The main conclusion from these measurements confirms the inner film must be removed prior to any occupation.

3 Film options ground floor

Two film types were inspected and measured on the ground floor of the building. Both films have been applied to the retail area glazing which comprises 16.8mm clear annealed laminate.

As the specification of glass is different to that along levels 7 & 8, CCL have calculated the performance of the films in isolation and reapplied them to the original glass type.

Solar performance and thermal fracture risk has been assessed for both films applied to surface 1 (external) of the South elevation glazing along level 7 & 8, as follows:

	As built	RHE 20 SI	N1020
Light transmittance	75%	13%	17%
Light reflectance	11%	62%	30%
Total solar heat transmittance (g value)	58%	10%	15%
Long wavelength shading coefficient	0.17	0.04	0.05

Whilst both films improve the solar performance of the original glass, only the more reflective RHE 20 SI film should be considered. The overall solar heat absorbed by the RHE 20 SI film is 33% which compares with the much less reflective N1020 film, which absorbs 63% of the sun's heat.

Thermal fracture risk calculations indicate the following maximum temperature differences.

Position	Film specification	Outer pane (K)	Inner pane (K)	Result
South	RHE 20 SI	19.0	15.7	Thermally Safe
South	N1020	40.3	22.3	Outer Pane At risk

CCL recommend building owners consider a maximum temperature difference of 40 K for this glass type. Once the expected temperature difference increases beyond 40 K there is a significant commercially unacceptable risk of glass fractures. CCL noted that some breakages have already been experienced within the inner panes.

The above calculations are based upon the installed glass having good quality edges. Those applying the film to the existing glazing should inspect the glass edges prior to film application and replace any units with significant damage.

4 Conclusions and discussion

1. The original glass installed along the South elevation of levels 7 & 8 has been confirmed by measurement and inspection. This is 8mm clear annealed outer, 16mm cavity, 8.8mm laminated Planitherm Futur N.
2. The internal film applied significantly increases the long wave shading coefficient, which explains the excessive overheating of the internal office space.
3. When comparing the two options for solar control film, only the RHE 20 SI film should be considered due to the thermal fracture risk presented with the N 1020 type.
4. The existing internal film must be replaced prior to occupation..

5 References

EN 410 Glass in building. Determination of luminous and solar characteristics of glazing.

EN 673 Glass in building. Determination of thermal transmittance (U value). Calculation method.

Code of Practice for in-situ Measurement and Evaluation of the Colour of Coated Glass

used in Façades, Glass for Europe

Glass and thermal safety, Pilkington, Jan 1980

Vitrages Decision, VD 5.25.5

End of Report

Appendix 1: Richard Kells CV

My primary areas of expertise are glass strength, when glass is being designed to resist mechanical stresses and methods of fixing glass to achieve the required performance. I have an in depth knowledge and recognised expert with the solar/optical/thermal performance of most glass types and the sorts of visual and performance faults that glass may develop in service.

The activities which I am involved in are:

1. Design of small, complex, glass structures which are outside the range of applications of glass covered by available National Standards.
2. Design advice on types and thickness of glass appropriate for specific purposes and on suitable methods of fixing glass.
3. Calculations to support the above.
4. Investigation of problems arising with glass in use, including structural, visual and fracture investigations. Recommendations for remedial or consequential actions can be provided.

BRIEF RESUME

Qualifications: BSc Applied Physics (1989/91)

1984-1998 Pilkington Research and Development. Technologist, providing expertise on glass annealing and cutting for production of flat glass.

1998-2004 Pilkington Technical Advisory Service. Senior Technical Advisor, providing all types of glass performance calculations and advice for customers, architects and consulting engineers.

2004-2010 Hansen Glass Processing Ltd. Technical Manager, responsible for small team providing technical support and quality control.

2010-2016 RK Glass Consultant Ltd.

2016-2019 GGF. Technical Officer.

2019-date Crossley Consult Ltd.