Test Report

BSI Product Services

Report No.	262/4944838 — This report consists of 7 pages
Client	Greaney Glass Products Ltd Carnmore Oranmore Galway Ireland
Authority & date	Quotation Acceptance Form reference No. BSI 0000058301, dated 3 July 2006. Equipment Record No. 10080539.
Items tested	6 off Insulating glass units Cavity gas - Argon Desiccant - Molecular seive - Grace Phonosorb 551 Primary sealant - PIB - Kommerling GD115 Secondary sealant - Polysulphide - Fenzi Thiover Spacer bar - Aluminium bendable - Alu.Pro. System description - GGP325 Date of manufacture - Before 15 February 2007
Specification	BS EN 1279-3:2002 Direct commission testing
Results	**See summary of results on page 2**
Prepared by	B Bustin (Senior Technician Engineer)
Authorized by	G Wackett (Senior Engineer)
Issue Date	20 June 2007
Conditions of issue	This Test Report is issued subject to the conditions stated in current issue of PS082 'General conditions relating to acceptance of testing'. The results contained herein apply only to the particular sample/s tested and to the specific tests carried out, as detailed in this Test Report. The issuing of this Test Report does not indicate any measure of Approval, Certification, Supervision, Control or Surveillance by BSI of any product. No extract, abridgement or abstraction from a Test Report may be published or used to advertise a product without the written consent of the Managing Director, BSI Product Services, who reserves the absolute right to agree or reject all or any of the details of any items or publicity for which consent may be sought.

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TEST AND EXAMINATION OF INSULATING GLASS UNITS TO BS EN 1279-3:2002

INTRODUCTION

At the request of Greaney Glass Products Ltd the insulating glass units (IGU's) detailed below were tested and assessed to the applicable requirements of BS EN 1279-3:2002, as indicated on the following pages of this report.
This request was authorised by Quotation Acceptance Form reference no. BSI 0000058301, dated 3 July 2006.

The test items were received on 15 February 2007 and identified under Equipment Record No. 10080539. The relevant units were subjected to the climatic test commencing on 16 March 2007.

TEST ITEMS

6 off insulating glass units each nominally 502mm x 352mm with a 13mm cavity between the two panes of 4mm glass. The components used in the construction were declared by the manufacturer as follows: -

Cavity gas -	Argon
Declared concentration -	90%
Temperature and pressure at which the IGU's were sealed -	11°C and 987mbar
Primary sealant -	PIB - Kommerling GD115
Secondary sealant -	Polysulphide - Fenzi Thiover
Desiccant -	Molecular seive - Grace Phonosorb 551
Spacer bar -	Aluminium bendable - Alu.Pro.
Corner keys -	Not applicable connector - Eduard Kronenberg
System description -	GGP325
Date of manufacture -	Before 15 February 2007

SUMMARY OF RESULTS

The insulating glass units subject to test exhibited the following characteristics:

Characteristic	IGU reference		Specified
	A	B	
Declared concentration $c_{i,o}$ (%):	90.00	90.00	-
Measured concentration c_i (%):	93.80	94.80	-5%, +10% of $c_{i,o}$
Gas leakage rate L_i (%a^{-1}):	0.41	0.56	1.00 Max

TEST PROCEDURE

Conditioning and dimensional measurement

The IGU's were received at BSI and stored in standard laboratory conditions of (23 ± 2)°C and (50 ± 5)% relative humidity for a period of not less than 14 days. The variation in temperature and relative humidity did not fall outside these parameters for the 14 day conditioning period. During this period the IGU's were randomly idetified as A through F, and the length and width of each unit was then measured. The results are shown below: -

IGU	Length (mm)	Width (mm)
A	501	352
B	502	352
C	501	351
D	502	352
E	501	352
F	502	352
Specified	(502 ± 2)mm	(352 ± 2)mm

Construction and appearance

Upon completion of the conditioning period two IGU's were visually examined for the following criteria and/or defects: -

Observation	IGU A	IGU B
General construction	Satisfactory	Satisfactory
Edge damage and cracks	None	None
Fractures	None	None
Specking in the cavity	None	None
Congruence of panes	Satisfactory	Satisfactory
Other visable defects	None	None

Determination of the internal cavity volume

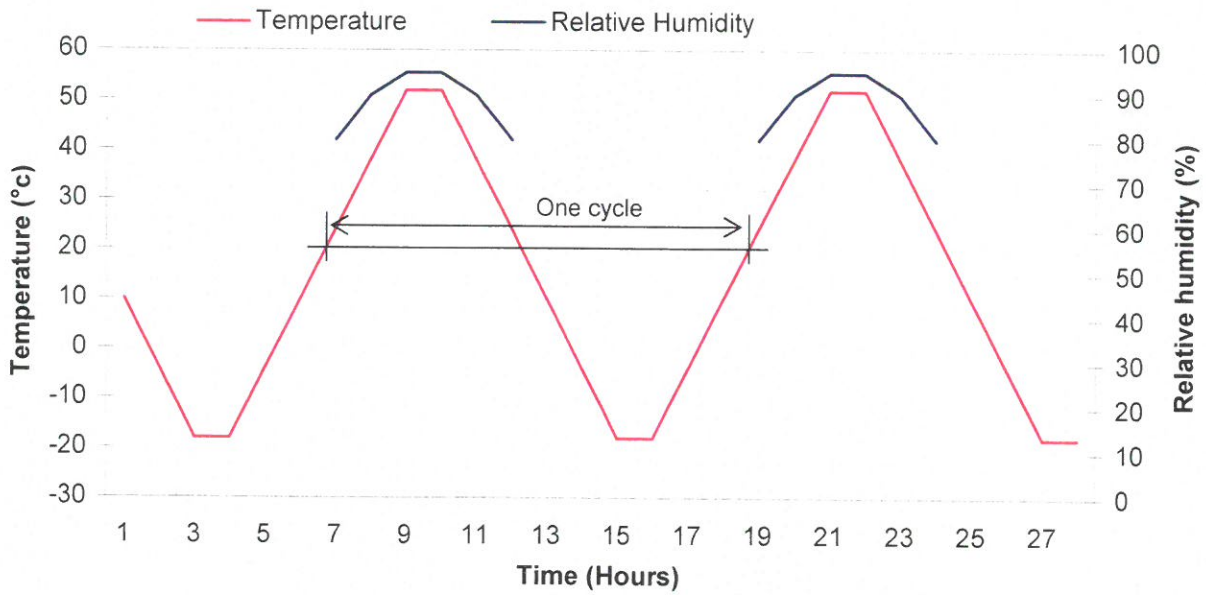
The two IGU's intended for test were measured to establish the internal volume. The clear distance between opposite spacers and the clear distance between the inner surfaces of the panes were measured and recorded.

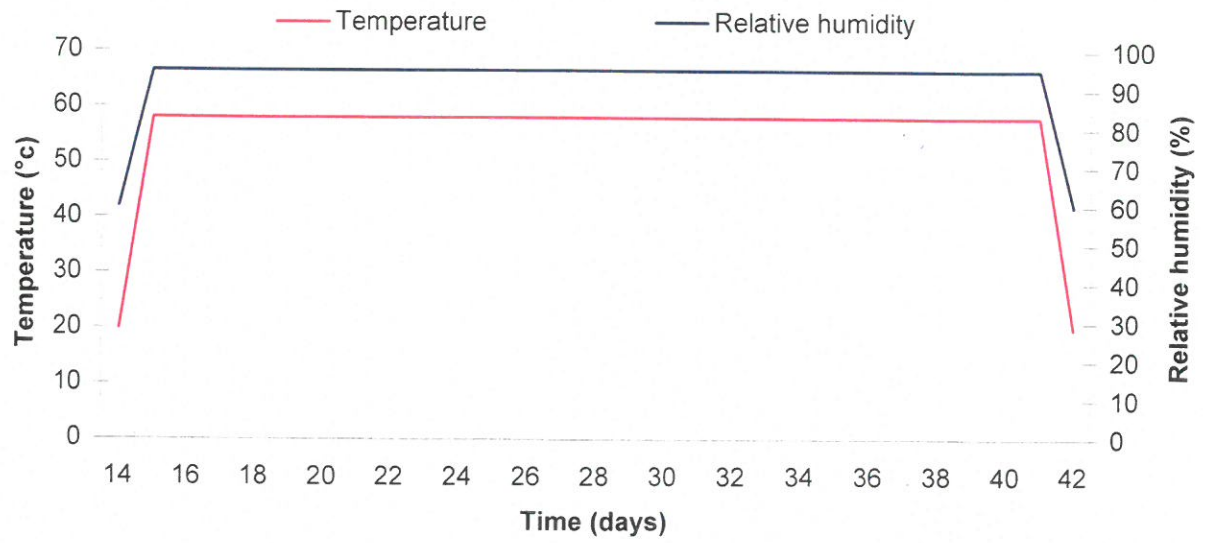
Dimensions (mm)	IGU A	IGU B
Internal cavity length	480	479
Internal cavity width	331	329
Internal cavity thickness (1)	12.7	12.6
Internal cavity thickness (2)	12.6	12.6
Internal cavity thickness (3)	12.9	12.8
Internal cavity thickness (4)	12.6	12.8
Average internal cavity thickness	12.70	12.70
Calculated internal cavity volume (cm^3)	2018	2001

TEST PROCEDURE (continued)

Climatic test

The two IGU's intended for test and two others were placed in a climatic test chamber. The remaining IGU's were stored in standard laboratory conditions as spare samples.
The climatic test consisted of two parts. The first consisted of 28 temperature cycles each of 12 hours with the temperature ranging from -18°C to +53°C and a temperature gradient of 14°C per hour. This was followed by a period of four weeks at constant temperature of +58°C. The relative humidity was maintained at 95% or greater for the whole of the second part and for the upper temperatures of the first part.
During this test the conditions within the chamber did not fall outside the parameters detailed in the standard.
The graphs shown below detail the two parts of this climatic test.





TEST PROCEDURE (continued)

Upon completion of the climatic test the 4 IGU's were again conditioned at standard laboratory conditions of (23 ± 2)°C and (50 ± 5)% relative humidity for a minimum of 28 days and a maximum of 49 days before commencing the gas leakage test.

Gas Leakage test

IGU A and B were subjected to the gas leakage test in accordance with the requirements of the standard using a full container.

The principal of the test is that the container creates a chamber around the edge of the IGU in which the air can be replaced with Helium. A steady flow of Helium is passed through the container, for several days, until all the air has been purged. The container is then isolated from the Helium supply. Throughout this test the container (and thus the IGU) are maintained at a temperature of (20 ± 1)°C.

After an isolation period of at least 20 hours, Helium is again purged through the container and any gasses that have escaped from within the IGU cavity are collected and measured using a gas chromatograph. The isolation and measurement processes are repeated until the standard deviation of at least four successive measurements is less than 0.25 micrograms/hour and at least one result is higher than the result immediately preceding it.

Gas concentration test

Following the gas leakage test a sample of gas was taken directly from the cavity of each IGU and the level of Argon was establish as a percentage of the total gas sampled.

To collect the cavity gas the IGU was held in a special test rig that allowed a drill bit and pipe assembly to be sealed to the IGU's outer edge. A hole was made in the edge of the IGU with a drill bit and a sample of the cavity gas extracted from the IGU via the flutes of the drill.
The gas sample was then analysed using the gas chromatograph.

TEST RESULTS

Gas leakage Unit A

Measurement	Isolation period (hours:minutes)	Measured argon (µl)	Calculated argon (µg/h)	Standard deviation
1	22:37	41.10	2.91	-
2	117:00	143.00	2.00	-
3	23:06	26.80	1.90	-
4	23:05	22.40	1.58	0.50
5	22:52	21.10	1.50	0.21
6	23:20	20.20	1.41	0.18
7	21:05	18.50	1.43	0.07
8	-	-	-	-
9	-	-	-	-

	Actual	Specified
Declared concentration (%):	**90**	-
Measured gas concentration (%):	**93.8**	**- 5%, +10% of Declared**
Calculated gas leakage rate (% per annum):	**0.41**	**1.00 % per annum**

Gas leakage Unit B

Measurement	Isolation period (hours:minutes)	Measured argon (µl)	Calculated argon (µg/h)	Standard deviation
1	23:15	42.50	2.93	-
2	117:07	154.30	2.15	-
3	23:07	31.70	2.24	-
4	23:01	26.90	1.90	0.38
5	22:53	25.30	1.80	0.18
6	-	-	-	-
7	-	-	-	-
8	-	-	-	-
9	-	-	-	-

	Actual	Specified
Declared concentration (%):	**90**	-
Measured gas concentration (%):	**94.8**	**- 5%, +10% of Declared**
Calculated gas leakage rate (% per annum):	**0.56**	**1.00 % per annum**

Note: For each sample, the calculated gas leakage is based on the mean of the last four results.

Appendix A

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Summary of Report No. 262/4944838 **Date: 20 June 2007**

Insulating glass units
Measurement of gas leakage and gas concentration
according to BS EN 1279-3:2002
For details, see the test report

Company name: **Greaney Glass Products Ltd**
Address: **Carnmore**
Oranmore
Galway
Ireland

Plant name: **Greaney Glass Products Ltd**
Address: **Carnmore**
Oranmore
Co. Galway
Ireland

System description reference: GGP325
Product Name: Argon filled units
Test report for moisture penetration index : 262/4777061

Applied gas :	**Argon**	
Unit number :	**A**	**B**
Measured concentration c_i (%) :	**93.8**	**94.8**
Declared concentration $c_{i,o}$ (%) :	**90**	**90**
Gas leakage rate L_i (%a^{-1}) :	**0.41**	**0.56**

G Wackett
Senior Engineer