

Chiltern House Stocking Lane Hughenden Valley
High Wycombe Buckinghamshire HP14 4ND UK

t +44 (0) 1494 569800 f +44 (0) 1494 564895
e cif@chilternfire.co.uk w www.chilternfire.co.uk

CONFIDENTIAL

Test report: Chilt/G06058

Report on the testing of insulating glass units, in accordance with EN 1279-2: 2002, Glass in building – insulating glass units – Part 2: Long term test method and requirements for moisture penetration

Test For: DP Plastics Ltd
Unit 4, International Industrial Park
Manor way, New Road
Rainham, Essex
RM13 8RH

Date: May 2007

Page 1 of 13

Notified laboratory number 1314

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No. 1762

1 Introduction

15 insulating glass units (IGUs) were submitted by the client and tested to the relevant requirements of EN 1279-2 as detailed in the following pages of this report.

The IGUs were manufactured and supplied for test by the client and delivered during September 2006. The IGUs were marked MTG/F06058 by Chiltern Dynamics. After the minimum 14 day conditioning period, testing to EN 1279-2 was conducted from 26th October 2006 to 3rd April 2007.

2 Description of specimens

15 insulating glass units of identical specification were supplied by the client, each with nominal dimensions of 502mm x 352mm. The specimens had a 12mm nominal air gap between two panes of 4mm nominal glass.

2.1 Specification of specimens

The specification of the specimens as declared by the customer (and verified where possible by Chiltern Dynamics) was as follows:

Glass manufacturer:	Pilkington Glass
Manufacturers reference:	4mm Float
Thickness:	4mm nominal (3.8mm measured)
Surface coating:	None

Desiccant type:	Molecular Sieve
Manufacturer:	Fenzi
Manufacturers reference:	Molver MGM
Sides filled:	Two Long Sides

Inner sealant material:	None
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Outer sealant material:	Hot Melt Butyl
Manufacturer:	Fenzi
Manufacturers reference:	Hot – Ver 2000
Equipment used for application:	Hot Melt Dispensing Machine (Bassra)
Seal depth:	7mm declared by client 4mm – 8mm measured by Chiltern Dynamics

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Spacer material:	Aluminium
Manufacturer:	Alu - Pro
Manufacturers reference:	Back Weld
Width:	12mm nominal (11.4mm measured)
Depth:	8mm nominal (6.9mm measured)

Corner keys or straight connector:	Corner Keys
Material:	Nylon
Manufacturer:	Alu - Pro
Manufacturers reference:	Nylon Corner Keys 11.5
Method of fixing:	Push Fit

Edge tape:	Black Cloth Tape
Manufacturer:	Empire Tapes
Manufacturers reference:	PCL Cloth Tapes

3 Test conditions

The IGU test laboratory conditions were maintained at standard laboratory conditions as follows throughout the test:

Temperature: 23 (± 2)°C
 Relative Humidity: 50 (± 5)%rh

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4 Test procedure and results

4.1 Conditioning and measurement of dimensions

The IGUs were conditioned for a period of not less than 2 weeks at standard laboratory conditions of ambient temperature (23 ± 2)°C and relative humidity of (50 ± 5)%. During the conditioning period, the IGUs were checked against the specification provided by the client, and each specimen was measured for length width and thickness. The results are shown in Appendix 2, Table 1.

4.2 Dew point measurement

After completion of the conditioning period, a dew point measurement test was carried out on each IGU. The glass surface of the IGU was cleaned with methylated spirit and held vertically, with a cooling cell braced against the centre of the glass surface. The junction between the glass and the cooling cell mirror was sealed with ethanol.

Note: The following method has been evaluated by Chiltern Dynamics against the reference method given in Annexe A of EN 1279 and determined to give the same results.

The cooling cell was filled with ethanol to a depth of between 30mm and 35mm, and the cooling cell was cooled to at least -60°C using dry ice. A digital thermometer and T type thermocouple was used to measure the temperature of the ethanol in the cooling cell. The cooling cell was maintained at a temperature below -60°C for at least 9 minutes in order to allow heat transfer through to the unit. The internal surface of the glazing unit was then inspected for condensation.

If condensation was not observed on the internal surface of the glass, the dew point temperature of the unit was taken as -60°C. Where condensation was observed, the IGU was left to allow the cooling cell to warm to room temperature. The cooling cell was again braced against the centre of the glass surface, and the dew point measured by dropping the temperature by no more than 2°C per minute, whilst continually observing the internal glass surface, and recording the temperature at which condensation was seen. The results of the dew point tests are shown in Appendix 2, Table 2.

4.3 Ranking of specimens

The specimens were ranked in descending order of the dew point value measured, starting with 1 for the highest value obtained, and ending with 15 for the lowest value obtained. Units with dew point values below -60°C were ranked at random. The rank numbers assigned are shown in Appendix 2, Table 2.

4.4 Designation of tests

According to the rank number, the units were selected for test as shown in the table below:

The table below shows the tests required to be carried out on each unit.

Rank number:	Tests conducted:
7, 8, 9 and 10	Measurement of initial moisture content of desiccant (Ti)
4, 5, 6, 11 and 12	Climate testing and measurement of final moisture content of desiccant (Tf)
2, 3, 13 and 14	Spare units to replace broken units for measurement of final moisture content of desiccant (Tf) (after climate testing)
1 and 15	Rejection or measurement of standard moisture adsorption capacity of desiccant (Tc) as required

4.5 Initial moisture content

Between 20 and 30 grams of desiccant was removed from each of the units with rank numbers 7, 8, 9 and 10 by method 2. See the procedure for removing desiccant in Appendix 3.

The desiccant was poured into porcelain dishes which had been cleaned and then weighed whilst empty on a four figure balance. The dishes with desiccant were then individually weighed on a four figure balance.

The porcelain dishes and desiccant were then heated in a muffle furnace to 950 (±50)°C within 60 (±20) minutes. The temperature was then held at 950 (±50)°C for a further 120 (±5) minutes. The dishes were removed from the furnace and then placed in a desiccator to cool to standard laboratory temperature.

Once at standard laboratory temperature, the porcelain dishes were weighed and the initial moisture content for each sample was calculated using the following formula:

$$T_i = (m_i - m_r) / (m_r - m_o)$$

Where:

T_i is the initial moisture content of desiccant

m_i is the mass of the dish and desiccant before drying in the furnace (with the lid removed)

m_r is the mass of the dish and desiccant after drying in the furnace (with the lid removed)

m_o is the weight of the empty porcelain dish (with the lid removed)

The results are shown in Appendix 2, Table 3.

The average initial moisture content for units with rank numbers 7, 8, 9 and 10 was then calculated.

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4.6 Standard moisture adsorption capacity

The generally accepted value for desiccant in bulk in table D1 of EN 1279-2:2002 was used to establish standard moisture adsorption capacity of the desiccant.

The results are shown in Appendix 2, Table 5.

4.7 Climate test

Units with rank numbers 4, 5, 6, 11 and 12 were subjected to the climate test. The test consisted of two parts as detailed below:

Climate test part 1

The first part of the test comprised 56 x 12 hour temperature cycles, starting at 23°C and cycling between -18 (± 2)°C and 53 (± 1)°C with a temperature gradient of 14 (± 2)°C per hour (temperatures quoted are for the central sample). The temperatures are those of the glass surface of the specimens. The temperature of the specimen placed centrally in the cabinet was continuously recorded, together with other specimens around the cabinet. During the part of the cycle where the temperature is at 53°C, the relative humidity of the chamber was 95% or higher.

Climate test part 2

Part 2 of the climate test was started within four hours of completing Part 1. The temperature of the specimens in the second chamber was then held at a temperature of 58°C with the relative humidity in the cabinet at 95% or higher, for a period of 7 weeks. Again temperatures were recorded of the central specimen and other specimens.

The measured temperature was at times above/below the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than non-compliance with the specification limit.

At the end of the second part of the climate test, the specimens were re-conditioned at standard laboratory conditions for a further 2 week period prior to the final moisture content measurement being carried out.

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4.8 Final moisture content measurement

Following the 2 week re-conditioning period, the final moisture content was measured for units with rank numbers 4, 5, 6, 11 and 12. Between 20 and 30 grams of desiccant was removed from each of the units by method 2. See the procedure for removing desiccant in Appendix 3.

The desiccant was poured into porcelain dishes which had been cleaned and then weighed whilst empty on a four figure balance. The dishes with desiccant were then individually weighed on a four figure balance.

The porcelain dishes and desiccant were then heated in a muffle furnace to 950 (± 50)°C within 60 (± 20) minutes. The temperature was then held at 950 (± 50)°C for a further 120 (± 5) minutes. The dishes were removed from the furnace, the lids replaced, and then placed in a desiccator to cool to standard laboratory temperature.

Once at standard laboratory temperature, the porcelain dishes were weighed and the final moisture content for each sample was calculated using the following formula:

$$T_f = (m_f - m_r) / (m_r - m_o)$$

Where:

T_f is the final moisture content of desiccant

m_f is the mass of the dish and desiccant before drying in the furnace (with the lid removed)

m_r is the mass of the dish and desiccant after drying in the furnace (with the lid removed)

m_o is the weight of the empty porcelain dish (with the lid removed)

The results are shown in Appendix 2, Table 4.

4.9 Moisture penetration index

The moisture penetration indices for each of the units which had been subjected to the climate tests were calculated using the following formula:

$$I = (T_f - T_{i,av}) / (T_{c,av} - T_{i,av})$$

Where:

I is the moisture penetration index

T_f is the final moisture content of desiccant

T_{i,av} is the average initial moisture content of desiccant

T_{c,av} is the average standard moisture adsorption capacity of desiccant

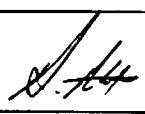


The results are shown in Appendix 2, table 6.

4.10 Results

The results are as follows:

The average moisture penetration index shall not exceed: 0.16	Average moisture penetration index achieved: 0.07	Result:
The unit with the highest moisture penetration index value shall not exceed: 0.25	Highest moisture penetration index value achieved: 0.20	Pass

The results only relate to the performance of the samples under the particular conditions of test.

	Written by:	Checked by:	Under the authority of:
Signature:			
Name:	Andre Moses	Dawn Simpkins	Vincent Kerrigan
Title:	Technician	Senior Test Engineer	Deputy Technical Manager
Date of issue:	02-05-2007		

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Appendix 1

Test report summary

Chiltern Dynamics
Chiltern House
Stocking Lane
Hughenden Valley
High Wycombe
Buckinghamshire
HP14 4ND



Summary of report number Chilt/G06058

Issue date: May 2007

Insulating glass unit – Moisture penetration results according to BS EN 1279-2

For details, see the test report

Company:	Name:	DP Plastics Ltd
	Address:	Unit 4, International Industrial Park Manor way, New Road Rainham, Essex RM13 8RH
Manufacturing Plant:	Name:	DP Plastics Ltd
	Address:	Unit 4, International Industrial Park Manor Way, New Road Rainham, Essex RM13 8RH

System description, file number:	DPPlastics07
Product name:	Double Glazed Units

System conforms to BS EN1279-2:

Yes

NOTE Comparisons of moisture penetration indices of different insulating glass unit systems are meaningless.

Andre Moses, Technician

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Appendix 2

Table 1 – Dimensions of specimens

Date measured: 28/09/06

Unit Ref:	Length (mm):	Width (mm):	Thickness(mm)
1	502	351	19.4
2	501	351	19.5
3	501	351	19.4
4	502	352	19.5
5	502	351	19.4
6	502	351	19.3
7	501	351	19.3
8	502	351	19.5
9	501	351	19.4
10	501	351	19.3
11	502	351	19.4
12	502	352	19.4
13	503	350	19.3
14	501	351	19.3
15	501	352	19.3

Table 2 – Dew point temperatures

Test date: 26/10/06

Unit Ref:	Dew Point Temp (°C):	Ranking Number:
1	-60	1
2	-60	2
3	-60	3
4	-60	4
5	-60	5
6	-60	6
7	-60	7
8	-60	8
9	-60	9
10	-60	10
11	-60	11
12	-60	12
13	-60	13
14	-60	14
15	-60	15

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Table 3 - Initial moisture content (T_i)

$$T_i = (m_r - m_r) / (m_r - m_o)$$

Test date: 14/02/06 - 16/02/07

Unit Rank No.	m_o	m_i	m_r	T_i
7	66.2420	94.0127	93.6192	0.0144
8	64.0515	93.2176	92.8536	0.0126
9	69.4244	97.8734	97.5064	0.0131
10	60.9661	89.5704	89.1451	0.0151
Average ($T_{i,av}$)				0.0138

Table 4 - Final moisture content (T_f)

$$T_f = (m_r - m_r) / (m_r - m_o)$$

Test date: 30/03/07 - 03/04/07

Unit Rank No.	m_o	m_f	m_r	T_f
4	52.0765	79.9430	79.4147	0.0193
5	49.0432	77.4697	76.9428	0.0189
6	51.0715	79.2224	78.6421	0.0210
11	50.8416	79.4992	78.1229	0.0504
12	49.8760	78.2904	77.7228	0.0204

Table 5 - Standard moisture adsorption capacity (T_c)

Standard moisture adsorption capacity (T_c) from table D.1

or from supplier

0.20

Table 6 - Moisture penetration index results I

$$I = (T_f - T_{i,av}) / (T_{c,av} - T_{i,av})$$

Unit Rank No.	Moisture Penetration Index (I)
4	0.03
5	0.03
6	0.04
11	0.20
12	0.04
Average (I_{av})	0.07

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Appendix 3

Procedure for removing desiccant. Where desiccant is present in more than one side of the unit, it is removed from two opposite sides (where possible).

Method 1

- The seal is cut through using a sharp knife and one pane of glass is removed.
- This is repeated for the second pane of glass.
- The spacer parts are separated where possible.
- The spacer is sawn in half through the centre, the spacer is bent and the desiccant poured into the prepared dish.
- The desiccant is mixed where it has come from more than one spacer bar.
- 20g to 30g are kept for the testing, avoiding contamination from the spacer in the desiccant.

Method 2

- The seal is removed from approximately 20mm of the unit.
- A 10mm diameter hole is drilled through the back of the spacer, avoiding drilling through the inner wall of the spacer.
- The desiccant is poured into a dish.
- The first 3g to 5g are discarded in order to prevent contamination from the spacer and other materials.
- 20g to 30g are kept for the testing.