

TEST AND EXAMINATION OF INSULATING GLASS UNITS

INTRODUCTION

At the request of PT Empire Glass Design the insulating glass units, detailed below and submitted by PT Empire Glass Design, were tested and assessed to the applicable requirements of BS EN 1279 : Part 2 : 2002, as indicated on the following pages of this Report. This request was confirmed on the Quotation acceptance BSI0000160022 dated 12 November 2008.

It is emphasized that assessments were not made against other clauses of the specification. This report relates to the actual units that have been tested and do not relate to any on-going production. BSI has not been involved in, or responsible for, the sampling of the test items. All references in this report to the identity of the product, sampling information and test items are based on information provided by the manufacturer.

TEST ITEMS

15 off insulating glass units each nominally 502 mm X 352 mm with a 12 mm air gap between the two panes of 4 mm glass. The test items were received on 19 November 2008 and identified under Equipment Record No 10100789. The components used in the construction were declared by the manufacturer as follows:

Desiccant -	Molecular sieve - Grace Phonosorb 558
Spacer bar -	Aluminium - Lisec
Primary sealant -	Butyl - LJF Totalseal 3524/1
Secondary sealant -	Two part polysulphide-LJF TotalTS2001C
Corner keys -	Lisec
Cavity gas -	Air
Date of manufacture -	Before 19 November 2008

The relevant units were subjected to the climatic test commencing on 19 December 2008.


SUMMARY OF RESULTS

The set of insulating glass units described above exhibited the following characteristics:

Characteristic	Actual	Specified
Average Moisture Penetration index	15.7% +	16.0%(max)
Maximum Moisture Penetration index	20.2% +	25.0%(max)
Initial Moisture Content	4.4%	Not specified
Final Moisture Content	6.9%	Not specified
Dimensional requirements	See page 3	502±2 x 352±2 mm

+ In the determination of the moisture penetration index a standard moisture absorption capacity of 20.0% has been used

Test Report

Report No	262/7295837	This report consists of 8 pages	
Client	PT Empire Glass Design JL Daan Mogot 11 No 100 M & N Komp Indo Jakarta - Ruko 11510 Indonesia		
Authority & date	Quotation acceptance BS10000160022 dated 12 November 2008 Equipment Record No 10100789		
Items tested	15 off Insulating glass units - Components declared by the Client Desiccant - Spacer bar - Primary sealant - Secondary sealant - Date of manufacture - System description reference - BS EN 1279 : Part 2 : 2002		
Specification	Average Moisture Penetration Index = 15.72% Specified (max) = 16.0% Maximum Moisture Penetration Index = 20.16% Specified (max) = 25.0%		
Results	S Gurney (Senior Technician Engineer)		
Prepared by	F Merrison (Laboratory Manager)		
Authorized by	27th March 2009		
Issue Date	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.		
Conditions of issue			

TEST PROCEDURE (continued)**Conditioning and dimensional measurement**

The insulating glass units were received at BSI and stored in standard laboratory conditions of $23 \pm 2^\circ\text{C}$ and $50 \pm 5\%$ 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 each unit was measured for length, width and thickness. The thickness of each glass pane was assessed and the cavity thickness evaluated. The results are shown below:

Unit	Ref No	Length (mm)	Width (mm)	Thickness (mm)	Cavity (mm)
A	1	502	352	19.9	11.9
B	2	502	352	19.9	11.9
C	3	502	352	20.0	12.0
D	4	502	352	20.0	12.0
E	5	502	352	19.9	11.9
F	6	502	352	20.0	12.0
G	7	502	352	19.9	11.9
H	8	502	352	20.0	12.0
J	9	502	352	19.9	11.9
K	10	502	352	19.9	11.9
L	11	502	352	19.9	11.9
M	12	502	352	20.0	12.0
N	13	502	352	19.9	11.9
P	14	502	352	19.8	11.8
R	15	502	352	19.8	11.8

Ranking

Upon completion of the conditioning period each unit was subjected to a dew point measurement test. Each unit was positioned vertically on its shorter edge and a dew point cooling cell placed in the centre of the glass. The cooling cell, containing methylated spirit, was cooled to a temperature of at least -60°C using dry ice and maintained at this value for a period of at least 2 minutes. The internal surface of the glass pane adjacent to the cooling cell was then inspected for evidence of condensation.

Note: This alternative method has been successfully evaluated against the reference method in prEN 1279-2 Annex A.

If condensation was not observed, the dew point was considered to be -60°C . If condensation was observed then the unit was reconditioned for a period of at least 24 hours and the dew point determined as specified in the standard.

The test specimens were ranked according to their dew point temperature with the unit exhibiting the highest dew point value as number 1 and the lowest dew point value as 15. Those units exhibiting a dew point temperature of -60°C or lower were randomly numbered.

In this test all units exhibited a dew point of -60°C or lower, such that the ranking process was conducted by numbering the 15 units randomly.

TEST PROCEDURE (continued)**Sample allocation**

Following the ranking process the units were selected for test as shown in the table below:

Ranking Number	Tests to be conducted
7,8,9 and 10	Measurement of initial moisture content of desiccant (T_i)
4,5,6,11,and 12	Climatic testing and measurement of final moisture content of desiccant (T_f)
2,3,13 and 14	Spare units to replace broken units for measurement of final moisture content of desiccant (T_f) after climatic testing.
1 and 15	Rejected or measurement of standard moisture absorption capacity of the desiccant (T_c)

Initial moisture content

The desiccant from each of the 4 units (7, 8, 9 and 10) was removed by drilling a 10mm diameter hole approximately 60 mm from a corner. A sample of approximately 25 g was obtained from each unit after discarding approximately the first 4 g from the unit. Waste material from the sealant and spacer bar was removed from the samples. The sample was collected in a dish and a lid used to ensure that the sample remained uncontaminated.

Each sample, contained in a dish, was weighed and then placed in a furnace. The temperature in the furnace was raised to 950°C over a period of 60 ± 20 minutes. The temperature was maintained at $950 \pm 50^\circ\text{C}$ for a further 120 ± 5 minutes.

The dish and sample were allowed to cool to room temperature and then weighed. The initial moisture content was calculated using the following formula:

$$\text{Initial moisture content } T_i = \frac{m_i - m_r}{m_r - m_o} \times 100$$

Where

- m_o = Mass of the dish when empty, clean and dry
- m_i = Mass of the dish plus desiccant and the initial water absorbed
- m_r = Mass of the dish plus the dried desiccant

The initial moisture content of the units are shown below.

Unit number	Result	Average T_i = 4.4%
7	5.1%	
8	4.1%	
9	4.3%	
10	4.3%	

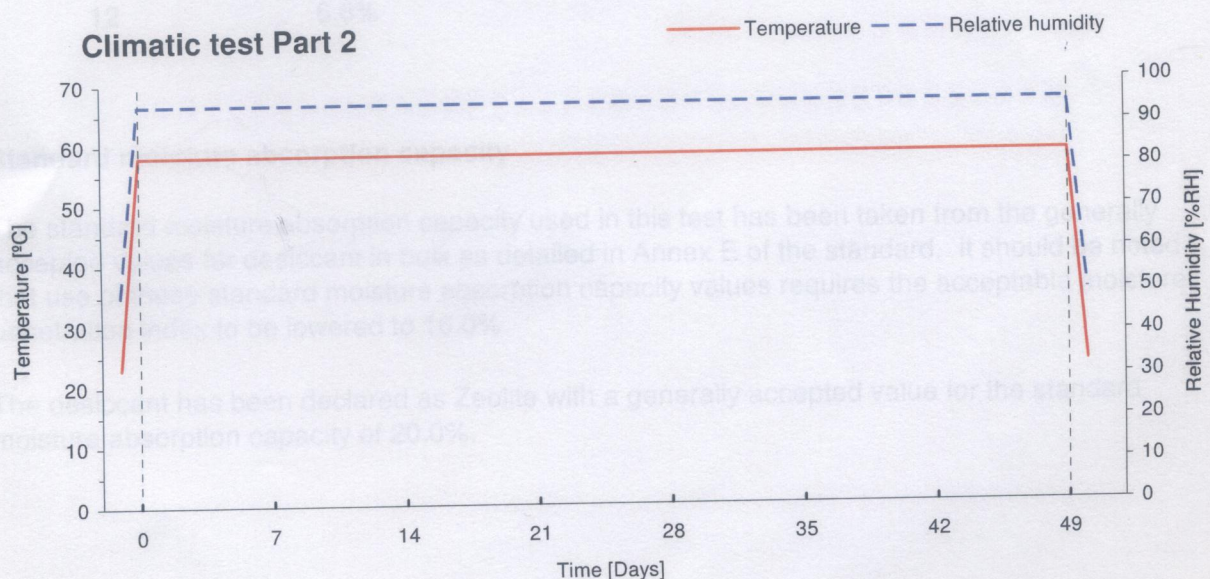
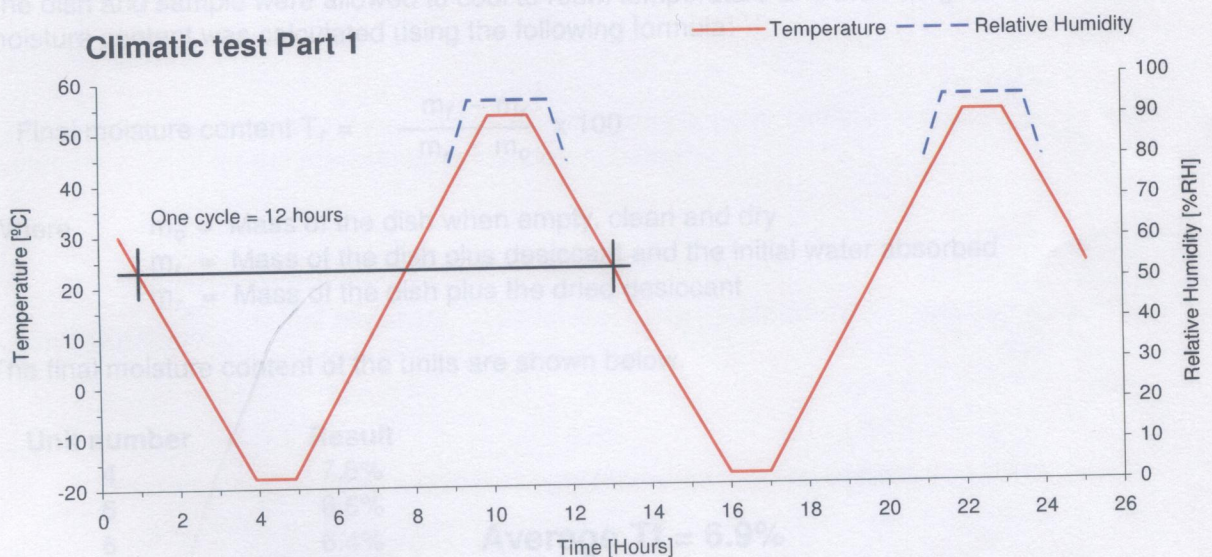
TEST PROCEDURE (continued)**Climatic test**

Units 4, 5, 6, 11, 12, and 13 were placed in the climatic test chamber. Units 2, 3 and 14 were stored in standard laboratory conditions as spare samples.

The climatic test consisted of two parts. The first part was 56 cycles each of 12 hours. The temperature dwells were for 1 hour at -18°C and $+53^{\circ}\text{C}$ with ramps of $14^{\circ}\text{C}/\text{hour}$ between the dwells, the humidity was maintained at 95%RH or greater for the upper temperatures. The second part was a period of seven weeks (49 days) at a constant $+58^{\circ}\text{C}/\geq 95\%\text{RH}$.

NOTE: BSI's environmental chambers are calibrated and programmed to produce the conditions required by the specification. However, due to the uncertainty of measurement associated with environmental chamber calibration, it cannot be guaranteed that the tolerances specified in the standard for the conditions within the chamber were maintained throughout the whole of the conditioning period.

The graphs shown below detail the two parts of this climatic test.



TEST PROCEDURE (continued)**Final Moisture content**

Upon completion of the climatic test the units were conditioned at standard laboratory conditions of $23 \pm 2^\circ\text{C}$ and $50 \pm 5\%$ relative humidity for a further 14 days.

The desiccant from each of the 5 units (4, 5, 6, 11, and 12) was removed by drilling a 10mm diameter hole approximately 60 mm from a corner. A sample of approximately 25 g was obtained from each unit after discarding approximately the first 4 g from the unit. Waste material from the sealant and spacer bar was removed from the sample. The sample was collected in a dish and a lid used to ensure that the sample remained uncontaminated.

Each sample, contained in a dish, was weighed and then placed in a furnace. The temperature in the furnace was raised to 950°C over a period of 60 ± 20 minutes. The temperature was maintained at $950 \pm 50^\circ\text{C}$ for a further 120 ± 5 minutes.

The dish and sample were allowed to cool to room temperature and then weighed. The final moisture content was calculated using the following formula:

$$\text{Final moisture content } T_f = \frac{m_f - m_r}{m_r - m_o} \times 100$$

Where m_o = Mass of the dish when empty, clean and dry
 m_f = Mass of the dish plus desiccant and the initial water absorbed
 m_r = Mass of the dish plus the dried desiccant

The final moisture content of the units are shown below.

Unit number	Result
4	7.6%
5	6.6%
6	6.4%
11	7.1%
12	6.8%

Average T_f = 6.9%

Standard moisture absorption capacity

The standard moisture absorption capacity used in this test has been taken from the generally accepted values for desiccant in bulk as detailed in Annex E of the standard. It should be noted that use of these standard moisture absorption capacity values requires the acceptable moisture penetration index to be lowered to 16.0%.

The desiccant has been declared as Zeolite with a generally accepted value for the standard moisture absorption capacity of 20.0%.

TEST PROCEDURE (continued)**Moisture penetration index**

The moisture penetration index for the five units subjected to the climatic test was calculated using the following formula:

$$\text{Moisture penetration index } I = \frac{T_f - T_{i,av}}{T_{c,av} - T_{i,av}} \times 100$$

Where T_f = Final Moisture content of the desiccant
 $T_{i,av}$ = Average initial moisture content of the desiccant
 $T_{c,av}$ = Average standard moisture absorption capacity
 (General accepted value for bulk desiccant)

TEST RESULTS

The results of the initial moisture content, final moisture content and the moisture penetration index for the relevant units are shown below:

Results			
Unit Number	Initial Moisture Content	Final Moisture Content	Moisture penetration index
4	N/A	7.6%	20.2%
5	N/A	6.6%	13.6%
6	N/A	6.4%	12.8%
7	5.1%	N/A	N/A
8	4.1%	N/A	N/A
9	4.3%	N/A	N/A
10	4.3%	N/A	N/A
11	N/A	7.1%	16.8%
12	N/A	6.8%	15.3%
Average	4.4%	6.9%	15.7%
Maximum	N/A	N/A	20.2%

F. Menison
Laboratory Manager

Appendix A

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Summary of Report No 262/7295837

Date 27th March 2009

Insulating glass units

Moisture penetration results according to BS EN 1279 part 2 : 2002

For details, see the test report

Company: Name: **PT Empire Glass Design**
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Plant: Name: **PT Empire Glass Design**
Address: **JL Daan Mogot 11**
No 100 M & N Komp Indo
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System description, file number: **INSULATED GLASS UNIT EN1279**

Product Name: **Plain units**

Average Moisture Penetration Index = 15.72% Specified (max) = 16.0%
Maximum Moisture Penetration Index = 20.16% Specified (max) = 25.0%

Note: Comparisons of the moisture penetration indices of different insulating glass unit systems are meaningless.

A handwritten signature in black ink, appearing to read 'F Merrison'.

F Merrison
Laboratory Manager