

17

Certificate of Test

Title:

JOTUN U.A.E. LIMITED

**DETERMINATION OF CARBON
DIOXIDE DIFFUSION COEFFICIENT
OF JOTASHIELD TEX ULTRA**


Certificate of Test No: 5703

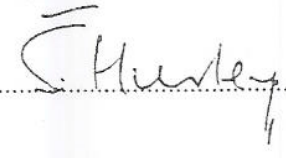
Client's Name & Address:

**Jotun U.A.E Limited
PO box 3671
Dubai
United Arab Emirates**

Our Ref:	231S/SS/JM/061
TEL Job No:	6729
Your Ref:	-
Date:	16 th August, 1999
Date Sample(s) Received:	10 th February, 1999
Sample(s) Received From:	Jotun U.A.E.

Sample No(s): 125228 and 125229

Tested By:  A T Blake

Authorised By:  S A Hurley
for

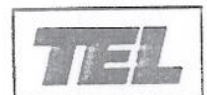
TAYWOOD ENGINEERING
CONSULTANTS IN DESIGN AND TECHNOLOGY

Technology
345 Ruislip Road, Southall, Middlesex, UB1 2QX
Tel. No. 0181 - 578 2366 Fax No. 0181 - 575 4215
Registered Office Southall Registered No. 1090601 England

This Certificate of Test is copyright. Reproduction of the whole or any part thereof must not be made without the express permission of Taywood Engineering.

This Certificate and the results shown are based upon the information drawings samples and tests referred to herein.

Taywood Engineering accepts no liability for any damages, charges costs (including, but not limited to, legal costs) or expenses in respect of or in relation to any damage to any property or other loss (save for death or personal injury occasioned by reason of any negligence on the part of Taywood Engineering) whatsoever arising directly or indirectly from the use of any goods or materials referred to in this Certificate of Test.



1. SAMPLE DESCRIPTION

One litre of Jotun Siloxane Acrylic Primer: Sample No. 125228. One litre of Jotun Jotashield Tex Ultra: Sample No. 125229.

2. METHOD

2.1 Preparation

The coating system was brush applied onto previously characterised porous plates using a weighing procedure to achieve the coverage rate required. Initially a flood coat of Jotun Siloxane Acrylic Primer was vertically applied. After six hours, two coats of Jotashield Tex Ultra were applied at a rate of 450g/m^2 per coat allowing a minimum of 4 hours drying time between each coat. The second coat was applied at 90° to the first.

The coated specimens were then conditioned at $23\pm 2^\circ\text{C}$ and $60\pm 5\%\text{RH}$ for a minimum period of 4 weeks prior to testing.

2.2 Determination of Carbon Dioxide Diffusion Resistance*

One coated tile (specimen no. 125229/6) was sealed in a circular steel rig such that the coated and uncoated faces were exposed. Carbon dioxide (15% in oxygen) at a known pressure and flow rate was passed over the coated face of the plate and helium gas was passed over the opposite face at the same pressure and flow rate. The helium gas stream was continuously monitored by gas chromatography to analyse for carbon dioxide. Equilibrium conditions were achieved after approximately 24 hours and the steady state flux of carbon dioxide was then calculated from the percentage of carbon dioxide in the helium stream and the flow rate of this gas.

The diffusion coefficient for carbon dioxide (D_{CO_2}) is calculated using Fick's Law of Diffusion and Crank's equation.

* In-House Test Procedure TP1303/90/4671 Issue 1.

3. RESULTS

The results of the analysis are detailed in Table 1.

Carbon Dioxide Diffusion Resistance

COATING	JOTASHIELD TEX ULTRA
TEL Specimen No.	125229/6
D_{CO_2} (cm^2s^{-1})	8.98×10^{-8}
μ -value	1659018
R (m)	312
S_c (cm)	78
Mean DFT (μm)	188
Test Date	11.05.99

Notes:

- i) R (equivalent air layer thickness) and S_c (equivalent thickness of concrete) are dependent on the film thickness and are calculated here for the dry film thickness (DFT) present on test specimen 125229/6.
- ii) D_{CO_2} and the diffusion resistance coefficient (μ -value) are calculated using the mean DFT measured on specimen no 125229/3
- iii) D_{CO_2} for an uncoated plate is $1.0 \times 10^{-3} cm^2s^{-1}$.
- iv) S_c is calculated assuming an average grade concrete where the μ -value has been estimated as 400. The value is dependent on the film thickness.
- (v) Klopfer criterion for effective anti-carbonation coating is R greater than 50 meters.

19

Certificate of Test

Title:

JOTUN U.A.E. LIMITED

**DETERMINATION OF LIQUID –
WATER TRANSMISSION RATE OF
JOTASHIELD TEX ULTRA**

Certificate of Test No: 5639

Client's Name & Address:

**Jotun U.A.E Limited
PO Box 3671
Dubai
United Arab Emirates**

Our Ref:	231S/SS/JM/034
TEL Job No:	6729
Your Ref:	-
Date:	12 th August, 1999
Date Sample(s) Received:	10 th February, 1999
Sample(s) Received From:	Jotun U.A.E.

Sample No(s): 125228 – 125229/1-3

Tested By: *S Stoute* S Stoute

Authorised By: *A T Blake* A T Blake

This Certificate of Test is copyright. Reproduction of the whole or any part thereof must not be made without the express permission of Taywood Engineering.

This Certificate and the results shown are based upon the information drawings samples and tests referred to herein.

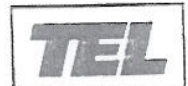
Taywood Engineering accepts no liability for any damages, charges costs (including, but not limited to, legal costs) or expenses in respect of or in relation to any damage to any property or other loss (save for death or personal injury occasioned by reason of any negligence on the part of Taywood Engineering) whatsoever arising directly or indirectly from the use of any goods or materials referred to in this Certificate of Test.

for

TAYWOOD ENGINEERING

CONSULTANTS IN DESIGN AND TECHNOLOGY

Technology
345 Ruislip Road, Southall, Middlesex, UB1 2QX
Tel. No. 0181 – 578 2366 Fax No. 0181 – 575 4215
Registered Office Southall Registered No. 1090601 England



51

1. SAMPLES DESCRIPTION

One litre of Jotun Siloxane Acrylic Primer: Sample No. 125228. One litre of Jotun Jotashield Tex Ultra: Sample No. 125229.

2. ANALYSIS REQUESTED

The Analytical Laboratories were requested to determine the Liquid - Water Transmission Rate of the Jotashield Tex Ultra coating system, in accordance with European Standard EN 1062-3 1998, paints and varnishes – coating materials and coating systems for exterior masonry and concrete – Part 3 : Determination and classification of liquid water transmission rate.

3. METHOD

3.1 Sample Preparation

Three test specimens were prepared using a brick substrate approximately 250 x 100 x 25mm. The substrate met the requirements EN 1062-3. One flood coat of Jotun Siloxane Acrylic Primer was applied (vertically) to the substrate. Two coats of Tex Ultra were brush applied at 450 g/m² with a minimum drying time of four hours between coats. The second coat was applied at right angles to the first. Before conditioning the reverse side and the edges of the test specimens were sealed against water using two coats of a two-component epoxy resin.

The coated specimens were conditioned over three cycles under the following conditions:

24 hours in water at 23°C ± 2°C and 24 hours drying at (50 ± 2) °C.

3.2 Liquid - Water Transmission Rate Coefficient Determination

The test was carried out in accordance with EN 1062-3 1998.

4. RESULTS

LIQUID WATER TRANSMISSION RATE OF
JOTASHIELD TEX ULTRA

Table 1

Client Identification	TE Sample Number	Liquid-Water Transmission Rate (kg / m ² h ^{0.5})	Classification
Jotashield Tex Ultra	125229/1	0.008	low
Jotashield Tex Ultra	125229/2	0.007	low
Jotashield Tex Ultra	125229/3	0.008	low

DFT of coating = 188 µm.

Date Tested : 20/05/99 - 21/05/99

Notes:

1. The liquid water transmission result of the brick substrate was 6.9 (kg/m² h^{0.5}).
2. The reduction in water absorption for the Jotashield Tex Ultra coating was calculated to be 99.9%.

12

Certificate of Test

Title:

JOTUN U.A.E. LTD

**DETERMINATION OF MOISTURE
VAPOUR TRANSMISSION RATE**

JOTASHIELD TEX ULTRA

Certificate of Test No: 5702

Client's Name & Address:

**Jotun U.A.E. Ltd
PO Box 3671
Dubai
United Arab Emirates**

Our Ref:	231S/SS/JM/060
TEL Job No:	6729
Your Ref:	-
Date:	12 th August, 1999
Date Sample(s) Received:	10 th February, 1997
Sample(s) Received From:	Jotun U.A.E

Sample No(s): 125228 and 125229/1

Tested By: *S. Stoute* S. Stoute

Authorised By: *A T Blake* A T Blake

For

TAYWOOD ENGINEERING
CONSULTANTS IN DESIGN AND TECHNOLOGY

Technology Division
345 Ruislip Road, Southall, Middlesex, UB1 2QX
Tel No. 0181 - 578 2366 Fax No. 0181 - 575 4215
Registered Office Southall Registered No. 1090601 England

This Certificate of Test is copyright. Reproduction of the whole or any part thereof must not be made without the express permission of Taywood Engineering.

This Certificate and the results shown are based upon the information drawings samples and tests referred to herein.

Taywood Engineering accepts no liability for any damages, charges costs (including, but not limited to, legal costs) or expenses in respect of or in relation to any damage to any property or other loss (save for death or personal injury occasioned by reason of any negligence on the part of Taywood Engineering) whatsoever arising directly or indirectly from the use of any goods or materials referred to in this Certificate of Test.



12

1. SAMPLE DESCRIPTION

One litre of Jotun Siloxane Acrylic Primer: Sample No. 125228. One litre of Jotun Jotashield Tex Ultra: Sample No. 125229.

2. METHOD

2.1 Preparation

Jotun Jotashield Tex Ultra was brush applied onto previously characterised cartridge paper using a weighing procedure to achieve the coverage rate required. Initially a flood coat of Jotun Siloxane Acrylic Primer was vertically applied. After 24 hours, two coats of Jotashield Tex Ultra were applied at a rate of 450g/m² per coat allowing a minimum of 4 hours drying time between each coat. The second coat was applied at 90° to the first coat.

The coated specimens were then conditioned at 23 ± 2°C and 60 ± 5% RH for a minimum period of 4 weeks prior to testing.

2.2 Determination of Moisture Vapour Transmission Rate

The test was carried out in triplicate at 23 ± 2°C for the coating specimen. Three discs (each 58mm in diameter) were cut from the coated cartridge paper and sealed in Payne permeability cups such that both faces were exposed. The coated face was exposed to a dry atmosphere (0% RH) and the other face to water vapour (100% RH).

The test cups were weighed periodically over a test interval of approximately 30 days. Equilibrium conditions were achieved after approximately 4 days and the subsequent steady state flow of water vapour was calculated from the rate of weight loss.

The diffusion coefficient with respect to water vapour for the coating (D_{H₂O}) was calculated from the measured flux for the coated cartridge paper (g/m².24hr) using Fick's law of diffusion and Crank's equation.

3. RESULTS

MOISTURE VAPOUR TRANSMISSION RATE

COATING SYSTEM	JOTASHEILD TEX ULTRA		
	125229/1A	125229/1B	125229/1C
Specimen No.	125229/1A	125229/1B	125229/1C
Flux (g/m ² .24hr)	19.7	24.7	21.6
D _{H₂O} (cm ² s ⁻¹)	1.94 x 10 ⁻⁵	2.47 x 10 ⁻⁵	2.14 x 10 ⁻⁵
μ-value	1.31 x 10 ⁴	1.03 x 10 ⁴	1.19 x 10 ⁴
S _D (m)	2.5	1.9	2.2
Mean, DFT (μm)	188	188	188

Date Tested: 07/05/99 - 14/06/99.

Notes

- (i) The S_D-value (equivalent air layer thickness) is dependent on film thickness and is calculated above for the mean of the measured dry film thickness (DFT).
- (ii) D_{H₂O} for the cartridge paper (thickness = 203 μm) is 4.3 x 10⁻⁴ cm²s⁻¹.
- (iii) The criteria for an acceptable anti-carbonation coating is for S_D to be equal to, or less than, 4m. This S_D value is dependent on the thickness of the test specimen.

Certificate of Test

co/

Title:

JOTUN U.A.E. LIMITED

Jotashield Tex Ultra

Determination of Crack Bridging Ability

Certificate of Test No: 5543

Client's Name & Address:

Jotun U.A.E. Limited
PO Box 3671
Dubai
United Arab Emirates

Our Ref:	231S/SS/PE/006a
TEL Job No:	6729
Your Ref:	-
Date:	13 th April, 1999
Date Sample(s) Received:	10 th February, 1999
Sample(s) Received From:	Mr S Mathew

Sample No(s): 125228 - 125229

Tested By: *S Stoute* S Stoute

Authorised By: *A T Blake* A T Blake

This Certificate of Test is copyright. Reproduction of the whole or any part thereof must not be made without the express permission of Taywood Engineering.

This Certificate and the results shown are based upon the information drawings samples and tests referred to herein.

Taywood Engineering accepts no liability for any damages, charges costs (including, but not limited to, legal costs) or expenses in respect of or in relation to any damage to any property or other loss (save for death or personal injury occasioned by reason of any negligence on the part of Taywood Engineering) whatsoever arising directly or indirectly from the use of any goods or materials referred to in this Certificate of Test.

for

TAYWOOD ENGINEERING

CONSULTANTS IN DESIGN AND TECHNOLOGY

Technology Division

345 Ruislip Road, Southall, Middlesex, UB1 2QX
Tel No. 0181 - 578 2366 Fax No. 0181 - 575 4215
Registered Office Southall Registered No. 1090601 England



1. **SAMPLE DESCRIPTION**

One litre of Jotun siloxane acrylic primer and one litre of Jotun Jotashield Tex Ultra was received by the Analytical Laboratories.

2. **ANALYSIS REQUESTED**

The Analytical Laboratories were requested to determine the crack bridging ability of a coated concrete slice.

3. **METHOD**

3.1 **Preparation**

Test specimens measuring 75 x 50 x 15mm were cut from a standard C40 concrete mix. As a crack propagator, the rear of the sample was cut to within 2mm of the front face, at the centre of the specimens. The coating system was then brush applied onto the concrete slices using a weighing procedure to achieve the coverage rate required. A flood coat of siloxane acrylic primer was applied to the substrate (vertically). Two coats of Jotashield Tex Ultra were then applied at a rate of 450g/m² (per coat) allowing a minimum drying time of four hours between coats. The top coat was applied at 90° to the previous coat.

The coated specimens were conditioned at 23 ± 2°C and 60 ± 5%RH for a minimum period of 3 weeks prior to testing.

3.2 **Crack Bridging Ability**

A plastic plate (approximately 20mm wide) was adhered to the front of the coated sample, leaving approximately 1cm free either side of the centre of the specimen. A crack was then initiated from the rear of the specimen by gently widening the slot cut in the rear of the sample. This produced a microscopic crack in the concrete along the coated face. The sample was then carefully placed in an Instron tensile testing instrument, model no. 1195, and the sample tested under tension until the first defect was noted in the coated face. The width of the crack was then measured in 4 locations using a measuring graticule. A defect was classed as a pin hole or opened stretch mark. The outside edges of the sample were not examined for defects, due to edge effects that may occur. The tensile tester cross head movement rate was set at 0.5mm/min. All testing was undertaken at 23°C and ambient humidity conditions.

4. **RESULTS**

The crack bridging ability of Jotun Jotashield Tex Ultra has been determined as up to 1.8mm. The average crack bridging ability of 5 test specimens was 1.4mm.

The results of the analysis are detailed in Table 1.

CRACK BRIDGING ABILITY

Jotashield Tex Ultra

Table 1

SAMPLE NUMBER	EXTENSION WHEN DEFECT FIRST NOTED (mm)				AVERAGE EXTENSION (mm)
	1	2	3	4	
125229/11	1.8	1.8	1.8	1.8	1.8
125229/12	1.4	1.4	1.5	1.5	1.5
125229/13	1.6	1.5	1.5	1.5	1.6
125229/14	1.1	1.1	1.0	1.0	1.1
125229/15	1.2	1.2	1.2	1.3	1.3
Average Extension					1.4

Date tested: 25.03.99.