Certificate of Test

Supplement to Certificate of Test number 7176 issued by Taylor Woodrow Technology on 30 September 2003, Certificate of Test number 9695 issued by Taylor Woodrow Technology on 5 February 2008 and Certificate of Test number 12078 issued by Taylor Woodrow Technology on 9 July 2009.

Since the original Certificates were issued, the product known as 'Jotashield Tex Ultra' has had no formulation change.

Since the original Certificate was issued, Taylor Woodrow Technology has rebranded as VINCI Construction UK Ltd. Technology Centre.

Title: Determination of Carbon Dioxide Diffusion Coefficient after 2500 hours Accelerated Weathering of Jotashield Tex Ultra

Certificate of Test Number: 13534

Client's Name & Address:

Jotun UAE LLC
Al Quoz Industrial Area
PO Box 3671
Dubai
United Arab Emirates

Our Ref: N950/V018

TC Job No: 3NF3 – 1.064.27

Your Ref: PO 54798

Date: 06 October 2010

Date sample(s) received: 5 November 2002

Sample(s) received from: Jotun UAE Ltd LLC

Sample No: 129543

Tested by: .....
D J Thompson (position: Engineer)

Authorised by: S.R.Mox.....
S R Moxon (position: Manager)

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

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TECHNOLOGY CENTRE

1. INTRODUCTION

This certificate of test describes the carbon dioxide diffusion testing carried out at the request of Jotun UAE Ltd LLC on 19 March 2003 at Technology Centre (TC), Leighton Buzzard.

The test was carried out in accordance with In-House Test Procedure TP950/05/13569 Issue 1, which is in general accordance with EN 1062-6:2002 after accelerated weathering.

2. SAMPLE DESCRIPTION

One litre of Jotun Siloxane Acrylic primer and one litre of Jotashield Tex Ultra were received in the Laboratories. When received, the samples were designated with unique sample reference numbers, which were use for our own identification purposes. No certificates of sampling were received.

The carbon dioxide diffusion coefficient of the coating system after 2500 hours accelerated weathering was to be determined.

3. TEST PROCEDURE

3.1 Coating Application

The coating system was brush applied to previously characterised unglazed ceramic tiles using a weighing procedure to achieve the coverage rate required. A flood coat of Jotun Siloxane Acrylic Primer was applied and allowed to dry for a minimum period of 8 hours. Two coats of Jotashield Tex Ultra were then applied at a rate of 465g/m^2/coat with a minimum drying period of 24 hours between coats. The second coat was applied at 90° to the first. The samples were allowed to dry in the laboratory for three days and were then conditioned for a minimum of 28 days at 23±2°C and 60±5% relative humidity.

3.2 Accelerated Weathering

The coated tiles were placed in a QUV weathering device under an exposure regime (QUV-A) designed to simulate UK conditions, 4 hours UV at 50°C followed by 4 hours condensation at 40°C.

After 2000 hours of accelerated weathering, the specimens were removed. The test specimens were then conditioned at 23±2°C and 60±5% relative humidity for a minimum period of four weeks prior to testing. The carbon dioxide diffusion coefficient was then re-measured.

3.3 Determination of Carbon Dioxide Diffusion Resistance

One coated tile (TC Ref. 129543) 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 (Dco_2) is calculated using Fick's Law of Diffusion and Crank's equation.

4. TEST RESULTS

CARBON DIOXIDE DIFFUSION RESISTANCE

Table 1

Coating System Name QUV Weathered for (hours)	Jotashield Tex Ultra 2500
TC Specimen No.	129543/M
Dco_2 (cm^2s^{-1})	6.03×10^{-08}
µ-value	2.47×10^{6}
R (m)	467
Sc (cm)	117
Mean Dry Film Thickness (µm)	189
Date of Test	19-Mar-03

Notes:

i) R (equivalent air layer thickness) and Sc (equivalent thickness of concrete) are dependent on the film thickness and are calculated here for the dry film thickness (DFT) present on the test specimens.

ii) Dco_2 and the diffusion resistance coefficient (µ-value) are calculated using the mean DFT measured on a spare unused specimen.

iii) Dco_2 for an uncoated plate is 1.0×10^{-3} cm^2s^{-1}.

iv) Sc is calculated assuming an average grade concrete where the µ-value has been estimated as 400.

v) Klopfer criterion for effective anti-carbonation coating is R greater than 50 metres.

vi) EN 1062-6 Classification C_1 for Carbon Dioxide Permeability requires the S_D value (R) greater than 50 metres.

END OF CERTIFICATE