

**DSET LABORATORIES**

A Division of Atlas Material Testing Technology LLC  
45601 North 47<sup>th</sup> Avenue  
Phoenix, Arizona 85087 U.S.A.  
Phone: +1 623-465-7356  
Toll Free: 800-255-3738 (U.S. only)  
Fax: +1 623-465-9409  
www.atlas-mts.com

Report No.: 36516-1  
Order No.: AE36516  
Client Reference: P.O. #: ADS-216272  
Date: September 21, 2016

**HEMISPHERICAL SPECTRAL REFLECTANCE  
and  
TOTAL EMITTANCE TEST REPORT**

prepared for:

**ADS WEATHERDEK CANADA, LTD.**  
600 Adams Rd.  
Kelowna, BC V1X7S1  
Canada

presented by:

Atlas Weathering Services Group  
DSET Laboratories  
45601 North 47th Avenue  
Phoenix, AZ 85087-7042  
Phone: 623-465-7356  
FAX: 623-465-9409

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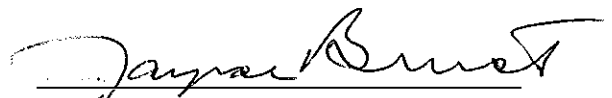
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Prepared by:



Erika Wunderlich  
Group Leader Evaluations Services

Approved by:



Jaynae Brust  
Group Leader Static Services

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## HEMISPHERICAL SPECTRAL REFLECTANCE and TOTAL EMITTANCE TEST REPORT

### 1.0 INTRODUCTION

This report presents results of spectral reflectance and total emittance measurements on the following thirteen Weatherdek 'Plus' PVC roof deck membrane specimens coded:

WD1 Classic Plus SHALE  
WD2 Classic Plus COBALT  
WD3 Classic Plus WALNUT  
WD4 Classic Plus BEACHWOOD  
WD5 Designer Plus NATURAL  
WD6 Designer Plus GRANITE  
WD7 Designer Plus CORAL  
WD8 Designer Plus TUNDRA  
WD9 Designer Plus NICKEL  
WD10 Signature Stone Plus HAZEL  
WD11 Signature Stone Plus FLINT  
WD12 Marble Tile Plus MAPLESTONE  
WD13 Marble Tile Plus CLAYSTONE

### 2.0 TEST METHODS AND PROCEDURES

#### Reflectance

Hemispherical spectral reflectance measurements were performed in accordance with ASTM Standard Test Method E903. The measurements were performed with a PerkinElmer Lambda 950 Spectrophotometer utilizing an integrating sphere (Fig X1.3 of E903). Total reflectance measurements were obtained in the solar spectrum from 2500nm to 300nm at an incident angle of 8°. The measurements employ a detector-baffled, wall-mounted integrating sphere that precludes the necessity of employing a reference standard except to define the instrument's 100% line. The measurements are properly denoted as being 'hemispherical spectral reflectance'.

Total Solar  $\rho$  reflectance was obtained by integrating the spectral data against Air Mass 1.5 (ASTM G159) direct solar spectrum utilizing 105 weighted ordinates. All spectral data are submitted herewith in the original.

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**2.0 TEST METHODS AND PROCEDURES (cont'd)****Emittance**

Near-normal infrared reflectance measurements were performed in accordance with ASTM E408, Method A. A Gier Dunkle Instruments Infrared Reflectometer Model DB 100 was utilized for the measurements.

Inside the detector portion are two semi-cylindrical cavities. One of the cavities is heated by an electrical heater and the other stabilizes at approximately room temperature. Thus, the two cavities are maintained at different temperatures. As the cavities rotate, the sample is alternately irradiated at 13 Hz. A vacuum thermocouple views the sample through an optical system that focuses through slits in the ends of the cavities. The detector receives energy emitted by the sample and energy reflected by the sample. Only the reflected energy contains an alternating component as the sample is alternately irradiated by the hot and cold cavities. An amplifier is synchronized with the cavity rotation to pass only the desired alternating signal, which is then rectified and filtered. The zero and gain are set with standards of known emittance. The calibration is rechecked at several intervals during the measurement. The Gier Dunkle Infrared Reflectometer is calibrated using high and low emittance standards. The standards were calibrated at and obtained from the National Physical Laboratory in England. The emittance value for the glass standard equals 0.89. The emittance value for the mirror standard equals 0.01.

Near-normal emittance for the client's specimens was calculated from Kirchhoff's Relationship where:

$$\rho + \alpha + \tau = 1, \alpha = \varepsilon$$

Since these specimens are opaque and have no  $\tau$  in the far IR, the preceding equation reduces to:

$$\rho + \varepsilon = 1 \text{ and } 1 - \rho = \varepsilon$$

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**2.0 TEST METHODS AND PROCEDURES (cont'd)**

**SRI**

The Solar Reflectance Index is calculated from ASTM E1980. The procedure defines a Solar Reflectance Index (SRI) that measures the relative “steady-state surface temperature” of a surface with respect to the standard white (SRI=100) and the standard black (SRI=0) under the standard solar and ambient conditions. The program used for the calculations was provided by Lawrence Berkeley Laboratory in California. All three wind conditions can be reported upon request; however, the medium wind condition is reported.

**3.0 OBSERVATIONS, DEVIATIONS, AND WAIVERS**

The values reported for emittance represent the average of at least four measurements.

Caution: ASTM Test Method E903, paragraph 5.4 clearly states “this test method has been found practical...except for those materials that are inhomogeneous, patterned, or corrugated”. In that the measured specimens exhibit inhomogeneities, the client is cautioned when utilizing the reported measurement values

With all test methods, there typically is a level of uncertainty for the test data due to the acceptable operating tolerances of the instrumentation and variation caused by the test method. The estimated tolerances are expected to be less than plus or minus 2% for most materials tested to ASTM E903.

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**4.0 RESULTS**

**Reflectance and SRI:**

Specimen Code	% Solar Reflectance	SRI
WD1 Classic Plus SHALE	41.1	48
WD2 Classic Plus COBALT	33.2	37
WD3 Classic Plus WALNUT	29.1	32
WD4 Classic Plus BEACHWOOD	44.6	52
WD5 Designer Plus NATURAL	30.8	34
WD6 Designer Plus GRANITE	27.7	31
WD7 Designer Plus CORAL	44.1	52
WD8 Designer Plus TUNDRA	17.6	17
WD9 Designer Plus NICKEL	14.7	14
WD10 Signature Stone Plus HAZEL	29.3	33
WD11 Signature Stone Plus FLINT	23.0	25
WD12 Marble Tile Plus MAPLESTONE	28.3	31
WD13 Marble Tile Plus CLAYSTONE	27.3	30

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**4.0 RESULTS (cont'd)**
Emittance:

Specimen Code	Reflectance ( $\rho$ ) Measured	Near-Normal Emittance ( $\epsilon$ ) Calculated
WD1 Classic Plus SHALE	.07	.93
WD2 Classic Plus COBALT	.07	.93
WD3 Classic Plus WALNUT	.07	.93
WD4 Classic Plus BEACHWOOD	.07	.93
WD5 Designer Plus NATURAL	.07	.93
WD6 Designer Plus GRANITE	.06	.94
WD7 Designer Plus CORAL	.06	.94
WD8 Designer Plus TUNDRA	.07	.93
WD9 Designer Plus NICKEL	.06	.94
WD10 Signature Stone Plus HAZEL	.06	.94
WD11 Signature Stone Plus FLINT	.06	.94
WD12 Marble Tile Plus MAPLESTONE	.06	.94
WD13 Marble Tile Plus CLAYSTONE	.06	.94