QAI LABORATORIES
CERTIFICATION TESTING INSPECTION

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CLIENT: **SUNGHYUN CHEMICALS CO., LTD**
465 Chogeum-ro Geumwang-eup Eumseong-gun
Chungbuk, Korea

Test Report No: RJ3838P-14	Date: June 10, 2015

SAMPLE ID: Hicote ET Vermiculite SFRM SGS Korea File No; AYAA15-07869.

SAMPLING DETAIL: Test samples were submitted to the laboratory directly by the client. No special sampling conditions or sample preparation were observed by QAI.

DATE OF RECEIPT: Samples were received at QAI on March 26, 2015.

TESTING PERIOD: April 27 thru May 8, 2015.

AUTHORIZATION: QAI Test Proposal SP-2014-081803 Rev.2 dated February 19, 2015 signed by June Lee of SGS Korea Co., Ltd on February 23, 2015.

TEST REQUESTED: Air Erosion Test per ASTM E 859-93 (Reapproved 2006), *Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRM's) Applied to Structural Members.*

TEST PROCEDURE: The SFRM was applied to a 0.37 m^2 (4 ft^2) rigid substrate at a uniform thickness of 22 mm following the manufactures specification. The test specimens were conditioned to constant weight for a minimum of 8 days at a temperature of 20° ± 5°C and a relative humidity of 50 ± 5% prior to testing.

The test specimen was then subjected to an air velocity of 6 m/s (20 ft/s) for a period of 24 hours and the amount of SFRM material collected on the filter, in grams, recorded after 1, 6 and 24 hour test intervals. The test was then repeated at an air velocity of 12.7 m/s (41.7 ft/s) for 4 hours.

TEST RESULTS: Test results are provided on Page 2 of this report.

Tested By

David Royer
Laboratory Technician

Signed for and on behalf of QAI Laboratories, Inc.

Larry Burmer
Project Leader-Physical Testing

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AIR EROSION TEST PER ASTM E 859-93

Test Results

Air Velocity 6 m/s (20 ft/s)	
Elapsed Time (Hours)	**SFRM Material Collected (grams)**
1	0.004
6	0.001
24	0.001

Air Velocity 12.7 m/s (41.7 ft/s)	
Elapsed Time (Hours)	**SFRM Material Collected (grams)**
4	0.003

******End of Report******

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CLIENT: **SUNGHYUN CHEMICALS CO., LTD**
465 Chogeum-ro Geumwang-eup Eumseong-gun
Chungbuk, Korea

Test Report No: RJ3838P-12	Date: June 10, 2015

SAMPLE ID: Hicote ET Vermiculite SFRM SGS Korea File No; AYAA15-07869.

SAMPLING DETAIL: Test samples were submitted to the laboratory directly by the client. No special sampling conditions or sample preparation were observed by QAI.

DATE OF RECEIPT: Samples were received at QAI on March 26, 2015.

TESTING PERIOD: April 27 thru May 22, 2015.

AUTHORIZATION: QAI Test Proposal SP-2014-081803 Rev.2 dated February 19, 2015 signed by June Lee of SGS Korea Co., Ltd on February 23, 2015.

TEST REQUESTED: Corrosion Test per ASTM E 937-93(2011), *Standard Test Method for Corrosion of Steel by Sprayed Fire Resistive Material (SFRM) Applied to Structural Members.*

TEST PROCEDURE: See pages 2 and 3 of this report for detailed test procedures.

TEST RESULTS: See pages 2 and 3 of this report for detailed test results.

Tested By

David Royer
Laboratory Technician

Signed for and on behalf of QAI Laboratories, Inc.

Larry Burmer
Project Leader-Physical Testing

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CORROSION TEST PER ASTM E 937-93(2011)

Test Procedure

Three sets of four 200 mm (8") x 200 mm (8") x 12 gage steel sheets were prepared for the test. One set consisted of bare steel, the second set consisted of shop-coated steel and the third set consisted of galvanized steel. The steel sheets were weighed to the nearest 0.1 gram. The SFRM was applied to the steel sheets at a uniform thickness of 22 mm following the manufactures specification. For testing purposes, a protective coating was applied to the back and edges of the steel sheets. Two specimens from each group were conditioned for 240 hours at a temperature of 20° ± 5°C and a relative humidity not greater than 60% and two specimens from each group were conditioned for 240 hours at a temperature of 35 ± 1.7°C and 95 ± 3% relative humidity. At the end of the conditioning period, the SFRM and protective coating was removed from the steel sheets, any surface rust removed with a wire brush and the metal surfaces cleaned with solvent.

Test Results

Bare Steel-A36 grade				
Sheet #	**Test Conditions**	**Original Weight (grams)**	**Final Weight (grams)**	**Weight Loss (g/mm^2)**
1	20°C & 60% RH	882.8	882.5	0.0000075
3	20°C & 60% RH	882.6	882.1	0.000013
Average		**882.7**	**882.3**	**0.000010**
2	35°C & 95% RH	882.5	881.5	0.000025
4	35°C & 95% RH	882.2	881.3	0.000023
Average		**882.4**	**881.4**	**0.000024**

Shop Coated Steel-A36 grade				
Sheet #	**Test Conditions**	**Original Weight (grams)**	**Final Weight (grams)**	**Weight Loss (g/mm^2)**
1	20°C & 60% RH	883.1	882.3	0.000020
3	20°C & 60% RH	883.0	882.3	0.000018
Average		**883.1**	**882.3**	**0.000019**
2	35°C & 95% RH	883.2	882.5	0.000018
4	35°C & 95% RH	883.2	882.2	0.000025
Average		**883.2**	**883.4**	**0.000022**

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CORROSION TEST PER ASTM E 937-93(2011) (CONT.)

Galvanized Steel-G60 grade				
Sheet #	**Test Conditions**	**Original Weight (grams)**	**Final Weight (grams)**	**Weight Loss (g/mm^2)**
1	20°C & 60% RH	884.9	884.1	0.000020
3	20°C & 60% RH	884.7	884.0	0.000018
Average		**885.8**	**884.1**	**0.000019**
2	35°C & 95% RH	884.9	883.2	0.000043
4	35°C & 95% RH	884.8	883.2	0.000040
Average		**885.9**	**883.2**	**0.000042**

******End of Report******

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