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APPROVAL REPORT

APPROVAL TESTING OF AFAST BV GUARDIAN FASTENERS IN SELECTED CLASS 1 STEEL DECK ROOF DECK CONSTRUCTIONS

Prepared for:

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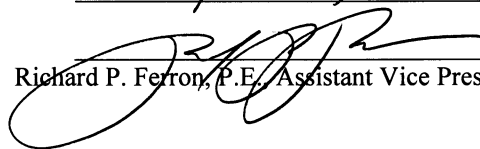
Project ID: 3034551

Class: 4470

Date of Approval:

April 8, 2009

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**APPROVAL TESTING OF AFAST BV GUARDIAN FASTENERS IN SELECTED CLASS 1
STEEL DECK ROOF DECK CONSTRUCTIONS**

from

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I INTRODUCTION

- 1.1 Afast BV submitted their Guardian roof fasteners to determine if they meet the approval requirements of the **Standards** listed below for Class 1 roof covers.
- 1.2 This Report may be reproduced only in its entirety and without modification.
- 1.3 **Standards:**

| Title | Class Number | Date |
|--|---------------------------|-------------|
| Approval Standard for Class 1 Roof Covers | 4470 | April, 1986 |
| American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or negative Differential Pressures | ANSI/FM Approvals 4474 | March 2004 |

- 1.4 Examination included deck fastener pull out pull over, corrosion and simulated wind uplift pressure testing.
- 1.5 Tests show that Afast BV Guardian fasteners, as tested, meet the Approval requirements of the **Standards** listed above for Class 1 Roof Covers.
- 1.6 **Listings:** The tested constructions meet the Approval criteria of FM Approvals when installed in roof constructions as specified in the **CONCLUSIONS** of this report. The products will be listed in RoofNav.

II DESCRIPTION:

- 2.1 The Afast BV’s Guardian R(P)-75 is an insulation tube washer used to attach roof insulation to roof decks. The Guardian R(P)-75 consists of a one piece round, combination tube and washer plate; manufactured of Polypropylene with a plate washer size of 75 mm (2.9 in.) diameter, the tube diameter is 13.9 mm (0.54 in.) and the tube length is 20 to 330 mm (0.78 to 12.9 in.). The Guardian R(P)-75 is used with the Guardian BS-4.8 (#10 steel fastener) or BS-6.1 (#15 steel fastener).

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- 2.2 The Afast BV's Guardian TB(P) 8040 is a barbed membrane tube washer used to attach roof covers to roof decks. The TB(P) 8040 consists of a one piece oval, combination tube and washer plate with two barbs located below the washer plate. The TB(P) 8040 is manufactured of Polyamid with a plate washer size of 43 mm x 76 mm (1.7 x 3.0 in.) with a tube diameter of 13.9 mm (0.54 in.) and a tube length of 30 to 210 mm (1.2 to 8.2 in.). The barbs are 15.33 mm (0.60 in.) in length. The TB(P) 8040 is used with the Guardian BS-4.8 (#10 steel fastener) and the Guardian BS-6.1 (#15 steel fastener).
- 2.3 The Afast BV's Guardian R(P)-45 is a membrane tube washer used to attach roof covers to roof decks. The Guardian R(P)-45 consists of a one piece round, combination tube and washer plate; manufactured of Polypropylene with a plate washer size of 43 mm (1.7 in.) diameter, the tube diameter is 13.9 mm (0.54 in.) and the tube length is 20 to 330 mm (0.78 to 12.9 in.). The R(P)-45 is used with the Guardian BS-4.8 (#10 steel fastener) and the Guardian BS-6.1 (#15 steel fastener).
- 2.4 The Afast BV's Guardian RB(P)-48 is a barbed membrane tube washer used to attach roof covers to roof decks. The Guardian RB(P)-48 consists of a one piece round, combination tube and washer plate with three barbs located below the washer plate; manufactured of Polypropylene with a plate washer size of 48 mm (1.9 in.) diameter, the tube diameter is 13.9 mm (0.54 in.) and the tube length is 20 to 330 mm (0.78 to 12.9 in.). The barbs are 11.00 mm (0.43 in.) in length. The RB(P)-48 is used with the Guardian BS-4.8 (#10 steel fastener) and the Guardian BS-6.1 (#15 steel fastener).
- 2.5 The Afast BV's Guardian SPA-8240-D1 is a oval membrane washer plate used to attach roof covers to roof decks. The Guardian SPA-8240-D1 is a cold rolled carbon steel washer plate with a hot dipped zinc coating. It is recessed in the center with a 4.85 mm (0.19 in) hole. The plate is 80 mm x 42 mm x 1.0 mm (3.1 x 1.6 x 0.078 in.) and is used with the Guardian DBT-4.8 (#10 steel fastener).
- 2.6 The Afast BV's Guardian SPA-7070-D1 is a square insulation washer plate used to attach roof insulation to roof decks. The Guardian SPA-7070-D1 is a cold rolled carbon steel washer plate with a hot dipped zinc coating. It is recessed in the center with a 4.85 mm (0.19 in) hole the plate is 70 mm x 70 mm x 1.0 mm (2.7 x 2.7 x 0.078 in.) and is used with the Guardian DBT-4.8 (#10 steel fastener).
- 2.7 The Guardian BS-4.8 steel fastener is designed for use with the Guardian R(P)-75, Guardian TB(P) 8040, Guardian RB(P)-48 and Guardian R(P)-45 tube washer plates. The BS-4.8 is manufactured with a Torx-25 recessed head drive and is used to penetrate steel decks up to 1.25 mm thick (0.049 in.). Standard length of the screws is 50 to 190 mm (1.9 to 7.5 in.). The fastener is treated with an Enduroguard 15 cycle coating.
- 2.8 The Guardian DBT-4.8 steel fastener is designed for use with the Guardian SPA-8240-D1 and the Guardian SPA-7070-D1 steel washer plates. The DBT-4.8 is manufactured with a Drill point Hex 8mm (0.31 in.) head drive and is used to penetrate steel decks up to 1.25 mm thick (0.049 in.). Standard length of the screws is 60 to 220 mm (2.4 to 8.6 in.). The fastener is treated with an Enduroguard 15 cycle coating.
- 2.9 The Guardian BS-6.1 steel fastener is designed for use with the Guardian TB(P) 8040, Guardian RB(P)-48 and Guardian R(P)-45 tube washer plates. The BS-6.1 is manufactured with a Torx-25 recessed head drive and is used to penetrate steel decks up to 1.00 mm thick (0.039 in.). Standard length of the screws is 60 to 120 mm (2.3 to 4.7 in.). The fastener is treated with an Enduroguard

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- 2.10 The Guardian CS-6.1 steel fastener is designed for use with the Guardian R(P)-75, Guardian R(P)-45, Guardian TB(P) 8040 and Guardian RB(P)-48 combination tube and washer plates. The CS-6.1 is manufactured with a Torx-25 recessed head drive and is used to penetrate concrete decks, pre-drilling is required. Standard length of the screws is 28 to 280 mm (1.1 to 11.0 in.). The fastener is treated with an Enduroguard 15 cycle coating.
- 2.1.1 All other products are as described in RoofNav along with other documents and correspondence applicable to this program.

III EXAMINATIONS AND TESTS

- 3.1 Samples were submitted for examination and testing as follows:
 - 3.1.1 Tests conducted were as required by the **Standards** listed in paragraph 1.3 above. All other testing was waived because of previous satisfactory performance of the insulations and the roof covers in a prior Approval programs sponsored by the cover or insulation manufacturers.
 - 3.1.2 The insulation and membrane samples were produced under the FM Approvals Facilities and Procedures Audit program as indicated by FM Approvals labels. All samples were considered to be representative of standard production and were examined and tested as indicated below.
 - 3.1.3 All data is on file at FM Approvals under Project I.D. 3034551 along with other documents and correspondence applicable to this program.
- 3.2 FM Approvals Corrosion Test
 - 3.2.1 A test was conducted using the FM Approvals Corrosion Test Apparatus to evaluate the potential resistance to corrosion of the fasteners.
 - 3.2.2 The test samples were placed in a DIN Standard 50018 Kesternick Test Cabinet and exposed to air saturated with water vapor at 104°F (40° C) containing a mild concentration of sulfur dioxide for 8 hours. After exposure, the samples were rinsed in distilled water and allowed to dry at room temperature for 16 hours. The samples were tested for 15 cycles. No ballast was used during the tests.
 - 3.2.3 The fasteners did not show more than 15% surface area corrosion and the coating was not blistered, peeled or cracked.
- 3.3 Comparative Tensile Withdrawal Tests
 - 3.3.1 Tensile withdrawal tests were conducted with the various fastener combinations to determine the comparative performance of the fasteners in resisting withdrawal from the deck. The results were compared and used as the basis for selection of the most critical fastener and deck to be used in the simulated wind uplift pressure tests.
 - 3.3.1.1 Tests were conducted using a Tinius Olsen tensile testing machine. Each fastener was installed in each deck sample with the fastener secured to the upper stationary jaws of the tester and the test jig holding the deck sample attached to the moving head. Force was exerted in a direct line parallel to the shank of the fastener at a crosshead speed of 2 in./min (51 mm/min) until failure occurred.

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3.3.2 Six samples (three for each fastener/deck combination) were prepared by installing fasteners along the center top flange of a 6 by 24 in. (150 by 610 mm) sample of each steel deck and inserting the deck sample in a test frame.

3.3.3 The results (average of three) of the tensile withdrawal tests were as follows:

| <u>Fastener</u> | <u>Deck (Thickness)</u> | <u>lbf (N)</u> |
|-----------------|------------------------------------|----------------|
| Guardian BS-4.8 | 0.0295 in. [0.7493 mm] thick steel | 593. (2638) |
| Guardian BS-6.1 | 0.0295 in. [0.7493 mm] thick steel | 746 (3319) |
| Guardian CS-6.1 | Concrete | 1366 (6080) |

3.4 FM Approvals 5x9 ft (1.5x2.7 m) Simulated Wind Uplift Pressure Tests

3.4.1 Tests were conducted using the FM Approvals Uplift Pressure Test Apparatus to evaluate the ability of the above deck components of the roofing system to resist a minimum simulated wind uplift pressure of 60 psf (2.9 kPa) without failure of the assemblies.

3.4.2 The simulated wind uplift pressure tests utilized a 9 ft. (2.7 m) long by 5 ft. (1.5 m) wide by 2 in. (51 mm) deep steel pressure vessel arranged to apply air pressure at pre-established standard rates to the underside of the test sample which formed the top of the pressure vessel. The vessel was pressurized with compressed air.

3.4.3 A net pressure of 30 psf (1.4 kPa) was applied to the test sample and maintained for 1 minute. The pressure was increased to 45 psf (2.2 kPa), then to 60 psf (2.9 kPa) and held for 1 minute at each increment. The pressure was increased in increments of 15 psf (0.7 kPa) every minute until failure occurred.

3.4.4 Four 5 by 9 ft. (1.5 by 2.7 m) samples were prepared. The components, sequence of installation and test results were as follows:

Sample No.1:

- Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck
- 2.0 in. (51 mm) thick ThermoRoof TR-26 FM pre-secured with Guardian R(P)-75 with the Guardian B -4.8 fastener and SPA 7070-D1 plates with the Guardian DBT-4.8 fastener.
- 0.047 in. (1.2 mm) Protan SE 1.2 mm roof cover (standard overlap) mechanically attached in the laps spaced 37 in. (940 mm) o.c. with Guardian RB(P)-48 polypropylene barbed membrane tube washer with the Guardian BS-4.8 fastener installed 12 in. (305 mm) o.c. in the 5 in. (127 mm) wide lap containing a 1.5 in. (38 mm) wide heat weld.

Test results: The sample met the 90 psf (4.3 kPa) minimum FM Approvals requirement for Class 1-90 windstorm classification. The sample failed after 9 seconds at 150 psf (7.2 kPa). The fail mode was membrane tearing around the seam plate. Assemblies evaluated via this method are limited to maximum Class 1-90 by FM Approvals.

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Sample No.2:

- Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck
- 2.0 in. (51 mm) thick Thermarroof TR-26 FM pre-secured with Guardian R(P)-75 with the Guardian BS-4.8 fastener and SPA 7070-D1 plates with the Guardian DBT-4.8 fastener.
- 0.047 in. (1.2 mm) Protan SE 1.2 mm roof cover (standard overlap) mechanically attached in the laps spaced 37 in. (940 mm) o.c. with Guardian TB(P) 8040 polypropylene barbed membrane tube washer with the Guardian BS-4.8 fastener installed 12 in. (305 mm) o.c. in the 5 in. (127 mm) wide lap containing a 1.5 in. (38 mm) wide heat weld.

Test results: The sample met the 90 psf (4.3 kPa) minimum FM Approvals requirement for Class 1-90 windstorm classification. The sample failed after 20 seconds at 150 psf (7.2 kPa). The fail mode was membrane tearing around the seam plate. Assemblies evaluated via this method are limited to maximum Class 1-90 by FM Approvals.

Sample No.3:

- Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck
- 2.0 in. (51 mm) thick Thermarroof TR-26 FM pre-secured with Guardian R(P)-75 with the Guardian BS-4.8 fastener or SPA 7070-D1 plates with the Guardian DBT-4.8 fastener.
- 0.047 in. (1.2 mm) Protan SE PFS (Prefabricated Flip System) 1.2 mm roof cover mechanically attached in the laps spaced 37 in. (940 mm) o.c. with Guardian R(P)-45 polypropylene membrane tube washer with the Guardian BS-4.8 fastener installed 18 in. (457 mm) o.c. in the 5 in. (127 mm) wide lap containing a 1.5 in. (38 mm) wide heat weld.

Test results: The sample met the 90 psf (4.3 kPa) minimum FM Approvals requirement for Class 1-90 windstorm classification. The sample failed after 13 seconds at 120 psf (5.7 kPa). The fail mode was tearing of the PFS strip around the seam plate. Assemblies evaluated via this method are limited to maximum Class 1-90 by FM Approvals.

Sample No.4:

- Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck
- 2.0 in. (51 mm) thick Thermarroof TR-26 FM pre-secured with Guardian R(P)-75 with the Guardian BS-4.8 fastener and SPA 7070-D1 plates with the Guardian DBT-4.8 fastener.
- 0.047 in. (1.2 mm) Protan SE 1.2 mm roof cover (standard overlap) mechanically attached in the laps spaced 37 in. (940 mm) o.c. with Guardian R(P)-45 polypropylene membrane tube washer with the Guardian BS-4.8 fastener installed 12 in. (305 mm) o.c. in the 5 in. (127 mm) wide lap containing a 1.5 in. (38 mm) wide heat weld.

Test results: The sample met the 60 psf (2.9 kPa) minimum FM Approvals requirement for Class 1-60 windstorm classification. The sample failed after 41 seconds at 75 psf (3.6 kPa). The fail mode was membrane tearing around the seam plate. Assemblies evaluated via this method are limited to maximum Class 1-90 by FM Approvals.

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3.5 FM Approvals 12x24 ft (3.7x7.3 m) Simulated Wind Uplift Pressure Tests

- 3.5.1 Tests were conducted using the FM Approvals Uplift Pressure Test Apparatus to evaluate the ability of the above deck components of the roofing system to resist a minimum simulated wind uplift pressure of 60 psf (2.9 kPa) without failure of the assemblies.
- 3.5.2 The simulated wind uplift pressure tests utilized a 24 ft. (7.3 m) long by 12 ft. (3.7 m) wide by 5 in. (127 mm) deep steel pressure vessel arranged to apply air pressure at pre-established standard rates to the underside of the test sample which formed the top of the pressure vessel. The vessel was pressurized with compressed air.
- 3.5.3 A net pressure of 30 psf (1.4 kPa) was applied to the test sample and maintained for 1 minute. The pressure was increased to 45 psf (2.2 kPa) then to 60 psf (2.9 kPa) and held for 1 minute at each increment. The pressure was increased in increments of 15 psf (0.7 kPa) every minute until failure occurred.
- 3.5.4 Nine 12 by 24 ft. (3.7 by 7.3 m) test samples were prepared. The components, sequence of installation and test results were as follows:

Sample No.1:

- FM Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck,
- 2.0 in. (51 mm) thick Ecotherm Toplevel XR, Foil Faced Isocyanurate foam insulation board, pre-secured to the deck with Guardian R(P)-75 Standard sleeve/tube washer combination with the Guardian BS-4.8 fasteners and the Guardian SPA 7070-D1 metal plate with the Guardian DBT-4.8 fastener.
- 0.047 in. (1.2 mm) thick Flachdach Technologie Gmbh & Co. Rhenofol CV 1.5 m wide roof cover mechanically attached 6 in. (152 mm) o.c. with Guardian TB(P)-8040 plastic barbed tube with washer plate and the Guardian BS-4.8 fastener on one half of the sample and on the other half the Guardian SPA 8240-D1 metal seam plate with the Guardian DBT-4.8 fastener in the 4.75 in. (120 mm) wide seams spaced 56 in. (1.4 m) on center, sealed with a 1.75 in. (44 mm) wide heat weld.

Test results: The sample met the 75 psf (3.6 kPa) minimum FM Approvals requirement for Class 1-75 windstorm classification. The sample failed 32 second at 90 psf (4.3 kPa). The failure mode was roof cover tearing around a seam plate.

Sample No.2:

- Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck (ASTM A653 SS Grade 80) secured to supports 6 ft. (1.8 m) o.c. with ITW Buildex ICH Traxx/5 fasteners 6 in. (150 mm) o.c. Side laps secured with ITW Buildex ICH Traxx/1 fasteners at 24 in. (610 mm) o.c.
- 2.0 in. (51 mm) thick Ecotherm Toplevel XR, Foil Faced Isocyanurate foam insulation board, pre-secured to the deck with Guardian R(P)-75 Standard sleeve/tube washer combination with the Guardian BS-4.8 fasteners and the Guardian SPA 7070-D1 metal plate with the Guardian DBT-4.8 fastener.
- 0.047 in. (1.2 mm) thick Protan SE 2.0 m, 78.74 in. (2.0 m) wide roof cover (standard overlap) mechanically attached 6 in. (152 mm) o.c. with Guardian TB(P) 8040 plastic barbed tube with washer plate and the Guardian BS-4.8 fastener in the 5 in. (127 mm) wide seams spaced 73.5 in. (1.8 m) on center, sealed with a 1.5 in. (38 mm) wide heat weld.

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Test results: The sample met the 90 psf (4.3 kPa) minimum FM Approvals requirement for Class 1-90 windstorm classification. The sample failed 10 seconds at 105 psf (5.0 kPa). The failure mode was roof cover tearing around the seam plate.

Sample No.3:

- FM Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck
- 2.0 in. (51 mm) thick Xtratherm XT/SP, Foil Faced Isocyanurate foam insulation board, pre-secured to the deck with Guardian R(P)-75 Standard sleeve/tube washer combination with the Guardian BS-4.8 fasteners and the Guardian SPA 7070-D1 metal plate with the Guardian DBT-4.8 fastener.
- 0.047 in. (1.2 mm) thick Protan SE 2.0 m, 78.74 in. (2.0 m) wide roof cover (standard overlap) mechanically attached 6 in. (152 mm) o.c. with Guardian RB(P)-48 plastic barbed tube with washer plate and the Guardian BS-4.8 fastener on one half of the sample and on the other half the Guardian SPA 8240-D1 metal seam plate with the Guardian DBT-4.8 fastener in the 5 in. (127 mm) wide seams spaced 73.5 in. (1.8 m) on center, sealed with a 1.5 in. (38 mm) wide heat weld.

Test results: The sample met the 75 psf (3.6 kPa) minimum FM Approvals requirement for Class 1-75 windstorm classification. The sample failed 1 second at 90 psf (4.3 kPa). The failure mode was roof cover tearing around a seam plate.

Sample No. 4:

- Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck (ASTM A653 SS Grade 80) secured to supports 6 ft. (1.8 m) o.c. with ITW Buildex ICH Traxx/5 fasteners 6 in. (150 mm) o.c. Side laps secured with ITW Buildex ICH Traxx/1 fasteners at 24 in. (610 mm) o.c.
- 2.0 in. (51 mm) thick Xtratherm XT/SP, Foil Faced Isocyanurate foam insulation board, pre-secured to the deck with Guardian R(P)-75 Standard sleeve/tube washer combination with the Guardian BS-4.8 fasteners and the Guardian SPA 7070-D1 metal plate with the Guardian DBT-4.8 fastener.
- 0.047 in. (1.2 mm) Protan SE PFS (Prefabricated Flip System) 1.2 mm roof cover mechanically attached in the prefabricated tabs located below the roof cover spaced 26 ½ in. (673 mm) o.c. with Guardian TB(P) 4080 polypropylene barbed membrane tube washer with the Guardian BS-6.1 fastener installed 6 in. (152 mm) o.c. in the 5 in (127 mm) wide tabs, sealed with a 2.0 in. (51 mm) wide heat weld.

Test results: The sample met the 195 psf (9.3 kPa) minimum FM Approvals requirement for Class 1-195 windstorm classification. The sample failed during the incremental increase to 210 psf (10.1 kPa). The failure mode was delamination occurring within the reinforcing scrim of the prefabricated tab.

Sample No. 5:

- FM Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck
- 2.0 in. (51 mm) thick Ecotherm Topline XR, Foil Faced Isocyanurate foam insulation, pre-secured to the deck with Guardian R(P)-75 Standard sleeve/tube washer combination with the Guardian BS-4.8 fasteners and the Guardian SPA 7070-D1 metal plate with the Guardian DBT-4.8 fastener.

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- 0.047 in. (1.2 mm) thick Protan SE 2.0 m, 78.74 in. (2.0 m) wide roof cover (standard overlap) mechanically attached 10 in. (254 mm) o.c. with two Guardian RB(P)-48 plastic barbed tube with washer plates installed side by side (2.5 in. [63 mm] o.c.) with the Guardian BS-4.8 fastener in the 5 in. (127 mm) wide seams spaced 74.75 in. (1.9 m) on center, sealed with a 2.0 in. (51 mm) wide heat weld.

Test results: The sample met the 60 psf (2.9 kPa) minimum FM Approvals requirement for Class 1-60 windstorm classification. The sample failed at 16 seconds into 75 psf (3.6 kPa). The failure mode was roof cover tearing around the seam plate.

Sample No.6:

- Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck (ASTM A653 SS Grade 80) secured to supports 6 ft. (1.8 m) o.c. with ITW Buildex ICH Traxx/5 fasteners 6 in. (150 mm) o.c. Side laps secured with ITW Buildex ICH Traxx/1 fasteners at 24 in. (610 mm) o.c.
- 2.0 in. (51 mm) thick Ecotherm Toplevel XR, Foil Faced Isocyanurate foam insulation board, pre-secured to the deck with Guardian R(P)-75 Standard sleeve/tube washer combination with the Guardian BS-4.8 fasteners and the Guardian SPA 7070-D1 metal plate with the Guardian DBT-4.8 fastener.
- 0.047 in. (1.2 mm) thick Renolit Belgium S.A. Alkorplan 35176, 1.6 m wide roof cover roof cover mechanically attached 6 in. (152 mm) o.c. with Guardian TB(P) 8040 plastic barbed tube with washer plate with the Guardian BS-4.8 on one half the sample and on the second half with the Guardian SPA 8240-D1 metal seam plate with the Guardian DBT-4.8 fastener in the 4 in. (102 mm) wide seams spaced 59 in. (1.5 m) on center, sealed with a 1.5 in. (38 mm) wide heat weld.

Test results: The sample met the 90 psf (4.3 kPa) minimum FM Approvals requirement for Class 1-90 windstorm classification. The sample failed 22 seconds at 105 psf (5.0 kPa). The failure mode was membrane tear around a seam plate.

Sample No.7:

- FM Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck
- 2.0 in. (51 mm) thick Xtratherm XT/SP, Foil Faced Isocyanurate foam insulation board, pre-secured to the deck with Guardian R(P) - 75 Standard sleeve/tube washer combination with the Guardian BS-4.8 fasteners and the Guardian SPA 7070-D1 metal plate with the Guardian DBT-4.8 fastener.
- 0.047 in. (1.2 mm) thick Sikaplan 12G 1.54 m wide roof cover mechanically attached 6 in. (152 mm) o.c. with Guardian RB(P)-48 plastic barbed tube with washer plate and the Guardian BS-4.8 fastener on one half the sample and on the second half with the Guardian SPA 8240-D1 metal seam plate with the Guardian DBT-4.8 fastener in the 4 in. (102 mm) wide seams spaced 57 in. (1.4 m) on center, sealed with a 1.5 in. (38 mm) wide heat weld.

Test results: The sample met the 75 psf (3.6 kPa) minimum FM Approvals requirement for Class 1-75 windstorm classification. The sample failed 57 seconds at 90 psf (4.3 kPa). The failure mode was roof cover tearing around a seam plate.

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Sample No.8:

- FM Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck (ASTM A653 SS Grade 80) secured to supports 6 ft. (1.8 m) o.c. with ITW Buildex ICH Traxx/5 fasteners 6 in. (150 mm) o.c. Side laps secured with ITW Buildex ICH Traxx/1 fasteners at 24 in. (610 mm) o.c.
- 2.0 in. (51 mm) thick Ecotherm Toplevel XR, Foil Faced Isocyanurate foam insulation board, pre-secured to the deck with Guardian R(P)-75 Standard sleeve/tube washer combination with the Guardian BS-4.8 fasteners and the Guardian SPA 7070-D1 metal plate with the Guardian DBT-4.8 fastener.
- 0.047 in. (1.2 mm) thick Sikaplan 12G 1.54 m wide roof cover roof cover mechanically attached 6 in. (152 mm) o.c. with Guardian TB(P) 8040 plastic barbed tube with washer plate or the Guardian BS-4.8 fastener in the 4 in. (102 mm) wide seams spaced 57 in. (1.4 m) on center, sealed with a 1.5 in. (38 mm) wide heat weld.

Test results: The sample met the 90 psf (4.3 kPa) minimum FM Approvals requirement for Class 1-90 windstorm classification. The sample failed 1 second at 105 psf (5.0 kPa). The failure mode was seam failure.

Sample No.9:

- Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck (ASTM A653 SS Grade 80) secured to supports 6 ft. (1.8 m) o.c. with ITW Buildex ICH Traxx/5 fasteners 6 in. (150 mm) o.c. Side laps secured with ITW Buildex ICH Traxx/1 fasteners at 24 in. (610 mm) o.c.
- 2.0 in. (51 mm) thick Ecotherm Xtratherm XT/SP, Foil Faced Isocyanurate foam insulation board, pre-secured to the deck with Guardian R(P)-75 Standard sleeve/tube washer combination with the Guardian BS - 4.8 fasteners and the Guardian SPA 7070-D1 metal plate with the Guardian DBT-4.8 fastener.
- 0.045 in. (1.1 mm) thick Dow Roofing Systems LLC. Stevens EP (TPO), 77.5 in. (1.97 m) wide roof cover roof cover mechanically attached 6 in. (152 mm) o.c. with Guardian TB(P)-8040 plastic barbed tube with washer plate with the Guardian BS-6.1 fastener in the 4.75 in. (120 mm) wide seams spaced 72.5 in. (1.8 m) on center, sealed with a 2.0 in. (51 mm) wide heat weld.

Test results: The sample met the 120 psf (5.7 kPa) minimum FM Approvals requirement for Class 1-120 windstorm classification. The sample failed 5 seconds at 135 psf (6.5 kPa). The failure mode was membrane tear around a seam plate.

IV MARKING

- 4.1 The manufacturer shall mark each board or wrapping with the manufacturer's name and product trade name. In addition, the board or wrapping must be marked with the Approval Mark of FM Approvals.
- 4.2 Markings denoting Approval by FM Approvals shall be applied by the manufacturer only within and on the premises of manufacturing locations that are under the FM Approvals Facilities and Procedures Audit program.
- 4.3 The manufacturer agrees that use of the FM Approvals name or Approval Mark is subject to the conditions and limitations of the Approval by FM Approvals. Such conditions and limitations must be included in all references to Approval by FM Approvals.

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V REMARKS

- 5.1 The securement of the roof system must be enhanced at the building corners and perimeter as outlined in FM Global Property Loss Prevention Data Sheet 1-29.
- 5.2 The roof covers must be installed using a roof perimeter flashing system Approved by FM Approvals. See RoofNav.

VI FACILITIES AND PROCEDURES AUDITS

The Afast BV manufacturing locations in Helmond, The Netherlands and Kwanmiao, Tainan Hsien, Taiwan R.O.C. are subject to periodic audit inspections to determine that the quality and uniformity of the materials have been maintained and will provide the same level of performance as originally Approved. The facilities and quality control procedures in place have been found to be satisfactory to manufacture product identical to that examined and tested as described in this report.

VII MANUFACTURER'S RESPONSIBILITIES

- 7.1 To assure compliance with his procedures in the field, the manufacturer shall supply to the roofer such necessary instruction or assistance required to produce the desired performance achieved in the tests.
- 7.2 The manufacturer shall notify FM Approvals of any planned change in the Approved products, prior to general sale or distribution, using Form 797, Approved Product Revision Report.

VIII DOCUMENTATION

The following documents describe the Afast Guardian fasteners and are filed under J.I. 3034551.

| Document | Issue or Revision | Description |
|-------------------------------|--------------------------|--------------------|
| Afast Audit Manual | 1/6/2009 | Audit Manual |
| Kwantex Research Audit Manual | 1/8/2009 | Audit Manual |

IX CONCLUSIONS

- 9.1 Test results from this FM Approvals approval program sponsored by Afast BV indicate that the TB(P) 8040, R(P)-45, RB(P)-48, tube/washer plates and the SPA-8240-D1, metal washer plate and Guardian BS-4.8, DBT-4.8, BS-6.1 and CS-6.1 fasteners meet the FM Approvals Standard 4470 (1986) Approval requirements for securement of Class 1 roof covers when installed in insulated steel deck and concrete deck constructions as follows:

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- 9.1.1 Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck (ASTM A653 SS Grade 80) secured to supports 6 ft. (1.8 m) o.c. with ITW Buildex ICH Traxx/5 fasteners 6 in. (150 mm) o.c. Side laps secured with ITW Buildex ICH Traxx/1 fasteners at 24 in. (610 mm) o.c. Any insulation Approved for use with Protan SE 1.2 mm (0.047 in.) thick roof cover, minimum 2.0 in. (51 mm) thick is presecured to the deck per Approval requirements. Minimum 0.047 in. (1.2 mm) thick Protan SE roof cover, maximum 39.37 in. (1.0 m) wide is mechanically attached with Guardian BS-4.8 fasteners and the Guardian RB(P)-48, Guardian R(P)-45 or TB(P)8040 membrane tube washer (steel deck) or Guardian CS-6.1 and Guardian RB(P)-48, Guardian R(P)-45 or TB(P)8040 Membrane Tube Washers (concrete deck – min 3/16 in. [5 mm] dia. pilot hole and min 1 in. [25 mm] embedment is required) spaced 12 in. (305 mm) o.c. in the membrane side laps. The rows of fasteners are a maximum of 37 in. (0.94 m) o.c. The laps are sealed with a 1.5 in. (38 mm) wide heat weld. Meets Class 1-90 windstorm classification.
- 9.1.2 Same as 9.1.1 above except 2.0 m (79 in.) wide Protan SE roof cover is secured maximum 73.5 in. (1.9 m) o.c. in the laps with Guardian BS-4.8 fasteners and Guardian TB(P) 8040 membrane tube washers (steel deck) or Guardian CS-6.1 and TB(P)8040 Membrane Tube Washers (concrete deck – min 3/16 in. [5 mm] dia. pilot hole and min 1 in. [25 mm] embedment is required) spaced 6 in. (152 mm) o.c. Meets Class 1-90 windstorm classification.
- 9.1.3 Steel (New) Concrete, Any insulation Approved for use with Protan SE, 1.2 mm (0.047 in.) thick roof cover, minimum 2.0 in. (51 mm) thick is pre-secured to the deck per Approval requirements. Minimum 0.047 in. (1.2 mm) thick Protan SE PFS roof cover, the pre-welded fastening strips are spaced a maximum of 39.37 in. (1.0 m) o.c. and mechanically attached with Guardian BS-4.8 fasteners and the Guardian R(P)-45 membrane tube washer (steel deck) or Guardian CS-6.1 and Guardian R(P)-45 Membrane Tube Washers (concrete deck – min 3/16 in. [5 mm] dia. pilot hole and min 1 in. [25 mm] embedment is required) spaced 18 in. (457 mm) o.c. in the 5 in. (127 mm) wide pre-welded fastening strips installed perpendicular to the length of the roll. The rows of fasteners are a maximum of 37 in. (0.94 m) o.c. The laps are sealed with a 1.5 in. (38 mm) wide heat weld. Meets Class 1-90 windstorm classification.
- 9.1.4 Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck (A1008/A1008M-01a, or A653/A653M-01a SS Grade 80) secured to supports 6 ft. (1.8 m) o.c. with ITW Buildex ICH Traxx/5 fasteners 6 in. (150 mm) o.c. Side laps secured with ITW Buildex ICH Traxx/1 fasteners at 24 in. (610 mm) o.c. Any insulation Approved for use with Protan SE, 1.2 mm (0.047 in.) thick roof cover, minimum 2.0 in. (51 mm) thick is pre-secured to the deck per Approval requirements. Minimum 0.047 in. (1.2 mm) thick Protan SE PFS roof cover, the pre-welded fastening strips are spaced a maximum of 26.5 in. (673 mm) o.c. and fastened with Guardian BS-6.1 fasteners and TB(P) 8040 membrane tube washers installed 6 in. (152 mm) o.c. Meets Class 1-195 windstorm classification.
- 9.1.5 Same as 9.1.4 above except concrete decks with Guardian CS-6.1 and Guardian TB(P) 8040 Membrane Tube Washers (concrete deck – min 3/16 in. (5 mm) dia. pilot hole and min 1 in. (25 mm) embedment is required).
- 9.1.6 Steel (New) Concrete, Any insulation Approved for use with Protan SE, 1.2 mm (0.047 in.) thick roof cover, minimum 2.0 in. (51 mm) thick is pre-secured to the deck per Approval requirements. Protan SE 2.0 m (79 in.) wide roof cover is mechanically attached with Guardian BS-4.8 fasteners and the Guardian RB(P)-48 membrane tube washer or Guardian DBT-4.8 fasteners and the SPA 8240-D1 seam plate (steel deck) or Guardian CS-6.1 and Guardian RB(P)-48 Membrane Tube Washers (concrete deck – min 3/16 in. [5 mm] dia. pilot hole and min 1 in. [25 mm] embedment is required) spaced 6 in. (152 mm) o.c. in the membrane side laps. The rows of fasteners are a maximum of 73.5 in. (1.8 m) o.c. The laps are sealed with a 1.5 in. (38 mm) wide heat weld.

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Meets Class 1-75 windstorm classification.

- 9.1.7 Same as 9.1.6 above except Protan SE 2.0 m (79 in.) wide roof cover is secured 10 in. (393 mm) o.c. with two fasteners installed side by side 2.5 in. (63 mm) apart. The rows of fasteners are a maximum of 73.75 in. (1.8 m) o.c. Meets Class 1-60 windstorm classification.
- 9.1.8 Steel (New), Concrete, Any insulation Approved for use with Flachdach Technologie GmbH & Co KG, Rhenofol CV, 1.2 mm (0.047 in.) thick, 1.5 m (59.05 in.) wide roof cover minimum 2.0 in. (51 mm) thick is pre-secured to the deck per Approval requirements. Roof cover mechanically attached with Guardian BS-4.8 fasteners and Guardian TB(P) 8040 Membrane Tube Washers or Guardian DBT-4.8 fasteners and Guardian SPA-8240-D1 plates (steel deck) or Guardian CS-6.1 and Guardian TB(P) 8040 Membrane Tube Washers (concrete deck – min 3/16 in. [5 mm] dia. pilot hole and min 1 in. [25 mm] embedment is required) spaced 6 in. (152 mm) o.c. in the side laps. The rows of fasteners are a maximum of 56 in. (1.4 m) o.c. The laps are sealed with a 1.75 in. (44 mm) wide heat weld. Meets Class 1-75 windstorm classification.
- 9.1.9 Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck (A1008/A1008M-01a, or A653/A653M-01a SS Grade 80) secured to supports 6 ft. (1.8 m) o.c. with ITW Buildex ICH Traxx/5 fasteners 6 in. (150 mm) o.c. Side laps secured with ITW Buildex ICH Traxx/1 fasteners at 24 in. (610 mm) o.c. Any insulation Approved for use with Renolit Belgium SA Alkorplan 35176, 1.6 m (63 in.) wide roof cover mechanically attached with Guardian BS-4.8 fasteners and Guardian TB(P) 8040 Membrane Tube Washers or Guardian DBT-4.8 fasteners and Guardian SPA-8240-D1 seam plates spaced 6 in. (152 mm) o.c. in the side laps. The rows of fasteners are a maximum of 59 in. (1.5 m) o.c. The laps are sealed with a 1.5 in. (38 mm) wide heat weld. Meets Class 1-90 windstorm classification.
- 9.1.10 Same as 9.1.9 above except Concrete Deck. Guardian CS-6.1 and Guardian TB(P) 8040 Membrane Tube Washers (concrete deck – min 3/16 in. [5 mm] dia. pilot hole and min 1 in. [25 mm] embedment is required) Meets Class 1-90 windstorm classification.
- 9.1.11 Steel (New) Any insulation Approved for use with Sika Services AG Sikaplan 12 G, 1.2 mm (0.047 in.) thick roof cover, minimum 2.0 in. (51 mm) thick is pre-secured to the deck per Approval requirements. Minimum 1.2 mm (0.047 in.) thick Sikaplan 12 G, 1.5 m (59 in.) wide is mechanically attached with Guardian BS-4.8 fasteners and the Guardian RB(P)-48 membrane tube washer or Guardian DBT-4.8 fasteners and the SPA 8240-D1 seam plate (steel deck) or Guardian CS-6.1 and Guardian RB(P)-48 Membrane Tube Washers (concrete deck – min 3/16 in. [5 mm] dia. pilot hole and min 1 in. [25 mm] embedment is required) spaced 6 in. (152 mm) o.c. in the membrane side laps. The rows of fasteners are a maximum of 57 in. (1.4 m) o.c. The laps are sealed with a 1.5 in. (38 mm) wide heat weld. Meets Class 1-75 windstorm classification.
- 9.1.12 Same as 9.1.11 above except Guardian BS-4.8 fasteners and the Guardian TB(P) 8040 membrane tube washer in the membrane side laps. Meets Class 1-90 windstorm classification.
- 9.1.13 Approved 22 ga. (0.0295 in. [0.7493 mm]) Steel deck (A1008/A1008M-01a, or A653/A653M-01a SS Grade 80) secured to supports 6 ft. (1.8 m) o.c. with ITW Buildex ICH Traxx/5 fasteners 6 in. (150 mm) o.c. Side laps secured with ITW Buildex ICH Traxx/1 fasteners at 24 in. (610 mm) o.c. Any insulation Approved for use with Stevens EP (TPO) minimum 2.0 in. (51 mm) thick is pre-secured to the deck per Approval requirements. Minimum 0.045 in. thick Dow Roofing Systems' Stevens EP (TPO), 1.97 m (77.60 in.) wide is mechanically attached Guardian BS-4.8 fasteners and the Guardian TB(P) 8040 membrane tube washers spaced 6 in. (152 mm) o.c. in the membrane side laps. The rows of fasteners are maximum 72 in. (1.8 m) o.c. The laps are sealed

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with a 2.0 in. (51 mm) wide heat weld. Meets Class 1-120 windstorm classification.

9.1.14 Same as 9.1.13 above except Concrete Deck. Guardian CS-6.1 and Guardian TB(P) 8040 Membrane Tube Washers (concrete deck – min 3/16 in. [5 mm] dia. pilot hole and min 1 in. [25 mm] embedment is required).

9.1.15 Test results from this program also indicates that the Guardian R(P)-75 insulation tube/washer with the Guardian BS-4.8 or BS-6.1 fasteners and Guardian SPA 7070-D1 insulation plates with the Guardian DBT-4.8 fastener meet the FM Approvals Standard 4470 (1986) Approval requirements for presecurement of insulation when used with mechanically attached single ply roof covers.

9.1.16 Consult RoofNav for details of approved constructions, windstorm classifications of specific insulation/fastener combinations and ASTM E 108-07 ratings.

9.2 Since a duly signed Master Agreement is on file for this customer, Approval is effective as of the date of this report.

9.3 Continued Approval will depend upon satisfactory field experience and periodic Facilities and Procedures Audits.

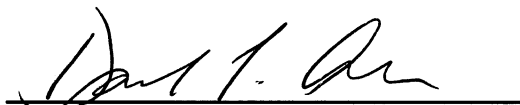
TESTING SUPERVISED BY: D. L. Alves

PROJECT DATA RECORD: 3034551

ORIGINAL TEST DATA: None

ATTACHMENTS: None

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