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APPROVAL REPORT

APPROVAL OF ALTERNATE SHEET WIDTHS, PLATES AND FASTENERS FOR USE WITH RHENOFOL CV MEMBRANE

Prepared for:

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**Project ID. 3008980
Class 4470
Date: November 26, 2001**

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**APPROVAL OF ALTERNATE SHEET
WIDTHS, PLATES AND FASTENERS
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I INTRODUCTION

- 1.1 FlachdachTechnologie GmbH & Co. KG submitted their alternate width Rhenofol CV membrane and Olympic Fasteners XHD 2-3/8 in. Barbed Plate and #12 Standard fastener to determine if they meet the approval requirements of the **Standard** listed below.
- 1.2 This Report may be reproduced only in its entirety and without modification.
- 1.3 **Standard:**

| Title | Class Number | Date |
|---------------------|---------------------|-------------|
| Class 1 Roof Covers | 4470 | April, 1986 |

- 1.4 This examination consisted of simulated wind uplift pressure testing.
- 1.5 Examination shows that the Rhenofol CV when used in conjunction with the Olympic Fasteners XHD 2-3/8 in. Barbed Plate and #12 Standard fastener meet the Approval requirements of the **Standard** listed above.
- 1.6 **Listings:** The tested constructions meet the Factory Mutual Research Approval criteria when installed as specified in the **CONCLUSIONS** of this report and when Approval is effective will be listed in the Factory Mutual Research Approval Guide.

II DESCRIPTION

- 2.1 Rhenofol CV roof cover is a 0.048 in. (1.2 mm) thick or 0.060 in. (1.5 mm) thick flexible PVC (polyvinyl chloride) sheet supplied with woven polyester reinforcing. The sheet is supplied in rolls of various dimensions. It consists of a woven polyester mat sandwiched between PVC plastic. The top surface is light gray in color and the bottom surface is dark gray.

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- 2.2 Olympic Fasteners XHD 2-3/8 in. Barbed Plate is a nominal 2 3/8 in. (60 mm) diameter barbed metal seam plate, minimum 0.035 in. (1.0 mm) thick AZ 55 Galvalume coated steel discs with 0.275 in. (7 mm) diameter center hole and six pointed barbs projecting downward 1/8 in. (3 mm) from the underside between two raised circular stampings.

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 **Standard** listed in paragraph 1.3 above. Factory Mutual Research Calorimeter testing for the potential for fire spread below the roof deck, ASTM E-108 Spread of Flame testing, Leakage, Hail and Foot Traffic testing were waived because of previous satisfactory performance of the membrane in a prior Approval program (Factory Mutual Research J.I. 3X4A5.AM). Factory Mutual Research corrosion resistance testing was waived because of previous satisfactory performance of the plates in prior Approval programs sponsored by the fastener manufacturer.

3.2 Factory Mutual Research 12x24 ft (3.7x7.3 m) Simulated Wind Uplift Pressure Tests

3.2.1 Tests were conducted using the Factory Mutual Research 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.

3.2.1.1 The simulated wind uplift pressure tests utilized a 24 ft. (7.3 m) long by 12 ft. (3.7 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.

3.2.1.2 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.

3.2.2 Two - 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: 12 ft 3 in. (3.7 m) sections of ASTM A611 grade E Factory Mutual Research Approved 22 gauge type B primed steel deck were installed parallel to the 24 ft (7.3 m) test frame dimension and secured to 1/4 in. (6.4 mm) thick steel structural supports spaced 6 ft 0 in. (1830 mm) on center with 12-14x1 1/4 ICH TRAXX/5 fasteners 6 in. (152 mm) on center at each bearing and puddle welds 12 in. (305 mm) on center at the perimeter of the test frame. Deck side laps were secured 24 in. (610 mm) on center with 10-14x7/8 ICH TRAXX/1 fasteners. 1.6 in. (40 mm) thick by 23-5/8 in. by 47-1/4 in. (600 by 1200 mm) Kingspan Industrial Insulation Kooltherm K1 FM insulation was loose laid with the longer dimension parallel to the 24 ft (7.3 m) test frame dimension and with the shorter joints staggered 47-1/4 in. (1200 mm). 48 mil (1.2 mm) thick Rhenofil CV roof cover in 59 in. (1500 mm) wide sheets with center lap seam parallel to the 12 ft (3.7 m) test frame dimension was

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fastened to the deck by centering the Olympic Fasteners 2 3/8 in. Barbed Steel Plate within the 5 in. roof cover laps, spaced 57 1/4 in. (1455 mm) o.c., and installing the #12 Standard fasteners 6 in. (150 mm) o.c. along the seam. The laps were sealed with a 1.6 in. (40 mm) heat weld.

Test Results: The test sample exceeded the 135 psf (6.4 kPa) minimum Factory Mutual Research requirements for Class 1-135 windstorm classification. The construction failed after maintaining a load of 150 psf (7.1 kPa) for 5 seconds.

Sample No.2: 12 ft 3 in. (3.7 m) sections of ASTM A611 grade E Factory Mutual Research Approved 22 gauge type B primed steel deck were installed parallel to the 24 ft (7.3 m) test frame dimension and secured to 1/4 in. (6.4 mm) thick steel structural supports spaced 6 ft 0 in. (1830 mm) on center with 12-14x1 1/4 ICH TRAXX/5 fasteners 6 in. (152 mm) on center at each bearing and puddle welds 12 in. (305 mm) on center at the perimeter of the test frame. Deck side laps were secured 24 in. (610 mm) on center with 10-14x7/8 ICH TRAXX/1 fasteners. 1.6 in. (40 mm) thick by 23-5/8 in. by 47-1/4 in. (600 by 1200 mm) Kingspan Industrial Insulation Kooltherm K1 FM insulation was loose laid with the longer dimension parallel to the 24 ft (7.3 m) test frame dimension with the shorter joints staggered 47-1/4 in. (1200 mm). 48 mil (1.2 mm) thick Rhenofol CV roof cover in 59 in. (1500 mm) wide sheets with center lap seam parallel to the 12 ft (3.7 m) test frame dimension was fastened to the deck by centering the Olympic Fasteners 2 3/8 in. Barbed Steel Plate within the 5 in. roof cover laps, spaced 57 1/4 in. (1455 mm) o.c., and installing the #12 Standard fasteners 12 in. (300 mm) o.c. along the seam. The laps were sealed with a 1.6 in. (40 mm) heat weld.

Test Results: The test sample exceeded the 60 psf (2.9 kPa) minimum Factory Mutual Research requirements for Class 1-60 windstorm classification. The construction failed after maintaining a load of 75 psf (3.6 kPa) for 5 seconds.

IV MARKING

- 4.1 The manufacturer shall mark each packing container with the manufacturer's name and product trade name. In addition, the container must be marked with the Factory Mutual Research Approval Mark and the words "Subject to the conditions of Approval as a roof cover when installed as described in the current edition of the Factory Mutual Research Approval Guide".
- 4.2 Markings denoting Factory Mutual Research Approval shall be applied by the manufacturer only within and on the premises of manufacturing locations that are under the Factory Mutual Research Facilities and Procedures Audit program.
- 4.3 The manufacturer agrees that use of the Factory Mutual Research name or Approval Mark is subject to the conditions and limitations of the Factory Mutual Research Approval. Such conditions and limitations must be included in all references to Factory Mutual Research Approval.

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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 Sheets 1-28 and 1-29.
- 5.2 The roof covers must be installed using a Factory Mutual Research Approved roof perimeter flashing system. See the current edition of the Factory Mutual Research Approval Guide.

VI FACILITIES AND PROCEDURES AUDITS

FlachdachTechnologie GmbH & Co. KG manufacturing location in Mannheim, Germany and the Olympic Fasteners manufacturing location in Agawam, MA 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 Factory Mutual Research of any planned change in the Approved product, prior to general sale or distribution, using Form 797, Approved Product Revision Report.

VIII DOCUMENTATION

No new critical documents have been created as a result of this project as all components used are Factory Mutual Research Approved.

IX CONCLUSIONS

- 9.1 Test results indicate that mechanically secured Rhenofol CV roof covers meet the Factory Mutual Research Standard 4470 (1986) Approval requirements for Class 1 roof covers when installed in insulated steel deck roof constructions as follows:
 - 9.1.1 Factory Mutual Research Approved steel roof deck meeting ASTM Designation A611 Grade E or ASTM Designation A653 Grade 80 (Mill certification to the building owner or designated representative required) is installed per the steel deck listing in the current edition of the Factory Mutual Research Approval Guide. Minimum 1.6 in. (40 mm) thick Kingspan Industrial Insulation Kooltherm K1 FM, 2 in. (50 mm) thick Rockwool Hardrock 391, minimum 1.6 in. (40 mm) to max 3.2 in. (80 mm) thick Powerdeck 20, Powerdeck A1 and RF43.3 or minimum 1.4 in. (36 mm) thick E'NRG'Y 2 is pre-secured to the deck. Rhenofol CV roof cover minimum, 48 mil (1.2 mm) thick in 59 in. (1500 mm) wide sheets, is secured through the insulation to the deck

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with the Olympic #12 Standard Fasteners & Olympic XHD 2-3/8 in. Barbed Plates in the minimum 5 in. (127 mm) wide roof cover side laps spaced a maximum of 54 in. (1370 mm) apart. The seams are then sealed with 1.6 in (40 mm) heat welds. Meets Class 1-135 windstorm classification with fasteners and plates a maximum of 6 in. (150 mm) on center. Meets Class 1-60 windstorm classification with fasteners and plates a maximum of 12 in. (300 mm) on center.

- 9.2 Consult the current edition of the Factory Mutual Research Approval Guide for further details on the Approved roof assemblies.
- 9.3 Tests show that the tested roof constructions in and of themselves would not create a need for automatic sprinklers.
- 9.4 Approval is effective when the Approval Agreement is signed and received by Factory Mutual Research.
- 9.5 Continued Approval will depend upon satisfactory field experience and periodic Facilities and Procedures Audits.

TESTING SUPERVISED BY:

S.R. Clark

PROJECT DATA RECORD:

3008980

ORIGINAL TEST DATA:

PDR for J.I. 3008980

ATTACHMENTS:

None

REPORT BY:



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REPORT REVIEWED BY:



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