

APPROVAL REPORT

APPROVAL EXAMINATION OF LIVEROOF MODULAR GREEN ROOF SYSTEMS PER FM STANDARD 4477

Prepared for:

**LiveRoof, LLC
PO Box 533
Spring Lake, MI 49456**

Project ID: 3041305

Class: 4477

Date of Approval: June 22, 2011

Authorized by:


Richard P. Ferron, Group Manager and AVP

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PER FM STANDARD 4477**

from

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PO Box 533
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I INTRODUCTION

- 1.1 LiveRoof, LLC submitted their LiveRoof Standard and LiveRoof Deep modular vegetative roof systems to determine if they meet the requirements of the **Standard** listed below when used in Class 1 roof deck constructions as described in the **EXAMINATIONS AND TESTS** section of this report.
- 1.2 Previous testing has been conducted on the FM Approved liquid applied, single ply, BUR asphalt based, modified bitumen or coal tar based roof cover assemblies over which the vegetative roof system will be installed. See RoofNav for details.
- 1.3 This report may be reproduced only in its entirety and without modification.
- 1.4 **Standard:**

Title	Class Number	Date
Vegetative Roof Systems	4477	June, 2010

- 1.5 Examination included foot traffic testing and engineering review of specifications and quality control documents.
- 1.6 Tests show that the LiveRoof Standard Tray and LiveRoof Deep Tray, as tested, meet the Approval requirements of the **Standard** listed above for vegetative roof systems.
- 1.7 **Listings:** The constructions meet the Approval criteria of FM Approvals when installed as specified in the **CONCLUSIONS** of this report. The assemblies will be listed in RoofNav.

II DESCRIPTION

- 2.1 LiveRoof Standard Tray is a 12x24x3.25 in. (305x610x83 mm) polypropylene tray with overlapping lips. Each tray contains a plastic collar which extends 1 in. (25 mm) above the top of the tray. When the tray is filled with engineered soil, the plastic collar may then be removed such that the top 1 in. (25 mm) of soil becomes a monolithic roof surface leaving the tray unexposed under a minimum engineered soil depth of 1 in. (25 mm).
- 2.2 LiveRoof Deep Tray is a 12x24x3.25 in. (305x610x83 mm) polypropylene tray with overlapping lips. Each tray contains a plastic collar which extends 2.75 in. (70 mm) above the top of the tray. When the tray is filled with engineered soil, the plastic collar may then be removed such that the top 2.75 in. (70 mm) of soil becomes a monolithic roof surface leaving the tray unexposed under a

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minimum engineered soil depth of 2.75 in. (70 mm).

- 2.3 All other products are as described in RoofNav. Proprietary formulations, specifications and drawings are on file at FM Approvals.

III EXAMINATIONS AND TESTS

- 3.1 Samples were submitted for examination and testing as outlined below.

3.1.1 Tests conducted were as required by the **Standard** listed in paragraph 1.4 above. Calorimeter testing has been waived due to structural concrete roof deck applications. ASTM E108 testing was waived due to satisfactory performance of the vegetation in previous FM sponsored testing. See testing under Project ID 3035693 for details. Leakage testing has been waived as no root barriers are included for examination in this program.

3.1.2 All samples were considered to be representative of standard production and were examined and tested as indicated below.

3.1.3 All components incorporated into test samples were selected by FM Approvals personnel. Test samples were prepared by, or under the supervision of, FM Approvals personnel.

3.1.4 All data is on file at FM Approvals under 3041305 along with other documents and correspondence applicable to this program.

3.2 FM Approvals Resistance to Foot Traffic Tests

3.2.1 Tests were conducted using the FM Approvals Resistance to Foot Traffic Test Apparatus to evaluate the ability of the drainage/retention panel (LiveRoof Tray) to resist simulated foot traffic without damage.

3.2.1.1 A 3 in. (76 mm) square steel plate with rounded corners shall be centered on the centerline of a 12 in. (305 mm) square horizontal panel and positioned along the butt edge and side joint of the drainage/retention panel (LiveRoof Tray). In modular tray systems, the steel plate shall be centered on the tray.

3.2.1.2 A 200 lb (91 kg) load shall be imposed on the plate. The superimposed load shall be reduced to zero and reloaded a minimum of four additional times, with penetration and residual readings taken each time without removing the plate. The specimen shall be inspected after the test and the condition of the substrate noted at the steel plate interface.

3.2.1.3 The top surface of the drainage/retention panel shall resist puncture from the 200 lb (91 kg) load distributed over the area of the 3 in. (76 mm) square plate. Under this same loading, modular tray system edges shall be tested where trays interconnect.

3.2.2 Two test samples were prepared. The components and sequence of installation were as follows:

Sample #1 – Drainage/retention:

Modular System: LiveRoof Standard Tray

Soil: LiveRoof engineered soil filled to edge of tray

No damage to the LiveRoof tray test sample described in Sample #1 above was observed after the

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test.

Sample #2 – Tray edge:

Modular System: LiveRoof Standard Tray
Soil: Not included, empty conditions

No damage to the LiveRoof tray test sample described in Sample #2 above was observed after the test.

IV MARKING

- 4.1 The manufacturer shall mark each tray, bundle or packing container with the manufacturer's name and product trade name. In addition, the tray, bundle or container 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.

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 Provide stone ballast or concrete paver blocks to cover all border zones as outlined in FM Global Property Loss Prevention Data Sheet 1-35.
- 5.3 The roof covers must be installed using an FM Approved roof perimeter flashing system. See RoofNav for details.

VI FACILITIES AND PROCEDURES AUDITS

The LiveRoof, LLC manufacturing location in Grand Haven, MI is subject to periodic audit inspections to determine the quality and uniformity of the materials have been maintained and will provide the same level of performance as originally FM 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.

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- 7.2 The manufacturer shall notify FM Approvals of any planned change in the FM Approved products, prior to general sale or distribution, using Form 797, FM Approved Product Revision Report.

VIII DOCUMENTATION

The following document describes LiveRoof, LLC roofing products and is filed under Project ID 3041305.

Document	Revision	Description
Audit Manual	April, 2011	LiveRoof @ Grand Haven, MI

IX CONCLUSIONS

- 9.1 Test results from this and previous programs indicate that LiveRoof Standard and LiveRoof Deep Trays meet the Standard 4477 Approval requirements for vegetative roof systems when installed as follows:

Construction #1: Structural Concrete Deck (new, recover). An FM Approved liquid applied, single ply, BUR asphalt based, modified bitumen or coal tar roof cover assembly is installed over the structural concrete. Root Barrier (where required, 9.3): A minimum 0.03 in. (0.8 mm) FM Approved root barrier, or FM Approved single ply roof cover to be used as a root barrier, is installed per FM Property Loss Prevention Data Sheet 1-35. Vegetative Roof System: LiveRoof Standard or LiveRoof Deep modular vegetative roof system consisting of vegetation in minimum 4.25 in. (108 mm) deep engineered soil in polypropylene trays. The engineered soil is formulated by region and consists of minimum 92% inorganic material.

- 9.1.1 LiveRoof Standard or LiveRoof Deep modular vegetative roof system: The trays are minimum 3.25 in. (83 mm) deep or 1 in. (25 mm) less the height of the soil depth. The trays are stand alone and arranged loose laid together such that when the engineered soil and vegetation packaging is removed, the top 1 in. (25 mm) (LiveRoof Standard Tray) or 2.75 in. (70 mm) (LiveRoof Deep Tray) of soil creates a monolithic engineered soil and vegetative surface that does not expose the polypropylene tray.
- 9.1.2 Vegetation: Minimum 60% vegetation coverage consisting of succulent plant species (Sedum, Sempervivium, Agave, Aloe, Crassula, Delosperma, Haworthia, Jovibarba or Senecio) to an average maximum height of 9 in. (229 mm). Flowering accent species Allium species may be used at a maximum coverage rate of 5% and may have a maximum average height of 14 in. (356 mm).
- 9.1.3 The following roof cover manufacturers have provided written authorization specifying compatibility between their components and LiveRoof components. LiveRoof vegetative roof systems may be installed over FM Approved liquid applied, single ply, BUR asphalt based, modified bitumen or coal tar roof covers (or in cases where single ply roof covers are acting as a root barrier) manufactured by the following companies.

Barrett Co.

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Carlisle SynTec Inc.
CertainTeed Corp.
Durapax LLC
Flex Membrane International Inc
GAF Materials Corp
Henry Company
IKO Industries Ltd
Kemper System America, Inc
Seaman Corporation
Versico LLC

- 9.1.3.1 When a single ply PVC roof cover is employed as a root barrier layer, it is not to be used over asphaltic or coal tar based systems.
- 9.2 The vegetative roof assembly shall be installed per FM Global Property Loss Prevention Data Sheet 1-35.
- 9.3 FM Property Loss Prevention Data Sheet 1-35 requires the following in regards to the root barrier layer.
 - 9.3.1 A root barrier must be provided over FM Approved BUR asphalt based, modified bitumen, coal tar based roof assemblies or single ply roof assemblies which do not incorporate welded laps.
 - 9.3.2 When the laps of the FM Approved waterproofing membrane are not welded (e.g., EPDM membranes), provide a root barrier with continuous welded seams.
 - 9.3.3 Seal all root barrier laps in accordance with FM Global Property Loss Prevention Data Sheet 1-35
- 9.4 Meets an ASTM E108 Class A rating at a slope of 2 in 12.
- 9.5 As the vegetative roof components are loose laid, there is no wind uplift rating associated with the vegetative roof assembly. The wind uplift rating of the system is per the FM Approved roof assembly over which the vegetative roof system is installed. In addition, the assembly must be installed within the limitations outlined in FM Global Property Loss Prevention Data Sheet 1-35.
- 9.6 Since a duly signed Master Agreement is on file for this customer, Approval is effective as of the date of this report.
- 9.7 Continued Approval will depend upon satisfactory field experience and periodic Facilities and Procedures Audits.

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TESTING SUPERVISED BY:

Michael C. Burke

PROJECT DATA RECORD:

3041072

ORIGINAL TEST DATA:

3035693

ATTACHMENTS:

None

REPORT BY:

REPORT REVIEWED BY:



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