

EXISTING PVC ROOF COVERS

Table of Contents

	Page
1.0 SCOPE	2
1.1 Changes	2
2.0 LOSS PREVENTION RECOMMENDATIONS	2
2.1 Construction and Location	2
2.1.1 Unreinforced PVC Roof Membranes	2
2.1.2 Reinforced PVC Roof Membranes	2
2.1.3 Reinforced and Unreinforced PVC Roof Membranes	3
3.0 SUPPORT FOR RECOMMENDATIONS	3
3.1 Loss History	3
4.0 REFERENCES	4
4.1 FM Global	4
APPENDIX A GLOSSARY OF TERMS	4
APPENDIX B DOCUMENT REVISION HISTORY	4
APPENDIX C ADDITIONAL INFORMATION	4

List of Figures

Fig. 1. This rubber walkway pad had been secured to the PVC membrane with heat-welded tabs.	3
--	---

1.0 SCOPE

This document gives guidelines regarding the examination of existing PVC (polyvinyl chloride) roof coverings. These supplemental guidelines are in addition to those dealing with roof cover systems in general, such as Data Sheet 1-29, *Above-Deck Roof Components*.

1.1 Changes

May 2000. This revision of the document has been reorganized to provide a consistent format.

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 Construction and Location

2.1.1 Unreinforced PVC Roof Membranes

2.1.1.1 All unreinforced PVC roof membranes (whether ballasted or unballasted) that exhibit the warning signs noted below should be replaced with a Factory Mutual Research Approved (see Appendix A, for definition) roof cover system.

Warning signs of potential for shattering:

- Prior to shattering, the membrane may appear stretched at penetrations, walkway pads and flashings (Fig. 1). This is a result of membrane shrinkage.
- The membrane may be embrittled. That is, it may have lost some flexibility. This is usually best investigated at penetrations.
- The membrane may have developed small holes or slits.

2.1.1.2 If confirmation of membrane condition is needed, an independent roofing consultant, familiar with the phenomenon, should be engaged to survey the areas in question, and to have necessary laboratory tests conducted. The consultant should comment on any loss of thickness, strength and elasticity in the PVC roof membrane, and also should prioritize areas needing replacement and/or future survey updates. The test results are compared to the original specifications of the installed material.

Factory Mutual Research Standards Division can assist in the interpretation of the test results.

2.1.1.3 For all unreinforced PVC covers that are five years of age or older, **including those not exhibiting warning signs**, replace the roof cover, or at a minimum, engage an independent roofing consultant (as noted above) to determine the roof condition.

2.1.1.4 Any replacement schedule should consider the occupancy's susceptibility to water damage. If practical, schedule inspection and replacement for periods of warm, clear weather, when the membrane temperature is 60°F (15.6°C) or higher.

2.1.1.5 **In addition to unreinforced PVC roof covers (ballasted and non-ballasted) in cold climates, risk improvement priority should be given to non-ballasted, unreinforced PVC roof covers located within the "hail belt" as defined by Data Sheet 1-29.** The "hail belt" represents areas where the occurrence of hail is probable and of concern. Such impact on a deteriorated roof cover could cause damage to the cover. At locations outside the U.S., those areas with an average of three or more hail storms per year are considered equivalent to the "hail belt."

2.1.2 Reinforced PVC Roof Membranes

2.1.2.1 Existing reinforced PVC roof covers within hail prone areas (defined in 2.1.1) that are five or more years old AND appear to be embrittled should also be investigated by a roof consultant as noted above.

Reinforced membranes typically will not appear stretched, as the reinforcement resists the shrinkage induced-stresses. They may however become embrittled. They are typically not prone to shattering but can have significantly reduced hail resistance.

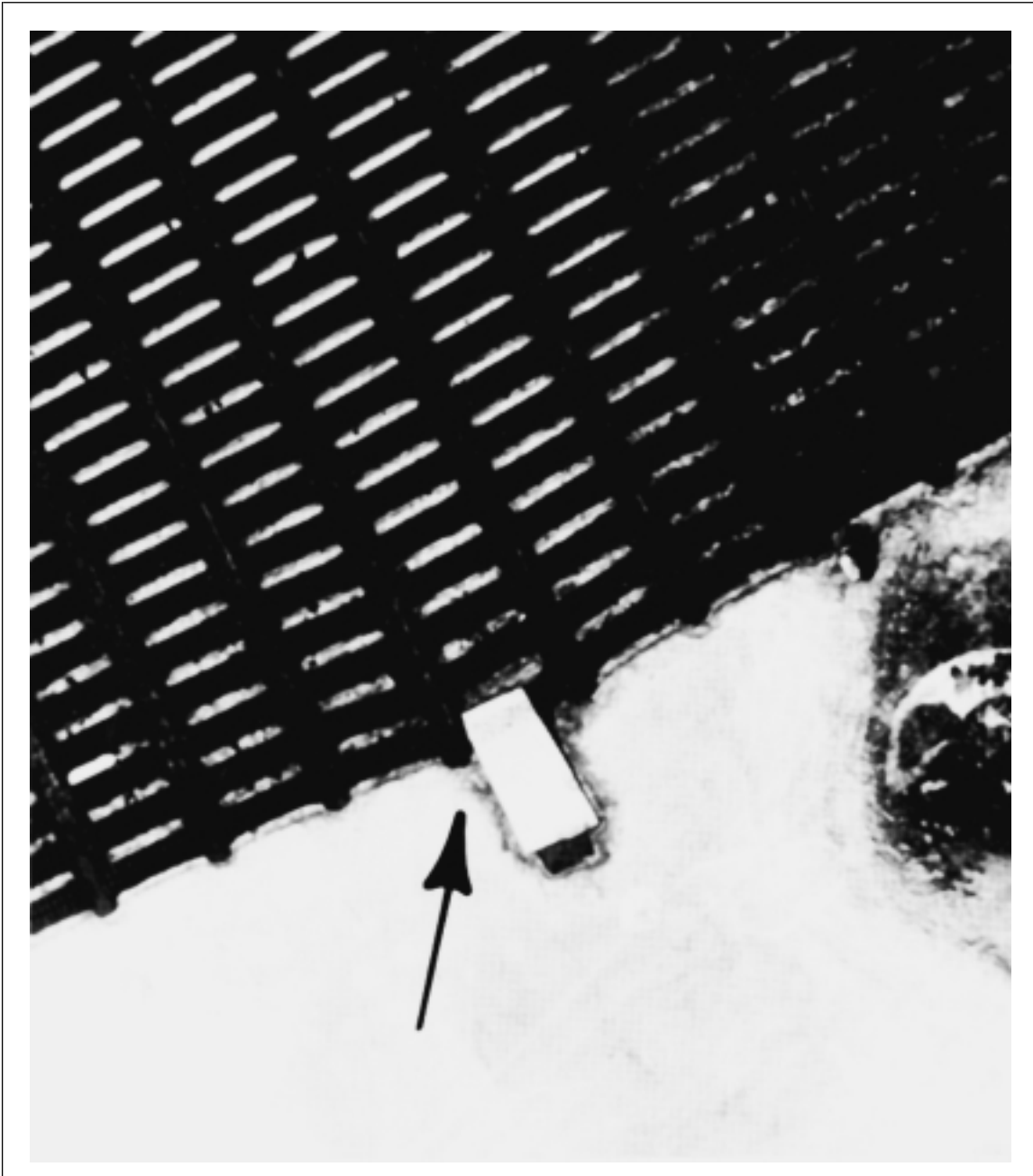


Fig. 1. This rubber walkway pad had been secured to the PVC membrane with heat-welded tabs.

2.1.3 Reinforced and Unreinforced PVC Roof Membranes

2.1.3.1 Any necessary foot traffic on older deteriorated PVC membranes (more than five years old) should occur only when the membrane is at least 60°F (15.6°C). Alternative paths or walkways to roof-mounted equipment, etc. should be provided where it is not practical to eliminate foot traffic.

3.0 SUPPORT FOR RECOMMENDATIONS

3.1 Loss History

Loss values that follow are gross amounts indexed to 1997 values.

During the period of 1987 to 1997 there were 43 losses to PVC roof covers involving the shattering/cracking/hail damage phenomenon. In most cases, the entire roof area or at least a large percentage of it was damaged. The average damaged area was 76,000 ft² (7814 m²). Most reported losses occurred between November and March. Twenty losses involved mechanically attached membranes, 23 involved ballasted membranes. All shattered membranes were unreinforced. In six losses, the deteriorated condition of the **reinforced** membrane allowed the damage upon impact from hail. In total, 20 losses were hail induced, 23 were cold weather induced.

4.0 REFERENCES

4.1 FM Global

Data Sheet 1-29, *Above-Deck Roof Components*.

APPENDIX A GLOSSARY OF TERMS

Approved: references to "Approved" in this data sheet means the product and services have satisfied the criteria for Factory Mutual Research Approval. Refer to the *Approval Guide* for a complete listing of products and services that are Factory Mutual Research Approved.

APPENDIX B DOCUMENT REVISION HISTORY

This document does not have any revision history.

APPENDIX C ADDITIONAL INFORMATION

The membranes used for ballasted roofs are not always Approved. Accelerated aging tests have been conducted by Factory Mutual Research during Approval testing since September 1987. In many cases, the membranes used in ballasted roof systems are of a less expensive make-up than their Approved adhered or mechanically attached counterparts.

Adhered and mechanically attached PVC membranes are exposed to ultraviolet (UV) radiation. Approved membranes are formulated to withstand this exposure. Older ballasted PVC membranes are usually unreinforced, and may not contain UV inhibitors that limit potential migration of plasticizer due to UV exposure. Migration of plasticizer can result in embrittlement, shrinking, puncturing, and cracking of the PVC membrane. Ballast coverage of PVC membranes has often not been effective in protecting against exposure. Loss of plasticizer can also result from contact with water and fines (silt) in improperly washed ballast, making proper roof slope and drainage critical as well.

Use of incompatible materials has been a factor in many losses as well. PVC membranes have been installed directly over polystyrene-based insulation and directly over existing asphalt or coal tar roofs. These substrates accelerate plasticizer migration.

There have been numerous losses where ballasted PVC roofs have cracked. These losses generally occur when the roof is five to ten years old. This problem has been due to the nature and formulation of ballasted PVC roofs, which are generally of a different formulation than Approved PVC roof covers.

In other cases, shattering has occurred to older, non-ballasted, unreinforced PVC roof covers. The cause of these losses is also believed to be due to plasticizer migration. Although shattering of PVC roof covers can occur without any warning, the warning signs noted in Recommendation 2.1.1.1 may be present.

To aid in identifying existing unreinforced PVC roof covers, it should be known that the PVC material is usually tan, grey or white in color (as opposed to black for EPDM). The existence of a reinforcement within the PVC material can sometimes be recognized by a visible surface pattern. It should be noted, however, that this visible surface pattern does not always exist when reinforcement is present. The reinforcement can always be seen in the cross-section of a cut edge, if one can be found (at roof-top equipment, roof hatches, etc.). Also, it is important to note that reinforced hypalon roof covers have a similar appearance to reinforced PVC roof covers.