



Property Risk Consulting Guidelines

FASTENING OF INSULATION ON METAL DECKS

INTRODUCTION

Windstorm damages many built-up roofing systems on metal decks each year. This damage has resulted not only from winds of hurricane and tornado force, but also from winds with velocities of less than 50 mph (80 km/h).

In most cases, failure of the roofing system results from:

- Poor or improper application or lack of adhesive;
- Delamination of insulation by loading that has been concentrated by the strip-application of adhesive;
- Weak flashing.

POSITION

Mechanically fasten the first layer of the insulation board to the metal deck.

New Installations

For installation of new roofing systems, mechanically fasten the insulation to the metal deck with the required number and type of fasteners listed for the maximum anticipated uplift pressure on the building. The maximum anticipated uplift pressure is determined by using the local building design standards¹ and PRC.2.0.1.1. Once the uplift pressure is determined, use Table 1 to determine which roof rating is acceptable for the uplift pressure.

TABLE 1
Maximum Uplift Pressure of Rating of Roofs

Roof Wind Uplift Rating	Maximum Uplift Pressure (psf)
30	15
60	30
90	45
120	60
150	75
180	90

SI Units: 1 psf = 47 Pa

Global Asset Protection Services, LLC, AXA Matrix Risk Consultants S.A. and their affiliates ("AXA XL Risk Consulting") provide loss prevention and risk assessment reports and other risk consulting services, as requested. In this respect, our property loss prevention publications, services, and surveys do not address life safety or third party liability issues. This document shall not be construed as indicating the existence or availability under any policy of coverage for any particular type of loss or damage. The provision of any service does not imply that every possible hazard has been identified at a facility or that no other hazards exist. AXA XL Risk Consulting does not assume, and shall have no liability for the control, correction, continuation or modification of any existing conditions or operations. We specifically disclaim any warranty or representation that compliance with any advice or recommendation in any document or other communication will make a facility or operation safe or healthful, or put it in compliance with any standard, code, law, rule or regulation. Save where expressly agreed in writing, AXA XL Risk Consulting and its related and affiliated companies disclaim all liability for loss or damage suffered by any party arising out of or in connection with our services, including indirect or consequential loss or damage, howsoever arising. Any party who chooses to rely in any way on the contents of this document does so at their own risk.

Existing Installations

For existing roof systems where it is known that the roof system is not adequately secured or cannot be determined if the roof system is adequately secured, use Table 2 to determine the required depth (distance in from the roof edge) of perimeter-nailing of the insulation. Select the depth based on the wind velocity and building height.

TABLE 2
Recommended Depth In Feet Of Perimeter Nailing For
Various Building Heights And Wind Velocities

Basic Wind Velocity in mph	Building Height	
	0 - 50 ft	50 - 100 ft
90	4	8
100 and greater	8	8

SI Units: 1 mph = 0.447m/sec; 1 ft = 0.305 m

The depths of perimeter fastening are based on steel decks of 22-gage (0.031 in., 0.78 mm) or heavier and buildings enclosed to the extent that wind will normally have minimal effect on internal pressures.

For open-sided structures, i.e., aircraft hangars, double the depth of perimeter nailing.

Install these fasteners with 2½ in. (54 mm) diameter metal discs or 3 in. (76 mm) square stress plates and in accordance with the insulation manufacturer's specifications. Usually these require four fasteners for a 2 ft × 4 ft (0.6 m × 1.2 m) insulation board, or six fasteners for a 3 ft × 4 ft (1 m × 1.2 m) board.

DISCUSSION

As wind passes over a building, it creates an uplift force on the roof. Extremely strong but localized negative pressure occurs near or at the edge of the roof. It is this pressure that first pulls the roof system apart.

The weakest link in the wind uplift resistance system is the method of securing the insulation to the metal deck. Without proper fastening of the insulation to the metal deck, wind can tear the roof system away. In the past, flood coating of steep asphalt was used to secure the insulation to the deck. However, the use of asphalt increases the combustibility of the roof to unacceptable levels.

To overcome the problem of combustible roofs, mechanically fastening the insulation to the deck reduces the amount of combustible materials that can contribute to the spread of fire. Once the first layer of insulation is secured to the metal deck, additional layers can be secured with adhesives, asphalt or mechanical fasteners. The presence of the adhesives or asphalt in the second layer does not contribute significantly to the fire loading.

REFERENCES

- ASCE 7, *Minimum Design Loads For Buildings And Other Structures*, American Society of Civil Engineers, Reston, VA.
 AS/NZS 1170.2 – *Structural Design Actions Part 2: Wind Actions*, Standards Australia, Sydney, AS – Australia & New Zealand
 EN 1991-1-4 - *Eurocode 1: Actions On Structures - Part 1-4: Wind Actions*, European Committee For Standardization, Brussels, Belgium – Europe
 NBCC - *National Building Code of Canada*, National Research Council of Canada, Ottawa, Canada – Canada
 GB50009 - *China National Standard*, China Architecture and Building Press, Baiwanzhuang, Beijing, China – China

REFERENCES (Cont'd)

CP-2004 - *Code of Practice of Wind Effects*, Building Department Hong Kong

IS875 (Part 3) - *Indian Standard Code of Practice*, Bureau of Indian Standards, New Delhi, India – India

SNI-03-1727 - *Standard National Indonesia*, Indonesia

AIJ-RLB - *Recommendations For Loads On Buildings*, Architectural Institute of Japan, Tokyo, Japan – Japan

KGG – KBC 2005 - *Korean Government Guidelines of Korean Building Code*, Korea

MS1553 - *Code of Practice of Wind Loading*, Malaysia Standard, Malaysia

NSCP - *National Structural Code of the Philippines*, Association of Structural Engineers of the Philippines, Manila, Philippines – Philippines

EIT-1018-46 *Wind Loading Code for Building Design*, Engineering Institute of Thailand, - Thailand

TCVN2737 – *Loads and Actions Norm for Design*, Vietnam