ROOF SYSTEM GUIDE

INTRODUCTION

The roof is one of the most critical portions of a building. It prevents rain and snow from entering a building, it keeps heat in, it gives us a framework to secure utilities, and is a place to mount heavy equipment off the floor.

Unfortunately, the roof system is one of the most vulnerable parts of the building to collapse, fire and windstorm damage. To minimize the potential of roof collapse or damage, the roofing system must be properly designed and installed. AXA XL Risk Consulting recommends all roof systems be capable of withstanding interior and exterior fire exposure and anticipated loading.

POSITION

Design all roof systems to withstand the anticipated loads including rain, snow, and wind in accordance with local building design standards[1] and PRC.2.0.1.1, PRC.2.0.3, PRC.2.1.1 and PRC.2.1.2.

Install a roofing system that has been tested and listed for interior and Class A exterior fire exposure.

Use only mechanical fasteners to secure the first layer of insulation to the metal deck. Never use asphalt adhesives to secure the insulation to the metal deck.

DISCUSSION

Wind and Snow Loads

Determining whether a roof system is adequate can be very difficult. First determine the ability of the roof system to withstand the anticipated loads. The calculation for snow and wind loading depends on many factors such as:

- Local weather conditions;
- Ground terrain;
- Building height;
- Building size;
- Roof slope;
- Parapets;
- Overhangs;
- Protection of openings;

- Roof projections.

Once the snow and wind loads have been determined, the roof system must be designed to carry these loads. The ability of the roof to carry the snow load is accomplished through structural design and calculation.

The ability of the roof system to carry the wind load is accomplished through either systems that have been tested or by applying sufficient ballast on a ballasted single-ply membrane roof. For the latter, see PRC.2.1.1. For the former, a listing guide is the only source of information.

Underwriters Laboratories (UL) has two separate and acceptable uplift test standards. They are UL 1897 and UL 580. On the UL *Online Certification Directory* those systems that are tested to UL 1897 are listed in the "Roofing Systems, Uplift Resistance (TGIK)" section. Those systems that are tested to UL 580 are listed in the "Roof Deck Constructions (TGKX)" section with a Wind Uplift rating indicated.

Roofing systems that are listed in the FM Approval's *Approval Guide* have been tested and listed for a certain uplift pressure.

The uplift pressures in both UL and FM directories correlate to the uplift pressure derived from local building design standards. In both directories, there are listings based on uplift classification, either 30, 60 or 90 for those listings in the TGKX section of the UL directory and 1-60, 1-90, 1-120, 1-150 or 1-180 for FM. Table 1 shows the maximum uplift pressure for each of the classifications.

In the TGIK section of the UL directory, there are assemblies with a broad range of uplift resistance ratings. Use these assemblies on buildings where the uplift pressure, derived from local building design standards, is no more than half of the listing. For example, if the listing states the assembly has been tested to 150 psf (7.1 kPa), it can be used in areas where the maximum calculated uplift pressure is 75 psf (3.5 kPa).

Fire Exposure

All roof systems must be tested and listed for both interior and exterior fire exposure.

In the UL directory, only those constructions listed in the "Roof Deck Constructions (TGKX)" section that are "Fire - Classified" satisfy the requirement for interior fire exposure. The roof coverings that have been tested for exterior fire exposure are listed in the "Roof Covering Materials (TEVT)" section as Class A, Class B or Class C Roof Coverings.

When using the UL directory to determine the fire exposure, be careful to check that the insulation material has been listed for both the exterior (TGFU) and interior (TGKX) fire exposure.

The Roof systems that are listed in FM Approval Guide as a Class 1 (MD-1) roof deck have been tested for both interior and exterior fire resistance.

TABLE 1
Maximum Uplift Pressure Of Class 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 = 0.0479 kPa

REFERENCES

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

ASCE 7-2010, *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, Australia.

AS/NZS 1170.3 – *Structural Design Actions* Part 3: *Snow Actions*, Standards Australia, Sydney, Australia.

EN 1991-1-3 - Eurocode 1: *Actions On Structures* - Part 1-3: *General actions – Snow Actions*, European Committee For Standardization, Brussels, Belgium.

EN 1991-1-4 - Eurocode 1: *Actions On Structures* - Part 1-4: *Wind Actions*, European Committee For Standardization, Brussels, Belgium.

NBCC - *National Building Code of Canada*, National Research Council of Canada, Ottawa, Canada

GB50009 - *China National Standard*, China Architecture and Building Press, Baiwanzhuang, Beijing, China.

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

IS875 (Part 4) - *Indian Standard Code of Practice*, Bureau of Indian Standards, New Delhi, India.

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

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

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.

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

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