Vibration Isolation and Seismic Control
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SNOW LOAD IS COMING

There are a wide range of vibration isolation systems for HVAC applications throughout the United States. The most known design forces associated with these applications are Seismic and Wind Load criteria. However, there is a third design force that needs consideration for these systems: snow load. Snow load is an axial force that is applied to roofs and rooftop equipment and is specified in the ASCE and IBC codes. Ground snow load is designated by P_g while flat roof snow load P_f is given in the below equation.

$$P_f=0.7C_eC_tI_sP_g \quad \text{(ASCE 7-10 7.3-1)}$$

There are a few different factors to determine your project's snow load. First, this force is based on the top area that snow load can accumulate. The larger the top area, the larger the snow axial force. Next, snow load is based on location. Location is essential for determining a body's snow load. The ASCE produces contour maps that determine what ground snow load is appropriate at which location. Also, there are online resources that can give you an appropriate value for your specific project (i.e. https://hazards.atcouncil.org/). The thermal condition of the rooftop equipment (see C_t, Table 7-3 ASCE 7-10) is another factor which can affect the total load. Lastly, Risk Category (see I_s) and Exposure Category (see C_e) can also affect your snow load force. These specifications can also be found on structural documents of a project. If you cannot find the specific design criteria, or don't have access to the structural documents, please contact either the Structural Engineer (EOR), Architect, or the local building department who has jurisdiction of your project.

Why do we need to consider snow load in vibration isolation design of rooftop equipment?
Snow load is an added axial force which needs consideration in appropriate rooftop settings. In Chapter 2 of the ASCE 7-16 (and in previous ASCEs), there exists load combination equations. These load combination equations are a determination of the different forces that may act on your system simultaneously. If you are in a region where snow is considered, one of the four below load combinations must be checked to make sure your system is complying with the latest IBC/ASCE codes.

ASCE 7-16 Allowable Stress Design Load Combinations with Snow Load (Table C2.4-1)

3. D+S
4. D+0.75S
6. D+0.75(0.6W)+0.75S
9. $D+0.525E_v+0.525E_{mh}+0.75S$

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Only one state in the continental United States does not need snow considered when designing rooftop vibration isolation equipment (Florida). A large snow force will produce a larger axial force that vibration isolation equipment would need to withstand (see P_w below). A common design of resisting these extra additional loads occurs in spring isolated systems. Housing is often provided with the isolator which withstands added axial forces.

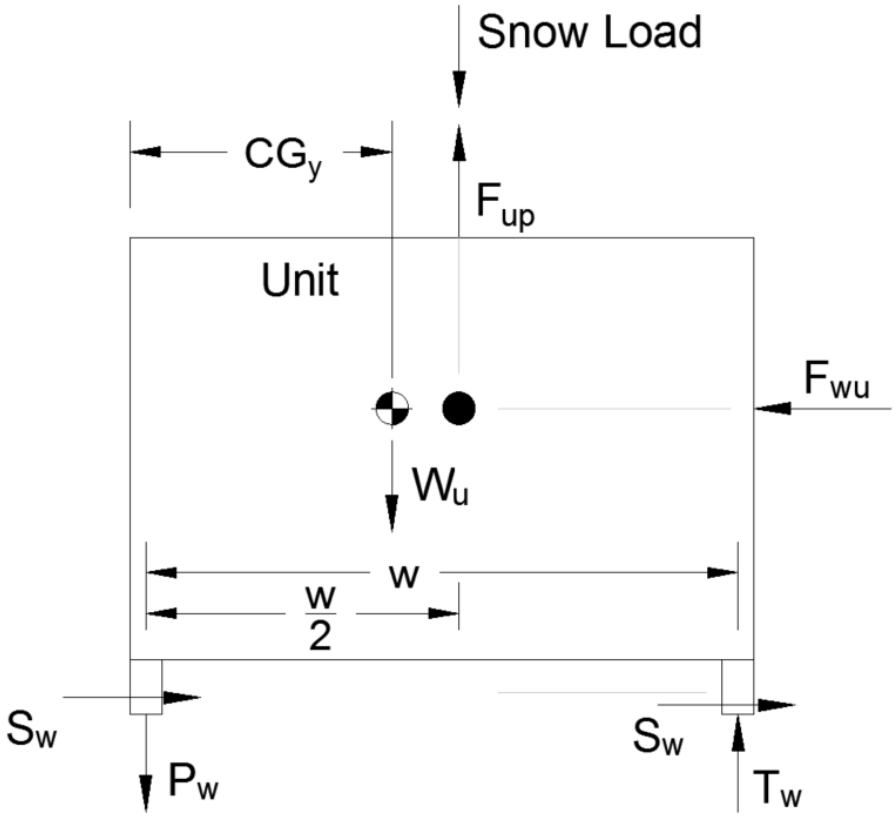

Figure 1
A vibration isolation system following Load Combination #6.
P_w is the axial total force on the vibration isolation equipment.

Is your project in a high snow load region? The Northeast, Northwest and Midwest generally have large ground snow loads. Utah is another state which is considered a high snow load environment. The next time your project needs vibration isolation for rooftop equipment, ask yourself: Does the equipment need to be snow load rated?

Bibliography

Minimum Design Loads for Buildings and Other Structures. ASCE, 2010.
Minimum Design Loads and Associated Criteria for Buildings and Other Structures. ASCE, 2016.
ATC Hazards by Location, ATC, hazards.atcouncil.org/.

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VISCMA is a non-profit association representing the manufacturers of seismic restraint, vibration isolation and noise control equipment. The primary objectives of the organization are to educate the construction industry on the proper use and application of vibration isolation and seismic restraint and to develop standards to continually improve the industry.

In partnership with FEMA and ASCE, VISCMA also publishes three Seismic Installation and Inspection Manuals designed to assist field personnel.

The association office is located at 994 Old Eagle School Road, Suite 1019, Wayne, PA 19087-1866 and can be reached at 610-971-4850 or info@viscma.com.

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