TRANE Chiller Mount Study

Machine isolation is an important consideration in the installation of machine equipment, such as HVAC Chiller systems, that incorporate rotating components. These rotating components can produce excitations that can affect the function and durability of the system as well as the comfort of the building occupants and even the perceived quality of the brand.

Machine isolation must be designed as a compromise between isolation and control.

An isolation system with very little stiffness will provide significant isolation, but without displacement control, this system may experience excessive stresses during external loads such as wind loads or during foundation movements (such as during an earthquake or simply building swaying in the wind.) Additionally, the system may experience excessive motion as the excitation from the rotating components aligns with resonance during start up and shut down events.

Alternatively, a system that is very stiff will provide significant displacement control, but will transmit too much vibration into the surrounding environment. These vibrations may affect the customer comfort as well as building integrity and the perceived quality of the system. The purpose of adding isolators to the system is to reduce these vibrations into building.

Ideally, a mount system should be designed such that the resonance of the chiller on its isolators occurs well below the minimum operating speed in a variable speed system while still maintaining enough control to minimize the effects of externally applied forces.

Additionally, isolator choice also influences other characteristics such as installed height.

A theoretical isolator can be described as a simple point stiffness, and can have almost any configuration. However, an actual isolator must be constructed of physical hardware that occupies real space and must be designed to survive the expected stresses experienced during its operational life cycle.

This study is comparing 2 different mount systems under consideration for a Trane Chiller system.

System A consists of 8 VibraSystems SRMT mounts with a loaded compression of 4” while System B consists of 8 VibraSystems SRMT mounts with a loaded compression of 2”.

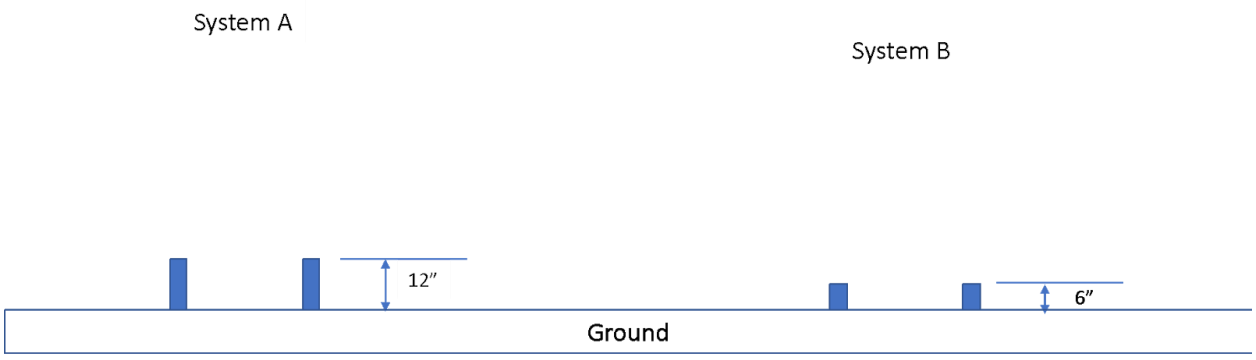
An example of an SRMT mount is shown in Figure 1.

Figure 1

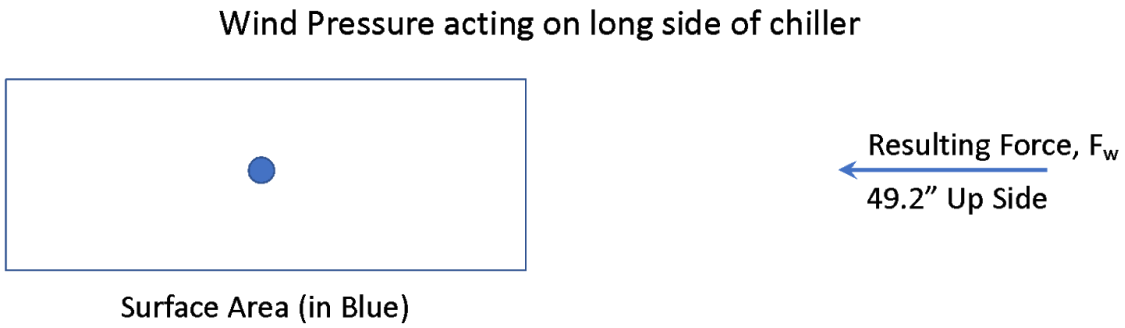
The Mounts in System A must be physically larger than in System B to achieve the desired deflection.

System Isolators	A	B
Unloaded Height	16”	8”
Installed Deflection	4”	2”
Installed Height	12”	6”

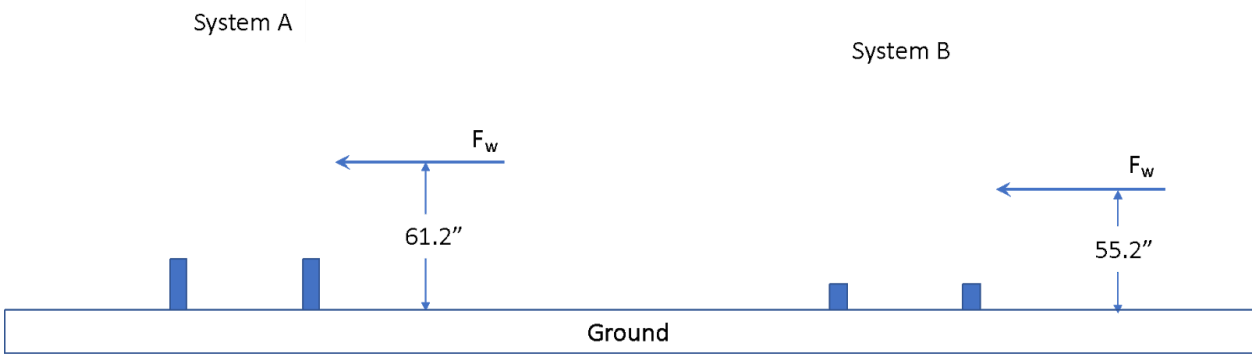
This difference in Mount height will result in a difference in the installed system height.



Now we must determine how each system reacts to an external load applied to the system, First, calculate the Center of Pressure from a wind blowing on the side of the chiller.



Add Resulting Force position to mount height for each system to determine the moment arm from the force to ground. From these forces and moment arms, we can calculate the torque applied to the system.



Torque is equal to Force times Moment Arm. Therefore, the increased moment arm in System A causes the torque in System A to be 11% higher than the torque in System B.

Furthermore, the system stiffness is also influenced by the height of the mount system. This stiffness difference is coupled with the torque difference such that the displacement at the center of the chiller is 21% higher than the displacement at the center of the chiller in system B.

Conclusions:

Both Systems A and B should provide significant isolation for the rotating components in the chiller. A more detailed study can more accurately identify the expected isolation from each mount system. However, a study like that would require detailed mass and inertia data as well as a more accurate representation of the excitation frequencies.

However, System B should also provide isolation that is more than adequate as well as more lateral control of the Chiller in response to lateral wind forces or building movement.

VibraSystems recommends System B, the 2” precompression mounts.