

REFRIGERATION REVIEW

Environmental Sustainability in Refrigerated Warehouses

To use an old sales term, “perceived value” has gotten some entrée in our refrigerated warehouse industry, with multiple rooftop machinery rooms being installed on the basis of avoiding OSHA regulations, using environmentally unfriendly refrigerants and significantly less sustainable investment. If nothing else, the manufacturing cost of 17 screw compressors plus maintenance is far less sustainable than a central system which may have seven compressors. Besides, that halocarbon-caused hole in the ozone layer is no way to treat our planet!

Just to take one aspect of multiple rooftop machinery rooms, consider the additional structural steel required to support, say, seven 20,000-pound, separately-enclosed machinery rooms, on the pretense that it is less costly than a stand-alone machinery room, has got to be close to absurd. If you consider one aspect of the structural calculations – the seismic requirements – and consider the additional cost to brace and support the axial and horizontal requirements of 15,000 pounds, you quickly realize this is “perceived value.” A screw compressor mounted on the floor of a machinery room doesn’t really require seismic structural steel.

Seismic requirements, such as those used in buildings in Japan in particular, are designed to be flexible, no different than the way we like to do ammonia pipelines. I remember years ago I ran into an old-timer who did a lot of HVAC systems in multi-story buildings and he was insisting on locking down the ammonia pipe to the building frame. As the engineer of record, I ardently opposed that process and insisted the pipeline be flexible, not only for seismic reasons, but also for expansion and contraction of the piping itself. I remember in the early 1970s when my father had one of the first large refrigeration systems and he called me up, somewhat excited, and said, “The vessels would sway when the air units were all put in defrost on the long pipelines!” Of course, this was resolved by staggering the defrost and making sure the air units were thoroughly pumped down.

Lesson learned: You don’t want to attempt to make a vessel totally rigid at the base, because in its life cycle, it may on occasion sway a little bit. You want the base to stay put, not shift.

I also recall the 6” pipeline in Miami that experienced a hurricane, and the pipeline was literally lifted and laid down on the roof adjacent to the pipe racks. While it could be debatable whether the pipeline should and could be fastened to the pipe racks, it also clearly demonstrates the flexibility of pipe, for 30 men got on the roof and lifted the piping back up onto its stand, and no pipes were broken.

Another case is one of the first long pipelines I designed that went in the back of a tilt-concrete building, off of an independent pole-supported pipe rack that had been constructed along the back side of the building approximately six feet away from the building. After pull down, it was very obvious that the piping system suction and liquid lines had clearly contracted, compressing the insulation on the branch line against the concrete wall. The half inch per 100 feet contraction as should have been expected had

occurred. Lesson learned: Either lengthen the branch lines or use expansion loops, and avoid rigid termination points wherever possible.

Another case in point regarding vibration and/or contraction is the mounting of compressors. Where reciprocating compressors experience impulse loading from the pistons during compression, and especially the old slow-speed HDI compressors, they needed large foundations, sometimes seven yards of concrete, to absorb the impact vibration, as do high-speed reciprocating compressors. Screw compressors are free of kinetic impact loads and can be supported on monolithic compressor pads as part of the machinery room floor. Other than the harmonics occasionally experienced in the oil separator, screw compressors are free of cyclic impact loads of a piston machinery room.

I remember the installation of some 700 HP diesel screws, which I elected to make monolithic foundations as part of the 24-inch compressor floor. My reasoning was simple: I would rather have the piping vibrate a little than have the piping vibrate a lot from an individual compressor pad under each diesel engine. Sometimes horse sense can prevail, and we do experience harmonics and vibrations in piping. Instead of “perceived value” such as multiple rooftop machinery rooms, let us make our refrigerated warehouse industry more sustainable and green for future generations.