
Andy Pearson

Machinery Room Ventilation

BY ANDY PEARSON, PH.D., C.ENG., FELLOW ASHRAE

The amount of ventilation required in refrigeration machinery rooms is one of the topics receiving a lot of attention in recent years in safety standards committee meetings around the world. Cutting through all the twists and turns in the debate, it can be said that a few things are clear: some existing rules are not based on science or logic, they are frequently misapplied and they do not cover all the situations in which ventilation is important.

Various rules are given for the sizing of machine room ventilation under different circumstances. Some ventilation is required when the room is occupied for any length of time (during maintenance work, for instance). More is required to control the room temperature when the machinery is operating. "Emergency ventilation" is needed to clear the air in the event of a refrigerant leak. This is the rule that generates most debate.

Both ASHRAE Standard 15-2013, *Safety Standard for Refrigeration Systems,* and ISO 5149-2014, *Refrigerating Systems and Heat Pumps—Safety and Environmental Requirements,* calculate an emergency airflow rate based upon the total weight of refrigerant in the system, even if most of that refrigerant is not in the machinery room. The ASHRAE and ISO formulae are not identical, but they are similar: the weight of refrigerant raised to some power and multiplied by a factor.

Even the power used is intriguing: ASHRAE uses the square root of the weight, while ISO uses the square of the cube root. It so happens that this means that if the weight of refrigerant in the system is 34,375 lb (15,625 kg) then the emergency ventilation rate required will be 18 540 cfm (8750 L/s) with either formula. At lower refrigerant weights the ASHRAE formula produces higher values than ISO and vice versa. The calculation takes no account of the flammability, toxicity or behavior of the refrigerant; the only variable in the equation is the weight of refrigerant in the system.

The origins of and the thinking behind the development of these formulae are unclear, though the *ASHRAE Standard 15-2001 User's Manual* says its equation may date back prior to 1930 and may have been used to set ventilation requirements for New York City fire codes. Putting two and two together, I can envisage that systems were expected to leak from every nonpermanent joint, so a ventilation rate related to the total refrigerant charge could be expected to roughly correlate to the number of joints. It is reasonable to assume that a larger charge system will have more valves, more controls and more compressors, all leaking.

Frankly, my dear, you might need a fan.

At some point I can also imagine that someone realized that for medium-sized systems, the simple formula resulted in rather high ventilation rates, so the ISO index was introduced, probably into a European standard first, then transposed into ISO 5149. I suspect the ventilation rate originally applied to background ventilation, which ran all the time and later was transferred to emergency ventilation triggered by a gas detector.

We do not build such leaky systems anymore. For HFC refrigerants, the goal is to minimize the indirect global warming potential. For ammonia, it is to avoid the smell. In all cases it is recognized that a leaky plant is less reliable and less efficient, so leaks are managed far more carefully. Equipment specifications are also much improved in this respect, with sealed compressors, better valve spindle seals and improved flange designs. It is, therefore, time to recognize that we do not need these archaic formulae anymore, even for emergency ventilation. I challenge you to propose a more logical, but no more complicated, formula for emergency ventilation. If you can also explain the origin of the old method, that would be nice, too. ■

Andy Pearson, Ph.D., C.Eng., is group engineering director at Star Refrigeration in Glasgow, UK.