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## Analysis of Refrigerant Use

The article “Analysis of Refrigerant Use for AC Equipment Maintenance” by Theresa Pistochini, P.E., Member ASHRAE; Roger Silveira; Derrick Ross, Associate Member ASHRAE; Robert McMurry; and Adarsh Umarani published in the October 2022 issue does not mention that Schrader valves are supplied with a seal cap.

Based on my personal experience, Schrader valves do not leak if the seal cap is installed properly no matter the age of the system.

On most systems I have inspected, the seal caps were missing.

The amount of refrigerant charged and invoiced is based on a honor system and cannot be used in a scientific article.

I made these statements in a lawsuit, and the parties quickly settled out of court.

*Reinhold Kittler, P.Eng, Fellow/Life Member ASHRAE, Virginia Beach, Va.*

## The Author Responds

The study reported the location of leaks as identified by the service technician. We are currently researching if seal caps are an effective method to prevent leaks from Schrader valves.

For refrigerant used, 82% was accounted for in terms of 30 lb canisters purchased and used fully by the facility (this is not an honor system). The remaining 18% was based on receipts from third-party service contractors. The article clearly states the methodology so the reader can consider findings in that context.

*Theresa Pistochini, P.E., Member ASHRAE, Davis, Calif.*

## Free Cooling for Data Centers

Thank you for the column “Which Free Cooling Technology Should We Select For Data Centers” by Mohammad Khurram Saeed, Associate Member ASHRAE, in the October 2022 issue. It gives us a good summary of the different free cooling options there are from a decade ago to now. Nevertheless, I would like to comment on some issues.

The author is referring to MLC/ELC in regard to ASHRAE Standard 90.4, but due to free cooling when water is a big factor (for instance adiabatic practices he mentions) the so-called WUE (water usage effectiveness) must be considered somehow in the final best selection, e.g., if that water comes from a wastewater plant or not, and if water scarcity exists at the site where the data center will be located.

In general, the free cooling technology is mixing the main two free cooling options, the one from the air side (air economizers) and the other from compressor or water free cooling in chillers. I think it must be separated since each one has different scopes, and for the same latitude and external pollutant conditions one could be selected and the other not, and vice versa.

In the case of free cooling with dual coil DX water-cooled, you missed that water treatment also is necessary in the case of dry cooler supported by an adiabatic system. For this option, you also missed that regarding *Legionella* water treatment is necessary since water is in cooling towers.

For the same option above you say “multiple dry coolers can be

avoided by using a common cooling tower to multiple CRAC units.” Nevertheless, that common cooling tower should be provided with redundancy. Thus, a multiple dry cooler system with lower size and capacity could be better in terms of costs and energy efficiency compared to 1 + 1 cooling towers, or even 2 + 1 cooling towers.

In general, you provide a good review about the main systems we can take to get a free cooling technology, but I think the column missed mentioning the kind of heat exchangers in the case of indirect free cooling (with thermal wheel for instance), which could be decisive depending on the latitude again.

Last but not least, I think the source to get the free cooling is neglecting the natural sources that were already described in some interesting articles in the *Journal*. These include water for condensing purposes coming from lakes or rivers or even from the sea coast, whereas the free cooling pipework bypass is giving us a very important opportunity to select something like that.

*Ignacio Gómez-Cornejo Gilpérez, Member ASHRAE, Madrid, Spain*

## The Author Responds

Thanks for your detailed comments and time. I agree that the cooling basics have been there for many years, but the way we apply them in a particular industry is ever-changing. For instance, liquid cooling basics have been there for decades, but we haven't yet seen it being applied in a data center in a meaningful manner, and now we are actually talking about using it in the data center industry. Also, the

column is more focused on where to select what in terms of free cooling technologies considering some important points.

The column says that MLC/ELC per ASHRAE Standard 90.4 is one of the most important criteria but not always the only deciding factor for choosing a particular cooling technology over others. I agree that wherever we use water-based cooling technology, water availability and WUE will also be an important metric besides PUE, which is common to all.

In most cases, the technology that results in reduced compressor hours is considered as free cooling technology, which may or may not mix two free cooling technologies. In a DX air-cooled cooling system, air economizer is the free cooling, which results in reduced compressor hours. Along with this air economizer, we can mix another free cooling technology like pumped refrigerant, which will also result in reduced compressor hours. But if it will be a viable solution from how much free cooling we are actually adding by this mixing is subject to analysis.

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There are other cooling technologies where the system does not use compressors (if we ignore trim systems in them that can have compressors/chilled water supply from a chiller having compressors), but still it is considered as free cooling like in a direct/indirect evaporative system, which actually depends on fresh air intake/ weather conditions.

In the case of free cooling with dual coil DX water cooler, the column says, “If a cooling tower is used, then water treatment is required.” Dry coolers in most cases are not provided with adiabatic systems. Hence the column ignored these special cases, but yes, you are right—if dry coolers have adiabatic systems, water treatment is needed. *Legionella* is covered under water treatment.

The reference to multiple dry coolers was regarding one CRAC/one condenser vs. multiple CRAC/few condensers (or common cooling tower). I agree that the quantity of condensers (or cooling towers) will depend upon the desired tier requirement of the data center as  $N + 1$ ,  $2N$ ,  $N + 2$ , etc., and the optimum unit sizes to result in a more energy efficient system depending upon the anticipated partial load on the units. It may result in higher capital cost but will be good for better operation cost.

We believe you will appreciate that it is not possible to make the list all inclusive. Hence the column introduction says, “Some of the main free cooling technologies available for data centers currently are detailed below. This is not an all-inclusive list.” I agree that energy wheels/heat exchangers also play an important role, and the source of free cooling like geothermal energy will also be interesting to consider wherever it is applicable.

*Mohammad Khurram Saeed, Associate Member ASHRAE, Sydney, Australia*

### Correction

November’s Letter’s section omitted the writers of the letter regarding “Airborne Disease Transmission Risk and Energy Impact of HVAC Mitigation Strategies.” The letter was written by W.K. Chow, Ph.D., Fellow ASHRAE, and C.L. Chow, Ph.D., from Hong Kong. You can read it at <https://tinyurl.com/2s49znwr>. ■

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