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University at Albany

Case Study on Implementing More Environmentally Friendly Refrigerants

Summary

The University at Albany, in line with their carbon mitigation goals, will use lower emission refrigerants in the gut renovation of the old Albany High School building. This is part of the multi-phased project focused on replacing outdated building systems with modern energy-efficient systems and equipment. The project included bid specifications on the use of a R513a chiller, with the low GWP of 631, which is a 52% reduction compared to the standard refrigerant R134a with a GWP of 1300.

Background

Traditionally, refrigerants are purchased under the CFR 40 608 guideline by certified technicians; leaks are repaired, and during repair work refrigerant release is kept to “de minimis” then the reclaimed refrigerant is return to the vendor for recycling. These procedures follow EPA regulation 40 CFR Part 82, Subpart F Section 608 of the Clean Air Act that requires technicians who maintain, service, repair, or dispose of equipment that could release ozone-depleting refrigerants into the atmosphere be certified.

UAlbany has a combination system of owning refrigerants and contracting out. An example of one contract is for the campus Data Center with Trane. Trane Building Services maintains and uses a Refrigerant Management Software (RMS) to capture, manage, and report refrigerant activity. The technician uses the report form to record all refrigerant activity that has occurred on each piece of equipment. The data is entered into RMS after it is submitted to and checked by central office personnel. Annually, Trane prints a report from RMS of all refrigerant activity that has occurred at each site. The report details all refrigerant activity performed by Trane building services technicians for each piece of equipment and can be used to satisfy reporting requirements.

Former Albany High School Building Project

The University at Albany has been renovating the former Albany High School Building, located on the University at Albany’s downtown campus, which is the planned home of the College of Engineering and Applied Sciences (CEAS). The building was originally constructed in 1912 as the City of Albany’s High School and was purchased by the university in 2013. It is four stories plus a below-grade sub-ground floor. The net area is approximately 129,000 gross square feet and is currently unoccupied. The Phase 4 scope will make 68,150 square feet of usable space available for the “First Occupiable Phase.”

This building has not been air-conditioned. The university chose a R513a chiller, with the low GWP of 631, which is a 52% reduction compared to the standard refrigerant R134a (GWP of 1300). Phase 4 of this building project is currently being bid and will include the first chiller of 175 tons cooling. The final installed tonnage is expected to be 525 tons.

The project uses a modular chiller plant design that will include two chillers of 85 Tons capacity each. Total plant capacity at full build is projected to be 510 Tons. The current modular chiller selection is for an IPLV of 0.3722 KW/Ton. The plant is designed for two temperature loops to improve operational chiller efficiency, increase free-cooling hours, and reduce the risk of condensation in the building.

In addition to the environmentally friendly refrigerant, chiller construction features and operational measures are included in the project to reduce the chilled water plant’s kW/ton electrical consumption and translate to a smaller carbon footprint.

Decision-making Process

The university has long sought to reduce the environmental footprint of our buildings. Since former President George Philip signed the Second Nature Climate Commitment in 2008, UAlbany has increasingly focused on greenhouse gas mitigation efforts within our building construction.

The university favors low-pressure machines for mechanical refrigeration. These are ideal because the workings of the centrifugal fan are subatmospheric. This type of machine is not prone to leaks like high-pressure units, and being a negative pressure machine, there is less chance for it to lose its charge. On this project, low-pressure alternatives such as R514A were investigated, but no equipment was available to fit the project requirements. Specifically, three low-pressure centrifugal chillers needed would not fit in the subbasement space, so the design incorporates six modular high-pressure centrifugal chillers with a GWP refrigerant R513A.

These environmental guidelines, refrigerant management practices, and chiller preference influenced the university to seek a unit with a lower global warming potential in rehabilitating the former Albany High School building. As such, bid specifications for this technology were developed for this project.

Conclusion

The benefits of moving towards this type of chiller are a lower carbon footprint, comparable cost, and performance and the technology aligns with the movement towards electrification. Some of the challenges include being careful about how the unit is charged because it involves a blend of many molecules and adjusting operational service from traditional units.

Resources

Centrifugal Chiller specification

Research

Bid Specifications:

To ensure the operating sequences will allow for the maximum kW/ton savings by using depressed cooling tower temperatures to achieve or better the manufacturer's "Integrated Part Load Value" of 0.3791 kW/ton, the following specifications were included in the bid:

- Compressors shall have oil-free technology using a permanent magnet synchronous motor, magnetic bearings, integral variable-frequency controller, and digital electronic controls.
- The magnetic bearing or roller element bearings levitated shaft positions shall be actively controlled and monitored by an X-, Y-, and Z-axis digital position sensor.
- Factory performance testing shall take place before shipping, according to AHRI 550/590, and the tests shall meet the following conditions:
    - Reduction in capacity from design to minimum load in steps of 10 with condenser fluid at design conditions
    - Reduction in capacity from design to minimum load in steps of 10 with varying entering condenser-fluid temperature from design to minimum conditions in 5 deg F increments
    - At 10 point(s) of varying part-load performance to be selected by the owner at the time of the test
- Allow the owner access to the place where chillers are being tested. Notify the owner in writing at least 30 days in advance of testing.