Hot Gas Bypass

Utah ASHRAE's Newsletter

April 2026 Edition

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Announcements

2026 ASPE Intermountain Chapter – 27th Annual Golf Tournament

Join ASPE Intermountain for their Annual Golf Tournament!

When: June 16, 2026 / 7:30am – 2:00pm

Where: South Mountain Golf Course

What: Golf Tournament, Networking, and Lunch

Find more information and register at:
https://aspeintermountain.starchapter.com/meetinginfo.php?id=119&ts=1773734797

New SLCC Building Commissioning Course & Workforce Training Partnership Initiative

SLCC has launched **WTCM100: Introduction to Building Commissioning**, a short-term, industry-informed training program designed to prepare participants for entry-level roles supporting commissioning providers, general contractors, engineering teams, and building trades that are engaged in the Commissioning process. The program emphasizes practical exposure to the commissioning process and workforce readiness for active construction environments.

Course Overview

- **Course:** WTCM100 – Introduction to Building Commissioning https://www.slcc.edu/workforce-training/program/comm-tech.aspx
- **Instructor:** Vince van Oostenbrugge
- **Dates:** 05/05/2026 – 06/25/2026
- **Format:** 45-hour, *8-week* hybrid course
- **In-Person Sessions:** 11 total
    - Eight Tuesday evening classes (6:00–9:00 pm)
    - Three Thursday evening in-person labs during the final three weeks
- **Outside/Online Work:** Approximately 12 hours
- **Tuition:** $500
- **Utah Resident Cost:** $125 (75% covered through Utah Short-Term Intensive Training funding)
- **Course Registration:** https://www.enrole.com/slcc/jsp/certificate.jsp?categoryId=94CD7B58&certificateId=COMMTECHCERT

Course Learning Outcomes:

- Apply the commissioning process across construction projects

- Develop and evaluate commissioning documentation
- Analyze HVAC, mechanical, plumbing, and electrical system performance
- Communicate effectively to strengthen project teams

This course is perfect for:

- Those who want a career in Commissioning
- College students and recent graduates who are exploring career opportunities in energy, construction management, or engineering
- New employees at commissioning, design, engineering, and construction firms that need a better understanding of the Cx Process
- Those seeking to advance a career in an energy-related field, including energy management, construction management, and property management by gaining an understanding of the Cx process
- Those looking to improve their knowledge of this essential component of the building process

Program contact: Rhett K. Bigelow; 801 957 5252; rhett.bigelow@slcc.edu

Message from the President

Thank you for taking time away from your professional responsibilities and personal lives to participate in ASHRAE. Your involvement is what makes our chapter strong, and I'm sincerely grateful for the volunteers and participants who contributed this past year and in the years leading up to it.

I hope your involvement has helped you grow, whether by advancing your knowledge, sharing your expertise, or building new connections within the HVACR community. Those relationships are at the heart of what we do, and they are one of the most valuable outcomes of being part of this organization.

One of the best ways to deepen those connections is by getting involved. Serving on a committee, either locally or at the society level, is a great way to engage, contribute, and get to know your peers on a more meaningful level. I've encouraged volunteerism throughout the year, and if you haven't yet taken that step, I hope you'll consider it in the year ahead. Don't be intimidated by the commitment; there are opportunities to contribute at every level. Even a small amount of time can make a meaningful impact.

As you look ahead, I encourage you to find something you're passionate about and identify one way you can help make it better. That might mean raising awareness of HVAC careers among students, supporting scholarships, contributing to sustainability initiatives, or working with local organizations to improve air quality and efficiency. And if you happen to share my enthusiasm for sweets, you could have a non-traditional role to ensure we have the best desserts at meetings. Whatever your interests, there is a place for you in our chapter, and your contributions matter.

Thank you again to everyone who participated this year, whether you attended a meeting as a guest or served in a leadership role on the Board of Governors. Your time, energy, and commitment are what make this community so valuable.

I look forward to staying involved in the years ahead and to continuing the work we've started together.

Thank you for a great year!

Sean Nielson
President, 2025-2026
ASHRAE Utah Chapter
President.UtahASHRAE@outlook.com

History Corner

We started the 2025-2026 year off with our annual fall social! Everyone had a great time eating great food and connecting with collegues. Our YEA group also started off the year with a Fall Social at Pins & Ales.

We also had some great monthly meetings where we learned about about building electrication, energy analytics, securing power for the future, distributed pumping, and creating better specs. We also got to tour the Daybreak Library and learn about how they designed and executed a net zero building! Our YEA group had meetings about HVAC Control 101, VRF System 101, and a tour of the UofU SCMI buidling.

We also contiued the tradition of our annual Top Golf event where we raised funds for ASHRAE Research. We’re so grateful for all those who supported this event.

Student Activities

This year in student activities has been eventful and we're hoping that it continues strong, not only for the remainder of this year but into next year.

We started off with the annual fall social kickoff. There we had the opportunity for students to meet and mingle with the ASHRAE community. I always recommend it, It's also generally the first time I remember that Utah gets cold.

Recently we participated in a STEAM night at Ascent Academy. We had the opportunity to introduce kids to the world of Engineering through a pressure drop STEM kit. (blowing bubbles into water through a longer and longer straw) Granted it made a bit of a mess, but that's the least of my worries, if we can bring up young minds to consider that engineering can be fun that's a win in my book.

In the future we're looking to a sustainability project where we meet with one of the local schools and discuss air quality. We might even get to build a *Corsi-Rosenthal* Box with the class. Remember those from Covid? This should be another exciting event that hopefully leads to another future engineer.

I know scholarships are always on the minds. And I would like to mention that we have the opportunity to give out some scholarships at the chapter level. Our requirements have recently been updated as well as the award amount. Please contact us for more information. From a society level there is also the college of fellows travel grant that graduate students can apply for. This is for travel to ASHRAE conferences Please reach out for more information.

Sincerely,

Brandon Stolworthy
Student Activites Chair
ASHRAE Utah Chapter
students.UtahASHRAE@outlook.com

Technical Article

Refrigerant Flow Control: The Hidden Driver of Refrigeration Capacity

Introduction

Refrigeration systems can sometimes be misleading because of the way their capacity is described. When selecting condensers, chillers, or other refrigeration equipment, engineers often reference tonnage as the primary description of size. The refrigeration unit ton is specific to North America and represents 12,000 BTU/hr. Historically, one ton of cooling corresponds to the rate of heat removal required to melt one ton of ice over a 24-hour period.

Labeling equipment generically by tonnage can sometimes create confusion because refrigeration capacity is dependent on operating conditions.

Refrigeration equipment is rated at specific operating conditions, typically defined by evaporating temperature and condensing temperature.

When a system deviates from these rated conditions, the actual cooling capacity will change. Understanding why this occurs requires examining the physics and thermodynamics that govern refrigerant flow within refrigeration systems.

The following article walks through these principles to provide a clearer picture of the variables at work that drive system capacity.

Capacity in Refrigeration Systems

In general, refrigeration capacity increases as **evaporator temperature increases** and decreases as **evaporator temperature decreases.** The opposite relationship exists for condensing temperature: capacity decreases as condensing temperature rises and increases as condensing temperature falls.

The evaporator is where the cooling effect of the refrigeration cycle occurs. It functions as a heat exchanger that transfers heat from the process fluid (liquid or gas) to the refrigerant. In residential air conditioning systems this component is typically located near the furnace and consists of a fin-and-tube heat exchanger. In chillers, evaporators are commonly shell-and-tube or brazed plate heat exchangers. In all cases, the purpose of the evaporator is to provide sufficient surface area for heat to transfer from the process fluid into the refrigerant.

The refrigerant flow into the evaporator is regulated by the **thermostatic expansion valve (TXV)**. The TXV throttles refrigerant flow to maintain a stable superheat at the outlet of the evaporator. When the load on the evaporator decreases—for example when the process fluid temperature drops—the TXV responds by throttling the refrigerant flow into the evaporator. This reduces the mass flow rate of refrigerant and therefore reduces the cooling capacity of the system.

After absorbing heat in the evaporator, the refrigerant vapor flows to the compressor where it is recompressed. The high-pressure vapor then enters the condenser. The condenser must reject all the heat absorbed in the evaporator along with the work energy added by the compressor. This heat is rejected to either ambient air or water depending on the system design. Air-cooled condensers typically use fin-and-tube heat exchangers, while water-cooled systems often use shell-and-tube or coaxial condensers.

As the temperature of the cooling medium (air or water) increases, the condensing temperature and pressure must also increase for heat rejection to occur. Higher condensing temperatures increase the work required by the compressor and reduce the overall refrigeration effect. In addition, the compressor will operate at a higher compression ration which reduces the amount of refrigerant the compressor can move. This results in a net decrease in system capacity.

The Compressor: Driver of Mass Flow

There are several types of compressors used in refrigeration systems, including scroll, reciprocating, screw, and centrifugal compressors. For the purposes of this discussion, we will focus on **scroll and reciprocating compressors**, which are the most common in small and medium refrigeration systems.

These compressors can generally be considered **fixed-displacement pumps**, meaning they move approximately a fixed volume of refrigerant vapor per revolution.

Compressor specifications typically include a **volumetric displacement**, often expressed in cubic feet per minute (CFM). In theory, this volumetric flow could be converted into a mass flow rate if the density of the suction vapor were known. In practice, however, this relationship is more complicated because real compressors experience losses such as leakage and re-expansion of gas remaining in the compression chamber.

Even with these limitations, **compressor displacement provides a much better indication of potential cooling capacity than the generic tonnage rating alone.**

During the compression cycle, low-pressure refrigerant vapor leaving the evaporator enters the compressor's compression chamber. As the compressor rotates, this vapor is compressed to a higher pressure and discharged to the high side of the system.

The cooling effect of the refrigeration cycle can be described by the relationship:

$$\mathbf{Q = \dot{m}(h_1 - h_2)}$$

Where the cooling capacity depends on the **mass flow rate of refrigerant** and the enthalpy difference across the evaporator.

Because positive displacement compressors move a fixed **volume** rather than a fixed **mass**, the density of the suction vapor becomes extremely important.

As evaporator saturation temperature decreases, the corresponding suction pressure also decreases. Lower pressure results in **lower vapor density**. When the compressor draws in the same volume of vapor under these conditions, the mass of refrigerant contained within that volume is smaller. As a result, the compressor circulates less refrigerant mass through the system and the refrigeration capacity decreases.

An additional limitation arises from the **clearance volume** within the compressor. A small amount of compressed gas always remains in the compression chamber after discharge. This gas expands during the next suction cycle and reduces the amount of fresh vapor that can enter the chamber. As condensing pressure increases, this re-expansion effect becomes larger, further reducing the mass flow rate through the compressor.

Because refrigeration capacity is directly related to refrigerant mass flow rate, these effects can significantly influence the overall performance of the system.

The Expansion Device

There are several types of expansion devices used in refrigeration systems. These range from simple fixed devices such as **capillary tubes** to dynamic control devices such as **thermostatic expansion valves (TXVs)** and **electronic expansion valves** using digital stepper motors.

Capillary tubes provide a fixed restriction and are well suited for small systems that operate at relatively constant conditions. As systems become larger and loads become more dynamic, active control devices such as TXVs or electronic expansion valves are generally preferred.

Thermostatic expansion valves regulate refrigerant flow into the evaporator by monitoring the **superheat at the evaporator outlet**. Superheat is determined by comparing the temperature of the suction line leaving the evaporator with the saturation temperature corresponding to the evaporator pressure.

Mechanical TXVs accomplish this using a sensing bulb that contains a small amount of refrigerant. The bulb is mounted to the suction line leaving the evaporator. As the temperature of this line increases, some of the refrigerant inside the bulb vaporizes, increasing the pressure inside the bulb.

This pressure is transmitted through a small capillary tube to the TXV head, often called the **power element**. Inside the valve a diaphragm responds to this pressure and moves a pin that opens or closes the valve orifice.

Opposing the bulb pressure are two forces: **evaporator pressure** and **spring pressure** within the valve. These forces balance each other to regulate refrigerant flow into the evaporator.

In smaller systems with minimal pressure drop through the evaporator, the valve can sense evaporator pressure internally. In larger systems where pressure drop across the evaporator becomes significant an **external equalizer line** is used. This line connects the valve to the evaporator outlet pressure to ensure accurate pressure sensing.

In an ideal system the TXV would maintain extremely low superheat, allowing the evaporator to fully utilize its heat transfer surface. Superheat represents the amount of temperature increase above the refrigerant’s saturation temperature and does not contribute additional refrigeration effect.

Excessive reduction in superheat creates the risk of **liquid refrigerant returning to the compressor**. Compressors are designed to compress vapor only, and liquid refrigerant entering the compressor can cause serious mechanical damage.

For this reason, system designers typically target **5–15°F of superheat** to ensure that all refrigerant leaving the evaporator is fully vaporized before entering the compressor.

Conclusion

Refrigeration systems naturally seek to operate at an equilibrium. The compressor continuously pulls vapor from the evaporator and compresses it before sending it to the condenser. In the condenser the refrigerant rejects heat and condenses back into a high-pressure liquid. This liquid then flows through the expansion valve, where the pressure is reduced and the refrigerant enters the evaporator as a low-pressure mixture. As the refrigerant boils in the evaporator, it absorbs heat from the process fluid before returning to the compressor to repeat the cycle.

The thermostatic expansion valve (TXV) constantly adjusts refrigerant flow in response to changes in evaporator conditions, throttling open or closed to maintain the desired superheat. The compressor, meanwhile, continuously circulates refrigerant vapor through the system.

If the load on the evaporator increases (temperature of the process fluid rises) the TXV will allow more refrigerant to flow into the evaporator so that additional heat can be absorbed. Conversely, if the load decreases, the valve throttles back to maintain stable operation.

Because refrigeration systems operate as a balance between compressor pumping and expansion valve metering, selecting equipment based solely on tonnage can sometimes lead to misleading expectations if the rated operating conditions are not carefully considered.

Key Takeaways

- Refrigerant mass flow rate primarily drives refrigeration capacity
- Positive displacement compressors move volume not mass. So suction vapor density drives system capacity
- System capacity decreases as evaporator temperature drops because lower suction pressure reduces refrigerant vapor density.
- Higher condensing temperatures increase compression ratio and reduce both refrigeration effect and mass flow.
- Expansion valves regulate refrigerant flow to maintain stable superheat at the evaporator outlet.
- Superheat is maintained primarily to protect the compressor from liquid refrigerant.
- Stable refrigeration systems depend on the balance between compressor pumping and expansion valve control.