Refrigeration 101

Refrigeration 101

- Early Refrigeration - What was used before modern refrigeration?
- Basic Refrigeration Principles - Terms and concepts of refrigeration.
- The Refrigeration Cycle - How does modern refrigeration work?

Early Refrigeration

Harvesting ice from clear frozen lakes used to be a booming seasonal industry in the late 1800s.

In fact, ice sales were the 3rd largest U.S. export after cotton and grain.

Early Refrigeration

In 1803, Thomas Moore patented a metal-lined butter-storage tub which became the prototype for the icebox.

Consumers preserved their food in iceboxes with ice purchased from ice harvesters.

Iceboxes were used until 1910.

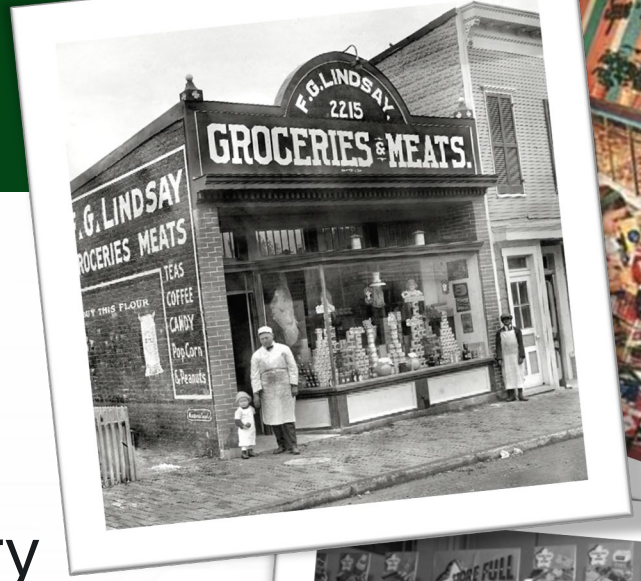
Early Refrigeration

In 1911, GE released a household refrigeration unit that was powered by gas.

In 1927, GE released the Monitor Top, the first electric refrigerator.

Early Refrigeration

As the ability to keep foods fresh at home became more commonplace, grocery stores and supermarkets began to proliferate. As they did, they added refrigerated display cases.



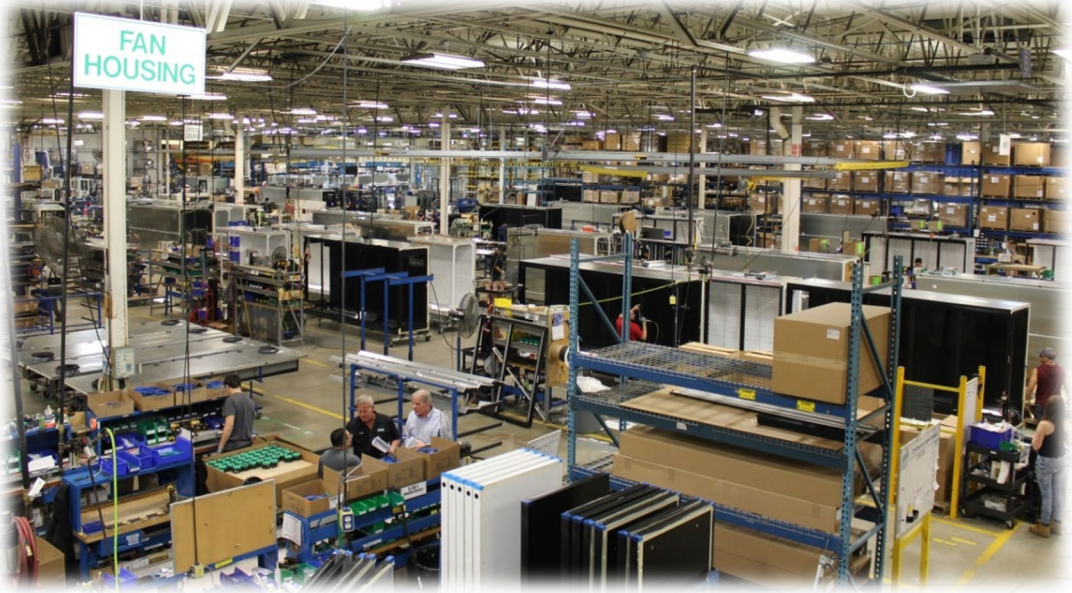
Early Refrigeration

In 1961, Zero Zone was founded with the pledge to “build the best freezers in the business at a competitive price”

The new company began operations in a rented dairy barn in Pewaukee, WI

Early Refrigeration

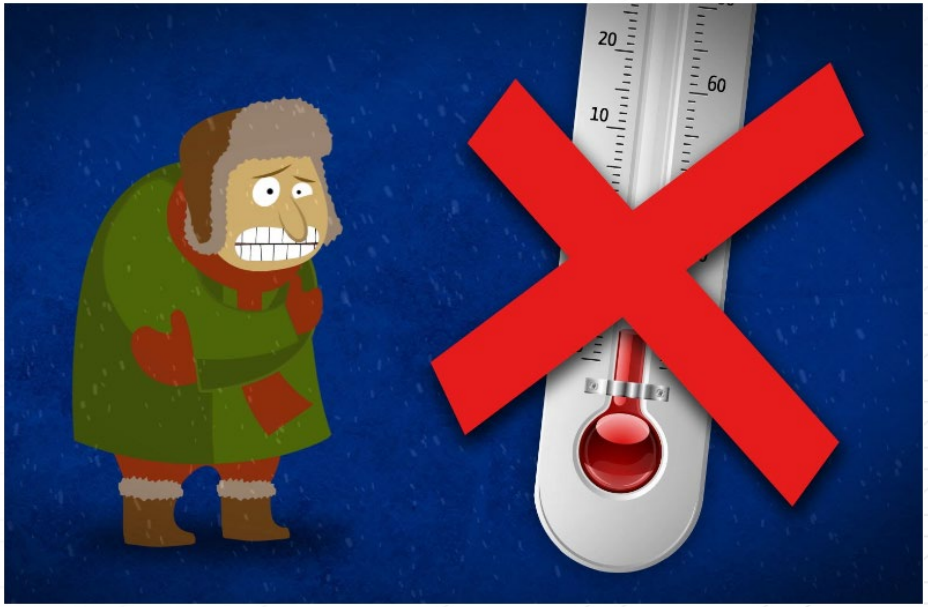
Today, Zero Zone manufactures the highest quality refrigerated cases in the industry.



Modern Refrigeration

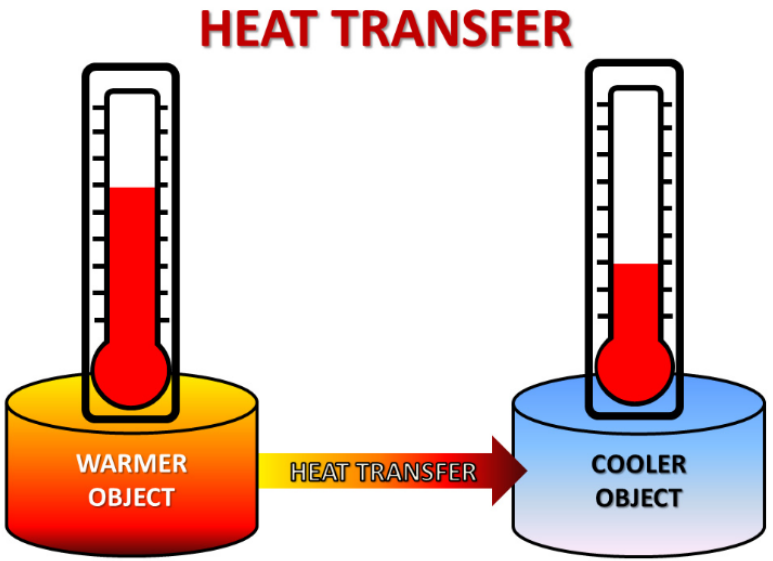
Basic Refrigeration Principles

We often think of refrigeration simply as making something cold. But refrigeration is actually removing heat, or more accurately, the transfer of heat.



Basic Refrigeration Principles

Heat always travels from a warm object to a colder one.



Basic Refrigeration Principles

One of the ways heat can move is through **Conduction**.

Conduction is the flow of heat through a substance.

By the way, Aluminum and Copper are very good conductors.

Basic Refrigeration Principles

The way we measure heat is through the **British Thermal Unit (BTU).**

1 BTU is about the amount of energy produced by a burning match.

A **BTU** is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

Basic Refrigeration Principles

Highlight™ Merchandiser RHZC30 & RHZC30BB Specs

Low Temp Reach-Ins with 30" x 68" Doors

Note: All Zero Zone display cases manufactured for shipment within the U.S. meet or exceed current DOE energy requirements.

ENERGY DATA	LINEUP DATA		INDIVIDUAL CASE DATA (Includes 1 Pair of End Panels)							
Refrigeration (see note #1 for components included in baseline Btuh)	Per Door Avg.		2-Door		3-Door		4-Door		5-Door	
	F.F.	I.C.	F.F.	I.C.	F.F.	I.C.	F.F.	I.C.	F.F.	I.C.
Evaporator Temperature (°F)	-7	-16	-7	-16	-7	-16	-7	-16	-7	-16
Baseline Btuh [1,2]	900	985	2,090	2,270	2,950	3,220	3,810	4,170	4,680	5,130
Discharge Air Temp. (°F) (w/ 8°F Superheat)	-3	-12	-3	-12	-3	-12	-3	-12	-3	-12
Btuh Deducts	Btuh									
Back-To-Back (Model BB)	-75	-85								
Btuh Adders	F.F.	I.C.								
Optional Glass Windowed End Panel (Each)	315	350								

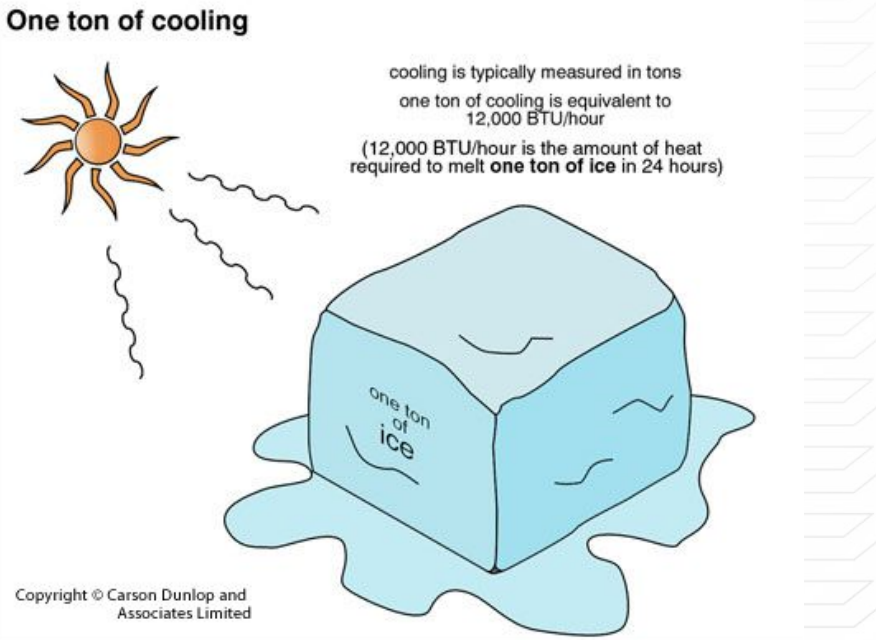
The **BTUs** given, is the amount of **heat** that needs to be removed from an operating case every hour.

Basic Refrigeration Principles

FUN FACT!

One Ton of Cooling capacity is the amount of heat required to melt one ton of ice in 24 hours.

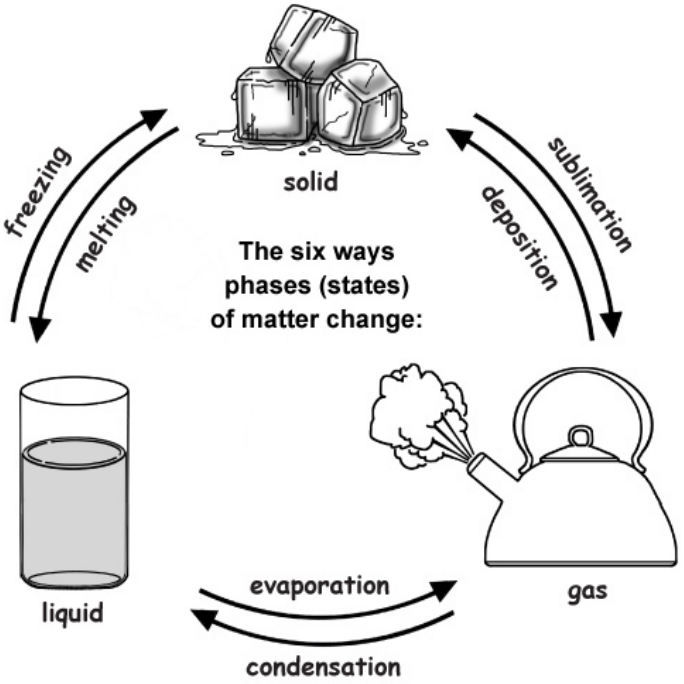
It is equal to 12,000 British thermal units (Btu) per hour.



Basic Refrigeration Principles

So how does a refrigeration system move energy?

Most common substances can exist as a solid, a liquid, or a vapor, depending on their **temperature** and the **pressure** to which they are exposed.



Basic Refrigeration Principles

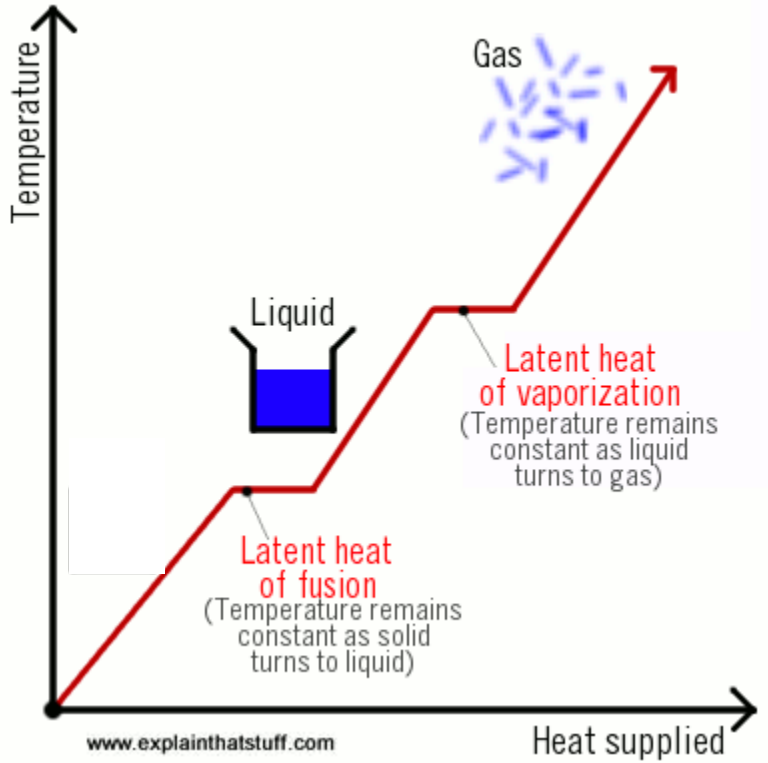
Water can exist in different states...

a Liquid or

a Vapor (Steam)

Basic Refrigeration Principles

Heat can change water's temperature, and it can also change its state.



Basic Refrigeration Principles

As we learned, ice can be used as a form of refrigeration. (Remember the ice box.)

Ice absorbs heat as it melts, and yet remains at a constant temperature of 32°F.

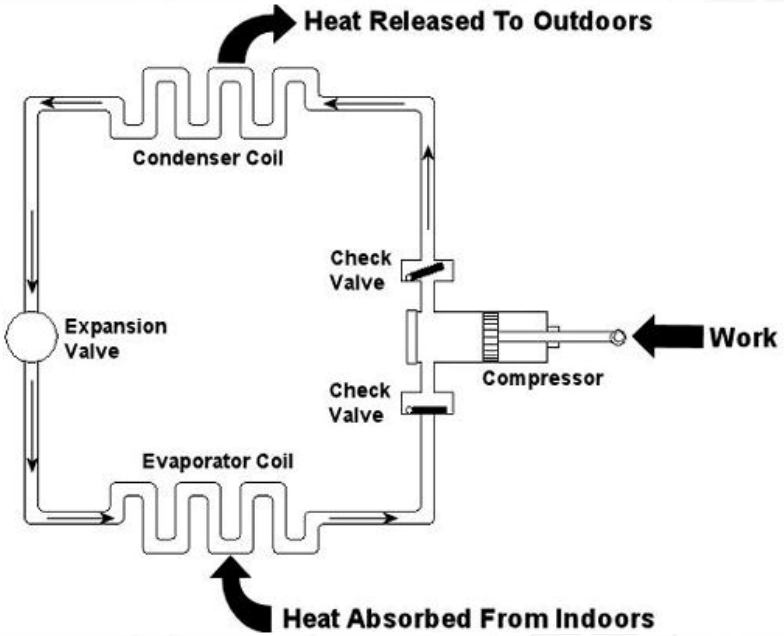
Basic Refrigeration Principles

Water absorbs heat as it is converted to vapor and remains at a constant temperature of 212°F.

No matter how much heat is applied, the temperature cannot exceed 212°F.

Basic Refrigeration Principles

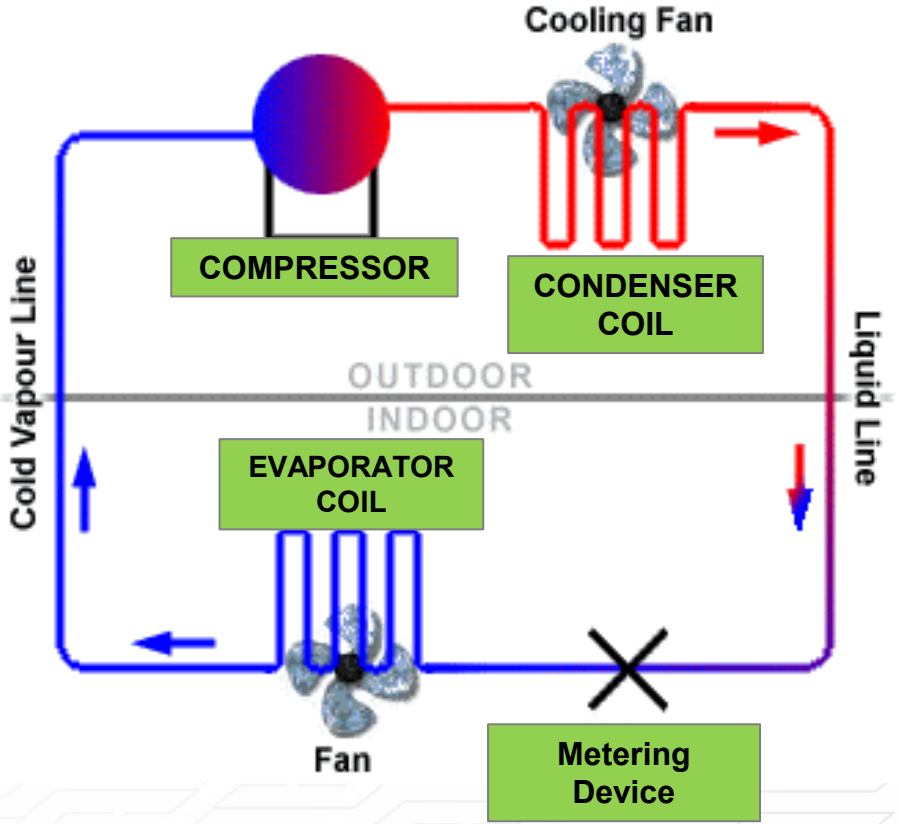
The absorption of heat by changing a liquid to a vapor, and the discharge of that heat by condensing the vapor to a liquid is the keystone to the mechanical refrigeration process.



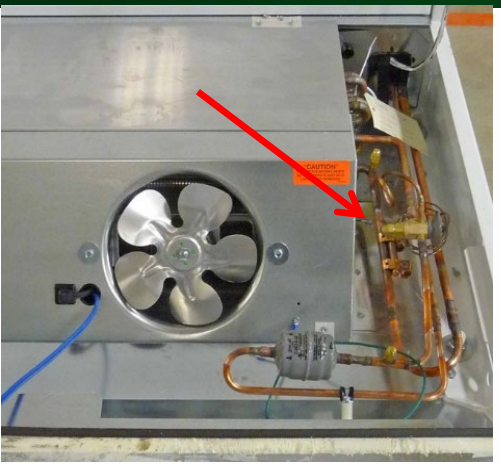
The Refrigeration Cycle

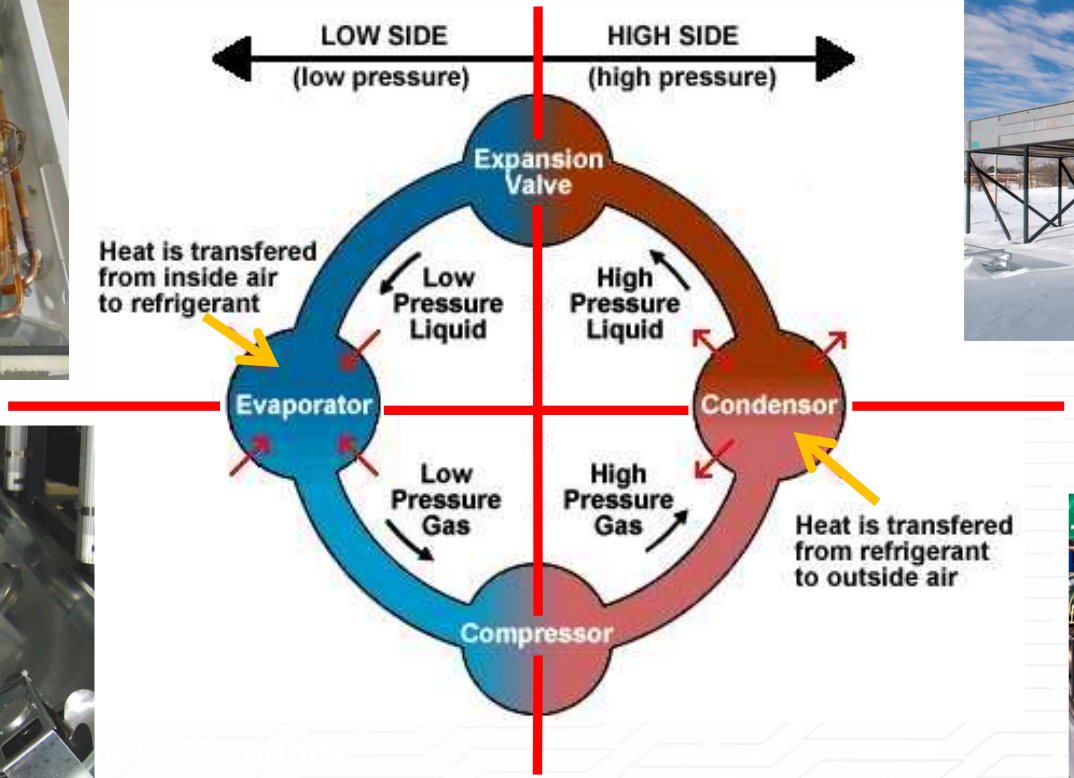
A Refrigeration System is a Sealed System that consists of four primary components:

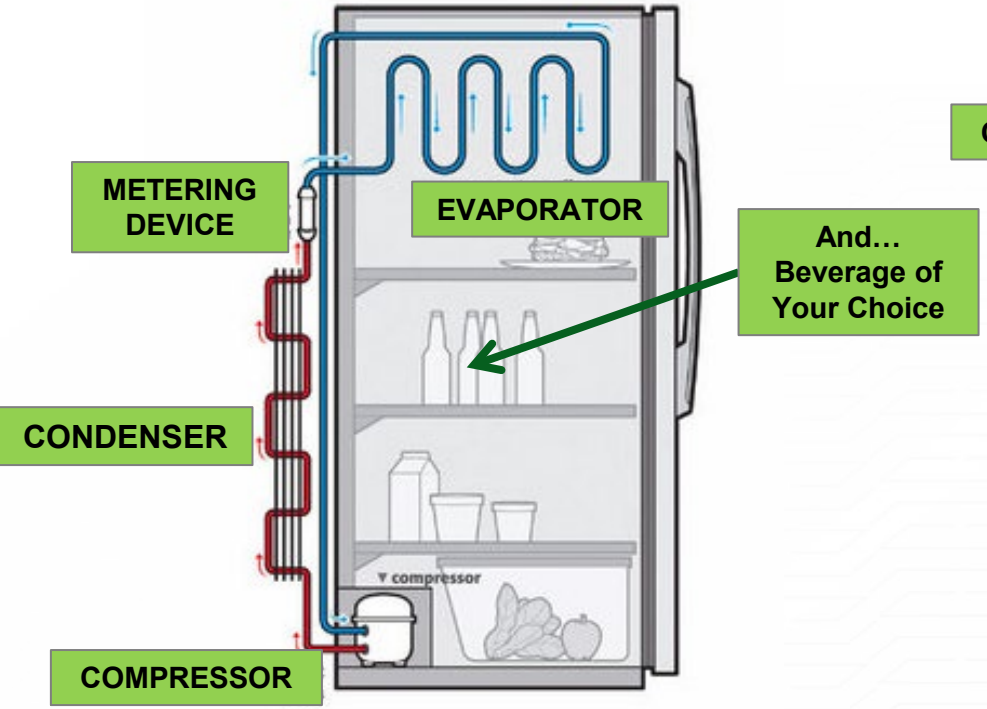
- A Compressor
- A Condenser Coil
- A Metering Device
- And An Evaporator Coil



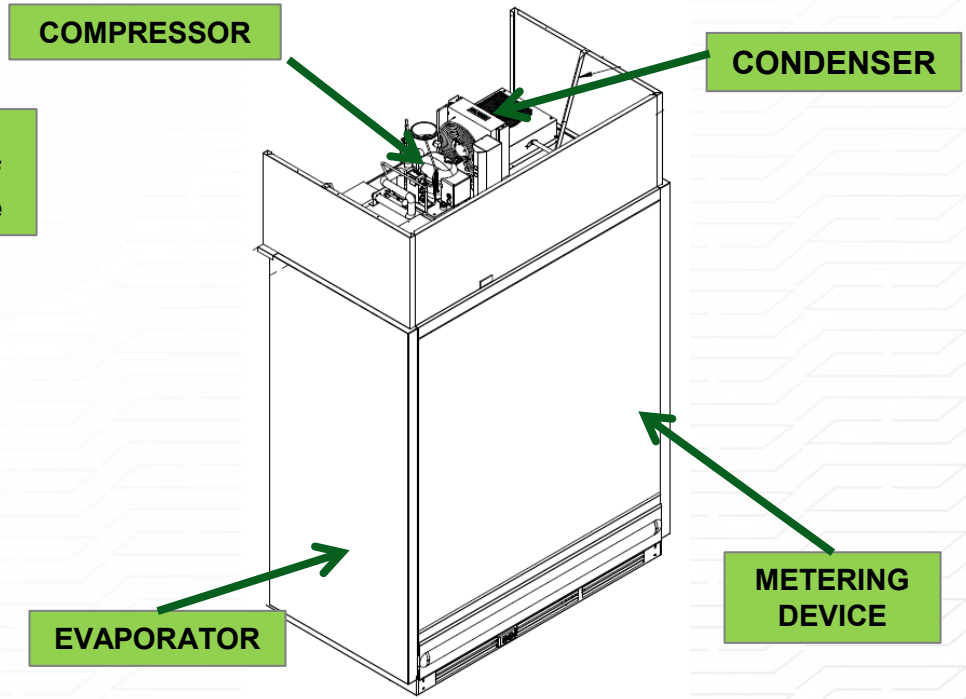
The Refrigeration Cycle







Your Home Refrigerator



Zero Zone Hybrid Case

The Refrigeration Cycle

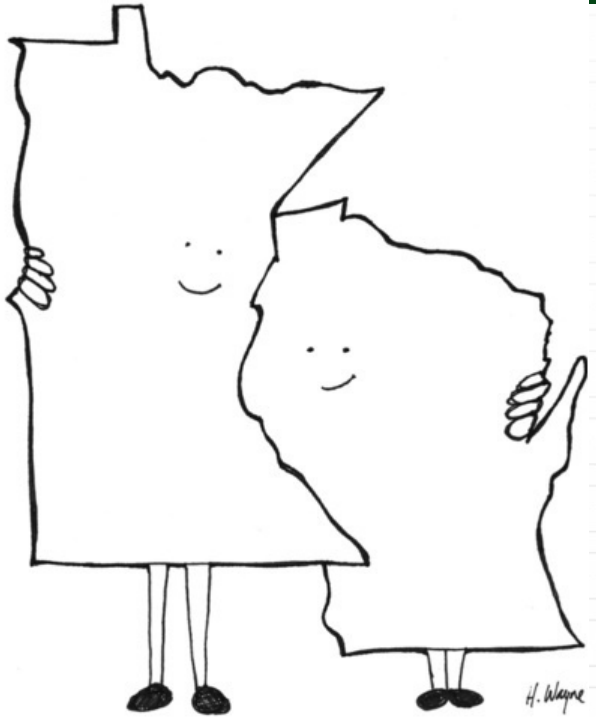
In a grocery store, *Refrigerant* moves through these components through copper pipe.

The Refrigeration Cycle

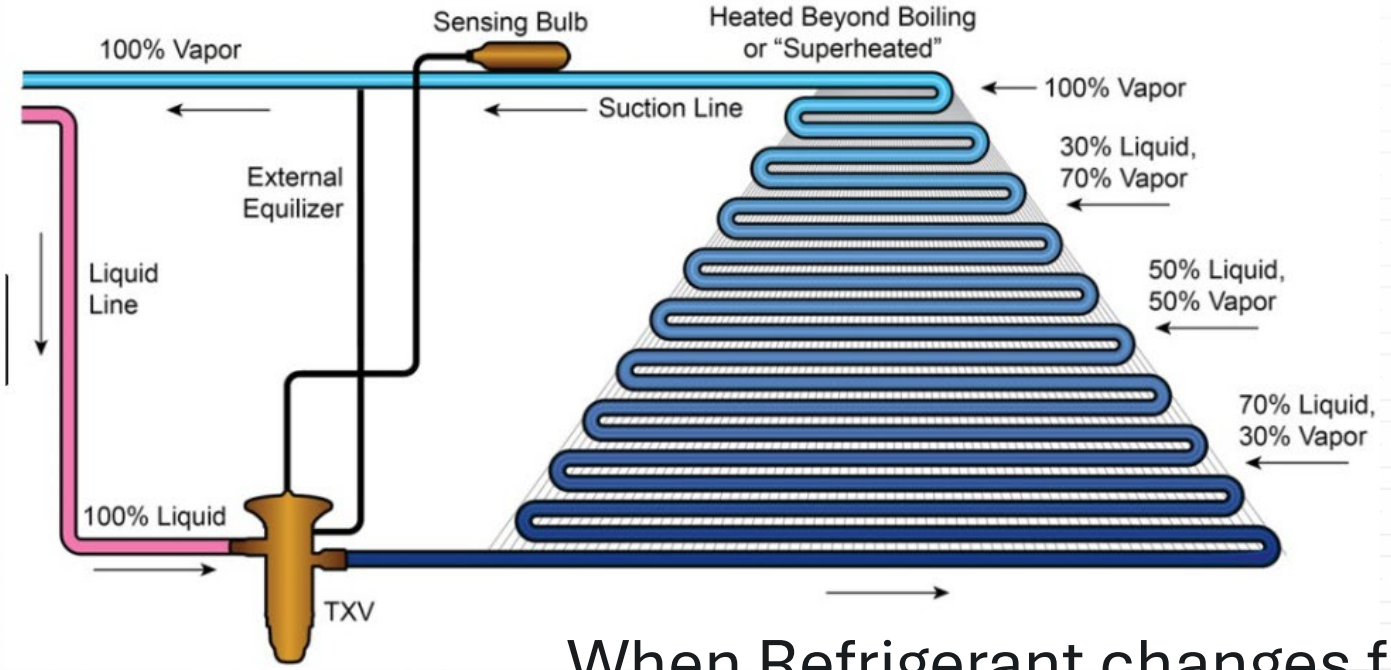
As the refrigerant moves through the system, it will go through a Change of State at some of the components (the evaporator and the condenser).

From a liquid to a gas, & from a gas to a liquid.

This Change of State happens over and over again and never wears out.

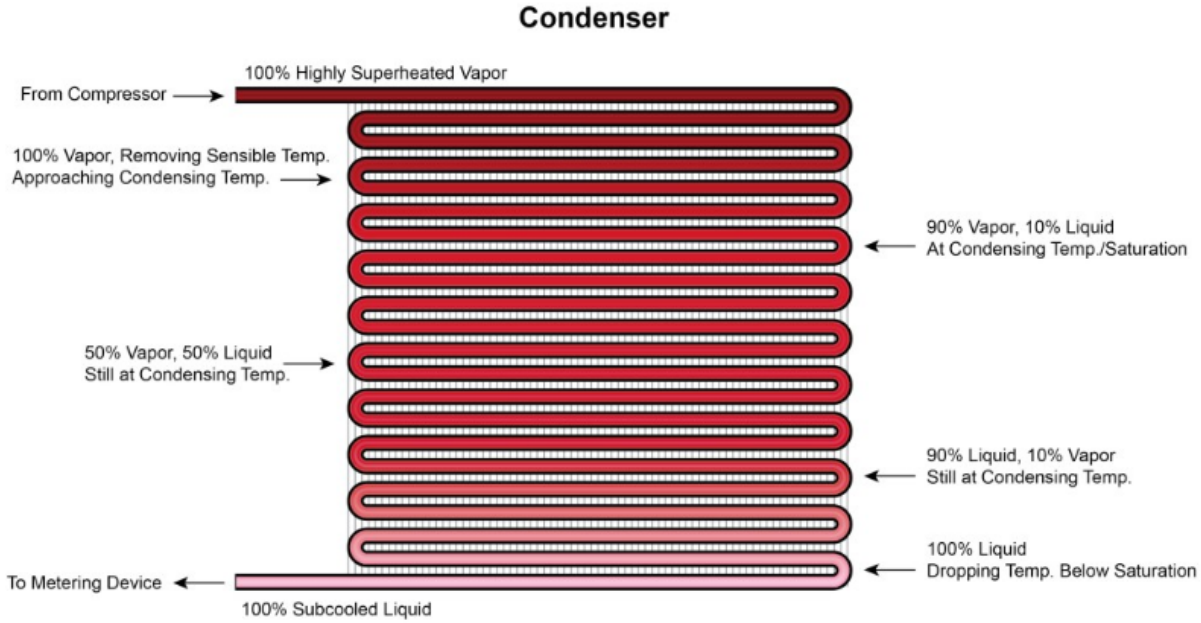


The Refrigeration Cycle



When Refrigerant changes from a liquid to a gas, it absorbs heat.

The Refrigeration Cycle



When Refrigerant changes from a gas to a liquid it releases heat.

Contact

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