Salinas Valley Ammonia Safety Day

May 26, 2011

Salinas, CA

Basic Refrigeration

By Russell Ramos, Sales Engineer, Joseph H. Schauf Co., Madera, CA

What is the Big Picture for Today's Safety Seminar?

- To do our "jobs" better.
- To get better at what we do and how we do it.
- To provide a means for all of us to gain more knowledge.

What is the Big Picture for Today's Safety Seminar?

- Because through knowledge:

  You, your Co-Workers, your Employees, your Plants, and Our Industry becomes safer.

Remember

The Basics of Refrigeration

Starts with

the Basics of Safety

HAND TOOLS

- What is the significance of this picture?
- Who is using the tools?

This is a reminder.
FACT: The overwhelming majority of accidents and releases are caused by operators and technicians who are working on the system.

In Memory of Mike Chambers

In other words:

WE have met the Enemy

…and <u>They</u> are US!

Examples of How and When Operators may cause Accidents.

1

2

3

4

5

Examples of How and When Operators may cause Accidents.

- Starting up a System.
- Lowering the System suction pressure too rapidly!
- Shutting down a System.
- Disconnecting a System.
- Simply closing or opening a single valve
- Adding ammonia to the system.

Examples of How and When Operators may cause Accidents.

- Performing Maintenance, like draining oil, servicing compressors, replacing valves or shaft seals, etc.
- During Pump Outs and Pump Downs.

Operator Challenge

Challenge to all Operators-Old and New

(List of specific things every operator should know and be able to do.)

- #1:You need to have the attitude that **Learning Is Fun.**

- #2:**You should be able to draw a detailed sketch of your HPR** and accurately locate and describe **all** the piping connections, especially the HPL line and the King Valve.

- #3: **You should be able to draw your entire system** (in a block flow diagram format) and <u>represent</u> every compressor, condenser, metering device, and evaporator, along with all vessels and pressure regulators if present. You should be able to draw and explain this system to all of the top management and engineers in your organization, with few notes if any, while explaining all the pressures, temperatures, the relative speed of flow and the condition of the refrigerant in every component.

- #4: You should know “**how close to perfect**” you can operate your system in regards to head pressure and non-condensables. In other words how close can you get your actual system head pressure to the pressure that corresponds to your actual system condensing temperature. Within 6 psig, 5? 3? 2?

- #5. You must be able to explain to me why I consider **the evaporative condenser** to be the most important component in the system. (My list, my opinion). Hint: How maintaining it properly can pay for your salary verses how not maintaining it can cost your company big bucks.

- #6. **You must be knowledgeable of the construction, operation, function and proper maintenance of all valves in your system**. (Why? Because through investigations the Chemical Safety Board has determined that most NH3 releases are related, somehow, to valves). This challenge is to be able to explain everything about the valves you have in your system using the correct terminology. (For example: **Body Style**: globe, angle, ball, other; **Connection Type**: threaded, socket weld or butt weld; **Bonnets**: bolted or threaded; **Stems**: stainless or carbon steel; **Packings**: graphite, teflon or "O" rings. If "O" rings, single or double; **Seats**: moveable (are they lead, teflon or other) and stationary; **Handwheels or Seal Caps**; **Directional Arrows, etc.** This discussion also includes **Regulators** and other **Control Valves like: Solenoids, Reliefs, Checks, Needle** and **Expansion valves,** etc., etc.

- #7. You must be **able to explain the function(s) of each system safety** that you have in your plant. You will be reading this off of a “chart or table” that you made (or that your plant already has). You will explain where these safeties are physically located, what their purpose is, how they work, how you know when they have “alarmed” or “tripped”, and how to reset them to put the system back into normal operation. Examples of system safeties would be: Ammonia Detection, Emergency Stop Buttons, King Solenoid Valve, High Liquid Level(s), Low Liquid Level(s), High Pressure(s), High Temperature(s), Oil Heater Controls, Ventilation System Controls, Transfer System(s), Purging system(s), Room Temps, etc., etc. Answer this question; How would you physically prove each one of these safeties? #7. You must be **able to explain the function(s) of each system safety** that you have in your plant. You will be reading this off of a “chart or table” that you made (or that your plant already has). You will explain where these safeties are physically located, what their purpose is, how they work, how you know when they have “alarmed” or “tripped”, and how to reset them to put the system back into normal operation. Examples of system safeties would be: Ammonia Detection, Emergency Stop Buttons, King Solenoid Valve, High Liquid Level(s), Low Liquid Level(s), High Pressure(s), High Temperature(s), Oil Heater Controls, Ventilation System Controls, Transfer System(s), Purging system(s), Room Temps, etc., etc. Answer this question; How would you physically prove each one of these safeties?

- #8* You must be competent with **navigating, reading and explaining** your plant's **P&IDs.**

- #9:**You must be able to explain all these items above in great detail**. (My philosophy is this…if you can't explain it, then you don't know it well enough yet. Keep practicing until you can explain it).

- When you accomplish these things, then you will be in a very elite group of operators.

- (Courtesy of Russell Ramos, Joseph H. Schauf Co., Madera, CA Cell: 559-351-4288)

BASIC REFRIGERATION

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Let’s Go Learn Something!

Learning is an attitude.

Let’s get excited about learning.

Let’s get excited about learning so we can eventually teach.

LET’s GO FOR IT!

Bring your “A” game.

Let’s Get It On!

It’s All About The HEAT

Terminology

Heat transfer

Compressor

Liquid and vapor

Condenser

High Side

Delta P

Evaporator

Low Side

Expansion Valve

King Valve

Suction

Discharge

HPR-High Pressure Receiver

HPL-High Pressure Liquid

Delta T

Basic System

- ??????????

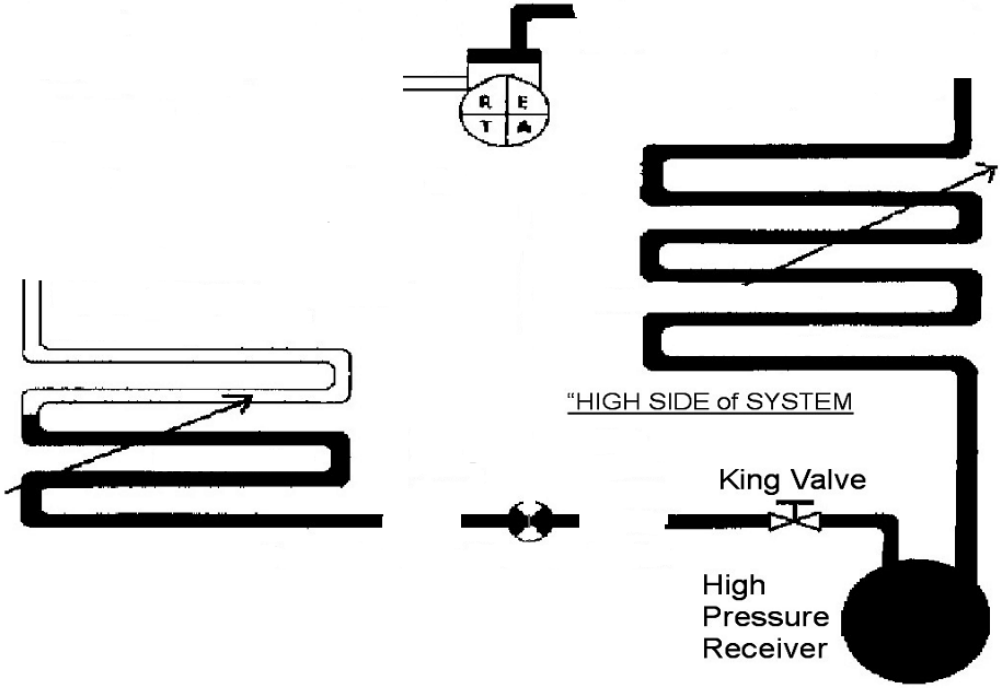
Basic System

- There are 4 basic components of a mechanical refrigeration system.

R
E
T
A

BASIC MECHANICAL REFRIGERATION SYTEM COMPONENTS

Refrigeration may be defined as the process by which HEAT is removed from a place (or an object) where it is not wanted, and then transferred to an area where it does no harm (usually the atmosphere).


R
E
T
A
"HIGH SIDE of SYSTEM
King Valve
High
Pressure
Receiver

Emergency Responders

- What do they want to know.

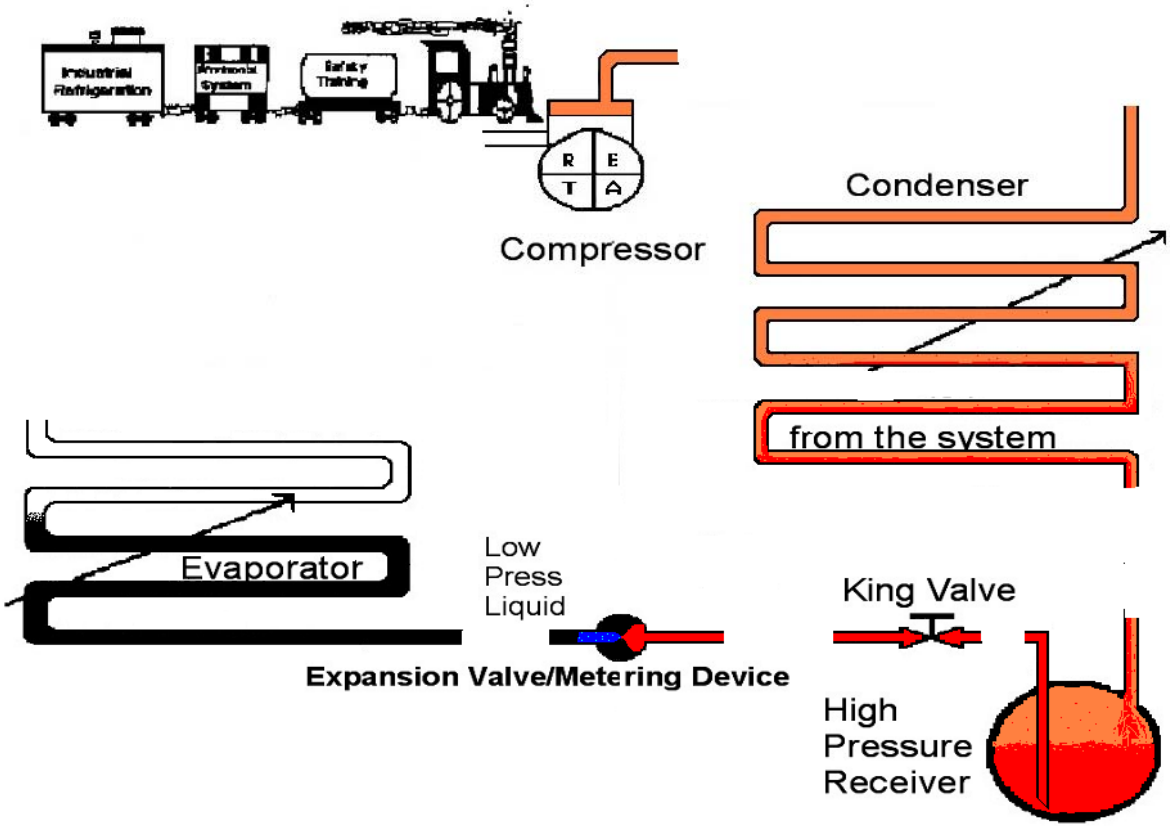
Emergency Responders

- What do they want to know?
- HPR and King Valve.
- What else do they want to know when they show up for an emergency?
- ???????

HEAT

- Let’s talk about the purpose of the System

Which is Transferring heat


Industrial Refrigeration
Ammonia System
Safety Training
R E
T A
Compressor
Condenser
from the system
Evaporator
Low
Press
Liquid
King Valve
Expansion Valve/Metering Device
High
Pressure
Receiver

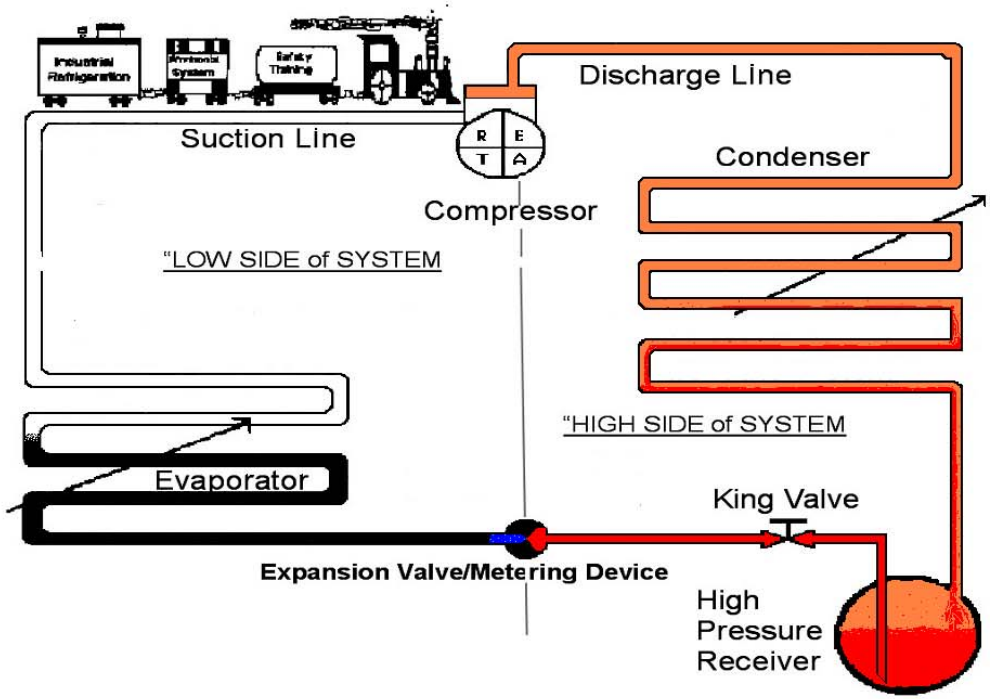
- Basic HEAT law #1 –
- HEAT energy **ALWAYS** flows from a high temperature to a lower temperature.

- In other words, HEAT **ALWAYS** flows from “hot” to “cold”.

- Mechanical refrigeration is simply the process of a liquid changing state to a vapor and back again. This happens when enough heat energy enters a liquid to cause that liquid to evaporate (or boil) into a vapor. Remember, this liquid had to be the coldest substance in the area for the HEAT energy to flow into it. This is what happens in the EVAPORATOR.

- This same vapor then travels through the compressor and enters the “high pressure side” of the system. At this point, when the high pressure – high temperature vapor <u>loses</u> enough heat energy to cooler surroundings, it will condense back into a liquid. This is what happens in the CONDENSER.

- Now, the cycle can be repeated if this high pressure liquid can be properly throttled to the lower pressure (or suction pressure) side of the system again.
- This is what happens at the METERING DEVICE, which can also be called an EXPANSION VALVE.


Industrial Refrigeration
Ammonia System
Safety Training
Discharge Line
Suction Line
R
E
T
A
Condenser
Compressor
"LOW SIDE of SYSTEM
"HIGH SIDE of SYSTEM
Evaporator
King Valve
Expansion Valve/Metering Device
High
Pressure
Receiver

Fan panel open for inspection and cleaning


11-17-2008

API 5L/ASTM A106/A53Gr.B/X42 1-1/4" *0.140" *20' 302777 MM-175614
API 5L/ASTM A106/A53Gr.B/X42 1-1/4" *0.140" *20' 302777 MM-175614
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11-17-2008


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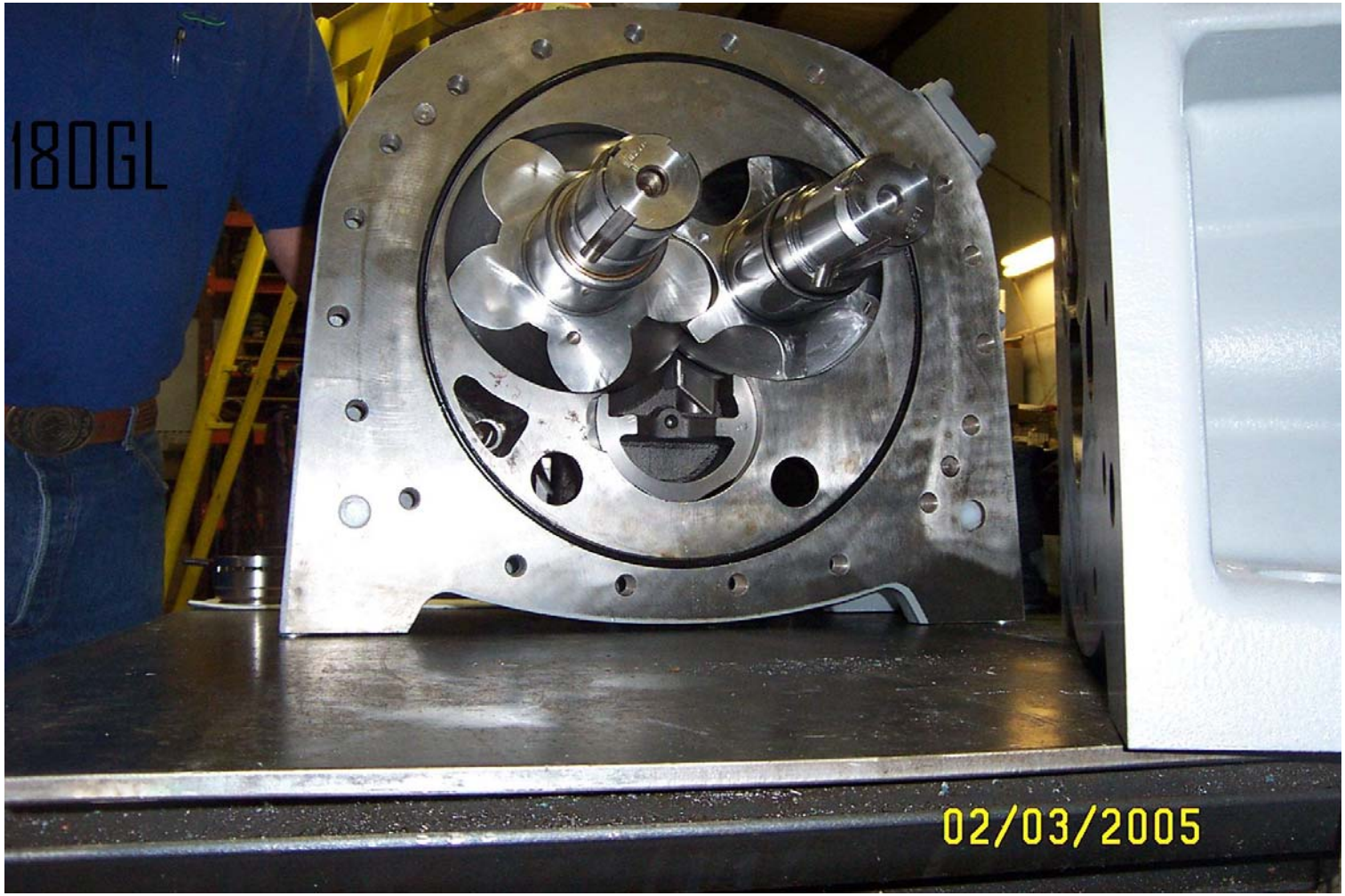
WERNER
02/14/2007


C3065
02/14/2007


02/14/2007


180GL
02/03/2005


180GL
02/03/2005


02/13/2007


Passivating only-Fans SN U040670901
are not on.
08/31/2004

WPS

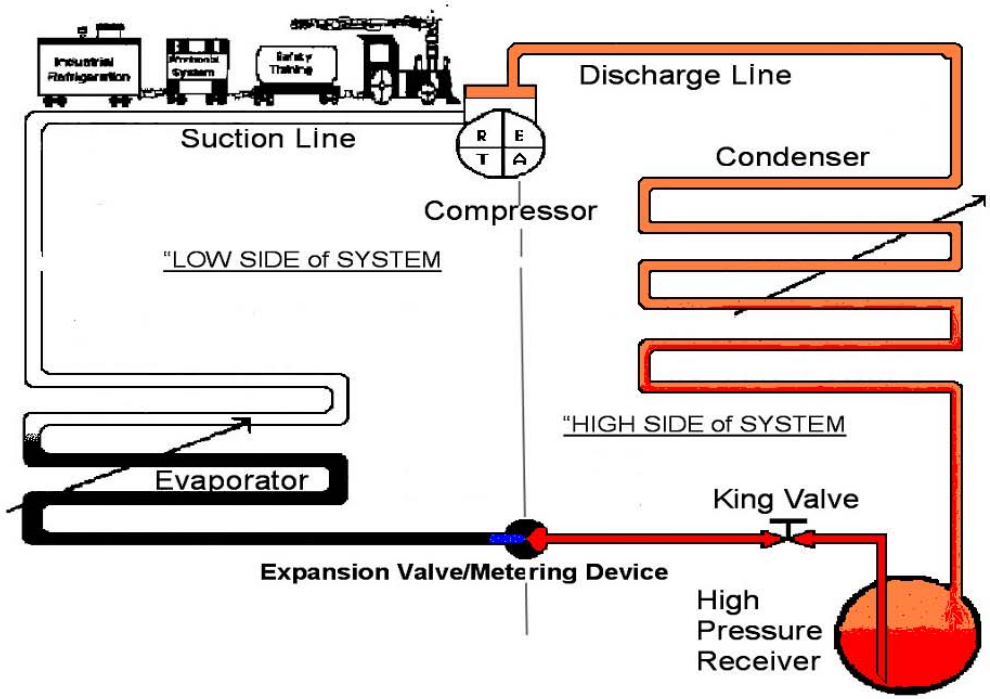
DX Evaporator

DX Evaporator

Gravity Flooded Evaporator

Liquid Recirculation


07/12/2006


Industrial Refrigeration
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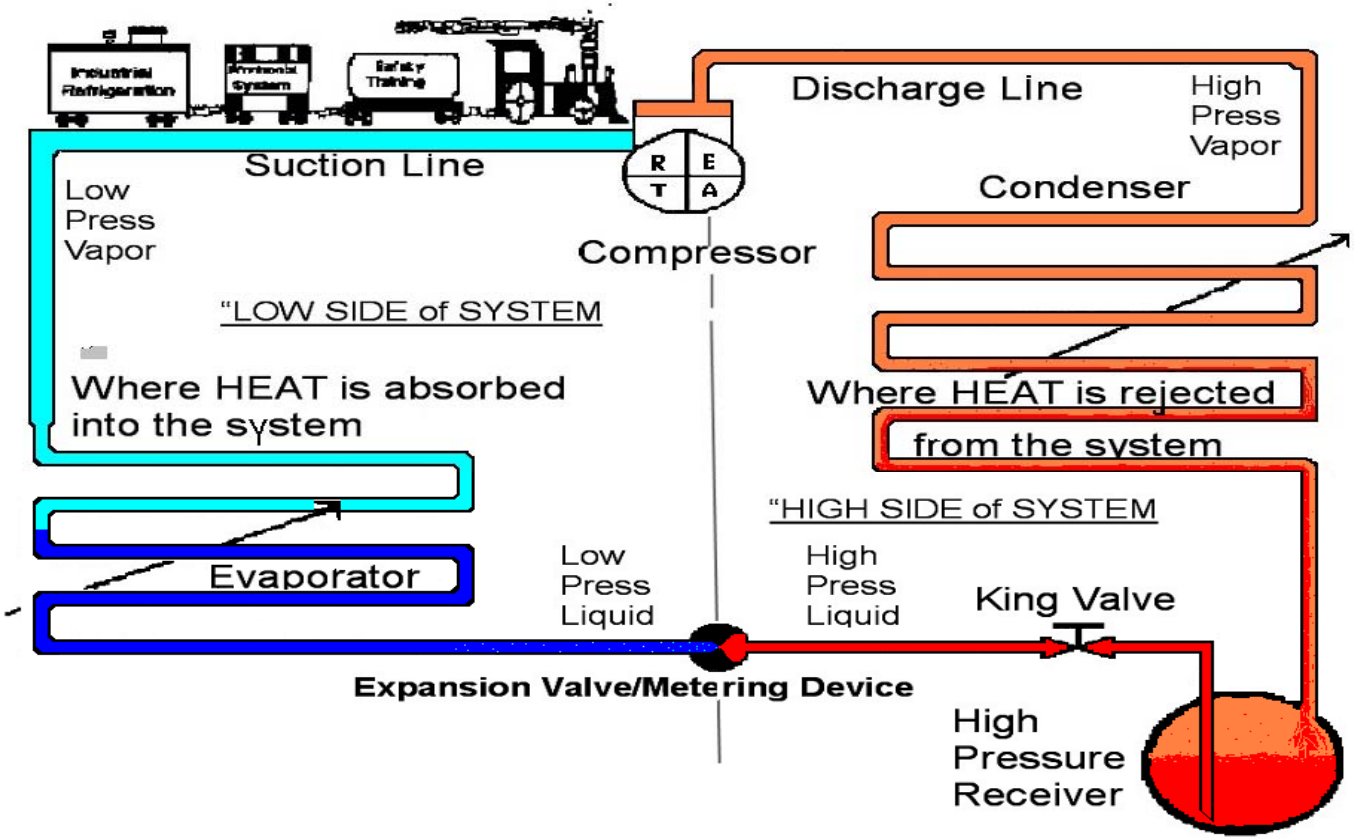
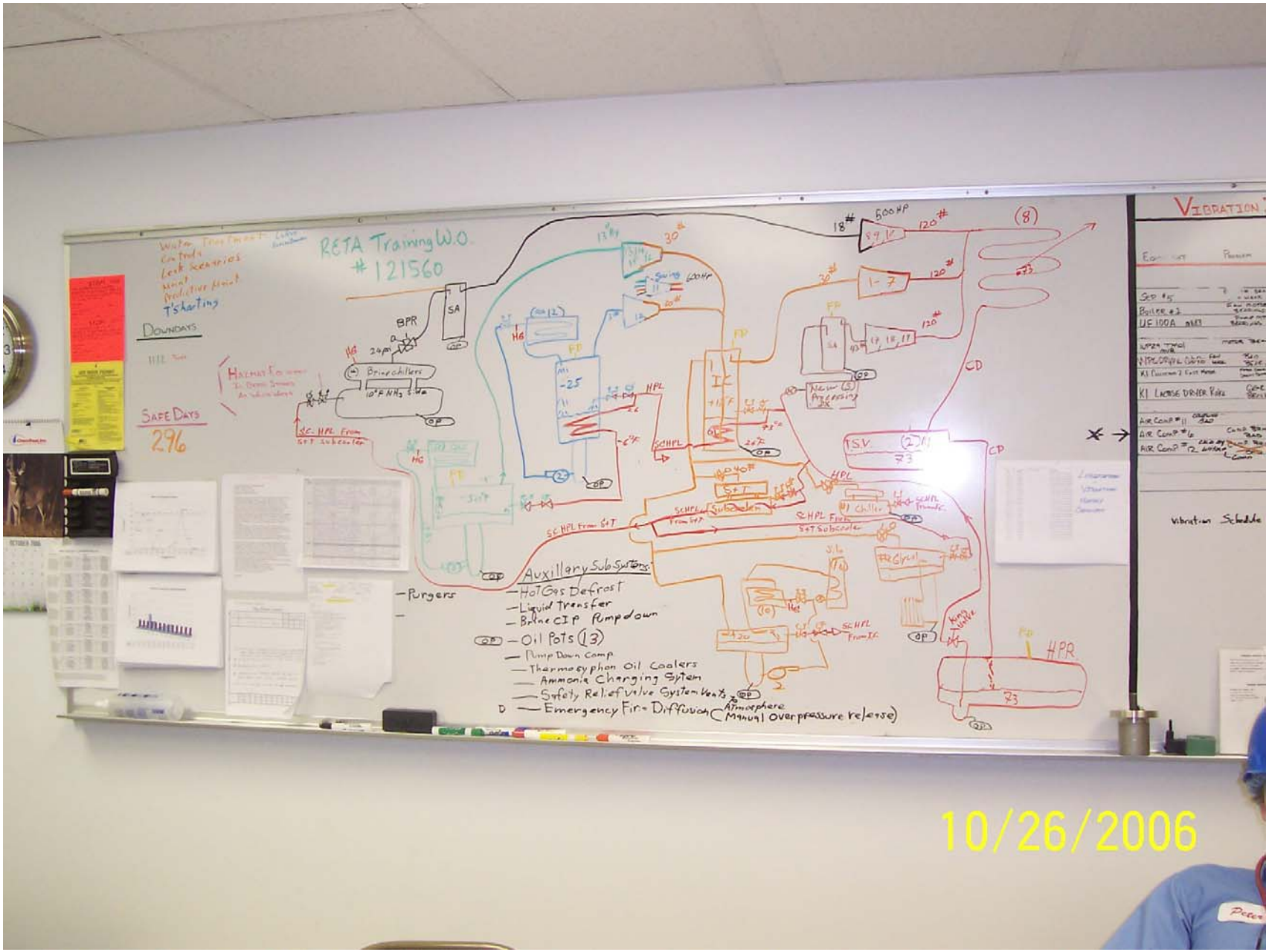
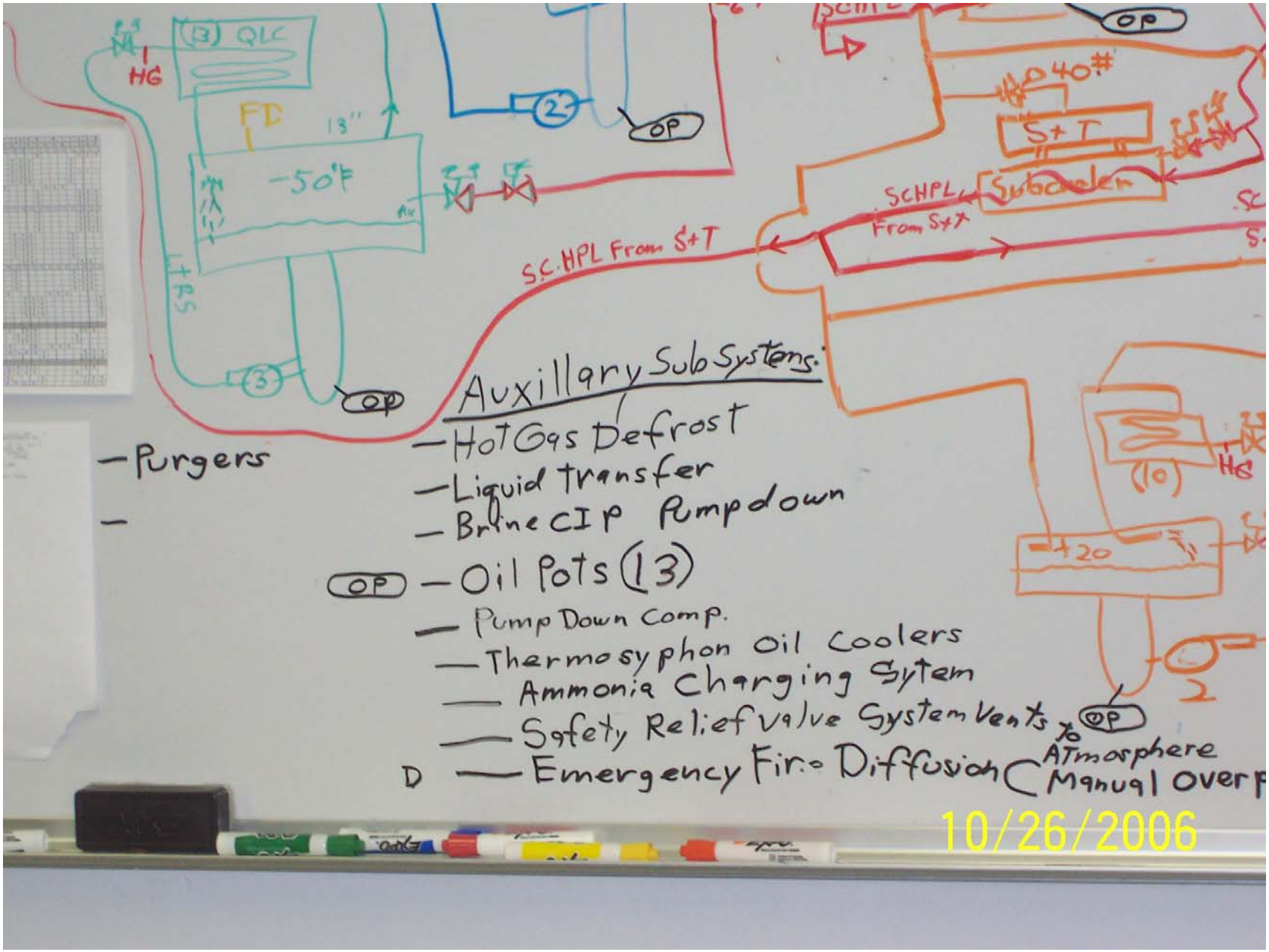
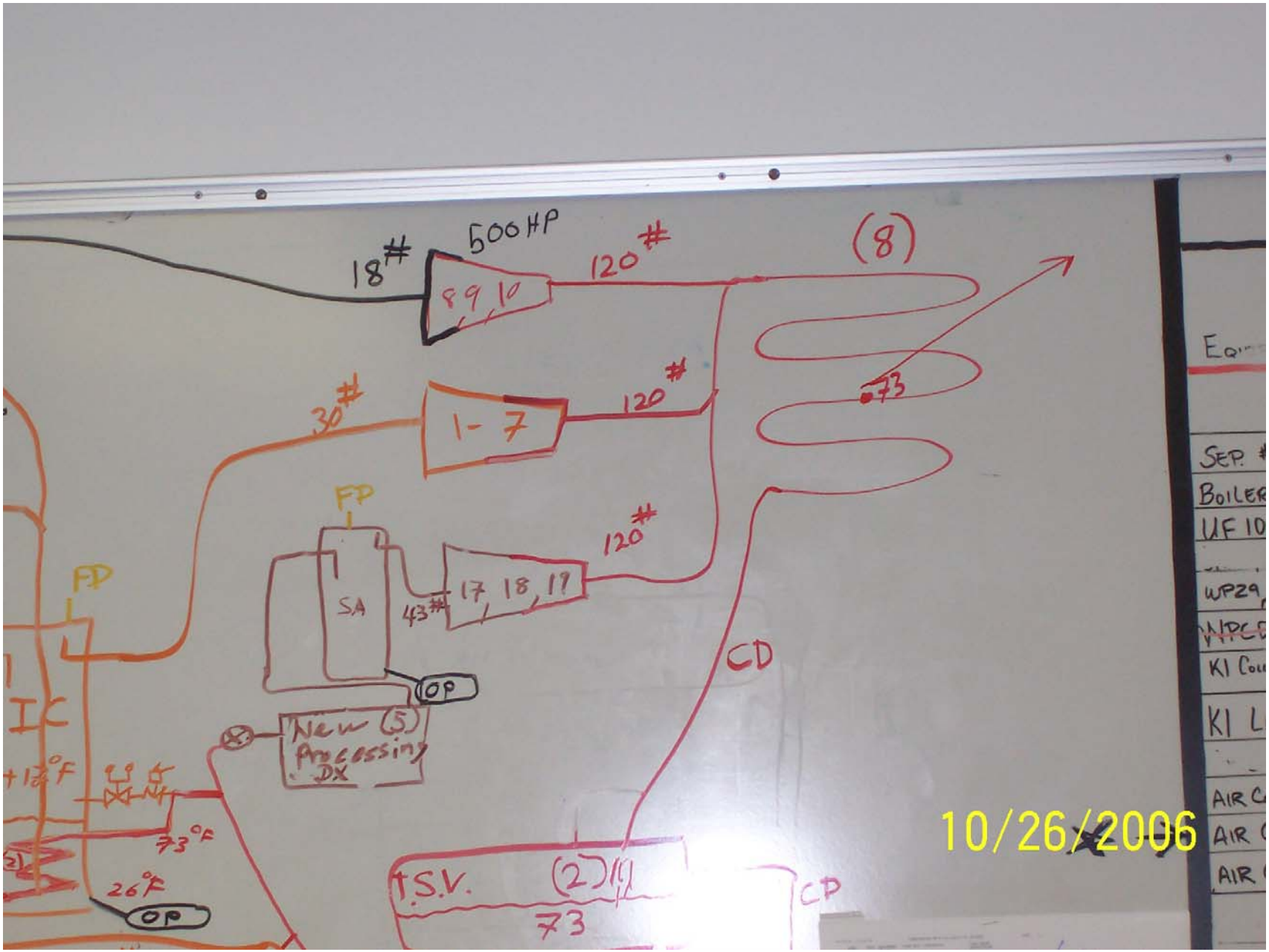
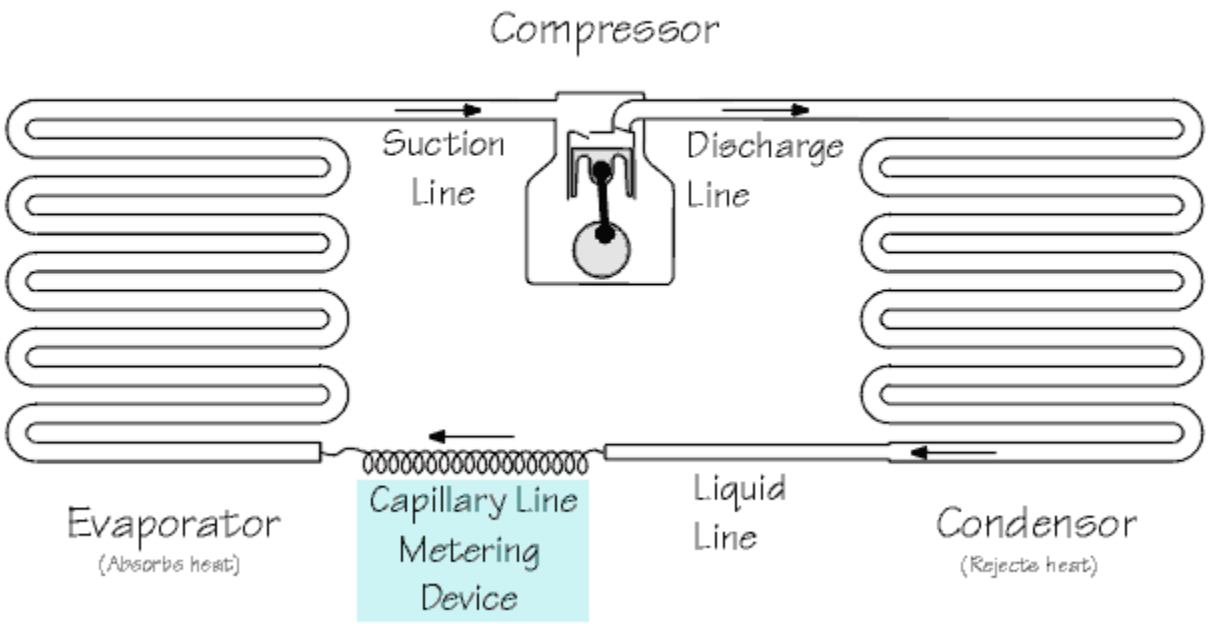
Evaporator
King Valve
Expansion Valve/Metering Device
High
Pressure
Receiver

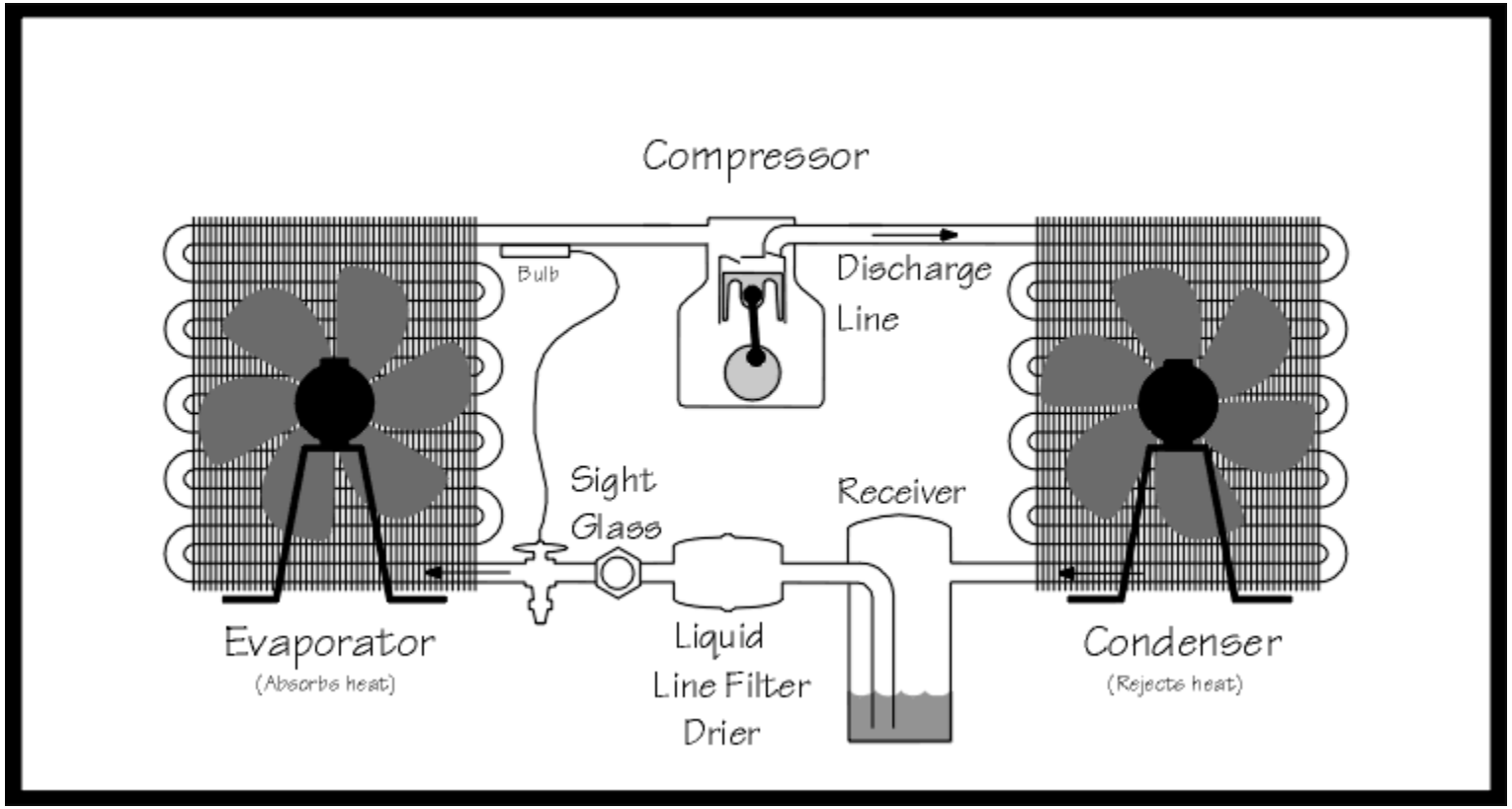

Industrial Refrigeration
Safety Training
Discharge Line
High Press Vapor
Suction Line
Low Press Vapor
R E T A
Condenser
Compressor
"LOW SIDE of SYSTEM
Where HEAT is absorbed into the system
Where HEAT is rejected from the system
"HIGH SIDE of SYSTEM
Evaporator
Low Press Liquid
High Press Liquid
King Valve
Expansion Valve/Metering Device
High Pressure Receiver


RETA Training W.O.
#121560
Downdays
Safe Days
296
Brine chillers
10°F NH3
BPR
SA
-25
HPL
SCHPL
TSV
HPR
CD
Auxillary Sub Systems
- Hot Gas Defrost
- Liquid Transfer
- Brine CIP Pumpdown
- Oil Pots (13)
- Pump Down Comp
- Thermosyphon Oil Coolers
- Ammonia Charging System
- Safety Relief valve System Vents
- Emergency Fire Diffusion (Atmosphere Manual overpressure release)
- Purgers
Vibration
Vibration Schedule
10/26/2006


(3) QLC
HG
FD
13"
-50°F
Air
LPS
(3)
OP
(2)
OP
OP
40#
S+T
Subcooler
SCHPL From S+T
S.C. HPL From S+T
Auxillary Sub Systems:
- Purgers
- Hot Gas Defrost
- Liquid transfer
- Brine CIP Pumpdown
OP - Oil Pots (13)
- Pump Down Comp.
- Thermosyphon Oil Coolers
- Ammonia Charging Sytem
- Safety Relief valve System Vents to Atmosphere
D - Emergency Fire Diffusion Manual Over
(10)
HG
120
(2)
OP
10/26/2006


18#
500 HP
8 9 10
120#
(8)
30#
1-7
120#
73
FP
SA
43#
17 18 19
120#
FP
CD
OP
New (5)
Processing
DX
IC
+12°F
73°F
26°F
OP
T.S.V.
(2)(1)
73
CD
10/26/2006


Compressor
Suction Line
Discharge Line
Evaporator
(Absorbs heat)
Capillary Line Metering Device
Liquid Line
Condensor
(Rejects heat)


Compressor
Bulb
Discharge
Line
Sight
Glass
Receiver
Evaporator
(Absorbs heat)
Liquid
Line Filter
Drier
Condenser
(Rejects heat)