Salinas Valley Ammonia Safety Day

May 19, 2010

Salinas, CA

Basic Refrigeration Systems

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.

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 other words:

WE have met the Enemy

…and They 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.

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

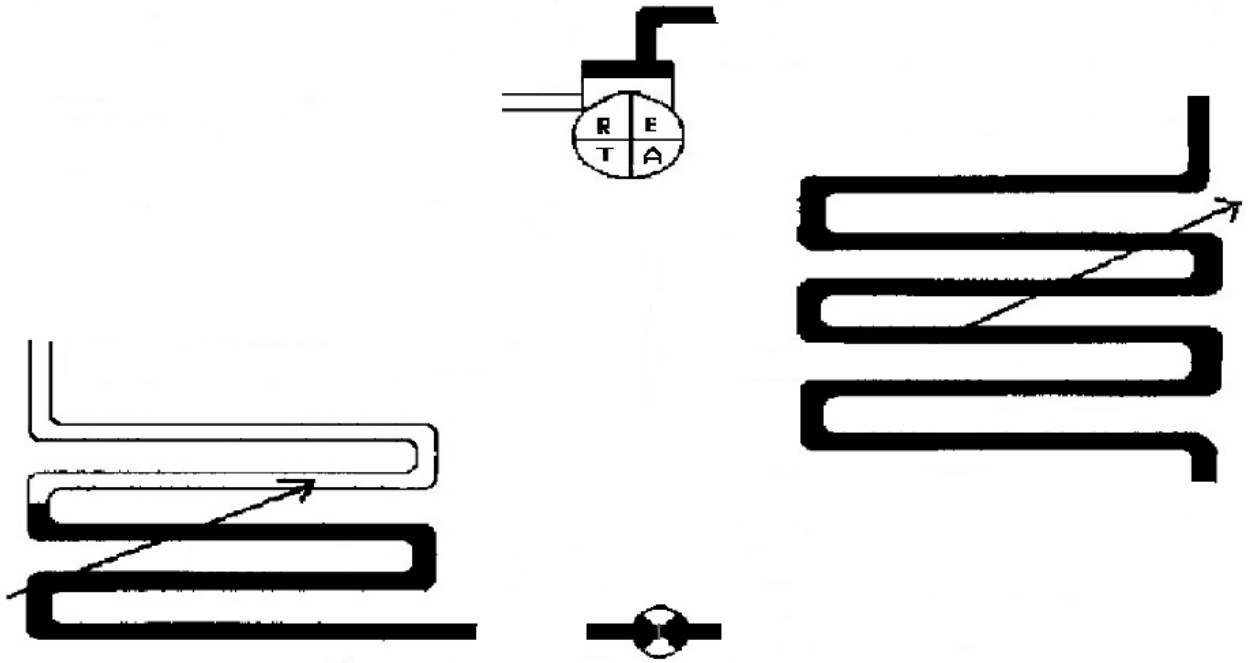
Delta T

Basic System

- ??????????

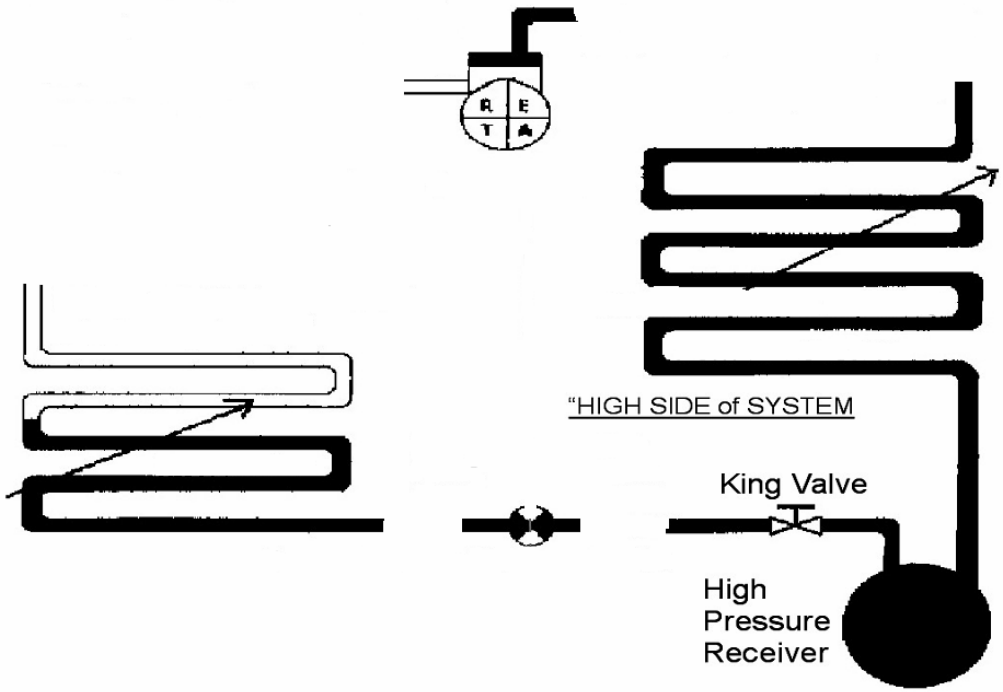
Basic System

- 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.

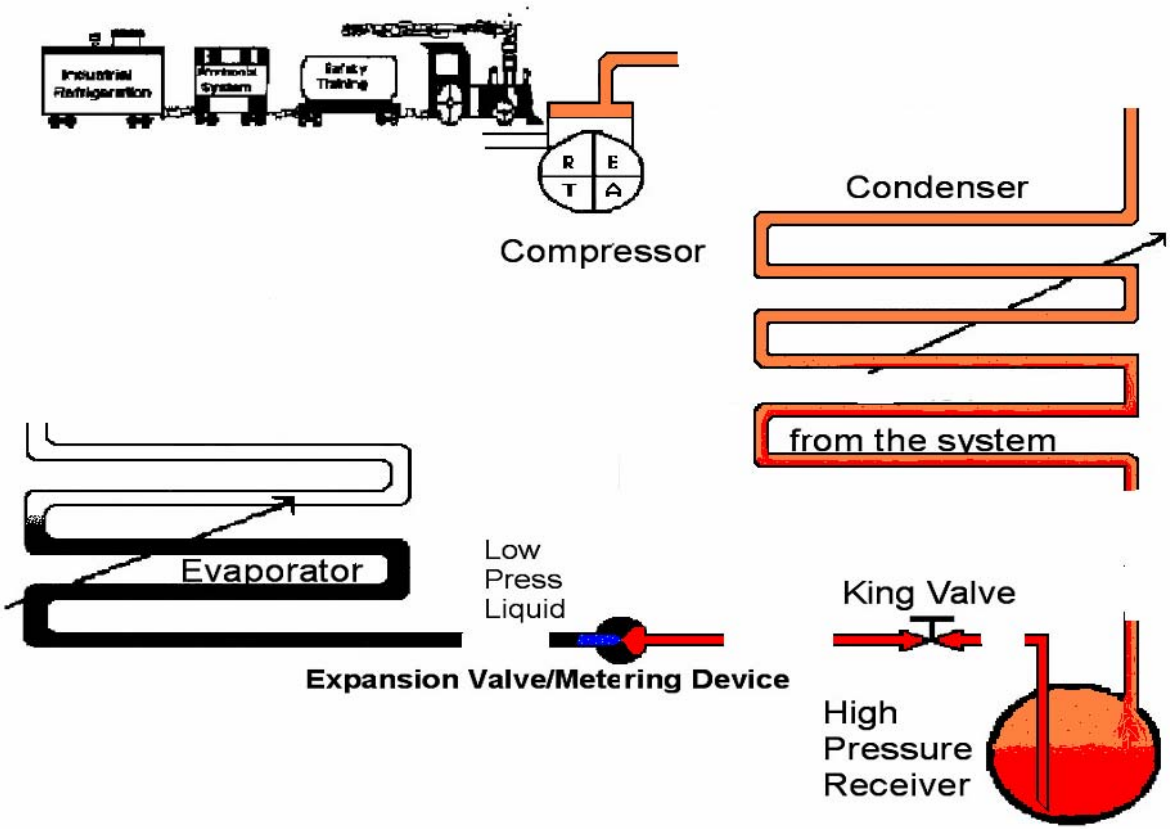
Emergency Responders

- 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 Transfering heat


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

BASIC MECHANICAL REFRIGERATION SYTEM COMPONENTS

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

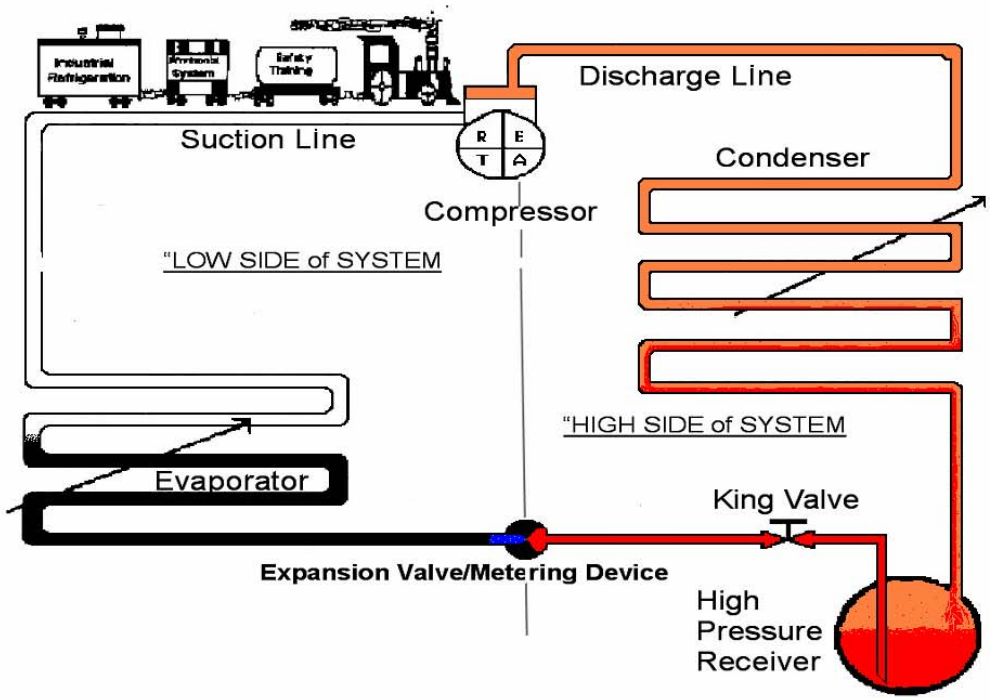
- In other words, HEAT **ALWAYS** flows from “hot” to “cold”.

BASIC MECHANICAL REFRIGERATION SYTEM COMPONENTS

- 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 loses 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
Baltimore Aircoil
02/01/2006


API 5L/ASTMA106/A53Gr.B/X42 1-1/4"
11-17-2008

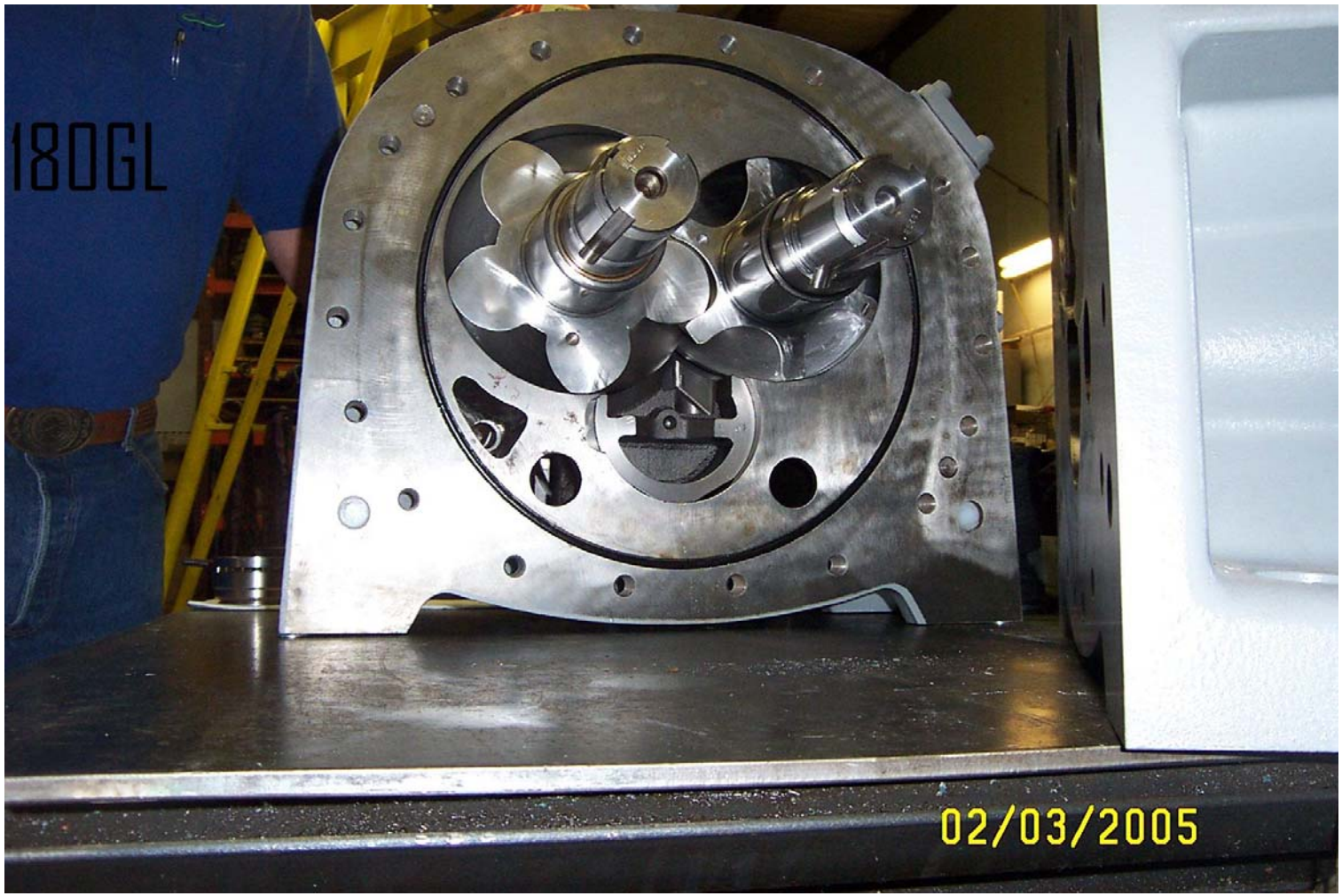

11-17-2008


11-17-2008


WERNER
02/14/2007


C3065
02/14/2007


02/14/2007

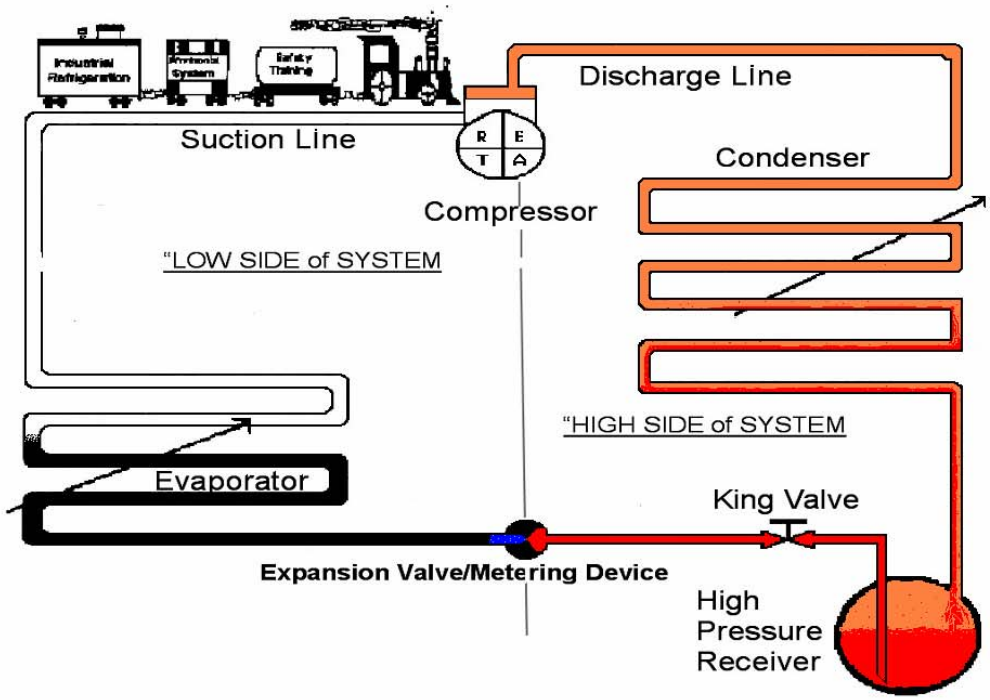

180GL
02/03/2005


180GL
02/03/2005


02/13/2007


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

WPS


Industrial Refrigeration
Ammonia System
Safety Training
Discharge Line
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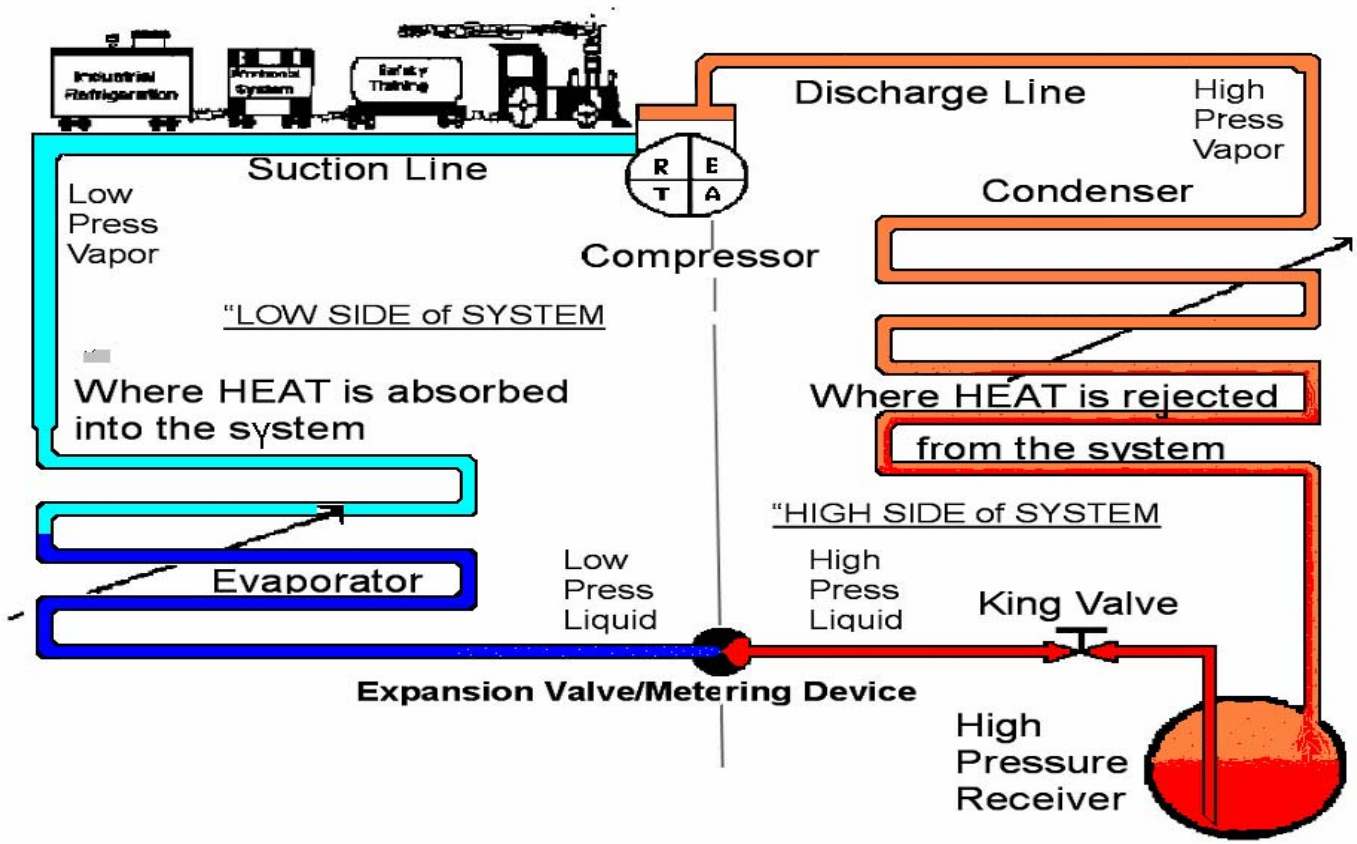
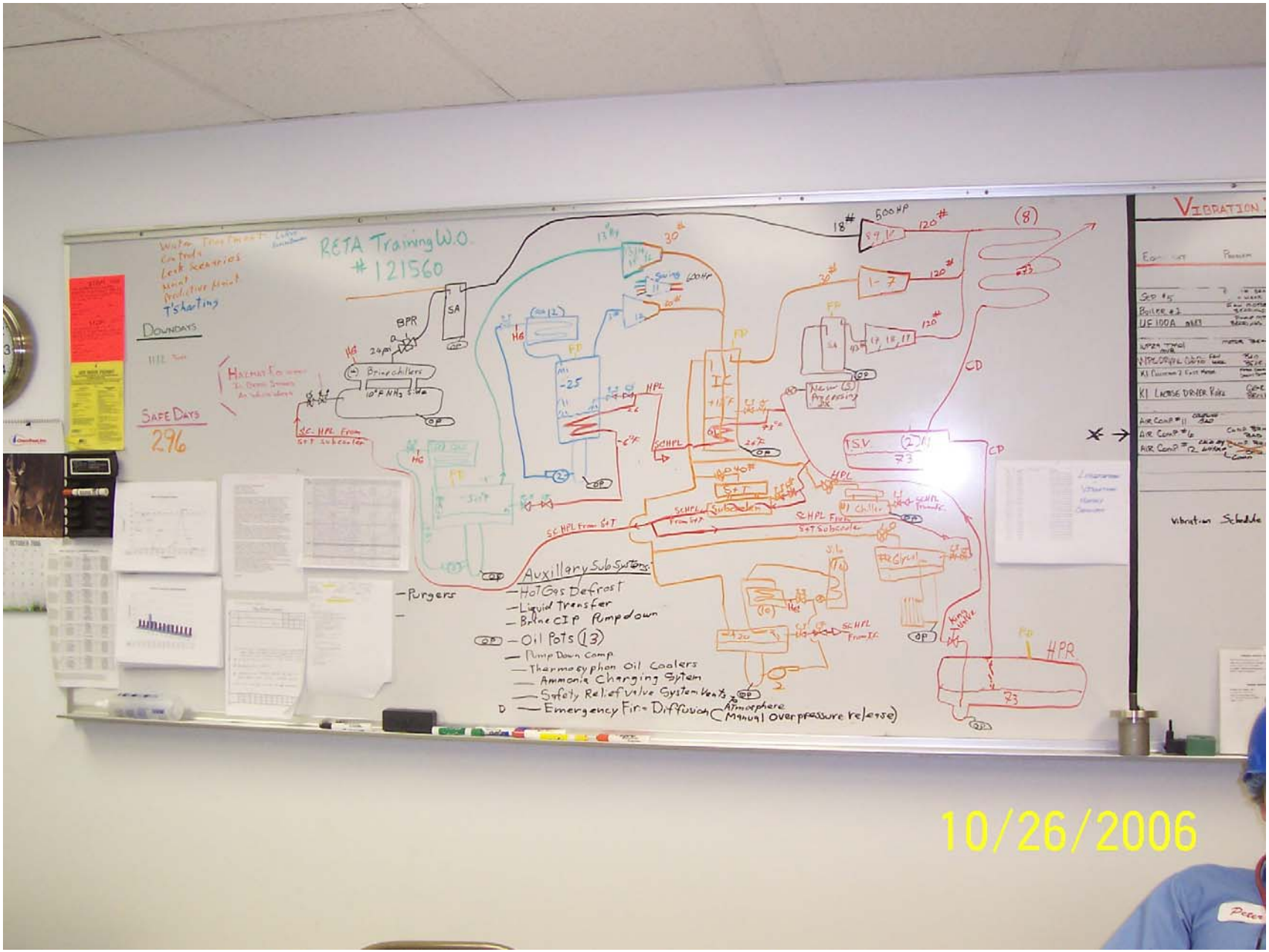
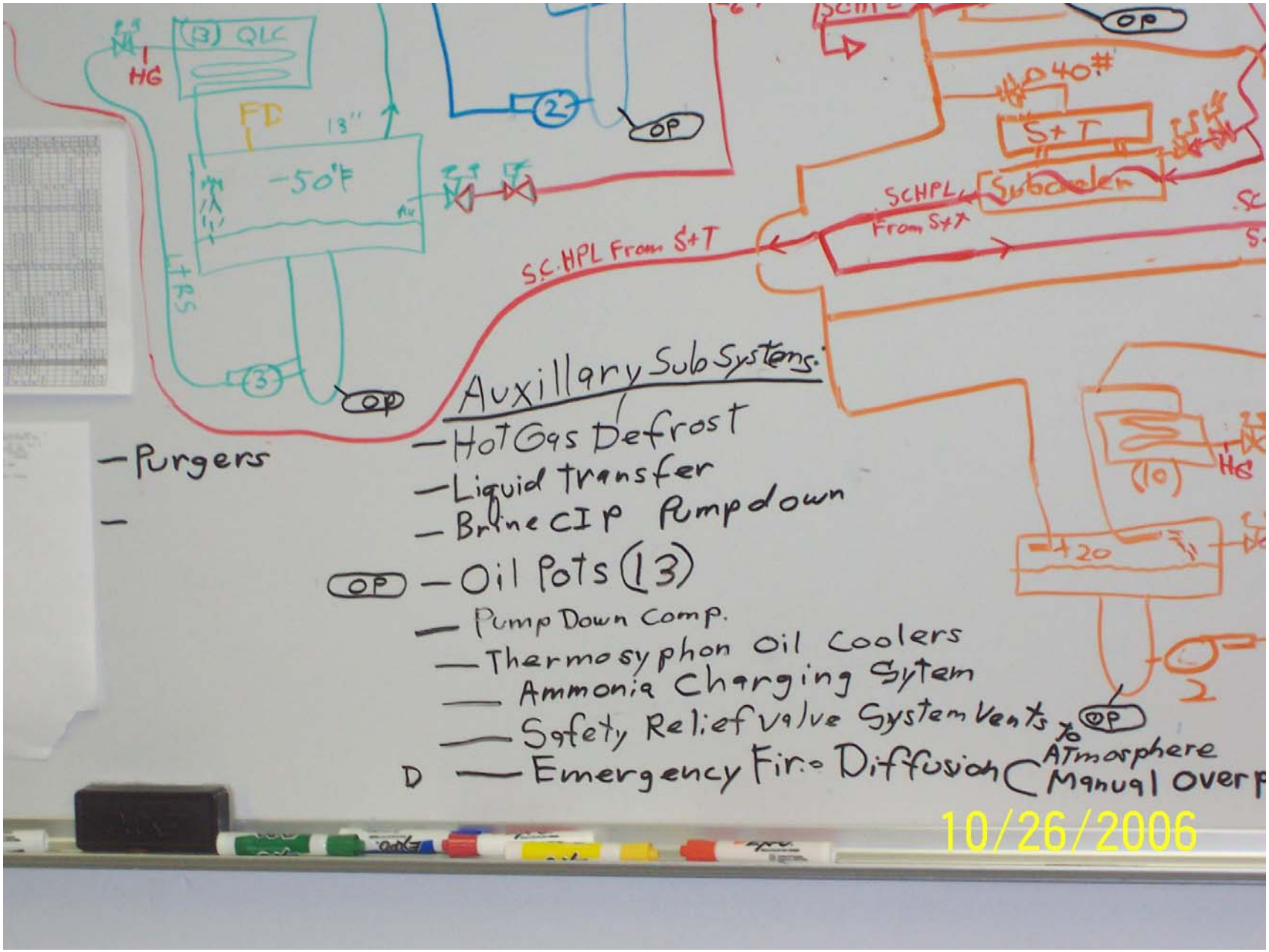
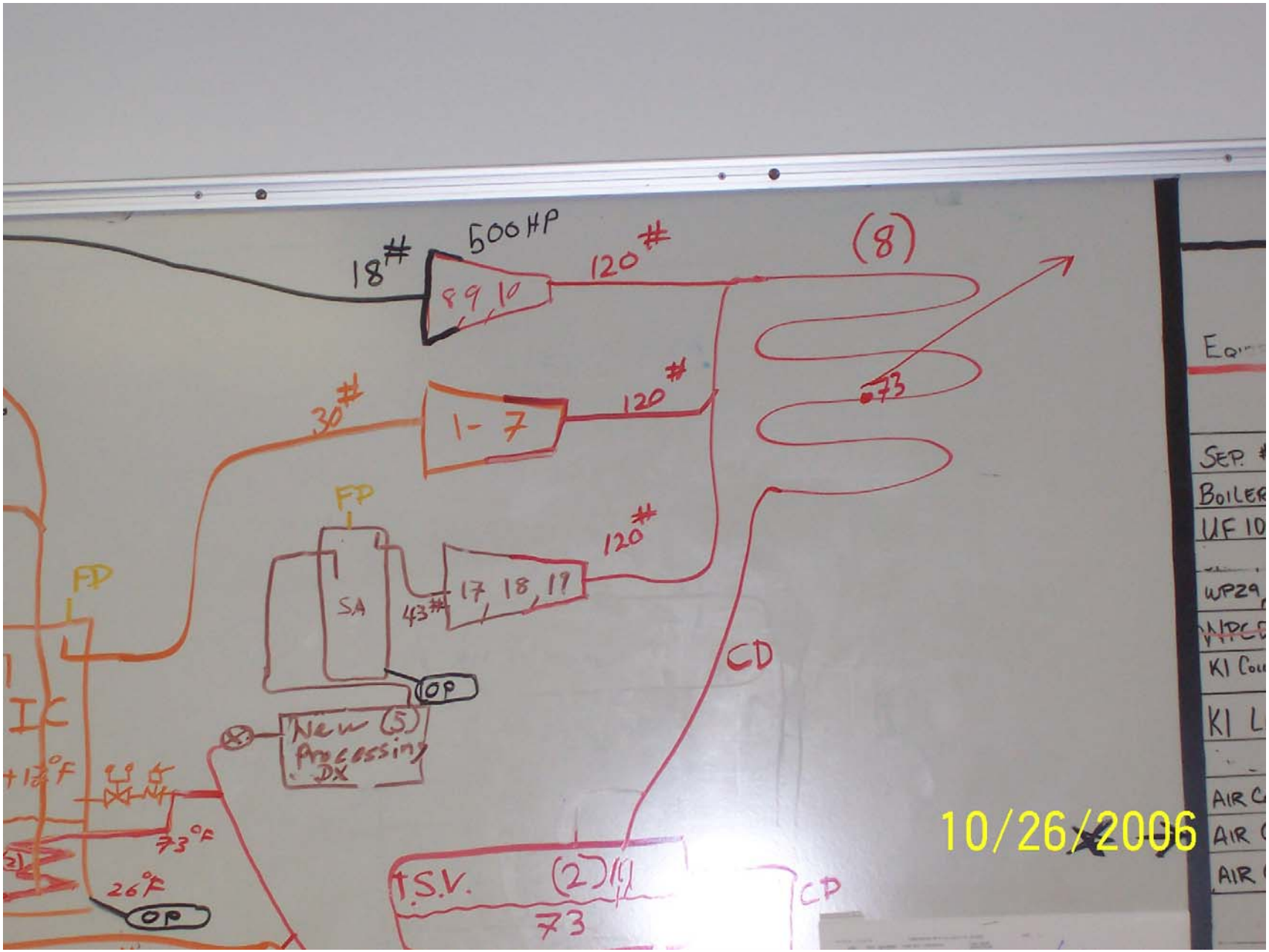
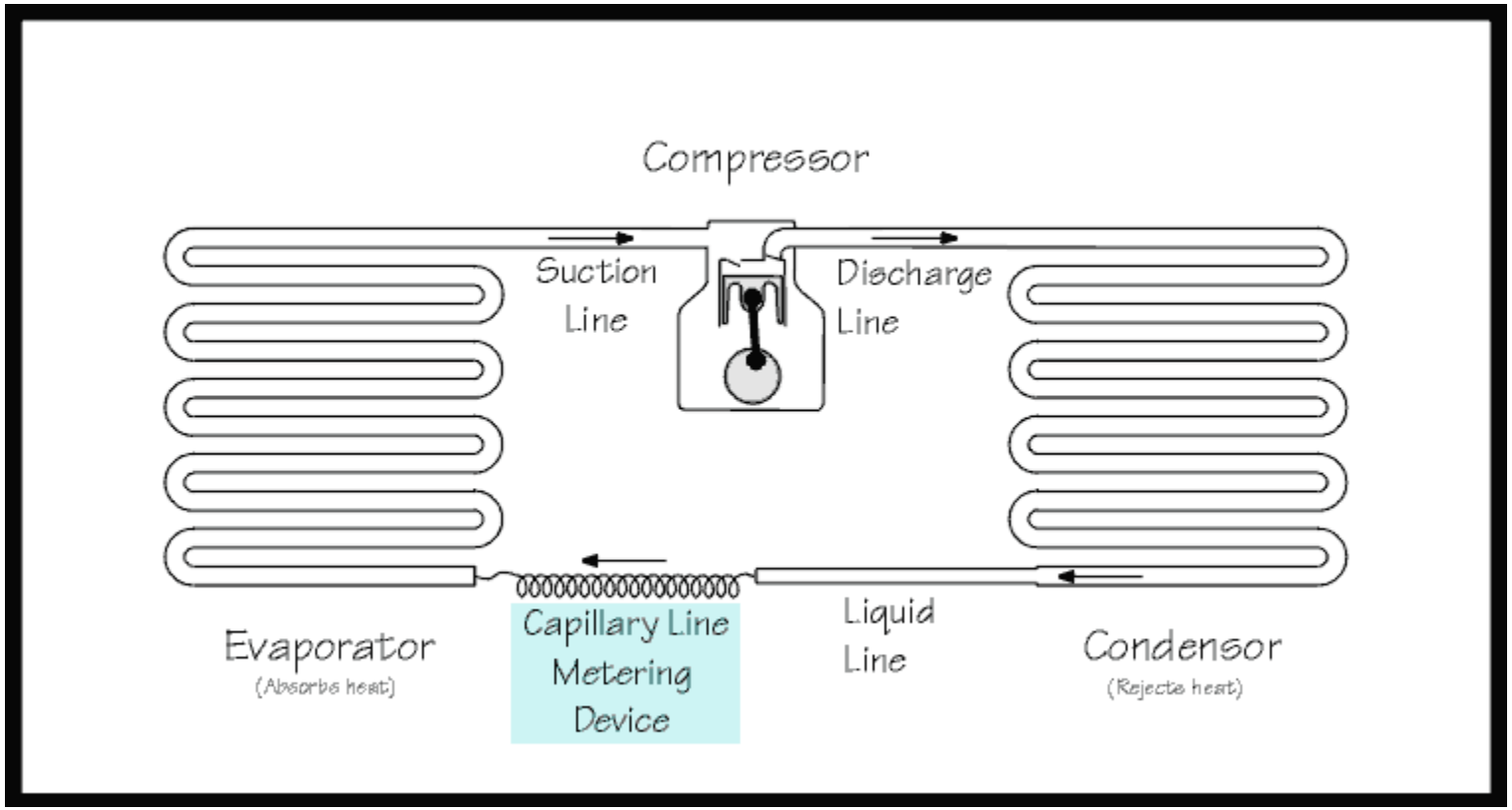
"HIGH SIDE of SYSTEM
Evaporator
King Valve
Expansion Valve/Metering Device
High Pressure Receiver

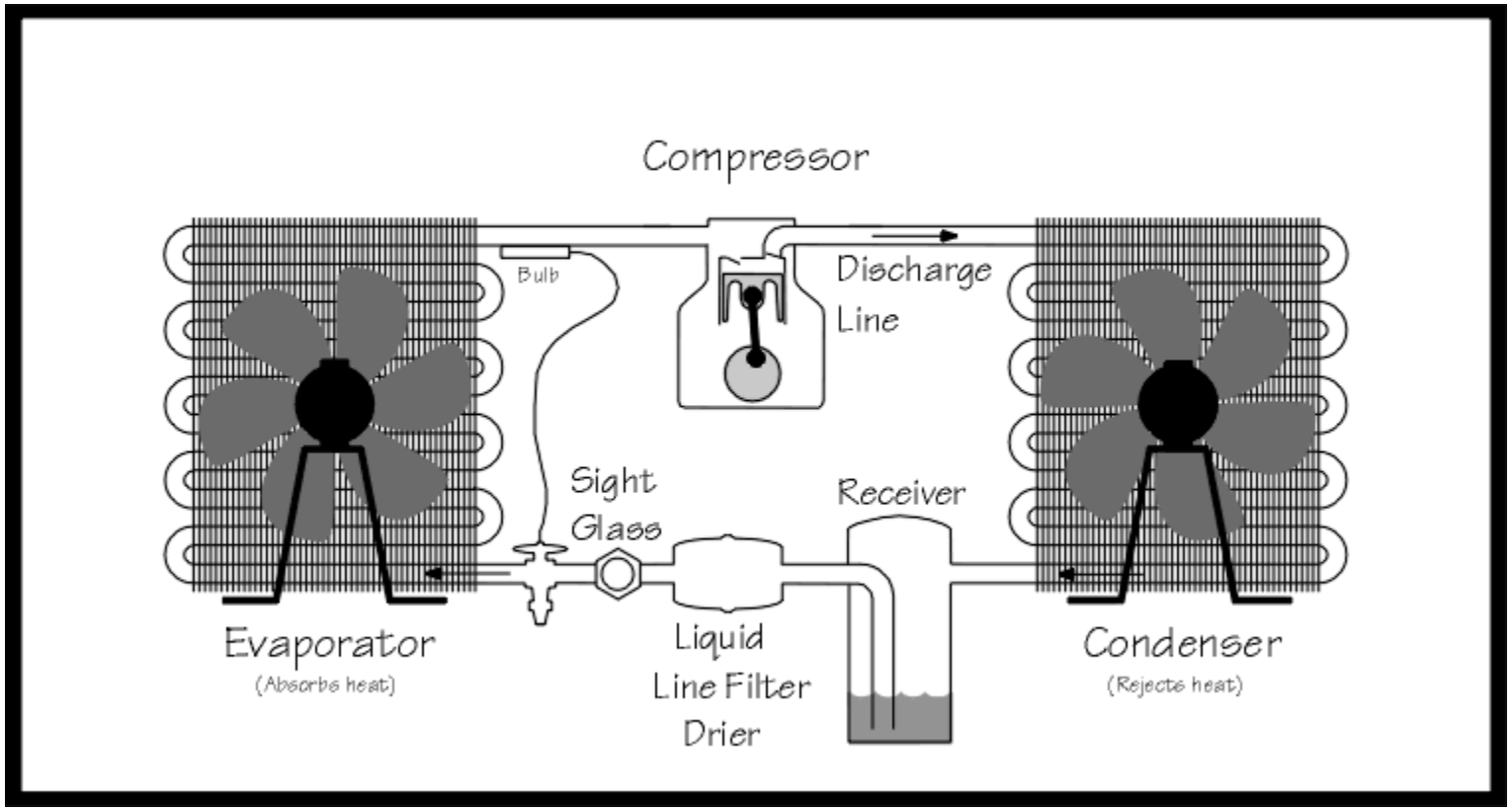

Industrial Refrigeration
Ammonia System
Safety Training
Discharge Line
High Press Vapor
Suction Line
Low Press Vapor
R E T A
Condenser
Compressor
"LOW SIDE of SYSTEM
Where HEAT is absorbed into the system
Where HEAT is rejected from the system
"HIGH SIDE of SYSTEM
Evaporator
Low Press Liquid
High Press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


RETA Training W.O.
#121560
Downdays
Safe Days
296
Brine chillers
10°F NH3
SA
BPR
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
HPR
TSV
Vibration
10/26/2006


(3) QLC
HG
FD
13"
-50°F
Air
LIQ
(2)
OP
40#
S+T
Subcooler
SCHPL From S+T
S.C. HPL From S+T
(3)
OP
Auxillary Sub Systems:
- Hot Gas Defrost
- Liquid transfer
- Brine CIP Pumpdown
OP - Oil Pots (13)
- Purgers
-
- 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
OP
10/26/2006


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

Challenge to all Operators-Old and New

(Short list of things you need to be able to know and do. Courtesy of Russ Ramos)

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

#2: **You should be able to draw a 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 represent 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 no notes, explaining all the pressures and temperatures, the condition and relative speed of flow 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 psig?

#5. You must be able to explain to me why the evaporative condenser is the most important component in the system. (Hint: How maintaining it properly can pay for your salary; or how not maintaining it can cost your company big bucks).

#6: **You must be able to explain all these things 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).

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