Commercial Refrigeration

A science of vague assumptions

based upon debatable figures

taken from inconclusive experiments

performed with instruments of problematical accuracy by

persons of doubtful reliability and questionable mentality

Secondary Coolant 101

Instructor

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Learning Center

Is Training Really Necessary?

Secondary Coolant 101

Objectives

- Explain the importance of refrigerant management
- List the steps in the secondary coolant refrigeration process
- Identify the major components of a secondary coolant system
- Describe how the system components operate
- Describe the Pump Control strategy for a secondary coolant system

Why Is Refrigerant Management Important?

Current Regulatory Conditions

- Regulatory agencies stepping up enforcement against HCFC violations and compliance failures – CONTINUING
- No new HCFC (R-22) equipment – 2010 – OLD NEWS
- Complete HCFC (R-22) phase-out by 2020 – OLD NEWS
- Most likely **increasing** HFC restrictions – YET TO BE DETERMINED
- Overall impact of new refrigerants developed and announced by major manufacturers - YET TO BE DETERMINED

Refrigerants and Environmental Impact

Refrigerant	Other Names	ODP Ozone Depletion Potential	
R-22	Freon-22 (HCFC)	0.055	
R-404A	HP-62 (HFC)	0	
R-507	AZ-50 (HFC)	0	
R-410A	AZ-20, Puron (HFC)	0	
R-717	NH_3, Ammonia	0	
R-744	CO_2, Carbon Dioxide	0	

Useful Definitions

Primary Refrigerant – The heat transfer fluid used to lower the temperature of a secondary coolant (i.e. R-22, R-404a, R-507, R-410A, R-744, etc…)

Secondary Coolant (a.k.a. secondary refrigerant, secondary fluid) – A fluid used to transfer heat from a heat source (i.e. refrigerated space, case, or walk-in) to a primary refrigerant

Current Direct Expansion

System Comparison

Traditional Direct Expansion (DX)

+ Familiar, low-cost, reliable technology
+ Centralized, serviceable, system

– Long pipe runs
– Numerous joints/welds
– Large refrigerant volumes

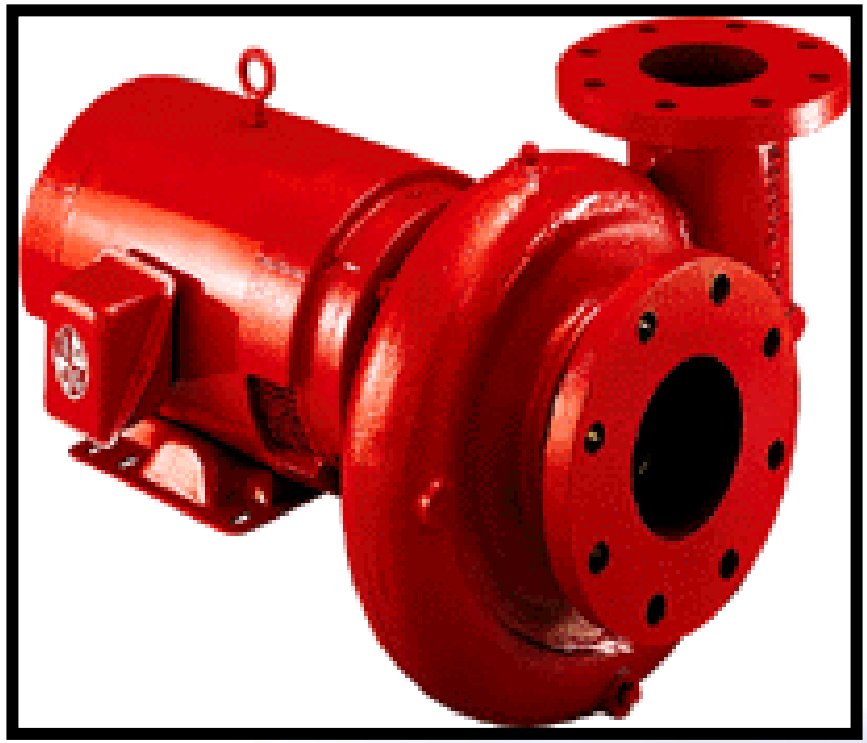
Secondary Coolant System

+ Significantly less refrigerant volumes
+ Lower maintenance
+ Leak potential isolated to machine room
+ Improved temperature control
  - ► reduced product shrink
+ Industry-accepted technology

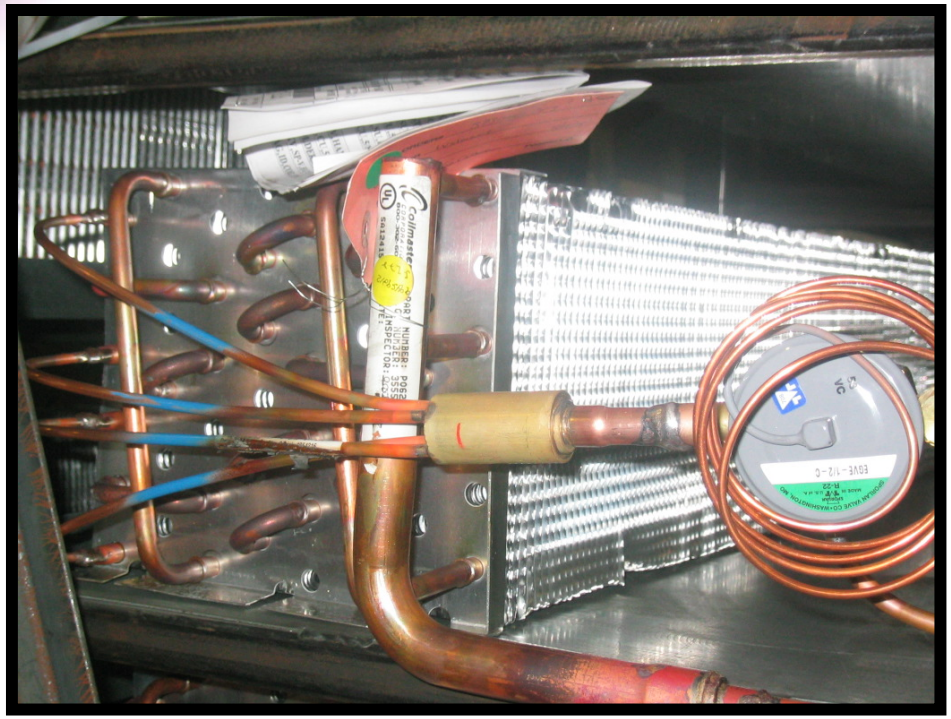
– Learning Curve

+ **We're here**

Nomenclature (?)



Nomenclature (?)



Secondary Coolant 101 Review

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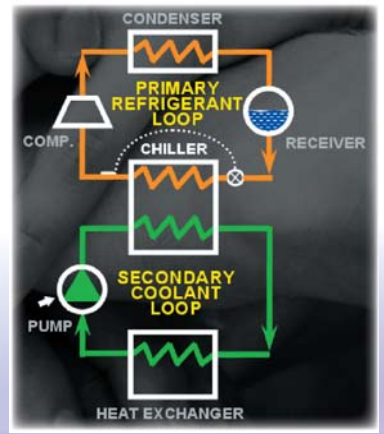
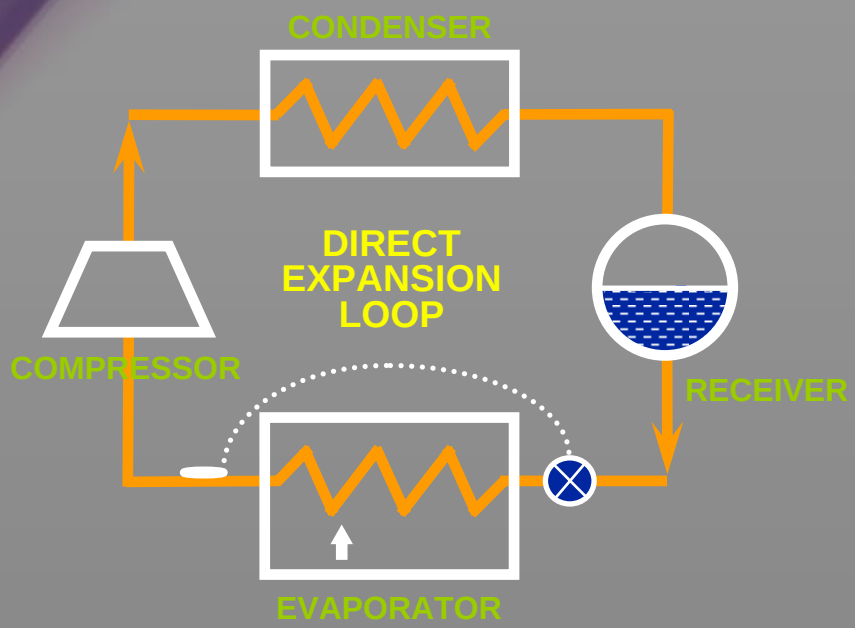
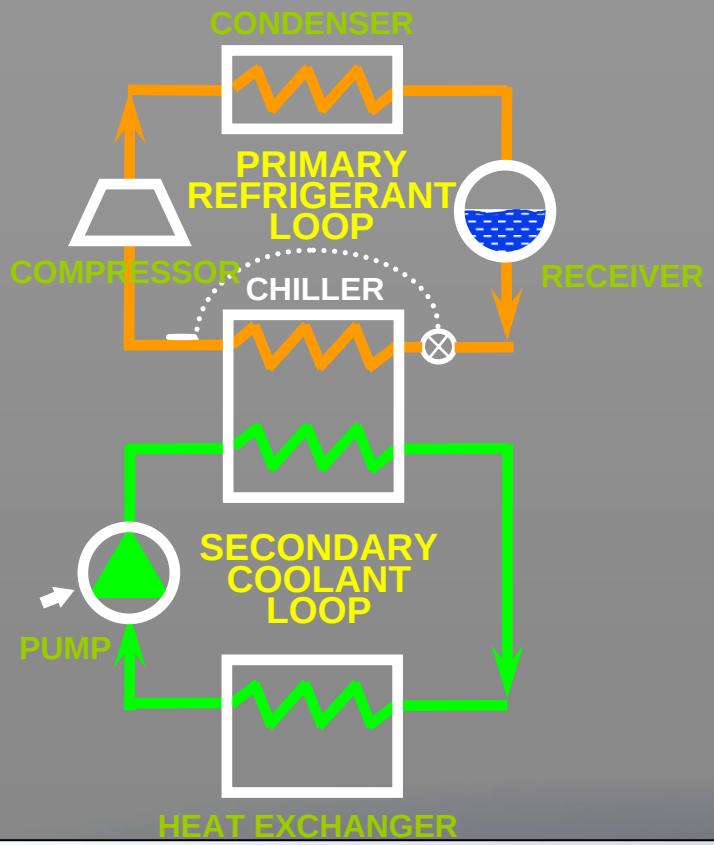


System Comparisons

Direct Expansion System



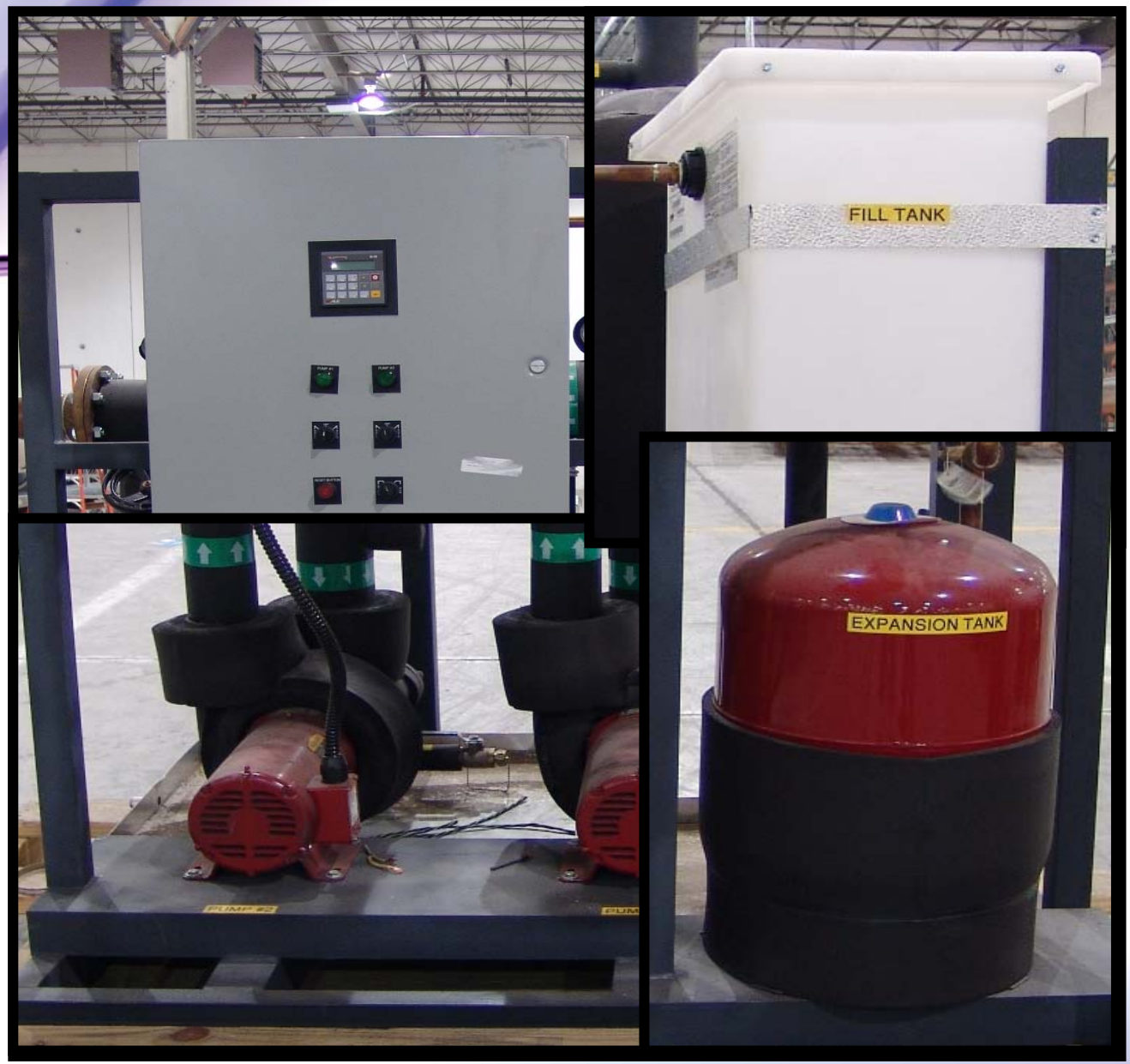
Second Nature® System



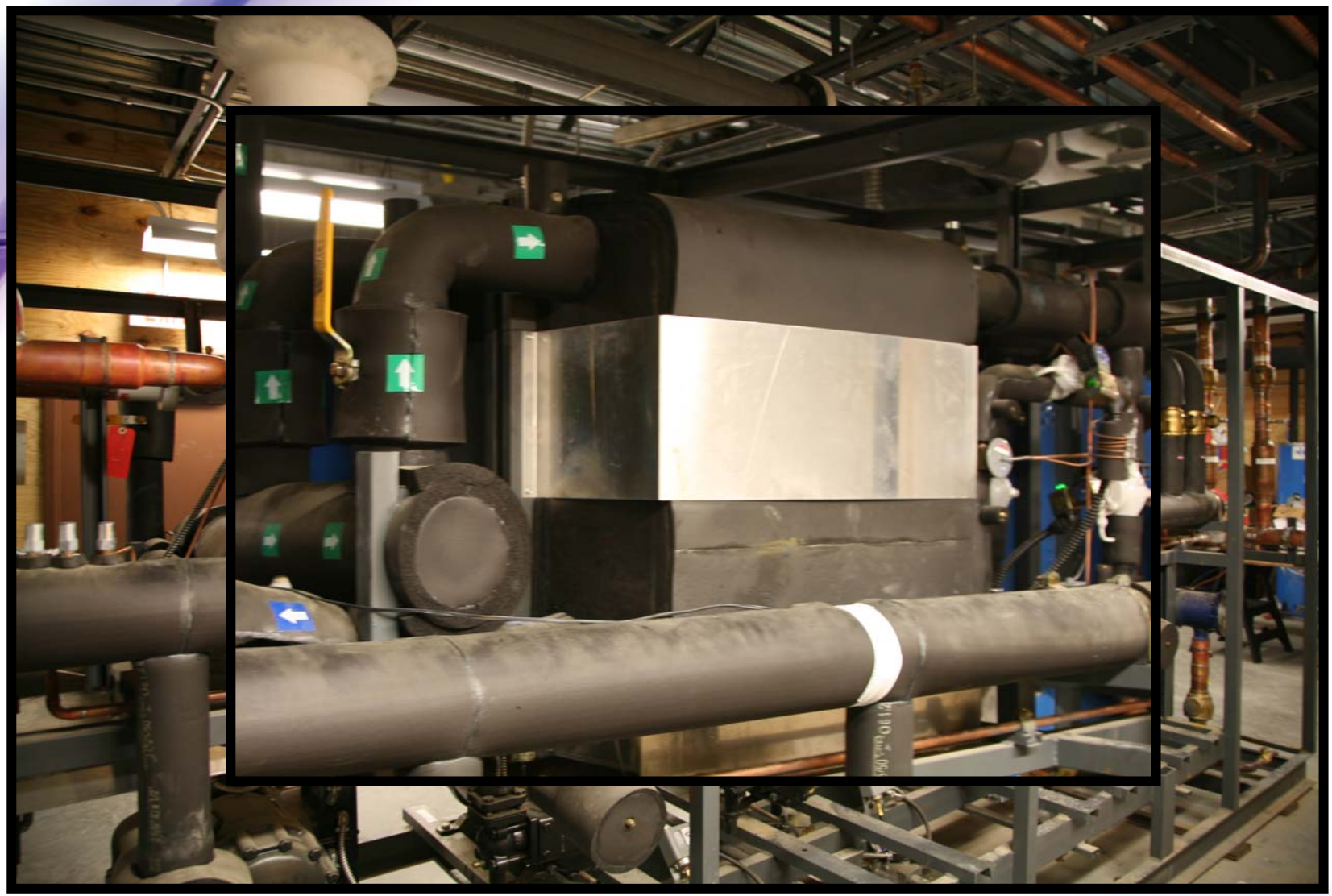
Secondary Main Components

- Brazed-plate heat exchanger (chiller)
- Pumps
- Finned tube-type heat exchanger (at the case)
- Expansion tank
- Fill tank
- Air separator
- Balance valves
- Valve stations


DX Refrig
Rack
ry Pump
Station

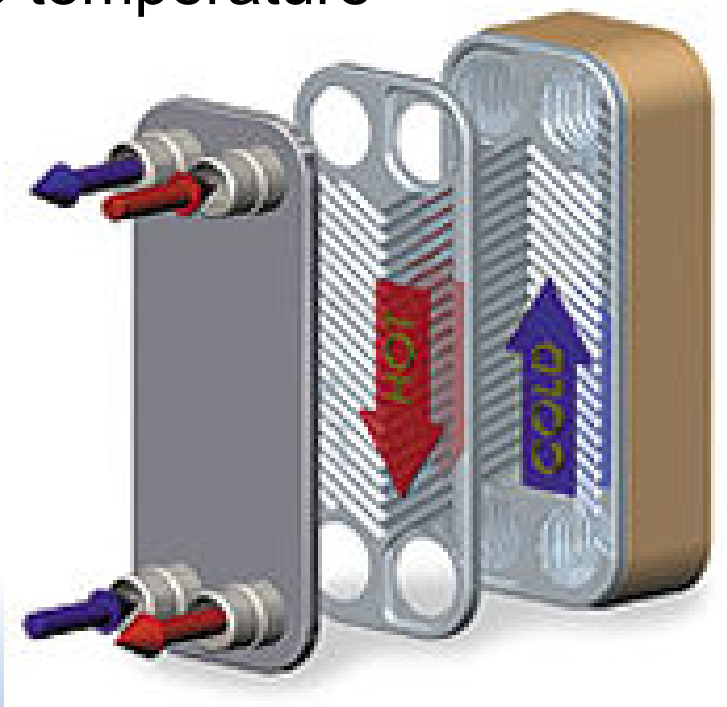

FILL TANK
EXPANSION TANK


AIR SEPARATOR

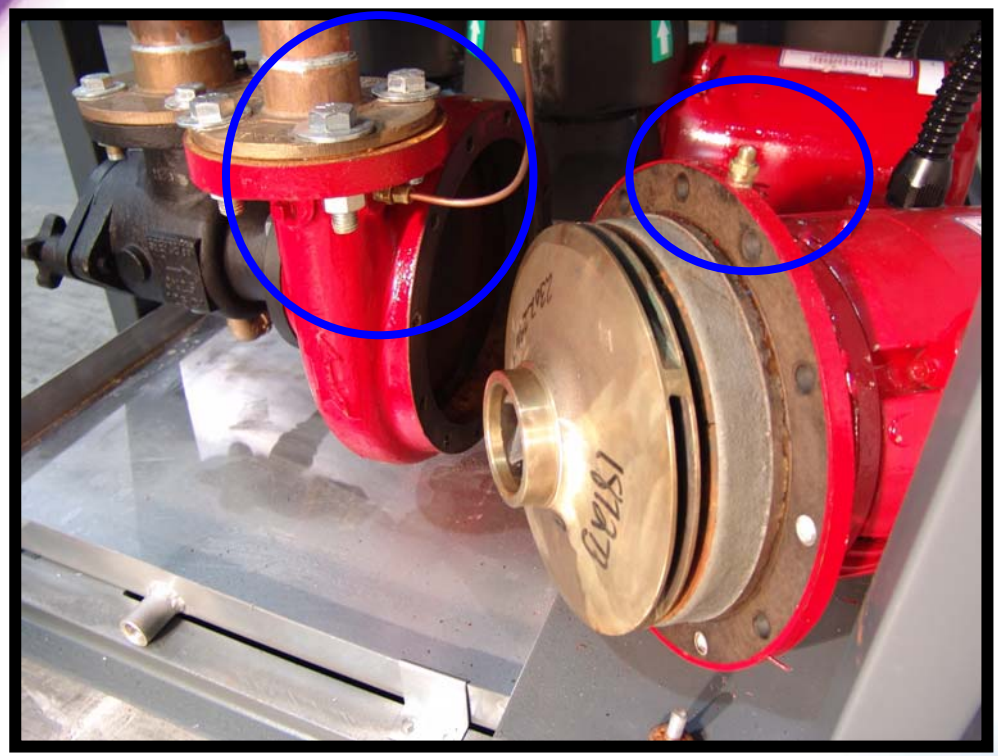


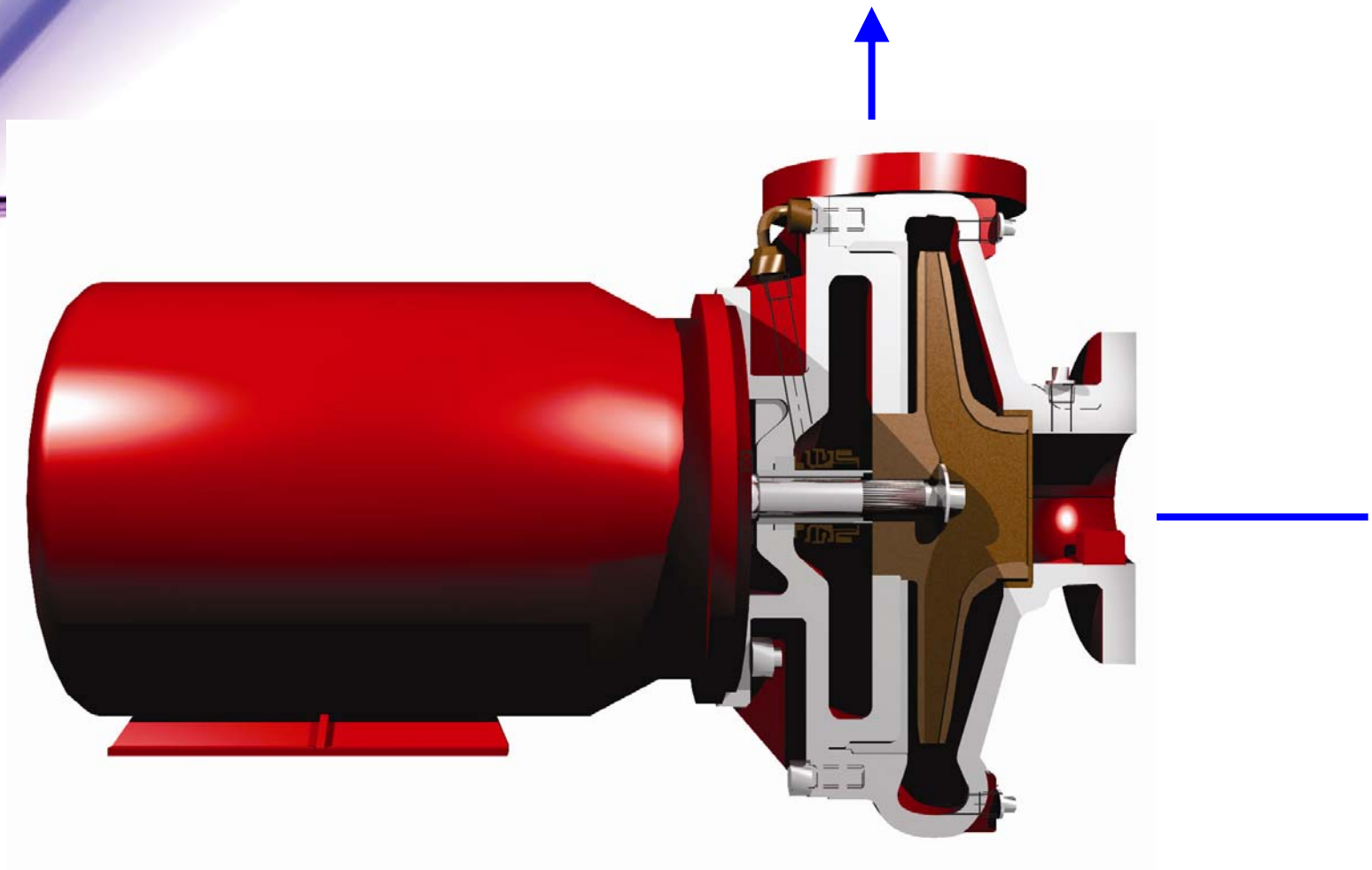
Chiller Operation

- Chiller Size = Case and cooler loads/Store size
- Chiller Approach = Supply fluid temp - SST
- What is SST = Suction converted to temperature



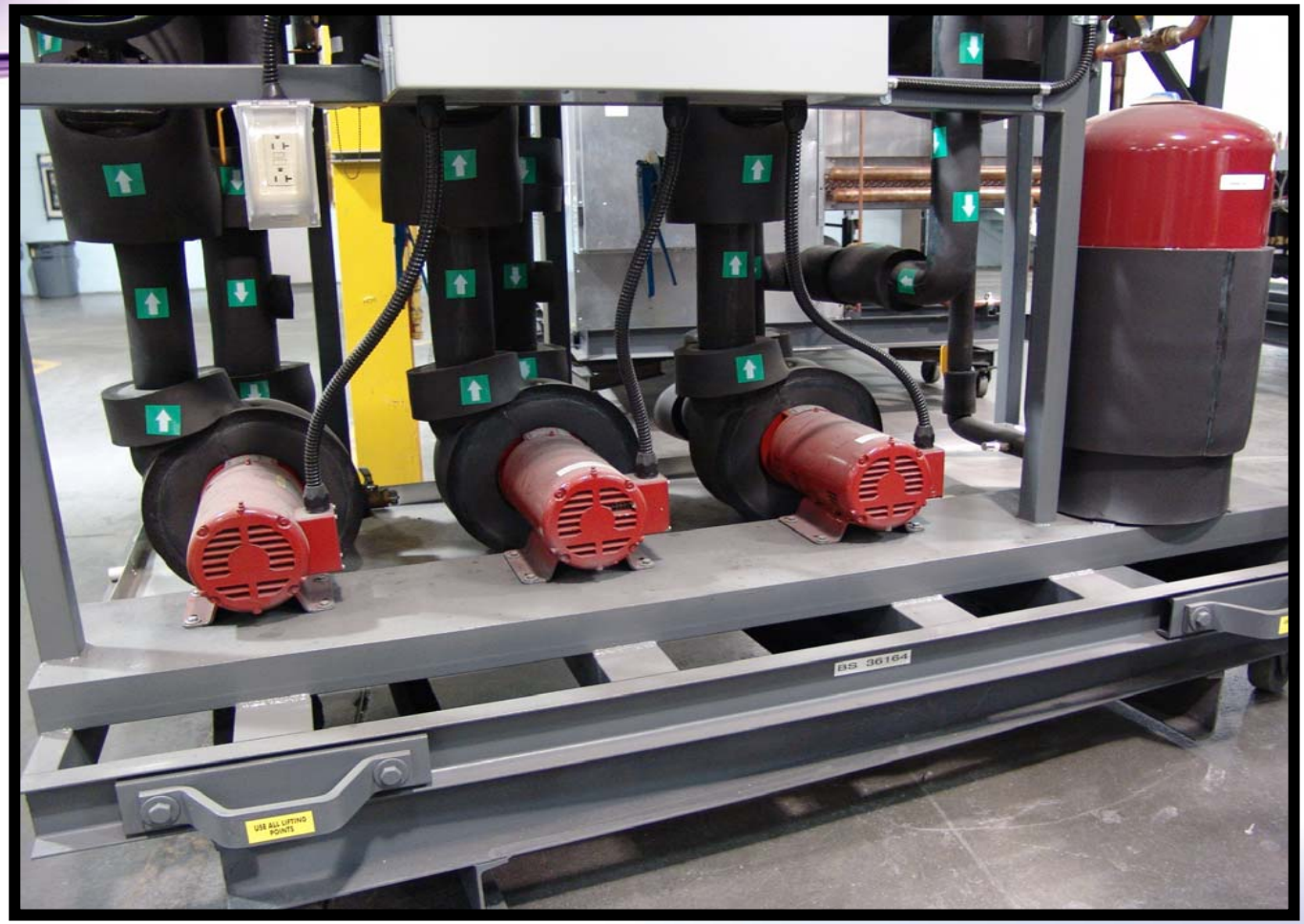
Centrifugal Pumps

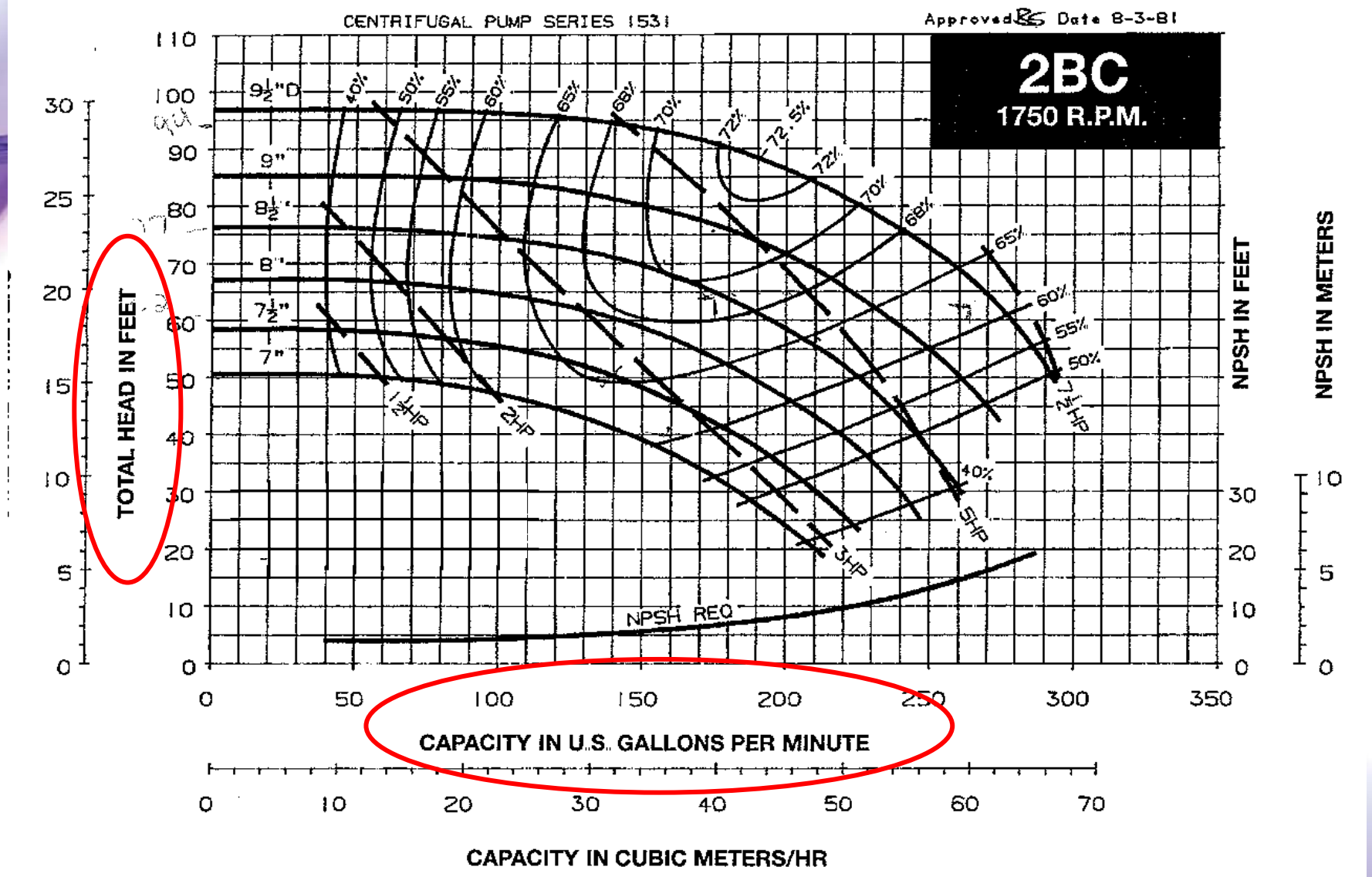


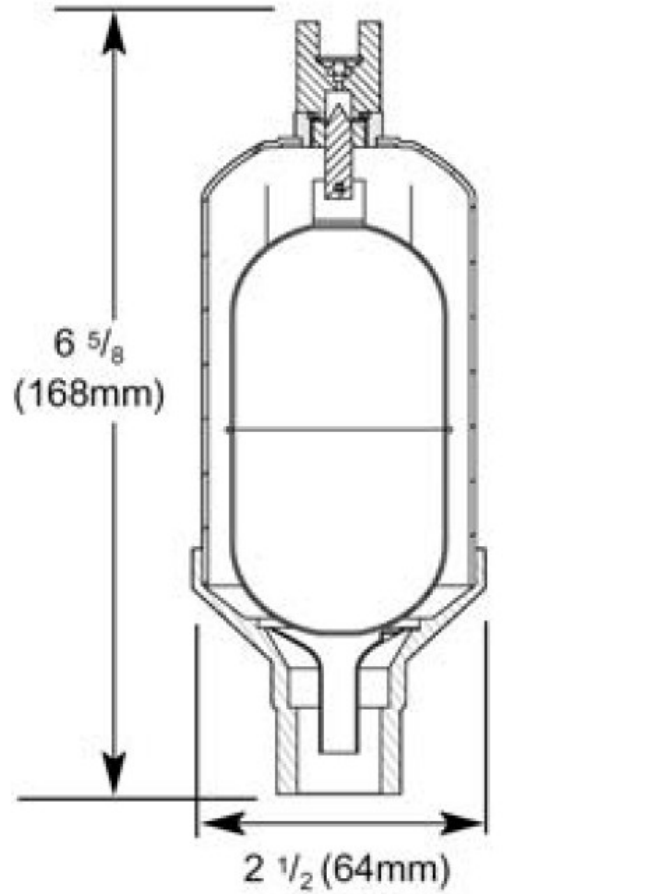


Duplex Pumping Station

Triplex Pump System



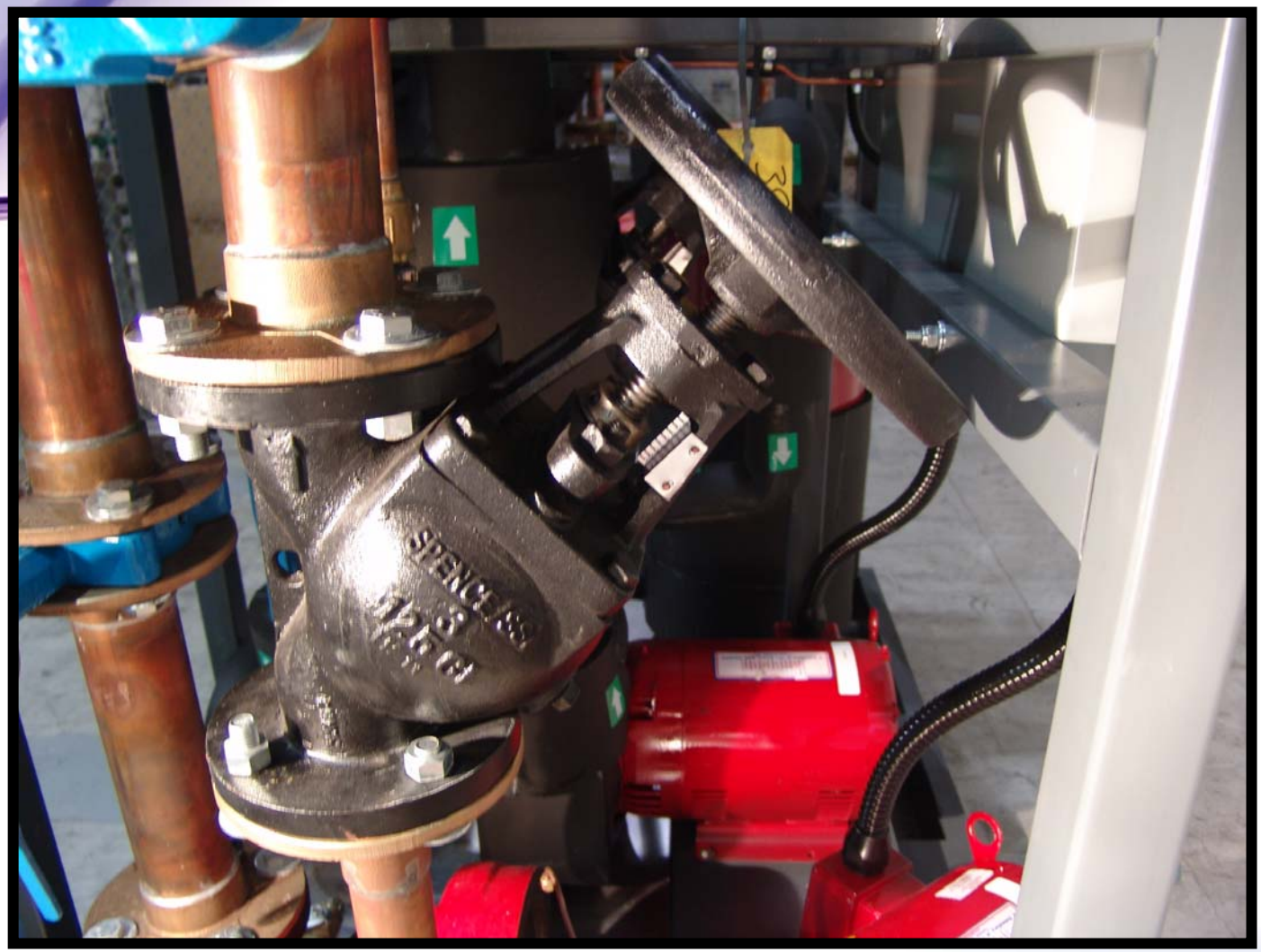

CENTRIFUGAL PUMP SERIES 1531
Approved RS Date 8-3-81
2BC
1750 R.P.M.
TOTAL HEAD IN FEET
NPSH IN FEET
NPSH IN METERS
9½"D
9"
8½"
8"
7½"
7"
40%
50%
55%
60%
65%
68%
70%
72%
72.5%
1½HP
2HP
3HP
5HP
7½HP
NPSH REQ
CAPACITY IN U.S. GALLONS PER MINUTE
CAPACITY IN CUBIC METERS/HR


6 5/8
(168mm)
2 1/2 (64mm)


14100-0040
NOTE:

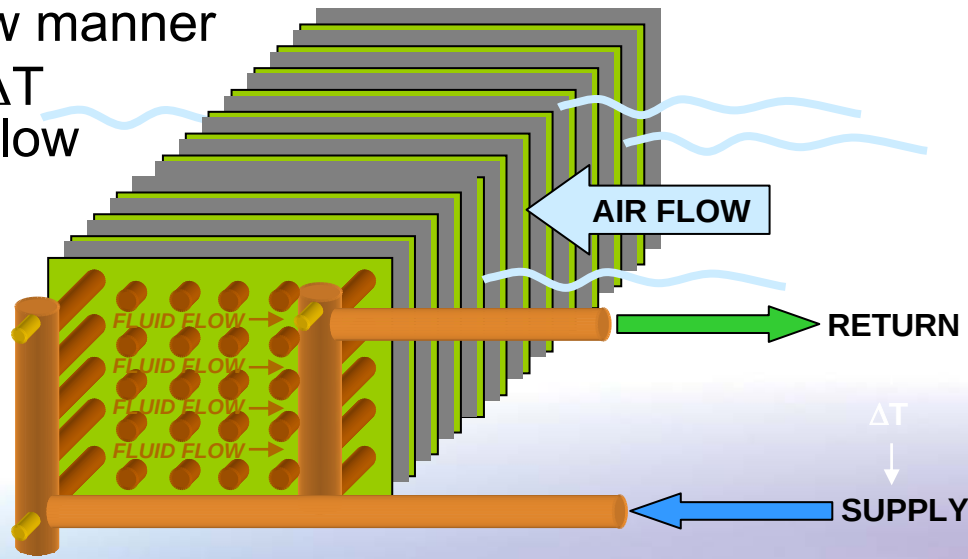

WATTS


150

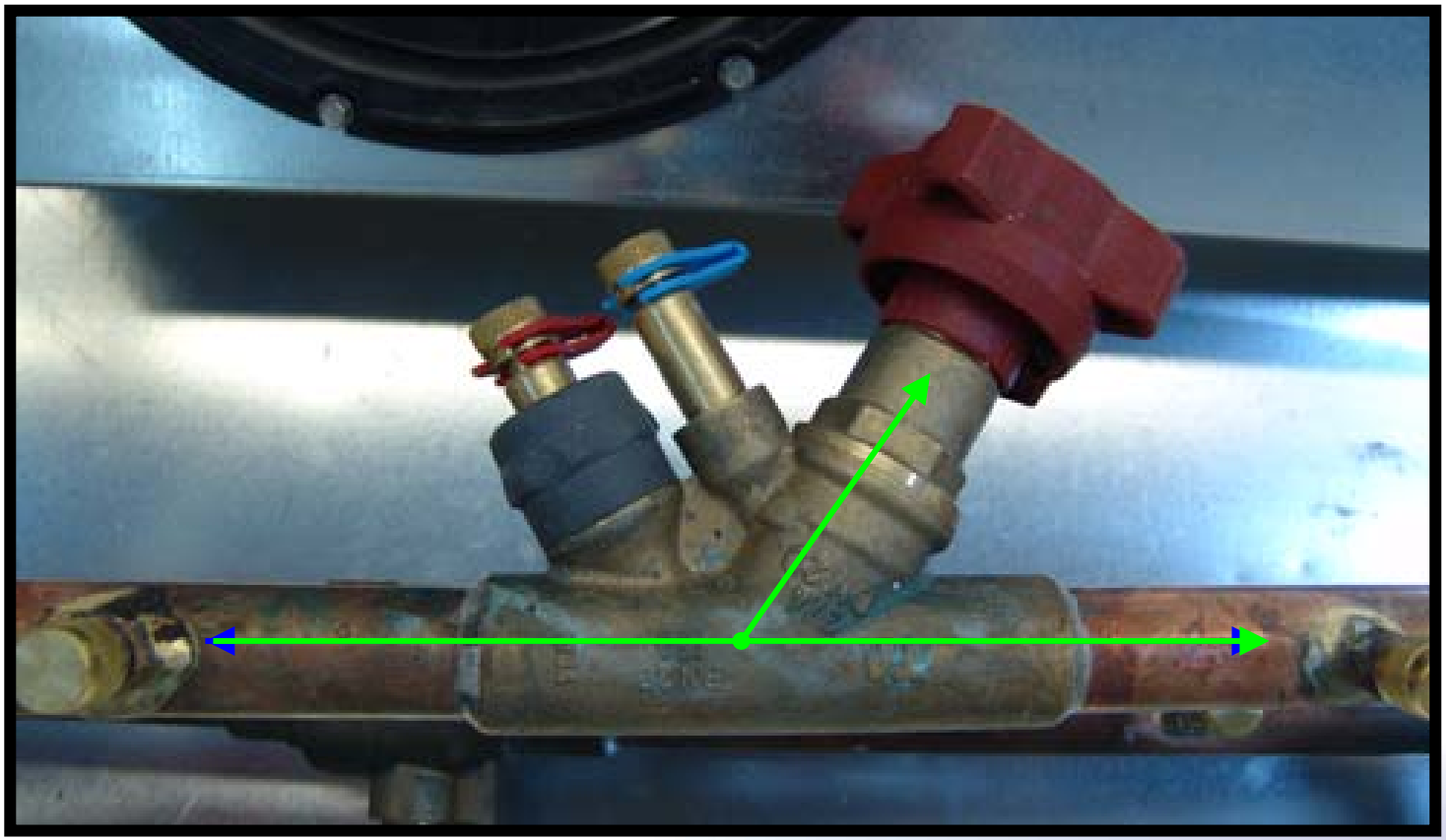

SPENCER
3
12.5 G

Finned-Tube Heat Exchanger

- Coils designed for DX application are in general, not appropriate for secondary systems
- Secondary coils must be designed to:
  - Eliminate air traps and remove air from coil
  - Drain from bottom of coil for service
  - Transfer heat in counterflow manner
  - Operate with high coolant ΔT *(to minimize flow rate)* and low pressure drop *(to minimize pumping power)*



Balance Valve or Circuit Setter

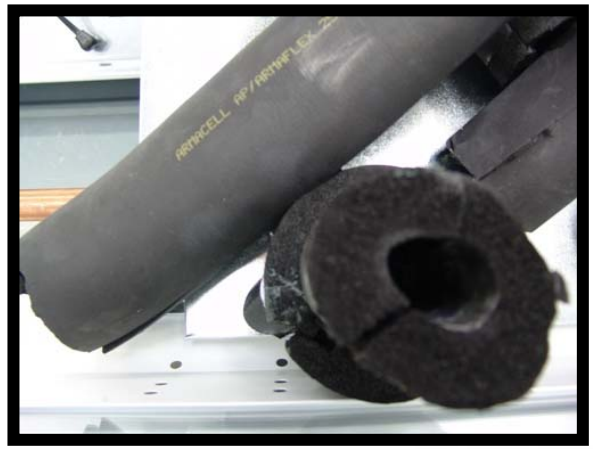


Inhibited Propylene Glycol

- Specific gravity (at 70°F) of 1.033
- Boiling point of 216°F
- Freezing point of +2°F
- pH of 8.0 to 10.0
- **Never** mix manufacturers

Insulation Considerations

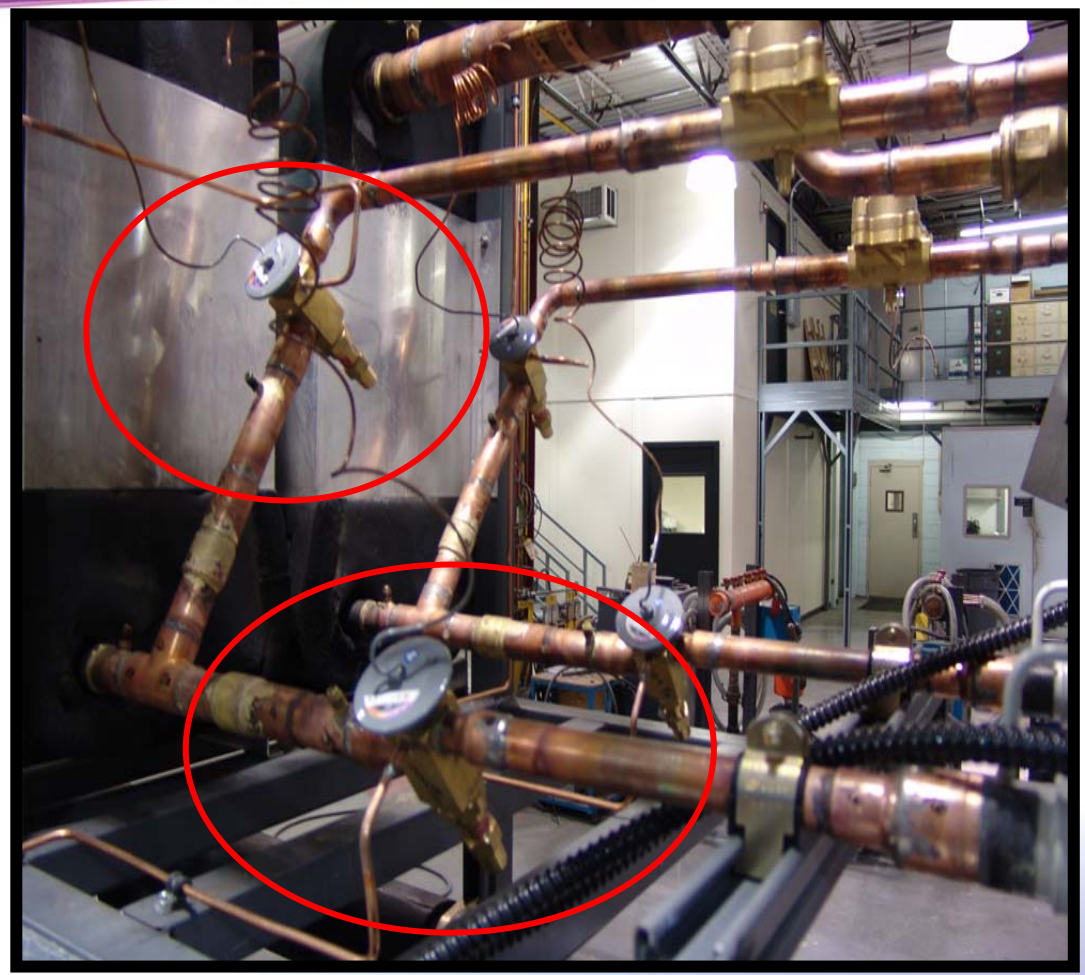
- The application (coolant) temperature
- Ambient conditions such as:
  - Dry-bulb temperature
  - Relative humidity
  - Surrounding air velocity
- Insulation material
- Desired performance



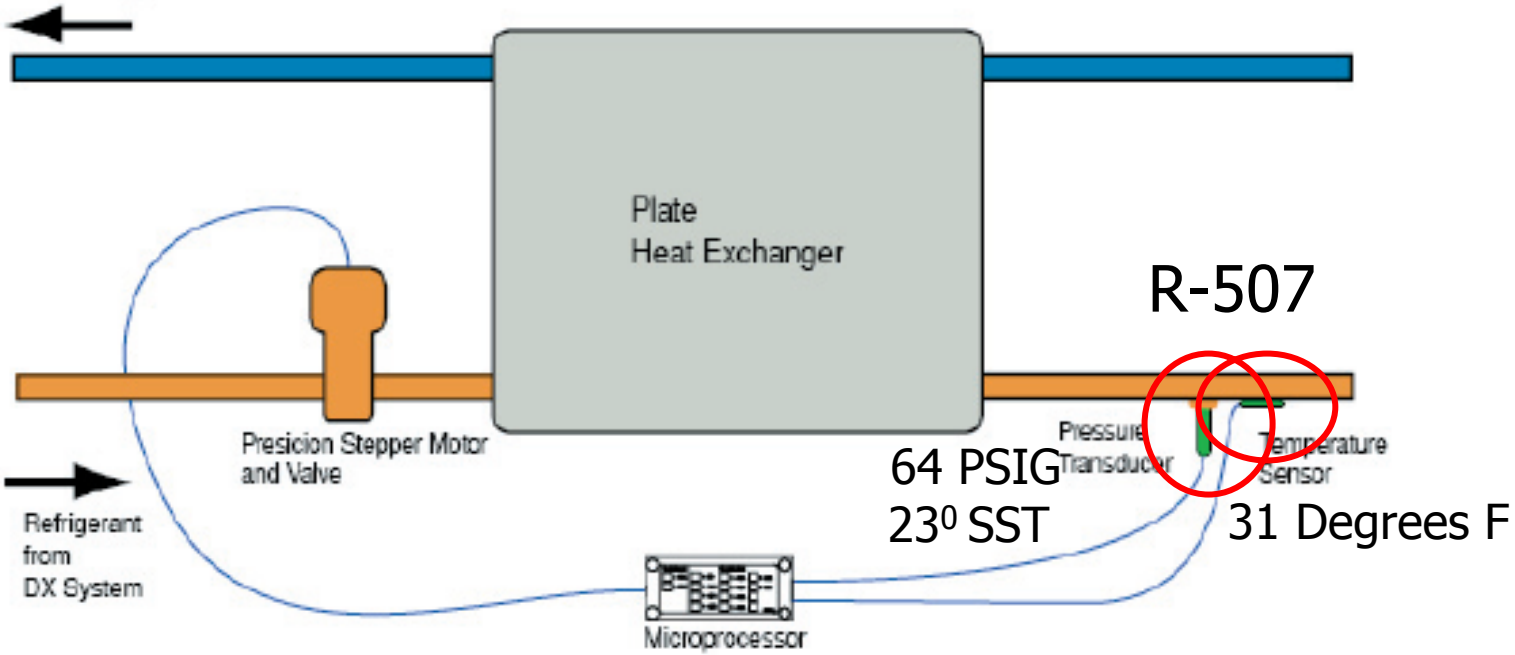
Ambient Conditions

- Mild Conditions – maximum severity of 80°F dry bulb temperature, 50% relative humidity, and 0 ft/min air velocity
- Normal Conditions – maximum severity of 85°F dry bulb temperature, 70% relative humidity, and 0 ft/min air velocity
- Severe Conditions – maximum severity of 90°F dry bulb temperature, 80% relative humidity, and 0 ft/min air velocity

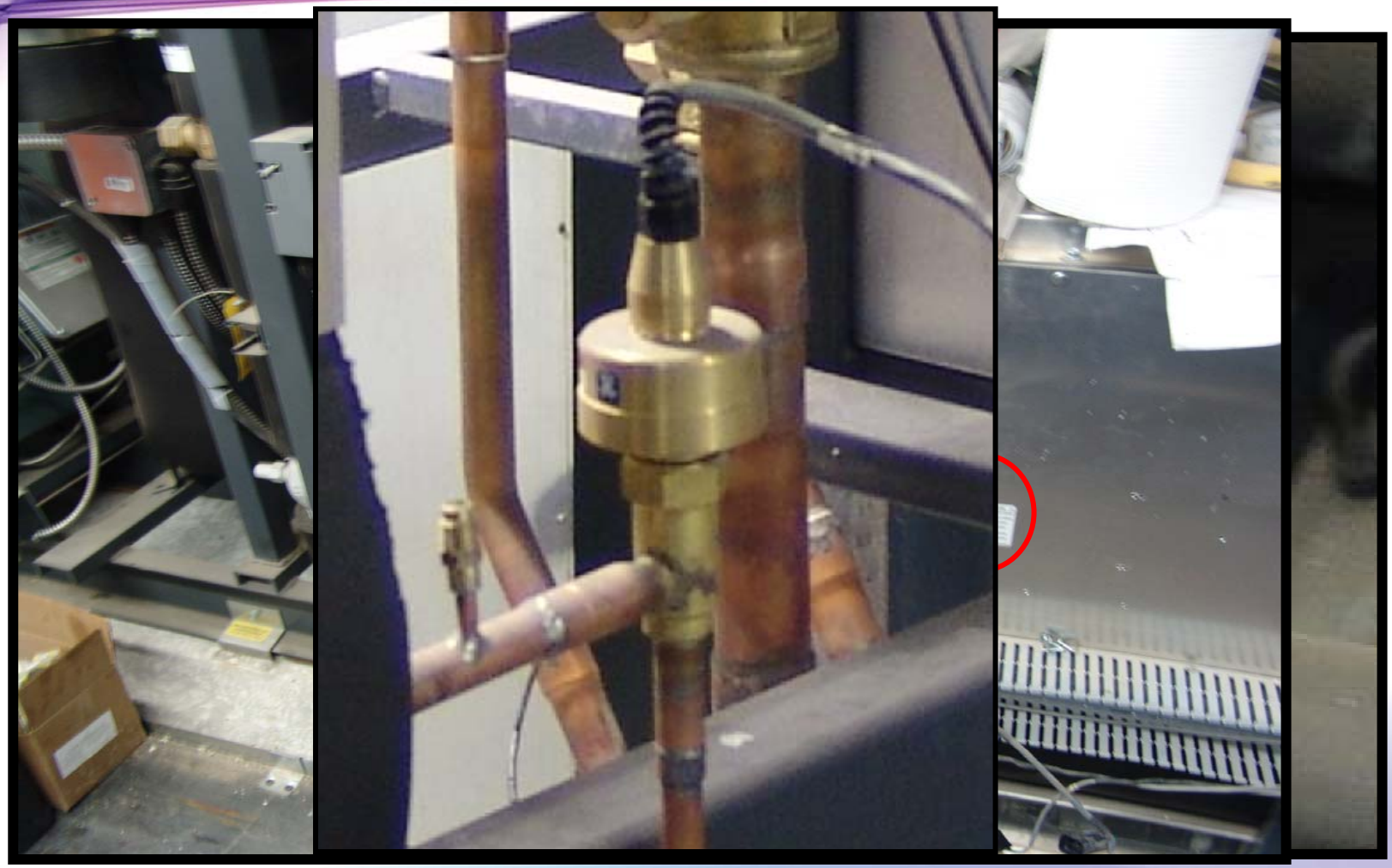
Mechanical Expansion Valves



Electronic Expansion Valves

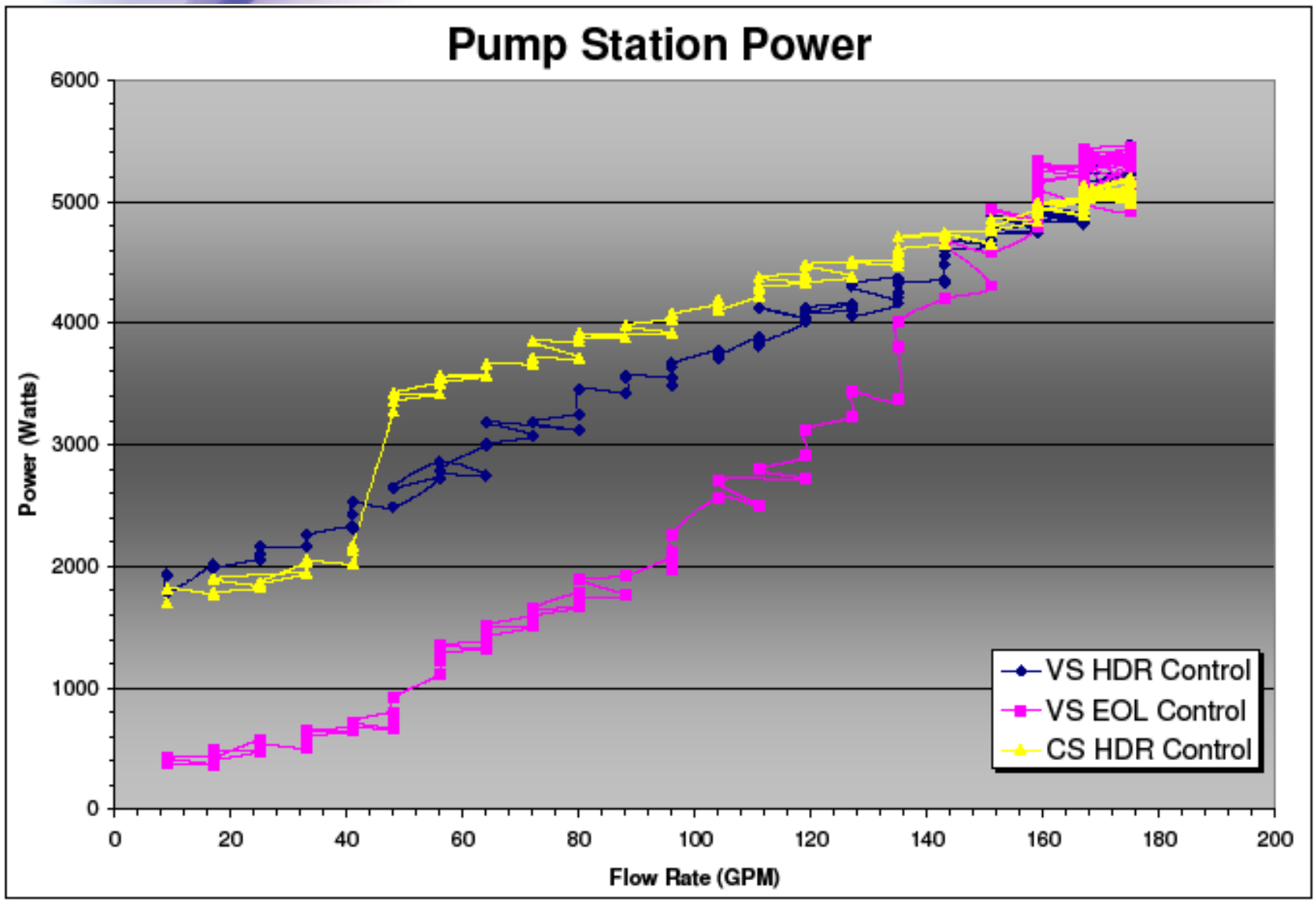


Electronic Expansion Valves



Secondary Pump Control

- Constant speed control
- Variable speed control


Pump Station Power
Power (Watts)
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
120
140
160
180
200
Flow Rate (GPM)
VS HDR Control
VS EOL Control
CS HDR Control

Variable Speed Pumps

PLC control with touch screen

One drive for each pump

Differential Pressure Control

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Questions