DEPPMANN ACADEMY 2024

Cleveland Detroit Grand Rapids

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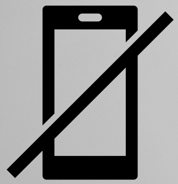
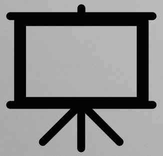
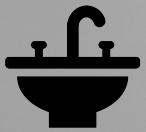
HOUSEKEEPING







AGENDA

8:30-9:30 –	**Insights from the Field –**	**Brad Notter**
9:30-9:45 –	Break	
9:45-10:45 –	Optimizing Hydronic Heating –	Ryan Groves
10:45-11:00 –	Break	
11:00-12:00 –	Don’t Let Your Sh*t Back Up –	Nick Tabar
12:00-1:00 –	Lunch	
1:00-2:00 –	Water Quality Solutions –	Andrew Ward
2:00-2:15 –	Break	
2:15-3:15 –	Guide to Smart Pumps –	Jason Winslow
3:15-3:30 –	Break	
3:30-4:30 –	Decarbonization Insights –	Kyle Wefing

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UNLOCKING HYDRONIC HEATING: INSIGHTS FROM THE FIELD

Presented by Brad Notter

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DISCUSSION POINTS FOR TODAY:

- Closed Loop System Pressure Control & Safeties
- Static Pressure – AKA Cold Fill Pressure
- Point of No Pressure Change (PONPC)
- Pumping In a System
    1. Pumping Away from the PONPC
    2. Pumping Towards the PONPC
    3. Applications of Each Method
        - Primary – Secondary Piping
        - Domestic Water Recirculation
- Questions from the group

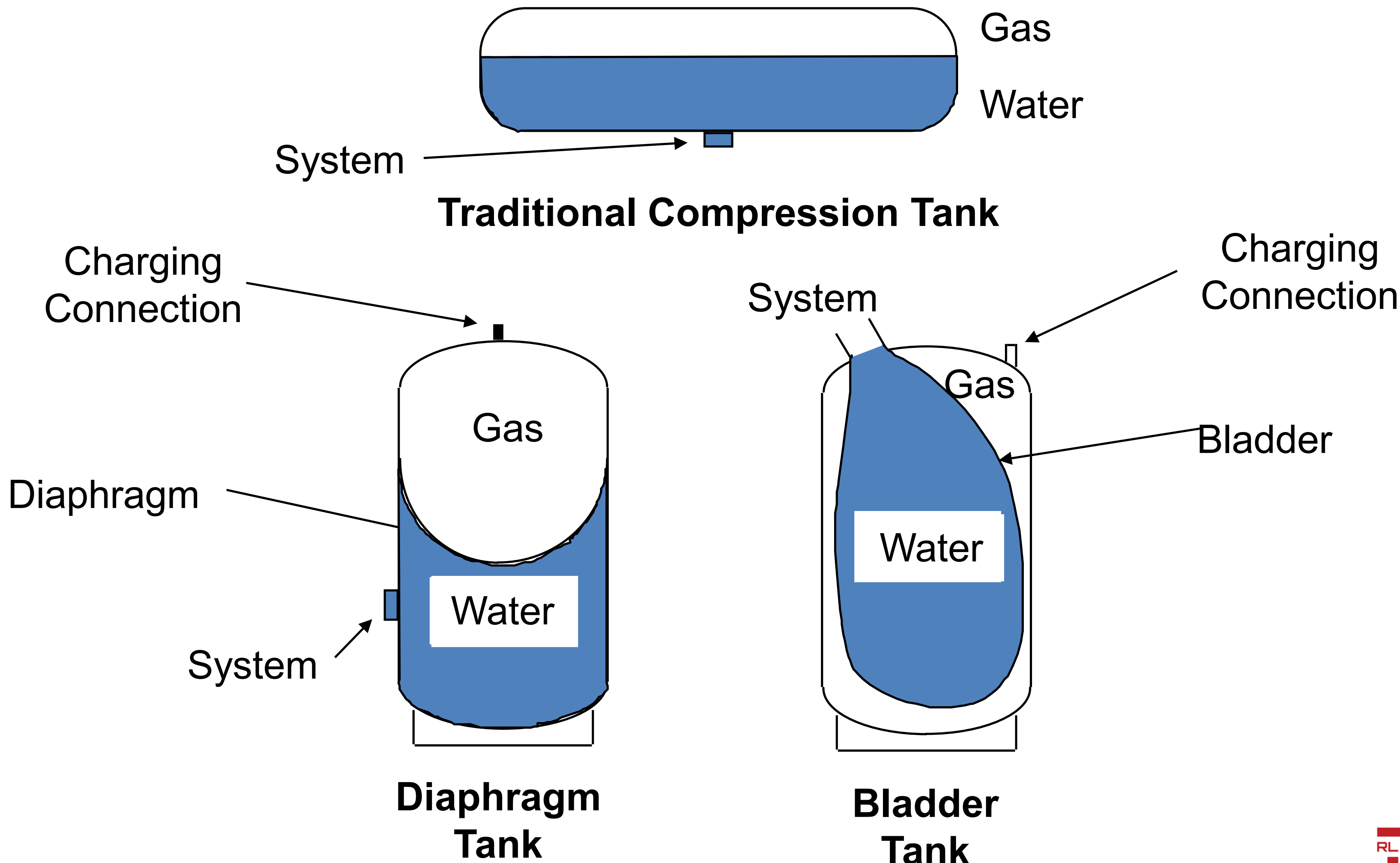
CLOSED LOOP PRESSURE CONTROL AND SAFETIES

CLOSED LOOP PRESSURE CONTROL

- All closed loop systems must have a way to handle the pressure increase due to the thermal expansion of the system fluid.
- An expansion tank or compression tank is used handle this pressure increase
- Needs to be selected as part of system design

EXAMPLE OF BLADDER TANK

TANK TYPES:



Gas
Water
System
Traditional Compression Tank
Charging
Connection
Gas
Diaphragm
Water
System
Diaphragm
Tank
System
Charging
Connection
Gas
Bladder
Water
Bladder
Tank

PROPER INSTALLATION AND USE OF TANKS

Bladder and Diaphragm Tanks

- Need air pre-charge set to the same as the cold fill static pressure
- Need to have water side drained and open to the atmosphere to change pre-charge
- Need to be piped with an anti-thermosyphon loop with a minimum drop of 12" to prevent gravity heating of the tank
  - Maximizes tank life by keeping the hot and cold system water off the bladder and diaphragm
- Pipe size to tank should be at a minimum the same size as the system connection on the tank
  - Needs to be larger when the tank is mounted farther from the system tie point

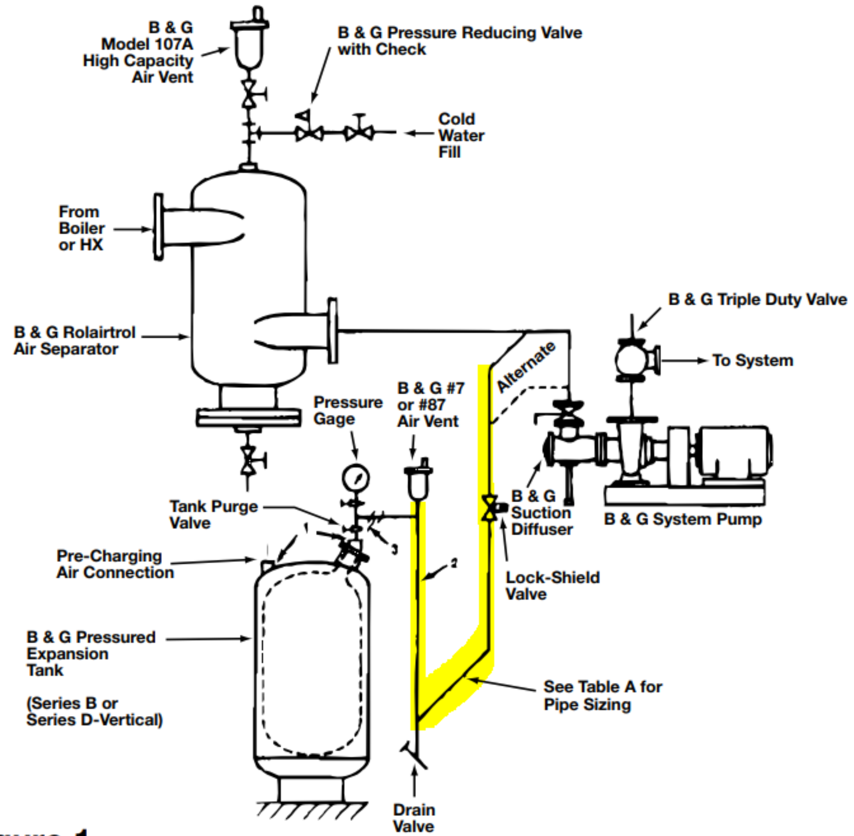


Figure 1
Vertical Tank Installation with Rolairtrol Air Separator

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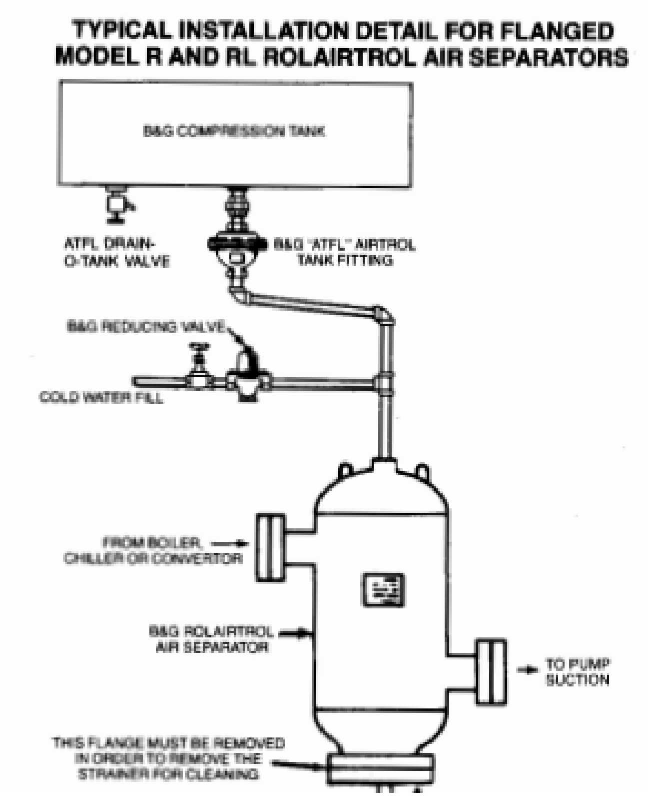
PROPER INSTALLATION AND USE OF TANKS

Compression Tanks

- Need to be mounted above the air separator
- Need to have piping from top of air separator pitched up to tank
- Need to use special tank fittings
  - B&G ATFL for 100 gal and above
    - Comes with special DT-2 Fitting
  - B&G ATF Fitting for 100 gal and below
  - B&G DT-2 Drain-O-Tank Fitting
  - Gauge Glass Set
- Pipe size to tank should be at a minimum the same size as the ATF or ATFL fitting being used
  - Needs to be larger when the tank is mounted farther from the system



CLOSED LOOP PRESSURE SAFETY DEVICE

- All closed loop systems must have a safety device to prevent catastrophic failure to the system or components of the system.
- A relief valve is the device that protects the system from an over pressurization event.
- Needs to be selected as part of system design
    - Standard settings 30,45,50,75,100,125,150

Example of Relief Valve

RELIEF VALVE APPLICATIONS

Always on boilers and water heaters.

Note that all relief valves installed on the same system need to have the same set pressure!

If your relief valve set pressure is greater than 30# then you need to use an ASME tank.

Commonly missed applications:

- Chilled Water Systems
- Heat Exchangers
  - Snowmelt Systems
  - Radiant Floor Systems
  - Heat Recovery Systems

COLD FILL PRESSURE
STATIC PRESSURE

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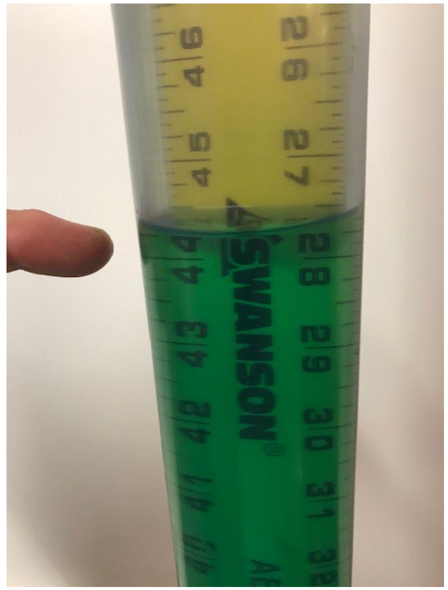
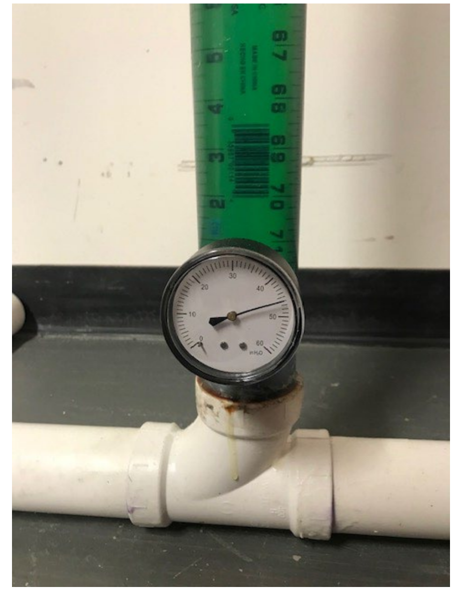
COLD FILL PRESSURE / STATIC PRESSURE





45” = 3.75Ft

3.75’ / 2.31PSIG / Ft = 1.62 PSIG

Display created by Mark Fine

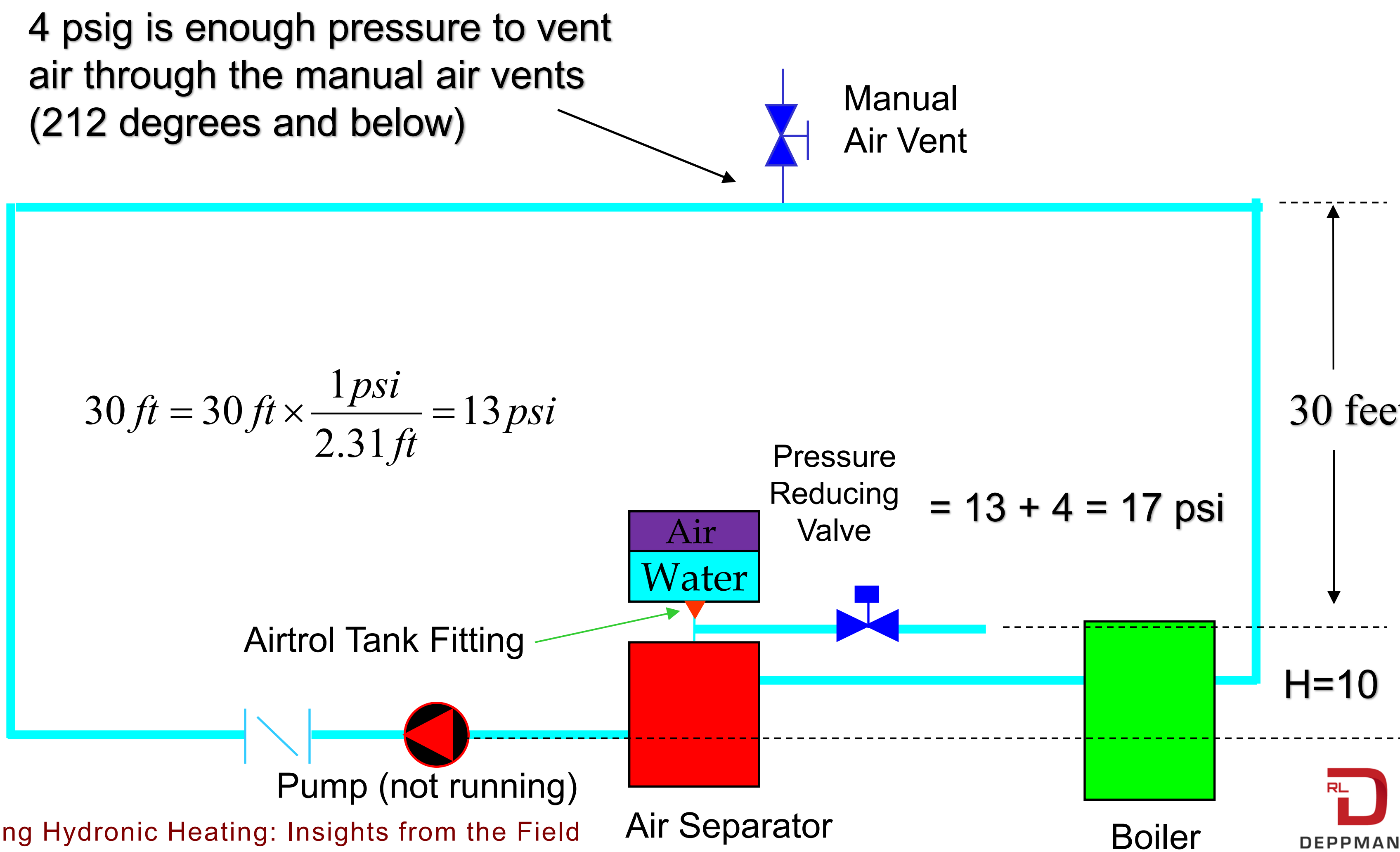
Pounds & Feet Relationship:

1 for water

$$1\ PSIG = 2.31\ Feet / Specific\ Gravity$$

at 60 deg F

PROPER COLD FILL PRESSURE



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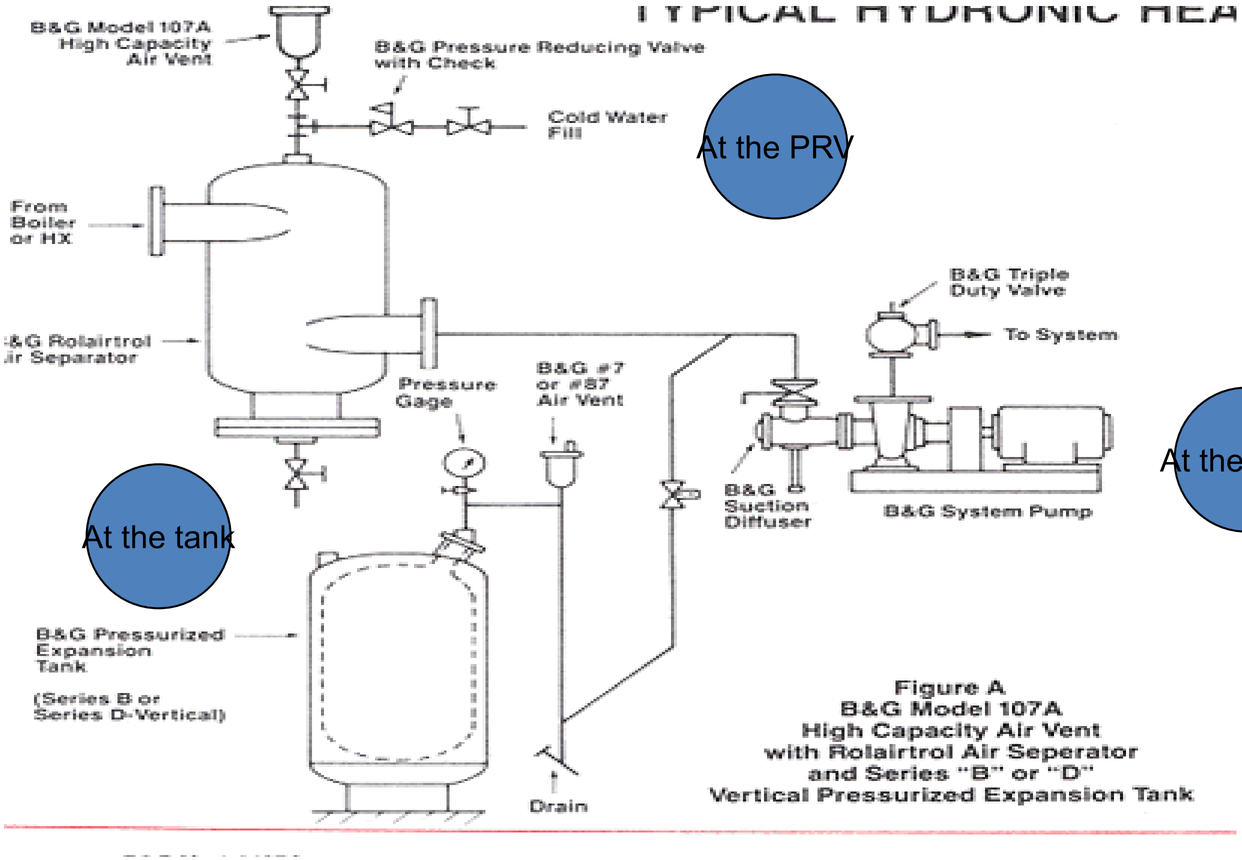
WHY ADD PRESSURE AT THE TOP?

Positive venting

- The needle will ‘bounce” and spit water if it is not seated positively

COLD FILL IS MEASURED WHERE THERE IS A GAUGE



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IT’S ALL ABOUT THE LOCATION OF THE SYSTEM ABOVE THE TANK

BELL & GOSSETT PRVS

SIZES & PERFORMANCE

MODEL NUMBER	SIZE INCHES		FACTORY SETTING PSIG	ADJUSTABLE RANGE PSIG
B-38	1/2	NPT	12	10-25
B 7-12	3/4	NPT	12	10-25
B-36TU	1/2	UNION NPT/SWEAT	12	10-25
FB-38	1/2	NPT	12	10-25
FB-38TU	1/2	UNION NPT/SWEAT	12	10-25
6	1/2	NPT	45	25-60
7	3/4	NPT	45	25-60

Maximum Flow 5 1/2-6 GPM at 125 PSIG inlet Pressure.

TANK AND COLD FILL PRESSURE ISSUES

We see issues with the tank pressure not being set in the field or being set incorrectly.

- Pre-charge too high leads to no change in pressure for a large rise in temperature then a sudden increase occurs or may pop the relief valve prior to reaching temp design setpoint.
- Pre-charge too low leads to the tank be full prematurely and may pop the relief valve prior to reaching temp design setpoint
- Both too low and too high will make the system think the tank is too small.

We see issues with static cold fill pressures as well.

- Too low cold fill pressure and you will never get all of the air out of your system
- Too high of a cold fill pressure and your relief valve may pop prematurely prior to reaching temp design setpoint.

TANK SIZING NEEDS

Items needed for the proper tank selection are

- System minimum temperature
- System maximum temperature
- System volume and fluid type (water, EG or PG and percent)
- System minimum pressure (cold fill pressure)
- System maximum pressure (90% of relief valve setting)

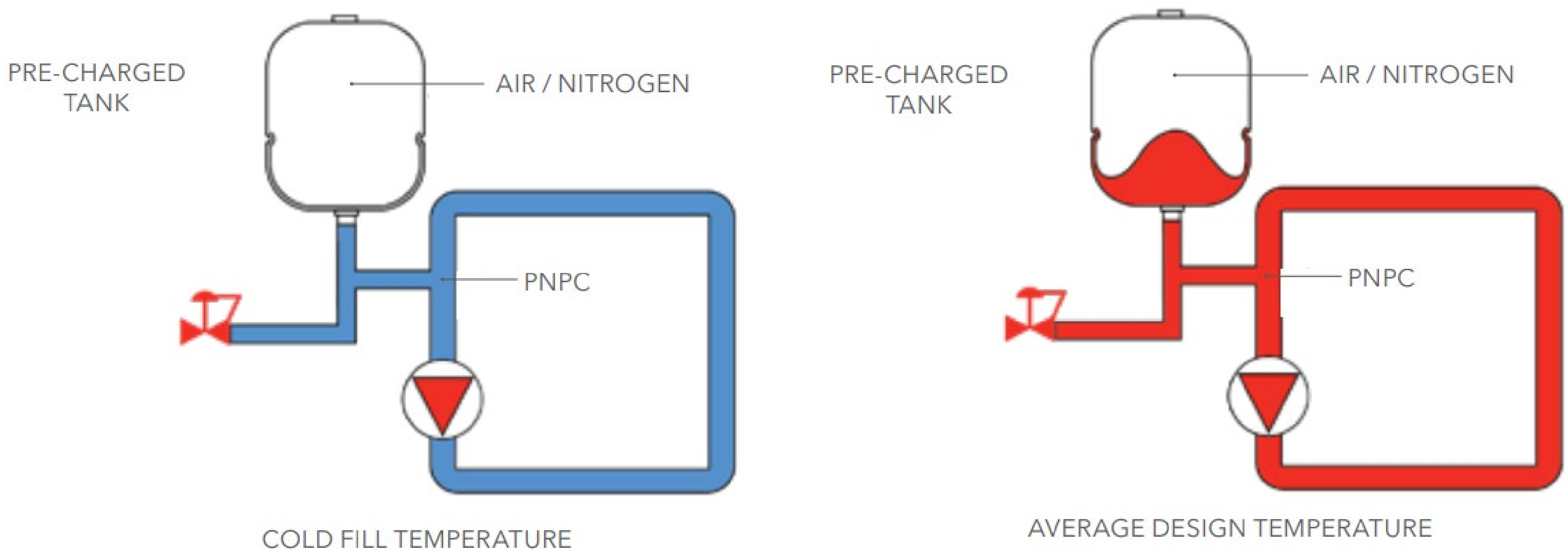
We are not going to size the tank here but…..

- *The initial cold fill pressure is used as part of the tank selection criteria*
- *Suggestion - add the cold fill pressure, pressure reducing valve model and tank pressure all to the expansion tank schedule*
- *This will take the guesswork out of the equation by the field people and eliminate the issues on the previous page*

POINT OF NO PRESSURE CHANGE - PONPC

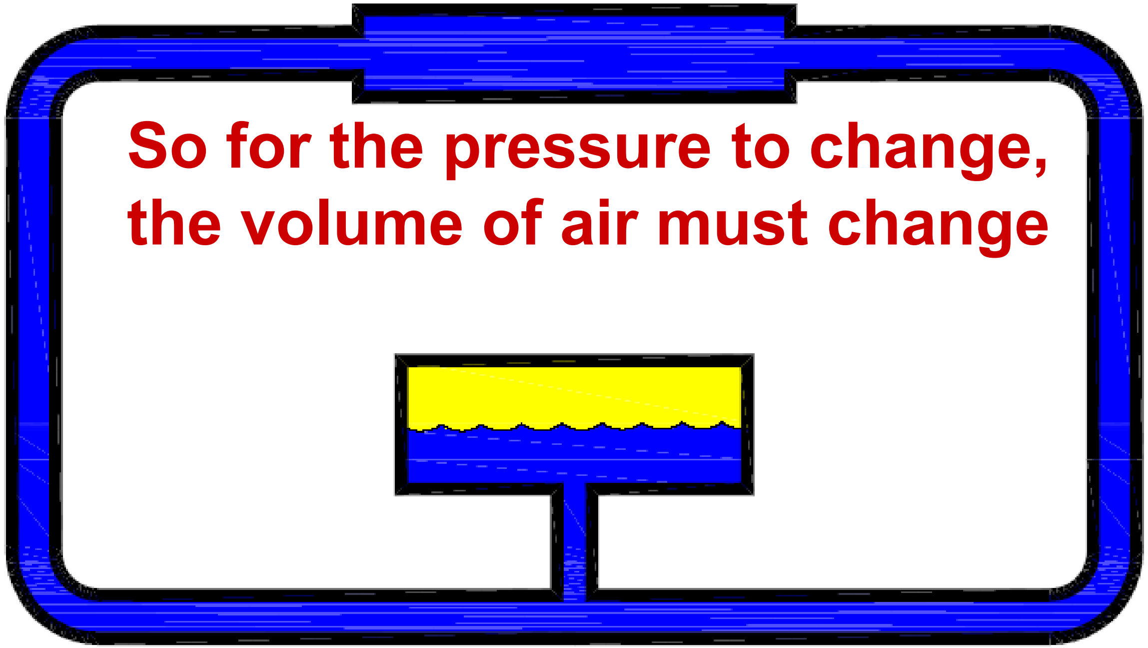
POINT OF NO PRESSURE CHANGE (PONPC)

The point of no pressure change is where the expansion tank or compression tank ties into the system



POINT OF NO PRESSURE CHANGE (PONPC)

In order for the pressure to change at the same temperature…..



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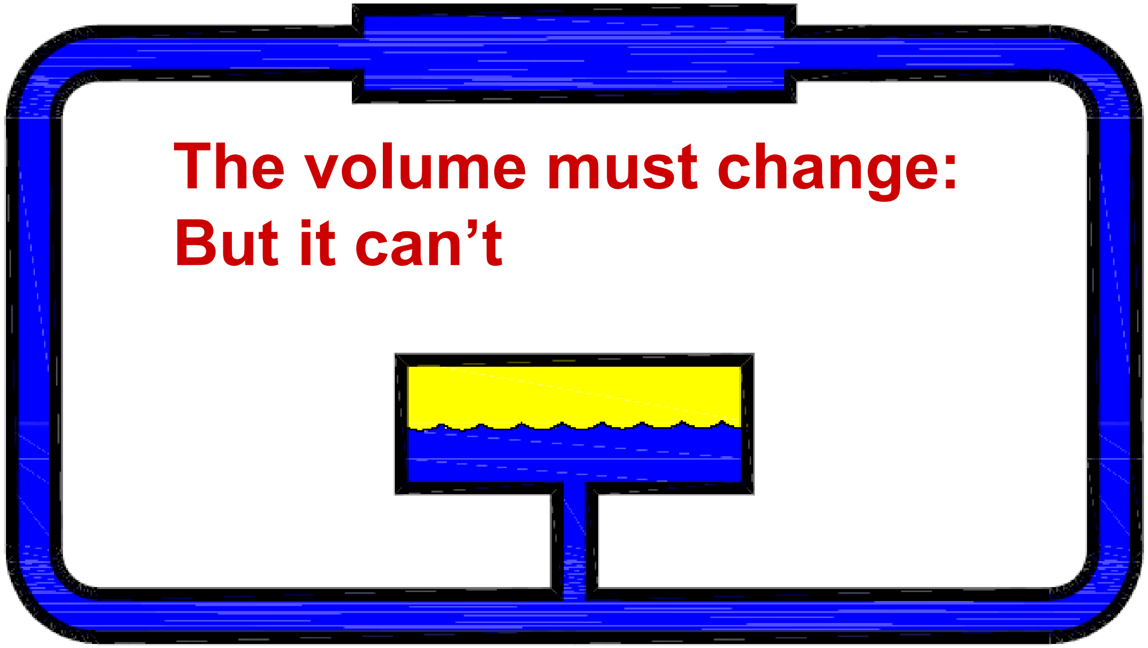

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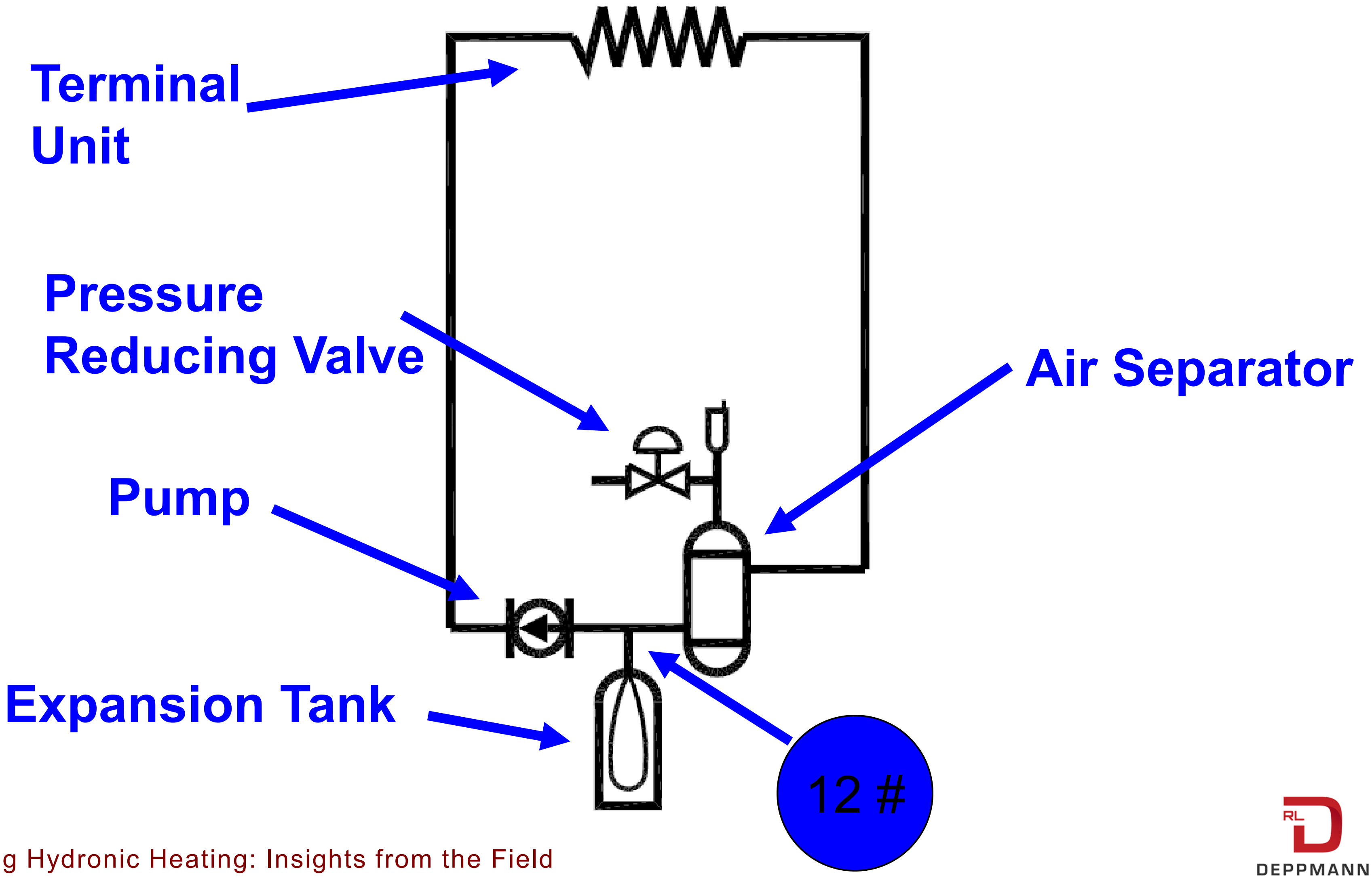
PUMPING IN A SYSTEM

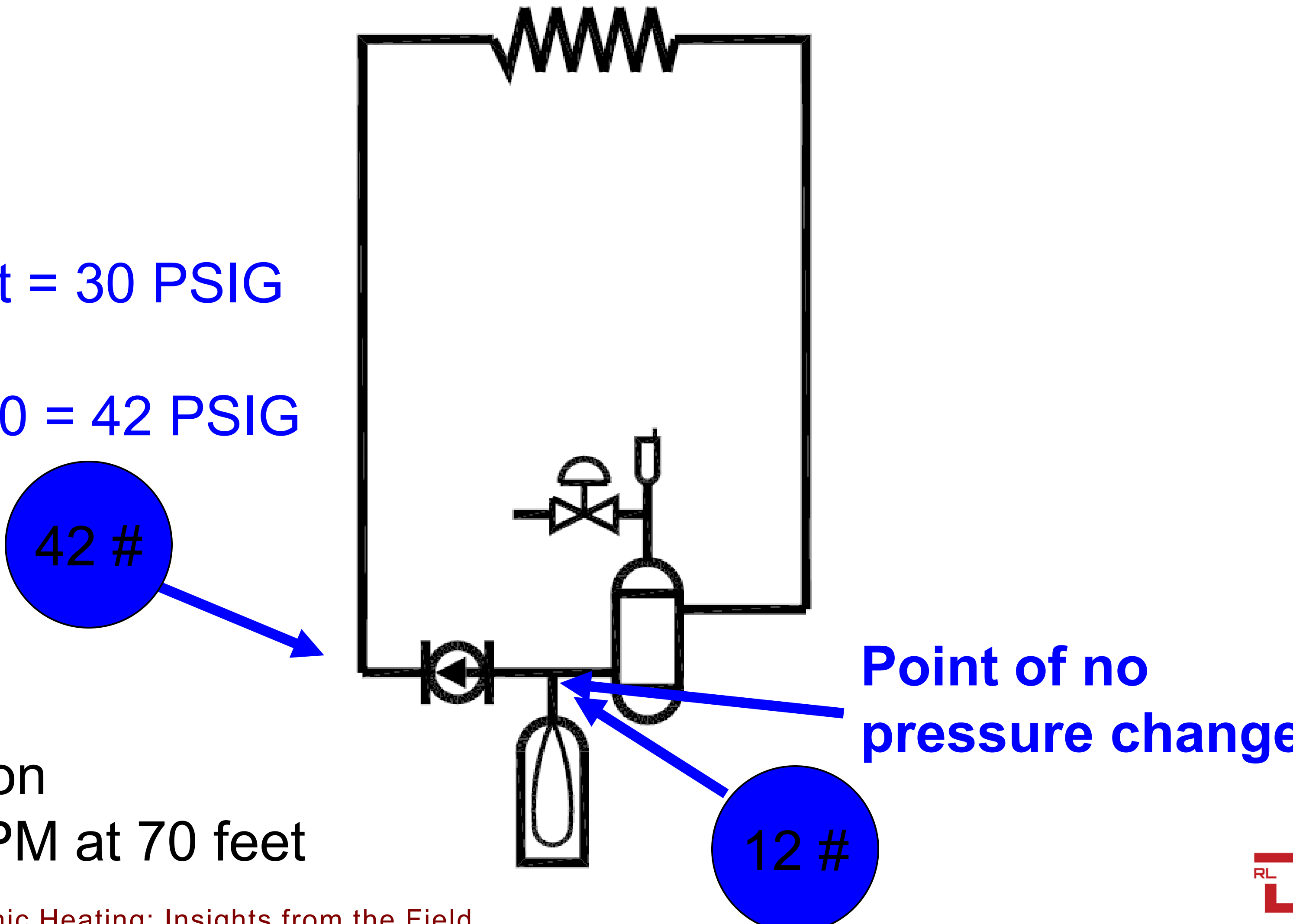
REPRESENTATION OF A CLOSED HYDRONIC SYSTEM



PUMP AWAY FROM ANY POINT OF NO PRESSURE CHANGE (PONPC)

70 feet = 30 PSIG

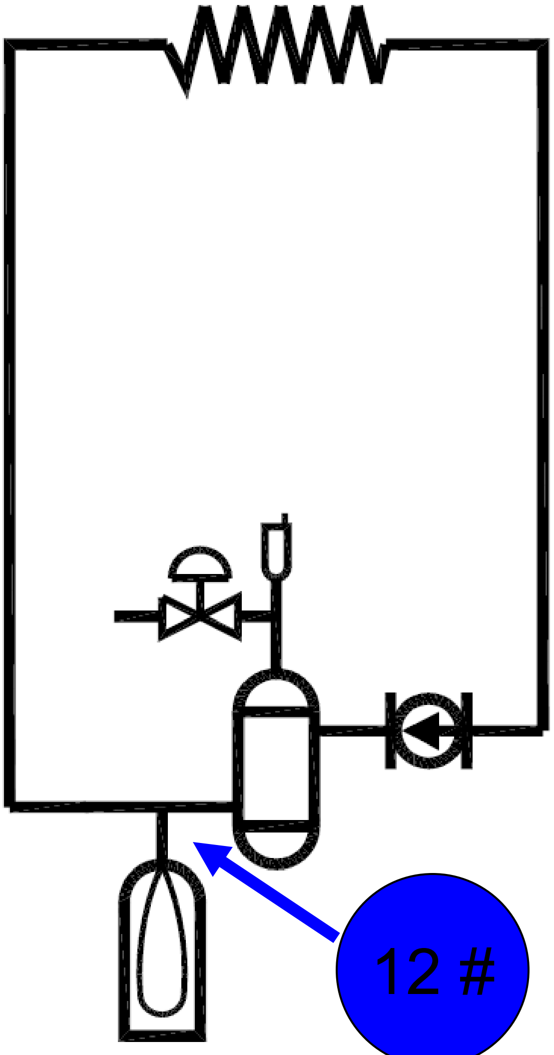
12 + 30 = 42 PSIG



Pump on
300 GPM at 70 feet

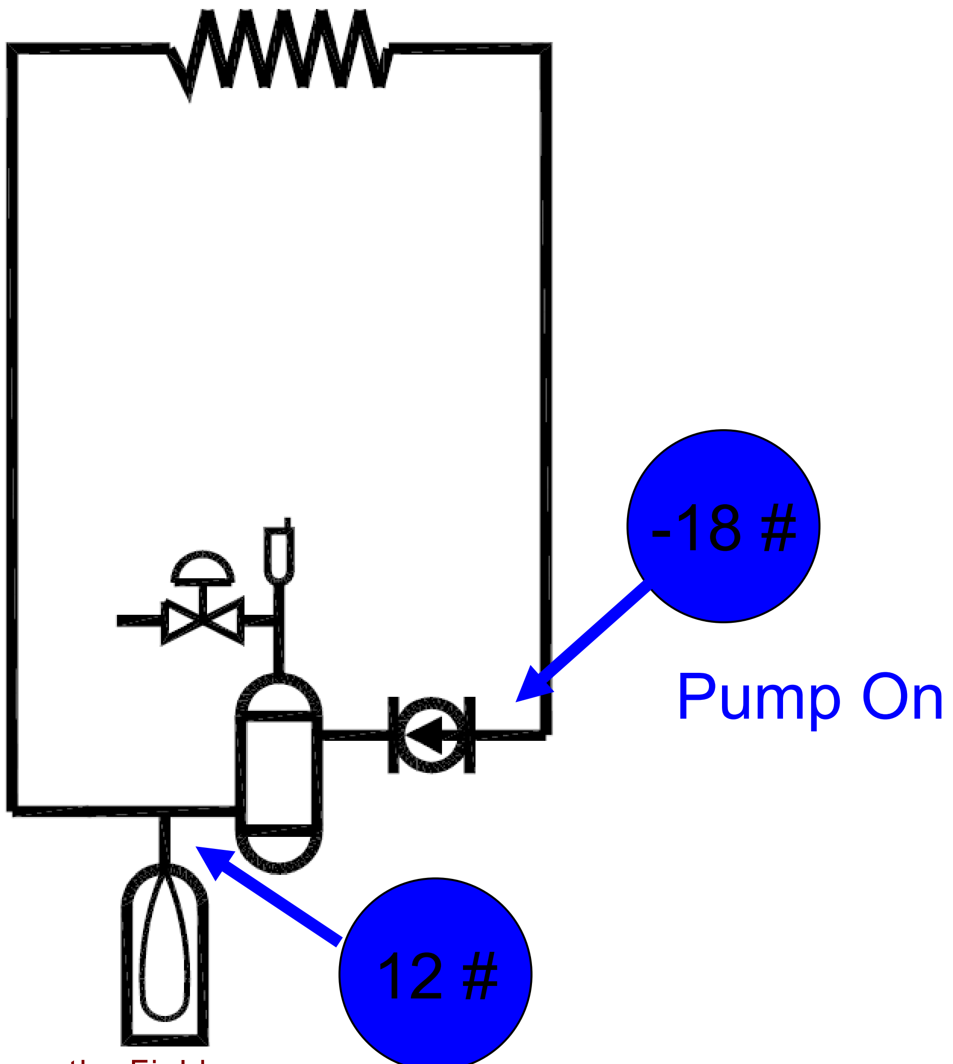
PUMPING INTO OR TOWARDS THE PONPC

When we turn the pump on is the pressure going up or down



Pump Off

PUMPING INTO OR TOWARDS THE PONPC



Pump on
300 GPM at 70 feet or 30 psig

IF YOU PUMP INTO OR TOWARDS THE POINT OF NO PRESSURE CHANGE!!

……THE SUCTION PRESSURE WILL DROP

…… YOU MAY PULL AIR INTO THE SYSTEM
…… YOU MAY TURN THE WATER INTO STEAM
…… YOU MAY DESTROY THE PUMP
…… YOU MAY HAVE AREAS WITH NO HEAT

THE SOLUTION IS…….

SOLUTION!!!

Try not to pump into the point of no pressure change!!!

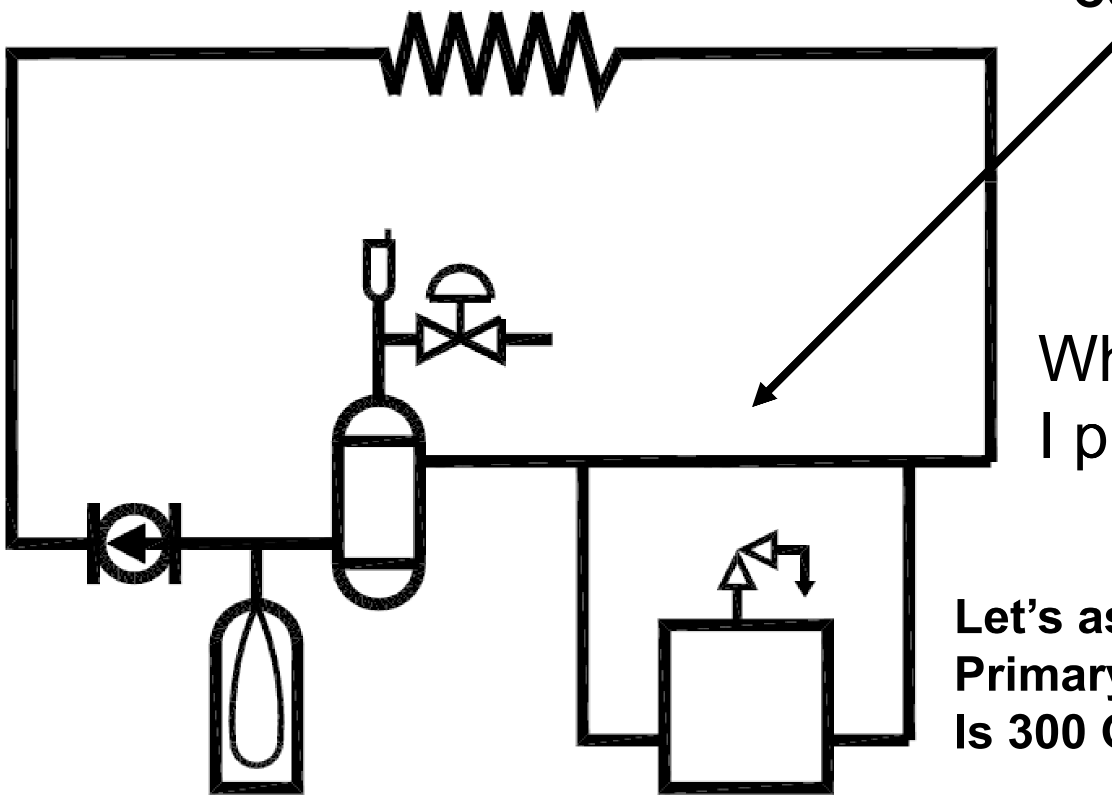
PUMPING TOWARDS OR AWAY FROM THE PONPC – SPECIAL APPLICATIONS

- Primary/Secondary Boiler Piping
- Domestic Water Recirculation Loops

LET'S MAKE THIS BOILER SYSTEM PRIMARY SECONDARY

Common Pipe

Secondary pump
300 GPM at 70 ft

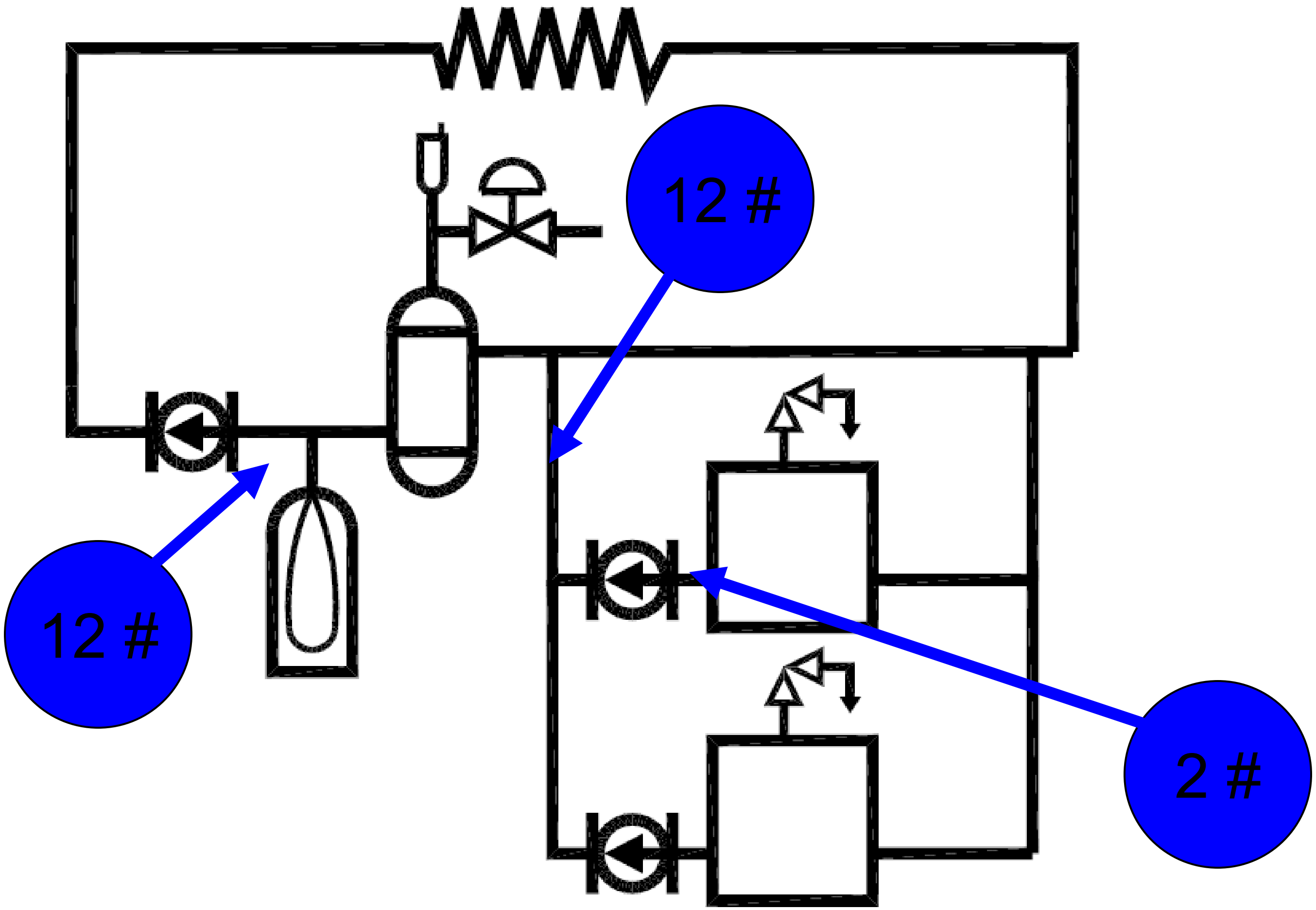


Where should
I put the Pump?

Let's assume our
Primary pump
Is 300 GPM at 23 feet

Remember 23 feet is 10#

PUMP OUT OF THE BOILER?



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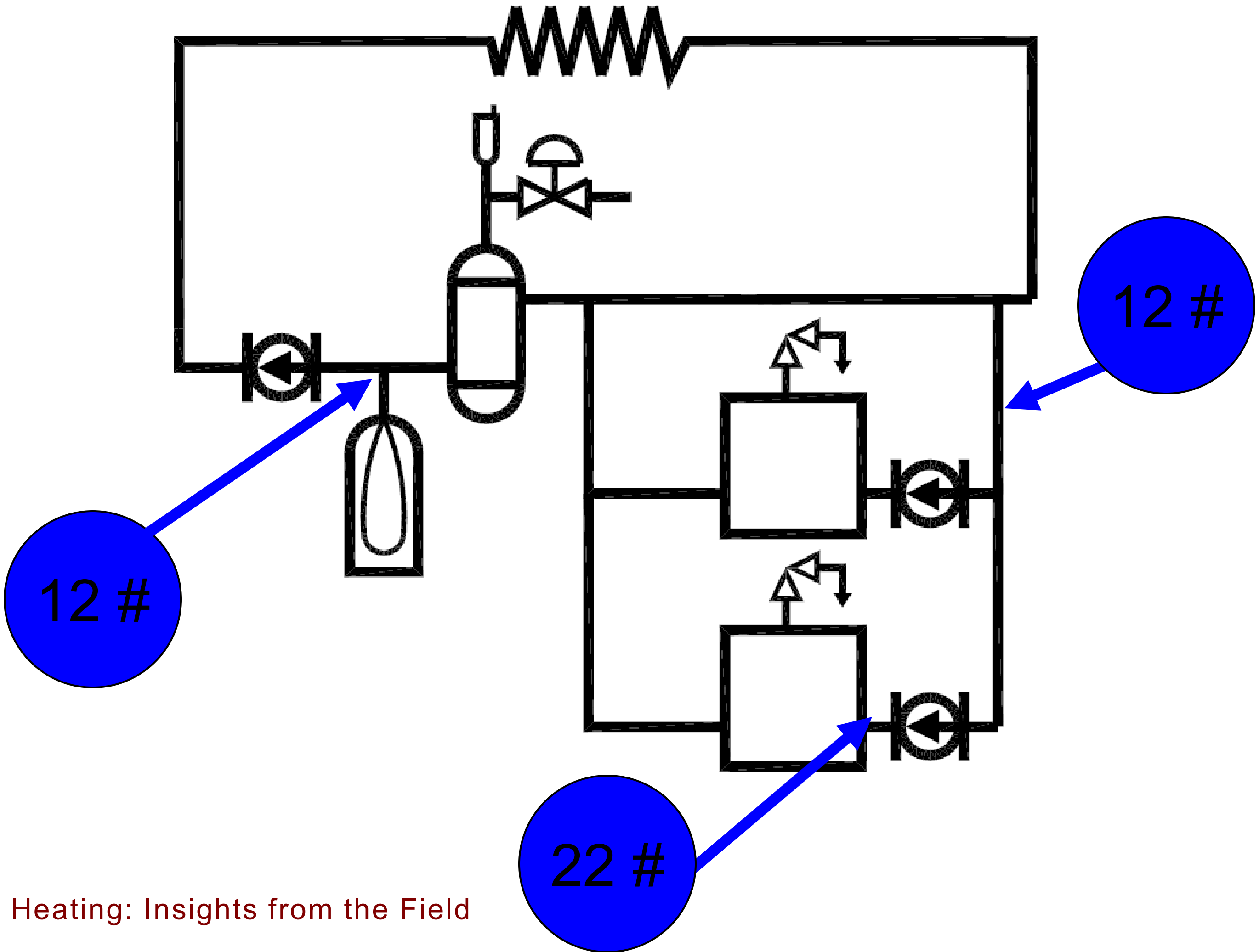
ISSUE

Primary Pumping out of the boiler will reduce the pressure at the boiler.

Design consideration: Is it a potential problem?

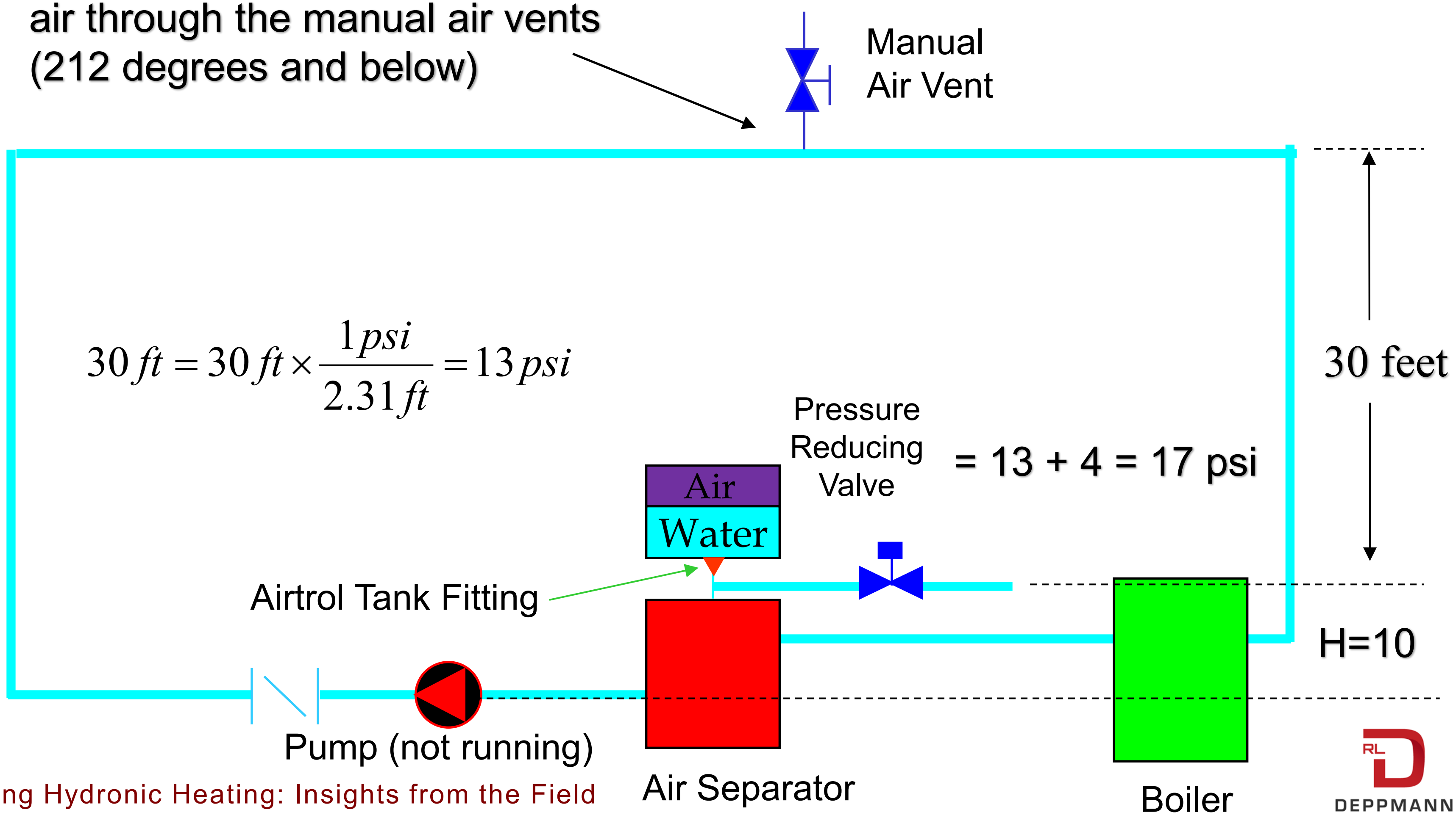
The pressure will increase as the system heats

PUMP INTO THE BOILER



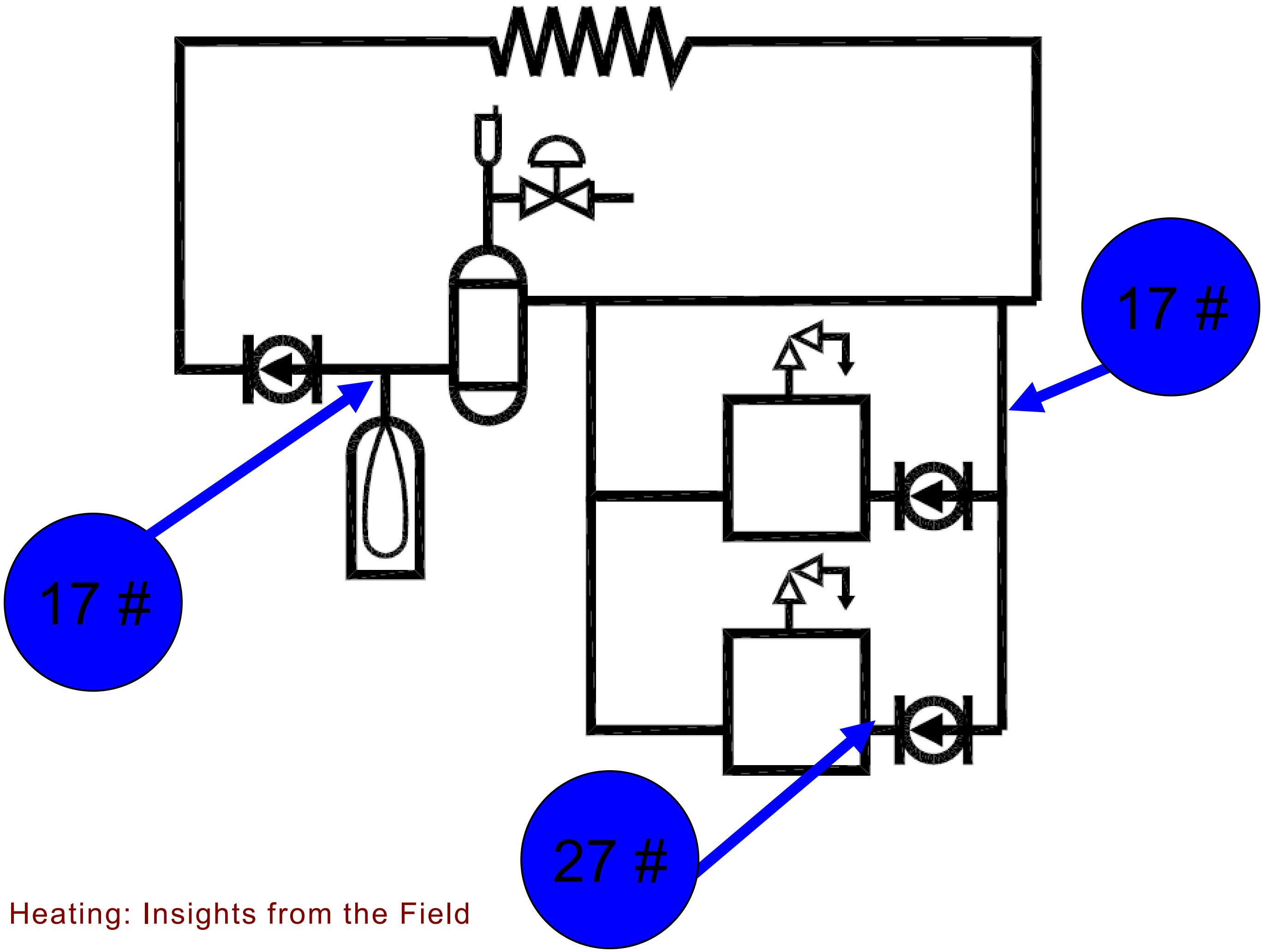
LOOK AT OUR OLD EXAMPLE

4 psig is enough pressure to vent air through the manual air vents (212 degrees and below)

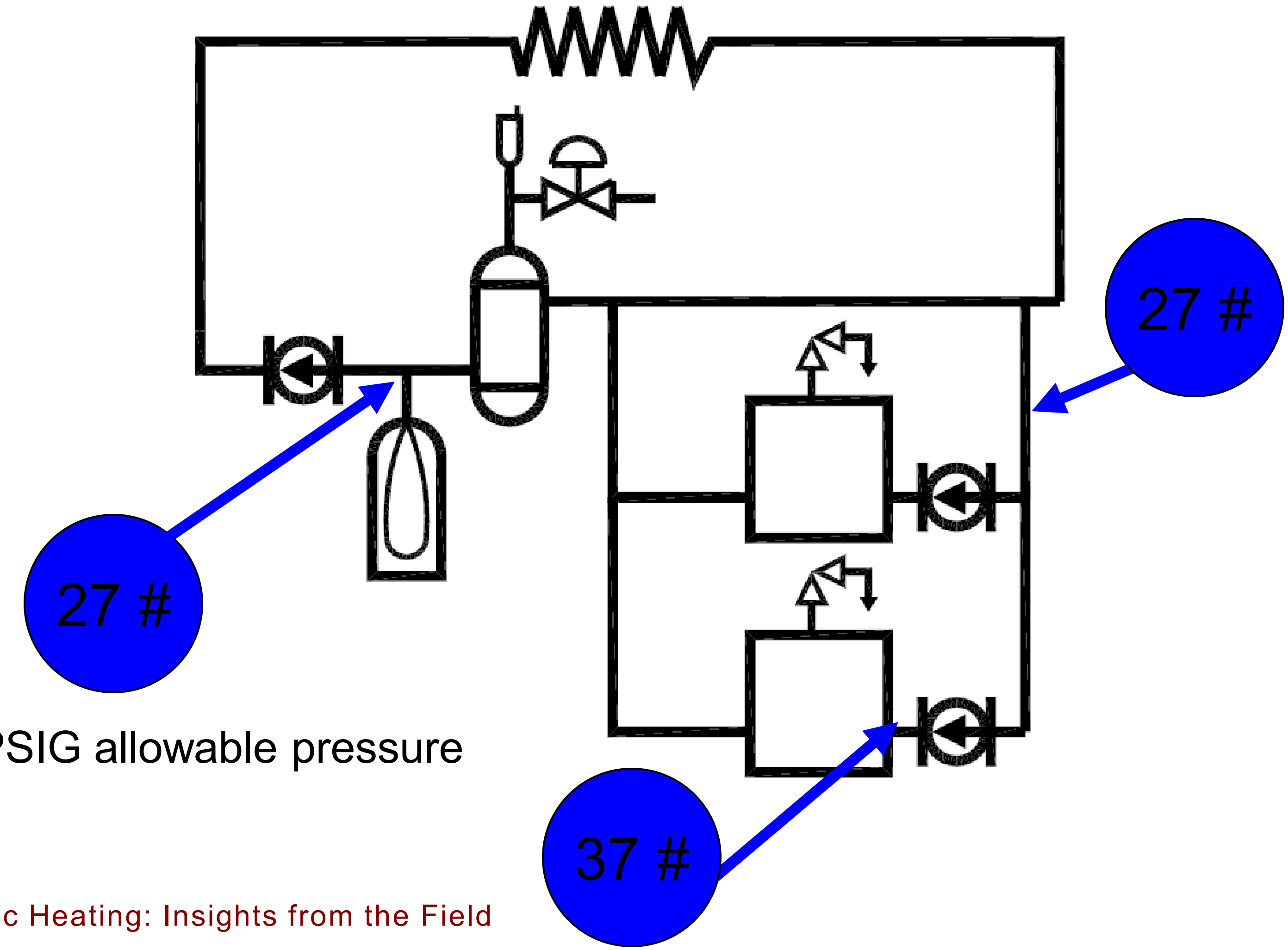


$$30\,ft = 30\,ft \times \frac{1\,psi}{2.31\,ft} = 13\,psi$$

PUMP INTO THE BOILER – AT COLD FILL PRESSURE



PUMP INTO THE BOILER PRESSURE AT MAXIMUM TEMPERATURE



Assumes 10 PSIG allowable pressure Increase

ISSUE

Primary Pumping into the boiler reduces the allowable tank pressure increase at design temp

Design consideration: Did you size the tank for that smaller pressure increase?

Assuming a 30# relief valve on the boiler and example 1 The tank sizing is based on 17 PSIG to 27 PSIG but at 27 PSIG at the tank the boiler is at 37 PSIG

SOLUTION

Raise the boiler relief valve higher during design

- Your design does not have to use 90% of the relief valve as maximum design pressure. Doing so will use the smallest tank size possible.

Brad's First Rule of Hydronics

If the expansion tank is too big – no one will know

If the expansion tank is too small – everyone will know

BOILER PUMPING

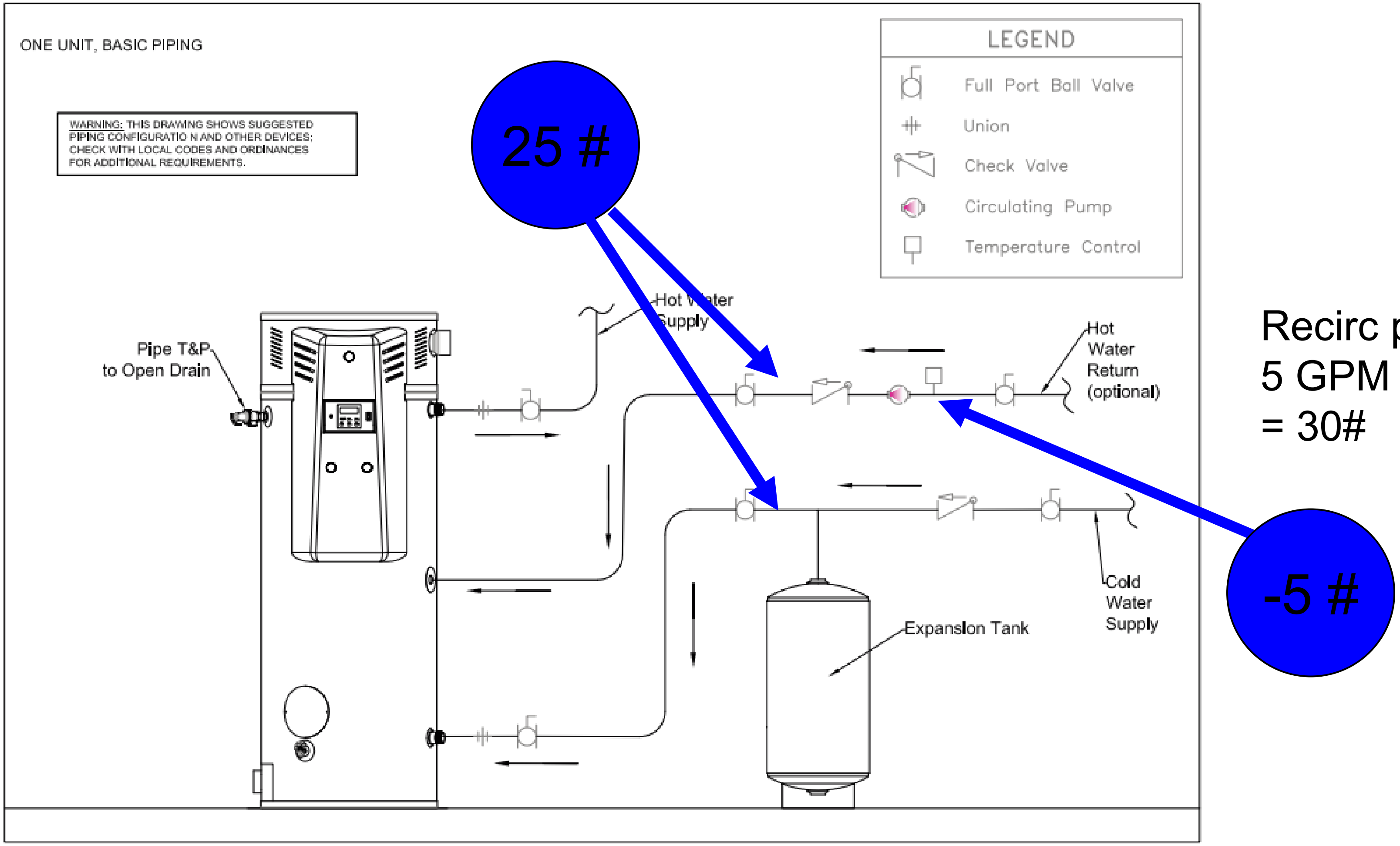
If you pump into the boiler with the primary boiler circ. at the top of the system

- Raise the relief setting by the primary pump head
- Size the tank normally using the lower relief valve pressure setting

If you pump out of the boiler with the primary boiler circ. at the top of the system

- Raise the fill setting to keep a minimum cold fill of 6 PSIG on the boiler
- AND make sure the maximum tank pressure is at least 10% below the relief setting on the boiler

DOMESTIC WATER RECIRCULATION PUMPS – HIGH HEAD WITH LOW WATER PRESSURE



Recirc pump
5 GPM at 70ft
= 30#

QUESTIONS???

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- Questions from the group

REFERENCE MATERIALS

Bell & Gossett Pressurized Expansion Tanks IOM

– A01500

Bell & Gossett Airtrol System IOM

– s10300h

Bell & Gossett Air Management Technical Manual

– TEH-1196C

Deppmann PSI to Feet of Head Conversion & Adjustments for Glycol Systems

– PSI to Ft Glycol Adjustments

Gil Carlson – Point of No Pressure Change Video

– Point of No Pressure Change

THANK YOU

Ex: Brad Notter, Startup & Warranty Manager
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Phone: 800.589.6120 ext 1305

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TRIVIA

What is the minimum PSI that should be added for proper air relief at the top of the system?

OPTIMIZING HYDRONIC HEATING SYSTEMS

THE PATH TO EFFICIENCY

Presented by: Ryan Groves

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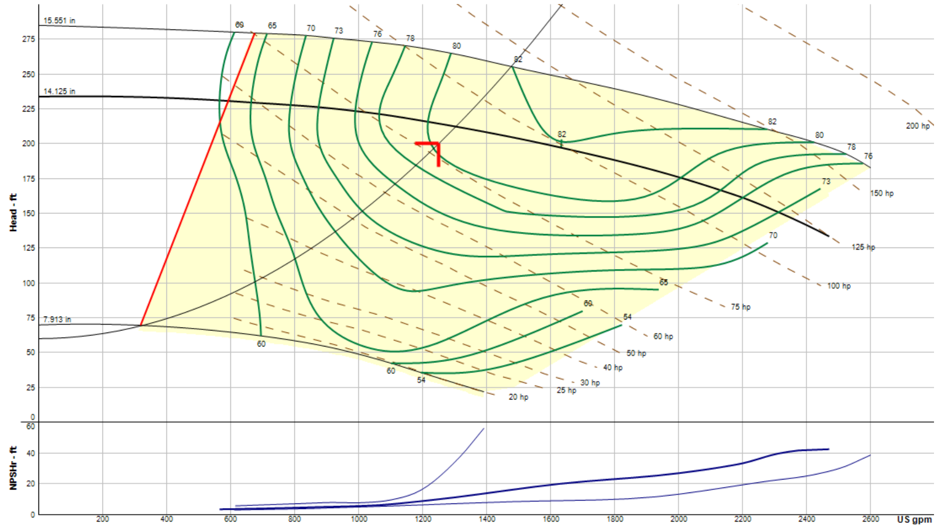
AGENDA

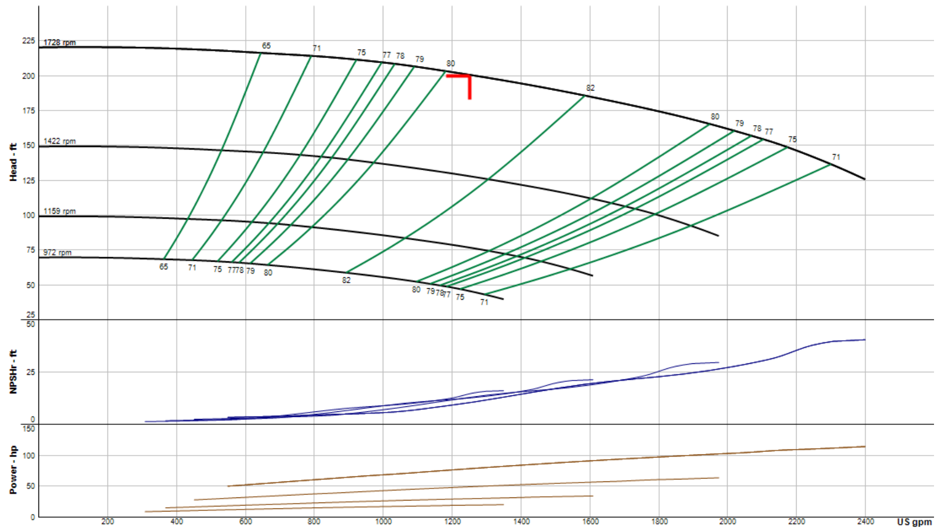
- Pump curves
- Affinity laws and PLEV
- Sensor locations
- Efficient design techniques
- Maintaining system efficiency
- Decarbonization and Electrification
- Hybrid systems
- Future of hydronics

PUMP CURVES

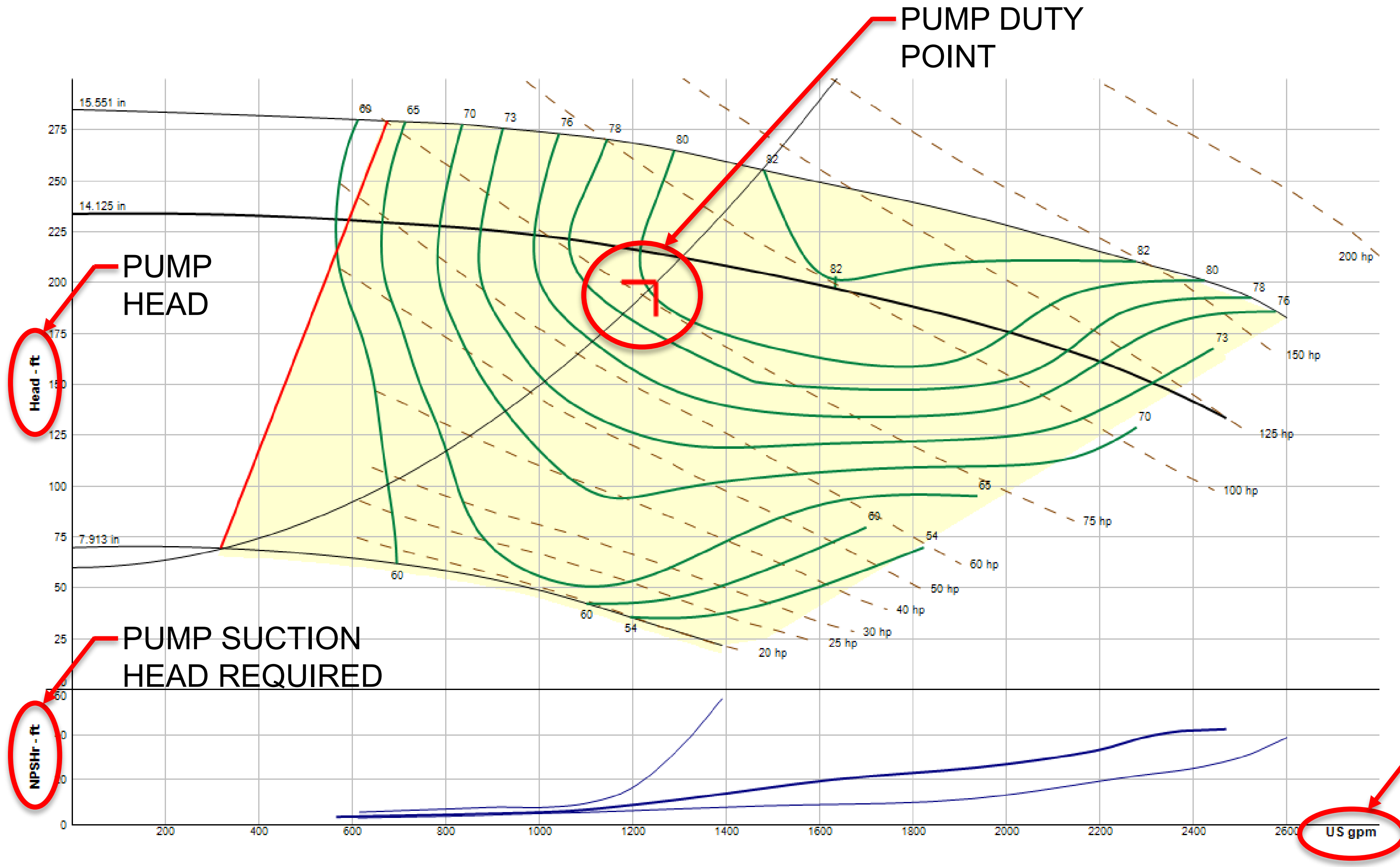
Constant Speed Curve



Variable Speed Curve

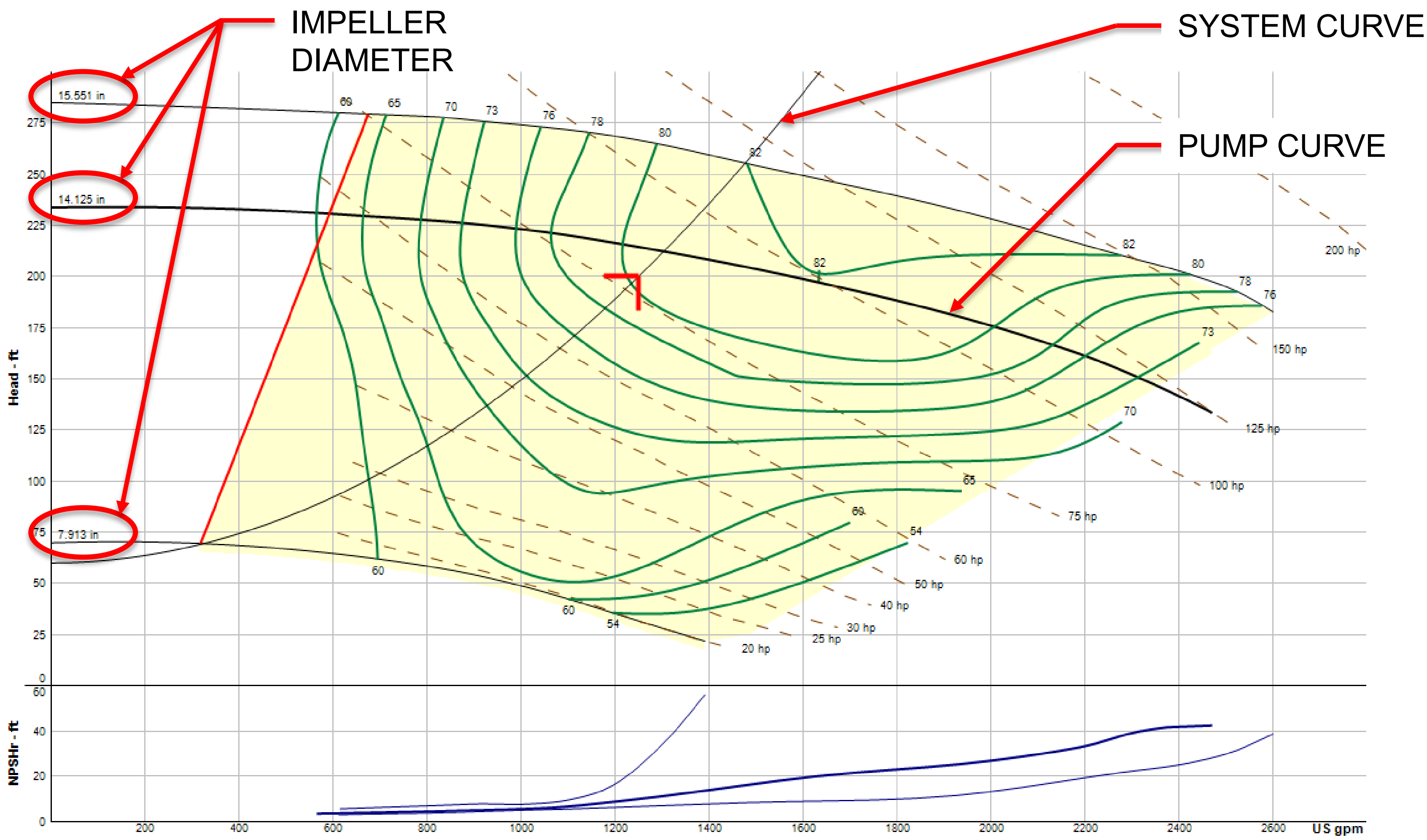


PUMP CURVES



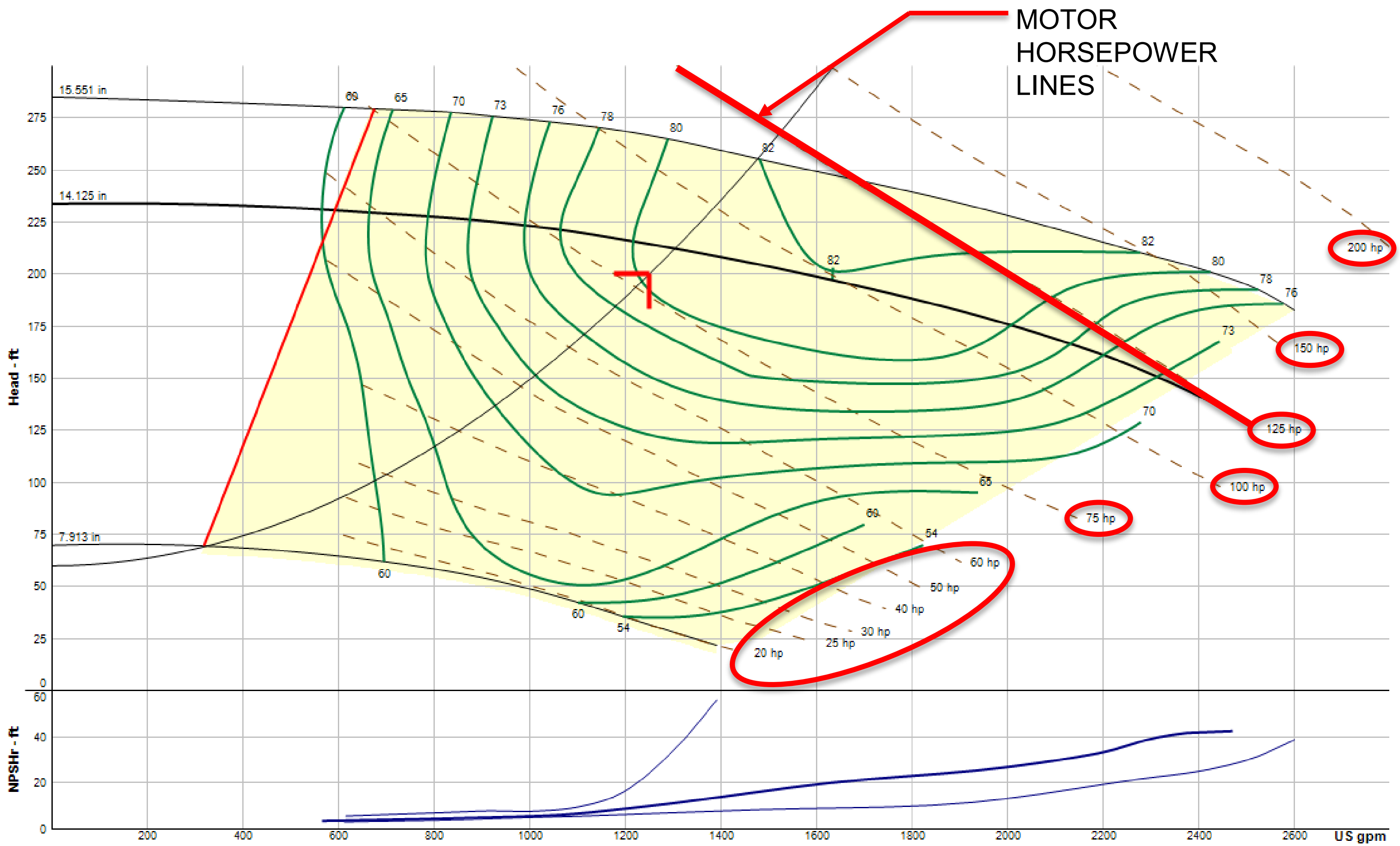
PUMP DUTY POINT
PUMP HEAD
PUMP SUCTION HEAD REQUIRED
FLOW
Head - ft
NPSHr - ft
US gpm
15.551 in
14.125 in
7.913 in
200 hp
150 hp
125 hp
100 hp
75 hp
60 hp
50 hp
40 hp
30 hp
25 hp
20 hp

PUMP CURVES

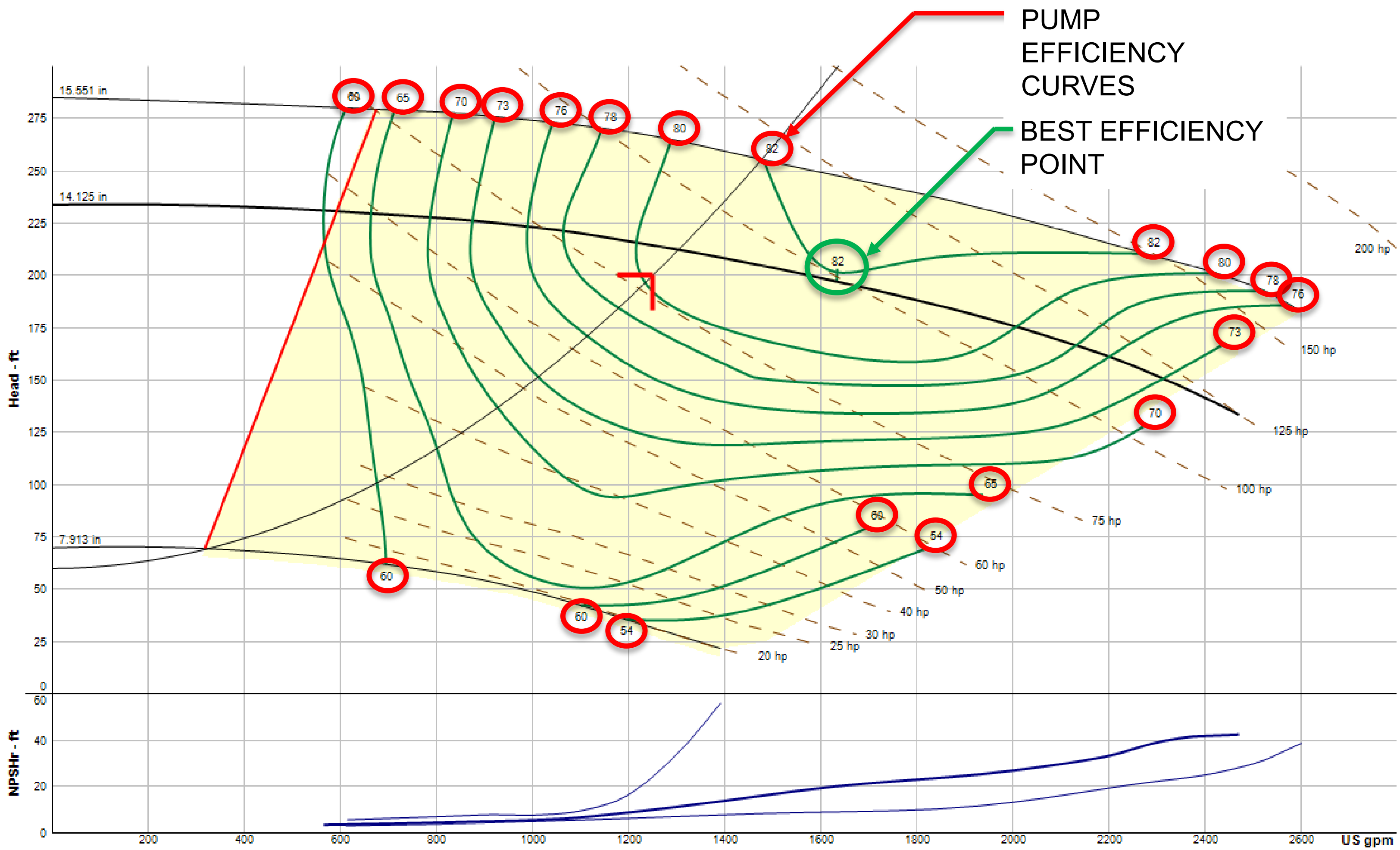


IMPELLER DIAMETER
SYSTEM CURVE
PUMP CURVE
15.551 in
14.125 in
7.913 in
Head - ft
NPSHr - ft
US gpm
200 hp
150 hp
125 hp
100 hp
75 hp
60 hp
50 hp
40 hp
30 hp
25 hp
20 hp

PUMP CURVES


MOTOR
HORSEPOWER
LINES
15.551 in
14.125 in
7.913 in
Head - ft
NPSHr - ft
US gpm
200 hp
150 hp
125 hp
100 hp
75 hp
60 hp
50 hp
40 hp
30 hp
25 hp
20 hp

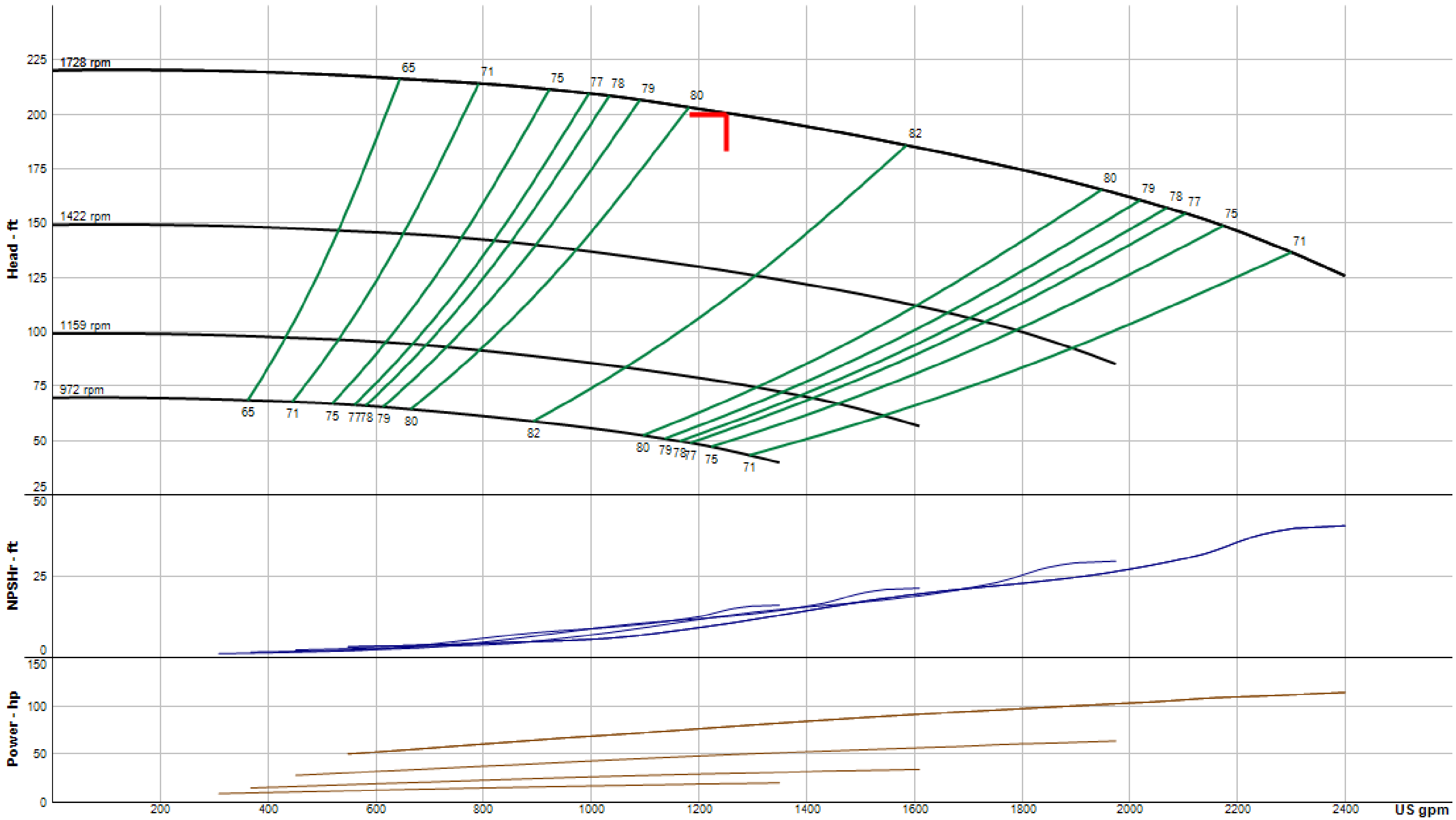
PUMP CURVES


PUMP EFFICIENCY CURVES
BEST EFFICIENCY POINT
15.551 in
14.125 in
7.913 in
Head - ft
NPSHr - ft
US gpm
200 hp
150 hp
125 hp
100 hp
75 hp
60 hp
50 hp
40 hp
30 hp
25 hp
20 hp

PUMP CURVES

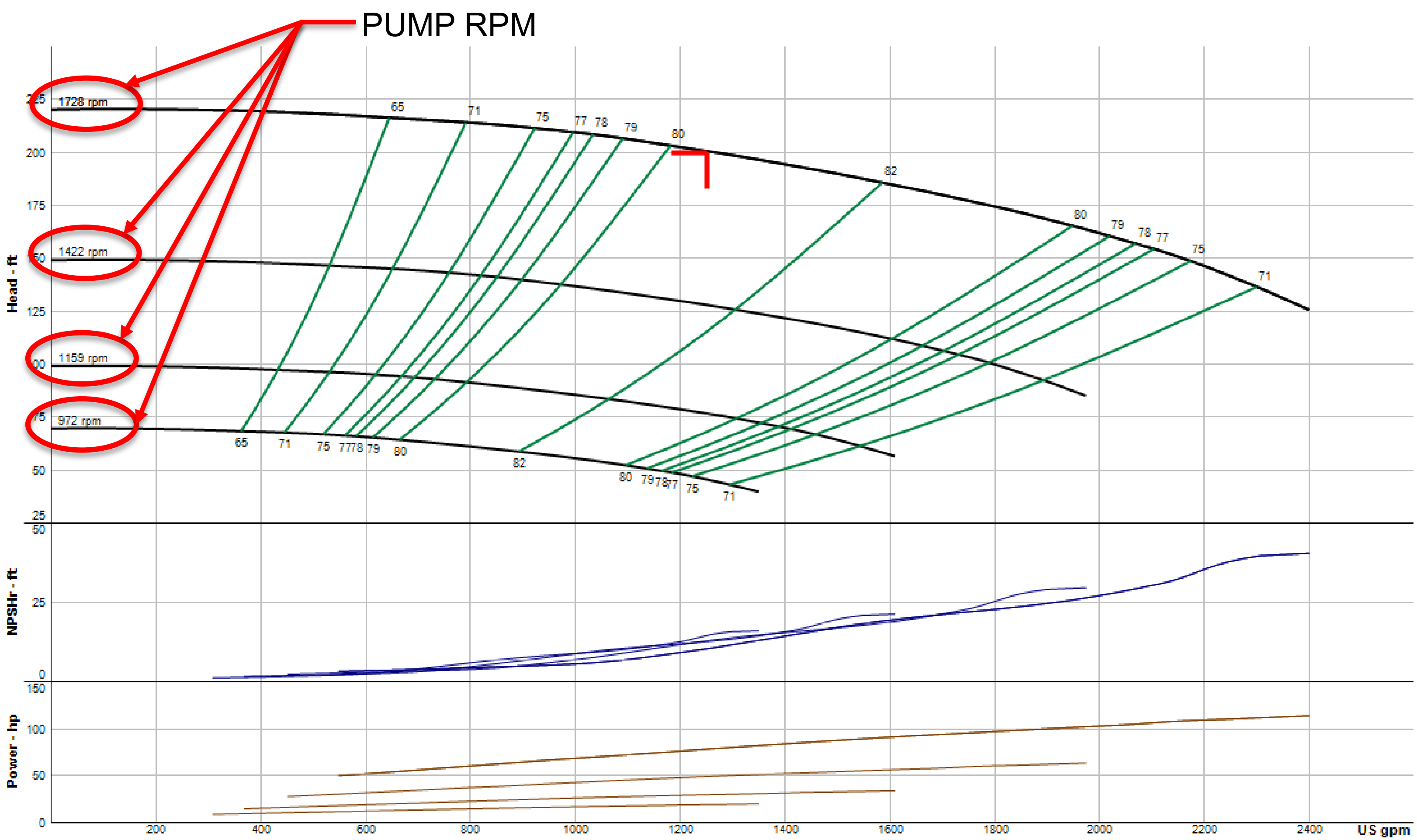
What if we are looking at a variable speed pump?

PUMP CURVES



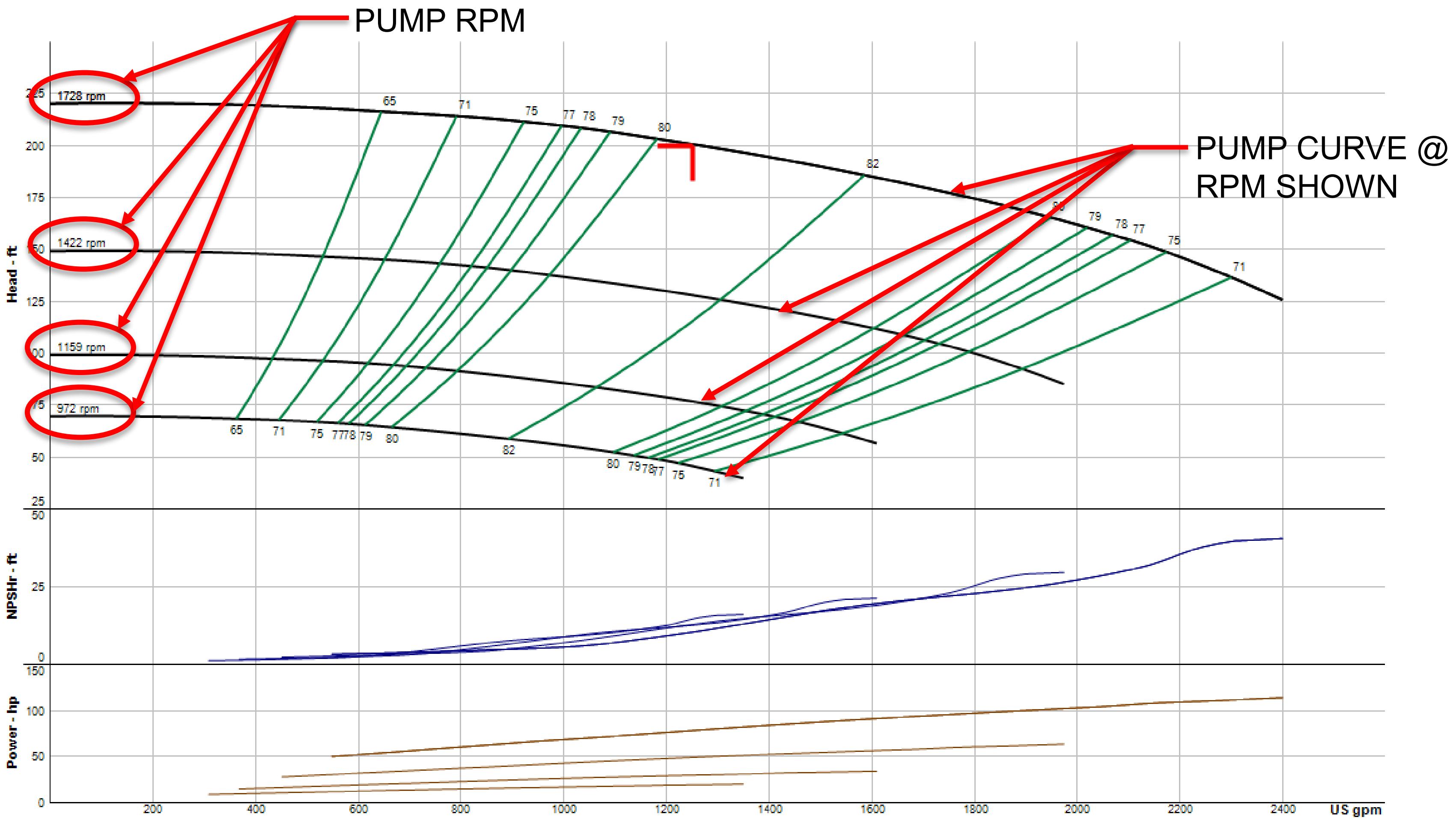
Pump Curves

PUMP CURVES



PUMP RPM
1728 rpm
1422 rpm
1159 rpm
972 rpm
Head - ft
NPSHr - ft
Power - hp
US gpm

PUMP CURVES



PUMP RPM
PUMP CURVE @ RPM SHOWN
1728 rpm
1422 rpm
1159 rpm
972 rpm
Head - ft
NPSHr - ft
Power - hp
US gpm

PUMP AFFINITY LAWS

FIRST AFFINITY LAW

$$\frac{GPM1}{GPM2} = \frac{RPM1}{RPM2}$$

SECOND AFFINITY LAW

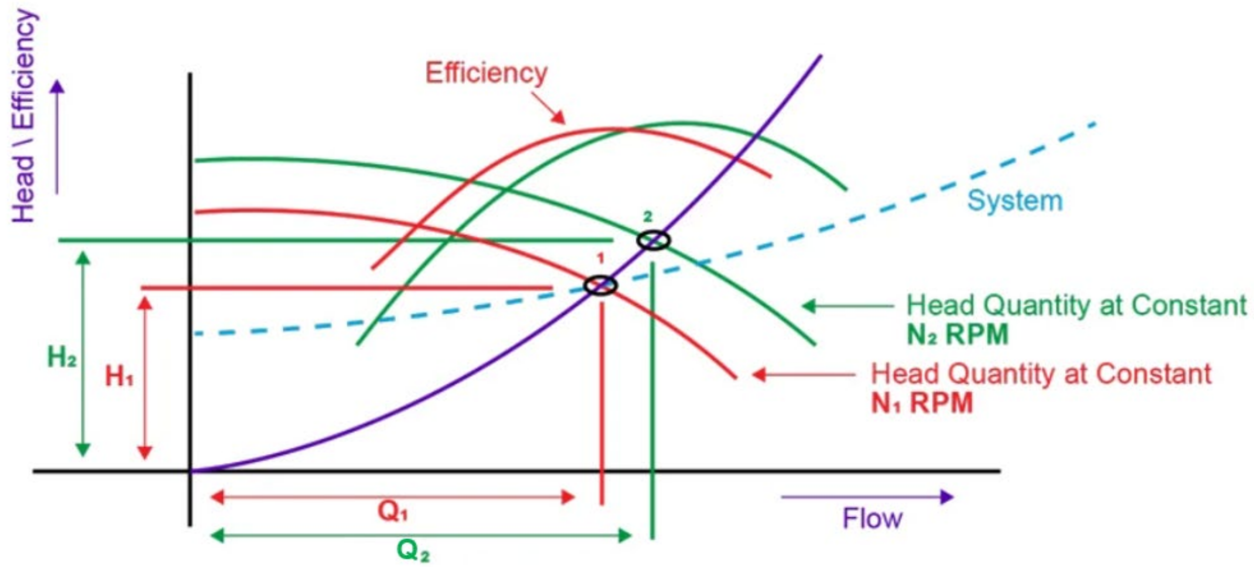
$$\left(\frac{RPM1}{RPM2}\right)^2 = \frac{HEAD1}{HEAD2}$$

THIRD AFFINITY LAW

$$\left(\frac{RPM1}{RPM2}\right)^3 = \frac{BHP1}{BHP2}$$

"Twice the speed gives twice the flow: Twice the speed gives four times the head: Twice the speed requires eight times the horsepower."

PUMP AFFINITY LAWS

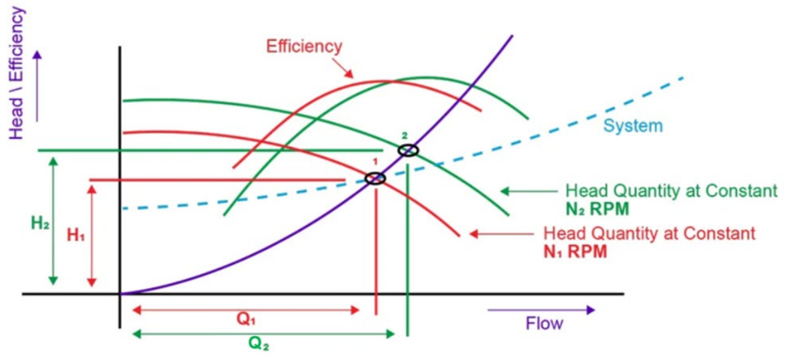


$$\frac{Q_1}{Q_2} = \frac{N_1}{N_2} \qquad \frac{H_1}{H_2} = \frac{N_1^2}{N_2^2} \qquad \frac{BHP_1}{BHP_2} = \frac{N_1^3}{N_2^3}$$

PUMP AFFINITY LAWS

$$\frac{Q_1}{Q_2} = \frac{N_1}{N_2} \qquad \frac{H_1}{H_2} = \frac{N_1^2}{N_2^2} \qquad \frac{BHP_1}{BHP_2} = \frac{N_1^3}{N_2^3}$$

Q_1 = 30,000 GPM	Q_2 = ?
H_1 = 240’ TDH	H_2 = ?
BHP_1 = 2138	BHP_2 = ?
N_1 = 560 RPM	N_2 = 475 RPM

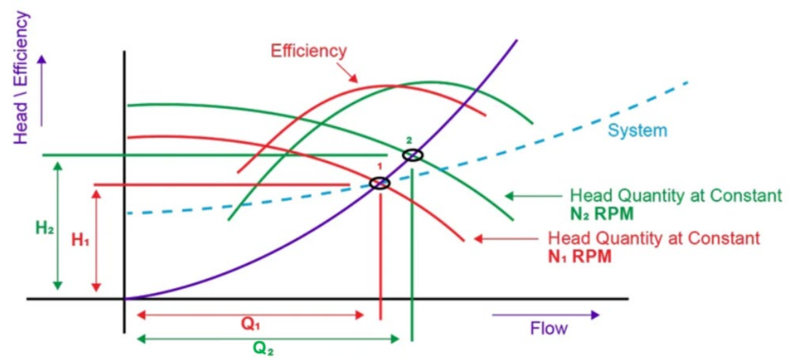


$$\frac{Q_1}{Q_2} = \frac{N_1}{N_2} \qquad \frac{H_1}{H_2} = \frac{N_1^2}{N_2^2} \qquad \frac{BHP_1}{BHP_2} = \frac{N_1^3}{N_2^3}$$

PUMP AFFINITY LAWS

$$\frac{Q_1}{Q_2} = \frac{N_1}{N_2} \qquad \frac{H_1}{H_2} = \frac{N_1^2}{N_2^2} \qquad \frac{BHP_1}{BHP_2} = \frac{N_1^3}{N_2^3}$$

Q_1 = 30,000 GPM	Q_2 = ?
H_1 = 240' TDH	H_2 = ?
BHP_1 = 2138	BHP_2 = ?
N_1 = 560 RPM	N_2 = 475 RPM

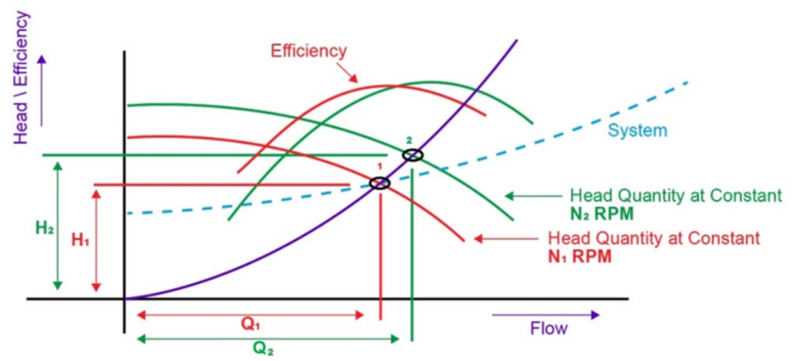


$$\frac{Q_1}{Q_2} = \frac{N_1}{N_2} \qquad \frac{H_1}{H_2} = \frac{N_1^2}{N_2^2} \qquad \frac{BHP_1}{BHP_2} = \frac{N_1^3}{N_2^3}$$

$$Q_2 = \frac{N_2}{N_1} \times Q_1 \Longrightarrow \frac{475}{560} \times 30{,}000 = 25{,}446 \text{ GPM}$$ → 15% Reduction

PUMP AFFINITY LAWS

$$\frac{Q_1}{Q_2} = \frac{N_1}{N_2} \qquad \frac{H_1}{H_2} = \frac{N_1^2}{N_2^2} \qquad \frac{BHP_1}{BHP_2} = \frac{N_1^3}{N_2^3}$$



$$\frac{Q_1}{Q_2} = \frac{N_1}{N_2} \qquad \frac{H_1}{H_2} = \frac{N_1^2}{N_2^2} \qquad \frac{BHP_1}{BHP_2} = \frac{N_1^3}{N_2^3}$$

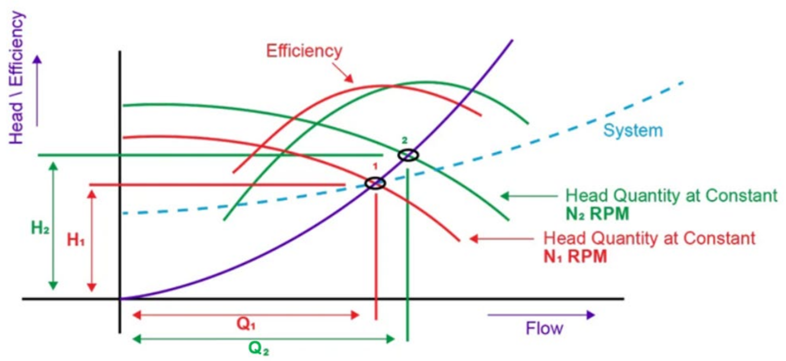
Q_1 = 30,000 GPM	Q_2 = ?
H_1 = 240' TDH	H_2 = ?
BHP_1 = 2138	BHP_2 = ?
N_1 = 560 RPM	N_2 = 475 RPM

$$Q_2 = \frac{N_2}{N_1} \times Q_1 \implies \frac{475}{560} \times 30{,}000 = 25{,}446 \text{ GPM}$$ → 15% Reduction

$$H_2 = \frac{N_2^2}{N_1^2} \times H_1 \implies \frac{475^2}{560^2} \times 240 = 173 \text{ TDH}$$ → 28% Reduction

PUMP AFFINITY LAWS

$$\frac{Q_1}{Q_2} = \frac{N_1}{N_2} \qquad \frac{H_1}{H_2} = \frac{N_1^2}{N_2^2} \qquad \frac{BHP_1}{BHP_2} = \frac{N_1^3}{N_2^3}$$



$$\frac{Q_1}{Q_2} = \frac{N_1}{N_2} \qquad \frac{H_1}{H_2} = \frac{N_1^2}{N_2^2} \qquad \frac{BHP_1}{BHP_2} = \frac{N_1^3}{N_2^3}$$

Q_1 = 30,000 GPM	Q_2 = ?
H_1 = 240' TDH	H_2 = ?
BHP_1 = 2138	BHP_2 = ?
N_1 = 560 RPM	N_2 = 475 RPM

$$Q_2 = \frac{N_2}{N_1} \times Q_1 \Longrightarrow \frac{475}{560} \times 30{,}000 = 25{,}446 \text{ GPM}$$ → 15% Reduction

$$H_2 = \frac{N_2^2}{N_1^2} \times H_1 \Longrightarrow \frac{475^2}{560^2} \times 240 = 173 \text{ TDH}$$ → 28% Reduction

$$BHP_2 = \frac{N_2^3}{N_1^3} \times BHP_1 \Longrightarrow \frac{475^3}{560^3} \times 2138 \approx 1{,}305 \text{ BHP}$$ → 39% Reduction

PLEV

Bell & Gossett "PLEV"

Part Load Efficiency Value for pumps

Based on 30% control head

PLEV Formula Weighting Factors & Water Pump Flow Rates						
	Weighting	Pump Flow Rate	Pump kw	Run Point	Pump Efficiency	Operating Hours
	1% 42% 45% 12%	100% 75% 50% 25%		A B C D		

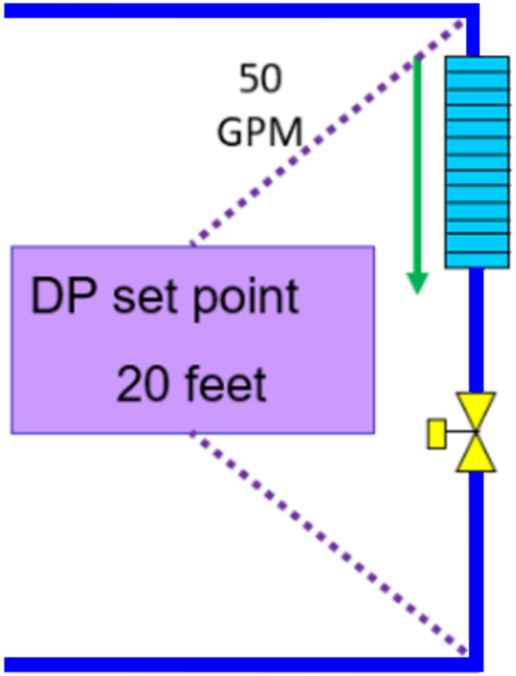
$$\text{Pump PLEV} = \frac{1}{\frac{1\%}{A} + \frac{42\%}{B} + \frac{45\%}{C} + \frac{12\%}{D}}$$

expressed in blended efficiency

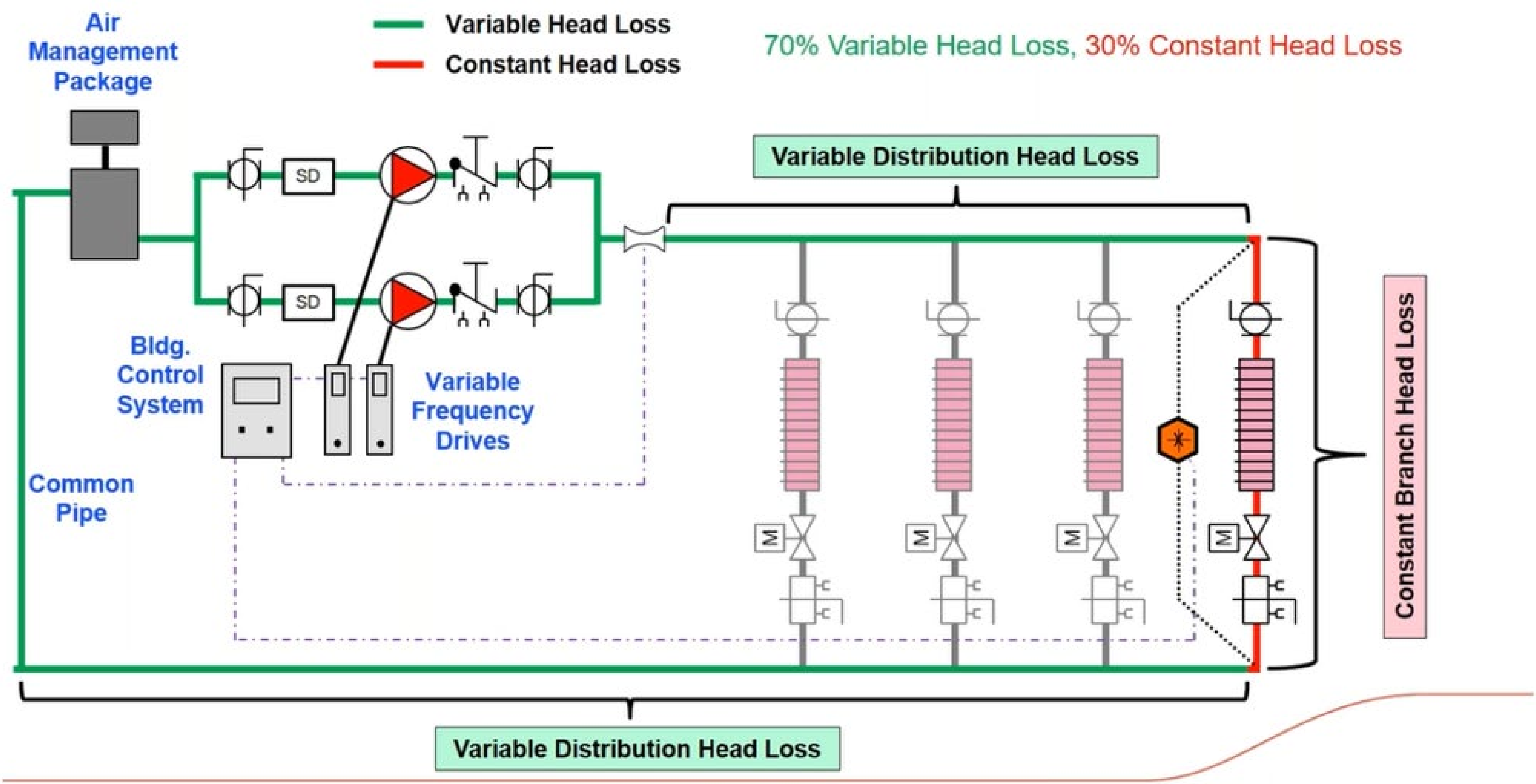
Helps designers in selecting pumps that operate at the highest efficiencies across the largest segment of the pump curve

CONTROL HEAD

<u>Control Head</u> – The minimum pump differential that the variable speed pump will ever produce while in operation.



SENSOR LOCATIONS



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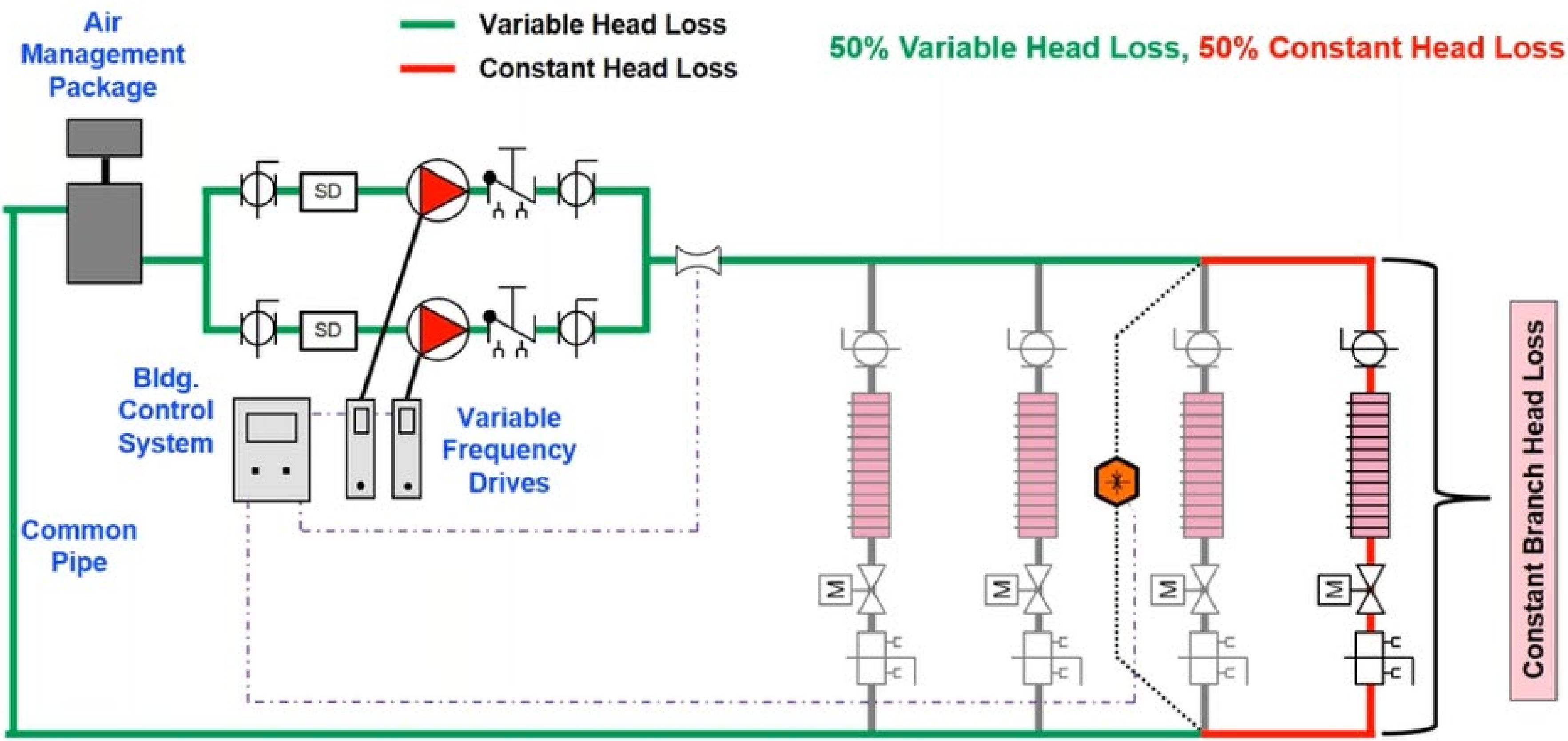

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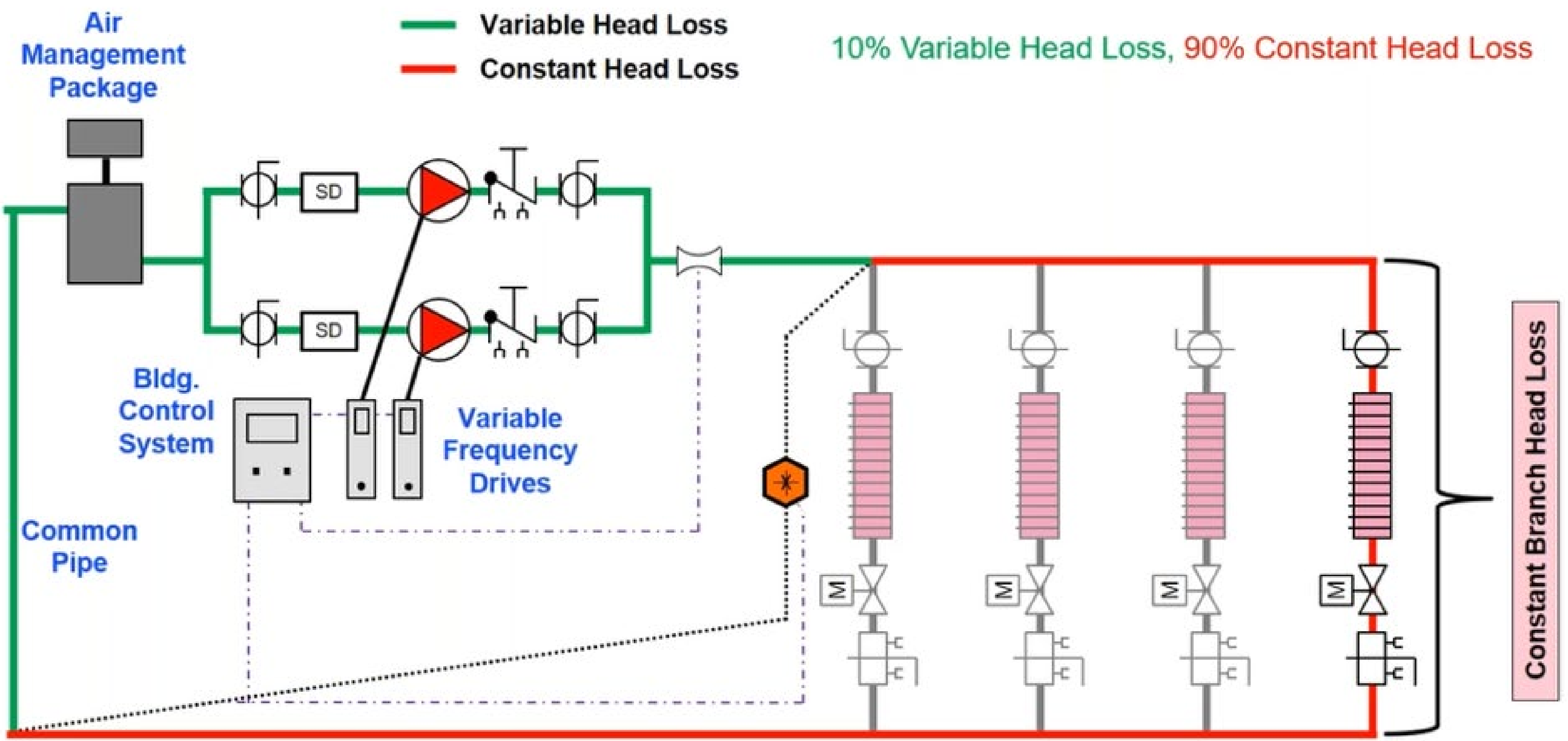

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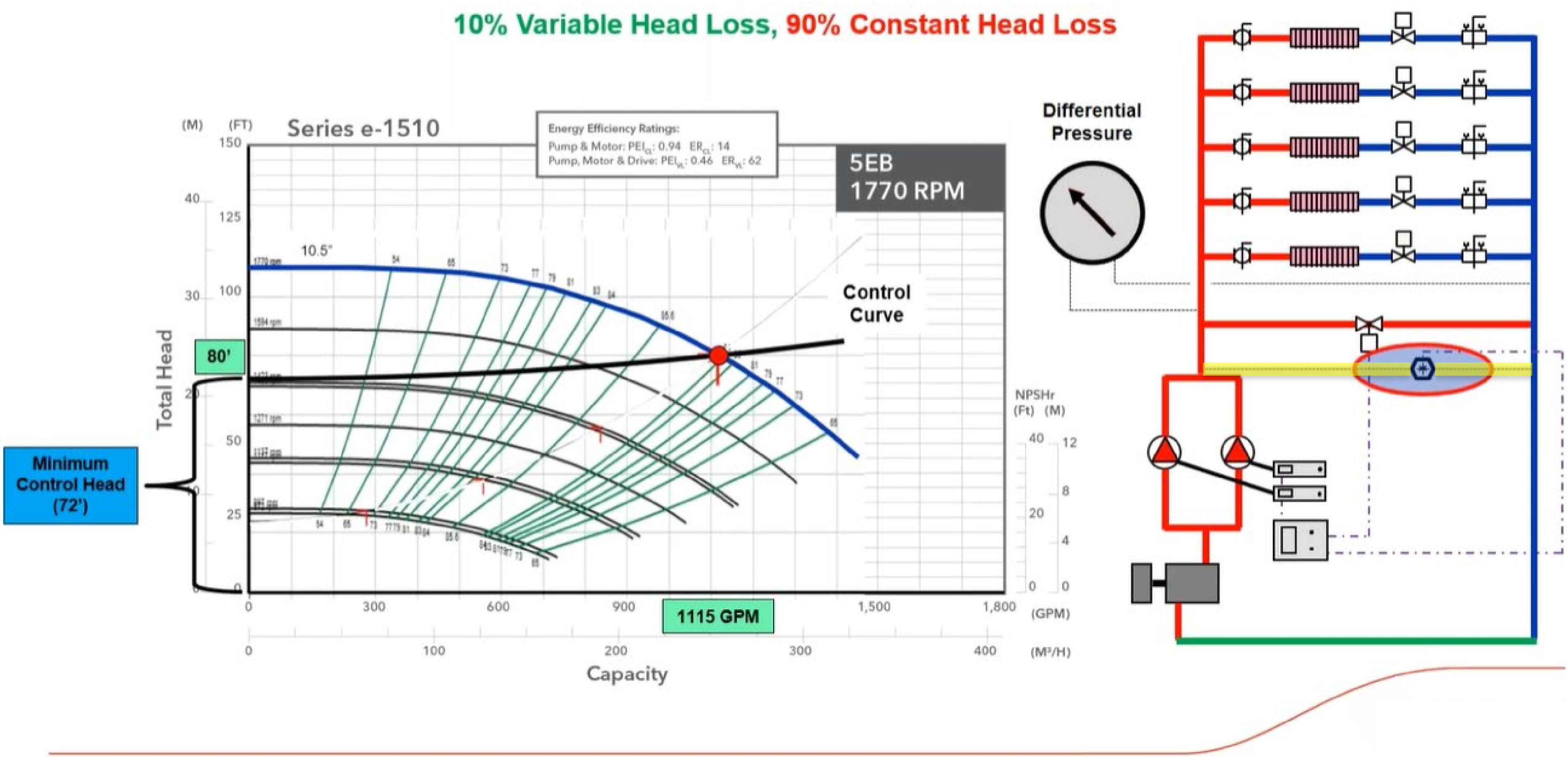

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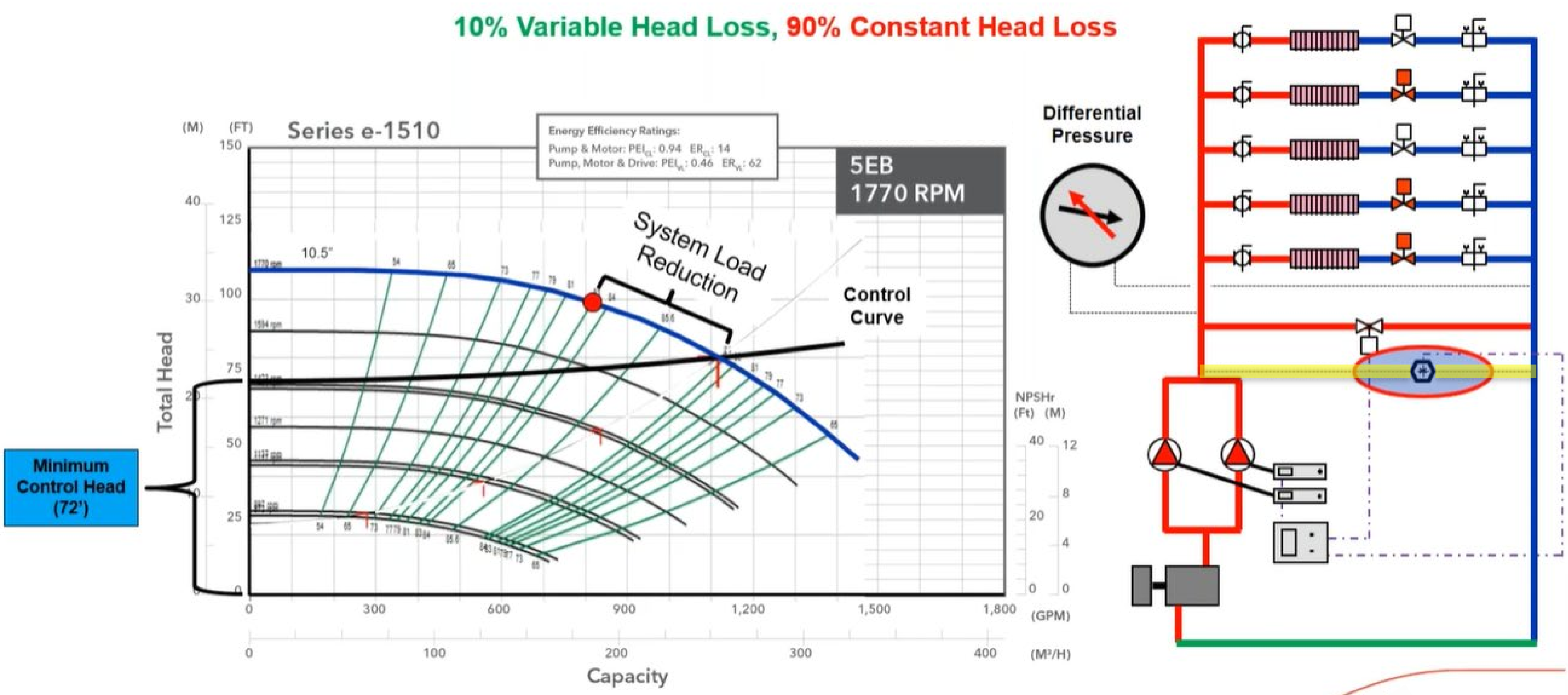

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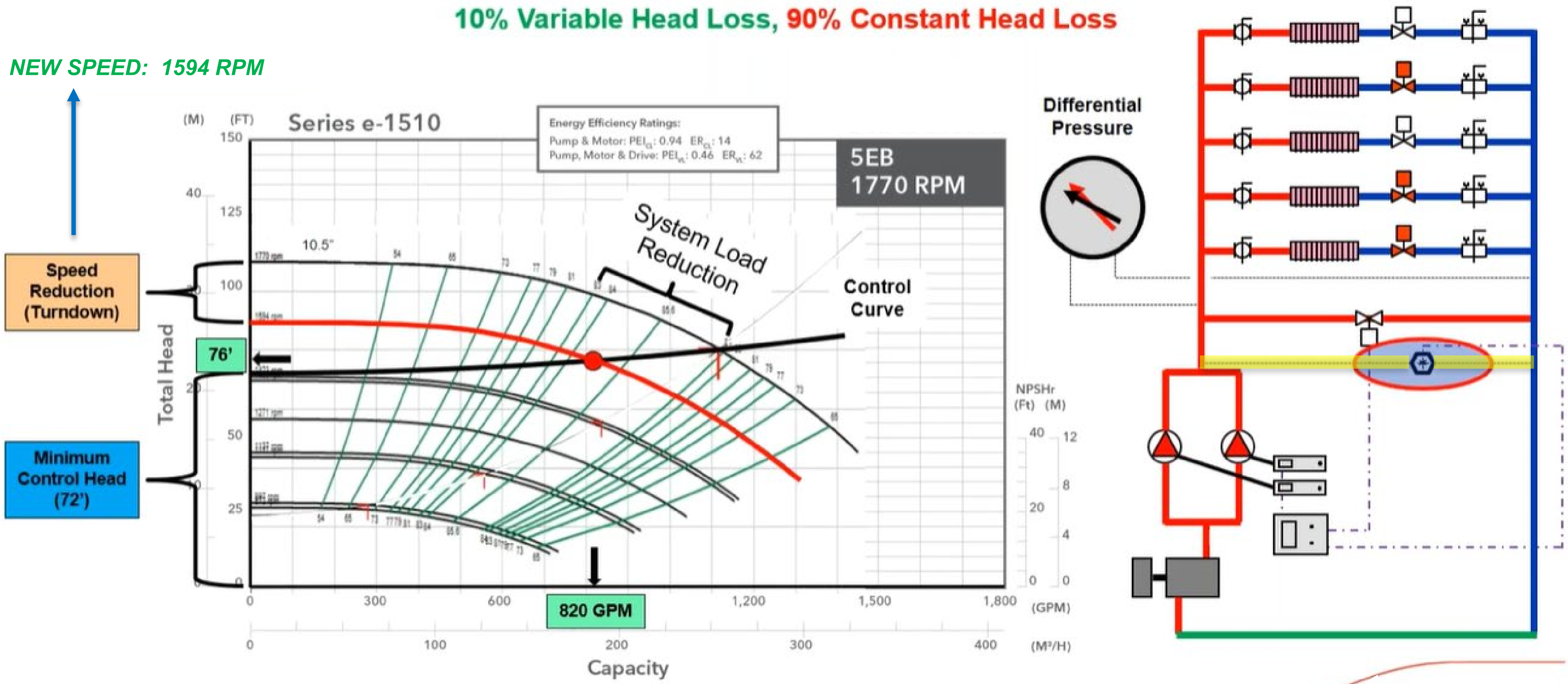

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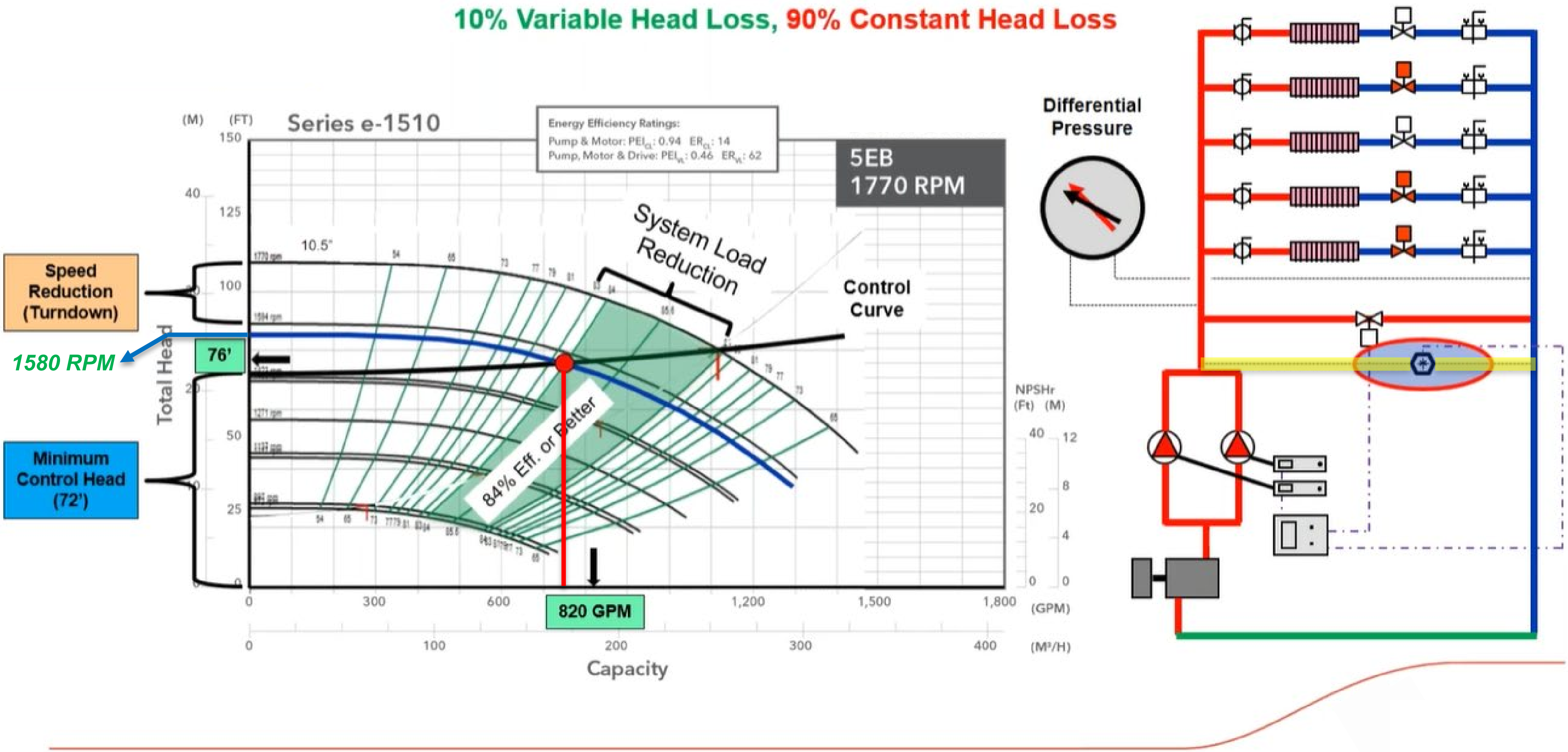

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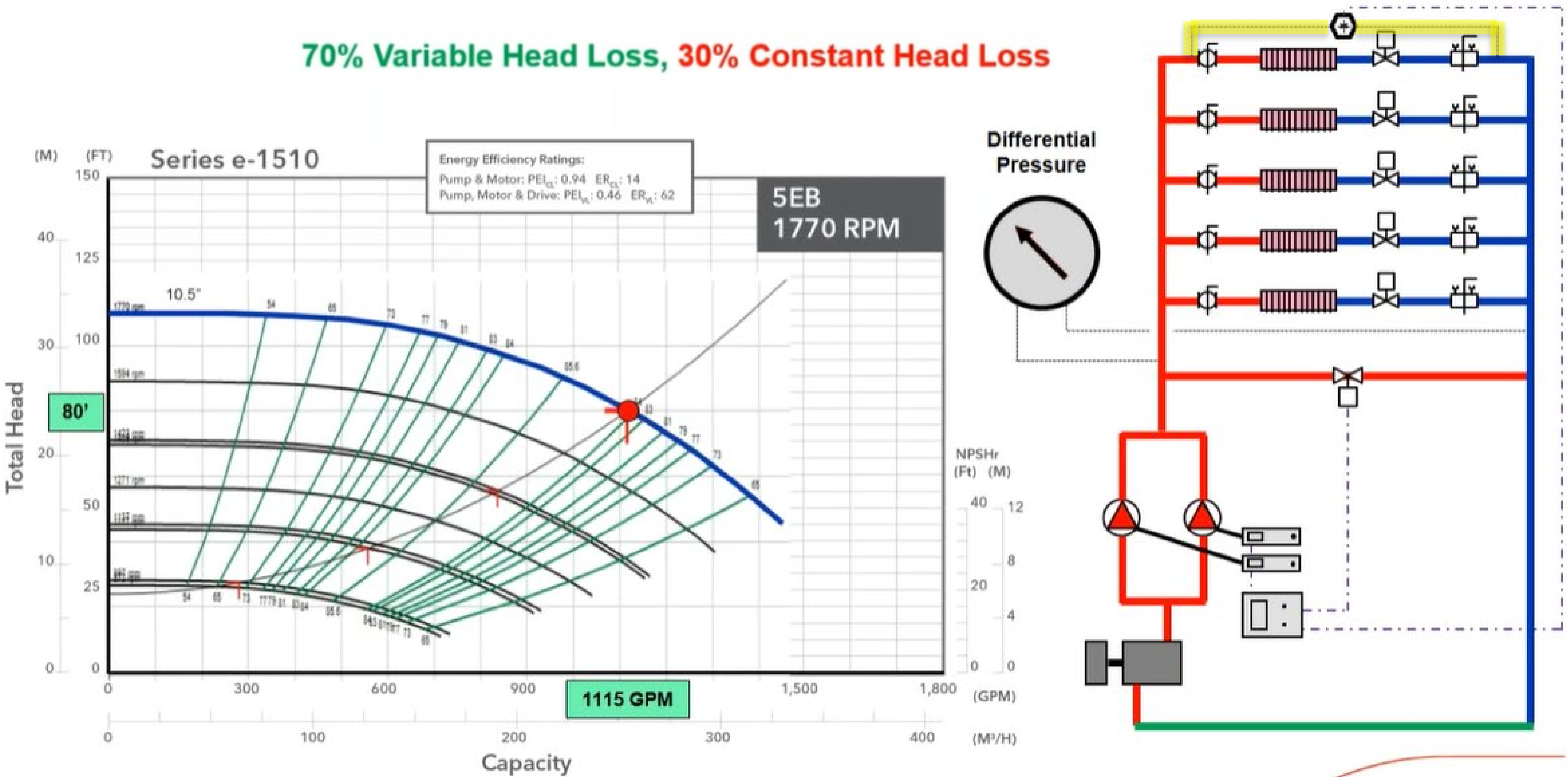

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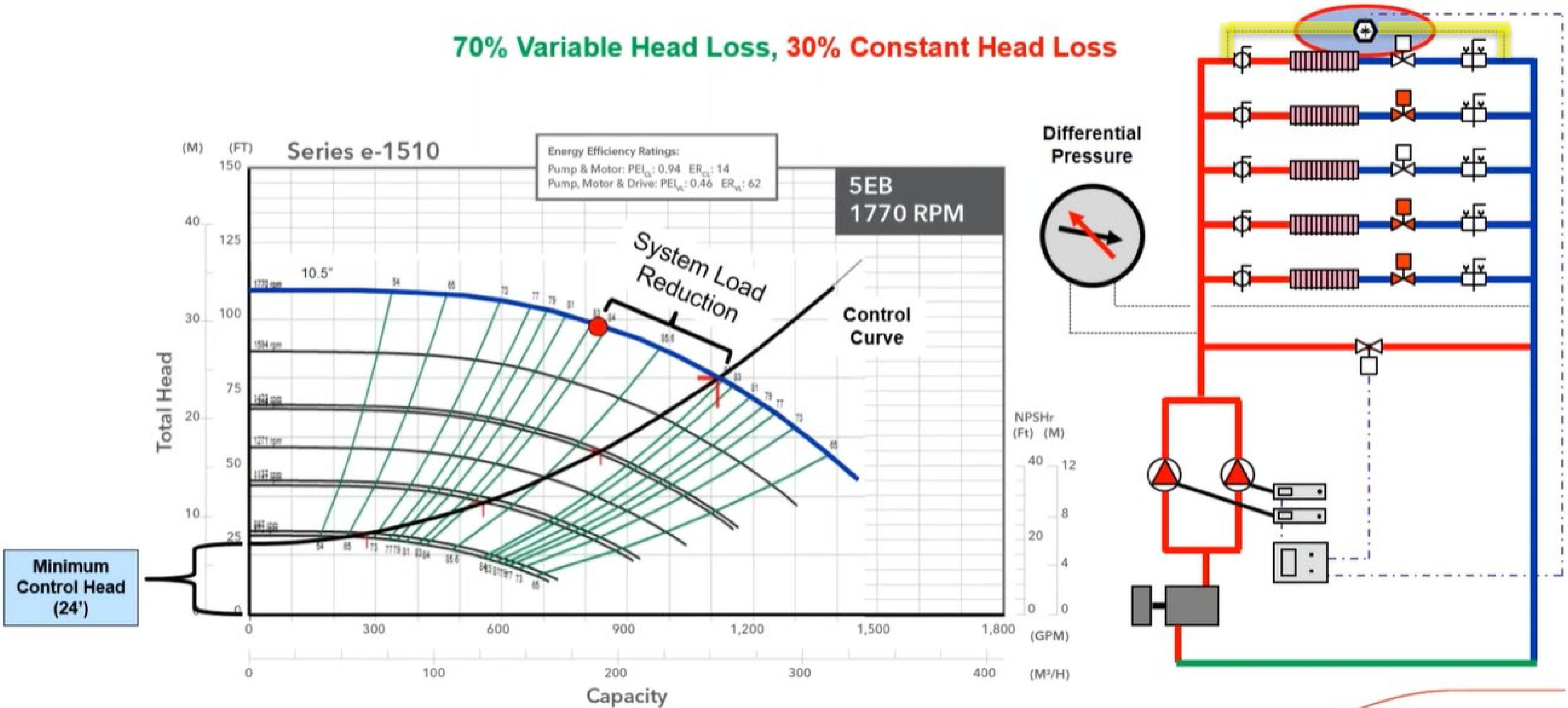

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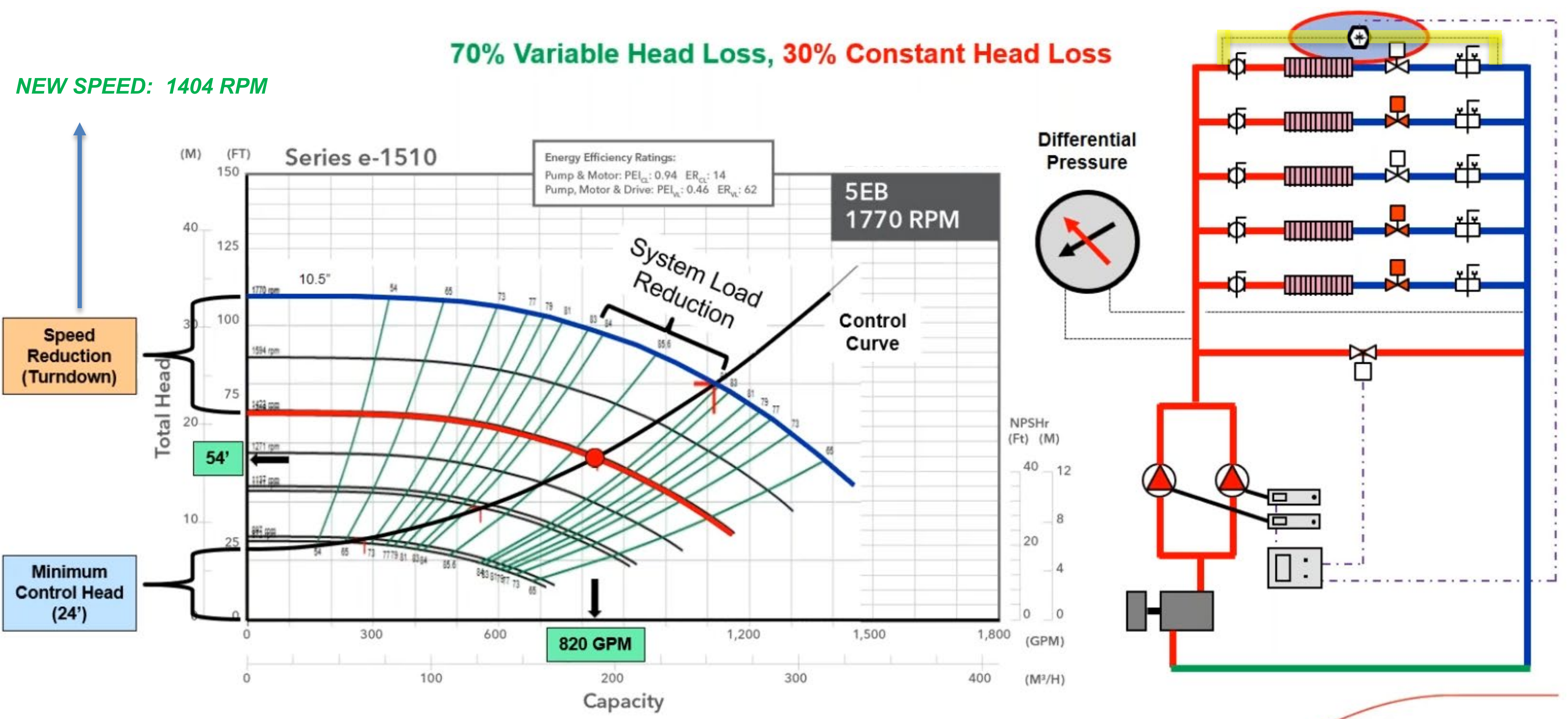

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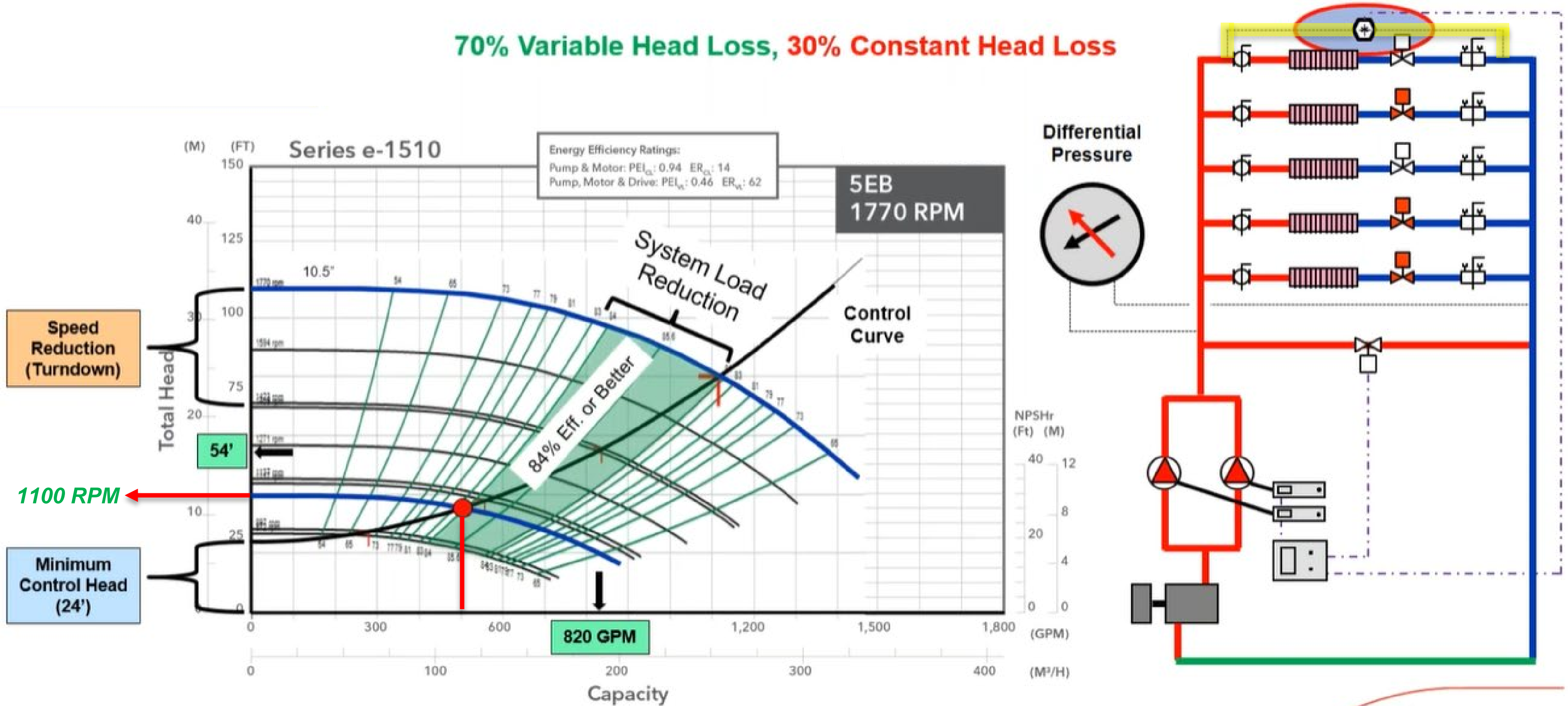

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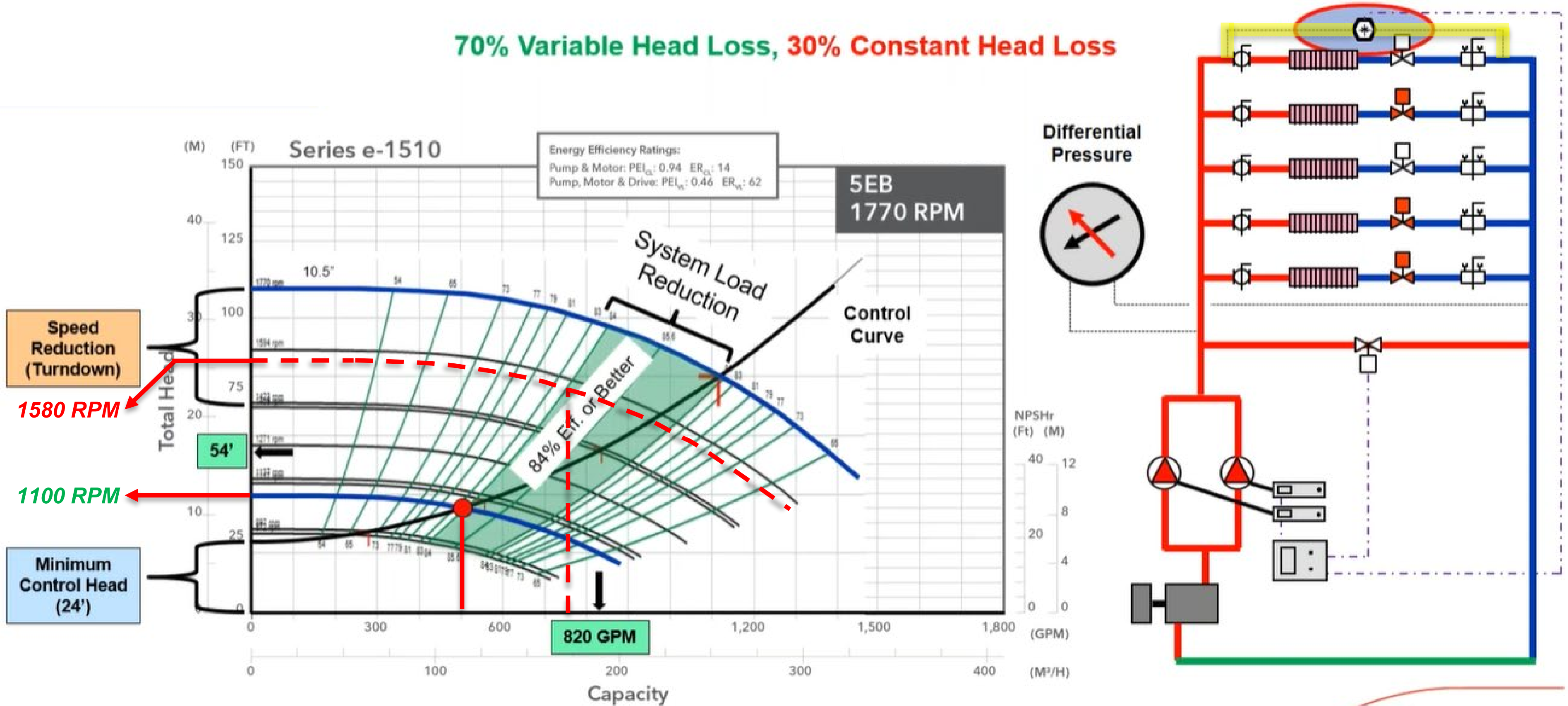


CONSTANT VS. VARIABLE

Oversized Constant Speed Pump					
225 GPM 108' Head 14.5 BHP	578 GPM 104' Head 21.7 BHP	705 GPM 101' Head 23.4 BHP	825 GPM 97' Head 24.6 BHP	978 GPM 89' Head 26.0 BHP	1115 GPM 80' Head 26.8 BHP
225 GPM 26' Head 2.3 BHP	578 GPM 39' Head 6.8 BHP	705 GPM 45' Head 9.7 BHP	825 GPM 55' Head 13.3 BHP	978 GPM 67' Head 19.3 BHP	1115 GPM 80' Head 26.8 BHP

Right sized Variable Speed Pump

EFFICIENT DESIGN

$Q = 500 \times gpm \times \Delta t$
Where :
Q = Load in btu/hr
500 = A units conversion constant
gpm = Flow rate in gallons per minute
Δt = Temperature difference across the element in °F

Accurate Head Estimation

- Allows for more efficient pump selections
- Keeps pump operating where it was designed
- Minimizes throttling

Differential Pressure Sensor Placement

- Minimizes constant head loss in system
- Maximizes variable head loss in system
- Lowers control head needed

Increasing Boiler ΔT

- Decreased system flow
- Decreased friction losses in piping
- Decreased pumping power required
- Allows for condensing in some cases
- More condensing = less energy wasted

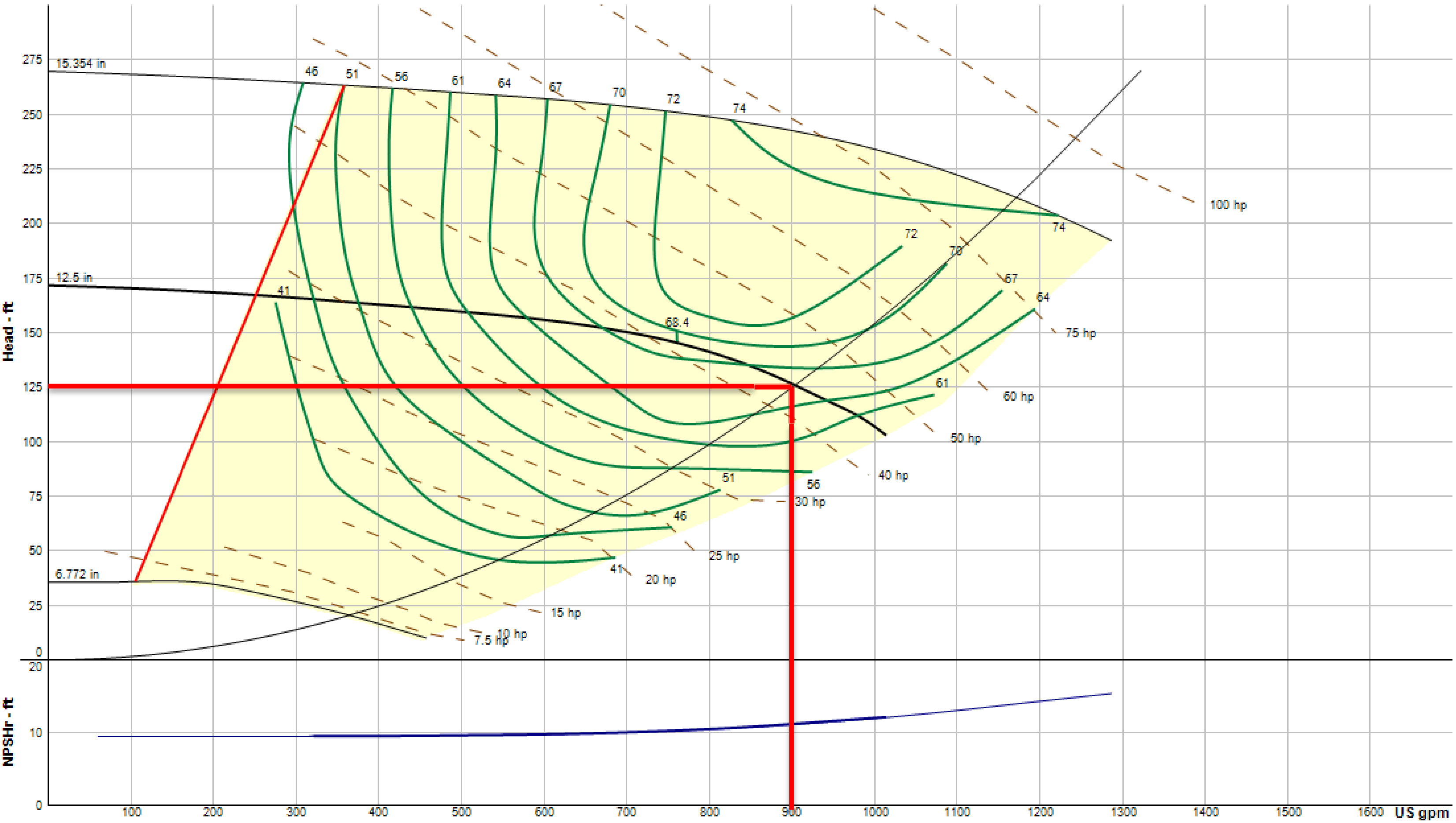
Decreasing Boiler Loads

- Keep fire rates low when possible
- Share loads between multiple units instead of keeping only one unit operating at higher fire rate
- Increases overall boiler plant efficiency

EFFICIENT DESIGN

Design Duty Point

- 900 GPM
- 125 Feet

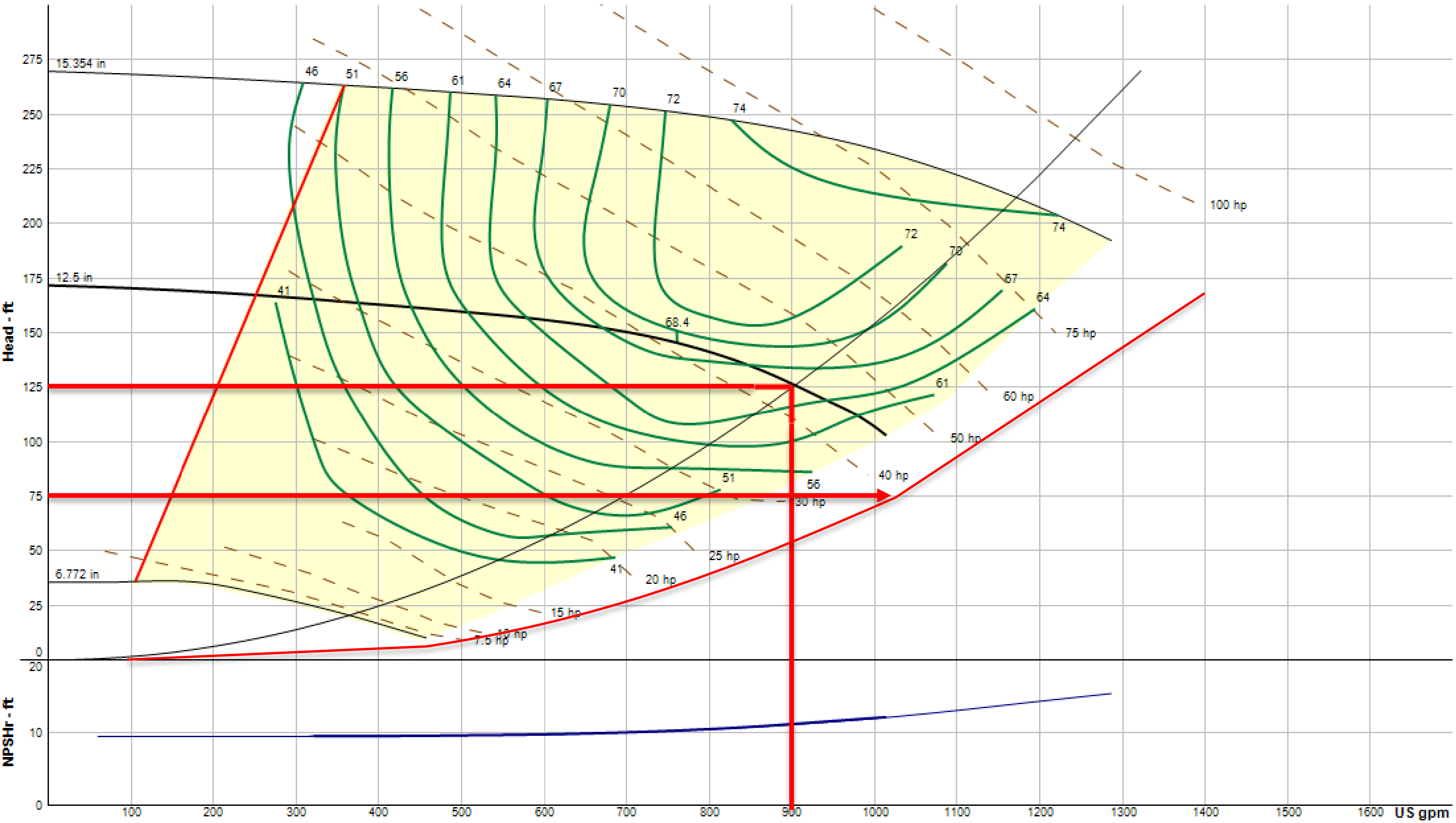


End of Curve Selections

EFFICIENT DESIGN

Design Duty Point
- 900 GPM
- 125 Feet

Actual Duty Point
- 900 GPM
- 75 Feet

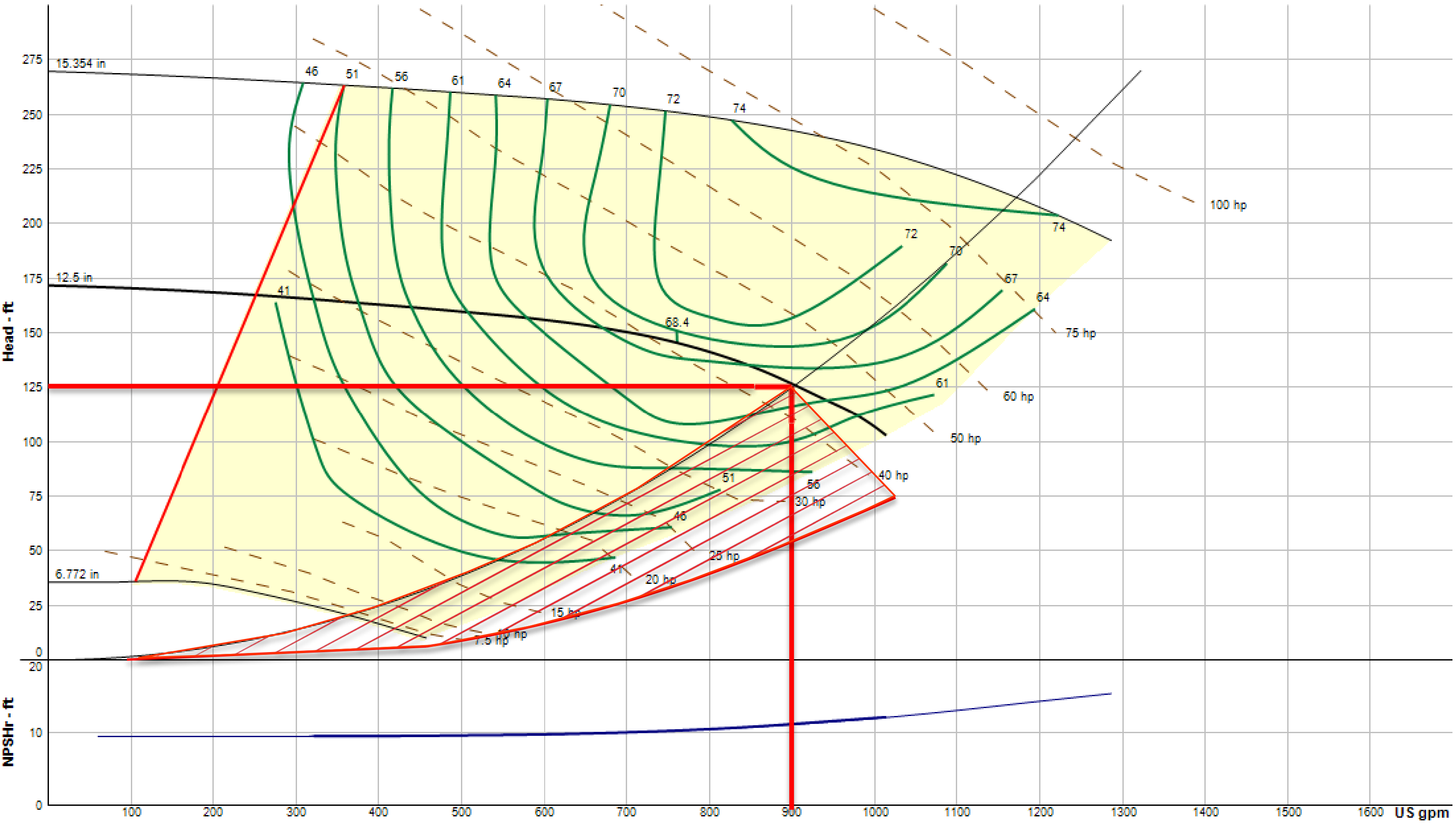


End of Curve Selections

EFFICIENT DESIGN

<u>Design Duty Point</u>
- 900 GPM
- 125 Feet

<u>Actual Duty Point</u>
- 900 GPM
- 75 Feet

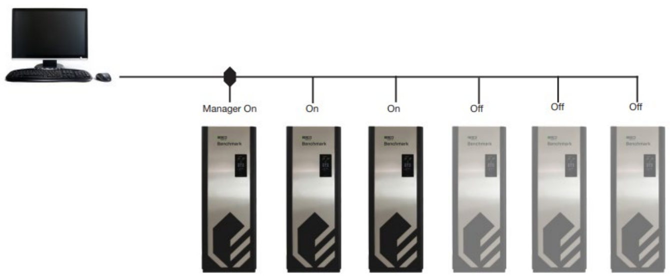


End of Curve Selections

EFFICIENT DESIGN

<u>Boiler Sequencing</u>

- Increased system turndown to maximize operating efficiency
- Keeps fire rate low for better operating efficiency



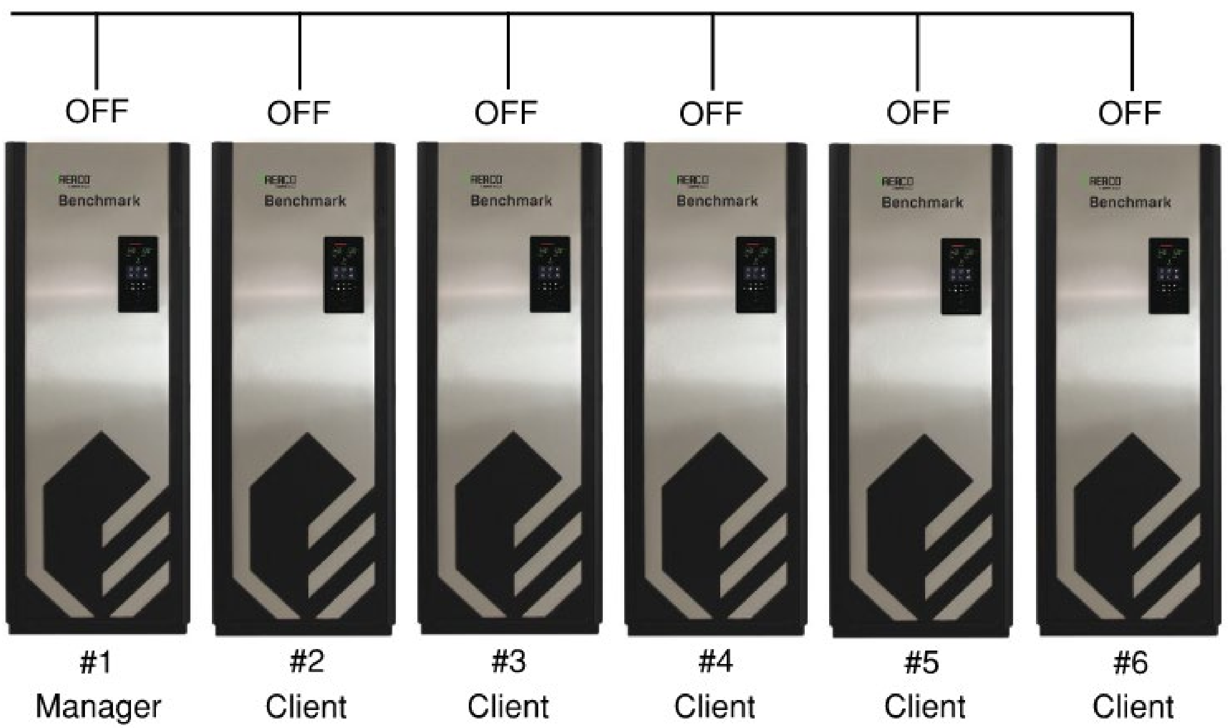
BST System Parameters

- BST mode
- BST setpoint
- BST auto master
- BST Unit outlet temp
- BST num units enabled
- BST units faulted
- ManagerUnit Address
- BST header temp
- BST outdoor temp
- BST fire rate output
- BST Unit Ignited
- BST Active Setpoint
- Next turn on fire rate
- BST setpoint mode

Boiler Parameters

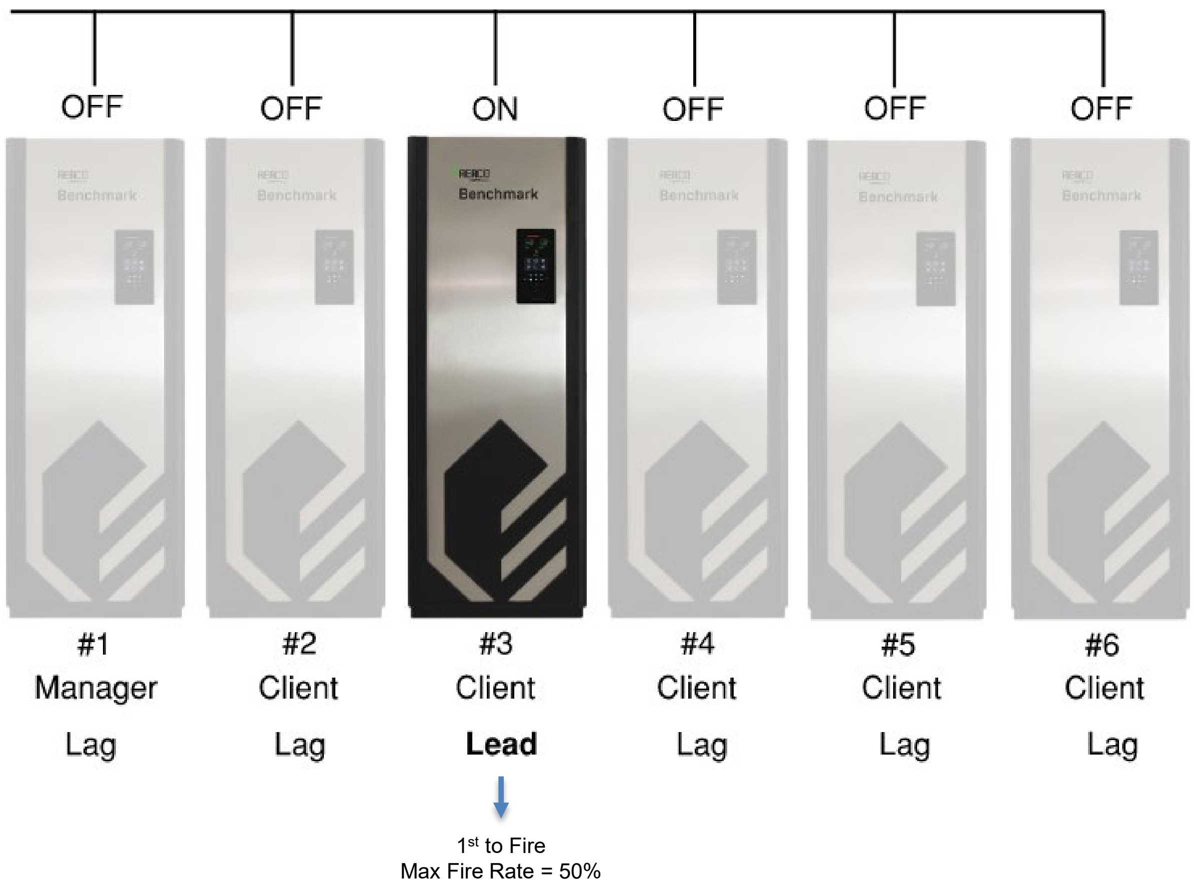
- Comm addr
- Unit Status
- Fault status
- Outlet temp
- Inlet temp
- Exhaust temp
- Air temp
- Flame strength
- Fire rate out
- Boiler Isolation Valve State
- Network remote setpoint
- Run cycles
- Run hours
- O_2 Level

EFFICIENT DESIGN



AERCO® RL DEPPMANN

EFFICIENT DESIGN



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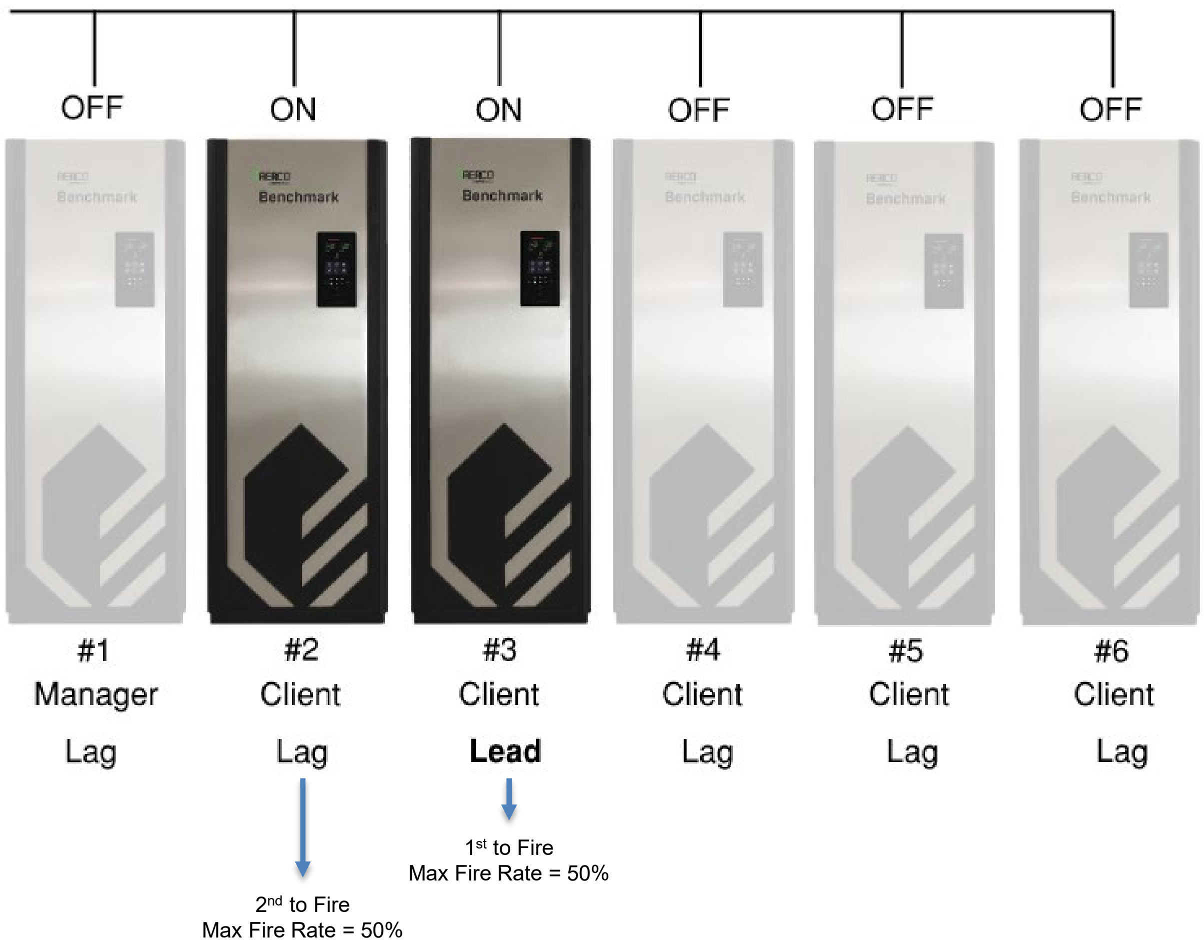

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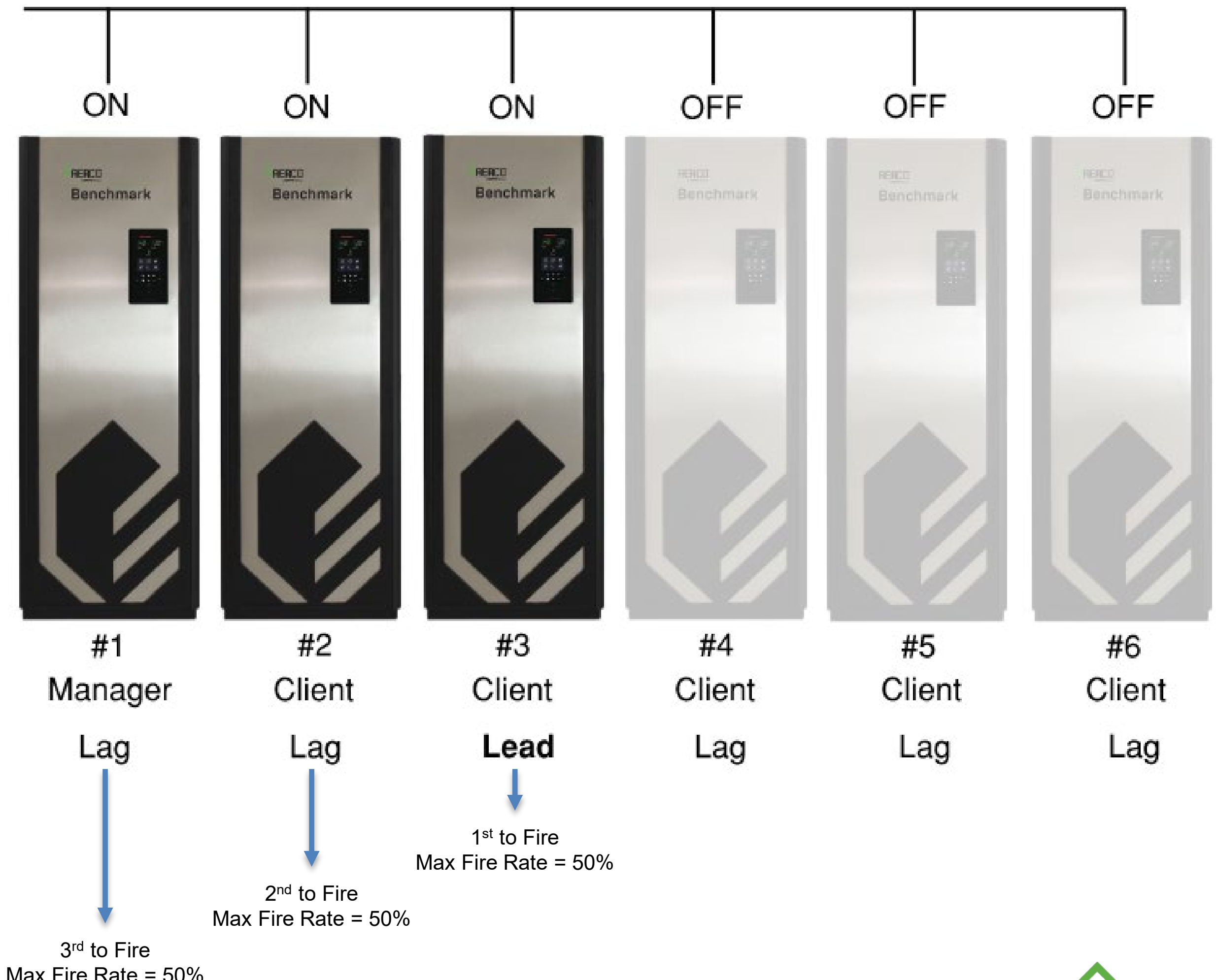

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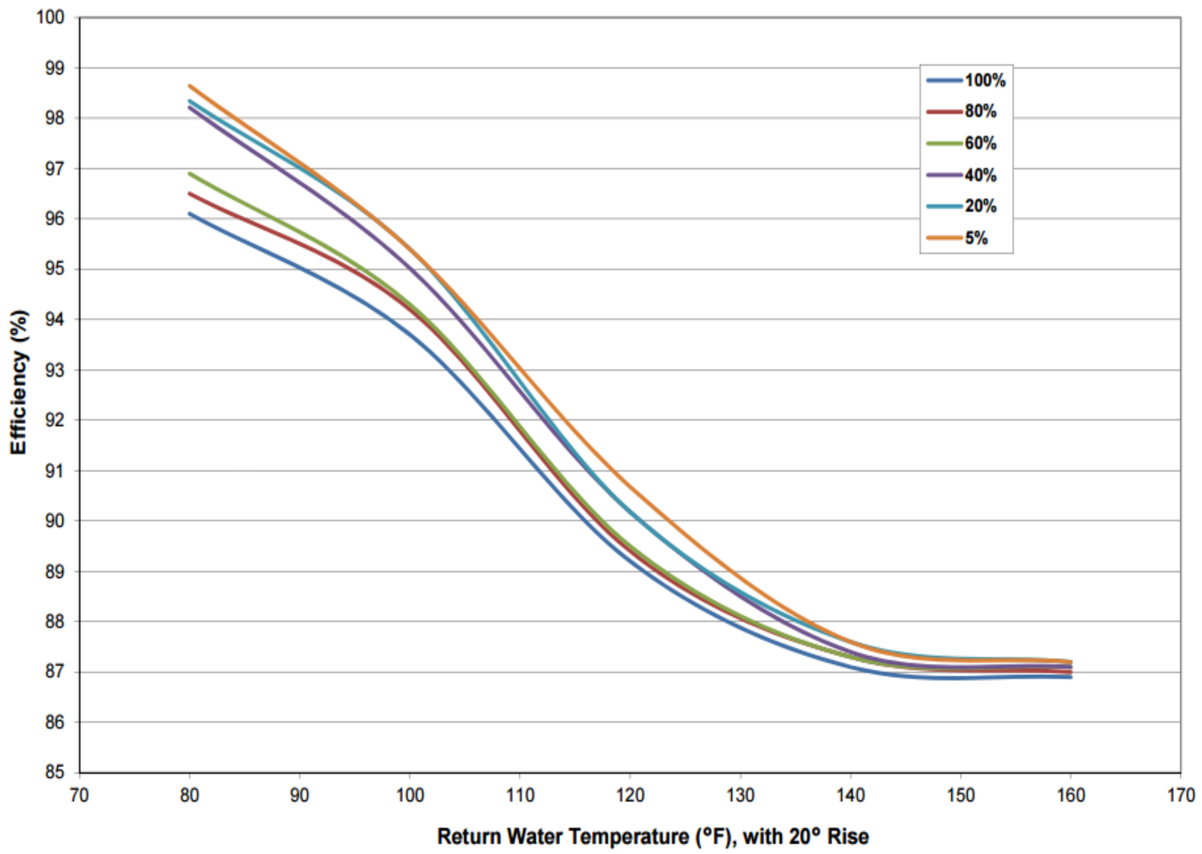
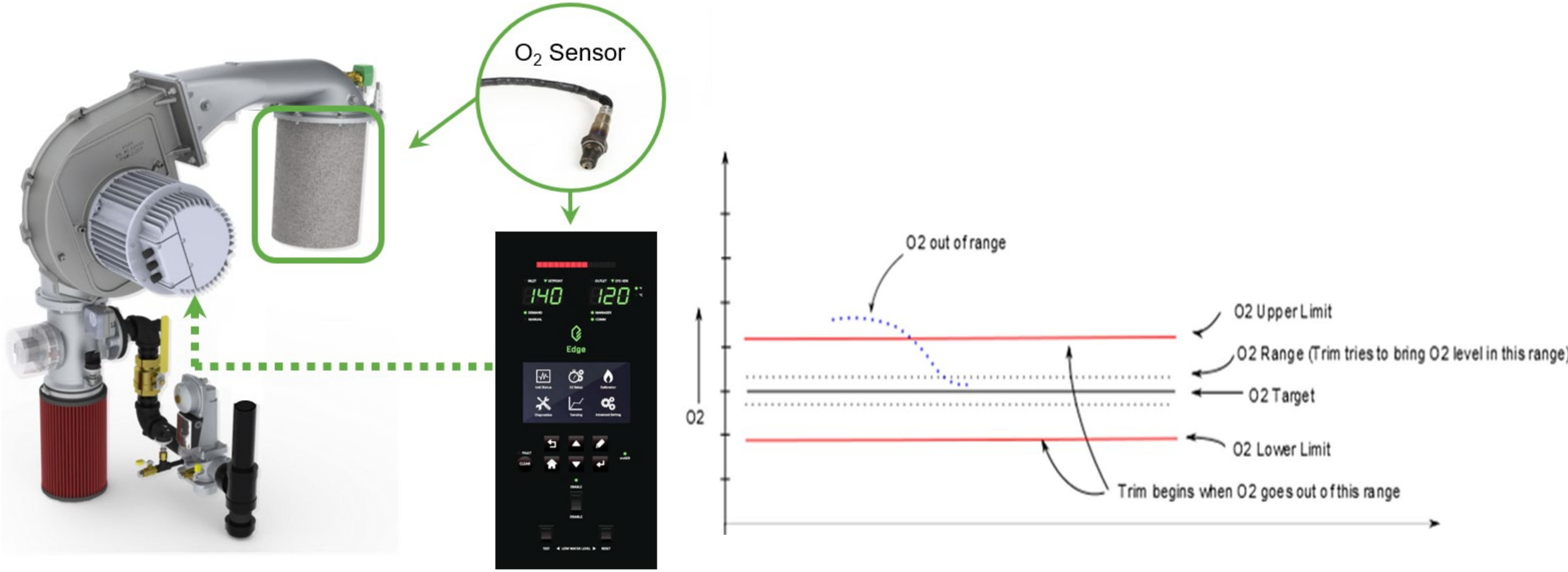


MAINTAINING EFFICIENCY

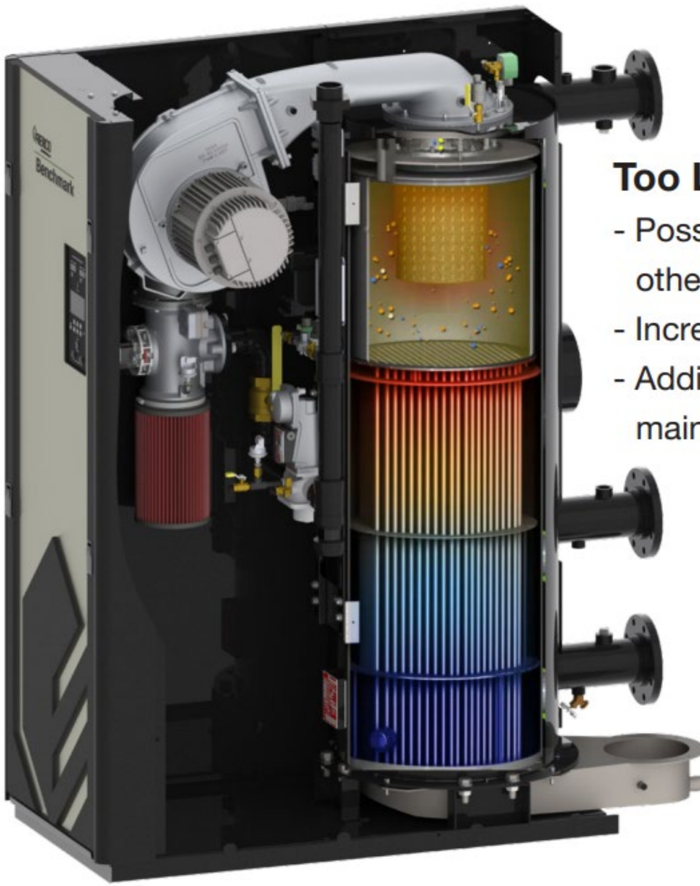


O2 Trim

MAINTAINING EFFICIENCY

AERtrim

- Optimal O_2 levels
- Saves energy and lowers operational costs
- Reduces unscheduled maintenance
- Decreases emissions



Too Little O_2

- Possible flame loss and other faults
- Increased emissions
- Additional unscheduled maintenance

MAINTAINING EFFICIENCY

<u>AERtrim</u>

- Optimal O_2 levels
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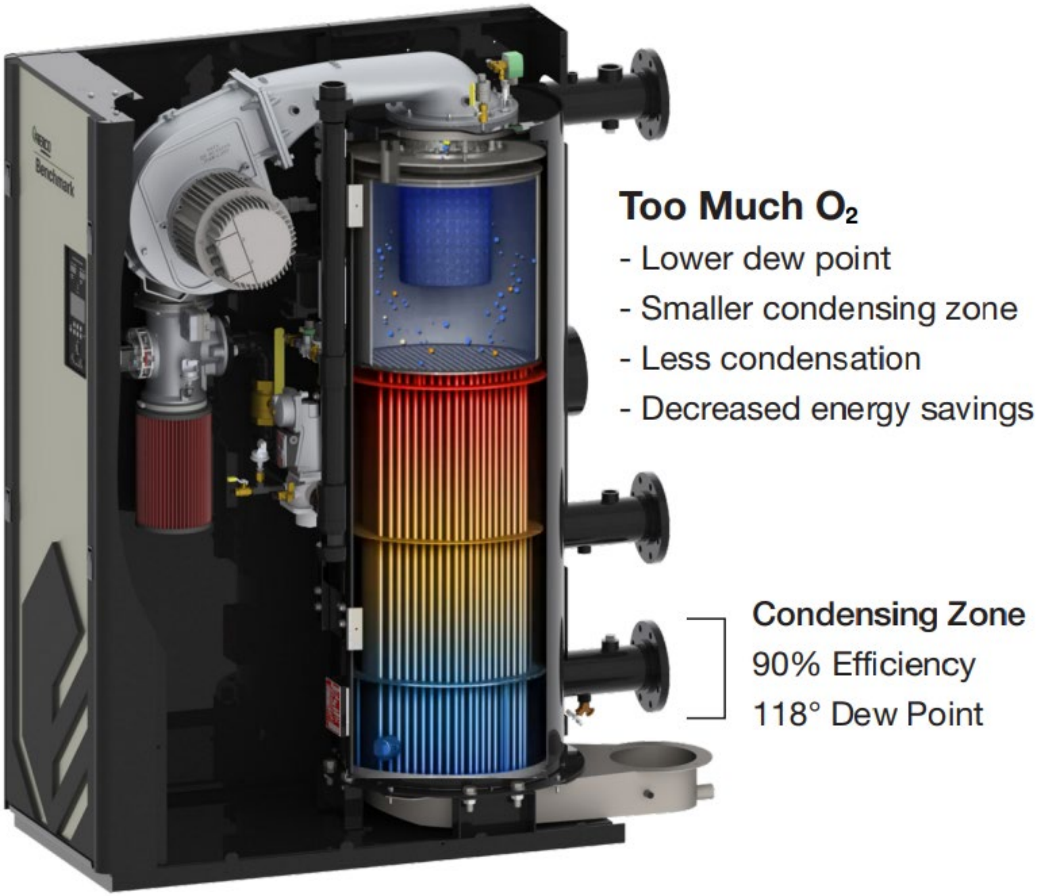

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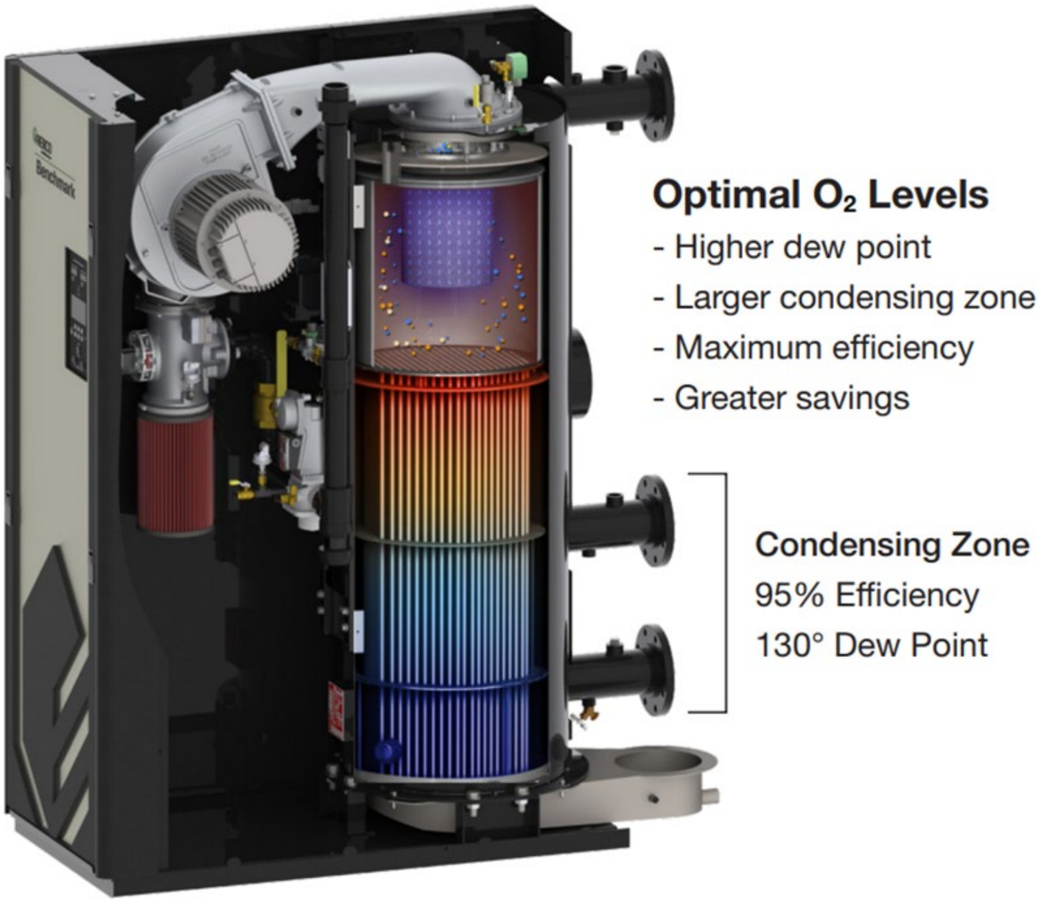

MAINTAINING EFFICIENCY

O²	CO²	Dew Point
3.0%	10.0%	133°F
4.0%	9.5%	131°F
5.0%	9.0%	130°F
6.0%	8.4%	128°F
7.0%	7.9%	123°F
8.0%	7.3%	122°F
9.0%	6.7%	118°F
10.0%	6.2%	116°F
11.0%	5.6%	113°F

Data provided by Thermal Solutions

MAINTAINING EFFICIENCY

O^2	CO^2	Dew Point
3.0%	10.0%	133°F
4.0%	9.5%	131°F
5.0%	9.0%	130°F
6.0%	8.4%	128°F
7.0%	7.9%	123°F
8.0%	7.3%	122°F
9.0%	6.7%	118°F
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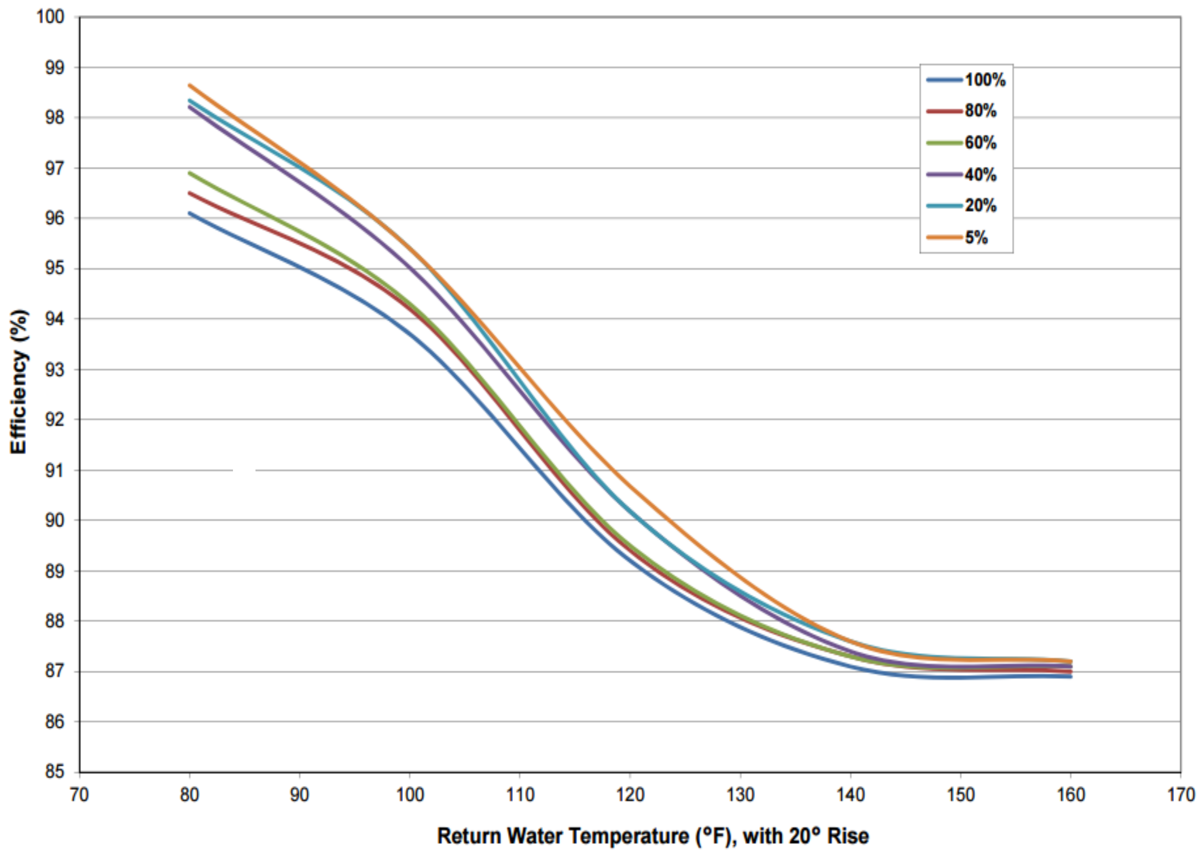
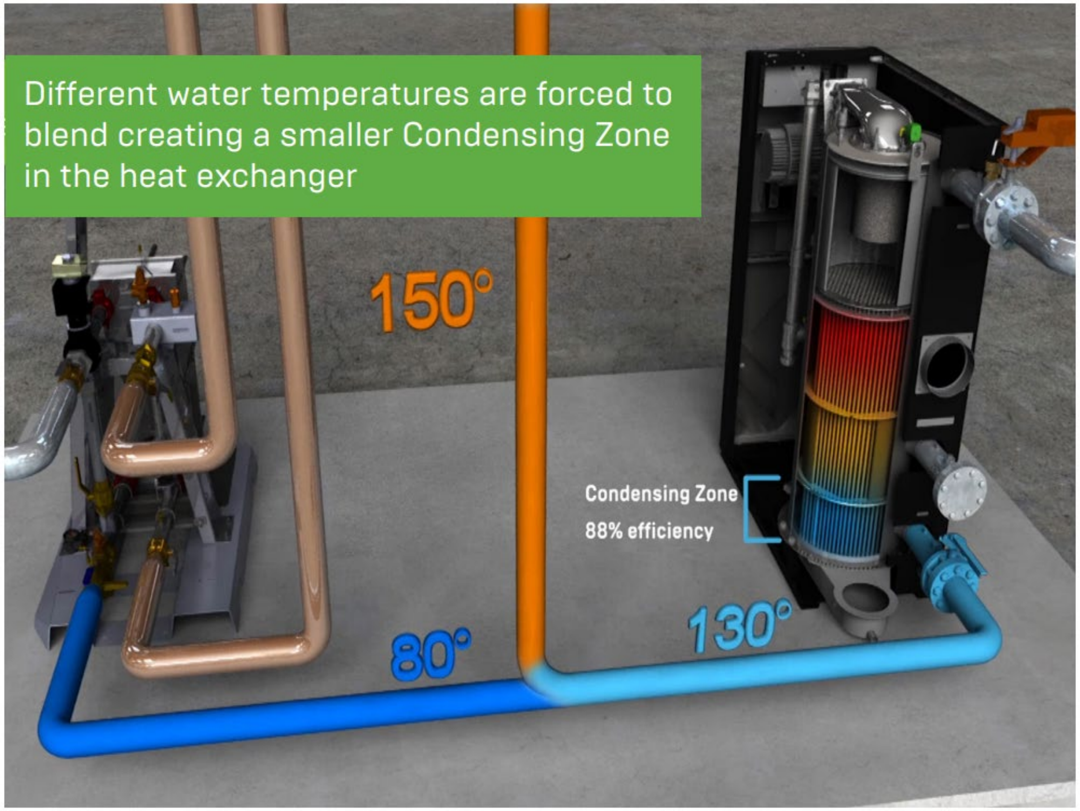


DEPPMANN

MAINTAINING EFFICIENCY

Single Returns



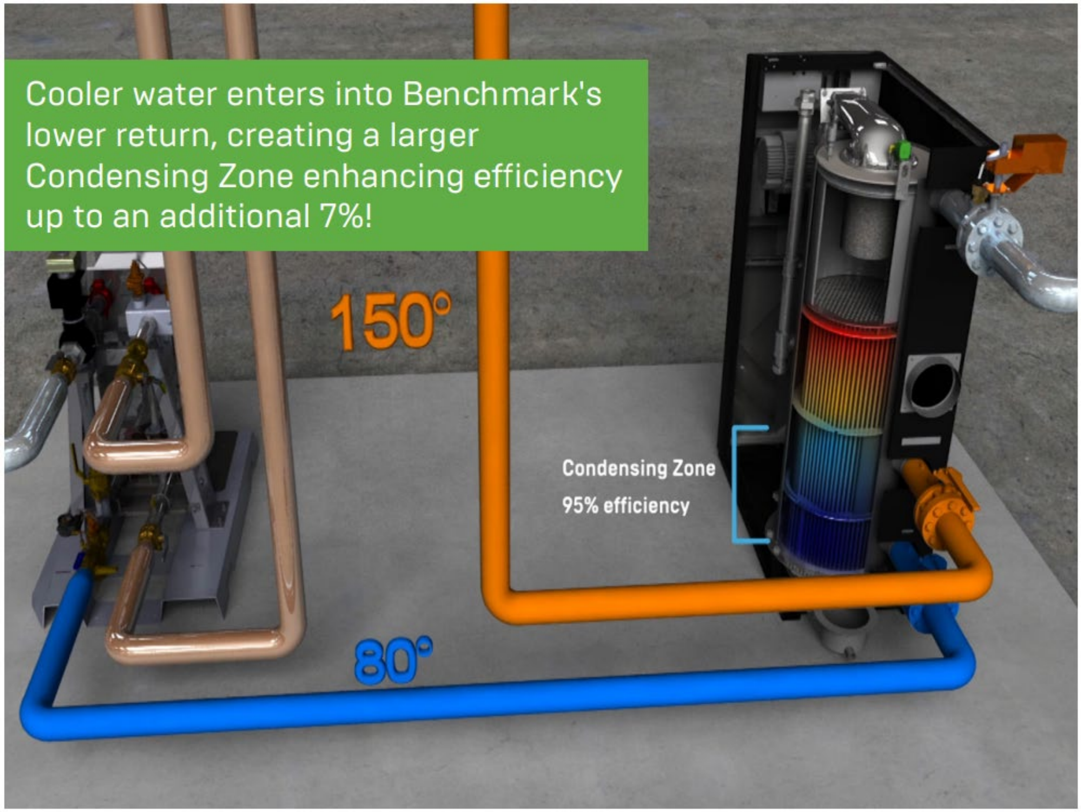
Dual Return Water Connections

- Improves overall thermal efficiency by up to 7%
- Great with multiple return water temperatures
- Saves energy

RL DEPPMANN

MAINTAINING EFFICIENCY

Dual Returns



Dual Return Water Connections

- Improves overall thermal efficiency by up to 7%
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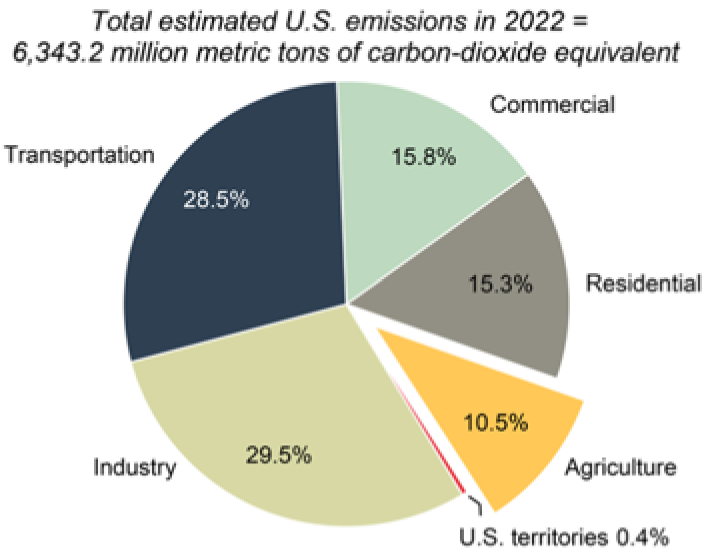
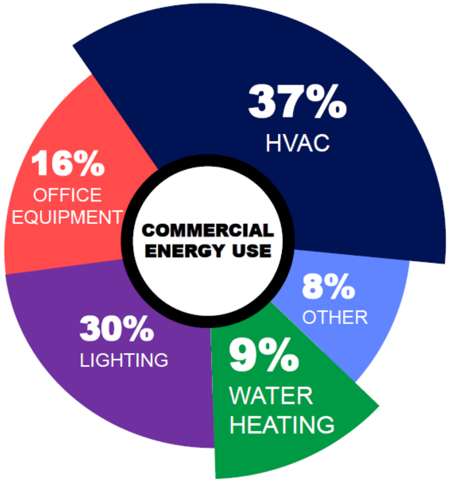
DECARBONIZATION

Decarbonization

- Reducing the amount of carbon dioxide occurring as a result of power generation and consumption





DEPPMANN

DECARBONIZATION

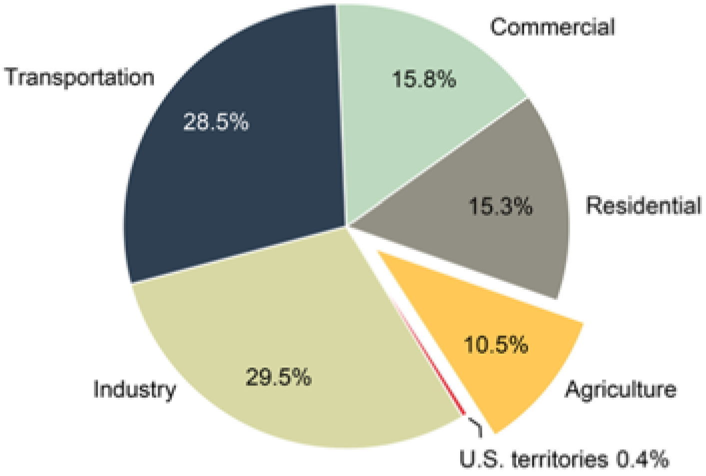
Decarbonization

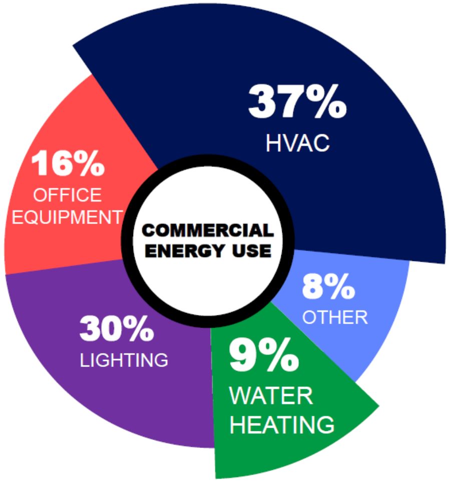
- Reducing the amount of carbon dioxide occurring as a result of power generation and consumption

Electrification

- Replacing technologies that use fossil fuels with alternative technologies that run on electricity ideally generated from renewable resources.

Total estimated U.S. emissions in 2022 = 6,343.2 million metric tons of carbon-dioxide equivalent





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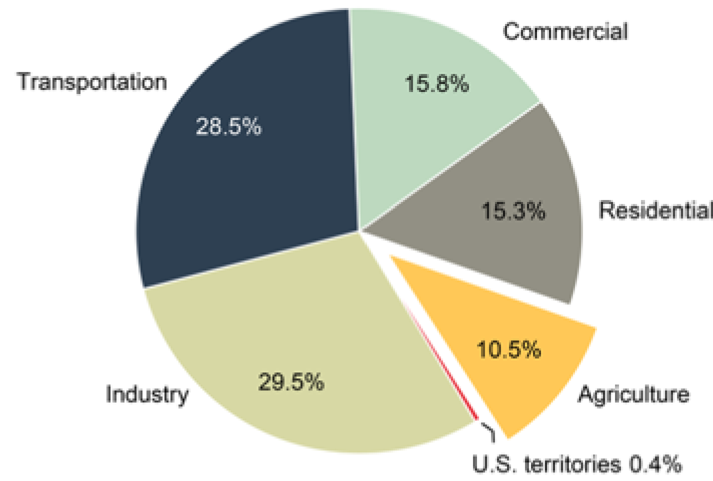
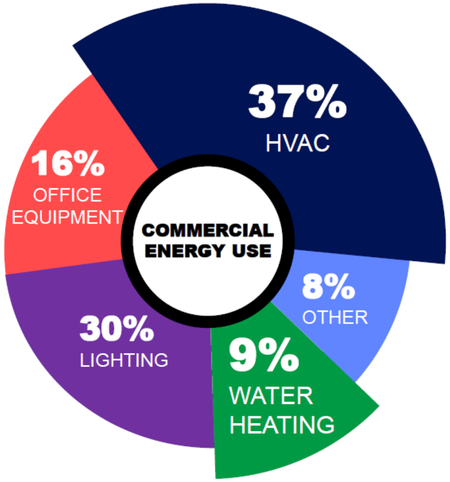
Impacts of Decarbonization

- Commercial buildings account for 16 percent of carbon emissions in the United States
- Decarbonization will impact all territories over time
- It will take years for the infrastructure to sustainably deliver the electricity required

Total estimated U.S. emissions in 2022 = 6,343.2 million metric tons of carbon-dioxide equivalent





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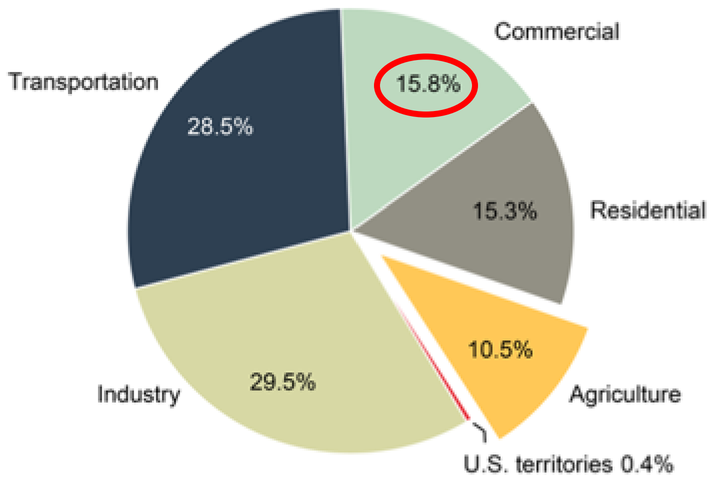
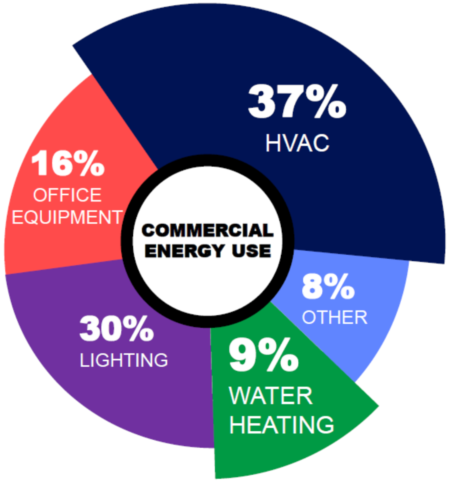
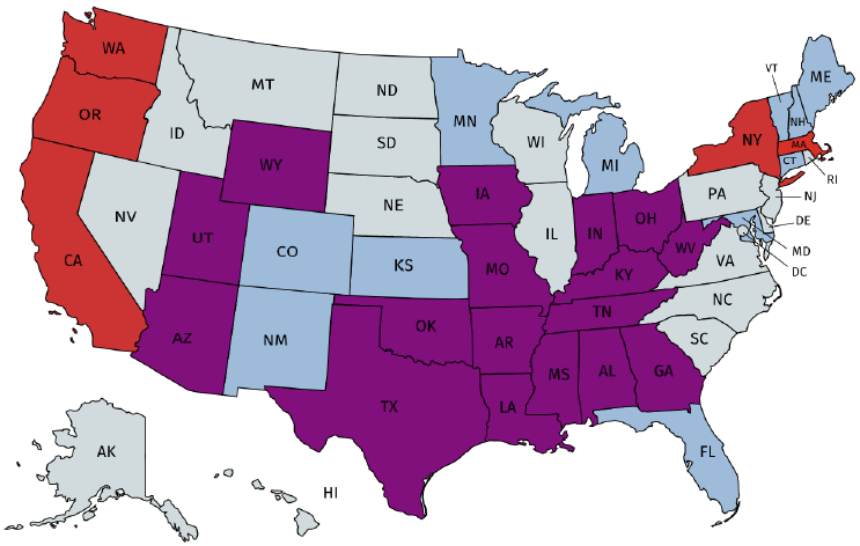




ELECTRIFICATION



Natural Gas Ban Enacted

Natural Gas Ban Proposed

Natural Gas Bans Prohibited

Forbes

There are more than 70 cities in the United States that have adopted regulations requiring or incentivizing all-electric building construction. Mar 4, 2024, 09:47am EST

House passes natural gas ban, despite strained energy grid

January 23, 2024

Despite pleas asking customers to turn down their thermostats to reduce strain on the energy grid during the state's frigid cold snap earlier this month, Washington moved another step closer to banning natural gas today.

N.Y. ditches gas stoves, fossil fuels in new buildings in first statewide ban in U.S.

The state ban on gas in new buildings could face legal challenges, but it marks a milestone in the energy transition sought by climate activists

Gov. Inslee signs controversial decarbonization bill

| **Published** March 29, 2024 10:38am PDT | News | FOX 13 Seattle |

OLYMPIA, Wash. - A bill that will eventually ban the use of natural gas in Washington has passed state legislature and was signed by Governor Jay Inslee on Thursday.

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ELECTRIFICATION

Can Power Grids Cope With Millions of EVs? › Palo Alto offers a glimpse at the challenges municipalities and utilities face

CLIMATE

Why the electric vehicle boom could put a major strain on the U.S. power grid

PUBLISHED SAT, JUL 1 2023-9:00 AM EDT | UPDATED FRI, JUL 7 2023-11:43 AM EDT

Grid Issues

- Current infrastructure cannot handle fully electrified systems
- Distribution network is aged and fragile
- Current energy distribution is very inefficient
- Grid studies on electric cars alone project up to 3000% increase in electricity use by 2035

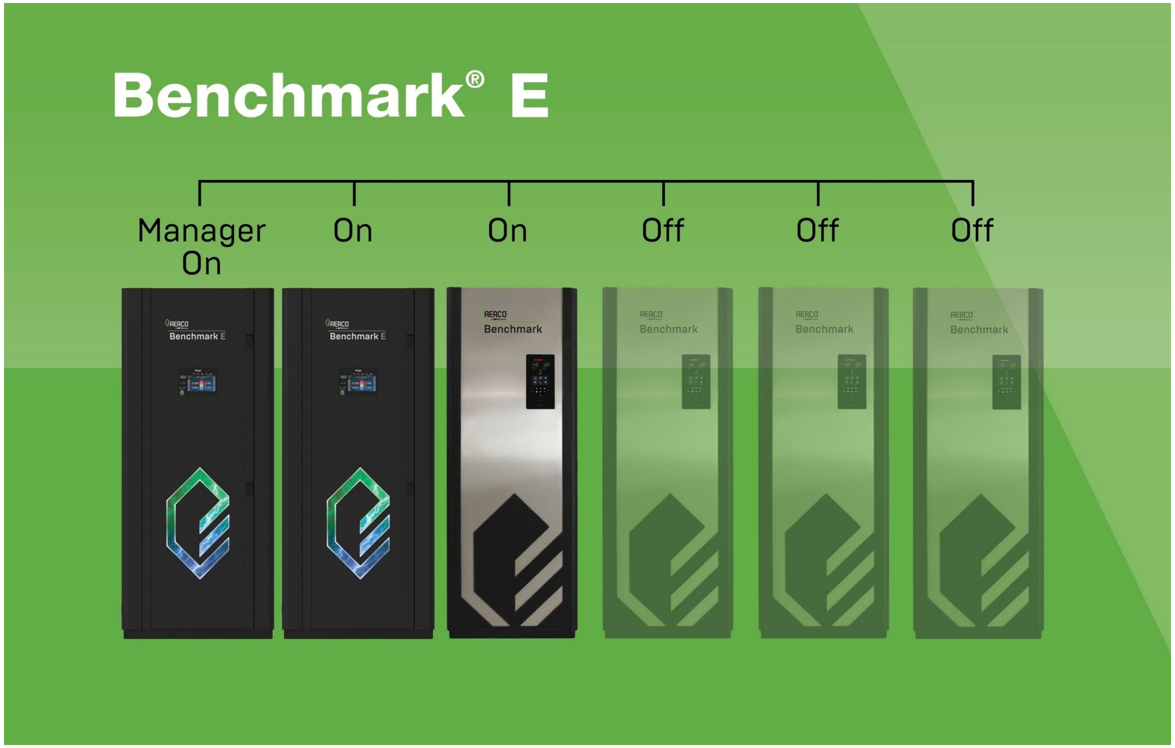
Refrigerant Based System Issues

- VRF push back on overstated energy savings
- Impending refrigeration standards is a concern
- Proprietary complex systems

HYBRID SYSTEMS

Hybrid Fuel Systems

- Utilize two or more energy types
- Increase overall plant efficiency
- Provide backup heat source
- Reduce plant emissions



RL DEPPMANN

ELECTRIC BOILERS

Cemline Electric Boiler
VB Series
12kW – 2016kW

Aerco Electric Boiler
Benchmark E
216kW – 684kW

Bryan Electric Boiler
Series BE
30kW – 390kW

ELECTRIC BOILERS

Aerco Benchmark E
- 216kW – 684kW
- 260A – 823A @ 480V / 3PH
- 6 – 10 Stages
- 80 W/in^2 element watt density

Electric Boiler Considerations
- Efficiency
- Space constraints
- Element characteristics
- Water quality
- Power available

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$$\eta = \frac{Power_{out}}{Power_{in}} \times 100\%$$

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$$\eta = \frac{684kW}{684kW} \times 100\% = 100\%$$

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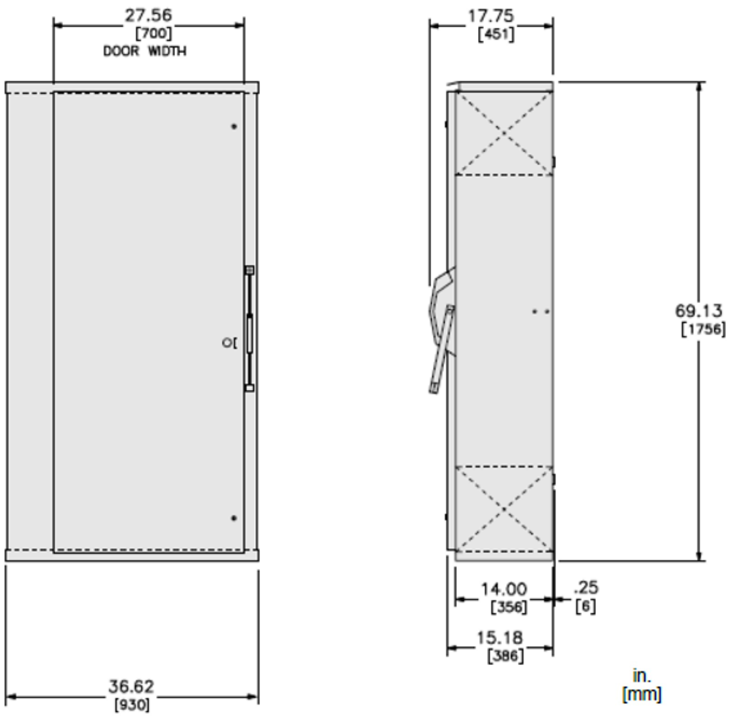
1000A Disconnect



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$$Heat\ Flux = \frac{Heat\ Transfer\ Rate(W)}{Unit\ Area\ (in^2)}$$

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- Element characteristics

$$Heat\ Flux = \frac{Heat\ Transfer\ Rate(W)}{Unit\ Area\ (in^2)}$$

Higher heat flux = Decreased Element Life
Lower heat flux = Increased Element Life

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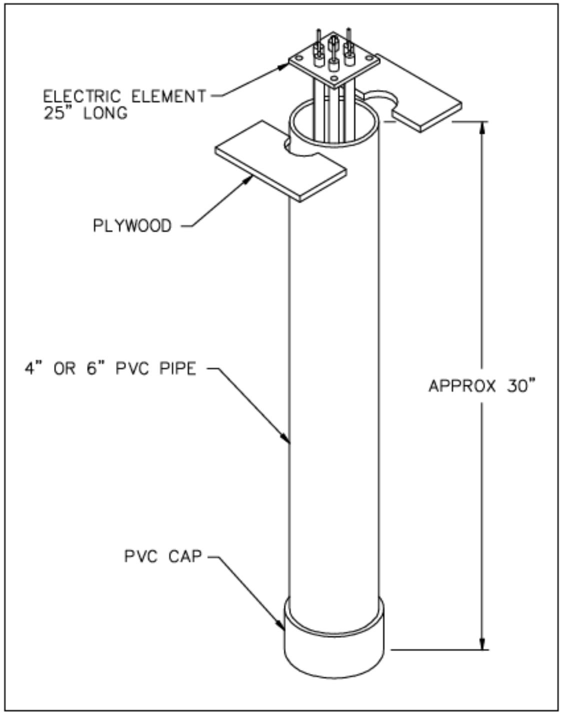
- Element characteristics
- Water quality



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- Efficiency
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- Element characteristics
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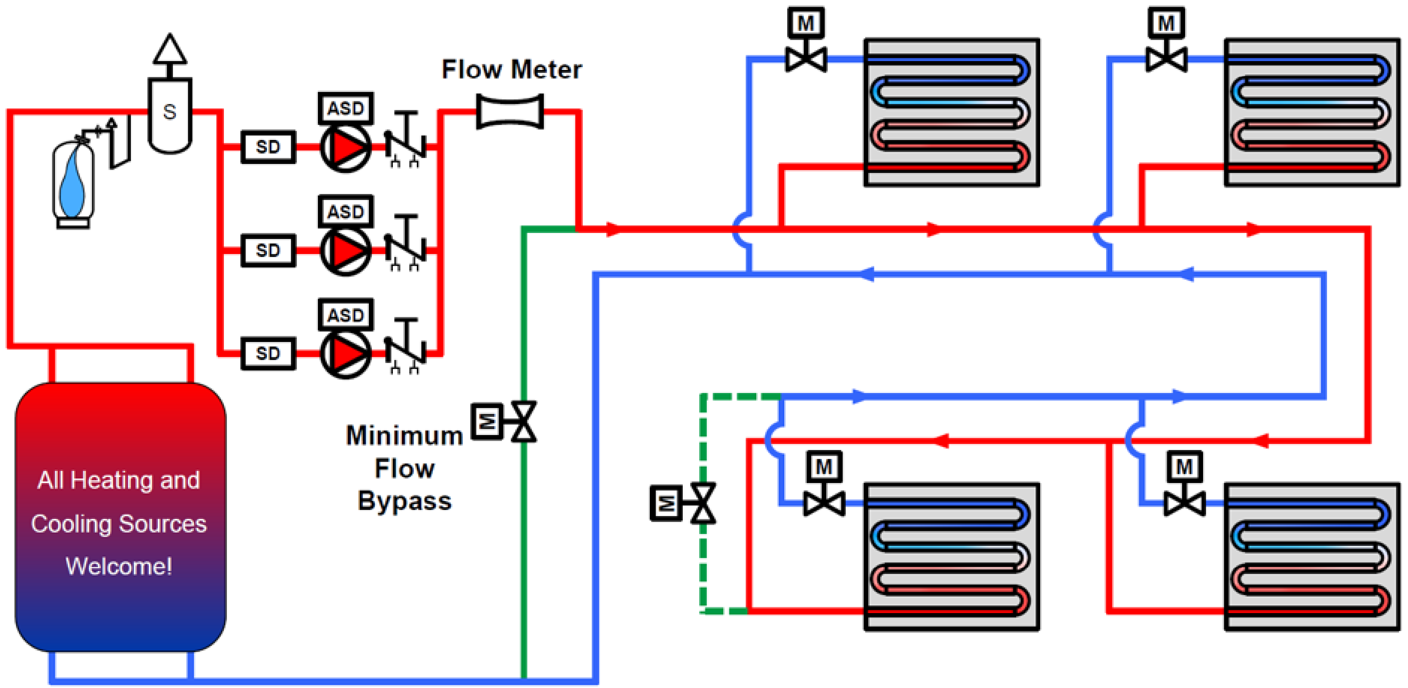
- Power available

FUTURE OF HYDRONICS

<u>Hydronics = Here to stay</u>

- Lower first cost, longer lifespan
- Use water with Global Warming Potential(GWP) of zero
- Hydronics are a trusted source of distribution
- Easy for service technicians to diagnose and maintain
- Hydronic systems easily integrate with a wide variety of sources
- Conversions to electric boilers or water source systems allows use of existing hydronic infrastructure




SmartPlate EV
Innovation
AM Series
Benchmark
Modulex EXT
Unical

QUESTIONS?

THANK YOU

www.deppmann.com

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AGENDA

8:30-9:30 –	Insights from the Field –	Brad Notter
9:30-9:45 –	Break	
9:45-10:45 –	Optimizing Hydronic Heating –	Ryan Groves
10:45-11:00 –	**Break**	
11:00-12:00 –	**Don't Let Your Sh*t Back Up –**	**Nick Tabar**
12:00-1:00 –	Lunch	
1:00-2:00 –	Water Quality Solutions –	Andrew Ward
2:00-2:15 –	Break	
2:15-3:15 –	Guide to Smart Pumps –	Jason Winslow
3:15-3:30 –	Break	
3:30-4:30 –	Decarbonization Insights –	Kyle Wefing

RL DEPPMANN

TRIVIA

What is largest emissions producer in commercial buildings?

Don’t Let Your $#!* Back Up: Sump Pumps and Sewage Ejectors

Nick Tabar, PE, MBA, CPD
R. L. Deppmann | Northern Ohio Sales Engineer

Agenda

Definitions

- Ohio and Michigan Code Definitions
- Simplified Definitions

Sewage Ejectors

- Applications
  - Basement Sanitary Systems
  - Building Additions
- Components
  - Pump
  - Basin
  - Controls
- Selection Criteria
- Example

Sump Pumps

- Applications
  - Storm Water
  - Foundation Drainage
  - Elevator Pits
- Components
  - Pump
  - Basin
  - Controls
- Selection Criteria
- Example

Plumbing in Cartoons

Source: YouTube

DEFINITIONS

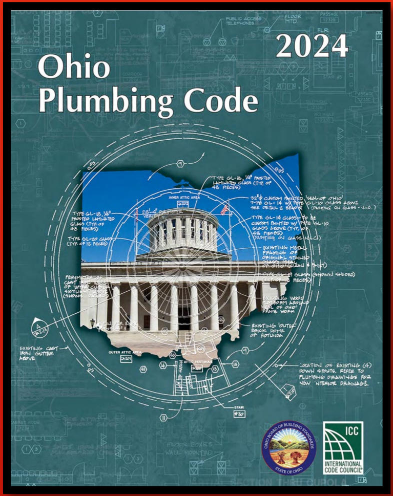
Ohio and Michigan Plumbing Code Definitions
Simplified Definitions

Definitions

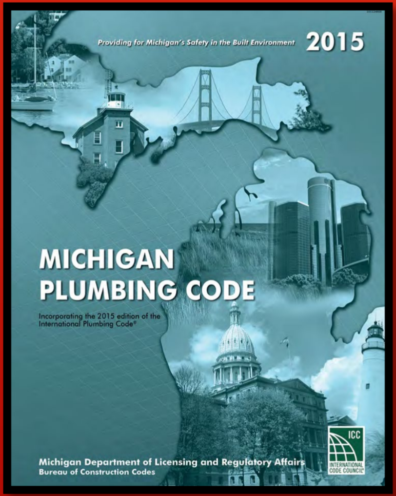
Source: Bell & Gossett

Source: Bell & Gossett

Ohio and Michigan Plumbing Code Definitions



Source: 2024 OH Plumbing Code



Source: 2015 MI Plumbing Code

SUMP PUMP. An automatic water pump powered by an electric motor for the removal of drainage, except raw sewage, from a sump, pit or low point.

SUMP. A tank or pit that receives sewage or liquid waste, located below the normal grade of the gravity system and that must be emptied by mechanical means.

SEWAGE. Any liquid waste containing animal or vegetable matter in suspension or solution, including liquids containing chemicals in solution.

SEWAGE EJECTOR. A device for lifting sewage by entraining the sewage in a high-velocity jet of steam, air or water.

Simplified Definitions

Sump Pumps

- Water / Greywater
- Elevator Pits
- Storm Systems

Sewage Ejectors

- Liquid and Solids
- Sanitary Systems

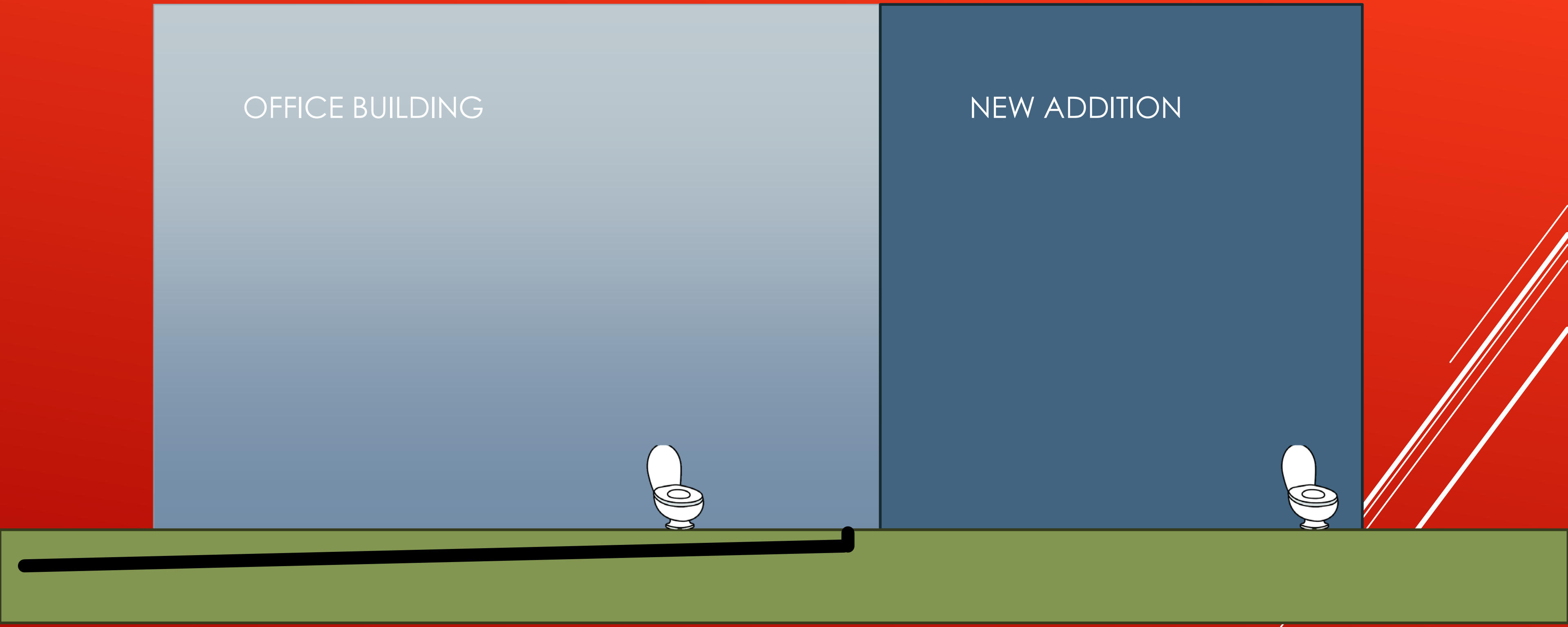
SEWAGE EJECTORS

Why?
Applications
Components
Selection Criteria

Why? – Sewage Ejector

Source: Mainline Inspection Services

Why? – Sewage Ejector



Applications – Sewage Ejector

Compliance with Code Requirements

- **2024 OPC: 712.1 Building Subdrains**. Building subdrains that cannot be discharged to the sewer by gravity flow shall be discharged into a tightly covered and vented sump from which the liquid shall be lifted and discharged into the building gravity drainage system by automatic equipment or other approved method. In other than existing structures, the sump shall not receive drainage from any piping within the building capable of being discharged by gravity to the building sewer.

Pumping Capacity and Size

- 2024 OPC: 712.4.2 Capacity. A sewage pump or sewage ejector shall have the capacity and head for the application requirements. Pumps or ejectors that receive the discharge of water closets shall be capable of handling spherical solids with a diameter of up to an including 2 inches. Other pumps or ejectors shall be capable of handling spherical solids with a diameter of up to and including 1/2 inch. The capacity of a pump or ejector based on the diameter of the discharge pipe shall be not less than that indicated in Table 712. 4.2.
  - Exceptions:
    - Grinder pumps or grinder ejectors that receive the discharge of water closets shall have a discharge opening of not less than 1 ¼ inches.
    - Macerating toilet assemblies that serve single water closets shall have a discharge opening of not less than ¾ inch.

TABLE 712.4.2
MINIMUM CAPACITY OF SEWAGE PUMP OR SEWAGE EJECTOR

DIAMETER OF THE DISCHARGE PIPE (inches)	CAPACITY OF PUMP OR EJECTOR (gpm)
2	21
$2^1/_2$	30
3	46

For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m.

Source: 2024 OH Plumbing Code

Pop Quiz

Why did the plumbing code writers choose these numbers?

TABLE 712.4.2
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For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m.

Source: 2024 OH Plumbing Code

Sizing Criteria – What Do You Need to Know?

Size of Solids to be Handled

- Effluent (liquid only) = < 1"
- Residential = 1 ½" or larger
- Commercial / Industrial = 2 & 2 ½" or larger

Capacity Required

- Calculated by converting fixture units to gpm.

Pump / Motor Run Time

- Units up to 1 hp should run a minimum of 1 minute.
- Units 1 1/2 hp and larger should run a minimum of 2 minutes.

Sizing Criteria – What Do You Need to Know?

Formula for Total Dynamic Head

- Vertical Elevation
- Friction Loss (pipe and fittings)
- Feet of Head to PSI multiplier (2.31)

Minimum Velocity

- Selected pump must maintain a minimum velocity of 2fps

Storage in Discharge Pipe

- Must turn storage in the discharge pipe a minimum of one time per cycle.

Basin / Cover

- Are the receiver basin and cover required?
- What materials, code requirements, venting, etc.?

Sizing Criteria – What Do You Need to Know?

What is the Power Available?

- Phase: 1Ø or 3Ø
- Voltage: 115, 200, 230, 460, or 575 V [must be specific with B&G]
- Hertz: 50 or 60 Hz

What pipe size will be used?

- Consult table for minimum flow to pipe size correlation.

Simplex or Duplex Required?

- Simplex is cost effective.
- Duplex guarantees service when it can't be interrupted.

Emergency Power?

- Do you want your sewage ejector to run in the event of a power outage?
- Will need to alert electrical engineer.
- Generally, this is for stormwater only.

Sizing Criteria – Step One – Gathering Information

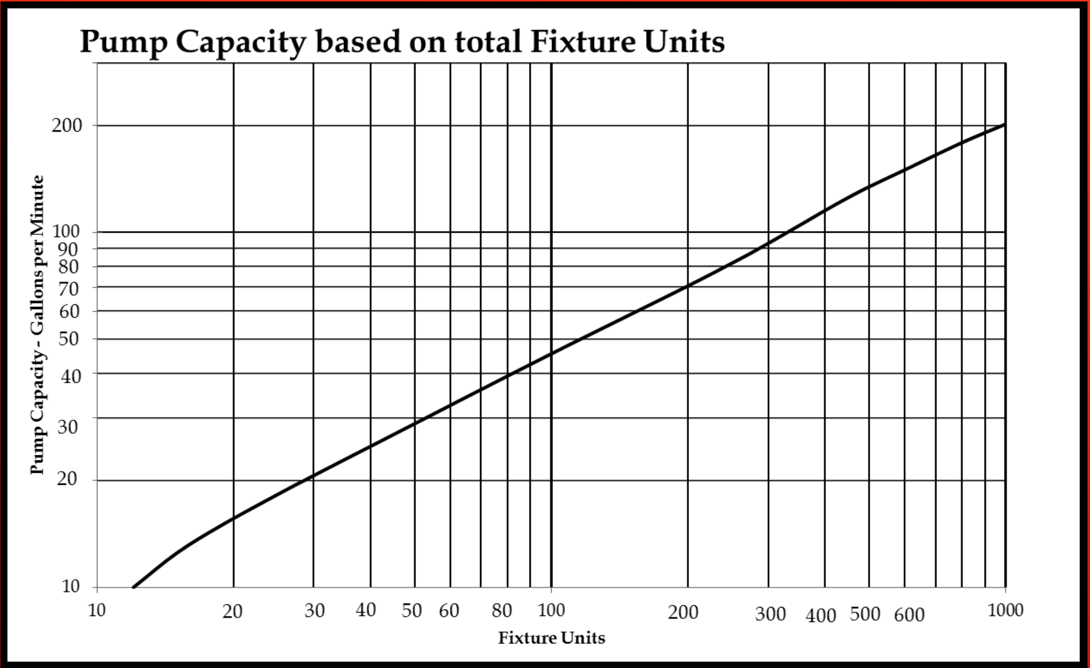
TABLE 709.1
DRAINAGE FIXTURE UNITS FOR FIXTURES AND GROUPS

FIXTURE TYPE	DRAINAGE FIXTURE UNIT VALUE AS LOAD FACTORS	MINIMUM SIZE OF TRAP (inches)
Automatic clothes washers, commercial[a,g]	Note a	Note a
Automatic clothes washers, residential[g]	2	2
Bathroom group as defined in Section 202 (1.6 gpf water closet)[f]	5	—
Bathroom group as defined in Section 202 (water closet flushing greater than 1.6 gpf)[f]	6	—
Bathtub[b] (with or without overhead shower or whirlpool attachments)	2	$1^1/_2$
Bidet	1	$1^1/_4$
Combination sink and tray	2	$1^1/_2$
Dental lavatory	1	$1^1/_4$
Dental unit or cuspidor	1	$1^1/_4$
Dishwashing machine[c], domestic	2	$1^1/_2$
Drinking fountain	$^1/_2$	$1^1/_4$
Emergency floor drain	0	2
Floor drains[h]	2[h]	2
Floor sinks	Note h	2
Kitchen sink, domestic	2	$1^1/_2$
Kitchen sink, domestic with food waste disposer, dishwasher or both	2	$1^1/_2$
Laundry tray (1 or 2 compartments)	2	$1^1/_2$
Lavatory	1	$1^1/_4$
Shower (based on the total flow rate through showerheads and body sprays) flow rate:		
5.7 gpm or less	2	$1^1/_2$
Greater than 5.7 gpm to 12.3 gpm	3	2
Greater than 12.3 gpm to 25.8 gpm	5	3
Greater than 25.8 gpm to 55.6 gpm	6	4
Service sink	2	$1^1/_2$
Sink	2	$1^1/_2$
Urinal	4	Note d
Urinal, 1 gallon per flush or less	2[e]	Note d
Urinal, nonwater supplied	$^1/_2$	Note d
Wash sink (circular or multiple) each set of faucets	2	$1^1/_2$
Water closet, flushometer tank, public or private	4[e]	Note d
Water closet, private (1.6 gpf)	3[e]	Note d
Water closet, private (flushing greater than 1.6 gpf)	4[e]	Note d
Water closet, public (1.6 gpf)	4[e]	Note d
Water closet, public (flushing greater than 1.6 gpf)	6[e]	Note d

For SI: 1 inch = 25.4 mm, 1 gallon = 3.785 L, gpf = gallon per flushing cycle, 1 gallon per minute (gpm) = 3.785 L/m.
a. Calculate per Section 709.3.
b. A showerhead over a bathtub or whirlpool bathtub attachment does not increase the drainage fixture unit value.
c. See Sections 709.2 through 709.4.1 for methods of computing unit value of fixtures not listed in this table or for rating of devices with intermittent flows.
d. Trap size shall be consistent with the fixture outlet size.
e. For the purpose of computing loads on building drains and sewers, water closets and urinals shall not be rated at a lower drainage fixture unit unless the lower values are confirmed by testing.
f. For fixtures added to a bathroom group, add the dfu value of those additional fixtures to the bathroom group fixture count.
g. See Section 406.2 for sizing requirements for fixture drain, branch drain and drainage stack for an automatic clothes washer standpipe.
h. See Sections 709.4 and 709.4.1.

Source: 2024 OH Plumbing Code

Sizing Criteria – Step Two – Convert DFU to GPM



Source: Sump and Sewage Pumps Manufacturers Association

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3	46

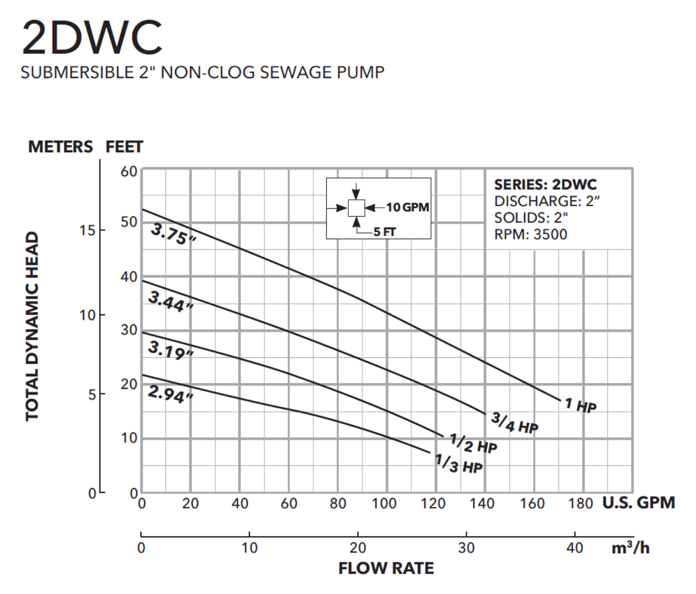
For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m.

Source: 2024 OH Plumbing Code

Sizing Criteria – Step Three – Preliminary Selection

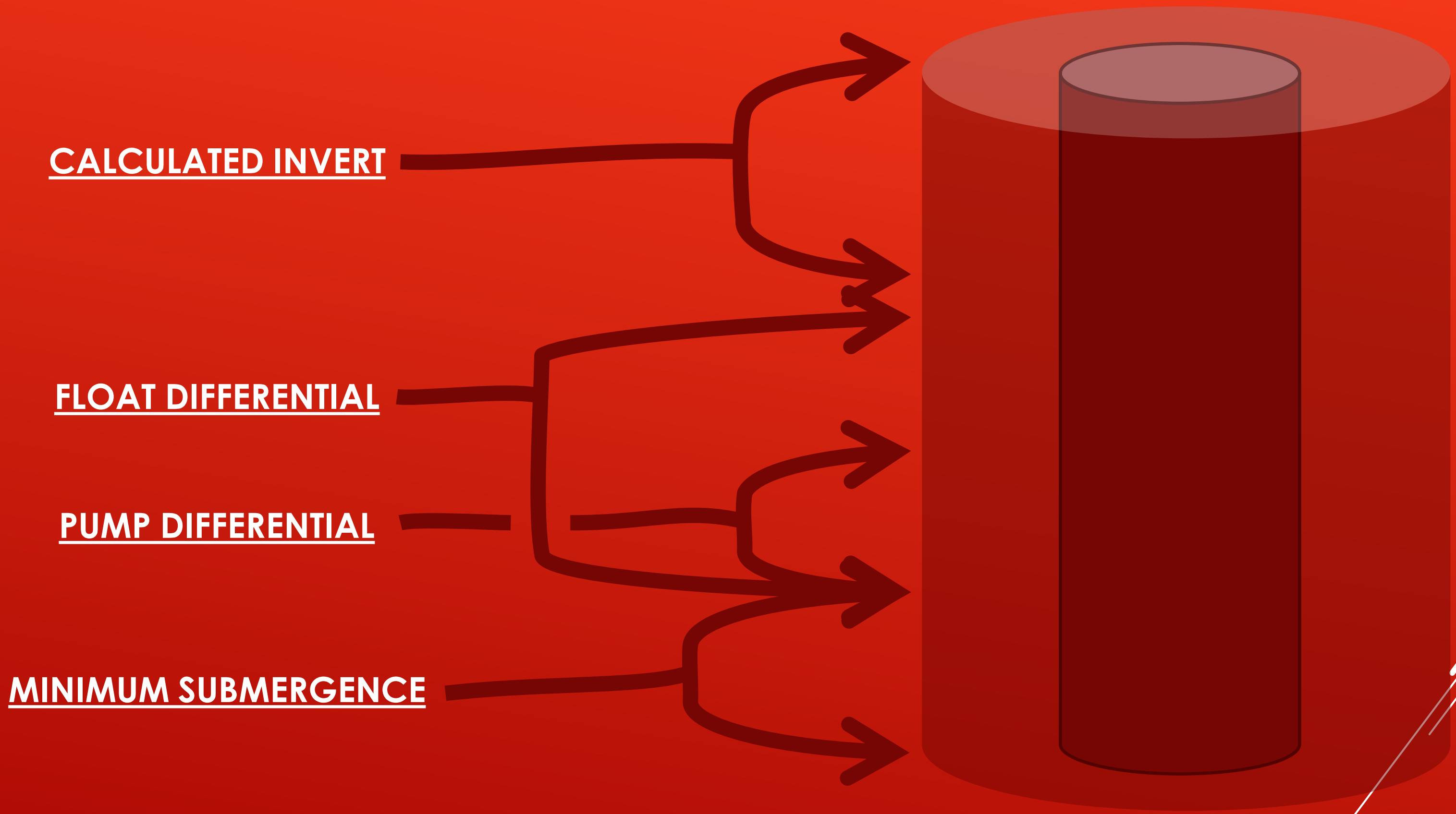
Pump / Motor Run Time

- Units up to 1 hp should run a minimum of 1 minute.
- Units 1 1/2 hp and larger should run a minimum of 2 minutes.



Source: Bell & Gossett

Sizing Criteria – Step Four – Understanding the Basin



Sizing Criteria – Step Four – Understanding the Basin

BOTTOM FLOAT "OFF" LEVEL

B&G PUMP SIZE & TYPE	RECOMMENDED FLOAT OFF* DEPTH FOR CONTINUOUS OPERATION	ABSOLUTE MINIMUM FLOAT OFF* DEPTH FOR INTERMITTANT OPERATION
1-1/2" Effluent	16"	10"
2" Effluent	18"	12"
2" Sewage	20"	14"
3" Sewage	28"	22"
4" Sewage to 7-1/2 HP	28"	22"
4" Sewage 7-1/2 to 20 HP	36"	30"

* Minimum level above the basin floor

Note: Consult the manufacturer's literature for explosion proof motor requirements

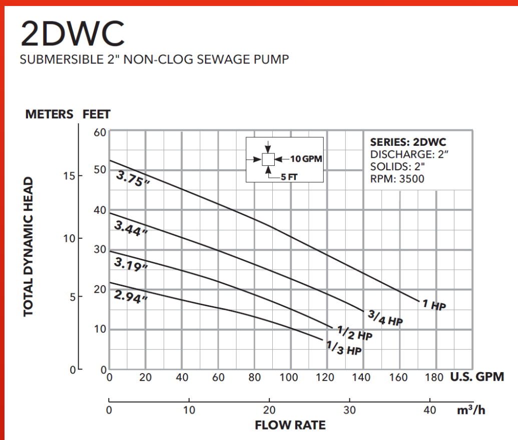
Source: R. L. Deppmann

Sizing Criteria – Step Four – Understanding the Basin

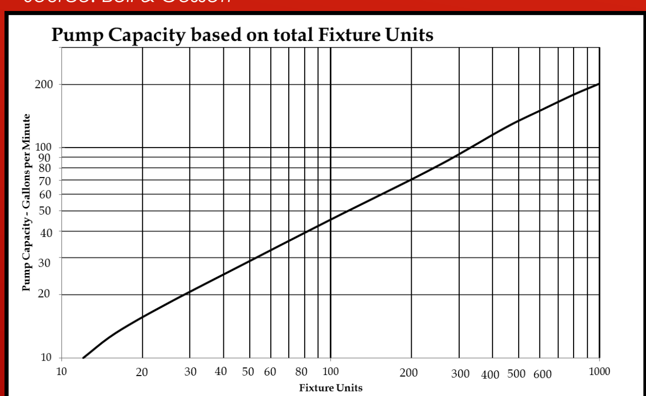
DIAMETER	MINIMUM DEPTH	GALLONS	GALLONS PER INCH - GREATER DEPTH*
24"	36"	65	1.70
30"	36"	110	3.00
36"	36"	159	4.30
42"	48"	274	5.70
48"	48"	361	7.50
60"	78"	955	12.20
72"	78"	1375	17.60

Source: R. L. Deppmann

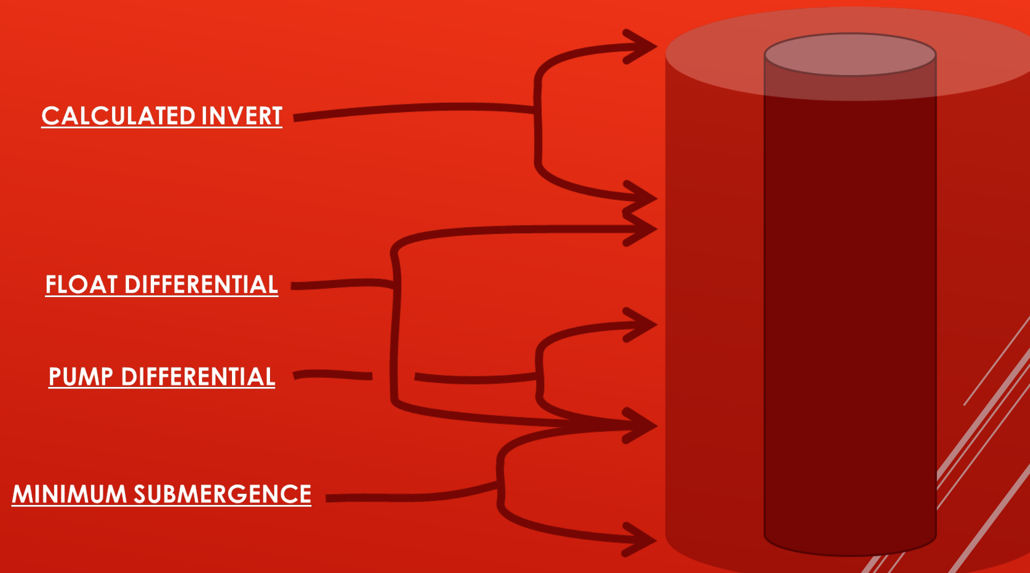
Sizing Criteria – Step Five – Compiling the Selection



Source: Bell & Gossett



Source: Sump and Sewage Pump Manufacturers Association



Sizing Criteria – Step Six – Additional Options

Source: Bell & Gossett

SIMPLEX

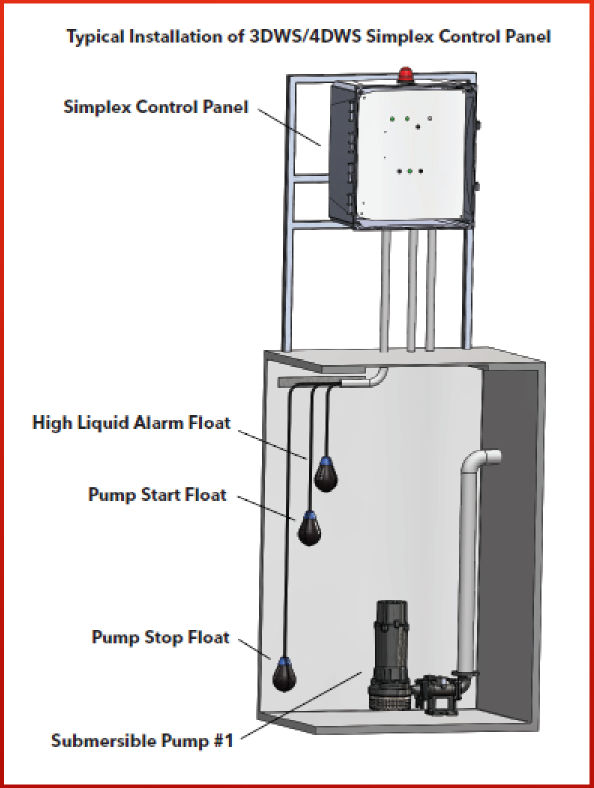
- Pump Off
- Pump On
- High Water Alarm

Source: Bell & Gossett

DUPLEX

- Pumps Off
- Lead Pump On
- Lag Pump On
- High Water Alarm

Sizing Criteria – Step Six – Additional Options



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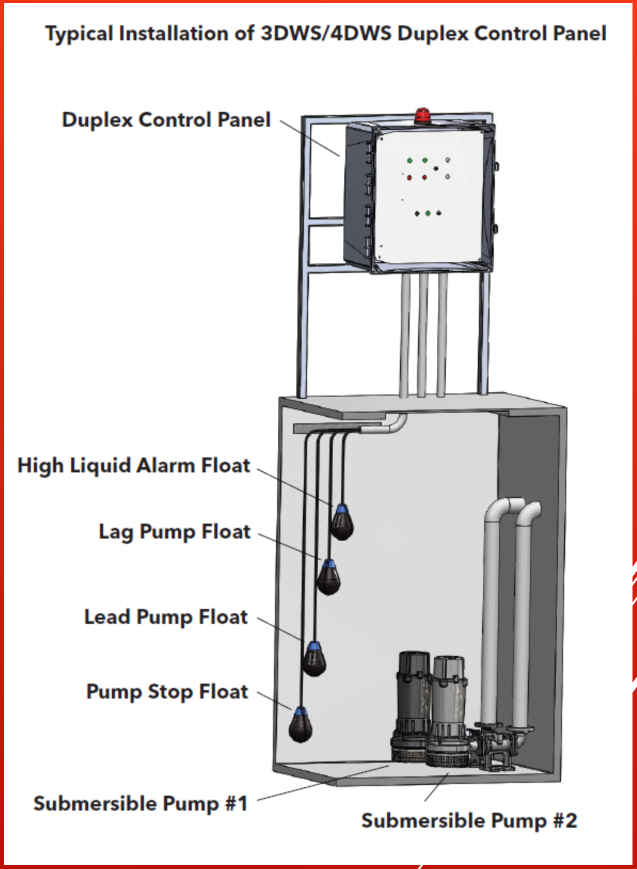


Source: Bell & Gossett

Sizing Criteria – Step Six – Additional Options

906.5 Sump vents. Sump vent sizes shall be determined in accordance with Sections 906.5.1 and 906.5.2.

906.5.1 Sewage pumps and sewage ejectors other than pneumatic. Drainage piping below the *building sewer* level shall be vented in the same manner as that of a gravity system. Building sump vent sizes for sumps with sewage pumps or sewage ejectors, other than pneumatic, shall be determined in accordance with Table 906.5.1.

906.5.2 Pneumatic sewage ejectors. The air pressure relief pipe from a pneumatic sewage ejector shall be connected to an independent vent *stack* terminating as required for vent extensions through the roof. The relief pipe shall be sized to relieve air pressure inside the ejector to atmospheric pressure, but shall be not less than $1^1/_4$ inches (32 mm) in size.

Source: 2024 OH Plumbing Code

TABLE 906.5.1
SIZE AND LENGTH OF SUMP VENTS

DISCHARGE CAPACITY OF PUMP (gpm)	MAXIMUM DEVELOPED LENGTH OF VENT (feet)[a] — Diameter of vent (inches)					
	$1^1/_4$	$1^1/_2$	2	$2^1/_2$	3	4
10	No limit[b]	No limit	No limit	No limit	No limit	No limit
20	270	No limit	No limit	No limit	No limit	No limit
40	72	160	No limit	No limit	No limit	No limit
60	31	75	270	No limit	No limit	No limit
80	16	41	150	380	No limit	No limit
100	10[c]	25	97	250	No limit	No limit
150	Not permitted	10[c]	44	110	370	No limit
200	Not permitted	Not permitted	20	60	210	No limit
250	Not permitted	Not permitted	10	36	132	No limit
300	Not permitted	Not permitted	10[c]	22	88	380
400	Not permitted	Not permitted	Not permitted	10[c]	44	210
500	Not permitted	Not permitted	Not permitted	Not permitted	24	130

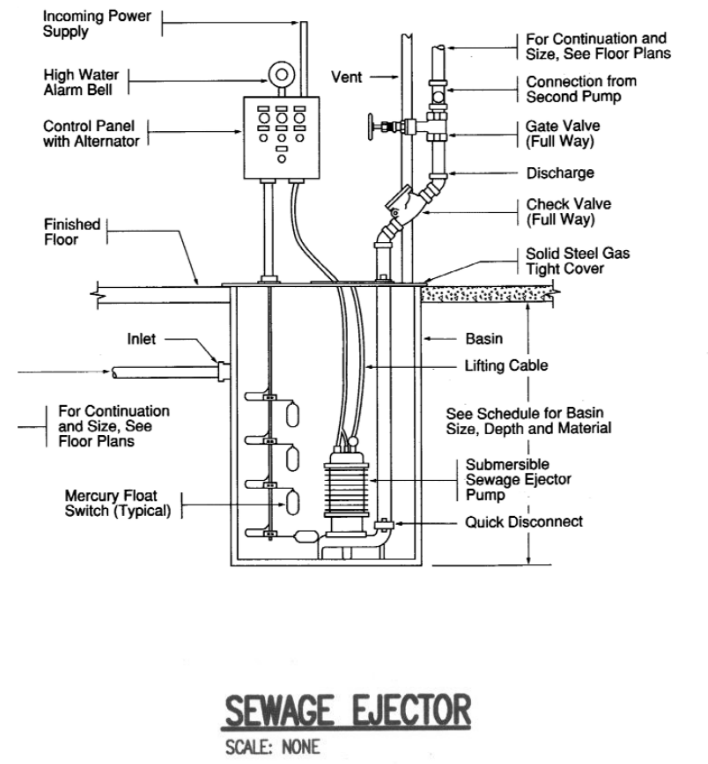
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

a. Developed length plus an appropriate allowance for entrance losses and friction due to fittings, changes in direction and diameter. Suggested allowances shall be obtained from NBS Monograph 31 or other approved sources. An allowance of 50 percent of the developed length shall be assumed if a more precise value is not available.

b. Actual values greater than 500 feet.

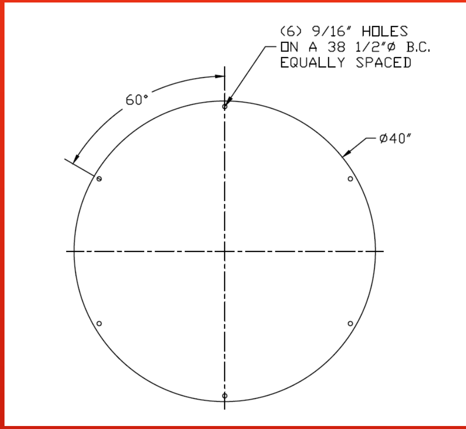
c. Less than 10 feet.

Source: 2024 OH Plumbing Code

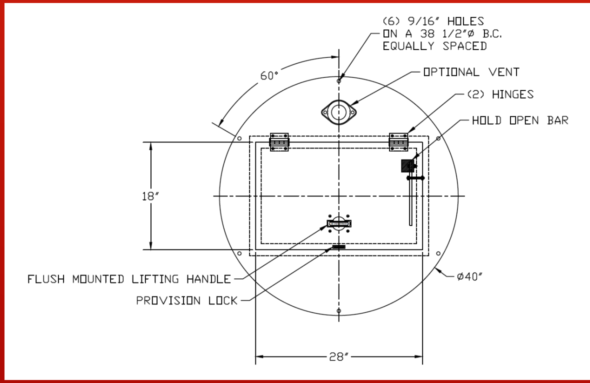


Source: ASPE Cleveland

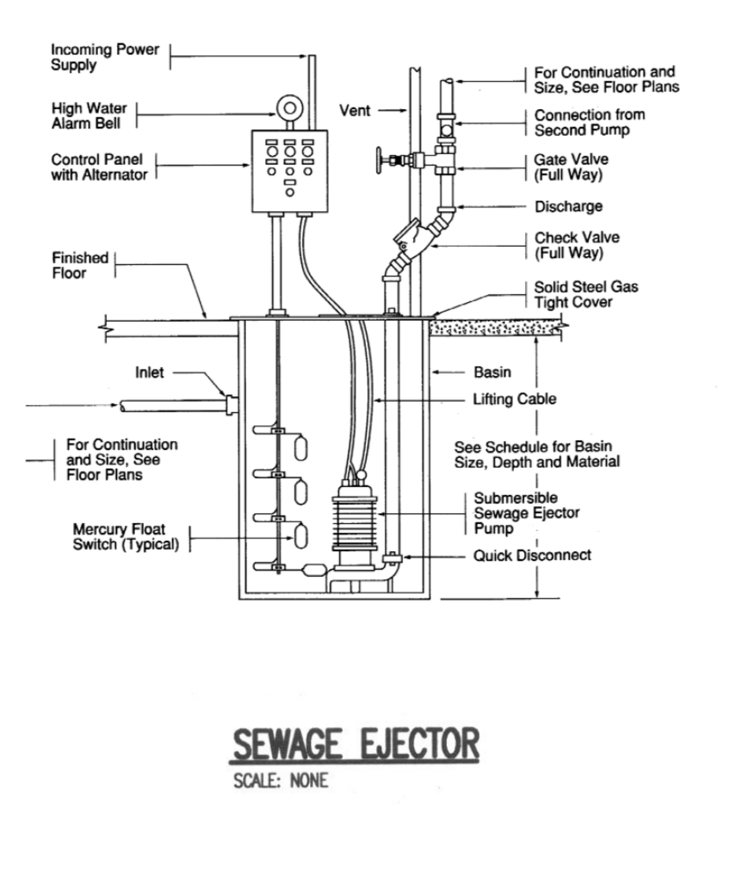
Sizing Criteria – Step Six – Additional Options



Source: AK Industries



Source: AK Industries



Source: ASPE Cleveland

Quick Example – Your Turn!

Source: YouTube

Quick Example – Step One – Gathering Information

FIXTURE LIST:
(6) Public Water Closet (1.6gpf)
(6) Public Lavatories
(1) Drinking Fountain

(6) X 4 dfu = 24 dfu
(6) X 1 dfu = 6 dfu
(1) X ½ dfu = ½ dfu

Total DFU = 30.5dfu

Assuming the TDH required is roughly 10ft floor to ceiling, approximately 6ft for loss through check and gate valve, and any additional loss in pit to floor level. We can assume 4ft here.

Total TDH = 20ft head

TABLE 709.1
DRAINAGE FIXTURE UNITS FOR FIXTURES AND GROUPS

FIXTURE TYPE	DRAINAGE FIXTURE UNIT VALUE AS LOAD FACTORS	MINIMUM SIZE OF TRAP (inches)
Automatic clothes washers, commercial[a,g]	Note a	Note a
Automatic clothes washers, residential[g]	2	2
Bathroom group as defined in Section 202 (1.6 gpf water closet)[f]	5	—
Bathroom group as defined in Section 202 (water closet flushing greater than 1.6 gpf)[f]	6	—
Bathtub[b] (with or without overhead shower or whirlpool attachments)	2	$1^1/_2$
Bidet	1	$1^1/_4$
Combination sink and tray	2	$1^1/_2$
Dental lavatory	1	$1^1/_4$
Dental unit or cuspidor	1	$1^1/_4$
Dishwashing machine[c], domestic	2	$1^1/_2$
Drinking fountain	$^1/_2$	$1^1/_4$
Emergency floor drain	0	2
Floor drains[h]	2[h]	2
Floor sinks	Note h	2
Kitchen sink, domestic	2	$1^1/_2$
Kitchen sink, domestic with food waste disposer, dishwasher or both	2	$1^1/_2$
Laundry tray (1 or 2 compartments)	2	$1^1/_2$
Lavatory	1	$1^1/_4$
Shower (based on the total flow rate through showerheads and body sprays) flow rate: 5.7 gpm or less Greater than 5.7 gpm to 12.3 gpm Greater than 12.3 gpm to 25.8 gpm Greater than 25.8 gpm to 55.6 gpm	 2 3 5 6	 $1^1/_2$ 2 3 4
Service sink	2	$1^1/_2$
Sink	2	$1^1/_2$
Urinal	4	Note d
Urinal, 1 gallon per flush or less	2[e]	Note d
Urinal, nonwater supplied	$^1/_2$	Note d
Wash sink (circular or multiple) each set of faucets	2	$1^1/_2$
Water closet, flushometer tank, public or private	4[e]	Note d
Water closet, private (1.6 gpf)	3[e]	Note d
Water closet, private (flushing greater than 1.6 gpf)	4[e]	Note d
Water closet, public (1.6 gpf)	4[e]	Note d
Water closet, public (flushing greater than 1.6 gpf)	6[e]	Note d

For SI: 1 inch = 25.4 mm, 1 gallon = 3.785 L, gpf = gallon per flushing cycle, 1 gallon per minute (gpm) = 3.785 L/m.
a. Calculate per Section 709.3.
b. A showerhead over a bathtub or whirlpool bathtub attachment does not increase the drainage fixture unit value.
c. See Sections 709.2 through 709.4.1 for methods of computing unit value of fixtures not listed in this table or for rating of devices with intermittent flows.
d. Trap size shall be consistent with the fixture outlet size.
e. For the purpose of computing loads on building drains and sewers, water closets and urinals shall not be rated at a lower drainage fixture unit unless the lower values are confirmed by testing.
f. For fixtures added to a bathroom group, add the dfu value of those additional fixtures to the bathroom group fixture count.
g. See Section 406.2 for sizing requirements for fixture drain, branch drain and drainage stack for an automatic clothes washer standpipe.
h. See Sections 709.4 and 709.4.1.

Source: 2024 OH Plumbing Code

Quick Example – Step Two – Convert DFU to GPM

Total = 30.5dfu

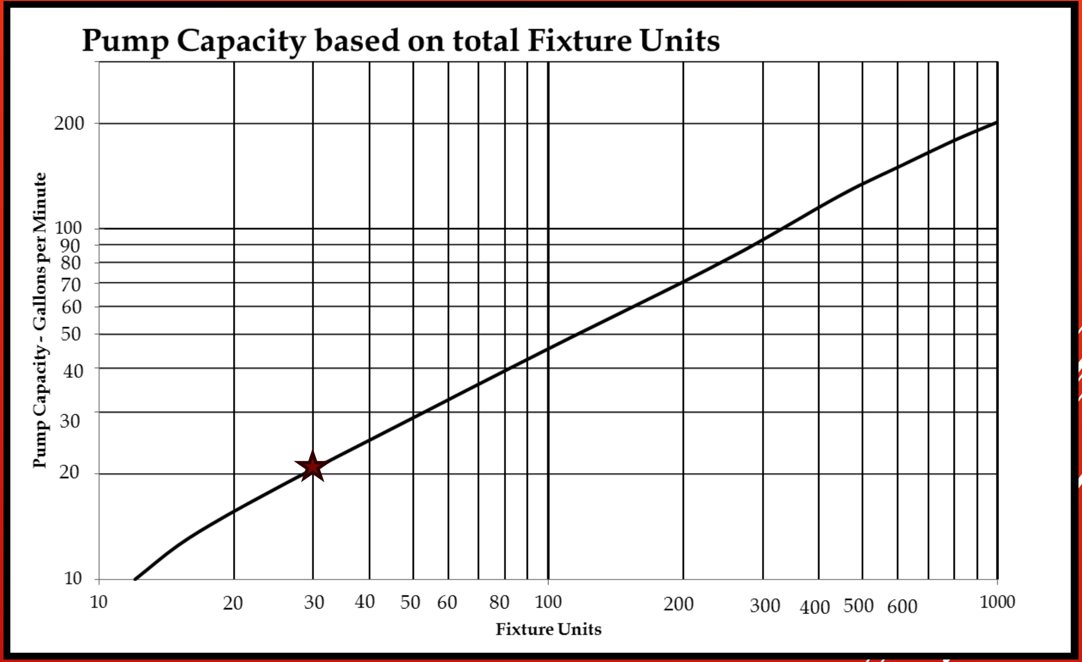
30.5 dfu = ~ 22gpm

TABLE 712.4.2
MINIMUM CAPACITY OF SEWAGE PUMP OR SEWAGE EJECTOR

DIAMETER OF THE DISCHARGE PIPE (inches)	CAPACITY OF PUMP OR EJECTOR (gpm)
2	21
$2^{1}/_{2}$	30
3	46

For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m.

Source: 2024 OH Plumbing Code



Source: Sump and Sewage Pump Manufacturers Association

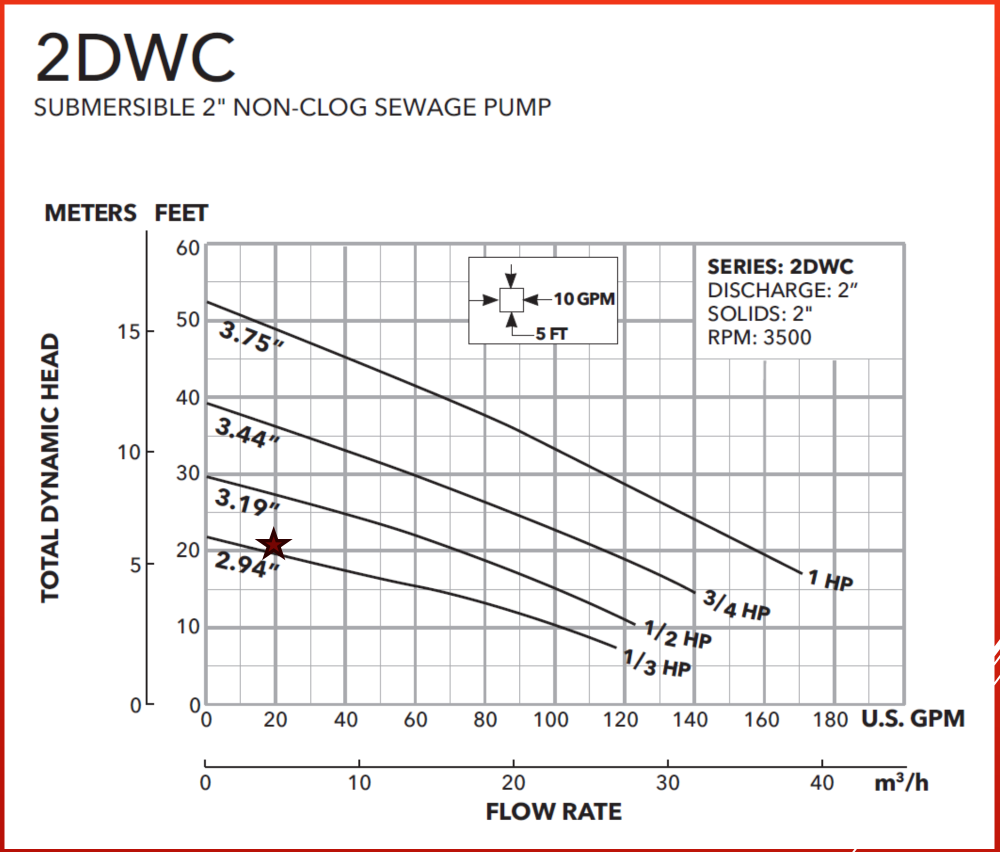
Quick Example – Step Three – Preliminary Selection

Total Capacity = 22gpm
Total TDH = 20ft

Based on these numbers, we are looking at a 2DWC at ½ hp.

Let's assume duplex because the operation is critical.

Now let's size the pit…



Source: Bell & Gossett

Quick Example – Step Three – Preliminary Selection

Pump / Motor Run Time

- Units up to 1 hp should run a minimum of 1 minute.
- Units 1 1/2 hp and larger should run a minimum of 2 minutes.

MINIMUM BASIN DIAMETER		
PUMP & PIPE SIZE	ABSOLUTE MINIMUM (Notes 1, 2, 3)	RECOMMENDED MINIMUM (Note 3)
Simplex -2"	24"	30"
Simplex -3"	30"	36"
Simplex -4"	36"	42"
Duplex -2"	36"	42"
Duplex -3"	48"	60"
Duplex -4"	60"	60"

Note 1: The absolute minimum assumes the check and shutoff valves are located outside of the basin.
Note 2: If the basin is selected at the absolute minimum and will be field assembled, we recommend a false bottom be specified.
Note 3: if the basin is over 6 feet deep, we recommend a factory installed system or a basin specified with a false bottom.

Source: R. L. Deppmann

DIAMETER	MINIMUM DEPTH	GALLONS	GALLONS PER INCH - GREATER DEPTH*
24"	36"	65	1.70
30"	36"	110	3.00
36"	36"	159	4.30
42"	48"	274	5.70
48"	48"	361	7.50
60"	78"	955	12.20
72"	78"	1375	17.60

Source: R. L. Deppmann

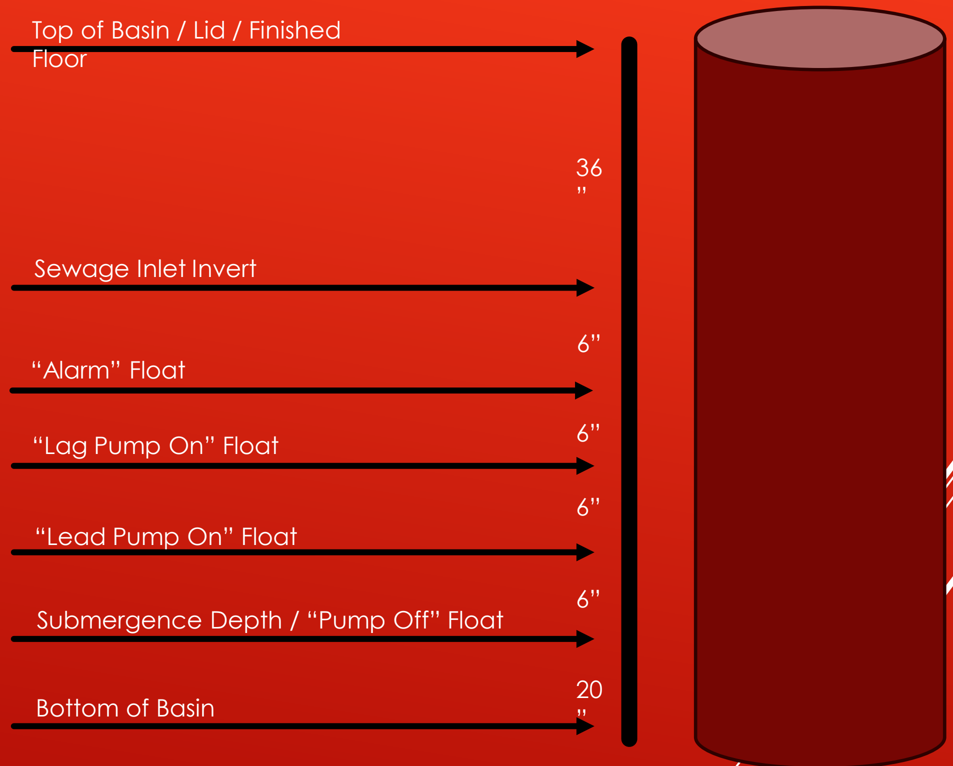
Quick Example – Step Four – Understanding the Basin

CALCULATED INVERT
- -2' – 0" at Cleanout
- 100 feet of pipe to SE
- -3' – 0" invert to SE pit

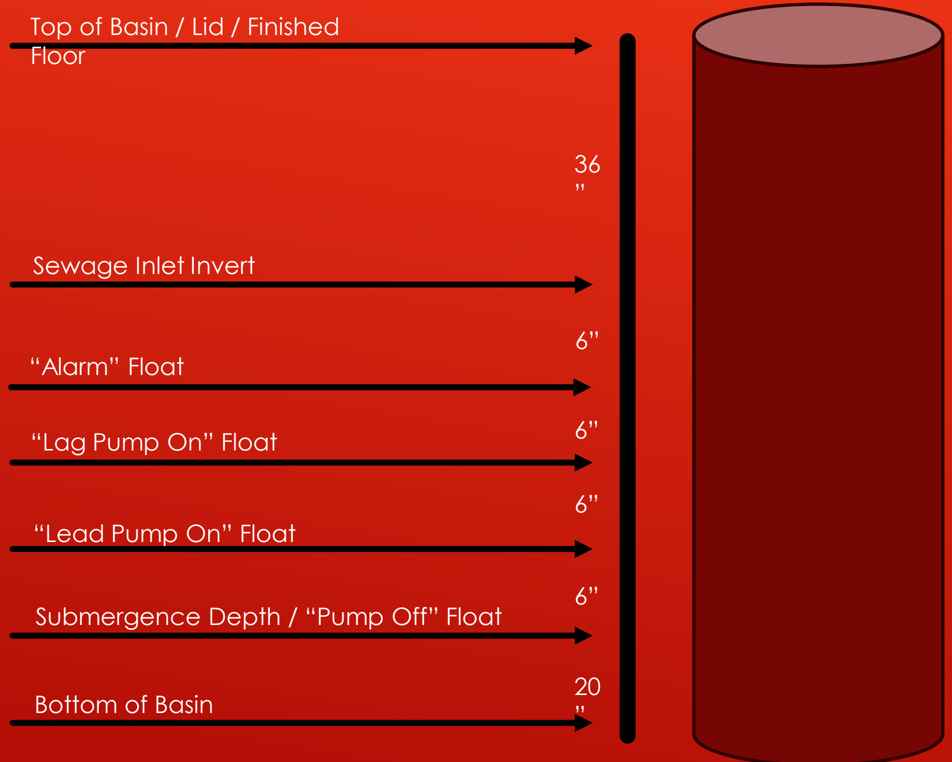
MINIMUM SUBMERGENCE:
- According to our chart, for a 2" discharge sewage pump, we should set this at 20" above bottom of basin.

PUMP DIFFERENTIAL:
- Previous step we calculated 22gal required for 1min cycle or run time.
- We know we have a 36" diameter basin.
- 4.3gal/inch in a 36" basin.
- 22gal / 4.3gal/in = 5.1in
- Let's round up to 6".

FLOAT DIFFERENTIAL:
- We are selecting a 4-float duplex system, so we need the "lag pump on" and "alarm" float.
- Generally, keep each dimension above the pump on float to be consistent. 6" works for this application.



Quick Example – Step Four – Understanding the Basin



<u>MINIMUM BASIN DEPTH REQUIRED:</u>

36"
6"
6"
6"
6"
<u>20"</u>
80"

Quick Example – Step Four – Understanding the Basin

Source: AK Industries

MINIMUM BASIN DEPTH REQUIRED:

36"
6"
6"
6"
6"
20"
80"

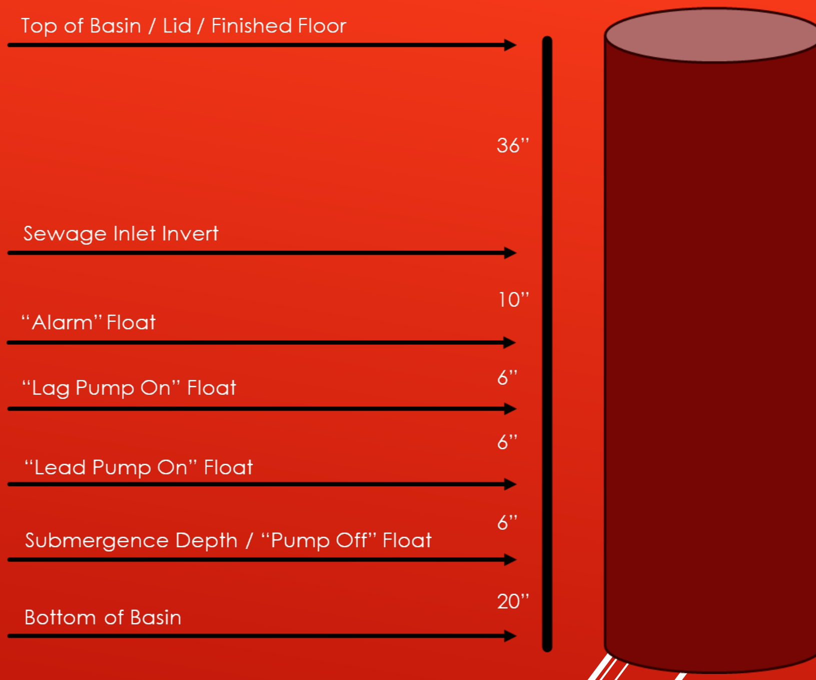
AVAILABLE BASIN DEPTHS (36" DIAMETER) FROM AK INDUSTRIES

24"
30"
36"
42"
48"
54"
60"
66"
72"
78"
84"
90"

Quick Example – Step Five – Compiling the Selection

FINAL SELECTION CRITERIA:

- Sewage Ejector (SE-1)
  - Sewage Ejector
    - Bell & Gossett 2DWC
    - 2DWC1C2F1G1A
  - Basin
    - AK Industries Fiberglass Basin
    - GB-36 X 084-200

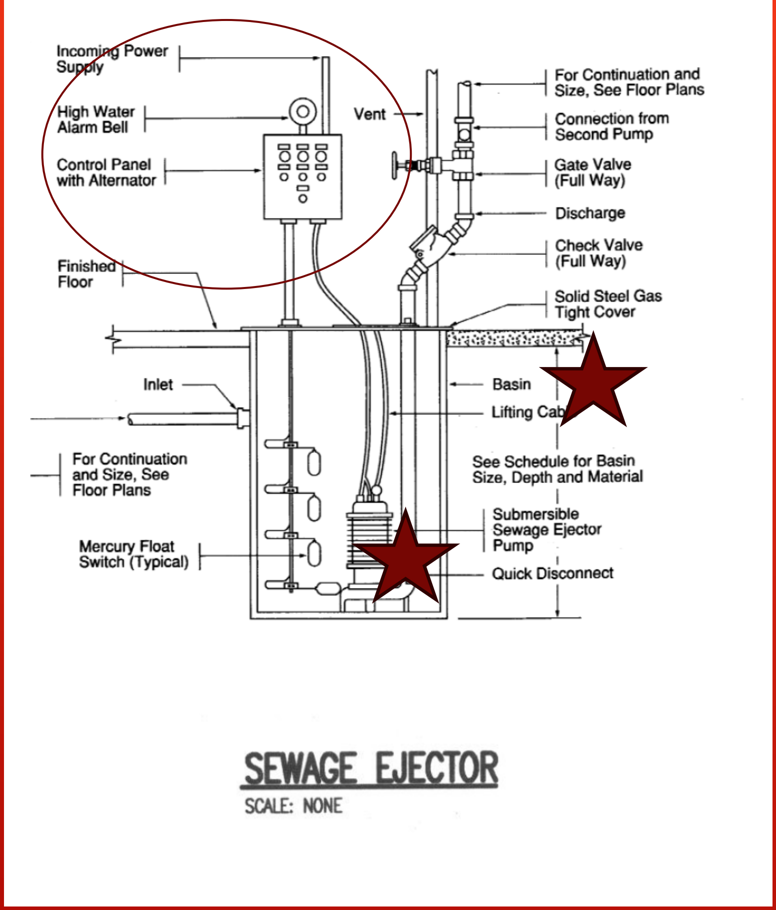


MODEL AND MOTOR INFORMATION

Order No.	HP	Phase	Volts	RPM	Impeller Dia. (in.)	Impeller Code	Maximum Amps	L.R. Amps	KVA Code	F.L. Motor Efficiency %	Resistance Start	Resistance Line-Line	Wt. (lbs.)
2DWC1A1F1H1A			115				12.4	46.0	M	54	7.5	1.0	
2DWC1A2F1H1A	0.33	1	208	3500	2.94	K	6.8	31.0	K	68	9.7	2.4	90
2DWC1A3F1H1A			230				6.2	34.5	M	53	9.6	4.0	
2DWC1C1F1G1A			115				14.5	46.0	M	54	7.5	1.0	
2DWC1C2F1G1A		1	208				8.4	31.0	K	68	9.7	2.4	
2DWC1C3F1G1A			230				7.6	34.5	M	53	9.6	4.0	
2DWC3C2F1G1A	0.5		200	3500	3.19	G	4.9	22.6	R	68	NA	3.8	94
2DWC3C3F1G1A			230				3.6	18.8	R	70	NA	5.8	
2DWC3C4F1G1A		3	460				1.8	9.4	R	70	NA	23.2	
2DWC3C5F1G1A			575				1.5	7.5	R	62	NA	35.3	
2DWC1D2F1F1A			208				11.0	31.0	K	68	9.7	2.4	

Source: Bell & Gossett

Quick Example – Step Five – Compiling the Selection



Source: ASPE Cleveland

Quick Example – Step Six – Additional Options

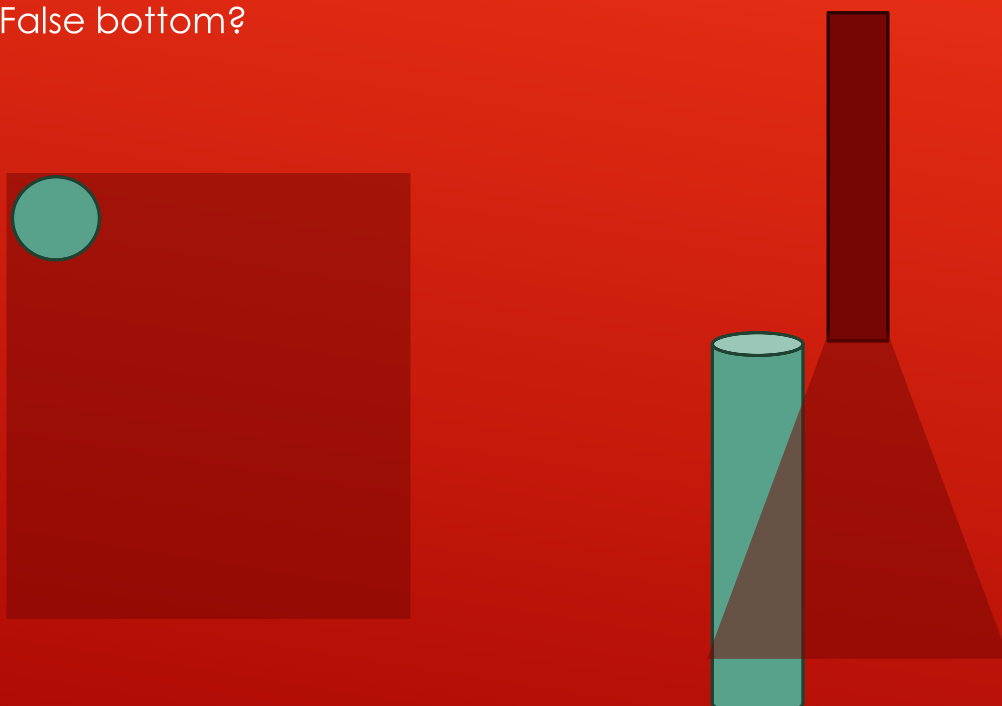
FINAL SELECTION CRITERIA:

- Sewage Ejector (SE-1)
  - Sewage Ejector
    - Bell & Gossett 2DWC
    - 2DWC1C2F1G1A
  - Basin
    - AK Industries Fiberglass Basin
    - GB-36 X 084-100
  - Control Panel
    - Bell & Gossett 3DWS/4DWS Duplex
    - Includes (4) Floats (50ft cord each)

Source: Bell & Gossett

Sewage Ejectors – Final Thoughts

- Should I use a fiberglass basin or concrete formed?
- Can I use a prefabricated basin with options?
- What about horizontal discharge systems?
- False bottom?



Source: AK Industries

SUMP PUMPS

Why?
Applications
Components
Selection Criteria

Why? – General Sump Pump

Source: Mainline Inspection Services

Applications – Sump Pumps

- General Storm Drainage
  - Patios
  - Garages***
  - Plenums / Air Intake or Exhaust Area Wells
  - Low Lying Areas where ponding might occur
- Groundwater / Foundation Drainage Plans
- Elevator Pits

Source: Bell & Gossett

Applications – Sump Pumps – Key Differences

- Fluid being pumped slightly different…
- Cycle Times or Cycles per Hour Differ
  - Standard Sewage Ejector: dependent on hp
  - Standard Sump Pump: 5 – 10 cycles per hour
  - Foundation Drainage Sump Pump: 3 – 5 cycles per hour
  - Elevator Sump Pump: ?

Consult the manufacturer!

1113.1.1 Pump capacity and head. The sump pump shall be of a capacity and head appropriate to anticipated use requirements.

1113.1.2 Sump pit. The sump pit shall be not less than 18 inches (457 mm) in diameter and not less than 24 inches (610 mm) in depth, unless otherwise *approved*. The pit shall be provided with *access* and shall be located such that all drainage flows into the pit by gravity. The sump pit shall be constructed of tile, steel, plastic, cast iron, concrete or other *approved* material, with a removable cover adequate to support anticipated loads in the area of use. The pit floor shall be solid and provide permanent support for the pump.

1113.1.3 Electrical. Electrical service outlets, where required, shall meet the requirements of NFPA 70.

1113.1.4 Piping. Discharge piping is to meet the requirements of Section 1102.2 or 1102.3 and is to include a full open gate valve and a full flow check valve. Pipe and fittings are to be the same size as, or larger than, the pump discharge tapping.

> **Exception:** In buildings where the *Residential Code of Ohio* applies, only a check valve is required on the discharge piping from the pump or ejector.

1113.1.5 Water-powered sump pumps. Water-powered sump pumps are only to be used as a secondary back-up pump for the subsoil drainage system and only with appropriate backflow protection in place as required by Section 608.

Source: 2024 OH Plumbing Code

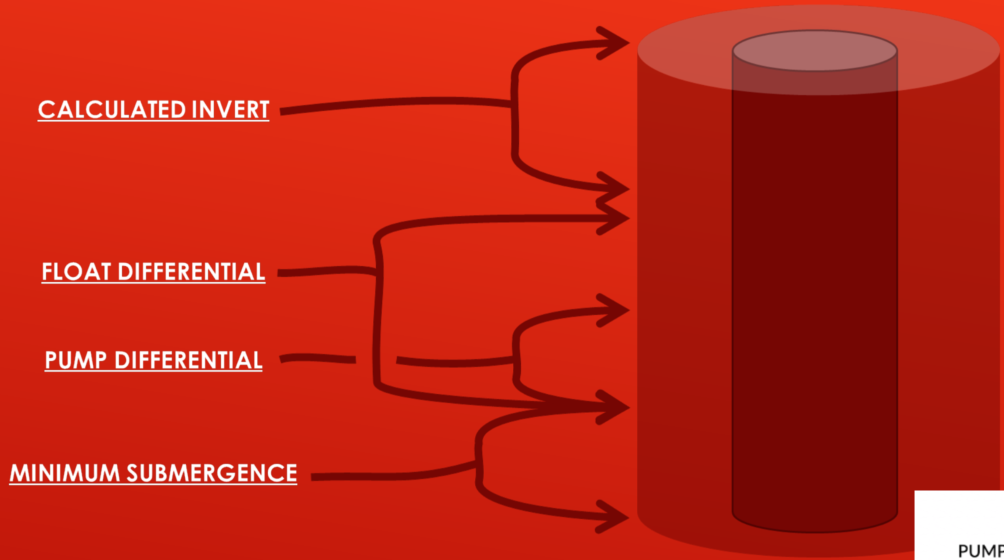
Application – General Stormwater Sump Pumps

Sizing Criteria for Storm Water

- In Cleveland and Detroit, the rainfall rate is 2.75 inches per hour according to the OPC and MPC.
- Converting to feet: 2.75in/hr * 1ft/12in = .229ft/hr
  - For our example, let's assume an area well that is 15ft x 5ft.
- Converting to cubic feet: .229 ft/hr * 15ft*5ft = 17.175 ft^3/hr
- Converting cubic feet/hr to gallons/hr: 17.175 ft^3/hr * 7.48gal/1ft^3 = 128.5 gal/hr
  - Recall that a good rule of thumb is 5 – 10 cycles per hour for a general stormwater sump pump. Let's size for 10 minute cycles, which would equate to 6 cycles per hour if the pump is running continuously.
- Convert gallons/hr to gallons/min [cycle time]: 128.5 gal/hr / 10min = 12.9gpm
- Add a safety margin: 12.9gpm * 1.2 =~ 16gpm

Source: 2024 Ohio Plumbing Code

Application – General Stormwater Sump Pumps



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60"	78"	955	12.20
72"	78"	1375	17.60

Source: R. L. Deppmann

MINIMUM BASIN DIAMETER

PUMP & PIPE SIZE	ABSOLUTE MINIMUM (Notes 1, 2, 3)	RECOMMENDED MINIMUM (Note 3)
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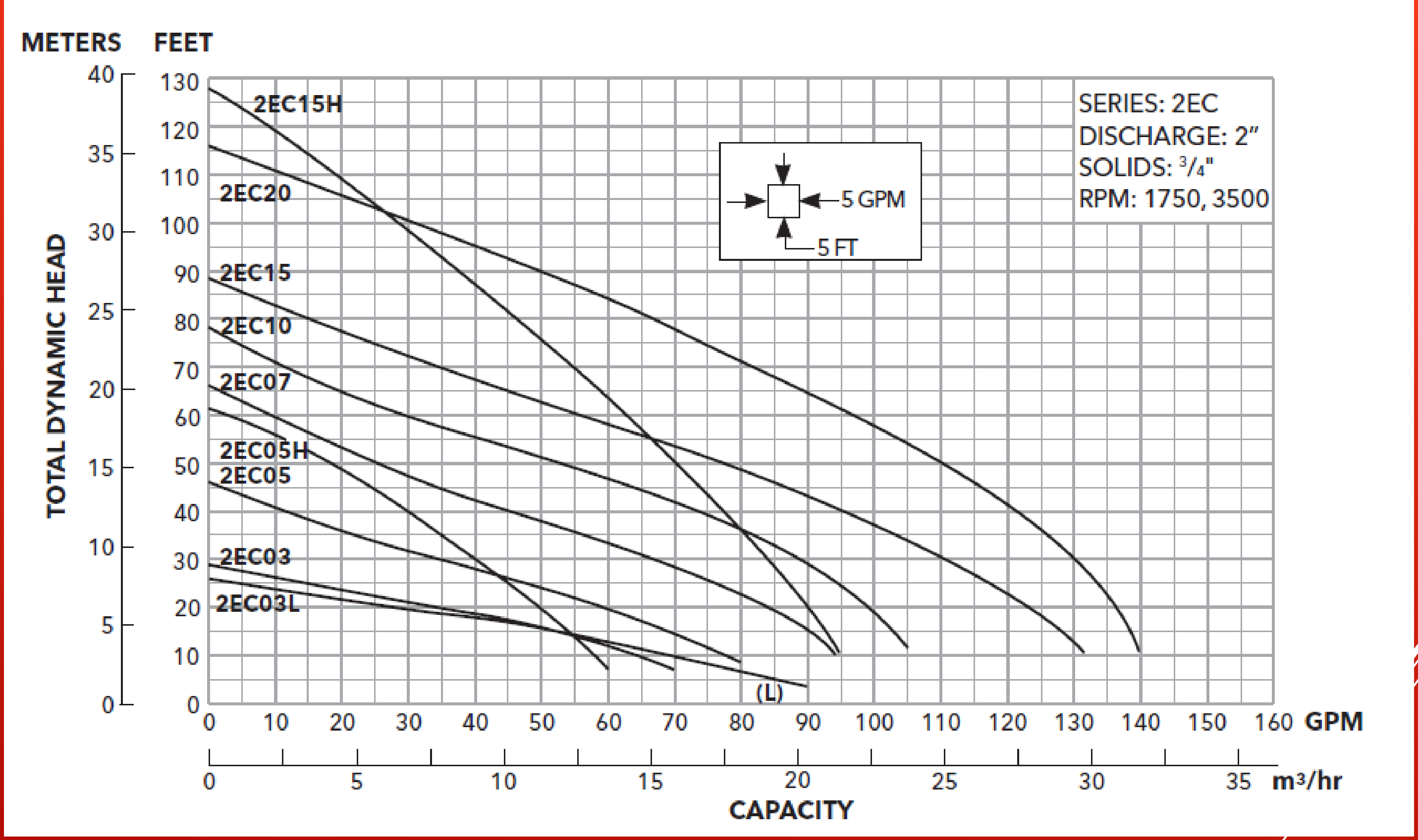
Note 1: The absolute minimum assumes the check and shutoff valves are located outside of the basin.
Note 2: If the basin is selected at the absolute minimum and will be field assembled, we recommend a false bottom be specified.
Note 3: if the basin is over 6 feet deep, we recommend a factory installed system or a basin specified with a false bottom.

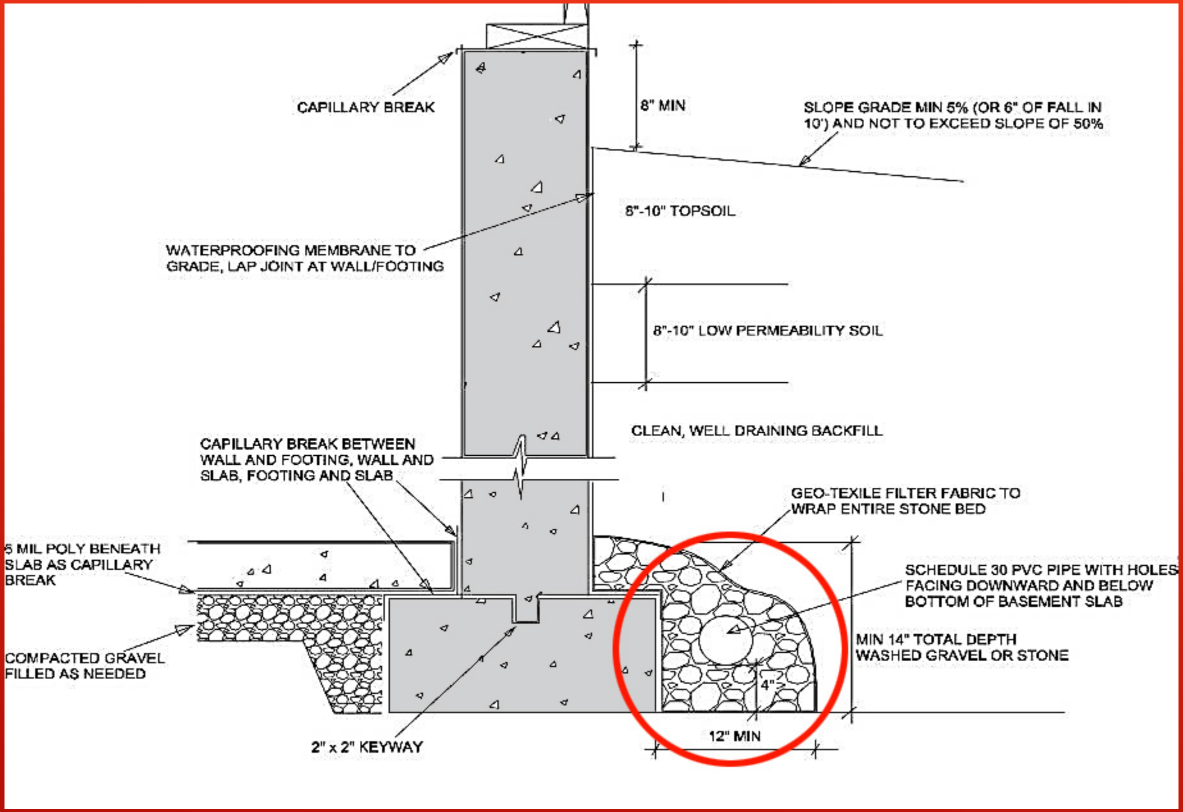
Source: R. L. Deppmann

Application – General Stormwater Sump Pumps



Source: Bell & Gossett

Application – Foundation Drainage



Source: theconstructor.org

Application – Foundation Drainage

Gathering Information

- Determining a flow from foundation drainage into a sump is generally *not* the responsibility of the plumbing engineer.
- This information generally comes from a geotechnical engineer.
- They can tell you a flow into a sump from the general elevation of the lowest level's impact on the water table.
- Once a flow is determined, then all that is needed is a corresponding pressure to select the foundation drainage pumps.

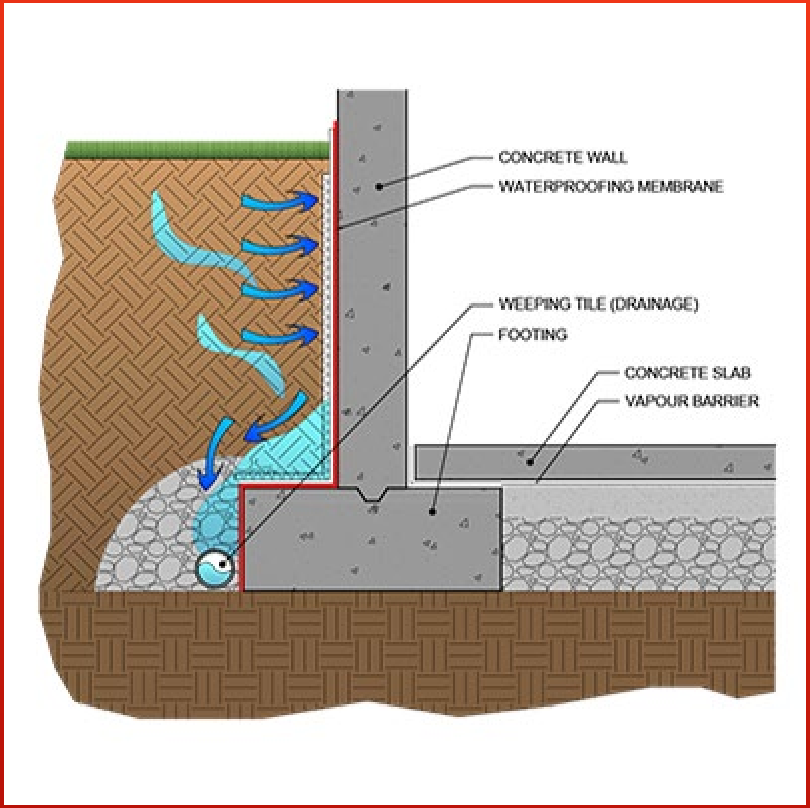
General Responsibilities (usually)

- Geotechnical Engineer – determine amount of flow into the sump/pit.
- Structural Engineer – detail how the foundation drainage interacts with structure.
- Civil Engineer – needs to be generally aware of what is happening at the foundation.
- Plumbing Engineer – provide a sump pump (usually duplex) to pump ground water to gravity system level.
- Everyone – communicate!!

Other Notes

- Don't forget about elevator depressions!
- Building slabs can be uneven, so be sure to check that all potential low points are addressed with the drainage system.

Applications – Foundation Drainage

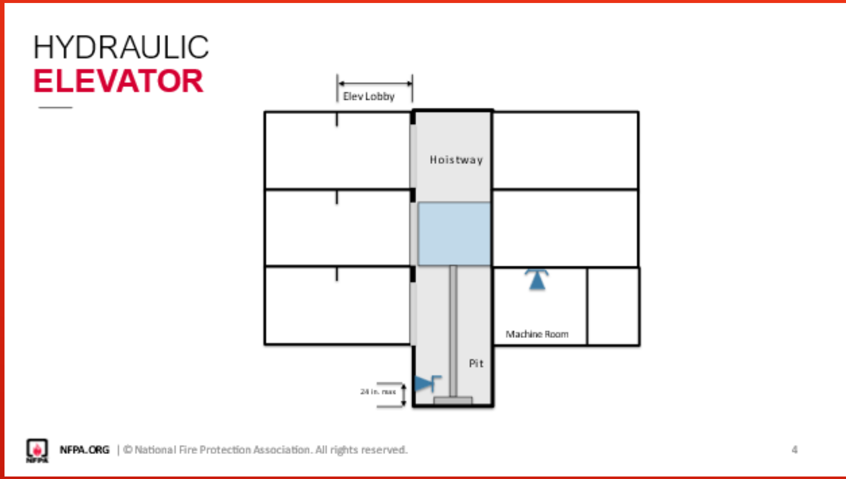


Source: Resisto

Why? – Elevator Sump Pump

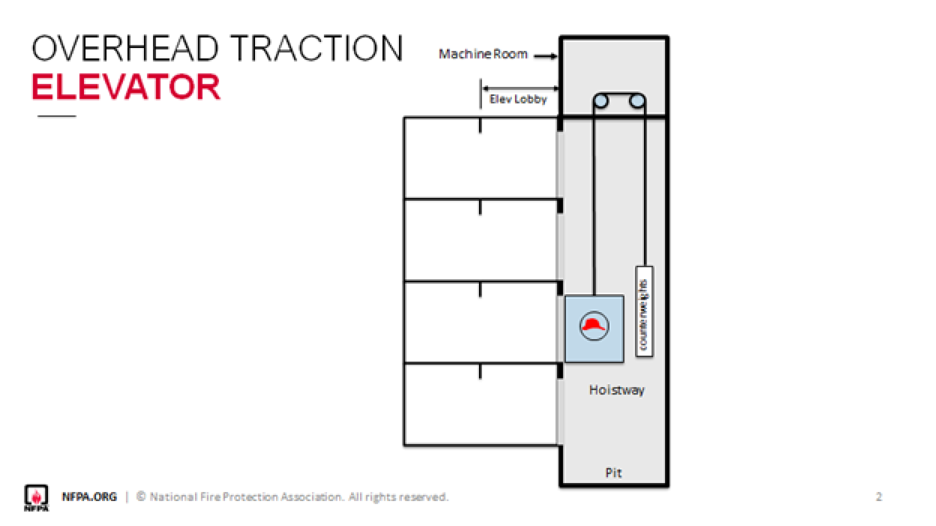
Source: Truxes Company

Why? – Elevator Sump Pump



Source: NFPA

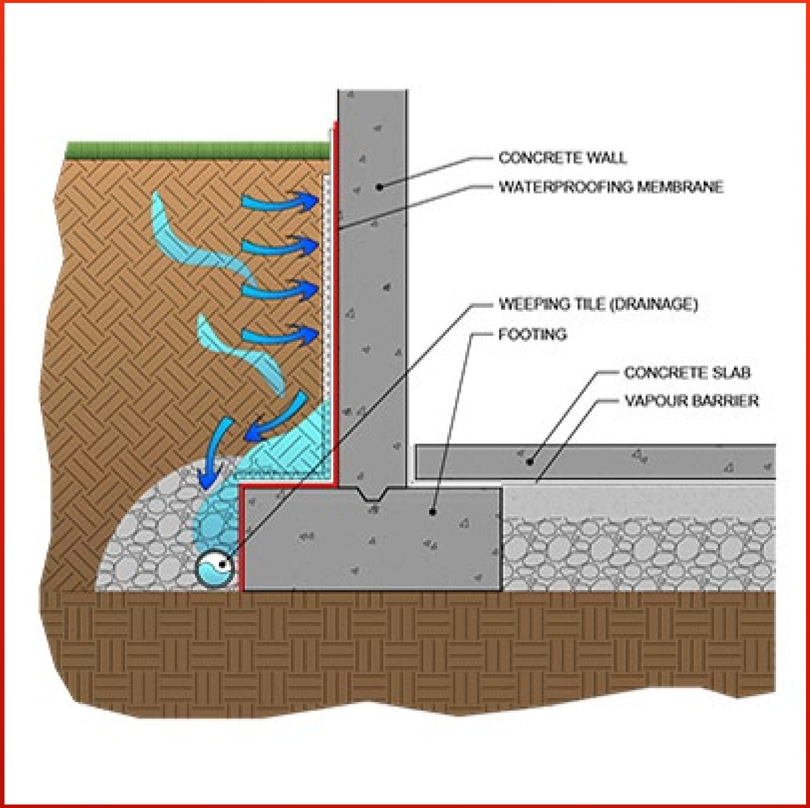
Oil Smart is required here… RLD can help!



Source: NFPA

Why? – Elevator Sump Pump

Why? – Elevator Sump Pump



Source: Resisto

Why? – Elevator Sump Pump

Source: TG Oil Services

Source: Chicago Elevator Maintenance

Pop Quiz

What is the required **gallons per hour flow rate** for water removal from an elevator sump pit according to *ASME A17.1*?

Source: YouTube

Application – Elevator Sump Pump

Compliance with Code Requirements

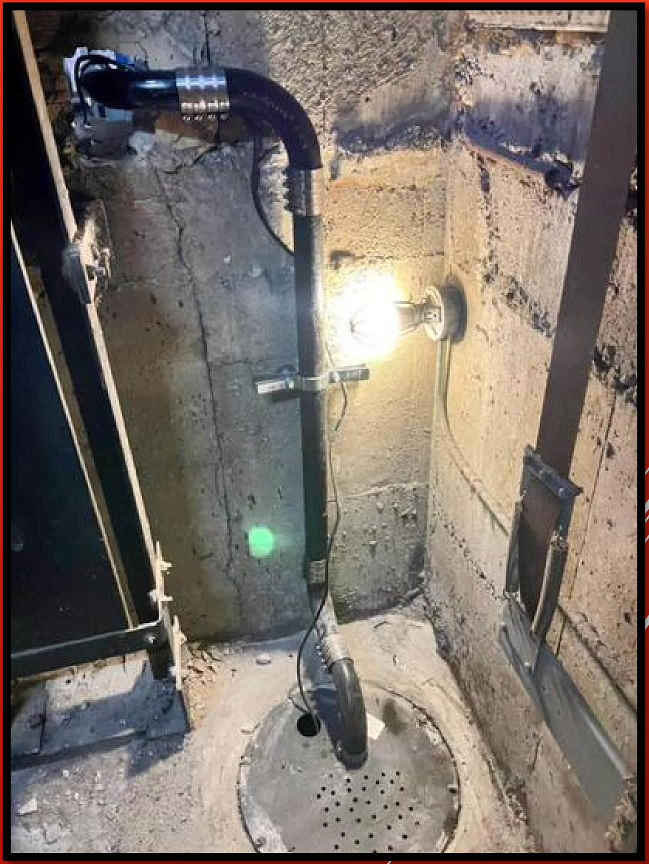
- ASME A17.1 (Safety Code for Elevators and Escalators)
- "Firefighters' Emergency Operation"
- These pumps cannot discharge directly into the sanitary or storm system.
  - Indirect Means
  - Direct to Exterior (think of an overflow discharge nozzle)
  - Mop Basin?

Pumping Capacity and Size

- "The pit drainage shall be designed to remove a minimum capacity of 3,000 gallons per hour per elevator car."
- This means that the sump pump should be sized at 50gpm per elevator car.
  - This is a "per car" requirement, not a "per elevator shaft" requirement.

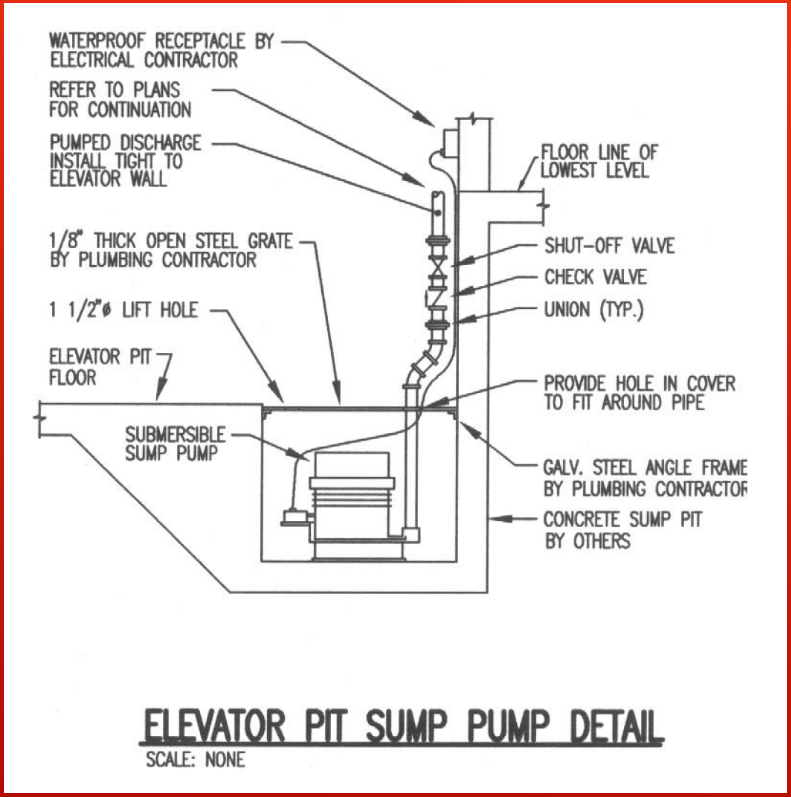
Pump and Alarm Integration

- Integrated water level alarms to alert personnel that the pump is operational.
- Sometimes can tie into the BAS as well.

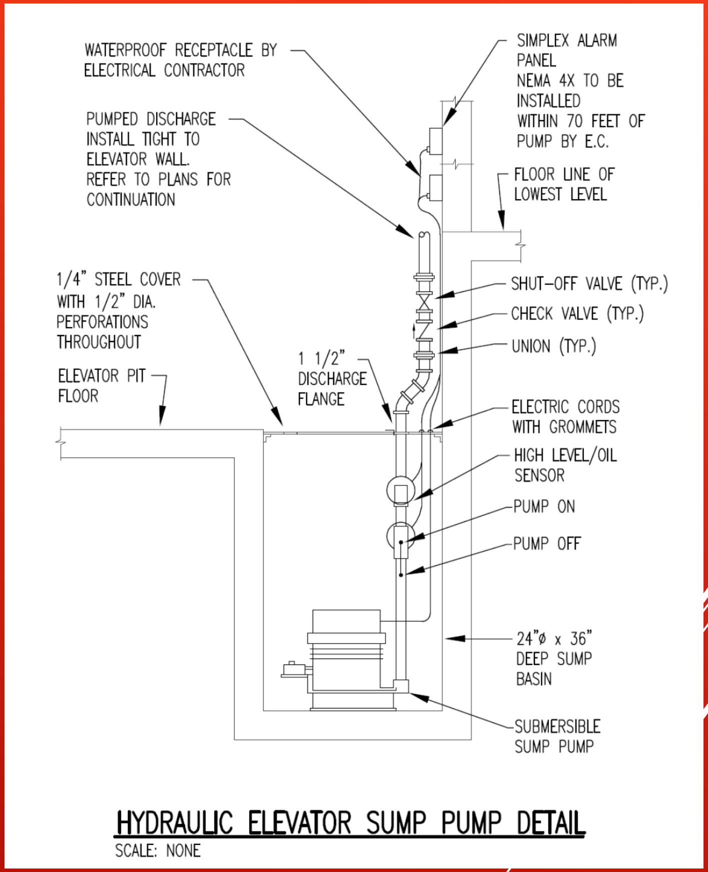


Source: TikTok

Components – Elevator Sump Pump



Source: ASPE Cleveland



Source: ASPE Cleveland

Components – Elevator Sump Pump

Source: Phoenix Modular Elevator

Components – Elevator Sump Pump

Source: Bell & Gossett

Sump Pumps and Sewage Ejectors

Source: Bell & Gossett

Don’t Let Your $#!* Back Up: Sump Pumps and Sewage Ejectors

Nick Tabar, PE, MBA, CPD
R. L. Deppmann | Northern Ohio Sales Engineer

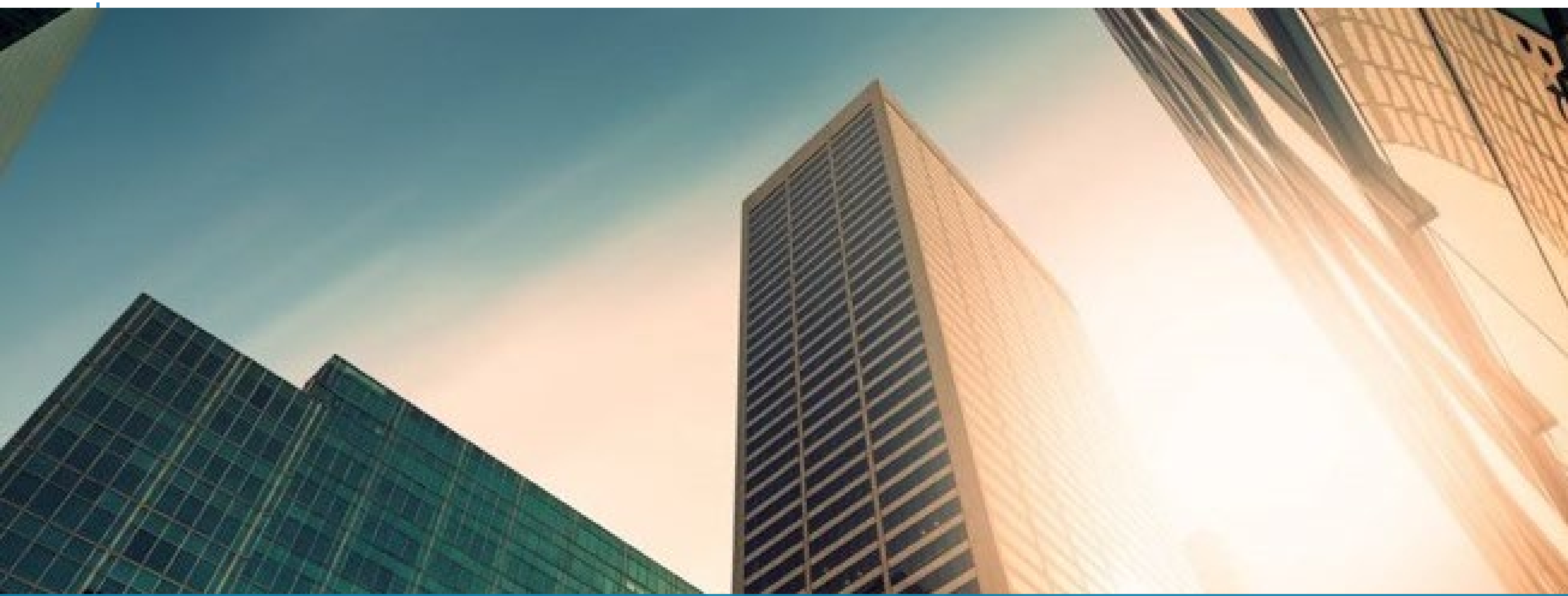
AGENDA

8:30-9:30 –	Insights from the Field –	Brad Notter
9:30-9:45 –	Break	
9:45-10:45 –	Optimizing Hydronic Heating –	Ryan Groves
10:45-11:00 –	Break	
11:00-12:00 –	Don't Let Your Sh*t Back Up –	Nick Tabar
12:00-1:00 –	**Lunch**	
1:00-2:00 –	**Water Quality Solutions –**	**Andrew Ward**
2:00-2:15 –	Break	
2:15-3:15 –	Guide to Smart Pumps –	Jason Winslow
3:15-3:30 –	Break	
3:30-4:30 –	Decarbonization Insights –	Kyle Wefing

TRIVIA

PVI currently uses a duplex alloy that blends the advantages of 300 and 400 grade stainless steel. What is the name of this technology?

DEPPMANN



ENGINEERING BUILDING WATER QUALITY

OCTOBER 29, 2024

Presented for: Deppmann Academy 2024

Introductions

Andrew Ward, M.S.

Water Solutions Group, Division Manager

Memberships: ASHRAE, WQA, ASPE, MiSHE

ASHRAE SSPC 400 committee member

DEPPMANN

Products System Design Water Solutions Contractors Service & Parts Education About RLD

Water Solutions

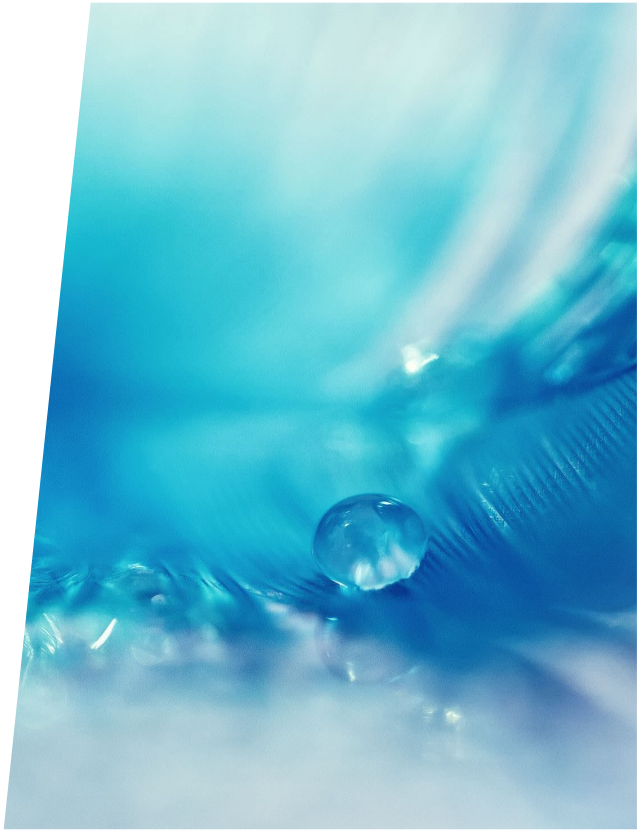
Water Solutions Group is a separate division of the R.L. Deppmann Company created to provide end users and engineers with a valuable resource in efforts to improve water quality. Our intimate knowledge of water systems positions WSG to be the first choice when evaluating operational issues that may arise because of poor water quality.

AGENDA

- Purpose: Describe the importance of incorporating water quality management into engineering specifications
- Process: Review water quality best practices for protecting large mechanical systems
- Payoff: Gain an understanding of common water quality challenges and the methods to mitigate the risk of contamination and product failure

WATER SOLUTIONS GROUP

Maintaining desired water quality starts with engineering design and requires consistent management to protect assets and public health



WATER SOLUTIONS GROUP

Water monitoring, testing and analysis

Product selection and solutions

Site visits and after installation support

Education and training

MEMBER Water Quality Association

BOILER MAG
Magnetic Filtration

EASY WATER
Conditioning
Reverse Osmosis
Filtration
Domestic Water Treatment
Ultraviolet
Lead & Toxin
Deionized

EVOQUA
Filtration
- Automatic Screen Filters
- Micro-Sand Filtration
- Reverse Osmosis
- Solids Separators

Disinfection
- UV Systems
- Ozone Systems
- Chlorine Generation Systems

Aquatics & Pool
- Filtration
- Disinfection
- Analyzers & Controllers

GENERAL WATER SYSTEMS
Chemical Bypass Feeders (Pot Feeders)
Solids Separators
Activated Carbon Filtration
Sand Filtration
Coupon Racks

HF SCIENTIFIC
Chlorine Analyzers
UV Analyzers
Total Residual Oxident and Chlorine Monitors

LYNC BY WATTS
Filtration
Disinfection
Conditioning
Instrumentation
Rain Water Harvesting

MORTON SALT
Softener Salt

PROPAK SOLUTIONS
Custom Packaged Solutions

WATTS WATER QUALITY SOLUTIONS
Commercial Water Softeners
Reverse Osmosis
Filtration — Media Systems, Bag, Spun
Ultra Violet (UV)
Chemical Feed, Metering

WESSELS
Filters
- Sediment Bag

OTHER SERVICES
Site Visits
Testing & Analysis
Monitoring

Visit Our Website to Learn More

MEMBER Water Quality ASSOCIATION

INCORPORATING WATER QUALITY IN DESIGN

WATER QUALITY

Water quality varies greatly across Michigan and throughout the rest of the country

No single treatment process satisfies all water conditioning and purification requirements

Physical

- Suspended solids
- Electrical conductivity
- Temperature
- Turbidity
- pH

Chemical

- Hardness
- Dissolved metals (lead, copper, iron)
- Harsh oxidizers
- Disinfection by-products
- Scale and corrosion
- PFOA/PFOS

Microbial

- *Legionella*
- Aerobic and anaerobic bacteria

Water Quality Parameter	Potable	Closed Loop Cooling	Closed Loop Heating	Cooling Tower
pH	6.5-8.5	8.5-9.0	8.5-9.0	6.5-7.5* 9-10**
Hardness (ppm)	60-120	<250	100-300	50-100
Turbidity (NTU)	<1	10-15	10-15	<10
Conductivity (µmhos/cm)	200-800	700-3,200	700-3,200	2,400-5,000
Alkalinity, Ca (ppm)	20-200	<200	<200	100-500
Ammonia (ppm)	<1.5	<2.0	<2.0	<50
Total dissolved solids (ppm)	50-150	2,000-3,500	2,000-3,500	<50***
Copper (ppm)	<1.3	<0.2	0.01-0.05	<0.5
Total aerobic plate count	0	<1000 cfu/mL	<1,000 cfu/mL	<10,000 cfu/mL

IDEAL WATER QUALITY

SOURCE: US EPA, WHO, ASPE

*chlorine-based treatment
**for aluminum materials
***total suspended solids

CONSEQUENCES OF INADEQUATE WATER TREATMENT

- Water must meet US EPA Safe Drinking Water Act and local health official requirements
- Water quality may not be suitable for hospitals or industrial purposes, and require external treatment

50 YEARS

SAFE DRINKING WATER ACT

Absent or inadequate treatment leads to:

- Reduced efficiency
- Increased energy costs
- Environmental impact
- Failures outside of warranty
- System downtime
- Liability for remedial/replacements work and costs
- Damage to reputation

ENGINEERING WATER QUALITY

Engineering specifications state water quality must be maintained to minimize corrosion, scale buildup, and biological fouling in HVAC equipment

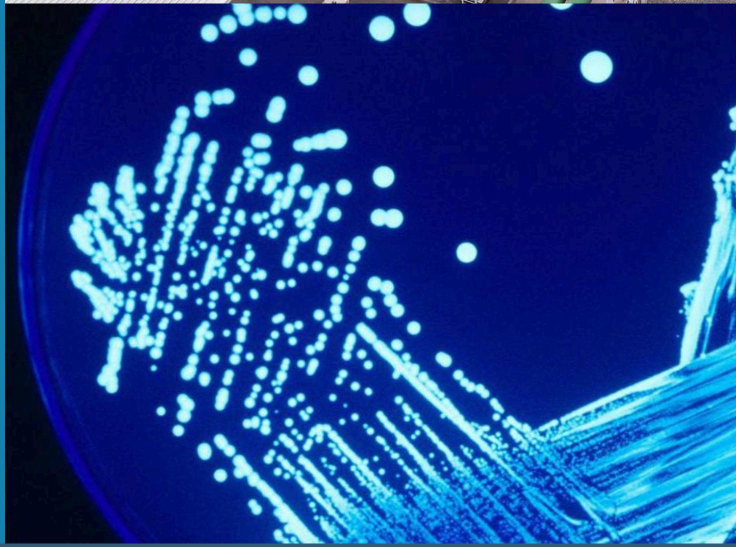
- Performance requirements
- Quality assurance
- Maintenance
- Products (chemical feed equipment, chemical treatment test equipment, chemicals)
- Installation and connections
- Field quality control and closeout submittals

Specifications are silent regarding practical aspects of determining and maintaining water quality through a system

LEGIONELLA

Legionnaires' disease caused by *Legionella pneumophila* which grows in building water systems

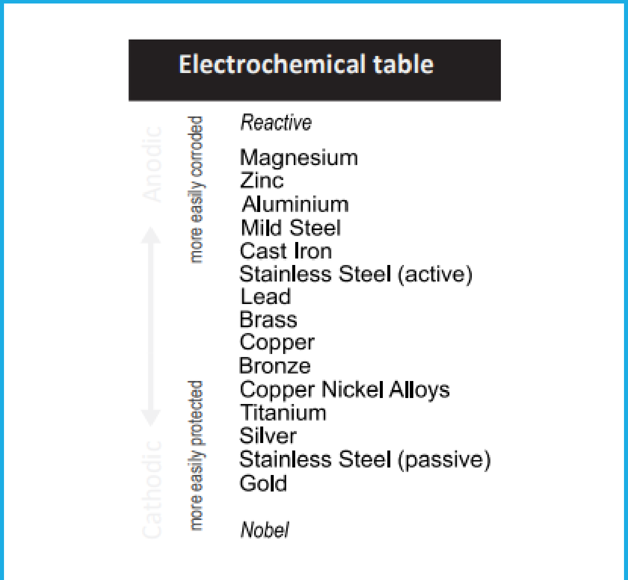
- Reduction of water flow in plumbing fixtures to conserve potable water
- Oversized water supply piping
- Reduced hot water temperatures
- Aging plumbing and HVAC infrastructure
- Water quality unknown or not considered in plumbing and HVAC engineering designs

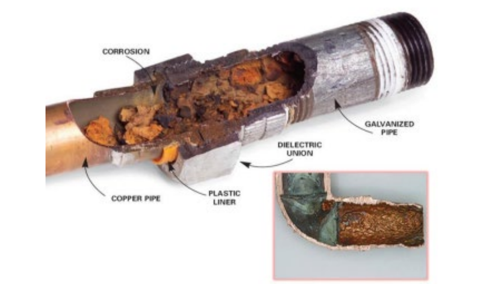


CORROSION

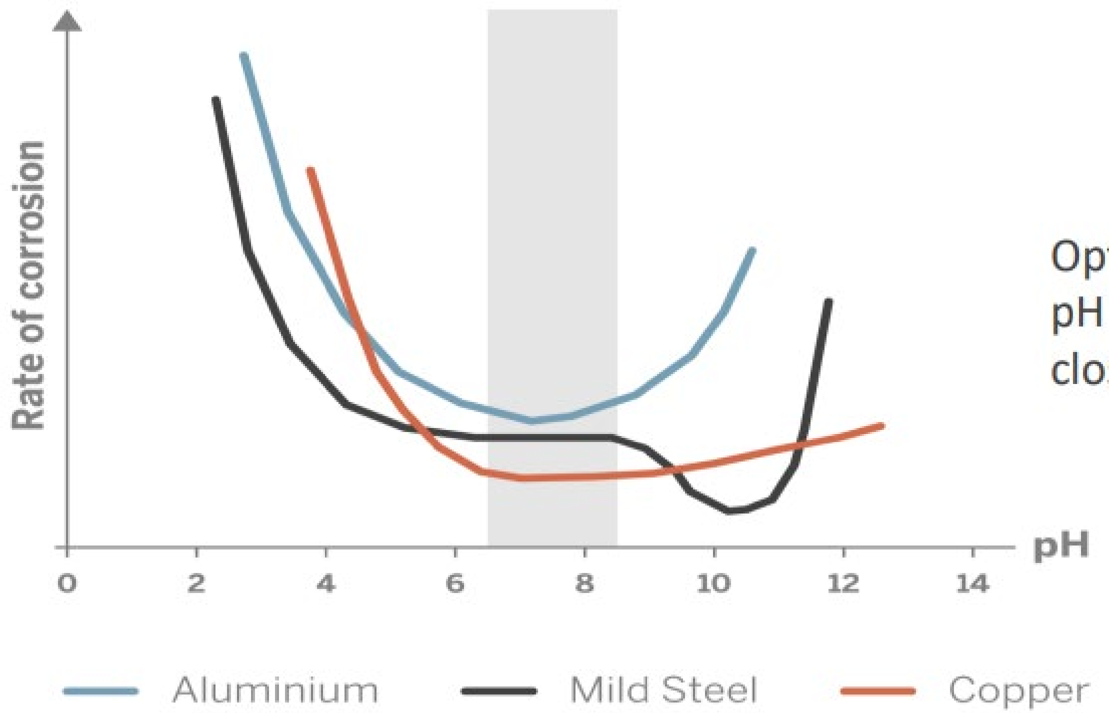
Primary causes

- Dissolved oxygen in makeup water
- Electrical conductivity
- pH
- Chemicals (oxidizers)





pH vs. rate of corrosion



Optimum range of pH of water in a closed system.

SCALE

5 grain per gallon of water hardness causes a 4% loss in efficiency and 4% increase in the cost of energy in storage tank water heaters when using 50 gal of hot water per day

Scale formation leads to biofilm growth and provides shelter and nutrients for bacteria

High pH, high alkalinity, phosphates, Ca, Mg, Fe

NON-METALLIC MATERIALS

Failure due to insufficient sealing pressure

Overstretching due to thermal expansion

Improper material selection

Excessively high pH or addition of chemical inhibitors

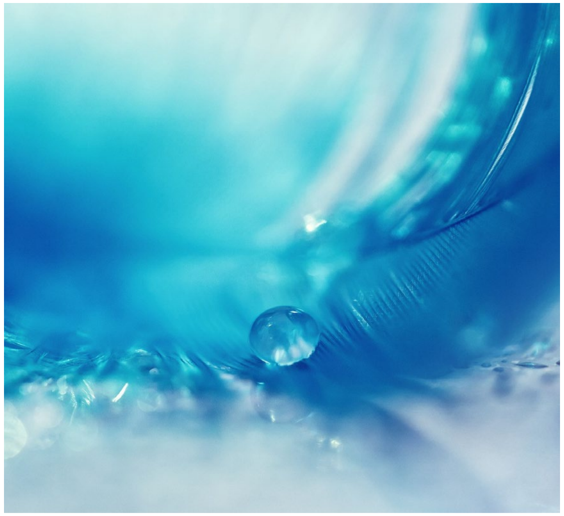
If seals are incorrectly sealed or improperly fitted, water in the sealing area will evaporate upon escaping which leads to accumulation of water constituents at the outside edge of the seal

CONTROLLING WATER CHEMISTRY

Traditional methodology

- Chemical disinfection
- Performance testing
- PM program
- Plumbing and HVAC is one part of overall commissioning
- Reactive to water problems

- Current methodology
  - Incorporate water quality into commissioning
  - Perform risk assessments
  - Analyze water quality
  - Develop and implement a water management program
  - Incorporate external treatment
  - Increase efficiency and reduce costs
  - Proactive water management



WATER MANAGEMENT PROGRAMS

Developed based on guidance in ASHRAE Standard 188 and Guideline 12-2020

- Extend equipment life
- Minimize energy and water consumption
- Maintain a safe environment

MANUFACTURER GUIDANCE

Manufacturers of boilers, chillers, and other large mechanical equipment specify minimum feed water quality and operating conditions

True operating conditions depend on the water quality received from the source and the necessary processing steps

Manufacturers are increasingly voiding warranties for failures due to problem water quality.

AERCO A WATTS Brand

Tech Bulletin

Date: June 20, 2024

Distribution: All Sales Representatives and all ATT and AMT Factory Trained Technicians

From: Tony Levens, Sr. Training Manager

Subject: Best Practices Boiler Initial Fill and Makeup Water

BRYAN STEAM

Bryan Steam Boiler Water Quality Guidelines
Form 228
10/1/202

WATER QUALITY SOLUTIONS

DESIGN CONSIDERATIONS

HOLISTIC APPROACH

First goal: simplify design as much as possible. Every component within the plumbing and HVAC system is another possible point of failure.

Second goal: select and install components considering unintended consequences

Achieving water quality goals not only extends the life of equipment but also helps reduce energy use and chemical usage

Water treatment solutions should be based not only on the quality of water received from the source (municipality, reclaimed) but also on the system characteristics (material of construction, operating conditions)

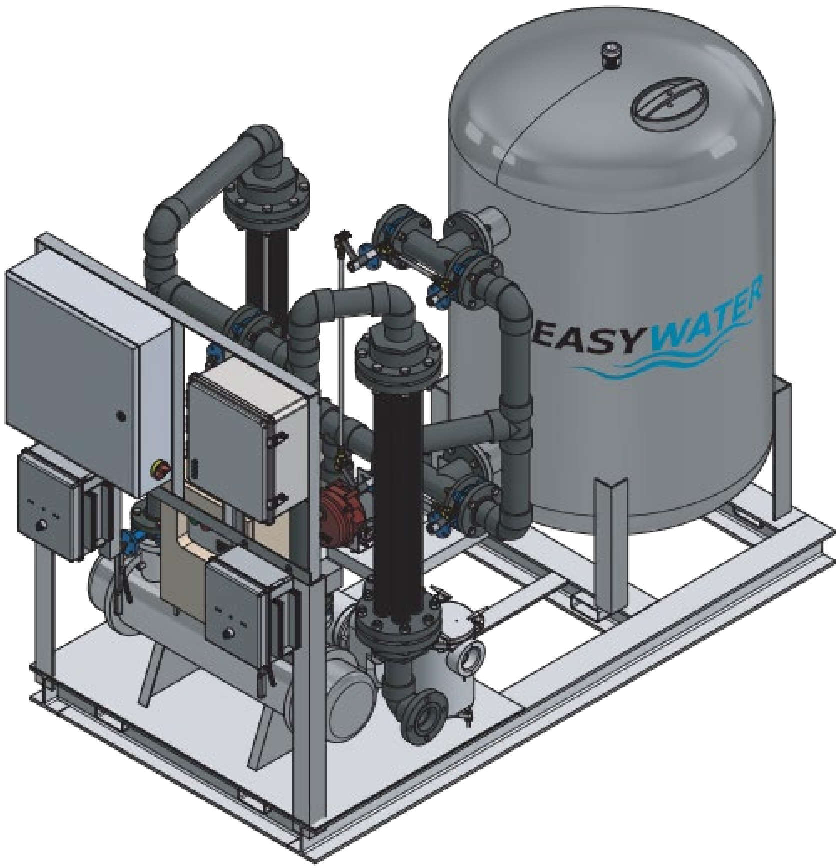
COOLING TOWER WATER SYSTEMS

Typical cooling tower treatment

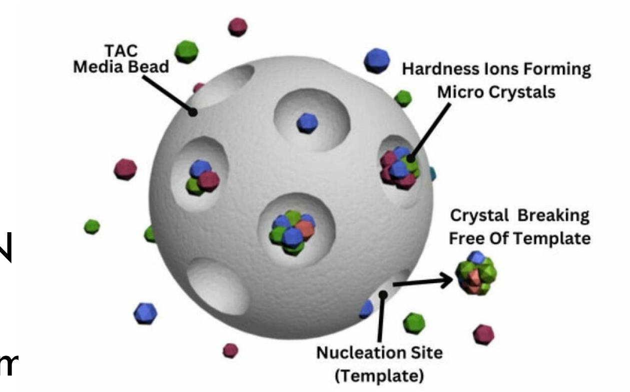
- Oxidizing biocide
- Non-oxidizing biocide
- Corrosion/scale inhibitor
- Dispersants
- pH adjustment

WHY NON-CHEMICAL?

- Cost – chemicals, maintenance, training, wastewater
- Efficiency – chemicals needs to be monitored continuously, replaced when expired or diluted
- Safety – workers suffer illness or death from exposure to chemicals under certain conditions
- Regulatory – AHJs reevaluating traditional methods



EXTERNAL TREATMENT METHODS



SCALE

- Ion exchange water softener
- Template/media assisted crystallization
- Magnetic/electromagnetic scale reducers
- Reverse osmosis

CORROSION

- Reverse osm
- Ion exchange
- Calcite filtration - increase pH by reintroducing hardness and alkalinity

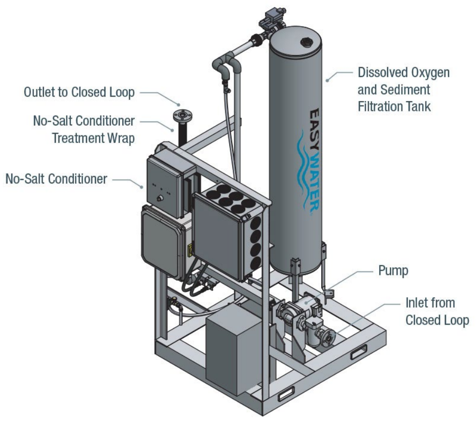
Typical applications: well water, domestic water, process water, side-stream cooling tower, side-stream closed loop

EXTERNAL TREATMENT – OPEN LOOP

- Media assisted crystallization
- UV
- Electrolytic chlorine reduces risk of chlorine burns and maintenance costs
  - 32% water savings
  - No chemicals needed – chlorine generated
- Blowdown management

Chemical treatment may include organic phosphonate and polymeric dispersants with alternating oxidizing and non-oxidizing biocides. Waste products of these treatments may enter in water sources.

EXTERNAL TREATMENT – CLOSED LOOP



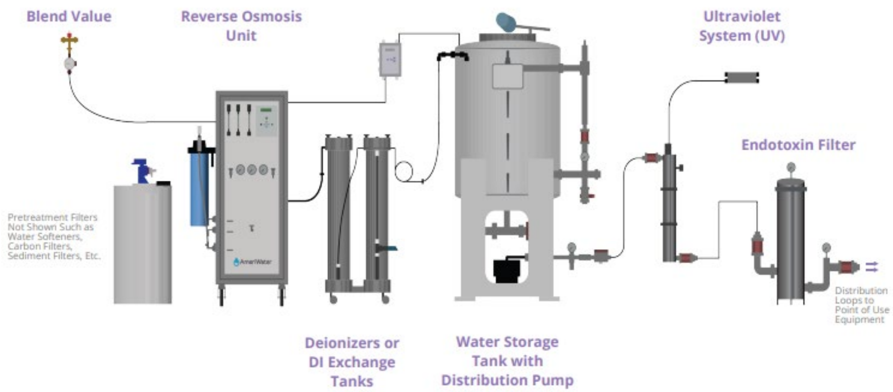
- No-salt water conditioners
- Dissolved oxygen and sediment filtration
- Corrosion and deposit prevention without chemicals

HEAT EXCHANGERS DEPOSIT CHART		
Deposit Thickness, In Inches	Fouling Factor	% Efficiency Loss
0	0.00	0
0.012	0.001	6.4
0.024	0.002	14.4
0.036	0.003	27.2

Typical chemical treatment

- Low temp hot water, closed cooling and chilled water: combination of sodium nitrite, borax, and molybdate with copper alloy inhibitor.
- Chilled water: phosphate, polymer borate, copper alloy inhibitors (non-oxidizing)
- Glycol low temp: glycol with buffered phosphate-based corrosion inhibitor with copper alloy inhibitor in DI water (if water chloride levels are 750 ppm and contains hard water ions)

AAMI ST108 – WATER QUALITY FOR MEDICAL DEVICE PROCESSING



Risk analysis

Water treatment design

Maintaining the water system

Monitoring water quality

- Utility water
- Critical water
- Steam

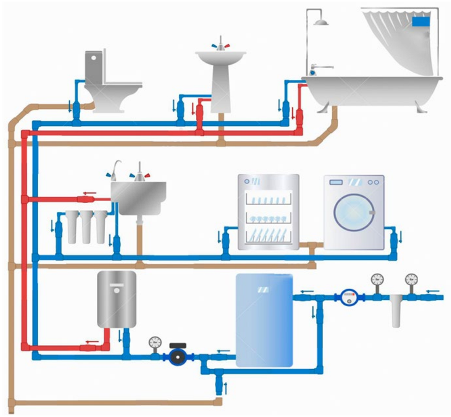
Validation

CONCLUSION

Maintaining desired water quality starts with engineering design and requires consistent management to protect assets and public health

Review water quality expectations in engineering specifications to ensure it is consistent with current industry standards

Water Solutions Group rapidly responds to design considerations and provides solutions to enhance water quality through external treatment



RL D WATER SOLUTIONS GROUP

CONTACT

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248-410-4028

award@deppmann.com

WATER
SOLUTIONS
GROUP

AGENDA

8:30-9:30 –	Insights from the Field –	Brad Notter
9:30-9:45 –	Break	
9:45-10:45 –	Optimizing Hydronic Heating –	Ryan Groves
10:45-11:00 –	Break	
11:00-12:00 –	Don’t Let Your Sh*t Back Up –	Nick Tabar
12:00-1:00 –	Lunch	
1:00-2:00 –	Water Quality Solutions –	Andrew Ward
2:00-2:15 –	**Break**	
2:15-3:15 –	**Guide to Smart Pumps –**	**Jason Winslow**
3:15-3:30 –	Break	
3:30-4:30 –	Decarbonization Insights –	Kyle Wefing

RL DEPPMANN

TRIVIA

If a customer is looking for a product to eliminate the presence of dissolved solids in domestic water, such as salts or toxic metals, they should use what type of product?

THE ENGINEER’S GUIDE TO SMART PUMPS: CRITICAL FACTORS TO KNOW

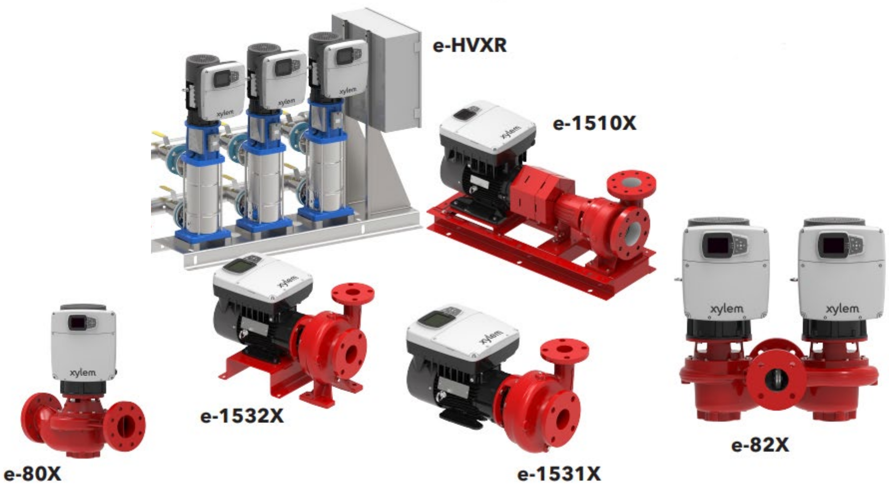
Presented by Jason Winslow

RL D DEPPMANN

AGENDA

- Introduction to smart pumps
- When to use what type of smart pump?
- Selection software
- Accessories
- Q & A

MANY OPTIONS



DEPPMANN

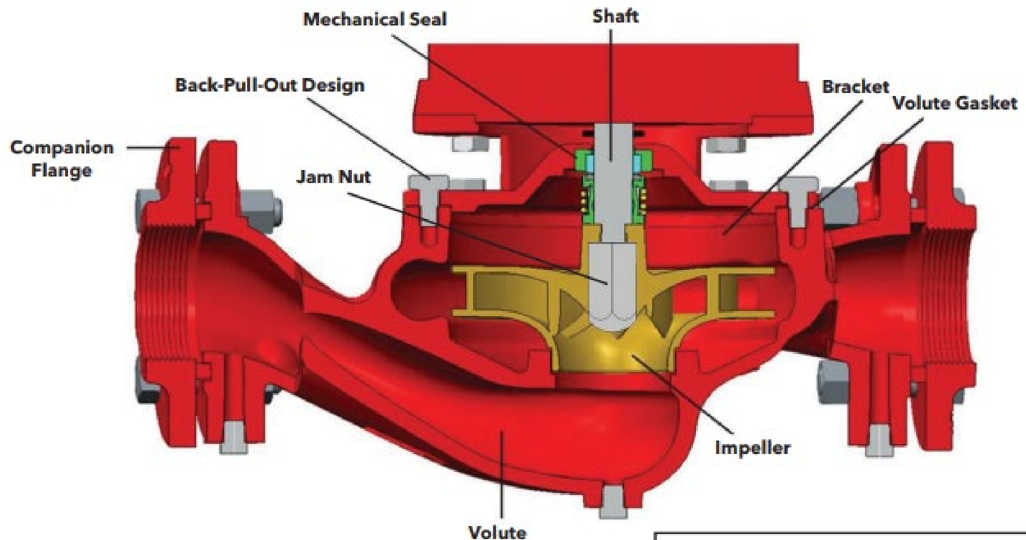
TERMINOLOGY

ECM Pumps – A type of pump that utilizes a brushless, electronically controlled motor.

ECM Smart Pump – A type of pump that utilizes an ECM motor, along with smart technology for even greater efficiency and control.

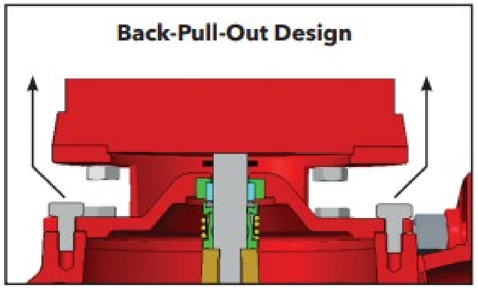
Smart Pump – A type of pump that utilizes a non-ECM motor, along with smart technology for even greater efficiency and control.

ECM PUMP CONSTRUCTION
E-90ECM



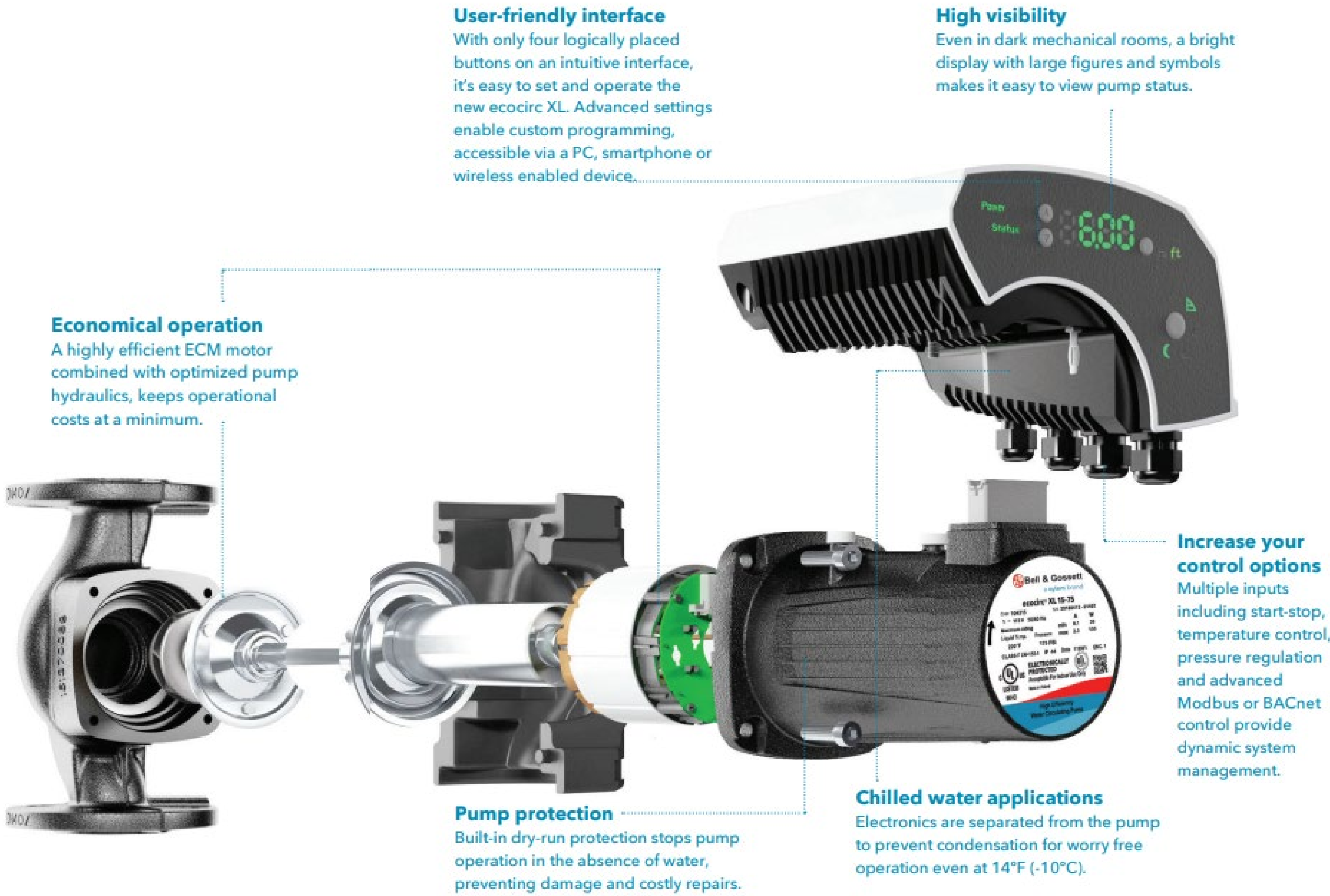
Ease of Maintenance

Back-pull-out design allows the pump to be serviced without disturbing the piping. Motors include sealed for life bearings. This pump design requires no coupler or stub-shaft to install. The one-piece unitized mechanical seal simplifies seal removal and replacement.

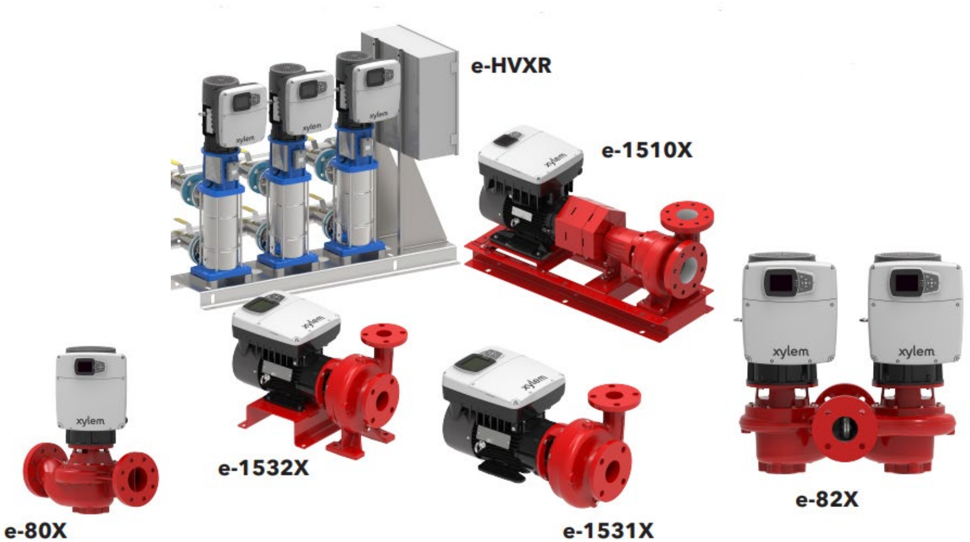


DEPPMANN

ECM SMART PUMP CONSTRUCTION
ECOCIRC XL



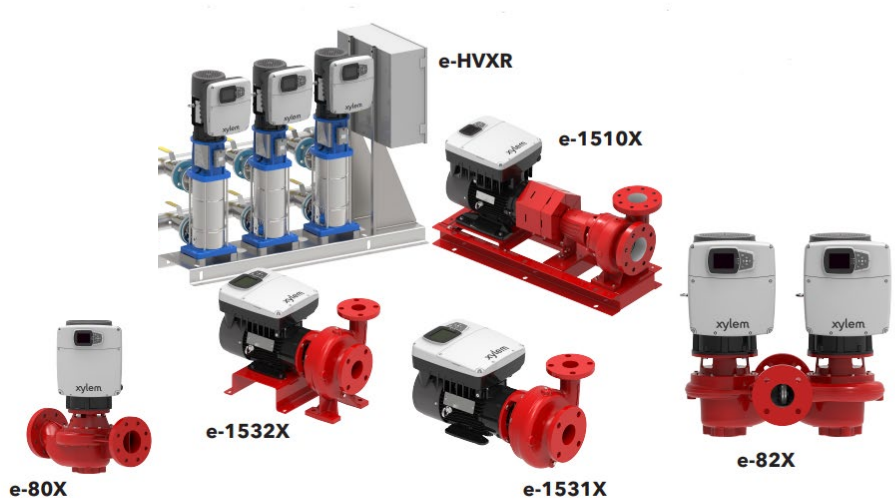
SMART PUMP CONSTRUCTION HYDROVAR X



PM Assisted Reluctance Motor Technology

	Permanent Magnet	PM Assisted Reluctance	Reluctance
Power density	Very high	High	Low
Efficiency	Very high and flat curve	Very high and flat curve	High
Material	Rare Earth Metals	Ferrite and Magnetic steel	Magnetic steel
Supply chain and Environmental impact	Complex / high fluctuations High	Stable Low	Stable Low
Energy consumption	Low	Low	Higher

WHEN DO WE USE WHAT TYPE?



DEPPMANN

WHEN DO WE USE WHAT TYPE?

- Style of pump
- Control Mode
- Horsepower / Voltage
- Clearance
- Footprint

STYLE OF PUMP

RLD suggested choices

Inline (7 year)

- Maximum 10 HP

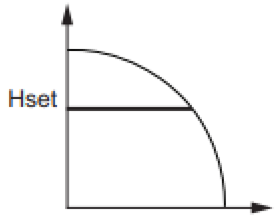
End Suction 40 HP (10 year)

- Use flex coupled or long coupled before close coupled except on 3500 RPM or constant start stop applications

CONTROL MODES

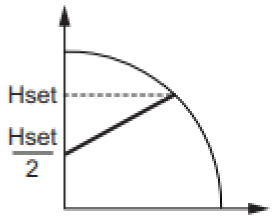
4.3.3.1 Constant Pressure (Head)

The circulator maintains a constant differential pressure at any flow demand;



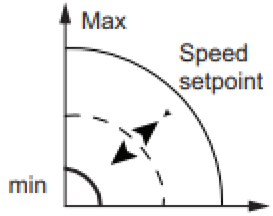
4.3.3.2 Proportional pressure (head)

The circulator pressure is continuously increased/ decreased depending on the increased/decreased flow demand;



4.3.3.3 Fixed speed

The circulator maintains a fixed speed at any flow demand;

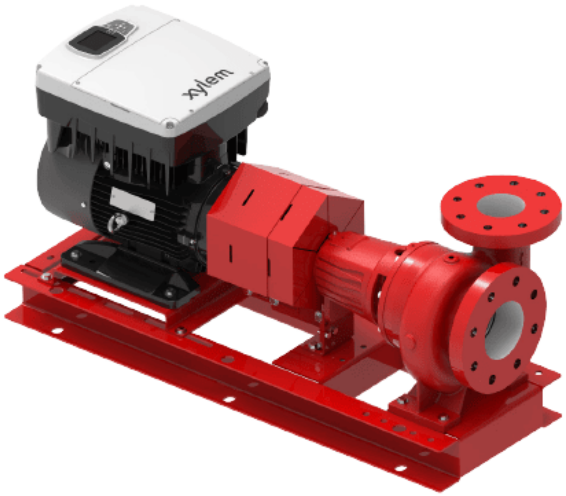


DEPPMANN

HORSEPOWER

Pump	e-90E	EcoCirc	Hydrovar-X
Motor Efficiency	Ultra-Premium Efficient - IE5	Ultra-Premium Efficient – IE5	Ultra-Premium Efficient – IE5
Motor Sizes	2 HP & 3 HP	1/12 HP – 3 HP	3 HP – 30 HP
Control Logic	-“Constant Pressure”	-Constant Speed -Constant Pressure -Proportional Pressure -Set Point Temp -Differential Temperature	-Actuator -Constant Pressure -Proportional Pressure -Proportional Quadratic Pressure -Constant Flow -Constant Temp -Constant Level
Communication	BACnet and MODBUS	BACnet and MODBUS	BACnet and MODBUS

NEC CODE COMPLIANCE

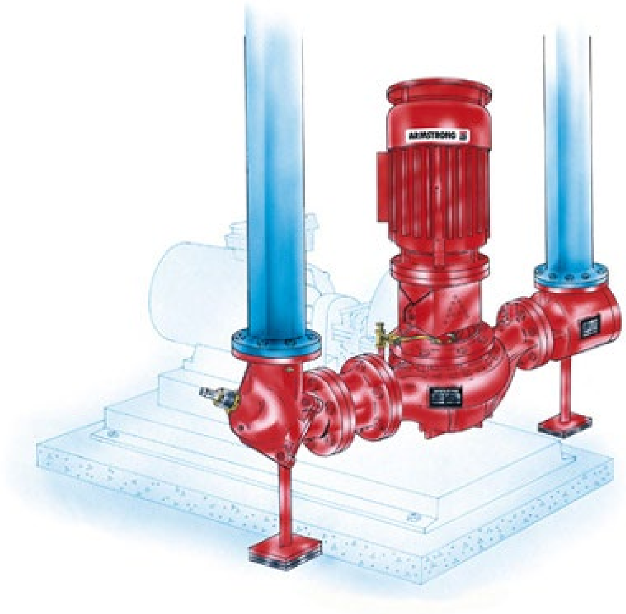


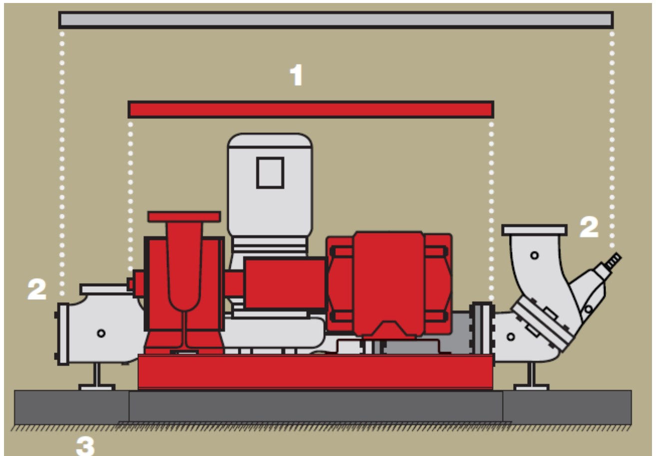
FOOTPRINT

e-1510 with wall mounted ITSC

e-1510X Smart Pump

FOOTPRINT





VSC versus traditional vertical inline pump

SELECTION

ESP systemwize™

SELECTION

<u>Conditions</u>

Application: New Construction, K-12

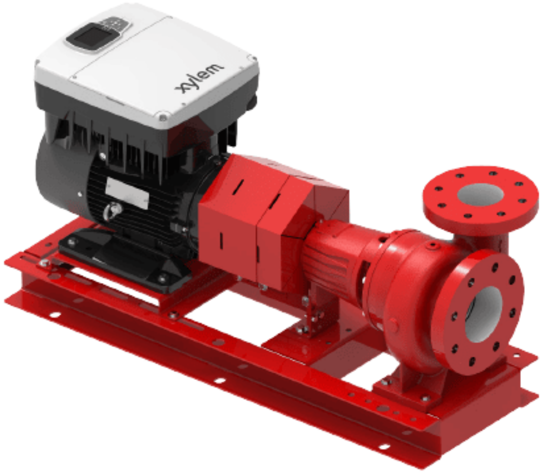
Heating System Pumps

Two Pumps in Parallel / One Standby

Total Flow: 300 GPM

Head: 90 Ft Head

Fluid: Water



SELECTION

Selection Options

Selection Mode: Variable speed

Controller Options: Sensored

Frequency: 60Hz

Unit of Measurement: Imperial/US

Product Family

Express Select

End-Suction (select all)

- e-1510
- e-1510Stock
- e-1510X
- e-1531
- e-1532
- e-1535Stock (obsolete)
- e-1535 (obsolete)

In-Line (select all)

- e-60ECM, e-60Stock
- e-80
- e-80Stock
- e-80X
- e-80SC
- e-80SCXL
- e-82
- e-82SC
- e-90
- e-90E
- e-90ECM
- e-90Stock
- ecocirc ECM Circulator Pumps
- Circulator Pumps
- e-60 (obsolete)

Double Suction (select all)

- e-HSC
- VSX-VSC
- VSX-VSCS
- VSX-VSH (obsolete)
- HSCS (obsolete)
- HSC-S (obsolete)
- HSC3 (obsolete)

Multi-Stage (select all)

- e-SV

SELECTION

Selection Options

Selection Mode	Controller Options	Frequency	Unit of Measurement
Variable speed	Sensored	60Hz	Imperial/US

Product Family

Express Select

End-Suction (select all)

- [ ] e-1510
- [ ] e-1510Stock
- [x] e-1510X
- [ ] e-1531
- [ ] e-1532
- [ ] e-1535Stock (obsolete)
- [ ] e-1535 (obsolete)

In-Line (select all)

- [ ] e-60ECM, e-60Stock
- [ ] e-80
- [ ] e-80Stock
- [ ] e-80X
- [ ] e-80SC
- [ ] e-80SCXL
- [ ] e-82
- [ ] e-82SC
- [ ] e-90
- [ ] e-90E
- [ ] e-90ECM
- [ ] e-90Stock
- [ ] ecocirc ECM Circulator Pumps
- [ ] Circulator Pumps
- [ ] e-60 (obsolete)

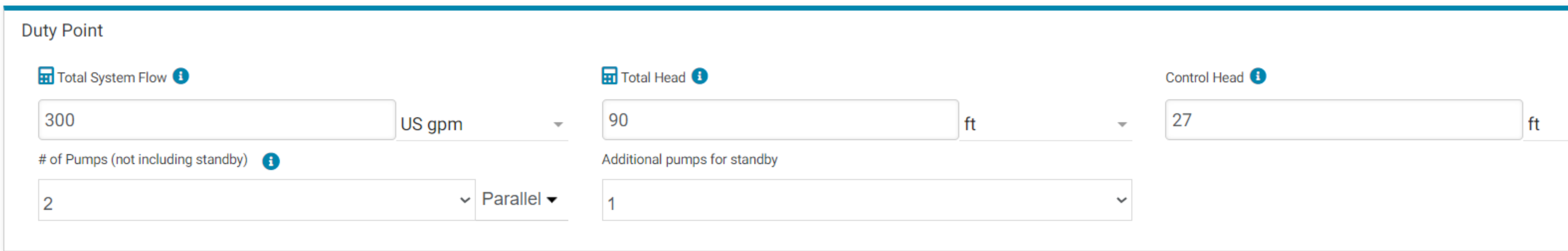
Double Suction (select all)

- [ ] e-HSC
- [ ] VSX-VSC
- [ ] VSX-VSCS
- [ ] VSX-VSH (obsolete)
- [ ] HSCS (obsolete)
- [ ] HSC-S (obsolete)
- [ ] HSC3 (obsolete)

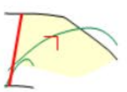
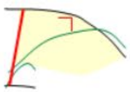
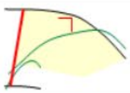
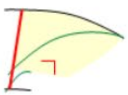
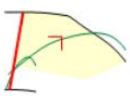
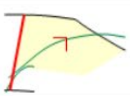
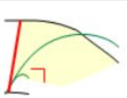
Multi-Stage (select all)

- [ ] e-SV

SELECTION


Duty Point
Total System Flow
300
US gpm
Total Head
90
ft
Control Head
27
ft
# of Pumps (not including standby)
2
Parallel
Additional pumps for standby
1

SELECTION

	Curve	% End Of Curve	Pump Series	Pump Size	Part Number	Pump PLEVv (%)	Pump Duty Point EFF (%)	Wire to Water EFF (%)	Pump Speed (RPM)	Impeller	Motor (HP)	NOL (BHP)	Motor Ra Speed (R	Actions
Compare		64	e-1510X HS 380-480V	1.5AD	1510XB1N4SX1	---	---	65.2	2413	7 in	20	---	—	Add to Schedule Documents
Compare		49.2	e-1510X LS 380-480V	2BD	1510XC5L5SX1	---	---	65.2	1721	9.5 in	7.5	---	—	Add to Schedule Documents
Compare		55	e-1510X LS 200-240V	2BD	1510XC5K5RX1	---	---	65	1955	8.5 in	5.5	---	—	Add to Schedule Documents
Compare		55	e-1510X LS 380-480V	2BD	1510XC5K5SX1	---	---	65	1955	8.5 in	5.5	---	—	Add to Schedule Documents
Compare		64	e-1510X HS 200-240V	1.5AD	1510XB1N4RX1	---	---	64.3	2413	7 in	20	---	—	Add to Schedule Documents
Compare		49.2	e-1510X LS 200-240V	2BD	1510XC5L5RX1	---	---	64.3	1721	9.5 in	7.5	---	—	Add to Schedule Documents
Compare		52.5	e-1510X LS 380-480V	2EB	1510XC6L5SX1	---	---	64.3	1740	9.5 in	7.5	---	—	Add to Schedule Documents
Compare		54.1	e-1510X HS 380-480V	2AD	1510XC1N4SX1	---	---	63.6	2489	7 in	20	---	—	Add to Schedule Documents

SELECTION

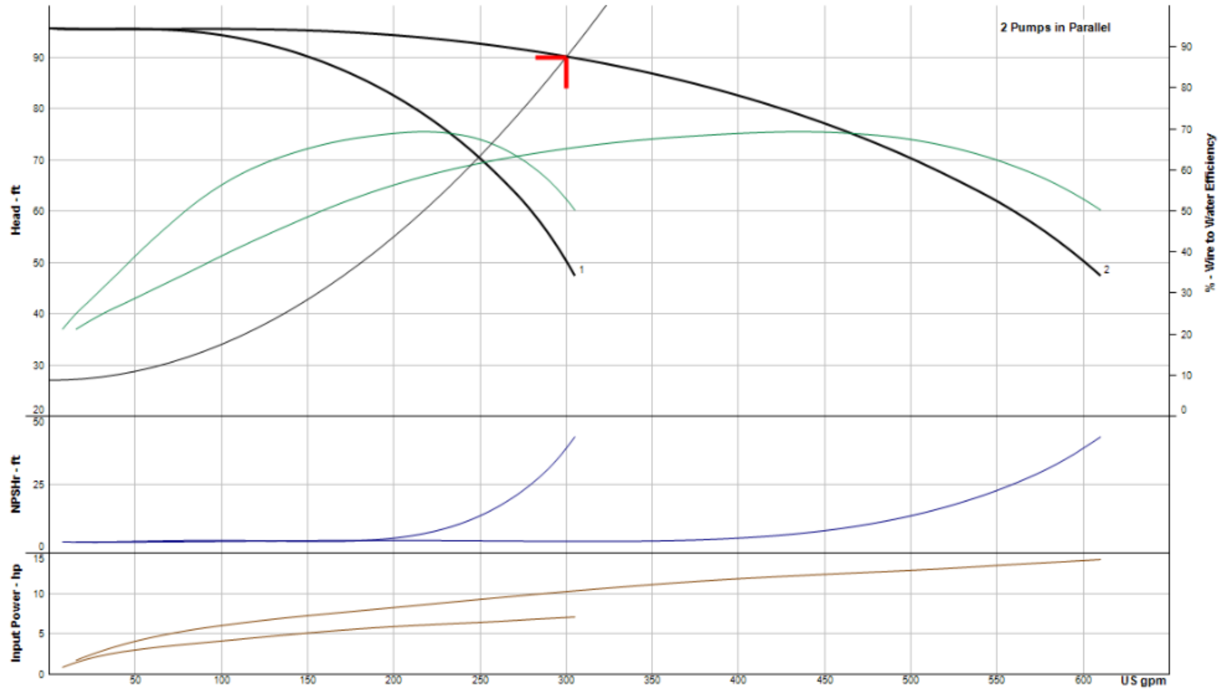
Multiple Pumps

Pump: e-1510X LS 380-480V 2BD

Multiple Pumps | Constant Speed

- [x] Efficiency
- [x] NPSHr
- [x] Power
- [x] Design Point

Download



SELECTION

Bell & Gossett a xylem brand

Submittal

Job/Project:	Representative: R.L. Deppmann	
ESP-Systemwize: WIZE-CA9B2078 Created On: 10/28/2024	Phone: (248) 354-3710	
Location/Tag:	Email: sales@deppmann.com	
Engineer:	Submitted By:	Date:
Contractor:	Approved By:	Date:

Base Mounted End Suction Pump

Series: e-1510X
Model: 2BD
Voltage: 380-480V

Features & Design
Simple
Sustainable
Intelligent performance
Built-in protections

Powered by Xylem's hydrovar® X Smart Motor, e-1510X Smart Pumps offer customizable pumping solutions designed to deliver ultra-premium efficiency, connectivity, and simplicity right out of the box! Each unit is fitted with Xylem's optimyze® sensor to monitor the health of the pump and provide early warnings of potential issues that could lead to downtime and service costs

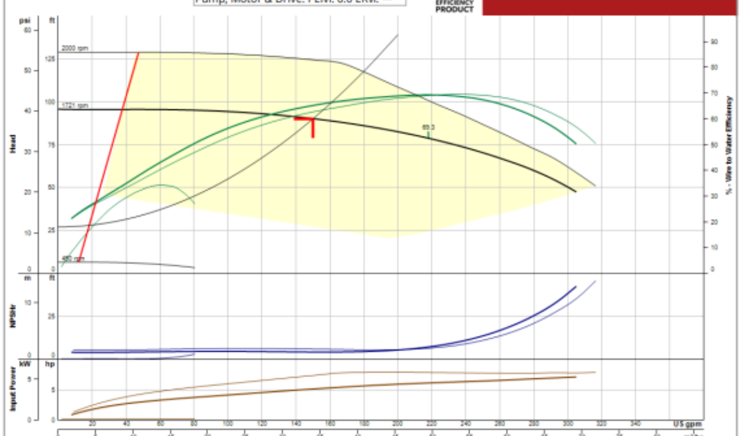
Pump Selection Summary	
Pump Capacity	150 US gpm
Pump Head	90 ft
Control Head	27 ft
Wire to Water Efficiency	65.2 %
Pump PLEVv Efficiency	N/A
Impeller Diameter	9.5 in
Motor HP	7.5 hp
Duty Point Input Power	5.12 bhp
Nominal Speed	2000 rpm
RPM @ Duty Point	1721 rpm
NPSHr	4.27 ft
Minimum Shutoff Head	95.6 ft
Minimum Flow at RPM	43.6 US gpm
Flow @ BEP	228 US gpm
Fluid Temperature	160 °F
Fluid Type	Water
Weight *(approx. - consult rep for exact)*	344 lbs
Pump Floor Space Calculation	3.85 ft²

Performance Curve

Energy Efficiency Ratings:
Pump & Motor PEIcl: 0.85 ERcl: ---
Pump, Motor & Drive: PEIvl: 0.0 ERvl: ---

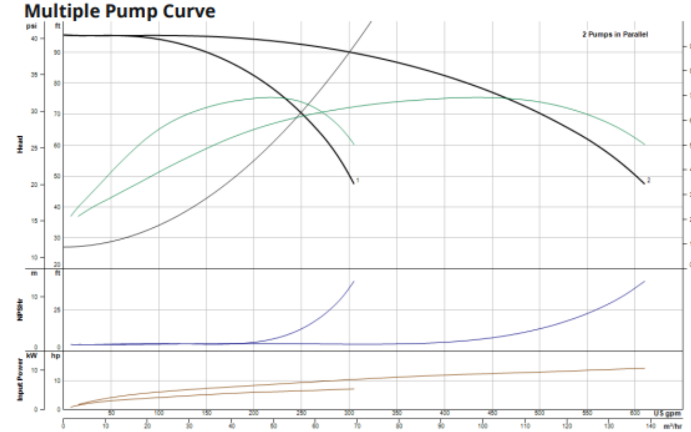
PREMIUM EFFICIENCY PRODUCT

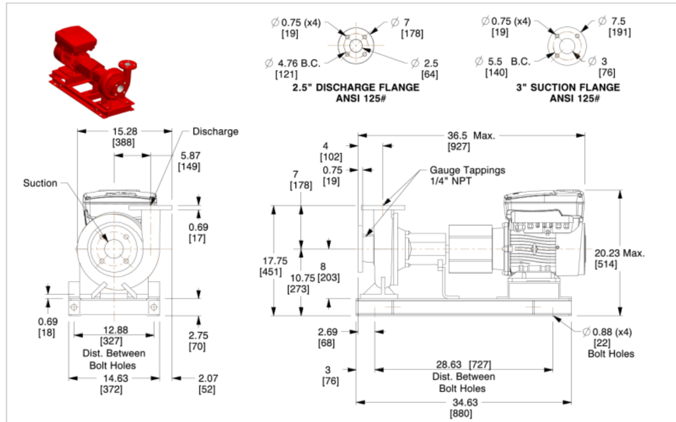
e-1510X
2BD



Performance curve meets 14.6 / ISO 9906 acceptance criteria

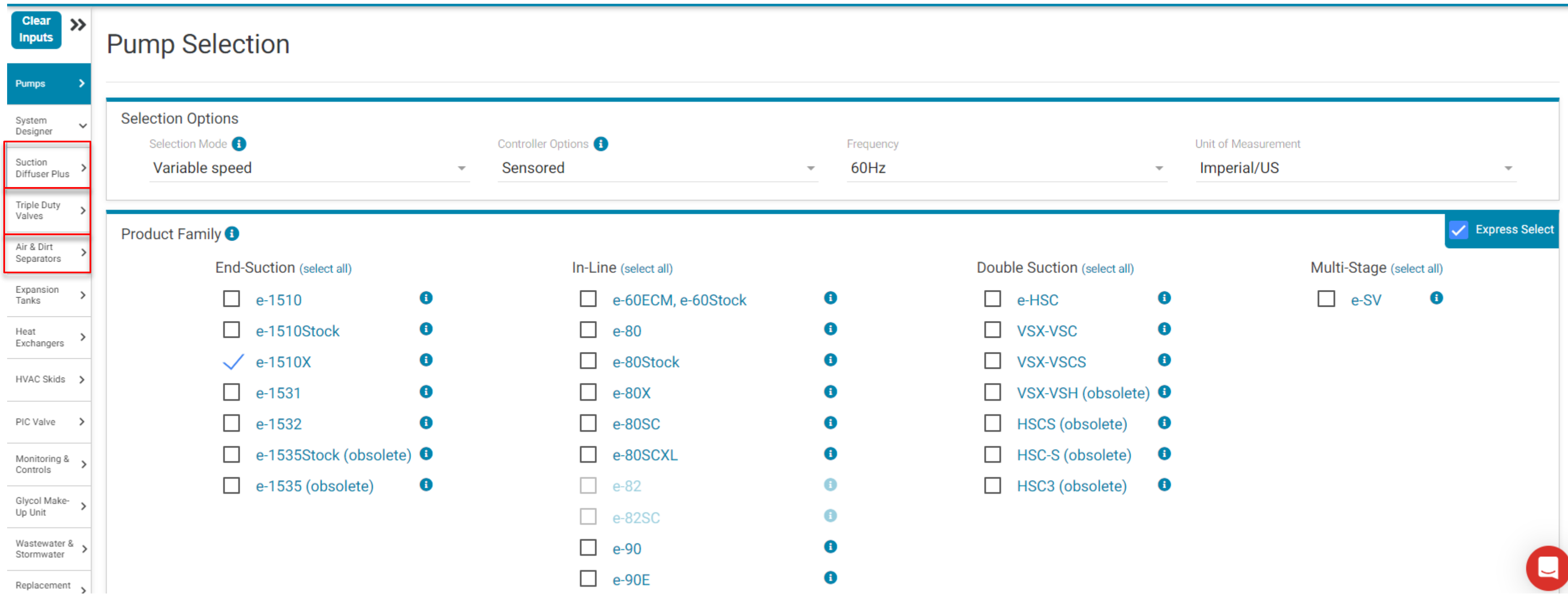
Multiple Pump Curve





Bell & Gossett a xylem brand 8200 N. Austin Ave. Morton Grove, IL 60053, USA	This drawing and the information depicted therein is the property of Xylem. Copies are issued in strict confidence and shall not be reproduced or copied, or used as the basis for the manufacture or sale of products without prior written permission of Xylem. Dimensions are subject to change Not to be used for construction unless certified	**2BD-1510XC5L5SX1** Series e-1510X Centrifugal Pumps with hydrover X - Base Mounted Seal Type: BUNA | Motor Frame: 213T-215T | Frame Type: S | Flange: ANSI 125# Dimensions : IN (mm) | Scale : N.T.S. | Submittal # : BGe1510X-1510XC5L5S

ACCESSORIES



ACCESSORIES

- System Designer
- Suction Diffuser Plus
- Triple Duty Valves
- Air & Dirt Separators
- Expansion Tanks
- Heat Exchangers
- HVAC Skids
- PIC Valve
- Monitoring & Controls
- Glycol Make-Up Unit
- Wastewater & Stormwater
- Replacement Parts
- Schedule 1
- Consulting Eng Schedules
- Projects
- REVIT FILE
- Account

Pump Selection: e-1510X HS 380-480V 1.25AD

Clear

Flow: 150 US gpm: 2 pumps = 75 US gpm ea
Pump Discharge Size (in): 1.25
Pump Suction Size (in): 1.5

Fluid: Water
Temperature: 160 °F
Density: 976.1289 kg/m3
Vapor Pressure: 32.7275 KPA
Viscosity: 0.3892 cP
Specific Gravity: 0.9779

Fluid: Water 160 °F

Selections

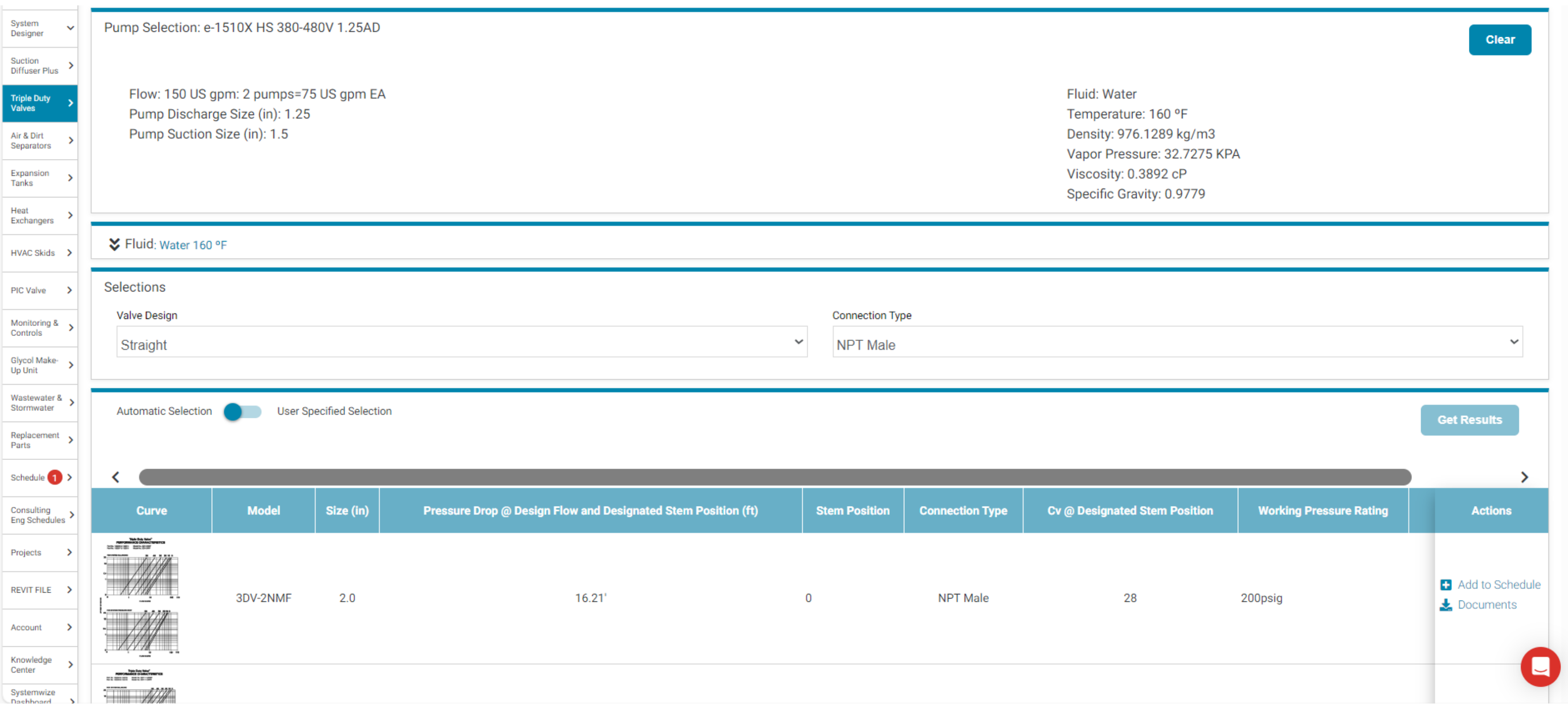
Connection Type: NPT/NPT

Pump Suction Size (in): 1.5

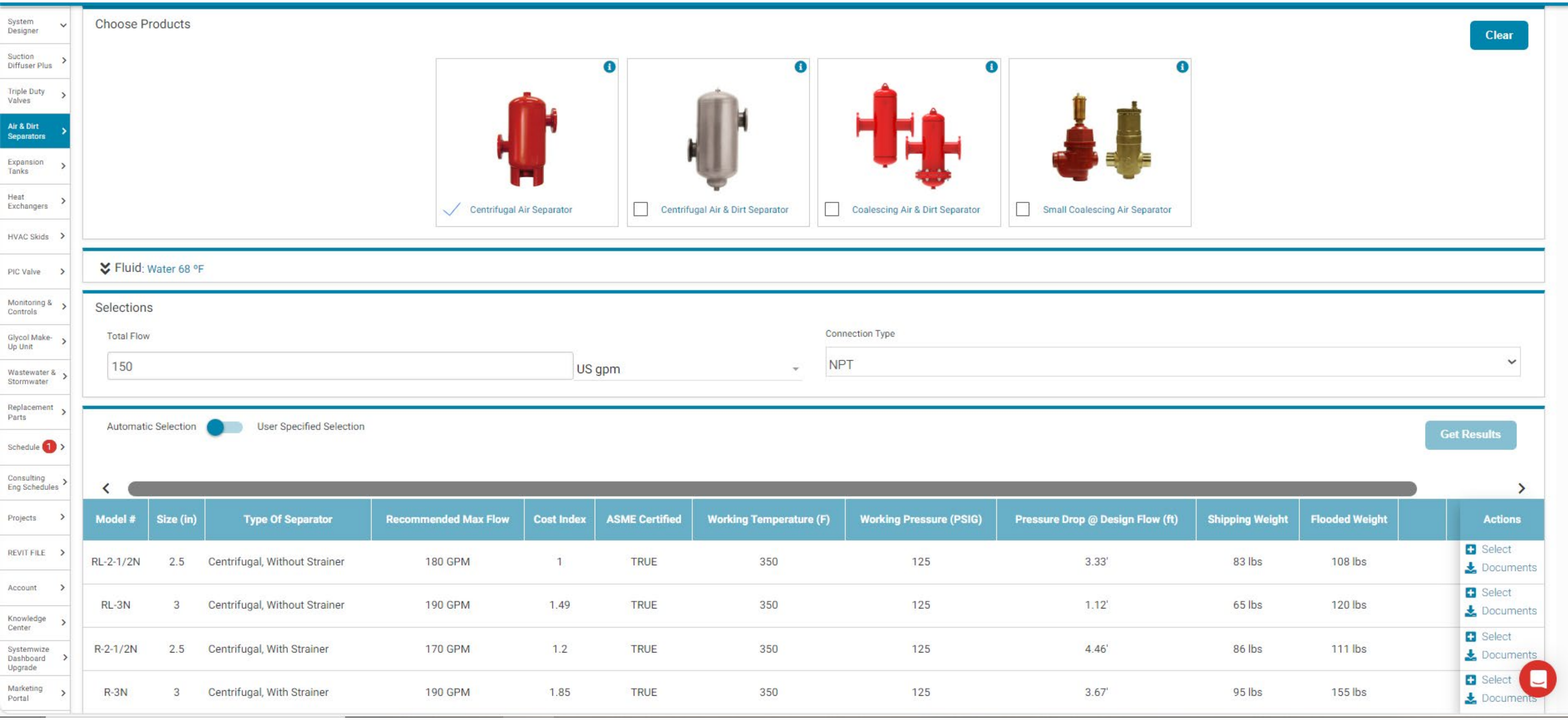
Get Results

Model	System Size (in)	Pump Size (in)	Pressure Drop @ Design Flow (ft)	Connection Type	Cv	Shipping Weight (lbs)	Actions
DA-3	3.0	1.5	2.75'	NPT/NPT	68	17	Select Documents
BA-3	2.0	1.5	5.08'	NPT/NPT	50	13	Select Docume

ACCESSORIES



ACCESSORIES



OTHER CONSIDERATIONS

- Applications that require a bypass

- Scheduling the speed of the pump
    - Balancing

ARE THERE ANY QUESTIONS?

That brings us to the end of this presentation. Thank you very much for your time!

THANK YOU FOR YOUR TIME!!

Jason Winslow
jwinslow@deppmann.com
734-524-4218

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AGENDA

8:30-9:30 –	Insights from the Field –	Brad Notter
9:30-9:45 –	Break	
9:45-10:45 –	Optimizing Hydronic Heating –	Ryan Groves
10:45-11:00 –	Break	
11:00-12:00 –	Don't Let Your Sh*t Back Up –	Nick Tabar
12:00-1:00 –	Lunch	
1:00-2:00 –	Water Quality Solutions –	Andrew Ward
2:00-2:15 –	Break	
2:15-3:15 –	Guide to Smart Pumps –	Jason Winslow
3:15-3:30 –	**Break**	
3:30-4:30 –	**Decarbonization Insights –**	**Kyle Wefing**

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TRIVIA

What is name of the new drive and motor combination used on the e-1510x?

DECARBONIZATION INSIGHTS:
Key takeaways from the 2024 ASHRAE conference

Kyle Wefing – Outside Sales Leader

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DECARBONIZATION

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INTRO: BACKGROUND

Definition: Decarbonization is the process of reducing or eliminating carbon emissions from commercial building operations by transitioning to cleaner energy sources and more efficient systems.

Significance: Buildings are responsible for nearly 40% of global carbon emissions, making the building sector a critical area for climate action.

INTRO: EVOLUTION & LONG-TERM GOALS

Evolution: Shifting from energy efficiency to comprehensive net-zero strategies, including electrification, renewable integration, and sustainable building materials.

Long-Term Goals: Net-Zero by 2050: Achieve zero net emissions across all building operations.

Milestone: Emission reduction targets by 2030

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GOALS: ENVIRONMENTAL

Emission Reduction: Lower both operational and embodied carbon emissions.

Energy Efficiency: Maximize efficiency in lighting, heating, cooling, and insulation to minimize total energy use.

Renewable Integration: Shift towards renewable energy sources to replace fossil fuels.

GOALS: ECONOMIC

Lower Operating Costs: Energy efficiency reduces utility costs, while renewable energy sources can stabilize energy expenses..

Enhance Property Value: Sustainable and energy-efficient buildings tend to attract high-quality tenants, potentially increasing rent or property resale value.

Access to Incentives: Many governments and organizations offer financial incentives, grants, and tax breaks to support decarbonization efforts.

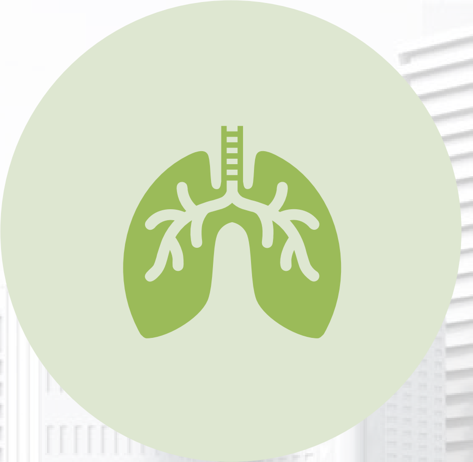
GOALS: OPERATIONAL

Improve Building Resilience and Uptime: Ensure systems are reliable, adaptable to grid changes, and capable of maintaining operations during power disruptions.

Enhance Occupant Comfort and Health: Decarbonized buildings with optimized HVAC systems can maintain better indoor air quality, temperature control, and humidity levels, improving tenant satisfaction.

Boost Tenant Retention: High-performance buildings align with tenant expectations for sustainability and health, increasing tenant loyalty and lowering turnover.

GOALS: COMMUNITY & SOCIAL



Support Healthier Urban Environments: Decarbonized buildings reduce local air pollution and greenhouse gases, contributing to cleaner urban areas.

Job Creation in Green Technology Fields: Workforce development for energy-efficient technologies, renewable energy, and building retrofitting creates skilled job opportunities.

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METRICS: ENERGY USE INTENSITY

Definition and Importance: Measures energy consumption per square foot, a fundamental metric for reducing energy and emissions.

EUI=kBTU/sq ft

Strategies for Reduction: HVAC optimization, LED lighting, enhanced insulation, and smart thermostats.

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METRICS: CARBON EMISSION REDUCTIONS

Scope 1: Direct emissions from on-site fuel combustion.

technical solutions matrix

		1. Ken Soble Tower	2. French Apartments	3. Int'l Tailoring Bldg	4. Wilmcote House	5. Valla Torg
heating	Boiler replacement: high efficiency, or oil to gas	○	●	●	○	○
	Boiler control improvements	○	●	○	○	○
	Steam riser balancing or TRVs	○	●	○	○	○
	Electrification of space heating	●	○	●	●	○
hot water	Hot water boiler replacement	●	●	●	●	○
	High efficiency water fixtures	○	●	○	○	○
	DHW distribution improvements	●	●	○	●	●
	Air source heat pump for DHW	○	○	●	○	●

Source: https://be-exchange.org/report/hi-rise-low-carbon-multifamily/

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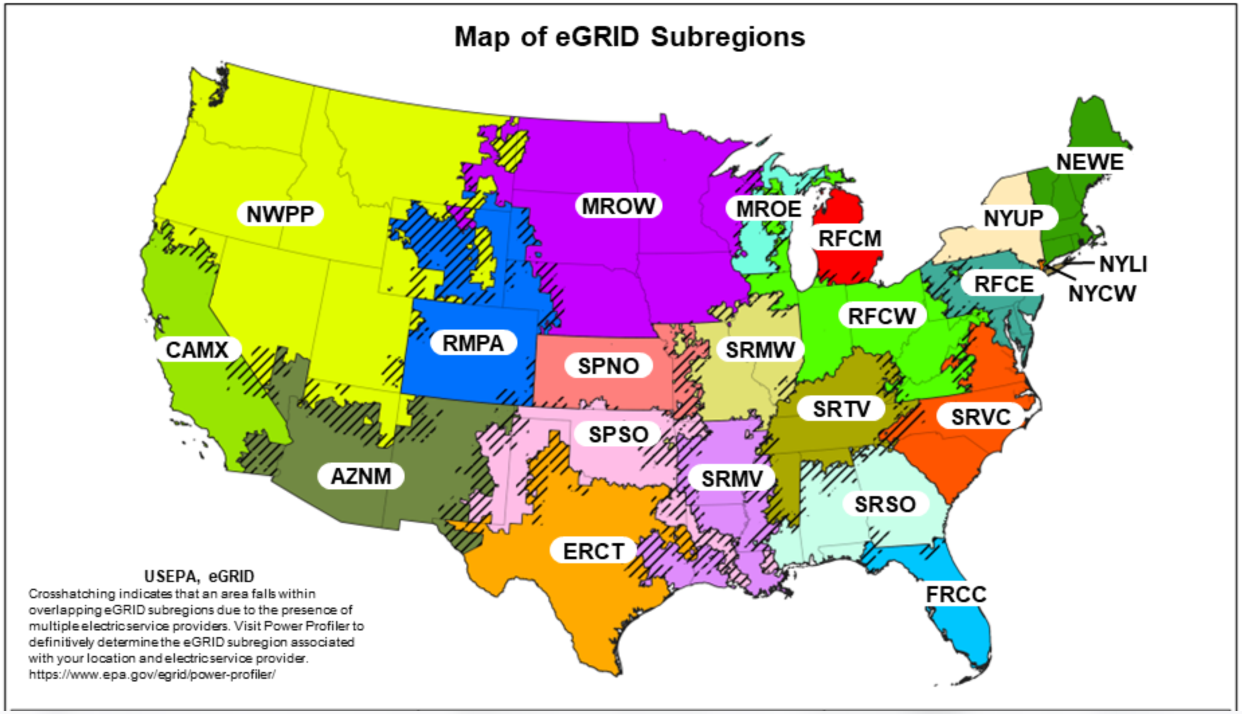
METRICS: CARBON EMISSION REDUCTIONS

Scope 2: Indirect emissions from purchased electricity.



Source: https://www.epa.gov/system/files/images/2024-05/egrid-subregion-map.png

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METRICS: CARBON EMISSION REDUCTIONS

Scope 3: Indirect emissions from supply chain activities.

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METRICS: FINANCIAL & LIFECYCLE

ROI Strategies: Focus on high-ROI projects, such as LED upgrades, smart building systems, and HVAC optimization.

Lifecycle Cost Analysis (LCA): Evaluates total cost of ownership, considering operational savings, maintenance, and initial investment.

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INCENTIVES: INFLATION REDUCTION ACT

Tax Credits:

Energy Efficient Commercial Building Deduction (Section 179D): Up to $5 per square foot for energy efficiency improvements.

Investment Tax Credits (ITCs) for renewable installations like solar and geothermal.

Production Tax Credits (PTCs) for clean electricity production.

Grans & Loan Programs

DOE's Funding Programs: Provides grants for energy efficiency, electrification, and emissions reduction.

IRA's Greenhouse Gas Reduction Fund: Supports low-interest loans and grants for energy retrofits.

Energy Audits and Consulting Incentives: Financial support for energy audits to guide decarbonization planning.

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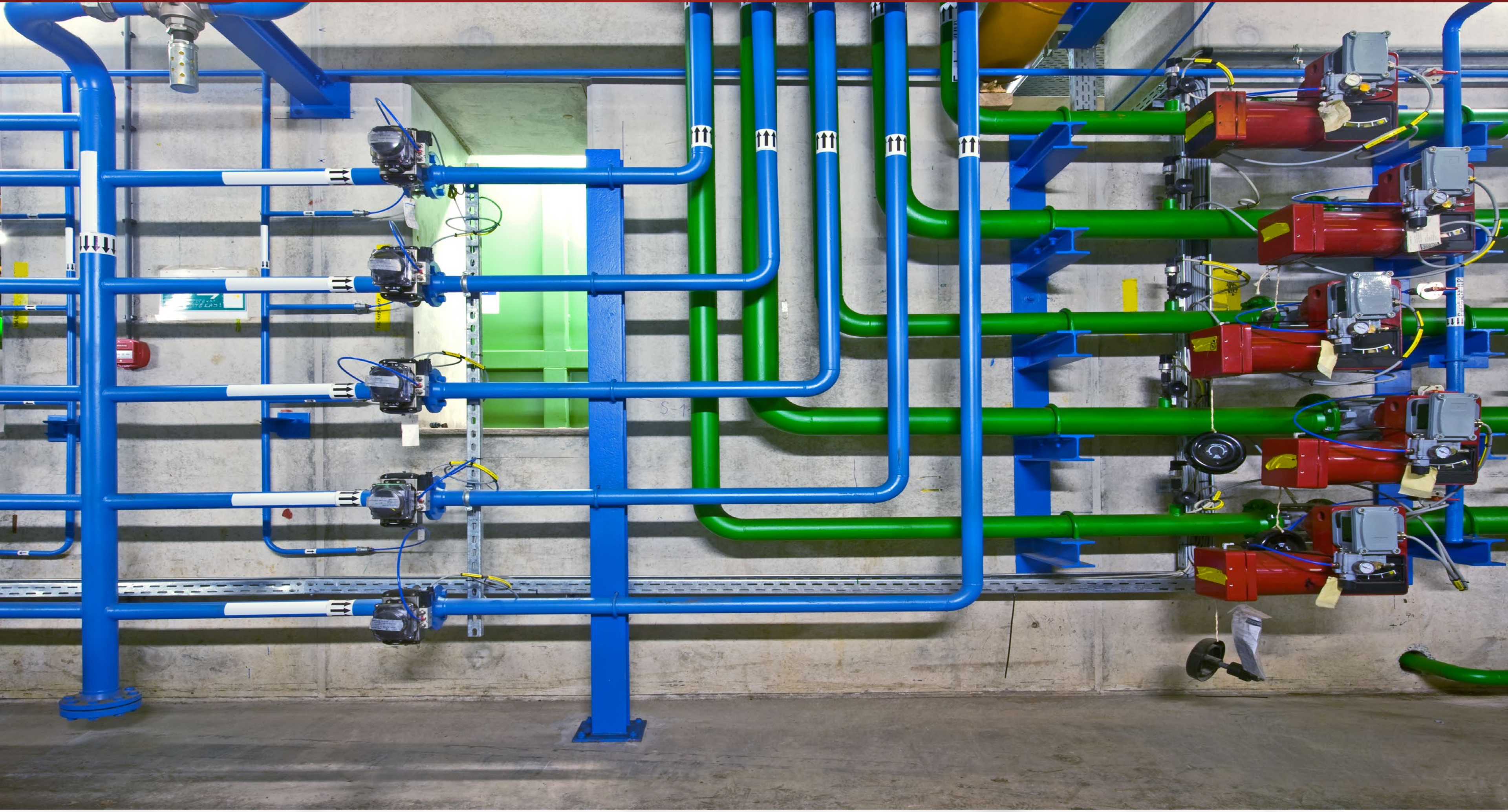
DESIGN: MECHANICAL ROOM



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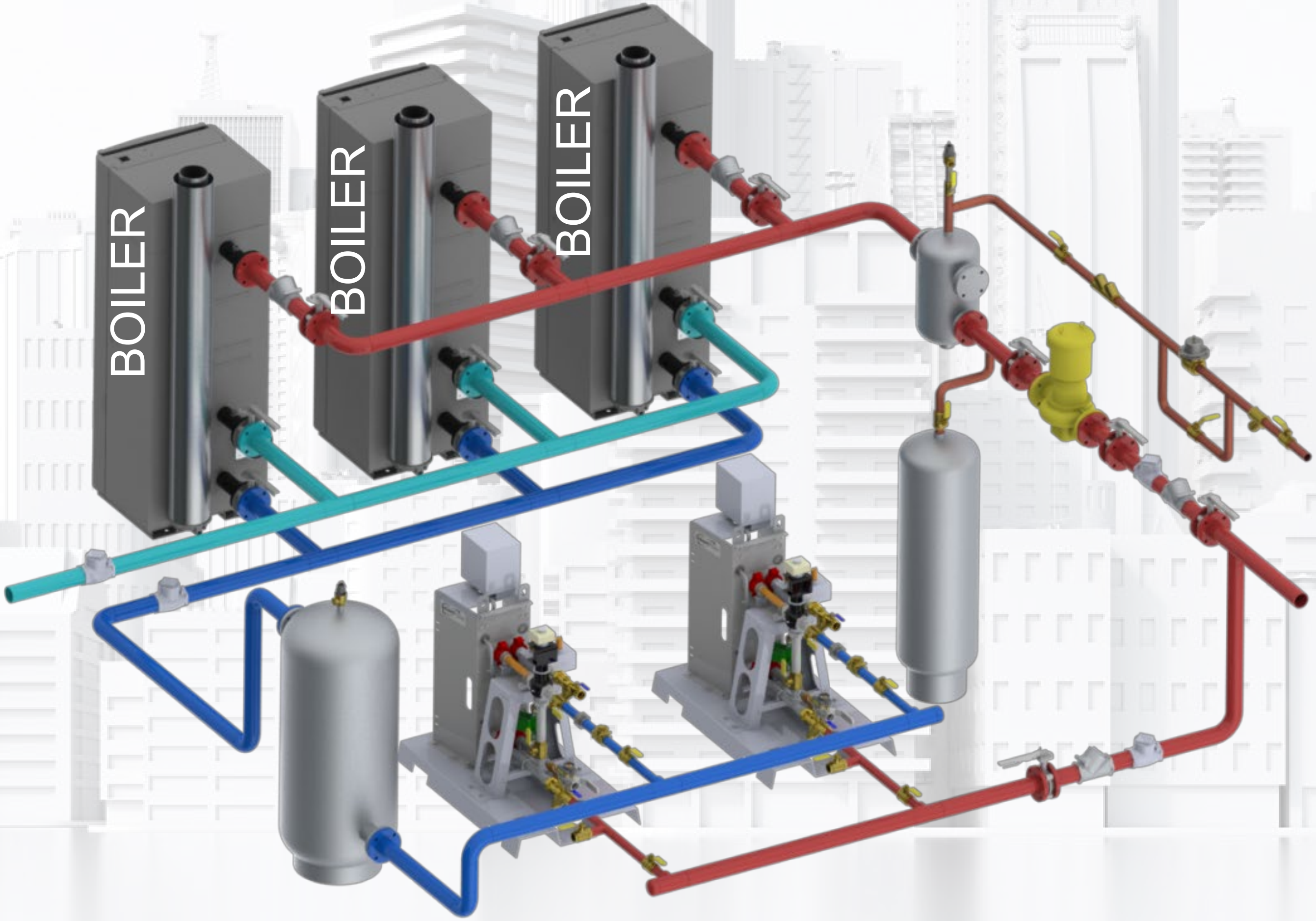
DESIGN: MECHANICAL ROOM



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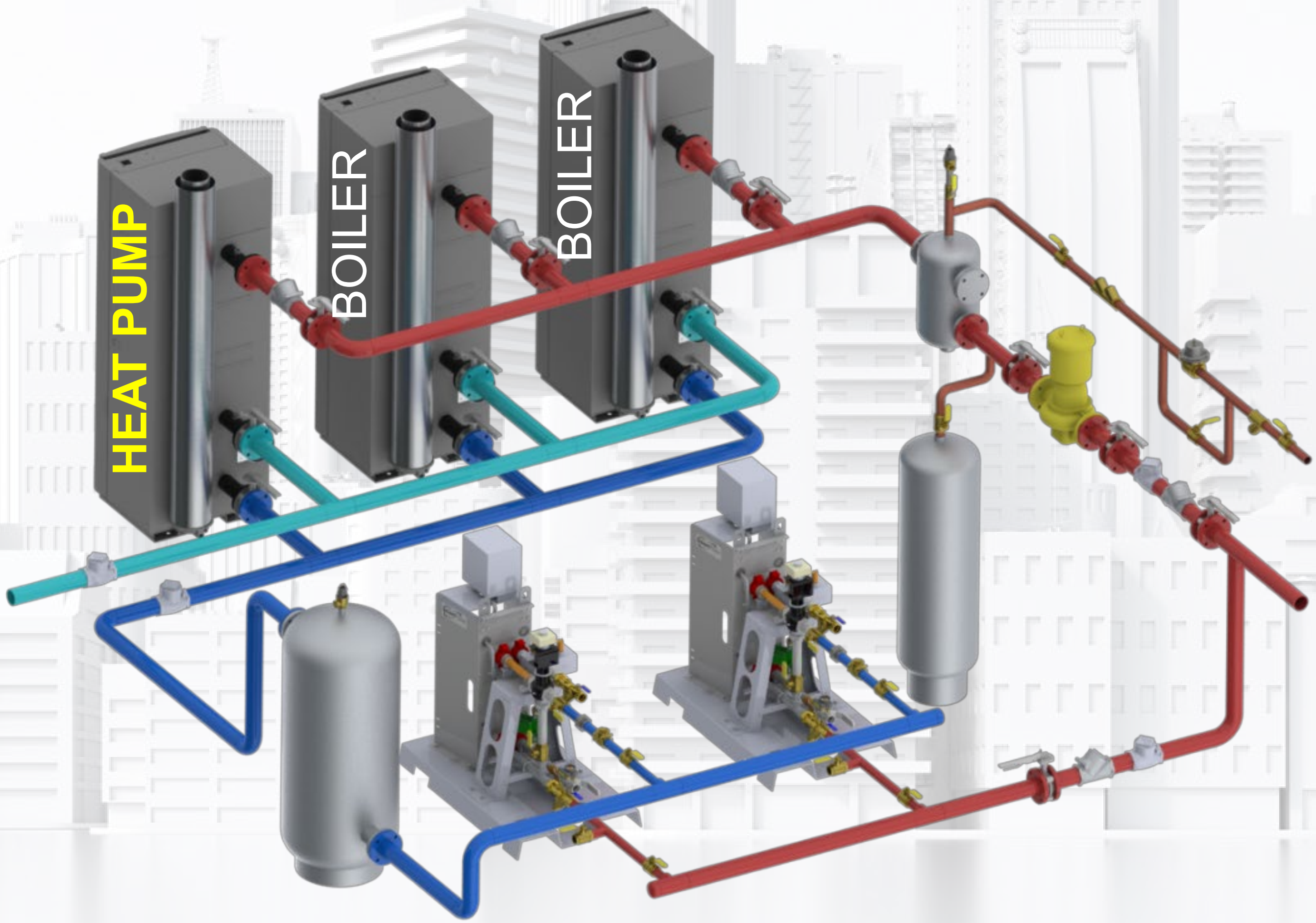
DESIGN: MECHANICAL ROOM



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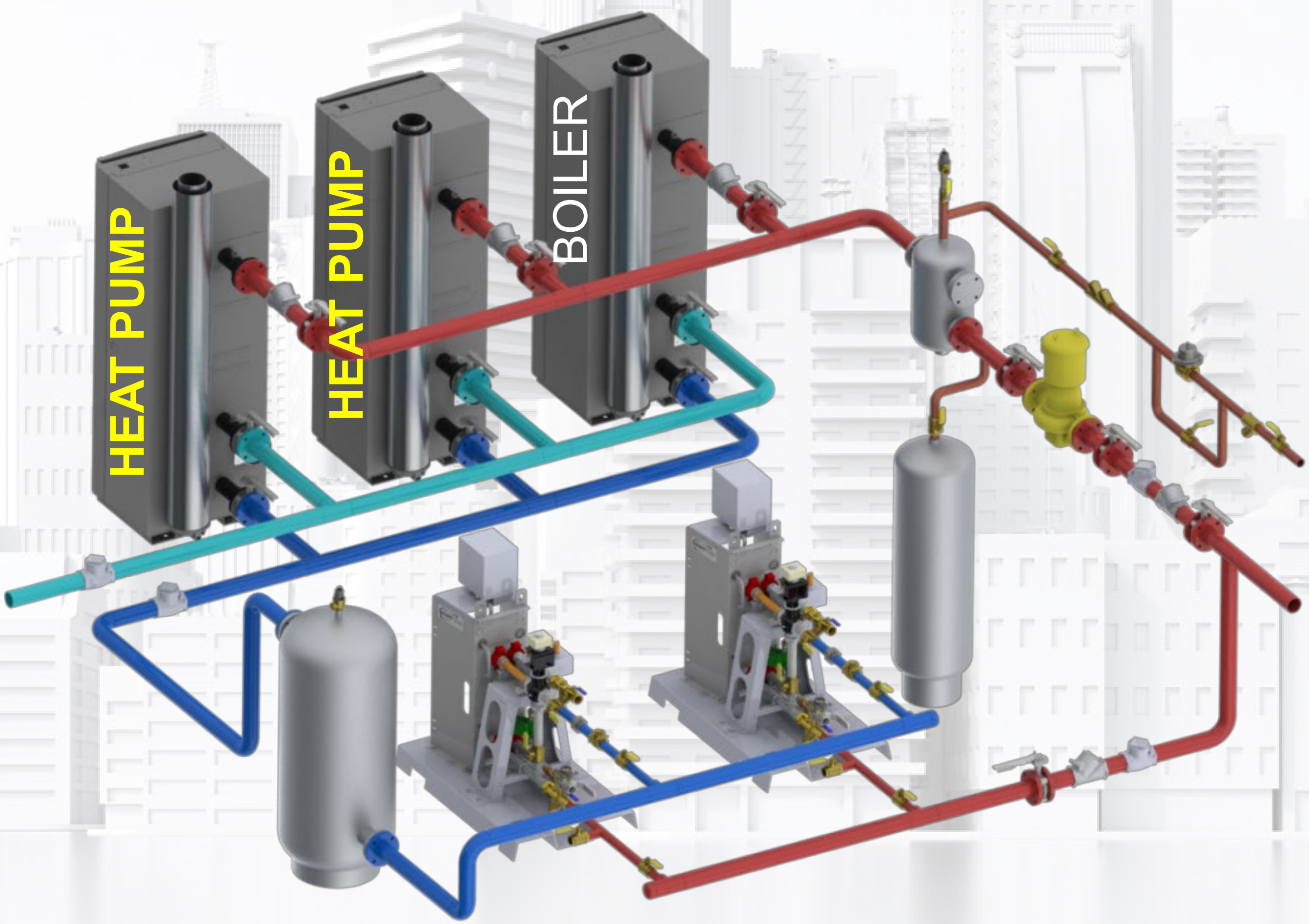
DESIGN: MECHANICAL ROOM



DESIGN: ADDITIONAL

Design Trends

- Electrification with heat pumps
- Variable Refrigerant Flow (VRF)
- Energy Recover Ventilation
- Building Automation & Smart Controls
- Low-Global Warming Potential (GWP)

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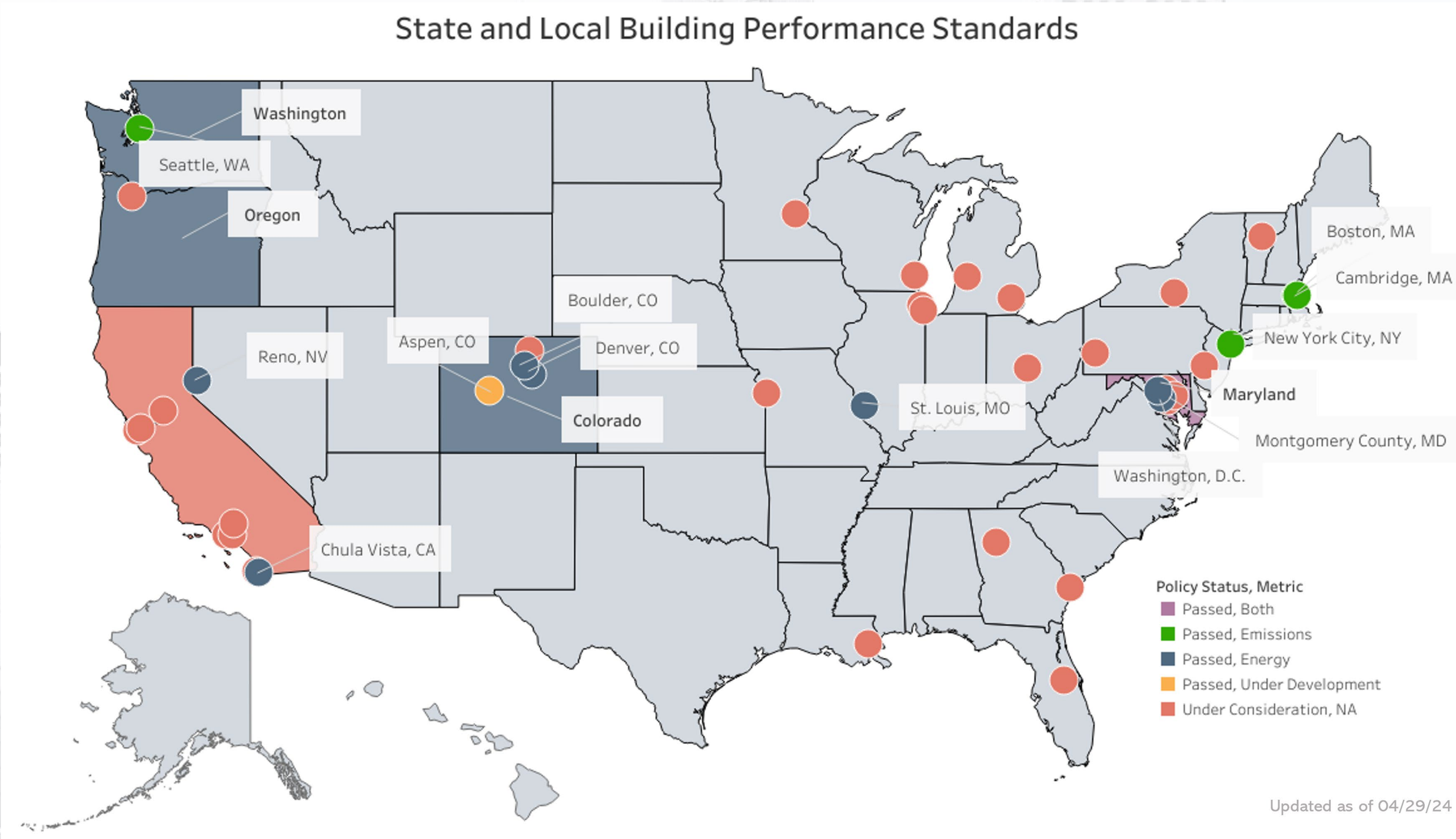
STANDARDS: REGULATION & ASHRAE 90.1



Source: https://www.energycodes.gov/BPS

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DECARB STRATEGIES & TAKEAWAYS

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DECARBONIZATION INSIGHTS:
KEY TAKEAWAYS FROM THE 2024 ASHRAE CONFERENCE

Thank you for your time today.

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DEPPMANN ACADEMY 2024

Thank you for your time today.

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