STEAM IS MORE *EFFICIENT* THAN MOST PEOPLE THINK

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Steam is our Passion

SPEAKERS:

Patrick Lach - Maxi-Therm
Jacek Grob - Boilersource

AGENDA

- Hydronic vs Steam
- What is Wrong with Steam?
- Steam Basics
- Vertical Condensing Design
- Steam Close Loop Network
- Why Consider Steam?
- Questions?

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ENERGY CAPACITY OF WATER vs STEAM

WATER

1 lb. of water
increased1°F
= 1 BTU

STEAM

1 lb. of steam at
0 psig that condenses
into 1 lb. of water at 212°F
= 970.3 BTU

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HYDRONIC vs STEAM

Primary/Secondary Loop System

Primary Loop of 35,140,000 BTU/HR

Hydronic Schedule for High Temperature Hot Water System (HTHW)

BOILER SCHEDULE - HOT WATER - GAS

UNIT NO.	LOCATION	SERVICE	TYPE	BOILER HP	MAXIMUM INPUT MBH	MAXIMUM OUTPUT MBH	FLUID	ENT. WATER TEMP. (DEG. F)	LVG. WATER TEMP. (DEG. F)	MAX WORKING PRESSURE (PSI)	MIN. EFF. REQ.		BLOWER		ELEC. CHARACTERISTICS			MANUFACTURER & MODEL No.		REMARKS
											EFF %	TEST PROC.	HP	RPM	VOLTS	HZ	PHASE	BOILER	BURNER	
B-1	MECH RM	HEATING	FLEX TUBE	525	20670	17570	WATER	165	240	250	85	DOE	10	3450	460	60	3	UNILUX AM ZF2000-W-GO	POWERFLAME LNICMR10B-G-30	1, 2, 3, 4
B-2	MECH RM	HEATING	FLEX TUBE	525	20670	17570	WATER	165	240	250	85	DOE	10	3450	460	60	3	UNILUX AM ZF2000-W-GO	POWERFLAME LNICMR10B-G-30	1, 2, 3, 4
B-3	MECH RM	HEATING	FLEX TUBE	525	20670	17570	WATER	165	240	250	85	DOE	10	3450	460	60	3	UNILUX AM ZF2000-W-GO	POWERFLAME LNICMR10B-G-30	1, 2, 3, 4

REMARKS:
1. BOILER SHALL BE DESIGNED TO 275 DEG.F. AT 250 PSI.
2. BOILER SHALL BE FITTED WITH RELIEF VALVE FOR 250 DEG.F. AND 150 PSI.
3. BOILER SHALL BE FITTED WITH FIELD INSTALLED REAR LADDER TO ACCESS RELIEF VALVES AT TOP OF BOILER.
4. BOILER SHALL BE EQUIPED WITH IFGR PIPING AND BURNER WITH 10" LCD TOUCH SCREEN DISPLAY.

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HYDRONIC vs STEAM

GPM & PPH of water for 35,140,000 BTU/HR

8.33 lbs./gallon of water
60 minutes = 1 hour

HYDRONIC

Water @ 75 ΔT

35,140,000 / 75 ΔT = 468,533 PPH
468,533 PPH / (8.33 x 60) = 937 GPM

STEAM

Steam @ 100 PSI

35,140,000 / 1019 BTU/lb. = 34,485 PPH
34,485 PPH / (8.33 x 60) = 69 GPM

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HYDRONIC vs STEAM

Properties of Saturated Steam

Pressure	Temp. (°F)	Heat (BTU/lb)			Volume (ft^3/lb)	
		Sensible	Latent	Total	Condensate	Steam
(Hg vac)						
25	133	101	1018	1119	0.01626	143.3
20	161	129	1002	1131	0.01640	75.41
15	179	147	991	1138	0.01650	51.41
10	192	160	983	1143	0.01659	39.22
5	203	171	976	1147	0.01666	31.82
(PSIG)						
0	212	180	970	1151	0.01672	26.80
1	215	184	968	1152	0.01674	25.21
2	219	187	966	1153	0.01676	23.79
3	222	190	964	1154	0.01679	22.53
4	224	193	962	1155	0.01681	21.40
5	227	195	961	1156	0.01683	20.38
6	230	198	959	1157	0.01685	19.46
7	232	201	957	1158	0.01687	18.62
8	235	203	956	1159	0.01689	17.85
9	237	206	954	1160	0.01690	17.14
10	239	208	953	1160	0.01692	16.49
12	244	212	950	1162	0.01696	15.33
14	248	216	947	1163	0.01699	14.33
16	252	220	944	1165	0.01702	13.45
100	338	309	881	1190	0.01785	3.891
105	341	312	878	1190	0.01789	3.736
110	344	316	876	1191	0.01792	3.594
115	347	319	873	1192	0.01796	3.462
120	350	322	871	1192	0.01799	3.340
125	353	325	868	1193	0.01803	3.226

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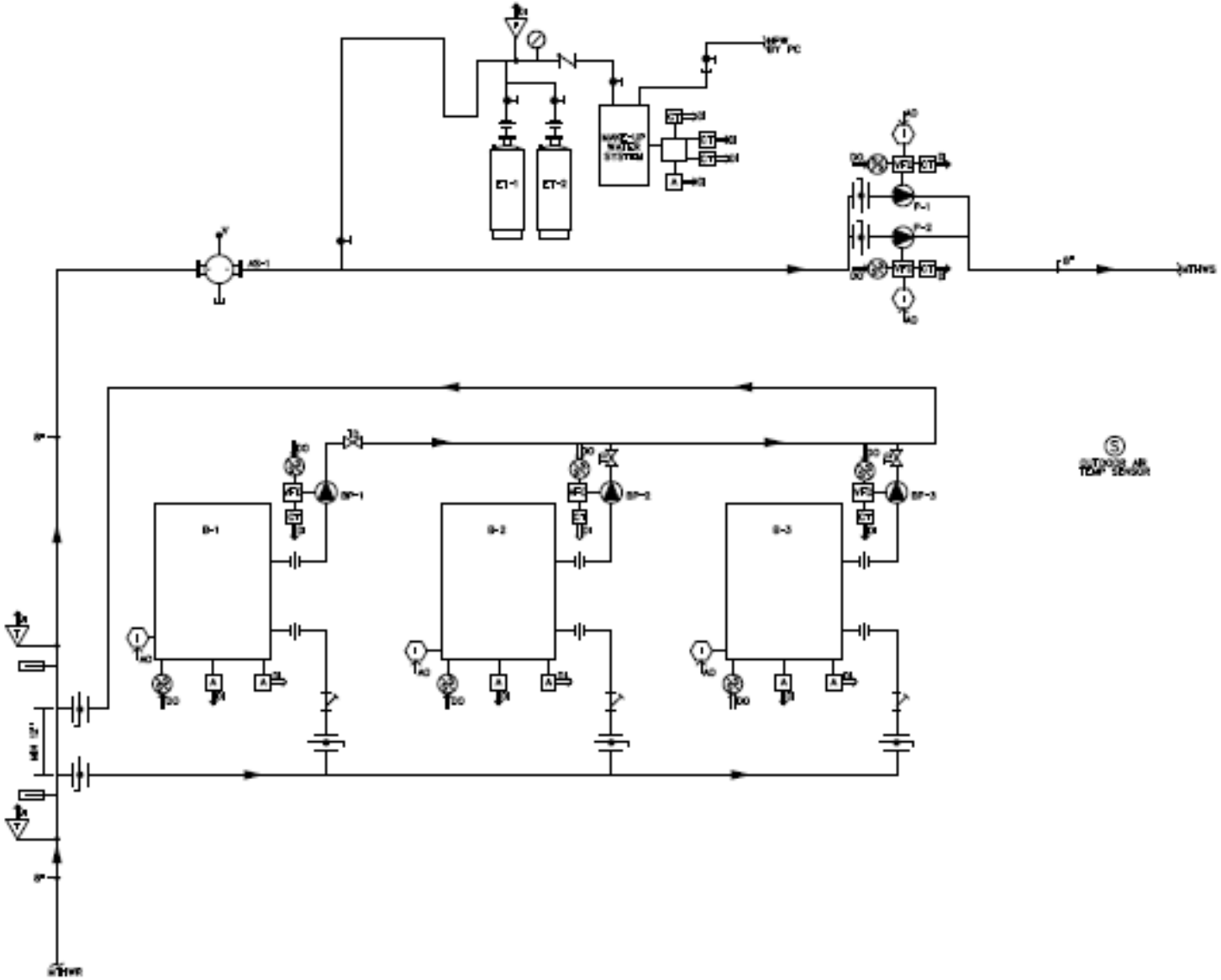
TYPICAL HYDRONIC SYSTEM



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937 GPM HYDRONIC vs 69 GPM STEAM

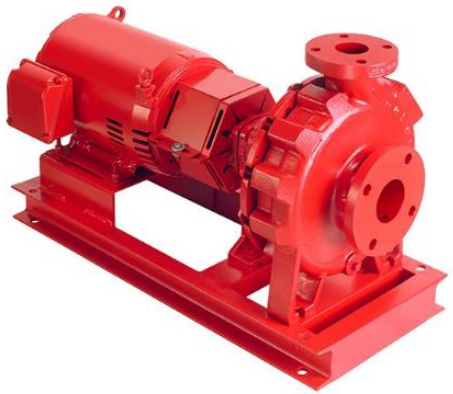
PUMP SCHEDULE

PUMP NO.	LOCATION	PUMP NAME	SERVICE	UNIT TYPE & DESCRIPTION	PUMP CAPACITY		MAX WWP	MOTOR CHARACTERISTICS					IMPELLER SIZE (DIA. In.)	FLUID TEMP. (Deg.F)	MIN. PUMP EFF. (%)	MAX. BHP	SUCTION & DISCHARGE SIZES	TRIPLE DUTY VALVE SIZE	SUCTION DIFFUSER SIZE	MANUFACTURER & MODEL No.	REMARKS
					FLOW (GPM)	TOTAL HEAD IN FEET		RPM	HP	VOLTS	PHASE	STARTER									
P-1	MECH ROOM	P-1	DIST. PUMPS	BASE-HIGH TEMP	1150	160	300	1800	60	460	3	ASD	14.125	350	75	55.9	6x4	6	6	DEAN PUMP R4180-4X6X15.5	2, 3
P-2	MECH ROOM	P-2	DIST. PUMPS	BASE-HIGH TEMP	1150	160	300	1800	60	460	3	ASD	14.125	350	75	55.9	6x4	6	6	DEAN PUMP R4180-4X6X15.5	2
CAP-1	MECH ROOM	CAP-1	COMB AIR	HORZ INLINE	34	25	175	1760	1/2	460	3	COMBO	5.4	240	52	.41	1.5x1.5	2	-	TACO 1915 - SEALIDE C SEAL	3
BP-1	MECH ROOM	BP-1	BOILER LOOP	BASE-HIGHTEMP AC	700	45	300	1800	15	460	3	ASD	8.5	350	81	14.2	6x4	6	6	DEAN PUMP RWA 4166 4x6x10 •2	1, 3
BP-2	MECH ROOM	BP-2	BOILER LOOP	BASE-HIGH TEMP AC	700	45	300	1800	15	460	3	ASD	8.5	350	81	14.2	6x4	6	6	DEAN PUMP RWA 4166 4x6x10 •2	1
BP-3	MECH ROOM	BP-3	BOILER LOOP	BASE-HIGH TEMP AC	700	45	300	1800	15	460	3	ASD	8.5	350	81	14.2	6x4	6	6	DEAN PUMP RWA 4166 4x6x10 •2	1
CHWP-1	MECH ROOM	CHWP-1	CHILLED WATER	BASEMOUNT	1730	90	125	1750	50	460	3	ASD	10.64	60	84	45	8x6	6	8	TACO FI6011	3
CHWP-2	MECH ROOM	CHWP-2	CHILLED WATER	BASEMOUNT	1730	90	125	1750	50	460	3	ASD	10.64	60	84	45	8x6	6	8	TACO FI6011	
CP-1	MECH ROOM	CP-1	CHILLER 1	INLINE	865	25	125	1160	10	460	3	ASD	8.25	60	80	6.8	8x8	8	-	TACO KS8011	3
CP-2	MECH ROOM	CP-2	CHILLER 2	INLINE	865	25	125	1160	10	460	3	ASD	8.25	60	80	6.8	8x8	8	-	TACO KS8011	

REMARKS:

1. FAN COOLED, HORIZONTAL, SINGLE STAGE, END SUCTION, ENCLOSED IMPELLER, CENTRIFUGAL, HIGH TEMPERATURE HOT WATER PUMP.
2. WATER COOLED OIL BEARING, HORIZONTAL, SINGLE STAGE, END SUCTION, ENCLOSED IMPELLER, CENTRIFUGAL, HIGH TEMPERATURE HOT WATER PUMP.
3. PROVIDE SPARE SEAL KIT WITH PUMP

90 HP



Two Boiler Pumps 15 HP Each
System Pump 60 HP
Total Pumping 90 HP

15 HP

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The pumps represent 3% of the overall energy needed for the hydronic loop

So What is Wrong with Steam?

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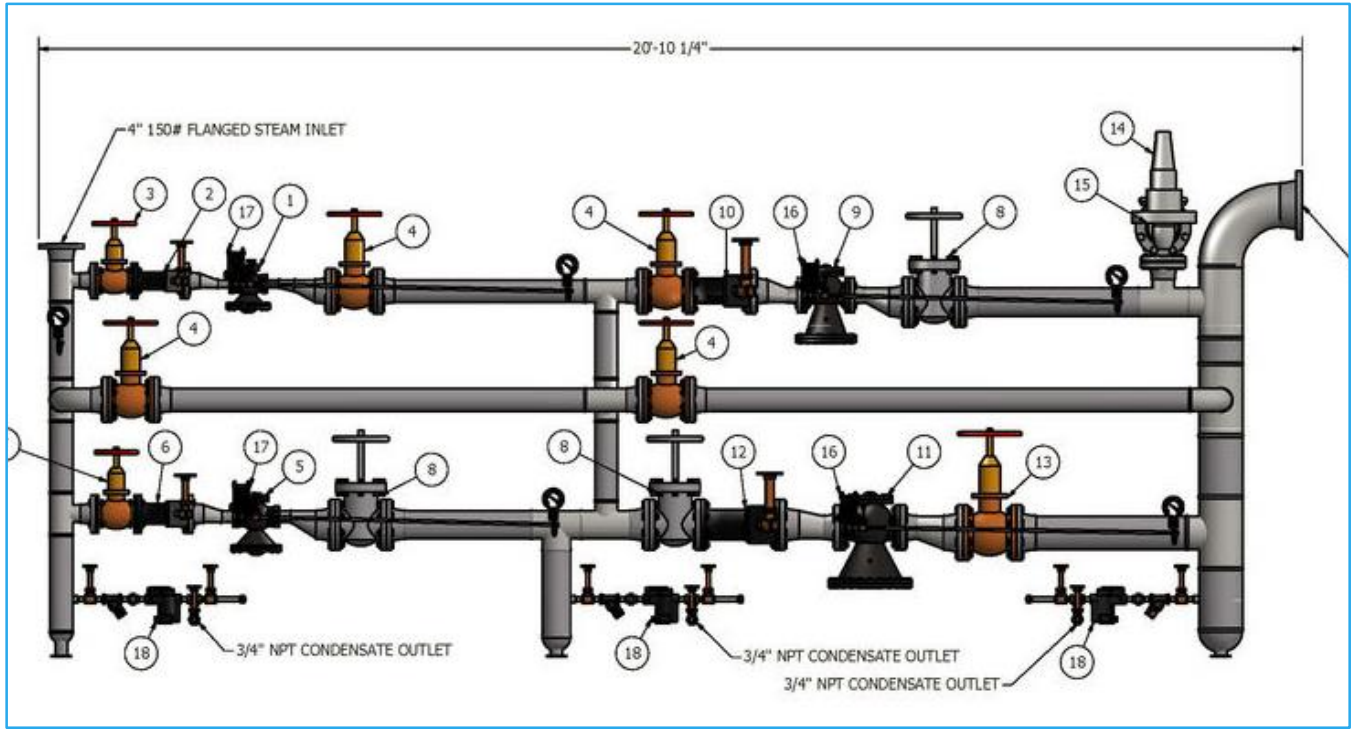
REDUCING STEAM PRESSURE



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CONDENSATE PUMPS, TRAPS AND VENTS

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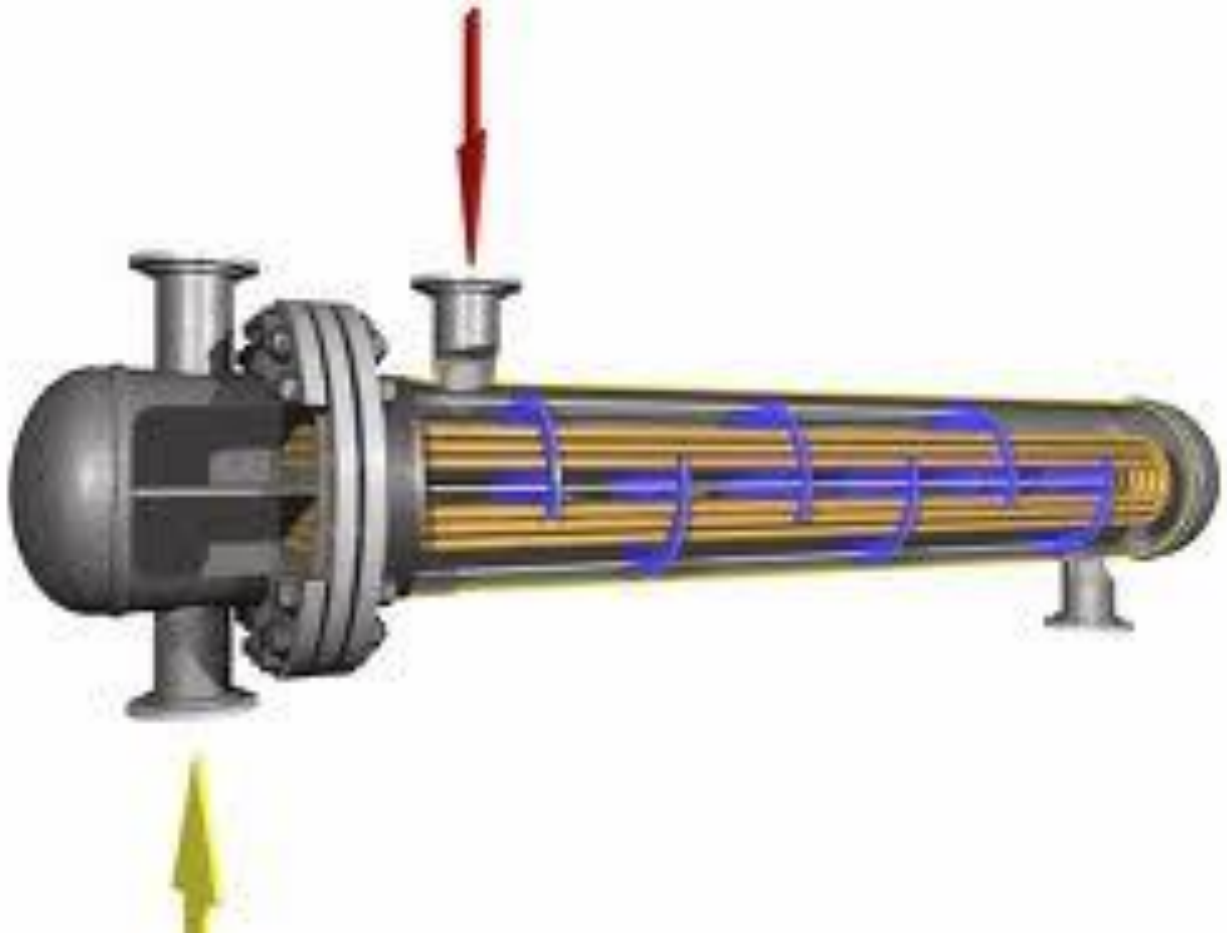
VACUUM BREAKERS



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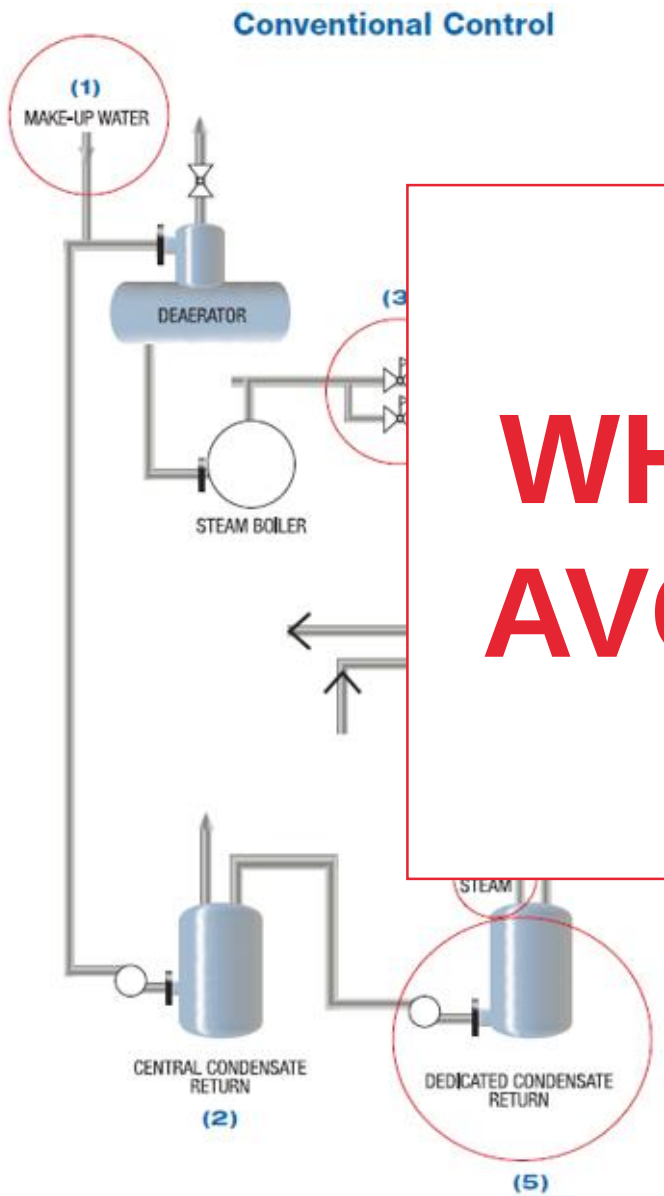
TYPICAL STEAM DESIGN



WHAT IF WE CAN AVOID ALL THIS ?

- Requires many components resulting in higher first cost and
- ation & maintenance
- m vents and steam trap failures
- uum breakers in to the condensate
- acid resulting in corrosion issues
- ensate piping
- r and more water treatment
- Architects prefer less holes through the roof

USING VERTICAL, CONDENSING STEAM HEAT EXCHANGERS

Properties of Saturated Steam

Pressure	Temp. (°F)	Heat (BTU/lb)			Volume (ft^3/lb)	
		Sensible	Latent	Total	Condensate	Steam
(Hg vac)						
25	133	101	1018	1119	0.01626	143.3
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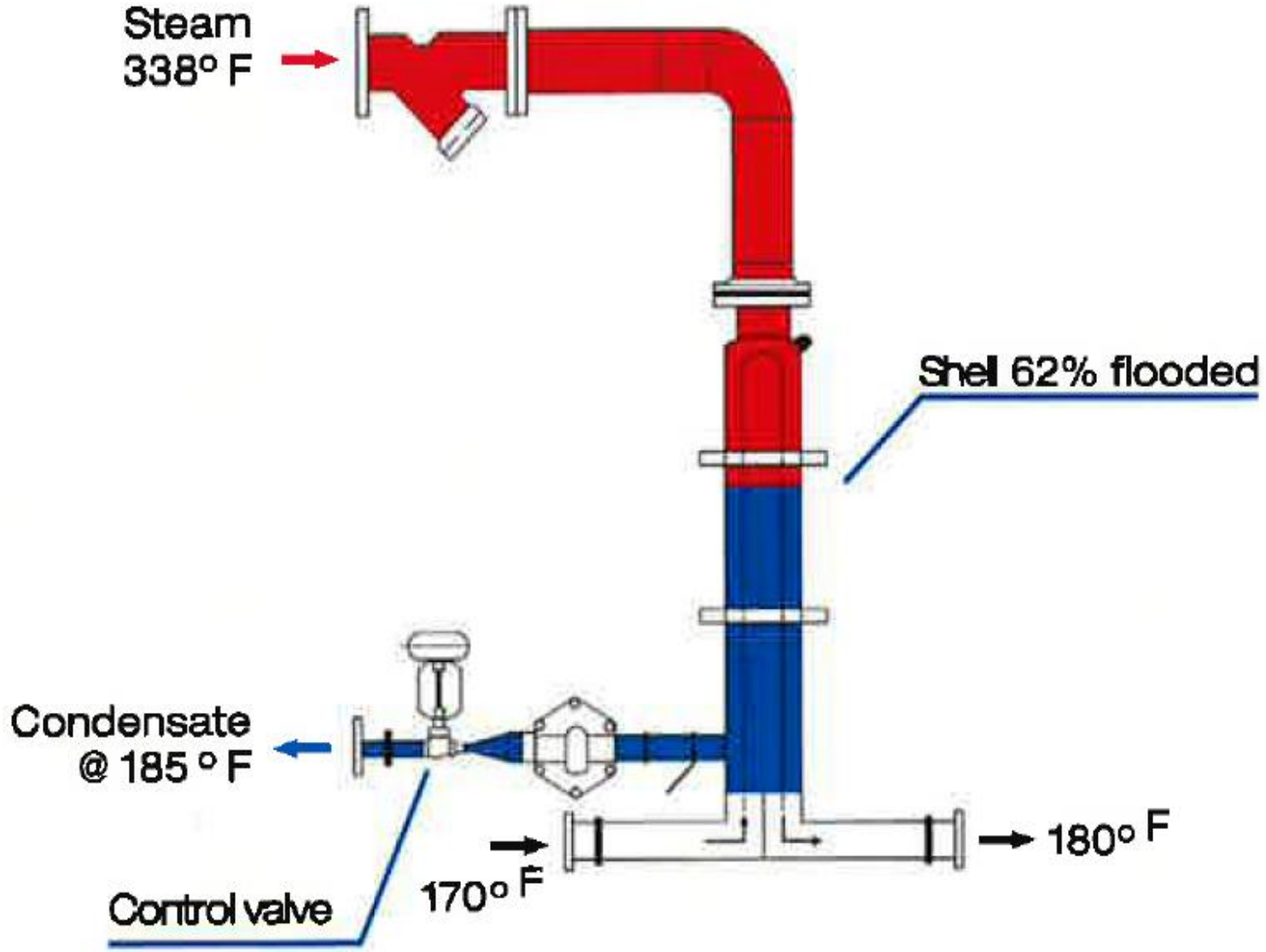
170 – 180˚F with 100 psi steam – 50% Load



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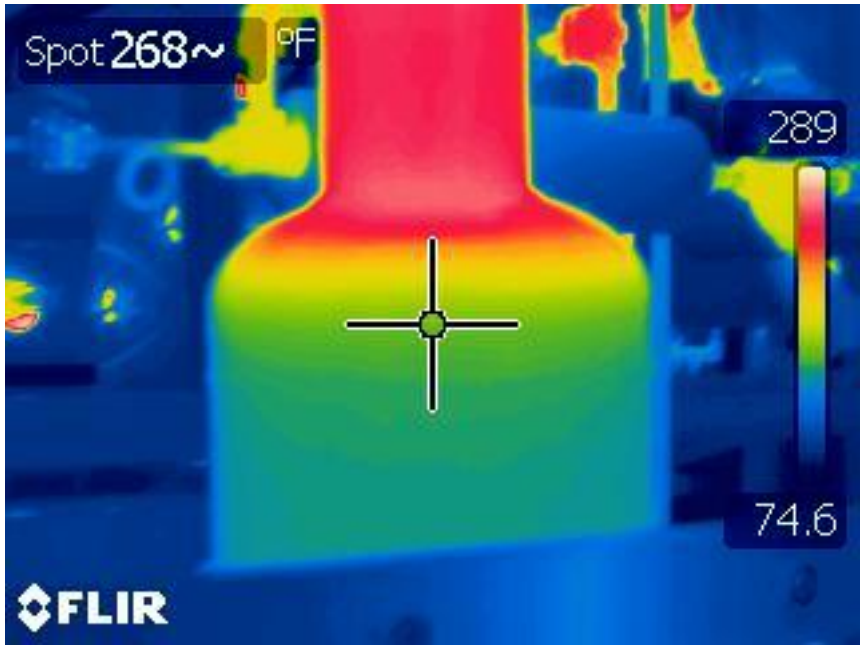

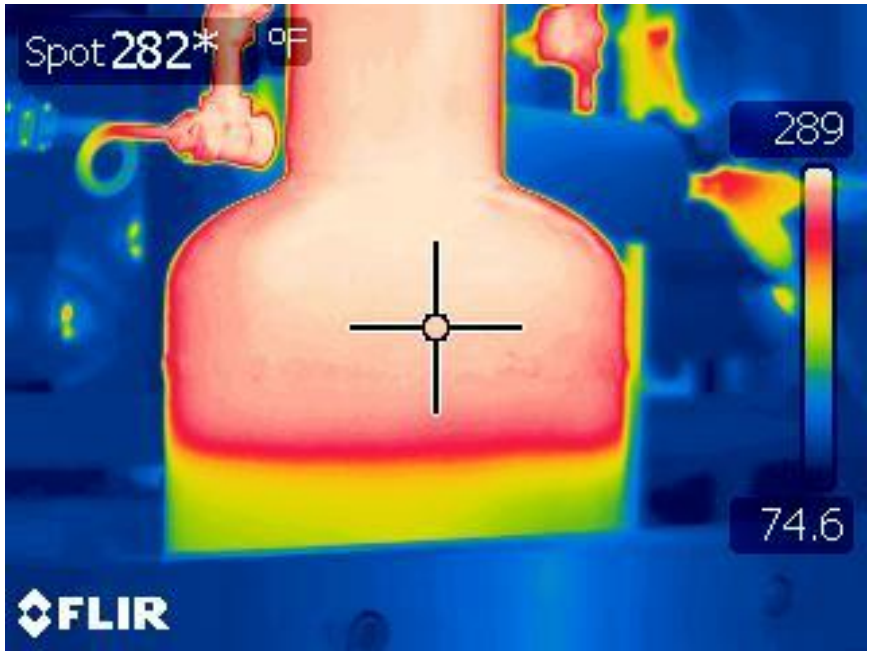

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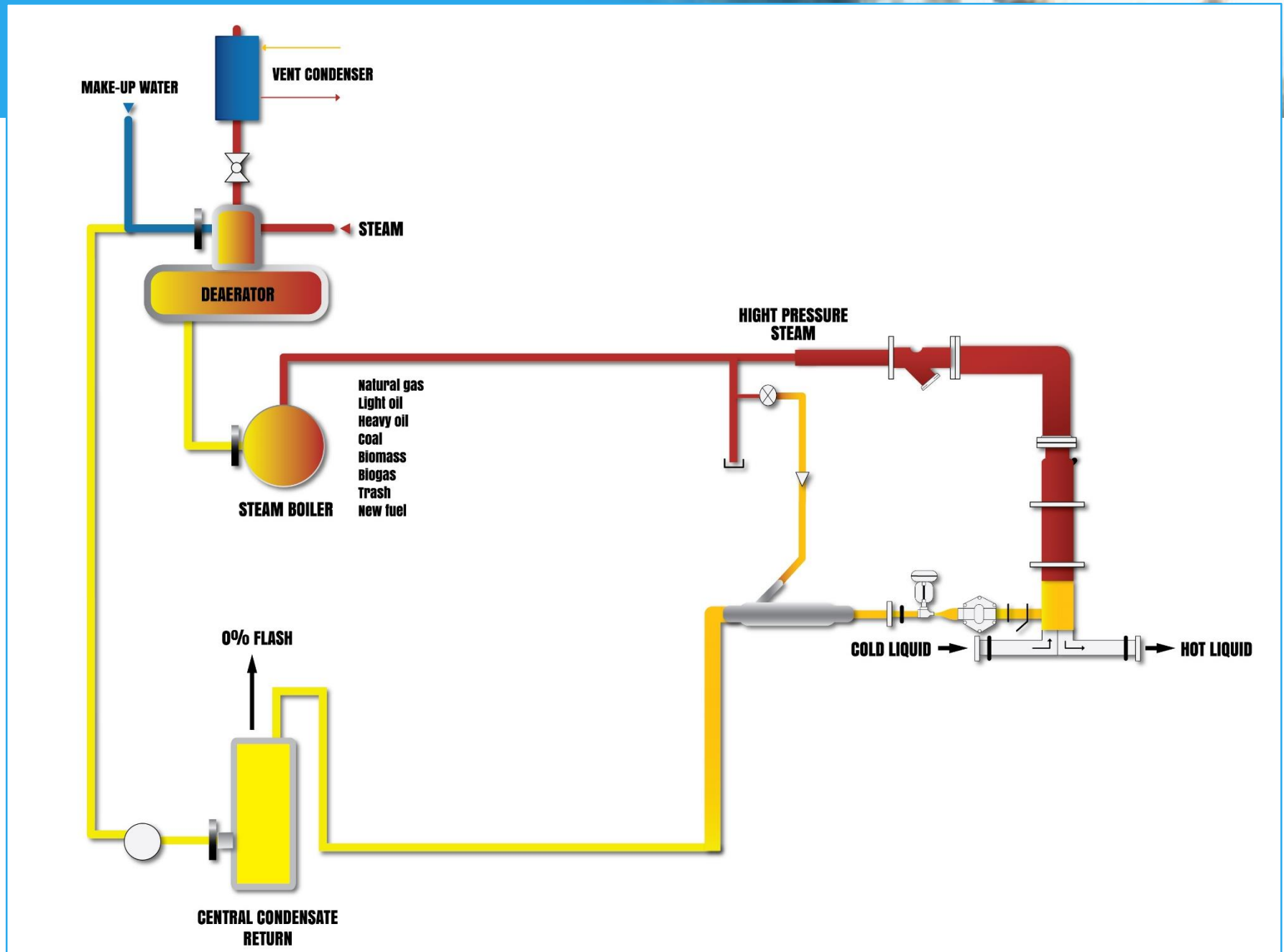

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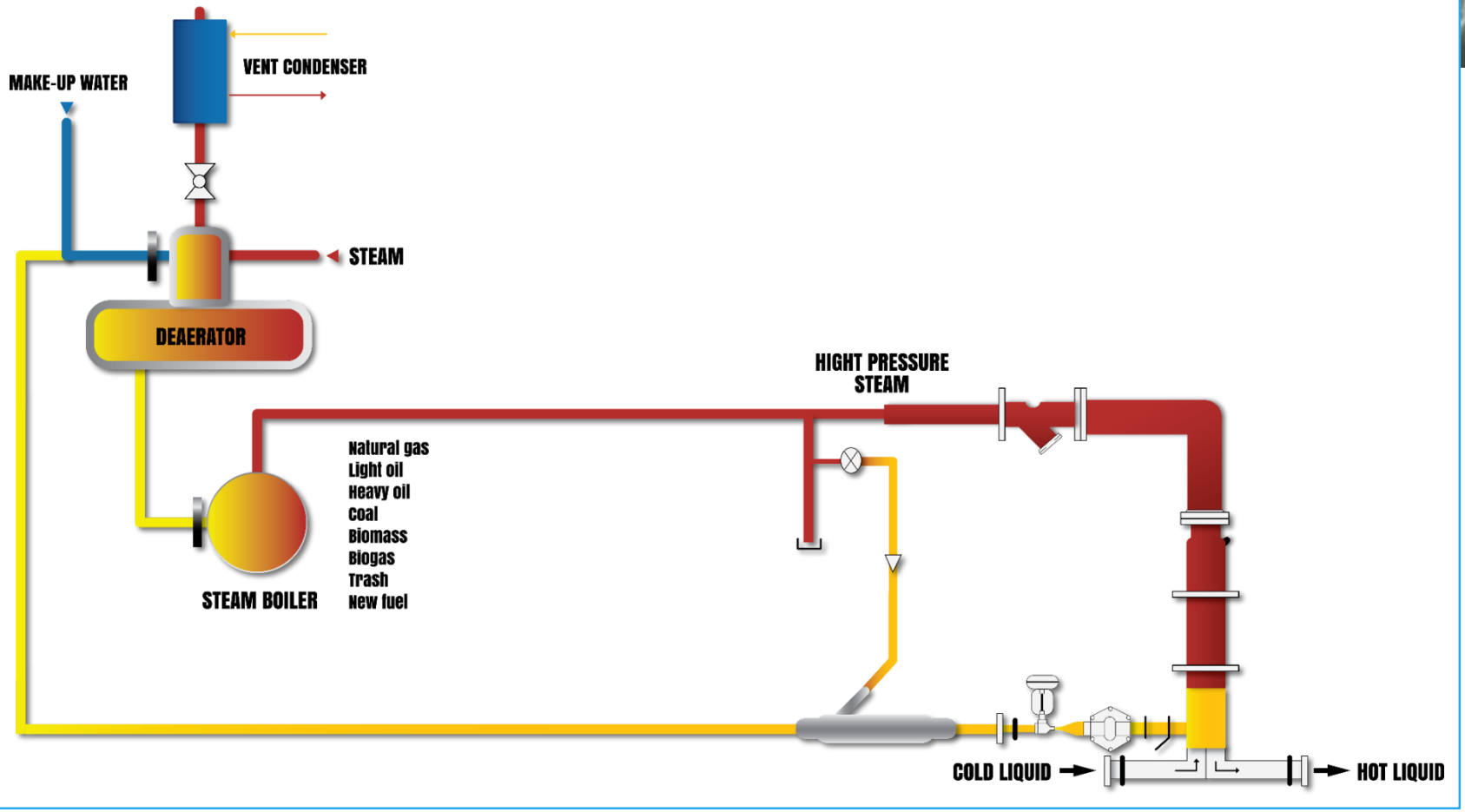

1 = Less Make-Up

2 = 0% Flash

3 = No Steam PRV

4 = No Safety Relief to Roof

5 = No Condensate Receiver Pump

6 = Smaller Pipe Size

7 = Smaller Control Valve

8 = No Vacuum Breaker

9 = Energy Savings of
Over 5.4% up to 20%

10 = Stability of Set Point 2^{o}F

11 = Less Maintenance cost

12 = 50:1 turndown

13 = Less blowdown on boiler

14 = Less chemicals for the
boiler & return lines

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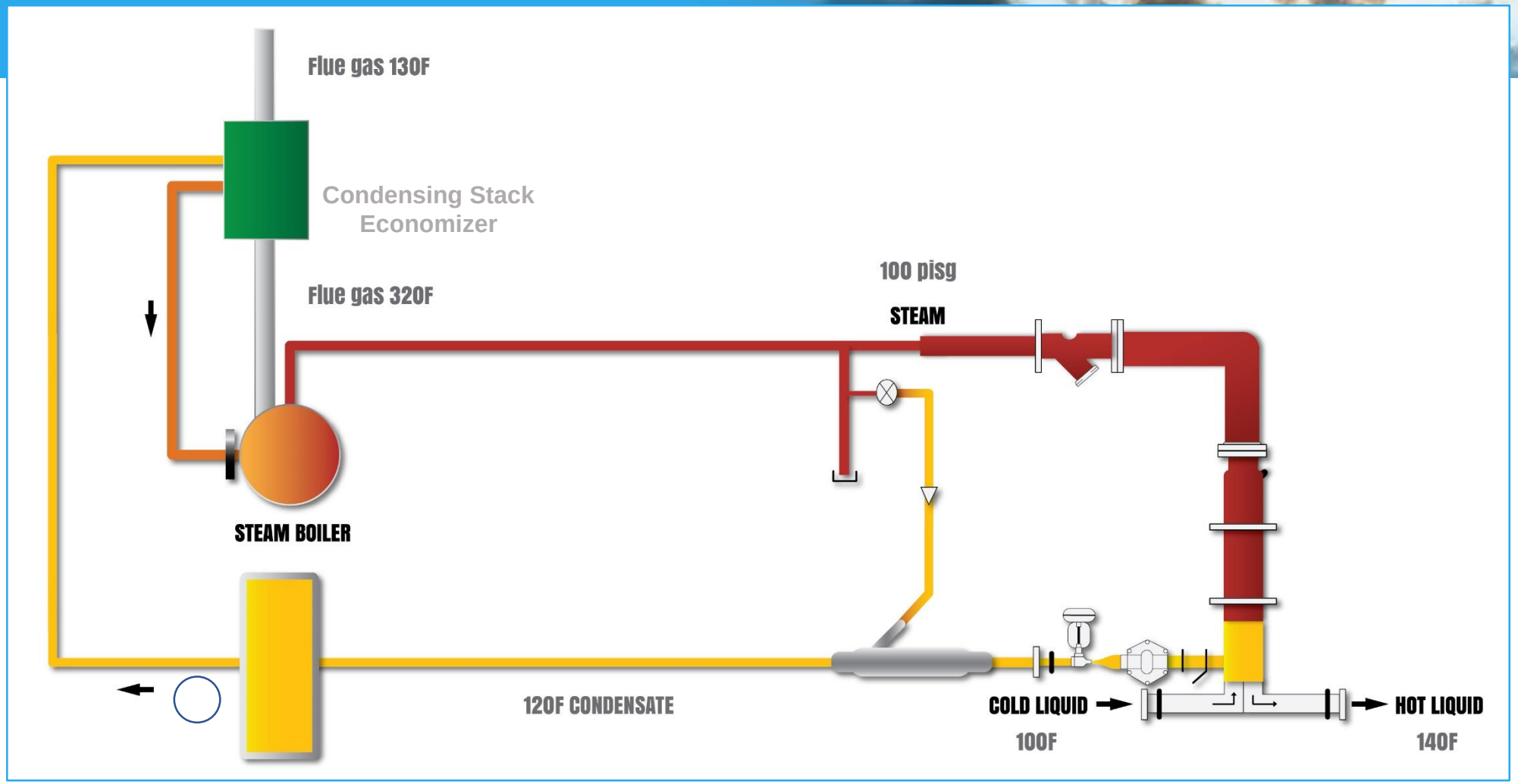

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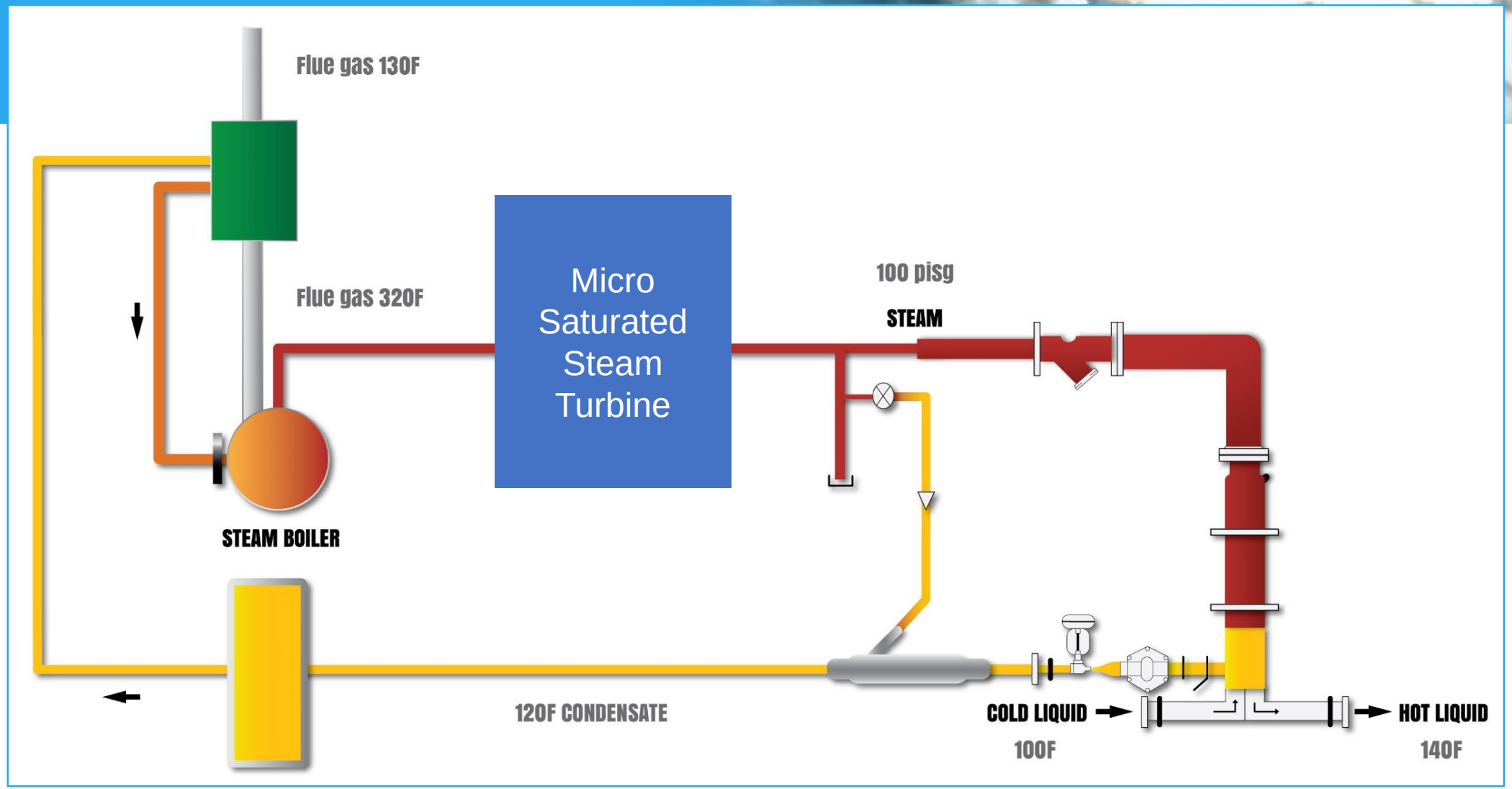

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Objet: Corrosion Question

Bonjour,

Lately we add a few questions from customers asking if our flooded design is more corrosive on return lines?

Attached is a resume of a corrosion test made by an independasnt firm in 2007 @ a Hospital in Montreal.

The test was performed comparing an existing conventional horizontal heat exchanger and a new Maxi-therm installation.

This test was made by a chemist consultant using typical black iron (alloy C1010) corrosion coupons. After 94 days of exposure the measured corrosion rated 2.36 mills per year were the conventional method was @ 14.63 MPA.

Per industry standards any result below 3 mills per year shows a good protection in a condensate system. More over a visual surface observation of the coupopn does not denote any pitting corrosion mechanism, which is also a positive point.

Let's not forget that we are a constant steam pressure design therefore no vacuum breaker is required, on a conventianl method the vacuum breaker injects room air to break the vacuum ,on low loads cooler condensate absorbs the air creates a corrosif return line.

Test result from a Hospital (2007)

	MAXI-THERM	CONVENTIONAL
Metallurgie	Black Iron	Black Iron
Days Exposed	94	94
Corrosion MPA	2.36	14.63

MPA= Mills per year

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BUILDING HEAT BASE UNIT

CAPACITY:

550 usgpm of 40% propylene glycol

from 146 to 180ºF using

125 psig steam.

OVERALL DIMENSIONS (L X W X H):

76’’ x 51’’ x 76’’

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BUILDING HEAT BASE UNIT

CAPACITY (each):

2200 usgpm of water from

150 to 180ºF using

125 psig steam.

OVERALL DIMENSIONS (L X W X H):

87’’ x 46’’ x 99’’

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BUILDING HEAT BASE UNIT

CAPACITY (each):

1900 usgpm of water from

93 to 120°F using

80 psig steam.

OVERALL DIMENSIONS (L X W X H):

89’’ x 52’’ x 86’’

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4MMBTU Redundant system

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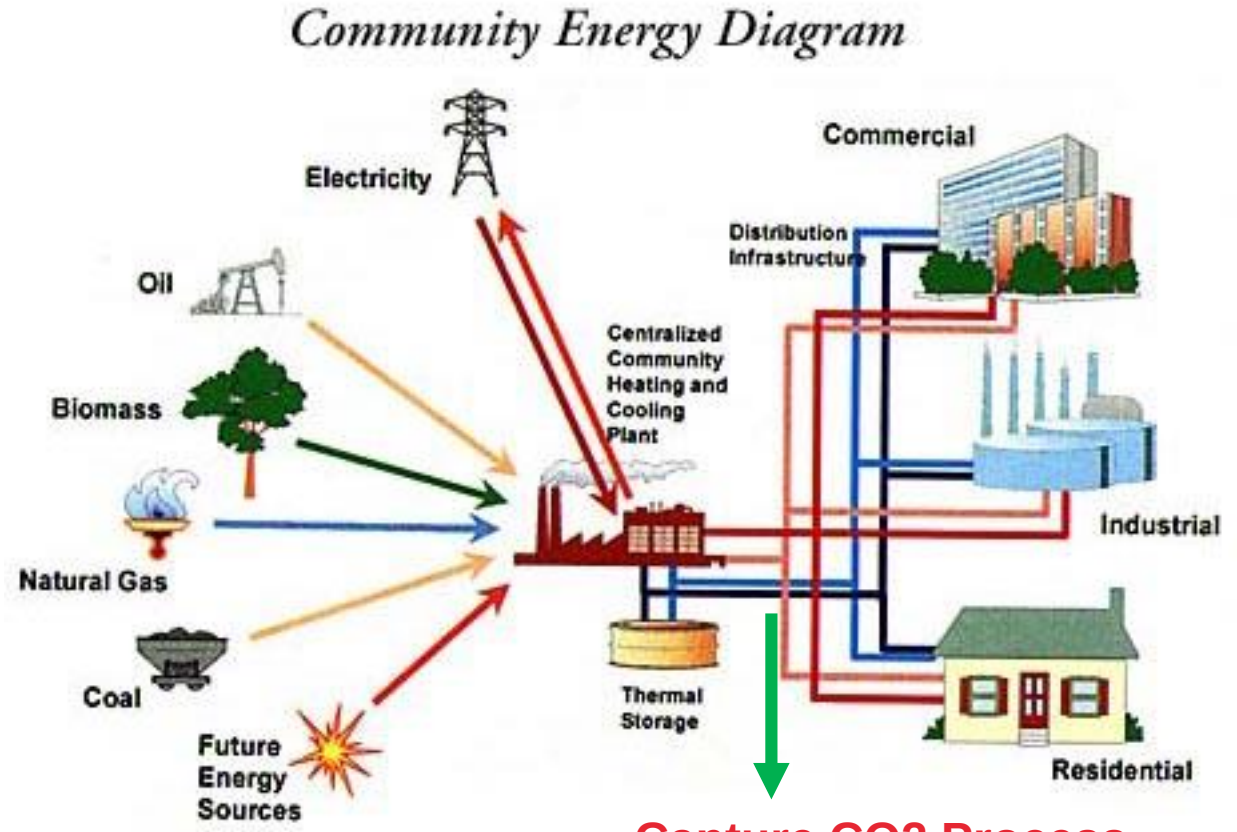
Why use STEAM?



Capture CO2 Process

- Greenhouses
- Farm plant
- Algae Bio diesel
- Plastic process
- Storage

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It is a Safe Device!

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Yale
UNIVERSITY


VE RI TAS
HARVARD
UNIVERSITY


PENNSTATE
1855


CMU
CENTRAL MICHIGAN
UNIVERSITY


COLORADO SCHOOL OF MINES
OFFICIAL SEAL
1874


MONTCLAIR STATE
UNIVERSITY


UNIVERSITY OF MINNESOTA


THE UNIVERSITY OF
CHICAGO


Penn


OHIO STATE


University of
Connecticut


THE UNIVERSITY of
WISCONSIN
MADISON


THE UNIVERSITY of
NEW MEXICO

SUMMARY OF USING A VERTICAL, CONDENSING STEAM HEAT EXCHANGER

- **Energy Savings & Maintenance Savings**
- Steam is the **SAFEST** and Most Reliable Energy Transfer Media
- Takes Between **40 to 60% LESS SPACE** in Mechanical Rooms
- Possibility to Have a Building Without Vents or Chimneys
- Only a **½ in. Control Valve up to 10 MMBTU/HR Process**
- Simple Automated Control System (Start-up, Shut Down and Restart)
- No Manual Valves to Touch, No Water Hammer
- **Longer Life** of the Condensate Return Lines and Less Chemical Use
- High Turndown Ratio, 50:1
- Reliable Energy Readings Via Condensate Flow Meter
- Possibility to have a condensing steam boiler and Cogeneration…
- Keeping **Stationary Engineer is an Asset** to the Facility

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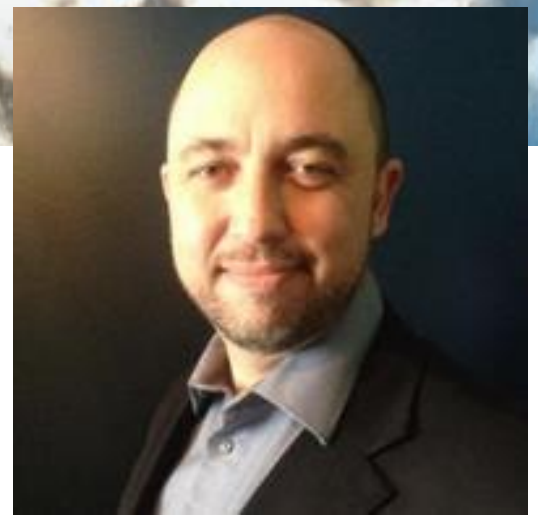
Patrick Lach



Steam Specialist

International Sales Manager

Offering Steam Heat Exchanger Solutions

Montreal, Canada Area | Machinery

https://ca.linkedin.com/in/steamspecialist

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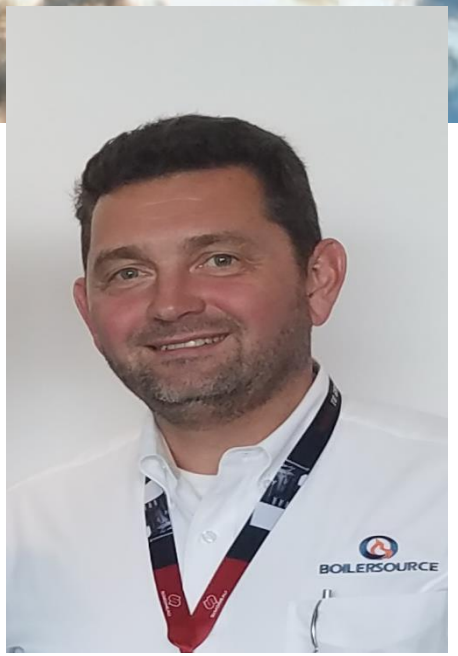

Representing Maxi-Therm in Illinois and Indiana

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http://www.boilersource.com

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Going Beyond the Boilerplate

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