Cleveland Chapter Meeting
Nov. 17th, 2022

Low Cost/No Cost Your Way to Success!

John Puskar

Who is John Puskar, P.E.?

- Licensed Professional Engineer
- Practicing over 40 years
- Founder – CEC Combustion Services
- BSME, Mechanical Engineering,
- Youngstown State Univ., 1981
- MBA, Weatherhead School of Mgt.
  Case Western Reserve Univ., 1985
- Member of ***NFPA 54, 56, 59A, 85, 820, ASME CSD-1, API 54, former NFPA 86***
- Author and presenter of more than 100 papers, more than 100 conferences and workshops, trained thousands worldwide.

AEE – CIEP & CEM

PRESCIENT LLC
TECHNICAL SERVICES

CEC Combustion Safety

ECLIPSE®
Innovative Thermal Solutions

CEC Combustion Safety becomes a part of Eclipse.

John Puskar and the team at C[illegible]ombustion Safety will continue their mission to ensure the safety of your staff [illegible]ork environment while m[illegible]mizing your fuel systems and combustion equi[illegible]

It i[illegible]

Over 3MM miles, in and out of over 300 industrial plants 14 countries

[illegible]ipse the [illegible]y to further extend [illegible]ocus on safety in the fuels and combustion safety markets" says Lach Perks, President of Eclipse. "**With the acquisition of CEC, safety solutions and services for thermal processors**

Left to Right: **Doug Perks**, Chairman and CEO of Eclipse, **John Puskar**, General Manager of CEC, **Lach Perks**, President of Eclipse.

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90% of my work, Industrial implementing projects, contractor experience

I'm a hands-on tool guy

I am trying to focus on unusual innovative things, not all the usual!

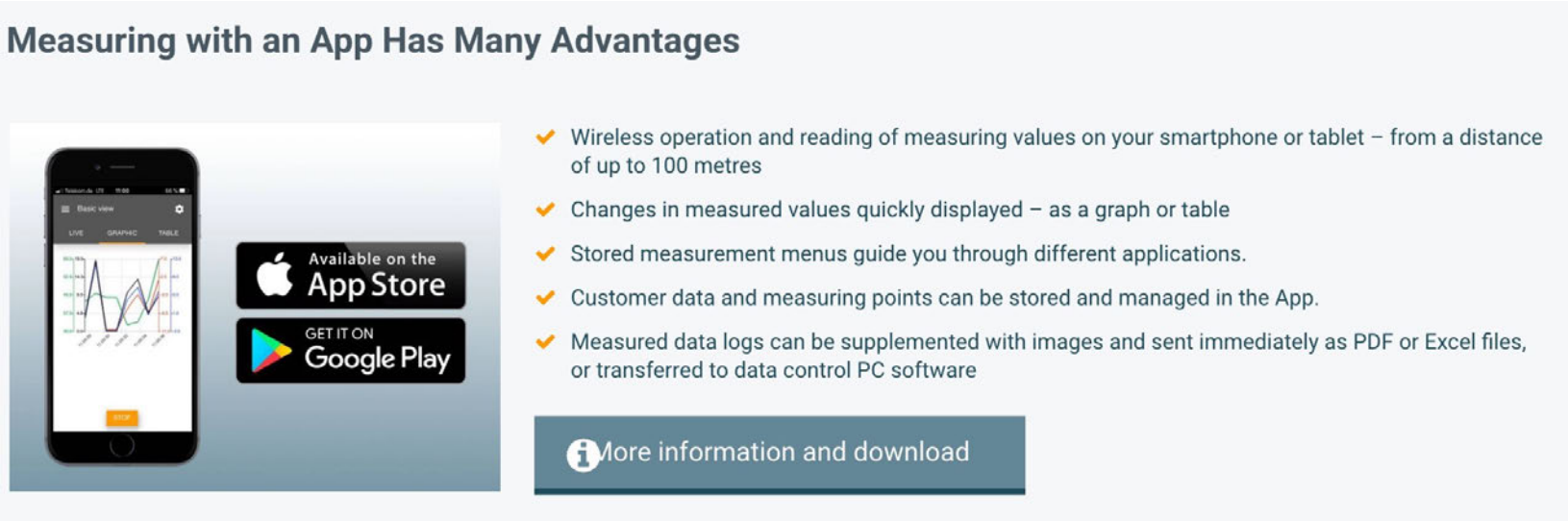
Low-cost/No-cost energy tools!

My favorite 10 Low Cost/No Cost tools!

1. Testo Smart Probes
2. Flir Ipad/phone Imagers
3. Micro data loggers
4. Smokeys
5. Combustion Analyzers
6. Ultrasonic flow meters
7. IAuditor software platform
8. TLV site, energy calculations
9. DOE Steam Modeler site
10. BD Modeler - measurement

#1 The world of Smart Instruments!

Lots of data collection, .



Yes, there's an app for that

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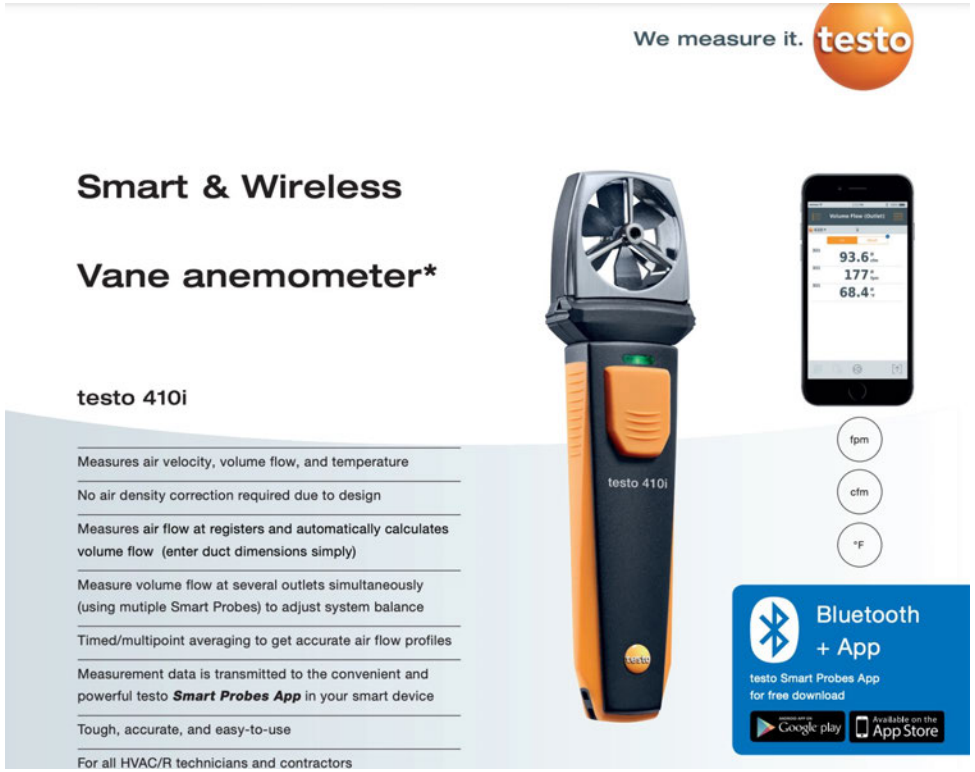
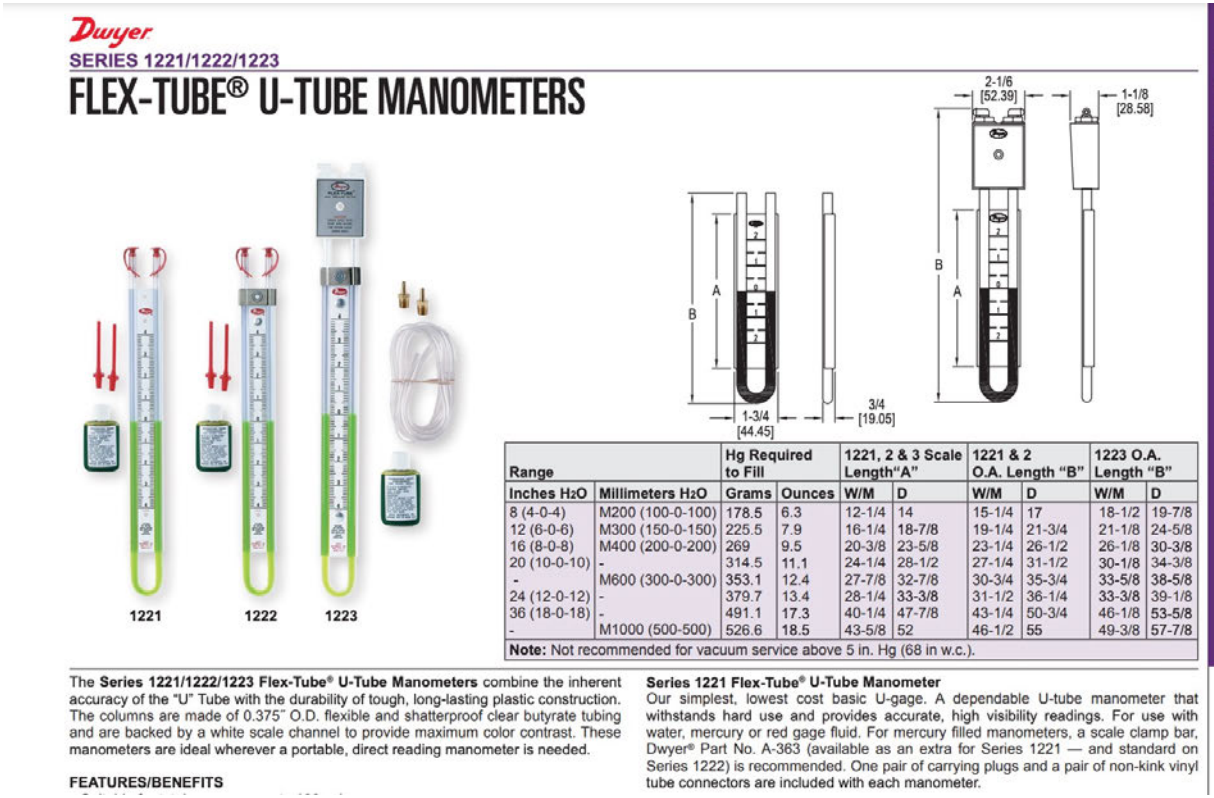
1.Testo Smart Probes, measure air flow and small pressures.



Air Flow, Anemometers – Hot Wire or Vane

But How Do I? – Measure Small Pressures



Range		Hg Required to Fill		1221, 2 & 3 Scale Length "A"		1221 & 2 O.A. Length "B"		1223 O.A. Length "B"	
Inches H_2O	Millimeters H_2O	Grams	Ounces	W/M	D	W/M	D	W/M	D
8 (4-0-4)	M200 (100-0-100)	178.5	6.3	12-1/4	14	15-1/4	17	18-1/2	19-7/8
12 (6-0-6)	M300 (150-0-150)	225.5	7.9	16-1/4	18-7/8	19-1/4	21-3/4	21-1/8	24-5/8
16 (8-0-8)	M400 (200-0-200)	269	9.5	20-3/8	23-5/8	23-1/4	26-1/2	26-1/8	30-3/8
20 (10-0-10)	-	314.5	11.1	24-1/4	28-1/2	27-1/4	31-1/2	30-1/8	34-3/8
-	M600 (300-0-300)	353.1	12.4	27-7/8	32-7/8	30-3/4	35-3/4	33-5/8	38-5/8
24 (12-0-12)	-	379.7	13.4	28-1/4	33-3/8	31-1/2	36-1/4	33-3/8	39-1/8
36 (18-0-18)	-	491.1	17.3	40-1/4	47-7/8	43-1/4	50-3/4	46-1/8	53-5/8
-	M1000 (500-500)	526.6	18.5	43-5/8	52	46-1/2	55	49-3/8	57-7/8

Note: Not recommended for vacuum service above 5 in. Hg (68 in w.c.).

The **Series 1221/1222/1223 Flex-Tube® U-Tube Manometers** combine the inherent accuracy of the "U" Tube with the durability of tough, long-lasting plastic construction. The columns are made of 0.375" O.D. flexible and shatterproof clear butyrate tubing and are backed by a white scale channel to provide maximum color contrast. These manometers are ideal wherever a portable, direct reading manometer is needed.

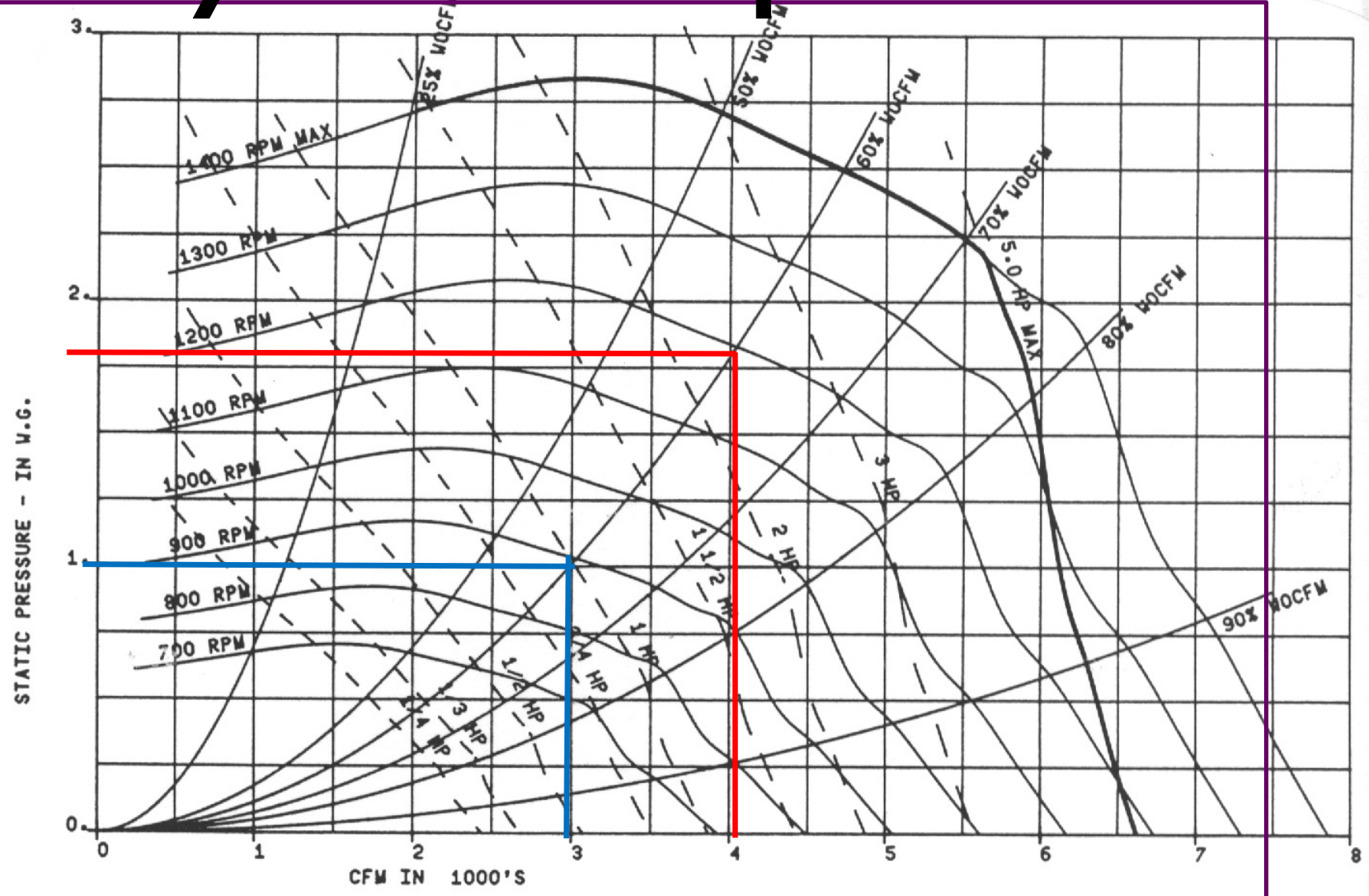
FEATURES/BENEFITS

Series 1221 Flex-Tube® U-Tube Manometer
Our simplest, lowest cost basic U-gage. A dependable U-tube manometer that withstands hard use and provides accurate, high visibility readings. For use with water, mercury or red gage fluid. For mercury filled manometers, a scale clamp bar, Dwyer® Part No. A-363 (available as an extra for Series 1221 — and standard on Series 1222) is recommended. One pair of carrying plugs and a pair of non-kink vinyl tube connectors are included with each manometer.

Manometers – Digital or U-Tube

#1

No one ever measures where they are on the perf. Curve!



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Fan Curves & Conditions watch it and document it on the app.

Things you will find:

VFD opportunities

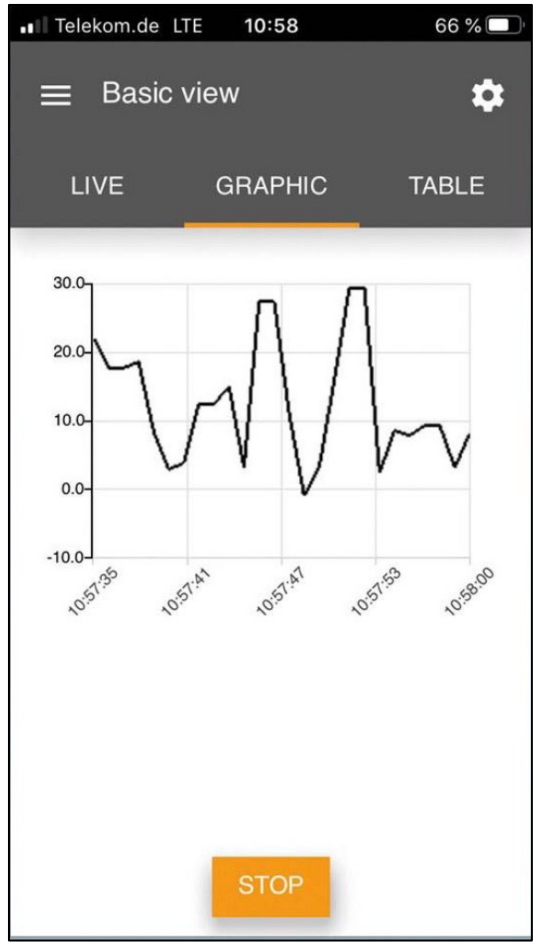
VFD's not set right

Motors oversized

Airflow way too high for the ventilation system needs

Air velocity required for ventilation system capture velocity not adequate

And more.....



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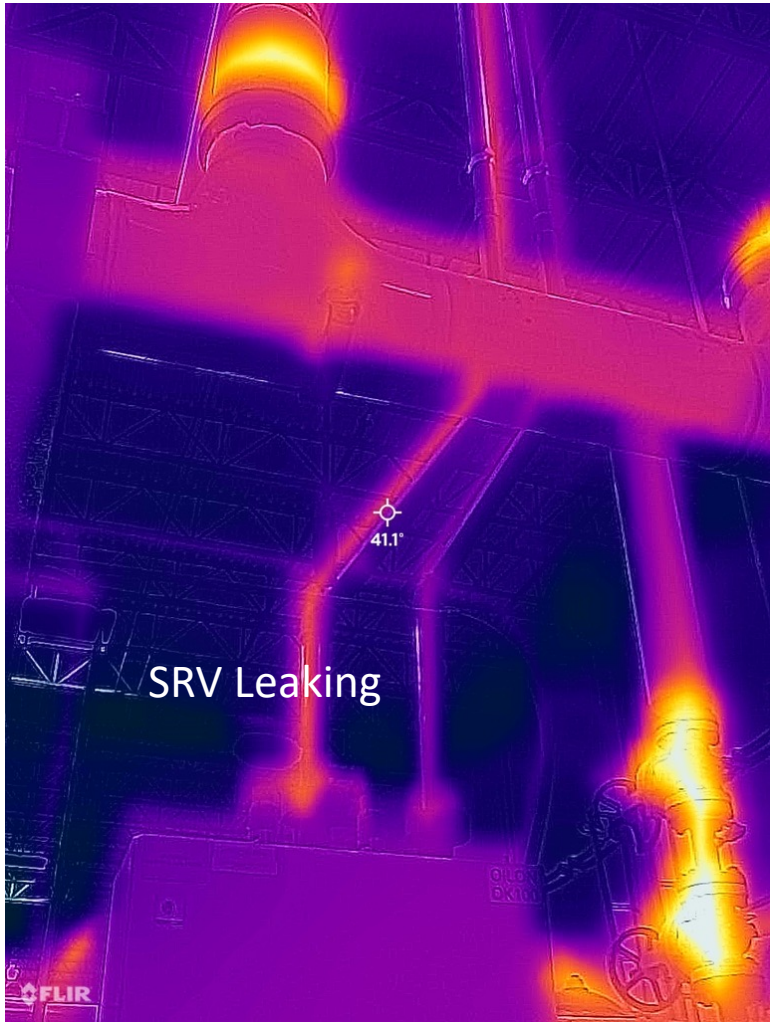
#2

Cheap Thermal Imaging!



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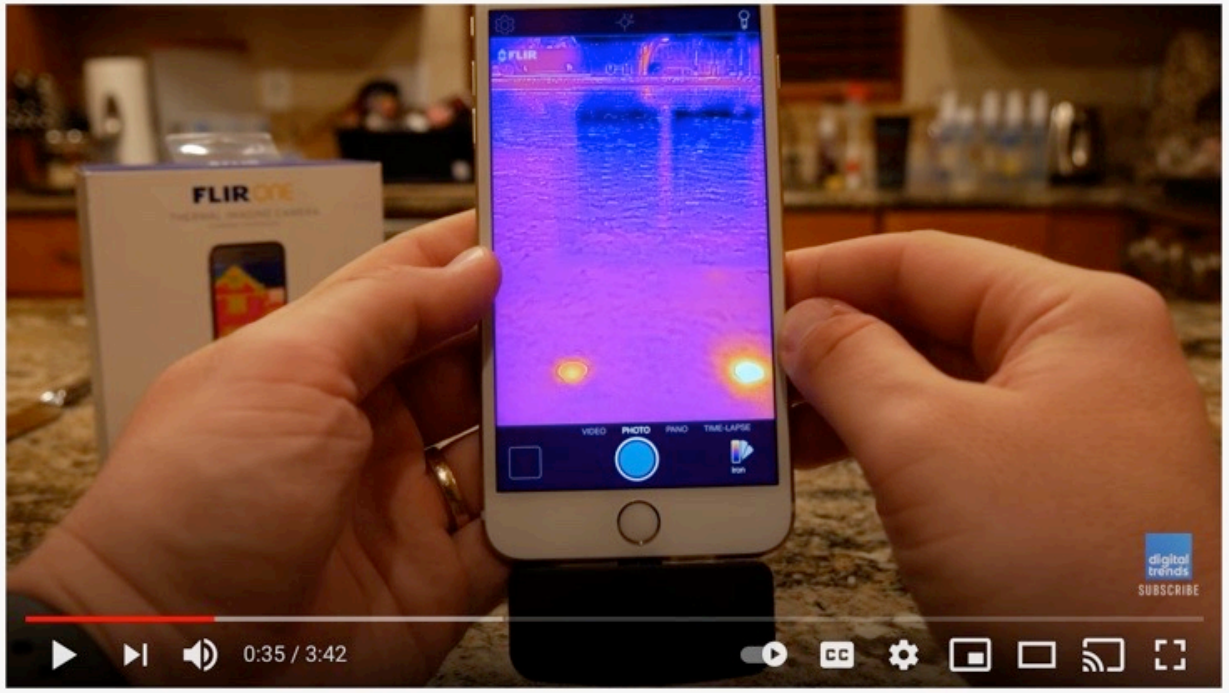
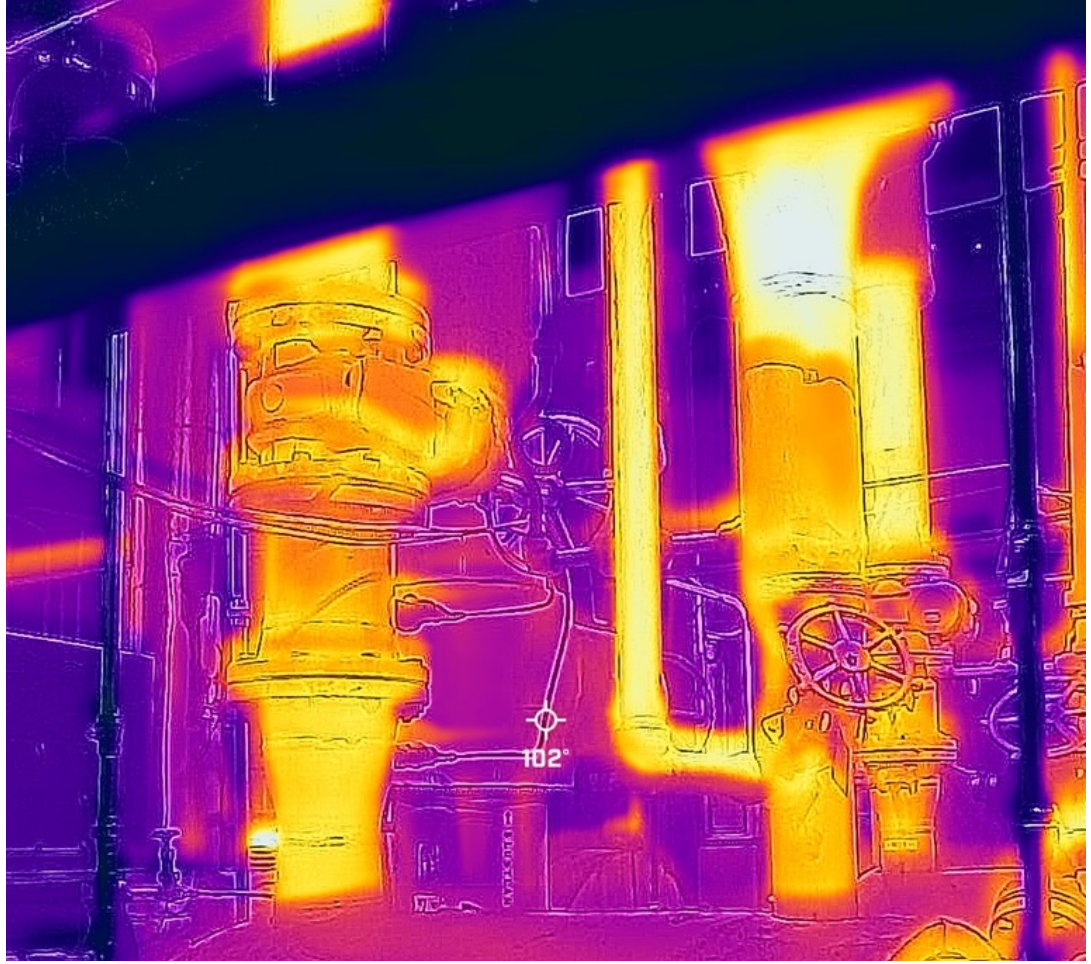
$400 from FLIR, be using it in 10 minutes

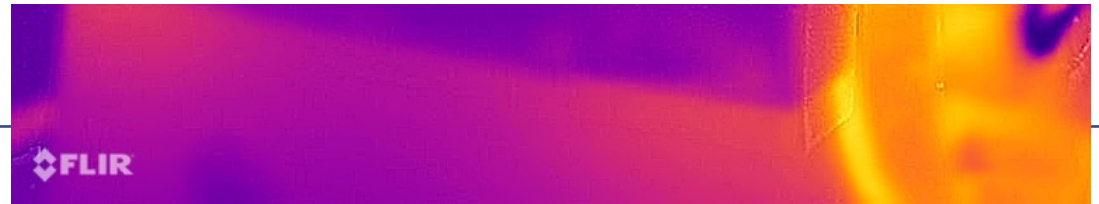
- Building envelope issues
- Electrical contact resistance
- Overloaded circuits
- Wet Roof Insulation
- Uninsulated piping and valves
- Failing bearings and couplings
- Leaking valves
- Leaking steam traps



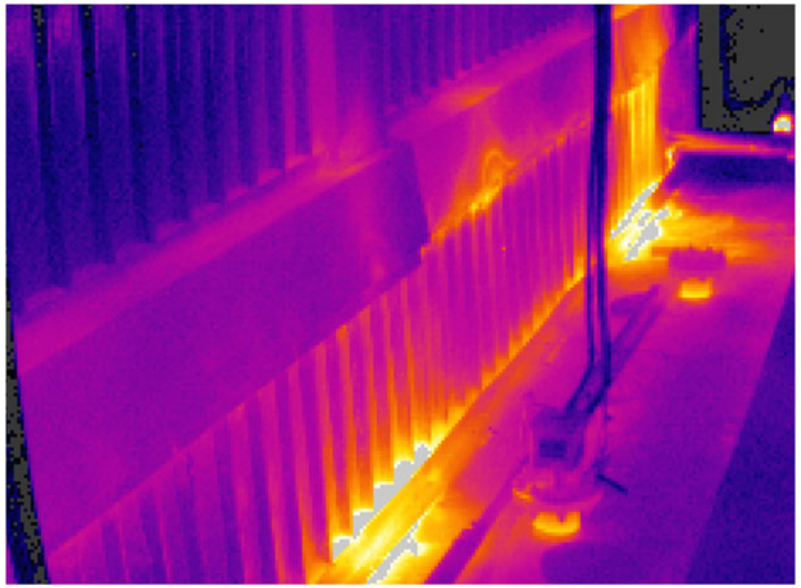
Flir One Thermal Imager for iOS and Android



Uninsulated piping with temperatures



Review furnace fireboxes, ducts, for air leaks, (infiltration), refractory issues.



Duct leakage

Looking into the kitchen

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#3 Micro Data Loggers to the Rescue

Wireless to your phone!

Channel 1: CW in Temp
Channel 2: CW out Temp
Channel 3: Air into coil Temp
Channel 4: Air out of coil Temp

Gateway available to send info To Cloud

HOBO 4-Channel Analog Data Logger

Part # MX1105

Bluetooth-enabled logger

$199 USD

Add to Cart

Build a Kit

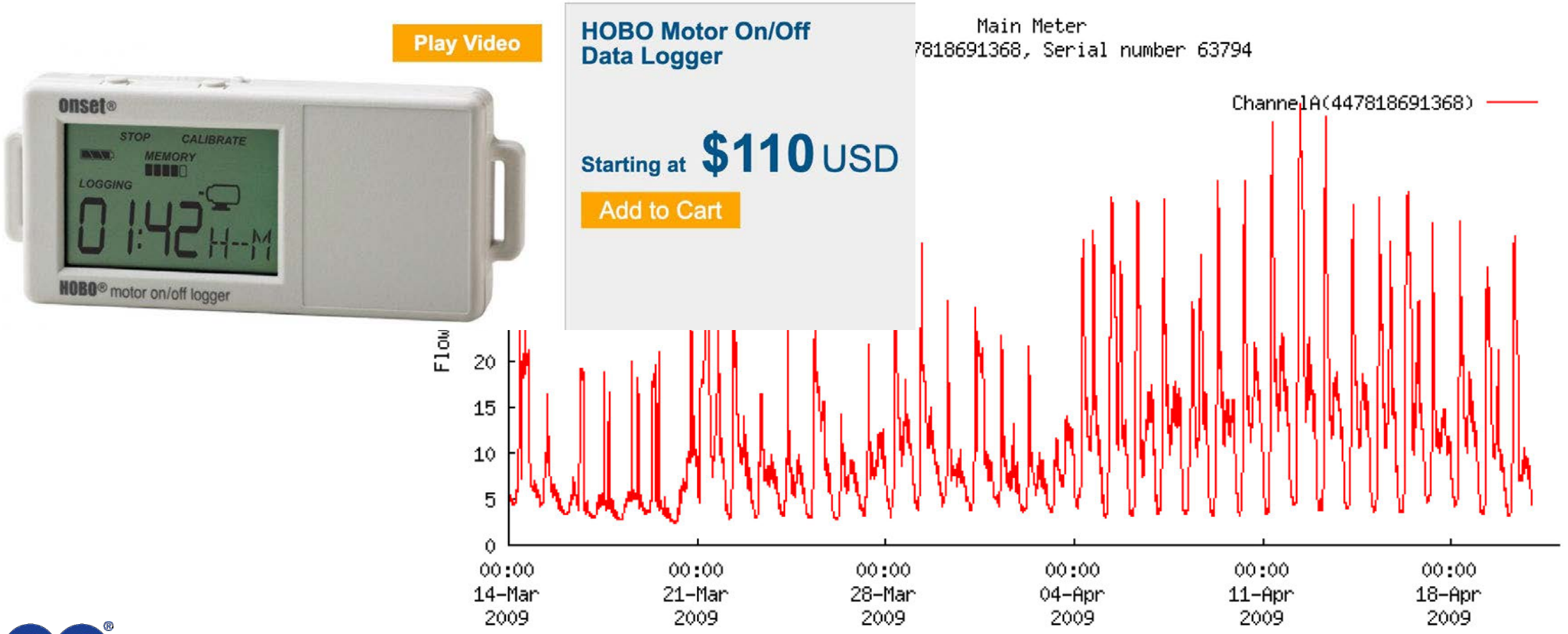
Important Info

Requires the HOBOconnect app and a compatible mobile device or Windows computer. System requirements can be found at the bottom of the HOBOconnect software page.

HOBOconnect Information

Need help deciding?

Oversized Equipment, short cycling



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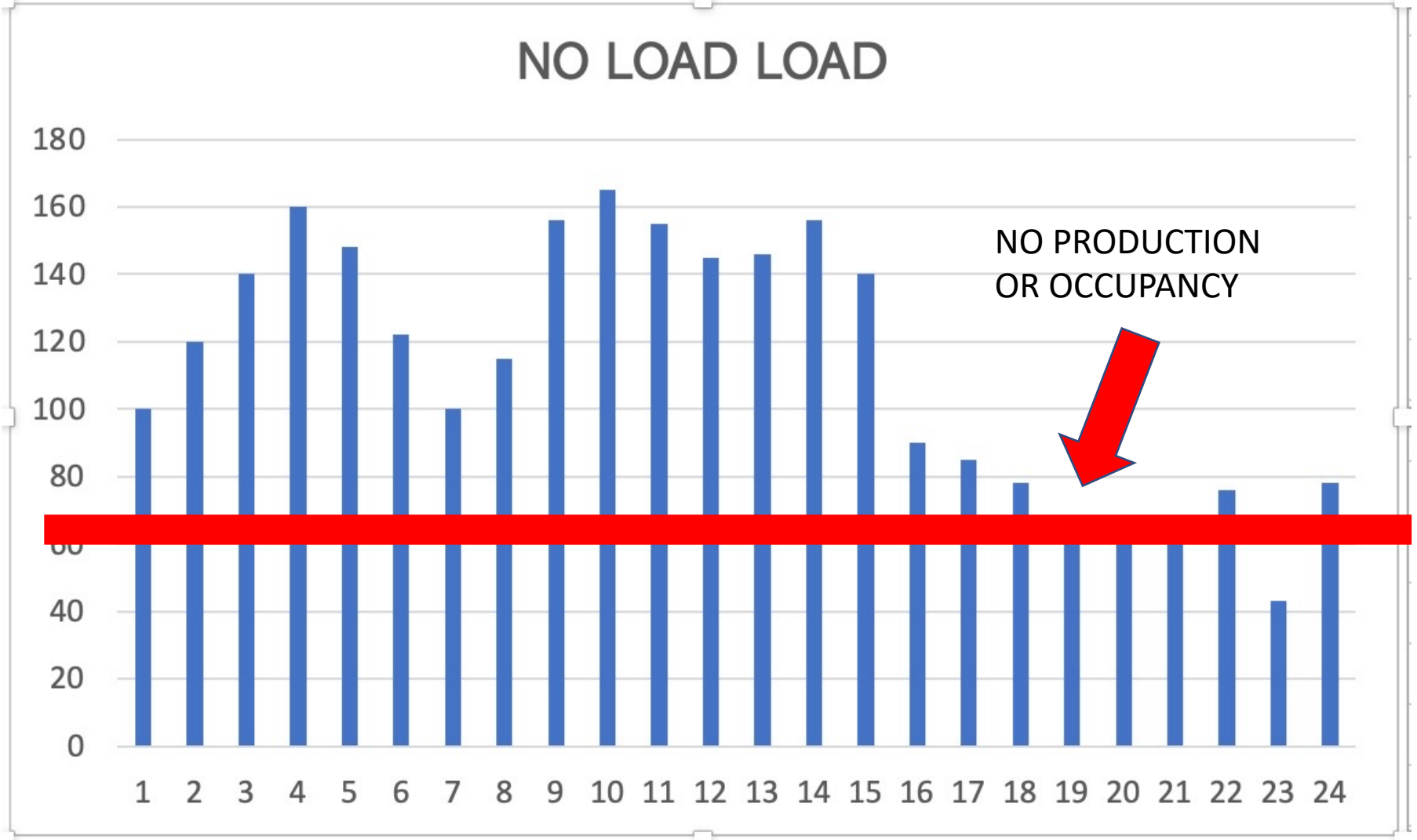
Boiler plant master control, (multiple boilers) lead/lag– 75% load, 3 minutes, 5 min. minimum

No Load – Load, leaks – comp. air, steam, water, etc. (CT's)



#4 SEEING IS BELIEVING – Smokeys

Smokeys 75 Second Smoke Emitter, Pack of 10

DIVERSITECH

Model #: 14175

Item #: DVT14175

Features:

- Smoke bomb
- 75-second running time
- 600 cubic feet
- Non-toxic, oil-free smoke

https://youtu.be/C-MZaHxQxAw

5:00

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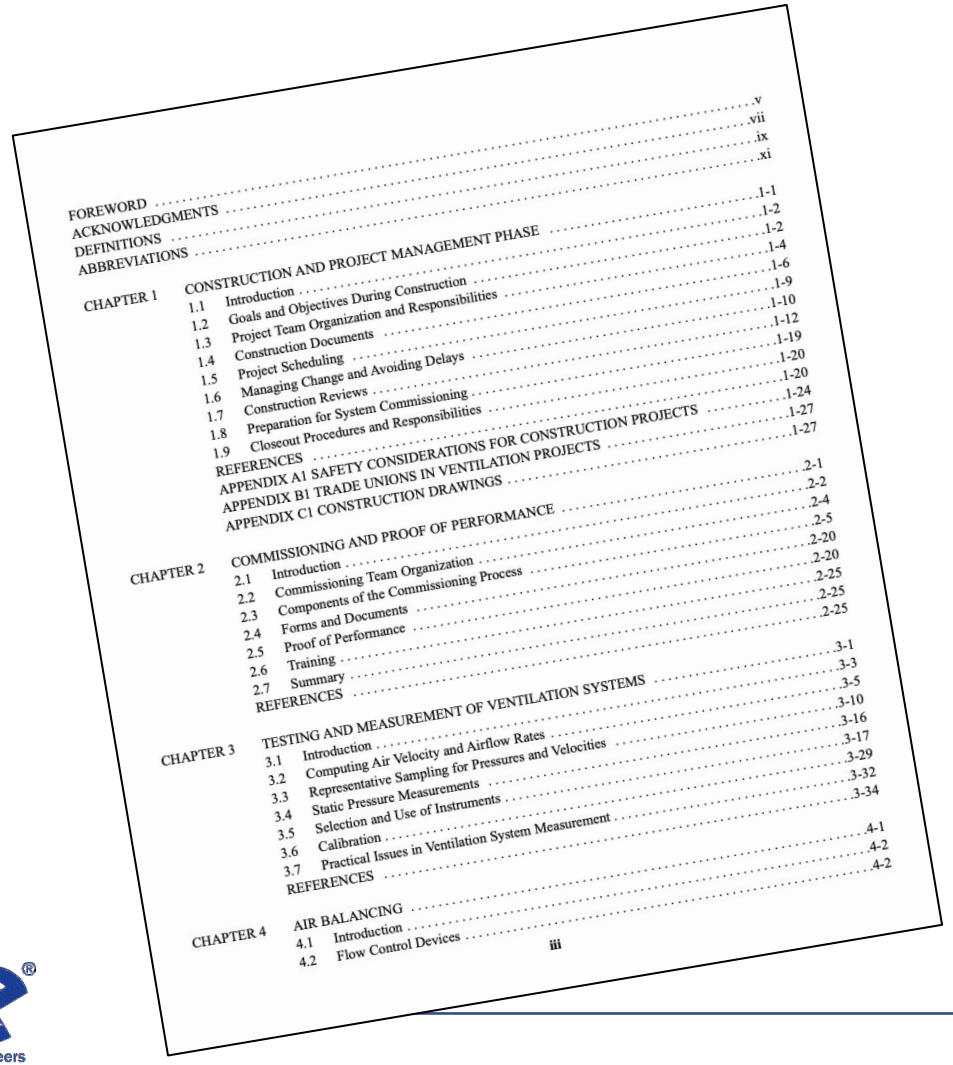
Best Industrial Ventilation I have ever found in over 40 years of practice! www.acgih.org



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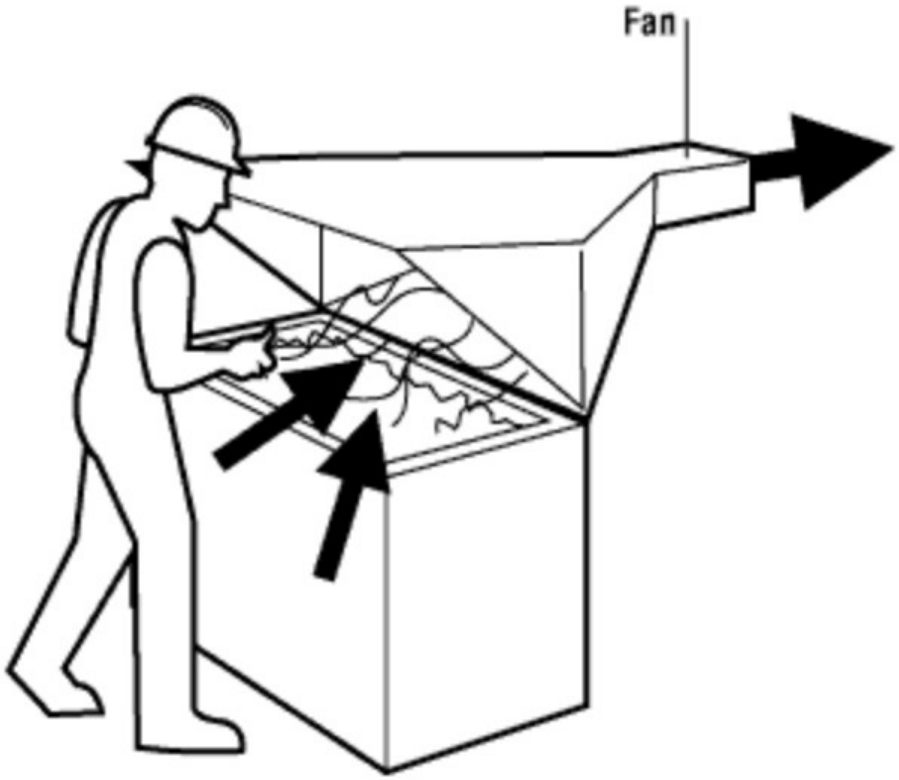
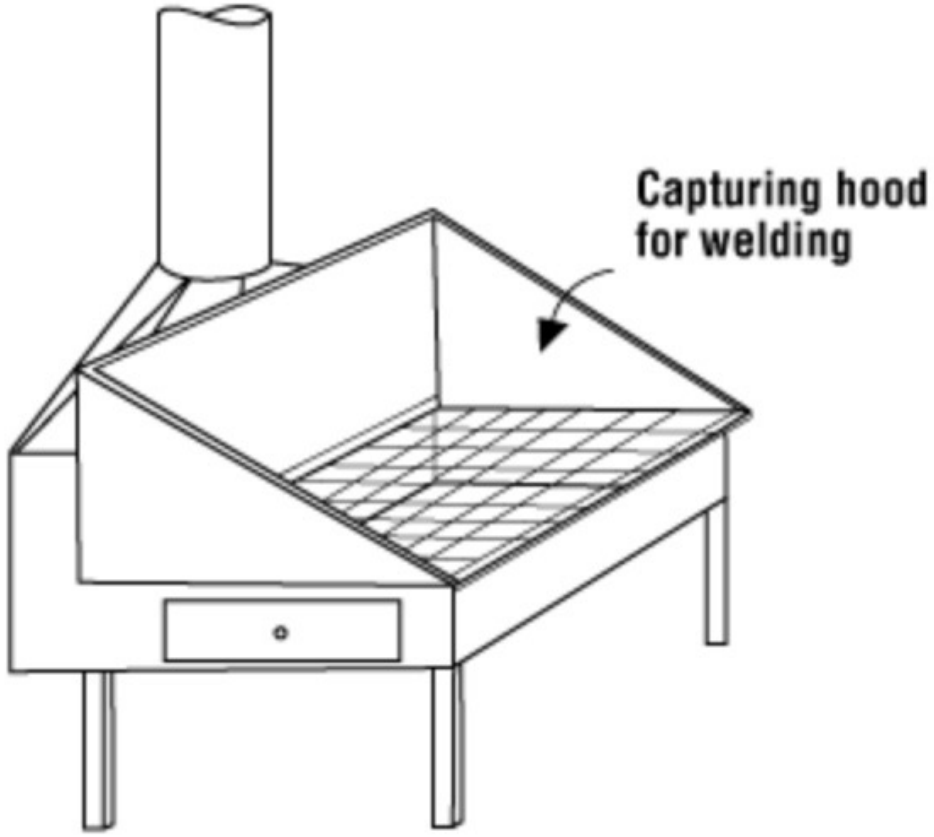
Practical use: capture velocities on hoods, duct leakage, air flow in ducts.



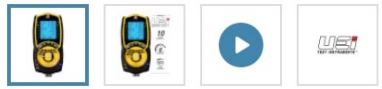


#5

What's the flame telling you?

Flue Gas Analyzers are now CHEAP!

Hover image to zoom



Home > HVAC Supplies > Tools > UEi Test Instruments > Combustion Analyzers

You ordered **1** on **Jul 20, 2022** Details

Flue Gas Combustion Analyzer w/ Differential Pressure

Brand: **UEi Test Instruments** SKU: **C163** (0) Q&A: (0)

− 2 + **$841.46** each

✓ ADDED

In Stock Get 1 **Fri, Sep 2**

More Available Inventory Details

MANUALS (4)

- Product Overview
- User Guide
- Quick Start Guide
- Warranty Info

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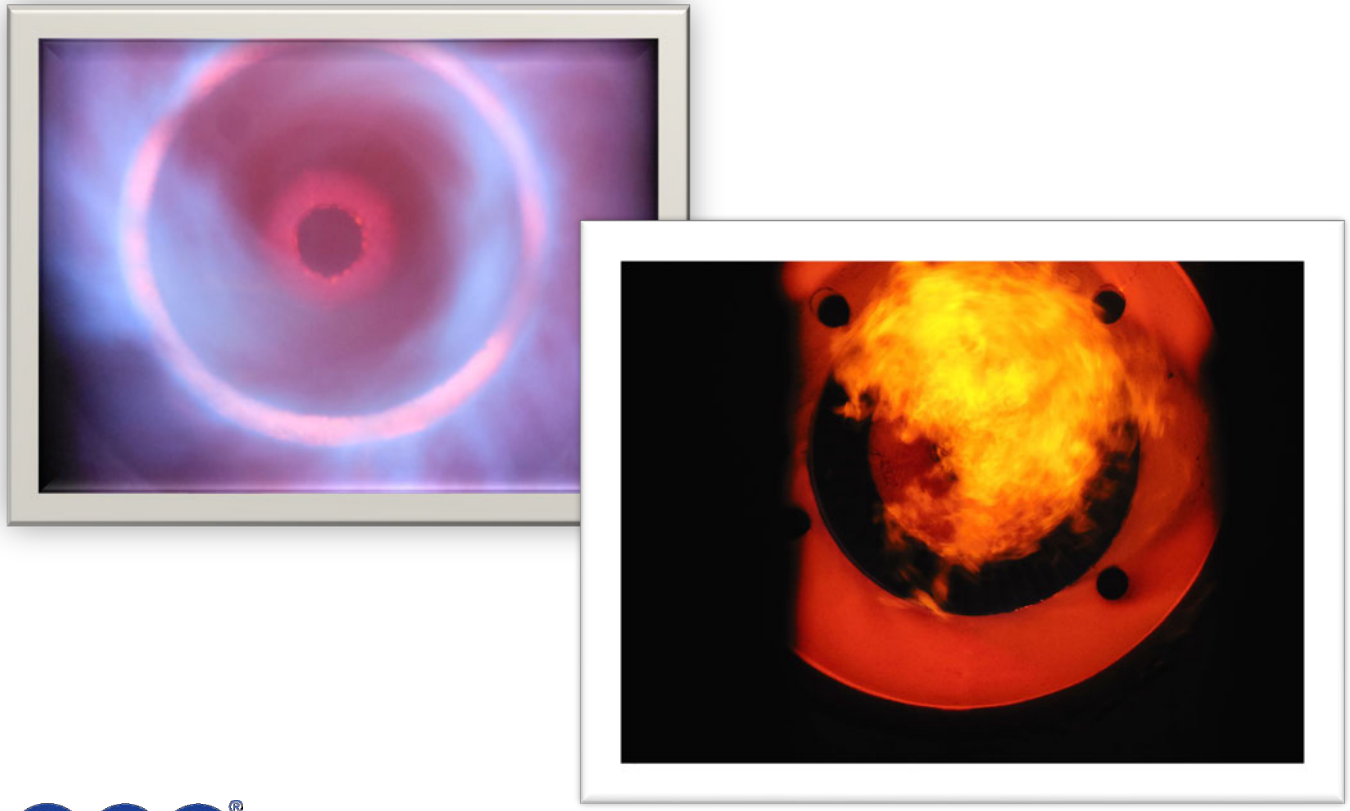
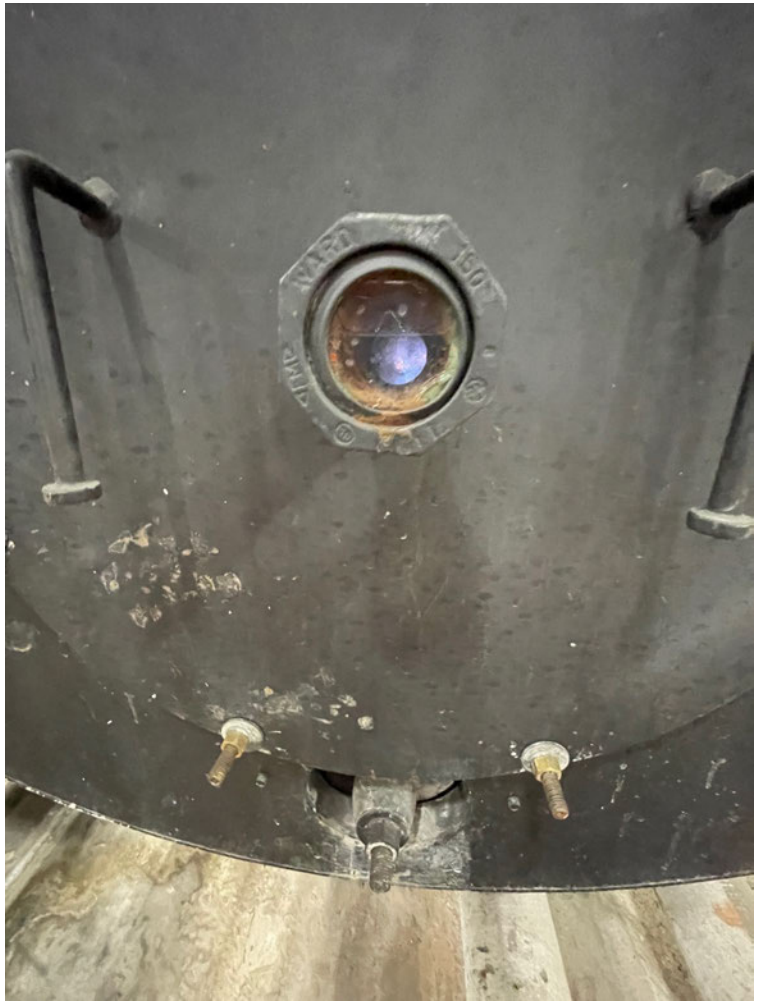
Energy Conservation Measure:
Tune burners – Optimize air/fuel ratios





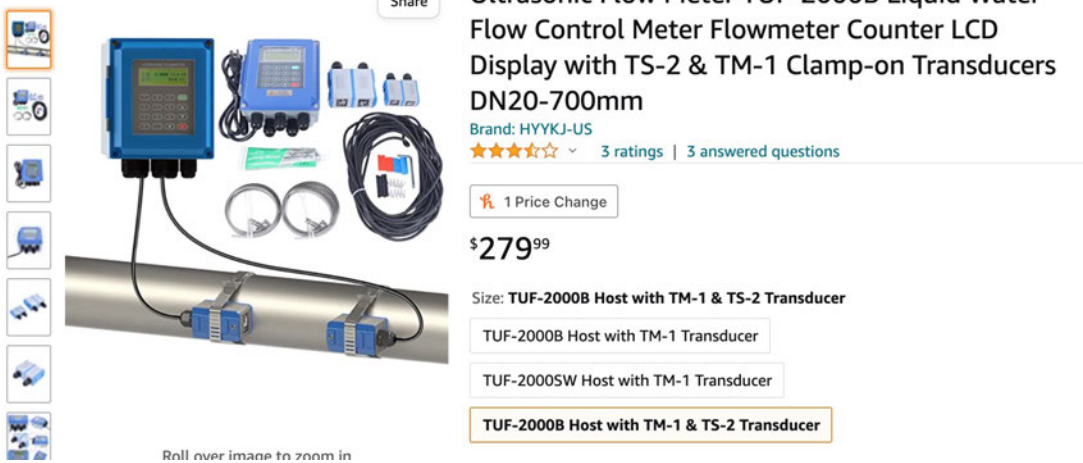
Don’t Try and Adjust, but you can diagnose And estimate savings easily!

Having an analyzer now makes it practical and easy to quantify your conditions and take action!

#6

Saving water, got to measure it to manage it.

Purchased 2 times.
Last purchased Nov 10, 2022
Size: TUF-2000B Host with TM-1 & TS-2 Transducer | View order



Share

Ultrasonic Flow Meter TUF-2000B Liquid Water Flow Control Meter Flowmeter Counter LCD Display with TS-2 & TM-1 Clamp-on Transducers DN20-700mm

Brand: HYYKJ-US

3 ratings | 3 answered questions

1 Price Change

$279.99

Size: **TUF-2000B Host with TM-1 & TS-2 Transducer**

TUF-2000B Host with TM-1 Transducer

TUF-2000SW Host with TM-1 Transducer

TUF-2000B Host with TM-1 & TS-2 Transducer

Roll over image to zoom in

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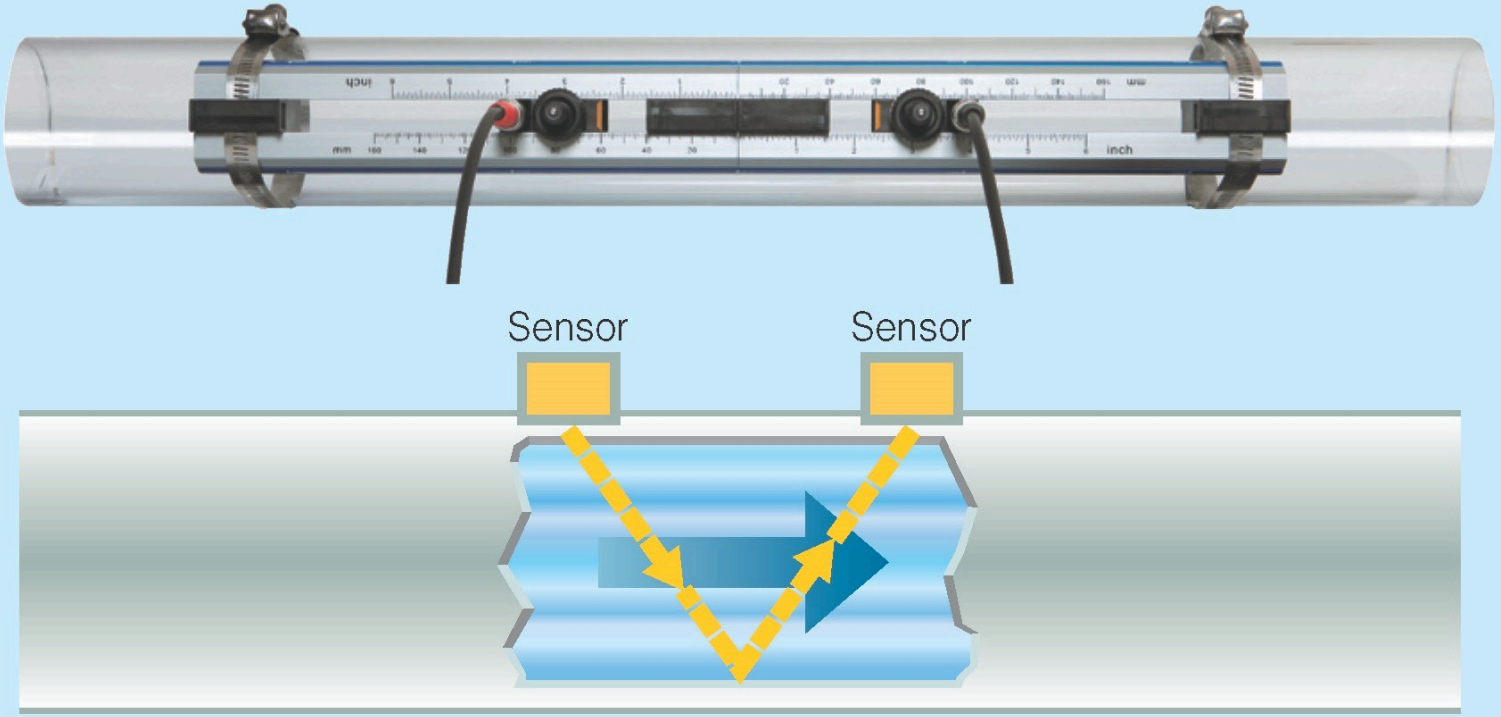
With ultrasonic pulses propagated diagonally between the upstream and downstream sensors mounted on the exterior of the pipe, the flow rate is measured by detecting the time difference caused by the flow.



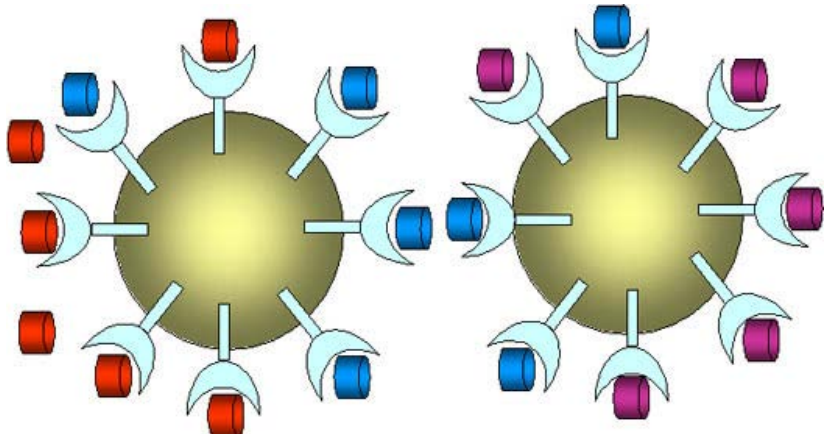
At a cooling tower overflow drain in Singapore, Pharma Plant - 2″ pipe

Now you can afford to have meters all over and avoid this!

Boiler Make-up great KPI

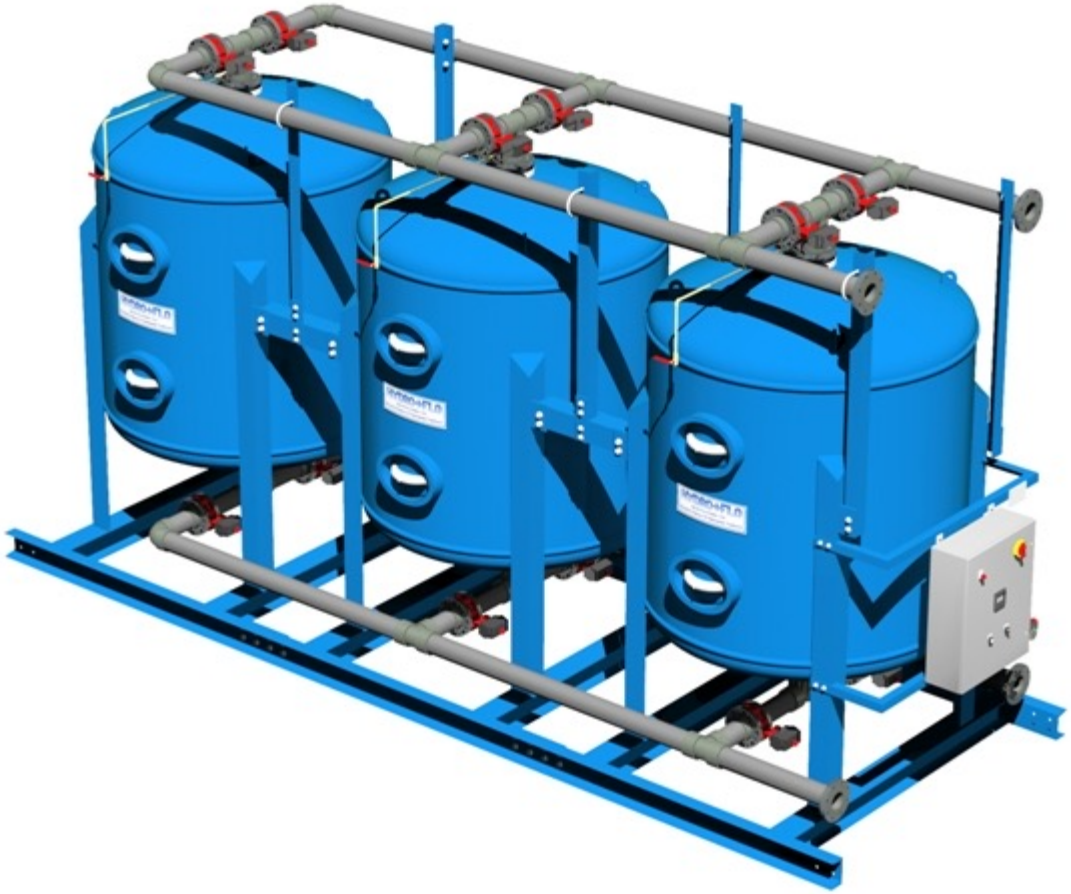
RO System

You can validate softener parameters



Different beads,
Cationic (- Negative charge)
Anionic (+ positive charge)
Have different affinities
& adsorb/elute cycles,
but all of this works
the same way

Vessels filled with different resin beads
one regenerating,
one in service,
one in standby



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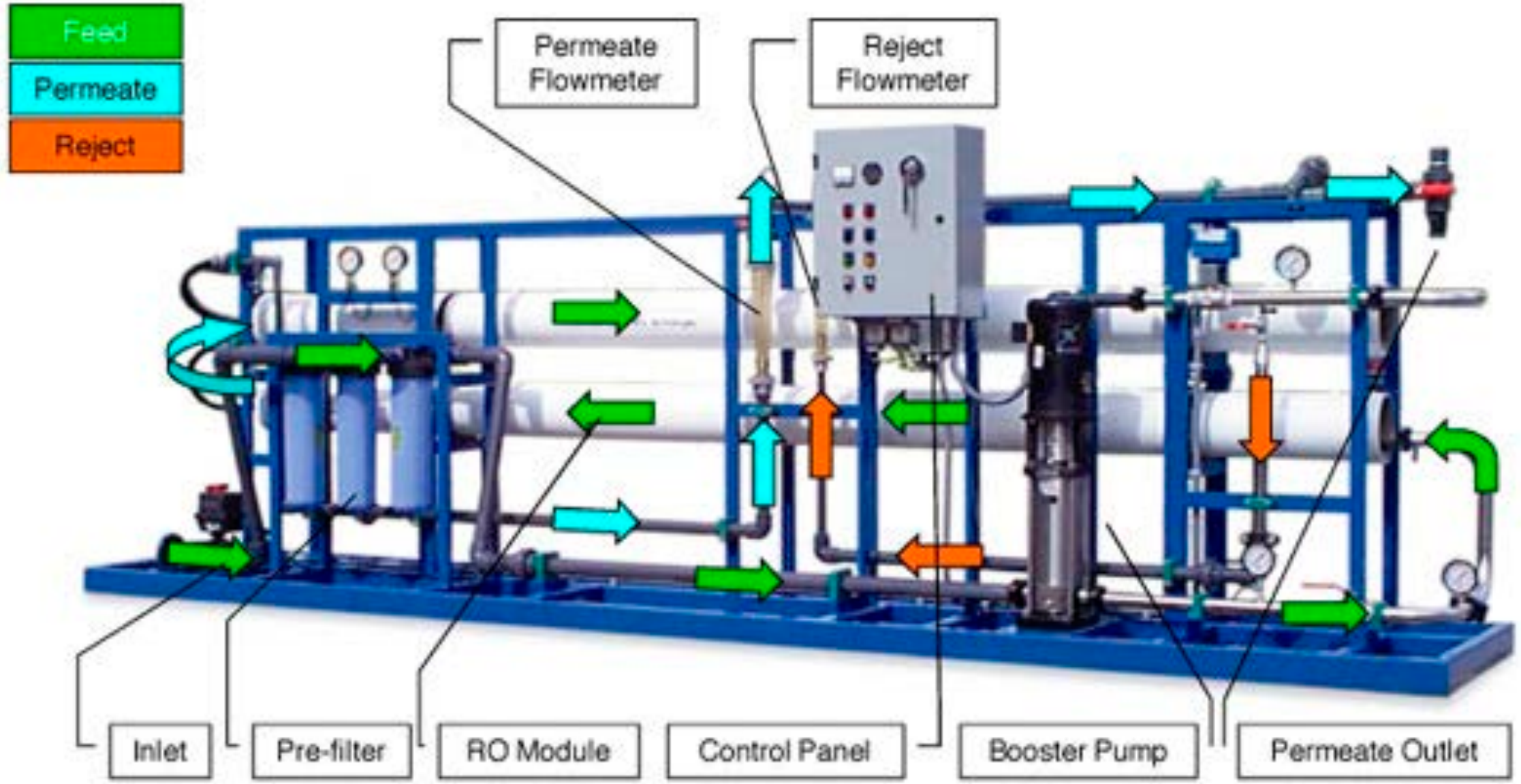
And RO parameters




You can find outfall
meter opportunities

#7

Daily rounds for obvious things with accountability

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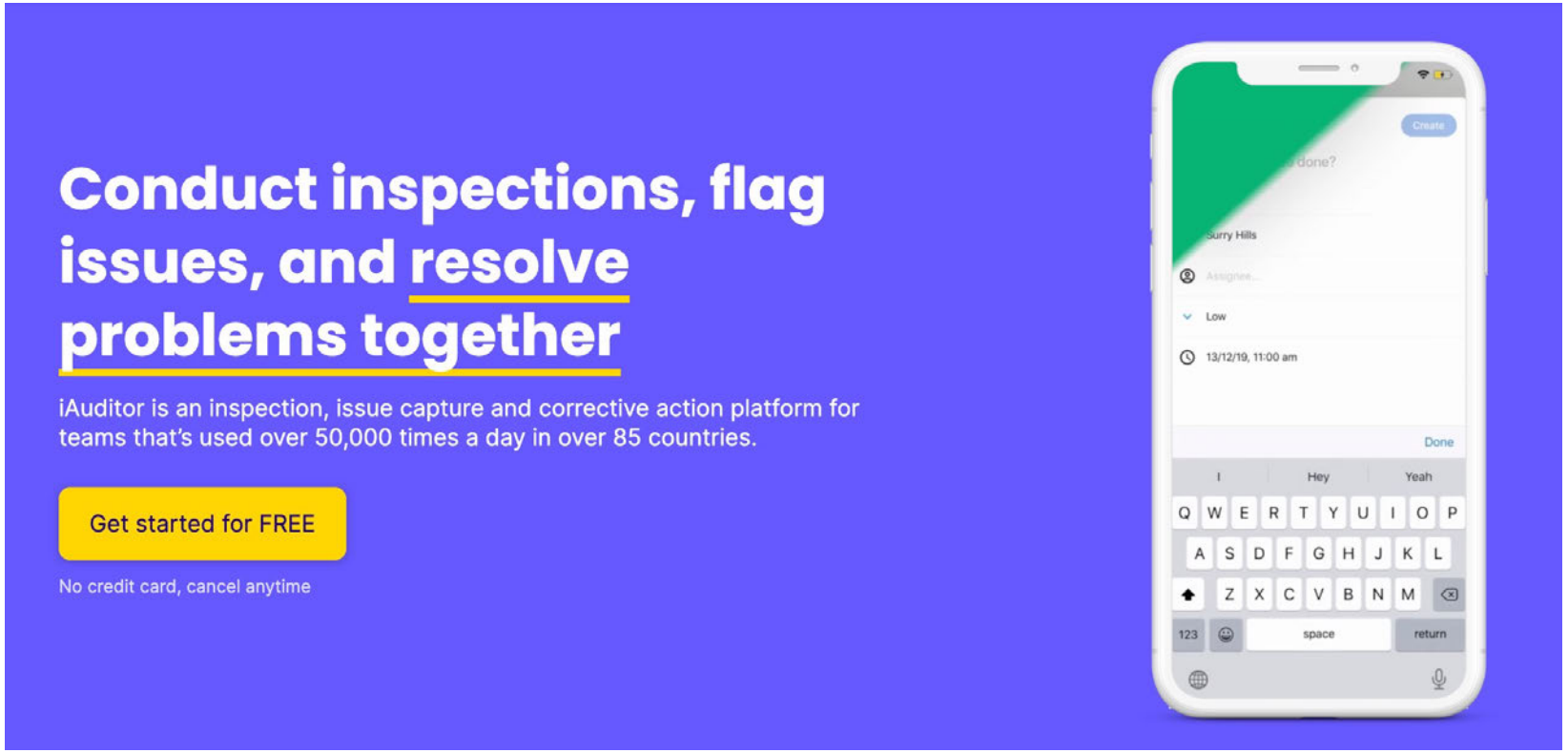
IAuditor, digitize any audit, capture reporting, analyze the results.



www.safetyculture.com

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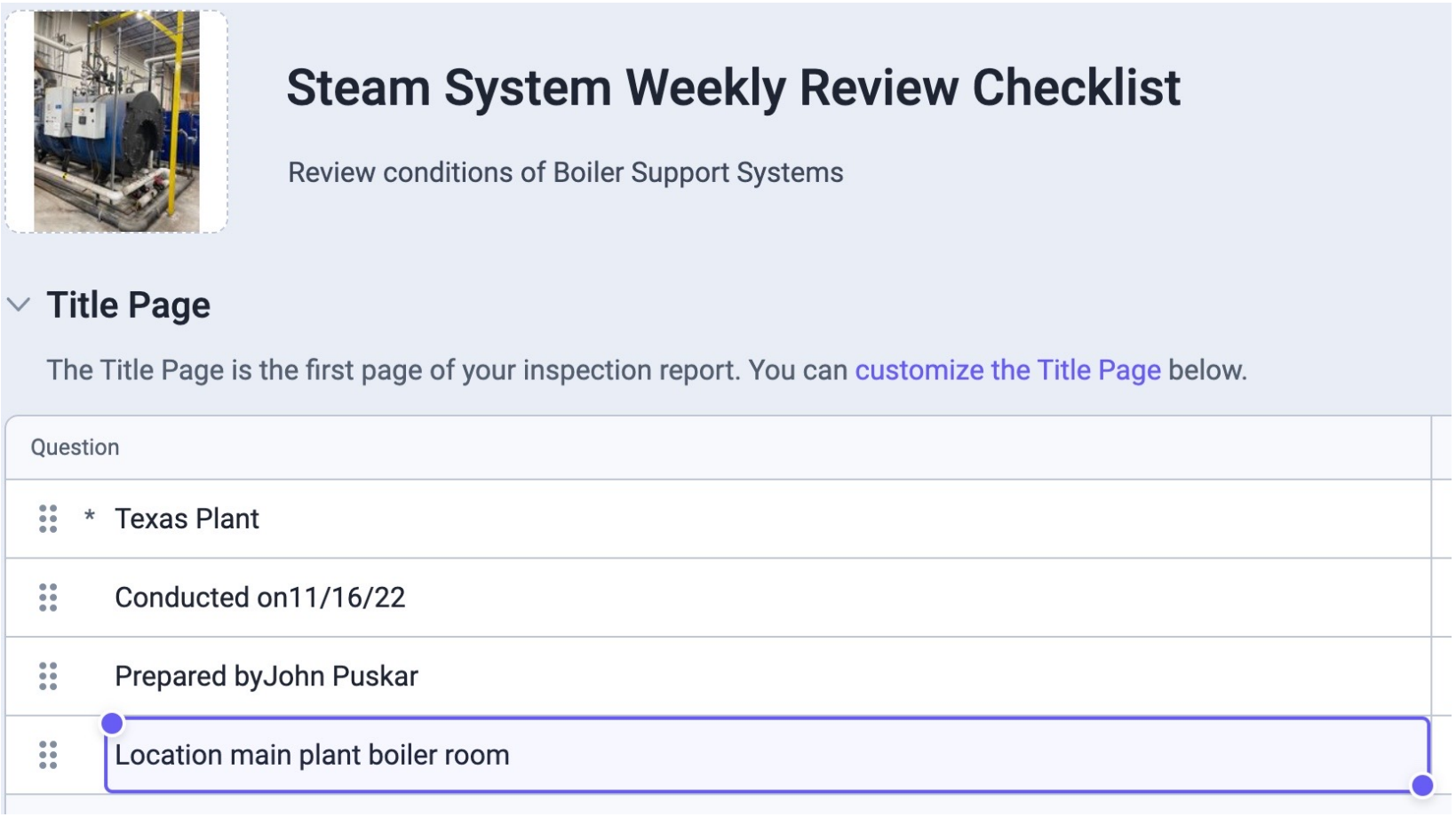
Automation of checklists, procedures, energy audits for multiple locations! – FIXING PEOPLE!

Imagine you run a school system, a university, a group of hotels or fast-food restaurants, or similar plant sites – here ya go!.

I am developing automated boiler logs with Algo's

No capital dollars - $20 a month

Great possibilities!



Steam System Weekly Review Checklist

Review conditions of Boiler Support Systems

Title Page

The Title Page is the first page of your inspection report. You can customize the Title Page below.

Question
* Texas Plant
Conducted on11/16/22
Prepared byJohn Puskar
Location main plant boiler room

Review of CV Station Pressure Control Equipment

This is where you add your inspection questions and how you want them answered. E.g. “Is the floor clean?”

Question	Type of response
Review relief valve discharge lines at CV1, is there an active discharge or leak?	Yes No N/A
Are there any steam leaks at CV1?	Yes No N/A
If answer is Yes then Notify × + trigger	
Are steam traps failed at CV1 pressure control station?	Yes No N/A
Review relief valve discharge lines at CV2, is there an active discharge or leak?	Yes No N/A
Are there any steam leaks at CV2?	Yes No N/A

No file chosen

Score

Review of CV Station Pressure Control Equipment

0 / 9 (0%)

Review relief valve discharge lines at CV1, is there an active discharge or leak?

Yes | No | N/A

Add note... Attach media Create action

Are there any steam leaks at CV1?

Yes | No | N/A

Add note... Attach media Create action

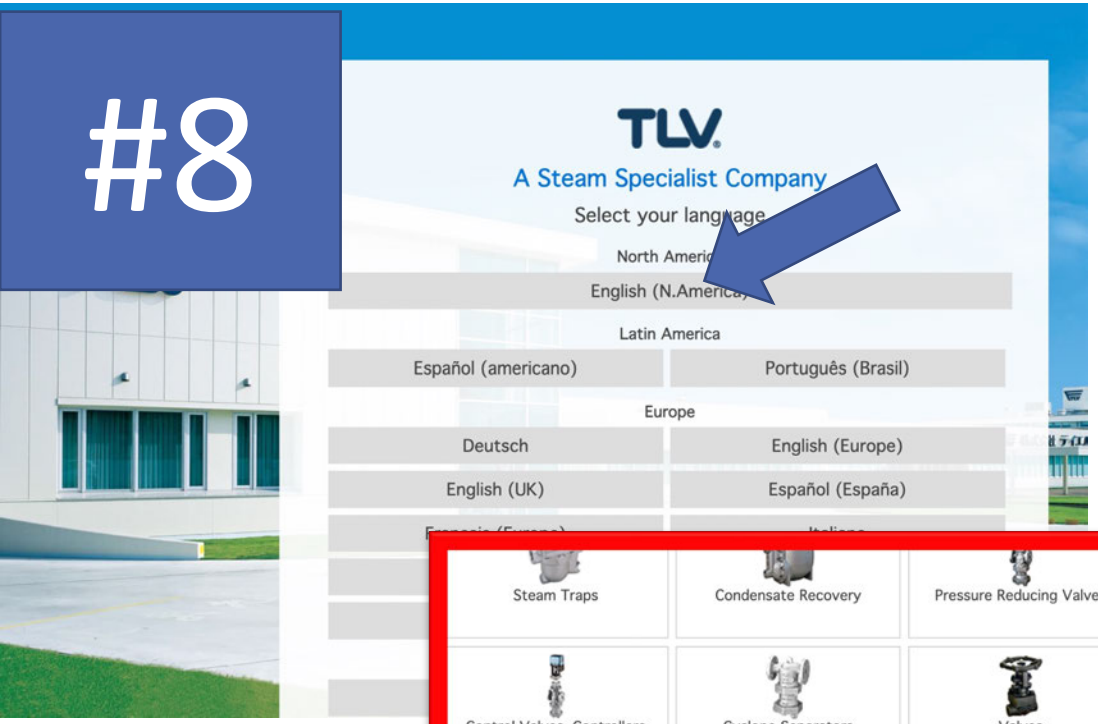
Are steam traps failed at CV1 pressure control station?

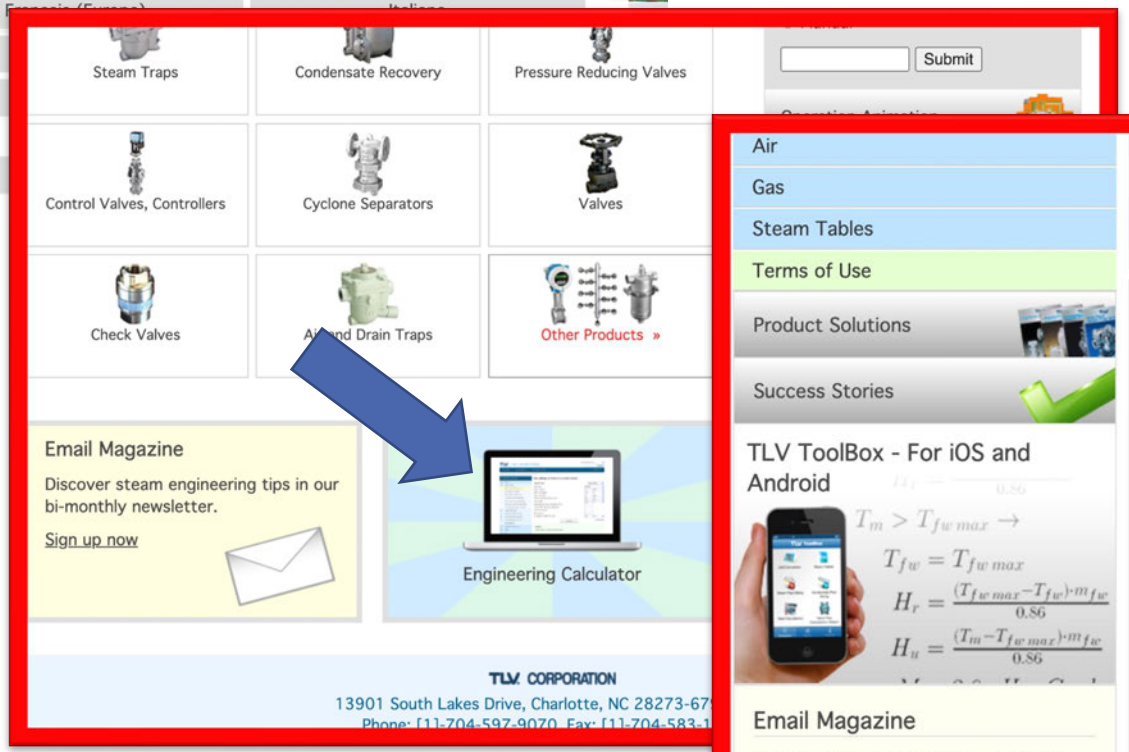
Yes | No | N/A

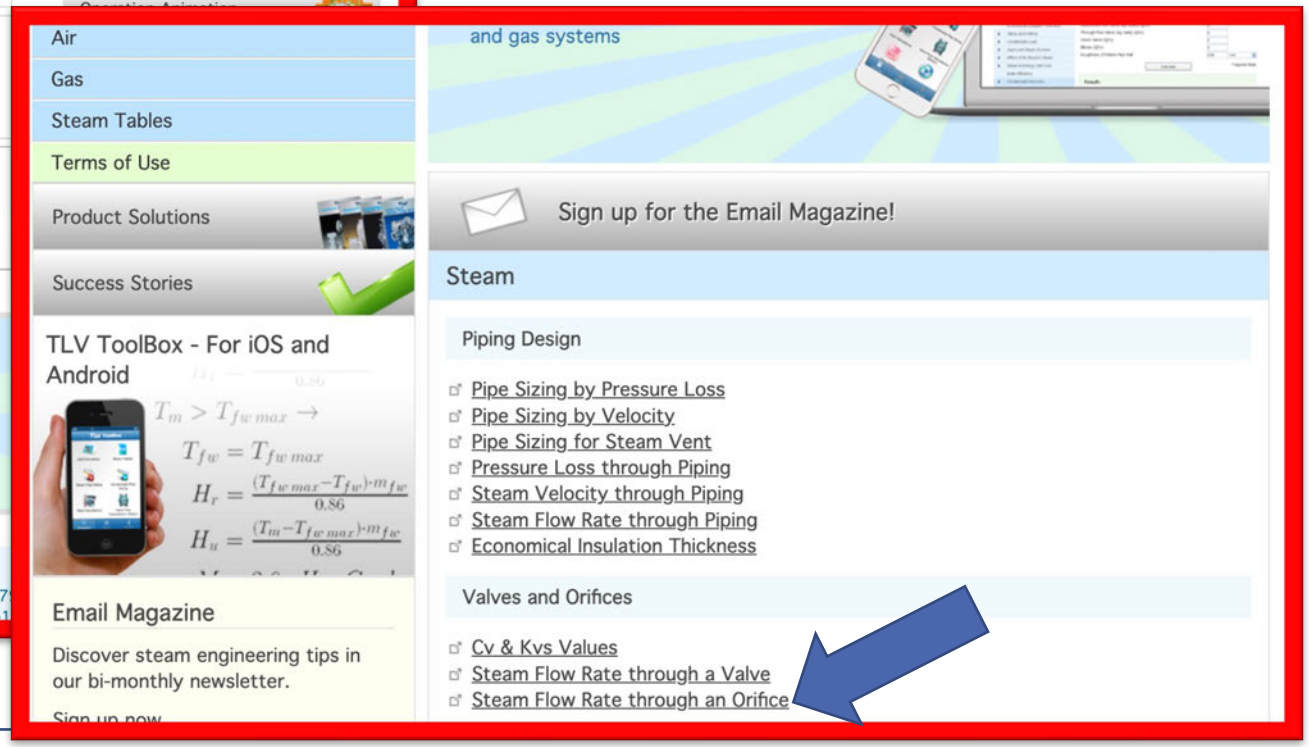
Add note... Attach media Create action

#8

TLV, website, more than 50 calculations, steam tables, easy







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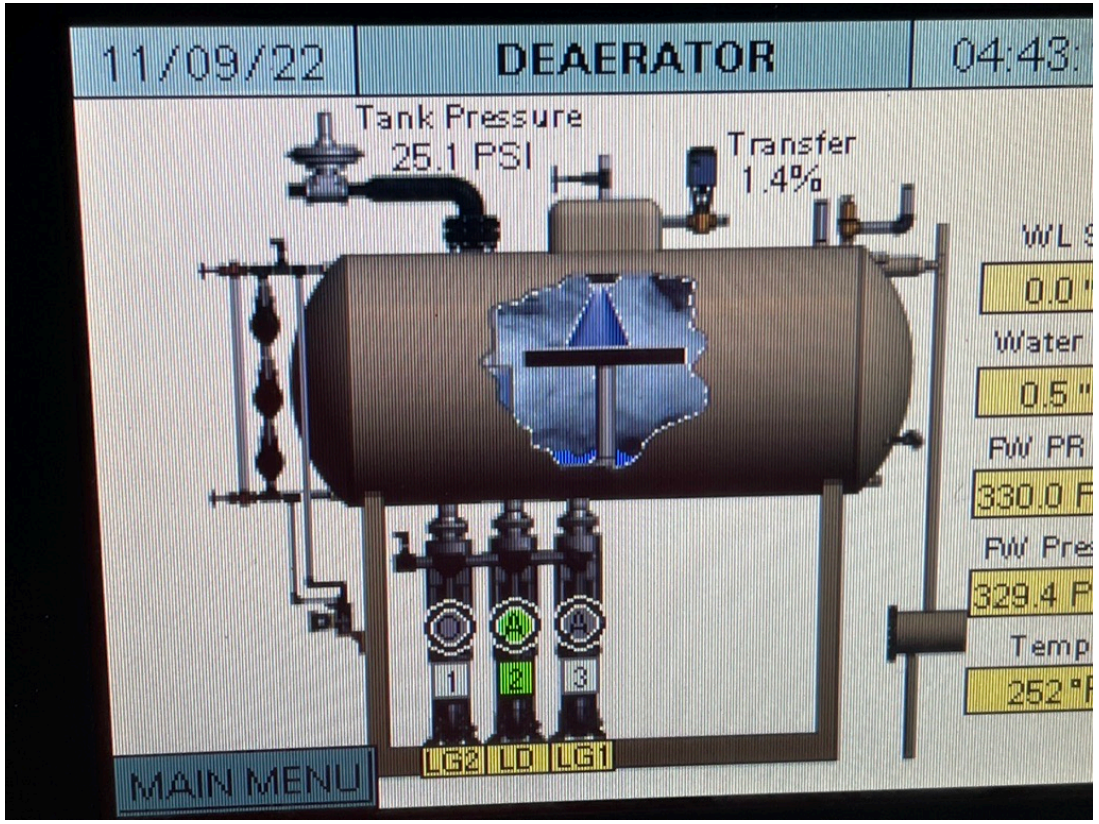
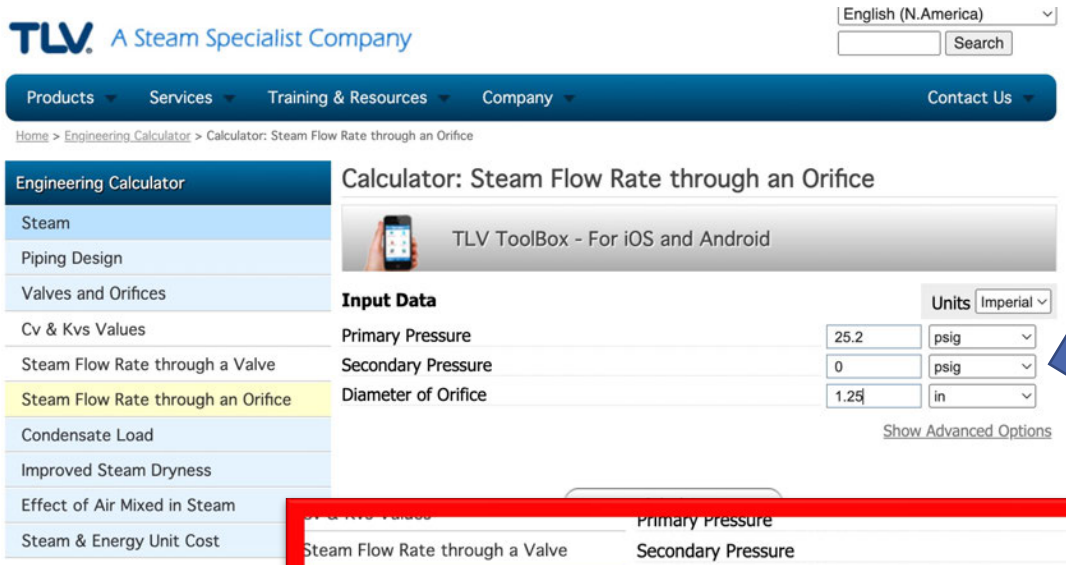
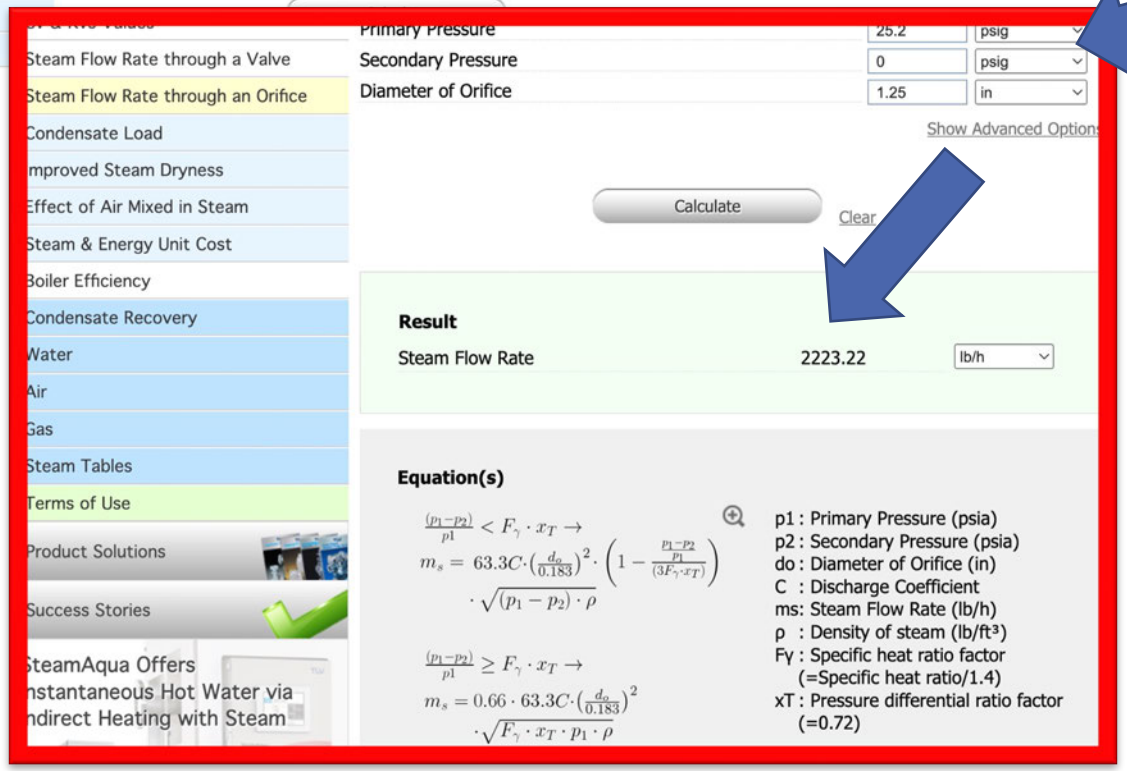
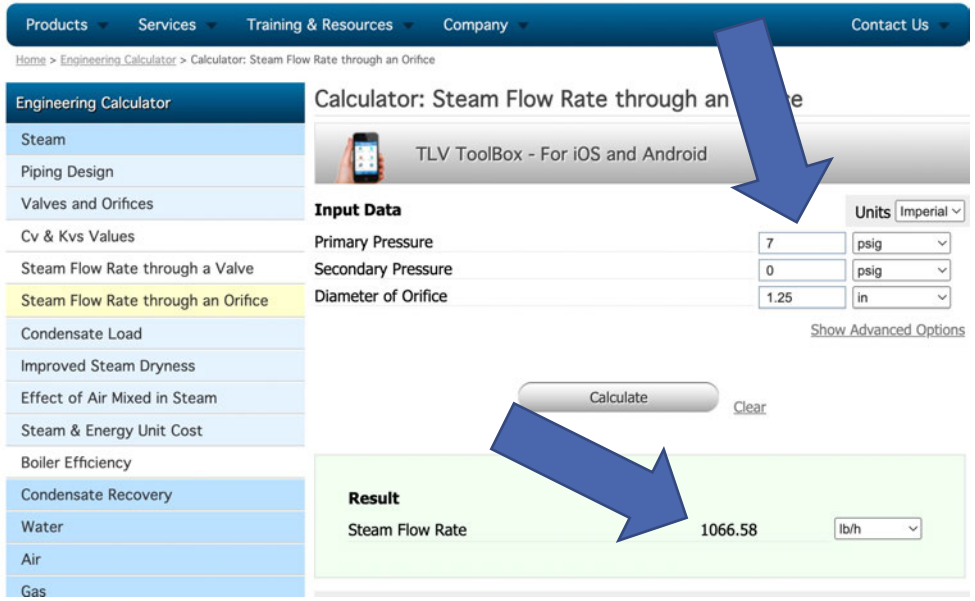
Deaerator operating conditions are horrible! Should be 6 to 8 psig



Supposed to be 18-24″ vent, kind of lazy







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Savings Calculations

2223 – 1066 = 1,157lbs/hour or about 1,157,000 BTU's/hour

1.157/.825 combustion eff. = 1.4MMBTU/hr. Nat. gas input

1.4MMBTU/hr. X $8/MMBTU X 8,500 hours = $95,200, or $100k with water/chemicals

What could this be worth?

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#9

Evaluating turbine and boiler operations and best practices.

Steam System Modeler Tool (SSMT)

Questions? AMOeCenterHelpDesk@ppc.com

EERE » Advanced Manufacturing Office » Steam Calculators » Steam System Modeler

Printable Version SHARE

Main
- About
- Preferences
- Glossary
- Resources
- Tutorials

Properties Calculators:
- Saturated Properties
- Steam Properties

Equipment Calculators:
- Boiler
- Heat Loss
- Flash Tank
- PRV w/ Desuperheating
- Header
- Deaerator

Steam Modeler

Overview | *Create Base Model* | *Reload Model*

Using the Steam System Modeler

watch tutorial | view guide

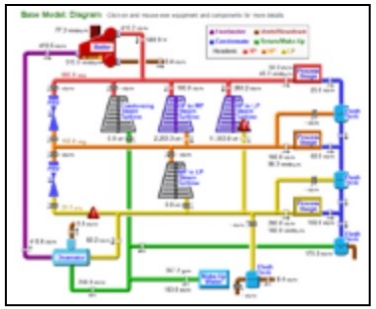
Step 1: Generate a Base Model
There are 3 ways to generate a Base Model:

- Manually enter specific steam system details [link]
- Load an example [below]
- Reload a previously downloaded model [link]

Step 2: Generate an Adjusted Model
A series of projects and system adjustments may be selected and combined with the Base Model to generate an Adjusted Model.

Step 3: Compare Base Model to Adjusted Model
A summary of Base Model vs Adjusted Model metrics will be generated once both a Base Model and Adjusted Model have been created.

A generated model may also be downloaded as an excel file and re-uploaded later.



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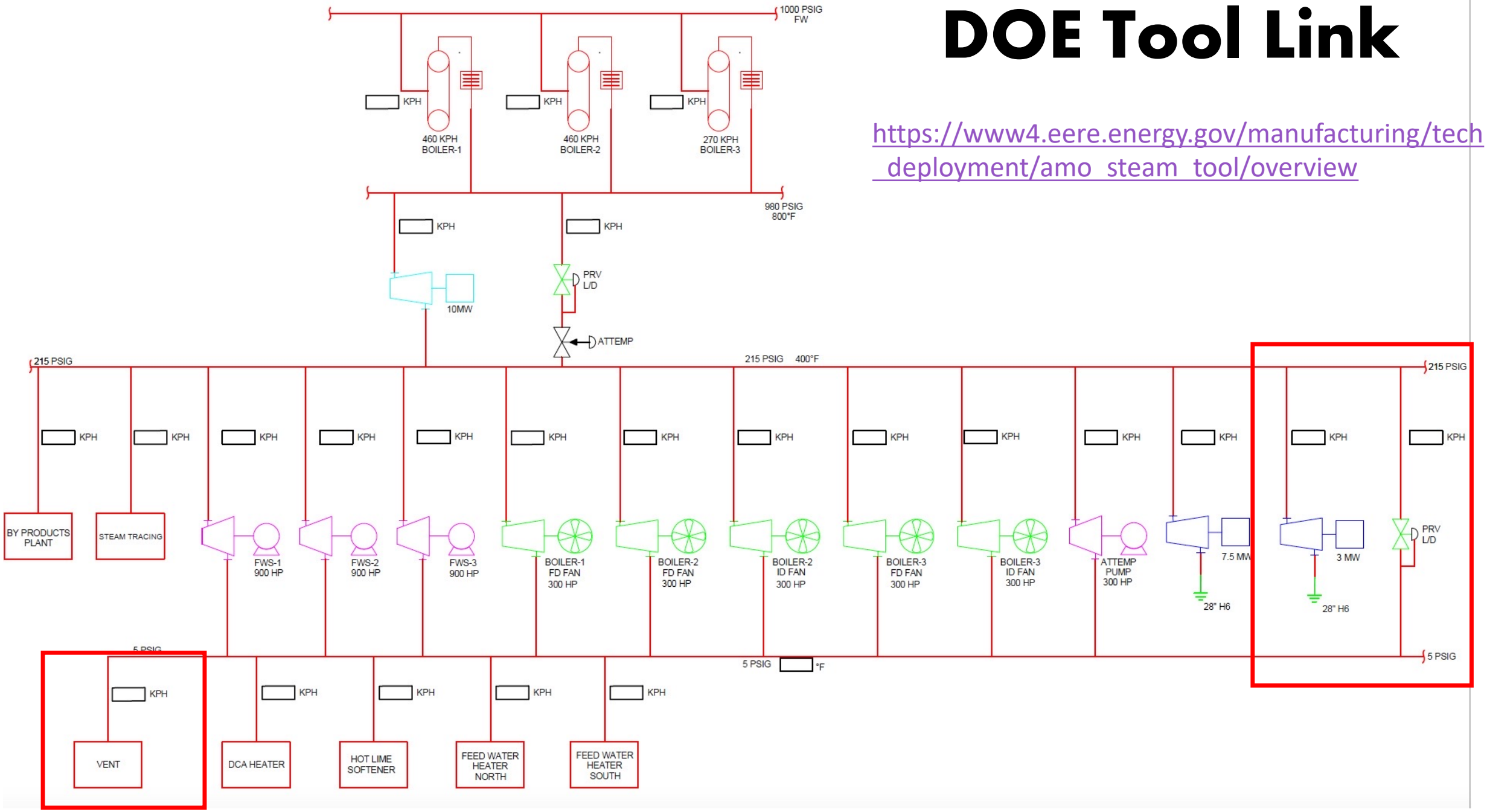
DOE Tool Link

https://www4.eere.energy.gov/manufacturing/tech_deployment/amo_steam_tool/overview



Great stuff here!

EERE » Advanced Manufacturing Office » Steam Calculators » Steam System Modeler

Printable Version

Main

- About
- Preferences
- Glossary
- Resources
- Tutorials

Properties Calculators:

- Saturated Properties
- Steam Properties

Equipment Calculators:

- Boiler
- Heat Loss
- Flash Tank
- PRV w/ Desuperheating
- Header
- Deaerator
- Steam Turbine
- **Steam System Modeler**

Steam Modeler

Overview | *Create Base Model* | *Reload Model*

Using the Steam System Modeler

watch tutorial | view guide

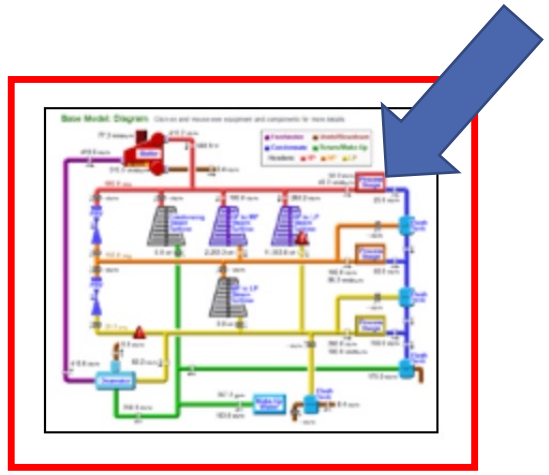
Step 1: Generate a Base Model
There are 3 ways to generate a Base Model:

- Manually enter specific steam system details [link]
- Load an example [below]
- Reload a previously downloaded model [link]

Step 2: Generate an Adjusted Model
A series of projects and system adjustments may be selected and combined with the Base Model to generate an Adjusted Model.

Step 3: Compare Base Model to Adjusted Model
A summary of Base Model vs Adjusted Model metrics will be generated once both a Base Model and Adjusted Model have been created.

A generated model may also be downloaded as an excel file and re-uploaded later.



Steam Modeler Examples

Click on any of the links below to load the example into the steam modeler:

Comparing electric motor on and 3MW CT, or 215/5 turbine and vent 5 psig steam

Steam Turbine Calculator

watch tutorial | view guide

Calculates the energy generated or steam outlet conditions for a steam turbine.

Use elec. motor for 600 HP load,

215/-13.5 10 Mlbs/hr. cond. turbine

Temperature	510.0 °F	Sp. Entropy	1.612 btu/lbm/R
Phase	Gas	Energy Flow	12.7 MMBtu/hr

Isentropic Efficiency	78.0 %
Energy Out	2.8 MMBtu/hr
Generator Efficiency	98.0 %
Power Out	811.3 kW

Turbine Properties		
Selected Turbine Property	Mass Flow	
Mass Flow *	10	klb/hr
Isentropic Efficiency *	78	%
Generator Efficiency *	98	%
Outlet Steam		
Pressure*	-13.5	psig
* Required	Enter [reset]	

Examples: Mouse Over

Outlet Steam			
Pressure	-13.5 psig	Mass Flow	10.0 klb/hr
Temperature	107.8 °F	Sp. Enthalpy	989.0 btu/lbm
Saturated	0.88	Sp. Entropy	1.753 btu/lbm/R
		Energy Flow	9.9 MMBtu/hr

Steam Turbine Calculator

watch tutorial | view guide

Calculates the energy generated or steam outlet conditions for a steam turbine.

Use turbine for 600 HP load, 215/5

10 Mlbs/hr. – vent 10mlbs/hr. 5 psig

Phase	Gas	Energy Flow	12.7 MMBtu/hr

Energy Out	MMBtu/hr
Power Out	444.7 kW

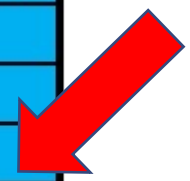
Turbine Properties		
Selected Turbine Property	Mass Flow	
Mass Flow *	10	klb/hr
Isentropic Efficiency *	78	%
Generator Efficiency *	98	%
Outlet Steam		
Pressure*	5	psig
* Required	Enter [reset]	

Examples: Mouse Over

Outlet Steam			
Pressure	5.0 psig	Mass Flow	10.0 klb/hr
Temperature	227.1 °F	Sp. Enthalpy	1,116.6 btu/lbm
Saturated	0.96	Sp. Entropy	1.676 btu/lbm/R
		Energy Flow	11.2 MMBtu/hr

Change the operating philosophy for $3-400k/yr

Gen Eff = 95%		Isentropic Eff = 70%				
CALENDAR YEAR 2022						
	Steam Bleed (lbs/hr)	Excess Steam Vented (per hr)	Avg. Daily Pot. Power (KW/hr)	Pot. MW lost	Pot. Revenue (@ $75/MW)	
Jan	7,453	2,250	160.8	119.64	$ 8,972.64	
Feb	5,203	0	0	0.00	$ -	Best Practice
Mar	9,375	4,172	298.2	221.86	$ 16,639.56	
Apr	16,889	11,686	835.4	601.49	$ 45,111.60	
May	22,488	17,285	1235.7	919.36	$ 68,952.06	
Jun	19,225	14,022	1002.4	721.73	$ 54,129.60	
Jul	13,594	8,391	599.9	446.33	$ 33,474.42	
Aug	14,781	9,578	684.7	509.42	$ 38,206.26	
Sep	14,161	8,958	640.4	461.09	$ 34,581.60	
Oct						
Nov						
Dec						
Total	123,169	76,342	5,458	4,001	$ 300,067.74	



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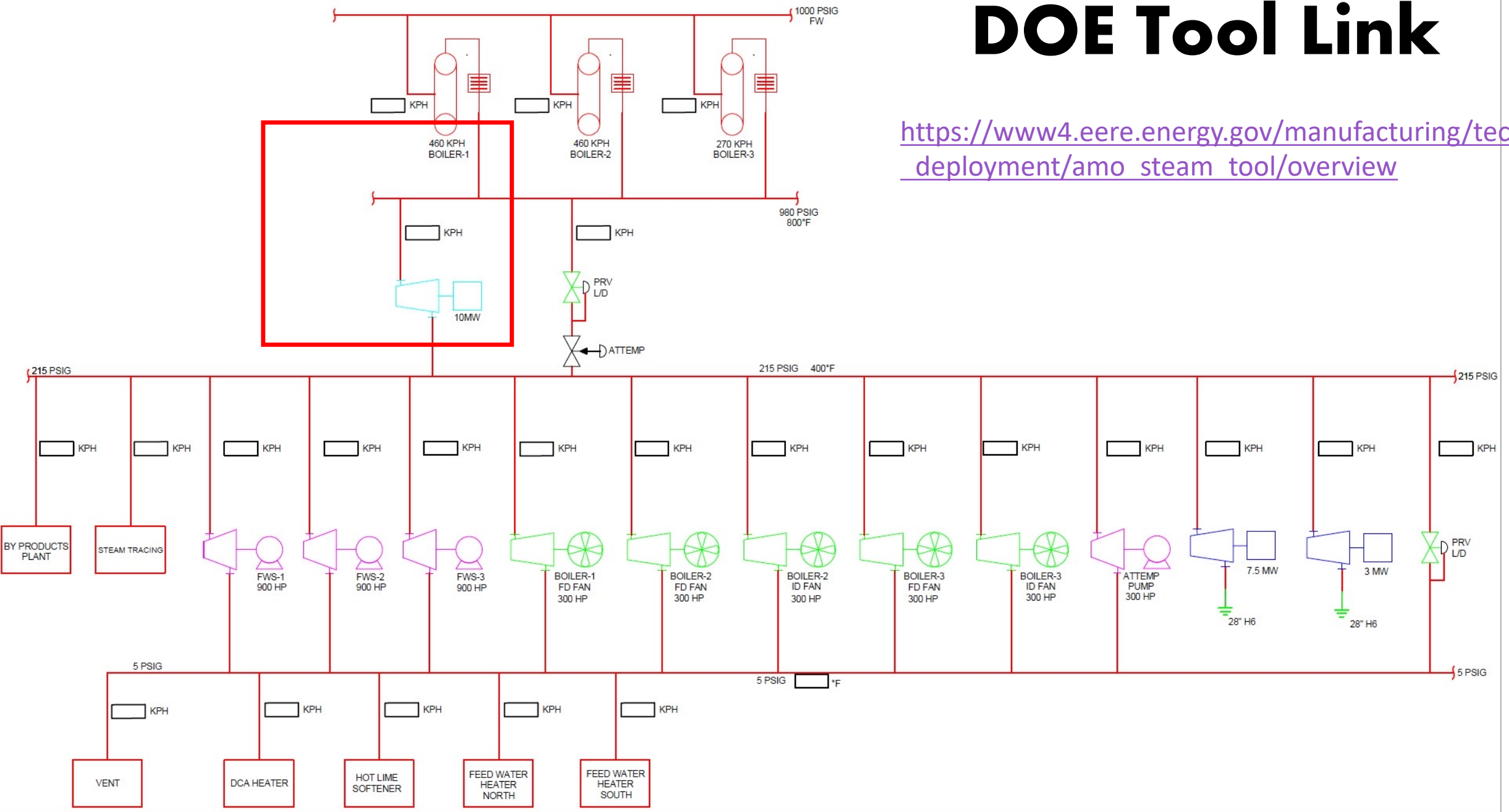

How come the heat rate changes so much?

In comparison to Feb 2022

CALENDAR YEAR OF 2021								Money Potential (per month) (@ $75.00/MW)
	Steam Generated (M lbs / hr)				MW from 10 Meg Gen	M lbs of Steam to make 1 MW	Pot. MW	
	Boiler #1	Boiler #2	Boiler #3	Total Generated				
Jan	106,260.75	101,379.03	2,481.18	210,120.97	6.2957	33,375.32	0.1940	$ 10,824.11
Feb	33,148.81	66,736.61	146,595.24	246,480.65	7.8006	31,597.67	0.1304	$ 6,571.47
Mar	616.94	829.30	200,550.00	201,996.24	6.7755	29,812.58	0.0665	$ 3,712.13
Apr	13,730.56	295.83	189,381.94	203,408.33	6.3125	32,223.10	0.1528	$ 8,249.07
May	59,279.57	1,301.08	130,489.25	191,069.89	6.0659	31,499.22	0.1269	$ 7,079.03
Jun	17,034.72	2,497.22	170,236.11	189,768.06	6.1035	31,091.52	0.1123	$ 6,063.07
Jul	166,907.26	27,745.97	4,407.26	199,060.48	5.9341	33,544.96	0.2000	$ 11,162.75
Aug	6,854.84	3,825.27	194,977.15	205,657.26	6.7325	30,546.82	0.0928	$ 5,177.82
Sep	-	-	195,244.44	195,244.44	6.4986	30,044.03	0.0748	$ 4,039.50
Oct	-	-	192,055.00	192,055.00	6.3642	30,177.17	0.0796	$ 4,439.94
Nov	429.17	-	204,579.17	205,008.33	7.2611	28,233.74	0.0100	$ 542.37
Dec	247.31	135.75	205,461.02	205,844.09	7.0551	29,176.61	0.0438	$ 2,442.60
Total								$ 70,303.87

Turbine seals, attemperator, letdown station

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#10 Managing boiler water chemistry Emerson BD software

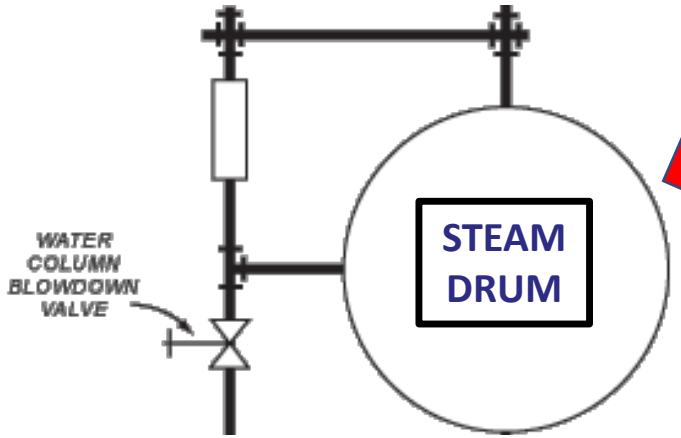
Utilities Plant - Steam Boilers

Test	Hurst Boiler 1	Hurst Boiler 2	DA	Softener
Controller Conductivity (Micromhos)	168 2000 max	1997 2000 max		

Test	Aquafeed 1410	KOH	K-BAC 1020	RO	RO - 1st Array	RO - 2nd Array	RO - 3rd Array
Conductivity (Micromhos)				23.1 200 max	19.8 200 max	6.5 200 max	16 200 max

How TDS, total dissolved solids get controlled
BLOWDOWN, surface and bottom

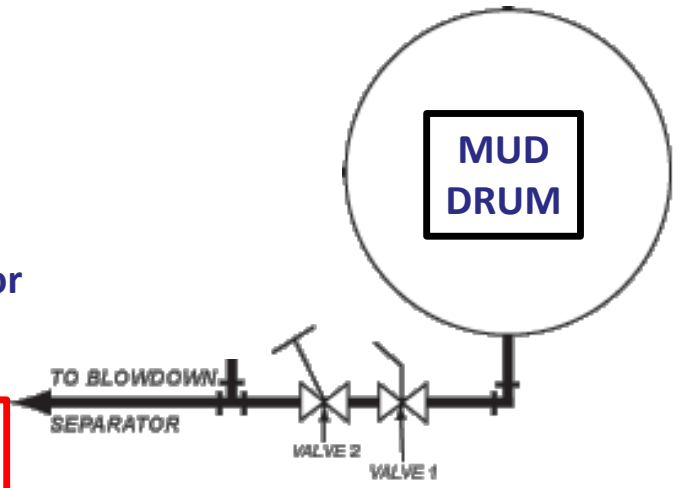
Blowdowns are hot saturated water



New Boiler Feed with Small amounts of Ca + Mg

SURFACE BLOWDOWN
Somewhat concentrated
Waters, continuously flushed out

Combined flow to
Blowdown separator or flash tank or
Heat recovery system



BOTTOM BLOWDOWN
Very concentrated
Waters, periodically flushed out

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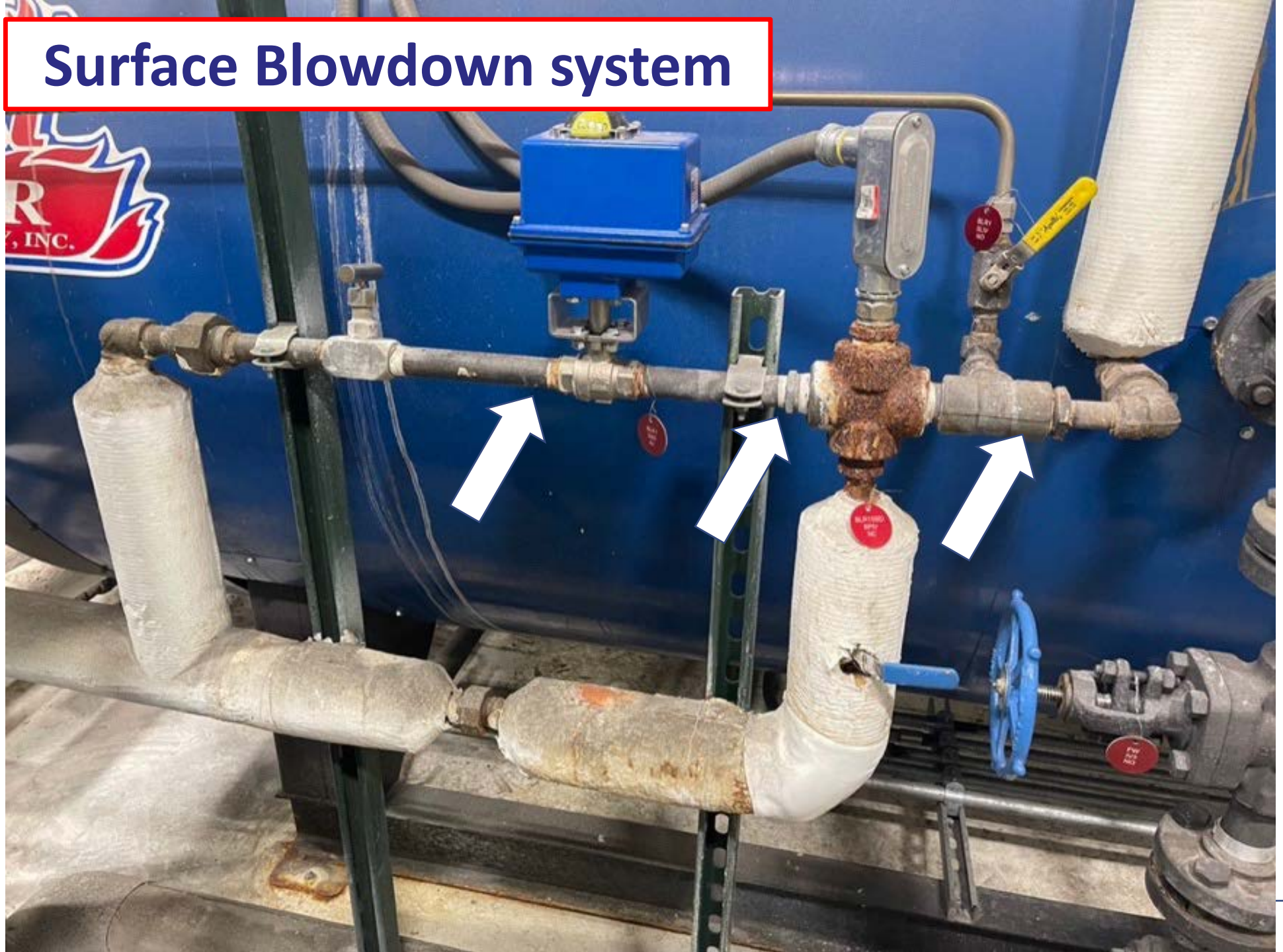
Surface Blowdown system



PRESCIENT
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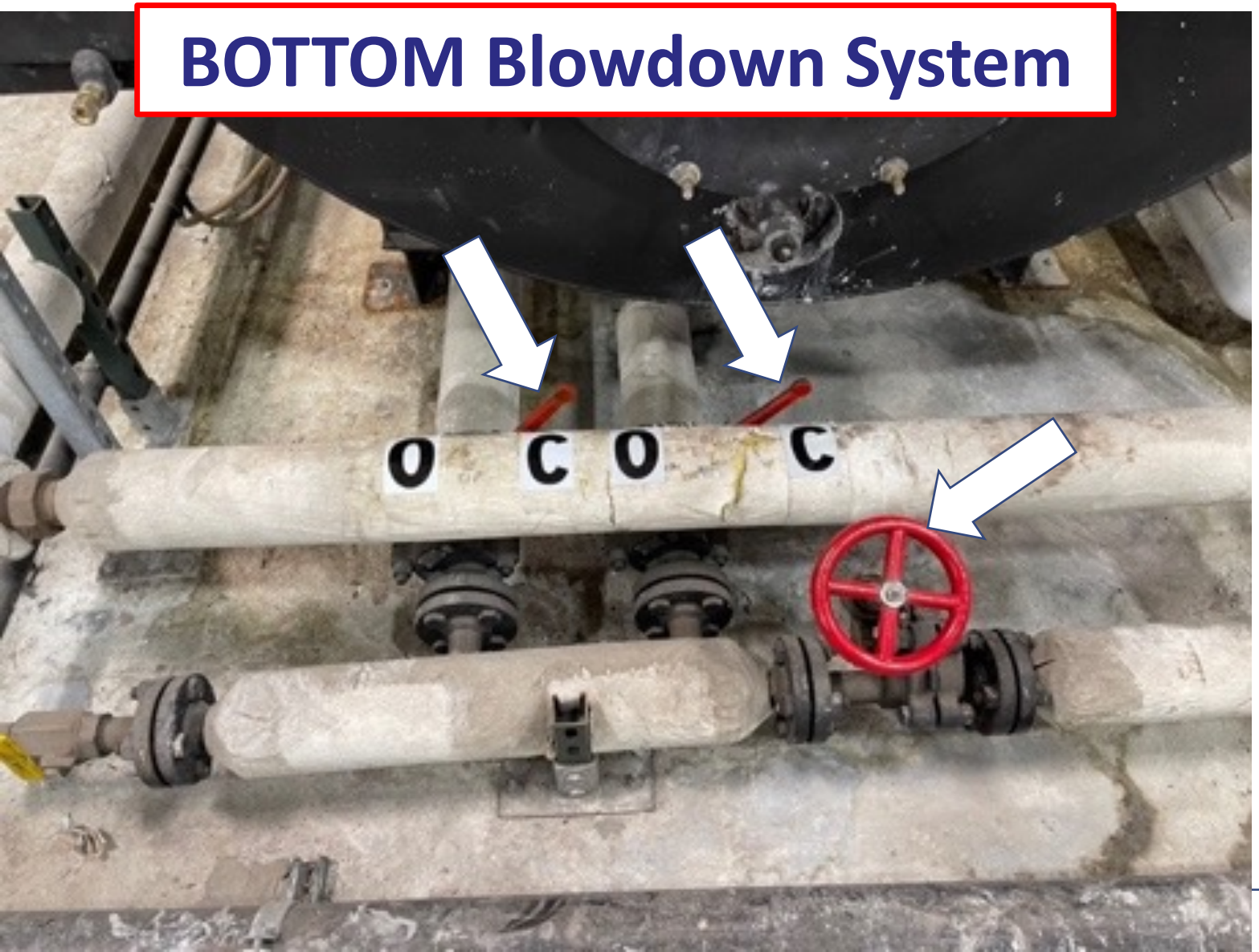
Conductivity Probes

PRESCIENT TECHNICAL SERVICES

BOTTOM Blowdown System



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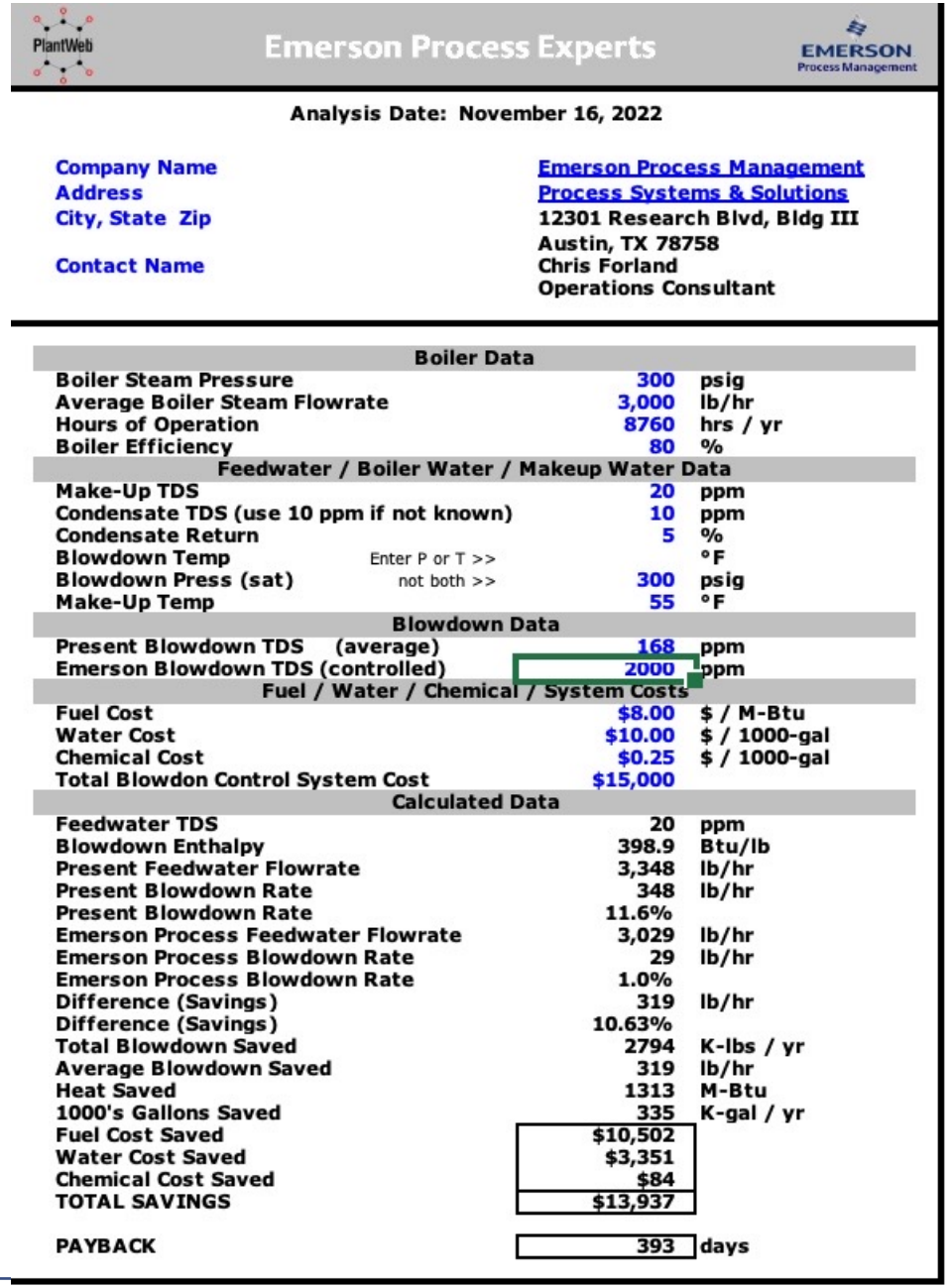
Doing the BEFORE & AFTER Scenario's



PlantWeb — Emerson Process Experts — EMERSON Process Management

Analysis Date: November 16, 2022

Company Name	Emerson Process Management
Address	Process Systems & Solutions
City, State Zip	12301 Research Blvd, Bldg III Austin, TX 78758
Contact Name	Chris Forland Operations Consultant

Boiler Data			
Boiler Steam Pressure		300	psig
Average Boiler Steam Flowrate		3,000	lb/hr
Hours of Operation		8760	hrs / yr
Boiler Efficiency		80	%
Feedwater / Boiler Water / Makeup Water Data			
Make-Up TDS		20	ppm
Condensate TDS (use 10 ppm if not known)		10	ppm
Condensate Return		5	%
Blowdown Temp	Enter P or T >>		°F
Blowdown Press (sat)	not both >>	300	psig
Make-Up Temp		55	°F
Blowdown Data			
Present Blowdown TDS (average)		168	ppm
Emerson Blowdown TDS (controlled)		2000	ppm
Fuel / Water / Chemical / System Costs			
Fuel Cost		$8.00	$ / M-Btu
Water Cost		$10.00	$ / 1000-gal
Chemical Cost		$0.25	$ / 1000-gal
Total Blowdon Control System Cost		$15,000	
Calculated Data			
Feedwater TDS		20	ppm
Blowdown Enthalpy		398.9	Btu/lb
Present Feedwater Flowrate		3,348	lb/hr
Present Blowdown Rate		348	lb/hr
Present Blowdown Rate		11.6%	
Emerson Process Feedwater Flowrate		3,029	lb/hr
Emerson Process Blowdown Rate		29	lb/hr
Emerson Process Blowdown Rate		1.0%	
Difference (Savings)		319	lb/hr
Difference (Savings)		10.63%	
Total Blowdown Saved		2794	K-lbs / yr
Average Blowdown Saved		319	lb/hr
Heat Saved		1313	M-Btu
1000's Gallons Saved		335	K-gal / yr
Fuel Cost Saved		$10,502	
Water Cost Saved		$3,351	
Chemical Cost Saved		$84	
TOTAL SAVINGS		$13,937	
PAYBACK		393	days

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The maximum recommended concentration limits according to the American Boiler Manufacturers Association (ABMA) is listed in the table below.

ABMA Recommended Feedwater Chemistry Limits

Boiler Operating Pressure (psig)	Total Dissolved Solids (ppm)	Total Alkalinity (ppm)	Total Suspended Solids (ppm)
0 - 50	2,500	500	
51 - 300	3,500	700	15
301 - 450	3,000	600	10
451 - 600	2,500	500	8
601 - 750	1,000	200	3
751 - 900	750	150	2
901 – 1,000	625	125	1

The American Society of Mechanical Engineers (ASME) has developed a best operating practices manual for boiler blowdown. The recommended practices are described in Sections VI and VII of the ASME Boiler and Pressure Vessel Code. You can identify energy-saving opportunities by comparing your blowdown and makeup water treatment practices with the ASME practices. The ASME Boiler and Pressure

Questions?

give me a call
216-213-6201

email me:

JPuskar@PrescientTS.com