

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





**CEC Combustion
Safety**

ECLIPSE®
Innovative Thermal Solutions

CEC Combustion Safety becomes a part of Eclipse.

John Puskar and the team at CEC Combustion Safety will continue their mission to ensure the safety of your staff and work environment while maximizing your fuel systems and combustion equipment.

It is

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

Eclipse the
to further extend
focus 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.

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!



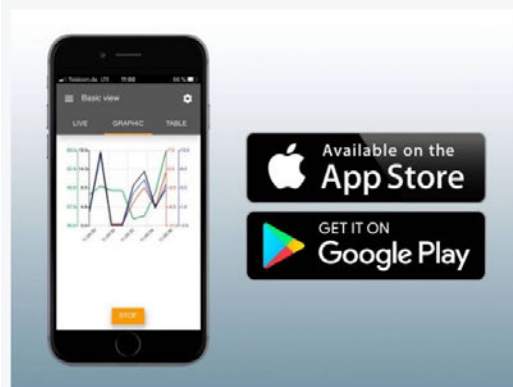
- 1. Testo Smart Probes**
- 2. Flir Ipad/phone Imagers**
- 3. Micro data loggers**
- 4. Smokeys**
- 5. Combustion Analyzers**
- 6. Ultrasonic flow meters**
- 7. IAuditor software platform**
- 8. TLV site, energy calculations**
- 9. DOE Steam Modeler site**
- 10. BD Modeler - measurement**

#1

The world of Smart Instruments!

Lots of data collection, .

Measuring with an App Has Many Advantages



- ✓ Wireless operation and reading of measuring values on your smartphone or tablet – from a distance of up to 100 metres
- ✓ Changes in measured values quickly displayed – as a graph or table
- ✓ Stored measurement menus guide you through different applications.
- ✓ Customer data and measuring points can be stored and managed in the App.
- ✓ Measured data logs can be supplemented with images and sent immediately as PDF or Excel files, or transferred to data control PC software

[More information and download](#)

Yes, there's an app for that

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

We measure it. **testo**

Smart & Wireless

Hot-wire anemometer*

testo 405i

- Measures air velocity, volume flow, and temperature
- Measures in-duct air flow and automatically calculates volume flow (enter duct dimensions simply)
- Small dia. (<0.5") and 15" telescopic shaft length is ideal for in-duct flow averaging and timed traverse
- Perform air duct leakage tests
- Measurement data is transmitted to the convenient and powerful testo **Smart Probes App** in your smart device
- Tough, accurate, and easy-to-use
- For all HVAC/R technicians and contractors



The image shows the Testo 405i hot-wire anemometer, a long, thin device with a black handle and a silver probe. Next to it is a smartphone displaying the Testo Smart Probes App interface, which shows three data points: 252.6, 393, and 68.4. Below the phone are three circular icons labeled 'fpm', 'cfm', and '°F'. At the bottom right is a blue box with the Bluetooth logo and the text 'Bluetooth + App', 'testo Smart Probes App for free download', and logos for Google Play and the App Store.


We measure it. **testo**

Smart & Wireless

Vane anemometer*

testo 410i

- Measures air velocity, volume flow, and temperature
- No air density correction required due to design
- Measures air flow at registers and automatically calculates volume flow (enter duct dimensions simply)
- Measure volume flow at several outlets simultaneously (using multiple Smart Probes) to adjust system balance
- Timed/multipoint averaging to get accurate air flow profiles
- Measurement data is transmitted to the convenient and powerful testo **Smart Probes App** in your smart device
- Tough, accurate, and easy-to-use
- For all HVAC/R technicians and contractors



The image shows the Testo 410i vane anemometer, a device with a black handle and a silver vane probe. Next to it is a smartphone displaying the Testo Smart Probes App interface, which shows three data points: 93.6, 177, and 68.4. Below the phone are three circular icons labeled 'fpm', 'cfm', and '°F'. At the bottom right is a blue box with the Bluetooth logo and the text 'Bluetooth + App', 'testo Smart Probes App for free download', and logos for Google Play and the App Store.

Air Flow, Anemometers – Hot Wire or Vane

But How Do I? – Measure Small Pressures

We measure it. **testo**

Smart & Wireless

Differential pressure manometer*

testo 510i

Differential pressure (manometer) measures static pressure, air flow, and volume flow (with Pitot tube not incl.)

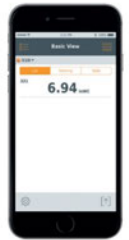

Measures manifold pressure and pressure drop across filters and coils

Measurement menu in App includes pressure drop alarms

Easy configuration and calculations for volume flow (enter pitot tube factor and dimensions easily)

Magnetic back holds instrument for hands-free operation

Measurement data is transmitted to the convenient and powerful **testo Smart Probes App** in your smart device



inWC

fpm

Bluetooth + App

testo Smart Probes App for free download


Google play

Available on the App Store

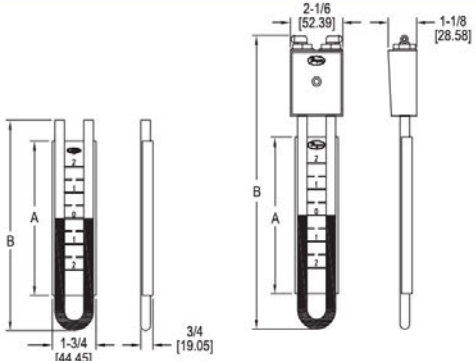
Dwyer

SERIES 1221/1222/1223

FLEX-TUBE® U-TUBE MANOMETERS



1221 1222 1223



Range		Hg Required to Fill		1221, 2 & 3 Scale Length "A"		1221 & 2 O.A. Length "B"		1223 O.A. Length "B"	
Inches H ₂ O	Millimeters H ₂ O	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 (500-0-500)	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.

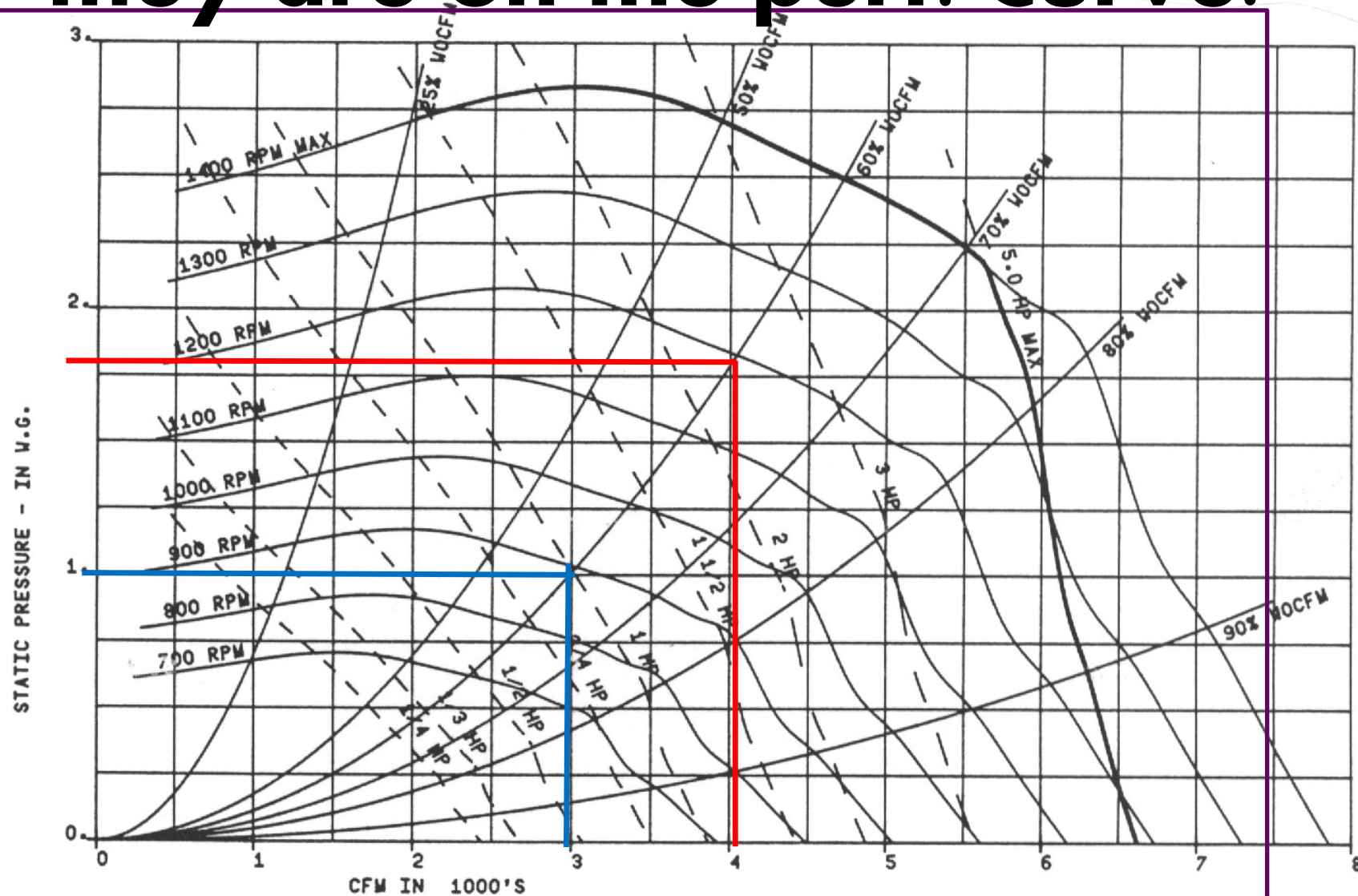
Series 1221 Flex-Tube® U-Tube Manometer
Our simplest, lowest cost basic U-gage. A dependable U-tube manometer that withstands hard use and provides accurate, high visibility readings. For use with water, mercury or red gage fluid. For mercury filled manometers, a scale clamp bar, Dwyer® Part No. A-363 (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.

FEATURES/BENEFITS

Manometers – Digital or U-Tube

#1

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



Fan Curves & Conditions

watch it and document it on the app.

Things you will find:

VFD opportunities

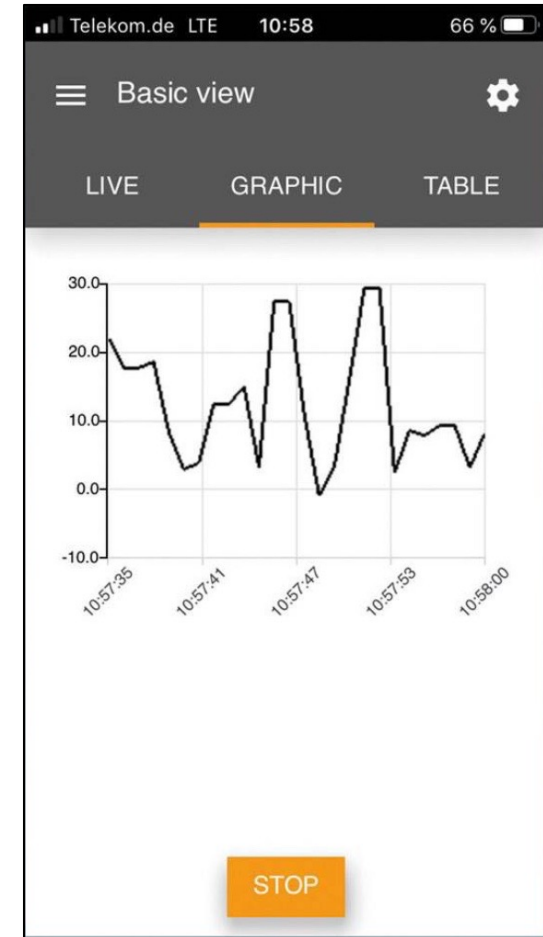
VFD's not set right

Motors oversized

Airflow way too high for the ventilation system needs

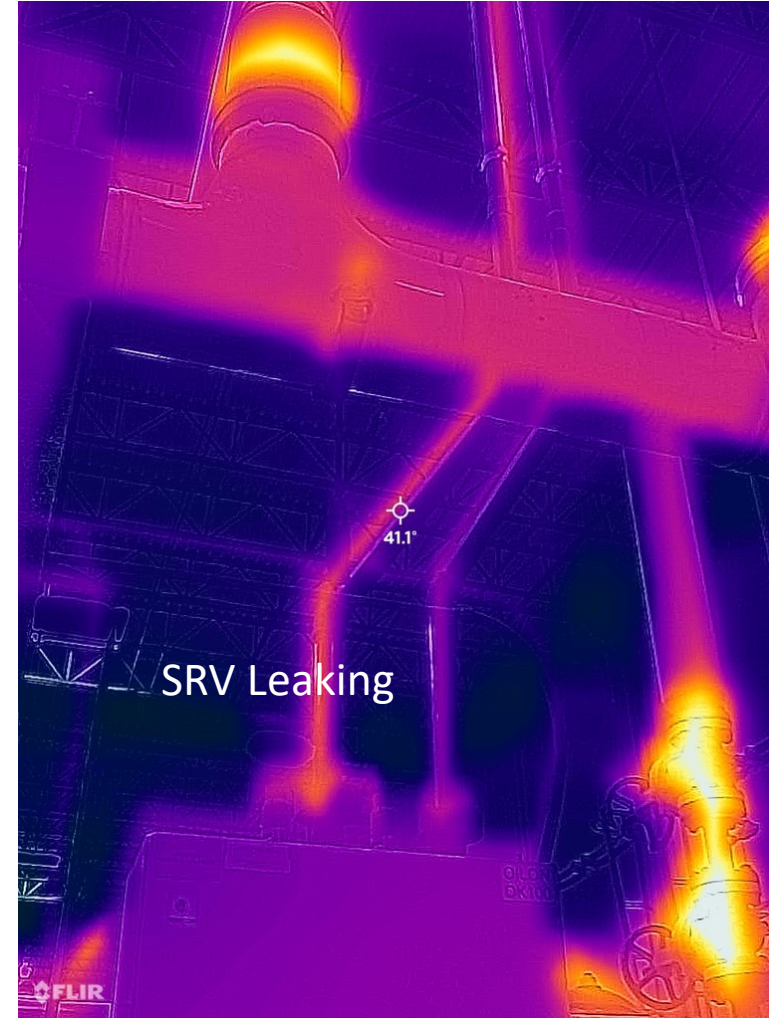
Air velocity required for ventilation system capture velocity not adequate

And more.....



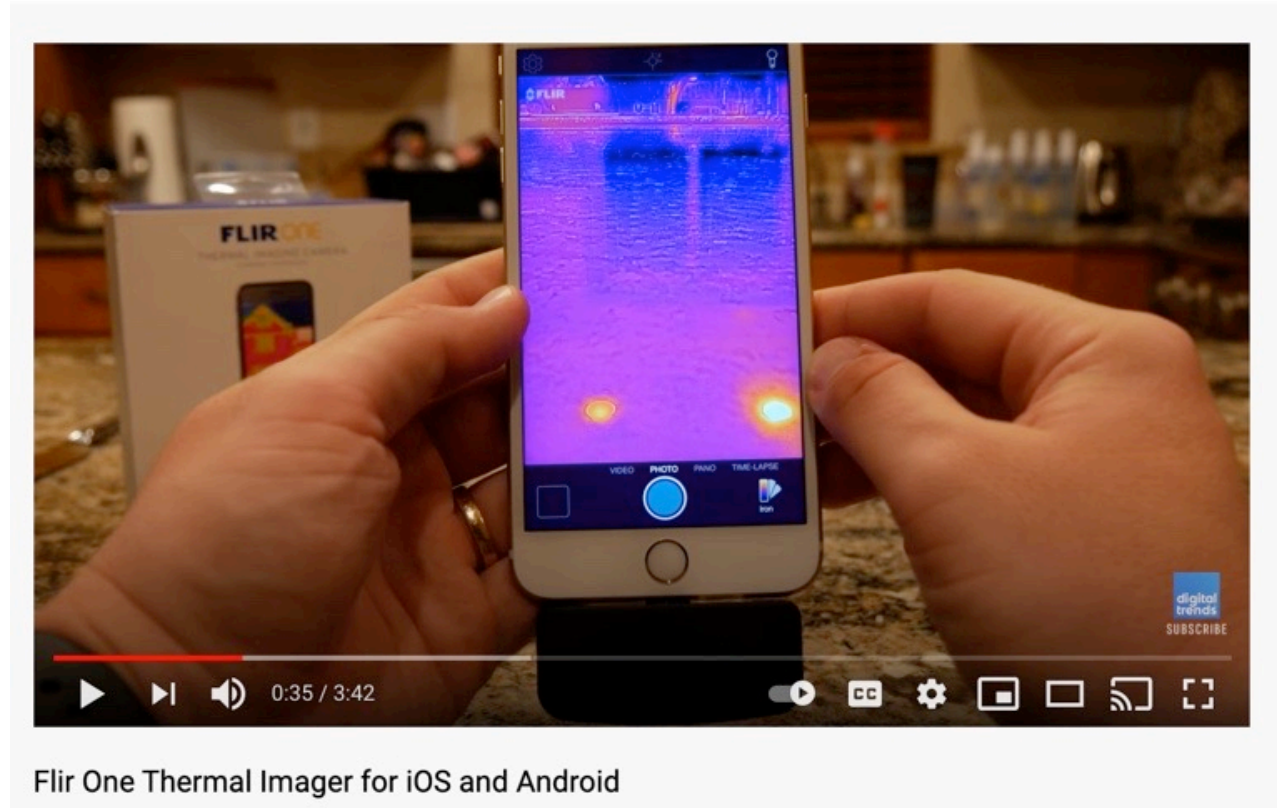
#2

Cheap Thermal Imaging!



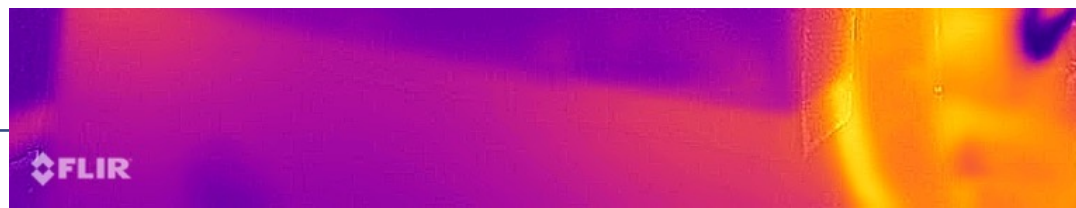
\$400 from FLIR, be using it in 10 minutes

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





Uninsulated piping with temperatures



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



Duct leakage



Looking into the kitchen



#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



**HOBOT 4-Channel Analog
Data Logger**

Part # MX1105

Bluetooth-enabled logger



\$199 USD

Add to Cart

Build a Kit

Important Info

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

-  HOBOTconnect Information
-  Need help deciding?



Oversized Equipment, short cycling



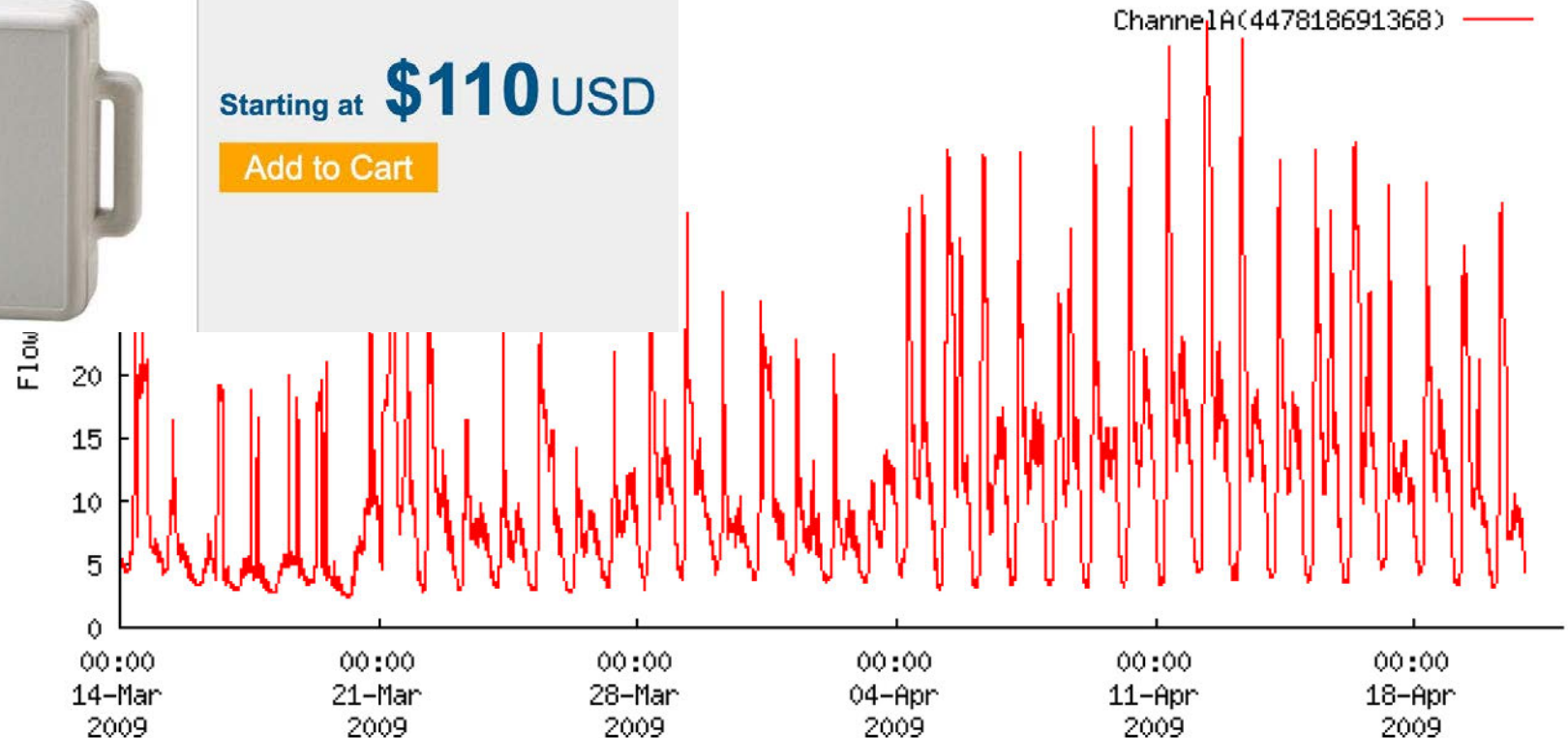
Play Video

HOBO Motor On/Off
Data Logger

Starting at **\$110** USD

Add to Cart

Main Meter
7818691368, Serial number 63794

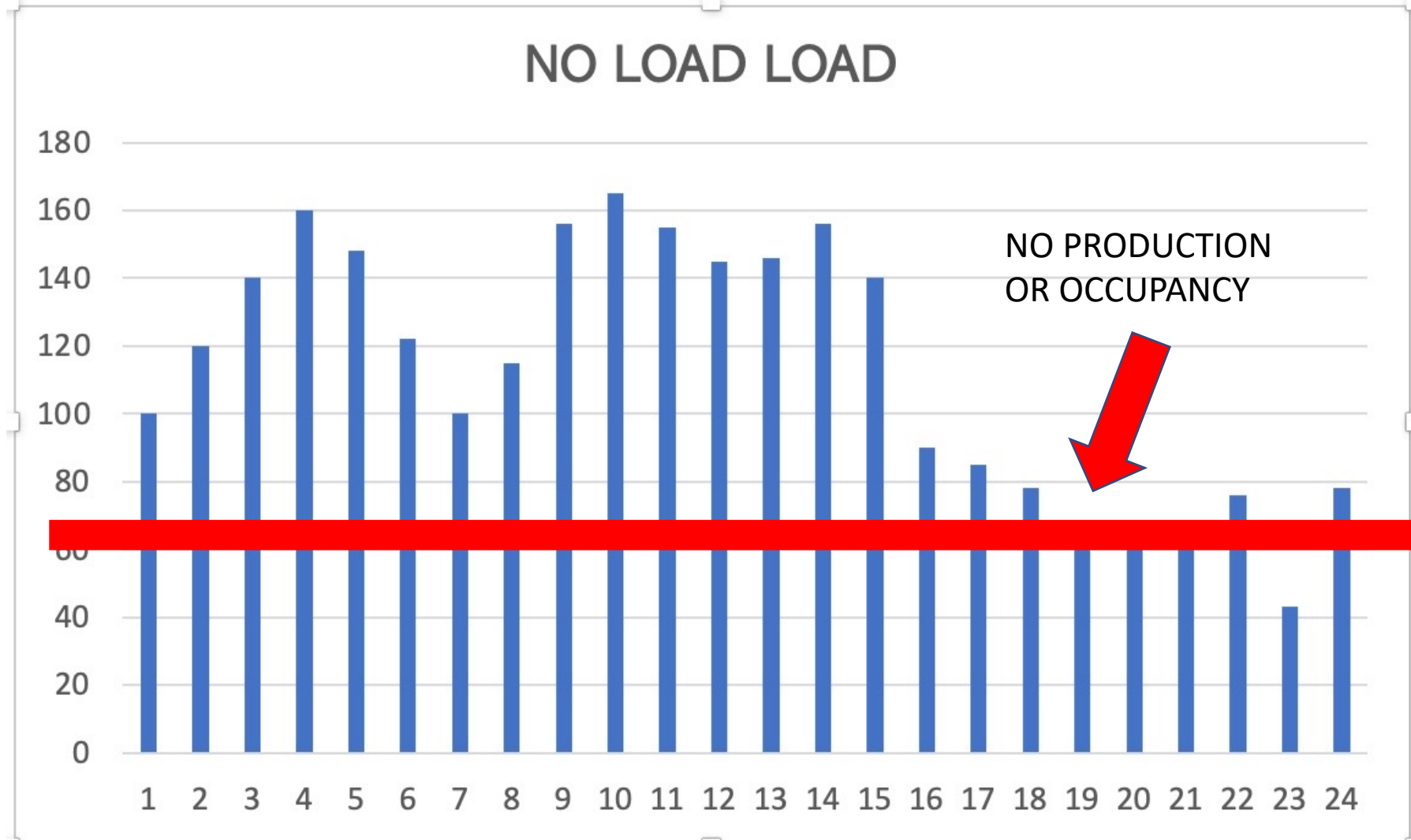


Boiler plant master control, (multiple boilers) lead/lag– 75% load, 3 minutes, 5 min. minimum



Channel 1: Flue gas Temp
Channel 2: Return Water Temp
Channel 3: Supply Water Temp
Channel 4: Motor on Cycle Time

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

5:00

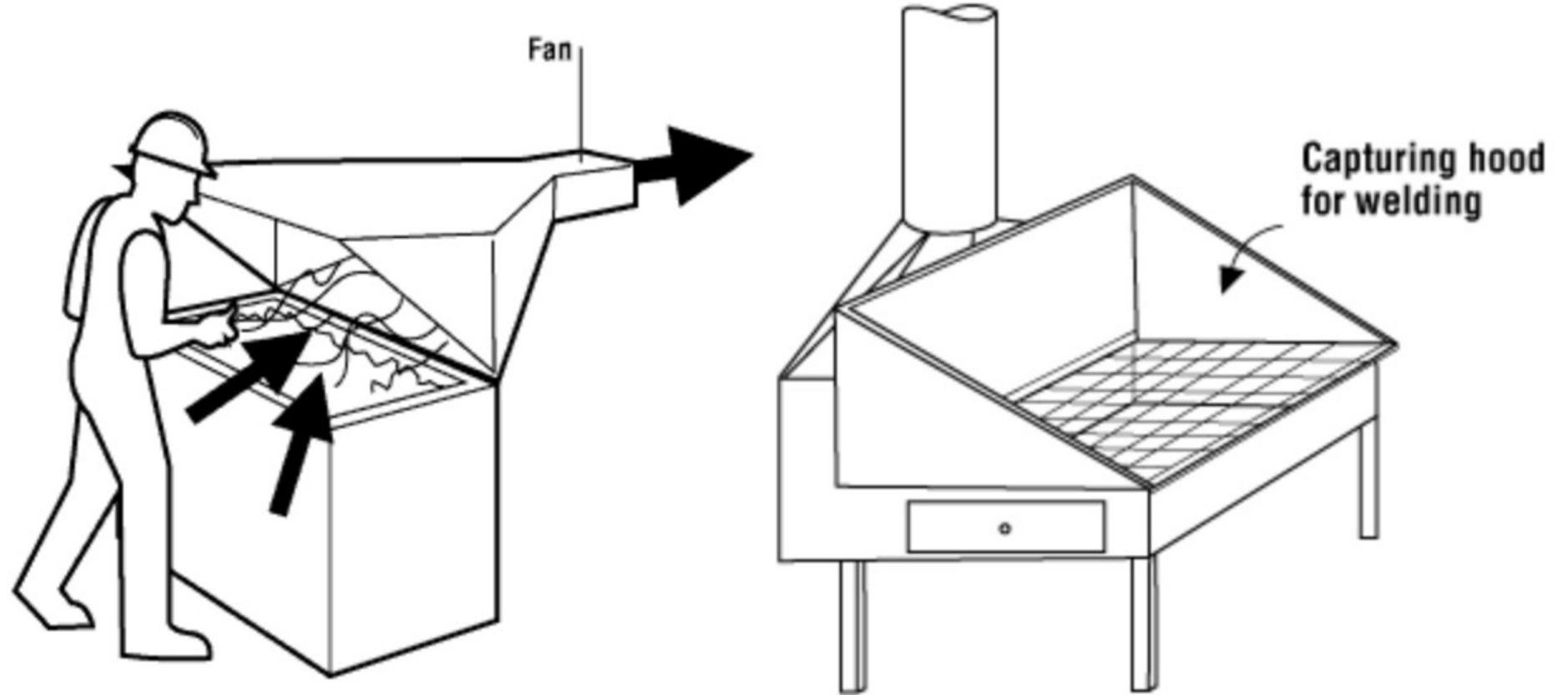
<https://youtu.be/C-MZaHxQxAw>

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.



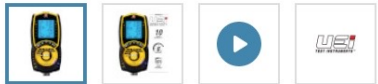
#5

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

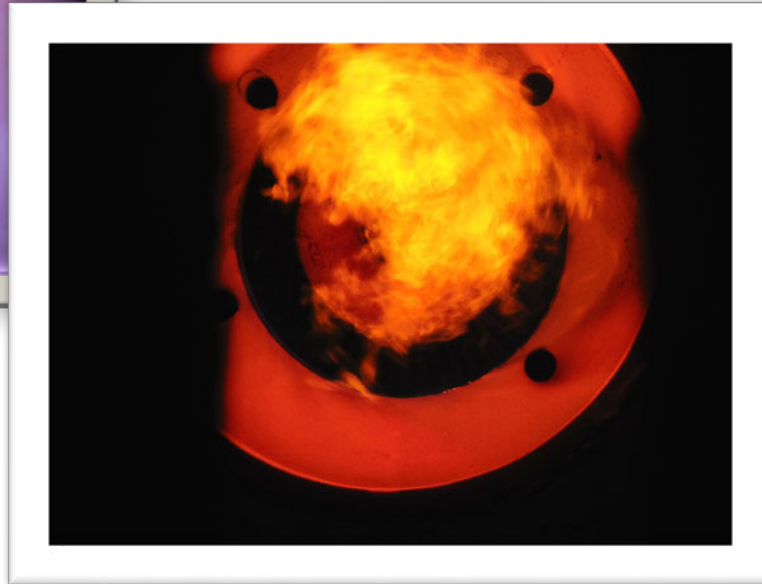
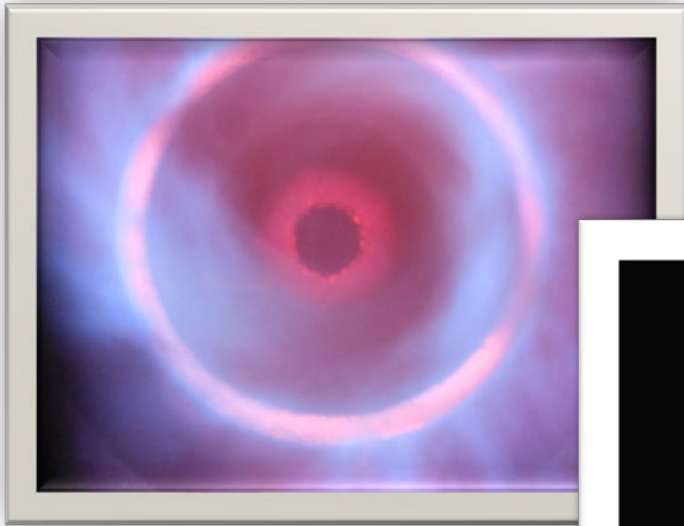
✓ **In Stock** Get 1 Fri, Sep 2
More Available [Inventory Details](#) ▾

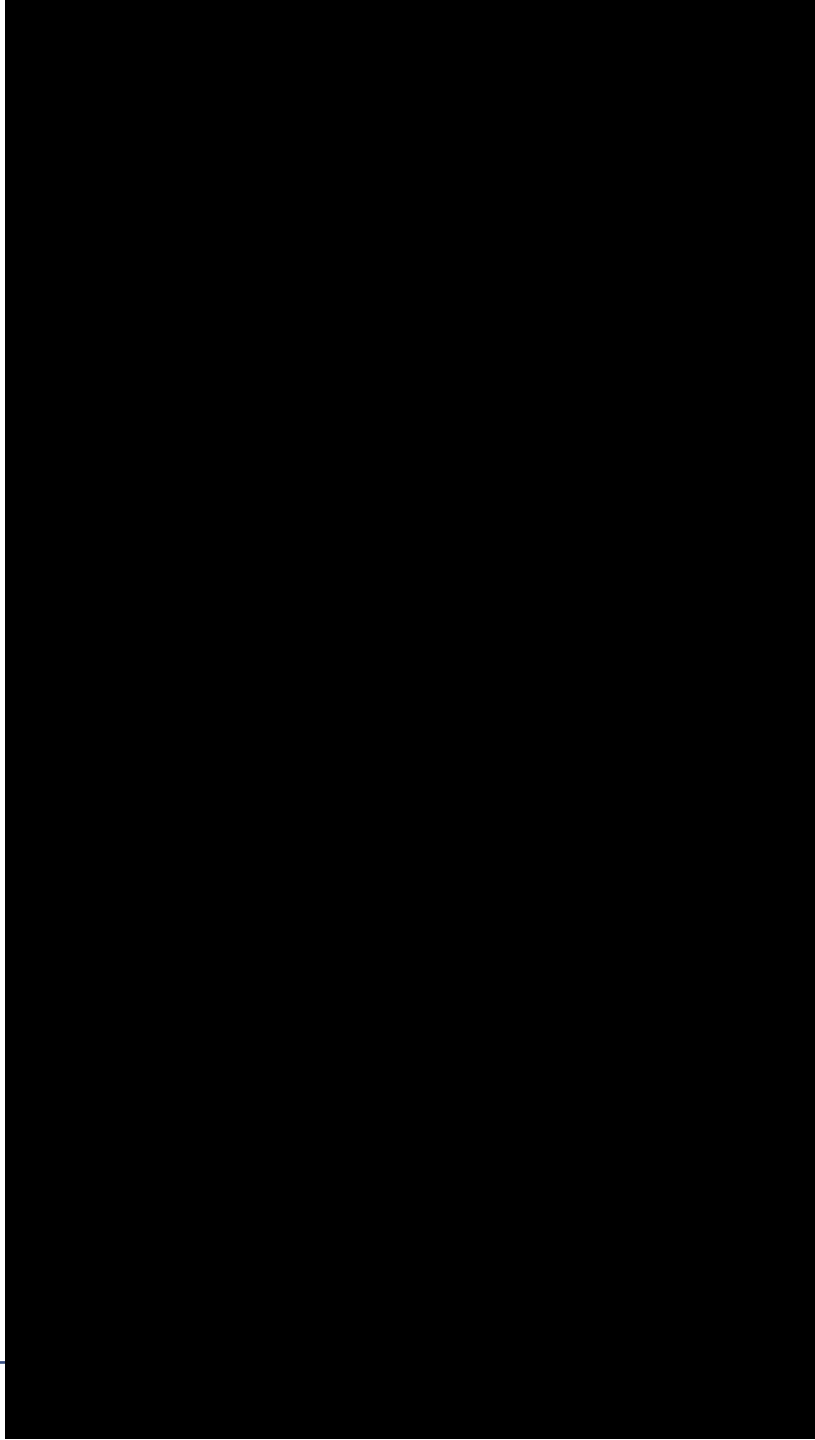
MANUALS (4)

-  [Product Overview](#)
-  [User Guide](#)
-  [Quick Start Guide](#)
-  [Warranty Info](#)



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](#)



Roll over image to zoom in

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

\$279⁹⁹

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

TUF-2000B Host with TM-1 Transducer

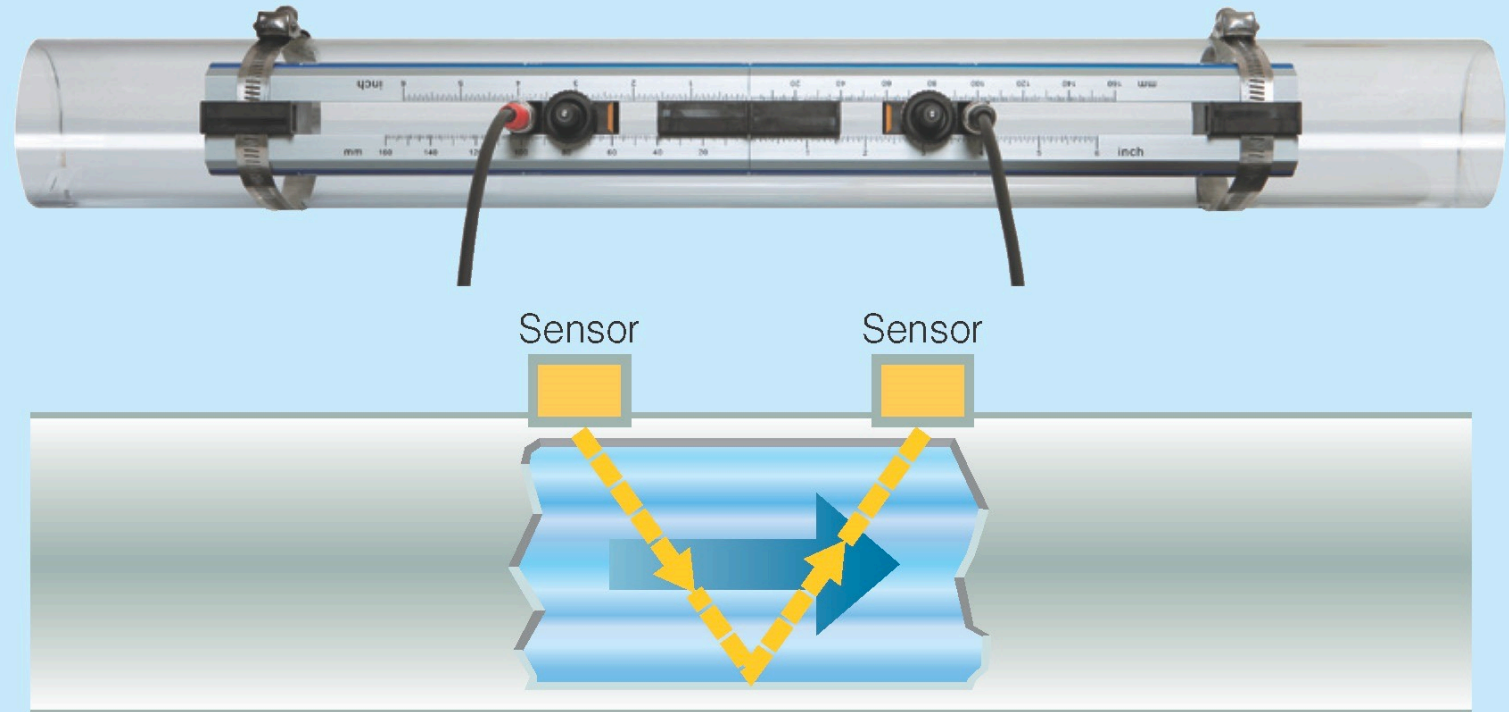
TUF-2000SW Host with TM-1 Transducer

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





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



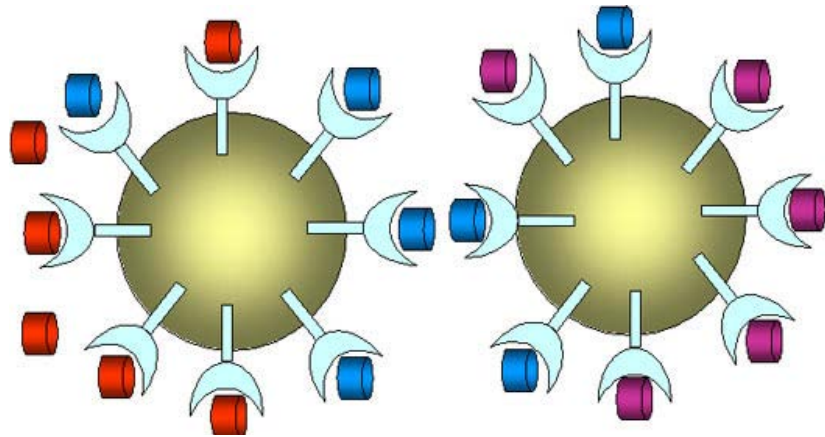
**Now you can
afford to have
meters all over
and avoid this!**

**Boiler
Make-up
great KPI**

RO System



You can validate softener parameters

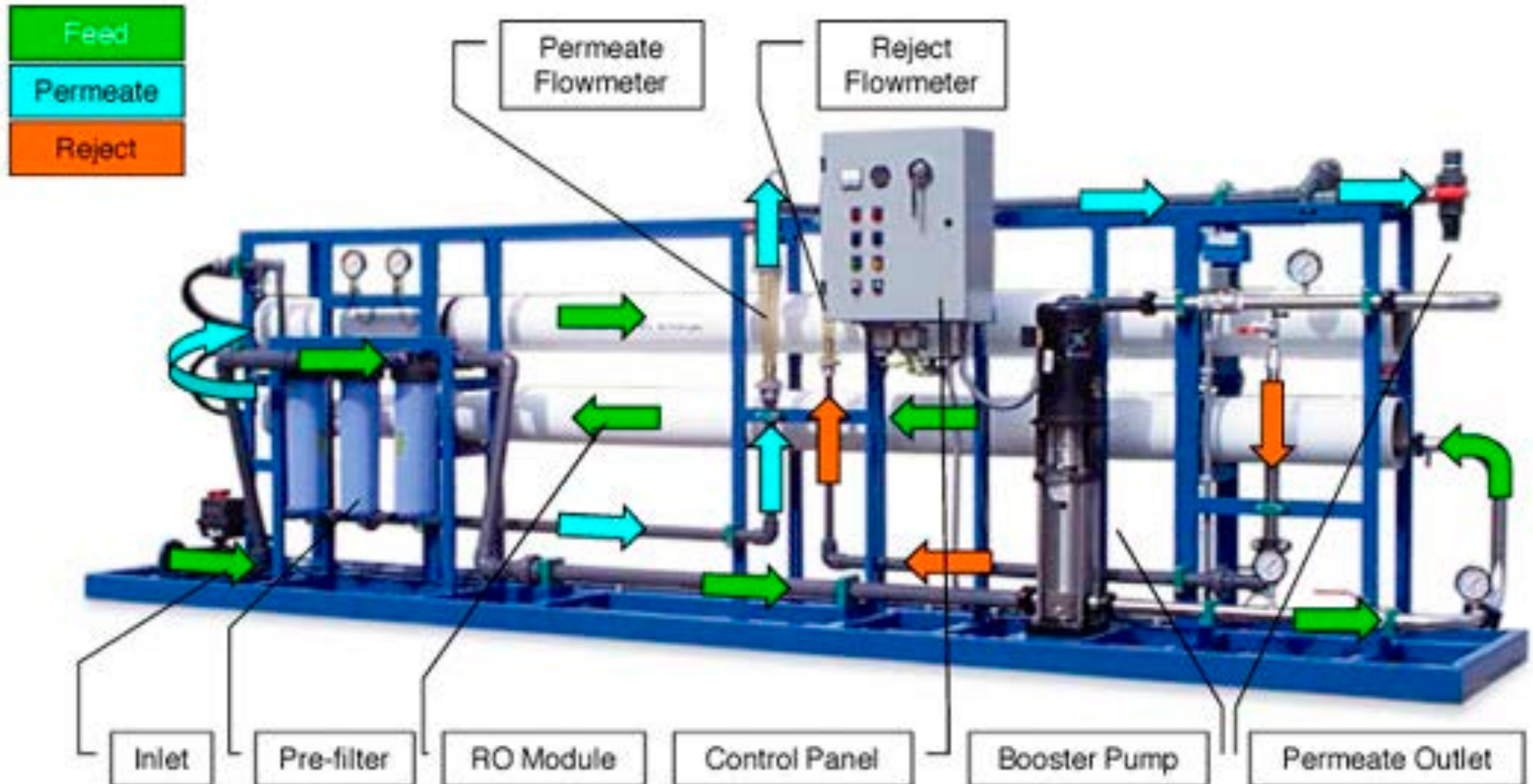


Different beads,
Cationic (- Negative charge)
Anionic (+ positive charge)
Have different affinities
& adsorb/elute cycles,
but all of this works
the same way

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



And RO parameters

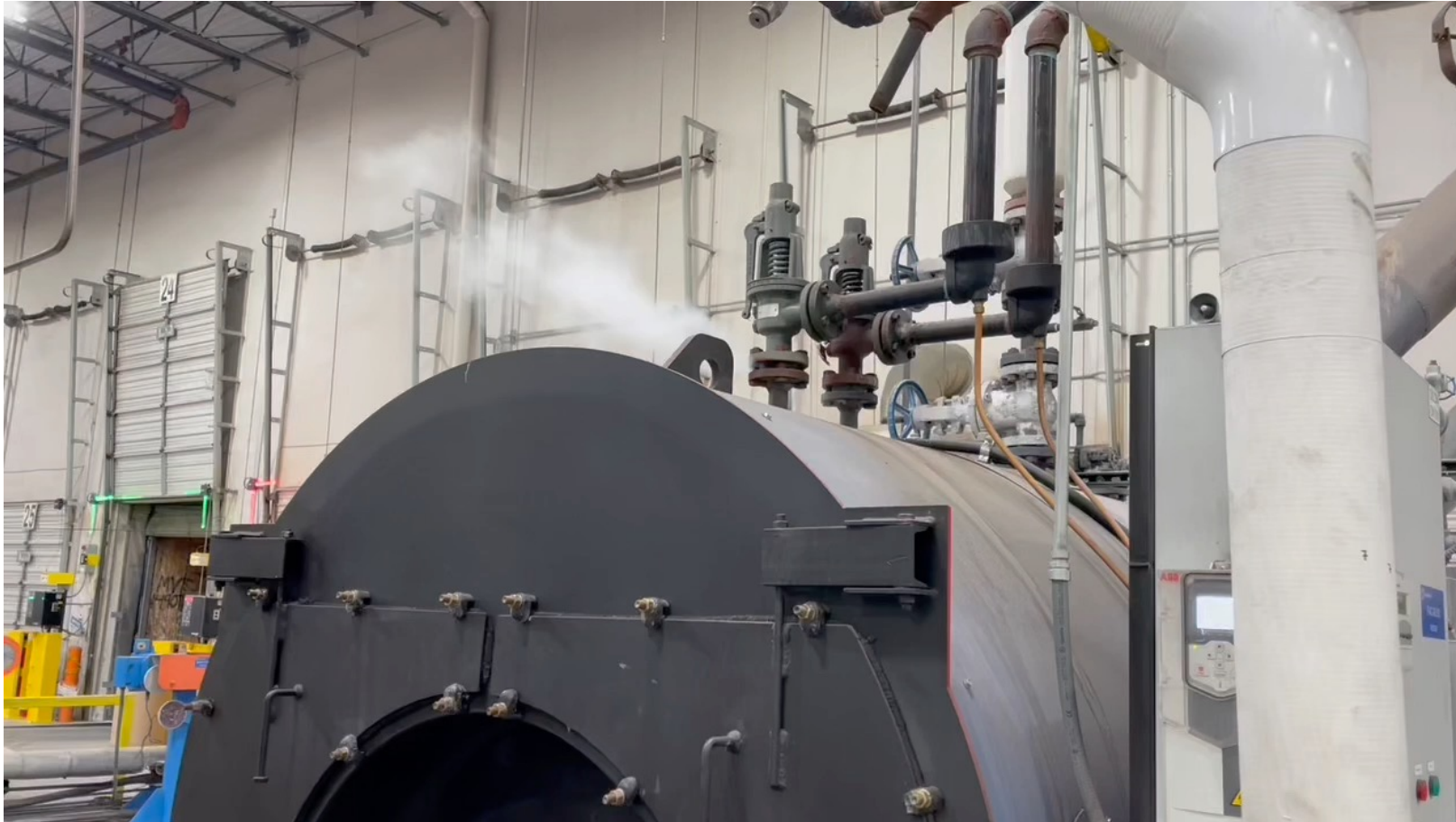


A photograph showing a metal grate covering a pipe. A white arrow points to the pipe. The pipe is made of metal and has a flange at the end. The grate is made of metal bars. The background is a concrete wall.

**You can find outfall
meter opportunities**

#7

Daily rounds for obvious things with accountability



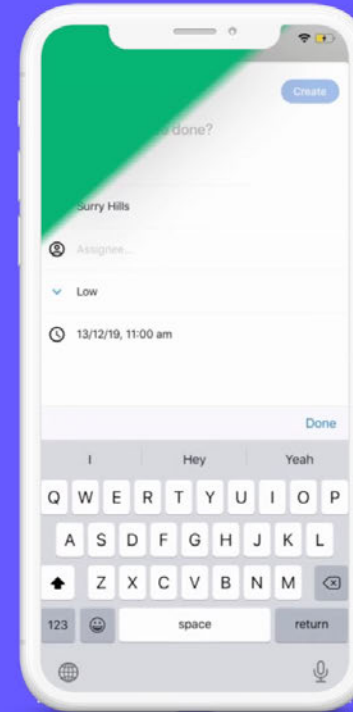
iAuditor, digitize any audit, capture reporting, analyze the results.

Conduct inspections, flag issues, and resolve problems together

iAuditor is an inspection, issue capture and corrective action platform for teams that's used over 50,000 times a day in over 85 countries.

Get started for FREE

No credit card, cancel anytime



www.safetyculture.com

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
<div>⋮</div> Review relief valve discharge lines at CV1, is there an active discharge or leak?	<div>Yes No N/A</div> ▼
<div>✓</div> Are there any steam leaks at CV1?	<div>Yes No N/A</div> ▼
<div>If answer <u>is</u> <div>Yes</div> then <div>🔔 Notify ×</div> <div>+ trigger</div></div> <div>⋮</div>	
<div>⋮</div> Are steam traps failed at CV1 pressure control station?	<div>Yes No N/A</div> ▼
<div>⋮</div> Review relief valve discharge lines at CV2, is there an active discharge or leak?	<div>Yes No N/A</div> ▼
<div>⋮</div> Are there any steam leaks at CV2?	<div>Yes No N/A</div> ▼

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...

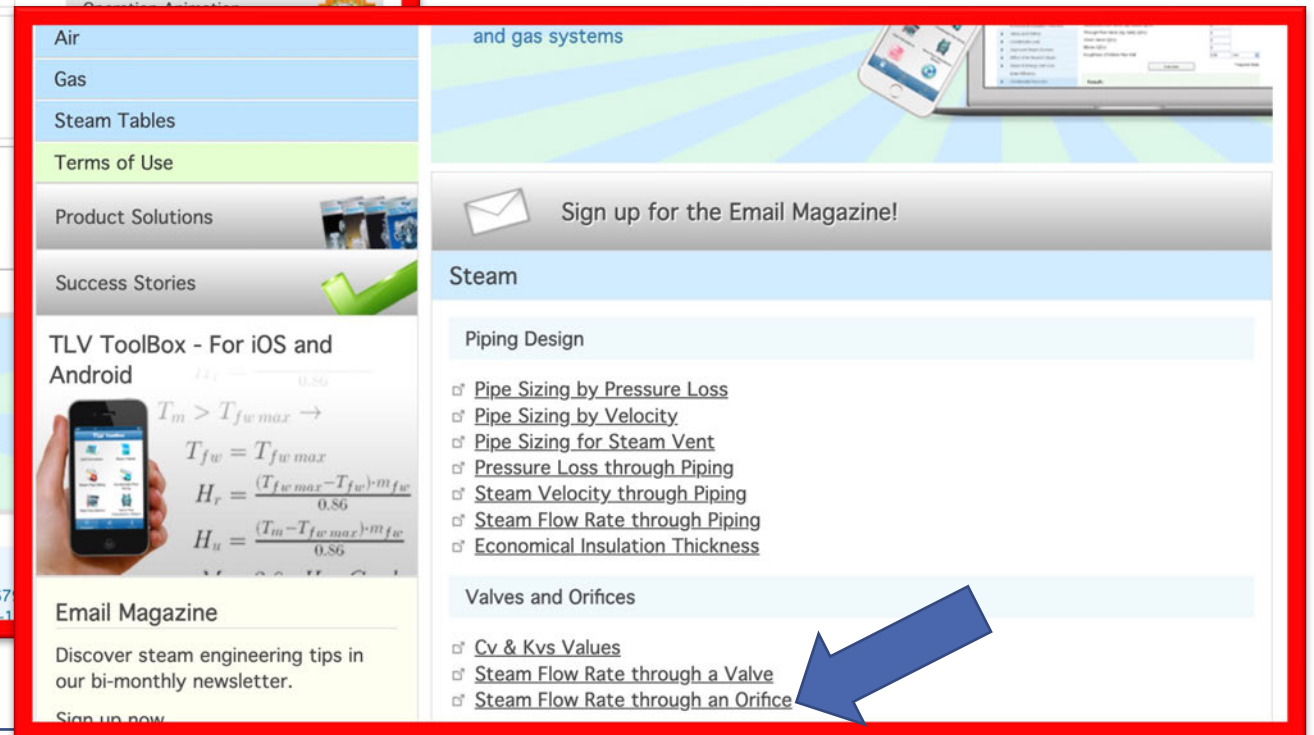
 Attach media

 Create action

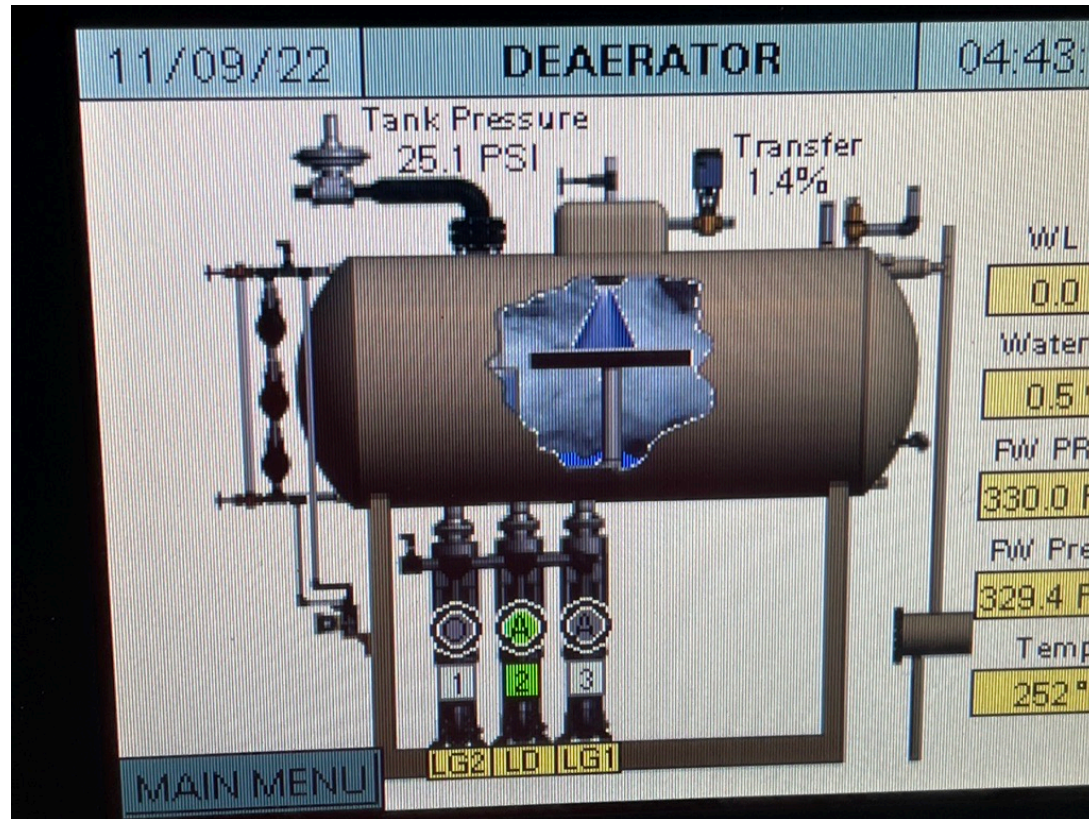
#8



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



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



**Supposed to be
18-24" vent,
kind of lazy**



- Engineering Calculator
- Steam
- Piping Design
- Valves and Orifices
- Cv & Kvs Values
- Steam Flow Rate through a Valve
- Steam Flow Rate through an Orifice
- Condensate Load
- Improved Steam Dryness
- Effect of Air Mixed in Steam
- Steam & Energy Unit Cost

Calculator: Steam Flow Rate through an Orifice

TLV ToolBox - For iOS and Android

Input Data

Units Imperial ▾

Primary Pressure25.2psig ▾

Secondary Pressure0psig ▾

Diameter of Orifice1.25in ▾

Show Advanced Options

Primary Pressure25.2psig ▾

Secondary Pressure0psig ▾

Diameter of Orifice1.25in ▾

Show Advanced Options

CalculateClear

Result

Steam Flow Rate2223.22lb/h ▾

Equation(s)

$$\frac{(p_1 - p_2)}{p_1} < F_\gamma \cdot x_T \rightarrow$$
$$m_s = 63.3 \cdot C \cdot \left(\frac{d_o}{0.183} \right)^2 \cdot \left(1 - \frac{p_1 - p_2}{(3 F_\gamma \cdot x_T)} \right) \cdot \sqrt{(p_1 - p_2) \cdot \rho}$$
$$\frac{(p_1 - p_2)}{p_1} \geq F_\gamma \cdot x_T \rightarrow$$
$$m_s = 0.66 \cdot 63.3 \cdot C \cdot \left(\frac{d_o}{0.183} \right)^2 \cdot \sqrt{F_\gamma \cdot x_T \cdot p_1 \cdot \rho}$$

p1 : Primary Pressure (psia)
p2 : Secondary Pressure (psia)
do : Diameter of Orifice (in)
C : Discharge Coefficient
ms: Steam Flow Rate (lb/h)
p : Density of steam (lb/ft³)
Fγ : Specific heat ratio factor (=Specific heat ratio/1.4)
xT: Pressure differential ratio factor (=0.72)

- Engineering Calculator
- Steam
- Piping Design
- Valves and Orifices
- Cv & Kvs Values
- Steam Flow Rate through a Valve
- Steam Flow Rate through an Orifice
- Condensate Load
- Improved Steam Dryness
- Effect of Air Mixed in Steam
- Steam & Energy Unit Cost
- Boiler Efficiency
- Condensate Recovery
- Water
- Air
- Gas

Calculator: Steam Flow Rate through an Orifice

TLV ToolBox - For iOS and Android

Input Data

Units Imperial ▾

Primary Pressure7psig ▾

Secondary Pressure0psig ▾

Diameter of Orifice1.25in ▾

Show Advanced Options

CalculateClear

Result

Steam Flow Rate1066.58lb/h ▾

Savings Calculations

$2223 - 1066 = 1,157\text{lbs/hour}$ or about
 $1,157,000 \text{ BTU's/hour}$

$1.157 / .825 \text{ combustion eff.} = 1.4\text{MMBTU/hr.}$
Nat. gas input

$1.4\text{MMBTU/hr.} \times \$8/\text{MMBTU} \times 8,500 \text{ hours} =$
 $\$95,200$, or $\$100\text{k}$ with water/chemicals

What could this be worth?



#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

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Main

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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 [\[link\]](#)

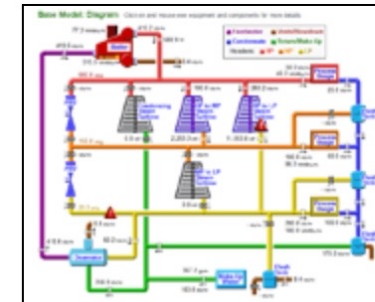
Step 2: Generate an Adjusted Model

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

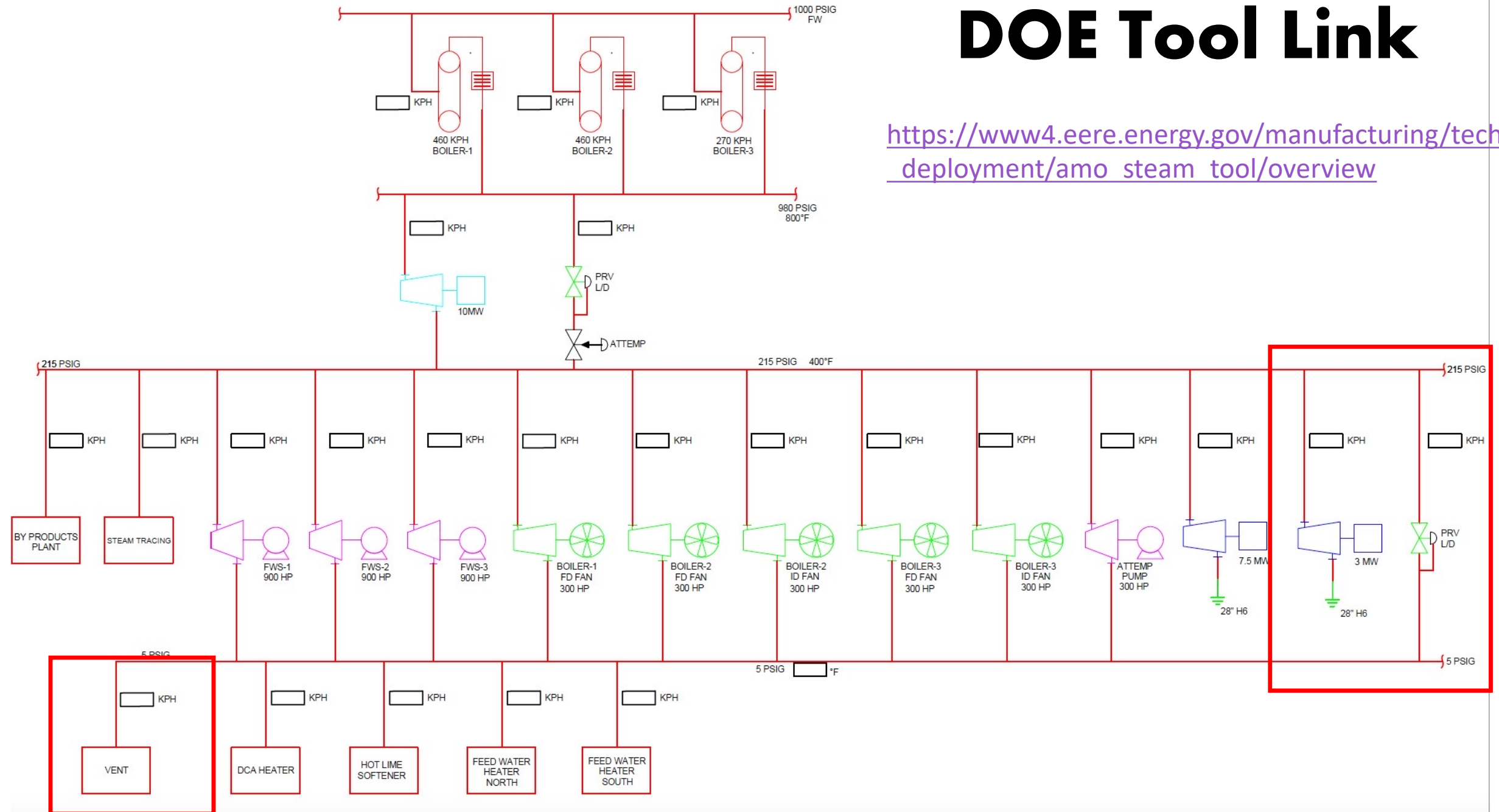
A summary of Base Model vs Adjusted Model metrics will be generated once both a Base Model and Adjusted Model have been created.

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



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](#)

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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.

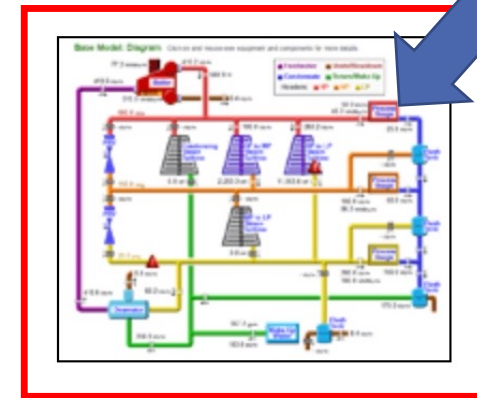
Step 3: Compare Base Model to Adjusted Model

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](#)

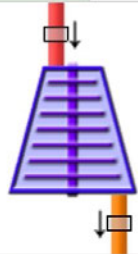
Calculates the energy generated or steam outlet conditions for a steam turbine.

Use elec. motor for 600 HP load,

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

Temperature	510 °F
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]

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

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

Steam Turbine Calculator [watch tutorial](#) [view guide](#)

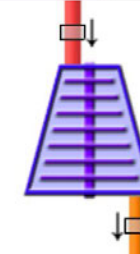
Calculates the energy generated or steam outlet conditions for a steam turbine.

Use turbine for 600 HP load, 215/5

10 Mlbs/hr. – vent 10mlbs/hr. 5 psig

Temperature	510 °F
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]

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

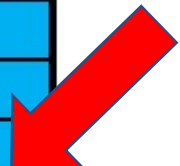


Isentropic Efficiency	78.0 %
Energy Out	11.2 MMBtu/hr
Generator Efficiency	98.0 %
Power Out	444.7 kW

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

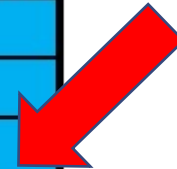
Change the operating philosophy for \$3-400k/yr

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	\$ -
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



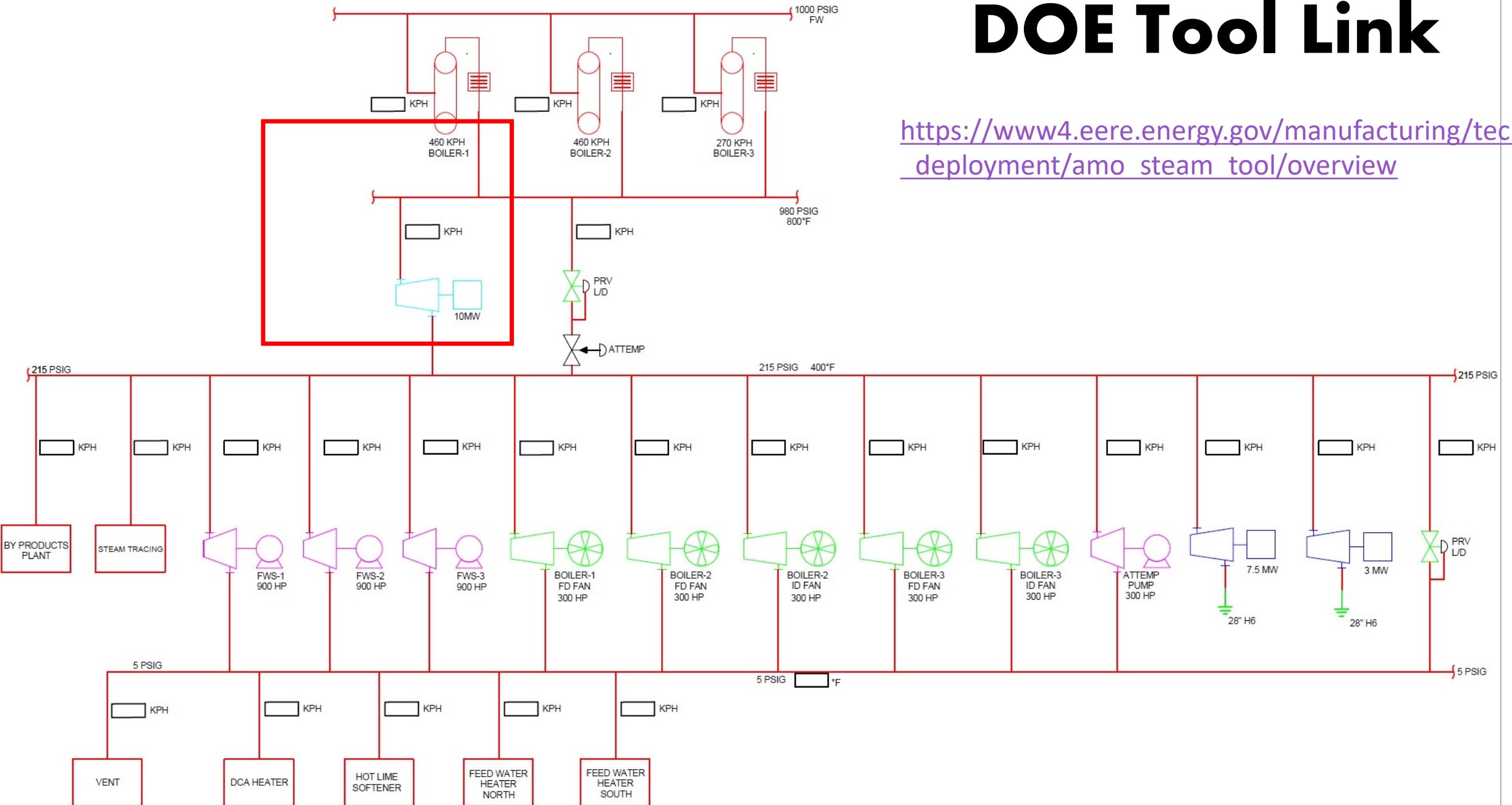
Best Practice

Best Practice



DOE Tool Link

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



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

#10

Managing boiler water chemistry Emerson BD software

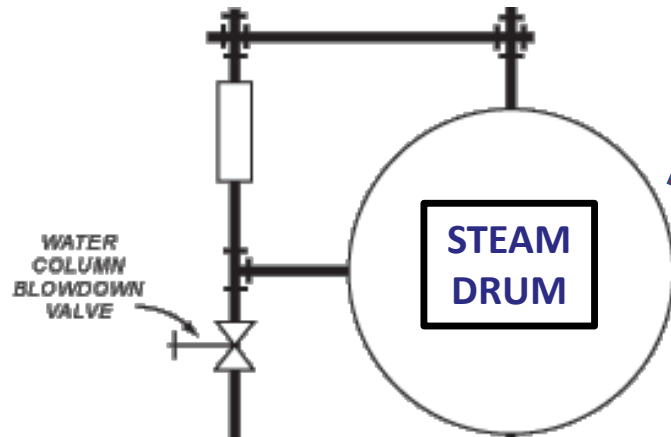
Utilities Plant - Steam Boilers

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**

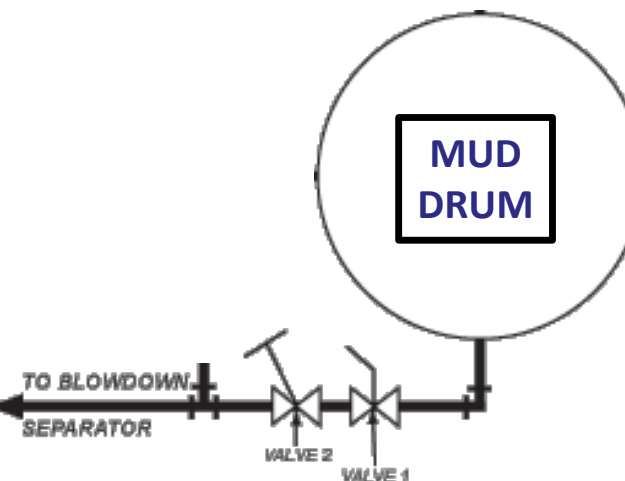


**New Boiler Feed with
Small amounts of Ca + Mg**

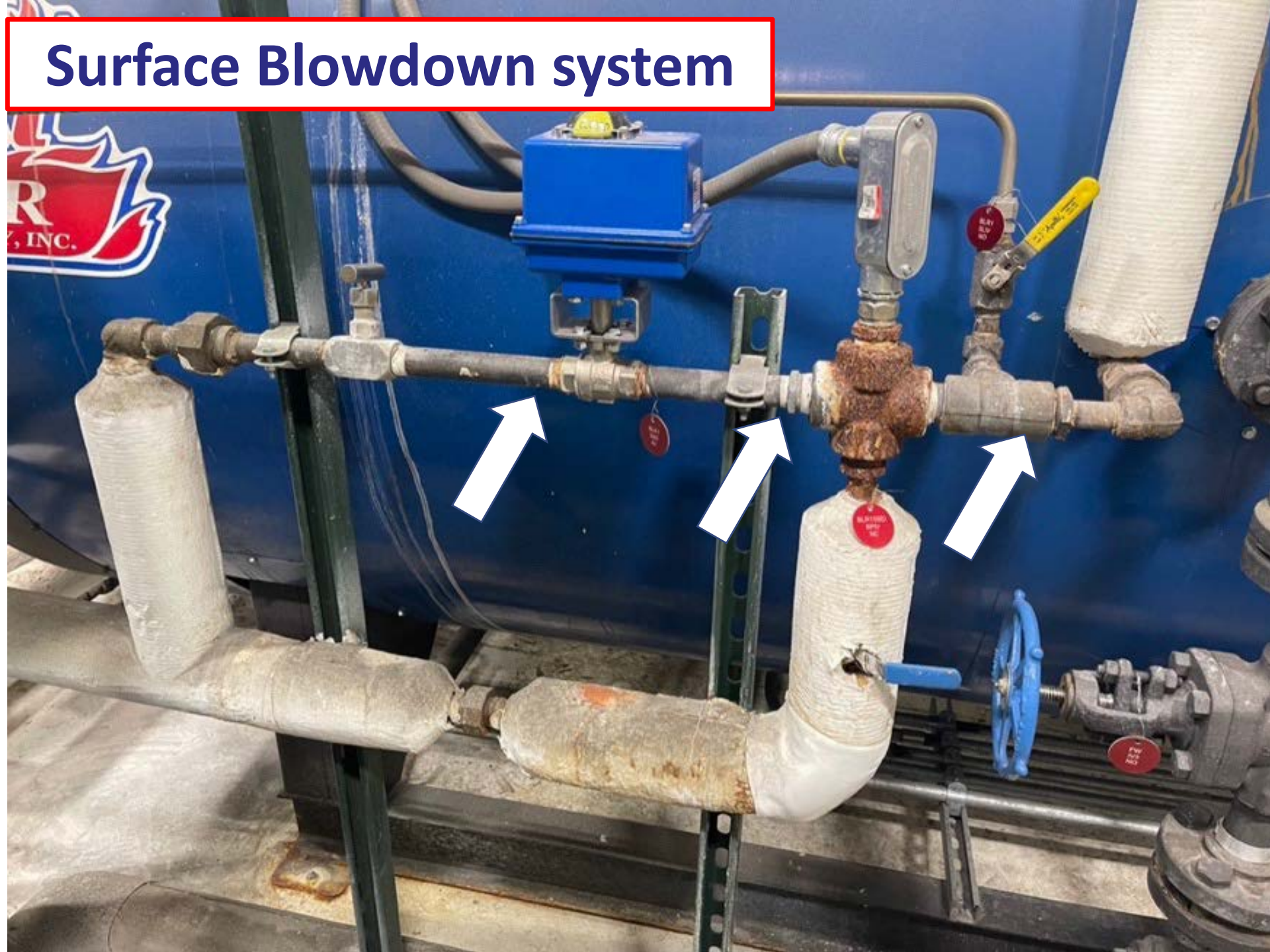
SURFACE BLOWDOWN
Somewhat concentrated
Waters, continuously flushed out

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

BOTTOM BLOWDOWN
Very concentrated
Waters, periodically flushed out



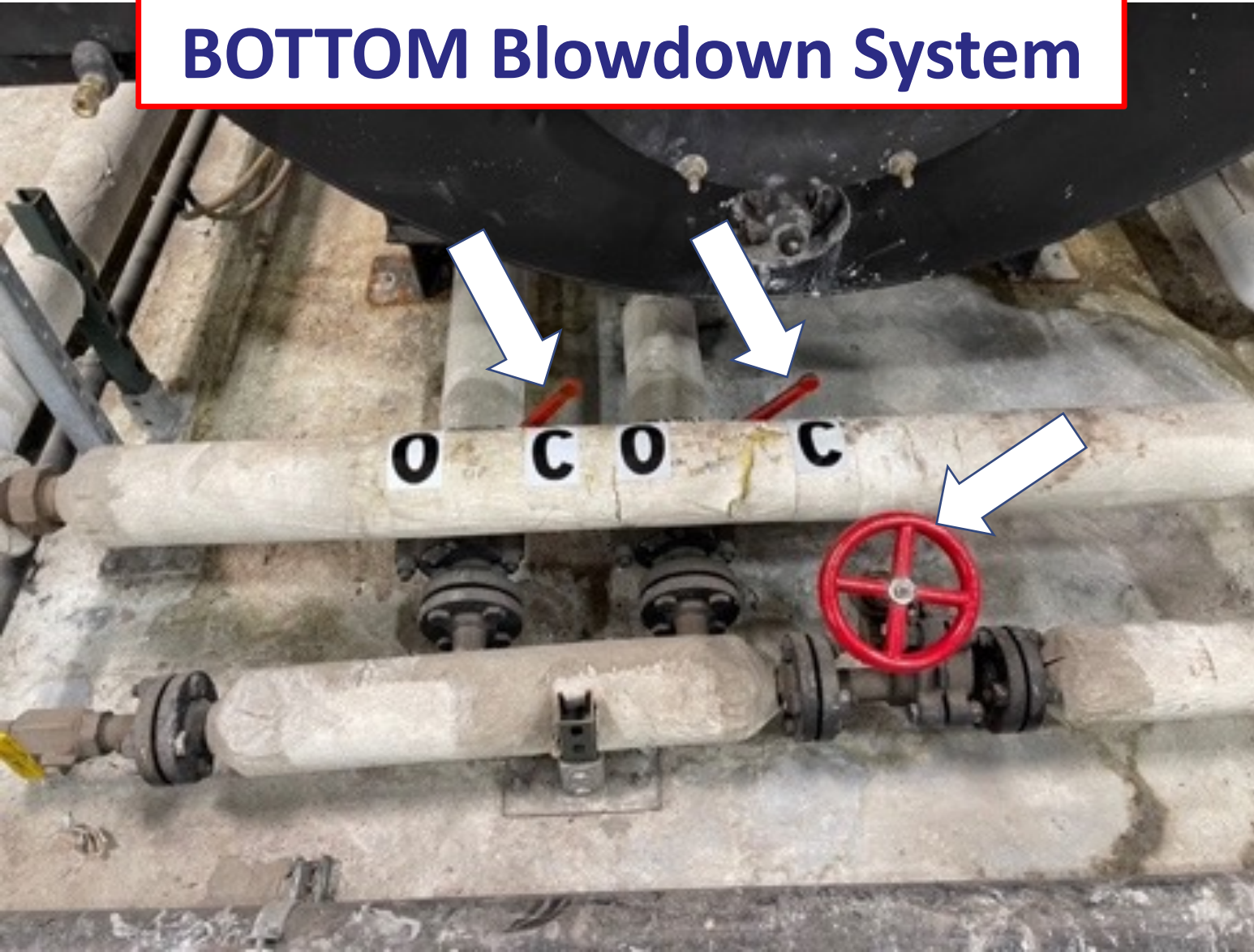
Surface Blowdown system





Conductivity Probes

BOTTOM Blowdown System





Doing the BEFORE & AFTER Scenario's



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 >>		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 Blowdown 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	

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

