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Presented by

What's Actually 'Out There' in the Real World of Heat Pump Water Heaters (HPWH) ?

Ron Kliewer
Principal
Kliewer and Associates

Building Science©

KLIEWER & ASSOCIATES

HPWH PERFORMANCE + ENERGY RESEARCH

The real world of Heat Pump Water Heaters throw some interesting curveballs at us. Troubled hot water knows how to find us! Here are some examples of what is lurking “out there”…

Troubleshooting… Spock Would Like It

- Assumptions not allowed! No prejudgment.
- Logically gather up all the facts -- past & present.
- “See” the system’s movements, like water flow & heat transfer.
- Shift your time frame & watch corrosion processes/ scale build up.
- Figure out tests for component and system function,
- And … if you have the time and budget: collect data

- If it’s complex, make a schematic.
- Use fun tools, like IR cameras, pressure gauges and ears.
- After gathering as much info as you can, the problem(s) must rise to the top.
- After these steps, use your diagnosis to form a plan of correction.

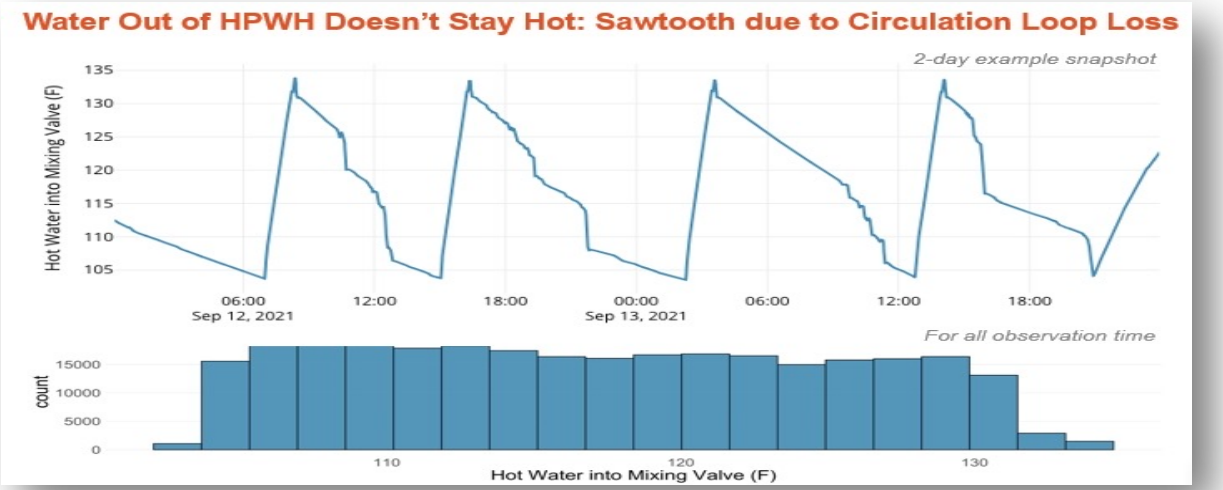
Group Home (Multi-Family):

HPWH vs. recirc loop controls… and a few other things. Who wins?

Problems: Not enough hot water PLUS High energy bills … HPWHs installed in small closets. 24 hour and timer recirc loops. Inconsistent plumbing. Mixing valves don't work. Problems with airflow in and out. Are plumbers allowed to see airflow through a heat exchanger? Do they know it exists? Most do not!

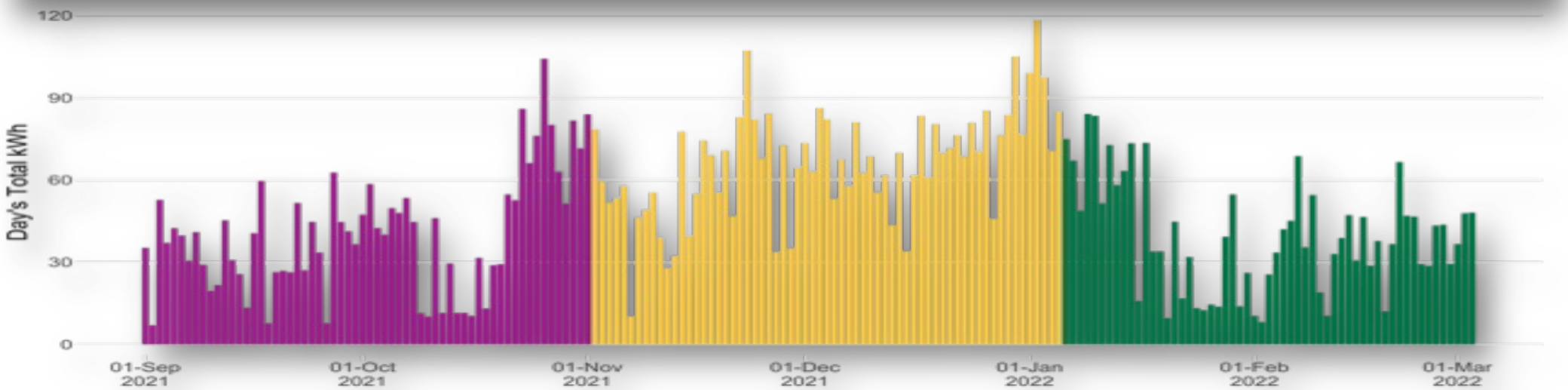
Actions Taken

- Round 1: Energy Saver Mode engaged (8/21)
- Round 2: HP airflow (11/21)
  - Kitchen: Reroute inlet duct so the air comes from above the refrigerator. Install a louver above the door to increase the exhaust area.
  - Laundry: Reroute inlet duct to inside or add an exhaust duct to the attic? Principle is for the air flow to stay in the same pressure zone.
- Round 2.5: Moved flow monitoring equipment to Bldg A Laundry
- Round 3: Changed the control for the circulation pump (1/22)
  - Kitchen: No control to demand control
  - Laundry: Time control to demand control



How much of the time is each water heater operating?

Building	Room	Heating Type	Proportion of Total... Time	Proportion of Total... Energy	Total Time (Days)	Total Energy (kWh)
A	Kitchen	Heat Pump Only	20%	12%	110	211
		Resistive / Resistive + Heat Pump	14%	88%		1,617
		Controls (No Heating)	66%	0%		2
	Laundry	Heat Pump Only	37%	66%		398
		Resistive / Resistive + Heat Pump	2%	34%		201
		Controls (No Heating)	61%	0%		0
B	Hall	Heat Pump Only	38%	96%	89	274
		Resistive / Resistive + Heat Pump	0%	4%		12
		Controls (No Heating)	62%	0%		0
	Laundry	Heat Pump Only	18%	90%		147
		Resistive / Resistive + Heat Pump	0%	10%		16
		Controls (No Heating)	82%	0%		0



Actions Taken

- Changed HPWH Supply Air from attic to kitchen (behind fridge for heat recovery)
- Change HW recirculation strategy to demand controls

Results

- Building air pressure now balanced
- More even hot water temps
- Greatly reduced electrical usage
- Did not solve HW quantity issue ☹
- HW issue solved by adding split HPWHs

Also, Airflow …

"Guhzintah minus losses equals Guhzoutah." This matters with HPs! Not a simple changeout. Commercial HPWHs installed in too small a space. Didn't have adequate venting info. Didn't initially separate inlet and output air, so it mixed, cutting into performance.

Thanks to Gary Klein & Larry Weingarten

Before

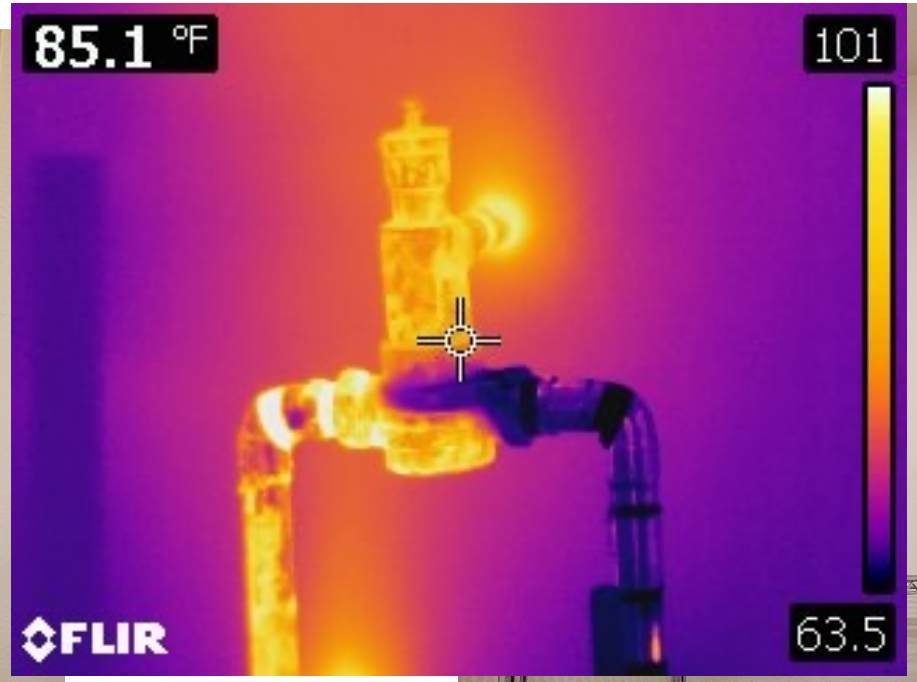
After

Got rid of airlock at pump by redoing piping. This just partly solved the problem. Flow would stop as things warmed. No physical obstruction found. Removing the mixing valve fixed things. ***It was listed under three standards*** and didn't allow hot enough water into the system. Was a headscratcher!

Credit to Gary Klein & Larry Weingarten

The LONEsome Mixing Valve

Oversize MV never has enough flow to activate

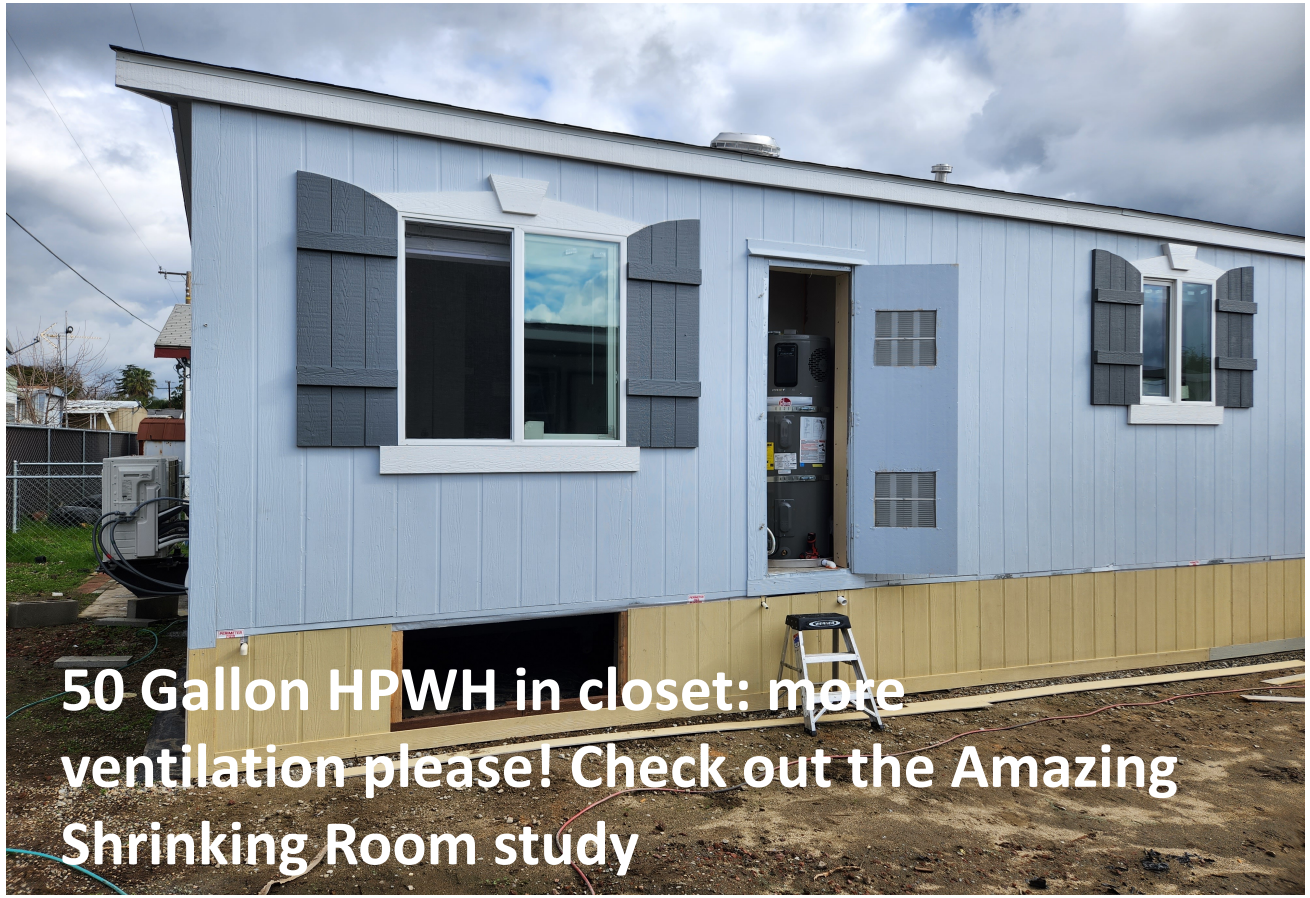


With a Shoehorn, Anything is Possible!

WAY MORE Ventilation needed

Manufactured Home With HPWH

Northwest Energy Efficiency Alliance (NEEA) | Heat Pump Water Heaters



Just why?

Am I missing something?

Correct wiring is crucial for a successful installation,
or just one that turns on!

“The bitterness of poor quality is remembered long after the sweetness of low price is forgotten.”

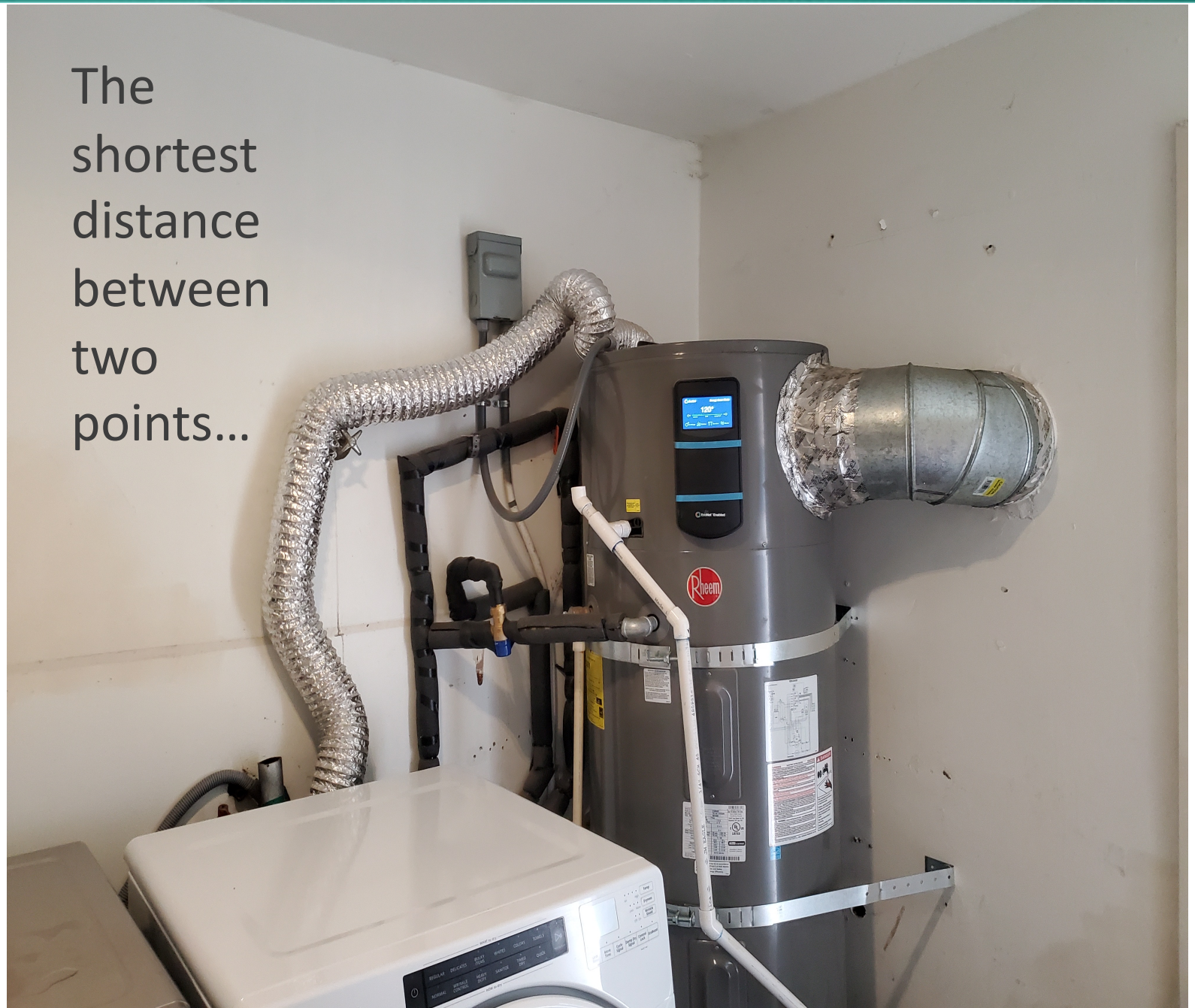
Less Than a Year in Use

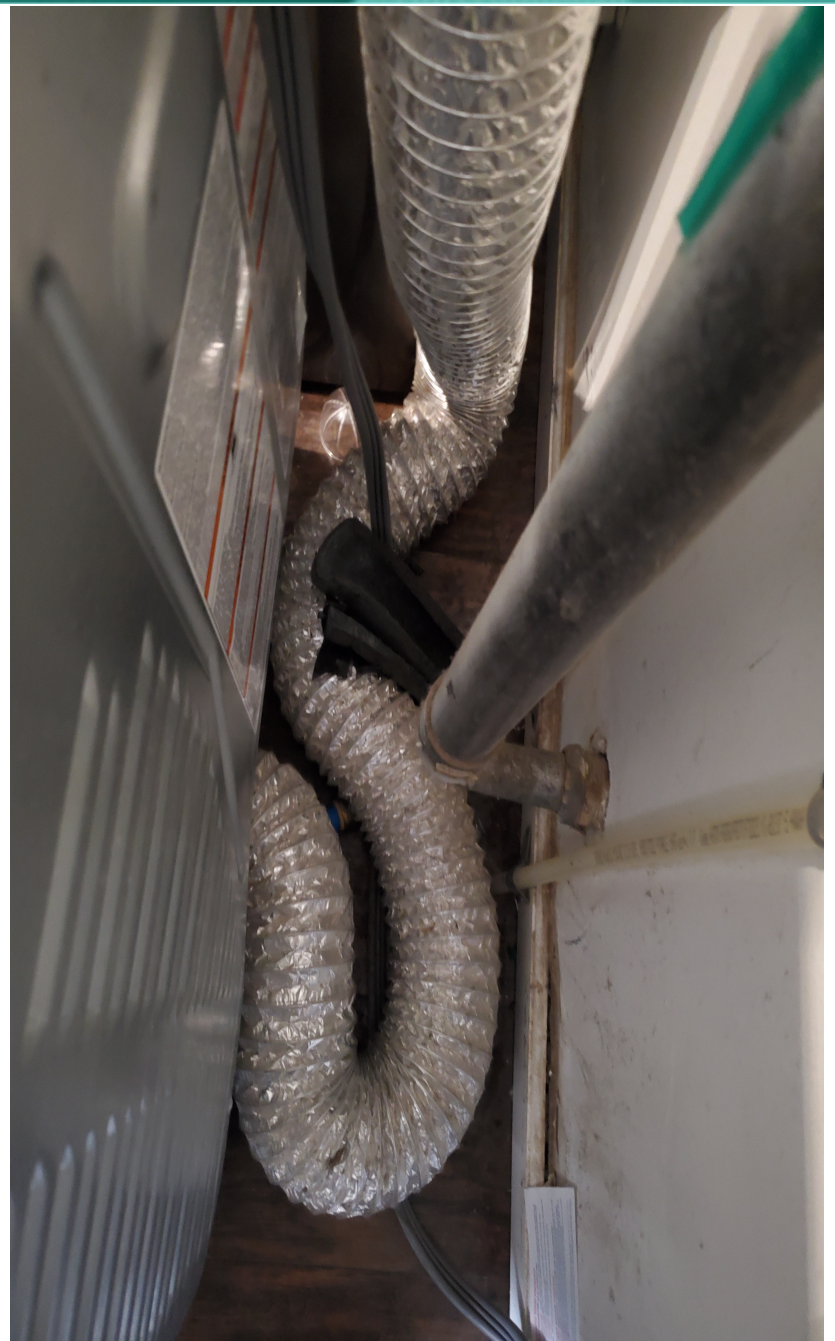
HPWH Filter Issues

You get what you INSPECT, not what you EXPECT

Filter cannot be removed for cleaning

The shortest distance between two points…



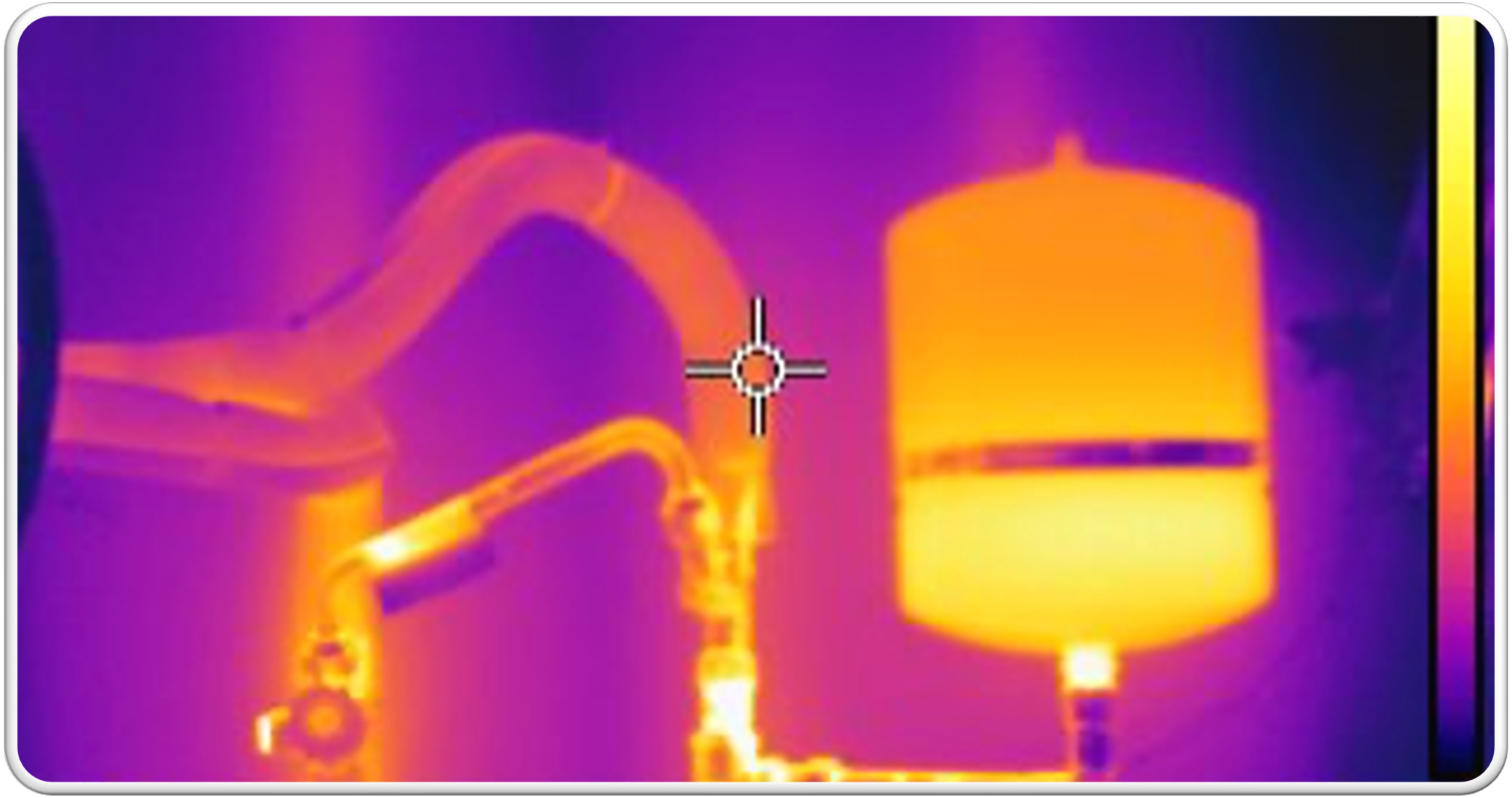



FRØTERNA
$155


Condensate and
TPR valve piped to
front porch

Pipes partially obstruct exhaust. Uninsulated pipe wicks heat all the way into the expansion tank. Expansion tank should be on cold water supply side.

Uninsulated Mixing Valve/Expansion Tank



Single-Family Home

The code doesn't really matter, does it?

Problem: Water heating system was costing $$$ to run and hot water delivery to kitchen was inadequate. 2-3 people in the house, should cost roughly $150-450 per year for hot water. How come the bill was over $5000?

Credit to Klein & Weingarten

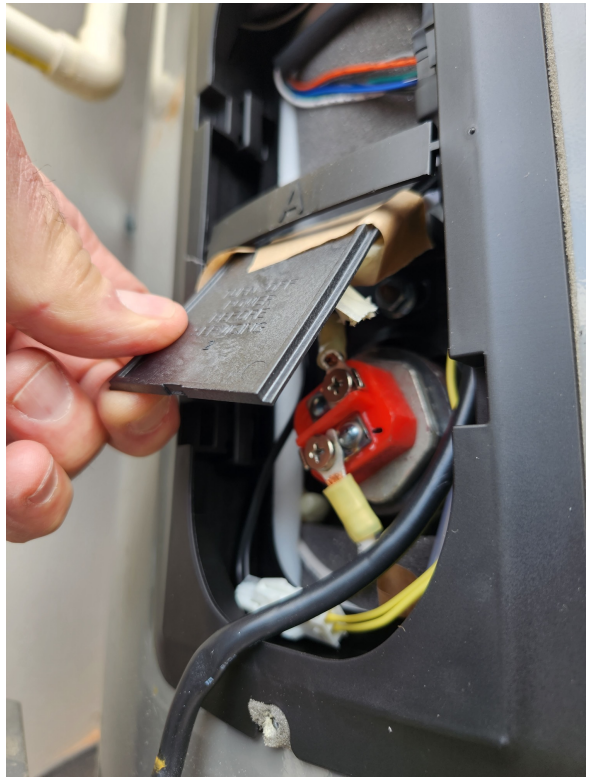
Notice the convoluted piping

Lessons to be Learned

- Modern water heaters are not a simple swap-out like they used to be.
- Trained plumbers are a must! Electricians, HVAC Techs.
- Recirc line losses can be a FAR bigger energy user than hot water use alone.
- Hot water is a ***system***, we pay a price when we forget that.
- Systems need to be designed & built so they are easy to maintain.
- New systems are often complex. We need to be prepared for this with skilled technicians.

And More!

- Insulation and right sizing pipes matters now more than ever.
- HPs work better with more storage (larger tanks), as they often have slower recovery.
- Airflow to and from HPs need to be carefully considered.
- Complex equipment must be monitored & *maintained* to work well.



Klein & Kliewer & Weingarten

See the ‘Amazing Shrinking Room,’ which shows how much air is actually needed to run a Heat Pump Water Heater efficiently: Northwest Energy Efficiency Alliance (NEEA) | Heat Pump Water Heaters…

Troubleshooting water heaters and other useful water heater info: https://www.waterheaterrescue.com/the-future-of-water-heating/possibilities.html

Questions? Contact us.

"Good buildings *aren't an accident*, they happen by design."
-Joe Lstiburek

Ron Kliewer
Sr. Building Scientist
Kliewer and Associates, LLC
ron@kabuildingscience.com
951-538-7705

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