

West Side Federation for Senior & Supportive Housing & Patterson-Kelley Boilers

An in-depth look into the application of Patterson-Kelley THERMIFIC boilers over a 25 year period. This whitepaper shows the longevity of PK equipment when properly and routinely maintained and some of the minor upgrades needed to keep a boiler room active for decades.

WSFSSH Background and PK Relationship

In the world of commercial HVAC equipment where there is so much focus on the latest and greatest technology, who has the best-looking marketing video and who offers the most bells and whistles, it's easy to lose sight of the most important metric: real-world results. It's these real-world results, spanning several decades and installations, that explain WSFSSH's decision to use Patterson-Kelley boiler and water heater equipment.

West Side Federation for Senior and Supportive Housing (WSFSSH) provides a vital service in the NYC community which is reflected in their mission statement:

- **Building** safe and sustainable affordable housing with supportive services
- **Enhancing** the independence and dignity of every resident
- **Supporting** the development of healthy neighborhoods
- **Preserving** and protecting housing for low income persons in our communities

This white paper features two WSFSSH installations and discusses the real-world results achieved with Patterson-Kelley equipment and local partnership with Accardi Companies.

Building #1: 2 Patterson-Kelley Thermific Boilers (Mfg. 1995)

The first building features two Patterson-Kelley Thermific model N-900 boilers originally manufactured in the

summer of 1995 and installed prior to the start of the '95-96 heating season. For 25 consecutive years, these 900,000 BTU/Hr natural gas fired boilers have been providing reliable hydronic heating AND domestic hot water to all the residents and WSFSSH staff.



25 years later: original heat exchangers, original burners, original gas valves, original blowers all intact. This happens when the owner invests in routine, preventative maintenance and is a testament to WSFSSH's commitment to their residents.

In early 2020, the boilers started to experience ignition/flame failures. Upon investigation by Accardi Companies technicians, it was determined the boilers were igniting reliably and combustion was tuned properly, but the original flame rod monitoring system on the steel core burner (below left) was not reliably monitoring and reporting back the flame signal:

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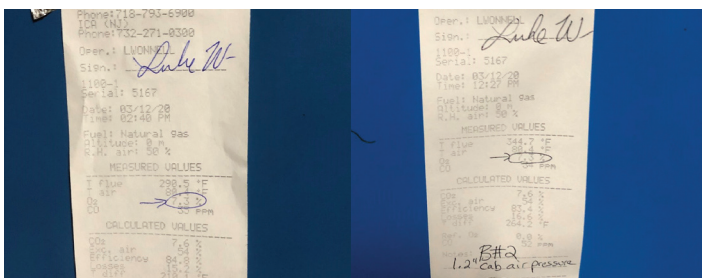


As the flame rod heats up during normal boiler operation, it has a tendency to migrate which reduces the flame signal strength as it moves further away from the burner cylinder. In order to improve the reliability of the flame signal and simultaneously reduce CO and NOx emissions, stainless steel mesh style burners were installed in both boilers, along with an external pilot assembly complete with UV flame monitoring (above right).

After installation, there was an immediate improvement in the flame signal strength at solid 5.0V as shown below:



After verifying the upgraded boilers were fully functional and all safety limits tested, combustion adjustment and efficiency testing was completed,



When these boilers left the Patterson-Kelley factory in 1995, their operating efficiency was 85%. Fast forward 25 years and Boiler #1 is still able to achieve 84.8% efficiency and Boiler #2 83.4% efficiency!

The image below shows the inside of the Patterson-Kelley Thermific copper finned-tube heat exchanger: thirty vertical copper-finned tubes arranged into three passes, ten tubes per pass. 25 years of year-round operation and all thirty tubes are present and accounted for and fully intact.



Building #2: 1x Patterson-Kelley Thermific Water Heater (Mfg. 1997)

The next building features QTY 1x Patterson-Kelley Thermific model D1900-2 water heater originally manufactured in 1997. For 23 consecutive years, this 1,900,000 BTU/Hr 2-stage (low fire/high fire) natural gas fired water heater has provided reliable domestic hot water in the spring, summer and fall months outside of the NYC heating season.



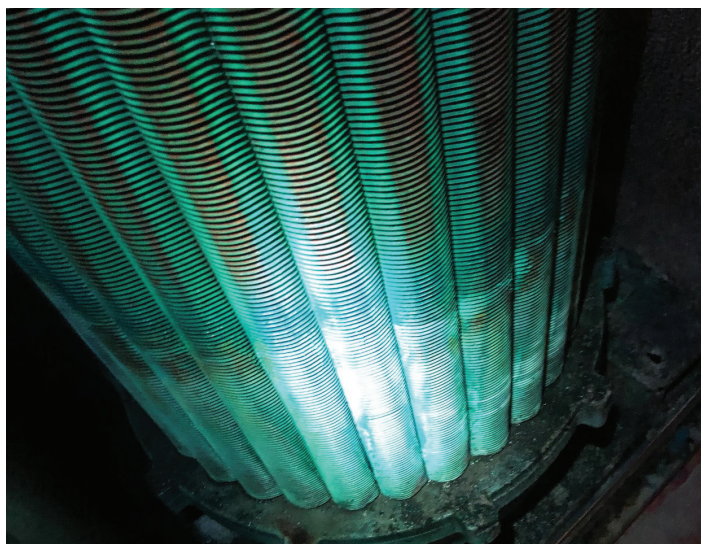
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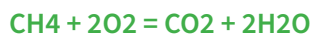
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23 years later: original heat exchanger, original gas valve, original blower all intact. The original steel core burner had been upgraded to the stainless steel mesh type, which dramatically reduces the CO and NOx emissions.

In early 2020, there was some concern by the facility staff that the water heater's heat exchanger may be compromised since there was water leaking onto the floor. Upon investigation and pressure testing by Accardi Companies technicians, the copper finned-tube heat exchanger was perfectly intact, but the water heater was subjected to heavy condensing-mode operation as shown by the green/white colored corrosion in the image below:



When Natural Gas is combusted inside a boiler or water heater, this is represented by the chemical formula below



In order to burn or "oxidize" one molecule of Natural Gas (primary component is Methane CH₄) two molecules of Oxygen (O₂) are required. The combustion process then generates one molecule of Carbon Dioxide (CO₂) and two molecules of water vapor (2H₂O) in the flue gas.

The temperature of combustion is roughly 2200°F, but when a nearby metal surface inside the water heater's

heat exchanger is 130°F or less, the water vapor (2H₂O) condenses back to liquid water. The water seen on the floor was not the domestic water leaking out of the heat exchanger, it was the liquid condensate forming in combustion due to the low operating temperatures.

After adjusting the operating temperature setpoint above condensing mode operation, the condensate problem was resolved once and for all.

Similar to Building #1, the decision was made to upgrade from the legacy flame rod monitoring system (below left) to UV flame monitoring technology (below right):



The original flame rod (above left) was producing very inconsistent flame strength signals compared to the upgraded UV scanner which reported a solid 5.0V flame signal at ignition, low fire, and high fire:



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After verifying the upgraded UV flame monitoring system was fully functional and all safety limits tested, combustion adjustment and efficiency testing was completed, the results of which are shown below:

O ₂	7.3%	Eff	85.6%
CO ₂	7.6%	Loss	14.4%
X _{air}	53%	CO	37P
T _g	261.6F	NO	6P
T _a	79.5F	NO _x	6P
ΔT	182.1F		
▶ RefO ₂			

When this water heater left the Patterson-Kelley factory in 1997, its operating efficiency was 85%. 23 years later and this water heater is able to achieve 85.6% efficiency!

Conclusion

As you research modern HVAC equipment, you will inevitably find recent white papers spanning a period of 6-12 months with picture-perfect installation photos where a particular building achieved X% reduction in their utility bills, and Patterson-Kelley is no exception. WSFSSH has made the decision to partner with Patterson-Kelley because of the real-world results they have achieved with P-K equipment over the past two decades plus. Accardi Companies provided WSFSSH with their expert equipment experience.

Reference Links:

For more information on the WSFSSH organization, visit the link: www.wsfssh.org

For more information on Patterson-Kelley boiler and water heater equipment, visit: www.pattersonkelley.com

For more information on Accardi Companies, visit: www.accardicompanies.com

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