

Water Quality Program



Patterson-Kelley

Water Quality Standards for Hydronic Boilers used in Multi-Metal Systems

WATER QUALITY STANDARDS FOR PEAK EFFICIENCY

pH	6.5 to 8.5 (6.5-9')
Alkalinity	<300 ppm
Copper	<3 ppm
Iron	<20 ppm
Aluminum	<3 ppm
TSS	<20 ppm
Chlorides	<100 ppm
Hardness	<200 ppm
Conductivity	<3000 uS/cm
Filtration Rate	10 microns

* Stainless
Do not use softened water



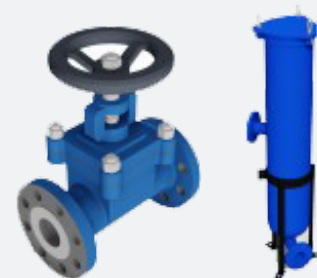
HARSCO Industrial Patterson-Kelley boilers are designed to be incorporated into any multi-metal hydronic heating system. All multi-metal hydronic systems require that attention be paid to water treatment. The chemical additives for any multi-metal system must be specifically formulated for use with all the various metals used in that system.

Any closed, hydronic heating systems should include a meter, to monitor water addition to the recirculating loop, and a filter, pursuant to ASHRAE Standard 189.1 and the AWT Handbook. Water added to a closed hydronic system should not exceed more than 10% of the system volume per year and meter readings should be recorded, at least monthly, to ensure system losses are minimized and corrective actions shall be taken when needed.

Treatment programs for multi-metal systems should meet or exceed the following generally accepted best practices water quality guidelines:

Prior to initiating any treatment program, a water sample of the proposed fill water should be sampled for analysis. Once filled and bled of air, a pH neutral, industrial cleaner for use in multi-metal systems should be used to clean the entire hydronic system. Samples of the system water with cleaner should be taken and analyzed to ensure proper cleaner strength. Once cleaned, the system should be flushed with fresh (fill) water until the system water is within 100 microsiemens in conductivity of the fresh water. When flushing is complete, a treatment program that is designed for use in that multi-metal system, after consideration of the metals it contains, must be used. Treatment programs should also comply with the standard water quality guidelines listed above.

Drain or purge the hydronic system without routing concentrated water treatment chemicals or debris into the boiler's heat exchanger



Water Sampling, Labeling, & Shipping Guidelines



SAMPLING

Proper sampling is necessary for water analysis test results to be accurate. The following guidelines should be followed when collecting water samples for analysis:

- ✓ Use of appropriate personal protective equipment (PPE) is required for all samples. Heavy rubber gloves and splash-proof goggles are required when collecting high temperature and/or highly acidic or highly alkaline water samples.
- ✓ Samples should be collected from a point that is representative of the water in the system – avoid dead legs.
- ✓ Flush sample points thoroughly. Allow the sample line to flow for a minute or more prior to collecting.
- ✓ Sample bottles should be well rinsed with representative sample prior to filling.
- ✓ Sample bottles should be filled completely to eliminate any air space and capped immediately after collection.

CLOSED LOOP SAMPLES

(Sample Bottle #1)

Samples should preferably be taken from an active recirculating line or operating heat exchange equipment (chiller, boiler, etc.). Closed loop samples can have a high alkalinity. Hot water closed loops can have high temperature and should be collected with care.

MAKE-UP WATER SAMPLES

(Sample Bottle #2)

Be sure the samples collected represents the water source that is actually used to replenish (make up) the systems being treated. In most instances, raw water samples can be obtained from a nearby faucet or tap that is used frequently. When obtaining water samples from pretreatment equipment, such as softeners, dealcalizers, or reverse osmosis units, make sure the sample is collected from active tanks or systems.

LABELING

1. Attach label to the sample bottle itself only after you have completed the information on the label, filled the sample bottle with the appropriate water, and dried the outside of the bottle (so information on the label stays clear).
2. Complete your company's name and address.
3. Note the unit's serial number and original "C" order number.
4. If you know the generic name of the water treatment products used (nitrite, molybdate, silicate, sulfite, etc.), add them to the "Products in System" portion.
5. Record the date collected.
6. Attach the "System Water" label and the "Make-Up Water" label to the appropriate sample bottles (do not attach to the mailer).

SHIPPING

DO NOT SEND SAMPLES TO HIP-K

Use the individual mailers/sleeves (containers) for each sample, and attach a premade shipping label. Use the carrier of your choice (FedEx or UPS) and ship to Chem-Aqua at:

MOHAWK LABORATORIES TECHNICAL ANALYSIS LABORATORY 2730 CARL ROAD IRVING, TX 75062

Water Quality Requirements

ALL BOILER INSTALLATION

1. Patterson-Kelley recommends installing isolation valves on both the boiler's return (inlet) and supply (outlet) pipe runs. These are used to hydraulically isolate the boiler from the system piping, which should be standard practice when flushing or adding concentrated cleaning chemicals.
2. Patterson-Kelley recommends installing purge valves on the system side of the boiler's isolation valves. These valves should be used to purge the hydronic system of debris and sediment prior to the initial start-up of the boiler equipment. Since the purge valves are located on the system side of the boiler's isolation valves, the debris and sediment will not be routed in direct proximity to the boiler's heat exchanger.
3. Patterson-Kelley recommends installing a standard mesh strainer (maximum 20 mesh) on the each boiler's return (inlet) piping. This is intended to prevent large particles, foreign debris, etc. from entering and obstructing flow or heat transfer through the boiler's heat exchanger. Each strainer should feature a manual blow-down valve in order to purge the debris from the strainer. NOTE: This strainer is not intended to remove fine particulate matter from the boiler system which will be discussed later in this document.
4. Patterson-Kelley recommends installing a water meter on the cold water fill piping. The intention of this device is to periodically monitor the amount of fresh water introduced into the system piping. It can also be used to establish a rough estimate of the total system volume during the initial fill. In general, the annual amount of fresh water make-up should be less than 10% of the total system volume. A water meter can also be useful to detect a leak in the hydronic system if you notice an unexpected increase in the volume of fill water.
5. Oxygen (O₂) elimination is critical to the longevity of any boiler system. Patterson-Kelley recommends installing an Air Separator (micro-bubbler style) that is capable of eliminating the dissolved Oxygen levels introduced from the cold water fill. In general, air separators are most effective when the boiler water is at highest temperature and lowest pressure.
6. Patterson-Kelley recommends installing an Automatic Air Vent on the Air Separator. In order for the Air Separator to continually purge the system of dissolved Oxygen, an Automatic Air Vent is preferred over a manual air vent.
7. Well in advance of the equipment startup, turn off all circulation pumps and close the isolation valves on each boiler's supply and return pipe runs. Connect a hose to the purge valves and run this hose to a nearby floor drain. Open each purge valve to flush out debris that is present in the water. This process may take several attempts until the discharge water is sufficiently clean. After successfully purging the system, make sure to open the boiler's isolation valves and turn on the circulation pumps.
8. Upon startup, Patterson-Kelley recommends collecting two water samples: one from the hydronic (boiler) loop and another from the cold water fill. It is best practice to circulate the hydronic system for at least one hour prior to collecting this initial water sample from the boiler loop in order to acquire a representative (blended) sample.

9. Within the first three months after startup, Patterson-Kelley recommends collecting a follow-up water sample from the hydronic (boiler) loop. This should be compared to the initial startup sample in order to determine any changes in pH, alkalinity, conductivity, etc. that may adversely affect the system performance.
10. Although the ongoing water treatment regimen will vary based on the supplier and application, Patterson-Kelley recommends a minimum annual water sample rate. The results of the annual water tests should be compared to past tests in order to determine any changes in pH, alkalinity, conductivity, etc. that may adversely affect the system performance. Under no circumstances should softened water be used if the system contains aluminum components.
11. Patterson-Kelley boiler equipment is designed for a maximum flow rate of 20°F ΔT at high fire. Please refer to the O&M for specific maximum flow rates per boiler model, but Patterson-Kelley advises against flow rates exceeding 20°F ΔT at high fire. Excessive flow rates can cause erosion of the boiler's heat exchanger or piping materials.
12. Patterson-Kelley boiler equipment varies in its minimum flow rate requirements. Please refer to the O&M for specific minimum flow rates per boiler model. Flowing below the minimum flow rates can lead to overheating of the boiler's heat exchanger materials and the formation of steam bubbles within the water passages.

RETROFIT INSTALLATIONS

- ✓ The primary concern in retrofit installations into existing boiler systems is the presence of suspended and dissolved solids. These are typically a result of deteriorating piping, fittings, or legacy boiler's heat exchangers. Patterson-Kelley recommends installing a side-stream filter (maximum 10 micron) to remove this existing particulate, sediment, etc. There are many different types of side-stream filters available, Patterson-Kelley recommends consulting your local water treatment provider in order to determine the best method for your particular application.
- ✓ If the existing hydronic system contains a significant amount of suspended and dissolved iron, Patterson-Kelley recommends the use of a side-stream filter with built-in magnet. This magnet helps attract and eliminate the iron particulate.
- ✓ Some water treatment additives/chemicals may cause leeching from the existing system piping. As more contaminants leech from the walls of the piping into the system water, the pH and the level of Total Dissolved Solids (TDS) may gradually climb to levels that will adversely affect the system performance. A side-stream filter will accommodate the increased TDS, but you may need to consult your local water treatment provider in order to combat the increased pH.

NEW INSTALLATIONS

- ✓ The construction of the hydronic (boiler) system piping involves many different operations that can introduce contaminants (weld slag, solder, flux, pipe dope, cutting oils, metal shavings, etc.). It is critical to properly flush the system well in advance of startup of the boiler equipment.
- ✓ In order to locate loose pipe connections, leaks, etc. after the initial construction of the hydronic (boiler) system piping, the Mechanical Contractor may fill and drain the system several times. During these initial fill-ups and drains, Patterson-Kelley recommends closing the boiler's isolation valves in order to separate them from the system piping. This will help limit the amount of dissolved oxygen and particulates that are brought in direct contact with the boiler's heat exchanger.



GLYCOL SYSTEMS

We are frequently requested to evaluate applications where propylene glycol is used in the system for freeze protection.

The accepted standard through the boiler industry has required a derating of the boiler, based on the percentage of glycol in the boiler water.

The de-rate factor is 0.2% for each 1% of glycol in solution.

For example, a 50% Propylene solution would require (0.2×50) a 10% derating



Water Quality Program for All Patterson-Kelley Boilers

Our main goal is to provide you with the best solution provider.

To ensure peak operational efficiency of HIP-K boilers, all water quality solutions should be administered by a certified, independent water treatment company. Each solution will have instructions and materials provided by the vendor. The vendor you engage will monitor compliance and provide support as needed.

Patterson-Kelley will provide guidelines based on best piping practices. These practices are a combination of in-house knowledge and the input from the various vendors that supply water treatment programs. We feel comfortable in recommending the vendors listed. The vendors have agreed to implement their individual programs including historical records of success involving multi-metal system treatment.

Patterson-Kelley assumes no liability in the performance of the treatment programs. This is borne by the vendor supplying the treatment program. We are confident that the program provided by the water treatment solution provider will keep your boiler operating at peak performance.

A treatment program for multi-metal systems that include either copper, aluminum or stainless steel boilers is required to maintain peak efficiency. Thermal loss in the heat exchanger up to 15% can be attributed to poor water conditions. This generally occurs within the first two years of operation but can occur in less than a year with extremely poor conditions.

The following vendors have been selected by Patterson-Kelley based on their track record in protecting boiler efficiency as well as extending boiler longevity:



Please refer to the included instructions from each vendor as to how to implement their program. Details as to how to obtain the chemicals and inhibitors needed as well as local dealers who can provide this service will be included in each packet. These options are open to any water treatment company you are currently working with. You can also choose to use a water treatment company affiliated with the vendor. This information is provided.

To summarize: Customers rely on us for our commitment to provide the right solution with the lowest total cost of ownership in the industry. The best boilers, protected by the best service in the industry. Water Treatment by companies well versed in multi-metal systems is a natural extension to complement what we offer. This will insure that our customers receive the highest level of technical and application support in the industry.