Technical Service Bulletin:

Heat Pump Water Quality Requirements

Models: SM, SM Split CS, CE, BP, SV, SV Split CS, SL, TW, BC, LV, LV Split CS, EP, CA, ES, LM, LM Split CS, EC, MC, WT, WW, TRS, RT

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Introduction

Water quality is important in both the performance and life of your unit. We recommend proper testing to ensure the fluid is suitable for use with water-source equipment (refer to table 1)

NOTICE
Failure to ensure proper water quality and flow rates can shorten the life of the heat pump and potentially void the warranty. A Cupro-Nickel coil is recommended for an open loop (well water) application although a Copper coil can be used where the water quality permits. See Table 1 for water quality limits for both Copper and Cupro-Nickel coils. Should any water characteristics exceed the limits in Table 1, severe corrosion is possible and the use of a separate heat exchanger between the well water and heat pump should be evaluated.

Maintaining proper water quality is important for ensuring the proper operation of the heat pump during it's expected service life. Closed loop and boiler/ tower systems water chemistry should be checked and maintained to ensure that corrosive elements, dissolved oxygen and pH levels are kept within limits. It is important to ensure that any additive, antifreeze or corrosion inhibitor that is added to the water loop is compliant with all applicable laws and regulations and is compatible with copper, brass and bronze alloys.

WARNING:
Ensure that all recommended safety precautions are followed when handling or adding chemicals to the water loop.

For open loop systems, water quality is very important. Refer to Table 1 which shows acceptable ranges for a variety of water quality factors. The three main concerns in open loop installations are scaling, corrosion and fouling.

In installations with hard water, scaling due to a buildup of carbonates on the heat exchanger wall can gradually degrade the heat pump performance over time. Heat pumps that are affected by scaling may exhibit low suction pressures in heating and high head pressures in cooling with a gradual loss of capacity and efficiency. Scaled heat exchangers can be cleaned by a qualified technician but care should be taken to avoid scaling in the first place.

To limit scaling, water flow rates should be kept at 3 gallons/minute per nominal cooling ton (a 10°F temperature rise in cooling) and care should be taken to avoid air in the water lines from suction side leaks. Cupro-nickel coils are generally recommended.

In installations where the water has a high chemical content, corrosion will be potential problem. In these installations the use of a Cupro-Nickel heat exchanger will be required, see Table 1. In addition to a Cupro-Nickel heat exchanger maintaining proper flow and keeping air out of the system will significantly reduce the risk of the system failure.

If water quality is outside of the values shown in Table 1 Water Quality Requirements, then a closed loop is recommended. Fouling due to iron bacteria can also pose problems in some open loop installations. The buildup of a slimy, orange-brown deposit is caused by iron bacteria, and can clog a water system as effectively as scale. Keeping the water line pressurized and free of air will inhibit the growth of iron bacteria. However, if iron bacteria are present in the water, it will form a deposit that will require periodic cleaning with an acid-chlorine solution. The use of a cupro-nickel heat exchanger will not reduce the growth of iron bacteria, but it will maximize the service life of the heat exchanger.

Water Quality Requirements

Table 1

Potential Problem	Water Characteristic	Acceptable Value with Water Coil in:	
		Copper	Cupro-Nickel
pH level	pH (Acidity/Alkalinity)	7-9	7-9
Scaling	Hardness ($CaCO_3$, $MgCO_3$)	< 350 ppm	< 350 ppm
	Ryznar Stability Index	6.0 - 7.5	6.0 - 7.5
	Langelier Saturation Index	-0.5 - +0.5	-0.5 - +0.5
Corrosion	Hydrogen Sulfide (H_2S)	< 0.5 ppm *	10 - 50 ppm
	Sulfates	< 125 ppm	< 125 ppm
	Chlorine	< 0.5 ppm	< 0.5 ppm
	Chlorides	< 20 ppm	< 150 ppm
	Carbon Dioxide	< 50 ppm	< 50 ppm
	Ammonia	< 2 ppm	< 2 ppm
	Ammonia Chloride	< 0.5 ppm	< 0.5 ppm
	Ammonia Nitrate	< 0.5 ppm	< 0.5 ppm
	Ammonia Hydroxide	< 0.5 ppm	< 0.5 ppm
	Ammonia Sulfate	< 0.5 ppm	< 0.5 ppm
	Dissolved Solids	< 1,000 ppm	< 1,500 ppm
Iron Fouling	Iron (Fe_2 + Iron Bacteria Potential)	< 0.2 ppm	< 0.2 ppm
	Iron Oxide	< 1 ppm	< 1 ppm
Erosion	Suspended Solids	< 10 ppm, < 6000 µm size **	< 10 ppm, < 6000 µm size **
	Maximum Water Velocity	6 ft/sec	6 ft/sec

* No "rotten egg" smell present at < 0.5 ppm H_2S

** Equivalent to 30 mesh strainer

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