HOSHIZAKI CARE
TECH-TIPS

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Volume 122
October 11, 1995

MOISTURE IN THE SYSTEM

Moisture vapor in the air is expressed in terms of relative humidity. When this vapor collects, a water droplet is formed. Moisture in any form or amount is considered the enemy of a refrigeration system. This is due to its effects on system operation and possible corrosive damage to internal components.

Water or moisture vapor is a formidable opponent because it can enter an open system easily and is hard to remove. Take into consideration that in an ice machine, there is always water and high humidity present. There are several ways for moisture to enter into a refrigeration system.

Moisture mainly enters through the gauge ports due to a failure to purge the manifold and hoses properly. Also, moisture can enter through a leak in the system or possibly through ports left open too long during a service repair. Remember that new HFC refrigerants require the use of synthetic oils. This will become more prevalent as manufacturers change over to the new synthetic oils which are more **hygroscopic** than mineral oil. This means that synthetic oils absorb and retain moisture much faster than mineral oil. Lastly, moisture can enter a system if contaminated refrigerant is used.

Some symptoms of moisture in a system are as follows: Depending on the amount, moisture can cause a "freeze-up" internally in the system. This is caused when moisture is picked up by the refrigerant and travels through the system. The moisture forms ice crystals at the point of restriction (the TXV) which slows or stops the flow of liquid refrigerant.

When additional restriction occurs at the expansion valve, it causes a reduction or complete loss of refrigeration. This freeze-up can melt as the valve body warms, allowing the moisture to pass through the TXV only to return again and repeat the freeze-up process. The results is intermittent refrigeration.

Moisture can also cause internal corrosion to the system components. When moisture mixes with refrigerant, acids form. In systems using CFC or HCFC refrigerants, the chlorine and water will form hydrochloric acid through hydrolysis. Acid corrodes the internal parts and can break down the lacquer coating on the motor windings. Once the lacquer breaks down, it can flow through the system plugging valve orifices. The windings can short causing a motor burn-out. Corrosion is also accelerated by additional heat build up due to added friction on corroded metal parts or oil break-downs.

Refrigerant oil is also affected by moisture. As you know, when oil and water mix a chemical reaction takes place. This reaction causes the oil to sludge thus reducing its lubrication qualities (oil break-down). Lack of lubrication allows additional friction which eats away at the metallic parts and causes excessive heat. Fine metal shavings mix with the sludge and flow through the refrigeration system. Wax also separates from mineral oil. Sludge and wax can plug strainers, driers, hot gas and line valves, bypass capillaries, and expansion valves. Since the sludge contains acids, it can corrode anything it sticks to increasing the system damage.

Now that we know the damaging effects of moisture, we should discuss how to remove it from the system. This will be covered in our next issue.

PSC MOTORS

Hoshizaki uses Permanent Split Capacitor (PSC) motors for condenser fan and pump motor applications. PSC motors have a moderate starting torque and a good running efficiency when compared to the basic split phase motors. The use of PSC motors adds to the overall unit efficiency and provides for longer component life.

A PSC motor uses a run capacitor in series with the start winding. This capacitor shifts the current flow for the start winding out of phase with the run winding. This creates the magnetic field which causes the rotor to turn. The black run capacitor used on our pump and fan motors is a dry electrolytic type. It is located either on the fan motor bracket or inside the control box for pump motors.

PSC motors have common, run, and auxiliary wires. The auxiliary winding will have a higher resistance reading when compared to the run. Our PSC motors have an internal thermal overload in the common circuit. The three most common failures that occur in a PSC motor are in the bearings, windings / overload, or a capacitor.

The motor bearings are sealed and can fail due to wear or moisture contamination. Bad bearings will usually squeal, seize up, or the rotor will not turn evenly because of rough spots in the bearings or shaft.

Windings can fail if the motor overheats, overloads, or is wired improperly. Check the windings with a good quality ohmmeter for an open, short or grounded condition. Remember that the PSC motor has an internal overload that will open if the motor overheats. If you are checking a motor that is hot to the touch, allow it to cool down before diagnosing it as an open winding.

The run capacitor provides the extra power in the start winding to spin the rotor in the right direction A bad capacitor can cause high amp draw, overheating, a slow running speed, or cause the motor to hum and not start. Always check the run capacitor using proper capacitor checkout procedures before condemning a PSC motor. Most replacements are shipped with a new run capacitor which should be installed with the new motor.

The use of PSC motors definitely adds value to the KM line. You should keep in mind that proper PSC motor diagnostics are important when trouble-shooting problems with KM pumps and condenser fan motors.

KM TRANSFORMERS

All KM units use a control transformer. On early models which used “A” or “B” control boards the control transformer was physically mounted on the control board. Consequently, if the transformer failed, the complete board had to be replaced. Inspecting the “reasons for control board failures” lead to the development of the “C” and Alpine boards. Now, a separate control transformer is located in the control box.

Over a period of approximately 7 years, we have used 5 different control transformers for various reasons. To keep it simple, we offer **1 universal control transformer replacement.** The part number for this replacement is **3U0172-01.** This transformer has a 115 volt primary and a 12 volt secondary. It comes with a pre-wired plug on the secondary which snaps into the K2 board connector.

Three phase and 50 cycle units include an additional power transformer to provide a 115 volt circuit for the 115 volt components used. This transformer is necessary since the supply wiring for these applications does not include a dedicated neutral wire. Depending on the model, there are either 3 or 4 wires. Since there are four different sizes of power transformers used between models, you must use the proper replacement by part number. Be sure to follow the wiring diagram

and the voltage markings on the transformer when replacement is necessary.

COMING NEXT MONTH...

1. Removing Moisture
2. Dispenser gear motors
3. New Products