



# HOSHIZAKI CARE TECH-TIPS

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Danny Moore  
Editor

Hoshizaki America, Inc.  
618 Hwy. 74 South  
Peachtree City, GA 30269  
Care Facsimile: (800) 843-1056

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## ***COMPRESSOR REFRIGERATION DIAGNOSIS***

Diagnosing a compressor refrigeration problem on an ice machine requires several preliminary checks. These checks must be done prior to condemning a compressor and will help avoid a mis-diagnosis.

Before we look at the pre-checks, it is important to understand what the compressor is designed to do in the refrigeration system. The compressor pumps a specified refrigerant through the system providing a specific ratio of suction to high side pressures. The other components are sized to balance the system providing the desired refrigeration effect. If this compression ratio changes, the net effect is inefficient operation. This will be evidenced by improper operating pressures.

A clean evaporator and condenser (water or air cooled) is necessary to achieve proper heat transfer. Scale or dirt build-up on either component can affect the operating pressures and cycle times of an ice machine. Assure proper refrigeration load by checking the water pump for adequate water flow. Also check the condenser fan or the water regulating valve to affirm a consistent condensing median.

The refrigerant charge is critical for proper operation (reference Critical Charge article Tech Tips Volume 121 Sept. 95). Always assure that the charge is weighed in according to the nameplate **type and amount** before condemning a compressor.

Once the correct charge is evident, check for proper operation of the TXV. It should open and close as the evaporator load varies from warm to cold. Placing ice on the TXV bulb should result in closing the valve. Likewise, warming the bulb should open

the valve allowing an increased refrigerant flow. Check for any restrictions in the refrigerant system that would affect the operating pressures. Look for temperature differentials across the liquid line drier, refrigerant header or distributor, line valve, and any refrigerant check valves in the system.

An increase of load on the evaporator can influence operating pressures and cycle times. Make sure the insulated evaporator covers are in place so that warm air cannot enter the evaporator compartment. Check the inlet water valve operation. If the inlet water valve leaks, the load on the evaporator will increase causing longer freeze cycles.

Once these items have been checked, if improper pressures and cycle times still exist, the compressor is suspect. You will find that faulty compression can be caused by internal mechanical problems or valves that are weak, cracked, or broken.

A mechanical failure could be anything from a dragging rotor to tight bearings. Anything that could slow down the compression stroke can reduce the compression ratio affecting basic refrigeration. These failures generally show up with symptoms of excessive noise, vibration, improper amp draw, breaker trips, or shutdown on internal overload.

Bad valves also produce pressure problems in the system. Broken valves, either suction or discharge, will cause higher suction and lower discharge pressures. The pressures usually balance out in this situation. Cracked or weak valves will result in higher low side and lower high side pressures and a lower discharge temperature. You will still have a compression ratio in this case, although it will be

lower than normal. You may actually have limited ice production however, the harvest times will be longer than normal due to the lower discharge temperatures. The amp draw will decrease and the compressor temperature likely will increase. As the valves become weaker the ratio decreases to the point that basic refrigeration is not possible.

Remember that bad compressor valves could be the result of liquid floodback. Since floodback can be caused by a bad TXV, a severe freeze-up or a refrigerant overcharge, a thorough system check should be performed. Operating with an undercharge can also damage the valves due to an increase in the compressor temperature which causes carbon build-up and overheated valves. To determine weak valves some suggest conducting a vacuum check first. Copeland however, recommends checking the amp draw of the compressor against the compressor specifications. The reason for failure must be determined and corrected before the unit is restarted.

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### ***HUGE CUBES***

When diagnosing an ice machine, there are many obvious symptoms that will point you in the right direction. One such symptom can be found by inspecting ice in the bin. Odd shaped ice cubes generally point to water related problems. By inspecting the shape of the cubes, you can know which area to check first.

Here's an example: A customer calls to complain of running out of ice (low production). Upon arriving at the site, you question the owner and find that the ice drops about once an hour. The owner also mentions that the

cubes appear bigger than normal. Looking in the bin, you find larger than normal or huge cubes. These cubes are thicker and taller than they should be and may roll up on the edges.

You remember that KM series control boards styles B, C, and Alpine have a 60 minute back-up freeze protection timer. This timer will automatically switch the unit to harvest, if the float switch does not open within 60 minutes. A 60 minute freeze time will utilize all the water in the reservoir to make ice and possibly cause the pump to suck air or cavitate towards the end of the cycle. Adding two and two together, 60 minute cycles plus huge cubes equals a float switch stuck in the up or closed position. Likely, the float switch is sticking due to scale build-up. You should clean the float switch with ice machine cleaner and check the operation with a quality ohm meter. Simply replace a float switch that doesn't check properly after you clean it.

There is another rare possibility in this case. This should be checked after you eliminate the float switch. Check to see if the inlet water valve leaks a little additional water into the reservoir. Just enough to cause a 60 minute cycle and huge cubes. You will find that in most cases, if a water valve leaks, it adds so much water to the reservoir that the ice bridges together on the entire evaporator. If the water valve is stuck wide open, the reservoir water temperature is tempered so much by the incoming water that no ice is produced. You will detect either ice bridging or a fully open water valve immediately.

Huge cubes will generally harvest properly unless combined with a dirty evaporator or low water flow. If all cubes do not fall during harvest, a freeze-up could occur. In this case a thorough preventative maintenance cleaning and external filter check should be completed.

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### ***INLET WATER VALVE SCREEN***

This is just a reminder that Hoshizaki inlet water valves have an 80 mesh screen in the inlet. This water screen catches the big trash that might enter the ice machine so that it does not plug the water distribution system. This

is an important check point when conducting a preventative maintenance cleaning. A plugged screen will reduce the water flow which could affect harvest and production.

The water valve screen is replaceable. The replacement part is #SP9200010. Be sure to replace the screen if it gets damaged because it definitely serves a useful purpose.

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***COMING NEXT MONTH...***

1. Compressor Changeout
2. Universal KM Float Switch
3. Drier Replacements