



# HOSHIZAKI TECHNICAL SUPPORT TECH -TIPS

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## *IM-51BAF SEQUENCE OF OPERATION*

While similarities exist between the IM and KM operation, you will find that the IM has a different approach to ice making. The IM has a horizontal evaporator. It has moving parts that require different control systems. This article will explain the complete sequence of operation for the IM51.

When the power switch is placed in the "ICE" position, the initial harvest cycle begins. The compressor, hot gas valve, and actuator motor are energized. The compressor starts in harvest so that it starts under a no-load condition.

The actuator motor turns (CCW) to lower the water pan down, away from the evaporator. The actuator motor turns two cam arms. These cam arms attach the water plate to the evaporator assembly on either side by two tension springs. The front cam arm includes a switch lever that operates the actuator toggle switch. When the water plate is completely down the switch lever moves the actuator toggle switch to the left. This allows the control board to energize the inlet water valve and condenser fan motor and de-energize the hot gas valve. It also sets the actuator motor circuit so that the actuator motor reverses (CW) and raises the water plate upward.

When the plate reaches the evaporator, the cam arm switch lever moves the actuator toggle switch to the right position. This stops the actuator motor and sets the circuit up to lower the plate in the next harvest cycle. The toggle switch energizes the pump motor

and the control board de-energizes the inlet water valve. The unit is now in the freeze cycle.

The freeze cycle is controlled by a thermistor which is mounted at the evaporator outlet. The pump is now spraying water up into the evaporator cells to form the square IM cubes. The average freeze cycle will be around 20 minutes. Once the thermistor senses  $-9.4^{\circ}\text{F}$  on the evaporator, a normal harvest occurs.

The  $-9.4^{\circ}\text{F}$  temperature signals the control board to energize the actuator motor circuit. The actuator motor now turns (CCW) to lower the water pan. The switch lever moves the actuator toggle switch to the left. The control board energizes the inlet water valve and hot gas valve and de-energizes the condenser fan motor. The toggle switch sets the actuator motor circuit to raise the water plate and the control board waits. Unlike the initial harvest, the normal harvest is controlled by the thermistor. When the thermistor reaches  $59^{\circ}\text{F}$ , the control board energizes the actuator motor circuit to raise the plate. When the plate reaches the evaporator, the actuator toggle switch is moved back to the right and the freeze cycle begins again. The average harvest cycle is about 3 minutes.

The unit will continue through the freeze and harvest cycle until the bin control shuts down the refrigeration system. The controls and moving parts in the IM machine may sound complicated however, once you understand the sequence, you will find it is a simple machine to service and maintain.

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## ***R-12 REFRIGERANT CONVERSION***

Last issue we discussed conversion of R-502 models. This issue, we will cover converting R-12 products. R-12 refrigerant was used in some IM, flaker, and DCM products prior to 1993. We get many questions as to what refrigerant to use when servicing the R-12 refrigeration systems. Here are our recommendations for all R-12 units along with some tips for conversion. There are many similarities with the R-502 refrigerant conversion.

As recommended with R-502 systems, if you have R-12 still available, use it. The time and effort you save will easily override the refrigerant cost. You will also find that the unit will operate closer to design specifications when using the OEM refrigerant. If you can't get R-12, we recommend **R-401A /MP-39**. This is our only recommendation.

When converting an R-12 unit to R-401A you must follow the generic conversion instructions provided by either the refrigerant or compressor manufacturer. (See Dupont # ART-5 or Copeland # 93-02-R2 retrofit guidelines.) They instruct you to use Alkylbenzene oil in the system. This means that you will need to change the refrigerant oil in the compressor. Like R-502 models, a new replacement compressor from Hoshizaki will have a mineral oil charge. If you convert to R-401A you must drain the mineral oil out and replace it with the same amount of Alkylbenzene oil. This is best done by inverting the compressor to drain the mineral oil then refilling it with the same amount of Alkylbenzene oil prior to installing it in the unit.

As for driers, replace the existing drier with a standard Hoshizaki drier or a properly sized non- OEM drier designed for use with R-401A. Models using R-12 require a 3 cu. in. drier.

When charging the system with R-401A, it is important to remember that it is a near azeotrope mixture. This means that it must be charged in a liquid state through the high side or flashed to the low side using a liquid dispensing device. The conversion guidelines instruct you to start with 70~75% of the R-502 amount by weight and add a little as needed up to 95% for

optimum the charge. The optimum charge amount will depend on the age and condition of the equipment. If a leak occurs with R-401A in the system, a complete evacuation and recharge with virgin refrigerant is required.

No changes are needed for the TXV. You will find that the suction pressure increases slightly and the high side pressure increases by as much as 20%. The high-pressure switch will provide protection a little sooner with R-401A however, it will work fine in this application.

Lastly, this is the only R-12 conversion refrigerant recommendation by Hoshizaki. As with an R-502 conversion, we understand that there are other possible alternatives available. There are so many different choices that we have not taken the time to do the additional testing needed for approvals. Since the unit is likely out of the warranty period you could use any compatible replacement you have experience with. The only drawback is that we have no experience or data for other alternatives.

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### ***SERVICE TIP***

The bin control on the IM-51BAF is a normally open magnetic proximity switch. This switch must close to shut the unit down. You will find that this is completely opposite from the thermostatic bin control operation. When the proximity switch closes, it supplies voltage from the 24-volt transformer to pins 6 and 3 on the K2 board connector. This causes the control board to shut down the unit.

The operating magnet is mounted in top of the switch actuator. It has a snap on cover and can be removed for cleaning or replacement. There is a top and a bottom on the magnet. The bottom is painted white and must be installed pointing down. There is also a dimple in the cover, which will only allow the magnet to be installed one way.

The bin control operation is timed. When operating, the unit will shut down when the bin control arm is held over for 10 seconds. When the arm is released, the unit will restart within 80 seconds. This timing is done

through the control board and provides compressor short cycle protection.

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

1. IM Control Board Settings
2. Thermistor Checkout
3. Service Q & A

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