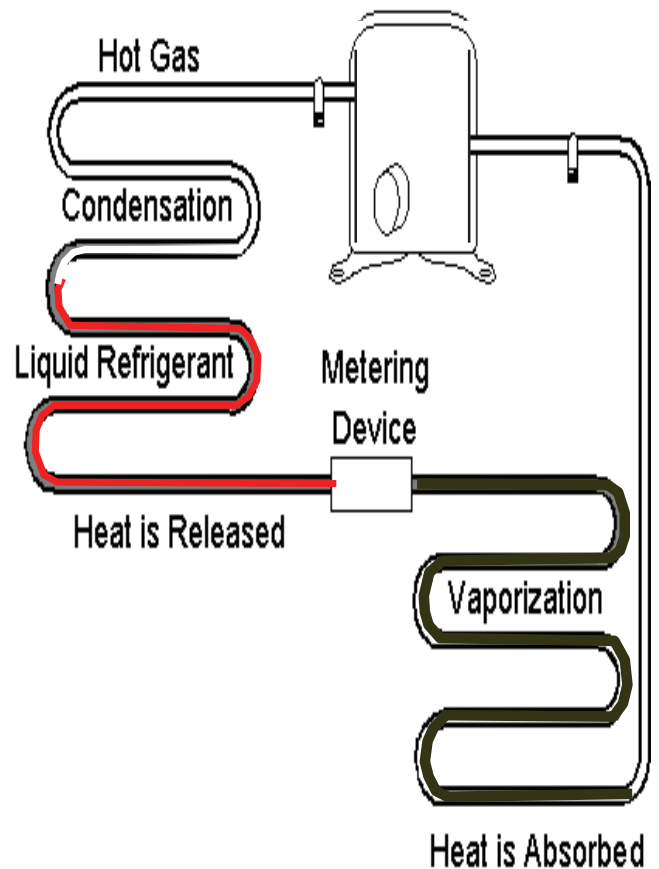
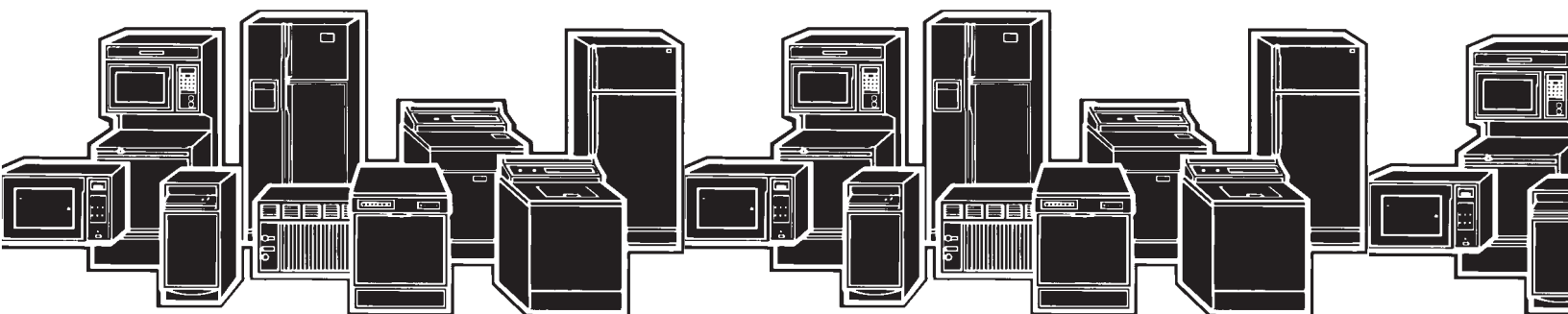




SEALED SYSTEM DIAGNOSIS



TRAINING MANUAL
Part No. 8178688



FORWARD

The following training manual information is provided to make you more knowledgeable about sealed system diagnosis.

Training manual information is designed for the experienced service specialist. It keeps you advised of the most recent improvements and product changes, and allows you to service these products more efficiently.

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— NOTES —

Sealed System Diagnosis

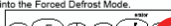
Technical Sheet

Always refer to the technical data sheet or Service Manual for the design specifications of the refrigerator under test

Service Specifications

WARNING
To avoid risk of electrical shock that can cause death or severe personal injury, disconnect unit from power before servicing unless tests require power. Discharge capacitors through a 10,000-ohm resistor before handling. Wires removed during disassembly must be replaced on correct terminals to ensure proper grounding and polarization.

- Release the refrigerator door light switch.
- The control will display Fd to confirm entry into the Forced Defrost Mode.

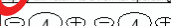


- Entry is confirmed by pressing the Refrigerator Down key once more. The unit is in the Defrost Mode. Note: All control functions will be turned off (Compressor, Defrost, Evaporator Fan, the damper will remain in its current position).

- The control will default to the short run period test as shown below.
- Note: You can toggle between the (S)hort and (L)ong test mode by pressing the Refrigerator UP key. Long Test mode is used for factory test and should not be used in the field.



- Once the desired mode is displayed, confirm the forced defrost by pressing the Refrigerator Down Key once. The defrost will begin immediately and the control will return to a normal operating display with set point values.



- Close the Refrigerator Door(s). You are in the defrost mode.

Note: Forced Defrost mode can be exited at any time prior to step 7 by closing the Refrigerator Door(s).

Service Test Mode
The service test functions are performed using the refrigerator display and keypad. Enter the Service Test Mode by performing the following sequence of events:

- Hold the refrigerator door light switch closed.
 - Press the Refrigerator Temperature Up keypad 3 times consecutively.
- Note: The 3 Keystrokes must be done consecutively and within 10 seconds.



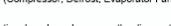
- Release the refrigerator door light switch.
- The control will display SE to confirm entry into the service mode.



- Entry to the Service Menu is confirmed by pressing the Refrigerator Up key once more.
- The control will display its software version for 3 seconds.



- Following the software revision display the freezer display will read the first test number in the diagnostic tree. The refrigerator display will be blank.



- You are now in the SERVICES TEST operational mode and may use the diagnostic tests. The Service Test Mode can be exited at any time by closing the Refrigerator Door(s).

Bottom Mount Refrigerator—Technical Information

AFD2535DEB AFD2535DEB0, AFD2535DEQ AFD2535DEQ0,
AFD2535DES AFD2535DES0, AFD2535DEW AFD2535DEW0,
MFD2560HEB MFD2560HEB0, MFD2560HEQ MFD2560HEQ0,
MFD2560HES MFD2560HES0, MFD2560HEW MFD2560HEW0

Due to a possibility of personal injury or property damage, always contact an authorized technician for service or repair of this refrigerator.

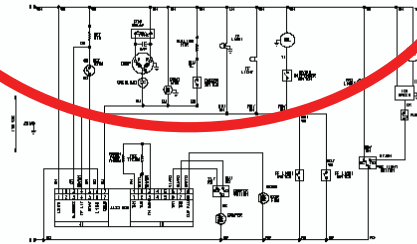
CAUTION
All safety information must be followed as provided in Service Manual 18022769.

WARNING
To avoid risk of electrical shock that can cause death or severe personal injury, disconnect unit from power before servicing unless testing is required. Discharge capacitors through a 10,000 ohm resistor before handling. Wires removed during disassembly must be replaced on correct terminals to ensure proper grounding and polarization.

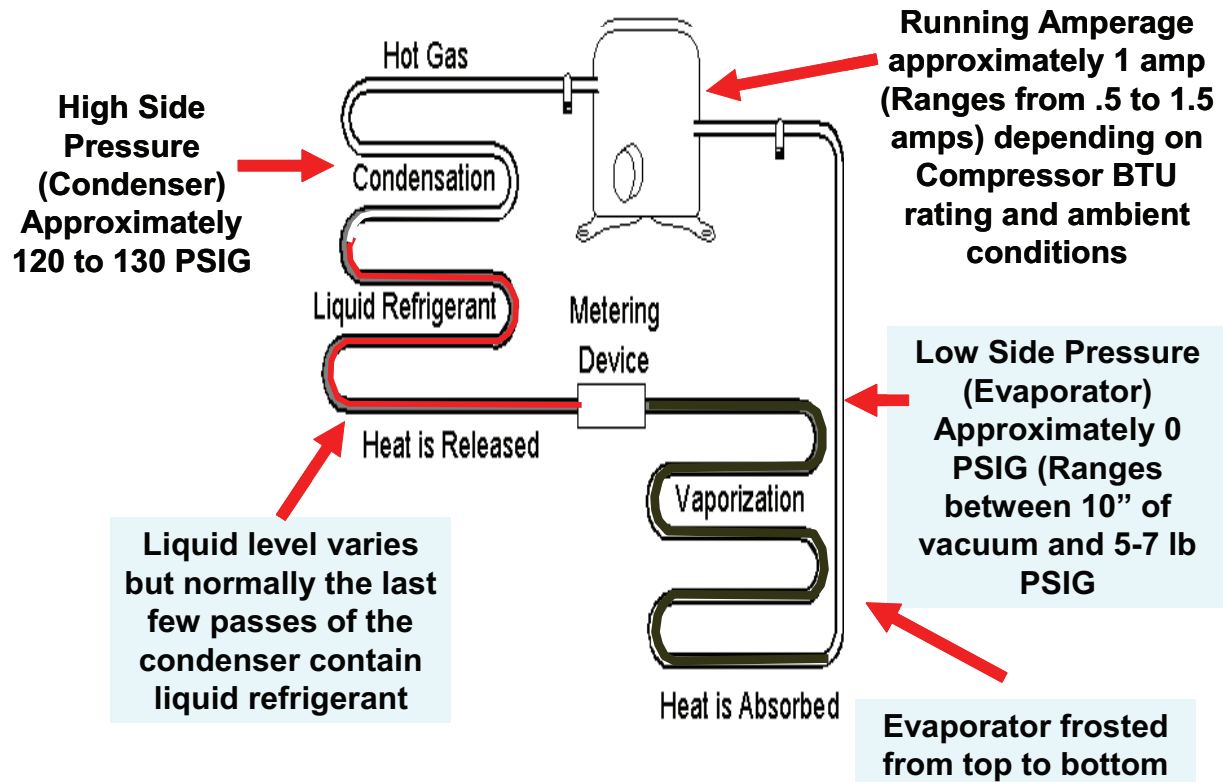
Ambient °F	No-Load Performance, Controls in Normal Position						Refrigerator Center Compartment Average Food Temperature ±3°F	Freezer Compartment Average Food Temperature ±3°F						
	Kwh/24 hr ±0.4		Percent Run Time ±10%		Cycles/24 hr ±2%									
70°	70°	90°	110°	70°	90°	110°	70°	90°	110°					
25 cu ft	1.6	1.60	2.3	28	48	65	35	38	25	38	35	0	0	0

Ambient °F	Temperature Relationship Test Chart											
	Evaporator Outlet ±3°F	Evaporator Inlet ±3°F	Suction Line ±7°F	Average Total Wattage ±10%	Suction Pressure ±2 PSIG	Head Pressure ± 5 PSIG						
70°	70°	90°	70°	90°	70°	90°						
25 cu ft	-20	-17	-20	-17	85	105	135	140	6”(Vac.)	0	87	137

Schematic



Normal Operating Cycle



Normal Operating Cycle:

Before we examine common sealed system failures, let's briefly review the normal operating conditions of a R-134a system. The conditions depicted above can be used as a basis of comparison for deviations from the norm caused by a failure.

Specifications of a typical R-134a refrigerator:

Freezer compartment temperature- Normal range is 0° F, +/- 3° F

Fresh food compartment temperature- Normal range is 38° F, +/- 3°

Compressor run current- Depending on BTU size of compressor and how hard it's working, current draw will range from about .5 amps to 1.5 amps.

Low side pressure- 0 PSIG. Actual pressures will range from 10 inches of vacuum at startup to about 7-8 PSIG in high ambient conditions or with an extreme heat load.

High Side pressure- 125 PSIG- Again, depending on conditions, actual pressures will vary and may range from 100 PSIG under very low load conditions to 150 PSIG in high ambient or high load conditions.

Frost pattern- Full (after the unit has been running)

Defrost - Tube and fin evaporators must be defrosted on a regular basis to prevent ice from plugging the coil. (Frost on the coil is normal. Ice buildup on the coil indicates that a defrost failure has occurred.)

Condenser liquid level- Varies but last 2-3 passes of condenser should feel cooler to the touch – if heated the tubing should remain the same temperature. The liquid refrigerant will absorb the heat as it changes state.

Condenser temperature- Warm at the inlet, cooler at the outlet

Compressor temperature- The dome (top) of the compressor will range from warm to very warm to the touch.

Compressor discharge line temperature- Warm to the touch (the greater the heat load and ambient, the warmer the line should feel)

Suction line temperature- Ambient, plus or minus a few degrees

Proper diagnosis of any sealed system begins with a thorough understanding of its normal operating characteristics. Deviations from the norm alert the technician to the possibility of a system malfunction.

The system often reacts to external forces in such a manner that makes it appear that a system failure has occurred. In reality, the system is behaving exactly as it should for the conditions that it encounters.

Environment- Refrigerators are intended to be used under normal household conditions- that is, they should be operated in temperatures that range between 55° F to a maximum temperature of about 95° F. The refrigerator may still function outside of this range but performance will be negatively impacted.

Loading Requirements- Over and under-filling of either the freezer or fresh food compartments with food should be avoided. Over-filling could hamper internal air movement. Under-filling could cause erratic compartment temperatures.

Operating Voltage- 120 VAC, +/- 10%. Voltages that are more than 10% over or under the prescribed voltage may destroy the compressor motor.

Improper voltage. Most compressors are rated for 120 VAC, +/- 10%. Any voltage over 132 VAC will shorten the life of the compressor. Any voltage under 108 VAC will absolutely destroy it. Low voltage causes compressor start problems and, as with any motor, the compressor draws high current until the motor is up to speed (and counter EMF is generated). Fortunately, most compressors are protected by an external device (overload) which kills power to the motor in the event of an over current or over heating condition.

The difficulty in diagnosing voltage problems is that the conditions that caused the system failure may not be evident when the technician arrives at the customer's home. During hot summer months it's not unusual for power companies to experience brownout conditions. Voltage could drop below 100 VAC during peak current demands. By the time the technician reaches the home, the voltage may be back to normal. Verifying that the failure was caused by low voltage will not be easy under these conditions.

Air movement- All fans must be operational. If static condenser is used, there must be sufficient air space around the condenser to allow for convection cooling. Forced air condensers need to be vacuumed from time to time to prevent lint, cat hair, dog hair, etc. from plugging the coil and reducing cooling capacity

More:

Proper air flow. Since most new refrigerators use tube and fin evaporators and forced air condensers, fan operation is critical. If the evaporator fan stops, heat transfer ceases and the freezer temperature rise. Likewise, a condenser fan failure inhibits the condenser's ability to release its heat and cooling capacity is severely diminished.

The system reaction to the lack of air movement depends on which of the fan motors fails.

Evaporator fan: Since the refrigerant is not absorbing heat, system pressures drop. Lower pressures mean that the compressor does not have to work as hard and current draw is reduced.

Note: Failure of one of the defrost system components will have the same effect as the evaporator fan stopping. If the frost is not removed regularly from the evaporator, the frost turns into and ice which eventually plugs the fins of the coil. Air movement through the coil stops. Additionally, the ice acts as an insulator, further reducing the transfer of heat to the refrigerant. Just as with a stopped evaporator fan, system pressures and current draw decrease with a plugged evaporator.

Condenser fan: System pressures increase since the refrigerant is not able to release its heat. Higher pressure means the compressor has to work harder and current draws increases. If the compressor gets hot enough, the overload may open the run circuit to the compressor and stop all cooling. **Note:** A condenser that is plugged with dog or cat hair will have much the same effect on sealed system performance as a stopped condenser fan motor.

Ambient Temperatures. High ambient temperatures (the temperature of the air that surrounds the exterior of the refrigerator) place an undue strain on any sealed system. Some of the negative effects are:

Uses more energy- Warmer air holds more moisture. Every time the customer opens either of the compartment doors, the cool dry air inside the refrigerator drops to the floor and is replaced with warm moist air. Not only does the system have to drop the sensible temperature of the air but a great deal of energy is used to remove the latent heat that is trapped in the moisture.

The air blowing across the condenser is warmer. This reduces the temperature differential between the condenser and the air and reduces the ability of the refrigerant to give up its heat.

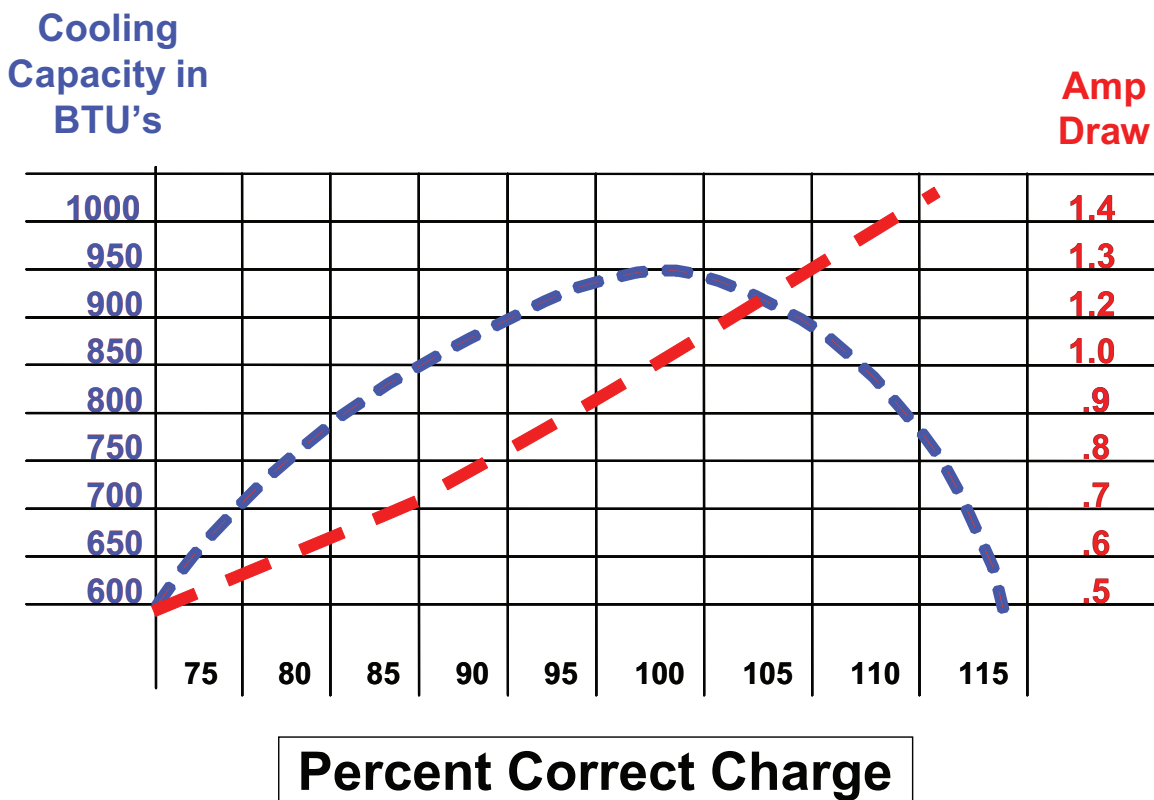
Pressures increase. The added heat load, in combination with the warmer condenser temperatures, increases both the low and high side pressures. Higher pressures mean that the boiling and condensing points of the refrigerant are raised. Not only is the refrigerant's ability to absorb heat reduced but the higher condenser temperature makes it more difficult for the refrigerant to release its heat.

Compressor works harder. Greater heat load in conjunction with higher pressures cause the compressor to draw more current.

Internal Factors Affecting System Performance

- Low Charge
 - High Side Leak
 - Low Side Leak
 - Undercharge – Very rare
- Overcharge
- Restrictions
 - Partial
 - Full
 - Floating
- Inefficient Compressor - Very Rare
- **Has the System been entered? If so, all the above factors should be considered.**

Refrigerant Charge



Refrigerant Charge

The system has to be properly charged with the factory recommended refrigerant. If the system loses any of its refrigerant, cooling capacity will be affected.

A system leak can take several years for enough refrigerant to escape from the system to affect the performance of the unit. A modern refrigerator is typically charged with less than 6 oz of refrigerant. That's not a whole lot, especially compared to the older R-12 units that could hold as much as 20 or 22 ounces of refrigerant. But even with these smaller charges, if the system only loses 1/2 oz per year, it could take 2 or three years before the customer notices a problem.

The chart below shows what happens to cooling capacity of a 950 BTU compressor when a system charge drops below 75% of nominal. Notice that at 75% of correct charge, the cooling capacity (dashed line) is only about 600 BTUs. The system is undercharged by 25% but the BTU rating drops by 36%.

Leaks normally occur at the joints where the system tubing is brazed together. If a leak occurs on the suction side of the compressor, this is referred to as a low side leak. If the leak occurs on the discharge side of the system, this is referred to as a high side leak. Low side leaks are especially harmful to a system because once the low side drops into a vacuum, the compressor begins to pull air from the kitchen into the system (through the hole in the tubing). Air is detrimental for a couple of reasons:

Air is a non-condensable. The air travels through the system and once in the condenser, no amount of pressure or cooling will force the air to condense into a liquid (thus the non-condensable label). Pressure in the condenser rises significantly and cooling stops.

The air that enters the system contains moisture. As we will learn later in this section, moisture creates its own set of problems for a sealed system.

If the system has been previously repaired and incorrectly charged, an overcharge can severely affect the operation of a refrigeration system. Just as an undercharge reduces the system's ability to absorb heat, an overcharge has a similar impact on cooling efficiency. Moreover, overcharges have the added impact of greatly increasing power consumption.

The chart above clearly shows that missing the correct charge by 5% in either direction (over or under) reduces cooling capacity of the compressor to about 900 BTU. But notice what happens when the system is overcharged. Not only is capacity diminished but power consumption rises by 20%. At a 10% overcharge, the power consumption rises 44%.

Unfortunately, on a system that only holds 5.5 oz of refrigerant, it only takes an extra ½ oz of refrigerant to overcharge the system by 10%. Considering that the hoses of a manifold gauge set can hold up to 2 oz of liquid refrigerant, overcharging a system by a ½ oz is not difficult.

Compounding the problem is that many technicians feel that if 5.5 ounces in the system is good, 6 ounces will be even better. In this case, more is not better. The added refrigerant raises system pressures and affects the boiling and condensing points of the refrigerant. Moreover, the compressor is forced to work harder because it has to pump against higher pressures.

The rule is, if the system charge calls for 5.5 oz of refrigerant, there should be 5.5 oz in the system. No more, no less! But, as we've learned from the above chart, if we miss the correct charge at all, it's better to be slightly undercharged than to be overcharged by any amount.

Contaminants and Moisture:

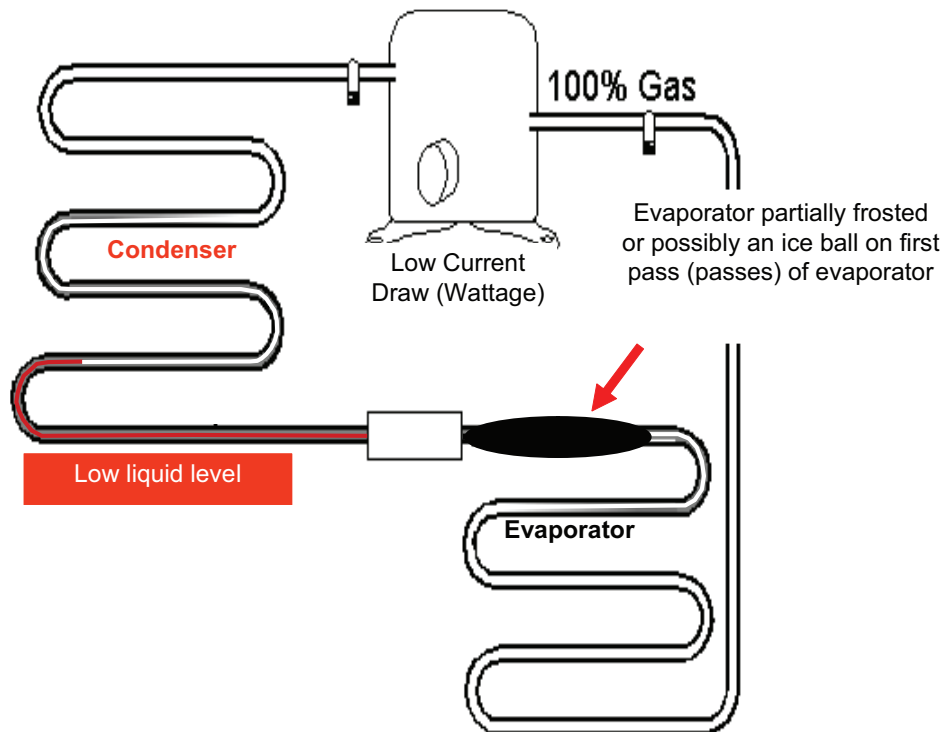
The system must be clean of contaminants and free of moisture. Moisture in a system is especially harmful. Three major issues arise with moisture contents that exceed 300 microns of pressure:

Water mixes with the refrigerant to form hydrochloric and hydrofluoric acids. These eat away at the insulation on the compressor windings and eventually shorts out the motor. It's not a question of if the compressor will fail; it's a matter of when. It may take several months or even a couple of years but the failure is inevitable.

Water mixes with the refrigerant to form salts and sludge that could plug the capillary tube. If refrigerant doesn't flow through the cap tube, cooling stops.

If there's enough water left in the system, the water could create a condition called a **floating restriction**. This type of restriction occurs when moisture travels with the refrigerant into the evaporator. There, the sub zero temperatures in the freezer cause the water to freeze. Ice forms on the end of the cap tube, blocks the flow of refrigerant and cooling stops. Once the freezer temperatures begin to rise, the ice melts off the end of the cap tube and the flow of refrigerant resumes. The restriction "floats" through the system and plugs the cap tube intermittently. The customer complains of food loss and erratic temperatures.

Leak: Refrigerant left in System



Leak, refrigerant still left in system

Compressor run current- Lower than normal

Low side pressure- Fairly deep vacuum

High side pressure- Lower than normal

Frost pattern- Less than full. If there is sufficient refrigerant left in the system, it's possible to encounter an ice build up (ice ball) where most of the refrigerant evaporation is taking place.

Condenser liquid level- Low

Condenser temperature- Very cool

Compressor temperature- Cooler than normal

Compressor discharge line temperature- Cooler than normal

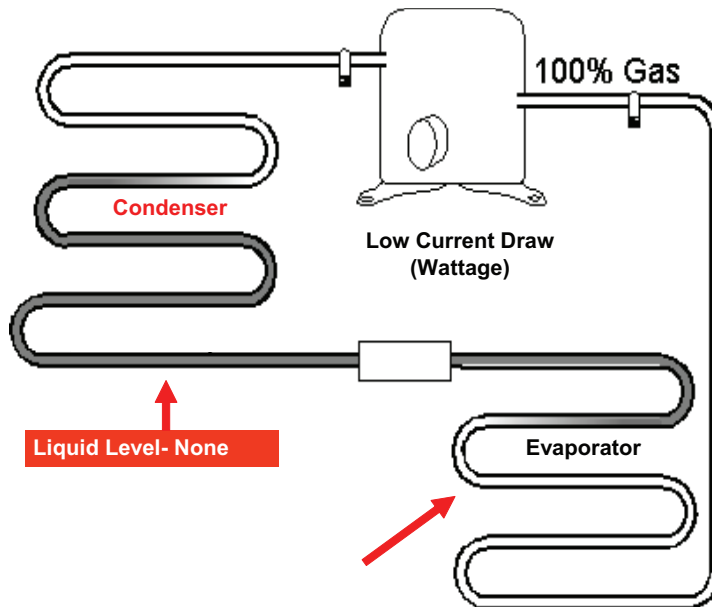
Suction line temperature- Warmer than normal

Evidence of a leak is best diagnosed by inspecting the evaporator. Anything less than a full frost pattern will normally indicate a leak. This can be further confirmed by the lower than normal current draw of the compressor and cool condenser (lack of heat movement by the refrigerant). The final tell tale sign is the lower than normal low and high side pressures.

Because of the loss in cooling capacity, the thermostat never satisfies and the unit runs continually.

Note: These conditions will only hold true as long as no air has entered the system. As soon as air gets sucked into the low side of the system, all of the parameters are affected. See "Low Side Leak, No Refrigerant Left in System" for the effects of non condensables on the system.

High Side Leak: No refrigerant in the system



High Side Leak- No refrigerant left in system.

Compressor run current- Lower than normal

Low side pressure- Deep vacuum

High side pressure- Lower than normal

Frost pattern- None

Condenser liquid level- Very low

Condenser temperature- Cool to the touch

Compressor temperature- Cool to the touch

Compressor discharge line temperature- Cool to the touch

Suction line temperature- Warmer than normal

Once all of the refrigerant has escaped the system, no further cooling takes place.

There is no evaporation going on, thus there is no frost pattern on the evaporator.

There is no refrigerant to condense so the liquid level is non-existent. Condenser temperatures drop. Because of the loss in cooling capacity, the thermostat never satisfies and the unit runs continually.

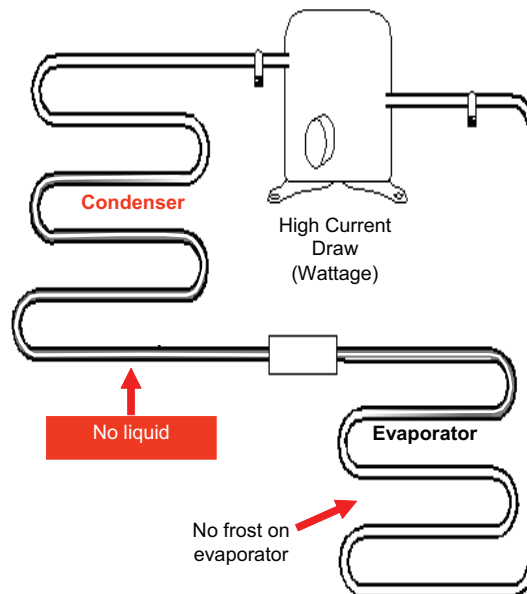
Unlike a low side leak, the chance of air being pulled into the system is not as great.

As long as the compressor is running and there is refrigerant in the system, the high side pressure never goes into a vacuum. And, as long as there is any positive pressure in the high side, it's impossible for air to infiltrate the tubing.

With little or no refrigerant in the system, the low side of the system will go into a very deep vacuum (around 30 PSI on the manifold gauge set). High side will show a slight positive pressure.

Note: On a system that is totally empty of refrigerant, it is possible for air to infiltrate if the unit loses power. Remember that without refrigerant, the low side of the system will drop to a very low vacuum. If the unit is unplugged and the compressor stops, the system will attempt to equalize and could pull air into the system.

Low Side Leak: Air in the system



Low side leak, air in system

Compressor run current- High

Low side pressure- Atmospheric to a slight vacuum

High side pressure- Very high

Frost pattern- None

Condenser liquid level- None

Condenser temperature- Very hot

Compressor temperature- Very hot

Compressor discharge line temperature- Very hot

Suction line temperature- Warmer than normal

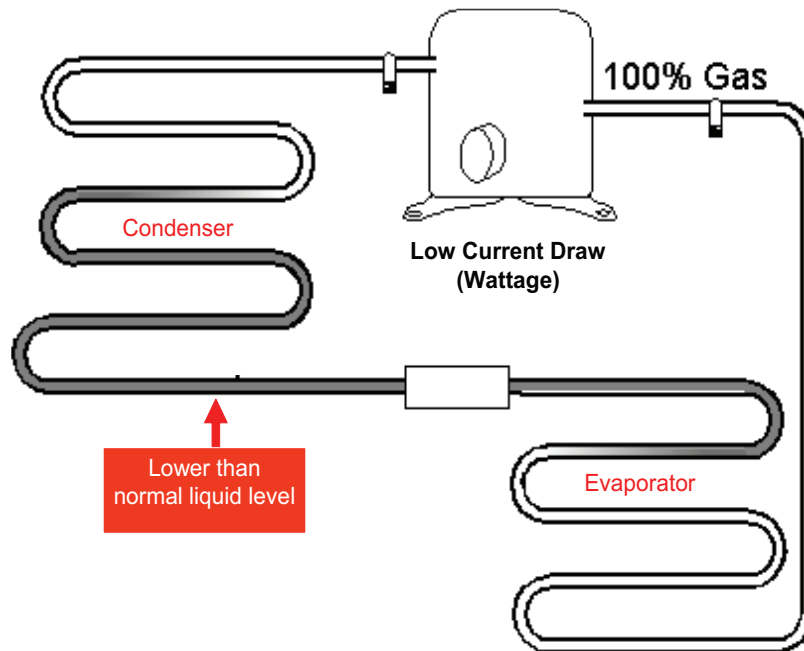
An empty system resulting from a low side leak displays odd characteristics that may not always be easy to diagnose. Depending on how much air the system has absorbed, compressor current draw and high side pressures could vary from slightly above normal to very high. The higher than normal pressures and temperatures are caused by the air in the system. Air is a non condensable, meaning that no amount of pressure or cooling will cause the air to condense. Pressure just continues to build and, along with the higher pressures, much warmer temperatures.

Because of the loss in cooling capacity, the thermostat never satisfies and the unit runs continually.

Just as with any leak, a check of the evaporator frost pattern will verify that there is no refrigerant left in the system. The difference between this condition and other leaks is best seen when gauges are attached to the system. The high side pressure will be much higher than normal (sometimes in excess of 200 PSIG). Low side pressure will vary from 0 psig to a slight vacuum.

Because the compressor is attempting to push more and more air into the condenser and the air never condenses, current draw increases. The compressor dome may become too warm to touch.

Undercharge



Undercharge

Compressor run current- Lower than normal

Low side pressure- Lower than normal. .

High side pressure- Lower than normal.

Frost pattern- Partial

Condenser liquid level- Lower than normal

Condenser temperature- Lower than normal

Compressor temperature- Cooler than normal

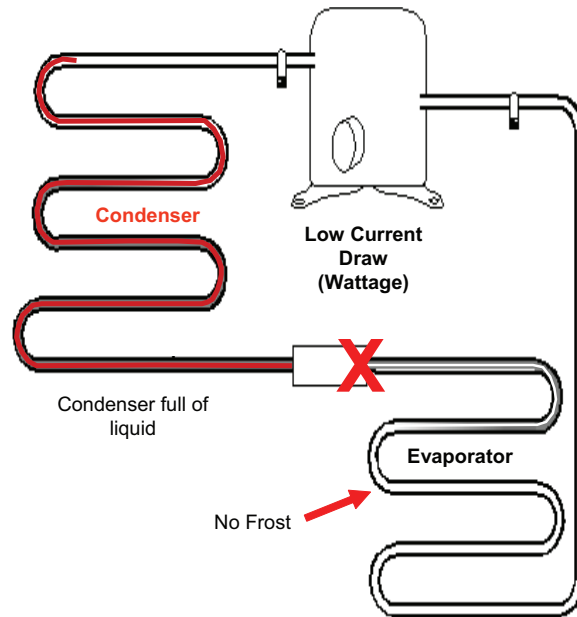
Compressor discharge line temperature- Cooler than normal

Suction line temperature- Warmer than normal

It is extremely rare for a refrigerator to leave the factory with the incorrect charge. Undercharges are usually the result of poor system processing after a system repair.

Conditions and diagnosis of an undercharge are identical to that of a leak.

Complete Cap Tube Restriction



Restriction

Compressor run current- Very low

Low side pressure- Deep vacuum

High side pressure- Lower than normal

Frost pattern- None

Condenser liquid level- Higher than normal

Condenser temperature- Ambient

Compressor temperature- Cooler than normal

Compressor discharge line temperature- Cooler than normal

Suction line temperature- Ambient

Restrictions occur when salts or other debris blocks the flow of refrigerant through the cap tube. Other possibilities are:

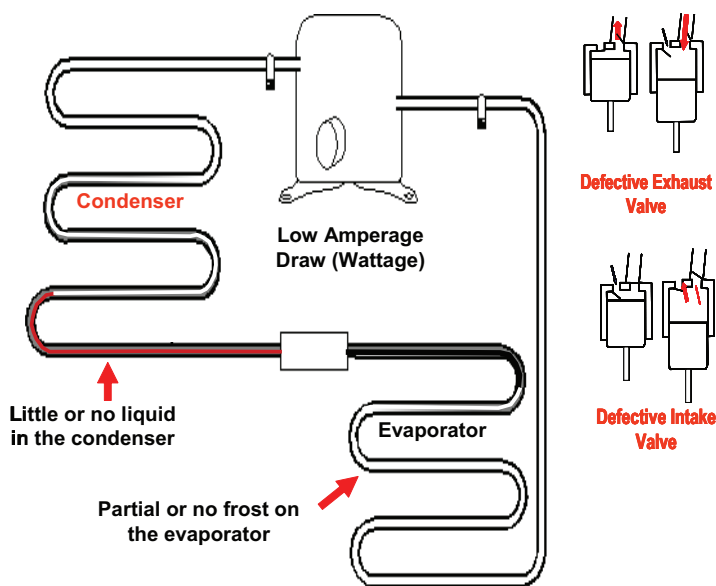
The manufacturing site pushed the cap tube too far into the drier and the tubing came to rest on the screen (blocking the flow of refrigerant).

Too much solder was used when the cap tube was brazed to the drier and solder wicked to the end of the cap tube to plug it.

A visual inspection of the evaporator will make this condition appear much like a leak. There will be no frost on the evaporator. Current draw will be lower than normal and the low side of the system will be in a deep vacuum. The compressor and condenser temperatures will be lower than normal. The difference is that, unlike a leak where there is no refrigerant in the system, all of the refrigerant is trapped in the condenser.

Note: For most technicians, the concept of lower than normal condenser pressures when all of the refrigerant is trapped in the condenser seems foreign. They reason that if refrigerant flow is blocked, the pressure should be higher than normal. They forget that once the refrigerant re-condenses back into a liquid and is now trapped in the condenser, the condenser acts as a storage vessel. Just as the pressure of refrigerant in a cylinder is dependent on the ambient temperature, the pressure of the condenser will depend on the temperature of the kitchen (or wherever the refrigerator is installed).

Inefficient Compressor



Inefficient Compressor

Compressor run current- Lower than normal

Low side pressure- Higher than normal

High side pressure- Lower than normal

Frost pattern- Little to none

Condenser liquid level- Lower than normal

Condenser temperature- Lower than normal

Compressor temperature- Cooler than normal

Compressor discharge line temperature- Cooler than normal

Suction line temperature- Warmer than normal

Compressors lose their efficiency when one of the two valves that control refrigerant flow in and out of the compression chamber fails to seat properly.

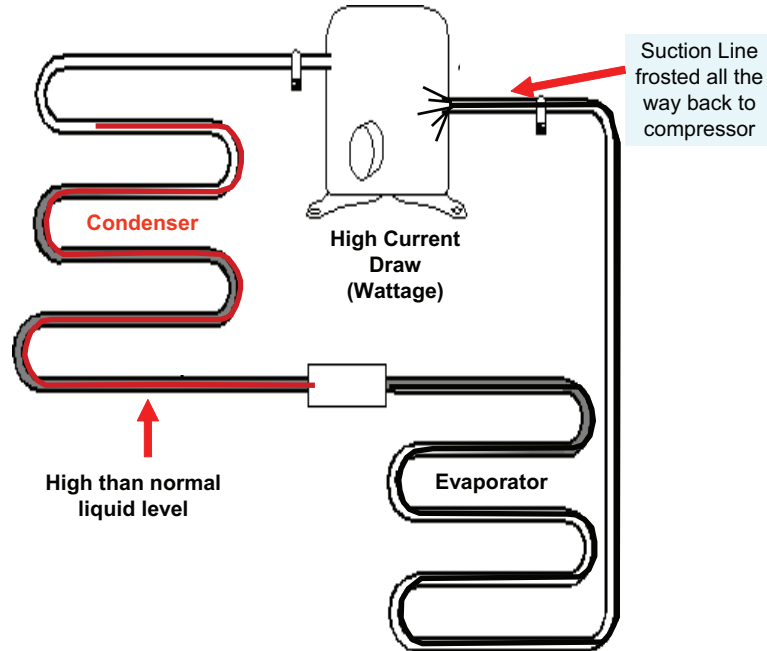
If the intake valve fails, refrigerant is pulled into the compression chamber during the intake stroke of the compressor in the normal manner. On the exhaust stroke however, instead of all of the refrigerant in the chamber being directed into the condenser, some of the refrigerant is pushed back into the dome of the compressor.

A defective exhaust valve will have a similar effect. On the exhaust stroke the refrigerant is pushed into the condenser. On the intake stroke, not only does the compressor pull refrigerant from the dome of the compressor but some of the refrigerant that was directed into the condenser is pulled back into the chamber.

Net result of either valve failing is the compressor loses its ability to set up the correct pressure differential required for proper evaporation and condensing of the refrigerant. Low side pressure rises and high side pressure drops.

Confirming your diagnosis: Recover the existing system charge. Add the correct system charge to the system. If conditions return, compressor is inefficient.

Overcharged System



Overcharge

Compressor run current- Higher than normal

Low side pressure- Higher than normal

High side pressure- Higher than normal

Frost pattern- Beyond the evaporator. In a cool ambient, may frost all the back to the compressor.

Condenser liquid level- Higher than normal

Condenser temperature- Warmer than normal

Compressor temperature- Warmer than normal

Compressor discharge line temperature- Very warm

Suction line temperature- Warmer than normal

Again, overcharges are caused by poor system processing. The chances of a system being overcharged at the factory are minimal. As we've already learned, overcharging a system plays havoc with pressures, cooling capacity and power consumption.

Diagnosing an overcharge begins by taking a current reading of the compressor. If the current draw, the system pressures and the system temperatures all point to a system failure, attach gauges to confirm your suspicions.

Confirming your diagnosis: Recover the charge and recharge with the exact amount called for on the serial plate.

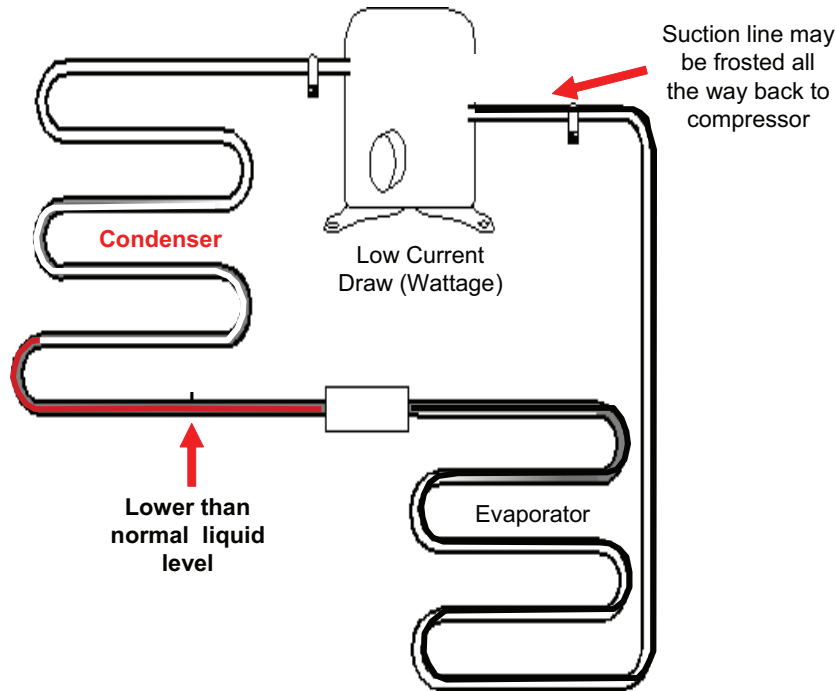
Sealed System Failure Chart

Sealed System Failures

Conditions	Indicators							
	Amps - Watts	Condenser Temp	Condenser Liquid Level	Frost Line	Compressor discharge Temp	Low Side Pressure	High Side Pressure	Pressure Equalization Rate
Overcharge	High	Higher than Normal	Higher than Normal	All the way back to suction line	Hot	Higher than Normal	Higher than Normal	Normal to slightly longer
Undercharge	Low	Lower than Normal	Lower than Normal	Partial	Cooler than normal	Lower than Normal	Lower than Normal	Quicker than Normal
Low-Side Leak- Refrigerant in System	High *	Normal to Slightly Higher*	Lower than Normal	Partial to Non existent (possible frost ball)	Cooler than normal	Normal to slightly higher*	Normal to slightly higher than Normal *	Normal
Low-Side Leak NO Refrigerant in System	High	High	None	Non existent	Hot	Atmospheric	Higher than Normal	Normal
High Side Leak	Low	Low	Low to non existent	None	Cooler than normal	Vacuum	Low	Quicker than Normal
Low Capacity Compressor	Low	Low	Low	Partial to Non existent	Cooler than normal	Higher than normal	Lower than Normal	Quicker than Normal
Restrictions								
Capillary Tube (Complete)	Low	Low	Higher than normal	None	Cooler than normal	Vacuum	Ambient	No equalization
Capillary Tube (Floating)	Low	Low	Higher than Normal	Intermittent	Intermittently cooler than normal	Intermittent Partial Vacuum	Intermittent lower than normal	Intermittent

* Exact conditions dependent on level of non condensables in the system

Restricted Evaporator Airflow



Conditions that mimic a sealed system failure:

Restricted Evaporator Airflow

Compressor run current- Lower than normal

Low side pressure- Lower than normal

High side pressure- Lower than normal

Frost pattern- Under low ambient conditions, may be frosted all the way back to compressor

Condenser liquid level- Lower than normal

Condenser temperature- Lower than normal

Compressor temperature- Cooler than normal

Compressor discharge line temperature- Cooler than normal

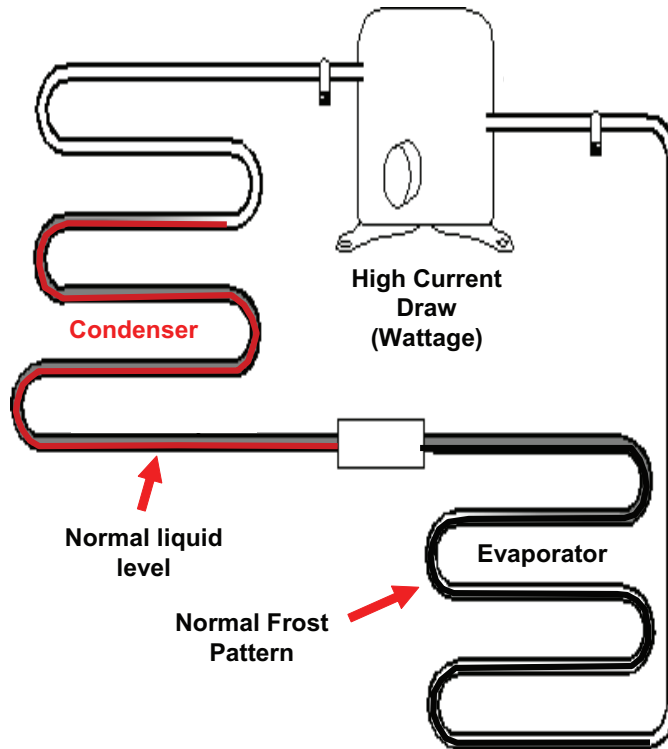
Suction line temperature- Very cool

A stopped evaporator fan motor (or an iced evaporator due to a defrost failure) restricts the airflow through the coil. If no air passes through the fins, heat doesn't transfer to the refrigerant. The refrigerant remains in liquid form all the way through the coil and into the suction line. Under cool ambient conditions, frost could form on the suction line all the way back to the compressor.

The symptoms of reduced evaporator air flow are very similar to an overcharge. A closer inspection of the evaporator, however, will clearly indicate that this is an airflow problem. A stopped fan could be caused by an electrical failure or the blade may be stopped due to ice conditions brought about by a defrost problem. Even with the fan running, ice on the coil could reduce air flow enough to create the same symptoms.

Confirming your diagnosis: Replace evaporator fan or defrost evaporator and diagnose defrost problem.

Restricted Condenser Airflow



Conditions that mimic a sealed system failure:

Restricted Condenser Air Flow

Compressor run current- Higher than normal

Low side pressure- Higher than normal

High side pressure- Higher than normal

Frost pattern- Normal

Condenser liquid level- Normal

Condenser temperature- Warmer than normal

Compressor temperature- Warmer than normal

Compressor discharge line temperature- Warmer than normal

Suction line temperature- Warmer than normal

Limiting the air that passes across the condenser severely reduces the cooling capacity of the system while increasing power consumption. It really doesn't matter if the failure occurs because the condenser fan is inoperative or because the condenser is so packed with dog hair that air can't pass through it.

If the condenser is not cooled as required, internal pressures rise. The condensation point of the refrigerant is increased and the refrigerant doesn't cool as thoroughly. The refrigerant travels back to the evaporator in a warmer state. The warmer refrigerant raises low side pressures which in turn raises the evaporator coil temperature. A warmer coil results in warmer air entering the freezer. Net result is that the system has to work much harder for the same amount of cooling.

Confirming your diagnosis: Clean condenser or replace inoperative fan motor

Abnormal Heat Load

- **Overloading unit with fresh food**
- **Doors left open**
- **Interior lights remaining on**
- **Defrost system failure – heater stays on**

Abnormal Heat Load

Overloading unit with fresh food

Doors left open

Interior lights remain on

Defrost system failure – heater stays on

Heat load. Heat load refers to the amount of heat energy that must be removed from the refrigerator compartments. Adding fresh food, leaving one or both of the doors open, or a light bulb that stays on when the doors are closed all increase the heat load. When heat load levels are raised, the low side pressure increases. And, with only a couple of exceptions, **anytime that the pressure goes up on one side of the system, the pressure on the other side follows suit.** Thus, if the low side pressure goes up, the high side pressure increases as well. This forces the compressor to work harder. The end result is pressures and current draw both rise with high heat loads. Additionally, the higher temperatures associated with the higher pressures limit the refrigerant's ability to absorb heat as readily. Cooling capacity is diminished at a time when the need is the greatest.

Conditions that Mimic Sealed System Failure Chart

Conditions	Indicators							
	Amps - Watts	Condenser Temp	Frost Line	Compressor discharge line temp	Low Side Pressure	High Side Pressure	Fresh Food Temp	Freezer Temp
Plugged condenser	High	Higher than Normal	Full	Higher than normal	Higher than Normal	Higher than Normal	Warmer than Normal	Warmer than Normal
Blocked Cond. Fan	High	Higher than Normal	Full	Higher than normal	Higher than Normal	Higher than Normal	Warmer than Normal	Warmer than Normal
Blocked Evap Fan	Low	Lower than Normal	Frost back to compressor	Lower than normal	Lower than normal	Lower than Normal	Warmer than Normal	Warmer than Normal
Evap Iced up (defrost failure)	Low	Lower than Normal	Frost back to compressor	Lower than normal	Lower than normal	Lower than Normal	Warmer than Normal	Warmer than Normal
High heat load	High	Higher than Normal	Full	Higher than normal	Higher than normal	Higher than normal	Warmer than Normal	Warmer than Normal
High ambients	High	Higher than Normal	Full	Higher than normal	Higher than normal	Higher than normal	Warmer than Normal	Warmer than Normal
Damper failed closed	Low	Lower than Normal	Full	Lower than normal	Lower than normal	Lower than normal	Warmer than Normal	Cooler than Normal
Damper failed open	Slightly higher than Normal	Slightly higher	Full	Normal	Slightly higher than normal	Normal	Cooler than Normal	Normal to slightly Warmer

Before Entering a Sealed System:

- Before entering a sealed system, eliminate all other possibilities for the poor cooling condition!

Temperatures:

- What is the freezer temperature?
- What is the fresh food compartment temperature?

Air flow-

- Are both the condenser and evaporator fans working?
- Is the damper operational?
- Is the return air duct from the fresh food compartment to the freezer free of obstructions?

Evaporator-

- Is the evaporator plugged with ice (defrost problems)?
- Is there a full frost pattern?
- Does the suction line going back to the compressor feel cool or warm to the touch?
- Is the suction line frozen?

Condenser

- Is the condenser clean?
- Is there enough room around the refrigerator to allow air flow (especially critical with static and warm wall condensers)?
- Does the condenser feel cool or warm to the touch?

Compressor-

- Is the compressor running or has the compressor kicked off on overload?

Ambient-

- Is the refrigerator installed in an area where the temperature often exceeds 95°F?
- Is the refrigerator installed in an area where the temperature drops below 55°F?
- Is the refrigerator installed next to a range?
- The answers to these questions will often pinpoint a condition that could mimic a sealed system problem.

Before Entering a Sealed System:

- Once all external causes for the reduction in cooling capacity are eliminated, a closer look at the system is in order. Follow these steps to verify a system problem:
- Remove the back cover to the machine compartment and feel the compressor discharge line.
 - A very hot line indicates that the compressor is operating under extreme duress (high ambient, overcharged, very high heat load).
 - A cool line indicates that the compressor is not doing much work (leak, very low ambient, evaporator plugged with ice).
- Check compressor current draw. Current draw should match the conditions that you encountered in first two steps.
 - Low current draw could indicate a loss of refrigerant, an inefficient compressor, a restriction (cap tube plugged), or lack of air movement through the evaporator
 - High current draw could point to high ambient, high heat load (such as a light on in the refrigerator), non- condensables in the system, defective compressor, lack of air movement through condenser or an overcharge.
- Feel the top of the compressor (compressor dome).
 - If too hot to touch but there is no cooling occurring, suspect air (non-condensable) has entered into the system.
 - If cool to the touch, compressor is not doing very much work and the system may be out of refrigerant or have evaporator air flow problems.
- If these further checks indicate that the problem is indeed with the sealed system, tap into the system.

Sealed System Procedures

Original Observation: Partial frost pattern

- Check for leaks using bubbles, electronic leak detection or other methods
- Note: When checking for leaks on the low-side you will need to turn off the appliance and warm the evaporator to get pressure back into the low-side.
- Since the dye is carried in the oil, it is possible to quickly leak out the refrigerant as a vapor and not have enough oil to show a leak. This should not be a problem because large leaks are easy to find with standard methods.
- Discharge refrigerant into an approved recovery system
- Install a dye drier, sweep and recharge system
- Repeat leak checks using bubbles, electronic leak detection or other methods
(Indication of a leak using the dye and light may not be possible within the first 30 minutes of run time)
- Check evaporator frost pattern after 20-30 minutes of run time

After sweep charging the unit and installing the dye drier a full frost pattern is confirmed:

- The system had a restriction at the original drier filter or...
- The system has/had a leak
- Repair restriction or leak if found
 - Just as in the past, it may be unknown what caused a low charge or restriction.
- Complete the service call

Note: This procedure is not different than what technicians followed in years past but now with one big difference... A DYE DRIER WAS INSTALLED! IF the customer calls back with a cooling problem it will be a sure thing that there is a leak. With several days or longer of run time, the leak should now be easily detected using the approved lights and goggles. This way no more than 2 service calls have occurred and the product is repaired.

After sweep charging the unit and installing the dye drier, if the original partial frost pattern reoccurs:

- The system has a restriction and with a new drier installed, it is likely at the capillary inlet to the evaporator or...
- The system has an inefficient compressor. This is very rare but is possible. Stop and immediately restart the compressor, if it trips on overload it indicates a restriction
- Repair restriction or replace compressor
- Complete the service call

Sealed System Procedures

Original Observation: No frost pattern

Discharge refrigerant into an approved recovery system Was refrigerant present?

- No refrigerant present, a leak is confirmed
- Refrigerant present, a restriction is confirmed
- Install a dye drier, sweep and recharge system
- Check evaporator frost pattern after 20-30 minutes of run time

No refrigerant was recovered:

After sweep charging the unit and installing the dye drier a normal frost pattern occurs

- The system has a leak
- Check for leaks
- Repair leak
- Complete the service call

Refrigerant was recovered:

After sweep charging the unit and installing the dye drier a normal frost pattern occurs

- The system had a restriction at the drier
- Check for leaks at the new drier
- Complete the service call

Dye Drier Procedures

If you get a repeat call after a dye drier has been installed and a partial frost pattern is found

- Check for leaks using the approved light and goggles
- Reduce ambient light if possible
- Use inspection mirror
- Check both sides of the evaporator
- Check the compressor, condenser and all tubing from all sides. LEAKS CAN BE ANYWHERE

— NOTES —

PRODUCT SPECIFICATIONS AND WARRANTY INFORMATION SOURCES

IN THE UNITED STATES:

FOR PRODUCT SPECIFICATIONS AND WARRANTY INFORMATION CALL:

FOR WHIRLPOOL PRODUCTS: 1-800-253-1301
FOR KITCHENAID PRODUCTS: 1-800-422-1230
FOR ROPER PRODUCTS: 1-800-447-6737

FOR TECHNICAL ASSISTANCE WHILE AT THE CUSTOMER'S HOME CALL:

THE TECHNICAL ASSISTANCE LINE: 1-800-832-7174

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FOR LITERATURE ORDERS:

PHONE: 1-800-851-4605

FOR TECHNICAL INFORMATION AND SERVICE POINTERS:

www.servicematters.com

IN CANADA:

FOR PRODUCT SPECIFICATIONS AND WARRANTY INFORMATION CALL:

1-800-461-5681

FOR TECHNICAL ASSISTANCE WHILE AT THE CUSTOMER'S HOME CALL:

THE TECHNICAL ASSISTANCE LINE: 1-800-488-4791

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