7. AB and other Danfoss BD compressor system servicing

Question My Adler Barbour unit appears to work but does not get cold. The fan runs and the unit runs. I have a set of gauges and some R134 refrigerant but need advice on how to use them.

Answer:I have been encouraging do it yourself refrigeration with my books for twenty years but unless the correct procedures are followed these small systems can be damaged. The key to successful troubleshooting is to begin with non destructive testing first. It must be determined if a unit that fails to cool properly is a control problem or a refrigerant system problem. It is very difficult to tell if these small Danfoss compressors are actually running because they are so quiet. Many times the fan noise is believed to be the compressor running. If it is confirmed that the compressor is running, then and only then, should destructive servicing equipment be connected to a capillary tube system.

These small units are very sensitive when it comes to servicing them with refrigerant. If the compressor is a model BD2.5 it must be serviced with R12 refrigerant. If the compressor is one of the following ,BD3, BD35 or BD50, 134a refrigerant is used.

Connecting a servicing gauge set to these units, if not done properly, can be destructive to the system. Here are some simple guide lines to follow when you question the refrigerant level and refrigerant flow conditions:

1. A system low on refrigerant may be running in a vacuum so do not connect the gauge set when it is running.
2. Purge gauge set and hose with refrigerant before connecting it. These small systems only contain 2 to 5 ounces of refrigerant and can easily be contaminated.
3. The amount of refrigerant pressure in the system when the gauge is connected is only an indication of whether all refrigerant was lost or there is still some left in the system. Pressure in a capillary tube system when it is not running is relative to the ambient temperature of all the components and not refrigeration volume.
4. If there is no pressure when gauge is connected, pressurize the system and find the leak and repair it. After the leak is repaired Vacuum system to remove air and moisture then service it with the correct refrigerant.
5. These systems are normally serviced by adding the correct volume of refrigerant by weight, but in the field when a measuring cylinder is not available they can be serviced by pressure in the suction side of the system. This pressure will very based on evaporator size, type of refrigerant and temperature in the evaporator. One ounce plus or minus from the correct volume will greatly affect the power consumption and performance.
6. If you have the small Abler Barbour with their small chamber (bin) evaporator the correct suction pressure with a 70˚ F. box and warm evaporator would be 8 to 10 psi for R12 refrigerant and 6 to 8 psi for 134a refrigerant. These readings must be reached in a time window of ten to twenty minutes after start up with a warm box. After twenty minutes suction pressure will drop as the plate temperature drops.

I have received your book and am ready (and certified) to embark on a R12 recharge of my system.

I do have a question (or two).

Most of the R12 cans/hose I see on ebay use a single blue tap-a-can setup w/no gauge. Is this acceptable for the type of recharge you advocate?

Second, I believe your instructions were to add refrigerant slowly until the evaporator frosts over. Your book references that you need to do this after 10 minutes of system startup and then within 15 minutes after that. Will the evaporator frost up within that time period? My impression was that the process you described was considerably slower paced that than.

Finally, does purging the single blue line involve opening the value at the tap part for a second or two. And then do you attach the hose to the servicing port? Will there be small amount of air trapped in the hose fitting and serving port cavity? Could you partly thread the fitting onto the serving port then purge thereby displacing the air in the fittings?
Answer The procedure below without gauge takes longer than the one in the book with gauge. It only takes a few minutes for evaporator frost to form. As long as you can detect frost all over the evaporator on your finger nail, refrigerant volume is good.

The servicing of a capillary tube system with refrigerant in the book is intended to be used with gauges.

1. Make sure the compressor is turned off before connecting refrigerant bottle as it will be in a vacuum if low on refrigerant.

2. Connect tap-a-can servicing unit to the small bottle of correct refrigerant. Be sure the pin is backed out far enough so that it won't puncture the can and be careful not to over tighten can as it will dent the top of can and break the seal area. It is better that this connection is not tight as if it leaks when bottle is punctured it can then be tightened a little.

1. Now screw T handle all the way in to puncture can, then open valve to purge the hose and close it again

2. Connect hose to compressor servicing port

3. With the can right side up letting only gas to flow into the system let the pressures equalize. This is done when the evaporator is warm if done when cold the system will be overcharged.

4. Start the compressor with valve open for 15 seconds then close.

5. If you are able to read the amp draw after ten minutes it then should read 5 amps if not add more refrigerant. If you are not able to read amperage, wait 20 minutes and check frost level on evaporator.

6. When there is frost covering 100% of the evaporator surface and no frost returning in the line outside the refrigerator the refrigerant charge is in the ball park.

With a small evaporator (freezer bin which measures 10"x6"x11") ambient running pressure should be 8 PSI (R12). The large evaporator (15"x6"x12") should be 12 PSI. After cycling begins, small evaporator should be around 5 PSI, large 7 PSI.

These systems are very critical on volume of refrigerant. When serviced at the factory refrigerant is added by weight in grams. In the field even service technicians rarely service these units correctly. The final result of fine tuning refrigerant level will be when frost covers 95% or slightly less of the evaporator's surface area and no frost on line leaving evaporator. The correct level of refrigerant will change if boat is moved to a warmer or cooler climate. Manufactures service refrigerant by predetermined weight based on standard day temperatures. The SU 200 has the low side servicing fitting located above the compressor dome. Warning do not use service fitting on pressure line below compressor.

In most cases the refrigerant service fittings on boat refrigerators are still the conventional ¼ inch flared fitting as used on the older Freon systems. Only auto industry is using a different style ACME 134a fitting. Tooling for servicing 134a refrigerant on refrigerators must be adapted to older type ¼ inch fitting. There are pictures in my 12/24 volt book on different ways to convert servicing equipment and detailed information on service your unit, or any auto parts store will help you solve the tooling problem. Important things to remember:

1. Unit must be turned OFF when connecting or disconnecting servicing equipment.

2. Purge air out of servicing equipment immediately before connecting it to compressor.

3. Only add small amounts of refrigerant at a time as too much will trigger compressor electronics and prevent compressor from running. If you can monitor amperage of unit add 134a refrigerant until you see 5 amps on meter, now run unit until frosted areas are visible, one hour or more then add small amounts of 134a until frost line is correct.

16. Standard Danfoss BD Compressor system adding Refrigerant and leak testing LOW ON REFRIGERANT

If a Gurgling sound is heard it confirms that gas and oil are moving so there is no blockage in your system. No frost on evaporator, amperage below 1.5 amps, and gas moving through system indicates lack of refrigerant.

These are the steps needed on a BD35 or BD50 compressor capillary Tube unit to re-commission your system:

1. Check gauge set to see that gauges read zero when not attached to unit if not adjust or make a note of their errors.

2. With both gauge hand valves closed, connect 134a bottle to center yellow hose. Check to see that blue gauge has blue hose and lose end of blue hose has a valve core depressor inside. Before connecting blue hose to low pressure connection open blue gauge valve for 2 seconds to purge yellow and blue hose then close valve and connect blue hose to service fitting on top of compressor.

Inspect valve cap you removes to see that rubber seal inside cap is still good. Slow leaks are sometimes traced to a bad cap seal.

3. With refrigerant bottle upright open blue gauge valve to add refrigerant. Blue gauge should now be reading system pressure of 30 to 60 psi depending on temperature of complete system. After blue gauge is connected and system has pressure in it you will need a one inch paint brush and a small amount of water and liquid dishwashing soap mixed 50/50% to locate refrigerant leak.

4. With 50 psi of gas pressure in system, use soap and water mixture to locate leak. By using brush to apply mixture to only one point at a time stabbing brush into location until a shaving cream mixture surrounds it you will break down to liquid surface tension so any leak must come through foam generating bubbles. Leak testing is done with compressor off.

5. After leak is found and repaired unit can be serviced with correct amount of refrigerant. In your situation best way to get correct charge is again raise pressure 50 psi then run compressor for 10 minutes and then and only then add refrigerant if necessary or reach 6 to 8 psi suction pressure. It is important that you not add refrigerant after 20 minutes run time as correct pressure can not be determined after 20 minutes. For final fine tuning unit needs to run for a day or more. Correct refrigerant charge for your unit is when 90 to 100% of evaporators surface is covered with frost and no frost on line outside refrigerator on line returning to compressor.

15. Another vote for Do It Yourself SERVICING

My AB cold machine model DCM-12 is, I'm pretty sure a 1989 unit. My boat is a freshwater only, Lake Michigan, 1989 Catalina 30. We bought the boat in 1992 w/35 engine hours and seemingly very little use. The fridge has performed flawlessly until this season. Before the recharge last week, it would run but not cool. After the recharge, it would cool, completely frost up the evaporator and frost up the upper refrigerant line as far as I could see into the bilge. The fridge ran continuously and would not shut off. I called the company that did the recharge and they were just here and removed about 3-4 oz. of refrigerant. He mentioned that when he got back to his shop and weighed the refrigerant installed, he thought he had put in too much. They did not bring a scale to measure the amount put in the first time. This time he brought a scale to determine how much he removed. I don't expect to be charged for the second service call. So far, so good, the fridge is cooling and cycling on and off as it used to.

Answer: Why do you believe your unit has too much refrigerant in it? Correct amount of refrigerant is indicated by frost covering 95% of evaporator's surface area and no frost on line outside refrigerator on return line going to compressor. If there is frost on line how far does it extend? What model Cold machine is it ? Is the unit less than 12 years old? if so it has a BD50 variable speed compressor with a trouble shooting LED. If it has the LED and the compressor does not run, how many times does it flash every 4 seconds? If LED flashes 3 times every 4 seconds there is probably too much refrigerant.. Answer my questions and I will provide information for you to correct problem.

Your refrigerator story is a common screw up because on small systems like yours refrigerant is measured in grams not ounces.The one question I have is did the mechanic find and fix the leak? There must have been a leak because AB units do not normally leak.

When your refrigerant charge is correct in a cold climate the evaporator will have more than 85% of its surface area covered with frost and no frost on line outside refrigerated box.

It leak was not repaired evaporator frost areas will slowly lose frost leaveing larger and larger area without frost.

Reply: They did not do a leak test. I am hoping that it took 23 years for the refrigerant to leak a miniscule amt and it just needed a tiny bit extra??? My bill $284.00 seemed pretty big.

2hrs @ $100.00 an hour for portal to portal, $1.50 per mile and $60.00/lb of refrigerant. I have asked them to review the bill. He was on the boat for about an hour and it didn't take a lb of refrigerant. IF it is fixed and runs for another ---- years, it will have been worth the money, if not, I'll probably be buying another unit. We shall see.