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By Stephen Sommer

Air Conditioner Check-up by "Touch and Feel"

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My air conditioner isn't cooling like it used to. How can I tell if it needs some more freon? Should I buy a set of air conditioning service gauges and check it myself?

First of all freon is not like oil. You shouldn't expect to need more as time goes on. It doesn't wear out and it shouldn't leak.

If you want to buy some gauges, go ahead. I almost never discourage anyone from buying tools. However, in some ways, you can do a better job of judging the freon charge with your fingertips instead of gauges. To understand how to do a fingertip air conditioner checkup, you need to know what is happening inside the pipes that you are touching and feeling.

Let's start discussing the circulating path where the freon is a cool gas, as it would come out of a tank of freon. The cool gas is compressed by the compressor, which causes it to heat up to at least 150 degrees. The hot gas then goes to the condenser, which uses seawater to cool it. First the gas is cooled to the point that it just begins to condense into liquid. This happens very easily and only requires a small portion of the condenser. Next is the big job, which is carrying away all the heat deposited by the condensation of all the gas into liquid. Once it is all liquid, the job is done. It's is just possible that there is still some of the condenser left, which will easily cool the liquid freon down to near the temperature of the seawater. If everything is working right, you should be able to feel that the first 10 to 20 percent of the condenser is hot to the touch, the majority of the condenser is consistently warm, and just the last bit of it may be cooler. The seawater leaving the condenser should be just noticeably warmer than the seawater that is entering.

After the hot gas is converted to warm liquid by the condenser, it goes through an expansion valve or capillary tube that restricts the flow and causes a pressure reduction. Because of the pressure reduction, the liquid begins evaporating spontaneously, and gets very cold. The evaporating liquid then goes to the evaporator, which transfers this coldness to the air being blown over the fan coil. If everything is working just right, the majority of the fan coil should be at the same cold (but not freezing) temperature. Do all of your touching and feeling on the U-tubes on the ends of the fan coil, paying attention to the path of the freon. After 80 or 90 percent of the fan coil, all of the freon has evaporated and the gas can be easily warmed. You can feel this last section is noticeably less cool. This cool gas returns to the compressor to start the whole cycle again.

Here are a few things that can be wrong in the condenser:

- If the majority of the condenser is hot, rather than warm, then you are not getting good cooling from the seawater. Low seawater flow or a dirty seawater path through the condenser can cause this. (Which often causes low flow too.) If the water leaving the condenser is a great deal warmer than the incoming water, then you have low water flow. Both problems are often fixed with a good muriatic acid cleaning. Just mix up a solution of 10% muriatic acid and water and run it through the seawater circuit slowly. You'll be amazed at the difference it makes.
- If more than a quarter of the condenser is cooler than the middle section, then you have too much freon in the condenser.
- It's hard to tell if there is too little freon in the condenser, unless you have a sight glass, which would show bubbles. If you don't feel any reduction in the temperature of the condenser or pipe leading to the expansion valve/capillary tube, the condenser MIGHT be low on freon. If you have an air conditioner with a heat pump mode then you should feel a reduction in the liquid temperature as it goes through the reversing valve. If there is no temperature reduction going through the reversing valve, then there is too little freon.

Here are a few things that can go wrong in the evaporator:

- If more than 20 percent of the fan coil is noticeably less cool than the middle, then the evaporator is low on freon.
- If a large portion of the evaporator is frosting up, then you have a problem with the air side, either due to low air flow or dirty fins.
- If a small portion is freezing up, the evaporator is low on freon.
- If the entire evaporator and the pipe leading back to the compressor are cold and apparently the same temperature, the evaporator has too much freon.

Over-all diagnosis:

- If you notice that the evaporator is low on freon and the condenser isn't over-full then your system needs some freon. Please for the sake of the environment (and environmental laws), plan on finding the leak that caused this condition. Leaks are almost always found at connections, service valves and the bottom of steel receiver-dryers and suction accumulators, which rust out. Look for leaks with soapy water. If you need to depressurize your system to fix a leak, have a service technician do it so that the freon can be captured instead of released into the environment.
- If, according to the above checks, you determine that the evaporator is low on freon and the condenser is over-full then you have a balancing problem than is caused by the expansion valve or the capillary tube not allowing enough freon to pass. This would have to be resolved by a qualified expert.
- If you find that both the condenser and evaporator are overfull, don't be surprised. There are a lot of people topping up AC's with freon for no good reason. Don't be one of them.

Stephen Sommer is a degreed electrical engineer with extensive experience in electrical, mechanical, refrigeration and air conditioning systems and holds a USCG Masters license. He consults in all areas of yacht systems, which include all the equipment on board yachts beyond a basic hull and motor or sails.

Have a systems problem or question? Ask Stephen Sommer. Email: steve@boatek.com