# Air Conditioning System

## TROUBLESHOOTING

In this section, I will list the typical component failures I have found, that a reasonably competent handyman could be expected to diagnose and replace. Failures in either the CCC or the control board require the replacement of the entire subassembly. Other components that could be replaced include capacitors, the fan motor or blades, PTCR and heater strip. Actually, there are not very many parts so the challenge is in the troubleshooting to determine which one has failed.

## Remember:

**Servicing a roof top A-C is dangerous. You should never work on your A-C with the power on, unless you are experienced and completely comfortable working with live 120 VAC electrical equipment.**

**Even with the power off you could have high voltages present stored in the large capacitors used in this equipment. Whenever you remove the A-C covers, you should discharge the capacitors in order to avoid a nasty shock. This is particularly dangerous since you are standing on a huge metal ground plane on top of a slippery roof.**

**Never remove the A-C covers if it is raining and the roof is wet. Touching a hot 120 VAC source will usually just give you a mild shock. However, with a wet surface the mild shock can become lethal.**

### Nothing Works

1. Check that you have 12.6 volts dc at the input power strip to the A-C unit and that the terminals are tight. This is required to run the control board. Are there any other dc appliances or lights not working? If yes, this could mean that a dc circuit breaker has failed.

If you hear a clicking sound near the dc circuit breaker board it could be a breaker turning on and off very rapidly. Most of the breakers are of the self-healing type, which means that they will open when their rating is exceeded and close when the current drops below the rated level. This could mean that either there is a short in the A-C control board or some other component on that line. Disconnecting the lead from the A-C power strip will tell you if the short is on the control board.

2. Check your 20-amp A-C circuit breaker (s). Check that you have at least 115 volts ac at the input power strip in the A-C unit and that the terminals are tight. Your ac shore power extension is rated at 30 amps and uses a special plug so it can easily provide the 20 amps needed for your A-C. If you need a longer extension, it must be a 30-amp rated power cord. Using a 15

or 20-amp shore power extension could result in a fire or a burnt power plug. The shore power cord should not have any hot spots since this is indicative of a high resistance and lost power. This will reduce the actual voltage supplied to the compressor and could result in significant damage to the A-C.

You should periodically clean the terminals on your 30 and 20 amp cords. When you plug or unplug them, with the power, on you will get some arcing. This leaves black carbon deposits that can eventually result in a poor connection.

3. If there is nothing on the CCC screen then either it is defective or not receiving 12 volts dc from the control board. You can remove the CCC cover and carefully check for 12 volts on the cable connector. No 12 volts would indicate that the 3-amp fuse on the control board has opened. If you replace this fuse and it blows again, you most likely have a failed component in the CCC, which is drawing excessive current. You can purchase a rebuilt CCC on the Internet; however, a new unit is only about $100.

If the CCC does have a temperature reading, it may still have a problem in the computer section. There may be specialized test equipment for checking a CCC, however, I have never run into any. Essentially, this is a computer (CCC) communicating with another computer (control board). The only way I know to test this is to plug a new CCC into the RJ-11 cable and if the system works, replace your unit. If the system does not work than you have a defective control board that needs to be replaced. Do not accept a one or two hour trouble shooting charge from a repair shop in order to evaluate the A-C. Just trying a new CCC takes about ten minutes. I ran into this problem a few years ago and instead of paying for an hour of trouble shooting, I just purchased a new CCC. I later found a loose 12-volt ground wire in the A-C unit and sold my spare CCC, to a very appreciative next-door neighbor, at last year's International Rally.

## Other Climate Appliances

1. Set your Mode selector button to fan and make sure it is working correctly. Check the heat strip and the furnace to see if they are working. If you have, multiple Zones check the same items in each Zone. If everything is working except for one A-C then we can reasonably assume that the CCC and control board are fine.

2. If the **fan is not working**, the problem is usually that the run time capacitor has an internal short or is open. Usually, the three terminal capacitor includes a separate run unit for both the fan and compressor with an additional capacitor used to assist in starting the compressor. Some systems have a dual capacitor with both sides use for the compressor (start and run). Then, the separate capacitor is used for the fan run time unit.

After properly discharging the capacitors, remove the wire terminals and using a Volt/Ohm Meter (VOM) (this is an analog meter and you are using its internal battery) test them as follows:

***Set the VOM meter to the highest ohm scale and connect the probes to the capacitor terminals. The reading should move rapidly from zero toward infinity and then slowly return to zero ohms. You should then reverse the leads and repeat the procedure. If there is no reading (open capacitor), or a prolonged zero reading (shorted capacitor), replace the capacitor. The combination capacitor has three terminals, the common terminal "C the terminals marked "F" and "HERM". To check the combination run capacitor, follow the discharge procedures above. Again, make sure you test from "C" (common) to "F" (fan) and "C" (common) to "HERM" (compressor).***

Some A-C units have a combination start and run three-terminal capacitor for the compressor with terminals labeled **S** (start), **R** (run) and **C** (common). These use a separate fan capacitor. If the capacitor is good then you could have a burnt out fan motor.

## Compressor Not Starting

1. This failure is typically caused by the compressor start capacitor. You can check this using the same procedure as above. Always replace the three-terminal capacitor even if only one of its sections is defective. If the capacitor is good then the PTCR has probably failed and effectively disconnected the compressor start capacitor. If the PTCR is good, it will measure in the 20 to 40 ohm range. A defective unit will not give any reading.

2. If the refrigerant is low or some internal component has failed, you will have to replace the entire compressor unit and recharge the system. Since the refrigerant system is sealed leaks usually occur due to the thinning of the coil tubing over time. Paying to find the leaks and recharging the system, if the A-C is over 20 years old, is just not a good investment. Rather than replacing the compressor, in this old a unit, you should be purchasing a new A-C.

## Compressor Starts Then Shuts Off

1. The first component to test would be the compressor **run** capacitor. Use the same procedure described above for the start capacitor. If the capacitor is good the problem might be the over load sensor, which has triggered because the compressor is consuming too much current. This could be caused by insufficient refrigerant, low ac line voltage or excessive dirt on the condenser coils.

2. In order to operate, the compressor and fan require about 15 amps for a 15,000 Btu A-C. This is about 1700 watts. If the ac line voltage goes down 10% than, since the power requirement remains the same, the operating current required will increase to 16.5 amps. With lower ac line voltages, startup compressor currents will also be higher. When the compressor cycles, on a hot day, the peak currents may be sufficient to trip the compressor over load sensor. To be safe I only run my A-C if the line voltage is over 107 volts. When running off a generator you should have at least a minimum 2800 watt rated unit. All of the manufacturers recommend

a 3000-3500 watt generator for use with their A-C's with either the 13,500 or 15,000 Btu sizes. For two units they recommend a 5000-watt minimum size generator.

3. Severe dirt build-up on the condenser coils can restrict airflow and result in excessive heat buildup, which will also trigger the over load sensor. The outside part (above the roof) of the A-C unit should be cleaned at least every two years.

## Not Cold Enough

1. A properly working system will provide a 16 to 22 degree drop in temperature as measured from the air inlet to the air outlet, directly on the A-C. If you are measuring in the return and/or outlet ductwork, your temperature drop may not be as high. This should be tested only after the unit has run for some time and the RV air temperature has been given enough time to stabilize. On hot days, you should be running your fan continuously to maximize the effectiveness of the A-C. This will help to keep the cool air circulating, provide a uniform temperature throughout the coach and reduce the startup current when the compressor cycles on and off. This is a particularly good idea for use in your home since the compressor will run less and this will also help reduce electricity costs.

2. A dirty interior air filter can severely reduce airflow and increase the length of time it takes to cool the coach. During the hot months, I would clean this filter at least once per week. Newer A-C units have washable filters that are easy to clean. Reverse blow the filter (use your vacuum cleaner in blower mode) to remove the loose dust and then wash them with a little soap and water. You can dry them quickly using the vacuum cleaner. You do not want too much air pressure as you might damage the filter material. If you have, the older paper filters replace them with the washable type and keep them clean.

If there is not a high enough airflow over the evaporator (condenser) coil or there is insufficient refrigerant you can develop icing which will further reduce the airflow. The icing sensor will turn off the compressor and put the fan on high speed. This will defrost the coils and allow the system to return to normal operation. If you suspect icing you can just turn off the A-C for an hour and let it melt.