

Refrigerator

Operation

Home refrigerators (fridge) use motor driven compressors to circulate Freon (R134a) to remove heat from the food compartment using what is called a vapor compression cycle. This is essentially the same type of system used in your automobiles where the compressor is belt driven from your engine. The compressor is large, heavy and requires 110 VAC to operate.

An RV fridge (absorption type) uses a source of heat and a closed ammonia based system to cool the food box rather than a mechanical compressor. Figure (19) shows the rather complex cooling system that serves to remove heat from the food box and extract it from the fridge food area.

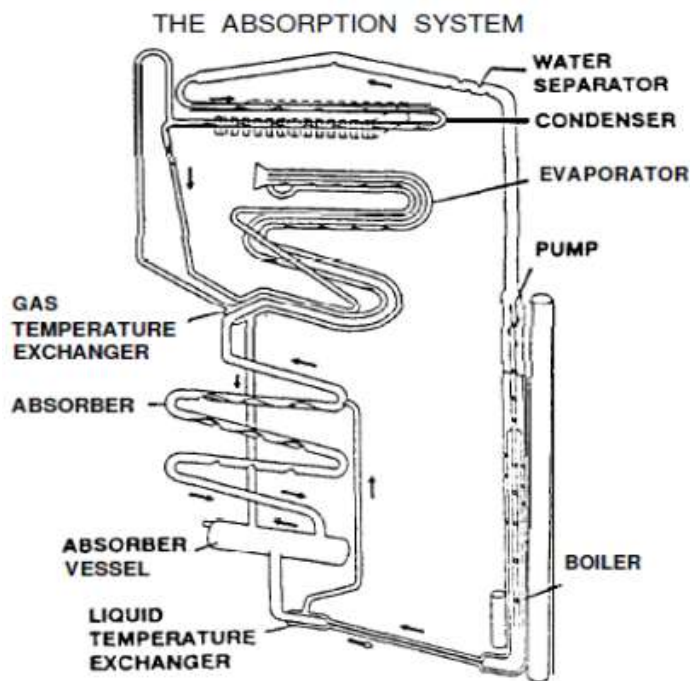


Figure (19) Cooling Unit

After about an hour of operation, the temperature at the absorber should be about the same as at the boiler regardless of the ambient temperature. This is a good indicator that the fridge is operating properly. Since this is a completely closed system, if you ever smell ammonia, your cooling unit has sprung a leak (usually from rust) and must be either repaired or replaced.

There are three heating systems available for an RV fridge: propane gas, 120 volts AC and 12 volts DC. All fridges, as a minimum, have a two way system which consists of propane and 120 VAC. Units that include a 12 volt DC mode are useful when the RV tow vehicle or motorhome engine is operating.

The battery drain in the 12 VDC operating mode is about 25 amps so it is really only useful when the engine is operating.

The basic fridge propane system is just like the water heater system with similar components and potential problem areas. Figure (20) illustrates the various components that make up a two way fridge. Major components are labeled with letters and wire

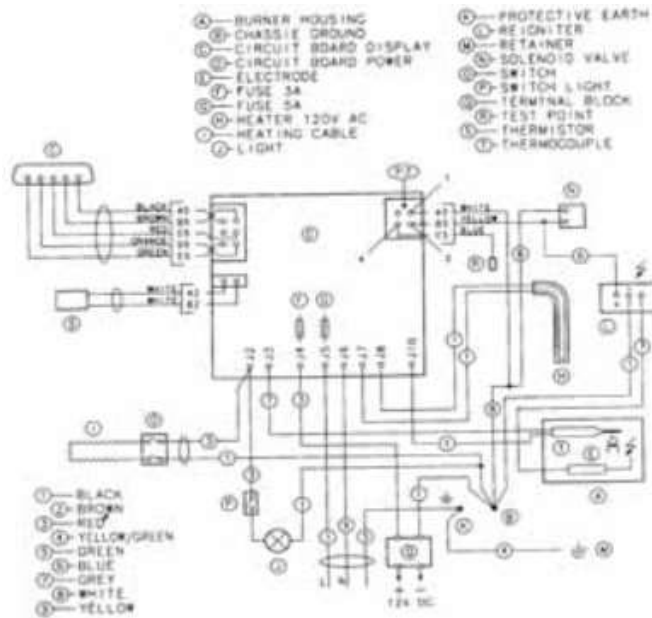


Figure (20) Two Way Refrigerator

colors are labeled with the actual color or with numbers. There are two circuit boards: (D) the main power board and (C) the display and control board.

Figure (21) illustrates the display/control panels for both two and three way fridges. The first button all the way to the left turns the fridge on. The next button selects auto, ac or gas operation. You use the same button for each of the modes by just pressing it

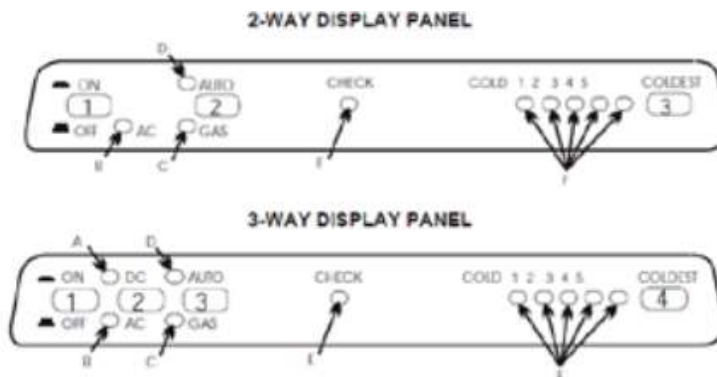


Figure (21) Display/Control Panel

multiple times till the proper light indicating the desired mode goes on. In auto the system automatically selects the heat source depending on what is available. AC is given priority when 120 VAC is present otherwise gas is selected. You can force the fridge to gas operation when both heat sources are present, if there is only limited AC available (just push the #2 button till the gas light goes on).

For the three way fridge there are three buttons with #2 able to select DC only. When the DC only is turned off then the #3 button can be used just like a two way fridge.

The check light will go on if the gas system stops functioning, the 12.6 VDC for the circuit board gets too low or the circuit board fails. In order to re-start the system, you must turn off the fridge for 45 seconds and allow everything to reset.

Note: All letters refer to components labeled on Figure (20).

For refrigerator operation, both circuit boards require 12.6 VDC to operate in any mode. This is fed from the terminal block (Q) to the circuit board via the 3 amp fuse (F). In the AC operation mode the heating element (H) is fed via the 5 amp fuse (G) from the circuit board. For 12 VDC a separate 12 VDC heating element is fed through a 35 amp fuse. The fuse locations are illustrated in Figure (22). For some models, these have been moved to other positions on the power circuit board.

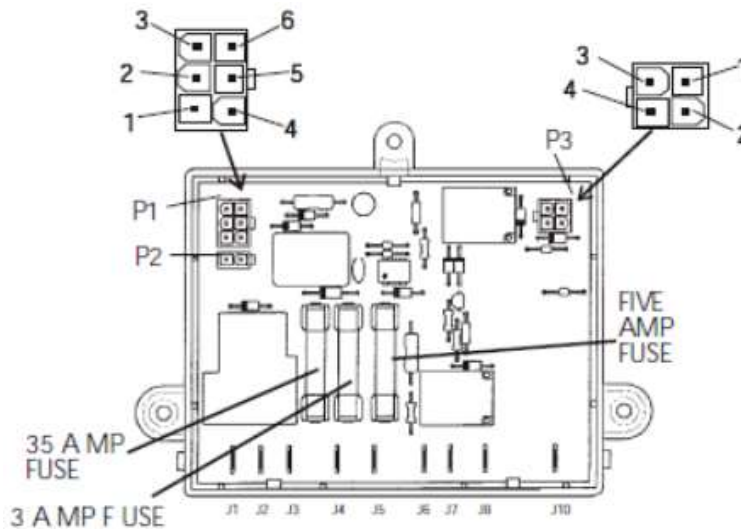


Figure (22) Fuse Location

In AC mode the 120 VAC element, (H) is mounted in the lower section of the boiler with two screws. In this mode the power circuit board connects the element to the AC voltage input cable, through the 5 amp fuse, to apply heat to the cooling system. In all modes the thermistor, (S), monitors the fridge temperature and based upon the temperature button setting turns off the AC heater as well as the gas valve. When the temperature goes above the set point it turns on the heater or gas valve to start the cooling unit again.

In gas mode, similar to the water heater, DC voltage is applied to the gas valve solenoid (N) and the re-igniter (L), Figure (23), at the same time. The gas flows to the burner (A) and the re-igniter sends a high voltage to the spark probe (E) which lights the propane gas. Once the gas is burning, the thermocouple (T) sends a signal to the circuit board

(D) indicating everything is working correctly. If the burner flame goes out then the signal from the thermocouple goes away and the circuit board turns off the gas solenoid.



Figure (23) Igniter

After about 45 seconds the cycle maybe repeated and the gas burner restarted. Figure (24) illustrates the burner and thermocouple placement in the gas assembly. The orifice is also called the jet which serves to shape the gas flow to the burner.

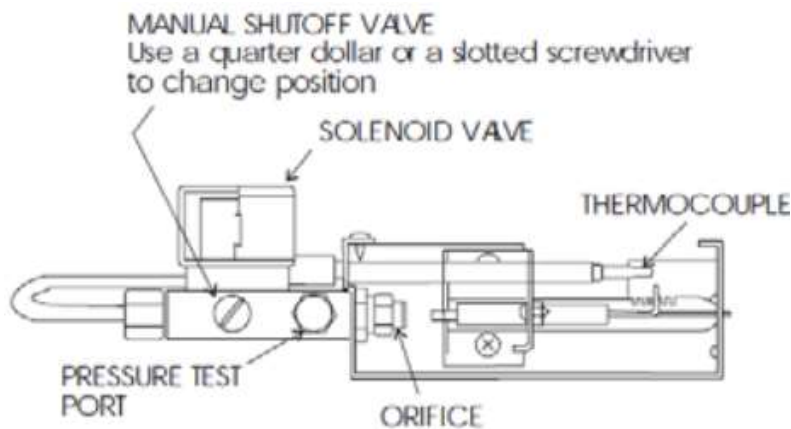


Figure (24) Burner Thermocouple

The spark probe wire must be adjusted (3/16 inch from the burner tube) as shown in Figure (25) in order to ignite the gas. The thermocouple must be in the nice blue flame in order to send the proper signal to the circuit board.



Figure (25) Spark Probe

Figure (26) illustrates the placement of the major fridge components. In order to gain access to the burner, thermocouple or jet, you must remove the sheet metal cover over the assembly. The power circuit board is protected with a Bakelite cover which must be removed to gain access to the fuses. Both the 12 VDC and 120 VAC wall plug are easily accessible for testing the source voltages.

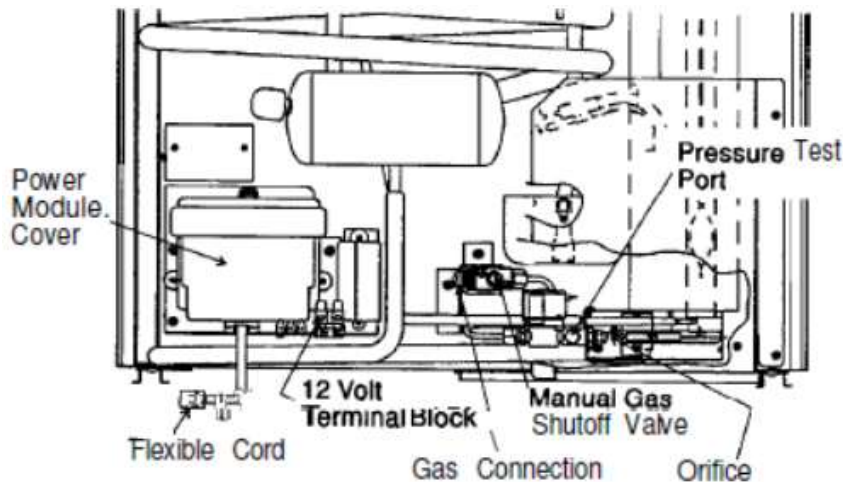


Figure (26) Major Component Location

Absorption refrigerators are considerably less efficient than our normal home type units. You should pre-cool the box to its operating temperature (at least a day) before you start putting food in. You should pre-cool the food and beverages before you put them in the fridge and let any hot foods cool to room temperature. Buy cold beverages whenever possible. Don't leave the door open for an extended time while searching for an item. Particularly in hot weather, if you have a significant drop in the box temperature, it can take hours to recover.

Troubleshooting

When troubleshooting for an electric problem, make sure the tank gas supply valve is turned off. When you cycle the fridge for testing it has built in time delays which will make sure you wait until any released propane has been dissipated.

Before you start your troubleshooting, obtain a set of at least two each of the needed fuses (two or three way unit). You need two because if the first replacement blows again, you will need the second fuse after you find out what is shorting out.

Nothing works

1. If you have no lights at all, check for 12.6 volts at the terminal block in the rear of the fridge. Again you may have a problem with your circuit breaker or batteries not providing sufficient DC voltage for operating the power board or you may have a bad connection.
2. If the voltage is at the terminal block, check the 3 ampere board fuse located at (F). You should remove the fuse to check it with an ohmmeter.
3. You may have loose or dirty connectors which attach to the circuit board. Remove and clean each connector with radio circuit spray.
4. If none of the above works, you probably have a bad board.

Refrigerator is not working in Gas Mode

1. Go through the same sequence of checks that was used for the water heater. Listen for gas valve operation (click), listen for spark probe arcing, check for 12 volts on the gas solenoid valve, check gas pressure etc.

2. If there is no spark voltage check to make sure the igniter is getting 12 volts on its input terminals. If it is, unplug the high voltage lead and see if it will arc to the chassis. You could have a bad lead or a defective igniter.
3. Check the jet to be sure the opening is clean. I have found that a clogged jet IS THE MOST COMMON PROBLEM with the gas refrigerator mode. On one WBCCI Caravan I fixed 10 refrigerators by simply cleaning the jets. This is a 10 mm unit and the opening is so small you cannot use a toothpick to clean it. If you have alcohol use it to soak the jet until it is clean. In a pinch, I have used vinegar which works OK except you have to soak it for at least two hours.

Burner lights, but flame goes out

1. Check the jet for cleanliness (as above).
2. Check thermocouple to make sure it is in the nice blue flame. Test the thermocouple by removing its connector and measuring the output voltage (should be 15 to 35 millivolts).
3. Check the gas pressure as described in the water heater section.

Fridge not cooling adequately

1. Thoroughly clean the jet (as above). Use the correct 10 mm wrench so you do not damage it.
2. Check the seals on the fridge doors. Close a piece of copy paper in the door seals and try to pull it out. It should have significant resistance.
3. Check the thermistor by removing it from the fridge, hooking up an ohmmeter, put it in a glass of ice water and measure the resistance (should be between 7000 to 10000 ohms).
4. Make sure the "O" ring seals used on the thermocouple are installed and in good shape.

Fridge not cold, freezer OK

On units with fins, check the location of the thermistor on the fridge internal fins at the rear top of the main food box. The vertical position of this thermistor allows the temperature of the box to be changed. Just move this up to decrease the box temperature (make the fridge colder) and conversely if the food is too cold, move it down. Do this in small increments with a thermometer in the box. Allow sufficient time for the temperature to stabilize. This actually allows you to balance the freezer/food compartment temperatures.

Fridge works on gas but not electric

1. Check for presence of 120 VAC at the electric wall outlet in the external compartment.
2. In electric mode, carefully check for heat on the flue. If it is cold, unplug the 120 VAC line to the wall plug, remove the power circuit board cover and check the 5 amp fuse. If it is good, remove the heating element plug from the board and test it with an ohmmeter (it should measure about 45 ohms). The heating element is located in the flue.
3. If you have a three way fridge and the 120 VAC works but not the 12 VDC mode, then it is either the 35 amp fuse or the 12 volt heating element. Go through the same steps as above (it should measure 0.67 ohms) for the 12 volt heating element which is also located in the flue.

Works OK, but on hot days not so good

You have got to get the heat out of the cooling unit cabinet. On extremely hot days you need some additional air flow from the outside cover to the roof mounted exhaust vent. I have used an auxiliary fan mounted in the cabinet as high as you can get (as close as possible to the roof vent). You need a quiet sealed motor fan that can take the moisture and dirt. Put a switch, which lights in the on position, inside on the wall near the fridge to control the fan. When the ambient temperature gets to 90 degrees and above just switch it on. This will help an older unit that has lost some of its initial cooling ability.

Maintenance

At least once per year clean the outside compartment (by hand not with a water hose). Remove and clean the burner housing and the jet. You can clean the burner with a small wire brush, compressed air and some alcohol. Before you clean the compartment, tap the flue gently and get all of the dirt and deposits out. A special long handled brush is available if it is particularly dirty. Don't forget to clean the cooling unit and fins. Yes, this requires you to remove the burner shield and a few screws. Remove the circuit board cover and use a low pressure air spray followed by the radio cleaner spray. Remove each connector spray with cleaner and tighten each wire connection.