

# FRIDGE ON THE FRITZ

*Replacing an absorption refrigerator cooling unit is a viable alternative to forking out big bucks for a new model*

By Bill Gehr  
Photos by Bob Livingston

**M**odern gas/electric absorption RV refrigerators are quiet and efficient. This

technology has been around since 1850 and, more importantly for RVers, these refrigerators will operate on LP-gas — which, unlike compressor-type residential units, enhances the ability to park off-grid. These versatile refrigerators have a network of tubes that are filled with ammonia, hydrogen, water and sodium chromate, a chemical that coats the inside of the piping to prevent rust from attacking the steel.

Like all refrigeration systems, there are many components that are needed to keep everything functioning properly. If you have owned an RV with a gas/electric refrigerator long enough, you may have experienced a failure of the cooling unit — which always

seems to happen when fully loaded and on vacation. That invariably spurs a discussion on whether to repair the existing unit or buy a new one. Of course, there are factors to consider, including age, condition, technology and desire for a new refrigerator. Swapping the cooling unit will save quite a bit of money — whether installing a new or a rebuilt replacement — while opting for a new refrigerator will likely mitigate the risk of premature failure. Remanufactured cooling units can be cheaper, but quality is in the hands of the rebuild company.

New, upgraded cooling units, on the other hand, will be slightly more expensive; however, they are typically more efficient and will likely even outlast a rebuilt unit. For me, installing a new cooling unit in a 10-year-old Norcold 1210 series refrigerator was the best option, considering I plan to hold on to the fifth wheel for several more years and the refrigerator was in good condition overall. Keep in mind that, should you choose to replace the refrigerator with a new model, cabinet modifications may be necessary, although refrigerator suppliers typically offer direct fit replacements. Also, residential or 12-volt DC-compressor-powered units are viable options for those who always plug into power in RV parks, but anyone who spends a lot of time boondocking will have to look at increasing their battery bank, adding a power inverter and providing an adequate charging system such as solar panels.

### **The Root Cause of Failure**

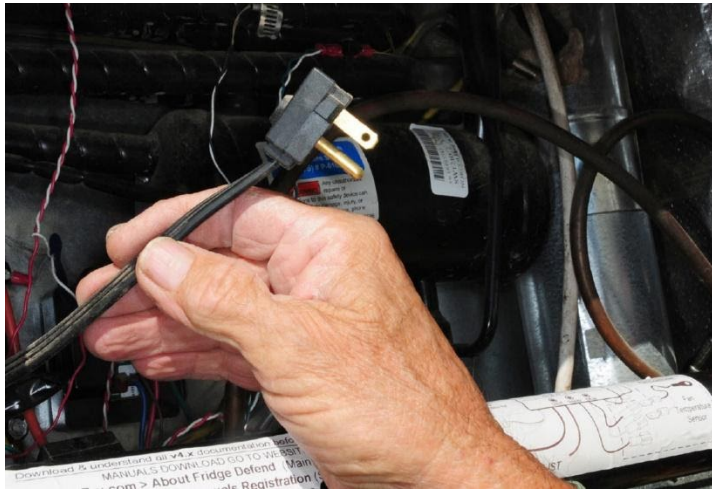
A major cause for early absorption refrigerator failure is off-level operation. Damage can occur in as little as 15 minutes and will accumulate over a period of time, leading to complete cooling-unit failure. Driving up or down steep grades for long periods of time, parking off-level while walking the dog or stopping for lunch and, of course, parking on off-level RV park sites all contribute to failure. Improper installation and poor ventilation can also lead to damage.

In a nutshell, when the refrigerator is run off level for extended periods of time, the boiler overheats and starts to precipitate out the aforementioned sodium chromate into solid crystals or flakes. Not only can this reduce the internal rust-preventive effect of the sodium chromate, but as happens with people's arteries, the sodium chromate flakes can cause a permanent blockage of tubing. As time goes on, rust — attacking from both the outside and inside — will make its way through the steel tubing, resulting in a leak and imminent failure.

Since parking on a level surface may not always be feasible while on a trip, installation of a Fridge Defend device is a good way to protect the refrigerator from damage. This product is designed to be installed easily in any absorption refrigerator and protects against high boiler temperatures. The system's automatic monitoring control uses a temperature sensor mounted to the boiler tube to send the control box a signal to shut down. After 10 to 30 minutes, depending on boiler temperature, the Fridge Defend starts the refrigerator back up. It is designed to shut down completely after 25 attempts at restarting before it goes into lockout. A readout in the Fridge Defend housing, mounted in the rear of the refrigerator, provides operational history.

The Norcold refrigerator for this project was shutting down two to three times a day, indicating abnormally high boiler temperatures even in cold weather. After a conversation with Fridge Defend owner Paul Unmack (when I sheepishly admitted I hadn't installed a Fridge Defend device), it was determined that the cooling unit was

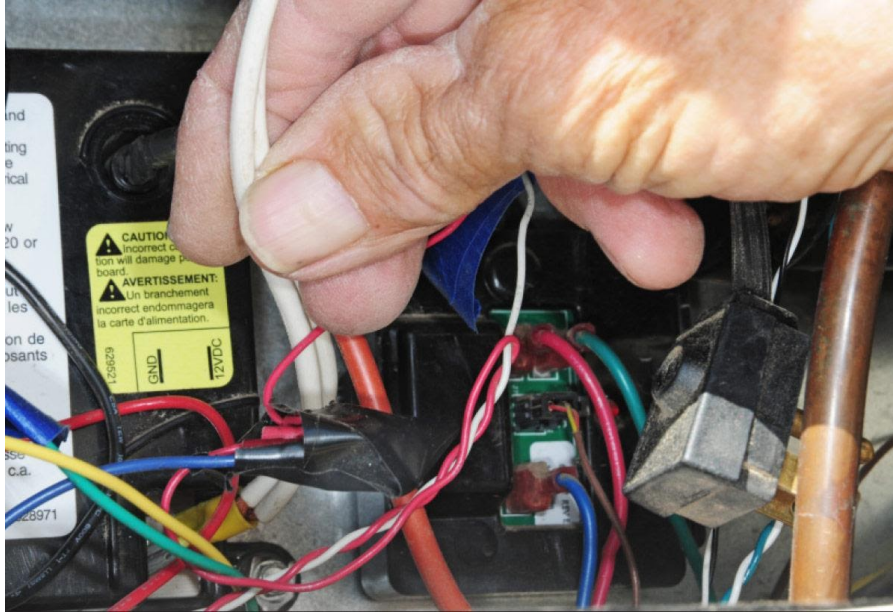
likely damaged and failure was imminent. Figuring that the refrigerator would be out of service for a longer-than-expected time based on current supply chain shortages if I went the “new” route, the decision was made to replace the cooling unit.



*The process starts from the back. Unplug the 120-volt AC power cord first to prevent damage when pulling the refrigerator out from the cabinet.*



*Be sure the LP-gas is turned off and use a back-up wrench when disconnecting the gas line.*



*Disconnect the 12-volt DC leads from the control board and mark polarity.*

After thorough research, it was decided to replace the cooling unit with a new Dutch Aire custom cooling unit manufactured by JC Refrigeration in Shipshewana, Indiana. These units feature strong build points — most importantly, the use of heavy-duty boiler tubing and double absorber coils. The boiler-tube upgrade helps protect against high temperature spiking, which can be typical of some refrigerators. Meanwhile, the double absorber coils make the refrigerator more efficient as it is able to drain the solution of hydrogen, ammonia and water to the bottom of the cooling unit into the absorber tank twice as fast. Dutch Aire cooling units are hand-built in the U.S., and the high quality is obvious upon initial inspection.

All JC Refrigeration cooling units come with a three-year hassle-free warranty and a three-year extended warranty is available. Electric heating elements, burners and other parts/accessories are also available on the company's website. The Dutch Aire cooling unit I chose for my fifth wheel sells for \$1,075 (plus shipping); electric elements are \$30 each. The Fridge Defend — which I added to my new unit, hindsight being 20/20 — can be purchased for \$147.50-\$225, depending on model.

### **Doing the Swap**

Installation can be extensive; however, no special tools are required to complete the cooling unit swap. Seasoned Saturday mechanics can do the job, but the help of one or two assistants is necessary. Plan on most of the day and wear a back brace if lifting heavy items is an issue.

First, be sure the power (AC and DC) to the refrigerator is off and the LP-gas gas supply is turned off at the source. Then, remove all the doors (which will make it easier to hold on to the refrigerator while removing it from the opening and also reduce weight). Out back, remove the hold-down screws, disconnect the LP-gas line, unplug the refrigerator from the 120-volt AC source and disconnect the 12-volt DC power lines. The cooling unit swap can be accomplished indoors, if there is sufficient room; in our case, we removed the kitchen island to open up floor space, which was deemed easier than lifting

the refrigerator through the entry door. Be sure to protect all interior surfaces with moving blankets, roll paper and so on as dings are sure to happen otherwise.



*Remove the screws in the bottom plate before attempting slide the refrigerator out of the cabinet structure.*

After removing the screws from the upper and lower panels, the refrigerator can be pulled from the cabinet; leave it standing upright for now. The screws will have to be removed from the freezer plate and the evaporator inside the refrigerator, the number and size of which will vary depending on the manufacturer of the refrigerator. Next, you will need to lay the refrigerator face down, using wood blocks to prevent the door hinges and floor covering from being damaged.

Remove all screws and components that are attached to the cooling unit including the AC (and DC if equipped) heating elements, unless new ones were purchased with the cooling unit. I recommend replacing the heating elements if the refrigerator is more than eight years old and operated under normal conditions or five years for full-time RVers. The electric heating elements are much easier to replace at this point than when the refrigerator is in the cabinet. It's best to take a picture of how the wiring from the heating element is attached to the control board to consult during reinstallation; both heating element wires must go to specific terminals. You'll also need to peel off the foil tape that seals the seam where the cabinet and the cooling unit foam meet. On some Dometic models, you may need to use a razor knife and slice down into the seam, making sure that you don't poke a hole through the plastic liner in the interior of the refrigerator. Once the tape is off or cut, the cooling unit can be removed from the refrigerator.



*Refrigerator doors are held on by brackets that are easy to access. Removing these brackets will free the doors. Take all the doors off the refrigerator to make it easier to pull the refrigerator out of the cabinet.*

Some cooling units get rather stubborn and might require the use of a block of wood and pry bar. Be careful not to pry against any tubing — it's extremely dangerous to create an ammonia leak, especially inside the RV.

You will need two people to pull the cooling unit from the cabinet. After extraction, scrape off any areas where the old thermal mastic was applied. Examine the cavity and remove any debris or thermal mastic from the sides of the foam pack. If the foam in the

refrigerator cabinet is wet, you might need to leave the cooling unit out for several days to allow it to dry. Doing otherwise will affect cooling efficiency.

Test fit the new cooling unit: The new foam pack should be flush with the top of the cabinet. Install two or three screws to hold the cooling unit in place before setting the refrigerator upright. Check the holes in the freezer plate and the evaporator fins to make sure that they line up. If they don't, remove the screws in the back and ask your helper to hold the cooling unit in place while you align the holes. Use a level across the condenser fins at the top before installing the top screw — it must be level with the top of the refrigerator for optimal performance.



*The refrigerator is held in place by several screws, top and bottom, which must be removed to free it from the cabinet structure.*

Next, reinstall the screws and add a couple of locator marks on the back of the cooling unit and the cabinet so you can drop it back into place and adjust it later. Lay the refrigerator back down on its face, remove any test screws and, using the supplied tube of thermal mastic, run a 1/2-inch-thick bead on all of the pipes that will contact the freezer plate and evaporator fins. You will need to run another bead side-to-side where the bottom of the fins will come in contact with the plastic liner; this assures proper sealing.

To prevent air leaks, run two beads of expanding foam around the sides of the cavity where the foam pack on the cooling unit will come in contact with the sides. Quickly drop the cooling unit into the cabinet, align and install the screws. Be sure that the foam pack is seated completely into the cabinet. Lift the refrigerator and install all of the screws into the freezer plate and the evaporator fins; install the screws in series, tightening them with minimum torque until the cooling unit has been pulled tightly up against the freezer plate. Lay the refrigerator back down on the blocks and install all of the screws that hold the cooling unit to the cabinet.

Apply aluminum sealing tape around where the foam pack is installed into the cabinet for added insurance against air intrusion. Install all components, including any optional fan kits, by basically reversing the removal process. Keep in mind that the thermal cut-off switch is in a different location on Dutch Aire cooling units, as are the fans. Inspect the cabinet opening and interior for any problems with insulation coming loose before reinstalling the refrigerator. Slide the refrigerator into the cabinet and reverse the removal process. Do not forget to check the LP-gas line for leaks with a leak-check solution. A propane leak down and pressure test and adjustment using a manometer is recommended.

After installation, the refrigerator can be started immediately — just make sure that your rig is level.

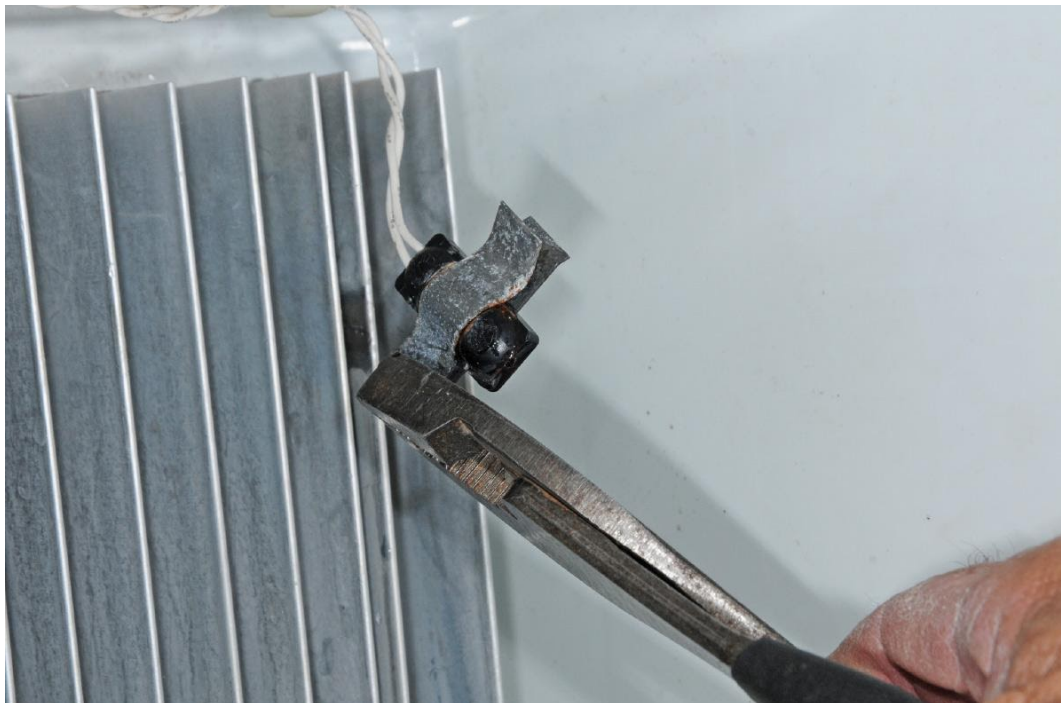




*This strip of molding also is removed before pulling fridge from the cabinet.*



*Inspect all areas to make sure all the tie-down points have been disconnected. The refrigerator is a tight fit and you don't want to be pulling against unknown fasteners.*



*Before pulling the thermistor from the evaporator fins, make sure it is unplugged to prevent snagging the wires.*





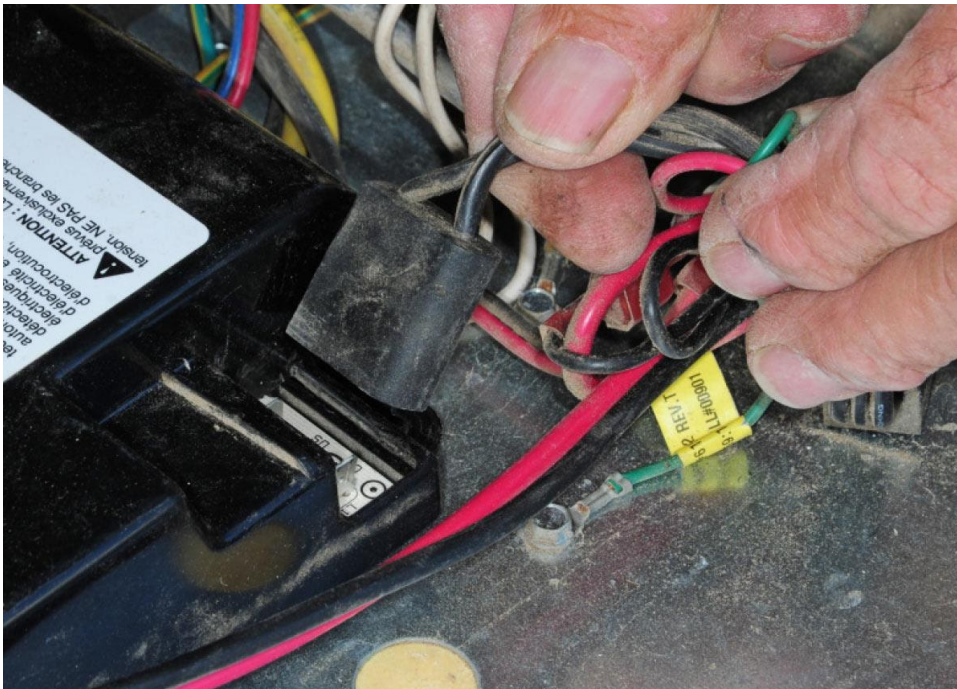
*Using a 5/16-inch nut driver, remove all the screws from the evaporator fins. The same nut driver can be used inside the freezer compartment to remove the screws from the freezer plate.*



*You'll need a couple of 4 x 4-inch boards to lay the refrigerator face down on the floor. This prevents damage to the hinges and floor. The refrigerator, especially this four-door model, is heavy and bulky to handle. We enlisted two friends to help position the refrigerator on the boards placed on the floor.*



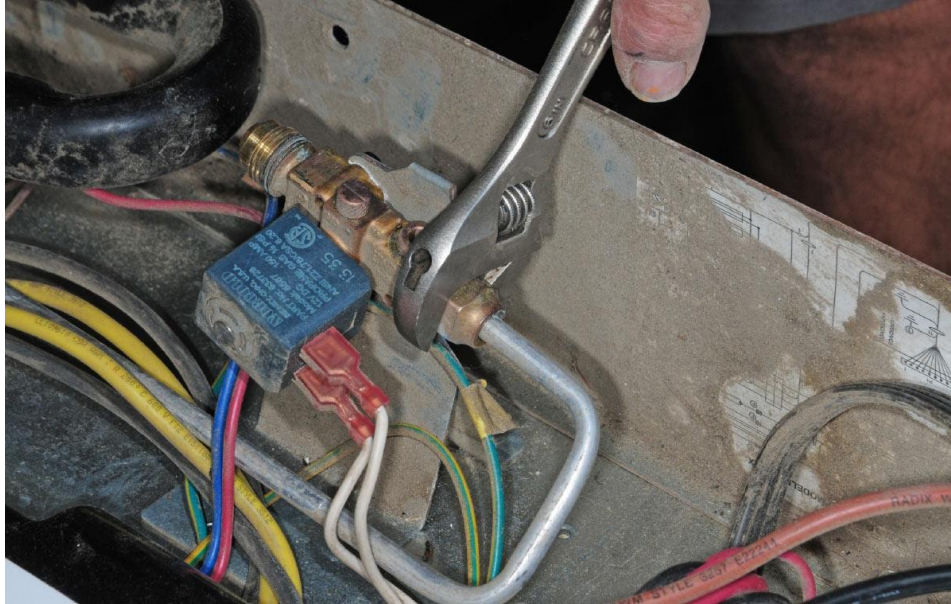
*Here, it's clear that the refrigerator was overheating, as suspected before ordering the new cooling unit. Excess heat caused the paint to peel of the boiler tube.*



*Before removing the connection to the heating element, the power cord to the control board must be unplugged. The cover is then removed (not shown).*



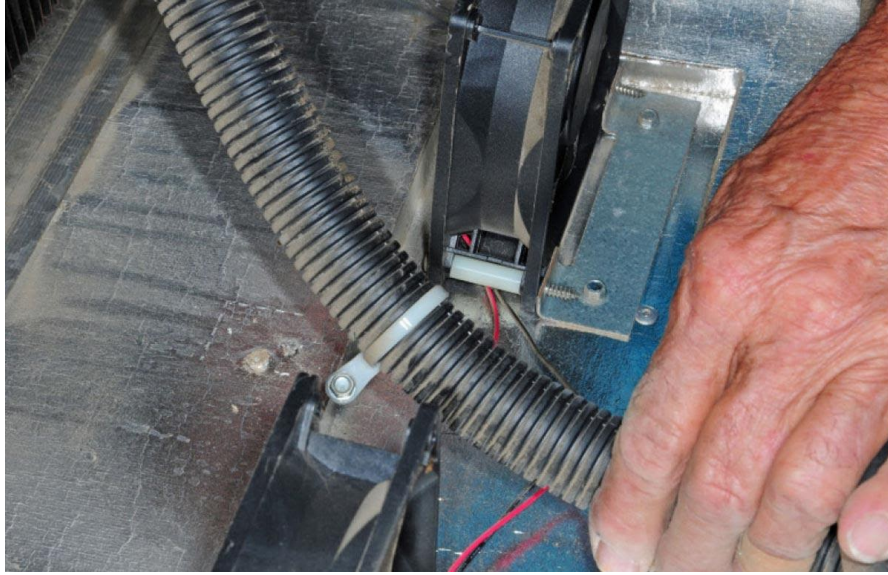
Once the cover is pulled away, a 1/4-inch nut driver is used to remove the burner box. Use a long Phillips screwdriver, remove the electrode and burner from the cooling unit frame.



*When the burner is out, disconnect the line from gas valve and set aside.*

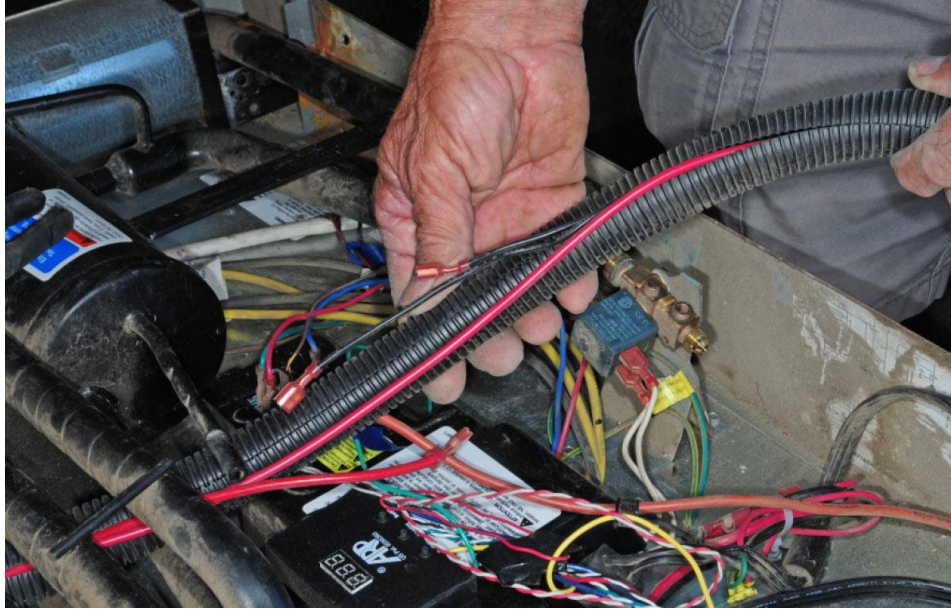


*Thoroughly inspect the gas line and burner and replace if damaged or badly rusted. Parts are available from the cooling unit supplier.*

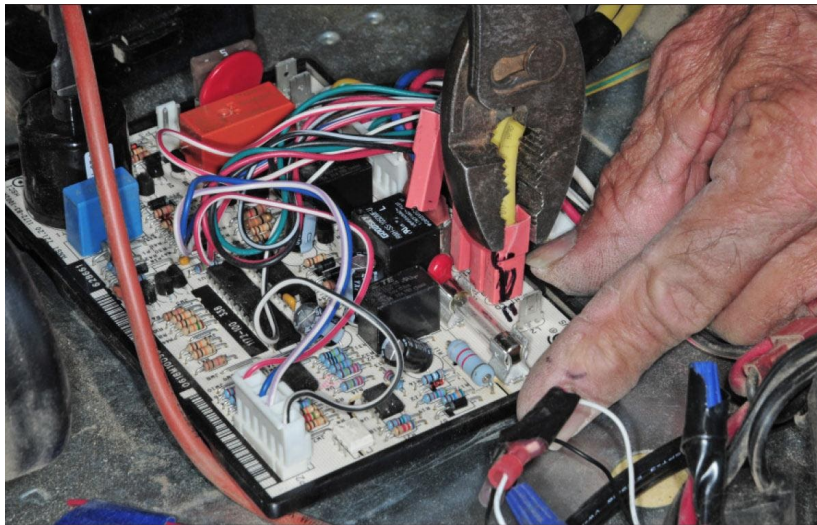


*Peel the split loom back several inches to access the connectors for the thermostat wires. Disconnect all wires including the ones to the thermostat and fans.*





*You'll need to remove the split loom and wiring that runs up through the absorber coils in order to remove the cooling unit.*



*After marking the position of the wires from the AC heating elements, remove the connectors from the control board.*

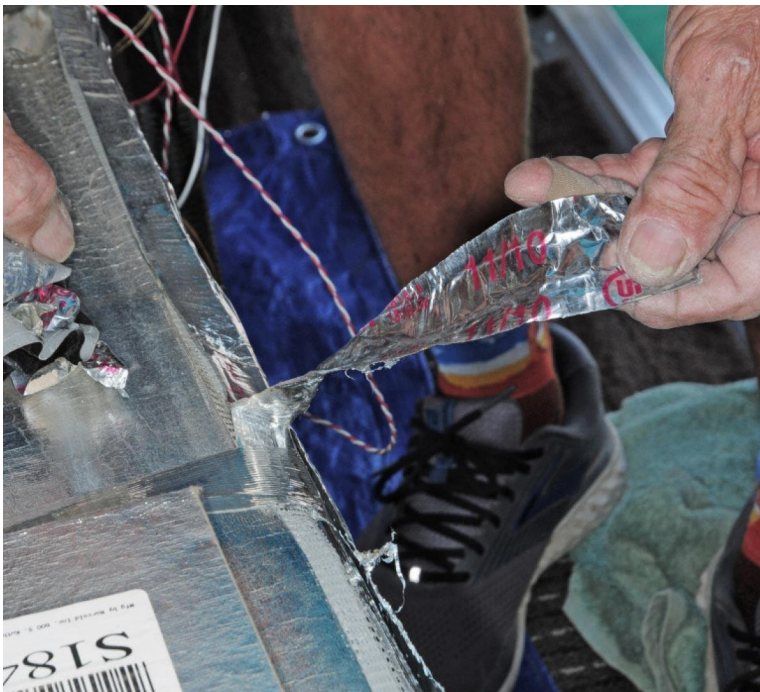


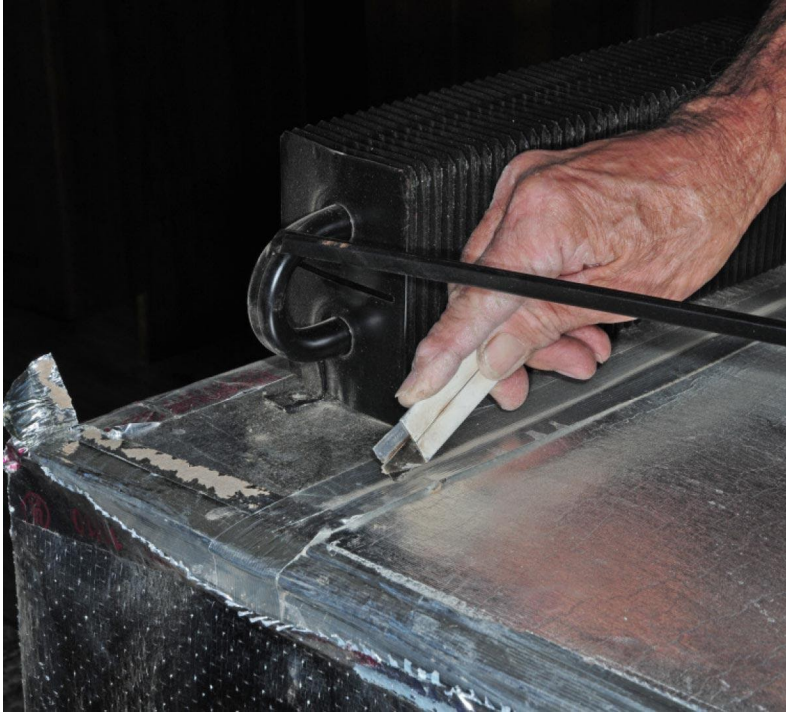
*The thermostat for the cooling fans will be saved for use in the same spot on a OEM cooling unit, but it is mounted in a different location on the new cooling unit.*





*Using a 5/16-inch nut driver, remove the screws that secure the cooling unit frame to the refrigerator cabinet. Remove the screws that hold the rest of the cooling unit in place with the 5/16-inch nut driver.*





*Peel off the aluminum tape that covers the seam between the two foam packs. It may be necessary to use a box cutter or knife in areas where the tape is difficult to remove. Be careful not to cut into the refrigerator liner.*



*You may need to use a long, dull knife to cut the seam from the foam packs loose. Do not cut into the inside liner.*



*This refrigerator came with two cooling fans, which will be removed and remounted on the new cooling unit.*





*Grab the tubes and start pulling the cooling unit out of the cabinet. It takes two people to extract the entire cooling unit from the cabinet once everything is cut free.*





*Scrape the old thermal mastic using a putty knife from condenser and evaporator. Then clean and remove any debris from inside the refrigerator cavity. Here, a shop vacuum does the trick.*



*The new cooling unit on the left has double absorber coils and heavier boiler tubes for increased efficiency. The design allows for more refrigerant and faster circulation for optimal cooling.*



*If the cabinet foam is damp, it should be left out to dry naturally, or a hair dryer can be used to expedite the process. A heat gun can be used, but it gets very hot, so extreme care must be taken.*

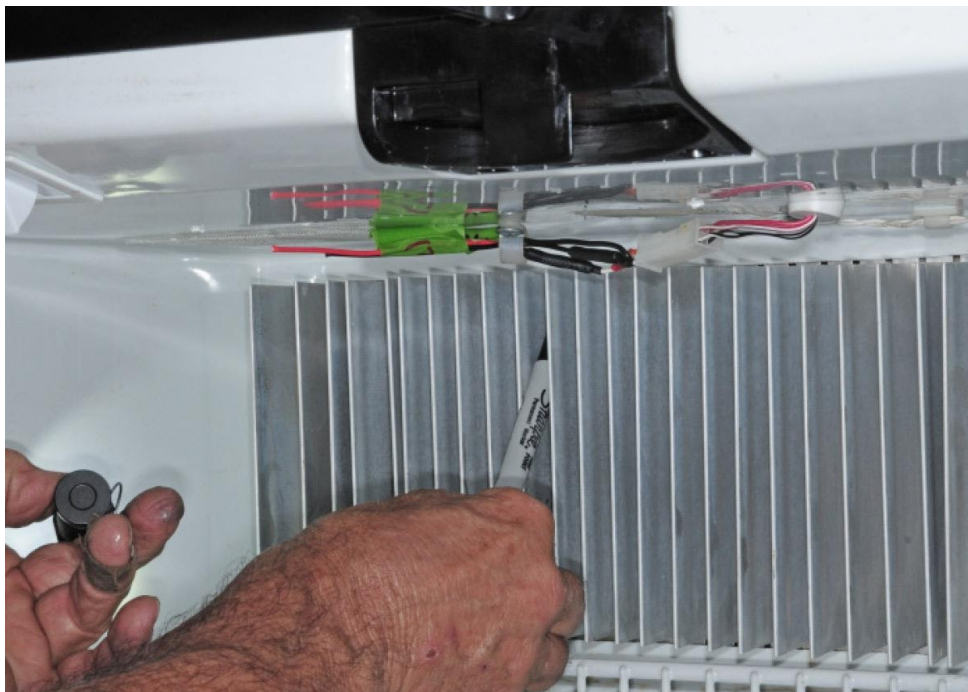




*The freezer plate may not line up with the holes in the back of the freezer compartment. Use an awl to align the holes in the new cooling unit.*



*Level the condenser to the back of the refrigerator and mark the location. Install a set screw (not shown) to keep it in place.*



*To align the holes in evaporator to the cooling unit, mark the location for positioning.*



*Clean all the surfaces where the thermal mastic will be applied with alcohol to ensure proper adhesion. Wipe the surfaces of the freezer plate where the thermal mastic will come in contact with new cooling unit when it is set in place.*



*Use a standard caulk gun to apply a ½-inch (thumb-sized) thick bead on the condenser and evaporator tubes. Also apply a bead of thermal mastic at the bottom of the evaporator fins to prevent moisture intrusion.*



*Two beads of liquid foam are applied to the foam pack on the refrigerator cabinet. This will seal off any gaps once the new cooling is in place and the foam expands.*

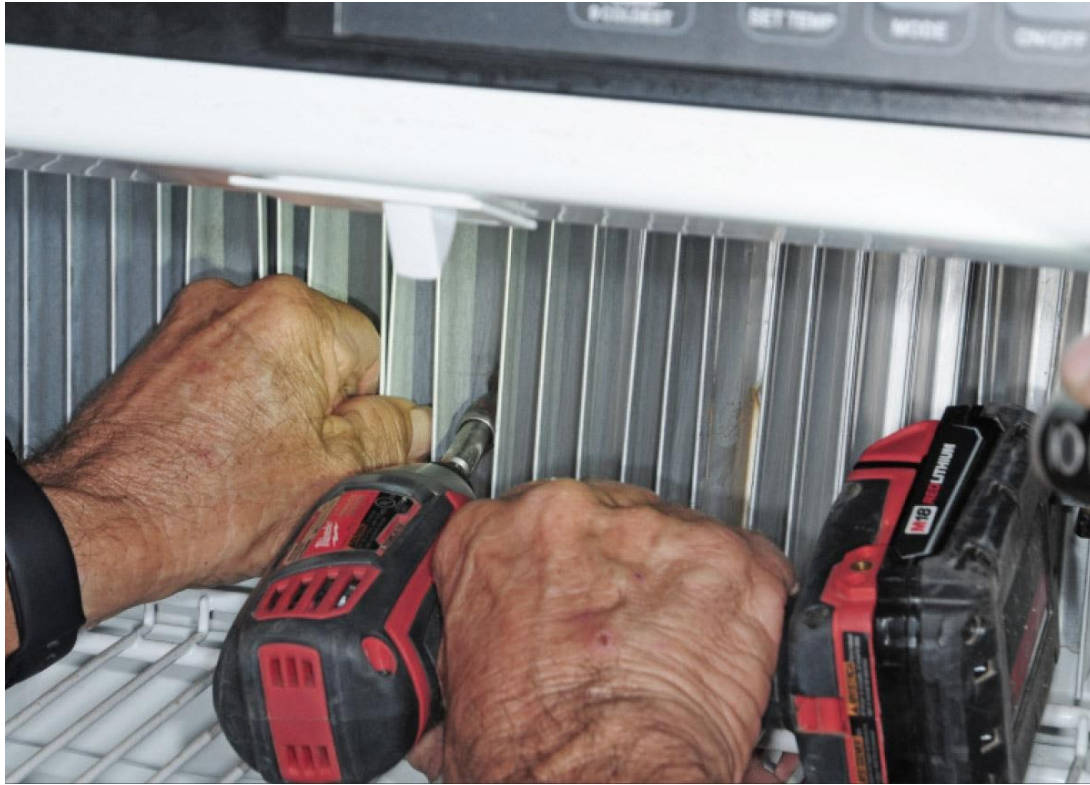




*Carefully place the cooling unit into the refrigerator cabinet while it is on the floor. This will take two people. Press down evenly to seal. After the cooling unit is in place, install the mounting screws using a 5/16-inch nut driver.*



*Install the set screws into the freezer. Here, the holes were a little off, so a helper was used to facilitate alignment.*



*Install the set screws through the evaporator fin and into the cooling unit using the 5/16-inch nut driver. Be careful not to overtighten the screws (read: know how to use*

*your screw gun). Then push the clip for the thermistor over the evaporator fin. Install on the second fin from the right.*



*Install aluminum tape on the gap between the cooling unit and refrigerator cabinet. This is added insurance against air intrusion. If tape around the outside of fridge box is dried out and failing, replace all with new aluminum tape. Some tape comes with the cooling unit, but rolls are available at most home centers.*



*The new location for the cooling fans is on the boiler tube.*





*Place both new electric heating elements into the tubes welded to the boiler. Make sure the fiberglass insulation completely surrounds the heating elements.*





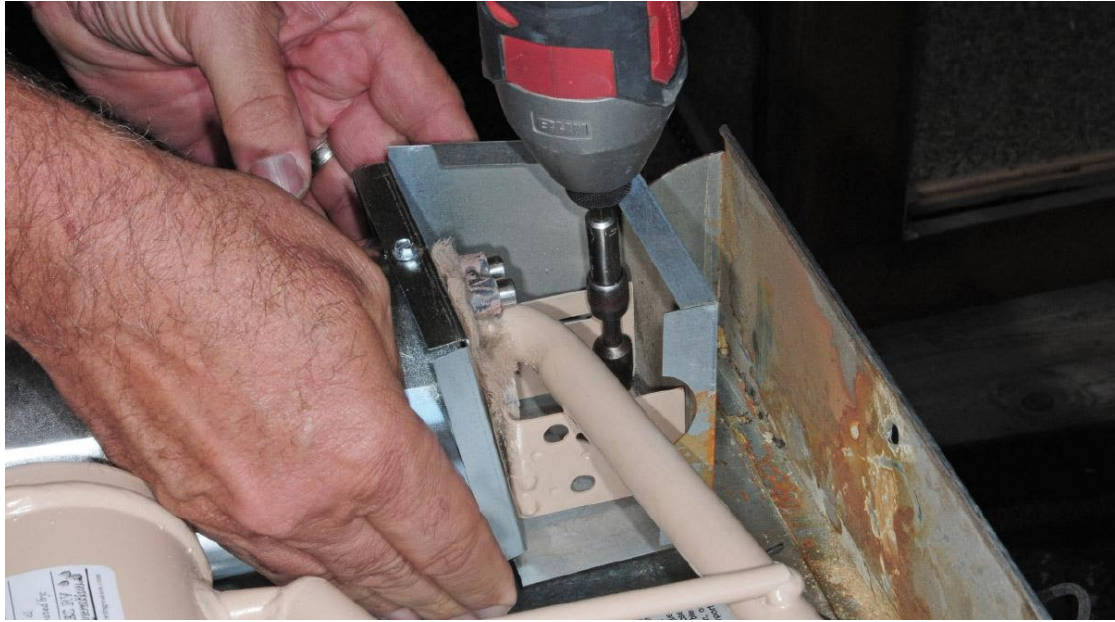
*Attach the existing cooling fans in the allocated location on the new cooling unit and attach the connectors, which are polarized to prevent mistakes.*

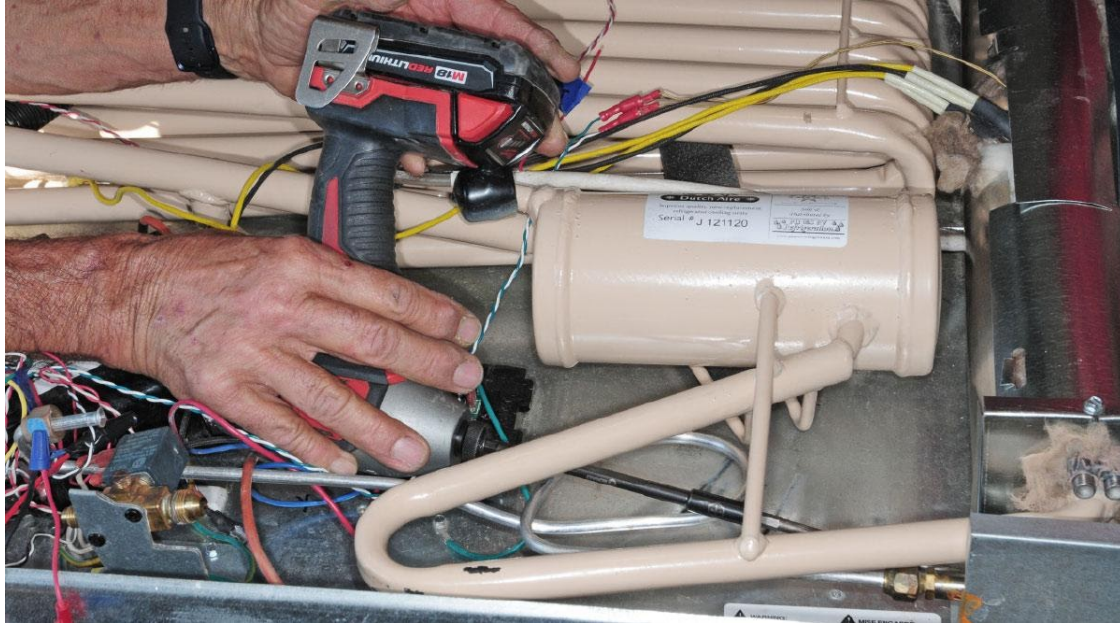


*The sensor for the Fridge Defend is clipped to the boiler tube about 1 to 2 inches above the heating elements.*

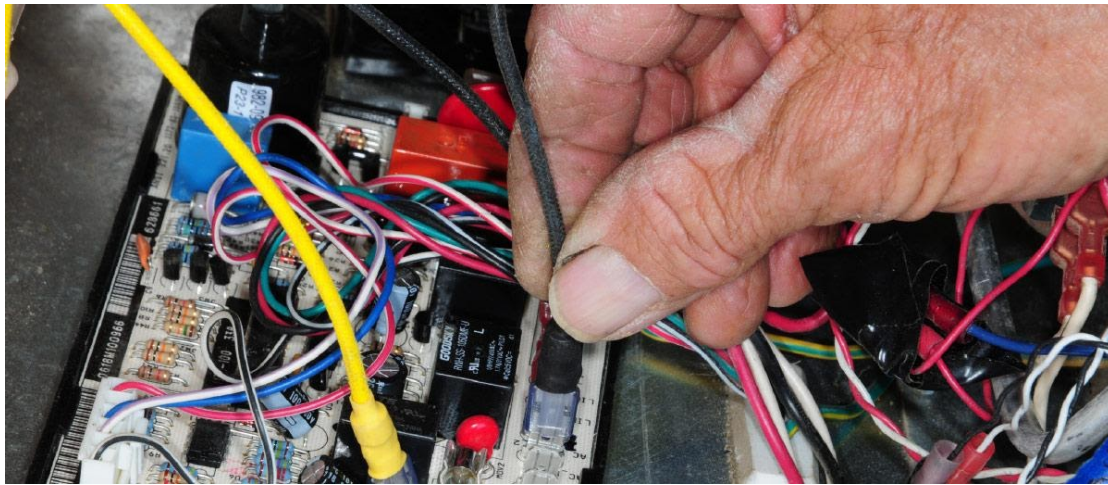


*Closing the housing for the heating elements takes some finesse, or a bunch of extra hands.*

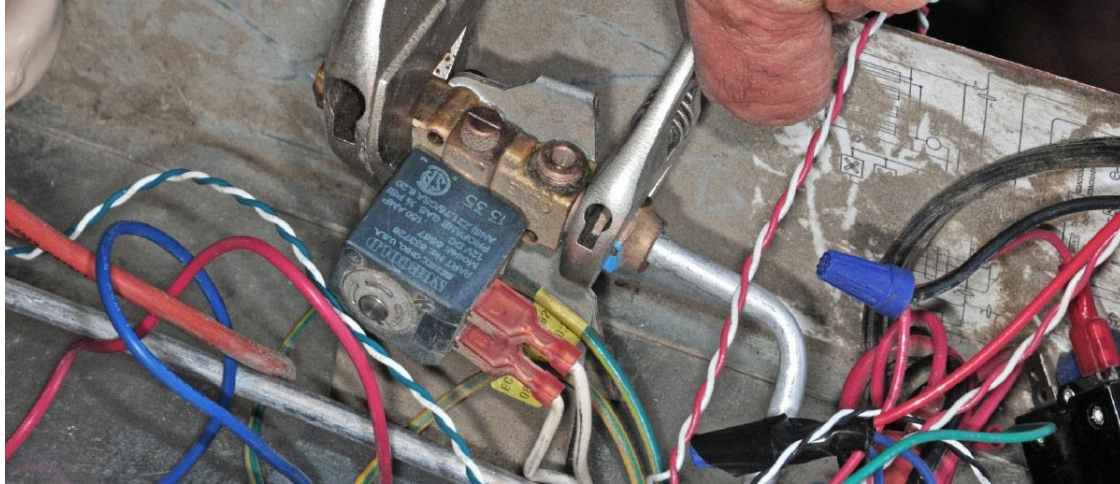




*Install the screws into the burner box and tighten with a ¼-inch nut driver. Installing the burner is somewhat awkward due to restricted workspace. Here, a long extension and screw gun get the job done.*



*Attach the heating element wires on to the control at the previously marked locations.*



*Using a back-up wrench, tighten the tube to the gas valve. This aluminum tube can be easily kinked and/or over-tightened and damaged, so use caution.*



*Use a long Phillips screwdriver to install the ignition electrode just above the burner. This is another tight fit that requires patience and a delicate touch.*



*The Fridge Defend absorber coil temperature sensor is installed with a hose clamp. Do not use a cable tie; the heat will cause it to fail in a short time. RVE.*

## **Sources:**

**Fridge Defend**

(406) 494-1959

[Arprv.com](http://Arprv.com)

**JC Refrigeration LLC**

260-768-4067

[jc-refrigeration.co](http://jc-refrigeration.co)