

Build DC powered refrigerator or freezer!

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Making your own DC powered refrigerator from a recycled AC refrigerator is very easy and operates at about a quarter or less of the energy of conventional refrigerators. The complete precharged units are fairly expensive, \$ 650 for the condenser unit and \$350 for the large evaporator. Using a flat bendable evaporator is less. This is a step by step guide that will show you how I built one myself.



1. The first step is finding a refrigerator that is in good physical condition on the inside. Clean, all the glass draws and shelves are intact. The refrigerator compartment should be less than 14 cu ft. for best efficiency. There's lots of these for free for the taking or at your recycling facility. Getting one at a recycling facility should ensure that the ozone depleting refrigerant gas has been safely removed and stored, which is very important. You don't want to carelessly rip the compressors and piping out and let the gas escape in to the environment.
2. Once you have found the ideal refrigerator that has had it's refrigerant removed, take the doors off and then proceed to remove all the AC components in the refrigerator. This would include the compressor, the evaporators and dehumidifiers, fans and wiring. Find the wire for the switch to the door which activates the inside light and separate it from others so it can be reconnected later.
3. Remove the freezer compartment. (Using a chest freezer has more room and uses less energy) Draw a line all the way around the refrigerator just above the refrigerator compartment. Using a metal cutting sawzall, or circular saw, carefully cut through the metal casing, insulation and any of the inside compartment. Remove the freezer and discard.



4. I built a platform out of 2x4's so that refrigerator would be higher off the floor and easier to access. On top of this platform, I stacked 2 layers of Tuff II urethane foam insulation as an insulating barrier.

5. Cut pieces of the Tuff II or any other good quality insulating foam, such as the blue foam for foundations, and fit them into the bottom of the frig, taping or gluing with a hot glue gun to hold in place. You can also fill any voids with spray foam. The bottom is very important to have insulated well, since cold goes down.

6. If you are going to use the interior light that came with refrigerator, find that wire and circuit to the switch and keep it available to pull through the insulation as you wrap the box. Later you will connect this either to a AC supply using a standard lamp plug or to a DC supply with a DC light bulb. Wrap the back, the side, top and the door with full pieces of the foam, alternating over lapping edges. Add at least 3 more inches of insulation, 4 if you have the room.



Installing the refrigeration components



In the marine field, especially sailboats that are on tight energy budgets, I've installed the Adler Barbour (Waeco) "Cold Machine" package many times and they have proven themselves to last in all kinds of environments. They have consistently survived poor electrical systems and low batteries. There's many that are over 20 years old and still operate well. There's a couple of companies that are making DC refrigerators and chest freezers and they are using the same compressor, which is the Danfoss BD 50. When purchasing the "Super Cold Machine", you will have a choice of either air or water cooled condensing units as well as choices of evaporator sizes and configurations. They all are 12 volt by default and when the electronic module senses voltages above 17 volts, it

switches to 24 volts. (But the cooling fan remains 12 volts, so the leads are moved to another connector on unit. I will discuss this later) I chose the air cooled model since I was placing the condensing unit in the basement where it is cooler in the summer. I am not sure what the energy gain would be with a water cooled set up. You would need some type of closed loop system with a cooling coil. The condensing unit can be placed up to 15' away from the evaporator, and is completely precharged and ready to hook up. Threaded couplings pierce a steel membrane in the other coupling as they close together. I then chose the large horizontal evaporator which doubles as small freezer compartment. Here is the complete [Adler Barbour installation instructions](#), which clearly explains all types of installations. Also for further reading and detailed information, there is an excellent book by R.L. Kollman, "12 & 24 volt Refrigeration Manual" for \$30 (plus 6.00 S&h). He has a website at www.kollmann-marine.com

There is also www.rparts.com. RParts.com also sells the Danfoss unit in a kit form for quite a bit less money, but does require assembling and charging, but with very detailed and very knowledgeable customer support. They also sell the excellent book by the well known author Nigel Calder. His book "Refrigeration for Pleasureboats" explains every aspect of DC and AC refrigeration systems and is available at "rparts.com"



1. Deciding where your condensing unit will be mounted is the next step. Well away from the refrigerator and some where with a lot of air circulation. (Outside the house does not work with sub freezing temperatures as it reverses the refrigeration cycle. But in warmer areas, outside in a weather proof enclosure in a shady area would work well.) In my case, I installed the unit below the refrigerator, through the concrete floor and mounted in the open web floor joists in the basement. Other considerations is the unit should be as close as possible to the DC supply, yet can't be more than 15' from the evaporator since this is how long the precharged copper lines are. The

unit requires a 10 amp breaker, even though continuous running current is between 3 and 5 amps, 12

volt or half that for 24 volts. In either case, size your wire according to the tables included in the instructions for the unit.

2. The next step is to install the evaporator into the refrigerator compartment. I installed my in the upper right hand corner so that the thermostat can go next to it. Drilled a 1 1/2" hole through the refrigerator and through the newly attached insulating foam. Push the refrigerant tube set carefully through and fasten the evaporator in place per the instructions.



3. With this in place, seal the hole with the putty that is included. Install the thermostat inside the refrigerator, though it can be installed on the outside.

4. With this and your wires secured, the whole refrigerator can be finished on the outside. In my case I a built in look. since my cabinetry was all oak, I used 1/4" Oak plywood and glued it with constructions adhesive such as Liquid Nails or PL \$00 to the door and the edges.

5. With this all in place, attach the tube set to the condensing unit along with fused power supply. The evaporator should get cold quickly. My refrigerator box was 12.5 cubic feet. I am running on a 24 volt system hooked to a Trimetric usage meter. The system starts up using 2.8 amps and quickly tapers off to 1.8 to 2.2 amps (24 volts) and runs for 15 minutes each cycle. With a hour meter installed on the 12 volt fan circuit, it is running 5 hours per 24 hour period, maintaining 38 degrees. This calculates to approximately 265 watts per day. I use a 5.8 cu ft chest freezer installed close by. This was a energy star rated Kenmore. I was surprised to find with a Kill a Watt meter that it used 700 watts per 24 hours empty when i first started it and now with it full, has tapered down to 400 watts.

My system has been operating for over a year and have been very pleased with it all. I have had to defrost it twice in that time. Which was very easy and quick since all the ice formed was around the evaporator. We've found that because of the high humidity that is present inside the unit,, that vegetables and other foods last much longer than a defrosting model that dries foods out immediately.