

Steca PF166 Refrigerator/Freezer



Application: The PF166 is a high-efficiency 5.9-cubic-foot unit that can be used as either a refrigerator or freezer, and can run on either 12- or 24-volt DC. Last year, I installed one on the north side of my family's off-grid home for frozen storage of our homegrown meat and vegetables.

Off-grid living can present challenges to having modern conveniences, and refrigeration and frozen food storage are high on that list. Conventional upright and chest freezers can be energy hogs because of poor insulation, inefficient compressors, and poor placement and use.

For years, we've kept a standard chest freezer outside a relative's on-grid home, about 3 miles away. In addition to the commuting costs and inconvenience, there was the larger problem of energy use: The older, 23-cubic-foot model used about 2 kilowatt-hours (kWh) per day during the coldest weather, and much more in the summer months. To keep it at our home, such an electric load would require increasing our solar- and wind-generating capacity by at least 20%, and would require more propane generator use on calm, overcast days.

When considering appliances for an off-grid home, it's critical to select for extremely high efficiency, unless your pocketbook can afford a huge renewable energy (RE) system to generate lots of kWh for wasteful appliances. It generally shocks people to hear that we spent almost \$3,000 on the fridge in our kitchen, for instance. But if we had purchased a typical fridge, we would have had to spend much more to expand our renewable generating systems—or run our fossil-fuel generator more every winter.

As a middle-class off-gridder without deep pockets, I'll opt for the high-efficiency appliance most every time. So when the Steca PF166 came along, I was happy to add it to our home's collection of appliances. I had worked with Steca's solar charge controllers in simple, off-grid systems in Central America, and was impressed with their quality and the user-friendliness of the interface. Steca is a German company that has been making products for the RE market since 1990. I expected nothing but high quality from them, and their freezer—which hit the market in 2007—delivered just that.

Installation

The installation was pretty straightforward, requiring rudimentary electrical abilities and some heavy lifting (or a good dolly). Note that the PF166 is a 12 or 24 VDC appliance. It will not work on 120 VAC or 48 VDC—though it would be worth considering a DC-to-DC converter if you have a 48 VDC battery bank.

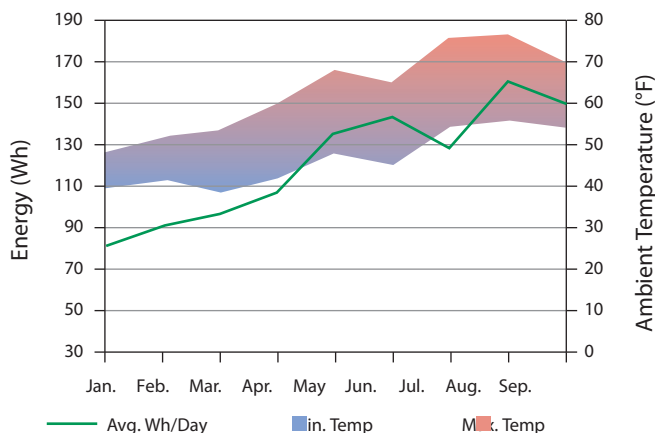
The freezer is hardwired to a 12 or 24 VDC circuit, and be sure to add the appropriate breaker in the circuit. The PF166 comes with a heavy-duty flexible cord. Proper polarity must be observed to operate, though the unit is reverse-polarity protected.

Install it on a flat, level surface, preferably in a cool location. Avoid installing the unit near heat sources or in direct sunlight. Keep at least 8 inches of clearance behind and beside the freezer to keep the ventilation grills unobstructed and ensure optimal cooling.

Features

The Steca freezer is small—at 5.9 cubic feet, it will not hold a full beef or a year's supply of salmon. But small can be beautiful, and it's worth asking yourself how big of a freezer you really need. If you have frozen goods soaking up your electricity for more than six months out of the year, perhaps you should consider cycling produce more quickly and using a smaller unit. In our home, we have two small, off-grid freezers, which gives us the option to run one or both as needed.

Monthly Energy Use & Ambient Temperature



The PF166's construction is clean, durable, and modern—inside and out. Two hanging baskets are included, as well as three freezer trays that act as partitions. A chemical ice pack prevents rapid temperature change in the event of a power outage.

A closeable drain allows easy cleaning after defrosting. Steca claims that their patented StopFrost system dehumidifies the incoming air that normally gets sucked into a freezer as the contents cool, significantly reducing the frost inside while increasing overall cooling efficiency.

Because freezers are “always-on” cycling appliances, users can't control these particular energy loads. However, the Steca has a low-voltage disconnect feature to protect a home's battery from ultra-deep discharge. The low settings are only reliable for emergency situations. Be aware of your battery's state of charge, and charge the bank fully on a regular basis.

Programming

The unit has sophisticated controls and monitoring. Its on/off switch makes it handy to shut down the unit without having to unwire the DC feed. The display flashes a symbol to indicate that the unit is off, but that electricity is still connected.

High Points

- Very low energy use
- Modern appearance
- Easy cleaning
- Low-voltage disconnect
- Power loss & maximum temperature alerts

Low Points

- DC only
- No 48 VDC available

Tech Specs

Steca PF166 Refrigerator/Freezer

External Dimensions:	36.1 x 34.3 x 27.9 in.
Weight:	134 lbs.
Nominal Voltage:	12 & 24 VDC (automatic selection)
Input Voltage Range:	10–17 V & 17–31.5 V
Low-Voltage Disconnect:	10.4 V & 22.8 V
Power Draw:	40–100 W
Recommended Fuses:	15 A & 7.5 A
Cooling Method:	Danfoss DC compressor
Usable Cooling Volume:	5.9 cu. ft.
Refrigerator Temperature Range:	35.6–53.6°F
Freezer Temperature Range:	–4–14°F
Ambient Temperature Range:	50–109°F
List Price:	\$1,200
Warranty:	Two years

While we have only used the Steca as a freezer, it also has a refrigerator mode, with a range of 35.6°F to 53.6°F. The default factory setting is 46.4°F, but a simple menu allows you to change to freezer mode, and another menu allows you to specify the temperature to within 1°. The operating temperature is displayed in either Fahrenheit or Celsius.

A reassuring feature is the power outage display, including an audible alarm and a flashing symbol. The unit also displays the highest temperature reached, so you'll know whether your food has thawed to the point where you should be concerned about its safety.

Performance

Steca's performance predictions suggest that this unit will consume 200 to 1,100 watt-hours (Wh) per day in freezer mode, and 50 to 350 Wh per day in refrigerator mode. These numbers depend on the ambient temperature and the thermostat setting. The manufacturer claims that the unit will run as a refrigerator on the energy from a single 70-watt solar-electric module “in most climates.”

The low energy use of this unit is nothing short of remarkable. I thought our previous low-voltage freezer was an energy sipper, but the Steca PF166 takes the prize. While our previous DC freezer is an older model (and the company has made advances since we bought it), compared to it, the Steca uses about half of the energy per cubic foot of freezer area. Compared to our on-grid freezer, the unit uses about one-fifth the energy per cubic foot.

Over our 10-month test period, the Steca averaged 120 Wh total per day. For context, 120 Wh is less than running three

Testing Tools & Method

We relied on two testing tools in evaluating this unit's performance. For energy consumption, we used a Watt's Up Watt Meter & Power Analyzer (www.rc-electronics-usa.com), which logs watt-hours, instantaneous and peak watts, instantaneous and minimum volts, instantaneous and peak amps, and amp-hours. Two meters were tested against each other initially, and a correction factor was applied to attain accuracy.

For logging minimum and maximum temperatures, both ambient and inside the unit, we used a Radio Shack maximum/minimum hygro-thermometer with remote.

15 W compact fluorescent light bulbs for three hours and much less than what it takes to do a load of laundry or dishes using high-efficiency appliances. This freezer is truly an energy sipper!

Our situation is not exactly average, since the unit is installed outside in a shed on the north side of our building. We also live in a moderate climate, with an average summertime high of about 72°F, so our freezer's performance numbers are probably better than if it was installed inside, or outside in warmer climes. Seek out a location for your freezer

that minimizes energy use, and then be realistic about your climate and situation.

Chill Out

So how does this freezer achieve its high efficiency? Primarily by using a high-efficiency compressor and heavy insulation. The Danfoss-made compressor has electronic variable speed control and uses a CFC-free coolant (R-134a). The 4-inch-thick foam insulation is seamless, with cooling tubes at the inner surfaces and a heat exchange condenser embedded in the outer surfaces. The door fits and seals well, keeping the coolness in.

This freezer/refrigerator gets high marks from me. It does its job well, using only a fraction of our precious solar and wind electricity. Its modern, clean box is attractive and easy to clean, and the lockable lid provides security. Its intelligent processor and monitoring delivers good temperature regulation and great information. Steca's done a fine job with this machine. If you have an application for a small, low-voltage DC fridge or freezer, check it out.

Access

Reviewer: **Ian Woofenden** (ian.woofenden@homepower.com) enjoys frozen beef, pork, veggies, and berries with his family at their off-grid home.

Manufacturer: Steca • www.stecasolar.com

U.S. Distribution: SunWize • www.sunwize.com

