

The Revolution Blog

How to make ice without electricity

- [By Jim Miller](#)
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In one of the last scenes of the pilot we see General Monroe place some ice into a glass. This got me wondering how you could make ice in a world without electricity. I know in the olden days people would collect ice during the cold months and store it in a ice house, but I wondered if there were ways to actually make ice without electricity. I did some research (i.e. Google searches) and found there are! In fact, making ice without electricity is quite common in the modern world. I never knew!

It goes without saying that to make ice you need to remove heat from water. There are a number of different ways to do this without using electricity. I was surprised to learn that some of the very first designs for refrigerators didn't require electricity. They used heat! That is still the case now for most non-electric refrigerators. The most common non-electric method for refrigerating things is an absorption refrigerator. The refrigerators in most RVs are this type of refrigerator and are powered by propane or other gas.

Absorption refrigerators use a gas (the refrigerant) like ammonia or lithium bromide that is alternatively absorbed into and released from a liquid in a closed loop. Heat is used to release the refrigerant from the liquid, then over time the refrigerant evaporates and is re-absorbed into the liquid. It is actually the evaporation that causes the cooling. One of the earliest of this type of system is called the icy ball.

Here are some web pages for the icy ball and absorption refrigerators in general. As mentioned above, absorption refrigerators are commonly used today in RVs, though they are more sophisticated than the simple icy ball. The refrigerator in the RV that Charlie and her brother were exploring in the pilot episode was mostly likely a gas absorption refrigerator.

[Icy Ball wiki](#)

[Icy Ball refrigerator video](#)

[Absorption refrigerator wiki](#)

[How it works – RV refrigerator](#)

Einstein, working with former student Leó Szilárd, invented a type of absorption refrigerator. Here's the link for that:

[Einstein refrigerator](#)

There are actually solar ice makers!

[Solar ice maker](#)

[ISAAC solar ice maker](#)

The first absorption cooling system was created in 1858 by French scientist Ferdinand Carré and used water and sulfuric acid. As stated above, all of the above systems use evaporation to create ice. What I find interesting is that the ancient Romans learned how to make ice via evaporation:

[Making Ice In Ancient Rome](#)

All of the above methods for making ice involved evaporation. Evaporation cools things because the phase change of the refrigerant from liquid to gas draws heat energy from the surroundings, cooling whatever is in contact with the refrigerant. A completely different way to draw heat energy from the surroundings is to rapidly decrease the

pressure of a gas. Stirling coolers use this method. Stirling coolers are basically just Stirling engines that are used in reverse. Stirling engines are early competitors to steam engines and use heat to produce mechanical motion. Instead of using steam they use a gas. Modern Stirling engines use helium but originally they simply used air. They are quite clever. The most basic Stirling engine has two cylinders that each have a piston. If you heat one of the cylinders and keep the other one cool then the pistons will move and can turn a shaft. What's really interesting is that if you turn the shaft with an external power source this causes the Stirling engine to act as a heat pump. One of the cylinders will become hot and the other one will become cold. Here's the wiki page for Stirling engines:

[Stirling Engine](#)

Stirling coolers are devices that use the principles of the Stirling cycle but are optimized for use as heat pumps rather than engines. All that is needed to use them to produce ice is an external power source to move the shaft connected to the pistons. This external source could be a windmill, water wheel, steam engine, diesel engine, bicycle, etc. There are many companies that make large and small Stirling coolers for defense, industrial, space applications, and more. Here are some links:

[Stirling Cooler slide show](#)

[Stirling Cooler for Motherboard](#)

Of course, you can also use endothermic chemical reactions to produce ice. These reactions draw heat out of the environment rather than release heat into the environment. If you have access to some ammonium nitrate here's a clever way to make ice:

[Ice Using Fertilizer](#)

Since endothermic reactions consume their ingredients they are probably not a good means for producing ice in a post-apocalyptic world unless you can use a chemical that is easy to obtain.

Another really interesting way to make ice without electricity is to use a vortex tube. Yeah, I never heard of them either. Here's the wiki on them, as well as a YouTube video of one in use. They are really loud and take a lot of compressed air.

[Vortex tube wiki](#)

Vortex tube video

Of course, you could use a windmill to charge up a tank of compressed air and then use that to run your vortex tube for a while. Here's a video of a wind-power air compressor:

Wind-powered air compressor

Perhaps the best way to make ice in a non-electric, post-apocalyptic world would be to run the compressor of a modern refrigerator via a diesel engine, steam engine, water wheel, or animal-powered shaft-and-gear system. Here's a document discussing animal-powered shaft systems:

Animal-driven shaft power

The Tillers International web site is pretty cool. It shows how to do a lot of useful things via low-tech methods. This page looks especially interesting, but is off-topic for this post:

<http://www.tillersinternational.org/farming/tools.html>

Lastly, here's a neat low-tech way to way to keep food cool. It can't make ice, but it could keep your fresh food fresh for awhile longer:

Low-tech fridge