

## Pots and Pie-Plate Water Distillers (14 Feb 05)

### How to build a Practical Back Pack Portable Water Distiller

Using light weight aluminum pots this can be made to weigh only about 2 lbs 5 oz for all three parts. See <http://home1.gte.net/mikelob/WDL-1.JPG>.



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A heavier more durable unit can be made that weighs 4 lb 14 oz. See <http://home1.gte.net/mikelob/WDH-1.JPG>.



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The unit can be constructed with minimal labor out of commonly available cheap pots and pans for around \$20-\$30. When in operation depending on the heat source it produces about .9 Oz/min or a glass of water every 10 Minutes (1.25 cups/10 min).

Designed for batch production, the water in the top and bottom pots will need to be changed approximately every 40 min. This time would depend on the amount of heat supplied to the bottom boiler pot. The water in the top cooling pot increases about 30 degrees F for each 10 minutes and after 40 min is up to about 180 degrees F. One should end off when steam starts to come out around the bottom of the top pot. This occurs around or above 180 degrees F. From start to finish the water level in the bottom or boiler pot should have changed about 1.75" depending on the size of the pot used. Don't let the bottom run dry. Use an output collection container that is marked to indicate when the boiler pot would be low on water. See <http://home1.gte.net/mikelob/WDL-2.JPG>.



At end of the cycle after about 40 minutes if one uses some of the hot water from the top to replace and refill the bottom water then one can get back into operation in minimal time. At this rate one could produce a gallon on the average of every 2.5 hours. This is taking into account the time for refilling with hot water and heating back up to boil.



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The idea for building this came from the following link. The e-still is made from SS and the idea of using a pot of water to do the cooling of steam is a good and practical approach. Consider purchasing one of these, if you don't plan on making it.

<http://www.sustainablevillage.com/servlet/display/product/detail/23848>

## E-Still (Non Electric Water Distiller)



Great for camping, remote living, emergency preparedness, easing y2k concerns - a stainless steel distiller with no moving parts! Use with any type of stove - gas, electric, wood, a propane burner or camping cook stove, in a home fireplace or outdoor camp fire, on a charcoal grill. All it needs is a source of heat to boil water, steam condenses into 99.9% pure distilled water. You get 24 ounces in just 34 minutes, one gallon in 40-45 minutes. Includes a Boiling Pan, Patent-Pending Disks, an Upper Condensing Pan, Stainless Steel Discharge Extension Tube, and a length of High Temperature Medical-Grade Silicon Tubing to provide further distance of the Receiving Vessel from the heat source. The Pure Survival e-Still is a Manual-Fill, Batch-Type Distiller. With a Propane Camp Stove used as the Heat Source, the e-Still produces 24 ounces of

Pure Sterile Distilled Water in 34 minutes as follows: 12 minutes to reach the Boiling Point and Produce Steam, 12 minutes to produce the First 12 Ounces of Distilled Water, 10 minutes to produce the Second 12 Ounces of Distilled Water, One 16.5 Oz Propane Bottle lasts for 8 batches ? producing 192 Oz [1.5 gallons] of Pure Sterile Distilled Water. The Production Batch Time varies with the Heat Source ? but, in general, the Pure Survival e-Still will produce 1 gallon of Pure Sterile Distilled Water in 40-45 minutes. With a Pure Survival e-Still in the house, you will never have to worry again about storing bottled water for an emergency. Create your own Pure Sterile Distilled Emergency Drinking Water when you need it the most ? in an emergency!

WC5372

N/A E-Still (Non Electric Water Distiller)

\$184.00

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Notes on construction out of commonly available parts: In general make the bottom boiler pot about 3 times smaller in capacity than the top pot. This will insure the top heats up to max before the bottom runs out of water. This assumes one fills the bottom about 2/3 or more of it's height with water before starting. It is important that the bottom boiler pot have a lid that fits snugly (doesn't let steam out easily). The lid should be rounded such that it is higher in the center than the edges. The lid should not be made out of glass but be made of some metal that allows for ease of making a large hole in the center.

I found between 4 and 4.6 quarts to work well for the bottom pot. The diameter of the bottom pot is not two important as long as it is stable when in use (wont easily tip over). Typically it is 8" to 10" in diameter. If you use much bigger than that it tends to interfere with the output pipe coming out the side of the pie pan.

The diameter of the upper pot is constrained by the choice of the pie pan and turns out to be about 10" to 10.75". The top pot needs to end up stable and held into place so will not easily slide off. Height of each pot is not too important. I found between 12 and 16

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quarts capacity to work well for this pot. I used it without a lid. Don't plan on anything much bigger than this it is too dangerous to move when emptying. It is heavy and the water will slosh if you move rapidly.

Warning: Scalding hot water accumulates in the top pot during use. Empty it with extreme care. I used leather gloves and moved extremely slow. This pot is heavy. If you have it -- wear water repellent heat protective clothing possibly an apron in case this accidentally spills in the process.

The choice of the pie pan is important in that one needs to solder to it and the extra extended lips on the Pie Pan helps to hold the upper pot in place. The sides being tapered help point the output pipe in the right direction See <http://home1.gte.net/mikelob/WDL-3.JPG>. With added soldered on flanges I believe in a pinch any pie pan would work.



Light weight Construction: (for back packing use. Total weight is 2 lb 5 oz.)

- 1) Top pot: Aluminum Covered Saucepot diameter 10.75" by 7.5" high (12 Qt/11.4 L) from MIRRO Co. P.O. Box 1330. Manitowoc, WI, 54221-1330 (mfg. No. C-7962) Cost was \$7.99 (from Big Lots a local store). Weight without lid is 14.5 oz.
- 2) Bottom pot: Aluminum Covered Saucepot diameter 7.75" by 4.8" high (4 Qt/3.8 L) from MIRRO Co. P.O. Box 1330. Manitowoc, WI, 54221-1330 (mfg. No. C-7974) Cost was \$7.99 (from Big Lots a local store). If needed the side handles can be unscrewed and taken off for use with a camp fire. Weight without lid is 8 oz.

Note: Being light and portable these pots above are very soft and will bend easily. One should take care to insure this does not happen. I then found some pots made out of SS

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and thicker aluminum. It end up being a little more than twice the weight but is defiantly more durable.

Heaver duty construction: (for stable location or back pack use. Weight about 4 lb 14 oz.)

Top pot: Retail Sales Link, Inc. Agora Hills Ca 91301 item number 104-16 QT. A Stainless Steel 16 Qt. Stockpot for \$5.99 (from Big Lots a local store). Weight without lid is 2 lbs. This is the best of what I tried, if you can find it. See <http://home1.gte.net/mikelob/WDH-2.JPG>.



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- 1) Alternative Top Pot: Kirby & Allen 12 Qt (11.4L) Stainless steel steamer pot with steamer plate. Cost \$9.99 from Big Lots # 103902. 1332 Livingston, Avenue, North Brunswick, NJ 08902. Weight 1lb 14 oz. See <http://home1.gte.net/mikelob/WDH-5.JPG>.
- 2) Bottom pot: Bene Casa Coldero no. 7 model: BC-17280 4.6 Qt/ 4.5 Ltr Made from Sheeted Aluminum with Mirror Coated Finish. Cost \$11.99. This pot measure .1" thick aluminum. see: <http://home1.gte.net/mikelob/WDH-3.JPG> and <http://www.mbrindustries.com/index.cgi/index.html> Weight is 1 lb for lid and 1lb 15 Oz for pot. This is the best so far, if you can find it.





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The Pie Pan of choice used for constructing both:

- 1) One Non-Stick Pie Pan 8.75" by 1.25" Style #92684 Lifetime Hoan Corporation Westbury, NY. The pan actually measures on the top outside diameter of 9.75" by 11.25" and the bottom is 7.25". Its weight is 9 oz. I chose steel so that one can sand off the non-stick layer and then solder to it. Cost was \$1.99 from Big Lots a local store. In one rendition the lips around the edges were bent up to hold the top pot into the same position each time it was set on it. Another way was to solder a .25" copper tubing, making a circle, to the pie pan. This keeps the top pot from sliding off. See <http://home1.gte.net/mikelob/WDH-4.JPG>.





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Turn this pan upside down and take a hammer and gently pound the bottom into a dome to match the curvature of the lid on the bottom pot. I used an old lid from a CD-ROM 100 dispenser to support it while gently pounding on the pie pan with a hammer. See <http://home1.gte.net/mikelob/WDL-4.JPG>.



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Move the CD dispenser or large pipe support around to near the side as you work your way around from center to edge, then from center to edge. Small dents from each hammer stroke gradually make a budge that will eventually fit the curvature of the lid for the bottom pot. The center section when fully constructed will weight between 12 oz and 1 lb 13 oz depending on the lid used for the lower pot. See <http://home1.gte.net/mikelob/WDL-5.JPG>.



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Notes on Small parts:

- 1) I used a Meat/Poultry Thermometer for measuring the temperature of the water in the top pot. It cost \$1.99 from Big lots. Weight is 1.5 oz. One can bend a paper clip to hold it on the side of the bucket. See <http://home1.gte.net/mikelob/WDT-1.JPG>.



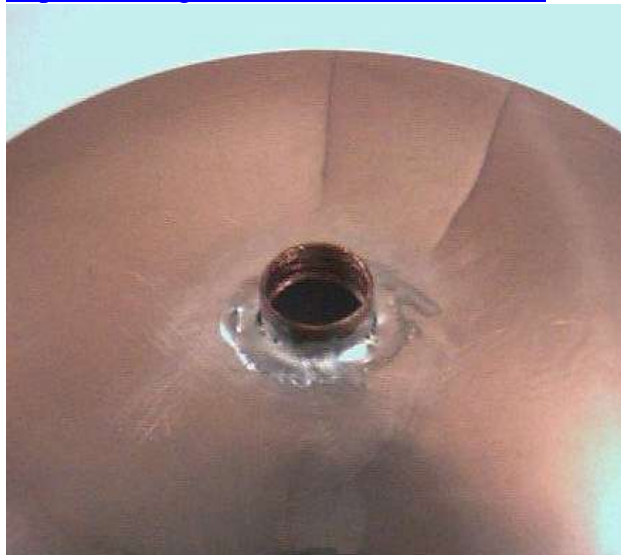
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- 2) The 5/16" distilled water output copper tube is about 4.5" long. Flare one end just a little bit and ream the ridge on the other end. Solder this in the side at a downward angle near the bottom of the pie pan. See <http://home1.gte.net/mikelob/WDL-6.JPG>.



- 3) Center support tube: Cut a 3/4" in diameter by 1/4" to 3/8" long end from a copper pipe. This pipe solders slightly sticking up though the bottom of the pie plate. It could also solder to the aluminum lid instead if you have an aluminum welding rods. One could also hold it in place with silicon rubber sealer. In a pinch this part is optional depending on the following test. Check the amount of cone up in the center by adding water and seeing if it runs out the side tube or whether more height is needed. In my case I did it just for insurance. See <http://home1.gte.net/mikelob/WDL-7.JPG>.





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- 4) Use two 8-32 x .75" Machine round slotted head SS or brass bolts and nuts to hold the top lid of the bottom pot to the pie pan. Two holes are drilled near the center. See <http://home1.gte.net/mikelob/WDL-8.JPG>.



A small washer is put between the lid and pie pan as a spacer to keep the fiber glass insulation from squashing completely flat. This step of bolting it together is optional and is not vital to it's operation, but at least one bolt is necessary for holding the splash guard in the next step. It also makes the center unit easier to handle so that it can be removed as a unit each time the water is changed. One can purchase these parts at Home Depot.

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- 5) A 3.25" by 3.25" sheet metal plate with rounded corners is placed under the bottom lid to deflect the splatter of boiling water and keep it from going through the .75" hole in the lid. It is positioned to be at least a 1/4" from the top to allow the steam to pass around it and out the hole in the top of the lid. Can use a piece cut out of a tin can. See <http://home1.gte.net/mikelob/WDL-9.JPG>.



- 6) A small amount of thin fiber glass insulation was used to fill about .1" space between the lid of the bottom pot and the bottom of the pie pan. One can purchase this from Home Depot. This is used to minimize heat transfer from the bottom pot lid to the water that has condensed and is ready to run out of the Pie pan. This is an optional part that is not vital to operation.

Assembly sequence:

- 1) Take knob off bottom pots lid.
- 2) Pound bottom of pie pan until it fits the lid of the pot being used for the boiler bottom pot.

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- 3) Mark center of pie pan and drill a small hole, then larger and larger until it is  $7/8$ ". If  $.75$ " is as close as you can drill then use a file or rotary rasp to make it bigger until the copper pipe just fits. See use of step drill bit in <http://home1.gte.net/mikelob/WDL-10.JPG>. Do the same for the pot lid. The step drill bit can be purchased from Harbor Freight tools.



- 4) Drill a side hole near the bottom of the pie plate for the  $5/16$ " copper pipe. Sand off nonstick layer on the outside.
- 5) Cut about 4.5" to 4.75" length of  $5/16$ " copper pipe and flare a bit of one end. Ream the inner ridge on the other end. Run the pipe through the hole and solder the pipe on the outside to the Pie pan.
- 6) Cut off a  $3/8$  inch length of  $.75$ " diameter copper pipe.
- 7) Solder the pipe to the pie pan or the top of the bottom pots lid.
- 8) Bend up holding tabs on the pie pan or solder  $.25$ " tubing circle to pie pan to hold top pot.
- 9) Mate the pie pan with the lid and drill holes for 8-32 SS bolts.
- 10) Cut a piece of fiber glass material to fit the size of the pie plate.
- 11) Put a bit of silicon sealer between the pie plate and the lid where the  $.75$ " pipe goes through, then assemble and tighten bolts.
- 12) Cut a 3.25" by 3.25" sheet metal piece can use an old caned food can lid. Drill a hole and put 2 or 3 washers under it and a nut on top.
- 13) Bend a paper clip and mount the meat thermometer on the side of the top pot.

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