How to build an electric food dehydrator

by Courtney Meier

The majority of the text and plans provided here were originally obtained from the Oregon State University Extension Service Circular 855, and were last revised in 1984 by Dale E. Kirk, professor emeritus of agricultural engineering at Oregon State University. The original plans have been modified slightly with regard to wiring and materials.

You can use a small food dehydrator in your home to preserve many types of fruits, vegetables, meats, and specialty items (e.g. tomato sauces, hummus, refried beans). The dehydrator shown here provides 8 ½ square feet of tray surface, which can accommodate approximately 18 lbs. of fresh, moist product.

The necessary heat for evaporating the moisture is supplied by standard incandescent household light bulbs, which are efficient, safe heating elements. You can use either a 8-inch or 6-inch diameter air-duct fan from a hardware store to provide the necessary air flow.

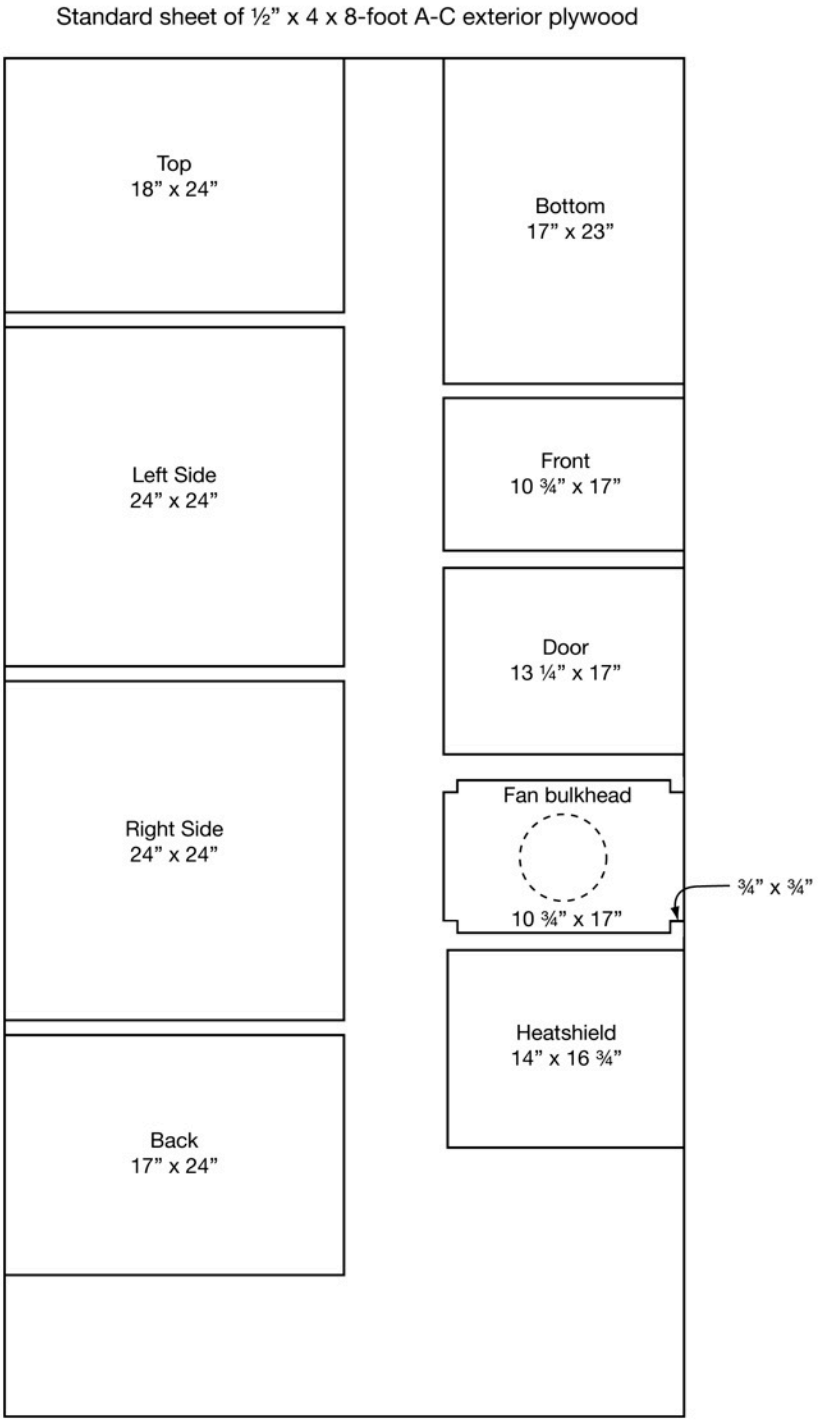
You can build the dehydrator with the following tools: a saw capable of cutting straight lines (e.g. table saw or skilsaw with a guide), a coping saw or jigsaw, drill, countersink, screwdriver, Arrowhead T50 stapler, razor knife, wire cutters, wire stripper, and scissors. You'll also need a square and a tape for measurements.

List of materials

The following items will be required to construct both the dehydrator box and the food trays:

- One sheet of ½ inch, 4 x 8 ft. A-C exterior grade plywood, though higher grade ½ inch plywood could also be used if one requires a more fashionable look
- Nine 8-foot pieces of 1 x 1-inch nominal (¾ x ¾-inch actual) wood strips.
- One 6-inch or 8-inch duct fan
- One pair of 2-inch metal butt hinges or an 18-inch length of piano hinge
- One ball chain or equivalent door latch
- Nine porcelain surface-mount sockets with concealed contacts
- Nine 75-watt bulbs
- Fifteen feet of #14 copper wire with insulation rating of 150 ˚C or higher
- Six feet of #14 wire extension cord, with male plug
- One 36-inch length of heavy-duty household aluminum foil wrap
- One hundred sixteen (116) #8 1-inch flathead wood screws
- Eighteen #7 5/8-inch roundhead wood or sheet-metal screws
- One 10-amp capacity thermostat, 100-160 ˚F range, either air-type or hot-water tank type. I used a thermostat suitable for the lower position on a standard sized electric hot water heater.
- Two standard light switches
- One 4-inch electrical utility box, with cover that accommodates two standard light switches
- Two ½-inch utility box compression fittings
- Three wire nuts
- Twenty L-brackets, for re-inforcing corners of food trays
- Forty #6 ½-inch flathead wood screws
- 100-inch x 20-inch length of 1 mm nylon screen
- One pack of ¼-inch T50 staples

Figure 1. Cutting plan to obtain the necessary plywood pieces with a minimum of saw cuts



Cutting plan

The cutting diagram at left shows how you can obtain all of the ½-inch plywood pieces from the single 4 × 8-foot plywood sheet. It is usually most satisfactory to measure from the factory cut edges as shown. Be sure to allow room for the saw kerfs between adjacent pieces.

Cut the plywood sections to size using either a table saw or a skilsaw with a guide. I was able to get reasonable results using a skilsaw with no guide (and then some *a posteriori* spackle), but it will be far easier to achieve a box that leaks less heat out the back with perfectly straight cuts.

Figure 2 shows, in part, how the pieces are assembled to form the dehydrator box. Detailed instructions are on the following pages.

Figure 2. Front view of dehydrator construction.

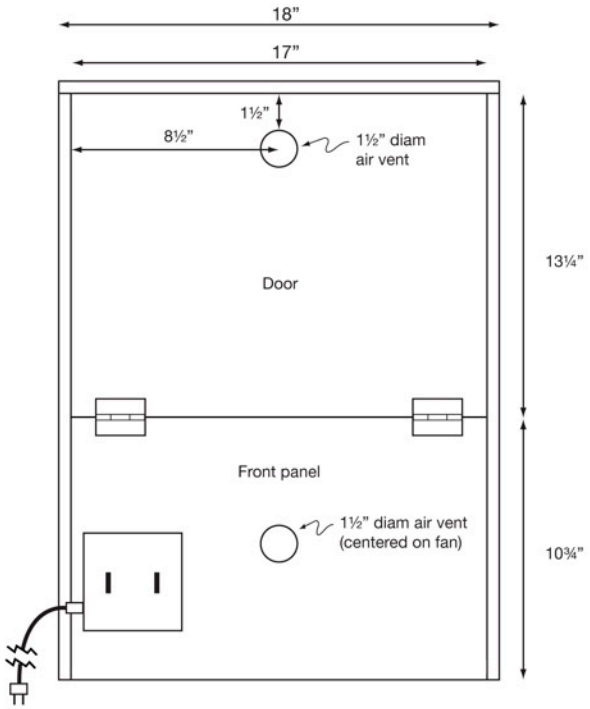


Figure 3. Front view cross-section of dehydrator construction

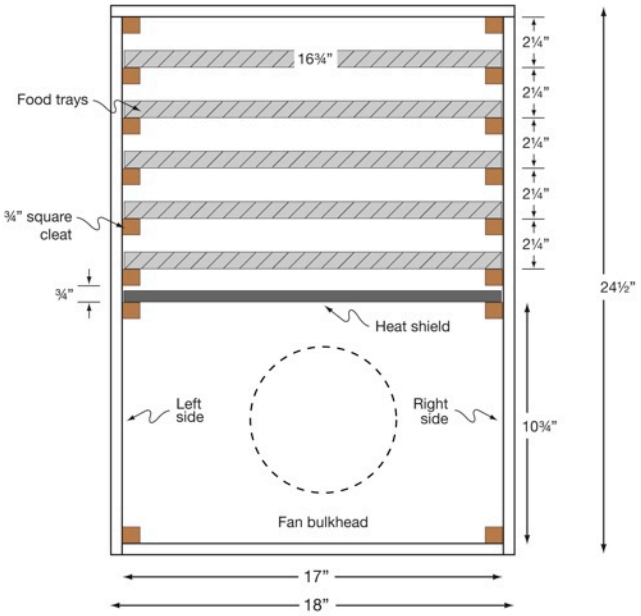
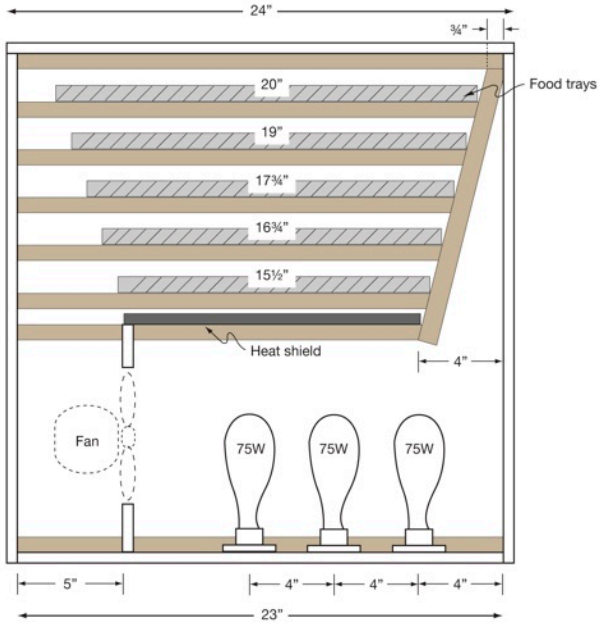


Figure 4. Side-view cross-section of dehydrator construction



Pre-assembly of sides and base

1. Cut the 1 × 1-inch wood strips into the lengths shown in figures 3 and 4.
2. These pieces will be used for tray-support cleats (brown in figs. 3 & 4), the tray frames (gray in figs. 3 & 4), and to hold the box together at the corners. Before cutting the tray-support cleats to their final size, I drew the correct positions on the left and right side panels, placed the cleat over the drawing, and marked exactly where the cut should be. Figure 5 illustrates the drawing/layout procedure for the tray-cleats.

Figure 5. Cleats laid out on the inside surface

3. Next, lay out the porcelain sockets, and fasten them to the base, as shown in figure 6. Fasten the wire to the porcelain sockets.

Figure 6. Layout of sockets and wiring plan

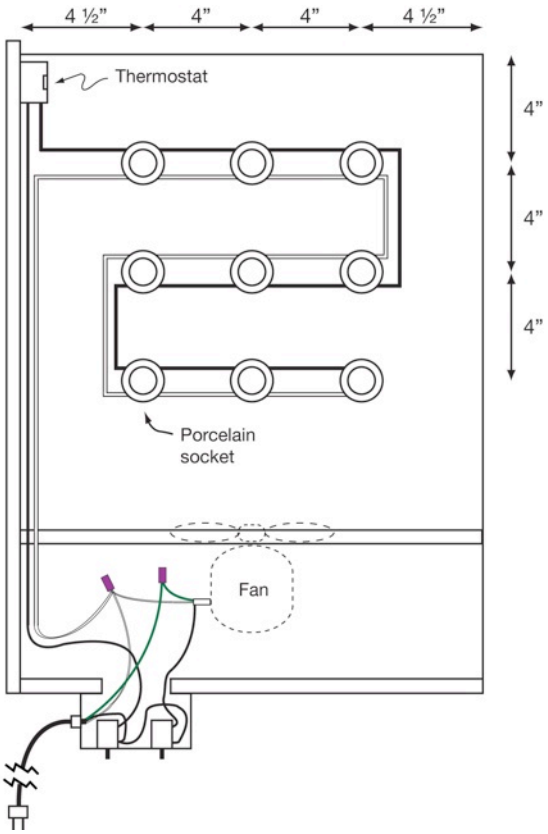


Figure 7. Assembly of front, left-side and base

4. Next, screw the left side panel and front panel to the base (figure 7). I also used wood glue (Titebond) to make the joints stronger.
5. Fasten the wire to the porcelain sockets. Connect the wire that goes to the yellow screws on the sockets to the thermostat, mounted near the rear on the left side panel. The yellow screws on the socket connect to the center pole, rather than the threaded wall of the socket.
6. Connect the wire that goes to the white screws on the sockets to the white wire in the extension cord (see figure 6).
7. Connect the ground wire (green) in the extension cord either to the ground wire coming from the fan motor (as in figure 6), or directly to the junction box.

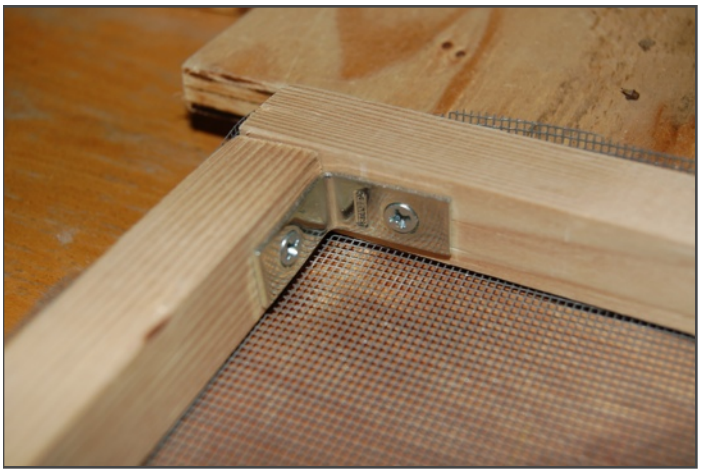
Figure 8. Fan mounted onto bulk-head via "tabs" made with tin-snips

8. If you're using a duct-type fan, which I recommend, cut the necessary hole in the bulkhead (about 8 ½ inches in diameter for an 8-inch fan; about 6 ½ inches in diameter for a 6-inch fan), and fasten directly to the bulkhead. The 6-inch duct fan I bought from Home Depot (not a personal endorsement) did not have an obvious mounting mechamism to attach to the bulkhead, so I used tin-snips to cut out mounting tabs (see figure 8).
9. Now set the bulkhead in place (5 to 5 ½ inches from the front panel, as in figure 4, and fasten it temporarily in position by two screws through the left side panel.
10. Center the 1 ½ inch diameter air vent hole in the front panel, directly in front of the fan motor, about 1 inch away from the motor. This will allow the relatively cool room temperature air to pass over the motor and cool it (figure 2).
11. Next, fasten the right side, back, and top in place using wood glue and #8 1-inch wood screws.
12. Enclose the heat shield in heavy-duty household aluminum wrap. This provides a reflective surface to protect the plywood heat shield. It also provides a smooth surface on the top of the shield for easier removal of juices that may drip from the drying trays.

Figure 9. Completed drying tray, assembled from ¾ × ¾-inch wood pieces and 1 mm mesh nylon screen

13. To build drying trays like that shown in figure 9, I used 1 × 1-inch nominal (¾ × ¾-inch actual) pieces of wood, cut to the lengths indicated in figures 3 and 4. Use L-brackets to re-inforce the corners of the trays and prevent twisting of the wood pieces (figure 10). Lay the 1 mm mesh nylon screen over the finished tray frame, and cut the screen around the tray frame, adding 1 ½ to 2-inches of screen to the overall dimensions.

Figure 10."L-bracket" used to re-inforce corners of drying trays



14. Staple the screen to one side of the tray frame using ¼-inch staples, then staple the opposing side after pulling the screen tight. Staple the remaining two sides in a similar fashion. Pull the screen as tight as is practical, as the weight of the fresh fruit will cause some sagging. Finally, trim the excess screen using scissors or a razor knife. It is possible that metal screen would be a better alternative to nylon, as metal screen would likely sag less, though nylon has worked fine for me.

15. You'll need some type of adjustable latch to hold the door in a partially opened position during the initial stages of drying, when the moisture is being removed rapidly. I used a small length of chain and a hook, but a standard ball-link chain with a catch would also work, as would a length of velcro glued to the side of the unit.

16. As a check on your thermostat setting, you should have a thermometer capable of reading within the range of 100 – 160 ˚F. A kitchen-type meat thermometer works nicely.

Operation

For most moist fruits and blanched vegetables, load the trays at the rate of 1 to 2 lbs. of fresh product per square foot of tray surface. Place nuts and meats only 1 layer deep on the trays.

The following thermostat settings are *suggestions*:

- Nuts; 100–105 ˚F
- Meat (jerky); start at 100 ˚F, increase to 165 ˚F (internal temperature of 155 ˚F; *follow professional advice for your situation*)
- Fruits; 135–145 ˚F
- Vegetables; 140–150 ˚F (max. 165 ˚F)

During the early stages of drying, open the door about ½ to ¾ inch to allow easy escape of moisture laden air. As moist air exhausts at the top of the unit, fresh air will be taken in along the sides of the partially opened door.

Test to determine when the first, high-moisture drying stage is completed. Hold your hand or a mirror at the opening at the top of the door. When moisture no longer tends to condense, close the door. The air exchange provided by the two 1 ½-inch diameter vents should be sufficient to complete the drying process.

Maintenance

Wash trays with hot water and a detergent when they become soiled with dried-on juices. Scrubbing the screens over a flat surface (e.g. a large cutting board) will allow you to clean the nylon mesh without stretching it and causing excessive sagging.