

How to make a solar cooker



OPERATING PRINCIPLE OF A BOX COOKER

Box cookers come in several different varieties, one of the most simple is shown in the picture above. For optimal performance the cooker needs to be oriented towards the sun. Sunlight comes in through the glass and this light is converted to heat which is trapped within the box. Reflectors are designed so that sunlight hitting them is reflected in through the glass and is also converted to heat. As more sunlight falls on the box and its reflectors the more light is converted to heat and thus the box continues to heat up. The box is usually insulated to prevent heat from escaping. Food is placed inside the box, preferably in a dark coloured cooking pot or container as dark colours absorb heat. This principle is very simple yet it takes longer for food to cook than it would using a conventional oven. For maximum heat gain the cooker needs to be turned every 15-30 minutes so that it is oriented directly at the sun. However, if food is to be left to cook for an extended period of time, simply orienting the cooker towards the north and leaving it will be sufficient.

WHAT TO COOK IN A BOX COOKER

Many different things can be cooked in a solar oven, casseroles, muffins, bread, rice, quiche... anything really. It takes about twice the cooking time of a conventional oven.

HOW TO MAKE A BOX COOKER

There are many different ways to make a solar cooker. Described below is the method to make the cooker shown. Although there are simpler methods of making a solar cooker the sturdy long lasting design of this cooker makes the effort worthwhile.

The cooker is made from two open (without lids) boxes, the outer made from plywood and the inner from aluminium. Between these two is a layer of insulation which helps to trap the heat within the cooker. A timber framed piece of glass forms the seal of these two boxes and a single reflector is attached to this top.

COMPLETE MATERIALS AND EQUIPMENT LIST

Wood glue,	Precut timber pieces:
Hammer,	4 lengths of 35 x 19mm timber:
Hand saw,	2 at 480mm length, 2 at 400mm
Jig saw,	length. Each length with 10mm x
7mm thick structural ply	10mm rebate and corners cut at
(930mm x 800mm),	45° angles,
Brads (small nails),	50mm insulation
13mm thick structural ply	(1170mm x 570mm),
(400mm x 965mm),	Precut glass
1mm thick aluminium sheet	(340mm x 420mm),
(900mm x 740mm),	Drill and screws,
Tin snips,	Stanley knife,
Clamps,	Glaziers pins,
Mallet,	Silicone,
Pop rivet gun,	¼ inch washers,
Pop rivets,	2 x 400mm piano hinges,
Aluminium foil,	¼ inch x 1 inch gutter bolt,
Straight edge block of wood	¼ inch wing nut.
or metal,	

OUTSIDE CASE

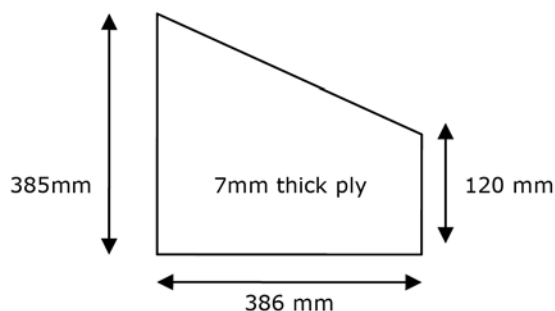
Materials and equipment required:

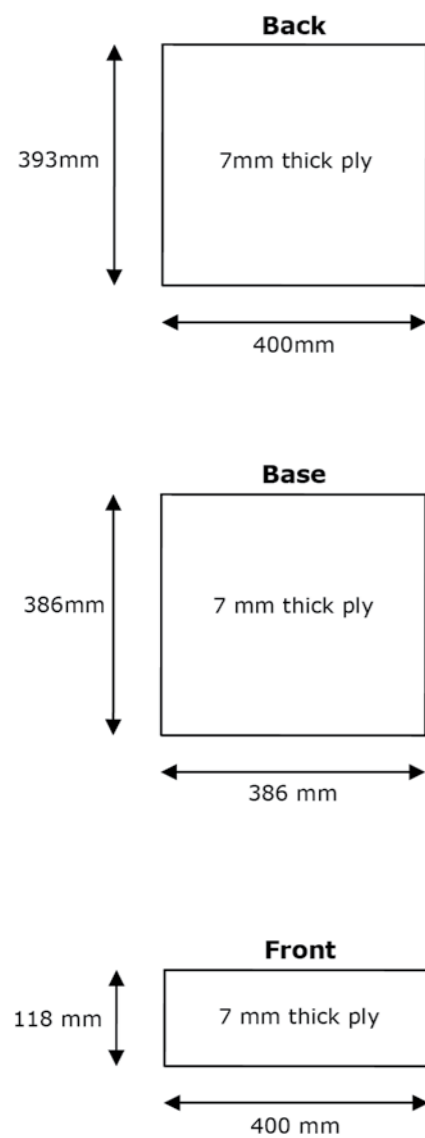
Wood glue,	Brads,
Hammer,	7mm thick structural ply,
Hand saw or bench saw	

Step 1: Cut the ply to the measurements shown in the diagrams below.

Left and right side

Left and right to be mirror image to get finished surface on the outside.

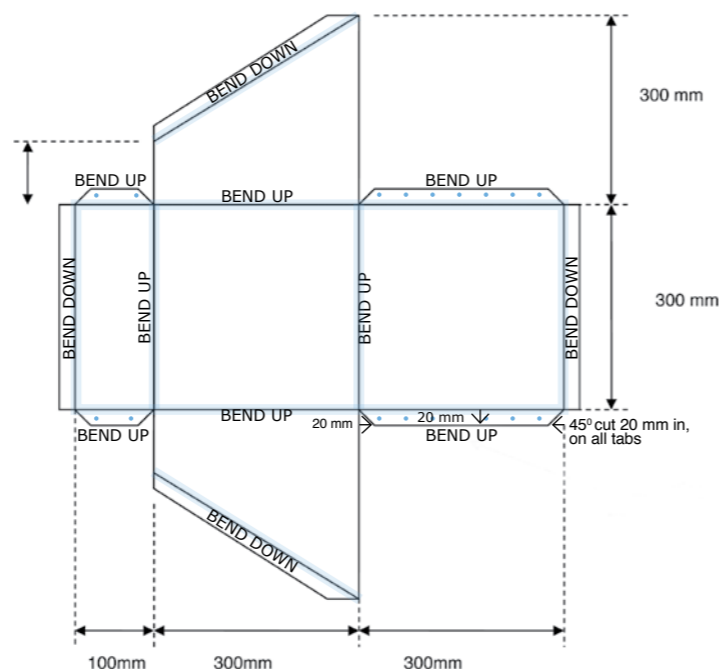




INNER CASE

Materials and equipment required

Tin snips, Clamps, Hammer/Mallet, Ruler, Pen/Pencil/Marker, Straight edge block of wood or metal, Pop rivet gun and Pop rivets, 1mm thick aluminium sheet 900mm x 740mm



Step 1: Accurately trace the diagram above onto the aluminium sheet.

Step 2: Snip the aluminium to the shape shown in the diagram above using tin snips.

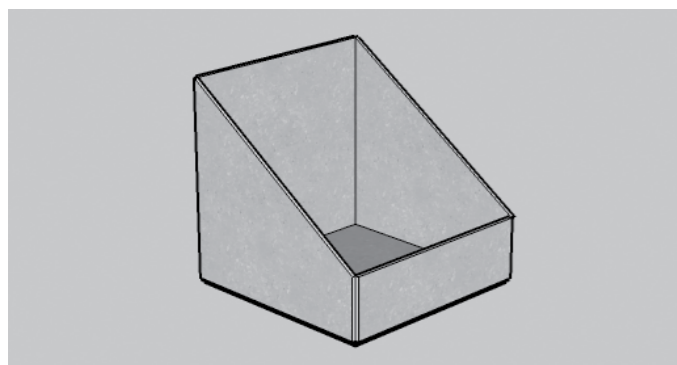
Step 3: In the diagram above, the lines highlighted in blue show where the aluminium must be bent. Using a small hammer or mallet and straight edge block of wood or metal held into place with clamps, bend the aluminium into a box shape which mimics that of the plywood box, only smaller. Begin by bending the outside tabs marked BEND DOWN. Then bend UP those tabs indicated with blue dots. Then bend up the centre edges. Bend up all edges to 90°.



Step 4: Pop rivet the tabs which have been bent UP to the edges that they overlap as indicated by the blue dots in the diagram at the top of the page. These edges hold the box into shape.

Step 2: Lie the base on a sturdy bench. Apply wood glue to two opposite sides along the outer edge of the base. Attach the two sides and using small nails (brads) evenly separated, secure the sides in place. It helps to have someone assist so they can hold as the nails are hammered in. Make sure that the short end of the sides face in the same direction.

Step 3: Apply wood glue along all the edges of the front and back of the base and the vertical edges of the sides. Attach the front and back, again using brads to secure the plywood. The completed box is shown below.

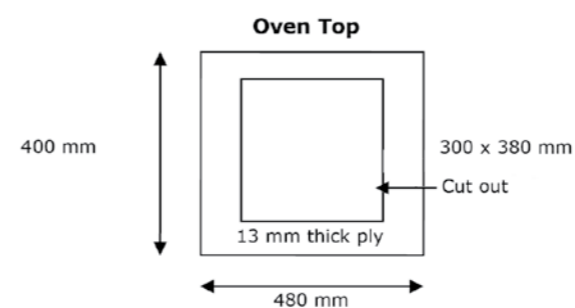


JOINING THE OUTSIDE AND INNER CASES

Materials and equipment required

Constructed inner case, 50mm insulation, Stanley knife, Jig saw, 13mm structural ply 400mm x 480mm

Constructed outside case, Drill and screws, Hammer and nails,



Step 1: Cut the 13mm structural ply to the above shape with a jigsaw.

Step 2: Place the inner case so that the opening is facing downwards onto the oven top piece. Align the opening of the aluminium with the cut out of the oven top. Join the aluminium tabs to the plywood using screws and a drill. (See photo below)



Step 3: Cut insulation to fit the base of the plywood box and the four sides (See picture below). Place the aluminium box inside the plywood box with the insulation between the two. The fit should be snug. Newspaper could be used in place of insulation, either scrunched up in balls or torn into shreds then packed first on the base and then between the walls of the two boxes.



Step 4: With the insulation firmly in place, join the plywood oven top to the outside case using glue and small nails evenly separated.

GLASS FRAME

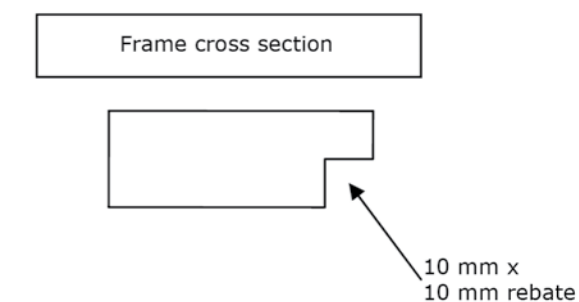
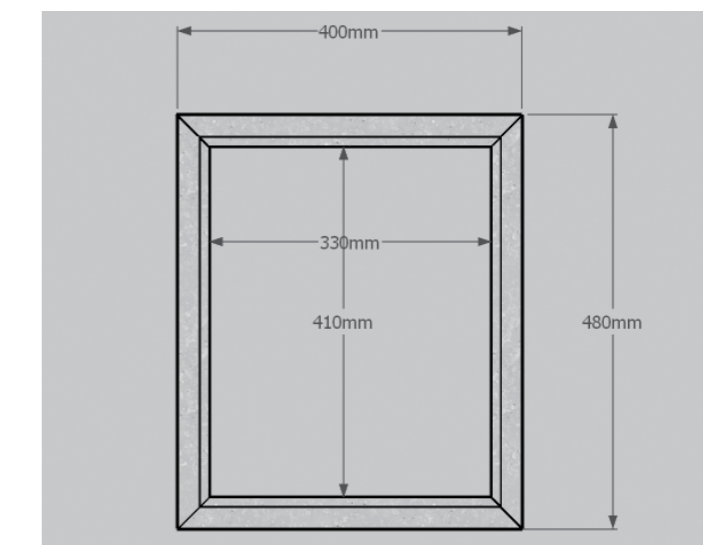
Materials and equipment required

Glaziers pins, Drill and screws, Pre-cut timber

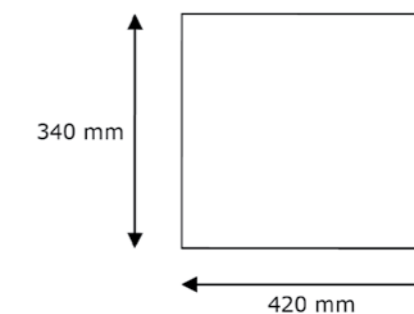
Silicone, Pre-cut glass (340mm x 420mm),

Glass Frame

Material —purchased precut pieces: Total of 4 lengths of 35x19mm timber with 10mm x 10mm rebate and corners cut at 45° angles: 2 at 480mm length, 2 at 400mm length.



Glass
Material: Minimum 3 mm clear glass



Step 1: Clamp adjoining sides of the frame together and ensure that the corner forms a right angle and that the ridge in the pieces of wood are both facing up.

Step 2: At the end of one piece, pre-drill a small hole all the way through both pieces of wood, then with a slightly larger drill piece, pre-drill a slightly larger hole into the first piece of wood only. With a recessing drill bit, drill a small recess into the edge of the hole. The following photo shows the drilling in progress.

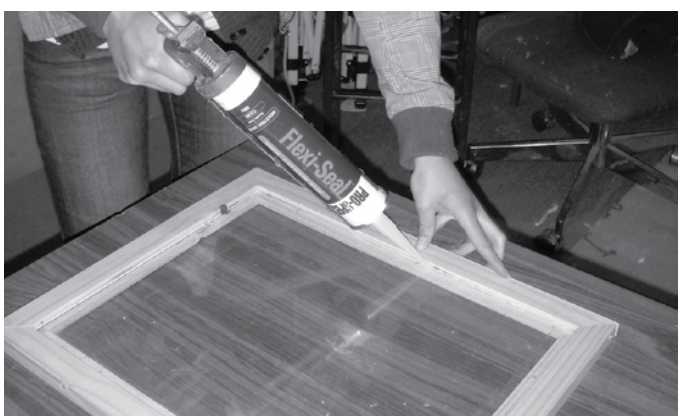
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Step 3: Unclamp the two pieces of wood and apply wood glue. Re-clamp and drill a screw into the pre-drilled hole.

Step 4: Repeat steps 1, 2 and 3 for all four corners of the frame. Make sure that the pieces of wood are positioned the correct way up so that the ridge on all four pieces join, to form a ledge for the glass to sit on.

Step 5: Place the glass inside the frame and apply clear silicone around the exterior edge as shown below. Affix several glaziers pins along each edge of the glass to guarantee it stays in place.



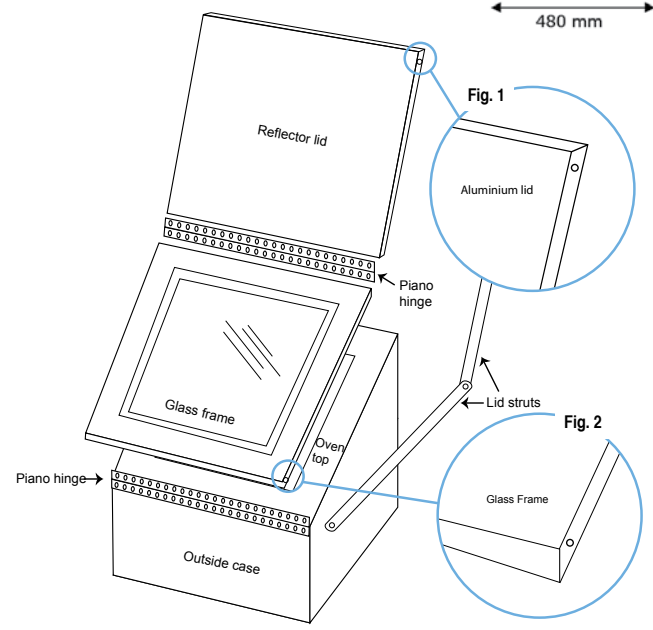
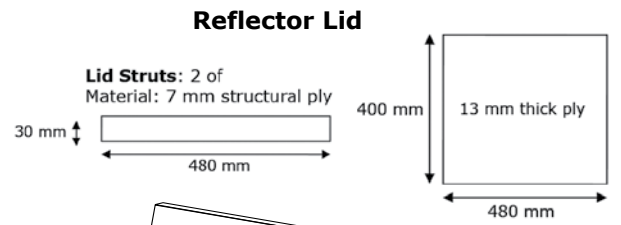
LID, LID STRUTS AND JOINING IT ALL TOGETHER

Materials and equipment required

- Aluminium foil,
- ¼ inch washers,
- 2 x 400mm piano hinges,
- ¼ inch x 1 inch gutter bolt,
- All constructed pieces made so far,
- ¼ inch wing nut,
- Wood glue,
- Drill and screws,
- 13mm structural ply (400mm x 480mm)

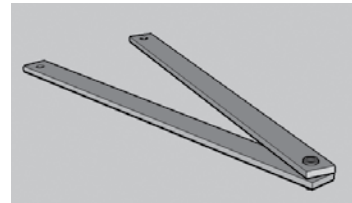
Step 1: Measure a piece of aluminium foil large enough to cover the lid. Apply glue on the lid and gently place the aluminium foil, shiny side out, on the lid. A paint roller can be used to roll the foil out flat and get rid of any bubbles, a soft cloth will also work, but care needs to be taken with either method to keep tears to a minimum.

Step 2: Using a drill and screws attach a piano hinge to join the glass frame to the main box. The hinge needs to be at the lower end of the box so the glass frame can be opened from the top to place food inside the box.



Step 3: Attach a second piano hinge to the top of the glass frame, this time connecting it to the reflecting lid, aluminium side down.

Step 4:



Drill a hole through the two lid struts approximately 10mm from both ends. Place a gutter bolt between the two struts and a wing nut on the end. This attaches the two struts yet lets them move separately from one another. It should look like the picture above with the wing nut underneath.

lets them move separately from one another. It should look like the picture above with the wing nut underneath.

Step 5: Drill a hole in the lid (see fig. 1) and one in the frame (see fig. 2). Be careful not to break the glass.

Step 6: Ensure that the wing nut faces outwards and attach the struts to the cooker using screws and the holes drilled in the previous step. A washer will be needed to ensure the screw doesn't escape the holes drilled into the struts. Washers should also be used as spacers, put one between the lid and the strut and two between the frame and strut, this allows for ease of opening and closing the cooker.

Step 7: Open the lid up and tighten the wing nut on the strut, the lid should be held into place forming a reflector into the cooking compartment.

The solar cooker is now complete, simply take it outside, orient it towards the sun and cook!

Thanks to: Steve Sawyer – for his design and the workshop he held to make the solar cookers; Solar Cookers International – www.solarcookers.org; DKA COOLmob – Robbie and Kat for holding the workshop and for the photos.