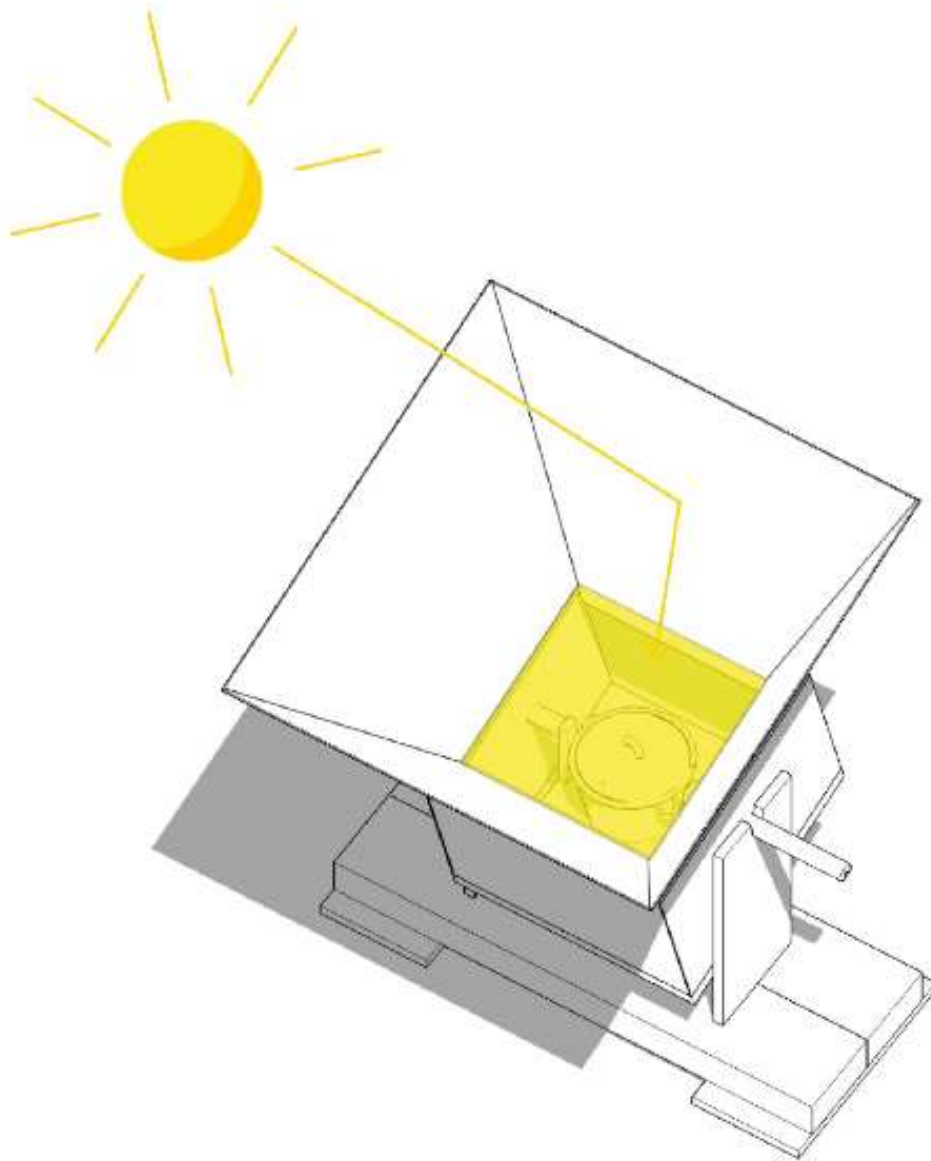


SOLAR OVEN for DOMESTIC COOKING MANUAL



INGEGNERIA SENZA FRONTIERE - GENOVA

INTRODUCTION

This manual will guide you in the self-construction of a wooden solar oven for domestic cooking, like the one shown in the picture below:



A solar oven like the one depicted here uses a system of mirrors (the aluminum covered panels in the picture) to guide the solar radiation into a small volume where the object to warm up is located (the pot in the picture above). The solar energy is therefore transformed into heat. As a consequence, the correct positioning of the oven, that must directly face the sun is really important for getting the highest possible temperatures.

A solar oven for domestic cooking consists mainly of:

- A support base,
- A box (or central body),
- A pot-holder
- A solar collector.

Materials you need are:

- Plywood panels
- Slats to be cut in pieces of different dimensions
- Straw, as thermal insulator
- A glass plate
- Aluminum tape or sheet to cover the solar collector panels

The work tools you need are:

- Saw
- Drill
- Screwdriver

- Universal glue
- Fabric tape
- Iron wire and clamps

The base works as support for the main oven body and it is made up by an horizontal base with feet and two vertical supports carrying the main oven body.

The central part of the oven is made up by two boxes (an inner and an outer one) with straw for thermal insulation in between (see pictures below).



The central part contains the pot-holder and it is closed by the glass plate, which works again as thermal insulator. Solar radiation can pass through the glass window, but the reflected radiation cannot. The pot-holder inside the oven is linked to the vertical supports of the base, so that it always stays horizontal even if the central part of the oven rotates.



The main oven body can rotate over the basis in order to follow the apparent sun motion along the day. A perforated rod (see picture below) is used to adjust the oven position.



Above the main part of the oven, the solar collector allows to concentrate sunlight towards it, so that temperature rises inside the oven allowing cooking foods. The solar collector is composed by plywood panels, inclined to form an angle of 60 degrees with incident sunlight.



NOTE: These panels must be covered with reflecting materials in order to convey the solar radiation towards the pot-holder. Otherwise, if you get access to mirrors of the required shape and dimensions, you can glue them on the plywood panels. In this case, pay attention to the increased weight of the solar collectors. Mirrors must be as thin as possible.

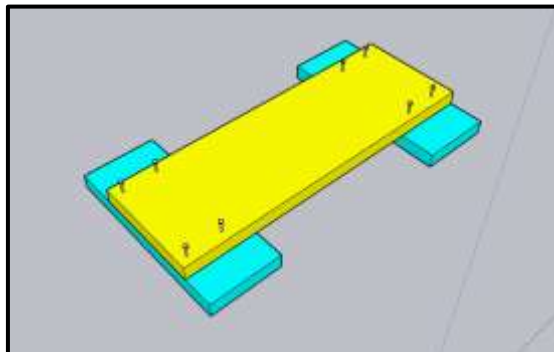
In the next, you will find some sections with explanation and drawings about the construction of each component (base, central part, pot-holder and solar collector). Please note that in the next, each piece of the solar oven is named with letters (A, B, C...) and at the beginning of each section (base, box, pot-holder and solar collector), you will find the list of pieces and quantities (in bracket) you need for that part. At the end of the manual, you will have a summary table containing all the measures, the quantities you need and some notes about each piece. The measures refer to a solar oven like the one in the first picture, but they can be scaled by a scaling factor according to your needs and the size of pots to be used in the oven.

INSTRUCTIONS FOR SOLAR OVEN ASSEMBLY

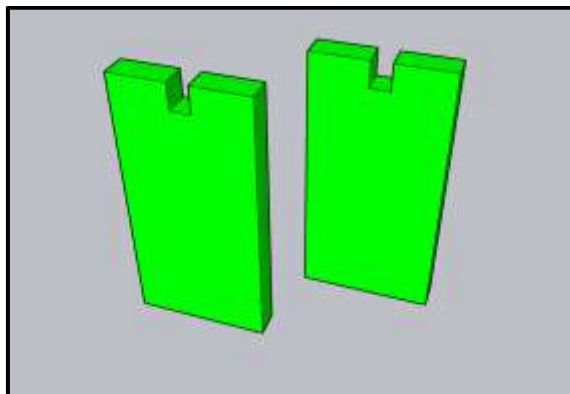
BASE

Pieces you need: A,B(2X),C(2X),D(2X)

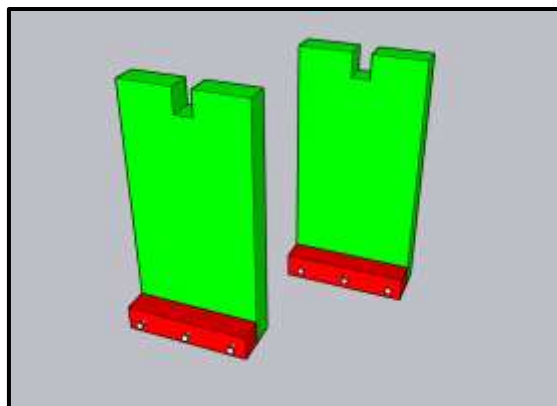
1. Fix the pieces named C (“foot”, light-blue) under the base A (yellow) oriented perpendicular to the length of A. C must be fixed in correspondence of the edges of the base A. To fix C to the base A you can use nails or screws



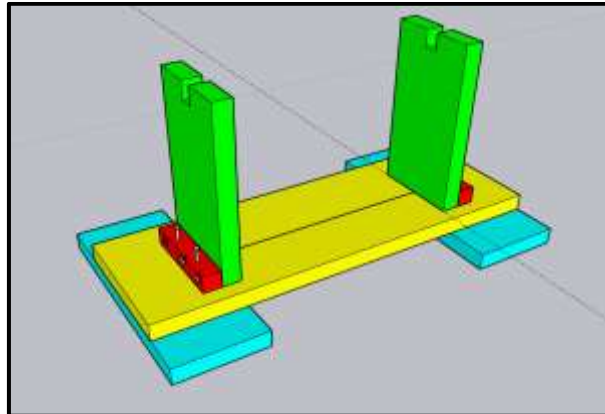
2. Make a square slot on one of the shorter edges of B. The slot must be in the middle of B width. Pay attention that the slot you realize must be large as the diameter of the piece named E (see the table at the end of the manual). The slot must be 1cm deeper than wide.



3. Fix D (2x) on the opposite side of B (2x) with respect to the slots that you realized at the previous point. To fix D to B you can use nails or screws as in the picture. Use 3 nails/screws evenly spaced



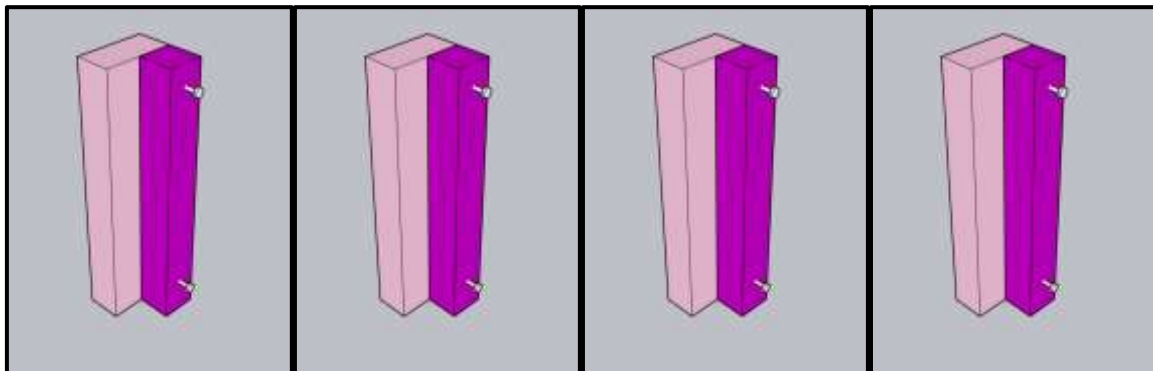
4. Fix the blocks B-D vertically on the base A. D (red) must be on the external side of B. The vertical supports (B) must be at a distance of 50cm. You can use nails/screws to fix D to the base A. Pay attention to the others nails/screws used to fix D on B. The nails/screws you are using now must be placed in between. Now the base is correctly assembled.



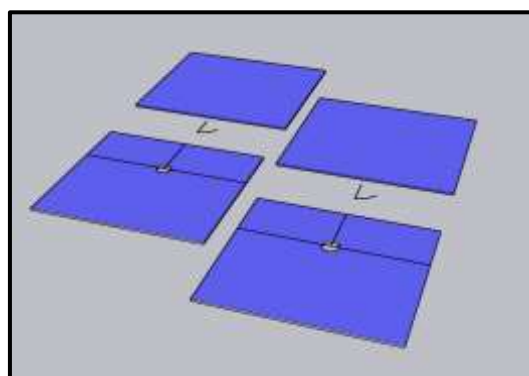
BOX (Main oven body)

Pieces you need: F(4X),G(4X),I(2X),T(2X),L1(2X),L2(2X),H,M(2X),N(2X)

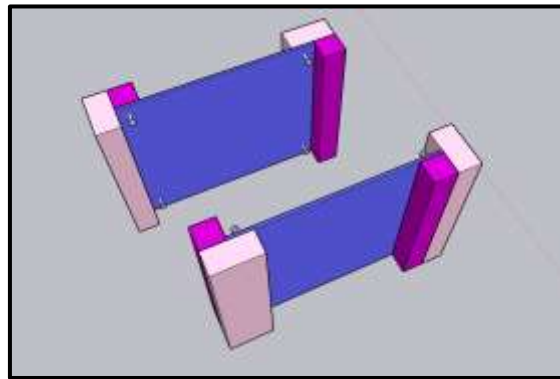
1. Join the pieces F and G together on their longest edge. Use 2 nails or screws. Nails/screws must be placed on G, thus on the thinner piece, as in the picture below.



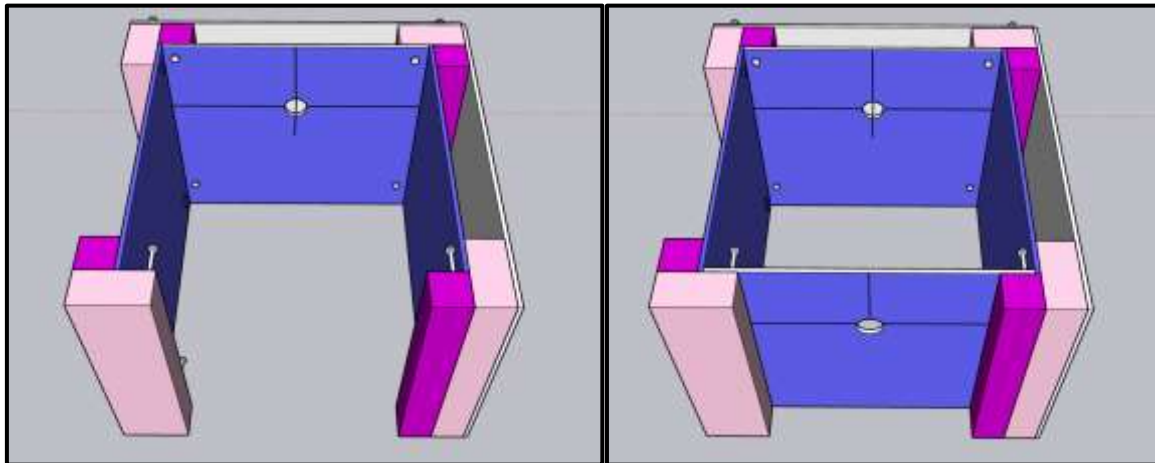
2. Drill the pieces names I1 (inner walls) to make a hole with the same diameter of E. The hole must be in the middle of the long side of I1. The center of the hole must be at 10 cm from the edge.



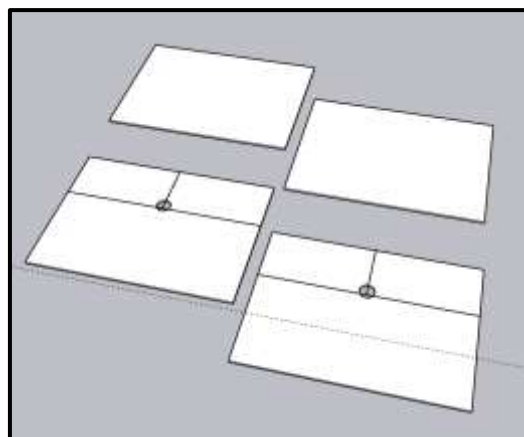
3. Fix the pieces named I2 (box inner walls-not drilled) on 2 blocks F-G (point 1). I2 must be fixed on the inner side of the corner made by the pieces F-G once linked together. Fix each of the I2 walls on 2 blocks F-G. You can use 2 nails/screws



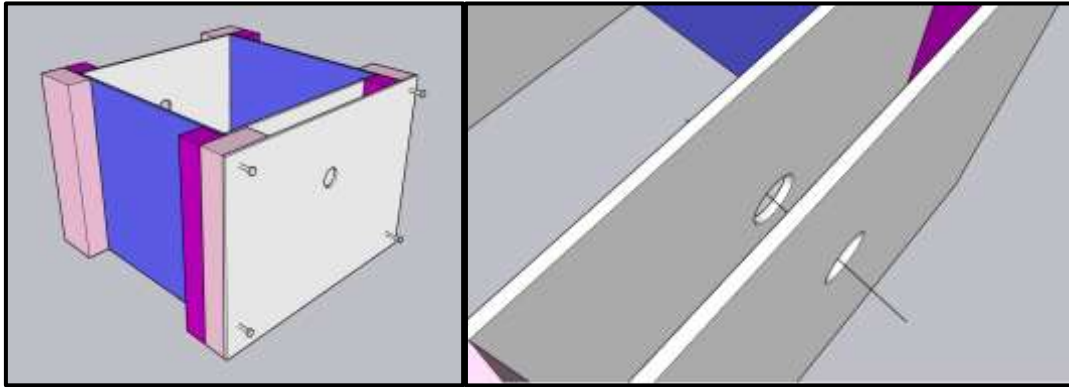
4. Fix the pieces I1 that you drilled on the blocks F-G on which you fixed the I2 ones. I1 must be fixed on the inner side of the corner made by the pieces F-G (as for I2). The vertical edges of I1 and I2 must be in contact. Fix each of the I1 pieces on 2 blocks F-G. You can use 2 nails/screws



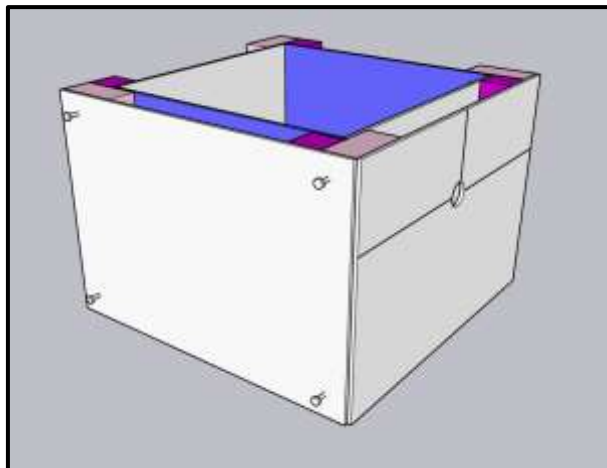
5. Drill L1 (outer walls) to make a hole with the same diameter of E. The hole must be in the middle of the long side of I1. The center of the hole must be at 10 cm from the edge. Pay attention that the holes you make on the L1 and the I1 pieces (inner and outer walls) must be aligned (see next point).



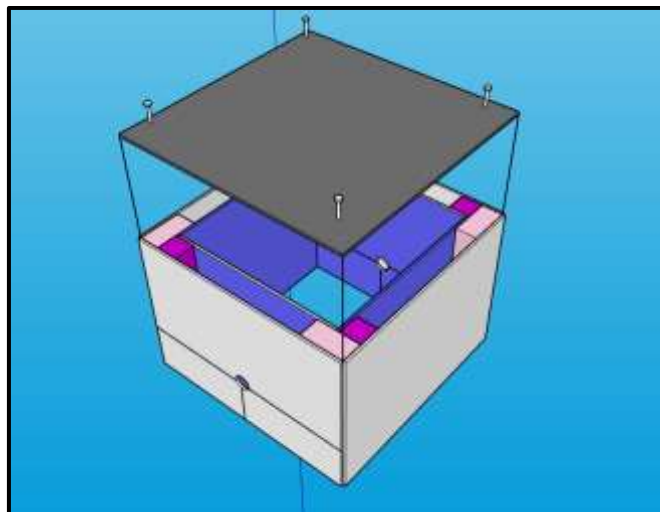
6. Fix the L1 walls on the external side of the box, on the blocks F-G on which you fixed I1 and I2. Be sure that you fix L1 on the same side of I1, so that the holes are aligned. You can use 2 nails/screws.



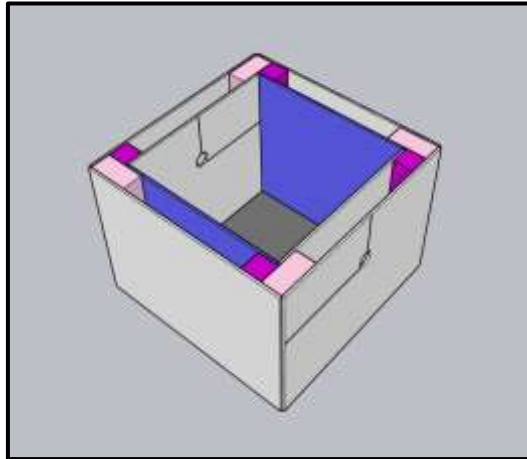
7. Fix now the L2 walls on the other sides of the blocks F-G to close the box. Again you can use 2 nails/screws



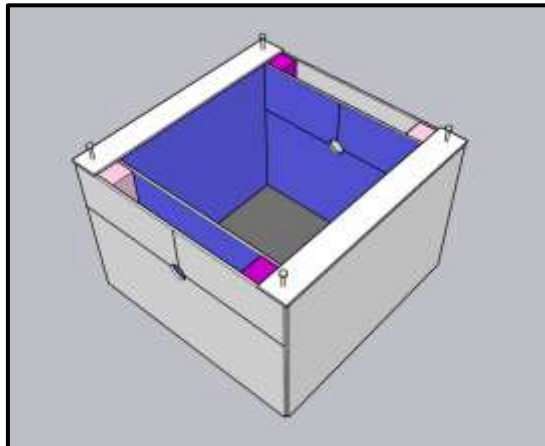
8. Fix now the pieces named H (bottom wall of the oven) on the lower ends of the block F-G. Be sure that you fix H on the opposite side of the holes you drilled on the L1 and the I1 walls.



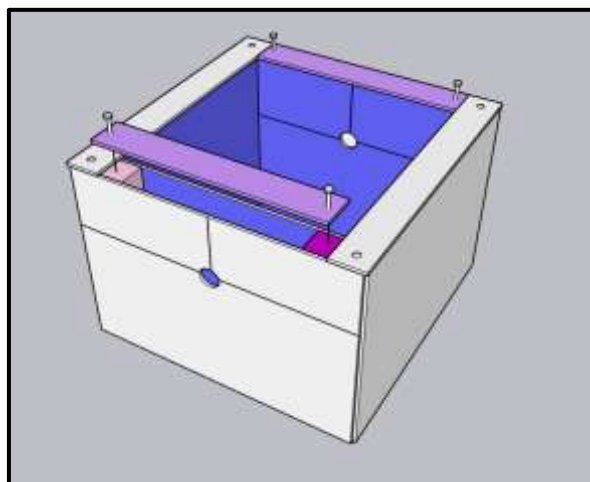
9. Fill the gap between the inner and the outer walls with straw, which is used for insulation. Insulation is really important for keeping high temperatures inside the oven, so do not skip this point.



10. Close the gap on the top side of the box using pieces M and N. Fix first M on the top of the blocks F-G, from one side (external) to the other of the oven body.



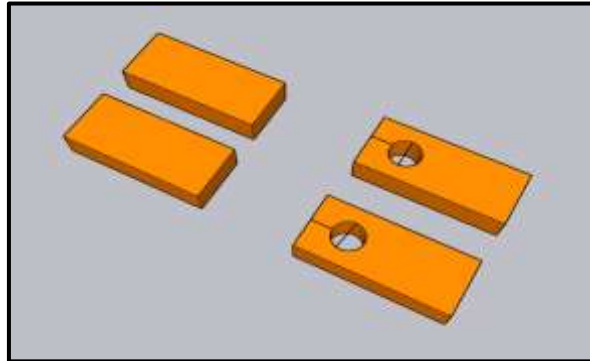
11. Fix N on the blocks F-G in between of M. Fix them on the top of the blocks F-G with 1 nail/screw.



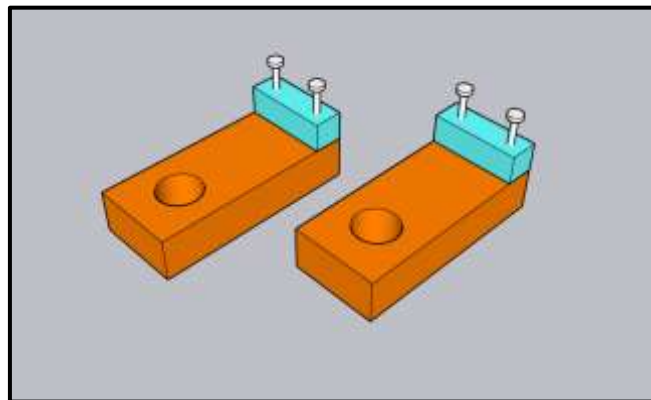
POT-HOLDER

Pieces you need: O, E (2X), P (2X), T (2X)

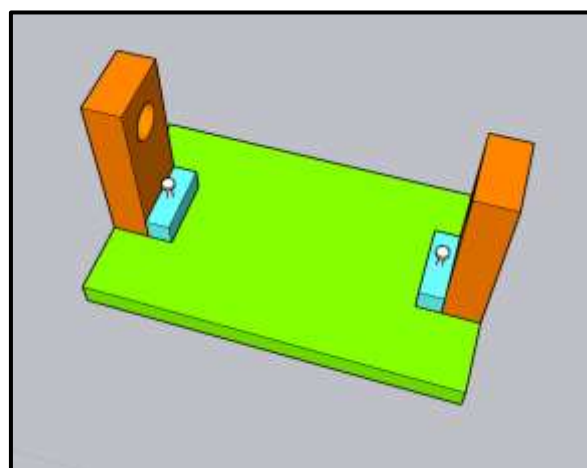
1. Drill the pieces named P. Make a hole with the same diameter of E. The center of the hole must be at 3.5 cm from the edge of P. Note that if you change the diameter of E, the pieces P must be enlarged so that once you drill them, you have at least 1 cm between the holes and the edges of P.



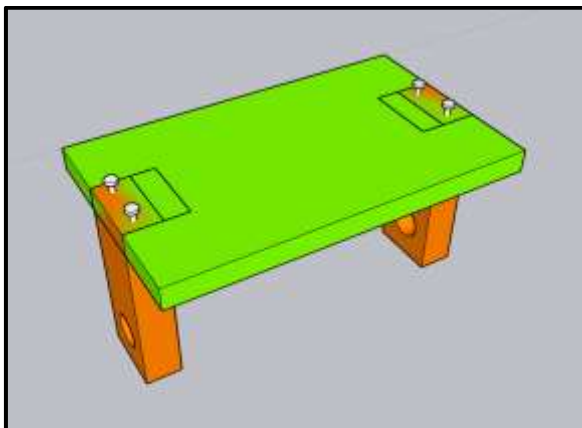
2. Fix now T on P. T must be fixed at the edge of P, on the opposite side with respect to the hole that you made at the previous point (see the picture below). Use 2 screws/nails placed from T to P. Repeat to obtain 2 blocks T-P.



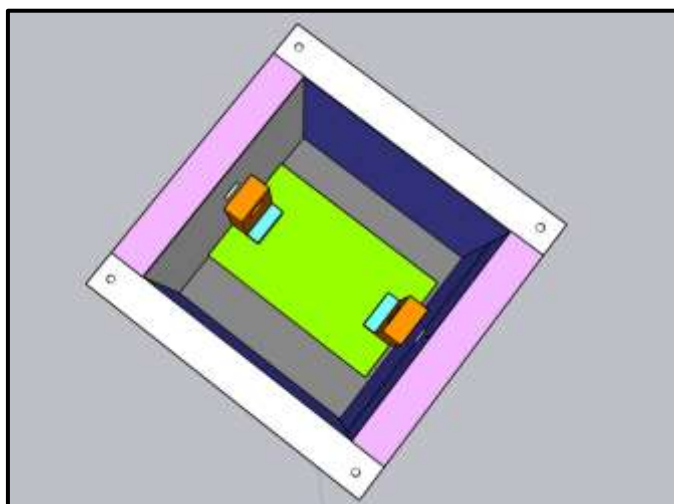
3. Fix the blocks T-P on the pot holder O. First, put 1 screw/nail on the middle of T. The screw/nail must be placed from T to O. Repeat for both blocks T-P.



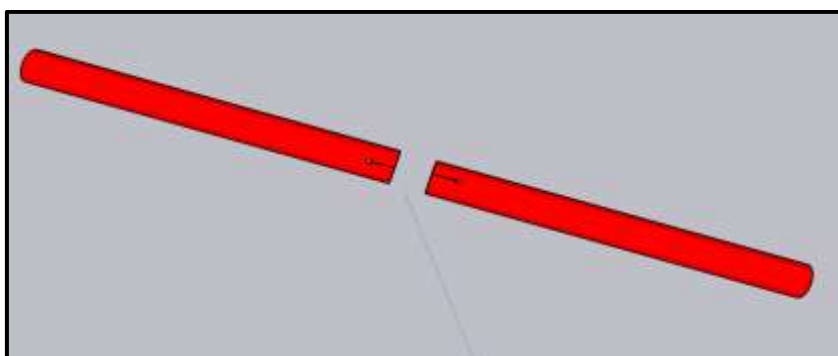
4. Rotate upside-down the block O-T-P. Insert now 2 screws/nails through the bottom of the horizontal pot holder to further link it to the vertical supports P (the drilled ones).



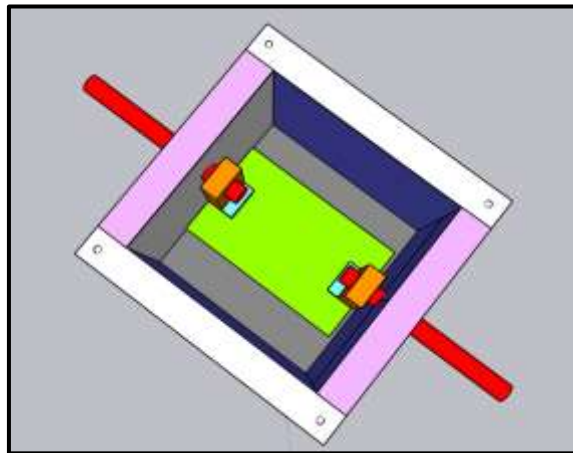
5. Insert now the pot holder into the oven body without positioning yet the rounded sticks E into the holes. Neither on the walls nor in the pot-holder supports. They will be placed in the next from outside to inside of the box.



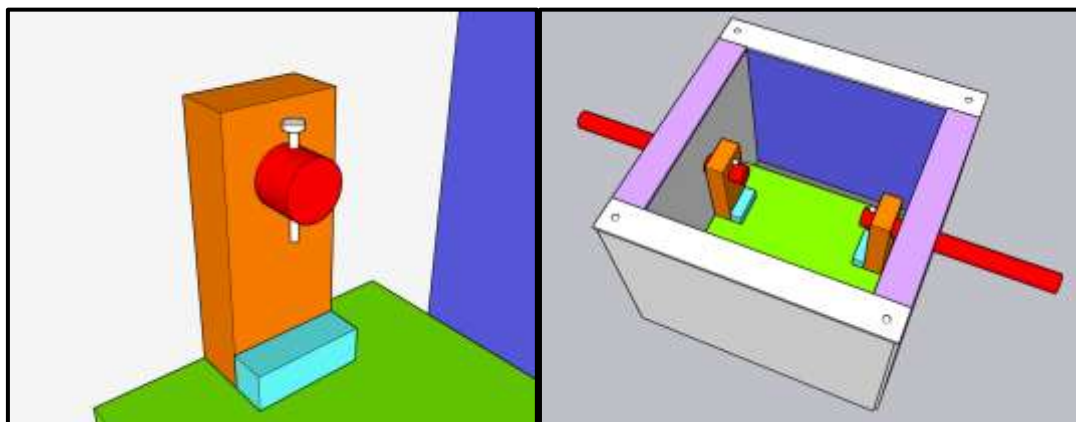
6. Drill the rounded sticks perpendicularly to their length at 2 cm from the end. A nail or a screw will be placed into the hole that you make. This is done to avoid pulling the rounded stick (E) out from the box once it is placed inside of it.



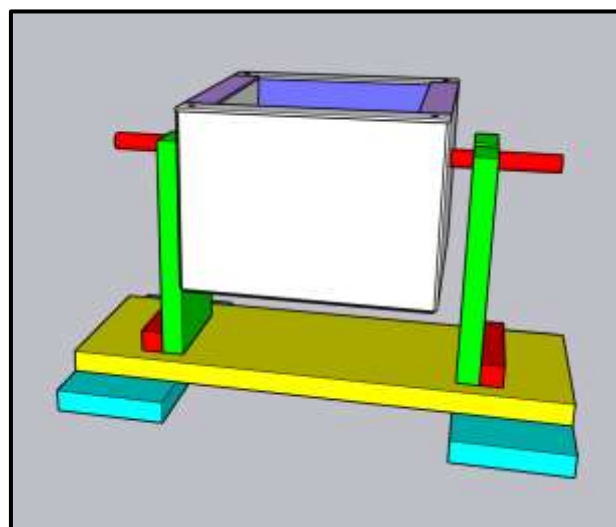
7. Insert the rounded sticks into the holes made on the outer and the inner walls of the oven body and then through the holes that you made on the vertical supports of the pot holder (P pieces). Pay attention that the hole you drilled on the stick E must be within the oven.



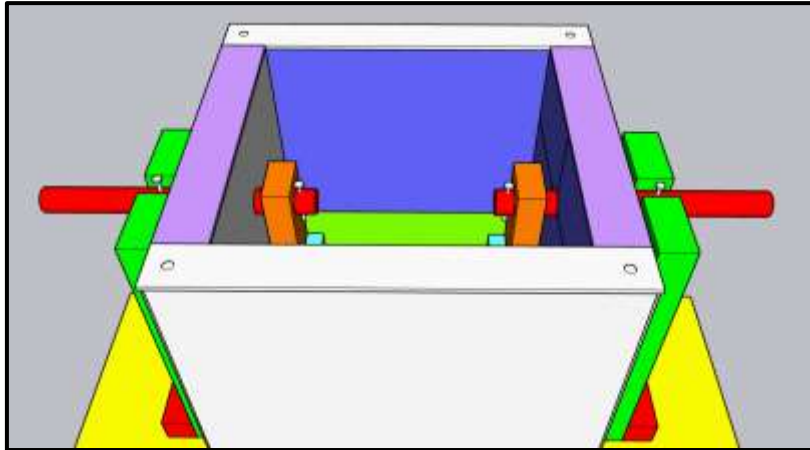
8. Put 1 screw in the hole of the rounded stick (E) made at point 6. Repeat for both sticks. The screws must stick out from the rounded sticks (E) on the opposite side of the one in which they are inserted.



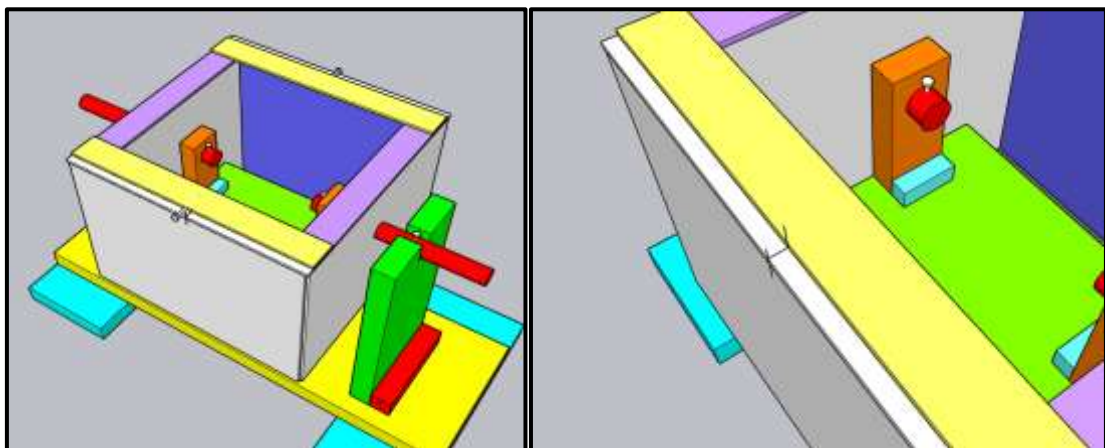
9. Place the oven with the pot-holder inside over the oven base. The rounded sticks (E) must be placed into the square slots of the vertical supports of the base (B)



10. Drill the round sticks vertically in correspondence of the vertical supports of the base. The hole must pass through the rounded sticks (E) to reach the vertical support of the base (B). Then place a screw into the hole to fix the entire oven on its base. Repeat for both rounded sticks. This will keep the pot-holder horizontal when rotating the entire oven body to follow the apparent sun motion. If you skip this point, foods may fall down from the pot holder.



11. Finally, place 2 screws into the opposite sides of the box (where no holes were made) just near the upper side of the external oven walls. They are used to anchor the solar collector, as described in the following.



SOLAR COLLECTOR

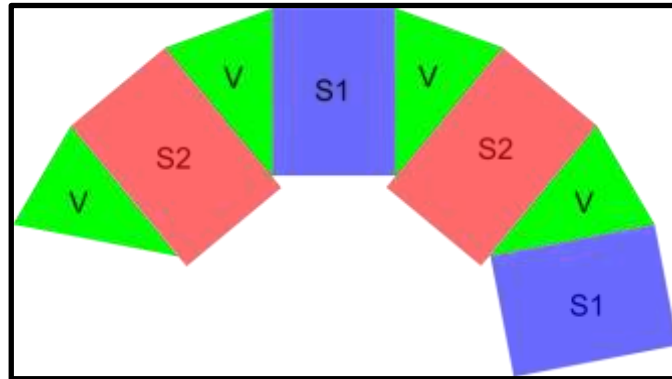
Pieces you need: V(x4), S1(x2), S2(x2)

In this section the solar collector is built and then located over the top of the oven body.

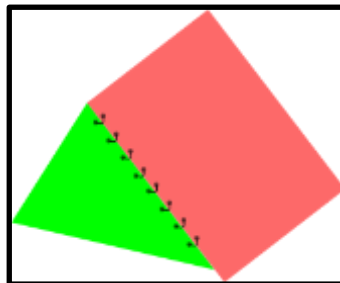
As a first step, cut the elements V(x4), S1(x2) and S2(x2) constituting the solar collector. You can use plywood panels or alternatively you can use metal foils. In any case, the surface must reflect the solar radiation, so all the elements named V(x4), S1(x2) and S2(x2) must be covered with aluminum sheet or reflecting tape in case you use plywood for their construction. Pay attention to this step because the smoother the reflecting surface, the more the radiation will actually hit the pot inside the oven.

After cutting the pieces named V(x4), S1(x2) and S2(x2) and covering them with reflecting material, place 1 screw/nail in half of the 2 panels named S2. You will use them to fix the solar collector to the oven body, by rolling a piece of iron wire over both this screw/nail and those located on the oven body (see point 11 of the previous section).

Finally, joint all the pieces constituting the solar collector as indicated in the figure below:



Connect them by placing all the elements on a planar surface as shown in the figure. To fix the pieces all together you can make some holes along the edges of each panel and lock them with iron wire:



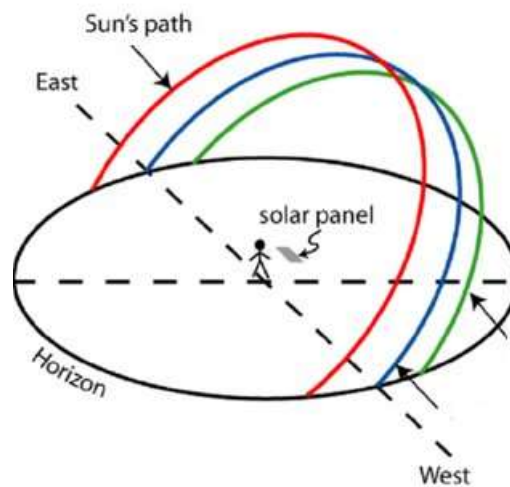
Finally, after linking the as in the picture above, link the first V element to the last S1 one to close the entire collector surface. Then, locate the solar collector on the top of the oven body and fix it. Pay attention that the pieces named S1 must be located over the oven walls where the rounded sticks (E) are inserted.

Finally, insert the glass sideways to close the oven. The glass should slide between the panels named S2 below those named (S1). This is the reason why S1 were made shorter than the S2 (see the table at the end of this manual).

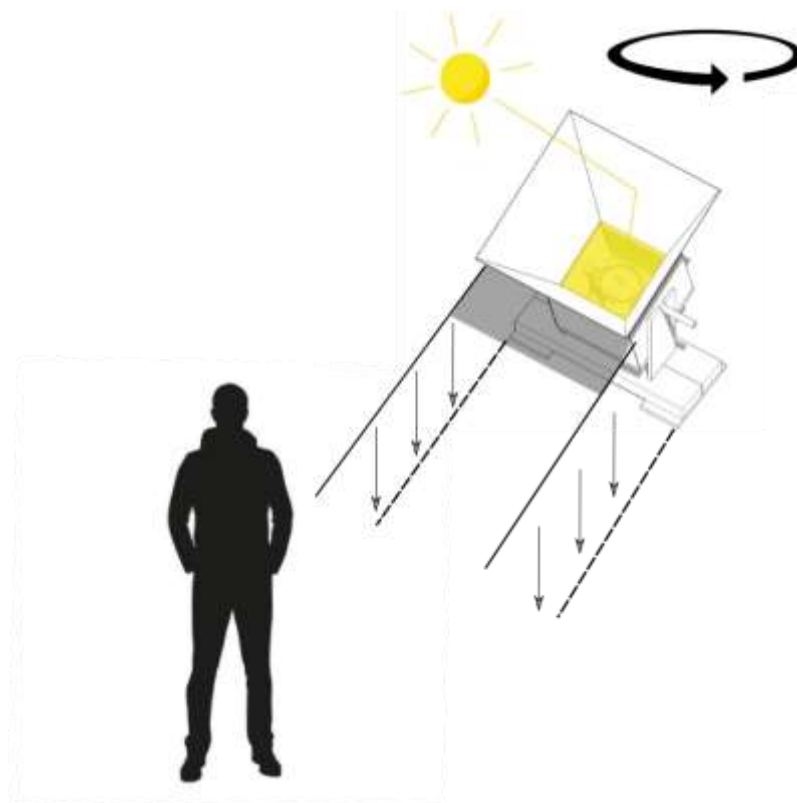


OPERATING INSTRUCTIONS

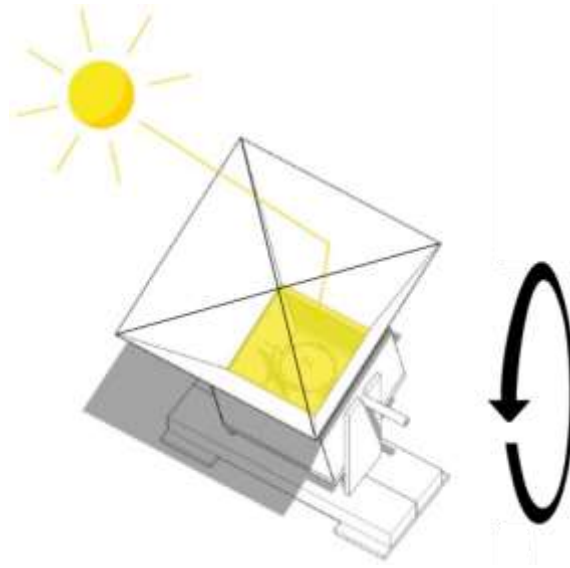
For the best operation of the oven, you must align it with the direction of the sun to maximize the radiation hitting the surface of the solar collector, which is then reflected inside the oven. Sun moves from east to west at different heights during the day (follow the green line for instance). Sun height also changes during the year (pass from green, to blue to red line).



First, you need to adjust the east-west orientation of the oven. To do that, locate yourself in front of the oven. If the east-west orientation of the oven is correct, then you must see its shadow in between of the base width. Otherwise, you must rotate it left-right over the ground.



Then, you need to optimize the vertical adjustment of the oven. To do that, you can place 2 strings on the diagonals of the solar collector:



When the oven is correctly aligned, the cross-shadow of the two strings must fall in the center of the glass window, thus on the pot. To adjust the vertical orientation rotate the oven body over the base

WARNING

- keep out of reach of children
- the glass plate may become hot, do not touch the glass plate when hot
- fix well the solar oven to the ground before using
- use the solar oven just in case of proper weather conditions (e.g., no wind, etc.)
- use the solar oven to cook just food
- in case of any doubt regarding the solar oven and its functioning, please write to isf.genova@gmail.com before using it (no responsibility is assumed for inappropriate use)

LIST OF COMPONENTS

Piece name	Length [mm]	Height [mm]	Thickness [mm]	Diameter [mm]	Quantity	DESCRIPTION
A	900	300	40	\	1	Horizontal base
B	400	200	40	\	2	Vertical supports
C	500	200	40	\	2	Support reinforcement
D	200	40	40	\	2	Angle bracket
E	300	\	\	0.03	2	Rounded shafts for oven rotation
F	300	40	80	\	4	Angle brackets for oven case
G	300	40	40	\	4	Angle brackets for oven case
H	420	420	5	\	1	Bottom wall
I1	300	340	5	\	2	Inner walls
I2	300	330	5	\	2	Drilled inner walls
L1	300	420	5	\	2	Drilled external walls
L2	300	420	5	\	2	External walls
M	430	50	5	\	2	Top cover
N	330	50	5	\	2	Top cover
O	300	180	20	\	1	Pot support
P	140	60	30	\	2	vertical supports
T	60	20	20	\	2	Angle brackets for support
Q	1000	20	30	\	1	Pole for oven positioning
R	350	450	5	\	1	Glass cover
S1	340	500	0.5		2	Rectangular mirror panels
S2	340	460	0.5		2	Rectangular mirror panels
V	310	430	0.5		4	Triangular mirror panels