

ULOG SOLAR OVEN COOKER

Installation Instructions

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Restrictions of whatsoever nature against the imitation of the hereinafter described Solar Oven Cooker do not exist under any legal patent protection.

The reprint even in part of these present instructions is also permitted provided the source is quoted.

This instructions are also available in German, French and Spanish

### SOLAR ENERGY FOR ALL

This is the motto of the ULOG Group ; a loose association of people in Switzerland committed to making solar energy available to the people of the world, and in particular to those less fortunate in the so called "third world". There, the most widely used fuel for cooking and baking is wood and in many places is becoming less and less plentiful. This over exploitation of natural resources must be stopped in all our interests as it leads to soil erosion and finally to the encroachment of desert conditions. The solar oven cooker is a useful and well proven alternative to wood fuels! It is an extremely simple piece of equipment ; capable of being put together almost anywhere ; and it requires no other fuelling than direct sunlight. Most dishes can be prepared with it, and without additional expenditure ; quite the opposite! Cooking with the solar oven requires practically no supervision, as there is no need to stir the pan.

The solar oven cooker functions on the basis of the "greenhouse effect", i.e. the light rays from the sun penetrate through the window panes; they become absorbed by the black surfaces of the interior and are thereby transformed into heat. Since the interior space of the cooker oven is hermetically sealed, and as glass for all intents and purposes hinders the passage of heat waves, the inside temperature rises until the radiation loss and the influx of energy balance themselves out. In order to prevent loss of heat, the window is double pane glazed and the oven cooker insulated all round against heat loss. In this manner temperatures of well over 100° C are generated ; sufficient to cook and even to bake. As only a small amount of warmth can be stored, the influx of direct sunlight is requisite during the greater period of the cooking time.

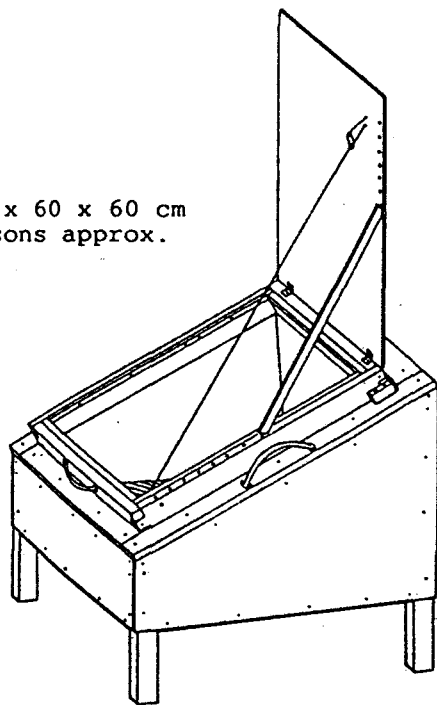
The following erection instructions should enable a layman with some knowledge of woodworking to set up a solid and permanent solar oven cooker. The materials involved are easily obtainable and cheap at the price. The basic dimensions can be altered according to requirements ; e.g. a different window size or a deeper oven space. The model described in this brochure is in two sizes and is suitable for non tropical areas, i.e. for all regions 25° to around 50° N or S of the Equator. For areas further away from the Equator, the window inclination angle would have to be appropriately increased. For Equatorial regions, there are special models having horizontal windows instead of inclined and are therefore easier to construct. For those on the move wishing to use their solar oven cooker whilst journeying, there are compact portable models, also in two sizes. Assembly instructions for all these other models are available from the ULOG Group, even in several languages. Constructional kits and ready to use solar oven cookers are suppliable in all models.

Apart from solar oven cookers, we also publish instructions for the construction of solar dryers for foodstuffs and simple water warmers. For larger communities, such as schools, hospitals, convents and monasteries, we have developed a solar kitchen with which cooking can be carried out for several hundred persons, based on fix focus mirror technology ; and should sunlight not be apparent, then conventional fuels can be employed by energy conserving means. We would be pleased to provide more details of what we have to offer!

If requested to do so, our men and women associates will travel to regions where a solar oven project is to be introduced, even to third world countries. Training will be given to local craftsmen in the construction, in the first instance, and to women for operating the equipment. Financial support is also available at the same time, from among others the "VKSE Society for the Furtherance of Small Scale Technological Exploitation of Solar Energy" P.O.Box, CH-4011 Basle, Switzerland.  
New members will be gladly welcomed!

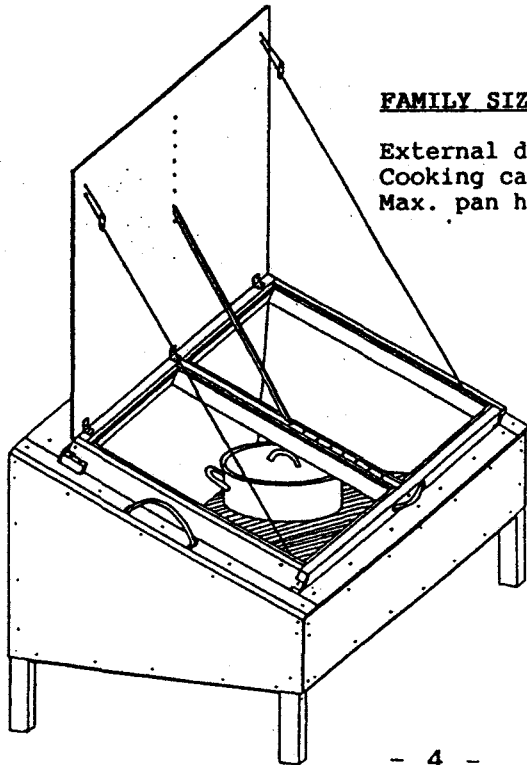
**STANDARD SIZE S**

External dimensions: 67 x 60 x 60 cm  
Cooking capacity: 6 persons approx.  
Max. pan height: 19 cm



**FAMILY SIZE F**

External dimensions: 120 x 60 x 60 cm  
Cooking capacity: 12 persons approx.  
Max. pan height: 19 cm



PARTS LIST FOR STANDARD (S) AND FAMILY (F) SIZES

Pos.	Amount		Description	Dimensions (cm)			Materials
	S	F					
1	2	4	Glass window pane	50	x	50 x 0.3	Window glass
2	4	2	Glass frame	54.9	x	6 x 2.2	Wood
3	-	2	Glass frame	107.6	x	6 x 2.2	Wood
4	-	1	Cross bar	50.5	x	6 x 2.2	Wood
5	8	16	Glass securing batten	49.5	x	1.4 x 1	Wood
6	4	8	Glass distancing batten	49.5	x	2.4 x 1	Wood
7	1	-	Reflector cover	55	x	55 x 0.5	Bakelized plywood
8	-	1	Reflector cover	108	x	55 x 0.5	Bakelized plywood
9	1	-	Reflector foil	55	x	55 x 0.01	Aluminium foil
10	-	1	Reflector foil	108	x	55 x 0.01	Aluminium foil
11	2	3	Hinge	3	x	3	Galvanized steel
12	1	1	Reflector support	50	x	1.5 x 1.5	Wood
13	1	2	Bracing line	0.2	x	100 approx.	Nylon
14	1	2	Line brace	3.5	x	1.5 x 0.5	Bakelized plywood
15	2	2	Window retaining batten	25	x	2.5 x 1	Hardwood
16	2	2	Stop block	5	x	2 x 2	Hardwood
17	2	2	Panel batten	66.5	x	6.3 x 1.5	Wood
18	1	-	Panel batten	55	x	4.3 x 1.5	Wood
19	-	1	Panel batten	107.8	x	4.3 x 1.5	Wood
20	1	-	Panel batten	55	x	7.4 x 1.5	Wood
21	-	1	Panel batten	107.8	x	7.4 x 1.5	Wood
22	3	3	Bow handle	16.5			Chromed steel
23	1	-	Oven bin	99.5	x	84.7 x 0.03	Offset plating
24	-	1	Oven bin	152.4	x	84.7 x 0.03	Offset plating
25	2	2	Oven framework	50.5	x	8 x 2.2	Wood
26	1	-	Oven framework	66.5	x	7 x 2.2	Wood
27	-	1	Oven framework	119.5	x	7 x 2.2	Wood
28	1	-	Oven framework	66.5	x	9 x 2.2	Wood
29	-	1	Oven framework	119.5	x	9 x 2.2	Wood
30	4	4	Connecting piece	15	x	7.5 x 0.8	Plywood
31	2	2	Side panel	60.5	x	43 x 0.5	Plywood
32	1	-	Front panel	66.5	x	15 x 0.5	Plywood
33	-	1	Front panel	119.5	x	15 x 0.5	Plywood
34	1	-	Rear panel	66.5	x	43 x 0.5	Plywood
35	-	1	Rear panel	119.5	x	43 x 0.5	Plywood
36	2	2	Front leg	30	x	4 x 4	Wood
37	2	2	Rear leg	56	x	4 x 4	Wood
38	2	2	Reinforcing batten	51.5	x	2.5 x 1.5	Wood
39	2	-	Reinforcing batten	58.5	x	2.5 x 1.5	Wood
40	-	2	Reinforcing batten	111.5	x	2.5 x 1.5	Wood
41	1	-	Bottom panel	67.5	x	60.5 x 0.5	Plywood
42	-	1	Bottom panel	120.5	x	60.5 x 0.5	Plywood
43	22	32	Countersunk wood screw	0.3	x	2	Steel
44	38	70	Countersunk wood screw	0.3	x	2.5	Steel
45	4	4	Countersunk wood screw	0.35	x	2	Steel
46	12	12	Countersunk wood screw	0.35	x	3.5	Steel
47	-	4	Countersunk wood screw	0.35	x	5	Steel
48	4	6	Flat round rivet	0.3	x	0.8	Aluminium
49	120	156	Flat headed nail	0.14	x	2	Steel
50	18	24	Countersunk nail	0.14	x	3	Steel
51	14	14	Countersunk nail	0.2	x	5	Steel
52			Wood glue				
53			Paint				Mat black
54			Insulating material			Strength 8 cm	Mineral wool matting
55			Weather-proofing				e.g. Linseed oil

ALTERNATIVES TO ITEMS IN THE PARTS LIST

- Pos. Alternatives:
- 1 Alternative glass thickness: min. 2mm and max. 5 mm, involving possible adjustment in the width of Pos. 5. For greater breakage security: hardened glass quality. Such so called Temperite or Security Glass is at least 3.5 mm thick and about double the price of normal window pane glass. It should be ordered for the correct measurements as it cannot be subsequently cut again. Such glass is not readily available. It is only worth the increased expenditure for a larger number of units.
- 2/3/4 Poor timber quality will require thicker battens and stay, up to 2.5 cm section approx. The length will then have to be appropriately adjusted so that measurements remain the same in the interior of the framework. Adjustments will also be necessary in Positions 17, 18, 19, 20 and 21.
- 5/6 In case of poor timber quality, thicker section battens should be considered up to 1.3 cm approx., together with an appropriate adjustment of the lengths.
- 7/8 Normal plywood of 8 mm to 10 mm gauge. When employing plywood of 4 mm to 5 mm gauge, the cover will have to be strengthened all round with a bracing frame. In the "F" version, an additional bracing batten will have to be provided, sited over the centre window stay. Battens of the dimensions as Pos. 38, for example. By the using of aluminium sheeting of 0.4 mm to 0.5 mm gauge in place of plywood, the reflector Pos. 9 and 10 will become superfluous.
- 9/10 Offset plating or aluminium sheeting. See 7/8.
- 11 Hinge straps of strong textile material or leather in 10 x 5 cm. Four pieces for the "S" version and 7 pieces for the "F" version. These should be attached to the upper face of the cover and on the glass framework with a plywood batten. Width 4.5 cm ; length for "S" version 54 cm and for "F" version 107 cm. Nails as in Pos. 49
- 22 Bow handle of bent branch timber or sawn from hardwood.
- 23/24 Aluminium sheeting from 0.2 mm to 0.5 mm gauge or galvanized corrugated sheeting (e.g. beaten flat corrugated sheeting) of max. 0.2 mm gauge.
- 25/26/27 Larger wood section should be employed in cases of  
28/29 poor timber quality, up to 3 cm approx. Appropriate adjustments will then become necessary to the distances between the top edges of the front and rear panels of Pos. 32 and 33 and/or 34 and 25 respectively and the top edges of the legs, Pos. 36 and 37 ; see drawing on page 16.

- Pos. Alternatives:
- 31/32/33 Plywood gauge 4 mm. In place of plywood, aluminium  
34/35/41 sheeting from 0.2 mm to 0.5 mm gauge or galvanized iron  
42 sheeting of max. 0.2 mm gauge may be employed. For  
reasons of stability however, the framework of the oven,  
oven frame, legs and bracing battens, should first be  
rigidly jointed together before the metal sheeting side  
and bottom panels be attached to the framework. It is  
recommended to allow the panels to overlap the oven  
framework by 1 cm approx. and to bend these overlaps  
round the corners before applying the panel battens.
- 36/37 In cases of poor timber quality, larger wood sections  
should be preferred which may also be square.  
Appropriate adjustments will then become necessary to  
the distances between the top edges of the front and  
rear panels of Pos. 32 and 33 and/or 34 and 25  
respectively and the top edges of the legs, Pos. 36 and  
37 ; see drawing on page 16.  
Longer leg lengths may be selected in order that the  
solar oven cooker has more ground clearance.
- 48 If the reflector cover, Pos. 7 and 8, has been fitted  
with a frame, the hinges should be fastened to the cover  
with countersunk wood screws as in Pos. 43. This is  
however also possible without a frame, by anchoring  
these with a batten applied to the upper face of Pos. 7  
and 8.
- 53 Blackboard paint or a self mixed paint according to the  
following recipe : mix soot or iron manganese powder  
with a semi oil preparation. This comprises part  
turpentine ~~or white spirit~~ and boiled linseed oil. Let  
the mixture stand over night. A small sample should be  
applied with a brush to the interior of the solar oven  
and should be allowed to set at a temperature of at  
least 130°C. If the result is too thin, add more powder  
or soot to the mixture. If the painted surface is too  
gloss, reduce the linseed oil content of the mixture.
- 54 Organic materials, such as hay, rice straw, coconut  
fibre, ground nut shells, wood wool, wood chips, kapok,  
raw cotton, twists of newsprint. No styropore, as this  
is not heat resistant.
- 55 Weather-proof coloured paint or varnish. When employing  
metal sheeting for the panels, cover and bottom, only  
the exterior wooden parts should be painted.

## ASSEMBLY INSTRUCTIONS

### 1. GENERAL:

- The assembly instructions refer to those items in the parts list. Alternatives to the various parts are listed on pages 5 and 6.
- When finishing the various parts and assembling these, it is recommended to work with absolute precision. Inaccuracies can have a negative influence on the functionality of the solar oven cooker. Much time will then be wasted on the subsequent locating, correcting and adjusting of errors.
- Except where expressly otherwise stated, all woodwork is to be joined together with wood glue.
- The symbols "S" and "F" stand for the "Standard" and "Family" versions. During assembly work, only those instructions should be followed which are preceded by the appropriate symbol.
- The position numbers and those of the various constructional parts appear in square brackets throughout, e.g. [15].
- The illustrated drawings are given only for the "S" version, but can also be taken as guidance for the "F" version, with the appropriate adjustments for size.

### 2. Window

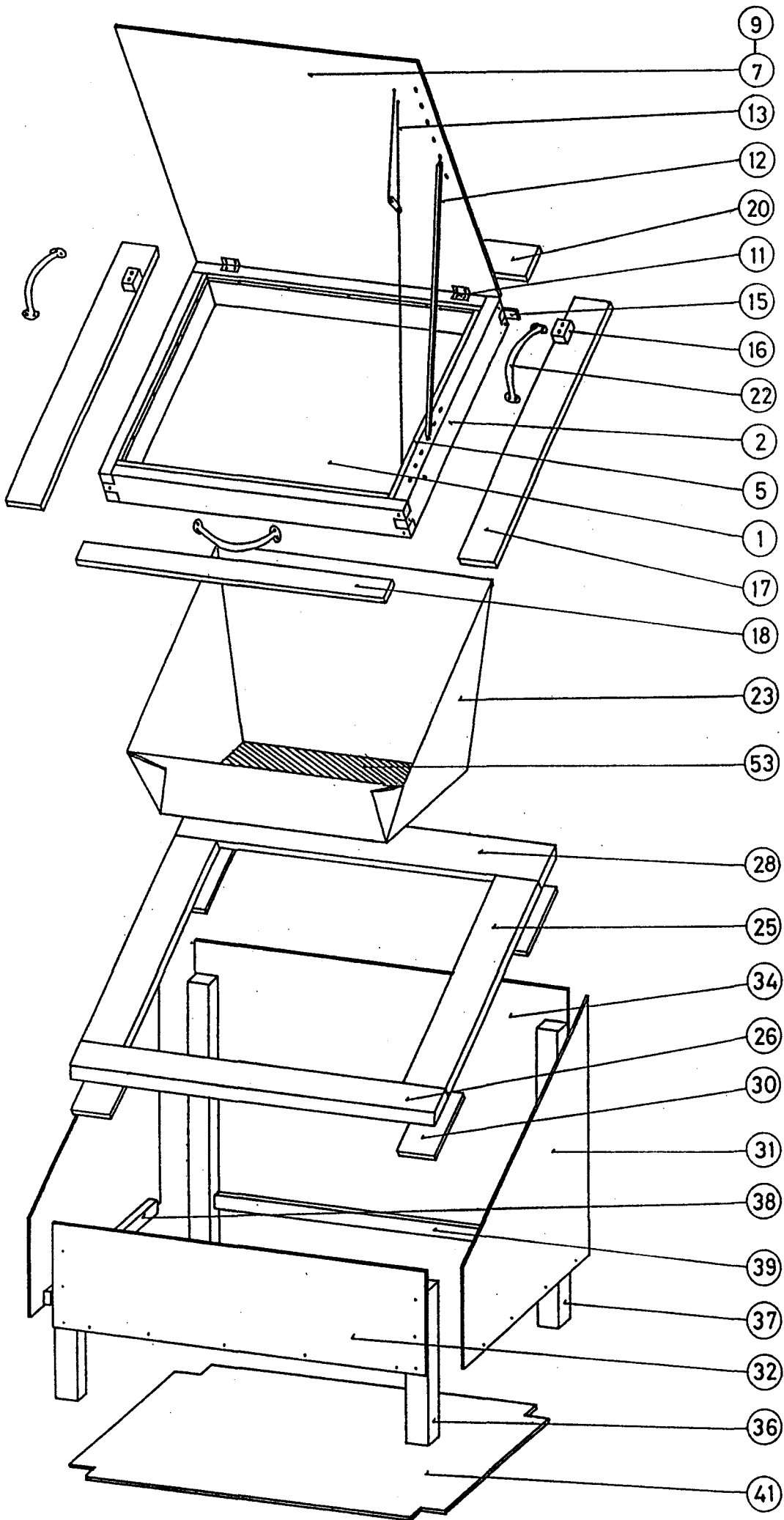
1. S,F: Cut tongue and groove joints on each end of the glass frame pieces [2] and [3], as indicated in the drawing under no. 2 on page 14, using a saw and chisel. Joint the 4 pieces together to form a rigid unwarped rectangular framework. Secure all tongue and groove jointings with a nail [51].
  - F: Attach the cross bar [4] in the centre of the rectangular framework with 4 screws [47], two at each end.
2. S: Attach 4 glass securing battens [5] on the inside of the glass frame abutting the outer edging, without a break in the 4 corners with 4 screws each [44] and without wood glue, to permit the replacement of damaged glass panes as required. The battens should be drilled in advance to 3 mm diam. The first glass window pane [1] should now be sited. This is to be secured all round with the 4 glass distancing battens [6]. Ensure that in the corners the ends of the various glass securing and distancing battens do not overlay each other but are staggered. This renders the window more airtight. 4 nails [49] are required to affix each batten. Before siting the second glass window pane, both glass panes should be thoroughly cleaned. To prevent condensation forming on the inner side of the glass panes when operating the solar oven cooker, these surfaces should be treated with glycerine or an anti-misting cloth. The glass should be rubbed with these several times up, down and across. Polish the glass panes with a dry cloth to remove anti-misting residue. Attach the second glass window pane in the same manner with the 4 remaining battens [5].
  - F: Follow the same instructions as for "S" for the two adjacent glass pane windows.
3. S,F: Draw the reflector foil [9] or [10] over the reflector cover [7] or [8]. If the foil is not self adhesive, apply with contact adhesive or waterproof household glue.



4. S,F: Attach the hinges [11] to the reflector cover on the mirror side with the rivets [48] (holes 3 mm diam., see drawing on page 15). The cover can now be attached to the glass frame with the screws [43]. In order that the cover fits tightly when closed, a chisel may be used on the frame, where the hinges are sited, to chip off wood corresponding to the thickness of the folded hinges.
5. S,F: Hammer a nail [51] into both ends of the reflector support [12] leaving 1 cm approx. showing. If hardwood is employed, pre-drill to avoid splitting the wood. Rip off the heads and file the ends off round. Bend both nails to approx. 45° in the same direction. Chip off both edge ends of the support to an angle of 45° under the bent nail until a surface of 1 cm approx. is formed (see drawing on page 15).
6. S: On the right hand side of the closed reflector cover drill 5 mm diam. holes for the reflector support through the reflector cover about 1 cm. into the glass frame thereunder, as well as drill 2 holes on the same side of the reflector cover 3 mm diam. for the bracing line, as in the drawing on page 15. The bracing line [13] is attached to the glass frame by drawing it through a drilled side aperture 3 mm diam. (see drawing on page 15). First countersink the hole conically from the outside and tie a stop knot on the end of the bracing line. Draw the bracing line through until the knot rests in the countersunk hole and secure it with a nail [49]. The end of the line brace [14] should be rounded off and a 3 mm diam. hole drilled through each end. The other end of the bracing line is drawn through one of the holes in the end of the line brace and then threaded through both holes in the reflector cover. Draw the end of the bracing line through the second hole in the line brace and apply a stop knot.
- F: The holes for the reflector support are to be drilled in the centre of the reflector cover and in the cross bar. Bracing lines are to be fitted to both ends of the window.

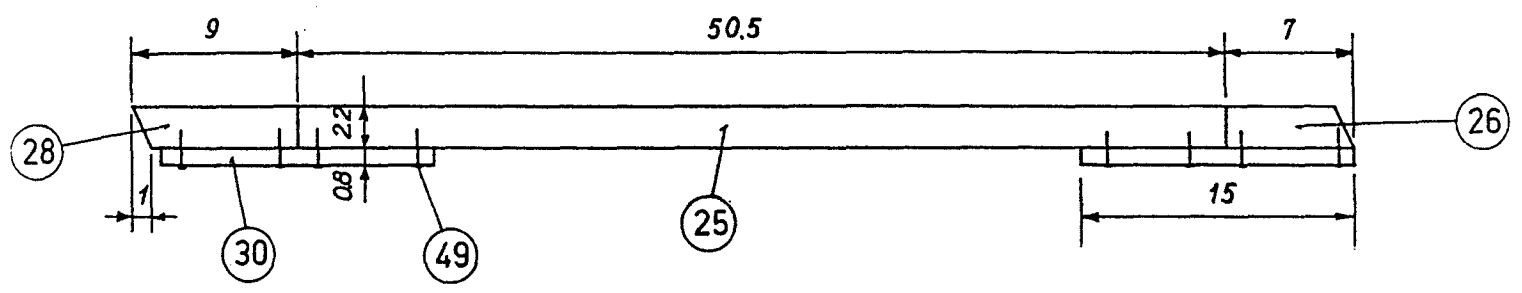
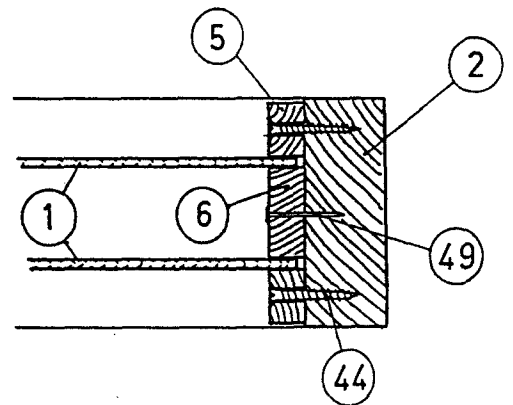
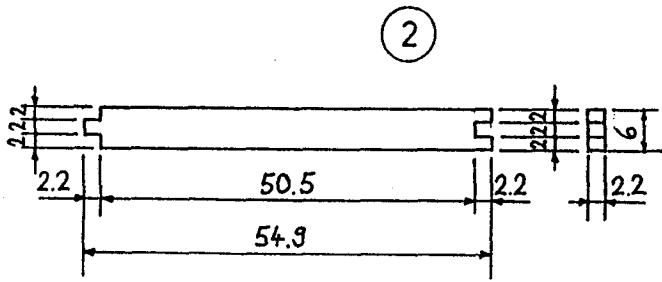
### 3. Oven

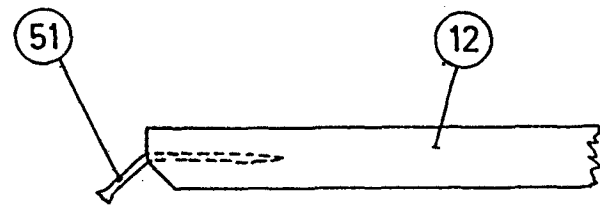
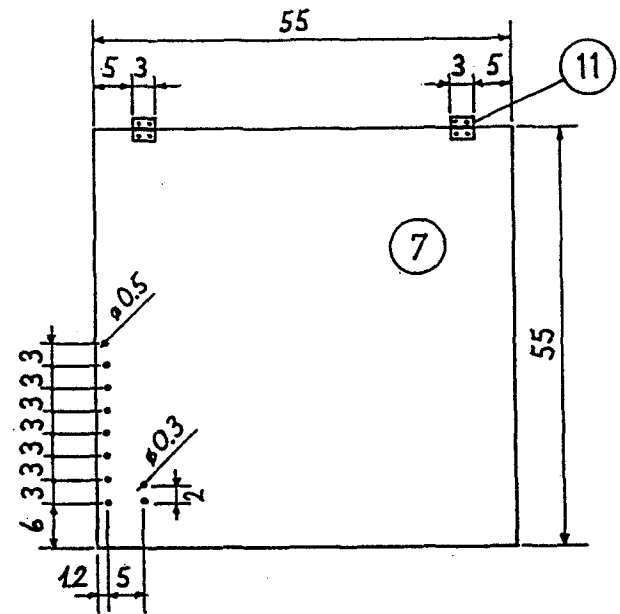
1. S,F: Form a rectangular shape with the 4 parts of the oven framework [25], [26] and [28] for "S" and [25], [27] and [29] for "F" and joint them together with the 4 connecting pieces [30] and 8 nails each. In the "S" version, this forms a square of 66.5 x 66.5 cm and in the "F" version, a rectangle of 66.5 x 119.5 cm. The exterior edgings of [26] and [28] and/or [27] and [29] respectively, should now be planed off at 25° angles (see drawing on page 14).
2. S,F: Attach both the front legs [36] with 3 nails [49] each to the front panel [32] and/or [33] respectively, as well as the reinforcing battens [39] with 5 nails [49] and/or [40] with 9 nails [49], as the case may be. In the same manner attach the rear legs [37] to the rear panel [34] and/or [35] respectively with 5 nails [49] each, as well as the reinforcing battens [39] and/or [40] as the case may be. Affix the reinforcing battens [38] to both side panels [31] with 4 nails [49] each, in such a way as to provide a finished left-hand and right-hand panel.

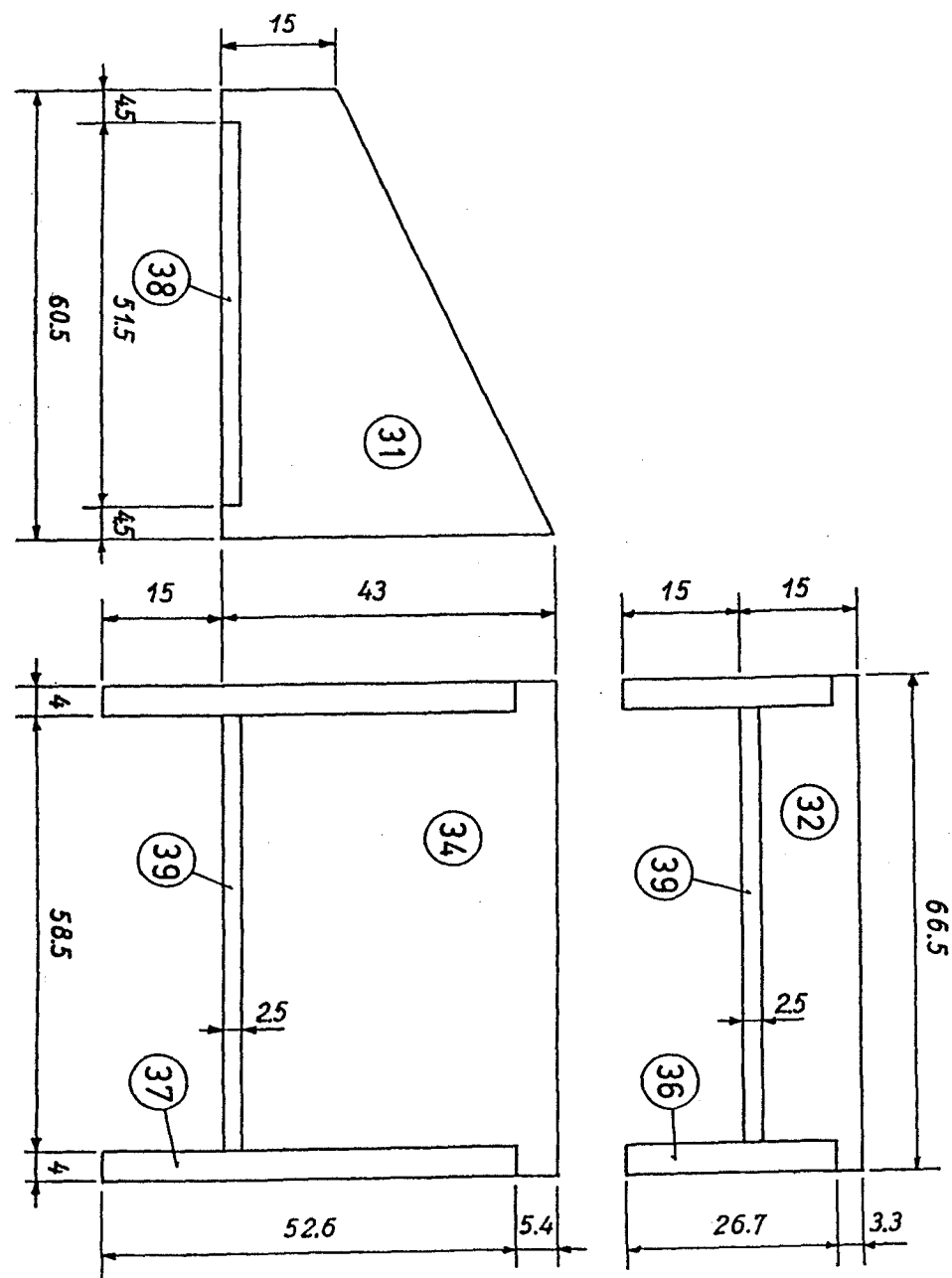


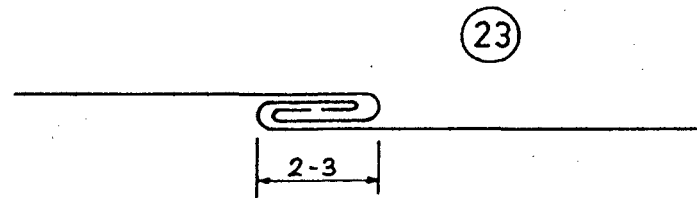
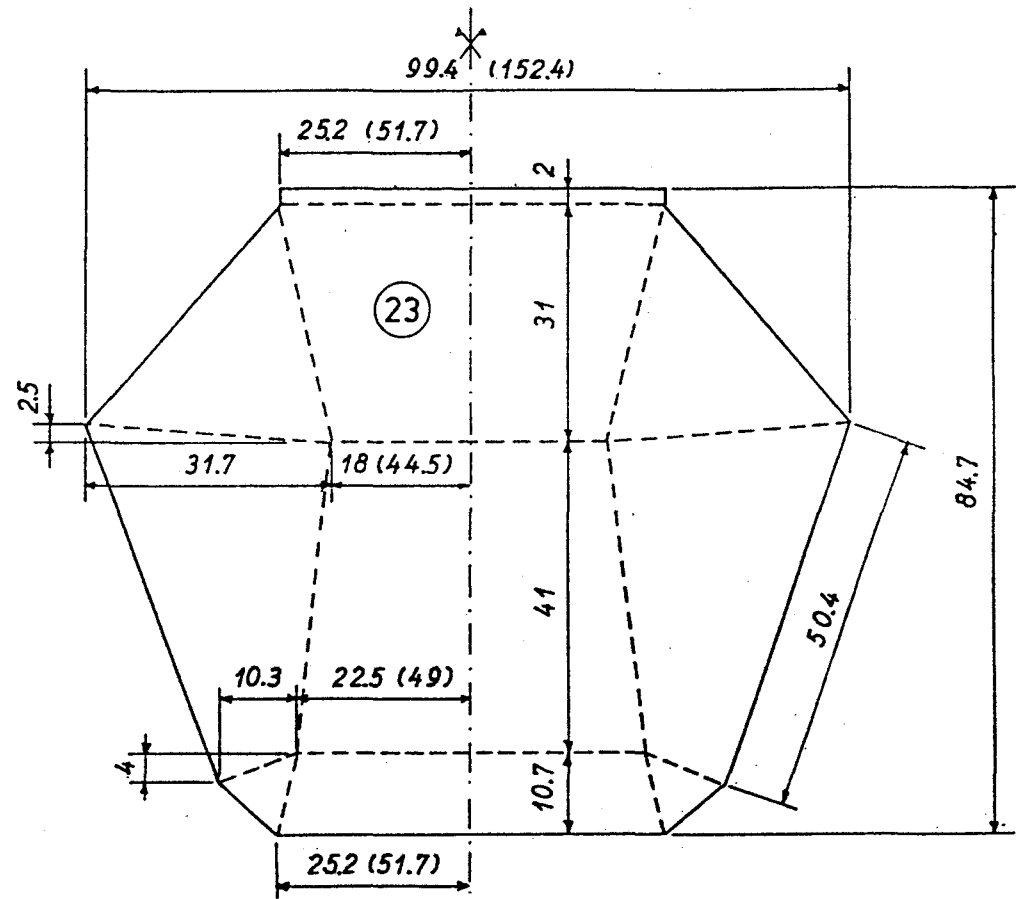
3. S,F: Assemble and attach the four panels, one after the other, with nails [49] to the oven framework and connect them together at the legs to form a rigid box form.
4. S,F: For forming the oven bin [23] and/or [24] respectively, transfer the drawing on page 17 to a sufficiently large offset plate and cut out the collapsed shape along the boundary lines (e.g. 2 or three cuts with a Stanley cutter and ruler and then break off by bending over). Should insufficiently large offset plates or aluminium sheeting be available, 2 or 3 smaller pieces may be employed, in joining them up severally by folding the edges together as shown at the bottom of the drawing on page 17. Ensure that such joints are made at the bottom and in the middle portions of the collapsed oven bin. The oven bin is now shaped in the following manner: first bend up the 4 side walls along the dotted lines by pressing a sharp edged piece of hardwood or metal against the edges of the bin bottom. Bring together each of the 2 points A, B, C and D at the four corners and then press the thereby formed triangular tips together in the middle. These tips must be bent over in such a way that they lay flat against a side panel (see drawing on pages 10 and 11). Finally bend the upper edge outwards, with advantage over the edge of a table. Before introducing the finished oven bin into its position in the oven framework, first attach it with its bent over upper edge to the inside edge of the rear of the oven framework [28] with 4 nails [49] and/or [29] with 7 nails [49] respectively, from the underside. The oven bin is now still standing vertically in an upwards position. The oven bin is now pulled down so that the bent over edge with the attaching nails is now no longer visible and the upper edge of the oven bin is flush with the upper edge of the oven framework. The remaining three sides can now be attached with 4 and/or 7 nails [49] each to the inner edge of the oven framework. In order to create a flush finish between the oven bin and the oven framework, thin battens can be applied along the front and side edges (e.g. of 5 mm gauge bakelized plywood in 1.5 cm width) flush with the upper edge of the oven framework to cover the join, directly with nails [49] without the necessity of previously attaching the metalwork to the oven frame. Should the oven bin be too pliable because of employing very thin metal sheeting, the bottom of the oven bin can be made rigid by applying 1 or 2 battens of the size [38] from below. The battens are then fixed at right-angles to the front and rear panels with nails, e.g. [50]. Paint the bottom of the oven bin with mat black stove flue paint [53].
5. S,F: Fill the cavity between the side panels and the oven bin and between the oven bin bottom and the bottom panel with insulating material [54]. Should loose material be employed, ensure that sufficient is compressed into the cavities so that no air pockets remain as well avoid shrinkage with time. On the other hand, not too much should be compressed into the cavities as optimum insulation is obtained with sufficient air present among the fibres of the material. Apart from this the solar oven cooker would become unnecessarily heavy.

6. S,F: Before the bottom panel [41] and/or [42] respectively can be attached, cut outs will have to be made in all 4 corners to accommodate the legs. The bottom panel is affixed with 18 screws [43] for the "S" version and with 26 screws [43] for the "F" version respectively, but without glue so that it can be easily removed subsequently to renew the insulation material.
7. S,F: To attach the panel battens [17], [18] and [20] and/or [17], [19] and [21] respectively, the window should first be laid in its correct position on the glass frame. Site the appropriate 4 battens closely abutting the glass frame ; [17] at the sides, [18] and/or [19] and [20] and/or [21] respectively front and back and attach these with a total of 18 nails [50] and/or 24 nails [50] respectively.
8. S,F: Attach the bow handle [22] with 4 screws [45] in the front centre of the glass frame in such a manner that the fingers can be comfortably introduced between the bow handle and the framework to open the window. To carry the solar oven cooker, affix 2 other bow handles at the side extremes on the panel batten [17] with 4 screws [46].
9. S,F: In order that the window cannot slip down on opening, an arrester facility is envisaged (see drawing on pages 4 and 10/11). This comprises 2 window retaining battens [15] on the one hand, which are attached to the rear part of the glass frame with 3 screws [44] each, in such a manner as to protrude by 2 cm, and on the other hand by 2 stop blocks [16], which are attached to the panel battens [17] with 2 screws [46] each and abutting the glass frame and the window retaining battens.
10. S,F: The whole solar oven cooker should be treated with weather-proofing [55] except in those parts of bakelized woodwork which is already weather-proof.











### SOME IMPORTANT TIPS FOR USING THE SOLAR OVEN COOKER (SO)

- Do not attempt to cook food on the first occasion or to use it so long as the black paint emits unpleasant odorous fumes.
- The SO only functions in direct sunlight. Clouds, hazy sky or dust in the atmosphere reduce the sun's radiation and correspondingly prolong the cooking time. The air temperature has however little influence!
- Place the SO out of the wind where no shadows are likely to be cast during the cooking time.
- In order to exploit the greatest possible radiated energy, the SO should be correctly directed towards the sun. The reflector serves to amplify the captured light rays. The optimum position of the SO towards the sun can be checked as follows: the shadow of the reflector support should fall upon the woodwork of the glass frame below it. Ideally, the reflection of the sun from the reflector should fall on the centre of the oven bin. The reflection is better recognisable by moving the equipment to and fro. Set the reflector in the correct position with the reflector support and fix with the bracing line. Repeated readjustments are unnecessary. If the SO is positioned just in front of the passage of the sun at the beginning of the cooking time, there is no need for any readjustment. Cooking can continue with the SO in the absence of the cook!
- In order only to lose as little heat as possible, open the SO as infrequently as possible, and then only very briefly. All condiments, apart from salt, should be with advantage added to the food at the beginning. Stirring is unnecessary as nothing can burn to the bottom of the pan or boil over.
- The cooking and/or baking time is 2 to 4 hours, depending on the meal, amount and sunshine. As food in the SO can hardly become overdone, it may also be left in the oven cooker longer than really necessary. Normally, temperatures are generated in the oven cooker of between 120°C and 150°C. Frying and crispy baking are therefore not possible. The best dishes are those cooked in water, such as cereals, beans and vegetables, whereby the conventional amount of water used should be reduced by approx. 1/3. Cereals and beans are more quickly done, when salt is added towards the end of the cooking time. The SO is well suited to the braising of meat and for the baking of bread or cakes. Other applications might be, among others, the roasting of nuts, boiling of water for drinking purposes and the dry sterilisation of medical instruments.
- In order to keep cooked food warm, e.g. until sunset, simply close the reflector cover. A dark plate of stone (e.g. soapstone or slate) or iron in the cooker will accumulate and store heat. On such a preheated plate grilling, baking and roasting is possible.
- In order to exploit the generation of heat best, the exterior of cooking utensils should be coloured dark, and preferably black. The consistency of the cooking utensils is on the other hand not of importance. So as to obtain shorter cooking times, thin metal aluminium utensils should be employed and the food distributed over several smaller pots. An improved heat exchange is obtained if these do not stand directly on the bottom of the oven bin but on a raised grill or simply on two thin battens.
- Apart from the cleaning of dirty window panes, maintenance of the SO is scarcely necessary. Even when provided with weather protection, ensure that the equipment is protected from damp. Renew weather protection materials from time to time. Care of the SO will repay itself as it will provide good service for many years.
- "Practice makes perfect", is the motto in cooking with the SO. Only through trial and error, will successful cooking be acquired and the greater the proficiency, the greater the fun obtained from using the SO!