SOLAR PARABOLIC COOKER
MODEL LD 150

USER MANUAL

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Attention! Directions of this manual must be observed! The proposed solar parabolic cooker is intended exclusively for personal use. Suitable only for cooking (by heating, boiling, steaming, frying, baking). Any other usage of the solar cooker is inconsistent with its purpose and can lead to damages or injuries. Producer and importer are not liable for damages and injuries caused by an inappropriate usage of the solar cooker.

Basic parameters of the LD150 model:
- Diameter of the reflector: 150 cm
- Depth of the reflector: 24 cm
- Focal length: 58.6 cm
- Opening (aperture): 1.77 m2
- Average power: 1200 W, for solar radiation 700 W / m2
- Maximum power: 1800 W, for solar radiation 1,000 W / m2

I. Description.

LD150

The solar parabolic cooker (SPC) utilizes the fundamental property of the parabola - the sun's rays that fall parallel to the axis of the reflector, after reflection pass through the focus of the reflector. Thus, SPC concentrates power in a small space area (focus).
Metal vessel (pot, pan) placed in the focus area absorbs radiant energy

concentrated there, heats up to a high temperature and thus the process of cooking food is being accomplished.
The reflector is made of six steel panels that form the parabola. The panels are coated with an adhesive aluminized film with high reflectance with respect to the solar spectrum. The film is easily replaceable in case of mechanical or other damage.

The reflector is supported by a steel stand, which provides its rotation in horizontal and vertical plane to follow the daily movement of the sun.

Relevant to the functioning of the SPC is only direct solar radiation - measured in W/m2. That's radiation reaching the solar cooker as a beam of parallel rays directly from the sun. The device operates only in clear weather and light clouding. Thick clouds suspend it.

The maximum efficiency of LD150 and every other SPC is achieved by the simultaneous fulfillment of the following four conditions:
- clear and dry weather;
- the sun is around its climax - which occurs at noon;
- the reflector is so aimed that its axis is parallel to the sun's rays;
- the reflecting surface is clean.

II. Usage requirements

The conversion of radiant energy into heat energy for the needs of the user is carried out successfully only by observing certain requirements.

Deployment of the solar parabolic cooker

1. SPC must be placed on a stable and even basis.
2. SPC should be placed in a protected from the wind site. Owing to the large area of the reflector, the pressure of the wind on it could be significant. If no protected area is available, further strengthening is necessary. One way to do that is at least 3 sandbags, each 20 kg, placed so as to ensure the stand and to prevent rotation and twisting of the reflector by the wind. Another way is rivetting to a concrete base.

It must be remembered that no reinforcement can protect SPC from stormy winds.

Material of the cooking vessel

Cooking vessels should be metallic. The high thermal conductivity of metals allows to heat up the entire vessel, although the focused light falls only on part of it. Plastic pots are not allowed.
All vessel parts should be metallic, including handles. Plastic handles are unsuitable as concentrated rays may melt them.

In SPC could be used any traditional metal cooking vessels that are being sold everywhere. It is advisable to be thick-walled with thermo-bottom. Also could be used thin-walled enameled pots, in which case it must be remembered that there is a risk of burning and scorching and special attention during cooking process is needed - stirring the food or shifting the pot from focus.

In powerfull (with large diameter) parabolics like LD150 and LD180 it is recommendable to use the heavier gauge steel pots; in this case the thinner variety could not only burn and scorch the food, but in case of thin aluminium could even the pot itself be damaged.

Color of the cooking vessel

Unlike the conventional cooking apparatuses, in SPC the pot color influences the duration of the cooking process.

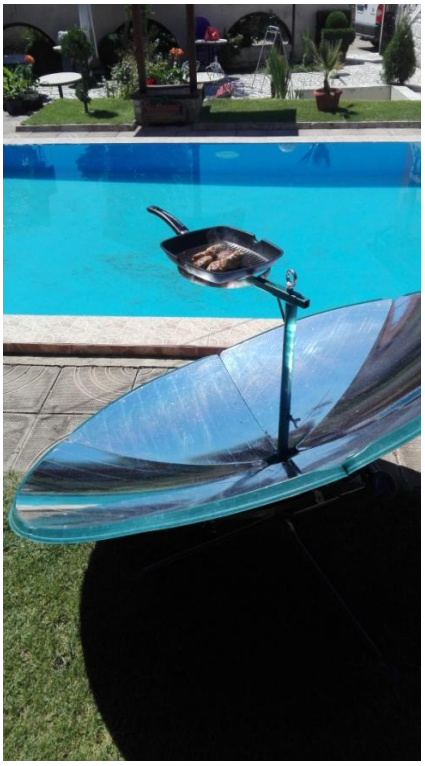
Vessels are recommendably painted black outside, in order to absorb more solar energy. If black vessels are not available, standard oven spray blacking could be used for that purpose.

The experience of HoSa Solar shows however, that in parabolics with a diameter of 150 cm and more, successfully could be utilized pots with color other than black – for example blue oder red. The cooking process in these cases proceeds more slowly, but is actually feasible. The reason is that in a large diameter aperture falls enough radiant energy, so that even at low absorption levels of the pot, the remaining power is still sufficient to effectively heat up and cook the food.

Hence, the requirement for black vessels is binding only for parabolics of small diameter. The larger the reflector is, the more diverse is the range of colors that can realize successful solar cooking; and the more possible for consumers to utilize the same vessels for solar cooking they use for their conventional cooking.

Focusing

Focusing of LD150-cooker is implemented in two different ways depending on whether the unit operates at noon or at day-end (early morning and late afternoon).



In early morning or late afternoon **at noon**

Early morning and late afternoon the reflector is steeply tilted to catch the low sun, and the pot holder is pulled back in direction to the reflector.

At noon the sun is high and the slope of the reflector is no longer so steep. The pot holder is moved forward to its normal position.

In high sun (at noon), the bright spot of the focus falls *on the bottom* of the pot, while in low sun it comes *sidewise* to the *rear of the pot*. In all cases, **the presence of a bright spot of concentrated light on the cooking vessel is a visual sign that SPC is properly focused.**

In general, focusing the reflector requires rotating in two planes: horizontally (from left to right) and vertically. In practice, however, **for a certain time interval around noon point, it is enough the rotation to be performed only in a horizontal plane - from left to right!** This due to the fact that during that period the sun changes only a little its height and therefore the focal spot remains within the reach of the vessel only by rotating in a single plane. For example, for the latitude of 42°N (the latitude of Blagoevgrad and Rome) in summer months, between 11:00 h and 15:00 h, it is sufficient the reflector to be rotated only horizontally!

Adjusting the position of the reflector is necessary to perform every 20 minutes.

Safety precautions when operating parabolic solar cooker

1. SPC should not be shifted during operation. Only activities related to refocusing and adjusting are permitted.

2. Within a radius of 3 meters around LD150 should not be kept flammable or easy-to-melt materials. The concentrated power of the device in contact with paper, cardboard, wood, plastic can lead to a rapid ignition and material damage. Items of plastic material could be melted. Leaves and fruits of fruit-trees or garden plants within the scope of the reflector could be burnt and turned black.

3. Wear sun glasses because of the danger of blinding.

4. Wear tight, bright clothes. Not recommended clothes with wide sleeves because of ignition danger.

5. Don’t seek the focus location with bare hand - risk of burning. Always use a suitable object made of metal or wood.
6. Pot handles are heated up to high temperatures. Always use mittens, preferably of cotton. Artificial fibers are easily melted.
7. The solar parabolic cooker should be operated mostly from behind the reflector.

8. The solar parabolic cooker should not be left unattended during operation.
9. When not in use, cover SPC or turn its back to the sun.
10. In windstorm or hail, SPC must be removed to a protected area. If not possible, at least dismantle the reflector and place it upturned on the ground.
11. When SPC is housed behind a transparent screen (window, transparent plastic wall, etc.), do not keep it turned to the sun because of the risk of damage to the surrounding objects.

Maintenance
1. The reflecting surface must be kept clean - as to extend the life of the unit and to not reduce its reflective ability. For cleaning use a soft cotton cloth, ordinary detergent and lukewarm water.
2. Rotating parts of the SPC must be regularly lubricated.

III. Combined usage with a fireless cooker

A fireless cooker (FC) is the perfect addition to the solar parabolic cooker.

HoSa Solar Ltd. offers fireless cookers of own production (see detailes in www.hosasolar.bg). Both photos show the model "Grossi", whose outer dimensions are 563 x 422 x 330 mm.

The operation principle of the fireless cooker is simple: a pot filled with preheated liquid food - soup, stew, etc., is inserted into a heat-insulated box, so achieving two things:

- keeping the meal warm for hours;
- if the preheating temperature is above 90 °C, the meal is not only retained hot, but also cooked in its own heat.

Cooking sequence: a pot is filled with food between 50% and 80% of its volume, then boiled on the solar cooker between 1 and 20 minutes depending on the dish, then moved to the FC and covered with special insulating pillows. Finally the lid is closed.

Advantages of the combination "parabolic cooker – fireless cooker":

- FC gives an answer to the eternal question about solar cooking: ***what to do when there is no sun!*** If the weather is getting poor (clouds, strong wind) - solar cooker ceases work, but then the pot is transferred to the FC and the cooking process continues;

- FC unlike SPC: does not need supervising; is used indoors and needs a small space; burning and scorching is not possible.

- FC increases the cooking capacity of SPC: in good weather the solar cooker together with the fireless cooker can prepare up to three dishes simultaneously. For example, the first two dishes could be in pots and placed in FC; the third dish could be prepared on SPC and could be placed in a pan.