

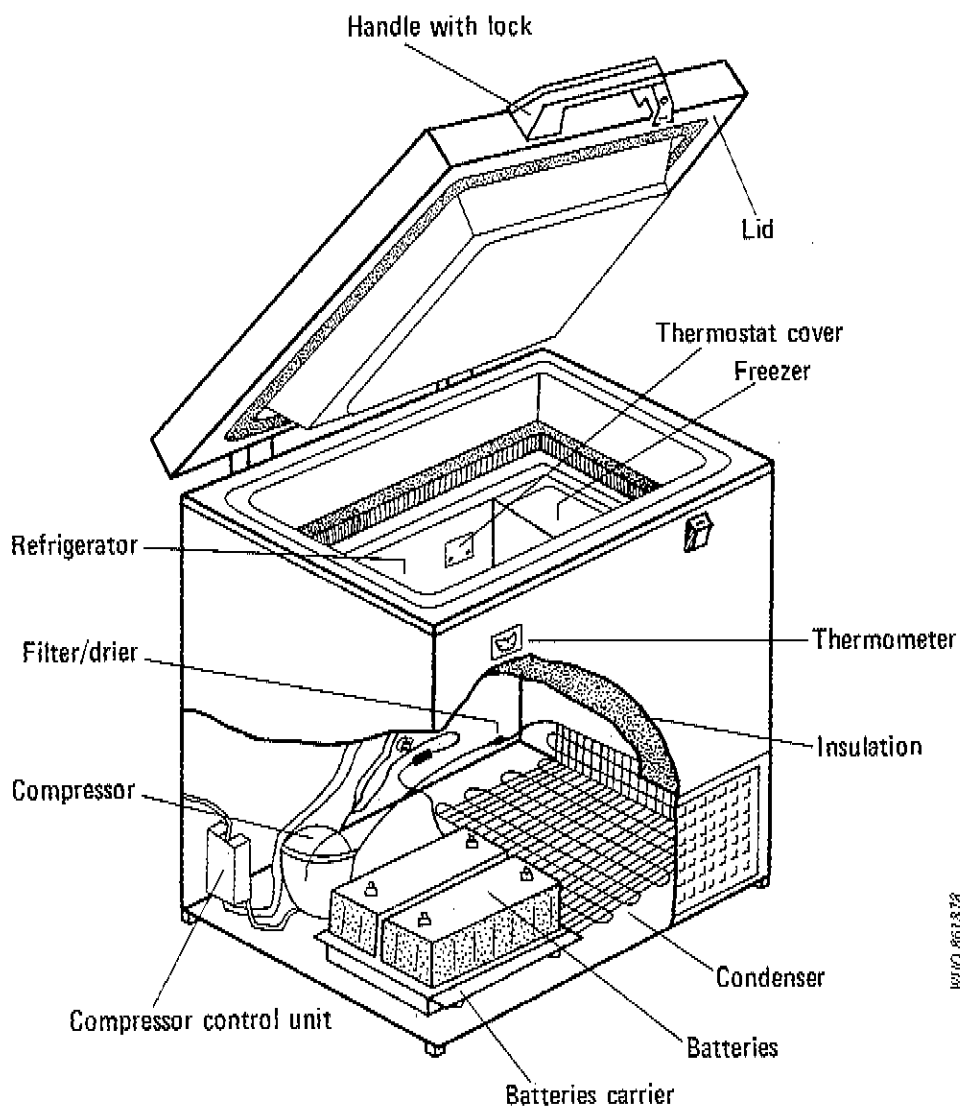
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SEE REV. 1

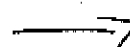
# USER'S HANDBOOK FOR SOLAR POWERED REFRIGERATORS

THIS DRAWING SHOWS  
A TYPICAL SOLAR REFRIGERATOR

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WHO/EPI/LOG/86/26

WORLD HEALTH ORGANIZATION  
EXPANDED PROGRAMME ON IMMUNIZATION

A USERS HANDBOOK  
FOR  
SOLAR POWERED REFRIGERATORS

July 1986

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SOLAR POWERED REFRIGERATORS

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### SCOPE

This handbook has been prepared for the World Health Organization Expanded Programme on Immunization.

It is a handbook for users of stand-alone, solar photovoltaic powered compression refrigerators operating at 12V or 24V DC in medical centres. These refrigerators are used for storing vaccines and medicine and for freezing icepacks. Stand-alone means here that the solar array does not supply any other device (eg. lights) with power and the refrigerator only receives power from the solar array.

This handbook should not be used for any other types of refrigerator.

There are two other handbooks available for solar powered refrigerators:

- SPR 1. Solar Powered Refrigerators: An Installation Handbook
- SPR 3. Solar Powered Refrigerators: A Technicians Handbook for Fault Finding and Repairs

## 1. ACTIONS ON HANDOVER

You should read this section before the installation technicians have left the health post. There are some important questions that you must ask them before they go.

### 1.1 Getting to know your solar refrigerator

Your new solar refrigerator is an important part of the cold chain. You can store vaccine and medicine in it safely, and freeze icepacks in the freezer compartment. But for the refrigerator to operate properly you must be familiar with its parts and understand how to use it.

A solar powered refrigerator is not the same as a refrigerator that burns kerosene or bottled gas. It is similar to a refrigerator that uses electricity but has a different power supply - Solar energy converted into direct current electricity by solar cells. The Annex in the back of this handbook contains pictures of the most commonly used solar powered refrigerators. Look at the picture of your refrigerator and find the parts that are marked on it. It is very important that you know where these parts are.

Figure 1 shows the basic parts of the solar electricity supply system for your refrigerator. These parts are: the solar array, the batteries, and the voltage regulator. Together they provide the electricity for the refrigerator. The solar array can be roof mounted or located at ground level.

A typical refrigerator cabinet and the location of the components are shown in Figure 2.

Before the installation technicians leave, you should ask them the following questions and make sure you know:

- (a) Where the following components are located:
- The refrigerator ON/OFF switch
  - thermostat/temperature controller (if there is one)
  - vaccine compartment
  - freezer compartment
  - condenser
  - compressor
  - compressor control unit
  - batteries
  - voltage regulator
  - solar array

- (b) Where the fuses are. There will be a fuse in the refrigerator and perhaps another one in the voltage regulator. Make sure that the technician leaves you with several spare fuses and shows you how to change a broken fuse.
- (c) What is the maximum number of icepacks that can be placed in the freezer compartment.
- (d) What warning lights are fitted, what they mean and what actions you should take if a warning light comes on.
- (e) What is the maximum amount of vaccine that can be stored in the main compartment of the refrigerator.

If the installation technician has a manual from the manufacturer of the solar refrigerator, ask him to leave it with you. You should read the manufacturer's manual to get more information about your solar refrigerator and how to use it properly.

You should also ask the installation technicians to fill in Table 1. This is important information that a service technician may need to know in the future.

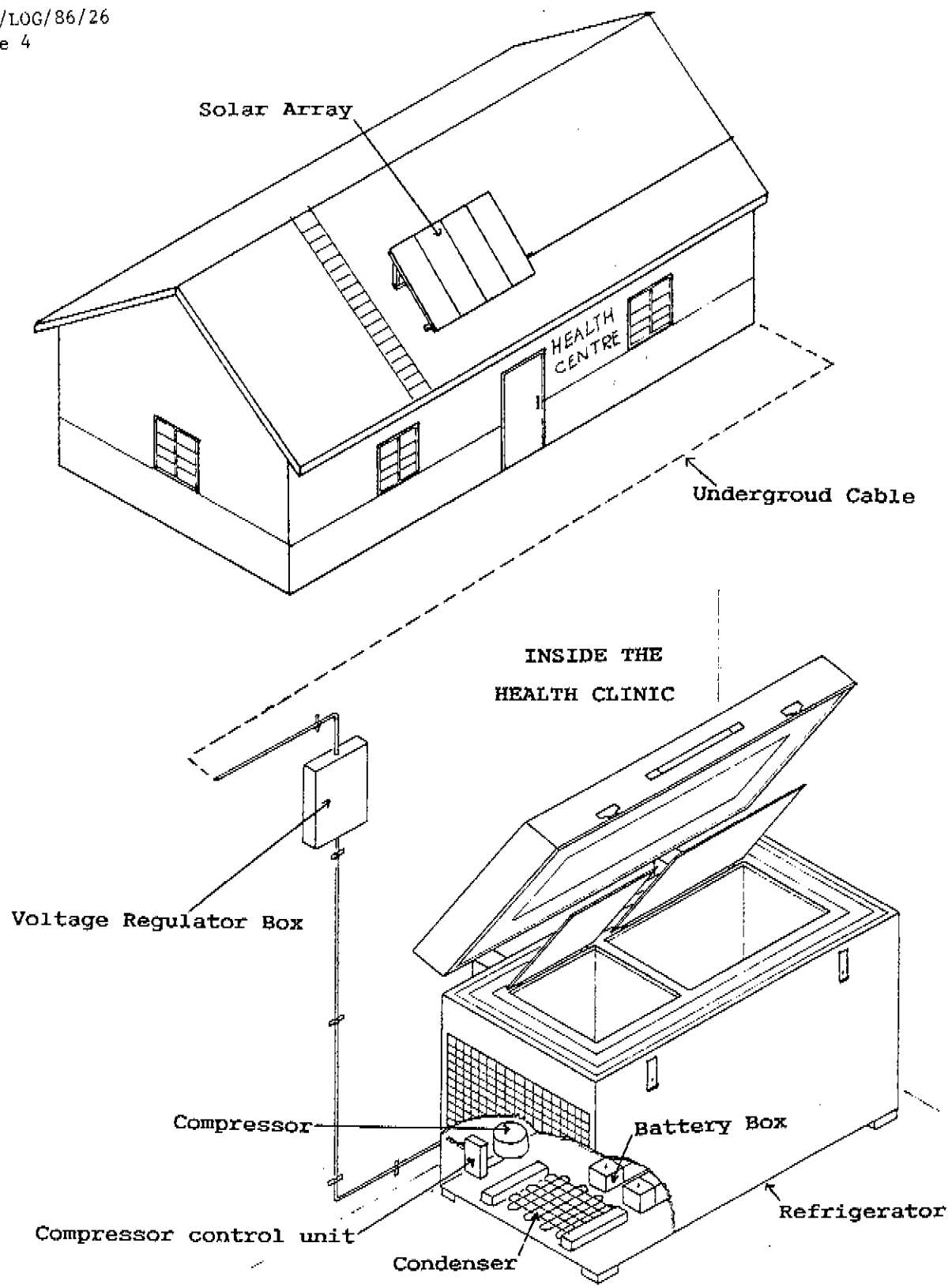


Figure 1. Solar Electricity Supply for a Solar Refrigerator

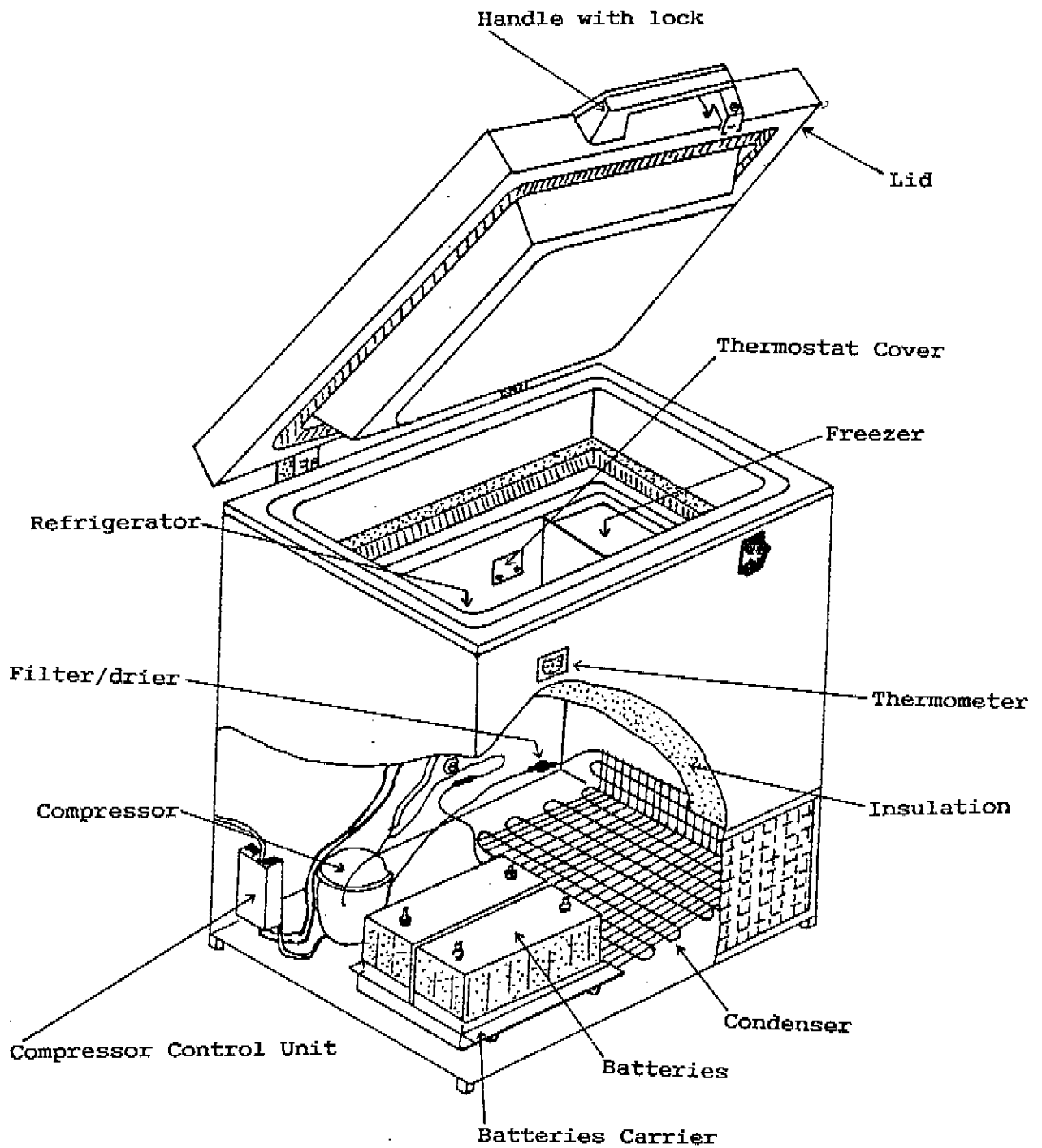


Figure 2. A Typical Refrigerator Cabinet

TABLE 1. ASK THE INSTALLATION TECHNICIAN TO PROVIDE  
YOU WITH THE FOLLOWING INFORMATION AND  
WRITE IT DOWN ON THIS PAGE

1. Maximum number of icepacks to be placed in the freezer in any one day .....
2. Vaccine capacity of refrigerator ..... litres
3. Is the refrigerator 12 or 24 volts? ..... Volts
4. The open circuit voltage of the solar array in peak sunlight is ..... Volts
5. The short circuit current of the solar array in peak sunlight is ..... Amps
6. The model of the refrigerator is .....
7. There are fuses located in .....  
and .....
8. There are reset switches located in .....  
Their function is to .....
9. The refrigerator has the following indicator lights:
  - a) position ....., colour ....., meaning .....  
action when on: ....., action when off: .....
  - b) position ....., colour ....., meaning .....  
action when on: ....., action when off: .....
  - c) position ....., colour ....., meaning .....  
action when on: ....., action when off: .....
10. A service technician can be contacted at: .....
11. The following manufacturers manuals were left with the refrigerator (tick)

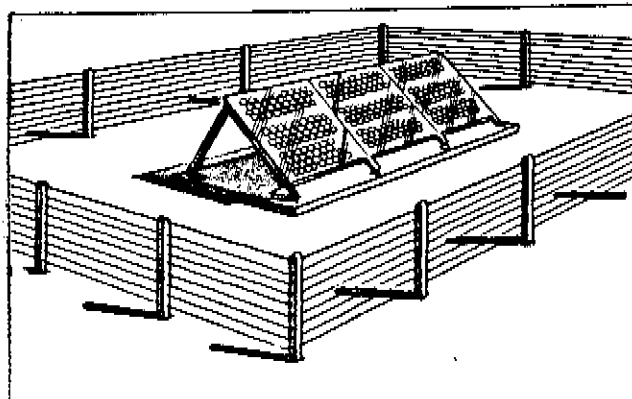
Users

Maintenance

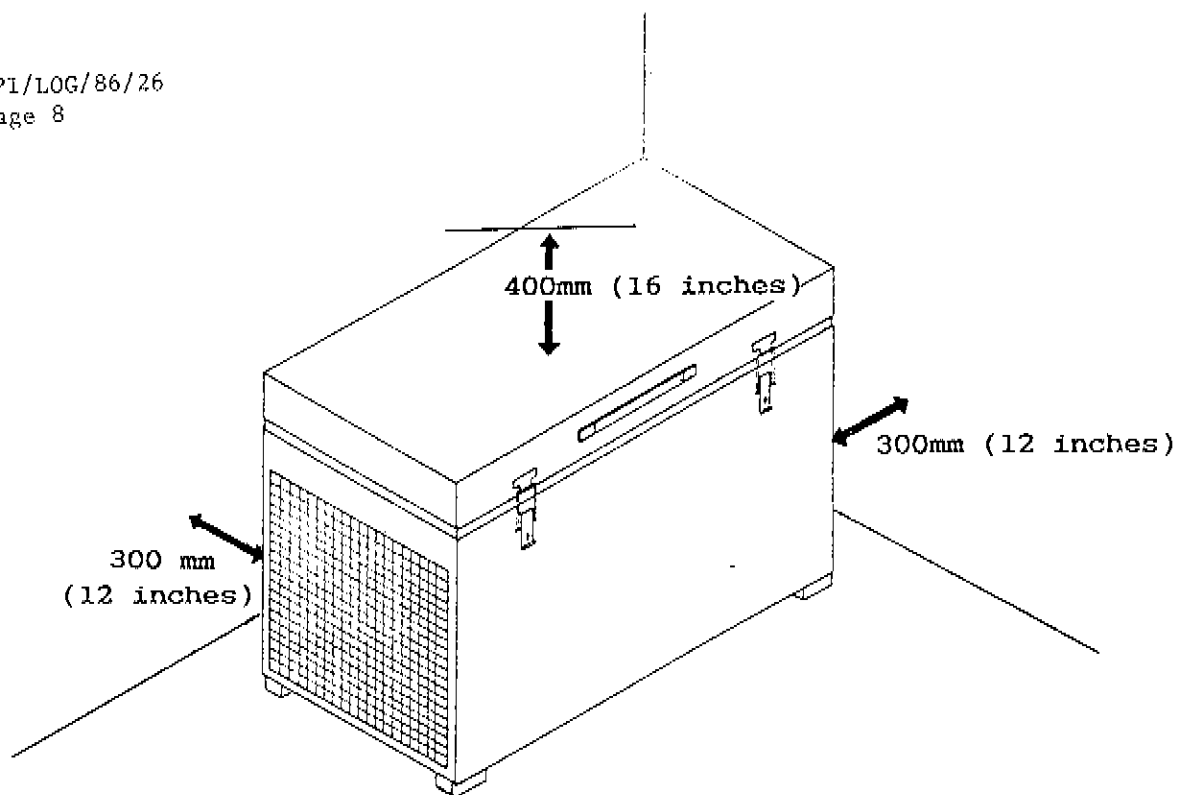
### 1.2 Is the Installation Satisfactory?

Are you satisfied with the installation?

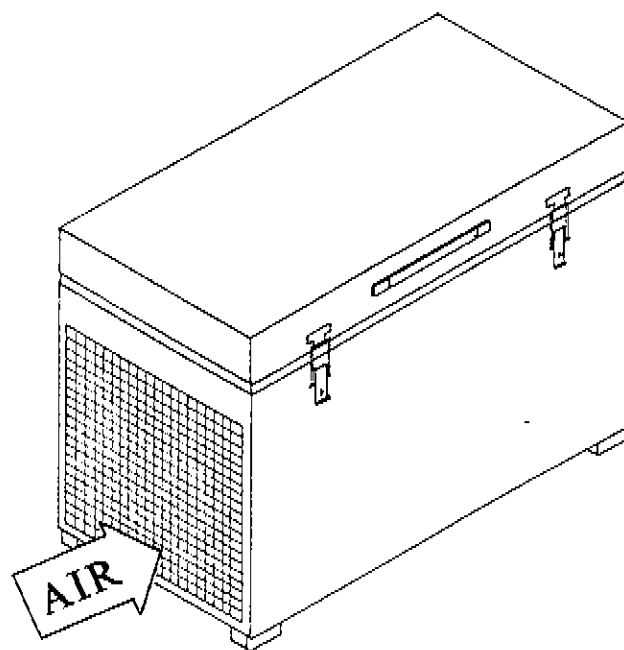
- (a) Is there a fence around the solar array to protect it from damage?
- (b) If the solar array is on the roof, is there a ladder or stairway so that you can reach the array safely to clean it?
- (c) Are the refrigerator voltage regulator and batteries in a shady place? If they are in direct sunlight ask the technician to move them to a shaded place.
- (d) Is there good air circulation around all sides of the refrigerator, especially near the ventilation grille?
- (e) Are the ventilation grilles clear?
- (f) Is there enough clearance between the refrigerator and the wall and the roof? Clearances must be at least as big as those shown in the picture on the next page.
- (g) Can you reach the doors and locks easily?



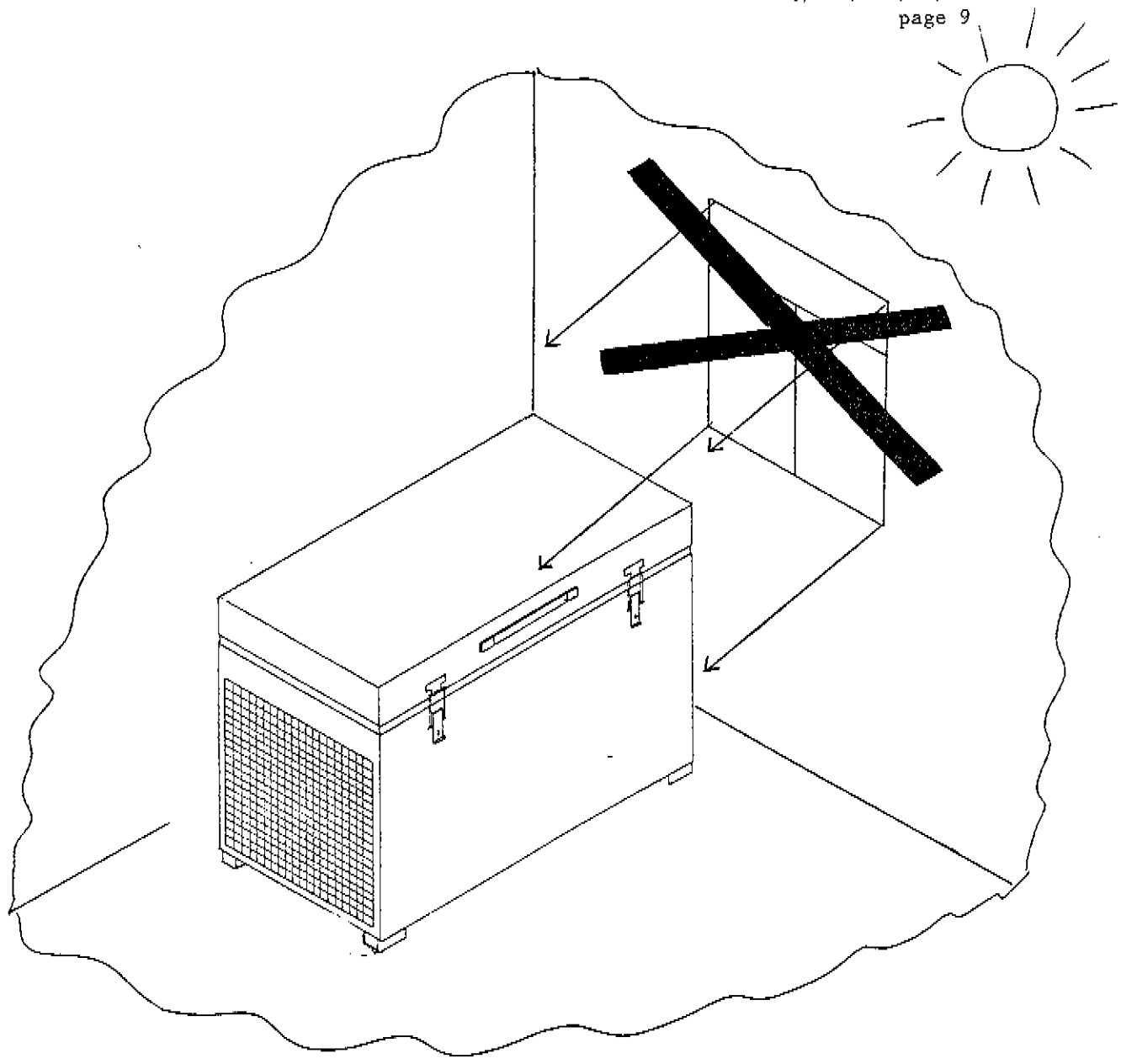
IS THERE A FENCE AROUND THE  
SOLAR ARRAY TO PROTECT  
IT FROM DAMAGE



**CLEARANCES AROUND THE REFRIGERATOR  
MUST BE AT LEAST AS BIG AS THOSE  
SHOWN IN THE PICTURE**



**MAKE SURE THAT AIR CAN REACH  
THE VENTILATION GRILLE**



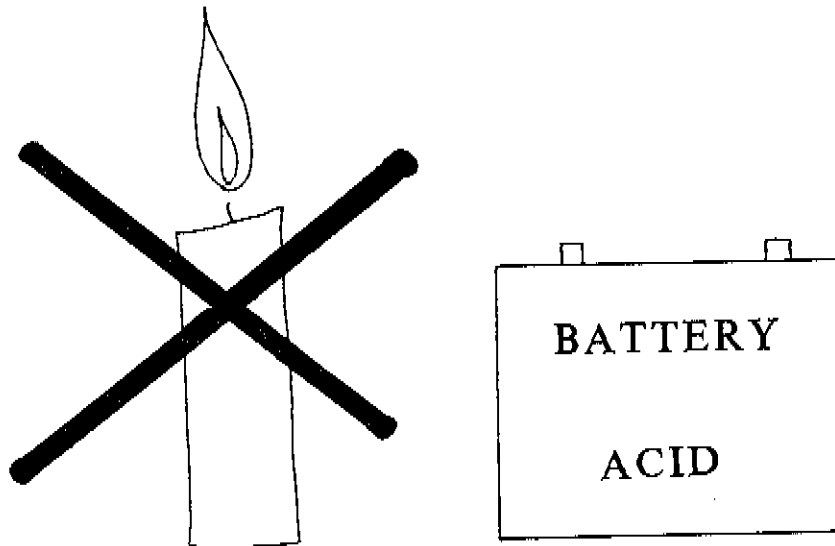
**KEEP THE REFRIGERATOR,  
REGULATOR AND BATTERIES  
OUT OF DIRECT SUNLIGHT**

1.3 Is the installation Safe?

BEWARE: BATTERIES CONTAIN ACID THAT CAN CAUSE SERIOUS INJURY IF IT COME INTO CONTACT WITH SKIN OR EYES. IT WILL ALSO DAMAGE CLOTHES.

BEWARE: NEVER GO NEAR THE BATTERIES WITH A NAKED FLAME. BATTERIES CAN GIVE OFF EXPLOSIVE GASES.

- (a) the batteries are located securely in a place where they can not be reached by children, or accidentally kicked or knocked over.
- (b) ensure that there is safe access to the solar array to enable you to clean it.



KEEP FLAMES AWAY FROM BATTERIES

#### 1.4 Spare Parts and tools

It is important that you are left the following for your solar refrigerator:

- (a) 5 or more spare fuses of the correct type and rating.
- (b) distilled water for topping up batteries. (Not required if the batteries are of the sealed type).
- (c) petroleum jelly to prevent battery terminals corroding.
- (d) two spanners to undo the battery connections.
- (e) a wire brush to clean the battery terminals.
- (f) talcum powder to prevent the lid/door seal sticking.

### 1.5 Check for Proper Operation

#### Before the installation technicians leave:

- (a) Make sure that the refrigerator is working properly and that they showed you how to operate it.
- (b) Check that the door or lid closes properly and that there are no gaps in the seal. See page 26 for instructions on how to check the seal.
- (c) Ask the installation technician to demonstrate to you that the batteries are fully charged, (12 or more volts for a 12 volt system and 24 or more volts for a 24 volt system). If there is a meter showing what the battery voltage is make sure you understand what it indicates.
- (d) If the batteries are of the non-sealed type and require topping up with distilled water check that they are filled to the correct level with distilled water and ensure that distilled water has been left for future topping up.

1.6 Adjusting the temperature

- (a) Always keep a thermometer inside the main compartment of the refrigerator.
- (b) The installation technicians should set the refrigerator thermostat at the correct temperature. Make sure that they show you how to adjust the temperature (if temperature adjustment is possible).

Write in the space below the method of adjusting the temperature to make the refrigerator colder or warmer

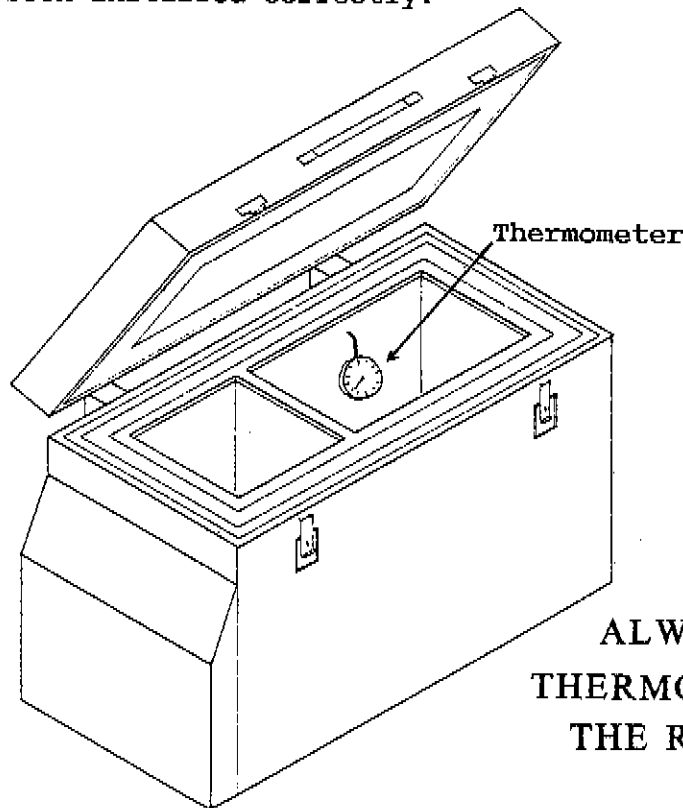
Adjust the temperature to a colder setting by: .....

.....

.....

.....

- (c) Measure the temperature inside the refrigerator 3 or 4 hours after it has been switched on. It must be between 0°C and +8°C. If it is too warm, adjust the temperature to a colder position. If it is too cold adjust the temperature to a warmer position.
- (d) If the temperature cannot be adjusted to between 0°C and +8°C, it is not working properly. Ask the installation technicians to check that everything has been installed correctly.



**ALWAYS KEEP A  
THERMOMETER INSIDE  
THE REFRIGERATOR**

## 2. OPERATION

### 2.1 Observing Temperatures

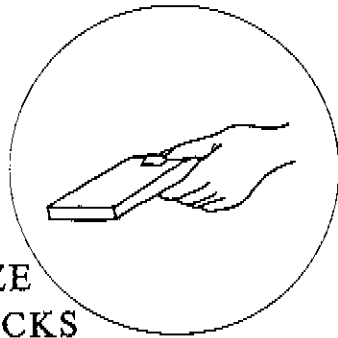
Check the temperature inside the refrigerator every morning and any time you open the refrigerator. If necessary adjust the thermostat control knob so that the temperature is between 0°C and +8°C.

If the temperature cannot be adjusted to between 0°C and +8°C, go to Section 4 of this handbook ("what to do if a fault occurs") for the action you must take.

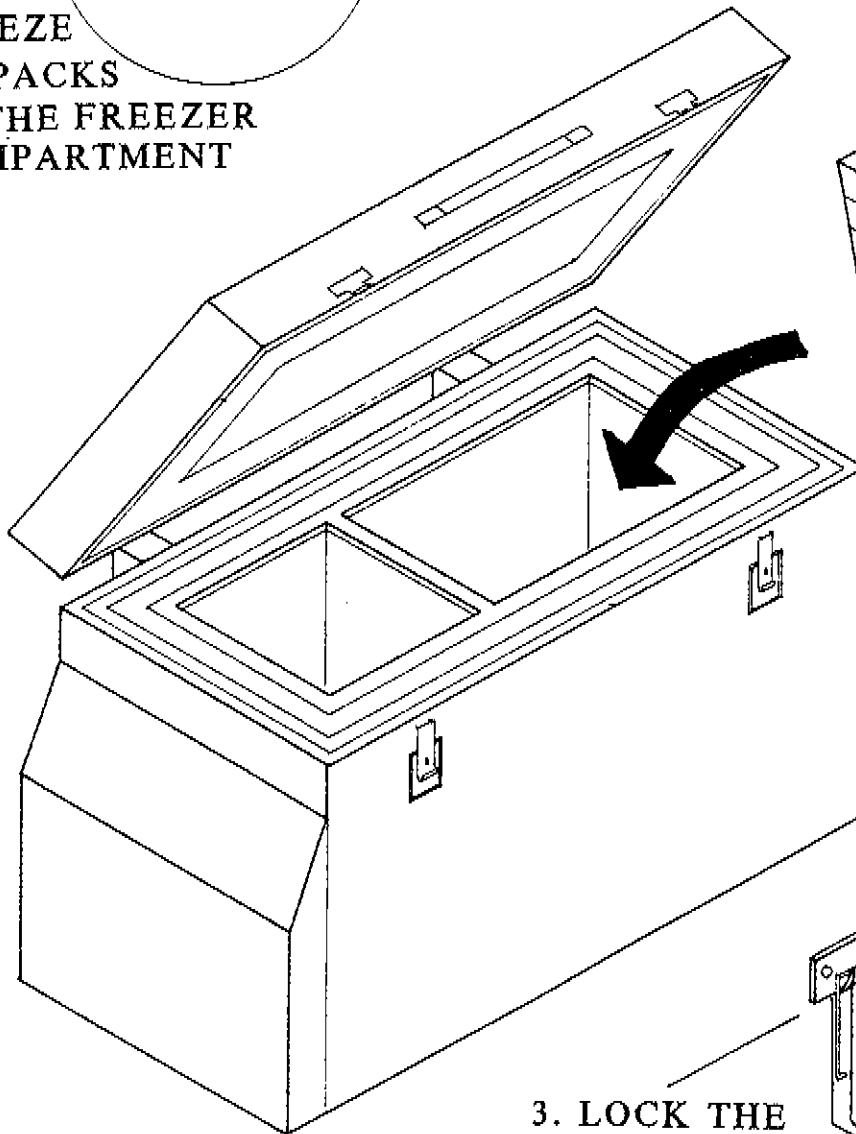
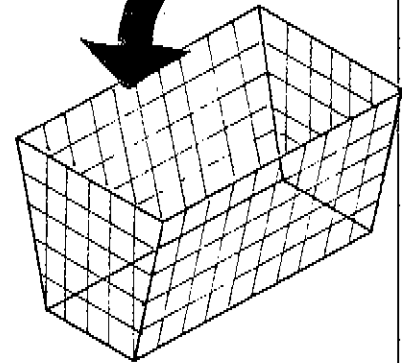
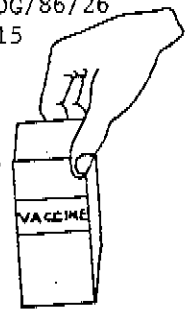
### 2.2 Loading the Refrigerator

- (a) It is best to load the refrigerator in the morning.
- (b) Do not put more than the recommended number of icepacks in the freezer compartment.
- (c) Do not put more than the recommended amount of vaccine in the main compartment.
- (d) Keep all vaccines in trays in the main compartment of the refrigerator and in accordance with EPI recommendations. The correct temperature here is between 0°C and +8°C. You must never put DPT or tetanus toxoid vaccines in the freezer compartment.
- (e) Always keep the same type of vaccine together and store your vaccines neatly. If you do not have wire trays, you can use cardboard boxes.
- (f) You must use all the old vaccines before the new ones. So you should put new vaccines underneath or behind old vaccines. Before use make sure that vaccine has not expired.
- (g) You should leave about 5 cm (2 inches) between the trays of vaccines. This allows the cold air to move around the refrigerator.
- (h) Do not keep food or drink in the refrigerator. The solar array can only produce a certain amount of electricity each day. If food or drink is placed in the refrigerator there will not be enough electricity to cool the vaccine.

1. FREEZE  
ICEPACKS  
IN THE FREEZER  
COMPARTMENT



2. LOAD VACCINES  
IN THE MAIN  
COMPARTMENT



3. LOCK THE  
REFRIGERATOR  
AFTER YOU  
HAVE FINISHED

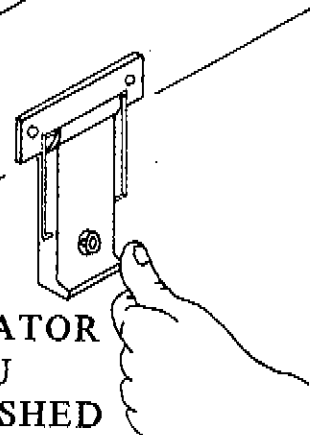


Figure 3. Loading the Refrigerator

### 2.3 Freezing icepacks

- (a) New (unfrozen) icepacks should be placed in the freezer compartment of the refrigerator between 8 am and 12 noon. Avoid placing unfrozen icepack in the freezer in the late afternoon or evening as this will place a heavy energy load on the system at a time when there will be little solar energy to keep the batteries charged.
- (b) Your refrigerator may have a "DO NOT FREEZE ICEPACKS" warning light. If this warning light is on do not place any more icepacks in the freezer compartment and remove any unfrozen icepacks.
- (c) Only open the refrigerator/freezer door when it is necessary and make sure that you close it quickly and securely. This will help it to work better.

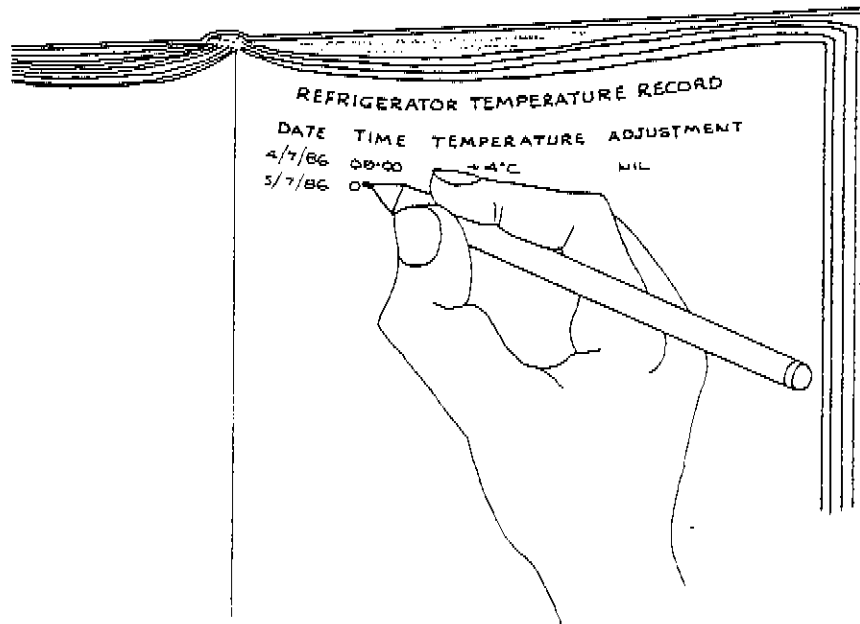
#### 2.4 Switching the refrigerator ON and OFF

- (a) The installation technician will leave the refrigerator switched ON and should show you the ON/OFF switch with the other parts of the system described in Section 1 of this handbook.
- (b) The refrigerator should always be turned on during normal use.
- (c) Only turn the refrigerator OFF when:-
  - o you need to change a fuse
  - o you need to defrost the evaporator

### 3. USER MAINTENANCE

#### 3.1 Daily tasks

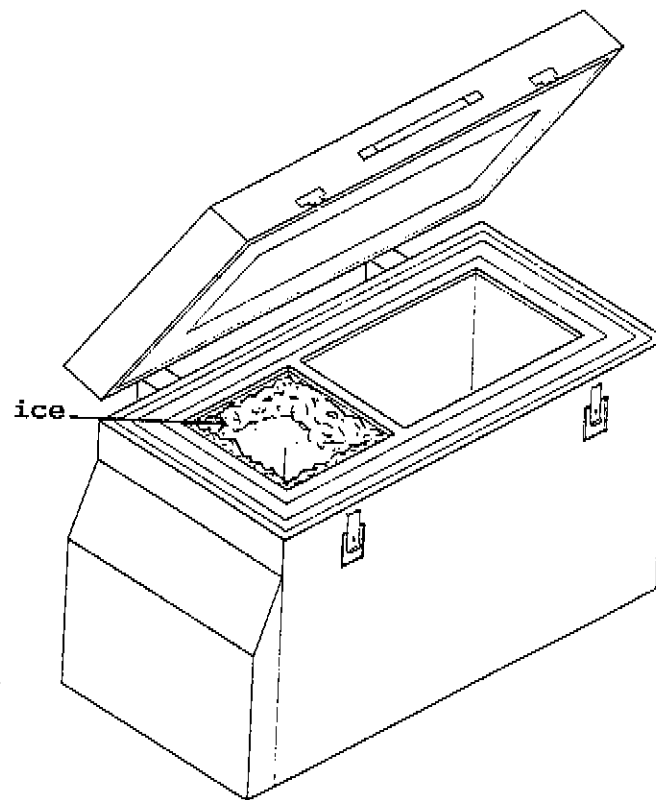
- (a) Check the temperature inside the refrigerator main compartment each morning and afternoon. It must be between 0°C and +8°C. If the temperature is not correct then adjust it as described in Section 1.6 (page 12).
- (b) Enter the temperature reading on the refrigerator temperature record sheet.
- (c) Make sure that the refrigerator ventilation grille (if fitted) is not blocked.
- (d) Make sure air can freely flow around all sides and, where possible underneath the refrigerator.
- (e) Check the warning lights to make sure that operation is normal.



RECORD TEMPERATURES DAILY

### 3.2 Weekly tasks

- (a) Check the ice forming around the freezer compartment. It is quite normal for a little ice to form in the freezer but if the ice is thicker than 5mm (1/4 inch), then the refrigerator must be defrosted. The proper steps are described on page 20. If defrosting is necessary every week the lid is probably not sealing properly. See page 26 to find out how to check the lid sealing gasket.
- (b) Clean the solar array as described on page 21.
- (c) Check for shadowing of part of the solar array (see page 22).



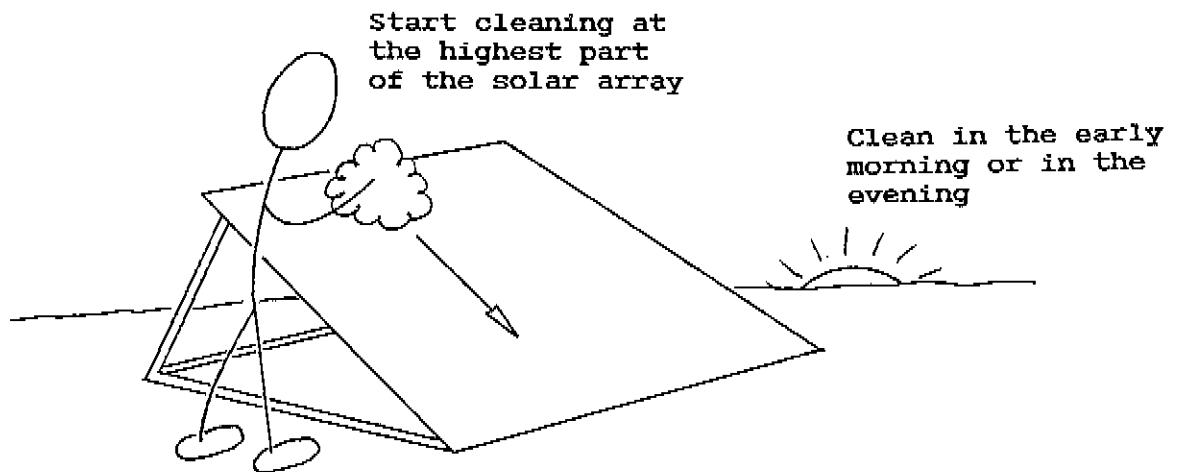
**CHECK THE ICE FORMING AROUND  
THE FREEZER COMPARTMENT**

### Defrosting the refrigerator

- (i) Move the vaccine into another refrigerator or store it in a cold box with ice-packs.
- (ii) Switch the refrigerator OFF.
- (iii) Open the lid/door of the refrigerator and freezer compartment.
- (iv) As soon as it is possible to remove ice with your fingers, do so. Do not remove ice with knives or other sharp objects.
- (v) Wipe the freezer compartment dry after all the ice has melted.
- (vi) Clean the refrigerator inside with soap and water, then dry it carefully. Never use scouring powder, steel wool or abrasive cleaners. Remember to clean the lid/door sealing gasket and put some talcum powder on it to prevent it sticking to the door frame.
- (vii) Switch the refrigerator back ON.
- (viii) Wait until the inside temperature has fallen to between 0°C and +8°C.
- (ix) Return the vaccine to the refrigerator and close the door/lid.
- (x) Defrosting must be carried out as quickly as possible to prevent damage to the vaccine.

### Cleaning the solar array

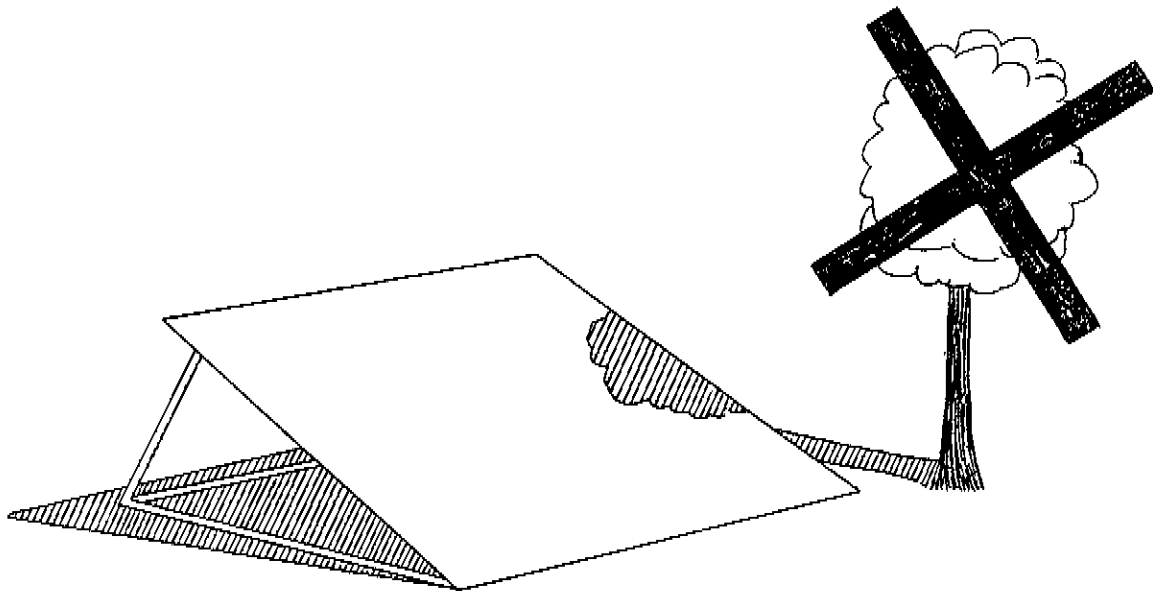
- (i) Remember - always clean in the early morning or evening when the solar array is not in strong sunlight.
- (ii) Wash the array using plenty of clean water and a clean soft cloth. Do not scratch the surface of the array.
- (iii) Wipe the surface of the solar array gently, starting at the highest point and working down to the lowest point. Make sure that all the dust is removed.
- (iv) Do not stand on the solar array, or lean heavily on it, as this may cause damage.
- (v) If the solar array is on a roof where there is no safe and easy way to reach it, do not try to climb onto the roof. Ask the service technician to clean the array when he next makes a visit and if possible to arrange for a climbing ladder to allow safe cleaning of the array.



### CLEANING THE SOLAR ARRAY

Checking for shadowing of the array

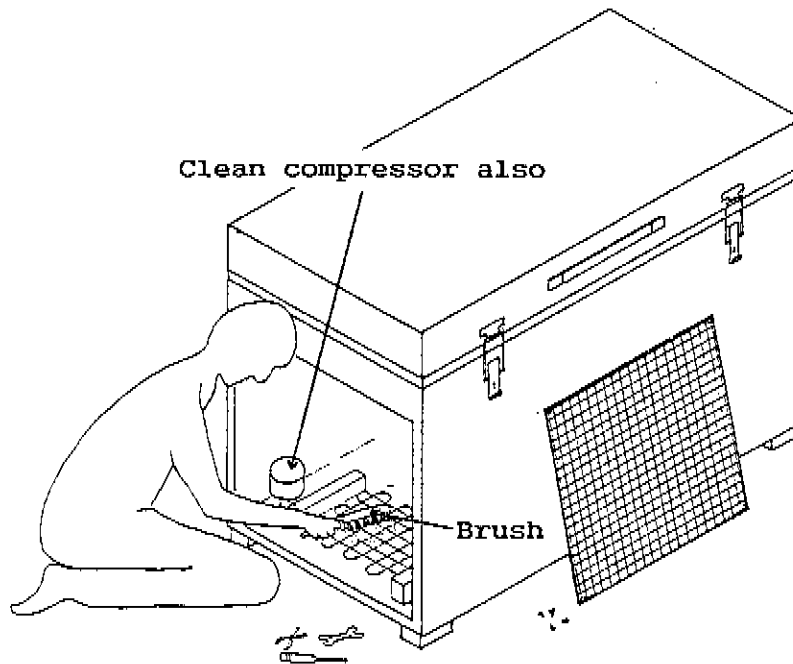
- (a) Shading of the array even partly will reduce the amount of electricity produced for the refrigerator. Check that the solar array is not shaded. This should be checked at approximately 8am, 12 noon and 4pm.
- (b) Cut back bushes and trees that may have started to shade the solar array between 8am and 4pm. Trees and bushes which only cause shading in early morning (before 8am) or late afternoon (after 4pm) do not need to be cut. Do not cut down more bushes or trees than necessary and always seek the permission of the person responsible by explaining why it is necessary.
- (c) Make sure that nobody has put anything in front of the solar array that may block the sunshine falling on it.
- (d) If new buildings cause shadows to fall on the array it may be necessary to move the array to an unshaded place. Ask your technician to check and if necessary move the array.



**CUT BACK BUSHES AND TREES THAT  
MAY HAVE STARTED TO SHADE THE  
SOLAR ARRAY**

### 3.3 Monthly tasks

- (a) Switch OFF the refrigerator.
- (b) Check that the condenser and compressor are clean. Remove any dirt and dust with a soft brush. The condenser and compressor must be kept clean or the refrigerator will not work properly.
- (c) If the condensor is fitted with a fan make sure that the fan rotates freely and brush dirt and dust away from the fan and fanmotor.
- (d) Switch the refrigerator ON again.
- (e) Wipe clean the outside of the refrigerator using soap and water.

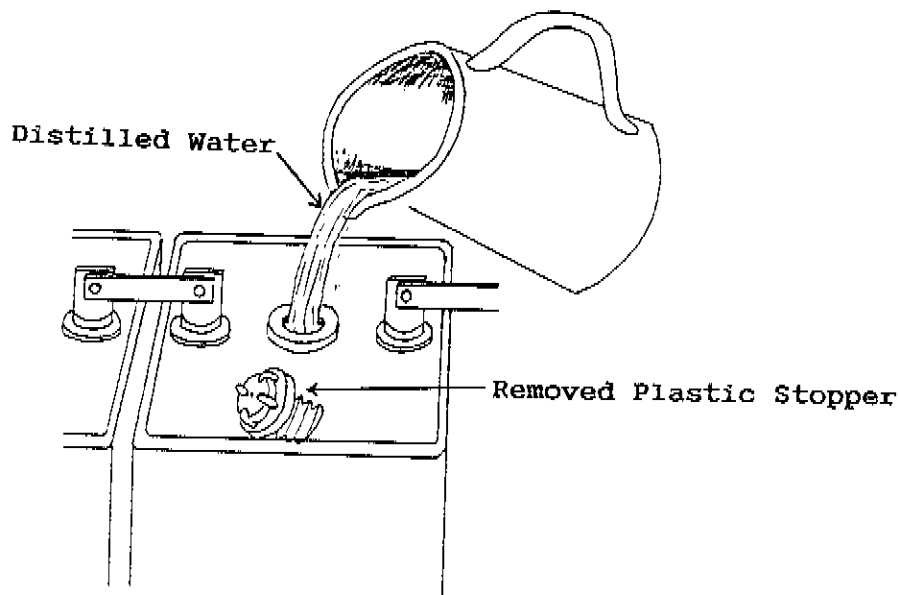


**CLEAN THE CONDENSER  
AND COMPRESSOR**

### 3.4 Six-monthly tasks

- WARNINGS: ○ KEEP NAKED FLAMES AWAY FROM BATTERIES AS EXPLOSIVE GASES MAY BE PRESENT.
- LIQUID (ELECTROLYTE) IN BATTERIES IS CORROSIVE. KEEP OFF SKIN AND AWAY FROM EYES. AVOID CONTACT WITH CLOTHES.
- (a) Check the wiring connections to the batteries. If the wiring connections are loose, tighten them. If the connections are very dirty or corroded, loosen them and clean them with a wire brush before tightening them again. If you cannot do this, call for the service technician.
- (b) Grease the tightened battery terminals with petroleum grease.
- (c) The batteries may not be of the sealed type. If they are not sealed, then they will have plastic stoppers in a row on the top. Remove each stopper one by one and see if the metal plates inside are covered by liquid. If the top of the metal plates are above the liquid level, add distilled water until they are completely covered, then replace the stopper. Do this for all of the compartments in each battery.

It is important that only distilled water is used.

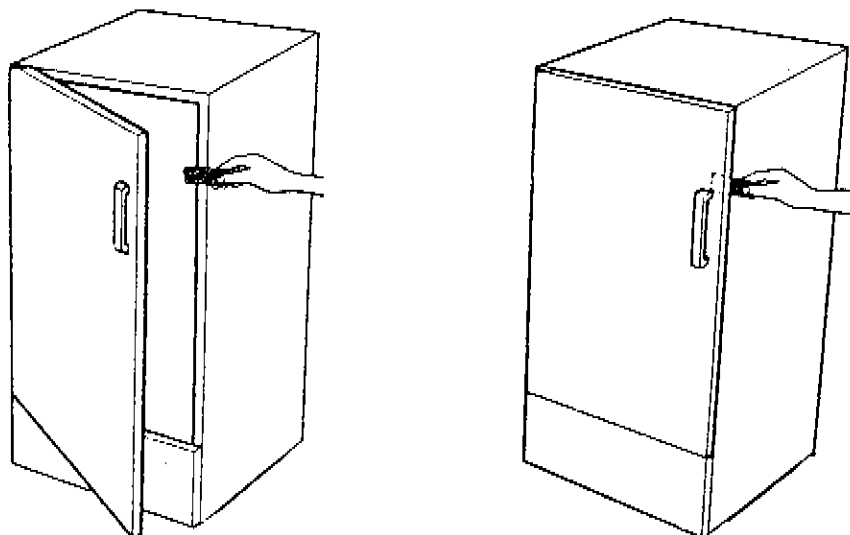


ADDING WATER TO THE BATTERIES

- (d) Check that all of the nuts and bolts in the solar array are tight, but do not do this if the array is difficult to reach. If you are unable to tighten the loose nuts or if you do not have the right tools call the service technician.
- (e) Check that there is no obvious damage to any of the electrical wiring. If there is, call the service technician.
- (f) Check the lid/door sealing seal as described on page 26.

### Checking the lid/door sealing gasket

- (a) Open the refrigerator and place a thin paper strip against the cabinet top, if it is a top-loading refrigerator. If it is a front loading refrigerator place the strip against the cabinet front.
- (b) Close the lid/door
- (c) Pull the paper strip. If it moves easily the sealing needs adjustment. Call the service technician to adjust the lid/door seal.
- (d) Check all the way around the lid/door in this way, paying particular attention to the corners.
- (e) If the seal is coming loose glue it back on. If this is not possible request a replacement seal.



CHECKING THE SEALING GASKET

#### 4. WHAT TO DO IF A FAULT OCCURS

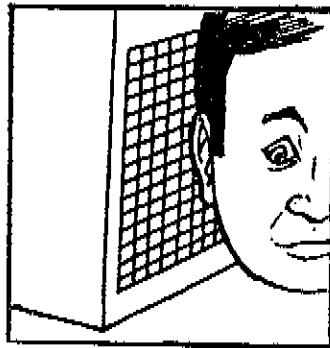
Firstly identify the symptoms of the fault. It will be one of the following:

- (a) The refrigerator is not working at all (the compressor is not running). (page 28).
- (b) The refrigerator works but is too cold. (Page 29).
- (c) The refrigerator works (compressor runs) but is too warm or will not freeze icepacks. (Page 30).

To find out if the refrigerator is working at all, listen for the motor noise from the compressor. If there is no noise from the compressor the refrigerator is not working at all.

Next go to one of the next three pages indicated by the symptoms of the fault and follow these instructions:

- (a) Always start with the first action listed on each page.
- (b) Make sure that the fault described does not exist before going onto the next one.
- (c) If, after checking all the faults, the refrigerator is still not working properly, start at the beginning and check everything again.
- (d) If, after checking all the faults twice, the refrigerator is still not working properly, move the vaccine into another refrigerator or a cold box (if possible) and call for the service technician.

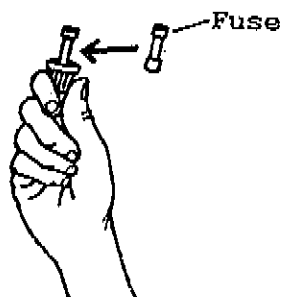


LISTEN FOR THE  
MOTOR NOISE  
FROM THE COMPRESSOR

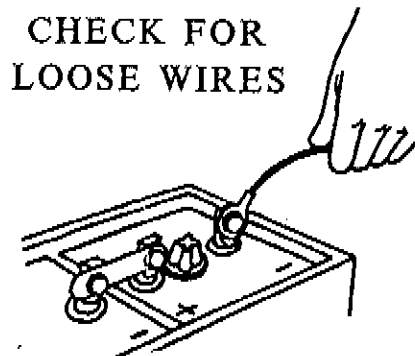
Important Note in the log book any actions you take or observations you make. This will assist the service or repair technician to keep your refrigerator working properly.

4.1 Refrigerator is not working at all (there is no noise from the compressor)

- (a) Check that it is switched ON. If it is not then switch it ON.
- (b) Adjust the thermostat (if possible). The refrigerator may start at a cooler temperature setting.
- (c) Check that the fuse has not blown. If it has, replace it. If the fuse blows again check that the batteries are connected with the positive (+) terminals to the positive (+) wire on the compressor controller and negative (-) to negative (-). If the fuse blows for a third time call the service technician.
- (d) Check all wiring connections. If there is a loose wire, and the connection point is obvious, then reconnect it. If it is not obvious then call the service technician. Do not connect a loose wire unless you are sure where it should go.
- (e) Check that the solar array is in the sun. If it is shaded, clear the obstruction. The batteries are probably discharged (flat) and a few days will pass before the batteries charge up and the refrigerator operates normally again.
- (f) It is possible that the batteries are discharged (flat). If a good battery of the same voltage and capacity is temporarily available replace the battery. If the compressor then starts the original battery is flat. Arrange for it to be re-charged. If this happens frequently tell the technician.
- (g) If none of these checks work, transfer the vaccine to another refrigerator or cold box and call the service technician.



CHECK THAT THE FUSE  
HAS NOT BLOWN



#### 4.2 Refrigerator works but is too cold (less than 0°C)

- (a) Remember - Some vaccines are destroyed if frozen. If the refrigerator is too cold and the vaccine is in danger of being frozen remove the vaccine to another refrigerator or cold box until the refrigerator temperature is again above zero °C.
- (b) Some refrigerators have a removable barrier between the freezer compartment and the refrigerator compartment. If this has been removed or is partly broken replace or repair it.
- (c) Adjust the thermostat temperature control to a warmer setting. It will take some time for the temperature to rise, but if after 1 hour the temperature has not risen noticeably transfer the vaccine to another refrigerator or cold box and call the service technician.

4.3 Refrigerator works (compressor runs) but is too warm (more than +8°C) or will not freeze icepacks

- (a) Adjust the thermostat control to a colder setting.
- (b) If ice formation on the freezer is more than 5mm (1/4 inch) thick, then defrost the refrigerator. Follow the instructions on page 19.
- (c) If there are unfrozen icepacks in the freezer compartment, remove them. This will reduce the load on the refrigerator.
- (d) Check that the door gasket is sealing properly, using the instructions on page 31.
- (e) Check that there is good air circulation around the condenser and that the ventilation grilles are unblocked.
- (f) Make sure that the refrigerator has been loaded properly, as described in Section 2.2.
- (g) Check that the condenser and compressor are clear of dust and dirt. If they are dirty, clean them with a soft brush as shown in page 22.
- (h) Check that the solar array is not dirty. If it is dirty, clean it as described on page 20.
- (i) Check that the solar array is not shaded as described on page 21. If it is shaded clear the obstruction.

Remember that it may take one or two days for the refrigerator to work properly again if any of the above faults have caused the batteries to be in a low state of charge. If a good battery of the same voltage and capacity is temporarily available replace the battery. If the compressor then starts the original battery is flat. Arrange for it to be recharged. If this happens frequently tell the repair technician.

- (j) If you have checked all these things, and the refrigerator is still not cold enough, move the vaccine to another refrigerator or cold box and call the service technician.

## GLOSSARY OF TECHNICAL TERMS

- BATTERIES:** store the electricity to supply the SOLAR POWERED REFRIGERATOR at night and in cloudy weather when there is no sunshine.
- COMPRESSOR:** pumps the REFRIGERANT around the COOLING CIRCUIT. There is an electric motor inside the COMPRESSOR which makes a humming noise when it is on. The COMPRESSOR will get warm when switched on. This is normal.
- CONDENSER:** the coil of metal tubing at the back or underneath the REFRIGERATOR on the outside which transfers the heat removed from the refrigerator to the outside air.
- COOLING CIRCUIT:** the metal tubing that passes around the FREEZER COMPARTMENT outside to the CONDENSER, then to the COMPRESSOR and then back to the FREEZER COMPARTMENT.
- COMPRESSOR CONTROL UNIT:** The electronic unit that converts the electricity supplied by the SOLAR ENERGY and stored in the BATTERIES to the requirements of the COMPRESSOR motor.
- DOOR/LID SEALING GASKET:** the strip of rubber or plastic that goes around the inside edge of the lid/door of the REFRIGERATOR. The SEALING GASKET stops cold air from getting out of the REFRIGERATOR and warm air from getting in.
- FREEZER COMPARTMENT:** the coldest compartment of the REFRIGERATOR, usually with its own separate door inside the main door. Icepacks are frozen inside the FREEZER COMPARTMENT.

FUSE: a small strip of metal (in a glass tube) that melts when there is too much electricity consumed. The FUSE protects the REFRIGERATOR from damage.

INSTALLATION TECHNICIAN: the person who brings the SOLAR POWERED REFRIGERATOR to the health post and who puts it together so that it is ready for you to use.

MAIN COMPARTMENT: the largest space in the REFRIGERATOR where the temperature is kept at 0 to +8°C. This is where vaccines and medicines are stored.

PHOTOVOLTAIC: the name for the way in which a SOLAR ARRAY converts sunlight to electricity. PV is a short way of saying PHOTOVOLTAIC.

REFRIGERANT: the fluid that is pumped through the COOLING CIRCUIT by the COMPRESSOR. The REFRIGERANT carries heat out of the REFRIGERATOR.

REFRIGERATOR: an insulated cabinet that can keep vaccine and medicine cold. The REFRIGERATOR may be front loading and have a door, or it may be top loading and have a lid. REFRIGERATORS need a source of energy to make them work.

SERVICE AND REPAIR TECHNICIAN: the person who visits the health post to carry out regular preventative maintenance on the SOLAR POWERED REFRIGERATOR and any repairs that are necessary.

SOLAR ARRAY: produces electricity when sunlight falls on it.

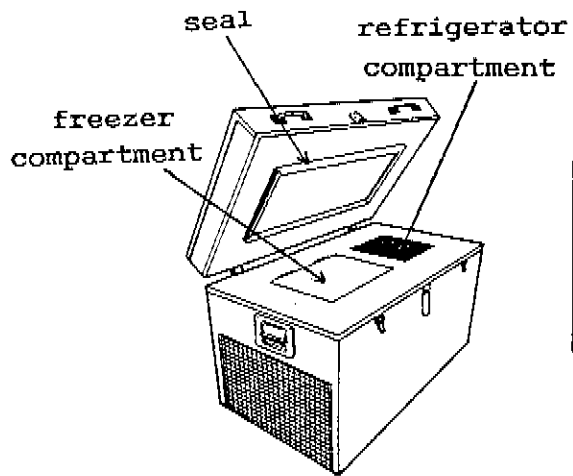
SOLAR POWERED REFRIGERATOR: a REFRIGERATOR supplied with electricity from a SOLAR ARRAY.

THERMOSTAT: the device that controls the temperature inside the MAIN COMPARTMENT of the REFRIGERATOR.

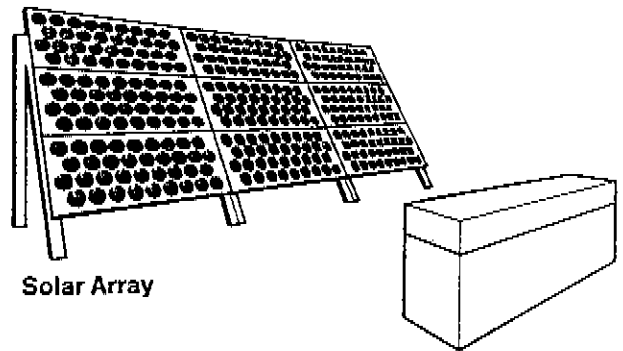
- TILT ANGLE: the angle that the SOLAR ARRAY makes with the ground.
- VACCINE COMPARTMENT: the MAIN COMPARTMENT of the REFRIGERATOR where the temperature is kept at 0 to 8°C for the storage of vaccine.
- VENTILATION GRILLE: an opening in the side of the SOLAR POWERED REFRIGERATOR that allows air to circulate and keep the CONDENSER and COMPRESSOR cool.
- VOLTAGE REGULATOR: the part of the SOLAR POWERED REFRIGERATOR that makes sure that electricity is supplied in the right quantity.

ANNEX

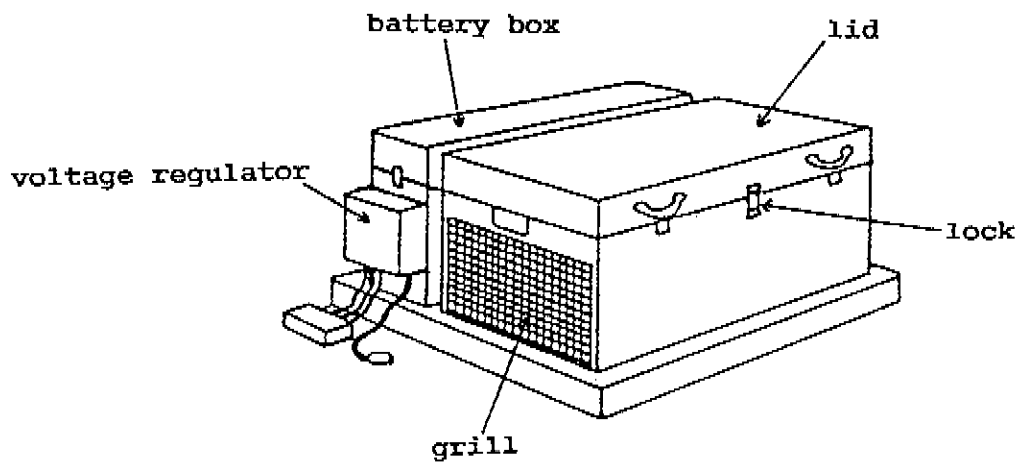
COMPONENT LAYOUTS OF SOME COMMONLY  
USED SOLAR REFRIGERATORS



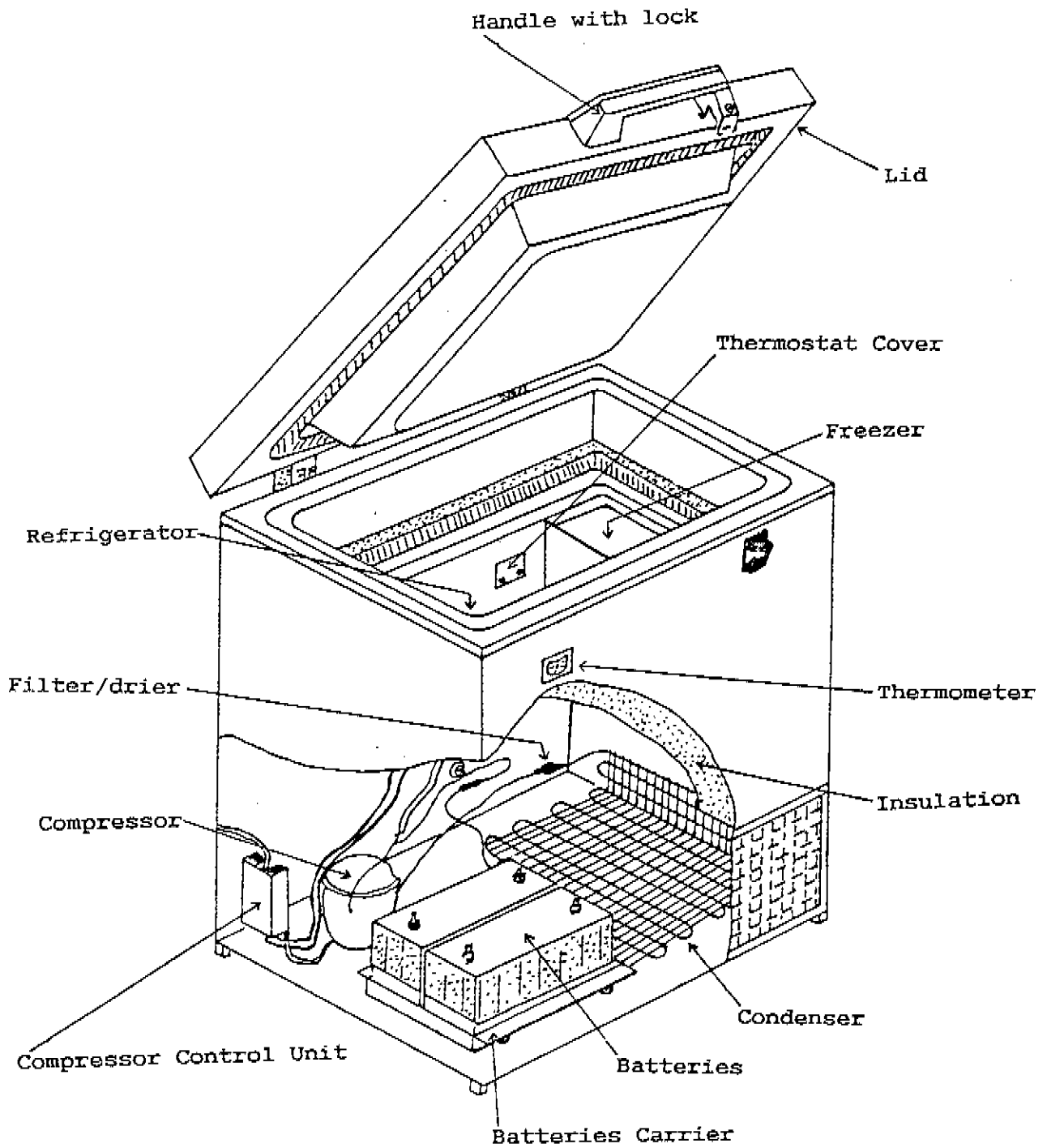
Refrigerator



Battery Enclosure



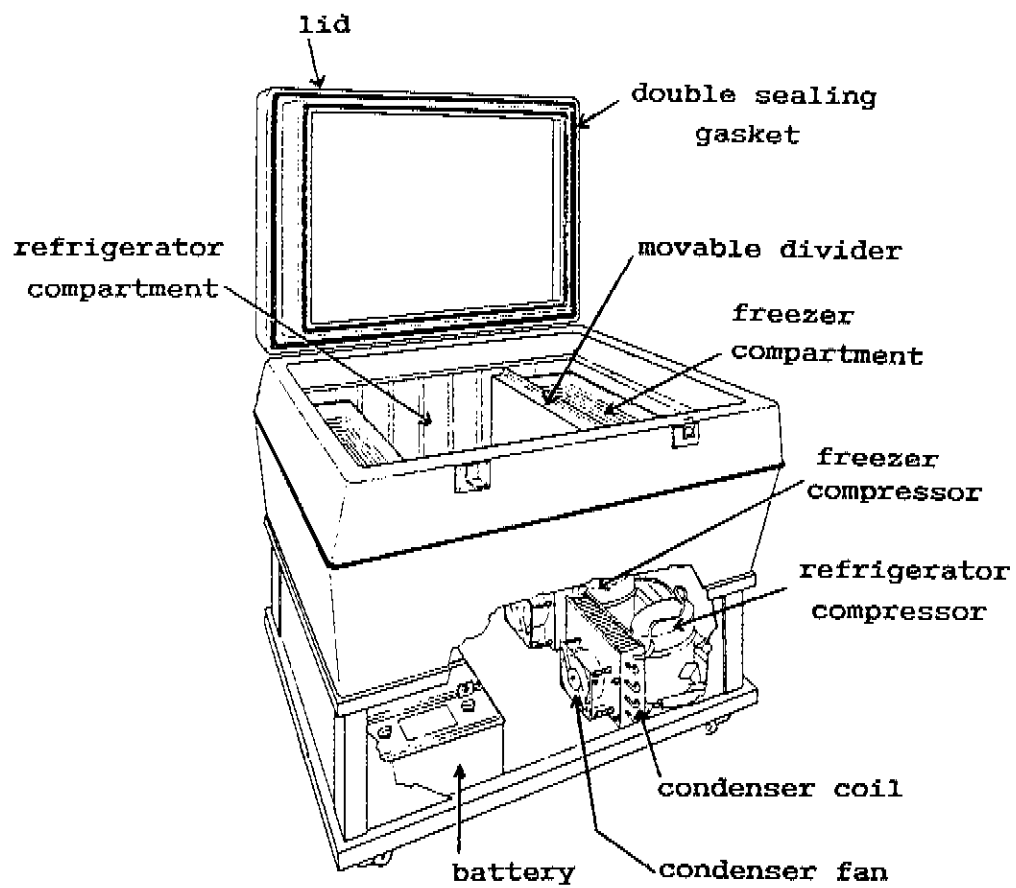
A1. BP/LEC Solar Refrigerator



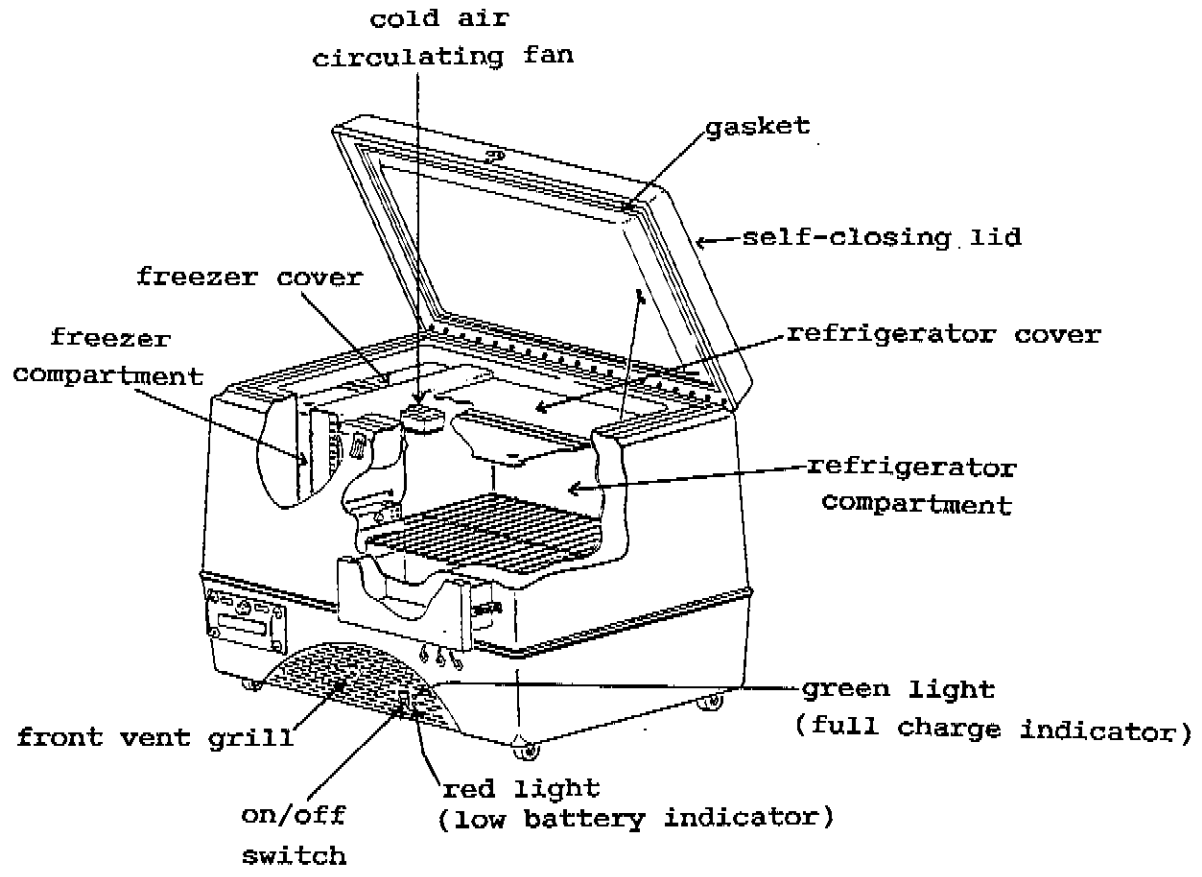
A2. FNMA 75 Solar Refrigerator

DIAGRAM NOT YET AVAILABLE

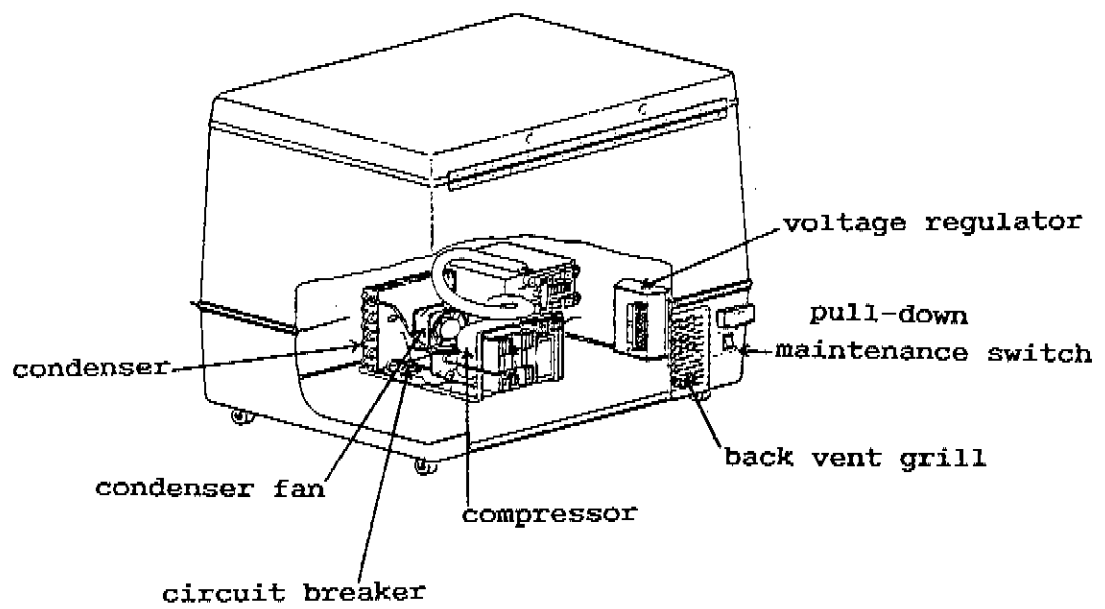
A3. Leroy Somer/ Solarfore Solar Refrigerator (Frigesol)



A4. Polar Products Solar Refrigerator, Model RR100



A5. Solavolt International/Marvel Solar Refrigerator Front view



A6. Solavolt International/Marvel Solar Refrigerator Rear view

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