

**MANUFACTURING OUTLINE FOR
THE 'BLUEBIRD'
SOLAR OVEN**

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OVERVIEW

The Bluebird is an effective solar oven, easy to manufacture, transport and use. This document assumes the reader is familiar with the Bluebird, and proceeds with an outline for mass production. Please contact the author if there are any questions with this information.

This oven is designed for high volume manufacturing techniques typical of the box making industry. Box making technology has now moved into the category of precision manufacturing, and this design utilizes that fact. Dimensions and tolerances are such that the lids will fit snugly, joints will seal well and all parts will be interchangeable. The HDPE ("Fluteboard") pieces can be nested to be cut from one and 1/8 4'x 8' sheets of plastic, with a minimum of waste. The pre-foiled cardboard can be similarly nested to come from a single sheet. A series of pictographs showing assembly should be pre-printed on the cardboard. This feature will remove language, or even literacy as a barrier to use. A label with usage instructions can be affixed to plastic outer box.

Hand labor is limited to bonding mylar to the reflector backing, fastening the polyester window to a corrugated frame, and kitting the different components into one bundle. It is meant to be shipped in bulk, with 50 - 60 ovens on a single 4' x 4' pallet. The oven is assembled using an integral set of self locking tabs and slots. The field assembly of this oven will take about 30 minutes for a novice, but that amount can be reduced significantly with practice. The pieces are designed to be 'idiot resistant'; ie. they go together easily only one way. This minimization of manufacturing labor is essential to meet the cost goal. The few manual steps which do remain should be looked at long and hard to find a way to eliminate them as well.

The interconnecting tabs and slots take a little effort to put together, but the intent is to only assemble it once. A different design would be recommended if the intent were to collapse this oven on a regular basis. Also, the tab and slot system is easy to produce with rule dies and presses, but does not lend itself to hand cutting. The goal was for a high volume design, and this design meets the goal. Again, a different design would be recommended if the intent were to cut by hand to a flat pattern.

A wide variety of materials and suppliers were considered for use in this project. Several capable sources were located, and final selections were made from among them. Certain material samples were subjected to heat, cold, moisture, sunlight, adhesives and other

conditions which they are expected to encounter in actual use. Though uncommon, the materials selected are not rare or hard to obtain. All materials selected are of standard industrial grade, have years of usage history in a variety of applications and have guaranteed properties suitable for this particular application. Sources were chosen by their long term history of providing a consistent product. The materials are commonly available in the US, and there are no export restrictions on any of them. Alternative sources could be found for all of the items listed.

All material sizes and drawing dimensions are in inches. The raw material used came in standard inch sizes, and it was most efficient to scale it this way. A similar, but metric scale oven could be made from other materials, if they were most available.

BILL OF MATERIALS

ITEM	QUANTITY/ OVEN	COST/ OVEN	SOURCE	CONTACT
Plastic board	1.125 sheets	9.00	Edelman Industries 1239 Bellamah NW Albuquerque, NM	Richard Guerrero 505-766-9499
Handle	1	.10	Same as above	Same as above
Foiled cardboard	1.00 sheet	~5.00	Mercury Die Alhambra, California	Rudy Rivas 818-308-0691
Polyester film	26" x 44", 4 mil		3M Corporation	
Double sided tape	18' x 1"	2.00	Airtech International	Frank Martinez (505) 294-8047
Aluminized Mylar	30" x 60"	1.66	The Shelter Institute Bath, ME	
Spray adhesive, 3M - 77®	as required	1.50	3M Corporation	
Sheet metal	19" x 19"	.50	Many sources	

PROCESS STEPS

BONDING

As with the cutting, this step should be performed at the initial manufacturing site. Once completed, the pieces can be packed flat for storage and transport.

Cut the reflective mylar or aluminum foil to fit the reflectors. Spray the adhesive (3M's 77 spray) liberally over the surfaces of the reflector panels, then lay the mylar or foil surface onto it. Rub down with a soft cloth to work out the wrinkles and bubbles. A narrow strip should be added to the exposed edge of the folding panel in the lid as well.

Place a strip of the double sticky tape around the inside edge of the window frame. Lay the clear mylar out on a flat surface, then place the window frame down on top of it. Press firmly all around to get a tight seal. Lay out another piece of mylar, and repeat on the other side of the window frame.

FIELD ASSEMBLY

OUTER and INNER BOXES

Fold the pieces along the scored lines. Insert the tabs through the slots, and insert a hook into each tab, to keep it from coming loose. Turn the boxes upside down, as they are assembled this way.

RISERS

Interlock the plastic risers into a square pattern using three horizontal and three vertical pieces. When seated, the riser will be about the size of the inner box, and 1" thick. Set the plastic riser on top of the upturned inner box.

INSULATION

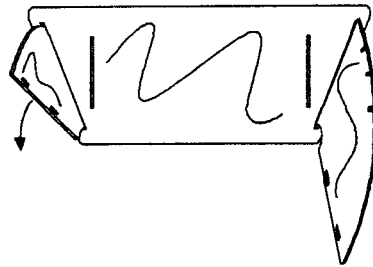
Fold the insulation panels in half, along the score lines. Place the panels along the appropriate side of the inner box, resting inside the upturned flange of the inner box. Place the assembled outer box over this whole assembly, inserting the flanges inside the outer box.

LID

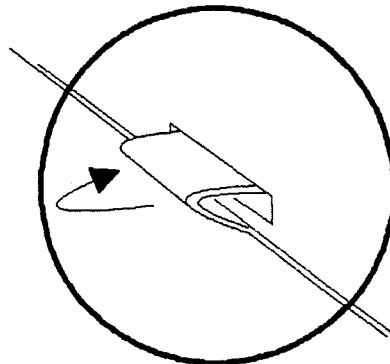
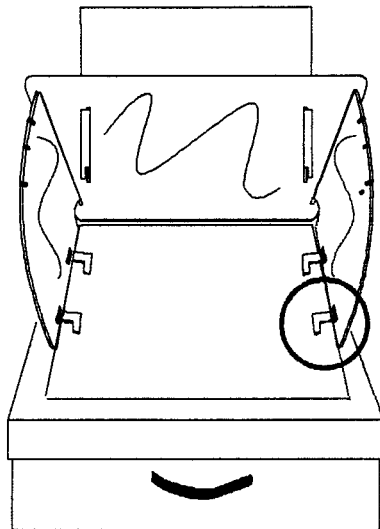
Fold the two sides of the lid upright. Fold one of the end up and around the side extensions, turning it all the way until the tabs on the very end snap into the row of slots. Repeat at the opposite end. Get the bonded window frame and snap it into the inside of the lid. It should fit snugly, and not be able to fall out.

REFLECTORS

Please refer to the following sketch for this step. Slide the two circular wings through the large reflector, from the back side. There is a right and left wing, and need to be inserted in the appropriate slot. All reflective surfaces should be facing inward when finally assembled. The reflectors are then ready to be connected to the lid. Lift the lid's panel up, and set the reflector assembly in front of it. Slide the two tabs from the lid's panel through the main reflector, from the back side.



The side reflectors are attached to the lid next. There are two small 'L' shaped tabs on each side of the lid. Fold them back and insert them through the small slots on the wing reflectors, entering from the reflective side. The oven is now fully assembled.



ADJUSTMENT

The main reflector moves along the two side wings to adjust for the variations in the sun's position. Point the oven towards the sun, then adjust the main reflector until the light is shining into the box. Look into the box during this step; the reflected light will be quite visible. Shining this light directly on the cookpot is the most effective way to cook.

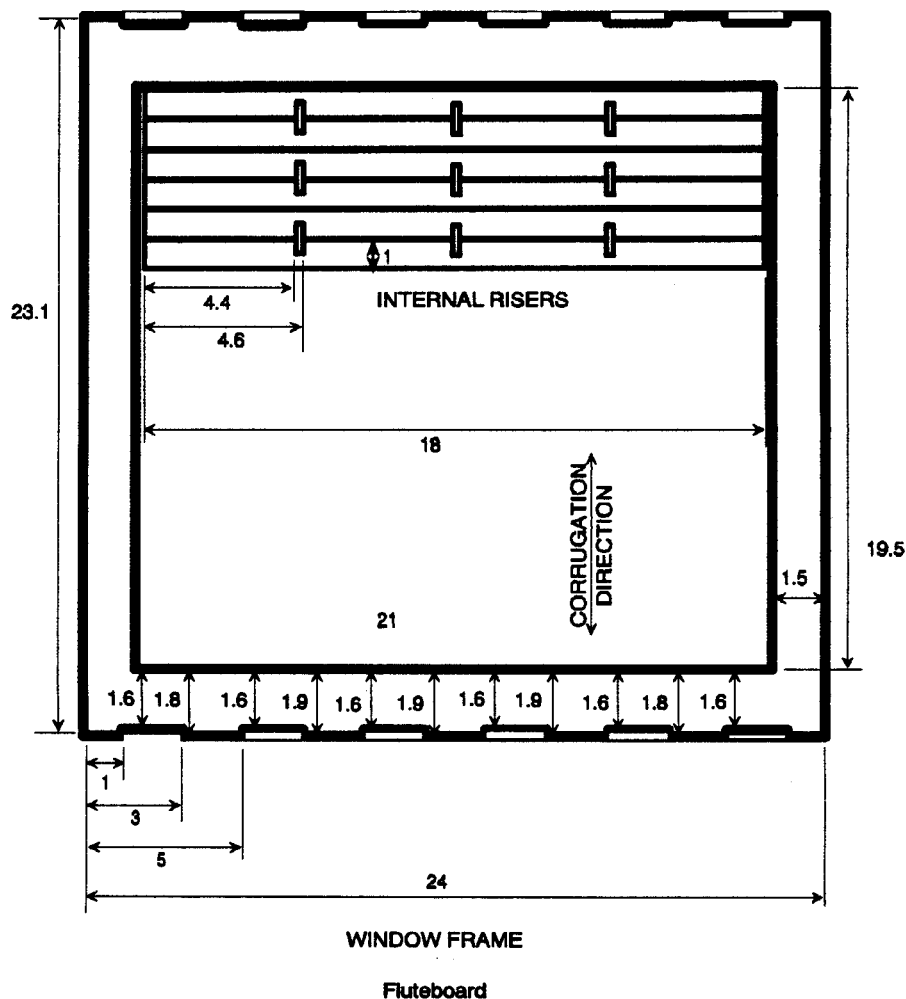
USE

The food should be raised up as high as possible, without touching the window. A cardboard riser is provided, but any appropriate sized riser could be used. Do not set cookware directly on the floor of the oven. A black metal panel on top of the riser helps to heat the food faster and more evenly.

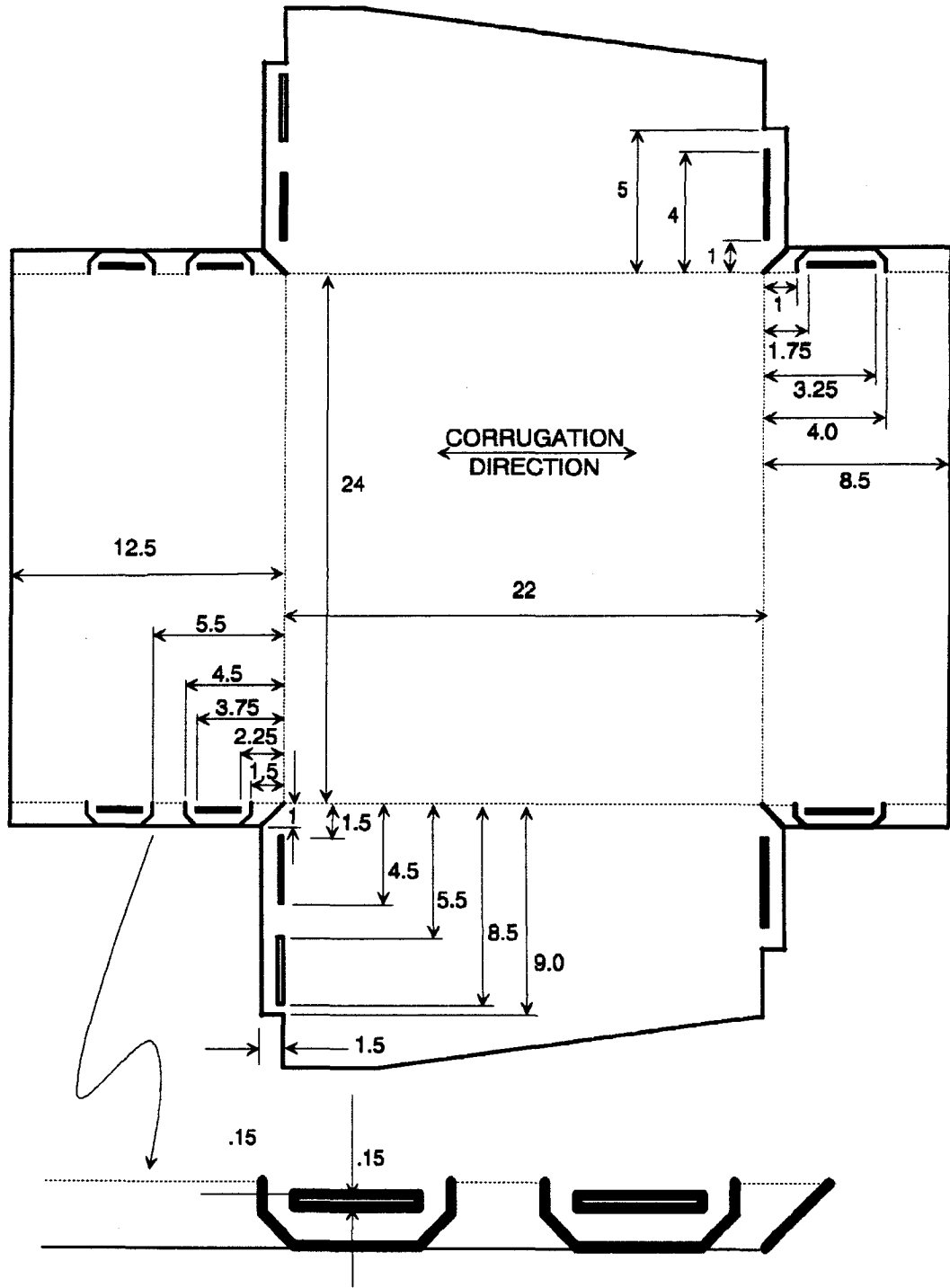
DRAWINGS

The following sheets are detailed, dimensioned drawings of each component of the Bluebird. All dimensions are in inches. At the end is a view of the nested rule die, minimizing material waste.

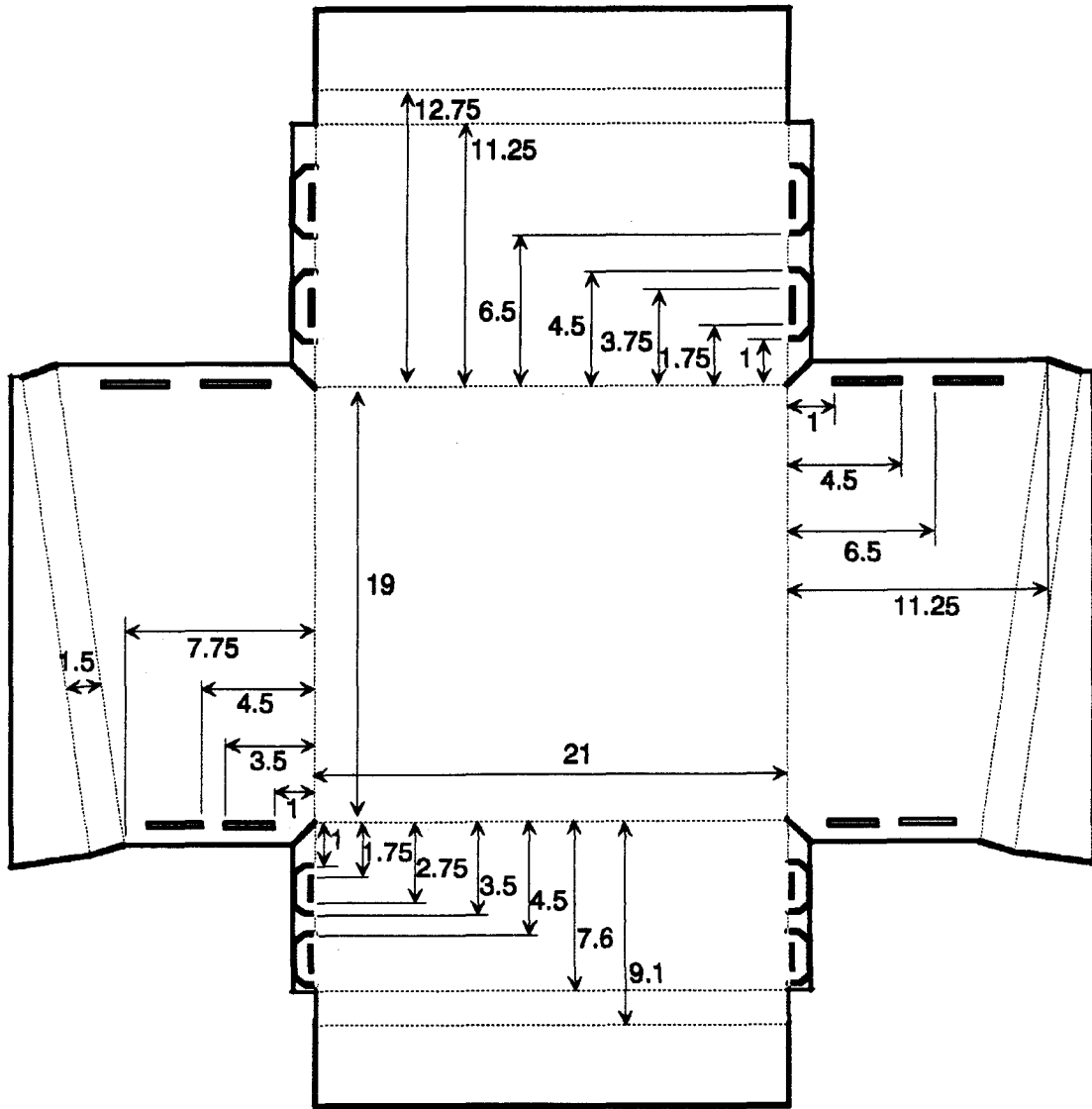
WINDOW & INTERNAL RISERS - Plastic sheet



OUTER BOX - Plastic sheet



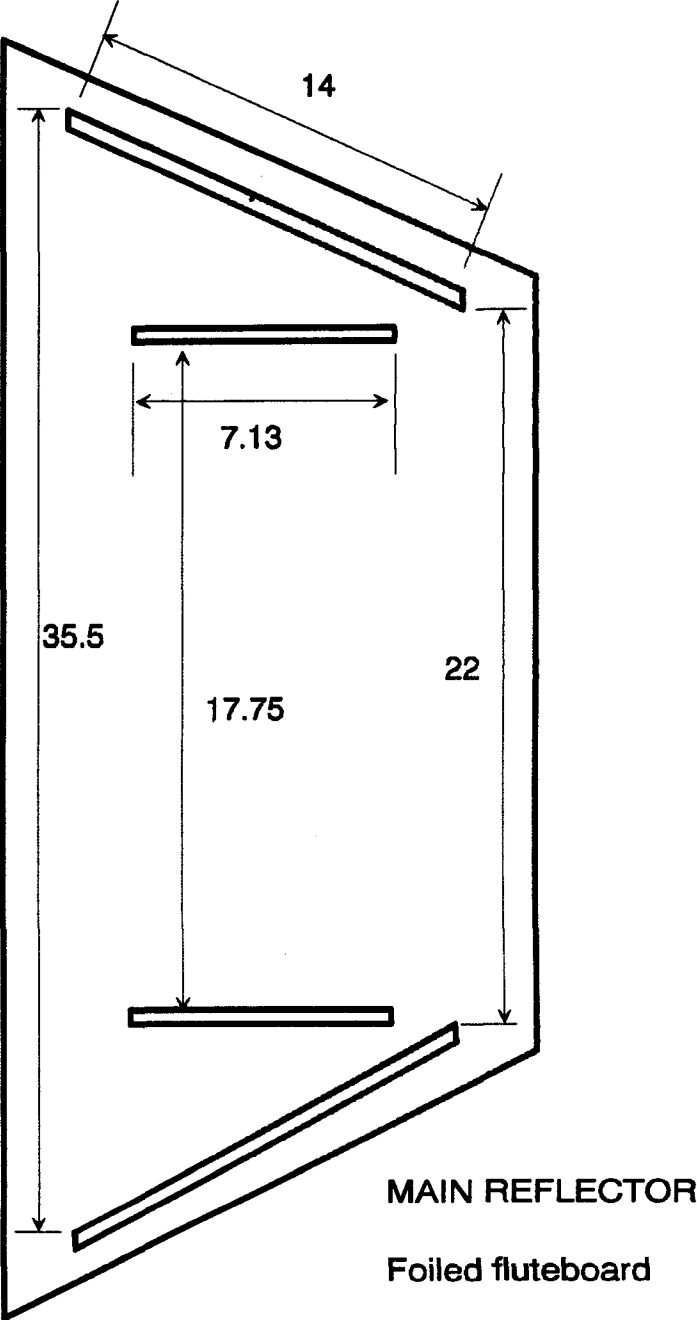
INNER BOX

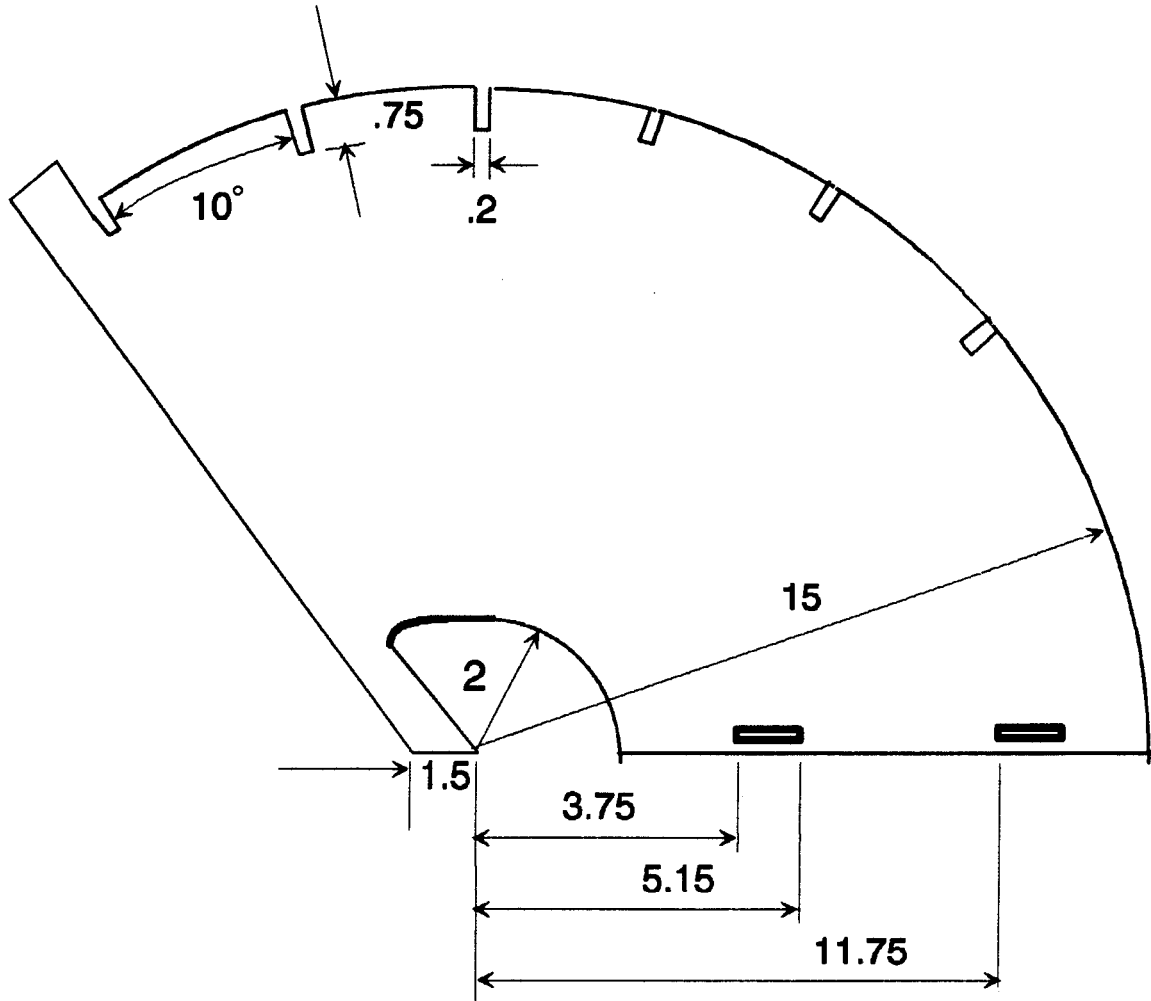


INNER BOX

Foiled Cardboard

REFLECTORS - Plastic sheet, foil covered

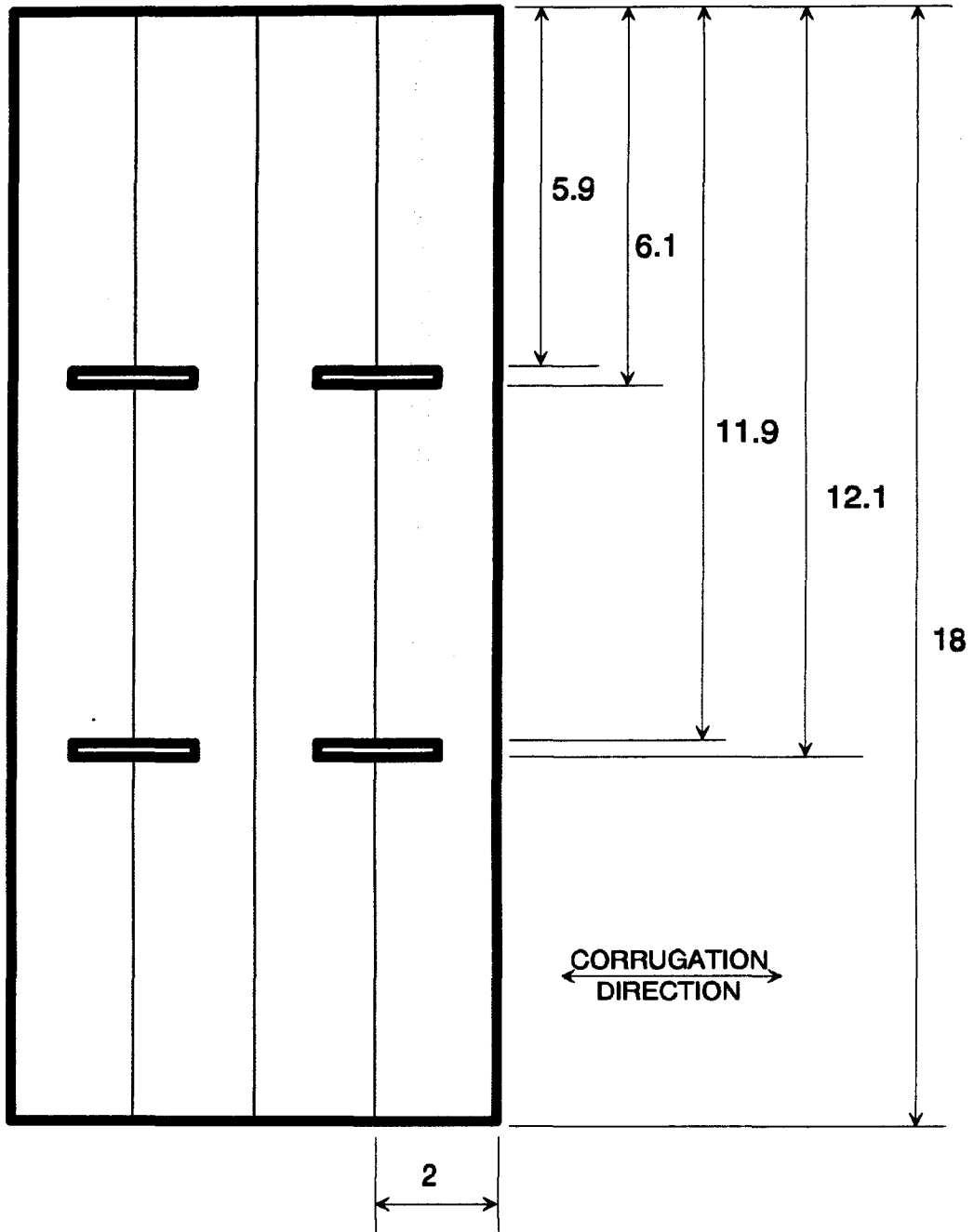




SIDE REFLECTOR (2 reqd.)

Foiled fluteboard

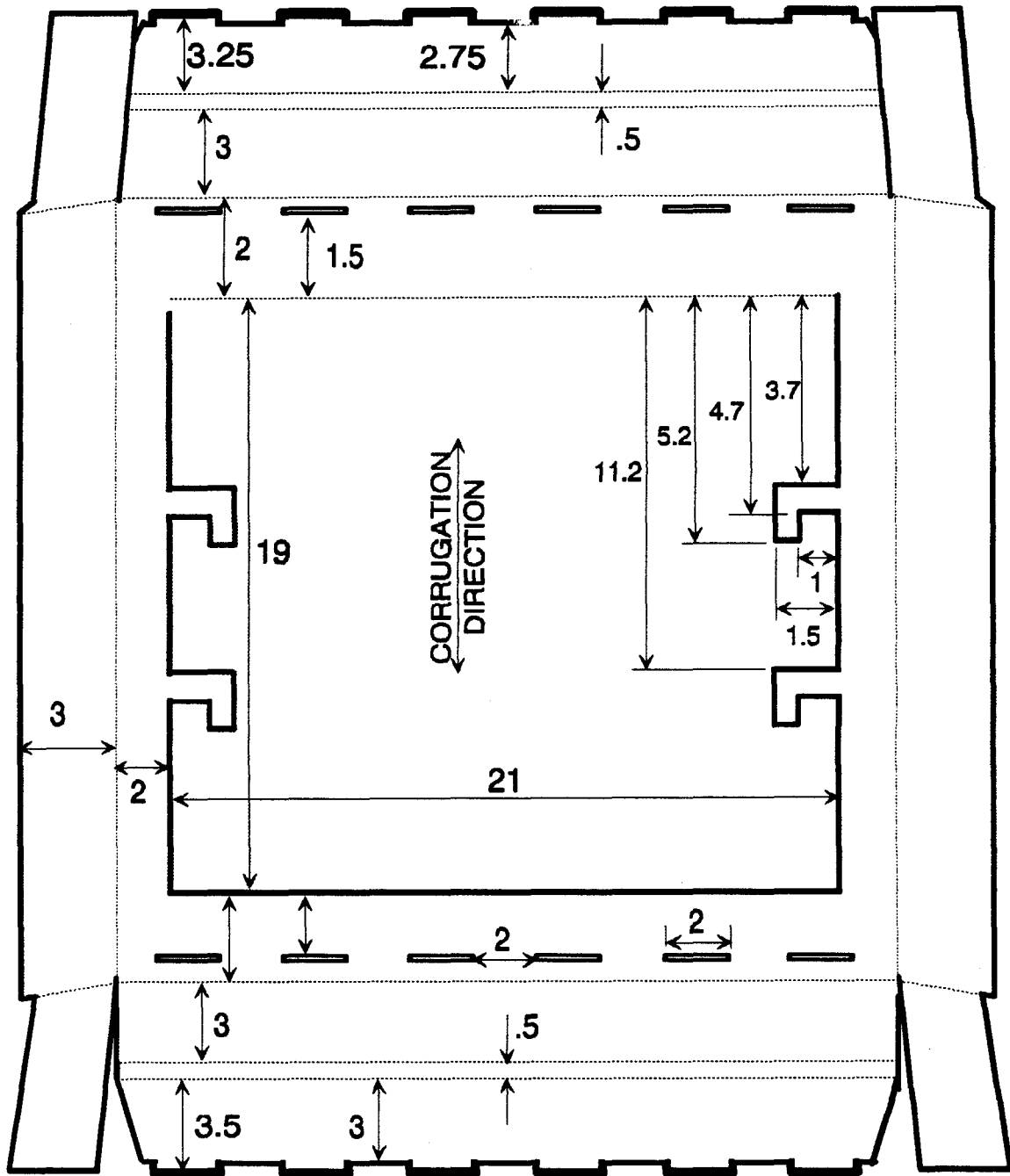
RISERS



RISER (in cooking area)

Cardboard

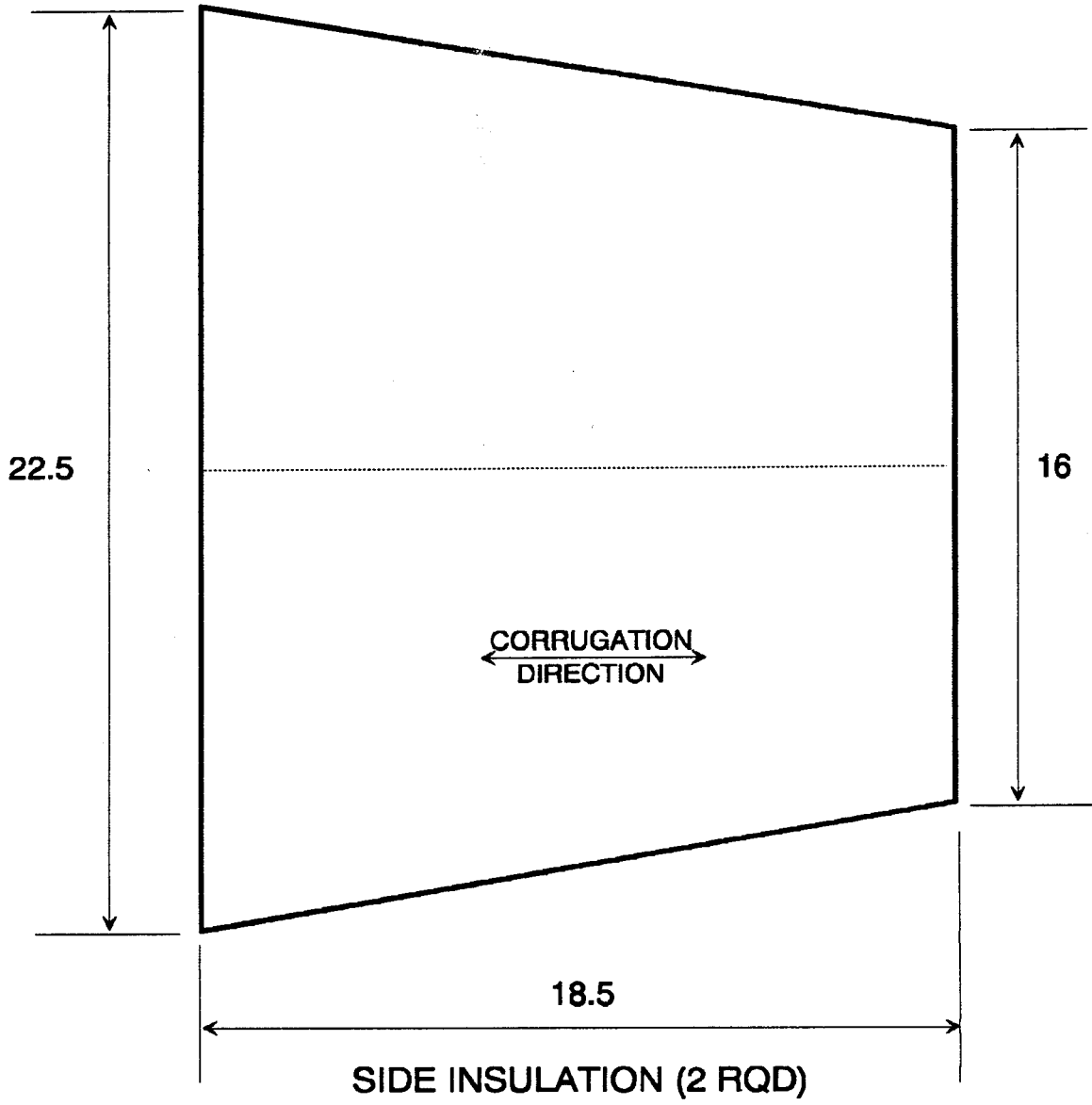
LID



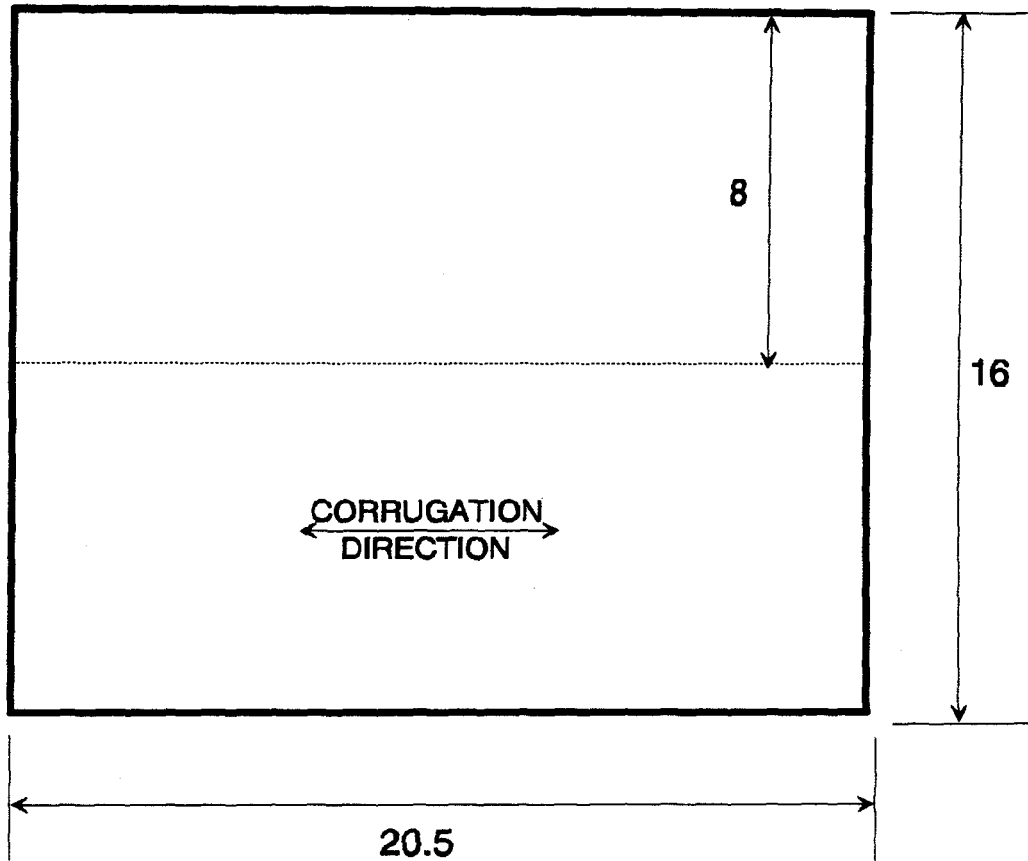
TOP

Fluteboard

INSULATION

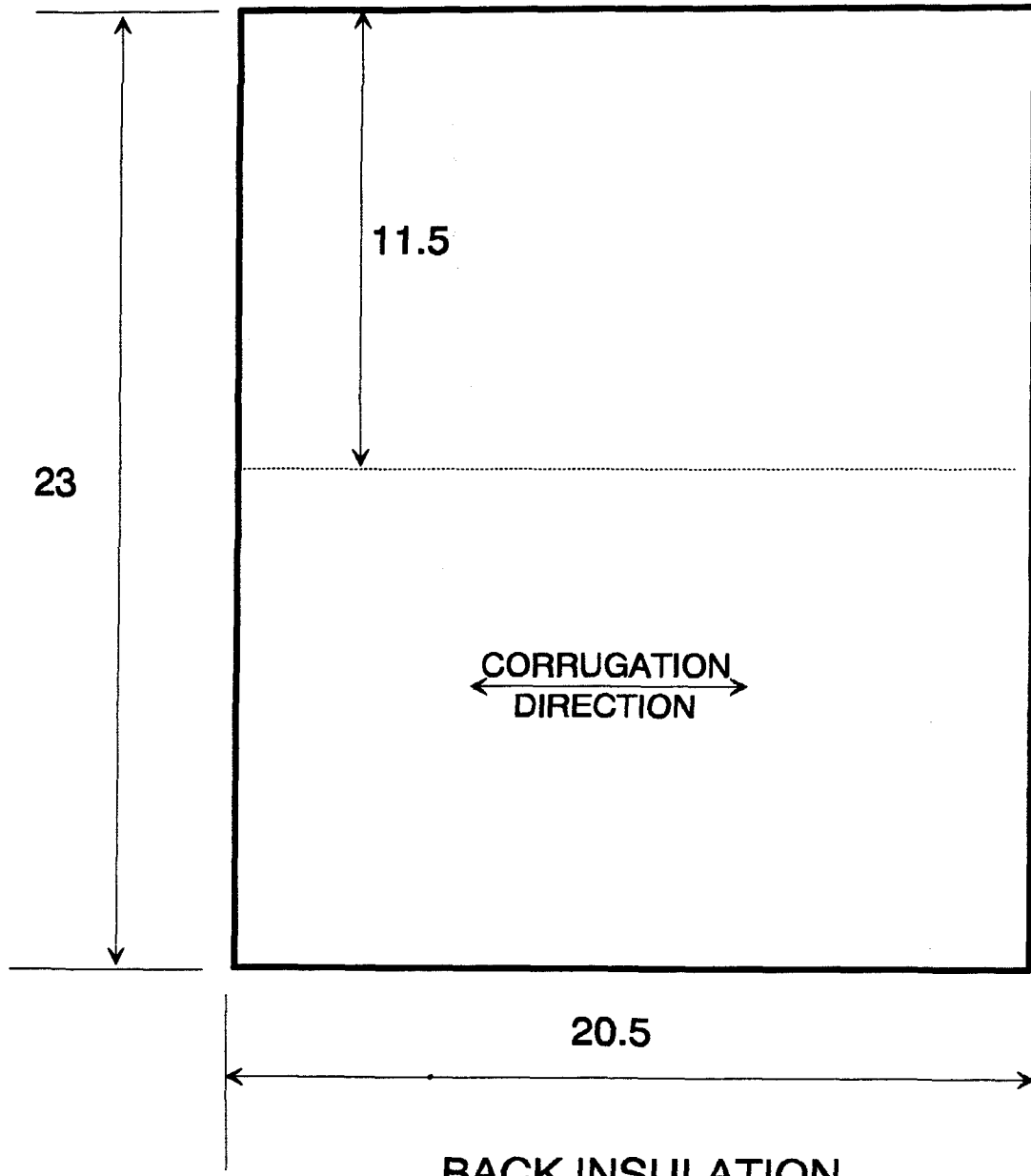


Foiled Cardboard



FRONT INSULATION

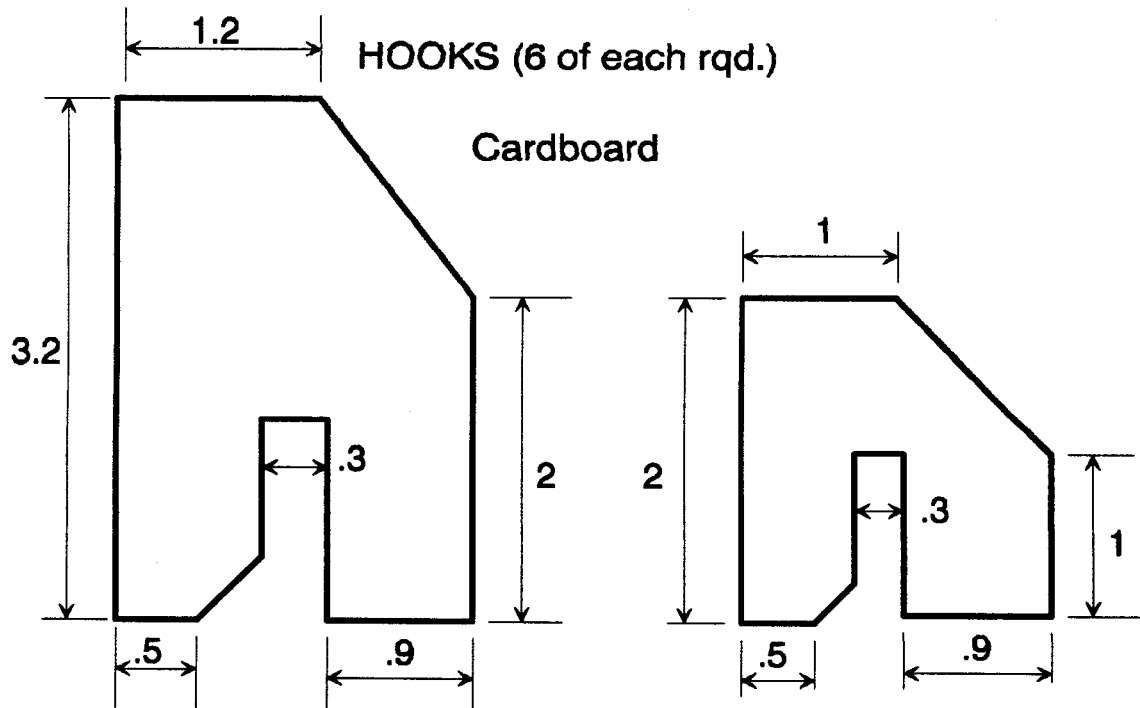
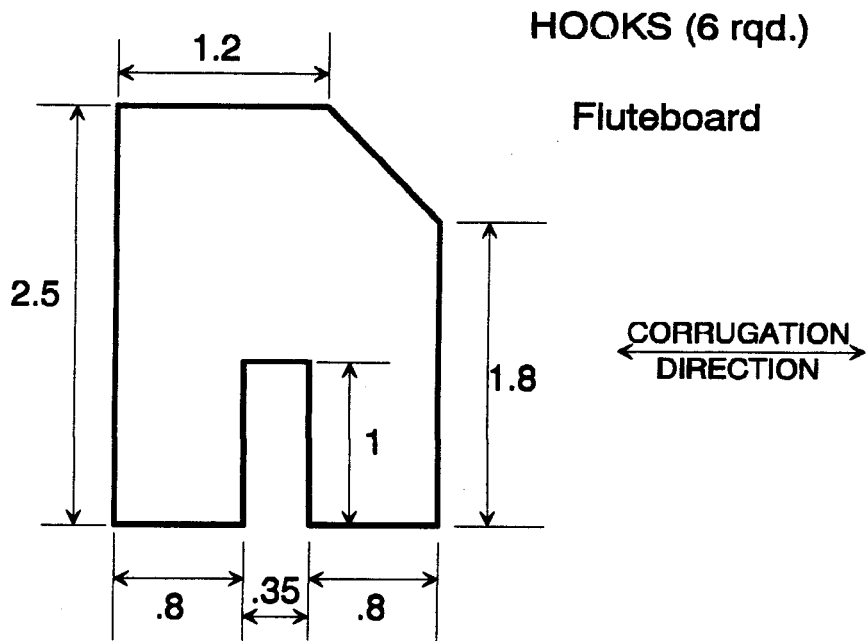
Foiled Cardboard



BACK INSULATION

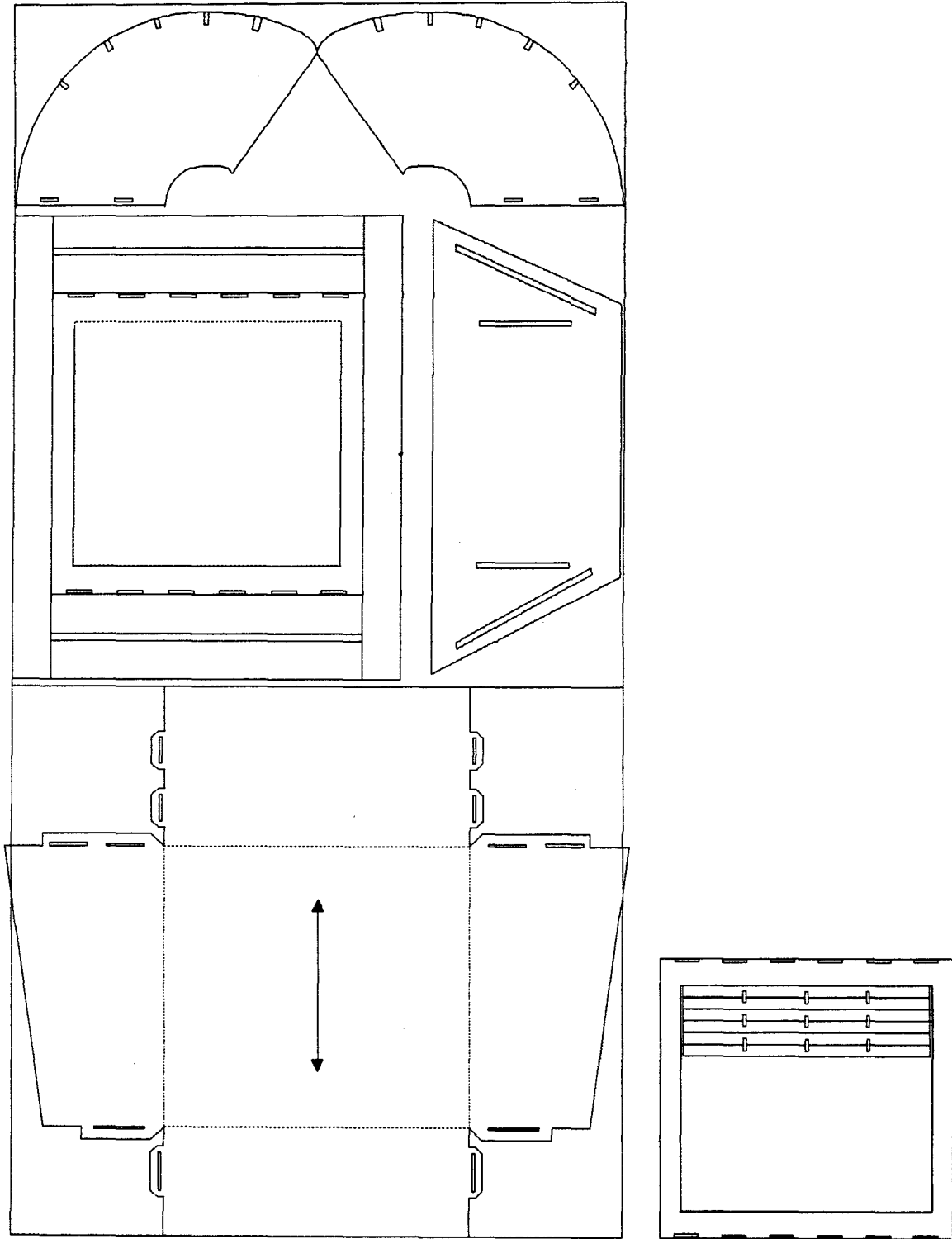
Foiled cardboard

HOOKS



TOOLING

RULE DIES - Generalized layout for efficient nesting in a single 8 x 4 foot sheet of plastic fluteboard. At least 3 ruledies are required, if 8 x 4 presses are available. Otherwise, smaller sections will be necessary.



Foiled cardboard - 8 x 4 feet

