

# **GTZ**

## **MANUAL BOOK**

### **FOR**

**MOULD PRODUCTION OF JIKO KISASA AND ROCKET MOULDS.**



***A DETAILED MANUAL FOR A HIGH STANDARD AND  
ACCURATE MOULD PRODUCTION.***

## **USE OF THIS MANUAL**

This manual has been produced by qualified technicians on Mould production, product research, product development and technical drawing. The dimensions in this book has been practically tested to be productively functional and therefore does not need any further test and research to produce the same.

The use of this book in mould production is therefore recommended by all standards.

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## **PREFACE**

Moulds have been identified as the most accurate and efficient means of producing quality products of any design, the production of both Rocket and Jiko Kisasa moulds are therefore no exception . It has been identified that the moulds, when designed accurately according to specification, produce a standard product with accurate measurements and dimension which may be difficult to produce without the help of mould.

The Jiko Kisasa and Rocket stove mould are more technically designed in a way that makes using them more productive and the products are therefore quality and accurate. The demand for Jiko kisasa and Rocket Jiko are high , it is therefore essential that the training on the production of the mould be done to as many people as possible so that they can meet the market demand. However, the market also demands quality products that meet the expectation of the consumers hence the production of this manual.

The dimensions and technical drawings in this book are in millimeters unless stated otherwise, in case the user of this book may not be well conversant with the stated measurement, their own translation will be advised only if it is accurate and reflect the same in its original measurements.

It is worth noting that the dimensions of the rocket moulds have undergone some changes in measurements, these changes have been necessitated by consumer comments and market demand, hence the reproduction of the report and manual.

## INTRODUCTION TO ROCKET STOVE LINER MOULD

**Table 1.1** below shows the tools and equipments needed in making Rocket mould;

No.	TOOLS AND EQUIPMENTS
1	Rail- 4"x3"x6'
2	Ballpen hammer – 3kgs
3	Steel cold chisel – sizes; 3/8", 1/2", 3/4", 1"x10"
4	Tape measure: both in inches and millimeters.
5	Try square
6	Scribers
7	Center punch
8	Welding machine; controllable.
9	Electric grinder
10	Steel ruler
11	Divider/campus
12	Rail support: can be any thick metal, log of wood etc
13	Tinsmith cutter
14	Flat file for finishing
15	Electric drilling machine
16	Hacksaw.

**T- 1.1**

**Table 1.2** below contains consumable items required;

ITEMS	SPECIFICATION
Welding rods	No. 10
Grinding disk	Normal size
Hacksaw blades	Standard
Wire brush	Rough
Emery cloth	Rough
Painting brush	3"
Paints	-Red oxide for undercoat -Black for final training

**T- 1.2**

**Table 1.3** below contains protective devices require during the production.

Devises	Use
Helmet	For head protection
Welding glass	For protecting the eye during welding
Hand gloves	For protecting hands during the work
Workshop boots	For protecting the feet against sharp objects
Overall	Official workshop ware
First aid box / kit	For first aid in case of any miner accidents

### T- 1.3

**TABLE 1.4 CONTAINS MATERIALS NEEDED FOR ROCKET MOULD.**

MATERIALS	SPECIFICATIONS
Plate	Mild steel 4mm for base plate and collar
Plate	Mild steel 3mm for body of the mould
Black pipe	12mm for rocket
Shaft	16mm/5/8 for center shaft
Rivets	Standard for riveting
Bolts	15mmx3/8 – 6pieces for joining the body
Flat bar	3mmx20mm
Wood screw	Standard size 24mm x1” for mounting the mould.

### T-1.4

#### **CUTTING MOULD MATERIALS**

- 1) Flat plate 22mm for cutting the door. It is also possible that a piece of drum plate or any other plate of that thickness can be used in making the cutting mould.

**NOTE:** All mould materials are the same except for the center shaft and the shaft.

Note also that the side collar is to be welded permanently on the mould body to Make permanent part of the body.

The center shaft for Jiko Kisasa mould is 16mm DIA and the pipe is 1”.

#### **DRAWING TOOLS, TYPES OF LINES, ABBREVIATION/SYMBOLS AND ANGLES.**


In order to come up with quality drawing and sketch drawing before cutting the plate, you need to understand drawing methods, tools and symbols.


#### **DRAWING TOOLS**

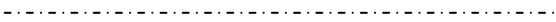
- 1) Drawing board - A2 size sheet = 420mm x594mm
- 2) T-square – used to draw parallel line across the board.
- 3) Adjustable square
- 4) Set square - 45 degree
- 5) Set square – 60 degrees
- 6) Scare square

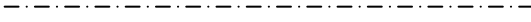
## **TYPES OF LINES**

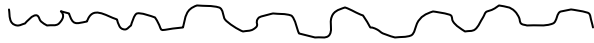
During the production of moulds, lines becomes a very important part of the process, lines will give strong direction on how you want to cut, bend or fold your materials according to the shape you want to produce. Below are just but a few lines you will use during the production of Moulds as illustrated in this book.

1)  Thick continuous line – for drawing visible parts and edges.

2)  Thin continuous line for drawing dimension leader line

3)  Thin dotted line /thin short dashed – used for drawing hidden outlines and edges

4)  Thin chained center line extreme position of movable parts

5)  Continuous irregular line - for sketching.

## **ABBREVIATION /SYMBOLS**

As illustrated in table 1.5 below, abbreviations are shortened references to technical terms, below are some of the abbreviations you will likely use in the production of moulds and its components.

TERMS	SYMBOLS
Across flat	A/F
Assemble	ASSY
Centers	CRS
Center line	C OR CL
Cylinder or cylindrical	CYL
Diameter in notes	DIA
Diameter preceding a dimensions	∅
Internal	INT
Materials	MTL

**Table 1.5**

## **ANGLES:**

In any production, it is imperatively important to understand the angles position of your final products, understanding angles will ease your work and will help you in producing accurate and quality product.

The following angles are very important in the production of templates and in particular truncated cone.

- 1) Acute angle – Less than 90degrees
- 2) Right angle – 90degrees
- 3) An obtuse angle – angles greater than 90 but less than 180 degrees.
- 4) A reflex angles – angles greater than 180 but less than 360 degrees.
- 5) Complementary angles - these are two angles which adds up to 90 degrees.  
Example; 30degrees is a complement of 60 degrees.
- 6) Supplementary angles - two angles which adds up to 180 degrees Example;  
60degrees is a complement of 120degrees.

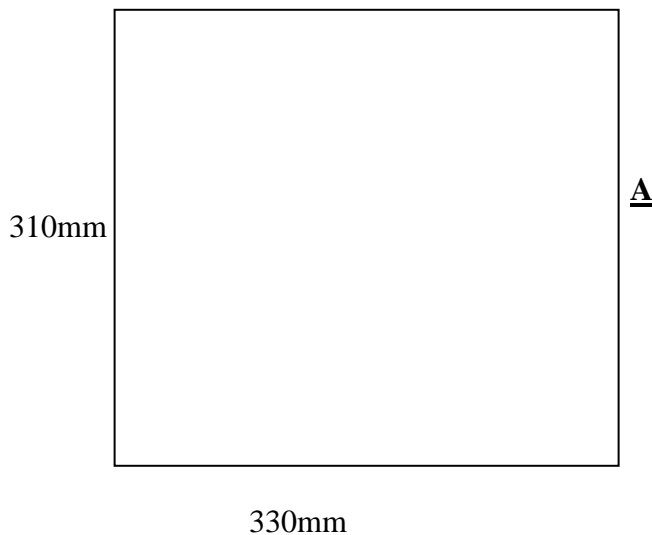
## THE PROCESS OF MAKING ROCKET STOVE LINER MOULD.

### **STEPS;**

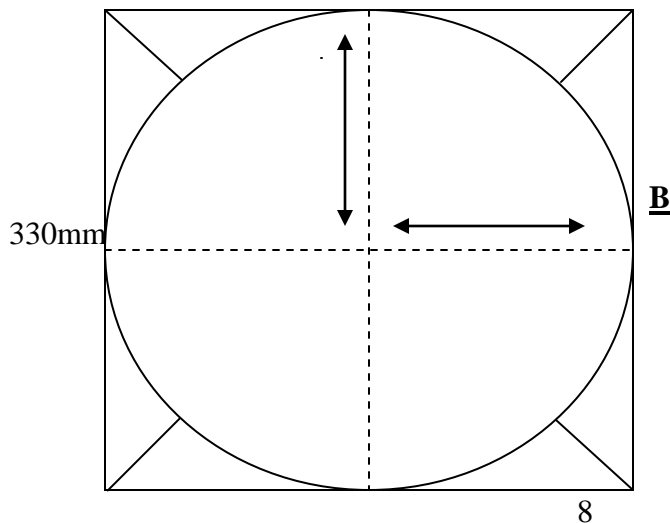
Follow the diagrams drawn below and be accurate in your measurements. The steps of the diagrams are indicated alphabetically as they appear below.

- A) – Cut 2 OFF plate measuring 310mm x 330mm, this is for mould body
- B) Cut 1 OFF plate measuring 310mm x 310mm, this is for the bottom plate.
- C) Diagram C shows a ready bottom plate measuring 330mm in DIA.
- D) In diagram D, you will need another plate of the same size to cut off the bottom collars. Ensure that the radius of your circle is 115.5 mm.
- E) In diagram E, you will need to bisect the plate as shown to give you two equal halves with two location holes on each half. Use the measurements accurately as drawn in the diagram.

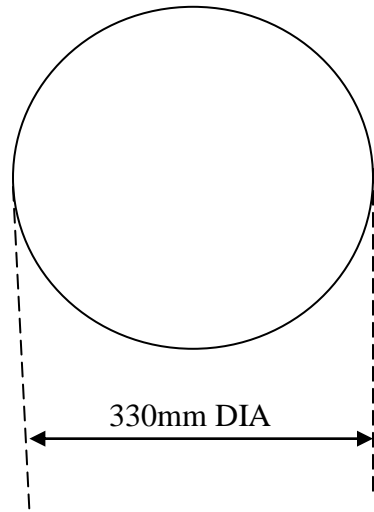
### **BODY. = 2 OFF**



### **BOTTOM PLATE 1 OFF**







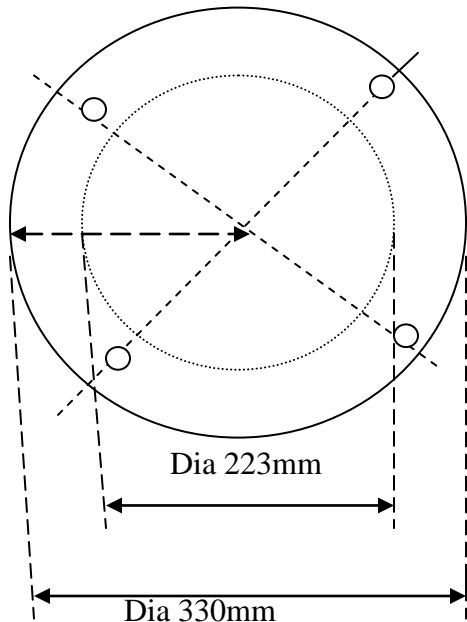
**C**

Note: connect the diagonals to help you locate the center of the plate as illustrated below.

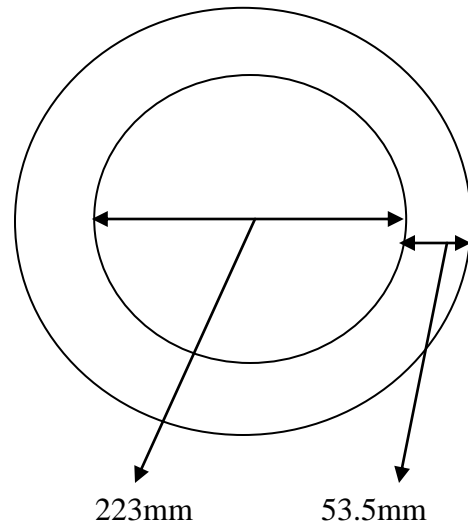
The arrows in the circle show the radius of 165mm that gives a DIA of 330mm.

In the below diagram, be advised that you can only get the 2 OFF bottom collars from one plate as indicated below, if you cut the collars separately, it will have two disadvantages; a) the collars will not connect accurately to the other part

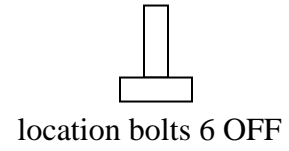
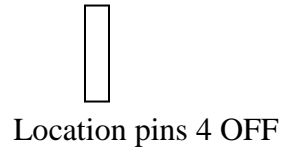
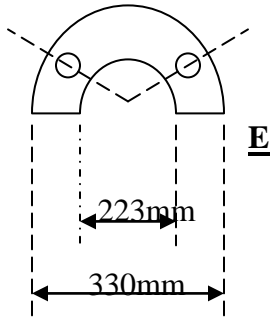
b) The collar plate will twist and therefore will not give you the right shape you want at the bottom



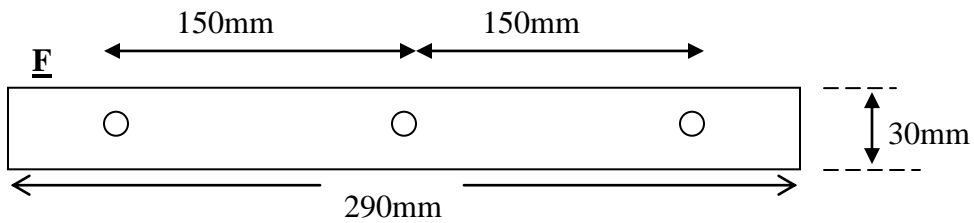
**D**



**BOTTOM COLLAR 2 OFF**

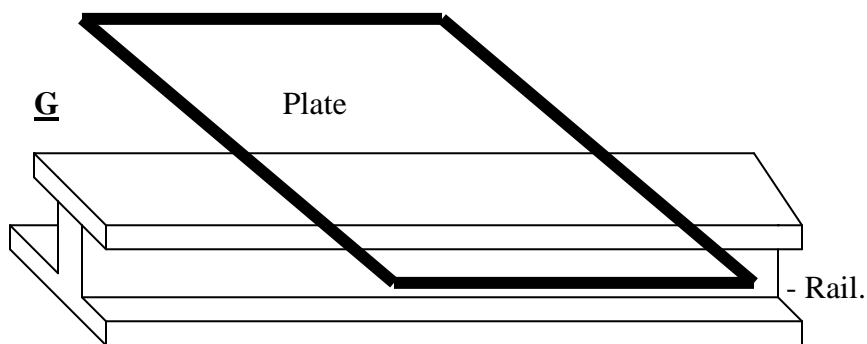


Vertical collar 4 OFF



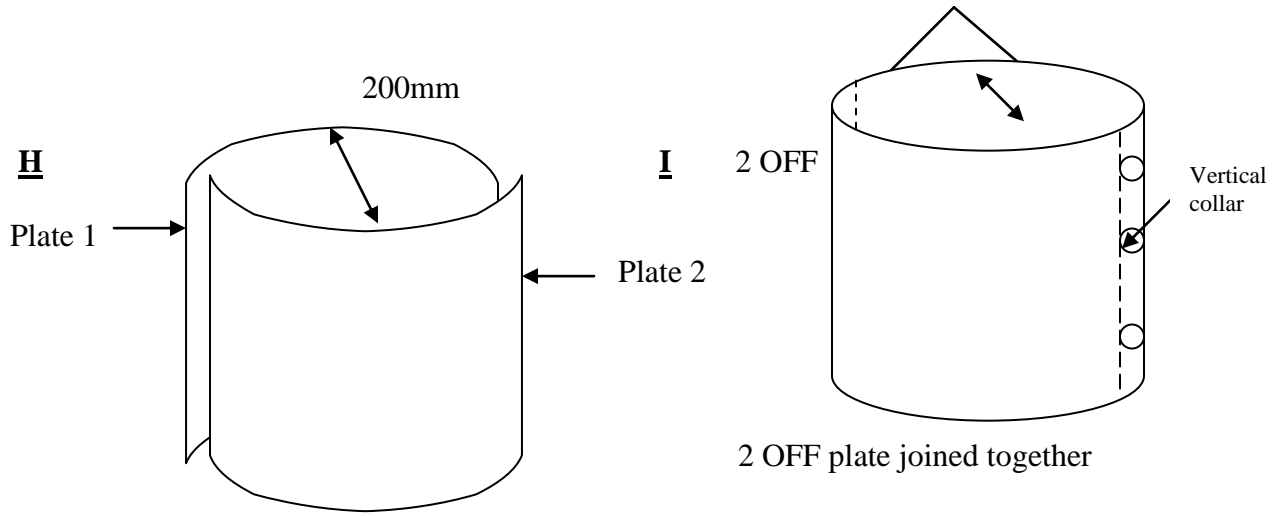
**THE PROCEDURE OF MAKING ROCKET LINER MOULD.**

- 1) Place the flat metal sheet on a rail, use your pall pain hammer and fold the plate into halves.

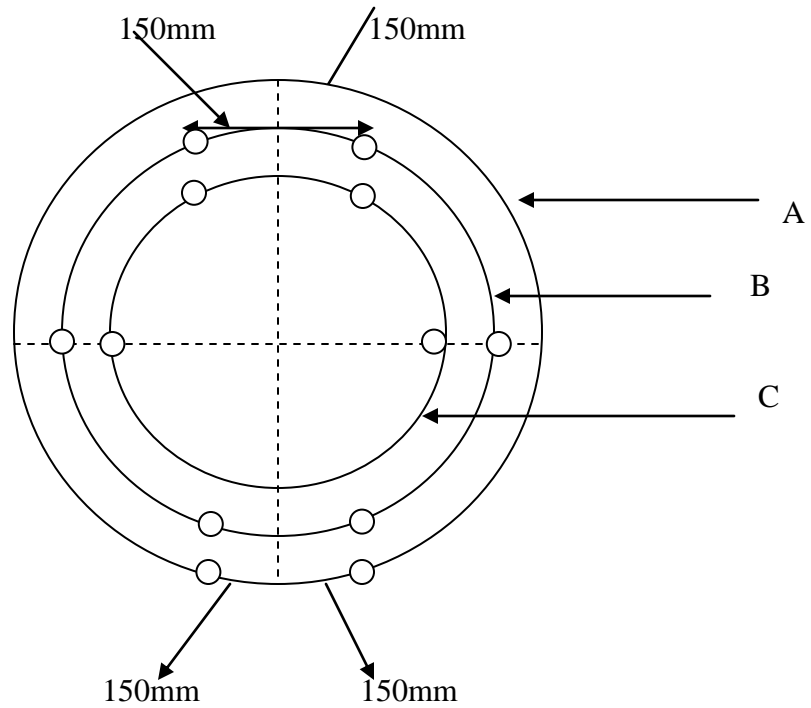


- 2) Hit the plate and make it round and even semi- circle of 2 OFF.

Joints of plate 1&2

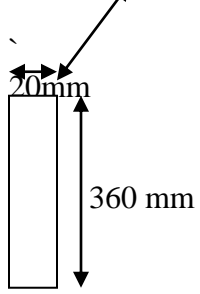


NOTE: location pins, location and location holes MUST be 10mm in sizes.



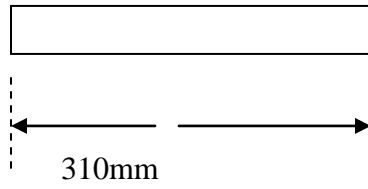
A – 330mm in DIA  
 B – 300mm in DIA  
 C- 250mm in DIA.

Paddle pipe 1 OFF.

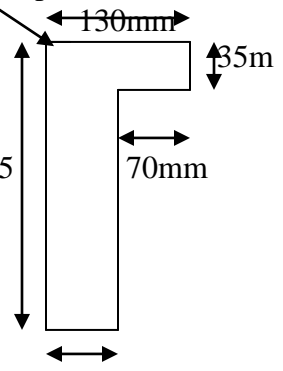


2

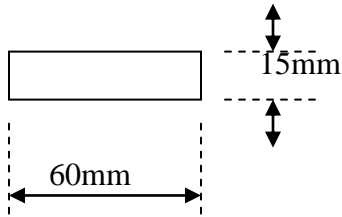
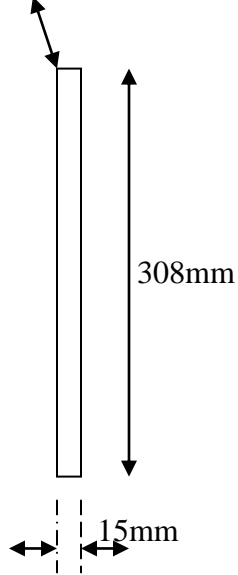
Paddle handle 1 OFF



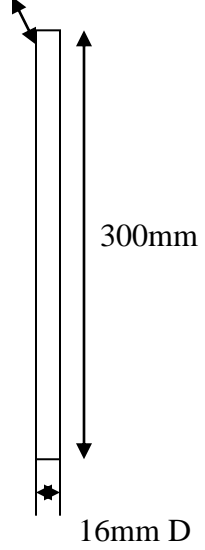
paddle plate 1 OFF



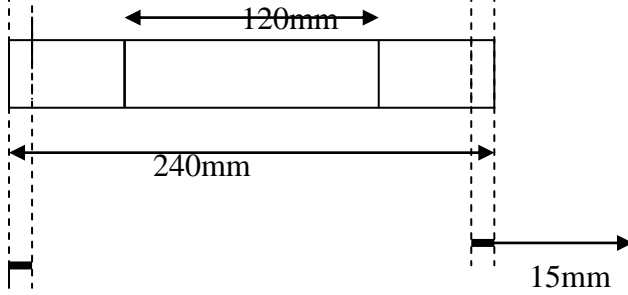
Paddle web reinforcement

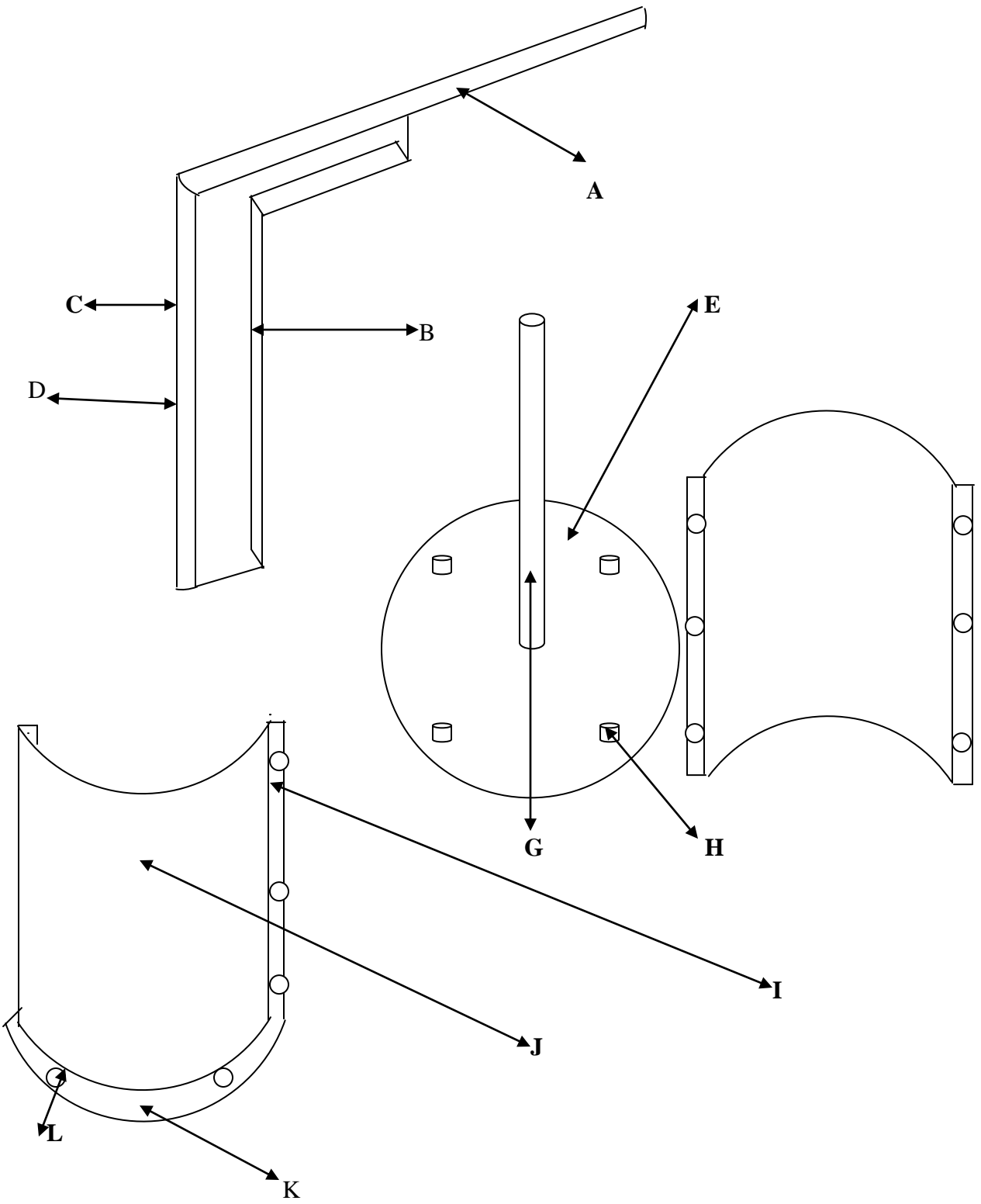


center shaft 1 OFF.



Paddle handle.





NOTE; The parts of the Rocket stove mould above are explained here below:

- A – Paddle handle – 310mm**
- B – Paddle reinforcement – 308mm**
- C – Paddle pipe – 360mm**
- D – Paddle plate – 345mm**
- E – Bottom plate- 330mm D**
- F – Location holes- 10mm D**
- G – Center shaft – 300mm**
- H – Location pin- 15mm**
- I – Vertical collar- 290mm**
- J – Mould body – 220 D**
- K – Bottom collar- See E above.**
- L – Bottom location hole – 10mm D**

### **PICTORIAL INFORMATION.**



As shown in the picture above, cut the 2 OFF metal plate using a cold chisel and a ball pain hammer, you will get two equals sizes of plate with measurement as shown in **A** above.



**Start folding the plate as shown in the above picture.**



**Continue folding the plate until it takes the shape as Shown above.**

As shown above and also in diagram **G** above, roll the plate on the rail as you hit it with a ball peen hammer to make an even semi-circle. Make two halves of the semi-circles.

See the diagrams in figures **H** and **I** drawn above, bring the two half circles together, tack weld them at the joint to allow you mount the vertical collar which you will permanently weld.

Place the body on the bottom collar and weld.

- Do the same to the other side and join the two halves using bolts.
- Mount the mould body on the bottom plate.
- Insert the paddle plate and your product will be ready for use.



**The final product of Rocket stove Mould**



## **JIKO KISASA MOULD.**

### **JIKO KISASA MOULD TEMPLETE**

Jiko kisasa template mould was the most technically complicated part of this training. The theory part of this process also took a little longer because it had a lot of explanations due to its unique technicality. The participants had difficulties in understanding the correct measurements and this forced the facilitators to extend the facilitation longer than expected, this part covered the whole morning session.

The jiko kisasa mould comprise of the following parts:

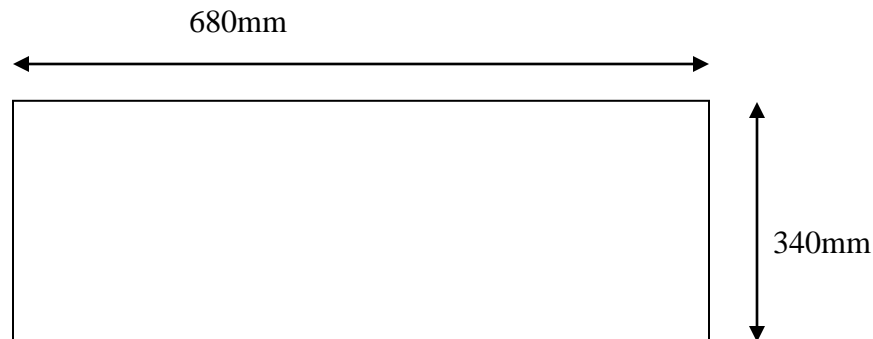
- 1) MOULD BODY
- 2) BOTTOM PLATE
- 3) RING COLLAR
- 4) PADDLE WEB
- 5) CENTER SHAFT
- 6) LOCATION PINS

## **PROCESS.**

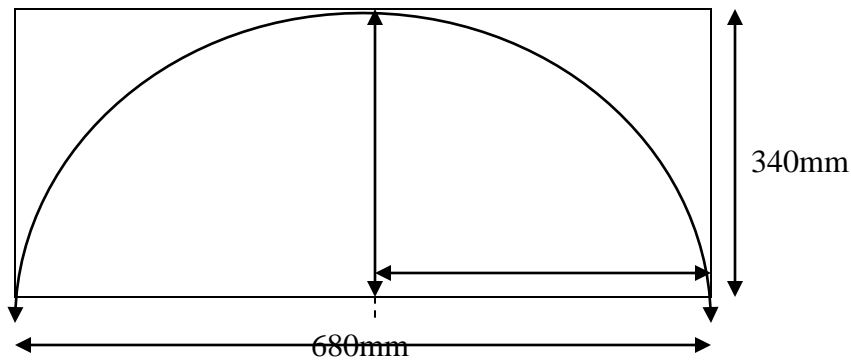
### **PRODUCE A TEMPLATE THAT WILL MAKE YOUR WORK EASIER AND ACCURATE.**

The process below shows how you can make a truncated cone template which you will use in cutting the shape of mould body.

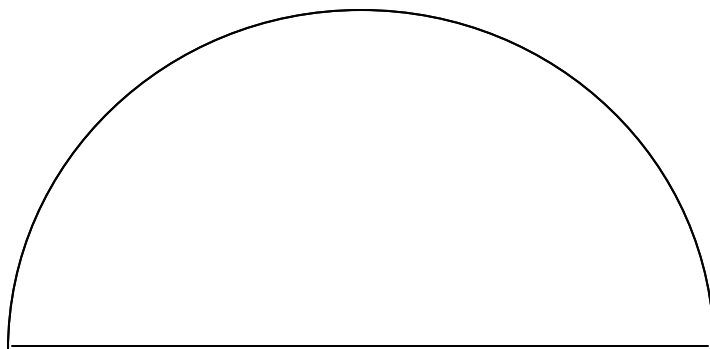
1. Use a thin iron sheet of gauge 30 to cut off the template.
2. Use your drawing tools and draw a shape measuring 680mm x 340mm as shown below.



3. Locate the center of 680mm, punch it using center punch, set your calipers at a radius of 340mm and scribe to get half circle as shown below.



The diagram below shows already cut semi circle where you will cut off your truncated cone template.



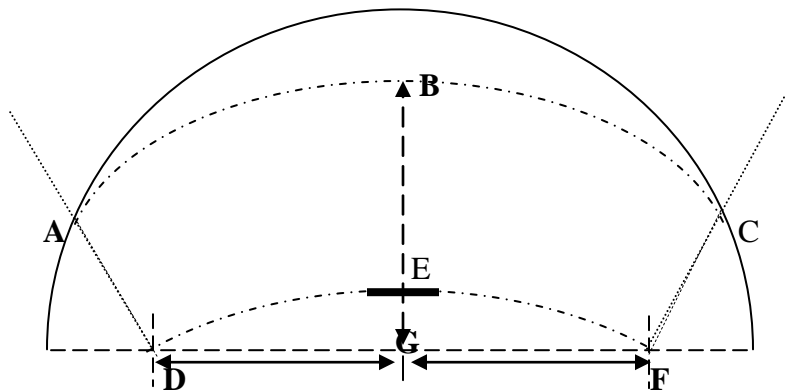
**A ready cut off semi- circle for truncated cone.**

The semi circle is measuring 680 mm DIA x 340mm RDS.

- The truncated cone has two lines of circles to be drawn ie inner circle and outer circle.
- To get the inner circle, you will leave an allowance of 30mm above from the center of the base of the semi- circle.
- Remember that the total diameter of the inner circle will be 230 mm including the allowance of 30mm.
- That means the height of the body of a truncated cone will be 200mm all round.
- All your measurement **MUST** start from the base line of the circle which is indicated as the diameter.
- The outer diameter of the cone **MUST** be 565mm
- Remember, the truncated cone **MUST** not be a circle, you will use flexible flat bar or rule to curve along the drawings.
- You will bisect the semi-circle in several degrees until you locate the angle at which the edges of the truncated cone are connected.
- After drawing and connecting the lines you have drawn, use your tinsmith to cut along the lines accurately tracing the thick continuous lines drawn on your plate.

- Your truncated cone template will be ready for use in cutting the body of jiko kisasa mould.

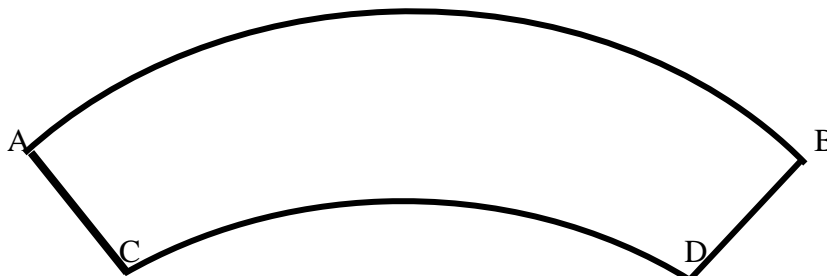
The diagrams drawn below shows the processes described above and will give a pictorial understanding of the process of making a truncated cone which will be the template for jiko kisasa mould body.



**Note the following important measurements and dimensions:**

- 1) A to C = 565mm, connect the curved line using your flexible steel ruler connecting A, B, C to get the outer shape of the truncated cone.
- 2) A to D, B to E, and C to F = 200mm, this is the height of the mould body, to get the inner shape of the truncated cone, connect D, E and F.
- 3) Note that from D to F is 465 mm
- 4) Also note that from E to G is 30mm , this is the allowance indicated in the explanation above, this allowance allows the bottom shape to rest flat on the bottom plate.
- 5) Note also that from G to B is 230mm; this is the total measurement from the center to the outer shape of the cone including the 30mm allowance.
- 6) Once the allowance is removed as explained above, the measurement will be now from B to E which is 200mm.

**The diagram below shows a complete template of jiko kisasa mould body.**



A to B is 565mm  
 C to D is 465mm  
 A to C and D to B is 200mm.

You will now use truncated cone template to draw the plate you want to cut the body of jiko kisasa mould. Remember, the body will be 2 OFF.

## STEP 2

Now that you have a template, you will have easy work getting the shape.

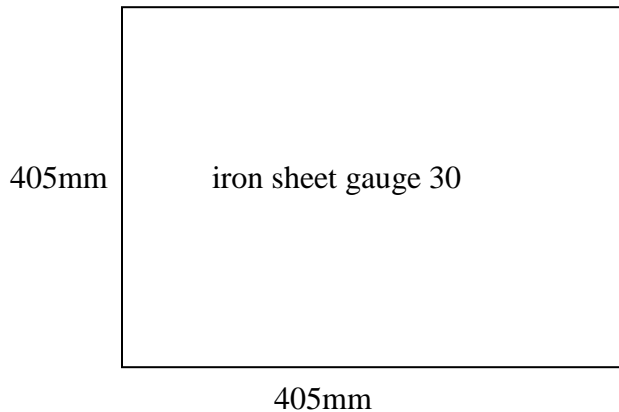
- 1) Place the template on the metal you want to cut.
- 2) Trace the template on the metal plate to get the shape you want to cut.
- 3) Use your cold chisel to cut out the two shapes.
- 4) Use the process indicated in making the Rocket stove mould.

NOTE: The process of folding the plates for both jiko kisasa and rocket mould are the same except the rocket mould is joined using bolts and jiko kisasa mould is welded permanently at the joint.

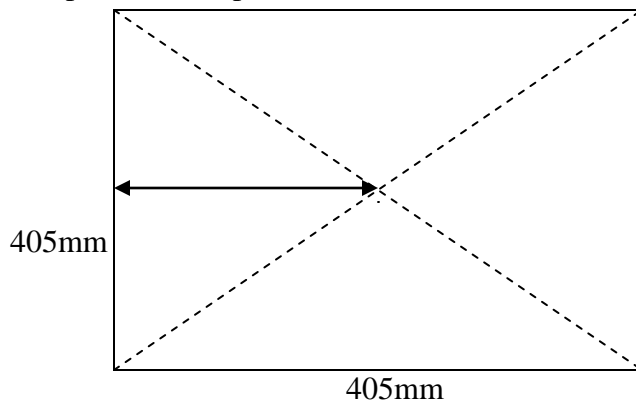
**The bottom ring and the bottom plate are explained in the drawing below:**

Bottom plate template.

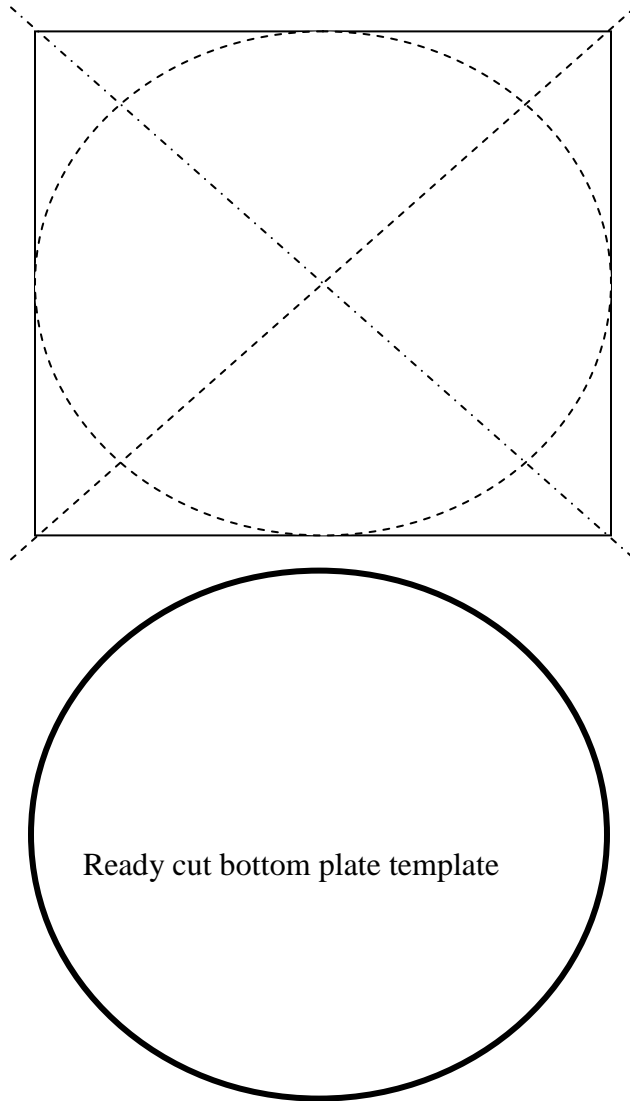
1. Cut an iron sheet of gauge 30 into the size of 405mm x 405mm.



2. Draw the diagonals and get the center of the sheet
3. Set your calipers at 202.5
4. point the calipers at the center and draw circle



- 5) Draw from the center and make a circle of radius 202.5mm and then use your tinsmith to cut out the shape along the thick continuous lines you have drawn.

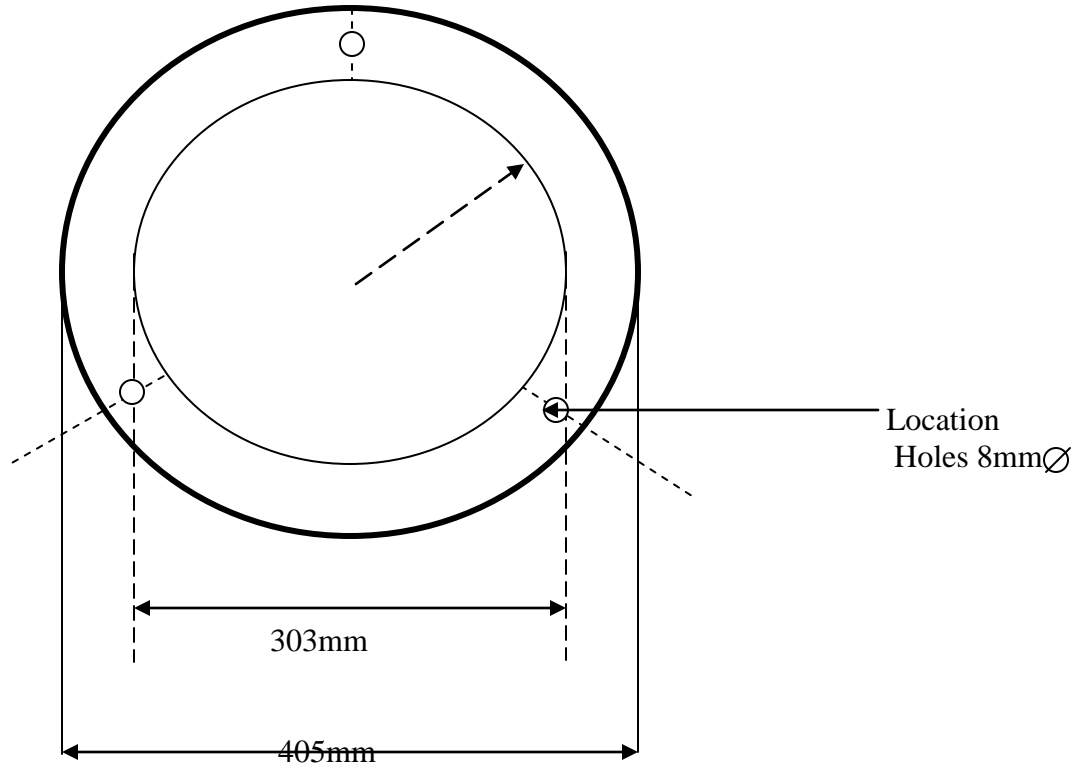


Note: you will use the same method as indicated above to cut another sheet of the same size which you will use to cut the bottom collar template.

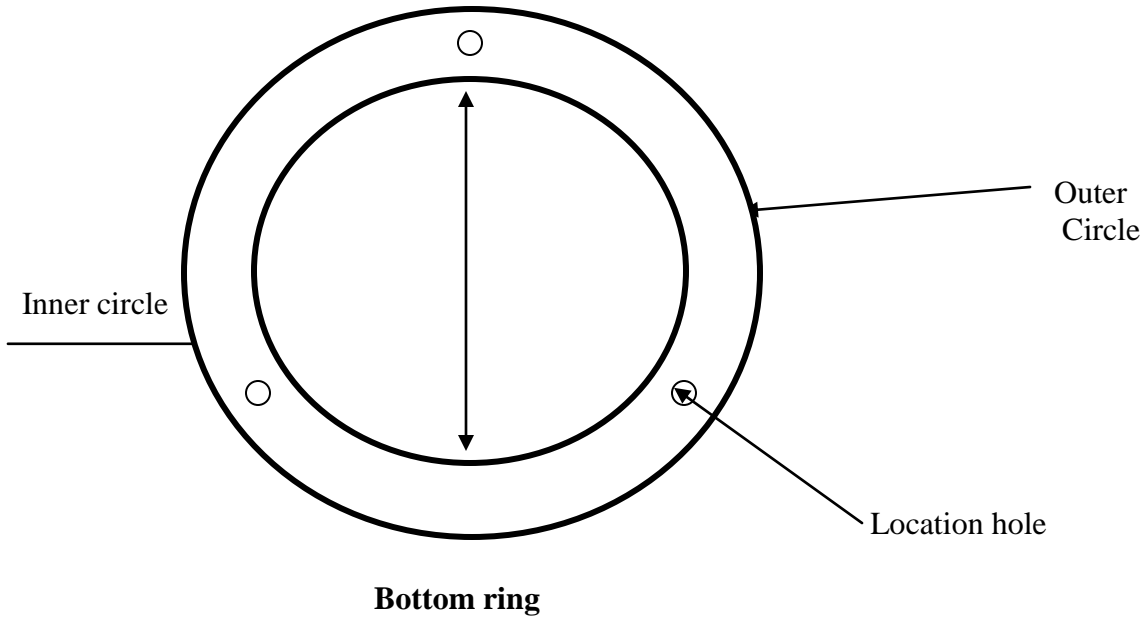
#### **PROCESS OF MAKING BOTTOM COLLAR.**

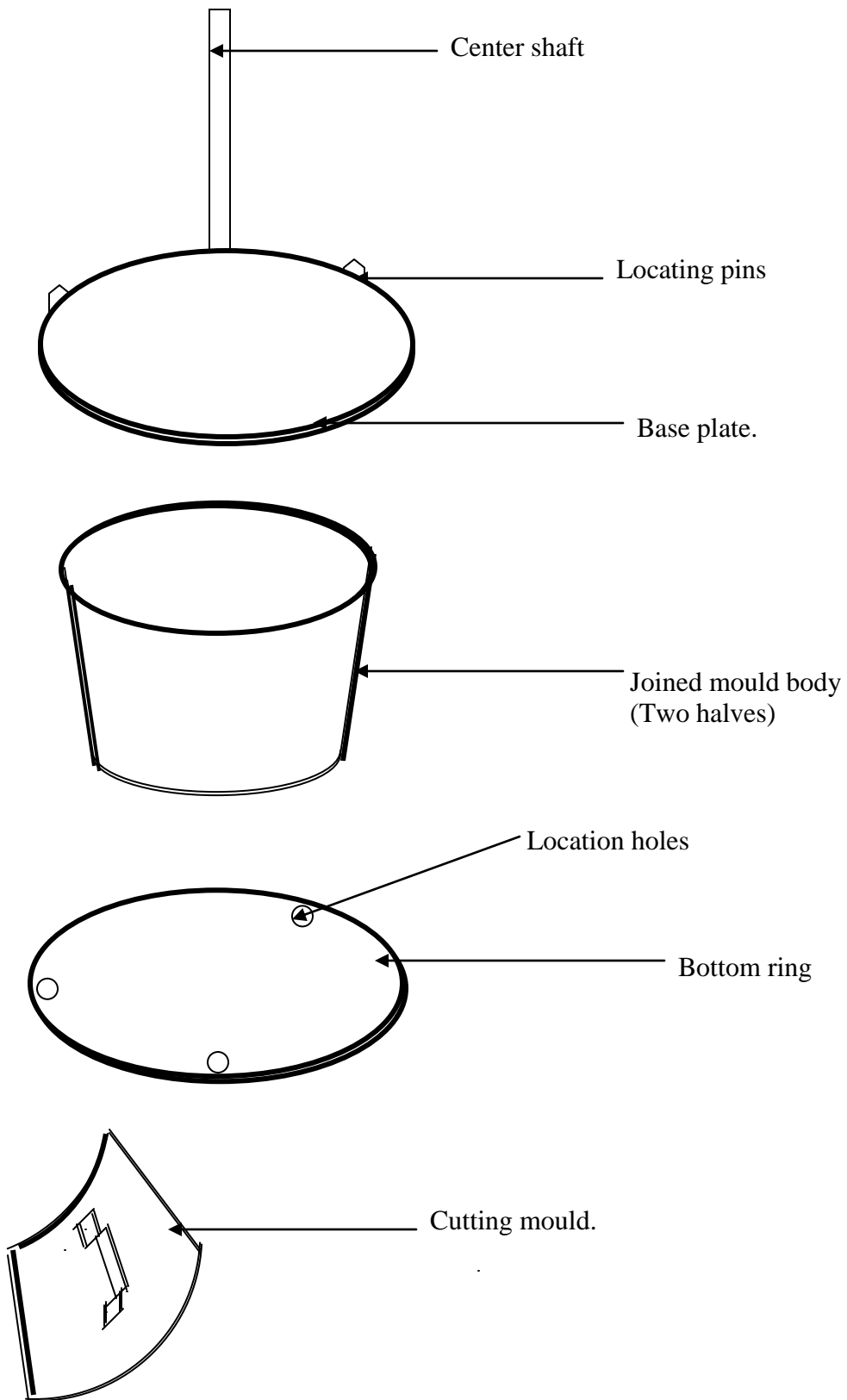
- 1) Take the sheet you have cut following the process above.
- 2) Place your calipers at the center of the circle at 150mm to get a smaller circle within this bigger circle
- 3) Note that the smaller circle will have a diameter of 300mm
- 4) You MUST give an allowance of 6mm which is also the thickness of the plate used in making the mould body, this means that the inside circle of the collar will now measure 306mm in DIA.
- 5) This means the collar will be 45mm all round

The drawing below gives a ketch of the how to cut a bottom collar.

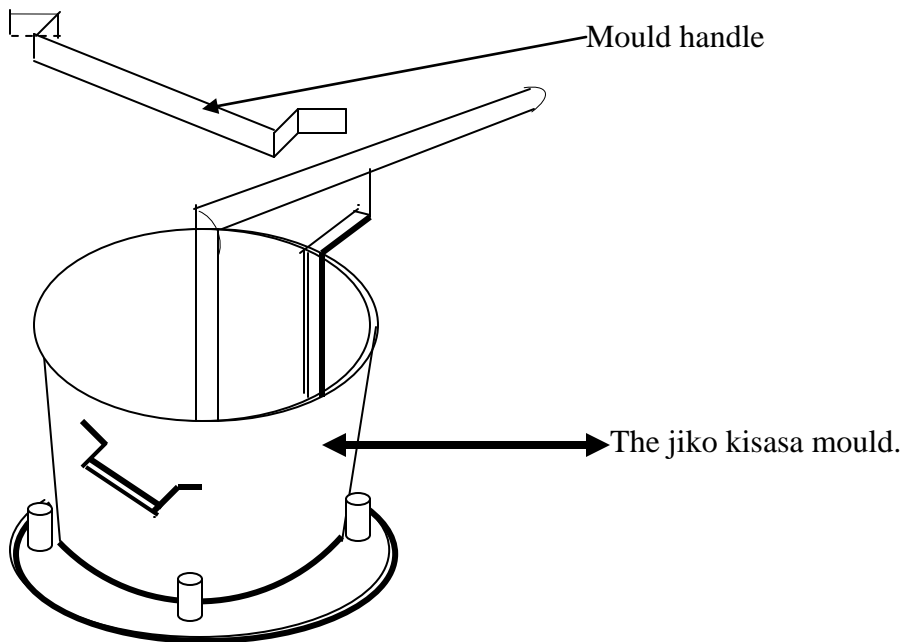
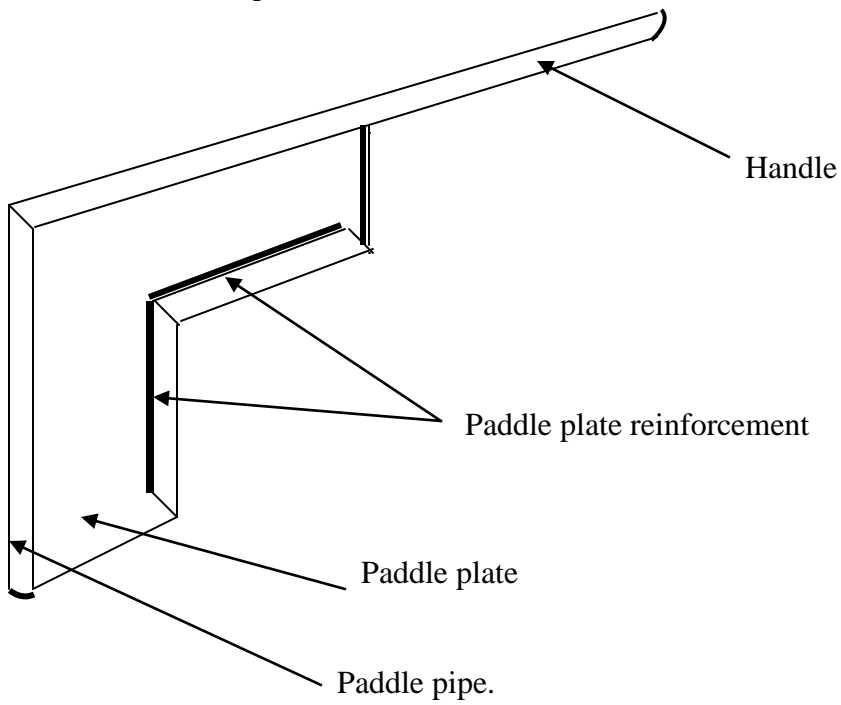


The location holes must be three put proposanly on the bottom collar.  
The location pins will also be three spot welded from the bottom on the bottom plate.





Paddle and Paddle parts.



The above diagram shows an assembled jiko kisasa mould. With all parts. Mount this on a stand and it is ready for production of jiko kisasa.



## **PICTORIAL INFORMATION**

Below are now the pictorial processes of making jiko kisasa mould. The pictures appear procedurally from the first to the last step.

**STEPS 1 – start folding the metal on a rail.**



**STEP 2 – continue folding as it takes the shape below**



**STEP 3 – Bring the shapes together and weld at the two joints**



**STEP 4 – continue welding as shown below until you join them permanently.**



**STEP 5 – weld the collar and mould body permanently. Insert the paddle web you have weld, do the grinding and finishing to make mould body smooth**



**STEP 6 – Mount the mould on a surface and use the already mixed clay to start testing the mould. Note: the ratio of mixing the clay is explained in the pages below.**



**STEP 7 – Insert the paddle on the center shaft and start moving the paddle clockwise around the mould.**



**STEP 8- Continue until you see the smooth product of Jiko kisasa. At this point, once the product is smooth and shaped satisfactorily, carry the mould body from the handle, remove it from the location pins and turn the mould upside down and the product will come out.**



## **MAKING CLAY.**

### **Important notes:**

Items and materials needed for mixing .clay.

#### **Materials:**

- 1) pottery clay
- 2) Sand
- 3) Ant hill
- 4) Water
- 5) Ash
- 6) polythine paper

#### **Process:**

- 1) Look for a quality pottery clay
- 2) Use fine sand
- 3) Fetch for a wet ant hill clay and
- 4) Get enough ash.

#### **Ratio;**

- 1) Take 3 gallons of black clay
- 2) Half gallon of sand
- 3) Half gallon of ant hill clay
- 4) Mix the above materials evenly and any particle.
- 5) Sprinkle the mixture with 1 gallon of water.
- 6) Cover the mixture with a polythine paper for 21 days
- 7) After 21 days, do the soaking using a piece of wood or your legs
- 8) Do thorough wedging and remove any particles from the clay.
- 9) The clay is ready for use.

**Note:** before you start the process of putting the clay of the mould, make sure you sprinkle enough Ash inside the mould; this will ease the removal of the products from the mould.

Alternatively, you can also buy the ready made mixture of clay from various potters who are selling the ready made clay. Remember, the quality of the clay will differ depending on the region where you buy it from.

## **TESTING OF THE MOULD AND PRODUCTION**

During testing of the mould some problems may be detected which must be rectified for the final product to be accurate. Below table shown some of the problems that may be seen during testing, the negative impact they may cause and the solution to such problems.

PROBLEMS	IMPACT ON PRODUCT	SOLUTION
Poor finishing of the mould and its parts	This brings unwanted marks on the final product hence poor quality	-proper grinding of the final product - smoothening and sandpapering and filing
Bend shape of the mould	This results to irregular shape of the final product	-Proper shaping and folding -accurate measurements and diagonals
Imbalanced center shaft	Poor shape on the either side of the final product in diameter	-hit the center shaft towards the bigger side of the mould -confirm the radius from the center shaft to the edge of the mould body until the shaft is right at the center.
Longer height on one side or the other of the mould.	This will bring difficulties in moving round the paddle during the process of making the product.	-make sure the height of the mould is the same all round from bottom. -grind accurately on the higher side until they become even at the top. - check the right measurements of the product you want to make and confirm with you mould measurements - make recommended corrections where advisable.
Product hard to remove from the mould.	This could result to final product breaking down or irregular shape coming up.	-apply enough ash inside the mould before you start putting clay. -ensure proper ratio during mixing of clay you want to use as already explained above.
Poor moisture and drying	This could lead to product cracking hence damaged product.	- avoid exposing the clay on direct sunlight.

In your final product make sure that the corrections are done to help you come up with a quality product according to specifications. After you are satisfied that the final product is good, apply the below final touches;

- 1) Use the Amerry cloth to sandpaper your final product.
- 2) Use a soft piece of cloth to wipe out any dust on the mould body.
- 3) Use a painting brush to apply a quality oil paint on your product.
- 4) Leave it to dry where there is enough moisture.
- 5) Once you are satisfied that your product has dried completely, it is ready for use and can be used in mould production.



**The final products of Jiko kisasa mould  
and Rocket stove mould.**

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