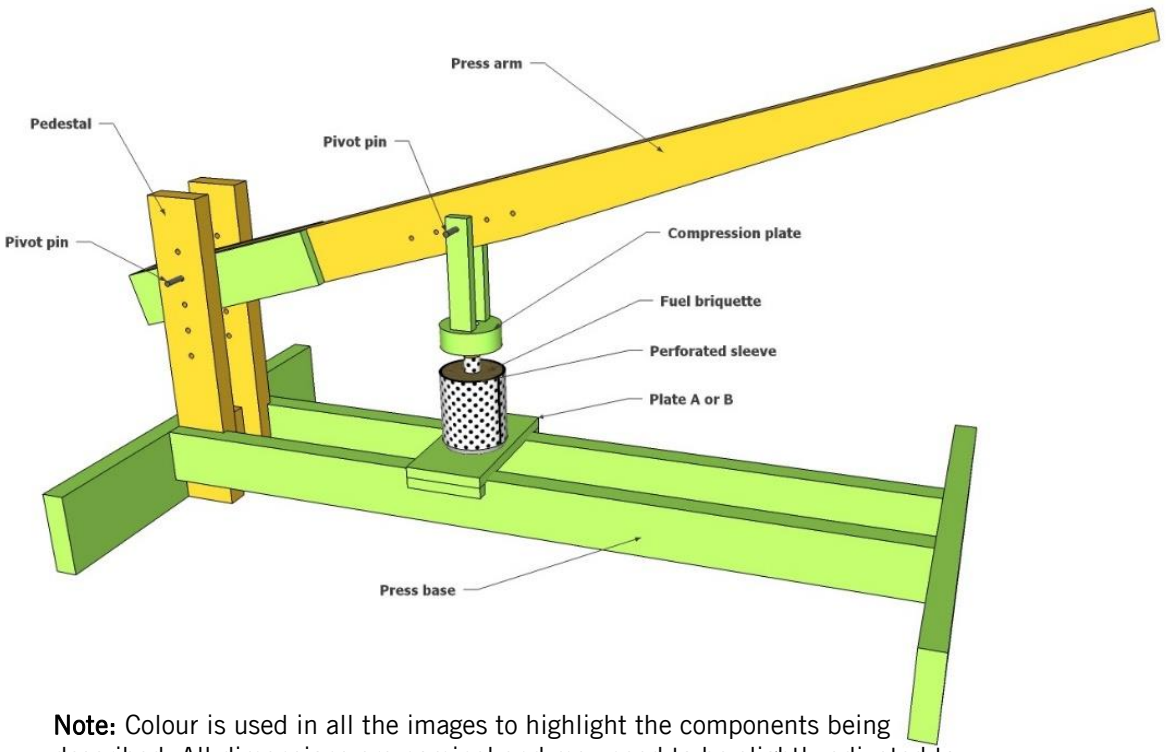
PRACTICAL ACTION
Technology challenging poverty

MAKING A MANUAL FUEL BRIQUETTE PRESS

technical brief

Fuel briquettes are a very useful source of fuel for cooking and heating. They are made out of various bio-degradable materials. Such as dried leaves, sawdust, old paper and cardboard. Using **fuel briquettes** can substantially cut down on the need for firewood. The regular use of fuel briquettes reduces deforestation and the amount of work and time required to collect firewood for domestic purposes.

This brief describes the process of making and using a **simple low-pressure manual press** for fuel briquette production. This press can also be used for other purposes, such as **vegetable oil extraction**. In this brief however we will concentrate on fuel briquette making only.



Note: Colour is used in all the images to highlight the components being described. All dimensions are nominal and may need to be slightly adjusted to achieve perfect fit among all parts.

The **manual press** consists of a **press base** and a fuel briquette **mould**. The **press base** consists of the **base** itself, a **pedestal** and a **press arm.** The latter two are linked through a metal **pivot pin.**

This set of components provides the forces required to squeeze and extract as much of the excess water as possible from the fuel briquette paste and to extract the **fuel briquette** at the end of the compression operation.

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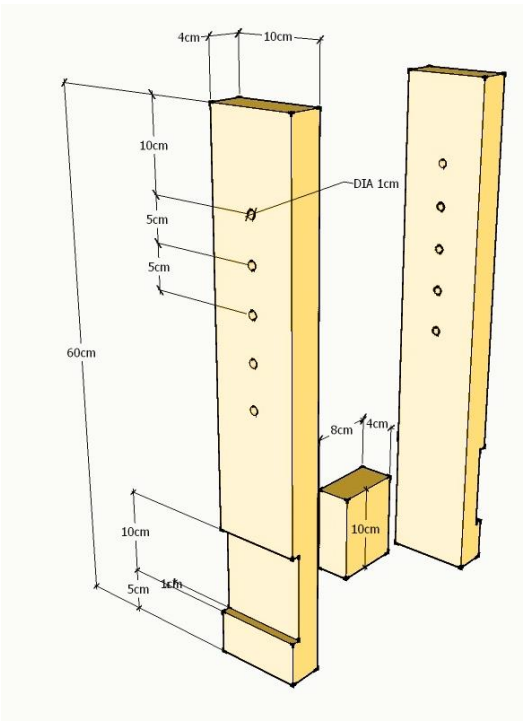
The briquette **mould** contains a few parts as shown in the image above. The **compression plate** that attaches to the press **arm** through a **pivot pin**, a PVC **perforated sleeve** and two **plates**, **A** and **B**, used to form the briquette (A) and to help extract it (B) from the mould.



The press pedestal

The press **pedestal** should be the first component to be built and assembled. Two **upright** pedestal pieces with the same dimensions and one **holding block** form the pedestal.

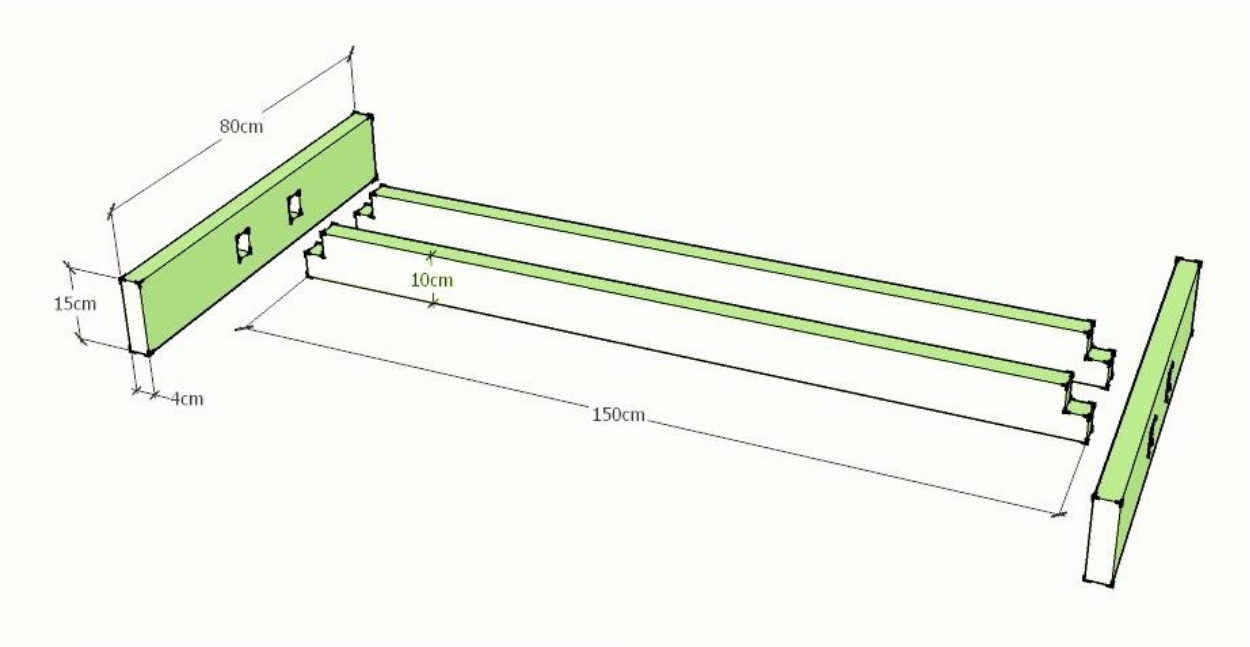
The small **holding block** between the two **upright** pieces is needed to ensure the required robustness of the whole pedestal.

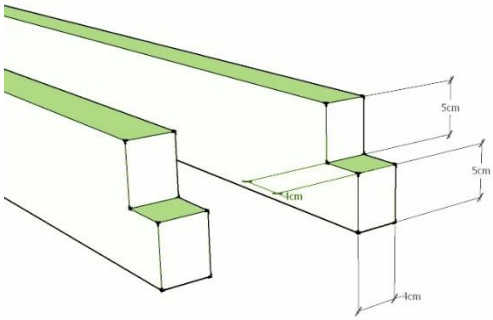
The notch at the bottom end of the two **uprights** will interlock with the base frame.

Holes are drilled to fit the **metal pin** used as a pivot for the press arm (not shown). A 25cm long piece of construction reinforced bar (**rebar**) 8mm or 10mm diameter can be used for this purpose.

The press base frame

The press **base frame** consists of two pairs of wooden pieces. Two 80cm **end pieces** and two 150cm **long pieces**.





These two 150cm **long pieces** should be notched on both ends as per the image on the left:

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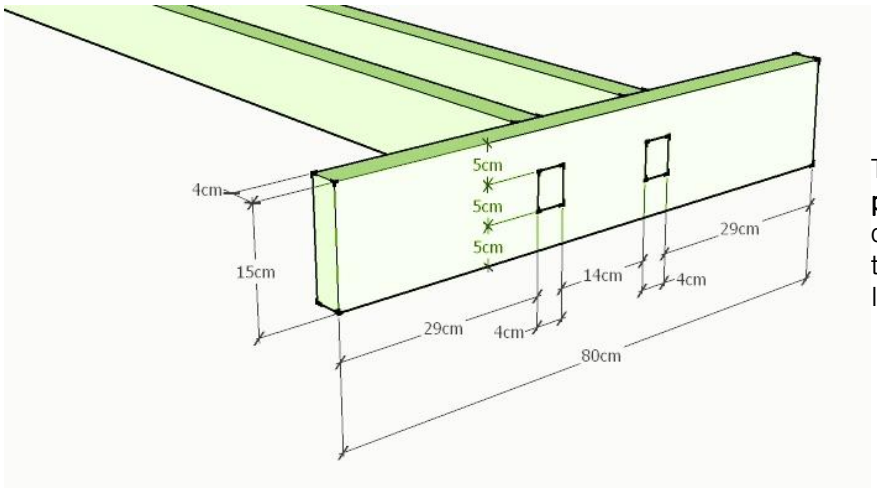
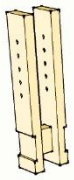


The two 80cm **end pieces** should be cut according to the image on the left:

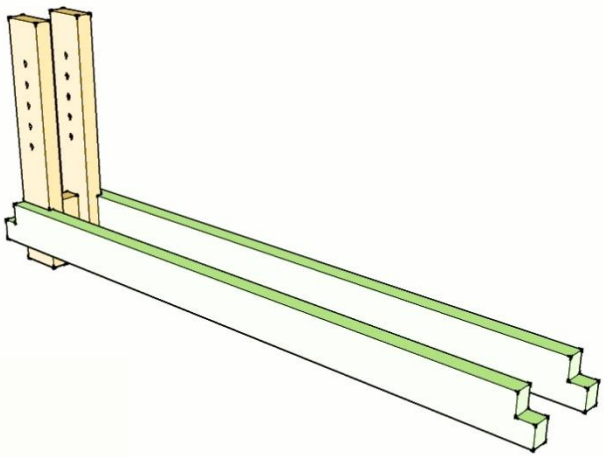
All pieces can be nailed together with 8cm nails. Holes for the nails should be pre-drilled to avoid splitting the wood.

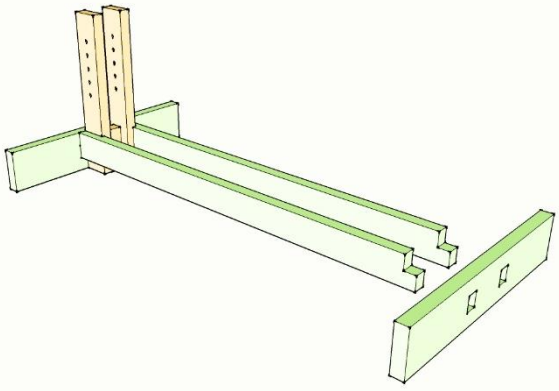
Assembly of the press base



The **pedestal** should be assembled first.

The two 150cm **long pieces** of the base frame should be inserted next…





… and finally the two 80cm base frame **end pieces** should be fitted and secured.

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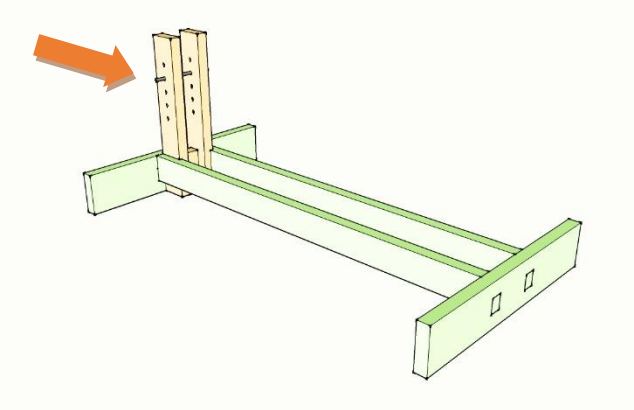
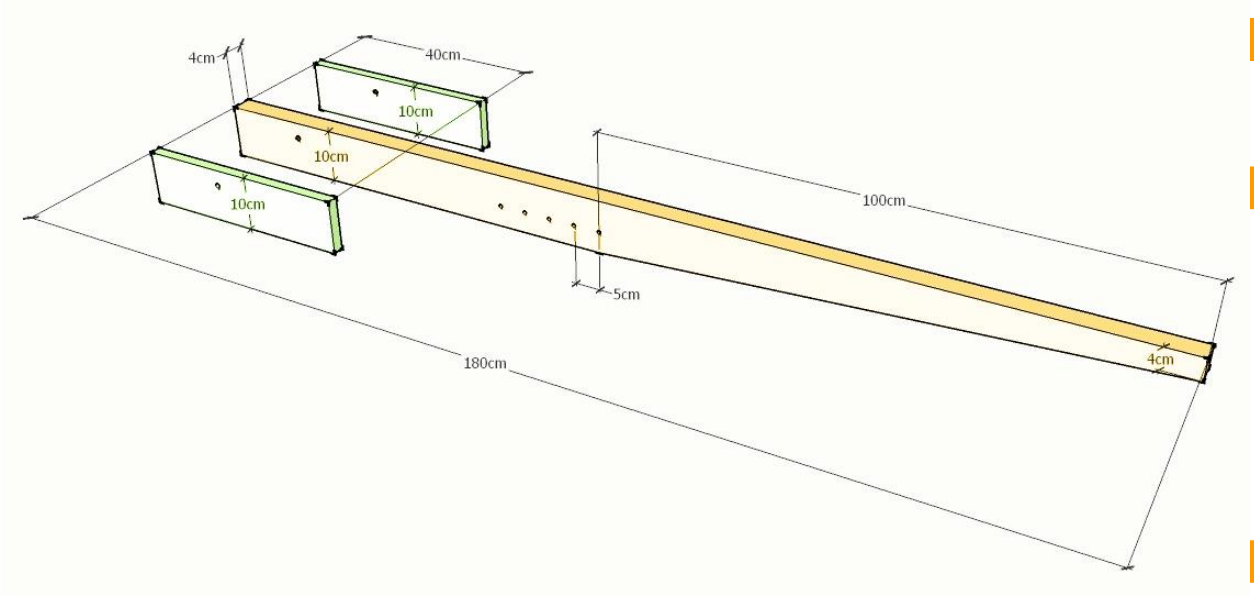
The 25cm rebar **metal pin** is shown inserted in one of the sets of holes on the **pedestal**.

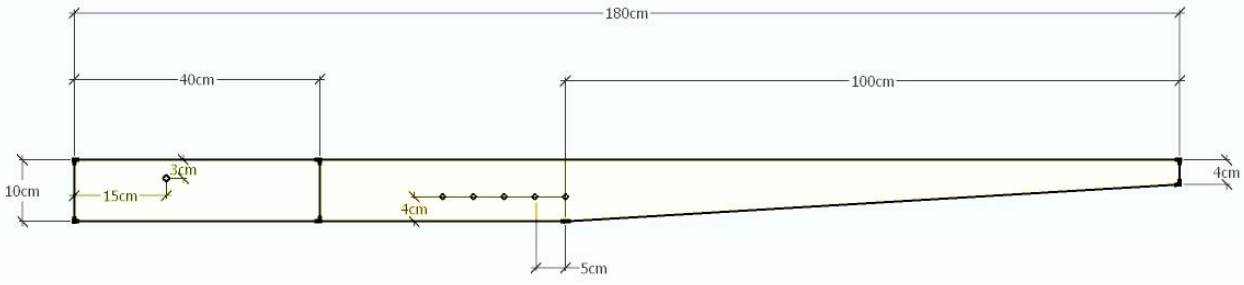


The press arm

The **press arm** consists of the 180cm **arm** itself (yellow) and two 40cm **reinforcement** pieces (green).



The **arm** is tapered on one end to make it easier to handle and to hold when the press is used. The holes for the metal pivot pins are not centred on purpose. This makes the arm more resilient to the pressure forces applied by the operator and the briquette mould on the pivoting points.



Detailed dimensions for the **press arm**.

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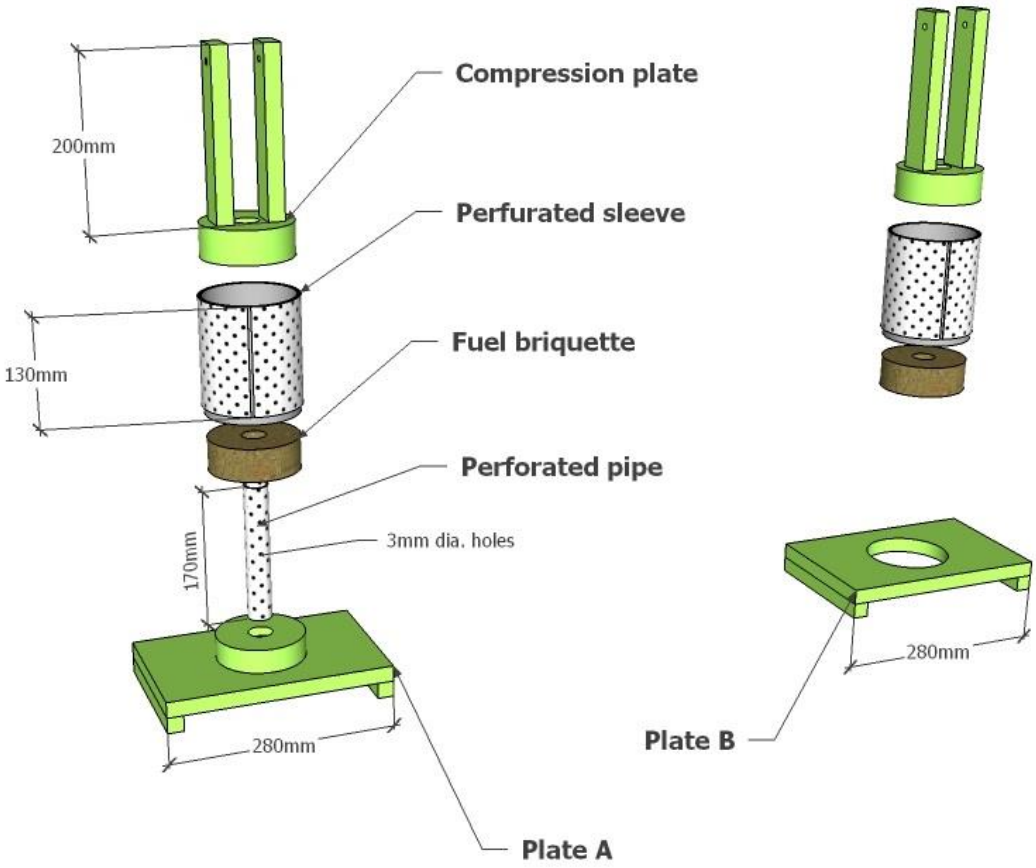
The briquette mould

The briquette **mould** has some wood components and some PVC components. The image will help to identify the various pieces.



There is a **compression plate** (green) that is attached to the press arm through a metal **pivot pin**. It applies force to the wet briquette material in order to squeeze out as much water as possible.

There is a **perforated sleeve** (white) made out of 110mm diameter, PVC pipe, 8mm wall thickness, and an associated 25mm diameter, PVC **perforated tube**, 2mm wall thickness. These two pieces form a chamber where the wet briquette raw material is inserted. As the briquette raw material is compressed the excess water pours out of the small holes.

Plate A (green) supports the filling in and the compression operations. **Plate B** (green) is used to extract the briquette that will be ready to be left out to dry. By applying force with the manual press the finished briquette will exit through the large hole in Plate B. The diameter of this hole should be as large as the inside diameter of the 110mm PVC pipe.

The **perforated sleeve** and **pipe** will be built first. This will allow us to adjust the diameters of the various other pieces so that they all fit snuggly but not tightly.

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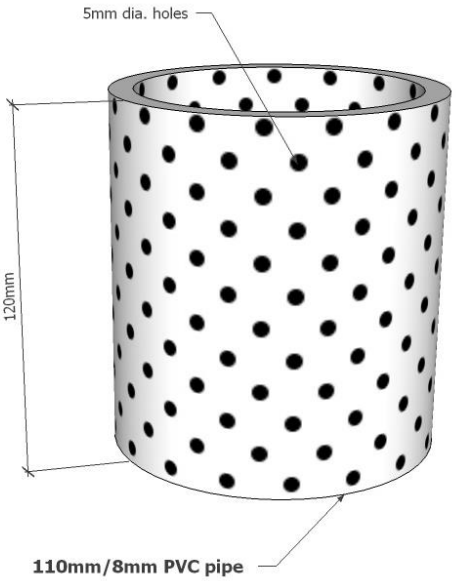
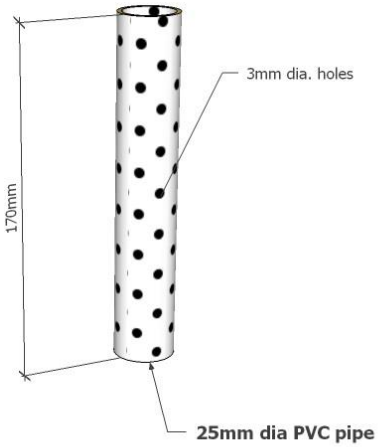
The perforated sleeve/pipe

The **perforated sleeve** is a 12cm long piece of 110mm PVC pipe with a wall thickness of 8mm to be strong enough for the desired purpose.

The 5mm diameter **drainage holes** are drilled in a checked pattern as shown and at about 2cm distance from each other.

These holes can be smaller than 5mm in diameter if the material to be compressed is of a small enough grain that it may start squeezing out of the holes.





The PVC **centre pipe** is made out of a 17cm long piece of 25mm PVC pipe. A 25mm PVC pipe has an outside diameter of about 32mm.

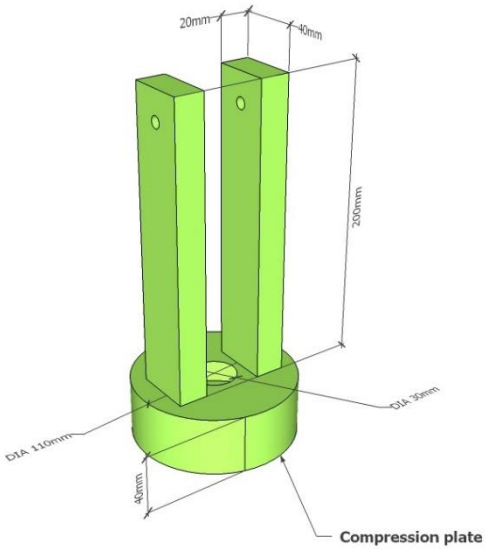
The drainage holes are 3mm in diameter and drilled every 2cm or so.

The compression plate

Follow the diagram to build a **compression plate**. Fix the pieces together with long screws or nails. Make sure you pre-drill all the parts to avoid splitting the wood.

The outside diameter (11cm) of the round plate must be adjusted so that it will fit snugly but not tightly inside the 110mm perforated PVC sleeve.

The inside hole diameter (3cm) will also have to be adjusted to fit snuggly **around** the 25mm **perforated** PVC pipe.



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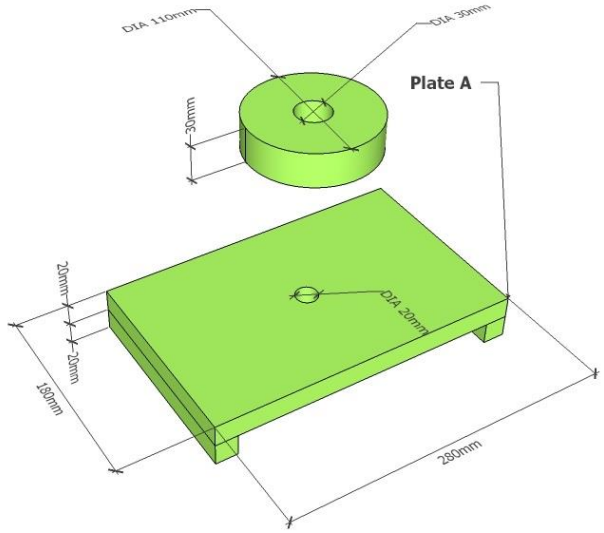


Plate A

The diagram to the left contains all the required dimensions for **Plate A**.

The outside diameter (11cm) of the **round disk** must be adjusted so that it will fit snugly but not tightly **inside** the 110mm **perforated** PVC **sleeve**.

The inside hole diameter (3cm) of this disk will also have to be adjusted to fit snuggly **around** the 25mm **perforated** PVC **pipe**.

A 2cm diameter drainage hole is drilled in the centre of the plate to drain all the water squeezing out of the perforate pipe.

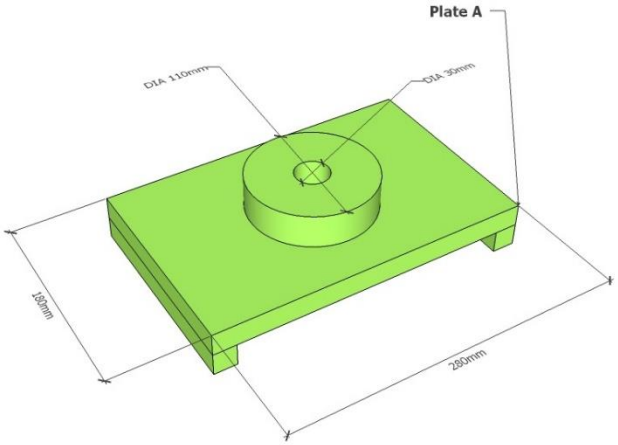


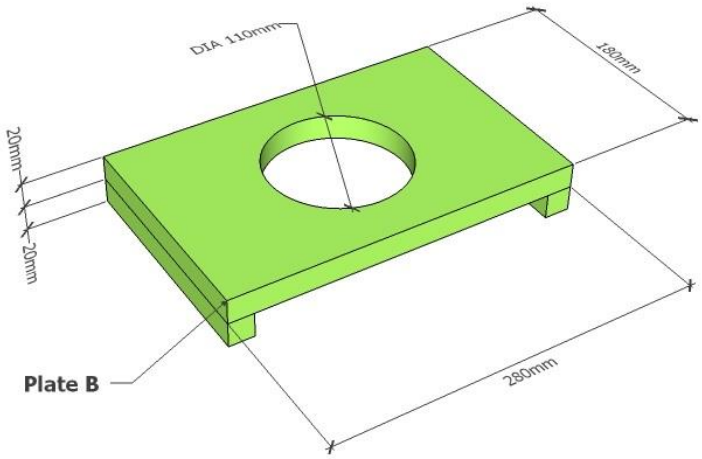
Plate A fully assembled.

Plate B

The diagram to the right contains all the required dimensions for

Plate B.
The (11cm) diameter of the round hole in the middle of the plate must be adjusted so that it will not let the 110mm **perforated** PVC **sleeve** slide through but will let the fuel briquette exit without damage..

It should however let the centring lip of the multi-layered PVC perforated sleeve (see next section) fit snuggly but not tightly.



technical brief

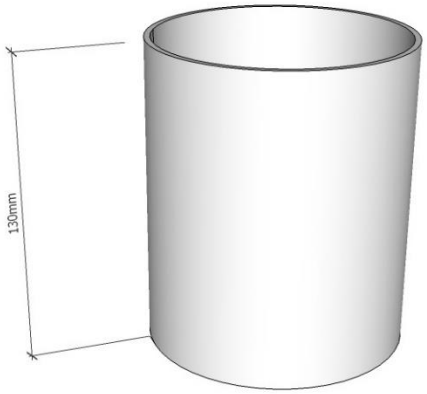
An alternative perforated sleeve

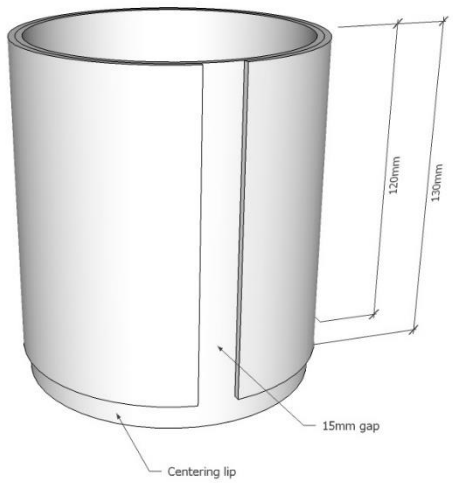
PVC sleeve made out of thin piping

The use of 110mm diameter, 8mm wall thickness, PVC piping, of the type used for underground applications, is recommended. When this is not available one may find 110mm pipe with a 2mm wall thickness as used for rainwater down pipes. This type of pipe is too thin to withstand the pressure forces required and one has to reinforce it to achieve a working **perforated sleeve**.

This is achieved by **layering** four (4) pipes over each other, **gluing** them together and perforating the whole thing after being glued as follows:

1. Cut the **first** sleeve with 13cm length out of a 110mm diameter, 2mm wall thickness, piece of PVC pipe,

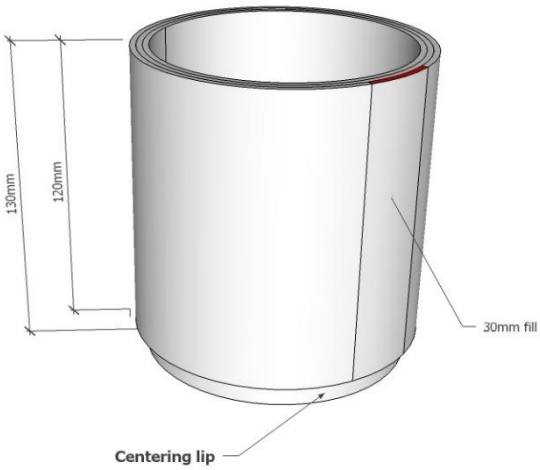




2. Cut a **second** sleeve with 12cm length, 1cm shorter than the first. Cut it lengthwise and glue it over the first sleeve with PVC glue. Make sure the **upper edges** are aligned. This sleeve will not go all the way around.

3. Cut a **third** sleeve, like the second, 12cm in length and cut it lengthwise. Glue it over the second sleeve with PVC glue.

This sleeve will not go around the whole way either. It will leave a gap, about 30mm wide (red in the image), which will be filled with a piece of the same PVC pipe like in the image above.



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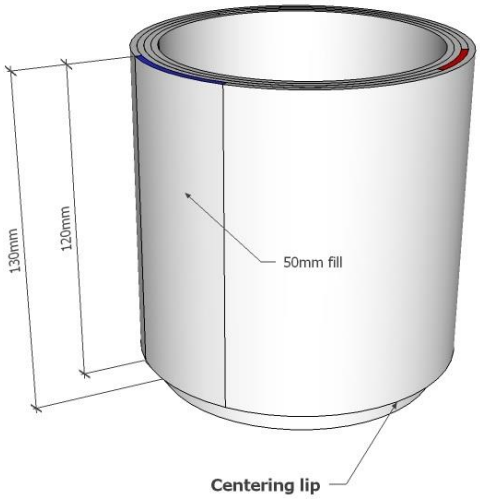
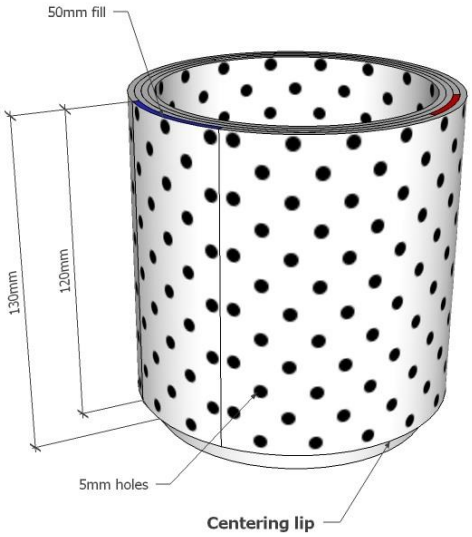


4. Cut a **fourth** sleeve, like the third, 12cm in length and cut it lengthwise. Glue it over the third sleeve with PVC glue.

This sleeve will not go around the whole way either. It will leave a gap, about 50mm wide (**blue** in the image to the left), which will be filled with a piece of the same PVC pipe like in the image to the left.



Now the **5mm drainage holes** will be drilled at regular intervals (about 2cm from each other) in a checked pattern as shown all around the thick portion of the completed sleeve.

Note that all layers align their top edges and that the **centring lip** of 1cm is left at the bottom.

This will be a strong sleeve made out of multiple layers of thin PVC pipe.

How to use the briquette press

Fuel briquettes for home use can be made out of a wide variety of local materials. From dried leaves, wood chips, sawdust, old newspaper and corrugated cardboard boxes. Paper and cardboard should be wet and shredded to mix well with the other materials. Plastic and non-bio-degradable materials must be avoided. They will emit toxic fumes when they burn. Briquette sizes can vary to some extent but one should consider what can fit in the existing stoves.

The fuel briquettes made during our workshop were made out of dried **banana leaves**, corrugated **cardboard**, old school **paper** and **sawdust**. The raw materials were soaked overnight in a bucket. By volume there was about as much water as there were other materials. The paste that was obtained was reasonable mouldable by hand and that is a good consistency.

This paste is then placed in the briquette **mould** and pressed to extract as much water as possible. The pressure depends on how strong one is and how strong the press is. In our workshop we had a 65kg man putting his whole weight at the end of the press arm. This translated into about 200kg pressure onto the press mould. The briquette pressing and removal operations usually need **two people**.

One person holding the briquette **mould** and guiding the **compression plate** action…

… and the other person pressing on the **press arm**.

Once the best possible result in **extracting water** from the briquette paste is reached the following steps are needed to extract the newly made fuel briquette (see images above):

1. One person holds the **mould** and the other pulls the **press arm up**,
2. Hold the briquette **mould** and remove the **perforated tube**,
3. Remove **Plate A** and insert **Plate B** under the briquette mould,
4. Push on the press arm until the **briquette** comes out of the bottom of Plate B.

The newly made briquettes are still wet but should be easily handled without breaking apart. Place them in a dry and warm place where they can dry completely. Once completely dry they can be used as fuel for cooking or heating.

Regular maintenance

The wood used to build the briquette press will get wet and will have to dry. A lot of water comes out of the mould during briquette fabrication and this should drain out and away from the work area. Because there are a lot of great forces applied to the arm and the briquette mould one should regularly check for fractures or potential failures.

Notes

Pipe dimensions and sizes may vary from country to country and need to be checked. Sometimes **pipe sizes** refer to the **inside diameter** (**ID**) and sometimes they refer to the **outside diameter** (**OD**). Check to be sure.

In this Technical note it was assumed that a 25mm PVC pipe has an **outside diameter** (**OD**) of 30mm to 32mm and a 110mm PVC pipe has an **outside diameter** (**OD**) of 110mm.

technical brief

References and resources

- https://3dwarehouse.sketchup.com/model.html?id=ufd7539d5-4030-4351-8cfa-883d2d60621e
- https://3dwarehouse.sketchup.com/model.html?id=ufbfb3ca5-288e-4aca-b6be-1f4e842aaed5
- http://haburas.org/make%20briquettes.pdf
- http://www.villagevolunteers.org/wp-content/uploads/2011/06/Fuel-Briquettes-Guide.pdf
- http://www.naturalbuildingblog.com/free-heat-for-your-home-homemade-briquettes-and-logs/sample-briquettes/
- http://www.nation.co.ke/counties/Firewood-kills-14300-Kenyan-women-a-year/-/1107872/2698000/-/fm85pz/-/index.html

Manual press for fuel briquettes was written by Nando Aidos, a volunteer with the Project Mais Valia (More Value). All images were created by the author. A detailed 3D drawing is available on *3D Warehouse* under the author's name. This project has been sponsored by the Calouste Gulbenkian Foundation in Portugal, which finances senior volunteers to travel and work with NGO's for development that work in Portuguese speaking African countries.

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