Roquetinho

Roquetinho is an application of the Batch Rocket design, that has proven to be outstanding efficient and incredibly clean. Initially it was meant for Portugal, where wood burning is a common form of space heating but technology is poor – with many inefficient and dirty wood burning appliances.
But also in other countries the Roquetinho design is very well applicable. It is relatively simple, cheap, and very efficient. The hope is to make Batch Rocket technology available to as many people as possible and for the lowest possible price.

The improved version:

The 2023 version is somewhat larger and more powerful. The riser is now constructed from 230 x 114 x 57 mm insulating firebricks, thus making it much easier to build. Concrete tiles as you find them everywhere in gardens are used to construct the bell. See the renewed *Building description* page.

Also see this video on YouTube. Download this website as a pdf here.

Update 2024:
The firebox sits now flush with the front of the bell and is a little easier to build. The door and frame have been adapted, and also the air inlet has been improved.

The stove

Power output: 3 to 4 kW.
System size: 115 mm (4,5”). Depending on insulation, the Roquetinho can heat a room from 20 to 35 m2.
In larger rooms it can serve as main heating: e.g. in combination with an existing central heating system.

Dimensions:
60 x 60 x 173 cm

Weight: about 530 kg

The core stove is made of refractory bricks. Concrete tiles are used for the stove’s casing; the top two layers are made of fire concrete. The top is a 6 mm thick steel plate, and the door is made out of 4 mm thick steel, having a refractory glass window of 175 x 220 mm.

Fuel: any well dried wood, cut in logs of max. 30 cm length. One *batch* is between 1,5 and 3 kg.

Testrun of the first prototype *at Casal do Abade, Portugal, Febr 13 2017*

Open in YouTube

It’s quite an impressive view - the extremely strong draft pulling the flames into the riser, together with the roaring sound!
Temperature can go up to almost 1200º C.

Rocket Stove, Batch Rocket, Roquetinho

In the 1980's, when the Rocket Stove was invented, it was a cooker that was very easy and cheap to build, needing very little wood to get water cooking and producing hardly any smoke. It went all over the world, and from that time many people started to think about how they could use this simple but genius technique not only to cook, but also to heat spaces.

Much of this development was published on the Rocket Stove Forum *donkey32.proboards.com* where a lot of people delivered contributions. In 2012 Lasse Holmes from Alaska started an experiment - a rocketstove with a "horizontal feed". Peter van den Berg took that concept further, developing and optimizing. At the end of 2012 he was rewarded for his dedication: he had found the right dimensions, and even he himself was amazed about how good it worked. No valves, ventilators or whatever. Just bricks and natural principles in an optimized configuration resulted in the high efficient and super clean woodstove that was then called the "Batch box rocket".

By now, many Batch rocket applications have been build. Mainly as “mass heaters” - making it very heavy, so heat is stored in the bricks, gradually releasing it to the space.

For Portugal’s climate, we thought, it would be better to have a “fast stove”: having the concrete casing only 5 cm thick, and with a steel top. Already within an hour it heats up the room (initially by convection). After an hour the stove will radiate another 3 - 4 hours. Other than with a mass heater, at that point you can decide whether or not you light another batch of wood.

Building description

In this description you can learn step-by-step how to make your own Roquetinho. All you need is some basic do-it-yourself skills, and for the metal work (someone with) welding skills. Material costs will be between 400 and 500 euro.

Roquetinho outline

Roquetinho is…

The visible part of the stove (the casing or *bell*) is made of concrete tiles, such as those often sold for garden paving (60 x 40 x 5 cm). Also second-hand ones can be used. The top two layers are made of refractory concrete. The top is an 6 mm thick steel plate. The bell absorbs the heat produced and gradually releases it into the room.

On the inside you'll find the rocket burner (the *core*) in which the combustion takes place. The core consists of a *firebox* made of hard refractory bricks, and a *riser*: a vertical channel made of refractory insulating bricks. In this riser, two whirlpools of fire (*double vortex*) are created, in which the wood gases are afterburned at very high temperatures.

Archive

In the archive you can find older versions of the Roquetinho.

And here's the SketchUp files for the 2023 model, the one this description is about. The folder contains the file of the stove, as well as seperate 3D files for the core, the secondary air duct and the frame & door unit.

Step 1 Preliminary considerations, tools, materials

Before getting started with the stove it's important to check a few things: the supporting floor needs to be strong enough for the 530 kg stove, the chimney should be okay, and volume and insulation of the space to be heated should be in such a way the Roquetinho can do the job. Read more...

Step 2 Casting and cutting concrete. Working with refractory concrete

It's practical to use plastic coated chipboards as a bottom for the moulds, since they are already waterproof and don't need to be painted. Saw the laths that form the mould and fix them on the bottom with screws (not with glue). Paint the laths (2 layers). When the paint has dried, fill the inside brims with a bit of acrylic sealant. Read more...

Step 3 Base layer, bottom slab, firebox and riser

From the opening in the ceiling through which the flue goes, draw a plumb line to the floor. At 42 cm to the left and 18 cm to the right of that point, draw a line. The first two 40 x 60 cm concrete tiles will be placed between these two lines. Read more...

Step 4 First layer of the bell. Placing the core

The top of the first layer of the bell should be exactly level with the firebox. In the SketchUp drawing, that first layer is 356 mm (including the glue). The firebox is 353 mm with 3 mm underneath for the strips of clay on which it will be placed. Read more…

Step 5 Construction of the bell

From the second layer, the corners are not only glued, but also additionally secured with a screw. For this, holes with a diameter of 6 mm are drilled on the longer parts, 25 mm from the side. Read more…

Step 6 Metalwork: floorchannel, frame and door unit, top plate

The dimensions of the floorchannel and the frame and door unit assume a core with outside dimensions of 220 x 353 x 570 mm. If these dimensions differ you need to adapt the figures. Read more...

Step 7 Assembly

You fix the frame with cob. Working with cob is really different from working with cement. Try it out first; the cob shouldn't be too dry or too wet. When applying, ensure you make an uninterrupted "roll"; there should be no gaps in it. Read more…

Step 1 Preliminary considerations, tools, materials

Before getting started with the stove it's important to check a few things: the supporting floor needs to be strong enough for the 530 kg stove, the chimney should be okay, and volume and insulation of the space to be heated should be in such a way the Roquetinho can do the job.
It is mainly a radiant heater and for that it should ideally be placed in the middle of the room. Often, however, placement against a wall will be chosen. In that case, it can be a great advantage if it concerns an interior wall that thus gets an accumulating function: both for the space to be heated and for the space next to it.

When placed against a wall, the distance to that wall must be at least 22 cm. And furthermore: a separate air supply is not necessary, but the ventilation of the room must be sufficient.

Foundation

A wooden floor does not have the strength needed to support the Roquetinho. A foundation is then a necessity. Most obvious is from the bottom under the floor. Sometimes it is possible to insert steel beams into the wall. This must be done by a professional!

Chimney

The flue must be at least 4 meters high, calculated from the outlet of the stove. Inside the room a singular inox tube of Ø 120 mm will do. Up from 30 cm below the ceiling it then changes into a double-walled flue pipe. The regulations for wood-burning stoves also apply to the Roquetinho: such as having the top of the flue above of the roof.

Tools

Vibration table

To cast forms out of refractory concrete, you need a (simple) vibration table. As soon as the concrete mixture goes into the mould, it must be vibrated to compact the material and force the air bubbles out.

Here you see a simple vibration table that you can put on a Workmate. A thick plywood board of 40x60 cm is attached to two 40 cm beams by four springs that you fasten with nuts and bolts. A 60 cm beam, attached to the two 40 cm beams, is clamped into the workmate. To stabilize the workmate you place 2 concrete tiles on it. On the side of the plywood plate you fix a thick metal plate, against which you hold the hammerdrill to vibrate. Fasten the mould to the top board with clamps. Make sure it is level.

Vibration is much easier when using a vibration motor. The firecrete mixture only has a short open time, so it saves a lot of stress if you don't have to shake it by hand. A simple 50 watt vibration motor is sufficient for this purpose. You screw it to the bottom of the vibrating plate, see the picture. Also see this YouTube video.

Other tools you need:

to grind / saw blocks and concrete:

- grinder
- diamond circular saw
- half or full face mask
- safety glasses
- clamps
- workmate
- ruler, tape measure, pencil

to make moulds:

- saw table
- saw
- drill
- tape measure
- screwdriver
- paint brush
- sandpaper

for the metalwork:

- metal cutter
- tig welding machine
- grinder
- drill press
- clamps

for gluing / bricklaying:

- trowel
- putty knife
- glue spreader
- bucket or tub
- level
- carpenter's square
- 2 clamps of 80 cm
- 1 clamp of 100 cm

List of materials

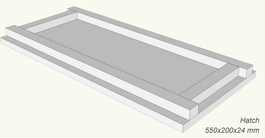
- aluminum cement (1 bag of 25 kg)
- chamotte granules (3 bags of 25 kg)
- refractory insulation bricks 230x114x64 mm, e.g. *ThermAll type-26*
- firebricks 220x110x30 mm for the firebox
- firebricks 220x110x60 mm for the firebox
- refractory glue (for example Moviset)
- cement glue (tile glue)
- concrete tiles 60x40x5 cm
- portland cement
- builders sand, fine gravel
- clay powder and fine sand to make cob
- ceramic insulation blanket 200 x 61 x 1.2 cm, for example Superwool
- refractory glass 220 x 175 x 4 mm
- fireproof glasstape 5 x 2 mm
- fire cord 10 mm and 5 mm
- 1 m. square steel tube for floorchannel (30 x 30 x 2 mm)
- 3 m. steel L-profile (40 x 40 x 4 mm) for door and frame
- 3 m. steel L-profile (25 x 25 x 3 mm) for the top of the bell
- 1.5 m. steel U-profile (10 x 10 x 1,5 mm) for the door
- steel plate (550 x 550 x 6 mm) for the top of the bell
- steel plate ± 180 x 170 x 4 mm for door and floorchannel
- steel plate ± 33 x 170 x 6 mm for lock
- some small pieces of steel plate of 1 and 2 mm
- laths, battens, beams, sheet of plywood for transport, etc.

Step 2 Casting and cutting concrete. Working with refractory concrete

Casting concrete

Making the moulds

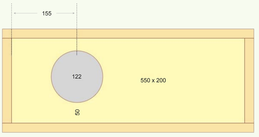
It's practical to use plastic coated chipboards as a bottom for the moulds, as they are already waterproof and don't need to be painted. Saw the laths that form the mould and fix them to the bottom with screws (not with glue). Paint the laths (2 layers). When the paint has dried, fill the inside brims with a bit of acrylic sealant.
If you use the mould again, first clean it well and fill the brims again.



Hatch 550x200x24 mm

Casts

There are two moulds to be cast: the hatch that closes the bottom of the stove, and the exhaust piece: the block with the opening for the flue pipe. Mixing ratio of the concrete is 1 portland cement : 2 sand : 3 fine gravel.



Exhaust block
550x200x50 mm with a Ø 122 mm opening for the flue pipe

The hatch is only 24 mm thick, so wait at least 5 days before demoulding.

To be sure the flue pipe will comfortably fit in, the exhaust piece has a cut-out of 122 mm: 2 mm larger than the flue pipe.
You can use the flue pipe as a shape for the opening. Cut a strip of plastic and wrap it around the end a few times. To hold the tube in place you tighten 4 screws into the mould. See the pictures.

Before casting, grease the mould well with oil to prevent the cured casting from sticking to the mould.
After pouring in the concrete, vibrate it by tapping the mould with a hammer for a few minutes. While curing, cover the mould with a piece of plastic. Even after demoulding, keep the castings in plastic to prevent evaporation. Concrete hardens through the reaction with water, and that's only completed after 28 days.

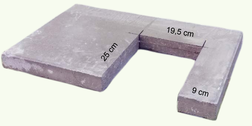
Saw concrete

Cutting the blocks and tiles to size can be done with an angle grinder, but it's much better and more precise with a water-cooled diamond circular saw.

Mark clearly and use a guide bar. With a 125 mm diamond blade you saw through a concrete tile in six passes: approximately 9 mm depth per pass.

The first two tiles, for the base layer, are 48 x 20 x 5 cm. First saw 6 cm from the short sides (see photo above), and then saw the tile in half.

The bottom slab of the stove, which will be laid on top of the base layer, consists of a whole and a half tile. There's a cut-out of 25 x 19.5 cm, 9 cm from the short side.



The blocks for the bell are 60 x 20 x 5 cm (a tile in half lengthwise) and 50 x 20 x 5 cm. For the latter, first saw off 5 cm from the short sides, and then cut the tile in half lengthwise.

Handling fire concrete

Working with fire concrete is very different from working with normal concrete. Things like temperature, amount of water to be added and the open time for handling come very exact. Mixing and vibrating are skills to be learned by experience; if you are doing this for the first time it's wise to try it out with a small amount first.

Temperature

To process the material well, the concrete as well as the water to be added need to have a temperature between 10 - 20º Celsius. The very minimum is 7ºC. Exceeding 20ºC the curing process will be substantially faster. There may be too little time then to process the mixture well.

Water

Use good quality drinking water of 10º - 20º C temperature. From the product information sheet, calculate the exact amount of water to be added. Note that this can be very different per product! Do not exceed the maximum amount as indicated on the product sheet.

Mould

Before putting the concrete into the mould, the inside of the mould needs to be thoroughly greased with oil, otherwise the concrete would be fixed to the mould after curing.

Mixing

Definitely use a dust mask to prevent breathing cement dust. Generally the concrete is shipped in sacs as a dry mix, needing only water to be added. For the bell of the Roquetinho you can very well use home-mixed fire concrete: one part aluminum cement to three parts chamotte granules.
Weigh the amount of concrete you need and put it in a bowl. Add the measured amount of water and mix thoroughly with a trowel. Mixing time shouldn't exceed 3 minutes. You now have an earth-humid material that immediately needs to be shoveled into the mould.

Applying

Fill up the mould and start vibrating. After some minutes of shaking the concrete will get more fluid and air bubbles will move out. With a putty knife, push the concrete into the corners. If needed, add more concrete into the mould. Vibrating time shouldn't be too short, but certainly not too long: that would cause demixing. Water on top of the mixture is an indication of demixing. This should be prevented.

Hardening

The concrete hardens by a chemical reaction between the aluminium cement and the water. This may produce heat. Directly after vibrating, cover the mould with a piece of plastic to prevent evaporation of the water. At 15 - 20ºC, hardening will take about 6 -8 hours. 80% of its strength is then attained (after ± 2 weeks the concrete has fully completed hardening). At lower temperatures of working space and/or material hardening will take longer. Before demoulding check if the concrete has hardened well. To demould, take off one side of the mould and tap the form out.

too much airbubbles

this is okay

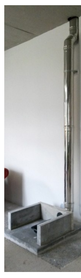
Two moulds for fire concrete parts

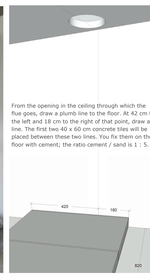
Inside dimensions: 600 x 200 x 50 mm (lxwxh). Short parts: 500 x 200 x 50.

As mentioned, it is definitely wise to first do a test with a small amount of fire concrete. Also because of the high purchase price of fire concrete, it would be a shame if a large form failed.
It's a matter of trying it out to find the right quantities and proportions. Too much water results in reduced quality of the fire concrete, too little makes vibration very difficult. As an indication: for the longer parts 10 kg (2.5 kg aluminum cement on 7.5 kg chamotte) with 1.7 liters of water, and for the shorter parts 8.3 kg (2 kg aluminum cement on 6.3 kg chamotte) with 1.4 liters of water.

Step 3 Base layer, bottom slab, firebox and riser

Location of the stove

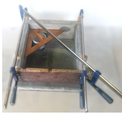


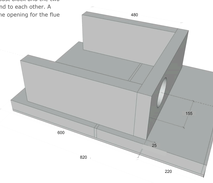


From the opening in the ceiling through which the flue goes, draw a plumb line to the floor. At 42 cm to the left and 18 cm to the right of that point, draw a line. The first two 40 x 60 cm concrete tiles will be placed between these two lines. You fix them on the floor with cement; the ratio cement / sand is 1 : 5.

Base layer

At 220 mm from the wall, glue the exhaust block and the two 480 x 200 mm pieces to the two tiles and to each other. A space of 25 mm is left on both sides. The opening for the flue pipe is now exactly in the right place. Use a carpenter's square and make sure it's level. With clamps you press the parts against each other. If necessary, correct with a clamp (see photo).





Spout

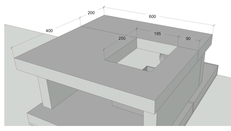
Condensate tray

During the first heating period, condensation will come out of the flue. To collect this, place a (baking) tray under the opening. A spout ensures that the water flows smoothly into the tray. For example, you cut it out of a tin can.

Condensate tray

Bottom slab

Glue the two parts of the bottom slab together; at the same time you lay the whole on the base layer, using cement mortar (1:5). It's important that the top is flat and level.



The firebox

It's best to build the firebox on a sturdy work table. First, make a transport board from a piece of 18 mm plywood or other sturdy plate with which you can transport the core. Fix a batten on both sides, in such a way the bottom bricks just fit in between.

About gluing with Moviset

You are going to glue the core together with Moviset or a similar refractory glue. Open the Moviset bucket and pour off the covering liquid. Stir well until it has the same consistency throughout. Add a little of the poured-off liquid if necessary. When you're done gluing, cover the remaining glue with a layer of water before putting the lid on.

The parts to be glued should be thinly but completely smeared on both sides, about half a millimeter thick. At 15° Celsius, the glue has hardened after about 24 hours. It takes much longer at lower temperatures.

1. Transport board with bottom bricks *2. Walls* *3. Top bricks, port, 45° bricks*

Bottom bricks

This building description assumes firebricks with measurements 220 x 110 x 30 mm and 220 x 110 x 60 mm.

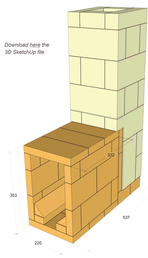
The front three bricks have a height of 30 mm, the rear two are 60 mm high. Measure the length of the five bricks including the 1 mm space for the glue, and shorten the fifth brick to obtain a total bottom length of 537 mm.

Gluing the firebox

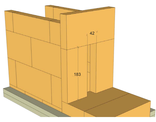
Butter the bottom bricks with glue and place them on the transport board. Using a large clamp, carefully apply pressure across the bricks until the glue begins to squeeze out. Make sure the bricks are level. Let it dry.

Now cut bricks for the walls of the firebox, in such a way they fit on the three bottom bricks (332 mm). You adjust the top layer in such a way that the total height of bottom bricks, walls and top bricks is 353 mm.

Download here the 3D SketchUp file

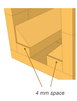


Next is adding the port bricks.



If the bricks are exactly 220 x 110 mm, the vertical port bricks will be 183 x 90 mm, as drawn in the SketchUp file. But if the bricks are slightly larger or smaller, those sizes must be adjusted. The most important thing is that the port opening will be 183 x 42 mm.

The vertical port bricks are glued to the 4th bottom brick, as well as to the walls. On top of them you glue the horizontal port brick. Make sure everything is flat, square and level.

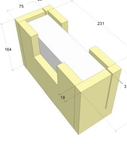


4 mm space

Next glue the top bricks in place, see the picture. On the inside of the firebox, glue on 30 x 48 mm cut bricks. They form the 61 x 30 mm slot that accepts the secundary air duct. The 45° chamfered bricks are glued on top of them. Fill any gaps with glue.

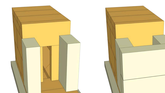
At the front, 4 mm of space is kept open for the metal plate that sits at the front of the floorchannel.

The riser: cutting and gluing insulation bricks

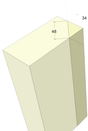


Saw guide

The insulation bricks are 64 mm wide, which should be reduced to 57 mm. You can easily saw them with a handsaw with hardened points, but sawing a narrow slice is difficult. Then a saw guide offers a solution. Make it out of timber, see the drawing.



Glue the first two (upright) bricks on either side of the port, spaced 115 mm apart (the width of a brick + 1 mm for the glue). Then the two horizontal bricks. If all goes well, the tops are flush.

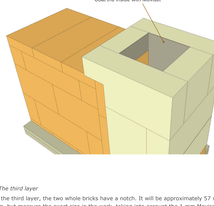


Triangular strips

Take a brick and draw a line 34 mm on either side of a corner. Draw the diagonal line at the short end and saw the brick lengthwise (see drawing). Do this at another corner as well.
You now have two triangular strips that will be glued to the inside of the riser (see drawing).

Now coat the inside of the insulation bricks with a thin layer of Moviset.

Coat the inside with Moviset



The third layer

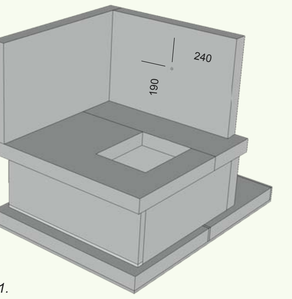
Of the third layer, the two whole bricks have a notch. It will be approximately 57 x 59 mm, but measure the exact size in the work, taking into account the 1 mm Moviset. A brick cut exactly in the middle completes the layer. The inside of the front half-brick is flush with the port.

Coat the inside of the layer with Moviset.

The upper part

You can already glue the upper part of the riser together. Coat the inside of each layer again with Moviset. Only later in the building process the upper part is put on top of the bottom part.

Step 4 First layer of the bell. Placing the core



1.

Bell: the first layer

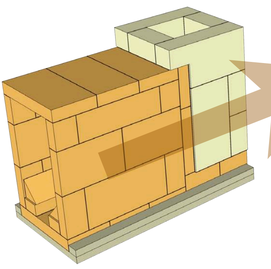
The top of the first layer of the bell should be exactly level with the firebox. In the SketchUp drawing, that first layer is 356 mm (including the glue). The firebox is 353 mm, with 3 mm underneath for the strips of clay on which it will be placed.
If the height of the firebox differs slightly, adjust the size of the concrete tiles.

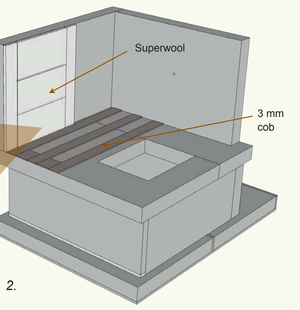
Drill a hole of Ø 8 mm and about 25 mm deep in the rear tile, at 240 mm from the right side and at 190 mm from the bottom (fig 1). You do the same on the inside of the front tile.

Now glue the left tile and the back tile in place. The rough side of the tiles is on the outside. Use clamps again to compress the parts. Make sure it is flat, square, level and at the same height.

Installing the core

The glue of the core must be fully hardened: let it dry for at least 3 days before lifting it into place. The two tiles of the first layer must also have had time to harden thoroughly.

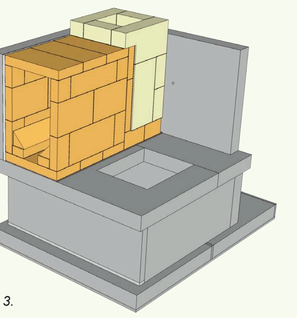




2.

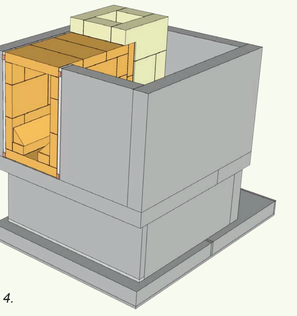
Place two strips of Superwool, 50 mm wide, against the left tile. In the drawing these are the vertical strips. On the bottom slab, where the core will be placed, apply three strips of cob, 3 mm high, from back to front (fig 2).

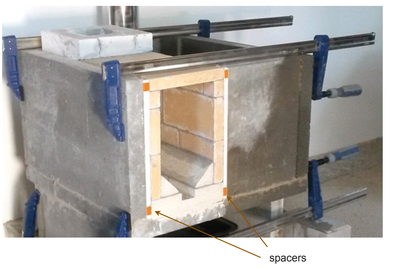
Then place the transport board with the core as close as possible to the bottom slab, preferably on an elevation of concrete blocks or something similar. Remove the battens from the transport board. Carefully lift the core from the board and place it on the three strips of cob (fig 3). The front must be flush with the front of the bell. Push the core firmly against the two strips of Superwool - it must be airtight. Check with a level, a square and a tape measure whether everything is in the right place.


3.

Once everything is in order, fill the gap at the left of the core with the three horizontal strips of Superwool. First press them flat so that they can easily be pushed into the opening.

Now cut the front concrete tile to size (fig 4) and drill the Ø 8 mm hole as indicated at the beginning of Step 4. A strip of Superwool is placed between the tile and the core. That strip is 12 mm thick and is pressed about 3 mm by the tile; the joint will therefore be 9 mm wide. Glue the tile to the bottom slab and secure it with a clamp.


4.



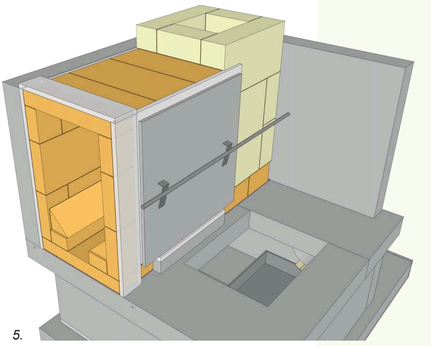
Spacers

Place two sawn-to-size blocks between the core and the left side tile, and also two between the core and the front tile.

This will keep the front tile in place when you glue and clamp the right side tile.

Tile

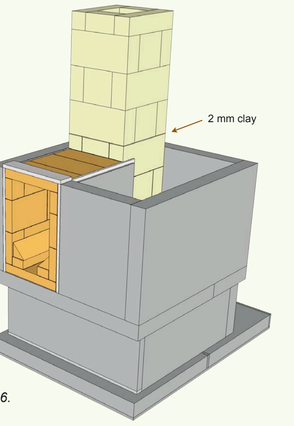
Place a piece of Superwool against the wall of the firebox, together with a floor tile of 30 x 30 cm. In the drilled holes you put a Ø 8 mm threaded rod or rebar of 52.5 cm length. Together with two wedges, it keeps the tile in place (fig 5).


5.

Upper part of the riser

You can now place the upper part of the riser onto the lower part. Due to the extreme temperatures in the riser, the two parts of the riser will expand at slightly different rates. To prevent cracks, you place the upper part on a layer of clay instead of gluing it. (fig 6).

Finally, on top of the firebox you place a 50 mm wide strip of Superwool.

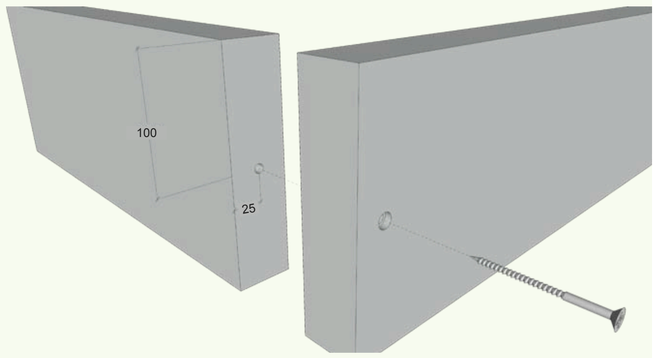


6.

Step 5 Construction of the bell

Drilling holes

Up from the second layer, the corners are not only glued, but also additionally secured with a screw. For this, holes with a diameter of 6 mm are drilled on the longer parts, 25 mm from the side. In the shorter parts the holes are drilled exactly in the middle of the ends; that's where the plugs come in.



Drilling is done with an ordinary concrete drill, *and* a diamond drill. Working with diamond drills is shown in this YouTube-video.

Precise marking is required. Do that with four lines around the hole, as shown below. Drill the hole in the longer part from both sides.

You drill the first 2 mm with a regular concrete drill, without the impact function. Drill the next centimeter with the diamond drill: this allows you to make very precise corrections. The rest can be done with the regular drill, and then with the impact function.

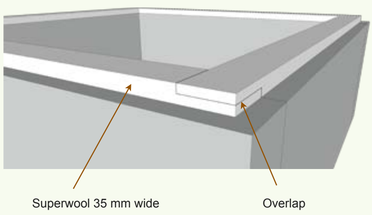
Second layer

Before you finally put the layers in place, you first make a test fit. On a flat surface you put the layers together without glue. Test that the screws will be tight. They should not be too loose, but certainly not too tight either. If necessary, you can drill out the hole a bit, or use other plugs.

The second layer is laid on top of the first with cement mortar 1:5 (1 part portland cement to 5 parts sand). Height of the mortar layer is 9 mm.

Place the four concrete blocks on the mortar one by one and glue the corners. With the help of clamps you press the parts exactly into place. Measure the two diagonals to make sure it's exactly square. If necessary, use the large clamp to correct. Once everything is square and level, tighten the stainless steel screws.
Now cover the top of the firebox with Superwool.

Third and fourth layer



Layer 3: Place 35 mm wide strips of Superwool on the inside of the previous layer. Make notches at the ends so that they overlap seamlessly at the corners.

Place spacers of 10 mm high in the corners an place the four concrete blocks on top. Use a level to check whether they are exactly above the previous layer.

A nut can also serve as a spacer

Glue them together and secure with screws. Make 9 mm high spacers from iron and replace those of 10 mm with these; the concrete blocks will rest on these spacers.

For layer 4, make a small scaffold on both sides of the stove so that you do not have to lift above your head.

Fifth and sixth layer of fire concrete

Layers 5 and 6 are made of fire concrete, as described in Step 2. Only when it has hardened properly you drill the holes for the screws. Make a test fit first.

Once the bell is completed you can fill the joints with cob: 1 part clay powder mixed with 1 part fine sand, and then mixed with water. Use masking tape to get it nice and tight.

Step 6 Metalwork: floorchannel, frame and door unit, top plate

The dimensions of the floorchannel and the frame and door unit assume a core with outside dimensions of 220 x 353 x 537 mm. If these dimensions differ you need to adapt the figures.

There's 3D SketchUp files for the floorchannel, and for the door/frame unit. There's also a 2D pdf-file that you can print.

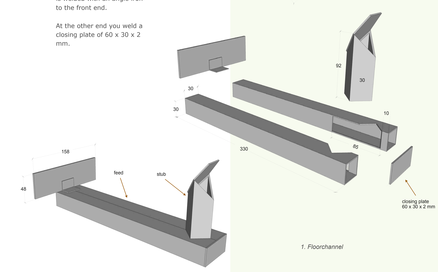
Making the floorchannel

From a 30 x 30 x 2 mm square tube, cut two 330 mm pieces and one 92 mm piece. A triangle of 26 x 26 x 37 mm is cut out of the two long pieces, at 10 mm from the end. A slot of 26 x 85 mm is also ground away. The two pieces are now welded together according to the drawing (fig 1).

On the 92 mm piece, mark four 45º angles from a diagonal and grind them off. On one side there will be a plate that has first been cut to size (see the drawing). The assembly (the "stub") is welded vertically onto the square opening of the horizontal tube (the "feed").

A plate of 158 x 48 x 4 mm is welded with an angle iron to the front end.

At the other end you weld a closing plate of 60 x 30 x 2 mm.



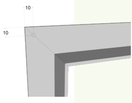
1. Floorchannel

Making the frame and door

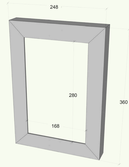
Frame

You need L-profile of 40 x 40 x 4 mm for the frame. Cut the 45º angles according to Figure 2 and weld the parts together. Four Ø 5 mm holes are drilled at the outer corners at 10 mm from the edges (fig 3).

2. Frame dimensions



3. Location of the holes

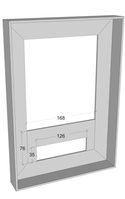


4. Door dimensions

The door

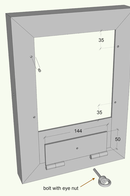
Also for the door you use 40 x 40 x 4 mm L-profile. Cut and weld according to Figure 4.

An air gap of 126 x 35 mm is cut out from a plate of 168 x 76 x 4 mm. This plate is then welded into the door (fig 5).



5. Air vent plate

6. U-profile

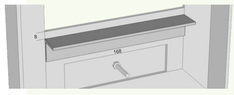


7. Holes, shut-off valve

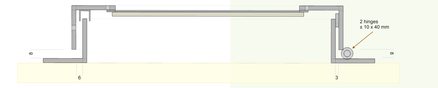
U-profile of 10 x 10 x 1.5 mm will now be placed on the inside of the door (fig 6). A corner of 15 x 6 mm is ground off on the hinge side of the two shorter pieces. They are welded tightly against the top and bottom. The profile on the side where the closure will be placed is fixed at a distance of 3 mm from the side. After assembly, the edges of the frame must fit exactly in this. There will be no U-profile on the hinge side, there will only be glass tape of 3 x 12 mm.

Figure 7 shows four 4mm holes, drilled 35mm from the top and bottom and 8mm from the side. This is where the bolts will come in that hold the window in place. You can also see the 144 x 50 x 4 mm valve that closes the air opening. Exactly in the middle you drill a hole of Ø 5 mm, through which a bolt goes on which an eye nut is attached.
Clamp the plate in place and weld the hinges. The valve can only be opened completely (the bolt then bounces against the edge) and closed completely.

Weld a length of 168 mm from a 25 x 25 x 3 mm L-profile to the inside of the door, 8 mm below the edge (fig 8). This will support the window.



8. L-profile 25 x 25 x 3

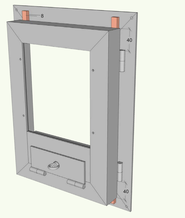


9. Cross-section of frame and door

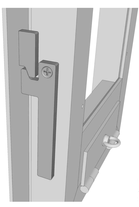
Assembling

The hinges are now welded on: on the door this is 40 mm from the top and bottom (fig 10). Place the frame on a flat table and place four 8 mm blocks on top. You place the door on the blocks; the door now "floats" 8 mm above the frame. Move the door in such a way that the space between the frame and the door is 6 mm on the side where the lock comes (see image above). The edges of the frame then fit exactly into the U-profile. Hold it in place with a few clamps.

Weld the hinges to the frame and door.



10. The welded-on hinges



11. Lock

Lock

Figure 11 shows the lock. The lock and the lip that accepts the grip are cut from a 6 mm thick steel plate (fig 12). You weld that lip onto the frame, the top 160 mm below the frame edge and the left side 18 mm from the edge.

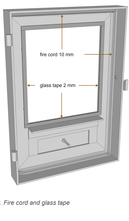
Now mount the door and place it on the 8 mm blocks on the closing side. Place the lock and determine the location where the hole will be (Ø 5 mm). You secure it with a bolt and two nuts.

12.

Sealing

Glue a 10 mm wide fire cord into the U-profile. At the window opening, glue strips of heat-resistant glass tape of 2 mm thick.

The window can now be placed.
Four stainless steel bolts of ± 20 mm hold the window in place. Two nuts ensure the correct distance (see picture).



13. Fire cord and glass tape

14. Window

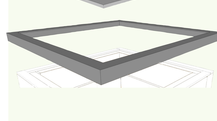
Top frame and top plate

Steel top frame

At the top of the bell is a frame made of 25 x 25 x 3 mm L-profile, to improve the sturdiness of the bell. The space between the bell and the frame is only 1mm, so it must be welded with care.
Dimensions are 608 x 608 mm on the outside, the square opening on the inside is 558 x 558 mm.

Top plate

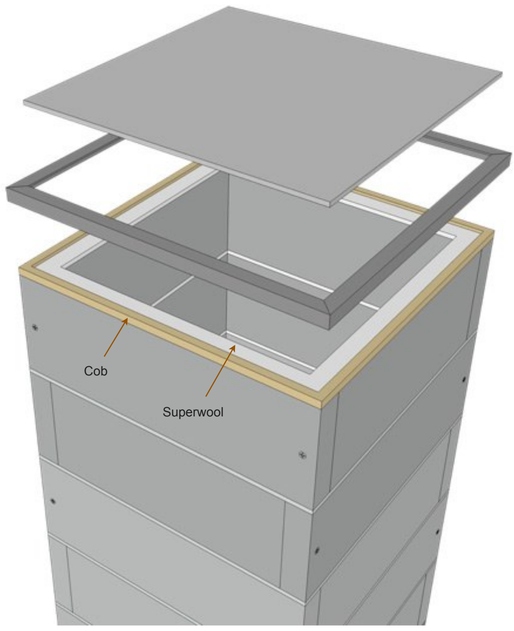
The top of the bell is a 6 mm steel plate with dimensions 550 x 550 mm.



Step 7 Assembly

You fix the frame with cob. Working with cob is really different from working with cement. Try it out first; the cob shouldn't be too dry or too wet. When applying, ensure you make an uninterrupted "roll"; there should be no gaps in it.

You can make cob very well with 1 part clay powder and 1 part fine sand. Mix well, and then add water.

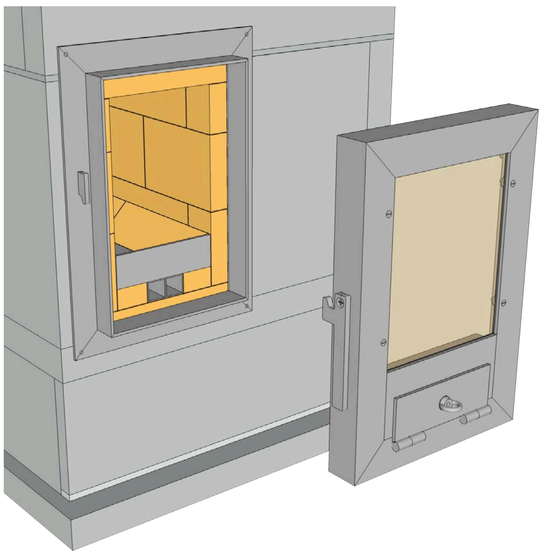


Top frame

Apply a layer of cob to the top of the bell and press the steel frame into it. Check carefully that it is level. Remove the cob that squeezes out. Height (cob + frame) must be ± 15 mm.

Top plate

Now place four strips of Superwool on the inside of the frame (mind the overlap). Place the top plate; between the plate and the frame is a margin of 4 mm.



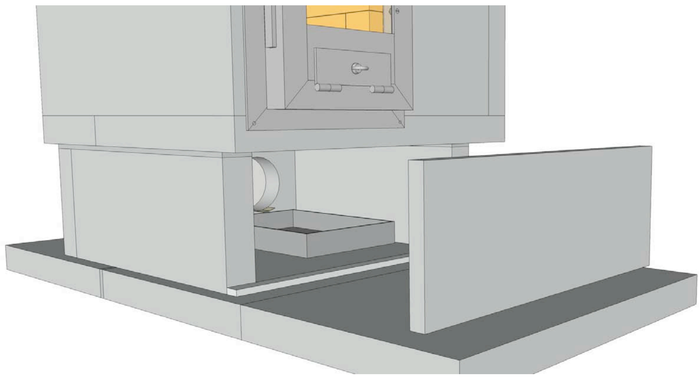
Installing the frame and door unit

Take apart frame and door and place the frame. Make sure the distance between the frame and the sides and top of the firebox is the same.
Mark the exact location of the holes, remove the frame and drill the holes. Insert plugs and fix the frame.

Seal the edges with some sealant; use masking tape to get it nice and tight. Then put the door back in.

Sweep access hatch

One more thing: the hatch at the bottom of the stove. During the running-in period you put it in place and cover the brims with tape. That's because you have to empty the condensate tray every now and then. But when the running-in period is over, you place the hatch permanently. You put it on a strip of Superwool and seal the other brims with sealant.



During firing, ash ends up in the base layer. Before a new heating season starts, it is therefore important to sweep that base layer. To do this, cut open the sealant edge and remove the hatch. When you have finished cleaning, put the hatch back in and seal the brims airtight.

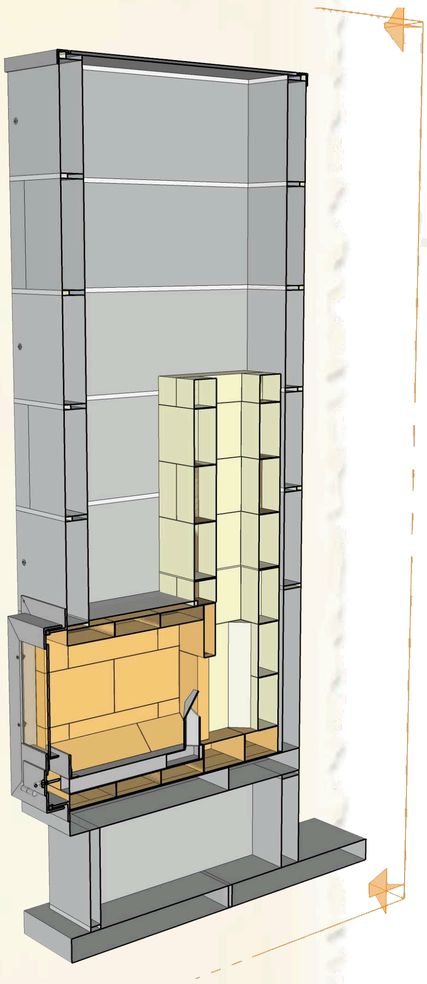
It is recommended to place a tile in front of the stove: this way you protect your floor against sparks and ashes.

Using the Roquetinho

Running-in

Once you have your own brandnew Roquetinho, it may be a disappointment that you can't use it on full speed right away. The point is that it needs to be "run in". There's a large quantity of damp in the construction that only gets out at high temperatures. This running-in process should be executed gradually to prevent cracks. The process takes about two weeks.

On day 1 you burn 0.7 kg every two hours. 0.1 kg is added each day, at intervals from 2 up to 3 hours. On day 14 you heat 2 kg / 3 hours, the nominal heating quantity for this stove.



A bypass is not necessary for the Roquetinho. Instead, the steel top can be temporarily replaced with a vermiculite plate (or other insulating material). It can also help to heat the bottom bend of the flue with an electric heater.
There may be quite a bit of condensation from the flue in the first few days. A few times a week, open the hatch at the bottom of the stove and empty the collection tray. Place the tray back and hermetically tape the edges of the hatch.

During the combustion period, the stove does not yet burn cleanly and efficiently. Only after all the moisture has gone out you will be able to start burning the normal way: 2 kg wood in one go, every 3 to 4 hours. Do not refill in between! The extra heat would go straight into the chimney because the bell is already saturated with heat. It would also result in poor combustion.

Burning the Roquetinho

Place some small kindling in the back of the firebox, just in front of the port. Light it with one or two firelighters. If necessary, leave the door ajar until there is sufficient draft. As soon as it burns well and the flames are drawn into the riser (you will hear a roar) you can fully load the firebox. Just place it straight, there's no need for crosswise stacking. First the thinner wood and then the thicker wood on top. Be careful: no wood in the port! Maximum thickness of the blocks is 5 x 5 cm.

If the stove has cooled down completely overnight, you can start it up with a "double batch": 4 kg instead of 2 kg. The bell can then absorb that extra heat well. As soon as the glowing phase starts, the next portion can be added.

Make sure that the fire flames well and the vortex “roars” well. The air inlet valve has only two positions: open and closed. You open it during the firing, and when the batch has burned out and is only glowing, you close it. This way you stop the draft after firing and prevent heat loss.

A firing (from lighting to the glowing phase) in the Roquetinho should take about half an hour. If it is much shorter, the firewood is too thin. If it takes longer, it is too thick. The vortex will then turn off sooner.
Always leave a layer of ash in the firebox: this extends the lifespan of the floor channel, and because it insulates it is also beneficial for starting a new fire.

Links

batchrocket.eu	Peter van den Berg's website, in 9 languages, with extensive information about operation, construction, designs and applications
donkey32.proboards.com	international forum with contributions from renowned developers of the rocketstove
permies.com	*“Where we talk about rocket mass heaters all the time”*

Contact

Roelof Groenenboom
roelof@roquetinho.eu