

Third report on the development of
Revised in 2008
The Ghana rain gutter

As part of an integral system for water harvesting
(collecting - storing - bottom infiltration)
A project of Pumping is Life

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1 Objectives

Rain gutters can be made of many materials and in many shapes. It depends on the availability of raw materials, tools, traditions and requirements which type a customer likes to purchase. Only now when more and more houses use galvanized corrugated iron sheets for their roofing and water re-infiltration appears successfully, there is an increasing demand for gutters.

The aim of the project is to achieve a very low cost water harvesting system.

For that reason the first design was made as small as possible. It appeared that only 50% of the water was collected. This was not enough. The gutter was enlarged from 120 to a wide of 151 mm. This means six gutters from one sheet with wide 910 mm. In 2007 the gutter was enlarged again: 5 pieces from one sheet. In practice 5 wave tops or 174 mm.

The aim is to collect 90 % of the water. A gutter does not need to be completely water tight.

Therefore soldering has been rejected as being too complicated and too expensive.

A system of "Stitching" has been adopted and proved to be durable.

As gutter material has been chosen for the thinnest steel galvanized corrugated roofing sheet.

Material for gutter supports was from doubled 1 mm galvanized iron sheet. Now was selected 2mm non galvanized sheet. This is cheaper and stronger

The light supports were mounted on top of the corrugated sheet. For that reason the gutter could not be too big. It would become too heavy when filled with water and consequently the roof could collapse under this weight. This time was chosen to mount the support under the corrugated sheet.

2 Costs

From one sheet 5 gutters can be produced.

Material costs are: $50\ 000/5 = 10\ 000/\text{pcs} = 30\% \text{ profit on materials}$	13 000 C/gutter
-Labour: Two persons of 90 000/day, makes 3 sheets per day or 15 gutters	6 000 C/gutter
	=====
TOTAL	19 000 C/gutter

-Every 0.7 m needs a support so: 3 pcs per 2,4 meter.

Material costs from the supports in this report are:

One galvanized sheet of 1.22 m x 2.44 m and 2 mm thick, costs 650 000 C and is good for 240 pieces. So $650\ 000:240 = 2\ 708\ \text{C} + 30\% \text{ profit} =$	3520 C
Labour: Two persons of 90 000/day makes 45 pcs a day	2000 C
	=====
Total	5520 C/pcs

In Accra a normal square gutter support made from old material and aluminium painted costs: 3000 Cedi

So the costs per gutter are:

3 supports á 5520 C	16560 C
gutter	19 000 C
Binding wire	300 C
Tar for gutter connection	300 C
	=====
Retail price	32 200 C/gutter

or: $361600\ \text{C} : 2.4\ \text{meter} = 15066\ \text{C/m}$ or 1.5GhC/m (1.07€m).

Assume a blacksmith with its helper mounts 5 m gutter a day:

The costs are: $90\ 000\ \text{C} + 45\ 000\ \text{C} + (5 \times 15\ 000\ \text{C}) = 210\ 000\ \text{C}$

So costs inclusive installation are: $210\ 000:5 = 42\ 000\ \text{C/m}$ or 4.2GHC/m.

3 Developments in 2007

3.1 New gutter form in 2006

The design of 2005 was too small and there was an overshoot of water. The gutter was enlarged and tried out. There was no overshoot, but with little water, the water did not reach the gutter. See photo 12.

The form of the hook was changed. See photo 13.

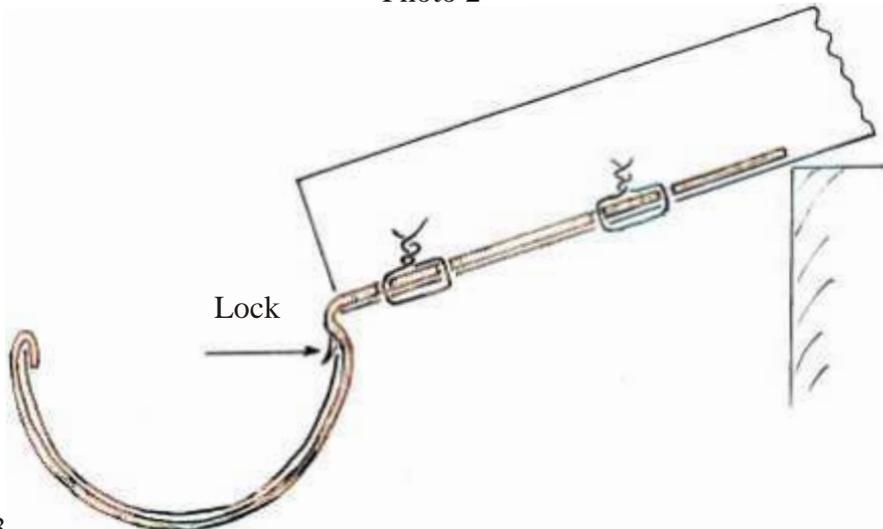
No photos are available at this moment of the system correctly mounted. See drawing 14 and 15



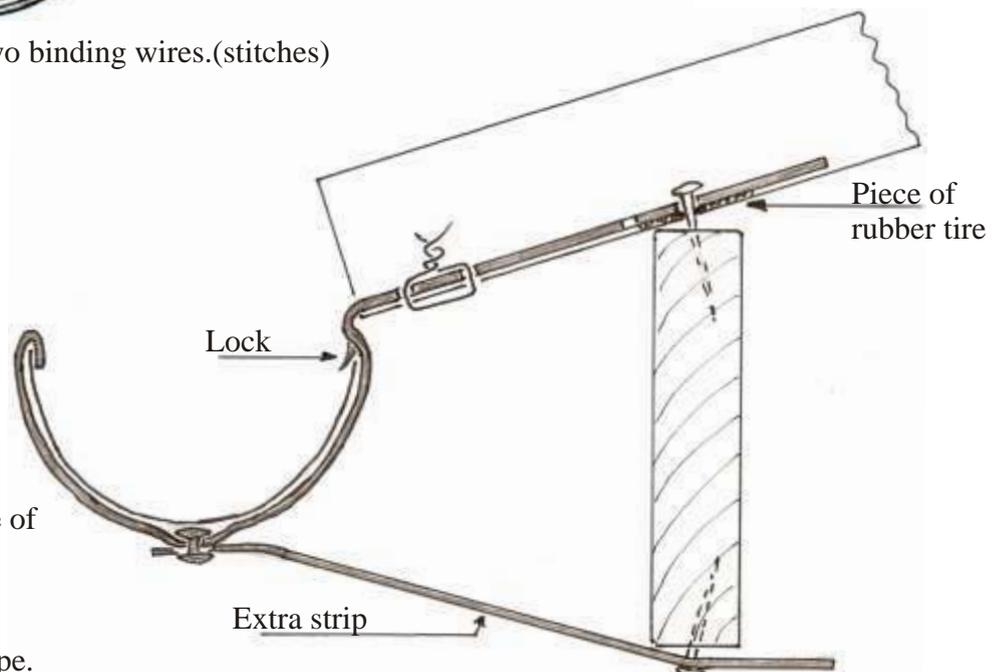
Photo 1



Photo 2



Drawing no: 3
Normal gutter support with two binding wires.(stitches)



Drawing no: 4
Gutter support with only one stitch. The board is too close.
A nail can be used and a piece of rubber to prevent leakage.

The extra strip is only placed on a support near the down pipe.



Photo 5

Perforating the roof with the “Perforator” with adjustable backstop. Here two binding wires could be used. Look to the position of the nails where the roofing sheet is nailed to the board under the roof.



Photo 6: The perforator

The especially shaped binding wire can be placed from one side.

Gutter connection.
In 2007 tar was applied and the connection became water tight.



Photo 101: The pin is placed and the second bend is made.



Photo 11: The product. Remark that the second bend can be made at different heights depending on the required gutter slope.



Photo 12



Photo 13

The bended flat strip is forged to a concave shape with the balpeen hammer. This results in a very strong product. The straight part is forged with the engineers hammer.

Photo 14

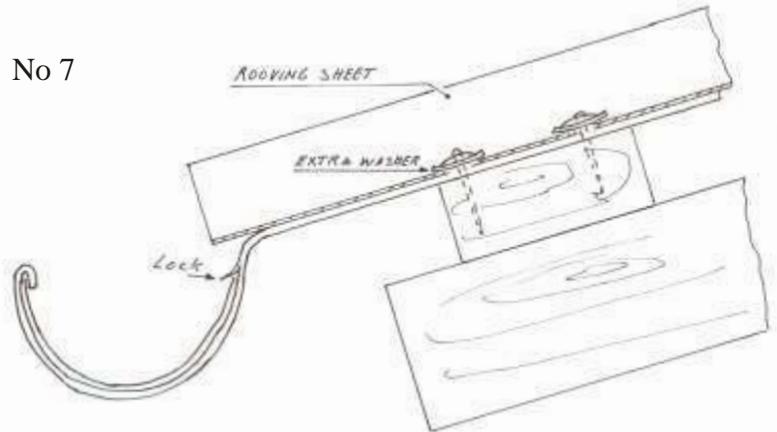
Photo 15



In 2007 supports are made from 2 mm not galvanized sheet and mounted **under** the roofing sheet. This is stronger and better to understand. 6



No 7



3.2 Making the gutter support in series

Strips are cut from the 2 mm sheet with help of the lever shear. With a length of 400 mm and a wide of 30 mm..



Photo 8: The end hook is bended. Remark that the photo is sun from the doubled 1 mm sheet..



Photo 9: The body is curved.

4 Cutting the strips for the gutter.

On the working table two angle irons are mounted in between the corrugated sheet is clamped. With a sharp hard pointed marker one scratch is given. The sheet is bended several times and will break off.

The edge is sharp but can be smoothed with sandpaper. The method with the steel wire was abandoned, because the edge became not straight.



Photo 15

4.1 Bending the gutter.

The bending unit is placed at the other side of the so called pannel beating table. A ½" pipe mounted on a lever is pressed into an angle iron. The corrugated sheet is flattened first and subsequently curved.



Photo 16

In 2007 two flat bars were welded to the angle iron. See arrow below



Photo 17: The pipe is rolled up at the left side.



Photo 18: The pipe is rolled up at the right side.

5 Pipes are stitched with the “Pipe stitcher”.



Photo 19: The pipe perforator is 2,5 m long



Photo 20: The top is lifted and the pipe shifted in.



Photo 21: The ring of the perforator supports on the ground and perforating is easy.



Photo 22: The stitch can be made.



Photo 23: Two or more pipes can become connected.



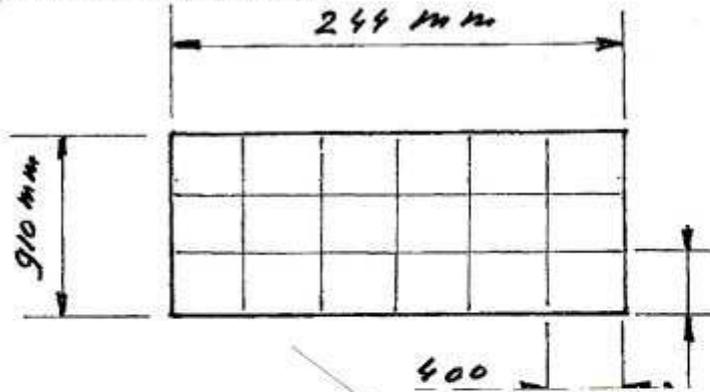
Photo 24: A pipe funnel can be made directly from the pipe. Photo 25: An example was made on Isaku house.



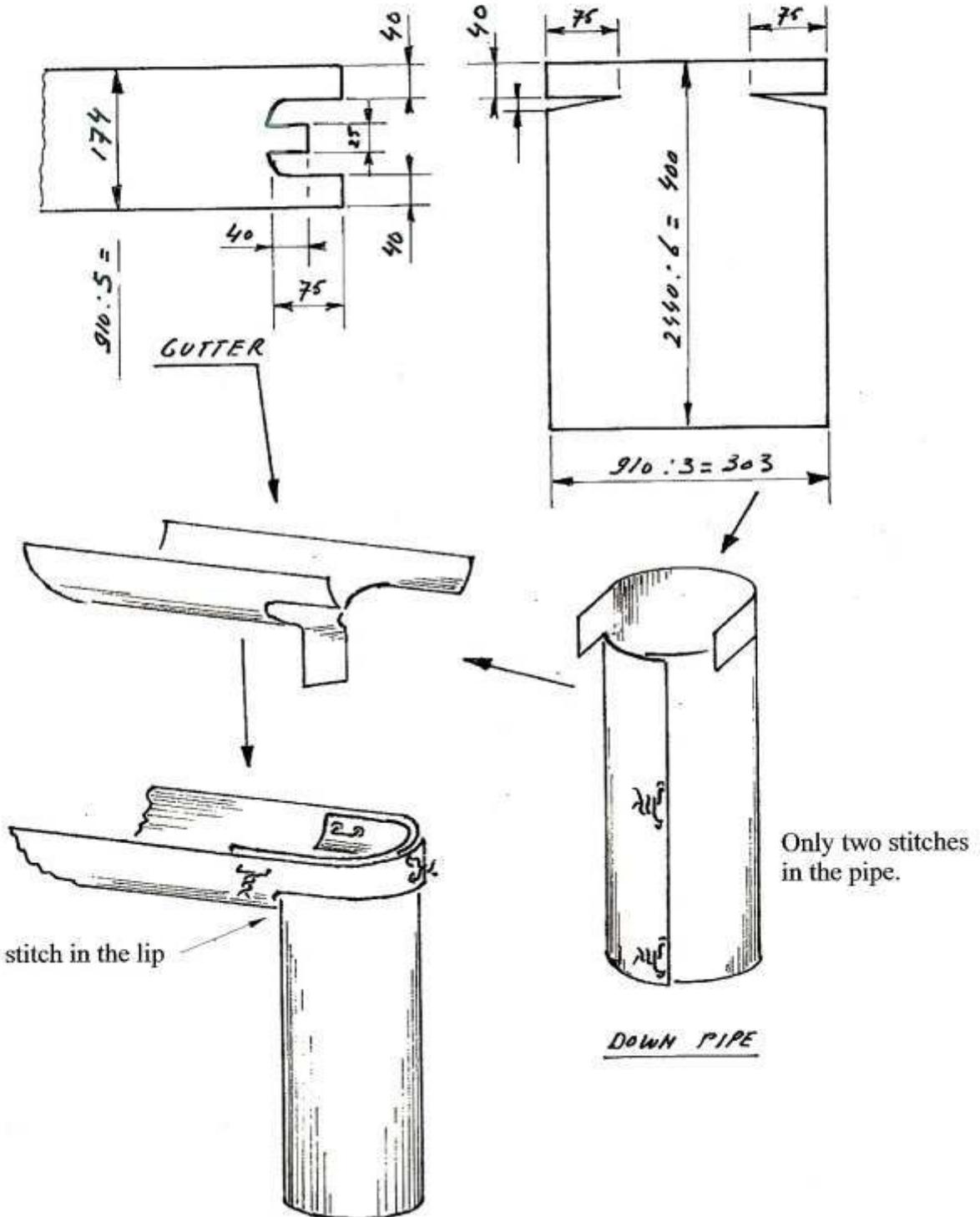
6 Making of the down pipe.

One complete sheet is cut into 18 pieces from 400x303 mm.

Material for down pipe



Downpipe.



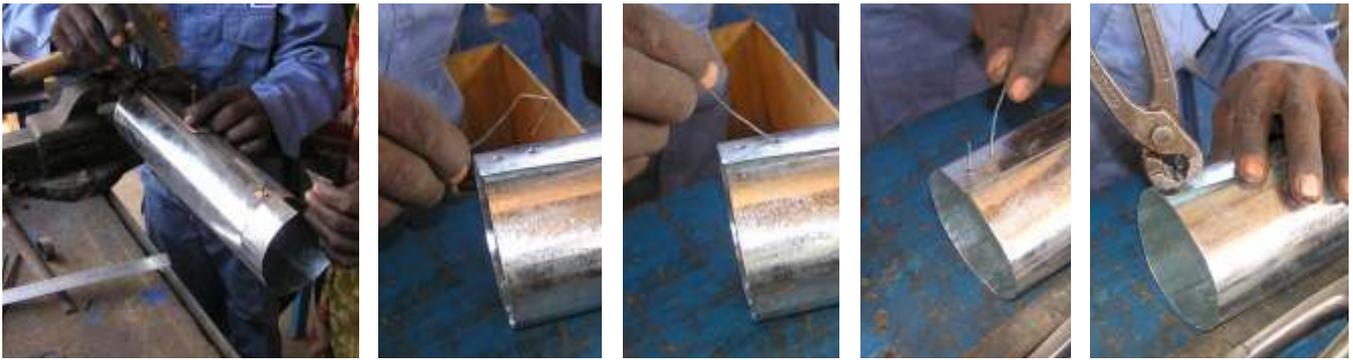


Photo 26 Punching the holes with the perforator and “Stitching” the overlap.



Photo 27 The pipe with two stitches



No photo was available from gutter with the lip



Photo 28 The pipe is placed



Photo 29: Two stitches are made



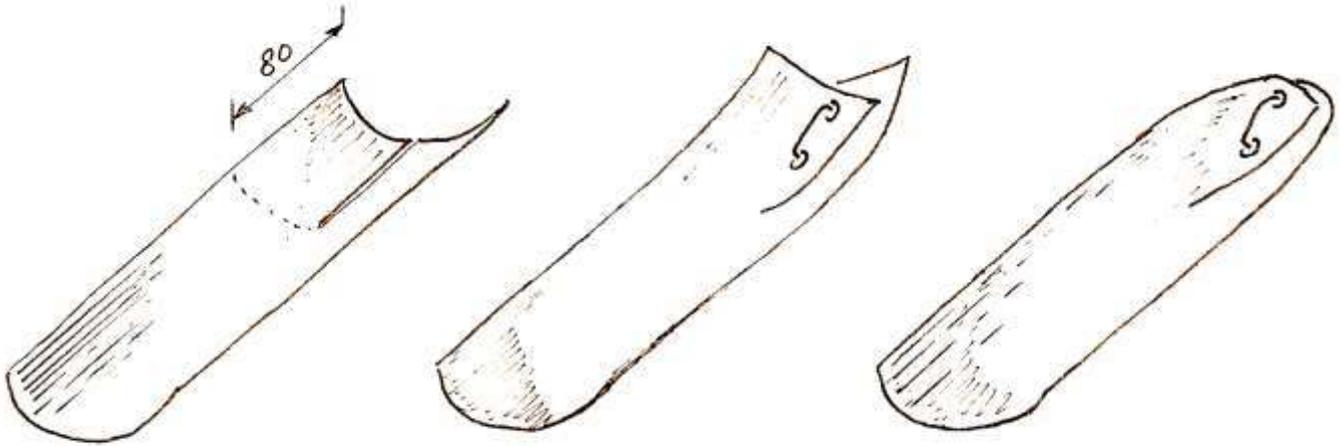
Photo 30 The third stitch connects the two ends.



Photo 31: With the perforator two holes are punched in pipe and lip. The fourth stitch can be made.

7 Making a closed gutter end.

- 1 Make a cut with the length of 80 mm in the end of the curved gutter.
- 2 Bend the two ends over each other.
- 3 Punch two holes with the perforator and make the “Stitch”.
- 4 If you wish: Cut the ends nicely round.



Drawing 32



Photo 33



Photo 34



Photo 35

When no receptacle is used. Two down pipes can be applied.

As described in the first report. It can be used when necessary.
The holes could also be punched with the perforator.



Photo 36

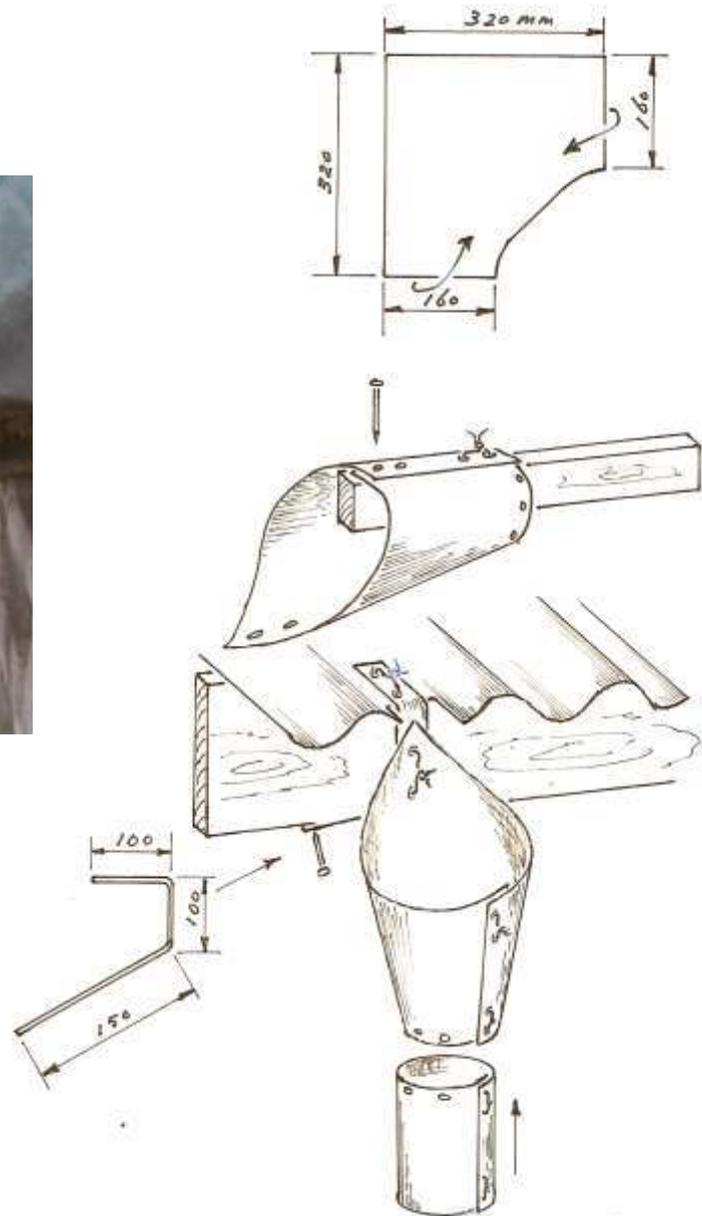


Photo 37 The first system installed with gutter which was too narrow.