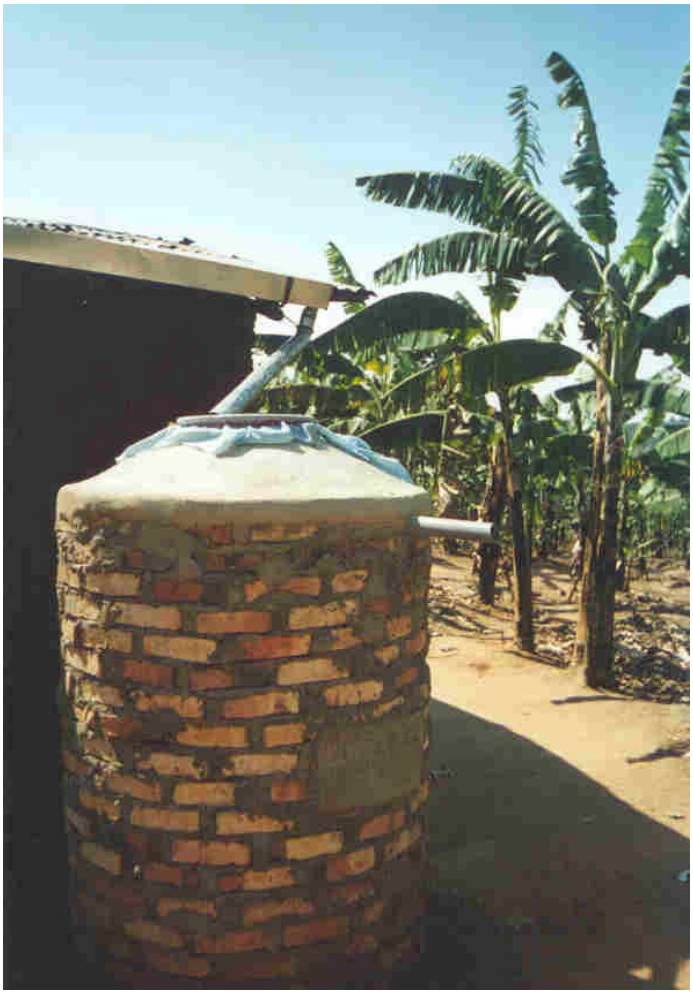
DTU Technical Release Series **TR-RWH07**

Brick Jars

Instructions for manufacture

(Based on the construction of a Brick Jar at Kyera Farm, Mbarara, Uganda)



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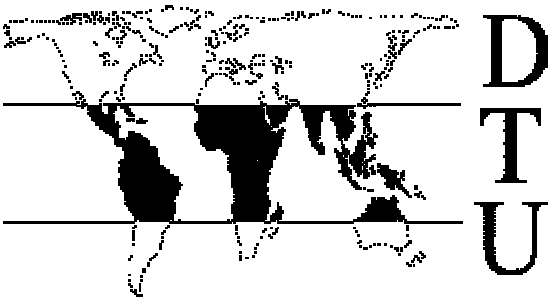

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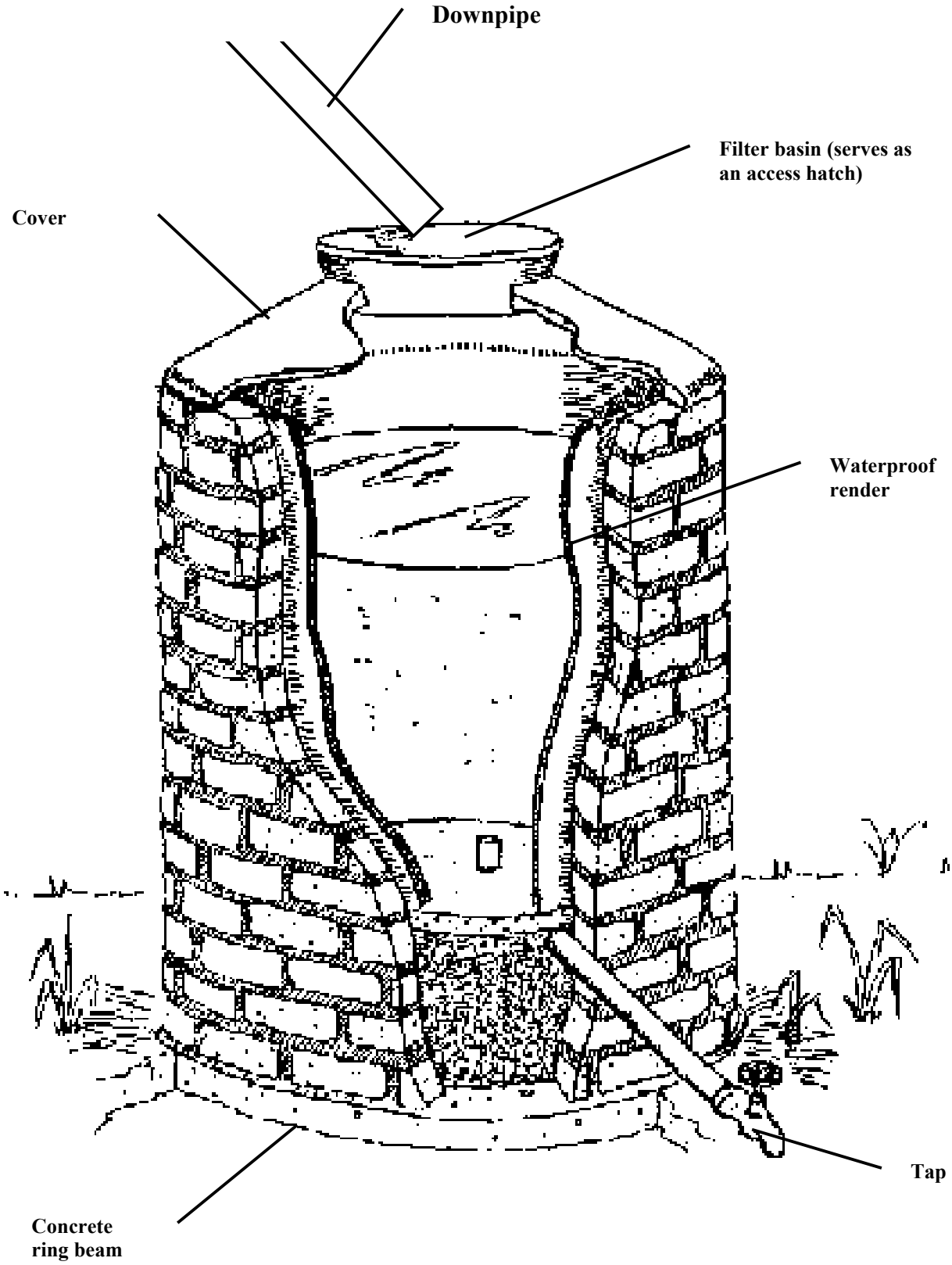


Cutaway sketch of the Brick jar

Introduction

This manual gives guidelines for the manufacture of a 700ltr Brick Jar, which was based on a jar built at Kyera Farm, Mbarara, Uganda during June and July 2000.
The jar consists of a brick outer section, a waterproof internal render and a thin mortar cover with a filter basin.

1. Merits and drawbacks of the Brick Jar

Pros:

- Low manufacturing time.
- Very low maintenance.
- Repairs are easily carried out.
- Suitable for most ground conditions

Cons:

- Cost per litre storage is higher than the Plastic Tube tank

2. Jar specifications

Table 1 gives the specifications for the jars main features:

Table 1 Brick Jar specification

Jar internal diameter	1.0m
Jar external diameter	1.2m
Jar height	1.6m
Jar capacity	Approximately 750 litres
Jar lining	Waterproof render
Water extraction	Gravity via tap
Top	Mortar shell with PVC filter basin

3. Material and labour requirements

Table 2 Material and labour requirements for the jar

	Unit	Ring beam	Walls	Infill	Render	Water Extraction	Cover	Totals
Cement	kg	10	37.5	10	25		10	92.5
Sand	kg	20	225	40	75		30	390
Aggregate <50mm	kg	40						40
Bricks	no		300					300
Rubble	kg			75				75
GI Pipe 1"	m					0.5		0.5
GI Elbow 1"	no					1		1
PVC Pipe 1.25"	m					0.5		0.5
Tap 0.5"	no					1		1
Reducer 1" - 0.5"	no					1		1
Basin	no					1		1
Labour (skilled)	days							2
Labour (unskilled)	days							4

4. Tools and equipment required

- Spade or shovel
- Hoe
- Tape measure (3m)
- Spirit level (600mm)
- Bucket
- Trowels
- Pipe wrench

5. Jar costing

Table 3 Jar costing

Item	Unit	No reqd	Unit cost UGS	Total UGS	Total US$	Total £
Cement	kg	92.5	300	27750	18.50	12.50
Sand	kg	390	20	7800	5.20	3.51
Aggregate <50mm	kg	40	25	1000	0.67	0.45
Bricks	no	300	42	12600	8.40	5.68
Rubble	kg	75	0	0	0.00	0.00
GI Pipe 1"	m	0.5	4200	2100	1.40	0.95
GI Elbow 1"	no	1	1500	1500	1.00	0.68
PVC Pipe 1.25"	m	0.5	1667	833.5	0.56	0.38
Tap 0.5"	no	1	5000	5000	3.33	2.25
Reducer 1" - 0.5"	no	1	1500	1500	1.00	0.68
Basin	no	1	1000	1000	0.67	0.45
Labour (skilled)	days	2	5000	10000	6.67	4.50
Labour (unskilled)	days	4	3000	12000	8.00	5.41
			Material costs	61083.5	40.72	27.52
			Total cost (incl. labour)	83083.5	55.39	37.43
			Cost per litre storage	81	0.05	0.04
			Cost per litre storage (incl. labour)	111	0.07	0.05

Notes
1. Some transport costs included (i.e. for sand, aggregates and bricks)
2. Cost of bucket slab not included

6. Site selection

It is important to select the right site for the jar so that it will remain a reliable source of water for years to come.
Some pointers for what constitutes a good site are given below:

- Good ground stability (i.e. not sandy soils)
- Jar should be close enough to the dwelling to avoid long lengths of guttering and downpipe (some suggest siting the jar mid way along the length of a building to reduce gutter size– this is fine if water from one side of the building only will be fed into the jar)
- Reasonably flat where possible – otherwise the ground will have to be levelled before marking out
- Away from trees which may undermine the foundations and cause cracking.
- Away from areas where animals will wander – fence off if needed
- Away from areas where surface water will gather (i.e. depressions)
- Not so close to the dwelling that the foundations are undermined
- Somewhere convenient for extracting water e.g. close to the kitchen area.

- It must be a suitable distance away from vehicle access as this may cause ground movement, fence off if necessary.

7. Manufacturing procedure for the jar

7.1 Making the jar cover

This will take a week to cure so this needs to be made first.

- Prepare a level piece of ground of 1.1m diameter (same as jar outside diameter) on which to make the cover for the jar.
- Mound up and compact soil on the prepared ground to a height of about 25cm and make a well in the centre for the filter basin as shown in Figure 1.

Figure 1 Mould for brick jar cement cover

- Cover the mound with plastic sheeting and place a series of bricks around the mound at a diameter of 1.1m as shown in Figure 2.

Figure 2 Mould ready for the cement render

- Render the plastic sheeting with a mortar mix of 3:1 (if the sand is low quality use chicken mesh on sandwiched between two layers of render) cover with grass or leaves and keep damp until cured which will take about seven days.

7.2 The Brickwork section

- After finding a suitable location for the jar make sure the ground is level for 1.5m in diameter.
- Place a stake in the centre of the area and mark out an inner and outer circle using a piece of string and a nail. The radii of these are 45cm and 65cm respectively.
- Excavate between the two circles to a depth of 10cm. (NB if soil tends to be unstable excavate to 20 cm deep and fill with aggregate 10cm deep, alternatively make a larger deeper ring beam)

Figure 3 Checking the level of the concrete ring beam

- Fill the excavation with a concrete mix of 4:2:1 (aggregate: sand: cement), as shown in Figure 3, and cover with damp grass/leaves and leave for two days.
- Start building the brick jar on top of the concrete ring using a mortar mix of 5:1 (sand: cement).
- After 0.55m height of brickwork fill the centre of the jar with rubble/aggregate. (this can be neglected if a sump for the jerrican/bucket is made instead)
- Insert a ∅3/4” GI pipe through one of the brickwork joints for the tap outlet, on which is fitted a ∅3/4” elbow at one end and a ∅3/4” to ∅1/2” reducer and a ∅1/2”tap at the other. Alternatively use a PVC pipe which can be threaded by the method described in Appendix 1

- Render the base of the jar with a mortar mix of 4: 1 (sand:cement) to 2.5cm deep, ensuring that the top of the elbow is level with the base.
- Continue building the brickwork up to a height 1.55m above the ground, periodically checking that the diameter is constant all the way up. On the last course of bricks fit in a short length of ∅1 ½" PVC pipe (or nearest size available) for the over flow as shown in Figure 4 and cover the end with a piece of mosquito mesh.
- Once the mortar between the brickwork has set render the inside of the jar with mortar mix of 4:1 to a depth of 1cm. Scratch this coat with a nail for a good mechanical key whilst it is still damp and leave for one day.

Figure 4 Full height of the brickwork clearly showing the position of the overflow

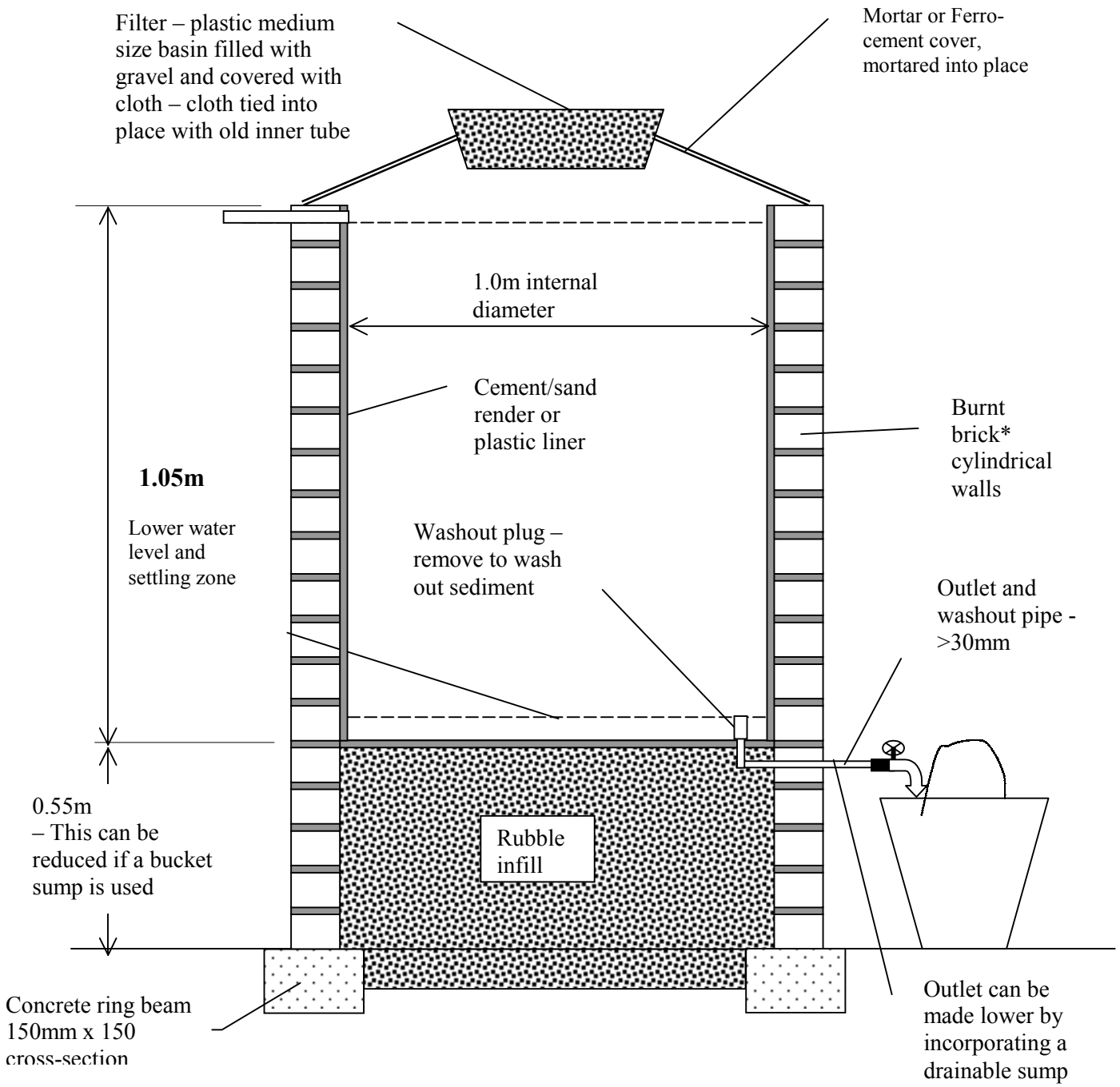
- Apply a mortar mix with a waterproof additive on to the walls and base (quantity as per manufacturers instructions) to a depth of 1cm. Cover and leave this for about twelve hours then pour in about 20 litres of water as this will help prevent cracking and shrinking (make sure the tap is turned off!), this should now be left for a further 24 hours.
- On the top course of bricks apply a layer of mortar and carefully lift on to this the shell cover, make a smooth radius around the base of the cover and the jar wall.
- Make a series of about twenty holes in the bottom of the basin using a hot nail or a drill (Ø6mm) for the rain to enter the jar. Fill the basin with aggregate (about 20mm) to about one third full.

- Cut out a square section of clean cloth that will cover the basin and have sufficient to overhang down the sides, then tie around the sides of the basin with string or rubber inner tube strip to hold the cloth in place.
- Lower the basin in to the jar.
- Fix the appropriate gutter to the roof and place the downpipe directly on to the cloth.

8. Care of the jar on completion

Once the jar is finished fill with 125mm of water each day so that the structure is gradually loaded rather than all at once.
It may be noticed that the jar will leak slightly somewhere around the sides, it is best if this is left for at least a week, as quite often the jar will eventually seal itself if the hole is small (this has come from masons personal experience in Uganda). However, if it shows no sign of sealing or the hole is quite visible, empty the contents and make the repair with a nil mix (i.e. purely a cement and water mix) from the inside of the jar.
It is important that there are no gaps around the filter and cover, or around the filter where light can enter as this will not only encourage the growth of algae but may be an entry point for mosquitoes both of which should be avoided.

9. Brick jar diagram



NB: for this tank the following brick details were:
* Burnt brick size – 225 x 100 x 75mm
1. Number of courses – 21*
2. Number of bricks per course - 14

Total number of bricks - 294

Diagram of Brick Jar construction

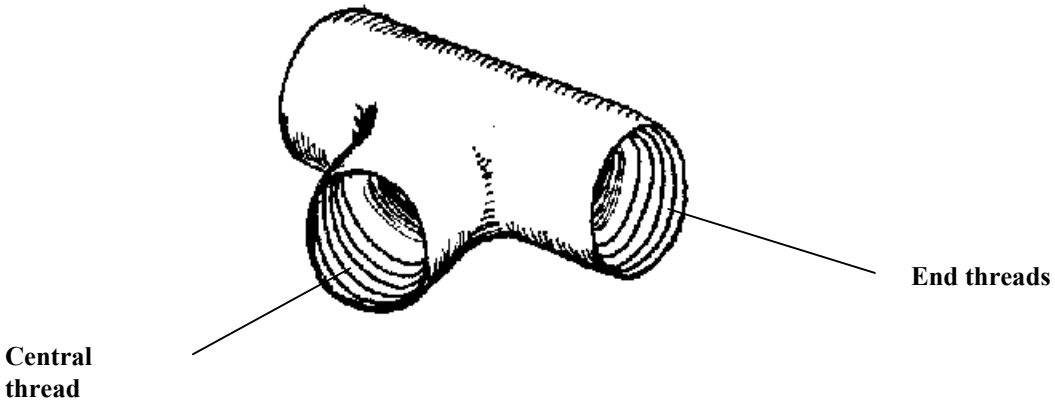
Appendix 1: Low cost threading of PVC pipes using a standard galvanised iron (GI) pipe fitting

There are many occasions were threads are required on PVC pipes so that other fittings can added to the pipe. This often involves the use of expensive threading equipment, which is not always available when needed and the charge for this service can become expensive when it is done repeatedly.
The method described here was tried out in Uganda after finding the problems mentioned above and was found to be a useful and successful solution that was very low cost. Though it requires some tools, a little bit of skill and some patience, once it has been made it will last for many threading operations and re-sharpening is simple to do.
The following example is for a ∅½" PVC pipe but the same procedure is carried out for other sizes:

Tools required:

One hacksaw blade (preferably with 24 teeth per inch)
A small (6"long) triangular file (the width across the faces should preferably be no more than about 3/16"or 4mm)
Pipe grips or a vice.
10" rough flat file.

The reliability of the threads for higher pressure applications has not been checked and care will be needed when trying this out.



10. Take a normal GI ∅½" Tee fitting as shown in Figure 1 and make three equally spaced saw cuts with the hacksaw blade in the central part of the Tee to just beyond the roots of the thread as shown in Figure 2.

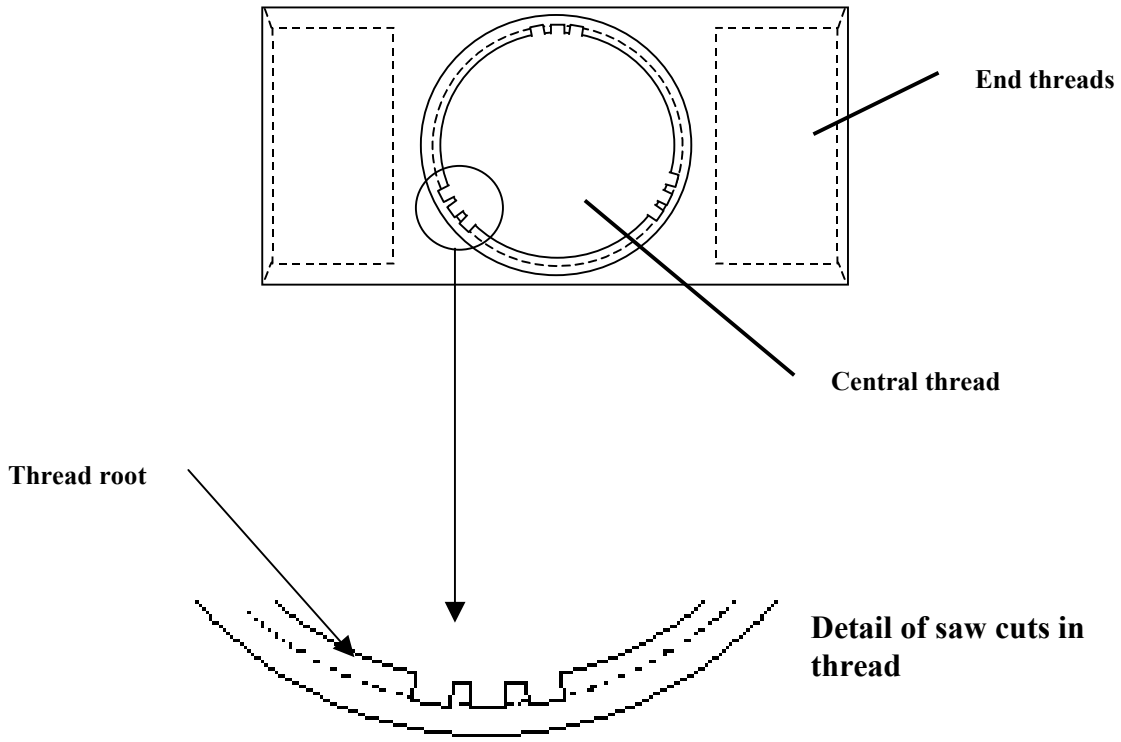


Figure 2 The GI Tee with the saw cuts equally spaced round the central thread

11. Make additional saw cuts as close as is practically possible to the first thread so that it is slightly wider than one of the faces of the triangular file, this is to ease the burden of filing.
12. Proceed to file each of the saw cuts so that the roots of the thread can no longer be seen.
13. File the left-hand side of the slot, as this will be the cutting edge, so that the profile is the same angle as the file i.e. 60° as shown in Figure 3.

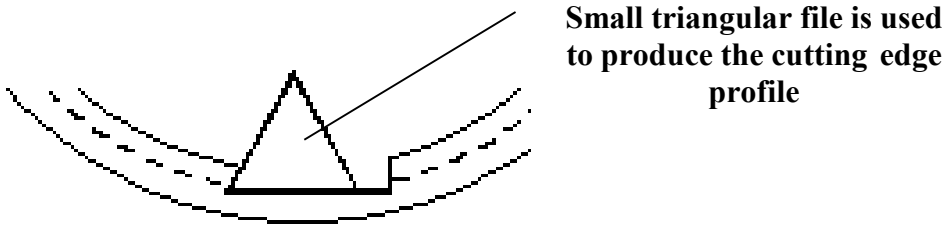


Figure 3 The GI Tee with detail of the cutting edge profile on thread

14. Using a rough file chamfer the end of the pipe to be threaded to the dimensions shown in Figure 4.

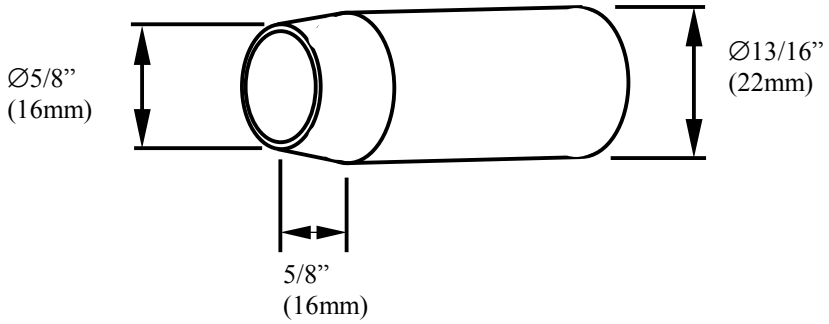


Figure 4 Chamfer dimensions for the ∅1/2” PVC pipe

15. Hold the pipe firmly in an upright position (using a vice or pipe grips) and apply a generous amount of grease or Vaseline to the thread cutter or to the pipe end. This will reduce the friction while thread cutting.
16. Place the thread cutter on top of the pipe and gently start to turn/thread it on to the prepared pipe, making sure that the top of the GI fitting is level as shown in Figure 5.

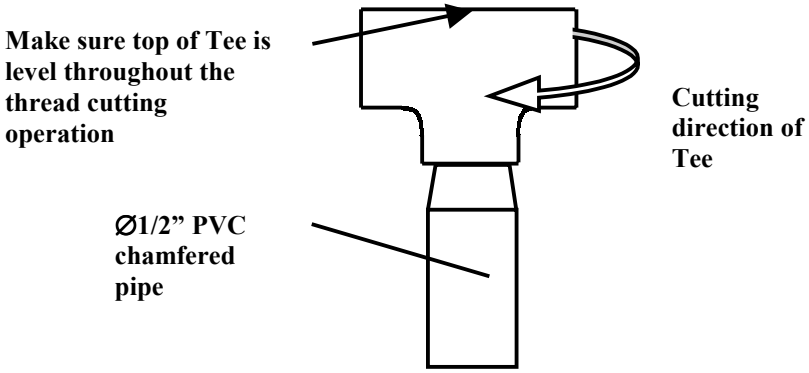


Figure 5 Starting the thread cutting

17. Turn several times (by inserting a screwdriver or steel rod through the Tee) then remove and clean out the thread of any plastic that has built up. For every revolution of the thread cutter turn back again half a revolution, this will break off the material being cut and avoid clogging of the cutting edge space.
18. Repeat the operation until a sufficient length of thread has been cut.

Re-sharpening the cutter is simply done by filing the cutting edge with the small triangular file until the blunt edge has been removed.
Polythene bags cut in to thin strips and wrapped round the thread is a good low cost substitute for PTFE tape.
Please note that it may take several attempts before a satisfactory thread has been made so practice on spare pieces of material until confidence and the quality is built up.