The Zimbabwe Bush Pump
(“B” type)

Useful templates and tools for examining the pump head

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Introduction

Inspection of the Bush Pump head is normally undertaken by measuring the parts with callipers, measuring tapes and rulers etc. In this case a series of templates has been prepared which can be held against the pump head and its parts to make an immediate check of the accuracy of the various components and the alignment of the pump head. In the B type Bush Pump, the alignment of the head is particularly important.

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Templates (prototypes)

A series of templates (initially hand crafted in plywood) have been made to make the initial inspection of the pump head easier and faster. These are fitted over various parts of the pump head and help to assess whether the geometry (angles and alignment) of the pump is accurate.

Templates to check distance between pivot pins (240mm) and the shape, size, configuration and hole location of the rising main support plate (“apron plate”).
Templates to assess distance between front of floating washer housing and rod (in most forward position) – 73mm + - 2mm. Also angle of pump stand (14 degrees).

Template to check base plate of water discharge unit. Tool to check positions of working holes in wooden block.

Floating washer housing. Spacer ring and upper plate. To specify the dimensions and correct positions of the holes
The templates for “apron plate” and lower plate of water discharge unit.

To ensure inter-changeability these plate sizes must be made exactly according to specifications.

Left - Template to check 90 degree angle of rising main support plate (Apron plate) and main pump stand channel. Right - Template to show configuration of U bracket.

Left - Template for Pivot Pin. Right - Template to show distance between rear pivot pin and upper end of channel section of pump stand.
Left - template to test for 90 degree angle of 65NB pipe on water discharge assembly base plate. Right - template and plumb-line for checking correct alignment of pump stand and entry of rod through the rising main support plate (“apron plate”).

Comparing the templates with manufactured parts

The Pivot Pins must be made correctly. Main shaft diameter 35mm. Main shaft length 165mm. Smaller shaft diameter 24mm (length 50mm) with 25mm threaded. U bracket with pivot pin head securing plate above the pin.

Left - Template for testing correct position of holes in wooden block (240mm between hole centers). Right - Template for testing 90 degree angle between floating washer housing base plate and 65mm NB pipe.
Checks on pump head before mounting on pump stand

Lengths of main channel section – total 750mm. (lower 400mm, upper 350mm)

Channel section – correct angle. Rising main support plate at 90 degrees to channel and 300mm above bottom of channel.

Checking length of side arms (720mm (original 700mm is OK)
Mounting pump on stand

The Bush Pump should be mounted on a steel pump stand supported by footings placed on level ground. The 150mm steel casing should be checked with a spirit level to ensure in the completely vertical. The alignment of the pump head and geometry (angles and distances) can be checked first before the parts of the pump are taken apart for individual measurement.

![Pump mounted on stand. Left photo with wooden block in horizontal position and rod in its most forward position. Right photo with wooden block dipped and rubber buffer resting on top floating washer (resting position).](image)

Observations: Note pivot pin nuts and lock washers on one side and pivot pin head securing plates on other side of block. Note securing plate above pivot pin on U bracket and below pivot pin on pump stand.
Rod should be in near central position when viewed from the front. The rod in its most forward position (when wooden block horizontal).

The semicircular template is placed on floating washer housing to check on most forward position of rod. The rod should pass through the slot on template which is 73mm + -2mm from front of floating washer housing. The rod should be in near central position.
The template checking the distance between the pivot pins.

This should be exactly 240mm. Note the distance between the working holes is critical, but the exact size of the block can vary slightly (cross section between 145mm to 150mm).

Left - Checking angle of pump stand channel section. Use template which shows 14 degrees of angle. Right - Checking on distance between rear pivot pin and upper end channel section (with wooden block removed). The distance between the centre of the pin and the upper channel should be 140mm.
Checking on pump stand alignment without the wooden block

Experience has shown that on many occasions, less experienced manufacturers do not make wooden blocks with consistently correct working hole positions. These should be drilled exactly 240mm apart at the hole centers. A special tool has been designed to check the stand alignment without the use of the wooden block. The pump stand is mounted vertically on the ground and checked with a spirit level. The pump is mounted on the stand. The “Apron plate” should be lie in an exactly horizontal position.

A special tool has been designed with a steel tube through which the rear pivot pin passes. The tube is bonded on to an extension arm which protrudes forwards. The distance between the pin centre and a hole at the distal part of the arm is 240mm. A plumb line is suspended from this distal hole. The extension arm is set in the horizontal position with a spirit level.

The plumb line descends vertically downwards through a special steel disc to which a 50mm socket has been welded (this can be the base plate of the water discharge unit). A short length of 50mm steel pipe, threaded at one end, is screwed into the socket from above. This plate is then placed on the rising main holding plate (“Apron plate”), so the holes between the plates match. This will reveal the position of the rising main as it descends from the pump head.
Photo of the pump mounted on a vertically set pump stand. The extension arm is horizontal with the plumb line descending vertically 240mm in front of the centre of the rear pivot pin. The descending plumb line falls through the base plate with short length of 50mm NB steel pipe threaded into a steel socket welded to the plate. The plumb line should fall around 10mm away from the internal wall of the 50mm pipe.

A more specialized plumb line can be used which is attached to a length of 16mm rod. In this case the distance between the rod and the inside of the pipe is around 2mm. The rod and the pipe should not touch when the rod is in its post forward position. Note: when the rod is in its most forward position, it should descend through the 50mm pipe in a forward position and not centrally through the pipe.
Conclusions

These simple templates and other measuring tools make it easy to assess whether the pump head has been made and welded together correctly to gain a correct alignment, so the pump rod falls through the rising main in the correct position.

This manual shows only wooden prototype templates which can be used to examine the pump head. These templates and tools should be copied in thin steel plate and stamped with an official Government of Zimbabwe stamp, to authenticate them.

Correct functioning of the “B” type Bush Pump head can only be achieved if it is fabricated correctly.

The correct functioning of the entire pump, including “down the hole” components (pump rods, rising main, brass cylinder and piston and heavy duty foot valve), can only be achieved with high quality components. Leather seals of the highest quality available should also be used.

By installing pumps which do not meet the required standard is the very best way of denying the users, most of them living in the rural areas of Zimbabwe, of a reliable supply of water, which is essential to life. This pump has been designed to provide a high quality service to its users. To install inferior and shoddily made equipment is quite unacceptable.

It is hoped that this manual and the use of high quality templates and other equipment, together with other manuals related to the Bush Pump, used by dedicated technical members of the Government, will lead to a higher standard of manufacture, use and maintenance of this important unit which has been designed to serve the rural populations of Zimbabwe.

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