The Zimbabwe Bush Pump

Inspection of the “B” type Bush Pump

Part 1. The pump head

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The Zimbabwe Bush Pump - an introduction

The National Hand Pump in Zimbabwe is called the "B" type Bush Pump and was standardised by the Government of Zimbabwe in 1989 following rigorous trials in very heavy duty and deep borehole settings. The pump was designed, like several of its predecessors, by staff of the Government of Zimbabwe. The “B” type pump head is used with standard "down the hole" components, comprising 50mm nominal bore galvanised steel rising main, 16mm mild steel pump rods, a 75mm diameter brass cylinder operating with a piston fitted with two leather seals and a heavy duty brass foot valve. These components are well tested and durable if correctly made and installed. Currently there are about 50 000 Bush pump installed in the rural areas of Zimbabwe. Optimum performance of this unit can only be expected if the components are correctly manufactured and also correctly installed. The “B” type Bush Pump head is internationally recognised with international specifications and is regarded as a “Public Domain” pump. The precise specifications are available from the Standards Association of Zimbabwe. The unique feature of all Bush Pumps is its use of a hardwood bearing.

Parts of the pump head - general
General photos of the pump head components

The lower part of the pump stand showing the base plate support plate (apron plate) and apron and the two large 16mm U bolts which secure the pump stand to the borehole casing. On the left the upper part of the pump stand and the U bracket in position.

The water discharge unit in position. The steel pipes of the rising main are connected to this through a heavy duty socket. The water discharge unit uses a “floating washer system” to accommodate the movements of the rods as they travel up and down during the pump stroke. A rubber buffer cushions the end of the down stroke. The floating washer system uses an inner and outer floating washer. The inner washer helps reduce foreign objects passing down into the rising main from above. The outer floating washer acts as a base for the rubber buffer to rest on.

The inner floating washer in place. A spacer ring separates the upper and lower plates of the floating washer system. On the right the upper plate has been secured in position and the outer floating washer and rubber buffer fitted.
The pivot pin. This has a diameter of 35mm and is hard wearing and supports the wooden block. It is held in place with a large nut and heavy duty spring washer.

The teak block is the main bearing and lever system on the Bush Pump. It has two sets of working holes. The steel handle is a length of steel water pipe attached to the wooden block with two 12mm U bolts. A central bolt which passes through the handle and the block secures the position of the handle to the block. Medium duty 50mm NB pipe is used as with the rising main – current standard SABS 62. Part 1. OD 60mm, ID 53mm, wall thickness minimum 3.2mm. Actual wall thickness near to 3.5mm.

Tools. The Bush pump can be maintained with unspecialised tools. But special tools have been designed specifically for the Bush Pump.
How the pump head works

One important feature of the B type pump head is that the wooden block (which acts as a long lasting bearing and lever mechanism) is connected directly to the pump rod through a sturdy “U” bracket. This feature eliminated the various shackles and other devises previously used to connect the block to the pump rod and reduced the number of wearing parts in the pump head.

The U bracket is slung from the front end of the wooden block through a strong pivot pin. A second pivot pin links the rear of the block to the pump stand. As the handle is moved up and down the pump rod also moves up and down. But this movement is not a vertical one. During the stroke the rod moves backwards and forwards. The pump configuration has been designed so that this backwards and forwards motion of the pump rod lies within the internal diameter of a 50mm NB steel rising main. Also in the normal pumping motion the pump rod also moves slightly from side to side. In other words the rod moves in an elliptical motion as it rises and descends during the pumping action. These movements of the pump rod take place within the 50mm steel pipe. Two floating washers form part of the “floating “washer housing.” These move about to accommodate the various positions adopted by the rod during its up and down motion.

Because the movements of the rod must take place within the confines of the 50mm pipe it is essential that the pump head is aligned precisely according to the specifications. Any variation in alignment of the pump head will lead to excessive wear on the moving parts of the pump head. This in turn will reduce the working life of the pump head.

It is essential, for instance, that the distances between the working holes in the wooden block are precisely 240mm apart. Note that there are two sets of working holes in the wooden block. This feature, taken from earlier bush Pumps, provides the wooden block with twice the working life with only one quarter extra wood being required.

It is also essential that the pump frame is welded together in a jig so that the pump rod falls vertically through the water discharge unit in the correct position.

NOTE that when the wooden block is in the horizontal position the rod (which descends from the U bracket) must lie in a forward position within the floating washer housing and within the pipe. As the wooden block is raised and lowered beyond the vertical position the rod moves to the rear of the pipe.

It is also important that the rod descends in the mid line of the pipe. That is not to one side or the other. Primary examination of the pump head and its parts centres first on these important features of the “B” type bush Pump.

These features are best shown in the diagrams and photos.
A guideline for choosing the correct handle size is given below:

<table>
<thead>
<tr>
<th>Installation depth (Position of cylinder)</th>
<th>Handle size</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 20 meter</td>
<td>DN 40, medium, 2 500 mm long</td>
<td>All steel handles should have minimum wall thickness of 3.2mm</td>
</tr>
<tr>
<td>20 to 60 meter</td>
<td>DN 50, medium, 2 500 mm long</td>
<td>This is the standard handle</td>
</tr>
<tr>
<td>Greater than 60 meter</td>
<td>DN 50, medium, 3 000 mm long</td>
<td>For very deep boreholes, the handle should be filled with concrete.</td>
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**FIGURE 40 – VARIOUS INFORMATION**

**Diagram of motion of the rod and wooden block**
EXAMINATION OF THE “B” TYPE PUMP HEAD

If a Bush Pump is to work well in the field it is important that the pump head (and down the hole components) are manufactured correctly according to laid down specifications (see Standards Association of Zimbabwe Specifications No.881:2011. Pumps cannot function properly if they are poorly made and do not following the recommended specifications. The pump stand and alignment are particularly critical. Neither can a pump work properly if it poorly installed. Pump parts need to follow the specifications so that spare parts can be interchanged on pumps from various manufacturers.

An examination chart has been available for the “B” type Bush Pump for some years and provides all the specifications or reference to drawings. This has been updated, below. In examining the pump as a whole, there are certain parts of the head which deserve close attention, as an overall priority.

Tools required for pump inspections

Callipers, micrometer, steel rule, measuring tape, templates for base plate holes and floating washer housing holes. These may be actual plates which have been approved correct.

The alignment of the pump head.

The B type pump head is designed with a direct link from wooden head block to rod though a U bracket. As the handle is moved up and down the rod performs a motion of its own in the horizontal plane. The rod passes through two floating washers which move within the floating washer system which is part of the water discharge assembly (see drawings). These washers allow sufficient flexibility of movement to cater for all rod movements within the normal pumping range.

The pump has been designed so that within the normal pumping range the rod does not rub against any parts of the rising main or water discharge assembly. There is some wear on the floating washers, but these are small easily replaced components. If however the alignment of the pump stand is incorrect, the rod may wear on components of the rising main or water discharge unit. This is highly undesirable, as undue wear will take place on the upper rod and water system. This also leads to friction between the parts and hardness of pumping. To gain maximum movement of the rod within the floating washer system it is also important that the rod falls through the centre line of the water discharge assembly not to one side. This allows for maximum forward and backward movement of the rod. In the normal motion there is also a small sideways movement of the rod through the floating washer system.

For these various reasons the correct alignment of the pump head is essential. The main pump stand components should therefore be formed and aligned in a jig so the correct angle of the pump stand is formed in the “channel section” which forms a major component of the pump head. Once the jig is accurate and all parts of the pump stand assembly are cut accurately, the rod should fall correctly within the water discharge assembly. The distance between the holes in the wooden block must also be accurate. This is 240mm.

Variations in the manufacture of pump stand components and drilling of holes in the block can lead to the rod descending through the water discharge assembly in an incorrect position.
On the finalised pump the correct location of the rod within the system can be determined in a simple manner. This is done by mounting the pump on a pump stand so that it stands horizontally. A length of 16mm rod is attached to the main U bracket (this will normally be fitted). This rod passes through the water discharge unit. A short length of 50mm GI pipe should be attached to the socket at the base of the water discharge assembly.

When the wooden block is in the horizontal and the rod in the vertical position the distance between the rod (front) and the outer part of the floating washer assembly should be 73.2mm +- 2mm. This is shown in the drawings. The pump and rods lie in this position it should be possible to move the rod slightly forward before it touches the 50mm pipe below.

When set in this position the rod should only touch the rising main on extreme downward movements of the handle, which are normally buffered (see installation manual) to avoid this. When observed from the front and when the wooden block is in the horizontal position the rod should lie in the centre of the floating washer assembly.

Examination of the rest of the pump head should follow the established Examination Chart for the “B” type pump head. This is attached below. This relates to taking correct measurements of the various parts. Note that parts between pumps from the same manufacturer and between manufacturers should be interchangeable. Certain parts of the pump are best checked with templates (eg Apron plate and floating washer plates) for correct locations of bolt holes.

**MOST CRUCIAL MEASUREMENTS**

1. The distance between the holes in the wooden block **(240mm)**
2. The angle of the pump stand (to ensure rod does not touch pipes during normal stroke).
3. A well made pivot pin (to ensure it holds tight).
“B” TYPE BUSH PUMP EXAMINATION

Tools required for pump inspections
Callipers, micrometer, steel rule, measuring tape, templates for base plate holes and floating washer housing holes. These may be actual plates which have been approved correct.

Mount pump on stand
Mount pump stand complete on length of 150mm borehole casing supported by footings. The casing should be exactly vertical. The teak block is removed first to measure the distance between working holes.

NOTE ENTER ACTUAL DIMENSIONS OF EXAMINED PART ON DOTTED LINE

MANUFACTURER’S NAME……………………
DATE INSPECTED ………………………
NUMBER OF PUMP ………………………

1. WOODEN (Teak) HEAD BLOCK
Correct sizes for wooden head block
Wooden block size (450 x 150 x 150 mm)……………
Shape of wood block (should be squared)…………………………………………………………
Distance between forward working hole centers (240 mm)……………………………………
Distance between rear working hole centers (240 mm) ………………………………………
Pivot pin hole diameter (36 mm – 37 mm)………………………………………………
Distance between handle U bolt holes (75 mm) ………………………………………
Block boiled in oil ……………………………

It is crucial that each set of working pivot pin holes are exactly 240mm apart in the block. The block can be planed down to 145mm X 145mm X 450mm. Note that there are two sets of working holes in the wooden block. The location of the holes is very important as it determines the correct entry point of the rod into the floating washer housing. The head bolts should rotate easily within the block. The bolt hole diameter should lie between 36 and 37 mm. The correct operation of the “B” type Bush Pump depends on correct alignment of the pump stand and accurate machining of the wooden block which acts as a lever and bearing surface. The holes for the handle U bolts should also be correctly placed and should be 75 mm apart. The U bolt nuts should be tightened against a plate 125 x 25 mm held tight by washers. The block is boiled in oil and cooled overnight for the oil to penetrate.

Two sets of working holes are drilled into the block. When the first set of holes is work (after many years) the second set can be put to use. This doubles the life of the teak block for an extra 25% of wood used. Each set of working holes is drilled 240mm apart. The wooden block should be boiled in oil.
2. PUMP STAND

2.1 The main steel channel section.
The pump stand is constructed from steel components specified in the technical drawings. The main frame of the stand is made from a 750mm length of 153mm (+-1mm) X 76mm steel channel. Each side of the channel is cut 400mm above the base and bent to the correct angle. A jig and press are required to obtain the correct 14 degree angle (see drawings). The exact angle of the jig should be checked as accurate before mass production proceeds. It is essential to ensure that the jig is correctly set up before mass production and that the angle of each pump stand is set on the jig. The final angle is set after testing the pump attached to a vertically mounted borehole casing as described later. The triangular opening in the channel formed after bending is filled with plate welded in position. A pump stand side plate is welded on each side of the channel (2). A rising main support plate is also welded to the channel. Two fixing plates are also welded to the main channel to secure the two main U bolts which secure the pump stand to the borehole casing.

Channel section
Width (153+-1mm) ..........................................
Total length (750mm) ............................................
Position of bend (400mm above base)........

Comments .......................

2.2 Size and thickness of pump stand side plates (2)
These are the two plates welded on each side of the steel channel section which makes up the main body of the pump stand.

Thickness (12 mm) ..................................................
Length (720mm) ...................................................
Width (65mm) ..........................................
Distance between side plates (153 +-1mm) ..............................:

Comments...........................................................................

2.3 Pivot pin holes in pump stand
These should be 36 mm (range 35.5 – 36 mm) and 25 mm (range 24.5 – 25 mm) respectively. The 25 mm hole should have a double thickness of 12 mm plate increased by a 12 mm thick washer welded to the pump stand to make a total thickness of 24 mm. NOTE: Head bolt securing plate should be below bolt head and horizontal (see drawings and photos).

Large hole in stand (36 mm) .........................
Small hole in stand (25 mm) .................................
12 mm thickness washer added (Y/N) .................................
Small hole in washer (25mm) .................................
Head bolt securing plate horizontal added (Y/N) ..................

Comments ..........................................................
2.4 The rising main support plate (apron plate)
This is the plate that supports the floating washer housing and is welded to the main frame of the pump stand. It is cut from 10mm steel plate and shaped according to the drawings. The bolt holes should match the holes in the floating washer housing. A hole is also made for the inclusion of a dip plug to measure water levels in the borehole or well. A steel apron is welded to the plate.

2.5 The main pump stand U bolt fixing plates and U bolts
Two U bolt fixing plates (260mm X 50mm) are welded to the main frame of the pump stand (see drawings). The 2 main pump stand U bolts are used to attach the pump stand to the borehole casing. They should follow the specification on the drawings i.e. 200 mm long beyond bend. They should be located in the fixing plates welded to the pump stand. These plates have hole centers 180 mm apart. Threads should be long enough to ensure complete tightening of head to borehole casing.

Comments……………………………………..

The two main U bolts and fixing plates welded to the pump frame.
2.6 Correct angle of pump stand
Fit all the components of the Bush Pump together and bolt up. Place the pump on a pump stand for inspection. Ensure that the steel casing is vertical with a spirit level. Set the wooden block in a horizontal position with the U bracket suspended vertically with a short length (50cm) of 16mm rod attached to the U bracket. Also check that the centers of the bolt holes in the wooden block are exactly 240 mm apart. When the pump stand angle is correct the front surface of the descending rod should be 73 +/- 3 mm behind the front edge of the floating washer housing. This is shown on the bush pump technical drawings.

Distance between pump rod and front of floating washer housing (73 +/- 3mm) …………………

Checking for pump stand alignment.
In a correctly aligned pump head, the rod should move freely within the rising main pipe without touching sides with the pipe. When the wooden block is in the horizontal position the pump rod should lie in a forward position within the water discharge unit. The distance between the rod and the leading edge of the water discharge unit should be 73mm or close. This is the pump rod’s most forward position. The pump rod moved backwards towards the pump stand when the rod is lowered to rest or elevated. The upper and lower parts of the pump stand (channel section) should be bent at an angle which should be predetermined in a jig. Ensure the jig is accurate before mass production of the pump. It is essential to ensure that the jig is correctly set and that the angle of each pump stand is set on the jig.

2.2 Alignment of pump head
The head should not be twisted and the pump should stand exactly vertically on the borehole casing. Set the wooden block in the horizontal position with the U bracket and short length of 16mm rod hanging below through the floating washer housing. Inspect the pump from front and side to see that the rod enters the floating washer housing correctly. From the front the rod should enter the housing along the mid line. From the side the rod should enter the housing in a forward position, so that when the rod is vertical, the rod does not touch the steel rising main. During use the rod should move up and down centrally within the floating washer housing. The pump stand should not be twisted and the wooden block drilled accurately to achieve this alignment. In use the handle performs a rotation movement, not just an up and down movement. The floating washers accommodate for this movement in the rod. The rod should not touch the rising main pipes during this movement.

In a correctly aligned pump head, the rod should move freely within the pipe without touching sides with the pipe. When the wooden block is in the horizontal position the pump rod should lie in a forward position within the water discharge unit (left photo). The distance between the rod and the leading edge of the water discharge unit should be 73mm or close. This is the pump rod’s most forward position. The pump rod moved backwards towards the pump stand when the rod is lowered to rest or elevated.
When the pump is mounted vertically on the pump stand and the wooden block is placed in the horizontal position the front edge of the rod descending from the U bracket should lie about 73mm from the front end of the floating washer housing. The rod will be in its most forward position when the pump and wooden block are set in these positions.

The upper and lower parts of the pump stand (channel section) should be bent at an angle which should be predetermined in a jig. Ensure the jig is accurate before mass production of the pump. It is essential to ensure that the jig is correctly set and that the angle of each pump stand is set on the jig.

2.2 Alignment of pump head

The head should not be twisted and the pump should stand exactly vertically on the borehole casing. Inspect the pump from front and side to see that the rod enters the floating washer housing centrally and not to one side.

The rod should move up and down centrally within the floating washer housing. The pump stand should not be twisted and the wooden block drilled accurately to achieve this alignment. Note positions of the pivot pin head securing plates on the pump stand and the U bracket.

3. EXAMINATION OF MAIN U BRAKET

The U bracket should be made from 12mm thick plate. The uprights and base section should be square and uprights 153mm ±1mm apart. The threaded socket, which secures the rod should be 30mm long and welded square to the U bracket. The rod should descend squarely from the U bracket. The rod should descend in a central line through the floating washer
housing. The securing plate holding the head bolt should be welded above the bolt head. The head bolt holes in the U bracket should be 36mm and 25mm in diameter respectively for insertion of the forward head bolt (pivot pin). A 12mm thick washer should be welded around the 25mm hole to increase the thickness of the U bracket at this point to 24mm. Forward and rear head bolts (pivot pins) are identical. The distance between hole centres and upper surface of the U bracket should be 165mm.

**Correct sizes for U bracket**

- Thickness plate (12 mm)
- Height of 16 mm rod socket (30 mm)
- Position of pivot pin head securing plate (above pin head)
- Head bolt hole (large 36 mm)
- Head bolt hole (small 25 mm)
- 12 mm thickness washer added (Y/N)
- Distance between hole centre and upper surface U base (165 mm)
- Distance between uprights (154 mm)

**Comments**

The U bracket showing positions of pivot pin head securing plate and washer and also the rod socket.

The U bracket which connects the pump rod to the wooden block. Note the position of the pivot pin head securing plate (left photo) and the washer (right photo).
4. EXAMINATION OF WATER DISCHARGE UNIT

4.1 Height of vertical member of Water Discharge Unit
The height should be 200 mm (65 mm nominal bore GI pipe – outside diameter 77 +/-1 mm. Diameter of dip plug hole should be 24 mm to suit M 24 plug.

Correct sizes for water discharge unit
Main vertical pipe
Height (200 mm) .................................................................
Size (65 mm NB) .................................................................

4.2 Diameter of Base Plate
Diameter (160 mm) .........................
Thickness (10 mm) .........................
Diameter of central hole (60 mm) .......
Note positions of holes in base plate (use template)
Dip plug hole.............present but no dip plug

4.3 Socket for attachment to GI rising main
This should be a heavy duty steel socket for use with 50mm GI pipe (such as steam pipe). It is essential the socket is welded to the base plate square so the rising main falls vertically.

Comments........
4.2 Diameter of Base Plate

Diameter (160 mm) ………………………
Thickness (10 mm) …………………
Diameter of central hole (60mm)
Note positions of holes in base plate (use template)

Bolt holes in base plate
Check positions of 4 holes in base plate (bottom flange) and support plate (apron plate) with sample template. This can be done by removing bolts and lifting the Water Discharge Unit and then inserting the template to see if the holes match.

The floating washer housing base plate and heavy duty socket.

4.3 Socket for attachment to GI rising main
This should be a heavy duty steel socket for use with 50mm GI pipe (such as steam pipe). It is essential the socket is welded to the base plate square so the rising main falls vertically.

4.4 EXAMINATION OF FLOATING WASHER HOUSING
The overall outer diameter of the housing should be 190 mm, the lower plate is 10 mm thick and the central spacer ring is 10 mm thick. The upper plate 6 mm thick. The central hole diameter should be 62+2mm. During the pumping stroke the rod moves around within the 60mm openings in the plates. The floating washer accommodates for the movement of the rod in all directions. The lower washer acts as a simple seal to reduce ingress of particles which could jam the piston and valve gear. The upper washer supports the rubber buffer.

Correct sizes for floating washer housing

Thickness of lower plate (10 mm) ……………………………………………………………
External diameter of lower plate (190mm) ………………………………………
Diameter of central hole in lower plate (60mm) ………………………………………
Thickness of upper plate (6 mm) ……………………………………………………………
External diameter of upper plate (190mm) ………………………………………
Diameter of central hole in upper plate (62+ 2mm) ………………………………………
Thickness of central spacer ring (10 mm) …………………………………………….
External diameter of central spacer ring (190mm) ………………………………………
Internal diameter of spacer ring (145mm) ……………………………………………

Comments…………………………………………………………

Check positions of 3 holes in floating washer housing plates using sample template. This can be done by removing bolts and lifting the floating washer housing plates and then inserting the template to see if the holes match.
The lower plate and spacer ring of the floating washer housing.

The spacer ring and the lower floating washer fitted in place.

The upper plate of the floating washer housing
The upper floating washer fitted above the upper plate. The upper and lower plates and spacer ring are bolted in place.

**IMPORTANT**

Check positions of 3 holes in floating washer housing plates using sample template. This can be done by removing bolts and lifting the floating washer housing plates and then inserting the template to see if the holes match.

**4.5 Floating Washers (2)**

**Correct sizes for floating washers**
- Thickness of plate (6 mm) .........................
- Diameter of washer (100 mm) .................
- Diameter of central hole (17 mm) ..............

The two floating washers. Both should move freely within the floating washer housing.

**4.6 Free movement of 100 mm diameter floating washers (2)**

Ensure that these move freely and to their full extent within the floating washer housing.

**Comment** ..........................................................
4.7 Water Outlet Pipe

This should follow drawings. Horizontal component about 264 mm. A 50 mm socket should be fitted to allow for cattle trough takeoff. This design facilitates fast delivery of water from the 75mm cylinder.

One modification has been made to the outlet pipe system. That is the inclusion of a perforated disc of steel welded in place in the distal part of the water outlet pipe and close to the 50mm socket. Over the course of years it has been noted that it is possible to push stones and other items down the pipe with a stick. This type of abuse can reduce the efficiency of the valve gear in the piston. The perforated disc prevents this type of abuse.

5. EXAMINATION OF PIVOT PINS (Main head bolts)

5.1 Pivot Pin sizes

Ensure that each bolt is fitted securely and are fastened by a M24 nut and 4.5 mm thick spring washer. There should be no play in the unit. Ideally the bolt should be made from a 35 mm diameter bright mild steel shaft and the overall bolt length should be 231 mm. The main working surface of the bolt is 165 mm long and should be 35 mm in diameter. One end of the bolt is reduced in thickness to 24 mm over a length of 50 mm. Half of this (25 mm) is threaded for an M24 nut. The remaining 25 mm length of 24 mm diameter shaft is unthreaded and is held within the U bracket or upper pump stand. The other end of the bolt is reduced to 20 mm diameter over a 16 mm length for attachment by welding to the bolt head. The bolt head measures 50 x 50 mm and is 16 mm thick with a central 20mm hole drilled in it for attachment and welding to the shaft (see drawings). The 16 mm thick securing plates limit the rotation of the pivot pins. These are fitted below the bolt (pivot pin) on the pump stand and above the head bolt on the U bracket. The securing plates should make contact with the head bolt and not be distant from it. They are designed to hold the bolt in place and stop it rotating. The securing plates should also be 16 mm thick. On the pump stand the securing plate should be horizontal (see pump drawings). The securing plates are designed to reduce the wear of the holes drilled in the pump stand and U bracket.
PIVOT PINS

<table>
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<tr>
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<th>two</th>
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</table>

Head bolt diameter – main shaft (35 mm) .................................................................
Head bolt diameter – reduced section of shaft (24 mm) ..................................................
Length of main shaft (165 mm) ....................................................................................... 
Length of reduced diameter shaft (50 mm) .....................................................................
Length of threaded section (25 mm) ............................................................................... 
Size of bolt head (50 x 50 x 16 mm) ................................................................................

Comments.........................................................................................................................

The pivot pin in its first form. Square heads are added to each pin and also a thread added to one side.

5.2 Spring washers on pivot pins

These are designed to keep the main head bolts tight. They should be heavy duty 4.5mm to 5mm thick. Thinner spring washers do not work well. Check whether these are in place and are 4.5 mm - 5 mm in thickness (ie heavy duty)

Comments.........................................................................................................................

The heavy duty spring washer and nut for the pivot pin. The squared head of the pivot pin.

6. EXAMINE OTHER PARTS

6.1 Rubber Buffer
Height (50 mm) .............................................................................................................
Width (60 mm) ..............................................................................................................
Central hole (17mm) .......................................................................................................

20
6.2 Handle
This should be **50 mm** medium duty GI pipe (SABS 62, part 1), **2.5 m** long unless otherwise specified. **NOTE.** For pumps used down to about 20 - 30 m a 40 mm handle is preferred 2.5m long. Deeper pumps require a 50 mm x 2.5 m handle filled with concrete fill. Very deep pumps (80 – 100 m) require a 50 mm x 3 m handle filled with concrete fill – (see installation manual). An extension on the handle may be required. For pumps set a 100m or more a strengthened pumps stand is recommended.

Comments ……………………………

6.3 Securing U bolts for handle
These should be correct length otherwise they may come into contact with the pump head. The lengths of these U bolts should be 210mm beyond the bend of the bolt.

Length of bolt beyond bean (**210mm**) ………………………………………

6.4. Handle U bolt securing plates
Size of securing plate (125mm X 25mm) ……………………………

Comment ……………………………………………………………

7. Quality of Welding

Comments ………………………………………………………………………

8. General Appearance (Painting etc.)

……………………………………………………………………………………

9. Pump makers plate added (Y/N)
A pump makers plate should be attached to the pump stand. It is wise also to stamp these details intro the fabric of the steel stand.

10 General Comments …………………………………………………………….

11. Recommendations …………………………………………………………

Signed …………………………… Date: …………………………………
Photos of parts of the pump during fitting

The pump head is lowered over the borehole casing and tightened with two large U bolts as shown. These are fitted with spring washers.

The water discharge unit and floating washer system

The upper part of the water discharge unit is fitted with a floating washer system. This allows the rod to move about freely within the pipe throughout the pump stroke. There are two floating washers, a spacer ring and an upper and lower plate.

The top plate is fitted on top of the spacer ring and an addition floating washer added on top.
Fitting the rubber buffer and U bracket

The rod is pulled up and the rubber buffer is slid down over the rod and the U bracket is then threaded on to the rod.

The rod is threaded through the U bracket socket and a further 12mm so the lock nut can be attached and locked tight. The thickness of the U bracket (12mm), half socket (25mm) and nut (12mm) is about 50mm.

The pump has now reached the stage where the wooden block and handle can be fitted. The extra outlet of the water discharge unit can be fitted at this time. The 50mm socket fitted along the water discharge pipe allows for a tee pieces to be fitted for an off take for cattle water trough.
Preparing the wooden block and handle

One unique feature of the Bush Pump is the bearing which has a long working life, extending to one or more decades. It is made of teak, which is boiled in oil and left to cool, so the wood absorbs the oil. This gives the wood self lubricating properties. The original Bush Pumps had two sets of holes, so that when the first were well worn, the second pair of holes could be used. However in practice the pump stand will wear and need refurbishment before the block holes wear to the point where they are not operational. The “B” type Bush Pump wooden block retains the double sets of holes.

The handle

The standard handle is made of heavy duty 50mm steel pipe, 2.5m long. In fact on shallower set pumps the handle can be made of 40mm (heavy duty) pipe. For pumps set between 1 – 29m a 40mm steel handle 2.5m long is adequate. For pumps set at between 30 and 45m (the most common setting), the handles are made of 50mm pipe and 2.5m long. This is the standard handle. For deeper settings the handle is made 3m long. On very deep boreholes (60m+) the 3m handle is filled with concrete. On 80m boreholes or greater (up to 110m) a heavy duty pump stand is recommended.

Mounting the wooden block

The wooden block is mounted on the pump stand and is supported by two large bolts known as pivot pins. These are 35mm in diameter and secured by large nuts held tight by spring washers. For convenience the pivot pin is placed through the U bracket first.
The heads of the pivot pins are squared and are held in place by supporting plates which restrict wear in the pivot pins holes in the upper pump frame and U bracket. Note that the pivot pin head restricting plate is placed above the pin on the U bracket and below the pin on the main pump frame. This is because the wear characteristics of the pin on the frame and U bracket are different. The pivot pin is held tight by the large nut and heavy duty spring washer.

Both pivot pins are secured and tightened.

Rear pivot pin secured and tightened by special Bush Pump spanner.

The pivot pins are best made of bright mild steel and the wooden block boiled in oil and cooled. These give the “steel to wood” bearing unique and long lasting qualities. Part of the maintenance requirements of the pump head necessitates keeping the pivot pins tight. If they loose, wear between the pivot pin and the pump head frame will begin.

Note that all well made “B” type Bush Pumps can be refurbished. That is taken into the workshop or back to the factory and brought back to near original condition.
Pump Tools

Pump tools. Bush Pumps all require routine maintenance. Bolts need to be tight and require spanners. Loose bolts can lead to wear. In fact the Bush Pump can draw water if all its bolts are loose or even missing. There will always be some way of using local improvisation to make it work. But this condition will lead to premature wear. Regular maintenance is required, as this prolongs the working life of the unit. If the pump head is cared for it will provide a long and valuable service to the community.

A tools list is prepared on another document.