Practical Guidelines for the inspection of the Zimbabwe "B" type Bush Pump

Geometry and preliminary inspection

Peter Morgan
Guidelines on the inspection of the B type Bush Pump

Introduction

This new guidelines has been produced to assist those who are examining the quality of manufacture of the “B” type Bush Pump. It should be used alongside the existing Pump Inspection Chart and the longer illustrated manual on inspection of the Pump (pump head and down the hole components). More concise explanations are given and special attention to the main points to look for when examining the pump head and “down the hole” components.

Examination of the pump is greatly assisted by having knowledge of why the “B” type Bush Pump was designed as it is. The primary aim was to simplify the pump head and reduce the number of wearing parts to a minimum. The B type pump was introduced at a time when many variants of the Bush Pump existed (1989) which led to confusion on maintenance and provision of spare parts.

In this manual, the use of special patterns or templates has been introduced to make preliminary inspection easier. These prototypes are carefully made plywood cut-outs which are fitted on to the test pump to establish whether the preliminary geometry of the pump is correct.

In the “B” type Bush Pump, the geometry of the pump must be 100% accurate, if the pump is to perform at its best. The inspection of the Bush Pump includes:

1) Inspection of Pump head
2) Inspection of “Down the hole” components: Cylinder, Piston, Foot valve

The inspection of the pump head should be undertaken with the pump mounted on a pump stand where the 150mm steel casing (on which the pump is mounted) is perfectly vertical. A range of spanners, rulers, callipers etc are required for the inspection. Also a set of templates to simplify the ease of initial inspection. Thus the inspection is in two parts

1) Initial inspection of geometry (that is alignment of the parts)
2) Measurements of the parts (see updated inspection chart)

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Peter Morgan
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The wooden block, which is made of teak, is attached to the pump stand and rotates around a large bolt called a pivot pin. The rods which connect to the piston within the cylinder below, move up and down within a “string” of steel pipes (known as the “rising main”). The uppermost rod passes through a floating washer housing, where a set of 2 moving washers accommodate for the horizontal movements of the rod within the pipe. The uppermost rod is connected to the pump head through a “U bracket.” The U bracket is attached to another pivot pin which passes through a forward hole in the wooden block. The wooden block has 2 sets of holes, a method derived from earlier Bush Pumps. The two sets of working holes must be exactly 240mm apart. When the first set of holes wears out, the second set can be put into use. The wooden bearing has a very long life. The geometry of the pump is very important and during manufacture, it is essential that the pump head is correctly aligned. The use of jigs and templates is very important.
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>
</tr>
</tbody>
</table>

**FIGURE 40 – VARIOUS INFORMATION**

Diagram of motion of the rod and wooden block
General photos of the pump head components

The lower part of the pump stand showing the rising main 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 (nominal bore) pipe is used as with the rising main – current standard SABS 62. Part 1. OD (outer diameter) 60mm, ID (inner diameter) 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.
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 follow the recommended specifications. 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, (see later in this manual). 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, set square, measuring tape, and spanners for taking the pump apart. In addition a series of templates have been designed which can be laid on the pump and its parts to ensure correct size, shape and alignment. 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 through 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 and photos. When 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). 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, steel rule, measuring tape, spirit level, set of spanners for taking the pump apart, set of templates for base plate holes, floating washer housing base and housing, angle of pump head, distance between pivot pin holes etc. These are wooden or steel plates which have been approved correct.

TOOLS

Measuring instruments

Steel rulers, callipers, spirit level, measuring tape

Spanners

Wrench spanners, adjustable spanner, Special pump spanners
Templates (prototypes)
A series of templates (initially hand crafted in plywood, but shortly to be crafted in thin steel plate) 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.
Templates

Large template made to test the overall geometry of the pump head with locations for pivot pin holes and pump stand angle with wooden block in horizontal position.

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.
Templates

Template to check 90 degree angle of rising main support plate and main pump stand channel. Template to show configuration of U bracket.

Template for Pivot Pin. Template to show distance between rear pivot pin and upper end of channel section of pump stand.

Template to test for 90 degree angle of 65NB pipe on water discharge assembly base plate. Template and plumb-line for checking correct alignment of pump stand and entry of rod through the rising main support 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.

Template for testing correct position of holes in wooden block (240mm between centres)

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 to underside of plate.

Checking length of side arms (720mm (original of 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 it is 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).

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.
Checking to establish that pump stand channel is fully attached to 150mm casing

When the rising main support plate is attached to the surrounding “skirt” by welding (underneath the plate), the welding spots can interfere with the close contact between the channel section of the pump frame and the borehole casing (150mm steel casing). When this happens the pump stand is not mounted correctly on the casing. Any weld spot which interferes with the contact between the pump stand and the 150mm casing should be removed by grinding. The channel section of the pump stand should come in to contact with the 150mm steel casing through its entire length.

These photos show a pump stand mounted on vertically mounted 150mm steel casing, where welding under the rising main support plate prevents complete contact between the channel and the steel casing. A gap appears between the casing and the pump stand beneath the rising main support plate. The casing and the channel are no longer parallel.

This condition leads to a situation where the rising main support plate is not horizontal, although the pump is mounted on a vertical steel casing. The photo shows a spirit level mounted on the rising main support plate which reveals that the plate is not exactly horizontal. This affects the vertical drop of the pump rod and the 50mm pipes of the rising main. It also affects the position where the rod passes through the floating washer housing. It is important that the steel channel of the pump stand is fully supported by the casing throughout its entire length and the rising main support plate is mounted horizontally.
Rod should be in near central position when viewed from the front. The rod in its most forward position (when wooden block horizontal).

The large template should be placed over the two threaded ends of each pivot pin. The wooden block should be placed in a horizontal position. This reveals the correct position of pivot pins, angle of pump head, and forward position of rod and U bracket. 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 + 22mm 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 145X145mm to 150X150mm).

Checking angle of pump stand channel section. Use template which shows 14 degrees of angle. 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.
Precise checking of pump stand alignment

Attach a short length of 50mm GI pipe to heavy duty socket welded to water discharge unit base plate. Locate over holes in rising main support plate. This test is performed with a base plate before it has been welded to the rest of the water discharge unit.

The wooden block is moved into a horizontal position. This can be supported by a special wooden or steel prop.

Check exact horizontal position with spirit level
Next mount plumb-line by attaching plumb line U mount to front working hole in wooden block. A steel pin supports the U mount.

The string of the plumb-line has a weight (nut) attached to it. This descends through the rising main support plate and indicates the position the pump rod.

The plumb-line should fall in the midline of the pipe socket welded to the support plate and 65mm behind the front edge of the support plate. In this correct position the pump rod falls clear and within the 50mm rising main pipe.
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 centres. A special tool has been designed to check the stand alignment without the use of the wooden block.

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 arm is places in a horizontal position using a spirit level. The plumb line descends vertically downwards through the rising main holding plate.

The special tool combining a water discharge base plate and a short length of 50mm pipe is placed on the rising main support plate and the bolt holes lined up. The plumb line descends vertically through the base plate.
The plumb line indicates the position the pump will take as it descends from the pump head. This should be a little forward of the mid-point of the descending rising main pipe.

The plumb line should descend through the mid line of the socket welded to the base plate, but forward of the centre as shown. The plumb line should descend 65mm behind the front edge of the base plate.

The plumb line should descend 65mm behind the front edge of the base plate.
Precise method of testing for Bush Pump stand alignment

The correct alignment of the Bush Pump head (stand) is very important. This section shows how a plumb line attached to a 16mm rod can be used to measure very precisely the position in which the rod falls through the rising main. When the pump is set in the vertical position and the rising main support plate is horizontal, and the plumb line falls vertically from a position 240mm in front of the rear pivot pin (from the extension arm), the rod should pass through the rising main in a forward position, but not touching the pipe. This can be checked with a specialised plumb line shown below. This consists of a plumb line which is connected to a 16mm pump rod. A short section of rising main (wall thickness 3.5mm) is threaded into heavy duty socket welded to the base plate template.

The testing equipment used to precisely check the pump head alignment. The plumb line is attached to the extension arm and also to a 400mm length of 16mm rod. A 50mm length of 50mm NB steel pipe is also prepared, threaded on one side to screw into the support plate template.

The extension arm is attached to the rear pivot pin after the pump has been set in the upright position. The short length of 50mm pipe is threaded into the support plate template. The plumb line attached to the 16mm rod is then hung from the extension arm.
Both the extension arm and the base plate template should be in the horizontal position – checked with a spirit level.

Photos showing the plumb line suspended from the extension arm, with the rod passing through the short length of 50mm pipe. A special shackle has been designed to link the plumb line to the rod.

The descending 16mm rod should not touch the front wall of the rising main pipe. The distance between the descending rod and the pipe should be around 1 – 2mm. The rising main pipe should be 3.5mm in thickness. The base plate of the water discharge unit has been made with bolt holes slightly larger than the securing bolts, which allows a little latitude in the position of the plate. In practice, the descending rod will be drawn towards the centre line lower down the pipe, allowing a small amount of tolerance. As the rod moves up and down during the normal pumping stroke, the rod moves backwards towards the back wall of the rising main pipe. The rod and pipe should not touch during the normal stroke.
Comments on correlation between templates and examined pump head

PHOTO

...Angle pump stand (14 degrees) .................................................................

...Pivot pin centres. 240mm.................................................................

...Rod position. 73mm........................................................................

.........Rod Position. 73mm ................................................................

.........Rod position. Central ................................................................

...Position bolt head securing plates...........................................

..... Pump mounted correctly on 150mm casing.........................
PUMP HEAD (Parts dismantled or partly dismantled)

PHOTO

COMMENTS

....Water discharge unit. Right angles..................................................

....190mm..........................................................................................

....190mm /62 +2mm...........................................................................

....Rising main support plate.............................................................

....Water discharge unit base plate.....................................................

....Hole centres block.240mm............................................................

....Pivot pin specs.............................................................................
U bracket specs.................................................................

Channel section (400mm + 350mm = 750mm)...............}

Angle pump stand..........................................................

Angle rising main support plate.................................

Side arms length (700 - 720mm)......................................

Distance upper channel and rear pivot pin centre (140mm)
Following these initial measurements, the more detailed measurements of the various components of the Bush Pump head can begin. The revised examination chart for inspection of the “B” type Push Pump head should be used. Also the illustrated version can be used for reference.
The Pump head is inspected by mounting and bolting the pump head on to a pump stand which is set (with a spirit level) in a vertical position.

Tools and equipment required: steel ruler and set square, calipers, measuring tape, pump spanners, set of officially certified templates.

The pump is inspected from the top downwards, starting with the pump mounted on pump stand and the wooden block mounted in a horizontal position.

## INSPECTION CHART FOR ‘B’ TYPE “BUSH PUMP” HEAD

**MANUFACTURER** …………………………………………….. **DATE** ………………………..

1. **Angle of pump head.**
   Test the angle of the pump stand with template (14 degrees) …………………………..

   Comments……………………………………………………………………………………………

2. **Distance between pivot pin centers**
   (240mm) …………………………….. Comments………………………………………………

3. **Dimensions of pump head**
   Main steel channel
   Total length 750mm (lower 400mm) … … … (upper 350mm) ……………………………
   Side arms
   Total length of side arm (720mm, 700mm acceptable) ……………………………

   Distance between rear pivot pin centre and upper end of channel (140mm) …………..
   Distance between upper end of channel and bend in channel (350mm) …………………
   Distance between bottom of channel and under-side of rising main support plate
   (300mm) ……………………………………………………………………………………………
   Rising main support plate set square with channel (Y/N) ………………………………..

   Comment…………………………………………………………………………………………..

4. **Checking the alignment**
   This is very critical. It can be tested by mounting the pump on a pump stand which is exactly vertical. (test with spirit level) and placing the wooden block in a horizontal position (test with spirit level) and the rod (and U bracket) set in the vertical position. Also check that the centers of the bolt holes in the wooden block are exactly 240 mm apart. When the pump head angle is correct the front surface of the descending rod should be 73 +/- 2mm mm behind the front edge of the floating washer housing. This is shown on the bush pump technical drawings. The distance between the centers of the two pivot pins should be exactly 240mm. This can be measured with set square and special template. Set the rod in vertical position and check position in relation to front edge of floating washer housing.

   Distance between two pivot pin centers (240 mm) ……………………

   Distance between pump rod and front of floating washer housing (73 mm) +/- 2mm (use set square, steel rule or tape.)

**COMMENTS:** ………………………………………………………………………………………………..
Alignment of pump head (front to rear)

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.

COMMENTS: .............................................................................................................

NOW REMOVE WOODEN BLOCK AND PLACE ON ONE SIDE

5. Examination of pump stand

5a Thickness of pump stand side arms (12mm) . COMMENTS: ......................... .......

5b Head bolt 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).

Large hole (36 mm) = ...................... Small hole (25 mm) = .................

12 mm thickness washer added (Y/N) .........................................................

Head bolt securing plate, below and horizontal (Y/N)
............................................................................................................................... 

6. Inspection of Pivot Pins

Ensure that the bolt is fitted securely and is fastened by a M24 nut and 4, 5 mm thick spring washer. There should be no play in the unit. 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 to be 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 a M 24 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. The 16 mm securing plate is welded below the pivot pin head on the pump stand and above the pivot pin head on the U bracket. The securing plates should make contact with the pivot pin head to stop rotation 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).

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

OTHER COMMENTS: ......................................................................................

Spring washer
Check whether these are in place and are 4,5 mm - 5 mm in thickness ..............

COMMENTS: .......................................................................................................

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7. **Inspection of Wooden Head block**

This should be made of teak. Check size with drawings (450 x 150 x 150 mm). With planning this may be reduced to 450mm X 145mmX 145mm which is acceptable. The critical measurement is the distance between the centers of each set of working holes. This should be exactly 240 mm. This is important as it determines the correct entry of the rod into the floating washer housing. The block shall have been boiled in oil for 4 hours and cooled overnight for the oil to penetrate.

The head bolts should rotate easily within the block. Test for this. The bolt hole diameter should lie between 36 and 37 mm but may require drilling to 38 mm if the wood is inclined to swell. 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 spring washers.

**COMMENTS**

- Size wooden block (450X150X150mm)
- Wood type (teak)
- Treatment
- Holes drilled square
- Distance between forward working holes (240 mm)
- Distance between rear working holes (240 mm)
- Hole diameter (36 mm – 37 mm)
- Distance between U bolt holes (75 mm)
- Handle U bolt securing plate (spring washer)

8. **Handle U Bolts**

These should follow the specifications on the drawing (210 mm beyond bend) and not too long otherwise they foul other moving parts of the pump. They should be fitted with spring washers mounted against the securing plate (see above).

**COMMENTS**
9. Inspection of floating washer housing

The floating washer housing forms part of the water discharge unit.

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 in the upper plate should be 62 +/− 2mm.

Thickness of upper plate (6 mm) .................................................................
Thickness of lower plate (10 mm) ..............................................................
Thickness of central spacer ring (10 mm) ...................................................
Diameter of upper plate (190 mm) ............................................................
Diameter of central hole (62mm +/- 2mm) ..................................................

Size of Floating Washers (2)

These should have a diameter of 100 mm from a 6 mm thick plate with a central hole 17 mm in diameter.
They should move freely within the floating washer housing

Thickness of plate (6 mm) .................................................................
Diameter of washer (100 mm) ........ Diameter of central hole (17 mm) ........

9. Water Discharge Assembly

The height should be 200 mm (65 mm nominal bore GI pipe – outside diameter 76 +/- 1 mm.
Diameter of dip plug hole should be 24 mm to suit M 24 plug.

Height (200 mm) = .............................................................................
Size (65 mm NB) = .............................................................................

Exactly vertical mount on base plate (Y/N) .................................

Base Plate of Water Discharge Assembly

Diameter (160 mm) ......................... Thickness (10 mm) .........................
Diameter of dip plug hole (24 mm to suit M 24 plug) .........................

Quality of 50 mm Socket for attachment to rising main support plate

This should be heavy duty steel pipe: COMMENTS ...........................................
10. Inspection of U Bracket

This should be 12 mm thick and follow all the measurements on the drawings. The uprights should rise 250 mm above the top of the horizontal section. The uprights and the base section should be square (uprights 154 mm apart). The threaded socket, which secures the rod, should be of the right length (30 mm) 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 pivot pin should be welded above the bolt head. The head bolt holes in the U bracket should be 36 mm and 25 mm in diameter for insertion of the forward pivot pin. The 25 mm hole should have a double thickness of 12 mm in diameter plate increased by a 12 mm thick washer welded to the U bracket to make a total thickness of 24 mm. Forward and rear pivot pins are identical. Distance between hole centers and upper surface of U bracket base should be 165 mm (177 mm to lower surface).

COMMENTS ON U BRACKET

Thickness plate (12 mm) = …………………………………………………………
Height 16 mm rod socket (30 mm) = ……………………………………………….
Position of bolt securing plate (above) ……………………………………………
Head bolt hole (large 36 mm) = ……………………………………………………..
Head bolt hole (small 25 mm) = ……………………………………………………..
12 mm thickness washer added (Y/N) …………………………………………..
Distance between upper surface of U bracket base and hole centers (165 mm) ………
Distance between upper surface of U bracket base and top of uprights (250 mm)………
Distance between uprights at top of U bracket. (154 mm) ……………………………

COMMENTS: …………………………………………………………………………

11. Rubber Buffer

This should be about 50 mm high and 60 mm in diameter with a central 17 mm hole.

Height (50 mm) …………………………… Width (60 mm) …………………………….
Central hole (17mm)……………………………………………………………….

12. Comparison with templates for rising main support plate and WDU base plate.

The template for the rising main support plate (apron plate) can be matched with the actual plate once the water discharge unit (WDU) has been removed. These reveal the hole positions for retaining bolts and also the location of the dip plug hole as well as the dimensions of the plate. The rising main support plate has a length of 210 mm and a width of 190 mm. The template for the base plate of the water discharge unit can also be compared with the unit being manufactured. The rising main support plate (apron plate) should be welded at exactly 90 degrees to the Channel section of the pump stand.

Comments………………………………………………………………………………
13. Pump handle

This should be 50 mm GI pipe, 2.5 m long unless otherwise specified. Wall thickness 3.5mm.

Diameter (50mm) ......................................... Length 2.5m)..............

Wall thickness (3.5mm) ........................................................................

NOTE. For pumps used down to about 20m a 40 mm handle is preferred. Deeper pumps require a 50 mm x 2.5 m handle which is standard. Very deep pumps (60 – 100 m) require a 50 mm x 3 m handle, the deepest filled with concrete. All handles should have a minimum wall thickness of 3.2mm.

14. 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.

COMMENT: ........................................................................................

15. Quality of Welding

COMMENTS ........................................................................................

16. General Appearance (Painting etc.)

..............................................................................................................

17. Metal Pump Makers Plate added (Y/N) ..............................................

a) Pump Stand Serial Number .................................................................

b) Discharge Unit Serial Number ............................................................

c) Cylinder Unit Serial Number ..............................................................

18. Caretakers Spanners

19mm combination (Y/N) ........................................................................

24/36mm (Y/N) ....................................................................................

19. General Comments ..............................................................................

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20. Recommendations ..............................................................................

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Signed ........................................... Date: .........................................