Water and Sanitation in Zimbabwe

A short history of the Zimbabwe Bush Pump

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The Bush Pump was born in Zimbabwe in 1933. It has been used as the national hand pump ever since.
Over the years there have been many variants of the Bush Pump. But 3 versions are particularly distinguishable: The Murgatroyd, the Anderson type and the “B” type.
All Bush Pumps have some common features.

- A hardwood (teak) block used as a bearing and lever.
- A stout steel pump stand with sturdy U bolts for attachment to borehole casing.
- Steel water pipe used as a handle
- Steel rising main (usually 50mm)
- Heavy duty pump rods (16mm)
- Brass cylinder (usually 75mm) and heavy duty foot valve
Bush Pumps are known for their durability and forgiving features. Most of the bolts in the pump head can be removed and the pump can still be made to work.
Early beginnings
The Bush Pump is wholly Zimbabwean

- The features of all Bush Pumps originate from the first masterpiece designed by Tommy Murgatroyd, a water supply officer who worked in Plumtree in the 1930’s.

- Murgatroyd designed his pump in 1933. For many years it was known as the Murgatroyd pump.

- Some of his pumps continue to operate to the present day.

- Muratroyd established the basic components of all later Bush Pump – wooden block, strong pump stand and heavy duty components.
The Murgatroyd pumps was designed in a blacksmithing era – it was bolted together – no welding was used.

Also the pump head was embedded in a large block of concrete caste near the borehole.

A shackle arrangement was used to connect the wooden block to handle.

50mm steel pipe was used as rising main and 16mm pump rods.

A large 75mm brass cylinder was used with heavy duty foot valve.
Murgatroyd pump – basic features
Slowly over the years these features started to change. Because the pump head was concreted into a base it could not be removed. Thus it had to be serviced on-site.
Later refinements

- Over the years a number of refinements were made, several of them relating to the introduction of welding. Also the need to be able to remove a pump and take it to a district workshop for maintenance and repair became more apparent as the number of pumps rose.

- Cecil Anderson, who worked for the Department of Water, established the next major pump design (in the 1960’s) which became known as the Bush Pump.

- Anderson introduced the use of U bolts to attach the pump stand to a borehole casing.

- He also used a sliding tube and sleeve arm arrangement to link the wooden block to the rod.
The pump head in 1980

- The pump inherited in 1980 by the new Zimbabwe government was the Anderson model. At this time a few thousand pumps existed.
Whilst the Zimbabwe government insisted that the Bush Pump be retained as the national standard hand pump, several NGO’s and government departments designed their own versions of the Bush Pump during the 1980’s. Over 8 different models emerged. This complicated the national programme and a new standardisation became necessary.

As a result The National Action Committee (NAC) undertook a study of the hand pumps and designed a new model which inherited all the sound features of the older Bush Pumps, but reduced the number of wearing parts and was more compact. After 2 years of rigorous testing it was adopted in 1989 as the new National Standard Hand Pump – it was called the “B” type Bush Pump. This has been retained as the National Hand Pump since that time.
PUMP TRIALS
First “B” type being tested in Epworth in 1987 (left) and further pumps were tested in Zvimba-Chirau and elsewhere. DDF was responsible for installation and testing. Several govt. ministries were involved.
Pump trials

Prototype “B” type Bush Pumps were tested in high demand situations (left) and deep borehole situations (right) during the trial period between 1987 and 1989. Where weaknesses were found, corrective measures were taken.
Pump trials

Most pumps were tested with the well tried standard “down the hole” components consisting of 50mm GI pipe, 16mm steel rods and a 75mm diameter brass cylinder with heavy duty foot valve.
Parts of the “B” type pump head
(wooden block, handle and U bracket)
Parts of the “B” type pump head

(water discharge unit, base of pump stand, rubber buffer)
Standard “down the hole” components

Nearly all Bush Pumps used in Zimbabwe use standard well tried and tested components – the 75mm brass cylinder equipped with check valve and piston (using two leather seals). A heavy duty foot valve is also used. These units are used in combination with 50mm galvanised iron pipe.
Zimbabwe Bush Pump
Research and development

High impact PVC was tested as an alternative rising main and rod material. Nitrile rubber seals were also tested in 50mm and 63.5mm cylinders.
Research and development

Plastic materials were found to be less durable than steel/brass/leather components.
Research and development

Also high density polyethylene was tried as rising main material. This required a heavy weight suspended beneath the cylinder to offset springiness. This material gave a rubbery feeling to pumping.
Research and development

Trials were also carried out on deep set pumps up to 100m+ depth. This is demanding for any hand operated pump.
Research and Development
During the 1980’s and 1990’s a considerable amount of research and development work was carried out to make the Bush Pump more user friendly.

- 50mm, 63.5mm and 75mm open top cylinder models (VLOM – user friendly) were designed and tested together with case hardened hook and eye pump rod connectors for simple rod and piston extraction. In pumps of this design it is not necessary to remove the pipes in order to replace piston seals.
- These units were used in selected programmes.
Research and development
VLOM (user friendly models)
Three basic sets of components were developed for 50mm, 63.5mm and 75mm “open top” cylinders.
User friendliness

Special case hardened hook and eye rods were developed to make rod extraction easy. Special tools were also designed.
**User friendliness**

The open top cylinder models made seal replacement relatively easy. At shallower depths school children could undertake this routine maintenance. The 50mm version was used in trials.
User friendliness

The 50mm user friendly model was tried on an experimental basis at schools and the larger 63.5mm open top cylinder supported by DFIDs in Bikita and Tsholotsho.
However the most commonly purchased version of the Bush Pump throughout the country retained the use of the standard 50mm GI pipes, 16mm rods and 75mm brass cylinder with HD foot valve.

- This is probably because the standard (non-specialised) components were (and are) more widely available and the output from the 75mm cylinder is greater than from 63.5mm and 50mm cylinders.
- However this version of the Bush Pump is not user friendly as the pipes must be withdrawn in order to change the seals.
- Seal replacement is the most commonly undertaken parts of routine O&M – operations and maintenance.
Manufacture.

A number of companies manufacture the pump head and market down the hole components in Zimbabwe. There is considerable variation in the quality of the products however. Poorly made pump provide unreliable service and damage the pump’s reputation.
Specifications and drawings

International specifications were drawn up by SKAT/HTN (Switzerland) in 1999, when the “B” type Bush Pump attained international status, and became a Public Domain Pump.
Specifications and drawings

These drawings are also available on CD and currently the Standards Association of Zimbabwe is preparing local specifications based on the International specifications.

The Aim is to improve overall pump quality. Poorly made pumps provide a poor service to the rural people and adversely affect the reputation of the pump.
The Bush Pump is a National Treasure
It has been honoured on a postage stamp
Overall conclusions

- The family of Bush Pumps has a long track record of providing reliable service to the rural communities of Zimbabwe for over 70 years. It is one of the few hand pumps which is “home grown” in Africa and still serves the country as a national standard.
- A huge amount of research and development has been performed on the Bush Pump. This parallels international trends in making pumps durable and more user friendly.
- International specifications were drawn up by SKAT/HTN (Switzerland) in 1999, when the “B” type Bush Pump attained international status, and became a Public Domain Pump.
- The most commonly purchased pump uses standardised “down the hole components” which are also durable and well tested.
- Open top cylinder models using 50mm and 63.5mm diameters have also been designed and tested. These have used case hardened steel hook and eye rods for ease of extraction.
- Research and development of the pump continues in Zimbabwe
- The Government of Zimbabwe is proud of the role they have played in the development of this pump and intends to retain the Bush Pump as their National Standard.