

# A handpump for Africa: the Afridev experience

by Michael Wood

**The Afridev pump is the result of a design and development process that began twenty years ago. It is now being manufactured in many different countries to a standard design, and the possibilities of local manufacture are being explored.**

THE WOMEN OF Lamarada, a small village in south-western Ethiopia, were shouting for joy! Why? Because they had just been shown how to install and maintain their own handpump on a well close to their homes. Two years later the pump is still working. The women have proved adept at carrying out the routine maintenance jobs of changing the piston seal and replacing the nylon handle bearings. Acting in partnership with Oxfam UK and the local government administration, the women have gained control of their safe water source and appreciate the benefits that this brings to their daily lives. The women of Lamarada and of other villages in rural Africa are enjoying the fruits of a development process that started back in the 1970s in southern Africa.

## First generation handpumps

During the 1970s it was recognized that a large proportion of handpumps installed in sub-Saharan Africa were breaking down prematurely. Not only were they breaking down, but they were staying broken down for months on end, until the government maintenance team got around to fixing them. These handpumps usually shared a number of characteristics: they

- were imported from industrialized countries;
- required heavy lifting gear to remove the rising mains;
- required many different tools to carry out repairs;
- needed trained mechanics to carry out repairs;
- used heavy, corrodible materials;
- needed imported spare parts; and

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- were sometimes even difficult to use.

In other words, these first generation handpumps were inappropriate for the environments in which they were installed. But they were installed in good faith, and because at the time it was felt that handpumps offered the best way of delivering a safe water supply to a community. These handpumps tended to be constructed of heavy duty materials, so they would

last a long time without maintenance in the African bush!

Some of these pumps did work for a long time, but inevitably, being mechanical, they eventually broke down. At the time little thought was given to the ongoing maintenance of these pumps, and a number of assumptions were made by donors and governments, including:

- that the pumps would keep working for years with little or no maintenance;
- that centralized government maintenance teams would be able to repair handpumps within a reasonable time frame;
- that government maintenance teams would have trained mechanics able to repair handpumps;
- that villagers would report handpump breakdowns promptly to government water agencies;
- that a steady supply of spare parts from abroad would continue after



*The women of Lamarada have become handpump caretakers and are installing their own Afridevs.*



*A handpump caretaker learns how to remove a footvalve from an Ibex Afridev in Asgori, Ethiopia.*

donors pulled out; and  
 ○ that the government water agency would have a budget to maintain handpumps.  
 Most of these assumptions proved inaccurate, which explains why so many handpumps failed.

### Development of the Afridev

In response to this situation, the World Bank/UNDP began, in the late 1970s, to develop a handpump which followed strict design criteria. It:

- used appropriate technology;
- used lightweight, non-corrosive, components;
- could be maintained by women;
- could be produced in African countries to exact specification;
- needed only one or two simple tools for installation and maintenance;
- was relatively inexpensive; and
- was designed with preventive maintenance in mind.

The first model, the Maldev, was produced in small numbers and field-tested in Malawi. The project moved to Kenya in the early 1980s because of difficulties with local manufacture and the pump, after some modifications, became known as the Afridev.

### Design features

One of the main design features of the Afridev is that the pump rods can be pulled out to change the piston seal and bobbin without having to remove the rising main. This eliminated the need for heavy lifting gear. The pump rods are designed with hook and eye connectors, so no tools are needed for dismantling. Another feature is that only one spanner is needed to install and maintain the pump, plus a small screwdriver or knife to change the piston seal. The pump was designed

so that parts could be replaced by hand, using snap-fits, and thus eliminating tools. So users can push in the nylon fulcrum and hanger bushes, and change the piston seal by pushing the old one off and rolling the new one into place over the piston. The rubber bobbins in the piston and footvalve can be removed and replaced by hand pressure alone. Some parts are interchangeable: the bushes can be used either on the fulcrum pin or the hanger pin; the piston or plunger can be used as a footvalve if inverted. Non-corrosive materials, such as nylon, nitrile rubber, stainless steel, and PVC are used in the Afridev.

Another important design feature is the spare parts kit. This consists of a small plastic bag containing the parts most likely to wear out, like the nylon/plastic fulcrum bearings, the nitrile rubber piston seals, and the rubber bobbins. These are designed to be replaced annually by the users.

### Local manufacture

The first Afridevs were made in a private workshop in Nairobi. A Swiss NGO, SKAT, assisted with the manufacture of the nylon bushes and the plunger seal. Together with the World Bank/UNDP, SKAT produced a set of specifications for the Afridev. The blueprints for the Afridev are in the public domain, so any company can use them to manufacture their own model. Local manufacture is now being carried out in several African countries as well as in Pakistan, India, Canada, and the UK by different companies.

In Ethiopia, the Research and Development Service (RADS) of the Water Resources Commission has played an active role in the development of an Afridev pump called the Ibex. About

50 have been installed in villages around the capital, Addis Ababa. Another 30 have been delivered to a Canadian funded rural water supply project in the south. Not all the parts are made in Ethiopia, however, because RADS cannot afford the \$60 000 moulds to make the nylon/plastic bushes or the piston/footvalve. So until moulds are available, these parts are being imported from Kenya.

### Teething troubles

The introduction of the Afridev has not been without its problems. In Malawi, the Joint Government of Malawi/UNHCR/SCF UK Water Programme for Refugees installed about 100 Aquadevs (made in the UK) in settlements for 800 000 Mozambiquan refugees. These pumps were heavily used, for up to 16 hours a day. A problem developed with the pump rod connector/centralizer; it was wearing a longitudinal groove on the inside of the PVC pipe which eventually caused a hole. Pipes had to be removed and the whole section replaced. Technicians filed down the fins of the nylon centralizer which solved the problem in the short term. After feedback from the experience, the manufacturers started making rubber centralizers that are designed to wear out before the PVC pipe. The manufacturer had also deviated from the original design for rod connectors, preferring a nylon snap-on coupling to the original hook and eye method.

In the north of Malawi, DANIDA was helping the government install Afridevs in the Karonga area. They had opted for the Inalsa Afridev from India. The problem detected in these pumps was that the rubber seal came off the piston during normal pumping. A representative of the company visited the site and the design of the seal was changed to make it a tighter fit.

Although the pump has had its problems, these examples show that manufacturers are willing to change their designs as a result of field experiences. The question, however, remains: why did the manufacturers not field-test their pumps before releasing them onto the market?

### Problems with local manufacture

There have also been some problems with local manufacture, centring mostly around quality control. With the Ibex in Ethiopia, for example, the welding on the handle of some of the early models failed at the fulcrum, and

the welding had to be redone. Tolerances on some of the pumphead parts are rather fine. Some Canadian-made Afridevs in Ghana were not able to be assembled because parts did not fit. (It was a new company's first production run, and the problems have since been rectified.) These individual problems have been resolved, but the question of quality control remains. In India, where a large percentage of Afridevs are now made, this has been overcome because manufacturers are now obliged to have samples of their pumps inspected by the independent Crown Agents. In Africa, third party inspection is still in its infancy.

Getting a private manufacturer interested in making Afridevs has been a problem in Ethiopia. During the previous communist regime private enterprise was stifled and is just now starting to re-emerge. The government agency RADS is not equipped to make large numbers of Afridevs, and in any case that is not their role.

Locally made Afridevs tend to be more expensive than imported versions. For example in 1991, the IbeX sold for about 1500 birr (US\$750), whereas an Afridev from India could have been purchased and shipped to Ethiopia for about \$480. High tariffs on imported steel and the chemicals needed to make nylon or plastic have resulted in African-made Afridevs being more expensive than the completed pumps, which can usually be imported by NGOs and aid agencies duty free. As more manufacturers enter the market, however, it is expected that the price will fall. In Pakistan, for example, Afridevs sold for about \$800 when the first ones were made. Now there are at least four manufacturers, and the price has fallen to about \$400.

## Standardization

As there is just one set of specifications for the Afridev, all Afridevs, whether produced in Pakistan or in Canada, should be more or less of the same design. As the parts are interchangeable, making the Afridev the standard handpump is feasible. The lack of standardization has resulted in the wide variety of handpumps currently adorning the African landscape. This brings with it the associated problems of stocking the different spare parts and training mechanics on all the different models.

In Ethiopia, the Water Resources Commission announced in January 1992 that it was advising donors to standardize on the Afridev for pumping lifts of up to 45m. Donors are responding positively to this an-

nouncement. Governments have been sceptical of imposing standards in the past for fear of alienating donors, but in many countries donors have been lacking in such guidelines and donors in Ethiopia have welcomed this move.

## The Afridev in the field

In Ethiopia, the Southern Region Rural Water Supply and Sanitation Project recently cancelled an order for Canadian-made non-VLOM handpumps and purchased 164 Afridevs instead. The main rationale was that the former were difficult to maintain — 23 different tools were needed to remove the pumping element! It was decided to install 75 Afridevs on demonstration projects in 16 communities. The objective was to show that communities can maintain their own water supplies with some initial assistance from an outside agency, provided an appropriate technology is used. In this case, water and sanitation committees were formed with the assistance of local *kebeles* (village councils). Committee members helped the Water Supply and Sewerage Authority to select sites for dug wells. Successful wells, ones yielding at least 10 000 litres a day, were lined with concrete rings and Afridev handpumps fitted. The pump caretakers, elected by the community,

attended the installations to see how the pumps worked. They were trained in the maintenance procedures and practised these until they were proficient. Plasticized cards illustrating the maintenance procedures with captions in Amharic were given to each caretaker.

At this stage the water authority is giving a maintenance kit to each water committee, but in future it is planned to make a nominal charge. A tariff of 0.25 birr (\$0.12) per household per month is being levied for the use of the pumps. In Lamarada, the caretakers are paid about 10 birr a month out of this tariff as compensation and motivation.

Research is going on to develop a means of putting a strong thread on PVC pipe so rising mains can be unscrewed. Some manufacturers have been able to bring the price down by installing brass instead of stainless steel cylinder liners.

But for now the Afridev is proving to be the best option for a village-level operated and maintained handpump for lifts up to 45m, which could include the vast majority of applications. As more manufacturers enter the market, the price may fall still further, making this pump more attractive to the communities and donors who prefer the handpump option. ●



*Women caretakers removing the pumprods from an Afridev in Mali.*