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, corrosible materials;
- needed imported spare parts; and
- 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

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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 fol-
lowed strict design criteria. It:
○ used appropriate technology;
○ used lightweight, non-corrosive,
components;
○ could be maintained by women;
○ could be produced in African coun-
tries to exact specification;
○ needed only one or two simple tools
for installation and maintenance;
○ was relatively inexpensive; and
○ was designed with preventive main-
tenance 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 modifica-
tions, 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 con-
nectors, 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 bushings, 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 inter-
changeable: 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-corro-
sive 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 manu-
facture 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 Devel-
opment 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. An-
other 30 have been delivered to a
Canadian funded rural water supply
project in the south. Not all the parts
are made in Ethiopia, however, be-
cause 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 Pro-
gramme 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
downed 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
plunger 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 releas-
ing 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
carly 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 the 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 now starting to re-emerge. The government agency RADIS 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 announcement. 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.