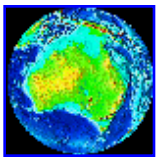

The Bamford "Hi-Ram Pump ®"

Installation and Drive Pipe Construction

[Introduction] [Pump Operation] [Installation] [Drive Pipe] [Installation Photographs]
[Hi-Ram Pump Home Page]

To return to the main Hi-Ram Pump pages after looking at these installation pages, click on the "Hi-Ram Pump Home Page" link such as can be seen above.

The Bamford "Hi-Ram Pump ®"

Australian Patent No 741896

Introduction

Welcome to a new type of self-powered water pump, using new technology combined with the long established operating principle of hydraulic ram pumps.

Please read very carefully the following information for pump installation and drive pipe construction. We suggest that you read this entire booklet before testing or installing a pump.

Our Internet Site at http://www.bamford.com.au also has additional information, which is progressively updated.

Installation Generally.

For proper operation, the pump and the drive pipe must operate as one unit. The drive pipe and associated pipes form "half" of the pump. Successful operation depends upon you constructing a

suitable drive pipe and correctly installing it.

The drive pipe determines the size of the "water hammer" needed in the operating cycle. Because of its rigidity, steel pipe gives the greatest water hammer effect to allow the best operation of the pump. The use of steel pipe is recommended wherever possible. For ease of transport the necessary lengths of drive pipe can be made up from shorter lengths of pipe, each say 1.5 metres long.

In normal operation, each operating cycle should be about one second long.

Based on experience, a standpipe should always be used at the entry to the drive pipe.

Initial Set-up to Test Pump.

If you have not previously installed a Bamford Hi-Ram Pump, you should temporarily set up the pump, drive pipe and standpipe on flat ground and run the pump from an existing source of piped or reticulated water.

This can be done, for example, by connecting a garden hose to the standpipe where water enters to drive the pump. There must be no water leakage at the hose connection to the standpipe. During testing, water should flow from the top of the standpipe. The standpipe gives the drive head for the pump and is best made about 2 metres high for first testing, but not more than 4 metres.

The outlet from the black plastic Philmac non-return valve should initially be blocked off (e.g. with a 1 inch plug) so that a back pressure is provided without a delivery pipe.

After flushing air etc out of the pump, get it going using the stainless steel tube with 2 or 3 holes at the bottom of the tube. It is important to get all air out of the system. Once you have it running, try variations of steel tubes, inlet head and outlet head.

Although it does not accurately reproduce normal operating conditions or pump output, this initial testing will give you experience and confidence in pump operation without the variations that may occur from a natural water supply.

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John Bamford & Associates

The Home Page

This internet site provides information about the business and other interests of John Bamford & Associates and family members.

Details of the Bamford "Hi-Ram Pump ®", a new and simple pump powered by water, are on the link below.

[Hi-Ram Pump] [pump.com.au] [Internet and Domain Names] [Latest News]

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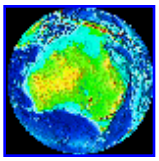


The Bamford "Hi-Ram Pump ®"

Installation and Operation

[Introduction] [Pump Operation] [Installation] [Drive Pipe] [Installation Photographs]
[Hi-Ram Pump Home Page]

Installation and Operation

The pump comes fully assembled, but with the two main assemblies loosely screwed together. This is partly for ease of packing. It also allows for an alternative drive pipe installation that is described later. In most pump installations, you will simply screw the two main assemblies tightly together, so that the blue cylinder is vertical when the pump is working.

The blue cylinder is the waste valve body. It contains a plastic ball. Attached to the top of the blue cylinder is a black plastic pipe connector. Prior to pump operation, any paper packing inside the black plastic pipe connector must be removed.

For pump operation, a steel tube is inserted into the blue cylinder through the top of the black plastic pipe connector.

Three steel tubes are provided. They have a different number of holes at each end, giving six ways to insert a steel tube into the blue cylinder. The number of holes at the bottom determines the amount of water flowing through the pump. The amount of water flowing determines the pressure and volume of water that are pumped. The pump is therefore adjusted for different operating conditions by using alternative tubes and switching them end for end.

Pipe Connections to the Pump

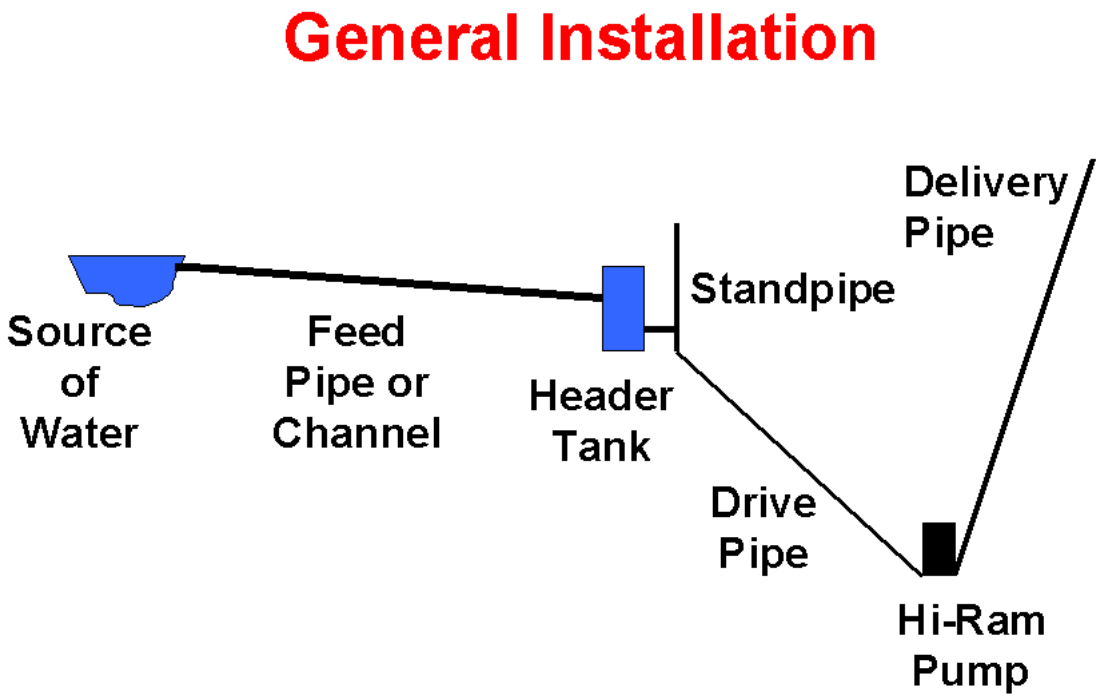
The drive pipe goes into the brass gate valve, which can be turned off to stop water going to the pump. The gate valve must be fully open when the pump is working, so that the steel tubes control the water flow.

The black plastic cylinder is a Philmac non-return valve. It is connected to the delivery pipe to take water uphill from the pump. Use the Teflon Tape provided, and do not overtighten this connection when connecting the delivery pipe.

Most of the water going into the pump overflows from the top of the black plastic pipe connector on top of the blue cylinder. The pump has taken the energy from this overflow water, so that the rest of the water is forced into the delivery pipe. The water flow from the top of the black plastic pipe connector should therefore not be impeded.

General Installation of the Hi-Ram Pump

The following diagram, which is not to scale, shows a typical installation. Look closely at the requirements for the drive pipe, as alternatives are possible in some circumstances.



The pump and the drive pipe must operate together for the pump to work properly. The drive pipe can therefore be thought of as "half" of the pump, and successful operation depends on the use of a suitable drive pipe and correct installation.

Starting the Pump

Before the delivery pipe is connected, run water through the pump to flush out all loose material and air. The steel tube with the most holes can be inserted and pushed down to hold the waste valve open. The gate valve can then be closed, and used to turn the pump off and on.

Connect the delivery pipe, and insert the steel tube with three holes into the pump. Open the gate valve.

The pump needs a backpressure in the delivery pipe for normal operation. To get this initially, operate the waste valve mechanism manually by pushing the steel tube up and down. If the delivery pipe is long or of large diameter, it may take a while to pump enough water to build up sufficient backpressure. If you can do so, it may be easier to get the initial backpressure by filling the delivery pipe with water from the top.

As necessary for running or adjustment, change the steel tube after closing the gate valve to stop the water flow.

Care and Maintenance

The plastic ball, the black plastic pipe connector on top of the blue cylinder, and the Philmac non-return valve are all wearing parts. Their life will depend on the conditions of operation, and the cleanliness of the water going through the pump. The replacement cost is small compared with the operating and installation costs for powered pumps.

The Philmac non-return valve must seal properly. The two ends of this non-return valve unscrew from the main body, and if need be the delivery pipe end can be unscrewed to clean components. A repair kit is also available for this non-return valve.

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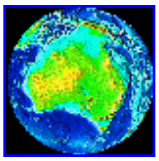


The Bamford "Hi-Ram Pump ®"

Pump Installation

[Introduction] [Pump Operation] [Installation] [Drive Pipe] [Installation Photographs]
[Hi-Ram Pump Home Page]

Installation of "Hi-Ram Pump ®".

Introduction.

For proper operation, the pump needs correct installation of the Drive Pipe, and on-going attention to ensure that operating conditions are maintained.

Recommendations for installation should not be lightly changed. Some changes may give results opposite to those expected e.g. larger Drive Pipes may reduce the quantity of water pumped.

Plan the installation of your pump carefully. Think about the alternatives that you have on your property so that you can select the best overall location. Measure as accurately as reasonably possible the head of water available to run the pump, the water flow available to go into the pump, and the height you want to pump water to. Measure also the corresponding distances at ground level. Although long horizontal distances have only a small effect on pump operation, you still have to provide the piping to take the water to and from the pump.

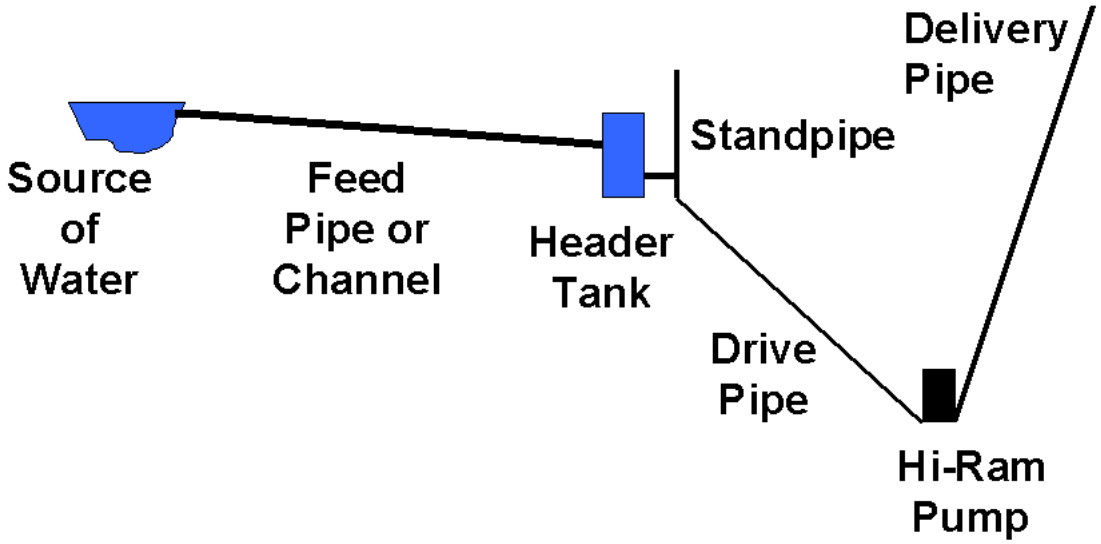
Aspects of Installation.

The following aspects of pump installation are covered in more detail in the following pages, and are also indicated in the next diagram.

Source of Water Feed Pipe or Channel Header Tank and Standpipe Drive Pipe Installation Mounting of Pump Water Overflow from Pump Delivery Pipe from Pump Drive Pipe Construction

General Installation

General Installation



Typical Sources of Water

Water from a stream can be diverted into a Feed Pipe or Channel, or a Feed Pipe can be placed in the stream. A small embankment or scoop can be used to force water into the pipe or channel.

Water overflow from a spring, dam or watercourse can be used, and taken into a Feed Pipe, a Channel, or directly into a Header Tank or the Standpipe.

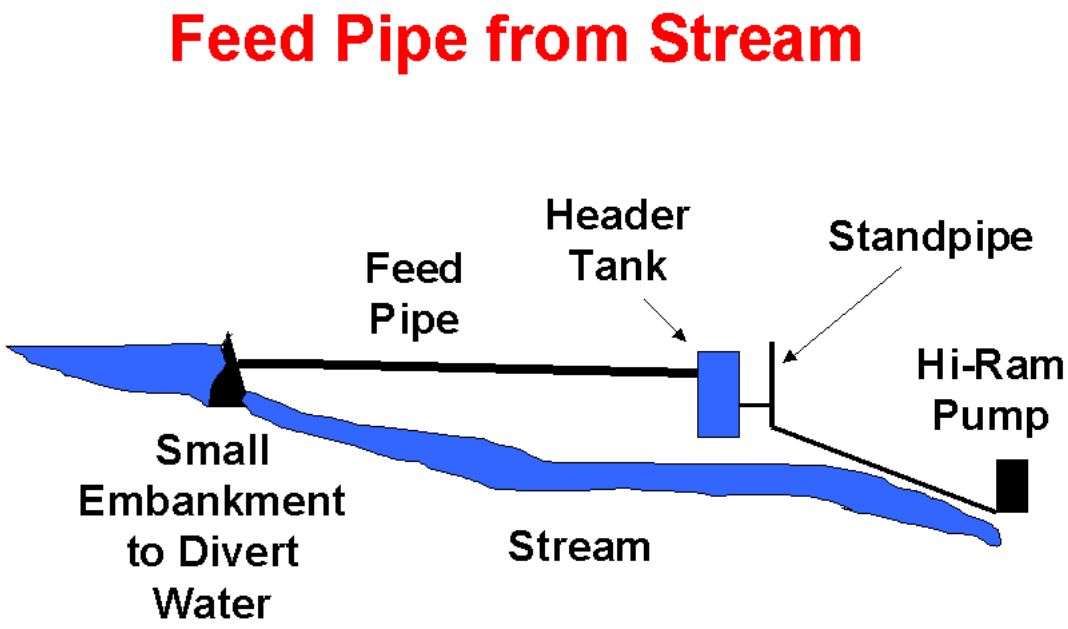
Allow for the possibility of large water flows after heavy rain, to minimize the possibility of damage to either the pipework or the pump.

Feed Pipes and Channels

A Feed Pipe or Channel is used to get water to a suitable height above the pump, for example by following around the bank above a stream.

Feed Pipes must be large enough to carry sufficient water with little loss of head, for example 40 mm Poly Pipe, although this depends on the length.

Feed Pipe from Stream



Header Tank

This allows the necessary head of water to be close to the pump. Excess water can flow over the top if there is more than sufficient water.

A Header Tank also helps stop bubbles of air or debris from entering the pump. A 200 litre container is suitable as a Header Tank.

Standpipe

This works as part of the Drive Pipe to improve pump efficiency. It should be the same internal diameter as the first part of the Drive Pipe, and can be Poly pipe but preferably steel.

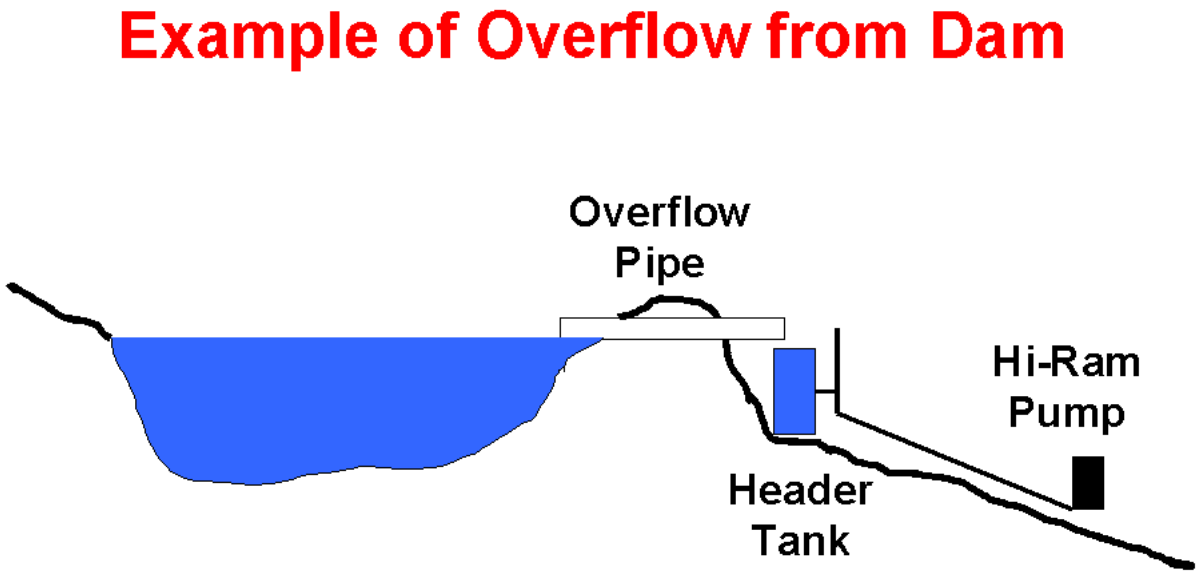
The top of the Standpipe should be above the inlet water level so that no water flows out of the top. The inlet to the Standpipe should be 1 metre or more below the surface of the inlet water so that air cannot be sucked in from the top of the Standpipe and mix with the water going to the pump.

Alternatives for Header Tanks

Use a Header Tank if the Feed Pipe is long e.g. over say 30 to 50 metres. A Standpipe should always be used.

If the Feed Pipe is short, it can go directly into the Standpipe (without using a Header Tank), provided the inlet water is clean with no debris.

Example of Overflow from Dam



Drive Pipe Installation

The length, construction and installation of the Drive Pipe are most important. The full force of the inlet water must enter the Drive Pipe.

The main length of the Drive Pipe can lie on the ground. Depending on the installation it can be horizontal, or slope downhill, and can be in several sections at an angle to each other. It is most important that air cannot remain trapped in the Drive Pipe, as the pump will not run properly and is likely to stop.

Mounting of Pump

Both Pump and Drive Pipe should be restrained to prevent movement. A simple restraint, for example using pegs in the ground, is usually enough to overcome forces caused by the pump.

The Drive Pipe construction shown later includes a right angle bend, which assists mounting to keep the pump Waste Valve Body vertical. The right angle bend also makes it easier to restrain the Drive Pipe and prevent movement.

As indicated before the mounting should also allow for other occasional events such as flooding of creeks.

Overflow Water from the Pump

Water comes from the top of the pump after its energy has been used to pump part of the inlet water uphill.

This overflow water can be allowed to go downhill to the stream etc from which it originally came. Alternatively it can be diverted to another place for storage, for example by means of a collection tray under the pump and associated pipes, or by using a channel in the ground.

Delivery Pipe

Although the flow rate of pumped water is small, 25 mm or 1 inch pipe is the minimum size recommended for the Delivery Pipe. This is because the pump sends pressure pulses up and down the Delivery Pipe. High pressure Poly pipe has thicker walls and a smaller inside diameter for the same nominal size, and 32 mm or 1 1/4 inch pipe or larger is the minimum recommended where such pipe is used in high pressure situations.

If you have enough volume or flow of water near the Hi-Ram Pump to allow the use of a powered pump such as a Fire Pump, there is much to be said for making the Delivery Pipe of 40 mm or 1 1/2 inch pipe. If you suddenly need a lot of water in a hurry, you then have the option of using a powered pump.

Additional Notes

Filters should be used to prevent debris or particles entering the drive pipe.

If at all possible, don't use siphons in the pipework that brings water to the Drive Pipe. Air always

seems to get into the siphon after a while and then the pump stops.

A gate valve should be fitted in the Delivery Pipe close to the pump. This allows the pump to be disconnected if necessary, without losing the water in the Delivery Pipe.

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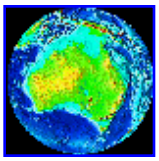

The Bamford "Hi-Ram Pump ®"

Drive Pipe Construction

[Introduction] [Pump Operation] [Installation] [Drive Pipe] [Installation Photographs]
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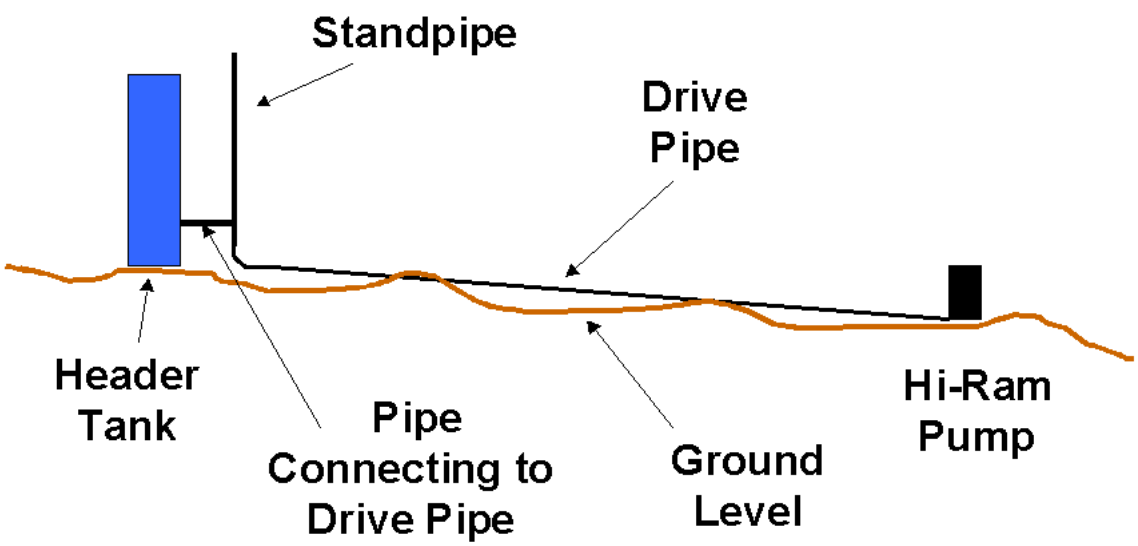
Drive Pipe Construction

Typical Drive Pipe Connection



Drive Pipe Construction

Two types of drive pipes are described.

Type A is intended for higher outlet heads. It consists of a 6.5 metres length of 25 mm (1 inch) galvanized steel pipe, reducing to 3.25 metres of 20 mm (3/4 inch) galvanized steel pipe, which is then connected to the complete pump assembly.

Type B may be better for lower outlet heads, around 10 to 15 metres or less. It uses the same pipes and fittings, but with the Outlet Valve at the join of the two pipes and the Main Pump Body at the end of the 20 mm pipe.

Overall views of the two types are shown in Photographs 3 and 6.

For most applications, it is suggested Type A be tried first.

Assembly of Drive Pipes

A 1 inch galvanized bend should be placed between the two lengths of galvanized pipe, so that they are at right angles to each other.

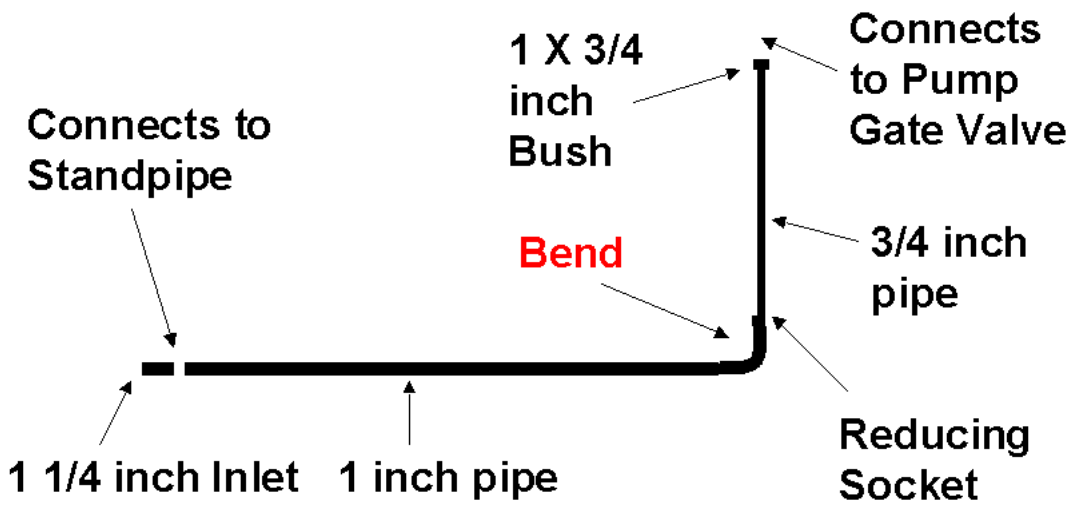
This improves pump operation, and also makes it easier to restrain the pump and keep the Main Pump Body upright.

An extra galvanized pipe bend and short pipe can also be placed at the end of the 3/4 inch pipe if this further helps to restrain the pump.

Type A Drive Pipe - View From Above

Type A Drive Pipe

View from above - Shows recommended right angle bend



Type A Drive Pipe - Side View

For ease in drawing, the Drive Pipe is shown in a straight line - please look at Photograph 3 to see the overall shape

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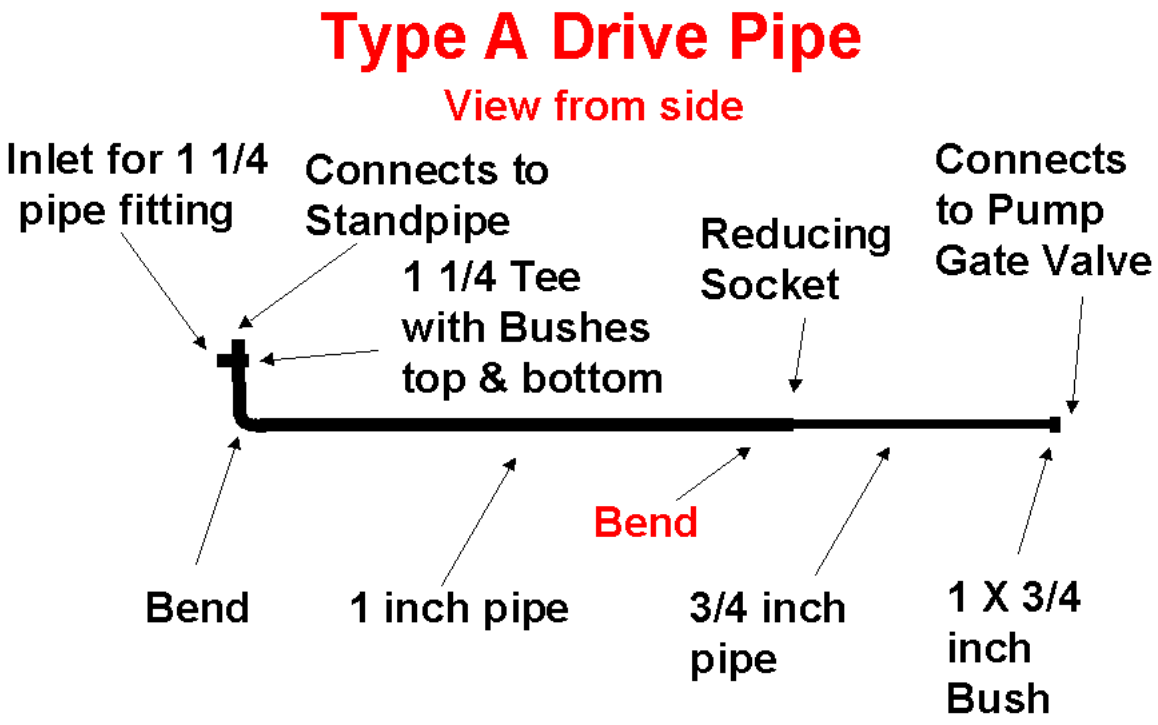
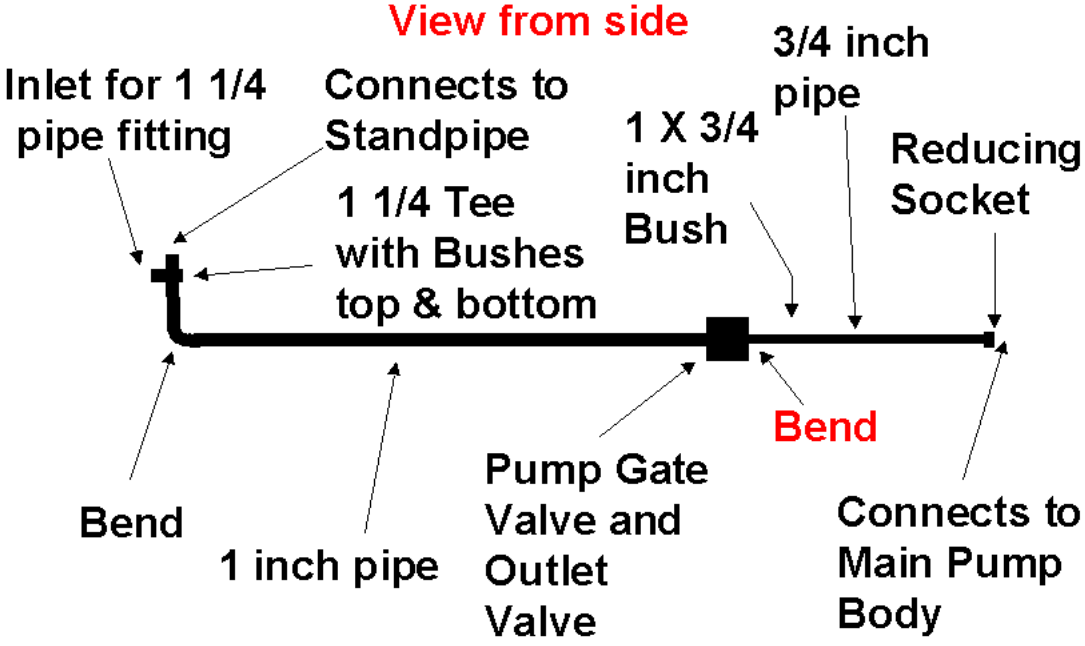


Type B Drive Pipe - Side View

For ease in drawing, the Drive Pipe is shown in a straight line - please look at Photograph 6 to see the overall shape.

Type B Drive Pipe

View from side



Materials List - Type A and Type B Drive Pipe

Basic Materials List 6.5 metres length of 1 inch (25 mm) galvanized steel pipe, screwed each end (i.e. one length of pipe)
3.25 metres length of 3/4 inch (20 mm) galvanized steel pipe, screwed each end (i.e. half a pipe length)
11/4 inch galvanized Tee
1 inch MI X FI galvanized 90 degree Bend (2 needed)
11/4 inch X 1 inch galvanized Bush (2 needed)
1 inch X 3/4 inch galvanized Reducing Socket
1 inch X 3/4 inch galvanized Bush
Fittings and Poly or steel pipe for Header Tank (or Feed Pipe), Standpipe, and Delivery Pipe.

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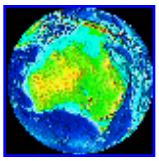

The Bamford "Hi-Ram Pump ®"

Drive Pipe Photographs

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After viewing each photograph, use the "Back" command on your internet browser to return to this page.

Drive Pipe Photographs.

The Drive Pipe diagrams indicate recommended methods of construction, although variations may also work.

The use of any plastic pipe in the Drive Pipe will greatly reduce performance, and the pump may not work at all.

1. Standpipe.

The same Standpipe arrangement is used for both Type A and Type B Drive Pipes. The entry into the Drive Pipe is from the gray concrete tank at the left (which can be regarded as a very large Header Tank).

1. Standpipe.

2. Standpipe Connections.

The same arrangement is used for both Type A and Type B Drive Pipes.

2. Standpipe Connections.

3. Type A Drive Pipe

The complete pump assembly with Outlet Valve is at the end of the Drive Pipe. This picture also

shows the right angle bend in the drive pipe.

3. Type A Drive Pipe

4. Bend in Type A Drive Pipe

4. Bend in Type A Drive Pipe

5. Complete Pump at End of Type A Drive Pipe

The Steel Pipe on the left is the end of the Drive Pipe. The black fitting at the bottom right is the non-return valve to which the Delivery Pipe is connected.

5. Complete Pump at End of Type A Drive Pipe

6. Type B Drive Pipe

In this arrangement, the Outlet Valve is part way along the Drive Pipe at the right angle bend.

6. Type B Drive Pipe

7. Bend in Type B Drive Pipe

A close up view of the Gate Valve and Outlet Valve part way along the Drive Pipe at the right angle bend.

7. Bend in Type B Drive Pipe

8. Main Pump Body at End of Type B Drive Pipe

8. Main Pump Body at End of Type B Drive Pipe

9. Set-up for Test Run of Pump.

Showing how the Pump, Drive Pipe, and Standpipe can be temporarily assembled and run using a garden hose connected to the Standpipe.

9. Set-up for Test Run of Pump.

10. Pre-Fabricated Drive Pipe.

A compact Drive Pipe assembly can be made from short lengths of pipe connected together using galvanized pipe bends. The picture shows such a Drive Pipe on a frame with the Pump and Standpipe attached, so that the complete assembly could be easily moved from one location to another.

10. Pre-Fabricated Drive Pipe.

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The Bamford "Hi-Ram Pump ®"

Introduction

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"Hi-Ram Pump ®" - A New, Simple and Economical Pump - Powered by Water.
An Australian Invention - Australian Patent No. 741896

**The pump is quiet and is operated solely by
the energy in a flow of water entering from above the pump.
It uses no external source of power such as electricity, petrol or diesel.**

A basic version of the "Hi-Ram Pump"
(The steel pipe on the left is the drive pipe entering the pump)

Particularly in developing countries, the choices for pumping water are often limited because reliable or affordable sources of power are not available. The idea of a water pump powered by water is not new, but is very relevant in a world where energy conservation is increasingly important. The hydraulic ram pump, invented more than 200 years ago, is one such pump.

Although the principle of operation of the Bamford Hi-Ram Pump is similar to that of a traditional

hydraulic ram pump, the new pump is considerably different in its construction and operating characteristics.

As is described in the section "About the Pump", the Bamford Hi-Ram Pump uses an inlet flow of water at low pressure to pump some of that water to a higher pressure or height. The pump has a self-sustaining cycle of operation about one second long. One typical installation is where water diverted from a stream drives the pump, with some of the water going up hill to a greater height, and the remaining water going to waste back to the stream.

The basis of the pump is a new waste valve mechanism with two moving parts, both of which can be very easily removed for maintenance or to adjust the pump.

In comparison with conventional hydraulic ram pumps, some of the different characteristics of the Bamford Hi-Ram Pump are as follows:

Its performance can be quickly adjusted for different pumping conditions, by using alternative moving parts in the valve mechanism.

Although the basic pump is very simple, additional components can be used to improve its performance in special roles.

It will work against both high and low output heads, thereby covering a much wider range of operating conditions.

The pump will operate when totally underwater (but the inlet flow of water to operate the pump must come from another source above the surface of the water).

The water going to waste need not spill out around the pump, but can be piped away for further use.

Depending on the operating conditions, the pump can be constructed wholly or partly from metal, plastics or other materials.

When constructed of non-metallic materials, the pump emits little noise.

The pump can be arranged to supply compressed air (but needs an air inlet pipe if underwater).

The pump can be arranged to provide a direct mechanical output to drive other devices.

The capability of the pump to "suck in" air can also be used to suck in water so that the pump acts as a suction pump for small suction heads.

Production pumps are now available as a basic water pump of the type shown above. Additional parts for the pump to product compressed air, or provide a mechanical output, or act as a suction pump are normally not provided. Provision of pumps for special applications needs to be the subject of a special order.

However, just in case of misunderstanding, you cannot pump water from a well or pool of water by just lowering the pump into the water - the pump must be driven by a flow of water coming from above the pump.

The Bamford Hi-Ram Pump considerably extends the usefulness of such devices for developing countries. Its ability to produce compressed air could be of particular use. Its ability to give a mechanical output could provide a means to pump clean drinking water from another source.

With reduced manufacturing costs and simplicity, the Bamford Hi-Ram Pump also has the potential to establish new roles in developed countries, and significantly increase the market for pumps using the hydraulic ram principle.

Queries from potential manufacturers or licensees are welcome.

Pumps are available for export, and more information about price and availability is shown in the "Latest News" Page.

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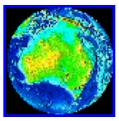

The Bamford "Hi-Ram Pump ®"

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