Sufficient information is given in our Product Leaflet to enable the correct size of Hydram to be chosen. However we recognise that not everyone is comfortable with technical matters and we therefore encourage customers to contact us to choose the Hydram size for them. To do this we need some basic information that is shown on our information sheet P21. Hydrams size 5 and above should be referred to us in any case.

The following text gives advice and information on installing Hydrams and is mainly concerned with the necessary physical layout.

At its most basic, installing a Hydram requires the following steps.

1) Create a feed well to collect the source water.
2) Lay a concrete slab on which to bolt the Hydram. (See note on working fall).
3) Fix a drive pipe between the two.
4) Install a delivery pipe from the Hydram to where the water needs to go.

Working Fall

The working fall is an important predetermined vertical distance from the surface of the water in the feed well, down to the level of the top of the Hydram waste valve. The minimum working fall we recommend is 1.1m. Falls above 12m should be referred to us. In general, the greater the fall the more water a Hydram will pump.

Feed Well

This serves as a collection tank for the source water and is built on the mouth of the drive pipe. It is usual to lay a concrete base and form the tank in brick or concrete. The top should be covered over to prevent pollution, but not made airtight.

If the surface of the water in the feed well is lower than the level of the source water, then an overflow pipe should be incorporated in the feed well. This is to ensure that a constant level of water is maintained in the feed well. Flap type stop valves are available which can be fitted to the end of the drive pipe in the feed well. These are not essential but are useful in shutting off the water to the Hydram for maintenance etc. (alternatively a gate valve could be fitted where the drive pipe enters the Hydram body).

Recommended sizes of feed well are listed below. It is better to make the tank larger rather than smaller.

Hydram Size	Feed well size, internal dimensions
Nos 1,2, & 3	0.7m square and 0.6m deep below water level
Nos 3.5 & 4	0.75m square and 0.75m " " " "
Nos 5,6 & 7	1.1m square and 1.1m " " " "
No 8	1.2m square and 1.2m " " " "
No 10	1.5 square and 1.5m " " " "

Usually water must be conveyed from the source to the feed well. This can be done by laying a pipe with a slight fall from the source to the feed well. The pipe may be of plastic or any other suitable material. For lengths up to 150 metres the following pipe sizes may be used as a guide and these will not cause a head loss of more than 150mm. (For Hydrams working on falls of 2m or less, or for longer distances, allowance will have to be made for head loss from the source to the feed well – please refer to us),

Up to	30 litres per minute flow	-	75 mm bore
	90	-	100mm bore
	180	-	125mm bore
	360	-	150mm bore
	900	-	225mm bore

Hydram Base

This provides a surface on which the Hydram may be bolted and which absorbs the pulsations when the Hydram is working. At the minimum it can be a simple concrete slab not less than 150mm thick for Hydram sizes 1,2 and 225mm thick for sizes 3, 3.5, 4, & 5.

The surface of this base must be a distance below the surface of the water in the feed well equal to the working fall plus the depth of the waste valve. This depth is:-

Hydram Size	Waste Valve Depth (mm)
1	125
2	150
3	175
3.5	200
4	225
5	250

(For larger size Hydrams, refer to the appropriate foundation drawings).

It is usual to construct some form of cover around and over the Hydram to protect it and prevent pollution. This is of course essential where the Hydram is sunk into a pit to gain the necessary fall. Arrangements must be made for access and servicing and also for the excess water to drain back into the source at some lower point. Drawings showing the foundations and housings are available on information sheet P22 for size up to No 5 and P23 for size 6 and larger. We recommend that the enclosure is constructed of brick or concrete for durability, bearing in mind that we are still supplying occasional spares for Hydrams that have been in service for over 100 years.

Drive Pipe

The Drive Pipe is a very important part of the Hydram and it should be laid straight with an even fall from the feed well to the Hydram. Information Sheet P12 gives more information on drive pipe layouts.

We strongly recommend the use of heavy wall steel tube for the drive pipe. Up to 150mm bore this is available in 7 metre lengths of galvanised steel tube, screw and socketted, to BS 1387. Up to size 3 the body of the Hydram is threaded to take this pipe directly. For larger Hydrams, the drive pipe is "leaded in" during installation. See information sheet P13 for details of this. Plastic drive pipes may be used in certain limited circumstances e.g. for small Hydrams where the fall and lift are low. **Please consult us first.**

The length of the drive pipe is also important and as a general rule for falls greater than 2 metres it should be a multiple of the fall, between 3.5 times and 5 it. E.g. for a fall of 10m, the length should be between 10 x 3.5 = 35 metres minimum and 10 x 6 = 60 metres maximum. For falls of 2m or less, the drive pipe should not be made less than 7 metres long (i.e. one length of pipe).

The following are the standard sizes of drive pipe for each Hydram. Do not deviate from these sizes without consulting us.

Hydram Size	Drive Pipe Size (bore)	
1	32mm	1¼"
2	38mm	1½"
3	50mm	2"
3.5	65mm	2½"
4	75mm	3"
5	100mm	4"
6	125mm	5"
7	150mm	6"
8	175mm	7"
10	200mm	8"

Delivery Pipe

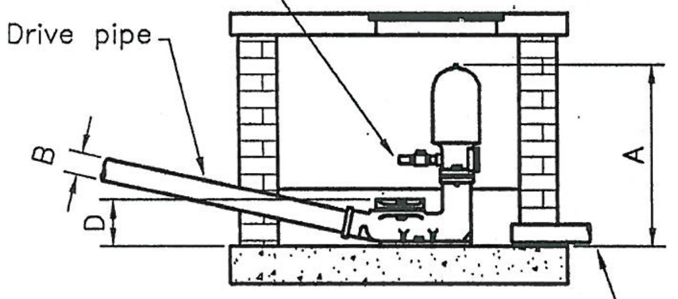
Plastic pipe may be used for this, providing the pressure rating is suitable. The Hydram delivery outlet is fitted with a non-return valve to which the delivery pipe can be fixed. (The purpose of this valve is to prevent the delivery pipe emptying if it is disconnected from the Hydram for any reason e.g. servicing).

The diameter of the delivery pipe depends on the length being used and the height and volumes of water being pumped. We will gladly advise on this.

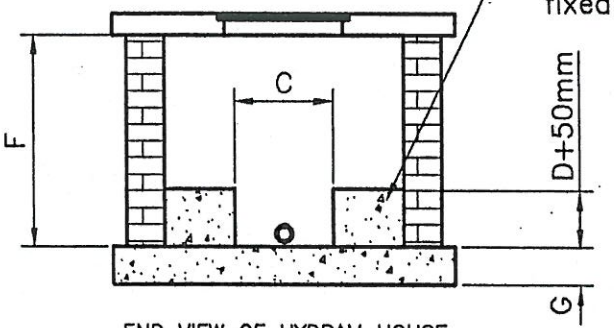
It is usual to deliver the water into a holding tank at the highest point, from whence it can be distributed by gravity to the points of use. This holding tank should have an overflow so that any excess water can drain away. The delivery pipe outlet should not be fitted with a ball float shut off valve, since this would stop the Hydram. In contrast any branches taken off the delivery pipe lower down should be fitted with float valves. This is so that when their demand is satisfied water continues to the higher levels. Delivery branches must not be taken off the main deliveries pipe until a vertical height equal to three times the fall has been reached otherwise the Hydram will not run reliably.

TITLE: Recommended sizes for Hydram Enclosure Nos. 1 to 5

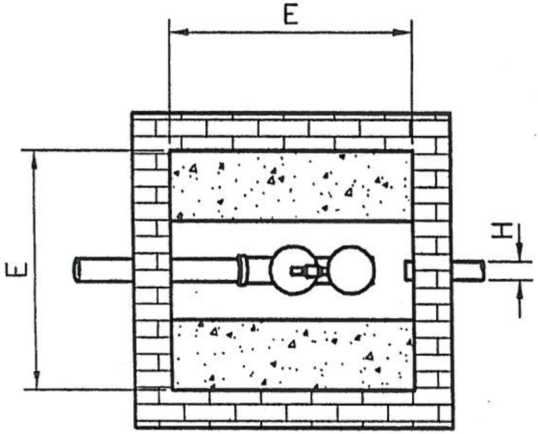
DETAILS OF HYDRAM ENCLOSURE



SECTIONAL SIDE VIEW OF HYDRAM HOUSE



END VIEW OF HYDRAM HOUSE
(looking from drive pipe B with Hydram removed)



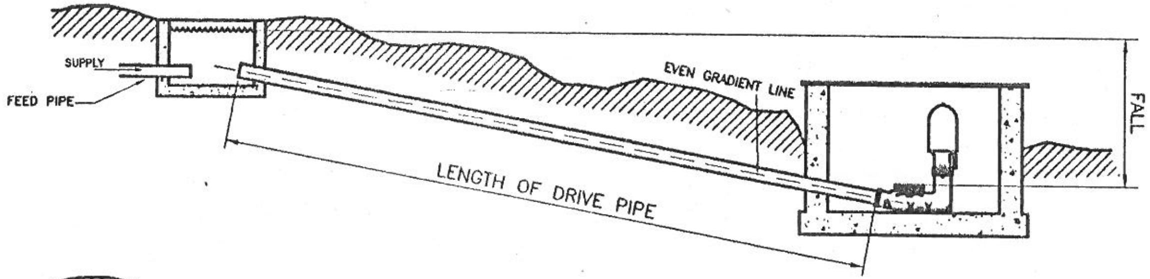
PLAN VIEW OF HYDRAM HOUSE
(looking from above)

Recommended Sizes (mm)								
Dimension	Hydram	1	2	3	3½	4	5	6
A	Hydram height	840	770	890	1020	1040	1220	1300
B	Drive pipe bore	32	38	50	64	75	100	125
C	Channel width	300	300	380	460	460	460	600
D	Waste valve height	125	150	175	200	225	250	320
E	Enclosure length & width	1070	1070	1200	1200	1530	1530	1830
F	Enclosure height	1070	1070	1200	1200	1370	1680	1680
G	Base thickness	150	150	225	225	225	225	300
H	Drain pipe bore	75	75	100	100	100	150	150

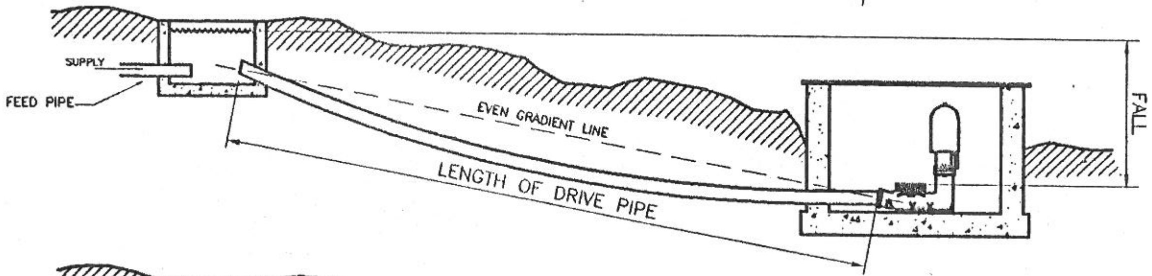
Eng. Dept. Allspeeds Ltd. Accrington	PRODUCT INFORMATION SHEET No. P12	Issue: 1 Date: 19.10.99 Page 1 of 2
TITLE:	HYDRAM DRIVE PIPES - RECOMMENDED LAYOUTS	

RECOMMENDED METHODS OF INSTALLING DRIVE PIPES

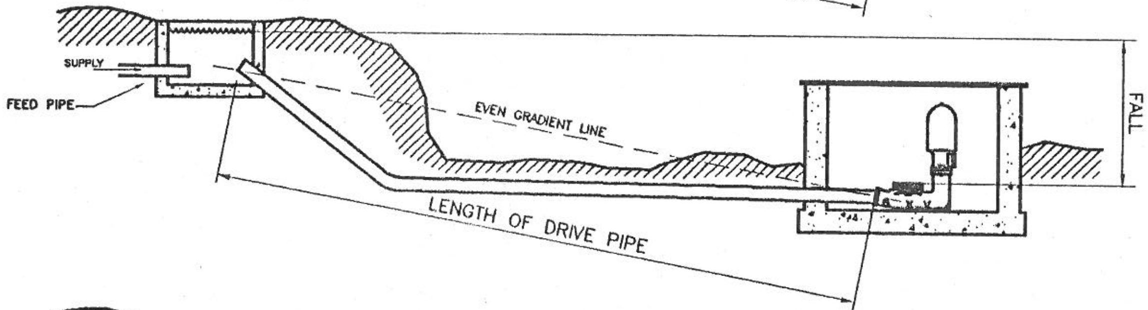
1. DRIVE PIPE MAY BE LAID ON AN EVEN GRADIENT



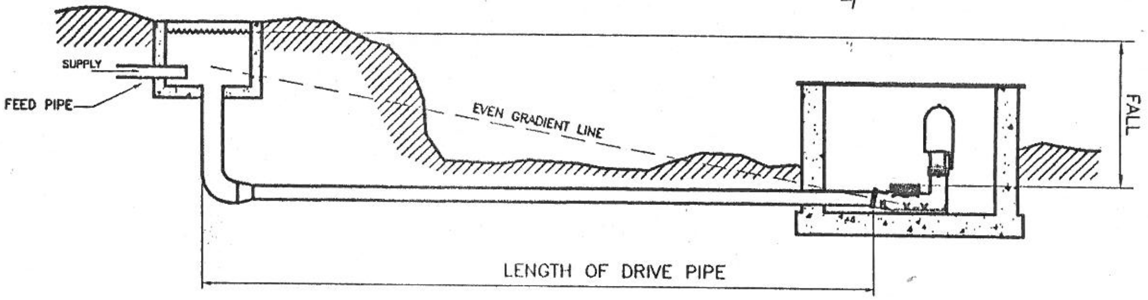
2. OR SAGGING BELOW THE EVEN GRADIENT



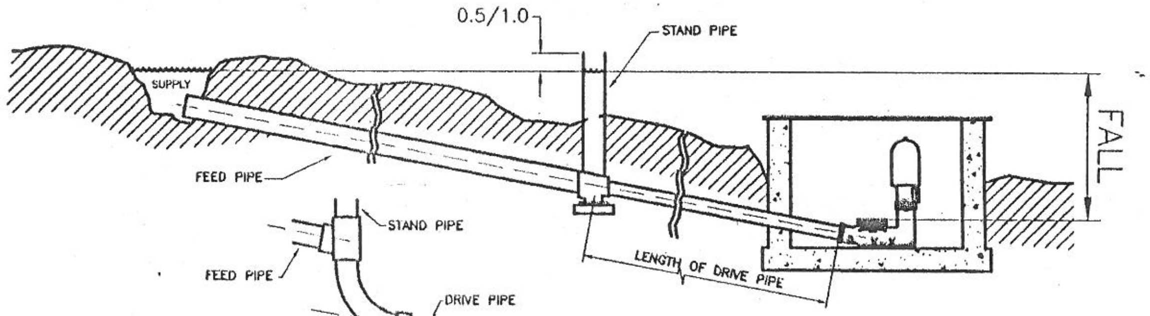
3. OR WITH A STEEP FALL THEN ALMOST HORIZONTAL



4. OR VERTICAL AND THEN HORIZONTAL WITH THE VERTICAL PORTION AND THE SLOW BEND AT THE BOTTOM TWICE THE BORE OF THE HORIZONTAL DRIVE PIPE

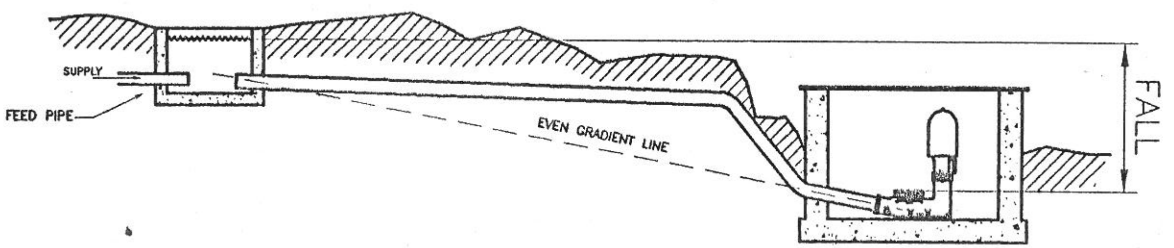


5. OR WITH A VERTICAL STAND PIPE. THE DRIVE PIPE IS OF THE USUAL CALCULATED LENGTH AND BORE. THE STAND PIPE IS DOUBLE THE BORE OF THE DRIVE PIPE WITH THE TOP 0.5/1.0 METRES ABOVE WATER LEVEL AT SUPPLY. THE FEED IS LARGE ENOUGH TO CARRY THE REQUISITE QUANTITY OF DRIVING WATER WITHOUT UNDUE LOSS OF HEAD IN THE STAND PIPE. FOR SMALL SIZE RAMS THE STAND PIPE BASE MAY BE ARRANGED WITH A SLOW BEND. IF THE STAND PIPE IS VERY HIGH IT MAY NEED TO BE STAYED

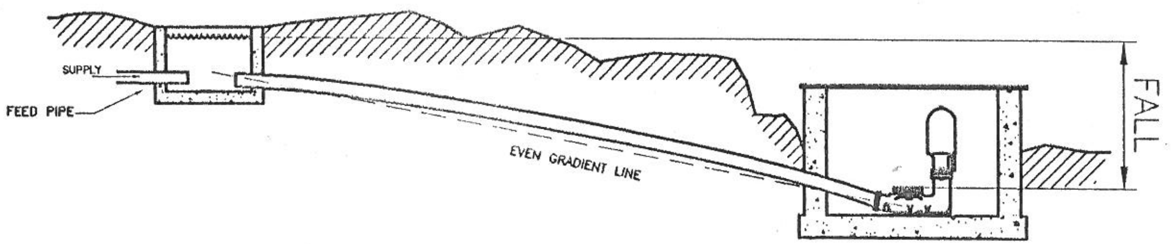


ALTERNATIVE FOR SMALL SIZE RAMS

METHODS SHOWN BELOW ARE NOT RECOMMENDED



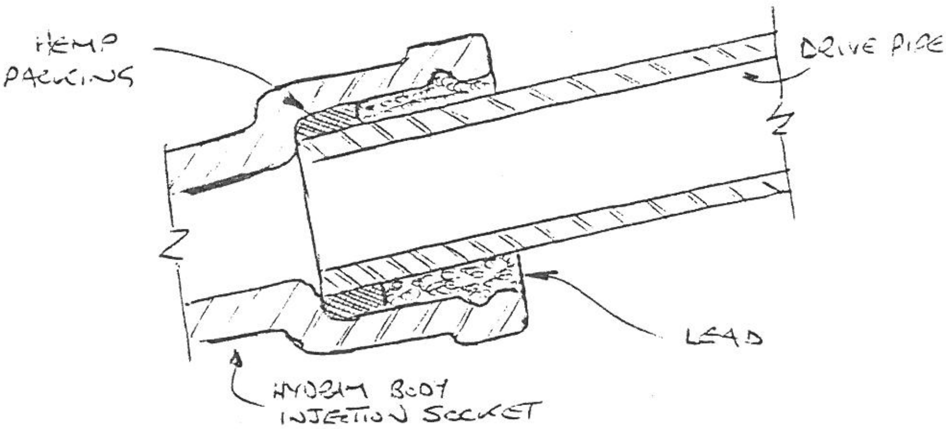
6. A DRIVE PIPE MUST ON NO ACCOUNT BE LAID WITH A RISE OR HUMP ABOVE THE EVEN GRADIENT AS SHOWN IN THE THESE EXAMPLES.



Eng. Dept. Allspeeds Ltd. Accrington	**PRODUCT INFORMATION SHEET No.** P13	Issue: 1 Date: 19.10.99 Page 1 of 1
TITLE:	HYDRAM DRIVE PIPES - LEAD FILLED PIPE JOINTS	

On larger Hydrams the drive pipes are fixed into the Injection socket by means of a leaded joint. See fig. 1.

Fig. 1

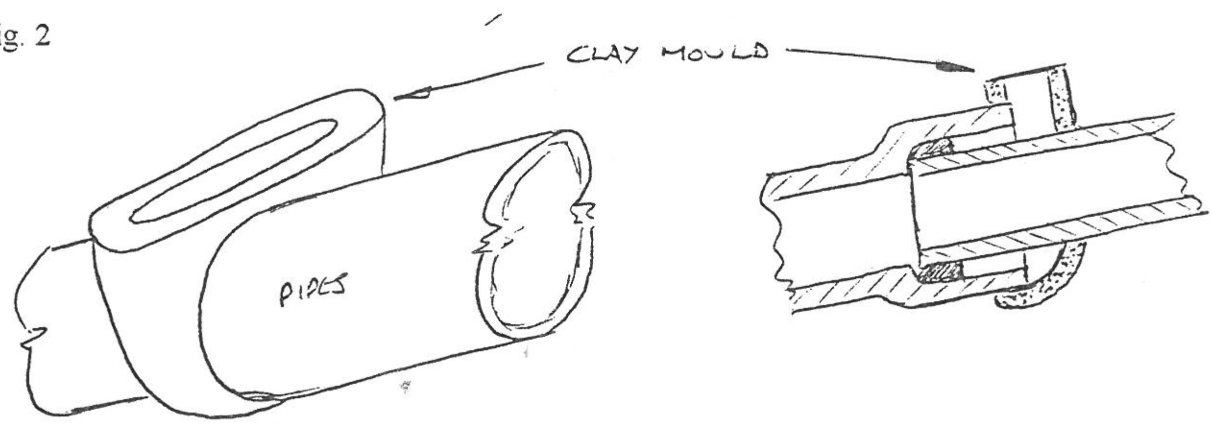


The leaded joint seals and retains the pipe and allows some initial adjustment of the drive pipe angle. The drive pipe is pushed into the socket as far as it will go and annular gap between the socket and the pipe is made approximately equal all round. The gap is packed tightly as shown with skeins of hemp (supplied). Lead wool is packed in behind the hemp to retain it and to lock the drive pipe in place. In service, the hemp gets wet and swells so completely sealing the pipe joint.

The correct way to make the joint is to use the proper size of curved caulking tools, and hammers, to tightly compress the hemp and then the lead wool.

If these tools are not available, then the hemp must be caulked tight using a blunt nose tool similar in size to a cold chisel. Next a clay dam needs to be made around the pipe and socket so that the lead can be melted and poured into the gap. See fig. 2. After the lead has solidified the clay and any excess lead can be removed

Fig. 2



If required, at time of order, we can lead in a short length of plain pipe at our factory. This will enable the drive pipe to be connected on site by a sleeve pipe coupling. (e.g.. a Victualic or similar) However this method does not have ability to adjust to the drive pipe slope as easily as leaded joints do.

This information sheet is the collected knowledge within the Company of matters relating to drive pipes. Information has been drawn from various internal sources and tables, few of the latter are dated,, and their provenance is unknown. For example it is accepted practice to use a table of factors to size Hydram performance. This assumes that a No. 1 Hydram has the same efficiency as a No. 10 for instance and this is not true in practice. In addition the factors in our brochure have been re-formatted several times, and, although believed to be conservative, we do not know the original source. We do not know if they refer to the current new streamline (N.S.) series and on which type of waste valve they are based.

In view of this the following tables should be taken as a guide rather than gospel.

<u>The Drive Pipe</u>

The drive pipe is the engine of the Hydram and is just as important as the ram itself. In fact the Hydram could be regarded simply as an appendage of valves hung on the end of the drive pipe and serving only to regulate the flow of water.

At the point when the waste valve closes, there is a mass m of water flowing in the drive pipe at a velocity v. This moving column of water has kinetic energy (from the relationship K.E. = $\frac{1}{2}mv^2$) and it is the conversion of this, as the water is brought to rest, that provides the energy for pumping.

<u>Drive pipes diameters</u>

In absolute terms there is not a single "correct" diameter of drive pipe for a Hydram. The current sizes are those which in practice have been found to be suitable for most conditions - they have been arrived at experimentally. Further information can be found under the heading Dynamically Equivalent Drive Pipes, <u>but</u> exercise great caution before increasing the pipe size.

<u>Drive pipe materials</u>

Whilst drive pipes have been made of many materials e.g.. copper, steel, plastic, spun iron etc., the preferred material is steel. The requirements are that the pipes be as rigid as possible so that energy is not expended in pipe expansion, and as thick a wall as possible for this and for longevity. Plastic pipes can be used in certain circumstances (see below) and have the advantage of a smooth corrosion free bore which reduces friction losses. The disadvantage is that they are not very rigid and more of the driving energy is absorbed in pipe expansion, reducing the Hydram efficiency.

<u>Steel drive pipes</u>

For drive pipes up to and including 6"Ø, galvanised heavy grade steel tube should be used. The tube is available in 7m lengths, screwed and socketed and is to specification BS 1387 : 1985. The heavy grade is identified by a red band. For diameters greater than 6", plain end tube should be used, contact an appropriate tube supplier for availability. The wall thickness should be not less than 0.25" increasing to say 0.375/0.5" as the bore approaches 12"Ø. Viking Johnson couplings, should be specified for joining pipe lengths.

<u>Spun Iron drive pipes</u>

These may be specified for larger drive pipes (>6") using the manufacturers recommended jointing system. Flanged pipes may be used but these can result in alignment difficulties during installation. Spigot and socket ends, for use with leaded joints, should not be specified.

Plastic Drive pipes

Due to the previously mentioned drawbacks, plastic pipes should only be used where water conditions cause problems with steel pipes and only under the following restricted circumstances.

Maximum pipe bore size = 2½"
Maximum Hydram delivery lift - 150 ft.

Although various types of plastics have been used in the past, Alkathene for instance, our current recommendation is UPVC water pipes, Class E, to BS 3505 : 1986. These are available in 6m lengths. Joints should be made using the manufacturers rubber ring joints rather than solvent joints which are permanent and can be unreliable.

In case of sourcing difficulties, UPVC pipe to BS 3506 : 1969 (Industrial pipes) is a possible alternative providing an equivalent specification level is chosen, i.e. wall thickness and pressure rating.

Drive pipe lengths & layout

The recommended lengths of standard drive pipes are based on a multiplication of the working fall as follows.

Hydram No. 1 & No. 2 (working fall 5' or greater)	minimum length = working fall x 4 maximum length = working fall x 6
Hydram No. 3 and larger (working fall 6' or greater)	minimum length = working fall x 3.5 maximum length = working fall x 6

Note: i) use the shorter length where convenient
ii) for falls less than 5'/6' respectively see sections on Dynamically Equivalent drive pipes.

Generally the drive pipe should be laid in a straight line between the feed tank and the hydram inlet, this results in the most efficient arrangement. If the drive pipe is laid as a curve, the water must change direction as it flows down the pipe and this results in a head loss and thus lower delivery performance. The possible layout are shown in Fig. 1.

In some cases the geography of the site will seem to require the use of a drive pipe much longer than 6 times working fall. In these cases a feed chamber must be incorporated in the line in such a position as to give a normal drive pipe length. Failing this, a stand pipe can be incorporated - see fig. 1. for advice on this arrangement.

Drive pipes for low falls/high head ratios

In certain cases these are limitations to the quantities of driving water that may be passed through a standard drive pipe. The normal quantity can be regained by fitting a larger bore drive pipe as follows.

For working fall less than 4' with Hydram No. 1 to No. 5
For working fall less than 5' with Hydrams No. 6 upwards
OR
A lift greater than 20 times the working fall, then

Hydram size	No. 1	2	3	3½	4	5	6	7	8	10	11	12
Larger bore diameter in.	1½	2	2½	3	4	5	6	7	8	9	10	12

(See also section on Dynamically equivalent drive pipes.)

Drive pipe energy content

For a given drive pipe flow velocity, the kinetic energy of the drive pipe water column is proportional to drive pipe length. Thus a drive pipe of 6 x fall will have 1½ times more energy than one of 4 x fall. The result is that long drive pipes will cause the Hydram to beat more slowly but will deliver more water per beat. A drawback to long drive pipes, apart from the cost, is that the friction losses are higher which has the effect of reducing the available driving head and thus overall delivery.

When a Hydram is adjusted down to limit the driving water usage, the effect is to reduce the flow velocity. Since kinetic energy varies as the square of velocity, the effects are considerable. (e.g. reducing the velocity to half would reduce the kinetic energy to ¼). The consequence of this is to cause the hydram to beat faster, but deliver less per beat. The ability to pump to very high head ratios would be impaired..

Dynamically equivalent drive pipes

Drive pipes can be said to be dynamically equivalent when their kinetic energies are equal. A simple way of expressing this is to say that they are equivalent when the factor $^{length}/_{dia.}$ is equal. Thus a 2" pipe x 20' long is equivalent to a 4" pipe x 80' long. The beat rate, and thus the power supplied to the Hydram, is constant for dynamically equivalent drive pipes.

The energy effects of simply changing the drive pipe bore can be a calculated from the expression

$$\left(\frac{\text{standard dia.}}{\text{proposed dia.}}\right)^2 \times 100\ \%$$

As an example the No. 8 Hydram has a standard 7" bore drive pipe which can be difficult to source. Readily available alternative are 6" & 8" diameters.

Use of 8" drive $(^7/_8)^2 \times 100 = 76$ % energy level

Use of 6" drive $(^7/_6)^2 \times 100 = 136$ % energy level

It can be seen from this that the use of an 8" pipe would result in only ¾ of the required energy being available, whereas the use of a 6" pipe would provide an energy level one third in excess of that required.

In very low fall applications, larger bore drive pipes can be used to reduce the frictional losses to a minimum and made longer to compensate for the energy loss. Conversely, for very high lifts, smaller bores can be used to provide higher energies.

The following tables 1, 2, & 3 show the area of application of standard and diametrically equivalent drive pipes in terms of Hydram efficiency, together with notes on length and lift limitations. It is not clear how these were used or if the term "diametrically equivalent" is synonymous with "dynamically equivalent".

INSTRUCTIONS

On completion of installation the operator should ensure that the Hydram is firmly bolted to its concrete base and that the drivepipe has been laid evenly (or at least without any humps or rises in it). The following procedure should then be adopted:—

1. Before starting up a Hydram it is recommended that the supply to the drive pipe be closed and the waste valve removed. The valve on the drivepipe should then be opened for a few minutes to allow the Hydram to be well flushed. When this has been done, shut off the supply and replace waste valve.

2. Start the Hydram by opening the valve on drivepipe. Usually the Hydram will start pulsating, but if this does not happen, the rubber clack may be pushed open a few times by inserting a blunt iron or steel rod through one of the perforations of the waste valve seat. Where a metal clack is fitted it may be opened a few times by pushing down on the top of the metal clack spindle. If the rising main is empty it may be necessary to repeat the above procedure several times.

3. The quantity of water taken to drive the Hydram (and consequently the rate of delivery to the high level) can be regulated as follows:—

   (a) Where a rubber clack is fitted to the waste valve the consumption (and delivery) may be reduced from the rated maximum for a given Hydram by screwing the wheel shaped guard closer up to the waste seating. This will cause the Hydram to beat faster. This adjustment is made by loosening the locknut on top of the valve spindle and turning the spindle with the box key provided. Be sure to retighten the locknut before the Hydram is started.

   (b) Where the waste valve is fitted with a metal mushroom shaped clack the length of the stroke may be varied by means of the two brass locknuts on the valve spindle. The stroke may vary from 1/16″ to 1/4″. The shorter the stroke, the less water the Hydram will require, the less it will deliver, and the faster it will pulsate.

The waste valve should normally be adjusted so that there is at least a slight overflow at the intake or the feedwell as the case may be. You can then be sure you are not overrunning the supply.

In times of water shortage it is preferable to operate the Hydram continuously on a quick stroke rather than intermittently on a slow one. By this means you will save trouble and pump up more water in the long run.

N.B.—No branches should be taken from the rising main to deliver water at a level lower than about three times the working fall otherwise the Hydram may stop each time the water is drawn through any such branches. Branches may be taken from higher points on the rising main, and for preference should be controlled by ballcocks.

When a stop valve is fitted on the drive pipe close to the Hydram, the valve should be fixed in a horizontal or oblique position to ensure no pockets of air will form in the valve mechanism.

Spare rubber clacks should be kept in a cool place and in the dark.

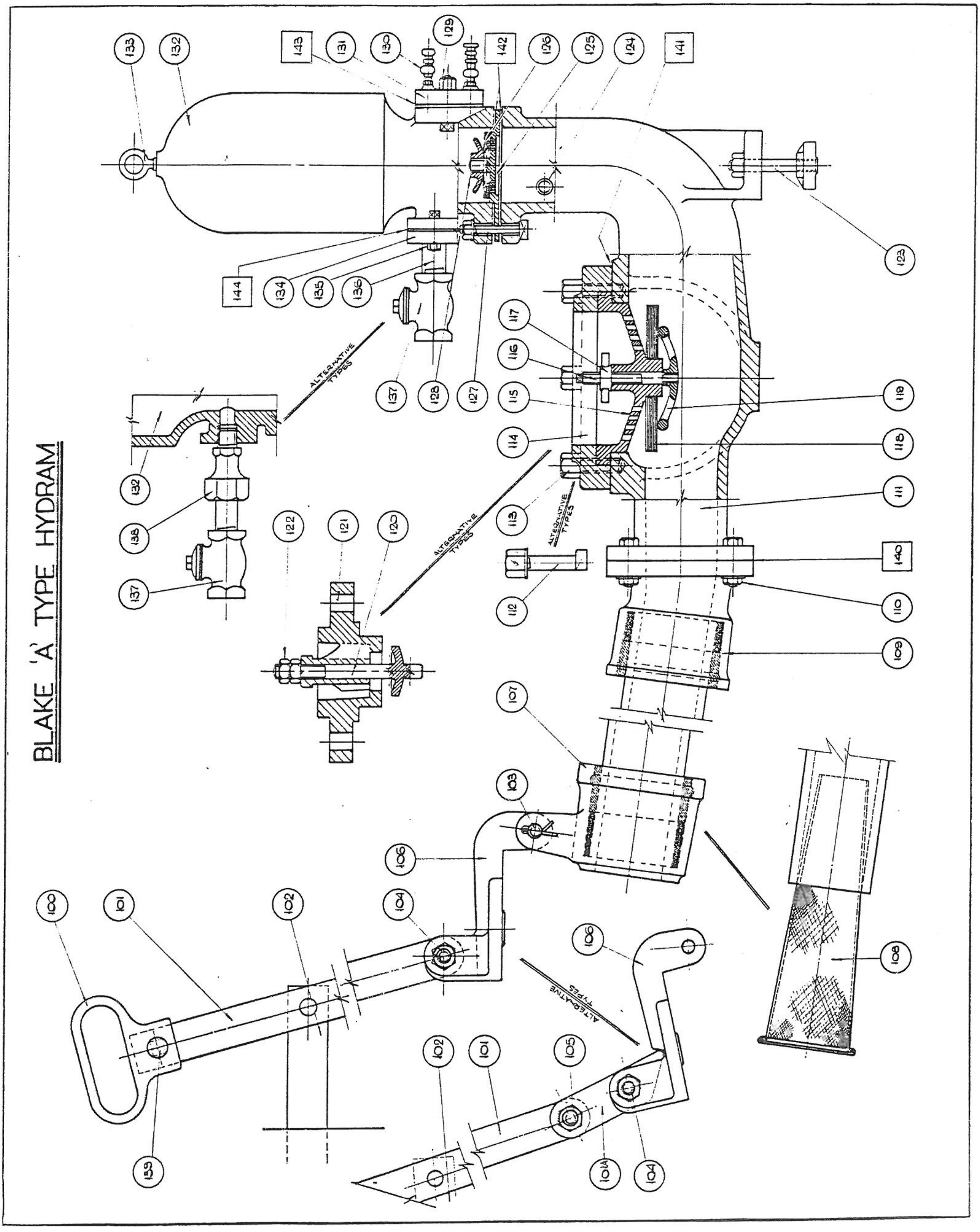
SPARE PARTS

When ordering spare parts it is essential to quote the serial number of the Hydram. The serial numbers of most Hydrams are to be found on the small brass plate attached to the air vessel.

To indicate the part that you require please quote the figure number and description in accordance with the parts list given below which refers to the sectional drawing.

Fig. No.	*Description*
100	Lifting Bar Handle.
101	Lifting Bar.
101a	Breaking Bar.
102	(Cross Bar
	(Cross Bar Pin.
103	(Swivel Pin for Flap Valve.
	(Split Pin for Swivel Pin.
104	(Bolt for Lifting Bar.
	(Nut for Lifting Bar Bolt.
105	(Bolt for Breaking Bar.
	(Nut for Breaking Bar Bolt.
106	Cover for Flap Type Valve.
107	Flap Type Valve Body.
108	Strainer (Conical or Flat).
109	Flanged Socket.
110	(Bolt for Flanged Socket.
	(Nut for Flanged Socket Bolt.
	(Washer for Flanged Socket Bolt.
111	Ram Body.
112	(Waste Valve H.D. Bolt.
	(Nut for Waste Valve H.D. Bolt
113	(Waste Valve Stud.
	(Nut for Waste Valve Stud.
114	Waste Valve Cover.
115	Waste Valve Seating.
116	Shutter Guard Spindle.
117	Waste Valve Lug Nut.
118	Waste Valve Clack (Rubber).
119	Shutter Guard.
120	Waste Valve Clack (Gunmetal).
121	Waste Valve Seat and Cover.
122	Brass Locknut for Clack.
123	(Holding Down Bolt or Stud.
	(Nut for H.D. Bolt or Stud.
	(Washer for H.D. Bolt or Stud.
	(Square Plate for H.D. Bolt or Stud
124	Air Valve.
125	Delivery Valve Seat.
126	Delivery Valve Clack.
127	(Air Vessel Flange Bolt.
	(Nut for Air Vessel Bolt.
	(Washer for Air Vessel Bolt.
128	Star Nut or Saucer.
129	(Air Vessel Door Bolt or Stud.
	(Nut for Air Vessel Door Bolt.
130	Air Tap.
131	Air Vessel Door.
132	Air Vessel.
133	Air Vessel Eyebolt.
134	Delivery Pipe Flange.
135	(Delivery Flange Bolt.
	(Delivery Flange Nut.
	(Delivery Flange Washer.
136	Nipple.
137	Back Pressure Valve (Screwed).
138	Delivery Pipe Union.
139	Cuphead Bolt and Nut for Lift Handle.
140	Socket Flange Joint Ring.
141	Waste Valve Joint Ring.
142	Delivery Valve Joint Ring.
143	Air Vessel Door Joint Ring.
144	Delivery Flange Joint Ring.
*145	D.E. Spanner.
*146	S.E. Spanner.
*147	Box Key
*148	Hydram Nameplate.
*149	Neckpiece.
*150	Neckpiece Joint Ring.
*151	Neckpiece Flange Bolts.
*152	Neckpiece Flange Studs.
*153	Nut for Neckpiece Bolts/Studs.
*154	Washer for Neckpiece Bolts/Nuts.
*155	Eyebolt for Waste Valve Cover.
*156	Setscrew for Delivery Valve.
*157	Lug Nut for Delivery Valve.
*158	Back Pressure Valve (flanged) Body.
*159	Back Pressure Valve (flanged) Seat.
*160	Back Pressure Valve (flanged) Cover.
*161	Back Pressure Valve (flanged) Star Nut.
*162	Back Pressure Valve (flanged) Rubber Disc.
*163	Nut for B.P.V. Cover.
*164	Washer for B.P.V. Cover.
*165	Bolt for B.P.V. Cover.
*166	B.P.V. Cover Joint Ring.

* Not Illustrated.


BLAKE 'A' TYPE HYDRAM
ALTERNATIVE TYPES
ALTERNATIVE TYPES
ALTERNATIVE TYPES
ALTERNATIVE TYPES

UNSATISFACTORY PERFORMANCE

The Hydram may work unsatisfactorily for any of the following reasons:

1. Insufficient water to drive it.
2. Worn Waste Valve.
3. Worn Delivery Valve.
4. Worn or blocked Air Valve.
5. Faulty Drivepipe.
6. Faulty Delivery Pipe.

Driving Water. The water supply to the feedtank on the upper end of the drivepipe must be sufficient to cover the mouth of the pipe, preferably to a depth of 12″–18″ at all times. If the water supply is restricted the requirements of the ram may be reduced by suitable adjustment of the waste valve (details are given in the operating instructions).

Waste Valve.

(a) Where the valve is fitted with a rubber clack this should be inspected to see if it has become hard, ridged or dished. A further period of useful life may sometimes be obtained by reversing the clack, but otherwise it should be replaced. Ensure no foreign matter has lodged in the grid of the valve.

(b) Where a gunmetal clack is fitted, if the surface of the seating has become very smooth, the clack may develop a tendency to adhere to the seating. This may be cured by carefully roughening the seating with a coarse file. The spindle of the clack should be checked for excessive wear in its guide, and the clack replaced if necessary.

Delivery Valve. (Situated inside and at the base of the air vessel) is reached through the door in the air vessel, or by the removal of the air vessel itself if it has no door. The rubber clack should be inspected to see if it has become ridged or hard, and replaced if necessary. Where a securing nut is fitted, this should be tightened without using excessive pressure. No adjustment is provided for this valve.

Air Valve is a small brass plug screwed into the neck of the Hydram. A pinhole is drilled through this plug which should emit a fine jet of water at each stroke of the Hydram. The pinhole may have become enlarged or blocked. Comparison with a new air valve will show whether enlargement has occurred. Should the valve be blocked it should be cleaned and care taken not to enlarge it during this operation.

A blocked air valve will result in the air vessel becoming waterlogged. This condition is indicated by:

1. An unusually heavy beat of the Hydram.

2. The water being delivered to the storage tank in spurts.

3. On a Hydram that has been operating for some time, when the upper of the brass drain cocks on the air vessel is opened, water only will flow slowly from the cock.

When this condition is encountered, the air vessel should be recharged as follows:

Close the valve on the drivepipe and open the two small brass cocks on the air vessel. Leave the cocks open until all the air and water has drained out. Close the cocks, re-open the valve on the drivepipe and restart the Hydram.

Drivepipe. Any leak or obstruction in the drivepipe will seriously affect the operation of the Hydram.

An indication of a leak will be for the Hydram to beat unsteadily and to stop. The pipe should be carefully inspected, especially at the upper end and in the immediate vicinity of the Hydram. Where a flap valve is fitted to the mouth of the drivepipe the presence of a leak may be investigated as follows:—

Close the waste valve (by holding up the clack where a metal waste valve is fitted, or by screwing the shutter guard as close as possible to the valve seat where a rubber clack is used) close the flap valve and wait 15 minutes. Reopen the flap valve suddenly and if numerous bubbles of air rise to the surface of the feedtank it is probable the drivepipe is leaking.

To investigate an obstruction in the drivepipe, the valve on the drivepipe should be closed and the waste valve removed. If the valve on the drivepipe is then opened there should be a good flow of water for a few minutes at least and this should rise 6″ or so above the waste valve housing. If the flow is sluggish it is probable that the pipe is restricted and it must be cleared or replaced.

Delivery Pipe. A reduction in output may be due to a leaking or obstructed delivery pipe. Leaks may be found by inspection or the use of a pressure gauge which will show a figure indicating the height of the leak above the Hydram instead of the normal full delivery head. Obstructions are also found by the use of a pressure gauge, which in this case, will show a pressure in excess of the normal static lift plus a suitable allowance for friction.