Planning and construction manual SCHLUMPF hydraulic ram

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Content

1. General Conditions

These planning and construction instructions are provided to our customers for their personal use. It is primarily intended for the operating personnel of the plant and should be always accessible to them.

The manual makes no claim to completeness or to a complete list of all instructions to be observed during the planning, operation, maintenance, dismantling and repair of the plant.

The operation, maintenance and assembly of the system covered by these operating instructions must be carried out by appropriately trained personnel.

Claims of any kind whatsoever cannot be derived from these instructions.

The copyright of this manual remains the property of Sigrist AG Turbinenbau.

This documentation serves to familiarize the operator with the plant and its intended use. It contains important information on how to install and operate the turbine correctly, safely and with the best results. However, it is by no means complete and in no way replaces the common sense and technical understanding of the operating personnel. Best judgment must be exercised at all times.

This document is a supplement to the valid national regulations and recommendations for the prevention of accidents and the protection of property and persons.

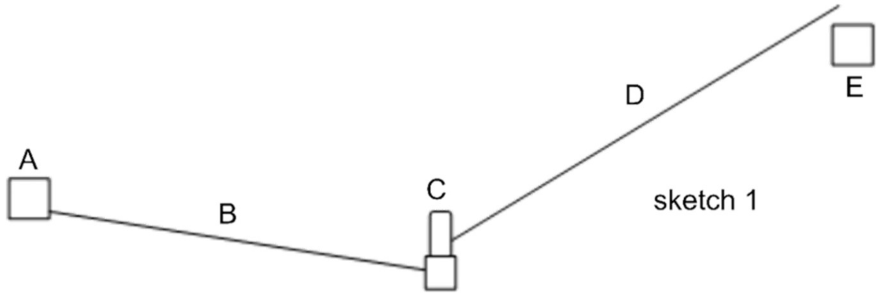
This documentation must be accessible to everyone during the entire period of use of the machine. It must be read by every person who is in any way involved in the following activities:

- Building the plant
- Operation, including troubleshooting in the workflow
- Maintenance of the plant
- Maintenance (servicing, inspection, repair)

2. Building a hydraulic ram pump

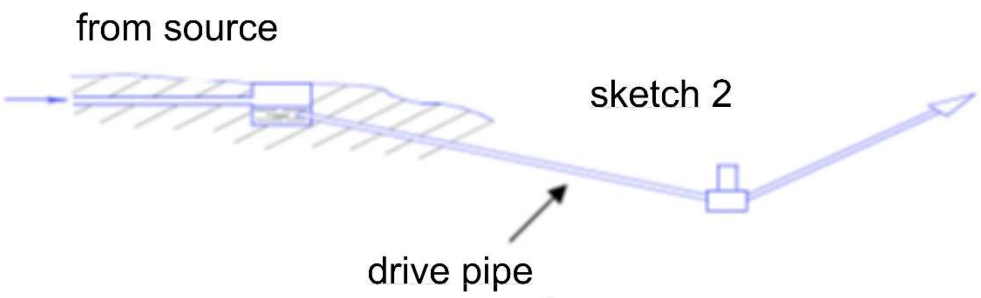
The hydraulic ram is an automatic water pump that can lift a portion of the available spring or stream water to a significantly higher point with a relatively small drop without outside power. The hydraulic ram operates automatically, without special supervision or maintenance, continuously day and night.

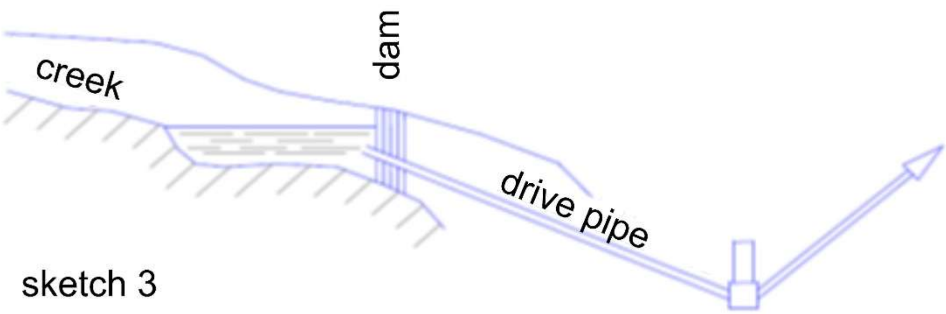
Example:
Spring or stream water is discharged into a collection well A. Part of this water is to be pumped into the reservoir at point E. From point A, the water is conveyed through the drive pipe B to the ram C. Part of the water is conveyed to reservoir E through drive pipe D (Sketch 1).



2.1 Collection shaft

The available water is fed into a collection shaft (well) or a basin (sketch 2). If the water is taken from a stream, it can be dammed accordingly (sketch 3). It must be ensured that no impurities enter the drive pipe.

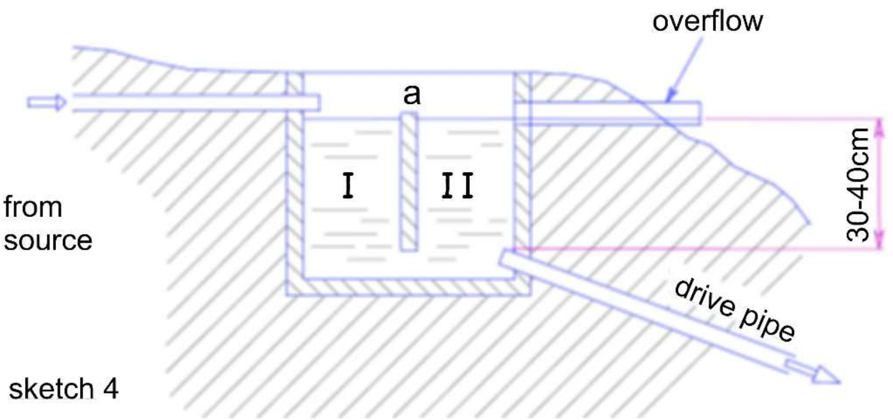




The collection shaft, also called a well, can be built as large as desired, e.g., cement pipe Ø 60 - 100 cm. It is important to ensure that the drive pipe is always sufficiently covered with water, at least approx. 30 - 40 cm (sketch 4).

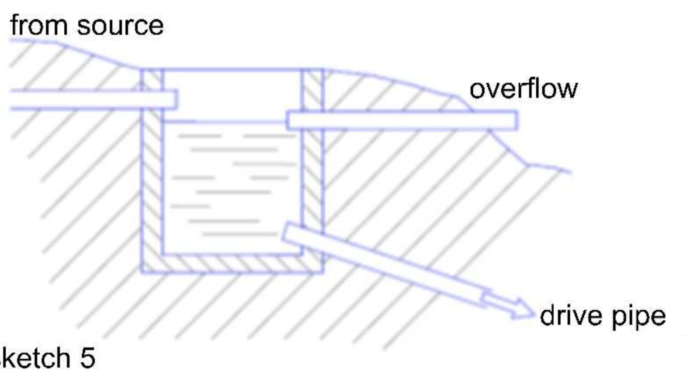
The well should be constructed in such a way that air bubbles caused by the water flowing in cannot get into the drive pipe under any circumstances. Air bubbles in the drive pipe impair the function of the ram. To protect against air bubbles, an intermediate wall **a** (sketch 4) can be built in the collection shaft.

The intermediate wall should have an opening at floor level so that the water can flow unhindered from chamber I into chamber II.

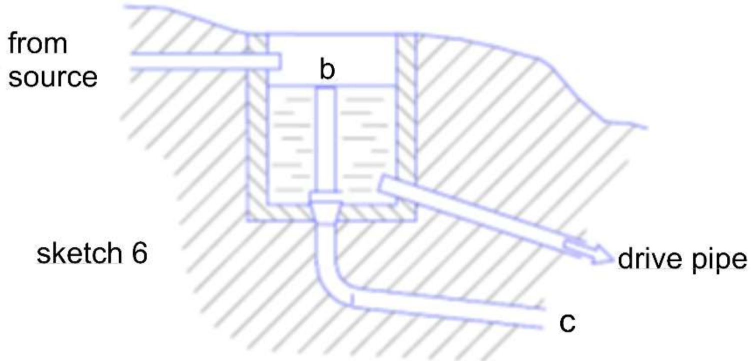


sketch 4

To prevent overflowing of the collection shaft, an overflow facility should be provided (sketches 4 - 6). In the design according to sketch 6, the water not required by the ram can be drained off through the idle plug b and through the idle pipe c. This design has the advantage that the collection shaft can be emptied and cleaned easily. The overflow must be positioned so that no backflow to the source can occur.



sketch 5



sketch 6

2.2 Drive pipe

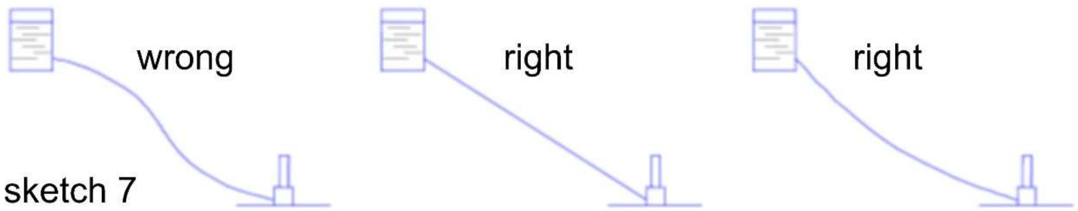
The pipeline from the collection shaft (well chamber) to the ram is called the drive pipe. The size of the drive pipe depends on the size of the ram and can be taken from the corresponding table.

Decades of experience show that a drive pipe with a graduated diameter provides increased security against wear damage to the pipe caused by the constant pressure vibrations. It is important for the function that at least the lowest third has the diameter according to the table (page 13), which corresponds to the ram size and the water quantity. The second third can be made one pipe dimension larger and the top third again one pipe dimension larger. It is important that the transitions are conical and not abrupt by means of step-shaped reductions. We supply corresponding specially manufactured conical pieces. Alternatively, a two-part drive pipe can also lead to good results. The lower half according to the table, the upper half one pipe dimension larger. The connection in the collection chamber must not be smaller than the first pipe section of the drive pipe.

Only iron, steel or cast-iron pipes may be used for the drive pipe. Plastic pipes are not permitted because of their elasticity.

The drive pipe must be constructed with all due care and must be perfectly leak-proof. The slightest leakage can affect the operation of the ram. Only sleeves with reinforced edges (e.g.GF 280) should be used for the pipe connections.

Conical faced pipe connectors are unsuitable and should be avoided. The slope onto the ram should be steeper in the upper part and flatter in the lower part (sketch 7).



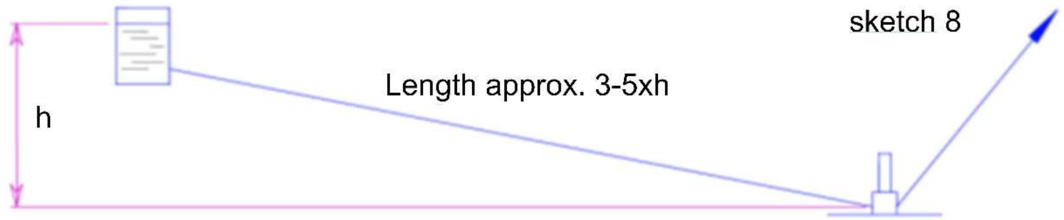
sketch 7

No more than 15° angles may be used, never 45° or even 90° angles. These would severely impair the flow and restrict or even make it impossible for the ram to operate properly.

The correct length of the drive pipe is important for the correct functioning of the system. It must be three to five times the vertical drop (sketch 8).

Caution: The pipe trenches must not be covered until the system is functioning properly.

sketch 8



2.3 Hydraulic SCHLUMPF ram

The ram is connected to the pipes using the flanges/connections supplied. The size of the ram depends on the amount of spring or stream water available, or on the amount of water to be pumped. The ventilation of our SCHLUMPF rams is automatic, without air valves.

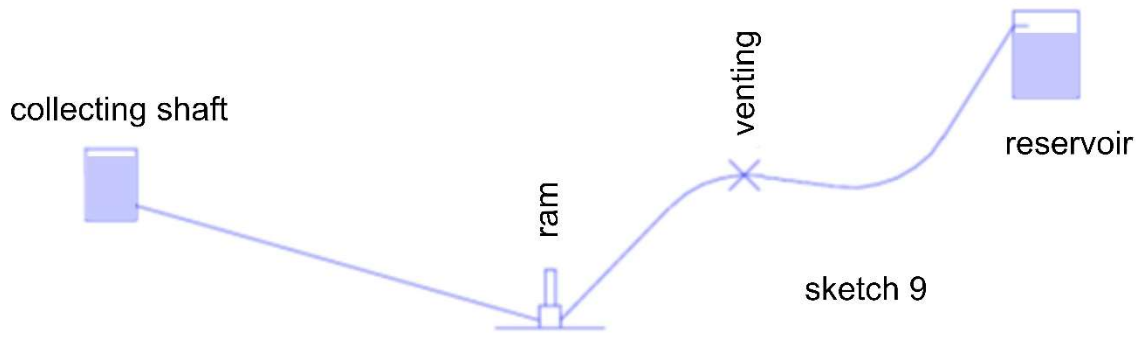
The ram can be installed outdoors. To prevent tampering by unauthorised persons, we recommend placing it in a lockable shaft. To determine the size of the ram chamber, the dimensions of the ram can be taken from the corresponding table (page 13).

The ram chamber must be provided with a drain so that the flowing water can flow off unhindered.

2.4 Delivery pipe

The pipe from the ram to the reservoir is called the delivery pipe. The size of the delivery pipe can be seen in the table (page 13). This pipe should be constructed without a counter gradient. If this is not possible, venting possibilities must be provided (sketch 9).

Plastic pipes are permitted for the delivery line, taking pressure resistance into account.
This pipe must have an open outlet so that the pumped water can flow out freely.



sketch 9

2.5 Reservoir

If the water is needed for watering, the outlet of the delivery pipe can be made to a watering trough, for example. For other uses, e.g.for household purposes, we recommend the construction of a reservoir above the place of demand. This way, the water pumped when it's not being directly used, can be stored and is available as a reserve at any time. Depending on the location of the reservoir, the desired water pressure can then be generated for at the point of use.

The inlet of the delivery pipe into the reservoir should be above the water level so that the delivery rate can be controlled at any time.

The connection of the consumption pipe should be opposite the inlet of the delivery pipe to ensure good circulation and keeping the water fresh in the reservoir.

2.6 Size of the ram

The size of the ram depends on the amount of spring or stream water available, or on the desired delivery rate.

Example
A spring delivers 30 l/min. Part of this is to be pumped 20 metres higher. For a water quantity of 30 l/min inflow, a ram no. S2/2021-5/4", adjustable for an inflow of approx. 15 - 35 l/min, is suitable.

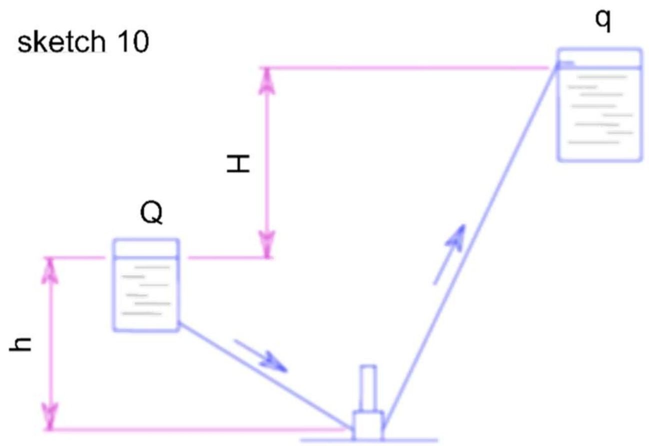
A spring delivers 150 l/min. Of this, 5 l/min should be pumped higher. In this case, it is not necessary to use a ram that can handle 150 l/min, because depending on the drop to the ram, a small ram is sufficient for the required output of 5 l/min.

2.7 Output of the ram

The flow rate depends on the altitude conditions and the available water volume. It is calculated according to the following formula:

$$q = \frac{h \times Q}{h + H} \times 0.7$$

q = Water volume pumped
h = Drop to the ram
H = Height difference from the collection shaft to the highest point of the delivery pipe
Q = Influx on the ram



Example 1
A spring supplies 30 l/min of water. As much of this as possible is to be pumped 20 m higher. According to the drop and performance table, the drop to the ram at 20 m height difference is at least 3 m; max. 20 m. The length of the drive pipe should be about three to five times the drop. The length of the drive pipe should be approximately three to five times the height of the drop. For a 3 m drop this means approx. 9 - 15 m, for a 20 m drop approx. 60 - 100 m.

According to the above formula, the delivery rate is:

at 3 m drop, flow rate q = $\frac{3 \times 30}{3 + 20} \times 0.7 =$ 2,7 l/min = 3’880 l/Tag

at 20 m drop, flow rate q = $\frac{20 \times 30}{20 + 20} \times 0.7 =$ 10,5 l/min = 15’120 l/Tag

This example shows how the flow rate changes at different drops. For the water flow of 30 l/min, a ram no. S2/2021 - 5/4", adjustable for an inflow of approx. 15 - 35 l/min, is suitable. For pipes and dimensions see brochure or dimension sheet.

Example 2
A spring supplies 2 l/min of water. As much of this as possible is to be pumped 80 m higher. The possible drop of the terrain is 20 m. The length of the drive pipe is approx. 60 - 100 m (three to five times the height of the slope).

According to the above formula, the flow rate is approx. 0.28 l/min (approx. 403 l/day). For 2 l/min inflow to the ram, ram no. S0/2021 - 1/2" is suitable, adjustable for inflow of approx. 1 - 3 l/min. The drop to the ram can also be selected smaller or larger (see corresponding tables). The flow rate changes accordingly.

Example 3
A source delivers 150 l/min. Of this, 5 l/min are to be pumped 50 m higher. The drop to the ram is 10 m. The quantity of water that must be processed by the ram so that 5 l/min is pumped up 50 m is calculated according to the following formula:

$$Q = \frac{(h + H) \times q}{h \times 0.7} = \frac{(10 + 50) \times 5}{10 \times 0.7} = 43 \text{ l/min}$$

In order to pump 5 l/min up 50 m, the inflow water quantity must be approx. 43 l/min at a 10 m drop. Ram no. S2/2021 - 1 1/2", which can be regulated from approx. 30 - 60 l/min flow, is suitable for this purpose.

2.8 Fittings

All rams are supplied with attached shut-off valve for the drive, delivery pipes and a drain cock for the delivery pipe. The drain cock is mounted between the shut-off valve and the air vessel. This allows the pressure in the air vessel to be released without having to empty the delivery pipe so that it can be dismantled safely.

Optional pressure gauge and drain valves can be supplied.

2.9 General

In addition to the standard sizes listed in the brochure, we also manufacture special designs for larger water volumes. Systems with drops of 1 m to 100 m and to heights differences of over 500 m are already in use.

Warning: For height differences over 100 m, the pressure conditions require special design precautions. In such cases, please contact us in advance.

For planning a special design, please always provide us with the following details:

1. How many litres of water does the spring or stream supply per minute (Q)? If possible, indicate the minimum and maximum amount of water.
2. How many metres of slope (h) are available from the source downwards, without hindering the flow of water?
3. How many metres should the water be raised from the source (H)?
4. Approximately how long will the delivery pipe be?
5. If the delivery pipe is ascending at a constant fall, undulating or with a counter-slope?
6. What is the approximate daily water requirement?

The above planning and construction instructions serve as a guideline for the construction of ram installations. If an installation cannot be executed according to these guidelines, please contact us.

Warning: When constructing a ram system, the pipe trenches must never be covered before the proper functioning of the system has been checked.

We reserve the right to make dimensional and constructional changes, as well as changes and additions to the planning and installation instructions.

For more than 135 years, our SCHLUMPF ram have proven themselves in practice through their simplicity, reliability and great performance with maintenance-free operation and have thus developed into a generally recognised concept of value.

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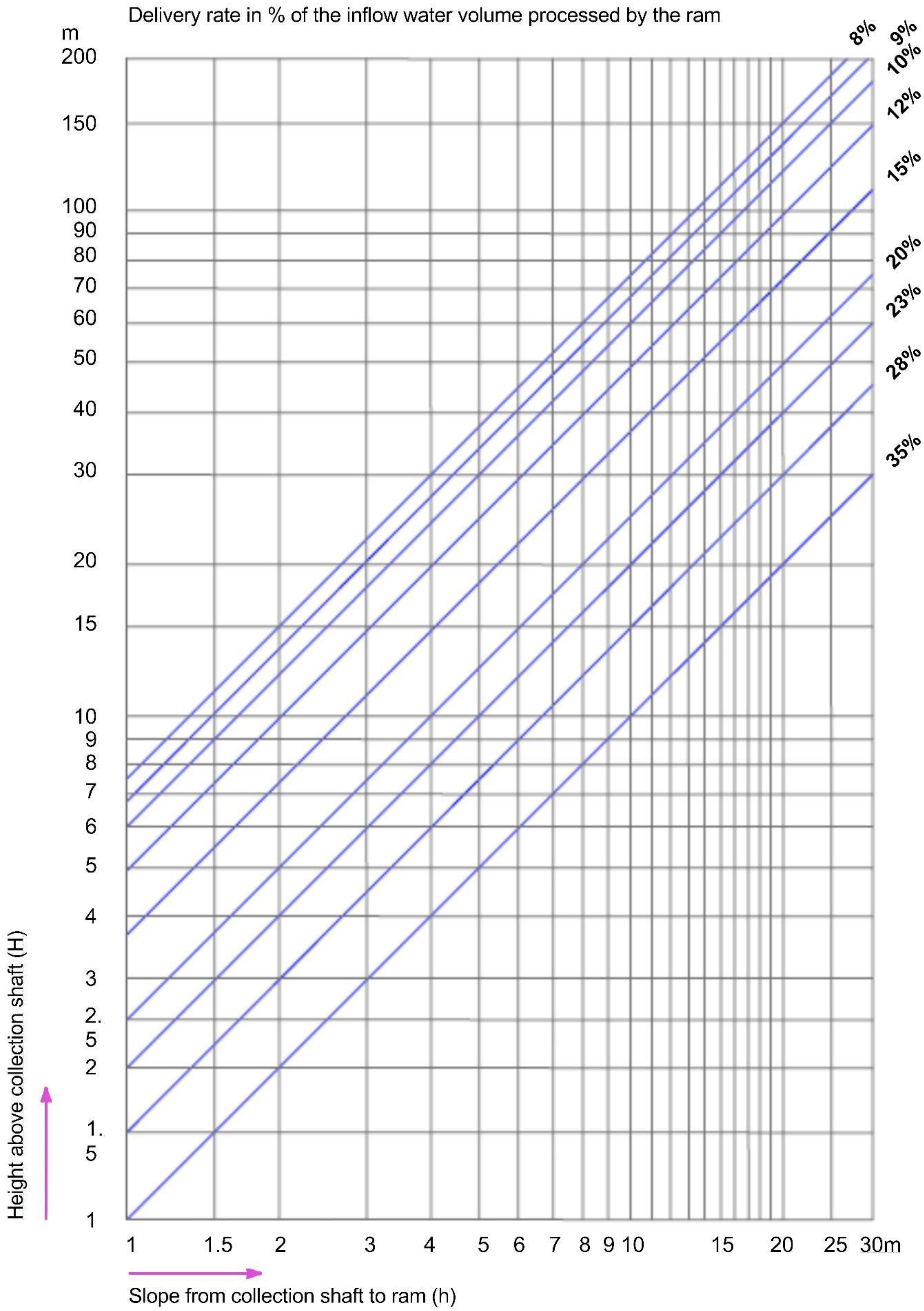
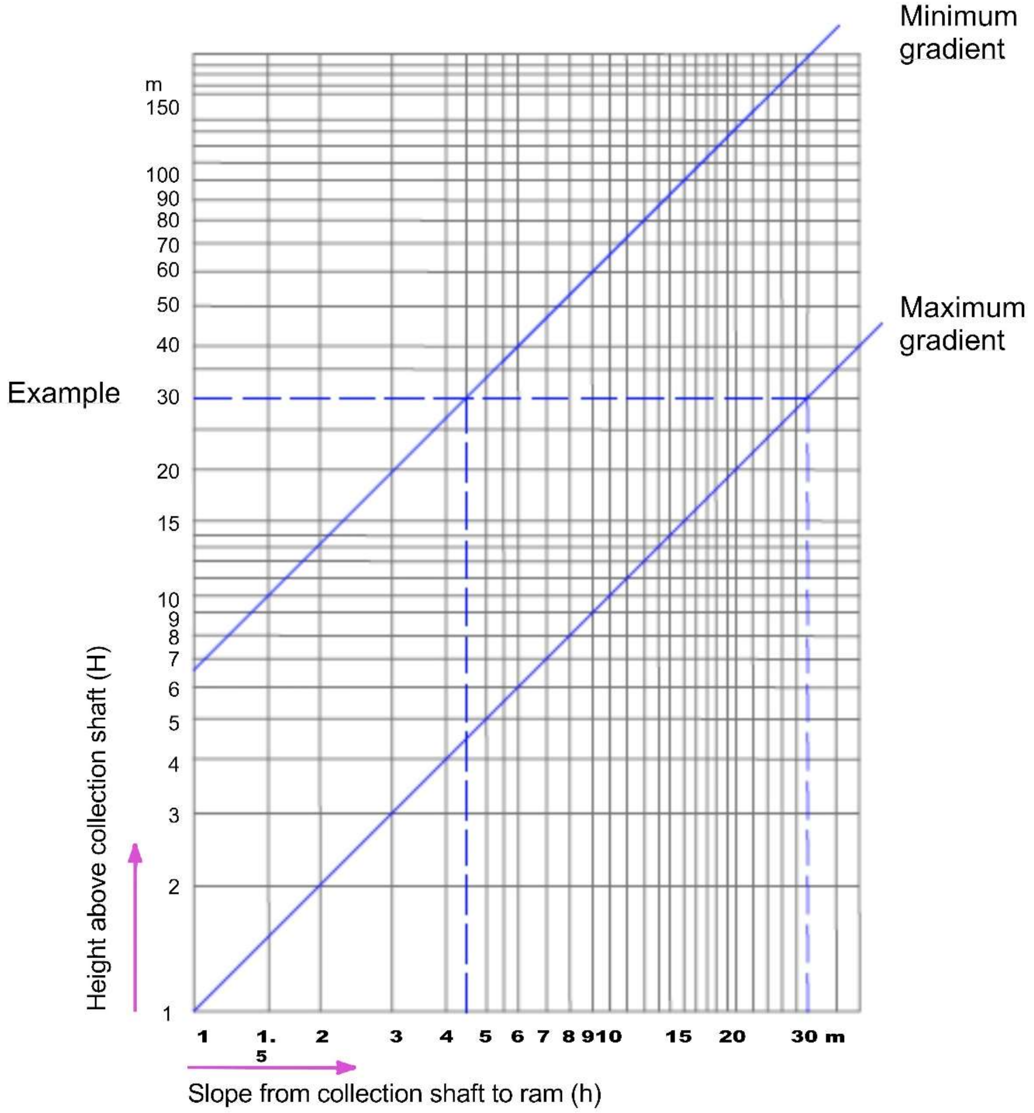
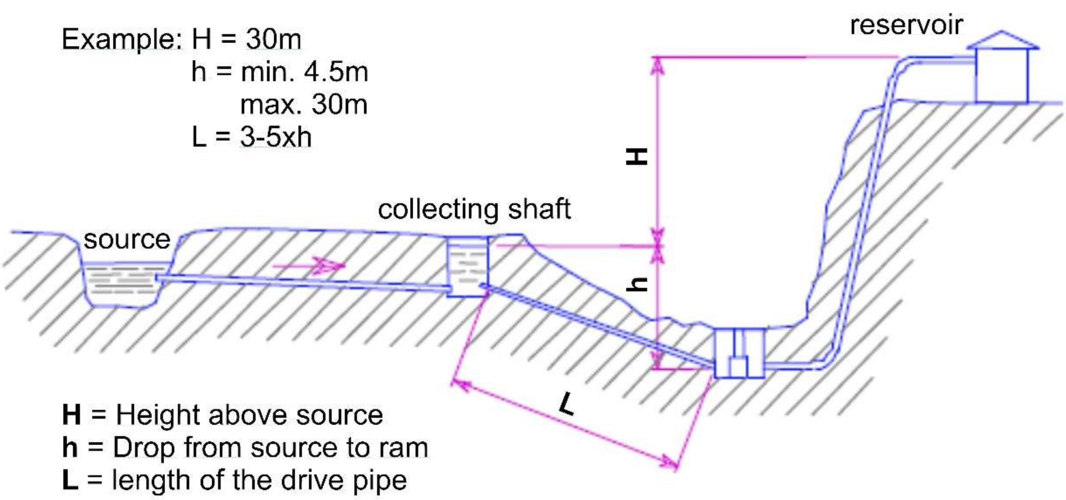
3. Drop and power table for hydraulic rams

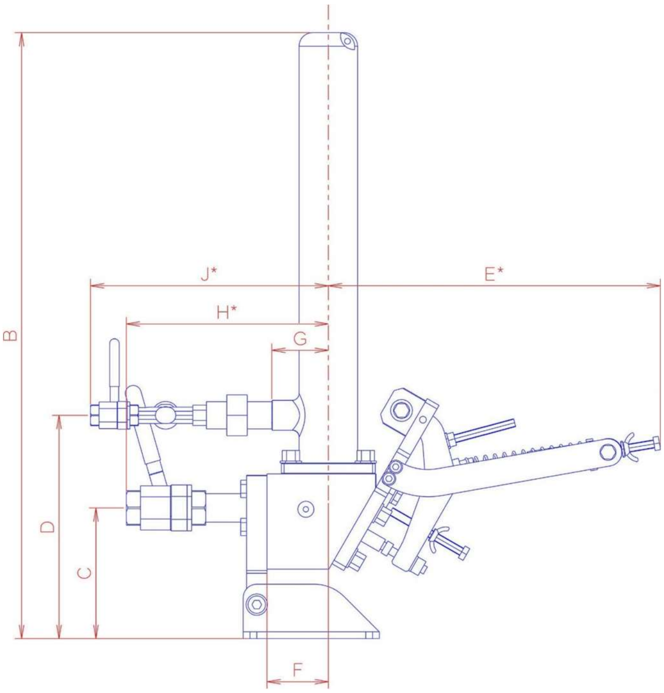


4. Drop table


Minimum gradient
Maximum gradient
Example
m
150
100
90
80
70
60
50
40
30
20
15
10
9
8
7
6
5
4
3
2
1
Height above collection shaft (H)
1 1.5 2 3 4 5 6 7 8 9 10 15 20 30 m
Slope from collection shaft to ram (h)


Example: H = 30m
h = min. 4.5m
max. 30m
L = 3-5xh
reservoir
collecting shaft
source
H
h
L
H = Height above source
h = Drop from source to ram
L = length of the drive pipe

5. Ram 2021 sizes 0 - 3

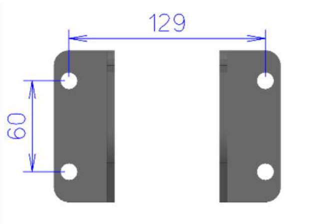


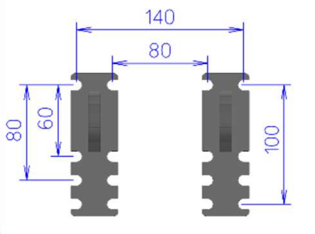
Size	S0		S1		S2		S3	
Drive pipe	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"
Conveyor pipe	1/4"	1/4"	1/2"	1/2"	3/4"	1"	1"	1 1/4"
B	445		570		720		900	
C	96		120		165		225	
D	164		210		284		410	
E*	244		350		455		650	
F	45		50		75		100	
G	41.5		60		90		120	
H*	150		167	173	195	210	370	330
J*	200		235		310	320	365	380
Width	150		150		220		300	
Weight	4 kg		10 kg		25 kg		65 kg	

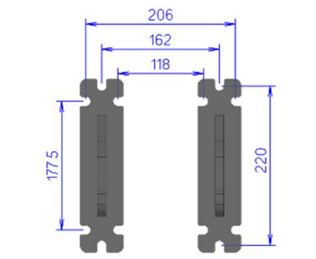
** These masses are approximate masses. In practice deviations are possible.*

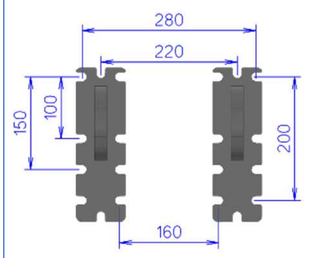
Type S0	Type S1	Type S2	Type S3
M8	M8	M12	M12

Side pipe connections









Side impact valve