

HM 150.15

Hydraulic ram – pumping using water hammer



The illustration shows the device and the GUNT Media Center, tablet not included

Description

- principle of a ram
- transparent tank and visible non-return butterfly valve for optimal observation of the function
- digital multimedia teaching material online in the GUNT Media Center: E-Learning course, worksheets, videos

Abruptly interrupting the water flow can cause water hammer in the pipeline. This generally undesired effect is used specifically in special equipment (hydraulic ram) to raise water to a higher level.

HM 150.15 can be used to demonstrate the formation and effect of water hammer and to study how a hydraulic ram works. The water is fed to the ram via a long pipe at a gradient.

Above a certain water velocity the waste valve in the ram closes automatically, due to the flow forces. This happens suddenly, so that the kinetic energy of the water in the pipe is converted into potential pressure energy. The pressure opens a non-return butterfly valve and the water flows into an air vessel. The air cushion in the air vessel dampens the water hammer and ensures a uniform lift into the elevated tank.

After the water hammer has subsided, the waste valve opens due to the dead weight, the water in the pipe starts to flow again and the process repeats itself.

The operation of the waste valve as a function of the weight load, the valve lift and the flow rate is studied. Furthermore, it is possible to show how the volume of air in the air vessel affects the lift. Valves are used to adjust the flow rate.

The water is supplied and flow rate measured by the base module HM 150. Alternatively, the experimental unit can be operated by the laboratory supply.

Digital multimedia teaching material is available at the GUNT Media Center. This includes E-Learning courses on basic knowledge and calculations. Videos show a complete experiment with preparation, execution and evaluation. Worksheets with solutions supplement the teaching material.

Learning objectives/experiments

- demonstrate formation and effect of water hammer
- principle of a ram
- function of an air vessel
- effect of air volume in the air vessel and the flow velocity on the pump behaviour
- efficiency analysis

GUNT Media Center, develop digital skills

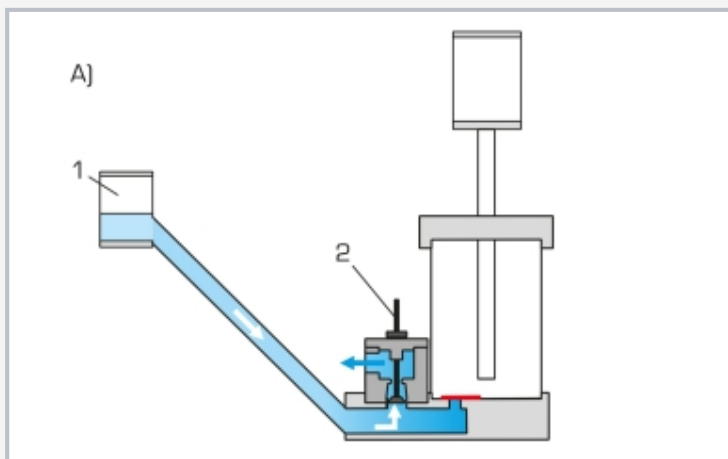
- E-Learning course with fundamental knowledge and calculations
- videos with detailed demonstration of the experiments: preparation, execution, evaluation
- assured learning success through digital worksheets
- retrieve information from digital networks

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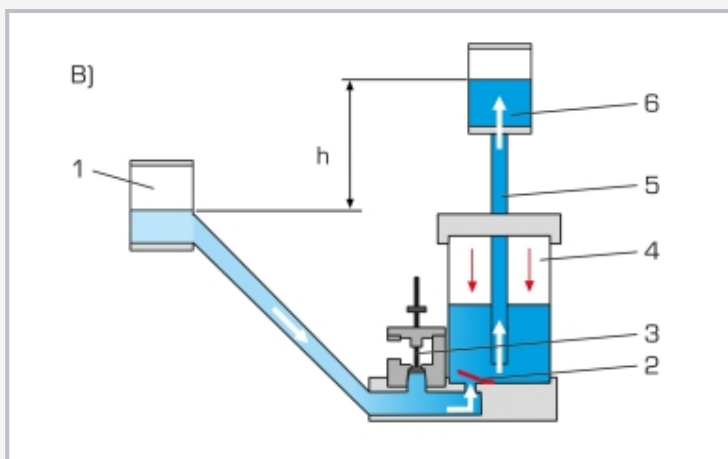
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1 inlet tank with fixed overflow, 2 water connection, 3 water discharge, 4 waste valve with lift, 5 air vessel with air volume and non-return butterfly valve, 6 riser, 7 pipe, 8 elevated tank, 9 adjustable overflow



Principle of operation of a hydraulic ram: A) waste valve open, non-return butterfly valve closed, water outlet through waste valve; 1 inlet tank, 2 waste valve



B) waste valve closed, non-return butterfly valve open, water inlet to air vessel and elevated tank; 1 inlet tank, 2 non-return butterfly valve, 3 waste valve, 4 air vessel with air volume, 5 riser, 6 elevated tank; h head

Specification

- [1] formation and effect of water hammer
- [2] pumping using water hammer
- [3] transparent tank and visible non-return butterfly valve for optimal observation of the function
- [4] fixed overflow tank is used as a water source, e.g. river, pool
- [5] elevated tank with variable pump head
- [6] waste valve with adjustable lift, closes cyclically due to flow force of the water
- [7] visible movement of the waste valve
- [8] tank with non-return butterfly valve and air volume is used as an air vessel
- [9] air volume in the air vessel is varied by vent valve
- [10] flow rate measurement using base module HM 150
- [11] water supply using base module HM 150 or via lab supply
- [12] digital multimedia teaching material online in the GUNT Media Center: E-Learning course, worksheets, videos

Technical data

- Ram
- max. head 0,27m
 - max. flow rate: 90L/h
- LxWxH: 1100x640x1400mm
Weight: approx. 57kg

Required for operation

HM 150 (closed water circuit) or water connection, drain; PC or online access recommended

Scope of delivery

- 1 experimental unit
- 1 set of hoses
- 1 set of weights
- 1 set of instructional material
- 1 online access to the GUNT Media Center

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Optional accessories

HM 150 Base module for experiments in fluid mechanics