HM 143

Transient drainage processes in storage reservoirs

Learning objectives/experiments

- demonstrating transient drainage processes in two rainwater retention basins located one behind the other
- demonstrating transient drainage processes in two storage lakes located one behind the other
- recording oscillations of the water level in a surge chamber after water hammer
- recording and displaying water level fluctuations

Description

- **investigation of transient drainage processes in storage reservoirs**
- **simulation of rainwater retention basin and storage lakes**
- **transparent surge chamber for observing oscillations after a water hammer**
- **GUNT software for displaying the water levels**

Transient drainage processes are taken into consideration when deciding on the dimensions of storage reservoirs. The processes occur for example, in rainwater retention basins and storage lakes.

The main purpose of the rainwater retention basin is to delay the drainage process by temporary intermediate storage. Storage lakes are used in applications such as water supply, energy conversion, or in flood protection. The water rises before it is fed over an overflow.

The drainage processes from reservoirs is realised by pipelines, tunnels or other means. A surge chamber prevents water hammer in pipes and fittings in the event of rapid changes in flow rate.

HM 143 is used to demonstrate transient drainage processes from storage reservoirs and how a surge chamber works. The trainer includes a basin with adjustable weir and a second, deeper-lying basin with overflow and drainage line. A surge chamber is installed in the drainage line.

In the "rainwater retention basin" experiment basin A and basin B simulate retention basins. The discharge is adjusted by using valves in the drainage line. This illustrates typical delayed drainage processes.

In the experiment "storage lakes", the transient drainage processes are shown in two long-term storage reservoirs. In this experiment the weir is used as a free overfall weir.

In the "surge chamber" experiment a water hammer is produced by rapidly closing a gate in the drainage line. The oscillation can be seen as pendulum movement of the water level in the surge chamber.

The water levels in the basins and at the surge chamber are detected by pressure sensors and displayed using the GUNT software.

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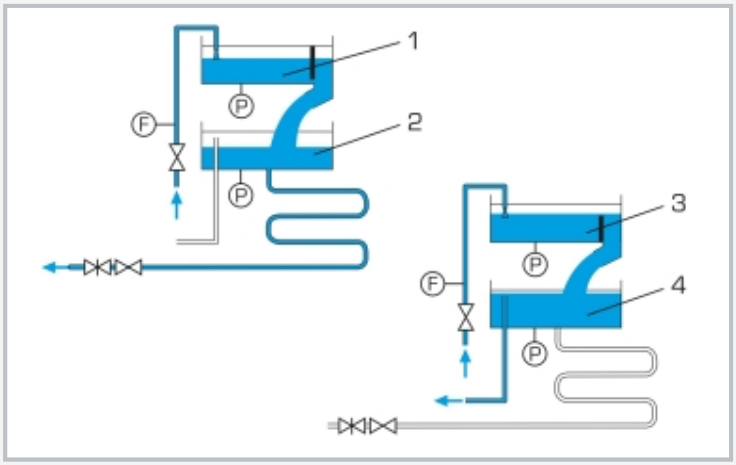
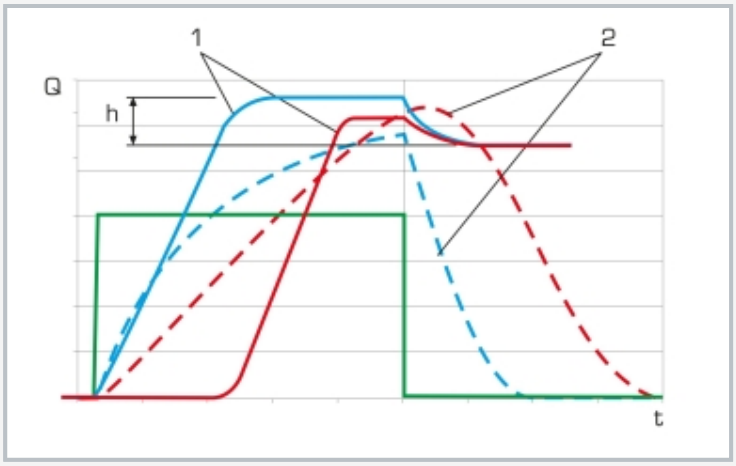
1 surge chamber, 2 basin A with adjustable weir, 3 overflow pipe, 4 valve in drain pipe, 5 gate for generating water hammer, 6 water connection, 7 flow meter, 8 basin B with overflow



Top: "rainwater retention basin": 1 basin A as drainage channel with gate, 2 basin B as rainwater retention basin; bottom: "storage lakes"; 3 basin A as storage reservoir with weir, 4 basin B as storage reservoir with overflow; F flow rate, P pressure



Transient drainage processes; blue: basin A, red: basin B, green: water supply; Q discharge, t time, h head; 1: "storage lakes", 2: "rainwater retention basin" with delayed drainage process

Specification

[1] transient drainage processes in storage reservoirs
[2] functioning of a surge chamber
[3] "rainwater retention basin" experiment: basin A and basin B as short-term storage reservoirs, rectangular weir as gate
[4] "storage lakes" experiment: basin A and basin B are used as long-term storage reservoirs, rectangular weir as overfall weir
[5] "surge chamber" experiment: transparent pipe as surge chamber in drainage line of basin B
[6] gate in the drainage line for generating water hammer
[7] pressure sensors at both basins and the surge chamber capture the water level fluctuations
[8] representation of the variation in the water levels with GUNT software
[9] GUNT software for data acquisition via USB under Windows 10

Technical data

Basin A: LxWxH: 900x900x300mm
- material: stainless steel
- rectangular weir according to Rehbock, adjustable
  - as gate, gate opening: 0...200mm
  - as weir, weir height: 0...200mm
  - overflowed width: 60mm

Basin B: LxWxH: 900x900x300mm
- material: stainless steel
- overflow: 200mm

Surge chamber
- material: PMMA
- Ø inner: 62mm
- height: 1800mm

Measuring ranges
- pressure: 2x 0...100mbar, 1x 0...200mbar
- flow rate: 300...3300L/h

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 1040x1220x2100mm
Weight: approx. 165kg

Required for operation

water connection, drain: 3300L/h
PC with Windows

Scope of delivery

1 trainer
1 GUNT software + USB cable
1 set of instructional material