

**P6515****PIPE SURGE AND WATER HAMMER APPARATUS****EXPERIMENTAL CAPABILITY**

- Investigating the effects of pipe hammer caused by a fast closing valve,
- Measuring the pressure profile of hammer,
- Measurement of the velocity of sound through a fluid in a pipe,
- Recording of hammer pressure profiles using the digital scope supplied (for display on the user's PC),
- Demonstration of pipe surge,
- Demonstration of water level oscillations in the surge shaft,
- Demonstration of frictional head loss between reservoir and surge shaft.

**DESCRIPTION**

The equipment comprises two stainless steel pipes, which can be used either for surge tests or for hammer tests. The pipes are supported on frames and use hand screw clamps to connect the surge and hammer components.

**INTRODUCTION**

Pipe Hammer and Surge are commonly occurring phenomena in the world but are rarely understood, even by engineers.

The flow of water through a pipe does not seem likely to be able to generate high pressures, or create a risk to joints and mountings, yet the effects of pipe hammer can be to burst joints and break mountings with relative ease.

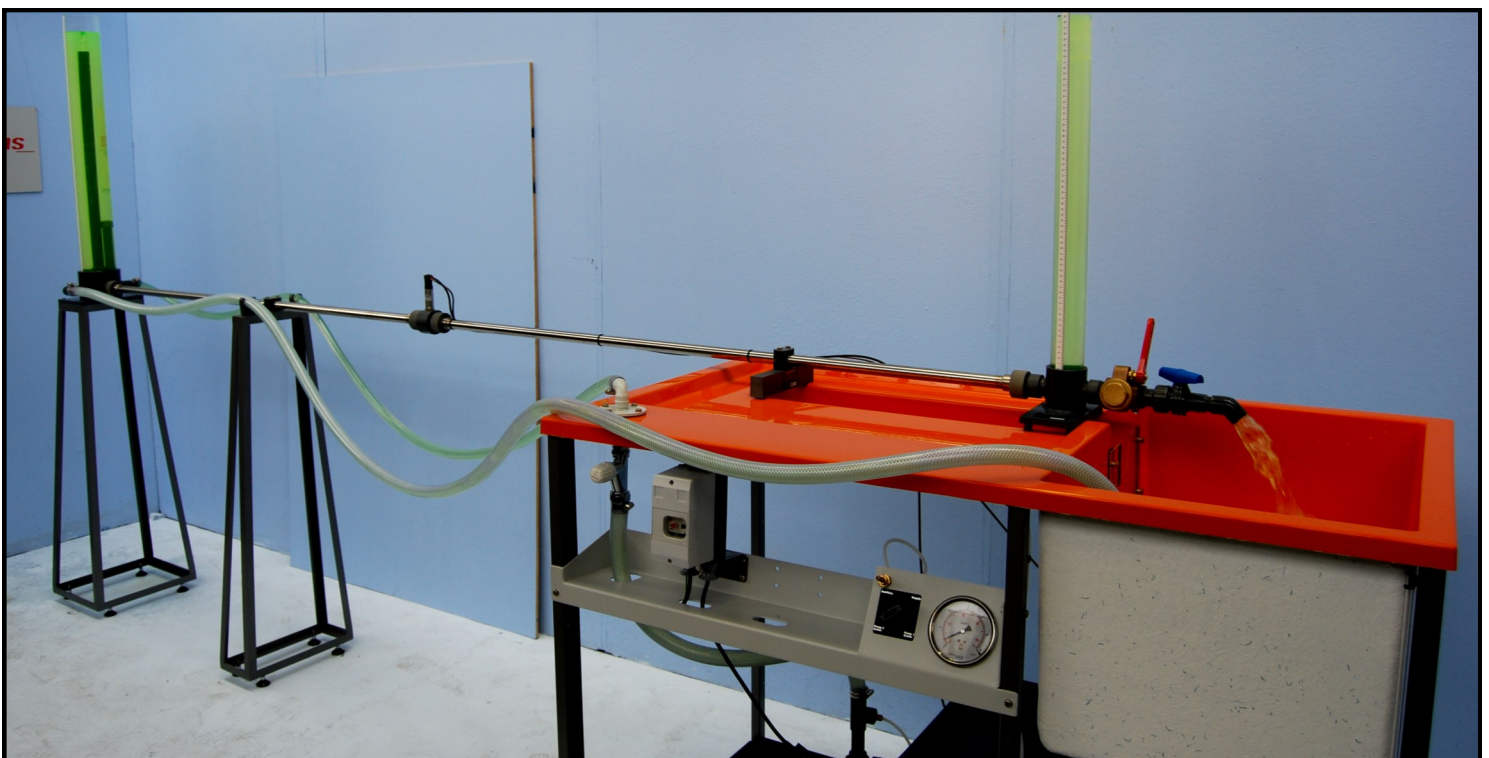
Water flowing through a length of pipe gains a momentum and the rapid closing of a valve requires the dissipation of that energy. The energy exerts itself in the form of a momentary increase in pressure above the normal static pressure.

If the valve closes very rapidly the pressure rise can lead to the effect of pipe hammer, where a wave of energy travels within the pipe at the speed of sound, creating a sound, and potential damage.

The pressure profiles are measured with the digital oscilloscope provided (for display on the user's PC)

A different phenomenon is experienced when a stream of water is fed through a pipe system that includes a chamber into which the buildup of pressure can find an outlet. Then the water will surge into the chamber, reducing or eliminating the hammer.

This is tested in the surge apparatus.



**P6515****PIPE SURGE AND WATER HAMMER APPARATUS****SURGE TEST CONFIGURATION**

In the configuration for surge tests (shown above left) the pipes are connected to a constant head tank. The P6100 Hydraulics bench (a required accessory not included within the P6515 package) provides the water supply to the constant head inlet tank from a pump and control valve. The constant head means that water enters the 3 meters of test pipes before passing through the base of a surge tube and then through a lever operated gate valve. From the gate valve the water discharges into the volumetric tank in the hydraulics bench. This tank can be used to measure the flow rate of the water flow. The water is returned to the sump tank via a dump valve.

Closure of the gate valve creates surge conditions. The surge tube is made from a clear acrylic and this enables the oscillations of the surge to be seen and measured using the scale mounted on the tube.

**HAMMER TEST CONFIGURATION**

When configured for Pipe Hammer tests the water inlet is connected directly to the end of the stainless steel pipes. The surge tube and gate valve are replaced by the Pipe Hammer apparatus comprising of a fast acting valve, operable by the user. The valve uses a small bobbin, moving with the water flow, and assisted by a spring, to close. The bobbin is held in the open position by a latch, and this allows the water to flow through the valve and into the measuring tank of the hydraulic bench. When the latch is pulled upwards the bobbin, driven by the spring and the flow of water closes very rapidly. A control valve is provided downstream of the fast acting valve to allow the flow rate to be controlled.

Two pressure transducers, measure the resulting pressure waves, one located adjacent to the bobbin head, the other at the mid-point of the stainless steel pipe run. The output of the pressure transducers is fed to a data card, suitable for use within the users PC, to display the pressure waves.

**INSTALLATION REQUIREMENTS**

220 - 240v 50 Hz 1ph supply

**DIMENSIONS AND WEIGHTS**

Volume: 1 m<sup>3</sup>

Gross Weight: 70 Kg

**TENDER SPECIFICATION****P6515 - Pipe Surge and Water Hammer Apparatus**

The P6515 is a unit designed to work with Cussons P6100 hydraulics bench to demonstrate the phenomena of pipe surge and water hammer. The apparatus includes two separate test pipes, a surge header tank and surge tube, a hammer inlet and hammer fast acting valve. Two pressure transducers provide electrical signals for connection to a digital oscilloscope (for use with users PC).

- Test pipes: 22 mm I/D x 3 m long stainless steel
- Surge shaft: 50 mm I/D x 1000 mm high
- Pressure transducers: range -1 to 15 bar

**REQUIRED ACCESSORIES****P6100 Hydraulics bench**