

H-6920 Pipe Friction Demonstrator

Purpose

The Hampden **Model H-6920** Pipe Friction Demonstrator provides complete facilities for the investigation of the phenomena associated with incompressible fluid flow in conduits.

Description

Each unit is factory equipped with all necessary mechanical control components, primary sensing instrumentation, transducers, and digital displays. A computer interface package (H-6920-CDL) is available at an extra cost. The entire apparatus is completely factory assembled and tested.

The Pipe Friction Demonstrator consists of a mobile carrier upon which are located the following:

- Flow circuits are comprised of one main path with three parallel branches at the top.
- Quick-connect water plugs are located in the lower right corner.
- Shut-off valves are located in the upper left corner
- Flow control valves are located in the lower right corner.
- Friction pipe lengths are the three parallel branches at the top.
- Friction in Fittings and Flowmeter locations are found in the return leg across the middle and lower sections of the carrier.
- Instrumentation is found in the center.

All interchangeable friction pipes and flowmeters are equipped with zero clearance fittings allowing quick insertion and removal of the components.

Specifications

Pipe Friction:

There are three lengths of pipe, each one having a pair of pressure taps spaced (72") apart. The distance from the ends of the pipes that pressure taps are located is based upon a ratio involving



Shown **Model H-6920-CDL** with optional **H-6920-MR** Mobile Storage Cart (left) for storage of Sensing and Transmitting accessories. Also shown, optional **H-6920-22** Water Pump system (right).
Dimensions: 78"H x 98"W x 30"D Weight: 1000 lbs.

the pipe diameter in order to minimize tube exit/entrance effects. These pipe lengths have nominal diameters of 3/8", 1/2", and 1" NPT respectively. Each pipe includes three interchangeable lengths constructed of copper tubing. Also available as an option, are two sets of three interchangeable pipe lengths, one set constructed of plastic pipe and one set constructed of stainless steel pipe.

Specify **Model H-6920-37**.

Pressure taps can be connected to a differential pressure transmitter.

Pipe Fitting Head Loss:

There are five different pipe fittings which are fitted with a pressure taps.

- 90° short radius elbow
- 90° long radius elbow
- 180° bend
- expansion
- contraction

The pressure taps can be connected to a differential pressure transmitter.

Flowmeter:

The water flow rate is measured by a differential pressure transmitter connected across an orifice plate assembly. There are five interchangeable orifice plates supplied which span the design flow range of the trainer.

Differential Pressure Transmitter:

The differential pressure transmitter supplied with the unit outputs a 4-to-20mA signal directly proportional to differential pressure. The output of this transmitter is displayed by a digital meter which can be calibrated in the desired engineering units. The full scale accuracy of the differential pressure transmitter is $\pm 0.25\%$.

Temperature Measurement:

The water temperature is measured by a type T thermocouple. It is connected to a digital panel meter with an accuracy of $\pm 0.4^\circ\text{C}$ and a resolution of 0.1°C .

All Hampden units are available for operation at any voltage or frequency

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Fluid Study/Mechanical Systems

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Mobile Carrier:

This is 72" high x 108" wide by 30" deep, with two swivel casters with brakes and two fixed casters. This unit is manufactured of 2" square mechanical tubing with 12 gauge support channels.

Services Required

- Electrical: 120VAC-1Ø-50/60Hz
- Water: 30 GPM @ 70 PSIG
- Waste: Drain

Experiment Capabilities

The head loss caused by fluid friction in straight pipes and the effects of fluid velocity, pipe diameter, surface roughness and temperature can be studied in detail. The experiments can be carried out over a wide range of Reynolds' numbers.

The head loss due to flow separation in pipe fittings can also be investigated. These include bends of different radii, expansions and contractions. In addition, the flow rate versus head loss characteristics of control valves can be studied as well as the operating characteristics of flowmeters. Also included with the bench is a spool section to allow optional flowmeters to be installed in the unit.

These experiments can be performed using the equipment listed in conjunction with the Operating Instructions, Bulletin 692-OI.

Also provided is an Experiment Manual Bulletin 692-EX and a Teacher's Manual Bulletin 692-TM.

A. Pipe Friction Head Loss

1. Flow regimes
 - (a) laminar
 - (b) transitional
 - (c) turbulent
2. Pipe diameters
 - (a) 3/8 inch NPT
 - (b) 1/2 inch NPT
 - (c) 1 inch NPT
3. Surface roughness

- (a) smooth
 - (b) drawn tubing
 - (c) steel pipe
4. Temperature effects

B. Pipe Fitting Head Loss

1. Bends
 - (a) 90° short radius elbow
 - (b) 90° long radius elbow
 - (c) 180° bend
2. Expansion
3. Contraction

C. Flow Measurement - Primary Sensing Elements

1. Orifice plate - standard
2. **H-6920-11** Venturi tube - option
3. **H-6920-12** Pitot tube - option
4. **H-6920-13** Flow nozzle - option
5. **H-6925-14** Vortex flowmeter - option
6. **H-6920-14-CDL** Vortex flowmeter, with CDL - option
7. **H-6920-15** Turbine flowmeter - option
8. **H-6920-15-CDL** Turbine flowmeter with CDL - option
9. **H-6920-16** Magnetic flowmeter - option
10. **H-6920-16-CDL** Magnetic flowmeter with CDL - option
11. **H-6920-17** Mass flowmeter - option

D. Flow Measurement- Secondary Sensing Elements

1. Differential pressure transmitter (flow rate) - standard
2. **H-6920-20** Differential pressure transmitter (pipe friction) - option
3. **H-6927-10** Digital Manometer - option

E. Control Valve Head Loss vs Flow Curves

1. **H-6920-31** Globe valve - option
2. **H-6920-32** Butterfly valve - option
3. **H-6920-33** Ball valve - option
4. **H-6920-34** Needle valve - option
5. **H-6920-35** Gate valve - option

F. H-6920-22 Water Pump System - option

G. H-6920-37 Stainless Steel Pipe and Plastic Pipe Interchangeable Sections - option

H. H-6920-MR Mobile Storage Cart - option

Computer Data Logging*

This feature adds differential pressure transducer, rotary transducer, digital displays, and power supply into the system. One interface package containing National Instruments I/O modules is provided for interfacing into a PC computer through the USB port.

Computer is included. Templates for LabVIEW® control software are included. National Instruments LabVIEW® Software is included.

Specify **Model H-6920-CDL**

*This option is available at time of original order only. Not available as after-market option.

H-6920-31 Globe Valve



H-6920-32 Butterfly Valve



H-6920-33 Ball Valve



H-6920-34 Needle Valve



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