LonGwin
Since 1985

Bernoulli equation describes a stable, incompressible, non-viscous flow motion.
There is a correlation among variations of pressure, velocity, and height,
and it gives a comprehensive explanation in fluid mechanics.
The apparatus is designed for studying the energy conservation of Bernoulli equation
by measuring pressure and velocity of different types of Venturi tubes.
By means of operating basic experiments,
students will own a deeper impression on the important concept.

Long Win's Educational Facilities for Thermal & Flow

LW-9341 Venturi Tube-Bernoulli's Equation Apparatus

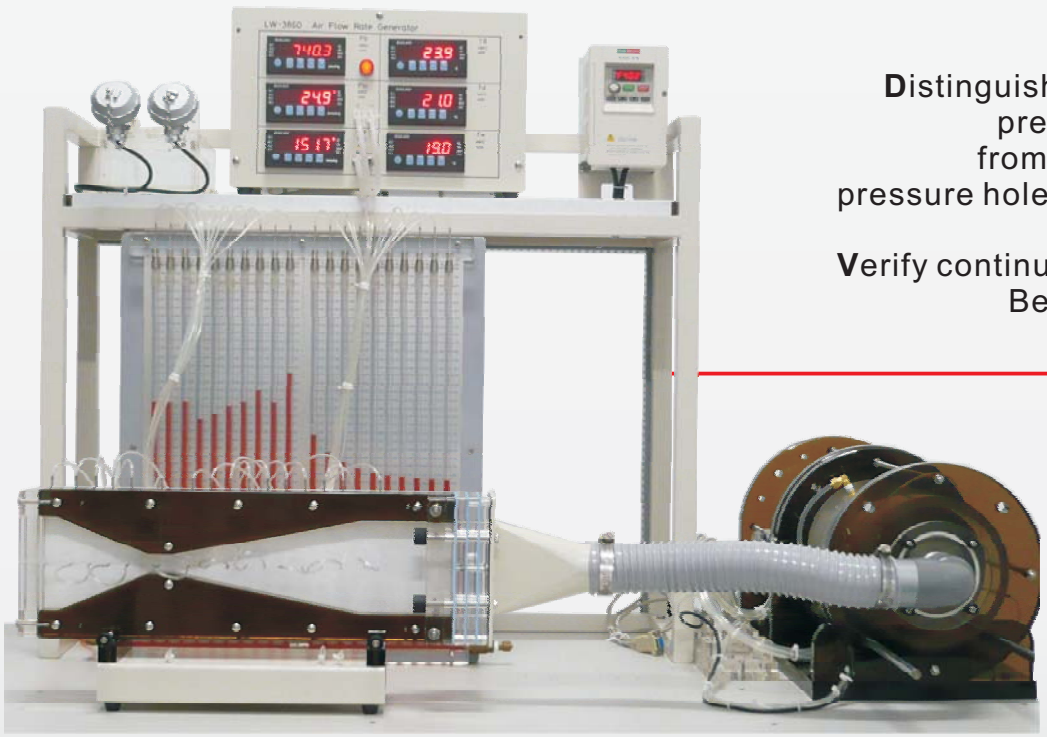
Experimental items

Standard flow rate generation and theory validation

Compare 4 types of Venturi tubes

Distinguish the difference of pressure distribution from upper and lateral pressure holes at Venturi tubes

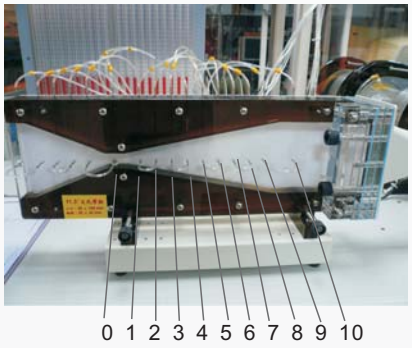
Verify continuous equation and Bernoulli's equation

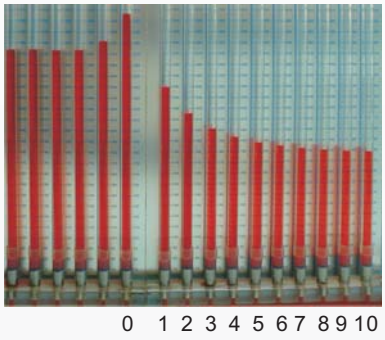


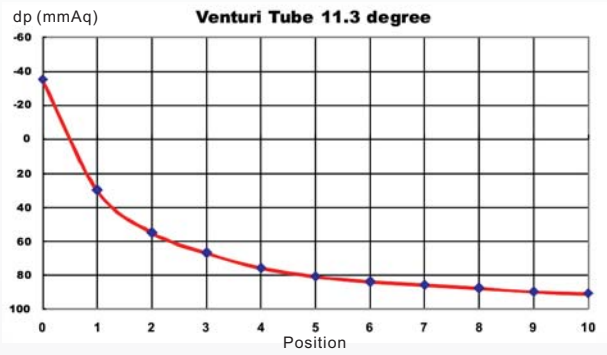
Observation of Pressure Distribution

Test condition: Q=1.13 CMM (Nozzle=24.02 mm; P_{56}=112 mmAq)

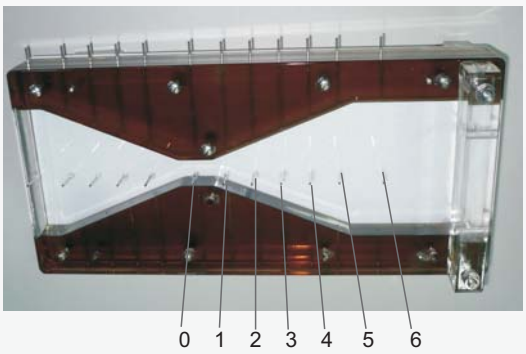
(I) Venturi tube- Inlet angle 11.3 degree

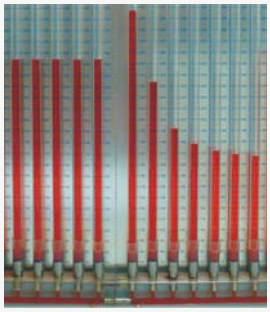


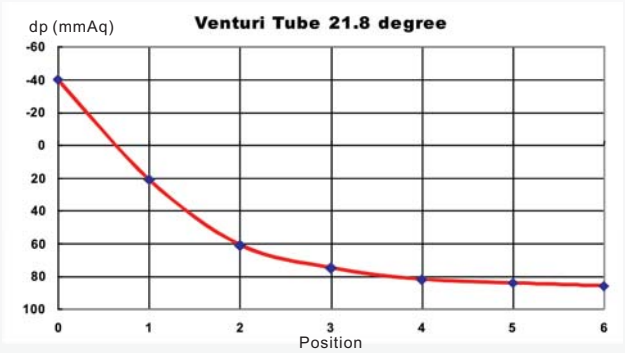




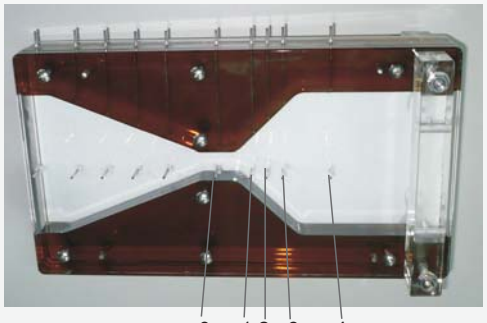
(II) Venturi tube- Inlet angle 21.8 degree

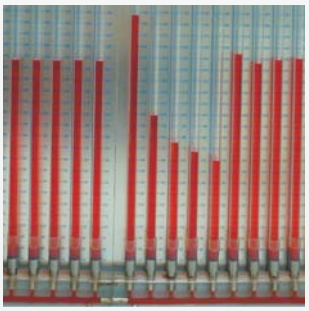


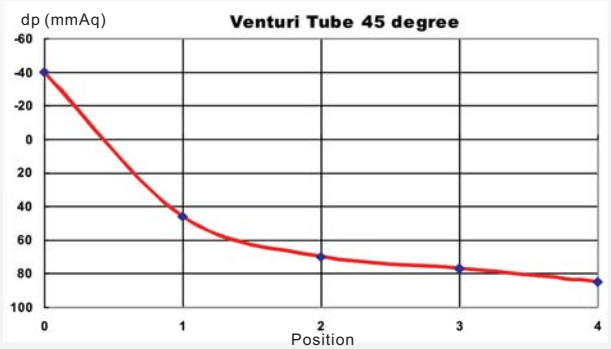




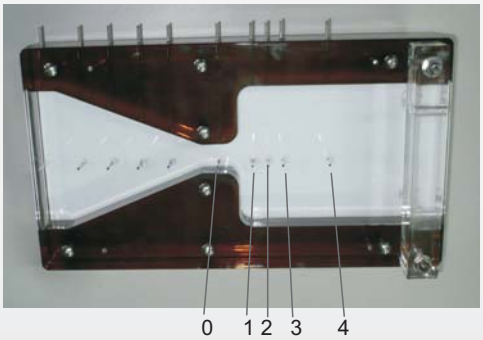
(III) Venturi tube- Inlet angle 45 degree

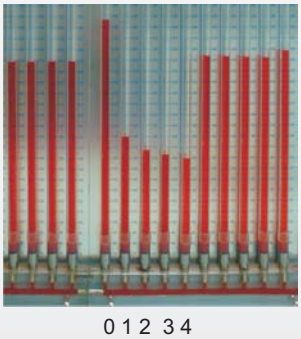


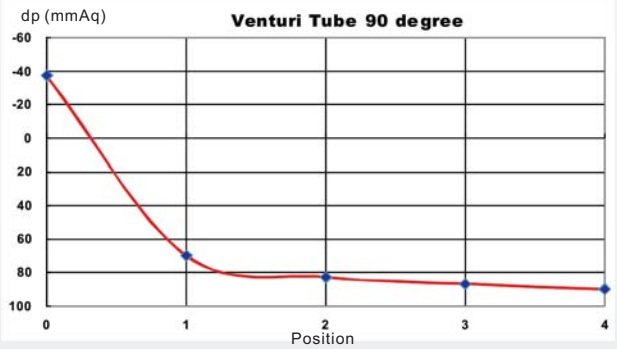




(IV) Venturi tube- Inlet angle 90 degree







Verifying Continuous Equation

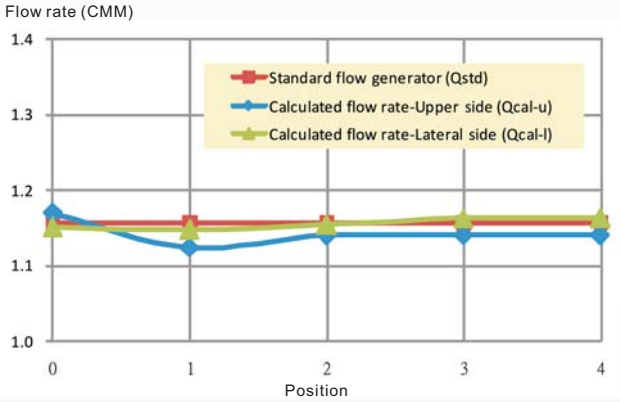
Continuous equation: ρvA =constant

Assume the air is incompressible, the density (ρ) keeps constant in the condition.

The equation can be rewritten as: $v_1 A_1 = v_2 A_2$

As the velocity of each point in Venturi tube can be calculated according to simultaneous equation of both continuous and Bernoulli equations, the experimental flow rate can be estimated.

EX: Venturi tube- Inlet angle 11.3 degree



As comparing with

1. the flow from the standard flow generator
2. the flow calculated from each differential pressure on the upper side of the Venturi tube
3. the flow calculated from each differential pressure on the lateral side of the Venturi tube

The flow rate keeps constant, and the situation verifies the law of conservation of mass.

Verifying Bernoulli Equation

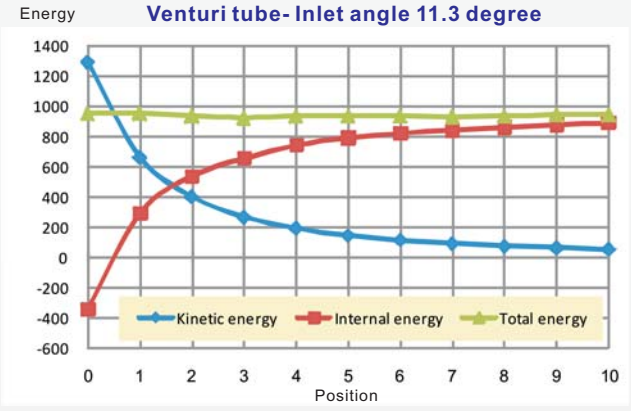
Bernoulli's Equation: $P + \frac{1}{2}\rho v^2 + \rho gh$ =constant

As each pressure hole of Venturi tubes has the same and neglected potential energy,

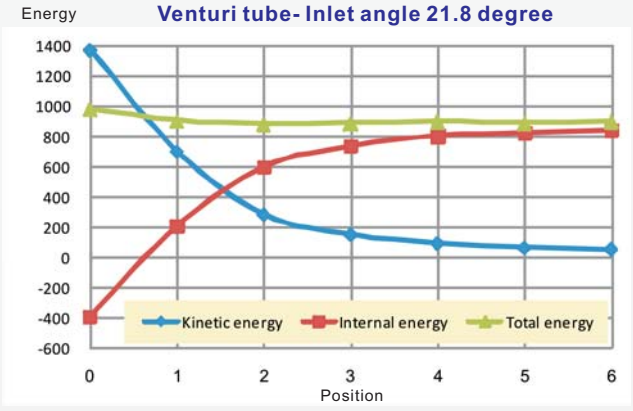
the equation goes to $P_1 + \frac{1}{2}\rho v_1^{\ 2} = P_2 + \frac{1}{2}\rho v_2^{\ 2}$

The internal energy(P) and kinetic energy ($\frac{1}{2}\rho v^2$) of each point follow the law of conservation of energy.

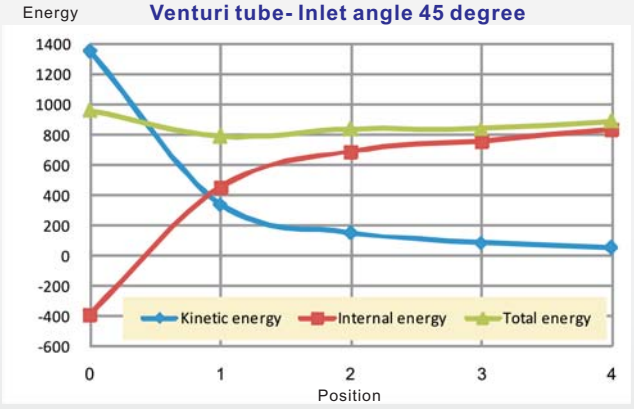
Venturi tube- Inlet angle 11.3 degree



Venturi tube- Inlet angle 21.8 degree



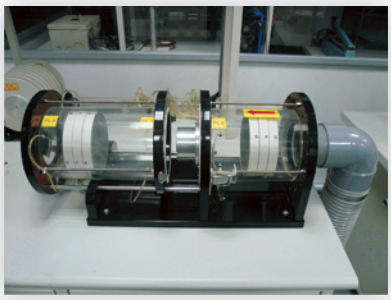
Venturi tube- Inlet angle 45 degree

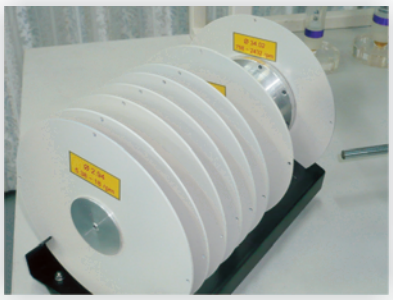


As the kinetic energy and the internal energy vary through the Venturi tubes, the total energy keeps constant.

The circumstance can be described that **all three types of Venturi tubes - Inlet angle of 11.3, 21.8, and 45 degree follow the law of conservation of energy.**

Features





Standard flow rate generator and a set of exchangeable nozzles meeting AMCA 210-99 Standard. By cooperating with digit display meters of parameters, the system can provide a flow rate criterion in fluid mechanics laboratory.

Specifications

Flow rate generator	According to		AMCA 210-99 Standard, Figure 15.
	Flow rate range		2.31 ~ 85.9 CFM (0.065~2.41 CMM)
	Accuracy		3%
	Common chamber		150 mm in inner diameter
	Measuring parameters	a. Dry-bulb temperature (Td)	d. Atmospheric pressure (Pb)
		b. Wet-bulb temperature (Tw)	e. Chamber static pressure (Ps)
		c. Chamber temperature (Tc)	f. Differential pressure of nozzle (P_{56})
Digit differential pressure meter	Accuracy of pressure transducer		0.25%
	Range		0~127 mmAq
20-column liquid manometer	Effective height		500 mm
	With a water level adjusting mechanism		
Venturi tubes	4 types of inlet angles: 11.3, 21.8, 45, and 90 degrees		
Overall size	With an operation table,		1.2 (L) × 0.7 (D) × 1.6 (H) m
Power source	AC220V, 5 Amp, 50/60 Hz, single phase.		

Design/Manufacture

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