MEDICIÓN DE CAUDAL POR DIFERENCIAL DE PRESIÓN

LABORATORIO DE INSTRUMENTACIÓN

OBJETIVOS

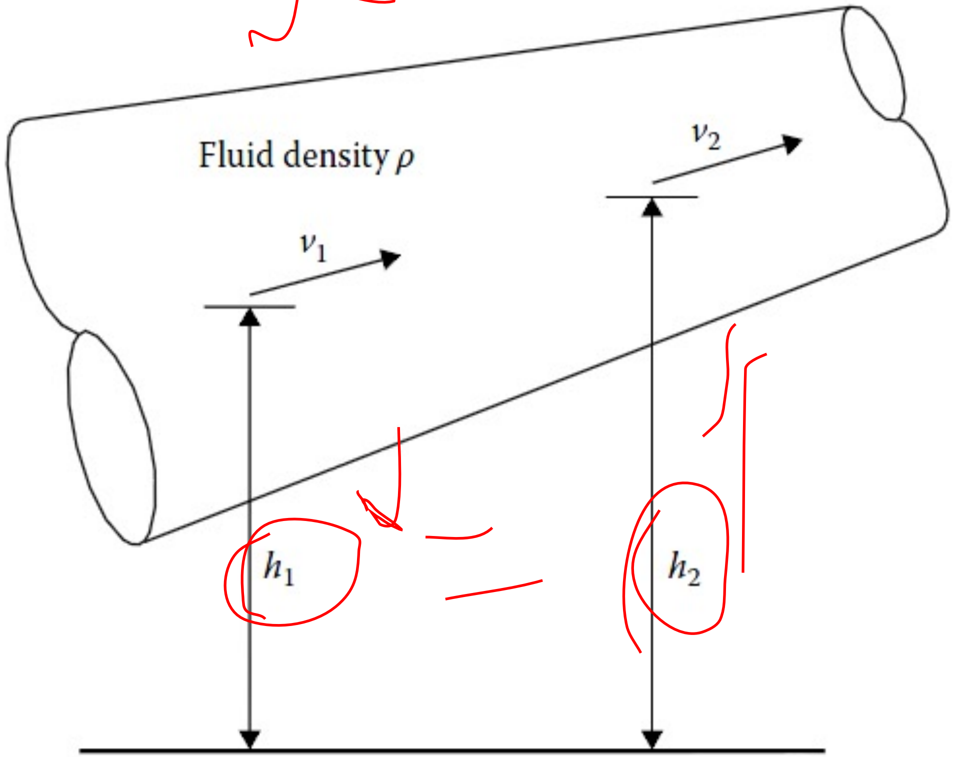
Conocer los diferentes métodos para medición de caudal en flujo incompresible (mecánico o por turbina, tiempo de llenado, y por diferencial de presión).

Demostrar la aplicación de los dispositivos de diferencial de cabezal en la medición de flujo volumétrico y velocidad del agua en una tubería.

Obtener de forma experimental los coeficientes de descarga para placa orificio y Venturi

PRINCIPIO DE FUNCIONAMIENTO: TEOREMA DE BERNOULLI

$$\frac{p_1}{\rho g} + \frac{v_1^2}{2g} + \text{[illegible]} = \frac{p_2}{\rho g} + \frac{v_2^2}{2g} + \text{[illegible]}$$



PRINCIPIO DE FUNCIONAMIENTO: TEOREMA DE BERNOULLI

Considerando una tubería horizontal se tiene:

$$h_1 = h_2$$

La ecuación general de Bernoulli se reduce a:

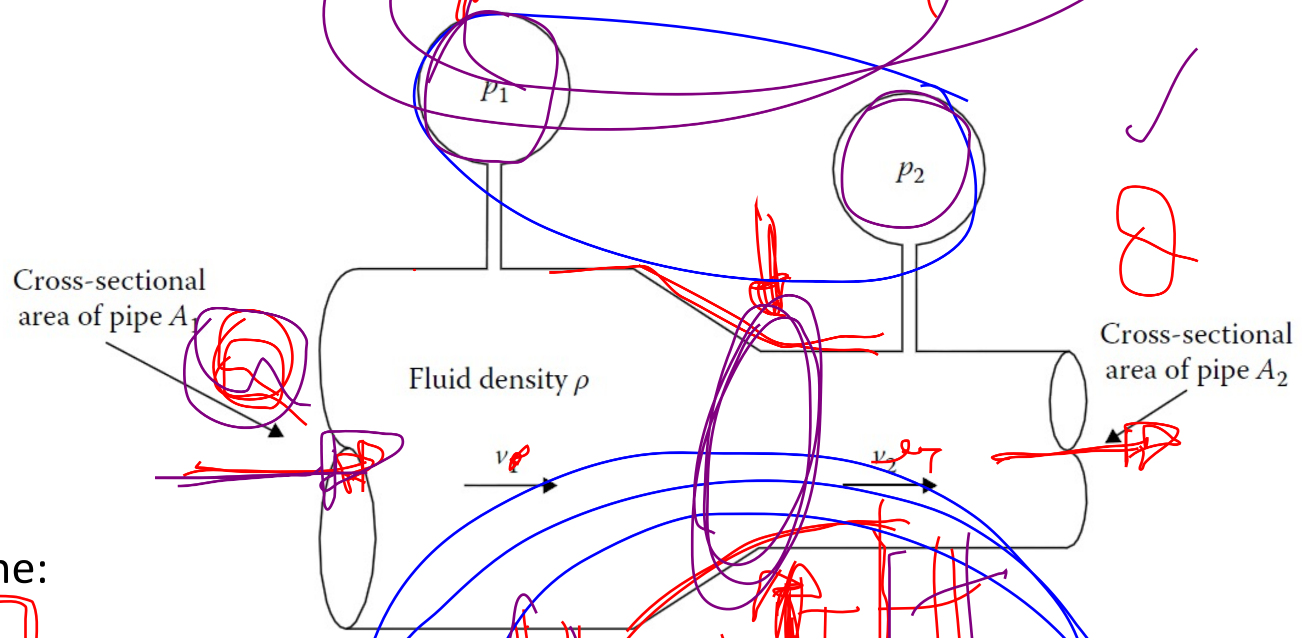
$$\frac{p_1 - p_2}{\rho} = \frac{v_1^2 - v_2^2}{2}$$

De acuerdo al principio de conservación de masa:

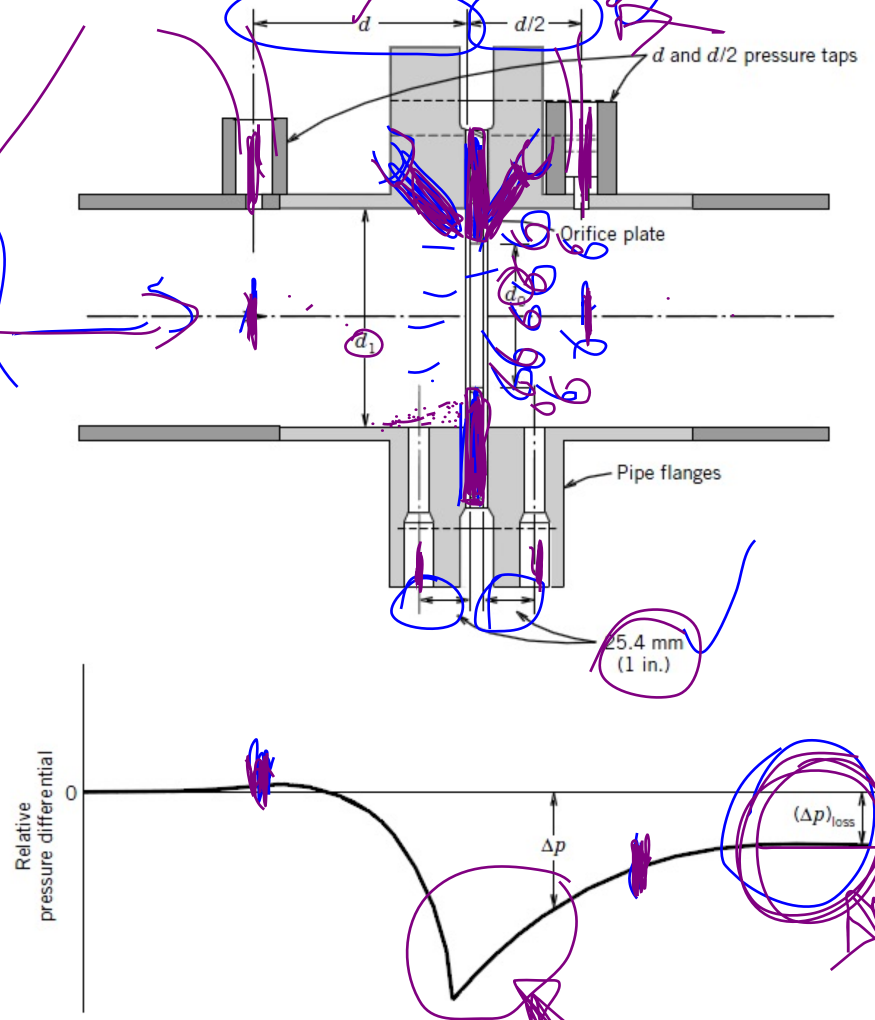
$$v_1 A_1 \rho = v_2 A_2 \rho$$

Reordenando las dos ecuaciones anteriores se obtiene:

$$Q = v_1 A_1 = \frac{A_2}{\sqrt{1-(A_2/A_1)^2}}\sqrt{\frac{2(p_1 - p_2)}{\rho}}$$

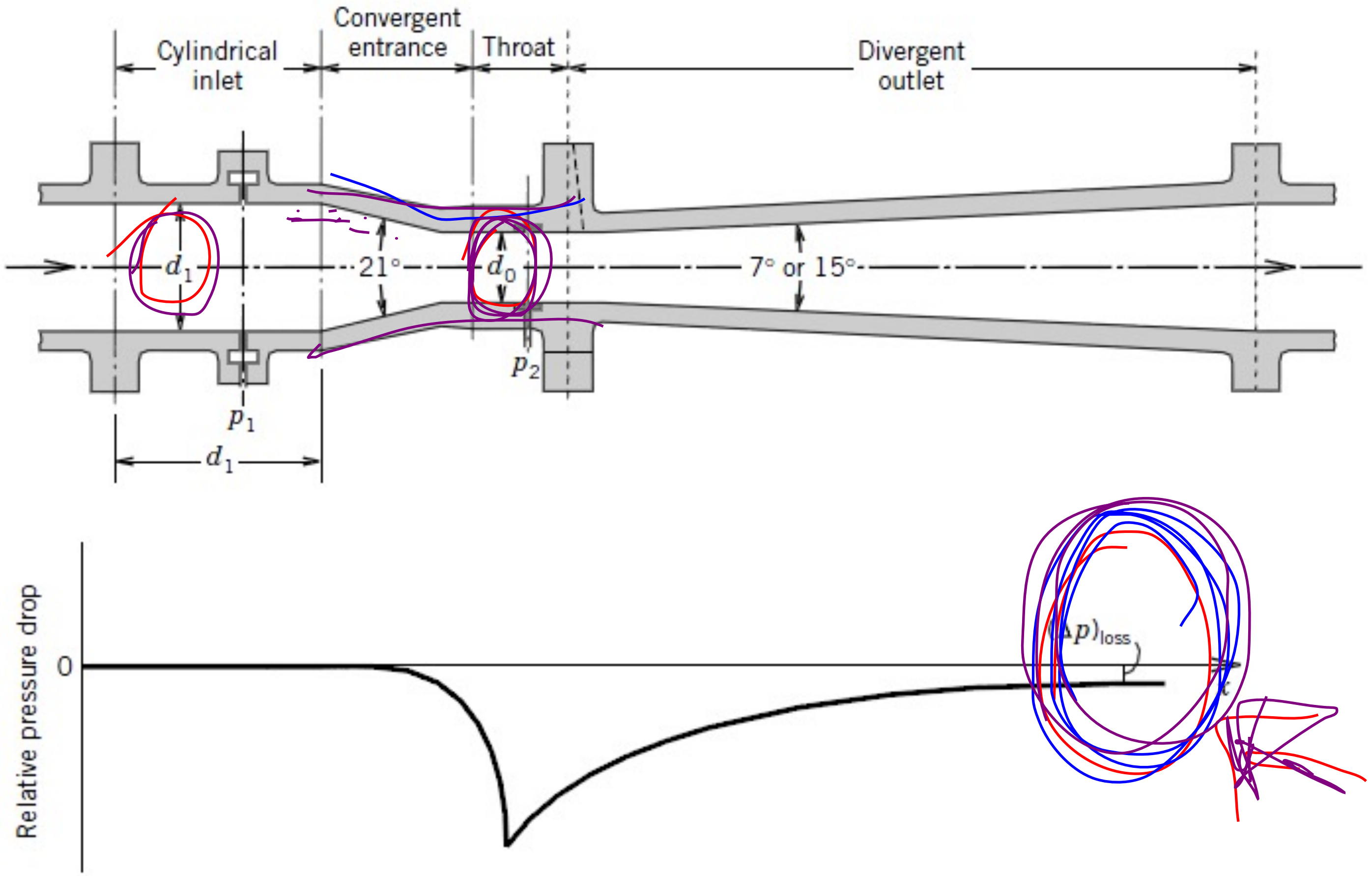


CAUDAL POR PRESIÓN DIFERENCIAL: PLACA ORIFICIO



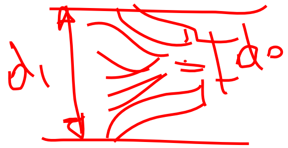
$$Q = C_d * A_0 \sqrt{\frac{2g * \Delta H_w}{1 - \left(\frac{A_0}{A_1}\right)^2}}$$

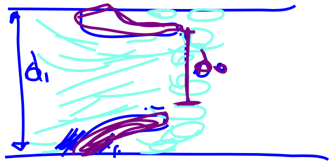
CAUDAL POR PRESIÓN DIFERENCIAL: TOBERA/TUBO VENTURI



$$Q = C_d * A_0 \sqrt{\frac{2g * \Delta H_w}{1 - \left(A_0/A_1\right)^2}}$$

APLICACIONES E INSTALACIÓN

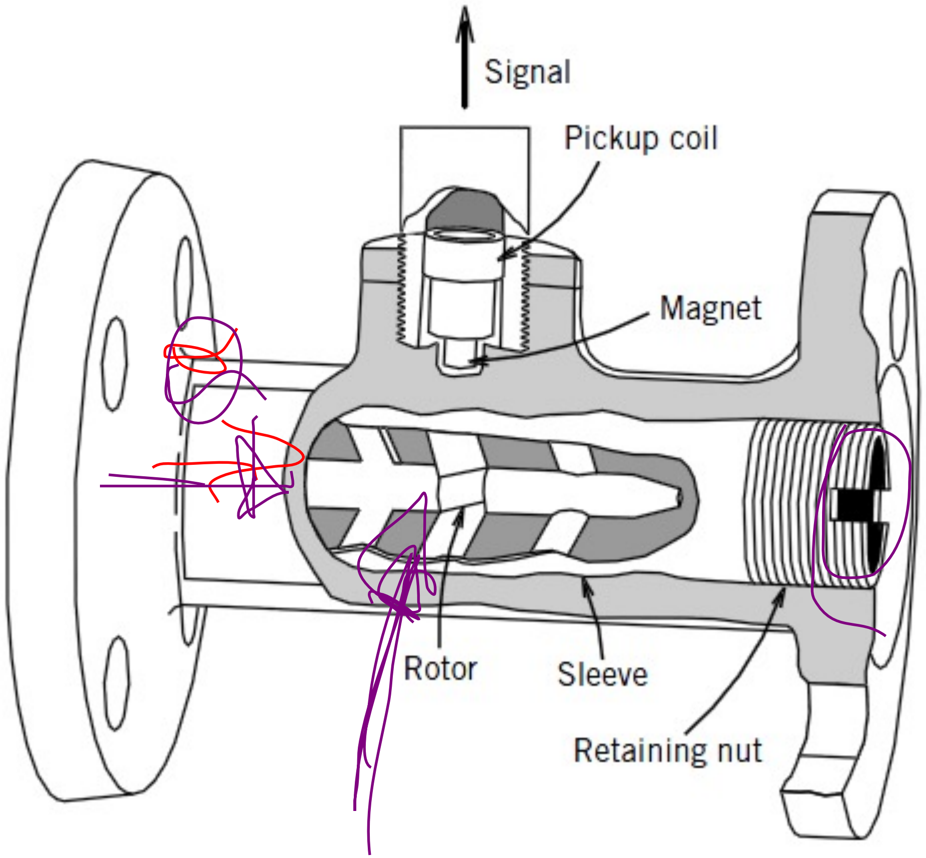


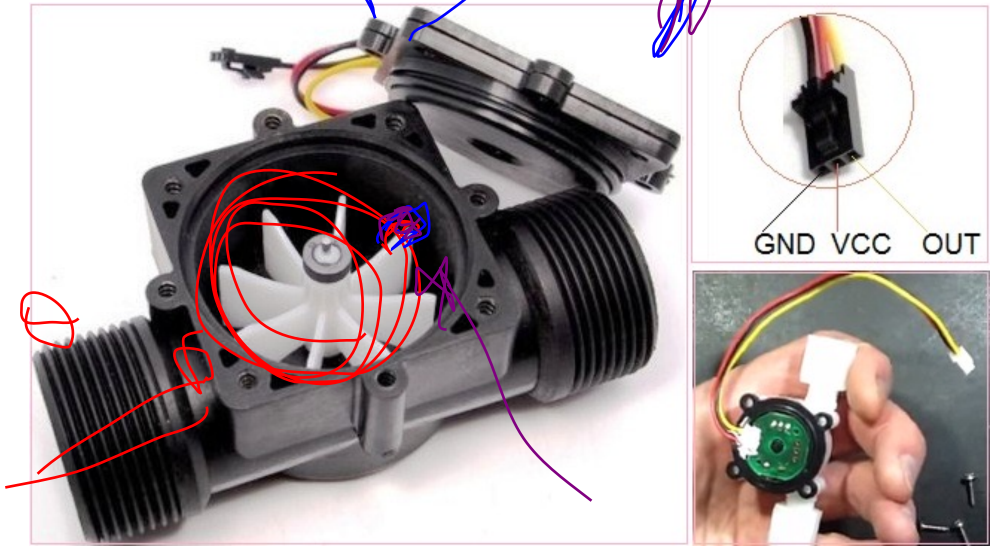


	Performance					Applications				
	Typical Uncalibrated Accuracy (%)	Typical Range	Typical Pipe Diameter (mm)	Permanent Pressure Loss	Comparative Cost	Clean Gas	Dirty Gas	Clean Liquid	Slurry	Steam
Orifice plate	±2	3:1	10–1000	High	Low	Yes	No	Yes	No	Yes
Venturi tube	±2	3:1	25–500	Low	High	Yes	Maybe	Yes	Maybe	Maybe
Nozzle	±2	3:1	25–250	High	Medium	Yes	Maybe	Yes	No	Yes

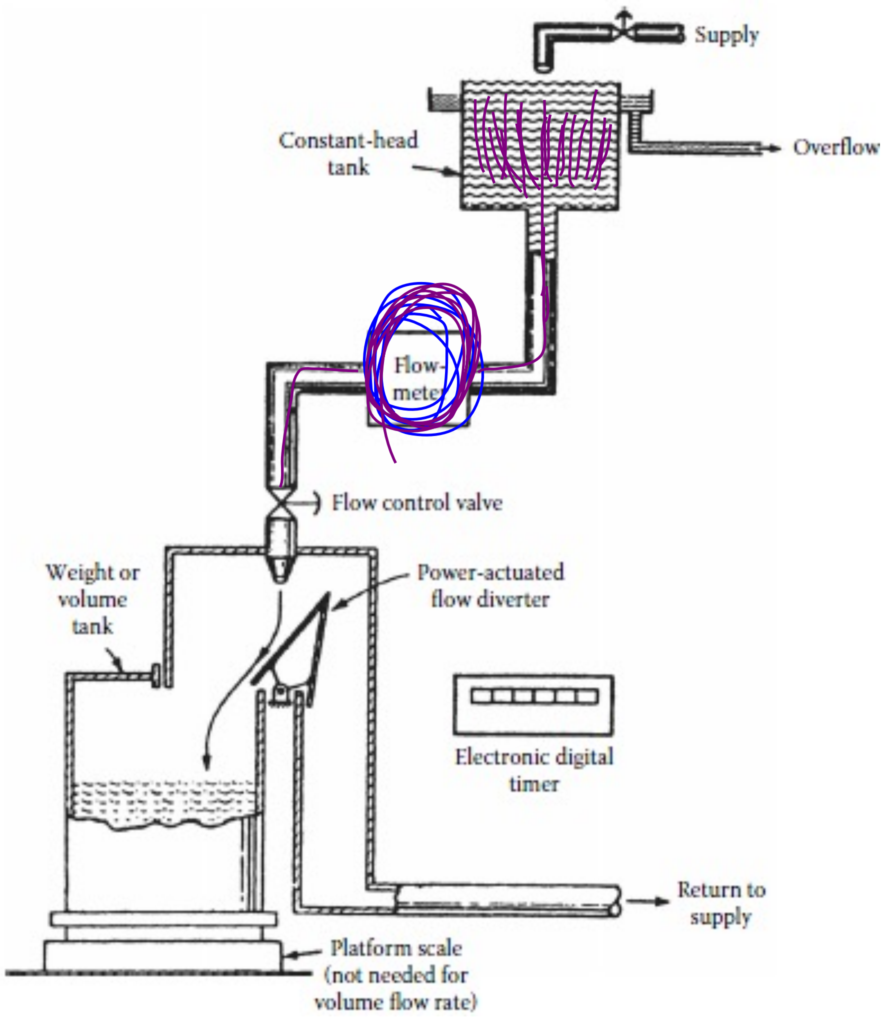
	Upstream of the Flowmeter				Downstream of the Flowmeter
Diameter Ratio β	Single 90° Bend	Two 90° Bends in the Same Plane	Two 90° Bends in Different Planes	Globe Valve Fully Open	For Any of the Fittings Shown to the Left
0.2	10	14	34	18	4
0.4	14	18	36	20	6
0.6	18	26	48	26	7
0.8	46	50	80	44	8

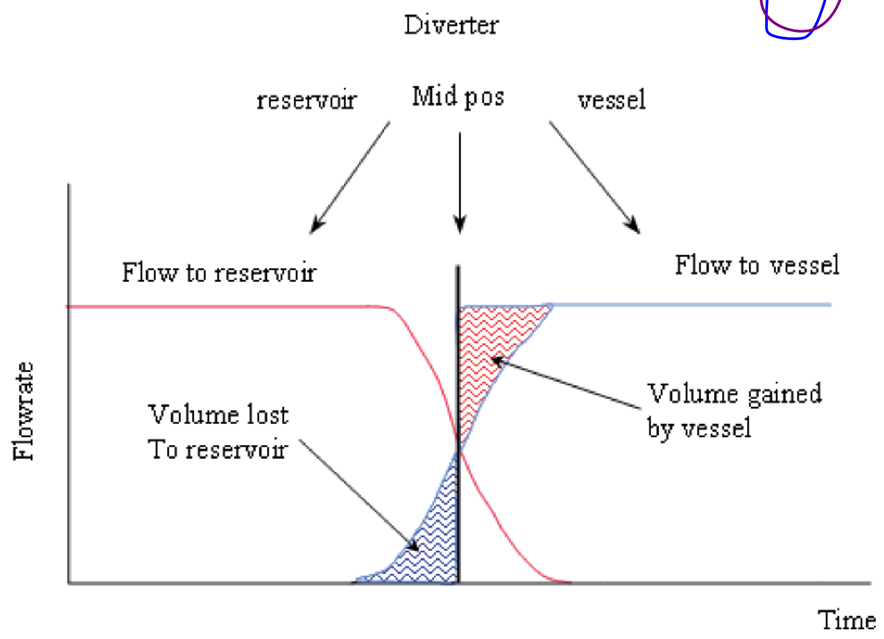
MEDICIÓN POR TURBINA





CALIBRACIÓN DE CAUDALÍMETRO

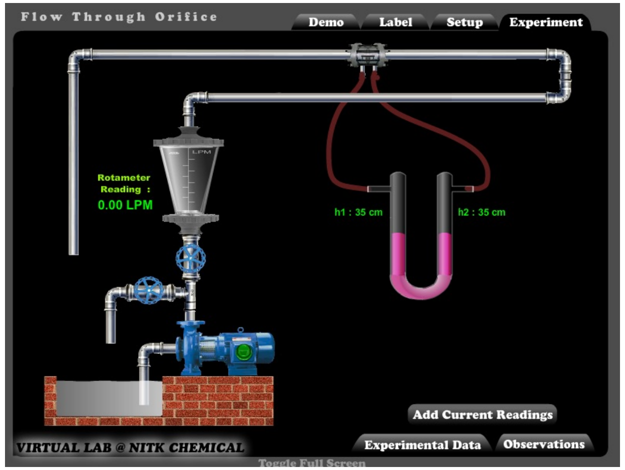




SIMULADORES

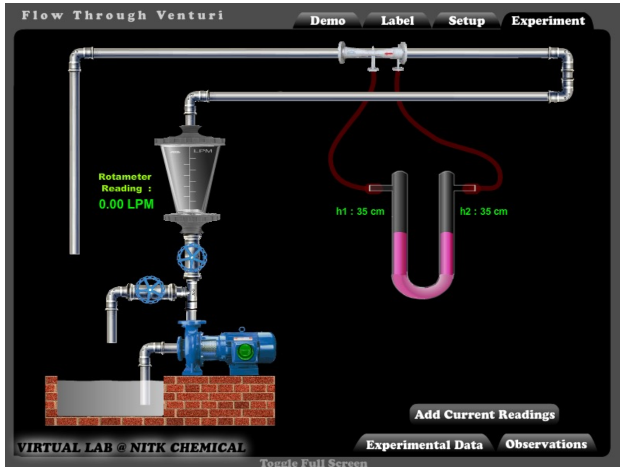
Placa orificio:

http://uorepc-nitk.vlabs.ac.in/exp3/index.html



Tubo Venturi:

http://uorepc-nitk.vlabs.ac.in/exp4/index.html



MATERIAL AUDIOVISUAL

Fluid Friction Apparatus (Armfield model)

https://www.youtube.com/watch?v=H38EqQgY2wM&t=299s

Turbine meters VISION - Measuring principles and applications

https://www.youtube.com/watch?v=Ix5qmIvO9qk

The Differential Pressure Flow Measuring Principle (Orifice-Nozzle-Venturi)

https://www.youtube.com/watch?v=oUd4WxjoHKY

Basics of Differential Flow Devices - Venturi Tubes, Orifice Plates, and Flow Nozzles

https://www.youtube.com/watch?v=GXDJvva1g9A

MATERIAL AUDIOVISUAL (OTROS MÉTODOS)

The Differential Pressure Flow Measuring Principle (Pitot tube)
https://www.youtube.com/watch?v=D6sbzkYq3_c

The Ultrasonic Flow Measuring Principle
https://www.youtube.com/watch?v=Bx2RnrfLkQg

The Electromagnetic Flow Measuring Principle
https://www.youtube.com/watch?v=f949gpKdCI4

The Thermal Flow Measuring Principle
https://www.youtube.com/watch?v=YfQSf2NBGqc

The Coriolis Flow Measuring Principle
https://www.youtube.com/watch?v=XIIViaNITIw

The Vortex Flow Measuring Principle
https://www.youtube.com/watch?v=GmTmDM7jHzA