

Sensors & Transducers

ROTAMETER

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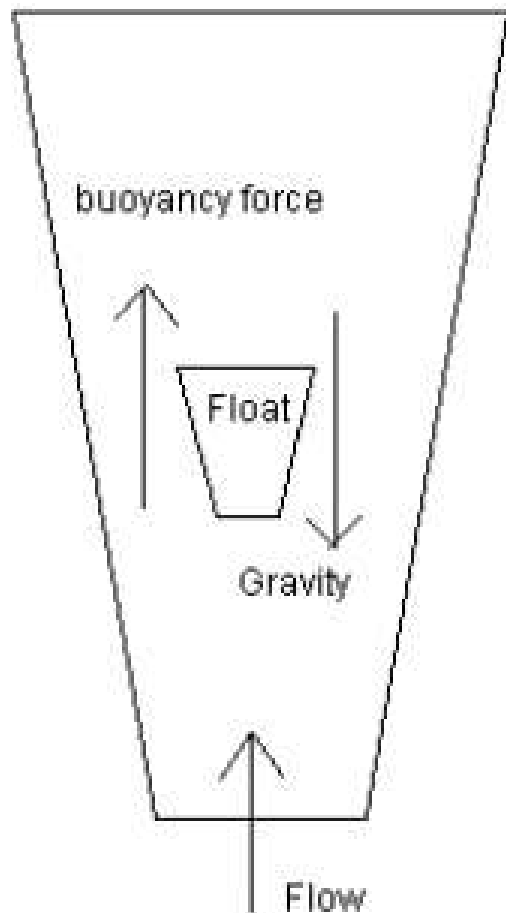


Rotameter-Variable area meter

□ What is rotameter ?

A device used to measure fluid flow, in which a float rises in a tapered vertical tube to a height dependent on the rate of flow through the tube.

Working Principle:



- It is a variable area meter which works on the principle of upthrust force exerted by fluid and force of gravity.

Introduction

- A rotameter measures the flow of liquids, gases and steam by using a float inside a conical tube.
- The rotameter principle is one of the oldest and most mature principles in flow measurement.
- The space between the tube and the float is larger at the top to allow more flow through the meter.
- As gravity works in a vertical orientation, the tube must be oriented vertically.

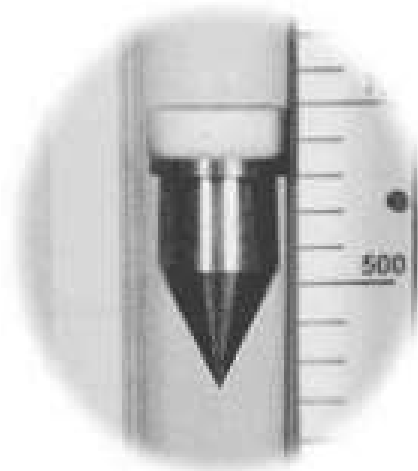
* The flow rate inside the rotameter is measured using a float that is lifted by the fluid based on the buoyancy and velocity of the fluid opposing gravity pulling the float down.

* Gravity flow meters. because they are based on the opposition between the downward force of gravity and the upward force of the flowing fluid.

Construction:

- ❖ Graduated tapered metering glass tube.

- ❖ Float



Tapered tube:

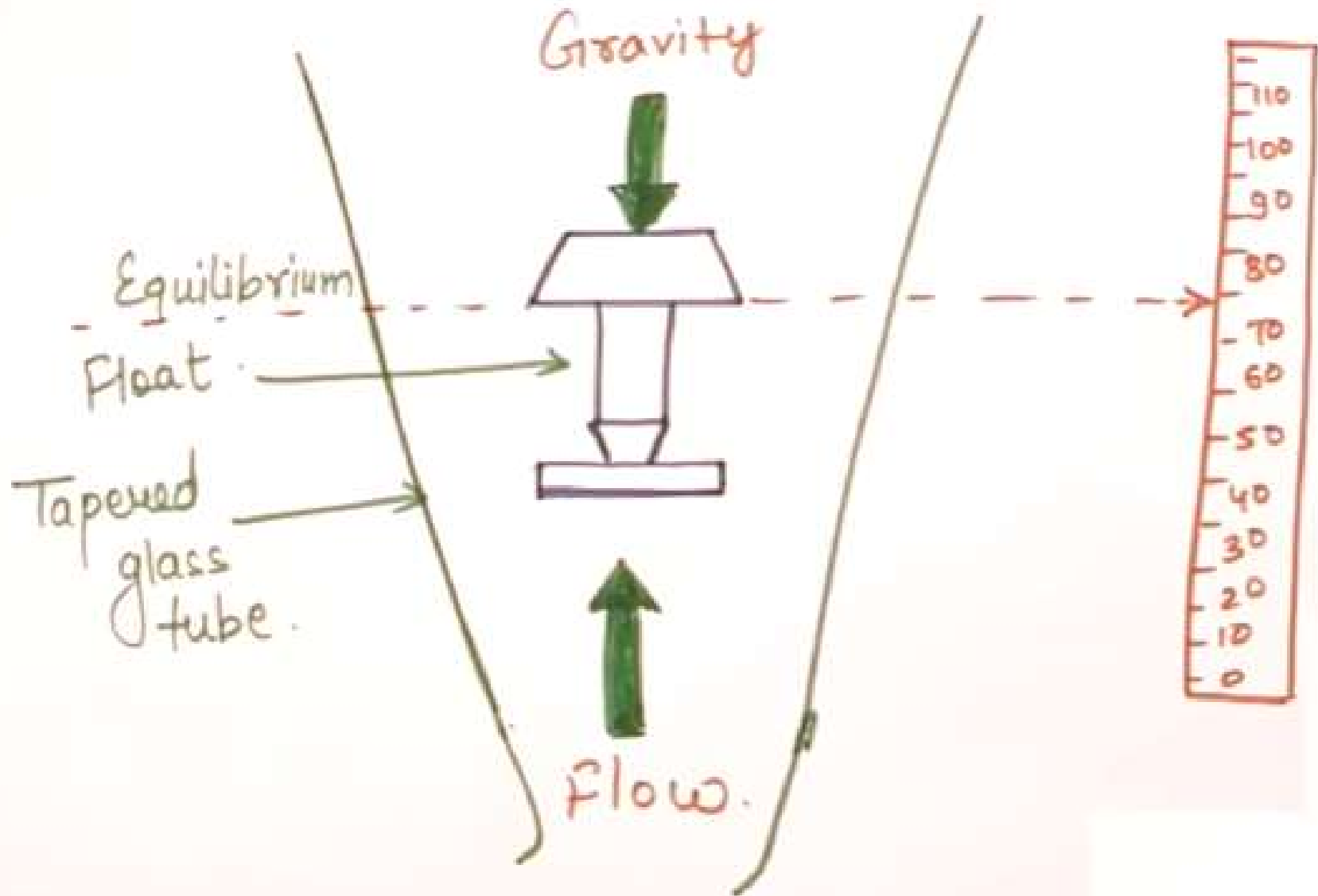


- Safety-shielded glass tube are in general use for measuring both liquids and gases.
- Metal tubes are used where opaque liquids are used or temperature or pressure requirement is quite high.
- Plastic tubes are also used in some rotameter designs due to their lower cost and high impact strength.



Float:

- Floats may be constructed of metals of various densities from lead to aluminum or from glass or plastic.
- Stainless-steel floats are common ones.
- Float shapes and proportions are also varied for different applications.
- For small flows floats are spherical in shape.



* As a liquid or gas passes through the tube, the flow causes the float to rise.

↳ gravity causes float to fall.

↳ float will rest where both forces are equal.

↳ that specific level can be read from scale.

* The tapered tube gradually increasing diameter, provides a related increase in the annular area around the float.

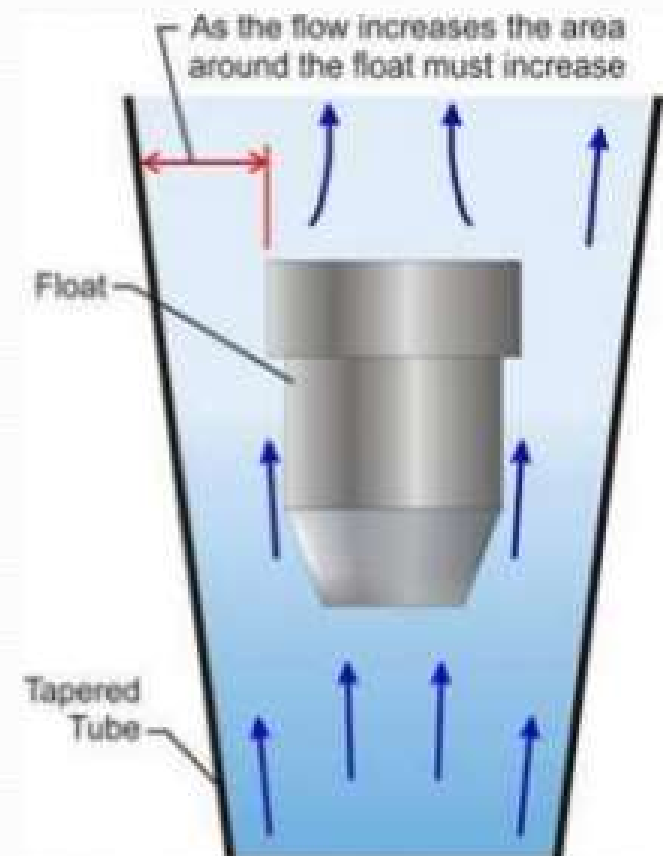
Volumetric flow rate equation →

$$Q = K A \sqrt{g h}$$

- Q- Flow rate
- K- Constant
- A- annular area between float and wall of tube
- g- force of gravity
- h- Pressure head

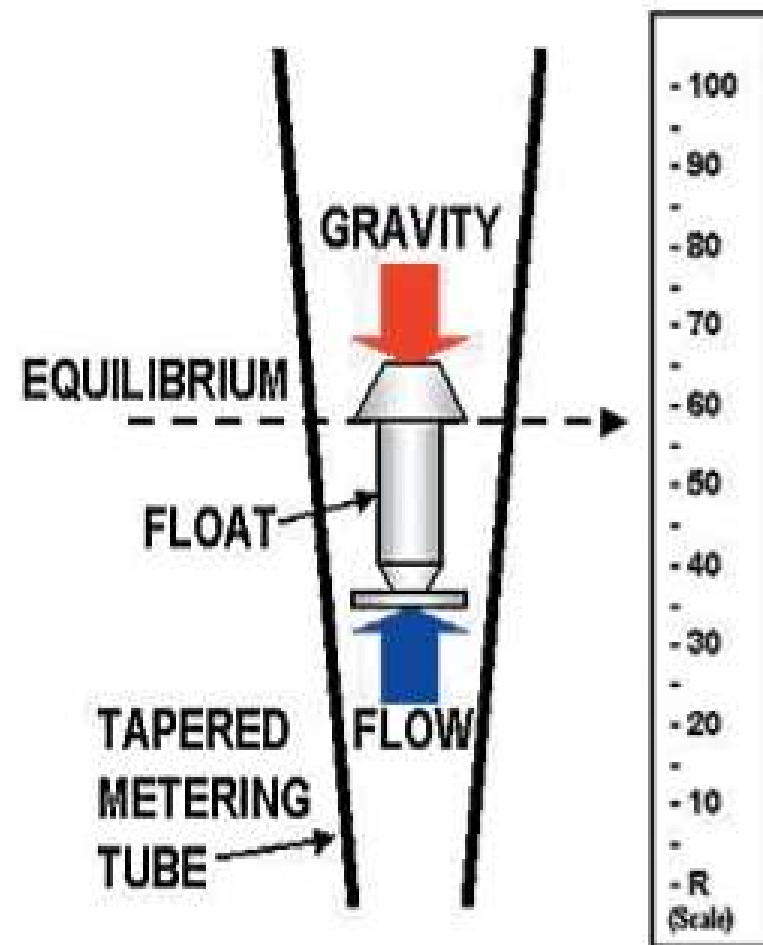
Working:

- ❑ Fluid enters the tapered tube, some of the fluid strikes directly the float. Some of the fluid passes from sides.
- ❑ Two forces are acting in this case:
 - Upthrust Force (Buoyancy)
 - Weight of the float
- ❑ Annular space increases due to increase in area of the tube.
- ❑ When equilibrium is established the float comes to rest.



Measurement of flowrate:

- ❑ The flowrate is measured directly from calibrated scale.
- ❑ The reading is noted generally from ending point of cap of the float.



Advantages

- Low cost
- Rotameter provides linear scale.
- It has a good precision for low and medium flows.
- The pressure loss is almost constant and small.

Disadvantages

- When opaque fluid is used, the float may not be visible.
- Types of glass tubes subject to breakage.
- It must be installed only in vertical position.

Applications

- process industries.
- monitoring gas and water flow in plants or labs.