Process Control Equipments

- Process control equipments can be classified in two groups;
  - Measuring devices: to check the controlled variable
  - Final control element: to adjust the manipulated variable

Some of the physical properties to be taken into consideration during process control:

1. Accelaration
2. Color
3. Contraction
4. Expansion
5. Electrical conductivity
6. Thermal conductivity
7. Chemical properties
8. Crystallization properties
9. Height
10. Mass
11. Momentum
12. pH
13. Specific heat
14. Specific mass
15 Thickness
16. Volume
17. Weight
18. Current
19. Voltage
20. Resistance
21. Density
22. Dimensions
23. Motion
24. Flow rate
25. Force
26. Frequency
27. Moisture
28. Pressure
29. Velocity
30. Temperature
31. Time
32. Ultrasound

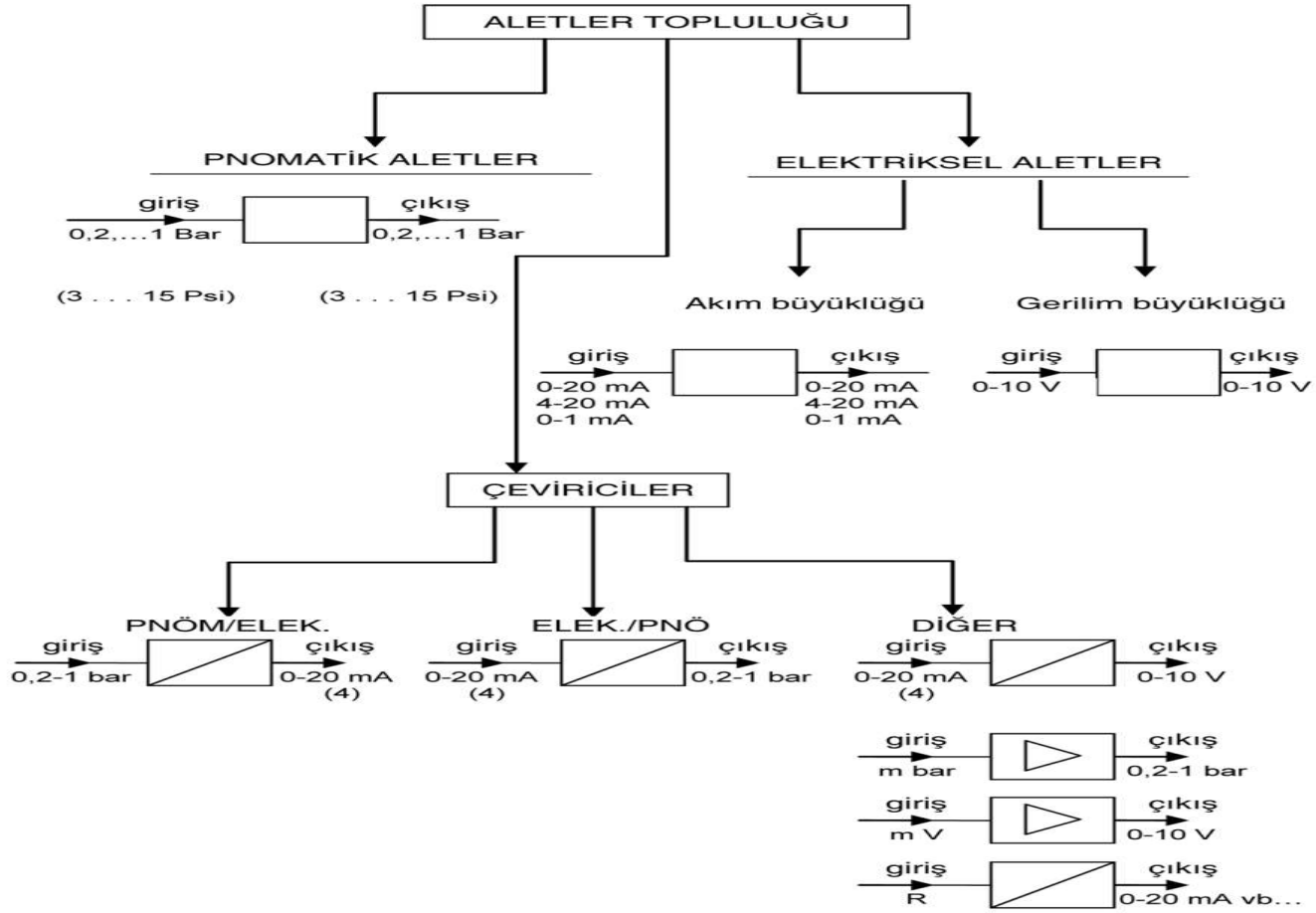
- Each has different application areas; but in food industry the ones which are most commonly used are;
  - Temperature
  - Flow rate
  - Level-height
  - Pressure
  - Concentration

  For measurement of these properties sensors which are called as measuring devices are used;

  Properties of these sensors are given as;

- Time constant and dead time should be small
- It should have high repeatability

1)Electrical Systems (works with electrical signals)
2)Pneumatic Systems (works with air)



Terminology

- Span (Açıklık)
- Zero (Sıfır)
- Accuracy (Doğruluk)
- Repeatability (Tekrarlanabilirlik)

Temperature Measurement Device

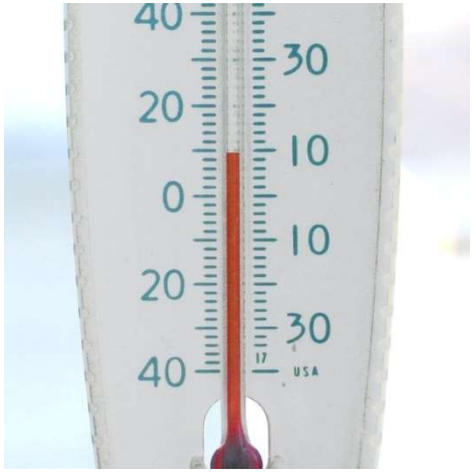
a)Thermometer:

Principle: expansion of mercury due to temperature increase

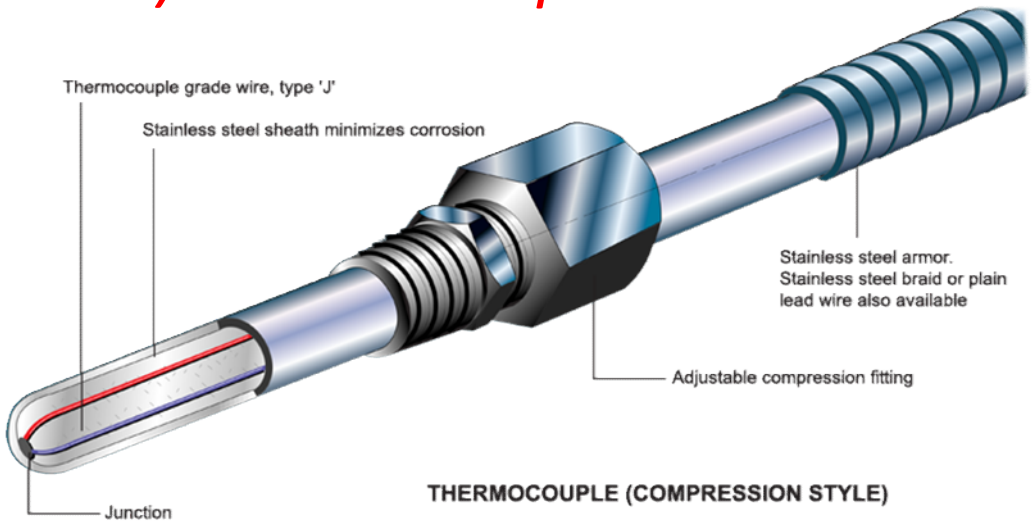
-It can be used between (-50°C) - (500 °C)

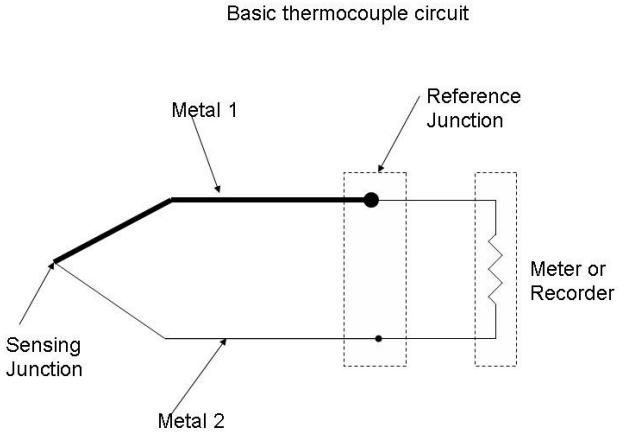
-Advantages: simplicity, cheap, longevity

-Disadvantages:hard-to-read, unability to transfer the signal



b) Thermocouple:





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Principle: voltage produced by metals proportional to temperature

-Fe-CuNi, NiCr-Ni, Rh-Pt

-Advantages: No limit for the application range, small dimensions, accuracy, produces an electrical signal, this signal can be trasported to far distances

c) Resistance thermometers:

Principle the resistance of the metals changes according to temperature variations

-Ni, Cu and Pt are the metals used for its production.

- It can be used between (-200 °C) - (500 °C)
- Pt-100 is the most commonly used resistance thermometer

Advantages: Rapid, small dimensions, high accuracy

Disadvantages: Contact resistance and self over heating

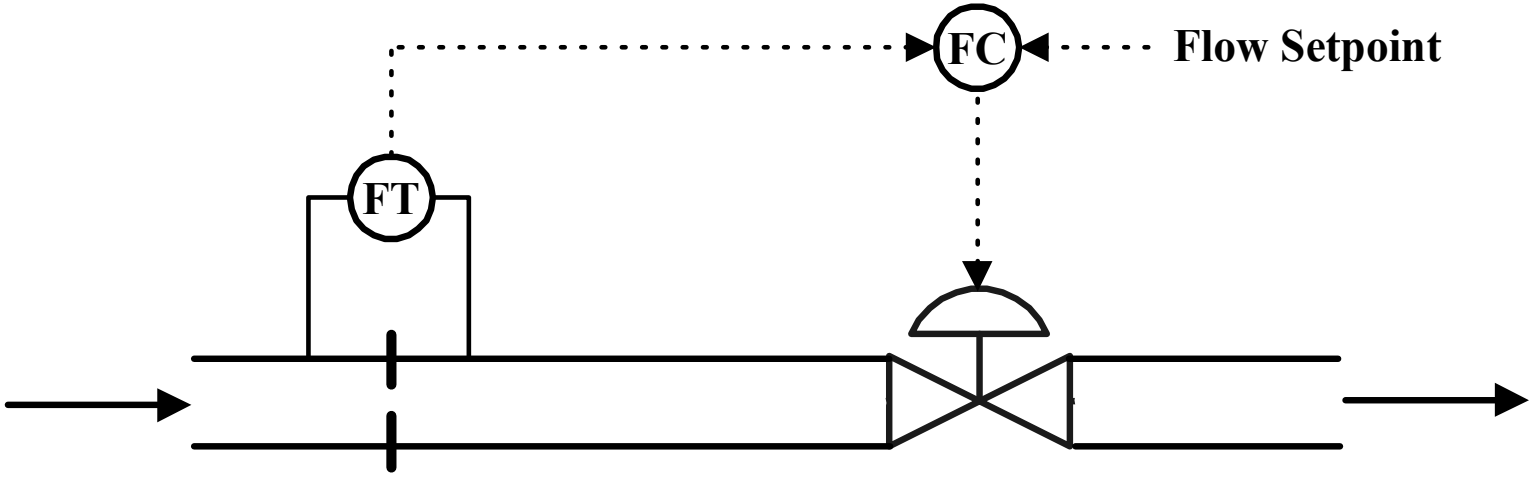
Flowmeters

a) Orificemeter

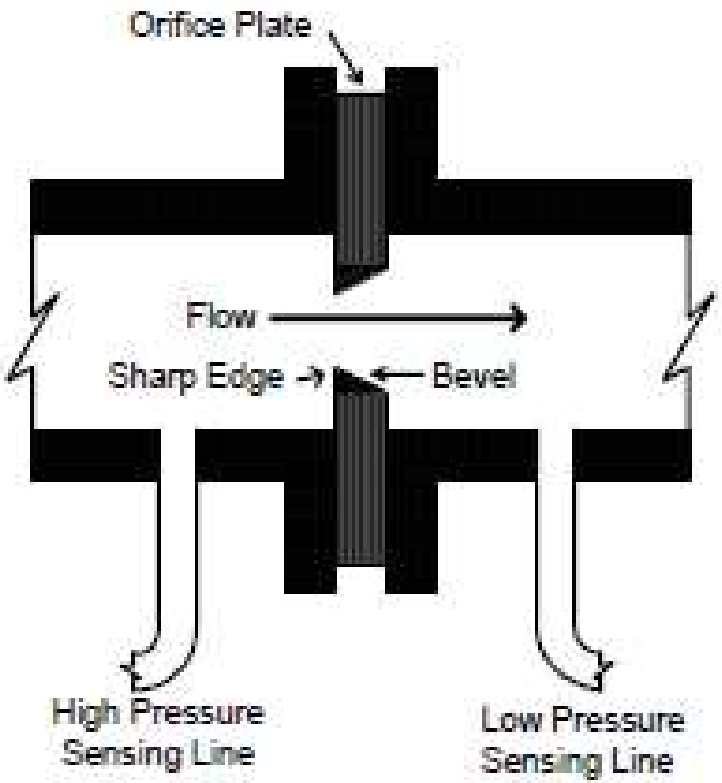
Principle the pressure drop due to the sudden contraction of the pipe because of the orifice plates.

-It can be used between (-50°C) - (500 °C)

-Advantages: High repeatability , rapid dynamic response



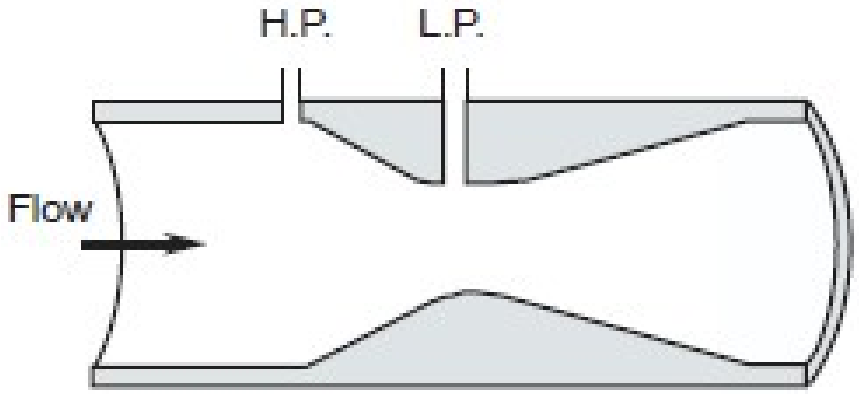
Orifice Plate



b) Venturimeter:

Principle Its principle is similar to orificemeter. The only difference is the reason of pressure drop; it is the sudden contruction of pipe itself.

-Disadvantage: its production is limited.

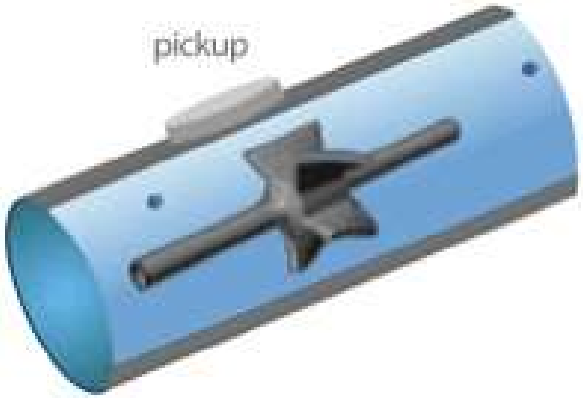


c) Rotameter:

-A rotameter is a device that measures the flow rate of liquid or gas in a closed tube

-Production from glass or a tranparent material and its dependency to the density of the fluid limits its application areas.

d) Turbine flowmeter: Turbine flowmeters use the mechanical energy of the fluid to rotate a “pinwheel” (rotor) in the flow stream. Blades on the rotor are angled to transform energy from the flow stream into rotational energy. The rotor shaft spins on bearings. When the fluid moves faster, the rotor spins proportionally faster.



-It can only be used clean fluids.