SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai

DEPARTMENT OF CARDIO PULMONARY PERFUSION CARE TECHNOLOGY

COURSE NAME : PRINCIPLES OF PERFUSION TECHNOLOGY PART 1

2ND YEAR

TOPIC : SAFETY DEVICES

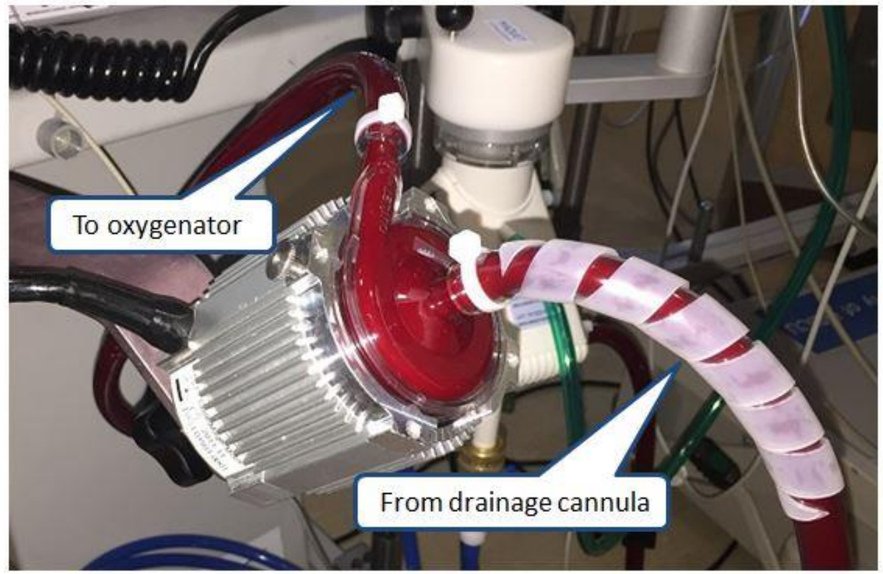
FLOW METERS

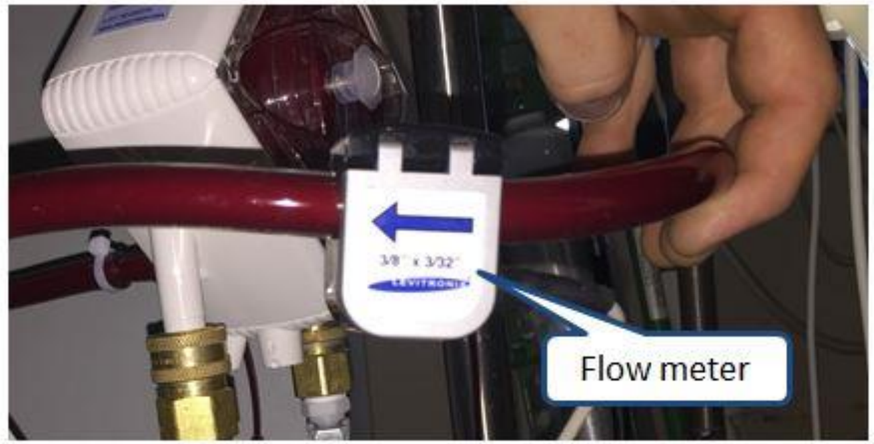
- The centrifugal pumps and the **non – occlusive pumps are pressure sensitive**, so they require a separate sensor of a flow meter.
- Flow meters are used to **monitor the blood flow** of the pump.

LOCATION OF FLOW METER IN ECC

- The flow meter should be incorporated into the "**arterial outflow**".

- The flow meter can also be located downstream of any "**purge**" or "**recirculation line**" in the circuit to accurately **measure blood flow** delivered to the patient.





TYPES OF FLOW METERS

- Flow meters are the **indispensable part** of the centrifugal pump.
- Two types of measuring techniques are used clinically, one is working with an **ultrasonic principle**, the other with an **electromagnetic principle**.

ELECTROMAGNETIC FLOW METER

- Electromagnetic flow probes depend on the fact that blood flowing through an electromagnet alters the magnetic field in a manner that can be measured continuously.

- It requires the connector that need to be build into the tubing and this will affect the blood flow.

- A disadvantage of the electromagnetic flow probes is that, there is the **difficulty in obtaining the good zero value**.

ULTRASONIC FLOW METER

- Ultrasonic flow meter is a type of flow meter that **measures the velocity of a fluid** with the ultrasound to calculate volume flow.
- The ultrasonic flow meter utilize either the **Doppler principle** or a variant known as **ultrasound transit –time**.

DOPPLER ULTRASONIC FLOW METER

- In doppler ultrasonic flow meters an acoustic pulse is transmitted into the stream of liquid by the transducers.

- These transducers then receive an echo of the pulse reflected by the particles of matter within the fluid.

- By comparing the transmitted and reflected signals, the rate of the flow can be computed.

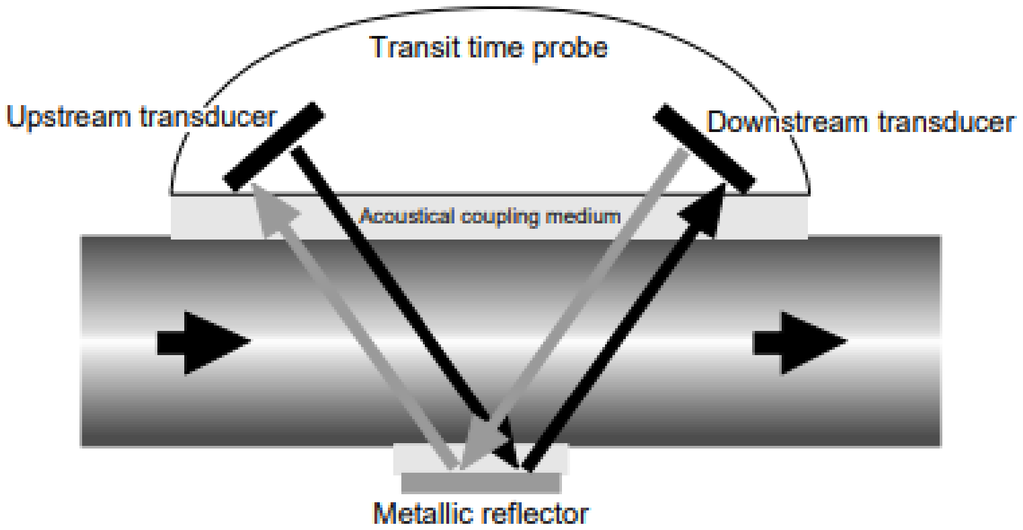
DISADVANTAGES OF DOPPLER PRINCIPLE

- The doppler principle is less frequently used in flow meter probes because the signal becomes **“noisy” at low velocities** and this results in inaccurate, low flow readings.
- It will only work properly if there is sufficient particulate material to reflect the pulses and if that material is flowing homogeneously within the fluid.

ULTRASOUND TRANSIT -TIME

- A transit –time flow probe consists of flow small **piezoelectric crystals**, one “upstream” (i.e., against the flow) and one “downstream” (i.e., in the direction of flow) mounted in a common tip that can be clipped on the tubing.

- The time it takes for a signal to travel downstream is compared with the time taken for a signal to travel upstream velocity is then calculated

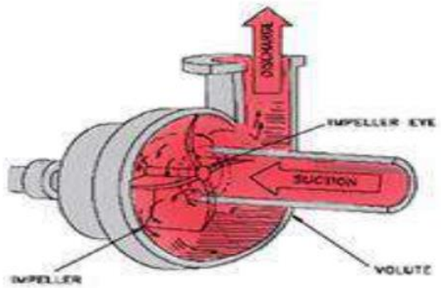


ADVANTAGES OF TRANSIT –TIME FLOW METERS

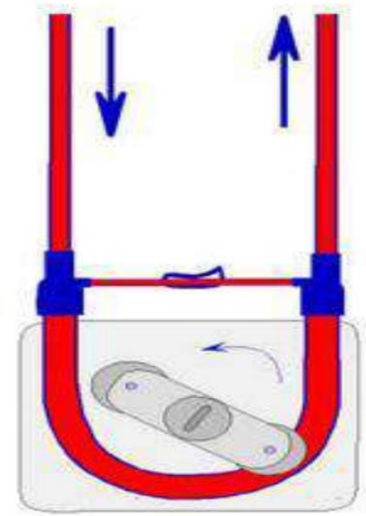
- Transit –time flow meters have an excellent correlation with direct measured blood flow evenly in very low flow ranges.

- They can be clipped on to the outside of the tubing and therefore no immediate contact between the blood and probe exists.

Ultrasonic Flow Sensor



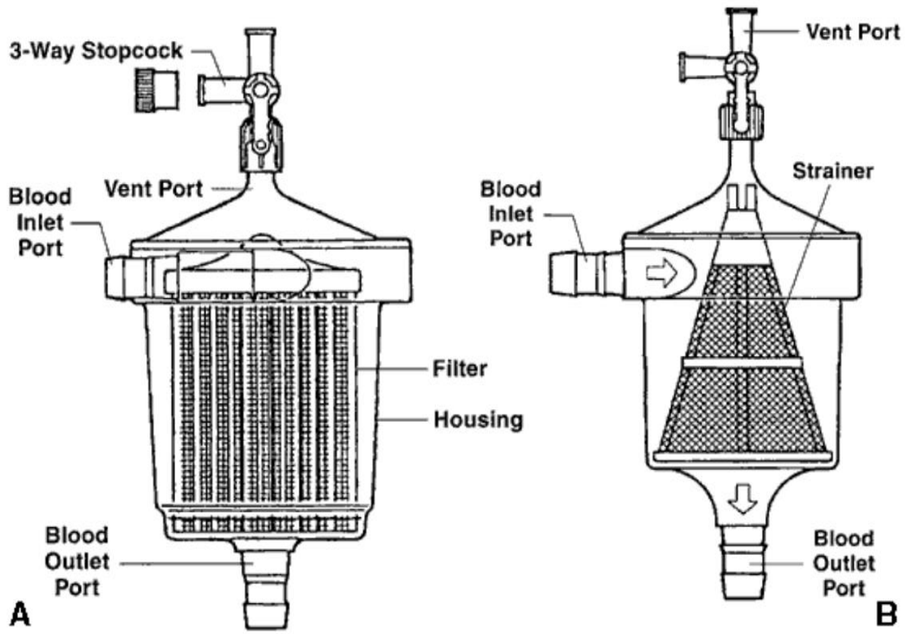
Centrifugal Pump



Roller Pump

BUBBLE TRAP

- Bubble trap which **removes air, micro emboli** in the arterial blood
- Bubble trap is placed in the **arterial line between arterial filters**.
- The bubble which is trapped in the bubble trap is then converted into a rotating stream.
- This unit is easily and quickly connected in the line using ¼” connection.
- The pressure rated up to 30 psi are effective in debubbling of aqueous solution.
- When a fluid containing bubble which flow through the unit, the bubbles are forced through the “microporous hydrophobic membrane”. Dynamic bubble trap reduce micro emboli during CPB.



LEVEL SENSOR

Level sensor is used **to sense the level of blood in the reservoir.**

- Uses:

It is needed **to maintain oxygenator volume** at a reasonable level, to allow the perfusionist time to react to sudden changes

TYPES OF LEVEL SENSOR

Types of level sensor:

- capacitance system
- weight system
- light system

CAPACITANCE SYSTEM

The capacitance system uses a **strip of metal tape which is placed on the side of the oxygenator** by the perfusionist at whatever level he wishes the alarm to sound and it does not stop the pump.

LIGHT SYSTEM

- The light sensor type is a device which attaches to the oxygenator holder and is moved up against the side of the oxygenator at certain level it gives alarm.

- In the light sensor type, as long as blood is in-front of the light sources, the light is reflected back on the sensor. When the sensor does not see a reflected light the device alarms.

- The draw back to this device is, if a clot form Infront of the light source, then the sensor will always see reflected light.

WEIGHT SYSTEM

- The weighting device actually weights the holder oxygenator and contents of the oxygenator.

- As the weight in the oxygenator increases due to increasing volume, the arterial pump head runs faster in order to maintain a set arterial reservoir level.

- The disadvantage of this device is that the device cannot differentiate between blood in the arterial reservoir and someone leaning on the weight arm.

TEMPERATURE PROBES

- Accurate measurement of temperature certainly one of the most important parameters followed during hypothermic perfusion and rewarming.

- Temperature probes are incorporated in the venous inlet and at the arterial side of oxygenator.

- In patients the temperature monitoring sites are, tympanic, nasopharynx, rectum during cardiac surgery.

BUBBLE DETECTORS & PRESSURE ALARMS

- The bubble detector is used at the arterial inlet of the circuit, so that the air embolism cannot enter the patient.

- Most modern HLM have integrated electronic alarms for limits of pressure during a case. There limits should be detected and corrected to an appropriate time

THANK YOU