E230 Aircraft Systems

Fire On Board

6th Presentation

School Of Engineering

What is Temperature

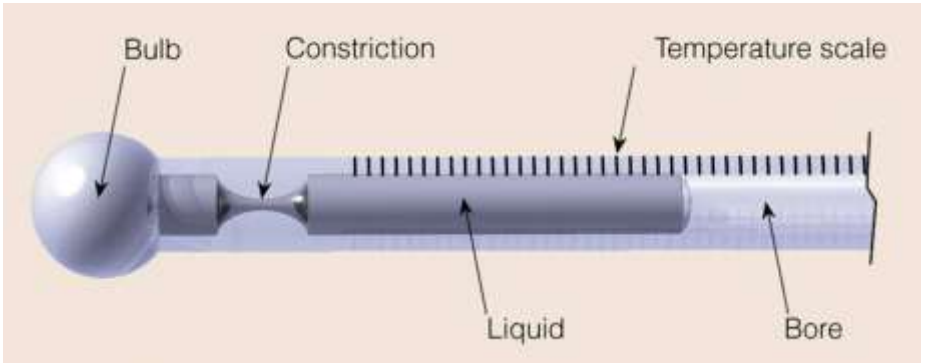
- Temperature is a measure of how hot or cold a substance is.
- The greater amount of heat energy, the higher the temperature of the substance
- Temperature can provide information about the status of an aircraft system
- A malfunctioning system or fire can be the cause of a high temperature.
- Prolonged over-temperature may damage aircraft system

Measurement of Temperature

- The variation of some property of a substance with temperature is utilised.
  - Most substances expand as temperature increase.
  - Gases increase pressure with temperature
  - Electrical resistance changes with temperature
  - Dissimilar metals when joined produced an e.m.f dependent on temperature between them

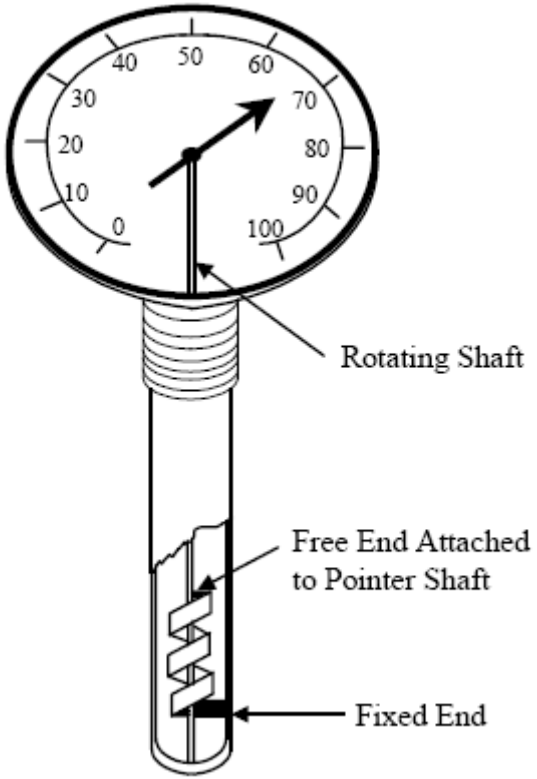
Liquid expansion type

- Consist of a liquid (e.g alcohol, mercury) enclosed in breakable glass tube.
- Increase in temperature causes the liquid to expand and push up in the tube.
- Height of liquid measured on a linear temperature scale.



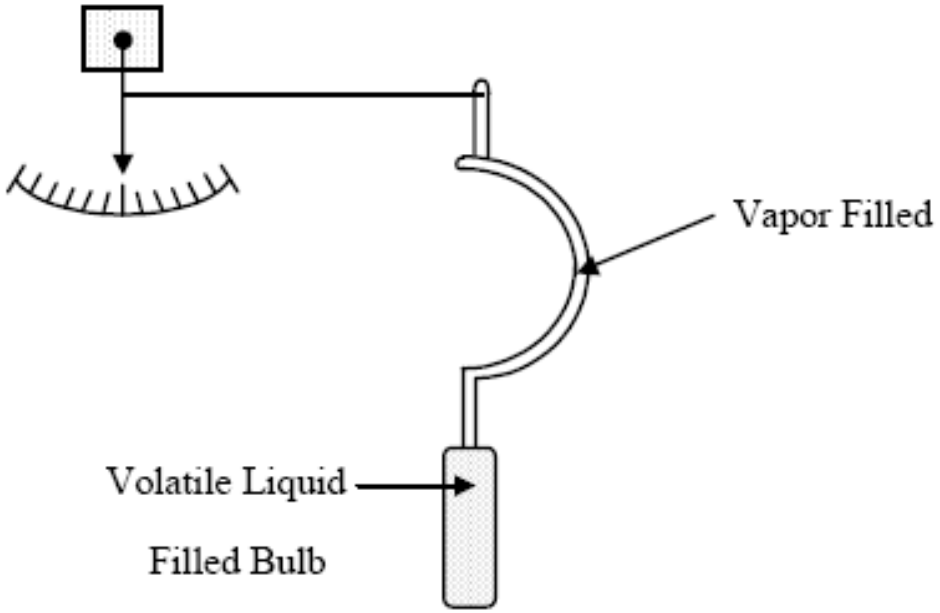
Solid expansion type

- Bimetallic strips consist of two dissimilar metals bonded together.
- Metals expand differently when heated.
- Bimetallic strip curls on temperature rise.
- Action causes deflection of needle that indicates temperature on scale



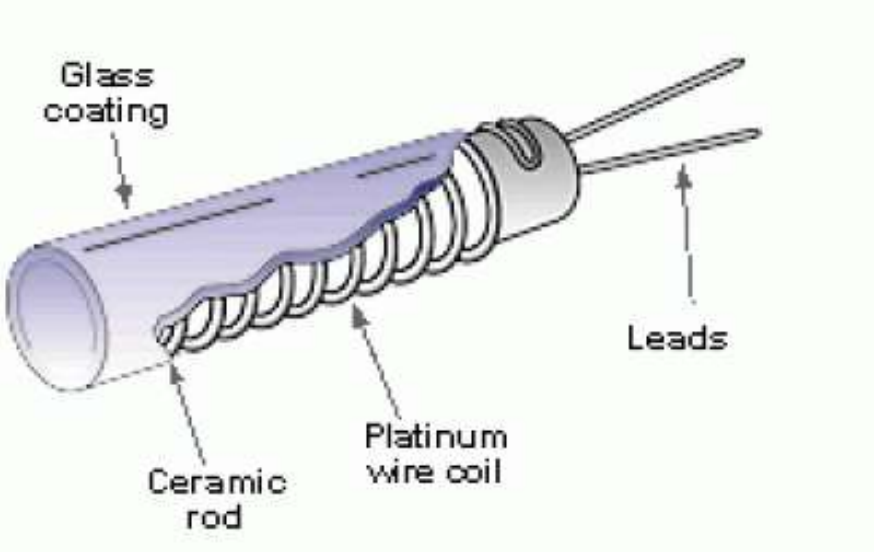
Gas expansion type

- Higher temperature vaporises the liquid
- Vapour produces a higher pressure
- Bourdon tube senses the pressure and straightens out
- Moves pointer across scale calibrated in temperature units



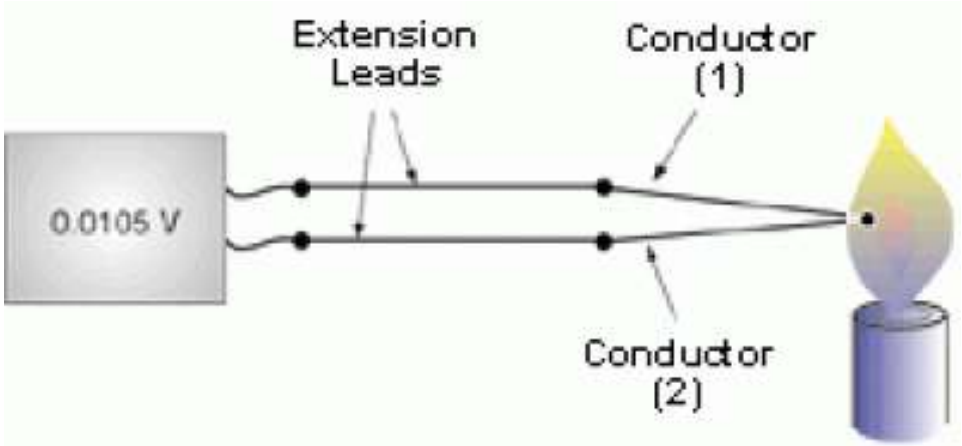
Electrical resistance type

- Fine nickel or platinum wire coil.
- Resistance of wire increases in proportion to change in temperature
- Temperature obtained using electrical circuits



Thermocouple type

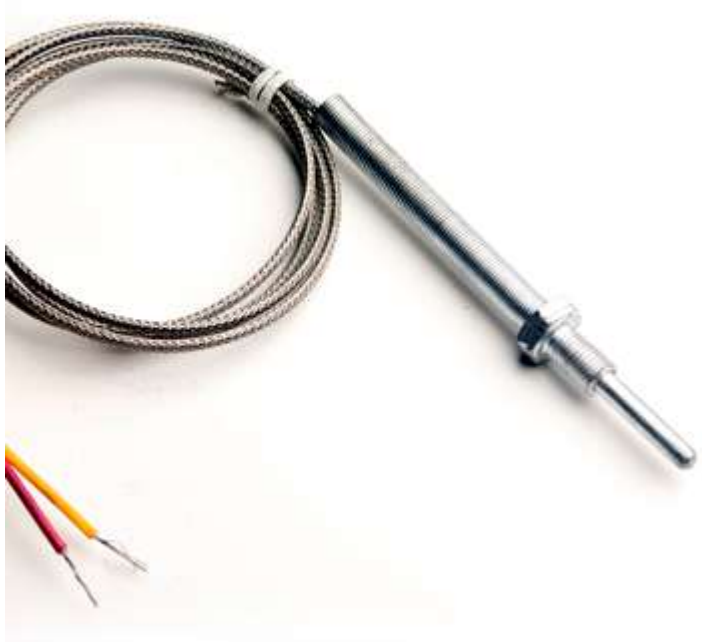
- Consist of two dissimilar metal joined at the point of measurement.
- When conductor is heated, voltage generated proportional to temperature difference
- Common application in EGT probes



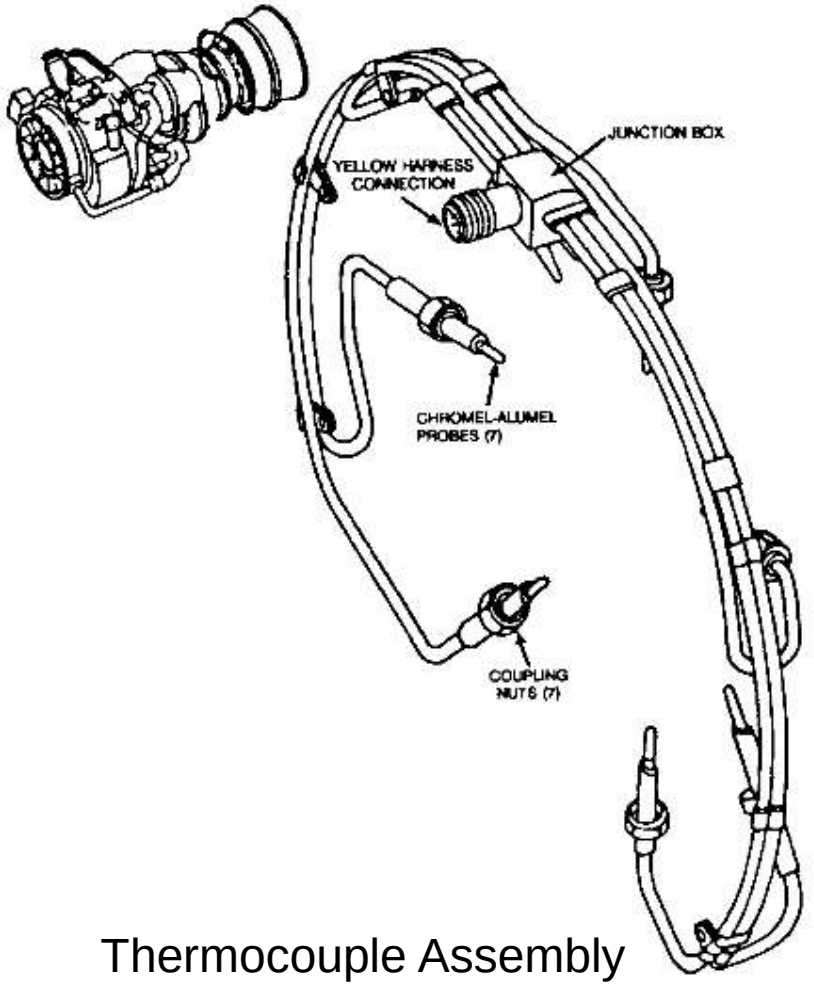
Exhaust Gas Temperature (EGT)

- EGT is used to monitor the mechanical integrity of turbine engine
- EGT is temperature of exhaust gases as they leave the turbine unit
- Chromel-alumel type thermocouple used for extremely high temperature
- Several thermocouples spaced at intervals are usually employed
- Displays on an indicator in the cockpit

EGT thermocouple



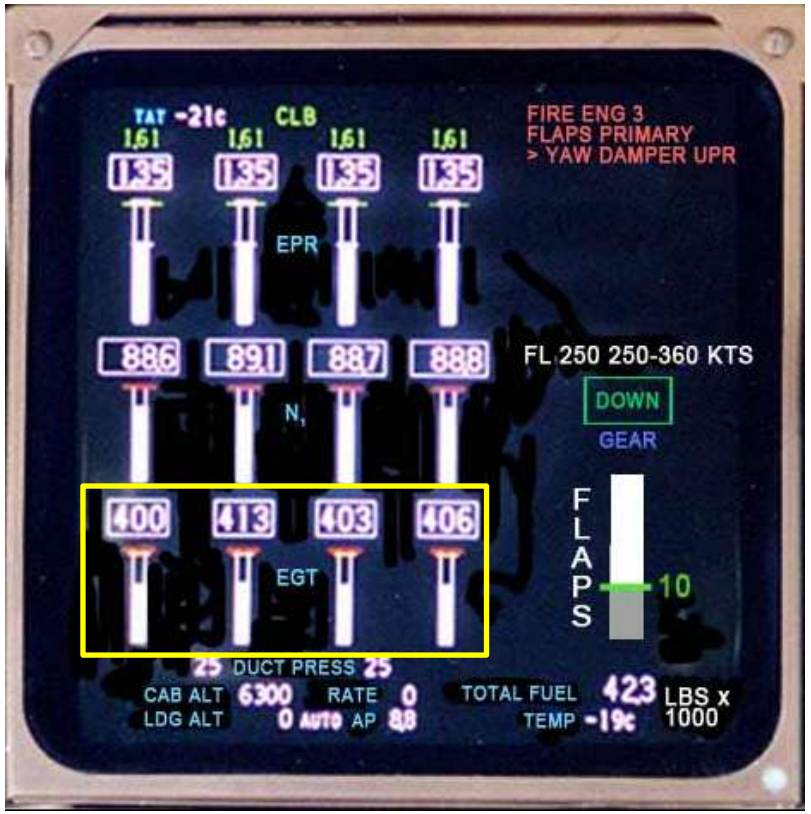
Thermocouple Unit



Thermocouple Assembly

EGT display

EGT analogue display



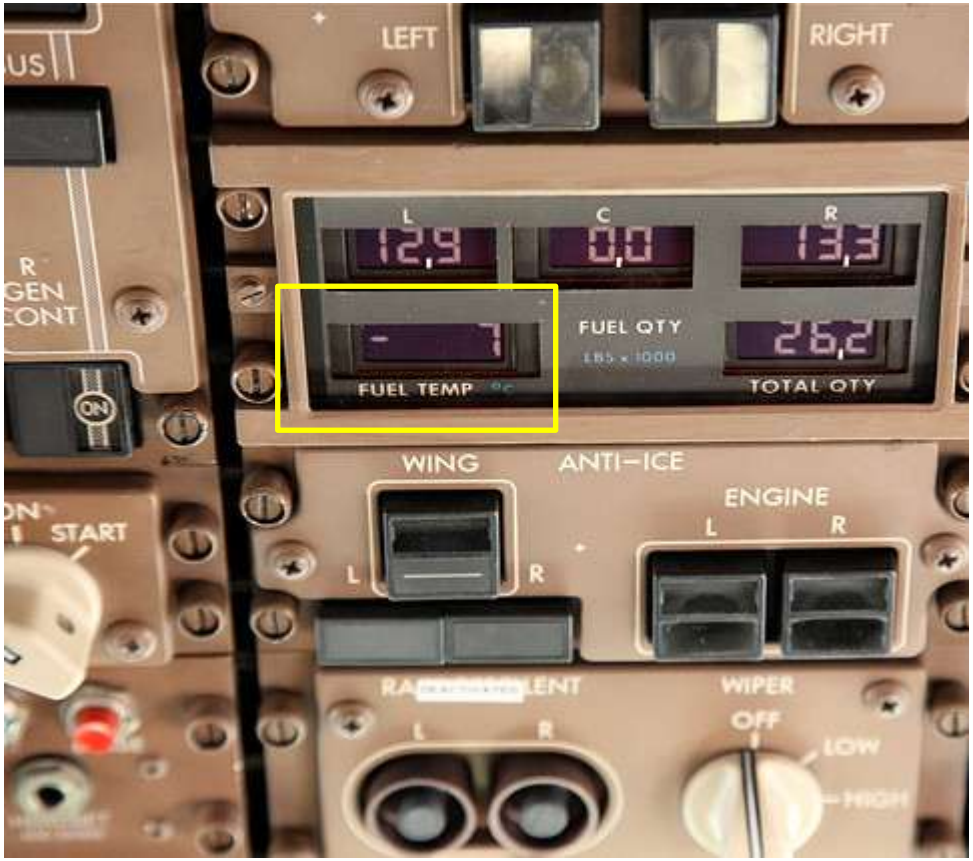
EGT digital display

Total Air Temperature (TAT)

- Directly measures temperature of air impacting on aircraft
- Required for true airspeed computation
- Employs resistance-type sensing element
- TAT is higher than static air temperature

Fuel Temperature

- Indicates fuel temperature in tank
- In low temperature, ice crystals forms in fuel.
- Ice blocking of fuel inlet to engine
- Fuel may be heated to prevent ice formation



Engine Oil temperature

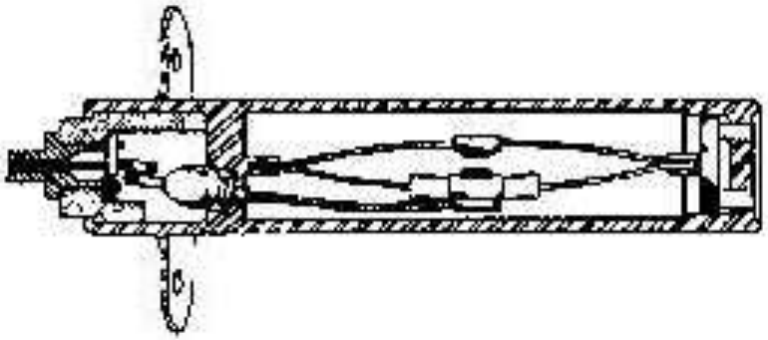
- Indicates temperature of lubricating oil entering the engine
- Too cold oil is viscous and cannot flow
- Too hot it loses lubricating properties to protect the engine from wear

Fire Protection

- Fire protection consist of:
  - Overheat and fire detection
  - Smoke detection
  - Fire extinguishing system

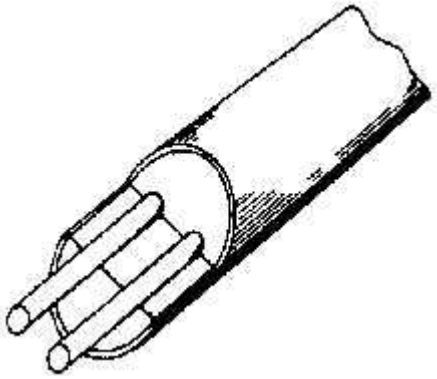
Fire and overheat detection

- Spot detector
  - Bimetallic detectors
  - Requires many to cover an area
  - E.g Bleed air manifolds

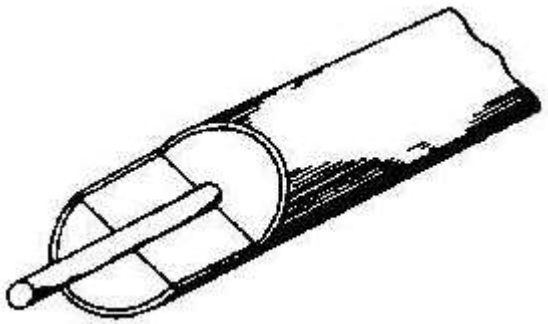


Fire and overheat detection

- Continuous detector
  - Fenwal, Kidde and Systron-Donner
  - One or two loops to cover an area
  - E.g Engine, APU, well wheel

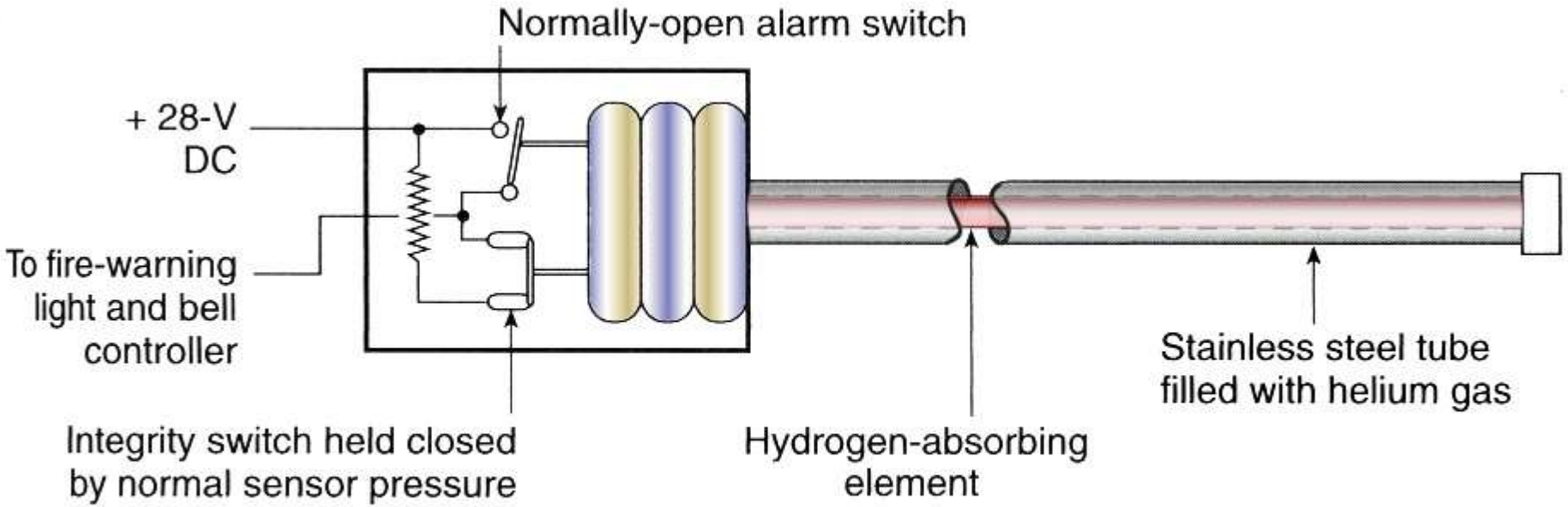


Kidde system



Fenwal system

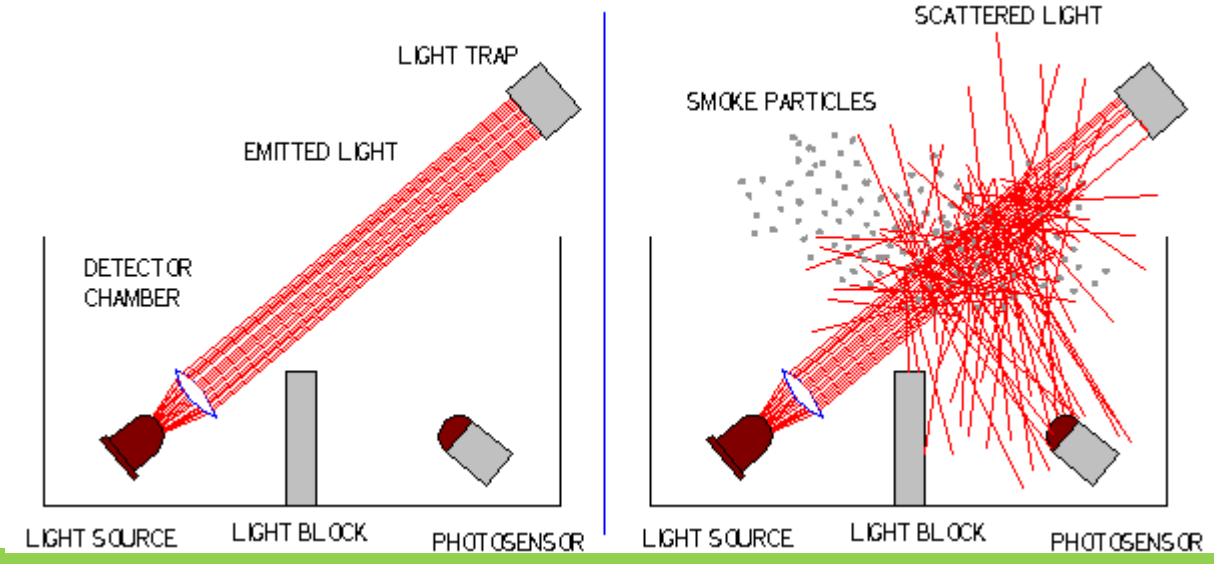
Fire and overheat detection



Systron-Donner pneumatic fire detection and overheat detector

Smoke detection

- Smoke is indicative of fire.
- Uses photoelectric sensors
- Samples air that flow in the area
- Found in cargo and lavatory area

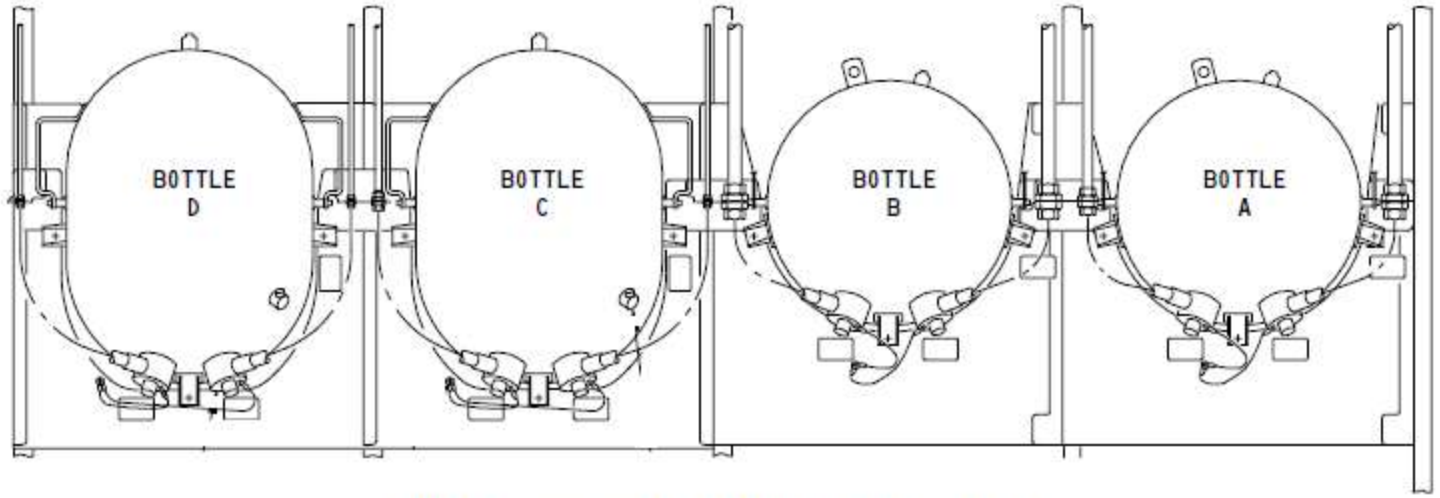


Fire Extinguishing

- Remote controlled discharge for engines, APU and cargo

Fire Extinguishing

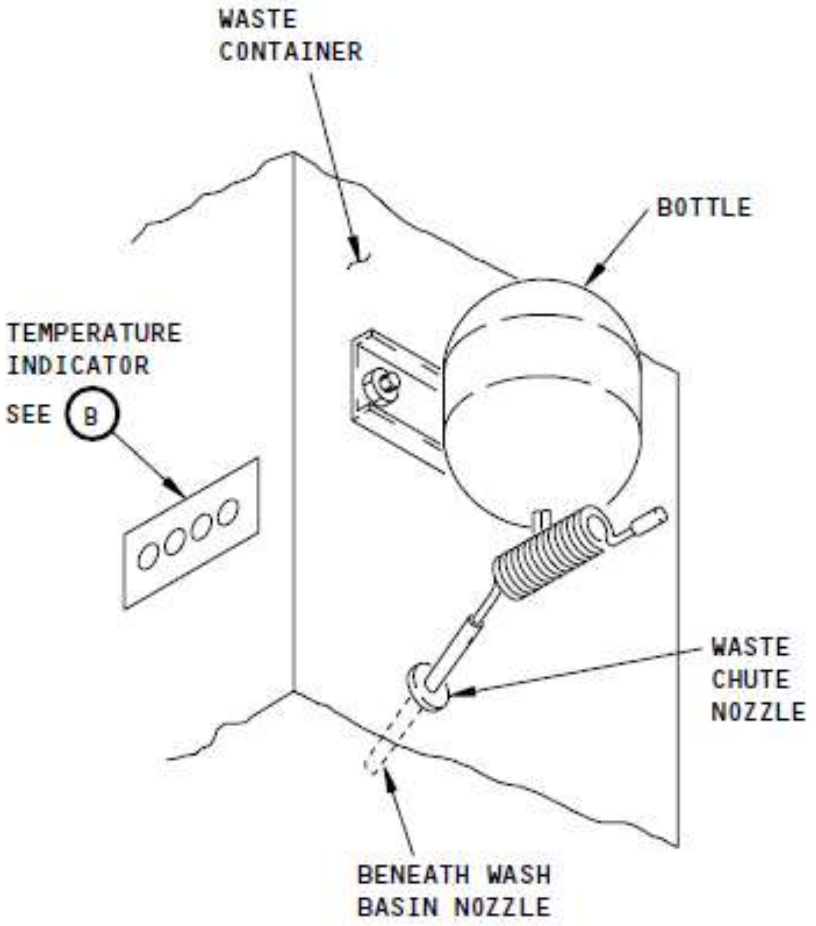
- Lower cargo has a two-action release
  - Initial rapid release to put out fire (small bottles)
  - Follow by slow metered release to suppress rekindling (big bottles)



LOWER CARGO FIRE EXTINGUISHER BOTTLES

Fire Extinguishing

- Auto discharge for waste container in lavatory
- Fire will melt the heat-fusible plug and release extinguishing agent



Learning objectives

- Discuss the different temperature measuring methods
- Describe how temperature measurement is taken on aircraft system
- Identify the types of fire protection system on an aircraft
- Explain how fire protection system works