E230 Aircraft Systems

Into Thin Air

6th Presentation

School Of Engineering

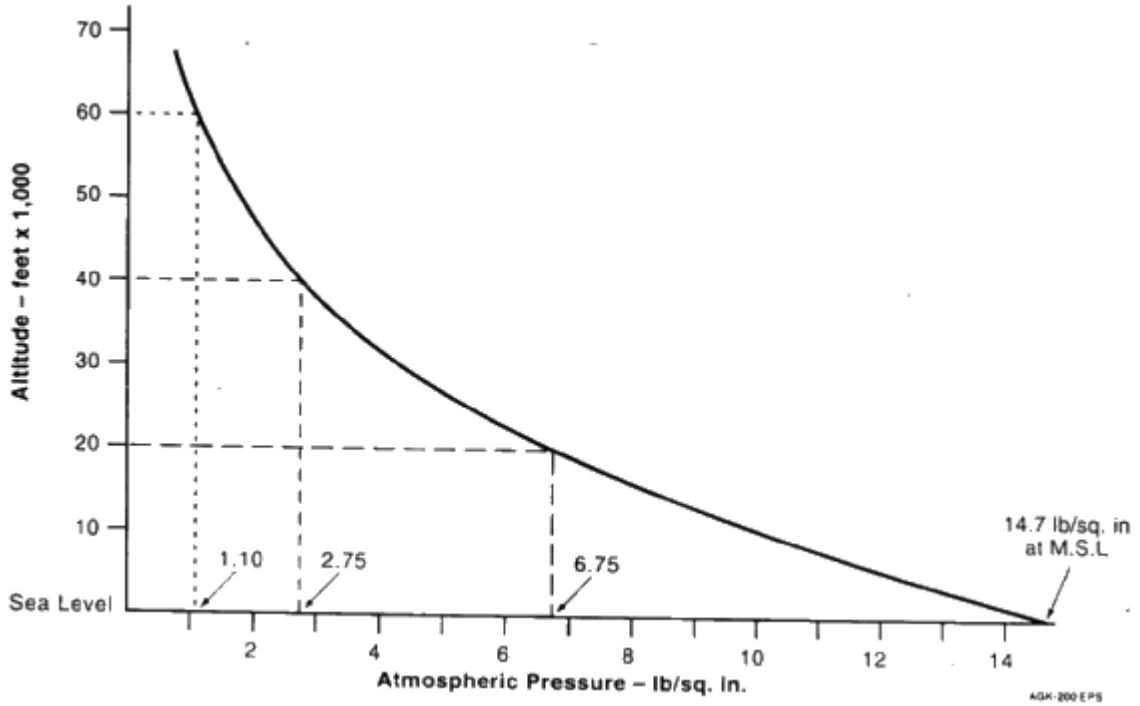
Environmental Control System

- Pressurisation
- Temperature control
- Humidity control
- Ventilation

Pressure

- ~20% of air is O_2, which is essential for humans to live.
- Low air pressure implies low oxygen content in the air
- Hypoxia (altitude sickness) occurs when your body is deprived of O_2.
- Symptoms: headaches, fatigue, nausea, shortness of breath

Atmospheric pressure



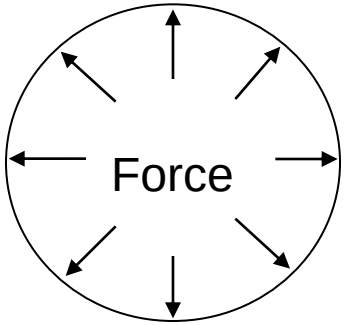
- Humans can still function normally at altitudes < 10000 ft

Cabin altitude

- The altitude at which the atmospheric pressure would be equal to the cabin pressure
- Cabin altitude must be kept below 10000 ft for passenger comfort, although aircraft may fly much higher than that.

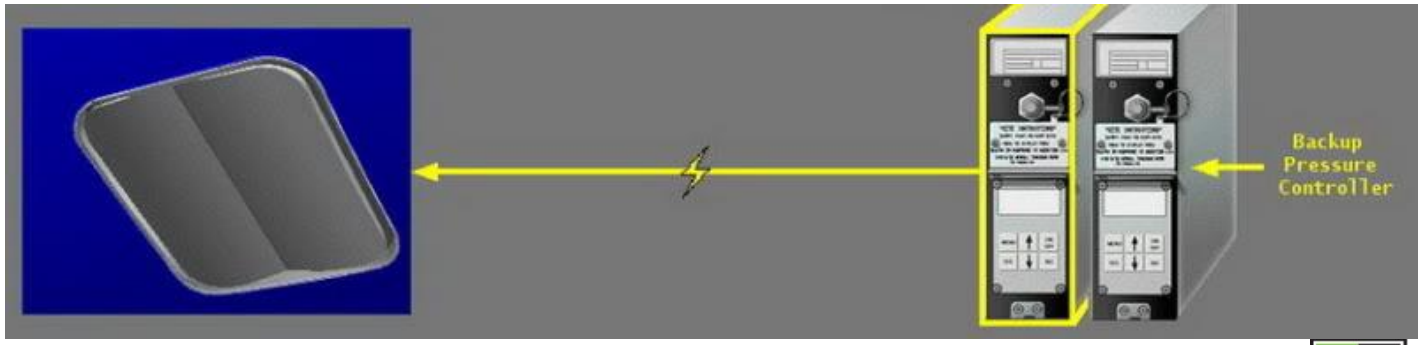
Differential pressure

- When aircraft is cruising above 10000 ft, cabin altitude < flight altitude
- Thus cabin pressure > pressure outside aircraft
- Force pushing against cabin structure



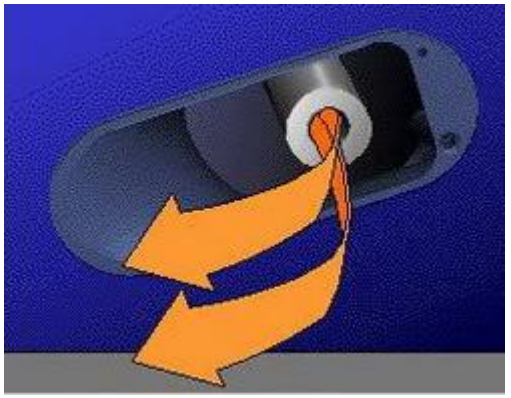
Cabin Pressure Control

- Cabin pressure is regulated through the outflow valve.
- It regulates the pressure by varying the outlet size.
- It can be controlled manually or automatically by cabin pressure controller.

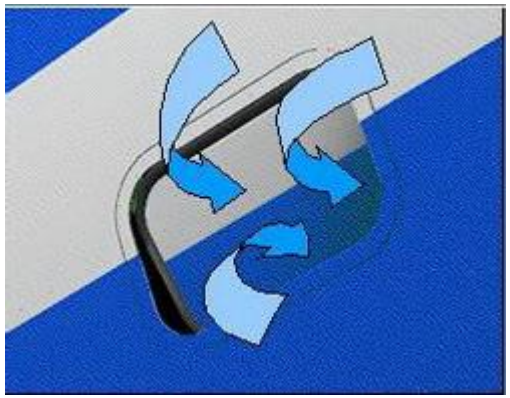


Positive and Negative Pressure Relief

- To prevent over pressurisation in the aircraft, pressure relief valve opens to prevent damage.
- To prevent underpressure, a negative pressure valve open to equalise with the ambient pressure.



Positive pressure relief valve



Negative pressure relief valve

Uncontrolled decompression

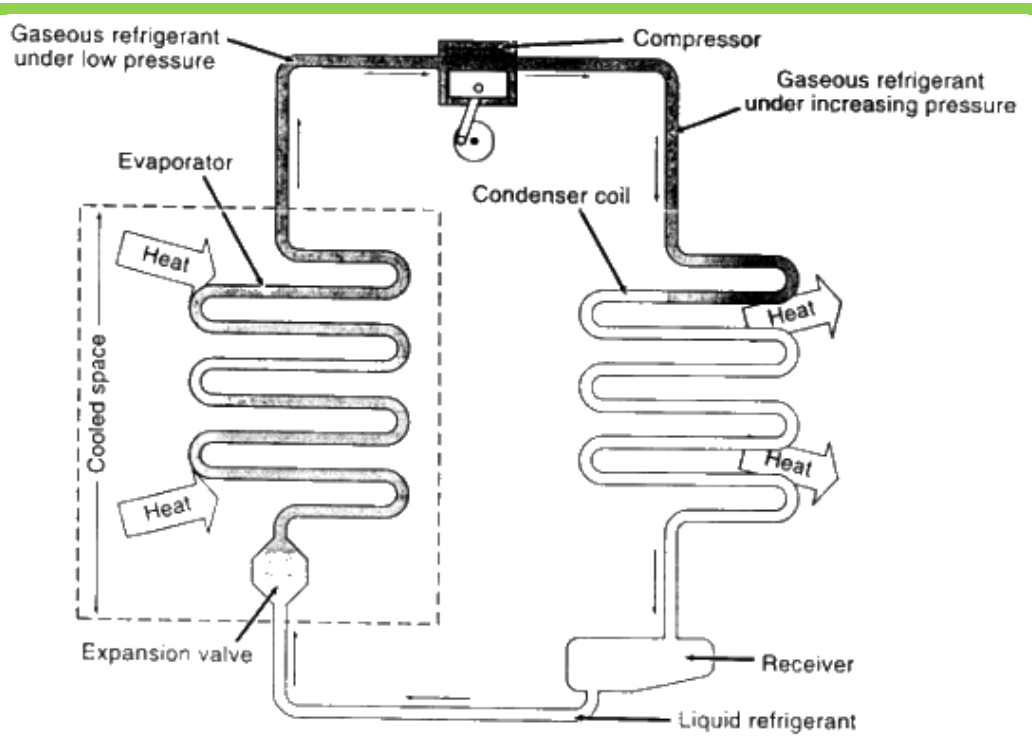
- Unexpected drop in cabin pressure
- Explosive decompression
  - Occurs within 0.5 seconds
  - Risk of lung damage
- Rapid decompression
  - Takes longer than 0.5 seconds
- Gradual decompression
  - Slow decrease in pressure
  - Detectable only by instruments

Emergency oxygen system

- Pressurised oxygen system
  - oxygen are pressurised (1800psi) and stored in tanks at cargo. Pipings are used to deliver O_2 to masks.
- Oxygen generator system
  - Chemical reaction in mixture produces O_2 and delivers directly to masks. Mixture is contained in a canister near to the masks.

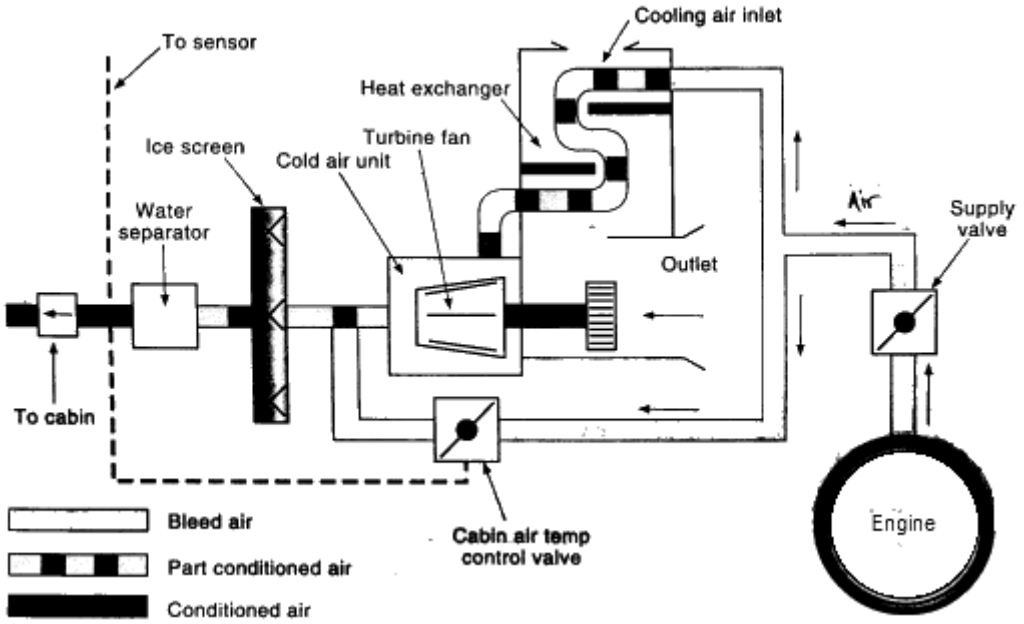
Vapour-cycle Cooling

- Hot gas from compressor passes through condenser and loses heat. Gas become liquid



- Liquid expands in evaporator →pressure and temperature drops, liquid become gas
- Compressor pressurizes the gas

Air-cycle Cooling



- Hot air from engine passes through heat exchanger to lose some heat.
- After passing through turbine, air becomes cold and low pressure

Learning Objectives

- Explain the need for environmental control system and list the components of the system
- How aircraft is pressurised and regulated
- Discuss on emergency oxygen system
- Explain the need for pressure relief
- Describe vapour cycle and air cycle cooling system