

34.1 Basic Electrical Concepts

- An electric current is the flow of electrons through a conductor. The force that causes this flow is known as the Electro Motive Force (EMF).
- □ Voltage (V or E): The measure of electrical pressure or EMF. It represents the potential difference between two points. Voltage is measured in Volts with a voltmeter, which is connected in parallel across the circuit.
- □ Current (I): The rate of flow of electrons. It is measured in Amperes (Amps) with an ammeter, which is connected in series within the circuit.
- □ Resistance (R): The opposition to the flow of current. It is measured in Ohms (Ω).
- Resistance of a conductor is affected by its material, length (longer = more resistance), cross-sectional area (thicker = less resistance), and temperature.
- □ Ohm's Law: The fundamental relationship between voltage, current, and resistance in a DC circuit.
- Voltage (V) = Current (I) $\times$ Resistance (R)
- □ Power (P): The rate at which electrical work is done. It is measured in Watts (W).
- Power (P) = Voltage (V) $\times$ Current (I)

34.2 Circuit Protection

- These devices are designed to automatically interrupt the flow of current in a circuit if the current exceeds a safe level, preventing damage and fire.
- □ Fuses: A fuse contains a thin wire with a low melting point. If the current gets too high, the wire melts and breaks the circuit. A blown fuse must be replaced.
- Current Limiters: A type of slow-blow fuse used in high-power circuits (like generator outputs) that can handle a temporary overload without blowing.
- □ Circuit Breakers (CBs): An automatic switch that "trips" (opens) when it detects an overcurrent. Unlike a fuse, a circuit breaker can be manually reset after it has cooled down.

- Most aircraft CBs are of the trip-free type, meaning they cannot be held closed against a
- fault current.

34.3 Capacitors

- A capacitor is a device that stores electrical energy in an electric field. It consists of two
- conductive plates separated by an insulating material called a dielectric.
- ☐ Functions:
 1. Stores an electrical charge.
 2. Appears to pass Alternating Current (AC).
 3. Blocks the flow of Direct Current (DC) once charged.
- ☐ Capacitance: The ability of a capacitor to store a charge, measured in Farads (F).

34.4 Batteries

- A battery converts chemical energy into electrical energy. It is comprised of one or more
- cells.
- ☐ Primary Cells: Cannot be recharged (e.g., standard flashlight batteries).
- ☐ Secondary Cells: Can be recharged by passing a current through them in the reverse
- direction (e.g., aircraft and car batteries).
- ☐ Capacity: A battery's ability to supply current over time, measured in Ampere-hours (Ah).
- An 80% charge is typically required before flight.
- ☐ Lead-Acid Batteries: Commonly used on light aircraft. They consist of lead peroxide
- positive plates and spongy lead negative plates immersed in an electrolyte of sulphuric acid
- and water. The battery is fully charged when the electrolyte's specific gravity is around 1.30.
- ☐ Nickel-Cadmium (NiCd) Batteries: Used on larger aircraft. They are lighter and perform
- better at low temperatures than lead-acid batteries but are more susceptible to a condition
- called thermal runaway, where the battery overheats during charging.