

36.1 Advantages of AC Power

- Large modern transport aircraft use AC as their primary power source due to several advantages:
- ☐ AC generators (alternators) are simpler, more robust, and have a better power-to-weight ratio than DC generators.
- ☐ Voltage can be easily stepped up or down using transformers.
- ☐ AC is easily converted to DC where needed using Transformer Rectifier Units (TRUs).
- ☐ Three-phase AC motors are simpler and more efficient than DC motors.

36.2 AC Terminology

- ☐ Cycle: One complete series of alternating values.
- ☐ Frequency: The number of cycles per second, measured in Hertz (Hz). The standard frequency for aircraft AC systems is 400 Hz.
- ☐ Three-Phase AC: Most large aircraft use a three-phase system, where three separate AC outputs are generated 120° out of phase with each other. This provides a smoother, more continuous supply of power.

36.3 Constant Frequency Systems

- To maintain a constant 400 Hz frequency, the alternator must be driven at a constant speed, even as the engine RPM varies. This is achieved by a Constant Speed Drive Unit (CSDU).
- ☐ CSDU: A complex hydromechanical gearbox that takes a variable speed input from the engine and produces a constant speed output to drive the alternator.
- ☐ Integrated Drive Generator (IDG): A modern unit where the CSDU and the generator are combined into a single housing.
- ☐ Paralleling Alternators: To connect multiple AC generators to a common bus bar, their voltage, frequency, and phase sequence must be synchronized. The system then automatically

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- manages load sharing to ensure each generator takes an equal share of the Real Load (kW)
- and Reactive Load (kVAR).

36.4 AC System Components and Backup Power

- ☐ Transformer Rectifier Unit (TRU): A device that uses a transformer to step down the 115V AC to a lower voltage and a rectifier to convert it to 28V DC for powering DC components.
- ☐ Inverter: A device that converts DC power (from a battery) into AC power (typically 115V / 400 Hz). This is used to power essential AC instruments in the event of a total AC generator failure.
- ☐ Auxiliary Power Unit (APU): The APU drives its own AC generator, which can power the entire aircraft electrical system on the ground and serve as a backup generator in flight.
- ☐ Ram Air Turbine (RAT): A final emergency power source. The RAT is a small turbine that deploys into the airstream and spins a small generator or hydraulic pump to power only the most essential flight controls and instruments.

36.5 Bonding and Screening

- ☐ Bonding: The process of electrically connecting all metal parts of the aircraft with flexible wire straps. This ensures that all parts are at the same electrical potential, preventing static electricity from building up and creating a spark (fire) hazard.
- ☐ Screening: Enclosing electrical wires in a metal sheath to prevent the electromagnetic fields they create from causing interference with radio and navigation equipment.
- ☐ Static Wicks: Small, pointed devices on the trailing edges of wings and control surfaces. They are designed to safely discharge static electricity that builds up on the airframe during flight back into the atmosphere, preventing it from interfering with communications.