EASA ATPL(A) · THEORY REVISION

The ATPL Cheat Sheet
021 Aircraft General Knowledge

The facts that actually get tested, stripped to the bone: definitions, key numbers, formulas, mnemonics and the classic exam traps for each subject. Built for the night before, the commute, and the last scroll before you walk into the exam hall.

021 Aircraft General Knowledge | **49** memory items

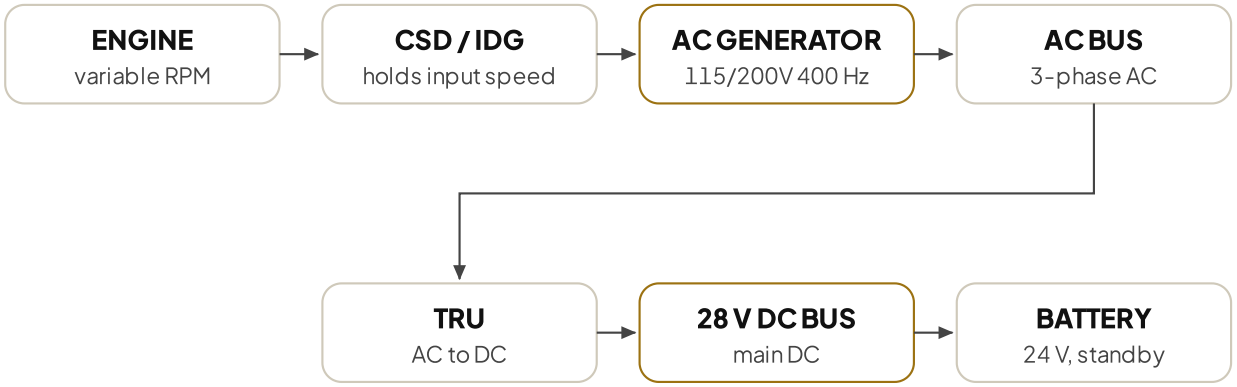
One of 14 subjects; the full set is free at skystudyatpl.com/atpl-cheat-sheet

You are reading the static PDF. The interactive web version of this cheat sheet at **skystudyatpl.com/atpl-cheat-sheet** adds a light and dark theme, a quiz mode that covers every key value so you can test your recall, instant search across every memory item, and hover or tap explanations for every aviation abbreviation. Like the rest of SkyStudy, it is free to use in the browser while the beta is open.

021 Aircraft General Knowledge

Airframe and structures, hydraulics, pneumatics, electrics, engines, propellers, systems.

AC AND DC ELECTRICAL GENERATION CHAIN



Constant-frequency AC: the CSD/IDG holds generator input speed so output stays at 400 Hz. Transformer-rectifier units feed the 28 V DC bus and battery. Modern types (e.g. B787) generate variable-frequency AC and delete the CSD; a RAT gives last-resort emergency power.

MUST-KNOW DEFINITIONS AND CONCEPTS

- Primary structure is **monocoque** (skin carries all loads) or **semi-monocoque** (skin plus stringers and frames share loads); semi-monocoque is standard on transport aircraft.
- **Fail-safe** design keeps adequate residual strength after a single element fails, until damage is found at the next inspection.
- **Damage tolerance**: structure and inspection are designed so a crack grows without catastrophic failure before detection.
- **Fatigue**: cyclic loading (pressurisation cycles, gusts) causes crack initiation and growth over time, independent of a single overload.
- Hydraulics: engine-driven pumps pressurise fluid, reservoirs allow for volume change, accumulators store pressure and dampen pulses; most transports use 3000 psi (some newer types 5000 psi).
- Pneumatic (bleed air): hot high-pressure air tapped from the compressor powers air conditioning, pressurisation, anti-ice and engine start.
- The **Air Cycle Machine** cools bleed air using the Brayton refrigeration cycle (compress, cool, expand), not a vapour cycle.
- Pressurisation: the outflow valve modulates cabin air exit to hold a scheduled cabin altitude and fails to a safe (open) position on loss of power.
- Ice protection: **thermal** (hot bleed air or electric), **pneumatic boots** (inflate to crack ice off), and **fluid** (weeping wing / TKS).
- **Anti-ice** prevents ice continuously; **de-ice** lets ice form then removes it cyclically.
- AC generation: engine-driven generators produce three-phase AC, typically 115/200 V at **400 Hz** on constant-frequency systems.
- A **Constant Speed Drive (CSD/IDG)** turns variable engine speed into a constant generator input speed so output stays at 400 Hz.
- Modern **Variable Frequency** systems (e.g. B787) generate variable-frequency AC and convert as needed, removing the CSD.
- **RAT** (Ram Air Turbine) deploys automatically to give emergency hydraulic and/or electrical power after major power loss.
- The **squat switch** (weight-on-wheels) switches logic between air mode and ground mode (spoilers, reverse, radio-altimeter callouts, pressurisation).
- Oxygen: gaseous cylinders for the crew, chemical generators (sodium chlorate) for passenger drop-down masks on most narrowbodies.
- Piston engine: **Otto cycle**, four-stroke, spark ignition, idealised constant-volume heat addition.
- Turbine engine: **Brayton cycle**, continuous flow, idealised constant-pressure heat addition.
- **Bypass ratio**: fan bypass mass flow divided by core mass flow; high-bypass engines are more efficient and quieter at airline cruise speeds.
- Constant-speed (variable-pitch) propellers use a governor to hold selected RPM by varying blade angle; **feathering** aligns blades with the airflow to stop windmilling drag.

KEY NUMBERS, LIMITS AND VALUES

- Standard transport AC frequency: **400 Hz**; generator output **115 V** line-to-neutral / **200 V** line-to-line, three-phase.
- Typical hydraulic pressure **3000 psi**; some modern types **5000 psi** VERIFY.
- Maximum certificated cabin altitude for a pressurised transport at max operating altitude: **8000 ft**.
- Cabin altitude warning typically triggers around **10,000 ft** cabin altitude VERIFY.
- Aircraft DC bus typically **28 V DC**; battery commonly **24 V** (Ni-Cd or lead-acid), fed via transformer-rectifier units.
- Turbine gas temperature limits (EGT/ITT/TGT) are engine-type specific and lowest at start; do not memorise a generic number VERIFY.
- Fire protection: typically **two bottles per engine**, discharged from the flight deck.
- V-speeds are aircraft-specific; for 021 learn the definitions, not fixed numbers.
- ISA reference for systems work: 1013.25 hPa, 15 C, 1.98 C/1000 ft to the tropopause at 36,090 ft.

FORMULAS AND RELATIONSHIPS

- Otto cycle efficiency rises with **compression ratio** (idealised constant-volume heat addition).
- Brayton cycle efficiency rises with **overall pressure ratio** (idealised constant-pressure heat addition).
- Thrust is proportional to **mass flow times change in velocity** (Newton's third law).
- AC output frequency is proportional to rotational speed, f = (pole pairs x RPM)/60, so the CSD must hold input speed constant for 400 Hz.
- Gas law PV = nRT underlies pressurisation and bleed systems: compressing bleed air raises pressure and temperature, so it needs cooling before cabin use.
- Basic electrical relationships V = IR and P = VI apply to DC systems, generator loading and load-shedding.

MNEMONICS AND MEMORY ITEMS

- **Anti before, De after**: anti-ice prevents ice, de-ice removes it once formed.
- **CSD keeps it constant**: Constant Speed Drive gives a constant 400 Hz.
- **Brayton = continuous burn** (turbine); **Otto = one bang per two revolutions** (piston).
- Squat switch: weight **on** wheels = ground logic; weight **off** wheels = air logic.
- Feathered blades turn edge-on to the wind (flat to the flow) to kill drag.
- **RAT** deploys when you lose the juice: last-resort emergency power.

COMMON EXAM TRAPS

- Do not confuse **anti-ice** (continuous prevention) with **de-ice** (cyclic removal); boots are de-ice, hot leading edges are usually anti-ice.
- Do not swap **Otto** (piston, intermittent, constant-volume) with **Brayton** (turbine, continuous, constant-pressure).
- 400 Hz is the standard constant frequency, but not every modern aircraft uses fixed frequency; some use variable-frequency generation with converters.
- Cabin altitude and aircraft altitude differ: the cabin is always at a lower altitude (higher pressure) than the aircraft in cruise; the 8000 ft limit is a design limit, not a target.
- Accumulators store energy and dampen pulses; the **pump** is the source of sustained pressure.
- The propeller governor controls **blade angle to hold RPM**; the power lever sets power, the RPM lever sets the governor target.
- Weight-on-wheels logic gates many unrelated systems (spoiler arming, autobrake, reverse, radio-altimeter callouts).
- Do not conflate **fail-safe** (structural redundancy) with **damage tolerance** (inspection-driven crack management).

EXAM FIGURES FROM THE SKYSTUDY QUESTION BANK

Gas turbine layout: the gas-path & stations

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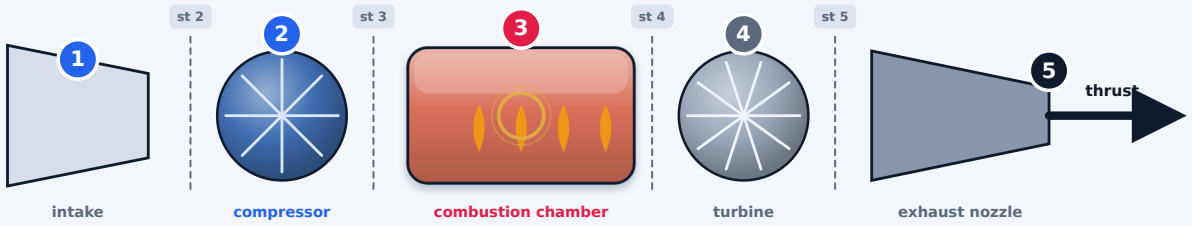

Turbofan: a fan and bypass duct wrap this core; station numbers mark gas-path boundaries.

1 Air intake

Slows and diffuses the incoming air, raising its static pressure before it reaches the compressor (station 2).

2 Compressor

Axial or centrifugal stages raise the air's pressure (and temperature) between stations 2 and 3.

3 Combustion chamber

Fuel burns continuously at roughly constant pressure, adding heat and greatly raising the gas temperature (station 3 to 4).

4 Turbine

Extracts enough energy from the hot gas (station 4 to 5) to drive the compressor on the same shaft.

5 Exhaust nozzle

Accelerates the remaining energy in the gas to a high velocity, producing thrust by reaction.

6 Brayton cycle & stations

The gas-path mirrors the Brayton cycle of compression, heat addition and expansion; stations 2 to 5 mark each stage boundary.

Intake, compressor, combustor, turbine, nozzle: the turbine only extracts enough energy to drive the compressor, the rest accelerates out as thrust. Drawn in code.

Hydraulic system schematic

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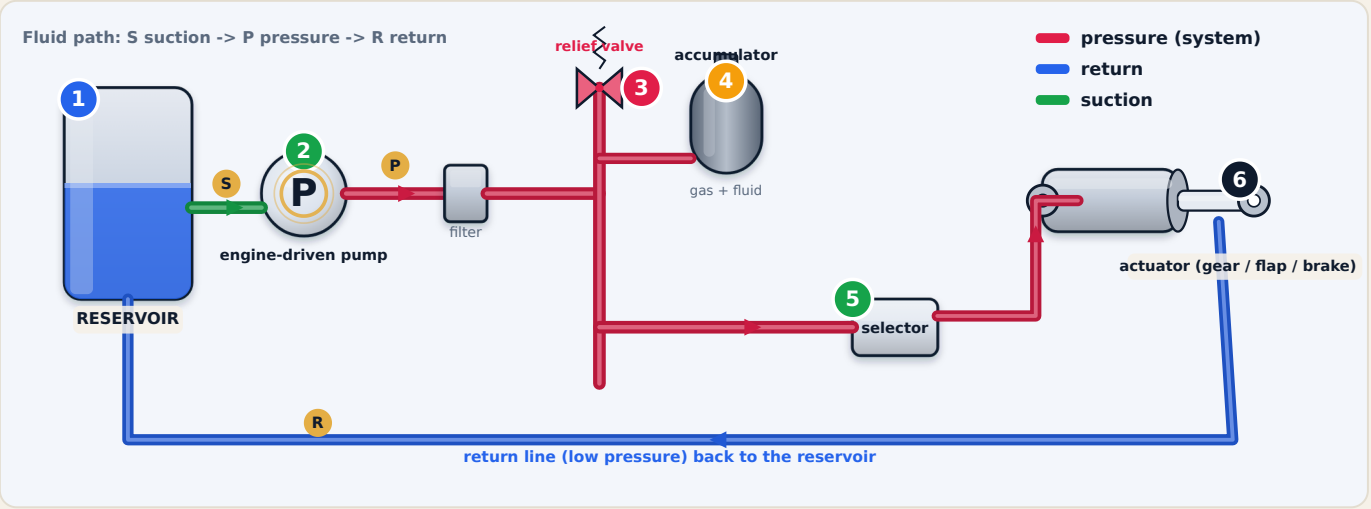

1 Reservoir
Stores fluid, allows for thermal expansion and actuator demand, and lets air separate out; often slightly pressurised to feed the pump.

2 Pump
Engine-driven (EDP) or electric (EMP) pumps raise the pressure; constant-delivery pumps need a regulator, but variable-delivery pumps self-regulate flow, so no unloading valve is needed.

3 Pressure relief valve
A safety valve that dumps fluid back to return if pressure exceeds a set maximum, protecting the system from over-pressure.

4 Accumulator
A gas-charged vessel that dampens pump pulsations, stores energy for peak demand and gives a short emergency supply.

5 Selector valves
Direct pressure to one side of an actuator and connect the other side to return, so the user moves the chosen way.

6 Actuators
Linear (jacks) or rotary (motors) convert pressure into the force that moves gear, flaps, brakes and flight controls.

Pump raises pressure from the reservoir; a relief valve caps it, an accumulator smooths and stores it, selectors feed the actuators, then fluid returns. Drawn in code.

Two of the 369 code-drawn study figures inside the SkyStudy question bank. Try them with the free demo at **skystudyatpl.com/demo**.

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