

15.1 The Need for Cooling

- The thermal efficiency of a piston engine is only about 25-28%⁶⁶. Over 70% of the heat
- energy from combustion is wasted, with about 40% going out the exhaust and 32% being
- absorbed by the engine components and oil⁶⁷. This excess heat must be removed to prevent:
 - ☐ Breakdown of the oil's lubricating properties.
 - ☐ Structural failure of engine components.
 - ☐ Pre-ignition and detonation⁶⁸.
- However,
- over-cooling is also detrimental, as it reduces the BHP available and can lead to poor fuel
- vaporization⁶⁹.

15.2 Cooling System Types

- ☐ Liquid Cooling: Uses a mixture of water and ethylene glycol pumped through passages in
- the engine and cooled by an air-cooled radiator⁷⁰. While efficient, these systems are heavy.
- ☐ Air Cooling: This is the preferred method for most aircraft piston engines due to its
- simplicity and lighter weight⁷¹. It relies on the flow of air over the engine.
- Cooling Fins: The cylinders are covered in thin metal fins to greatly increase the surface area
- available for heat dissipation⁷².
- Cowling and Baffles: The engine is enclosed in a streamlined cowling with internal baffles
- that are designed to direct the cooling air evenly over all cylinders⁷³⁷³⁷³.
- Cowl Flaps: These are adjustable doors at the cooling air outlet. They are opened during
- high-power, low-airspeed conditions (like takeoff and climb) to maximize airflow and
- cooling. They are closed during cruise and descent to maintain optimal engine temperature
- and reduce drag⁷⁴.

15.3 Monitoring Engine Temperature

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- ☐ Cylinder Head Temperature (CHT) Gauge: The pilot monitors engine temperature with a
- CHT gauge⁷⁵. The sensor is a
- thermocouple, which produces a voltage proportional to its temperature⁷⁶. If only one is
- fitted, it will be on the hottest-running cylinder, typically one of the rear ones⁷⁷.

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