

COOLING SYSTEM

In an internal combustion engine, fuel is burned, resulting in the production of a tremendous amount of heat.

This heat is distributed across the engine and absorbed by the metal.

Without some sort of engine cooling, this heat would result in warping which would end in engine failure.

Some airplanes use liquid coolant.

The most common method of dissipating engine heat is by circulating cooler air around the engine cylinders.

Horizontally opposed and radial engines are air-cooled.

Some in-line engines are air-cooled; a few are liquid cooled.

PARTS OF AN AIR COOLING SYSTEM

FINS:

- Added to the external surface of the engine cylinders to provide a greater surface area for heat to be absorbed,
- Ram air enters the engine cowls and cools the fins as it passes by, and
- Openings in the rear of the cowls expel this air.

COWLING FLAPS:

- Devices that control the size of the openings at the rear of the engine cowls, and
- The baffles then force the cooling air around the cylinders.

COOLING FANS:

- Gear driven,
- Mounted on the front of the engines, and
- Assist the flow of cooling air at higher altitudes.

AUGMENTOR TUBES:

- Also known as jet pumps,
- Direct exhaust gases through these tubes,
- Produces suction strong enough to increase the flow of cooling air past the cylinders.

4 FUNCTIONS OF OIL

1. **Cooling:** Carries away excessive heat generated by the engine.
2. **Sealing:** Provides a seal between the piston rings and cylinder walls, preventing "blow-by" loss of power and excessive oil consumption.
3. **Lubrication:** Prevents wear and tear of metal parts by maintaining a film to reduce friction.
4. **Flushing:** Cleans and flushes engine interior of contaminants that enter or are formed during combustion.

REQUIREMENTS OF A GOOD OIL

1. **VISCOSITY** is the resistance to flow, stickiness or body:
 - gives proper distribution of oil throughout the engine and prevents rupturing of the oil film,
 - an oil with a high viscosity index is one in which the changes in viscosity, due to varying operating temperatures, are small,
 - use of an oil of too high viscosity will cause high oil pressure, and
 - use of an oil of too low viscosity will cause low oil pressure.
2. **HIGH FLASH POINT:**
 - temperature beyond which a fluid will ignite, and
 - should be in excess of the highest engine temperature.
3. **LOW CARBON CONTENT:**
 - to leave as little carbon as possible should oil work past the scraper ring and burn,
 - good oil should also have a low wax content, and
 - oils, which have good resistance to deteriorate and the formation of lacquer and carbon deposits, are said to have good oxidation stability.
4. **LOW POUR POINT:**
 - the temperature at which a fluid solidifies, and
 - necessary for cold weather starting

METHODS OF LUBRICATION

FORCE FEED BY DRY SUMP

- Oil is contained in a separate tank,
- Forced under pressure from a pressure pump through the hollow crankshaft to lubricate the engine,
- A by-pass around the filter is incorporated to prevent damage in case of failure to clean the filter, and
- Gauge to monitor oil pressure.

FORCE FEED BY WET SUMP

- Oil supply is contained in a sump or pan under the crankcase.
- Oil passes through a filter into a suction type of pressure pump.
- Pressure pump is engine driven.
- Advantage: light weight and simple, being free of extra tank, tubing and linkages characteristic of dry sump system.
- But limited by the size and design of the nacelle or cowling.

FUEL SYSTEM

- Stores and delivers the proper amounts of fuel at the right pressure to meet the demands of the engine.
- Usually several tanks to store the quantity of fuel required to give the airplane reasonable range.
- Tanks usually located in the wings, although extra tanks may be added.
- Pilot can switch between tanks by way of selector valve.

TYPES OF FUEL SYSTEMS

1. **GRAVITY FEED:** Used in high-wing aircraft (when fuel tanks are above engine). Gravity does the work.
2. **FUEL PUMP:** Used in low wing aircraft (when tanks are not above engine). Electric and/or engine driven pump does the work.

COMPONENTS OF THE FUEL SYSTEM

FUEL TANKS:

- vary in size, shape and location,
- construction material is light and chemically inert to fuel,
- have a drain at the bottom and have internal baffles to prevent spilling during sudden changes of attitude, and
- the tops of the tank are vented to maintain atmospheric pressure inside the tank.

FUEL SELECTOR CONTROL:

- this device permits the pilot to select from which tank he/she wants to draw fuel

FUEL LINE AND FILTERS:

- connect the fuel tanks to the carburetor,
- made of varying materials, and
- one or several filters present prior to reaching the carburetor.

FUELS

- Fuels for modern high compression engines must burn slowly and expand evenly rather than explode quickly.
- The fuels that possess this quality are known as high octane fuels.

OCTANE RATING:

- Octane – a substance which possesses minimum detonating qualities.
- Heptane – a substance which possesses maximum detonating qualities.
- The proportion of octane to heptane in a fuel is expressed as a percentage.

GRADES OF FUEL

USAGE	GRADE OR TYPE	COLOUR
Low power output	Grade 80 (or 80/87)	red
Medium power output	Grade 100 (high lead)	green
Medium power output	Grade 100 LL (low lead)	blue
Jet fuel	Kerosene	clear/straw

IF PROPER GRADE IS NOT AVAILABLE, USE THE NEXT HIGHER GRADE.