

Allison Engine Quiz Answers:

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- What is the nominal coolant temperature rise through the engine? **Answer:** At takeoff, 3000 rpm, the coolant temperature will increase about 9 – 10 degF as it passes through the engine. At lower rpms the temperature increase remains about 9 – 10 degF because the speed of the coolant pump decreases proportionally.
- What was done to make the left-turning V-1710-15(C9) engine for the XP-38?
 - A. Reversing idler gear fitted in the reduction gear
 - B. Reversed the crankshaft, end-for-end
 - C. Reversed the firing order
 - D. Built a new crankshaft with opposite throws

Answer: “D”, A new crankshaft was fabricated with the throw sequence reversed, effectively appearing as if the crank had been rotated end-for-end, as was done on the later E/F model engines. The early C/D model engines had the propeller drive gear machined integrally with the crank, where the later E/F engines bolted the drive coupling to the “front” of the crankshaft. In either case new ignition wiring is required to match the revised firing order between banks. In both instances an idler was required in the accessory drives to keep the cams and supercharger rotating the same direction.

- Approximately how many V-1710s were built? **Answer:** About 70,000.
- Approximately how many V-3420s were built? **Answer:** About 157.
- How many ounces of silver are used to plate the main and connecting rod bearings in one engine? **Answer:** Approximately 37 ounces, (2.3 pounds, one kilogram) which during the 1940s cost approximately \$1/oz. At the current market price of \$12.50/oz, the value of the silver in a single engine is approximately \$462.50.
- What is the maximum allowable percentage of water in the coolant of a wartime V-1710? **Answer:** A maximum of 4%. Pure ethylene glycol was used, with approximately 0.5 % corrosion and foam preventing additive. Ethylene glycol is “hygroscopic”, meaning that it will draw in water vapor whenever it is open to the atmosphere. Furthermore, when coolant was changed in the aircraft the old coolant was flushed from the system using water, which could not be fully drained. Hence the need to allow for up to 4 % water in the system, which caused the operating pressure in the system to increase to about 2 – 3 psig, and determined the header tank relief valve setting of 5 psig. Water in excess of this amount seriously increases system pressure, and reduces the boiling point of the coolant.

- What were the five supercharger gear ratios used in V-1710-E/F/G production engines? **Answer:** 6.44:1 (-27/29 P-38 sea-level engines), 7.48:1 (-49/53 and -51/55 P-38 sea-level engines), 8.10:1 (later P-38 and P-63 sea-level rated engines), 8.80:1 and 9.60:1 altitude rated engines used in P-39, P-40, and P-51A.
- At 3000 rpm, how many horsepower is used to drive a 9.6:1 engine stage supercharger at takeoff? **Answer:** About 230 horsepower.
- At 3000 rpm, how many horsepower is used to drive a 6.44:1 engine stage supercharger at takeoff? **Answer:** About 100 horsepower. **Comment:** In both instances the engines are rated on Grade 100/130 fuel, so the IMEP acting on the pistons is the same, the horsepower delivered to the crankshaft is the same, and the friction in the engine is the same. Since the supercharger requires less horsepower with the lower gear ratio the engine BHP (power delivered by the crankshaft to the propeller) is actually greater, by 130 bhp in this case. The reason for using the higher supercharger gears was to raise the rated critical altitude of the engine.
- What is the “g” load on the piston when running at 3000 rpm and it reverses direction at TDC? **Answer:** Approximately 1000 g’s. **Comment:** The new ACE Allison’s pistons are about 6 ounces lighter than stock Allison pistons, meaning that the load on the connecting rod bearing (which is maximum during the exhaust stroke) is reduced by 375 pounds.