

Engine Specification No. 123-E

Date Issued: Dec. 19, 1938  
Revised: June 1, 1939  
Alternate: June 7, 1939  
Revised: Sept. 30, 1939  
Revised: Oct. 20, 1939  
Revised: Sept. 20, 1940

MODEL SPECIFICATION FOR  
ENGINE, AIRCRAFT MODEL V-1710-39

ALLISON DIVISION  
General Motors Corporation  
Indianapolis, Indiana

(ALLISON MODEL DESIGNATION V-1710-F3R)

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Allison Division of General Motors Corp.

(Allison Model Designation V-1710-F3R)

A. APPLICABLE SPECIFICATIONS.

A-1. The current issue of the following specifications in effect on date of issuance of proposals shall form a part of this specification:

AN-9500 - Engines, Aircraft, General Specifications.

U.S. Army 95-28710 - Engine, Aircraft Type V-1710 (Allison) Type Specification For

B. TYPE.

B-1. This specification covers the requirements for the Model V-1710-39 engine.

C. GENERAL REQUIREMENTS.

C-1. The requirements of specifications listed in Section A shall constitute general requirements for the engine.

D. DETAIL REQUIREMENTS.

D-2. Drawings. - The following Allison Engineering Company drawings form part of this specification:

- 37551-B Engine Assembly, Complete - (showing accessory drive oil seals.)
- 37550-C Installation Drawing (showing clearances for engine accessories and their removal.)
- 36905-B Priming System Assembly
- 37364-C Screen Assembly, air inlet
- 36398-C Gasket, Screen, air inlet
- 37791-A Carburetor, PD-12K2 Bendix Stromberg

- 37228-D Spark Plug Assembly BG LS321
- 37696-D Spark Plug Assembly Aero LS-3AD
- 37466-C Terminal, Spark Plug(Contact)
- 37230-A Lubrication System Diagram  
Clearance Chart
- 33006-K Magneto
- 37980-B Radio Shielding Assembly
- 37583-B Manifold Assem.--Spark Plug Cooling R.H.
- 37584-B Manifold Assem.--Spark Plug Cooling L.H.
- 33536-E Nut - Magneto Cable Shielding Conn.
- 36496-B Nut - Spark Plug Shielding
- 37463-E Shielding-Spark Plug Cable-Intake
- 37476-H Shielding-Spark Plug Cable-Exhaust

D-4. Weight. - The dry weight of this engine complete shall not exceed 1310 pounds.

D-5. Performance Characteristics. - The engine shall be rated as follows, using fuel conforming to Specification AN-9531 and oil conforming to Specification AN-9532, Grade 1120.

The terms used herein and the standard conditions are in accordance with the applicable definitions specified in Specification AN-9503.

880 B.H.P. at 2600 R.P.M. at sea level

1000 B.H.P. at 2600 R.P.M. at 10,800 ft., normal

1150 B.H.P. at 3000 R.P.M. take-off for 5 minutes

1150 B.H.P. at 3000 R.P.M. military rating at  
12,000 ft., military rated altitude

3120 R.P.M., rated overspeed dive R.P.M.

D-5a. The curves shown on pages 8 to and including page 9 shall form a part of this specification, and together with the ratings given above, shall constitute the power and specific fuel consumption guarantees.

D-5c. Specific Oil Consumption. - The specific oil consumption shall not exceed .025 lb./BHP/Hr. at normal rated power and speed, .025 lb./BHP/Hr. at 70 per cent normal rated power and 89 per cent normal rated speed.

D-7. Propeller. - The engine shall have a No. 50 propeller shaft end. Provision shall be made for a governor type of propeller control mechanism of the hydromatic type.

D-12. Overall Dimensions. - The overall dimensions of the engine shall not exceed the following:

Length	88-3/8 inches
Width	29-9/32 inches
Height	36-17/32 inches

D-14. Preparation for Storage. - The engine shall be prepared for storage prior to shipment, in accordance with the current issue of Air Corps Technical Order No. 02-1-1 using corrosion preventive compound conforming to Air Corps Specification No. 3568-B where Specification 3568 is called for by the technical order.

D-16b. Parts List of the Engine. - The parts list which successfully completes Government tests shall form a requirement of this specification.

D-18. Propeller Drive. - The engine shall be equipped with a reduction gear ratio of 2.00:1. The direction of propeller rotation, when viewed from the anti-propeller end, shall be clockwise only.

D-19. Impeller Gear. - The impeller gear ratio shall be 8.80:1 and the impeller shall be 9-1/2 inches in diameter.

D-20. Pistons. - The engine shall be fitted with pistons of 6.65:1 compression ratio.

D-23a(1). Spark Plugs. - The engine shall be fitted with BG LS321 and Aero LS-3AD Spark Plugs.

D-23b. Radio Shielded Ignition Assemblies. - The engine shall be equipped with radio shielded ignition assemblies with the following exceptions to Specification AN-9510:

(1) (Reference, paragraph D-1e Mounting Lugs) Mounting clamps shall be provided in place of integral, soldered, or welded mounting lugs.

(2) (Reference, paragraph E-8 Capacitance) The capacitance between the shielding and each ignition cable contained therein shall not exceed 175 micro-microfarads.

(3) (Reference, paragraph E-1a, Single Cable Conduits) Single cable conduit connections shall be as shown on Allison Drawings Nos. 33536, 36496, 37463, and 37476.

D-23d. Magnetos. - The engine shall be equipped with one Scintilla Type DF 4 pole magneto in accordance with Air Corps Specification No. 28159, Allison Drawing No. 33006.

D-23d(2). Distributors. - (Reference, Specification AN-9511, paragraph E-4) - Separate distributors shall be provided with distributor block cable connections in accordance with Fig. 13 except that the clearance between the contact screw point and wall of cable hole shall be .001" to .080".

D-23g. Cooling. - (Reference, Specification AN-9500, paragraphs D-23g and D-23g(1)) - The engine shall be so designed as to permit the installation of adequate means for cooling the magnetos to required maximum temperature of 80°C. (176°F.). Provision for cooling the spark plugs and spark plug elbows shall consist of air ducts, as shown in installation drawing No. 37550 and drawings Nos. 37583 and 37584, to which the airplane manufacturer shall connect. For flight and ground operation, spark plug elbows shall be satisfactory provided the ignition wire temperature measured in the elbow does not exceed 115°C. (239°F.) and provided the cable furnished in accordance with Specification AN-9512 does not fail below this temperature.

D-24j(1). Oil Connections. - (Reference, Specification AN-9500, paragraph D-24j(1)) - The oil inlet and outlet flanges shall conform to the dimensions of appendix No. 15, but no oil connections shall be furnished with the engine.

D-25. Fuel Metering System. - The engine shall be equipped with one Bendix-Stromberg Model PD-12K2 injection carburetor in accordance with Specification AN-9515, except for the following:

- (1) (Reference paragraph C-1c, Steel Parts) Lockwashers and bent washers shall not be plated.
- (2) (Reference paragraph D-8, Strainer) The carburetor shall meet requirements except that foreign material is not removed with the strainer.
- (3) (Reference paragraph D-12, Fuel Line Connection) The fuel inlet connection shall be one 3/4" pipe thread.

- (4) (Reference paragraph D-17, Control Levers) The carburetor shall meet requirements except that there are 110 degrees in which the throttle lever cannot be installed due to interference.
- (5) (Reference paragraph D-21a, Idle Mixture Adjustment Marking) The carburetor has the direction of adjustment marked, but not the rich and lean limits.
- (6) (Reference paragraph D-26, Inserts) Stainless steel inserts shall not be cadmium plated.
- (7) (Reference paragraph D-34 Metering Characteristics) The carburetor shall reproduce the desired flow curve, in the region between 30 per cent and 70 per cent of air flow at engine normal rated power and speed, within a tolerance of plus or minus 2 per cent. The tolerance at altitude shall be plus or minus 3 per cent of master carburetor up to 16,000 ft. altitude and plus or minus 4 per cent of master carburetor at altitudes above 16,000 feet.

D-32. Exhaust System. - The engine shall not be equipped with a hot spot.

D-32a. Exhaust Flanges. - Exhaust flanges and gaskets in accordance with installation drawing No. 37550 shall be furnished with the engine.

D-36. Accessory Drives. - The gear ratio of each accessory drive to the engine crankshaft, the maximum permissible torque in inch-pounds for continuous operation, the maximum permissible static torque in inch-pounds, and the direction of rotation when looking at the end of the accessory drive shaft in the engine shall be as follows:

<u>Accessory Drives</u>	Ratio to Crankshaft	<u>TORQUE RATINGS</u>		<u>Rotation</u>
		<u>In. - Lbs.</u>	<u>Continuous</u>	
<u>Starter</u>	1.000:1	-	16200	C
<u>Generator or Accessory Gear Box Drive</u>	1.440:1	600	6000	C
<u>Fuel Pump</u>	0.864:1	25	450	C C
<u>Vacuum Pump (Rear)</u>	1.440:1	150	2250	C
<u>Vacuum Pump (Side)</u>	1.440:1	150	2250	C C
<u>Tachometer (two drives)</u>	0.500:1	2.5	12.5	C
<u>Propeller Governor</u>	0.845:1	53	150	C C

Note: C C indicates counter clockwise rotation.

C indicates clockwise rotation.

D-36a. Starter. - The starter mounting pad diameter shall be 6 inches. The direction of rotation when looking at the starter dog attached to the engine shall be clockwise. The number of jaws on the starter dog shall be 3.

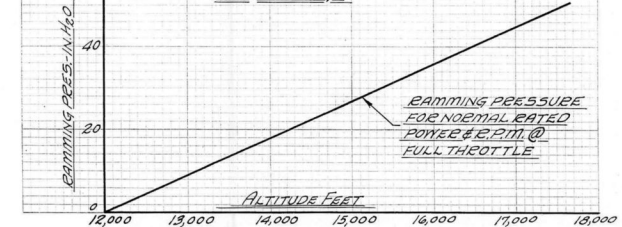
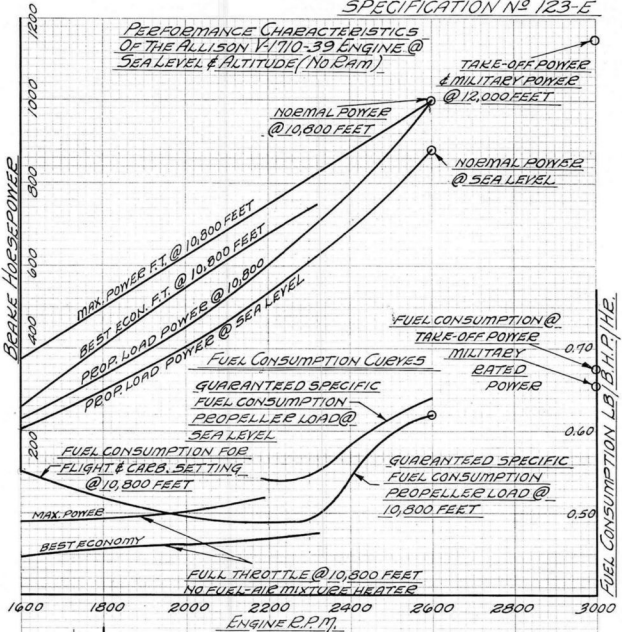
D-36a(1) (Reference, Specification AN-9517 paragraph E-4b) Clearance shall be provided as shown on installation drawing No. 37550.

D-36c. Power Take-off Drive. - A power take-off drive shall not be provided for driving a gear box assembly.

D-36e. Gun Synchronizer Impulse Generator. - (Reference, Specification AN-9500, paragraph D-36e) The gun synchronizer mounting pad and external spline drive shall be in accordance with Specification AN-9520 excepting that the pad shall be located in a plane perpendicular to the longitudinal axis of the crankshaft. Accomplishment of AN type drive shaft and flange is effected by the use of an adapter assembly which will assemble direct to the synchronizer opening normally provided for the Allison type E-4 synchronizer.

F-2c(2) The cooling liquid outlet temperature shall be 121°C. (250°F.) The coolant flow shall be 215 plus or minus 10 per cent G.P.M. at maximum engine R.P.M.

PERFORMANCE CHARACTERISTICS  
OF THE ALLISON V-1710-39 ENGINE @  
SEA LEVEL & ALTITUDE (NO RAM)





**TO FIND ACTUAL HORSEPOWER FROM ALTITUDE, R.P.M., MANIFOLD PRESSURE AND AIR INLET TEMP**

- 1 LOCATE A ON FULL THROTTLE ALTITUDE CURVE FOR GIVEN R.P.M. & MANIFOLD PRESS.
- 2 LOCATE B ON SEA LEVEL CURVE FOR R.P.M. & MANIFOLD PRESSURE & TRANSFER TO C.
- 3 CONNECT A & C BY STRAIGHT LINE & READ HORSEPOWER AT GIVEN ALTITUDE D.
- 4 MODIFY HORSEPOWER AT D FOR VARIATION OF AIR INLET TEMPERATURE Y FROM STANDARD ALTITUDE TEMPERATURE  $T_s$  BY FORMULA:-

$$\left[ \frac{HP}{AT D} \right] \times \sqrt{\frac{460 - Y}{460 + T_s}} = \text{ACTUAL HP}$$

(APPROXIMATELY 1% CORRECTION FOR EACH 1°F VARIATION FROM  $T_s$ )

**CORRECTIONS FOR VARIATION OF AIR INLET TEMPERATURE**  
 FROM 60° SHOULD BE MADE BY THE FORMULA:-

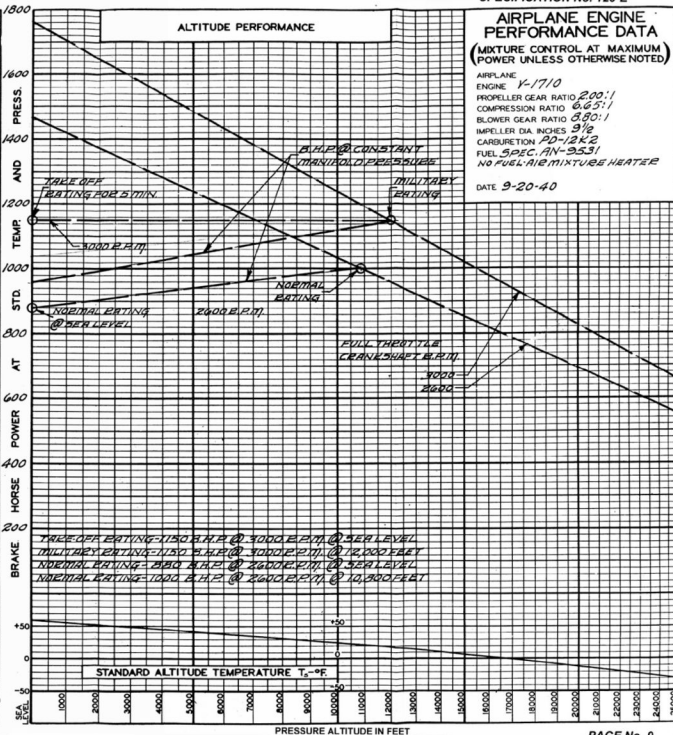
$$\left( \frac{520 - Y}{520} \right) \times \text{CORRECTED HP} = \text{ACTUAL HP}$$

MANIFOLD PRESSURE @ NORMAL RATING - 36.5 IN. Hg  
 MANIFOLD PRESSURE @ TAKE-OFF - 45.5 IN. Hg

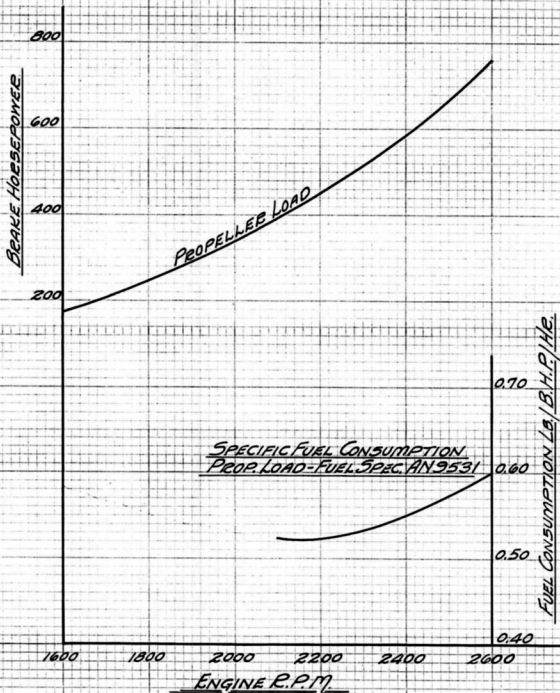
**SEA LEVEL PERFORMANCE**
**ALTITUDE PERFORMANCE**
**AIRPLANE ENGINE PERFORMANCE DATA**  
 (MIXTURE CONTROL AT MAXIMUM POWER UNLESS OTHERWISE NOTED)

AIRPLANE ENGINE Y-1710  
 PROPELLER GEAR RATIO 200:1  
 COMPRESSION RATIO 6.65:1  
 BLOWER GEAR RATIO 3.80:1  
 IMPELLER DIA. INCHES 3 1/2  
 CARBURETOR PD-12K2  
 FUEL SPEC. AN-2531  
 NO FUEL/AIR MIXTURE HEATER

DATE 9-20-40

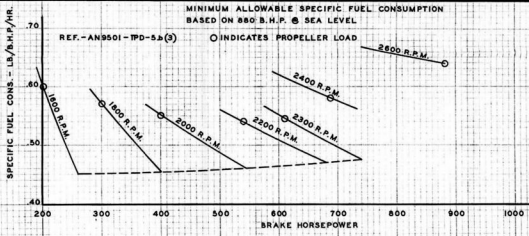
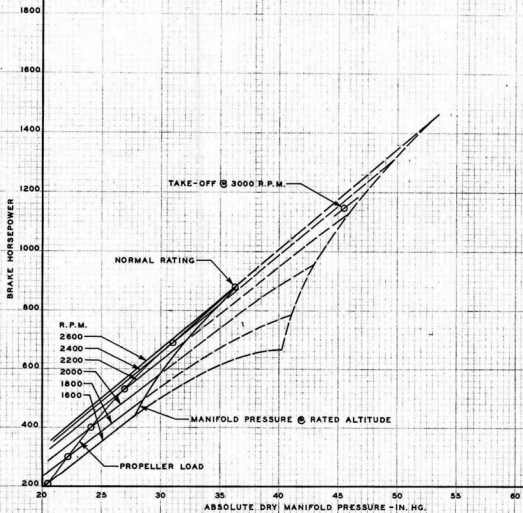


APPENDIX TO ALLISON SPECIFICATION 123-E  
GUARANTEED PERFORMANCE CHARACTERISTICS OF  
THE ALLISON V-1710-F3R ENGINE @ 18,250 FT. ALTITUDE  
WITHOUT RAM OR 20,000 FT. WITH 1750 FT. RAM



MANIFOLD PRESSURE @ SEA LEVEL WITHOUT RAM

REF. - AN9501 - TPD-5<sub>b</sub>(1)



SPECIFICATION IN-11-27

# AIRPLANE ENGINE PERFORMANCE DATA

(AT GUARANTEED MINIMUM SPECIFIC FUEL CONS.)

AIRPLANE  
ENGINE V-1710-39  
PROPELLER GEAR RATIO 2.0:1  
COMPRESSION RATIO 6.65:1  
BLOWER GEAR RATIO 8.60:1  
IMPELLER DIA. INCHES 9½  
CARBURETION PD12K2  
FUEL SPEC. AN9531-100 OCT. (ARMY)

DATE 9-20-40

## ALTITUDE PERFORMANCE WITHOUT RAM

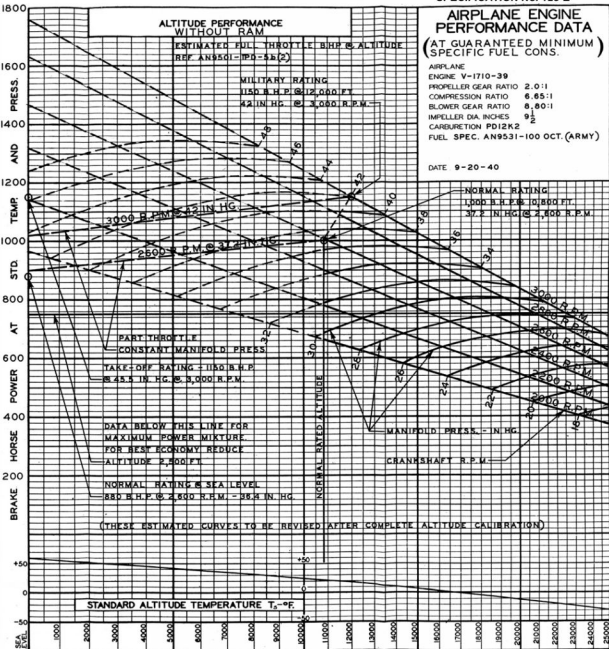
ESTIMATED FULL THROTTLE BHP @ ALTITUDE  
REF AN9531-100-55(2)

### MILITARY RATING

1150 B.H.P. @ 12,000 FT.  
42 IN. HG. @ 3,000 R.P.M.

### NORMAL RATING

1000 B.H.P. @ 8,000 FT.  
37.2 IN. HG. @ 2,800 R.P.M.

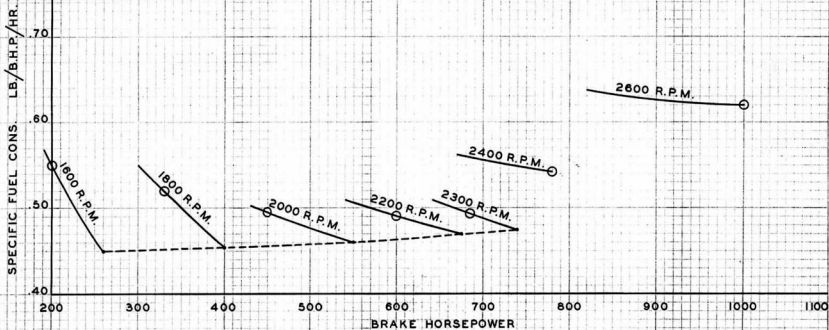


ALLISON V-1710-39 ENGINE PERFORMANCE @ 10,800 FEET  
ALTITUDE GUARANTEED MIN. SPECIFIC FUEL CONS.  
VERSUS B.H.P. FOR VARIOUS CRANKSHAFT SPEEDS (WITHOUT RAM)

1000 B.H.P. @ 10,800 FEET

REF: AN 9501-TPD-5b(3)

○ INDICATES PROPELLER LOAD



ALLISON V-1710-39 ENGINE PERFORMANCE @ 18,250 FEET  
ALTITUDE GUARANTEED MIN. SPECIFIC FUEL CONS.  
VERSUS B.H.P. FOR VARIOUS CRANKSHAFT SPEEDS (WITHOUT RAM)  
OR 20,000 FEET WITH 1750 FT. RAM

REF: AN-9501 - TPD-5b(3) &

