Engine Specification No. 119-D

Date Issued:	September 9, 1938
Revised:	March 7, 1939
Revised:	March 22, 1939
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MODEL SPECIFICATION FOR

ENGINE, AIRCRAFT MODEL V-1710-27

ALLISON DIVISION

General Motors Corporation

Indianapolis, Indiana

(ALLISON MODEL DESIGNATION V-1710-F2R)

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Allison Division of General Motors Corp.

(Allison Model Designation V-1710-F2R)

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	- Engine, 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-1710-27 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:

36971-	Engine Assembly, Complete - (showing accessory drive oil seals.)
36970-C	Installation Drawing (showing clearances for engine accessories and their removal.)
36905-B	Priming System Assembly
36399-C	Screen Assembly, air inlet.
36398-C	Gasket, Screen, air inlet.
37261-C	Carburetor, PD-12G1 Bendix Stromberg
37228-A	Spark Plug Assembly BG LS321

37248-B Spark Plug Assembly Aero LS-4AD

37466-A Terminal, Spark Plug (Contact)

37230-A Lubrication System Diagram

33006-J Magneto

37515-A 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.

37696 Spark Plug Assembly LS-3AD.

D-3. Acceptance. - (Reference, Specification AN-9502 Paragraph F-3c) - Power calibrations of engine shall be made without loading the accessory drives.

D-4. Weight - The dry weight of this engine complete shall not exceed 1305 pounds.

D-5. Performance Characteristics. - The engine shall be rated as follows, using fuel conforming to Specification AN-9530 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.

1000 B.H.P. at 2600 R.P.M. at sea level

1000 B.H.P. at 2600 R.P.M. at 25,000 ft. with an exhaust turbo supercharger installation of suitable output.

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 25,000 ft., military rated altitude, with an exhaust turbo supercharger installation of suitable output.

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 govemor 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	85 5/8 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.

D-19. Impeller Gear. - The impeller gear ratio shall be 6.00:1 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-4AD or 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 drawing No. 33536.

D-23c. Ignition Cable. - (Reference, Specification AN-9500, paragraph D-23c) Ignition cable shall conform to Air Corps Specification No. 32152 except that the wire diameter shall be .011" in lieu of .013".

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 Figure 13, except that the clearance between the contact screw point and wall of cable hole shall be .001" to .080".

D-23g. Cooling. - (Reference AN-9500 Specification, 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. 36970 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 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-12G1 injection carburetor, in accordance with Specification AN-9515 except for the following:

(1) Steel Parts. - (Reference, paragraph C-1c) - Lockwashers and bent washers shall not be plated.

(2) Strainer. - (Reference, paragraph D-8) - The carburetor shall meet requirements except that the foreign material is not removed with the strainer.

(3) Fuel Line Connection. - (Reference, paragraph D-12) The fuel inlet connection shall be one 3/4" pipe thread.

(4) Control Levers. - (Reference, paragraph D-17) The carburetor shall meet requirements except that there are 110 degrees in which the throttle lever cannot be installed due to interference.

(5) Idle Mixture Adjustment Marking. - (Reference, paragraph D-21a) The carburetor has the direction of adjustment marked, but not the rich and lean limits.

(6) Inserts. - (Reference, paragraph D-26) Stainless steel inserts shall not be cadmium plated.

(7) Metering Characteristics. - (Reference, paragraph D-34) - 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. 36970 shall be furnished with the engine.

D-36. Accessory Drives. - The gear ratio or 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:

Accessory Drives	Ratio to Crankshaft	TORQUE RATINGS In.-Lbs. Continuous	Static	Rotation
Starter	1.000:1	-	12000	C
Generator or Accessory gear box drive	1.440:1	600	6000	C
Fuel Pump	0.864:1	25	450	C C
Vacuum Pump (Rear)	1.440:1	150	2250	C
Vacuum Pump (Side)	1.440:1	150	2250	C C
Tachometer (two drives)	0.500:1	2.5	12.5	C
Propeller Governor	0.845:1	15	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 D-4b) Clearance shall be provided as shown on installation drawing No. 36970.

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. - Provision shall not be made for driving gun synchronizing impulse generators.

F-2c(2) The cooling liquid outlet temperature shall be 121° C. (250° F.).

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 T FROM STANDARD ALTITUDE TEMPERATURE T_s BY FORMULA:-

$$[\text{H.P. AT D}] \times \sqrt{\frac{460 + T_s}{460 + T}} = \text{ACTUAL H.P.}$$

[APPROXIMATELY 1% CORRECTION FOR EACH 10° F. VARIATION FROM T_s]

SEA LEVEL PERFORMANCE
WITHOUT RAM

CORRECTIONS FOR VARIATION OF CARB. INLET TEMP. "T" FROM 60°F. SHALL BE MADE BY THE FORMULA:-

$$\text{CHART H.P.} \times \left[\frac{520}{460 + T}\right]^{0.67} = \text{CORRECTED H.P.}$$

ALTITUDE PERFORMANCE
WITHOUT RAM

WITH EXHAUST TURBO SUPERCHARGER INSTALLATION AT FULL THROTTLE & GUARANTEED SPECIFIC FUEL CONS.

CONDITIONS TO RATED ALTITUDE:
- CARB. INLET PRES. - 30" HG. ABS. (DRY)
- CARB. INLET TEMP. - 60° F.
- EXHAUST BACK PRES. - 30" HG. ABS.

MILITARY RATED POWER 3000 R.P.M.

NORMAL RATED POWER 2600 R.P.M.

BRAKE HORSE POWER AT STD. TEMP. AND PRESS.

1200
1100
1000
900
800
700
600
500

+50
0
-50

STANDARD ALTITUDE TEMPERATURE T_s - °F.

+50
0
-50

SEA LEVEL 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000 12000 13000 14000 15000 16000 17000 18000 19000 20000 21000 22000 23000 24000 25000

PRESSURE ALTITUDE IN FEET

ABSOLUTE MANIFOLD PRESSURE IN HG

AIRPLANE ENGINE PERFORMANCE DATA
(MIXTURE CONTROL AT MAXIMUM POWER UNLESS OTHERWISE NOTED)

AIRPLANE
ENGINE V-1710-27
PROPELLER GEAR RATIO 2.00 : 1
COMPRESSION RATIO 6.65 : 1
BLOWER GEAR RATIO 6.00 : 1
IMPELLER DIA. INCHES 9 1/2
CARBURETION PD-12G1
FUEL SPECIFICATION AN-9530
NO FUEL-AIR MIXTURE HEATER

DATE 12 - 5 - 39