

Engine Specification No. 126-D

Date Issued: December 21, 1938
Revised: March 6, 1939
Revised: June 1, 1939
Revised: August 8, 1939
Revised: December 5, 1939

MODEL SPECIFICATION FOR
ENGINE, AIRCRAFT MODEL V-1710-33

ALLISON DIVISION
General Motors Corporation
Indianapolis, Indiana

(ALLISON MODEL DESIGNATION V-1710-C15)

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Allison Division of General Motors Corp.
(Allison Model Designation V-1710-C15)

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-1710-33 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:

- 37501-A Engine Assembly, Complete - (showing accessory drive oil seals.)
37500-C Installation Drawing (showing clearances for engine accessories and their removal.)
36905-B Priming System Assembly.
37537 Screen Assembly, air inlet.
37536-A Gasket, Screen, air inlet.
37035-A Carburetor, PT-13E1 Bendix Stromberg
37228-A Spark Plug Assembly BG LS321
37696 Spark Plug Assembly Aero LS-3AD.

Specification 126-D

- 37248-B Spark Plug Assembly LS-4AD
- 37466-A Terminal, Spark Plug (Contact)
- 33006-J Magneto
- 37200-E Radio Shielding Assembly
- 37583-B Manifold Assem. - Spark Plug Cooling
R. H.
- 37584-B Manifold Assem. - Spark Plug Cooling
L. H.
- 33536-E Magneto Cable Shielding Conn. Nut.
- 36575 Lubrication System Diagram
- 37560 Assem. Gun Sync. Impulse Gen R. H.
- 37561 Assem. Gun Sync. Impulse Gen L. H.

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 1340 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.

- 840 B. H. P. at 2600 R. P. M. at sea level.
- 960 B. H. P. at 2600 R. P. M. at 12,000 ft., normal.
- 1090 B. H. P. at 3000 R. P. M. take-off for 5 minutes.
- 1090 B. H. P. at 3000 R. P. M. military rating at 13,200 Ft., military rated altitude.
- 3120 R. P. M., rated overspeed dive R. P. M.

D-5a. The curves shown on page 8 to and including page 13 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, and .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.

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

Length	98 17/32 inches
Width	29 9/32 inches
Height	41 7/8 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 No. 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 8.77:1 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 or 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 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 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, 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. 37500 and drawing 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-241. Temperature Measurement. - (Reference, Specification AN-9500, Paragraph D-241) - No provision shall be made for measuring oil inlet temperature.

D-24j(1) Oil Connections. - (Reference, Specification AN-9500, Paragraph D-24j(1)) - Oil connections shall be as shown on installation drawing No. 37500.

D-25. Fuel Metering System. - The engine shall be equipped with one Bendix-Stromberg Model PT-13E1 injection carburetor in accordance with Spec. AN-9515 except for the following:

(1) Steel Parts - (Reference, paragraph C-1c) Lockwashers and bend 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 Connections - (Reference, paragraph D-12) The fuel inlet connection shall be one 3/4 inch pipe thread.

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

(5) Metering Characteristics. - (Reference, paragraph D-34) The carburetor shall reproduce the desired flow curve, in the region between 30 percent and 70 percent of air flow at engine normal rated power and speed, within a tolerance of plus or minus 2 percent. The tolerance at altitude shall be plus or minus 3 percent of master carburetor up to 16,000 ft. altitude and plus or minus 4 percent 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. 37500 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	TORQUE RATINGS		<u>Rotation</u>
		Continuous	In. - Lbs. Static	
<u>Starter</u>	1.000:1	-	12000	C C
<u>Generator or Accessory gear box drive</u>	1.442:1	500	5250	C
<u>Fuel Pump</u>	0.773:1	25	450	C C
<u>Gun Synchronizer Impulse Generator (two drives)</u>	0.500:1	25	125	C C
<u>Vacuum Pump</u>	1.202:1	50	850	C
<u>Tachometer (two drives)</u>	0.500:1	2.5	12.5	*
<u>Propeller Governor</u>	0.850:1	15	150	C C

* Left hand drive counter clockwise rotation.
Right hand drive clockwise rotation.

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 counter clockwise and 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. 37500.

D-36b. Generator. - (Reference Specification AN-9518, paragraph E-4) - Clearance volume shall be provided as shown on installation drawing No. 37500.

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

D-36c(1) - (Reference, Specification AN-9522, paragraph D-1) - The drive shall be inclined 15° and located as shown on the installation drawing No. 37500.

D-36c(2) Accessibility. - (Reference, Specification AN-9522, paragraph D-2) - Clearance for 6 1/4 inch diameter cylinder is provided.

D-36e. Gun Synchronizer Impulse Generator. - (Reference, Specification AN-9520) - Provision shall be made for driving gun synchronizing impulse generators conforming to Allison drawing No. 37560 & 37561.

D-36f. Vacuum and Hydraulic Mechanism Oil Pump. - (Reference, Specification AN-9521, paragraph E-1, E-3a and Figure 1) - Only one Type I drive shall be provided in accordance with Figure 1 of Specification AN-9521, except the pad shall be as shown on installation drawing No. 37500.

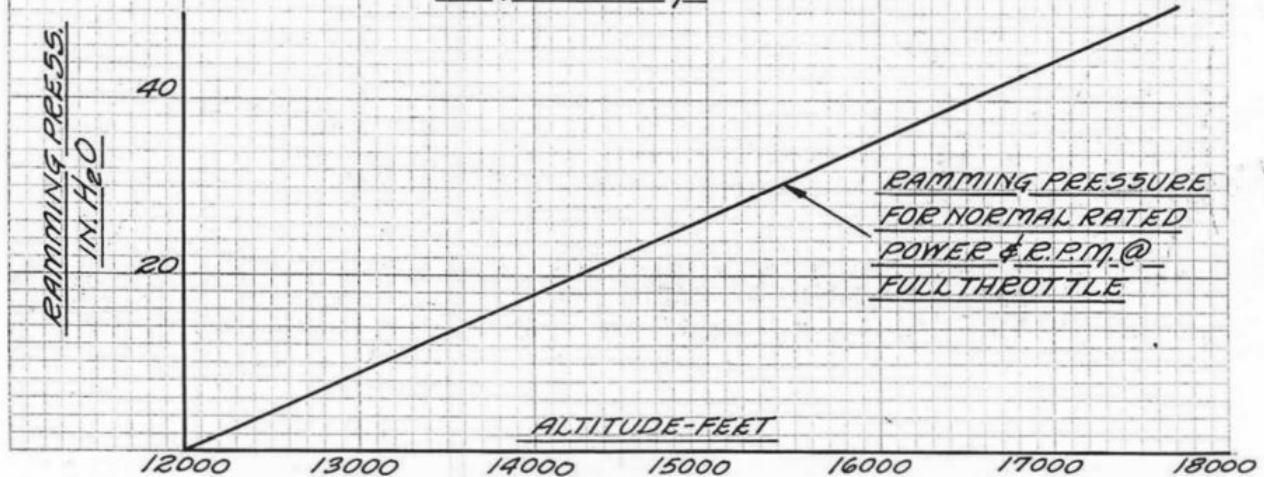
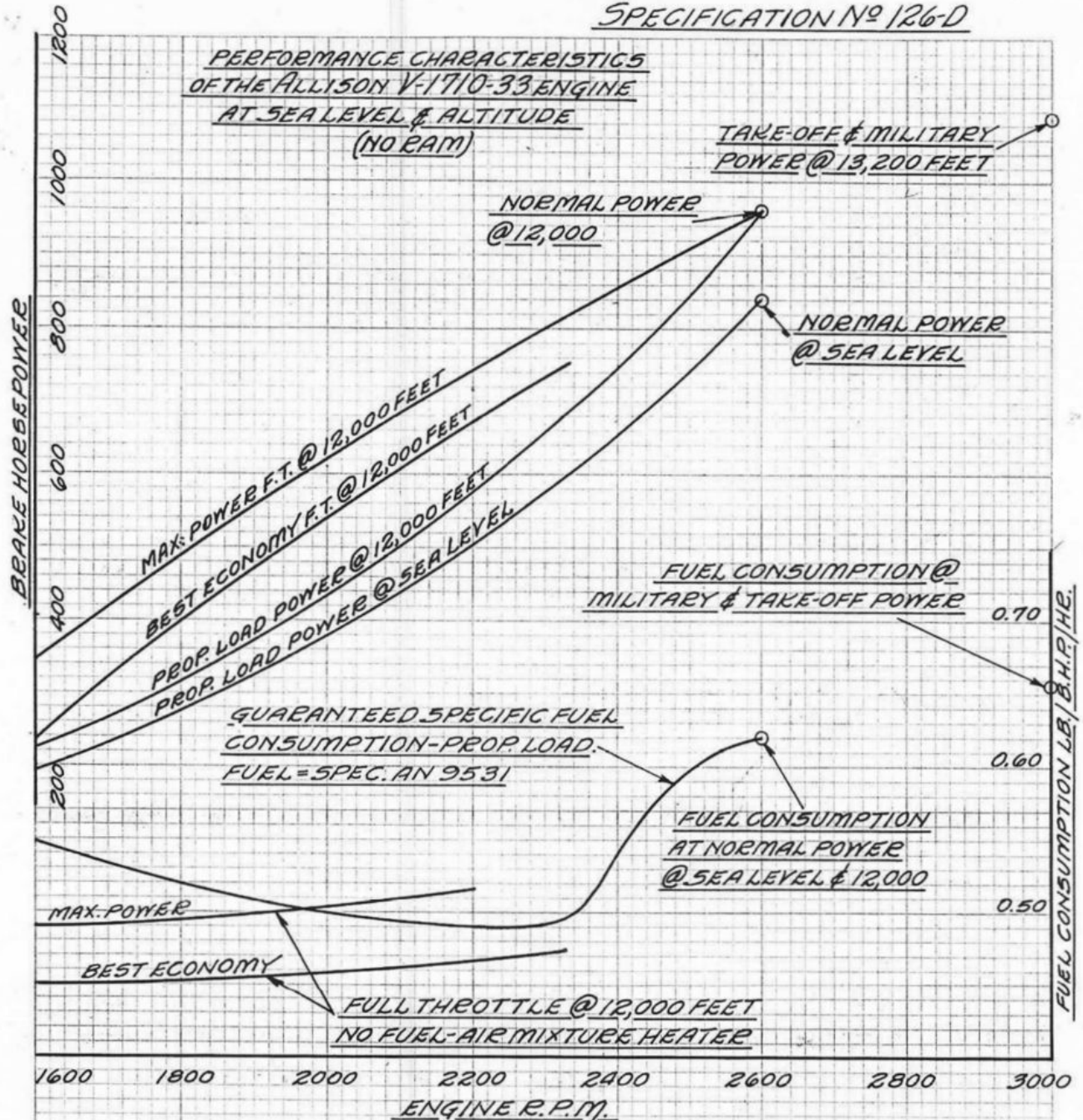
D-36g. Tachometer Drives. - (Reference Specification AN-9533, paragraph D-1) - Two Type I drives shall be provided. A Type II drive shall not be provided. (Reference Specification AN-9533, paragraph E-2b) - A Type E-4 tachometer can be installed on the left hand tachometer drive.

F-2c(1) Oil Flow & Heat Rejection. - When operating at the maximum allowable power and speed for five minutes operation with 85° C. (185° F.) oil inlet temperature and other conditions as in paragraph F-2c(2) the oil flow shall be 125 lbs/min. $\pm 10\%$ at 60 to 65 lbs./sq. in. gage main oil pressure, with minimum oil pump inlet pressure of 0 lbs/sq. in. gage, and the heat rejection to the oil under these conditions shall be 100 horsepower $\pm 15\%$. These data shall be applicable to engine operation with oil conforming to specification AN-9532, (Grade 1120).

F-2c(2) Coolant Flow & Heat Rejection. - When operating with 121° C. (250° F.) coolant outlet temperature at the maximum allowable power and speed for five minutes operation and at the guaranteed specific fuel consumption, the coolant flow shall be 215 gallons per minute $\pm 10\%$ and the heat rejection to the coolant shall be 410 horsepower $\pm 10\%$ with 10 M. P. H. and 15° C. (59° F.) air blast on the engine. The manufacturer reserves the right to add fixed orifice adjustments at the cylinder block outlet which will give the above specified flows and will not subject the radiators on any particular installation to a pressure in excess of 6 lbs./sq. in.

SPECIFICATION No 126-D

PERFORMANCE CHARACTERISTICS
OF THE ALLISON V-1710-33 ENGINE
AT SEA LEVEL & ALTITUDE
(NO RAM)



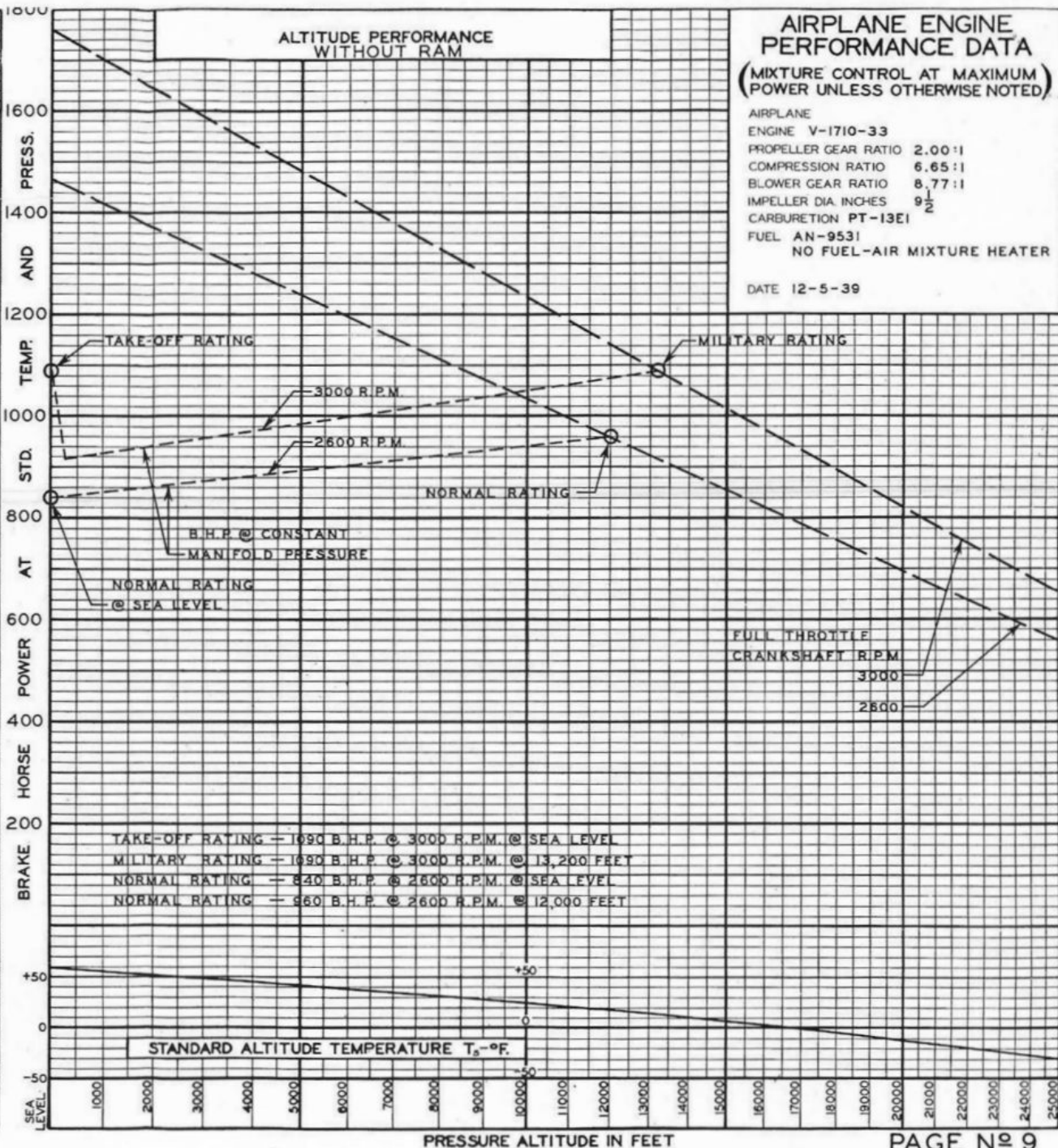
AIRPLANE ENGINE PERFORMANCE DATA

(MIXTURE CONTROL AT MAXIMUM POWER UNLESS OTHERWISE NOTED)

AIRPLANE
 ENGINE V-1710-33
 PROPELLER GEAR RATIO 2.00:1
 COMPRESSION RATIO 6.65:1
 BLOWER GEAR RATIO 8.77:1
 IMPELLER DIA. INCHES 9½
 CARBURETION PT-13E1
 FUEL AN-9531
 NO FUEL-AIR MIXTURE HEATER

DATE 12-5-39

ALTITUDE PERFORMANCE WITHOUT RAM



SEA LEVEL PERFORMANCE

ORSEPOWER
 M, MANIFOLD
 INLET TEMP.

DTTLE ALTITUDE
 MANIFOLD PRESS.
 CURVE FOR R.P.M.
 TRANSFER TO C
 HT LINE & READ
 ALTITUDE D.
 D FOR VARIATION
 RE T FROM
 PERATURE T_s BY

CTUAL HP
 ECTION FOR
 OM T_s

FOR VARIATION
 T TEMP. "F"
 SHALL BE MADE
 U.A.:

0.87
 $\left(\frac{520}{460+T}\right) = \text{CORRECTED H.P.}$

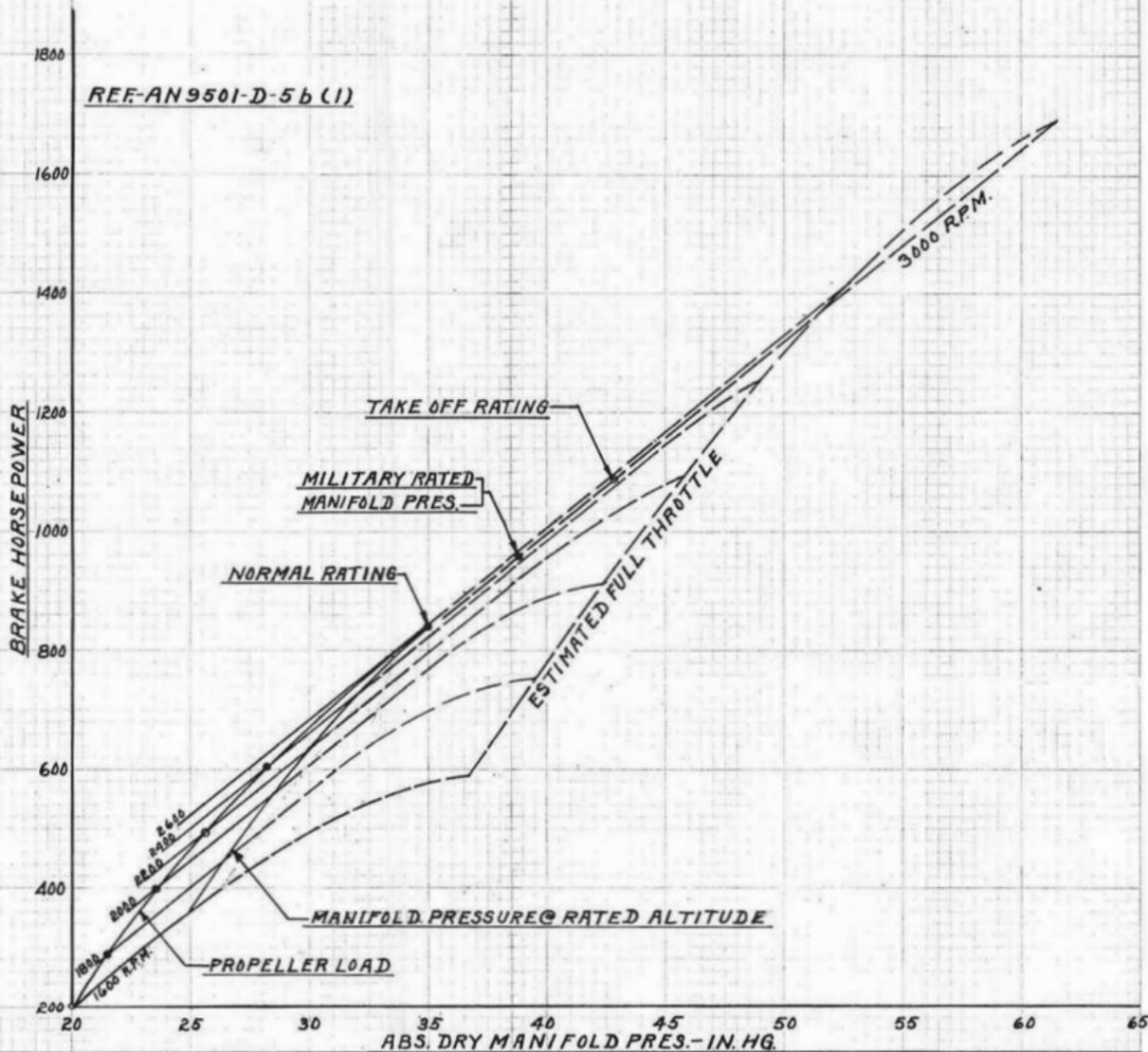
LD PRESSURE @ NORMAL RATING = 35.0 IN. HG.
 LD PRESSURE @ TAKE-OFF = 42.9 IN. HG.

bsolute Manifold Pressure, in. hg.

Pressure Altitude in Feet

PAGE No 9

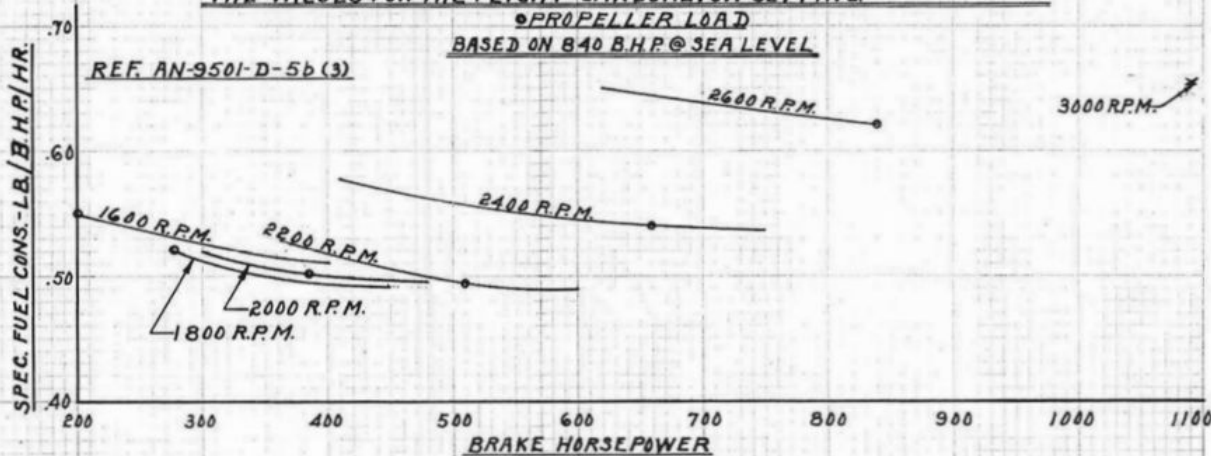
REF-AN9501-D-5b (1)



THESE VALUES OF FUEL CONS. ARE THE MINIMUM ALLOWABLE & NOT THE VALUES FOR THE FLIGHT CARBURETOR SETTING.

PROPELLER LOAD
BASED ON 840 B.H.P. @ SEA LEVEL

REF-AN-9501-D-5b (3)



ORSEPOWER
V., MANIFOLD
INLET TEMP.

ITTLE ALTITUDE
MANIFOLD PRESS.
CURVE FOR RPM.
TRANSFER TO C-
IT LINE & READ
TITUDE D.

FOR VARIATION
IE T FROM
PERATURE T_s BY
7

CTUAL HP

SECTION FOR
OM T_s

SEA LEVEL PERFORMANCE

ALLISON V-1710-33
ALTITUDE PERFORMANCE
WITHOUT RAM

FULL THROTTLE B.H.P. @ ALTITUDE
REF. AN 9501-D-50 (R)

AIRPLANE ENGINE
PERFORMANCE DATA

(AT GUARANTEED MINIMUM
SPECIFIC FUEL CONSUMPTION)

AIRPLANE
ENGINE V-1710-33
PROPELLER GEAR RATIO 2.0:1
COMPRESSION RATIO 6.65:1
BLOWER GEAR RATIO 8.77:1
IMPELLER DIA. INCHES 9 1/2
CARBURETION PT-13E1
FUEL SPEC. AN 9531-100 OCT. (ARMY)

DATE 12-5-39

NORMAL RATING
940 B.H.P. @ 12000 FT.
35.0 IN. HG. @ 2600 R.P.M.

MILITARY RATING
1030 B.H.P. @ 13200 FT.
38.9 IN. HG. @ 3000 R.P.M.

30.8" Hg. @ 3000 R.P.M.

35.0" Hg. @ 2500 R.P.M.

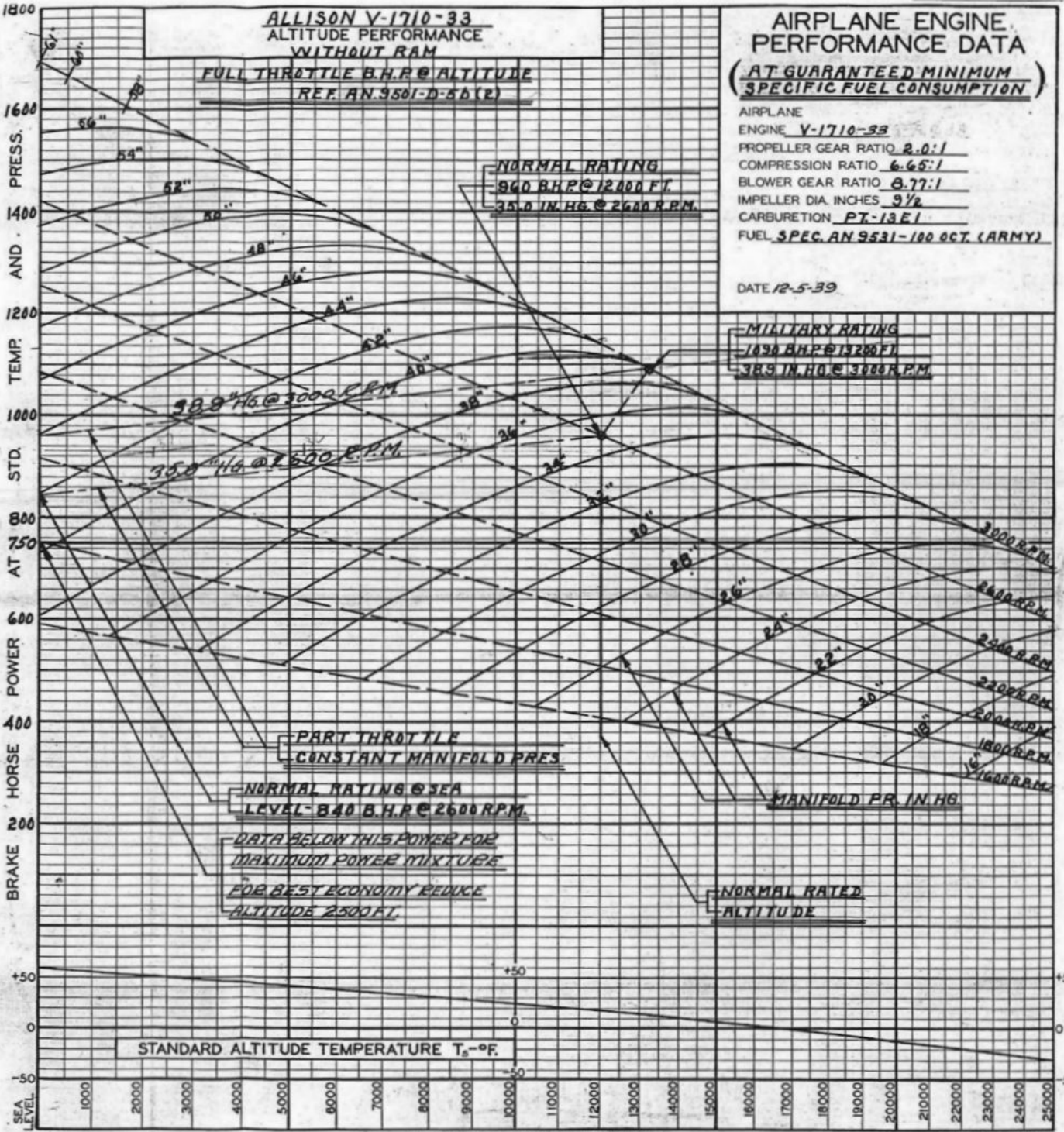
PART THROTTLE
CONSTANT MANIFOLD PRES.

NORMAL RATINGS @ SEA
LEVEL - 840 B.H.P. @ 2600 R.P.M.

DATA BELOW THIS POWER FOR
MAXIMUM POWER MIXTURE
FOR BEST ECONOMY REDUCE
ALTITUDE 2500 FT.

NORMAL RATED
ALTITUDE

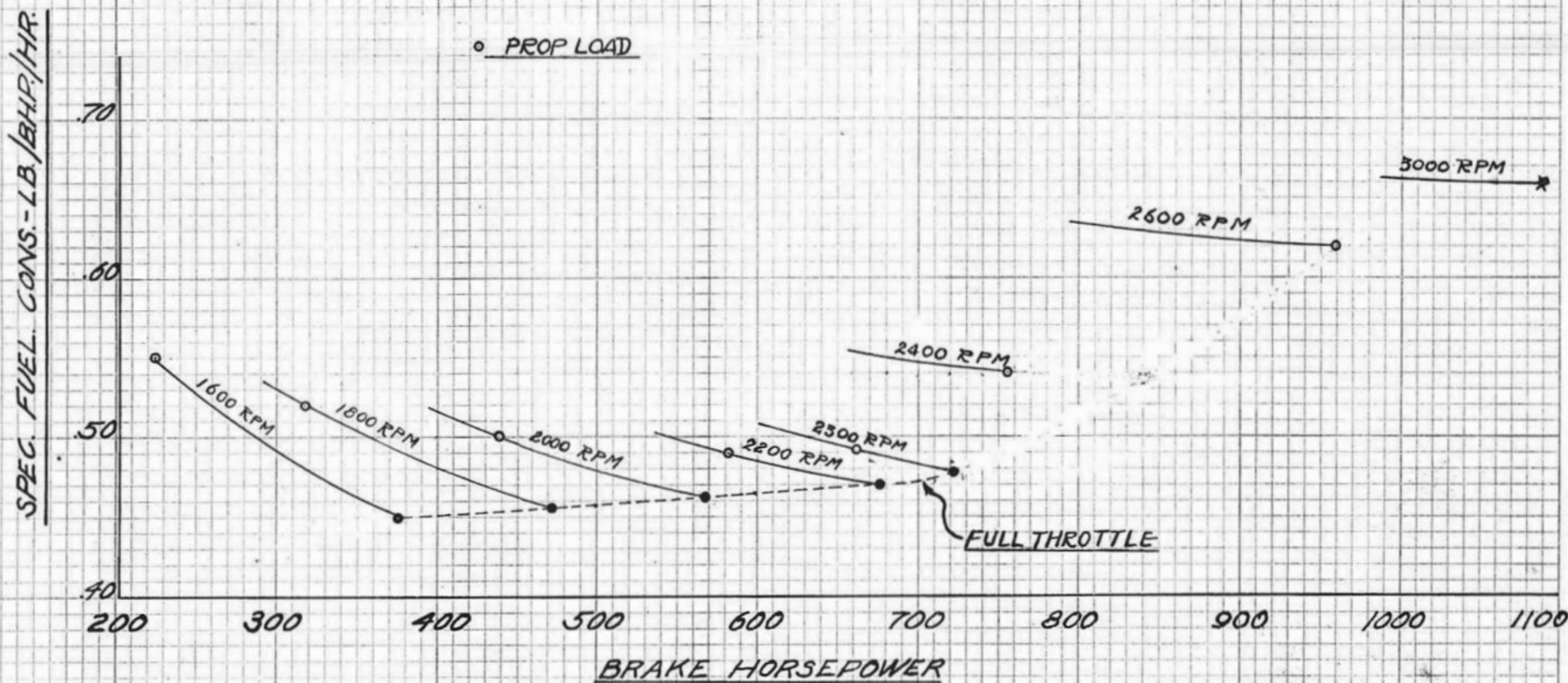
MANIFOLD PR. IN. HG.



ALLISON V-1710-33 ENGINE PERFORMANCE @ 12000 FT. ALTITUDE
GUARANTEED MIN. SPEC. FUEL CONS. VERSUS BRAKE HORSEPOWER
FOR VARIOUS CRANKSHAFT SPEEDS (WITHOUT RAM)

960 B.H.P. @ 12000 FT.

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



ALLISON V-1710-33 ENGINE PERFORMANCE AT 15000 FT ALTITUDE
GUARANTEED MIN. SPEC. FUEL CONS. - VS - BRAKE HORSEPOWER FOR
VARIOUS CRANKSHAFT SPEEDS (WITHOUT RAM)

REFERENCE: AN-9501-D-5b(3)a

