Spec. No. 164-B

Date Issued: Apr. 24, 1942
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Nov. 2, 1942

MODEL SPECIFICATION
ENGINE, AIRCRAFT: MODEL V-1710-83

ALLISON DIVISION
General Motors Corporation
Indianapolis, Indiana

(ALLISON MODEL DESIGNATION V-1710-E18)

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Allison Division of General Motors Corporation

(Allison Model Designation V-1710-E18)

A. APPLICABLE SPECIFICATIONS.

A-1. The following specifications of the issue in effect on date of invitation for bids shall form a part of this specification:

A-1a. Army-Navy Specification.

AN-9500 Engines, Aircraft: General Specification and applicable specifications of the issues indicated on Page 17.

B. TYPE AND MODEL

B-1. This specification covers the requirements for the V-1710-83 engines.

C. MATERIAL AND WORKMANSHIP.

C-1. The requirements for material and workmanship shall be as specified in Specification AN-9500.

D. GENERAL REQUIREMENTS.

D-1. See Section E.

E. DETAIL REQUIREMENTS.

E-2. Drawings. - The following Allison Division drawings form part of this specification:

43211 Engine Assembly, Complete - (Showing Accessory Drive Oil Seals.)

43210	Installation Drawing (Showing clearances for engine accessories and their removal.)
36905-E	Priming System Assembly
42113	Carburetor, PD12K6 Bendix-Stromberg
40600-J	Spark Plug Assembly AC-LS85
40601-B	Spark Plug Assembly Champion C34S
42354	Terminal, Spark Plug (Contact)
40209	Lubrication System Diagram
41809	Magneto
42290	Radio Shielding Assembly
37583-B	Manifold Assem. - Spark Plug Cooling R. H.
37584-B	Manifold Assem. - Spark Plug Cooling L. H.
33536-K	Nut - Magneto Cable Shielding Conn.
40751-F	Gasket - Exhaust Port Flange
42348	Shielding - Spark Plug Cable - Intake
42347	Shielding - Spark Plug Cable - Exhaust
42288-B	Plug Crankcase Dehydrator
41310-B	Nut - #60 Prop. Shaft Thread Protecting
41616-C	Bag - Engine Shipping
41694-A	Bag - Reduction Gear Box Shipping

E-3 Acceptance. Approval of this engine is based upon Model Tests of V-1710-67 (E8) and V-1710-81 (F20R) and flight tests of V-1710-59 (E12) engines.

E-4 Weight. The total dry weight of the engine shall not exceed the values indicated below:

Basic engine, including integral supercharger, supercharger drive mechanism, propeller reduction

gears, coolant pump and piping on the engine, engine lubrication system oil pumps, starter connection, including starter dog, tachometer drives, fuel pump drive, generator drive, vacuum pump drives, propeller governor drive and all piping and controls between engine parts	1346.0 lbs.
Carburetor and injection nozzle	34.0
Carburetor Screens and Gaskets	1.0
Magneto, Shielded	13.0
Ignition Distributors (included in Shielding Assembly)	
Radio Shielded Ignition assembly, complete with Cable and Distributors	31.0
Spark Plugs	7.0
Priming System on Engine	1.0
Cooling Air Deflectors and Baffles	none
Accessory Drive Covers	2.0
TOTAL DRY WEIGHT OF ENGINE	1435 lbs.

E-5. Performance Characteristics.- The use of an automatic boost control shall be a requirement in the installation of this engine. The ratings specified herein, and the curves specified herein and shown on Pages 14 to 15, shall constitute the power and specific fuel consumption guarantees. The terms used and the standard conditions shall be in accordance with the applicable definitions contained in Specification AN-9502.

E-5a. Ratings. - The engine shall be rated as follows, using fuel conforming to Specification AN-VV-F-781 (Amendment #5) and oil conforming to Specification AN-VV-O-446, Grade 1120.

870 B.H.P. at 2600 R.P.M. at sea level
1000 B.H.P. at 2600 R.P.M. at 14,000 ft. - Normal
1200 B.H.P. at 3000 R.P.M. take-off for five minutes
1125 B.H.P. at 3000 R.P.M. military rating at 15,500 feet for 15 minutes - Military Rated Altitude

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

E-5b. Curves. - The following curves shall be furnished as part of this specification:

E-5b.(1) BHP vs Altitude at Rated Speeds as shown on Page 14.

E-5b.(2) Estimated performance data at altitude as shown on Page 15.

E-5b.(3) Estimated fuel consumption curves as shown on Page 16.

E-5e. 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 percent normal rated power and 89 per cent normal rated speed.

E-5h. Coolant Flow and Heat Rejection. - The following guarantee is given for the coolant flow and heat rejection to the coolant.

Conditions:

Operation	On dynamometer for 5 minutes
Power	Take-off 1200 BHP
Speed	Take-off 3000 RPM
Fuel Consumption . . .	Auto Rich
Oil Inlet Temp	185°F.
Oil Pressure.	65 p.s.i.
Coolant Outlet Temp . .	250°F.
Oil Flow	140 lb./min.
Air Blast on Engine . .	60° F. at 10 M.P.H.

Guaranteed Maximum

Coolant Flow - 250 G.P.M.
Heat Rejection to Coolant - 430 H.P.

E-5i. Oil Flow and Heat Rejection. - The following guarantee is given for the oil flow and heat rejection to the oil.

Conditions:

Operation	On dynamometer for 5 minutes
Power	Take-off - 1200 BHP
Speed	Take-off - 3000 RPM
Fuel Consumption . . .	Auto Rich
Oil Inlet Temp.	185°F.
Oil Pressure.	65 p.s.i.
Coolant Outlet Temp . .	250°F.
Coolant Flow.	250 G.P.M.
Air Blast on Engine . .	60°F. at 10 M.P.H.

Guaranteed Maximum

Oil Flow - 140 lb./min.
Heat Rejection to Oil - 140 H.P.

E-7. Propeller. - The engine shall have a No. 60 propeller shaft end as shown on Installation Drawing No. 43210. Provision

shall be made for a governor type of propeller control mechanism. Reference AN-9507, Paragraph E-2a) - The governor drive shaft shall rotate at 2778 RPM at military rated engine speed. No provision shall be made for hydraulic propeller operation. An oil vapor opening shall be provided on the governor mounting pad as shown on Installation Drawing No. 43210. Oil pressure shall not be supplied to the pad.

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

Length	194	inches
Width	29-9/32	inches
Height	37-9/16	inches

E-14. Preparation for Storage. - The engine shall be prepared for storage in accordance with AN-F-E-568 with the following exceptions:

(1) (Reference, Par. F-3g., Carburetor) The oil for filling the carburetor shall conform to Allison Division Specification ES-10.

(2) (Reference, Par. F-3h., Intake Manifold) - The dehydrator bags shall be placed on the top of the carburetor screen and the carburetor sealed by securing a gasketed cover to the carburetor.

(3) (Reference, Par. F-3n., Crankcase) - A dehydrator plug conforming to Allison Division drawing No. 42288 shall be installed in an appropriate opening of the crankcase as soon as it can be made available.

(4) (Reference, Par. F-3o., Propeller Shaft) - A propeller shaft thread cap conforming to Allison Division Drawing No. 41310 shall be installed.

(5) (Reference, Par. F-4a., Packing Procedure) - The engine bag and outboard reduction gear bag shall conform to Allison Division Drawing Nos. 41616 and 41694.

(6) (Reference, Par. F-4a(1).,After removing the engine from the engine case it shall be possible to reheat seal the openings which must be cut in the engine bag to insert the lifting hooks.

(7) (Reference, Par. F-4b.) - The engine shipping case shall conform to Allison Division Drawing No. 37780 which provides a window through which the indicator card may be inspected instead of a hinged door.

(8) The outboard reduction gear assembly and extension shafts shall be prepared for storage as nearly as practical in conformance with AN-F-E-568.

E-16b. **Parts List of the Engine.** The parts list applicable in all details for this engine shall be the same as for the V-1710-63 (E6) engine as it passed the Model Test and was approved by the Materiel Center letter of April 20, 1942 (SGN-jft-70-5) with the exception of:

(1) Such design improvements as mutually agreed upon between the contractor and Government, including the intake manifold assembly No. 43330.

(2) The exception of parts peculiar to the 9.6:1 supercharger gear ratio as herein specified.

E-18. **Propeller Drive.** The engine shall be equipped with a reduction gear ratio of 2.00:1. The propeller drive shall be mounted on a remote gear box located outboard of an extension shaft which operates at crankshaft speed. The gear box should be lubricated from an external tank of not less than 2 gallons capacity which shall not be provided with the engine. The direction of propeller rotation when viewed from the anti-propeller end, shall be clockwise. The maximum oil flow required for the reduction gear box is 20 lbs./min. at military rated speed. The gear box will function satisfactorily, provided the correct specified lubricant is used and an oil inlet temperature of 60°C. (140°F.) is not exceeded. The lubricant for the gear box oil system shall conform to Air Corps Specification Y-3587.

E-19. **Impeller Gear.** The impeller gear ratio shall be 9.6:1 and the impeller shall be 9-1/2 inches diameter.

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

E-23a(1) **Spark Plugs.** The engine shall be fitted with Champion C34S or AC-LS85 spark plugs.

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

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

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

(3) (Ref. Par. E-1a. Single Cable Conduits) Single cable conduit connections shall be as shown on Allison Drawings No. 33536, 42347, and 42348.

E-23c. High Tension Ignition Cable. - (Reference AN-9500, Paragraph D-23c.) - High tension ignition cable conforming to U. S. Army Specification 95-32152 shall be used on all distributor head to spark plug leads, with the exception to paragraph E-7a that the marking shall be accomplished by stamping the date on the external surface of the cable instead of an interwoven thread. All other high tension cable shall conform to AN-J-C-56.

E-23d. Magnetos. - The engine shall be equipped with one Scintilla Type DFLN-6 magneto in accordance with Specification AN-9511 with the following exceptions:

(1) (Reference, Paragraph D-1b(1). - Threads) - Connections for the high tension terminals are 15/16-18 threads.

(2) (Reference, Paragraph E-1b(2). - Type D Magneto) - The heads of screws for securing the bearing retainer in the flange project beyond the .125" minimum recess in pilot specified in Figure No. 3.

(3) (Reference, Paragraph E-2c. - Normal Operating Temperature) - The temperature rise of this magneto is 55.5°C. (100°F.) above room temperature.

(4) (Reference, Paragraph E-2d. - Endurance, F-4a (11)b.) - (Elevated Temperature Run) - This magneto will not meet the temperature requirements specified except for very short periods of time.

(5) (Reference, Paragraph E-3e. - Simulated Service) - F-4a(10)a., Rain and Spray Test) - The magneto will not meet the requirements when subjected to the test specified in this paragraph. The installation of this magneto on a liquid-cooled V engine requires and permits maximum ventilation in breaker cover.

E-23f. Cooling - (Reference, Specification AN-9500, Paragraph D-23f.) - 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 on Installation Drawing No. 43210 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 U.S. Army Specification 95-32152 does not fail below this temperature.

E-24c. Oil Leakage Test. - (Reference, Specification AN-9500, Paragraph D-24c.) - With a mixture of equal parts of aviation gasoline and oil conforming to Spec. AN-VV-O-446, Grade 1100, supplied to the pressure oil pump inlet under a head of 36 inches the total flow of oil into the engine shall not exceed 0.2 pounds per hours.

E-24e. Scavenging and Pressure Pumps. - (Reference, Specification AN-9500, Paragraph D-24e. and D-24f.) - Provided no air traps exist in the enternal scavenging system, the engine scavenging system shall adequately scavenge the engine for extended periods of time under normal operating conditions, with a back pressure on the scavenging system not to exceed a maximum of 30 pounds per square inch at maximum flow, and two pounds per square inch at minimum idling speeds when using either Grade 1100 or Grade 1120 oil, conforming to Specification AN-VV-O-446 at an inlet viscosity of 100 plus or minus 5 Saybolt Universal seconds. The oil pressure pump shall function properly when its inlet pressure is 88% or more of the absolute atmospheric pressure and no air leaks exist in the external oil inlet line.

E-24g. Oil Cleaner. - The engine shall be equipped with one Automatic Cuno No. 10863, oil strainer, and shall meet the requirements of AN-9500, Par. D-24g. under normal operating conditions.

E-24j. Provision for Oil Connections. - The oil inlet connection shall be a 2 in., 4-stud opening as shown on Installation Drawing No. 43210.

E-24q. Crankcase Breathers. - Ample breathing capacity shall be provided in accordance with Paragraph D-24q. of AN-9500; however, the airplane manufacturer shall locate the front and rear breather outlets to maintain a crankcase pressure measured at the front within the limits of +8 to -4 inches of water on any new or modified airplane installation. It is desired that the pressure at the front breather be held to 2 to 6 inches of water higher than pressure at the rear breather to provide proper ventilation through the engine from front to rear.

E-25. Fuel Metering System - The engine shall be equipped with one Bendix-Stromberg Model PD12K6 injection carburetor. The carburetor shall meet the requirements of Specification AN-9515 except for the following:

(1) (Reference, Paragraph D-7. - Strainer) - The carburetor shall meet requirements except that foreign material is not removed with the strainer.

(2) (Reference, Paragraph D-17. - Mixture Control) - The mixture control positions are located as follows:

(A) Idle Cut-off Full Forward
(B) Automatic Lean Directly Back of A.
(C) Automatic Rich Directly Back of B.

(D) Full Rich Directly Back of C.

(3) (Reference, Paragraph D-26,-Protective Treatment of Steel Parts) - Cadmium plated parts shall have a minimum plating thickness of .0003".

(4) (Reference, Paragraph D-32a(1). - Metering Characteristics) - Sea Level) - The carburetors shall meet requirements except that at 30 to 70 per cent of air flow for normal rated power and speed the variation in fuel/air ratio shall be plus or minus 2 per cent.

(5) (Reference, Paragraph D-32b(1). - Metering Characteristics, Master Carb.) - At take-off power and speed, the carburetor shall contain a setting which in the rich mixture control position will furnish mixture strengths within +4% -0% of the guaranteed fuel consumption.

(6) (Reference, Paragraph D-32b(13). - Carburetor Heat on Test) - The complete airflow to the carburetor shall be heated to avoid icing conditions on test. Duplication of the airplane method of admitting warm air shall not be attempted.

(7) (Reference, Paragraph D-32c. - Metering Characteristics of Production Carburetors) - The carburetors shall meet requirements except that at 30 to 70 per cent air-flow for normal rated power and speed the variation in fuel/air ratio shall be plus or minus 2 per cent.

(8) (Reference, Paragraph F-4e(3). - Metering Tests of Production Carburetors) - A procedure for air box testing production carburetors, in accordance with War Department, Air Corps, Materiel Division letter of April 29, 1938, Serial No. E-57-809-16, shall be used, the procedure being as follows:

Mixture readings are obtained on the normal rated power and speed propeller load curve, using the following points; such points being subject to change to agree with individual carburetor specifications:

AIRFLOW	METERING TOLERANCE	MIXTURE CONTROL POSITION
Take-off airflow	±2%	Auto. Rich
100% rated power airflow	"	Auto. Lean
75% " " "	"	Full Rich
62-1/2% " " "	"	
50% " " "	"	Auto. Lean
35% " " "	"	Full Rich

AIRFLOW	METERING TOLERANCE	MIXTURE CONTROL POSITION
22-1/2% rated power airflow	±5%	Auto. Rich
15% " " "	"	" "
10% " " "	"	" "
Airflow at min. idling speed	"	" " Idle cut-off

In addition, carburetors designed for automatic altitude compensation are checked at an airflow equivalent to 50% of normal rated power airflow with the mixture control in the automatic rich position and readings are taken at air box pressures of 0, 4, 8, and 14 inches of Hg. less than atmospheric pressure.

E-26. Fuel Priming System. - Provision shall be made for priming the engine with fuel from a separately installed priming pump and lead line, supplied by the airplane manufacturer and attached to the engine priming connection.

E-29. Coolant Pump. - The coolant pump shall be supplied with an internal spring loaded packing. Replacement of the packing is made by disassembly of the pump. No provision shall be made for external packing adjustment.

E-30. Coolant Temperature. - The cooling liquid outlet temperature for liquid cooled engines shall be 121°C. (250°F.)

E-31a(3) Supercharger Drain Valve. - (Reference, Specification AN-9500, Paragraph D-31a(3).) - A gurgle passage without a valve shall be the only provision made for automatic drainage of the induction system.

E-32a. Exhaust Flanges. (Reference Specification AN-9500, Paragraph D-32a) - Exhaust flanges and gaskets in accordance with Installation Drawing No. 43210 and Drawing No. 40751 shall be supplied, but shall not be included in the engine dry weight. Flanges and gaskets shall be shipped with, or separate from the engine, at the request of the procuring agency.

E-36. Accessory Drives. - The gear ratio of each accessory drive to the engine crankshaft, based on the lowest normal rated speed of the engine, 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 IN. - LBS. CONTINUOUS	RATINGS STATIC	ROTATION
Starter	1.000:1	-	16200	C
Generator	1.440:1	600	6000	C
Fuel Pump	0.864:1	25	450	CC
Vacuum Pump(Rear)	1.440:1	150	2250	C
Vacuum & Hyd. Mech. Oil Pump (Red.Gear Box)	1.313:1	150	2250	CC
Tachometer (two drives)	0.500:1	2.5	12.5	C
Propeller Governor	0.926:1	15	150	CC
Gun Synchronizer Impulse Generator (Two drives)	0.500:1	25	125	CC

NOTE: CC indicates counter-clockwise rotation
C indicates clockwise rotation.

E-36a. Starter. - The starter mounting pad and drive shall be Type I, in accordance with Specification AN-9517. The direction of rotation when looking at the starter dog attached to the engine shall be clockwise.

E-36a(1) (Reference, Specification AN-9517, Paragraph E-4b) Clearance shall be provided as shown on Installation Drawing No. 43210.

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

E-36e. Pad and Drive for Gun Synchronizer Impulse Generator. Provision shall be made for driving Gun Synchronizing Impulse Generators by a Type I pad and drive in accordance with Spec. AN-9520 with the following exception to Paragraph D-1a: The two pads shall be located on the rear face of the reduction gear box and the face of the mounting pad shall be perpendicular to the longitudinal axis of the engine.

E-36e(1) Gun Synchronizing Impulse Generators shall not be furnished.

E-36f. Vacuum and Hydraulic Mechanism Oil Pump. - Provision shall be made for two drives with the following exception to

the drive on the outboard reduction gear box:

(1) (Reference AN-9521, Paragraph D-1) - Provision shall not be made for supplying oil pressure to the outboard reduction gear box hydraulic mechanism oil pump pad.

(2) (Reference AN-9521 Paragraph E-26.) The slotted drive adapter bushing shall not be furnished.

F. METHODS OF SAMPLING, INSPECTION, AND TESTS.

F-1. The requirements for sampling, inspection, and tests shall be as shown in Specification AN-9500.

G. PACKAGING, PACKING, AND MARKING FOR SHIPMENT.

G-1. The requirements for packaging, packing, and marking for shipment shall be as shown in Specification AN-9500.

AIRPLANE ENGINE PERFORMANCE DATA

(MIXTURE CONTROL AT MAXIMUM POWER UNLESS OTHERWISE NOTED)

AIRPLANE

ENGINE V-1710-83 (E18)

PROPELLER GEAR RATIO 2.0 : 1

COMPRESSION RATIO 6.65 : 1

BLOWER GEAR RATIO 9.6 : 1

IMPELLER DIA. INCHES 9.5

CARBURETION PD12K6

FUEL AN-VV-F-781 (AMEND. 5)

DATE 11-2-42

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:-

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

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

SEA LEVEL PERFORMANCE

ABSOLUTE MANIFOLD PRESSURE, IN. HG.

ALTITUDE PERFORMANCE WITHOUT RAM

BRAKE HORSE POWER AT STD. PRESS. AND TEMP.

1400
1300
1200
1100
1000
900
800
700
600

TAKE-OFF RATING
1200 BHP AT 3000 R.P.M.
FOR 5 MINUTES.

MILITARY RATING
1150 BHP AT 13500 FT.
AT 3000 R.P.M.

3000 R.P.M. CONSTANT M.P.

2600 R.P.M. CONSTANT M.P.

NORMAL RATING
1000 BHP AT 2600 R.P.M.
AT 14000 FT.

NORMAL RATING
870 BHP AT 2600 R.P.M.
AT SEA LEVEL

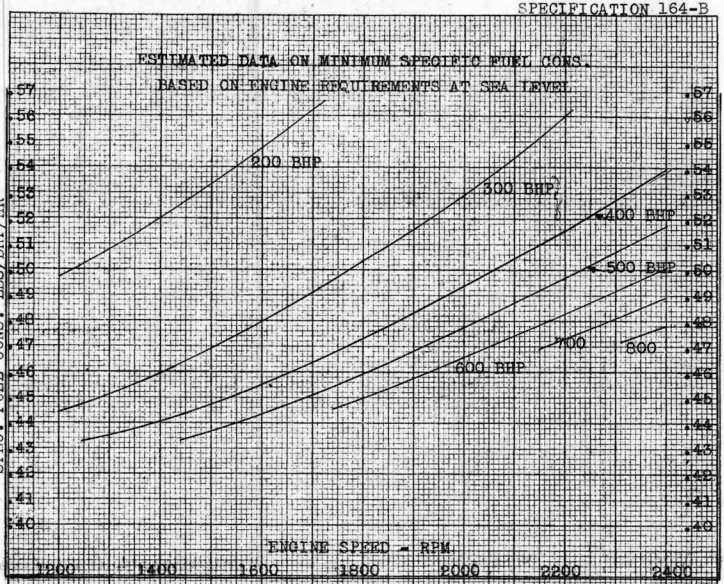
THE CHARACTERISTICS OF THE AUTOMATIC MANIFOLD PRESSURE REGULATOR IS SUCH THAT THE MANIFOLD PRESSURE WILL DROP OFF FROM THE SEA LEVEL SETTING BY 1½ INCHES HG. AS THE FULL THROTTLE OR CRITICAL ALTITUDE CONDITION IS REACHED.

+50
0
-50

STANDARD ALTITUDE TEMPERATURE T_s - °F.

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



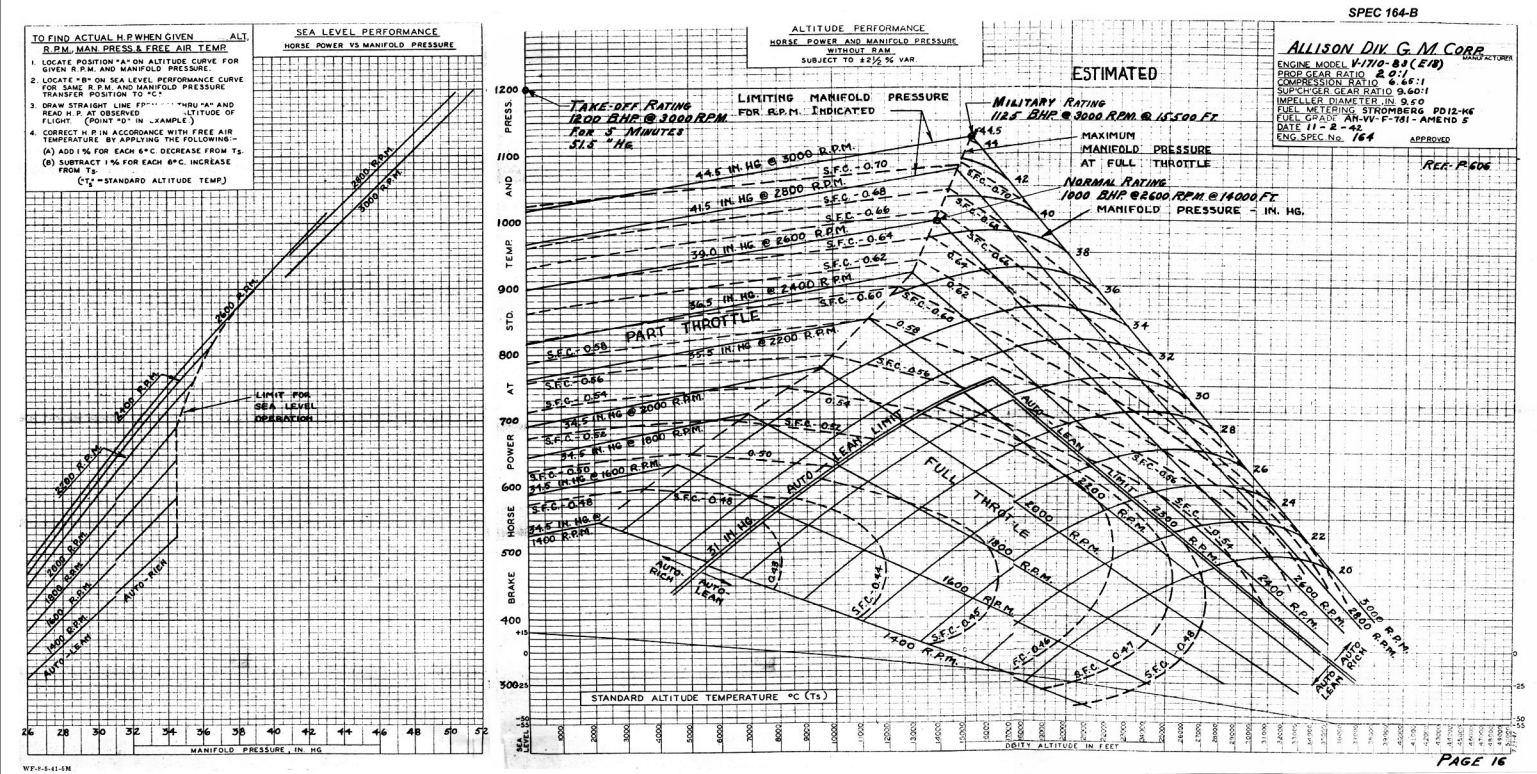
ESTIMATED SPECIFIC FUEL CONSUMPTION ON PROP LOAD AS INDICATED USING PD12K6 CARBURETOR AT SEA LEVEL

% Normal Power	LBS/BHP/HR 870 BHP	LBS/BHP/HR 1000 BHP
100%	0.64	0.66
90%	0.62	0.64
80%	0.58	0.60
75%	0.56	0.57
65%	0.52	0.53

Take-off Power-- 0.74
At Sea Level

Military Power-- 0.71
At 15,500 Feet

15


TO FIND ACTUAL H.P WHEN GIVEN ALT, R.P.M, MAN PRESS & FREE AIR TEMP
1. LOCATE POSITION "A" ON ALTITUDE CURVE FOR GIVEN R.P.M. AND MANIFOLD PRESSURE.
2. LOCATE "B" ON SEA LEVEL PERFORMANCE CURVE FOR SAME R.P.M. AND MANIFOLD PRESSURE TRANSFER POSITION TO "C".
3. DRAW STRAIGHT LINE FROM "C" THRU "A" AND READ H.P. AT OBSERVED ALTITUDE OF FLIGHT. (POINT "D" IN EXAMPLE.)
4. CORRECT H.P. IN ACCORDANCE WITH FREE AIR TEMPERATURE BY APPLYING THE FOLLOWING:—
(A) ADD 1% FOR EACH 6°C. DECREASE FROM Ts.
(B) SUBTRACT 1% FOR EACH 6°C. INCREASE FROM Ts.
(Ts = STANDARD ALTITUDE TEMP.)
SEA LEVEL PERFORMANCE
HORSE POWER VS MANIFOLD PRESSURE
2800 R.P.M.
2600 R.P.M.
2400 R.P.M.
2200 R.P.M.
2000 R.P.M.
1800 R.P.M.
1600 R.P.M.
1400 R.P.M.
AUTO-RICH
AUTO-LEAN
LIMIT FOR SEA LEVEL OPERATION
26 28 30 32 34 36 38 40 42 44 46 48 50 52
MANIFOLD PRESSURE, IN. HG.
ALTITUDE PERFORMANCE
HORSE POWER AND MANIFOLD PRESSURE
WITHOUT RAM
SUBJECT TO ±2½% VAR.
ESTIMATED
LIMITING MANIFOLD PRESSURE FOR R.P.M. INDICATED
TAKE-OFF RATING
1200 BHP @ 3000 RPM
FOR 5 MINUTES
51.5 "Hg.
MILITARY RATING
1125 BHP @ 3000 RPM @ 15,500 FT.
MAXIMUM MANIFOLD PRESSURE AT FULL THROTTLE
NORMAL RATING
1000 BHP @ 2600 RPM @ 14000 FT.
MANIFOLD PRESSURE - IN. HG.
Ref: P.606
44.5 IN HG @ 3000 R.P.M.
41.5 IN. HG @ 2800 R.P.M.
39.0 IN HG @ 2600 R.P.M.
36.5 IN HG @ 2400 R.P.M.
34.5 IN HG @ 2200 R.P.M.
34.5 IN HG @ 2000 R.P.M.
34.5 IN HG @ 1800 R.P.M.
34.5 IN HG @ 1600 R.P.M.
34.5 IN HG @ 1400 R.P.M.
31 IN HG
PART THROTTLE
FULL THROTTLE
AUTO LEAN LIMIT
AUTO RICH
AUTO LEAN
S.F.C. 0.70
S.F.C. 0.68
S.F.C. 0.66
S.F.C. 0.64
S.F.C. 0.62
S.F.C. 0.60
S.F.C. 0.58
S.F.C. 0.56
S.F.C. 0.54
S.F.C. 0.52
S.F.C. 0.50
S.F.C. 0.48
S.F.C. 0.46
S.F.C. 0.44
S.F.C. 0.47
S.F.C. 0.48
0.24
0.28
0.30
0.32
0.34
0.36
0.38
0.40
0.42
0.44
0.46
0.48
2800 R.P.M.
2600 R.P.M.
2400 R.P.M.
2200 R.P.M.
2000 R.P.M.
1800 R.P.M.
1600 R.P.M.
1400 R.P.M.
PRESS. AND TEMP. STD. AT POWER HORSE BRAKE
1200
1100
1000
900
800
700
600
500
400
300
+15
0
25
STANDARD ALTITUDE TEMPERATURE °C (Ts)
MAX. LEVEL
OBITY ALTITUDE IN FEET
ALLISON DIV G M CORP
MANUFACTURER
ENGINE MODEL V-1710-83 (E18)
PROP GEAR RATIO 2.0:1
COMPRESSION RATIO 6.65:1
SUPERCHGER GEAR RATIO 9.60:1
IMPELLER DIAMETER IN 9.60
FUEL METERING STROMBERG PD12-K6
FUEL GRADE AN-VV-F-781 - AMEND 5
DATE 11 - 2 - 42
ENG. SPEC No. 164
APPROVED

WP-5-5-41-UM

Specifications as of dates listed below shall be applicable to this model specification. Any specification revisions and/or amendments issued prior to date of bid for this model engine and after the particular dates listed below shall not be applicable.

Army-Navy Spec.	AN-9500a	March 30, 1940
" " "	AN-9501a	March 30, 1940
" " "	*AN-9502a	March 30, 1940
" " "	*AN-9503a	March 30, 1940
" " "	*AN-9504	March 1, 1939
" " "	(2)*AN-9506	March 1, 1939
" " "	(3)*AN-9507	March 1, 1939
" " "	*AN-9510a	July 31, 1940
" " "	AN-9511a	July 31, 1940
" " "	AN-9513	March 1, 1939
" " "	*AN-9515a	March 30, 1940
" " "	AN-9516	March 1, 1939
" " "	AN-9517	March 1, 1939
" " "	AN-9518	March 1, 1939
" " "	AN-9519	March 1, 1939
" " "	*AN-9521	March 1, 1939
" " "	AN-9533	March 1, 1939
" "	(2)*AN-9520	March 1, 1939
A-N Aero Spec.	AN-F-E-568	Nov. 27, 1941
" " "	*AN-GGG-S-126	July 5, 1939
" " "	*AN-J-C-56	Oct. 10, 1941
" " "	*AN-P-4	Jan. 14, 1942
" " "	(2)*AN-QQ-M-181	March 24, 1939
" " "	*AN-VV-C-566	August 1, 1939
" " "	*AN-VV-F-746	Oct. 5, 1940
" " "	*AN-VV-F-748	Sept. 22, 1941
" " "	(5)*AN-VV-F-781	Sept. 26, 1940
" " "	AN-VV-O-446	Dec. 15, 1941
U. S. Army Spec.	95-32152	Nov. 5, 1941
Army-Navy Dwg.	AN-4033	March 1, 1939
" " "	AN-4034	Feb. 25, 1939
" "	AN-4037	June 10, 1940
AND Dwg.	AND-10201	April 12, 1940

Note: *(Asterisk) and preface number in ( ) (parentheses) indicate that the specification has been amended and the particular amendment that is applicable.

REVISION RECORD 164-B

V-1710-83 E18

This revision was made primarily to incorporate the change in take-off speed from 2800 to 3000 RPM. Inasmuch as all engines on the contract have been manufactured to date, there have been no changes made except paragraphs pertaining to the change in speed, except that additional data has been added showing estimated performance and fuel consumption.

Detailed changes in the paragraphs listed below have been made as follows:

Page 1 — Revision date, November 2, 1942 added.

Par. A-1a — **Army-Navy Specifications.**

Page 16 changed to Page 17.

Par. E-3 — Acceptance.

The following sentence has been deleted:
"The approval of the 1200 BHP rating at 2800 RPM take-off rating is based upon tests run at Materiel Center in accordance with Par. F-3d(2) of Spec. AN-9502a using fuel conforming to AN-VV-F-781 Amendment No. 5."

Par. E-5a — Ratings.

Speed at take-off changed from 2800 to 3000 RPM.

Par. E-5b(2) — Curves.

"Curves required shall be furnished after altitude calibration" has been changed to "Estimated performance data at altitude as shown on Page 15."

Note: The required altitude chamber calibration has not been received, but in order to make the specification more complete, the estimated curves have been included.

Par. E-5b(3) — Curves.

"Specific Fuel Consumption curves shall not be furnished (See Page 15)" has been changed to "Estimated fuel consumption curve as shown on Page 16."
Note: The SFC has not been shown on 164-A since the carburetor had already been calibrated on an engine of different blower ratio. The curves included in the B revision are not guarantees but indicate the probable fuel consumption obtained with the PD12K6 carburetor.

REVISION RECORD 164-B

V-1710-83 E18

Par. E-5h Coolant Flow and Heat Rejection.

Take-off speed changed from 2800 to 3000RPM.

Par. E-5i Oil Flow and Heat Rejection.

Take-off speed changed from 2800 to 3000RPM.

Page 14 Performance at Rated Speeds.

Take-off speed has been changed from 2800 to 3000 RPM and the constant manifold pressure line from take-off to full throttle at 3000 RPM has been added.

Page 15 Fuel Consumption.

As indicated under the Par. E-5b(3) of this revision record, the fuel consumption has been estimated rather than listing the authority for using the PD12K6 carburetor without further calibration.

Page 16 Estimated Altitude Performance.

As indicated under Par. E-5h(2) above, the estimated performance at altitude has been shown.

Note: This revision record is submitted for convenience. In case of discrepancy between the revision record and the specification, the specification shall be considered correct.