

Spec. No. 142-C

Date Issued: September 24, 1940

Revised: June 6, 1941
July 16, 1942
January 16, 1943

MODEL SPECIFICATION

ENGINE, AIRCRAFT: MODEL V-1710-93

ALLISON DIVISION
General Motors Corporation
Indianapolis, Indiana

(ALLISON MODEL DESIGNATION V-1710-E11)

MODEL SPECIFICATION
ENGINE, AIRCRAFT: MODEL V-1710-93
Allison Division of General Motors Corp.
(Allison Model Designation V-1710-E11)

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 Specifications and applicable specifications of the issues indicated on Page No. 23.

B. TYPE AND MODEL.

B-1 This specification covers the requirements for the V-1710-93 engine.

C. MATERIAL AND WORKMANSHIP.

C-1 The requirements for material and workmanship shall be as specified in Spec. 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:

40076 Engine Assembly, Complete (showing accessory drive oil seals.)

40075-J Installation Drawing (showing clearances for engine accessories and their removal.)

43090-E Auxiliary Super. Control, Model SC3.

43850-H Regulator-Assembly - automatic manifold pressure, Model PC4.

- 43590 Priming System Assembly.
- 42295-M Carburetor, PT-13E-9 Bendix Stromberg.
- 40600-M Spark Plug Assembly AC-LS85.
- 40601-H Spark Plug Assembly Champion - C34S.
- 43389-B Spark Plug Assembly Champion - C35S.
- 42354-D Terminal, Spark Plug (Contact)
Lubrication System Diagram.
- 42279-G Magneto.
- 43553-B Radio Shielding Assembly.
- 43016 Manifold Assembly - Spark Plug Cooling R.H.
- 43017 Manifold Assembly - Spark Plug Cooling L.H.
- 33536-Q Nut - Magneto Cable Shielding Conn.
- 42348-D Shielding - Spark Plug Cable - Intake.
- 43556-B Shielding - Spark Plug Cable - Exhaust.

E-3 Acceptance.

E-3a Acceptance Test. The acceptance of this engine in production shall be based upon tests run in accordance with AN-9503a with the following exceptions:

- (1) (Ref. Par. F-5a) Two Hour Initial Run.
During the last fifteen minutes of the 90% normal rated manifold pressure and the last 10 minutes of the normal manifold pressure runs, the auxiliary stage coupling shall be adjusted for minimum slip and the manifold pressure reduced to a limit with a safe operation margin to prevent **damage to engine.** During the first part of the runs, the auxiliary stage coupling control shall be adjusted to give maximum slip.
- (2) (Ref. Par. F-5a (1)a) Clutch Shift Run.
The engine shall be run at 100% normal rated speed, and at approximately 60%

normal rated power. Ten changes at intervals of not less than two minutes shall be made from maximum slip to minimum slip immediately prior to, or at the conclusion of, the two hour initial run.

- (3) (Ref. F-5a (1)b) Take-off Run. The auxiliary stage coupling control shall be set to obtain the slip required for take-off manifold pressure.
- (4) (Ref. F-5a (3) Penalty Run. At the option of the contractor, penalty runs affecting any one of the three major assemblies (Engine, Auxiliary Stage, Outboard Reduction Gear) may be run with other "workhorse" or standby assemblies.
- (5) (Ref. F-5b) Running in Prior to Final Run.
This run shall consist of a one hour run instead of a two hour run.
- (6) (Ref. F-5c) Final Run. The last 10 minutes of the last half hour normal power run shall be made with the auxiliary stage coupling control set for minimum slip and the manifold pressure reduced to a limit with a safe margin to prevent detonation. During the first one-half hour run and the first twenty minutes of the last run, the auxiliary stage coupling shall be set for maximum slip.
- (7) (Ref. F-5c(2)) Clutch Shifts. A single cycle (two shifts at not less than 2 minute intervals) of auxiliary stage speed changes shall be made as specified under E-3a(2) above.
- (8) (Ref. F-5c(3)) Take-off checks shall be made with the auxiliary stage coupling control set to obtain the slip required for take-off manifold pressure.
- (9) (Ref. F-5c(4)) Magneto Check. The auxiliary stage coupling shall be set as per above Par.8 Ref. F-5c(3) slip.

- (10) (Ref. Par. F-6a(1)) The knock rating of the fuel shall be in accordance with AN-F-28, Grade 130.
- (11) (Ref. Par. F-6j) Multi-stage Superchargers. The carburetor is located on the inlet side of the auxiliary stage and provisions of this paragraph are inapplicable. The tests outlined under E-3a of this specification are applicable.

E-3b. Model Test. The engine shall be model tested in accordance with AN-9502, with the following exceptions:

- (1) (Ref. Par. F-1) General. The deviations contained herein are based upon the assumption that the model test will be conducted at a Government laboratory and that the runs at altitude conditions will be made in an altitude chamber.
- (2) (Ref. Par. F-3) Test Methods. It is desired that two engines be used for the tests required. Altitude performance calibration shall be incorporated on page 21 of this specification after mutual concurrence by the Government and the contractor of the data obtained.
- (3) (Ref. Par. F-3e(2)) Two Stage, Two Speed Supercharged Engines. Tests outlined in this paragraph are not applicable. See Par. 4 Ref. F-3e(3) below.
- (4) (Ref. Par. F-3e(3)) Special Features. Special tests shall be required for this engine in that design features differ from the conventional arrangement as follows:
- (a) The carburetor body containing the air throttle shall be located on the air inlet side of the auxiliary stage.

- (b) The fuel injection nozzle shall inject fuel into the inlet side of the engine stage supercharger.
- (c) The automatic manifold pressure regulator and control arrangement are a part of the engine and are required for obtaining engine operating characteristics.
- (d) The speed of the auxiliary stage shall be determined by an automatic device which controls the slip of the hydraulic coupling and is dependent upon altitude.
- (5) (Ref. AN-9502 Par. F-3d) 150 Hour Endurance Run. Following the power control calibration, the second engine shall be given the following 150 hour endurance run conducted by the Procuring Agency. For all runs the automatic coupling control shall be set at the setting agreed upon between the contractor and the Procuring Agency at the time of model testing.

Run No.	Hours	Alt. Periods	Power	Speed	Altitude Condition	
					N.A.C.A. Report No. 218	
1.	5	Continuous	1040	2600	10,000 feet	
2.	5	15 minutes	936	2520	10,000 feet	
		15 minutes	1040	2600	10,000 feet	
3.	7-1/2	15 minutes	1270	3000	10,000 feet	
		15 minutes	350	1950	10,000 feet	
4.	5	Continuous	1000	2600	20,000 feet	
5.	5	Continuous	900	2520	20,000 feet	
6.	5	15 minutes	900	2520	20,000 feet	
		15 minutes	1000	2600	20,000 feet	

Run No.	Hours	Alt. Periods	Power	Speed	Altitude Condition
					N.A.C.A. Report No.218
7.	7-1/2	15 minutes	1150	3000	22,400 feet
		15 minutes	320	1950	22,400 feet
8.	15	5 minutes	1325	3000	Sea Level
		10 minutes	Idle	Idle	Sea Level
9.	25	2-1/2 hours	1050	2600	Sea Level
		2-1/2 hours	840	2420	Sea Level
10.	25	2-1/2 hours	1050	2600	Sea Level
		2-1/2 hours	735	2320	Sea Level
11.	25	2-1/2 hours	1050	2600	Sea Level
		2-1/2 hours	630	2180	Sea Level
12.	15	Continuous	630	1820	Sea Level
13.	5	Continuous	1050	2860	Sea Level

- (6) (Ref. F-3g) Dive Tests. Dive tests shall be conducted with the auxiliary stage coupling control set in the position required for take-off.
- (7) (Ref. F-4a(1)) Knock Rating of Fuel. The fuel used shall conform to AN-F-28, Grade 150, Art. 5.
- (8) (Ref. F-4g) Fuel and Oil Consumption. The fuel consumption for model testing shall be maintained within the limits of +3 -0% of the guaranteed values listed on Page 22 for sea level runs. For runs at altitude conditions the fuel consumption shall be that agreed upon between the Government and contractor following the calibration of the first engine.
- (9) (Ref. F-4m(1)) Data. In addition to the data normally taken, it is required that oil inlet and outlet temperatures and pressures be taken on the auxiliary stage, and that provisions be made to measure the speed of the auxiliary stage impeller during all tests when practical. The temperature of the air at the auxiliary stage outlet and the mixture temperature in the center manifold shall also be taken at the specified intervals.

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

Basic Engine, including integral supercharger, supercharger drive mechanism, auxiliary stage supercharger and drive mechanism, propeller reduction gears, coolant pump and piping on the engine, engine lubrication system oil pumps, starter connection including starter deg, tachometer drives, fuel pump drive, generator drive, vacuum pump drives, propeller governor drive, auxiliary supercharger coupling control, manifold pressure regulator, and all piping and controls between engine parts.	1513.5 lbs.
Carburetor and Injection Nozzle	52.0
Carburetor Screens and Gaskets	1.5
Magneto, Shielded	13.0
Ignition Distributors (included in Shielding Assembly)	
Radio Shielded Ignition Assembly, complete with Cable and Distributors	32.0
Spark Plugs	6.0
Priming System on Engine	.5
Cooling Air Deflectors and Baffles	none
Accessory Drive Covers	1.5
TOTAL DRY WEIGHT OF ENGINE	1620.0

E-5 Performance Characteristics. The ratings specified herein, and the curves specified herein and shown on Pages 20, 21, and 22, 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 Spec. AN-9502.

E-5a Ratings. The engine shall be rated as follows, using fuel conforming to Spec. AN-F-28, Grade 130, and oil conforming to Spec. AN-VV-0-446, Grade 1120.

1050	BHP at 2600 RPM at sea level.
1000	BHP at 2600 RPM at 20,000 feet normal rated altitude.
1325	BHP at 3000 RPM take-off for five minutes.
1150	BHP at 3000 RPM military rating at 22,400 feet military rated altitude for 15 minutes.

These ratings are based on standard sea level and altitude temperatures and pressures at the carburetor inlet. Control of the auxiliary stage supercharger hydraulic coupling is to be obtained by use of the auxiliary supercharger coupling control so adjusted as to give approximately the engine performance characteristics as shown on the rated power curves, Page 20.

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 20.
- E-5b(2) Estimated altitude performance as shown on page 21.
- E-5b(3) Fuel consumption curves as shown on Page 22.

E-5e Specific Oil Consumption. The specific oil consumption of the engine, including that consumed by the auxiliary stage and drive, shall not exceed .025 lbs./BHP/hr. at normal rated power and speed; .025 lbs./BHP/hr. at 70 per cent 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 1325 BHP
Speed	Take-off 3000 RPM
Fuel Consumption	Guaranteed Specific
Oil Inlet Temp.	185°F.
Oil Pressure	65 p.s.i. (Engine & Aux. Stage)
Coolant Outlet Temp.	250°F.
Oil Flow	
Engine	155 lb./min.
Aux. Stage	38 lb./min.
Air Blast on Engine.	60°F at 10 MPH

Guarantee:

Coolant flow not to exceed - 265 gal./min.
Heat rejection to coolant not to exceed - 430 HP.

E-5h(1); E5h(1)(a); E-5h(1)(b) Coolant Pump Data. Curves required shall be furnished following completion of tests of the coolant pump with an external system to be used in the airplane as furnished by the airplane manufacturer.

E-51 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 1325 BHP
Speed Take-off 3000 RPM
Fuel Consumption Guaranteed Specific
Oil Inlet Temp. 185°F.
Oil Pressure 65 p.s.i. (Engine and Aux. Stage)
Coolant Outlet Temp. 250°F.
Coolant Flow 265 GPM
Air Blast on Engine 60°F. at 10 MPH

Guarantee:Engine:

Oil flow not to exceed - 155 lb./min.
Heat rejection to oil not to exceed - 155 HP.

Auxiliary Stage:

Oil flow not to exceed 38 lb./min.
Heat rejection to oil not to exceed 45 HP.

E-6 Engine Performance. (Ref. AN-9500, Par. D-6)
The complete engine shall function satisfactorily up to an altitude of 40,000 feet or to the service ceiling of the airplane whichever is the minimum value.

E-7 Propeller. This engine shall have a No. 60 (modified) propeller shaft end as shown on Installation Drawing No. 40075. Provision shall be made for a governor type of propeller control mechanism. No provision shall be made for hydraulic propeller operation. An oil vapor opening shall be provided on the governor mounting pad as shown on the Installation Drawing No. 40075; 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	215-13/16 inches
Width	29-9/32 inches
Height	40-1/16 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) (Ref. Par. F-3n. Crankcase) A dehydrator plug conforming to Allison Division Drawing No. 42288 shall be installed in a suitable ^{late} opening of the crankcase.
- (2) (Ref. Par. F-3o. Propeller Shaft) A propeller shaft thread cap conforming to Allison Division Drawing No. 41310 shall be installed.
- (3) (Ref. Par. F-4a. Packing Procedure) The engine bag and outboard reduction gear bag shall conform to Allison Division Drawings No. 41616 and 41694.
- (4) (Ref. 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.
- (5) (Ref. 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.
- (6) The outboard reduction gear assembly, extension shafts, and auxiliary stage supercharger 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 to the engine which successfully completes Government tests shall constitute a requirement of this specification.

E-18 Propeller Drive. The engine shall be equipped with a reduction gear ratio of 2.23:1. 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 shall 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 20.0 lbs./min. at military 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 Spec. Y-3587.

E-19 Impeller Gear. The impeller gear ratios shall be 8.1:1 and 6.85:1 and the impellers shall be 9-1/2 inches and 12-3/16 inches in diameter. (Aux. stage ratio of 6.85:1 with no slip in hydraulic coupling).

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

E-23 Ignition System. Supercharging of the distributors and the magneto shall be accomplished by a connection to the auxiliary stage supercharger as shown on Installation Drawing No. 40075.

E-23a(1) Spark Plugs. The engine shall be fitted with AC-LS85, Champion C34S, or Champion C35S 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 Spec. 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, 43556, and 42348.

E-23c. High Tension Ignition Cable. (Ref. AN-9500 Par. D-23c) The distributor to spark plug leads shall be 5mm neoprene covered ignition cable conforming to Packard Cable Part No. 52473R. All other cable shall conform to AN-J-C-56 (7mm).

E-23d. Magneto. The engine shall be equipped with one Scintilla Type DFLN6 magneto in accordance with Spec. AN-9511 with the following exceptions:

- (1) (Ref. Par. D-1b(1) Threads) Connections for the high tension terminals are 15/16-18 threads.
- (2) (Ref. Par. E-2c Normal Operating Temperature) The temperature rise of this magneto is 55.5°C (100°F) above room temperature.
- (3) (Ref. Par. E-2d Endurance) These requirements shall not be met except that during the Operating Run, Par. F-4a(11)a, the breaker shall be lubricated at intervals of approximately 100 hours, and during the Elevated Temperature Run, Par. F-4a(11)b, the ambient temperature shall be 150°F.

E-23f. Cooling. (Ref. AN-9500 Par. 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. 40075 and Drawing Nos. 43016 and 43017, 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 Par. E-23c of this spec. does not fail below this temperature.

E-24. Lubricating System. The oil supply for the out-board reduction gear assembly shall be separate from the engine as stated in Par. E-18 of this specification.

The auxiliary stage supercharger shall be equipped with scavenge and pressure oil pumps which are independent from the engine. The unit is designed to operate from either the engine oil supply tank or a separate oil supply tank.

E-24c Oil Leakage Test. (Ref. Spec. AN-9500 Par. D-24c) With a mixture of equal parts of aviation gasoline and oil having a viscosity of approximately 100 S.U.S. at 210°F supplied to the pressure oil pump inlet at room temperature under a head of 36 inches, the total flow of oil into the engine due to leakage through the pump shall not exceed 0.2 pounds per hour, after the model test.

E-24e Scavenging System. The engine and auxiliary stage scavenging systems shall adequately scavenge the oil under the following conditions:

- (a) No air traps exist in the external scavenging systems.
- (b) Operating conditions are normal.
- (c) Maximum back pressure on scavenge pumps:

Max. Flow	40 p.s.i.
Min. Idle	10 p.s.i.

Note: Since the gear type pump will not "prime" when air locked, the back pressures given above shall be permissible if not more than 2 p.s.i. of the pressure is due to a spring loaded relief valve. The reason is to permit free passage of air at all times through the scavenging pumps.

- (d) Oil - grade 1100 or 1120 of AN-VV-O-446.
- (e) Viscosity of Inlet oil - 100 \pm 5 S.U.S.

E-24f Pressure Pump. In addition to the requirements of Par. D-24f of AN-9500 the oil pressure pumps shall function satisfactorily when the inlet pressures are 82% or more of the absolute atmospheric pressure, down to a minimum of 8 inches Hg. absolute, when no air leaks exist in the external oil inlet lines.

E-24g Oil Cleaner. The engine shall be equipped with one Manual Cuno, Allison Part No. 44044, oil strainer. The aux. stage shall be equipped with one Automatic Cuno No. 11597. Both cleaners shall meet the requirements of AN-9500 Par. D-24g under normal operating conditions.

E-24c Lubrication Points. The various components of the assembly requiring lubrication other than from the engine lubrication system are as follows:

<u>Component</u>	<u>How Lubricated</u>
Outboard Reduction Gear Assembly	Separate oil tank, see Par. E-18.
Extension Shaft Center Bearing	Manual lubrication Mobilgrease Zero.
Auxiliary Stage Supercharger	Separate system as described in Par. E-23-24
Auxiliary Stage Supercharger - Flexible Drive	Manual lubrication Mobilgrease Zero.

E-24q. Crankcase Breathers. Ample breathing capacity shall be provided in accordance with Par. D-24q of Spec. 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 of the 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 the front to the rear.

E-25. Fuel Metering System. The engine shall be equipped with one Bendix-Stromberg PTL3E9 injection carburetor in accordance with Spec. AN-9515 except for the following:

- (1) (Ref. Par. D-7 Strainer) The carburetor shall meet requirements except that foreign material is not removed with the strainer.
- (2) (Ref. Par. D-10 Fuel Line Connections) The carburetor shall be furnished with one 3/4 inch pipe thread fuel line connection.
- (3) (Ref. Par. D-22a Name Plate) The carburetor will be furnished with present name plate until such a time that new name plates are available and present name plate stock is exhausted.
- (4) (Ref. Par. D-26 Protective Treatment of Steel Parts) Cadmium plated parts shall have a minimum plating thickness of .0003 inches.
- (5) (Ref. Par. D-32a(2) and (3) Altitude and Carburetor Air Temperature Compensation) The carburetor, which compensates automatically for temperature and altitude, shall hold the fuel-air ratio at constant air flow to within the following limits:
 - (a) $\pm 2\%$ from sea level to 16,000 feet altitude within temperature limits of -20°F. to 120°F.

- (b) $\pm 3\%$ from 16,000 to 25,000 ft. altitude within temperature limits of -40°F to 40°F .
- (c) $\pm 5\%$ from 25,000 to 40,000 ft. altitude within temperature limits of -67°F to 0°F .
- (6) (Ref. Par. D-32b to D-32b(3) inclusive. Metering Characteristics) In lieu of the requirements of these paragraphs, the carburetor shall be set to give the mixture strength as shown on Page 19.
- (7) (Ref. Par. D-32b(17) Fuel Pressure) The fuel pressure used during the reference carburetor tests shall be maintained at 16 ± 1 p.s.i.
- (8) (Ref. Par. F-4e(3) Metering Tests of Production Carburetors) The requirements of this paragraph shall be met except that mixture readings in automatic lean shall be checked only at airflows corresponding to 30, 40, 50, and 60% normal rated power airflows and at normal and take-off airflows.

The carburetors shall be checked for automatic altitude compensation at airflows equivalent to 50% of normal rated power airflow with the mixture control in the auto-lean position at air box pressures of 0, -8, -14, -23 inches 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, Drawing No. 43590.

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. A fuel aspirator without a valve shall be the only provision made for automatic drainage of the induction system of the integral supercharger.

E-32a. Exhaust Flanges. (Ref. Spec. AN-9500 Par. D-32a) The use of exhaust flanges in accordance with Allison Part No. 44018 (AMS 5080) or Part No. 34667 (AMS-5645) and exhaust flange gaskets Part No. 40751 shall be a requirement in the installation of this engine. The exhaust flanges shall not be furnished with the engine and separate procurement must be initiated by the airplane manufacturer. The gaskets and nuts shall be furnished with the engine.

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:

<u>Accessory Drives</u>	<u>Ratio to Crankshaft</u>	<u>Torque Ratings</u>		<u>Rotation</u>
		<u>In.-Lbs</u>		
		<u>Continuous</u>	<u>Static</u>	
Starter	1.000:1	-	16200	C
Generator	1.440:1	600	6000	C
Fuel Pump	0.864:1	25	450	CC
Gun Synchronizer Impulse Generator	0.449:1	25	125	CC
Vacuum Pump (Rear)	1.440:1	150	2250	C
Vacuum Pump (Side)	1.440:1	150	2250	CC
Tachometer (Two Drives)	0.500:1	2.5	12.5	C
Propeller Governor	0.832:1	15	150	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 AN-9517 except that one stud shall be off location by 15° to permit removal of starter as shown on Installation Drawing 40075. The direction of rotation when looking at the starter dog attached to the engine shall be clockwise.

E-36a(1) (Ref. Spec. AN-9517 Par. E-4b) Starter clearance values as specified shall not be provided. (Clearance shall be provided as shown on the Installation Drawing No. 40075.)

E-36b. Generator. (Ref. Spec. AN-9518 Par. E-4) Generator clearance values as specified shall not be provided. (Clearance shall be provided as shown on Installation Drawing No. 40075).

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 Par. 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. Two Type II mounting pads and drives in accordance with AN-9521 shall be furnished with the exceptions to Par. E-3b that the slotted adapter bushing shall not be furnished on either pad and the adapter flange shall not be furnished on the side drive.

F METHODS OF SAMPLING, INSPECTION, AND TESTS.

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

G PACKAGING, PACKING, AND MARKING FOR SHIPMENT.

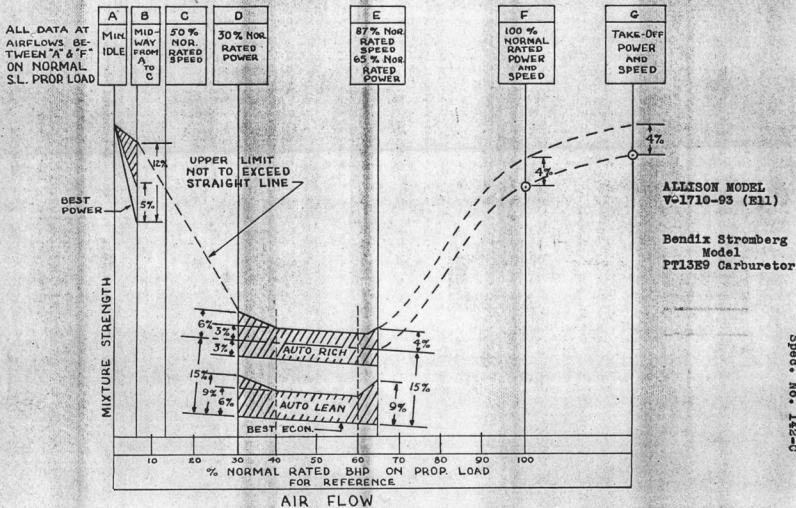
G-1 The requirements for packaging, packing and marking for shipment shall be as shown in Spec. AN-9500.

CARBURETOR SETTINGS

IN LIEU OF PAR. D-32b TO D-32b(3) OF AN951b THE CARBURETOR SETTING SHALL BE ESTABLISHED AS SHOWN BELOW.

○ - GUAR. SPECIFIC FUEL CONSUMPTION POINTS

▨ - SETTING WILL FALL WITHIN SHADED AREA AND WITHIN LIMITS SPECIFIED AT SPECIFIED AIRFLOWS.



PERFORMANCE
MANIFOLD PRESSURE

ALTITUDE PERFORMANCE
HORSE POWER AND MANIFOLD PRESSURE
WITHOUT RAM
SUBJECT TO ±2½% VAR.

MAXIMUM POWER
(UNLESS OTHERWISE NOTED)
ALLISON DIVISION G.M. CORP.
ENGINE MODEL V-1710-93 (E11)
PROP GEAR RATIO 2.23:1
COMPRESSION RATIO 6.65:1
SUP-CHGR GEAR RATIO 8.1 ING 6.85 AUX.
IMPELLER DIAMETER IN 9 7/8 & 12 1/8
FUEL METERING P113-E3 (STROMBERG)
FUEL GRADE AVIATION-28-GRADE 130
DATE 7-16-43
ENG. SPEC. No. NR APPROVED

RATINGS GIVEN WITH GUARANTEED SPECIFIC FUEL CONS.

1400
1300
1200
1100
1000
900
800
700
600
+15
0
-25
SEA LEVEL
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
15000
16000
17000
18000
19000
20000
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36000
37000
38000
39000
40000
41000
42000
43000
44000
45000
46000
47000
48000
49000
50000

TAKE-OFF RATING
1325 BHP AT 3000 RPM
FOR FIVE MINUTES
(50% W.G. M.P.)

3000 RPM

MILITARY RATING
1120 BHP AT 2200 FT.
3000 RPM FOR 15 MINUTES
(50% W.G. M.P.)

NORMAL RATING
1850 BHP AT SEA LEVEL
2500 RPM
(43% W.G. M.P.)

2500 RPM

NORMAL RATING
1000 BHP AT 20000 FT.
2500 RPM (42.5% W.G. M.P.)

THE POWER CURVE CHARACTERISTICS
SHOWN MAY BE OBTAINED WITH
SUBSTANTIALLY CONSTANT CONTROL
SETTING ON THE HYDRAULIC COUPLING
CONTROL AND AUTOMATIC MANIFOLD
PRESSURE REGULATOR

2000 RPM
1500 RPM

STANDARD ALTITUDE TEMPERATURE °C (Ts)

DENSITY ALTITUDE IN FEET

MAXIMUM POWER

(UNLESS OTHERWISE NOTED)
ALLISON DIV. G.M. CORP. MANUFACTURER
 ENGINE MODEL **V-1710-93(E-11)**
 PROP GEAR RATIO **2.23:1**
 COMPRESSION RATIO **6.65:1**
 SUP'CH'GR GEAR RATIO **8.1 ENG. 6.85 AUX.**
 IMPELLER DIAMETER IN. **9 3/8 & 12 3/16**
 FUEL METERING **P-13 E3 (STRAMBRO)**
 FUEL GRADE **AV-148 - GRADE 130**
 DATE **1-18-43**
 ENG. SPEC. No. **142** APPROVED

ESTIMATED PERFORMANCE AND OPERATING LIMITS

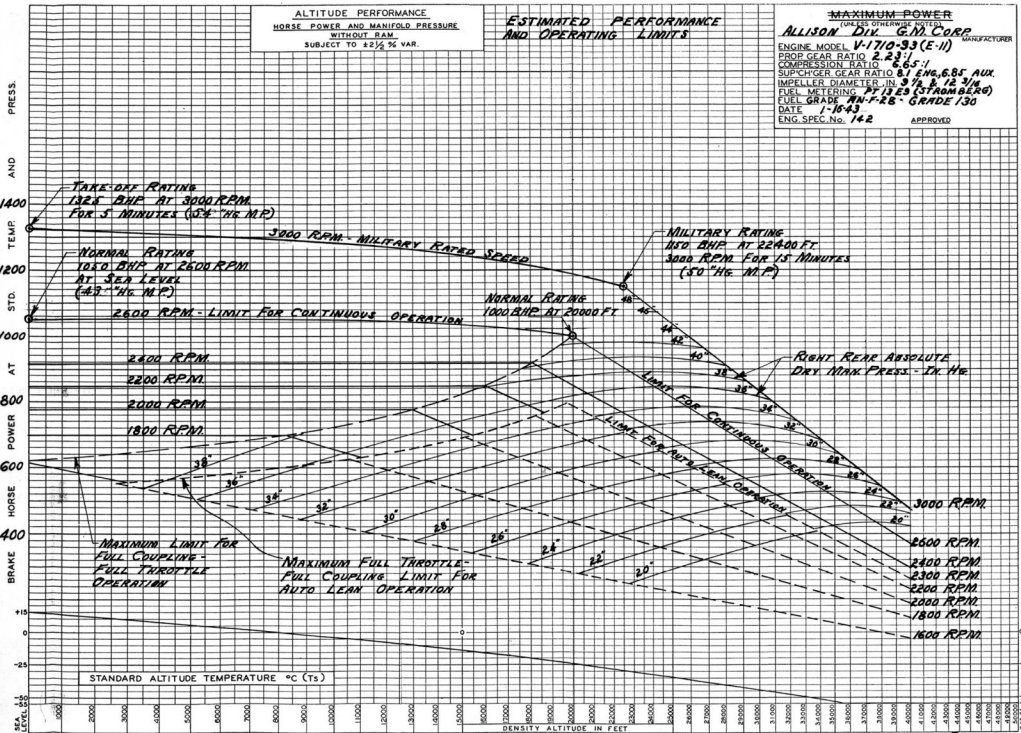
ALTITUDE PERFORMANCE
 HORSE POWER AND MANIFOLD PRESSURE
 WITHOUT RAM
 SUBJECT TO $\pm 2\frac{1}{2}$ % VAR.

SEA LEVEL PERFORMANCE

HORSE POWER VS MANIFOLD PRESSURE

TO FIND ACTUAL H.P. WHEN GIVEN PRESS ALT., R.P.M., MAN. PRESS & FREE AIR TEMP.

- LOCATE POSITION "A" ON ALTITUDE CURVE FOR GIVEN R.P.M. AND MANIFOLD PRESSURE.
- LOCATE "B" ON SEA LEVEL PERFORMANCE CURVE FOR SAME R.P.M. AND MANIFOLD PRESSURE. TRANSFER POSITION TO "C".
- DRAW STRAIGHT LINE FROM "C" THRU "A" AND READ H.P. AT OBSERVED DENSITY ALTITUDE OF FLIGHT. (POINT "D" IN EXAMPLE.)
- CORRECT H.P. IN ACCORDANCE WITH FREE AIR TEMPERATURE BY APPLYING THE FOLLOWING--
 (A) ADD 1% FOR EACH 6° C. DECREASE FROM T_s.
 (B) SUBTRACT 1% FOR EACH 6° C. INCREASE FROM T_s.
 (T_s = STANDARD ALTITUDE TEMP.)

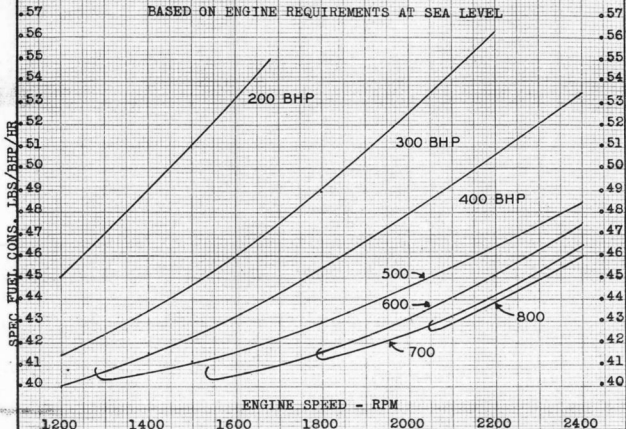


INDICATES MAXIMUM ALLOWABLE BHP FOR CONTINUOUS OPERATION WITH FULL COUPLING AND FULL THROTTLE. ACTUAL SETTING ON COUPLING CONTROL MAY VARY THE ALTITUDE AT WHICH FULL COUPLING CAN BE OBTAINED.

INDICATES MAXIMUM BHP FOR CONTINUOUS OPERATION IN AUTO LEAN AT RPM INDICATED.

INDICATES MAXIMUM BHP FOR CONTINUOUS OPERATION AT RPM INDICATED AND MUST BE IN AUTO RICH.

ESTIMATED BEST ECONOMY SPECIFIC FUEL CONS.
 BASED ON ENGINE REQUIREMENTS AT SEA LEVEL



Guar. B.S.F.C. on normal
 S.L. Rated Prop. Load at
 Sea Level.
 (For Model Testing)

% Normal Power	LBS/BHP/HR
100%	0.63
90%	0.60
80%	0.54
70%	0.48
60%	BEST ECON. EST. 0.45

Take-off Power -- 0.71

Military Power 0.75
 at Critical Altitude

(REF. PD 43)

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
" " "	(2)*AN-9510a	July 31, 1940
" " "	AN-9511a	July 31, 1940
" " "	AN-9513	March 1, 1939
" " "	AN-9515b	Aug. 6, 1942
" " "	AN-9516	March 1, 1939
" " "	AN-9517	March 1, 1939
" " "	AN-9518	March 1, 1939
" " "	AN-9619	March 1, 1939
" " "	(2)*AN-9520	March 1, 1939
" " "	*AN-9521	March 1, 1939
" " "	AN-9533	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-181a	Mar. 31, 1942
" " "	*AN-VV-C-566	August 1, 1939
" " "	*AN-VV-F-748	Oct. 5, 1940
" " "	*AN-VV-F-748	Sept. 22, 1941
" " "	AN-F-28	Dec. 23, 1942
" " "	AN-VV-C-446	Dec. 15, 1941

Army-Navy Dwgs.	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 142-C

V-1710-93 (E11)

This revision was made to adjust the data from the 142-B specification to those values which have been determined by development and altitude chamber tests. This revision contains those requirements requested by Materiel Center during preliminary correlation. No attempt will be made to list detailed changes except that a list of paragraph numbers changed are given below and also a list of major items.

Pages or Paragraphs changed:

Page 1	E-5a	E-23f
Par. E-2	E-5b	E-24e(c)
E-3a(1)	E-5e	E-24g
E-3a(10)	E-5h	E-25
E-3b(4)d	E-5i	E-26
E-3b(5)	E-12	E-32a
E-3b(7)	E-14	E-36a
E-3b(8) added	E-19	All curve sheets
E-4	E-23b(3)	and
E-5	E-23e	Page 23

Major items changed or incorporated in the 142-C Specification:

1. Fuel specification changed from AN-VV-F-781, amdnt. #5 to AN-F-28, Grade 130.
2. Altitude ratings changed from 21,000 ft. to 22,400 ft. military; and 19,000 to 20,000 ft. normal.
3. Weight increased from 1595 to 1620 pounds, total.
4. Engine oil flow increased from 150 to 155 lbs./min.
5. Engine stage supercharger ratio changed from 7.48:1 to 8.1:1.
6. Carburetor written up on the basis of AN-9515b instead of AN-9515a.
7. Automatic Engine Cuno changed to manual.
8. Exhaust flanges to be procured on separate contract - not to be furnished with the engine. See Par. E-32a.
9. All curve sheets revised.