

*See comments of
letter dated 9 Jan. 1946*

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Specification No. 2030-A
Original Date: April 10, 1945
Revised Date: June 4, 1945
Revised Date: November 29, 1945

MODEL SPECIFICATION
Engine; Aircraft XR-7755-5

Page No. 1 of 9

LYCOMING
Division-The Aviation Corporation

A. APPLICABLE SPECIFICATIONS:

A-1. The specifications listed on pages 8 and 9 shall form a part of this specification.

B. TYPE AND MODEL:

B-1. This specification covers the requirements for the model XR-7755-5 engine.

B-1a. The XR-7755-5 engine is a 36 cylinder, 6.375 inch bore, 6.75 inch stroke, liquid cooled, four row radial type engine equipped with a single speed propeller reduction gear unit, a single stage single speed supercharger, and fuel injection equipment.

C. MATERIAL AND WORKMANSHIP:

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

D. GENERAL REQUIREMENTS:

D-1. See Section E.

E. DETAIL REQUIREMENTS:

E-2. Drawings and Data. The following Lycoming Division-The Aviation Corporation drawings form a part of this specification:

<u>Drawing No.</u>	<u>Title</u>
80053	Engine Assembly, complete (showing accessory drive oil seals)
80006	Installation Drawing, fuel injection engine (showing clearances for engine accessories and their removal)
80234	Priming System Assembly
80232	Fuel Injector Pump
81411	Mixture Control Unit
20972	Spark Plug Assembly
20971	Spark Plug Assembly
20905	Terminal, Spark Plug

80030 Lubricating System Diagram
 80233 Shielding Assembly
 Complete list of AN Standard Parts used on Engine.

E-4. Acceptance. The acceptance of this engine shall be predicated upon the satisfactory completion of a test in accordance with specification No. AN-9503c except as follows:

F-9. Preparation for Storage. The engine shall be prepared for storage prior to shipment in accordance with Specification AN-F-E-568c, except as specified in paragraph E-4l herein.

E-6. Engine Weight.

E-6a. Dry Weight of Complete Engine. The total dry weight of the engine complete shall not exceed the following values:

Basic engine, including internal supercharger, supercharger drive mechanism, propeller reduction gears, coolant pumps and piping on the engine, engine lubrication system oil pumps, starter connection, including starter dog, tachometer drives, fuel pump drive, generator drive, power take-off drive, vacuum and hydraulic pump drives, propeller governor drive, and all piping and controls between engine parts	5187.5
Fuel Injector (Complete with pumps, control, nozzles and fuel lines)	167.0
Carburetor Screens and Gaskets	1.5
Ignition System	231.0
Priming System on Engine	3.0
Cooling Air Deflectors and Baffles	None
Accessory Drive Covers	2.0
Supercharger Pressure Regulator	<u>None</u>
TOTAL DRY WEIGHT OF ENGINE	5592.0 lbs.

E-7. Performance Characteristics. The ratings, curves, and guarantees specified herein are based on the terms and standard conditions defined in Specification No. AN-9503c.

E-7a. Guarantees.

E-7a(1). The performance guarantees are listed in the following table. These data are based on the use of fuel conforming to Specification AN-F-28 and oil conforming to Specification AN-VV-O-446a Grade 1120. When necessary these guarantees shall be demonstrated only on a dynamometer.

TABLE I
RATINGS AND SPECIFIC FUEL CONSUMPTION

<u>Ratings</u>	<u>BHP</u>	<u>RPM</u>	<u>Alt. (Ft.)</u>	<u>Spec. Fuel Cons.</u>	<u>Maximum Static Exhaust Pressure "Hg. Abs.</u>	<u>Maximum Allowable Temp. Cool. °C.</u>	<u>Minimum Dry Static Air Press. at Carb. Inlet "Hg. Abs.</u>
Take-Off Military	5000	2600	0	.70	32	121°	30
(a) Sea Level	5000	2600	0	.70	32	121°	30
(b) Critical Alt.	5000	2600	*	.70	32	121°	30
Normal							
(a) Sea Level	4000	2300	0	.62	32	121°	30
(b) Critical Alt.	4000	2300	*	.62	32	121°	30
90% Normal Rated Prop. Load	3600	2220	0	.56			
80% Normal Rated Prop. Load	3200	2135	0	.50			
70% Normal Rated Prop. Load	2800	2040	0	.485			

Minimum Specific Fuel Consumption for Cruising - .37 lbs/BHP/Hr.

* The critical altitude will correspond to the altitude at which the turbo supercharger can maintain 30 "Hg. Abs. pressure at the carburetor inlet without exceeding specified limits.

E-7a(1)a. The requirements of this paragraph will be fulfilled when sufficient engine test data are available.

E-7a(1)b. The ratings as given in Table I are based on a minimum of 37.8°C. (100°F.) carburetor air temperature.

E-7a(2). Ratings. The requirements of this paragraph will be fulfilled when sufficient engine test data are available.

E-7a(3). Curves. Curve No. 3985 shows H.P. versus altitude at take-off and normal rated speeds.

E-7b. Estimated Curves. The following estimated curves shall form a part of this specification. The remainder shall be furnished when sufficient test data are available.

Curve No. 3985.

E-7d. Specific Oil Consumption. The specific oil consumption shall not exceed .040 pounds per BHP-hour at military power and speed and .025 pounds per BHP per hour at normal rated power and speed and .020 pounds per BHP per hour at 70 per cent normal rated power and 89 per cent normal rated speed with the lowest degree of supercharging used at sea level.

E-7g. Coolant Flow and Heat Rejection.

E-7g(1). Normal Rated Power and Speed. When operating with a coolant outlet temperature of 121°C. (250°F.) at normal rated power and speed and guaranteed specific fuel consumption, the coolant flow shall not exceed 660 gallons per minute and the heat rejection shall not exceed 76,400 BTU per minute (1800 horsepower) with a 20 MPH, 60°F. air blast on the engine when measured on a dynamometer.

E-7g(2). Military Rated Power and Speed. When operating with a coolant outlet temperature of 121°C. (250°F.) at military rated power and speed and guaranteed specific fuel consumption, the coolant flow shall not exceed 750 gallons per minute and the heat rejection shall not exceed 95,000 BTU per minute (2,250 horsepower) with a 20 MPH, 60°F. air blast on the engine when measured on a dynamometer.

E-7g(3). Flow Characteristics of the Coolant Pump. The requirements of this paragraph will be fulfilled when sufficient coolant pump test data are available.

E-7i. Oil Flow and Heat Rejection.

E-7i(1). Normal Rated Power and Speed. When operating on a rigid test stand at normal rated power and speed, with an oil inlet temperature of 85°C. (185°F.), and with the specified oil pressure of 100 psi and other conditions as specified above under paragraph E-7g(1), the oil flow shall not exceed 400 pounds per minute, and the heat rejection to the oil shall not exceed 20,400 BTU per minute (480 horsepower). These data shall be obtained with oil conforming to Specification AN-VV-O-446a, Grade 1120.

E-7i(2). Military Rated Power and Speed. When operating on a rigid test stand at military rated power and speed, with an oil inlet temperature of 95°C. (203°F.) and with the specified oil pressure of 100 psi, and other conditions as specified above under paragraph E-7g(2), the oil flow shall not exceed 450 pounds per minute, and the heat rejection to the oil shall not exceed 25,500 BTU per minute (600 horsepower). These data shall be obtained with oil conforming to Specification AN-VV-O-446a, Grade 1120.

E-8. Engine Performance. The complete engine shall function satisfactorily up to the service ceiling of the airplane in which it is installed.

E-9. Torquemeter. The engine shall be equipped with a torquemeter.

- E-11. Overall Dimensions. The overall dimensions shall be substantially as follows:
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|----------|---|
| Length | - 100.47 inches |
| Width | - 60.50 inches |
| Height | - 66.25 inches (at Rear over sump & breather) |
| Diameter | - 61.00 inches |
- E-14. Pistons. The engine shall be fitted with pistons of approximately 8.5:1 compression ratio. Final compression ratio shall be that necessary to give guaranteed performance.
- E-15. Propeller. Provision shall be incorporated for a system without oil transfer provisions to propeller. The engine shall have a propeller shaft which, forward from the reference line for dimensions on the forward face of the propeller shaft thrust nut shall be No. 70 involute spline, and which aft from said reference line conforms to a nose for a No. 80 spline shaft. The direction of rotation when viewed from the anti-propeller end shall be clockwise.
- E-16. Propeller Drive. The propeller drive shall be equipped with a reduction gear ratio of $\frac{161}{286}$ (.563:1).
- E-18. Impeller Gear. The impeller gear ratio shall be approximately 6.0:1 and the impeller shall be 14.4 inches in diameter. Final gear ratio shall be that required to give guaranteed performance.
- E-25. Coolant Temperature. The cooling liquid outlet temperature shall not exceed 121°C. (250°F.). The coolant used shall be 70% ethylene glycol, 30% water by volume.
- E-25a. Coolant Pressure. The maximum inlet pressure to the cooling liquid pump shall be 30 pounds per square inch absolute.
- E-27. Fuel Metering System. The engine shall be equipped with two (2) Bosch EGN6393-69 fuel injection pumps and thirty-six (36) fuel injection nozzles. The normal operating fuel pressure at the inlet to the fuel injection pumps shall be 17 psi and the range of allowable fuel pressures shall be 15 to 20 psi. A reference fuel metering system shall not be submitted for approval for this engine model.
- E-27a. Following flight tests conducted by the aircraft manufacturers, sufficient data shall be submitted to the engine manufacturer to enable him to check the performance of the carburetor air scoops with any approved setting and to submit his recommendations to the Procuring Agency. Approval by the Government of any reference carburetor or required metering curve established therefrom shall not relieve the engine manufacturer of the responsibility for proper functioning of that carburetor and setting in various models of aircraft providing the recommendations of the engine manufacturers regarding scoop design changes are placed in effect.

- E-28. Special Connections to Induction System.
- E-28b. After Supercharger. No connection shall be provided in the intake manifold for combustion type heaters.
- E-30. Engine Starting. Provision shall be made for starting the engine with oil conforming to Specification AN-VV-O-446a Grade 1120, diluted with AN-F-28 fuel so that the viscosity of the oil is 35,000 Saybolt seconds at -28.9°C. (-20°F.). The engine shall start at -28.9°C. (-20°F.) with AN-F-28 fuel.
- E-31e. Scavenging System. When using an oil or diluted oil as specified in AN9500c, inlet temperature shall be maintained between _____°C. (____°F.) and _____°C. (____°F.).
- E-31h. Oil Pressure. The main engine oil pressure at normal rated power and speed shall be _____ and the engine nose section pressure shall be _____.
- E-32a(1). Spark Plugs. The engine shall be fitted with Champion C34S spark plugs. An alternate spark plug shall be selected at a later date. A Bendix low tension, low frequency ignition coil shall be mounted on each of the 72 spark plugs.
- E-32d. Magnetos. The engine shall be equipped with two Bendix low tension ignition generators Model number DRN-7. Specification AN-M-4 shall not be applicable except for material and workmanship. Ignition timing shall be _____°BTC as measured on number _____ cylinders.
- E-32d(2). Distributors. The engine shall be equipped with four Bendix low tension distributors, Lycoming drawing No. 80978.
- E-33. Accessory Pads and Drives. The requirements for accessory pads and drives shall be as specified in AN9500c except as follows:

Gun Synchronizing Impulse Generator. Provision shall not be made for installation of a Gun Synchronizing Impulse Generator.

Accessory Drive	Type	Gear No.	Gear Ratio	Maximum Permissible Continuous	Maximum Permissible Static	Direction of Rotation
				Torque Pound-Inches	Torque Pound-Inches	
Starter	I	2	3.040:1	-----	4800	Counter-Clockwise
Generator	I A	1	3.429:1	500	2200	Clockwise
Power Take-Off	III A	1	3.429:1	1500	6600	Clockwise
Vacuum Pump	II	2	1.567:1	250	1650	Clockwise
Fuel Pump	--	1	.937:1	50	600	Counter-Clockwise
Tachometer	II	2	.50:1	10	100	Counter-Clockwise
Prop. Governor	--	1	.986:1	125	2300	Counter-Clockwise
Fuel Injector	--	3	5000:1	300	1200	Clockwise

E-40a(1). Cadmium Plating. The requirements for cadmium plating shall be as specified in AN-9500c, except as follows:

The cadmium plating shall conform to specification AN-P-61.

E-41. Preparation for Storage. The engine shall be prepared for storage prior to shipment, in accordance with Specification AN-F-E-568c except as follows:

B-1a. AN Aeronautical Specifications.

AN-C-80 This specification shall not be applicable.

F-4a. Packing Procedure. An engine bag conforming to the Lycoming Division-The Aviation Corporation drawing No. _____ of a material conforming to AN-P-54, class A, except as follows shall be used to enclose the engine.

D-4. Shock Strength. A test ball shall not rupture the film from any height less than 23 inches with the film at a temperature of $21.1 \pm 2.8^{\circ}\text{C}$. ($70^{\circ} \pm 5^{\circ}\text{F}$).

F. METHODS OF SAMPLING, INSPECTION, AND TESTS.

F-1. The requirements for sampling, inspection, and tests shall be as shown in Specification No. AN-9500c, except as follows:

F-2b. Magnetic Inspection. The requirements for magnetic inspection shall be as specified in Specification No. AN-9500c except that the magnetic inspection shall be in accordance with Specification number AMS-2640.

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-9500c.

<u>Specification No.</u>	<u>Title</u>	<u>Date Issued</u>	<u>Amendment</u>
<u>Army-Navy Aeronautical Specifications</u>			
AN-C-53	Compound, Anti-Seize; White Lead Base, For Threaded Fittings	Apr. 24, 1942	No. 2
AN-F-E-568c	Engines; Aircraft; Preparation for Storage, Process for	June 27, 1944	
AN-M-4	Magnetos; Aircraft Engine Driven	Dec. 7, 1942	No. 2
AN-QQ-M-181a	Metals; Magnetic Inspection of (Process and Application)	Mar. 31, 1942	No. 2
AN-N-1	Noses; Aircraft Engine	Sept. 21, 1944	
AN-GGG-P-363	Pipe-Threads; Taper, Aircraft	Dec. 14, 1940	No. 2
AN-P-54	Plastic-Film; Transparent, Moisture-Impervious	Feb. 7, 1944	
AN-P-61	Plating; Cadmium	Aug. 1, 1944	
AN-P-4	Plugs; Aircraft-Engine Spark	Jan. 14, 1942	No. 4
AN-GGG-S-126a	Screw-Threads; Standard Aircraft	Jan. 30, 1943	
AN-VV-C-576a	Compound; Corrosion-Preventive, Aircraft Engine	Mar. 1, 1943	No. 2
AN-VV-C-566	Compound; Anti-Seize; Mica-Base (For Threaded Fittings)	Aug. 1, 1939	No. 3
AN-F-28	Fuel; Aircraft Engine, Grade 130	Dec. 23, 1942	No. 2
AN-VV-O-446a	Oil; Lubricating Aircraft Engine	Jan. 5, 1943	

Army-Navy Specifications

AN-9500c	Engines; Aircraft; General Specification	Oct. 26, 1944	
AN-9501c	Engine, Aircraft; Model Specification (Instructions for Preparation)	Oct. 26, 1944	
AN-9503c	Engines, Aircraft; Acceptance Test	Oct. 26, 1944	
AN-9504	Engines, Aircraft; Torsional Vibration Characteristics	Mar. 1, 1939	No. 1
AN-9515c	Carburetor; Aircraft Engine, General Specification	Oct. 26, 1944	

Army-Navy Aeronautical Bulletins

152b	Numbers; Aircraft Engine Serial	Nov. 4, 1944	
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<u>Specification No.</u>	<u>Title</u>	<u>Date Issued</u>
<u>Army-Navy Drawings</u>		
AND10001	Mounting Pad and Drive-Type II, Vacuum and Hydraulic-Power Pumps	December 27, 1944
AND10002	Mounting Pad and Drive-Aircraft Engine Generator and Power Take-Off	December 27, 1944
AND10003	Mounting Pad and Drive-Aircraft Engine Fuel Pump	December 27, 1944
AND10004	Mounting Pad and Drive-Aircraft Engine Starter	December 27, 1944
AND10005	Mounting Pad and Drive-Aircraft Engine Tachometer Generator	December 27, 1944
AND10010	Mounting Pad and Drive-Aircraft Engine Propeller Governor or Hydro-Control Valve	January 5, 1945
AND10058	Fitting End-Hose Connection (Standard Dimensions for)	September 20, 1944
AND10201	Screens and Gaskets; Carburetor, Design Requirements for	December 7, 1943
AND10202	Plate-Design Requirements for Engine Data	October 21, 1943
AND10206	Plug-Shielded Aircraft Engine Spark	April 22, 1944
AND10301	Pump, Vacuum Installation Clearance-Type II Mounting Pad Drive	March 28, 1942
AND10302	Pump, Hydraulic-Power, Installation Clearance; Type II Mounting Pad and Drive	March 19, 1942
AND10304	Starter Installation Clearance; Aircraft Engine (for Type I and III Mounting Pads)	September 2, 1941
AND10305	Generator Installation Clearance-Aircraft Engines	February 28, 1942
AND10307	Propeller Governor Installation Clearance; Aircraft Engine (for Engines Rated at 1000 H.P. and Over)	November 25, 1941
AND10310	Tachometer Generator Installation Clearance-Aircraft Engine	December 5, 1941
AND10320	Fuel Pump Installation Clearance-Aircraft Engine	February 16, 1942
AN4061	Plug-Crankcase Dehydrator	November 9, 1944