FRANKLIN 335

OPERATORS INSTRUCTIONS

AIRCOOLED MOTORS, INC.
SYRACUSE, NEW YORK

Your Franklin engine is built with high quality materials and workmanship and is a sturdy piece of precision equipment. The service it gives depends much upon proper inspection and maintenance.

This is the owners' responsibility and the purpose of this booklet is to aid in the proper care and maintenance of your Franklin engine.

No attempt has been made to cover detailed technical information in this handbook on mechanical construction, adjustments or repairs.

WARRANTY

Aircooled Motors, Inc. warrants each new Franklin engine or new part manufactured by it against defects in material or workmanship under normal use, but its obligation under this warranty is specifically limited to replacing or repairing at its factory any such engine or part which shall, within 90 days after delivery thereof to the original purchaser and prior to 50 hours of operation, be returned to Aircooled Motors, Inc., with its permission, transportation charges prepaid, and which upon examination by Aircooled Motors, Inc., is determined by Aircooled Motors, Inc. to be defective.

This warranty shall not apply to any such engines or parts which have been repaired or altered outside Aircooled Motors, Inc. factory is any way so to affect, in its judgement, its operation, or which have been subjected to misuse, neglect, improper maintenance or accident, or which shall have been operated at a speed exceeding the factory rated speed.

Aircooled Motors, Inc. makes no warranty with respect to ignition apparatus, carburetors, instruments, trade accessories, or other equipment which it does not itself build or manufacture inasmuch as such equipment is usually guaranteed by the respective manufacturers thereof.

The foregoing is the exclusive warranty made by Aircooled Motors, Inc. There are no other warranties expressed or implied, in fact or in law, made by Aircooled Motors, Inc.

Aircooled Motors, Inc.

Syracuse 8, New York

INDEX

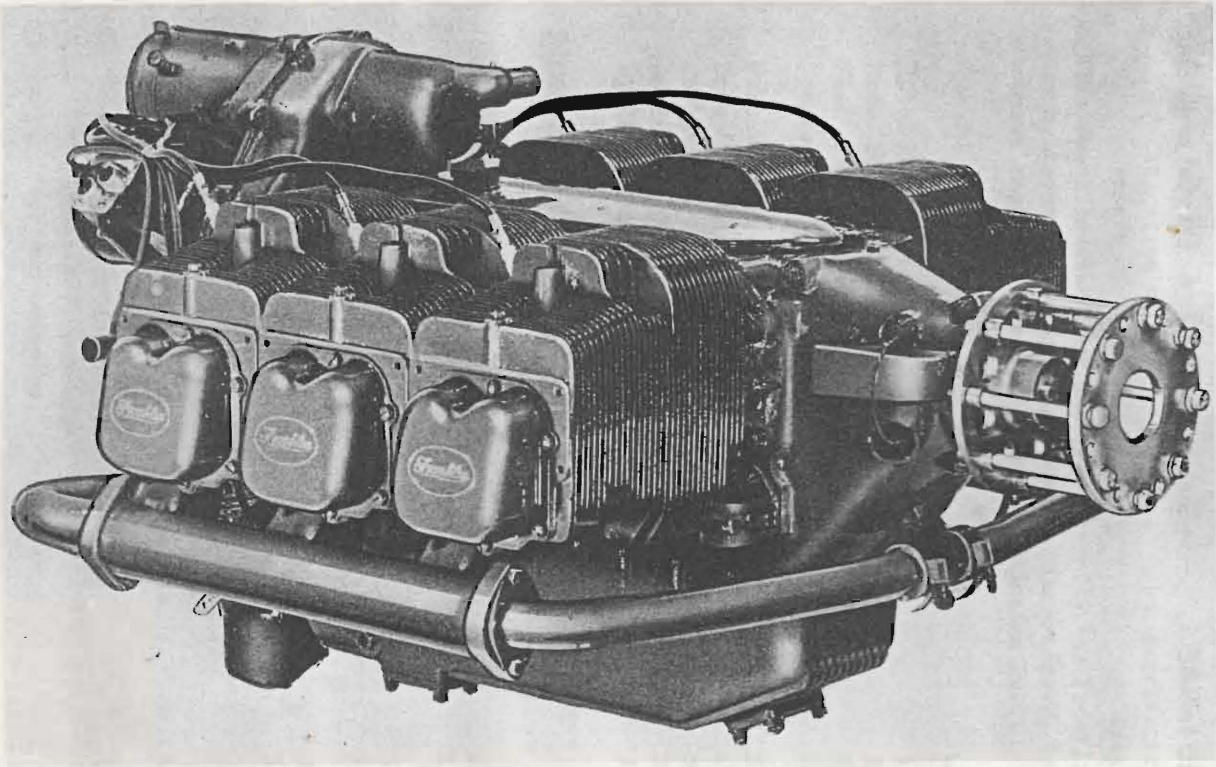


Figure 1 3/4 Front View of Franklin 335

ENGINE MODELS

6A4-150-B3 & B31

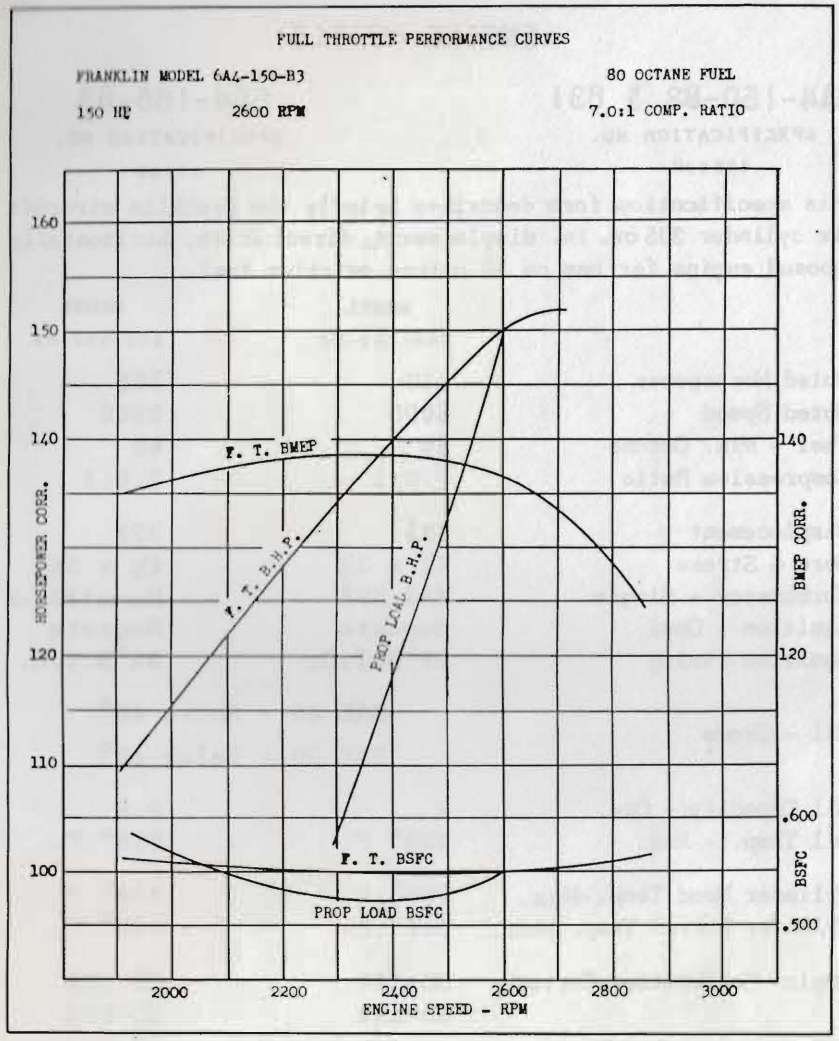
SPECIFICATION NO. 17569B

6A4-165-B3

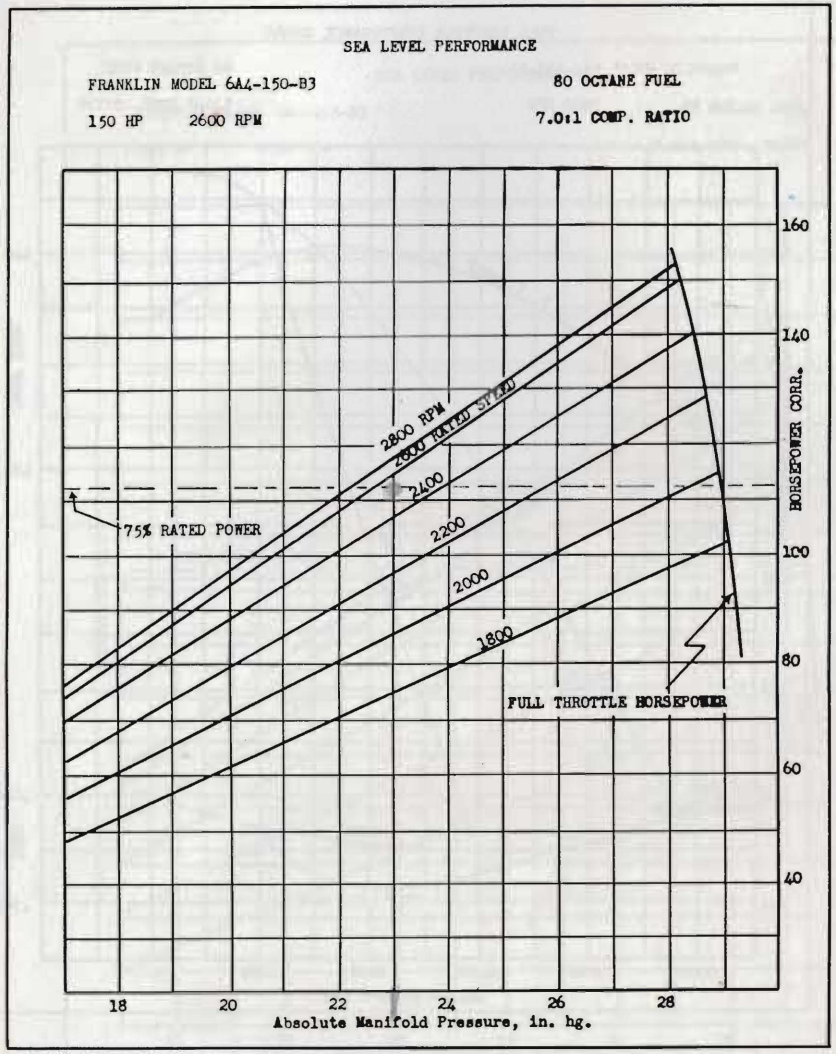
SPECIFICATION NO. 18403

This specification form describes briefly the Franklin aircraft six cylinder 335 cu. in. displacement, direct drive, horizontally opposed engine for use on 80 octane aviation fuel.

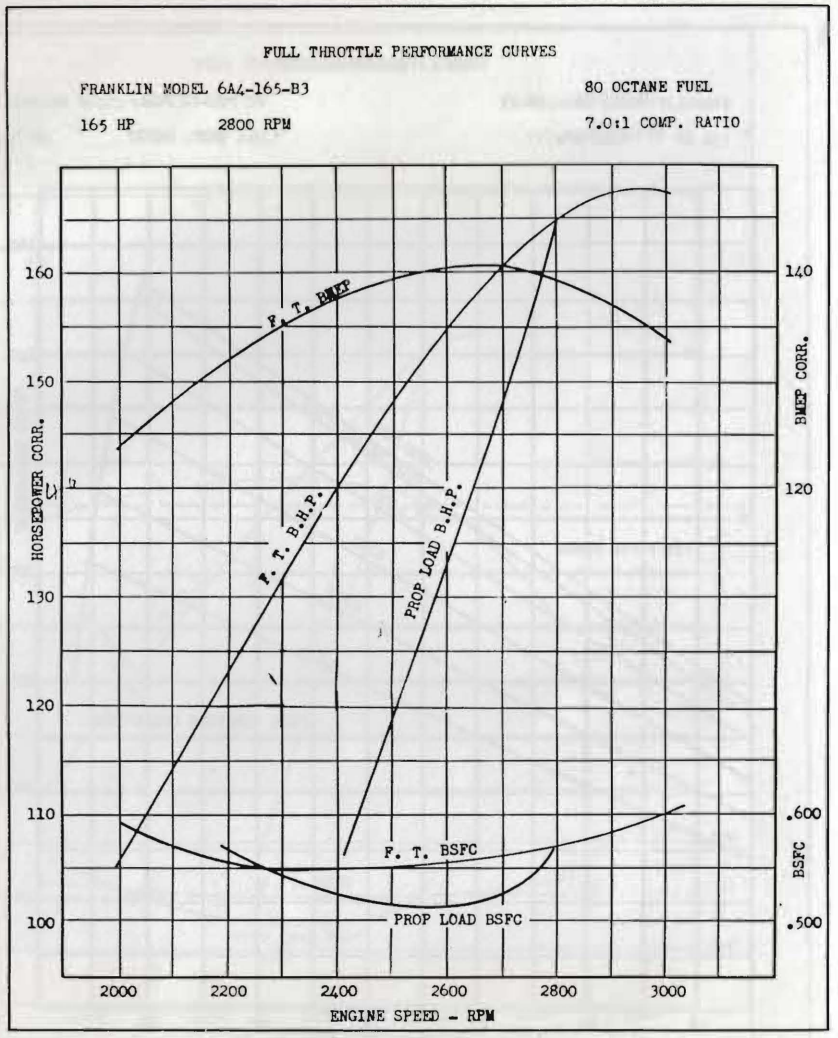
	MODEL 6A4-150-B3	MODEL 6A4-165-B3
Rated Horsepower	150	165
Rated Speed	2600	2800
Fuel - Min. Octane	80	80
Compression Ratio	7.0:1	7.0:1
Displacement	335	335
Bore & Stroke	4½ x 3½	4½ x 3½
Carburetor - Single	MA3-SPA	Marvel MA4-5
Ignition - Dual	Magneto	Magneto
Ignition Timing	28°B.T.C.	32°B.T.C.
Oil - Grade	SAE 40 - Above 40° SAE 20 - Below 40°	
Oil Capacity - Qts.	8	8.8
Oil Temp. - Max.	230° F.	230° F.
Cylinder Head Temp.-Max.	500° F.	520° F.
Cylinder Barrel Temp.-Max.	300° F.	310° F.
Engine Calibration Curves	SD-138 SD-142	SD-251 SD-252
Engine Installation Drawing	17753	18400
Weight - Standard Engine, including oil cooler, starting motor, generator, carburetor and magnetos.	318.6 lbs.	323.5 lbs.



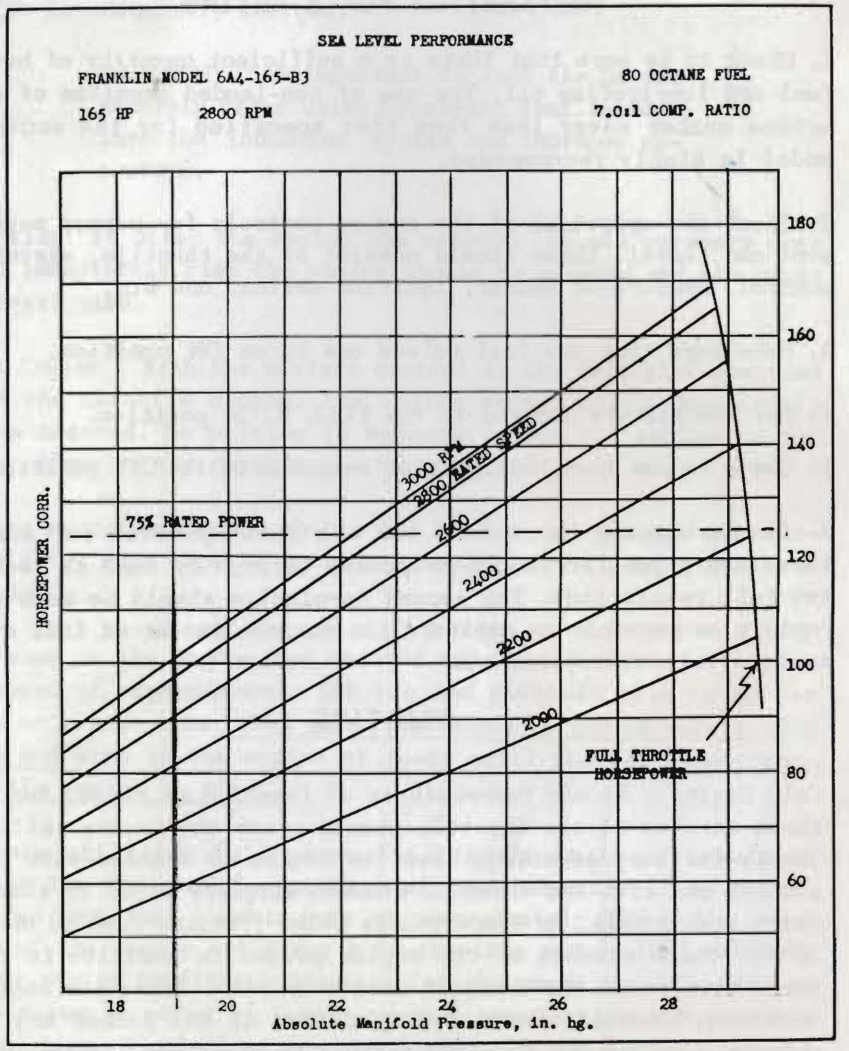
Full Throttle Performance Curves 6A4-150-B3



Sea Level Performance 6A4-150-B3



Full Throttle Performance Curves 6A4-165-B3



Sea Level Performance 6A4-165-B3

PREPARATION FOR STARTING

1. Check to be sure that there is a sufficient quantity of both fuel and lubricating oil. The use of non-leaded gasoline of an octane number never less than that specified for the engine model is highly recommended.

2. Check the operation of the engine controls for proper movement and travel. These should consist of the throttle, mixture control, carburetor heater, ignition switch, and etc.

3. Make sure that the fuel valves are in an ON position.

4. Set the mixture control to the FULL RICH position.

5. Check to see that the ignition switch is in the OFF position.

6. If the engine is cool or has not been operated for some time, the propeller should be pulled through by hand at least two full revolutions. The second revolution should be made as rapidly as possible to aspirate the maximum amount of fuel air mixture into the cylinders.

STARTING

Cold Engine - At air temperatures of freezing or above, two or three strokes of the throttle should prime the engine sufficiently for easy starting. When the engine is cranked with the starter and with the throttle cracked slightly open, it should start immediately. At temperatures below freezing down to about 10°F. three strokes of the engine primer in addition to the three strokes of the throttle should be used. After the engine initially starts, occasional operation of the primer may be necessary during the first 30 seconds of operation. At temperatures below 10°F., additional priming may be necessary. The mixture control should be in the full rich position for all starting attempts. If the starter fails to turn the engine on the first or second try, the engine should be turned through by hand a few times with the ignition switch off. If the starter still

fails to crank the engine, the battery should be checked to see if it is adequately charged.

> CAUTION: It is important to lock the primer securely after using to prevent fuel leakage into the induction system and improper operation.

Caution: If after the engine has started the oil pressure does not immediately rise the engine should be stopped and the cause investigated.

Hot Engine - With the mixture control in the full rich position and the throttle closed, the engine should start immediately when cranked. No priming is necessary when the engine is hot regardless of the outside air temperature.

Under no circumstances should the starter be operated continuously for more than 30 seconds consecutively in any two minute period.

As soon as the engine has started adjust the throttle to give a speed of approximately 900 rpm and maintain this speed for one or two minutes. Then raise the speed to approximately 1200 rpm and warm up the engine at least until the oil temperature needle begins to rise.

Before utilizing full power for takeoff it is advisable to check the individual operation of each magneto. It is recommended that this check be made at approximately 85% of the rated rpm of the engine but since this requires nearly full throttle under static conditions, the time for the check should be held to a minimum in order to insure against overheating and possible detonation. Single ignition rpm during the check should not be more than 200 rpm below that of the dual ignition.

RUNNING THE ENGINE

For maximum economy and long engine life the engine should be

operated at the recommended cruise RPM. Cost of operation increases rapidly near full throttle with high fuel and oil consumption above cruising conditions.

Reference to the specifications of page 1 covers full requirements. A non-leaded gasoline of the proper octane number should be used. Furthermore the engine should never be operated on fuel of an octane number lower than that specified for the particular model engine.

In diving the aircraft the loads on the various reciprocating parts within the engine are greater at high rpm with closed throttle than at the same rpm with a partially opened throttle. Here again the fewer the high speed dives the longer the life of the engine.

The engine should be thoroughly warmed with the altitude mixture control in the FULL RICH position. It should remain in this position during takeoff and climb and at all times during flight when the ship is below an altitude of 3000 feet. When cruising at an altitude above 3000 feet the throttle should be placed at the desired cruise RPM position and the altitude mixture control manipulated slowly and left in the position at which the engine reaches its maximum RPM. Such a point is the best power setting for this throttle position and altitude. During the descent, the mixture control should be placed at the FULL RICH position.

We wish again to stress the importance of the judicious use of the altitude control. The improper use of this device may well cause burned and warped valves, piston failure or even power plant failure.

Best cruise at sea level altitude for the 6A4-150-B3 engine has been determined to be approximately 75% of rated power. By proper setting of the engine speed and manifold pressure to cross the 75% rated power line as drawn on the sea level performance curve on page 3 the proper cruise is maintained.

Best cruise at sea level altitude for the 6A4-165-B3 engine has

been determined to be approximately 75% of rated power. By proper setting of the engine speed and manifold pressure to cross the 75% rated power line as drawn on the sea level performance curve on page 5 the proper cruise is maintained.

STOPPING THE ENGINE

It is desirable to cool the engine by running for a short time at approximately 800 to 900 RPM before stopping. With the engine turning at approximately 800 RPM, place the carburetor control to IDLE CUT OFF and when the engine ceases to fire turn the ignition switch to the OFF position. Finally turn off the main fuel supply valve.

GENERAL CARE

The general requirements for care of the engine are few but are never the less important.

The recommended inspection periods should be followed as closely as possible.

The exterior of the engine should be kept clean.

The fuel tank should contain only gasoline of the proper octane number.

The selection of the brand of oil should be based on the reputation of the manufacturer. A heavy duty oil of good quality and proper viscosity is recommended. Maintain the recommended oil level and frequent oil changes are advisable.

INSPECTION PERIODS

Adherence to regular inspection schedules tends not only to keep your engine at a peak performance but at times prevents costly repairs.

Inspection procedures recommended are as follows.

PERIODIC INSPECTIONS CHECK LIST

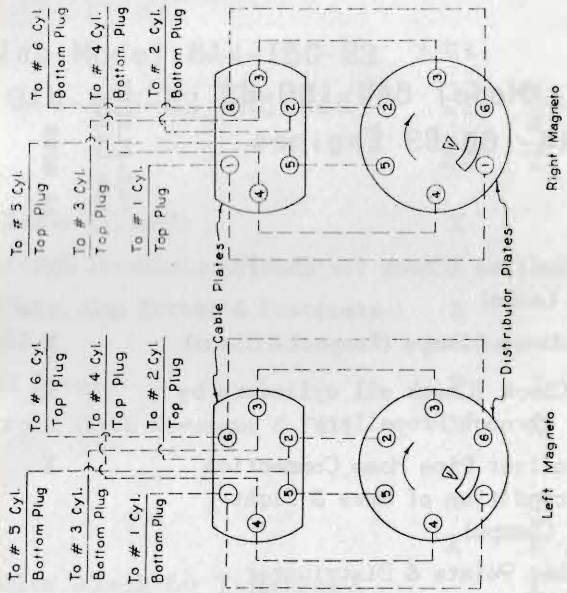
Covering Model 6A4-150-B3 and 6A4-165-B3 Engines

	PRE-FLIGHT AND DAILY	25 HOUR	50 HOUR	100 HOUR
Propeller Blades (Visual)	X			
Ignition Wires & Terminals (Visual)	X			
Accessible Nuts, Cap Screws & Fasteners (Visual)	X			
Fuel and Oil Level	X	X	X	X
Engine Controls (Free Movement & Full Range)	X	X	X	X
Oil Leaks	X	X	X	X
Fuel Leaks	X	X	X	X
Propeller Bolts (Check for Tightness & Safetying)		X	X	X
Ignition Wires & Terminals (Check for Tightness, Chafing & Soldered Connections - Clean)		X	X	X
Accessible Nuts, Cap Screws & Fasteners (Check for Tightness & Safetying)		X	X	X
Engine Controls (Check Free Movement, Full Range & Linkage System, Lubricate)		X	X	X
Oil Change (More Often if Operating Conditions Warrant)		X	X	X
Propeller Track		X	X	X
Exhaust System (Check for Leaks & Tightness)		X	X	X
Drain Plugs (Check for Tightness, Safetying & Gasket Condition)		X	X	X

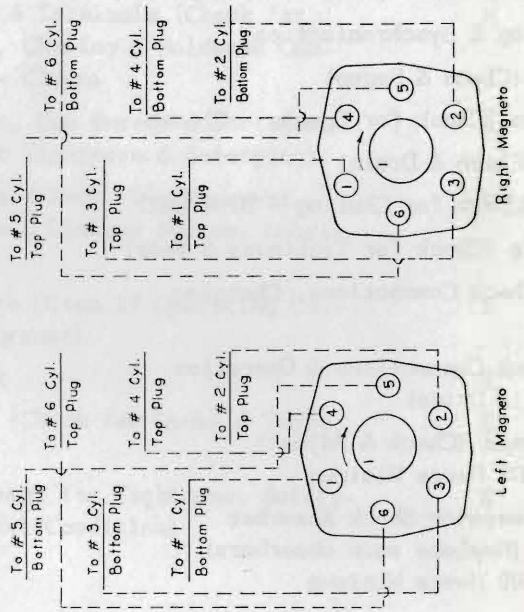
PERIODIC INSPECTIONS CHECK LIST

Covering Model 6A4-150-B3 and 6A4-165-B3 Engines

	PRE-FLIGHT AND DAILY	25 HOUR	50 HOUR	100 HOUR
Cooling Air Baffles (Check for Obstructions & Leaks)		X	X	X
Filters, Strainers & Sumps (Inspect & Clean)		X	X	X
Compression Check (Check all cylinders by pulling through Propeller)		X	X	X
Manifold Equalizer Pipe Hose Connection (Check condition of Hose & Tightness of Clamps)		X	X	X
Magneto Breaker Points & Distributor (Check condition of Rotor & Distributor & Point Condition & Gap)				X
Magneto Timing & Synchronization				X
Spark Plugs (Clean & Regap)				X
Cylinder Fins (Check for Breaks - Clean)				X
Carburetor (Clean & Drain)				X
Fuel Lines (Check for Chafing - Blow Out)				X
Engine Mounts (Check for Tightness & Wear)				X
Generator (Check Connections, Charging Rate)				X
Starter (Check Connections & Operation of Bendix Drive)				X
Valve Clearance (Check & Adjust) Every 200 Hours Minimum				
Magneto & Generator Shock Absorber Drives (Replace worn absorbers) Every 300 Hours Minimum				



Wiring Diagram 6A4-150-B3 & 6A4-165-B3
Engines Equipped with LA6 Eisemann
Magnetos



Wiring Diagram 6A4-150-B3 & 6A4-165-B3
Engines Equipped with Bendix Scintilla
Magnetos

TOP OVERHAUL

A top overhaul should be completed when inspection and operating conditions determine it necessary.

MAJOR OVERHAUL

Major overhaul should be completed when necessary as determined by inspection and operating conditions. Under good operating conditions major overhaul may not be necessary before 650 to 750 hours.

MAINTENANCE

In order to assist in proper handling of small maintenance problems the following section is included.

MAGNETOS

The 6A4-150-B3 and B31 engine is equipped with Eisemann magnetos while the 6A4-165-B3 engine is equipped with Bendix-Scintilla magnetos. The two different make magnetos are similar in principle. In this text each unit is handled separately.

MODEL 6A4-150--B3 & B31

Magneto Point Setting - Eisemann Magneto

It is essential that the amount of opening of the magneto breaker points be maintained at .019 to .021 of an inch in order that the ignition may have a proper high voltage and correct timing. This adjustment should always be made before checking or adjusting the timing of the magneto.

In order to accomplish the adjustment proceed as follows:

First remove the cover from the magneto as illustrated in Figure 7. Secondly, turn the magneto over by rotating the engine crankshaft until the fibre cam follower is on the peak of the cam lobe as shown in Figure 8. The nut and gear have been removed in this illustration only for purposes of clarity.

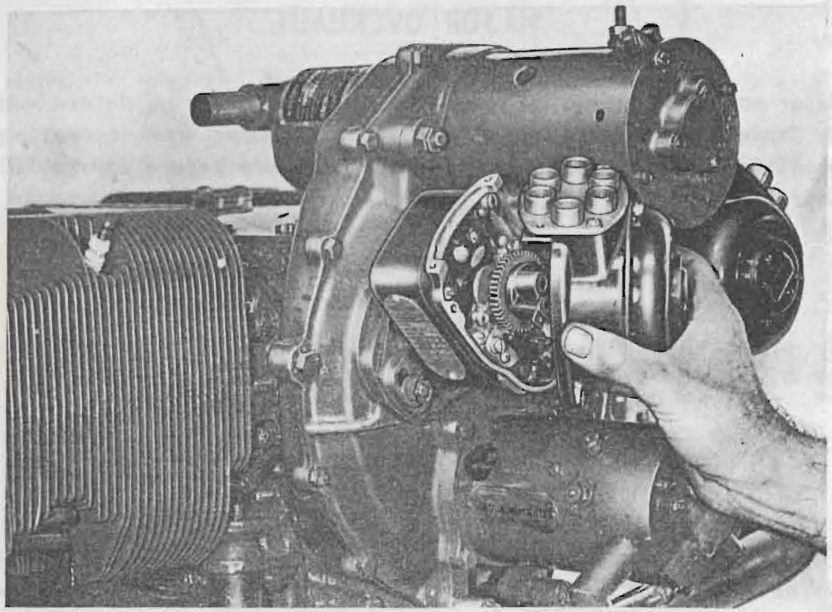


Figure 7 Removing Eisemann Magneto Cover

Thirdly, loosen screw No. 1 as shown in Figure 8 and by use of the adjusting cam No. 2, adjust the point gap to the specified opening. Tighten the lock screw No. 1 and re-check the gap to be sure that the adjustment has not changed.

Magneto Timing

In setting the magneto timing it is best to set the engine at a predetermined point and to adjust the magneto accordingly. To complete this setting proceed as follows:

Remove the valve cover from No. 1 cylinder in order to observe the valve action. Turn the engine in the normal direction of rotation until the intake valve has been completely depressed and returned. At this point the cylinder is on its compression stroke and turning should be continued slowly until the distributor (see fig. 8) snaps ahead by release of the impulse coupling. Reverse the rotation until the applicable timing mark is just

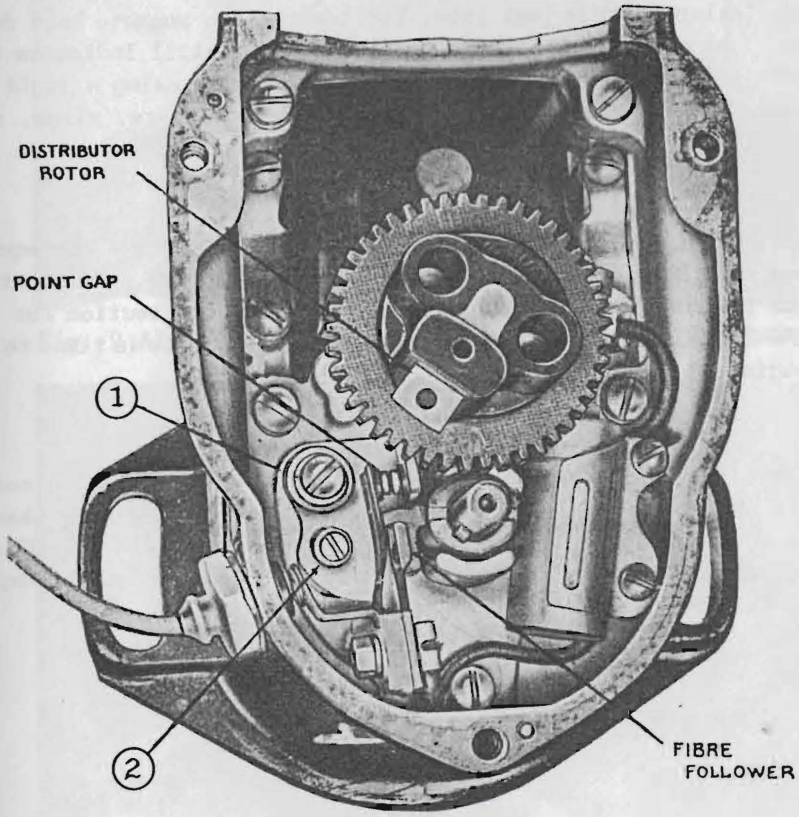


Figure 8 Interior of Eisemann Magneto

passed and once more rotate normally until the timing mark is exactly aligned with the center line of the crankshaft. (See fig. 9) The proper ignition timing is 28° BTC. The two nuts holding

the magneto to the engine should be loosened just sufficiently to allow the magneto to be turned on the engine by bumping with the heel of the hand. The breaker points should be separated just sufficiently to insert a .0015 feeler gauge. If the feeler stock is found to be loose tap the magneto carefully in a counterclockwise direction until the points tighten firmly on the feeler. Now tap the magneto slowly in a clockwise direction until the feeler stock is just free. Tighten the two magneto hold down nuts and check to see that the feeler stock still indicates the same setting. Check setting by turning engine using a light or .0015" feeler gauge. If properly timed the covers, wires, and valve cover on No. 1 cylinder may be reinstalled.

Engines #13885 through 13996 of the 6A4-150-B3 Series are equipped with Bendix Scintilla magnetos and the proper point setting and timing should be performed as outlined in the section for the 6A4-165-B3 engine with the exception that magneto is timed to the engine at 28° BTC.

The Eisemann magneto is installed on some of the late model 6A4-165-B3 engines. The proper point setting and timing should be performed as outlined in the section for the 6A4-150-B3 engine, with the exception that the magneto is timed to the engine at 32° BTC.

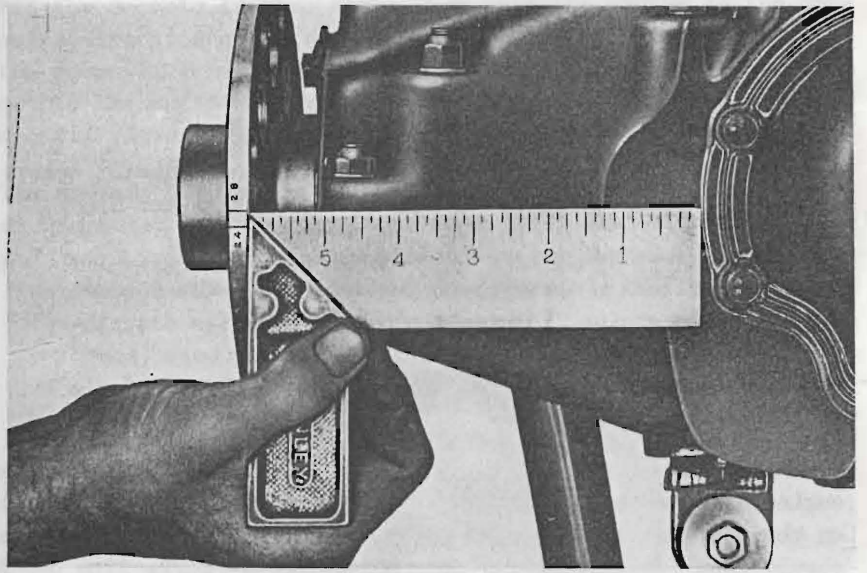


Fig. 9 Aligning Crankshaft Flange with Crankcase Centerline

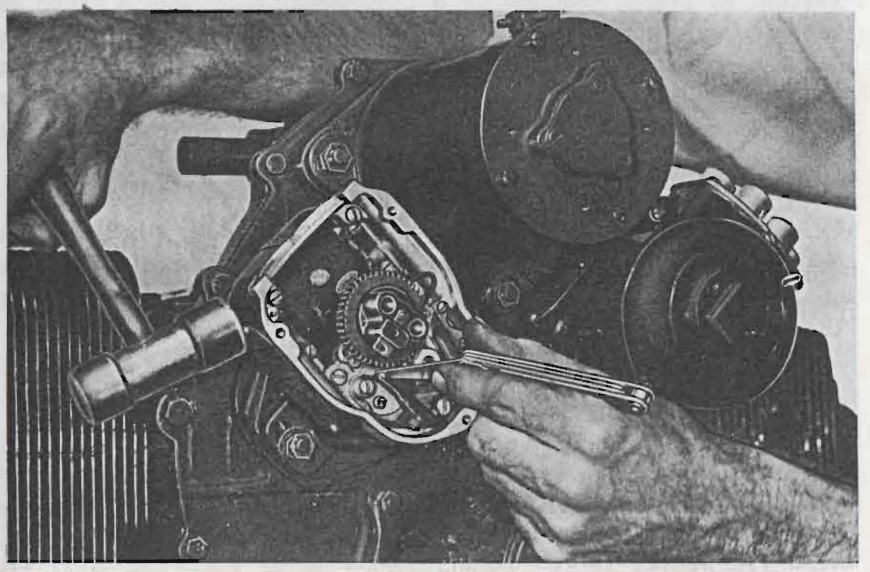


Fig. 10 Timing Magneto

Magneto Point Setting - Bendix Scintilla

Remove the timing inspection plug on top of the magneto, remove the breaker cover which is just below the distributor block.

> CAUTION: Do not remove the five screws which hold the two sections of the magneto together while the magneto is on the engine. To do so would disengage the distributor gears, causing the distributor timing to be "lost" and requiring complete removal and retiming of the magneto.

Look into the timing inspection hole on the magneto and turn the engine in the normal direction of rotation until the white tooth on the gear is lined up with the timing line. The breaker points should then just be starting to open when these marks line up. A timing light or .0015 feeler gauge may be used to determine the instant of point opening. If a timing light is used a piece of heavy paper must be placed between the breaker grounding spring and the magneto housing to act as an insulator in the event that the ground wire is removed. If this is not done the primary circuit is continually grounded, and the timing light will not go out when the points open.

If the points do not open when the white tooth is lined up with the timing marks, loosen the adjusting screw in the slotted hole of the breaker assembly and shift the breaker slightly so that the points just open when the marks are aligned.

Magneto Timing

To time the magneto to the engine remove the timing cover that is located on the top of the magneto. Remove the valve cover from No. 1 cylinder so that the valve action may be observed. Turn the engine in the normal direction of rotation until the intake valve has opened and closed. The number one piston is now on the compression stroke. Continue to turn the engine until the magneto impulse snaps. Now turn the engine in the opposite direction of normal rotation past the 32° timing mark on the propeller flange. Continue rotation a few degrees and again rotate the engine in the normal direction until the 32° mark is exactly lined up with the crankcase centerline. (As in fig. 9)

The magneto breaker points should now be just starting to open as indicated by a timing light or a .0015 feeler gauge. If the points do not begin to open when the engine timing marks are lined up, the nuts that secure the magneto to the engine should

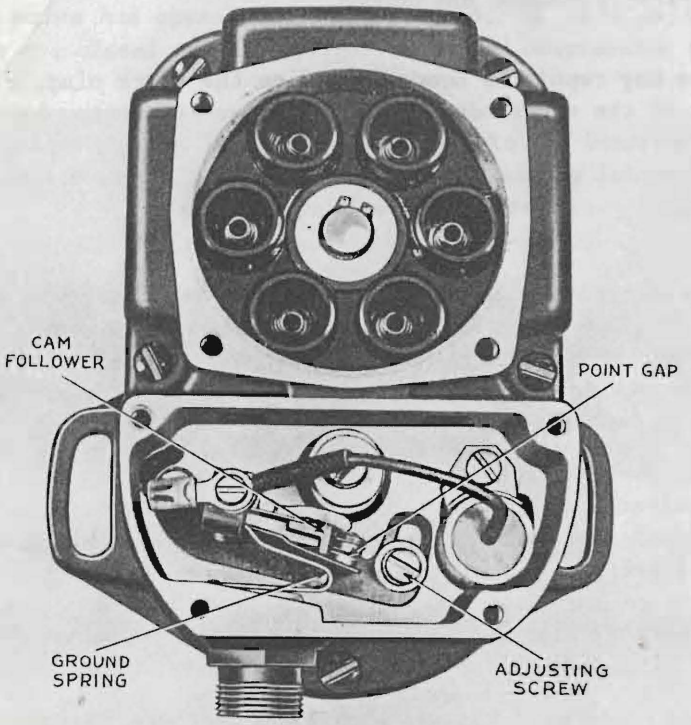


Figure 11 Interior of Scintilla Magneto

be loosened sufficiently to allow the magneto to be rotated slightly by bumping with the hand. The magneto should be rotated

slowly in this manner until the points just start to open. The mount nuts should then be tightened. The setting should be re-checked to see that the points open when the timing marks are lined up. The magneto is now timed to the engine and the magneto inspection plug, breaker cover, and No. 1 valve cover may be reinstalled on the engine.

SPARK PLUGS

As indicated in the inspection procedures the spark plugs should be regularly cleaned and gapped.

Before any repair is accomplished on the spark plug, a visual check of the electrodes should be made. If burning has materially reduced the size of either electrode the spark plug should be discarded without further work. In order to prepare the spark plug for replacement proceed as follows:

The entire plug should first be soaked in a suitable solvent which has been checked to ascertain complete absence of oil of any type. If a coating of oil is left on the spark plug by such cleaner, it would cause blasting material to pack in the small crevices in the lower portion of the spark plug.

The solvent and whatever dirt it may have removed should be thoroughly removed from the spark plug and the whole completely dried. Where sand blasting is necessary it should be kept to a minimum consistent with thorough cleaning since this blasting tends to roughen and erode the insolator and points which leads to more rapid burning as well as carbon deposit.

The approved non-shielded spark plug for the engines covered in this handbook is the Champion AJ-66. The approved shielded spark plug is the Champion C-10S. The spark plug gap setting for both plugs is .014" to .018". Spark plugs should be screwed into the cylinder with the fingers only until they are snug to avoid crossing the threads. They should be tightened with a torque wrench to a value of 180 to 240 in. lbs.

VALVE ROCKER ADJUSTMENT

Your engine is equipped with hydraulic type valve lifters which adapt themselves to changes in the engine produced by temperature differences. Because of the operation of these hydraulic lifters valve adjustment is seldom necessary.

Should adjustment be made necessary by changes or removal of any of the component parts proceed as follows:

First, turn engine in the normal direction of rotation until the inlet valve has opened and closed again. At this point both valves are closed and the cylinder is on the compression stroke.

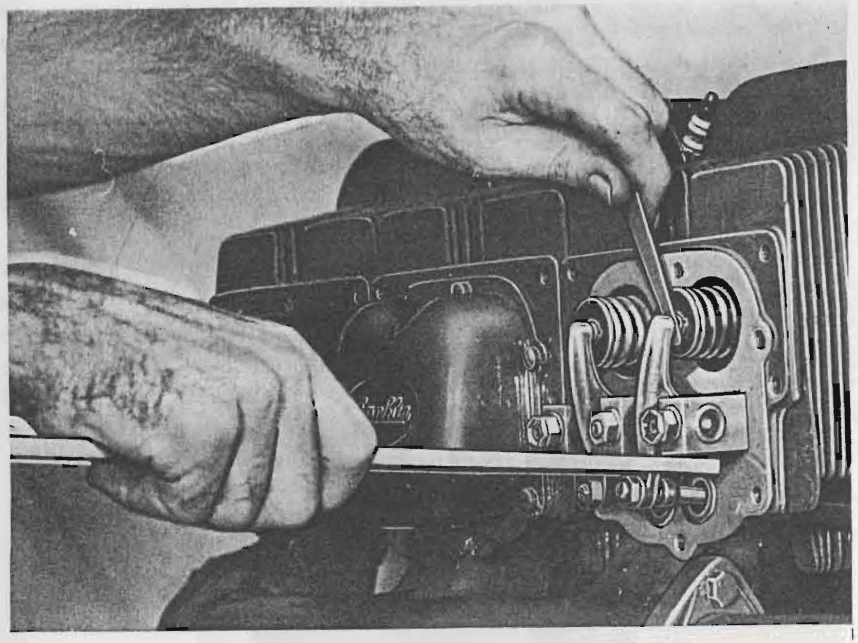


Figure 12 Bleeding Down Hydraulic Lifters

Bleed all of the oil out of the lifter as illustrated in figure No. 12. Maintain a steady pressure until the maximum clearance

between the valve rocker and valve stem is obtained. At this point the space between the valve rocker and the valve stem should be checked with a feeler gauge, all the time maintaining an even pressure on the bleed down tool.

With the lifter fully bled down adjustment is made by turning the rocker adjusting screw until the specified clearance of .040 is reached between the rocker tip and the valve stem. The lock nut is then tightened using care not to disturb the setting. Again bleed the lifter down and check the clearance.

CAUTION: When using the bleed down tool apply an even pressure and do not jerk on the tool. Such severe action may damage the lifter or bend the push rod.

CARBURETOR ADJUSTMENT

There is little that can go wrong in the adjustment of the carburetor since the main metering characteristics are controlled

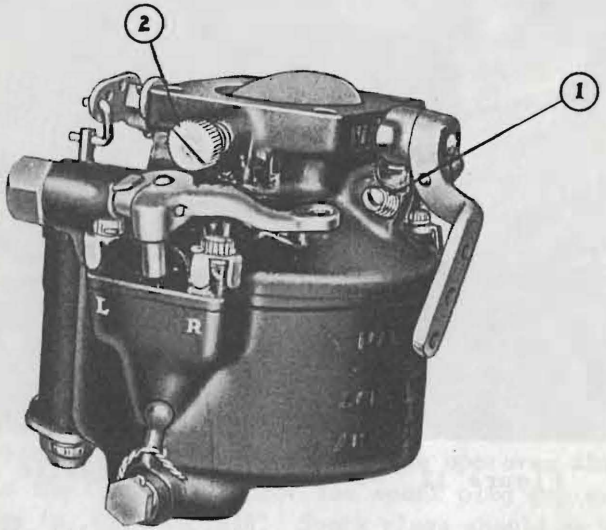


Figure 13 Carburetor

to a great extent by fixed jets. Therefore, the only adjustments recommended in the field are those for idle speed and idle mixture. To complete these adjustments, proceed as follows:

Turn the idle adjusting screw No. 1 of Figure No. 13, in or out until an idle RPM of approximately 600 is obtained. It is advisable to run the engine up during this adjustment and then allow it to come back to make sure that the idle RPM will obtain through normal operation.

Should the engine receive excessive fuel during idle, a heavy black smoke and rolling or surging of the engine may be noted. In this case the idle mixture screw No. 2 of Figure No. 13 should be turned in very slowly to lean out the mixture. This adjustment should be made very slowly and in small increments with some wait between adjustments to allow the engine to settle out to its new mixture. Should the idle mixture be lean as indicated by hard starting, stopping or popping in the carburetor, the idle screw as indicated above should be backed out slowly to richen the mixture. This adjustment also should be made slowly and with extreme care.

The Model 6A4-150-B3 engine uses the Marvel MA-3SPA carburetor while the Model 6A4-165-B3 engine uses the Marvel MA4-5 carburetor. Both carburetors function in the same manner however the idle mixture for the MA4-5 carburetor is obtained by adjusting the indicator arrow which may be moved from the rich stop (marked "R") to the lean stop (marked "L") and left to the point at which the smoothest operation is obtained.