A Series
C Series
O-200

CONTINENTAL® AIRCRAFT ENGINE

OPERATOR'S MANUAL

Continental Motors, Inc.

FAA APPROVED

Publication X30012

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Supersedure Notice

This manual revision replaces the front cover and list of effective pages for Publication Part No. X30012, dated December 1980. Previous editions are obsolete upon release of this manual.

Effective Changes for this Manual

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Effective Changes for this Manual

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Cover	1						
A	1						
i	1						
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NOTICE

THE ENGINE(S) DESCRIBED IN THIS MANUAL MUST BE OPERATED IN ACCORDANCE WITH THE INSTRUCTIONS CONTAINED HEREIN. FAILURE TO SO COMPLY WI LL BE DEEMED AS ENGINE MISUSE, THUS RELIEVING THE ENGINE MANUFACTURER OF ANY RESPONSIBILITY.

THIS MANUAL CONTAINS NO WARRANTIES, EITHER EXPRESSED OR IMPLIED. THE INFORMATION AND PROCEDURES CONTAINED HEREIN PROVIDE THE OPERATOR WITH TECHNICAL INFORMATION AND INSTRUCTIONS APPLICABLE TO SAFE OPERATION.

TABLE OF CONTENTS

INTRODUCTION

The Operating instructions outlined in this manual have been developed from comprehensive evaluation of the engine performance in relation to its installation in an aircraft. Recommendations, cautions and warnings regarding operation of this engine are not intended to impose undue restrictions on operation of the aircraft, but are inserted to enable the pilot to obtain maximum performance from the engine commensurate with safety and efficiency. Abuse, misuse, or neglect of any piece of equipment can cause eventual failure. In the case of an aircraft engine it should be obvious that a failure may have disastrous consequences. Failure to observe the instructions contained in this manual constitutes unauthorized operation in areas unexplored during development of the engine, or in areas in which experience has proved to be undesirable or detrimental.

Notes, Cautions and Warnings are included throughout this manual. Application is as follows:

NOTE: Special interest information which may facilitate the operation of equipment.

CAUTION: Information issued to emphasize certain instructions or to prevent possible damage to engine or accessories.

WARNING: Information which, if disregarded, may result in severe damage to the engines and/or personal injury.

Users are advised to keep up with the latest information by means of service bulletins, which are available for study at any approved Teledyne Continental Distributor or Dealer, and are obtainable on an annual subscription basis. Subscription forms are available from the Distributor or from Teledyne Continental Motors, P. O. Box 90, Mobile, Alabama 3660l, Attention: Publications Department.

WARNING: This engine must be installed in accordance with all requirements and limitations listed in the Detail Specification for Teledyne Continental Aircraft Engines. Any deviations caused by installation, or operation, such as acrobatic maneuvers will be deemed as misuse and Teledyne Continental Motors shall be relieved of any further responsibility.

SECTION I

OPERATING SPECIFICATIONS AND LIMITS

When increasing power, enrich mixture and advance throttle in that order. When reducing power, retard throttle, then adjust mixture.

CAUTION . . . Cylinder head and oil temperatures must never be allowed to exceed the limitations specified. Near-maximum temperatures should occur only when operating under adverse conditions, such as high power settings, low airspeed, extreme ambient temperature, etc. If excessive temperatures are noted, and cannot reasonably be explained, or if abnormal cowl flap and/or mixture settings are required to maintain temperatures, then an inspection should be performed to determine the cause. Possible causes of high temperatures may include broken or missing baffles, inoperative cowl flaps (if applicable), or restricted fuel inlets (resulting in lean-running cylinders). Faulty instruments or thermocouples may cause erroneously high (or low) temperature indications. Refer to Section VIII of this manual and/or the aircraft overhaul manual for trouble shooting procedures.

WARNING. . .Do not use any propeller that is not certificated and specifically designed for operation on this engine.

SPECIFICATIONS

	A65	A75	C75	C85	C90	0-200
Type Certificate No.	205	213	233	233	252	252
Bore (inches)	3-7/8	3-7/8	4-1/16	4-1/16	4-1/16	4-1/16
Stroke (inches)	3-5/8	3-5/8	3-5/8	3-5/8	3-7/8	3-7/8
Comp. Ratio	6.3:1	6.3:1	6.3:1	6.3:1	7.0:1	7.0:1
Piston Disp. (cu. in.)	171	171	188	188	200.91	200.91
Rated Power (Sea Level)	65	75	75	85	90*	100
Rated R.P.M.	2300	2600	2275	2575	2475*	2750
Max. Allowed Press. (in. Hg.) at rated R.P.M. at Sea Level	29.4	29.3	29.2	29.0	29.3	29.3
Recommended Cruising R.P.M.	2150	2350	2275	2400	2350	2500
Maximum Recommended Manifold Press. (in. Hg.) for cruising at Sea Level	26.8	26.0	24.0	24.5	24.5	24.0
Minimum Fuel Grade	80/87	80/87	80/87	80/87	80/87	80/87
Oil Pressure at Cruising (p.s.i.)	30-35	30-35	30-35	30-35	30-60	30-60
Min. Idling Oil Pressure (p.s.i.)	10	10	10	10	10	10
Minimum Oil Temperature--°F	75	75	75	75	75	75
Maximum Oil Temperature--°F	220	220	225	225	225	225
Max. Cylinder Head Temperature (°F.)	550	525	550	540	525	525
Approx. Fuel Consumption in Gals. per Hr. Cruising	4.4	4.8	4.8	5.4	5.9	6.3
Approx. Max. desirable Oil Consumption in Qts. per Hr.	.37	.4	.37	.4	.5	.6
Oil Sump Capacity in Qts.	4	4	4-1/2	4-1/2	5	6
Tappet Clearance: Operating	0	0	0	0	0	0
Lifters Deflated	.030-.110	.030-.110	.030-.110	.030-.110	.030-.110	.030-.110
Ignition Timing BTC						
Right	30°	30°	28°	28°	26°	24°
Left	30°	30°	30°	30°	28°	24°

NOTE: (*) Take-off rating is 95 H.P. at 2625 R.P.M. (1 minute only.)

OPERATING LIMITS – A 65

OPERATION	MAX. CONTINUOUS HORSEPOWER	MAX. RECM. CLIMB	MAX. RECM. CRUISE	RECM. CRUISE	ECONOMY CRUISE	RUN UP
%NRP	100	75	75	65	55	-
BHP (SEA LEVEL)	65	49	49	42	36	-
RPM	2300	2100	2100	2000	1900	800
FUEL FLOW (PPH)	SEE FUEL FLOW CURVE					
CYLINDER HEAD TEMPERATURE (F)						
MINIMUM	240	240	240	240	240	200
NORMAL	360-420	300-400	300-400	300-380	300-350	200-400
MAXIMUM	550	550	550	550	550	550
OIL TEMPERATURE (F°)						
MINIMUM	75	-	-	-	-	-
NORMAL	120-180	120-180	120-180	120-180	120-180	75-180
MAXIMUM	220	220	220	220	220	220
OIL PRESSURE (PSI)						
MINIMUM IDLE	10	10	10	10	-	10
NORMAL	30-35	30-35	30-35	30-35	30-35	30-35
MAXIMUM	35	35	35	35	35	100**

**With Cold Oil Only.

OPERATING LIMITS – A 75

OPERATION	MAX. CONTINUOUS HORSEPOWER	MAX. RECM. CLIMB	MAX. RECM. CRUISE	RECM. CRUISE	ECONOMY CRUISE	RUN UP
%NRP	100	75	75	65	55	-
BHP (SEA LEVEL)	75	56	56	49	41	-
RPM	2600	2350	2350	2060	2120	800
FUEL FLOW (PPH)	SEE FUEL FLOW CURVE					
CYLINDER HEAD TEMPERATURE (F°)						
Minimum	240	240	240	240	240	200
NORMAL	360-420	300-400	300-400	300-380	300-350	200-400
MAXIMUM	525	525	525	525	525	525
OIL TEMPERATURE (F°)						
MINIMUM	75	100	100	100	100	180
NORMAL	120-180	120-180	120-180	120-180	120-180	75-180
MAXIMUM	220	220	220	220	220	220
OIL PRESSURE (PSI)						
MINIMUM IDLE	10	10	10	10	10	10
NORMAL	30	30	30	30	30	30
MAXIMUM	35	35	35	35	35	100**

**With Cold Oil Only.

OPERATING LIMITS – C 75

OPERATION	MAX. CONTINUOUS HORSEPOWER	MAX. RECM. CLIMB	MAX. RECM. CRUISE	RECM. CRUISE	ECONOMY CRUISE	RUN UP
%NRP	100	75	75	65	55	-
BHP (SEA LEVEL)	75	56	56	49	41	-
RPM	2275	2085	2085	1990	1890	800
MANIFOLD PRESSURE	29.2	-	-	-	-	-
FUEL FLOW (PPH)	SEE FUEL FLOW CURVE					
CYLINDER HEAD TEMPERATURE (F°)						
MINIMUM	240	240	240	240	240	200
NORMAL	360-420	300-400	300-400	300-380	300-350	200-400
MAXIMUM	550	550	-	-	-	-
OIL TEMPERATURE (F °)						
MINIMUM	100	100	100	100	100	75
NORMAL	120-200	120-180	120-180	120-180	120-180	75-180
MAXIMUM	225	225	225	225	225	225
OIL PRESSURE (PSI)						
MINIMUM IDLE	10	10	10	10	10	10
NORMAL	30-35	30-35	30-35	30-35	30-35	30-35
MAXIMUM	35	35	35	35	35	100**

**With Cold Oil Only.

OPERATING LIMITS – C 85

OPERATION	MAX. CONTINUOUS HORSEPOWER	MAX. RECM. CLIMB	MAX. RECM. CRUISE	RECM. CRUISE	ECONOMY CRUISE	RUN UP
%NRP	100	75	75	65	55	-
BHP (SEA LEVEL)	85	64	64	55	47	-
RPM	2575	2340	2340	2230	2120	800
FUEL FLOW (PPH)	SEE FUEL FLOW CURVE					
CYLINDER HEAD TEMPERATURE (F°)						
MINIMUM	240	240	240	240	240	200
NORMAL	360-420	300-400	300-400	300-380	300-350	200-400
MAXIMUM	540	540	540	540	540	540
OIL TEMPERATURE (F°)						
MINIMUM	100	100	100	100	100	75
NORMAL	150-200	150-180	150-180	150-180	150-180	75-180
MAXIMUM	225	225	225	225	225	225
OIL PRESSURE (PSI)						
MINIMUM - IDLE	10	10	10	10	10	10
NORMAL	30-35	30-35	30-35	30-35	30-35	30-35
MAXIMUM	35	35	35	35	35	100**

**With Cold Oil Only.

OPERATING LIMITS – C 90

OPERATION	MAX. CONTINUOUS HORSEPOWER	MAX. RECM. CLIMB	MAX. RECM. CRUISE	RECM. CRUISE	ECONOMY CRUISE	RUN UP
%NRP	100	75	75	65	55	-
BHP (SEA LEVEL)	90	68	68	59	50	-
RPM	2475	2250	2250	2140	2020	1700
FUEL FLOW (PPH)	SEE FUEL FLOW CURVE					
CYLINDER HEAD TEMPERATURE (F°)						
MINIMUM	-	-	-	-	-	-
NORMAL	400-425	-	-	-	-	-
MAXIMUM	525	525	525	525	525	525
OIL TEMPERATURE (F)						
OIL PRESSURE (PSI)						
MINIMUM IDLE	10	10	10	10	10	10
NORMAL	30-60	30-60	30-60	30-60	30-60	30-60
MAXIMUM	60	60	60	60	60	100**

**With Cold Oil Only.

OPERATING LIMITS – O-200

OPERATION	MAX. CONTINUOUS HORSEPOWER	MAX. RECM. CLIMB	MAX. RECM. CRUISE	RECM. CRUISE	ECONOMY CRUISE	RUN UP
%NRP	100	75	75	65	55	-
BHP (SEA LEVEL)	100	75	75	65	55	-
RPM	2750	2525	2525	2400	2260	1700
FUEL FLOW (PPH)	SEE FUEL FLOW CURVE					
CYLINDER HEAD TEMPERATURE (F°)						
MINIMUM	240	240	240	240	240	200
NORMAL	420	300-420	300-420	300-420	300-420	200-400
MAXIMUM	525	525	525	525	525	525
OIL TEMPERATURE (F°)						
MINIMUM	75	75	75	75	75	75
NORMAL	150-200	150-170	150-170	150-170	150-170	75-170
MAXIMUM	225	225	225	225	225	225
OIL PRESSURE (PSI)						
MINIMUM IDLE	10	10	10	10	10	10
NORMAL	30-60	30-60	30-60	30-60	30-60	30-60
MAXIMUM	60	60	60	60	60	100**

**With Cold Oil Only.

SECTION II

NORMAL OPERATING PROCEDURE

CAUTION . . . This section pertains to operation under average climatic conditions. The pilot should thoroughly familiarize himself with Section V, Abnormal Operating Conditons. Whenever such abnormal conditions are encountered or anticipated, the procedures and techniques for normal operation should be tailored accordingly. For example, if the aircraft is to be temporarily operated in extreme cold or hot weather, consideration should be given to an early oil change and/or a routine inspection servicing.

GENERAL.

The life of your engine is determined by the care it receives. Follow the instructions contained in this manual carefully.

The engine receives a run-in operation before leaving the factory. Therefore, no break-in schedule need be followed. Straight mineral oil (MIL-C-6529 Type II) should be used for the first oil change period (25 hours).

The minimum grade aviation fuel for this engine is 80/87. In case the grade required is not available, use a higher rating. Never use a lower rated fuel.

WARNING. . .The use of a lower octane rated fuel can cause pre-ignition and/or detonation which can damage an engine the first time high power is applied. This would most likely occur on takeoff. If the aircraft is inadvertently serviced with the wrong grade of fuel, then the fuel must be completely drained and the tank properly serviced.

PRESTARTING.

Before each flight the engine and propeller should be examined for damage, oil leaks, security and proper servicing.

1. Position the ignition switch to the "OFF" position.

2. Operate all controls and check for binding and full range of travel.

3. Assure that fuel tanks contain proper type and quantity of fuel.

4. Drain a quantity of fuel from all sumps and strainers into a clean container. If water or foreign matter is noted, continue draining until only clean fuel appears.

5. Check oil level in sump.

6., Check cowling for security.

STARTING

1. Fuel Selector - On.

2. Battery Switch - On.

3. Ignition Switch - On.

4. Mixture - Full Rich.

5. Throttle - Full Open.

6. Prime - Operate 3 to 5 strokes.

NOTE . . . The amount of prime required depends on engine temperature. Familiarity and practice will enable the operator to estimate accurately the amount of prime to use. If the engine is hot, do not prime before starting. After priming, turn primer handle completely "OFF" to avoid possibility of engine drawing fuel through the primer.

7. Throttle - Open approximately 1 inch.

8. Starter-Engage until engine starts, then release.

CAUTION . . .Do not engage the starter when the engine is running as this will damage the starter. If difficulty in starting is experienced, do not crank for longer than thirty seconds at a time as the starter motor may overheat. If the engine does not start after thirty seconds of cranking, allow a 3 to 5 minute cooling period before continued attempts. If flooding is suspected proceed as follows:

1. *Throttle - Open*
2. *Mixture - Idle Cutoff.*
3. *Starter - Engage until engine starts, then release.*
4. *Throttle Retard to 1200 RPM.*
5. *Mixture - Full Rich.*

9. Oil Pressure - Check. If no oil pressure is noted within 30 seconds (60 seconds in cold weather), shut down the engine and investigate.

GROUND RUNNING; WARM-UP.

Teledyne Continental aircraft engines are aircooled and therefore dependent on the forward speed of the aircraft for cooling. To prevent overheating, it is important that the following rules be observed.

1. Head the aircraft into the wind.

2. Avoid prolonged idling at low RPM. Fouled spark plugs can result from this practice.

3. Leave mixture in "Full Rich". (See "Ground Operation at High Altitude Airports", Section V, for exceptions.)

4. Warm-up 900-1200 RPM.

PRE-TAKEOFF CHECK

1. Maintain engine speed at approximately 900 to 1000 RPM for at least one minute in warm weather, and as required during cold weather to prevent cavitation in the oil pump and to assure adequate lubrication.

2. Advance throttle slowly until tachometer indicates an engine speed of approximately 1200 RPM. Allow additional warm-up time at this speed depending on ambient temperature. This time may be used for taxiing to takeoff position. The minimum allowable oil temperature for run-up is 75°F.

CAUTION . . . Do not operate the engine at run-up speed unless oil temperature is 75°F. Minimum.

3. Perform all ground operations with cowling flaps, if installed, full open, with mixture control in "FULL RICH" position.

4. Restrict ground operations to the time necessary for warm-up and testing.

NOTE . . . Carburetor ice can form on the ground with the engine idling. Therefore, just before take-off and during the magneto check, position the carburetor heat to "ON". Leave it in that position until the throttle is advanced for the take-off run, then position the carburetor heat to "cold air". This gives maximum power for take-off. Monitor engine for any indication of ice (roughness or loss of RPM) during climb and add full carburetor heat at the first sign of icing. The correct way to use carburetor heat is to first apply full heat to remove any ice that has formed. Determine the minimum amount of heat required to prevent ice forming, each time removing any ice that has formed by applying full heat.

5. Increase engine speed to 1700 RPM only long enough to perform the following checks:

a. Check Magnetos: Move the ignition switch to "R" position and note engine RPM, then move switch back to "BOTH" position to clear the other set of spark plugs. Then move the switch to "L" position and note RPM. The difference between the two magnetos operated individually should not differ more than 75 RPM' Observe engine for excessive roughness during this check. Maximum allowable drop when operating on one magneto is 150 RPM.

If no drop in RPM is observed when operating on either magneto alone, the switch circuit should be inspected.

> **WARNING. . .Absence of RPM drop when checking magnetos may indicate a malfunction in the ignition circuit. Should the propeller be moved by hand (as during preflight) the engine may start and cause injury to personnel. This type of malfunction should be corrected prior to continued operation of the engine.**

CAUTION . . . Do not underestimate the importance of a pre-takeoff magneto check. When operating on single ignition, some RPM drop should be noted. Normal indications are 25-75

RPM drop and slight engine roughness as each magneto is switched off. Absence of a magneto drop may be indicative of an open switch circuit or improperly timed magneto. An excessive RPM drop usually indicates a faulty magneto or fouled spark plugs.
Minor spark plug fouling can usually be cleared as follows:

1. Magnetos - Both On.

2. Throttle - 2200 RPM.

3. Mixture - Move toward idle cutoff until RPM peaks and hold for ten seconds. Return mixture to full rich.

4. Magnetos - Recheck.

If the engine is not operating within specified limits, it should be inspected and repaired prior to continued operational service.

Avoid prolonged single magneto operation to preclude fouling of the spark plugs.

CAUTION . . . Do not operate the engine at a speed in excess of 1700 RPM longer than necessary to test operation and observe engine instruments. Proper engine cooling depends upon forward speed of the aircraft. Discontinue testing if temperature or pressure limits are approached.

6. Instrument Indications.

a. Oil Pressure: The oil pressure relief valve will maintain pressure within the specified limits if the oil temperature is within the specified limits and if the engine is not excessively worn or dirty. Fluctuating or low pressure may be due to dirt in the oil pressure relief valve or congealed oil in the system.

b. Oil Temperatures: The oil cooler will maintain oil temperature within the specified range unless the cooler oil passages or air channels are obstructed. Oil temperature above the prescribed limit may cause a drop in oil pressure, leading to rapid wear of moving parts in the engine.

c. Cylinder Head Temperature: Any temperature in excess of the specified limit may cause cylinder or piston damage. Cooling of cylinders depends on cylinder baffles being properly positioned on the cylinder heads and barrels, and other joints in the pressure compartment being tight so as to force air between the cylinder fins. Proper cooling also depends on operation practices. Fuel and air mixture ratio will affect cylinder temperature. Excessively lean mixture causes overheating even when the cooling system is in good condition. High power and low air speed, may cause overheating by reducing the cooling air flow. The engine depends on ram air flow developed by the forward motion of the aircraft for adequate cooling.

d. Battery Charging: The ammeter should indicate a positive charging rate until the power used for starting has been replaced by the battery charging circuit, unless the electrical load on the alternator is heavy enough to require its full output. The ammeter reading should return to the positive side as soon as the load is reduced. A low charging rate is normal after the initial recharging of the battery. A zero reading or negative reading with no battery load indicates a malfunction in the alternator or regulator system.

TAKEOFF.

a. Position mixture to "FULL RICH". Where installed, cowl flaps should be positioned as specified by aircraft manufacturer.

b. Slowly advance throttle to Full Throttle.

CAUTION . . . Avoid rapid throttle operation.

CLIMB.

a. Climb must be done at "FULL RICH" mixture setting, with cowl flaps, if provided, set to maintain desired temperature.

CRUISE.

1. After a desired altitude has been reached, adjust the throttle so as not to exceed the RPM for the cruise power selected.

2. Any irregularities in RPM, oil temperature and oil pressure may be indicative of engine trouble. Land as soon as practical and investigate.

3. At altitudes of more than 5,000 feet above sea level adjust mixture control for best rich power by moving toward "lean" position until maximum RPM is obtained with fixed throttle. Return control toward "FULL RICH" position until RPM drops just perceptibly. This procedure produces best power with mixture slightly on the rich side to prevent overheating. Readjust the fuel-air mixture for each change in throttle setting or altitude.

CAUTION . . . Do not lean the fuel-air mixture, unless such adjustment results in a higher RPM. Excessively lean mixtures cause over-heating and may result in damage to the engine.

DESCENDING AND LANDING.

1. The mixture control must be in "FULL RICH" position during descent.

2. If a long glide is made, apply power at short intervals to clear the cylinders and retain engine temperatures in the event that instant power is required.

3. Carburetor heat is available only at engine outputs well above idle. Apply carburetor heat before closing the throttle and place carburetor heat "OFF" before opening the throttle so full power will be available if necessary.

STOPPING THE ENGINE.

1. Normally the engine will have cooled sufficiently during the glide and taxiing period to permit placing the ignition switch in the off position without additional idling. If taxi time has been excessive, operate the engine at 800-1000 RPM for two or three minutes before stopping.

2. If the engine is equipped with a Stromberg NA-53A1 carburetor, stop from idling speed by turning the ignition switch to "OFF". As the engine stops open the throttle rapidly, and leave it open to prevent after-firing. If the carburetor is a Marvel-Schebler MA-3PA model, stop by moving the mixture control to the full "lean" position, where it acts as an idle cut-off. Do not open the throttle, because it actuates the accelerator pump and rapid opening will flood the engine.

SECTION III

IN-FLIGHT EMERGENCY PROCEDURES

If a malfunction should occur in flight, certain remedial actions may eliminate or reduce the problem. Some malfunctions which might conceivably occur are listed in this section. Recommended corrective action is also included; however, it should be recognized that no single procedure will necessarily be applicable to every situation.

A thorough knowledge of the aircraft and engine systems will be an invaluable asset to the pilot in assessing a given situation and dealing with it accordingly.

ENGINE ROUGHNESS.

Observe engine for visible damage or evidence of smoke or flame. Extreme roughness may be indicative of propeller blade failure. If any of these characteristics are noted, follow aircraft manufacturer's instructions.

1. Engine Instruments - Check. If abnormal indications appear, proceed according to Abnormal Engine Instrument Indications (this section).

2. Mixture-Adjust as appropriate to power setting being used. Do not arbitrarily go to Full Rich as the roughness may be caused by an already overrich mixture.

3. Magnetos - Check On.

If engine roughness does not disappear after the above, the following steps should be taken to evaluate the ignition system.

1. Throttle - Reduce power until roughness becomes minimal.

2. Magnetos - Turn Off, then On, one at a time. If engine smooths out while running on single ignition, adjust power as necessary and continue. Do not operate the engine in this manner any longer than absolutely necessary. The airplane should be landed as soon as practical and the engine repaired.

If no improvement in engine operation is noted while operating on either magneto alone, return all magneto switches to On.

CAUTION . . . The engine may quit completely when one magneto is switched off, if the other magneto is faulty. If this happens, close throttle to idle and move mixture to idle cutoff before turning magnetos on. This will prevent a severe backfire. When magnetos have been turned back on, advance mixture and throttle to previous settings.

WARNING . . . If roughness is severe or if the cause cannot be determined, engine failure may be imminent. In this case, it is recommended that the aircraft manufacturer's emergency procedure be employed. In any event, further damage may be minimized by operating at a reduced power setting.

ABNORMAL ENGINE INSTRUMENT INDICATIONS

HIGH CYLINDER HEAD TEMPERATURE.

1. Mixture - Adjust to proper fuel flow for power being used.

2. Cowl Flaps-Open. (if installed)

3. Airspeed - Increase.

If temperature cannot be maintained within limits, reduce power. Have the engine inspected before further flight.

HIGH OIL TEMPERATURE.

NOTE . . . Prolonged high oil temperature indications will usually be accompanied by a drop in oil pressure. If oil pressure remains normal, then a high temperature indication may be caused by a faulty gauge or thermocouple. If the oil pressure drops as temperature increases, proceed as follows:

1. Cowl Flaps - Open. (if installed)

2. Airspeed - Increase to normal climb or cruise speed.

3. Power - Reduce if steps 1 and 2 do not lower oil temperature.

CAUTION . . . If these steps do not restore oil temperature to normal, an engine failure or severe damage can result. In this case it is recommended that the aircraft manufacturer's emergency instructions for engine failure be followed.

LOW OIL PRESSURE.

If the oil Pressure drops unexplainably from the normal indication of 30 to 60 psi, monitor temperature and pressure closely and have the engine inspected at termination of the flight. If oil pressure drops below 30 psi, an engine failure should be anticipated and the aircraft manufacturer's instructions for such should be followed.

IN-FLIGHT RESTARTING.

CAUTION . . . Actual shutdown of an engine for practice or training purposes should be minimized. Whenever engine failure is to be simulated, it should be done by reducing power.

The key point in restarting is to increase fuel flow gradually from idle cutoff so the engine will start when a proper mixture is reached. The mixture may then be increased and power adjusted as desired.

SECTION IV

ENGINE PERFORMANCE

The charts in this section are provided as a reference for use in establishing power conditions for takeoff, climb and cruise operation. Refer to aircraft manufacturers flight manual for tabular climb and cruise data.

CRUISE CONTROL BY CHART.

To determine actual horsepower, employ the following procedure:

1. Locate RPM and manifold pressure on altitude chart (Point "A").

2. Locate RPM and manifold pressure on sea level chart (Point "B").

3. Transfer "B" to sea level on altitude chart (Point "C").

4. Draw a line from "C" through "A".

5. Locate Point "D" at pressure altitude and read horsepower.

6. Correct horsepower for inlet air temperature as follows:

   a. Add 1% for each 10°F. below T_S

   b. Subtract 1% for each 10°F above T_S

   (T_S=Standard Altitude Temperature)

CAUTION . . . When increasing power, enrich mixture, and advance throttle in that order. When reducing power, retard throttle, then adjust mixture.

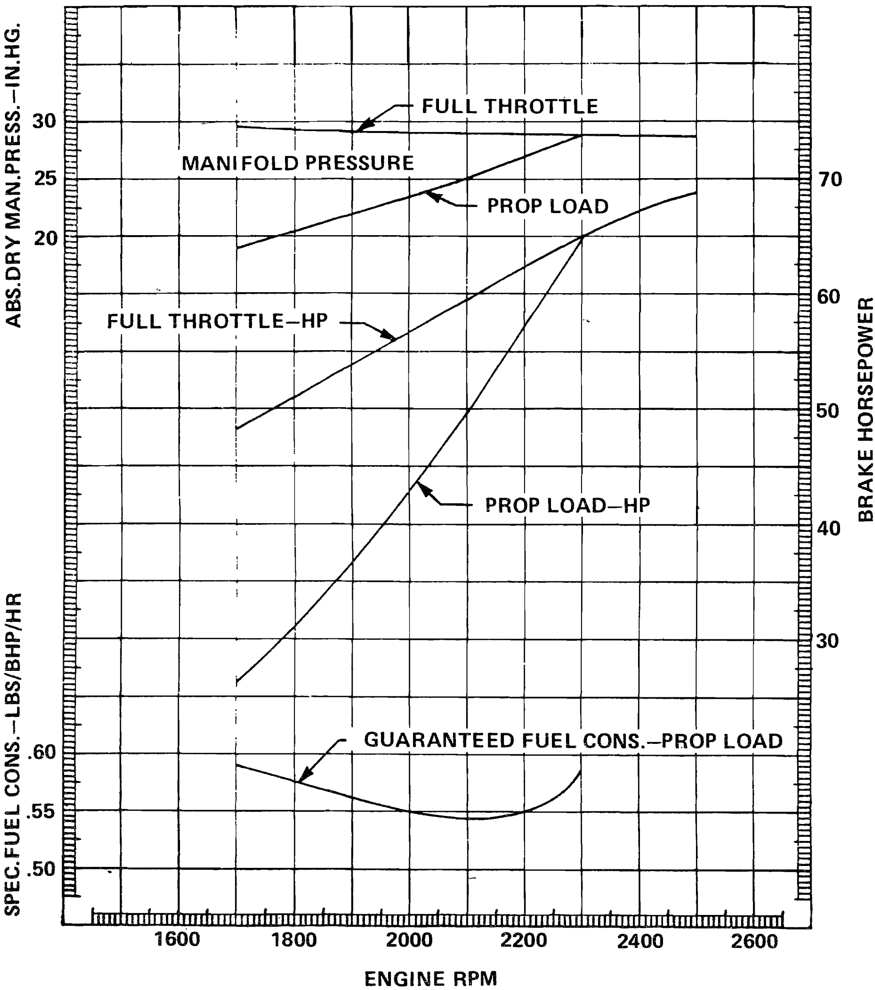


Figure 1. Model A65 — Sea Level Performance Curve

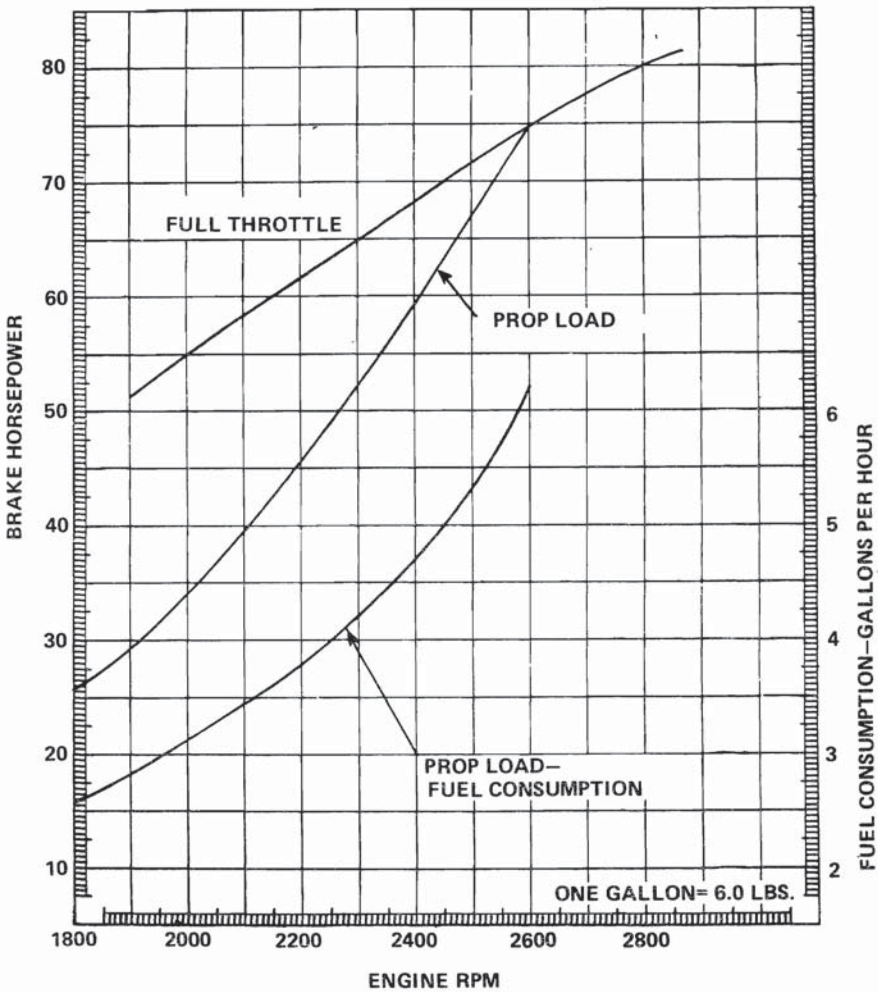


Figure 2. Model A75 – Sea Level Performance Curve

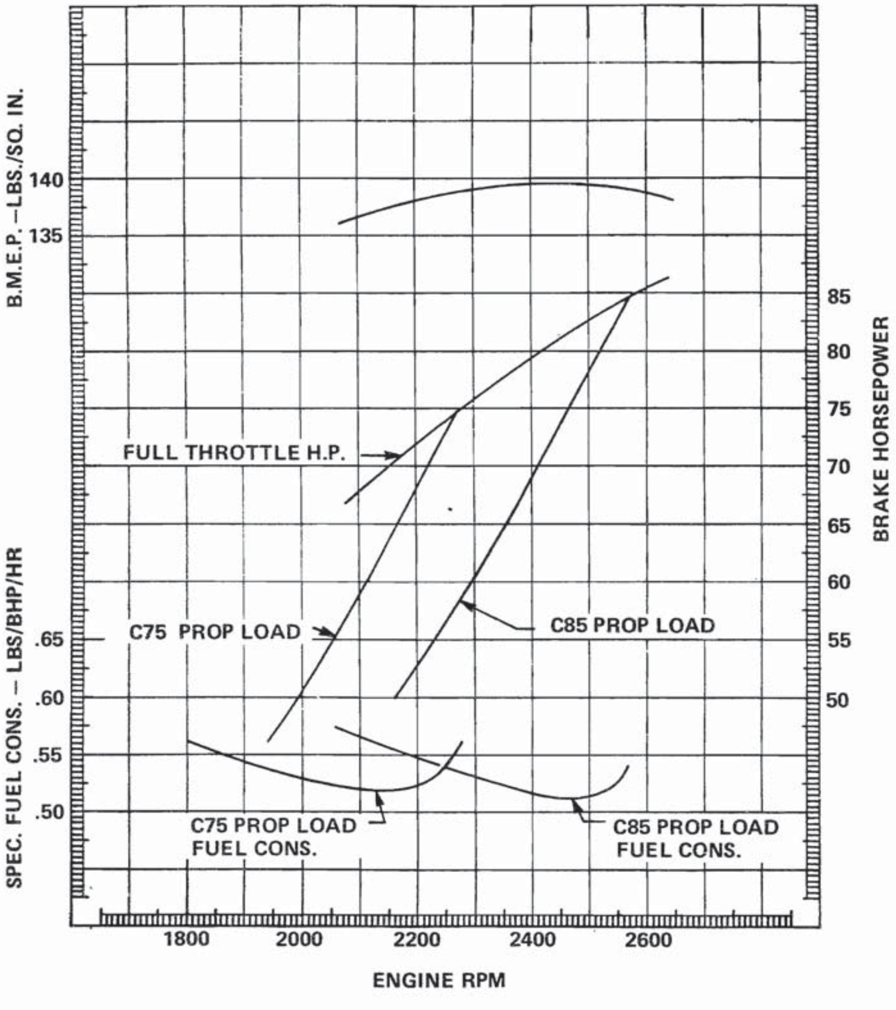


Figure 3. Model C75 & C85 – Sea Level Performance Curve

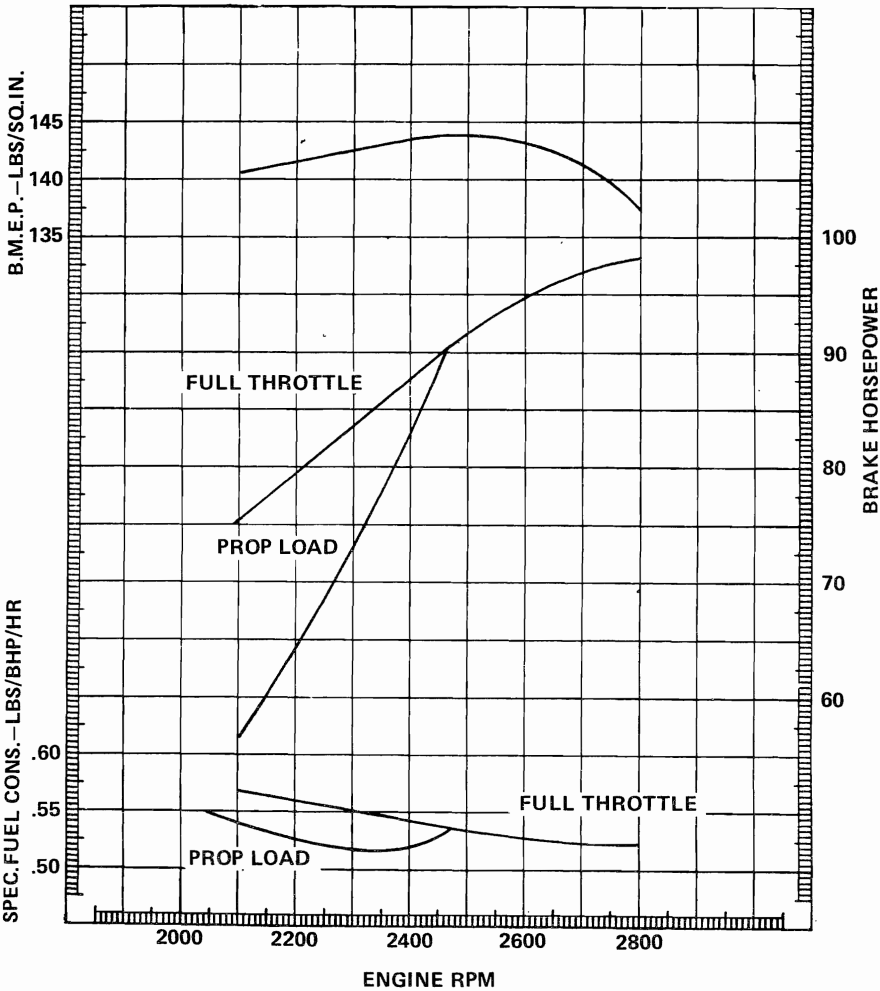


Figure 4. Model C90 – Sea Level Performance Curve

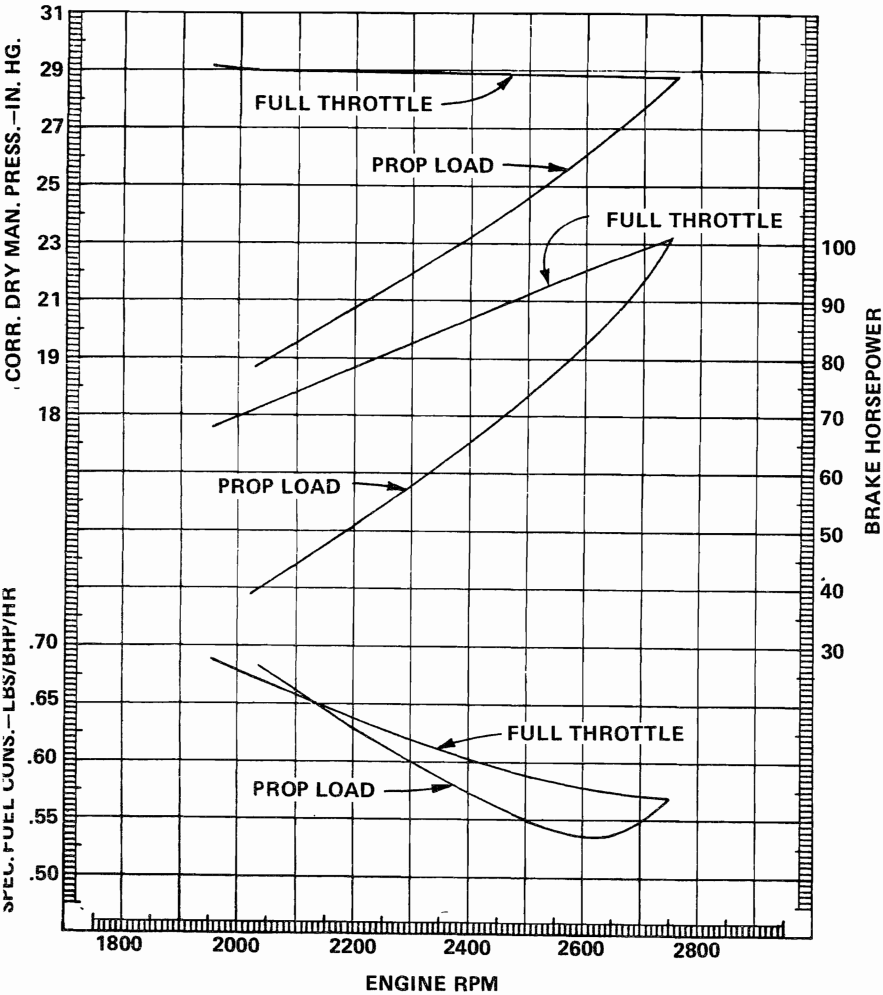


Figure 5. Model O-200 – Sea Level Performance Curve

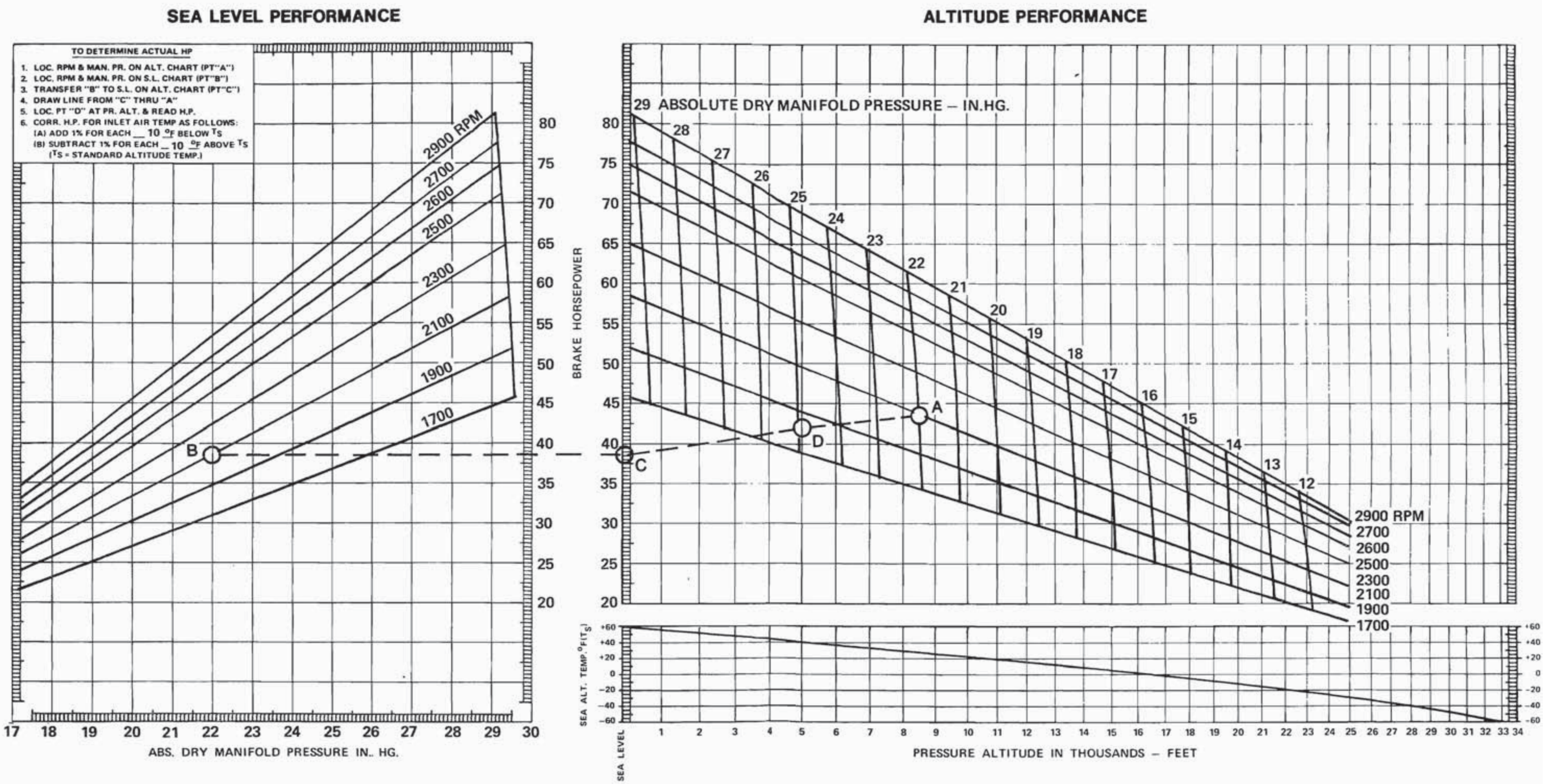


Figure 6. Model A65 – Altitude Performance Curve

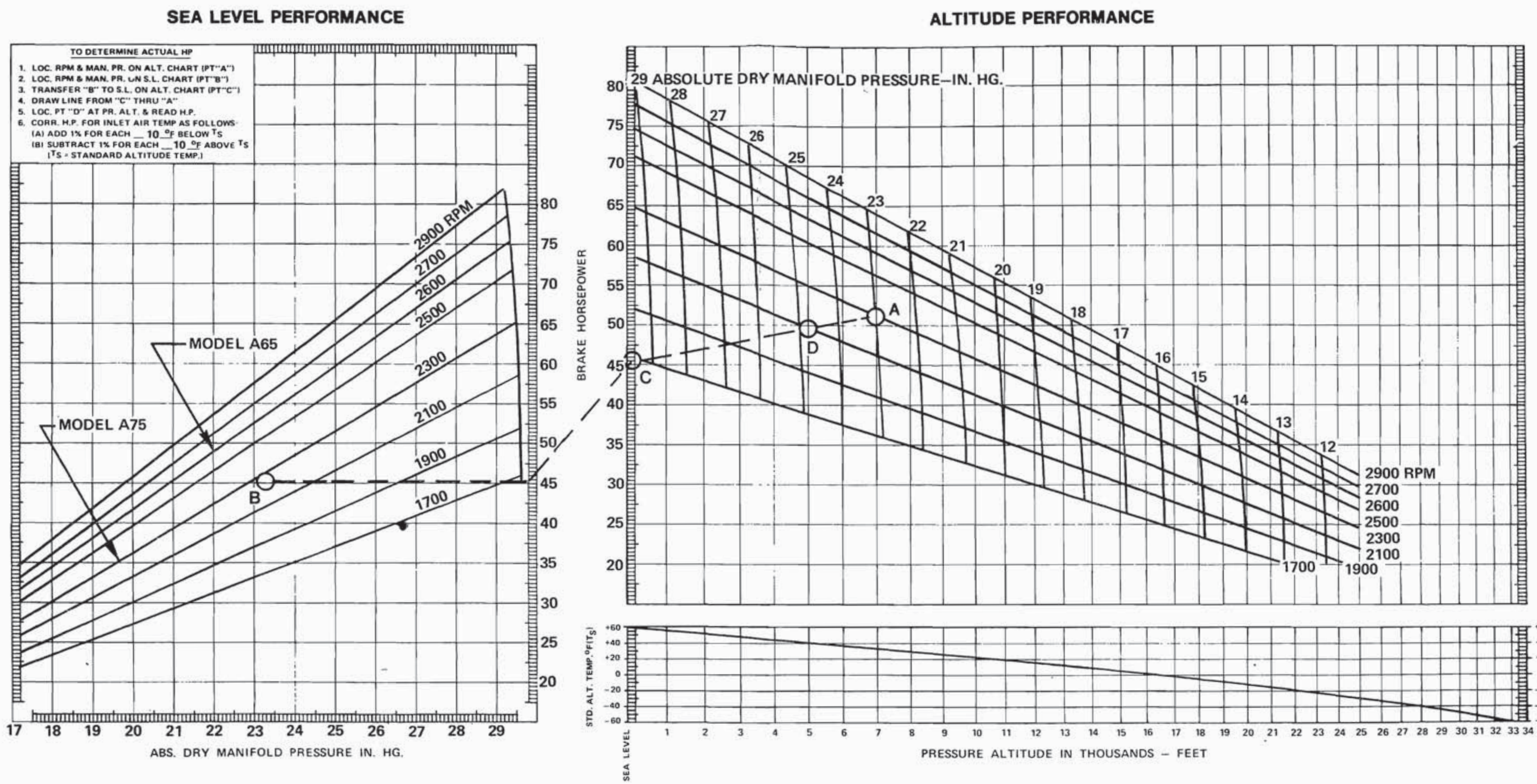


Figure 7. Model A75 — Altitude Performance Curve

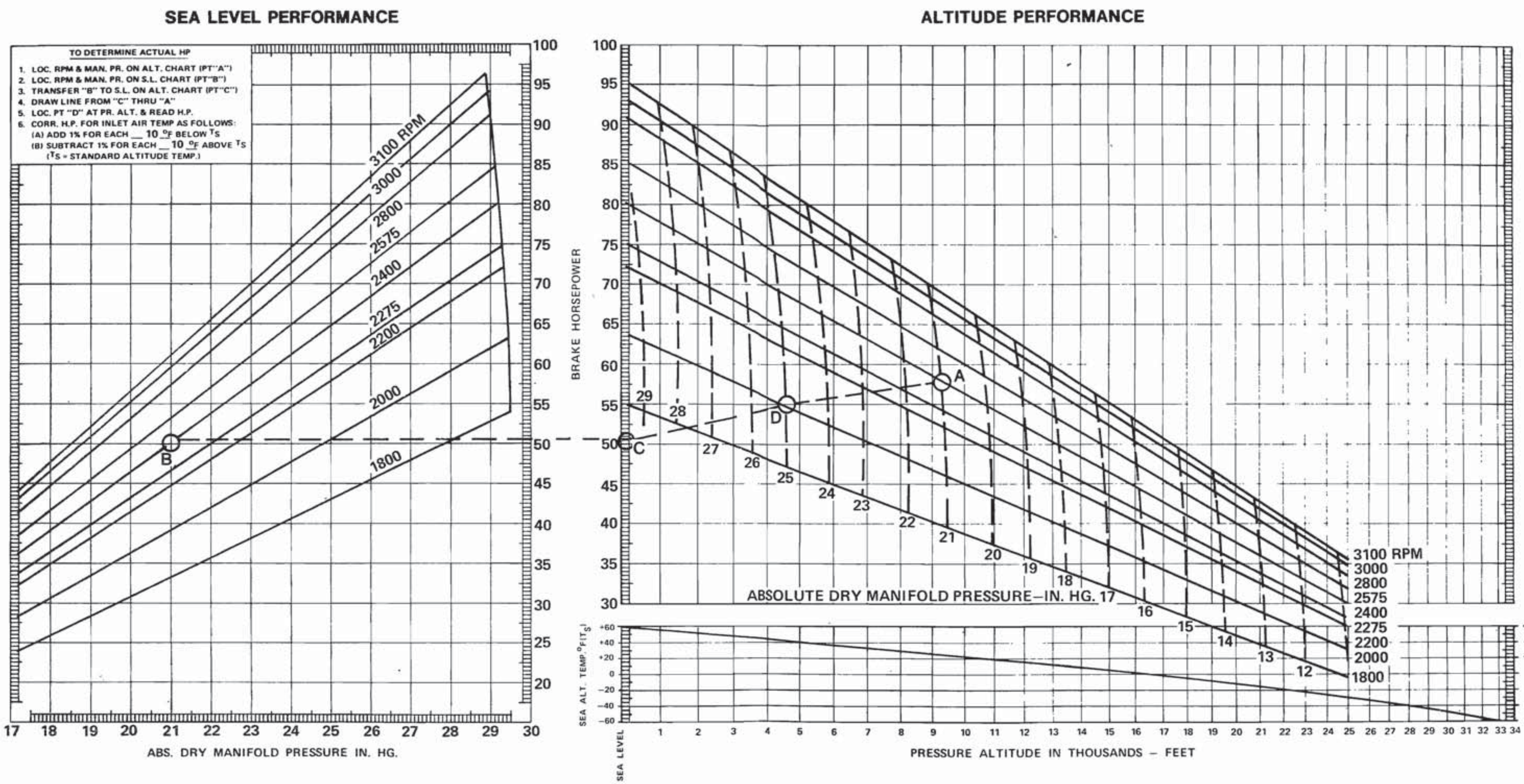


Figure 8. Model C75 & C85 – Altitude Performance Curve

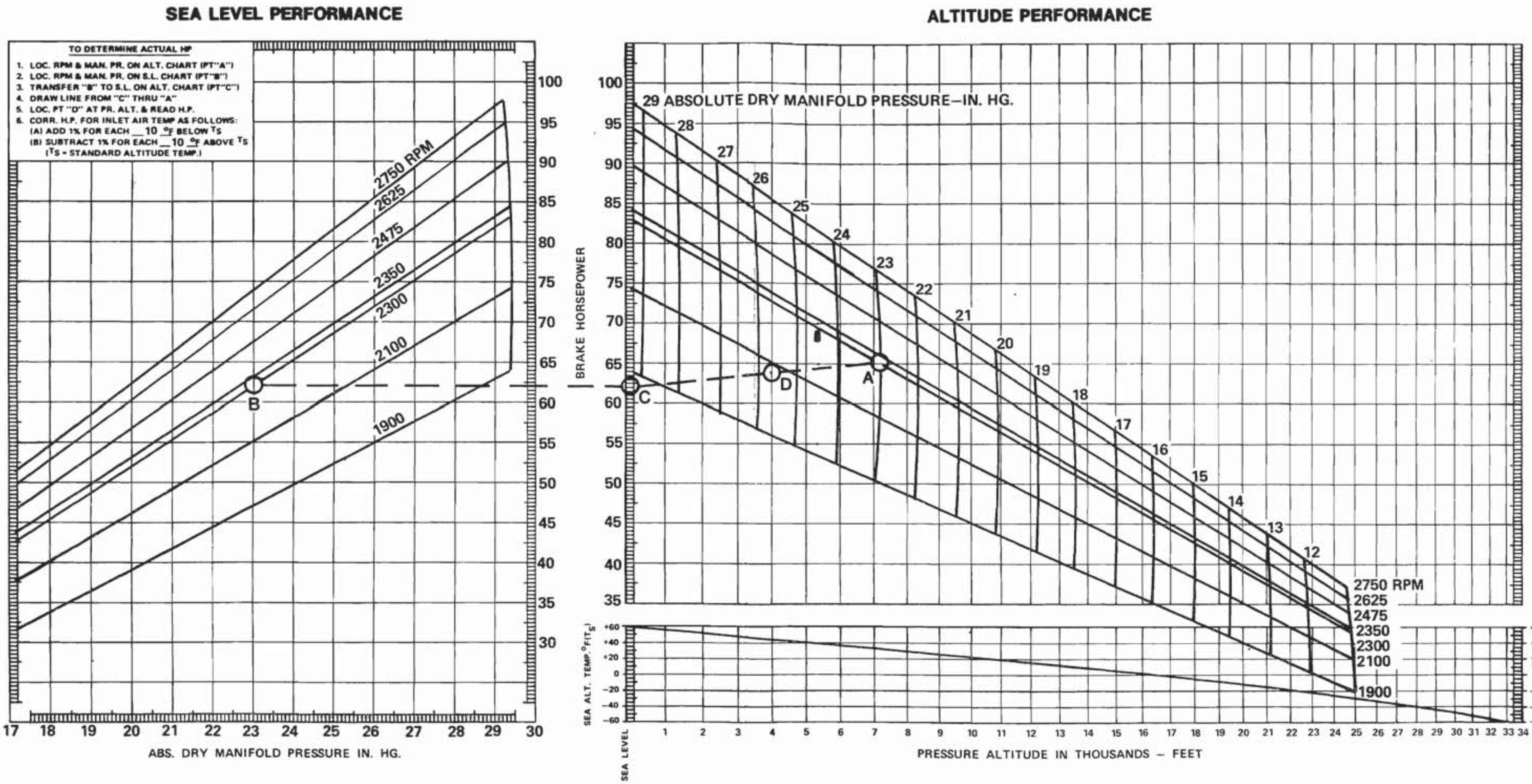


Figure 9. Model C90 – Altitude Performance Curve

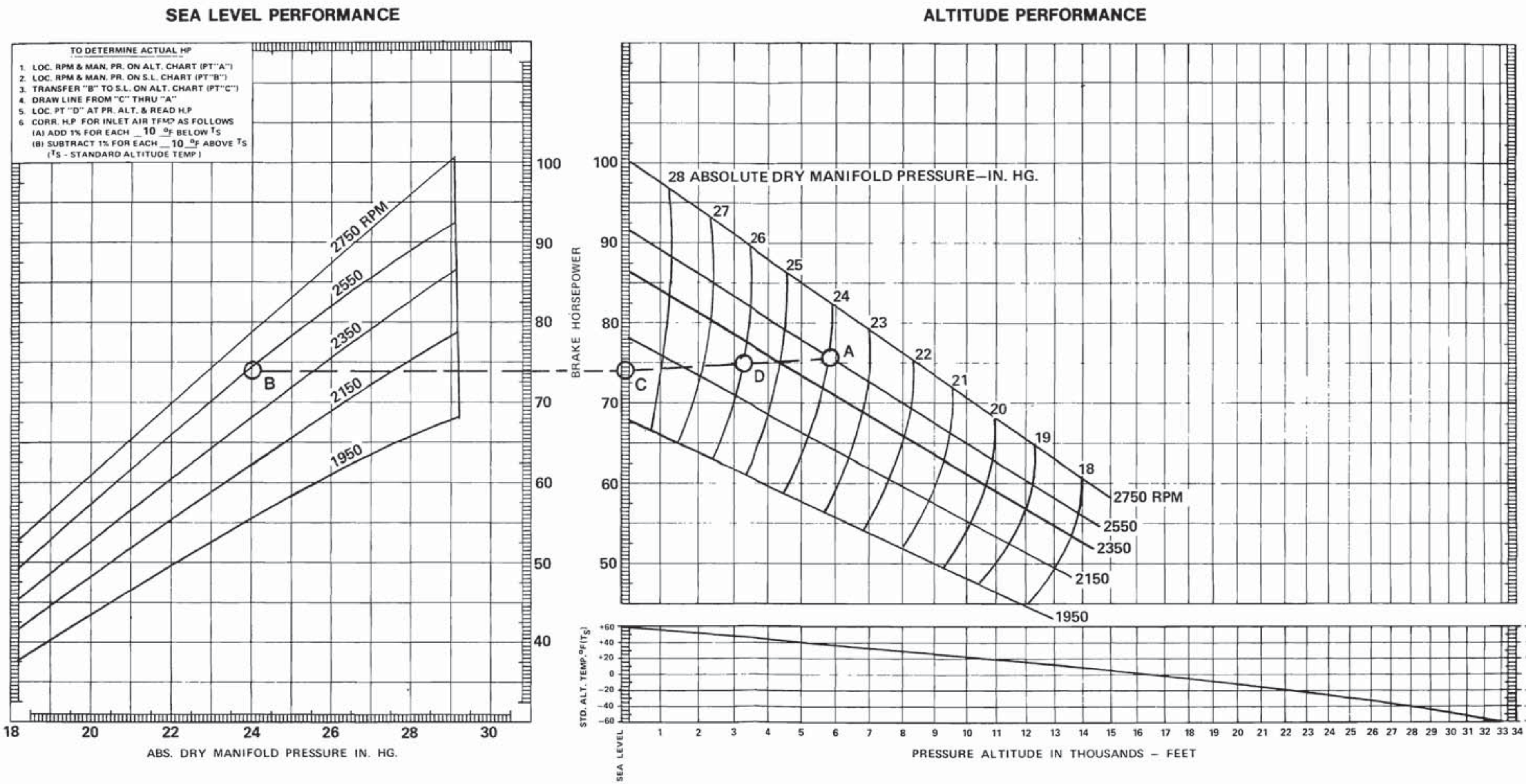


Figure 10. Model O-200 – Altitude Performance Curve

SECTION V

ABNORMAL ENVIRONMENTAL CONDITIONS

Three areas of operation may require special attention. These are (a) extreme cold weather, (b) extreme hot weather and (c) high altitude ground operation. The following may be helpful to the operator in obtaining satisfactory engine performance under adverse conditions.

COLD WEATHER OPERATION (Ambient Temperature Below Freezing).

NOTE . . . Prior to operation and/or storage in cold weather assure engine oil viscosity is SAE 30. In the event of temporary cold weather operation, not justifying an oil change to SAE 30, consideration should be given to hangaring the aircraft between flights.

Engine starting during extreme cold weather is generally more difficult than during temperate conditions. Cold soaking causes the oil to become more viscous and may rob even a fully charged battery of one-half its capacity. These conditions result in slow cranking speed and rapid discharge of the battery. At low temperatures, gasoline does not vaporize readily, further complicating the starting problem.

False starting (failure to continue running after starting) often results in the formation of moisture on the spark plugs due to condensation. This moisture can freeze and will necessitate thawing of the plugs either by removing them or applying heat to the engine.

PREHEATING.

The use of preheat and auxiliary power (battery cart) will facilitate starting during cold weather and is recommended when the engine has been cold soaked at temperatures of 10°F. and below in excess of two hours. Successful starts without these aids can be expected at temperatures below normal, provided the aircraft battery is in good condition and the ignition and fuel systems are properly maintained.

The following procedures are recommended for preheating, starting, warm-up, run-up and takeoff.

1. Select a high volume hot air heater. Small electric heaters which are inserted into the cowling "bug eye" do not appreciably warm the oil and may result in superficial preheating.

WARNING . . . Superficial application of preheat to a cold-soaked engine can have disastrous results.

A minimum of preheat application may warm the engine enough to permit starting but will not de-congeal oil in the sump, lines, cooler, filter, etc. Typically, heat is applied to the upper portion of the engine for a few minutes after which the engine is started and normal operation is commenced. The operator may be given a false sense of security by indications of oil and cylinder temperatures as a result of preheat. Extremely hot air flowing over the cylinders and oil temperature thermocouples may lead one to believe the engine is quite warm; however, oil in the sump and filter (if installed) are relatively remote and will not warm as rapidly as a cylinder. For example, even when heat is applied directly, oil lines are usually "lagged" with material which does an excellent job of insulating.

Congealed oil in such lines may require considerable preheat. The engine may start and apparently run satisfactorily, but can be damaged from lack of lubrication due to congealed oil in various parts of the system The amount of damage will vary and may not become evident for many hours. On the other hand, the engine may be severely damaged and could fail shortly following application of high power. Improper or insufficient application of preheat and the resulting oil and cylinder temperature indications may encourage the pilot to expedite his ground operation and commence a takeoff prematurely.

Proper procedures require thorough application of preheat to all parts of the engine. Hot air should be applied directly to the oil sump and external oil lines as well as the cylinders, air intake and oil cooler. Excessively hot air can damage non-metallic components such as seals, hoses and drive belts, so do not attempt to hasten the preheat process.

Before starting is attempted, turn the engine by hand or starter until it rotates freely. After starting, observe carefully for high or low oil pressure and continue the warm-up until the engine operates smoothly and all controls can be moved freely. Do not close the cowl flaps to facilitate warm-up as hot spots may develop and damage ignition wiring and other components.

2. Hot air should be applied primarily to the oil sump and filter (if installed) area. The oil drain plug door or panel may provide access to these areas. Continue to apply heat for 15 to 30 minutes and turn the propeller, by hand, through 6 to 8 revolutions at 5 or 10 minute intervals.

3. Periodically feel the top of the engine and, when some warmth is noted, apply heat directly to the upper portion of the engine for approximately five minutes. This will provide sufficient heating of the cylinders and fuel lines to promote better vaporization for starting. If enough heater hoses are available, continue heating the sump area. Otherwise, it will suffice to transfer the source of heat from the sump to the upper part of the engine.

4. Start the engine immediately after completion of the preheating process. Since the engine will be warm, use normal starting procedure.

NOTE . . .Since the oil in the oil pressure gauge line may be congealed, as much as 60 seconds may elapse before oil pressure is indicated. If oil pressure is not indicated within one minute, shut the engine down and determine the cause.

5. Operate the engine at 1000 RPM until some oil temperature is indicated. Monitor oil pressure closely during this time and be alert for a sudden increase or decrease. Retard throttles, if necessary, to maintain oil pressure below 100 psi. If oil pressure drops suddenly to less than 30 psi, shut down the engine and inspect lubrication system. If no damage or leaks are noted, preheat the engine for an additional 10 to 15 minutes before restarting.

6. Before takeoff, run up the engine to 1700 RPM. If necessary, approach this RPM in increments to prevent oil pressure from exceeding 100 psi.

NOTE . . .Continually monitor oil pressure during run up.

7. Check magnetos in the normal manner.

HOT WEATHER OPERATION (Ambient Temperature in Excess of 90° F.)

CAUTION . . .When operating in hot weather areas, be alert for higher than normal levels of dust, dirt or sand in the air. Inspect air filters frequently and be prepared to clean or replace them if necessary. Weather conditions can lift damaging levels of dust and sand high above the ground. In the event the aircraft should be flown through such conditions, an oil change is recommended as soon as is practical. Do not intentionally operate the engines in dust and/or sand storms. The use of dust covers on the cowling will afford additional protection for a parked aircraftt.

In-flight operation during hot weather usually presents no problem since ambient temperatures at flight altitudes are seldom high enough to overcome the cooling system used in modern aircraft design. There are, however, three areas of hot weather operation which will require special attention on the part of the operator. These are: (1) Starting a hot engine, (2) Ground operation under high ambient temperature conditions and (3) Takeoff and initial climbout.

1. Starting a Hot Engine. After an engine is shutdown, the temperature of its various components will begin to stabilize; that is, the hotter parts such as cylinders and oil will cool, while other parts will begin to heat up due to lack of air flow, heat conduction, and heat radiation from those parts of the engine which are cooling. At some time period following engine shutdown the entire unit will stabilize near the ambient temperature. This time period will be determined by temperature and wind conditions and may be as much as several hours. This heat soaking is generally at the worst from 30 minutes to one hour following shutdown. During this time, the fuel system will heat up causing the fuel in the pump and lines to "boil" or vaporize. During subsequent starting attempts, the fuel pump, (if installed), will initially be pumping some combination of fuel and fuel vapor. Until the entire fuel system becomes filled with liquid fuel, difficult starting and unstable engine operation will be experienced.

Another variable affecting this fuel vapor condition is the state of the fuel itself. Fresh high octane fuel contains a concentration of volatile ingredients. The higher this concentration is, the more readily the fuel will vaporize and the more severe will be the problems associated with vapor in the fuel system. Time, heat or exposure to altitude will "age" aviation gasoline; that is, these volatile ingredients tend to dissipate. This reduces the tendency of fuel to vaporize and, up to a point, will result in reduced starting problems associated with fuel vapor. If the volatile condition reaches a low enough level, starting may become difficult due to poor vaporization, since the fuel must vaporize in order to combine with oxygen in the combustion process.

The operator, by being cognizant of these conditions, can take certain steps to cope with problems associated with hot weather/hot engine starting. The primary objective should be that of permitting the system to cool. Low power settings during the landing approach will allow some cooling prior to the next start attempt. Ground operation tends to heat up the engine, therefore, minimizing this will be beneficial. Cowl flaps (if installed), should be opened fully while taxiing. The aircraft should be parked so as to face into the wind to take advantage of the cooling effect. Restarting attempts will be the most difficult during the 30 minutes to one hour following that interval, the fuel vapor will be less pronounced and normally will present less of a restart problem.

Normal starting procedure should be used except that the throttle should be opened more while cranking.

2. Ground Operation Under High Ambient Temperature Conditions. Oil and cylinder temperatures should be monitored closely during taxiing and engine run up. Operate with cowl flaps (if installed) full open and do not operate the engines at high RPM except for necessary operational checking. If takeoff is not to be made immediately following engine run up, the aircraft should be faced into the wind and the engine idled at 900 - 1000 RPM.

3. Takeoff and Initial Climbout. Temperatures should be closely monitored and sufficient airspeed maintained to provide adquate cooling of the engine.

GROUND OPERATION AT HIGH ALTITUDE AIRPORTS.

Prior to take-off from fields above 5000 feet elevation, the mixture should be leaned to give maximum RPM in a full-throttle, static runup.

SECTION VI

ENGINE DESCRIPTION

The original model designation of Continental engines contained a letter followed by a number which indicated the cylinder bore size and the power rating. The series letters used herein are:
A - 3-7/8-inch bore
C - 4-1/16-inch bore

The horsepower ratings are 65, 75, 85 and 90. Following the series letter and power designation, a figure, and in some instances, a suffix letter or two in the complete model designation denote the installation of certain parts or equipment designated to adapt the basic engine to various aircraft. Those dash numbers and suffix letters are as follows:

- 8: No provision for starter or generator.
- -12: Starter, generator and associated parts installed.
- -14: Lord engine mount bushings installed.
- -16: Provisions for vacuum pump added.
- F: Flange type crankshaft installed (replaces tapered shaft).
- H: Crankcase and crankshaft adapted to feed oil to hydraulic controllable pitch propeller.
- J: Ex-Cell-O fuel injection equipment installed (replaces carburetor).

NOTE . . . Ex-Cell-O fuel injection no longer available.

The significance of the components of the O-200-A model designation are as follows:

O - "Opposed" - refers to the cylinder arrangement.
200 - Refers to the displacement in cubic inches.
A - Refers to the specific engine model.

LUBRICATION.

Oil is drawn from the oil sump through a suction tube extending down into the sump and delivered under pressure to a screen which filters out any foreign particles. From the screen, the oil goes through drilled passages in the crankcase cover and crankcase to all drive bearings, through the crankshaft and to the crankpins. Engine oil from the pressure pump is carried through drilled passages in the crankcase to the hydraulic tappets. After entering the tappets, it travels out through the overhead mechanism through hollow push rods, and is spilled over the rocker arm and valve mechanism. As it drains away, it thoroughly oils the valve stems and valve guides. The oil is returned to the crankcase by way of the push rod housings, and drains back into the sump through the opening at the rear of the crankcase. The cylinder walls and pistons are lubricated by spray. The excess oil in the crankcase is returned to the sump. The pressure relief valve is set to give approximately 35 pounds of pressure at speeds of 1900 to 2300 RPM.

On engines so equipped, oil from the pump is directed to the oil cooler adapter on the left crankcase. The oil passes through the adapter into the cooler, flows through the cooler core and returns to the adapter outlet passage. The adapter outlet port delivers the oil stream to the crankcase inlet hole leading to the left oil gallery. A spring loaded ball check valve closes a by-pass in the adapter between the inlet and outlet passages. In the event of an increase in delivery pump pressure, such as that caused by an oil cooler restriction, or cold, viscous oil, the by-pass valve will open allowing the oil to by pass the cooler.

FUEL SYSTEM.

Fuel is supplied to the carburetor either by gravity feed or cam operated fuel pump, depending on the installation. An eccentric on the rear of the camshaft provides for the rocker arm travel of the fuel pump. When a dual fuel pump installation is required, a push rod transfers the eccentric motion to the second pump. The pump inlet elbow is connected to the aircraft fuel supply line. The pump delivery tube is connected to the pump outlet elbow and the carburetor inlet. Check valves in the pump allow the fuel to flow only toward the carburetor.

INDUCTION SYSTEM.

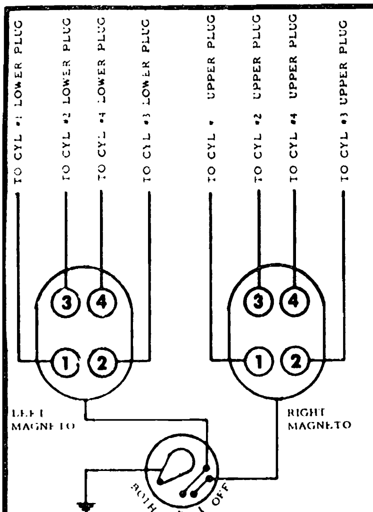
The intake manifold is attached to two studs in the crankcase lower flange. The carburetor is attached to the flange on the bottom of the manifold. The air passage through the manifold divides into four horizontal outlets, to which the cylinder intake tubes are sealed by rubber hoses and clamps. The air intake housing is attached to the bottom of the carburetor flange and the front end flares upward to match the outline of the square air filter. A hot air supply tube and a fuel drain tube are incorporated in the intake housing.

IGNITION SYSTEM.

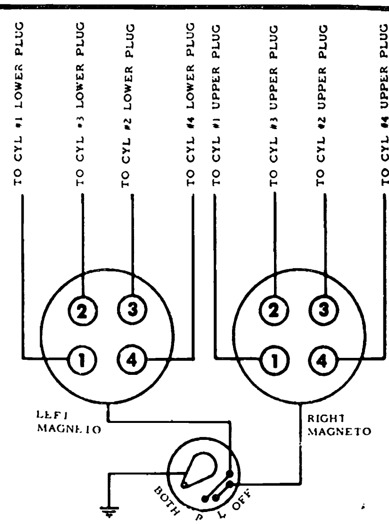
Unshielded ignition cables and unshielded spark plugs are standard on the A and C series engines. Radio shielded ignition systems are standard on the O-200 models and available as customer options on the A and C series. In all cases, dual ignition systems are provided with cables from the right magneto connected to the upper plugs and cables from the left magneto connected to the lower plugs.

Early models in the A and C series were furnished with J. I. Case, Eisemann or Scintilla magnetos. Current engines are equipped with either Bendix or Slick magnetos.

Impulse coupling operation is standard on all magnetos used although on the early A and C series, the impulse coupling was installed in the left mag with the right mag being driven by a gear mounted directly on the rotor shaft. The function of the impulse coupling is to hold back the magneto rotor, just before the breaker opening position, while the drive gear continues its rotation, thereby retarding the spark. The second function of the impulse coupling is to release the rotor at approximately T.D.C., allowing the coupling to spin the rotor rapidly through its neutral position, opening the breaker and producing a hot spark at cranking speed.

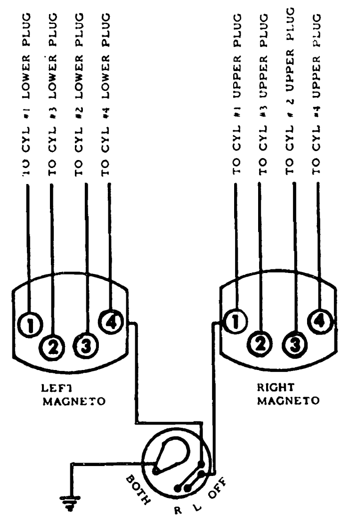


Ignition wiring diagram
for Bendix S4RN-21 magnetos
Series 8 Engines



Ignition wiring diagram
for Slick magnetos

NOTE: The firing order of the magneto, as shown, should not be confused with the engine firing order which is 1-3-2-4 on A and C series engines.



Ignition wiring diagram
for Bendix S4LN-21 magnetos
Series 12 & O-200 Engines

Figure 11. Ignition Wiring Diagram

SECTION VII

SERVICING AND INSPECTION

SERVICING.

Maximum efficiency and engine service life can be expected when a sound inspection program is followed. Poor maintenance and operation requirements, that we find widely disregarded, do determine, to a large degree, the service life of the modern aircraft engine.

Fuel	Aviation Grade 80/87

> **WARNING . . . The use of a lower octane rated fuel can result in damage to an engine the first time high power is applied. This would most likely occur on takeoff. If the aircraft is inadvertantly serviced with the wrong grade of fuel, then the fuel must be completely drained and the tank properly serviced.**

Oil: (First 25 hours operation)	Mineral (Non-Detergent)oil (MIL-C-6529 Type II)
Normal Service	SAE 50 (Above 40°F) SAE 30 (Below 40°F)
Oil Sump Capacity:	4-5 U.S. Quarts
Oil Change Interval:	50 hours

NOTE . . . The use of multi-viscosity oil is approved.

CAUTION . . . Use only oils conforming to Teledyne Continental Motors Specification MHS-24 after break-in period.

APPROVED PRODUCTS	BRAND
Phillips Petroleum Company	Phillips 66 Aviation Oil, Type A
Shell Oil Company	Aeroshell Oil W
Continental Oil	Conoco Aero S
Texaco, Inc.	Texaco Aircraft Engine Oil - Premium AD
Mobil Oil Company	Mobil Aero Oil
Castro Limited (Australia)	Castrolaero AD Oil
Pennzoil Company	Pennzoil Aircraft Engine Oil
Sinclair Oil Company	Sinclair Avoil
Exxon Company, U.S.A.	Exxon Aviation Oil EE
BP Oil Corporation	BP Aero Oil
Quaker State Oil & Refining Co.	Quaker State AD Aviation Engine Oil
Delta Petroleum Company	Delta Avoil Oil
Union Oil Company of California	Union Aircraft Engine Oil HD
Gulf Oil Company	Gulfpride Aviation AD
Phillips Petroleum Company	X/C Aviation Multiviscosity Oil SAE 20W-50
Red Ram Limited (Canada)	Red X/C Aviation Oil 20W-50
Shell Oil Company	AEROSHELL Oil W SAE 15W/50

INSPECTIONS.

The following procedures and schedules are recommended for engines which are subjected to normal operation. If the aircraft is exposed to severe conditions, such as training, extreme weather, or infrequent operation, inspections should be more comprehensive and the hourly intervals decreased.

DAILY INSPECTION (PREFLIGHT).

Before each flight the engine and propeller should be examined for damage, oil leaks, proper servicing and security. Ordinarily the cowling need not be opened for a daily inspection.

50 AND 100 HOUR INSPECTIONS.

Detailed information regarding adjustments, repair and replacement of components may be found in the appropriate Overhaul Manual. The following items should be checked during normal inspections:

50 HOUR INSPECTION.

1.	Engine Conditions:	Magneto RPM drop:	Check
		Full Power RPM:	Check
		Idle RPM:	Check

Record any values not conforming to engine specifications in order that necessary repair or adjustment can be made.

2.	Air Filter:	Inspect and clean or replace as necessary.
3.	High Tension Leads:	Inspect for chafing and deterioration.
4.	Magnetos:	Check and adjust only if discrepancies were noted in Step 1.
5.	General:	Check hoses, lines, wiring, fittings, baffles, etc. for general condition.
6.	Adjustments & Repairs:	Perform service as required on any items found defective.
7.	Engine Condition:	Run up and check as necessary for any items serviced in Step 6. Check engine for oil leaks before returning to service.

8.	Oil:	Drain while engine is warm. Refill sump.

100 HOUR INSPECTION.

Perform all items listed under 50 Hour inspection, and add the following:

1.	Valves/Cylinders:	Check compression (refer to Service Bulletin M73-19).
2.	Spark Plugs:	Inspect, clean, regap (if necessary) and reinstall. Rotate plugs from upper to lower position and visa versa to improve plug life.
3.	Cylinder, Fins, Baffles:	Inspect.
4.	Control Connections	Inspect and Lubricate.
5.	Fuel and Oil Hoses and Lines:	Inspect for deterioration, leaks, chafing.
6.	Exhaust:	Check all fittings for condition and leaks.
7.	Alternate Air Door:	Check Operation.
8.	Magnetos:	Check. Adjust points and timing if necessary.

NOTE . . . Minor changes in magneto timing can be expected during normal engine service. The time and effort required to check and adjust the magnetos to specifications is slight and the operator will be rewarded with longer contact point and spark plug life, smoother engine operation and less corrective maintenance between routine inspections.

9. Oil Pressure Relief Valve:	Inspect and clean
10. Throttle Shaft and Linkage:	Lubricate
11. Adjustments and Repairs:	Perform complete run up. Check engine for fuel or oil leaks before returning to service

SECTION VIII

TROUBLE SHOOTING

The trouble shooting chart which follows, discusses symptons which can be diagnosed and interprets the results in terms of probable causes and the appropriate correctiive action to be taken.

For additional information on more specific trouble shooting procedures, refer to Maintenance and Overhaul Manual.

All engine maintenance should be performed by a qualified mechanic. Any attempt by unqualified personnel to adjust, repair or replace any parts, may result in damage to the engine.

WARNING . . . Do not attempt to use this manual as a guide for performing repair or overhaul of the engine. The Engine Overhaul Manual must be consulted for such operations.

TROUBLE SHOOTING

A. FAILURE OF ENGINE TO START

1. Lack of fuel.
   (a) Check whether there is sufficient gasoline in tank for proper flow to carburetor.
   (b) See that carburetor float and needle-valve are functioning properly.
   (c) Make certain that the vent holes in gasoline tank caps are open.

2. Overpriming or Underpriming.
   (a) Several unsuccessful attempts to start, accompanied by weak or intermittent exposions and puffs of black smoke issuing from the exhaust pipe, would indicate overpriming or flooding. This is remedied by turning ignition switch "OFF", setting throttle full open and pulling the propeller through three or four revolutions.
   (b) If engine is underprimed, repeat instructions given for starting engine.

3. Defective Ignition.
   (a) Check ignition wiring for proper connections, breaks in insulation and possible shorts at terminals.
   (b) Check all spark plugs for insulation, clean points and correct gap clearance. Gap clearance service limits are .018 - .022".
   (c) Check condition of magnetos as given in magneto instructions and check ground terminal for possible shorting between magneto and switch.

4. Cold Oil.

   During extremely cold weather the lubricating oil becomes very thick. With the ignition switch in the "OFF" position, turn the propeller over by hand several turns to help break the drag created by cold oil between pistons, rings and cylinder walls. In zero temperature it is advisable to preheat the engine oil in order to remedy this position.

B. LOW OIL PRESSURE

1. Check the quantity and quality of oil in sump.
2. Check for dirt in the oil screen and clean thoroughly.
3. Check oil pressure relief valve for having dirt at seat, and for plunger sticking in its guide.
4. Check for worn bearings.
5. Remove oil sump, inspect and clean oil screen at end of suction tube.

C. HIGH OIL TEMPERATURES

1. Check for insufficient amount of oil in sump.
2. Check for dirty or diluted oil.
3. Failure to remove winter baffles, interference of loose or broken baffles and broken cylinder fins.
4. Prolonged ground operation at high R.P.M.
5. Check oil cooler shutters (if any) for not being open.
6. Check for excessively lean fuel mixtures.

D. LOW POWER

1. Check propeller for track and balance. If propeller has been exposed to damp weather for any length of time, the blades may have warped, increasing pitch, or if controllable pitch propeller is used, the pitch may be too great.
2. Check ignition system in general.
3. Check intake system in general for air leaks.
4. Check for full opening of throttle valve and for full closing of carburetor air heater valve.
5. Check for icing conditions.
6. Check tachometer for registering accurately.

E. ROUGH RUNNING

1. Check propeller for balance, track and tightness of hub and/or attaching bolts.
2. Remove spark plugs, clean, regap (if necessary) and reinstall.
3. Check ignition system in general.
4. Check for any evidence of sticking valves.
5. Check engine mounting for any breaks and proper tightness of mounting bolts.
6. Check for proper operation of carburetor.

F. ENGINE FAILS TO ACCELERATE PROPERLY

1. Check for engine not being sufficiently warm.
2. Check mixture control for being too lean.
3. Check carburetor heat control for proper functioning and "off" position.
4. Check for worn intake valve guides and piston rings.
5. Check carburetor idling jet for not being adjusted properly or plugged.

G. ENGINE FAILS TO IDLE PROPERLY

1. Check for incorrect idle speed adjustments.
2. Check for air leaks in the intake system.
3. Check for improper spark plug gap.
4. Check for dirt in carburetor idling jet.
5. Check for poor compression, caused by leaking valves, stuck or worn piston rings.

SECTION IX

STORAGE AND REMOVAL FROM STORAGE

A. FLYABLE STORAGE (7 to 30 DAYS).

1. Preparation for Storage. If an aircraft, which has been in operation, is to be stored much longer than a week under normal climatic conditions, and if periodic running to circulate the oil will not be carried out, it is advisable to prepare the engine for storage in the following manner:

a. Operate the engine until the oil temperature reaches the normal range. Drain the oil supply from the sump as completely as possible, and replace the drain plug.

b. Fill the sump to the full mark on the dipstick gauge with MIL-C-6529 Type II oil which will mix with normal oil, which is suitable as a lubricant, and will provide protection against corrosion.

c. Run the engine at least five minutes at a speed between 1200 and 1500 RPM with the oil temperature and cylinder head temperature in the normal operating range.

2. During Flyable Storage.

a. Each seven days during flyable storage, the propeller shall be rotated by hand without running the engine. After rotating the engine six revolutions, stop the propeller 45° to 90° from the position it was in.

b. If at the end of thirty (30) days the aircraft will not be removed from storage, the engine shall be started and run. The preferred method will be to fly the aircraft for thirty (30) minutes. If flying is impractical, a ground run shall be made of thirty (30) minute duration, and up to, but not exceeding normal oil and cylinder temperatures.

3. Preparation for Service.

a. If the engine has a total time of more than twenty-five (25) hours, the MIL-C-6529 oil shall be drained after a ground warm-up. Install the recommended oil before flight. It should be noted that MIL-C-6529 is the recommended oil for the first twenty-five (25) hours of flight.

B. TEMPORARY STORAGE (UP TO 90 DAYS).

1. Preparation for Storage.

a. Remove top and bottom spark plugs and atomize spray preservation oil, (Lubrication Oil - Contact and Volatile, Corrosion-Inhibited, MIL-L-46002, Grade 1) (221.° - 250° F.) through upper spark plug hole of each cylinder with the piston in the down position. Rotate crankshaft as each pair of cylinders is sprayed. Stop crankshaft with no piston at top position.

NOTE . . . Shown below are some approved preservative oils recommended for use in Teledyne Continental engines for temporary storage.

MIL-L-46002, Grade 1 Oils:

NOX Rust VCI-105	-	Daubert Chemical Company 4700 S. Central Avenue Chicago, Illinois
TECTYL 859A	-	Ashland Oil, Inc. 1401 Winchester Ave. Ashland, Kentucky

b. Re-spray each cylinder without rotating crank. To thoroughly cover all surfaces of the cylinder interior, move the nozzle or the spray gun from the top to the bottom of the cylinder.

c. Reinstall spark plugs.

d. Apply preservative to engine interior by spraying the above specified oil (approximately 2 ounces) through the oil filler tube.

e. Seal all engine openings exposed to the atmosphere using suitable plugs, or non-hygroscopic tape, and attach red streamers at each point.

f. Engines, with propellers installed, that are preserved for storage in accordance with this section should have a tag affixed to the propeller in a conspicuous place with the following notation on the tag: **"DO NOT TURN PROPELLER - ENGINE PRESERVED".**

2. Preparation for Service.

a. Remove seals, tape, paper and streamers from all openings.

b. With bottom plugs removed, hand turn propeller several revolutions to clear excess preservative oil, then reinstall plugs.

c. Conduct normal start up procedure.

d. Give the aircraft a thorough cleaning, visual inspection and test flight.

SECTION X

GLOSSARY

NOTE . . . Information contained in this section is not necessarily applicable to the engine(s) covered herein.

ADMP—Absolute dry manifold pressure. It is used in establishing base-line standards of engine performance. Manifold pressure is the absolute pressure in the intake manifold; it is expressed in inches of mercury (Hg").

AMBIENT—A term used to denote a condition of the surrounding atmosphere at a particular time. For example: Ambient Temperature or Ambient Pressure.

BHP—Brake Horsepower. The power actually delivered to the engine propeller shaft. It is so called because it was formerly measured by applying a brake to the power shaft of an engine. The required effort to brake the engine could be converted to horsepower-hence: "brake" horsepower.

BSFC—Brake Specific Fuel Consumption. Fuel consumption stated in pounds per hour per brake horsepower. For example, an engine developing 200 horsepower while burning 100 pounds of fuel per hour, has a BSFC of .5.

COLD SOAKING—Prolonged exposure of an object to cold temperatures so that its temperature throughout approaches that of ambient.

CRITICAL ALTITUDE—The maximum altitude at which a component can operate at 100% capacity. For example, an engine with a critical altitude of 16,000 feet cannot produce 100% of its rated manifold pressure above 16,000 feet.

DENSITY ALTITUDE—The effective altitude, based on prevailing temperature and pressure, equivalent to some standard pressure altitude.

DYNAMIC CONDITION—A term referring to properties of a body in motion.

EXHAUST BACK PRESSURE–Opposition to the flow of exhaust gas, primarily caused by the size and shape of the exhaust system. Atmospheric pressure also affects back pressure.

E.G.T–Exhaust gas temperature. Measurement of this gas temperature is sometimes used as an aid to fuel flow management.

FOUR CYCLE–Short for "Four Stroke Cycle". It refers to the four strokes of the piston in completing a cycle of engine operation (Intake, Compression, Power and Exhaust).

FUEL INJECTION–A process of metering fuel into an engine by means other than a carburetor.

GALLERY–A passageway in an engine or component. Especially one through which oil is flowed.

HG–"Inches of Mercury." A standard for measuring pressure, especially atmospheric pressure or manifold pressure.

HUMIDITY–Moisture in the atmosphere. Relative humidity, expressed in percent, is the amount of moisture (water vapor) in the air compared with the maximum amount of moisture the air could contain at a given temperature.

IMPULSE COUPLING–A device used in some magnetos to retard the ignition timing and provide higher voltage at cranking speeds for starting.

LEAN LIMIT MIXTURE–The leanest mixture permitted for any given power condition. It is not necessarily the leanest mixture at which the engine will run,

MANIFOLD PRESSURE–Absolute pressure as measured in the intake manifold. Usually measured in inches of mercury.

MIXTURE–Mixture Ratio. The proportion of fuel to air used for combustion.

NORMALLY ASPIRATED (ENGINE)—A term used to describe an engine which obtains induction air by drawing it directly from the atmosphere into the cylinder. A non-supercharged engine.

NRP—Normal Rated Power.

OCTANE NUMBER—A rating which describes relative anti-knock (detonation) characteristics of fuel. Fuels with greater detonation resistance than 100 octane are given Performance Ratings.

OIL TEMPERATURE CONTROL UNIT—A thermostatic unit used to divert oil through or around the oil cooler, as necessary, to maintain oil temperature within desired limits.

OVERBOOST VALVE—A safety device used on some turbocharged engines to relieve excessive manifold pressure in event of a malfunction or improper manipulation of engine power controls.

OVERHEAD VALVES—An engine configuration in which the valves are located in the cylinder head itself.

PERFORMANCE RATING—A rating system used to describe the ability of fuel to withstand heat and pressure of combustion as compared with 100 octane fuel. For example, an engine with high compression and high temperature needs a higher Performance Rated fuel than a low compression engine. A rating of 100/130 denotes performance characteristics of lean (100) and rich (130) mixtures respectively.

PRESSURE ALTITUDE—Usually expressed in feet, using absolute pressure (static) as a reference, equivalent to altitude above the standard sea level reference plane (29.92 Hg).

PROPELLER LOAD CURVE—A plot of horsepower, versus RPM using a fixed pitch propeller.

PROPELLER PITCH–The angle between the mean chord of the propeller and the plane of rotation.

RAM–Increased air pressure due to forward speed.

RATED POWER–The maximum horsepower at which an engine is approved for operation. Rated power may be expressed in horsepower or percent.

RETARD BREAKER–A device used in magnetos to delay ignition during cranking. It is used to facilitate starting.

RICH LIMIT–The richest fuel/air ratio permitted for any given power condition. It is not necessarily the richest condition at which the engine will run.

ROCKER ARM–A mechanical device used to transfer motion from the pushrod to the valve.

SCAVENGE PUMP–A pump (especially an oil pump) to prevent accumulation of liquid in some particular area.

SONIC VENTURI–A restriction, especially in cabin pressurization systems, to limit the flow of air through a duct.

STANDARD DAY–By general acceptance, a condition of the atmosphere wherein specific amounts of temperature, pressure, humidity, etc. exist.

STATIC CONDITION–A term referring to properties of a body at rest.

SUMP–The lowest part of a system. The main oil sump on a wet sump engine contains the oil supply.

T.D.C. through the connecting rod end axis and the piston pin center would be a straight line. Ignition and valve timing are stated in terms of degrees before or after TDC.

THERMAL EFFICIENCY–Regarding engines, the percent of total heat generated which is converted into useful power.

T.I.T.–Turbine Inlet Temperature. The measurement of E.G.T. at the turbocharger turbine inlet.

TORQUE–Twisting moment, or leverage, stated in pounds - foot (or pounds - inch).

TURBOCHARGER–A device used to supply increased amounts of air to an engine induction system. In operation, a turbine is driven by engine exhaust gas. In turn, the turbine directly drives a compressor which pumps air into the engine intake.

VAPOR LOCK–A condition in which the proper flow of a liquid through a system is disturbed by the formation of vapor. Any liquid will turn to vapor if heated sufficiently. The amount of heat required for vaporization will depend on the pressure exerted on the liquid.

VISCOSITY–The characteristic of a liquid to resist flowing. Regarding oil, high viscosity refers to thicker or "heavier" oil while low viscosity oil is thinner. Relative viscosity is indicated by the specified "weight" of the oil such as 30 "weight" or 50 "weight". Some oils are specified as multiple-viscosity such as 10W30. In such cases, this oil is more stable and resists the tendency to thin when heated or thicken when it becomes cold.

VOLATILITY–The tendency of a liquid to vaporize.

VOLUMETRIC EFFICIENCY–The ability of an engine to fill its cylinders with air compared to their capacity for air under static conditions. A "normally aspirated" engine will always have a volumetric efficiency of slightly less than 100%, whereas superchargers permit volumetric efficiences in excess of 100%.

WASTEGATE VALVE– A unit used on turbocharged engines to divert exhaust gas through or around the turbine, as necessary, to control turbine speed.

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