OPERATOR'S HANDBOOK

for

A50 Series 4, 5, 6, 7, 8 & 9

A65 Series 1, 3, 6, 7, 8 & 9

A75 Series 3, 6, 8 & 9

A80 Series 3, 6, 8 & 9

CONTINENTAL AIRCRAFT ENGINES

June 1, 1941

Continental Motors Corporation
Aircraft Engine Division
Muskegon, Michigan, U. S. A.

WARRANTY

The Aircraft Engine Division of Continental Motors Corporation warrants each new engine or part to be free from defects in material and workmanship, when properly installed and used under normal conditions, for ninety days, or in no case to exceed fifty (50) hours of operation after the shipment of each engine or part from the plant. This warranty is limited to replacing or repairing at its shops, any part or parts which have been returned to the Aircraft Engine Division with transportation charges prepaid, and which, in its opinion, are defective. This warranty is expressly in lieu of all other warranties and representations, expressed or implied, and all other obligations or liabilities on the part of the Aircraft Engine Division of Continental Motors Corporation.

This warranty does not cover any labor charges for replacement of parts, adjustments, repairs or any other work done on Continental Aircraft engines or parts.

This warranty shall not apply to any engine or part which shall have been repaired or altered outside of our factory in any way so as, in our judgment, to affect its operation, or which has been subject to misuse, neglience or accident, or which shall have been operated at a speed exceeding the factory rated speed.

The Aircraft Engine Division of Continental Motors Corporation makes no warranty with respect to ignition apparatus, carburetors, instruments or other trade accessories, inasmuch as they are usually warranted specially by their respective manufacturers.

The Aircraft Engine Division of Continental Motors Corporation reserves the right to change engine or parts specifications or prices without incurring any responsibility with regard to engines or parts previously sold or replaced.

CONTINENTAL MOTORS CORPORATION
Aircraft Engine Division
Muskegon, Michigan, U.S.A.

FOREWORD

We are happy that you have selected a Continental Aircraft Engine, and take this opportunity to express our desire to co-operate closely with you in order that you will get the best results from this power plant.

Continental Motors Corporation has protected your engine in every conceivable way. An excellent metallurgical laboratory passes on the fitness of all materials in the A50, A65, A75 and A80 engines. Specially developed machine tool equipment maintains the highest degree of accuracy. Fully equipped dynamometers check the power developed. With such facilities and highly skilled personnel, a quality product is assured.

However, even the finest type of engine may be ruined through lack of a proper understanding of its functioning; therefore, Continental's first effort to co-operate is given in the following pages which contain necessary information for operating, servicing and overhauling the A50, A65, A75 and A80 engines. It is our suggestion that you study this entire manual closely. A strict adherence to the instructions outlined herein will assure you a fine operating record. However, if any point is not entirely clear, do not hesitate to contact your nearest Authorized Continental Service Station or the factory Service Department.

In the event of failure of any engine parts, notify your nearest Authorized Continental Service Station at once, giving the engine serial number, and full particulars. Do not attempt any repairs without factory permission if any adjustment is expected.

GENERAL INDEX

GENERAL SPECIFICATIONS

Model	A-50 Series 4,5,6,7,8 & 9	A-65 Series 1,3,6,7,8 & 9	A-75 Series 3,6,8 & 9	A-80 Series 8 & 9
Type	Horizontally-Opposed, 4-cycle, Overhead Valve, Air-Cooled	Horizontally-Opposed, 4-cycle, Overhead Valve, Air-Cooled	Horizontally-Opposed, 4-cycle, Overhead Valve, Air-Cooled	Horizontally-Opposed, 4-cycle, Overhead Valve, Air-Cooled
Type Certificate	ATC #190	ATC #205	ATC #213	ATC #213
Number of Cylinders	Four	Four	Four	Four
Bore and Stroke	3-7/8 x 3-5/8	3-7/8 x 3-5/8	3-7/8 x 3-5/8	3-7/8 x 3-5/8
Piston Displacement	171 Cubic Inches	171 Cubic Inches	171 Cubic Inches	171 Cubic Inches
Compression Ratio	5.4 to 1	6.3 to 1	6.3 to 1	7.5 to 1
Rated B.H.P. at Sea Level	50 @ 1900 R.p.m.	Series 1 - 65 @ 2350 R.p.m. Ser.3,6,7,8,9-65 @ 2300 R.p.m.	75 @ 2650 R.p.m.	80 @ 2700 R.p.m.
Maximum Speed	1900	2300	2600	2700
Cruising Speed	1800	2150	2450	2450
Rotation of Crankshaft	Clockwise (facing rear end)	Clockwise (facing rear end)	Clockwise (facing rear end)	Clockwise (facing rear end)
Oil Pressure (Idling to rated power)	10 to 35 lbs. / sq. in.	10 to 35 lbs. / sq. in.	10 to 35 lbs. / sq. in.	10 to 35 lbs. / sq. in.
Oil Temperature	120° F (min) to 215° F (max)	120° F (min) to 220° F (max)	120° F (min) to 220° F (max)	120° F (min) to 220° F (max)
Oil Consumption (Cruising)	1/4 pint / hour	1/4 pint / hour	1/3 pint / hour	1/3 pint / hour
Carburetion	Stromberg NA-S3 Carburetor or Fuel Injection	Stromberg NA-S3A1 Carburetor or Fuel Injection	Stromberg NA-S3A1 Carburetor or Fuel Injection	Stromberg NA-S3A1 Carburetor or Fuel Injection
Approved Fuel	73 Octane Aviation	73 Octane Aviation	73 Octane Aviation	80 Octane Aviation
Recommended Fuel	73 Octane Aviation or better	73 Octane Aviation or better	73 Octane Aviation or better	80 Octane Aviation or better
Fuel Consumption (Carburetor) Cruising	3-1/2 U.S. gals / hour	4-1/4 U.S. gals / hour	4-1/2 U.S. gals / hour	5 U.S. gals / hour
Fuel Consumption (Fuel Injection) Cruising	3-1/2 U.S. gals / hour or less	4-1/4 U.S. gals / hour or less	4-1/2 U.S. gals / hour or less	5 U.S. gals / hour or less
Ignition	Bendix-Scintilla Magnetos, Single or Dual	Bendix-Scintilla Magnetos, Single or Dual	Bendix-Scintilla Magnetos, Dual	Bendix-Scintilla Magnetos, Dual
Spark Plugs	Champion 13	Champion C-26	Champion C-26	Champion C-26
Firing Order	1-3-2-4	1-3-2-4	1-3-2-4	1-3-2-4
Single Ignition-Magneto Fires	28° B.T.C. (Series 4 & 7)	30° B.T.C. (Series 1 & 7)		
Dual Ignition	(Series 5,6,8 & 9) 25° B.T.C.	(Series 3,6,8 & 9) 30° B.T.C.	(All Series) 29° B.T.C.	(All Series) 29° B.T.C.
Right Magneto-fires upper plugs				
Left Magneto-fires lower plugs	28° B.T.C.	30° B.T.C.	32° B.T.C.	32° B.T.C.

ENGINE DESCRIPTION

CRANKCASE

The crankcase is a two-piece heat-treated aluminum alloy casting bolted together at the vertical lengthwise plane through the crank and camshafts. Rigid transverse webs hold the three main crankshaft bearings and the three camshaft journals. A specially designed oil seal prevents oil leakage at the propeller. Large tappet guides are formed in the crankcase in a plane below and parallel to the cylinders. Cast-in tubes are used to provide pressure lubrication of the tappet guides, camshaft and main bearings. Circumferential stiffening ribs under the cylinder pads give additional strength and stiffness to the cylinder hold-down bosses. Four engine mount bosses for 3/8 inch bolts are provided at the rear of the crankcase for mounting similar to that of radial engines. To the rear and on the bottom of the crankcase there is a large flange for supporting the oil sump.

CYLINDERS

Heat-treated, aluminum alloy cylinder heads are screwed and shrunk to forged steel barrels. Closely spaced cooling fins are provided on barrels and cylinder heads to provide ample and efficent radiation surface. Cylinder bores are ground to mirror finish and held within extremely close limits. Aluminum bronze spark plug inserts are screwed and pinned in while aluminum bronze intake and austenitic steel exhaust valve seats are shrunk into the cylinder heads. Rocker boxes are cast integral with the heads and are provided with oil-sealed covers. They are scavenged by the drainage of oil back to the crankcase through the push rod housings. Cylinder heads have underside exhaust ports to permit more positive exhaust scavenging, simplicity of streamlining and cowling design, and to insure quieter operation.

PISTONS

All models have heat-treated aluminum alloy permanent mold pistons. The A75 and A80 pistons are internally ribbed for greater strength and heat dissipation. Two compression rings and two oil control rings, one of the latter being below the piston pin, are provided on the A50 and A65 piston, while the A75 and A80 pistons have a third compression ring above the piston pin, thus having five rings on them. The A50 pistons have a compression ratio of 5.4:1, the A65 and A75 pistons 6.3:1, and the A80 pistons 7.5:1.

CONNECTING RODS

Connecting rods are of conventional split-bearing design and of heat-treated alloy steel forgings. The split crank journal end bearing is of replaceable thin steel back shell-type, copper-lead lined. At the piston pin end is a pressed-in bronze bushing. The connecting rods used in the A75 and A80 have specially drilled oil holes for extra oiling of all cylinder walls.

CRANKSHAFT

The alloy steel, one-piece, four-throw crankshaft is supported by three steel backed copper-lead lined main bearings. The crankshaft is drilled for lightness and to provide pressure lubrication of crankpin journals. The crankshaft end clearance is fixed by the front main bearing setting between the forward crank cheek and a collar machined on the shaft. This construction provides a thrust bearing for either tractor or pusher installation.

CAMSHAFT

The camshaft is of cast alloy steel and has six hardened cams and three

bearing journals. The exhaust cams are adjacent to the journals while the intake cams are common to opposing cylinders. At the rear end of the shaft is a flange for attachment of a gear by cap screws. Special camshafts that provide fuel pump operation and either fuel injection or combination fuel injection and fuel pump operation are available as optional equipment.

VALVE GEAR

Hydraulic tappets fit aluminum alloy guides machined in the crankcase and so sealed as to positively prevent oil leakage. Tappets are drilled in such a manner that an oil passage is provided from the tappets to the push rods, rocker arm bearings and rocker end. Push rods are made of light steel tubing with pressed-in ball ends, hardened and ground, and drilled their entire length to provide an oil passage to the overhead mechanism. The push rod is fully enclosed, and the outer end fits into a socket in the rear of the valve rocker. The rocker acts directly on the valve through a specially designed "foot" so constructed as to prevent side-thrust on the valve stem. Splash lubrication keeps valve guides oiled at all times. Oil is returned to the crankcase by the push rod housing.

ACCESSORY CASE

The accessory gear case casting at the anti-propeller end of the engine provides support for ignition units, oil pump, and tachometer drive. Provision is made for starter mounting on series 6 and series 9 models. The gear case has the oil suction tube, the oil drain, oil screen, the pressure relief valve and oil lines to match the several crankcase oil lines. The entire assembly with accessories is removable as a unit.

INTAKE AND EXHAUST SYSTEM

Standard carburetion is supplied by an updraft Stromberg NA-S3 (A50) NA-S3A1 (A65, A75 and A80) carburetor connected to an "X" manifold. This manifold is attached by two studs to the underside of the crankcase mid-way between cylinders. Steel intake pipes connect this manifold to each of the four intake ports. A primer connection is provided at each of the cylinders to facilitate cold weather starting. There is also a primer connection just above the carburetor and below the manifold "X".

FUEL INJECTION

The fuel injection system of carburetion, an exclusive Continental feature is supplied as optional equipment. The injector mounted at the lower front center of the crankcase supplies fuel through individual spray nozzles to each intake elbow, where it is completely mixed with inducted air in proper proportion at the intake port, just before entering the cylinder. Fuel injection carburetion eliminates carburetor icing, increases economy, reduces fire hazard, adds smoothness, and assures dependability.

LUBRICATION

The A50, A65, A75 and A80 engines are essentially dry sump engines, but to minimize installation problems and to reduce the number of external oil lines, a sump is attached directly to the crankcase. Oil is drawn from the oil tank through a suction tube extending down into the tank and delivered under pressure to a filter from which it goes through drilled passages in the accessory and main cases to all drive bearings, through the crankshaft and to the crankpins. On the A75 and A80 models, oil is ejected from each connecting rod cap to the adjacent cylinder wall, thus insuring adequate lubrication under the most severe conditions.

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 oil sump through the large opening provided for this purpose. In the A50, A65, A75 and A80 models,

cylinder walls and piston pins are lubricated by a spray, while the system discussed in the preceding paragraph is provided for supplementary lubrication in the A75 and A80. Excess oil in the crankcase is returned to gravity by the oil sump. The pressure relief valve is set to give approximately 33 pounds of pressure at speeds of from 1900 to 2650 r.p.m.

TESTING

Engines are run 3-1/2 to 5 hours of which 1 hour is at full-throttle with propeller load, then completely disassembled and inspected. After reassembling they are given an additional 2 hour check run at full load, full-throttle. The thoroughness employed in testing production engines is a safeguard to Continental quality. Performance of engines in the field amply justifies the care expended in proving the engine's right to bear the Continental winged seal of quality.

INSTALLATION

ENGINE MOUNTING

The engine should be fastened to the airplane at the four mounting pads provided, using 3/8" bolts of good quality. Spool or cone type rubber mounting washers so installed as to prevent any direct metal to metal contact between the engine and its mounting frame should be used to reduce noise and vibration transmission to the airplane structure. The presence of these washers makes the tension of the mounting bolts of prime importance, and these bolts should be adjusted from time to time in service to compensate for any permanent compression which may take place during usage.

FUEL AND CARBURETION SYSTEM

The fuel tank should be arranged so that the head under extreme conditions of climb should not fall below 2 inches. The head required to flood the carburetor in nose-down position is about 90 inches, and provision should be made not to exceed this head in a steep glide.

The primer may be connected either at the manifold riser above the carburetor, or at the intake ports of each cylinder. The manifold position should give good starts under atmospheric conditions above 20 degrees Fahrenheit, while the port position for the primers is recommended for operation at lower temperatures.

A carburetor entrance duct, or air scoop, provided with a valve to regulate the carburetor air temperature is usually supplied as standard equipment with each engine when new. The entrance duct should be extended forward if necessary, so that impact air will be supplied to the carburetor. A 2" tube connection at the rear of the carburetor entrance valve should be connected to a source of heated air, so that air at 100° F. will be available to the carburetor under the coldest atmospheric air conditions. The formation of ice will be prevented in this manner, and the general operation of the engine improved in cool weather. In warm weather, little or no heat is required.

OIL SYSTEM

The engine is essentially a dry sump engine, but through skillful engineering, the advantages of both wet and dry sump engines have been combined in this one unit by the attachment of the oil sump to the crankcase. The oiling system is entirely self-contained, and no special instructions as regards its installation are necessary.

Install an oil line to the pressure gauge on the instrument board. The

therometer bulb is screwed into the oil screen also located in the accessory case.

COOLING OF ENGINE

The engine is designed for crossflow cooling, that is, the air must pass from the top of the engine downward through the cylinder fins or vice versa. Baffles of some type are nearly always required.

The temperatures ordinarily considered satisfactory are 400° F. at the spark plug gaskets (top spark plugs) and 250° F. at the cylinder base. The cylinder base temperatures are measured at the cylinder flange on the rear side of the horizontal centerline, and the spark plug gasket temperature is obtained with the standard thermocouple gasket having a tab for receiving the thermocouple wires.

In unconventional installations, special tests may be required to demonstrate satisfactory cooling conditions.

OPERATION

GAS AND OIL

Fuels equal to or better than Domestic Aviation gasoline of 73 octane rating are recommended. Low grade gasoline will cause hard starting and overheating in flight, and result in high maintenance costs.

The oil sump should be filled with a minimum of one gallon of a standard brand of an aviation or high grade automobile engine oil. Since the Civil Aeronautics Administration requires each airplane equipped with an air-cooled engine to have an oil thermometer, we recommend that the selection of the grade of oil be based upon the average oil temperature, rather than according to seasons of the year. The engine oil temperature should normally run between 120° F and 200° F. Where aviation grade oils are available grade #80 aviation, or SAE 40 should be used. When the oil temperature cannot be warmed up to beyond 120° F., as in very cold weather, not heavier than grade #60 aviation, SAE 30, should be used. It is recommended that the engine not be operated for a long period of time with oil temperatures below 90° F.

As a comparatively small quantity of oil is carried in the oil tank, it should be drained and refilled with fresh oil every 20 hours of operation. It should, of course, be replenished as often as necessary. In extremely cold weather, starting will be easier if the oil is warmed up before filling the tank.

INSPECTION PRIOR TO OPERATION

Do not attempt to start your engine unless inspection and service has been completed in accordance with the established requirements of the Civil Aeronautics Administration. With the ignition switch set at the "off" position, turn engine over by hand several times to make certain that it is ready for starting.

STARTING AND GROUND TESTING

In extreme cold weather operation, engine oil should be drained from the sump, heated, and replaced before starting.

The throttle should be closed and with the gasoline supply valve turned on, the engine should be primed two or three strokes. Over-priming should be avoided to prevent the danger of washing lubricating oil from the cylinder walls.

With the ignition switch off, turn the engine over by hand five or six times with the throttle still closed. Turn the ignition switch on and open throttle slightly. Start engine by pulling propeller through. If the engine fails to start, the above procedure should be repeated. If the engine loads up, the ignition switch should be turned off, the throttle opened, and the engine turned backward to unload the cylinders.

Innumerable variations in circumstances, temperature, conditions, engine characteristics, etc., make it impossible to lay down rules covering engine warm-up procedure. Use of good judgment by operating personnel will be necessary during the execution of each warm-up.

After starting, the speed should be maintained between 700 and 900 r.p.m. and the oil pressure carefully observed. If the gauge fails to show oil pressure within thirty seconds after starting, stop the engine immediately and correct the trouble before continuing operation. As with any aircraft engine, the throttle should not be opened wide until the oil has been warmed to within 20° of normal operating temperature. The normal temperature will vary with different installations, but should not be less than 120° F. Continue the warm-up procedure (700-900 r.p.m.) for at least three to five minutes. Gradually increase the engine speed until the normal operating temperature is reached, which should be accomplished under normal conditions within 15 minutes. Testing each magneto of dual ignition engines individually, the engine speed should not drop off more than seventy-five r.p.m. Do not operate on either single magneto for more than thirty seconds at a time.

All ground testing should be done with the carburetor mixture control (NAS-3A1 Carburetor) set at full "rich" and all controllable cowling flaps, gills etc. full "open". Prolonged periods of operation at idling and full throttle while on the ground should be avoided.

CARBURETOR MIXTURE CONTROL

The carburetor furnished has a fixed main jet which has been found to give the maximum of performance with the greatest economy and should not be changed without consulting the factory. The NAS-3A1 carburetor has an attitude mixture control adjustment supplied as standard equipment. Extreme care must be observed in its use. The idling can be adjusted by means of a small thumb screw on the side of the carburetor body. Engines being run on the ground, during take-off, and during acrobatics, should be operated with the mixture control in full "rich" position only. Engines being operated cross-country may be "leaned-out" by moving the mixture control to the "lean" position very slowly and at the same time watching the tachometer carefully. When the mixture is leaned sufficiently to produce a small drop of r.p.m. and a slight scattered missing of the engine, move the control toward the rich position sufficiently to bring power and steady operation back. It should be remembered that leaning of the mixture will cause an engine to run hotter, and it should therefore, be attempted only when load and conditions appear to warrant it. The control should always be returned to the full-rich position before returning to full-throttle operation or before a landing is attempted. If a manual operation of mixture control is not provided, the mixture control lever on the carburetor should be safety-wired in the full-rich position.

TAKE-OFF

Take-offs should be accomplished with the mixture control in the full "rich" position only, and at maximum throttle and power. The engine should be reduced to cruising r.p.m. as soon as practicable after take-off.

FLIGHT

An aircraft engine should not be flown for any great length of time at full throttle. The most satisfactory service may be obtained if the engine is cruised at a speed of 100 to 250 r.p.m. below full-throttle level flight r.p.m. However, should it be desired to cruise the engine at say 100 r.p.m. below its full-throttle level flight r.p.m., same can be safely done with certain penalties attached. The valve life will be appreciably shortened, as well as the piston

ring and bearing life. Also, of significant importance is the fact that there will be a considerable sacrifice in economy as regards gasoline and oil consumption. However, it is not likely that any mechanical difficulties or engine failures will result due to any cruising speed up to the full-throttle rated speed.

During flight, the oil temperature and oil pressure gauges should be watched. If the temperature rises above 215-220° F., or the pressure falls below 20 pounds, a landing should be made immediately, and the trouble ascertained.

When approaching the landing field from any altitude, the engine r.p.m. should not be reduced to less than from 800 to 1000. The throttle should be left just slightly open. This will prevent the engine from cooling too rapidly, and will also keep the engine "clear" and ready for instant use should full-throttle be needed due to overshooting or undershooting the field. Just before landing, the engine power should be reduced to idling. In all landing maneuvers the altitude control adjustment on the carburetor must be in full-rich position.

STOPPING

When shutting off the engine, never cut the switch immediately after landing, as this tends to cool the engine too rapidly. The main gasoline supply valve should be shut off and the engine allowed to idle until the gas runs out. This permits an even and slow cooling of parts. As soon as the engine has stopped, due to the lack of gas, the ignition switch should be turned off.

By following the above cooling-off procedure the possibility of "after-firing" is greatly reduced and the cylinder walls and pistons are left in a well-lubricated condition, because the oil on them has cooled and does not drain off as readily as it does when an engine is stopped while at high operating temperatures. It is equally as important as the warm-up procedure in starting a cold engine. The subsequent warm-up time is appreciably shortened and, because of the piston and cylinder wall lubrication remaining the danger of loss of lubrication caused by over-priming is greatly reduced.

FUEL CONSUMPTION

The fuel consumption to be expected under various operating conditions is given in the following table. The first chart represents those obtained from the operation of the A50, while the second chart those obtained from operation of the A65 and A75. The values shown are average, and atmospheric conditions, engine condition, etc., may be expected to vary these figures throughout the range plus or minus 8 %.

INSTRUCTIONS: Assume that you are checking up on the gasoline consumption of an A50 engine. From the left-hand column of the first chart, choose the full-throttle level flight r.p.m. The figure then on the extreme right should be the gasoline consumption. All values under the full-throttle consumption represent the cruising consumption at speeds indicated on the extreme left.

EXAMPLE: A50 full-throttle level flight r.p.m. 2050. Gasoline consumption 5.49 gallons per hour. Cruising at 1750 r.p.m. gasoline consumption 3.28 gallons per hour. Cruising at 1800 r.p.m., gasoline consumption 3.47 gallons per hour, etc.

GALLONS PER HOUR

A50

ENGINE R.P.M.															
2100	5.57														
2050	4.71	5.49													
2000	4.31	3.60	5.42												
1950	4.00	4.20	4.50	5.34											
1900	3.75	3.91	4.11	4.42	5.26										
1850	3.53	3.67	3.82	4.04	4.26	5.18									
1800	3.35	3.47	3.59	3.75	3.96	4.28	5.10								
1750	3.17	3.28	3.39	3.52	3.66	3.89	4.22	5.02							
1700	3.02	3.11	3.21	3.32	3.43	3.59	3.81	4.13	4.93						
1650	2.88	2.96	3.05	3.14	3.24	3.35	3.51	3.73	4.08	4.85					
1600	2.75	2.81	2.89	2.98	3.07	3.17	3.29	3.45	3.65	3.97	4.77				
1550	2.62	2.68	2.75	2.83	2.91	3.00	3.10	3.23	3.38	3.57	3.90				
1500	2.50	2.55	2.62	2.69	2.77	2.85	2.94	3.04	3.16	3.29	3.50				
1450	2.38	2.43	2.49	2.56	2.63	2.71	2.79	2.88	2.99	3.08	3.22				
1400	2.27	2.32	2.37	2.44	2.50	2.58	2.66	2.75	2.83	2.93	3.02				

GALLONS PER HOUR

A65 and A75

2850	6.52														
2800	5.87	6.46													
2750	5.43	5.84	6.42												
2700	5.26	5.51	5.83	6.37											
2650	5.02	5.23	5.49	5.74	6.31										
2600	4.81	4.98	5.20	5.35	5.75	6.25									
2550	4.72	4.77	4.94	5.14	5.41	5.58	6.18								
2500	4.44	4.57	4.72	4.90	5.13	5.30	5.54	6.12							
2450	4.28	4.40	4.53	4.67	4.87	5.01	5.20	5.44	6.04						
2400	4.12	4.23	4.35	4.49	4.64	4.76	4.92	5.09	5.38	5.96					
2350	3.97	4.06	4.18	4.31	4.44	4.53	4.68	4.81	5.04	5.28	5.88				
2300	3.83	3.91	4.02	4.14	4.25	4.35	4.48	4.58	4.77	4.95	5.30	5.80			
2250	3.68	3.76	3.87	3.97	4.10	4.17	4.29	4.39	4.54	4.68	4.94	5.10	5.71		
2200	3.55	3.60	3.72	3.81	3.92	3.99	4.10	4.19	4.33	4.44	4.61	4.77	5.02	5.62	
2150	3.40	3.47	3.58	3.66	3.76	3.83	3.94	4.03	4.14	4.23	4.38	4.50	4.68	4.89	5.53
2100	3.27	3.33	3.44	3.51	3.60	3.67	3.78	3.85	3.96	4.06	4.17	4.27	4.42	4.58	4.85
2050	3.14	3.20	3.29	3.37	3.46	3.52	3.61	3.68	3.78	3.87	3.97	4.07	4.18	4.32	4.53
2000	3.01	3.07	3.16	3.23	3.31	3.37	3.47	3.53	3.61	3.70	3.80	3.88	3.98	4.10	4.28
1950	2.88	2.94	3.02	3.09	3.17	3.23	3.31	3.38	3.45	3.53	3.61	3.69	3.79	3.90	4.06
1900	2.76	2.82	2.89	2.95	3.03	3.09	3.17	3.23	3.30	3.37	3.46	3.53	3.61	3.71	3.87
1850	2.62	2.70	2.76	2.81	2.88	2.95	3.02	3.08	3.15	3.22	3.29	3.37	3.45	3.53	3.67

GALLONS PER HOUR

A80

ENGINE R.P.M.															
2850	6.78														
2800	6.10	6.72													
2750	5.54	6.07	6.68												
2700	5.47	5.73	6.06	6.62											
2650	5.22	5.44	5.71	5.97	6.56										
2600	5.00	5.18	5.41	5.56	5.98	6.50									
2550	4.91	4.96	5.14	5.35	5.63	5.80	6.43								
2500	4.62	4.75	4.91	5.10	5.34	5.51	5.76	6.36							
2450	4.45	4.57	4.71	4.86	5.06	5.21	5.40	5.66	6.28						
2400	4.28	4.40	4.52	4.67	4.83	4.95	5.12	5.29	5.60	6.20					
2350	4.13	4.22	4.35	4.48	4.62	4.71	4.87	5.00	5.24	5.49	6.12				
2300	3.98	4.07	4.18	4.31	4.42	4.52	4.66	4.76	4.96	5.15	5.51	6.03			
2250	3.83	3.91	4.02	4.13	4.26	4.34	4.46	4.57	4.72	4.87	5.14	5.30	5.94		
2200	3.69	3.74	3.87	3.96	4.08	4.15	4.26	4.36	4.50	4.62	4.79	4.96	5.22	5.84	
2150	3.54	3.61	3.72	3.83	3.91	3.98	4.10	4.19	4.31	4.40	4.56	4.68	4.87	5.09	5.75
2100	3.40	3.46	3.58	3.65	3.74	3.82	3.93	4.00	4.12	4.22	4.34	4.44	4.60	4.76	5.04
2050	3.27	3.33	3.42	3.50	3.60	3.66	3.75	3.83	3.93	4.02	4.13	4.23	4.35	4.49	4.71
2000	3.13	3.19	3.29	3.36	3.44	3.50	3.61	3.67	3.75	3.85	3.95	4.04	4.14	4.26	4.45
1950	3.00	3.06	3.14	3.21	3.30	3.36	3.44	3.52	3.59	3.67	3.75	3.84	3.94	4.06	4.22
1900	2.87	2.93	3.01	3.07	3.15	3.21	3.30	3.36	3.40	3.50	3.60	3.67	3.75	3.86	4.02
1850	2.72	2.81	2.87	2.92	3.00	3.07	3.14	3.20	3.27	3.35	3.42	3.50	3.59	3.67	3.82

MAINTENANCE

Due to the modern improvements and engineering features of the Continental A50, A65, A75 and A80, required maintenance has been reduced to a minimum. As a general rule, these engines will need only the Engine Check every 100 hours, and a Major Overhaul every 500 to 600 hours. The operating time before a Major Overhaul is, of course, greatly dependent upon the care the engine has been given, and the type of service to which it has been subjected. Experience has shown us that operating periods of from 500 to 600 hours between Major Overhauls can easily be reached by normal operation and maintenance.

No general top overhaul is recommended, but in the event a valve begins to leak or the engine performance falls off, the cylinder causing the trouble should be located and removed and the condition corrected. However, if the engine behavior indicates that special maintenance is needed before a Major Overhaul, it is well to make a careful check of all controls, spark plugs, mixture and spark setting, ignition breaker points, fuel system, and propeller to make sure that poor functioning of one of these items is not affecting the performance.

ENGINE CHECK

(Every 100 Hours)

An engine check is done without removing the engine from the airplane and is as follows:

1. Check all engine mounting bolts to see that they are tight. If the engine has a rubber mounting, the bolts at the engine mounting lugs should be tightened firmly but should not be drawn down too solidly.

2. Check propeller hub bolts for tightness and check propeller for tract, making corrections if necessary. The propeller should track within 1/8".

3. Inspect for oil leaks. Any undue amount of oil appearing at any point on the engine is an indication of trouble and should be thoroughly investigated.

4. Inspect gasoline and oil lines for breaks or loose connections.

5. Check control linkages for undue wear, missing cotter pins, and see that full travel of all controls is obtained.

6. Check altitude control adjustment, making sure that positive and full movement of the control arm on the carburetor is obtained.

7. Remove and clean the scavenge oil strainer located in the accessory case below and back of #2 cylinder. Clean gasoline sediment bulb.

8. Check the spark plugs, clean and reset points to .015 inch.

9. Check ignition wires for breaks or broken insulation, and clean terminals going into the magneto.

10. Inspect ignition breaker points and reset according to manufacturer's specifications.

11. Check engine thoroughly for loose bolts and nuts, and make sure that all palnuts are in place.

12. Wash the engine thoroughly with a cleaning fluid, preferably not inflammable to avoid fire hazard.

MAJOR OVERHAUL

(Every 500 - 600 Hours)

A Major Overhaul should be done only at the factory or at an Authorized Continental Service Station. The engine must be removed from the airplane. A clean table should be provided on which the engine parts may be arranged for inspection as they are removed and cleaned. Keeping parts grouped according to cylinders and assemblies will greatly facilitate inspection and subsequent assembly operations.

Do not stamp numbers on parts for identification on assembly, as failure of such parts may be caused by cracks originating at the marks made by the numbering die. Small paper tags may be used for identifying and locating parts not numbered at the factory.

TOOLS

A minimum amount of special tools is required for the Major Overhauling of the A50, A65, A75 and A80 engines. Aside from a valve spring compressor, no other special hand tools are required. Bench tools such as an automatic valve refacing machine, valve seat refacing tool set and similar standard service tools can be obtained from various manufacturers who specialize in aircraft service tools.

DISASSEMBLY

Following is the procedure which should be used in disassembling and assembling the A50, A65, A75 and A80 engines assuming same have been removed from the airplane.

1. The spark plugs should be removed and stored in a safe place free from dirt. Remove the ignition wire conduits and magneto (or magnetos). The exhaust manifolds are also removed. Remove the carburetor by unscrewing the four 1/4 inch nuts that hold the carburetor to the intake manifold.

2. Remove the oil sump by removing the six 7/16" castle nuts that hold it to the crankcase, and drop it straight down. The oil intake pipe can be removed by unscrewing the hex portion at the top by using a 7/8" wrench.

3. Loosen the hose connections at the cylinder on all the intake pipes and slide the rubber hose toward the carburetor. Now remove the two 3/8" nuts holding the intake manifold to the crankcase, thus allowing the intake manifold cluster to be dropped down and removed.

4. Next, remove the nuts and palnuts holding the rocker box covers to the cylinders, and remove covers. After the covers are removed, the rocker arm shaft may be pushed out with the finger, provided the cam is in such a position that the intake and exhaust valves are closed. As the rocker shafts are pushed out, the rocker arms may be removed, and the push rod may be pulled out of the push rod housings.

Loosen the clamps holding the hose connections at the foot of the push rod housing, and push the clamp and rubber hose back up on the housing toward the cylinder head. This entirely disconnects the housing from the flanged foot and crankcase. After the six cylinder base nuts have been removed, the cylinder and push rod housing may be taken off as a unit. Care should be taken to see that the piston does not drop down and become damaged as the cylinder is removed from it. During this operation the piston should be on the outer end of the stroke. As soon as the cylinder is removed the piston pin should be pushed out and the piston removed so that no damage will occur to it. Remove all four cylinders by this same procedure.

6. Remove each push rod housing flanged foot by removing the nuts holding it to the crankcase. Remove the small caps on the push rod end of the hydraulic valve tappets, and then with a small wire hook, the inside mechanism of the tappet may be pulled out. Usually the piston and cylinder of the hydraulic tappet will stick together, but if they do not, they may be taken out separately by the use of a pair of thin nose pliers. Be sure to keep the tappets numbered according to the order in which they are removed, and that the assemblies are kept grouped together. The tappet housing (or cam follower) cannot be removed until the crankcase is disassembled.

7. Now the thirteen 5/16" nuts holding the accessory case to the crankcase proper may be removed. The accessory case may then be lifted off as a complete unit. The oil pump, relief valve and tachometer drive units remain intact in the accessory case.

8. After the accessory case is removed, remove the four 1/4" cap screws holding the cam gear to the cam. It will be noted that these four cap screws are so spaced that the gear cannot be replaced incorrectly. Also note that the cam and crankshaft gears are marked for the correct timing of the valves, and in rebuilding the engine, these markings must mesh. It will not be necessary to remove any of the other gears at this time, but the cam gear must be removed before the crankcase can be disassembled.

9. Remove all of the 1/4" nuts holding the two halves of the crankcase together. These nuts are on the centerline of the crankcase on both top and bottom of the engine. Now remove the two 7/16" nuts which are attached to long studs located at the front of the crankcase on the #2-4 side (referring to cylinder numbers), and also the two 7/16" nuts to be found one just above the intake pipes between the cylinders, and one between and to the rear of #1 cylinder on #1-3 side.

10. Now with the motor laying on its #1-3 side, the #2-4 side of the case may be lifted off. Lift the crankshaft, together with the connecting rod, out of the crankcase.

11. It will be noted that the main bearings are of the shell type, and are machined to exactly fit, and require no reaming whatsoever. Further, no adjustment of clearances is required. All bearings have "lips" on them, and can be replaced only in their proper positions.

12. Remove all connecting rods from the crankshaft.

13. Remove the four 1/4" nuts holding the oil pump gear plate to the accessory case, and the oil pump gears may then be removed. The aluminum casting housing the tachometer drive in the accessory case has a left-hand thread, and same can be unscrewed and removed from the case.

14. By compressing the valve springs in the rocker box, the locks may be removed from the valve stem, and the spring seat, springs and washers may be removed. In removing the valves from the guides, care should be excerised to see that they do not scratch or mar the cylinder walls.

INSPECTING the ENGINE

(Note: See page 22 for Service Tolerances.)

CRANKSHAFT

Clean the crankshaft oil pressure holes thoroughly with clean gasoline, and blow out with air. Inspect journals for scuffing and check journal fillets for cracks.

BEARINGS

Inspect the main and connecting rod bearings for cracks or checks. If cracks or checks are visible, replace both halves of the bearing. If it is necessary to replace any main or connecting rod bushings, same may be done by simply pressing in new bushings with the fingers. Connecting rod upper and lower bushings are identical except in the A75 and A80 engines where the cap end bushing is drilled for an oil passage. Check bronze piston pin bushings for signs of scuffing or overheating, and if bushing appears burned or rough, make replacement.

PISTONS, PISTON PINS, PISTON RINGS

Remove all rings, clean carbon from ring grooves and heads of pistons. Do not polish the contact surfaces of the piston. If slight score marks are visible, stone lightly with a fine Pike stone. Stone only enough to remove the metal which has piled up, as deep scratches cannot be removed. If scoring is heavy, the pistons must be replaced. Inspect the pin bosses. If worn, the piston must be replaced. Check piston ring grooves for wear. If worn beyond service tolerances, the piston must be replaced. Piston rings should always be replaced at the time of a Major Overhaul.

CYLINDERS

Check for scores. Very light scores can be removed with crocus cloth. If the cylinders have heavy scores, they should be replaced. Check valve seat inserts, and if badly burned, replace. (Valve seat replacements can only be made with special equipment and if necessary to do this work, same should be returned to the factory or to a shop well equipped for this type of work. Cylinder barrels can also be replaced by the factory.) Check valve guides, and if worn beyond the tolerances given in this manual, they should be replaced. Check cylinder heads thoroughly for cracks, and deep scratches. Any dents or deep scratches should be stoned out since same may result in a failure.

VALVE AND VALVE SPRINGS

Recut all valve seats; reface all valves, replacing those that do not clean up on valve refacing machines. Regrind all valves. Clean all gum from the valve stems, but do not polish, as you will remove the hard glaze which is desirable. Check all valve springs for wear, tension and breakage.

CAMSHAFTS

Inspect lobes on the cam. If scuffed, stone lightly. Inspect cam bearings for scratches. If the cam lobes are scuffed, the cam followers are probably also scuffed and will have to be stoned lightly on the inner end.

CRANKCASES

Check crankcase thoroughly for fatigue cracks. Clean with gasoline, blowing out all all oil lines.

PRESSURE RELIEF VALVE

Clean thoroughly and reinstall. The plunger should work freely in its cage without sticking.

OIL PUMP

Check the oil pump gears and if nicked or scratched, stone lightly. Remove all burrs. If the gears are badly dented or worn, they should be replaced

TACHOMETER DRIVE AND CRANKSHAFT OIL SEAL

It is desirable to always replace all gaskets and packings at the time of a Major Overhaul.

HYDRAULIC TAPPETS

Inspect the tappet mechanism thoroughly for burrs and gum formation. The tappet is a very rugged mechanism and no damage is likely to occur to it if handled with any reasonable amount of care. Care should be excerised to see that it is not dropped or nicked because of coming in contact with other metallic objects. The tappet is composed of only four parts which can be disassembled. These parts are described as the cap, cylinder, piston and guide. The tappets should be washed thoroughly and the piston should work freely in the cylinder. If either the piston or cylinder is damaged, then both parts must be replaced. The guide, or actually, the cam follower, and the cup are supplied as units separate from the piston and cylinder; however, all may be obtained as a complete hydraulic tappet assembly. A wire may be inserted in the tube at the end of the cylinder to relieve the ball check so that the piston can be moved freely, thereby allowing a better examination of the unit.

MAGNETO

Inspect the points and true up if pits are visible, making sure that the points are flat against each other. Oil only according to magneto instruction book. Inspect wiring harness. If wires are damaged, they should be replaced. See that all wires are well anchored and that positive contact is made. Of special interest is the fact that the magnetos of the type used on these engines do not have any set point gap clearance. When the magneto is timed internally correctly, the point gap is automatically set. See Magneto instruction manual for internal timing instructions.

CARBURETOR

The carburetor needs practically no attention aside from draining the float bowl of water, which can be done by removing the 1/4" pipe plug in the bottom of the float chamber. For reconditioning the carburetor, special instructions should be obtained from the manufacturer of that item.

GASKETS AND PACKINGS

It is always the best policy to use new gaskets and packings throughout, whenever reassembling an engine.

ASSEMBLING THE ENGINE

The A50, A65, A75 and A80 engines are extremely simple in principal, and they have been so constructed that a minimum amount of effort and skill is required both in the assembling and disassembling procedures. Also, by the employment of advanced engineering features and methods, many of the clearances formerly requiring much attention, are now built right into the engines and can be disregarded by the mechanic. Connecting rods and main bearings are not to be reamed or fitted in any way. Crankshaft end play is determined by the length of the front main bearings, and if such clearance is excessive, replace the bearing.

1. All parts should be thoroughly cleaned before the assembling is started. Serious injury to the engine can often be traced to dirt and parts not thoroughly cleaned during the overhaul.

2. The cylinders should first be cleaned, and valves, springs, etc., assembled. After grinding the valves, the ports should be filled with gasoline and tested for leaks. If gasoline leaks past the valve within 15 seconds the valve should be reground. Be sure all valve grinding compound is removed from the valve stem and guide, as well as the cylinder bore. After oiling the valve stems thoroughly, and wiping the guides clean, assemble the valve,

washers, springs and locks to the cylinder. Wipe the cylinder bore clean and set aside until assembly has progressed further on the engine crankcase.

3. Snap the connecting rod bushings in place and reassemble the connecting rods to the crankshaft in such a way that all connecting rod numbers will be pointing up when the shaft is reassembled to the engine. All connecting rods are, of course, assembled in their respective positions.

4. Snap in all main bearings in their respective positions, and working with each half of the crankcase separately, insert the cam followers and in order that they will not fall out of place, it is suggested that a rubber band be drawn around each pair of them on the outside of the crankcase. This is merely to hold the followers in place while the two halves of the crankcase are being assembled.

5. Now with the #1-3 side (referring to cylinder numbers) of the crankcase laid with bearings up, set the crankshaft in place. Counting from the rear of the engine, connecting rods #1 and #3 should be placed through the cylinder openings. Also, lay the camshaft in position. The #2-4 side of the crankcase may now be lifted on, and the two halves bolted together. No gasket is used between the two halves of the crankcase, but in order to prevent a slight oil seepage, each contact surface should be covered with a thin coat of Fostoria Titeseal. Before applying the Fostoria, however, be sure to see that all contact surfaces are clean.

6. The cam gear is next attached to the cam, and same should be placed in such a manner that its marking meshes with the markings on the crankshaft gear. It will be noted that the spacing of the screws holding the cam gear is such that the gear can be placed on in only one position. Safety wire the cap screws after they have been firmly tightened.

7. The hydraulic tappets should be installed next. First, all parts should be washed thoroughly and oiled with a thin coat of light oil. Inserting a piece of safety wire into the tube of the unit against the ball ckeck valve to relieve the trapped air and oil, insert the piston in the unit body and with a twist of the piston and spring to the right, seat the spring to its recessed shoulder. Still holding the ball ckeck valve in release with the piece of safety wire, depress the piston with the thumb several times to be certain that it is functioning smoothly. Though it is not necessary to entirely deflate and bleed the units before inserting them in their housing bodies they must be partially deflated. To install the units simply slide them into their respective housing bodies, tube end first.

If it should be necessary to remove a hydraulic unit from its housing body without completely disassembling the engine the cylinder must be removed. Using a piece of safety wire, hooked on an end, hook the piston and carefully work the whole unit out of the housing body. If the piston and spring alone pull out it will be necessary to press a hardwood dowel, of a diameter slightly larger than that of the piston, into the unit body and, while rotating the dowel, carefully withdraw it and the unit body.

8. Place the small cup for the foot of the push rod on top of the tappet and immediately install the push rod housing flanges. A new gasket should be used at the push rod housing flange, and in order to make a perfect oil-tight seal, a small amount of Fostoria should be applied to the push rod housing gasket before it is installed. As you will note, the push rod housing flange has a small lip which will securely hold the push rod housing cup in its correct position.

9. After new rings have been installed on the pistons, the assembly may be fitted to its respective connecting rod with the numbered side facing the propeller end of the crankshaft. As the pin is tapped into position, the piston must be carefully supported to avoid its coming in contact with other metallic surfaces. Be sure that all piston pin plugs remain in place.

10. It is noted that the push rod housings are a part of the cylinder assembly, and must be installed as such. Before any cylinder is reassembled to

the crankcase, the crankshaft should be turned until its position is brought to the outer end of the stroke. The cylinder should be carefully wiped off with a clean cloth and both cylinder and piston thoroughly oiled. On all engines a new rubber cylinder base packing should be used between the cylinder base flange and the crankcase. In order to afford a positive seal against oil leakage, it is desirable to use a small amount of Fostoria Titeseal around the cylinder flange on the flat surface that will contact the crankcase.

11. Before the cylinders are installed, however, new push rod housing rubber hoses should be installed on the housing and pushed back up toward the cylinder head for clearance while the remainder of the assembly is taking place. Holding the cylinder firmly against the body to steady it, this unit is placed over the piston. After the rings have been rotated until the gaps are evenly spaced about the piston, they are then compressed until the cylinder is over them. As soon as the cylinder is in place several of the cylinder base nuts should be drawn down before another cylinder is started. By following this same procedure, assemble all four cylinders to the crankcase. Tighten all cylinder base nuts firmly, but not excessively.

12. After the cylinders are in place, the rubber hose connections on the push rod housing can be slipped down in place and tightened with the metal hose clamp.

13. New hose connections should be placed on all intake pipes. Attach the carburetor intake manifold, and again by manipulation of the rubber hoses, the intake pipes can be installed. Attach and safety the carburetor as well as place safety nuts on all crankcase and cylinder nuts. Do not tighten the intake manifold studs more than just firmly.

14. The oil pump is reassembled into the accessory case, as well as is the tachometer drive unit. As the tachometer drive shaft goes through the rawhide oil seal, make sure that the packing remains in position, and is not pushed out of place by the drive shaft. It may be advisable to use a 7/16" rod to lead the shaft through the packing in order that it will not be pushed out of position. Be sure to safety the nuts holding the oil pump plate to the accessory case.

15. By properly meshing the oil pump drive in the cam gear, the accessory case may be attached to the engine. Tighten all nuts firmly and safety with palnuts.

16. With the engine rotated to such a position that the intake and exhaust valves are closed on any one particular cylinder, the push rods and rocker arms may easily be installed. Insert the push rods into their respective housings, and as the rocker arm is held in place, push in the rocker arm shaft.

17. It is indeed seldom necessary to even check the valve tappet clearances as they are built right into the engine. However, no method is provided for adjusting clearances so remote is the possibility that such will ever be required. Tappets will function properly with "dry" clearances ranging from .030 inch to .110 inch. At the factory, clearances are set from .050 inch to .080 inch.

If, however, it is desired to check the clearances, a screw driver blade should be inserted between the valve stem and rocker arm in such a manner that the valve is held partially open. This should be done, of course, with the cam in a position such that the valve would be closed. Leave the screwdriver in place for ten or fifteen minutes to allow all oil and air to leak out of the tappets, thus leaving them perfectly "flat." Remove the screwdriver, and while keeping considerable pressure on the push rod end of the rocker arm (taking up all spring tension) check the clearances between the rocker arm and valve stem. This clearance should be between .030 and .110 inch.

Before starting the engine after the tappet clearance check, the tappet should be removed and pumped up as described in paragraph 7 above, or else it may require two or three hours of operation before the tappet pumps up automatically, and in this period of time a considerable amount of damage can be done to the engine.

18. The engine is now ready for the magneto installation. First, rotate magneto until the mark on the gear, which can be seen through the inspection window, is in line with the small pointer, which is also visible. This places the magneto in firing position for cylinder #1. Rotate the engine in a counter clockwise direction until the firing stroke of #1 cylinder is reached.

The A50 and A65 engines are supplied in dual and single ignition models, while the A75 and A80 are supplied only in the dual ignition model. In all instances, the right magneto, facing the accessory case from the rear of the engine, fires the top plugs, while the left magneto fires the lower plugs.

FOR THE SINGLE MAGNETO A50-4 & 7 ENGINE

Set the engine at 28° Before Top Dead Center on the firing stroke. This puts the engine in the firing position for #1 cylinder. The magneto coupling is then inserted into the serrated magneto drive gear without turning the motor or magneto. The mounting studs may be tightened enough to hold the magneto in position against the accessory case.

The magneto is now approximately in firing position. Before checking the exact breaker opening position, the magneto should be rotated in a counter-clockwise direction by tapping the mounting flange until it is near the end of the travel permitted by the slots. The crankshaft may then be turned backward a little, and brought slowly up to firing position to take the back-lash out of the driving gear train.

If available, a .0015 inch feeler should be inserted between the breaker points, and each magneto flange tapped in a clockwise direction until the exact point of release is reached. Cellophane is a very good substitute if a .0015 inch feeler is not available. After tightening the mounting nuts, the timing should be checked by backing up the crankshaft and turning it slowly forward at short intervals to determine if the feeler is released the instant the disc reaches the 28 degree mark. All traces of cellophane must be removed before replacing the breaker cover.

FOR THE DUAL IGNITION A50-5,6,8 & 9 ENGINE

The procedure as described above is repeated for each magneto, except that for the left magneto (firing lower plugs), the crankshaft location for attaching the magnetos should be 28° Before Top Dead Center, and 25° Before Top Dead Center for the right magneto (firing upper plugs). The magnetos on the dual ignition model rotate in opposite direction to that of the single ignition model, and this should be borne in mind in following the above instructions.

FOR THE SINGLE IGNITION A65-1 & 7 ENGINE

The same procedure as described above for the A50-4 engine is followed except that the magneto timing should be 30° Before Top Dead Center.

FOR THE DUAL IGNITION A65-3,6,8 & 9 ENGINE

The procedure described above for the A50-5 engine is followed exactly with the exception that the timings of both magnetos should be 30° Before Top Dead Center.

FOR THE DUAL IGNITION A75 & A80-3,6,8 & 9 ENGINE

The procedure as described above for the A50-5 engine should be followed exactly with the exception that the left magneto (firing lower plugs) should be set at 32° Before Top Dead Center, while the right magneto (firing top plugs) should be set at 30° Before Top Dead Center.

19. Tighten and safety magneto flange nuts. Install all valve rocker covers and safety. Check over the entire engine and be sure that palnuts are used on all exposed nuts.

The engine is now ready to be installed in the aircraft.

RUN-IN

It is very important that an engine be carefully run-in after a complete or top overhaul. The length of time necessary for this depends upon the new parts installed during the overhaul and the facilities available for the running-in process. A flying propeller does not cool the engine properly if the airplane is not in flight, and any continued full-throttle operation should be avoided on the run-in unless a special cooling propeller is used. It is also advisable to have a thermocouple attached at the base of the spark plugs and not allow the cylinder head temperature to exceed 500° F.

When new pistons or bearings are installed, at least 5 hours of run-in time should be put on the engine. New rings may be broken in sufficiently for flight in possibly 3 to 4 hours.

The engine should be filled with a light grade of oil and run at approximately 800 r.p.m. until the oil is thoroughly warm. Then at intervals of 15 to 20 minutes, the speed should be increased by 100 r.p.m. If a special propeller is not being used, a speed of approximately 1400 r.p.m. should not be exceeded for more than a few minutes at a time with the airplane on the ground. If a thermocouple is used, speeds may be increased until the cylinder head temperature reaches 500° F. The remainder of the run-in may be put on in cruising flight, with a final run of about 30 minutes at a speed approximately 100 r.p.m. less than full-throttle. Any flight run-in should be made over the airport in order that a quick landing may be made if any trouble develops.

If new pistons have been installed, the cylinders should again be removed and the pistons and cylinder walls inspected. If found to be in perfect order, reassemble and warm up for 20 minutes before final test flight.

TABLE OF FITS AND LIMITS

A50 - Series 4,5,6,7,8 & 9
A65 - Series 1,3,6,7,8 & 9
A75 - Series 3,6,8 & 9
A80 - Series 8 & 9

	Nominal Size	Desired	Min.	Max.	Max. Allowable After Use
1. Piston in cylinder (skirt)	3-7/8	.014	.014	.017	.020
2. Top piston ring in groove (A50)	3/32	.0035	.0025	.004	.008
3. Top piston ring in groove (A65)	3/32	.006	.002	.0035	.006
4. 2nd piston ring in groove (A50)	3/32	.003	.002	.0035	.0055
5. 2nd piston ring in groove (A65)	3/32	.0035	.0025	.004	.0055
6. Top piston ring in groove (A75 & A80)	3/32	.006	.005	.0065	.0085
7. 2nd piston ring in groove (A75 & A80)	3/32	.0035	.0025	.004	.0055
8. 3rd & 4th piston ring in groove (A50)	3/32	.002	.001	.0025	.0055
9. 3rd piston ring in groove (A65, A75 & A80)	3/32	.0035	.0025	.004	.0055
10. 4th piston ring in groove (A65)	3/32	.002	.001	.0025	.0055
11. 4th piston ring in groove (A75 & A80)	3/32	.0035	.0025	.004	.0055
12. 5th piston ring in groove A75 & A80)	3/32	.002	.001	.0025	.0055
13. Piston ring gap (A75 & A80)	.014	.014	.012	.017	.025
14. Piston ring gap (A50 & A65)	.012	.012	.007	.017	.025
15. Piston pin in conn. rod bushing	55/64	.0014	.0013	.002	.003
16. Piston pin in piston	55/64	.0004	.0001	.0007	.0015
17. Piston pin and plug in cylinder	3-7/8	.025	.010	.042	.070
18. Plug in piston pin	5/8	.001	Size	.002	.004
19. Conn. rod bearing to shaft	1-15/16	.002	.0013	.0028	.004
20. Crankshaft in front main bearing (end clearance)	3-1/4	.011	.005	.017	.020
21. Crankshaft in main bearings	1-7/8	.003	.0025	.004	.0055
22. Exhaust valve in guide	11/32	.0037	.0027	.0047	.006
23. Intake valve in guide	11/32	.002	.001	.003	.005
24. Valve guide in cylinder head	17/32	.002	.001	.003	.005
25. Camshaft journals in crankcase	1-3/8	.002	.001	.003	.005
26. Camshaft rear journal in crankcase (end clearance)	1-1/32	.006	.004	.008	.010
27. Valve tappet in crankcase	23/32	.0013	.0005	.002	.0031
28. Rocker shaft in rocker bearing	39/64	.0016	.0011	.0021	.004
29. Rocker shaft in cylinder head	39/64	.0007	.0002	.0017	.003
30. Oil pump drive shaft in cover	9/16	.002	.0015	.003	.005
31. Oil pump driven shaft in cover	9/16	.002	.0015	.003	.005
32. Oil pump drive shaft in plate	9/16	.002	.0015	.003	.005
33. Oil pump gears (end clearance)	3/8	.003	.004	.008	.015
34. Inner valve spring (comp. to 55/64)		30#	28#	32#	25½#
35. Outer valve spring (comp. to 61/64)		44#	41#	47#	37#
36. Oil relief valve spring (comp. to 1-9/16)		5-1/4#	5-1/8#	5-3/8#	5#
37. Crankpins out-of-round		-	-	-	.0015
38. Cylinder bores out-of-round		-	-	-	.0025
39. Crankshaft run-out (center main)		-	-	-	.005