



INSTRUCTION MANUAL

for the

“CIRRUS MINOR” AERO ENGINE

IMPORTANT NOTICE.

The Company is keeping a Register of purchasers of this Manual, and if the purchaser notifies the Company of any change of address all amendments and additions will be forwarded post free.

Each page is numbered, marked with the Section to which it belongs, and is also dated.

Additional pages, when issued, will bear the correct Section and next page number.

If, however, a page is issued bearing a suffix A., B. or C. (*e.g.*, Section 3, page 4A), these should be treated as continuations of page 4 of Section 3.

Amendment pages will bear the same page number as the original issue, but the date will indicate that the old page is cancelled.

Please co-operate with us by notifying us of any changes of address and keeping the Manual up to date. (G.E.'s please quote initials and Licence Number.)

We leave the pages blank one side for notes or sketches.

“Cirrus Minor” Manual

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Notice to Owners of Aircraft with "Cirrus Minor" Engines

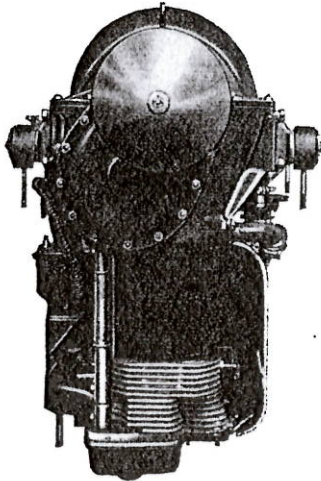
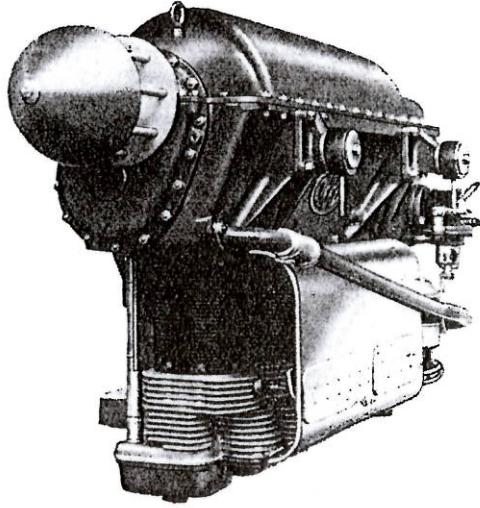
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We refer you to the preceding page for explanation of the numbering of amendment sheets, etc.

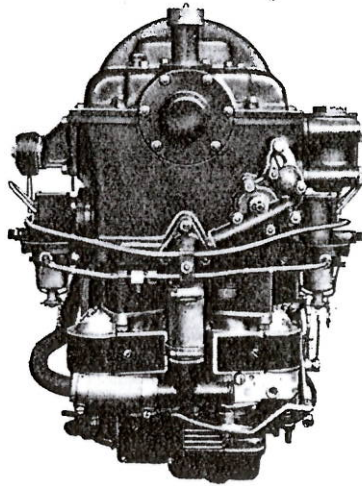
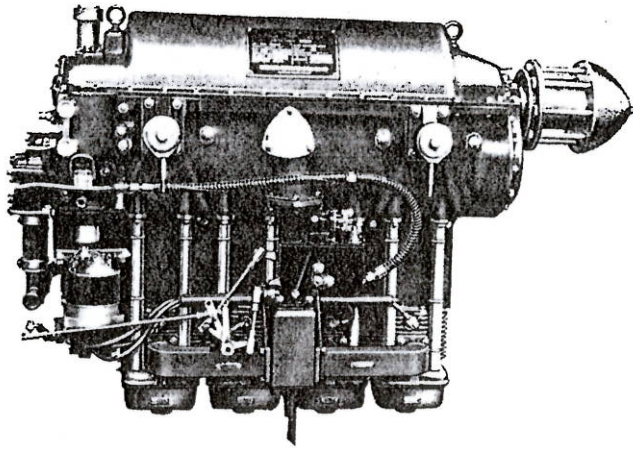
CIRRUS-HERMES ENGINEERING CO., LTD.,
BROUGH,
YORKS.

TELEGRAMS & CABLES :
"OCIRRUSO." PHONE, BROUHYORKS.

CODE : BENTLEYS.
TELEPHONE : BROUGH 121.



The 80/90 h.p. "CIRRUS MINOR" Engine



The 80/90 h.p. "CIRRUS MINOR" Engine

SPECIFICATION.

Bore	95 m/m
Stroke	127 m/m
Capacity	3605 c.c.
Compression Ratio	5.8 : 1
Normal B.H.P. , at 2300 r.p.m.	82
Maximum B.H.P. , at 2600 r.p.m.... ..	90
Rotation	Left Hand Tractor. Direct drive
Cruising r.p.m.	2200-2300
Fuel Consumption	3½-4 galls. per hour at normal r.p.m.
" "	6-6½ galls. per hour at maximum r.p.m.
Oil Consumption	½ to 1½ pints per hour
Oil Pressure	25, 35 lbs. per sq. in. (15 lbs. per sq. in. minimum)
Oil in circulation	½ Gallon
Head of Petrol required	1¼ lbs. per sq. inch
Overall Length (<i>less</i> Spinner)	958 m/m
Overall Height	640 m/m
Overall Width	419 m/m
Weight with Air Intake, Induction Manifold, Carburettor, 2 Magnetos, Sparking Plugs, Oil Pump, Filter and Controls	195 lbs. ± 5 lbs.
Airscrew Hub and Spinner	7 lbs. 6 ozs.
Cooling Chute and Cylinder Baffle	4 lbs. 5 ozs.
Four Bearer Feet, Silent Blocs and Stirrups	5 lbs. 7 ozs.
Two Amal Fuel Pumps, and Interconnecting Pipes	4 lbs. 6 ozs.

GENERAL DESCRIPTION.

CYLINDERS.

The type of Cylinder used on the "MINOR" is a new feature in Cirrus Aero Engines, and they are designed to dispense with the usual long stud to the Cylinder Head. They are machined all over from high grade steel and are located in the Crankcase by spigots and are secured at their base by four short stout bolts. This method banishes the main cause of cylinder head distortion, namely, uneven pulling down of the cylinder heads.

CYLINDER HEADS.

These are high grade castings in Y Alloy and are detachable, being spigotted on the Cylinder and clamped by eight studs to a flange on the Cylinder, a gas tight joint being secured by laminated copper washers.

The Cylinder Head forms one half of the valve gear box and is fitted with an elektron cover which acts as an oil bath for the valve mechanism.

The form of the induction and exhaust ports provides a wide air passage over the head and between the ports, and results in a very cool engine.

The valve mechanism is extremely simple and is very similar to that which has proved so efficient and reliable on the HERMES MARK IVA engines.

PISTONS.

The Y Alloy Pistons are of slipper type with fully floating gudgeon pins located by circlips. They carry two compression and one scraper ring.

CONNECTING RODS.

These are Hiduminium forgings of heavy section with White metal bearings in steel shells, which are ground to ensure a perfect fit in the rod.

CRANKSHAFT.

The Crankshaft is a robust steel forging and is carried in five plain bearing with a ball thrust bearing at the front end.

A spinner is fitted and the airscrew boss is of a pattern which simplifies removal of the airscrew. The rear end is fitted with a gear for operating the Magneto vertical driving shafts. A dog is fitted to the crankshaft in readiness for an Inertia Starter.

CAMSHAFT.

The camshaft is carried in five plain bearings and is driven from the front end of the engine through a simple train of spur gears.

CARBURATION.

This is provided by a Claudel Hobson A.I. 40 type down draught carburettor with 32 m/m choke, which has an independent altitude control. The Induction manifold is another new "Cirrus" feature and is in three pieces. The centre portion is the heater muff and is an Alpac casting.

VALVE GEAR.

The Valves are made from K.E. 965, the inlet being of tulip pattern and the exhaust of mushroom type.

The Valves are operated by the Camshaft through double ball-ended push rods and rocker levers, and the Tappets are cup-ended and in one piece passing through duralumin guides.

The whole of the valve rocker mechanism is enclosed. Valve clearances are easily adjusted by means of an adjustable ball cup in the rocker with lock-nut and tab washer. Instead of a hardened pad on the rocker a ball is fitted in the cup ended rocker and a flat on the ball makes contact with the valve stem. The ball being free to turn in its housing the flat maintains correct relative position on the valve stem and eliminates all wear.

IGNITION.

Two B.T.H. S.G.4—2 Magnetos of spigot type, one with Impulse Unit, are fitted with distributors facing downwards and 14 m/m sparking plugs are fitted.

CRANKCASE.

This is an elektron casting with all pressure oilways carried in the crankcase.

If required, Amal Fuel Pumps can be fitted to the Crankcase, one on either side at the rear, being operated by cams on the separate Magneto vertical driving shafts.

Hand Priming levers are fitted on these Pumps to obtain the initial supply of petrol to the carburettor

The Cover to the Crankcase has lifting eyes attached on the centre line front and rear.

At the rear end it carries the breather centrally located, whilst on one side the tachometer drive is taken off and provision made on the opposite side for any similar drive that may be required.

The cover to the timing gears at the front end is split on the crankshaft line, and can be removed with the crankcase cover, but acts merely as a cover to the gears.

LUBRICATION.

The Oil Pump which has been specially designed is of the oscillating piston type, and is carried at the rear of the Crankcase, being driven from the Camshaft. This pump is a great improvement on the gear type of pump, particularly where the oil tank is situated at some distance below the engine, as it is capable of working with far greater lift.

An oil filter is provided as a separate unit, and is attached to the Crankcase on the rear R.H. side. The filter consists of a number of conical filters with a common outlet from the tube on which they are fitted. The whole unit is withdrawn complete with the cap.

BEARER FEET.

Resilient Type Bearer Feet with "silent bloc" bushes are supplied.

INSTALLATION INSTRUCTIONS.

UNPACKING.

Remove nuts securing engine feet to metal brackets on the stand or packing case.

Lifting eyes are provided on the engines and they should be lifted by this means wherever possible. If slung up by the Bearer Feet take care to insert spacing bars between the cables or ropes to prevent them crushing controls and tappet cover tubes.

ENGINE MOUNTING.

The Crankcase has four spigotted faces for the bearer feet and care should be taken to ensure that the bearer feet spigots are correctly located in the recess in the crankcase.

Standard bearer feet are available and are arranged to locate the crankshaft centre line 82 m/m above the engine bearer face. These are available in the following widths between bearer centres: 386 m/m, 423 m/m or 459 m/m. (See Drawing C.F.B. 1102/1.)

It should be noted that these bearer feet cannot be used inverted as the air intake will then foul the engine bearer frame.

COWLING.

The engines are supplied with side cooling chute and cylinder baffles, and the front end of the air chute should be matched up with the nose cowling so as to leave the full area of the air chute open at the front. **This opening is of approx. 30 sq. inches, and must not be restricted.**

The vertical slot in the nose piece for cooling the front cylinder should not be less than 3 sq. in. and located as shown in Drawing CFD. 1001/2).

Provision must be made for the escape of the hot air, and on an average aircraft the outlet should be approx. 50 square inches in area, but should it be found desirable to reduce this to a lower figure, which might be done on an aircraft with a higher speed than the average, then the installation must be checked as to cylinder head temperature before it is finally approved and put into service.

The exit can be provided by bulging the cowling at the rear in the form of a gill or cutting away the fuselage at the bulkhead, thus leaving a gap between the side cowling and the fuselage.

To check installation for cooling efficiency a Thermo coupling should be fitted to the cylinder heads, where a boss is provided for the special Cirrus type Thermo couple, which can be supplied.

The temperature reading whilst making a flight at maximum climb with full throttle should not exceed 240°C.

A good cowling will produce readings not in excess of 210°C.

The oil inlet temperature should not normally exceed 70°C., and on no account exceed 85°C.

Failure to provide suitable escape for the air in the cowling will result in a loss in efficiency of the air chute and an overheated engine.

(See list of approved oils. Appendix B.)

The oil temperature will, of course, be governed to a certain extent by the position of the oil tank, and this should therefore be placed in the airflow where possible, either in the cowling or in the leading edge of a wing.

The oil tank should be located to permit of a steady fall from the front oil drain to the top of oil tank when the machine is in its normal gliding angle.

FUEL SYSTEM.

The engines are normally supplied to operate from a gravity tank feed, but if required for low wing monoplanes or for installations which place the engine above the petrol tank, provision is made by fitting two Amal Fuel Pumps.

In the case of direct gravity feed the petrol pipe from tank is connected direct to the Carburettor union, but if pumps are used the pipe from the tank is taken to a junction piece connecting the two pumps through pipe lines. The pumps are then interconnected to the carburettor. The drain connection on the Induction Manifold must be connected to a small pipe and carried outside of the cowling.

The supply pipe should not be less than $\frac{5}{16}$ in. bore and should be kept free of acute bends which might cause air locks in the petrol system.

For gravity feed the head of petrol should not be less than 10 in. at the steepest angle of climb and the flow of petrol should not be less than 13 gallons per hour with the Carburettor disconnected.

If pumps are fitted no gravity tank is necessary and the Carburettor can be flooded by means of the priming levers fitted to them for this purpose.

The normal pressure of these pumps should be between $1\frac{1}{2}$ and 2 lbs. per square inch, and each pump should be tested by operating the priming lever. A petrol pressure gauge can be temporarily inserted for test purposes if required.

FITTING PETROL PUMPS.

In the event of it being decided to fit Amal Petrol Pumps to an engine not so fitted up by the Manufacturers, first remove the blanking plate, then, should there be a shim or shims under this plate these should be left in position, as they adjust the length of stroke of the pump plunger.

A plate, Part No. C.F.B. 745/2, carrying the pump plunger assembly should now be placed in position, a washer, Part No. C.F.A. 185, being fitted between this plate and the crankcase.

Having fitted the plate carrying the plunger assembly, another washer, Part No. C.F.A. 738/1, is fitted between the plate and the pump, and the pump can then be placed in position and secured.

If on testing the petrol pumps they are found to deliver at too great a pressure (when operating with the engine running) this pressure must be reduced by fitting further shims under the plunger assembly plate. These can be supplied on request.

The drain connection on each pump should be connected to a small pipe and carried outside of the cowling to carry away any excess petrol. It is sometimes desirable to flood the carburettor from the cockpit and in order to avoid having to open the cowling for this, it may be done by fitting two

Bowden Controls, one to a fuel pump lever and the other to depress the Car-burettor tickler.

(See Appendix G for Amal Petrol Pumps and their maintenance.)

IGNITION.

The earthing terminals of the Contact Breaker should first be connected to the Duplex Switch in the cockpit and the earth connection wired direct to the crankcase.

Failure to observe this point will result in the ignition being "On."

OIL SYSTEM.

The oil supply pipe from tank to engine of not less than $\frac{1}{2}$ in. I.D. should be coupled to the oil pump which is above the starboard or R.H. Magneto as viewed from the rear of the engine, a standard $\frac{1}{2}$ in. B.S.P. Union being used.

The oil pressure pipe line to the oil gauge is connected to the union fitted on the crankcase just above the pump, a standard $\frac{1}{2}$ in. B.S.P. Union being used.

An oil drain is fitted from the front port side of the engine near the front cylinder and another is fitted centrally at the rear of the engine. These are connected by a junction piece and a common return should be made to the oil tank.

The pipe used should be of Superflexit or other oil resisting armoured hose.

The relief valve is adjusted before the engine leaves the Manufacturers' Works and should not be interfered with.

The oil pump should be primed before the engine is first tried out. To do this inject oil into the pump whilst turning the engine by hand.

Rocker box covers on cylinder head should be filled with engine oil to the level indicated on the cover.

The oil pressure registered on starting up the engine should not be less than 25 lbs. per sq. inch.

CONTROLS.

A separate Magneto advance and retard control is not fitted as the magnetos are interconnected with the throttle.

In the event of an independent altitude control being fitted, it must be so arranged that on closing the throttle lever in the cockpit the altitude control becomes interconnected and closed by the same movement. Failure to observe this will result in engine cutting out when "coming in" to land.

Drawing C.F.D. 1001/2 shows required movement of throttle and altitude controls.

EXHAUST SYSTEM.

The standard practice is to deliver "Minor" engines fitted with exhaust stubs approx. 6 in. long and set back at an angle of 20°. These stubs are fitted with lugs to attach an exhaust manifold which can be supplied with silencer when required.

Connecting links are supplied with the manifold and are left long for fitting

on the machine. Care should be taken to see that the stubs project 1 in. into the manifold and they should be cut off at a right angle to their longitudinal axis.

The stubs may be shortened as required to locate the manifold in the best position.

AIRSCREW BOSS.

Take care when fitting the airscrew (particularly in the case of wooden airscrews) that the nuts are evenly tightened.

The Airscrew Hub should not be removed from the crankshaft when removing the Airscrew.

ELECTRIC STARTER (WHEN FITTED).

The two terminals on the starter should be connected through a pull type switch mounted in the cockpit.

The cable used should be not less than 195/0145 (Uniflex No. 37), and it is advisable to so locate the battery as to keep the leads as short as possible to avoid voltage drop across the leads. (See Appendix I. for Starter Instructions.)

N.B.—STORAGE OF ENGINES.

If an engine is not in regular use care should be taken to avoid the effects of corrosion through condensation.

If the engine is to be left in the machine, turn the engine at least once a week.

If the machine is to be laid up for a matter of months take the engine out of the machine and stand the engine with cylinders uppermost.

Remove sparking plugs and inject $\frac{1}{2}$ pint of engine oil into each cylinder leaving engine in upright position. Turn the engine once a week through 2 revolutions to maintain the oil film on cylinders, pistons and rings (use an old set of sparking plugs to blank off plug holes).

Before reinstalling after storage check up magnetos to see that fibre bushes etc., are not swollen through effects of damp atmosphere, drain the oil out of cylinders, to avoid oiling up sparking plugs.

RUNNING INSTRUCTIONS.

See that the throttle opening on the carburettor is not restricted by the movement on the throttle lever in the cockpit.

Assuming that all of the foregoing installation notes have been complied with the engine may now be "run up" and the following points should be observed.

STARTING WITH STARTER.

Flood Carburettor by depressing float needle (and operating the priming levers on the petrol pumps if fitted) until petrol runs from the drain pipe on the induction pipe. Switch on, pull out starter button, keeping throttle closed for first few turns, then opening slightly. Engine will then fire.

STARTING BY HAND. (IF NO STARTER FITTED).

Flood Carburettor, turn engine over briskly for a few revolutions with throttle shut and with switch "off."

Then open throttle slightly, switch "on" and turn engine over sharply.

The engine should now start, but if it fails to start after a few attempts the procedure should be repeated.

On a cold day it will be found necessary to use a slightly bigger throttle opening than on a warm day. If the engine is already warm it will not be necessary to "suck in" as otherwise it will get too rich and it will be necessary to expel the petrol by turning the engine back with throttle open. After the engine has "picked up" it should be allowed to warm up at 1000 r.p.m.

In the case of a new engine being installed it is advisable to run the engine on the ground for approximately 20 minutes to enable a thorough supply of oil to reach all working parts.

The engine will be sent out with standard size jets, but if it is found difficult to start, the slowing running jet needs adjusting by means of the quantity screw on the side of the carburettor. (See notes on Carburettor in Appendix E.)

See that the correct oil pressure is registered and if a petrol pressure gauge is fitted see that the pressure is between $1\frac{1}{2}$ lbs. to 2 lbs. per square inch.

IMPORTANT NOTE.

An independent altitude control is fitted and it must not be opened on the ground. If it is intended to make use of this control it must be so arranged that closing of the throttle lever interconnects and closes the altitude control.

If it is not intended to use altitude control, lock same in closed position. Leaving open this control will cause engine to "cut out" at ground levels if throttle is opened as when about to land.

After first test flight check over propeller boss nuts for tightness.

MAINTENANCE SCHEDULE.

* The first five items should be done at the end of the first ten hours on new machines to clean out any residue from tanks and pipe lines, and every fifty hours thereafter.

AFTER 50 HOURS FLYING.

- * 1. Clean Suction and Pressure Oil Filters.
- * 2. Clean Petrol Filters on Amal Petrol Pumps.
- * 3. Drain Oil System and fill with fresh oil.
- * 4. Remove jets and clean float and jet chambers by flushing through with petrol.
- * 5. Check tightness of propeller bolts. (Do this more frequently in hot climates.)
6. Clean and reset points of sparking plugs and test same.
7. Check magneto contact breaker gaps and reset if necessary.
8. Check valve clearances and reset if necessary.
9. An occasional drop of oil should be given to control joints and the spindle behind carburettor.

AFTER 300 HOURS FLYING.

Carry out top overhaul as per Section 4 of this manual.
Change all rubber joints in oiling system.

AFTER 600 HOURS FLYING.

Carry out complete overhaul as per Section 5 of this manual.