

PART II

HANDLING

NOTE.—The handling information contained in these Notes covers the operation of the aircraft up to an all-up weight of 72,000 lb. only. Information regarding handling at weights above 72,000 lb. will be issued by amendment.

55. Management of the fuel system

(i) *Use of the booster pumps*

To prime the fuel lines and injectors before starting the engines, one booster pump on each side should be switched ON for not more than fifteen seconds, after the fuel tank cocks and engine master cocks have been switched ON. At no other time should the booster pumps be ON when the engines are not running and the engine master cocks are ON. All the booster pumps must be ON for take-off, climbing, and for landing, but they may be switched OFF when cruising. They should, however, be switched ON whenever there is any sign of fuel starvation.

(ii) *Use of the fuel tanks*

When flying with all the fuel tank cocks switched ON, the fuel from the Nos. 3 and 4 tanks will flow into the distributor tank before that from the Nos. 1 and 2 tanks. To prevent undue upward flexing of the wings during flight, the weight of fuel should be kept outboard as much as possible by using Nos. 1 and 2 tanks first. The following method of using the tanks is therefore recommended:—

Take off on No. 1 and No. 2 tanks and use them until a total of 550 gallons on each side remains in these tanks. Then switch on No. 3 tank cocks and continue with all the wing tank cocks ON.

(iii) *Use of the auxiliary fuel tank*

If a bomb bay auxiliary tank is carried, take off on No. 1 tank, and as soon as space is available, transfer the fuel from the auxiliary tank into the No. 1 tanks. When the

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bomb bay tank is empty, switch ON the No. 2 tank cocks and continue as in (ii) above.

(iv) Use of the cross-feed line and cock

The cross-feed cock should be kept closed except when it is necessary to feed fuel from the tanks in one wing to the engines in the other. In this case, the booster pumps on the side from which the fuel is being used must be ON, and the booster pumps on the other side must be OFF.

56. Management of air-intake filter and charge temperature controls

(i) Air intake filter

- Clean air should never be selected when high super-charger gear is engaged unless water/methanol is used.
- Clean air should be used for all ground running, taking off, flying in dust conditions and for landing.
- If airfield restriction make the use of maximum take-off power essential, or severe icing conditions exist, unfiltered air should be selected before take-off.
- Clean air should be selected under certain circumstances should the automatic charge temperature control fail. (See sub para. (iii) (c) below).

(ii) Automatic charge temperature control

- The following maximum charge temperature must not be exceeded:—

R.P.M.	°C.
2,750	145
2,600	135
2,400	120
2,200	110
2,000	95
1,800	80
1,600	70
1,400	60

Minimum charge temperature at any cruising r.p.m. 40°C.

- COLD air should be used for take-off, climbing, when using "operational necessity" powers, and landing. At all other times the control may be set to AUTO unless the charge temperature at any given r.p.m. rises to within 5°C. of the limit given above.

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(iii) Failure of the automatic charge temperature control

- If excessively high charge temperatures are experienced it may be due to failure of the temperature control unit, causing the shutter to open fully with a consequent rapid temperature rise. In this case the shutter must be "inched" manually to keep the charge temperatures within the limits.
- Failure of the electrical supply will cause the shutters to remain in the position at the moment of failure and, depending on this position, may result in either excessively high or low charge temperatures. In this case charge temperatures may be brought within limits by manually "inching" the coolant radiator shutter. Opening the radiator shutter causes a reduction in charge temperature and vice-versa. If, with the coolant radiator shutter fully open, the charge temperature cannot be brought within limits, CLEAN air should be selected and low gear engaged.
- When flying in high gear the charge temperature may be substantially reduced by selecting low gear.
- If at any time the charge temperature falls below 40°C. and cannot be raised by operating the charge temperature control or coolant temperature control manually, the engine should be cleared every hour by running at 12 lb./sq. in. boost, or with the throttle at the gate, and 2,600 r.p.m. for one minute.

(iv) Icing conditions

Normally with the charge temperature control set to AUTO sufficient heat will be available at the intake to provide de-icing under all conditions. If, however, a progressive falling off in boost pressure indicates that engine icing has occurred, the charge temperature control should be set to HOT until the charge temperature reaches the maximum permissible for the r.p.m. being used. The control should then be set to STOP. Prior to take-off and landing, the correct degree of intake heating should be obtained by selecting unfiltered air, increasing power to give 2,600 r.p.m. and adjusting the charge temperature control to give 120°C.

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57. Starting the engines and warming up

- (i) After completing the Pilot's Check List to item 80, continue as follows:—
- | | | |
|-----------------------|--------|-------------------------------------|
| Fuel cocks | | Tank cocks ON as required |
| | | Engine master cocks ON |
| Booster pumps | | ON for 15 secs., then OFF |
| Priming pump selector | | PORT ON or STARBOARD ON as required |
- (ii) Then, for each engine:—
- | | | |
|-------------------------|--------|------------------|
| Ignition switches | | On |
| Throttle | | One quarter open |
| Starter pushbutton | | Press |
| Booster-coil pushbutton | | Press |

As the engine is turning, the priming pushbutton should be pressed for a period depending on the air temperature, as shown in the following table:—

Outside air temperature	Priming Period 100 Oct.
20°C. and above	1 second
10°C. to 20°C.	2 seconds
5°C. to 10°C.	3 seconds
0°C. to 5°C.	4 seconds
-5°C. to 0°C.	6 seconds
-10°C.	15 seconds
-20°C.	22 seconds

When the engine fires, release the starter pushbutton and if necessary assist the engine to run smoothly by use of the primer. When the engine is running evenly, release the priming and booster-coil pushbuttons, and set the throttle to give 1,200 r.p.m. until the oil pressure is steady.

- (iii) If an engine fails to fire within 20 seconds, wait for 30 seconds before turning it again. No further priming should be given until another attempt to start has been made.
- (iv) If high-volatility fuel is used for priming at air temperatures below freezing, the priming pump selector must be kept at OFF and the priming pushbutton must be held depressed to allow the priming fuel to reach the induction system. Before starting an engine the ground crew should work the hand priming pump until the fuel reaches the priming nozzles; this may be judged by an increase in resistance. Then while the engine is being turned the ground crew should work the pump as required until the engine is running steadily.

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- (v) When all the engines are running, switch OFF the priming pump selector and set the ground/flight switch to FLIGHT.
- (vi) Open up each engine to 1,500 r.p.m. and warm up at this speed.
- (vii) Whilst warming up, carry out the checks detailed in the Pilot's Check List, items 81 to 86.

58. Exercising and testing

- (i) When the oil temperature is 15°C. and the coolant temperature 40°C., test each magneto as a precautionary check before increasing power. Then for each engine:—
- (ii) Open up to the static boost reading, close the generator field circuit breaker and press the resetting pushbutton. Check that the generator is charging.
- (iii) At the same boost check the operation of the supercharger.
- (iv) At the same boost check the operation of the constant-speed unit by moving the r.p.m. control lever slowly through the full governing range at least twice.
- (v) At the same boost, test each magneto in turn. If the single ignition drop exceeds 100 r.p.m. or is accompanied by rough running, a full power check should be carried out (see sub para. (vi) below). If there is no drop in r.p.m., the switch is suspect.
- NOTE.—The following checks may be carried out after repair, inspection other than daily, or at the discretion of the pilot.
- (vi) Open the throttles fully and check the take-off boost and r.p.m. Throttle back to +11 lb./sq. in. boost, and test each magneto. If the single ignition drop exceeds 100 r.p.m. the aircraft should not be flown.
- (vii) After completing the checks, either at the static boost or full power, switch off the generator and throttle back to the fully closed position, and check that the engine idles steadily at 600-700 r.p.m. Then open up to 1,200 r.p.m.
- (viii) Before taxiing, carry out items 87 to 89 of the Pilot's Check List.

59. **Taxying**

Heavy footloads are necessary to control the aircraft when taxiing across or down wind, and when standing across wind it is necessary for the second pilot to assist in keeping the rudders central. In calm conditions the aircraft can be directionally controlled to some extent by use of the rudders, with the inboard engines set at 1,000 r.p.m. Ensure that the radiator shutters are in the OPEN position to keep oil temperatures as low as possible before take-off. Check that the generators are off.

60. **Take-off (without water/methanol)**

- (i) Carry out the checks laid down in the Pilot's Check List, items 90 to 104.
- (ii) Align the aircraft carefully on the runway, making sure that the tail wheel is straight. Then hold the brakes on and open up to 0 lb./sq. in. boost to ensure even response.
- (iii) Release the brakes and open up smoothly and quickly to take-off power. There is no tendency to swing and the aircraft can be kept straight in a cross wind by use of the rudders. The rudders are very effective as soon as full power is on.
- (iv) At a weight of 72,000 lb. the aircraft should be eased off the ground at a speed of 95 to 100 knots.
- (v) When comfortably airborne, brake the wheels and retract the undercarriage. There is a slight nose-up change of trim as the undercarriage retracts.
- (vi) The safety speed at a weight of 72,000 lb. at +18 lb./sq. in. boost is 105 knots.
- (vii) When the undercarriage is retracted, reduce power to +14 lb./sq. in. boost, 2,600 r.p.m. At a safe height raise the flaps. There is a nose-down change of trim but no tendency to sink as the flaps come up.

61. **Take-off (using water/methanol)**

To be issued later by amendment.

62. **Climbing**

- (i) *Maximum rate of climb*
 - (a) The speed for maximum rate of climb is 125 knots but for oil cooling considerations a speed of 135 knots is recommended. The aircraft is easy to trim to maintain this speed.
 - (b) Climb in low gear at +14 lb./sq. in. boost and 2,600 r.p.m. with the charge temperature control set to COLD. Unfiltered air should be selected as soon as the aircraft is clear of any dust layer.
 - (c) When, with the throttles at the gate, the boost has fallen to +11 lb./sq. in. high gear should be engaged, and the throttles then adjusted to give +14 lb./sq. in. If, however, CLEAN air has been retained until this boost drop occurs, unfiltered air should be selected and the climb in low gear continued until the boost again falls to +11 lb./sq. in. before changing gear.
 - (d) High gear should never be used on the climb below 5,000 feet or in filtered air.

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(ii) *Reduced power climb*

- (a) Climb at 135 knots using +9 lb./sq. in. boost and 2,400 r.p.m. with the charge temperature control set to AUTO.
- (b) When, with the throttles at the gate, the boost has fallen to +6 lb./sq. in. high gear should be engaged and the throttles adjusted to give +9 lb./sq. in. boost.

63. **Cruising**

- (i) Continuous operation of the engines at r.p.m. below 1,550 is not permissible. Continuous operation of r.p.m. between 2,200 and 2,400 should be avoided as much as possible.
- (ii) The recommended speed for maximum range varies between 150 and 170 knots depending upon weight.
- (iii) Although +9 lb./sq. in. boost and 2,400 r.p.m. is permissible for continuous cruising power, powers of +7 lb./sq. in. boost and 2,200 r.p.m. and below are recommended.
- (iv) Fly in low gear with the charge temperature control set to AUTO and set the throttles to give the maximum obtainable boost but not exceeding +7 lb./sq. in. Obtain the recommended airspeed by adjusting the r.p.m. between 1,550 and 2,200. If with 1,550 r.p.m. the required airspeed is exceeded, the boost should be reduced as required. If speeds are required which entail the use of powers higher than +7 lb./sq. in. boost and 2,200 r.p.m. they should be obtained by retaining the r.p.m. at 2,200, increasing the boost progressively from +7 lb. to +9 lb./sq. in. and then, if necessary, setting the r.p.m. to 2,400.
- (v) If more than 2,400 r.p.m. are required in low gear to maintain the desired airspeed, change to high gear and adjust the r.p.m. and boost as in (iv) above. High gear should not be used below 5,000 feet or when clean air is selected.
- (vi) When flying with the throttles at or near the gate to obtain the required boost, greater economy due to more advanced ignition will be obtained by throttling back until a sharp drop in boost occurs and then moving the throttles forward $\frac{3}{4}$ inch to 1 inch.
- (vii) The use of higher charge temperatures than those normally obtained with the charge temperature control set to AUTO will result in a reduction in range.

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(viii) The speed for maximum endurance is 120 to 130 knots.

64. **Flight planning charts**

To be issued by amendment.

65. **Position error corrections**

- (i) The position error on the starboard pressure head serving the 2nd pilot's A.S.I. varies from $-\frac{1}{2}$ knot at 120 knots to $-2\frac{1}{2}$ knots at 240 knots, with the undercarriage and flaps up.
- (ii) The position error on the port pressure head serving the 1st pilot's A.S.I., the navigator's A.S.I. and the air mileage indicator varies from 0 at 120 knots to $-4\frac{1}{2}$ knots at 240 knots, with the undercarriage and flaps up.
- (iii) The airspeeds quoted throughout these Notes refer to the 1st pilot's A.S.I.

66. General flying

(i) The aircraft is pleasant to fly and easy to trim under all normal conditions of flight.

(ii) Controls

The controls are well harmonised and the elevator is relatively light and effective under all conditions except when landing at the forward c. of g. (see para. 68 (iv)). The ailerons are moderately light and effective, becoming heavier with increasing speed; at low speeds the response is sluggish. The rudders are moderately light and very effective.

(iii) Change of trim

Undercarriage up ...	Slightly nose up
Undercarriage down ...	Negligible
Flaps up ...	Nose down
Flaps down ...	Nose up
Bomb doors open ...	Slightly nose up
Bomb doors closed ...	Slightly nose down
Radiator shutters open or closed ...	No change

(iv) Flying at reduced airspeed

Reduce speed to 150 knots and lower the flaps to TAKE-OFF. Set the r.p.m. to 2,400, and adjust the throttles to give the required speed, which may be reduced to 125 knots. The stalling speed under these conditions is 85-90 knots depending on weight.

(v) Diving

There is a progressively increasing nose-up change of trim as speed is increased; the aircraft should, therefore, be trimmed gently into the dive.

(vi) Flying in turbulent conditions

In turbulent conditions, the aim should be to maintain a speed of approximately 180 knots.

67. Stalling

(i) There is no warning of the approach to the stall except that, with the engines fully throttled back, a slight tremor of the control column may be felt when the airspeed has fallen to approximately 5 knots above the stalling speed.

At the stall aileron snatching accompanied by a wing dropping may occur. Normal recovery action is effective.

(ii) The approximate stalling speeds at a weight of 72,000 lb. are as follows:—

Power off

Undercarriage and flaps up ...	100 knots
Undercarriage and flaps down ...	90 ..

Power on (normal final approach power)

Undercarriage and flaps up ...	95 ..
Undercarriage and flaps down ...	85 ..

68. Approach and landing

(i) Carry out the checks laid down in the Pilot's Check List, items 105 to 114.

(ii) At the maximum landing weight the speed on the initial straight approach should be approximately 115 knots, and the speed over the airfield boundary should be 100 knots.

(iii) The round-out should be made with some power still on so that the aircraft crosses the end of the runway in a level attitude; if the control column is then moved progressively backwards and the throttles closed, a three-point landing can comfortably be made.

(iv) If the engines are throttled back before the round-out is made, the elevator loses effectiveness and it becomes difficult to check the descent and achieve a three-point attitude. This is particularly apparent when the aircraft is loaded to a forward c. of g.

69. Mislanding and going round again

The aircraft will climb away satisfactorily at the maximum landing weight with the undercarriage and flaps down, using intermediate power. After increasing power, select undercarriage UP and the flaps to TAKE-OFF in quick succession. Climb at 125 knots and at a safe height

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select flaps UP. There is a strong nose-up change of trim when power is increased.

70. Instrument approach

To be issued by amendment.

71. After landing

- (i) After turning off the runway, carry out the checks laid down in the Pilot's Check List, items 115 to 122.
- (ii) Before stopping the engines, if the serviceability of an engine is in doubt, such items of the run-up given in para. 58 as may be necessary should be carried out.
- (iii) Run each engine at 1,800 r.p.m. for two minutes in order to scavenge oil from the propeller translation bearings. Then throttle back to 1,200 r.p.m.
- (iv) Idle the engines at 1,200 r.p.m. for a short period, and if no other check of the ignition has been made, the magnetos should be tested for a "dead cut".
- (v) Stop the engines by pressing the fuel cut-off pushbuttons until the engines stop. Then carry out the checks detailed in the Pilot's Check List, items 123 to 134.

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