

2nd EDITION

A.P.1804A—P.N.

PILOT'S NOTES  
FOR  
**TYPHOON**  
MARKS IA AND IB  
SABRE II OR IIA ENGINE



PROMULGATED BY ORDER OF THE AIR COUNCIL

A handwritten signature in black ink, appearing to be 'A. G. ...', with a horizontal line underneath.

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## AMENDMENTS

Amendment lists will be issued as necessary and will be gummed for affixing to the inside back cover of these notes.

Each amendment list will include all current amendments and will, where applicable, be accompanied by gummed slips for sticking in the appropriate places in the text.

Incorporation of an amendment list must be certified by inserting date of incorporation and initials below.

A.L. No.	INITIALS	DATE	A.L. No.	INITIALS	DATE
1			7		
2			8		
3			9		
4			10		
5			11		
6			12		

## NOTES TO USERS

THIS publication is divided into five parts: Descriptive, Handling, Operating Data, Emergencies, and Illustrations. Part I gives only a brief description of the controls with which the pilot should be acquainted.

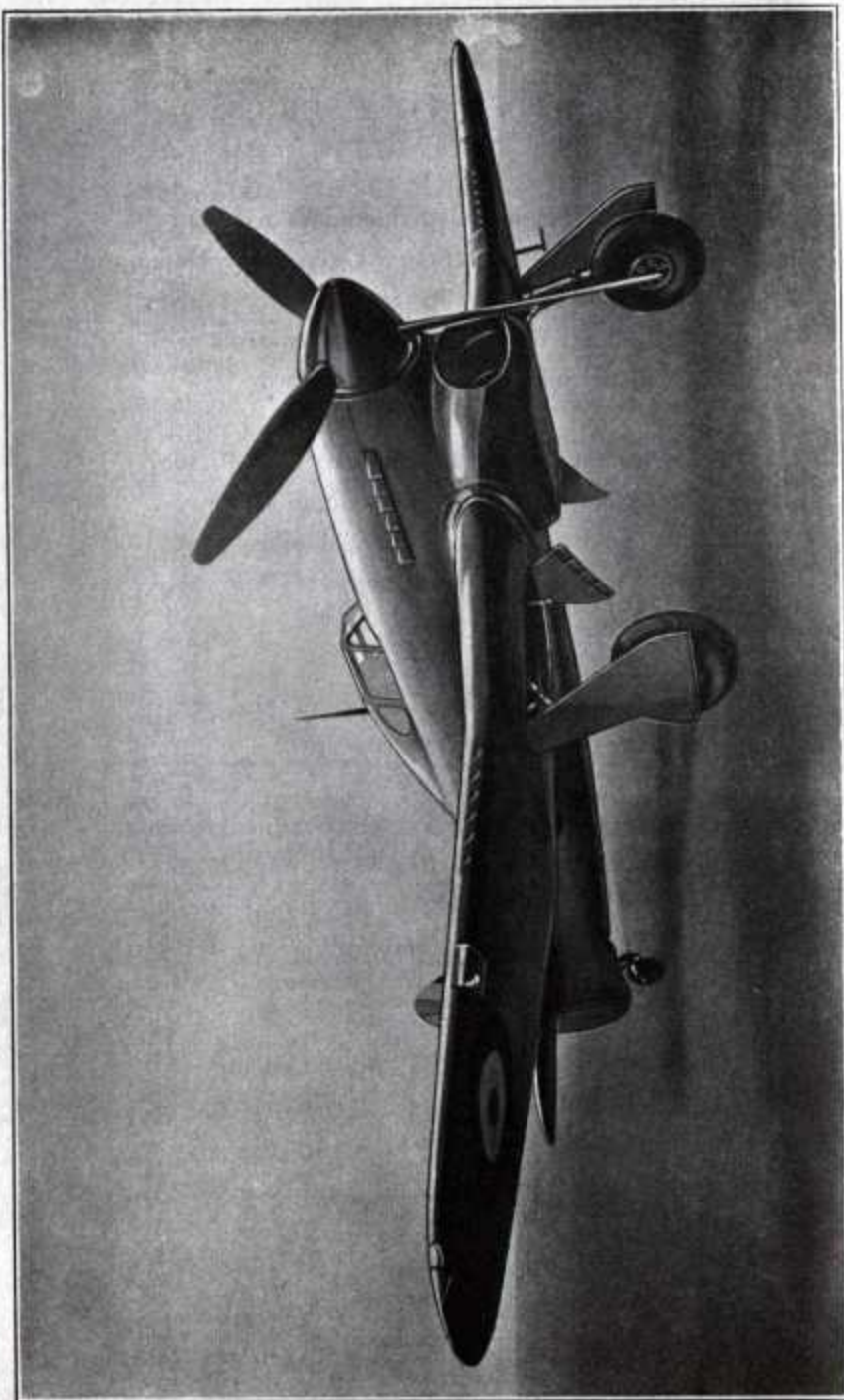
These Notes are complementary to A.P. 2095 Pilot's Notes General and assume a thorough knowledge of its contents. All pilots should be in possession of a copy of A.P. 2095 (see A.M.O. A93/43).

Words in capital letters indicate the actual markings on the controls concerned.

Additional copies may be obtained from A.P.F.S., Fulham Road, S.W.3, by application on R.A.F. Form 294A, in duplicate, quoting the number of this publication in full—A.P. 1804A—P.N.

Comments and suggestions should be forwarded through the usual channels to the Air Ministry (D.T.F.).





TYPHOON IA

AIR MINISTRY  
November 1943

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*Pilot's Notes*

## TYPHOON PILOT'S NOTES

*Second Edition. This edition supersedes all previous issues.*

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## PART I

## DESCRIPTIVE

NOTE.—The numbers quoted in brackets after items in the text refer to key numbers of the illustrations in Part V.

## INTRODUCTION

1. The Typhoon Mk. IA fighter and Mk. IB fighter/bomber are each fitted with a Sabre II or IIA engine and a de Havilland 35° Hydromatic propeller. Fuel drop tanks or bombs are carried by the Mark IB, which differs from the Mark IA mainly in armament.

## FUEL, OIL AND COOLANT SYSTEMS

2. **Fuel tanks** (see Fig. 1)—Fuel is carried in four self-sealing tanks, two in each main plane, and is delivered to the carburettor by an engine-driven pump. Two auxiliary drop tanks, one under each wing, may be carried (Mk. IB aircraft only), the fuel in these being supplied direct to the engine-driven pump by air pressure. The tank capacities are as follows:

Two main tanks (40 gals. each): ..	80 gallons
------------------------------------	------------

Two nose tanks (37 gals. each): ..	74 gallons
------------------------------------	------------

<i>Total</i> (normal): ..	154 gallons
---------------------------	-------------

Two drop tanks (45 gals. each): ..	90 gallons
------------------------------------	------------

<i>Total</i> (long range): ..	244 gallons
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Part I  
Para. 2

To meet the possibility of engine cutting due to fuel boiling in warm weather at high altitudes, the tanks can be pressurised (operative above 10,000 ft.). Pressurising, however, impairs the self-sealing of tanks and should therefore be turned off if a tank is holed.

## PART I—DESCRIPTIVE

### 3. Fuel cocks

(a) *Main and nose tanks.*—A three-way cock control (38) in the cockpit allows fuel to be drawn simultaneously from both main tanks or from both nose tanks as required, but not from the main and nose tanks at the same time.

(b) *Auxiliary drop tanks (Mk. IB aircraft only).*—The cock control (70) for the drop tanks has three positions, OFF, PORT and STARBOARD, and is mounted together with the jettison lever (71) on the right-hand side of the cockpit. The lever is pulled down to jettison both tanks, but cannot be moved until the cock is set to OFF. When the lever is operated, the air supply to these tanks is automatically cut-off.

(c) *Tank pressurising cock.*—The tank pressurising cock (55) is on the right-hand side of the cockpit.

4. **Fuel contents gauge.**—The gauge (43) on the instrument panel is operated by selecting the tank required on the adjacent arm and pressing the switch arm (44).

5. **Fuel pressure warning light.**—The red light (50) below the contents gauge comes on when the pressure drops to  $1\frac{1}{2}$  lb./sq.in.

6. **Oil system.**—The oil tank is fitted immediately aft of the fireproof bulkhead and has a capacity of 16 gallons of oil and 2 gallons air space. The cooler forms an integral part of the radiator. The oil pressure (42) and temperature (54) gauges are on the right-hand side of the instrument panel.

7. **Coolant system.**—The system is thermostatically controlled, the radiator being by-passed until the coolant reaches a certain temperature. The radiator shutter is hydraulically operated by a lever (37) in the cockpit, the DOWN position opening the shutter. In the event of failure of the engine-driven pump the shutter may be operated by the hydraulic handpump. The temperature gauge (40) is on the right-hand side of the instrument panel.

## PART I—DESCRIPTIVE

### MAIN SERVICES

8. **Hydraulic system.**—An engine-driven hydraulic pump, which maintains a constant pressure of approximately 1,800 lb./sq.in., supplies the power for operating the undercarriage and its fairing flaps, the wing flaps and the radiator shutter. A handpump (1) is fitted in the cockpit for use in the event of engine pump failure.

9. **Pneumatic system.**—An engine-driven air compressor and a storage cylinder supply a pressure of 450 lb./sq.in. for operation of the brakes and gun-firing mechanism. A triple pressure gauge (27) is fitted on the instrument panel.

10. **Electrical system.**—A 24-volt generator supplies two accumulators for the operation of the whole electrical system. A generator ON-OFF switch and a voltmeter (61) are on the right-hand side of the cockpit. On later aircraft a "Power Failure" light (41) on the right-hand side of the instrument panel comes on when the generator is not charging the accumulators.

### AIRCRAFT CONTROLS

#### 11. Flying controls and locking gear

(i) The control column is of the spade-grip pattern and incorporates the brake lever and gun and cannon firing control. The rudder bar is fitted with two-position rudder pedals and is adjusted for reach by a foot-operated wheel (29) on the rudder bar.

(ii) The locking gear is stowed in a bag on the left-hand side of the cockpit and comprises a hinged clamp and four cables. The clamp is fitted to the control column with the projecting lugs in contact with the fork-end nuts of the aileron tie-rods, and the two front cables are hooked on to the rudder pedals. With the seat adjusting lever in the third notch from the top, the rear cables are hooked to each side of the seat and the cables tensioned by adjusting the rudder bar and then raising the seat.



PART I—DESCRIPTIVE

12. **Trimming tabs.**—The elevator trimming tabs are controlled by a handwheel on the left-hand side of the cockpit and the rudder trimming tab by a smaller handwheel to the left of it. Both wheels work in the natural sense and tab position indicators are fitted between them.
13. **Undercarriage control.**—The undercarriage selector lever (35) moves in a slot on the left-hand sloping panel, marked UP in the forward position; the knob of the lever has to be turned clockwise before the lever can be moved. The safety catch must be pushed to FREE before the lever can be moved to UP, and automatically returns to LOCK when the lever is moved to the DOWN position. For emergency lowering of the undercarriage see Para. 53.
14. **Undercarriage indicators**

- (i) The electrical visual indicator (15) on the instrument panel comprises three green lights (for main wheels and tail wheel) and two red lights (for main wheels only). The indications are:

Green: Corresponding wheel locked down.  
 Red: Corresponding main wheel between locks.  
 No lights: Main wheels locked up.

There are two types of instrument and on both the green lights are duplicated; they differ only in the methods of putting the reserve set of green lights into operation and of operating the anti-dazzle screen. These are as follows:

To put into operation reserve green lights	Pull knob in centre	Rotate knob in centre
To operate anti-dazzle screen	Rotate knob	Move lever at side

The indicator ON-OFF switch (9) on the instrument panel has a sliding bar which prevents the ignition being switched on unless this switch is on.

- (ii) Mechanical indicator buttons protrude through the upper surface of each wing when the corresponding wheel is down.

PART I—DESCRIPTIVE

15. **Undercarriage warning horn and light.**—A horn behind the headrest sounds and a red light (11) on the instrument panel comes on if the throttle is less than one-third open and the wheels are not locked down. A pushbutton (18) on the instrument panel tests the horn and light.
16. **Flap control and indicator.**—The flaps are hydraulically operated by a lever (36) on the left-hand sloping panel, backward movement of the lever lowering the flaps. They can be set to any intermediate position by returning the lever to the VALVE SHUT position. An indicator (21) is fitted on the instrument panel. In the event of failure of the engine-driven pump they can be operated by the handpump.
17. **Wheel brakes.**—The control lever is fitted on the control column spade grip, differential control of the brakes being provided by a relay valve connected to the rudder bar. A catch for retaining the brake lever in the on position for parking is fitted near the lever pivot. The triple pressure gauge, on the instrument panel shows the air pressure in the storage cylinder and at each brake.

ENGINE CONTROLS

18. **Throttle and mixture controls.**—The throttle lever (7) is moved forward to the climb and TAKE-OFF positions, the latter being gated. The friction adjuster (5) also adjusts friction of the propeller control. On Mark Ib aircraft a bomb-release pushbutton is incorporated in the top of the lever. The mixture control lever (8) (if fitted) is moved forward to WEAK and is automatically set to RICH when the throttle lever is between CLOSED and 14° open, but at other throttle positions may be set at either RICH or WEAK as required. On some early aircraft the mixture lever is also returned to RICH when the throttle is moved beyond the climb position.

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19. **Propeller control.**—The speed control lever (6) in the engine control box varies the governed r.p.m. from 3,700 down to 1,600 or below. Speeds below 2,000 should, however, not be used for flight operation, except in the event of a forced landing, when it is necessary to lengthen a glide. The friction adjuster also adjusts the friction of the throttle lever. On some aircraft the rear end of the slot is marked POSITIVE COARSE FITCH, although in actual fact there is no such setting of the propeller.

20. **Supercharger control.**—The lever (4) in the engine control box is moved downward for FULL (S ratio) supercharging and upward for MODERATE (M ratio) supercharging.
21. **Starting and slow-running cut-out control.**—The lever (30) on the left-hand sloping panel has three positions: START, NORMAL and CUT-OUT. At START a stop is introduced into the throttle quadrant to give the throttle lever setting for starting, but a safety catch beside the lever must be moved down before START can be selected.
22. **Priming pumps.**—Two pumps are fitted on the right-hand sloping panel, the inboard pump (39) for priming the cylinders and the outboard pump (56) the carburettor. The pump handles are released by unscrewing and should be screwed down again after use.
23. **Ignition switches.**—The main switches (10) are on the left-hand side of the instrument panel and are prevented by a sliding bar from being switched on unless the under-carriage indicator switch is also on.
24. **Cartridge starter.**—The cartridge starter and booster-coil pushbuttons (23 and 22) are on the left-hand side of the instrument panel and must be depressed simultaneously in order to start the engine. On some aircraft the pushbuttons are on the right-hand side of the instrument panel.
25. **Starter reloading control.**—The toggle (69) on the right-hand sloping panel is used to insert the next of the five cartridges provided into the starter breech.
26. **Oil dilution.**—A pushbutton (66) is provided on the right-hand decking shelf, but the system has not yet been fitted to this engine.

#### OPERATIONAL EQUIPMENT AND CONTROLS

27. **Guns and cannon.**—The machine guns and cannon are fired pneumatically by means of the pushbutton (26) on the control column spade grip. The compressed air supply is taken from the same source as the brake supply, the available pressure being shown on the gauge.

28. **Camera gun.**—A camera gun inside the radiator fairing is operated by the gun-firing pushbutton on the control column spade-grip, a succession of exposures being made during the whole time the button is depressed. A footage indicator and an aperture switch are mounted on the wedge plate (63) above the camera master switch (65). A separate pushbutton (28) on the spade-grip operates the camera gun independently of the guns. When not in use, the plug to the indicator should be placed in the dummy socket (64) on the right-hand shelf.
29. **Bomb release controls (Mk. IB aircraft only).**—Two selector switches (for port and starboard bombs) and two nose and tail fusing switches (48) are fitted on the right-hand side of the cockpit. The bomb release pushbutton is incorporated in the top of the throttle lever.

#### OTHER CONTROLS

30. **Sliding hood.**—The sliding hood on later aircraft is operated by a handle on the port cockpit wall. To open the hood the knob is pulled out and the handle rotated anti-clockwise. It can be locked in any intermediate position by releasing the knob. For jettisoning of hood see Para. 55.

## PART II

## HANDLING

## 31. Management of fuel system

## (i) Flying restrictions

When fitted with auxiliary drop tanks—Mk. IB aircraft only.

- (a) Speed must not exceed 400 (380) m.p.h. I.A.S.  
 (b) Spinning and aerobatics are not permitted and violent manoeuvres must be avoided as far as possible.  
 (c) Tanks should be jettisoned at about 200 m.p.h. I.A.S., but in an emergency they may be released at any speed up to 350 m.p.h. I.A.S.  
 (d) Tanks should be jettisoned only in straight and level flight.

## (ii) Management of tanks

(a) Start, warm up and take-off on the MAIN tanks. If these tanks are less than half full set the cock to NOSE tanks.

NOTE.—Under no circumstances should a take-off be made on a set of tanks which is less than half full.

(b) At a safe height, change over to the starboard drop tank first (if both tanks are carried) and then turn OFF the main tanks.

(c) When changing over from the starboard drop tank to the port drop tank, or when the fuel pressure warning light (or gauge) shows a drop in fuel pressure, or if at any time the engine should cut owing to suspected fuel shortage.

(i) immediately turn the drop tank cock to OFF, and

(ii) turn the main tank cock ON, in this sequence.

After ensuring that the fuel pressure is restored and the engine running satisfactorily, change over to the port drop tank and turn the main cock OFF. When changing from port drop tank to MAIN tanks, first turn OFF the port drop tank and immediately turn ON the main tanks.

(d) If at any time the engine cuts through lack of fuel, the pilot's first reaction must always be to close the throttle fully and advance the propeller control lever to maximum r.p.m. Change over the tanks quickly and then continue slowly to open and close the

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 Para. 31  
 (ii) cont.

throttle about 1/3 until the engine picks up. The engine will cut almost immediately after the fuel pressure warning light shows a drop in pressure; when flying at low altitudes it is therefore important to change over to the second drop tank or to the main supply when it is estimated that the drop tank in use is nearly empty, and before the pressure warning light comes on. When the drop tanks have not been run dry, and there is doubt about sufficient fuel remaining in the main tanks for the return journey, the drop tanks may be run dry at a height sufficient to allow the engine to cut and pick up again. The approach and landing should finally be made on the main tanks.

WARNING.—If the throttle is left open when the engine cuts, or opened still further, it is extremely unlikely that the engine will pick up at all. If it does, serious over-speeding will result owing to the inability of the constant speed unit to control under these conditions.

(e) As it is essential that the pressurising valve be ON when using drop tanks above 10,000 feet, it is recommended that it be left ON at all times, unless a tank is holed (see para. 2).

(f) If not fitted with drop tanks use main tanks first and then change over to nose tanks.

## 32. Preliminaries

- (i) On entering the cockpit check:
- |   |      |
|---|------|
| Undercarriage lever . . . . .               | DOWN |
| Undercarriage lever locking catch . . . . . | LOCK |
- (ii) Switch on the undercarriage indicator and check that the green lights appear.
- (iii) See that the cabin roof is locked down on both sides, that both doors are properly fastened, and that the footstep is retracted.

WARNING.—Unless Mod. No. 293 has been embodied it is most important that oxygen be used at all times as a precaution against carbon monoxide poisoning. The regulator should be set to ~~at least 10 p.s.i.g. flow~~ and the flow checked before starting.

A.L.1.

- A.L.1. (iv) Full rudder, <sup>etc.</sup> may be required for take-off. Ensure, therefore, that the rudder bar is correctly adjusted.

## 33. Starting the engine and warming up

NOTE.—Before starting the engine the aircraft should be faced into wind and if a full run-up is intended, the tail must be tied down. Ensure that there are no aircraft or personnel behind.

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 (ii)



## (i) Set:

Ignition switches . . . .	OFF
Fuel cock(s) . . . .	MAIN TANKS.
	Drop tanks (if fitted): OFF
	Pressurising cock: OFF
Mixture control (if fitted)	RICH
Propeller speed control	Fully forward
Supercharger control . . .	MODERATE
Radiator shutter . . . .	DOWN

NOTE.—(a) If the main tanks are less than half full, set fuel cock to NOSE TANKS.

(b) In cold weather the radiator shutter should be closed (UP) in order to avoid freezing up of the radiator.

- (ii) Check that there is not a live cartridge in the firing position, then have the engine hand-turned through three or four revolutions to ensure that it is free.

## (iii) Starting

WARNING.—The pilot must obtain an affirmative visual *all clear* signal before firing *each* cartridge. Personnel are warned of the possibility of sleeve seizure when starting a cold engine. This will be indicated by the angular rotation of the propeller becoming less as each cartridge is fired.

- (a) Set the starting lever to START.  
 (b) Open the throttle gently to the stop.  
 (c) Prime the carburettor until the fuel pressure reaches  $1\frac{1}{2}$  to 2 lb./sq.in. Then screw down the pump.  
 (d) Load the cartridge starter. The following types of cartridge should be used:

At air temperatures above  $+5^{\circ}$  C.: No. 2, Mark II.

At air temperatures below  $+5^{\circ}$  C.: No. 3, Mark I.

- (e) Switch ON the ignition.  
 (f) Carefully operate the cylinder priming pump until increased resistance is felt (so as to fill the pipe line and pump) and then prime the cylinders with full vigorous strokes as follows:

Oil temperature	No. of strokes
$0^{\circ}$ C. to $+10^{\circ}$ C.	5
$+10^{\circ}$ C. to $+20^{\circ}$ C.	4
$+20^{\circ}$ C. to $+30^{\circ}$ C.	3

If the engine has been standing less than half an hour, prime the cylinders with only one pumpful; if over half an hour and the oil temperature is still above  $+30^{\circ}$  C., prime with two pumpfuls. If, however, after half an hour the oil is below  $+30^{\circ}$  C., prime as above.

(g) Immediately after priming, press the booster-coil and starter pushbuttons simultaneously. Keep the booster-coil pushbutton depressed and as the engine fires operate the priming pump, if and as required, until the engine is running steadily.

NOTE.—Do not jerk the throttle if the engine fails to pick up, as no useful purpose is served by so doing and the air intake will be flooded with fuel, probably leading to a fire.

(h) As soon as the engine is running steadily depress the priming pump slowly and screw it down. Release the booster-coil pushbutton.

(i) Set the starting lever to NORMAL.

(j) If the engine fails to start at the first attempt it must not be primed again until it fires on a subsequent attempt. Then prime vigorously, as required, until the engine is running steadily.

NOTE.—If the engine fails to start after three cartridges have been fired switch off, blow the engine out and recommence at sub. para. (a).  
 Priming of the engine on starting is limited to 15 full strokes of the priming pump, after which, if the engine fails to start, the cylinders must be primed with oil.

- (iv) Fire.—If the engine catches fire the following drill must be carried out:

(a) Ground personnel shout "FIRE".

(b) The pilot must switch OFF the ignition immediately and then extend both arms outside the cockpit to indicate that the engine is safe.

(c) When the man with the extinguisher sees that the pilot has his arms extended he must immediately apply the extinguisher to the air intake.

## PART II—HANDLING

- (v) Run the engine at 800-1,000 r.p.m. and check that it is functioning normally. Maintain this speed until the oil pressure falls below 100 lb./sq.in.
- (vi) With the oil pressure below 100 lb./sq.in. increase engine speed progressively to 2,000 r.p.m.
- (vii) Warm up at 2,000 r.p.m. until the oil temperature reaches 40°C.

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Part II  
Para. 34 34. Testing the engine and installations.

**NOTE.**—It is most important that the engine be allowed to warm up properly before being opened up. Under normal circumstances the engine should not be opened up until the oil temperature reaches 40°C., but if operationally necessary this can be done at 20°C.

*While warming up:*

- (i) Make the usual checks of temperatures, pressures and controls. Normal pneumatic pressure: 450 lb./sq.in. If the pressure is low ensure that the pump is definitely building up pressure; if not, the aircraft should not be flown.

- (ii) Minimum gun firing pressure : 220 lb./sq.in.

*After warming up:*

- (iii) With propeller control lever in fully forward position, in rich mixture, open throttle up to 2,400 r.p.m. Pull propeller control lever fully back and then return to fully forward position *twice*. This is to check operation, and ensure flow of warm oil through C.S. unit.
- (iv) Open up to zero boost in rich mixture and check each magneto in turn. Drop should not exceed 50 r.p.m.

**NOTE.**—The following full run-up is normally made after inspection or repair, or when circumstances indicate, and the tail *must* be tied down. If, however, pilot's check run-up only is desired, 3,150 r.p.m. or zero boost (whichever is reached first) must not be exceeded and the tail need not be tied down.

- (a) Open up to zero boost in rich mixture and exercise and check operation of the two-speed supercharger once only. R.p.m. should fall when S ratio is engaged.
- (b) With the propeller control lever fully forward, open the throttle lever fully and check take-off boost and static r.p.m. Check that the generator is charging; the power failure light should be out and the voltage 28 or over.
- (c) Throttle back to +4½ lb./sq.in. boost and test each magneto in turn. The drop in r.p.m. should not exceed 50.

## PART II—HANDLING

## 35. Taxying

The brakes should be used with care, particularly if they are new, and they should not be used more than is absolutely necessary. Excessive use of the brakes causes seriously overheating and loss of efficiency.

## 36. Check list before take-off \*

- (i) T—Trimming tabs .. Elevator: neutral.  
Rudder: full port.
- M—Mixture control (if fitted) .. .. . RICH.
- P—Propeller control .. Fully forward.
- F—Fuel .. .. . Check cock setting and contents of both sets of tanks.  
Pressurising cock—OFF.  
Drop tank cock—OFF.  
(Under no circumstances must the take-off be made on a set of tanks which is less than half full.)
- F—Flaps .. .. . 10°-15° down. Selector at VALVE SHUT position.  
(When taking off from very small airfields the flaps should be lowered 30°.)
- Supercharger .. .. MODERATE.
- Radiator shutter .. DOWN.
- (ii) Open up the engine to 2,500 r.p.m. to clear it and then, if necessary, wipe the oil off the outside of the windscreen.

## 37. Take-off

- (i) Whenever the take-off path permits, not more than +4 lb./sq.in. boost should be used for take-off.
- (ii) When the take-off is made with flaps 10°-15° down there is very little tendency to swing. The tail should be held slightly below the flying attitude and the aircraft allowed to fly itself off.

PART II—HANDLING

- (iii) When the take-off is made with flaps 30° down, there is a strong tendency to swing to starboard, and unless the throttle is opened progressively as speed increases, rudder control may be insufficient to keep the aircraft straight. Also, the tail comes up rather more easily and care must be taken not to get it too high, as there is very little clearance between the propeller and the ground.
- (iv) Do not start to climb steeply until a speed of 150 m.p.h. I.A.S. is attained.
- (v) If flaps have been used, raise them at 200–300 feet. Return the selector to VALVE SHUT.

38. Climbing

- (i) The speed for maximum rate of climb is 185 m.p.h. I.A.S. up to 16,000 feet reducing speed by 3 m.p.h. per 1,000 feet above this height.
- (ii) For maximum rate of climb change to S ratio when the boost has dropped by 5 lb./sq.in.

39. General flying

- (i) *Stability.*—The aircraft is stable directionally and laterally but slightly unstable longitudinally, except at high speeds, when it is just stable. Aileron control remains light and effective up to the maximum permissible speed, but is sluggish at low speeds and heavy when carrying bombs. Elevator control is rather light and care must be taken not to use it too harshly. There is a tendency to “tighten up” in the looping plane. If “black out” conditions are accidentally induced in steep turns or aerobatics the control column should be moved firmly forward.

(ii) *Change of trim :*

Flaps down .. ..	No change
Undercarriage down ..	Nose down
Radiator shutter up ..	Nose down

Directional trim changes with variations in airspeed and throttle setting, and full use should be made of the rudder trimming tab to avoid flying with sideslip. This tab,

PART II HANDLING

however, is very sensitive and should, therefore, be used gently. Fore and aft trim is affected by changes in directional trim. Left yaw produces a tendency for the nose to drop and right yaw for it to rise.

- (iii) For all conditions of flight other than taxiing, take-off, climb and flying with flaps lowered, the radiator shutter should be UP.
- (iv) The oil temperature should be watched carefully.
- (v) The main tanks must always be used first in order to prevent adverse change of C.G.
- (vi) When flying at high speeds allowance must be made for the large position error in altimeter readings. (See Para. 49.)
- (vii) *Flying at low airspeeds.*—Speed may be reduced to about 155 m.p.h. I.A.S. and the flaps lowered about 30°–40°. The radiator shutter must be DOWN and the propeller speed control set to give about 3,100 r.p.m.
- (viii) *Formation flying.*—Engine speed should not be reduced below 2,600 r.p.m. when flying in formation.

A.L. 1  
Part II  
Para. 39  
(ix) (x)  
& 40

- (ix) The negative g oil tank has been fitted primarily to enable pilots to carry out “push downs” in combat. Even when this is fitted, inverted flying is not to be carried out, and any condition of inverted flight arising from manoeuvres should be limited, as far as possible, to about one second.

(x) *When carrying 2 × 1,000 lb. bombs:*

- (i) Maximum weight for take-off (overload) .. .. 14,000 lb.  
Maximum weight for landing, except in emergency .. 12,000 lb.  
Take-off to be made from smooth hard runways only.
- (ii) Diving speed must not exceed 450 m.p.h. I.A.S. When approaching the limiting diving speed slight pitching and rocking is noticeable, but this does not affect the aiming of the aircraft.
- (iii) Release of either bomb independently is inadvisable owing to poor control with one bomb on.
- (iv) In emergency a landing with one bomb on is possible but conditions must be exceptionally favourable, i.e., smooth air, long hard runway. If such a landing is made the following rules must be observed:
  - (a) make the circuit with the heavy wing on the outside—as, if this wing drops, it is very difficult to pick it up again.
  - (b) approach at 140 m.p.h. I.A.S. and touch down at high speed on the main wheels. Do not use brakes till near end of run.

40. Stalling

- (i) At the stall either wing may drop sharply with flaps either up or down.
- (ii) The stalling speeds (m.p.h. I.A.S.) at various loads are as follows :

	Flaps and u/c UP	Flaps and u/c DOWN
A.U.W. plus two M.10 tanks or two 500 lb. bombs (12,450 lb.) .. ..	90–100	70–75
Normal A.U.W. (11,400 lb.) .. ..	80–90	65–70
All ammunition and nearly all fuel expended (9,900 lb.) .. ..	75–80	65–70

## 41. Spinning

(i) Practice recovery from incipient spins is permitted subject to the following limitations.

(a) Spinning while carrying bombs, drop tanks, R.P. rails, or M.10 tanks, is prohibited.

(b) Spins must be started between 15,000 and 20,000 feet.

(c) Recovery action is to be initiated after not more than one turn.

## (ii) Characteristics and recovery

(a) In general, recovery from spins which have not been allowed to develop beyond two turns to either the right or the left is normal and straightforward. Full rudder should be applied and the control column then moved slowly forward to about central. It is essential that the rudder be held over until rotation stops; this may continue up to two turns (left) or two and a half turns (right) after opposite rudder is applied.

(b) Use of engine assists recovery from a spin to the left, although recovery can normally be effected without it.

(c) At 25,000 feet and above, cases have occurred when the spin has become flat. In this event the control column comes hard back and is very heavy to push forward. The pilot should apply full opposite rudder and, with both hands on the control column, slowly and deliberately pitch the aircraft fore and aft (moving the control column as far as possible in each direction), until the nose goes sufficiently far down to recover from the spin. 8,000 to 10,000 feet may be lost before recovery is effected.

(d) In all cases it is important not to ease out of the ensuing dive until the I.A.S. reaches 200 m.p.h., or the aircraft may stall and spin again.

## (iii) Practice

Until proficient, pilots should practise spins to the left first.

A.L.1  
Part II  
Para. 41  
(i) (a)

## 42. Diving

(i) Before diving make certain that the radiator shutter is UP, for a violent nose-down pitch results from closing the shutter in a dive.

(ii) If a dive is to be continued below 10,000 feet M ratio should be selected before commencing the dive. The throttle lever should not be fully closed.

(iii) In a dive the aircraft tends to become tail heavy but no retrimming is necessary. The elevator trimming tabs are very sensitive and should, therefore, not be used when diving. If, however, they are used, the control should be moved slowly and gently.

(iv) As speed increases the aircraft tends to yaw to port. The rudder trimming tab should be used to correct this, but as it is very sensitive the control should be moved slowly and gently.

## 43. Aerobatics

All the normal aerobatics are easy to perform, but a large amount of height may be gained or lost during some manoeuvres and an ample margin must be allowed.

*Looping.*—Use maximum cruising power and start the loop at a speed of at least 350 m.p.h. I.A.S. Care must be taken to avoid any harsh backward movement of the control column as this may induce a high speed stall.

*Rolling.*—Speed should be at least 250 m.p.h. I.A.S. and the roll should be "barrelled" just sufficiently to keep the engine running and to avoid any risk of loss of oil pressure.

*Half roll off loop.*—Maximum climbing power should be used and the speed should be at least 400 m.p.h. I.A.S. when starting the loop.

*Upward roll.*—Maximum climbing power should be used and the speed at the bottom of the dive should be about 450 m.p.h. I.A.S. for a fairly steep climbing roll, and 450 m.p.h. I.A.S. or more for a vertically upward roll.

*Flick manoeuvres* are not permitted. When carrying bombs, drop tanks, R.P. rails, or M.10 tanks, aerobatics are prohibited.

A.L.1  
Part II  
Para. 43



PART II—HANDLING

44. Check list before landing

- (i) Check contents of main tanks, and, if less than half full, change over to NOSE TANKS.
- (ii) Reduce speed to 160 m.p.h. I.A.S. and check brake pressure.
- U—Undercarriage .. DOWN (Check wing indicators, green lights and horn).
- M—Mixture control (if fitted) .. .. RICH.
- P—Propeller control .. Fully forward.
- Supercharger .. MODERATE.
- F—Flaps .. .. DOWN (As soon as the flap indicator shows that the flaps are fully down, return lever to VALVE SHUT position).
- Radiator shutter .. DOWN.
- (iii) A considerable tendency to yaw is noticeable as the undercarriage comes down. The indicator lights usually change to red, then green and back to red again two or three times before finally remaining green.
- (iv) The flaps are large and the rate of descent with them lowered is consequently rapid.
- (v) Approach speeds (m.p.h. I.A.S.)

Flaps:—	Down	Up
Engine assisted	105	120
Glide .. ..	120	130

On a flapless approach it is necessary to yaw the nose occasionally because of the obstructed view ahead.

NOTE.—Do not turn at speeds below 130–140 m.p.h. I.A.S.

- (vi) Landings should preferably be made without bombs, but if this is unavoidable extra care should be taken to ensure that a swing is not allowed to develop, as the extra load will cause the undercarriage to collapse. It should be remembered that the brakes will be less effective.

PART II—HANDLING

- (vii) When landing with bombs the approach speeds (m.p.h. I.A.S.) are as follows:

Engine assisted .. ..	115
Glide .. ..	130

NOTE.—With one 500-lb. bomb stuck up it is necessary to approach at 140 m.p.h. I.A.S. in order to hold up the wing.

45. Mislanding

- (i) The aircraft will climb away easily with undercarriage and flaps down, and the use of full take-off boost is unnecessary.
- (ii) Open the throttle slowly to about + 4 lb./sq.in. boost and counteract the tendency to swing right by firm use of the rudder.
- (iii) Before the undercarriage is raised, the flap selector must be at the VALVE SHUT position; otherwise, the undercarriage will not retract completely.
- (iv) Climb at about 130–140 m.p.h. I.A.S. and raise the flaps at about 200 feet. The flaps come up slowly.

46. After landing

- (i) Raise the flaps before taxiing.
- (ii) Change to S ratio once and back to M ratio.
- (iii) To stop the engine, idle for a few seconds at its slowest speed, then open up to about 1,000 r.p.m. and immediately move the starting lever to CUT OUT.
- (iv) When the engine has stopped, switch OFF the ignition and turn the fuel cock to ALL OFF, and return starting lever to normal.
- NOTE.—Starter cartridges should be removed overnight so as to avoid deterioration.

A.L.I.

PART III  
OPERATING DATA

47. Engine data: Sabre II & IIA

- (i) Fuel.—100 octane only.
- (ii) Oil.—Specification D.T.D. 472B "X".
- (iii) Engine limitations.

	R.p.m.	Boost lb./sq.in.	Temp. °C. Clnt. Oil
MAX. TAKE-OFF TO 1,000 FEET ..	M 3,700	+7	— —
MAX. CLIMBING ONE HOUR LIMIT	M } 3,500 (3,700)	+6 (+7)	125 90
MAX. RICH CONTINUOUS ..	M } 3,150	+4½	110 80
MAX. WEAK CONTINUOUS ..	M } 3,150	+3	110 80
COMBAT 5 MINS. LIMIT ..	M } 3,700	+7 (+9)	130 95

NOTE.—The figures in brackets are permitted only on Sabre IIA engines. For recommended associated r.p.m. and boosts see diagram opposite.

OIL PRESSURE:

NORMAL .. .. . 60/90 lb./sq.in.  
EMERGENCY MINIMUM (5 MINS.) 50 lb./sq.in.

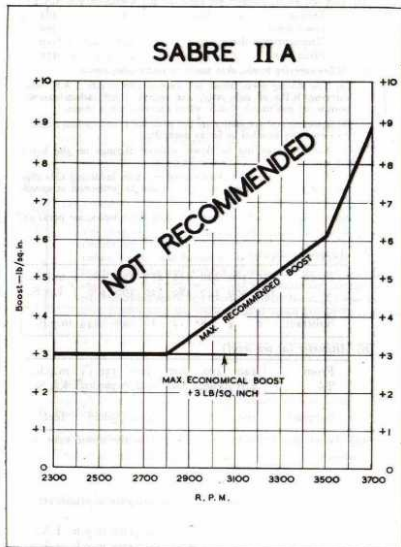
MINIMUM TEMP. FOR TAKE-OFF:

OIL .. .. . 40° C.  
COOLANT .. .. . 20°C if operationally necessary 65° C.

FUEL PRESSURE .. .. . 2½ lb./sq.in.

A.L.I.

- (iv) Supercharger gear changing.—Gear changes between 10,000 and 12,000 feet may be made at 3,500 r.p.m., but at all other altitudes and for ground checks r.p.m. must not exceed 3,150.



PART III—OPERATING DATA

A.L.I.  
Part III  
Para. 48  
(i) & (ii)

48. Flying limitations

- (i) The aircraft is designed for the following speeds (m.p.h. I.A.S.):

Diving .. .. .	525
Hood open .. .. .	300
Undercarriage down .. .. .	210
Flaps down .. .. .	155

- (ii) When carrying bombs, drop tanks, or under-wing stores

(a) The diving speed must not exceed 480 m.p.h. I.A.S. when carrying R.P.s or rails only, 450 m.p.h. I.A.S. when carrying bombs, or 400 m.p.h. I.A.S. when carrying other stores.

(b) Spinning and aerobatics are not permitted, and violent manoeuvres must be avoided as far as possible.

(c) Aircraft must not be flown without fairings on the bomb carriers.

(d) When carrying M.10 tanks evasive action involving side slips must be avoided: empty tanks must not be jettisoned at speeds in excess of 200 m.p.h. I.A.S.

NOTE.—For restrictions when carrying drop tanks, see para. 31.

49. Maximum rate of climb

- (i) Airspeed indicator.

From ..	120	160	200	240	280	320	360	} m.p.h. I.A.S.
To ..	160	200	240	280	320	360	400	
Subtract	0	4	8	12	16	20	24	m.p.h.

- (ii) Altimeter (at sea level).

From ..	220	250	290	320	350	} m.p.h. I.A.S.
To ..	250	290	320	350	380	
Subtract	100	200	300	400	500	feet

- (iii) When the altimeter is connected to the static vent, the corrections to height may be ignored.

50. Maximum performance

- (i) *Climbing*.—The speeds for maximum rate of climb are as follows:

Up to 16,000 feet .. .. .	185 m.p.h. I.A.S.
At 21,000 feet .. .. .	170 m.p.h. I.A.S.
At 26,000 feet .. .. .	155 m.p.h. I.A.S.
At 31,000 feet .. .. .	140 m.p.h. I.A.S.

PART III—OPERATING DATA

For intermediate heights reduce speed by 3 m.p.h. per 1,000 feet.

For maximum rate of climb change to S ratio when boost has dropped by 5 lb./sq.in.

- (ii) *Combat*.—Change to S ratio when the boost is 5 lb./sq.in. below the maximum permitted.

51. Economical Flying (see curves on Page 29).

- (i) *Climbing*.—Use + 3 lb./sq.in. boost and 3,150 r.p.m. in weak mixture at the speed recommended for maximum rate of climb. Change to S ratio when the boost has fallen to about + 1/2 lb./sq.in.

A.L.I.  
Part III  
Para. 51  
(ii)

- (ii) *Cruising*.—The recommended speed for maximum range is 210 m.p.h. I.A.S. When carrying drop tanks above 10,000 ft. 200 m.p.h. I.A.S. is recommended. Fly in weak mixture at maximum obtainable boost not exceeding + 3 lb./sq.in. and reduce r.p.m., which may be as low as 2,000 if this will give the recommended speed without vibration and uneven running of the engine. If, at 2,000 r.p.m., and the maximum obtainable boost recommended speed is exceeded, reduce boost. Change to S ratio if at 3,150 r.p.m. the recommended speed cannot be maintained in M ratio.

52. Fuel capacity and consumption

- (i) *Fuel capacity*.

Two main tanks (40 gallons each) ..	80 gallons
Two nose tanks (37 gallons each) ..	74 gallons
	154 gallons
Two drop tanks (if fitted) (45 gallons each)	90 gallons
Total .. .. .	244 gallons

- (ii) *Fuel consumptions* (see Page 28)

## FUEL CONSUMPTIONS WEAK MIXTURE

M ratio at 5,000 feet.

Boost lb./sq.in.	R.P.M.				
	3,150	2,900	2,700	2,500	2,300
+3	100	91	84	—	—
+1½	91	84	78	72	66
+1	—	—	—	—	63
0	—	—	—	—	58
-2	—	—	—	—	49
-4	—	—	—	—	42

M ratio at 15,000 feet.

Boost lb./sq.in.	R.P.M.				
	3,150	2,900	2,700	2,500	2,300
0	94	—	—	—	—
-1	87	79	—	—	—
-2	80	74	69	63	—
-3	74	68	63	59	—
-4	67	62	58	54	49

S ratio at 25,000 feet.

Boost lb./sq.in.	R.P.M.					
	3,150	3,000	2,900	2,800	2,700	2,600
0	94	—	—	—	—	—
-1	—	86	—	—	—	—
-1½	—	—	81	—	—	—
-2	—	—	—	75	—	—
-3	—	—	—	—	70	—
-3½	—	—	—	—	—	64

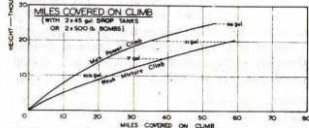
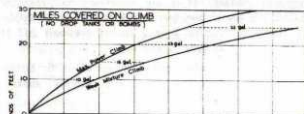
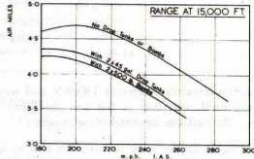
## RICH MIXTURE

Boost lb./sq.in.	R.p.m.	M ratio	
		at 5,000 feet	at 15,000 feet
+7	3,700	190	190
+6	3,500	150	165
+4½	3,150	125	132

## ECONOMICAL FLYING

(See Para. 51)

### RANGE CURVES





## PART IV

## EMERGENCIES

## 53. Undercarriage emergency operation

If after selecting DOWN the red indicator lights do not come on, try the reserve set of lights. If the engine pump will not lower the undercarriage, the handpump or emergency release pedals (34 and 72) must be used as follows:

- (i) Leave the undercarriage selector DOWN and work the handpump until resistance is felt and the green lights come on. At least 120 strokes will be required.
- (ii) If the red lights do not come on after the first 12 strokes of the handpump, leave the selector DOWN and use the emergency pedals. It is not necessary to press both pedals at the same time, but a firm push must be applied until the pedal moves 3 or 4 inches forward and the corresponding red light comes on.

NOTE.—It is important when using the pedals to fly straight and level. Applying "g" will merely make it harder to release the wheels.

- (iii) After the wheels have been released, it may be necessary to skid the aircraft from side to side before the green lights will come on. If one or both green lights still fail to come on after skidding, look at the wing indicators. If these show that both wheels are down, it should be assumed that they are locked.
- (iv) If the flaps cannot be lowered, approach 15 m.p.h. I.A.S. faster than normally.

## PART IV—EMERGENCIES

## 54. Door and roof jettisoning (Early aircraft)

The levers (13 and 49), one on each forward doorpost jettison the doors when pulled smartly down and inwards simultaneously. Considerable leverage may be obtained on them by crossing the arms, that is to say, by releasing the port door with the right hand and the starboard door with the left hand. The roof panel is released automatically by this operation.

IMPORTANT.—Both door latches must be released before operating the jettison levers.

## 55. Hood jettisoning (Later aircraft)

The sliding hood and cockpit starboard panel on later aircraft can be jettisoned by pulling the handle at the bottom of the instrument panel, to the right of the blind flying panel.

## 56. Ditching

See A.P. 2095, Pilot's Notes General.

- (i) Every endeavour should be made to bale out rather than ditch.
- (ii) If flying low over the sea the aircraft should be pulled up steeply, but only if engine power is still available.
- (iii) On the climb sutton harness and helmet should be released and the R/T plug disconnected. The doors (on later aircraft the hood) should be jettisoned.
- (iv) Bale out from as much height as can be gained.
- (v) If ditching is unavoidable, flaps should be lowered half-way and the touchdown made at as low a speed as possible with the tail well down.

## 57. Forced landing

In the event of having to make a forced landing, the glide may be lengthened considerably by moving the propeller speed control fully back. With flaps and undercarriage UP the angle of glide is very flat at about 150 m.p.h. I.A.S.

PART IV—EMERGENCIES

58. Tyre bursting

If a tyre has burst on take-off no attempt should be made to land with the undercarriage lowered. Greater safety to the pilot and less damage to the aircraft will result from a belly landing.

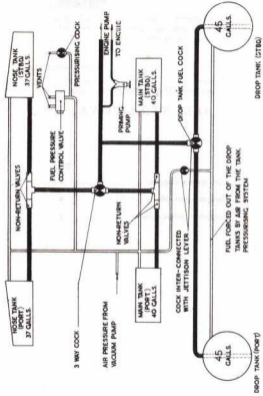
59. First-aid outfit

The first-aid outfit is stowed on the inside of the radio access panel on the port side of the fuselage.

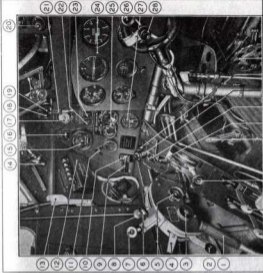
PART V  
ILLUSTRATIONS

	Fig.
Fuel system diagram .. .. .	1
Cockpit—port side .. .. .	2
Cockpit—starboard side .. .. .	3

## FUEL SYSTEM SIMPLIFIED.

KEY TO FIG. 2  
COCKPIT - PORT SIDE

1. Hydraulic handpump.
2. Landing lights lever.
3. Friction adjuster.
4. Depressure control lever.
5. Friction adjuster lever.
6. Throttle lever.
7. Throttle lever (bomb release pushbutton incorporated).
8. Mixture control lever.
9. Undercarriage indicator switch.
10. Ignition switches.
11. Bomber indicator light.
12. Radio controller.
13. Post door jettison lever.
14. Port cockpit hand controller.
15. Starboard cockpit hand controller.
16. W/T controller.
17. W/T controller.
18. Undercarriage buzzer test pushbutton.
19. Reflector sight diameter switch.
20. Compass light diameter switch.
21. Flap indicator.
22. Bomber-ail pushbutton.
23. Engine starter pushbutton.
24. Depressure flying panel.
25. Bombing altimeter.
26. Bombing altimeter.
27. Pressurized pressure gauge.
28. Canister gas pushbutton.
29. Bomber pedals adjustment wheel.
30. Starting and slow-rotating cut-out control.
31. Landing lights switch.
32. Beam approach marker switch.
33. Undercarriage emergency release pedal.
34. Undercarriage emergency release pedal.
35. Flap indicator lever.
36. Bomber flap selector lever.



## COCKPIT—STARBOARD SIDE

38. Fuel cock control.  
39. Cylinder priming pump.  
40. Radiator temperature gauge.  
41. Power failure warning light.  
42. Oil pressure gauge.  
43. Fuel contents gauge.  
44. Fuel contents gauge selector switch.  
45. Fuel gauge indicator.  
46. Fuel gauge selector switch.  
47. Starboard cockpit lamp.  
48. Bomb fusing and selector switches.  
49. Starboard door jettison lever.  
50. Fuel pressure warning light.  
51. Starboard window winding handle.  
52. L.P.F. pushbutton and switch.  
53. Cockpit heating control.  
54. Fuel temperature gauge.  
55. Fuel temperature gauge selector switch.  
56. Fuel temperature gauge selector switch.  
57. Carburetor priming pump.  
58. Spooling switches.  
59. Pressure-head heater switch.  
60. Navigation lights switch.  
61. Valvecover.  
62. Radio connector heater switch.  
63. Wedge plate for engine gas leakage indicator.  
64. Section for engine room.  
65. Section for engine room.  
66. Control switch.  
67. Oil dilution pushbutton.  
68. Switch for panel light.  
69. Windscreen de-icing pump and needle valve.  
70. Engine starter releasing control.  
71. Deep tank cock control.  
72. Underride emergency release panel.

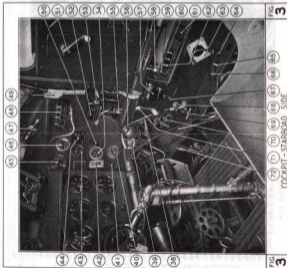


FIG. 3

FIG. 3  
COCKPIT—STARBOARD SIDE

RESTRICTED  
(For Official Use Only)

Amendment List No. 1  
to A.P. 1824X—P.N.  
Second Edition

## TYPHOON

Incorporation of this Amendment List must be certified by inserting date of incorporation and initials in the spaces provided on the inside front cover of the Notes.

A.L.	PARA.	AMENDMENT
✓ 1	2	Amend last seven lines by sticking over gummed slip supplied herewith.
✓ 1	19	Amend by sticking over gummed slip supplied herewith.
✓ 1	31 (i) (a)	Delete (18c).
✓ 1	31 (b)	Amend by sticking over gummed slips supplied herewith.
✓ 1	32 (iii)	Delete "at least 15,000 feet" and substitute "the 25 mark".
✓ 1	34 (iv)	Alter to read "Full left rudder, etc."
✓ 1	35 (iii)	Amend WARNING by sticking over gummed slip supplied herewith.
✓ 1	34	Amend by sticking over gummed slip supplied herewith.
✓ 1	39 (ix) (x) & 40	Add 30 (ix) (x) and amend 40 by sticking over gummed slip supplied herewith.
✓ 1	41 (i) (a)	Amend by sticking over gummed slip supplied herewith.
✓ 1	43	Amend last two lines by sticking over gummed slip supplied herewith.
✓ 1	45 (iv)	Alter "ALL OFF" add " and return the starting lever to NORMAL."
✓ 1	47 (iii)	MINIMUM TEMP. FOR TAKE-OFF OIL. After "40 C." add "120" C. if operationally necessary".
✓ 1	48 (i) & (ii)	Amend by gummed slip supplied herewith.
✓ 1	51 (ii)	Amend by sticking over gummed slip supplied herewith.