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AIR PUBLICATION 1564B & D

Pilot's Notes

PILOT'S NOTES

HURRICANE IIA, IIB, IIC,  
IID AND IV AIRCRAFT

MERLIN XX ENGINE

Prepared by direction of the  
Minister of Aircraft Production

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Promulgated by order of the Air Council

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AIR MINISTRY

## AMENDMENT CERTIFICATE

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Amendt. List No.	1	2	3	8	11	12	13	17	18	21
Prelimy. matter	✓								✓	
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Introducn.									✓	
Section 1				✓		✓		✓		
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Air Ministry  
March 1944

Amendment List P  
to  
AIR PUBLICATION 1564B  
Pilot's Notes

HURRICANE II AIRCRAFT

MERLIN XX ENGINE

Note: Amendment Lists to this Air Publication which affect the Pilot's Notes are now allotted a letter only. The letters run consecutively, omitting I and O. The Pilot's Notes will be complete when this Amendment List has been incorporated.

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- (1) PRELIMINARY MATTER Remove existing Front Cover and substitute new cover supplied herewith.
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NOTE: This Amendment List applies to A.P.1564B, Pilot's Notes, only. A corresponding amendment list, No.42, to A.P.1564B, Volume I, is being distributed separately by A.P.F.S., Harrogate.

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Section 1. Controls and equipment for pilot

Section 2. Handling and flying notes for pilot

Revised in Vol. I by A.L.42 AIR PUBLICATION 1564B & D  
and in Pilot's Notes by A.L/P. Volume I and Pilot's Notes

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PILOT'S CONTROLS AND EQUIPMENT  
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## INTRODUCTION

1. The Hurricane Mk. II and IV are each fitted with a Merlin 20 engine and a Rotol 35° propeller. The Mk. IID and IV are low-level attack versions of the earlier Marks and are equipped to carry various alternative armaments. The aircraft controls, including the undercarriage, flaps and brakes are identical with those on Mark I aircraft.

## FUEL, OIL AND COOLANT SYSTEMS

2. Fuel tanks (See Figs. 5 and 5A).-

- 1) Main and Reserve tanks.- The main tanks are housed within the centre section, one on each side of the fuselage, and a reserve tank is carried between the fireproof bulkhead and the instrument panel. Fuel is delivered to the engine by an engine-driven pump. These tanks are self-sealing and their effective capacities are as follows:

Main tanks:	33 gallons each.
Reserve tank:	28 gallons.

To meet the possibility of engine cutting due to fuel boiling in warm weather at high altitudes, these tanks can be pressurised (operative above 20,000 feet). Pressurising, however, impairs the self-sealing of tanks and should, therefore, be used only when the fuel pressure warning light comes on, or when auxiliary drop tanks are used (see below).

- (ii) Auxiliary tanks: When not fitted with under-wing armament or containers, a pair of auxiliary tanks may be carried, one under each wing. The types of tank and their capacities are as follows:

Fixed:	44 gallons each.
Drop:	45 or 90 gallons each.

With the exception of some fixed tanks which are used for combat duties, these tanks are non-self-sealing. Fuel in the fixed tanks is delivered to the main tanks by electrically driven immersed pumps, but fuel in the drop tanks is supplied direct to the engine fuel pump by air pressure.

3. Fuel cocks.-

- (i) The main fuel cock control (48) on the left-hand side of the cockpit has a spring safety plate which prevents the fuel supply being turned off inadvertently. The control can only be turned to the OFF position whilst the safety plate is held depressed.
  - (ii) A switch for the electric pump in each fixed auxiliary tank is fitted on the left-hand side of the cockpit, either just above the elevator trimming tab control, or on the lower part of the electrical panel.
  - (iii) The fuel cock control (73) and jettison lever (74) for the drop tanks are mounted together on the right-hand side of the cockpit, below the windscreen de-icing pump. The cock control has three positions: OFF, PORT and STARBOARD. The pressurising cock must be turned on when the tanks are used. The jettison lever is pulled down to jettison both tanks simultaneously, but cannot be moved until the fuel cock is set to OFF. When the lever is operated, the air pressure supply is automatically cut off.
  - (iv) The tank pressurising cock (22) is fitted on the left-hand side of the cockpit, below the throttle quadrant, and is marked AIRSPHERE and PRESSURE.
4. Fuel contents gauge.- A gauge (49) on the right-hand side of the instrument panel indicates selectively the contents of each of the three main tanks. A switch unit (48), comprising a combined selector and pushbutton, is fitted above the gauge.
5. Fuel pressure warning light.- The warning light (50) on the right-hand side of the instrument panel comes on if the pressure drops to 6 lb/sq.in.
6. Oil system.- The self-sealing oil tank, which has an effective capacity of 9 gallons, forms the port leading edge of the centre section. The oil passes through a filter before entering the engine and then through a cooler inside the coolant radiator. Pressure (54) and temperature (53) gauges are fitted on the instrument panel. When 90-gallon fuel drop tanks are carried, an auxiliary oil tank of 4 gallons capacity is fitted behind the seat, the cock control for which is on the left-hand side of the seat, above the radiator flap control quadrant.

7. Coolant system.- The system is thermostatically controlled, the radiator being by-passed until the coolant reaches a certain temperature. The header tank is mounted on the fireproof bulkhead and is fitted with a pressure relief valve. The air flow through the radiator is controlled by a flap lever in the cockpit.

MAIN SERVICES

8. Hydraulic system.- An engine-driven hydraulic pump supplies the power for operating the undercarriage and flaps. The system is automatic, selection of the desired operation of the undercarriage or flaps, by means of the selector lever, being sufficient to commence the operation. A handpump (71) is provided for use in the event of engine failure or engine-driven pump failure.
9. Electrical system.- A 12-volt generator, controlled by a switch (3) on the left-hand side of the cockpit, supplies an accumulator which in turn supplies the whole of the electrical installation. There is a voltmeter (31) on the left-hand side of the cockpit, and a red light (36) marked POWER FAILURE on the instrument panel comes on when the generator is not charging the accumulator.
10. Pneumatic system.- The wheel brakes and the gun-firing mechanism are operated pneumatically, air being supplied by an engine-driven compressor and stored in a cylinder at a maximum pressure of 300 lb/sq.in.

AIRCRAFT CONTROLS

11. Flying controls.- The control column is of the spade-grip pattern and incorporates a gun-firing pushbutton and the brake lever. The rudder bar is adjustable for leg reach by means of a star-wheel midway between the two pedals.
12. Trimming tabs.- The elevator trimming tabs are controlled by a handwheel (84) on the left-hand side of the cockpit and an indicator is fitted next to it. Forward rotation of the hand-wheel corrects tail heaviness. The automatic balance tab on the rudder can be set for trimming purposes by means of a small control wheel (23) on the left-hand side of the cockpit, which is turned clockwise to apply right rudder.

13. Undercarriage and flap control.- The selector lever (76) for the undercarriage and flaps is on the right-hand side of the cockpit and works in a gate, having a neutral position and an UP and DOWN position for both undercarriage and flaps, the positions for operating the flaps being outboard. The catch on the side of the lever must be pressed in order to release it for movement from an operative position, but the lever can be moved from the neutral position without first releasing the catch. To obviate inadvertent selection on the ground of the wheels up position, a safety catch (77) is provided on the gate which must be turned in a clockwise direction to permit entry of the selector lever into the wheels UP slot. For emergency lowering of the undercarriage see Para.35.
14. Undercarriage indicator.- The electrical indicator (41) is on the left-hand side of the instrument panel and has duplicate pairs of lamps, the green lamps indicating when the undercarriage is locked in the DOWN position, and the red lamps when the undercarriage is fully retracted and locked. There are two switches to the left of the indicator, the left-hand one (38) being the ON-OFF switch for the green lamps, and the right-hand one (39) being the change-over switch for the duplicate sets of lamps. A dimmer switch is provided in the centre of the indicator. When the undercarriage is retracted, the wheels are visible through two small windows in the bottom of the cockpit.
15. Undercarriage warning light.- A red light on the instrument panel comes on at any time when the throttle lever is less than one-third open and the undercarriage is not locked down. When the throttle is opened again or the undercarriage is lowered the light goes out.
16. Flap indicator.- This (72) is mechanically operated, the pointer moving along a graduated scale marked UP and DOWN at its extremities. It is situated immediately below the hydraulic selector lever.
17. Wheel brakes.- The brake lever is fitted on the control column spade-grip and a catch for retaining it in the on position for parking is fitted below the lever pivot. A triple pressure gauge, showing the air pressure in the pneumatic system cylinder and at each brake, is mounted forward of the foot of the control column.

18. Flying control locking gear.- The locking struts, interference bar and bracket are stowed in a canvas bag in the starboard side of the wireless bay. The bracket clips on to the control column, just below the spade grip, for locking of the aileron control and the two struts, attached to the bracket by shackles, lock the rudder bar and control column. The spring loaded interference bar fits on to the bracket and is inserted in a slot in the back of the seat.

## ENGINE CONTROLS

19. Throttle.- The throttle lever (7) works in a slot in the decking shelf on the left-hand side of the cockpit. The take-off position is gated. There is a friction adjuster (16) on the inboard end of the lever spindle. The mixture control is fully automatic and there is no pilot's control lever.
20. Boost control cut-out.- The automatic boost control may be cut out by pulling the knob (34) on the left-hand side of the instrument panel.
21. Propeller control.- The speed control lever (10) on the left-hand side of the cockpit varies the governed rpm from 3,000 down to 1,800. A friction adjuster is fitted on the inboard side of the control.
22. Supercharger control.- The push-pull control (17) is fitted below the left-hand side of the instrument panel, and must be pushed in for low (M) gear and pulled out for high (S) gear.
23. Radiator flap control.- The airflow through the coolant radiator and oil cooler is controlled by a lever (26) on the left-hand side of the pilot's seat. In order to release the lever for operation the thumb-button must be depressed.
24. Slow-running cut-out.- The control on the carburettor is operated by pulling out the knob (64) immediately to the right of the undercarriage and flap selector lever.
25. Cylinder priming pump.- The priming pump (59) is fitted below the right-hand side of the instrument panel.



26. Engine starting.- The starter and booster coil pushbuttons (32 & 33) are to the left of the ignition switches (58) on the instrument panel. An external supply socket for the starter motor is accessible through a removable panel in the starboard engine cowling, and two handles for hand starting are stowed in the undercarriage wheel recess under the centre section.

27. Oil dilution.- The pushbutton (4) for operating solenoid valve is on the left-hand side of the cockpit.

#### OTHER CONTROLS

28. Gun controls.- The machine guns and cannon are normally fired by the pushbutton on the control column spade grip. The two 40 mm guns on Mk.III and IV aircraft are fired electro-pneumatically by the pushbutton in the throttle lever; they cannot be fired, however, until the master switch (11) on the decking shelf, forward of the throttle quadrant, is switched on. The cocking lever (28) on the electrical panel to the left of the seat should be pushed down in the event of a misfire.

29. R.P. controls.- The projectiles are fired by the pushbutton in the throttle lever and a selector switch (40) below the left-hand side of the windscreen enables them to be fired in PAIRS or as a SALVO. They must not be fired with the flaps lower.

30. Bomb controls.- There are two selector switches and two nose and tail fusing switches on a small panel (67) on the right-hand side of the cockpit. The bombs are released by the pushbutton in the throttle lever.

31. S.C.I. controls.- These are operated by the pushbutton in the throttle lever and there is a container jettison pushbutton (63) on the right-hand side of the cockpit.

32. Camera gun control.- The camera gun operates only when the guns and cannon or the R.P. are fired, or when the lower pushbutton on the control column spade grip is depressed.

33. Landing lamps.- The landing lamps, one in the leading edge of each wing, are controlled by a two-way switch (15) to the left of the instrument panel, which enables either lamp to be used; both lamps are off when the switch is in the upright position. A dipping lever (5) on the left-hand side of the cockpit can be held in any position by tightening the knurled wheel; when the wheel is unscrewed, the lever is pulled aft into the UP position by a return spring in each of the lamp units.

34. Recognition device.- The flares are selected and released by a single lever (25) immediately aft of the trimming tab control. The slot is marked SELECT and FIRE.

#### EMERGENCIES

35. Undercarriage emergency operation.-

(i) In the event of failure of the engine-driven hydraulic pump, the undercarriage may be lowered by moving the selector lever to the WHEELS DOWN position and then operating the handpump.

(ii) If the handpump fails to lower the undercarriage the selector lever should still be left in the WHEELS DOWN position and the red-painted foot pedal (21), outboard of the port heelrest, should be firmly pushed forward. The wheels should then fall and lock down under their own weight.

(iii) If difficulty is experienced in operating the undercarriage and flap selector lever it may be overcome by first selecting the opposite to that which is required. If, for example, the selection of undercarriage down is found to be difficult, the lever should first be moved into the undercarriage up position and then immediately moved to the down position.

36. Hood jettisoning.- To jettison the hood the lever aft of the radiator flap control should be pulled sharply forward and upwards. If the hood does not readily leave the aircraft it should be assisted by pushing it upwards, or failing that, by releasing the emergency exit panel (see below) in addition to operating the jettison control.

Note: When jettisoning the hood it is advisable to lower one's head as far as possible so as to avoid injury when it leaves the aircraft.

37. Emergency exit panel.- The large detachable panel on the starboard side of the cockpit is secured by horizontal spring-loaded plungers and a bolt operated by the cockpit hood. To jettison the panel, the hood must first be fully opened and the release lever (66) then moved aft and upwards.
38. Abandoning by parachute.- When abandoning the aircraft by parachute it is important to decrease speed and then dive over the side immediately. The pilot must not stand on the seat and delay in jumping or he will hit either the aerial mast or the tailplane.
39. 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 and gliding at about 130 mph IAS. With undercarriage and flaps up the gliding angle at speeds of 120-140 mph IAS is very flat.
40. Ditching (See A.P. 2095, Pilot's Notes General)
- (1) In general, the pilot should if possible abandon the aircraft by parachute.
- (ii) In the event of having to ditch, auxiliary drop tanks, bombs, or containers (if fitted) should be jettisoned and the following procedure should be observed:
- (a) The cockpit hood should be jettisoned.
- (b) Flaps should be lowered fully in order to reduce landing speed as much as possible.
- (c) The undercarriage should be retracted.
- (d) Safety harness should be kept on, with straps tight, and the R/T plug disconnected.
- (e) The engine, if available should be used to help make the touch-down in a tail-down attitude at as low a speed as possible.
- (f) When about to touch the water a normal banked turn, with full rudder, should be made so as to prevent "hooking" the radiator into the water.
41. First-aid outfit.- The first-aid outfit is attached to the inside of a detachable panel on the port side of the cockpit and is accessible by kicking in the panel, breaking the stringers, and tearing the fabric.
42. Crowbar.- A crowbar, for use in an emergency, is stowed in clips to the right of the seat.

KEY TO FIG. 1

1. Radio contactor master switch.
2. Cockpit light dimmer switch.
3. Generator switch.
4. Oil dilution pushbutton.
5. Landing lamp control lever.
6. Oxygen supply cock.
7. Throttle lever (incorporating pushbutton).
8. Socket for footage indicator plug.
9. Wedge plate for camera gun footage indicator.
10. Propeller speed control.
11. Cannon master switch.
12. Compass light dimmer switch.
13. Cockpit light.
14. Cockpit light dimmer switch.
15. Landing lamp switch.
16. Friction adjuster.
17. Supercharger control.
18. Fuel cock control.
19. T.R. 9D contactor switch.
20. Radio contactor.
21. Undercarriage emergency release lever.
22. Fuel tank pressurising control.
23. Rudder trimming tab control.
24. Elevator trimming tab control.
25. Recognition device selector lever.
26. Radiator flap control lever.
27. Heated clothing socket.
28. Cannon cocking lever.
29. Microphone/telephone socket.
30. Hood catch control.
31. Voltmeter.

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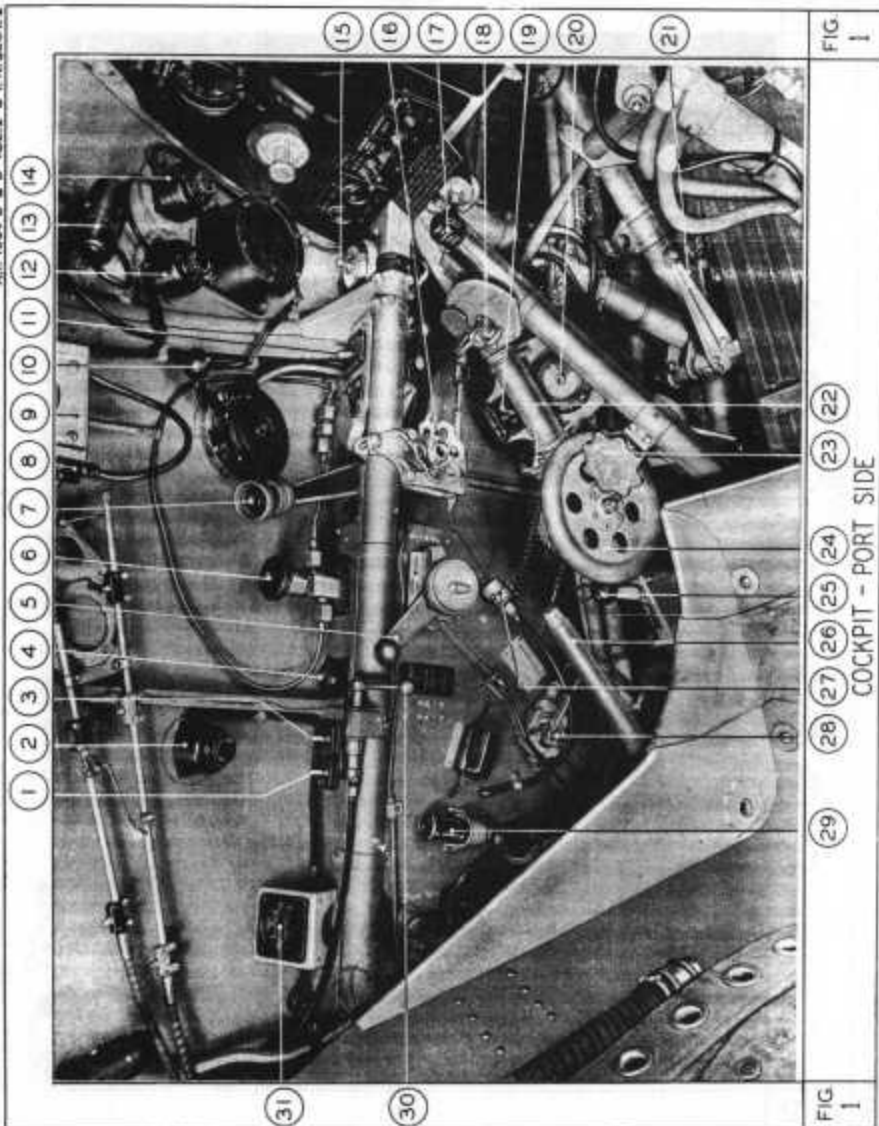


FIG  
1

22  
23  
24  
25  
26  
27  
28  
29  
COCKPIT - PORT SIDE

FIG  
1

F57

KEY TO FIG. 3

- 59. Cylinder priming pump.
- 60. Cockpit light.
- 61. Cockpit light dimmer switch.
- 62. Signalling switch box.
- 63. Container jettison pushbutton.
- 64. Slow-running cut-out.
- 65. Windscreen de-icing pump.
- 66. Emergency exit panel jettison lever.
- 67. Bomb fusing and selector switches.
- 68. Sutton harness release.
- 69. I. F. P. master switch.
- 70. I. F. P. pushbuttons.
- 71. Hydraulic handpump.
- 72. Flap indicator.
- 73. Drop tank fuel cock control.
- 74. Drop tank jettison control.
- 75. Seat adjustment lever.
- 76. Undercarriage and flap selector lever.
- 77. Undercarriage selector safety catch.

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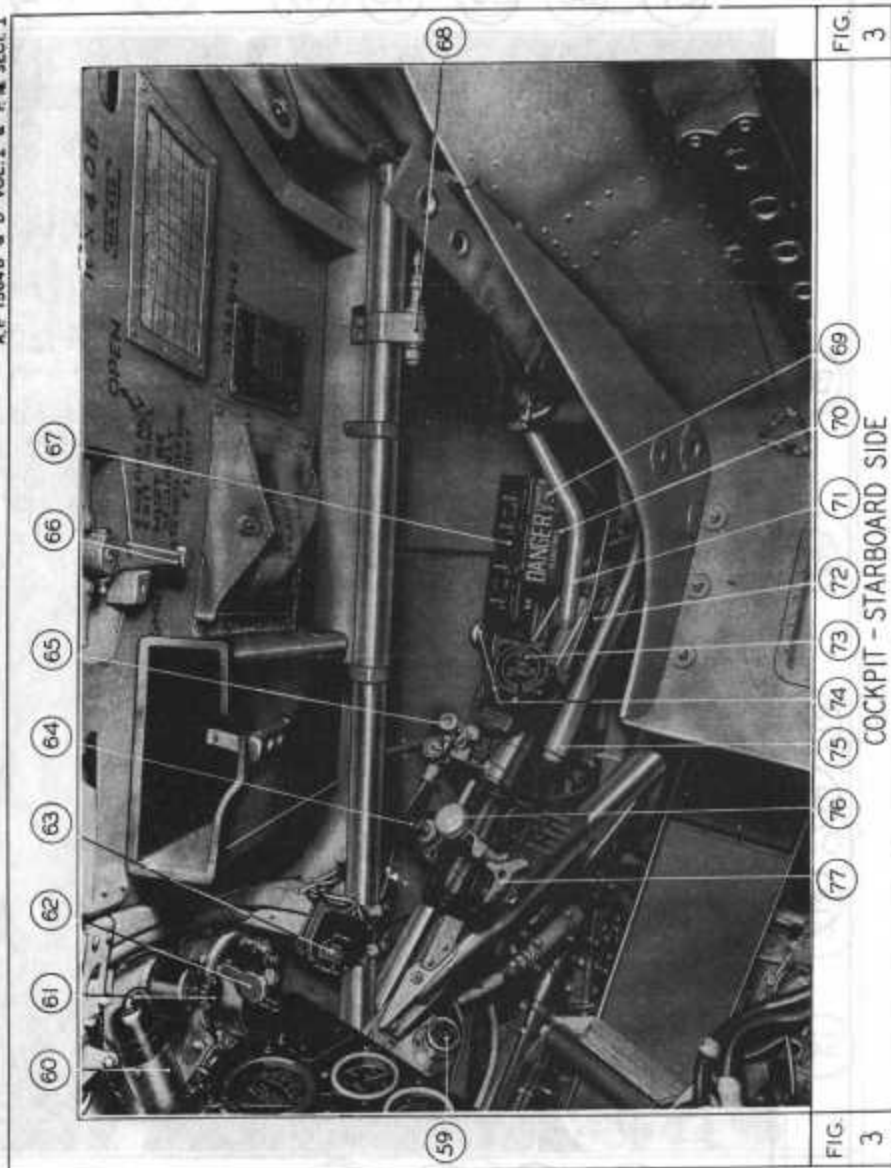


FIG. 3  
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COCKPIT - STARBOARD SIDE

FIG. 3

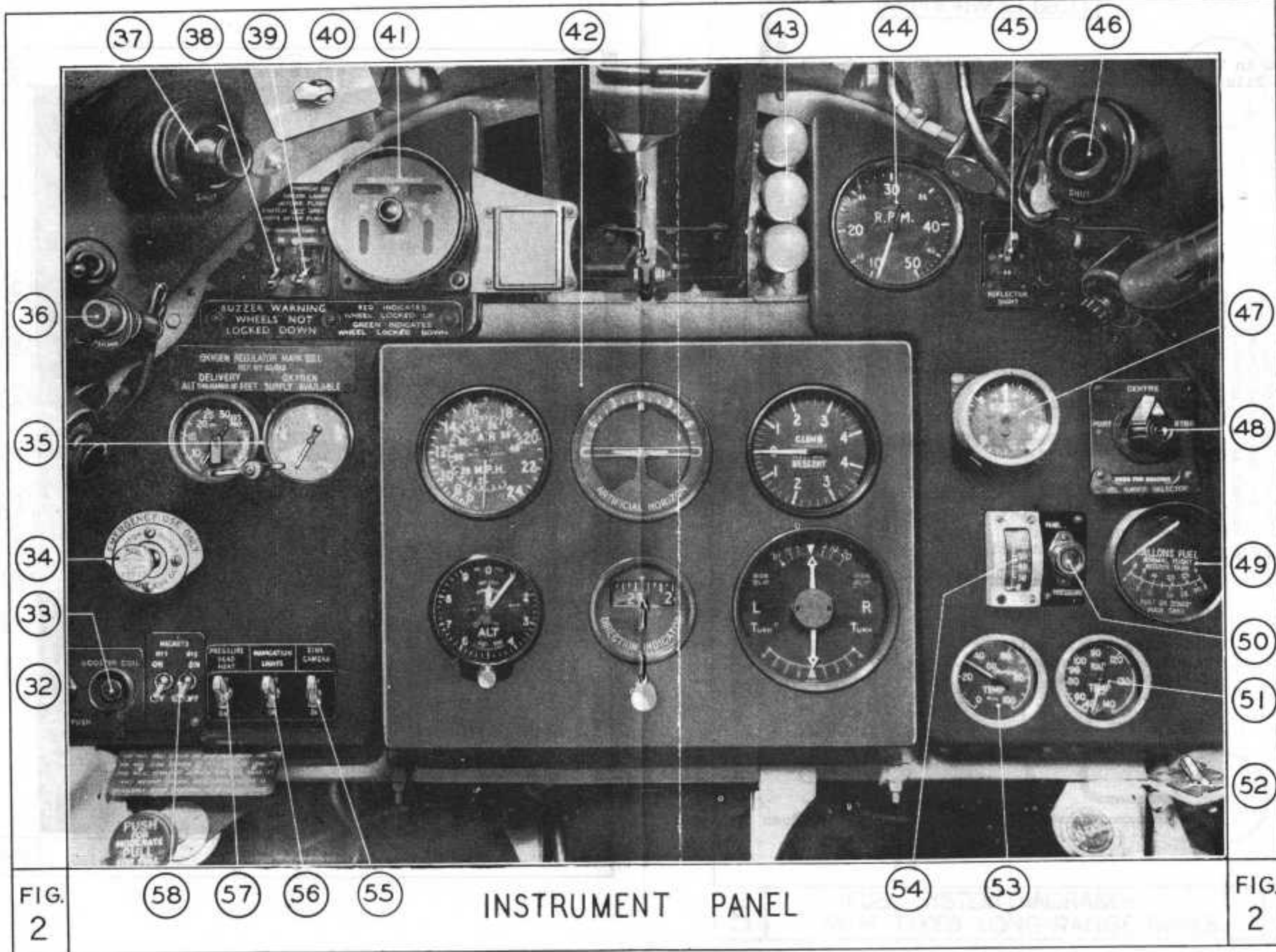


FIG. 2

FIG. 2

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and in Pilot's Notes by A.L/P. Volumes I and Pilot's Notes

KEY TO FIG. 2

- 32. Engine starter pushbutton.
- 33. Booster coil pushbutton.
- 34. Boost control cut-out.
- 35. Oxygen regulator.
- 36. Power failure warning light.
- 37. Cockpit ventilator.
- 38. Undercarriage indicator ON-OFF switch.
- 39. Undercarriage indicator change-over switch.
- 40. R.P. selector switch.
- 41. Undercarriage indicator.
- 42. Instrument flying panel.
- 43. Reflector sight spare lamps.
- 44. Engine speed indicator.
- 45. Reflector sight switch.
- 46. Cockpit ventilator.
- 47. Boost gauge.
- 48. Fuel contents gauge selector switch.
- 49. Fuel contents gauge.
- 50. Fuel pressure warning light.
- 51. Radiator temperature gauge.
- 52. Beam approach master switch.
- 53. Oil temperature gauge.
- 54. Oil pressure gauge.
- 55. Camera gun switch.
- 56. Navigation lights switch.
- 57. Pressure head heater switch.
- 58. Ignition switches.

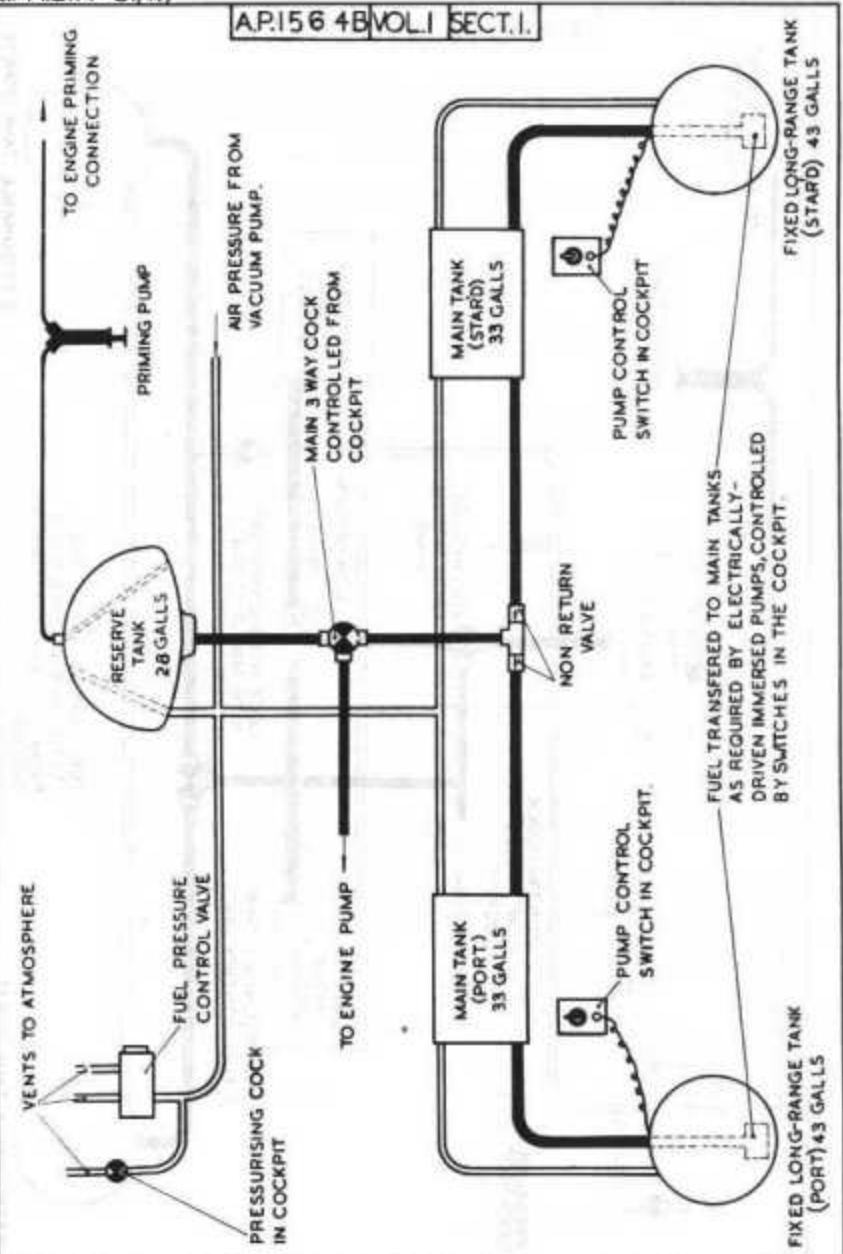


FIG. 5 FUEL SYSTEM DIAGRAM - WITH FIXED LONG-RANGE TANKS. FIG. 5

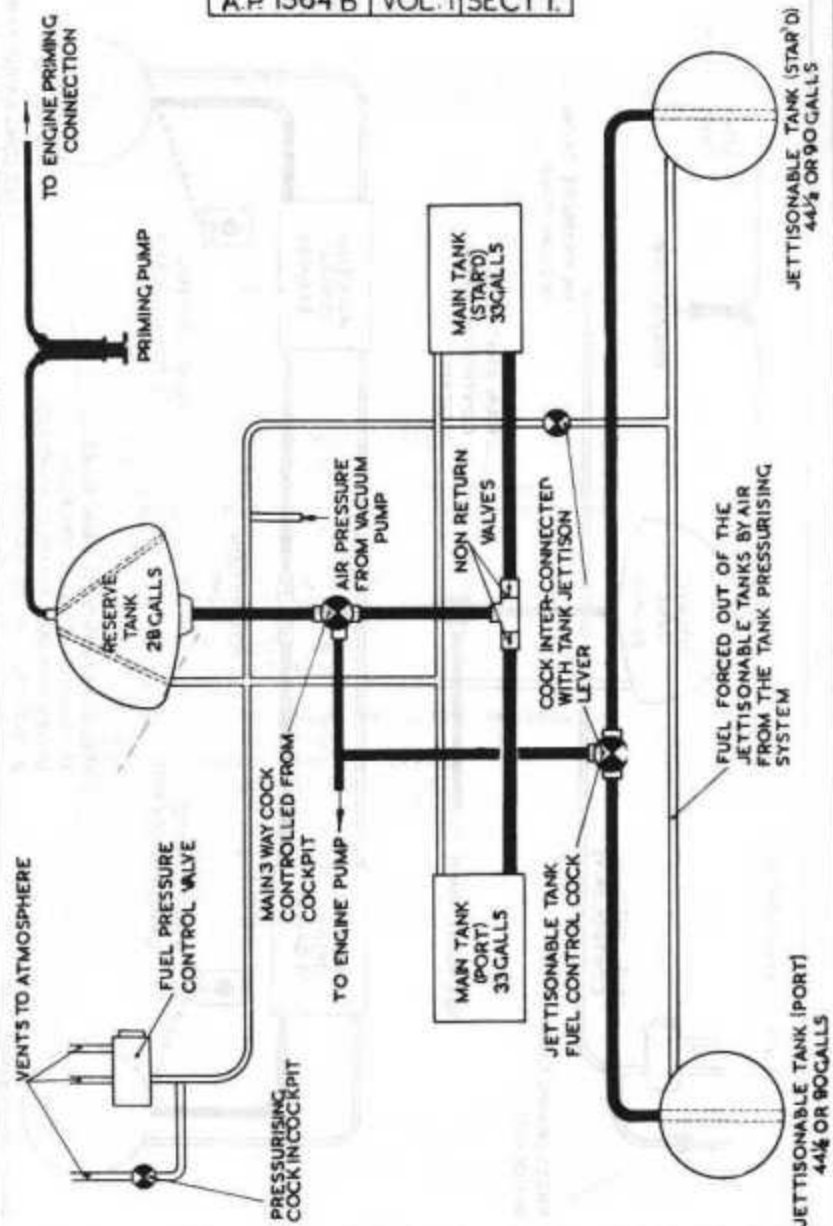


FIG. 5A FUEL SYSTEM DIAGRAM- WITH JETTISONABLE LONG-RANGE TANKS 5A

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SECTION 2

HANDLING AND FLYING NOTES FOR PILOT

1. ENGINE DATA: MERLIN XX
  - (i) Fuel: 100 octane only.
  - (ii) Oil: See A.P. 1464/C.37.
  - (iii) Engine limitations:

		R.p.m.	Boost lb/sq.in.	Temp. °C Clnt. Oil
MAX. TAKE-OFF TO 1,000 FEET	M	3,000	+12	-
MAX. CLIMBING 1 HR. LIMIT	M) S)	2,850	+ 9	125 90
MAX. RICH CONTINUOUS	M) S)	2,650	+ 7	105± 90
MAX. WEAK CONTINUOUS	M) S)	2,650	+ 4	105± 90
COMBAT 5 MINS LIMIT	M S	3,000 3,000	+14* +16*	135 105 135 105

Note: \* Combat boost is obtained by operating the boost control cut-out.

± 115°C coolant temperature is permitted for short periods at cruising rpm.

OIL PRESSURE: NORMAL: 60-80 lb/sq.in.  
MINIMUM: 45 "

MINM. TEMP. FOR TAKE-OFF: OIL: 15°C  
COOLANT: 60°C

FUEL PRESSURE: 8-10 lb/sq.in.

## 2. FLYING LIMITATIONS

### (1) Maximum speeds (mph IAS):

Diving:	390
Undercarriage down:	120
Flaps down:	120

- (ii) At AUWs in excess of 8,750 lbs. care is necessary in ground handling and the aircraft should be taken off only from concrete or equivalent runways.
- (iii) Spinning is prohibited at all times of Mark IID and IV aircraft, and of Mark IIA, B and C aircraft only when carrying 90-gallon drop tanks, bombs, SCI, containers, or RP.
- (iv) Aerobatics are prohibited and violent manoeuvres must be avoided when carrying 90-gallon drop tanks, bombs, SCI, containers, or RP (Mk. IIA, B and C aircraft only).
- (v) Aircraft carrying drop tanks should not be dived.
- (vi) Mark III containers must not be dropped at speeds in excess of 150 mph IAS and at heights lower than 500 feet.
- (vii) Bombs should be jettisoned and RP fired, if possible, before landing.

## 3. POSITION ERROR CORRECTIONS

From	100	120	150	180	210	270	mph IAS
To	120	150	180	210	270	320	mph IAS
Add	4	2	0				mph
Subtract			0	2	4	6	mph

## 4. MANAGEMENT OF FUEL AND OIL SYSTEMS

- (1) The Main Tanks should be used first, but if the Reserve Tank is used before the Main Tanks, the following precautions must be observed:
  - (a) Change over to MAIN TANKS ON before emptying the Reserve tank.
  - (b) If this has not been done and the engine cuts, close the throttle (to avoid over-revving when the engine picks up) and change over to MAIN TANKS ON at once.

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and in Pilot's Notes by A.L/P. Volume I and Pilot's Notes

- (c) In order to displace air drawn into the fuel system from the empty reserve tank, the engine must be windmilled at high speed, when it will pick up after a few seconds. It is emphasised that the pick-up will not be immediate after the change-over.
- (ii) If fitted with fixed auxiliary tanks:
  - (a) Start and take-off in the normal way on the main tanks.
  - (b) As soon as the contents gauge registers only 5 gallons in the main tanks, switch ON the auxiliary tank pumps.
  - (c) Switch OFF the pumps immediately the contents gauge registers 25 gallons.
  - (d) When the contents of the MAIN TANKS are again reduced to 5 gallons, switch ON the pumps until the contents gauge again registers 25 gallons and then switch OFF the pumps. The auxiliary tanks will then be practically empty.
- (iii) If fitted with drop tanks:
  - (a) Start and take-off in the normal way on the main tanks.
  - (b) At a safe height (say 2,000 feet) change over to a drop tank and turn the pressurising cock to PRESSURE. Turn OFF the main tanks.
  - (c) When the drop tank is empty and the fuel pressure warning light comes on, change-over to the second drop tank and at the same time turn ON the reserve tank, which should still be full. This will enable the engine to pick up more quickly and when it does so, turn OFF the reserve tank and change-over to the second drop tank.
  - (d) When the second drop tank is empty and the fuel pressure warning light comes on, turn ON the main tanks and turn OFF the drop tank. If the engine does not pick up on the main tanks, prime the system by using the reserve tank as before.



- (e) The cock for the auxiliary oil tank (if fitted) should be turned on about 3½ hours after take-off, but not before this time. After having been turned on, the cock cannot afterwards be turned off during flight.
- (f) On reinforcing flights, under maximum range engine conditions (2,650 rpm and +4 lb/sq. in. boost on climb to height, and level flight at 190 mph IAS reducing to 160 mph L.S. after jettisoning tanks) oil consumption is considerably reduced and, therefore, the auxiliary oil tank should not be turned on until after approximately 5 hours flight, when there will be sufficient space in the main tank to accommodate the extra 4 gallons. The normal oil tank should be filled to 8 gallons only.

#### 5. PRELIMINARIES

- (1) If fitted with R.P. and a drop tank or R.P. and a bomb, the aircraft should be trimmed carefully to relieve stick load. The recommended aileron tab setting is neutral at full load. When with a drop tank fitted under the port wing, changes in load will cause the following alterations in trim:
- |                                  |                         |
|----------------------------------|-------------------------|
| Tank empty:                      | Slightly right wing low |
| Tank empty and R.P. fired:       | Trim satisfactory.      |
| Tank jettisoned and R.P. fired:  | Slightly right wing low |
| Tank jettisoned, R.P. not fired: | Right wing low.         |
- (ii) Switch on the undercarriage indicator and check green lights. Test the change-over switch.
- (iii) See that the short (lower) arm of the hydraulic selector safety catch is across the wheels up slot of the gate.
- (iv) Check that the throttle pushbutton master switch is OFF.
- (v) Check contents of fuel tanks. If fitted with auxiliary tanks see that the pump switches or cock control are OFF.
- (vi) Test operation of flying controls.
- (vii) See that the cockpit hood is locked open.

Revised in Vol. I by A.L. 42 A.P. 1564B & D, Sect. 2  
and in Pilot's Notes by A.L/P. Volume I and Pilot's Notes

#### 6. STARTING THE ENGINE AND WARMING UP

- (1) Set fuel cock to MAIN TANKS ON.
- (ii) Set the controls as follows:
- |                      |   |               |
|----------------------|---|---------------|
| Throttle             | - | ½ inch open   |
| Propeller control    | - | Fully forward |
| Supercharger control | - | MODERATE      |
| Radiator shutter     | - | OPEN          |
- (iii) If an external priming connection is fitted, high volatility fuel (Stores ref. 34A/111) should be used for priming at air temperatures below freezing. Work the priming pump until the fuel reaches the priming nozzles; this may be judged by a sudden increase in resistance.
- (iv) Switch ON the ignition and press the starter and booster coil pushbuttons. Turning periods must not exceed 20 seconds, with a 30 seconds wait between each. Work the priming pump as rapidly and vigorously as possible while the engine is being turned; it should start after the following number of strokes if cold:
- |                       |     |     |     |    |     |     |
|-----------------------|-----|-----|-----|----|-----|-----|
| Air temperature °C:   | +30 | +20 | +10 | 0  | -10 | -20 |
| Normal fuel:          | 3   | 4   | 7   | 12 |     |     |
| High volatility fuel: |     |     |     | 4  | 8   | 18  |
- (v) At temperatures below freezing it will probably be necessary to continue priming after the engine has fired and until it picks up on the carburetor.
- (vi) Release the starter button as soon as the engine starts and as soon as it is running satisfactorily release the booster coil pushbutton and screw down the priming pump.
- (vii) Open up slowly to 1,000 rpm, then warm up at this speed.

#### 7. TESTING THE ENGINE AND INSTALLATIONS

##### While warming up:

- (1) Check temperatures and pressures, and test operation of hydraulic system by lowering and raising the flaps.

After warming up, with two men on the tail:

Note: The following tests constitute a comprehensive check to be carried out after inspection or repair, or at the pilot's discretion. In normal circumstances they may be reduced in accordance with local instructions.

- (ii) Open up to +4 lb/sq.in. boost and exercise and check operation of the two-speed supercharger. Rpm should fall when S ratio is engaged.
- (iii) At +4 lb/sq.in. boost exercise and check operation of the constant speed propeller. Rpm should fall to 1,800 with the control fully back. Check that the generator is charging; the power failure light should be out and the voltage 14 or over.
- (iv) With the propeller control fully forward open the throttle up to +12 lb/sq.in. boost and check static boost and rpm which should be 3,000.
- (v) Throttle back to +9 lb/sq.in. boost and test each magneto in turn. The drop should not exceed 150 rpm.
- (vi) Before taxiing check brake pressure (100 lb/sq.in. minm.) and pneumatic supply pressure (230 lb/sq.in.).

8. CHECK LIST BEFORE TAKE-OFF

- |                       |   |
|-----------------------|---|
| T - Trimming tabs     | - Rudder: Fully right   |
|                       | Elevator: Neutral   |
| P - Propeller control | - Fully forward   |
| F - Fuel              | - Check contents of main tanks.                                       |
|                       | - MAIN TANKS ON   |
|                       | - Aux. tank cock or pumps - OFF                                       |
|                       | - Pressurising cock - ATMOSPHERE                                      |
| F - Flaps             | - UP (28° down - two divs. on indicator - for shortest take-off run). |
|                       | Supercharger control - MODERATE                                       |
|                       | Radiator shutter - Fully OPEN   |

9. TAKE-OFF

- (1) Open the throttle slowly to the gate, or fully if full take-off boost is necessary.

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and in Pilot's Notes by A.L/P. Volume I and Pilot's Notes

- (ii) Any tendency to swing can be counteracted by the rudder. When fitted with 2 x 500 lb. bombs the tendency to swing left is slightly more pronounced.
- (iii) After raising the undercarriage return the selector lever to neutral, and retrim nose heavy.
- (iv) Do not start to climb before a speed of 140 mph IAS is attained.

10. CLIMBING

- (1) The speeds for maximum rate of climb are as follows:

Up to 16,000 feet:	140 mph IAS
At 21,000 feet:	155 mph IAS
At 26,000 feet:	130 mph IAS
At 31,000 feet:	125 mph IAS

Change to S ratio when the boost has fallen by 5 lb/sq.in.  
At full load 155 mph IAS is the most comfortable climbing speed.  
Considerable surging may be experienced above 8,000 feet on aircraft on which the air intake duct has been removed.

- (ii) When fitted with 2 x 90-gallon drop tanks the aircraft are longitudinally unstable on the climb.
- (iii) When fitted with 2 x 500 lb. bombs there is a similar tendency to pitch if the rudder is not held steady.
- (iv) The fuel tank pressure control should normally be kept to ATMOSPHERE (except when required to supply fuel from the drop tanks), but should be turned on (PRESSURE) if the fuel pressure warning light comes on.

11. GENERAL FLYING

- (1) Stability: The aircraft are normally just stable longitudinally, but when carrying 90-gallon drop tanks, or R.P. and one 90-gallon drop tank, they become unstable longitudinally and, in the first case, 190 mph IAS is the minimum comfortable flying speed. In conditions of absolute calm this can be reduced to 180 mph IAS. When carrying bombs, R.P., or containers, longitudinal stability is unaffected.

(11) Change of trim:-

Undercarriage down - Nose slightly down  
Flaps down - Nose down

(iii) In steep turns there is a tendency to tighten up.

(iv) In bad visibility near the ground, flaps should be lowered to about 40° (3 divisions) and the propeller speed control set to give 2,550 rpm. Speed may then be reduced to about 110 mph IAS. The radiator shutter must be opened to keep the temperature at about 100°C.

(v) When operating in tropical conditions prolonged flying at maximum cruising power should be avoided when top speed is not essential.

12. MAXIMUM PERFORMANCE

(i) Climbing

See Para.10(i).

(ii) Combat

Use S ratio if the boost in M ratio is 2 lb/sq.in. below the maximum permitted.

13. ECONOMICAL FLYING

(i) Climbing: Climb at 2,850 rpm and +9 lb/sq.in. boost at the speeds recommended for maximum rate of climb (See Para.10).

(ii) Cruising: For maximum range fly in M ratio and at maximum obtainable boost not exceeding +4 lb/sq.in. and reduce speed by reducing rpm which may be as low as 1,800, but check that the generator is charging. On some early aircraft it will not do so at below 2,000 rpm. If at 1,800 rpm (or 2,000 if necessary) the speed is higher than that recommended, reduce boost. S ratio should only be used if at 2,600 rpm the recommended speed cannot be obtained in M ratio.

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and in Pilot's Notes by A.L/P. Volume I and Pilot's Notes

(iii) The recommended speeds (mph IAS) for maximum range are:

Standard aircraft:	160
When fitted with 2 x 44 or 45 gal. tanks:	160
When fitted with 2 x 90 gal. tanks:	170
	or as near as possible.
When fitted with 2 x 250 lb. bombs:	170
When fitted with 2 x 500 lb. bombs:	180

Below 5,000 feet these speeds should be increased by about 10 mph.

14. STALLING

(i) At the stall one wing usually drops sharply, often over the vertical, with flaps either up or down.

(ii) The average stalling speeds (mph IAS) for the aircraft at various A/W (from 7,600 lbs to 9,200 lbs.) are:

Undercarriage and flaps UP:	80-90
Undercarriage and flaps DOWN:	60-75

The speeds for individual aircraft may vary by 5 mph.

15. SPINNING

(i) Spinning of Mk.IID and Mk.IV aircraft is prohibited at all times.

(ii) On Mark IIA, B and C aircraft spinning is prohibited when carrying 90-gallon drop tanks, bombs, S.C.I. or R.P.

(iii) Recovery is normal, but the loss of height involved in recovery may be very great and the following limits are to be observed:

(a) Spins are not to be started below 10,000 feet.

(b) Recovery is to be initiated before two turns are completed.

(iv) A speed of 150 mph IAS should be attained before starting to ease out of the resultant dive.

## 16. AEROBATICS

- (1) The following speeds are recommended:

<u>Loop:</u>	At least 280 mph IAS
<u>Roll:</u>	280-250 mph IAS
<u>Half roll off loop:</u>	At least 300 mph IAS
<u>Upward roll:</u>	300 mph IAS.

## 17. DIVING

- (1) Speed builds up slowly in the dive and the aircraft becomes tail heavy as the speed increases. The elevator trimming tabs should be used with care.
- (ii) Care should be taken not to allow the aircraft to yaw to the right, as this produces a marked nose-down pitching tendency.
- (iii) If fitted with bombs, S.C.I., or containers, the aircraft should be eased out of the dive gently. If fitted with drop tanks it should not be dived.

## 18. CHECK LIST BEFORE LANDING

- (1) Check brake pressure (100 lbs/sq.in. minm.).
- (ii) Reduce speed to 120 mph IAS and check that cockpit hood is locked open.
- U - Undercarriage - DOWN (check green lights)
- P - Propellor control - Fully forward
- Supercharger control - MODERATE
- F - Flaps - DOWN

## 19. APPROACH AND LANDING

- (1) Approach speeds (mph IAS) at normal load:

Engine assisted:	95	(flaps up)
Glide:	105	(105)
		(115)

Note: If carrying drop tanks, bombs, or R.P., the normal engine assisted approach should be made at about 110 mph IAS.

- (ii) Undercarriage: The lever should have been left in neutral, but if it has been left in the UP position, be careful to disengage the thumb catch by easing the selector lever forward before trying to move it to the DOWN position, otherwise the lever may become jammed. Return the lever to neutral as soon as the undercarriage is down.

- (iii) Flaps: If 120 mph IAS is exceeded with the flaps fully down, they will be partially raised by the airflow. They will automatically move to the fully down position when speed is reduced sufficiently, provided that the selector lever is left at DOWN.
- (iv) Landing with R.P. only on one wing should be made at as high a speed as possible and care must be taken to counteract drooping of the wing.

## 20. MISLANDING

- (1) Raise the undercarriage immediately.
- (ii) Climb at about 90 mph IAS.
- (iii) Raise the flaps at a safe height of about 200-300 feet, at a speed of not less than 120 mph IAS.
- (iv) With one 500 lb. bomb stuck up open the throttle slowly and speed on the initial climb should be 110 mph IAS before raising flaps at 120 mph IAS.

## 21. AFTER LANDING

- (1) Raise the flaps before taxiing.
- (ii) To stop the engine, idle for  $\frac{1}{2}$  minute at 800-900 rpm, then pull the slow-running cut-out and hold it out until the engine stops.
- (iii) Turn OFF the fuel cock and switch OFF the ignition.
- (iv) Check that the hydraulic selector safety plate is covering the WHEELS UP position.
- (v) Oil dilution.- (See A.P.2095 Pilot's Notes General)  
The correct dilution period for these aircraft is:
- Atmospheric temperature above  $-10^{\circ}\text{C}$ : 1 minute  
Atmospheric temperature below  $-10^{\circ}\text{C}$ : 2 minutes

22. FUEL CAPACITIES AND CONSUMPTION

(i) Fuel capacities:

(a) Normal:  
 Two Main tanks (33 gals. each): 66 gallons.  
 One Reserve tank: 28 gallons.  
 Total: 94 gallons.

(b) Long-range (totals):

With 2 fixed under-wing tanks (44 gallons each): 182 gallons.  
 With 2 x 45 gallon drop tanks: 184 gallons.  
 With 2 x 90 gallon drop tanks: 274 gallons.

(ii) The approximate consumptions (gals/hr.) in WEAK mixture are as follows:

Boost lb/sq. in.	M ratio at 8,000 - 20,000 ft.			S ratio at 14,000 - 30,000 ft.		
	R.p.m.			R.p.m.		
	2,650	2,300	2,000	2,650	2,300	2,000
+4	56	50	46	57	51	47
+2	52	46	42	53	47	45
0	47	42	38	48	43	39
-2	42	37	34	43	39	35
-4	37	33	30	38	34	31

(iii) The approximate consumptions in RICH mixture are as follows:

R.p.m.	Boost lb/sq. in.	Galls/hr.
3,000	+12	115
3,000	+ 9	100
2,850	+ 9	95
2,650	+ 7	80

23. BEAM APPROACH

STAGE	Indicated height (feet) *	I.A.S. m.p.h.	R.p.m.	Approx. Boost	Actions	Change of trim and Remarks
PRELIMINARY APPROACH	1,500 1,500	120 120	2,400 2,400	-2 -1	Flaps down 30° Lower w/o on Q.D.R. over I.M.B.	Strongly nose down Slightly nose down
AT OUTER MARKER BEACON	600	95-100	3,000 3,000	-4 0	Flaps down to 60°	Nose down Should give level flight
AT INNER MARKER BEACON	100	90-95	3,000			Nose up
OVERSHOOT	Up to 400	95-100	3,000	Full throttle	Raise w/c and retrim. Raise flap to 30° and retrim. Raise flaps fully and retrim. Adjust boost and r.p.m. at 1,000 feet	Nose up Nose up Nose up

\* Altimeter adjusted for Q.P.E. and touch-down error as follows:  
 At take-off, with no flap, the altimeter reads -30 feet.  
 At touch-down, with 60° flap, the altimeter reads -55 feet,  
 so add two millibars to Q.P.E. to give zero reading at touch-down.  
 Note: The above speeds should be increased by 5 m.p.h. for Mark IID and IV aircraft.

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Amendment List 7  
to  
AIR PUBLICATION LIST  
Title's Notes

Air Ministry  
March 1944

AMENDMENT LIST

SECTION II

Amendment List to Air Publication List  
Affecting the Title's Notes and  
only. The letters are consecutively  
I and 2. The Title's Notes will be  
this Amendment List has been incorporated.

(1) SECTION I  
Amendment List to Air Publication List  
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NOTE: This Amendment List applies to A.P.1000-1000  
Notes only. A corresponding amendment list  
to A.P.1000-1000 is being distributed  
separately by A.P.1000-1000.

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