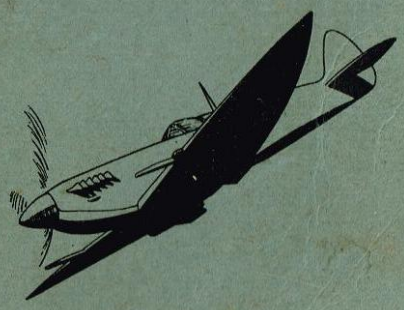
A.P. 1565 G & H—P.N.

F/Lt. HAYWOOD

PILOT'S NOTES
FOR
SPITFIRE

MARK F.VII—MERLIN 64 or 71 ENGINE
MARK F.VIII—MERLIN 63, 66 or 70 ENGINE



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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.

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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. 1565 G & H—P.N.

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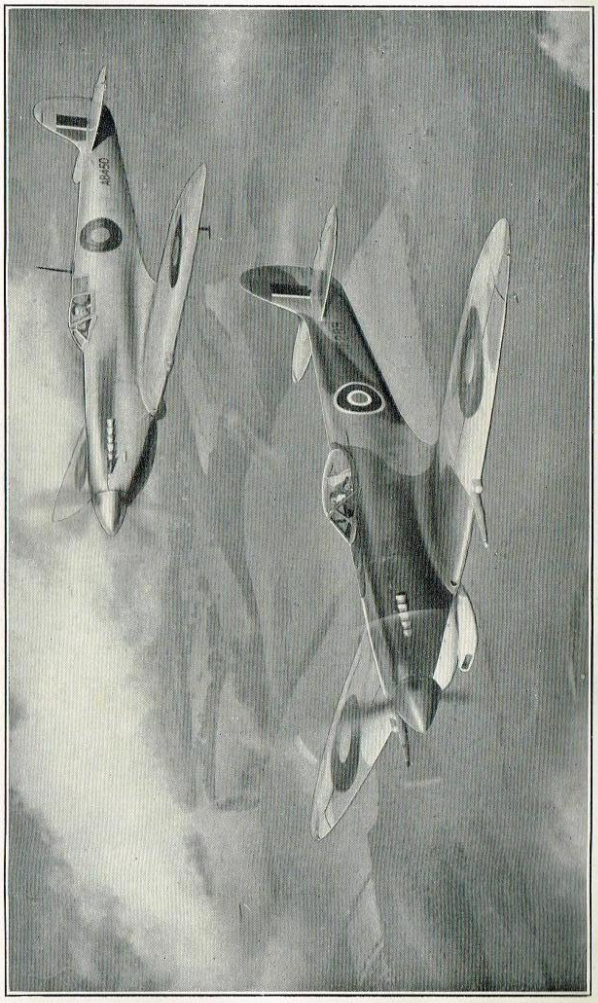


SPITFIRE F.VII and F.VIII

AIR MINISTRY
December 1943

AIR PUBLICATION 1565G & H—P.N.
Pilot's Notes

SPITFIRE F. MK. VII AND F. MK. VIII PILOT'S NOTES

LIST OF CONTENTS

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 Spitfires Mk. VII and Mk. VIII are fitted with the following Marks of Merlin engine:

The F. Mk. VII	Merlin 64
The HF. Mk. VII	Merlin 71
The F. Mk. VIII	Merlin 63
The LF. Mk. VIII	Merlin 66
The HF. Mk. VIII	Merlin 70

Merlin 63 and 64 engines have SU carburettors and Merlin 66, 70 and 71 engines have Bendix-Stromberg carburettors. All are fitted with Rotol 35° four-bladed propellers. The Spitfire VII is fitted with a pressure cabin and the Spitfire VIII is fully tropicalised. The aircraft controls, including the undercarriage, flaps and brakes, are identical with those on earlier Marks.

FUEL, OIL AND COOLANT SYSTEMS

2. **Fuel tanks** (*see* Fig. 4).—Fuel is carried in four self-sealing tanks, two (one above the other) forward of the cockpit and one in each wing. The top tank feeds into the lower tank and fuel in the wing tanks is transferred to the top tank by means of air pressure through a transfer valve controlled by the pilot. It is delivered to the carburettor, through a filter, by an engine-driven pump. On Merlin 63 and 64 engine installations there is a fuel cooler, and on Merlin 66, 70 and 71 installations a de-aerator in the carburettor which is vented to the top tank.

The tank capacities are as follows:

Top tank	47 gallons
Bottom tank	49 gallons
2 Wing tanks (13 gallons each)	26 gallons
Total	122 gallons

An auxiliary drop tank of 30, 90 or 170 gallons capacity can be fitted under the fuselage. To meet the possibility of engine cutting due to fuel boiling in warm weather at high altitudes, the fuselage top and bottom 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.

3. **Fuel cocks.**—The cock control for the main tanks is a lever (54) fitted below the engine-starting pushbuttons; the pressurising cock (65) is below the right-hand side of the instrument panel. The transfer valve selector lever (55), for admitting pressure to either wing tank, is next to the main cock control. The cock control (72) and jettison lever (71) for the auxiliary drop tank are mounted together on the right-hand side of the cockpit, below the undercarriage control unit. The jettison lever is pulled up to jettison the drop tank, but cannot be operated until the cock control is moved forward to the OFF position.

4. **Fuel pumps.**—On Stromberg carburettor installations an electric booster-pump, operated by a switch on the left-hand side of the cockpit, is fitted in the lower main tank for facilitating engine starting and engine recovery during combat, and should, therefore, be left on in flight. On early aircraft, where this pump is not fitted, a hand-wobble pump, just forward of the remote contactor, is provided.

NOTE.—The idle cut-off lever must be in the fully aft position before the pump is operated with the engine stationary.

5. **Fuel contents gauge and warning light**

(*a*) The contents gauge on the right-hand side of the instrument panel has two dials, one for the top tank and another for the bottom tank. A red mark on the former indicates the level of fuel at which fuel should be transferred from the wing tanks. On early aircraft there is only one dial (44) showing the combined contents of both tanks.

(*b*) The fuel pressure warning light (46) comes on when the pressure drops to 6 lb./sq.in. (10 lb./sq.in. on Stromberg carburettor installations) and is switched off by the undercarriage indicator switch.

(*c*) Provision is made on later aircraft for a fuel tank low level warning light.

6. **Oil system.**—On early aircraft the oil tank is housed in the rear fuselage, immediately aft of the cockpit, and has an oil capacity of 7·5 gallons. On later aircraft it is fitted below the engine mounting, and the oil capacity is increased to 8·5 gallons. Either tank has an air space of approximately 3 gallons. The oil tank is pressurised to $2\frac{1}{2}$ lb./sq.in. and the supply passes through a filter before entering the engine. A cooler is fitted inside the fairing of the port wing radiator and oil pressure (47) and temperature (43) gauges are fitted on the instrument panel. When carrying an auxiliary fuel tank of 170 gallons capacity a larger oil tank of either 8·5 or 14·5 gallons capacity must be fitted.

7. **Engine coolant system.**—The system is thermostatically controlled, the under-wing radiators being by-passed until the coolant reaches a certain temperature. The header tank is mounted above the reduction gear casing and is fitted with a relief valve. The radiator flaps are fully automatic and are designed to open at a coolant temperature of 115°C. A pushbutton on the electrical panel is fitted for ground testing, and there is a coolant temperature gauge (42) on the instrument panel.

MAIN SERVICES

8. **Hydraulic system.**—Oil is carried in a reservoir on the fireproof bulkhead and passes through a filter to an engine-driven pump for operation of the undercarriage and tailwheel.

9. **Electrical system.**—A 12-volt generator supplies an accumulator which in turn supplies the whole of the electrical installation. A voltmeter (32) across the accumulator is fitted at the top of the instrument panel and a red light (16) on the electrical panel, marked POWER FAILURE, is illuminated when the generator is not charging the accumulator.

NOTE.—If the electrical system fails or is damaged, the supercharger will be fixed in M ratio and the radiator flaps will remain closed.

10. **Pneumatic system.**—An engine-driven air compressor feeds two storage cylinders for operation of the flaps, radiator flaps, supercharger operating ram, brakes and guns. The cylinders each hold air at 300 lb/sq.in. pressure.

NOTE.—If the pneumatic system fails, the supercharger will be fixed in M ratio, but the position of the radiator flaps will depend on the nature of the failure.

AIRCRAFT CONTROLS

11. **Flying controls.**—The control column is of the spade-grip pattern and incorporates the brake lever, gun and cannon firing control (6) and camera gun pushbutton (7). The rudder pedals have two positions and are adjustable for leg reach by rotation of star wheels on the sliding tubes.

12. **Trimming tabs.**—The elevator trimming tabs are controlled by a handwheel (12) on the left-hand side of the cockpit, the indicator (52) being on the instrument panel. The rudder trimming tab is controlled by a small handwheel (20) and is not provided with an indicator. The aircraft tends to turn to starboard when the handwheel is rotated clockwise.

13. **Undercarriage control.**—The undercarriage selector lever (73) moves in a gated quadrant on the right-hand side of the cockpit. To raise the undercarriage the lever must be moved downwards and across, to disengage it from the gate, and then moved forward to the full extent of the quadrant. When the undercarriage operation is completed the lever will automatically spring into the forward gate.

To lower the undercarriage the operation is reversed and the lever will spring into the rear gate when the undercarriage is down.

The lever must never be moved into either gate by hand, as this will cut off the hydraulic pressure. An indicator in the quadrant shows DOWN, IDLE or UP, depending on the position of the hydraulic valve. UP and DOWN should show only during the corresponding operation of the undercarriage, and IDLE when the lever is in either gate. If, when the engine is not running, the indicator shows DOWN, it should return to IDLE when the engine is started; if it does not, probable failure of the hydraulic pump is indicated.
For emergency lowering of the undercarriage, *see* Para. 65.

14. **Undercarriage indicators**

(*a*) *Electrical visual indicator.*—The electrically operated visual indicator (25) has two semi-transparent windows on which the words UP on a red background and DOWN on a green background are lettered; the words are illuminated according to the position of the undercarriage. The master switch (23) incorporates a sliding bar which prevents the ignition switches from being switched on until the indicator is illuminated. The switch also operates the tailwheel indicator light and the fuel pressure warning light.

(*b*) *Mechanical position indicators.*—A rod that extends through the top surface of the main plane is fitted to each undercarriage unit. When the wheels are down the rods protrude through the top of the main planes and when they are up, the tops of the rods, which are painted red, are flush with the main plane surface.

(*c*) *Tailwheel indicator.*—A green light (24) below the undercarriage indicator is illuminated when the tailwheel is in the fully down position.

15. **Undercarriage warning horn.**—The horn sounds when the throttle lever is nearly closed and the undercarriage is not lowered. It may be silenced, however, by depressing the pushbutton on the side of the throttle quadrant. As soon as the throttle is opened again the pushbutton is automatically released and the horn will sound when the throttle is again closed.

16. **Flap control.**—The split flaps have two positions only, up and fully down. They are controlled by a finger lever (28) on the instrument panel.

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 (53), showing the air pressures in the pneumatic system cylinders and at each brake, is mounted on the instrument panel.

18. **Flying control locking struts.**—Two struts are stowed on the right-hand side of the cockpit, aft of the seat. The longer strut and the arm attached to it lock the control column to the seat and to the starboard datum longeron, and the shorter strut, attached to the other strut by a cable, locks the rudder pedals. The controls should be locked with the seat in its highest position.

ENGINE CONTROLS

19. **Throttle.**—The throttle lever (11) is gated at the take-off position. There is a friction adjuster (10) on the side of the quadrant. The mixture control is automatic and there is no pilot's control lever.

20. **Propeller control.**—The speed control lever (9) on the throttle quadrant varies the governed r.p.m. from 3,000 down to 1,800. The friction adjuster is on the side of the quadrant.

21. **Supercharger controls.**—The two-speed two-stage supercharger automatically changes to S ratio at about 21,000 feet (14,000 feet on Merlin 66 installations) on the climb, and back to M ratio at about 19,000 feet (12,500 feet on Merlin 66 installations) on the descent. An over-ride switch (39) is fitted on the instrument panel by means of which M ratio may be selected at any height. There is a pushbutton (15) on the electrical panel for testing the gear change on the ground, and a red light (41) on the instrument panel comes on when S ratio is engaged, on the ground or in flight.

22. **Intercooler protector.**—The pushbutton (38) on the instrument panel, on early aircraft, springs out when the charge temperature becomes excessive and the supercharger automatically changes to M ratio. When the temperature of the charge returns to normal the supercharger will return to S ratio, but only if the button is pushed in.

23. **Radiator flap control.**—The pushbutton (14) for testing the radiator flaps is on the electrical panel.

24. **Slow-running cut-out.**—(Merlin 63 and 64 installations.) The control on the carburettor is operated by pulling the ring below the left-hand side of the instrument panel.

25. **Idle cut-off control.**—(Merlin 66, 70 and 71 installations.) The idle cut-off is operated by moving the lever on the throttle quadrant to the fully aft position.

26. **Cylinder priming pump.**—A hand-operated pump (45) for priming the engine is fitted below the right-hand side of the instrument panel.

27. **Ignition switches and starter buttons.**—The ignition switches (22) are on the left-hand side of the instrument panel and the booster-coil (49) and engine-starter (48) pushbuttons immediately below the panel. Each pushbutton is covered by a safety shield.

28. **Ground battery starting.**—The socket for starting from an external supply is mounted on the starboard engine bearer.

29. **Hand starting.**—A starting handle is stowed behind the seat and a hole in the starboard side of the engine cowling gives access for connecting the handle to the hand-starting gear.

30. **Carburettor air intake control (Mark VIII aircraft only)** On early aircraft the filter in the air intake can be by-passed, in the event of it becoming choked, by moving the control lever (8) in the cockpit from COLD to HOT. Unfiltered air is then admitted from the engine bay. On later aircraft the normal air intake (OPEN position of the control lever) is not filtered and is used at all times except for take-off and landing on sandy or dusty aerodromes, or when flying through sand storms, when the CLOSED position should be used. Filtered air is then taken from the engine bay.

31. **Oil dilution.**—A pushbutton (13) for operating the solenoid valve is fitted on the electrical panel.

PRESSURE CABIN (Mark VII aircraft only)

32. **Automatic valve.**—The differential pressure in the cabin is automatically controlled by a valve to a maximum of +2 lb./sq.in. and commences to build up on the climb, the maximum being reached and maintained at heights of 28,000 feet and above. The reverse holds on the descent.

33. **Air supply.**—Air is drawn through an intake just below the starboard exhaust manifolds, passes through a filter to an engine-driven blower and then enters the cabin by an inlet at the rear of the pilot's seat. A spill valve in the supply line, operated by a control (61) on the right-hand side of the cockpit, diverts the air supply to atmosphere when pressurising of the cabin is not required.

34. **Cabin hood.**—On early aircraft the hood is of the detachable type and is secured by four catches operated by the pilot, but on later aircraft a jettisonable, sliding, balloon hood is fitted. This hood is similar to the standard Spitfire hood, but is fitted with a rubber seal in the gap between the hood and the fuselage, pressure for which is taken from the air supply line inside the cockpit and controlled by a lever on the left-hand side of the cockpit. For jettisoning and emergency opening of hood, *see* Para 66.

35. **Cabin ventilators.**—Two hand-operated ventilators are provided in the cockpit, an intake incorporated in the rear view mirror and an extractor (62) to the right of the pilot.

NOTE.—If, at low altitudes, the cockpit is uncomfortably warm, the direct vision panel should be opened.

36. **Cabin instruments.**—The cabin instruments are grouped on a small panel immediately below the right-hand side of the main instrument panel. An altimeter (57) is provided to which the pilot refers when adjusting the oxygen supply, and visual indication of any drop in cabin pressure is given by two red warning lights (56) which come on when the differential pressure has fallen by 1 lb./sq.in.

37. **Operation of controls:**

(i) *To pressurise the cabin:*

(*a*) Close the two ventilators (if open).

(*b*) Close the spill valve (if open) by moving the lever (61) marked TO PRESSURISE, on the right-hand side of the cockpit, forward and downward in the direction of the arrow.

(*c*) Turn ON the HOOD SEAL PRESSURE cock (if fitted) on the left-hand side of the cockpit.

(ii) *To exhaust cabin pressure:*

(*a*) Turn OFF the HOOD SEAL PRESSURE cock (if fitted).

(*b*) Open the spill valve and ventilators to cool the cabin as required.

For jettisoning and emergency opening of hood, *see* Para. 66.

NOTE.—It is recommended that the cabin should be pressurised before or immediately after take-off. If the cabin is pressurised or exhausted at altitude the hood sealing control should be moved slowly to avoid the risk of damage to the ears by a sudden change of pressure.

OTHER CONTROLS

38. **Cockpit door (Mark VIII aircraft only).**—The cockpit door is provided with a two-position catch (1) which allows it to be partly opened and so prevent the hood from sliding shut when taking off and landing, and in the event of a forced landing. It will be found that the catch operates more easily when the aircraft is airborne than when on the ground.

39. **Identification lamp.**—The downward identification lamp is fitted flush with the under surface of the starboard wing and is controlled by the forward switch and morsing key on the signalling switchbox (58). A colour (red, green and amber) selector lever is fitted just aft of the switchbox for operation of the colour disc.

40. **Signal discharger.**—The recognition device fires one of six cartridges out of the top of the rear fuselage when the handle to the left of the pilot's seat is pulled upwards. On some aircraft a pre-selector control is mounted above the operating handle.

PART II

HANDLING

41. **Management of fuel system**

(i) *Flying restrictions:*

(*a*) When fitted with a 90-gallon or 170-gallon drop tank the aircraft is restricted to "straight flying" (*See* A.P. 2095 1.A3) until the tank is jettisoned.

NOTE.—This restriction does not apply when fitted with a 30-gallon drop tank.

(*b*) Drop tanks should be jettisoned only in straight and level flight, and then only if absolutely necessary.

(ii) *Management of tanks:*

Main fuel system:

(*a*) Start and warm up on the main tanks.

(*b*) Take-off on the main tanks and when the contents of these drop to 80 gallons or less (to the red mark on the contents gauge on later aircraft), fuel should be transferred to the top tank from one of the wing tanks. The transfer valve selector cock should be turned OFF after three minutes.

(*c*) Repeat the above procedure with the second wing tank when the contents of the main tanks again drop to 80 gallons or less (to the red mark on the gauge on later aircraft). It is important to leave the transfer selector cock OFF, or pressurising of the main tanks will not be effective.

When fitted with auxiliary tanks:

(*d*) Start, warm up and take-off on the main tanks and change over to the drop tank at a safe height (say 2,000 feet). Turn OFF the main tanks.

(*e*) When the fuel pressure warning light comes on, turn OFF the drop tank, turn ON the main tanks, and if maximum range is required, or in other special circumstances, jettison the tank.

(*f*) If a tank has to be jettisoned before it is empty, first turn ON the main tanks and then turn OFF the drop tank.

NOTE.—It is necessary to ensure that the drop tank cock is OFF when the tank is empty or jettisoned; otherwise, air may be sucked into the main fuel system.

42. **Preliminaries**

(i) Check contents of fuel tanks. If fitted with a drop tank check that the cock is OFF.

(ii) Check that the undercarriage selector lever is down; switch on the indicator and see that DOWN and tailwheel light show green. Check voltmeter: 12 volts minm.

(iii) Test operation of flying controls.

(iv) On Mark VII aircraft secure the hood catches (if fitted) or check that the hood seal pressure control is OFF.

(v) In order to avoid damage to the propeller, the ground immediately below it should be cleared of any small stones or rubble before starting the engine.

43. **Starting the engine and warming up—F. Mks. VII and VIII (Merlin 63 and 64 engines)**

(i) Set main fuel cock ON and wing tank selector cock OFF.

(ii) Set the controls as follows:

Throttle	½ inch open
Propeller control	Fully forward
Supercharger over-ride switch	AUTO

(iii) If an external priming connection is fitted, high volatility fuel (Stores ref. 34A/111) should be used for priming at temperatures below freezing. Work the Ki-gass 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 buttons. 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 carburettor.

(vi) Release the starter button as soon as the engine starts and as soon as the engine is running satisfactorily release the booster-coil button and screw down the priming pump.

(vii) Open up slowly to 1,000 r.p.m., then warm up at this speed.

44. **Starting the engine and warming up—LF. Mark VIII and HF. Marks VII & VIII (Merlin 66, 70 and 71 engines)**

(i) Set main fuel cock ON and wing tank selector cock OFF.

(ii) Set the controls as follows:

Throttle	½ inch open
Propeller control	Fully forward
Idle cut-off control	Fully aft
Supercharger over-ride switch ..	AUTO

(iii) If an external priming connection is fitted, high volatility fuel (Stores ref. 34A/111) should be used for priming at temperatures below freezing. Work the Ki-gass priming pump until the fuel reaches the priming nozzles, this may be judged by a sudden increase in resistance, and then give the following number of strokes:

Air temperature °C.	+30	+20	+10	0	−10	−20
Normal fuel ..	3	4	7	12		
High volatility fuel				4	8	18

(iv) Switch ON the booster pump (or operate the wobble pump until the pressure warning light goes out).

NOTE.—Neither the booster pump nor the wobble pump must be operated unless the cut-off valve is closed or the engine is running. The wobble pump may be operated again, if necessary, after the engine has started and the idle cut-off control has been moved forward.

(v) Switch ON the ignition and press the starter and booster-coil pushbuttons.

(vi) As soon as the engine fires release the starter button and move the idle cut-off control forward. Release the booster-coil button and screw down the priming pump as soon as the engine is running satisfactorily.

NOTE.—If the engine is over-primed and fails to start, operate the idle cut-off control and switch off the booster pump while the engine is cleared by turning it through two or three revolutions.

(vii) Open up slowly to 1,000 r.p.m., then warm up at this speed.

45. **Testing the engine and installations**

While warming up:

(i) Check temperatures and pressures.

(ii) Press the radiator test pushbutton and have ground crew check that shutters open.

After warming up, with three men on the tail and one on the starboard wing-tip:

(iii) Open up to +4 lb./sq.in. boost and exercise and check operation of the two-speed supercharger by operating the test pushbutton. R.p.m. should fall when S ratio is engaged and the red light should come on.

(iv) At +4 lb./sq.in. boost, exercise and check operation of the constant-speed propeller. R.p.m. should fall to 1,800 with the control fully back. Check that generator is charging; the power failure light should be out and the voltage 14 or over.

(v) With the propeller control fully forward, open the throttle to the gate and check take-off boost and static r.p.m., which should be 3,000 at take-off boost.

(vi) Throttle back to +9 lb./sq.in. boost and test each magneto in turn. The drop should not exceed 150 r.p.m.

(vii) Before taxying, check brake pressure (80 lb./sq.in.) and pneumatic supply pressure (220 lb./sq.in.).

46. Check list before take-off

T—Trimming tabs	Elevator: Half a division nose down Rudder: Fully right
P—Propeller control	Fully forward
F—Fuel	Check contents of main tanks Main tank cock—ON Transfer cock—OFF Drop tank cock—OFF Electric booster pump (if fitted) —ON
F—Flaps	UP
Supercharger ..	Over-ride switch—AUTO Red light out

47. Take-off

(i) Open the throttle slowly, to the gate if +12 lb./sq.in. boost is needed. +7 lb./sq.in. is sufficient for a normal take-off.

(ii) Any tendency to swing can be counteracted by the rudder.

(iii) After raising the undercarriage see that the red indicator light—UP—comes on and the tailwheel light goes out. It may be necessary to hold the lever hard forward against the quadrant until the red indicator light does come on. Failure of the wheels to lock up may spoil the airflow through the radiators and oil cooler and result in excessive temperatures.

(iv) Do not start to climb before a speed of 140 m.p.h. I.A.S. is attained.

48. Climbing

(i) The speed for maximum rate of climb is 160 m.p.h. I.A.S. from sea level up to 25,000 feet, reducing by 3 m.p.h. per 1,000 feet above this height.

(ii) The fuel tank pressure cock should normally be kept OFF, but should be turned ON if the fuel pressure warning light comes on.

(iii) If, with the cabin pressurised (Mark VII aircraft), at any height above 35,000 feet the red warning lights come on, increase the oxygen supply and descend immediately to not more than that height.

(iv) Regulate the oxygen supply by the cabin altimeter.

49. General flying

(i) *Stability.*—On later aircraft fitted with horn balance elevators and large rudders there is a marked increase in longitudinal and directional stability, particularly at altitude.

(ii) *Change of trim:*

Undercarriage down	Nose down
Flaps down	Nose down
Flaps down (if fitted with horn balance elevator)	Nose up

(iii) In bad visibility near the ground, flaps should be lowered and the propeller set to give 2,650 r.p.m. Speed may then be reduced to 130 m.p.h. I.A.S.

50. **Stalling**

The stalling speeds (engine off) in m.p.h. I.A.S. at normal load (7,850 lb.) are as follows:—

Undercarriage and flaps up: 82

Undercarriage and flaps down: 74

51. **Spinning**

(i) Spinning is permitted and 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.

(ii) A speed of 150 m.p.h. I.A.S. should be attained before starting to ease out of the resultant dive.

(iii) Spinning is not permitted when fitted with a drop tank or when carrying a bomb.

52. **Diving**

(i) The aircraft should be trimmed into and out of the dive.

(ii) A tendency to yaw to starboard should be corrected by use of the rudder trimming tab.

(iii) When carrying a bomb, the angle of dive must not exceed 40°.

53. **Aerobatics**

(i) The following speeds (m.p.h. I.A.S.) are recommended:

Loop	280–300
Roll	220–250
Half-roll off loop	320–350
Upward roll	330–380

(ii) Flick manœuvres are not permitted.

54. **Check list before landing**

(i) Reduce speed to 160 m.p.h. I.A.S. and open the cockpit hood.

U —Undercarriage	DOWN	(Check indicator)
Tailwheel	Green light on	
P —Propeller control	Fully forward	
Supercharger	Red light out	
F —Flaps	DOWN	

NOTE.—The undercarriage operation takes considerably longer with engine off than with engine on. The undercarriage must, therefore, be lowered early on a glide approach.

(ii) Check brake pressure (80 lb./sq.in.) and pneumatic supply pressure (220 lb./sq.in.).

55. **Approach and landing**

(i) Approach speeds in m.p.h. I.A.S. at normal load 7,850 lb.:

		(flaps up)
Engine assisted:	95	(105)
Glide:	105	(110)

NOTE.—In all cases speed may be reduced by 5 m.p.h. when cannon ammunition or considerable fuel has been expended.

(ii) The aircraft is nose-heavy on the ground; the brakes, therefore, must be used carefully on landing.

56. **Mislanding**

(i) Raise the undercarriage.
(ii) Climb at about 130 m.p.h. I.A.S. with flaps fully down.
(iii) Raise flaps at a safe height of about 200–300 feet.
(iv) Retrim.

57. **After landing**

(i) Raise the flaps before taxying.
(ii) To stop the engine, idle for ½ minute at 800–900 r.p.m. then pull the slow-running cut-out and hold it out until the engine stops. On Merlin 66, 70 and 71 installations the booster-pump must be switched off and the idle cut-off control moved fully aft.
(iii) Turn OFF the fuel cock and switch OFF the ignition.

(iv) Oil dilution. (*See* A.P. 2095, Pilot's Notes General). The correct dilution period for this aircraft is:

Atmospheric temperatures *above* —10°C.: 1 minute

Atmospheric temperatures *below* —10°C.: 2 minutes

58. **Beam Approach**

(i) The recommended speeds (m.p.h. I.A.S.), r.p.m. and flap settings are:

	Maintaining height		
	Preliminary manœuvring	Manœuvring with u/c down	Final approach
Speed	180	160	120
Flaps	UP	UP	DOWN
R.p.m.	2,650	2,650	Fully forward

(ii) For change of trim *see* Para. 49 (ii).

(iii) Approach at 900 feet over the outer marker beacon, reducing to 200 feet over the inner marker beacon.

PART III

OPERATING DATA

59. **Engine data: Merlins 63, 64, 66, 70 and 71**

(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. Coolant	Temp. °C. Oil
MAX. TAKE-OFF TO 1,000 FEET	M	3,000	+12	135	—
MAX. CLIMBING 1 HOUR LIMIT	M, S	2,850	+12	125	90
MAXIMUM CONTINUOUS	M, S	2,650	+ 7	105 (115)	90
COMBAT 5 MINS. LIMIT	M, S	3,000	+18	135	105

NOTE.—(*a*) For economical cruising *see* Para. 63 (ii).

(*b*) The figure in brackets is permitted for short periods.

OIL PRESSURE:

NORMAL .. .. 60–80 lb./sq.in

MINIMUM .. .. 45 lb./sq.in.

MINIMUM TEMPERATURE FOR TAKE-OFF:

OIL .. .. 15°C.

COOLANT .. .. 60°C.

FUEL PRESSURES:

Merlins 63 and 64 .. .. 8–10 lb./sq.in.

Merlins 66, 70 and 71 .. .. 14–16 lb./sq.in.

60. **Flying limitations**

(i) *Maximum speeds:*

Diving	470 m.p.h. I.A.S.
Undercarriage down	160 m.p.h. I.A.S.
Flaps down	160 m.p.h. I.A.S.

(ii) *Restrictions:*

(*a*) When carrying a bomb, spinning is not permitted and violent manœuvres must be avoided. The angle of dive must at no time exceed 40°.

(*b*) For restrictions when carrying a drop tank *see* Para. 41 (i).

61. **Position error corrections**

From	120	140	160	190	210	230	260	290	310	m.p.h.
To	140	160	190	210	230	260	290	310	380	I.A.S.
Add	6	4	2	0						m.p.h.
Subtract				0	2	4	6	8	10	m.p.h.

62. **Maximum performance**

The speeds for maximum rate of climb are as follows:

S.L. to 25,000 feet:	160 m.p.h. I.A.S.
25,000 to 30,000 feet:	145 m.p.h. I.A.S.
30,000 to 35,000 feet:	130 m.p.h. I.A.S.
35,000 to 40,000 feet:	115 m.p.h. I.A.S.
Above 40,000 feet:	Reduce speed by 3 m.p.h. per 1,000 feet.

63. **Economical flying** (*see* curves, page 29)

(i) *Climbing.*—For maximum fuel economy, climb at +7 lb./sq.in. boost and 2,650 r.p.m. at the speeds for maximum rate of climb. When climbing to altitudes below 30,000 feet, however, the climb may be made at +12 lb./sq.in and 2,850 r.p.m. without seriously increasing the total fuel consumption over that obtained on a climb at +7 lb./sq.in. boost and 2,650 r.p.m.

(ii) *Cruising.*—Greatest range will be obtained at medium heights. The recommended speeds are as follows:

(*a*) *Without auxiliary tanks, or if carrying a 30-gallon drop tank:*

170 m.p.h. I.A.S. At low altitudes speed should be increased by 10 to 20 m.p.h.

(*b*) *If carrying a 90-gallon drop tank:*

175 m.p.h. I.A.S. at low altitudes 180 m.p.h. I.A.S.

(*c*) *If carrying a 170-gallon drop tank:*

185 m.p.h. I.A.S. at start of level flight, reducing as fuel is consumed to 170 m.p.h. I.A.S. when the drop tank is empty. By reducing r.p.m. by 50 at the end of each hour the I.A.S. will be reduced by approximately the correct amount.

NOTE.—At low altitudes the recommended speed is 180 m.p.h. I.A.S. after jettisoning the tank.

Fly at 1,800 r.p.m. (but check that the generator is charging) and adjust the throttle to give the recommended speed, but do not exceed + 7 lb./sq.in. boost. If at 1,800 r.p.m. and full throttle the recommended speed cannot be obtained, increase r.p.m. as necessary.

64. **Fuel capacities and consumption**

(i) *Normal fuel capacity:*

Top tank	47 gallons
Bottom tank	49 gallons
2 Wing tanks (13 gallons each) ..	26 gallons
Total	122 gallons

(ii) *Long-range fuel capacities:*

With 30-gallon drop tank	152 gallons
With 90-gallon drop tank	212 gallons
With 170-gallon drop tank	292 gallons

(iii) *Fuel consumptions:*

The approximate fuel consumptions (gals./hrs.) for Merlin 63 and 64 engines are as follows:

Weak mixture (as obtained at +7 lb./sq.in. boost and below):

Boost lb./sq.in.	R.p.m.				
	2,650	2,400	2,200	2,000	1,800
+7	80	—	—	—	—
+4	71	66	61	54	49
+2	66	61	57	50	43
0	60	55	51	45	39
−2	53	49	45	40	35
−4	45	42	38	34	20

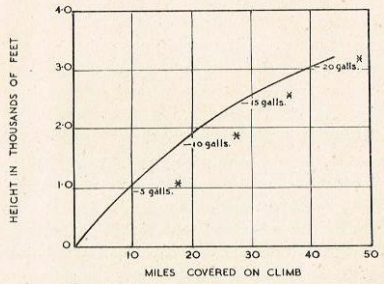
Rich mixture (as obtained above +7 lb./sq.in boost):

Boost lb./sq.in.	R.p.m.	gals./hr.
+18	3,000	150
+15	3,000	130
+12	2,850	105

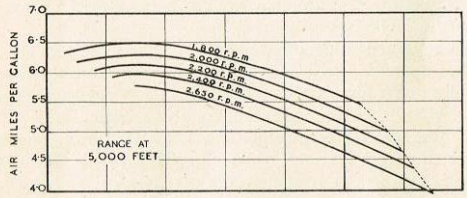
NOTE.—Consumption figures for the Merlin 66, 70 and 71 engines are not at present available, but will be inserted at a later date.

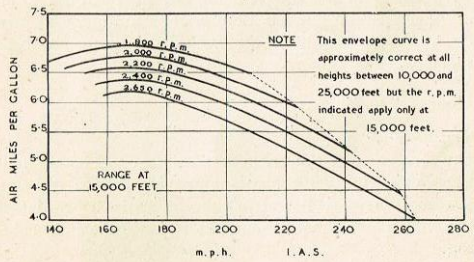
RANGE CURVES FOR SPITFIRE VII & VIII

NO BOMBS OR EXTERNAL TANKS



* These figures for fuel consumed on climb do not include an allowance of 9 gallons for run-up and take-off.





PART IV

EMERGENCIES

65. **Undercarriage emergency operation**

(i) If the lever jams and cannot be moved to the fully down position after moving it out of the gate, return the lever to the fully forward position for a few seconds, to take the weight of the wheels off the locking pins and allow them to turn freely, then move it to the DOWN position.

(ii) If, however, the lever is jammed so that it cannot be moved either forward or downward it can be released by taking the weight of the wheels off the locking pins either by pushing the control column forward sharply or inverting the aircraft. The lever can then be moved to the DOWN position.

(iii) If the lever springs into the gate and the indicators show that the undercarriage is not locked down, hold the lever fully down for a few seconds. If this is not successful, raise and then lower the undercarriage again.

(iv) If the undercarriage still does not lock down, ensure that the lever is in the DOWN position (this is essential) and push the emergency lever (67) forward and downward through 180°. It should not be returned to its original position and no attempt must be made to raise the undercarriage until the emergency bottle has been replaced.

66. **Hood jettisoning**

Spitfire VII:

(i) On early aircraft the cabin top is jettisoned by undoing the four securing catches and pushing it into the slipstream. On some aircraft it may be necessary to detach the rubber hose connections before jettisoning the cabin top.

(ii) On later aircraft the sliding hood is jettisoned by pulling the red knob on the instrument panel marked HOOD JETTISON—PULL. Considerable force may be necessary.

NOTE.—If jettisoning the hood on the ground, it must be lifted upwards so as to fall clear of the aircraft.

(iii) The jettisonable sliding hood may be opened from the outside by breaking the cellophane cover on the port side of the fuselage, below the sliding hood, and pulling the release ring marked EMERGENCY—PULL TO RELEASE HOOD.

Spitfire VIII:

(iv) The hood may be jettisoned by pulling the rubber knob inside the top of the hood in a forward and downward movement, and pushing the lower edge of the hood outboard with the elbows.

67. **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 m.p.h. I.A.S. The cockpit hood should be opened and the door put on the catch. The drop tank (if fitted) should be jettisoned, but only in straight flight.

68. **Ditching**

(*See* A.P. 2095, Pilot's Notes General.)

(i) In general, the pilot should, if possible, abandon the aircraft by parachute.

(ii) In the event of having to ditch, the auxiliary drop tank (if fitted) should be jettisoned, but only in straight flight, and the following procedure should be observed:

(*a*) The cockpit hood should be jettisoned.

(*b*) Flaps should be lowered 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*) Ditching should be along the wave crests or wave tops.

PART IV—EMERGENCIES

69. **Failure of pneumatic system**

(*a*) If the flaps fail to lower when the control is moved to the DOWN position, it is probably due to a leak in the pipe line, resulting in complete loss of air pressure and consequent brake failure.

(*b*) Alternatively, if a leak develops in the flap control diaphragm the flaps will lower, but complete loss of air pressure will follow and the brakes will become inoperative. (In this case a hissing sound may be heard in the cockpit after selecting flaps DOWN.)

(*c*) In either case the flap control should immediately be returned to the UP position in order to allow sufficient pressure to build up, so that a landing can be made with the brakes working but without flaps.

NOTE.—As a safeguard, pilots should always check the pneumatic pressure supply after selecting flaps DOWN.

70. **First-aid outfit**

The first-aid outfit is stowed aft of the wireless equipment and is accessible through a hinged panel on the port side of the fuselage.

71. **Crowbar**

A crowbar (21), for use in an emergency, is stowed on the left-hand side of the cockpit.

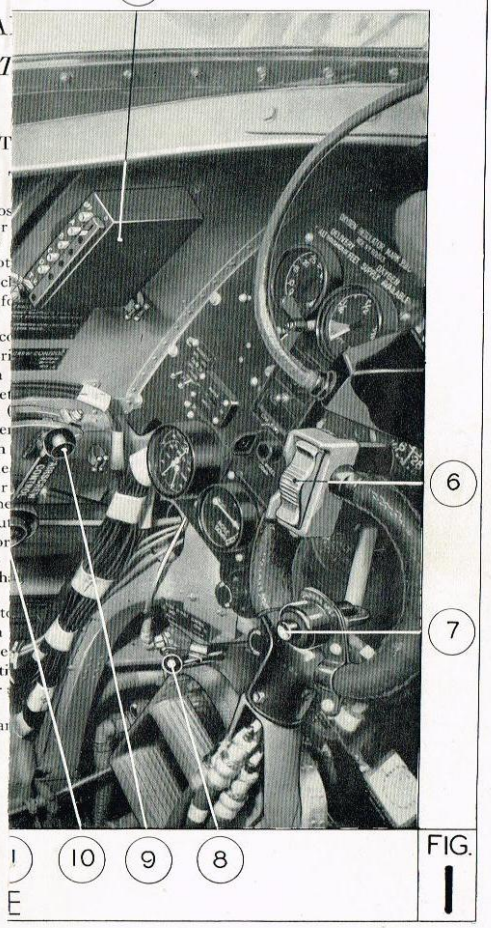
PA

ILLUST

COCKPIT

KEY

1. Two-pos for door
2. Wedge gun foot
3. Port cock
4. Socket fo plug.
5. Radio co
6. Gun fir
7. Camera
8. Carbure control
9. Propelle
10. Friction
11. Throttle
12. Elevator handwhe
13. Oil dilu
14. Radiator button.
15. Superch button.
16. Generat
17. Camera
18. Pressure
19. Navigati
20. Rudder wheel.
21. Crowba



E

FIG. 1

PART V
ILLUSTRATIONS

COCKPIT—PORT SIDE

KEY TO *Fig. 1*

1. Two-position catch lever for door (Mark VIII only).
2. Wedge plate for camera gun footage indicator.
3. Port cockpit light.
4. Socket for footage indicator plug.
5. Radio controller.
6. Gun firing pushbutton.
7. Camera gun pushbutton.
8. Carburettor air intake control (Mark VIII).
9. Propeller speed control.
10. Friction adjuster.
11. Throttle lever.
12. Elevator trimming tab handwheel.
13. Oil dilution pushbutton.
14. Radiator flap test pushbutton.
15. Supercharger test pushbutton.
16. Generator failure light.
17. Camera gun heater switch.
18. Pressure-head heater switch.
19. Navigation lights switch.
20. Rudder trimming tab handwheel.
21. Crowbar.

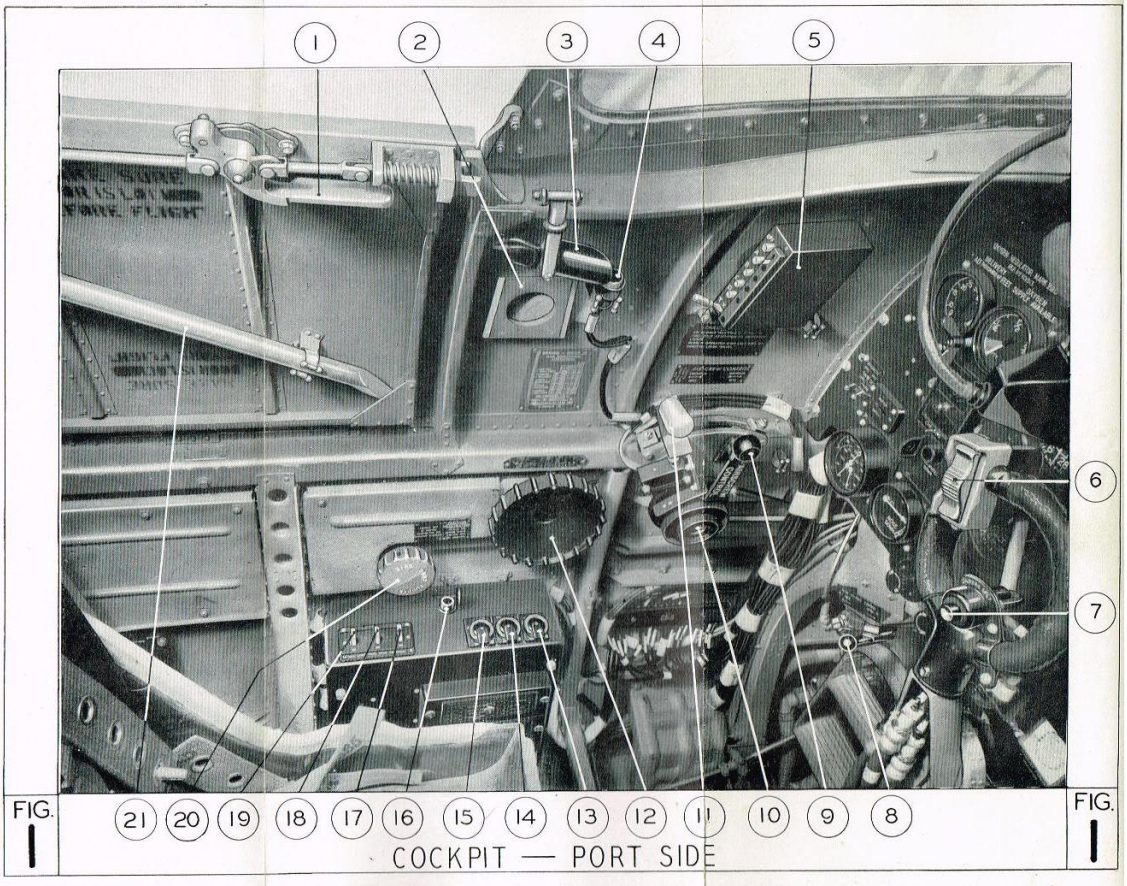


FIG. 1 COCKPIT — PORT SIDE FIG. 1

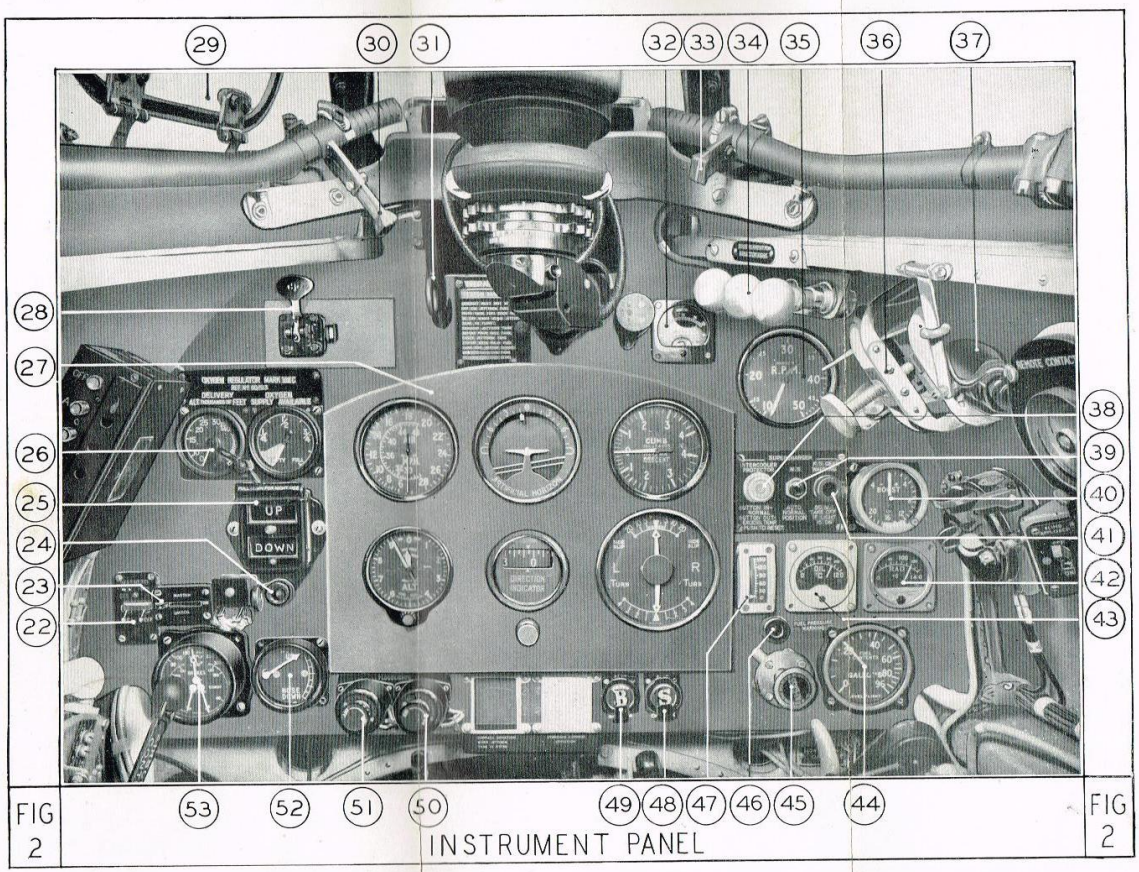


FIG 2 INSTRUMENT PANEL FIG 2

INSTRUMENT PANEL

KEY TO *Fig. 2*

22. Ignition switches.
23. Master switch.
24. Tailwheel light.
25. Undercarriage indicator.
26. Oxygen regulator.
27. Instrument flying panel.
28. Flap lever.
29. Direct vision panel.
30. Windscreen air supply cock (early aircraft).
31. Reflector sight screen lifting ring.
32. Voltmeter.
33. Windscreen air supply cock (early aircraft).
34. Spare lamps for reflector sight.
35. Engine-speed indicator.
36. Cockpit ventilator (intake) (early aircraft).
37. Starboard cockpit light.
38. Intercooler protector push-button (early aircraft).
39. Supercharger override switch.
40. Boost gauge.
41. Supercharger warning light.
42. Radiator temperature gauge.
43. Oil temperature gauge.
44. Fuel contents gauge (early aircraft).
45. Cylinder priming pump.
46. Fuel pressure warning light.
47. Oil pressure gauge.
48. Engine starter pushbutton.
49. Booster-coil pushbutton.
50. Cockpit light dimmer switch.
51. Cockpit light dimmer switch.
52. Elevator trimming tab indicator.
53. Pneumatic pressure gauge.

COCKPIT—
STARBOARD SIDE

KEY TO *Fig. 3*

54. Main tank fuel cock control.
55. Fuel transfer valve selector lever.
56. Cabin pressure warning lights (Mark VII).
57. Cabin altimeter (Mark VII).
58. Signalling switch box.
59. Beam approach master switch.
60. Remote contactor and switch.
61. Spill valve control.
62. Cockpit ventilator (extractor).
63. Oxygen supply cock.
64. Microphone/telephone socket.
65. Fuel tank pressurising cock.
66. Windscreen de-icing pump.
67. Undercarriage emergency lowering control.
68. I.F.F. master switch.
69. I.F.F. pushbuttons.
70. Windscreen de-icing cock.
71. Drop tank jettison control.
72. Drop tank cock control.
73. Undercarriage control lever.

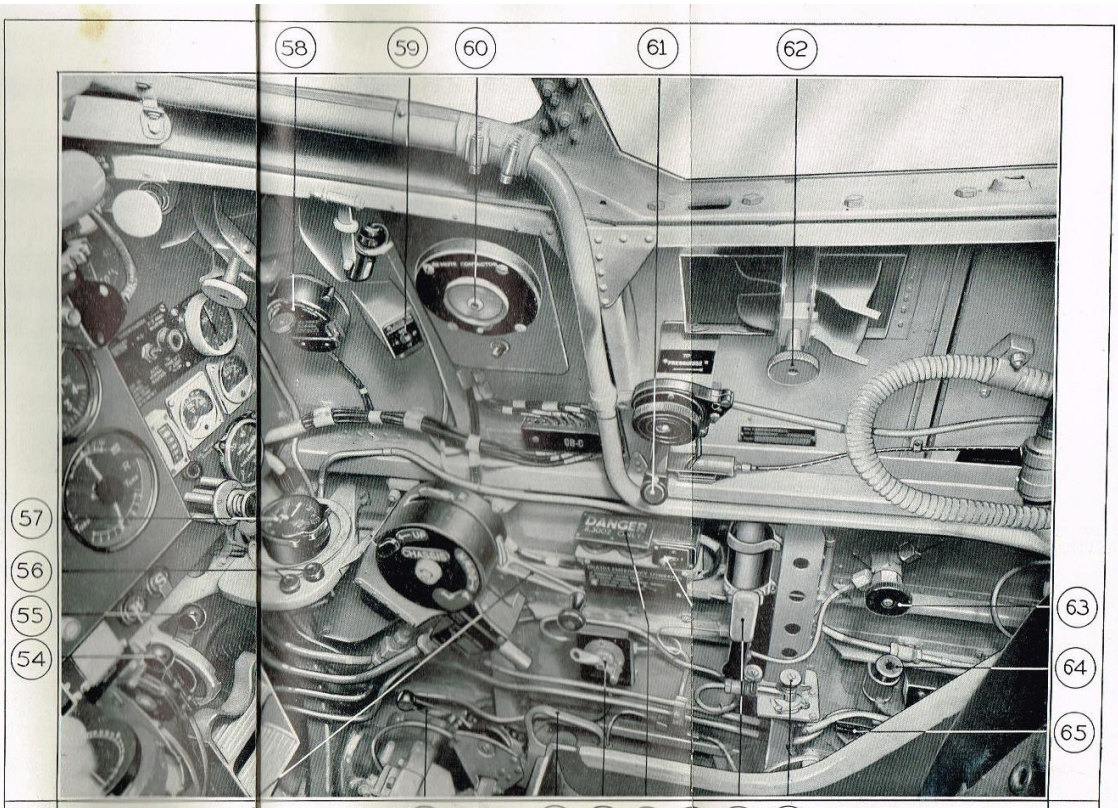


FIG. 3 COCKPIT—STARBOARD SIDE. FIG. 3

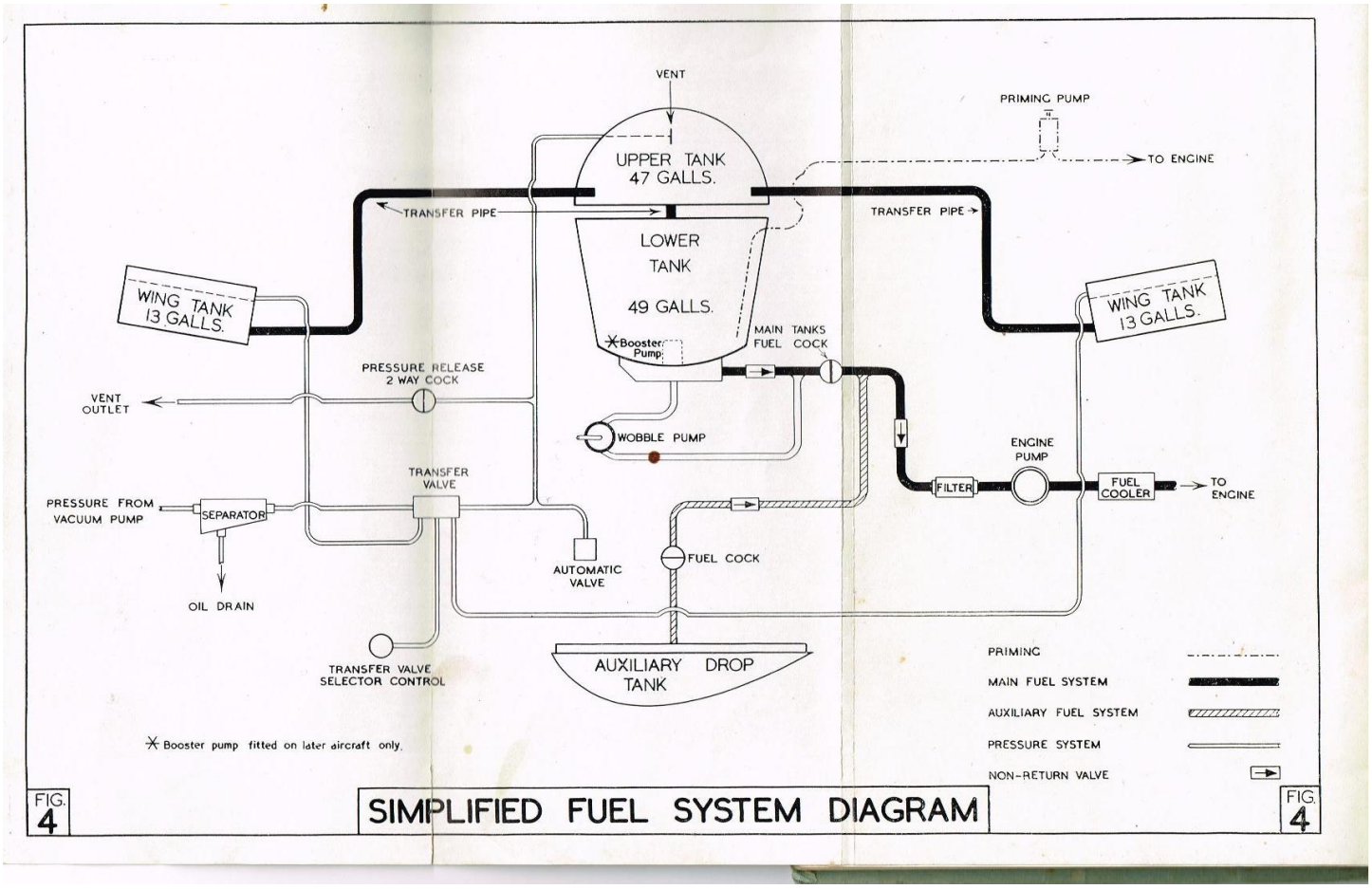


FIG. 4

SIMPLIFIED FUEL SYSTEM DIAGRAM

FIG. 4