A.P. 2280 F. & G.—P.N.

PILOT'S NOTES

FOR

SEAFIRE 45 & 46

MARK 45—GRIFFON 61 ENGINE

MARK 46—GRIFFON 87 ENGINE

PREPARED BY DIRECTION OF THE MINISTER OF SUPPLY

A. T. Rowlands.

PROMULGATED FOR INFORMATION AND GUIDANCE OF ALL CONCERNED BY COMMAND OF THEIR LORDSHIPS

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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, 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	M.P.	5/3/49.	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.F.O. 3467/44).

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

Additional copies may be obtained from S.N.S.O. Cricklewood by application on Royal Navy Forms S134D or D397. The number of this publication must be quoted in full—A.P. 2280 F. and G.—P.N.

Comments and suggestions should be forwarded through the usual channels to the Admiralty (D.A.W.)

SEAFIRE 45

SEAFIRE 45 AND 46

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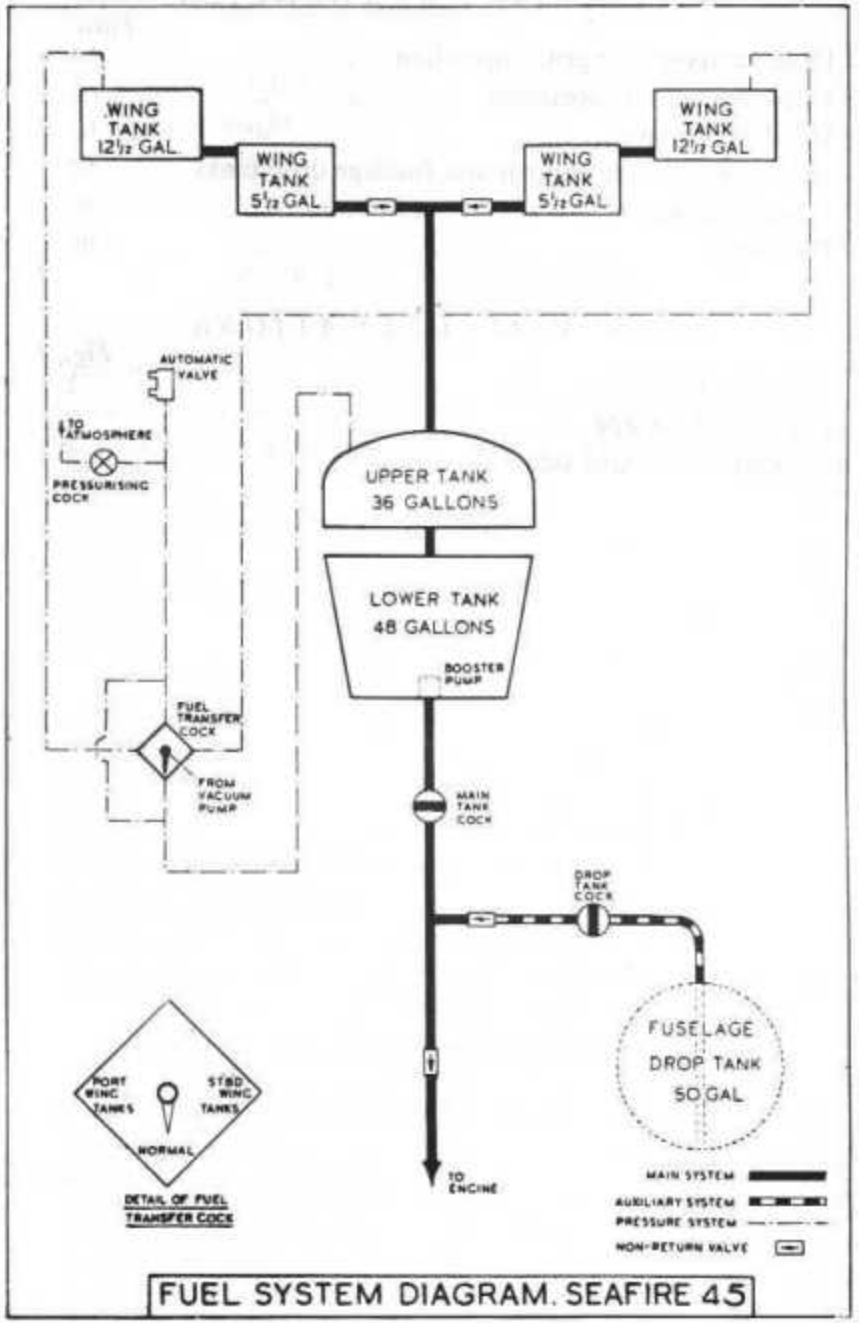


FUEL SYSTEM DIAGRAM. SEAFIRE 45

PART I
DESCRIPTIVE

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

INTRODUCTION

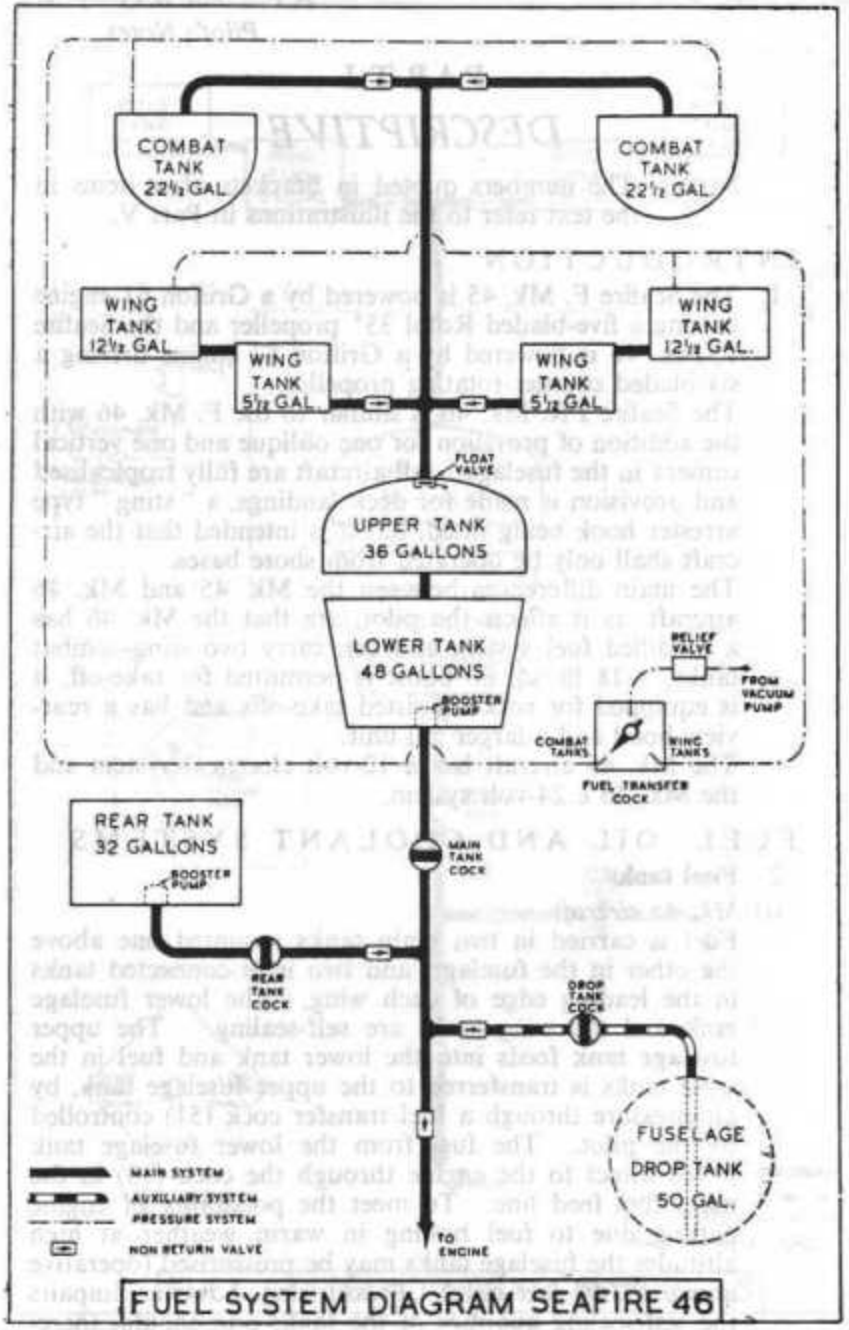
1. The Seafire F. Mk. 45 is powered by a Griffon 61 engine driving a five-bladed Rotol 35° propeller and the Seafire F. Mk. 46 is powered by a Griffon 87 engine driving a six-bladed counter-rotating propeller.
The Seafire FR. Mk. 46 is similar to the F. Mk. 46 with the addition of provision for one oblique and one vertical camera in the fuselage. All aircraft are fully tropicalised and provision is made for deck landings, a " sting " type arrester hook being fitted, but it is intended that the aircraft shall only be operated from shore bases.
The main differences between the Mk. 45 and Mk. 46 aircraft, as it affects the pilot, are that the Mk. 46 has a modified fuel system and can carry two wing-combat tanks, +18 lb./sq. in. boost is permitted for take-off, it is equipped for rocket-assisted take-offs and has a rear-view hood and a larger tail unit.
The Mk. 45 aircraft has a 12-volt electrical system and the Mk. 46 a 24-volt system.

FUEL, OIL AND COOLANT SYSTEMS

2. **Fuel tanks**

(i) *Mk. 45 aircraft*

Fuel is carried in two main tanks mounted one above the other in the fuselage, and two inter-connected tanks in the leading edge of each wing. The lower fuselage tank and the wing tanks are self-sealing. The upper fuselage tank feeds into the lower tank and fuel in the wing tanks is transferred to the upper fuselage tank, by air pressure through a fuel transfer cock (51) controlled by the pilot. The fuel from the lower fuselage tank is fed direct to the engine through the cock (30) in the main fuel feed line. To meet the possibility of engine cutting due to fuel boiling in warm weather at high altitudes the fuselage tanks may be pressurised (operative above 15,000 feet only). Pressurising, however, impairs the self-sealing qualities of the tanks and should, there-



FUEL SYSTEM DIAGRAM SEAFIRE 46

fore, be turned ON only when the fuel pressure warning light comes on. Permanent tank capacities are as follows :

Upper fuselage tank	36 gallons
Lower fuselage tank	48 gallons
2 wing tanks (12½ gallons each) ...	25 gallons
2 wing tanks (5½ gallons each) ...	11 gallons
Total :	120 gallons

A fuselage drop tank of 50 gallons capacity can be fitted under the fuselage, and the fuel from it is fed direct into the main fuel feed line through a separate cock (87).

(ii) *Mk. 46 aircraft*

In addition to the above tankage these aircraft are fitted with one rear fuselage tank of 32 gallons capacity aft of the pilot's seat, and they can be fitted with 2 wing combat tanks (each 22½ gallons capacity) one under each mainplane. The fuel from the rear fuselage tank feeds into the main fuel feedline through its own cock (54). The fuel from the wing combat tanks is transferred to the upper fuselage tank in a similar manner to the wing-tank fuel, by air pressure from the exhaust side of the vacuum pump.

A float-valve in the upper fuselage tank prevents it from being overfilled, thus allowing the fuel transfer cock to be turned to WING TANKS or COMBAT TANKS irrespective of the amount of fuel in the upper fuselage tank.

3. **Fuel cocks**

(i) The cock control for the lower fuselage tank is a lever (30) fitted just below the centre of the instrument panel. The cock control (87) for the fuselage drop tank is mounted on the right-hand side of the cockpit and is interconnected with the fuselage drop tank jettison lever (86). For jettisoning of fuselage drop tank see para. 64.

(ii) On Mk. 46 aircraft fitted with a rear fuselage tank, the rear fuselage tank cock (54) is on the floor of the cockpit to the left and slightly forward of the pilot's seat.

(iii) *Fuel transfer cock*

(a) *Mk. 45 aircraft.* The fuel transfer cock for admitting air pressure to either pair of wing tanks is below and slightly forward of the throttle quadrant. It is important that this cock be returned to the NORMAL position after use, or pressurising of the main tanks will not be effective. The pressurising cock is to the right of the seat.

(b) *Mk. 46 aircraft.* The fuel transfer cock (51) for admitting air pressure to either the wing tanks or to the wing-combat tanks is below and slightly forward of the throttle quadrant. The main tanks are not pressurised so there is no pressurising cock.

4. **Booster pumps**

An electric fuel booster pump is fitted in the bottom of the fuselage tank and is controlled by a switch (61) on the electrical panel. On Mk. 46 aircraft there is a second booster pump fitted in the rear fuselage tank and the switch on the electrical panel has then got three positions, MAIN, OFF and REAR. Test pushbuttons (58) and (59) for checking the operation of the pumps are also fitted.

5. **Priming system**

A priming pump (26) and cock (25) are fitted on the right-hand side of the cockpit below the instrument panel. The cock has three positions marked ALL OFF, MAIN and GROUND. The GROUND position allows high volatile fuel from an external supply to be used for starting in very cold weather. When in the MAIN position, priming fuel is drawn from the bottom of the lower fuselage tank. The cock should always be kept in the ALL OFF position except when priming the cylinders prior to starting the engine.

6. **Fuel contents gauges**

The contents gauge (27) on the right-hand side of the instrument panel shows the combined contents of the upper and lower fuselage tanks. On Mk. 46 aircraft a second gauge (23) shows the contents of the rear fuselage tank. The gauges register only when electrical power is available. There are no contents gauges fitted for the wing tanks, the wing combat tanks or the fuselage drop tank.

7. **Fuel warning lights**

The fuel pressure warning light (24) is on the instrument panel above the contents gauges and comes on if the fuel pressure drops appreciably below normal.
A low level warning light (22) to the right of the fuel pressure warning light comes on when sufficient fuel for only 30 minutes flying at maximum economical cruising conditions remains in the lower fuselage tank.

8. **Oil system**

(i) Oil is supplied by a tank of 9 gallons oil capacity, and 3 gallons air space, mounted between the upper fuselage tank and the fireproof bulkhead. The oil passes through a filter before entering the engine. An oil cooler is fitted inside the fairing of the starboard wing radiator and oil pressure (19) and temperature (20) gauges are fitted on the right-hand side of the instrument panel.

(ii) An oil dilution system is fitted The pushbutton (55) for operating the solenoid valve is on the electrical panel.

9. **Coolant system**

The header tank is mounted above the reduction gear casing and is fitted with a relief valve. The radiator shutters are fully automatic and are designed to open at a coolant temperature of 115° C. A pushbutton (56) on the electrical panel is fitted for ground testing but when Mod. 736 is embodied the pushbutton is replaced by a two-position switch which enables the radiator shutters to be opened manually for taxying, ground-running and A.D.D.L's. A coolant temperature gauge (21) is fitted on the right-hand side of the instrument panel.

MAIN SERVICES

10. **Hydraulic system**

Oil is contained in a reservoir on the fireproof bulkhead, and passes through a filter to an engine-driven pump for operation of the undercarriage and tailwheel.

11. **Pneumatic system**

An engine-driven air compressor feeds two storage cylinders for operation of the wing flaps, radiator flaps, air-intake shutter, supercharger gear-change, and brakes. The cylinders each hold air at 300 lb./sq. in. pressure which is fed to the services through a pressure-reducing valve at 220 lb./sq. in. and the pressure at each brake is 80–90 lb./sq. in. When Mod. 489 is incorporated, the pressure at each brake is increased to 140 lb./sq. in.

12. **Electrical system**

(i) An engine-driven generator charges the aircraft batteries which supply the whole of the electrical installation. The system is 12 volts on Mk. 45 aircraft and 24 volts on Mk. 46 aircraft.

(ii) A ground supply socket is fitted outside the aircraft on the port side of the fuselage just below and behind the cockpit.

(iii) On Mk. 45 aircraft the electrical master switch is interlinked with the ignition switches so that the master switch must be ON before the ignition can be put on.
On Mk. 46 aircraft the electrical master GROUND/FLIGHT switch (48) is on the panel on the left-hand side of the cockpit along with most of the electrical switches and pushbuttons. With this switch set to GROUND all the electrical services can be tested by plugging in an outside battery. The switch should always be set to FLIGHT before starting the engine.

(iv) A red warning light (33) mounted below the instrument panel (and marked GEN. FAILURE) comes on when the generator is not delivering current to the aircraft batteries.

AIRCRAFT CONTROLS

13. Flying controls

The control column is of the spade-grip pattern and incorporates the brake lever (31), gun-firing control, bomb release and R.P. control, cine-camera pushbutton (14), gyro-caging control (13) and R/T transmit pushbutton (11). The rudder pedals have two positions for the feet and are adjustable for leg reach by rotation of the star wheels on the sliding tubes.

14. Flying controls locking gear

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.

15. Trimming tabs

The elevator trimming tabs are controlled by a handwheel (42) on the left-hand side of the cockpit, the indicator (34) being on the left-hand side of the instrument panel. The rudder trimming tab is controlled by a small handwheel (41) aft of the elevator trimming tab control and is not provided with an indicator. Clockwise rotation of the handwheel turns the aircraft to starboard.

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16. Undercarriage control

The undercarriage selector lever (65) moves in a quadrant on the right-hand side of the cockpit. The quadrant has a gate at each end, and an automatic cut-out coupled to the selector lever moves the latter into a slot (the IDLE position) outboard of the gate when a movement of the undercarriage either up or down is completed. In addition, the selector lever is connected by chains and sprockets to the undercarriage locks; the locks are disengaged and the automatic cut-out closed by direct action of the lever. Before selecting UP or DOWN it is essential to ensure that the hydraulic pressure is taking the weight of the undercarriage off its locks; otherwise, the locks will be difficult to withdraw and the selector lever may jam.

To raise the undercarriage the lever must be moved downwards to disengage it from the slot, inwards through the lower gate, and then forward to the full extent of the quadrant. The lever should then move outwards through the upper gate, when released, and when the undercarriage is locked up, the lever will automatically spring back into the upper slot.

To lower the undercarriage the lever must be held forward for about two seconds, moved through the upper gate, and then back in one movement to the full extent of the quadrant. The lever should then move outwards through the lower gate, when released, and when the undercarriage is locked down, the lever will automatically spring forward into the lower slot.

An indicator in the quadrant shows DOWN, IDLE or UP depending on the position of the hydraulic valve. UP or DOWN should show only during the corresponding operation of the undercarriage, and IDLE when the lever is in either slot.

WARNING.—If mishandled or out of adjustment, the selector lever may spring back on the wrong side of the gate and the indicator may show IDLE, therefore, it is important to check that the lever is correctly positioned *in the slot.*

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. If the hydraulic system fails, the undercarriage may be lowered by means of CO_2 bottles (see para. 61).

17. Undercarriage indicators

(i) The electrically operated visual indicator (5) 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 main wheels. The indicator is switched

on and off by the master switch on Mk. 45 aircraft and by the ground/flight switch on Mk. 46 aircraft. The tailwheel (green) light (2) is below the undercarriage indicator and goes out when the tailwheel is retracted.

(ii) On most aircraft a small rod protrudes through the upper surface of each wing when the undercarriage main wheels are down.

18. **Flaps control**

The split flaps have two positions only, up and fully down, but can be set manually to 18° by means of spring-loaded pins, one on each flap, or on early aircraft by means of wooden blocks. The flaps are controlled by a three-position lever (9) on the top left-hand side of the instrument panel marked UP, AIR OFF and DOWN. The lever should be left in the DOWN position after the flaps have been lowered, but after the flaps have been raised the lever should always be returned to the AIR OFF position.

19. **Arrester hook control**

The release handle (82) is to the right of the pilot's seat. It must be pulled upwards about 1½ inches to release the arrester hook.

WARNING.—The pilot must ensure that all personnel are clear of the tail before testing the action of the hook. When operated it shoots out forcibly.

20. **Arrester hook indicator light**

A green light (4) on the left-hand side of the instrument panel comes on when the hook is lowered for landing.

NOTE : The light may not come on until speed is reduced to approximately 110 knots I.A.S.

21. **R.A.T.O.G. controls**

Provision is made on Mk. 46 aircraft for rocket-assisted take-offs and the following controls are fitted in the cockpit :—

(a) *Master switch* (37). This is fitted at the bottom of the instrument panel on the left-hand side, and is fitted with a locking slide and nut.

(b) *Firing pushbutton* (38). This is incorporated in the top of the throttle lever.

(c) *Jettison lever* (35). This is fitted alongside the master switch. To jettison the carriers the T-handled lever is pulled out fully.

22. **Wheel brakes**

The brakes 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 pressures in the pneumatic system (300 lb./sq. in. maximum) and at each brake (80 lb./sq. in. or 140 lb./sq. in. if Mod. 489 is fitted) is mounted on the instrument panel.

ENGINE CONTROLS

23. **Throttle and mixture control**

The throttle quadrant is gated at +12 lb./sq. in. boost position. Mixture control is fully automatic and there is no pilot's control lever. The throttle lever handgrip (47) incorporates a G.G.S. range control and a R.A.T.O. firing pushbutton. The short lever (50) on the inboard side of the quadrant is a friction adjuster for the throttle control lever. The lever should be pushed forward to increase friction damping or locking, but in pulling back the lever to reduce damping, care should be taken not to pull the lever too far back, as it is possible to increase the friction again in this manner.

24. **R.p.m. control**

The r.p.m. control lever (49) on the throttle quadrant varies the governed r.p.m. from 2,750 down to below 1,800.

25. **Fuel cut-off control**

The fuel cut-off control (46) which is used when starting and stopping the engine, is mounted in a gate on the outboard side of the throttle quadrant. It is spring-loaded and is set forward to allow the carburettor to deliver fuel to the engine. Fuel is cut off when the lever is pulled back and engaged in the gate.

26. **Supercharger control**

(i) The supercharger change-gear control is operated by an electro-pneumatic ram, and high gear is engaged and disengaged automatically by an altitude switch when the pilot's switch (16) is set to AUTO NORMAL POSITION.

When this switch is set to MS the supercharger remains in low gear at all altitudes. A test pushbutton (57) on the electrical panel allows high gear to be selected during a ground run-up so as to test the gear-change, and a red light (17) beside the supercharger switch comes on whenever high gear is engaged either on the ground or in flight. The test pushbutton will only function when the supercharger switch is set to the AUTO NORMAL position.

(ii) The supercharger intercooler radiator is mounted in front of the coolant radiator under the port main plane.

27. **Carburettor air-intake filter**

The filter control lever (53) on the left-hand side of the cockpit, forward of the elevator trimming tab control, has two positions, NORMAL INTAKE and FILTER IN OPERATION. The latter position must be used for all ground running, for take-off and landing, and when flying in sandy or dust-laden conditions.

NOTE: The lever must always be moved slowly.

28. **Starting controls**

(i) The shielded pushbutton (29) just above the main fuel cock fires the starter cartridge and also operates the booster coil. The ignition switches (3) are on the extreme left-hand side of the instrument panel.

(ii) The re-indexing control (28) is at the bottom right-hand side of the instrument panel and should be pulled out and then returned slowly to index the next cartridge in the breech. A total of five cartridges is contained in the magazine.

COCKPIT EQUIPMENT

29. **Cockpit lighting**

Two lights are mounted one on each side of the cockpit and they are operated by dimmer switches on the centre of the instrument panel.

30. **Sliding hood controls.**

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(i) On Mk. 45 aircraft the sliding hood is opened by means of a handgrip in the frame of the hood.

(ii) On Mk. 46 aircraft the sliding hood is opened by means of a crank handle which is mounted on the cockpit right-hand wall and which must be pulled inwards before it can be rotated.

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The hood may be locked in any intermediate position by releasing the crank handle, which then engages with the locking ratchet. If the lock fails to engage, the handle should be moved back and forth until it does. The handle should be placed in the locked position before take-off and landing. From outside the cockpit the hood may be opened and closed by hand, provided the pushbutton below the starboard hood rail is held depressed.

(iii) On both Mk. 45 and Mk. 46 aircraft the cockpit door is provided with a two-position catch which allows it to be partly open and so prevent the hood from being shut. Care must be taken on Mk. 46 aircraft that the cockpit door is properly closed before attempting to wind the sliding hood shut. The cockpit door on all aircraft should be placed in the intermediate position before any landing is made. In the event of a forced landing or ditching if it is not possible to jettison the hood (see para. 63), putting the door in the intermediate position is a safeguard against the hood sliding shut during landing.

31. **Windscreen de-icing**

A tank containing de-icing fluid is mounted on the lower right-hand side of the cockpit. There is a cock (85) above the tank and a pump (83) and needle valve further aft to control the flow of the fluid, which is pumped to a spray at the base of the windscreen, over which it is blown by the slipstream. When not required the plunger should be locked down by the catch and the cock returned to the OFF position.

OPERATIONAL CONTROLS

32. **Guns**

The guns are fired pneumatically by means of a selective pushbutton (10) on the control column spade grip. On Mk. 45 aircraft pressing the top of the button fires the outboard guns, pressing the bottom of the button fires the inboard guns, and all four guns are fired simultaneously if the centre of the button is pressed. On Mk. 46 aircraft, pressing the top of the button fires all four guns simultaneously, and pressing the bottom of the button fires the R.P. or bombs.

33. **Bombs and R.P. controls**

(i) The bomb distributor, fusing and selector switches (44) are mounted together on the left-hand side of the cockpit, just forward of the door. On Mk. 45 aircraft the bomb release pushbutton is incorporated in the top of the throttle lever, but on Mk. 46 aircraft the bombs are released by the pushbutton on the control column (the button in the throttle lever being used for RATOG).

A.L.1 para. 33 (ii) page 18

(ii) On Mk. 46 aircraft the R.P. controls consist of the bombs/R.P. master switch, the auto-selector switch (39), the pairs-salvo switch (8) and the firing control. With the master switch at R.P. and the pairs-salvo switch at PAIRS, pressure on the firing button will fire the rockets in pairs according to the setting of the auto-selector switch. With the switch at SALVO and the auto-selector set at 1 or 3, pressure on the firing button will release all bottom tier rockets. A second pressure on the firing button (2 or 4 on auto-selector) will release all top tier rockets.

34. **Gyro gunsight**

The ranging control for the gyro-gunsight is incorporated in the top of the throttle lever; the master switch (36) is at the bottom left-hand corner of the instrument panel, and the dimmer-selector control (66) is on the right-hand wall. On Mk. 46 aircraft the control (7) to enable the sight to be used in conjunction with R.P. is just forward of the bombs control panel, and a pushbutton (13) for caging the gyro during manoeuvres likely to cause toppling is mounted on the control column spade grip.

35. **Cine-camera**

A cine-camera is mounted in the leading edge of the starboard wing. On some Mk. 45 aircraft it is operated by pressing either the top or bottom of the gun-firing pushbutton while on other Mk. 45 aircraft it is operated by a separate pushbutton on the spade-grip.
On Mk. 46 aircraft it is operated by pressing the top half of the gun-firing pushbutton (10), or by an independent pushbutton (14).

36. **P.R. Cameras**

Provision is made on FR Mk. 46 aircraft for carrying vertical and oblique cameras for photographic-reconnaissance duties, the control switches (45) being mounted just forward of the bombs control panel. A mud-flap is fitted over the vertical camera aperture and is jettisoned after take-off (if it is wished to use the camera) by the control (75) on the right-hand wall of the cockpit.

PART II

HANDLING

37. **Management of the fuel system**

NOTE (a) When necessary all external fuel tanks may be jettisoned (see para. 64).

(b) For flying restrictions when external fuel tanks are carried see para. 56.

(c) The booster pump must be switched on for take-off and landing, when changing tanks, and at any time when the fuel pressure warning light comes on, or signs of fuel starvation are apparent. When climbing to high altitude the pump should be left on after take-off. The booster pump must never be switched on when the engine is stationary unless the fuel cut-off is in the cut-off position; otherwise fuel may be injected into the engine and there will be a serious risk of fire.

(i) *Order of use of tanks—Mk.* 45

(a) *Main fuel system.*—Start, and warm up on the lower fuselage tank, ensuring that the fuel transfer cock is at NORMAL.
Take-off and fly on the lower fuselage tank until the contents of the upper fuselage tank drop to the red mark on the gauge. Then transfer the fuel from one pair of wing tanks, returning the fuel transfer cock to NORMAL after five minutes. Then transfer the fuel from the other pair of wing tanks and return the transfer cock to NORMAL after a further five minutes. This is essential otherwise the pressurising of the main tanks will not be effective.

(b) *When fitted with fuselage drop tank.*—Start, warm up and take-off on the lower fuselage tank and change over to the drop tank at a safe height by turning ON the drop tank cock and then turning OFF all other fuel cocks and the booster pump switch. Owing to a possible delay in picking up after the engine pump has run dry, it is recommended that the lower fuselage tank cock be turned ON and the drop tank

cock turned OFF before the drop tank is completely empty, working on a time basis. If it is essential to use all fuel from the drop tank, proceed as follows: It must be run dry only at a safe height and the throttle closed immediately the fuel pressure warning light comes on. The drop tank cock should be turned OFF immediately, and the lower fuselage tank cock turned ON. The booster pump should be turned to ON and the engine idled until it runs smoothly, before opening up.

NOTE: If the fuselage drop tank has to be jettisoned before it is empty, first turn ON the lower fuselage tank cock, and then turn OFF the drop tank cock. At all times when the drop tank is empty or has been jettisoned, ensure that the drop tank cock is fully OFF.

(ii) *Order of use of tanks—Mk. 46*

NOTE: (a) If the rear tank cock is turned ON and the rear tank booster pump is on, the lower fuselage tank cock should be OFF or fuel from the rear tank will be pumped into the lower fuselage tank. If the latter tank is already full, it will overflow through the vent.

(b) Regardless of what other tanks are full, the fuel in the rear fuselage tank must be used as soon as possible after take-off because of C.G. considerations. The lower fuselage tank should, however, be used for take-off so as to leave a small space in the upper fuselage tank for the carburettor spill-back which is vented to this tank.

(a) *Main fuel system only, when rear fuselage tank is not used.*

Start and warm up on the lower fuselage tank.

Take-off on this tank with the fuel transfer cock set to WING TANKS. As fuel is used from the fuselage tanks the upper tank will be replenished automatically from the wing tanks. When the contents gauge reading falls below 70 gallons this indicates that all fuel has been transferred from the wing tanks and the fuel transfer cock should then be returned to the normal position.

(b) *Main fuel system including rear fuselage tank full.*

Start and warm up and take-off on the lower fuselage tank.

Change over to the rear fuselage tank at a safe height ~~of 2,000 ft~~ by turning ON the rear tank cock, switching the booster pump switch to REAR and then immediately turning OFF the lower fuselage tank cock.

When 2 to 3 gallons remain in the rear fuselage tank turn ON the lower fuselage tank cock, switch the booster pump switch to MAIN and then turn OFF the rear tank cock. Proceed as in (a) above.

NOTE: If it is desired to empty the rear tank completely, so as to obtain maximum range, this may be done later in the flight as follows: When the fuel level in the upper fuselage tank drops below 70 gallons showing that all fuel has been transferred from the wing tanks, turn ON the rear tank cock again and switch the booster pump switch to REAR. The remaining fuel in the rear tank will quickly be pumped into the lower fuselage tank. The rear tank cock must then be turned OFF and the booster pump switch turned to OFF or MAIN. On no account must the booster pump in the rear tank be allowed to run dry for longer than two minutes after the tank has emptied.

(c) *When flying with full internal tanks and wing combat tanks.*

Use the rear tank fuel first as in (b) above.

Having turned back on to the lower fuselage tank, have the fuel transfer cock turned to COMBAT TANKS so that the upper fuselage tank is replenished by the fuel from the wing combat tanks. When the contents gauge reading falls below 70 gallons this indicates that all fuel has been transferred from the wing combat tanks and the fuel transfer cock should then be turned to WING TANKS to transfer the fuel from them as in (a).

(d) *When flying with full internal tanks, wing combat tanks and fuselage drop tank.*

Use the rear tank first as in (b).

Then select the fuselage drop tank by turning ON the drop tank cock, and turning OFF all other fuel cocks and the booster pump switch.

When the fuselage drop tank is nearly empty turn ON to the lower fuselage tank and proceed as in (c). (For method of changing over from drop tank to lower fuselage tank see para. 36 (b)).

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38. **Preliminaries**

(i) Before entering the cockpit carry out the usual external checks and ensure that the arrester hook is retracted. On Mk. 45 aircraft check that the hood jettison pins are home in the slipper pins.

(ii) On entering the cockpit check :—

Gun-firing button	SAFE
Bomb master switch ...	OFF
RATOG master switch (Mk. 46 aircraft)...	OFF
Ignition switches	OFF
Undercarriage selector lever	DOWN
Flaps selector lever	AIR OFF
Fuel cut-off lever	CUT-OFF
Pneumatic supply pressure	300 lb./sq. in. (max.)
Flying controls	Full and correct movement

Switch on the electrical master or Ground/Flight switch and check that all electrically-operated instruments indicate :—

Undercarriage indicator ...	DOWN
Tail wheel green light ...	ON
Fuel ... gauges	Check contents
drop tank cock ...	OFF
rear tank cock (Mk. 46 aircraft)	OFF
transfer cock ...	NORMAL (This is most important on Mk. 45 aircraft.)
booster pump switch	OFF

Check that the hood jettison control is correctly stowed and test the security of the sliding hood by drawing it (or winding it) forward until it is within about 1 inch of the fully-closed position, and exert outward pressure at each forward corner to ensure that the hood slippers are securely engaged on the rails. On Mk. 46 aircraft check by visual examination that the jettison pins are home in the slipper pins. Re-open the hood.

(iii) Note the static boost reading. (0 lb./sq. in. under "standard atmosphere" conditions.)

39. **Starting the engine and warming up**

(i) Set the controls as follows :—

Lower fuselage tank cock ...	ON
Throttle	1 inch open
R.p.m. control lever	INCREASE (fully forward)
Supercharger change-gear switch	AUTO NORMAL
Air-intake filter control	FILTER IN OPERATION.
Radiator shutters switch (if fitted)	OPEN

(ii) Index the Coffman starter breech. The following types of cartridges should be used :—
At air temperatures above −5°C., No. 4, Mk. I
At air temperatures below −5°C., No. 5, Mk. I

(iii) With the fuel cut-off lever at CUT-OFF switch on the booster pump in the lower fuselage tank for 10-15 seconds. Then switch the booster pump off again and move the fuel cut-off lever fully forward.

(iv) Turn the priming selector cock to MAIN and operate the priming pump until fuel reaches the priming nozzles ; this is indicated by a sudden increase in resistance. Prime with the following number of strokes according to the air temperature.

Air Temperature °C.	+30	+20	+10	0	−10	−20
Normal fuel	½	1	1	2	3	
High Volatile Fuel				1	2	3

NOTE : The number of strokes given above apply when the engine is cold. Less priming will be required when it is warm and when it is hot it is unlikely that any priming will be required. However, since individual engines differ, the pilot should always discuss the amount of priming required with the ground crews concerned. The priming pump should not be operated very vigorously as it is possible to build up excessive pressure inside the pump and cause it to leak at the gland.

Leave the priming plunger out ready for use.

(v) Switch on the ignition.

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(vi) Press the engine starter pushbutton, keeping it pressed as it also operates the booster coil. If the engine fails to start on the first cartridge, subsequent priming action will depend on whether the engine was initially over- or under-primed. Normally, no further priming should be given except for half a stroke as each subsequent cartridge is fired, or less if the air temperature is high. At low air temperatures it may be necessary to continue priming after the engine has fired, and until it picks up on the carburettor.

(vii) When the engine is running smoothly, release the starter pushbutton, screw down the primer and return the selector cock to ALL OFF.

(viii) Allow the engine to run slowly until the oil pressure steadies, then open up smoothly to 1,200–1,400 r.p.m. and warm up at this speed.

40. **Testing the engine and services**

(i) While warming up :—
Check all temperatures and pressures.
Test the operation of the pneumatic system by lowering and raising the flaps, and check with the ground crew the operation of the radiator shutters.
Test each magneto as a precautionary check before increasing power further.

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(ii) After warming up to at least 15°C. oil temperature and 40°C. coolant temperature :—

(a) Open up to the static boost reading and exercise and check the operation of the constant-speed propeller by moving the lever over its full range at least twice. With the lever fully forward check that the r.p.m. are within 50 of those normally obtained.

(b) At the same boost, check the operation of the two-speed supercharger. R.p.m. should fall and boost rise when high gear is engaged. Change back to low gear and ensure that the original conditions are restored.

(c) At the same boost, check that the generator is charging by ensuring that the generator failure warning light is out.

(d) At the same boost test each magneto in turn. If the single ignition drop exceeds 100 r.p.m. but there is no undue vibration, the ignition should be checked at higher power, see below. If there is marked vibration the engine should be shut down and the cause investigated.

NOTE.—The following full power checks should be carried out after repair, inspection other than daily, when the single ignition drop at the static boost reading exceeds 100 r.p.m. or at the discretion of the pilot. Except in these circumstances if the checks above are satisfactory no useful purpose will be served by a full power check. When these checks are made the tail of the aircraft must be securely lashed down.

(e) Open the throttle fully and check take-off boost and r.p.m. This check should be as brief as possible.

(f) Throttle back until the r.p.m. fall just below the take-off figure and test each magneto in turn. If the single ignition drop exceeds 100 r.p.m. the aircraft should not be flown.

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(iii) After completing the checks, either at the static boost reading, or at full power, steadily move the throttle to the fully-closed position, and check the idling r.p.m., then open up to between 1,000 and 1,200 r.p.m.

41. **Taxying**

Before taxying, check that the brake pressure is 80 lb./sq. in. (140 lb./sq. in. if Mod. 489 is embodied) and pneumatic supply pressure 300 lb./sq. in. If lower, ensure that it has built up while the engine has been running.

WARNING.—The aircraft is nose-heavy on the ground and care should be taken when using the brakes.

42. **Check list before take-off**

Trimming tabs		
Elevator		
(Mk. 45)	Neutral	
(Mk. 46)	2 divs. nose up	
Rudder		
(Mk. 45)	Fully left (Handwheel fully back)	
(Mk. 46)	Neutral	
R.p.m. control lever	INCREASE (fully forward)	
Fuel	Check contents	
Mk. 45		
Lower fuselage tank cock	ON	
Fuel transfer cock	NORMAL	
Drop tank cock	OFF	
Booster pump	ON	
Mk. 46		
Rear fuselage tank cock	OFF	See para. 37 (ii) if full fuel is not carried
Lower fuselage tank cock	ON	
Fuel transfer cock	COMBAT TANKS	
Drop tank cock	OFF	
Booster pump	MAIN	
Flaps	UP (lever at AIR-OFF)	
Supercharger control	M.S. (AUTO NORMAL for combat)	
Air-intake filter control ...	FILTER IN OPERATION	
Radiator shutters switch (if fitted)	OPEN	

43. **Take-off**

(i) *Mk. 45*
Whenever possible open the throttle slowly up to +7 lb./sq. in. boost only. This is important as there is a strong tendency to swing right and to crab in the initial stages and if much power is used tyre wear is severe on runways. +12 lb./sq. in. boost should be used on becoming airborne, but +7 lb./sq. in. is sufficient for a normal take-off.

(ii) *Mk. 46.*
Full power may be used for take-off: there is no swing. Normally, however, from a runway +12 lb./sq. in. boost (obtained at the gate) is quite sufficient.

(iii) When comfortably airborne brake the wheels and retract the undercarriage. Check that it is locked up by the indicator. 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) Unless operating in sandy or dust-laden conditions set the carburettor air-intake control to NORMAL INTAKE at 1,000 feet, and return the radiator shutters switch to CLOSED (automatic position).

(v) On Mk. 46 aircraft change over to rear fuselage tank at 2,000 ft. (see para. 37).

44. **R.A.T.O.G. (Mk. 46 aircraft)**
(To be issued by Amendment)

45. **Climbing**

(i) The recommended climbing speed is 150 knots I.A.S. from sea level to 25,000 feet, thereafter reducing speed by 3 knots per 1,000 feet.

(ii) On a combat climb the supercharger will automatically change to high gear at 11,000 feet approximately, but under normal conditions (2,600 r.p.m. and +9 lb./sq. in. boost) the maximum rate of climb is obtained by delaying the gear change until the boost has dropped to $+6\frac{1}{4}$ lb./sq. in. To do this fly with the override switch in the M.S. position until the boost has fallen to this figure.

(iii) Use of the air-intake filter considerably reduces the full throttle height.

46. **General flying**

(i) *Stability*
Mk. 45 aircraft. At all loads stability about all axes is satisfactory except when climbing at low airspeeds, when some deterioration in longitudinal stability is apparent.
Mk. 46 aircraft. Longitudinal stability is improved as compared with Mk. 45 aircraft.

(ii) *Changes of trim*

Undercarriage down	nose down
Undercarriage up	nose up
Flaps down	nose up
Flaps up	nose down
Radiator shutters open	nose up
Radiator shutters closed	nose down

On Mk. 45 aircraft there is a marked change of directional trim with changes in speed and power.

(iii) *Controls and trimmers*
The controls are light and effective throughout the speed range. Both trimmers are very effective. In a high speed dive the rudder and rudder trim tab must be handled carefully as any sudden application of either will cause the aircraft to skid violently.

(iv) *Flying* ~~in poor visibility~~ at reduced airspeeds. Ah 1
Speed should be reduced to 140 knots I.A.S., flaps lowered and the r.p.m. control lever set to give 2,400 r.p.m. Speed may then be reduced to 115 knots I.A.S. A careful check must be kept on oil and coolant temperatures

47. Stalling

(i) The stalling speeds, engine off, in knots I.A.S. are :—

	At typical service load	At full load
Undercarriage and flaps up	80	85
Undercarriage and flaps down	72	76

(ii) Warning of the approach of a stall is given by buffetting some 5–10 knots before the stall itself which is immediately preceded by aileron snatch. At the stall either wing and the nose drop gently. Recovery is straightforward and easy.

(iii) Adequate warning of the approach of a stall at high speed is given by pronounced buffetting and aileron snatch. At the stall the aircraft will normally flick either to right or left. Recovery is immediate if pressure on the control column is relaxed.

48. Spinning

Intentional spinning is prohibited. Should an inadvertent spin occur, normal recovery action should be initiated immediately.

49. Diving

(i) The aircraft become increasingly tail heavy as speed is increased and should be trimmed into the dive. The elevator trim tab may be used to assist recovery but should be handled carefully as it is powerful and sensitive.

(ii) On Mk. 45 aircraft the tendency to yaw should be corrected by accurate use of the rudder trim tab. This tendency is not apparent on Mk. 46 aircraft.

50. Aerobatics

(i) The following speeds are recommended :—

Roll	180–220 knots I.A.S.
Loop	320–340 knots I.A.S.
Roll off loop ...	330–350 knots I.A.S.
Upward roll ...	360-400 knots I.A.S.

(ii) Flick manœuvres are prohibited. Inverted flying, other than that involved in executing the above manœuvres, should be avoided because of the rapid fall in oil pressure.

51. Check list before landing

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(i) Reduce speed to below 140 knots I.A.S., open the sliding hood and lock it by setting the door in the intermediate position, and then (for deck landing) lower the arrester hook and check the indicator light which may not come on until speed has been reduced to 110 knots I.A.S.
(If mods. 498 and 519 are embodied, speed need only be reduced to 170 knots I.A.S. before lowering the undercarriage.)

(ii) Check pneumatic supply pressure (300 lb./sq. in.) and brake pressure (80 lb./sq. in.—or 140 lb./sq. in. if Mod. 489 is embodied).

Fuel	Check contents Booster pump on in tank in use.
Supercharger control ...	M.S. (red light out)
Air-intake filter control	FILTER IN OPERATION
Radiator flaps switch (if fitted)	OPEN
Then :—	
Undercarriage	DOWN. Check by indicator and external mechanical indicators (if fitted)—also selector lever has returned automatically to IDLE, and in the gate.
Tail wheel	Green light on
R.p.m. control lever ...	Set for 2,600 r.p.m. ~~fully forward on final approach~~ A.L.1.
Flaps	DOWN (then check pneumatic pressure again)

52. Approach and landing

(i) The recommended final approach speeds in knots I.A.S. are :—

	At maximum landing weight	
	Flaps down	Flaps up
Engine assisted	85	90
Glide	100	100

(ii) The initial approach should be made at a speed some 10–15 knots higher than these quoted above. In all cases speed may be reduced by 5 knots when ammunition or considerable fuel has been expended.

NOTE. Flapless landings require rather a long landing run. Care should be exercised when using the brakes because the aircraft are rather nose heavy on the ground.

(iii) The recommended final approach speed for deck landing is 75 knots I.A.S. An improved view of the deck is obtained if a curved approach is made.

53. **Mislanding**

(i) The aircraft will climb away easily at climbing power with the undercarriage and flaps down, and the use of full take-off power is not advised on Mk. 45 aircraft due to the large change of directional trim. On Mk. 46 aircraft, there is not the same large change of directional trim because of the counter-rotating propeller.

(ii) Open the throttle to +9 lb./sq. in. boost, raise the undercarriage and retrim.

(iii) Climb away at 115 knots I.A.S. with the flaps fully down.

(iv) Above 300 feet raise the flaps and retrim.

WARNING.—On Mk. 45 aircraft the application of instantaneous full power when near the stall results in a considerable rolling tendency to starboard added to a very strong tendency to turn to starboard which cannot always be checked by the use of opposite rudder and aileron alone. Care should be taken after a mislanding, especially during a deck landing approach, not to open the throttle at such a rate that the tendencies to roll and turn to starboard cannot be controlled.

54. **After landing**

A.L.1 para. 54 (i) to (iii) page 30

(i) Before taxying, raise the flaps, set the propeller speed control lever fully forward and switch off the booster pump. Check that brake pressure is sufficient for taxying. On reaching the dispersal area :—

(ii) If the serviceability of the engine is in doubt, such items in the run-up given in para. 40 as may be necessary should be carried out. In all cases, however, the engine should be idled at 1,200 r.p.m. for a short period and if no other check of the ignition has been made the magnetos should be tested for a dead cut.

(iii) To stop the engine move the fuel cut-off control to the fully aft position.

(iv) When the engine has stopped, turn off the ignition, set the radiator shutters to CLOSED (if switch is fitted) and switch off all the electrical services including the electrical master switch. Turn off the fuel.

(v) Oil dilution (See A.P. 2095)
The correct dilution periods for this aircraft are :—
Atmospheric temperatures above – 10°C.—1 minute.
Atmospheric temperatures below – 10°C.—2 minutes

PART III

OPERATING DATA

55. **Engine data—Griffon 61 and 87**

(i) *Fuel :* 100 octane (100/130 grade) only.

(ii) *Oil :* See NAMO ENGNS/S.1

(iii) Engine limitations :

		R.p.m.	Boost lb/sq. in.	Temp. °C Coolant	Oil
MAX. TAKE-OFF TO 1,000 FT.	M	2,750	+ 12 (Griffon 61) + 18 (Griffon 87)	—	—
MAX. CLIMBING 1 HR. LIMIT	M S	2,600	+9	125	90
MAXIMUM CONTINUOUS	M S	2,400	+7	105	90
COMBAT 5 MINS. LIMIT	M S	2,750	+18	135	105

NOTE.—Boosts above +12lb./sq. in. must not be used at less than 2,600 r.p.m.

OIL PRESSURE		
NORMAL	60–80 lb./sq. in.	at 2,400 r.p.m., 90°C
MINM. IN FLIGHT ...	45 lb./sq. in.	
MINM. TEMPS. FOR TAKE-OFF—		
OIL		15° C.
COOLANT		40° C.

56. **Flying limitations**

(i) The aircraft are designed for the duties of a single-seat fighter and fighter/bomber, but intentional spinning is not permitted. When external stores or drop tanks (other than wing combat tanks on Mk 46 aircraft) are carried, aerobatics are prohibited and violent manœuvres are to be avoided.

(ii) The Mk. 45 aircraft is cleared to carry the following stores :

1—50 gallon fuselage drop tank.
1—250 lb. or 500 lb. fuselage bomb.

The Mk. 46 aircraft is cleared to carry the following stores :

2—22½ gallon wing combat tanks
1—50 gallon fuselage drop tank.
1—250 lb. or 500 lb. fuselage bomb.
8—25 lb. or 60 lb. head R.P.

(iii) *Maximum speeds*

(a) *Without external stores*

From sea level to 10,000 ft. ...	455	knots I.A.S.
From 10,000 ft. to 15,000 ft. ...	410	„ „
From 15,000 ft. to 20,000 ft. ...	375	„ „
From 20,000 ft. to 25,000 ft. ...	340	„ „
From 25,000 ft. to 30,000 ft. ...	300	„ „
From 30,000 ft. to 35,000 ft. ...	270	„ „
Above 35,000 ft.	240	„ „

A.L.1 para. 56 (iii) (a) page 32

NOTE.—These speeds also apply if the aircraft is carrying external fuel tanks with the following exceptions :—
If Mod. 790 has not been embodied the aircraft is restricted to 300 knots I.A.S. when a 50-gallon fuselage tank is carried.
If Mod. 955 has not been embodied the aircraft is restricted to straight flying and gentle manœuvres only when the wing combat tanks are carried.

(b) *With external stores*

All external stores may be carried and released up to the maximum permissible diving speeds given in (a) above. The following table gives the maximum angle of dive at which each store may be released.

500 lb. SAP and 250 lb. A.S. bombs ...	50°
*10 lb. and 25 lb. practice bombs	50°
500 lb. M.C. (fitted 77 tail) bomb	45°
500 lb. smoke bomb	20°
Mk. XI depth charge	20°
*Reconnaissance flares 4 in. and 4.5 in. training	straight and level

*Four, on light series carrier and adaptor, Mk. III.

(c) *With* 8-60 *lb. or* 8-25 *lb. R.P.* (Mk. 46 only)

The R.P. may be carried and fired at all speeds up to the maximum permissible diving speed of the aircraft.

R.P. may not be carried in combination with either the fuselage bomb or wing combat tanks.

(d) *Maximum speeds for jettisoning external fuel tanks (full or empty)*

Wing combat tanks	400 knots I.A.S.
Fuselage drop tank	300 „ „

NOTE.—The tanks should be jettisoned in level flight.

(e) *Other maximum speed limitations*

For lowering undercarriage	175 knot I.A.S. (If Mods. 498 and 519 are embodied). 140 knots I.A.S. (If Mods. 498 and 519 are not embodied.)
For lowering flaps ...	140 knots I.A.S.
For emergency release of complete fuselage bomb installation ...	130 knots I.A.S.
For flying with RATOG carriers still attached	150 knots I.A.S.

(iv) *Landing limitations*

Landing with stores on or with external fuel tanks full should always be regarded as an emergency measure. Landings with live bomb attached are prohibited but in the event of a hang-up of dummy bombs or R.P. or of the impossibility of emptying wing combat or fuselage drop tanks, landings may be made on airfields at the discretion of Commander (Air). If possible the landing should not be made until sufficient fuel or ammunition has been used to reduce the landing weight to the maximum weight permitted for landings (see sub. para. (v)).

(v) *Maximum permissible all-up weights*

Mk. 45 *aircraft*

Take-off straight flying and gentle manœuvres only	10,000 lb.
All forms of flying and landing	9,500 lb.

NOTE.—Landings above this weight should only be made in an emergency.

Mk. 46 *aircraft*

Take-off, straight flying and gentle manœuvres only	11,400 lb.
All forms of flying	10,500 lb.
Landing	9,900 lb.

NOTE.—Landings above this weight should only be made in an emergency.

(vi) *Approximate aircraft weights (lb.) with different stores*

	F. Mk. 45	F. Mk. 46	F.R.Mk.46
*T.S.L.	9,360	10,050	10,140
T.S.L. + 50 gal. fuselage drop tank	9,770	10,460	10,550
T.S.L. + 500 lb. fuselage bomb	9,910	10,600	10,690
T.S.L. + wing combat tanks + 50 gal. fuselage drop tank	—	10,830	10,920
T.S.L. + 8.60 lb. R.P. + 50 gal. fuselage drop tank	—	11,270	11,360

* T.S.L. means Typical Service Load, ie., with full internal fuel and ammunition.

57. Position error corrections

From ..	100	140	185	225	280	Knots
To	140	185	225	280	350	I.A.S.
Add	8	4	0	—	—	Knots
Subtract ..	—	—	0	4	8	Knots

58. Maximum performance

(i) *Climbing*

(a) The speed for maximum rate of climb is 150 knots I.A.S. from sea level to 25,000 feet, thereafter reducing speed by 3 knots per 1,000 feet.

(b) On a combat climb the supercharger will automatically change to high gear at 11,000 feet, but under normal climbing conditions (2,600 r.p.m. and +9 lb./sq. in. boost) the maximum rate of climb is obtained by delaying the gear change until the boost has dropped to +6¼ lb./sq. in. To do this, fly with the override switch in the M.S. position until the boost has fallen to this figure.

(c) Use of the air intake filter considerably reduces the full throttle height.

(ii) *Combat*

Set the supercharger override switch to NORMAL AUTO, the r.p.m. control lever to give 2,750 r.p.m. and the throttle fully open.

59. Economical flying

(i) The recommended speed for maximum range is 160-170 knots I.A.S.

(ii) With the supercharger override switch at MS fly at the maximum obtainable boost (not exceeding +7 lb./sq. in.) and obtain the recommended airspeed by reducing r.p.m. as required.

NOTE.—(a) R.p.m. should not be reduced below a minimum of 1,800. At low altitudes, therefore, it may be necessary to reduce boost or the recommended speed will be exceeded.

(b) As the boost falls at high altitudes it will not be possible to maintain the recommended speed, even at maximum cruising r.p.m. and full throttle. It will then be necessary to set the supercharger override switch to AUTO. Boost will then be restored and it will be possible to reduce r.p.m. again (as outlined in (a) above).

(c) In both low and high gears r.p.m. which promote rough running should be avoided.

60. Fuel capacities and consumptions

(i) *Fuel capacities*

Upper fuselage tank	36 gallons
Lower fuselage tank	48 gallons
Rear fuselage tank (Mk. 46 only) ...	32 gallons
2 wing tanks (12½ gallons each) ...	25 gallons
2 wing tanks (5½ gallons each) ...	11 gallons
2 wing combat tanks (22½ gallons each) (Mk. 46 only)	45 gallons
Total (Mk. 45)	120 gallons
Total (Mk. 46)	197 gallons
Fuselage drop tank	50 gallons

(ii) *Fuel consumptions (approx. gals./hr.)*

(a) Weak mixture (as obtained at +7lb./sq. in. boost and below) and low gear at 5,000 feet:

Boost lb./sq. in.	R.p.m.			
	2,400	2,200	2,000	1,800
+7	88	85	80	—
+4	74	71	67	60
+2	65	63	59	52
0	57	55	51	46
−2	50	47	43	41

NOTE.—For every 5,000 feet increase in height *add* 4 gals./hr.

(b) Weak mixture (as obtained at +7lb./sq. in. boost and below) and high gear at 20,000 feet:

Boost lb./sq. in.	R.p.m.			
	2,400	2,200	2,000	1,800
+7	95	92	87	—
+4	82	78	74	70
+2	73	70	66	63
0	66	63	59	56
−2	59	56	52	49

(c) Rich mixture (as obtained above +7lb./sq. in. boost) and low gear at 5,000 feet:

Boost lb./sq. in.	R.p.m.	Gals./hr.
+18	2,750	180
+12	2,750	130
+ 9	2,600	103

PART IV

EMERGENCIES

61. Undercarriage emergency operation

(i) If the selector lever jams and cannot be moved to the fully down position after moving it out of the gate, return it 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.

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(iii) If the lever springs into the slot and the indicator shows that the undercarriage is not locked down, hold it 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 (81) forward and downward through 110°. The CO_2 cylinder will lower only the main wheels unless Mod. 638 is embodied, in which case it will also lower the tailwheel. The lever should not be returned to its original position and no attempt must be made to raise the undercarriage until the CO_2 bottle has been replaced.

NOTE.—(a) Although the emergency system prior to Mod. 638 is not designed to lower the tailwheel it has been known to do so, and should be tried if the main wheels have lowered satisfactorily but the tailwheel green light fails to show.

(b) *Warning.* If the tailwheel has not lowered and a landing is made, the deck hook fairing may be bent upwards and jam the rudder, when the tail of the aircraft strikes the ground. Pilots are warned, therefore, that the landing should be completed, and no attempt be made to "go round again."

(c) If the CO_2 cylinder has been accidentally discharged with the undercarriage selector lever in the up position, the undercarriage will not lower unless the pipeline from the cylinder is first broken.

62. Flaps emergency operation

On aircraft fitted with Mod. 600 the flaps may be lowered in the event of failure of the normal system as follows:

If the flaps fail to lower when the control is moved to the DOWN position, or if, having been lowered, the air bottle empties completely due to a leak in the flaps control system, the flaps lever should be returned to the UP position, and the flaps may then be lowered by operating the lever on the CO_2 cylinder which is on the cockpit right-hand wall.

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

63. Hood jettisoning

The hood may be jettisoned in an emergency by pulling the rubber knob inside the top of the hood forward and downward, and pushing the lower edge of the hood outboard with the elbows.

64. Jettisoning of wing combat and fuselage drop tanks

(i) The wing combat tanks (on Mk. 46 aircraft) may be jettisoned by pulling the release levers (52) at the left of the pilot's seat, as far aft as they will go.

(ii) The fuselage drop tank may be jettisoned by operating the handle (86) on the right-hand side of the cockpit below the undercarriage control. The handle is pulled up to jettison the tank, but it cannot be operated until the drop tank cock (87) is moved forward to the OFF position.

65. Forced landing

In the event of engine failure necessitating a forced landing:

(i) If a drop tank is carried it should be jettisoned.

(ii) The fuel cut-off control should be pulled fully back and the booster pump switched off.

(iii) The cockpit hood should be jettisoned or else opened and the door set on the catch (see para. 30).

(iv) A speed of at least 125 knots I.A.S. should be maintained while manœuvring with the undercarriage and flaps retracted.

(v) Flaps must not be lowered until it is abundantly clear that the selected landing area is within easy gliding reach.

(vi) The final straight approach should be made at a speed of 95 knots I.A.S.

(vii) If oil pressure is still available the glide can be lengthened considerably by setting the r.p.m. control lever fully back past the stop on the quadrant.

66. Ditching

(i) Whenever possible the aircraft should be abandoned by parachute rather than ditched, since the ditching qualities are known to be very poor.

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(ii) Successful ditchings are possible in favourable conditions of wind and sea and when ditching is inevitable the wing combat tanks and the fuselage drop tank (if fitted) should be jettisoned (release will be more certain if the aircraft is gliding straight) and the following procedure observed:—

(a) The cockit hood should be jettisoned.

(b) Flaps should be lowered in order to reduce the touchdown speed as much as possible.

(c) The undercarriage should be kept retracted.

(d) The safety harness should be kept tightly adjusted and the R/T plug should be disconnected.

(e) The engine, if available, should be used to help make the touchdown in a tail-down attitude at as low a forward speed as possible.

(f) Ditching should be along the swell, or into wind if the swell is not steep, but the pilot should be prepared for a tendency for the aircraft to dive when contact with the water is made.

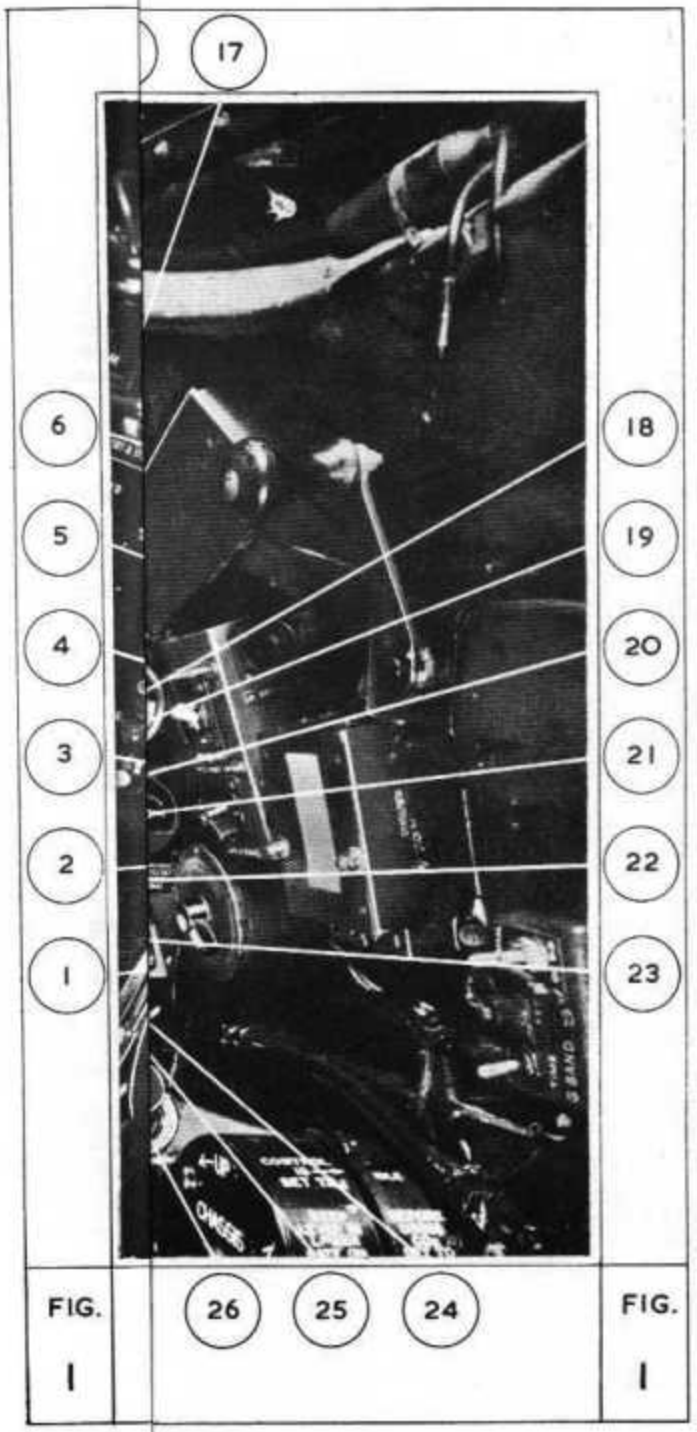
PART V

ILLUSTRATIONS

KEY TO *Fig.* 1.

INSTRUMENT PANEL

1. Pneumatic supply and brakes pressure gauge.
2. Tailwheel indicator light.
3. Ignition switches.
4. Arrester hook indicator light.
5. Undercarriage position indicator.
6. Oxygen regulator.
7. Gyro gunsight—R.P./Guns selector (Mk. 46 only).
8. R.P. (PAIRS - SALVO) switch (Mk. 46 only).
9. Flaps selector control.
10. Gun and cine-camera firing pushbutton.
11. "Press-to-transmit" pushbutton.
12. Gyro-gun-sight.
13. Gyro-caging pushbutton.
14. Cine-camera independent pushbutton.
15. Engine speed indicator.
16. Supercharger gear-change switch.
17. Supercharger high gear warning light.
18. Boost gauge.
19. Oil pressure gauge.
20. Oil temperature gauge.
21. Coolant temperature gauge.
22. Fuel contents warning light.
23. Rear tank fuel contents gauge (Mk. 46 only).
24. Fuel pressure warning lamp.
25. Priming selector cock.
26. Cylinder priming pump.
27. Main tanks fuel contents gauge.
28. Engine starter re-indexing control.
29. Engine starter pushbutton.
30. Lower fuselage tank cock.
31. Brakes lever.
32. Compass.
33. Generator failure warning light (Mk. 46 only).
    Note: On Mk. 45 this light is on electrical panel below the trimming tab controls.
34. Elevator trimming tab indicator.
35. RATOG carrier jettison control (Mk. 46 only).
36. Gyro gunsight master switch (Mk. 46 only).
    Note: On Mk. 45 this switch is on right-hand side of cockpit, above the undercarriage control.
37. RATOG master switch (Mk. 46 only).
38. RATOG firing pushbutton (Mk. 46 only).
    Note: On Mk. 45 this pushbutton is used for release of bombs.



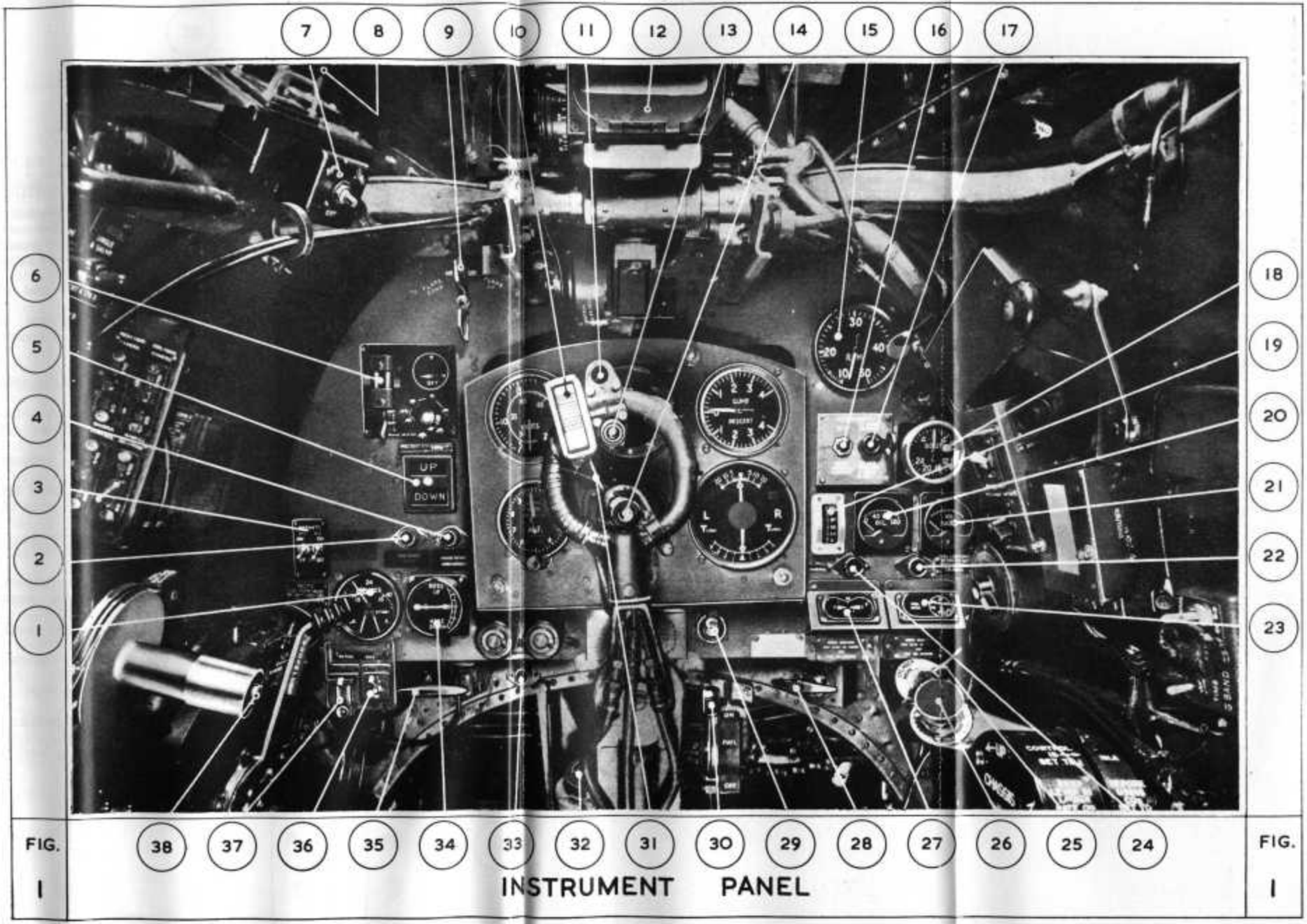


FIG. 1

INSTRUMENT PANEL

FIG. 1

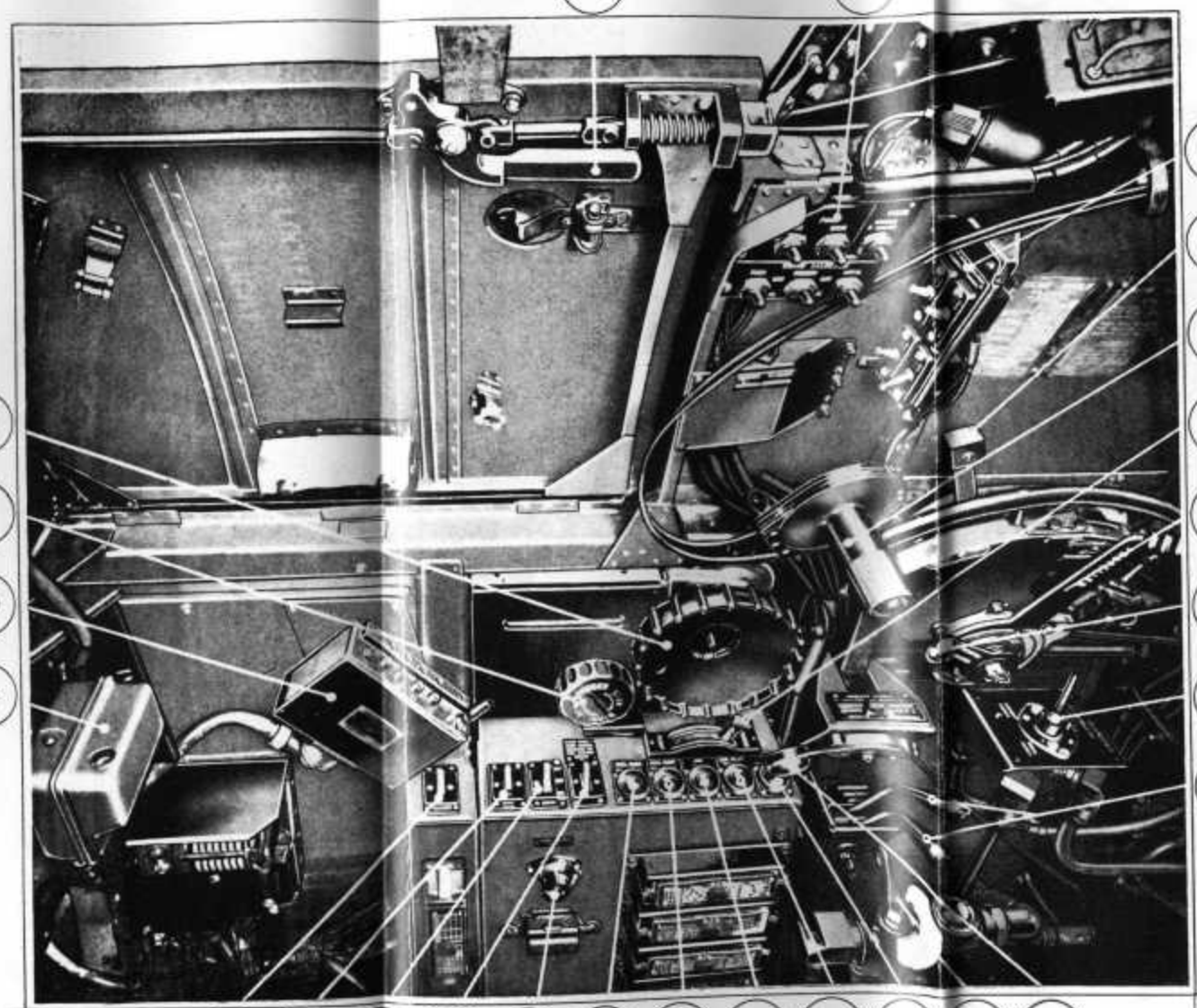


FIG. 2 COCKPIT — PORT SIDE FIG. 2

KEY TO *Fig.* 2

COCKPIT—PORT SIDE

39. R.P. auto selector control.
40. General purpose radio controller.
41. Rudder trimming tab control.
42. Elevator trimming tab control.
43. Door handle.
44. Bomb selector and fuzing switches.
45. Vertical and oblique camera controls (FR Mk. 46 only).
46. Fuel cut-off lever.
47. Throttle control.
48. Ground/flight switch (Mk. 46 only).
49. R.p.m. control lever.
50. Throttle friction damper lever.
51. Fuel transfer cock.
52. Wing combat tanks jettison levers (Mk. 46 only).
53. Air-intake filter control lever.
54. Rear fuselage tank cock (Mk. 46 only).
55. Oil dilution pushbutton.
56. Radiator shutters — test push-button.
57. Supercharger test pushbutton.
58. Rear tank booster pump test pushbutton.
59. Main tanks booster pump test pushbutton.
60. Fuel booster pumps ammeter test socket.
61. Fuel booster pumps master switch.
62. Navigation lamps switch.
63. Pressure-head heater witch.
64. Cine-camera master switch.

KEY TO *Fig.* 3.

COCKPIT—STARBOARD SIDE

65. Undercarriage selector control.
66. Gyro gunsight selector dimmer.*
67. Identification lamps colour selector (Mk. 46 only).
68. Identification lamps master switch (Mk. 46 only).
69. Identification lamps morse push-button (Mk. 46 only).
    Note: On Mk. 45 the identification lamps are controlled by a switchbox mounted in place of items (67) (68) and (69).
70. Telephone junction box.*
71. Sliding hood winding lever (Mk. 46 only).
72. IFF auxiliary control unit (Mk. 46 only).
73. IFF demolition switches.
74. Homing control unit.*
75. Vertical camera mud flap release (F.R. Mk. 46 only).
76. Pilot's harness release.
77. Heated gloves switch (Mk. 46 only).
78. Heated boots switch (Mk. 46 only).
79. IFF "D" switch.
80. IFF "F" switch.
81. Undercarriage emergency control.
82. Deck hook release.
83. Windscreen de-icing pump.
84. Oxygen supply tube.
85. Windscreen de-icing cock.
86. Fuselage drop tank jettison handle.
87. Fuselage drop tank fuel cock.

* These items are mounted in slightly different positions on Mk. 45 aircraft, because of the absence of the sliding hood winding lever (71).

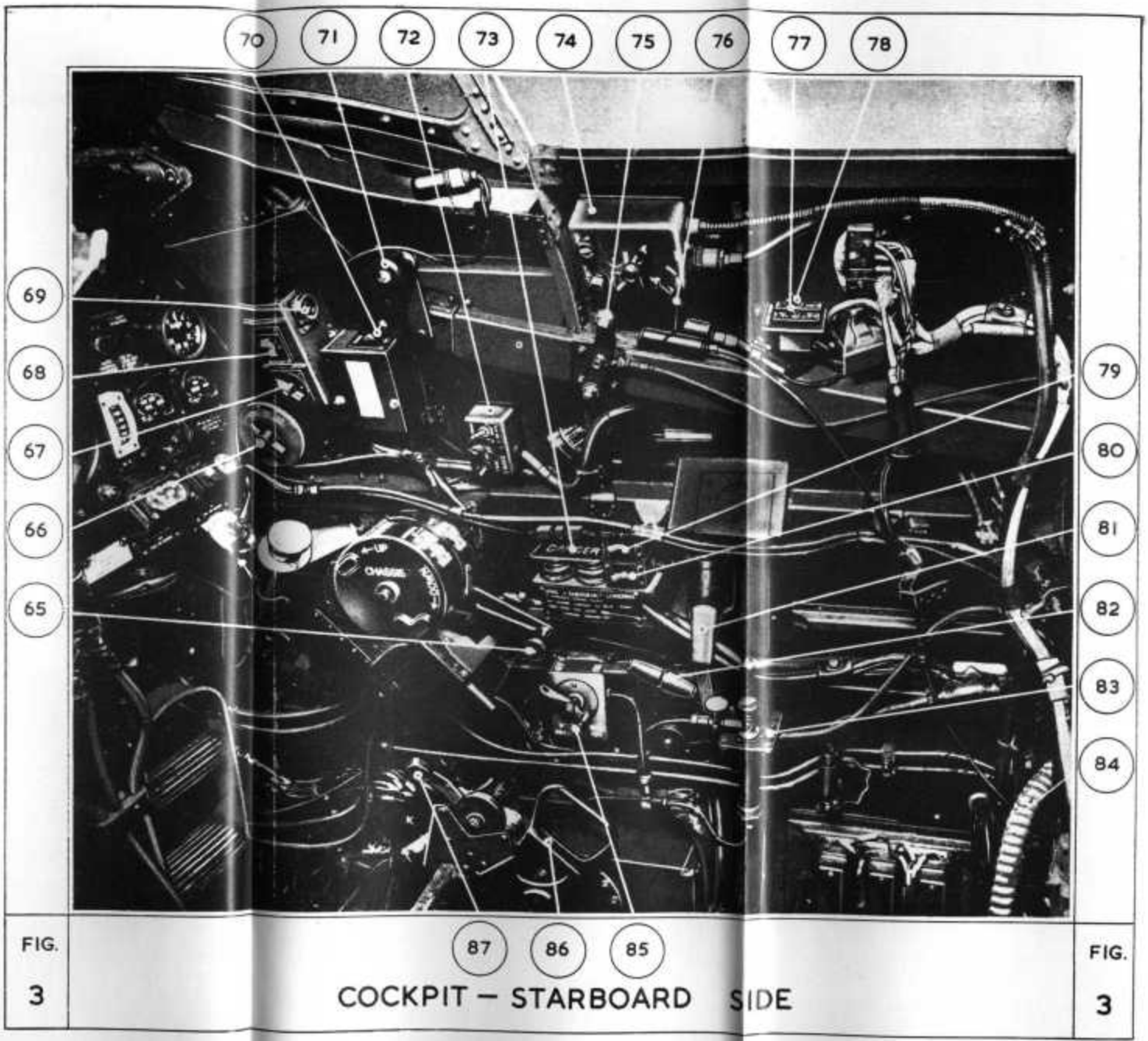


FIG. 3

COCKPIT — STARBOARD SIDE

FIG. 3