A.P. 1565T & W—P.N.

PILOT'S NOTES
FOR
SPITFIRE
XIV & XIX
GRIFFON 65 or 66 ENGINE

PREPARED BY DIRECTION OF THE MINISTER OF SUPPLY

O. S. Franks.

PROMULGATED BY ORDER OF THE AIR COUNCIL

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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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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

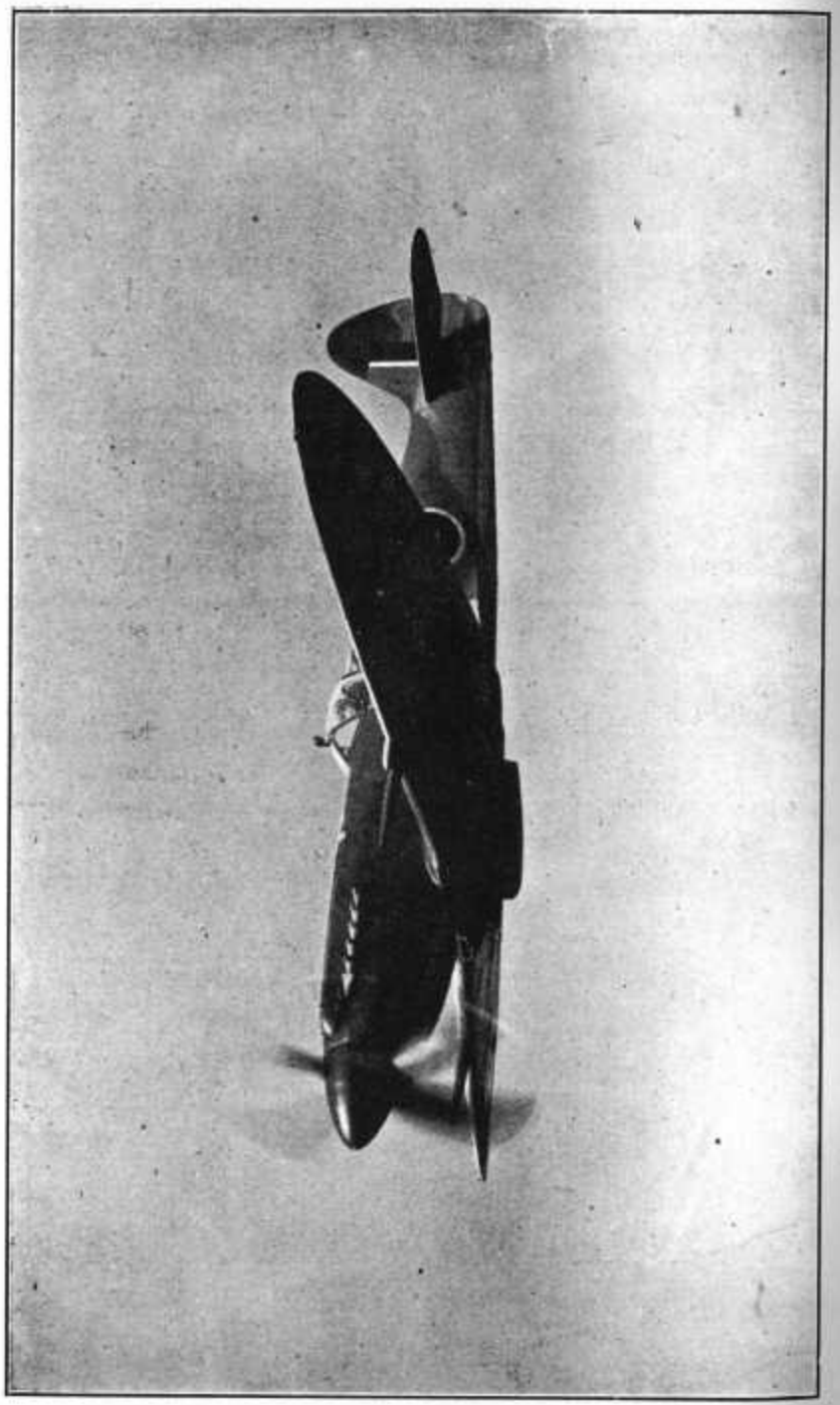
THIS publication is divided into five parts: Descriptive, Handling, Operating Data, Emergencies, and Illustrations. Part I gives only a brief description of the controls with which the pilot should be acquainted.

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 by the Station Publications Officer by application on Form 294A, in duplicate, to Command headquarters for onward transmission to A.P.F/S., 81, Fulham Road, S.W.3 (see A.M.O. A1114/44). The number of this publication must be quoted in full—A.P.1565T & W—P.N. (2nd Edition).

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



SPITFIRE F Mk. XIV

AIR MINISTRY
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SPITFIRE XIV & XIX PILOT'S NOTES

LIST OF CONTENTS

PART I—DESCRIPTIVE

A " blister " type drop tank of 30, 45 or 90 gallons capacity, or a " torpedo " type drop tank of 50 gallons capacity, may be carried beneath the fuselage.

The capacities of the permanent tanks are:—

Top main tank	36 gallons
Bottom main tank	49 gallons
2 wing tanks (each 13 gallons)	26 gallons
Total	111 gallons

(ii) *F.R. Mk. XIV aircraft:* An additional tank of 31 gallons capacity is fitted in the rear fuselage behind the cockpit. Fuel in it is fed direct into the main pipeline through an on-off cock mounted on the left-hand side of the cockpit.

NOTE.—Except for special operations, as directed by the appropriate Operational Commander, the rear fuselage tank is sealed off and is not to be used.

(iii) *P.R. Mk. XIX aircraft:* The two wing tanks, the capacities of which are increased to 66 gallons each, feed direct to the engine through separate on-off cocks and non-return valves. The total tank capacity is 217 gallons.
Pressure cabin aircraft have an additional tank of 20 gallons capacity in each wing from which fuel is fed automatically into the top main tank by means of air pressure and a float operated cut-off valve.

3. Fuel cocks

(i) *F. Mk. XIV aircraft:* The cock control for the main tanks (24) is mounted below the engine starter pushbutton. The transfer valve selector cock (41) for admitting air pressure to either wing tank, is below and slightly forward of the throttle quadrant. It is important that this cock be returned to the NORMAL VENTING or PRESSURISING position after use, or pressurising of the main tanks will not be effective. The pressurising cock (65) is mounted on the right-hand cockpit wall, just below seat level.

The cock control (75) and jettison lever (73) for the auxiliary drop tank are mounted together on the right-hand side of the cockpit, below the undercarriage selector lever. The jettison lever is pulled up to jettison the drop tank, but it cannot be operated until the cock control lever is moved forward to the OFF position.

(ii) *F.R. Mk. XIV aircraft:* The control for the rear tank cock is a small hand wheel mounted on the left-hand side of the cockpit, below the throttle box.

(iii) *P.R. Mk. XIX aircraft:* The cocks of the two 66-gallon wing tanks are operated by two levers, one for each tank, mounted together on a bracket below the left-hand side of the instrument panel.

4. Fuel booster pumps

(i) *F. Mk. XIV aircraft:* On early aircraft a hand wobble pump (78) for raising fuel pressure before starting the engine, is mounted below the signalling switchbox on the right-hand cockpit wall.

On later aircraft this pump is replaced by an electric booster pump which is fitted in the bottom main tank. The switch (49) for this pump is mounted on the electrical panel together with a test pushbutton (48).

(ii) *F.R. Mk. XIV aircraft:* There are two electric booster pumps, one in the lower main tank and the other in the rear tank. The pumps are controlled by a three-position switch mounted on the electrical panel. In the outboard position this switch operates the booster pump in the lower main tank and in the inboard position it operates the booster pump in the rear tank.

(iii) *P.R. Mk. XIX aircraft:* There are three electric booster pumps, one in each 66-gallon wing tank and one in the bottom main tank. The three pumps are controlled by a master switch and a three-way selector switch, mounted together on the right-hand side of the cockpit. A test push-button for each pump is fitted below the two switches.

NOTE.—The fuel cut-off lever must be kept in the fully aft position when a booster pump is on and the engine is not running; otherwise, fuel will be injected into the supercharger at high pressure and there will, in consequence, be a serious risk of fire.

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

(i) *F. Mk. XIV aircraft:* The contents gauge (20) for the main fuel tanks is on the right-hand side of the instrument panel. It has two dials which give readings for the combined contents of the top and bottom tanks. A red mark (at 60 gallons) indicates the level of fuel at which transfer from the wing tanks should be commenced.

The warning light (21) on the right-hand side of the instrument panel, just below the oil pressure gauge, comes on at any time when the fuel pressure at the carburettor falls appreciably below normal.

The contents gauges and warning light are switched on and off by the undercarriage indicator switch.

(ii) *F.R. Mk. XIV aircraft:* The contents gauge for the rear fuselage tank is mounted to the left of the main tanks contents gauge.

(iii) *P.R. XIX aircraft:* There is a contents gauge for each 66-gallon wing tank on the corresponding side of the cockpit.

6. **Oil system**

Oil is supplied from a tank of 9 gallons oil capacity and 3 gallons air space, mounted between the top main fuel tank and the fireproof bulkhead. The oil passes through a filter before entering the engine. A cooler is fitted inside the fairing of the port wing radiator and oil pressure (19) and temperature (18) gauges are mounted on the right-hand side of the instrument panel.

An oil dilution system is fitted. It is controlled by a shielded pushbutton (45) on the electrical panel.

7. **Coolant system**

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 (17) on the right-hand side of the instrument panel.

MAIN SERVICES

8. **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 tail wheel.

9. **Electrical system**

A 12-volt generator charges an accumulator which supplies the whole of the electrical system. A red light (53) on the electrical panel, marked GEN. FAILURE, is illuminated when the generator is not charging the accumulator.

NOTE.—If the electrical system fails, or is damaged, the supercharger will remain in (or return to) low gear and the radiator flaps will remain closed.

10. **Pneumatic system**

An engine-driven air compressor feeds two storage cylinders for the operation of the

brakes
cannon
flaps
machine guns
radiator flaps and
supercharger gear change ram.

The cylinders each hold air at a pressure of 300 lb./sq. in.

NOTE.—If the pneumatic system fails, the supercharger will remain in (or return to) low gear, but the position of the radiator flaps will depend on the nature of the failure.

The brakes (see para. 68), flaps, and gun and cannon firing mechanism will also be inoperative.

AIRCRAFT CONTROLS

11. Flying controls

(i) The control column is of the spade-grip pattern and incorporates the brakes lever (28) and gun and cannon firing control.

(ii) The rudder pedals (42 and 76) have two positions for the feet and are adjustable for reach by rotating the star wheels (43) on the sliding tubes.

12. Flying controls locking gear

Two struts (63) are stowed on the right-hand cockpit wall. 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.

13. Trimming tabs controls

(i) The elevator trimming tabs are controlled by a handwheel (55) on the left-hand side of the cockpit and their setting is shown on an indicator (27) on the bottom left-hand side of the instrument panel.

(ii) A smaller handwheel (54) aft of the elevator trimming tab control operates the rudder trimming tab. No indicator is provided.

NOTE.—When this handwheel is wound clockwise it tends to turn the aircraft to the right.

14. Undercarriage selector lever

The undercarriage selector lever (74) moves in a gated quadrant on the right-hand side of the cockpit.

To raise the undercarriage the lever must be moved downwards and inwards to disengage it from the gate, and then moved forward smartly in one movement to the full extent of the quadrant. When the undercarriage is locked up the lever will automatically spring into the forward gate.

To lower the undercarriage, the lever must be held forward for about two seconds, then pulled back in one movement to the full extent of the quadrant. When the undercarriage is locked down the lever will spring into the rear gate.

Warning.—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. 67.

15. Undercarriage indicator

The electrically operated visual indicator (6) 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 indicator switch (4) incorporates a sliding bar which prevents the ignition switches from being switched on until the indicator is also switched on. The indicator switch also operates the tailwheel indicator light (5) and the fuel pressure warning light.

16. Flaps control

The split flaps have two positions only, up and fully down. They are controlled by a finger lever (9) fitted on the top left-hand side of the instrument panel.

17. 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 (2), showing the air pressures in the pneumatic

system and at each brake, is mounted on the left-hand side of the instrument panel.

ENGINE CONTROLS

18. Throttle control

The throttle lever (34) moves in a quadrant gated at the take-off position. Mixture control is fully automatic and there is no pilot's control lever. The short lever (40) on the inboard side of the quadrant is a friction adjuster for the throttle and propeller speed control levers; forward movement increases the friction damping or locking.

19. Propeller control

On early aircraft the propeller speed control (39) on the throttle quadrant varies the governed r.p.m. from 2,750 down to below 1,800. Speeds below this figure should, however, not be used except in the event of a forced landing when it is necessary to lengthen the glide.

On later aircraft the propeller speed control is interconnected with the throttle control. The interconnection is effected by a lever similar to the normal speed control lever and known as the override lever. When this is pulled back to the stop in the quadrant (the AUTOMATIC position) the r.p.m. are controlled by the positioning of the throttle lever. When pushed fully forward to the MAX. REVS. position it overrides the interconnection device and r.p.m. are then governed at approximately 2,750. The override lever can be used in the same way as the conventional propeller speed control lever to enable the pilot to select higher r.p.m. than those given by the interconnection.

It must be remembered that the interconnection is effected only when the override lever is pulled back to the stop in the quadrant; indiscriminate use of the lever in any position forward of this stop will increase fuel consumption considerably.

At low altitudes the corresponding r.p.m. for a given boost with the override lever set at AUTOMATIC are as follows:

Boost (lb./sq. in.)	*R.P.M.*
+ 3 and below	1800 to 1850
+ 7 (cruising)	2250 to 2400
+12 (at the gate)	2725 to 2775
+18 (fully open)	2725 to 2775

20. Supercharger controls

The two-speed two-stage supercharger is controlled by a switch (14), marked MS and AUTO NORMAL POSITION, mounted on the right-hand side of the instrument panel. When this switch is set to MS the supercharger remains in low gear at all altitudes; when it is set to AUTO NORMAL POSITION an electro-pneumatic ram, which is controlled by an aneroid, automatically engages high gear at about 13,000 ft. when the aircraft is climbing and re-engages low gear at about 12,000 ft. when the aircraft is descending.

There is a pushbutton (47) on the electrical panel for ground testing the gear change and a red light (15) on the instrument panel, next to the supercharger switch, comes on whenever high gear is engaged, either on the ground or in flight.

21. Radiator flaps control

The radiator flaps are fully automatic and there is no manual control. A pushbutton (46) for ground testing the operation of the flaps is fitted on the electrical panel.

22. Fuel cut-off control

The fuel cut-off control (37), which is used when starting and stopping the engine, is mounted outboard of the throttle lever. It is spring-loaded and is set forward to allow the carburettor to deliver fuel to the engine. The fuel supply is cut off when the lever is pulled back and engaged in the gate.

23. **Cylinder priming pump and cock**

A Ki-gass, type K.40, pump (77) for priming the engine is mounted immediately forward of the undercarriage selector lever. The priming selector cock (59), just forward of the Ki-gass pump, is marked MAIN, GROUND and ALL OFF. The first position is used for priming with normal fuel from the main fuel tanks, and the GROUND position for priming with high volatility fuel from an outside source in cold weather. In flight the cock must be in the ALL OFF position.

24. **Ignition switches**

The ignition switches (3) on the left-hand side of the instrument panel cannot be moved to the ON position until the undercarriage indicator is switched on.

25. **Cartridge starter re-indexing control**

The Coffman starter breech re-indexing control is a pull-grip toggle (22) below the right-hand side of the instrument panel. The magazine for the starter holds five cartridges which are fired by the engine starter push-button (23). This also operates the booster coil.

26. **Hand starting**

No provision is made for starting the engine by hand.

27. **Carburettor air intake filter control**

The filter control lever (44) 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.

OPERATIONAL EQUIPMENT AND CONTROLS

28. **Guns and cannon**

The machine guns and cannon are fired pneumatically by means of a selective pushbutton (1) on the control column spade-grip; pressing the top of this pushbutton

fires only the machine guns, pressing the bottom fires only the cannon, but pressing the centre of it fires the machine guns and cannon together.

The pushbutton is locked in the SAFE position by a catch at the bottom of its casing. When the catch is pushed up to FIRE a small stud can be felt projecting through the top of the casing.

29. **Gyro gun sight controls**

The ranging control for the gyro gun sight on later aircraft is incorporated in the top of the throttle lever, and the selector and ON—OFF switches are on the right-hand cockpit wall, above the undercarriage selector lever.

30. **Camera gun and camera**

(i) A G.45 camera gun is mounted in the starboard wing root and is pneumatically operated by the gun and cannon firing pushbutton or by a separate pushbutton (26) on the control column spade-grip. There is a master switch on the electrical panel which must be ON before the camera gun will operate.

(ii) On FR. Mk. XIV aircraft a F.24 oblique camera is installed in the rear fuselage.

The type 35 control for this camera is mounted high up on the right-hand cockpit wall.

(iii) On P.R. Mk. XIX aircraft alternative groups of cameras may be installed in the rear fuselage. The cameras are controlled by four switches on the electrical panel and a type 35 control mounted at the top of the instrument panel. A green light at the side of each of the three switches comes on when the corresponding camera is switched ON. The fourth switch is a master switch.

The oblique camera (when fitted) can also be operated separately by the pushbutton in the throttle lever.

31. **Bomb release controls**

The bomb distributor, fusing, and selector switches (31 and 32) are mounted together on the left-hand side of the

cockpit, just forward of the door. The bomb release pushbutton (38) is incorporated in the top of the throttle lever.

In an emergency the bombs may be jettisoned by pulling the toggle mounted below the left-hand side of the instrument panel and marked DANGER, EMERGENCY BOMB RELEASE.

OTHER CONTROLS

32. **Cockpit door**

The cockpit door is fitted with a two-position catch (30) which allows it to be partly opened, thus preventing the sliding hood from coming forward in the event of a crash or forced landing.

It will be found that the catch operates more easily when the aircraft is airborne than when it is on the ground.

33. **Sliding hood**

(i) The " tear drop " hood on later F. Mk. XIV aircraft and all F.R. Mk. XIV aircraft is opened and closed by a crank handle mounted on the right-hand cockpit wall, above the undercarriage selector lever.

The handle must be pulled inwards before it can be rotated.

The hood may be locked in any intermediate position by releasing the crank handle which then engages with the locking ratchet.

(ii) 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) The hood may be jettisoned in emergency (see para. 69).

34. **Windscreen de-icing**

A tank containing de-icing fluid is mounted on the lower right-hand side of the cockpit. There is a cock (72) above the tank and a pump (66) and needle valve (67) further aft to control the rate of flow of the fluid. This is pumped to a spray at the base of the windscreen over which it is blown by the slipstream.

After use the plunger must be locked down by the catch and the cock then returned to the OFF position.

35. **Navigation and identification lights**

(i) The switch (52) controlling the navigation lights is on the electrical panel.

(ii) The downward identification lights are controlled by a signalling switchbox (79) on the right-hand cockpit wall, above the Ki-gass priming pump. Amber, red or green lights may be selected by a three-position switch beneath the coaming.

36. **Cockpit lighting**

Two floodlights are fitted, one on each side of the cockpit. The right-hand light (58) can be moved vertically and the left-hand light (36) can be moved in all directions. Both are shielded to prevent glare and are controlled by dimmer switches (25) mounted on the bottom of the instrument panel.

37. **Cockpit ventilation**

A small thumb lever (13) at the top right-hand side of the instrument panel opens and closes the scoop which admits cold air to the cockpit.

PRESSURE CABIN (P.R. Mk. XIX aircraft)

38. **Automatic valve**

The differential pressure in the cabin is automatically controlled by a valve to a maximum of $+2\frac{1}{2}$ lb./sq. in. and commences to build up at about 11,000 feet, the maximum being reached and maintained at heights of 28,000 feet and above. The reverse holds on the descent.

39. **Air supply**

Air is drawn through an intake just below the port 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 on the right-hand side of the cockpit, diverts the air supply to atmosphere when pressurising of the cabin is not required.

40. **Cabin hood**

The hood 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. 69.

41. **Cabin ventilation**

Two hand-operated ventilators are provided in the cockpit, an intake incorporated in the rear view mirror and an extractor in the right-hand cockpit wall.

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

42. **Cabin instruments**

The cabin instruments on the right-hand side of the instrument panel comprise an altimeter to which the pilot refers when adjusting the oxygen supply, and a red warning light which comes on when the differential pressure in the cabin has fallen by 1 lb./sq. in.

43. **Operation of cabin controls**

(i) *To pressurise the cabin:*

(*a*) Close the intake and extractor ventilators.

(*b*) Close the spill valve by moving the lever to TO PRESSURISE.

(*c*) Turn ON the HOOD SEAL PRESSURE cock.

NOTE.—It is recommended that the cabin 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.

(ii) *To exhaust cabin pressure*

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

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

PART II

HANDLING

NOTE.—Except for special operations, as directed by the appropriate Operational Commander, the rear fuselage tank on F.R. Mk. XIV aircraft is sealed off and is not to be used.

44. **Management of the fuel system**

(i) *F. Mk. XIV and F.R. Mk. XIV aircraft*

(*a*) Start the engine, warm up, taxy and take-off on the main tanks. On F.R. Mk. XIV aircraft change over to the rear fuselage tank at 2,000 feet and turn OFF the main tanks. On F. Mk. XIV aircraft (and after emptying the rear fuselage tank on F.R. Mk. XIV aircraft) transfer the fuel from one of the wing tanks when the contents of the top main tank fall to the red mark on the gauge. After 3 minutes return the transfer valve selector cock to NORMAL, then transfer the fuel from the second wing tank and after a further 3 minutes return the selector cock to NORMAL again.

NOTE.—When all the fuel has been transferred the selector cock must be set to NORMAL, otherwise pressurising of the main tanks will not be effective.

A.L.1
Part II
Para. 44
(i) (*b*)

(*b*) *When fitted with a drop tank*

Start the engine, warm up, taxy and take-off on the main tanks, then at a safe height (2,000 ft.) change over to the drop tank and turn off the main tanks cock.

NOTE.—On FR Mk. XIV aircraft change over to the rear fuselage tank and empty it before using fuel from the drop tank.

(*c*) Unless flying at ground (or sea) level, it is safe to drain the drop tank completely. When the fuel pressure warning light comes on or the engine cuts:—

(i) Close the throttle at once.

(ii) Turn off the drop tank cock and then turn on the main tanks cock and switch on the booster pump.

(iii) Idle the engine until it runs smoothly, then open up slowly.

NOTE.—If no booster pump is fitted, the hand wobble pump may be used to assist the pick up.

(*d*) If it is necessary to jettison the drop tank before it is empty, switch on the main tanks booster pump and turn on the main tanks cock before turning the drop tank cock off.

NOTE.—(i) When flying at ground (or sea) level it is recommended that the change over to the main tanks is made before the drop tank is completely empty, working on a time basis.

(ii) Always ensure that the drop tank cock is in the fully OFF position after the tank has been emptied or jettisoned; otherwise, air may be drawn into the main fuel system and thus cause engine cutting.

(ii) *P.R. Mk. XIX aircraft*

(*a*) Start the engine, warm up, taxy and take off on the main tanks; then change over to one of the wing tanks at 2,000 feet. (If a drop tank is carried fuel should be used from it first.) Fly on each wing tank alternately for twenty minutes until the fuel in both has been used up; this will be indicated by the fuel pressure warning light. Then change back to the main tanks.

NOTE.—By operating the wing tank cocks every 20 minutes the possibility of them freezing up at altitude is lessened.

(*b*) For each change of tanks, first turn ON the cock of the next tank in sequence, select the appropriate booster pump and then turn OFF the cock of the tank just used.

(iii) *Use of the booster pumps*

(*a*) The main tanks booster pump should be switched on for starting the engine, take-off and landing and at all times when these tanks are in use in flight.

(*b*) On F.R. Mk. XIV aircraft the rear fuselage tank booster pump should be switched on at all times when changing to or using fuel from that tank.

(*c*) On P.R. Mk. XIX aircraft the booster pumps master switch must be switched OFF when the pumps are not in use.

45. **Preliminaries**

(i) Switch on the undercarriage indicator and check the contents of the fuel tanks. On Mk. XIV aircraft see that the wing tank transfer valve selector cock is in the NORMAL position and that the rear fuselage tank (if fitted) cock is OFF. On Mk. XIX aircraft see that both wing tank cocks are off. If a drop tank is fitted, check that the cock is OFF.

(ii) Check that the undercarriage selector lever is down and that the indicator light shows DOWN and the tailwheel light is on.

(iii) Test the operation of the flying controls and trimming tab controls and adjust the rudder pedals for equal length.

(iv) Ensure that the fuel cut-off lever is in the fully aft position, then check the operation of the booster pumps by sound.

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

NOTE.—The tail must be tied down for a full run up. Ensure that there are no aircraft or personnel behind.

(i) Set the main fuel cock ON.

(ii) Set the controls as follows:

Ignition switches	OFF
Throttle	1½ inches open
Propeller control ..	Fully forward
or override lever	MAX. REVS
Fuel cut-off control ..	Fully aft
Supercharger switch ..	AUTO NORMAL POSITION
Carburettor air intake filter control	FILTER IN OPERATION
Priming selector cock ..	MAIN (GROUND for HV. fuel)

NOTE.—High volatility fuel (Stores ref.: 34A/111) should be used for priming at air temperatures below freezing.

(iii) Operate the Ki-gass priming pump until the fuel reaches the priming nozzles; this can be judged by a sudden increase in resistance.

(iv) Switch on the main tanks booster pump.

NOTE.—When the engine is not running the booster pump must not be switched on unless the fuel cut-off control is in the fully aft position.

(v) Index the cartridge starter. The following types of cartridge should be used.

At air temperatures *above* +10°C: No. 4, Mk. I

At air temperatures *below* +10°C: No. 5, Mk. I

(vi) Immediately before attempting to start switch ON the ignition and prime with the following number of strokes if the engine is cold:

Air temperature °C:	+30	+20	+10	0	—10	—20
Normal fuel:	1	1	2	5	—	—
High volatility fuel:	—	—	—	1	2	3

Leave the priming pump plunger out and press the cartridge starter pushbutton. As soon as the engine fires release the fuel cut-off control. (Keep the button pressed until the engine is running steadily as it also controls the booster coil.)

NOTE.—(*a*) It may be necessary to continue priming until the engine picks up on the carburettor.

(*b*) A visual all-clear signal must be obtained from the ground crew before each cartridge is fired.

(vii) Screw down the priming pump and turn OFF the priming selector cock.

(viii) Open up slowly to 1,200 r.p.m., then warm up at this speed.

(ix) Switch off the booster pump and check that the fuel pressure warning light does not come on. Then switch the pump on again.

(x) If the engine fails to start on the first cartridge the fuel cut-off control must be returned immediately to the fully aft position and the booster pump must be switched off. No further priming should be given except for half a stroke as each subsequent cartridge is fired.

NOTE.—If a cartridge fails to fire, a wait of at least one minute must be allowed before the next cartridge is inserted in the Coffman breech.

47. Testing the engine and services

While warming up:

NOTE.—If a drop tank is carried it should be selected and the flow of fuel from it checked by running on it for at least one minute.

(i) Check temperatures and pressures.

(ii) Check the operation of the flaps.

(iii) Press the radiator test pushbutton and have the ground crew check that the flaps open.

(iv) Test each magneto in turn as a precautionary check before increasing power further.

After warming up to at least 15° C. oil temperature and 60° C. coolant temperature:

(v) Open up to 0 lb./sq. in. boost and exercise and check the operation of the supercharger by pressing and holding in the test pushbutton. Boost should rise slightly and the red warning light should come on when high gear is engaged. Release the pushbutton after 30 seconds.

(vi) At the same boost exercise at least twice and check the operation of the constant speed propeller. Check that the generator is charging.

NOTE.—*The following comprehensive checks should be carried out after repair, inspection other than daily, or at any time at the discretion of the pilot. When these checks are performed the tail of the aircraft must be securely lashed down. Normally they may be reduced in accordance with local instructions and the tail need not then be lashed down.*

(vii) With the propeller speed control or override lever fully forward, open the throttle to the gate and check take-off boost and static r.p.m.

(viii) Throttle back to +9 lb./sq. in. boost, or further if necessary to ensure that r.p.m. fall below the take-off figure, then test each magneto in turn. The single ignition drop should not exceed 100 r.p.m.

(ix) If an interconnection is fitted, throttle back to +3 lb./sq. in. boost and set the override lever to AUTOMATIC; r.p.m. should fall to 1,800—1,850. Return the lever to MAX. REVS.

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

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

T—Trimming tabs

Rudder:	Fully left (hand-wheel fully back)
Elevator:	(*a*) At typical service load (full ammunition, but no fuel in the rear fuselage tank, and no external stores) 8,375 lb.: Neutral
	(*b*) At typical service load plus rear fuselage tank fuel, but no external stores, 9,000 lb.: Neutral—½ division NOSE DOWN
	(*c*) At typical service load plus rear fuselage tank fuel and full 90-gallon drop tank, 9,772 lb.: ½–1 division NOSE UP
P—Propeller control or override lever	Fully forward MAX. REVS.
F—Fuel	Main tanks cock ON Main tanks booster pump on Transfer valve selector cock NORMAL Drop tank cock OFF
F—Flaps	UP
Supercharger ..	Switch—AUTO NORMAL POSITION Red light—out
Carburettor air intake filter control	FILTER IN OPERATION

NOTE.—It is particularly important on these aircraft to clear the engine before take-off.

49. **Take-off**

(i) 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 to the right and to crab in the initial stages of the take-off run. If much power is used tyre wear is severe.

+12 lb./sq. in. boost may be used at heavy load, and should in any case be used on becoming airborne to minimise the possibility of lead fouling of the sparking plugs, but +7 lb./sq. in. boost is sufficient for a normal take-off.

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

(iii) If fitted, move the override lever smoothly back to AUTOMATIC when comfortably airborne.

(iv) Unless operating in sandy or dust laden conditions, set the carburettor air intake filter control to NORMAL INTAKE at 1,000 ft.

50. Climbing

The recommended climbing speed from sea level to 22,000 ft. is 180 m.p.h. (155 knots) I.A.S.

NOTE.—(i) With the supercharger switch at AUTO high gear is engaged automatically when the aircraft reaches a height of about 13,000 ft. This is the optimum height for the gear change if full combat power is being used, but if normal climbing power (2,600 r.p.m. +9 lb./sq. in. boost) is being used, the maximum rate of climb is obtained by delaying the gear change until the boost in low gear has fallen to +5 lb./sq. in.

This is achieved by leaving the supercharger switch at MS until the boost has fallen to this figure.

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

51. General flying

(i) *Stability:*

(*a*) On early F. Mk. XIV aircraft with normal fuselages stability about all axes is satisfactory, but on those aircraft which have rear-view fuselages, and on all F.R. Mk. XIV aircraft, directional stability is reduced. On these aircraft the application of yaw, especially at high altitude, promotes a marked change of longitudinal trim and the rudder and rudder trimming tab must always be used with care.

(*b*) The addition of rear fuselage tank fuel impairs longitudinal stability and with this tank full the F.R. Mk. XIV aircraft should not be flown above 15,000 feet.

(*c*) When a 90-gallon drop tank is carried on F.R. Mk. XIV aircraft there is a marked reduction in longitudinal and directional stability. In this condition the aircraft is restricted to straight flying and very gentle manœuvres at low altitude in good weather conditions only, and it should be flown only by experienced pilots.

NOTE.—On those aircraft which have large chord rudders the instability described in (*c*) above is not so pronounced.

(ii) *Controls:* The elevator, and the rudder and elevator trimming tabs are powerful and sensitive and must be used with care.

(iii) *Changes of trim:*

Undercarriage down	Nose down
Undercarriage up..	Nose up
Flaps down ..	Initially nose up, finally little change
Flaps up	Nose down*

Changes of power and of speed induce marked changes in directional trim. These should be counteracted by careful and accurate use of the rudder trimming tab.

(iv) *Flying at low altitude in conditions of bad visibility:*
Reduce speed to 160 m.p.h. (140 knots) I.A.S. and lower the flaps. Set the propeller speed control or override lever to give 2,400 r.p.m. and open the cockpit hood. Fly at about 160 m.p.h. (140 knots) I.A.S., keeping a close watch on oil and coolant temperatures.

52. **Stalling**

(i) The stalling speeds (engine off) in m.p.h. (knots) I.A.S. are:

Undercarriage and flaps	F. Mk. XIV	F.R. Mk. XIV	
	At typical service load	At typical service load (plus rear tank fuel)	At typical service load (plus rear tank fuel and full 90-gallon drop tank)
	8,375 lb.	9,000 lb.	9,772 lb.
Up	85 (74)	93 (82)	98 (86)
Down ..	75 (65)	78 (68)	85 (74)

Warning of the approach of a stall is given by slight tail buffeting, the onset of which can be felt some 5 m.p.h. (4 knots) I.A.S. before the stall itself, and by a tendency for the right wing to drop. At the stall the right wing and the nose drop together and the tail buffeting becomes very pronounced.

(ii) Warning of the approach of a stall in a steep turn is given by tail buffeting which can be felt some 5–10 m.p.h. (4–8 knots) I.A.S. before the stall itself.
At the stall there is pronounced lateral buffeting and a tendency to flick to the left. Recovery is straightforward and immediate if pressure on the control column is relaxed.

53. **Spinning**

(i) Spinning is not permitted when external stores are carried, or when (on F.R. Mk. XIV aircraft) there is any fuel in the rear fuselage tank.

(ii) Recovery from a spin by the standard method is normal, but the loss of height involved 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.

(iii) The spin itself is erratic, the nose rising and falling and the rate of rotation varying, increasing as the nose falls and decreasing almost to a stop as it rises. Considerable tail buffeting persists throughout the spin.

(iv) A speed of 180 m.p.h. (160 knots) I.A.S. should be attained before starting to ease out of the resultant dive.

54. **Diving**

(i) As speed is gained, the aircraft becomes increasingly tail heavy and should, therefore, be trimmed into the dive. The tendency to yaw to ~~starboard~~ PORT should be corrected by accurate use of the rudder trimming tab.

(ii) No attempt should be made to reach the maximum diving speed (470 m.p.h., 410 knots I.A.S.) at heights above 20,000 feet, otherwise compressibility effects may be encountered. These effects produce a nose-down change of trim. If such a change of trim is observed, it must be held on the control column alone and no attempt must be made to correct it with the elevator trimming tab, for while this action will not immediately prove effective, it is likely to render the recovery violent when the Mach number falls at a lower altitude. It is equally important to avoid yawing the aircraft in an attempt to reduce speed.

(iii) The speeds in excess of which compressibility effects become apparent are as follows:

Up to 20,000 ft.	470	m.p.h.	I.A.S.
20,000 to 25,000 ft.	430	,,	,,
25,000 to 30,000 ft.	390	,,	,,
30,000 to 35,000 ft.	340	,,	,,

(iv) When carrying a bomb load the angle of dive must not exceed 60°.

55. Aerobatics

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

Roll	220–250 (190–220)
Loop	320–350 (230–300)
Half roll off the top of a loop ..	350–400 (300–350)
Climbing roll	350–450 (300–400)

(ii) Aerobatics are not permitted when carrying any external stores (except the 30-gallon " blister " type drop tank) or when there is any fuel in the rear fuselage tank.

(iii) Flick manœuvres are prohibited.

56. Check list before landing

(i) Reduce speed to 160 m.p.h. (140 knots) I.A.S., open the sliding hood and check:

U—Undercarriage ..	DOWN (check indicator)
Tailwheel	Light on
P—Propeller control or override lever ..	Set to give 2,400 r.p.m. (fully forward on the final approach)
Supercharger ..	Red light out
Carburettor air intake filter control ..	FILTER IN OPERATION
F—Fuel	Main tanks cock ON
	Main tanks booster pump on
F—Flaps	DOWN

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

NOTE.—The undercarriage operation takes considerably longer with the engine " off " than with it " on ".

57. Approach and landing

The recommended final approach speeds in m.p.h. (knots) I.A.S. are as follows:

	At typical service load (8,375 lb.)	
	Flaps down	*Flaps up*
Engine assisted	100 (87)	110 (96)
Glide	110 (96)	~~112~~ (100) 115 (102)

NOTE.—(i) The initial straight approach should be made at a speed some 20–25 m.p.h. (17–22 knots) I.A.S. above these figures.

(ii) On those aircraft which have " clipped " wings the speeds above should be increased by 5 m.p.h. (4 knots) I.A.S.

(iii) On those aircraft which have large chord rudders it is recommended that the rudder trimming tab control should be set approximately to neutral on the final straight approach in order to reduce the heavy footload necessary if the landing is baulked.

58. Mislanding

(i) The aircraft will climb away easily with the undercarriage and flaps down and the use of full take-off power is unnecessary.

(ii) Open the throttle steadily to give the desired boost.

NOTE.—The torque effect of the Griffon engine is opposite to and more powerful than that of the Merlin engine, and is of opposite sign.

(iii) Raise the undercarriage immediately.

(iv) With the flaps down climb at about 160 m.p.h. (140 knots) I.A.S.

(v) Raise the flaps at 300 ft. and retrim.

(vi) On aircraft which have large chord rudders the footload necessary in the event of a mislanding will be very great if the rudder trimming tab is not pre-set during the final approach (see para. 57 NOTE (iii)).

A.L.1 Part II Para. 59

59. **Beam Approach**

At weights up to " typical Service load " (8,375 lb.).

	Preliminary Approach	Inner Marker on Q.D.R.	Outer Marker on Q.D.M.	Inner Marker on Q.D.M.
Indicated height (feet)	Down to 1,500	1,000	700—800	150
Action ...	—	Lower the undercarriage	Lower the flaps and set the rudder trimming tab control to neutral	Throttle back slowly
Resultant change of trim	—	Nose down	Initially nose up, finally little change	Slightly nose down
I.A.S. m.p.h. (knots)	170(150)	160(140)	125(109)	110(96)
R.P.M. ...	2,400	2,400	2,750*	2,750*
Boost (level flight)	–4	–4	–1	—
Boose (500 ft./min.)	–5	–5	–3	—
Boost (overshoot)	—	—		+7
Remarks :		Reduce speed to 160 m.p.h. (140 knots) I.A.S. before lowering the undercarriage	OVERSHOOT Open up to +7 lb./sq. in. boost. Raise the undercarriage and climb at 160 m.p.h. (140 knots) I.A.S. Raise the flaps at 300–400 ft. and retrim.	

*With interconnected controls there is a tolerance on maximum r.p.m. (see para. 19).
Altimeter error at take-off —50 feet
Altimeter error at touch-down—80 feet
Add 3 millibars to Q.F.E. to give zero reading at touch down.

60. **After landing**

(i) *Before taxying:*

(*a*) Raise the flaps.

(*b*) Switch off the booster pump.

(ii) *On reaching dispersal:*

(*a*) Open up to 0 lb./sq. in boost and exercise the supercharger once (see para. 47 (v)).

(*b*) Throttle back to 800–900 r.p.m. and idle at this speed for a few seconds, then stop the engine by moving the fuel cut-off control fully aft.

(*c*) When the propeller has stopped rotating switch off the ignition and all other electrical services.

(*d*) Turn off the fuel.

(iii) *Oil dilution* (*see A.P.*2095)

The correct dilution period for these aircraft is:

1 minute at atmospheric temperatures *above* — 10° C.
2 minutes at atmospheric temperatures *below* — 10° C.

PART III

OPERATING DATA

61. Engine data : Griffon 65 and 66

(i) *Fuel*—100 octane only.

(ii) *Oil*—See A.P. 1464/C.37.

(iii) *The principal engine limitations are as follows:*

	Super-charger gear	R.P.M.	Boost lb./sq. in.	Temp. °C.	
				Coolant	Oil
MAX. TAKE-OFF TO 1,000 FT.	Low	2,750*	+12	—	—
MAX. CLIMBING 1 HR. LIMIT ..	Low / High	2,600	+9	125	90
MAX. CONTINUOUS ..	Low / High	2,400	+7	105 (115)	90
COMBAT 5 MINS. LIMIT ..	Low / High	2,750*	+18	135	105

*With interconnected controls there is a tolerance on "maximum" r.p.m. (see para. 19).

The figure in brackets is permitted for short periods.

OIL PRESSURE:

NORMAL .. .. .. 60–80 lb./sq. in

MINIMUM IN FLIGHT .. .. 45 lb./sq. in.

MINIMUM TEMPERATURES FOR TAKE-OFF:

OIL .. .. 15° C.

COOLANT .. .. 60° C.

62. Flying limitations

(i) *Maximum speeds in m.p.h. (knots) I.A.S.*

Diving (without external stores)* 470 (410)

Undercarriage down 160 (140)

Flaps down 160 (140)

*When external stores are fitted the limiting diving speeds are as follows:

(*a*) With 1 × 500 lb. AN/M 58 bomb, or 1 × 500 lb. AN/M 64 bomb, or 1 × 500 lb. AN/M 76 bomb, or 1 × 65 lb. nickel bomb Mk. II .. 440 (380)

(*b*) With 1 × 500 lb. S.A.P. bomb or smoke bomb Mk. II 400 (350)

(*c*) With 10 lb. practice bomb 420 (370)

(ii) *Maximum weights in lbs.*

	F.XIV	F.R.XIV	P.R.XIX
Overload:			
Take-off and gentle manœuvres only ..	9,900*	10,280*	9,400
Normal:			
Take-off and all forms of flying	8,600	8,980	8,600
Landing (except in emergency)	8,600	8,750	8,600

* At this weight take-off must be made only from a smooth, hard runway.

(iii) *Flying restrictions*

(*a*) Spinning is not permitted when carrying any external stores or when (on F.R. Mk. XIV aircraft) there is any fuel in the rear fuselage tank.

(*b*) Aerobatics and combat manœuvres are not permitted when carrying any external stores (except the 30-gallon "blister" type drop tank) or when (on F.R. Mk. XIV aircraft) there is any fuel in the rear fuselage tank.

(*c*) When a 90-gallon drop tank or a bomb load is carried, the aircraft is restricted to straight flying and only gentle manœuvres.

(*d*) When wing bombs are carried in addition to a drop tank or fuselage bomb, take-off must be made only from a smooth, hard runway.

(*e*) When carried, the 90-gallon drop tank must be jettisoned before any dive bombing is commenced.

(*f*) The angle of dive when releasing a bomb or bomb load must not exceed 60°.

(*g*) Except in emergency, the fuselage bomb or drop tank must be jettisoned before landing with wing bombs fitted.

(*h*) When jettisoning a drop tank, the aircraft should be flown straight and level at a speed not greater than 300 m.p.h. (260 knots) I.A.S.

63. Position error corrections

The corrections for position error are as follows:

From	130	160	180	210	240	260	300	340	380	m.p.h. I.A.S.
To	160	180	210	240	260	300	340	380	420	
Add	4	2	0	—	—	—	—	—	—	m.p.h.
Subtract	—	—	0	2	4	6	8	10	12	

From	115	140	155	180	210	230	260	300	330	knots I.A.S.
To	140	155	180	210	230	260	300	330	370	
Add	4	2	0	—	—	—	—	—	—	knots
Subtract	—	—	0	2	4	6	8	10	12	

64. Maximum performance

(i) *Climbing:*

(*a*) The speed for maximum rate of climb is 180 m.p.h. (155 knots) I.A.S. from sea level to 22,000 ft., thereafter reducing speed by 3 m.p.h. (2 knots) per 1,000 ft.

(*b*) With the supercharger switch at AUTO high gear is engaged automatically when the aircraft reaches a height of about 13,000 ft. This is the optimum height for the

A.L.1
Part III
Para. 64
Page 39

gear change if full combat power is being used, but if normal climbing power (2,600 r.p.m. +9 lb./sq. in boost) is being used, the maximum rate of climb is obtained by delaying the gear change until the boost in low gear has fallen to +5 lb./sq. in. This is achieved by leaving the supercharger switch at MS until the boost has fallen to this figure.

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

(ii) *Combat :*

Set the Supercharger switch to AUTO and open the throttle fully.

NOTE.—On those aircraft which do not have interconnected throttle and propeller controls, the propeller speed control lever must be advanced to the maximum r.p.m. position before the throttle is opened fully.

65. Economical flying

(i) *Climbing:*

On aircraft not fitted with interconnected throttle and propeller controls:

(*a*) Set the supercharger override switch to MS, the propeller speed control lever to give 2,400 r.p.m. and climb at the speeds given in para. 64 (i), opening the throttle progressively to maintain a boost pressure of +7 lb./sq. in.

(*b*) Set the supercharger override switch to AUTO when the maximum obtainable boost is +3 lb./sq. in., throttling back to prevent overboosting as the change to high gear is made.

On aircraft fitted with interconnected throttle and propeller controls:

(*a*) Set the supercharger override switch to MS, set the throttle to give +7 lb./sq. in. boost and climb at the speeds given in para. 64 (i).

(*b*) As height is gained, the boost will fall, but the throttle should not be advanced to restore it,, since r.p.m. will then be increased beyond the maximum permitted for continuous operation.

(*c*) When the boost has fallen to +3 lb./sq. in. set the supercharger override switch to AUTO.

(ii) *Cruising*

The recommended speed for maximum range is 200–210 m.p.h. (175–185 knots) I.A.S.

On aircraft not fitted with interconnected throttle and propeller controls:

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

NOTE. — (i) 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.

(ii) As the boost falls at high altitudes it will not be possible to maintain the recommended speed in low gear, 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 thus be restored and it will be possible to reduce r.p.m. again (as outlined in (*a*) above).

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

On aircraft fitted with interconnected throttle and propeller controls:

Set the supercharger override switch to MS and adjust the throttle to obtain the recommended speed. Avoid a throttle setting which promotes rough running.

NOTE.—At moderate and high altitudes it will be necessary to advance the throttle progressively to restore the falling boost and thus maintain the recommended speed. Now as the throttle is opened r.p.m. will increase and at a certain height the recommended speed will be unobtainable at a throttle setting which gives 2,400 r.p.m. At this height the supercharger override switch should be set to AUTO and the throttle then adjusted as before to maintain the recommended speed.

66. Fuel capacities and consumptions

(i) *Fuel capacities:*

(*a*) *Normal fuel capacities (F Mk. XIV and F.R. Mk. XIV aircraft)*

Top main tank	36 gallons
Bottom main tank	49 gallons
2 wing tanks (each 13 gallons)	26 gallons
Rear fuselage tank	31 gallons
Total all tanks (F.R. Mk. XIV)	142 gallons
Total all tanks (F. Mk. XIV)	111 gallons

(*b*) *Normal fuel capacity (P.R. Mk. XIX aircraft)*

Top main tank	36 gallons
Bottom main tank	49 gallons
2 wing tanks (each 66 gallons)	132 gallons
2 wing tanks (each 20 gallons)*	40 gallons
Total all tanks	257 gallons

* Pressure cabin aircraft only.

(*c*) *Long-range fuel capacities (gallons):*

	F. Mk.XIV	*F.R.Mk.XIV*	*P.R.Mk.XIX*
With 1 × 30 gal. drop tank	141	172	287
With 1 × 45 gal. drop tank	156	187	302
With 1 × 50 gal. drop tank	161	192	307
With 1 × 90 gal. drop tank	201	232	347

(ii) *Fuel consumptions* (approximate gals./hour)

(*a*) *Weak mixture and low gear at* 5,000 *ft.*

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

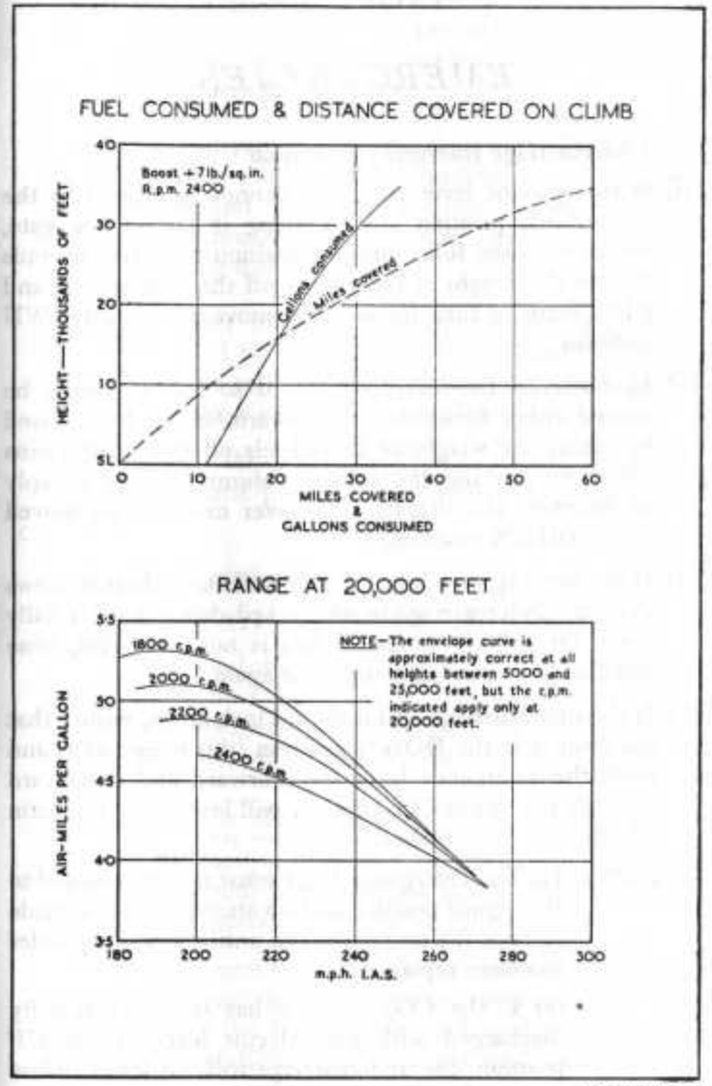
NOTE.—For every 5,000 ft. increase in height add 4 gallons per hour.

(*b*) *Weak mixture and high gear at* 20,000 *ft.*

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 and low gear at* 5,000 *ft.*

Boost lb./sq. in.	R.P.M.	
	2,750	2,600
+18	180	—
+12	130	—
+ 9	—	103



SPITFIRE XIV

PART IV

EMERGENCIES

67. 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.

(iii) If the lever springs into the gate 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 (68) forward and downward through 180°. (The CO_2 cylinder will lower only the main wheels, not the tailwheel.)

NOTE.—(*a*) The emergency lever must not be returned to its original position and no attempt must be made to raise the undercarriage until the CO_2 cylinder has been replaced.

(*b*) If the CO_2 cylinder has been accidentally discharged with the selector lever in the UP position, the undercarriage will not lower unless the pipeline from the cylinder is broken, either by hand or by means of the crowbar.

68. Failure of the pneumatic system

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

(ii) Alternatively, if a leak develops in the flaps control system 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.)

(iii) In either case the flaps 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 operative but without flaps.

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

69. Hood jettisoning

(i) *F. Mk. XIV and F.R. Mk. XIV aircraft*

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

(ii) *P.R. Mk. XIX aircraft*
ON ALL MARKS A/C

The hood is jettisoned by pulling the red knob on the instrument panel marked HOOD JETTISON—PULL. Considerable force may be necessary.

From outside the cockpit the hood may be opened in an emergency by breaking the cellophane cover on the port side of the fuselage and pulling the release ring marked EMERGENCY—PULL TO RELEASE HOOD.

WARNING.—Before jettisoning the hood, the seat should be lowered and the head then kept well down.

70. **Forced landing**

In the event of engine failure necessitating a forced landing:

(i) If a drop tank or bomb load 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 sliding hood should be opened and the cockpit door set on the catch (see para. 32).

(iv) A speed of at least ~~130~~ 140 m.p.h. (~~115~~ 122 knots) I.A.S. should be maintained while manœuvring with the undercarriage and flaps retracted.

(v) The 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 ~~90–95 m.p.h. (79–83 knots) I.A.S.~~ RECOMMENDED IN PARA. 57

(vii) If oil pressure is still available, the glide can be lengthened considerably by pulling the override lever fully back past the stop in the quadrant.

71. **Ditching**

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

(ii) When ditching is inevitable any external stores should be jettisoned (release will be more certain if the aircraft is gliding straight) and the following procedure observed:

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

(*b*) The 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 taildown 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.

72. **Crowbar**

A crowbar (29) for use in emergency is stowed in spring clips on the cockpit door.

PART V
ILLUSTRATIONS

Key to *Fig. 1*

INSTRUMENT PANEL

1. Gun firing pushbutton.
2. Pneumatic pressure gauge
3. Ignition switches.
4. Undercarriage indicator master switch.
5. Tailwheel indicator.
6. Undercarriage indicator.
7. Radio pushbutton controller.
8. Oxygen regulator.
9. Flap control.
10. Instrument flying panel.
11. Voltmeter.
12. Engine speed indicator.
13. Cockpit ventilator control.
14. Supercharger override switch.
15. Supercharger warning light.
16. Boost gauge.
17. Coolant temperature gauge.
18. Oil temperature gauge.
19. Oil pressure gauge.
20. Fuel contents gauge.
21. Fuel pressure warning light.
22. Starter breech reloading control.
23. Engine starter pushbutton.
24. Fuel cock control.
25. Cockpit floodlight switches.
26. Camera gun pushbutton.
27. Elevator tab indicator.
28. Brake lever.

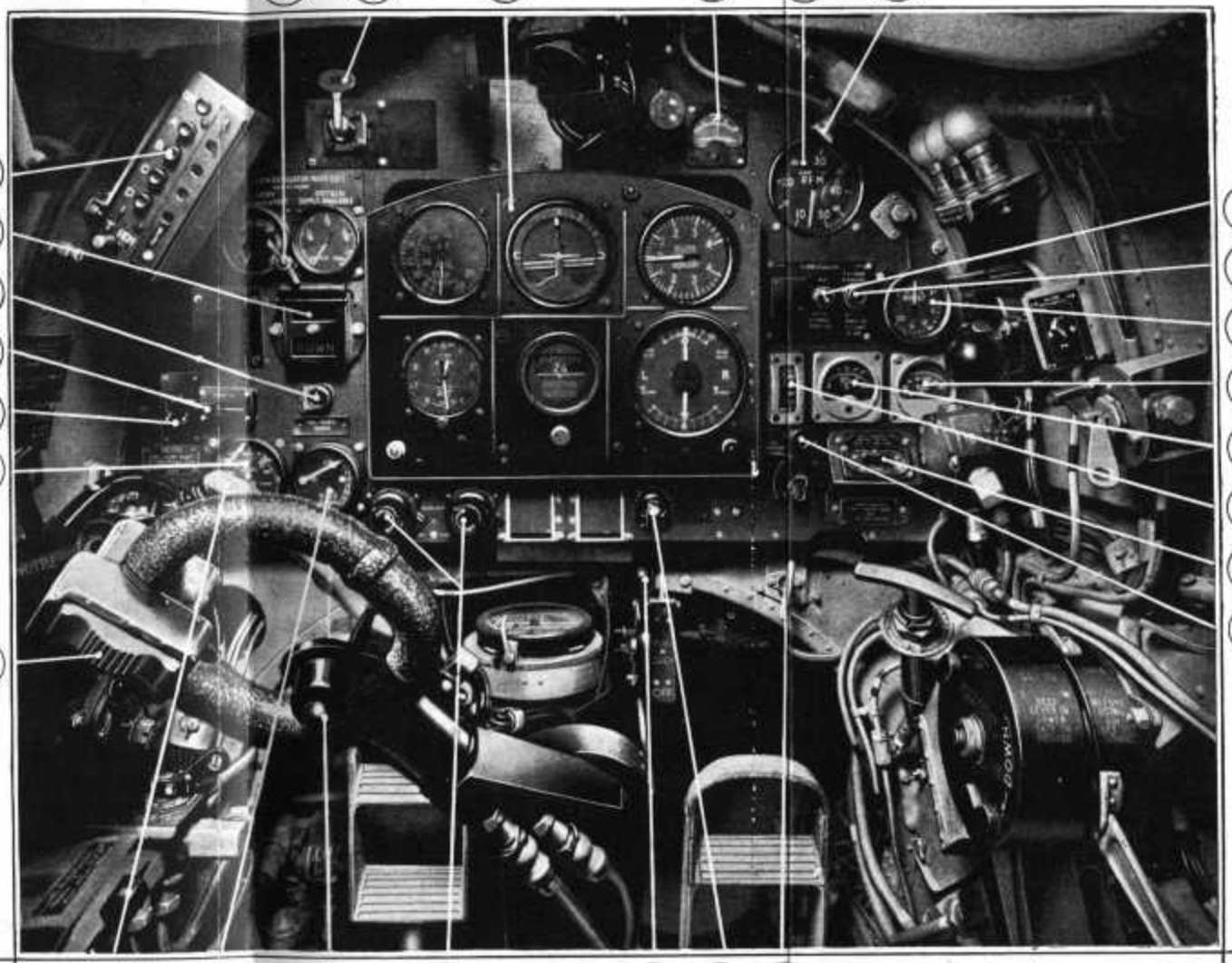


FIG. 1 INSTRUMENT PANEL FIG. 1

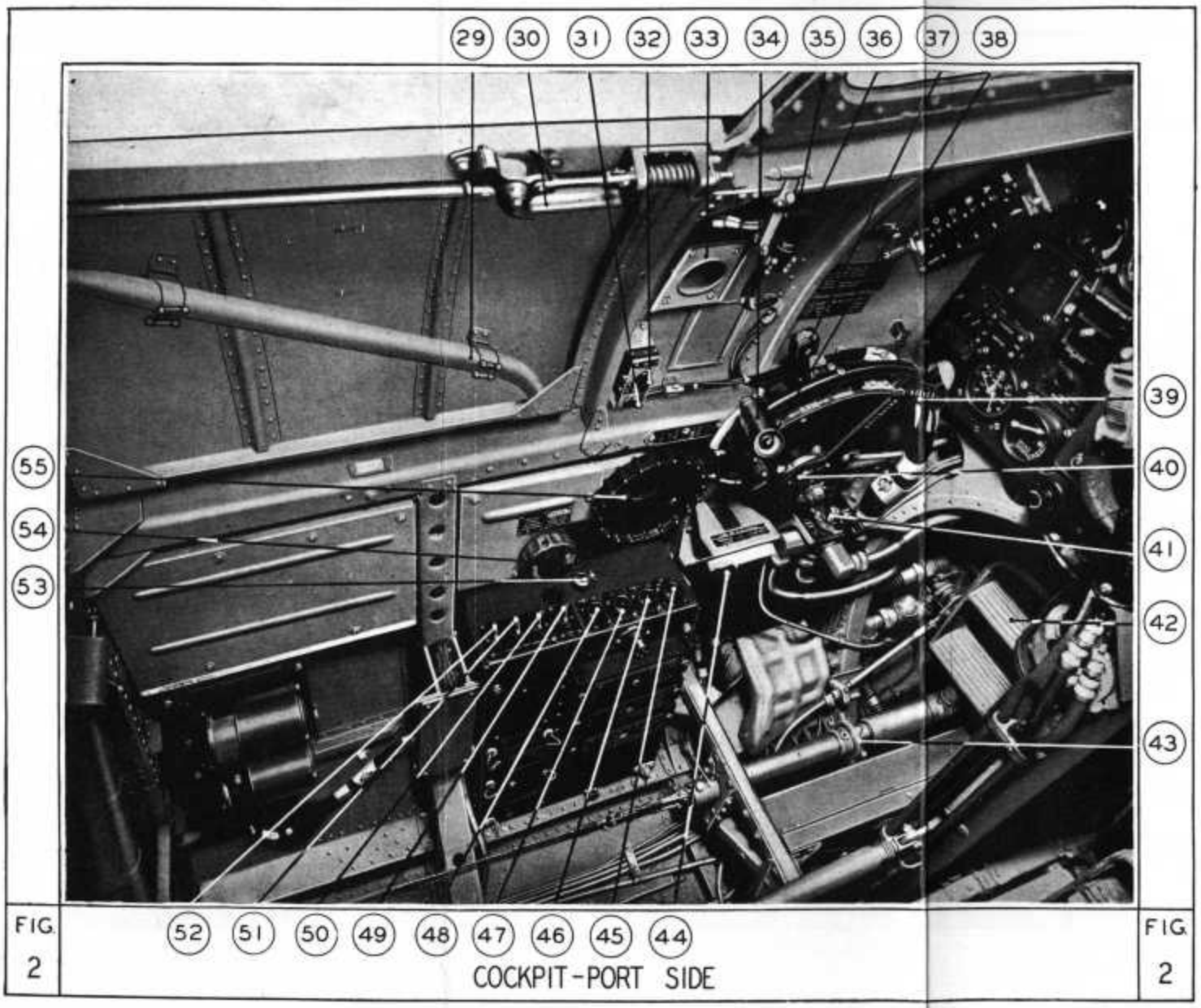


FIG. 2 COCKPIT-PORT SIDE FIG. 2

Key to *Fig. 2*

COCKPIT—PORT SIDE

29. Crowbar.
30. Two-position door catch lever.
31. Bomb fusing switch.
32. Bomb master switch.
33. Wedge plate for camera gun footage indicator.
34. Throttle lever.
35. Socket for footage indicator plug.
36. Floodlight.
37. Fuel cut-off control.
38. Bomb release pushbutton.
39. Propeller speed control.
40. Friction adjuster.
41. Fuel transfer selector cock.
42. Rudder pedal.
43. Rudder pedal adjustment star-wheel.
44. Carburettor air intake control.
45. Oil dilution pushbutton.
46. Radiator ground test pushbutton.
47. Supercharger ground test push-button.
48. Fuel booster pump test push-button.
49. Fuel booster pump switch.
50. Camera gun heater switch.
51. Pressure-head heater switch.
52. Navigation light switch.
53. Power failure warning light.
54. Rudder trimming tab handwheel.
55. Elevator trimming tab handwheel.

Key to *Fig. 3*

COCKPIT—STARBOARD SIDE

56. Reflector sight spare lamps.
57. Beam approach master switch.
58. Floodlight.
59. Cylinder priming selector cock.
60. Sutton harness release control.
61. Heated clothing socket.
62. Oxygen supply cock.
63. Flying control locking struts.
64. Micro/telephone socket.
65. Fuel tank pressure cock.
66. Windscreen de-icing pump.
67. Windscreen de-icing needle valve.
68. Undercarriage emergency lowering control.
69. IFF main switch.
70. IFF distress switch.
71. IFF pushbuttons.
72. Windscreen de-icing cock.
73. Drop fuel tank jettison control.
74. Undercarriage control lever.
75. Fuel drop tank cock control.
76. Rudder pedal.
77. Cylinder priming pump.
78. Fuel wobble pump.
79. Signalling switchbox

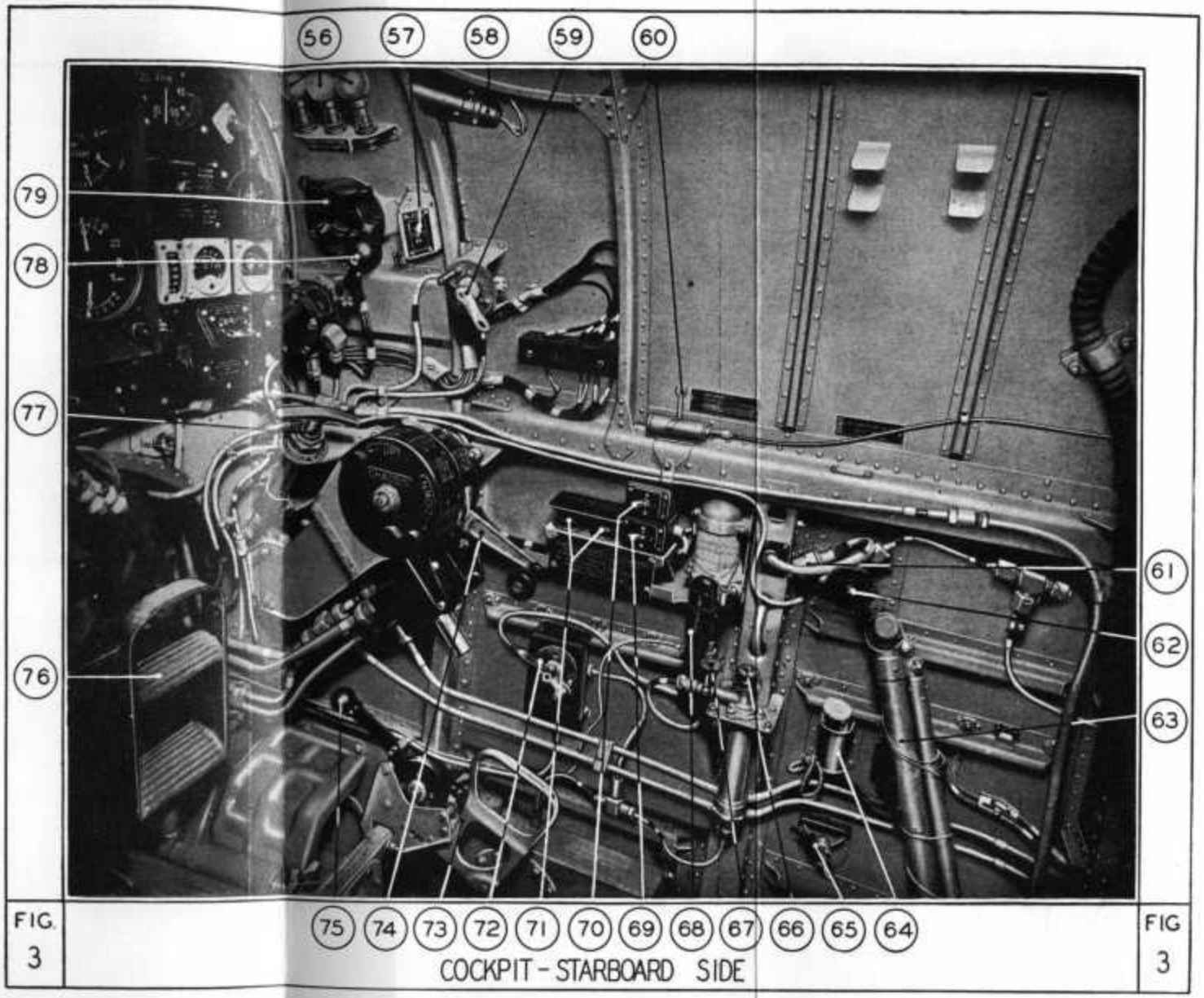


FIG. 3

COCKPIT - STARBOARD SIDE

FIG 3