Pilot's Manual

for

SUPERMARINE SPITFIRE IIA and IIB

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LIST OF SECTIONS

(A detailed Contents List is given at the beginning of each Section)

SECTION 1

PILOT'S CONTROLS AND EQUIPMENT

INTRODUCTION

The Spitfire IIA and IIB are single seat, low wing monoplane fighters each fitted with a Merlin XII engine and a de Havilland 20° (P.C.P.) or Rotol 35° constant speed airscrew.

MAIN SERVICES

2. Fuel system – Fuel is carried in two tanks mounted one above the other (the lower one is self-sealing) forward of the cockpit and is delivered by an engine driven pump. The tank capacities are as follows:

Top tank:	48 gallons
Bottom tank:	37 gallons

The top tank feeds into the lower tank, and the fuel cock controls (38 and 39), one for each tank, are fitted below the instrument panel.

3. Oil system - Oil is supplied by a tank of 5.8 gallons capacity fitted below the engine mounting, and two oil coolers in tandem are fitted in the underside of the port plane.

4. Hydraulic system - An engine-driven hydraulic pump supplies the power for operating the under-carriage.

5. Pneumatic system - An engine-driven air compressor feeds two storage cylinders for operation of the flaps, brakes, guns and landing lamps. The cylinders are connected in series, each holding air at 200 lb/sq. in pressure.

6. Electrical system - A 12 Volt generator, controlled by a switch (56) above the instrument panel, supplies an accumulator which in turn supplies the whole of the electrical installation. There is a voltmeter (55) on the left of the switch.

7. (a) Primary flying controls and locking devices - The control column (37) is of the spade-grip pattern and incorporates the brake lever and gun and cannon firing control. The rudder pedals (41) have two positions for the feet and are adjustable for leg reach by rotation of star wheels (42) on the sliding tubes.

(b) Control locking struts are stowed on the right hand side of the cockpit, behind the seat. To lock the control column, the longer strut should be clamped to the control column handle at one end and the other end inserted in a key-hole slot in the right hand side of the seat. The fixed pin on the free end of the arm attached to this strut at the control column end should then be inserted in a lug (72) on the starboard datum longeron, thus forming a rigid triangle between the column, the seat and the longeron.

(c) To lock the rudder pedals, a short bar with a pin at each end is attached to the other struts by a cable. The longer of the two pins should be inserted in a hole in the starboard star wheel bearing and the shorter in an eyebolt (77) on the fuselage frame directly below the front edge of the seat. The controls should be locked with the seat in its highest position.

8. Flying instruments - A standard blind flying instrument panel is incorporated in the main panel. The instruments comprise airspeed indicator (28), altimeter (30), directional gyro (31), artificial horizon (29), rate of climb and descent indicator (49), and turn and bank indicator (48).

9. Trimming tabs - The elevator trimming tabs are controlled by a hand wheel (7) on the left hand side of the cockpit, the indicator (2l) being on the instrument panel. The rudder trimming tab is controlled by a small hand wheel (3) and is not provided with an indicator. The aeroplane tends to turn to starboard when the handwheel is rotated clockwise.

10. (a) Undercarriage control and Indicators (visual and audible) The undercarriage selector lever (75) moves in a gated quadrant, on the right hand side of the cockpit. An automatic cut-out in the control moves the selector lever into the gate when it has been pushed or pulled to the full extent of the quadrant.

(b) To raise the undercarriage the lever is pushed forward, but it must first be pulled back and then across to disengage it from the gate. When the undercarriage is raised and locked, the lever will spring into the forward gate.

(c) To lower the undercarriage the lever is pulled back, but it must be pushed forward and then across to disengage it from the gate. When the undercarriage is lowered and locked, the lever will spring into the rear gate.

(d) Electrical visual indicator - The electrically operated visual indicator (22) 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 switch for the DOWN circuit of the indicator is mounted on the inboard side of the throttle quadrant and is moved to the ON position by means of a striker on the throttle lever; this switch should be returned to the OFF position by hand when the aeroplane is left standing for any length of time. The UP circuit is not controlled by this switch.

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

(f) Warning horn - The push switch controlling the horn is mounted on the throttle quadrant and is operated by a striker on the throttle lever. The horn may be silenced, even though the wheels are retracted and the engine throttled back, by depressing the push button (9) on the side of the throttle quadrant. As soon as the throttle is again advanced beyond about one quarter of its travel the push-button is automatically released and the horn will sound again on its return.

11. Flap control - The split flaps have two positions only, up and fully down. They cannot therefore, be used to assist take-off. They are operated pneumatically and are controlled by a finger lever (25): A flap indicator was fitted only on early Spitfire I aeroplanes.

12. (a) Undercarriage emergency operation - A sealed high-pressure cylinder containing carbon-dioxide and connected to the undercarriage operating jacks is provided for use in the event of failure of the hydraulic system. The cylinder is mounted on the right hand side of the cockpit and the seal can be punctured by means of a red painted lever (76) beside it. The handle is marked EMERGENCY ONLY and provision is made for fitting a thin copper wire seal as a check against inadvertent use.

(b) If the hydraulic system fails, the pilot should ensure that the undercarriage selector lever is in the DOWN position (this is essential) and push the emergency lowering lever forward and downward. The angular travel of the emergency lever is about 100° for puncturing the seal of the cylinder and then releasing the piercing plunger; it must be pushed through this movement and allowed to swing downwards. NO attempt should be made to return it to its original position until the cylinder is being replaced.

13. Wheel brakes - The control lever (35) for the pneumatic brakes is fitted on the control column spade grip; differential control of the brakes is provided by a relay valve (4-3) connected to the rudder bar. A catch for retaining the brake lever in the on position for parking is fitted below the lever pivot. A triple pressure gauge (18), showing the air pressures in the pneumatic system cylinders and at each brake, is mounted on the left hand side of the instrument panel.

ENGINE CONTROLS

14. Throttle and mixture controls - The throttle and mixture levers (10 and 11) are fitted in a quadrant on the port side of the cockpit. A gate is provided for the throttle lever in the take-off position and an interlocking device between the levers prevents the engine from being run on an unsuitable mixture. Friction adjusters (8) for the controls are provided on the side of the quadrant.

15. Automatic boost cut-out - The automatic boost control may be cut out by pushing forward the small red painted lever (14) at the forward end of the throttle quadrant.

16. Airscrew controls - The control lever (12) for the de Havilland 20° or Rotol 35° constant speed airscrew is on the throttle quadrant. The de Havilland 20° airscrew has a Positive Coarse Pitch position which is obtained in the extreme aft position of the control lever, when the airscrew blades are held at their maximum coarse pitch angles and the airscrew functions as a fixed airscrew.

17. Radiator flap control - The flap at the outlet end of the radiator duct is operated by a lever (40) and ratchet on the left hand side of the cockpit. To open the flap, the lever should be pushed forward after releasing the ratchet by depressing the knob at the top of the lever'. The normal minimum drag position of the flap lever for level flight is shown by a red triangle on the top of the map case fitted beside the lever. A notch beyond the normal position in the aft direction provides a position of the lever when the warm air is diverted through ducts into the main planes for heating the guns at high altitude.

18. Slow-running cut-out - The control on the carburetor is operated by pulling the ring (74) on the right hand side of the instrument panel.

19. Fuel cock controls and contents gauges - The fuel cock controls (3b and 39), one for each tank, are fitted at the bottom of the instrument panel. With the levers in the UP position the cocks are open. Either tank can be isolated, if necessary. The fuel contents gauge (46) on the instrument panel indicates the contents of the lower tank, but only when the adjacent push button is pressed.

20. Fuel priming pump - A hand-operated pump (44) for priming the engine is mounted below the right hand side of the instrument panel.

21. Ignition switches - The ignition switches (17) are on the left hand bottom corner of the instrument panel.

22. Cartridge starter - The starter push-button (47) at the bottom of the instrument panel operates the L.4 Coffman starter and the booster coil. The control (70) for re loading the breech is below the right-hand side of the instrument panel and is operated by slowly pulling on the finger ring and then releasing it.

23. Hand starting - A starting handle is stowed behind the seat. A hole in the engine-cowling panel on the star board side gives access for connecting the handle to the hand starting gear.

24. Engine instruments - The engine instruments are grouped on the right hand side of the instrument panel and comprise the following: engine-speed indicator (58), fuel pressure gauge (59), boost gauge (61), oil pressure gauge (69), oil inlet temperature gauge (67), radiator outlet temperature gauge (63) and fuel contents gauge (46) ,

COCKPIT ACCOMMODATION AND EQUIPMENT

25. Pilot's seat control - The seat is adjustable for height by means of a lever on the right hand, side of the seat.

26. Safety harness release - In order that the pilot may lean forward without unfastening his harness, a release catch (73) is fitted to the right of the seat.

27. Cockpit door - To facilitate entry to the cockpit a portion of the coaming on the port side is hinged. The door catches are released by means of a handle at the forward end. Two position catches are incorporated to allow the door to be partly opened before taking off or landing in order to prevent the hood from sliding shut in the event of a mishap.

28. Hood locking control - The sliding hood is provided with spring catches for holding it either open or shut; the catches are released by two finger levers at the forward end of the hood. From outside, with the hood closed, the catches can be released by depressing a small knob at the top of the windscreen. Provision is made on the door to prevent the hood from sliding shut if the aeroplane over turns on landing.

29. Direct vision panel - A small knock-out panel is provided on the right hand side of the hood for use in the event of the windscreen becoming obscured.

30. Cockpit lighting - A floodlight (62) is fitted on each side of the cockpit and is dimmed by a switch (34) immediately below the instrument panel.

31. Cockpit heating and ventilation - A small adjustable flap on the starboard coaming above the instrument panel is provided for ventilation of the cockpit. The flap is opened by turning a knurled nut (57) underneath the flap.

32. Oxygen - A standard regulator unit (23) is fitted on the left hand side of the instrument panel and a bayonet socket (65) is on the right hand side of the cockpit. A separate cock is provided in addition to the regulator.

33. Mirror - A mirror providing a rearward view is fitted at the top of the windscreen.

34. Map cases - A metal case (6) for a writing pad and another (2) for maps, books, etc. are fitted on the left hand side or the cockpit. Stowage (71) for a height-and-airspeed computor is provided below the wireless remote contactor.

OPERATIONAL EQUIPMENT AND CONTROLS

35. (a) Guns and cannon - The eight machine guns on the Spitfire IIA are fired pneumatically by a push-button on the control column spade grip. The compressed air supply is taken from the same source as the brake supply, the available pressure being shown by the gauge (l8). The push-button is surrounded by a milled sleeve which can be rotated by a quarter of a turn to a safe position in which it prevents operation of the button. The SAFE and FIRE positions are engraved on the sleeve and can also be identified by touch as the sleeve has an indentation which is at the bottom when the sleeve is in the SAFE position and is at the side when the sleeve is turned to the FIRE position.

(b) The guns and cannon on the Spitfire IIB are fired pneumatically by a triple push-button on the control column spade grip. A milled finger lever extending from the bottom of the push-button casing provides the means of locking the button in the SAFE position, SAFE and FIRE being engraved on the adjacent casing. When the lever is in the FIRE position a pip extends also from the top of the casing enabling the pilot to ascertain by feel the setting of the push-button.

(c) To prevent accidental firing of the cannon on the ground, a safety valve is fitted in the firing system. This is mounted below the undercarriage control unit and is coupled to the undercarriage locking pin cable in such a way that the cannon firing system is inoperative when the wheels are locked down. For practice firing at the butts, however, a finger lever on the safety valve can be operated to allow the use of the firing system.

(d) The cannon are cocked pneumatically by a cocking valve mounted on the right hand side of the cockpit.

36. (a) Reflector gun sight - For sighting the guns and cannon a reflector gun sight is mounted on a bracket (53) above the instrument panel. A main switch (50) and dimmer switch (51) are fitted below the mounting bracket. The dimmer switch has three positions marked OFF, NIGHT and DAY. Three spare lamps for the sight are stowed in holders (60) on the right hand side of the cockpit.

(b) When the sight is used during the day the dimmer switch should be in the DAY position in order to give full illumination, and if the background of the target is very bright, a sun-screen (54) can be slid behind the windscreen by pulling on the ring (52) at the top of the instrument panel. For night use the dimmer switch should be in the NIGHT position; in this position a low-wattage lamp is brought into circuit and the light can be varied by rotating the switch knob.

37. (a) Camera - A G.42B cine-camera is fitted in the leading edge of the port plane, near the root end and is operated by the cannon-firing button on the control column spade grip, a succession of exposures being made during the whole time the button is depressed, provided the selector switch (5) on the left hand side of the cockpit is ON.

(b) A footage indicator and an aperture switch are mounted on the wedge plate above the throttle lever. The switch enables either of two camera apertures to be selected, the smaller aperture being used for sunny weather. A stowage clip is provided to receive the electrical cable (13) when the indicator and switch are not fitted.

NAVIGATIONAL, SIGNALLING AND LIGHTING EQUIPMENT

38. (a) Wireless - The aeroplane is equipped with a combined transmitter-receiver, either type T.R.9D or T.R.H33, and an R.3002 set.

(b) With the T.R.9D installation a Type C mechanical controller (19) is fitted on the port side of the cockpit above the throttle lever and a remote con tractor (66) and contactor master switch are fitted on the right hand side of the cockpit. The master contactor is mounted behind the pilot's headrest and a switch controlling the heating element is fitted on the forward bracket of the mounting. The heating element should always be switched OFF when the pilot leaves the aeroplane. The microphone/telephone socket is fitted on the right hand side of the pilot's seat.

(b) With the T.R.1133 installation the contactor gear and microphone/telephone socket are as for the T.R.9D installation, but the Type C mechanical controller is replaced by a push-button electrical control unit.

39. (a) Navigation and identification lamps - The switch (24) controlling the navigation lamps is on the instrument panel.

(b) The upward and downward identification lamps are con trolled from the signalling switchbox *(6k)* on the right hand side of the cockpit. This switchbox has a switch for each lamp and a morsing key, and provides for steady illumination or morse signalling from each lamp or both. The switch lever has three positions: MORSE, OFF and STEADY.

(b) The spring pressure on the morsing key can be adjusted by turning the small ring at the top left hand corner of the switchbox, adjustment being maintained by a latch engaging one of a number of notches in the ring. The range of movement of the key can be adjusted by opening the cover and adjusting the screw and locknut at the centre of the cover.

40. Landing lamps - The landing lamps, one on each side of the aeroplane, are housed in the undersurface of the main plane. They are lowered and raised by a finger lever (36) below the instrument panel. Each lamp has an independent electrical circuit and is controlled by a switch (16) above the pneumatic control lever (36) with the switch in the central position both lamps are off; when the switch is moved to the left or to the right, the port or the star- board lamp respectively, is illuminated. A lever (15) is provided to control the dipping of both landing lamps. On pulling up the lever the beam is dipped.

41. Signal discharge - A straight pull of the toggle control on the left hand side of the cockpit fires one of the cartridges out of the top of the fuselage, aft of the cockpit.

DE-ICING EQUIPMENT

42. (a) Windscreen de-icing - A tank containing the de-icing solution is mounted on the left hand side of the cockpit directly above the bottom longeron. A cock is mounted above the tank, and a pump and a needle valve to control the flow of the liquid are mounted below the undercarriage emergency lowering control. Liquid is pumped from the tank to a spray at the base of the windscreen, from which it is sprayed upwards over the front panel of the screen.

(b) The flow of liquid is governed by the needle valve, after turning ON the cock and pushing down the pump plunger to its full extent. The plunger will return to the extended position on its own, and if required it can be pushed down again. When de-icing is no longer required the cock should be turned to the OFF position.

43. Pressure head heater switch - The heating element in the pressure head is controlled by switch (4) below the trimming tab handwheels. It should be switched off on landing in order to conserve the battery.

ENERGENCY EQUIPMENT

44. Hood jettisoning - The hood may be jettisoned in an emergency by pulling the lever mounted inside the top of the hood in a forward and downward movement, and pushing the lower edge of the hood outboard with the elbows. On aeroplanes not fitted with a jettison type hood, a crowbar is provided to assist in jettisoning the hood.

45. Forced landing flare - A forced landing flare is carried in a tube fixed inside the fuselage. The flare is released by means of a ring grip (1) on the left of the pilot's seat.

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

1. Flare release control
2. Map stowage box
3. Rudder trimming tab control
4. Pressure head heating switch
5. Camera-gun master switch
6. Writing pad container
7. Elevator trimming tab control
8. Throttle and mixture friction adjusters
9. Push switch for silencing warning horn
10. Throttle lever
11. Mixture lever
12. Airscrew control lever
13. Connection for cine-camera footage indicator
14. Boost cut-out control
15. Landing lamp dipping lever
16. Landing lamps switch
17. Main magneto switches
18. Brake triple pressure gauge
19. Wireless remote controller
20. Clock
21. Elevator trimming tabs position indicator
22. Undercarriage position indicator
23. Oxygen regulator
24. Navigation lamps switch
25. Flaps control

27. Instrument-flying panel
28. Airspeed indicator
29. Artificial horizon
30. Altimeter
31. Direction indicator
32. Setting knob for (31)
33. Compass deviation card holder
34. Cockpit lamp dimmer switches
35. Brake lever
36. Landing lamp lowering control
37. Control column
38. Fuel cock lever (top tank)
39. Fuel cock lever (bottom tank)
40. Radiator flap control lever
41. Rudder pedals
42. Rudder pedal leg reach adjusters

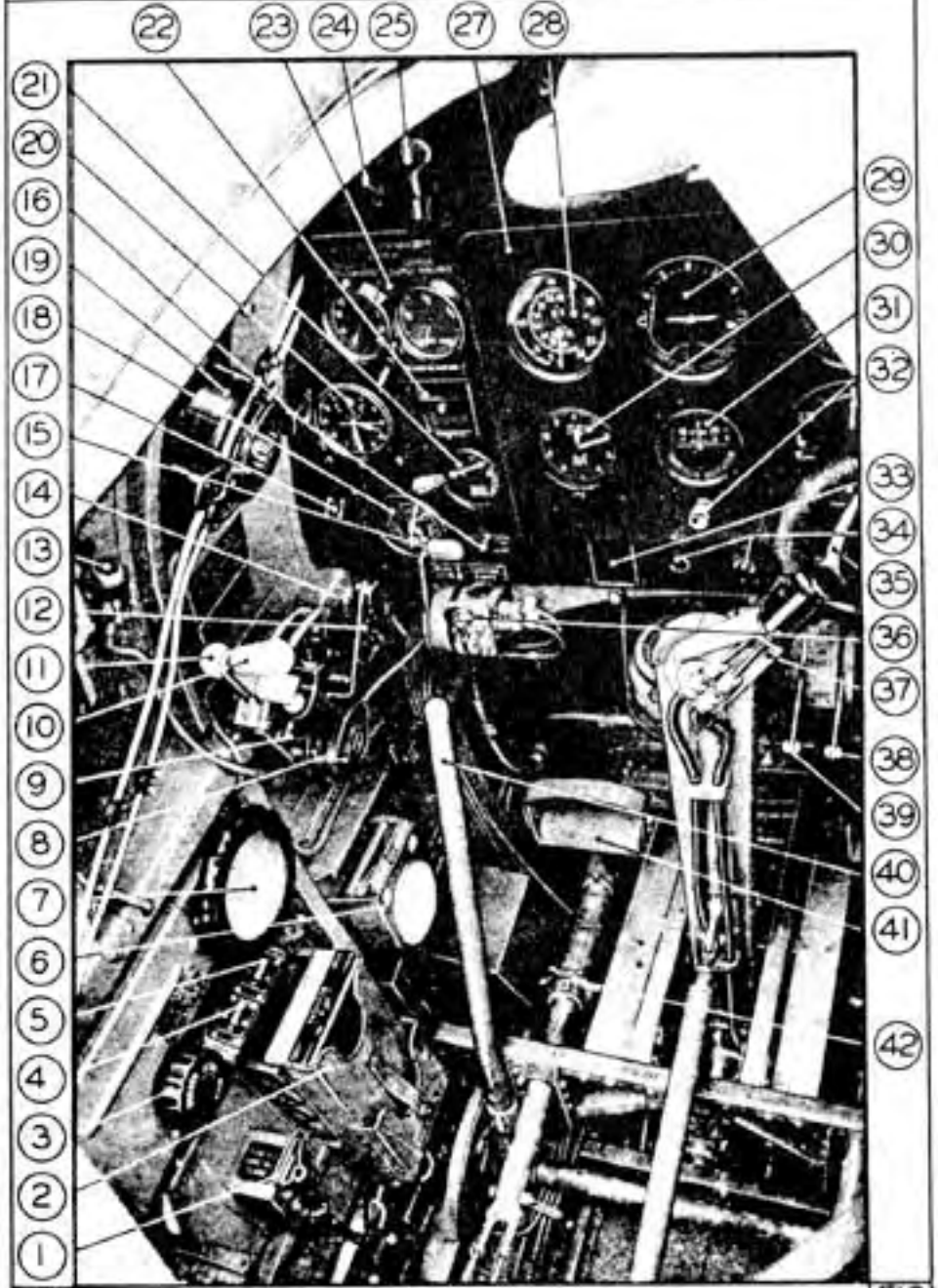


FIG 1 PORT SIDE OF COCKPIT FIG 1

29. Artificial horizon
31. Direction indicator
34. Cockpit lamp dimmer switch
38. Fuel cock lever (top tank)
39. Fuel cock lever (bottom tank)
43. Brake relay valve
44. Priming pump
45. Compass
46. Fuel contents gauge
47. Engine starting push-button
48. Turning indicator
49. Rate of climb indicator
50. Reflector sight main switch
51. Reflector sight lamp dimmer switch
52. Lifting ring for dimming screen
53. Reflector gun sight mounting
54. Dimming screen
55. Ammeter
56. Generator switch
57. Ventilator control
58. Engine speed indicator
59. Fuel pressure gauge
60. Spare filaments for reflector sight
61. Boost gauge
62. Cockpit lamp
63. Radiator temperature gauge
64. Signalling switch box
65. Oxygen socket
66. Wireless remote contactor mounting and switch
67. Oil temperature gauge
68. Engine data-plate
69. Oil pressure gauge
70. Cartridge starter reloading control
71. Height and airspeed computor stowage
72. Control locking lug
73. Harness release
74. Slow-running cut-out control
75. Undercarriage control lever
76. Undercarriage emergency lowering lever
77. Control locking lug

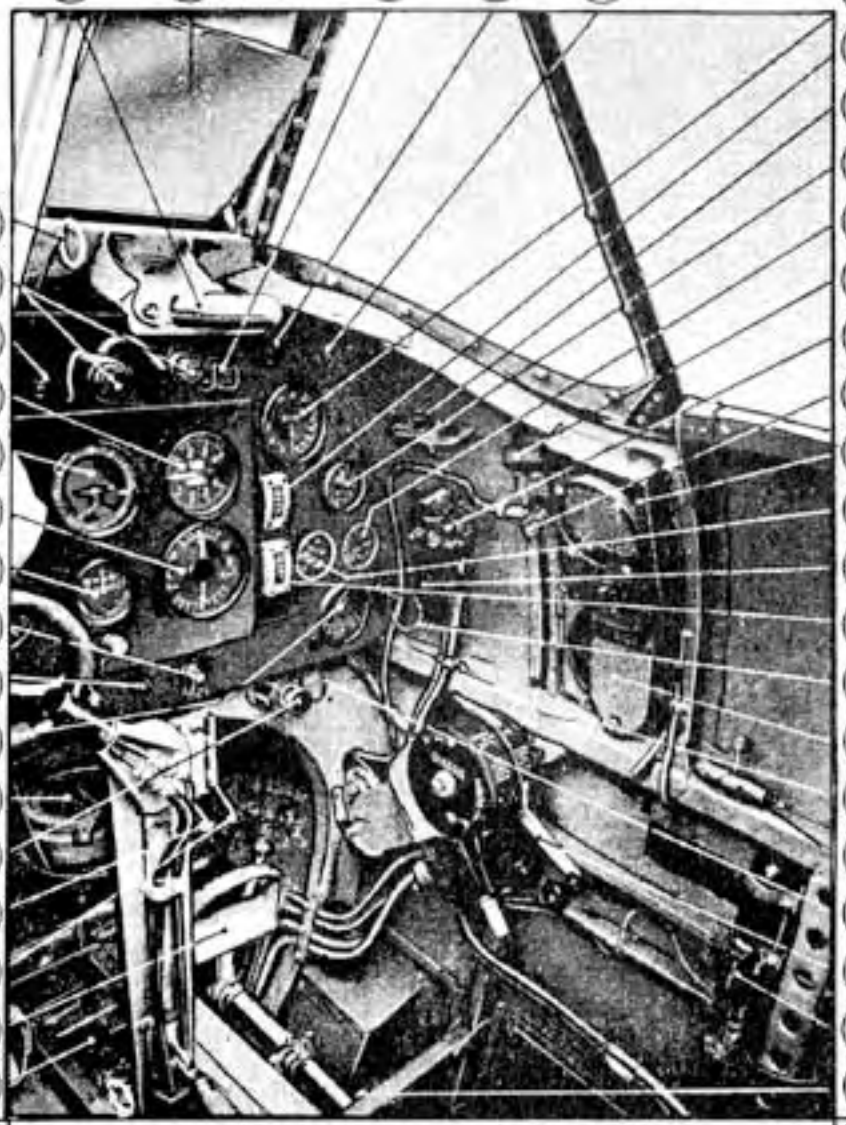
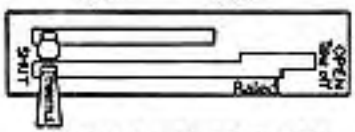


FIG 2 STARBOARD SIDE OF COCKPIT FIG 2



THROTTLE AND MIXTURE CONTROLS

NOTE – Relief valves integral with pump

Filler

48 gallons

Vent outlet

Perforated stack pipe

37gallons

Perforated stack pipe

2 way cocks controllable from cockpit

Priming pump

To carburettor

To cylinders

Engine pump

Filler

Drain cock

FUEL SYSTEM DIAGRAM

Fig. 1

SECTION 2

HANDLING AND FLYING NOTES FOR PILOT

1. ENGINE DATE: MERLIN XII

(i) Fuel: 100 Octane (the reduced limitations for use with 87 Octane fuel are shown in brackets)

(ii) Oil: See A.P.1464/C.37

(iii) Engine limitations:

	R.P.M.	Boost Lb/Sq.In.		Temp. Clnt.	°C Oil
MAX. TAKE-OFF TO 1,000 FEET	3,000	+12.5	(+7)	_	_
MAX.CLIMBING 1 HR. LIMIT	2,850	+ 9	(+7)	125	90
MAX. RICH CONTINUOUS	2,650	+ 7	(+5)	105	90
MAX. WEAK CONTINUOUS	2,650	+ *4*	(+2.5)	105	90
COMBAT 5 MINS.LIMIT	3,000	+12	(+7)	135	105

115°C. permitted for short periods if necessary.

Note: +12 Lb/Sq.In. combat boost is obtained by operating the boost control cut-out and is effective up to about 10,500 feet.

OIL PRESSURE: MINIMUM IN FLIGHT: 30 Lb/Sq.In.

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

FUEL PRESSURE: NORMAL: 2.5-3 Lb/Sq.In.

(iv) Other limitations:

Diving: Maximum R.P.M.: 3,600
3,000 R.P.M. may be exceeded only for 20 seconds, with the throttle not less than one-third open.

(v) Combat concession:

3,000 R.P.M. may be used above 20,000 feet for periods not exceeding 30 minutes.

2. FLYING LIMITATIONS

(i) Maximum speeds (M.P.H. - I.A.S.)

Diving:	450
Undercarriage down:	160
Flaps down:	140
Landing lamps lowered:	140

(ii) A.S.R. dinghy:

Aircraft carrying air/sea rescue dinghy equipment must be fitted with an inertia weight in the elevator control circuit. Aerobatics and violent manoeuvres are not permitted until the equipment is dropped.

PRELIMINARIES

On entering the cockpit check:

Undercarriage selector lever - DOWN

(Check that indicator shows DOWN; switch on light indicator and check that green lights appear).

Flaps - UP

Landing lamps - UP

Contents of lower fuel tank

STARTING THE ENGINE AND WARMING UP

(i) Set:

Both fuel cock levers - ON

Throttle - 1/2 Inch open

Mixture control - RICH

Airscrew speed control - Fully back DH 20°

Rotol 35° Propellor - Lever fully forward

Radiator shutter - OPEN

(ii) Operate the priming pump to prime the suction and delivery pipes. This may be judged by a sudden increase in resistance of the plunger.

(iii) Prime the engine, the number of strokes required being as follows:

Air temperature °C:	+30	+20	+10	0	-10	-20
Normal fuel:	3	4	7	13		
High volatility fuel			4	8	15	

(iv) Switch ON ignition and pull out the priming pump handle.

(v) Press the starter push-button and at the same time give one stroke of the priming pump. The push-button also switches on the booster coil and should be kept depressed until the engine is firing evenly.

Note: If the engine fails to start on the first cartridge, no more priming should be carried out before firing the second, but another stroke should be given as the second cartridge is fired.

(vi) As soon as the engine is running evenly, screw down the priming pump.

TESTING ENGINE AND INSTALLATIONS

(i) While warming up, exercise the airscrew speed control a few times. Also make the usual checks of temperatures, pressures and controls. Brake pressure should be at least 120 Lb/Sq.In.

(ii) See that the cockpit hood is locked open and that the emergency exit door is set at the "half-cock" position.

(iii) After a few minutes move the airscrew speed control fully forward.

(iv) After warming up, open the throttle to give maximum boost for cruising with WEAK mixture and test the operation of the constant speed airscrew.

(v) Open the throttle to give maximum boost for cruising with RICH mixture and check each magneto in turn. The drop in R.P.M. should not exceed 150.

(vi) Open the throttle fully momentarily and check static R.P.M. boost and oil pressure.

(vii) Warming up must not be unduly prolonged because the radiator temperature before taxying out must not exceed 100 C.

"When engines are being kept warm in readiness for immediate take-off, de Havilland 20° C.S. propeller should be left in fine pitch - control lever fully forward".

6. TAXYING OUT

It may be found that one wing tends to remain down while taxying. This is due to stiffness in the undercarriage leg, especially in a new aeroplane.

FINAL PREPARATION FOR TAKE-OFF - DRILL OF VITAL ACTIONS

7. Drill is "T.M.P., Fuel, Flaps and Radiator"

T - Trimming Tabs - Elevator about one division nose down from neutral. Rudder fully to starboard.

M - Mixture control - RICH

P - Pitch - Airscrew speed control fully forward

Fuel - Both cock levers ON and check contents of lower tank.

Flaps - UP

Radiator shutter - Fully open

TAKE-OFF

8. (i) Open the throttle slowly to the gate (RATED BOOST position). Any tendency to swing can be counteracted by coarse use of the rudder. If taking off from a small aerodrome with a full load, maximum boost may be obtained by opening the throttle through the gate to the TAKE-OFF BOOST position.

(ii) After raising the undercarriage, see that the red indicator light - UP - comes on (it may be necessary to hold the lever hard forward against the quadrant until the indicator light comes on).

(iii) Do not start to climb before a speed of 140 M.P.H.-A.S.I.R. is attained.

CLIMBING

9- Up to 15,000 feet the maximum rate of climb is obtained at 160 M.P.H.-A.S.I.R. but for normal climbing the following speeds are recommended:

Ground level to 13,000 Feet	185	M.P.H.-A.S.I.R.
13,000 Feet, to 15,000 Feet	180	" "
15,000 Feet to 20,000 Feet	160	" "
20,000 Feet to 25,000 Feet	140	" "
25,000 Feet to 30,000 Feet	125	" "
30,000 Feet to 35,000 Feet	110	" "

GENERAL FLYING

10. (i) Stability and control - This aeroplane is stable. With metal covered ailerons the lateral control is much lighter than with the earlier fabric covered ailerons and pilots accustomed to the latter must be careful not to overstress the wings. Similar care is necessary in the use of the elevators which are light and sensitive.

(ii) For normal cruising flight the radiator shutter should be in the minimum drag position.

(iii) Change of trim

Undercarriage down - nose down
Flaps down - nose down

(iv) Maximum range is obtained with WEAK mixture, 1,700 R.P.M. and at 160 M.P.H.-A.S.I.R.

(v) Maximum endurance is obtained with WEAK mixture, 1,700 R.P.M. and at the lowest speed at which the machine can be comfortable flown.

(vi) For combat manoeuvres, climbing R.P.M. should be used.

(vii) For stretching a glide in the event of a forced landing, the airscrew speed control should be pulled right back and the radiator flap put at the minimum drag position.

STALLING

11. (i) At the stall one wing will usually drop with flaps either up or down and the machine may spin if the control column is held back.

(ii) This aeroplane has sensitive elevators and, if the control column is brought back too rapidly in a manoeuvre such as a loop or steep turn, stalling incidence may be reached and a high-speed stall induced. When this occurs there is a violent shudder and clattering noise throughout the aeroplane which tends to flick over laterally and unless the control column is put forward instantly, a rapid roll and spin will result.

(iii) Approximate stalling speeds when loaded to about 6,250 Lb. are:

Flaps and undercarriage UP - 73 M.P.H.-A.S.I.R.
Flaps and undercarriage DOWN - 64 M.P.H.-A.S.I.R.

SPINNING

12. (i) Spinning is permitted by pilots who have written permission from the C.O. of their squadron (C.F.I. of an O.T.U.). The loss of height involved in recovery may be very great, and the following height limits are to be observed:

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

(b) Recovery must be started not lower than 5,000 feet

(ii) A speed of over 150 M.P.H.-I.A.S. should be attained before starting to ease of of the resultant dive.

AEROBATICS

13. (i) This aeroplane is exceptionally good for aerobatics. Owing to its high performance and sensitive elevator control, care must be taken not to impose excessive loads either on the aeroplane or on the pilot and not to induce a high-speed stall. Many aerobatics may be done at much less than full throttle. Cruising R.P.M. should be used, because if reduced below this, detonation might occur if the throttle is opened up to climbing boost for any reason.

(ii) The following speeds are recommended for aerobatics:

Looping - Speed should be about 300 M.P.H.-LA.S. but may be reduced to 220-250 M.P.H. when the pilot is fully proficient.

Rolling - Speed should be anywhere between 180 and 300 M.P.H.-I.A.S. The nose should be brought up about 30° above the horizon at the start, the roll being barrelled just enough to keep the engine running throughout.

Half roll off loop - Speed should be 320-350 M.P.H.-I.A.S.

Upward roll - Speed should be about 350-400 M.P.H.-I.A.S.

Flick manoeuvres - Flick manoeuvres are not permitted.

DIVING

13- a (i) The aeroplane becomes very tail heavy at high speed and must be trimmed into the dive in order to avoid the dangers of excessive acceleration in recovery. The forward trim should be wound back as speed is lost after pulling out.

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

LANDING ACROSS WIND

16. The aeroplane can be landed across wind but it is undesirable that such landings should be made if the wind exceeds about 20 M.P.H.

AFTER LANDING

17. (i) After taxying in, set the propeller control fully back and open up the engine sufficiently to change pitch to coarse. DH20°

(ii) Allow the engine to idle for a few seconds, then pull the slow-running cut-out and hold it out until the engine stops.

(iii) Turn OFF the fuel cocks and switch OFF the ignition.

FLYING AT REDUCED AIRSPEEDS

18. Reduce the speed to about 120 M.P.H.-I.A.S. and lower the flaps. The radiator shutter must be opened to keep the temperature at about 100°C. and the propeller speed control should be set to give cruising R.P.M.

POSITION ERROR TABLE

19. The corrections for position error are as follows:

M.P.H.-I.A.S.									
From	100	110	120	130	140	150	165	180	195	220 and
To	110	120	130	140	150	165	180	195	220	over
Add	10	8	6	4	2	---				
Subtract						---	2	4	6	8

FUEL AND OIL CAPACITY AND CONSUMPTION

20. (i) Fuel and oil capacities -

Fuel capacity:

2 Main tanks -	top tank	48 gallons
	bottom tank	37 gallons
Total effective capacity		85 gallons

Oil capacity:

Effective capacity 5.8 gallons

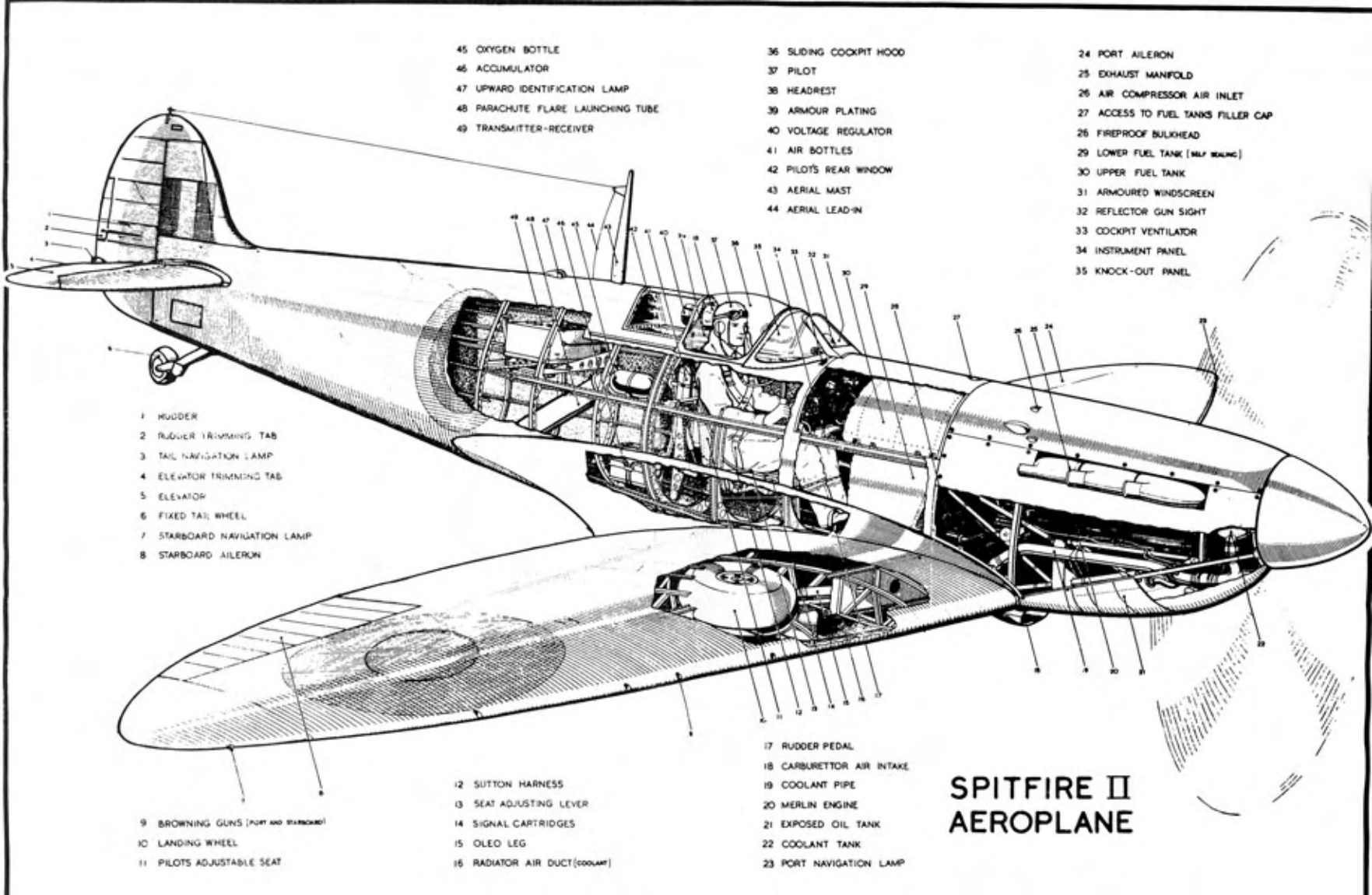
(ii) Fuel consumption -

Max. R.P.M. and Boost for	Height Feet	Approx.Consumption Gallons/Hour
Climbing	13,000	94
Cruising RICH	13,000	78
Cruising WEAK	18,000	56
All-out Level	14,500	98

OIL DILUTION IN COLD WEATHER

21. See A.P.2095/4. The dilution period should be:

Atmospheric temperatures above-10$_{o}$C: 1 1/2 minutes
Atmospheric temperatures below-10 C: 2 1/2 minutes



SPITFIRE II AEROPLANE