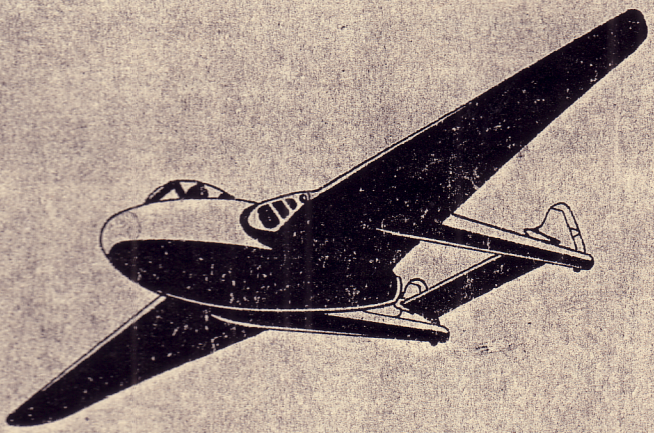
2nd Edition

A.P. 4099 E.&G.—P.N.

PILOT'S NOTES

FOR

VAMPIRE F.B.5 & F.B.9



PREPARED BY DIRECTION OF THE MINISTER OF SUPPLY

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PROMULGATED BY ORDER OF THE AIR COUNCIL

J. H. Barnes.

NOTES TO USERS

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. A718/48).

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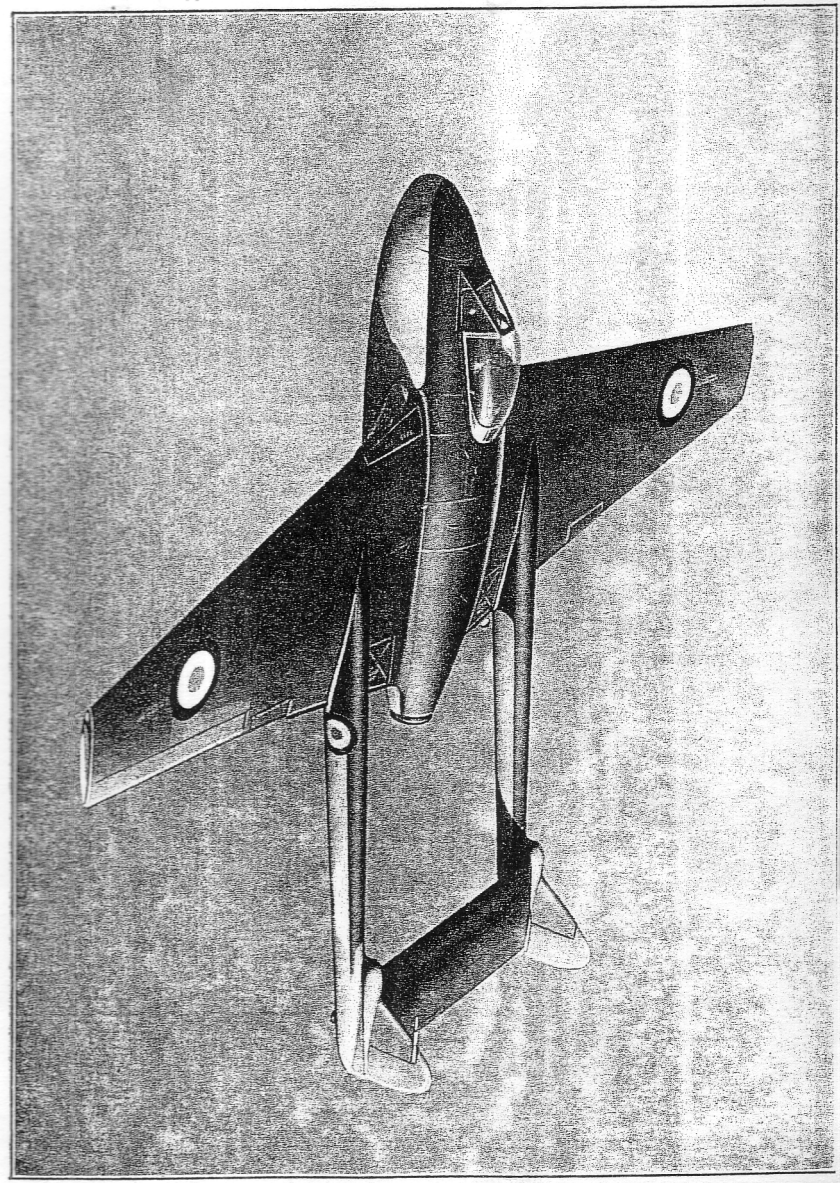

AIR MINISTRY
July, 1952

A.P. 4099E & G—P.N.
Pilot's Notes
2nd Edition

VAMPIRE F.B.5 & F.B.9

2nd Edition. This edition supersedes all previous issues.

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(Excluding checks of operational equipment)

ITEM	CHECK
External checks	
Start at the port side of the nose and work clockwise around the aircraft.	
Fuselage underside panel	Secure
Gun nose panel	Secure
Camera access panel	Secure
Nose wheel	Extension of oleo Condition of door Tyre for cuts and creep Valve free
Fuselage underside panel	Secure
Starboard ammunition door	Locked
Engine air intake	Cover removed
Starboard mainplane	Condition of top and bottom surfaces Inner and outer fuel tank caps secure
Starboard undercarriage	Ground safety lock removed Condition of door Extension of oleo leg Brake lead secure Tyre for cuts and creep Valve free
Drop tank (if fitted)	Secure Filler cap secure
I.F.F. aerial	Secure
Starboard navigation light	Condition
Starboard aileron	Condition of aileron and servo tab External lock removed
Air brake	Condition
Flaps	Condition
Downward identification lights (under jet pipe)	Condition
Engine top and bottom panels	Secure
Jet pipe	Blanking plate removed
Starboard fin and rudder	Condition External lock removed Condition of rubber skid
Tailplane	Condition of tailplane, elevator and trim tab External lock removed Security of mass balances
Port fin and rudder	Condition Pressure-head cover removed External lock removed Condition of rubber skid Condition of navigation light
Flaps	Condition
Air brake	Condition
Port aileron	Condition of aileron and servo tab External lock removed
V.H.F. aerial	Secure

ITEM	CHECK
Port navigation light	Condition
Port mainplane	Condition of top and bottom surfaces Inner and outer fuel tank caps secure
Drop tank (if fitted)	Secure Filler cap secure
Port undercarriage	Ground safety lock removed Condition of door Extension of oleo leg Brake lead secure Tyre for cuts and creep Valve free
Engine air intake	Cover removed
Fuselage tank	Cap secure
Port ammunition door	Locked
Windscreen and canopy	Canopy secure Absence of cracks
Internal checks	
Footstep	Retracted
Flying controls	Control locks removed Controls for freedom
Cockpit checks	
(Work from left to right.)	
Crowbar	Stowed
Drop tanks/ bomb carriers jettison lever	Fully down
Ground/Flight switch	FLIGHT
Windscreen and canopy demisting cock (if fitted)	OFF
Cockpit pressure control wheel (F.B.9)	OFF

ITEM	CHECK
Cockpit emergency lamp	Test Off
Cockpit lighting	As required
Undercarriage emergency retraction switch	OFF
Undercarriage selector lever	Down
Flap selector lever	As required
Air brakes selector lever	OFF
H.P. fuel cock	On
L.P. fuel cock	ON
Throttle friction adjuster	As required
Elevator trimmer	Operation
V.H.F. controller	OFF
Undercarriage indicator	Three green lights Check bulbs change over
Hydraulic hand pump	Test by operating flaps
Generator failure light	On STOW IN THE O POSITION
Fuel pressure warning light	On Switch ON booster pump Check light goes out
Undercarriage warning light	Out
Fuel contents gauge(s)	Check contents
Fire warning light	Out
Standby compass	Serviceability
Cockpit pressure warning light	Out
Oxygen regulator	On Contents
Brake pressure	Supply pressure sufficient Brakes on
Windscreen de-icer hand pump	Off

ITEM	CHECK
Cockpit pressure control lever (F.B.5)	OFF
Canopy jettison lever	Fully forward
Canopy seal cock	OFF
Auxiliary starting switch	Off (normally)
Interlinked starter master switches	Off
Mk. 4F compass and flight instruments linked switches (if fitted)	Off
Booster pump switch	ON
Fuel pump emergency switch (if fitted)	N.A. (not connected)

ITEM	CHECK
Pressure-head heater switch	Off
Navigation lights switch	Off
Identification lights selector switch	As required
Camera switch and gunsight switch	Off
R.P. and bomb switches	As required
Guns/R.P. selector	As required
Cockpit hot/cold air control (F.B.5)	As required
Mk. 4F compass circuit breaker (if fitted)	On

PART I
DESCRIPTIVE

NOTE.—(a) Words in capital letters indicate markings on the controls concerned.

(b) The numbers quoted in brackets after items in the text refer to the illustrations in Part V.

(c) Unless otherwise stated, all airspeeds and mach numbers quoted are "Indicated".

INTRODUCTION

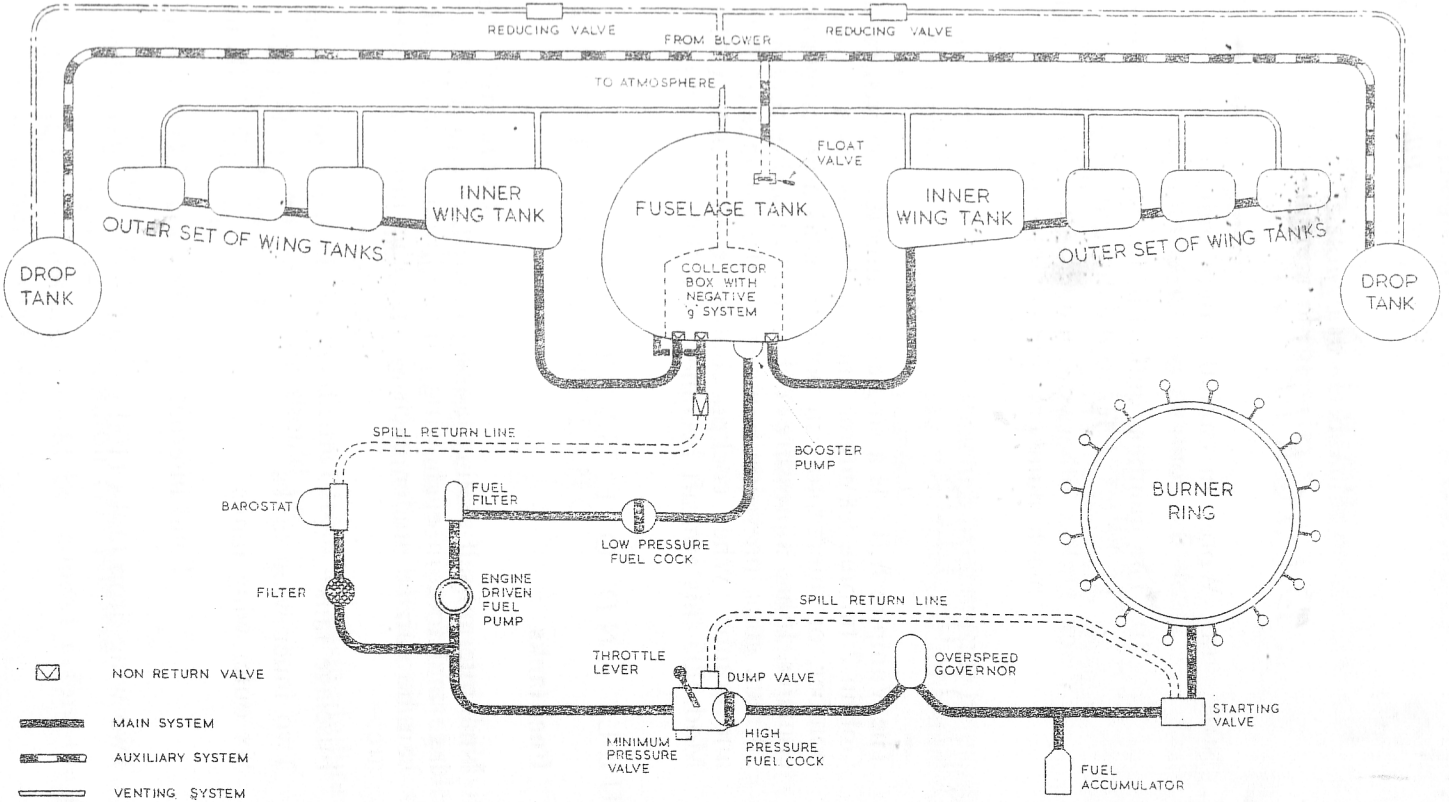
The Vampire F.B.5 is a single-seat aircraft powered by a Goblin 2 turbine jet engine and can be used as a fighter-bomber, or interceptor, in both tropical and temperate climates. It has a pressure cockpit and in addition to four 20 mm. guns, provision is made for the carriage of R.P. and bombs. When cockpit cooling is introduced under Mod. 905 this aircraft becomes an F.B.9.

FUEL AND OIL SYSTEMS

1. Fuel tanks

Nine internal self-sealing tanks are fitted, one in the fuselage and four in each wing. In addition, a drop tank can be carried under each wing. The tank capacities are:—

Fuselage tank	96 gallons
Two inner wing tanks	104 gallons
Six outer wing tanks	130 gallons
Total internal capacity ...	330 gallons
Two wing drop tanks (100 gallons each)	200 gallons
Total ...	530 gallons



SIMPLIFIED FUEL SYSTEM DIAGRAM

NOTE.—When Mod. 694 is not embodied some fuel will not flow from the inner and outer wing tanks into the collector box and is therefore "unusable". The amount varies with the attitude of the aircraft and in the nose-up attitude is a maximum of 35 gallons. The effective internal capacity is:—

Mod. 694 not embodied	...	295 gallons
Mod. 694 embodied	...	325 gallons

2. **Fuel system**

(i) The fuel flows from all the internal tanks to a collector box which incorporates a negative "g" arrangement affording a fuel supply for ten seconds inverted flight. The tanks which are not pressurised, are vented to atmosphere. A satisfactory delivery pressure at altitude is ensured by a booster pump, immersed in the fuselage tank.

(ii) The wing drop tanks are pressurised from the engine compressor casing; Mod. 591 incorporates a reducing valve for each wing drop tank, thus ensuring that fuel can be supplied from one tank should the other be holed. The flow of fuel from the wing drop tanks to the fuselage tank is controlled by a float valve mounted at the top of the fuselage tank.

(iii) Fuel from the booster pump passes through a low-pressure cock and a filter to an engine-driven pump capable of maintaining a constant fuel pressure throughout the power range. An aneroid-operated barostat, fitted to the delivery line of this pump, controls the fuel supply by returning surplus fuel to the collector box as height is gained; the engine r.p.m. therefore remains substantially constant at any selected throttle opening. From the engine-driven pump, fuel passes to the throttle (fuel control valve) and the high-pressure cock. A minimum pressure valve ensures that, regardless of the throttle setting, sufficient pressure will be maintained at the burner ring to prevent flame extinction at altitude. Maximum pressure at the burner ring is controlled by an overspeed governor. From the overspeed governor fuel passes to the starter valve, and the line is tapped to supply an

accumulator. The purpose of the accumulator is to provide a fixed quantity of fuel at a known pressure at the moment of starting. A dump valve drains any fuel present in the system before the pressure builds up on starting. When stopping the engine, it prevents free fuel from draining into the combustion chambers after the pressure has fallen.

3. **Fuel cocks**

The low pressure fuel cock is controlled by a lever (16) mounted under the engine control box on the cockpit port wall. It has two positions marked FUEL OFF (down and back) and FUEL ON (forward and up). The high pressure fuel cock is controlled by a lever (6) mounted outboard of the throttle lever; when in the forward position it is held by a spring catch. There are no separate fuel cocks for the wing drop tanks.

4. **Fuel booster pump and fuel pressure warning light**

(i) The booster pump is controlled by an on-off switch (60) on the electrical panel.

(ii) A fuel pressure warning light (19) is above the left-hand side of the instrument panel. This light will come on when the booster pump ceases to deliver fuel; normally when the booster pump is switched ON, the warning light should go out. The light will be on at all times when the booster pump is switched off.

5. **Fuel contents gauge(s)**

(i) Five fuel contents gauges (38) are fitted below the instrument panel. The top left and right-hand gauges indicate the contents of the corresponding inner wing tank. The centre gauge indicates the contents of the fuselage tank. The lower left and right-hand gauges are for the outer wing tanks.

(ii) The gauges fitted prior to Mod. 629 under-read when the aircraft is in some attitudes; they indicate less than the

actual contents. These gauges can be recognised by the "full" marks which are:— inner tanks 52 gallons—outer tanks 55 gallons—fuselage tank 80 gallons.

(iii) When Mod. 624 is embodied the "full" marks are:— inner tanks 47 gallons—outer tanks 57 gallons—fuselage tank 75 gallons.

(iv) Later aircraft have a pacitor type gauge. The single indicator mounted at the right-hand side of the instrument panel shows the total contents of the internal tanks.

(v) All gauges indicate when the Ground/Flight switch is at FLIGHT. In the case of the pacitor gauge there is some delay after switching to FLIGHT before the gauge functions.

6. **Oil system**

(i) There is no oil tank, but the engine has a sump which contains about $1\frac{1}{2}$ gallons of oil for lubricating the engine-driven accessories and the impeller bearings.

(ii) The oil pressure and oil temperature gauges are fitted on the left-hand side of the instrument panel. The oil pressure gauge is not fitted on later aircraft.

ENGINE CONTROLS

7. **Throttle control**

The throttle control lever (8) which moves in a quadrant marked SHUT-THROTTLE-OPEN, extends from the engine control box. The friction adjuster (7) is on the side of the engine control box.

8. **Engine starting system**

(i) The electrical starter motor is controlled by an automatic system operated by the engine starting pushbutton (78) and interlinked starter and master switches (59) on the electrical panel. This pushbutton, which should be pressed for about two seconds and then released, sets in

motion the timing switch which automatically operates the starting sequences; giving first a turning period sufficient for the attainment of the correct r.p.m. for the "light up" and then a further period to accelerate the engine to idling r.p.m. before the starter motor is cut out.

(ii) An auxiliary starting switch (58) is fitted forward of the master and starter switches. It should be switched ON as soon as the burners light up to cause a third relay to function, allowing full current for the starter motor, thus assisting the engine to attain idling r.p.m. It should be switched off as soon as idling r.p.m. have been attained. On some aircraft a modified system (Goblin Mod. 357), excludes the use of the auxiliary starting switch, in which case it will be wired in the off position.

(iii) A booster coil pushbutton (9) on the cockpit left-hand coaming is for testing the ignition equipment.

(iv) There is no method of re-starting the engine in flight.

9. **Engine instruments**

A jet pipe temperature gauge (49), an r.p.m. indicator (20) and an oil temperature gauge (40) are mounted on the left-hand side of the instrument panel. In addition some aircraft have a rear-bearing temperature gauge (48) and an oil pressure gauge (40).

MAIN SERVICES

10. **Hydraulic system**

(i) Hydraulic pressure supplied by an engine-driven pump is stored in an accumulator for the operation of the:—

Undercarriage
Flaps
Air brakes

(ii) Sufficient pressure will be available in the accumulator, if fully charged, for one complete one-way operation of the undercarriage and the flaps after failure of the engine-driven hydraulic pump.

(iii) A hand pump (17) is provided to the left of the pilot's seat for use when accumulator pressure is not available. Operation of the hand pump will transmit hydraulic fluid from a reserve supply in the reservoir to the jacks concerned—without going through the accumulator—under sufficient pressure to operate the undercarriage and flaps at a reduced rate. The hand pump will not operate the air brakes.

11. Pneumatic system

(i) An engine-driven compressor charges a bottle for the operation of the wheel brakes. The triple pressure gauge (32) on the right-hand side of the instrument panel, shows the available pneumatic pressure; when fully charged this should be 450 lb./sq. in. The maximum pressure at each brake should be 150 lb./sq. in.

(ii) An engine-driven vacuum pump provides suction for the instruments and for deflating the canopy seal. When the artificial horizon and turn indicator are electrically operated as on later aircraft, there is no vacuum pump and the canopy seal is deflated to atmosphere.

12. Electrical system

(i) An engine-driven generator charges the aircraft batteries. These, in turn, supply the electrical system at 24 volts, except part of the automatic engine starting system. A generator warning light mounted on the left-hand side of the instrument panel, when Mod. 850 has been incorporated, indicates when the generator is not charging the batteries.

(ii) The Ground/Flight switch (2) is on the cockpit port wall. When set to GROUND the electrical services are isolated from the generator and aircraft batteries. Two external sockets are fitted one on each side of the fuselage below the wing. The port socket is for normal ground test purposes and is marked RADIO TEST SOCKET. The socket on the starboard side is marked 24 VOLT GROUND STARTER SOCKET, and is wired only to part of the automatic engine starting system.

(iii) An inverter supplies A.C. for the Mark 4F compass when fitted and the artificial horizon when electrically operated.

AIRCRAFT CONTROLS

13. Flying controls

(i) The control column is of the spade-grip pattern and incorporates the brake lever, the gun firing pushbutton (42), the cine-camera control (41) and a press-to-transmit switch (43).

(ii) The rudder pedals can be adjusted for length by lifting them from one slot to another.

14. Flying controls locking gear

The flying controls locking gear consists of a V-shaped fitting which joins a peg on the floor, near the control column, to the port rudder pedal, and a V-shaped tubular fitting which joins the control column spade-grip to the coaming above the instrument panel. A stowage is fitted to the left-hand side of the pilot's seat.

15. Elevator trimming tab control

The elevator trimming tab control wheel (13) is on the side of the engine control box. The indicator (22) is on the top left-hand side of the instrument panel.

16. Undercarriage control

The undercarriage selector (1) is the longest of three levers extending from the rear face of the engine control box and has two positions, up and down. When the weight of the aircraft is on the wheels, the selector is locked in the down position by a spring-loaded lock. When the weight of the aircraft is off the wheels, this lock is withdrawn electrically. In an emergency, the undercarriage can be selected up when the aircraft is on

the ground if the switch (3) marked U/C EMERGENCY RETRACTION, fitted on the cockpit port wall, is first operated.

17. Undercarriage position indicator

A standard undercarriage position indicator (46) is on the bottom left-hand side of the instrument panel.

Indications are:—

Undercarriage locked up	...	No lights
Undercarriage unlocked	...	Three red lights
Undercarriage locked down		Three green lights

An additional red light, positioned above the top centre of the instrument panel, on the right of the elevator trim indicator, comes on if a wheel is not locked down and the throttle is less than a quarter open.

18. Flap control and position indicator

(i) Operation of the flaps is controlled by the selector lever (4) next to the undercarriage selector lever. It has three positions, up, neutral, and down, and any angle up to 80° can be obtained by returning the selector lever to neutral when the desired setting has been reached. The selector should be left in the down position when the flaps are fully down, and in the up position when the flaps are fully up.

(ii) A flap position indicator (47) is fitted next to the undercarriage position indicator. The marking at 30° is the take-off position. The marking at 40° has no significance.

19. Air brakes control

A lever (5) the shorter of three extending from the rear face of the engine control box, has two positions, ON and OFF. The air brakes cannot be operated by the hand pump.

20. **Wheel brakes**

The brake control lever and parking catch are on the control column. Differential control of the brakes is obtained by movement of the rudder pedals.

COCKPIT EQUIPMENT

21. **Canopy operation**

(i) The canopy is opened and closed by the crank handle (52) mounted on the cockpit starboard wall. A peg on the crank handle locks it in any desired position when the handle is released.

(ii) When closing the canopy the crank handle should be rotated as far forward as possible to ensure that the peg engages in the last locking hole, thus providing for the efficient working of the canopy seal.

(iii) The canopy can be jettisoned by operating the lever (30) marked CANOPY JETTISON situated forward of the crank handle on the cockpit starboard wall.

(iv) A pushbutton, on the outside of the fuselage on the starboard side, labelled PRESS—TO SLIDE CANOPY BACK, enables the canopy to be operated from outside. There is a retractable foot-step on the port side of the fuselage.

22. **Canopy sealing and cockpit altimeter**

(i) The canopy seal cock (51) is mounted on the cockpit starboard wall forward of the canopy crank handle. When ON, the cock admits air pressure to the canopy seal from the engine impeller casing. The canopy seal cock must not be ON when the canopy is open.

(ii) When the canopy is fully closed and the canopy seal cock ON, the crank handle will foul the canopy seal cock if an attempt is made to wind the canopy open. This serves to remind the pilot to turn off the seal before opening the canopy.

(iii) The cockpit altimeter (29), a cockpit pressure gauge (28) and a warning light (31) are on the right-hand side of the instrument panel. The warning light will indicate when the cockpit pressure is $\frac{1}{2}$ lb./sq. in. less than the correct pressure for the altitude of the aircraft: it may flicker off and on during the climb.

23. Cockpit pressurising (F.B.5)

Cockpit pressure is supplied by an engine-driven cabin blower which can be engaged by the lever (57) marked ON—CABIN BLOWER—OFF. This lever is forward of the canopy seal cock and should be moved down for pressurising and up when pressure is not required. The cockpit pressure is automatically controlled by a valve which spills air to atmosphere. Below approximately 15,000 ft. the valve is fully open and there is no build-up of pressure in the cockpit. Above this height the valve spills less air and so permits the differential pressure to increase progressively with height, up to a maximum of 3 lb./sq. in. (equivalent to 21,000 ft.) at 35,000 ft.

24. Cockpit heating and ventilation (F.B.5)

(i) The cockpit heating is controlled by a lever (54) marked HOT—CABIN BLOWER AIR—COLD mounted on the cockpit starboard wall at the rear of the electrical panel. This lever regulates the amount of air from the cabin blower passing through a cooling radiator, and is therefore effective only when the cabin blower is operating.

(ii) An adjustable cold air ventilator (11) fitted on the cockpit port wall embodies a non-return valve which prevents leakage of air when the cockpit is pressurised. On later aircraft the ventilator is positioned further aft to avoid masking the machmeter.

(iii) On some aircraft a supply of hot air can be fed to a gallery pipe round the cockpit coaming. The cock on the cockpit port wall is labelled WINDSCREEN AND CANOPY DEMISTING and has two positions, OFF (up) and ON.

25. Cockpit pressurising and air conditioning (F.B.9)

(i) A control wheel on the cockpit port wall has positions marked OFF—COLD—MIX—HOT. When the wheel is rotated to any position forward from the OFF position, air from the engine impeller casing is admitted to the cockpit. The cockpit pressure is automatically controlled by a valve which spills air to atmosphere. Below approximately 15,000 ft. the valve is fully open and there is no build-up of pressure in the cockpit. Above this height the valve spills less air and so permits the differential pressure to increase progressively with height, up to a maximum of 3 lb./sq. in. (equivalent to 21,000 ft.) at 35,000 ft.

(ii) When the air leaves the impeller casing it is cooled by a cold-air unit fitted in the starboard wing; by rotating the control wheel the proportion of hot air passing through the cold-air unit can be varied.

(iii) The temperature of the air entering the cockpit may be varied by the air conditioning control, increasing as the control is rotated further forward. The proportion of air going through the louvre and gallery pipe may be varied by altering the position of the louvre.

(iv) The air conditioning control must always be OFF when the aircraft is on the ground, otherwise overheating of the unit will occur.

26. Windscreen de-icing and de-misting

(i) A hand pump (36) for windscreen de-icing, together with a regulator, is mounted on the bottom right-hand side of the instrument panel.

(ii) On some E.B.5 aircraft, a hot air supply assists in canopy and windscreen de-misting. The controlling lever is mounted on the cockpit port wall above the undercarriage selector lever.

27. External lighting and cockpit lighting

(i) *External lighting*

The identification lights selector (65) and pushbutton (76) are on the electrical panel. Switches for the navigation

lights (64) and landing lamp (75) are also on the electrical panel.

NOTE. Until Mod. 934 is incorporated, the identification lights must not be operated as there is a risk of fire.

(ii) *Cockpit lighting*

Dimmer switches for U/V lights, instrument panel and floodlamp lighting, are on the cockpit port wall close to the Ground/Flight switch. The emergency light switch is located in the same position.

28. Pressure head heater

The switch (61) for the pressure head heater is on the electrical panel.

29. Flight instruments and compasses

(i) Some aircraft have suction-driven flight instruments. There is no vacuum pressure gauge. An R.I. compass is fitted, controlled by the switch (62) on the electrical panel.

(ii) On later aircraft the turn indicator and the artificial horizon are electrically operated and a Mk. 4F compass is fitted. Two coupled switches are linked with the starter-master switches. When the coupled switches are ON the turn indicator will function and, provided the circuit breaker positioned above the oxygen economiser is on, the artificial horizon and the Mk. 4F compass will also operate. When a Mk. 4F compass is fitted an E.2A stand-by compass is fitted on the right-hand side of the gunsight.

(iii) Mod. 951 introduces a Lear radio compass in F.B.9 aircraft. The amplifier and loop are in the nose of the aircraft in place of the I.F.F. set. The control box is on the inboard face of the electrical panel and the indicator is on the wedge plate (34).

30. **Seat adjustment**

A lever (56) on the right-hand side of the seat provides adjustment for height.

31. **Oxygen system**

The Mark 11C regulator (37) is mounted on the right-hand side of the instrument panel.

OPERATIONAL CONTROLS

32. **Guns, R.P., bombs and cine-camera operation**

(i) The gun-firing mechanism is electrically operated and has a pushbutton (42) fitted on the control column spade-grip. The pushbutton has a spring-loaded safety flap which must be lifted before the guns can be fired. When the flap is at SAFE and the cine-camera master switch (66) is ON, the cine-camera can be operated independently by pressing the cine-camera control (41). When it is set to FIRE, the gun-firing pushbutton will fire the guns. The cine-camera will operate simultaneously providing the cine-camera master switch is ON.

(ii) When the nose wheel is lowered, a micro-switch prevents the guns from being fired. To fire the guns when on the ground, the aircraft must first be trestled and the nose wheel retracted.

(iii) The gyro gunsight master switch (67) is on the electrical panel. The combined dimmer and selector control (25) is on the top right-hand side of the instrument panel, and the ranging control (10) is incorporated in the throttle grip. A camera recorder can be fitted on the gyro gunsight. The R.P. guns selector switch (53) is above the electrical panel.

(iv) The R.P. PAIRS-SALVO selector switch (68) is on the electrical panel. The firing pushbutton (12) is mounted in the throttle control lever and can be used for the release of bombs after operating the coupled master-selector switch (74) which is on the electrical panel

marked R.P.—BOMBS. The R.P. auto selector switch (55) is behind and inboard of the electrical panel.

(v) The bomb selectors (70) (71), the fusing switches (72) (73) and the bomb distributor salvo switch (69) are on the rear end of the electrical panel.

(vi) The bombs and carriers are jettisoned by the operation of the wing drop tank jettison lever (18). There is no means of jettisoning the R.P.

33. Radio and radar equipment

(i) The T.R. 1464 V.H.F. controller (14) is mounted on the lower left-hand side of the instrument panel. In later aircraft, this is superseded by the T.R. 1934 controller mounted in the place of the burner ring pressure gauge and rear bearing temperature gauge.

(ii) The I.F.F. control unit (35) with F and D switches and the controller (33) are fitted on the lower right-hand side of the instrument panel. The G pushbutton (45) and the auto/manual switch (44) are on the lower left-hand side of the instrument panel.

(iii) The mic-tel socket (15) is positioned on the forward side of the pilot's seat.

PART II
HANDLING

34. Management of the fuel system

(i) The internal tanks and wing drop tanks all feed the engine automatically when the low and high-pressure fuel cocks are on.

(ii) The booster pump should be switched ON before starting and left on at all times when the engine is running. Below 20,000 ft. the booster pump is not essential and failure of the pump, indicated by the fuel pressure warning light coming on, will not cause fuel starvation. Above 20,000 ft., if the light comes on it may not be possible to obtain maximum r.p.m.

(iii) Transfer of fuel from the wing drop tanks into the fuselage tank begins when approximately 20 gallons have been used from the fuselage tank.

(iv) The pacitor-type gauge should show a fall of approximately 20 gallons, then (when transfer begins) should remain constant until the wing drop tanks are empty. It should then fall at the usual rate. If Mod. 694 is embodied the gauge should indicate approximately 5 gallons when all "usable" fuel has been consumed. If Mod. 694 is not embodied it should indicate approximately 35 gallons when all "usable" fuel has been used.

(v) With the gauges described in para. 5 (i) and (ii) (five dials) there should be little, if any, fall in the contents shown by the fuselage tank until the wing drop tanks are empty. The level in the fuselage tank will then fall to the region of 50 gallons before fuel starts to drain from the inner and outer wing tanks. When about 30 gallons are shown on the fuselage tank gauge it will be observed that the level in this tank is falling but that there is no change in level of the inner and outer wing tanks. The pilot can thus tell that no more fuel is passing from the inner and outer wing tanks and that the amount of "usable" fuel remaining in the aircraft is that indicated on the fuselage tank gauge.

35. **Checks before starting**

(i) After carrying out the external and internal checks (see pages 6 to 8) ensure:—

Ground/Flight switch ...	FLIGHT
Cockpit pressure control wheel (F.B.9) ...	OFF
Low pressure fuel cock	ON
High pressure fuel cock	On
Throttle	Fully closed*
Booster pump	ON

*When Mod. 921 is embodied the throttle should be set 1" open for starting, and returned to the closed position when idling r.p.m. have been attained.

(ii) Have a 230 ampere-hour, 24 volt, ground starter battery plugged in and switched on. It is essential that the starter battery be fully charged, otherwise it will not accelerate the engine to idling speed after the light-up.

(iii) Switch on the interlinked starter master switches and press the engine starting pushbutton, releasing it after two seconds.

(iv) When the engine is running at idling speed, check that the jet-pipe temperature is not more than 600°C. Have the ground starter battery switched off and disconnected. Switch off the interlinked starter master switches and the auxiliary starting switch, if used.

NOTE.—When Goblin Mod. 357 is not embodied the auxiliary starting switch should be switched ON as soon as the light-up is heard, or observed on the jet pipe temperature gauge, and then switched off when idling speed is attained. When Goblin Mod. 357 is embodied the auxiliary starting switch is not normally necessary and is wired in the off position. If, however, difficulty is experienced in starting in temperatures below −20°C. the switch should be set ON before commencing to start the engine and returned to off after idling speed is attained.

If the burners fail to light up or the r.p.m. do not accelerate to the idling speed, the engine should be shut down as follows:—

(a) Close the high-pressure fuel cock. If the cock is not in the fully closed position fuel will leak past the starter valve, giving insufficient pressure for the next start.

(b) Switch off the interlinked starter master switches and the auxiliary starting switch, if used.

(c) Have the ground crew depress the tail and remove any fuel from the jet pipe; if fuel has drained on to the ground, have the aircraft moved to another position.

(d) Check that the compressor has stopped turning before making another attempt to start. Should the engine fail to start on the second attempt the cause should be investigated before further attempts are made.

Checks after starting

Flaps	Test
Air brakes	Test
Generator warning light	Out
Radio	Test
Brakes	450 lb./sq. in. or pressure sufficient and supply increasing
Flight instruments ...	Check altimeter setting Synchronise Mk. 4F compass and check with E2 compass (or switch on R.I. compass and synchronise direction indicator) Check turn indicator

37. **Checks before taxying**

Brakes	Check pressure. Check brakes as soon as possible.
Pressure head heater ...	ON (if required)

38. **Checks before take-off**

Trim	Neutral
Fuel	Contents H.P. and L.P. cocks fully on Booster pump ON
Flaps	Up or take-off position Air brakes OFF
Instruments	Check and set Pressure head heater ON
Oxygen	On
Harness	Tight and locked
Canopy	Closed

39. **Take-off**

(i) Align the aircraft on the runway. Open the throttle smoothly and fully.

(ii) When the shortest take-off run is essential, some advantage can be gained by applying the brakes after the aircraft is aligned on the runway, opening the throttle fully, and then releasing the brakes.

(iii) To keep straight initially it may be necessary to use gentle braking, then, as speed is gained, coarse rudder.

(iv) Ease the nose wheel off the ground at about 80 knots. Care must be taken not to get the nose too high or the tail may touch the ground. The aircraft should be flown off at approximately 105 knots at normal load and at approximately 115 knots at maximum load.

(v) When comfortably airborne brake the wheels and then retract the undercarriage.

(vi) Raise the flaps, if used. Turn on the canopy seal and the cockpit pressure, if required.

(vii) When wing drop tanks are carried, if the undercarriage is not retracted before a speed of about 130 knots is reached, the airflow may prevent the undercarriage doors from closing. If the indicator shows that the undercarriage is not fully retracted, slight yawing of the aircraft at about 140 knots should lock it up. Where this is unsuccessful, climb to a safe height keeping the airspeed below 175 knots. Select undercarriage down, reduce speed as much as possible and select undercarriage up.

30. Climbing

(i) For maximum rate of climb the following speeds should be used:—

Clean:—

260 knots at sea level, reducing by 15 knots per 10,000 ft. up to 30,000 ft., thereafter by 45 knots per 10,000 ft.

2 x 100 gall. drop tanks:—

240 knots at sea level, reducing by 15 knots per 10,000 ft. up to 30,000 ft., thereafter by 40 knots per 10,000 ft.

2 x 500 lb. bombs:—

235 knots at sea level, reducing by 15 knots per 10,000 ft. up to 30,000 ft., thereafter by 40 knots per 10,000 ft.

2 x 1,000 lb. bombs:—

235 knots at sea level, reducing by 15 knots per 10,000 ft. up to 30,000 ft., thereafter by 35 knots per 10,000 ft.

2 x 500 lb. bombs or 8 x 60 lb. R.P.:—

220 knots at sea level, reducing by 15 knots per 10,000 ft. up to 30,000 ft., thereafter by 40 knots per 10,000 ft.

FINAL CHECKS FOR TAKE-OFF

TRIM	...	NEUTRAL
FUEL	...	CONTENTS H.P. AND L.P. COCKS ON BOOSTER PUMP ON
FLAPS	...	UP OR TAKE-OFF AIR BRAKES OFF
INSTRUMENTS	...	CHECK AND SET PRESSURE HEAD HEATER ON
OXYGEN	...	ON
HARNESS	...	TIGHT AND LOCKED

FINAL CHECKS FOR LANDING

WHEELS	LOCKED DOWN THREE GREEN LIGHTS
BRAKES	CHECK PRESSURES OFF
FUEL	CONTENTS
FLAPS	FULLY DOWN ON FINAL AIR BRAKES OFF
COCKPIT PRESSURE	OFF
HARNESS	TIGHT AND LOCKED

(ii) Whilst climbing at full power, the jet pipe temperature may slowly increase to the maximum. It may be necessary to reduce r.p.m. slightly in order to keep the jet pipe temperature within the limits.

(iii) If the cockpit has not already been pressurised the warning light will come on at approximately 7,000 ft. The cockpit should then be pressurised and the light should go out when the pressure rises.

41. General flying

(i) All controls are light, effective and well harmonised, and the aircraft is easy and pleasant to fly. The elevator is powerful throughout the speed range and relatively small stick forces may induce large accelerations. Under some conditions, the elevator is particularly light at high I.A.S. and requires careful use. When carrying wing drop tanks, or when flying without ammunition there is a tendency to tighten in turns at high altitude.

(ii) *Changes of trim*

Undercarriage up or down	No change
Flaps down ... MARKED	Nose up
Flaps up	Nose down
Air brakes on	Nose up
Air brakes off	Nose down

When wing drop tanks or external stores are carried the changes of trim induced by the air brakes are more pronounced and increase with speed. At high I.A.S. the trim changes are strong.

(iii) *Throttle manipulation*

Movement of the throttle should normally be made slowly to avoid surging and high jet pipe temperatures. The engine may be throttled back fully at any altitude and the minimum pressure valve will ensure that the burner pressure does not fall too low to support combustion. The higher the altitude the higher will be the idling r.p.m.

42. Flying at reduced airspeed

Fly at 130 knots. Flaps may be lowered to the take-off position if desired. THE CANOPY MAY BE OPENED IN FLIGHT AT ANY SPEED UP TO 150 KTS.

43. Flying in conditions of severe turbulence

The recommended speed is 220 knots.

44. Flight planning charts

(i) The flight planning charts show the range obtainable, clean, and with various external stores, at several heights when flying at the speed for maximum range. The time taken from take-off and the amount of fuel remaining at certain stages of the flight are also quoted.

(ii) As indicated on the text on each chart, the climb should be carried out at maximum r.p.m. and the descent made at a mach number of .65—270 knots below approximately 25,000 ft.—with the throttle fully closed and the air brakes off.

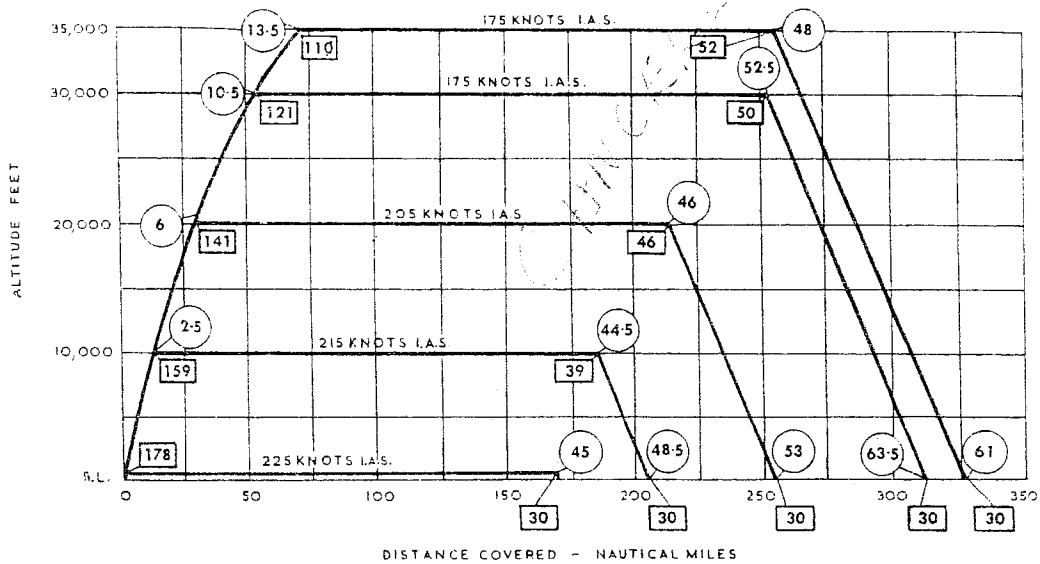
(iii) The charts are based on the assumption that Mod. 694 is not embodied, in other words that 35 gallons are unusable. The following table shows the allowances made for each part of the flight. The figure in brackets applies when wing drop tanks are carried.

Taxying and take-off	24 gallons
In flight	241 (441) gallons
Landing 30) Unusable 35)	65 gallons

(iv) The descent is designed to begin at a point which ensures that 65 gallons remain on joining the circuit. This means that 30 gallons are available, being sufficient for joining the circuit, going round again once, and landing.

(v) If Mod. 694 is embodied, making available 30 gallons more than is allowed for in the charts, ranges greater than those shown will be possible. From the charts, compare the fuel used in level flight with the distance covered in level flight and thus obtain the level flight A.N.M.P.G. The added distance which the 30 gallons will give can

WITHOUT DROP TANKS



CLIMB AT 10,200 R.P.M. CRUISE AT I.A.S. FOR MAXIMUM A.N.M.P.G. DESCEND THROTTLE CLOSED, CLEAN AT A MACH NUMBER OF ·65 ABOVE 25,000 FEET, 250 KNOTS BELOW 25,000 FEET

□ FUEL REMAINING (GALLONS)

○ TIME FROM TAKE-OFF (MINUTES)

CHART 1

2 × 500 LB BOMBS

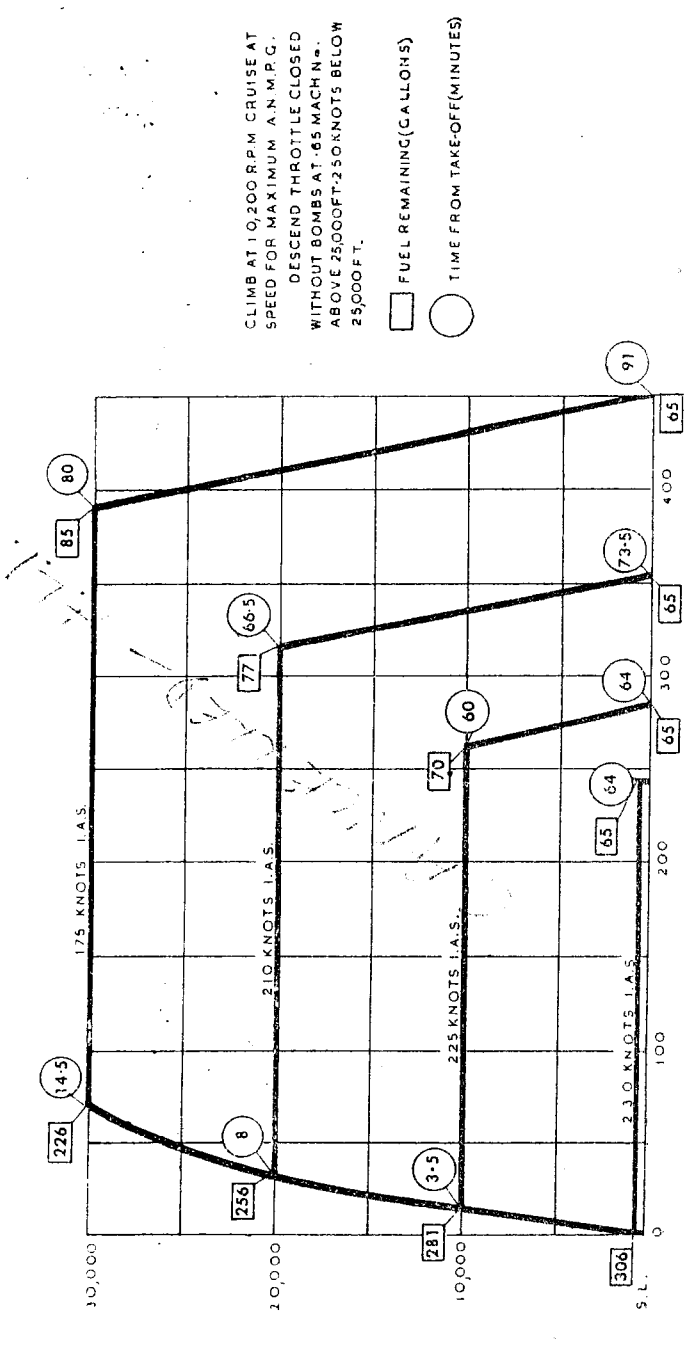


CHART 2

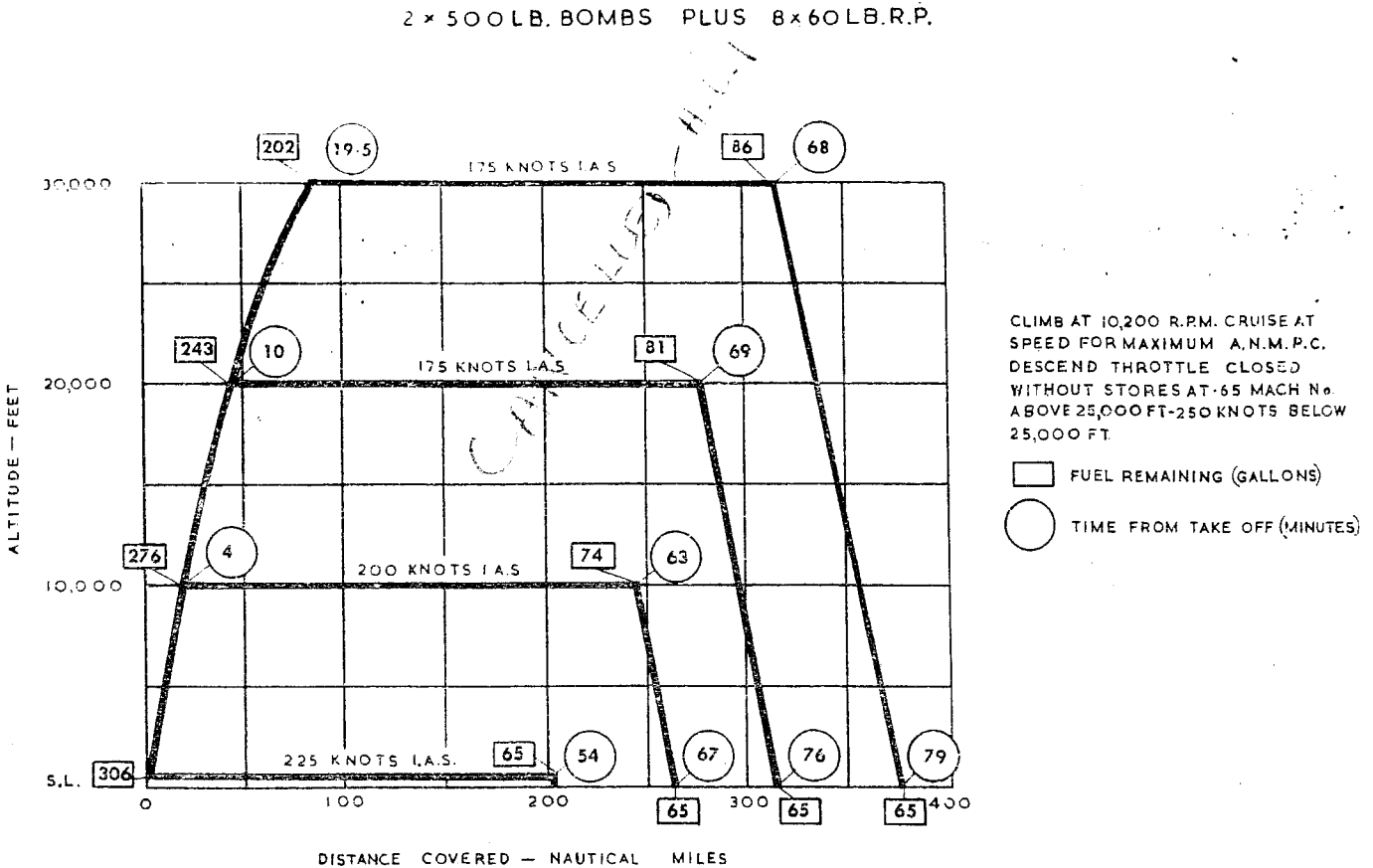
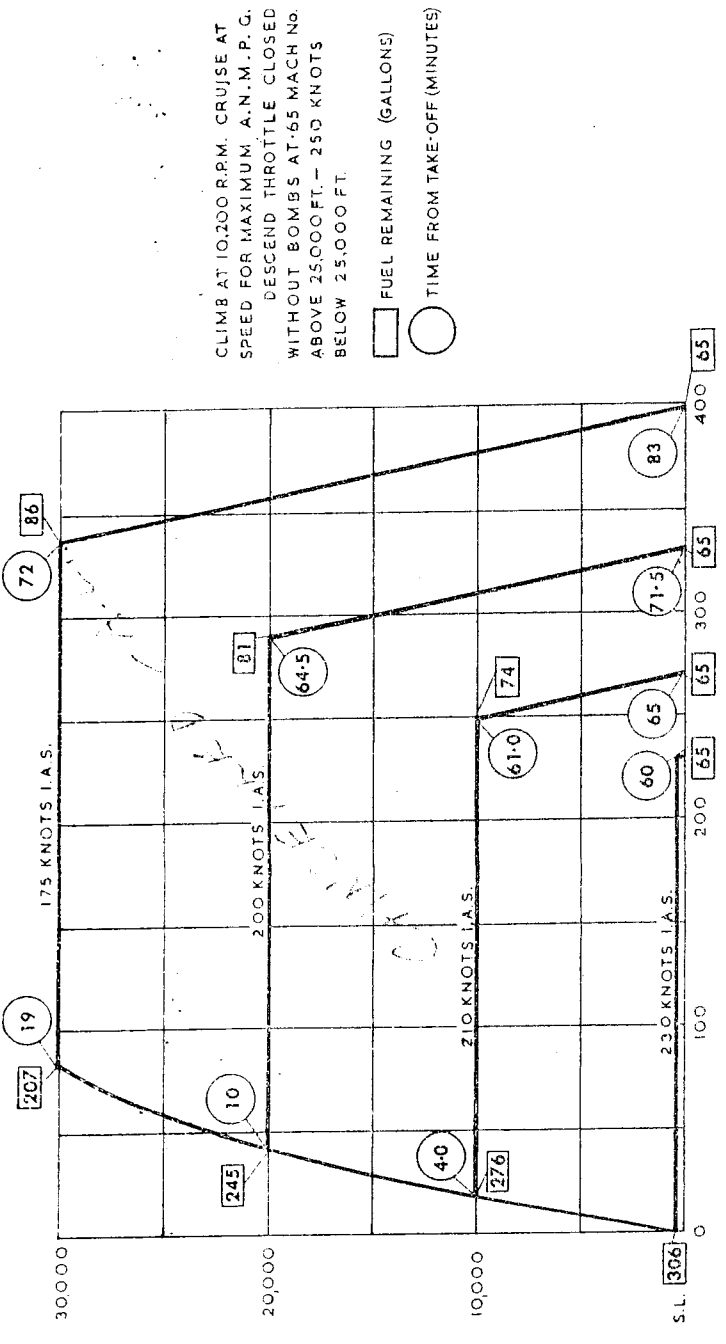

2 × 500 LB. BOMBS PLUS 8 × 60 LB. R.P.
202
19·5
175 KNOTS I.A.S
86
68
30,000
243
10
175 KNOTS I.A.S
81
69
20,000
ALTITUDE — FEET
276
4
200 KNOTS I.A.S
74
63
10,000
S.L.
306
225 KNOTS I.A.S.
65
54
67
76
79
0
100
200
65
300
65
65
400
DISTANCE COVERED — NAUTICAL MILES
CLIMB AT 10,200 R.P.M. CRUISE AT SPEED FOR MAXIMUM A.N.M.P.C. DESCEND THROTTLE CLOSED WITHOUT STORES AT ·65 MACH No. ABOVE 25,000 FT-250 KNOTS BELOW 25,000 FT.
FUEL REMAINING (GALLONS)
TIME FROM TAKE OFF (MINUTES)

CHART 3


2 × 1,000 LB. BOMBS
CLIMB AT 10,200 R.P.M. CRUISE AT SPEED FOR MAXIMUM A.N.M.P.G.
DESCEND THROTTLE CLOSED
WITHOUT BOMBS AT·65 MACH No. ABOVE 25,000 FT.— 250 KNOTS
BELOW 25,000 FT.
FUEL REMAINING (GALLONS)
TIME FROM TAKE-OFF (MINUTES)
175 KNOTS I.A.S.
200 KNOTS I.A.S.
210 KNOTS I.A.S.
230 KNOTS I.A.S.
ALTITUDE FEET
30,000
20,000
10,000
S.L.
0
100
200
300
400
DISTANCE COVERED — NAUTICAL MILES
CHART 4

2 × 100 GALLON DROP TANKS

CLIMB AT 10,200 R.P.M. CRUISE AT I.A.S. FOR MAXIMUM AN.M.P.G. DESCEND THROTTLE CLOSED. CLEAN AT A MACH NUMBER OF ·65 ABOVE 25,000 FEET 250 KNOTS BELOW 25,000 FEET

FUEL REMAINING (GALLONS)

TIME FROM-TAKE (MINUTES)

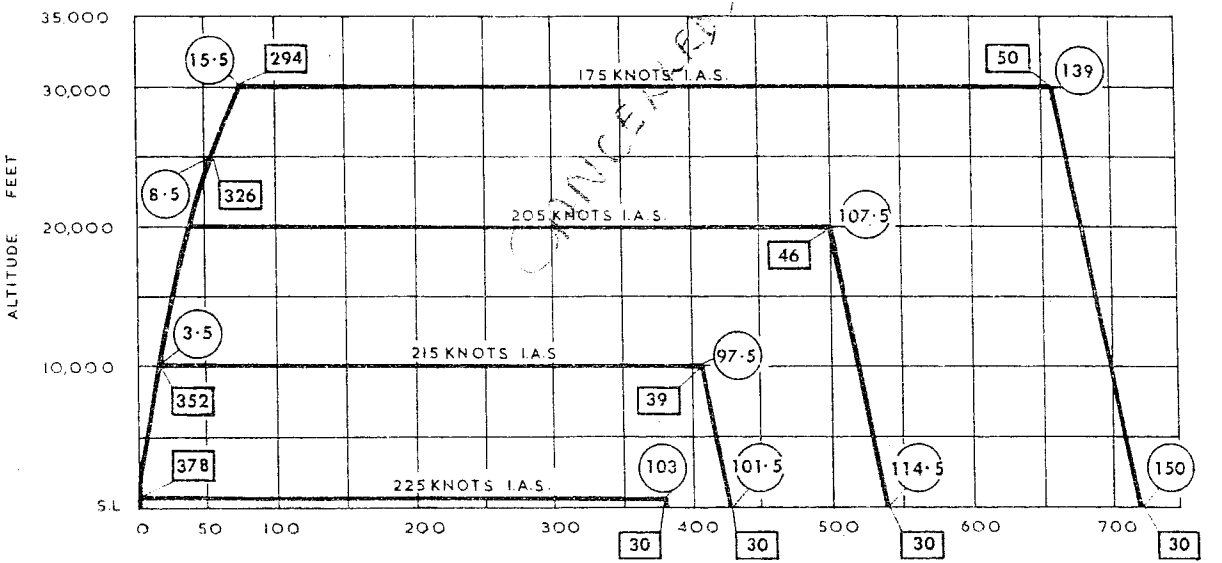
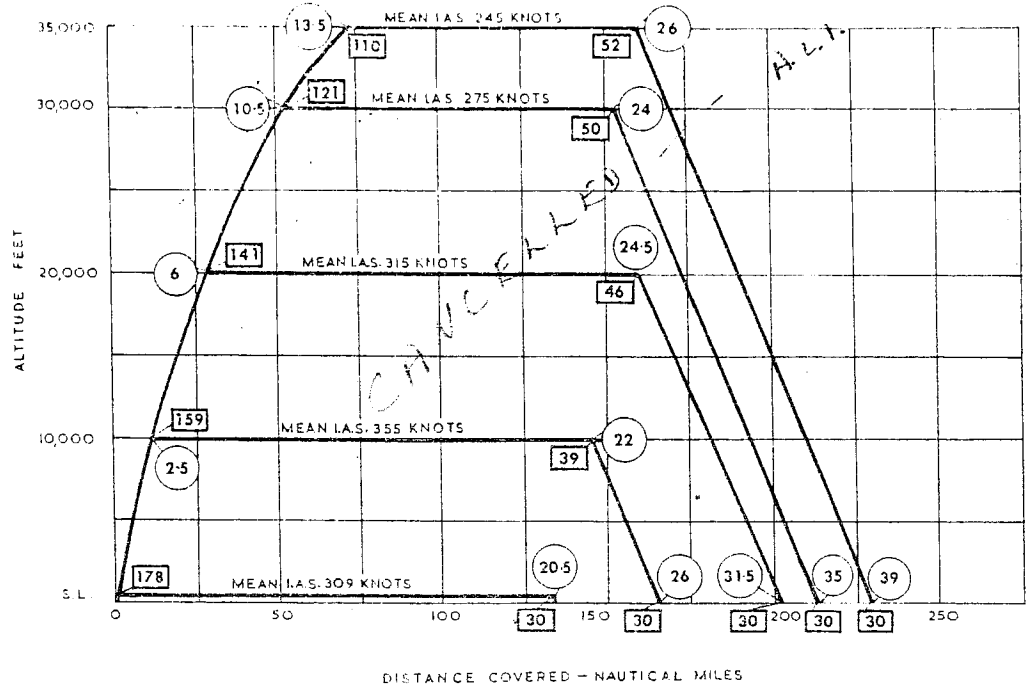


CHART 5

WITHOUT DROP TANKS

CRUISING AT MAXIMUM CONTINUOUS R.P.M.



DISTANCE COVERED — NAUTICAL MILES

CHART 6

then be ascertained; similarly, the extra time in terms of minutes of cruise can be found at the altitude and I.A.S. given.

(vi) Chart No. 6 gives the range performance for the clean aircraft when cruising at maximum continuous r.p.m. The I.A.S. shown is the mean which maximum continuous r.p.m. give since the I.A.S. will increase slightly as fuel is used.

(vii) The speeds given on the charts are the speeds for maximum range, but the use of any speeds within the following bands should not cause a reduction in range of more than 5 per cent.

	Clean	With external stores
Sea level ...	165-300	... 175-285
10,000 ft. ...	160-270	... 165-255
20,000 ft. ...	155-240	... 160-230
30,000 ft. ...	150-215	... 150-210
35,000 ft ...	150-200	... 150-195

(viii) When rocket rails are fitted the rate of climb is lower, the loss being 5% at sea level, becoming 15% at 35,000 ft. The reduction in ANMPG is 4% at sea level, becoming 8% at 35,000 ft. The range of a flight at 35,000 ft. from take-off to touchdown is, however, decreased by 12% due to the increased fuel consumption on the climb.

45. **Endurance**

(i) At any altitude, maximum endurance will be obtained by flying at the I.A.S. which requires the lowest r.p.m. to maintain height.

(ii) Increase in altitude gives improved endurance but the overall endurance depends not only upon the improvement gained by flying at altitude, but also upon the amount of fuel used for climb and for the descent.

(iii) Should it be necessary to remain in the air for as long as possible the aircraft should remain at the height at which it is flying when this is 30,000 ft. or above. When flying below 30,000 ft. with 100 gallons or less remaining, the endurance will not be increased by climbing, but, with 200 gallons or more remaining climb to 30,000 ft. at maximum r.p.m. If external stores or drop tanks are carried this height becomes 25,000 ft. instead of 30,000 ft.

46. Pressure error corrections

From	140	200	270	350	knots
To	200	270	350	455	
Add	2	4	6	8	knots

47. Stalling

(i) The approximate stalling speeds in knots, power off, are as follows:—

	Undercarriage and flaps up	Undercarriage and flaps down
At maximum landing weight (10,560 lb.) ...	90	80
Maximum A.U.W. (13,100 lb.)	105	90

(ii) The stalling characteristics are similar for all loads.

(a) With the undercarriage and flaps up, warning of the approach of a stall is given by a slight buffeting some 20 knots before the stall occurs, becoming slightly more pronounced as it approaches. At the stall the nose drops and the A.S.I. fluctuates widely. If the control column is held back there is pronounced pitching and a tendency for either wing to drop. With power on there is less warning of the stall but an increased tendency for either wing to drop.

(b) With the undercarriage and flaps down, there is general airframe vibration at all times but some warning is given by slight buffeting which commences about 15 knots before the stall. At the stall, there is pronounced buffeting, the nose and either wing may drop sharply and the A.S.I. fluctuates widely. Continued backward pressure on the control column results in stronger buffeting and an increased tendency for either wing to drop. With power on there is less warning of the approach of the stall but the characteristics are unaffected.

(c) The air brakes do not noticeably affect the stalling speeds or characteristics.

(iii) At all loads, warning of the approach of the stall in a steep turn or in recovery from a dive is given by buffeting and at the stall the aircraft may flick in either direction. Stick forces are light and it is relatively easy to stall the aircraft at low speeds in a steep turn particularly at high altitudes with loadings near the aft C.G.

(iv) In all cases recovery is normal.

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Para. 48

48. Diving and high speed flying

(i) The following is a guide to the compressibility characteristics. It is recommended that pilots investigate the effects of compressibility progressively as there may be differences in behaviour from aircraft to aircraft.

(ii) There is a progressively nose-up change of trim with increase of speed and the trim tab may be used to reduce the stick force but should not be used above .74 M. When, after trim has been applied, the mach number is reduced the aircraft will become nose heavy as the effects of compressibility diminish and it should therefore be retrimmed. During recovery the elevator should be used with care.

(iii) *Above 20,000 ft., clean aircraft*

(a) The nose-up change of trim commences between .71 M and .76 M and may become large enough to require a considerable push force to maintain the dive. Aileron snatching and intermittent wing dropping may also occur at these speeds, combined with a slight airframe buffet which becomes more marked as the mach number increases. The wing dropping can usually be held with aileron but may become uncontrollable about .04 M above the speed at which it commenced.

2
40
48

(b) In addition, porpoising may occur at about .78 M. During the porpoising the forces required to limit the movement are generally light but may become large, the nose-up part of the porpoising movement necessitating a greater restraining force than the nose-down.

(iv) *Below 20,000 ft., clean aircraft*

At these altitudes the characteristics are similar to those described above but the aileron snatching is less marked and there is less likelihood of an uncontrollable wing drop. The porpoising, however, is more marked and may become severe very quickly. Because of the aggravated porpoising characteristics at these altitudes and of the possibility of over-stressing the aircraft when the stronger nose-up movement coincides with the recovery from the dive, it is recommended that high mach number practice dives should be confined to altitudes above 20,000 ft. Below this height entry speeds into steep dives should be kept sufficiently low to preclude the possibility of attaining mach numbers at which the above characteristics may occur.

(v) *Carriage of external stores*

The compressibility effects set in at lower mach numbers, depending on the stores carried, and the effects described above may be more severe. It should be borne in mind that, with drop tanks on, there is a marked nose-up change of trim when air brakes are extended at high indicated airspeeds.

(vi) Recovery from compressibility conditions should be effected by throttling back and easing the aircraft out of the dive. The airbrakes can also be used, but when carrying external stores the strong nose-up change of trim must be anticipated and restrained. Whenever the aircraft is porpoising the air brakes should not be used until the porpoising has subsided.

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Paras. 49 and 50

49. **Aerobatics**

(i) The following speeds are recommended:—

Roll	230-250
Loop	300-320
Roll off the top	320-340
Climbing roll	340 plus

(ii) Aerobatics are prohibited when carrying external stores or wing drop tanks.

(iii) The negative "g" system ensures a supply of fuel for 10 seconds inverted flight.

50. **Spinning**

Intentional spinning is prohibited. Should an inadvertent spin occur, normal recovery action should be initiated immediately. Care must be taken when moving the control column forward to avoid excessive negative acceleration and a very steep nose down attitude. The rudder should be centralised immediately rotation ceases to avoid flicking into a spin in the opposite direction, and in the initial stage the pull out from the ensuing dive should be made gently.

51. **Checks before landing**

Undercarriage	Down Three green lights
Brakes	Check pressures Off
Fuel	Contents
Flaps	Fully down on final Air brakes OFF
Cockpit pressure ...	OFF
Harness	Tight and locked

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Page 41
Paras. 52

52. **Approach and landing**

(i) The turn on to the final approach should be made at 130 knots and the airfield boundary crossed at the following speed:—

Maximum landing weight* ... ... 95 knots

(ii) A powered approach is necessary to ensure a quicker thrust response if it is necessary to open the throttle. When flap is lowered, the marked nose up change of trim necessitates a large forward movement of the control column. The stick force required is not great and can

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be easily held without the use of elevator trim. The artificial horizon and the Mk. 4F compass, however, become partially obscured by the control column and care must be taken when flying on instruments to ensure that the correct direction and attitude are maintained.

* The maximum landing weight of 10,560 lb. represents an aeroplane with full ammunition, full internal fuel (330 gall.) but without drop tanks or external stores.

53. Instrument approach

The following are recommended for use during instrument approach with the undercarriage down:—

	R.P.M.	Flaps	Airspeed
Pattern	8,500	$\frac{1}{4}$	140 knots
Final	8,500	$\frac{1}{2}$	115 knots
Glide Path	8,500	full	105 knots

54. Going round again

Going round again from a powered approach is straightforward. If the go-around is begun after touch-down when engine r.p.m. have fallen, there is some delay before full power can be obtained.

(i) Open the throttle fully.

(ii) Retract the undercarriage.

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(iii) Climb at 115 knots. Because of a tendency for the aircraft to sink, the flaps should not be raised until a height of 2-300 ft. is reached.

55. Checks after landing

Flaps ... ... Up

Pressure-head heater ... Off

Brakes ... ... Check pressure

56. **Stopping the engine**

Allow the engine to idle for approximately 30 seconds to stabilise engine temperatures, then turn off the H.P. cock and check:—

Booster pump	Off
All switches	Off
Ground/Flight Switch	GROUND
Oxygen	OFF
Brakes	Off
Canopy seal cock ...	OFF

PART III
LIMITATIONS

..L.3
ara. 57
age 44

57. Engine data—Goblin 2

The principal engine limitations are as follows:—

	R.p.m.	Jet pipe temp. °C. Maximum
Take-off and operational necessity *30 Mins. Limit*	10,200*	745 (680 if mod. 404 not embodied)
Max. continuous	9,700	620
Idling	3,000 ± 200	600

*R.p.m. must be reduced to a maximum of 10,000 above 25,000 ft. in a climb or above 35,000 ft. in level flight.

Oil temperatures
Maximum in flight ... ... 80°C.
Minimum for opening up ... ... −10°C.

Oil pressures
Normal at 9,700 r.p.m ... ... 40/45 lb./sq. in.
Emergency minimum (5 min. limit) ... 25 lb./sq. in.

..L.2
age 44
ara. 58

58. Flying limitations

The aircraft is designed for the duties of a single seat fighter-bomber. Intentional spinning is prohibited.

(i) *Maximum speeds and mach numbers*

(a) Clean aircraft ... ... 455 knots
No mach number limitations but see para. 48.

(b) With drop tanks, with or without R.P.
Sea level to 5,000 ft. ... ... 390 knots
Above 5,000 ft. ... ... .65 M

NOTE.—When carrying wing drop tanks (full or empty) above 15,000 ft. full ammunition or equivalent ballast must be carried and the guns must not be fired. Below this height full ammunition or ballast need not be carried and the guns may be fired. Gentle manoeuvres only are permissible when carrying wing drop tanks.

(c) *With 2 x 1,000 lb. bombs*

Sea level to 5,000 ft.	400 knots
Above 5,000 ft.	.65 M

(d) *With 2 x 500 lb. bombs or 2 x 250 lb. bombs or 8 R.P.*

Sea level to 5,000 ft.	455 knots
Above 5,000 ft.	.75 M

(e) *With 8 x 25 lb. practice bombs*

Sea level to 5,000 ft.	400 knots
Above 5,000 ft.	.65 M

(f) Air brakes open ... ... No limit
Undercarriage down ... ... 175 knots
Flaps down ... ... 155 knots

(ii) *Maximum weights*

(a) For take-off from prepared runways and for gentle manoeuvres only ... 13,100 lb.

(b) For all permitted forms of flying and for landing ... ... 10,560 lb.

(iii) *Jettisoning of wing drop tanks*

The wing drop tanks may safely be jettisoned in level flight at speeds below 260 knots.

(iv) *Maximum height*

A height of 35,000 ft. must not be exceeded unless Mod. 727 (cockpit canopy) is embodied.

PART IV
EMERGENCIES

EMERGENCY CONTROLS AND EQUIPMENT

59. **Undercarriage and flaps emergency operation**

(i) In the event of failure of the engine-driven hydraulic pump and exhaustion of accumulator pressure, the handpump to the left of the seat can be used to operate the undercarriage and flaps.

(ii) In an emergency, the undercarriage can be retracted when the aircraft is on the ground. The undercarriage emergency retraction switch (3) must first be switched ON (back) before the undercarriage selector lever can be operated.

59
46 NOTE.—Up to 115 strokes of the hydraulic handpump may be necessary to lock the undercarriage down.

60. **Wing drop tank and bomb jettisoning**

To jettison the wing drop tanks or bombs and carriers, pull up the lever (18) marked JETTISON FUEL TANKS to the left of the seat.

61. **Canopy jettisoning**

(i) The canopy jettisoning lever (30) on the cockpit right-hand coaming should be pulled to jettison the canopy.

(ii) Speed should be reduced as much as possible, the seat should be lowered fully, and the pilot should keep his head well down at the moment of jettisoning.

62. **Engine fire-extinguisher and warning light**

(i) The fire-extinguisher is operated by pressing the shielded pushbutton (77) on the electrical panel.

(ii) The fire warning light (26) positioned on the left of the instrument panel depends for its method of operation upon the modification state.

(a) *Mod. 844 not embodied:* Flame switches in the engine bay, when actuated by fire, cause the warning light to come on. Normal fire action should then be taken. The light will remain on after the fire has been extinguished.

(b) *Mod. 844 embodied:* In addition to flame switches in the engine bay, re-setting thermal switches are located next to some combustion chambers. Hot air from a fracture will close a re-setting switch and the fire warning light will come on. If the throttle is closed the flow of hot air will diminish and after a few seconds delay, the switch will re-set and the light will go out.

(c) When the light comes on, the throttle should be closed immediately. If the light remains on for a further five seconds, a fire, as distinct from a fractured air casing, is indicated. Normal fire action should be taken and the light will remain on after the fire has been extinguished.

(d) If after closing the throttle the warning light goes out, a fractured air casing is indicated. It is safe to use the engine in this condition, but a landing should be made as soon as practicable. Reduced power should be used. Unless the power necessary is small the light will come on again and remain on. It is advisable, therefore, to throttle back fully approximately every five minutes and repeat the 5 seconds test, to ensure that a fire has not started.

63. **Emergency equipment**

(i) *First aid*

This is stowed on the inside face of the port ammunition door.

(ii) *Crowbar*

A crowbar is stowed in spring clips on the armour plate to the left and rear of the seat.

(iii) *Desert equipment*

Desert equipment can be stowed as follows:—

Water bottle	Reached from outside by opening the port ammunition access door.
Cartridges Heliograph Compass Very pistol Ordinary rations	Reached from outside by opening the starboard ammunition access door.
Flying rations Water bottle Tool kit Signalling strips AP3031	On floor of cockpit to right- and left-hand side of pilot's seat.

EMERGENCY HANDLING

64. **Fire action**

WARNING.—Fire in the engine bay may render the flying controls and pressure instruments useless, necessitating immediate abandoning of the aircraft.

In the event of fire, as distinct from air casing failure in para. 62 above, action should be:—

(a) L.P. cock OFF.

(b) Throttle closed.

(c) H.P. cock off.

(d) Booster pump off.

(e) Extinguisher pushbutton (77) pressed.

If possible, airspeed should be reduced before the fire extinguisher is operated.

65. Landing with asymmetric load

(i) *With empty drop tank*

No special precaution is necessary when landing with one empty, or nearly empty, drop tank.

(ii) *With full drop tank or with one 1,000 lb. bomb*

When flying with asymmetric load, some rudder will be found necessary at the lower airspeeds. Before landing, the rudder pedals should be re-adjusted to ensure that full aileron can be applied without the control column fouling the pilot's knee. A wide circuit should be made at 150 knots, and this speed maintained until on the final approach. Full flap should then be lowered and speed reduced so that the airfield boundary is crossed at 115 knots. The aircraft should be flown on to the ground.

NOTE.—Landing in this condition should not be necessary since the fuel from one tank will transfer, even if the other tank has been jettisoned. Also the bomb can be dropped electrically, or jettisoned with its carrier, mechanically.

66. Flapless landing

(i) The turn on to the final approach should be made at 130 knots. The approach is very flat, and little power, if any, is required. The airfield boundary should be crossed at 105 knots. A long landing run results.

(ii) The landing run can be reduced slightly if the engine is stopped after touch-down. The L.P. cock should be closed in such an emergency as it is more easily operated than the H.P. cock.

67. Crash landing

(i) Jettison the canopy.

(ii) Jettison the drop tanks and external stores. R.P. cannot be jettisoned; they can only be fired.

(iii) If power is available, make a normal landing, but keep the undercarriage retracted.

(iv) If power is not available glide at 140 knots, which is the best gliding speed, and maintain this speed whilst manoeuvring to land.

(v) Keep the undercarriage retracted and lower the flaps as required. With full flap, the rate of descent is high. A maximum of half flap should be selected until the landing area is within certain reach.

(vi) Reduce speed to 110 knots over the boundary of the landing area.

68. **Abandoning the aircraft**

Speed should be reduced if possible, and the aircraft inverted to enable the pilot to fall out.

69. **Ditching**

The aircraft should be abandoned rather than ditched as tests indicate that the ditching qualities are poor in any but the calmest seas.

If ditching is inevitable:—

(a) Jettison the canopy.

(b) Jettison the drop tanks and external stores.

(c) Adjust the safety harness. Disconnect R.T. and oxygen leads.

(d) Keep the undercarriage retracted. Use up to a maximum of 40° of flap.

(e) If power is available it should be used to enable the touch-down to be made at as low a forward speed as possible. It is probable that the touch-down can be made at 75-80 knots.

(f) If power is not available, the final approach should be made at 120 knots. The touch-down will probably occur at 80 knots.

70. **Engine failure in flight**

(i) Should there be complete loss of engine power in flight:—
Turn off H.P. cock and L.P. cock
Turn off all non-essential electrical services
Initiate distress procedure

(ii) No relight equipment is fitted, but in extreme emergency and when the engine failure is due to flame extinction, the following procedure has been known to effect a successful relight. Chances of a successful relight are increased with a decrease in altitude and airspeed.

(a) Reduce airspeed to a safe minimum.
(b) Booster pump on.
(c) Throttle closed.
(d) Move H.P. cock to $\frac{3}{4}$" open position.
(e) Press the booster coil pushbutton on the right-hand side of the cockpit for a maximum of 15 seconds.
(f) Watch engine r.p.m. and j.p.t. If either of them indicate a relight, move the H.P. cock slowly to the fully open position. Then open the throttle very slowly and check j.p.t.
(g) Once relight has occurred, diving the aircraft may assist the engine to accelerate. If high j.p.t. persists the H.P. cock must be closed immediately and the attempt to relight abandoned.
(h) If no light up occurs after 15 seconds, the attempt *must* be abandoned, otherwise a grave fire risk exists.

PART V
ILLUSTRATIONS

KEY TO *Fig.* 1

COCKPIT—PORT SIDE

1. Undercarriage selector lever.
2. Ground/Flight switch.
3. Undercarriage emergency retraction switch.
4. Flap selector lever.
5. Air brakes control lever.
6. High-pressure fuel cock lever.
7. Throttle friction adjuster.
8. Throttle lever.
9. Booster-coil pushbutton.
10. Gyro gun-sight ranging control.
11. Cockpit ventilator.
12. R.P. and bombs firing pushbutton.
13. Elevator trimming tab control.
14. Controller for TR.1464 (early aircraft).
15. Mic-Tel. socket.
16. Low-pressure fuel cock lever.
17. Hydraulic handpump.
18. Wing drop tanks jettison lever.

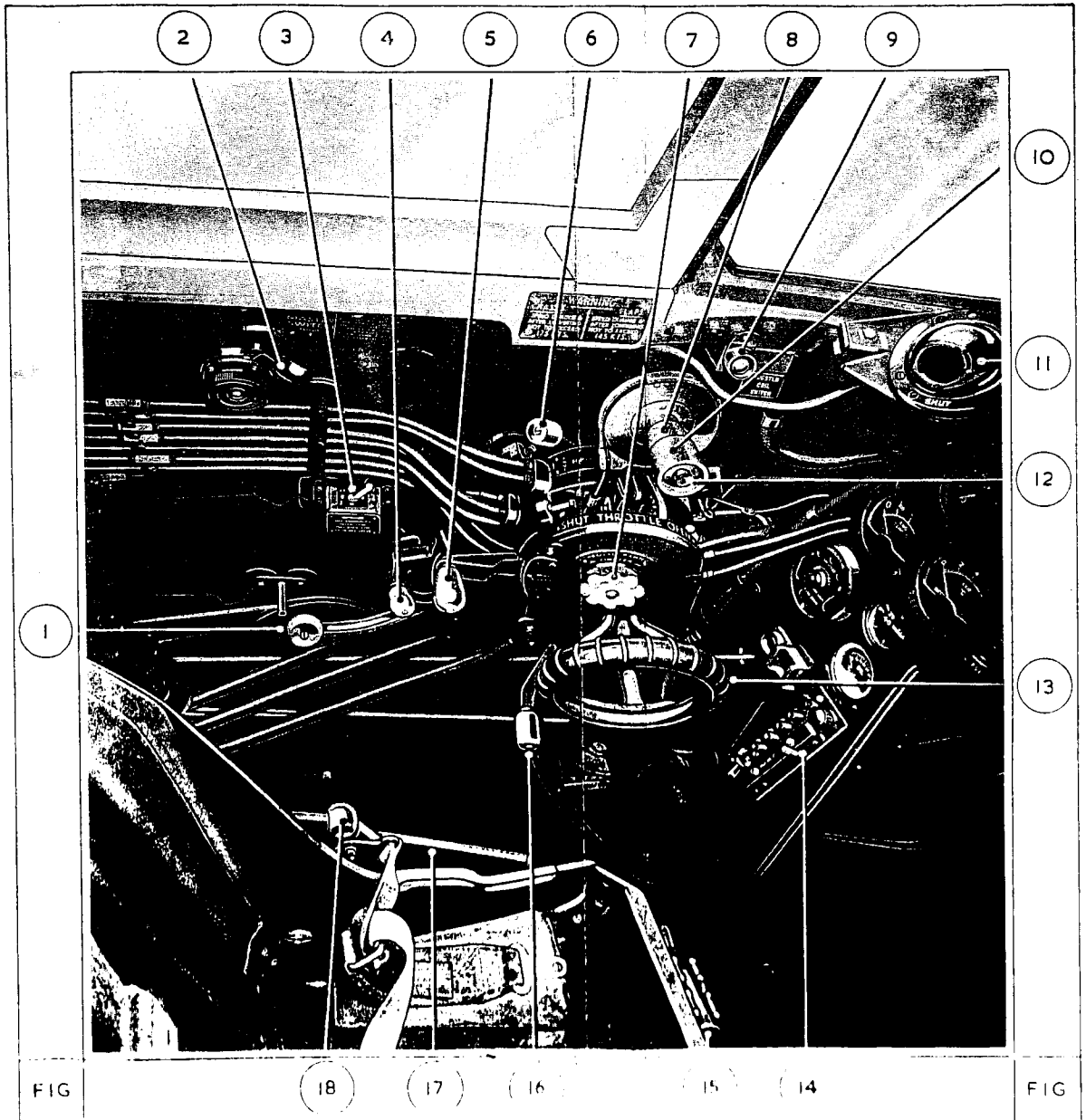

FIG 1 COCKPIT—PORT SIDE FIG 1

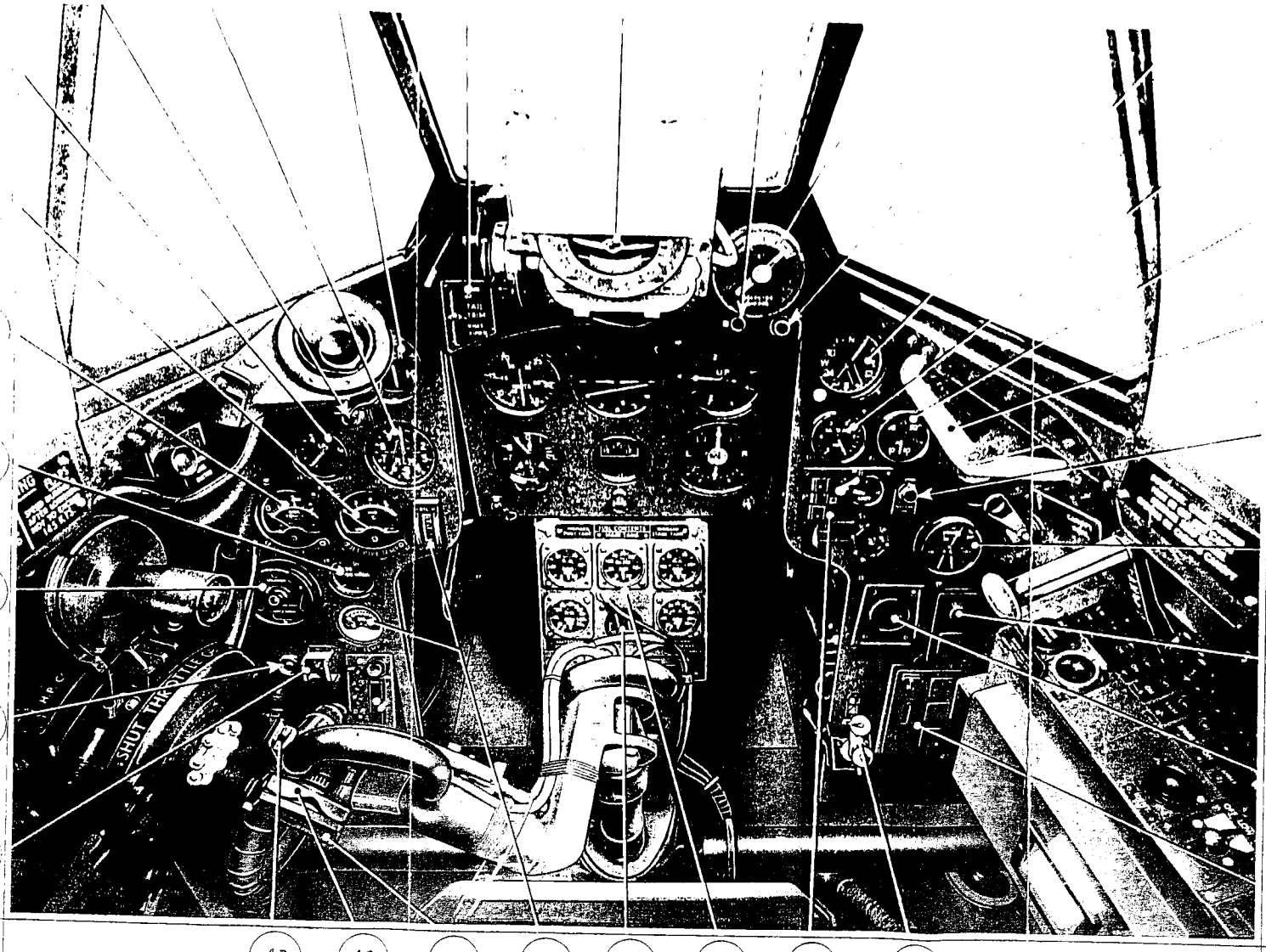

FIG. 2

COCKPIT-CENTRE

KEY TO FIG. 2

COCKPIT CENTRE

19. Fuel pressure warning light.
20. R.p.m. indicator.
21. Machmeter.
22. Elevator trim indicator.
23. Gyro gun sight.
24. Not in use.
25. Gun-sight selector and dimmer control.
26. Fire warning light.
27. R.I. compass indicator (if fitted).
28. Cockpit pressure gauge.
29. Cockpit altimeter.
30. Canopy jettison lever.
31. Cockpit pressure warning light.
32. Pneumatic triple pressure gauge.
33. Controller for R.3121 (IFF).
34. Cine-camera footage indicator location (F.B.5 aircraft only).
35. Control unit for R.3121 (IFF).
36. Windscreen de-icer handpump and regulator.
37. Oxygen regulator.
38. Fuel tank contents gauges.
39. Clock location.
40. Oil pressure and oil temperature gauges.
41. Cine-camera control.
42. Gun firing pushbutton.
43. Press-to-transmit switch.
44. Auto/manual switch for R.3121 (IFF).
45. G. pushbutton for R.3121 (IFF).
46. Undercarriage position indicator.
47. Flap position indicator.
48. Rear bearing temperature gauge (if fitted).
49. Jet pipe temperature gauge.
50. Burner ring pressure gauge (deleted by Mod. 680).

KEY TO *Fig.* 3

COCKPIT—STARBOARD SIDE

51. Canopy seal cock.
52. Canopy winding handle.
53. R.P./Guns selector switch.
54. Cockpit heating control (F.B.5 aircraft only).
55. R.P. auto selector switch.
56. Seat adjusting lever.
57. Cockpit pressurising lever (F.B.5 aircraft only).

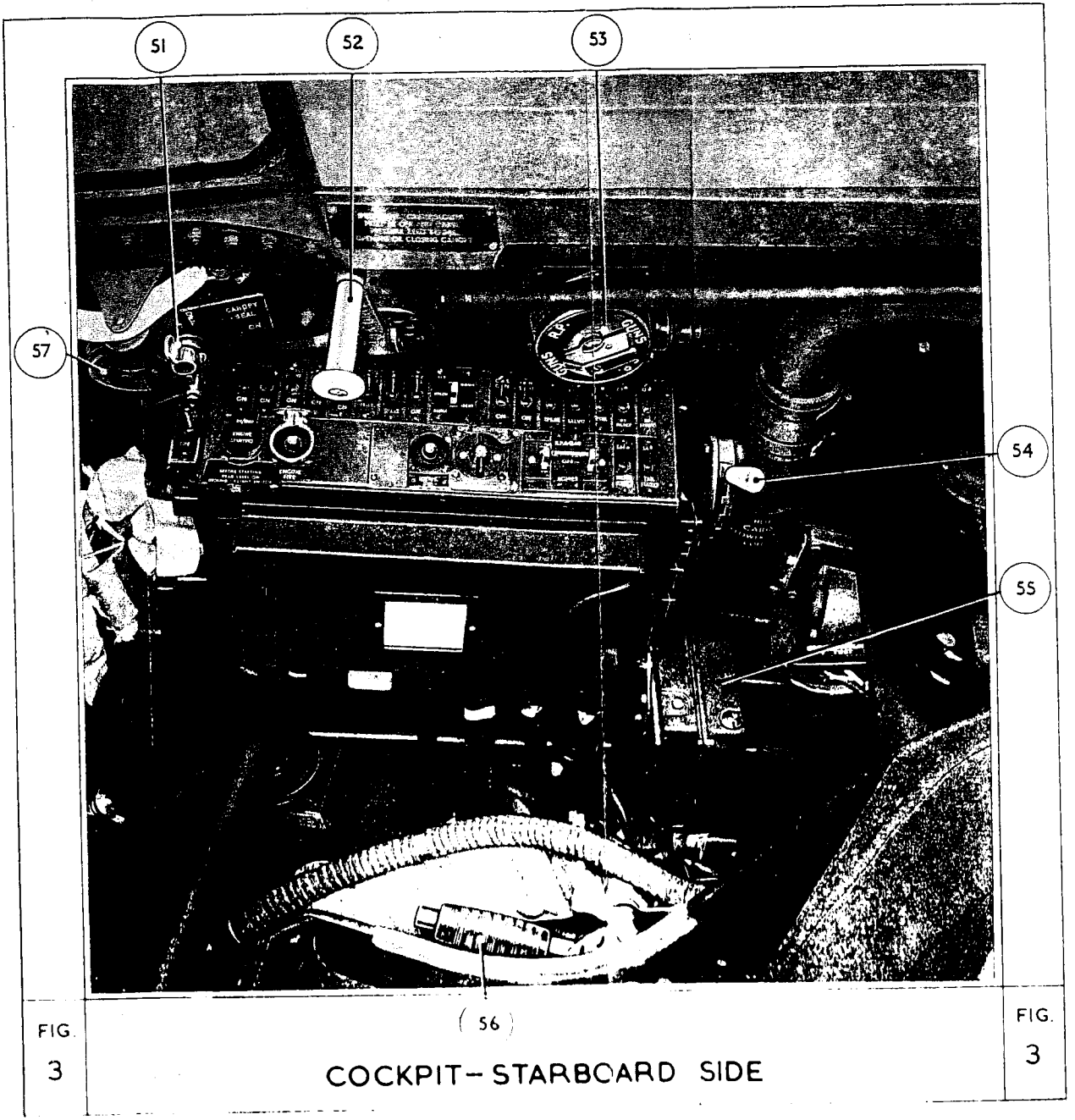

FIG. 3

COCKPIT—STARBOARD SIDE

FIG. 3

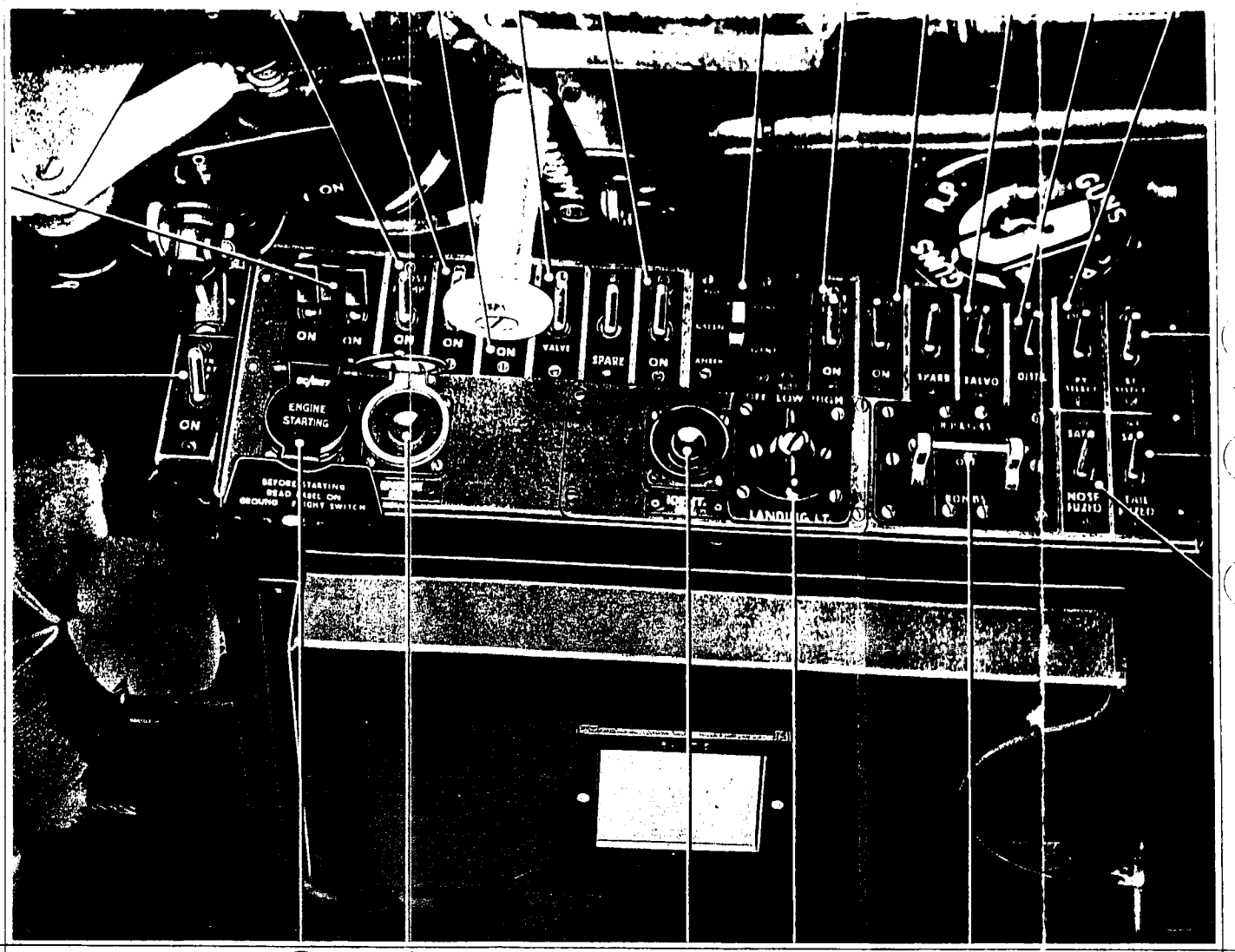

FIG 4

ELECTRICAL PANEL

FIG 4

KEY TO *Fig.* 4

ELECTRICAL PANEL

58. Auxiliary starting switch.
59. Engine starter and master switches.
60. Fuel booster pump switch.
61. Pressure-head heater switch.
62. R.I. compass switch (if fitted).
63. Switch marked FUEL PUMP EMERG., SW. ON FOR TAKE-OFF (not in use).
64. Navigation lights switch.
65. Identification lights selector switch.
66. Cine-camera master switch.
67. Gyro gun-sight master switch.
68. R.P. pairs—salvo switch.
69. Bomb distributor—salvo switch.
70. Bomb selector switch. Port.
71. Bomb selector switch. Starboard.
72. Bombs, tail fusing switch.
73. Bombs, nose fusing switch.
74. R.P./Bombs master switch.
75. Landing lamp switch.
76. Identification lights pushbutton.
77. Fire-extinguisher pushbutton.
78. Engine-starter pushbutton.