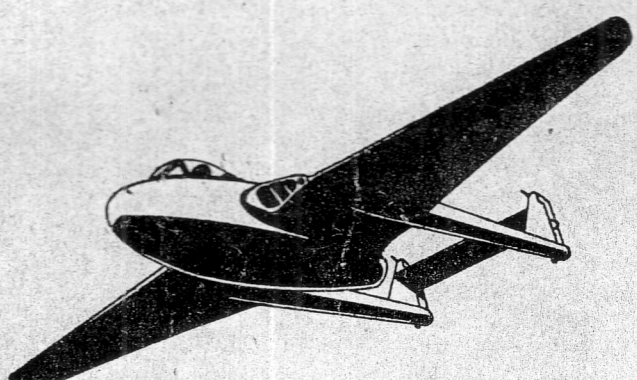
A.P. 4099A—P.N.

PILOT'S NOTES

FOR

VAMPIRE FI

GOBLIN I OR II ENGINE



PREPARED BY DIRECTION OF THE MINISTER OF SUPPLY

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PROMULGATED BY ORDER OF THE AIR COUNCIL

W. B Brown

NOTES TO USERS

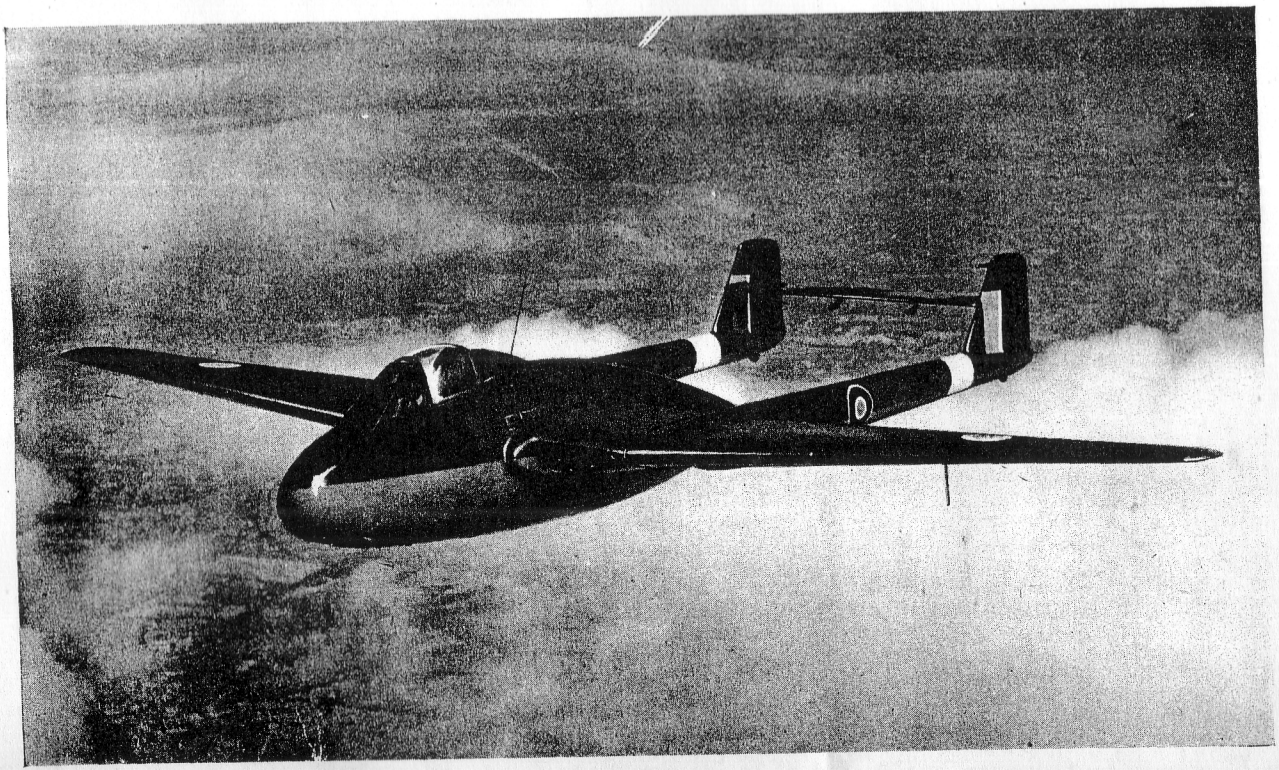
THIS publication is divided into five parts : Descriptive, Handling, Operating Data, Emergencies and Illustrations. Part I gives only a brief description of the controls with which the pilot should be acquainted.

These Notes are complementary to A.P.2095 Pilot's Notes General and assume a thorough knowledge of its contents. All pilots should be in possession of a copy of A.P.2095 (see A.M.O. A93/43).

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

Additional copies may be obtained by the Station Publications Officer by application on Form 294A, in duplicate, to Command headquarters for onward transmission to A.P.F.S., 81, Fulham Road, S.W.3 (see A.M.O. A1114/44). The number of this publication must be quoted in full—A.P.4099A—P.N.

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



VAMPIRE FI

VAMPIRE FI

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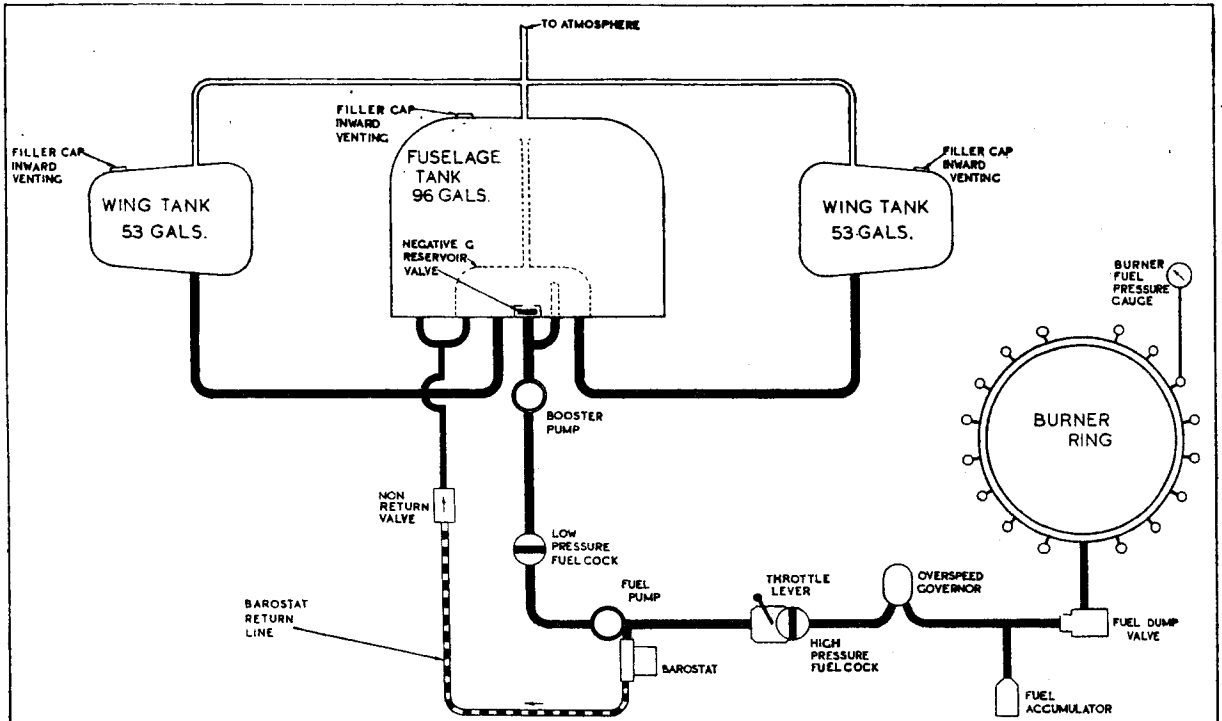


SIMPLIFIED FUEL SYSTEM DIAGRAM

PART I

DESCRIPTIVE

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

INTRODUCTION

The Vampire F. Mk. I is a jet-propelled, single-seat, twin-boom fighter armed with four 20 mm. guns. On early aircraft the power plant is a Goblin Mk. I straight-flow-combustion gas turbine engine. On later aircraft this is replaced by a Goblin Mk. II engine of higher power.

FUEL AND OIL SYSTEMS

1. **Fuel tanks.**

(i) Three permanent self-sealing tanks are fitted, one in the centre fuselage and one in each wing. The tank capacities are as follows :—

Centre fuselage tank	... 96 gallons
Wing tanks (53 gallons each) ...	... 106 gallons
Total	... 202 gallons

(ii) The fuel from all three tanks passes to a collector box incorporating a negative "*g*" valve which affords a fuel supply for approximately 20 seconds inverted flight. The tanks, which are not pressurised, are vented to atmosphere. A satisfactory delivery pressure at altitude is ensured in later aircraft by a booster pump fitted in the main delivery line from the collector box.

(iii) Fuel passes from the collector box, 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, so controls this pressure by returning surplus fuel to the collector box that, as height is gained, the engine r.p.m. remain substantially constant at the selected throttle lever setting.

From the engine-driven fuel pump, fuel passes under pressure to the throttle (fuel control valve) and a high pressure cock. Modification action is being taken to fit a *minimum* pressure valve in parallel with the throttle, to ensure that at altitude, regardless of the throttle setting, sufficient pressure will be maintained at the burner ring to prevent flame extinction. *Maximum* pressure at the burner ring is controlled by an overspeed governor. From the overspeed governor, fuel passes to the trip valve, and the line is tapped to supply a fuel 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 is fitted to drain any fuel present in the system before pressure has been built up when starting the engine, and after it has fallen when shutting down the engine in order to prevent free fuel draining into the combustion chambers.

2. **Fuel gauges**

(i) Contents gauges : Three fuel contents gauges (33) are mounted below the lower instrument panel. The left-hand gauge shows the contents of the port wing tank, the centre gauge shows the contents of the centre fuselage tank, and the right-hand gauge shows the contents of the starboard wing tank. The gauges will indicate the contents of their respective tanks when the MASTER SWITCH (1) is at FLIGHT.

(ii) Burner Fuel Pressure Gauge : A burner pressure gauge (16), which is calibrated in hundreds of pounds and records the fuel pressure at the burner ring, is fitted on the left-hand side of the instrument panel.

3. **Fuel booster pump**

(i) The booster pump fitted in later aircraft is controlled by an ON-OFF switch (43) on the electrical panel. It is used to maintain delivery pressure from the fuel tanks at heights above 20,000 ft., but it may safely be left ON at all times in flight.

(ii) Early aircraft may not have a booster pump or a minimum pressure valve and if this is the case they must not be flown above 20,000 ft. owing to the danger of engine failure through fuel starvation. (See para. 33, Note (*b*)).

4. **Fuel cocks**

In early aircraft the low pressure and the high pressure cocks are both controlled by one lever (9) which is mounted under the engine control box on the left-hand cockpit wall. It has two positions, marked FUEL OFF (down and back) and FUEL ON (forward and up). In later aircraft, this lever operates the low pressure fuel cock only and a second lever, mounted outboard of the throttle lever (6) (and which in early aircraft operates the CANOPY SEAL) controls the high pressure cock.

5. **Oil system**

(i) There is no oil tank, but the power unit has a sump of about 1½ gallons capacity, for lubrication of the engine-driven accessories and of the impeller bearings.

(ii) The oil pressure gauge (34) is fitted on the left-hand side of the instrument panel. It records the main oil pump pressure, which should normally be 40-45 lb./sq. inch.

MAIN SERVICES

Part I Para. 6 (i)

6. **Pneumatic System**

An engine-driven compressor charges a bottle for operation of brakes. The triple pressure gauge (30), on right-hand side of the strument panel, shows the available pneumatic pressure. On ea aircraft this pressure, after having been through the reducing val is 200 lb./sq. in. On later aircraft the actual bottle pressure is sho and registers 450 lb./sq. in. The brake pressure when the bra are operated should be 90 lb./sq. in. on early aircraft and 120 lb., in. on later aircraft.

(ii) An engine-driven vacuum pump operates the instrument flying panel. On some aircraft a suction gauge, marked SUCT. INS. HG. is fitted on the right-hand side of the instrument panel and should normally record 4-4½ ins. Hg.

(iii) A rubber cabin seal is inflated by pressure (from the pressure side of the vacuum pump) which is controlled by a lever marked ON—CANOPY SEAL—OFF. On early aircraft the lever (5) is on the engine control box, outboard of the throttle lever. On later aircraft this

lever becomes the high pressure fuel cock, and the CANOPY SEAL lever is mounted on the right-hand wall of the cockpit.

(iv) On later aircraft the cockpit can be pressurised by a lever mounted forward of the CANOPY SEAL lever. This lever should be moved DOWN for pressurising and UP when pressuring is not required.

7. **Electrical system**

(i) An engine-driven 24-volt generator charges two 12-volt batteries connected in series. These in turn supply the whole of the electrical system except the automatic engine starting system.

(ii) A generator warning light (31), and (on some aircraft) a voltmeter, are mounted on the top right-hand side of the instrument panel. The warning light indicates when the generator is not charging the batteries : it is wired directly to the batteries and will, therefore, be on continuously, irrespective of the position of the MASTER SWITCH, whilst the engine is not running.

(iii) A MASTER SWITCH (1) with GROUND and FLIGHT positions, is fitted on the left-hand cockpit wall. 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 the automatic engine starting system.

(*a*) *When the MASTER SWITCH is set to GROUND :* the electrical services are isolated from the generator and aircraft batteries ; the system (except the automatic starter) can be connected to a ground battery if this is plugged in to the port socket.

(*b*) *When the MASTER SWITCH is set to FLIGHT :* all the electrical services, except the automatic engine starting system, are connected to the aircraft batteries; the automatic engine starting system can be operated if a 200 ampere-hour, 24-volt ground starter battery is plugged into the starboard socket but only if the MASTER SWITCH is at FLIGHT.

8. **Hydraulic system**

(i) Hydraulic pressure, supplied by an engine-driven pump is stored in a pressure accumulator, from which it operates the

Undercarriage,
Flaps,
Dive Brakes

when the appropriate selector lever is placed in the required position.

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

(iii) A handpump is provided on the left of the pilot's seat for use when accumulator pressure is not available: with the appropriate selector lever in the required position, operating the handpump will transmit hydraulic fluid direct from a reserve supply in the reservoir to the jacks (without going through the accumulator) under sufficient pressure to operate the desired service (except the dive brakes) at a reduced rate.

AIRCRAFT CONTROLS

9. **Undercarriage**

(i) The undercarriage selector lever (2) is on the rear face of the engine control box, and has two positions only, UP and DOWN. As long as the wheels are on the ground it is locked in the DOWN position by a solenoid. The solenoid can be over-ridden to permit UP to be selected on the ground, in case of emergency, by a switch marked U/C EMCY. RETRACTION, fitted at the top left-hand side of the instrument panel.

(ii) The undercarriage position indicator (12) is on the bottom left-hand side of the instrument panel. The warning lights have dimmer screens for night flying, which should be open by daylight or indications will be too weak to be noticed. Indications are:

Wheels locked UP	No lights
Wheels between UP and DOWN	Three red lights
Wheels locked DOWN ...	Three green lights.

There is no warning horn but an additional red light (20), fitted above the R.P.M. indicator, comes on if the wheels are not locked down and the throttle is less than a quarter open.

(iii) If engine-driven pump pressure is not available and the residual accumulator pressure is insufficient, the undercarriage can be raised and lowered by the handpump with the selector lever in the appropriate position.

10. **Flaps control**

(i) Operation of the wing flaps is controlled by the selector lever (3) marked FLAPS next to the undercarriage selector lever. It has three positions : UP—NEUTRAL—DOWN. Any angle up to 80° can be obtained by returning the selector lever to neutral when the desired angle has been reached. The selector lever will not return automatically to neutral on completion of an operation. It should be left in the up position when the flaps are up.

(ii) A flaps position indicator (14) is fitted next to the undercarriage position indicator.

(iii) If engine-driven pump pressure is not available, and the residual accumulator pressure is insufficient, the flaps can be operated by the handpump, with the selector lever in the appropriate position.

11. **Dive brakes control**

The red-topped lever (4) fitted on the rear face of the control box has two positions only—ON and OFF, the dive brakes cannot be operated by the handpump.

12. **Flying controls**

(i) The control column is of the spade-grip pattern and incorporates the brake lever, the gun firing pushbutton, the cine-camera control and a spring-loaded PRESS-TO-SPEAK switch.

(ii) The rudder pedals can be adjusted for reach in flight.

13. **Flying controls locking gear**

The flying controls locking gear, for which there is no stowage in early aircraft, consists of a V-shaped fitting which joins a peg in the floor, near the control column, to the port rudder pedal, and of a Y-shaped tubular fitting which joins the control column spade-grip to the coaming above the instrument panel. On later aircraft a stowage is fitted on the left-hand side of the pilot's seat.

14. **Elevator trimming tab control**

The elevator trimming tab control wheel (8) is on the engine control box : the indicator is on the top left-hand side of the instrument panel.

15. **Wheel brakes**

The brake control lever and parking catch are on the control column. Differential control of the brakes is afforded by a relay valve connected to the rudder pedals.

ENGINE CONTROLS

16. **Throttle control**

(i) A conventional throttle lever (6), marked SHUT—THROTTLE—OPEN, fitted in the engine control box, is the only engine control and is used to regulate power in the normal way. The lever must be operated very slowly and at a uniform rate. The friction control is on the engine control box above the elevator trimming tab control wheel.

(ii) A REAR BEARING TEMP. GAUGE (13), a JET PIPE TEMP. GAUGE (15) and an R.P.M. indicator (17) are mounted on the lower left-hand side of the instrument panel.

17. **Engine starting controls**

(i) An electrical starter motor is fitted and is controlled by an automatic system which is operated by the ENGINE STARTING pushbutton (48), and interlinked MASTER and STARTER switches (37-36) on the electrical panel on the right-hand cockpit wall. This pushbutton, which should be pressed for about two seconds and then released, sets in motion the timing system which automatically controls and operates the starting sequences : it

provides first a turning period sufficient for attainment of the correct r.p.m. before combustion commences, and then a further period to allow r.p.m. to build up sufficiently to ensure satisfactory running before the starter motor is cut out. If the engine fails to start or to continue running after one sequence the defect must be found and remedied before a second attempt is made.

NOTE—(*a*) The engine should not be re-started for four minutes after it has been shut down.

(*b*) In early aircraft it is not possible to re-start the engine in flight. In later aircraft it will be possible to do so by means of a booster-coil switch on the left-hand cockpit wall (this must not be confused with the fuel booster pump switch on the electrical panel).

18. **Stopping the engine**

Cut-out controls are not fitted and the engine is stopped by closing the throttle fully and then turning off the fuel.

NOTE.—On aircraft which have two fuel cock control levers, only the high pressure cock should be turned off.

OPERATIONAL CONTROLS

19. **Guns**

(i) The selective firing pushbutton, on the control column spade grip, is fitted with a spring-loaded safety flap. When the flap is at SAFE, the cine-camera can be operated by pressing the knurled portion of the gun-firing switch. When it is set to FIRE the push-button will fire the guns and operate the cine-camera simultaneously.

(ii) The Gyro gun-sight master switch (44) is on the electrical panel, the combined dimmer and selector switch (24) is on the top right-hand side of the instrument panel, and the ranging control is incorporated in the top of the throttle lever.

(iii) There is a cine-camera footage indicator on the lower right-hand side of the instrument panel.

20. **Signalling equipment**

(i) The type 90R and 89R controller units are fitted on the lower right-hand side of the instrument panel, whilst the TR 1464 controller (35) is on the lower left-hand side of the instrument panel, next to the G switches.

(ii) The detonator for the R 3121 (42) is on the electrical panel.

(iii) The identification lights are controlled by an ON—OFF switch, and operated by a pushbutton (45) on the electrical panel.

COCKPIT EQUIPMENT

21. **Sliding hood**

(i) The sliding hood is opened and closed by the crank handle mounted on the right-hand cockpit wall. A spring loaded plunger, which is located in the crank-handle, engages in one of ten positions on a base plate. This permits the hood to be locked in any desired position.

(ii) When closing the hood, the crank handle should be rotated with sufficient force to ensure that the spring-loaded plunger engages in the next hole after the one in which it would engage if the extra force was not used.

(iii) The hood can be jettisoned in flight by first pulling smartly on the rubber knob fitted on the top centre of the windscreen (which releases two rail retaining catches) and then operating the yellow CANOPY JETTISON handle forward of the normal crank handles.

NOTE.—(*a*) On later and pressurised cabin aircraft the rubber knob is not fitted and it is only necessary to operate the canopy jettison handle.

(*b*) The canopy rail catches should be tested for freedom of movement by the pilot by operating the spring-loaded levers at the end of the rails with the hand, they must then be returned into the normal closed position. This applies to the first fifty aircraft only on which this type of hood is fitted.

(iv) A pushbutton on the outside of the fuselage, marked PRESS TO SLIDE CANOPY, is pressed to permit the hood to be opened from the outside.

22. **Cockpit heating and ventilation**

(i) On early aircraft there is no cockpit heating, but a pneumatically-operated rubber cabin seal is provided to exclude draughts : it is inflated when the CANOPY SEAL lever is moved to the ON position. The cabin seal should only be inflated when the sliding hood is closed, and must be deflated before the hood is opened. In early aircraft the lever is on the engine control box, outboard of the throttle lever : in later aircraft, it is on the right-hand wall of the cockpit, and the lever on the engine control box becomes the high pressure fuel cock.

(ii) Cockpit heating is provided in later aircraft, fitted with pressurised cabins, and is controlled by a lever marked HOT—CABIN BLOWER AIR—COLD, mounted on the right-hand cockpit wall, to the rear of the electrical panel.

(iii) An adjustable cold air ventilator is fitted on the left-hand cockpit wall, beneath the coaming.

23. **Cabin pressurising**

(i) When a pressurised cabin is fitted, the cabin blower is engine-driven and supplies air to the cabin through the cabin air regulator. The cabin pressure is automatically controlled by a Westland valve which starts pressurising the cabin at about 15,000 feet when the lever is DOWN, see para. 6 (iv), and progressively increases the differential cabin pressure to a maximum of $2\frac{3}{4}$ lb./sq. in. at 35,000 feet.

(ii) The cabin altimeter on the right-hand side of the instrument panel will show the altitude corresponding to the cabin pressure, and the pilot should regulate his oxygen supply to correspond with this altitude. A cabin pressure gauge and warning light are also provided. The warning light glows when the cabin pressure is $\frac{1}{2}$ lb./sq. in. below the standard ; this light may flicker on and off during the climb.

24. **Seat adjustment**

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

25. **Oxygen**

A Mark XIA oxygen regulator (29) high pressure control and indicator are mounted together on the right-hand side of the instrument panel.

26. **Windscreen de-icing**

A handpump with a regulator is mounted on the bottom right-hand side of the instrument panel.

PART II

HANDLING

NOTE.—All handling speeds quoted apply when the pressure head is positioned on the leading edge of the port fin.

27. **Management of the fuel system**

All three permanent tanks feed the engine when the cock lever below the throttle box is pushed forward to the FUEL ON position. In aircraft with two fuel cock levers, the second lever, outboard of the throttle lever, must also be in the ON position.

28. **Preliminaries**

On entering the cockpit check :

(i) MASTER SWITCH ... ... FLIGHT
All individual electrical services switches OFF
(ii) Undercarriage selector lever ... ... DOWN
Undercarriage position indicator lights ... Green
(iii) DIVE BRAKES control lever ... ... OFF
(iv) CANOPY SEAL control lever ... ... OFF
Pressurising lever ... ... OFF
(v) the contents of the fuel tanks.
(vi) the flying and trimming tab controls for full and free movement, and the rudder pedals for equal adjustment.
(vii) the operation of the hydraulic handpump by lowering and raising the flaps ; return the selector lever to neutral.

29. **Starting the engine** (see para. 17)

NOTE.—(*a*) Any attempt to start with the MASTER SWITCH at GROUND will damage the starter equipment : this will be accentuated if, after commencing the starting sequence, the MASTER SWITCH is then changed to FLIGHT.

(*b*) Before starting the engine, check that the air intake guards are in position, that the aircraft is facing into wind and that nothing behind it will be damaged by the "wake" of the jet, the danger length of which extends for more than 100 yards.

(i) Have a 200 ampere-hour, 24 volt ground starter battery plugged into the starboard socket.

(ii) Ensure that the throttle lever is fully closed.

(iii) Set the fuel cock lever(s) to FUEL ON.

(iv) Switch ON the interlinked STARTER MASTER switches and press the engine starting pushbutton releasing it after two seconds.

(v) The engine should start and r.p.m. should increase gradually to the idling setting (2,800-3,200) without further attention.

(vi) When the engine is running steadily at 3,000 ± 200 r.p.m. switch OFF the interlinked STARTER and MASTER switches.

(vii) Switch ON the booster pump (if fitted).

(viii) Before taxying, check all temperatures and pressures and the operation of the engine-driven hydraulic pump by opening and closing the dive brakes. Ensure that the generator is charging the accumulators by noting that the power failing warning light is out, then have the air intake guards removed.

(ix) Switch ON the R.I. compass.

NOTE.—Do not run up the engine. This is unnecessary and wastes fuel.

30. **Taxying**

(i) The nose wheel can swivel freely through 360° and it is easy to make turns of such short radius that the inside main wheel remains stationary.

This practice must always be avoided since it causes undesirable stresses on the tyres and oleo legs.

(ii) The throttle must not be opened rapidly or excessive jet pipe temperatures will result.

Part II
Para. 31

Check list before take-off

T—Trim Elevators ...	... At typical Service load (full ammunition, full internal fuel)
	Goblin I 8,616 lb. Neutral / Goblin II 8,700 lb. Neutral
F—Fuel	... Cock lever(s) FUEL ON Booster pump ON (if fitted)
F—Flaps	... UP (30° down for shortest run)
Dive brakes control lever	... OFF
Sliding hood ...	... Closed and securely locked (see para. 21(ii))
Pneumatic pressure	... Early aircraft 200 lb./sq. in. Later aircraft 450 lb./sq. in.
Brake pressure ...	... Early aircraft 90 lb./sq. in. Later aircraft 120 lb./sq. in. (See para. 6(i))

(See para. 6(i).)

32. Take-off

(i) Align the aircraft carefully on the runway, making certain that the nose wheel is straight.

(ii) Open the throttle slowly to full take-off r.p.m. against the brakes ; check all engine instruments and, if the temperatures and pressures are satisfactory, release the brakes.

(iii) Keep straight initially by gentle use of the brakes, then, as speed is gained, by coarse use of the rudders.

(iv) As soon as the aircraft reaches a speed of 70—80 m.p.h. (60—70 knots) I.A.S. lift the nose wheel just clear of the ground, then at 95—100 m.p.h. (82—87 knots) I.A.S. ease the aircraft off the ground.

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

NOTE.—If the solenoid lock sticks and prevents the selector lever from being raised it can be overridden by operating the U/C EMCY. RETRACTION switch on the top left-hand side of the instrument panel.

(vi) Raise the flaps (if used) as soon as the undercarriage is fully up.

(vii) Set the CANOPY SEAL control lever to ON.

33. **Climbing**

The recommended speeds, for maximum rate of climb in m.p.h. (knots) I.A.S. are :

	GOBLIN I	GOBLIN II
From sea level to 5,000 ft. ...	250 (220)	260 (226)

reducing speed by 2 m.p.h. (knots) I.A.S. every 1,000 ft. thereafter.

NOTE.—(*a*) The temptation to climb at a speed comparable to that recommended for any contemporary propeller-driven single-seat fighter must be resisted since the efficiency of the jet engine is poor at low airspeeds.

(*b*) Providing the following modifications have been incorporated the aircraft may be flown up to a height of 35,000 feet ; otherwise, it is restricted to 20,000 feet.

(i) For aircraft with Goblin I Engine and no pressure cabin.

Vampire Mod. 9.
,, ,, PP9 (or PP3, Goblin 129, P21 and Goblin 187).

Goblin Mod. 50.
,, ,, 94.
,, ,, 136.

(ii) For aircraft with the Goblin II engine and no pressure cabin :

Vampire Mod. 9.
,, ,, PP16 (or PP3, Goblin 129, PP21 and Goblin 187).

Goblin Mod. 94.
,, ,, 136.

(iii) For aircraft with Goblin II engine and pressure cabin :

Vampire Mod. 9.
,, ,, 258.
,, ,, PP16 (or PP3, Goblin 129, PP21 and Goblin 187).

Goblin Mod. 94.
,, ,, 136.

34. General flying

(i) *Stability*

When a 13 lb. inertia weight is fitted in the elevator control circuit, longitudinal stability is reasonably satisfactory at low and moderate altitudes.

NOTE.—The carriage of a full ammunition load improves stability and does not entail an appreciable loss of performance.

Although stable directionally, the aircraft is prone to "snaking" in bumpy conditions, especially at high speeds.

(ii) *Changes of trim*

Undercarriage down ...	... Slightly nose up
Undercarriage up ...	... Slightly nose down
Flaps down	... Nose down
Flaps up	... Nose up
Dive brakes open (ON) ...	... Slightly nose up
Dive brakes closed (OFF)	... Slightly nose down

(iii) *Controls*

Both the elevator and the elevator trimming tab are light and powerful and must be used with care.

(iv) *Throttle manipulation*

The throttle should normally be operated very slowly to avoid high temperatures and surging. In emergency, however, at low altitudes, as in the case of a baulked landing the throttle may be opened rapidly.

(v) *Flying at reduced airspeed in conditions of poor visibility*

Reduce speed to below 170 m.p.h. (148 knots) I.A.S. using the dive brakes as required, then lower the flaps 30° and fly at 130 m.p.h. (114 knots) I.A.S.

35. **Stalling**

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

	At typical service load (Full ammunition, full internal fuel)	
	Goblin I 8,616 lb.	Goblin II 8,700 lb.
Undercarriage and flaps up	95 (83)	102 (88)
Undercarriage and flaps down	78-80 (68-70)	85 (72)

(ii) With the undercarriage and flaps up, warning of the approach of a stall is given by faint tail buffeting, the onset of which can be felt at a speed some 20 m.p.h. (17 knots) I.A.S. before the stall itself. At the stall the tail buffeting is more pronounced, the nose drops gently, the A.S.I. needle may fluctuate widely and some aileron snatching may be felt. If the control column is held back, the snatching of the ailerons is more marked and either wing will drop.

(iii) With the undercarriage and flaps down, warning of the approach of a stall is again given by faint tail buffeting. Snatching of the ailerons is pronounced and either wing drops sharply. The wing drop can be checked by coarse use of the rudders and ailerons.

(iv) *High speed stall*

Ample warning of the approach of a stall in a steep turn is given by elevator buffeting. When this warning is observed the acceleration should be reduced since further backward movement of the control column can cause the aircraft to " flick " on to its back.

NOTE.—Turns steep enough to cause aileron snatching may overstress the ailerons.

36. **Diving**

(i) The aircraft becomes increasingly tail heavy as speed is gained and should, therefore, be trimmed into the dive.

(ii) The dive brakes are effective but promote considerable buffeting.

(iii) The elevator is light and powerful and must be used carefully during the recovery to avoid the imposition of excessive accelerations.

(iv) At speeds very little in excess of the maximum permissible speeds quoted in para. 44 (ii) (which represent a Machmeter reading of 0.75) considerable porpoising is encountered. The mean change of trim during porpoising is nose up : but warning of the onset of porpoising is given by a mild nose-down change of trim, which may be experienced shortly before the limiting speed is reached (i.e. at Mach. Nos. of 0.72—0.75) when the speed should not be allowed to increase further. The limiting speed should never be exceeded intentionally.

37. **Aerobatics**

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

Roll	260 (226)
Loop	380 (330)
Half roll off the top of a loop ...	400 (345)
Climbing roll	400 (345)

(ii) A large amount of height may be lost or gained in manoeuvres in the looping plane and an ample margin must be allowed for recovery.

Part II Para. 38

38. **Check list before landing**

Use the dive brakes to reduce speed to 200 m.p.h. (174 knots) I.A.S., then check :

U—Undercarriage down	Check indicator and warning light
CANOPY SEAL control lever ...	OFF

and, when speed has fallen below 170 m.p.h. (148 knots) I.A.S. check :

F—Flaps	Dive brakes closed (OFF) Flaps 30° down, fully down on the final approach
Pneumatic pressure	Early aircraft 200 lb./sq. in. Later aircraft 450 lb./sq. in.
Brake pressure	Early aircraft 90 lb./sq. in. Later aircraft 120 lb./sq. in. (see para. 6 (i))

39. **Approach and landing**

(i) At a weight of 7,808 lb. (full ammunition, half fuel remaining) the recommended final* approach speeds in m.p.h. (knots) I.A.S. are :

Flaps down	... ...	100 (87)
Flaps up	... ...	120—125 (104—108)

* This is the speed at which the airfield boundary is crossed.

NOTE.—(*a*) Except in the case of a " flapless " landing, the initial straight approach should be made at a speed some 20—25 m.p.h. (18—22 knots) I.A.S. above these figures.

(*b*) If it is necessary to make a " flapless " approach it should be low and fairly flat.

(ii) The response to throttle manipulation is not so prompt as on a propeller-driven aircraft and early corrective action must be taken if there is any tendency to under-shooting ; similarly, when the throttle is closed, deceleration is slow owing to the absence of propeller drag.

(iii) Make a normal tricycle landing, holding the nose-wheel well clear of the ground. Do not apply the brakes until the nose-wheel has settled firmly on the ground.

40. **Mislanding**

The aircraft will climb away easily with the under-carriage and flaps down.

(i) Open the throttle slowly to full take-off r.p.m. (See para. 34 (iv.))

(ii) Raise the undercarriage and climb initially at about 120 m.p.h. (105 knots) I.A.S.

(iii) As soon as the undercarriage is fully up raise the flaps, then increase speed to 180 m.p.h. (156 knots) I.A.S.

41. **Beam approach**

	Preliminary Approach	Inner Marker on Q.D.R.	Outer Marker on Q.D.R.	Outer Marker on Q.D.M.	Inner Marker on Q.D.M.
Indicated height (feet)	Down to 1,000	1,000	1,000	7-800	100
Action ...	—	Lower undercarriage	Lower $\frac{1}{3}$ flap	Lower flaps fully	Throttle back slowly
Resultant ... change of trim	All changes of trim are slight and can be held without retrimming				
I.A.S. ...	170	150	130	115	100
R.P.M. (level flight)	6,000	7,000	7,000	8,000	
R.P.M. (—500 ft./min). ...	5,000	6,000	6,000	7,000	
R.P.M. (overshoot)					10,000
Altimeter error at take-off Altimeter error at touch-down } Negligible				*Overshoot* Open the throttle fully. Raise the undercarriage and climb initially at 110 I.A.S. raising the flaps when the undercarriage is locked up.	

42. **After landing**

(i) Before taxying raise the flaps.

(ii) On reaching dispersal :

Close the throttle fully.

Set the fuel cock lever to FUEL OFF (on aircraft with two levers, only the high pressure cock should be turned off).

Switch the booster pumps OFF (if fitted).

Switch off all the electrical services individually.

Set the MASTER SWITCH to GROUND.

See that the air intake guards are placed in position.

PART III

OPERATING DATA

43. Engine data, Goblin I and II

(i) *Fuel.* Aviation Kerosene, Spec. AV/TURB—stores ref. : 34A/179, plus 1% lubricating oil " X " stores ref. : 34A/32.

(ii) *Oil.* Lubricating oil, turbine engines, to specification RDE/0/59 (Intava 620) (Stores Ref. 34A/187).

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

	R.P.M.		Max. Temperatures °C			
			Jet Pipe		Rear	Oil
	Goblin I	Goblin II	Goblin I	Goblin II	Bearing	
TAKE-OFF (5 min. limit)	10,000	10,200	670	720	130	70*
MAX. CLIMBING (30 min. limit)	9,500	9,700	610	650		
MAX. CONTINUOUS	8,500	8,700	540	550		
COMBAT (5 min. limit)	10,000	10,200	670	720		
IDLING (10 min. limit)	3,000†	3,000†	540	550		

* Minimum for opening up ... ... MINUS 5°C.

† (± 200 r.p.m.)

OIL PRESSURE :

Goblin I	Goblin II	
Normal, at 8,500 r.p.m. ...	8,700 r.p.m.	40/45 lb./sq. in.
Emergency minimum (5 min. limit)		25 lb./sq. in.

44. Flying limitations. (AP. 2095, 3rd Edition, Part I, Chap. I refers).

(i) The aircraft is designed for the duties of a single-seat fighter but, until spinning trials have been completed, intentional spinning is prohibited. If an unintentional spin occurs, normal recovering action should be applied immediately.

(ii) *Maximum speeds*: The maximum permissible speeds are:

Diving:

If Mod. No. 148 *is not incorporated*: 400 m.p.h. (348 knots) I.A.S.

If Mod. No. 148 *is incorporated or when a pressure cabin is fitted*:

Sea level to 5,000 ft. :	525 m.p.h.	(455 knots)	I.A.S.
5,000 ft. to 10,000 ft. :	480 ,,	(416 ,,)	,,
10,000 ft. to 15,000 ft. :	440 ,,	(382 ,,)	,,
15,000 ft. to 20,000 ft. :	400 ,,	(348 ,,)	,,
*20,000 ft. to 25,000 ft. :	350 ,,	(305 ,,)	,,
*25,000 ft. to 30,000 ft. :	320 ,,	(280 ,,)	,,
*30,000 ft. to 35,000 ft. :	290 ,,	(255 ,,)	,,

*See para. 33, Note (*b*).

If a Machmeter is fitted a reading of 0.75 must not be exceeded.

Dive brakes open	Up to the maximum permissible diving speed		
Undercarriage down :	200 ,,	(174 ,,)	I.A.S.
Flaps down :	180 ,,	(156 ,,)	,,

(iii) *Maximum weights*:

For take-off and all forms of flying ... ... 8,700 lb.
For landing ... ... 8,500 lb.

(iv) *Maximum altitude* ... ... (See para. 33, Note (*b*)).

(v) The navigation lights cause considerable compass deviation when they are switched on: they should, therefore, not be used until modification Vampire 163 has eliminated interference.

45. **Position error corrections**

At sea level.

From ...	170	230	280	325	370	415	460	495	m.p.h.
To ...	230	280	325	370	415	460	495	525	I.A.S.
Add ...	4	6	8	10	12	14	16	18	m.p.h. or kts
From ...	170	220	270	320	365	405	435		knots
To ...	220	270	320	365	405	435	455		I.A.S.

46. **Maximum performance**

(i) *Climb* : The speed for maximum rate of climb at full climbing power is :

Goblin I, 250 m.p.h. (220 knots) I.A.S.
Goblin II, 260 „ (226 „) I.A.S.

from sea level to 5,000 ft., and a reduction of 2 m.p.h. (knots) I.A.S. for every 1,000 ft. thereafter, is recommended.

(ii) *Cruise* : The indicated speeds quoted in para. 44 (ii) must not be exceeded in any circumstances nor, to attain them at altitude, should power be increased beyond the maximum continuous r.p.m. quoted in para. 43 (iii).

47. **Economical flying**

For maximum range, cruise at maximum permissible continuous r.p.m. provided that the resultant speed does not exceed 320—360 m.p.h. (278—312 knots) I.A.S. from sea level to 5,000 feet. Reduce this optimum figure by 20 m.p.h. (17 knots) I.A.S. for every subsequent 5,000 feet.

48. **Estimated fuel consumptions**

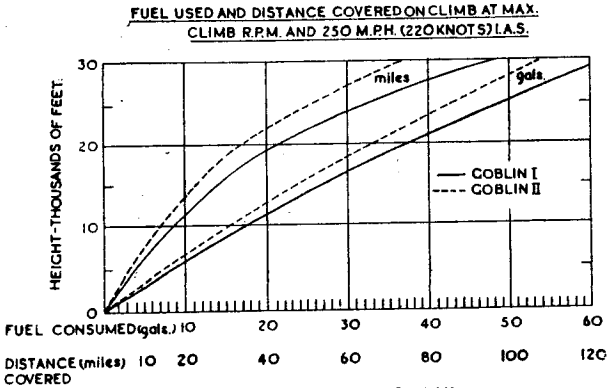
(i) The following table and curves have been estimated from test-bed data, and are subject to confirmation when calculations based on flight performance are available.

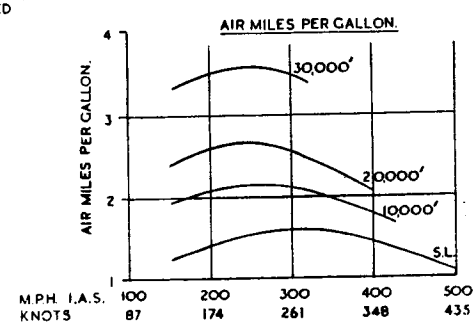
(ii) Consumption, in gallons per hour :

Altitude	R.P.M.							
	Goblin I				Goblin II			
	Take-off and Combat		Max. climb	Max. cont.	Take-off and Combat		Max. climb	Max. cont.
Sea level	460	(2.6)*	360	250	500	(2.6)*	385	275
10,000 ft.	355	(2.0)*	265	180	387	(2.0)*	290	205
20,000 ft.	275	(1.75)*	200	135	300	(1.8)*	220	155
30,000 ft.	210	(1.5)*	150	95	225	(1.5)*	170	105

* Reduction of endurance, in minutes, for every minute of operation.

(iii) The cruising speeds shown below must not be used if, to obtain them, it is necessary to exceed the maximum permissible continuous r.p.m.





PART IV

EMERGENCIES

49. Undercarriage and flaps emergency operation

In the event of failure of the engine driven hydraulic pump the handpump on the left of the seat can be used to operate the undercarriage and flaps through the normal pipelines. (See paragraphs 8, 9 and 10.)

NOTE.—The handpump will not operate the dive brakes.

50. Sliding hood jettisoning

The sliding hood can be jettisoned by first pulling smartly on the rubber knob, fitted on the top centre of the windscreen, and then pulling back the yellow release lever mounted on the right-hand cockpit wall forward of the hood crank handle.

NOTE.—On later, and pressurised cabin aircraft, the rubber knob is not fitted, and it is only necessary to operate the canopy jettisoning handle. In all cases before jettisoning the hood, the seat should be lowered fully and the pilot should keep his head well down.

51. Fire-extinguisher

(i) The engine fire-extinguisher is controlled by a shielded pushbutton on the electrical panel on the right-hand cockpit wall. There is a shielded engine fire warning light just forward of the pushbutton.

(ii) Should fire become apparent in the engine nacelle,

(*a*) the high pressure fuel cock lever should at once be set to FUEL OFF

(*b*) the throttle should be closed fully

(*c*) speed should be reduced as far as practicable by opening the dive brakes and pulling up the nose of the aircraft before the extinguisher is operated.

52. Ditching

(i) Whenever possible the aircraft should be abandoned by parachute rather than ditched, since model tests indicate that, in any but the calmest seas, the ditching qualities will be very poor.

(ii) If ditching is inevitable,

(*a*) the sliding hood should be jettisoned,

(*b*) the undercarriage should be kept retracted, but the flaps should be lowered 40° to reduce the touch down speed as much as possible,

(*c*) the safety harness must be tightly adjusted and the R/T plug must be disconnected,

(*d*) if power is available, it should be used to help make the touch down in a tail down attitude at as low a forward speed as possible,

(*e*) ditching should be along the swell or into wind if the swell is not steep,

(*f*) when contact with the water is made the tailplane will probably break off and the aircraft will tend to bounce.

NOTE.—When modification 173 is incorporated to special order, introducing 100 gallon drop tanks (airship shape), these tanks must be jettisoned prior to ditching.

53. Emergency equipment

A crowbar is stowed in spring clips on the left-hand side of the bulkhead behind the pilot's seat.

PART V

ILLUSTRATIONS

KEY TO *Fig.* 1

COCKPIT—LEFT HAND SIDE

1. Master switch.
2. Undercarriage selector lever.
3. Flaps selector lever.
4. Dive brakes control.
5. Canopy seal lever—early aircraft.
   High pressure fuel cock—later aircraft.
6. Throttle lever.
7. Friction adjuster.
8. Elevator trimming tab control.
9. Fuel cock lever—early aircraft.
   Low pressure fuel cock—later aircraft.

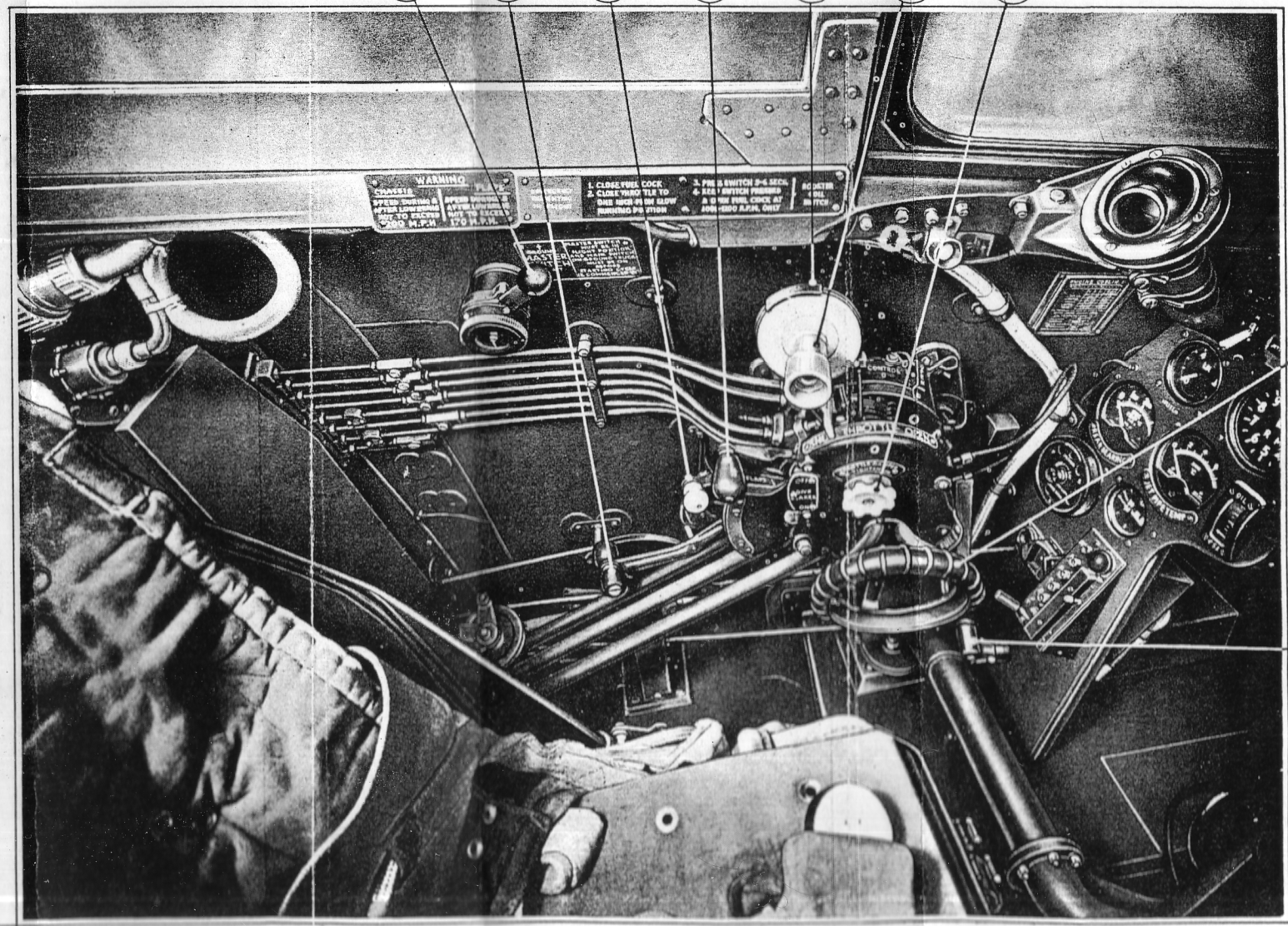


FIG. 1 COCKPIT — LEFT HAND SIDE FIG. 1

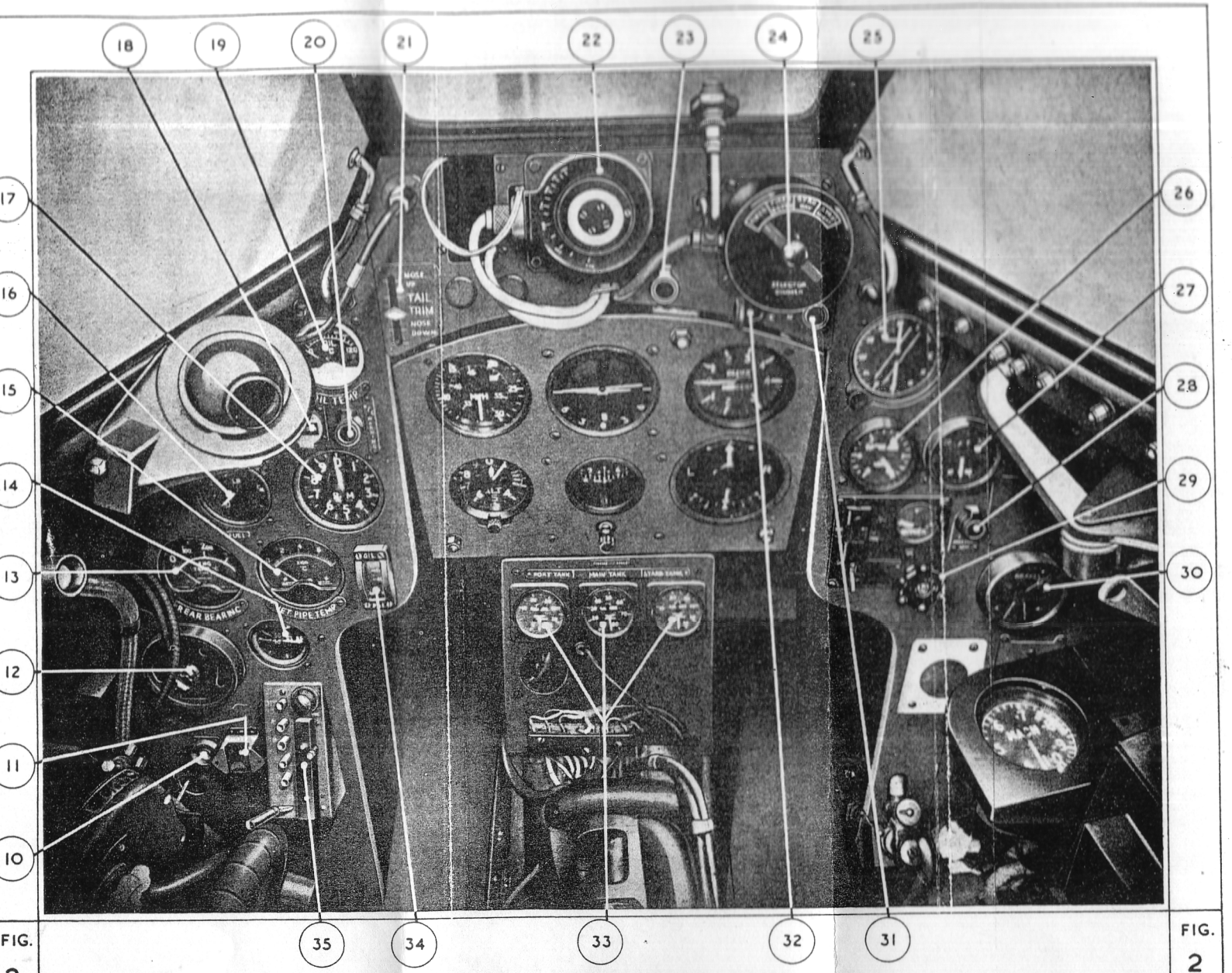


FIG. 2

COCKPIT — INSTRUMENT PANEL

FIG. 2

KEY TO *Fig.* 2

COCKPIT—INSTRUMENT PANEL

10. 'G' switch.
11. Auto manual.
12. Undercarriage position indicator.
13. Rear bearing temp. gauge.
14. Flaps position indicator.
15. Jet pipe temp. gauge.
16. Burner pressure gauge.
17. R.P.M. Indicator.
18. Fuel tanks jettison switch.
19. Oil temp gauge.
20. Undercarriage warning light.
21. Elevator trim indicator.
22. Gyro gunsight.
23. Fuel pressure warning lamp.
24. Gunsight selector dimmer control.
25. R.I. Compass indicator.
26. Cabin air pressure gauge.
27. Cabin altimeter.
28. Cabin air pressure warning lamp.
29. Oxygen regulator.
30. Brakes pressure gauge.
31. Generator warning lamp.
32. Fire warning lamp.
33. Tanks contents gauges.
34. Oil pressure gauge.
35. Controller TR 1464.

KEY TO *Fig.* 3.

COCKPIT—RIGHT HAND SIDE

36. Interlinked starter switch.
37. Interlinked master switch.
38. R.I. Compass switch.
39. Pitot-head switch.
40. Navigation lights switch.
41. Landing lights.
42 Detonator R 3121.
43. Booster pump switch.
44. Gunsight switch.
45. Identification lights push-button.
46. Identification lights.
47. Fire extinguisher button.
48. Starter button.
49. De-icer pump.

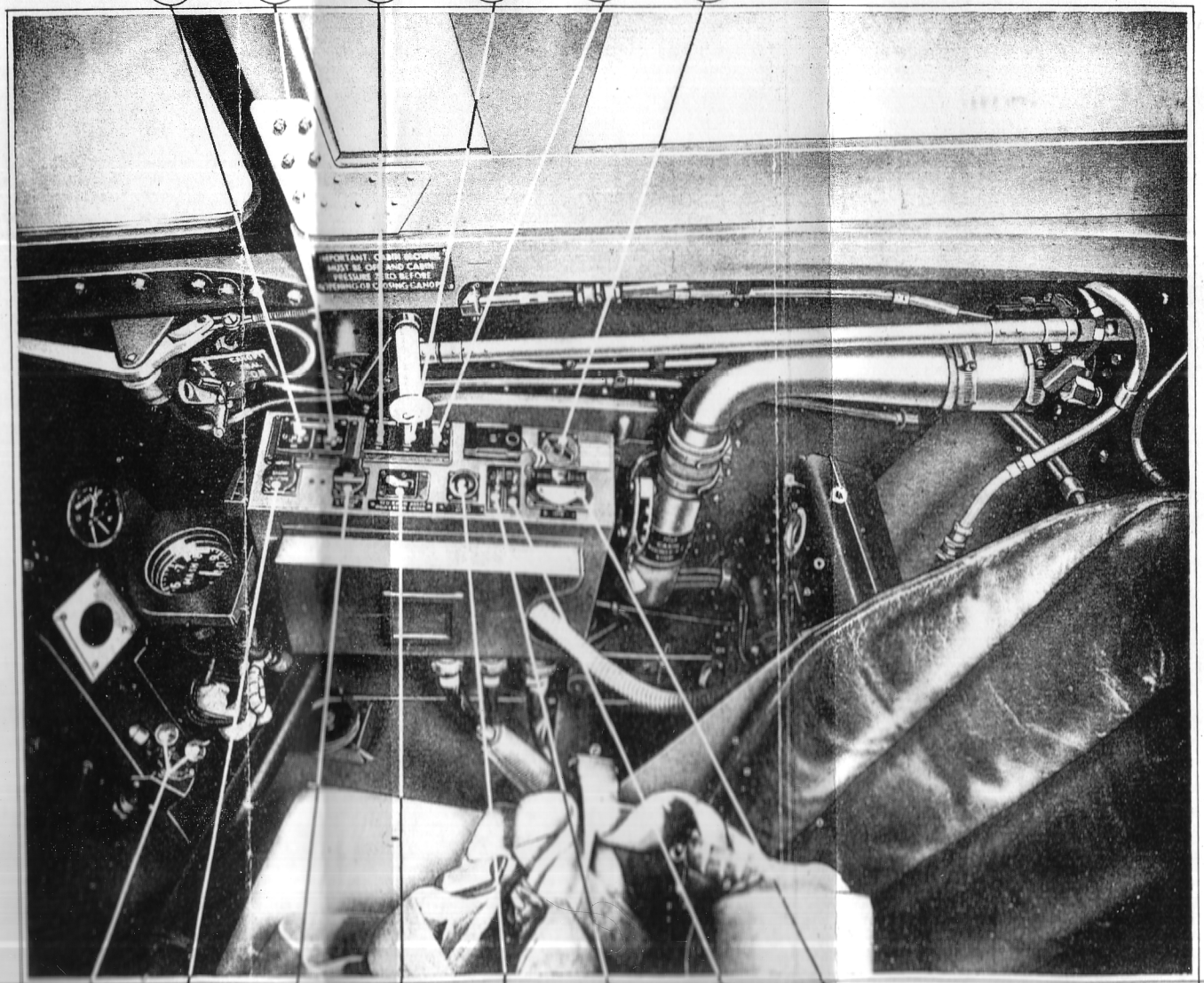


FIG. 3

COCKPIT—RIGHT HAND SIDE

FIG 3

FLIGHT PLANNING CHARTS (REFERENCE FUEL — NORMAL AVTAG Sp. Gr. = 0·77)

CHART 1

CLEAN AIRCRAFT (330 GALL) BEST RANGE SPEED

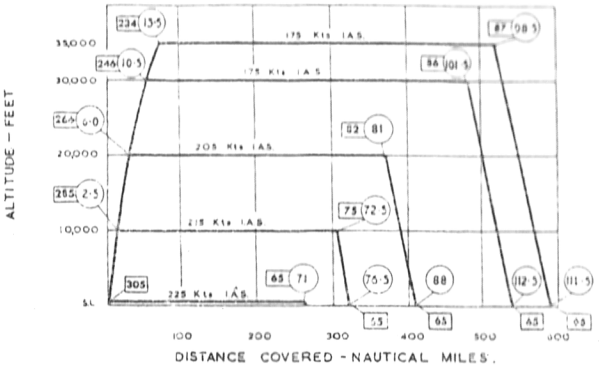


CHART 2

2×500 LB BOMBS (330 GALL) BEST RANGE SPEED.

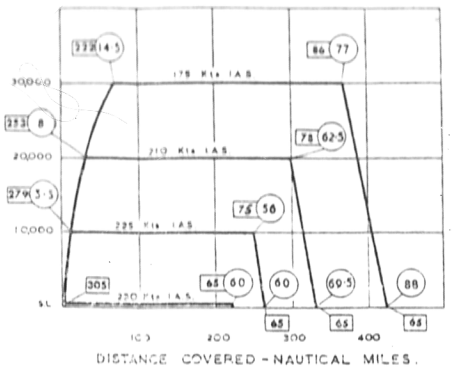
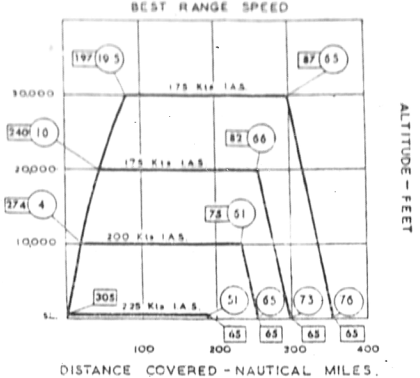


CHART 3

2×500 LB BOMBS AND 8×60 LB RP (330 GALL) BEST RANGE SPEED



THESE CHARTS ARE BASED ON :-

(a) CLIMBING AT 10,200 R.P.M. REDUCING TO 10,000 R.P.M. ABOVE 25,000 FT.

(b) DESCENDING WITH THROTTLE CLOSED AT :-

0·65 M. ABOVE 25,000 FT.

250 Kts. BELOW 25,000 FT.

□ FUEL REMAINING (GALL)

○ TIME FROM TAKE-OFF (MINS)

CHART 4

2×1000 LB BOMBS (330 GALL) BEST RANGE SPEED.

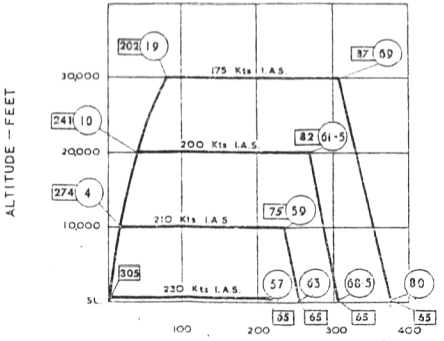


CHART 5

2×100 GALLON DROP TANKS (530 GALL) BEST RANGE SPEED.

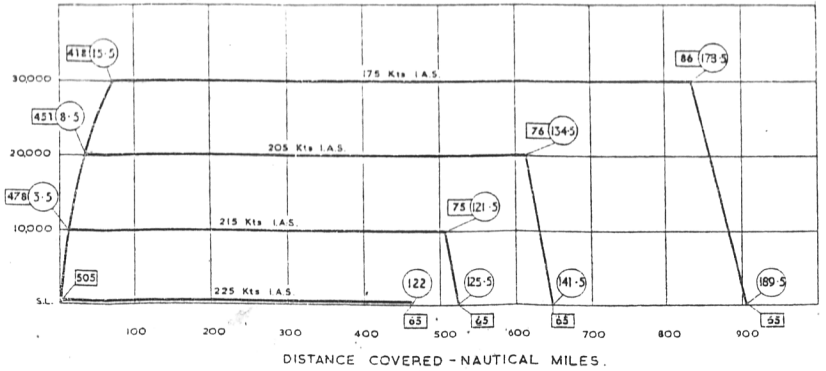
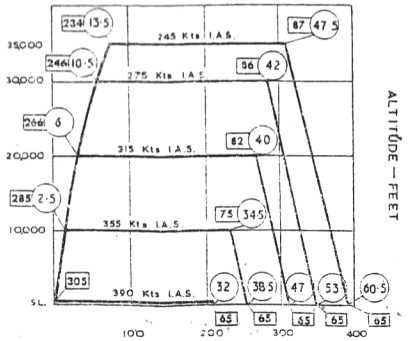


CHART 6

CLEAN AIRCRAFT (330 GALL) CRUISE AT 9,700 R.P.M.



FOR EVERY 0·03 VARIATION IN S.G. FROM 0·77, THE TOTAL RANGE SHOULD BE ALTERED IN ACCORDANCE WITH THE FOLLOWING :-

ALTITUDE FT.	N.MILES.
SEA LEVEL	10
10,000	15
20,000	20
30-35,000	25

ADD IF S.G. IN TANK IS MORE THAN 0·77, SUBTRACT IF S.G. IN TANK IS LESS THAN 0·77.