4th Edition
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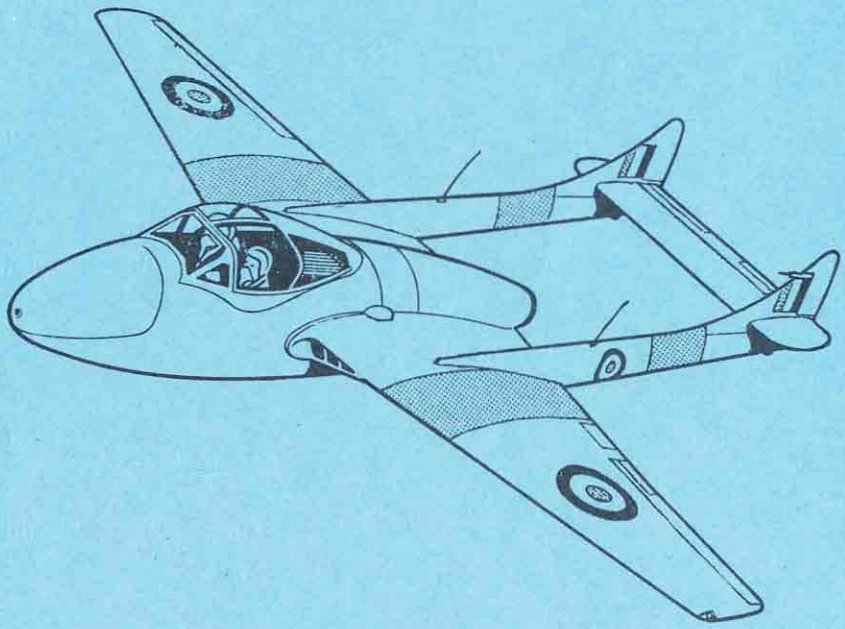
A.P.4099J—P.N.

# PILOT'S NOTES

# VAMPIRE T.11



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## LIST OF ASSOCIATED PUBLICATIONS

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|---|---|
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| Pneumatic equipment, aircraft | 4303C |
| Vampire T 11 general and technical information | 4099J<br>Vol. 1 |

# NOTES TO USERS

These Notes are complementary to A.P. 129 (6th Edition), Flying. It is assumed that all concerned have a thorough knowledge of the chapters of A.P. 129 relevant to the operation of this type of aircraft (see A.M.O. A.293/55).

Additional copies may be obtained by the station publications officer by application on R.A.F. Form 294A in quadruplicate to Command Headquarters for onward transmission to A.P.F.S. (see A.P.113A). The number of this publication must be quoted in full—A.P. 4099J—P.N. (4th Edition).

Comments and suggestions should be forwarded to Officer Commanding, Handling Squadron, R.A.F., Boscombe Down, Wilts.

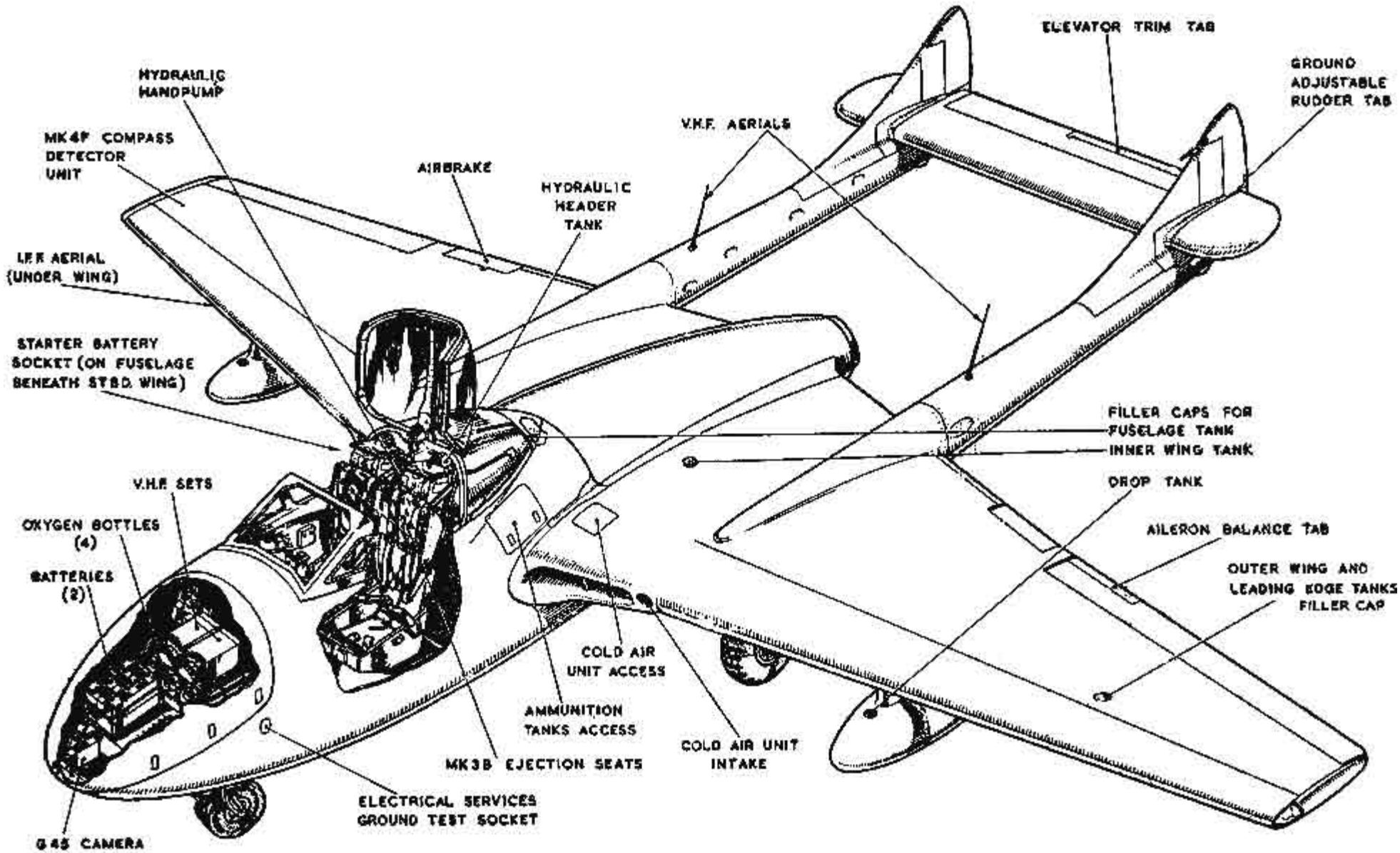
## AMENDMENTS

Amendment lists will be issued as necessary and will be gummed for affixing to the inside front cover of these notes. Each amendment list will, where applicable, be accompanied by gummed slips for sticking in the appropriate places in the text. Each amendment list will give a list of all Special Flying Instructions and/or modifications which are covered thereby.

Incorporation of an amendment list must be certified by inserting date of incorporation and initials below.

| A.L. NO. | INITIALS | DATE | A.L. NO. | INITIALS | DATE |
|---|---|---|---|---|---|
| 1 | [illegible] | 20/2/70 | 4 | [illegible] | 20/2/70 |
| 2 | [illegible] | 20/2/70 | 5 | [illegible] | 20/2/70 |
| 3 | [illegible] | 20/2/70 | 6 | | |

PRINCIPAL DIMENSIONS:- SPAN 38 FT. 0 IN. LENGTH 34 FT. 5 IN. HEIGHT 8 FT. 7 IN.




# VAMPIRE. T 11.

# VAMPIRE T 11

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# PART I

# *DESCRIPTIVE*

NOTE.—Throughout this publication the following conventions apply:—

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

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

(c) Unless otherwise stated, all speeds and Mach numbers quoted are " indicated."

## 1. **Introduction**

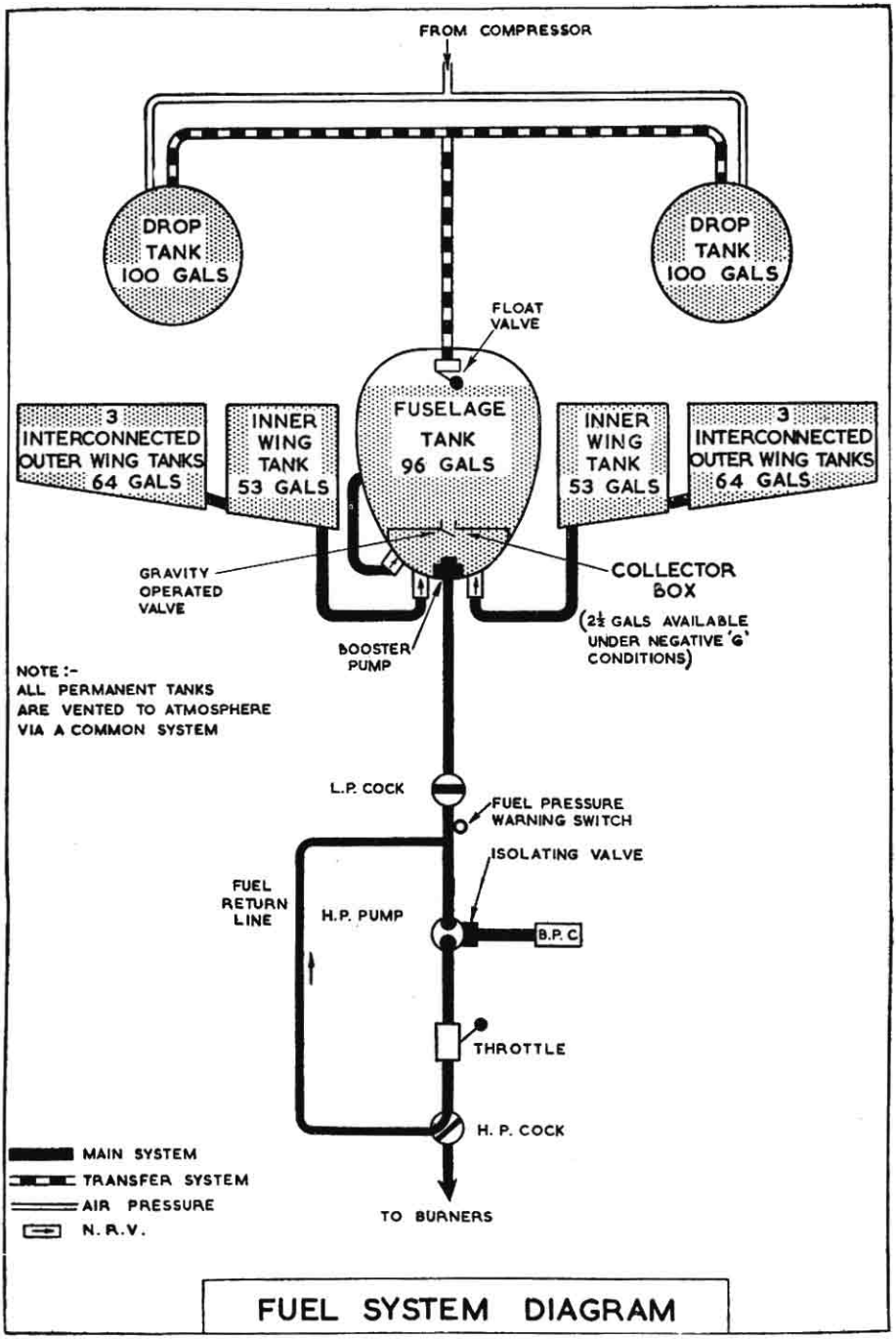
(a) The Vampire T 11 is a side-by-side two-seater dual control aircraft powered by a single Goblin 3 turbo-jet engine developing 3,200 lb. static thrust at sea level. All flying controls are duplicated for the occupant of the starboard seat; the cockpit is pressurised and is equipped with two Mk. 3B pilot-ejection seats.

(b) The armament consists of two or four 20 mm. guns; provision is made for the carriage of R.P. and bombs.

## FUEL SYSTEM

## 2. **Fuel tanks**

(a) Fuel is carried in nine internal tanks, one in the fuselage and four in each wing. The tanks in each wing consist of one inner wing tank and three interconnected outer wing tanks which act as a group. The fuselage tank contains a collector box which should permit approxi-




FUEL SYSTEM DIAGRAM

mately 15 seconds flight under negative G conditions. Wing drop tanks may be carried and may be jettisoned by pulling back the WING TANKS JETTISON lever positioned between the seats.

(b) The total internal fuel carried is 330 gallons made up as follows:—

| | *Gallons* | *lb. AVTAG (7·7 lb./gall.)* |
|---|---|---|
| Fuselage tanks .. .. .. | 96 | 739 |
| Inner wing tanks 2 × 53 gall. .. | 106 | 816 |
| Outer wing groups 2 × 64 gall. .. | 128 | 985 |
| Total (internal) .. | 330 | 2,540 |
| Wing drop tanks 2 × 100 gall. .. | 200 | 1,540 |
| Total (all tanks) .. | 530 | 4,080 |

### 3. Fuel contents gauge

A single electrical fuel contents gauge (18) calibrated in pounds registers the combined fuel contents of all internal tanks when the Ground/Flight switch is at Flight, and is mounted centrally on the instrument panel. When SRIM 2284 is embodied the gauge is moved to the port instrument panel. There is no fuel gauge for the drop tanks; the main gauge will begin to show a drop in fuel level when the drop tanks have emptied.

### 4. Fuel asymmetry gauge

**cancelled AL.2**

Mod. 3598 introduces a fuel asymmetry gauge, having three indicator needles. The two upper needles indicate the port and starboard wing fuel contents and the bottom needle indicates fuel asymmetry. This asymmetry needle moves over a central green sector, for " safe-to-spin " conditions, with red sectors on either side of the green indicating the " unsafe-to-spin " condition. The needle moves in the direction of the heavy wing. When the needle is in the green sector the fuel asymmetry does not exceed 30 gallons (230 lb.) maximum.

5. **Fuel transfer system**

Fuel from the internal wing tanks is fed by gravity to the fuselage tank collector box. Fuel from the drop tanks is transferred to the fuselage tank by air pressure from the engine. The transfer commences when about 120 pounds have been used from the fuselage tank, the rate of transfer being controlled by a float-operated valve near the top of the tank.

6. **Fuel system**

(a) An electrically-driven booster pump, in the fuselage tank collector box, delivers fuel through the L.P. cock and filter to a single engine-driven H.P. pump. The booster pump is controlled by a switch (49) below the turn and slip indicator. A red light below the selector dimmer control (17) comes on when the pump is switched off or when pressure from the pump is below a satisfactory minimum.

(b) From the H.P. pump fuel is delivered through the throttle and H.P. cock to the engine.

7. **L.P. fuel cock**

The low pressure fuel cock is controlled by a lever (7) marked FUEL OFF (down)–FUEL ON (up) AL.1 situated under the engine controls box on the cockpit port wall. On no account should this control be used to stop the engine except in an emergency.

## ENGINE CONTROLS

8. **Goblin Mk. 3 engine**

(a) *General*

The engine is a centrifugal gas turbine developing 3,200 lb. static thrust at sea level. The main engine systems include:—

An electric starting system (see para. 11).
Relighting facilities (see para. 12).
A high-pressured fuel system monitored by a barometric pressure control.
Self-contained oil system.

(b) *Oil system*

Oil is carried in the engine sump, the oil capacity of which is 10 pints. One pressure pump maintains a continuous circulation through a filter to the engine and aircraft accessories and to two metering pumps which supply oil to the front and rear bearings AL.1

9. **Throttle control**

(a) The throttle levers (5) move in quadrants marked SHUT-THROTTLE-OPEN one on each pilot's engine control box.

(b) A jet pipe temperature gauge and an r.p.m. indicator are mounted on the left of the instrument panel.

10. **H.P. fuel cock**

The high pressure fuel cock is controlled by a lever (3) marked OPEN (forward)—SHUT (aft) situated inboard of the port throttle lever. This lever should always be used to stop the engine.

11. **Engine starting system**

(a) The engine is started by an electric motor which rotates the engine to the required light-up and self-sustaining speed. The circuit for the electric current supply is controlled by the interlinked starter and master switches (32) at the lower centre of the instrument panel and the starter circuit-breaker. The starting sequence is controlled entirely by a clockwork time switch.

(b) The time switch is fully wound initially by pressing the starter button for about two seconds. When the button is released, current is supplied to the starter motor. After 4 to 7 seconds, during which time the engine is rotated slowly, the starter motor accelerates the engine to a suitable r.p.m. (700–900) for light-up. At this speed the igniter plugs light up the fuel and the starter motor further assists the engine in acceleration.

(c) After a total period of 30–40 seconds the time switch cuts off the starting circuit and the engine accelerates under its own power to idling r.p.m. 3,000 ± 200.

12. **Engine relighting system**

A pushbutton (4) is incorporated in the end of the H.P. cock lever. It should be pressed to energise the igniter plugs when relighting in flight. It may also be used as an audible check that the H.E. ignition is functioning. The relight system will operate irrespective of the engine starter master switch.

13. **H.P. pump isolating valve**

(a) The output of the H.P. pump is monitored by the B.P.C. through the pump servo system. A solenoid-operated isolating valve is fitted to enable the pump to be isolated from the servo system. When the FUEL PUMP ISOLATING SWITCH (48) adjacent to the booster pump switch is on, the valve isolates the H.P. pump from the servo system and the pump then moves to full stroke and is controlled only by the pump overspeed governor and by the throttle position.

(b) The isolating valve is primarily intended as a means of restoring power in flight if failure of the servo system causes a sudden drop in engine r.p.m. It may also be used as a safeguard against failure of the system during take-off, if desired. It must be switched OFF as soon as a safe height is reached, otherwise overfuelling will occur, resulting in rising j.p.t. and increasing r.p.m. as height is gained.

NOTE.—If failure of the servo system occurs whilst isolated there is a probability of fuel starvation leading to flame-out when the switch is returned to OFF.

14. **Engine fire-extinguisher**

(a) The combined fire-extinguisher pushbutton (29) and engine FIRE warning light is on the right of the upper panel above the flap position indicator. When Mod. 3471 is incorporated a second red light is positioned

alongside the pushbutton. The presence of fire is indicated by either or both warning lights coming on, but more certainly by the latter. The fire-extinguisher cannot be operated unless electrical power is available. When Mod. 3524 is incorporated power is available direct from the aircraft battery. In unmodified aircraft the Ground/Flight switch must be in the Flight position at r.p.m. below generator cut-in speed. Above this cut-in speed the position of the Ground/Flight switch is immaterial.

(b) Fire warning indication is subject to three different modification states:

(i) *Mod.* 3238. Comprising 10 non-resetting flame detectors in the engine bay and 8 resetting detectors around the combustion chambers. If the fire warning light comes on and the throttle is then closed the warning light will remain on if a fire has occurred but will go out if a hot gas leakage is present. If a fire has occurred the warning light will remain on after the fire has been extinguished.

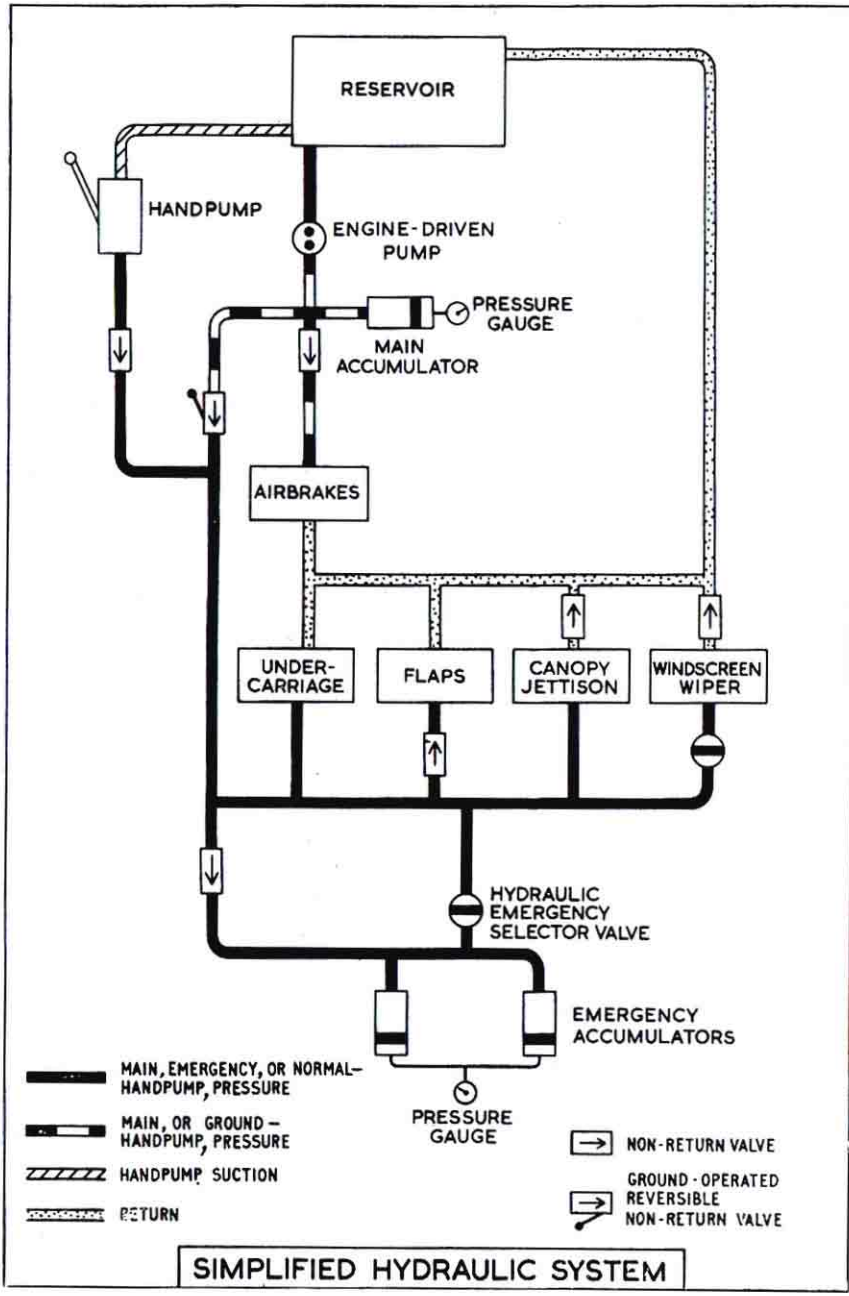
(ii) *Mod.* 3475. This deletes the 8 resetting detectors in the engine bay. If the fire warning light comes on, it will remain on irrespective of whether fire or hot gas leakage is present and irrespective of any subsequent action.

(iii) *Mod.* 3418. This replaces the 10 non-resetting detectors with 10 resetting detectors, set to operate at 300° C. If the fire warning light comes on and the throttle is then closed the warning light will remain on if a fire has occurred but will go out if a hot gas leakage is present. If a fire has occurred the warning light will go out after the fire has been extinguished.

## MAIN SERVICES

### 15. **Pneumatic system**

An engine-driven air compressor charges a bottle to 450 lb./sq. in. maximum for the operation of the wheel




SIMPLIFIED HYDRAULIC SYSTEM

brakes, hood seal and hood raising mechanism. A standard triple pressure gauge (16) is on the left-hand side of the upper panel.

## 16. Hydraulic system

(a) An engine-driven pump supplies pressure in the hydraulic system for the operation of the:—

Undercarriage
Flaps and airbrakes
Hood jettisoning
Windscreen wiper

(b) (i) Pre-mod. 3627 an accumulator is fitted in the system to ensure rapid operation of the services. If the engine-driven pump fails, the accumulator may provide enough reserve of pressure to lower the undercarriage once; in addition sufficient pressure may also remain to operate the flaps. The pilot must be prepared to assist these selections as outlined in para. 24.

(ii) Post-mod. 3627, two additional accumulators are provided for the emergency operation of the undercarriage, flaps and hood jettison systems. The accumulators are isolated from these systems by a selector valve controlled by a yellow-and-black painted EMERGENCY HYDRAULICS lever between the pilots' seats. When the lever is pulled aft in the direction of the arrow the accumulators are in circuit. The airbrakes cannot be operated by the accumulators; the windscreen wiper can be operated, but its use thereby is not recommended.

(c) A handpump, located between the seats at shoulder height, is provided for ground test and for emergency operation of undercarriage, flaps and hood jettison systems. It may also be used to charge the mod. 3627 accumulators. The airbrakes cannot be operated in the air by the handpump. The maximum effect is produced only when the handpump is operated at full stroke. When not in use the handpump should be left in the up position.

## 17. Electrical system (24-volt)

(a) *D.C. supply*

(i) A single engine-driven generator supplies the whole of the electrical system and charges two 12-volt batteries connected in series.

(ii) A generator failure warning light is on the right of the instrument panel. The warning light indicates when the generator is not supplying power. Post Mod FTC 104 the light will only come on if the battery discharge rate exceeds 4–7 amps. It will not illuminate when an external supply is used. It may not come on prior to start-up until the flight instruments and booster pump are switched on. It may come on in flight when the throttle is closed.

(iii) Mod. 3378 introduces a voltmeter, filled below the inverter circuit breakers on the port instrument panel. With the generator off-line the meter indicates battery voltage: with the generator on-line the meter indicates generator output voltage. In flight the voltmeter needle should normally be in the white (25–29v) sector; in either red sector (15–22v or 30–35v) the indication is that a generator output fault exists.

(iv) The Ground/Flight MASTER SWITCH (53) is below the centre of the instrument panel. It should be pulled out for Ground and pushed IN FOR FLIGHT. Two external sockets are fitted, one on each side of the fuselage. The socket midway along the starboard underside *is for ground starting only*. The socket on the port side of the fuselage nose is for ground test use. All electrical services (except automatic engine starting) can be connected to the ground battery when it is plugged into the port socket.

(v) The Ground/Flight switch must be set in before electrical power is available to the starting system from an outside source.

(b) *A.C. supply*

(i) Two type 100A inverters are fitted. No. 1 inverter normally supplies the flight instruments and No. 2 acts as a standby to meet the case of failure of No. 1 inverter.

(ii) Below the port instrument panel are two circuit breakers, one for each inverter supply. A magnetic indicator (51) which shows black when No. 1 inverter is supplying power, and white when change-over to No. 2 inverter occurs or when electrical supply is lacking, and a reset pushbutton (50) are on the starboard instrument panel. The flight instruments switch (33) is adjacent to the starter master switch.

(iii) When the FLIGHT INST switch is set ON before starting the engine, No. 2 inverter starts up and supplies the artificial horizon and causes the Mark 4F

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Para. 17
(b) (iii)
(iv)
A.L.1

compass to function. The magnetic indicator remains white. Post F.T.C. Mod. 101 the indicator changes to black during start up. Pre F.T.C. Mod. 101, after start up, when engine r.p.m. are above generator cut-in speed, automatic change-over to No. 1 inverter occurs and the indicator changes to black.

(iv) During taxying, if engine r.p.m. are reduced below generator cut-out speed the inverters will auto-change to No. 2 and the indicator will show white. If this occurs engine r.p.m. should be increased and if necessary the reset pushbutton pressed to re-engage No. 1 inverter. With F.T.C. Mod. 101 fitted auto-change should not occur until well below engine idling r.p.m. In this case if the indicator reverts to white No. 1 inverter is unserviceable.

WARNING.—The reset pushbutton must not be used during flight when auto-change-over has occurred or incorrect operation of the magnetic indicator may result.

(v) After take-off, operation of the port undercarriage door lock micro-switch completes a circuit to a hold-in relay which ensures continuity of the inverters circuit should the FLIGHT INST switch subsequently be set inadvertently to OFF. This hold-in relay operates despite any subsequent undercarriage lowering. After flight either inverter may only be switched off by setting the Ground/Flight switch to the Ground position.

18. **Oxygen system**

(a) The oxygen supply is contained in four interconnected cylinders. The regulator (12) at the port side of the instrument panel controls the flow to the port economiser and to the starboard regulator (44). The economisers are
AL.1 fitted behind the **port** seat. Adjacent to the bottles is fitted a charging valve, access to which is gained through the fuselage nose panel.

(b) Mod. 3432 introduces an automatic line valve, incorporating an ON/OFF lever (2), between the supply cylinders and the regulator, the on/off cock of which is locked fully on. Below 8,000 feet the line valve lever may be used as a master control and oxygen is only supplied with the lever ON. At 8,000 feet the lever, if OFF, moves automatically to ON and cannot be turned OFF again until height is reduced below 8,000 feet.

## AIRCRAFT CONTROLS

### 19. Flying controls

The flying controls are conventional. Each control column handgrip incorporates a brake lever, gun firing switch, bomb/R.P. release switch and camera operating switch. The rudder pedals are adjustable for leg reach by lifting them from one slot to another.

### 20. Flying controls locking gear

The flying controls locking gear consists of a "Y" shaped fitting, which connects the rudder pedals and control column, and a quick release pin which prevents the upper portion of the stick from moving, thereby locking the ailerons.

### 21. Trimming tab controls

(a) The elevator trimming tab control wheel (8) is positioned on the side of each engine control box. An indicator (19) is fitted at the top left-hand side of the instrument panel.

(b) No pilot-operated controls are fitted for aileron and rudder trim, but a ground adjustable tab is fitted on each aileron and each rudder.

### 22. Undercarriage control and position indicator

(a) The selector lever (11) on the left of the cockpit extends from the rear of the engine control box. The selector lever (65) on the right is mounted in a quadrant on the starboard wall. Each lever has two positions, UP and DOWN and being mechanically interconnected, either may be used to operate the undercarriage. When the weight of the aircraft is on the wheels, the port selector lever is locked in the DOWN position by a solenoid operated plunger.

(b) A standard position indicator (24) is above the centre of the instrument panel. An undercarriage WARNING light (22) is below the indicator and comes on if any of the wheels is locked up and the throttle is less than a third open.

23. **Flaps control and position indicator**

(a) The selector lever (10) on the left of the cockpit extends from the rear of the engine control box. The selector lever (62) on the right is in the quadrant on the starboard wall. Each lever has three positions, UP-NEUTRAL-DOWN and either may be used to operate the flaps.

(b) Any flap setting up to 80° can be obtained by returning the selector lever to neutral when the desired setting has been reached. The selector should normally be left in the up or down position when the flaps are fully up or fully down.

(c) The flap position indicator (30) is fitted above the rate of climb indicator.

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24. **Undercarriage and flaps emergency operation**

(a) As soon as hydraulic failure is suspected ensure that the flap selector lever is at neutral and the windscreen wiper selector is at OFF to avoid unnecessary dumping of fluid via the flap or windscreen wiper pipelines.

(b) If the engine-driven pump fails, and Mod. 3627 is not embodied the handpump between the seats can be used to operate the undercarriage, flaps and windscreen wiper after selecting the desired service by the normal selector lever. Up to 115 strokes of the hydraulic handpump may be necessary to lower the undercarriage fully.

(c) If Mod. 3627 is embodied select the desired service and, if the main accumulator has insufficient pressure, move the EMERGENCY HYDRAULICS lever fully aft.

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(d) If it is required in an emergency to retract the undercarriage, when on the ground, the solenoid-operated plunger which retains the undercarriage operating lever in the DOWN position can be overridden by setting either of the two U/C OVERRIDE guarded switches (15), (54) to ON. Undercarriage UP may then be selected.

25. **Airbrakes control**

(a) Two positions only—ON and OFF—can be selected by the lever (9) which is duplicated at the port and starboard engine control boxes.

(b) The airbrakes cannot be operated by the hydraulic handpump in flight.

26. **Wheelbrakes control**

The wheelbrakes are controlled by the lever on each control column handgrip. To lock the brakes in the on position, either lever can be pressed and the parking catch engaged.

## GENERAL EQUIPMENT AND CONTROLS

27. **Hood operation**

(a) The hood may be locked from the inside by pulling back the internal locking handle and then engaging the catch. The safe position of the catch is indicated by a red line on the hood member. When the catch is fully engaged the hood seal cock is operated to inflate the hood seal.

(b) The hood is opened from the inside by disengaging the locking catch, pushing the locking handle fully forward and then pressing the shielded pushbutton (14) on the left of the instrument panel to raise the hood pneumatically. The hood support strut is held open by a spring-loaded handle which must first be pulled before closing the hood again.

(c) The hood is opened from outside by lifting and then turning through 90° the flush fitting external handle, housed at the aft end of the hood. A press-to-release button must first be pressed before the lever can be raised. Turning the lever may require some force.

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28. **Hood jettisoning**

(a) When the handle (56) above the Ground/Flight switch is pulled a hydraulic selector valve is operated to actuate a hydraulic jack. The jack releases the hood support strut, the latches and the hinges. The front of the hood should then spring up under the action of the pneumatic hatch lifting strut when it will be blown clear of the aircraft.

(b) A certain minimum hydraulic pressure is required to actuate the jack and if normal pressure is not available

and Mod. 3627 is not embodied the jack may be operated by the handpump.

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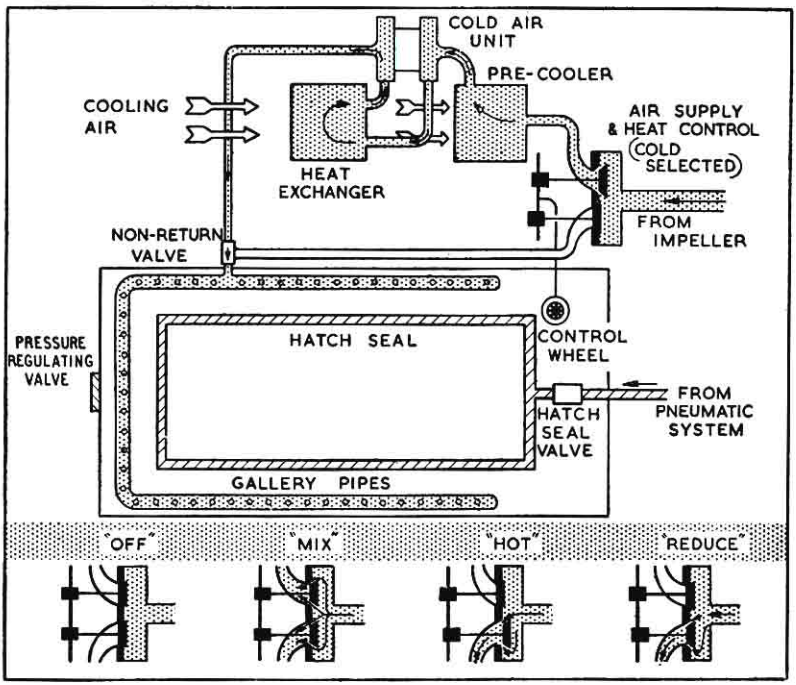
(c) If Mod. 3627 is embodied, pull the jettison handle and, if necessary move the EMERGENCY HYDRAULICS lever aft.

## 29. Cockpit pressurising, heating and ventilation




COCKPIT PRESSURIZATION AND HEATING

(a) The pressurisation heating and ventilation system is controlled by a wheel (1) on the port wall which alters the settings of two valves, one admitting hot air and one cold air. The hot air is obtained direct from the engine impeller. The cold air supply is from the same source, but is first passed through a cold air unit in the port wing. The settings of the wheel are as follows:—

| | |
|---|---|
| OFF | Both valves shut, no pressurisation. |
| COLD | Hot air valve shut, cold air valve fully open. |
| MIX | Both valves partially open. As the wheel is |

moved towards HOT the hot air valve opens further and the cold air valve closes.

HOT Cold air valve shut, hot air valve fully open.

REDUCE Cold air valve shut, hot air valve partially open. The temperature of the incoming air remains the same, but since its volume is reduced the overall cockpit temperature is thus reduced.

(b) With the wheel set other than OFF pressurised air is admitted to the cockpit through gallery pipes round the lower edges of the hood and windscreen. The quantity of warm air entering the gallery pipes, which provide for windcreen and hood demisting, can be varied by altering the position of two ventilators (63) in the shape of rotatable sleeves, one on each wall of the cockpit. A valve in the cockpit allows a steady increase in pressure differential at heights above 12,000 ft., increasing with altitude until at 35,000 ft. the full pressure differential of 3 lb./sq. in. is reached. At this height the cockpit altimeter (25) should read 21,000 ft. A CABIN PRESS LOW warning light (26) comes on whenever the pressure falls substantially below the correct figure.

(c) If a reduction of cockpit temperature is desired at altitude, MIX is to be preferred to REDUCE otherwise the reduced volume of air entering the cockpit may adversely affect the pressure differential. COLD or MIX *must not* be selected on the ground otherwise overheating of the cold air unit may occur with subsequent damage.

30. **Windscreen de-icing, windscreen wiper and d/v. panels**

(a) The W'SCREEN DE-ICER PUMP control (55) is above the Ground/Flight switch. The handle is turned anti-clockwise to unlock and pushed in to raise pressure. As the handle returns to the out position, the windscreen is sprayed.

(b) Two d/v panels are fitted, one on each side of the main windscreen. Each is locked shut by a sliding bolt and screw clamp. AL.1

(c) The hydraulically-operated windscreen wiper for the port windscreen is controlled by an ON-OFF-PARK knob (13) below the port instrument panel.

31. **Cockpit lighting**

(a) *U/v and red lamps*

These are controlled by three on/off dimmer switches on the extreme left of the instrument panel.

(b) *Emergency lamp*

This, fitted above the centre instrument panel, is controlled by the EMERGENCY LIGHT switch (37) in the centre of the instrument panel and powered by a separate 2·4v. alkaline battery.

32. **External lighting**

(a) *Identification lights*

The DOWN IDENT lights STEADY-OFF-SIGNAL switch (35) is adjacent to the emergency lamp switch.

(b) *Navigation lights*

The on/off switch (46) is below the generator failure warning light.

(c) *Landing lamp*

The landing lamp switch (38) is on the starboard side of the instrument panel.

33. **Electrically-operated flight instruments**

(a) The Mk. 4F compass and artificial horizon are operated by A.C. electrical power (see para. 17 (b)).

(b) *Turn and slip indicator*

The turn and slip indicator is available whenever D.C. electrical power is available. When no power is available, the word OFF appears in a window in the dial of the instrument.

34 **E2 compass**

This is positioned above the centre of the instrument panel.

35. **Pitot head heater**

The pitot head heater switch (47) is adjacent to the navigation lights switch.

36. **Emergency equipment**

(a) *First aid kit*

This is on the aft portion of the hood behind the port seat.

(b) *Crowbar*

This is on the starboard wall.

(c) *Hand fire-extinguisher*

A hand fire-extinguisher (61) is on the cockpit floor, starboard side, forward.

## EJECTION SEATS MK. 3B

37. **General**

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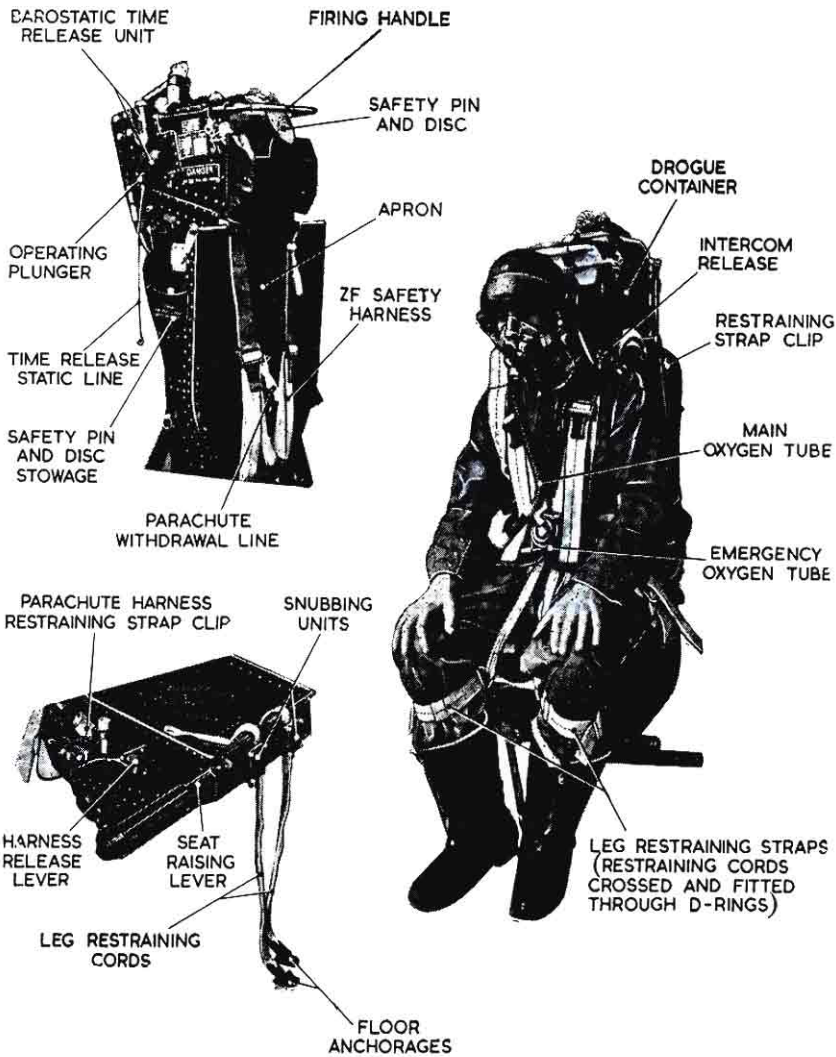
(a) Two Mk. 3B pilot ejection seats are fitted, each incorporating a type ZF or ZH harness, headrest, parachute container for the Mk. 9 or Mk. 19 parachute, a seat well for the dinghy and emergency oxygen supply and leg restraining straps.

(b) At the rear of each seat is the 50 ft./sec. ejection gun and a drogue gun. Stowages for the seat safety pins are on either side of each seat.

(c) When Martin Baker Mods. 293, 387 and 491 are all embodied a G-stop is incorporated to prevent the opening of the main parachute if the speed of the seat after ejection is too high for safe deployment. The switch prevents the operation of the barostatic time delay unit until the speed of the seat has fallen to a safe figure.

(d) Irrespective of the Mod. state, the seat can be used at 200 feet and above provided that the aircraft's flight path is parallel to the ground. If the aircraft is descending or nose-down, more than that minimum altitude will be required.

(e) A negative G strap is attached to the seat pan and passes upwards through a bracket at the front of the seat. It terminates in a Y-piece, the two end loops of which are engaged by the shoulder harness lugs when strapping in (See para. 56 (d)). Tightening the strap prevents forward movement of the p.s.p. and the seat occupant and gives improved vertical restraint under negative G conditions.




EJECTION SEAT MK.3B

38. **Seat adjustment handle and lean-forward release**

The seat height may be adjusted by the handle on the starboard side of the seat. The harness lean-forward release is to the rear of this lever.

39. **Manual override D-ring**

The manual override D-ring is fitted over the rip-cord D-ring. If manual separation from the seat is necessary the override D-ring should be pulled to its fullest extent. The parachute is then disconnected from the automatic opening line and the protective canvas flap over the rip-cord D-ring is removed.

40. **Ripcord D-ring**

This is normally covered by a canvas flap retained in position by two press studs and is removed by the action of pulling the manual override D-ring. It is provided for manual opening of the parachute should either the seat fail to eject or automatic opening of the parachute fail after ejection.

41. **Leg restraining straps and adjusting controls**

(a) The straps ensure that the occupants' legs are drawn back automatically and restrained close to the seat pan during ejection, thus providing clearance and preventing the legs being blown apart after ejection. The straps pass through snubbing units, at the front of the seat pan, which allow the straps to pass freely down through the unit but prevent them passing upwards. An adjusting button under each snubbing unit, when pressed, allows the occupant to adjust the cords to give comfortable leg movement in the aircraft.

(b) After ejection the legs are held in position until the occupant is separated from the seat. The restraining straps are then pulled through the leg restraint garter D-rings to free the legs.

42. **Normal operation of the seat**

(a) When the firing handle is operated the seat is ejected and the drogue gun fired half a second later.

(b) All leads incorporate quick releases which are automatically broken on ejection.

(c) As the seat is ejected a static line readies the barostatic time-delay mechanism. When the free descent reaches 10,000 ft. or at once if ejection has taken place below that height and provided that the G-stop has not operated, the barostat removes an obstruction from the gear train of the mechanism allowing it to operate.

(d) After three seconds (1½ with G-stop fitted) the seat harness is released, the seat-stabilising drogues are freed and by a connecting lifting line the face screen is disconnected and the parachute deployed. The occupant is momentarily prevented from leaving the seat by two restraining straps until deployment of the parachute lifts him clear of the seat.

## OPERATIONAL CONTROLS

### 43. Radar controls

(a) *Rebecca* 8

The control panel (39) is below the starboard gunsight and the indicator is below the port gunsight. When SRIM 2284 is embodied the indicator is moved to the position formerly occupied by the j.p.t. gauge.

(b) *I.F.F. controls*

The MANUAL ON/OFF and G/D switches (64) together with the central AUTO pushbutton are on the starboard wall.

### 44. Radio controls

The TR.**1934/1935** control unit (57) and changeover switch (52) is below the instrument panel. A mic./tel. socket is attached to each seat and a press-to-transmit switch (6) is in the end of each throttle lever twist-grip. The R/T muting switch (58) is below **the altimeter.** **A.L.1**

### 45. Gyro gunsights Mk. 5

The GGS master retracting switches (23) (31) are on the inboard sides of the mountings. The selector dimmer

(17) and GUNS/RP selector switches (59) (60) are on the port side of the instrument panel and the electrically-operated ranging control is incorporated in the throttle twist-grip. Circuit breakers (41) are provided on the instrument panel. A changeover switch (42) for the ranging control is on the starboard side of the instrument panel.

46. **G.G.S. emergency lowering**

Should either gunsight fail to lower by the normal method, emergency lowering may be effected by striking the knob (21) (36) adjacent to the gunsight, a hard blow.

47. **G.45 camera**

(a) The cine-camera automatically operates during both R.P. and gun firing when the camera master switch (at 40) is ON. An aperture switch (at 40) is positioned on the right-hand side of the instrument panel.

(b) The test switch (43) is below the G.G.S. circuit breakers.

48. **Gun firing**

(a) Gun firing controls are located on each control column and consist of a firing switch and a safety switch. Both safety switches must be at FIRE before either firing switch will fire the guns. When the catch is at SAFE and the camera master switch on the upper panel is ON, the cine-camera can be operated by pressing the port button on either control column.

(b) A micro switch in the nose-wheel well isolates the firing circuits when the nose-wheel is down and locked. For added safety, when the guns are loaded, the electrical leads to the gun firing units should be left unconnected until just before flight.

49. **R.P. firing and bomb release**

(a) A BOMBS/R.P. master selector switch (45) is on the starboard panel together with a PAIRS-SALVO switch. A firing push switch is on each control column.

(b) The bomb selector and fusing switches are also on the starboard panel. Bomb release is by the same push switch as for R.P. firing; the master switch in this case must be set to BOMBS.

(c) A safety break is provided in each main wheel well for the R.P. circuits.

# PART II

# *LIMITATIONS*

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## 50. Engine limitations—Goblin 3

| Power Rating | Time limit | R.P.M. | J.p.t. °C. |
|---|---|---|---|
| Take-off .. .. | †15 mins. | 10,750* | 710 |
| Intermediate .. .. | †20 mins. | 10,350 | 660 |
| Max. Continuous .. | Unrestricted | 10,250 | 650 |
| Ground Idling .. | Unrestricted | 3,000±200 | 600 |

Operation at speeds between 8,150 and 8,650 r.p.m. and at 10,500 r.p.m. must be kept to an absolute minimum. Above 25,000 feet maximum r.p.m. must not exceed 10,350.

NOTE: *In R.A.F. use, max. r.p.m. are restricted to 10,650.
†In R.N. use, these time limits are 5 mins. and 30 mins. respectively.

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Para 51
(a)(b)
AL5

## 51. Flying limitations

(a) Spinning up to a maximum of four turns is permitted.

(b) *Maximum Speeds*

| | |
|---|---|
| Clean aircraft or with R.P. | Above 10,000 ft., 455 knots<br>Below 10,000 ft., 350 knots at sea level increasing by 9 knots per 1000 ft., to 440 knots at 10,000 ft. |
| With drop tanks or bombs | Above 15,000 ft., 0.76M<br>Below 15,000 ft., 350 knots at sea level increasing by 9 knots per 1000 ft., to 390 knots. |
| Operation of airbrakes, when carrying drop tanks | 0·70M. |
| Jettisoning drop tanks .. | 260 knots. |
| For operation of undercarriage up or down .. .. | 175 knots. |

For operation of flaps between:—

| | |
|---|---|
| 0° and 30° .. .. | 155 knots. |
| 30° and fully down .. | 145 knots. |

The speed quoted for the operation of a service also applies for flight with the service in the extended position.

(c) *Maximum all-up weights:—*

| | |
|---|---|
| Take-off and gentle manoeuvres only .. .. .. .. | 13,380 lb. |
| All other permitted forms of flying .. .. .. .. | 11,610 lb. |

(d) *G limitations*

The following accelerometer readings must not be exceeded:—

| | |
|---|---|
| Clean aircraft .. .. .. | + 6G. |
| With drop tanks (full or empty).. | + 4G. |

The maximum permitted negative accelerometer reading is $-3\frac{1}{3}$G.

NOTE.—Until Mod. 3500 or Mod. 3535 is embodied the application of negative G should be avoided; otherwise there is a risk of flash fire caused by penetration of fuel into the engine bay.

(e) The aircraft must not be taxied with the canopy open.

Page 31 Para. 51 A.L.3 (f) *Aircraft approach limitations*

The A.A.L.'s are as follows:

| | |
|---|---|
| G.C.A., precision radar .. | 250 ft |
| G.C.A., search radar .. .. | 400 ft. |

# PART III

# *MANAGEMENT OF SYSTEMS AND USE OF EQUIPMENT*

## 52. Management of the fuel system

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

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(b) The booster pump must be switched ON before starting and left on at all times when the engine is running. The fuel pressure warning light will come on when pressure is low, indicating that there is a fault in the system or that the booster pump is switched off. The engine will run satisfactorily with the booster pump off below 20,000 ft. but above this height, full power may not be obtained. Avoid harsh throttle movements and negative G.

(c) Transfer of fuel from the wing drop tanks into the fuselage tanks begins when approximately 120 lb. have been used from the fuselage tanks.

## 53. Engine handling

(a) *Engine control*

(i) Throttle movements should be made slowly to avoid resonance and high jet pipe temperature. When Goblin Mod. 1130 is incorporated the engine may be throttled fully back at any altitude, the minimum pressure valve ensuring that burner pressure does not fall too low to support combustion; the idling r.p.m. are therefore increased with altitude.

(ii) Cases have occurred of flame-out or near flame-out (burbling) at altitude when carrying out manoeuvres involving a stall. This is due to a combination of

low B.P.C. pressure and low forward speed leading to reduced fuel flow at the burners. Goblin Mod. 1130 increases both the B.P.C. pressure setting and minimum fuel flow. Until the Mod. is embodied it is recommended that, to reduce the possibility of flame-out, engine r.p.m. in stall manoeuvres should not be less than the following:—

| | |
|---|---|
| 20,000 ft. .. .. | 5,500 r.p.m. |
| 30,000 ft. .. .. | 7,500 r.p.m. |
| 35,000 ft. .. .. | 8,500 r.p.m. |

(iii) During sustained turns at all altitudes there may be a tendency for engine r.p.m. to fall off slightly, up to a maximum of 1,000 r.p.m. The original r.p.m. will be regained when straight and level flight is resumed.

(b) *H.P. pump isolating check*

(i) Increase engine r.p.m. to 4,000 and set the isolating switch ON. This should result in an increase of about 1,000 r.p.m., pre-mod. 1130, or of about 800–900 r.p.m. post-mod. 1130. Should the desired increase not be achieved the system is unserviceable and the aircraft must not be flown.

(ii) After the check return the switch to off and note that the r.p.m. drop to the original figure.

(c) *Use of the H.P. pump isolating switch for take-off*

If the isolating switch has been set to ON for take-off it must be returned to off at a safe height whilst still at full throttle. This should cause little or no drop in r.p.m.; the engine can then be throttled to the desired power. If the isolating switch is switched to off after power has been reduced a sudden drop of approximately 1,000 r.p.m. will result.

(d) *Use of the H.P. pump isolating switch in flight*

If a sudden inexplicable drop in engine r.p.m. occurs the throttle should be closed and the isolating switch set to ON. (If the isolating switch is not switched to ON within 4 seconds there is a probability of flame extinction). Once the switch has been set to isolate it must

be left there and the engine opened up slowly to the desired r.p.m. Idling r.p.m. will be high and landing must be carried out with caution.

54. **Management of the pressurising and demisting systems**

(a) The control wheel for regulating the supply and temperature of the pressurised air must be set to OFF, HOT or REDUCE when the aircraft is on the ground with the engine running, in order to avoid overheating the cold air unit. COLD or MIX must not be selected on the ground.

(b) It is recommended that the cockpit is pressurised immediately after take-off. If not, the pressure warning light will come on at about 17,000 ft. The pressure control should then be operated and the warning light will go out as pressure builds up.

(c) In conditions where hood misting is anticipated, the control wheel should be at HOT, the r.p.m. should be kept as high as practicable and the ventilators in the gallery pipes closed to give maximum flow of hot air to the windscreen.

(d) To reduce temperature at high altitudes, the control wheel should be moved to MIX or COLD, since movement to REDUCE may result in a reduction of cockpit pressure.

55. **Management of the electrical system**

(a) Push in the GROUND/FLIGHT switch before starting and check that the turn and slip indicator starts up. Then set the FLIGHT INST switch ON and check that the artificial horizon OFF flag disappears, that the Mk. 4F compass annunciates and that the magnetic indicator remains white.

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(b) After starting, when the generator is on line, check that auto-changeover occurs as shown by the magnetic indicator turning black. If the indicator reverts to white at any stage before becoming airborne, increase r.p.m. and if necessary press the reset pushbutton. With F.T.C. Mod. 101 fitted auto-changeover occurs before engine idling r.p.m. are reached. In this case if the indicator reverts to white the No. 1 inverter system is unserviceable.

WARNING.—Do not operate the button if auto-changeover occurs in flight.

(c) After stopping the engine and when the generator warning light comes on, pull out the GROUND/FLIGHT switch. This will ensure that all electrical services, including the generator warning light are isolated from the battery.

56. **Use of ejection seat equipment**

Each occupant must:—

(a) Check that the safety pin is in position and that the firing cable, drogue gun and time delay mechanism trip rods are correctly secured. Check that the safety pin has been removed from the emergency oxygen cylinder and that the drogue gun quick-release pin has been withdrawn from the safety lock on the drogue gun. If the aircraft is to be flown solo, check that the instructor's harness is secured.

(b) Enter the cockpit and adjust the seat height for optimum position.

(c) Connect the survival pack to the life-saving waistcoat, ensuring that the quick release is below the parachute waist-belt.

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(d) Fasten, but do not tighten, the safety harness lap straps, and then proceed as follows:—

(i) Pass the left leg restraint cord through the right leg garter D-ring, under the safety harness lap straps and slide the right shoulder harness lug through the loop on the cord. Pass the negative G strap under the safety harness lap straps and slide the loop on the right arm of the Y-piece onto the right shoulder harness lug. Secure the shoulder harness lug in the quick release box.

(ii) Repeat for the other leg restraint cord and other arm of the negative G strap. Ensure that the right cord passes through the left leg garter D-ring and that the loop slides over the left shoulder harness lug. Secure the harness.

(iii) Ensure that the safety harness quick release box is below and clear of the parachute harness so that the parachute over-ride D-ring is accessible. Tighten the safety harness lap straps and the negative G restraining strap, then tighten the harness shoulder straps.

(e) Connect the main oxygen and emergency oxygen supply tubes to the oxygen mask tube and the locating chain to the life-saving waistcoat. To prevent possible entanglement ensure that the emergency oxygen tube is connected under the seat safety harness.

(f) Connect the mic./tel. lead.

(g) Check that the firing handle can be reached with both hands together.

(h) Have the ejection seat safety pins removed and stowed.

# PART IV

# *HANDLING*

## STARTING, TAXYING AND TAKE-OFF

### 57. External checks

(a) *Before checking aircraft:—*

| | |
|---|---|
| Form 700 | Check and sign |
| Position of aircraft | Suitable wind dir. for start |
| Chocking | Correct |
| Fire extinguishers | In position |
| Starter trolley acc. of correct voltage | Available. |

DELETED

(b) *Starboard intake*

| | |
|---|---|
| Boundary layer fairing | Condition. |
| Air intake | Condition, loose objects, compressor undamaged, check for oil leak from front bearing. |
| Upper starboard rear fuselage | Condition, cowlings fastened, ammo. bay doors. |
| Generator cooling, gun heating and B.P.C. intake | Clear, B.P.C. pipe undamaged. |
| Lower starboard rear fuselage | Condition, cowlings fastened. |
| Fuel and oil vents | Condition. |

(c) *Starboard undercarriage*

| | |
|---|---|
| Fairing and door | Condition and security, check door knuckle pads for signs of damage. |
| Oleo leg | Condition and extension. |
| Tyre | Cuts, cracks, creep, condition of tread, inflation, freedom of valve, walls for signs of rubbing. |
| Brake pipes | Condition and security. |
| Undercarriage bay | Clean, no oil leaks from hydraulic pipe and jack, micro switch clean, hydraulic pipe wrapping for chafing. |
| | **deleted A.L.1** |
| | Door locking pin not showing. |
| Ground lock | Removed. |
| Flaps | Condition of lower skin. |

(d) *Starboard mainplane*

| | |
|---|---|
| Lower surface | Condition, panels secure |
| I.F.F. aerial | Secure. |

| | |
|---|---|
| Leading edge | Condition. |
| Upper wings | Condition and panels. |
| D.M.E. aerials | Secure. |
| Navigation light and wing tip | Condition. |
| Aileron | Condition of surfaces, hinge and linkage. Full and free movement, position of balance tab, reset aileron to neutral. Check for distortion. |
| Fuel filler caps | Secure. |
| Airbrakes | Condition. |
| Flaps (outboard of boom) | Condition of upper skin, security, lines and jacks for leaks and interconnection of inboard and outboard sections. Aileron control cables—position and condition. |

(e) *Starboard boom*

| | |
|---|---|
| Boom | Condition. |
| V.H.F. Aerial | Security. |

(f) *Tail unit*

| | |
|---|---|
| Fins and tailplane | Condition and surfaces. |
| Tail fairing covering rudder mass balance | Condition. |
| Tail bumpers | Undamaged. |
| Elevator and rudders | Condition of surfaces, hinges and linkages. Full and free movement of each control surface, check free position of rudders and bias tabs for security. Check clearance between the rudder and elevator with the elevator neutral. |
| Elevator mass balance | Condition and security. |

| | | |
|---|---|---|
| (g) | *Engine* | |
| | Engine cowlings | Condition and secure. |
| | Centre fuel tank panel | Secure. |
| | Jet pipe and pyrometer | Condition. |
| | Turbine | Condition. |
| (h) | Hydraulic filler cap | Flush. |
| (j) | *Flaps* | |
| | Flaps (inboard of boom) | Condition, security, check fire extinguisher bottle for security and connections. |
| (k) | *Tail unit*—continued | |
| | Tail navigation lights | Condition. |
| | Pressure head | Cover off and secure. |
| | | Condition. |
| (l) | *Port boom* | |
| | As for starboard. | |
| (m) | *Port mainplane* | |
| | As for starboard, with | |
| | Landing lamp | Condition and fitting. |
| (n) | *Port undercarriage* | |
| | As for starboard, with | |
| | Undercarriage safety lock micro switch | Condition and clean. |
| (o) | *Port intake* | |
| | As for starboard with | |
| | Cold air unit | Condition and clear. |
| | Cold air unit panel | Secure, dipstick secure. |
| (p) | *Front fuselage (Port)* | |
| | Canopy ecternal handle | Flush. |
| | Rear hood perspex fairing | Condition. |
| | Gun bay panel | Secure. |
| | Fuel vent pipe | Condition. |
| | Hinged nose fairing | Secure, thumb press locks flush, condition of cine camera or nose light window. |

(q) *Nose wheel bay*

| | |
|---|---|
| Nose wheel | Cuts, cracks, creep, inflation, freedom of valve and wear of tyre. |
| Hinged leg fairing | Condition and security. |
| Nose oleo | Condition and extension (approximately $3\frac{1}{2}$ in.) |
| Bay | Clean, no oil leaks from hydraulic pipes or jack. |
| Nose wheel door | Condition, secure. |

(r) *Front fuselage (Starboard)*

As for front fuselage, port.

---

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(s) *At the cockpit*

Before entering the cockpit check that the ejection seat safety pins are engaged through the face screen lock. Check the windscreen and canopy for cleanliness and condition and that the First Aid Kit is secure.

(t) *Ejection seat*

Facing rearwards, commence a left to right check as follows:—

| | |
|---|---|
| Time release mechanism | Pin attaching static line to guide rail secure. |
| Top latch | Flush, safety pin fully home |
| Scissor shackle | Lying flat. |
| Gun firing sear | Connected to face blind. |
| Drogue withdrawal line | Routed over lifting line. |
| Drogue gun. | Drogue piston and restraining split pin in position. Safety pin removed. Static rod connected to drogue gun and to guide rail. |

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(u) *Parachute and dinghy assembly*

In each seat:—

Check both rip cord handles are secure in their pockets.

Ensure that the parachute and dinghy assembly is correctly fitted in the seat.

Ensure that the emergency oxygen bottle does not overlap the seat pan. Check emergency oxygen bottle safety pin removed

(w) Before strapping in, check:

Leg restraint straps connected to floor beneath seat

Pneumatic pressure above 200 p.s.i.

Fire extinguisher secure

Crowbar secure

No loose articles

58. **Cockpit checks**

(a) When flying solo ensure all straps, harnesses and quick release boxes in the 2nd pilot's seat are secured and that the emergency oxygen quick release cable is secured against detachment from the seat unit.

(b) *Strapping in*

Strap in, ensuring that the dinghy connections are made as appropriate to the mark of equipment.

Ensure that the safety harness Q.R.B. is below and clear of that of the parachute harness so that the parachute override ' D ' ring is accessible. Don headgear, connect main and emergency oxygen tubes, pass the emergency tube under the parachute waist webbing to ensure that it does not foul the parachute override ' D ' ring.

Have R/T connected.

Adjust seat for height and rudder pedals for extension.

Put the brakes ON and then have the safety pin removed from the seat.

Check this visually and have it stowed.

(c) Check the hood is closed and locked with the seal inflated.

Test the controls for full and correct movement, and check brakes for correct functioning. Then:

Ground/Flight MASTER SWITCH — ON—Rate of turn indicator functioning.

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Begin the checks at the extreme left of the cockpit and work from left to right:—

| | |
|---|---|
| Cockpit pressure control | OFF. |
| Oxygen auto-line valve switch | ON. |
| Undercarriage selector lever | Fully DOWN. |
| Flap selector lever | UP. |
| Airbrakes | OFF selected. Both selectors synchronised. |
| Cockpit air ventilator | As required. |
| Throttle | Full and free movement, synchronised with centre pedestal throttle, set SHUT. |
| H.P. cock | Press the relight button with the cock in the open position (if serviceable an irregular clicking sound is audible).<br>Set closed. |
| Elevator trim | Full and free movement, synchronised with centre pedestal control. Set neutral. |
| L.P. cock | ON. |
| Oxygen | Wired on, check contents, emergency switch OFF, check high flow, both flow Ind. showing connections and supply at mask. |
| Cockpit lighting switches | As required. |
| U/C override switch | Down and guarded. |
| Windscreen wiper control | In " Parked " position. |
| Brake gauge | Total pressure above 200 lb./sq. in. |
| Port clear vision panel | As required. |
| Accelerometer | Set to + 1G. |
| Second altimeter | Serviceability. Set 0 feet for subsequent check against Q.F.E. |

| | |
|---|---|
| R.P.M. indicator | Serviceability. |
| D.M.E. Range meter | Serviceability OFF. |
| J.p.t. gauge | Serviceability. |
| Clock | Correct and working. |
| G.G.S. selector dimmer | As required. |
| Fuel gauge | Contents and serviceability. |
| Fuel pressure warning light | On. |
| Guns/R.P. selector switches | As required. |
| Inverter circuit breakers | Closed. |
| R/T mute switch | As required. |
| E.2 compass | Serviceability. |
| Cabin altimeter | Zero. |
| Machmeter | Serviceability. |
| Fire warning light. | Out, test with FIL. TEST button. |
| Port G.G.S. switch | Test if required, switch OFF. |
| Undercarriage position indicator | Three green lights on, Check bulb changeover. |
| Cabin pressure warning light | Out. |
| Generator warning light | On. (Pre-mod. F.T.C. 104) |
| Flap position indicator | Note flap position. |
| Starboard G.G.S. switch | Test if required, switch OFF. |
| Undercarriage warning light | Out. |
| Flight instruments | Check serviceability, set 0 ft. on altimeter for subsequent check against Q.F.E. Set approximate heading on Mk.4F compass. |
| No. 1 R/T set | Off. |
| Hood jettison handle | Wired in. |
| V.H.F. changeover switch | As required. |
| WINDSCREEN DE-ICER PUMP | In. |
| No. 2 R/T set | Off. |
| Undercarriage override switch | Down and guarded. |

| | |
|---|---|
| Starter master switch | ON. |
| Flight instruments switch | ON. Check artificial horizon. OFF flag disappears. |
| Inverter magnetic indicator | White. |
| Booster pump switch | On, check fuel pressure warning light goes out and generator warning light comes on. (Post F.T.C. 104). |
| F.P.I. switch | OFF. |
| Downward identification and emergency cockpit light switches. | As required. |
| Pitot head heater | ON. |
| Navigation lights | As required. |
| Starter circuit breaker | Closed. |
| D.M.E. control panel | OFF. |
| Landing Lamp | OFF. |
| G.45 camera switches | As required. |
| G.G.S. circuit breakers | Closed. |
| Bomb and R.P. switches | As required. |
| G.45 camera test switches | Test if requried. |
| Instructor/pupil G.G.S. changeover switch. | As required. |
| Oxygen | Check emergency switch OFF, check high flow, both flow indicators showing, connections and supply at mask. |
| Cockpit ventilator | As required. |
| Undercarriage selector lever | Fully DOWN. |
| Flap selector lever | UP. |
| I.F.F. switches | As required. |
| Stbd. clear vision panel | As required. |
| Hood locking handle | Locked and secured by catch. |
| Hydraulic handpump | Check operation against flap position indicator. Return lever to uppermost position. |

Pass the hand between the seats to ensure that they are not inter-connected.

| | |
|---|---|
| Drop tank jettison lever | Forward. |
| Emergency hydraulics lever | Forward. |

59. **Starting the engine**

Check that the area around the aircraft is clear, and that the fire extinguishers are available.

Have the controls set as in the check lists, i.e.:

| | |
|---|---|
| Parking brake | On. |
| Ground/Flight MASTER SWITCH | On. |
| H.P. cock | Set closed. |
| Throttle | SHUT. |
| L.P. cock | ON. |
| STARTER and FLIGHT INST. Circuit breakers | Closed. |
| STARTER MASTER and FLIGHT INST. switches | On. Mk. 4F compass and Art. hor. erecting. Magnetic indicator white. |
| Booster pump switch | ON. check aurally.—Fuel pressure warning light out. Generator warning light on (Post F.T.C. Mod. 104) |
| F.P.I. switch. | OFF. |

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(a) Press the starter button for two seconds, then release.

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(b) After 15 seconds open the H.P. cock fully and allow the engine to accelerate to 3,000 ± 200 r.p.m. Check that the j.p.t. does not exceed 710° C. (except momentarily) and settles below 600° C. max. Constantly check fire warning light during start up. If F.T.C. Mod. 101 is embodied check that the inverter indicator goes black.

(c) When the engine is running smoothly switch off the STARTER MASTER switch and have the ground supply battery disconnected.

(d) Should the engine fail to light up, or accelerate to the idling r.p.m. or should the j.p.t. exceed 710° C. (except momentarily) SHUT the H.P. cock. Ensure that all surplus fuel is drained before attempting a further start.

Should excessive fuel have drained onto the ground, have the aircraft moved. Wait until the impeller has stopped rotating before attempting a restart.

(e) If after a second attempt the engine fails to start, the cause should be investigated before any further attempts are made.

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**60. Checks after starting**

| | | |
|---|---|---|
| (a) | Fire warning light | Out |
| | Idling r.p.m. | 3,000 ± 200. |
| | J.p.t. | 600° C. Max. |

| | | |
|---|---|---|
| (b) | R.p.m. | Increase to 4,000. |
| | F.P.I. switch | ON. |
| | R.p.m. increase | 1,000 r.p.m. pre-mod. 1130. 800–900 r.p.m. post-mod. 1130. |

If the desired increase is not achieved the system is unserviceable and the aircraft must not be flown.

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| | | |
|---|---|---|
| (c) | Inverter magnetic indicator | Black. |
| | Generator failure warning light | Out. |
| | F.P.I. switch | Off and check r.p.m. drop to original figure. |
| | V.H.F. | Select Set/Frequency as required. |
| | Throttle | Close. Check idling R.P.M. |
| | Artificial Horizon | Erect if necessary. |
| | Mk. 4F compass | Synchronise and compare with E.2. |
| | D.M.E. | STANDBY. |

| | | |
|---|---|---|
| (d) | Flaps | Up, indicated up. |
| | Airbrakes | Test. |
| | Brake pressure | Min. 200 lb./Max. 450 lb. sq. in. |

## 61. Taxying

(a) The brakes are very effective and the nose wheel is self centring. Consistent with safety, it is better to taxy the aircraft boldly, moderate use of brakes then giving good steering qualities.

(b) Rapid throttle opening at low r.p.m. should be avoided as it may cause excessive j.p.t. and resonance. Use of excessive power when the aircraft is stationary may melt tarmac surfaces due to the downward inclination of the jet efflux.

## 62. Checks before take-off

| | |
|---|---|
| Trim | Neutral. |
| Airbrakes | In. |
| Fuel | H.P./L.P. cocks fully ON. |
| | Fuel pressure warning light out. |
| | Contents. |
| | Booster pump ON. |
| | F.P.I. switch OFF (but see para. 53 (c)). |
| Flaps | Up, indicated up (or 30° if drop tanks are fitted). |
| Instruments | A/H Off flag away, erected, Mk. 4F compass synchronised, annunciating. T. & S. OFF flag away, correct functioning Magnetic indicator—Black, Pitot head heater—ON. |
| Oxygen | Fully ON. |
| | Contents. |
| | Emergency OFF. |
| | High flow. |
| | Connections checked. |
| Hood | Closed and locked. |
| | D.V. Panels shut. |
| Harness | Tight and locked. |

63. **Take-off**

(a) Align the aircraft and nose wheel, then open the throttle smoothly and fully. Check:—**max. permitted for T/O**

| | |
|---|---|
| R.p.m. | |
| J.p.t. | Below 710° C. |
| Fire warning light | Out. |

(b) Keep straight initially by the use of gentle braking until the rudders become effective at 50–55 knots.

(c) Raise the nose wheel at 80–85 knots, maintain this attitude and fly the aircraft off at 110–115 knots at typical service load. At maximum all-up weight raise the nose wheel at 105–110 knots, the aircraft then becomes airborne at 120–125 knots.

(d) When safely airborne

Brake wheels.

Retract undercarriage.

Flaps UP.

Check undercarriage red lights out before 175 knots.

(e) When wing drop tanks are carried, if the undercarriage is not retracted before a speed of 130 knots is reached, the airflow will prevent the undercarriage doors from closing. For this reason 30° of flaps is recommended to reduce acceleration. If the indicator shows that the undercarriage is not fully retracted, yawing the aircraft at about 140 knots should enable it to lock up. Where this is unsuccessful select undercarriage down and climb to a safe height, then reduce speed as far as is practicable and reselect undercarriage up.

(f) At a safe height

| | |
|---|---|
| FPI switch (if used for take-off) | OFF (at full throttle). |
| R/T | Airborne call. |
| | Change frequency as required. |
| | Check call. |
| Pressurisation | ON. |

## HANDLING IN FLIGHT

### 64. Climbing

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(a) Climb within the j.p.t. limitations at the max. permitted r.p.m. up to 25,000 ft. and at 10,350 r.p.m. thereafter. With or without drop tanks fitted climb at 250 knots until 0·60 M is reached, then maintain 0·6 M for the remainder of the climb.

(b) If maximum rate of climb is not essential climb at 10,250 r.p.m. using the same airspeeds.

(c) During the climb the r.p.m. will increase slowly, and it is necessary to reduce power to avoid exceeding the climbing r.p.m. It may also be necessary to reduce r.p.m. in order not to exceed the maximum permissible j.p.t.

### 65. General flying

(a) At all loads the aircraft is pleasant to fly. The ailerons are light and remain effective down to the stall. The elevator is light but comes more sensitive at high speed and should be used with care. Up to 25,000 ft. the aircraft is easy to trim, but above this height the trimmer is less effective. The airbrakes are moderately effective and produce a general airframe buffet at all speeds.

(b) *Changes of trim*

| | |
|---|---|
| Undercarriage UP or DOWN | No change. |
| Flaps DOWN | Marked nose-up. |
| Flaps UP | Nose-down. |
| Airbrakes out | Nose-up. |
| Airbrakes in | Nose-down. |

The nose-up change of trim on selecting airbrakes out becomes more pronounced with increase of speed. When wing drop tanks or 1,000 lb. bombs are carried the change of trim in very pronounced.

### 66. Flying at reduced speed

Reduce speed to approximately 140 knots. Flaps may be lowered 30° if desired. The D.V. panels can be opened up to a recommended maximum speed of 240 knots.

67. **Flying in conditions of severe turbulence**

The recommended speed is 230 knots.

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68. **Pre-stall, spinning and aerobatic checks**

| | |
|---|---|
| Height | Sufficient. |
| Airframe | Undercarriage and flaps as required, Airbrakes test and as required. |
| Security | No loose articles.<br>Harness tight and locked. |
| Location | Clear of built-up areas, airfields and restricted airspaces. |
| Lookout | Clear of other aircraft and cloud. |

69. **Stalling**

(a) Due to the positioning of the pitot head there is considerable fluctuation of the airspeed indicator at the stall. The following table of stalling speeds in therefore only approximate.

| | Typical Service Load | Max. A.U.W. |
|---|---|---|
| | Knots | Knots |
| Undercarriage and flaps UP | 95 | 105 |
| Undercarriage and flaps down | 85 | 95 |

(b) Warning of the approach of the stall is given by slight elevator buffeting commencing about 15 to 20 knots before the stall and increasing as speed is reduced. At the stall the nose drops gently. There is little tendency for a wing to drop at lower altitudes, but at heights above 20,000 feet this tendency becomes more marked and if the aircraft is held in the stall it will roll in either direction into an inverted position.

(c) The position of the airbrakes or the presence of external stores makes no noticeable difference to the stalling characteristics.

(d) In a steep turn warning of a stall is given by elevator buffeting which occurs immediately before the stall. At the stall the aircraft may drop a wing suddenly.

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## 70. Spinning

(a) Intentional inverted spinning is prohibited and is unlikely to occur unless the stick is forcibly held forward. An accidental spin from inverted flight will usually be an erect spin. Practice erect spinning is permitted up to four turns. The minimum recommended entry height is 25,000 feet A.G.L.

(b) To ensure positive entry into the spin, yaw in the required direction should be induced at about 115 knots, i.e. slightly in excess of the stalling speed, by applying full rudder and stick hard back. The elevator trimmer should be neutral.

(c) With the stick held fully back and full rudder applied, the aircraft will then spin or flick roll for one or two turns before adopting a nose-down attitude. For several turns there is marked yawing and pitching with variations in the rate of rotation. After about four turns a further steepening in attitude occurs accompanied by a reduction of the yawing and pitching tendencies and an increase in the rate of rotation.

(d) The standard spin recovery action is:—

(i) Check throttle closed and aircraft clean.
(ii) Confirm that roll (determined visually) and yaw (as indicated by the needle) are in the *same* direction.
(iii) Apply full rudder to oppose the yaw.
(iv) Pause.
(v) With the ailerons neutral move the stick steadily forward until the spin stops. This may require full forward movement of the stick.
(vi) Centralise all controls immediately the spin stops.
(vii) Recover to normal flight.

(e) If the roll and yaw are in *opposite* directions (i.e. the spin is inverted):

(i) Apply full rudder to oppose the yaw.
(ii) Pause.
(iii) With the ailerons neutral move the stick steadily backward until the spin stops. This may require full backward movement of the stick.
(iv) Centralise all controls immediately the spin stops.
(v) Recover to normal flight.

Both erect and inverted spins will sometimes continue for one or two turns after full recovery action has been taken. If the aircraft fails to recover after three turns with full standard spin recovery action applied, carry out the following supplementary spin recovery actions:—

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(f) The supplementary spin recovery action is:—

(i) Check that *correct full* anti-spin control has been applied, ensuring that the rudder is opposed to the indicated yaw.

(ii) Apply full aileron in the direction of roll.

The recovery with aileron in the direction of roll may be characterised by a sharp increase in the rate of rotation for about three turns before the spin suddenly changes to a spiral dive. The ailerons should be centralised immediately to avoid the development of a tight spiral with rapidly increasing airspeed.

(g) If an unintentional spin is entered recover in the incipient stage by centralising the controls and closing the throttle. If this is ineffective full spin recovery action must not be applied until the spin has developed in a downward direction.

Note:—1. If at 15,000 feet the aircraft is still spinning, jettison the canopy. This may aid recovery.

2. If the spin is not under control at 10,000 feet the aircraft must be abandoned. (Altimeter errors and fast rate of descent leave no time for hesitation).

3. The risk of disorientation may be reduced by looking at the horizon through the canopy instead of the ground through the windscreen.

## 71. Aerobatics

(a) Until experience is gained, the following speeds, in knots, are recommended:—

| | |
|---|---|
| Roll .. .. .. | 250–270 |
| Loop .. .. | 300–320 |
| Roll off the top .. | 340–360 |
| Vertical roll | 370 and above |

(b) The centre tank collector box should ensure a supply of fuel for approximately 15 seconds flight under negative G conditions.

(c) Aerobatics are not permitted when carrying external stores.

## 72. High speed flying

(a) The high speed characteristics vary with altitude and individual aircraft, and machmeter errors may be considerable. The following compressibility effects are therefore quoted against approximate indicated mach numbers and reliance should be placed more on the behaviour of the aircraft than on machmeter readings. It is recommended that the performance of the aircraft

is investigated with care until pilots are aware of the high speed characteristics.

(b) *Clean aircraft or with RP's*

At high altitudes the first sign of compressibility is given by a slight lateral rocking at about 0·78M. At this speed there is generally slight airframe buffet and the ailerons are very sensitive. Compressibility effects are, however, not marked, but as speed is further increased porpoising commences reaching a maximum at 0·84M giving considerable stick force as the nose rises. Below 20,000 ft. the symptoms are similar but occur at slightly lower mach numbers and are less marked. When flying with RP's the high mach number characteristics are similar, but become apparent at lower speeds. At high indicated airspeeds the controls become noticeably heavier, and the aircraft must be trimmed into the dive.

(c) *With drop tanks or bombs*

The onset of compressibility is denoted by lateral unsteadiness at about 0·74M and may be accompanied by rudder buffet. As speed is further increased a general airframe buffet becomes apparent. When 1,000 lb. bombs are carried there is a noticeable aileron buffet and increased lateral rocking. Porpoising commences at about 0·76M. Lateral rocking and aileron buffeting is also encountered at indicated airspeeds in excess of 360 knots when aiming 1,000 lb. bombs.

(d) *Recovery*

Recovery is effected by extending the airbrakes and throttling back. Use of airbrakes at high mach numbers or airspeeds produces a sudden nose-up change of trim and an increase in general airframe buffet. When drop tanks are carried the airbrakes are not to be extended above 0·70M.

## CIRCUIT PROCEDURE AND LANDING

### 73. **Circuit procedure**

(a) Join the circuit with sufficient fuel for a landing and possible overshoot, i.e. approx. 450 lb. Select the correct V.H.F. frequency and unmute. Airspeed should be

below 175 knots. A setting of approximately 7,000 r.p.m. will give a circuit speed of 170–175 knots with undercarriage and flaps UP.

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(b) *Downwind vital actions*

| | |
|---|---|
| Airbrakes | IN. |
| Undercarriage | DOWN (below 175 knots). |
| Fuel | Contents. |
| Harness | Tight and locked. |
| Brakes | Check U/C—3 green lights. |
| | Pressure—On—Off—Exhausting. |
| Flaps | As required (below 155 knots for 30°, below 145 knots for full flap). |

(c) *Finals checks*

| | |
|---|---|
| Airbrakes | In. |
| Undercarriage | 3 green lights |

NOTE.—These checks should be completed as soon as possible after starting the final turn, after which the R/T call "Finals, three green" should be made. The call should be completed by the 90° position. Lower flaps as required.

74. **Approach and landing**

(a) *Approach*

(i) The approach should be commenced at 140 knots with approximately 6,000 r.p.m. depending on prevailing wind conditions.

(ii) Lower full flap when required.

(iii) At 400 ft. the airspeed should not be less than 125 knots, and to ensure rapid engine response should it be necessary to increase power, r.p.m. should not be reduced below 5,500 until it is certain that the runway can be reached.

(iv) The roundout should be commenced at the following speeds:—

| | |
|---|---|
| Typical service load .. .. | 100 knots |
| Maximum landing weight .. | 105 knots |

NOTE.—When lowering full flap a marked nose-up change of trim occurs necessitating a large forward movement of the control column. The counteracting force required is not great and should be provided by movement of the control column rather than by retrimming, as the nose-up tendency largely disappears when the flaps are fully down and speed is reduced on the final part of the approach.

(b) *Landing*

The aircraft should not be stalled onto the ground, but the rate of descent checked, and when the main wheels touch, the control column moved gently backwards to keep the nose-wheel off the ground and to provide maximum aerodynamic braking. The elevator remains sensitive at low speeds and coarse movements of this control must be avoided. When the nose-wheel is firmly on the ground, the brakes should be used gently at first as it is possible to cause nose-wheel shimmy by harsh usage. Continuous or intermittent braking may be effected.

NOTE.—Should it be necessary to land with the isolating switch ON the landing run will be longer as the idling r.p.m. will be higher.

75. **Going round again**

(a) Open the throttle fully. Application of power produces a nose-up change of trim, which can be held without retrimming.

(b) Retract the undercarriage.

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(c) Climb at 120 knots. The aircraft has a tendency to sink as the flaps are raised and they should not be retracted below 200 ft. As the flaps raise allow speed to build up to normal climb speeds.

## 76. Instrument Approach

Instrument approach settings:—

| Stage | Approx. engine settings (r.p.m.) | Airspeed (knots) | Action | |
|---|---|---|---|---|
| C.D.T.C. .. | 7,000 | 250 | Airbrakes out | |
| Level .. | 7,800 to 8,000 | 140 | Flap and A/B retracted | Under-carriage down |
| Glide path | 7,800 to 8,000 | 120/130 | One-half flap | |

## 77. Checks after landing

When well clear of the runway:—

Stop the aircraft and check:—

| | |
|---|---|
| Pressurisation | OFF. |
| Flaps | UP. |
| Brake pressure | Sufficient for taxying. |
| No. 2 radio | OFF. |
| Pitot head heater | OFF. |
| D.M.E. | OFF. |

## 78. Stopping the engine

Allow the engine to idle for 30 seconds to stabilise engine temperatures. During this period check:—

| | |
|---|---|
| Booster pump | OFF. |
| Flight instrument switch | OFF. |
| Oxygen | OFF, or line valve (if fitted) OFF. |

After 30 seconds:

| | |
|---|---|
| H.P. cock | OFF. |
| Flaps | Lower fully when engine r.p.m. are less than 1,000. |
| Radio sets | Off. |
| Ground/Flight switch | Ground. |
| Ejection seats | Firing handles safe. |
| Chocks | In position. |
| Brakes | Off. |

# PART V

# *EMERGENCY HANDLING*

## 79. Engine failure in flight

(a) *Mechanical defect*

If the engine fails due to an obvious mechanical defect, set:—

| | |
|---|---|
| Throttle | SHUT. |
| H.P. and L.P. cocks | SHUT. |
| Booster pump | Off. |
| Non-essential electrical services | Off. |

Do not attempt to relight.

(b) *Sudden drop in engine r.p.m.*

If a sudden inexplicable drop in engine r.p.m. occurs, close the throttle and set the isolating switch ON. (If the isolating switch is not switched to ON within 4 seconds there is a probability of flame extinction.) Once the switch has been set to isolate it must be left there and the engine opened up slowly to the desired r.p.m. Idling r.p.m. will be high and landing must be carried out with caution.

(c) *Flame out*

(i) Should the failure be caused by mishandling, set:—

| | |
|---|---|
| Throttle | SHUT. |
| H.P. cock | SHUT. |
| Non-essential electrical services | Off. |

(ii) If flame-out occurs as a result of a fuel system defect e.g., engine pump B.P.C. or from a servo system defect proceed as at (i) above and switch ON the isolating switch, leaving it on for the remainder of the flight. AL.1

## 80. Relighting

(a) The engine is more likely to relight below 25,000 ft. Airspeed during the relight should be 170–180 knots, otherwise the engine tends to overheat, particularly at high altitudes. If because of weather it is desirable to attempt a relight above 25,000 ft., airspeed during the attempt should be 220 knots.

(b) Check:—

| | |
|---|---|
| Throttle | SHUT. |
| H.P. cock | SHUT. |
| Non-essential electrical services | Off. |
| Isolating switch | ON. (If the flame-out is due to a defective fuel system). |
| Booster pump | ON. |

(c) Press the relight button and OPEN the H.P. cock simultaneously keeping the relight button pressed. A relight should occur within 20 seconds.

(d) If height permits, dive aircraft when relight occurs to reduce the risk of high j.p.t. and to help increase r.p.m.

(e) When relit open the throttle carefully to avoid overheating.

## 81. Failure to relight

(a) If the engine fails to relight SHUT the H.P. cock and allow 60 seconds before attempting a further relight to enable the engine to dry out. In an emergency the time may be reduced to 30 seconds.

(b) If a number of unsuccessful attempts are made, relighting may be attempted with the throttle fully OPEN, closing it immediately relight occurs.

(c) The most likely cause of failure to relight will be insufficient voltage. Therefore switch off all non-essential electrical services with the exception of the booster pump before attempting to relight.

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## 82. Action in the event of fire

(a) If a fire warning is given in the air the following actions are recommended.

(b) *Immediate actions*

Close the throttle (if impracticable, eject). Reduce speed to approximately 150 knots, if possible. Check for confirmatory signs of fire, e.g. smoking jet wake, heat, fumes, system or control malfunctioning.

(c) *Subsequent actions*

(i) *Fire warning goes out within 5 secs. (hot gas leak)*

If there are no other signs of fire, prepare to land as soon as possible at the nearest suitable airfield, using minimum necessary power. If the warning comes on again throttle back at frequent intervals to check that it goes out at lower power.

(ii) *Fire warning stays on, no signs of fire*

Decide whether to treat the warning as real or spurious.

If real, continue at (iii) below. If spurious land as soon as possible using minimum power. Be prepared to resume fire drill or eject if there are further signs of fire.

(iii) *Definite signs of fire*

| | |
|---|---|
| H.P. cock | Off |
| L.P. cock | Off |
| Booster pump | Off |
| Extinguisher button | Press when airspeed is 150 knots approx. (if possible). |
| If fire goes out | Warning extinguishes within 30 secs. |
| If fire persists | Eject |

(iv) Carry out the NOXIOUS FUMES drill (see FRC's).

NOTE.—The pressure instruments, control and trim cables are sensitive to engine bay fires. If flight is continued following a hot gas leak or spurious warning or if the fire is extinguished, check the integrity of the elevator trim frequently.

## 83. Undercarriage and flaps emergency operation

(a) As soon as hydraulic failure is suspected ensure that the flap selector lever is at neutral, to avoid possible dumping of hydraulic fluid via the flaps pipelines, and that the windscreen wiper is set OFF.

(b) If the engine-driven hydraulic pump fails and Mod. 3627 is not embodied, the hand pump between the seats at shoulder height can be used to operate the undercarriage

and flaps only, after selecting the desired service by normal selector lever. Up to 115 strokes of the hand pump may be necessary to lower the undercarriage fully.

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**(c) If Mod. 3627 is embodied select the desired service and, if the main accumulator has insufficient pressure, move the EMERGENCY HYDRAULICS lever fully aft.**

(d) In an emergency the undercarriage may be retracted on the ground provided that electric power and a certain minimum hydraulic pressure are available and provided that either U/C OVERRIDE switch is set to up. The hand pump may be used if normal pressure is not available or Mod. 3627 is not embodied.

84. **Bomb and drop tank jettisoning**

Jettison drop tanks or bombs and bomb racks in straight and level flight at any speed up to 260 knots, by pulling back the WING TANKS JETTISON lever.

85. **Flapless landing**

When landing without flaps the approach is very flat and the aircraft requires a long landing run. Speed falls off slowly, and little power is required. Maintain a minimum airspeed of 140 knots until the final turn into wind is completed, then reduce speed to 130 knots for the approach. Cross the runway threshold at 115 knots.

86. **G.G.S. emergency lowering**

If either gunsight fails to lower normally, strike the emergency lowering knob, adjacent to the affected gunsight, a sharp blow with the hand.

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87. **Abandoning the aircraft**

NOTE.—The second pilot should eject first, followed by the captain. The minimum conditions for safe ejection are 200 feet and 120 knots in level flight.

(a) If possible achieve an optimum speed of 200 knots; this however is of secondary importance to aircraft altitude and attitude.

(b) Set the parachute container fully back, lower the seat and visor.

(c) Retract the gun sights and jettison the hood.

(d) Withdraw the feet from the rudder pedals and at the same time grasp the firing handle. The elbows must be drawn in close to the body and both hands must grasp the firing handle with the backs of the hands facing forward.

(e) Draw the handle and face screen firmly over the face keeping the head pressed hard against the headrest. It is not necessary to jerk the handle and in no circumstances should the blind be pulled away from the face as it may not then be possible to fire the cartridge.

(f) After ejection the drogue gun will fire automatically.

(g) If ejection takes place above 10,000 ft. automatic separation will not occur until that height is reached. If ejection has taken place at or below 10,000 ft. automatic separation will take place within three seconds or within 1½ seconds if a G stop is fitted and has not operated.

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(h) *Action if automatic separation fails after ejection:—*

(i) Pull the override " D " ring to isolate the parachute auto device.

(ii) Operate the harness quick release.

(iii) Lift the flap over the parachute " D " ring and grasp the handle.

(iv) Fall clear of the seat and pull the rip cord handle.

NOTE.—If difficulty is experienced in falling clear of the seat, the body should be straightened to free the parachute restraining straps.

(*j*) *Action if the seat fails to eject*

(i) Retract the airbrakes.

(ii) Isolate the auto device by pulling the override " D " ring.

(iii) Roll the aircraft into the inverted position.

(iv) Release the safety harness.

NOTE.—If both seats have failed the captain should remain tightly strapped into his seat until the other occupant has cleared the aircraft.

88. **Crash landing**

(a) Jettison the hood and external stores.

(b) Where power is available make a normal approach and landing, and lower the undercarriage **regardless of the terrain.**

(c) If power is not available glide at 160 knots, the best gliding speed. When manoeuvring to land maintain 140 knots until the selected landing area is within reach.

(d) Lower flaps as required.

(e) Cross the threshold at 105 knots.

89. **Ditching**

(a) The ditching characteristics are believed to be poor due to the probability of the tail booms hitting the water causing a nose-down pitch and subsequent dive in, or the tail booms may break off. It is recommended therefore that the aircraft should be abandoned rather than ditched.

(b) Successful ditchings may be possible in ideal conditions using the following technique:—

(i) Jettison the hood and external stores.

(ii) Lower 10° flaps only and approach with engine assistance if possible.

(iii) Touch-down about 10 knots above normal speed, avoiding a nose-up attitude likely to cause the tail booms to hit the water. If the booms do not hit, the aircraft should plane well on the fuselage.

(iv) To prevent any tendency to porpoise, the rate of descent at touchdown should be at a minimum.

90. **Hood jettisoning**

(a) Successful hood jettison trials have been carried out at speeds between 105 and 280 knots, but the minimum recommended speed is 150 knots.

(b) If the hood jettison fails to operate, unlock the hood by releasing the hood locking catch. Under no circumstances should the handle be gripped.

(c) A certain minimum hydraulic pressure is required to operate the jettison jack. If Mod. 3627 is not embodied, operate the jack by handpump pressure; if it is embodied move the EMERGENCY HYDRAULICS lever aft and then pull the jettison handle.

# PART VI

# *OPERATING DATA*

## 91. Loading and C.G. data

(a) *C.G. limitations*

The following are the C.G. limits, with undercarriage down:

| | |
|---|---|
| Forward limit .. .. | 3·24 in. fwd. of datum. |
| Aft limit (normal) .. .. | 4·404 in. aft of datum. |
| Aft limit (ferrying only) .. | 4·812 in. aft of datum. |
| Total permissible normal C.G. range of movement .. .. | 7·644 in. |

(b) *Loading restrictions*

The loading restrictions are dependent upon the number of guns fitted and are in accordance with the following tables:—

(i) *With two guns*

| Configuration | Clean | With R.P.'s and drop tanks | With practise bombs | With 500 lb. bombs | With 1,000 lb. bombs |
|---|---|---|---|---|---|
| No. of crew .. (See NOTE) | 2 | 2 | 2 | 2 | 2 |
| Max. ammo. .. | 300 | 300 | 300 | 300 | 300 |
| A.U.W. .. | 10,998 | 13,560 | 11,337 | 12,128 | 13,238 |

NOTE.—When flown solo and with full drop tanks, 300 rounds of ammo. or 8 × 60 lb. R.P.'s must be retained (or equivalent ballast carried) until fuel transfer from the drop tanks is complete. This does *not* apply in the ferrying case.

(ii) *With four guns*

| Configuration | Clean | With R.P.'s and drop tanks | With practise bombs | With 500 lb. bombs | With 1,000 lb. bombs |
|---|---|---|---|---|---|
| No. of crew .. (See NOTE) | 1 | 1 | 1 | 1 | 1 |
| Max. ammo. .. | 600 | 360 | 600 | 600 | 360 |
| A.U.W. .. | 11,195 | 13,607 | 11,534 | 12,325 | 13,285 |

NOTE.—When flown with two crew, ammunition *must not* be carried in any of the above configurations in order that the C.G. is kept within the forward limit.

(c) *Effect of expendable stores*

(i) Consumption of drop tank fuel causes the C.G. to move aft.

(ii) Consumption of internal fuel causes the C.G. to move forward, reaching the most forward position when about 230 pounds remain.

(iii) Firing of ammunition and R.P.'s or dropping bombs causes the C.G. to move aft.

## 92. Pressure error corrections

(a) The following are the A.S.I. corrections at sea level:—

| | | | | |
|---|---|---|---|---|
| At .. .. .. | 150 | 200 | 300 and above | knots |
| Add .. .. .. | 0 | 2 | 3 | knots |

(b) The machmeter correction between 0·7 and 0·8 is + 0·01.

## 93. Take-off distances

The approximate take-off distances at sea level, in yards, for various wind and temperature conditions are given

below. For every 1,000 ft. the aerodrome altitude is above sea level increase the above distances by:—

10 per cent. for ground run.

8 per cent. to clear 50 ft.

(a) *Clean aircraft*

| Temperature °C. | | −15 | 0 | +15 | +30 | +45 |
|---|---|---|---|---|---|---|
| Zero Wind | Ground run .. | 560 | 630 | 720 | 820 | 940 |
| | To clear 50 ft. | 1,000 | 1,140 | 1,300 | 1,460 | 1,640 |
| 30 knot Wind | Ground run .. | 290 | 330 | 380 | 430 | 490 |
| | To clear 50 ft. | 610 | 700 | 800 | 900 | 1,000 |

(b) *With drop tanks*

| Temperature °C. | | −15 | 0 | +15 | +30 | +45 |
|---|---|---|---|---|---|---|
| Zero Wind | Ground run .. | 830 | 980 | 1,120 | 1,280 | 1,480 |
| | To clear 50 ft. | 1,480 | 1,680 | 1,920 | 2,200 | 2,520 |
| 30 knot Wind | Ground run .. | 380 | 550 | 630 | 710 | 820 |
| | To clear 50 ft. | 950 | 1,100 | 1,250 | 1,410 | 1,600 |

## 94. **Fuel consumptions**

The following are the approximate fuel consumptions in pounds per hour for various altitudes and power settings.

| Altitude (feet) | At 10,600 r.p.m. | At 10,250 r.p.m. | At best range speed | |
|---|---|---|---|---|
| | | | Clean | With tanks |
| Sea level .. .. | 4,910 | 4,235 | 1,925 | 2,150 |
| 10,000 ft. .. .. | 3,850 | 3,310 | 1,425 | 1,690 |
| 20,000 ft. .. .. | 2,920 | 2,460 | 1,115 | 1,230 |
| 30,000 ft. .. .. | 2,230 | 2,000 | 962 | 1,078 |
| 40,000 ft. .. .. | 1,540 | 1,540 | 880 | 1,078 |

95. **Endurance**

Maximum endurance is obtained at 30,000 ft. Climb to this height at maximum permitted power and cruise at 160–185 knots, depending on the weight. If less than 1,540 pounds remain it will be better to maintain height than expend fuel in a climb. At 160 knots the fuel consumption varies from about 1,380 pounds per hour at sea level to 850 pounds per hour at 30,000 ft.

96. **Flight planning data**

(a) The tables on the following pages show the flight planning data for:—

(i) *Climbing*

The climb table gives the data for climbs in I.S.A. conditions using the speed recommended in para. 64.

(ii) *Cruising*

Each separate altitude block in the cruise table shows:—

1. The speed for maximum range, the approximate A.N.M./100 lb. and the approximate fuel consumption for the particular height. In addition a speed is given, use of any speed between it and the max range speed should not cause more than a 5 per cent. reduction in range.
2. The range obtainable for various amounts of available fuel when flying at the best range speeds for the height. The range given is to the point of let-down, allowance being made for the descent fuel required.
3. The range obtainable for various amounts of available fuel including the distance covered on the climb, if a climb is made to another altitude. In this case the climb must be made at the speed given in para. 64 and the flight continued at the new altitude at the best range speed for that height.

NOTE.—The range at any altitude is independent of temperature, but dependent on the weight of fuel carried.



[*Contd. on p. 74*]

## CLEAN AIRCRAFT

FUEL CONTENTS .. 2,540 lb. AVTAG (7·7 lb./gall.)
2,640 lb. AVTUR (8 lb./gall.)

START-UP, TAXY AND TAKE-OFF ALLOWANCE .. .. .. .. 230 lb.

LANDING ALLOWANCE .. .. 460 lb.
(excluding descent fuel)

## CLIMB DATA

| From | To | Fuel lb. | Dist. (N.M.) | Time (Mins.) |
|---|---|---|---|---|
| Sea Level .. .. | 10,000 ft. | 385 | 10 | 3 |
| | 20,000 ft. | 540 | 30 | 6½ |
| | 30,000 ft. | 690 | 60 | 12 |
| | 40,000 ft. | 920 | 100 | 20 |
| 10,000 ft. .. .. | 20,000 ft. | 155 | 20 | 3½ |
| | 30,000 ft. | 305 | 50 | 9 |
| | 40,000 ft. | 535 | 90 | 17 |
| 20,000 ft. .. .. | 30,000 ft. | 150 | 30 | 5½ |
| | 40,000 ft. | 380 | 70 | 13½ |
| 30,000 ft. .. .. | 40,000 ft. | 230 | 40 | 8 |

Fuel and time figures are from start-up and wheels rolling respectively.
Climb at max. r.p.m. reducing to 10,350 above 25,000 ft.

## DESCENT DATA

| From | To | Lb. | Dist. | Mins. |
|---|---|---|---|---|
| 40,000 ft. .. .. | 30,000 ft. | 23 | 20 | 4 |
| | 20,000 ft. | 53 | 40 | 8 |
| | 10,000 ft. | 114 | 65 | 11 |
| | Sea Level | 177 | 80 | 15 |
| 30,000 ft. .. .. | 20,000 ft. | 30 | 20 | 4 |
| | 10,000 ft. | 91 | 45 | 7 |
| | Sea Level | 154 | 60 | 11 |
| 20,000 ft. .. .. | 10,000 ft. | 61 | 25 | 3 |
| | Sea Level | 124 | 40 | 7 |
| 10,000 ft. .. .. | Sea Level | 63 | 15 | 4 |

AIRBRAKES .. IN
THROTTLE .. .. CLOSED
SPEED .. .. .. 0·65M above 25,000 ft.
250K below 25,000 ft.

## CRUISE DATA—CLEAN AIRCRAFT

| FUEL AVAILABLE | POUNDS | 2,310 | 2,000 | 1,500 | 1,000 |
|---|---|---|---|---|---|
| **Sea Level** | Range | 240 | 200 | 135 | 70 |
| | 10,000 ft. | 320 | 260 | 170 | **75** |
| ANM/100 lb.–13·0 | 20,000 ft. | 400 | 320 | 190 | 60 |
| Lb./min.–31·8 | 30,000 ft. | 445 | 350 | **195** | 45 |
| Best Range Speed–250K | 40,000 ft. | **480** | **360** | 165 | — |
| 95 per cent. Range Speed–360K | | | | | |
| **10,000 ft.** | Range | | 280 | 185 | 90 |
| | 20,000 ft. | | 350 | 220 | **90** |
| ANM/100 lb.–18·8 | 30,000 ft. | | 390 | **235** | 80 |
| Lb./min. 23·8 | 40,000 ft. | | **410** | 215 | |
| Best Range Speed–230K | | | | | |
| 95 per cent. Range Speed–300K | | | | | |
| **20,000 ft.** | Range | | 370 | 240 | **110** |
| ANM/100 lb.–26·0 | 30,000 ft. | | 415 | **260** | 105 |
| Lb./min.–18·5 | 40,000 ft. | | **450** | 255 | 60 |
| Best Range Speed–210K | | | | | |
| 95 per cent. Range Speed–270K | | | | | |
| **30,000 ft.** | | | | | |
| ANM/100 lb.–31·2 | Range | | 430 | 275 | **120** |
| Lb./min.–16·2 | 40,000 ft. | | **480** | **285** | 90 |
| Best Range Speed–190K | | | | | |
| 95 per cent. Range Speed–230K | | | | | |
| **40,000 ft.** | | | | | |
| ANM/100 lb.–39·0 | Range | | **530** | **335** | **140** |
| Lb./min.–14·6 | | | | | |
| Best Range Speed–190K | | | | | |
| 95 per cent. Range Speed–200K | | | | | |
| FUEL AVAILABLE POUNDS | | 2,310 | 2,000 | 1,500 | 1,000 |

## WITH DROP TANKS

FUEL CONTENTS .. 4,080 lb. AVTAG (7·7 lb./gall.)
4,240 lb. AVTUR (8 lb./gall.)

START-UP, TAXY AND TAKE-OFF ALLOWANCE .. .. .. .. 230 lb.

LANDING ALLOWANCE .. .. 460 lb.
(excluding descent fuel)

## CLIMB DATA

| From | To | Fuel lb. | Dist. (N.M.) | Time (Mins.) |
|---|---|---|---|---|
| Sea Level .. .. | 10,000 ft. | 440 | 10 | 5 |
| | 20,000 ft. | 750 | 40 | 10 |
| | 30,000 ft. | 960 | 80 | 19½ |
| | 35,000 ft. | 1,170 | 120 | 27½ |
| 10,000 ft. .. .. | 20,000 ft. | 310 | 30 | 5 |
| | 30,000 ft. | 520 | 70 | 14½ |
| | 35,000 ft. | 730 | 110 | 22½ |
| 20,000 ft. .. .. | 30,000 ft. | 210 | 40 | 9½ |
| | 35,000 ft. | 420 | 80 | 17½ |
| 30,000 ft. .. .. | 35,000 ft. | 210 | 40 | 8 |

Fuel and time figures are from start-up and wheels rolling respectively.
Climb at **max.** r.p.m. reducing to **10,350** above 25,000 ft.

## DESCENT DATA

| From | To | Lb. | Dist. | Mins. |
|---|---|---|---|---|
| 35,000 ft. .. | 30,000 ft. | 23 | 10 | 2 |
| | 20,000 ft. | 53 | 30 | 6 |
| | 10,000 ft. | 114 | 55 | 9 |
| | Sea Level | 177 | 70 | 13 |
| 30,000 ft. .. | 20,000 ft. | 30 | 20 | 4 |
| | 10,000 ft. | 91 | 45 | 7 |
| | Sea Level | 154 | 60 | 11 |
| 20,000 ft. .. | 10,000 ft. | 61 | 25 | 3 |
| | Sea Level | 124 | 40 | 7 |
| 10,000 ft. .. | Sea Level | 63 | 15 | 4 |

AIRBRAKES .. IN
THROTTLE .. CLOSED
SPEED .. .. 0·65M above 25,000 ft.
250K below 25,000 ft.

## CRUISE DATA—WITH DROP TANKS

| FUEL AVAILABLE POUNDS | | 3,850 | 2,640 | 2,000 | 1,500 | 1,000 |
|---|---|---|---|---|---|---|
| **Sea Level** | Range | 395 | 255 | 180 | 120 | 60 |
| | 10,000 ft. | 485 | 320 | 220 | 140 | **60** |
| ANM/100 lb.–11·7 | 20,000 ft. | 625 | 425 | 270 | **155** | 40 |
| Lb./min.–35·9 | 30,000 ft. | **670** | **455** | **265** | 120 | — |
| Best Range Speed–250K | 35,000 ft. | 640 | 445 | 255 | 110 | — |
| 95 per cent. Range Speed–310K | | | | | | |
| **10,000 ft.** | Range | — | 330 | 230 | 155 | **80** |
| | 20,000 ft. | — | 450 | 300 | **185** | 70 |
| ANM/100 lb.–15·6 | 30,000 ft. | — | **495** | **315** | 175 | — |
| Lb./min.–28.2 | 35,000 ft. | — | 485 | 305 | 165 | — |
| Best Range Speed–225K | | | | | | |
| 95 per cent. Range Speed–280K | | | | | | |
| **20,000 ft.** | Range | | 470 | 320 | 205 | **90** |
| ANM/100 lb.–23·4 | 30,000 ft. | | **540** | **360** | **220** | 80 |
| Lb./min.–20·2 | 35,000 ft. | | 530 | 350 | 210 | — |
| Best Range Speed–200K | | | | | | |
| 95 per cent. Range Speed—250K | | | | | | |
| **30,000 ft.** | | | | | | |
| ANM/100 lb.–28·6 | Range | | **580** | **400** | **260** | **120** |
| Lb./min.–17·9 | 35,000 ft. | | 570 | 390 | 250 | 110 |
| Best Range Speed–190K | | | | | | |
| 95 per cent. Range Speed—220K | | | | | | |
| **35,000 ft.** | | | | | | |
| ANM/100 lb.–28·6 | Range | | **575** | **395** | **255** | **115** |
| Lb./min.–17·9 | | | | | | |
| Best Range Speed–185K | | | | | | |
| 95 per cent. Range Speed—200K | | | | | | |
| FUEL AVAILABLE POUNDS | | 3,850 | 2,640 | 2,000 | 1,500 | 1,000 |

(iii) *Descent*

The descent table gives the data for descending from one height to another.

(b) *Use of the tables*

(i) *Pre-flight planning*

Enter the cruise data table in the sea level block at the fuel stage applying immediately after take-off. Select the height at which maximum range is available at that fuel state. The distance available includes distance covered on the climb, but not on the descent. (Absolute maximum range is obtained by adding on the descent distance provided that the let-down is commenced at that distance from the destination). For short range flights inspect the sea level block and select the height at which the distance to be covered requires the least amount of fuel. This is the best altitude for the flight.

(ii) *In-flight planning*

At any stage of a flight the available range may be ascertained by applying the fuel state to the level flight range in the particular block. If an increase in range is required, or if a climb has to be made, the new available range may be obtained by entering the existing block at the particular fuel state and moving vertically downwards within the block until the new altitude is reached. Figures in heavy type indicate the best altitude for the maximum increase in range. Above these heights no further range increase is possible. If a descent is necessitated the new range is shown by moving direct from the existing altitude level flight range for the particular fuel state to the new altitude level flight range.

# PART VII

# *ILLUSTRATIONS*

## KEY TO FIGS. 1, 2 AND 3

1. Cabin temperature/pressure selector
2. Oxygen line valve control lever
3. H.P. fuel cock lever
4. Relight button
5. Throttle lever (port)
6. Press-to-transmit switch
7. L.P. fuel cock lever
8. Elevator trim control
9. Airbrakes control
10. Flaps control (port)
11. Undercarriage control (port)
12. Oxygen regulator (port)
13. Windscreen wiper control
14. Hood opening control
15. Undercarriage emergency up override selector switch
16. Wheelbrakes pressure gauge
17. Selector dimmer control
18. Fuel contents gauge
19. Elevator trim position indicator
20. Accelerometer (in port GGS mounting)
21. Port GGS emergency lowering control
22. Undercarriage/throttle warning light
23. Port GGS master switch
24. Undercarriage position indicator
25. Cabin pressure altimeter
26. Cabin pressure low warning light
27. Machmeter
28. Filament test button for fire warning light
29. Fire warning light and extinguisher button
30. Flap position indicator
31. Starboard GGS master switch
32. Starter master switch
33. Instruments inverter switch
34. Starboard GGS
35. Downward identity lights switch
36. Starboard GGS emergency lowering control
37. Emergency lamp switch
38. Landing lamp control

39. Rebecca 8 control panel
40. Camera gun switches
41. GGS retraction circuit breakers
42. Instructor/pupil GGS changeover switch
43. Camera test switch
44. Oxygen regulator (stbd.)
45. Bombs/RP selector and master switches
46. Navigation lights switch
47. Pitot head heater switch
48. HP pump isolating switch
49. Booster pump switch
50. Inverter reset button
51. Inverter failure indicator
52. No. 2 VHF set and changeover switch
53. Ground/Flight switch
54. Undercarriage emergency up override selector switch
55. Windscreen de-icing pump control
56. Hood jettison control
57. No. 1 VHF set
58. Radio muting switch
59. Guns/RP selector
60. Guns/MRP/SRP selector
61. Hand fire extinguisher
62. Flaps control (stbd.)
63. Ventilation louvre (stbd.)
64. IFF control switches
65. Undercarriage control (stbd.)

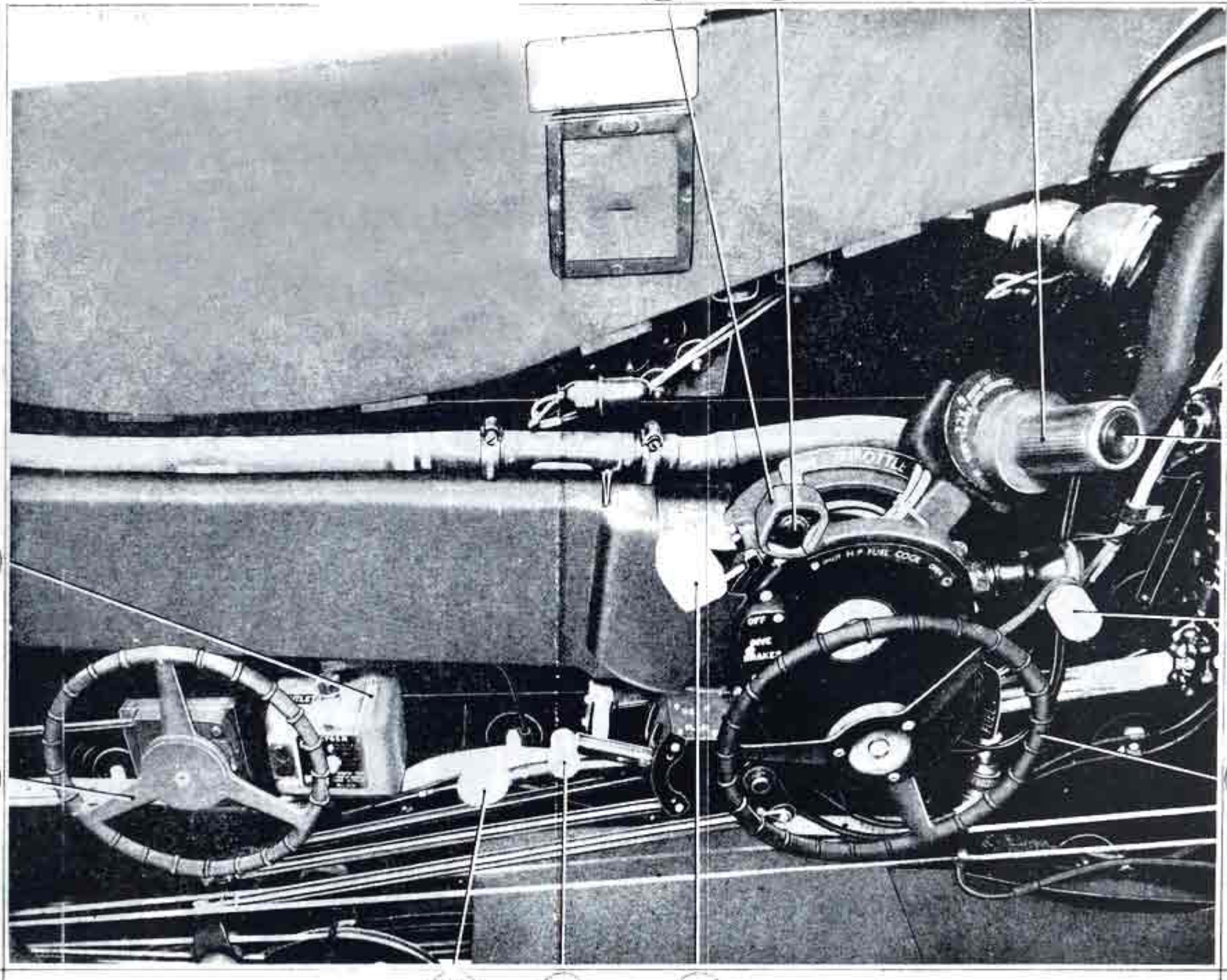
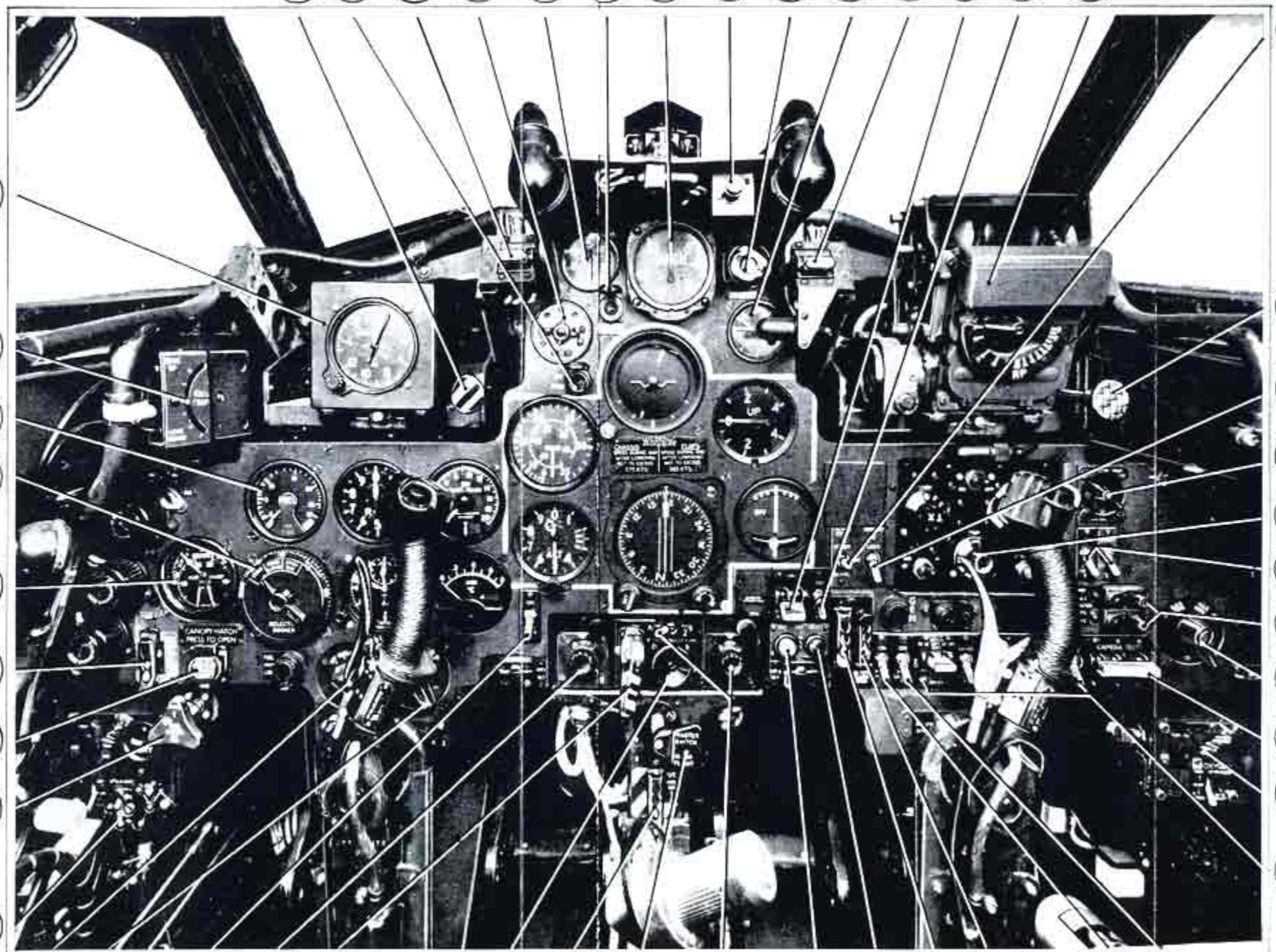



FIG 1

COCKPIT-PORT SIDE

FIG 1




COCKPIT - FORWARD VIEW

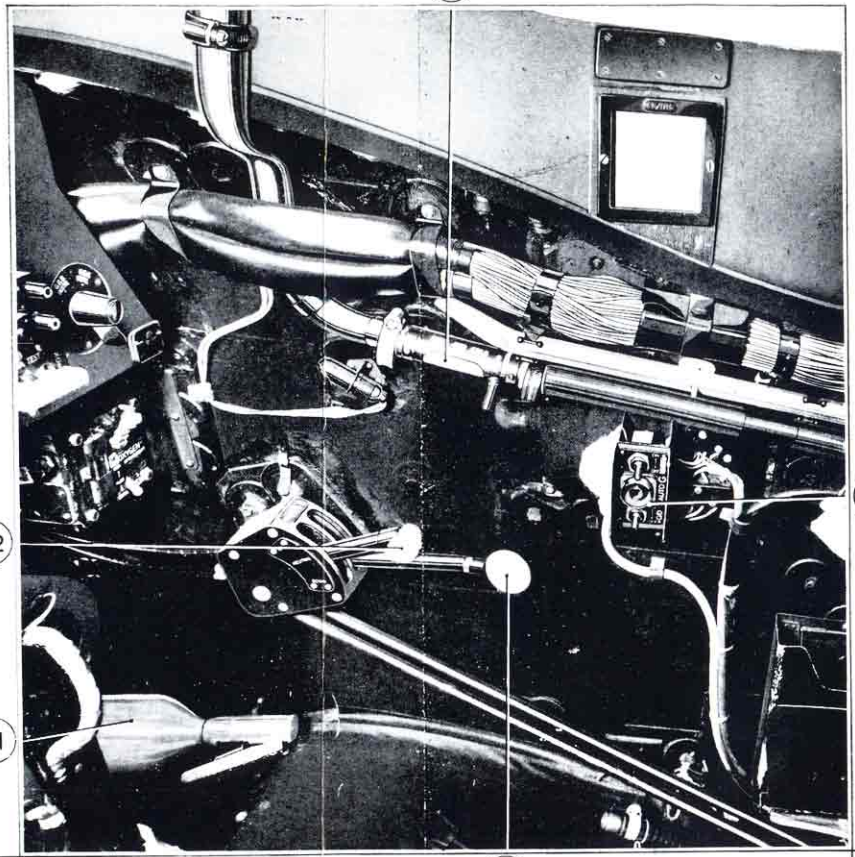



FIG 3

COCKPIT-STARBOARD SIDE

FIG 3

# CHECK LISTS

## CHECKS BEFORE TAKE-OFF

| | |
|---|---|
| Trim | Neutral. |
| Airbrakes | In. |
| Fuel | H.P./L.P. cocks fully on.<br>Fuel pressure warning lights out.<br>Contents.<br>Booster pump ON<br>F.P.I. switch OFF (see para. 53 (c)). |
| Flaps | UP, indicated up (or 30° if drop tanks are fitted). |
| Instruments | A/H OFF flag away, erected. Mk. 4F compass synchronised, annunciating. T. & S. OFF flag away, correct functioning. Magnetic indicator black.<br>Pitot head heater—ON. |
| Oxygen | Fully ON.<br>Contents.<br>Emergency OFF.<br>High flow.<br>Connections checked. |
| Hood | Closed and locked<br>D.V. panels shut. |
| Harness | Tight and locked. |

## CHECKS BEFORE LANDING

| | |
|---|---|
| Airbrakes | In. |
| Undercarriage | DOWN (below 175 knots). |
| Fuel | Contents. |
| Flaps | As required (below 155 knots for 30°, below 145 knots for full flap). |
| Harness | Tight and locked. |
| Brakes | Check U/c—Three green lights.<br>Pressure–ON–OFF–Exhausting. |

## THRESHOLD SPEEDS

| | |
|---|---|
| Max. weight | 105 knots. |
| T.S.L. | 100 knots. |
| Flapless | 115 knots. |

Outside rear cover A.L.3

## INSTRUMENT APPROACH

| | R.P.M. | Speed | Action |
|---|---|---|---|
| C.D.T.C. | 7,000 | 250 | A/B Out |
| Level | 7,800-8,000 | 140 | u/c Down |
| Glide Path | 7,800-8,000 | 120/130 | ½ flap |

Outside rear cover A.L.3

## ENGINE LIMITATIONS

| | |
|---|---|
| Take-off and operational necessity (15 mins.) | *†10,750 r.p.m. 710°C |
| Intermediate (20 mins.) | 10,350 r.p.m. 660°C |
| Max. continuous | 10,250 r.p.m. 650°C |
| Ground Idling | 3,000±200 r.p.m. 600°C |

*10,350 r.p.m. above 25,000 ft. †RAF users restricted to 10,650 r.p.m.

# EMERGENCY DRILLS

## ENGINE FAILURE

(a) Mechanical

| | |
|---|---|
| Throttle | SHUT |
| H.P. & L.P. Cocks | SHUT |
| Booster pump | Off |
| Non-essential electrics | Off |

Do not attempt to relight.

(b) Drop in engine speed. Throttle back and put isolating switch ON within 4 secs. Leave switch at ON until after landing. Use throttle carefully.

(c) Flame-out

| | |
|---|---|
| Throttle | SHUT |
| H.P. cock | SHUT |
| Non-essential electrics | Off |

## RELIGHTING

| | |
|---|---|
| Altitude | Below 25,000 ft. |
| Airspeed | 170–180 knots |
| Throttle | SHUT |
| H.P. cock | SHUT |
| Non-essential electrics | Off |
| Isol. switch | ON (if defective fuel system) |
| Booster pump | ON |

Press relight button and open H.P. cock simultaneously keeping button pressed. When relit dive aircraft if possible to reduce j.p.t. Use throttle carefully.

If relight fails try again after 60 secs. (30 sec. in emergency). If several relight attempts are unsuccessful, try with throttle OPEN.

Close throttle immediately after relight.

## ACTION IF FIRE OCCURS

1. Close throttle immediately.
2. Turn off H.P. and L.P. cocks.
3. Switch off booster pump.
4. Reduce airspeed to 150 knots and press extinguisher button.
5. Set oxygen to emergency and turn off cockpit pressure.
   If fire persists—abandon.

Inside rear cover .. L.3

## ABANDONING (min. height/speed—200 ft./120K) (level flight)

1. Reduce speed to 200 knots if possible.
2. Set parachute container fully aft.
3. Lower seat and visor.
4. Retract GGS and jettison hood.
5. Feet from rudder pedals.
6. Grasp firing handle.
7. Head back hard on rest.
8. Pull handle over face.
   Drogue fires automatically—auto-separation below 10,000 ft.

Failure of auto-separation.

1. Pull override D-ring.
2. Operate seat harness quick release.
3. Raise and grasp parachute D-ring.
4. Fall clear and pull D-ring.

Failure to eject.

1. Retract airbrakes.
2. Pull override D-ring.
3. Invert aircraft.
4. Release safety harness (captain last).

## UNDERCARRIAGE AND FLAPS EMERGENCY A.L.1

Select service and use the handpump or, if Mod. 3627 embodied, move EMERGENCY HYDRAULICS lever aft.

Flaps neutral and windscreen wiper OFF before lowering undercarriage.

## CRASH LANDING

1. Jettison hood and external stores.
2. If power available make normal approach with u/c as required.
3. Power off-glide 160 knots. Manoeuvre at 140 knots.
4. Lower flap as required.
5. Cross threshold at 105 knots.

## DITCHING

1. Jettison hood and external stores.
2. Lower flaps 10° and use engine approach if possible.
3. Touch down 10 knots above normal. Avoid nose-up attitude.
4. Keep rate of descent at touchdown to a minimum.