2.

RESTRICTED

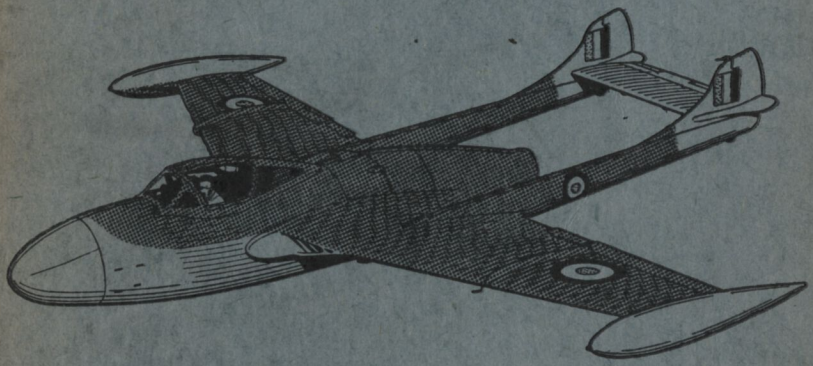
1st Edition

A.P.4335C—P.N.

T.P.

PILOT'S NOTES

VENOM N.F.3



Prepared by Direction of the Minister of Supply

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Promulgated by Order of the Air Council

J. H Barnes

not in charge to HQB

RESTRICTED

AIR MINISTRY
May, 1956

Amendment List No. 1
to A.P.4335C—P.N.
Pilot's Notes

VENOM N. F. 3.

NOTE.—1. Incorporation of this Amendment List must be certified by inserting the date of incorporation and initials in the spaces provided on page 1.

2. When a manuscript amendment is made, the adjacent margin should be endorsed with the AL number, viz., "A.L.1."

3. When the Amendment List is fully incorporated, *affix* this sheet to the inside front cover of the Notes.

PAGE	PARA.	AMENDMENT
1	NOTES TO USERS	*Amend* first paragraph by gummed slip herewith.
1	LIST OF ASSO-CIATED PUBLI-CATIONS	Item 5 *amend* to read 1641F. Item 12 *amend* to read 2538 HA.
12	7, line 2	*Amend* "16 pints" to read "18 pints".
13	11(i)	*Amend* by gummed slip herewith.
14	11(ii) contd.	*Amend* by gummed slip herewith.
17	16(i)d, line 13	*Delete* "when in manual".
18	18(iii)	*Amend* by gummed slip herewith.
22	27(ii) last line	*Amend* "white" to read "black".
26	—	*Amend* by gummed page herewith.
28	38	*Amend* by gummed slip herewith.
29	—	*Amend* by gummed page herewith.
31	—	*Amend* by gummed page herewith.
32-33	44	*Amend* by two gummed slips herewith.
39	52	*Amend* NOTES by gummed slip herewith.
42	57(i) line 1	*Amend* "speds" to read "speeds".
45	—	*Amend* by gummed page herewith.
48	65	*Amend* by gummed slip herewith.
49	66(ii) (d)	*Delete* from "If difficulty" to "open position".
49	66(ii) (g) IMPOR-TANT	*Delete* this note.
50	—	*Amend* by gummed page herewith.
51	—	*Amend* by gummed page herewith.
53	70(i)	*Amend* by gummed slip herewith.
54	74	*Add* at end of line 4 "(on regulator)".

NOTES TO USERS

A.L.1 Notes to Users Page 1

These Notes are complementary to A.P.129 (6th Edition) Flying, and assume a thorough knowledge of the chapters which are 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.4335C.—P.N.

Comments and suggestions should be forwarded to the Officer Commanding, Handling Squadron, Royal Air Force, Boscombe Down, Wiltshire.

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

A.L. NO.	INITIALS	DATE	A.L. NO.	INITIALS	DATF
1	Dfd.	18-4-57	4		
2			5		
3			6		

VENOM N.F.3

LIST OF ASSOCIATED PUBLICATIONS

	A.P.
Cine-camera and G.G.S. recorder	1355D
Cold air unit	4340
Electrical equipment manual	1095A to C
Engine — Ghost Mk. 104	4320B
Hispano 20 mm. guns	1641B & F
Hydraulic equipment — Lockheed	1803B, C
Instrument manual	1275A to E
Intercommunication A1961	2876E
Pneumatic compressor	1519
Pneumatic equipment — Hymatic	4303C
R.P. installations	2802A
Transmitter — receiver TR1934	2538H & A
Turbo starter — Teddington	1181
Turbo starter cartridges	1661F
Windscreen de-icing system	1464D

AIR MINISTRY
April, 1955

A.P.4335C—P.N.
Pilot's Notes
1st Edition

VENOM N.F.3

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MAIN SERVICES

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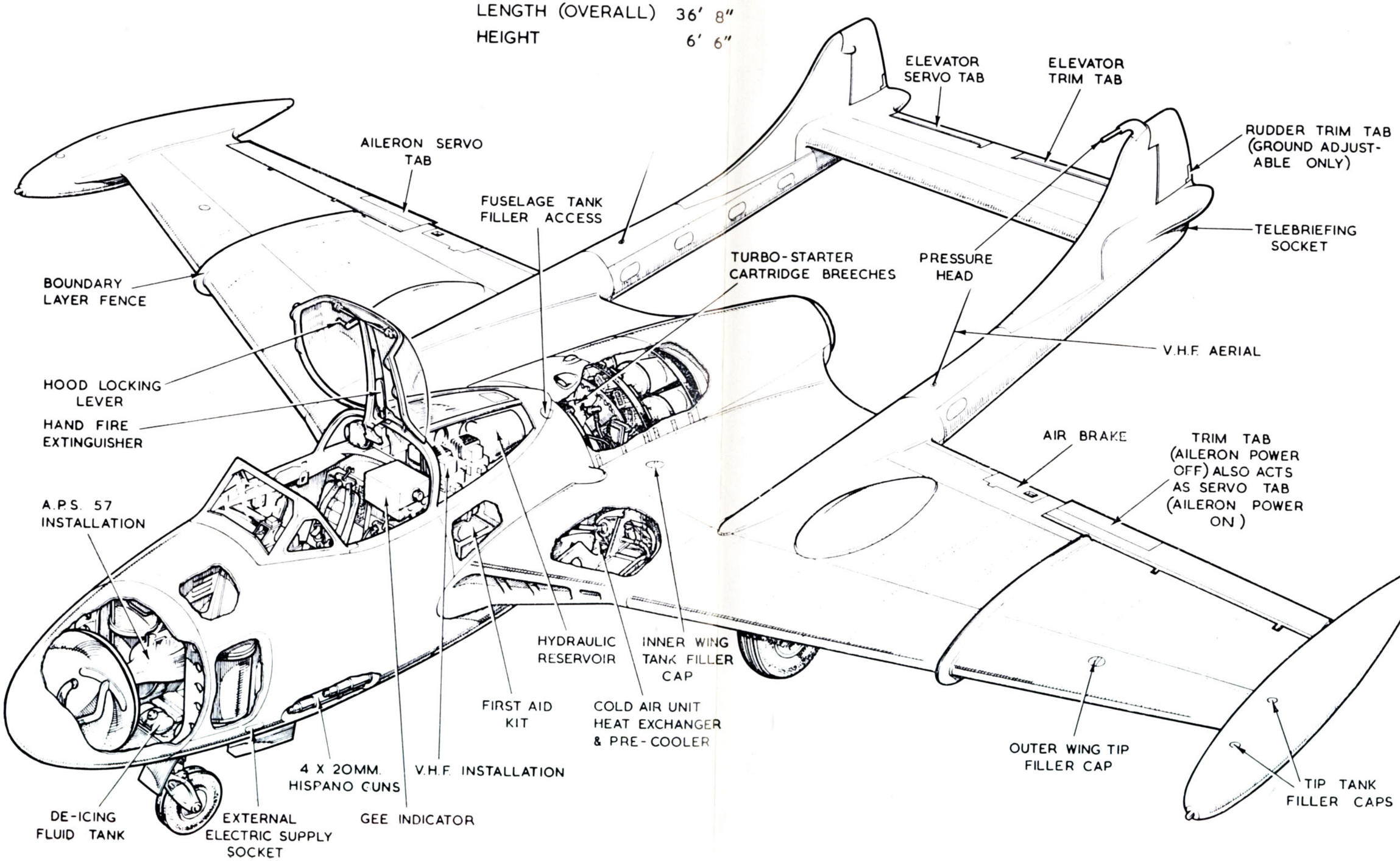
MAIN DIMENSIONS :— WING SPAN 42′ 9″
LENGTH (OVERALL) 36′ 8″
HEIGHT 6′ 6″



VENOM NF 3

COCKPIT EQUIPMENT

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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 VI.

(c) Unless otherwise stated, all airspeeds and mach numbers quoted are 'indicated'.

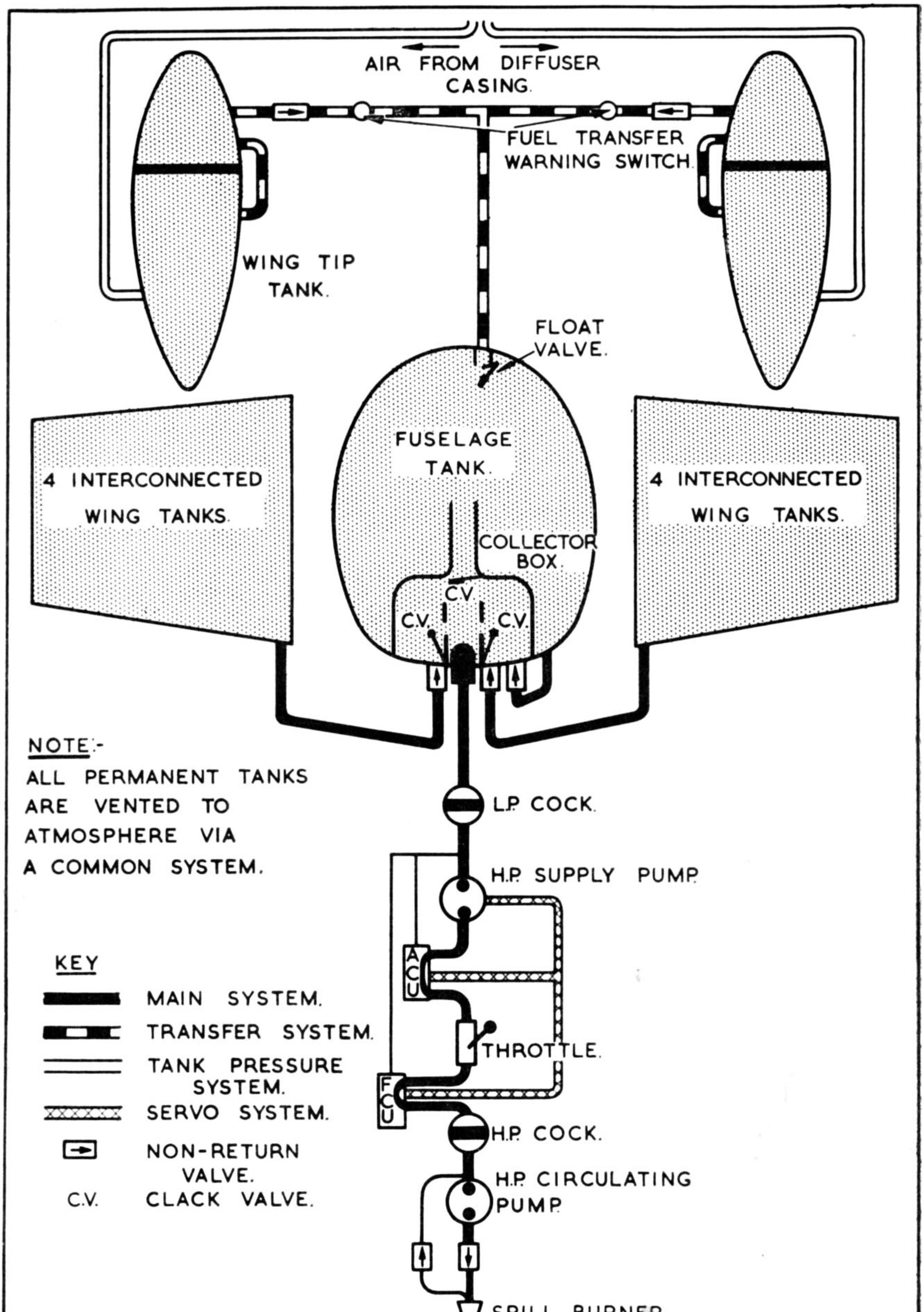
1. **Introduction**

The Venom N.F.3 is a two-seater night fighter powered by a Ghost Mk. 104 turbo-jet engine, developing 4,950 lb. static thrust at sea level. It is basically the same as the Venom N.F.2, but is equipped with A.P.S.57 search equipment, and has power-operated ailerons. The cockpit is pressurized, and four 20 mm. guns are mounted, two on each side of the nose.

FUEL AND OIL SYSTEMS

2. **Fuel tanks**

(i) Nine internal fuel tanks are fitted, one in the fuselage and four in each wing. A drop tank can be attached to each wing tip. Provision is made for fitting pylon tanks.



NOTE:-
ALL PERMANENT TANKS ARE VENTED TO ATMOSPHERE VIA A COMMON SYSTEM.

KEY

- MAIN SYSTEM.
- TRANSFER SYSTEM.
- TANK PRESSURE SYSTEM.
- SERVO SYSTEM.
- NON-RETURN VALVE.
- C.V. CLACK VALVE.

FUEL SYSTEM DIAGRAM

The tank capacities are as follows:—

	Gall.	lb. AVTAG
Fuselage tank	90	692
Two wing root tanks (2 × 59) ...	118	908
Six wing tanks	134	1,030
Total internal capacity ...	342	2,630
Two wing-tip drop tanks (2 × 81)	162	1,248
Total	504	3,878

All the internal tanks are pressure-vented to atmosphere via a common outlet. The drop tanks are pressurized, to enable fuel to be transferred by air pressure.

(ii) *Collector box*

The collector box in the base of the fuselage tank contains enough fuel to keep the engine running up to the limit of ten seconds under negative loading, or when flying in attitudes near the vertical.

(iii) *Unusable fuel*

Between 10 and 22 gallons of fuel are unusable, depending on the aircraft attitude, the amount increasing with aircraft tail-down attitude.

3. Fuel contents gauge

A Pacitor (electrically-operated) type fuel contents gauge (38) at the top right-hand side of the instrument panel gives the combined contents of all the internal tanks (full —342 gallons). There is no gauge for the wing-tip tanks.

NOTE.—There is an error in the reading on the gauge when fuels other than AVTUR are used, as the gauge is calibrated for AVTUR. (SG = 0.80.) If fuel of greater specific gravity is used, the gauge will over-read; lesser specific gravity, under-read. Later aircraft will be fitted with mass unit gauges. The indications of such gauges are more accurate than the volumetric calibrated gauges.

4. Fuel transfer system and indicators

(i) The engine is fed with fuel from the collector box in the bottom of the fuselage tank, and the fuel from the internal wing tanks is fed by gravity to the collector box. The fuel from the wing-tip tanks is automatically transferred to the fuselage tank by air pressure from the engine. Transfer takes place before fuel is used from the internal wing tanks and commences when approximately 15 gallons have been used from the fuselage tank, the rate of transfer being controlled by a float-valve near the top of the tank.

(ii) Two magnetic indicators (39) are fitted at the top of the right-hand instrument panel beside the fuel contents gauge. They show black when transfer from the wing-tip tanks and pylon tanks is taking place or when no electrical supply is available, and white when transfer is not taking place.

(iii) When the level in the fuselage tank has fallen sufficiently (30-40 gallons remaining), transfer starts from the internal wing tanks, by gravity only.

5. Fuel feed to the engine

(i) *Low pressure*

A booster pump in the base of the fuselage tank delivers fuel through the L.P. cock to two engine-driven H.P. fuel pumps.

If the booster pump fails, fuel bypasses the pump by gravity. A low pressure warning indicator (42) at the right-hand side of the instrument panel shows white when the pump delivery pressure falls below $1\frac{1}{2}$ lb./sq. in., (or when the pump is switched off). A socket and switch (47) are fitted on the starboard shelf and are for ground test use only.

(ii) *High pressure*

(a) A spill-flow fuel system is provided. The spill burner is similar in operation to the Simplex burner

with the addition of a passage to spill excess fuel away. Fuel is supplied to the burner swirl chambers at a continuous high pressure. As fuel demand decreases with increasing altitude or decreasing r.p.m. surplus fuel is returned from the burner, leaving less to pass through the atomizing orifice.

(b) To achieve this, two engine-driven pumps are employed; an H.P. supply pump to feed fuel to the throttle and an H.P. circulating pump to supply fuel to the burner inlets and to draw the excess fuel from the burners via a return spill line. Only the supply pump incorporates an overspeed governor.

(c) An acceleration control unit (A.C.U.) is connected downstream of the H.P. supply pump and a flow control unit (F.C.U.) downstream of the throttle. The A.C.U. and the F.C.U. are operated by a common servo control system connected to the H.P. supply pump. The F.C.U. controls the fuel flow past the throttle valve by maintaining a constant fuel pressure for any given altitude or forward speed. The A.C.U. adjusts the fuel flow from the supply pump, only under conditions likely to lead to rich extinction (i.e. during throttle opening). It then temporarily overrides the F.C.U. (through the servo system) to ensure an acceptable air/fuel mixture.

(d) The H.P. cock lever controls the fuel flow from the throttle to the H.P. circulating pump.

6. **Fuel controls**

(i) *Booster pump switch*

The booster pump is controlled by a switch (41) marked FUEL PUMP switch, at the right-hand side of the instrument panel. The circuit-breaker (54) is on the starboard control panel.

(ii) *L.P. cock lever*

The L.P. cock lever (2) is on the underside of the engine control box and is marked FUEL OFF (down and aft)

and FUEL ON (forward and up). The L.P. cock should be closed in the event of an engine fire, but must not be used to stop engine, except in an emergency, as the H.P. pumps will be damaged, and the fuel system aerated.

(iii) *H.P. fuel cock lever*

The H.P. fuel cock lever (10) is to the rear of the throttle lever on the engine control box, and is marked ON (up) and OFF (down). A catch secures the lever in the up position. This lever must always be used to stop the engine; it must also be closed if the engine fails. A re-light button is incorporated in the end of the lever.

(iv) *Fuel tank jettisoning*

The wing-tip tanks may be jettisoned electrically by pressing the outboard switch (9) to the left on the port shelf behind the throttle box. They can also be jettisoned mechanically by pulling back the outboard lever aft of the port shelf. The pylon tanks are jettisoned by the inboard switch (9) to the right or by the inboard lever.

7. **Oil system**

Oil is carried in the engine sump only, the capacity of which is 18 pints. An oil temperature gauge is at the bottom of the instrument panel.

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ENGINE CONTROLS

8. **Throttle control**

The throttle lever (14) which moves in a quadrant marked SHUT—THROTTLE—OPEN, is on the throttle box on the port side of the cockpit. The lever incorporates a V.H.F. press-to-transmit button. A friction damper (13) is on the inboard side of the box, and is rotated clockwise to tighten.

9. **Engine starting system**

(i) The engine is started by a cartridge system. The engine STARTER MASTER switch (34) to the right of the

instrument panel above the radar crate must be on to engergise the firing circuit. The cartridge is fired by pressing in the button (35) marked STARTER next to the master switch; the button is then held in electro-magnetically for 30 seconds, and during this time the high-energy ignition system is in operation. The delay prevents a second cartridge being fired too soon after a misfire. During a normal start, the turbo-starter brings the engine r.p.m. up to approximately 1,500. The r.p.m. will then drop to approximately 1,100-1,200 when a light up should occur. The engine should then accelerate to the normal idling speed of 3,000 r.p.m.

(ii) The starter system contains two cartridges; the second one is auto-selected as the starter button resets. A stowage for four spare cartridges is in the port flap compartment.

10. Relighting control

An engine relighting pushbutton is incorporated in the end of the H.P. cock lever (10). It should be pressed to energise the igniter plugs when relighting in flight, and may be used as an audible check that the H.E. ignition is functioning before starting up. The relight system will operate irrespective of the position of the engine starter master switch.

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11. Engine fire-warning light and extinguishers

(i) *Fire-warning*

A fire-warning light is incorporated in the extinguisher push-button (37) at the top right-hand side of the instrument panel. When Mod. 885 is incorporated, a second warning light is fitted adjacent to the pushbutton. The presence of engine fire is indicated by either or both warning lights coming on. Successful extinction of a fire is indicated by the lights going out after carrying out action in the event of fire. The lights may be tested by pulling out the button. After test, the button should be returned gently to its normal position. Mod. 932 introduces a modified pushbutton and warning light with. beside it, a separate pushbutton for testing the light.

(ii) *Fire extinguisher*

Two fire-extinguisher bottles are stowed one in each flap shroud, and are operated by pressing the pushbutton

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(described in (i) overleaf). The contents of the extinguishers are discharged simultaneously through spray nozzles, mounted one on each side of the engine diffuser casing. The system will operate irrespective of the position of the battery isolating switch. The cockpit pressure control must be OFF before operating the extinguishers.

12. Engine instruments

The following engine instruments are provided:—

R.P.M. indicator.
J.P.T. gauge.
Oil temperature gauge.

13. Hydraulic system

(i) A single engine-driven pump provides pressure in the system for the operation of the:

Undercarriage
Flaps
Aileron power
Airbrakes
Wheel brakes
Hood jettison

(ii) Three accumulators are fitted to provide a reserve of hydraulic pressure in an emergency. The main accumulator is connected to all the above services, but its capacity is such as to provide only one one-way operation of the undercarriage, flaps or airbrakes. A second accumulator is connected only to the wheel brakes system, while the third accumulator serves both the aileron power and the wheel brakes. The limited capacity of this third accumulator provides a maximum of only three full aileron reversals in an emergency.

(iii) Failure of the system is given by an audio warning which indicates lack of flow in the system. The audio warning may be cut out by an on/off switch (17).

(iv) If the system fails, a handpump (67) on the right of the pilot's seat can be used to operate *only* the undercarriage. flaps, hood jettison systems, and to charge the wheel brakes accumulator.

(v) On the ground the airbrakes and aileron power circuits may also be tested by the handpump following the opening of a by-pass valve accessible through a door beneath the fuselage port side.

14. **Pneumatic system**

An engine-driven compressor charges an air bottle to a pressure of 450 lb./sq. in. From the bottle the pneumatic supply passes through reducing valves to the hood seal and charges the anti-G system bottle.

15. **Electrical system**

(i) *Supply*

(a) *Generators.* Power is supplied from two generators, each with an output of 200 amps at 28 volts. Generator failure warning lights (29) for the pilot are at the top of the instrument panel, and (52) for the observer on the starboard shelf. A test panel for the generators is at the back of the cockpit fairing.

(b) *Battery.* A 24 volt, 25 amp. hr. battery is mounted on a tray at the rear of the gun bay. The battery may be isolated by means of the switch (53) on the starboard electrical panel.

(c) *External D.C. supply.* An external 24 volt battery may be plugged in at the socket at the front port side of the fuselage. When the external supply is plugged in, the aircraft battery and generators are isolated. There is no ground/flight switch.

(d) *Flight instruments A.C. supply.* Two inverters, MAIN and STANDBY, supply A.C. for the flight instruments (M4. F compass and artificial horizon). The circuit breakers (54) for the two inverters are

on the starboard shelf. The main inverter switch (34) at the top of the instrument panel is linked with the starter master switch, and is labelled STARTER AND FLIGHT INSTRUMENTS. The standby inverter switch (41) at the right-hand side of the instrument panel is linked with the booster pump switch, and is labelled FLIGHT INSTRUMENTS. Both inverters will therefore be on whenever the engine is running, but the instruments are supplied only by the main inverter. If this fails, then the supply is automatically taken up by the standby inverter. A magnetic indicator (55) on the starboard shelf shows white in this event.

(e) *Radar supply*. A.C. supply for the GEE equipment is obtained from an inverter controlled by the switch (48) on the starboard shelf, and for the F.I.S. and A.P.S. 57 equipment from an inverter controlled by the inverter switch and circuit breaker on the starboard electrical panel, above item 51.

AIRCRAFT CONTROLS

16. Flying and trimming controls

(i) *Ailerons*

(a) The ailerons may be operated either hydraulically or manually. Hydraulic operation is selected by a valve (68) on the floor by the right of the pilot's seat. The valve is pushed down for MANUAL operation and pulled out for POWER operation; it is turned clockwise to lock in either position. If hydraulic pressure fails, the aileron control reverts to manual automatically. A red light (at 17) at the front of the port shelf illuminates when hydraulic pressure in the aileron circuit falls or MANUAL is selected.

(b) *Power operation*. Movement of the control column is transmitted by cables to servodynes at each aileron. Artificial feel is provided by a spring strut in the aileron circuit, giving a force proportional to aileron deflection but not to airspeed. The stick position can be adjusted by rotating the strut (1), on the left-hand side of the cockpit, in the natural sense.

(c) *Manual operation.* When hydraulic pressure falls, or is turned off by pushing down the selector valve, ports are opened connecting both sides of the servodyne pistons; manual operation is then obtained.

(d) *Servo-tabs.* Each aileron has a servo-tab, which operates during power operation to relieve loads on the servodynes. When hydraulic pressure falls or is selected off, a pressure switch enables the ailerons to be trimmed by means of an actuator connected to the port servo-tab. The spring-loaded trim switch (4) is on the port shelf and a circuit breaker (57) on the starboard shelf. A trim cut-out switch aft of the trim switch may be used to isolate the actuator in case of a runaway trim. A warning light (at 17) on the port shelf forward of the throttle box lights up when the port aileron tab is not in the neutral position. ~~when in manual.~~ The tab must be in the neutral position with the light out before power is engaged. A.L. 1

(ii) *Elevator*

The elevator is manually operated and has a servo-tab to assist the pilot, and a trimming tab controlled by the handwheel (15) on the engine control box. The trim indicator (12) is on the rear face of the box.

(iii) *Rudder*

The rudder is not power operated. Each rudder has a ground adjustable trim tab. A spring in the rudder circuit supplements the aerodynamic forces in centralising the rudder. The rudder pedals can be adjusted for reach by lifting them and then sliding them forward or aft into the required slot.

17. Flying controls locking gear

(i) *Internal*

A single V-shaped bar assembly secures the pedals and prevents fore and aft movement of the control column. The quick-release pin secured to this assembly is inserted

through the hinge of the upper portion of the column to prevent aileron movement. When not in use, the locking gear is stowed behind the pilot's seat.

(ii) *External*

Clamping blocks are provided for the ailerons. Safety locks, each with a red flag, may be inserted in the radius rods of the main undercarriage struts. Stowage for these locks is provided in the starboard gun-bay door.

18. **Undercarriage**

(i) *Normal operation*

The undercarriage selector lever (26) is on the left of the instrument panel, and is pulled *out and up* to select up. When the wheels are on the ground, the lever is locked in the down position by a solenoid-operated plunger.

(ii) *Position indicator*

A standard undercarriage position indicator (23) is below the lever. Indications are:—

Undercarriage locked up and doors closed	No lights
Undercarriage unlocked	Three red lights
Undercarriage locked down	Three green lights

A red light (25), above the indicator, comes on only if any of the three wheels are *locked up* and the throttle is less than a quarter open. The light is extinguished when *all* the wheels start to come down.

(iii) *Emergency operation*

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If the engine-driven pump fails, and accumulator pressure is exhausted, the undercarriage can be lowered by means of the handpump on the right of the pilot's seat. Before using the handpump set the *flap* selector lever to neutral to prevent possible dumping of hydraulic fluid. Up to 115 strokes of the handpump may be necessary to lower the undercarriage fully and lock it down.

(iv) *Undercarriage emergency override*

The undercarriage can be retracted in emergency when the aircraft is on the ground by first operating the guarded switch (at 17) on the port shelf forward of the throttle box, provided that electric power is available, and then using the normal undercarriage selector.

19. **Flaps**

(i) *Normal operation*

The flaps selector lever (11) is on the rear face of the engine control box. There are three positions on the selector lever quadrant, UP—NEUTRAL—DOWN. Any degree of flap movement may be obtained by selecting and then returning to neutral after the required position is reached. If it is necessary in emergency to conserve accumulator pressure, the lever should be returned to neutral after the flaps are fully down but may be left in the up position when they are up.

(ii) *Position indicator*

A flaps position indicator (24) is fitted at the left-hand side of the instrument panel. It is connected to the right-hand flap only, and may give a false reading for intermediate flap settings on the ground. When the flaps are under air load, the indication is correct.

(iii) *Emergency operation*

The flaps may be operated by the handpump after normal selection, if the engine-driven pump fails and the main accumulator is exhausted.

20. **Airbrakes**

(i) *Normal operation*

The airbrakes are operated by a lever (16) extending from the top of the engine control box. No intermediate settings are available.

(ii) *Emergency operation*

The airbrakes cannot be operated in flight by the hand-pump.

21. Wheel brakes

The maxaret wheel brakes are operated by a lever, incorporating a parking catch, on the control column, and differential braking by use of the rudder bar. The available pressure in the system (2,400 lb./sq. in. max.) and at each wheel brake (1,500 lb./sq. in. max.) is indicated on the triple-reading pressure gauge (17) on the port shelf. This pressure allows several full applications of the brakes if the main system has failed, and in this event the pressure will fall to 1,400 lb./sq. in. as the brakes are used. At this point the accumulator will be fully discharged and the gauge reading will drop rapidly to zero. Pressure may however be restored by use of the handpump. The maxaret units permit the use of full braking without the possibility of wheel locking and consequent tyre damage. The units can only come into operation when the wheels are rotating. In no circumstances should the brakes be applied until after touchdown

COCKPIT EQUIPMENT

22. Access to cockpit

The cockpit is entered by means of a retractable footstep on the port side of the fuselage; this footstep normally retracts as the weight of the foot is removed.

Alternatively the cockpit may be entered by means of a ladder which can be locked in a ferrule on either side of the cockpit.

23. Hood operation

(i) *Opening the hood from outside*

The flush-fitting external release handle is housed centrally just aft of the hood. A pushbutton on the handle

is pressed to make the handle spring out of its housing; the handle is then turned anti-clockwise through 90° to release the hood lock (some force may be necessary). The hood can then be raised by hand; an arrangement balances the hood in any position, making movement up or down easy. When fully open, it is locked by a spring-loaded catch acting on the hood strut.

(ii) *Closing the hood from inside*

The hood is lowered by hand after operating the hood balance arm release knob marked HATCH STRUT RELEASE and locked when closed by pulling the large handle, at the top and centre of the windscreen, back and up. When this is done, a locking lever, next to the internal handle, should snap forward onto the handle—if it does not, it should be pushed forward. The locking lever, when fully forward, inflates the hood seal in addition to preventing any inadvertent operation of the handle.

24. Hood jettisoning

(i) *Hydraulic jettisoning*

The hood may be jettisoned hydraulically by pulling up the handle (69) on the cockpit floor, forward and to the right of the pilot's seat. When the handle is pulled up, a Bowden cable releases the hood at the rear end; at the same time a jack is operated, throwing the hood open.

(ii) *Manual jettisoning*

If the hydraulic mechanism fails or the Bowden cable breaks, the hood can be jettisoned manually as follows: the ring handle just to the right-hand side of the hinge mechanism is pulled out—this releases the rear end of the hood which is then opened normally at the front by releasing the locking lever and pushing the internal handle down and forward. Care must be taken to keep the hand unclenched to avoid snatch of the wrist when the hood suddenly lifts.

NOTE.—Attempts to jettison manually by first opening the hood in the normal way, and then pulling the ring handle, must never be made.

25. Cockpit lighting

(i) Eight red flood lamps and four U/V lamps are fitted at various places in the cockpit, including one of each on the forward face of the control column. The master and dimmer switches (6) are all on the switch panel on the port shelf.

(ii) A single amber emergency lamp fed from a small dry battery is fitted on the port wall and is controlled by a switch (40) to the right of the j.p.t. gauge.

26. Seat and harness adjustment

(i) *Seat*

The pilot's seat can be raised or lowered by a lever (66) on the right of the seat; a plunger at the top must be depressed before the lever can be moved. The observer's seat is not adjustable.

(ii) *Harness release*

The lever for the pilot's harness release is on the cockpit port wall. The observer's harness release is on the starboard wall of the cockpit.

27. Oxygen system

(i) A pressure-demand system is fitted. Oxygen is stored in three cylinders.

(ii) The pilot's regulator (46) is just by his right leg; the observer's regulator (63) is on the starboard panel. A contents gauge (18) is below the instrument panel. Additional magnetic flow indicators, (43) for the pilot, and (36) for the observer, are at the right-hand side of the instrument panel. These show alternate white and black when oxygen flow is available. Failure of oxygen supply is shown by a permanent ~~white~~ black indication.

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(iii) The Mk. 17C regulator has the following controls:—

(a) ON/OFF valve—controls the flow of oxygen.

(b) Air-dilution NORMAL—100% OXYGEN valve—controls the flow of air.

(c) Three-position EMERGENCY SWITCH.

(d) Flow and blinker unit.

When the ON/OFF valve is ON and the dilution valve is at NORMAL, an air/oxygen mixture is fed to the mask up to a height when 100% oxygen is automatically delivered. When the dilution valve is at 100% OXYGEN, no air is added, irrespective of the height. This position should be selected if any symptoms of anoxia are present. The emergency switch, when moved to either right or left, admits oxygen under greater pressure. Normally it should be central, but should be offset if cabin pressure failure occurs. The mask may be tested before flight by firmly pressing in the emergency valve, when in the central position; oxygen is then supplied under pressure. The firmer the switch is pressed the greater the pressure (up to five times that obtained with the switch in either side-position). The mask can then be adjusted until no leaks are present.

28. **Cockpit air conditioning**

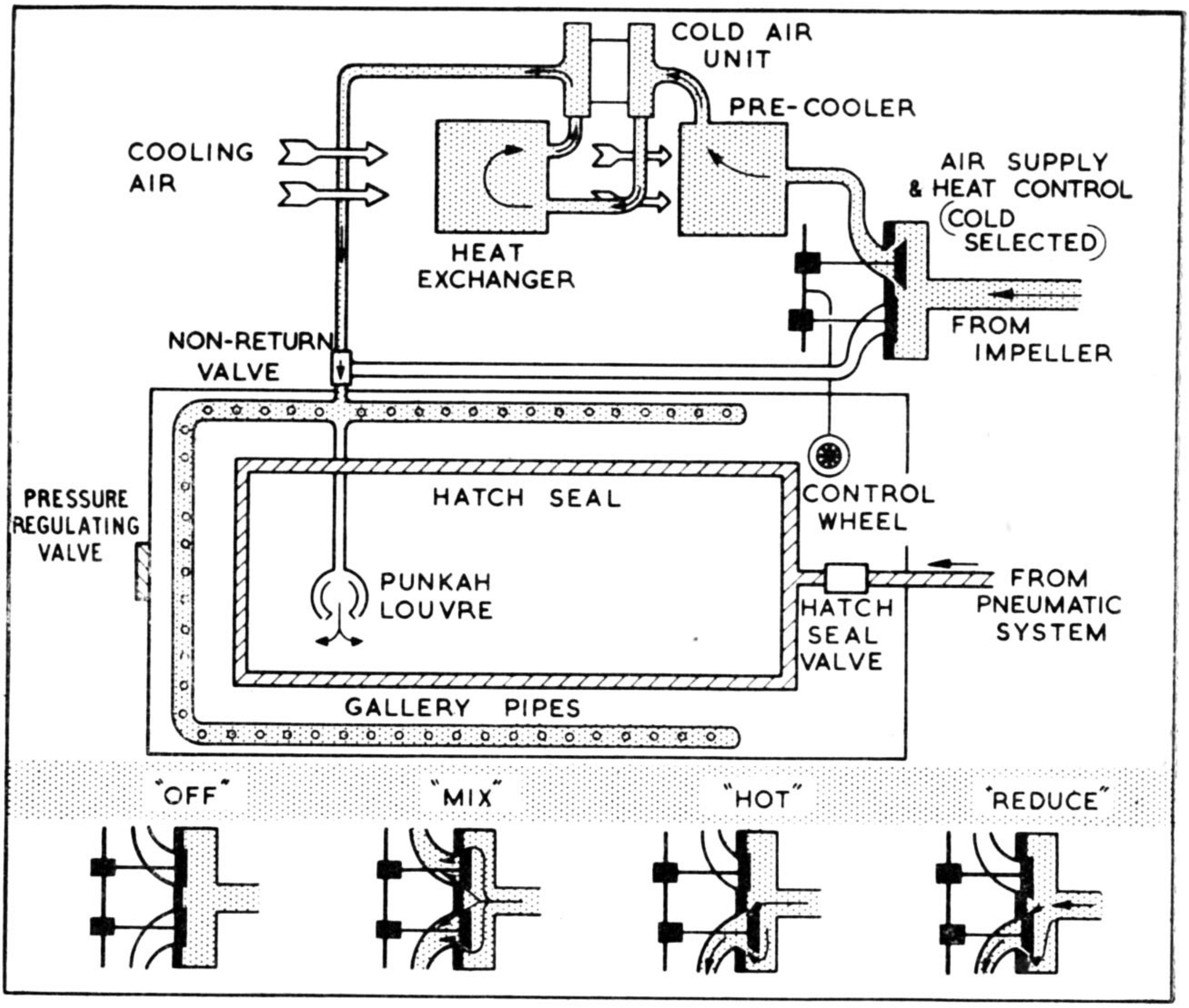
(i) Cockpit pressurising, heating, and cooling are controlled by movement of the wheel (3) on the port shelf. The wheel rotates through 270°, and has five marked positions: OFF—COLD—MIX—HOT—REDUCE. If a reduction of cockpit temperature is desired at altitude, MIX is to be preferred to REDUCE otherwise 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.

(ii) *Pressure*

With the hood seal control on (i.e. with the hood handle lock in the forward position) the cockpit pressure is automatically controlled by a valve which allows a steady build-up of differential cockpit pressure above approximately 12,000 feet, until at 35,000 feet the full differential

pressure is reached. The cockpit pressure is indicated on an altimeter (45) at the bottom right-hand side of the instrument panel. A warning light (44) beside the altimeter comes on when the cockpit altitude falls below the allowable minimum for a given altitude. The table below shows the cockpit altitudes corresponding to the minimum pressures. When the control is at REDUCE the cockpit pressure will be reduced.

Actual altitude (ft.)	Equivalent altitude (cockpit)	Approx. cockpit altitude at which light comes on
20,000	15,000	16,500
30,000	19,000	20,750
40,000	24,000	26,000
45,000	28,500	31,000



COCKPIT PRESSURIZATION AND HEATING

(iii) Air for pressurising enters the cockpit through a louvre and also through holes in the gallery pipe for windscreen and hood demisting.

29. Windscreen de-icing

The windscreen de-icing system is controlled by a hand pump (19) on the cockpit floor. The handle is turned anticlockwise to unlock, and pumped in to raise pressure. The handle returns slowly to the out position while spraying the windscreen.

30. Direct-vision panel

A direct-vision panel is fitted in the port quarter of the front windscreen, and is opened by turning a screw knob at the top. When the panel is open it lies at an angle across the top of the cockpit and in this position it presents a hazard to the pilot in a crash landing. It can however, be removed and handed to the observer—no stowage is provided.

31. Windscreen wiper

A windscreen wiper may be fitted on later aircraft. Details will be included by amendment.

32. Anti-G equipment

Pressurised air for anti-G suits is taken from connections attached to the seats. The selector lever (21) on the cockpit floor at the centre is pulled out and up for ON. The test button nearby is pushed down to test. The observer's test button is to the left of the observer's seat.

33. Emergency equipment

A hand-operated fire-extingusher is fitted to the port side of the hood centre beam. Stowage for a first-aid kit is provided inside the port ammunition access door. A crowbar (58) is on the cockpit starboard wall.

PART I—DESCRIPTIVE

FLIGHT AND NAVIGATION EQUIPMENT

34. Flight and navigation instruments

(i) *Mk. 4F compass and artificial horizon*

(a) The Mk. 4F compass and artificial horizon will function whenever alternating current is available, provided the flight instruments switches are on and the circuit breakers are in. If the main inverter supply fails, the standby inverter is automatically brought into circuit. See para. 15(i)(d).

(b) Mod. 923 introduces a Mk. 4 artificial horizon, which incorporates a fast-erection button and an OFF flag to indicate power failure.

(ii) *Turn and slip indicator*

The turn and slip indicator will function whenever d.c. electrical power is available. When Mod. 569 is embodied, the emergency lights battery may be used to supply the instrument in the event of electrical failure. The emergency supply switch is below the Mk. 4F compass, next to the oil temperature gauge.

(iii) *Pressure-operated instruments*

The pressure head heater switch (49) is on the starboard shelf.

(iv) *E.2.A. stand-by compass*

An E.2.A. stand-by compass is mounted to the right of the observer's crash guard.

(v) *Radio altimeter*

The radio altimeter indicator (27) is on the left of the standard flying panel, the limit switch (22) underneath, and the limit lights (30) just underneath the clear vision panel.

(vi) *Clock*

A Mk. 4 clock is on the left of the instrument panel.

(vii) *Accelerometer*

Mod. 798 introduces an accelerometer, to the left of the gunsight.

35. External lighting

Lights	Switch position
Navigation lights.	(48) on starboard shelf, plus circuit breaker (54) on starboard shelf.
Identification lights	(48) on starboard shelf plus circuit breaker (54) on starboard shelf.
Landing lamp.	Three-position selector switch (65) OFF—LOW—HIGH on starboard shelf.

SIGNALS EQUIPMENT

36. Wireless installation

(i) *VHF-TR1934/1935 (ARI.5490)*

The two VHF controllers (7) with changeover selector switch (8) are mounted on the panel aft of the throttle quadrant. The pilot's press-to-transmit switch is on the throttle GGS twist-grip (14). The navigator's press-to-transmit switch (60) is on the starboard shelf. A press-to-mute switch is on the control column handgrip. The navigator's foot-operated mute switch is near his right foot position.

(ii) *Intercommunication (A.1961)*

Two switches are fitted, an OFF — NORMAL — EMERGENCY switch for the pilot and a HOMING—INTERCOM switch (56) for the navigator. When the pilot's switch is at NORMAL and the navigator's switch is at INTERCOM, the A.1961 amplifier is used for intercommunication purposes. With the switches thus set, when either press-to-transmit switch is pressed only the pilot or navigator's transmission is heard. With the pilot's switch at EMERGENCY or OFF intercommunication is via the VHF system and all conversations will be broadcast if either press-to-transmit switch is used.

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(iii) *Telebriefing (ARI.18012)*

The pilot's warning lamp, which indicates the system is in use, and the press-to-talk push switch (5) are on the port panel. The landline connector is in the end of the port tailboom.

37. Radar installation

AN/APS.57 (ARI.5860), ARI.5847, Mk. 3 Gee (ARI.15816), AYF (ARI.5284) and IFF Mk. 3 GR (ARI.5131) installations are fitted. The radar scanner is carried within the detachable nose fairing.

ARMAMENT EQUIPMENT

38. Guns

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Four 20 mm. guns are mounted, two on each side of the nose, and are fired electrically by a trigger on the control column, after the safety catch has been released. To prevent the inadvertent firing of the guns when the aircraft is on the ground, the electrical firing circuit is broken when the undercarriage is locked down. Unless Mod. 934 is embodied, there is no override switch. This modification introduces an override switch, which is located in the gun bay.

39. Gunsight

(i) *Gyro-gunsight*

A retractable gyro-gunsight Mk. 5 is fitted above the instrument panel, and is normally raised or lowered by means of a switch (32) beside the sight provided that the gunsight circuit breaker (59) on the starboard shelf is in. If the electrical system fails it is possible to lower the sight by a manual control (31). This control should be used only in an emergency since servicing will be necessary before the sight can be used again.

(ii) *Gyro-gunsight selector—dimmer control*

A G.G.S. selector—dimmer control (33) is at the top of the instrument panel to the right of the gunsight. Ranging

is radar controlled through the A.I. Mk. 21, but the pilot has an override control embodied in the throttle grip. When radar ranging is switched on, the pilot's control should be kept at the minimum (200 yds.) position while executing any sharp manœuvres, but should be moved to the maximum (800 yds.) position when tracking smoothly, to enable the sight to be radar controlled whenever the target range drops below 800 yds. Mod. 877 introduces a strobe disconnect switch, marked RADAR-MANUAL, which allows manual control of the sight if the strobe unit fails. The switch is located in the position normally occupied by the starter master switch (34); the latter switch is then moved to the right of the starter pushbutton.

40. Cameras

(i) *Gyro-gunsight recorder camera*

A recorder camera may be fitted on the top of the gun-sight. It will operate whenever the guns are fired or the camera button on the control column is pressed, provided the camera master switch (47) on the starboard shelf is on. Stowage for the camera is provided on the back of the pilot's seat. The test switch (47) on the starboard panel enables both the recorder camera and G.45 camera circuits to be energized on the ground.

NOTE.—The recorder camera must only be fitted and removed when the GGS is in the retracted position.

(ii) *G.45 camera*

A G.45 camera is pod-mounted under the port wing and will operate whenever the guns are fired or the camera switch is pressed, provided the camera master switch is on. A sunny-cloudy switch is on the starboard shelf. beside the camera master switch.

PART II
LIMITATIONS

41. Engine limitations—Ghost Mk. 104

Power Rating	Time Limit	R.P.M.	Max. J.P.T. (°C.)
Take-off and operational necessity	30 mins. (combined)	10,250*	760
Maximum continuous	Unrestricted	9,750	660
Approach idling	—	5,000 (min.)	—
Ground idling	Unrestricted	3,000 ± 200	450

* Maximum permissible r.p.m. are to be reduced to 10,100 above 25,000 ft. when climbing, and above 35,000 ft. in level flight.

Oil temperatures

Maximum	105°C.
Minimum for starting and opening up using oil OM.71 or OEP-71	−10°C.
Minimum for starting and opening up using oil OX-38	−40°C.

42. Flying limitations

(i) Intentional spinning is prohibited.

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(ii) *Maximum speeds*

Below 6,000 ft.	500 knots
Between 6,000 ft. and 25,000 ft.	0.83M
Above 25,000 ft.	The IMN at which the marked nose-up trim change starts.
Undercarriage lowering	220 knots
Flaps lowering 0-30°	190 knots
Beyond 30°	170 knots

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

(iii) *Jettisoning speeds*

Full tip tanks	130 to 260 knots
Empty tip tanks	180 to 260 knots

(iv) *Maximum all-up weights*

Take-off (Full internal fuel, full tip tanks, 2 crew)	14,620 lb.
Landing (Full internal fuel, empty tip tanks, 2 crew)	13,390 lb.

NOTE.—Landings with fuel in the tip tanks must only be made in an emergency.

(v) *G limitations*

An accelerometer reading of $+5\frac{1}{2}$ G must not be exceeded.

(vi) *Special limitations*

Intentional manual reversion must be carried out at speeds below 0.82M. If automatic reversion occurs, speed must be reduced immediately to below 0.82M.

(vii) *Temporary limitations*

(a) Until further tropical experience has been gained, flight in tropical conditions at maximum r.p.m, below 5,000 feet, should not exceed 10 minutes.

(b) Unless Mod. 993 is embodied, radar search equipment is not to be used after gun-firing until the R.A.M. screen has been inspected for lifting.

PART III
HANDLING

43. External checks

The outside of the aircraft should be systematically checked for obvious signs of damage, security of panels, filler caps, doors, wheel fairings, and tip tanks. The engine intakes and tank vents should be free of debris, the jet pipe should be checked for wrinkling and the turbine and compressor blades for damage. The pressure head cover, undercarriage ground-locks and aileron clamping blocks must be removed.

Check that the hood external locking handle is flush.

44. C.G. data

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NOTE.—When the aircraft is flown with two crew, ammunition need not be carried. When flown solo, ballast (which may be in the form of ammunition and which must not then be used during flight) must be carried in lieu of the navigator.

(i) *C.G. limits*

Forward limit (all configurations)	0.9 ins. a.o.d.
Aft limits	
Clean aircraft	5.7 ins. a.o.d.
With empty tip tanks	6.2 ins. a.o.d.
With full tip tanks	8.9 ins. a.o.d.

(ii) *Effect of consumable and expendable stores*

(a) Consumption of tip tank fuel causes the C.G. to move rapidly forward.

(b) The furthest aft C.G. position for a clean aircraft occurs when carrying two crew, no ammunition and with about 290 gallons (2,240 lb. AVTAG) fuel remaining.

(c) Consumption of internal fuel causes the C.G. to move forward, the most forward C.G. position being reached in flight with two crew, full ammunition and with about 70 gallons (540 lb. AVTAG) fuel remaining.

(d) The C.G. moves aft when ammunition is expended.

45. Cockpit checks

Remove and stow control locks, close and lock the canopy, checking locking catch is engaged. Switch on the battery isolating switch, and then commence checks on the cockpit port wall and work from left to right.

Item	Check
Cockpit pressure control wheel (3)	Off
Tip and pylon tank jettison levers	Off
I/C switch	NORMAL
I.F.F. switches (5)	Off
Aileron trim cut - out switch	On
Aileron trim switch (4)	Operation Check trim light for correct operation Set neutral (light out)
V.H.F. set selector switch (8)	As required
Tip and pylon tank jettison switches (9)	Off
H.P. cock (10)	Off
Flaps (11)	Check operation with hand-pump
Elevator trim (15)	Check operation, set to neutral
Throttle friction (13)	Adjusted
Throttle	Closed
Airbrakes (16)	IN
L.P. cock (2)	ON

Item	Check
Aileron spring strut adjuster (1)	Correctly set If in doubt wind fully to one side and reset $2\frac{1}{2}$ turns back
Hydraulic audio warning switch (17)	On
Undercarriage emergency retraction switch (17)	OFF
Brakes pressure gauge (17)	Check pressure Brakes on
Aileron power warning light (17)	On
Undercarriage position indicator (23)	Check 3 green lights (test changeover)
A.Y.F. (22)	OFF
Direct-vision panel	Secure
Generator warning lights (29)	On
Turn-and-slip indicator	Functioning
Fuel transfer indicators (39)	White
Fuel gauge (38)	Contents
Fire warning light (37)	Out. Pull to test
Starter master and flight instrument switch (34)	Off
Emergency lamp switch (40)	Off
Fuel pump and flight instrument switches (41)	Off
Fuel pressure indicator (42)	White
De-icing pump (19)	Locked in
Pilot's oxygen regulator (46)	Wired on. Air - dilution switch NORMAL Indicator and blinker responding to breathing

Item		Check
		Test mask fit by pushing the emergency switch fully in, in the central position
		Check contents
Hood jettison lever (69)		Down
Anti-G valve (21)		OFF
Aileron power control (68)		Check operation Select up and locked—POWER
Radar supplies		Off
A.P.S.57 radar control panel (51)		Off
Generator warning lights (52)		On
Main inverter failure indicator (55)		Black
Fuel pump (54)	Circuit breaker.	Set in
External lights (54)		
Instrument (54)		
Aileron trim (57)		
Pressure head heater switch (49)		Off
All other switches		As required
Navigator's oxygen regulator (63)		As for pilot's check
Gun door tool (61)		Secure
Crowbar (58)		Secure
Fire-extinguisher		Secure

46. Management of the Fuel System

The internal tanks, wing tip and pylon drop tanks, all feed automatically when the L.P. and H.P. cocks are on. Two fuel transfer indicators show black when fuel is transferring from the external tanks. The indicators will show white if the fuel transfer flow ceases, or if the

external tanks are empty. Before starting the engine, the fuel booster pump must be switched on to prime the spill flow fuel system. Failure of the pump, indicated by the fuel pressure magnetic indicator turning white, below approximately 20,000 ft. should not cause fuel starvation. If the pump fails above 20,000 ft. it may not be possible to obtain maximum r.p.m.

47. **Starting the engine**

(i) *Checks before starting*

NOTE.—The high energy ignition should be checked before starting by pressing the relight button and listening for the clicking noise of the igniter plugs sparking.

Fuel pump and flight instrument switch	On Check fuel pressure indicator black Main inverter failure indicator white Check instruments
Starter master and flight instruments switch	On Main inverter failure indicator black
Throttle	Closed

(ii) *Starting the engine*

(a) Turn on the H.P. cock, and then press the starter pushbutton.

(b) The r.p.m. will rise rapidly to approximately 1,500 r.p.m. and then drop to approximately 1,100-1,200 r.p.m., when light-up will occur. The r.p.m will then rise again until idling speed is reached.

(iii) If the engine does not start correctly it will be in one of the following sets of circumstances. The pilot should carry out whichever instructions are applicable:—

(a) *Cartridge fails to fire*

If a cartridge does not fire, close the H.P. cock and wait at least 15 seconds before re-opening it. Should

the first cartridge fail to fire, the starter pushbutton will be held electrically in the depressed position and will return to the starting position only at the end of the automatic starting sequence. The remaining cartridge may then be fired after re-opening the H.P. cock.

(b) *Engine fails to rotate*

If the engine does not rotate or does so at low r.p.m. and there is a heavy discharge of yellow smoke from the starter exhaust for a period of approximately 10 seconds, the safety disc has probably blown. The H.P. cock should be closed and the cause of failure rectified before attempting a further start.

(c) *Failure to light up*

If the engine rotates but the r.p.m. show progressive drop below 1,100-1,200 indicating that the engine has not lit up, the H.P. cock must be closed before the r.p.m. have fallen to 800.

(iv) Two successive failures to start indicate a fault which should be investigated before a further start is attempted.

(v) After failure to light up, surplus fuel must be allowed to drain from the jet pipe.

(vi) The cartridge breeches should not be reloaded until they have cooled down; expended cartridges can be removed however, and the breeches left open to assist in cooling.

(vii) To avoid difficulty in removal, expended cartridges should not be left in the breech for more than eight hours.

48. Checks after starting

Engine idling r.p.m.	3,000 ± 200
Jet pipe temperature	Max. 450°C.
Fire warning light	Out
Generator warning lights	Out
Aileron power warning light	Out

49. Checks before taxying

Hydraulics	Test flaps and airbrakes
V.H.F.	As required
Brakes	Pressure 2,400 lb./sq. in.
Mk. 4F compass	Set, check heading with E.2 compass
Altimeter	Set
Pressure head heater	As required

50. Taxying

The rudders are ineffective at normal taxying speeds and it is necessary to use brake to turn the aircraft.

51. Checks before take-off

Trim	Elevator neutral
Throttle friction	Adjusted
Airbrakes	IN
Fuel	L.P. cock ON
	H.P. cock ON (catch engaged)
	Contents
	Booster pump ON (fuel pressure indicator black)
Flaps	30° down

Instruments	Check and set Main inverter failure indicator—black Pressure head heater—ON
Oxygen	ON and reaching mask Blinkers operating
Pressurisation	OFF, HOT or REDUCE
Hood	Closed and locked
Harness	Tight and locked
Flying controls	Ailerons in POWER, warning light out Full, free and correct movement

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52. **Take-off**

NOTE.—1. **30° flap must be used for take-off, otherwise the take-off run will be unduly prolonged and may result in damage to the nosewheel oleo.**

2. **The aircraft should not be flown if the static r.p.m at full throttle are less than 10,150 or if, during the take-off run, they fall below 10,050.**

(i) Align the aircraft on the runway with the nosewheel straight release the brakes and open the throttle smoothly to full power. A slightly shorter take-off run will be obtained if the throttle is fully opened before releasing the brakes.

(ii) To keep straight initially it may be necessary to use brake: the rudders become effective at about 70 knots.

(iii) The nosewheel should be eased off at about 100 knots and the aircraft flown off at about 120 knots.

(iv) When comfortably airborne, apply the brakes momentarily and raise the undercarriage.

(v) Raise the flaps.

(vi) If applicable, check that fuel is transferring from the drop tanks.

53. Climbing

(i) The recommended climbing speeds, with or without wing-tip tanks fitted, using 10,250 r.p.m. reducing to 10,100 r.p.m. above 25,000 ft. are:—

Altitude	Knots	Mach No.
Sea level	330	.50
5,000 ft.	315	.52
10,000 ft.	295	.53
15,000 ft.	275	.55
20,000 ft.	255	.56
25,000 ft.	235	.57
30,000 ft.	215	.58
35,000 ft.	200	.61
40,000 ft.	180	.62
45,000 ft.	165	.62

(ii) After take-off the aircraft may be allowed to accelerate to the recommended speed while climbing, provided that this speed is reached below 5,000 ft.

(iii) While climbing, the r.p.m. may increase slowly and must be checked periodically to ensure that the maximum permissible figure is not exceeded. If the jet pipe temperature or r.p.m. reaches the maximum, power must be reduced.

(iv) Above 40,000 ft. it is important that the correct speeds be maintained; should the speed fall below that recommended, the rate of climb will suffer and it may be found necessary to resort to level flight to regain climbing speed.

(v) All throttle corrections in the air must be made slowly and smoothly, particularly at high altitudes or when increasing power from low power settings.

54. General flying

(i) *Flying controls*

(a) *Ailerons in POWER.* The powered ailerons make the aircraft light and pleasant to control laterally. As artificial feel is provided by a spring strut in the

aileron circuit, the force required varies with aileron deflection and not with speed. At indicated speeds above 375 knots, the power control stalls progressively so that although the initial response is immediate, the rate of roll is limited by the power control stall, restricting the amount of aileron applied.

(b) *Elevator.* At low speeds the elevator forces are moderate but increase progressively with increase in airspeeds.
Elevator effectiveness is good throughout the speed range.

(c) *Rudder.* The rudder centralising forces are very strong, being assisted by a powerful spring. The rudder lacks feel and effectiveness at low speeds but becomes more effective at high speeds. Directional control in all normal conditions of flight is, however, adequate.

(ii) *Trimmers*

(a) *Aileron.* There is practically no lateral trim change with speed; any adjustment which is required should be made with the spring strut adjuster.

NOTE.—The electrically-operated trim tab, for use in manual control, must be in the neutral position whenever the ailerons are in POWER.

(b) *Elevator.* The elevator trimmer increases in sensitivity as speed increases and must be used with caution at high airspeeds. At high mach numbers it becomes less effective.

(c) *Airbrakes.* The airbrakes are relatively ineffective at slow speeds, but become progressively more effective at increased speeds. A mild general airframe buffet is produced when they are extended.
Throttling back and extending the airbrakes at high airspeeds produces a rapid deceleration. At high altitudes, deceleration is poor.

(iii) *Changes of trim*

(a) Undercarriage down	Slight nose-down
(b) Flaps down—0°- 30°	Slight nose-down
Flaps down—beyond 30°	Strong nose-up
(c) Airbrakes on extension	Nose-up trim change followed by a nose-down trim change, then a return to trimmed condition
Airbrakes on retraction	Slight sink followed by characteristic behaviour described above

(iv) *General engine handling*

In flight, particularly at altitude, there may be a lag in engine response to throttle movement and/or an inability to obtain maximum r.p.m. Normal engine control can only be regained by reducing altitude.

55. **Flying at reduced speed**

(i) Reduce speed to 150 knots. At this speed the aircraft is comfortable to handle. 30° of flap may be lowered which will increase the forward visibility but considerably more power will be required to maintain 150 knots and general airframe buffet will be present.

(ii) The D.V. panel can be removed in flight. Because of the noise it is recommended that a speed of 170 knots is not exceeded.

(iii) Visibility in rain is poor and unless a windscreen wiper is fitted it may be necessary to remove the D.V. panel before a landing is attempted.

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

The recommended speed for flying in conditions of severe turbulence is 330 knots up to 20,000 feet, thereafter reducing progressively to 220 knots at 40,000 feet and above.

57. **Stalling**

A.L.1 (i) Stalling speeds are found to vary considerably dependent upon the way the stall is approached (small amounts of

G increase the stalling speed considerably), and the condition of the aircraft. The precise stalling speed at certain weights and in certain configurations is difficult to determine due to fluctuation of the A.S.I. needle at low airspeeds.

(ii) The following are the approximate stalling speeds in knots with the throttle closed:—

	U/C and Flaps up	U/C and Full Flap down
Typical service load Full tip tanks, full internal fuel and ammunition, 2 crew	120	105
Typical landing weight Empty tip tanks, 140 gallons internal fuel, no ammunition, 2 crew	115	100

(iii) At all weights and configurations there is little or no warning of the stall. It usually occurs with mild buffet and a tendency for either wing to drop gently. The wings can be held level by use of aileron but this will create a yaw and a heavy rudder force is required to counter it.

(iv) Use of flaps causes buffet and this masks any pre-stall warning that may be present.

(v) Use of airbrakes does not affect the stall.

(vi) Recovery is straightforward and is effective immediately the pressure on the control column is relaxed, but unless full power is used there will be a considerable loss of height.

(vii) *G-stalling.* When G is applied, warning of the stall is given by buffeting and continued rearward movement of the control column will cause either wing to drop. Recovery is immediate upon relaxing the pressure.

58. **High speed flight**

NOTE.—The limitations are laid down for structural reasons and must not be exceeded.

(i) The characteristics described below may be experienced at slightly higher or lower indicated mach numbers than those stated due to variation of mach meter pressure error.

(ii) The high mach number characteristics may vary slightly from aircraft to aircraft, they also depend, particularly at high altitudes, on the angle of dive (rate of increase of speed), on G, and on the condition of the aircraft.

(iii) Tip tanks
The carriage of wing tip tanks does not affect the high mach number characteristics.

(iv) (a) *Below 6,000 ft.*

The limiting speed is 500 knots

The behaviour of the aircraft at high airspeeds is good. The elevator control is crisp and the trimmer is very sensitive so care must be taken not to exceed the limit of $+5\frac{1}{2}$ G (accelerometer reading). Above 375 knots the aileron power control stalls progressively with increase in speed, so that full aileron deflection will not be possible. Rate of roll will therefore be reduced.

(b) *Between 6,000 ft. and 25,000 ft.*

The aircraft is limited to 0.83M.

At about 0.82M a moderate nose-down change of trim will occur which should trim out as the limit of 0.83M is reached. Slight general buffet is present above 0.81M.

(c) *Above 25,000 ft.*

The aircraft is limited to the mach number at which the marked nose-up trim change starts.

This will occur at approximately 0.86M. The typical behaviour before and beyond this point is described below:—

0.815M - 0.82M	Moderate nose-down trim change starts.
0.845M - 0.85M	Nose-up trim change starts.
0.86M	Nose-up trim change marked.
0.87M	Nose-up trim change strong.
0.885M	Left wing drops. Nose-up trim change disappears, and may be succeeded by a nose-down change, concurrently with, or slightly after, the wing drop. Full aileron is required to hold the wing drop.

Slight general buffet is present above 0.81M.

59. Aerobatics

(i) Until experience is gained the following minimum speeds in knots are recommended:—

Roll	270
Loop	350
Roll off the top	370

(ii) Aerobatics are permitted with tip tanks full or empty.

(iii) The negative G traps in the fuselage tank ensure a supply of fuel for 10 seconds of inverted flight.

60. Spinning

Intentional spinning is prohibited, but if an unintentional spin occurs normal recovery action is effective. The aircraft is reluctant to enter a spin to port unless pro-spin controls are applied; it will however spin readily to starboard. The rate of rotation in a spin to starboard is faster than in a spin to port. The elevator is extremely effective in unstalling the wings and must be used with care. The control column should be moved slowly and progressively forward *only until rotation ceases.* The ailerons should be kept neutral throughout the recovery and the rudder centralized the moment rotation ceases. If the undercarriage and flaps are down they should be raised.

On recovery the aircraft assumes a steep attitude, and should be eased gently out of the dive, otherwise if a harsh recovery is made a high speed stall may result. If the recovery is effected in an inverted attitude it may be advantageous to half roll and ease the aircraft out of the ensuing dive. If a spin occurs at high altitudes, once recovery has been effected, the airbrakes should be used to prevent a high mach number from being reached.

61. Circuit and landing

NOTE.—The aircraft is at the normal maximum landing weight with a full crew, empty tip tanks, no ammunition and full internal fuel.

(i) *Circuit procedure*

A setting of approximately 7,000 r.p.m. will give a circuit speed of 200 knots with undercarriage and flaps up.

(ii) *Checks downwind*

Brakes	Pressure—operation—off
Airbrakes	IN
Undercarriage	Down (below 220 knots) Three green lights
Fuel	Contents
Flaps	As required. (Below 190 knots for 0-30°)
Harness	Tight and locked

A setting of approximately 8,000 r.p.m. will be required to maintain 150 knots with undercarriage and 30° flap down.

(iii) *Final approach*

(a) The turn onto the final approach should be made at 140 knots and full flap lowered when required.

(b) To ensure a rapid response to throttle opening, power should not be reduced below 5,000 r.p.m. until the final decision to land has been made.

(c) The runway threshold should be crossed at the following speeds:—

At normal landing weight ...	...	110 knots
At maximum landing weight	...	115 knots

(d) If the speed is allowed to fall below 110 knots the drag characteristics are such that a large increase in power will be necessary to counteract any excessive sink.

(iv) *Landing*

(a) It is difficult to hold the nosewheel off the runway after touchdown.

(b) The brakes can be used continuously as the maxaret units will prevent wheel locking; however, to prolong the efficiency and life of the brakes, braking should be judicious according to the length of landing run available.

(c) The aircraft must be firmly on the ground before applying brakes. If the aircraft is allowed to touch down with the brakes on, the maxaret units will not operate and the wheels will lock. However if, once having started turning, the wheels should stop because of a skid or a bounce, they will not lock unless the skid or bounce continues for more than 4 seconds.

62. **Instrument approach**

The following speeds and approximate power and flap settings are recommended for use during instrument approaches with the undercarriage down. These figures apply with wing-tip tanks fitted, but empty.

	R.p.m.	Flaps	Airspeed (knots)
Downwind	7,500	$\frac{1}{4}$	150-155
Final	7,500	$\frac{1}{2}$	140-145
Glide path	7,500	$\frac{3}{4}$*	125-130

* When the runway comes into view the flaps may be lowered fully.

63. **Going round again**

(i) Open the throttle smoothly to the power required. Normally the use of full power is unnecessary and 9,000 r.p.m. will generally be sufficient. When full power is used, the control column will be near its forward limit.

(ii) The following procedure is recommended:—

(a) Increase power as required.

(b) Raise the undercarriage.

(c) Raise the flaps. It is recommended that the flaps are raised in stages, especially at night, as slight sink occurs and the control column displacement as the flaps retract is considerable.

64. Checks after landing

Flaps	UP
Brakes	Pressure sufficient for taxying
Pressure head heater switch	Off
Cockpit pressure control	Off

65. Stopping the engine

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Close the throttle fully and allow the engine to run at idling r.p.m. for at least half a minute before closing down. Then:

H.P. cock	Off
V.H.F.	Off
Fuel pump and flight instrument switch	Off
Master starting and flight instrument switch	Off
All other switches	Off
Chocks	In position
Brakes	Off

NOTE.—1. Put the L.P. cock off if the aircraft is to remain on the ground for long periods between flights. This will help to avoid hot starts and thus prolong the life of the engine.

2. The battery master switch should not be moved to BATTERY ISOLATED until the generator power failure light has come on, otherwise the electrical system may be damaged.

PART IV
EMERGENCY HANDLING

66. Engine failure and relighting in flight

(i) *Mechanical*

If the engine fails due to obvious mechanical causes, immediately turn off the L.P. and H.P. cocks, switch off the booster pump and all non-essential electrical services.

(ii) *Flame-out*

(a) Close the H.P. cock immediately.

(b) Wait if possible for one minute, to allow excess fuel to drain from the tail pipe before proceeding with the drill.

(c) Relighting may be accomplished at altitudes up to 40,000 ft., but is more certain at 30,000 ft. and below.

(d) Set the throttle closed. ~~If difficulty is experienced in relighting, the throttle may be moved to the one-quarter open position.~~ A.L.1

(e) Maintain forward speed between 180 and 250 knots.

(f) Press the relight button on the H.P. cock while proceeding as in (g) below.

(g) Return the H.P. cock to the fully open position keeping the relight button pressed for 20-25 seconds.

~~IMPORTANT.—If a normal light up does not occur within 5-6 seconds of opening the H.P. cock, *close the throttle*, if it is open, to encourage flame propagation, and to avoid flooding of unlit cans with subsequent fire risk.~~ A.L.1

(h) If the engine has not relit within 20-25 seconds of having opened the H.P. cock, close the cock again and wait about one minute before repeating the cycle of operations.

NOTE.—If practicable, all electrical services, except those which are immediately essential, should be switched off in order to obtain the maximum output from the batteries. Do not switch off the booster-pump.

67. Action in the event of engine fire

(i) Should the fire warning light(s) come on, close the throttle immediately. If the light goes out within 5 seconds of closing the throttle, a fractured air casing, as distinct from fire, is indicated. It is safe to use the engine in this condition but a landing should be made as soon as practicable. Reduced power should be used but, unless the power required is small, the light(s) will probably come on again. It is advisable, therefore, to throttle back every 5 minutes, to check that the light goes out and so ensure that a fire has not started.

(ii) If the light does not go out after closing the throttle, proceed as follows:—

(a) Close the L.P. and H.P. cocks.

(b) Switch off the booster-pump.

(c) Reduce the airspeed as far as practicable and turn OFF the cockpit pressure before operating the extinguisher. If the fire is extinguished, the warning light should go out.

(d) Any attempt to relight the engine may result in a further outbreak of fire, which will be uncontrollable, since the extinguisher cannot be used again.

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

PART IV—EMERGENCY HANDLING

68. Flying in manual control

NOTE.—1. Intentional manual reversion must be carried out at speeds below 0.82M.

2. If automatic reversion occurs above 0.82M aileron buffet will be encountered, the severity of which will depend on the amount of G being applied. Use of the trim switch should be avoided as response above 0.82M is slow and when it does take effect with decrease in speed the amount of trim may be in excess of that required for the lower speed, causing the aircraft to roll rapidly.

3. Although flying in manual control presents no difficulties, it must be remembered that it is a "get you home" device and its use must not be abused.

(i) If hydraulic pressure fails, the aileron control will revert to manual automatically. For practice purposes, manual control can be selected by means of the selector valve on the floor by the right of the pilot's seat. It must be pushed down and turned clockwise to lock in the MANUAL position.

(ii) When manual reversion takes place a slight longitudinal trim change occurs caused by the ailerons upfloating.

(iii) The aileron forces in manual are very heavy, requiring at times both hands on the control column to bank the aircraft. There will be slight backlash at the control column due to dead travel of the servodyne selector valve.

(iv) The aircraft can be trimmed by the trimmer (4). Care should be taken in its use, as the tab actuator speed is high and over-correction may result, particularly at high I.A.S. At high Mach numbers the tab effectiveness is decreased (see NOTE 2). The use of the trimmer for manœuvring the aircraft is not recommended, as it will be found that its action is so much in advance of aircraft response that it is impossible to check the aircraft laterally when required. In case of malfunctioning of the trim tab actuator, it can be switched off by means of the cut-out switch. In the event of a tab runaway to full travel, it is unlikely that the aircraft could be held laterally level at speeds in excess of 250 knots.

(v) Landing in manual control is straightforward but because of the considerable force required and the slow response of the ailerons a slightly larger circuit will have to be made.

69. Hydraulic pump failure

(i) If the hydraulic pump fails, pressure is available in three accumulators for emergency use.

(h) If the engine has not relit within 20-25 seconds of having opened the H.P. cock, close the cock again and wait about one minute before repeating the cycle of operations.

NOTE.—If practicable, all electrical services, except those which are immediately essential, should be switched off in order to obtain the maximum output from the batteries. Do not switch off the booster-pump.

67. Action in the event of engine fire

(i) Should the fire warning light(s) come on, close the throttle immediately. If the light goes out within 5 seconds of closing the throttle, a fractured air casing, as distinct from fire, is indicated. It is safe to use the engine in this condition but a landing should be made as soon as practicable. Reduced power should be used but, unless the power required is small, the light(s) will probably come on again. It is advisable, therefore, to throttle back every 5 minutes, to check that the light goes out and so ensure that a fire has not started.

(ii) If the light does not go out after closing the throttle, proceed as follows:—

(a) Close the L.P. and H.P. cocks.

(b) Switch off the booster-pump.

(c) Reduce the airspeed as far as practicable and turn OFF the cockpit pressure before operating the extinguisher. If the fire is extinguished, the warning light should go out.

(d) Any attempt to relight the engine may result in a further outbreak of fire, which will be uncontrollable, since the extinguisher cannot be used again.

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

PART IV—EMERGENCY HANDLING

68. Flying in manual control

NOTE.—1. Intentional manual reversion must be carried out at speeds below 0.82M.

2. If automatic reversion occurs above 0.82M aileron buffet will be encountered, the severity of which will depend on the amount of G being applied. Use of the trim switch should be avoided as response above 0.82M is slow and when it does take effect with decrease in speed the amount of trim may be in excess of that required for the lower speed, causing the aircraft to roll rapidly.

3. Although flying in manual control presents no difficulties, it must be remembered that it is a "get you home" device and its use must not be abused.

(i) If hydraulic pressure fails, the aileron control will revert to manual automatically. For practice purposes, manual control can be selected by means of the selector valve on the floor by the right of the pilot's seat. It must be pushed down and turned clockwise to lock in the MANUAL position.

(ii) When manual reversion takes place a slight longitudinal trim change occurs caused by the ailerons upfloating.

(iii) The aileron forces in manual are very heavy, requiring at times both hands on the control column to bank the aircraft. There will be slight backlash at the control column due to dead travel of the servodyne selector valve.

(iv) The aircraft can be trimmed by the trimmer (4). Care should be taken in its use, as the tab actuator speed is high and over-correction may result, particularly at high I.A.S. At high Mach numbers the tab effectiveness is decreased (see NOTE 2). The use of the trimmer for manœuvring the aircraft is not recommended, as it will be found that its action is so much in advance of aircraft response that it is impossible to check the aircraft laterally when required. In case of malfunctioning of the trim tab actuator, it can be switched off by means of the cut-out switch. In the event of a tab runaway to full travel, it is unlikely that the aircraft could be held laterally level at speeds in excess of 250 knots.

(v) Landing in manual control is straightforward but because of the considerable force required and the slow response of the ailerons a slightly larger circuit will have to be made.

69. Hydraulic pump failure

(i) If the hydraulic pump fails, pressure is available in three accumulators for emergency use.

Open the hood in the normal way, taking care to keep the hand unclenched to avoid snatch of the wrist when the hood suddenly lifts.

NOTE.—Attempts to jettison manually, by first opening the hood in the normal way and then pulling the ring handle, must never be made.

73. Generator failure

If one generator fails, the output of the other, even at flight idling r.p.m., will be sufficient to keep the battery charged, using the normal services including Gee.

74. Loss of cabin pressure

In the event of cabin pressurization failure occuring at heights above 42,000 ft. the following emergency drill should be used:—

Warn crew and order "Emergency oxygen" (on regulator).

Descend to below 42,000 ft. and then turn off emergency oxygen.

Check that 100% is selected.

The aircraft should not be flown between 40 and 42,000 ft. for longer than 15 minutes and between 38 and 40,000 ft. for longer than 30 minutes.

75. Landing with one full tip tank

Landing with a full tip tank on one side and an empty one on the other presents no difficulty. The runway threshold speed should be increased by 5 knots above the normal.

76. Drop tank jettisoning

(i) *Wing tip tanks*

The tanks can safely be jettisoned in straight and level flight at any speed in the following range:—

Tanks full ...	...	...	130 to 260 knots
Tanks empty	...	...	180 to 260 knots

The electrically-operated jettison switch is on the port shelf behind the throttle box. If it fails to operate, the mechanical jettison lever on the port side behind the shelf should be used.

(ii) *Pylon drop tanks*

To be issued later.

77. Forced landing

(i) In all cases of engine failure, and when a relight is not possible, the following immediate actions should be carried out:—

L.P. and H.P. cocks	Off
Booster pump	Off
All non-essential electrics	Off
Glide at 165 knots	

(ii) Even if the engine is windmilling it is unlikely that sufficient hydraulic pressure will be generated to keep the accumulators charged and the ailerons in power, so the following procedure is recommended:—

(a) Select manual control. (See para. 68.)

(b) If circumstances permit, jettison the wing-tip tanks.

(c) Jettison the hood.

(d) When manoeuvring to land, maintain 140 knots until the selected area is within reach.

(e) Lower the flaps aiming to cross the threshold of the landing area at 120 knots.

NOTE.—Do not use the airbrakes (see para. 69 (ii) (a).)

78. Flapless landing

The turn onto the final approach should be done at 145 knots. A long, flat approach requiring little power should be made and the runway threshold crossed at 130

knots. This speed can be reduced to 125 knots if the weather conditions are calm.

79. **Ditching**

(i) It is believed that the ditching qualities of this aircraft are poor.

(ii) If ditching is inevitable:—

(a) Jettison the hood.

(b) Jettison all drop tanks.

(c) Lower the flaps 30°. If power is available it should be used to make the touchdown speed as low as possible.

(d) When contact with the water is made, the tail booms will probably break off, the aircraft may bounce and then bury its nose.

NOTE.—If the water is calm there may be a greater chance of a successful ditching if the flaps are only lowered 10° and the approach is made at normal landing speed, aiming to prevent the booms touching the water first.

80. **Abandoning**

Speed should be reduced if possible, and the aircraft inverted after trimming nose-heavy, to enable the crew to fall out.

PART V
OPERATING DATA

81. **Pressure error corrections**

(i) The A.S.I. pressure error corrections at sea level are:—

From	150	200	250	300	350	400	knots
To	200	250	300	350	400	450	knots
Add	1	2	3	4	4	5	knots

(ii) The altimeter pressure error corrections near sea level are:—

At:	150	200	250	300	350	400	450	knots
Add:	0	40	60	90	120	160	210	ft.

82. **Take-off distances**

The approximate take-off distances (in yards) are given below:—

(a) Clean aircraft

Temperature °C.		−15	0	+15	+30	+45
Zero wind	Ground run	620	730	880	1,020	1,130
	To clear 50 ft.	1,180	1,350	1,580	1,760	2,020
30 knot wind	Ground run	350	400	480	560	620
	To clear 50 ft.	760	860	1,030	1,120	1,270

(b) With tip tanks

Temperature °C.		−15	0	+15	+30	+45
Zero wind	Ground run	780	910	1,090	1,280	1,420
	To clear 50 ft.	1,400	1,630	1,890	2,160	2,400
30 knot wind	Ground run	420	500	600	660	730
	To clear 50 ft.	900	1,030	1,200	1,400	1,500

83. **Fuel consumptions**

The approximate fuel consumptions in lb./min. for various engine speeds are given below. If it is required to know the consumptions in gall./min., divide the figures below by the weight of fuel/gallon.

NORMAL AVTAG = 7.7 lb./gall.

AVTUR = 8.0 lb./gall.

Height	at 10,250 r.p.m.	at 9,750 r.p.m.	at best range speed
Sea level	120	90	45
10,000 ft.	90	70	35
20,000 ft.	70	55	30
30,000 ft.	50	40	25
40,000 ft	35	25	20

84. **Flight planning data**

(i) The tables on pages 60, 61 and 62 show the climb, cruise and descent data in tabular form. Heights are given at 10,000 ft. intervals, but interpolation is possible for intermediate heights.

(ii) The climb and descent data tables give the necessary information for climbing or descending from any one height to another. Climb distances are included where necessary in the cruise data table but not descent distances, since in some cases the descent may be made from

overhead and in others some distance from the destination. Allowance is, however, made for fuel used on the descent.

(iii) The cruise data table consists of five separate altitude blocks. Each block shows:—

(a) The level flight range to the let-down point in nautical miles, at the particular height for various fuel states.

(b) The best range I.A.S. at the particular height together with approximate A.N.M. per 100 lb. fuel used and the approximate fuel consumption in lb./hr. (To convert ANM/100 lb. to A.N.M.P.G. multiply by the density (wt. per gall.) and divide by 100.)

(c) The range, *including* the distance covered on the climb, if a climb is made to any other altitude during flight.

(iv) *Use of the tables*

(a) *Pre-flight planning*

Enter the cruise data table in the sea-level block at the fuel state 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.

(b) *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 altitude block.

contd. on P.64

CLIMB DATA — WITH TIP TANKS

R.P.M. — 10,250 below 25,000′ — 10,100 above 25,000′

From	To	Lb.	Dist.	Mins.
Sea Level	10,000′	190	15	2
	20,000′	385	30	4.5
	30,000′	580	50	8.25
	40,000′	820	95	15
	45,000′	1100	160	24
10,000 ft.	20,000′	195	15	2.5
	30,000′	370	35	6.25
	40,000′	630	80	13
	45,000′	910	145	22
20,000 ft.	30,000′	195	20	3.75
	40,000′	435	65	10.5
	45,000′	715	130	19.5
30,000 ft.	40,000′	240	45	6.75
	45.000′	520	110	15.75
40,000 ft.	45,000′	280	65	9

TOTAL FUEL – – – – –	504 gall.	3,878 lb. AVTAG
TAXY AND TAKE-OFF ALLOWANCE –	35 gall.	270 lb. AVTAG
LANDING ALLOWANCE – – –	65 gall.	500 lb. AVTAG

(Excluding descent fuel)

DESCENT DATA

CLEAN OR WITH TIP TANKS

From	To	Lb.	Dist.	Mins.
45,000 ft.	40,000′	5	5	½
	30,000′	10	10	1½
	20,000′	20	20	2½
	10,000′	65	35	5
	Sea Level	130	45	7½
40,000 ft.	30,000′	5	5	1
	20,000′	15	15	2
	10,000′	60	30	4½
	Sea Level	125	40	7
30,000 ft.	20,000′	10	10	1
	10,000′	55	25	3½
	Sea Level	120	35	6
20,000 ft.	10,000′	45	15	2½
	Sea Level	110	25	5
10,000 ft.	Sea Level	65	10	2½

R.P.M. – – 7.000
AIRBRAKES – OUT
SPEED – – 0.75M above 20,000 ft.
240 knots below 20,000 ft

CRUISE DATA — WITH TIP TANKS

FUEL STATE—LB.		3600	3200	2800	2400	2000	1600	1200	800
Sea Level	Range	335	290	250	205	160	120	75	**32**
	10,000′	410	335	300	245	190	135	**80**	25
IAS 290K	20,000′	515	440	365	290	215	140	65	—
ANM/100 lb. 10.8	30,000′	620	525	430	335	240	145	50	—
lb./hr. 2,700	40,000′	**770**	**650**	**525**	**400**	**280**	**155**	—	—
	45,000′	740	620	495	370	250	—	—	—
10,000 ft.	Range	—	370	315	260	200	145	90	**33**
	20,000′	—	460	385	310	235	160	**85**	—
IAS 250K	30,000′	—	555	460	365	270	175	80	—
ANM/100 lb. 14.1	40,000′	—	**680**	**555**	**430**	**305**	**180**	55	—
lb./hr. 2,050	45,000′	—	655	530	405	280	155	—	—
20,000 ft.	Range	—	480	405	330	260	185	110	**35**
IAS 225K	30,000′	—	585	490	395	300	205	**110**	—
ANM/100 lb. 18.6	40,000′	—	**725**	**600**	**475**	**350**	**225**	100	—
lb/hr. 1,600	45,000′	—	700	575	450	325	200	—	—
30,000 ft.	Range	—	610	515	420	325	230	135	**42**
IAS 210K	40,000′	—	—	**640**	**515**	**390**	**265**	**140**	—
ANM/100 lb. 23.6	45,000′	—	—	615	490	365	240	115	—
lb./hr. 1,400									
40,000 ft.	Range	—	**795**	**670**	**550**	**425**	**305**	**180**	**54**
IAS 200K	45,000′	—	—	645	525	400	280	155	—
ANM/100 lb. 31									
lb./hr. 1,250									
45,000 ft.	Range	—	**790**	**665**	**545**	**420**	**300**	**175**	**50**
IAS 195K									
ANM/100 lb. 31									
lb./hr. 1,300									
FUEL STATE									
Galls AVTUR		450	400	350	300	250	200	150	100
Galls AVTAG		468	416	364	312	260	208	155	104

CLIMB DATA — CLEAN AIRCRAFT

R.P.M. — 10,250 below 25,000′ — 10,100 above 25,000′

From	To	Lb.	Dist.	Mins.
Sea Level	10,000′	155	10	1¾
	20,000′	310	25	3¾
	30,000′	465	45	6½
	40,000′	650	75	11¾
	48,000′	950	160	23
10,000 ft.	20,000′	155	15	2
	30,000′	310	35	4¾
	40,000′	495	65	10
	48,000′	795	150	21¼
20,000 ft.	30,000′	155	20	2¾
	40,000′	340	50	8
	48,000′	640	135	19¼
30,000 ft.	40,000′	185	30	5¼
	48,000′	485	115	16½
40,000 ft.	48,000′	300	85	11¾

TOTAL FUEL — — — — — 342 gall. 2,630 lb AVTAG

TAXY AND TAKE-OFF ALLOWANCE — 35 gall. 270 lb. AVTAG

LANDING ALLOWANCE — — — 65 gall. 500 lb. AVTAG
(Excluding descent fuel)

DESCENT DATA—CLEAN AIRCRAFT

As for tip tank case

CRUISE DATA — CLEAN AIRCRAFT

FUEL STATE—LB.		2400	2000	1600	1200	800
Sea Level	Range	205	160	120	75	**32**
	10,000′	260	200	140	80	20
IAS 290K	20,000′	325	245	165	**85**	—
ANM/100 lb. 10.8	30,000′	390	285	180	75	—
lb./hr. 2,700	40,000′	**440**	**310**	**180**	—	—
	48,000′	420	290	160	—	—
10,000 ft.	Range	—	215	155	95	**35**
IAS 250K	20,000′	—	265	185	105	25
ANM/100 lb. 15.3	30,000′	—	315	210	**105**	—
lb./hr. 1,900	40,000′	—	**350**	**220**	90	—
	48,000′	—	330	200	—	—
20,000 ft.	Range	—	280	200	120	**38**
IAS 225K	30,000′	—	335	230	125	20
ANM/100 lb. 20	40,000′	—	**385**	**255**	**125**	—
lb./hr. 1,500	48,000′	—	365	235	—	—
30,000 ft.	Range	—	360	255	150	**47**
IAS 210K	40,000′	—	**410**	**280**	**150**	—
ANM/100 lb. 26	48,000′	—	390	260	130	—
lb./hr. 1300						
40,000 ft.	Range	—	**445**	**315**	**185**	**55**
IAS 195K	48,000′	—	430	300	170	—
ANM/100 lb. 32.5						
lb./hr. 1150						
48,000 ft.	Range	—	**440**	**310**	**180**	**50**
IAS 175K						
ANM/100 lb. 32.5						
lb./hr. 1150						
FUEL STATE						
Galls AVTUR		300	250	200	150	100
Galls AVTAG		312	260	208	155	104

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* altitude 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 found by moving direct from the existing altitude level-flight range for the particular fuel state to the new altitude level-flight range.

PART VI
ILLUSTRATIONS

KEY TO FIGS. 1, 2 and 3

1. Aileron spring-strut adjuster.
2. L.P. cock lever.
3. Cabin pressure control handwheel (behind seat).
4. Port aileron tab trim switch.
5. IFF and telebriefing control panel.
6. Cockpit lighting switches.
7. VHF sets controllers
8. VHF set changeover switch.
9. Tip and pylon tanks jettison switches.
10. H.P. cock lever and relight button.
11. Flap selector lever.
12. Elevator trim tab indicator.
13. Throttle damper.
14. Press-to-transmit switch.
15. Elevator trim control.
16. Airbrakes selector lever.
17. Wheel brakes pressure gauge, aileron tab-position warning light, U/C emergency retraction switch. Aileron power-failure warning light and hydraulics audio-warning cut-out switch.
18. Oxygen contents gauge.
19. Windscreen de-icing pump.
20. Anti-G test button (pilot).
21. Anti-G control lever.
22. AYF limit setting switch.
23. Undercarriage position indicator.
24. Flap position indicator.
25. Undercarriage warning light.
26. Undercarriage selector lever.
27. Radio altimeter (AYF).
28. Machmeter.
29. Generator failure warning lights (pilot).

30. AYF limit indicators.
31. GGS emergency lowering control.
32. GGS master switch.
33. GGS selector dimmer.
34. Starter master and main inverter switch.
35. Starter pushbutton.
36. Navigator's oxygen-flow indicator.
37. Fire-warning light and extinguisher pushbutton.
38. Fuel contents gauge.
39. Fuel transfer warning indicators.
40. Emergency lamp switch.
41. Standby inverter and booster pumps switches.
42. Fuel pressure warning indicator.
43. Pilot's oxygen-flow indicator.
44. Cabin pressure warning light.
45. Cabin altimeter.
46. Pilot's oxygen regulator.
47. Switches, left to right:—Camera master, camera aperture, camera ground test and L.P. pump test.
48. Switches, left to right:—Navigation lights, ident. lights, Gee inverter and power.
49. Pressure-head heater switch.
50. F.I.S. pushbutton.
51. APS.57 radar control panel.
52. Generator failure warning lights (navigator).
53. Battery isolating switch.
54. Circuit breakers, left to right:—L.P. pump, external lights, main inverter, standby inverter.
55. Main inverter failure indicator.
56. Homing/intercomm. switch.
57. Port aileron trim tab circuit breaker.
58. Crowbar.
59. GGS circuit breaker.
60. Navigator's press-to-transmit button.
61. Gun door tool.
62. Panel lamps dimmer switch.
63. Navigator's oxygen regulator.
64. Mk. 4F compass corrector box.
65. Landing lamp switch.
66. Pilot's seat-raising lever.
67. Hydraulic handpump.
68. Aileron power selector.
69. Hood jettison handle.

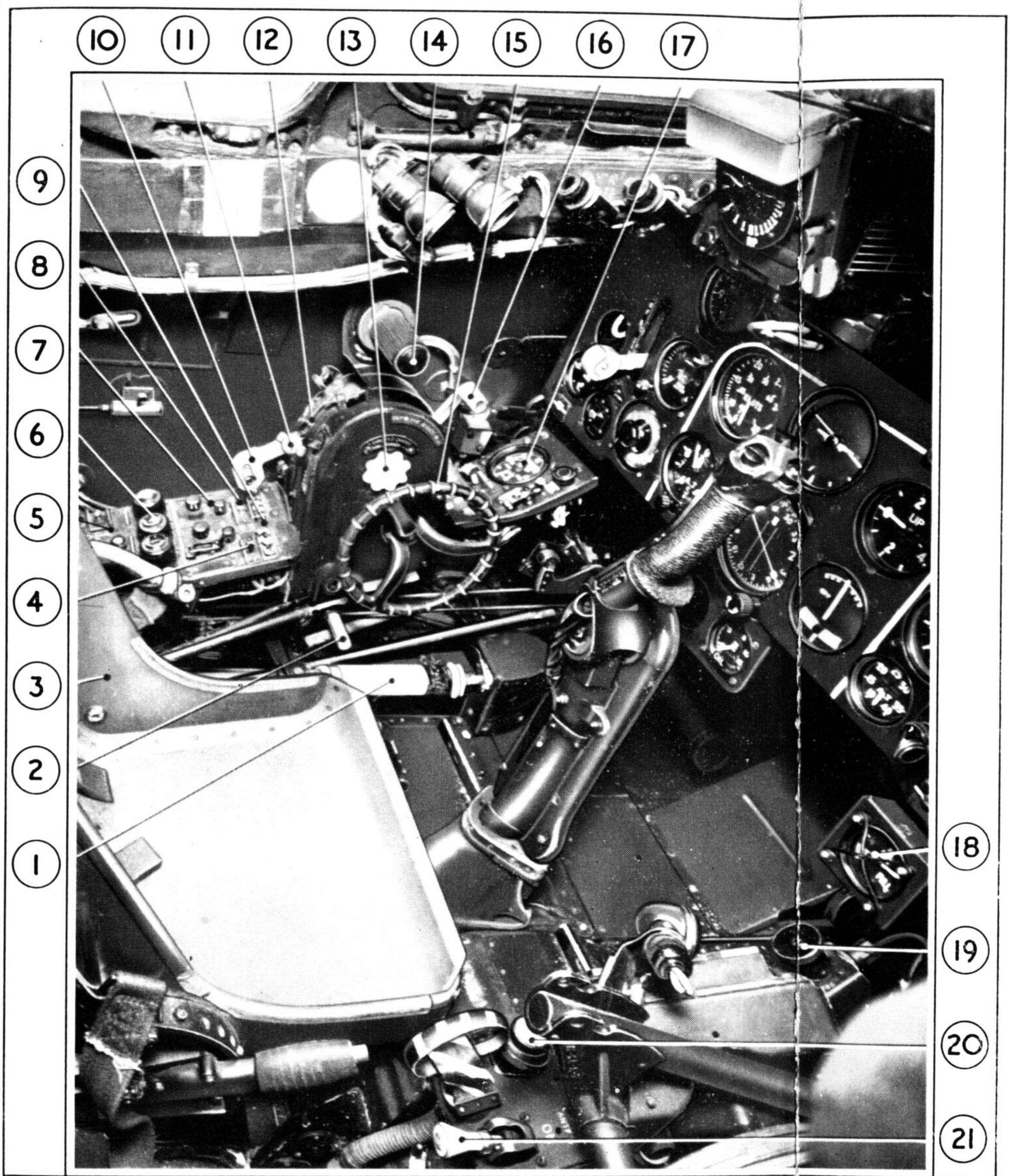


FIG 1

COCKPIT - PORT SIDE

FIG 1

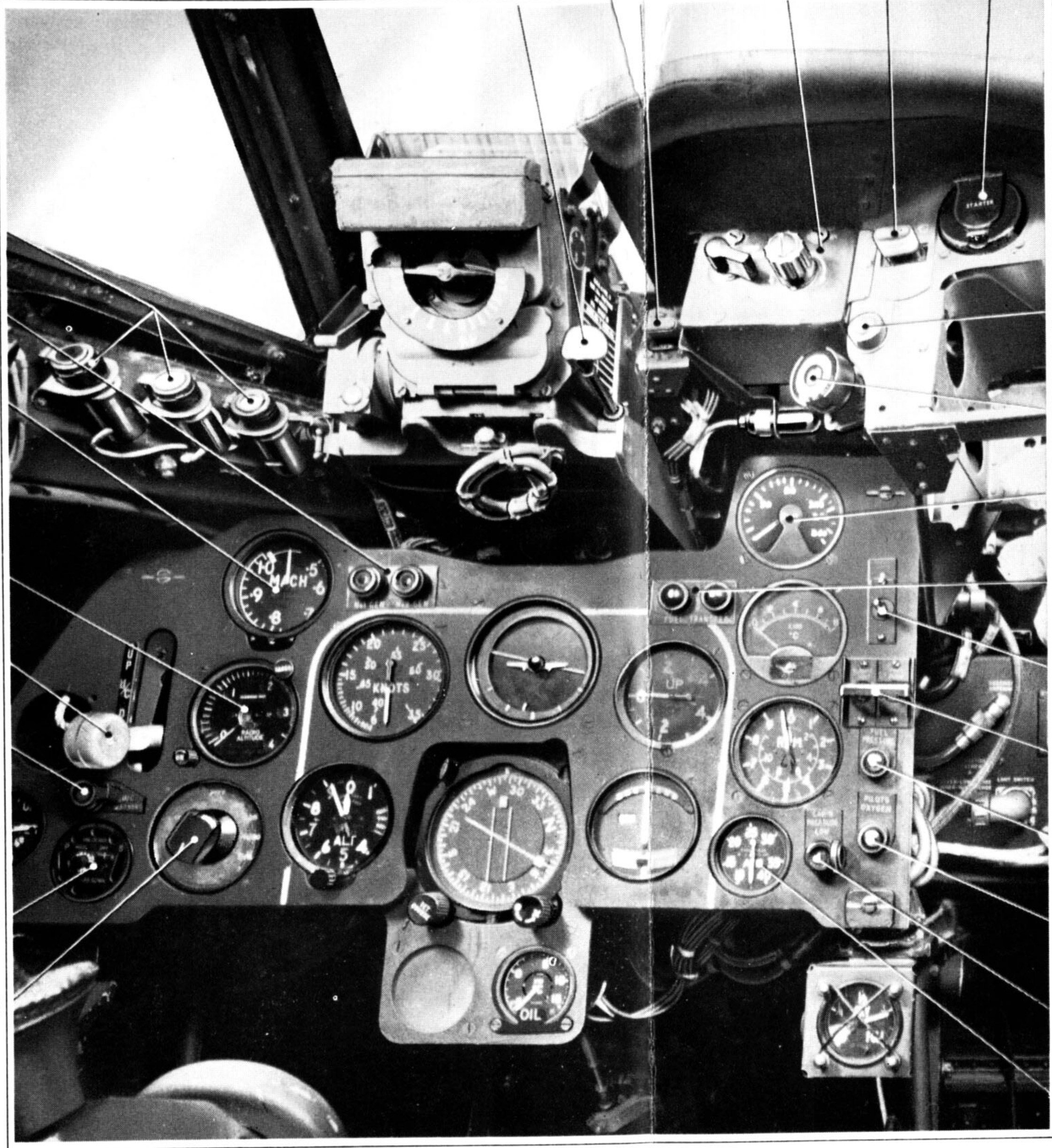
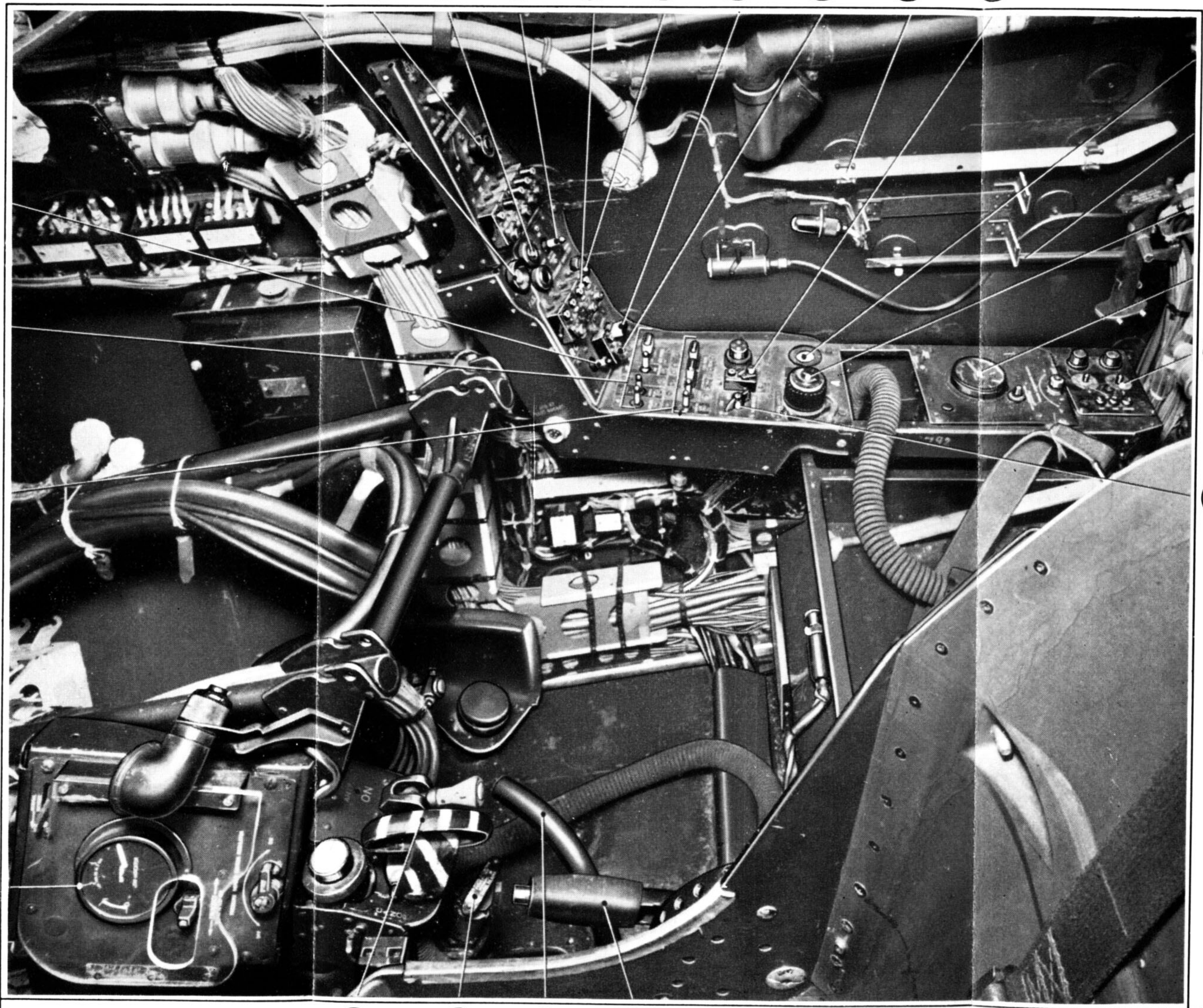


FIG 2

COCKPIT - FORWARD VIEW

FIG 2

50 51 52 53 54 55 56 57 58 59



49 48 47 46

60 61 62 63 64 65

69 68 67 66

FIG 3

COCKPIT - STARBOARD SIDE

FIG 3

EMERGENCY DRILLS

RELIGHTING

1. If mechanical DO NOT RELIGHT.
   L.P. and H.P. cocks — Off
   Booster pump and all non-essential electrics — Off
2. Flame-out

H.P. cock	Closed
L.P. cock	On
Throttle	Closed
Height	Below 30,000 ft.
Speed	180-250k

Press relight button and open H.P. cock, keeping button pressed for 20-25 seconds.

When at idling r.p.m., increase power carefully.

ACTION IN THE EVENT OF FIRE

1. Close throttle immediately.
2. If light remains on:—

L.P. and H.P. cocks	Off
Booster pump	Off
Airspeed	Minimum
Cockpit pressure	Off

3. Press extinguisher button.
   Light goes out if fire is extinguished.
4. If fire persists, abandon aircraft.

ABANDONING

1. Trim nose-heavy.
2. Invert aircraft
3. Fall out. Navigator first followed by pilot.

HYDRAULICS FAILURE

1. Audio warning sounds.
2. Aileron power failure warning light comes on.
3. Select manual below 0.82M.

HYDRAULICS FAILURE (contd.)

4. DESCENT
   Reduce speed below 200 knots.
   Lower undercarriage (by handpump if necessary).
   Descend at not more than 220 knots.
   Lower full flap before glide path is reached.
5. Brakes pressure sufficient for landing. If necessary, charge accumulator by handpump.

UNDERCARRIAGE EMERGENCY

1. Lower by normal selection.
2. If unsuccessful, use handpump. (Up to 115 strokes may be necessary.)
3. Emergency up on ground by first operating override and then raising normal selector lever.

FLAP EMERGENCY

Lower by normal selection or by handpump.

HOOD JETTISON

1. Pull jettison handle. If hydraulics U/S, use handpump.
2. If unsuccessful:—
   Pull handle at right of hinge.
   Open hood normally, keeping hand unclenched.

LOSS OF CABIN PRESSURE

1. If above 42,000 ft. select EMERGENCY OXYGEN.
2. Descend below 42,000 ft. (or if already below)
   Emergency oxygen — Off
   Select 100% on regulator.

Do not fly above 40,000 ft. for more than 15 mins. or at 38-40,000 ft. for more than 30 mins.

[OVER]

CHECK LISTS

FINAL CHECKS FOR TAKE-OFF

Trim	Elevator neutral
Throttle	Friction adjusted
Airbrakes	IN
Fuel	L.P. cock ON H.P. cock ON (catch engaged) Booster pump ON Fuel pressure indicator black
Flap	30° down
Instruments	Check and set, main inverter failure indicator black Pressure head heater ON
Oxygen	On and reaching mask Blinkers operating
Pressurization	OFF, HOT or REDUCE
Hood	Closed and locked
Harness	Tight and locked
Flying controls	Ailerons in power Warning light out Full, free and correct movement

FINAL CHECKS FOR LANDING

Brakes	Pressure, operation, Off
Airbrakes	IN
Undercarriage	Down (Below 220 k.) Three green lights
Fuel	Contents
Flaps	As required
Harness	Tight and locked

APPROACH SPEEDS (runway threshold)

Max. weight	115 K.
Normal weight	110 K.

INSTRUMENT APPROACH

DOWNWIND		
7,500 r.p.m.	½ flap	150/155 K.
FINAL		
7,500 r.p.m.	½ flap	140/145 K.
GLIDE PATH		
7,500 r.p.m.	¼ flap*	125/130 K.

* Flaps may be lowered fully when runway comes into view.

ENGINE LIMITATIONS

Take-off and operational necessity (30 mins.)	10,250 r.p.m.*	760°C.
Max. continuous	9,750 r.p.m.	660°C.
Approach idling	5,000 (min.) r.p.m.	—
Ground idling	3,000 ± 200	450°C.

* Reduce to 10,100 above 25,000 ft. in climb or 35,000 ft. in level flight.