A.P. 2847A & B—P.N.

# PILOT'S
AND
# FLIGHT ENGINEER'S
# NOTES

# LINCOLN I & II

**MARK I—FOUR MERLIN 85 OR 85A POWER PLANTS**
**MARK II FOUR MERLIN 68 OR 68A POWER PLANTS**

PREPARED BY DIRECTION OF THE MINISTER OF SUPPLY

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PROMULGATED BY ORDER OF THE AIR COUNCIL

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**RESTRICTED**

## AMENDMENTS

Amendment lists will be issued as necessary and will be gummed for affixing to the inside back 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 date of incorporation and initials below.

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| 1 | [illegible] | 10/10/50 | 7 | | |
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| 6 | | | 12 | | |

## NOTES TO USERS

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

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

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

Additional copies may be obtained by the Station Publications Officer by application on Form 294A, in duplicate, to Command headquarters for onward transmission to A.P.F.S., 81 Fulham Road, S.W.3 (*see* A.M.O. A1114/44). The number of this publication must be quoted in full—A.P. 2847A & B—P.N.

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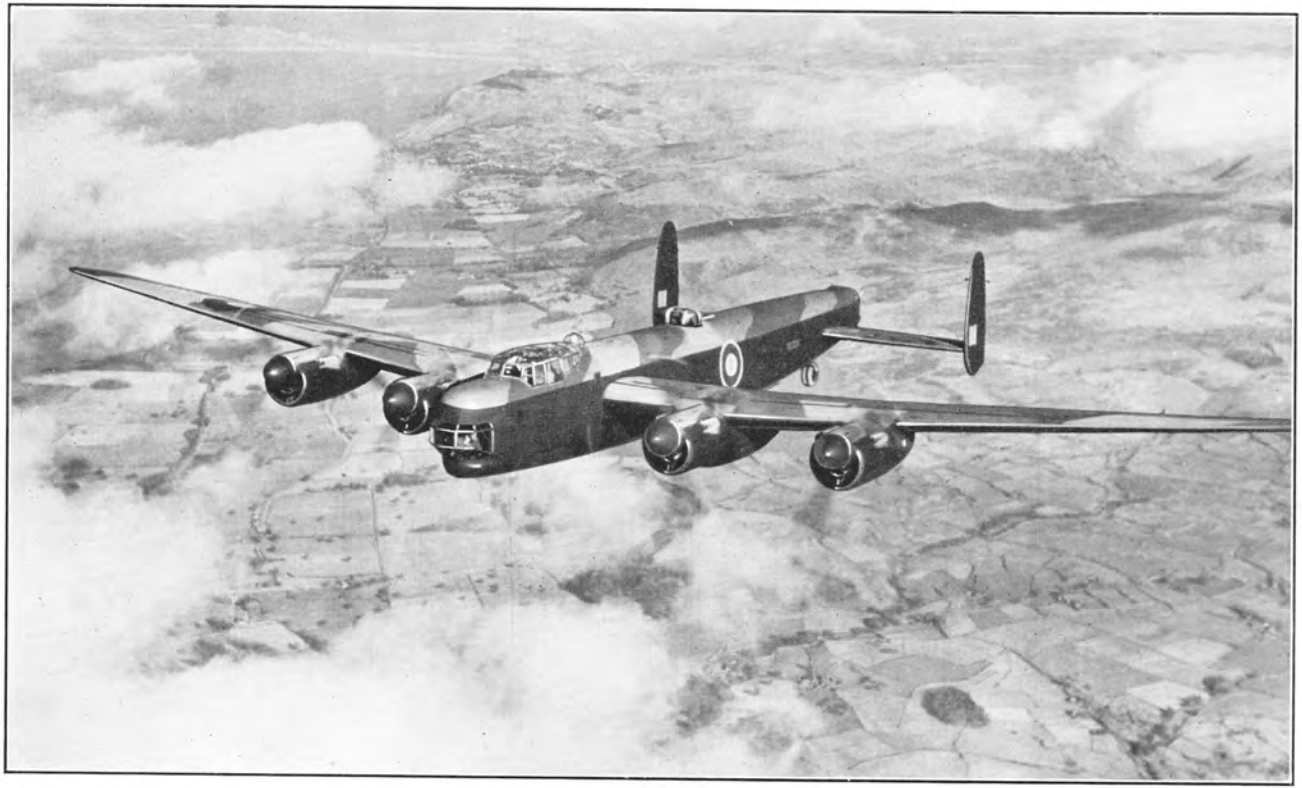

# LINCOLN I & II

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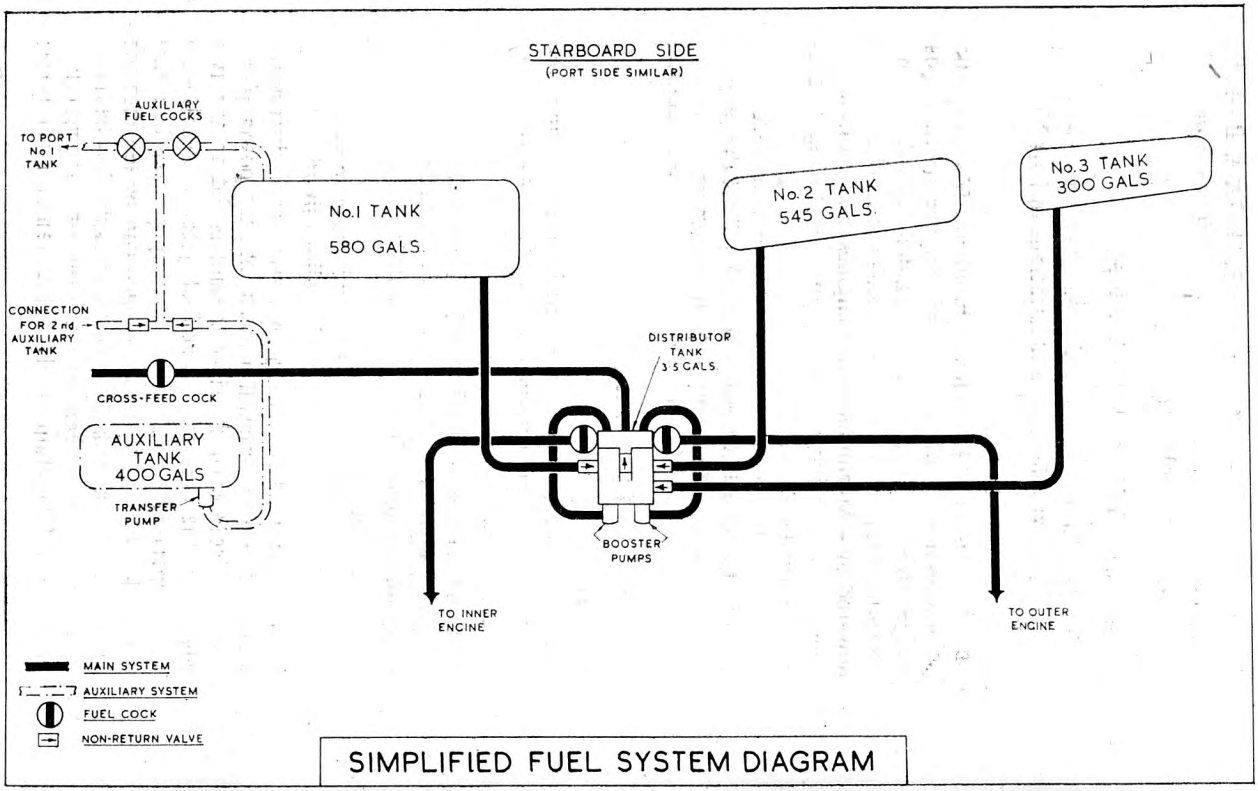
### PART I—DESCRIPTIVE




SIMPLIFIED FUEL SYSTEM DIAGRAM

# PART I

# *DESCRIPTIVE*

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

## INTRODUCTION

1. Lincolns Mk. I and II are heavy bombers. Mk. I aircraft are powered by 4 Merlin 85 or 85A engines (mounted as power plants) driving Rotol 4-bladed fully-feathering hydraulic propellers. Mk. II aircraft are similar but are powered by 4 Merlin 68 or 68A engines, also mounted as power plants, driving 4-bladed fully-feathering hydromatic propellers.

The main difference between the Merlin 68 and 68A, and between the Merlin 85 and 85A, as it affects the pilot, is that the Merlin 68A and 85A have automatic charge temperature control incorporated. (*See* para. 44 (vi).)

## FUEL AND OIL SYSTEMS

2. **Fuel tanks**

Three self-sealing tanks are fitted in each wing and numbered 1, 2 and 3 outboard from the fuselage.

The capacities are :

| | |
|---|---|
| Port and starboard No. 1 : | 580 gallons each |
| Port and starboard No. 2 : | 545 gallons each |
| Port and starboard No. 3 : | 300 gallons each |
| Total : | 1425 gallons each side |
| | 2850 gallons in all |

These tanks feed by gravity into two small distributor tanks, one on the firewall of each inboard power plant, and fuel from each distributor tank is fed to the two engines on the same side. The fuel systems in each wing are independent but are connected by a cross-feed pipe and cock. As fuel is used, nitrogen can be fed into the tanks to avoid the risk of explosion, should they be holed by enemy action. There is provision for carrying either one or two 400-gallon auxiliary fuel tanks in the bomb

bay. The fuel from these tanks may be transferred to either or both No. 1 tanks. The contents of No. 1 tanks only are jettisonable.

3. **Fuel cocks**
The pilot controls four engine master cocks, operated by levers (26) and (29) on either side of the control pedestal. There are no tank selector cocks. The cross-feed cock is on the floor just forward of the front spar, with the handle visible through the front spar cover. Normally the cross-feed cock should be kept OFF. When the auxiliary tanks are carried, two fuel cocks for controlling the transfer of fuel into the No. 1 tanks are fitted behind the front spar in the centre of the fuselage.

4. **Fuel booster pumps**
Two "Pulsometer" pumps are fitted in each distributor tank, each pump being controlled by a switch (77) on the flight engineer's panel ; a test push-button (76) for each pump is fitted below its ON-OFF switch. The main use of these booster pumps is to maintain fuel pressure at high altitudes. They are also used for priming the carburettors before starting, and at take-off all four booster pumps should be switched on.

5. **Auxiliary transfer pumps**
An electric transfer pump is provided in each auxiliary tank, when fitted, to transfer the fuel to the No. 1 tanks. The auxiliary fuel cocks (see para. 3) must be on. Two switches and test buttons for the transfer pumps are provided on the fuel contents gauges panel on the starboard side of the fuselage.

6. **Fuel gauges**
Electrical fuel contents gauges are fitted for all tanks except the distributor tanks. The gauges (70) for the permanent tanks are on a panel on the starboard side of the cockpit and will indicate whenever the ground/flight switch is turned to FLIGHT. "Gallons gone" flow-meters (75), recording the quantity of fuel used by each engine, are on the flight engineer's panel. These are set to zero before starting the engines by turning the milled knobs.

7. **Fuel pressure warning lights**
The four fuel pressure warning lights (59) on the flight engineer's panel are switched on and off by the ground/flight switch. They will come on at any time when the fuel pressure at the carburettor falls appreciably below normal.

8. **Nitrogen system**
The control cock for the nitrogen system is on the starboard side of the fuselage between the front and rear spars. When it is required to use the system the cock should be turned fully on before take-off, and turned off after landing. A pressure gauge is fitted above the control cock.

9. **Fuel jettison control** (see para. 66)
The control for the jettison valves in the No. 1 tanks is on the floor to the left of the pilot's seat. It is painted red and is pulled up and turned anti-clockwise to jettison fuel.

10. **Priming pumps**
On early aircraft there is one Ki-gass priming pump and two priming cocks in each inboard engine nacelle ; each pump draws fuel from the distributor tank on that side and serves one inboard and one outboard engine.
On later aircraft (when mod. 1715 is fitted) an electric priming pump in each inboard nacelle serves one inboard and one outboard engine ; the pumps are controlled by a three-position master switch (65) and four priming pushbuttons (17) on the right-hand side of the instrument panel. The central position of the master switch is the OFF position and when switched to the right-hand position the pump on the starboard side is brought into circuit, and a warning light to the right of the switch comes on ; when switched to the left-hand position the pump on the port side is brought into circuit and a warning light to the left of the switch comes on.

11. **Oil system**
Each engine has its own self-sealing oil tank, capacity 37½ gallons of oil with 4½ gallons air space. An oil dilution system is fitted on some aircraft and is operated by pushbuttons on the fuel contents gauges panel.

## MAIN SERVICES

12. **Hydraulic system**

(i) If Mod. 1769 has not been incorporated, one pump only is fitted on the port inner engine and operates the following services through a small accumulator :

Bomb doors
Flaps
Fuel jettisoning
Undercarriage

NOTE.—A handpump for ground test purposes is mounted on the left-hand side of the fuselage, but owing to its small capacity it is unsuitable for use in flight.

(ii) If Mod. 1769 has been incorporated a second pump is fitted on the starboard inner engine, but this pump is only intended for use if the pump on the port inner engine fails or, for any other reason, is not working. A two-position cock is fitted on the forward face of the front spar and is marked STARB'D PUMP TO RESERVOIR and STARBOARD PUMP DELIVERY. Normally this cock must be kept at STARB'D PUMP TO RESERVOIR, but in an emergency if the pump on the port inner engine is not working, this cock should be turned to STARB'D PUMP DELIVERY and the hydraulic accumulator will then be charged by the pump on the starboard inner engine.

WARNING.—If this cock should be left in the STARB'D PUMP DELIVERY position while the pump on the port inner engine is still working, the operation of the flaps will be erratic and much too fast.

13. **Pneumatic system**

(i) A compressor driven by the starboard inboard engine charges an air bottle to 450 lb./sq. in. for the operation of :—

Wheel brakes
Electro-pneumatic rams for radiator shutters, automatic supercharger gear change (on Mk. I aircraft) slow-running cut-out controls, hot-and-cold air intake controls (when fitted) and the air-cleaners.

A pressure-maintaining valve in the supply line from the air bottle only allows pressure to be supplied to the power-plant services if the pressure in the air bottle exceeds 160 lb./sq. in. (This is to ensure sufficient pressure for the brakes.)

It is necessary, therefore, to check on the triple pressure gauge (43) that pressure is at least 160 lb./sq. in. before changing the supercharger gear, or operating the slow-running cut-out, air intake heat, or air cleaner controls.

(ii) A compressor driven by the port inboard engine operates the Mark VIII Auto Pilot.

(iii) **Vacuum system**

Three vacuum pumps are fitted, two on the port inboard engine (connected to one pipe-line) and one on the starboard inboard engine. When the vacuum change-over cock (19) is at NORMAL, the starboard vacuum pump operates the instrument flying panel and the port pumps operate the Mk. XIV bombsight, the computor unit and other special equipment when fitted. When the vacuum changeover cock is set to EMERGENCY, the port pumps operate the instrument flying panel. The vacuum gauge (18) is connected to the pipeline which feeds the instrument flying panel.

14. **Electrical system**

(i) Two 6,000-watt generators (one on each inboard engine), connected in parallel, charge the aircraft batteries (24 volt), and supply the usual lighting and other services, including :—

Auto Pilot
Bomb distributor heating
Bomb fusing and release
Bomb slip heating
Camera
Dinghy release
D.R. compass
Electro-pneumatic rams for the supercharger gear change (on Mk. I aircraft) radiator shutters, slow-running cut-out controls, hot-and-cold air intake controls (if fitted) and the air cleaners

Engine priming and starting
Engine instruments
Fire-extinguishers
Flaps position indicator
Flare chute
Fuel booster and transfer pumps
Fuel contents and flowmeter gauges
Oil dilution
Propeller feathering
Pressure-head heater
Radio and Radar
Supercharger gear-change (Mk. II aircraft)
Turrets
Undercarriage position indicator

(ii) An alternator may be fitted to each outboard engine to supply special radar equipment, but when Mod. 1430 is introduced these two alternators are replaced by two 6,000-watt generators which feed into the aircraft batteries in the same way as do the generators on the inboard engines. The special radar equipment then gets its supply from two Type IV motor generators installed in the aircraft and driven from the main aircraft batteries.

(iii) A ground/flight switch on a panel on the starboard side of the fuselage between the spars is used to isolate the aircraft batteries when the aircraft is parked or when using a ground starter battery. The ground battery socket is on the starboard side of the fuselage, above the rear end of the bomb doors. The generator field circuit breakers, an emergency master switch, generator failure warning lights (one for each generator) and a voltmeter, are provided on a panel on the starboard side of the fuselage forward of the front spar. (See para. 77 for use of the generator field circuit breakers and the emergency master switch.)

(iv) All the electrical circuits are protected by circuit breakers which spring out if the circuit is overloaded and which may be reset by the pushbuttons mounted on a panel above the ground/flight switch. There are two pushbuttons for each circuit breaker, one of which is marked " O." To reset a circuit breaker press the pushbutton at

the side and then press the pushbutton marked " O." If the latter springs out continuously it indicates that the circuit is defective.

NOTE.—(i) The circuit breakers are not labelled to show which circuit they protect.

(ii) The circuit breakers should be reset only after the over-loaded circuit has been allowed to cool for 30 seconds.

## AIRCRAFT CONTROLS

15. **Trimming tabs**

The elevator (56), rudder (55) and aileron (54) trimming tab controls are mounted together on the right of the pilot's seat. All operate in the natural sense and each has an indicator showing the setting of the tab.

16. **Undercarriage control**

The undercarriage lever (58) is locked in the DOWN position by a safety bolt (57) which has to be held aside in order to raise the lever. The bolt engages automatically when the lever is set to DOWN. The undercarriage may be lowered in an emergency by compressed air (see para. 63).

WARNING.—There is no automatic lock other than the safety bolt to prevent the undercarriage being raised by mistake when the aircraft is on the ground.

17. **Undercarriage position indicator**

The indicator (41) on the lower left-hand side of the instrument panel operates as follows :

| | | |
|---|---|---|
| Undercarriage locked down : | | Two green lights |
| ,, | unlocked : | Two red lights |
| ,, | locked up : | No lights |

The indicator is switched on and off by the ground/flight switch.

18. **Undercarriage warning horn**

The horn sounds if either inboard throttle is nearly closed when the undercarriage is not locked down. The outboard throttles do not operate the horn.

19. **Flaps control**
The push-pull selector (53) is on the right of the pilot's seat, and has three positions, UP, neutral and DOWN. The " neutral " position is provided to allow partial flap to be selected. When the flaps have been fully lowered for landing, the selector should be left in the DOWN position until landing is complete, to prevent any possibility of the flaps creeping up. In an emergency the flaps may be lowered by compressed air *after lowering the undercarriage* (see para. 64).

20. **Flaps position indicator**
The flaps position indicator (28) on the bottom centre of the instrument panel is switched on and off by the ground/flight switch.

21. **Bomb doors control**
The control lever (34) on the left-hand side of the pilot's seat has two positions only. The bomb release system is rendered operative soon after the doors begin to open and before they are fully open. The position of the doors must, therefore, be checked visually before releasing bombs. To operate the bomb doors by handpump requires considerable effort. If the aircraft is to be bombed up for the next flight, therefore, the bomb doors should be opened before stopping the engines.

22. **Automatic pilot**
A Mark VIII Auto Pilot is fitted. For operation see A.P. 2095. Operation is normal except that a stop is provided to prevent the control cock from being moved from the SPIN position to the OUT position. The Mark VIII Auto Pilot and the Mark XIV bombsight can be used simultaneously.

## ENGINE CONTROLS

23. **Throttle controls**
(i) *Mk. I aircraft*
Climbing boost +12 lb./sq. in. is obtained with the throttles at the gate. To obtain +18 lb./sq. in. boost for take-off and combat, the throttle levers are moved fully forward. On these aircraft the automatic boost control cut-out is inoperative.

(ii) *Mk. II aircraft*

With the automatic boost control cut-out in the up position climbing boost is obtained with the throttles at the gate, and +18 lb./sq. in. boost with them fully forward. With this control in the down position, +21 lb./sq. in. boost is obtained with the throttles at the gate and also in the fully forward position.

Any major reduction in barometric pressure and increase in air temperature reduces the boost and power obtained when through the gate ; therefore, when at hot or high airfields, the boost control cut-out should be operated before take-off. The throttle movement will then give +18 lb./sq. in. boost at same setting before the gate is reached.

24. **Mixture control**

Rolls Royce Bendix-Stromberg pressure injection carburettors are fitted. There is no pilot's mixture control, the mixture strength being regulated by the power so that an economical mixture is obtained below +7 lb./sq. in. boost.

25. **Slow-running cut-out controls**

The slow-running cut-outs which are used for stopping the engines are operated by electro-pneumatic rams controlled by four switches (14) on the right-hand side of the instrument panel just above the engine starter pushbuttons. The switches must be held in the down position to put the controls into the IDLE-CUT-OFF position. If Mod. 1789 has not been incorporated the slow-running cut-out switches are not spring-loaded and will stay in the IDLE-CUT-OFF (down) position when set there. The up position is marked ENGINE ON.

WARNINGS.—(*a*) The fuel booster pumps must never be switched on when the engines are not running unless the slow-running cut-outs are in the idle-cut-off position, or the engine master cocks are OFF.

(*b*) If the pneumatic supply pressure is less than 160 lb./sq. in. it is possible to start

the engines with the slow-running cut-out switches in the IDLE-CUT-OFF position (if Mod. 1789 has not been incorporated); then when the supply pressure builds up the idle-cut-off rams will operate and all four engines will stop.

26. **Propeller controls**

(i) The propeller speed control levers (49), which vary the governed r.p.m. from 3,000 to 1,800, must be pushed down beyond the minimum governing position through gates before feathering action can be taken.

(ii) The feathering pushbuttons (60) are on the lower right-hand side of the instrument panel. For feathering and unfeathering see paras. 60 and 61.

A.L.1 Part I para. 27

27. **Supercharger controls** (13)

When the supercharger gear-change switch is set to AUTO, the two-speed two-stage superchargers are automatically changed to high gear at approximately 11,000 ft. (and back to low gear at a slightly lower height when descending). The switch can be set to M.S. for cruising in low gear at heights above 11,000 ft. Four warning lights, one for each engine, show when high gear is engaged. A pushbutton switch below the main supercharger switch is provided for ground-testing the gear change. On Mk. I aircraft the gear change is operated by an electro-pneumatic ram; on Mk. II aircraft it is operated by an electrical solenoid.

~~by an electrical solenoid~~.

28. **Radiator shutters**

The shutters are thermostatically controlled when the switches (68) on the flight engineer's panel are in the up position. When the switches are down, the control is over-ridden, and the shutters are opened; this position should be used for all ground running and taxying. If the switches are left in the up position the shutters will open when the coolant temperature exceeds ~~105°~~ 115°C and will close when the temperature is reduced to ~~95°~~ 109°C. A.L.1. A.L.1.

29. **Hot and cold air intake control**

The hot and cold air intake shutters are operated by electro-pneumatic rams controlled by a two-position switch (24) on the pilot's instrument panel. The top position is marked HOT AIR OFF, COLD AIR ON, and the bottom position is marked HOT AIR ON, COLD AIR OFF. (*See* para. 44(vii).)

NOTE.—These controls are not operative on early aircraft.

30. **Carburettor air cleaners**

The air cleaners are operated by spring-return electro-pneumatic rams controlled by a switch (25) on the right-hand side of the instrument panel. The air cleaners are automatically brought into operation when the undercarriage is lowered and at any time when the pneumatic pressure falls below 160 lb./sq. in.

## GENERAL EQUIPMENT AND OTHER CONTROLS

31. **Cockpit heating**

(i) Hot air from a radiator connected to the starboard inboard engine cooling system heats the nose of the aircraft and the cockpit, the heat being controlled by a knob behind a sliding door just forward of the front spar on the starboard side. To assist circulation of the air an adjustable louvre is provided on the port side of the fuselage nose.

(ii) A similar system connected to the port inboard engine cooling system heats the dorsal and tail turret positions.

32. **Oxygen**

The pilot's flexible oxygen pipe (35) is secured by spring clips to the left-hand cockpit rail. A regulator (63) which controls the supply throughout the aircraft is on the right of the instrument panel. A portable oxygen bottle for the pilot is fitted in a stowage (33) on the back of his seat.

33. **Pilot's seat**

The pilot's seat is adjustable for height by movement of a lever on the left-hand side, and the safety harness is released by a lever (36) on the right arm-rest.

34. **Pressure head heater switch**

The switch (61) and a test push-button (62) interconnected with the ammeter (67) are on the left-hand side of the flight engineer's panel.

35. **Windscreen de-icing**

Two de-icing sprays for the windscreen are operated by a handpump (51) on the floor, forward and to the left of the pilot's seat, drawing fluid from a 4-gallon reservoir (fitted below the step at the rear of the nose) which also supplies the air bomber's window.

Clear vision panels are fitted, one on either side of the windscreen, and open inwards.

# LINCOLN (MARKS I AND II)

## PILOT'S CHECK LIST

### (Excluding Checks of Operational Equipment)

| ITEM | | CHECK |
|---|---|---|
| 1. | Weight and balance. | Within permissible limits. |
| 2. | Authorisation book. | Sign. |
| | **External checks.** N.B.—Start at the entrance door and work clockwise around the aircraft. | |
| 3. | Dinghy external release. | Secure. |
| 4. | Tail oleo. | Extension. |
| 5. | Tail wheel. | Tyre for cuts and creep.<br>Valve for freedom. |
| 6. | Starboard tailplane. | Condition.<br>Leading edge. |
| 7. | Starboard fin. | Condition.<br>Leading edge. |
| 8. | Starboard rudder. | Condition.<br>Trimmer.<br>External control lock removed. |
| 9. | Starboard elevator. | Condition.<br>Trimmer.<br>External control lock removed. |
| 10. | Rear turret. | Locked fore and aft. |
| 11. | Rear lights. | Condition. |
| 12. | External aerials. | Condition. |
| 13. | Port elevator. | Condition.<br>Trimmer.<br>External control lock removed. |
| 14. | Port rudder. | Condition.<br>Trimmer.<br>External control lock removed. |
| 15. | Port fin. | Condition.<br>Leading edge. |
| 16. | Port tailplane. | Condition.<br>Leading edge. |
| 17. | Static vent. | Plug removed. |
| 18. | Port mainplane. | Condition of upper surfaces.<br>Tank covers secure. |
| 19. | Port flaps. | Position. |
| 20. | Port aileron. | Condition.<br>Trimmer.<br>External control lock removed. |
| 21. | Port identification lights. | Condition. |
| 22. | Port navigation light. | Condition. |
| 23. | Port mainplane. | Condition of leading edge.<br>Condition of under surfaces.<br>Landing lamps retracted. |
| 24. | Port outer engine. | Security of oil tank cover and coolant cap cover.<br>Security of cowlings.<br>Condition of propeller and spinner.<br>Oil and coolant leaks. |

| ITEM | CHECK |
|---|---|
| 107. Ignition switches. | Off. |
| 108. Boost gauges. | Check static reading. |
| 109. Flap indicator. | Check reading against position of flaps. |
| 110. Supercharger switch. | " M " gear. |
| 111. Starboard inner and outer engine master cocks. | Off. |
| 112. Air intake heat control switch. | Cold. |
| 113. Air cleaner control switch. | Air cleaners in. |
| 114. Fuel cut off switches. | Engine on. |
| 115. Identification light switches. | As required. |
| 116. Throttle controls friction adjuster. | Function. |
| 117. R.P.M. control levers friction adjuster. | Function. |
| 118. Elevator trimmer. | Full and correct movement. |
| 119. Aileron trimmer. | Full and correct movement. |
| 120. Rudder trimmer. | Full and correct movement. |
| 121. Emergency lights switch. | Test. |

| ITEM | CHECK |
|---|---|
| 122. Pilot's harness. | Adjust.<br>Check lock. |
| 123. Intercom. | Adjust headset.<br>Check with crew. |
| 124. Oxygen. | Delivery. |
| 125. Ground/flight switch. | Ground. |
| 126. Form 700. | Sign. |
| 127. Entrance ladder. | Stowed. |
| 128. Entrance door. | Locked. |
| **Start and warm up the engines** (see para. 38). | |
| 129. Radiator shutters. | Open. |
| 130. D.R. compass. | On and setting.<br>Synchronise repeaters. |
| 131. Suction. | Test normal and emergency supply. |
| 132. Radio. | Test V.H.F. and other radio aids.<br>Check altimeter setting with Control. |
| 133. Direction indicator. | Set with magnetic compass.<br>Check with D.R. compass.<br>Uncage. |
| **Run up the engines** (see para. para. 39). | |
| 134. Generators. | Charging. |
| 135. Fuel flowmeters. | Operation. |
| 136. Pneumatic pressure. | Supply increasing to maximum. |
| 137. D.R. compass. | Normal. |

| ITEM | CHECK |
|---|---|
| 138. Chocks. | Clear. |
| 139. Taxying. | As soon as possible test brakes.<br>Direction indicator for accuracy.<br>Artificial horizon for accuracy.<br>Check temperatures.<br>Check brake pressure.<br>Pressure head heater on if necessary. |
| **Checks before take-off** (see para. 41). | |
| **Checks during flight as required.** | |
| **Checks before landing** (see para. 47). | |
| **After landing.** Clear runway. | |
| 140. Pneumatic pressure. | Supply. |
| 141. Flaps. | Up.<br>Selector neutral. |
| 142. Radiator shutters. | Open. |
| 143. R.P.M. control levers. | Maximum R.P.M. position. |
| 144. Booster pumps. | Off. |
| 145. Pressure-head heater. | Off if necessary. |

| ITEM | CHECK |
|---|---|
| **On reaching dispersal.** Run down the engines (see para. 50) and when they have been stopped. | |
| 146. Flaps. | Select down. |
| 147. Electrical services. | All off. |
| 148. Chocks. | In position. |
| 149. Brakes. | Off. |
| 150. Direction indicator. | Caged. |
| 151. Intercom. | Off. |
| 152. Flying controls. | Locked. |
| 153. Radiator shutters. | Auto. |
| 154. Ground/flight switch. | Ground. |
| 155. Hydraulic accumulator. | Pressure. |
| 156. Main oxygen supply. | Off. |
| 157. Nitrogen system. | Off if necessary. |
| 158. Static vents. | Plugs in. |
| 159. Pressure head. | Cover on. |
| 160. Form 700. | Sign. |
| 161. Authorisation Book. | Sign. |

| ITEM | CHECK |
|---|---|
| 25. Port inner engine. | Security of oil tank cover and coolant cap cover.<br>Security of cowlings.<br>Condition of propeller and spinner.<br>Oil and coolant leaks. |
| 26. Port undercarriage. | Distributor tanks drain cock—Off.<br>Fuel servicing cock plates in position.<br>External lock removed.<br>Micro-switches clean and free.<br>Extension of oleo legs.<br>Brake leads secure.<br>Towing shackles secure.<br>Locking ring for creep and wedges in position.<br>Valve free.<br>Tyre for cuts and creep.<br>Chock in position. |
| 27. Port fuel jettison pipe cover plate. | Pin secure. |
| 28. Bomb doors. | Condition. |
| 29. Pressure head. | Cover removed. |
| 30. External fire extinguishers. | In position. |
| 31. Starboard fuel jettison pipe cover plate. | Pin secure. |
| 32. Starboard undercarriage. | Fuel servicing cock plates in position.<br>External lock removed.<br>Micro-switches clean and free.<br>Extension of oleo legs.<br>Brake leads secure.<br>Towing shackle secure.<br>Locking ring for creep and wedges in position.<br>Valve free.<br>Tyre for cuts and creep.<br>Chock in position. |
| 33. Starboard inner engine. | Security of oil tank cover and coolant cap cover.<br>Security of cowlings.<br>Condition of propeller and spinner.<br>Oil and coolant leaks. |
| 34. Starboard outer engine. | Security of oil tank cover and coolant cap cover.<br>Security of cowlings.<br>Condition of propeller and spinner.<br>Oil and coolant leaks. |
| 35. Starboard mainplane. | Condition of leading edge.<br>Condition of under surface. |
| 36. Starboard navigation light. | Condition. |

# PART II

## *HANDLING*

NOTE.—The speeds quoted may vary on individual aircraft particularly as yaw promotes considerable fluctuation of the air-speed indicator reading.

36. **Management of the fuel system**

(i) *Testing the electric fuel booster and fuel transfer pumps.* Before starting the engines each booster pump should be tested as follows :

(*a*) The master engine cocks must be kept OFF. (Alternatively the slow-running cut-out switches must be held in the IDLE CUT-OFF position, and the pneumatic pressure must be above 160 lb./sq. in.)

(*b*) The pump switch should be OFF.

(*c*) Press the test pushbutton for each pump in turn and check the ammeter reading. This should be steady at between 4 and 7 amps.

(ii) *Use of the booster pumps.* All four booster pumps must be switched on for take-off and for landing, but they may be switched off during flight. They should however be switched on at any sign of fuel starvation.

WARNING.—The booster pumps must never be switched on when the engines are not running unless all the master cocks are OFF (or the slow-running cut-outs are in the IDLE CUT-OFF position, and the pneumatic pressure is above 160 lb./sq. in.).

i) *Use of the tanks.* The three tanks in each wing feed by gravity into the fuel distributor tank on that side. Because of their positions in the wing No. 3 tank will empty before No. 2 tank, and No. 2 tank will empty before No. 1. When the auxiliary fuel tanks are carried in the bomb bay, their contents may be transferred into either or both No. 1 wing tanks when there is space

available, by switching on their transfer pumps, and turning on the auxiliary tank cocks. It is advisable to transfer fuel from the auxiliary tanks 100 gallons at a time as space becomes available in the No. 1 tanks rather than wait until there is sufficient space in the No. 1 tanks to transfer all the auxiliary tank fuel. *Care must be taken, however, to ensure that the No. 1 tanks are never overfilled.*

(iv) *Use of the cross-feed line and cock.* The cross-feed cock should normally be kept closed, unless it becomes necessary in an emergency to feed fuel from the tanks in one wing to the engines in the other wing.

In these circumstances the booster pumps in the distributor tank being used should be switched on.

37. **Preliminaries**

(i) Before entering the aircraft carry out the usual external checks and ensure that the pressure head cover and static vent plugs are removed.

(ii) On entering the aircraft check the following with the flight engineer :

| | |
|---|---|
| Hydraulic accumulator ... | Pressure should not be less than 220 lb./sq. in. with the engines stationary. |
| Hydraulic pumps change-over cock (if Mod. 1769 is fitted) ... ... | Cock set to STARB'D PUMP TO RESERVOIR. |
| Cross-feed cock ... ... | OFF |
| Auxiliary tanks transfer cocks ... ... ... | OFF |
| Booster and transfer pumps switches ... ... ... | OFF |

(iii) On reaching the cockpit check

| | |
|---|---|
| Ignition switches ... ... | OFF |
| Engine master cocks ... | OFF |
| Undercarriage selector lever | Safety bolt engaged. |

(iv) Have the ground/flight switch set to FLIGHT and check

| | |
|---|---|
| Generator field and all other circuit-breaker pushbuttons | In |
| Fuel contents gauges ... | Check contents. |
| Fuel flowmeters ... ... | Set to zero. |
| Undercarriage indicator ... | All lights green. |
| Pneumatic supply pressure | 160 lb./sq. in. minimum. |
| Vacuum change-over cock | Set to NORMAL. |

(v) Test all the fuel booster and transfer pumps by ammeter (see para. 36(i)), making sure first that the engine master cocks are OFF.

(vi) Have the ground/flight switch turned to GROUND and have a ground starter battery plugged in.

38. **Starting the engines and warming up**

NOTE.—If it is desired to test the hydraulic pump on the starboard inner engine (if Mod. 1769 is fitted), this engine must be started first before the port inner engine. The hydraulic change-over cock should be turned to STARB'D PUMP DELIVERY and when the engine is started the operation of the flaps should be checked. The change-over cock should then be returned to STARB'D PUMP TO RESERVOIR before starting the port inner engine.

(i) Set the engine controls as follows :

| | |
|---|---|
| Engine master cocks ... | ON |
| Slow-running cut-out controls ... ... ... | ENGINE ON |
| Boost control cut-out (Mk. II aircraft) ... ... | Up |
| Throttles ... ... ... | 1 inch open |
| Propeller controls ... ... | Speed control levers fully up. |
| Supercharger control ... | Low gear (Warning lights not showing). |
| Hot and cold air intake control switch ... ... | Up (HOT AIR OFF, COLD AIR ON). |
| Radiator shutters ... ... | Override switches at AUTOMATIC. |

(ii) Have a fire-extinguisher ready in case of emergency.

(iii) Prime the carburettors of both engines on the same side by holding down the slow-running cut-out switches and switching on the booster pumps in the distributor tank on that side for a period of 10 seconds. *Switch off the booster pumps and then release the slow-running cut-out switches.*

(iv) Turn the priming pump master switch to the appropriate position and switch on the ignition. Then for each engine in turn press the starter, booster-coil and priming pushbuttons simultaneously. The priming pushbutton should be released after the following periods,

| Air temp. °C ... | +30 | +20 | +10 | +5 | 0 | —10 | —20 |
|---|---|---|---|---|---|---|---|
| Injection period (secs.) : | | | | | | | |
| Normal fuel ... | 2 | 3 | 4½ | 6 | 7½ | 20 | 35 |
| High volatility fuel ... | | | | | 3 | 6 | 12½ |

If hand priming pumps are fitted in place of the priming pushbuttons the ground crew will work the priming pump as firmly as possible while the engine is being turned ; it should start after the following number of strokes

| Air temp. °C ... | +30 | +20 | +10 | +5 | 0 | —10 | —20 |
|---|---|---|---|---|---|---|---|
| Normal fuel ... | 3 | 4 | 7 | 12 | 13 | | |
| High volatility fuel | | | | | 4 | 8 | 18 |

For priming at air temperatures below freezing, high volatility fuel (stores ref. 34A/111) should be used if an external priming connection is fitted.

NOTE.—The amount of priming given above applies when the engine is cold. Less priming will be required when it is warm, and when it is hot it is unlikely that any priming will be necessary. However, since individual engines differ in this respect the pilot should always discuss the amount of priming required with the ground crew concerned.

(v) The starter pushbutton should not be pressed for more than 20 seconds with a 30-second wait between each turning period. It will probably be necessary to continue priming after the engine has fired and until it picks up on the carburettor.

(vi) When the engine is running satisfactorily, release the booster-coil and priming pushbuttons. When all the engines are running satisfactorily switch off the priming pump master switch.

(vii) Have the ground battery disconnected, then set the ground/flight switch to FLIGHT.

(viii) Open each engine up slowly to 1,200 r.p.m. and warm up at this speed.

NOTE.—Do not run at a lower speed for any length of time as this leads to fouled sparking plugs.

39. **Testing the engines and services**

*While warming up*

(i) Check all temperatures and pressures. Check the trimming tab and flying controls for full and free movement. Check the operation of the hydraulic system by lowering and raising the flaps, and opening and closing the bomb doors.

NOTE.—Do not operate the bomb doors if a bomb load is on board.

(ii) Keep the fuel booster pumps switched off so as to check the operation of the engine-driven pumps ; the fuel pressure lights should stay out.

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(iii) Test each magneto as a precautionary check before increasing power further.

*After warming up to 15°C. (oil) and 40°C. (coolant)*

(iv) Switch the radiator shutters override switches to OPEN, and switch on the fuel booster pumps. Then for each engine

(v) Open up to static boost reading observed before starting the engines (0 lb/sq. in. under 'standard atmosphere' conditions) and exercise and check the operation of the two-speed two-stage superchargers as follows :

Set the gear-change switch to AUTO

Press and hold the test pushbutton for 30 seconds.

NOTE.—(*a*) R.p.m. should fall and boost should rise slightly as high gear engages.

(*b*) The appropriate warning light should come on and remain on while high gear is engaged.

(vi) At the same boost exercise and check the operation of the constant speed unit by moving the r.p.m. control lever

over the whole range at least twice. Return the lever to the maximum r.p.m. position. Then check that the r.p.m. are within 50 of those normally obtained.

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(vii) At the same boost test each magneto in turn. If the single ignition drop exceeds 200 r.p.m. but there is no undue vibration the ignition should be checked at higher power—see sub. paras. (ix) and (x) below. If there is marked vibration the engine concerned should be shut down and the cause investigated.

(viii) While running at this power, check with the flight engineer that all the generators are charging.

NOTE.—The following checks should be carried out after repair, rectification, inspection other than daily, when the single ignition drop at the static boost reading exceeds 200 or at the discretion of the pilot. Normally if the checks in sub. paras. (v) to (vii) are satisfactory no useful purpose will be served by a full power check.

(ix) *Mk. I aircraft*

Open the throttle of each engine in turn to the take-off position, and check take-off boost (+18 lb./sq. in.) and r.p.m. (3,000).

*Mk. II aircraft*

Set the boost control cut-out down, then open the throttle of each engine in turn to the gate and check take-off boost (+18 lb./sq. in.) and r.p.m. (3,000).

(x) Throttle back to +9 lb./sq. in. boost, or further if necessary to ensure that r.p.m. fall below the take-off figure, indicating that the propeller is not constant-speeding; then test each magneto in turn. If the single ignition drop exceeds 200 r.p.m. the aircraft should not be flown.

40. **Check list before taxying**

| | |
|---|---|
| Entrance door ... | Fastened |
| Instrument flying panel | Gauge should read 4½ in. Hg. with cock at NORMAL. |
| Ground/flight switch ... | FLIGHT |
| DI and DR Compass ... | Uncaged and synchronised. |
| Radiator shutters override switches ... | OPEN |

| | |
|---|---|
| Pneumatic supply pressure ... ... | 450 lb./sq. in. (brakes : 125 lb./sq. in.) |

NOTE.—If supply pressure is less than 450 lb./sq. in. check that pressure has increased since starting the starboard inboard engine. Taxying and take-off must not be attempted if pressure is less than 350 lb./sq. in.

41. **Check list before take-off**

| | |
|---|---|
| T—Trimming tabs | |
| Elevator ... ... ... | Neutral (at 65,000 lb.)<br>1½ divisions nose-heavy (at 75,000 lb.)<br>2 divisions nose-heavy (at 82,000 lb.) |
| Rudder ... ... ... | Neutral |
| Aileron ... ... ... | Neutral |
| M—Mixture Group | |
| Hot and cold air intake control ... ... ... | HOT AIR OFF, COLD AIR ON (Up) |
| Carburettor air cleaner switch ... ... ... | AIR CLEANER IN (Up) |
| Boost control cut out (Mk. II aircraft) ... | Up (but *see* para. 23(ii).) |
| Superchargers ... ... | MS (red lights out) |
| P—Propeller speed control levers ... ... ... | Up (Maximum r.p.m.) |
| F—Fuel ... ... ... | Check tank contents<br>Engine master cocks ON<br>Booster pumps ON<br>Slow-running cut-outs at ENGINE ON |
| F—Flaps ... ... ... | 1/3 down |
| G—George (Auto pilot) ... | Clutches IN<br>Control cock SPIN |
| Gyros ... ... ... | Check synchronised with compass |
| Radiator shutters override switches ... ... | AUTOMATIC |

42. **Take-off**

(i) Align the aircraft carefully on the runway making certain that the tailwheel is straight.

(ii) Open up to 0 lb./sq. in. boost against the brakes to check that all four engines are responding evenly.

(iii) Release the brakes gently and open the throttles slowly to the take-off position.

(iv) Keep straight by coarse use of the rudders and by differential throttle opening.

(v) As speed is gained ease the control column forward to raise the tail. Do not attempt to raise the tail by exerting a heavy push force on the control column during the very early stages of the take-off run.

(vi) Ease the aircraft off the ground at the following speeds :

| All up weight | Knots (m.p.h.) I.A.S. |
|---|---|
| 65,000 lb. | 100–105 (115–120) |
| 75,000 lb. | 105–110 (120–125) |
| 82,000 lb. | 110–115 (125–130) |

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

(viii) With the flaps 1/3 down, the safety speeds are :

| All up weight | Power | Knots (m.p.h.) I.A.S. |
|---|---|---|
| 75,000 lb. | +21 lb./sq. in. boost, 3,000 r.p.m. | 135 (155) |
| | +18 ,, ,, ,, ,, | 125 (145) |
| | +12 ,, ,, ,, ,, | 110 (125) |
| 82,000 lb. | +21 lb./sq. in. boost, 3,000 r.p.m. | 140 (160) |
| | +18 ,, ,, ,, ,, | 130 (150) |
| | +12 ,, ,, ,, ,, | 115 (132) |

(ix) When it is necessary to use full take-off power, it is recommended that this power be maintained only until the safety speed at +12 lb./sq. in. boost and 3,000 r.p.m. is attained ; power should then be reduced to the maximum climbing setting.

(x) Raise the flaps in stages above 400 ft. Then return the selector to neutral.

43. **Climbing**

(i) The recommended climbing speed is 145–150 knots (165–170 m.p.h.) I.A.S. from ground level to 20,000 feet.

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(ii) When climbing at maximum climbing power (+12 lb./sq. in. boost, 2,850 r.p.m.) the supercharger gear-change switch should be set to M.S. Change to high gear by putting the switch to AUTO when the boost obtainable in low gear has fallen to +9 lb./sq. in. If, in an emergency, combat power is being used, the change gear switch should be left in AUTO, and high gear will be selected at the correct height to give best performance at this power.

44. **General flying**

(i) *Stability.* Stability is satisfactory under all conditions.

(ii) *Controls.* The elevator is relatively light and effective, but tends to become heavy in turns. The ailerons are moderately light but somewhat spongy at cruising speeds. They become increasingly heavy at speeds above 245 knots (280 m.p.h.) I.A.S. and lose some effectiveness at high altitude. The rudders are effective but become very heavy at speeds above 245 knots (280 m.p.h.) I.A.S.

(iii) *Change of trim*

| | |
|---|---|
| Undercarriage up ... ... | Slightly nose up. |
| Undercarriage down ... | Initially nose up then slightly nose down. |
| Flaps up ... ... ... | Nose down (the change of trim over the last 25° of flap movement is marked). |
| Flaps down ... ... ... | Nose up (the change of trim over the first 25° of flap movement is marked). |
| Bomb doors open ... ... | Slightly nose down. |
| Bomb doors closed ... | Slightly nose up. |
| Radiator shutters open or closed ... ... ... | No change |

(iv) *Effect of rotation of the tail turret.* Rotation of the tail turret causes the aircraft to yaw in the direction of rotation and causes a slight pitch.

(v) *Flying at reduced airspeed in conditions of poor visibility.* Reduce speed to 140 knots (160 m.p.h.) I.A.S. and lower the flaps 1/3. Set the propeller speed control levers to give 2,650 r.p.m. Speed may then be reduced to 120 knots (140 m.p.h.) I.A.S.

(vi) *Engine handling.* Aircraft fitted with Merlin 68A or 85A engines have automatic charge temperature control incorporated to maintain the charge temperature in the induction manifold of each engine above 45°C., since fouling of the sparking plugs by lead deposit may occur if the charge temperature falls below 40°C. On aircraft having Merlin 68 or 85 engines, which have no automatic charge temperature control, the use of low r.p.m. for cruising in very cold weather should be avoided ; some aircraft may have a charge temperature gauge fitted, and if the temperature falls below 40°C., the hot air intakes should be used, and the r.p.m. increased if necessary.

(vii) *Use of carburettor air-intake heat control.* In snow or icing conditions a layer of ice will form over the ice-guards and so reduce to a minimum the risk of ice forming in the air intake. This covering of the air intake will reduce the boost by 1 to 2 lb./sq. in. at the full throttle cruising conditions. Should there be a progressive reduction in boost, or any other symptom (such as rough running) denoting ice accretion in the air intake, move the air intake heat control switch to the HOT AIR ON, COLD AIR OFF position.

45. **Stalling**

(i) Warning of the approach of a stall is given by tail buffeting, which can be felt some 5–6 knots before the stall itself. With the undercarriage and flaps down the buffeting continues after recovery until speed has increased to 95–105 knots (110–120 m.p.h.) I.A.S. In both cases the stall is gentle and recovery is straightforward.

(ii) *High speed stall.* Warning of the approach of a stall in a steep turn is given by elevator buffeting. Continued backward pressure on the control column will then cause the nose and inner wing to drop slightly, but recovery is immediate if the pressure on the control column is relaxed.

## FINAL CHECKS FOR TAKE-OFF

| | | |
|---|---|---|
| TRIM | ... | ELEVATOR : NEUTRAL AT 65,000 lb. 2 DIVS. NOSE HEAVY AT 82,000 lb. |
| | | RUDDER : NEUTRAL |
| | | AILERON : NEUTRAL |
| PROPS. | ... | MAX. RPM. |
| FUEL | ... | CHECK CONTENTS |
| | | ENGINE MASTER COCKS : ON |
| | | BOOSTER PUMPS : ON |
| | | SLOW RUNNING CUT-OUTS : ENGINE ON |
| FLAPS | ... | $\frac{1}{3}$ DOWN |
| AUTO PILOT | | CLUTCHES : IN |
| | | CONTROL COCK : SPIN |

## FINAL CHECKS FOR LANDING

FUEL ... BOOSTER PUMPS : ON

BRAKES ... OFF. CHECK PRESSURES

WHEELS ... DOWN AND LOCKED
(175 KTS. MAX.)

PROPS. ... 2,850 RPM. ON FINAL

FLAPS ... AS REQUIRED
(FULLY DOWN 150 KTS.
MAX.)

(iii) The stalling speeds, engines "off," in knots (m.p.h.) I.A.S. are as follows :

| | Undercarriage and flaps UP | DOWN |
|---|---|---|
| at 82,000 lb. ... | 115 (132) | — |
| at 75,000 lb. ... | 100 (115) | — |
| at 65,000 lb. ... | 95 (110) | 80 (92) |
| at 56,000 lb. ... | 85 (100) | 70 (81) |

46. **Diving**

The aircraft becomes increasingly tail heavy as speed is gained and should, therefore, be trimmed into the dive. The elevator trimmer tab is powerful and sensitive and the control must be used with care.

47. **Check list before landing**

Auto pilot control cock ... SPIN

Reduce speed to 140 knots (160 m.p.h.) I.A.S. lower the flaps 1/3 then check :—

| | |
|---|---|
| B—Brakes ... ... ... | Pneumatic supply pressure 450 lb./sq. in.<br>Pressure at each brake 125 lb./sq. in. |
| U—Undercarriage ... ... | DOWN<br>(Check by indicator, visually and by the horn). |
| M—Mixture Group | |
| Hot and cold air intake control ... ... | HOT AIR OFF, COLD AIR ON (up). |
| Carburettor air cleaner switch ... ... ... | AIR CLEANER IN (up) |
| Superchargers ... ... | MS (red lights out) |
| P—Propellers ... ... | Speed control levers set for 2,650 r.p.m. (2,850 for the final approach) |
| F—Flaps ... ... ... | Fully down (or as required) on final approach |
| F—Fuel ... ... ... | Booster pumps ON. |

48. **Approach and landing**

(i) The recommended final approach speeds in knots (m.p.h.) I.A.S. are as follows :

| | At maximum landing weight (65,000 lb.) | At Light load (56,000 lb.) |
|---|---|---|
| Engine assisted | 95 (110) | 90 (105) |
| Glide ... ... | 105 (120) | 100 (115) |

(ii) The initial straight approach should be made at a speed some 10–15 knots or m.p.h. above these figures.

49. **Mislanding**

The aircraft will climb away satisfactorily at the maximum landing weight at 115 knots (130 m.p.h.) I.A.S. with the undercarriage and flaps down.

(*a*) Raise the flaps to 1/2 down.

(*b*) Raise the undercarriage.

(*c*) Increase speed to 125 knots (145 m.p.h.) I.A.S. and raise the flaps in stages above 400 ft.

50. **After landing**

(i) Before taxying, raise the flaps, open the radiator shutters, switch off all booster pumps, and move the propeller speed control levers to the maximum r.p.m. position.

*On reaching dispersal*

(ii) Open up all four engines together to approximately 0 lb./sq. in. boost and exercise the two-speed two-stage superchargers (see para. 39(v) ).

(iii) Before stopping the engines throttle back slowly and allow them to idle at about 1,000 r.p.m. for one minute ; open the bomb doors for bombing up (if required).

(iv) *Stopping the engines.* To stop an engine, check first that the booster pumps are switched off and that the pneumatic pressure gauge reads at least 160 lb./sq. in., then move the slow-running cut-out switch to the IDLE CUT-OFF position, holding it there until the engine stops. When the engine has stopped, turn off the engine master cock, switch off the ignition and then return the slow-running cut-out switch to the ENGINE ON position.

NOTES.—(*a*) If the pneumatic pressure is low, open up the starboard inboard engine to about 1,500 r.p.m., checking that the pressure commences to build up; then stop this engine last.

(*b*) If Mod. 1789 is fitted, the slow-running cut-out switch will return to the ENGINE ON position as soon as it is released. If Mod. 1789 is not fitted it has to be returned manually to the ENGINE ON position.

If the switches are left in the IDLE CUT-OFF position, the rams will return to the ENGINE ON position as soon as the ground/flight switch is set to GROUND. Then, if any ground maintenance work is carried out which necessitates turning on and off the ground/flight switch, the rams will be operated continually.

(*c*) The engines must not be stopped by turning off the engine master cocks as this will empty the carburettors of fuel and cause air locking in the regulator units, which entails much trouble when starting the engines again.

(v) Switch off all electrical services and set the ground/flight switch to GROUND.

(vi) *Oil dilution.* See Pilot's Notes General A.P. 2095.

The correct dilution period for this aircraft is :

At air temperatures above — 10°C. One Minute
At air temperatures below — 10°C Two Minutes

## 51. **Beam Approach**

| | Pre-liminary Approach | Outer Marker on Q.D.R. | Outer Marker on Q.D.M. | Inner Marker on Q.D.M. |
|---|---|---|---|---|
| Indicated height (feet) ... | 1,500 | 1,500 | 600 | 150 |
| Action ... | Lower flaps 1/4 | Lower under-carriage | Lower flaps 1/2 | Lower flaps fully only when certain of getting into airfield. |
| Resultant Change of Trim | Strongly nose up. | Slightly nose down. | Slightly nose up. | — |
| I.A.S. ... | 130 knots (150 m.p.h.) | 120 knots (137 m.p.h.) | 115 knots (133 m.p.h.) | 105 knots (120 m.p.h.) |
| R.P.M. ... | 2,650 | 2,650 | 2,850 | 2,850 |
| Boost (level flight) | +1 | +2 | +4 | +10 |
| Boost ( −500 ft./ min.) | −3 | −1 | +1½ | +3 |
| Boost (overshoot) | — | — | — | +12 |

Remarks ... Flaps may be lowered 1/4 at speeds up to 175 kts. (200 m.p.h.) I.A.S.

Altimeter error at take-off −40 feet
Altimeter error at touch down +30 feet
Subtract 1 millibar from Q.F.E. to give zero reading on touchdown.

OVERSHOOT

Open throttles to the gate. Raise the flaps to ½ down. Raise the undercarriage. Climb at 115 kts. (133 m.p.h.) I.A.S. and raise the flaps in stages above 300 feet. Then increase speed to 130 kts. (150 m.p.h.) I.A.S.

# PART III

# *OPERATING DATA*

## 52. Engine data—Merlin 68, 68A, 85 or 85A

(i) *Fuel.* 100 octane only (100/130 grade).

(ii) *Oil.* See A.P. 1464 C/4.

(iii) The principal engine limitations are as follows :

| | | R.P.M. | Boost lb./sq. in. | Temp. °C. | |
|---|---|---|---|---|---|
| | | | | Coolant | Oil |
| MAX. TAKE-OFF TO 1,000 FT. ... | MS | 3,000 | +18* | | |
| MAX. CLIMBING 1 HOUR LIMIT | MS<br>FS | 2,850 | +12 | 125 | 90 |
| MAX. ... ... CONTINUOUS ... | MS<br>FS | 2,650<br>2,850 | + 7 | 105 | 90 |
| COMBAT ... ... 5 MINS. LIMIT ... | MS<br>FS | 3,000 | +18 | 135 | 105 |

+18 lb./sq. in. boost must not be used below 2,850 r.p.m.

* +21 lb/sq. in. boost is permitted for take-off only on Merlin 68 and 68A in cases of operational necessity.

OIL PRESSURE :
Minimum in flight ... ... ... ... 30 lb./sq. in.

MINIMUM TEMP. FOR TAKE-OFF :
OIL ... ... ... ... ... ... 15°C.
COOLANT ... ... ... ... ... ~~60°C.~~ 40°C ALI

## 53. Flying limitations

(i) The aircraft is designed for manoeuvres appropriate to a heavy bomber and care must be taken to avoid imposing excessive loads with the elevators during recovery from dives and in turns at high speed. Spinning and aerobatics are not permitted. Gentle manoeuvres only are permitted at weights above 75,000 lb.

(ii) Maximum speeds :

| | |
|---|---|
| Diving ... ... ... | 313 knots (360 m.p.h.) I.A.S. |
| Bomb doors open ... ... | 313 knots (360 m.p.h.) I.A.S. |
| Undercarriage down ... | 174 knots (200 m.p.h.) I.A.S. |
| Flaps down ... ... ... | 152 knots (175 m.p.h.) I.A.S. |

(iii) Maximum weights :

| | |
|---|---|
| Take-off and all forms of flying ... ... ... | 75,000 lb. |
| Take-off (runways only) ... | 82,000 lb. (Lincoln II only). |
| Landing ... ... ... | 65,000 lb. |

NOTE.—Aircraft on which Mod. 1395 is not embodied are restricted to 70,000 lb. for take-off and 60,000 lb. for landing, when used for training purposes.

(iv) Bomb clearance angles :

| | |
|---|---|
| Dive ... ... ... ... | 30° |
| Climb ... ... ... | 20° |
| Bank ... ... ... ... | 10° (with S.B.C. 25°) |

54. **Position error corrections**

(i) When the aircraft is fitted with $H_2S$ Mk. II blister (small) the position error correction is —1 knot (or m.p.h.) at all speeds up to 313 knots (360 m.p.h.) I.A.S.

(ii) When the aircraft is fitted with $H_2S$ Mk. IV " Camel " blister (large) the position error correction is as follows :

| | M.P.H. I.A.S. | | | KNOTS I.A.S. | | |
|---|---|---|---|---|---|---|
| From ... ... | 140 | 180 | 240 | 120 | 160 | 210 |
| To ... ... | 180 | 240 | 360 | 160 | 210 | 310 |
| Subtract ... | 1 | 2 | 3 | 1 | 2 | 3 |

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55. **Maximum performance**

(i) *Climbing.* The speed for maximum rate of climb is 145 knots (165 m.p.h.) I.A.S. from sea level to 20,000 ft., thereafter reducing speed by 2 knots per 1,000 ft. When climbing at maximum climbing power change to high gear when boost in low gear has fallen to +9 lb./sq. in. When climbing at combat power set the supercharger gear-change switch to AUTO, and high gear will be selected automatically at the correct height for best performance.

(ii) *Combat :*

Mk. I aircraft.

Set the supercharger gear-change switch to AUTO, r.p.m. to 3,000, and throttles fully forward.

Mk. II aircraft.

Set the supercharger gear-change switch to AUTO, r.p.m. to 3,000, boost control cut-out down, and the throttles to the gate.

56. **Maximum range**

(i) *Climbing.* Set the supercharger gear-change switch to MS, r.p.m. to 2,650, and open the throttles progressively to maintain +7 lb./sq. in. boost. When the boost has fallen to +4 lb./sq. in. with the throttles at the gate, set the supercharger gear-change switch to AUTO and re-adjust the throttles to give +7 lb./sq. in. boost. Climb at 145–150 knots (165–170 m.p.h.) I.A.S. to 20,000 ft. and reduce speed above that height by 2 knots per 1,000 ft.

(ii) *Cruising* (including descent) :

(*a*) The recommended speed is 145 knots (167 m.p.h.) I.A.S. Speeds above that recommended may be used without serious loss of range if obtainable at the lowest possible r.p.m. in low gear.

(*b*) Fly in low gear at maximum obtainable boost not exceeding +7 lb./sq. in. and obtain the recommended airspeed by adjusting r.p.m., which may be as low as 1,800 if this will give the speed required.

(*c*) At high altitudes, set the supercharger gear-change switch to AUTO if the recommended speed cannot be maintained in low gear at 2,500 r.p.m. and full throttle.

(iii) If the air intake control is set to HOT AIR ON, COLD AIR OFF (down), air miles per gallon will not be reduced to any great extent.

57. **Fuel capacities and consumptions**

Permanent tanks

| | Total |
|---|---|
| (i) Two No. 1 tanks—each 580 gallons | 1,160 gallons |
| Two No. 2 tanks—each 545 gallons | 1,090 gallons |
| Two No. 3 tanks—each 300 gallons | 600 gallons |
| | 2,850 gallons |
| Non-permanent tanks | |
| Two 400-gallon auxiliary fuselage tanks | 800 |
| Total all tanks | 3,650 gallons |

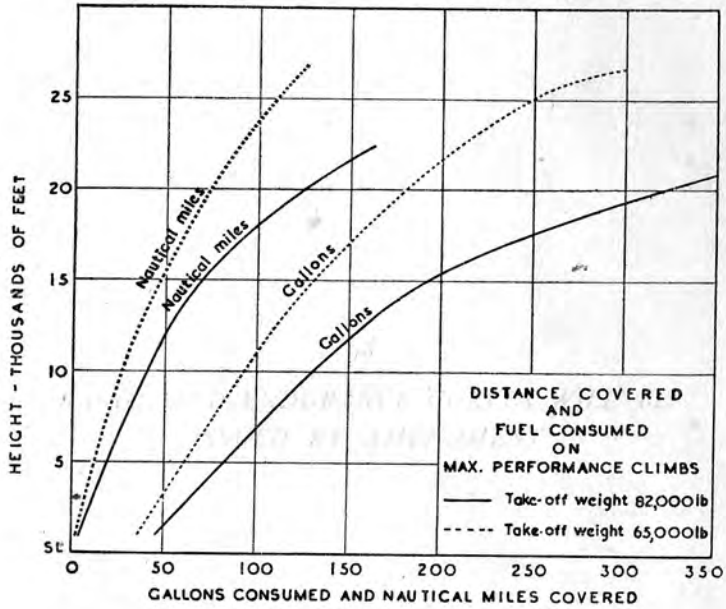
(ii) Approximate total fuel consumption in gallons/hour at 20,000 feet :

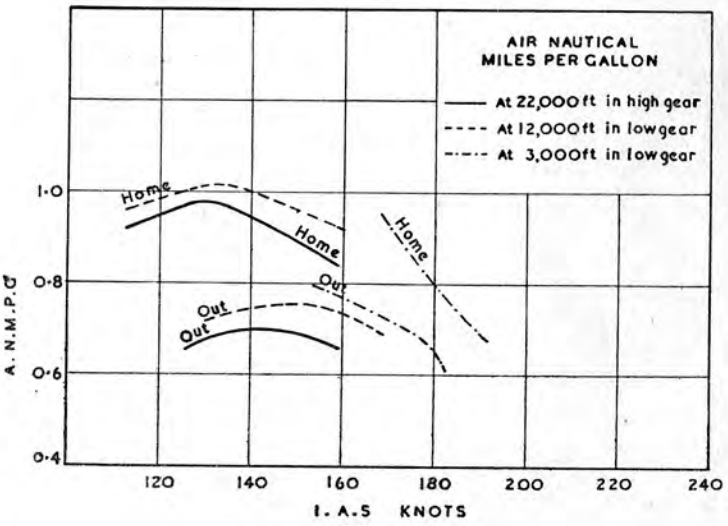
| BOOST lb./sq. in. | R.P.M. | | | | | | |
|---|---|---|---|---|---|---|---|
| | 3,000 | 2,850 | 2,650 | 2,400 | 2,200 | 2,000 | 1,800 |
| +18 | 600 | | | | | | |
| +12 | | 460 | | | | | |
| +7 | | | 288 | | | | |
| +4 | | | 252 | 232 | 204 | 176 | 148 |
| +2 | | | 232 | 212 | 188 | 164 | 140 |
| 0 | | | 208 | 188 | 172 | 152 | 132 |
| −2 | | | 184 | 168 | 156 | 144 | 128 |
| −4 | | | 160 | 148 | 140 | 132 | 124 |

At 30,000 feet these figures will be increased by approximately 20 gallons/hour.

## *PART III—OPERATING DATA*

### PERFORMANCE CURVES—LINCOLN 2



# PART IV

# *EMERGENCIES*

58. **Engine failure during take-off**

(i) With the flaps 1/3 down safety speeds are :

| at 82,000 lb. | Knots (m.p.h.) I.A.S. |
|---|---|
| +21 lb./sq. in. boost, 3,000 r.p.m. | 140 (160) |
| +18 ,, ,, ,, ,, | 130 (150) |
| +12 ,, ,, ,, ,, | 115 (132) |
| at 75,000 lb. | |
| +21 lb./sq. in. boost, 3,000 r.p.m. | 135 (155) |
| +18 ,, ,, ,, ,, | 125 (145) |
| +12 ,, ,, ,, ,, | 110 (125) |

(ii) If an outer engine fails before safety speed has been reached it will always be necessary to throttle back the opposite outer engine, at least partially to prevent control being lost. Once the propeller of the failed engine has been feathered and rudder trim applied it may be possible to reopen the throttle of the live outer engine gradually, increase speed and climb away.

(iii) If the port inboard engine fails during take-off it will be necessary for the Wireless Operator to set the hydraulic change-over cock to STARBOARD PUMP DELIVERY (if Mod. 1769 is incorporated) so that the undercarriage can be retracted.

(iv) With the propeller of the failed engine feathered, the undercarriage up, flaps 1/3 down and the rudder trim applied, the aircraft will climb away slowly at full load at 125 knots (145 m.p.h.) I.A.S.

(v) At a safe height when the undercarriage is up, raise the flaps in stages, retrimming as necessary, allow the speed to build up to 145 knots (165 m.p.h.) I.A.S. and continue the climb.

59. **Engine failure in flight**

(i) If the failed engine cannot be made to pick up, feather its propeller and turn off the engine master cock. When the engine has stopped (or nearly stopped) rotating, switch off the ignition.

NOTES.—(*a*) If spring-loaded cut-out switches (Mod. 1789) are fitted it is *most important* to turn off the engine master cock quickly, if the booster pumps are switched on.

(*b*) If Mod. 1789 is not fitted, the slow-running cut-out switch may be placed in the IDLE CUT-OFF position before turning off the engine master cock.

(ii) *Handling on three engines.* At 20,000 feet in high gear (in favourable conditions), and below 10,000 feet in low gear the aircraft will maintain height at full normal load on any three engines. Under these conditions the aircraft can be trimmed to fly hands and feet off at a speed of about 130 knots (150 m.p.h.) I.A.S.

NOTE.—At 82,000 lb. it will not be possible to maintain height at high altitudes with the live engines running at cruising power.

(iii) *Three-engined landing.* Lowering of 1/3 flap and of the undercarriage may be carried out as on a normal circuit, but the flaps should not be lowered further until it is certain that the airfield is within easy reach. The initial straight approach should be made at 120 knots (140 m.p.h.) I.A.S. and the three live engines used to regulate the rate of descent. Power and speed should be gradually reduced and the airfield boundary crossed at the correct engine-assisted approach speed (see para. 48).

(iv) *Handling on two engines* (asymmetric power). Below 10,000 feet in low gear the aircraft will maintain height at 120–125 knots (140–145 m.p.h.) I.A.S. at full normal load. If full rudder trim is applied to reduce the foot-load it is possible to induce mild rudder overbalance and this is more likely when both port engines are out of action. If not more than 10 divisions of rudder trim are applied rudder overbalance should not occur at this speed, but if encountered it can be easily corrected by winding off rudder trim. If the bomb load is jettisoned it will be possible to maintain height on two engines at a higher speed and the amount of rudder trim required (and the risk of overbalance) will, in consequence, be much reduced.

(v) *Two-engined landing* (asymmetric power). A left-hand circuit can safely be made irrespective of which engines have failed, provided speed is not allowed to fall below 125 knots (145 m.p.h.) I.A.S. Keep extra height in hand if possible and lower the undercarriage later than normally, aiming to have it locked down just before the final approach. Lower the flaps 1/3 and use the live engines to regulate the rate of descent. The flaps should not be lowered further until it is certain that the airfield is within easy reach. The initial approach should be made at 125 knots and power and speed gradually reduced, aiming to cross the airfield boundary at the correct engine assisted approach speed (see para. 48).

60. **Feathering**

(i) Close the throttle immediately.

(ii) Push the propeller speed control lever down through the feathering gate.

(iii) (*a*) On Mk. I aircraft press the feathering pushbutton and hold it in until feathering is complete.

(*b*) On Mk. II aircraft press the feathering pushbutton and hold it in only long enough to ensure that it stays in by itself ; then release it so that it can spring out when feathering is complete.

NOTE.—Pressing the button accelerates the feathering. The propeller will feather slowly at a decreasing rate, and not quite to the full, on the lever alone.

(iv) Turn off the engine master cock immediately. This is most important if the booster pumps are still switched on. If Mod. 1789 is not fitted the slow-running cut-out switch may be placed in the IDLE CUT-OFF position before turning off the engine master cock.

(v) Switch off the ignition when the propeller has stopped rotating.

NOTE.—If an engine fails during take-off the sequence may be (ii), (iii), (iv), (i).

61. **Unfeathering**

(i) Put the ignition on, set the throttle as for starting and the propeller speed control lever just forward of the feathering gate.

(ii) Check that both booster pumps on the same side as the engine to be started are off, then set the slow-running cut-out switches to ENGINE ON (not necessary if Mod. 1789 is incorporated) and the engine master cock ON.

(iii) Hold in the feathering pushbutton until the r.p.m. rise to 800–1,000.

NOTES.—(*a*) On Mk. II aircraft the pushbutton will not spring out until r.p.m. rise to 1,750–1,800.

(*b*) It is advisable not to unfeather at speeds higher than normal cruising in order to avoid the risk of overspeeding.

(*c*) The propeller will not unfeather without the electrical assistance introduced by pressing the pushbutton.

62. **Engine auxiliaries which will be affected by feathering**

| | | |
|---|---|---|
| Port outboard | ... | Generator (if Mod. 1430 is fitted). Alternator for special radio (if Mod. 1430 is not fitted). |
| Port inboard | ... | Generator. Main services hydraulic pump. Compressor for Autopilot. Vacuum pumps for Mk. XIV bombsight. |
| Starboard inboard | ... | Generator. Main services hydraulic pump (if Mod. 1769 is fitted). Compressor for pneumatic system. Vacuum pump for instrument flying panel. |
| Starboard outboard | | Generator (if Mod. 1430 is fitted). Alternator for special radio (if Mod. 1430 is not fitted). |

A.L.1
Part IV
para. 63

63. **Undercarriage emergency operation**

(i) If the undercarriage or flaps will not lower by the normal means, it may be due to failure of the hydraulic pump on the port inner engine. If Mod. 1769 is fitted, the cock on the forward face of the front spar should be turned to STARBOARD PUMP DELIVERY so as to charge the accumulator from the pump on the starboard inner engine (see para. 12 (ii)).

(ii) If the hydraulic system fails completely the undercarriage can be lowered by compressed air from a special bottle or bottles, irrespective of the position of the undercarriage selector lever.
NOTE.—The flap selector must be in the neutral position before using the undercarriage emergency air system.

(iii) The control (71) for the air system is just aft of the flight engineer's seat on the right-hand side of the cockpit. The undercarriage cannot be raised again by this method.
NOTE.—Although the emergency air system will lower the undercarriage irrespective of the position of the undercarriage selector lever, this should, if possible, be set to DOWN for landing. If left in the UP position any leakage of air pressure might cause the undercarriage to collapse.

64. **Flaps emergency operation**

*After* lowering the undercarriage by turning on the emergency air control, the flaps may be lowered by means of the normal flap selector, which then admits the air pressure to the flaps system. The flaps can be raised again, but there may not be sufficient air pressure to lower them a second time ; furthermore, raising the flaps may cause the header tank to burst. If it is absolutely necessary to raise the flaps by the emergency method extreme care must be taken to raise them slowly by stages. When the flaps have been lowered by the emergency method, the selector lever must be left in the down position after landing.

65. **Bomb jettisoning**

(i) Open the bomb doors, and check visually that both are fully open. See para. 21.

(ii) Then jettison the containers first by the switch (66) on the right-hand side of the instrument panel.

(iii) Jettison the bombs by the handle (64) beside the container jettison switch.

(iv) Close the bomb doors.

66. **Fuel jettisoning**

To jettison the contents of the No. 1 tanks :

(i) Reduce speed to 130 knots (150 m.p.h.) I.A.S. and lower flaps 1/4.

(ii) Lift and turn the jettison control on the left of the pilot's seat. Return the control after jettisoning.

(iii) The jettison valve should be closed when about 100 gallons remain in each tank ; if the jettison valve is open, all the fuel will be jettisoned less approximately 70 gallons, but the last 30 gallons of jettisonable fuel run out slowly and may possibly get splashed over the fuselage. The jettison valve may be closed at any time during jettisoning.

NOTES.—(*a*) The approximate weight of jettisonable fuel, leaving 100 gallons in each tank, is 6,900 lb.

(*b*) The fuel jettison system must not be operated unless the pressure in the hydraulic accumulator is more than 650 lb./sq. in. When the flaps are lowered prior to jettisoning, the accumulator pressure should build up rapidly to 650–850 lb./sq. in. If, however, the gauge indicates a lower pressure, one of the main hydraulic systems should be operated momentarily, e.g., the bomb doors control should be moved to OPEN and then returned at once to CLOSED. This will cause the hydraulic cut-out valve to function and the pumps will then build up pressure in the system. To ensure the most efficient operation of the jettison system the control valve should be opened as the rising pressure passes 650 lb./sq. in., and a member of the crew should watch the gauge and signal the pilot at this moment.

67. **Parachute exits**

(i) The hatch in the floor of the nose should be used by all members of the crew if time is available ; originally it was released by a handle in the centre, lifted inwards and jettisoned, but when Mod. 1337 is incorporated the hatch is enlarged and is opened by a handle at the port side. It opens inwards and is secured by a clip which holds the hatch up on the starboard side. It can also be opened from outside the aircraft.

(ii) The main entrance door should be used as a parachute exit only in extreme emergency.

68. **Crash exits**

Two push-out panels are fitted in the roof, one above the pilot, the other just forward of the rear spar.

69. **Air-sea rescue equipment**

(i) The type Q dinghy stowed in the starboard wing may be released as follows :

(*a*) from inside by pulling the release cord running along the fuselage roof aft of the rear spar.

(*b*) from outside by pulling the cable loop on the starboard side of the rear fuselage, forward of the tailplane leading edge.

(*c*) automatically by two immersion switches.

A dinghy radio, emergency pack type 4, and an AVRO type emergency pack are stowed with the dinghy.

(ii) *K type dinghies*

Seven stowages are provided adjacent to the parachute stowages.

70. **Ditching** (See A.P. 2095)

The flaps should be lowered 1/3 for ditching, but if they will not lower by the hydraulic system, *do not attempt to lower them by the compressed air system, as this will also cause the undercarriage to lower.*

71. **Fire-extinguishers**

(i) Each engine is provided with a fire-extinguisher system, and warning lights are mounted on the respective propeller pushbuttons ; if a fire warning light comes on, pressing the feathering button also operates the fire-extinguisher system. The pilot should, however, press the fire-extinguisher pushbutton (23) as well (see A.P. 2095). If the warning light is not on, pressing the feathering pushbutton will not operate the extinguisher. The engine fire-extinguishers are also operated automatically by a crash switch.

NOTE.—(*a*) Aircraft not fitted with Mod. 1245 have four fire warning lights mounted on the bottom right-hand side of the instrument panel (not on the feathering pushbuttons). On these aircraft it is necessary to press the fire-extinguisher pushbutton to operate the system.

(*b*) Mod. 1750 introduces low level coolant indicators, and if a fire warning light flashes instead of remaining on steady, it indicates low coolant level (*see* A.P. 2095).

(ii) *Hand fire-extinguishers*

Four hand fire-extinguishers are carried on the aircraft in the following positions :

(*a*) One on the starboard side of the nose.

(*b*) One on the port cockpit rail.

(*c*) One on the starboard side of the fuselage, forward of the front spar.

(*d*) One on the starboard side aft of the main floor.

**Instructions for parachuting wounded men by static line**

(i) If possible fly aircraft at 120 knots I.A.S. with flaps lowered 15°.

(ii) Assist the casualty towards the bomb-aimer's compartment and place him on the floor at the Flight Engineer's station with his feet on the glycol tank.

(iii) Check the wounded man's parachute harness, fit parachute pack and remove helmet.

(iv) Remove the static line from stowage. Care should be taken that the threads keeping the static line folded are not broken.

(v) Take the snap-hooks at the end of static line and attach to parachute as follows :

(*a*) Pass the safety becket on the static line through the double 8 cord safety loop, then pass the small snap-hook through the safety becket.

(*b*) Snap the hook down on the rip-cord handle. Insert and close the safety pin to lock the shroud to the snap-hook.

(*c*) Stow the slack of the static line between the becket and the snap-hook under the adjacent pack elastic to obviate all danger of this slack length fouling anything and thus pulling the rip-cord too soon.

(vi) Open the front escape hatch.

(vii) Slide the casualty through the exit feet first, facing aft. Care must be taken to keep his hands to his sides. Do not hold on to the static line by hand.

NOTE.—Crew members assisting the casualty must ensure that their parachutes are on, ready for immediate use.

# PART V

# *SUPPLEMENTARY NOTES FOR FLIGHT ENGINEER*

NOTE.—On aircraft not incorporating Mod. 1447 all the flight engineer's instruments are mounted on a panel on the starboard side of the cockpit aft of the undercarriage emergency operating knob. When Mod. 1447 is incorporated most of the instruments are mounted on a new panel further forward but still on the starboard side of the fuselage, and the original panel then only contains the fuel tank contents gauges, the auxiliary tank pump switches and test pushbuttons, the oil dilution pushbuttons and a cockpit lamp and dimmer switch.

72. **Oil system**

A self-sealing oil tank is fitted in each engine nacelle : the normal capacity is 37½ gallons with 4½ gallons air space. As the filler cap is at the top of the inboard tank, a dipstick must always be used when filling to ensure that the air space is not filled with oil. If the tanks are inadvertently overfilled, there is a drain cock at the bottom of each tank. A reserve of 2–3 gallons is provided in each tank for feathering the propeller. Normal high-pressure oil feeds the propeller constant speed unit. Under cruising conditions, it is recommended that the oil temperatures should not exceed 60°C, but up to 90°C may be used without damage to the engine. The oil consumption should be between 8 and 16 pints per hour.

73. **Coolant system**

Both the main coolant system and the intercooler system use 30% Glycol (DTD. 344A inhibited) and 70% distilled water. The intercooler header tank is built into the intercooler. The main coolant system header tank is mounted over the reduction gear of each engine. On the

ground with the engines running a small coolant discharge is normal, but not in flight. From B block on each inboard engine, coolant is led to the cabin heating radiators through which the flow of air is regulated by controls on the starboard side of the fuselage, one for the forward cabin forward of the front spar, the other for the rear part of the aircraft aft of the rear spar.

NOTE.—If the fuselage section of the cabin heating installation should be damaged it can be isolated from the coolant system by two stop cocks near the fuselage floor just forward of the front spar.

74. **Hydraulic system** (see para. 12)

The hydraulic accumulator has an air charging valve and an air pressure gauge aft of the front spar on the port side ; the gauge should read 220 lb./sq. in. when there is no hydraulic pressure in the system. Misleading pressure gauge readings will occur if the accumulator air pressure is incorrect. The gauge should read between 800–850 lb./sq. in. under working pressure ; at this pressure the cut-out operates isolating the pump. The accumulator then provides the initial pressure to operate the various systems. When the hydraulic pressure falls to approximately 450 lb./sq. in. the pump will automatically cut in to operate the system and build up accumulator pressure again.

NOTE.—On aircraft not incorporating Mod. 1288 the pump will not cut in until pressure falls to 180 lb./sq. in.

75. **Nitrogen system**

Six bottles on the starboard side of the fuselage and four bottles on the port wall forward of the rear spar, and a further seven bottles on the forward face of the rear spar are charged to a pressure of 1,800 lb./sq. in. (±200 lb./sq. in.) from a charging point fitted on the starboard wall of the bomb bay. A pressure gauge graduated in hundreds of pounds is fitted above the nitrogen control cock on the starboard side of the fuselage. This cock should be

turned on before starting the engines and should be turned off after landing. In flight, pressure gauge readings should be taken every half hour : a reading which differs by more than 100 lb./sq. in. from the previous reading indicates faulty operation of the system and should be reported on landing.

76. **Pneumatic system**

The pressure (normally 450 lb./sq. in.) is controlled by a pressure-regulating valve, which permits recharging when the pressure drops to 390–410 lb./sq. in. If the pressure drops to 160 lb./sq. in. or below, a pressure-maintaining valve closes, rendering the entire pneumatic system, with the exception of the brakes, inoperative. Should this occur low gear will automatically be engaged, and it will not be possible to operate the idle-cut-off controls, radiator flaps, air intake heat controls, or the air cleaners. If pressure cannot be built up, throttle right back and stop the engines by turning off the engine master cocks. This will drain the carburettors, which should be carefully primed to expel all the air from the fuel chambers before restarting.

77. **Electrical system** (see para. 14)

Four accumulators, connected in series parallel, giving a capacity of 80 ampere hours at 24 volts, are charged by the generators. A voltmeter on the main electrical control panel indicates the state of the accumulators, reading 28–29 volts in flight under normal conditions and over 24 on the ground with the engines stopped. Generator field circuit breakers and reset pushbuttons and generator failure warning lights are on the electrical control panel, together with the generator emergency master switch which should normally be in the OFF position.

Should a generator failure warning light come on :—

(i) Check that the field circuit breaker is in. If not, reset it ; if it springs out again, nothing more can be done during flight.

(ii) If the field circuit breaker is in, try closing the emergency master switch and reset the pushbutton.

(iii) Should the generator still fail to function switch off the emergency master switch.

NOTES.—(*a*) On aircraft which have not got Mod. 1623 fitted, generator control switches are fitted instead of generator field circuit breakers. These generator control switches should normally be ON; but in the event of a generator failing to function, its control switch must be set to OFF.

(*b*) The generator emergency master switch must be left OFF for normal operation of the generators.

Three banks of fuses, one on the starboard side of the fuselage forward of the front spar, one on the right-hand cockpit wall, and the third on the port side of the fuselage between the entrance door and the mid-upper turret, are protected by circuit breakers mounted on a panel above the ground/flight switch.

# PART VI

## *ILLUSTRATIONS*

KEY TO Fig. 1

1. Auto pilot pitching control.
2. Pilot's call light.
3. Downward identification light switch.
4. Brakes control lever.
5. " Press to transmit " pushbutton.
6. Camera warning light.
7. Bomb aiming warning light.
8. Engine speed indicators (4).
9. Boost gauges (4).
10. Auto pilot control switch.
11. D.R. Compass repeater.
12. Ignition switches (4 pairs).
13. Supercharger controls.
14. Slow-running cut-out switches (4).
15. Engine starting pushbuttons (4).
16. Engine booster-coil pushbuttons (4).
17. Engine priming pushbuttons (4).
18. Vacuum gauge.
19. Vacuum change-over cock.
20. IFF master switch.
21. Identification lamps switchbox.
22. IFF demolition switches.
23. Fire-extinguishers pushbuttons (4).
24. Air-intake heat control switch.
25. Air-cleaner control switch.
26. Starboard engines fuel cocks (2).
27. Oil pressure gauges (4).
28. Flaps indicator.
29. Port engines fuel cock (2).
30. Glider tow tail lamp switch.
31. Emergency light switch.
32. External lamps warning light and switch.

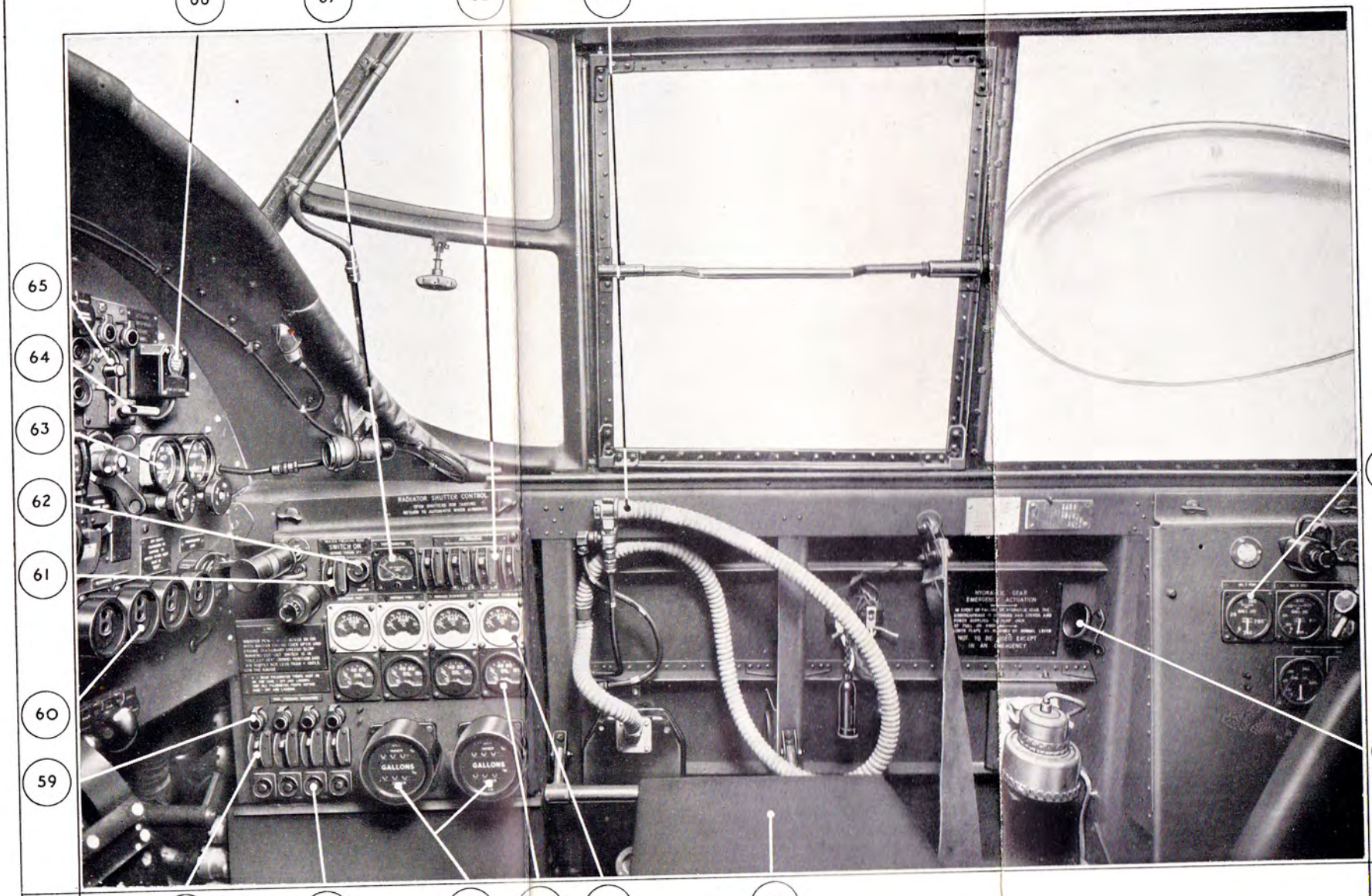



FIG. 3

COCKPIT — STARBOARD SIDE

FIG. 3

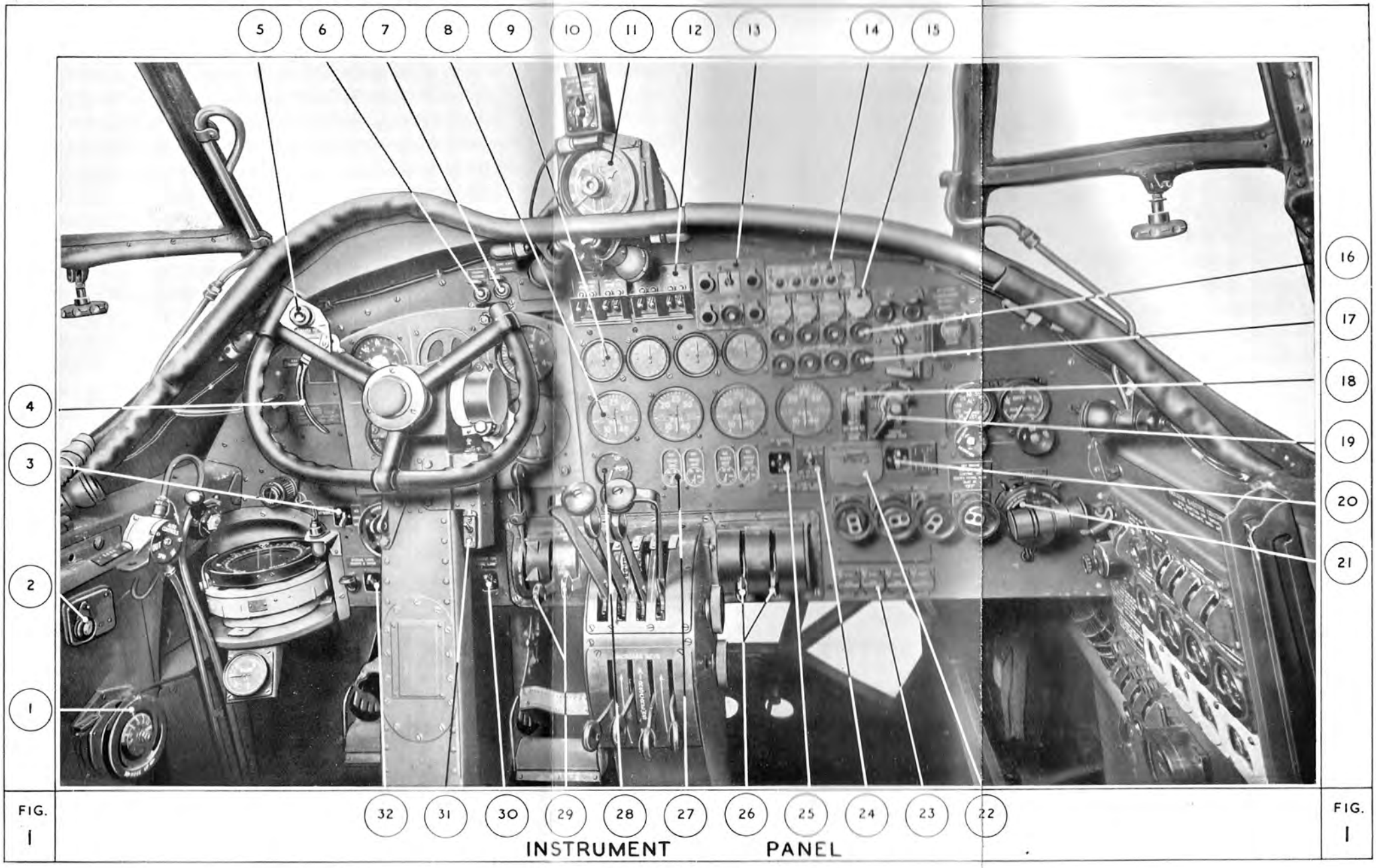



FIG. 1

INSTRUMENT PANEL

FIG. 1

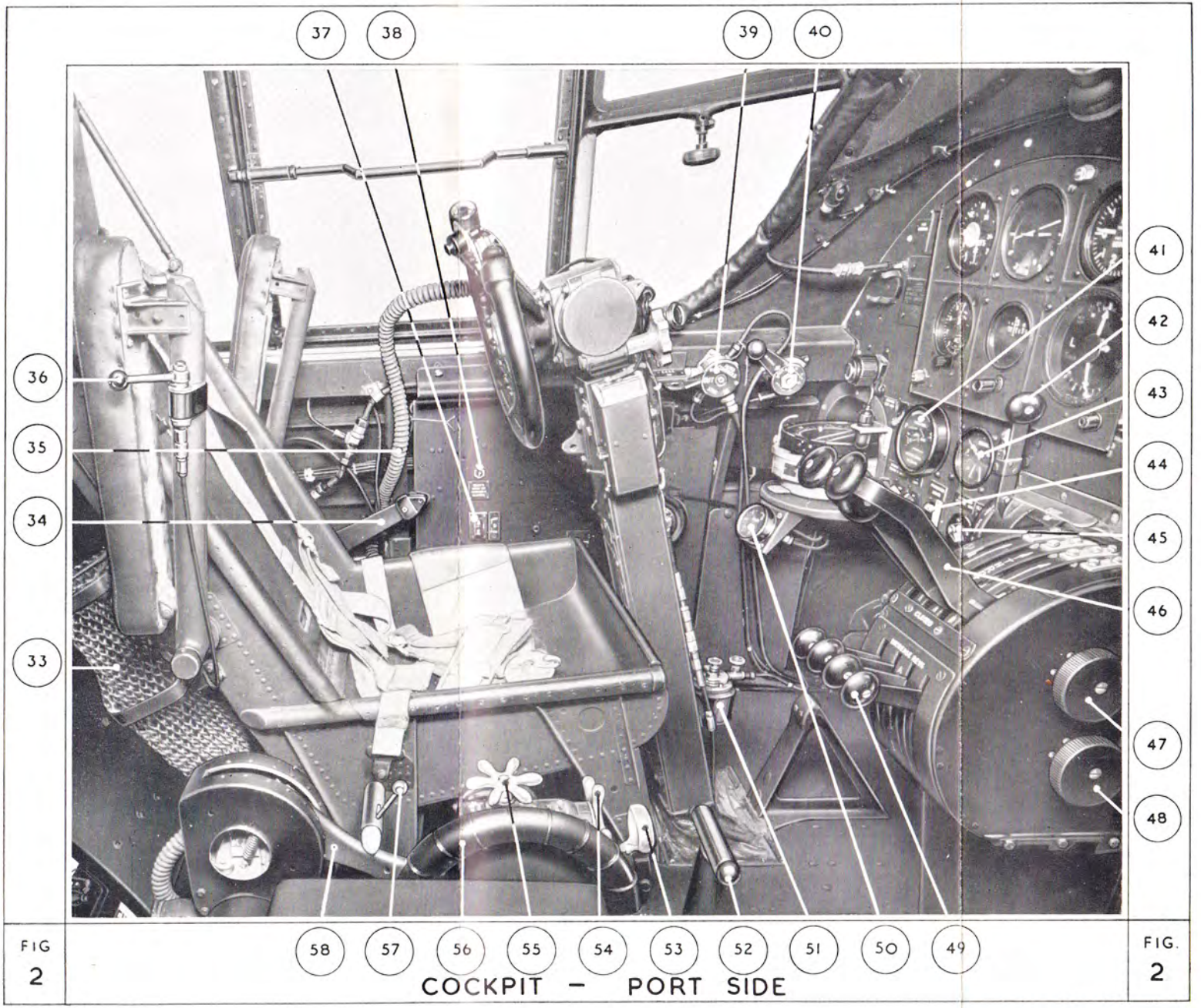



FIG 2

COCKPIT – PORT SIDE

FIG. 2

## KEY TO Figs. 2 AND 3

33. Portable oxygen stowage.
34. Bomb doors control.
35. Pilot's oxygen connection.
36. Sutton harness release lever.
37. IFF distress switch.
38. Isolation switch for navigator's telephone.
39. Auto pilot controls cock.
40. Auto pilot clutch lever.
41. Undercarriage position indicator.
42. Boost cut-out control.
43. Air supply and brakes pressure gauge.
44. Navigation light switch.
45. Landing lamps switch.
46. Throttle control levers (4).
47. Throttle friction damper.
48. Propeller friction damper.
49. Propeller control levers (4).
50. Auto pilot pressure gauge.
51. Windscreen de-icing pump.
52. Glider tow release.
53. Flaps selector control.
54. Aileron trimming tab control.
55. Rudder trimming tabs control.
56. Elevator trimming tabs control.
57. Undercarriage control safety bolt.
58. Undercarriage control lever.
59. Fuel pressure warning lights (4).
60. Feathering pushbuttons and fire warning lights (4).
61. Pressure head heater switch.
62. Pressure head test pushbutton.
63. Oxygen regulator.
64. Bomb jettison handle.
65. Engine priming master switch.
66. Bomb containers jettison switch.
67. Test ammeter.
68. Radiator shutter switches (4).
69. Flight engineer's oxygen connection.
70. Fuel contents gauges.
71. Undercarriage and flaps emergency control.
72. Flight engineer's seat.
73. Coolant temperature gauges (4).
74. Oil temperature gauges (4).
75. Gallons-gone fuel flowmeters (2).
76. Booster pump test pushbuttons (4).
77. Booster pump switches (4).

AIR MINISTRY
*November*, 1948

Amendment List No. 2
to A.P. 2847 A & B—P.N.
*Pilot's Notes*

# LINCOLN 1 & 2

Incorporation of this Amendment List must be certified by inserting date of incorporation and initials in the spaces provided on the inside front cover of the Notes.

| PART | PARA. | AMENDMENT |
|---|---|---|
| III | Page 37 | *Insert* "Performance curves for Lincoln 2" supplied herewith by gumming over existing page 37. |

*Affix* this Amendment List to inside back cover of the Notes retaining A.L.1.

| | | |
|---|---|---|
| | (iii) to (x) | *Amend* by two gummed slips supplied herewith. |
| II | 43 (ii) | *Amend* by gummed slip supplied herewith. |
| II | Pages 28 & 29 | *Insert* attached white-on-black check lists between pages 28 and 29 by opening the wire staples of the book to the vertical position and fixing in the check lists so that the staples pierce the insert along its fold, and its pages register exactly with pages 28 and 29. Firmly close down the staples taking care not to damage the insert so that it is liable to pull away. |
| III | 52 (iii) | Last line. *Amend* "60°C" to read "40°C." |
| III | 55 (i) | *Amend* by gummed slip supplied herewith. |
| IV | 59 (v) | Lines 1 and 2: *Delete* "A left-hand circuit" and *substitute* "A circuit in either direction" |
| IV | 60 (v) | *Delete* NOTE at bottom of page 40. |
| IV | 63 | *Amend* by gummed slip supplied herewith. |
| IV | page 46 | *Insert* "Instructions for parachuting wounded men" supplied herewith. |

*Affix* this Amendment List to inside back cover of the Notes.

(14318) Wt. 8233—1118 4m 6/47 G.S.St.