R05 & 330 98.
F/SGT. FAHEY.

A.P. 2445A & C—P.N.

PILOT'S NOTES

FOR

DAKOTA I & III

TWO TWIN WASP R1830—92 ENGINES

PROMULGATED BY ORDER OF THE AIR COUNCIL

RESTRICTED

(FOR OFFICIAL USE ONLY)

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 include all current amendments and 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.

A.L. NO.	INITIALS	DATE	A.L. NO.	INITIALS	DATE
1			7		
2			8		
3			9		
4			10		
5			11		
6			12		

NOTES TO USERS

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

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

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

Additional copies may be obtained from A.P.F.S., Fulham Road, S.W.3, by application on R.A.F. Form 294A, in duplicate, quoting the number of this publication in full—A.P. 2445A & C—P.N.

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

DAKOTA I & III

AIR MINISTRY
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Pilot's Notes

DAKOTA I (C.47) AND DAKOTA III (C.47A) PILOT'S NOTES

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PART I—DESCRIPTIVE

PART I—*continued*

PART I

DESCRIPTIVE

FUEL AND OIL SYSTEMS

1. **Fuel tanks.**—Fuel is carried in four tanks, two in each wing. The capacities are as follows:

Each main tank (forward)	202 U.S. gallons
Each auxiliary tank (aft)	200 U.S. gallons
Total per side	402 U.S. gallons

(12 U.S. gallons = 10 Imp. gallons)

In addition, up to eight tanks can be carried in the fuselage, four on each side, each of 102 U.S. gallons capacity. Each engine may be fed by its own engine-driven fuel pump from any of the wing tanks, but normally will be fed from the tanks on its own side.

2. **Fuel cocks**

(i) Each engine has a selector valve for the wing tanks with five positions—OFF, LEFT AUX., LEFT MAIN, RIGHT MAIN and RIGHT AUX. The selector valve controls are on top of the control pedestal. For starting and take-off the port engine fuel selector should be set to LEFT MAIN and the starboard engine fuel selector should be set to RIGHT MAIN, as these lines will give the most direct flow to the engines, and also the carburettor vapour return lines feed back to the main tanks.

(ii) Two screw-down valves for the long-range fuselage tanks are under the floor just aft of the navigator's compartment. To use these tanks, open the screw-down valves and turn off the engine fuel selectors.

(iii) Two pressure cross-feed valves are operated by a single control at the bottom right-hand corner of the control pedestal. Normally the cross-feed control will be OFF; when the control is set ON, the pressure side of each engine-driven fuel pump is connected, so that if one engine-driven pump fails, the other pump will supply fuel to both engines through the cross-feed line.

3. **Wobble pumps.**—Two wobble pumps, one for each engine, are operated simultaneously by the handle to starboard and behind the pilot's seat, for raising the fuel pressure in the carburettor for priming and starting the engine. When starting the first engine, the fuel selector valve for the other engine should be OFF.

4. **Priming system.**—Electrically-operated priming valves, one for each engine, are provided. Two switches are provided on the port electrical control panel, and are moved DOWN to prime the engine (the same switches operate the oil dilution valves in the UP position). Carburettor fuel pressure must be maintained with the wobble pump while priming. Mixture control must be at IDLE CUT-OFF.

5. **Fuel quantity gauge.**—A liquidometer fuel quantity gauge is provided on the starboard side of the instrument panel. To read the contents of any fuel tank, turn fuel gauge selector to appropriate tank. The master battery switch and the instruments switch must be on.

6. **Fuel pressure gauges and warning lights.**—Two fuel pressure gauges, one for each engine, are on the right-hand side of the instrument panel. On Dakota I, fuel pressure warning lights are fitted and indicate when the fuel pressure is less than about 10 lb./sq.in. Fuel pressure warning lights are not fitted on Dakota III.

7. **Oil system**

(i) Each engine has an oil tank of 29 U.S. gallons capacity.

(ii) *Oil cooler shutters.*—The oil cooler shutters are manually operated by two controls, on the port side of the control pedestal. They move forward to open the shutters and aft to close the shutters, and can be set to any intermediate position and locked there by the lock lever on their right.

(iii) *Oil dilution.*—An oil dilution system is provided. The switches are on the port electrical control panel, and move UP to operate the oil dilution valves. In the DOWN position these switches operate the primers.

(iv) *Oil pressure warning lights.*—On Dakota I, oil pressure warning lights indicate when the oil pressure is less than about 50 lb./sq.in. Oil pressure warning lights are not fitted on Dakota III.

MAIN SERVICES

8. **Hydraulic system**

(i) There are two hydraulic systems—the Sperry Gyropilot system, and the main hydraulic system. Two engine-driven pumps, one on each engine, supply hydraulic pressure:—normally, with the engine pump selector handle straight down, the port engine-driven pump supplies the main hydraulic system, and the starboard engine-driven pump supplies the Sperry Gyropilot system, but the engine pump selector valve on the hydraulic control panel can be changed over to allow the starboard pump to operate the main system and the port pump the Sperry Gyropilot system. To do this, pull handle up and forward. At any time when hammering or vibration of the regulator occurs, the engine pump selector should be put to the alternative position.

(ii) *Main hydraulic system.*—This operates:

Undercarriage Brakes Flaps
Cowling gills Windscreen wiper

A hydraulic accumulator is provided, and a pressure regulator maintains hydraulic pressure in the system between 650 and 850 lb./sq.in.; this will be shown on the rear hydraulic pressure gauge on the starboard side of the fuselage. The forward gauge shows the pressure in the undercarriage down line. A handpump is provided for operating all the services in the event of engine pump failure; the handpump draws fluid from the bottom of the reservoir, whereas the engine pumps draw from an outlet higher up which leaves a reserve of fluid for manual operation. The handpump bypass valve, in the centre of the hydraulic control panel, is normally wired in the OFF position, when the handpump will directly operate any selected hydraulic service and will not charge the hydraulic accumulator; in this position, the handpump pressure will not be recorded on the rear hydraulic pressure gauge. The handpump may also be used to charge the hydraulic accumulator on the ground if the bypass valve is turned ON; the rear hydraulic pressure gauge will then record the handpump pressure. Always return bypass valve to OFF.

9. **Vacuum system.**—Two vacuum pumps, one driven by each engine, together operate the gyro instruments and automatic pilot. The pressure side of the vacuum pumps operates the Goodrich de-icing system.

10. **Electrical system**

(i) On Dakota I, two generators, one driven by each engine, and two batteries, supply electric power at 12 volts. On Dakota III two generators and two 12-volt batteries connected in series supply electric power at 24 volts. The electrical services are:

Cabin lighting
Instrument lighting
Fluorescent lighting
Navigation and landing lights
Engine starter motors
Propeller feathering pump motors
Oil dilution solenoid
Pitot-head heater
Instruments
Undercarriage warning horn and indicator
Fuel and oil pressure warning lights
Radio
Priming valves
Propeller de-icing pump

(ii) *Switches.*—The master battery switches are on the port electrical control panel. These switches must be off for use with a ground battery, which can be plugged in on the underside of the fuselage just forward of the leading edge of the wing. The generator switches are in the main junction box on the forward side of the port bulkhead behind the pilot's compartment.
The ignition master switch must be on in addition to the battery switches for operation of certain circuits.

11. **Heating and ventilating system**

A.—Dakota I aircraft

(i) An air intake valve just under the roof on the port side of the navigator's compartment regulates the amount of air entering the aircraft. This valve has four positions.

(ii) A second valve aft of the air intake valve permits the air either to pass over a steam radiator or to bypass around it. The steam radiator is fed by a boiler heated by the starboard exhaust pipe.

(iii) The steam regulator is on the aft wall, starboard side of the navigator's compartment. When it is pulled up, the steam supply to the radiator is shut off.

(iv) A control for .cutting off all air to the navigator's and pilot's compartment is provided in the navigator's compartment above the door leading to the cabin. A similar control for the rear cabin is provided aft of the door.

(v) In the port aft corner of the navigator's compartment there is an auxiliary water tank. If the main tank should become exhausted, indicated by the pressure of the steam gauge falling to zero, the auxiliary water supply can be used by turning on the two cocks at the top and bottom of the auxiliary tank.

B.—Dakota III aircraft

(i) The cabin heating is provided by air passing through exhaust-heated muffs in each engine nacelle.

(ii) On some aircraft, five controls for the hot air system are in the radio compartment. The two outboard controls operate spill valves on the exhaust muffs, and these should be opened if the air becomes too hot; warning lights in the radio compartment and at the second pilot's position indicate when the air is becoming too hot. The next two controls regulate the heat in the radio compartment and the cockpit respectively, and the inboard control is a bypass which is used in the event of engine failure to pass hot air to the crew's quarters only.

(iii) On later aircraft, there are only three controls in the radio operator's compartment : the two spill valves and a heat regulator for the radio compartment. The bypass valve is not fitted. The cockpit heat regulator is in the cockpit, behind the second pilot's seat.

AIRCRAFT CONTROLS

12. **Rudder pedals.**—These may be adjusted in five positions for reach during flight by depressing the lever on the outside of each pedal.

13. **Trimming tab controls.**—Elevator, aileron, and rudder trimming tab controls are on the control pedestal. Movements are all in the natural sense.

14. **Automatic Pilot.**—A Sperry gyropilot type A–3 is fitted. *See* A.P. 2095. The engaging lever is on the face of the control pedestal. Before the gyropilot can be engaged the oil shut-off valve on the hydraulic control panel must be ON. The automatic pilot oil pressure gauge on the instrument panel should indicate 120 lb./sq.in. for operation of the gyropilot.

15. **Flying control locks.**—The flying controls are locked at the actual control surfaces. Stowage for the locking gear is provided in the rear of the cabin. There is no nuisance bar or any indication in the cockpit, and it must be checked before entering the aircraft that all control locks are removed.

16. **Undercarriage**

(i) *Selector lever.*—The undercarriage selector lever is on the hydraulic control panel. There are three positions—UP, NEUTRAL, DOWN. The selector engages in a slot at the NEUTRAL position and must be moved outwards before selecting UP or DOWN. In flight the selector should always be returned to NEUTRAL after an operation ; this will trap the fluid in the undercarriage jacks ; but, owing to the fact that there are no undercarriage up-locks, the wheels have a tendency to lower under their own weight and hydraulic pressure will rise in the undercarriage lines ; periodically, when the pressure builds up by about 150 lb./sq.in. on forward hydraulic gauge, reselect UP and return selector NEUTRAL. On the ground, if the aircraft is to be left standing for some time, the selector should be set DOWN to allow for variations in temperature.

(ii) *Safety latch control.*—The control for the undercarriage downlocks (which is also linked with the undercarriage selector) is on the floor to the right of the pilot's seat ; there are three positions—POSITIVE LOCK (full forward), SPRING LOCKED (lever about 45° to floor), LATCH RAISED (lever vertical). In the POSITIVE

LOCK position the latch lever is held to the floor by a clip; this position is used after the undercarriage is fully lowered to engage the downlocks solidly and make retraction impossible—the selector cannot be moved to UP when the latch is at POSITIVE LOCK. The latch should not be set at POSITIVE LOCK in flight with the undercarriage retracted, because it will be impossible to lower the undercarriage completely with the latch positively locked. In the SPRING LOCKED position, the selector lever cannot be moved to UP; the latch lever should be moved to this position before lowering the undercarriage; the downlocks will then engage by spring action when the wheels are fully lowered.

In the LATCH RAISED position the downlocks are completely disengaged and the undercarriage selector can be moved UP or DOWN. The latch lever is locked in the LATCH RAISED position by a dog at the undercarriage selector; after the undercarriage has fully retracted and the selector has been returned NEUTRAL, the dog is automatically disengaged and the latch lever springs back to the SPRING LOCKED position. If, however, the lever is at LATCH RAISED and it is desired to return it to SPRING LOCKED without retracting the undercarriage, the dog can be disengaged by pulling forward the small knob on the undercarriage selector against the spring, or alternatively by moving the selector slightly to UP and then returning NEUTRAL.

(iii) *Ground locking.*—Safety pins are provided for locking the undercarriage on the ground. It must be checked that these are removed before entering the aircraft.

(iv) *Warning lights.* These indicate as follows :

Undercarriage locked down, selector NEUTRAL	green light.
Undercarriage locked down, selector not NEUTRAL	red light.
Undercarriage up, selector NEUTRAL	red light.
Undercarriage neither up nor down	red light.

A switch is provided on the starboard instrument panel for dimming the undercarriage warning lights.

(v) *Warning horn.*—This will sound
(*a*) when the undercarriage is not locked down, and either throttle is closed;
(*b*) when the undercarriage is locked down but the selector is not neutral.

17. **Flaps**

(i) The flap selector, on the hydraulic control panel, engages in a slot at the NEUTRAL position and must be moved outwards before selecting UP or DOWN. The flaps can be set at any position by returning the selector to NEUTRAL when the desired position is indicated on the flaps position indicator. In flight the selector should always be returned to NEUTRAL after an operation, but when the aircraft is standing on the ground for long periods the selector should be set UP to allow for variations in temperature.

(ii) *Flaps position indicator.*—The flaps position indicator on the instrument panel shows the position of the flaps at all times.

18. **Brakes**

(i) Differential braking is obtained by depressing the rudder pedals.

(ii) *Parking brake.*—To apply parking brake, depress brake pedals fully and pull out parking brake handle, then release pedals. To release parking brakes depress rudder pedals. The minimum hydraulic pressure for effective operation of the brakes is 600 lb./sq.in. If pressure is below 600 lb./sq.in. turn ON the handpump by-pass valve and raise it with the handpump. The brakes should not be left on in hot weather without relieving them occasionally as hydraulic fluid expands and subjects the lines to high pressure.

19. **Tailwheel lock lever.**—The tailwheel lock lever is on the control pedestal under the throttle quadrant ; to unlock tailwheel and render fully castoring, pull lever back and to port ; the lever will engage in this position. To lock the tailwheel, shift lever to starboard and it will then spring back to the locked position ; the tailwheel will then become locked when it is centralised.

ENGINE CONTROLS

20. **Carburettor**

(i) *Mixture controls.*—Stromberg injection carburettors are fitted. The mixture control levers are fitted with spring catches which engage in slots at the AUTO LEAN and AUTO RICH positions. The IDLE CUT-OFF position is used for stopping and when starting the engine. The AUTO LEAN position gives a weak mixture automatically compensated for boost pressure, temperature and altitude and is used only when cruising below maximum weak continuous boost and r.p.m. (30 inches, 2,250 r.p.m.). The AUTO RICH position gives an automatically compensated rich mixture and is used for operating at all engine conditions higher than maximum weak continuous. The EMERGENCY position is not compensated for altitude and boost pressure and is used only if the automatic mixture control should stick at high altitude, giving too weak a mixture for operating at lower altitudes ; this is not likely to occur.

(ii) *Carburettor air intake heat control.*—Two controls on the starboard side of the control pedestal move forward to give cold air, aft to give hot air. It is possible to lock the controls in any intermediate position by the LOCK lever to the left of them. Normally the carburettor air intake heat controls should be set for cold air, but in icing conditions they should be set to maintain carburettor air temperatures at 32°C. Carburettor air temperature gauges are provided on the starboard side of the instrument panel.

(iii) A switch on the starboard electrical control panel controls a supply of alcohol for de-icing the carburettor.

21. **Throttles**

(i) Automatic boost control is not provided.

(ii) A friction lock is provided for the throttles on the underneath of the throttle quadrant box.

22. **Propeller controls.**—Hamilton Standard Hydromatic propellers are fitted. The speed control levers move forward to INCREASE R.P.M., aft to DECREASE R.P.M.

The propeller feathering buttons are on the electrical control panels above the windscreen, one on each side. When the button is pressed for feathering, it is held in electrically until feathering is complete. When the button is pressed for unfeathering, it must be held in by hand until the required r.p.m. are reached.

23. **Cowling gills.**—The selector levers for the cowling gills are on the starboard side wall beside the second pilot.

On Dakota I and some Dakota III aircraft, the selectors have five positions: CLOSED, OFF, TRAIL, OFF and OPEN. The TRAIL position, which gives about 15° of gill opening, is used for take-off and climb. The OPEN position is used only for ground running. If the fully OPEN (or CLOSED) position of the gills is required in flight, move selector OPEN or CLOSED and return to OFF when the operation is complete. When the aircraft is standing on the ground for long periods the selectors should be left at OPEN to allow for temperature variations. On some Dakota III aircraft the cowling gill controls have only three positions—OPEN, CLOSE, OFF. The gills can be set at any position by returning the controls OFF when the desired position is reached.

24. **Engine starters.**—On Dakota I, Eclipse inertia starters are fitted. The engine starter safety switch and the two engine starter switches are on the right-hand side of the electrical panel. To energize the starter, hold the safety switch and the appropriate starter switch up for about 12 to 15 seconds. To mesh the starter with the engine, hold the safety switch and the starter switch down.

On Dakota III aircraft, Jack and Heintz direct cranking inertia starters are fitted. They are controlled by two switches marked ENERGIZE and MESH respectively. Both switches are spring loaded to the central position. There is no safety switch. The starters can be hand-cranked and engaged by a manual engaging cable in each nacelle; if one of these starters is engaged by operating the manual engaging cable, the brushes are

lifted off the starter motor, consequently the starter cannot be electrically energized until the brushes are lowered: to do this, operate the MESH switch in the cockpit; return switch again before energizing.

OTHER CONTROLS

25. **Leading edge de-icers.**—The control for the Goodrich de-icers is behind the second pilot's seat on the aft cockpit wall. Turn to starboard to operate de-icers.

26. **Propeller anti-icers.**—An electrical pump which supplies anti-icing fluid to both propellers is controlled by a master switch on the port electrical panel and a rheostat which controls the rate of flow of fluid, on the bulkhead behind the pilot's seat.

27. **Windscreen de-icing.**—A handpump for providing a de-icing spray is on the starboard side of the cockpit. The two green cocks on the port and starboard cockpit walls must be on, and also the green cock on the de-icing fluid tank, to allow de-icing fluid to flow to the pump. There is also an electrical pump for supplying glycol to the windscreen. The master switch and a rheostat for controlling the rate of flow of de-icing fluid is on the port instrument panel.

28. **Windscreen wiper.**—The windscreen wipers are hydraulically operated. The knob on the port instrument panel is rotated to control the rate of operation of the wipers. Do not use the wipers on dry glass.

29. **Cabin door warning light.**—A red light on the bottom of the starboard instrument panel indicates when the cabin door is open. The master battery and instruments switches must be on.

30. **Oxygen.**—On some aircraft an oxygen system is provided. The master valve is on the left-hand side of the cockpit immediately forward of the cabin door; this controls the supply to pilots, crew and passengers.

PART II

HANDLING

31. Management of fuel system

(i) Starting engines and taking off :

Cross-feed valve ..	..	..	OFF
Port engine selector	..	..	LEFT MAIN
Starboard engine selector		..	RIGHT MAIN

but while starting first engine, leave other selector off.

(ii) In flight :

(*a*) After take-off continue to fly on LEFT MAIN and RIGHT MAIN tanks for about half an hour, because the carburettor vapour return lines are connected to these tanks, and if the tanks are full up some fuel may be lost.
(*b*) If long-range fuselage tanks are fitted, after half an hour's flying turn on the cocks for the fuselage tanks (under floor just aft of navigator's compartment). Turn off the engine fuel selectors. When these tanks are nearly empty and fuel pressure begins to drop, turn on the engine fuel selectors to LEFT MAIN and RIGHT MAIN, and turn off the long-range fuselage tank cocks. Fly for at least half an hour on main tanks before changing over to auxiliary tanks.
(*c*) The tanks should be changed as soon as fuel pressure begins to drop; do not wait for warning lights to indicate.

(iii) The cross-feed valve control should be kept OFF unless one of the engine pumps has failed ; the cross-feed valves should then be opened by the single control, and both engines fed from the same tank by the working pump.

32. Preliminaries

Before entering aircraft

Check that flying control locks are removed and stowed in aircraft (2 aileron locks, 2 elevator locks, 1 rudder lock). Check that undercarriage safety pins are removed, wheels chocked. Check all covers removed.

After entering aircraft

Generator switches ..	ON
Master ignition switch ..	Push in
Magneto switches ..	OFF
Master battery switches ..	OFF, if using ground battery
Instruments switch (if fitted)	ON
Parking brake	On ; hydraulic pressure 600 lb./sq.in.
Undercarriage	Selector NEUTRAL Latch POSITIVE LOCK
Undercarriage warning light	Green
Handpump bypass valve	Off
Engine pump selector valve	Normal position (handle vertical)
Gyropilot	Shut-off valve off Engaging lever disengaged
Wing, windscreen, propeller and carburettor deicing controls	Off

33. Starting engines and warming up

(i) Set starboard (or port) engine fuel selector to RIGHT MAIN

Set port (or starboard) engine fuel selector to OFF.

Set cross-feed valve control OFF.

(ii) Set engine controls as follows :

Throttles ..	$\frac{1}{4}$ open
Mixture control	IDLE CUT-OFF
Propellers ..	Fully forward (INCREASE R.P.M.)
Air intake heat ..	COLD
Gills	OPEN
Oil cooler ..	CLOSED

(iii) Have each engine turned slowly by hand for at least three revolutions of the propeller.

(iv) Operate wobble pump to raise and maintain fuel pressure to about 5 lb./sq.in.

(v) Prime engine with about 4 quick flicks of the primer switch.

(vi) *Dakota I aircraft:*

(*a*) Switch on magnetos. Move starter safety switch and appropriate starter switch up, to energise starter for about 12–15 seconds. Never exceed 20 seconds.

(*b*) Return switches central, pause for a second, then mesh starter by moving both switches down. Additional priming should be given as soon as the engine starts turning, and continued until it is running. Keep starter engaged until engine is running, as it also switches on the booster coil.

(*c*) When engine fires regularly, return starter switches central, move mixture control to AUTO RICH, and stop priming. If engine shows signs of being over-rich, return to IDLE CUT-OFF until it is running smoothly.

(vii) *Dakota III aircraft:*

(*a*) Switch on magnetos. Energise starter for about 20 seconds.

(*b*) Keeping energising switch on, mesh starter, and as the engine starts turning, give additional priming in short flicks of the switch.

(*c*) When the engine fires and picks up speed, release switches; the energising switch must not be held on for more than 30 seconds. Move mixture control to AUTO RICH and stop priming. If engine shows signs of being over-rich, return to IDLE CUT-OFF until it is running smoothly.

(viii) If engine fails to start

(*a*) Stop priming and move mixture control to IDLE CUT-OFF.

(*b*) Wait till propeller stops rotating.

(*c*) Switch off magnetos.

(*d*) Close the switches to engage flywheel with engine to ensure that flywheel stops, then return switches central.

(*e*) Have propeller turned forward half a revolution at least by hand to disengage flywheel from engine. If

engine has been over-primed, open throttle and have it turned forward several revolutions.
On Dakota III aircraft, wait two or three minutes before another attempt.

(ix) Open throttle slowly and warm up at 1,000 r.p.m.

(x) Set port (or starboard) engine fuel selector to LEFT (or RIGHT) MAIN and start other engine.

34. **Testing engines and installations**

While warming up:

(i) Check temperatures and pressures. While the oil temperature is below 40°C., the oil pressure will be up to 300 lb./sq.in.

(ii) Check again that aileron locks are removed, as the flaps are liable to foul these locks when they are in position. Test operation of hydraulic system by lowering and raising flaps. Return selector NEUTRAL. Check that hydraulic pressure builds up to 650–850 lb./sq.in. when operation is complete.

(iii) Check all fuel cock controls in all positions and watch fuel pressure. Check fuel cross-feed cock by turning one selector valve off and turning cross-feed cock on; fuel pressure should be maintained at both engines.

(iv) Bleed boost pressure gauges by cock on instrument panel.

After warming up to 40°*C.* (*oil*) *and* 120°*C.* (*cyl.*)

NOTE.—The following comprehensive checks should be carried out after repair, inspection (other than daily), or at the pilot's discretion. Normally they may be reduced in accordance with local instructions.

(v) Open up to 30 inches boost and check the operation of the constant-speed propeller.

(vi) Open up to the take-off position and check take-off boost (48 inches) and r.p.m. (2700).

(vii) At 32½ inches boost test each magneto in turn. The drop should not exceed 100 r.p.m.

35. **Check list before taxying**

Master battery switch ..	ON
Hydraulic system pressure	650–850 lb./sq.in.
Undercarriage jack pressure	Put undercarriage selector DOWN, check that undercarriage jack pressure rises to 850 lb./sq.in., then return selector neutral.
Flaps	UP. Selector neutral.
Parking brake	Release.

36. **Taxying out**

(i) The brakes are light and powerful.

(ii) When taxying straight, keep tailwheel locked. Always unlock tailwheel before turning.

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

T —Trimming tabs ..	All neutral.
M—Mixture controls ..	AUTO RICH.
Air intake heat ..	COLD
P —Propeller speed control	Fully forward (INCREASE R.P.M.).
F —Fuel	Check contents. Port engine selector LEFT MAIN. Starboard engine selector RIGHT MAIN Cross-feed valve off.
F —Flaps	UP, or $\frac{1}{4}$ down. Selector neutral.
Gills:	
5-position control..	TRAIL.
3-position control..	Half-open, selector neutral.
Oil coolers ..	Open as necessary.
Generators	ON
Undercarriage ..	Latch lever to SPRING LOCKED position.
Tailwheel	Locked.
Gyro instruments ..	Uncaged.
Cabin door	Closed. Warning light off.

38. **Take-off**

(i) The flight engineer should keep his left hand on the wobble pump (to guard against inadequate fuel pressure) and right hand near the throttles (to prevent creep).

(ii) Do not hurry the tail off the ground. Raise the tail when it is ready to come up with a normal load on the control column.

(iii) Before raising undercarriage, use the brakes to stop the wheels spinning.

(iv) On signal from pilot, flight engineer will put undercarriage latch lever to LATCH RAISED and select undercarriage up. When undercarriage is fully up pressure will build up in the hydraulic accumulator and the hydraulic pressure regulator will open with a bang. Return selector NEUTRAL.

(v) Safety speed for starting to climb is 110 m.p.h. I.A.S.

(vi) If used, raise flaps when 500 feet is reached.

39. **Climb**

The speed for maximum rate of climb at sea level is 125 m.p.h. I.A.S.

40. **General flying**

(i) *Stability.*—The aircraft is longitudinally stable under all conditions of flight. The aircraft is stable in turns; there is no tendency to increase bank or rate of turn.

(ii) *Change of trim*

Undercarriage up	Nose heavy.
Flaps up	Slightly nose heavy.

These changes of trim can be held on the control column.

(iii) *Controls.*—The controls are reasonably light and positive in effect.

(iv) *Flying low in bad visibility.*—Lower flaps to two-thirds. Increase r.p.m. to 2,250. The speed may then be reduced to 105–110 m.p.h. I.A.S. When the clear-vision panel is opened, it is advisable to open the side window as well, to avoid steaming.

41. **Stalling**

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

Undercarriage and flaps up	80
Undercarriage and flaps down ..	70

The stall is straightforward and there is no tendency for either wing to drop. With undercarriage and flaps up, tail buffeting is felt at about 90 m.p.h. I.A.S., and at 80 m.p.h. I.A.S. the nose drops.

42. **Check list before landing**

Leading edge de-icers ..	OFF.
Gyropilot	Off.
Gills	CLOSED, then return selector OFF.
Oil cooler	Closed as necessary.
Hydraulic pressure ..	650/850 lb./sq.in.
Reduce speed to 160 *m.p.h. I.A.S.*	
U —Undercarriage ..	Safety latch SPRING LOCKED. Hold selector DOWN until forward hydraulic gauge shows 850 lb./sq.in. and hydraulic pressure regulator cuts out with a bang. Return selector neutral and check that green lights come on. Then put latch lever to POSITIVE LOCK.
Tail wheel	Locked.
M—Mixture control ..	AUTO RICH.
Carburettor air intake heat	COLD.
P —Propeller	Fully forward (INCREASE R.P.M.).
F —Fuel	Cross-feed valve OFF. Selector valves to fullest tanks.
Reduce speed to 120 *m.p.h. I.A.S.*	
F —Flaps	Fully down.
Approach speeds:	
Engine assisted	90–95 m.p.h. I.A.S.
Glide	100–105 m.p.h. I.A.S.

43. Landing

(i) A normal three-point landing can be made, but a wheel landing should be made when carrying passengers or freight.

(ii) The brakes are fierce and should be used with care.

44. Mislanding

(i) Open throttle to take-off position and retrim.

(ii) Raise undercarriage immediately, and retrim as necessary.

(iii) Above 300 feet the flaps can be retracted in stages. The change in trim can be held on the elevator.

45. After landing

(i) Raise flaps and open gills before taxying.

(ii) Unlock tail wheel before making turns.

(iii) Idle the engines at about 800 r.p.m. for a short time to allow the cylinder temperatures to fall to 205°C. (150° to 180° if possible) then open up to 1,100 r.p.m. and move mixture control to IDLE CUT-OFF.

(iv) After engines have stopped switch off master ignition and magneto switches. Turn engine fuel selectors OFF.

(v) Turn OFF master battery switches, and all electrical switches and rheostats.

(vi) If the aircraft is to be left standing, put undercarriage selector DOWN, flaps selector UP, cowling gills selector OPEN, to allow for expansion in the hydraulic lines due to temperature variations. Release the brakes and have the wheels chocked. Have undercarriage safety pins inserted and flying controls locked.

(vii) *Oil dilution.—See* A.P. 2095. The oil dilution period is two minutes.

PART III

OPERATING DATA

46. Engine data: Twin Wasp R. 1830–92

(i) *Fuel.*—100 octane.

(ii) *Oil.*—*See* A.P. 1464/C.37.

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

	R.p.m.	Boost inches Hg.	Temperature ° C. Cylr.	Oil Max.	Oil Desired
MAX. TAKE-OFF 5 MINS. LIMIT ..	2,700	48	260		
MAX. CLIMBING 1 HOUR LIMIT ..	2,450	40½	260	95*	50–70
MAX. RICH CONTINUOUS ..	2,250	32½	230	70	50–70
MAX. WEAK CONTINUOUS ..	2,250	30	230	70	50–70
MAX. ALL OUT 5 MINS. LIMIT ..	2,700	45	260	95	

* For short period only.

NOTE.—On account of vibration, pilots must not dwell in the range 1,300–1,600 r.p.m. and must not cruise continuously below 1,700 r.p.m. Speeds between 2,450 and 2,650 r.p.m. are also to be avoided.

OIL PRESSURE:	
MAXIMUM	105 lb./sq.in.
NORMAL	75/95 lb./sq.in.
MINM. FOR CRUISING	60 lb./sq.in.
MINM. FOR IDLING	15 lb./sq.in.
MINM. TEMP. FOR TAKE-OFF:	
OIL	40° C.
CYLINDER	120° C.
MAX. TEMP. BEFORE TAKE-OFF:	
CYLINDER	205° C.
MAX. TEMP. FOR STOPPING ENGINE ..	205° C.
FUEL PRESSURE—NORMAL	14/17 lb./sq.in.
IDLING	7 lb./sq.in.

47. Flying limitations

(i) The aircraft is designed for duty as a transport aircraft, and must be handled like a civil air liner. In particular care must be exercised in handling the aircraft at weights above 29,000 lb.

(ii) *Maximum speeds in m.p.h. I.A.S.*:

Diving and level flight:

At overload weight 31,000 lb. ..	180
At 29,000 lb. and below	200
Undercarriage down	160
Flaps down	125

(iii) *Maximum all-up weight*:

Overload take-off and straight flying only ..	31,000 lb.
Normal	29,000 lb.
For landing	26,000 lb.

(iv) *Distribution of load*:

(*a*) Maximum load 750 lb. uniformly distributed may be imposed directly above any one floor beam.

(*b*) If the load is concentrated at the centre of the beam, 400 lb. must not be exceeded.

(*c*) Concentrated loads must not exceed 66 lb./sq.in.

(*d*) The total load on cabin floor must not exceed 9,000 lb.

(*e*) The aircraft must always be so loaded that the centre of gravity position lies between 239.6 inches and 263.1 inches behind the nose of aircraft. (*See* Figs. 6A and B for C.G. data.)

48. Position error correction

Approximately +5 m.p.h. throughout the speed range.

49. Maximum performance

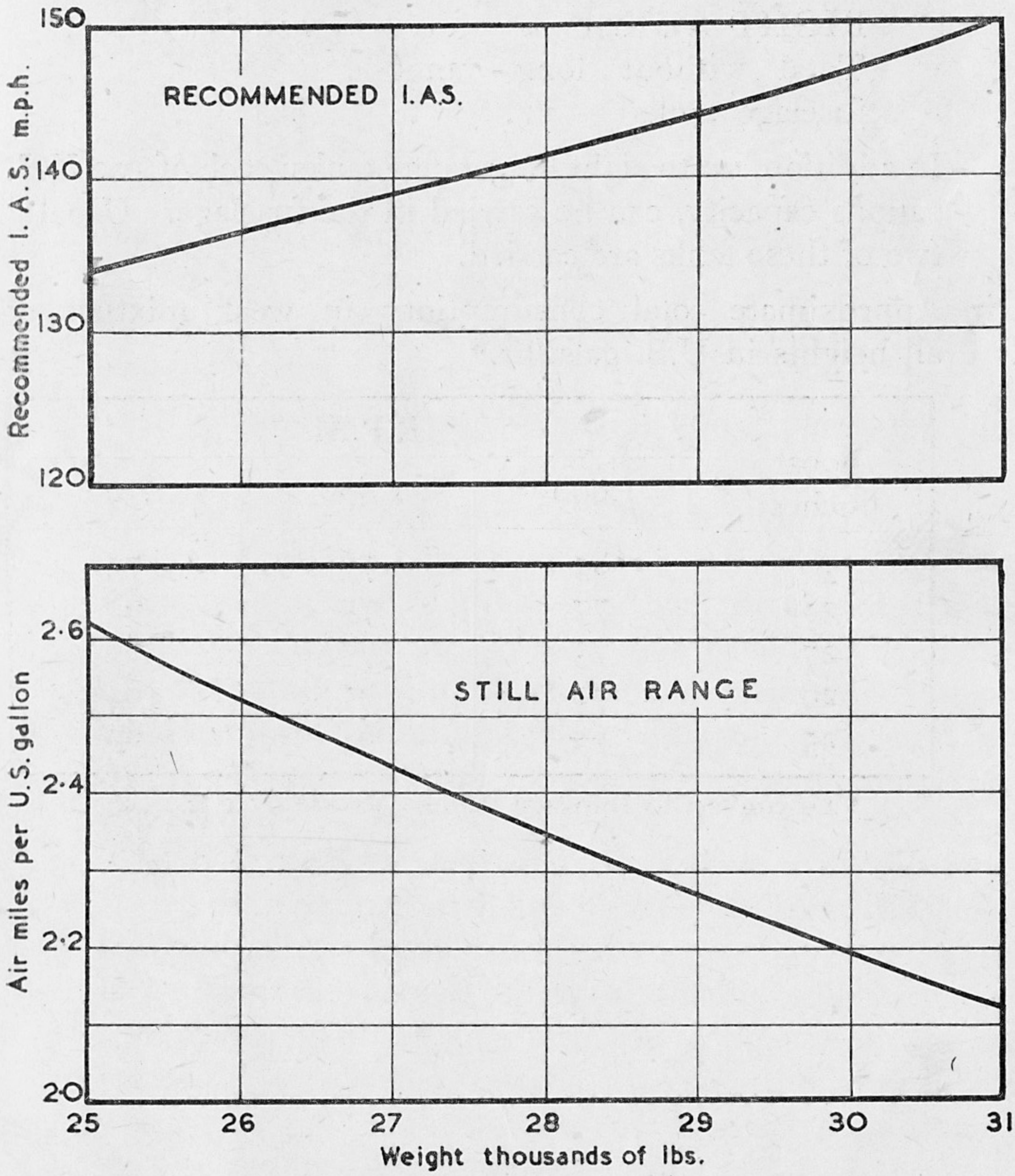
The speeds for maximum rate of climb are:

125 m.p.h. I.A.S. from S.L. to 7,000 feet.
120 m.p.h. I.A.S. from 7,000 to 10,000 feet.
115 m.p.h. I.A.S. from 10,000 to 13,000 feet.
110 m.p.h. I.A.S. above 13,000 feet.

50. **Maximum range**

(i) Fly in weak mixture at 30 inches boost (if obtainable) and reduce speed by reducing r.p.m. as necessary down to 1,700. Do not reduce r.p.m. below 1,700 on account of serious vibration. At light loads and low heights, if at 1,700 r.p.m. and 30 inches boost the recommended speed is exceeded, reduce boost.

(ii) The following curves give the recommended speed for obtaining maximum range and the corresponding air miles per gallon in still air conditions. These figures apply at all heights between 5,000 and 10,000 feet.



To obtain the utmost range, the recommended speed should be reduced in stages as fuel is consumed and weight is lost ; but if one speed is to be maintained throughout the flight, use an I.A.S. 5 m.p.h. greater than the speed corresponding to the estimated mean weight ($\frac{1}{2}$ fuel gone). The loss in range incurred by flying at one speed throughout the flight will not be great.

51. **Fuel capacity and consumptions**

(i) Fuel capacity :

LEFT MAIN tank ..	202	U.S. gallons.
LEFT AUX. tank	200	,, ,,
RIGHT MAIN tank ..	202	,, ,,
RIGHT AUX. tank ..	200	,, ,,
Total without long-range fuselage tanks	804	,, ,,

In addition, up to eight long-range tanks, each of 102 U.S. gallons capacity, can be carried in the fuselage. Usually two of these tanks are carried.

(ii) Approximate total consumptions in weak mixture at all heights in U.S. gals./hr.*

Boost inches	R.P.M.		
	1,900	1,800	1,700
30	83	77	73
28	77	72	68
27	73	70	66
26	71	67	64
25	—	64	60

*To convert to Imperial gallons, divide by 1.2.

PART IV

EMERGENCIES

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

Close both throttles and land straight ahead, if the weight is above 26,000 lb.

53. **Engine failure during flight**

(i) The propeller of the dead engine should be feathered, the gills closed, and the oil cooler closed.

(ii) The aircraft can be trimmed to fly without foot load at 105–110 m.p.h. I.A.S.

(iii) Turn off fuel selector to dead engine. Set live engine fuel selector to one of the tanks on the dead engine side, as this will help to improve trim.

(iv) Set engine pump selector to connect main hydraulic system to live engine.

(v) Watch temperature on live engine and if necessary, open gills.

(vi) At 28,000 lb., or less, height can be maintained at climbing power, or less, at 105–110 m.p.h. I.A.S. Do not attempt to maintain height at speeds less than 105 m.p.h. I.A.S.
The table on page 30, gives an *approximate* indication of the maximum height which can be maintained on one engine at full climbing power (2,450 r.p.m. and 40½ inches boost, or full throttle) in standard ICAN conditions.
The best performance on one engine will, however, always be obtained at heights below full-throttle height (approximately 5,500 feet).
NOTE that the actual ceiling attainable will vary considerably with the pilot's skill, the condition of the aircraft, the air-cleaner installation, and the atmospheric conditions; in hot summer or tropical conditions may be reduced by as much as 3,000 feet.

Weight lb.	Single-engine ceiling (using max. climbing power) Feet
29,000	—
28,000	5,500
27,000	7,500
26,000	8,000
25,000	9,000

54. **Feathering**

(i) Hold the switch only long enough to ensure that it stays in by itself ; then release it so that it can spring out when feathering is complete.

(ii) Close throttle immediately and set mixture control to IDLE CUT-OFF.

(iii) Switch off only when engine has stopped.

55. **Unfeathering**

(i) Set throttle closed or slightly open, mixture control to AUTO RICH, propeller fully back and ignition on.

(ii) Hold the button in until r.p.m. reach 1,000 to 1,300.

(iii) If the propeller does not return to normal constant-speed operation, open throttle slightly.

56. **Emergency undercarriage operation**

(i) *Rear hydraulic pressure gauge* (*main system pressure*) *shows less than* 500 *lb./sq.in. after selecting DOWN*

(*a*) Try changing over engine pump selector to connect main hydraulic system with the other engine. If this does not work :

(*b*) Operate handpump. If forward hydraulic pressure gauge (undercarriage downline pressure) does not start to build up, stop hand pumping and proceed as in (ii).

(ii) *Forward hydraulic pressure gauge does not build up after selecting DOWN.*

Leave undercarriage selector DOWN ; dive and pull out two or three times to lower the wheels under their own weight ; return selector NEUTRAL. If green indicator light does not show, the downlocks have not engaged and the procedure should be repeated.

(iii) *Red warning light shows after returning selector neutral, but forward hydraulic pressure gauge indicates* 500 *lb./sq.in. or more.*

This indicates that the undercarriage has lowered but that downlocks have failed to engage ; with the undercarriage selector in NEUTRAL it will be safe to land, but avoid using the brakes as far as possible, as this will tend to make the undercarriage collapse and will increase the pressure in the undercarriage lines ; do not exceed 1,500 lb./sq.in. on the forward pressure gauge.

57. **Emergency flaps operation**

If flaps fail to go down when selected, leave flaps selector DOWN and operate handpump. Return selector NEUTRAL when operation is complete, or unsuccessful.

58. **Emergency brakes operation**

If no hydraulic system pressure is available, depress brake pedals and operate handpump. The brakes must not be released or all pressure will be lost.

59. **Fuel pump failure**

If fuel pressure on one engine fails while the fuel quantity gauge for the tank that is feeding still indicates an adequate fuel supply, operate wobble pump to check whether pressure can be maintained at the carburettor ; if no resistance is felt to hand pumping, the fuel line is broken and it is not safe to open the cross-feed valve; turn off the fuel selector valve. If resistance is felt to hand pumping it should be safe to open the cross-feed valve ; turn off the fuel selector on the faulty side, and feed both engines from the same tank on the other fuel selector, through the cross-feed line.

60. **Parachute exits**

Cabin door	Step on lever at forward side of door to release hinge pins, and push out.
Two cabin emergency exits (one port, one starboard)	Turn handles to right, and push panels out and up.

61. **Crash exits**

Pilot's emergency exit hatch	Rotate handles towards centre, and push up on forward edge of panel.

62. **Parachutes**

Stowage for the crew's parachutes is provided under the navigator's table. The passengers' parachutes may be stowed under each passenger or paratroop seat.

63. **Fire-extinguishers**

(i) *Engine fire-extinguishers*

The fire-extinguisher selector valve and operating handle are under a cover in the floor between the pilots' seats. To operate, set fire-extinguisher selector valve to engine on fire, and pull handle hard. No automatic fire-extinguishers are provided.

(ii) *Hand fire-extinguishers.*—Two fire-extinguishers are provided—one in the pilot's cockpit on the starboard side of fuselage, and one just aft of the main cabin door.

64. **Crash axes**

On some aircraft three crash axes are provided, two in the rear cabin and one just aft of the pilot's compartment on the starboard side of the bulkhead.

65. **First-aid kit**

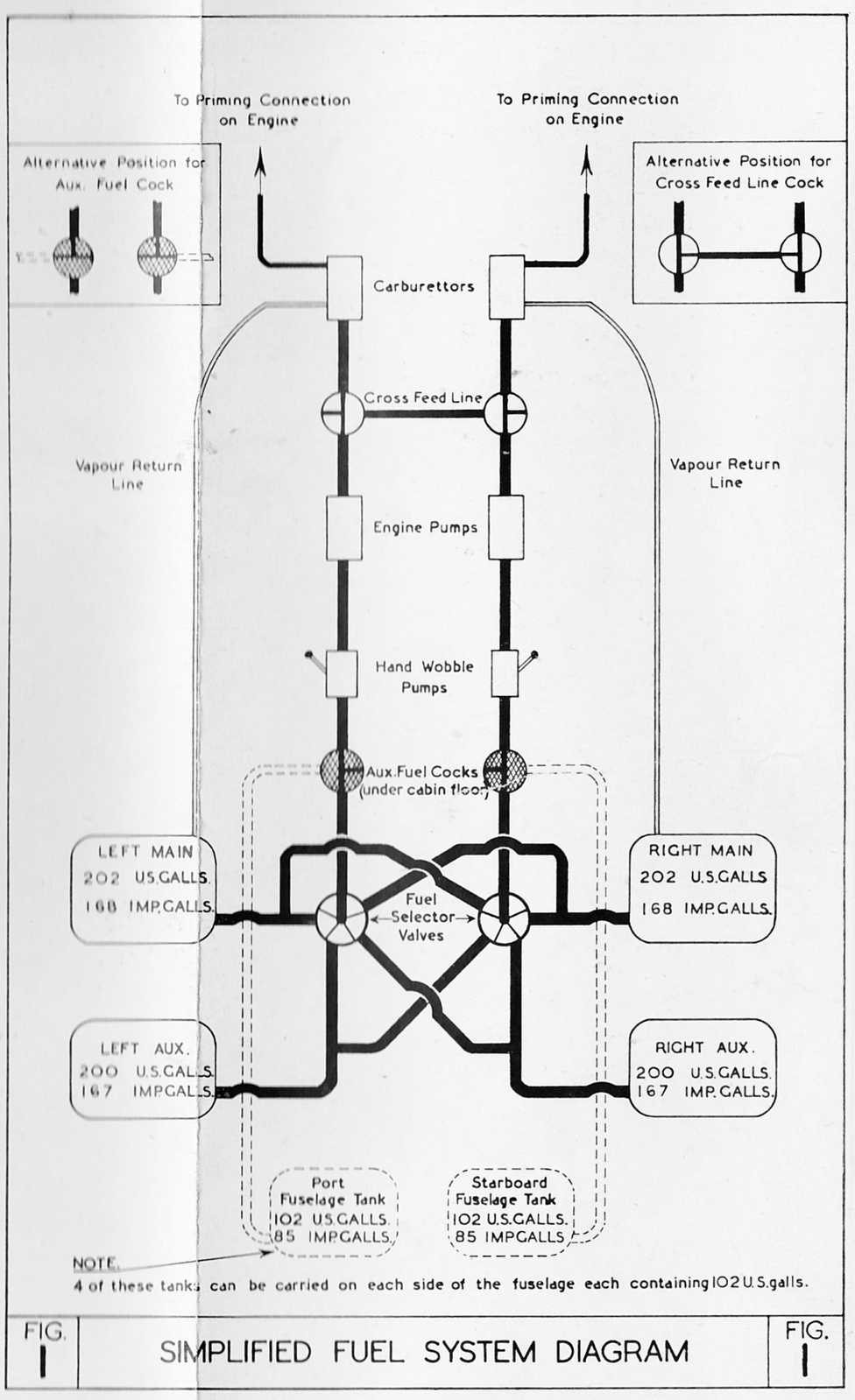
The first-aid kit is stowed on the aft bulkhead of the rear cabin on the starboard side.

66. **Destructor bombs**

On some aircraft two incendiary bombs are provided on the starboard wall of the rear cabin.

PART V

ILLUSTRATIONS



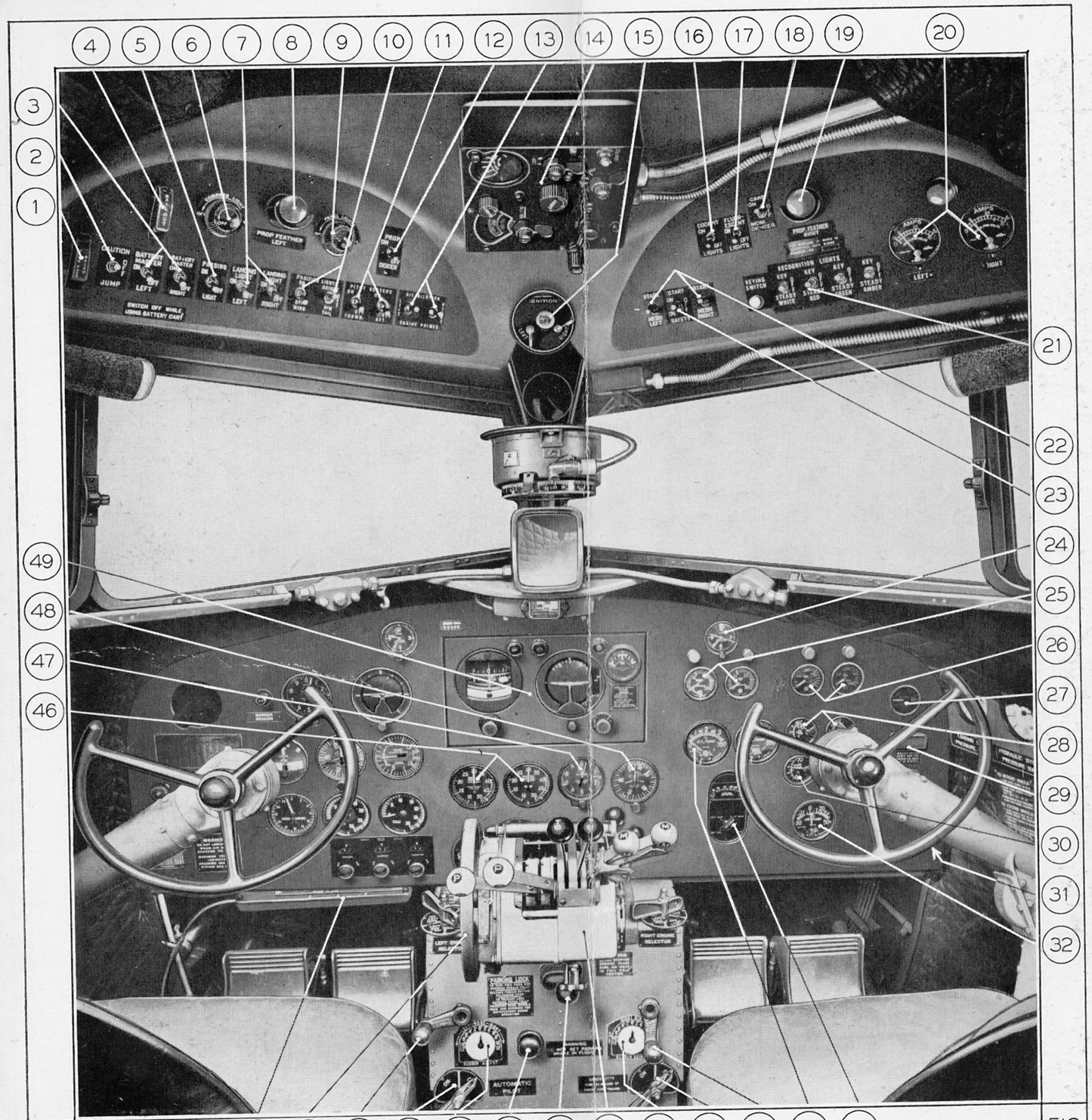


FIG. 2

GENERAL VIEW OF COCKPIT

GENERAL VIEW OF COCKPIT

KEY TO *Fig. 2*

1. Switch for paratroop pack salvo
2. Switch for paratroop jump signal light
3. Master battery switches
4. " Bale out " warning switch
5. Navigation light switch
6. Compass light rheostat
7. Landing light switches
8. Propeller feathering button (port engine)
9. Panel light rheostat
10. Position light switches
11. Pitot-head heater switches
12. Propeller de-icer master switch
13. Oil dilution and engine primer switches
14. Radio compass controls
15. Ignition switches
16. Cockpit lights switch
17. Fluorescent lights switch
18. Carburettor de-icing switch
19. Propeller feathering button (starboard engine)
20. Ammeters
21. Identification lights switchbox and key
22. Engine starter switches
23. Starter safety switch
24. Watch
25. Fuel pressure gauges
26. Oil pressure gauges
27. De-icer air pressure gauge
28. Oil temperature gauges
29. Undercarriage warning light
30. Carburettor air temperature gauge
31. Undercarriage warning light test switch
32. Outside air temperature gauge
33. Fuel contents gauge and selector switch
34. Cylinder temperature gauges
35. Aileron trimming tab control
36. Fuel cross-feed cock
37. Aileron trimming tab indicator
38. Engine control quadrant
39. Tailwheel locking lever
40. Parking brake
41. Rudder trimming tab indicator
42. Gyro pilot engaging lever
43. Rudder trimming tab control
44. Elevator trimming tab control
45. Flaps position indicator
46. Boost pressure gauges
47. Altimeter
48. A.S.I.
49. Sperry gyropilot instruments

LEFT-HAND SIDE OF INSTRUMENT PANEL

KEY TO *Fig. 3*

24. Watch
38. Engine control quadrant
45. Flaps position indicator
47. Altimeter
48. A.S.I.
49. Sperry gyropilot instruments
50. Gyropilot servo speed controls
51. Windscreen de-icer pump rheostat
52. Windscreen wiper control
53. Windscreen de-icer pump master switch
54. Radio compass indicator
55. Turn and bank indicator
56. Marker beacon warning light
57. Gyro horizon
58. Rate of climb indicator
59. R.P.M. indicators

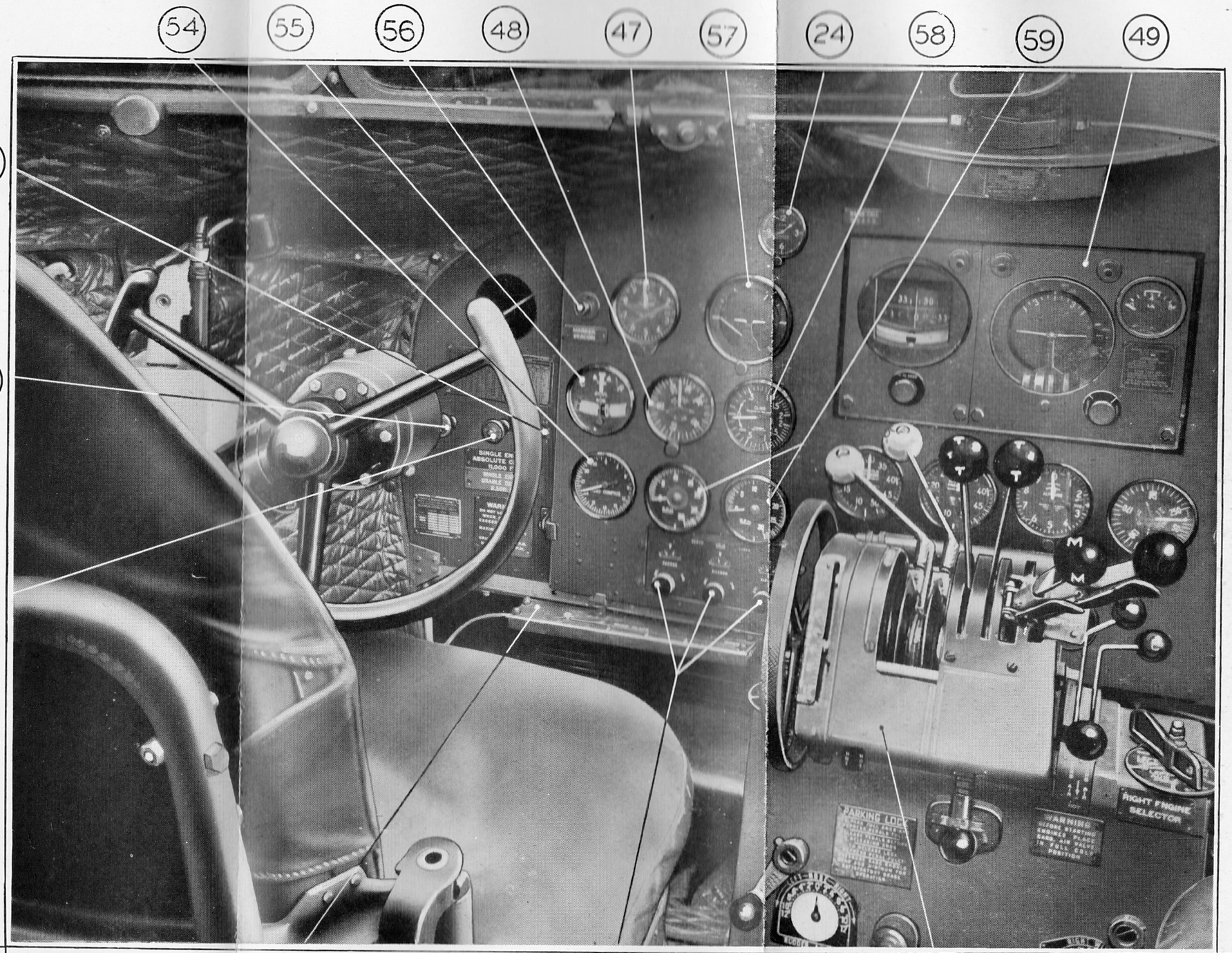


FIG. 3

LEFT-HAND SIDE OF INSTRUMENT PANEL

FIG. 3

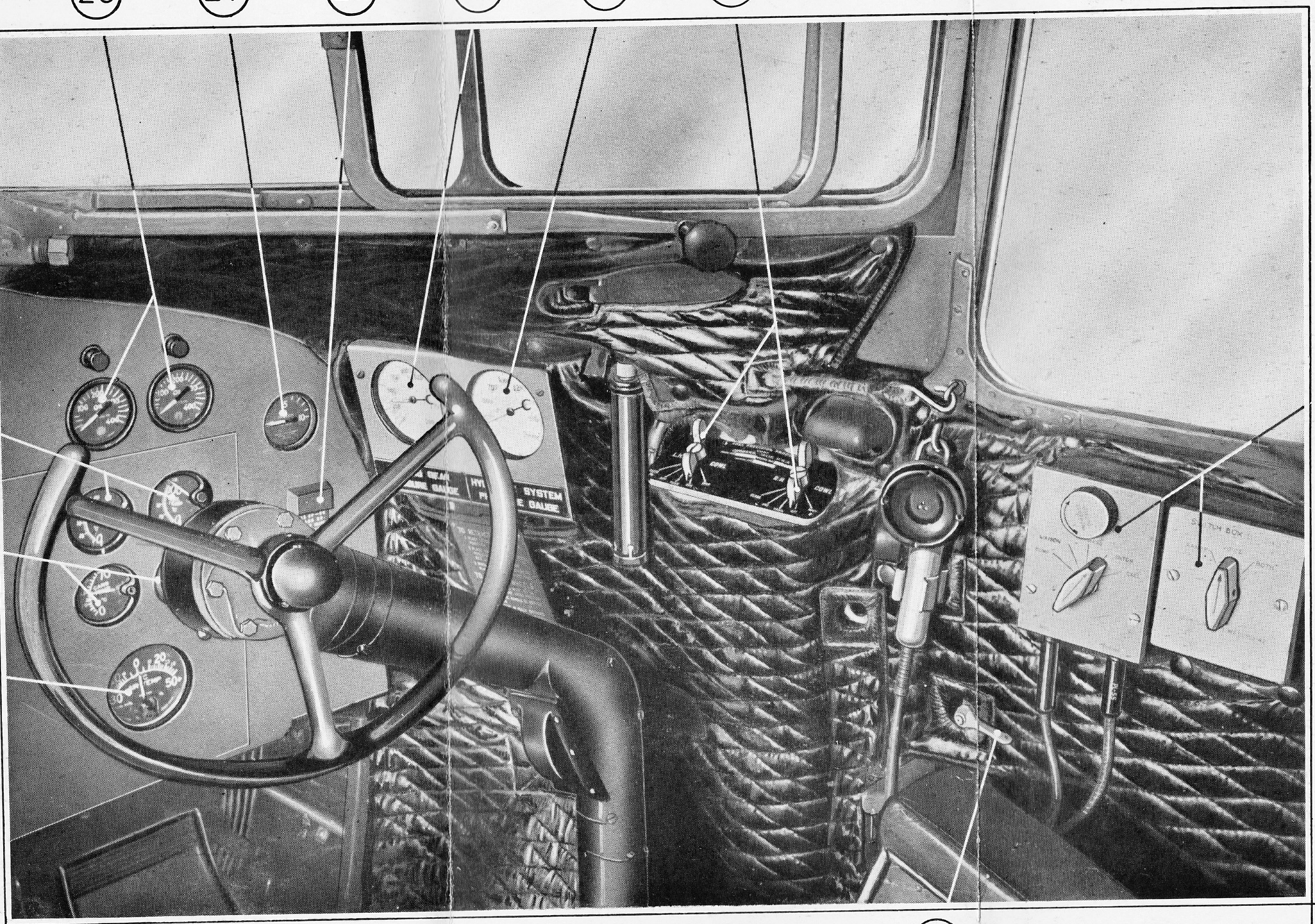


FIG. 4

STARBOARD SIDE OF COCKPIT

FIG. 4

STARBOARD SIDE OF COCKPIT

KEY TO *Fig. 4*

26. Oil pressure gauges
27. De-icer air pressure gauge
28. Oil temperature gauges
29. Undercarriage warning light
30. Carburettor air temperature gauges
32. Outside air temperature gauge
60. Undercarriage down-line pressure gauge
61. Hydraulic system pressure gauge
62. Cowling gill controls
63. Intercom. station boxes
64. Windscreen de-icing fluid supply cocks

ENGINE CONTROL QUADRANT

KEY TO *Fig. 5*

44. Elevator trimming tab control
46. Boost pressure gauges
47. Altimeter
48. A.S.I.
65. Gyropilot oil pressure gauge
66. Manifold pressure gauge selector (for testing boost gauges)
67. A.S.I. static pressure selector
68. Panel light
69. Carburettor air intake heat controls
70. Fuel tank selectors
71. Locking lever for carburettor air intake heat controls
72. Throttle levers
73. Mixture control levers
74. Propeller speed control levers
75. Oil cooler shutter controls
76. Locking lever for oil cooler shutter controls

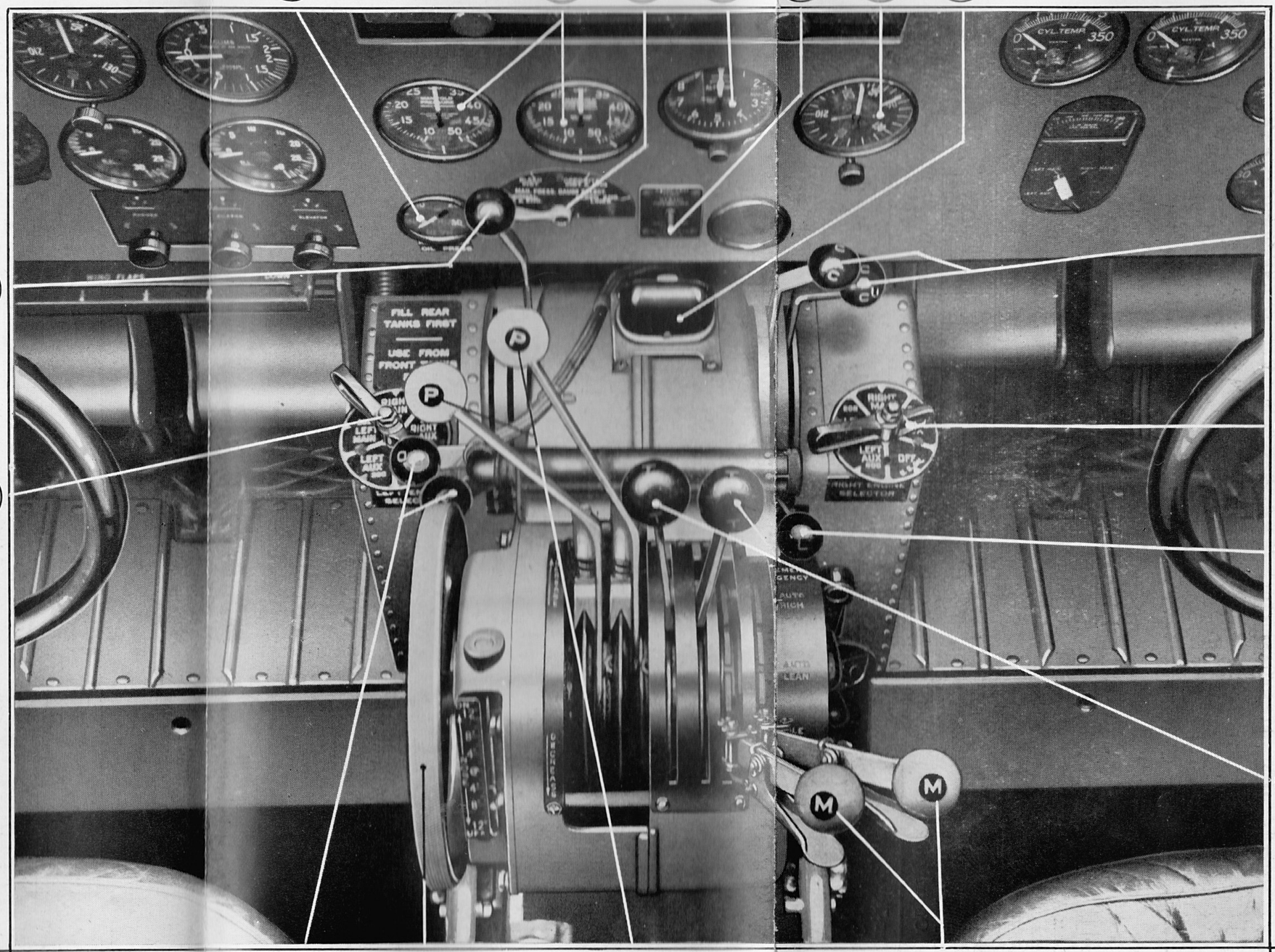


FIG. 5 ENGINE CONTROL QUADRANT FIG. 5

LOADING CHART

Item	Weight	Index Units
Weight Empty	16,621	403·1
Pilots (2) and Parachutes	400	2·8
Radio Operator (or Crew Chief) and Parachute	200	3·3
Oil, Full (58 gallons)	435	8·0
Trapped Fuel (3 gallons)	20	1·6
Trapped Oil (11 gallons)	84	
Fixed Sub-Total	17,760	418·8
Alcohol, Carburettor De-icer (10·0 gal.)	66	·8
Alcohol, Propeller De-icer (4·2 gal.)	28	·2
Alcohol, Windshield De-icer (6·5 gal.)	43	·5
Filters, Carburettor Air (2)	18	·2
Floor, Special Removable	40	1·1
Life Rafts, Type A-2(2) in L.H. Baggage Compt.	120	1·8
Life Rafts, Type B-3(1) in L.H. Baggage Compt.	34	·5
Litters (with Patient and 4 Blankets in each)		
Front Position (1)	233	5·1
Centre Position (1)	233	7·4
Rear Position (1)	233	9·7
Parachute Pack Release Rack, Front (1)	57	1·3
Parachute Pack Release Rack, Centre (1)	57	1·7
Parachute Pack Release Rack, Rear (1)	57	2·3
Parachute Pack, Front (Consider as Cargo at Cargo Sta. 60)		
Parachute Pack, Centre (Consider as Cargo at Cargo Sta. 130)		
Parachute Pack, Rear (Consider as Cargo at Cargo Sta. 220)		
Propellers as Cargo, Front (Consider as Cargo at Cargo Sta. 100)		
Propellers as Cargo, Rear (Consider as Cargo at Cargo Sta. 250)		

NOTE.—No British Mods are included in this weight data, but if the FIXED SUB-TOTAL is suitably adjusted for the individual aircraft, the chart can still be used.

FUEL WEIGHT AND INDEX UNITS.

Rear Wing Tanks			Full Rear Wing Tanks Plus Front Wing Tanks		
U.S. Gals.	Wt. Lb.	Index Units	U.S. Gals.	Wt. Lb.	Index Units
50	300	8·3	450	2,700	73·5
100	600	16·6	500	3,000	80·7
150	900	24·9	550	3,300	87·9
200	1,200	33·1	600	3,600	95.1
250	1,500	41·4	650	3,900	102·3
300	1,800	49·7	700	4,200	110·0
350	2,100	58·0	750	4,500	116·7
400	2,400	66·2	804	4,824	124·5

Two long-range fuselage tanks at Cargo Station 35·5:
Weight of tanks empty = 2 × 113·5 lb.
Weight of 2 × 102 U.S. gallons = 2 × 612 lb.
Index units for tanks and fuel = 30·9.

INDEX UNITS PER PASSENGER (200 LBS. EACH).

Row	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Index Unit	3·8	4·2	4·6	4·9	5·3	5·7	6·1	6·5	6·8	7·2	7·7	8·0	8·4	8·8

Total for 28 passengers : Weight 5,600 lbs. Index units 175·8

Fuselage Station = Distance in inches from nose. (marked on top of frame.)
Cargo Station 0 = Fuselage Sta. 177·5.
M.A.C. = Mean Aerodynamic Chord.

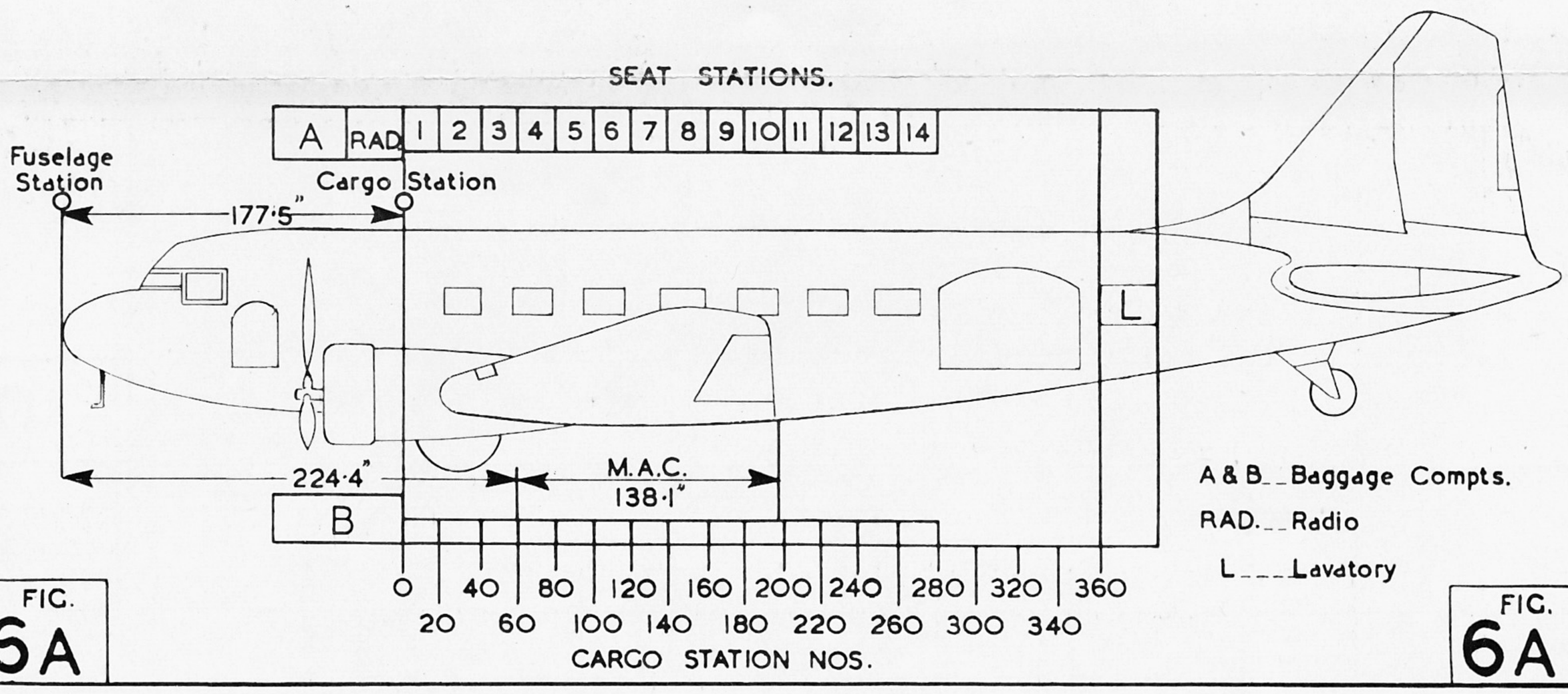
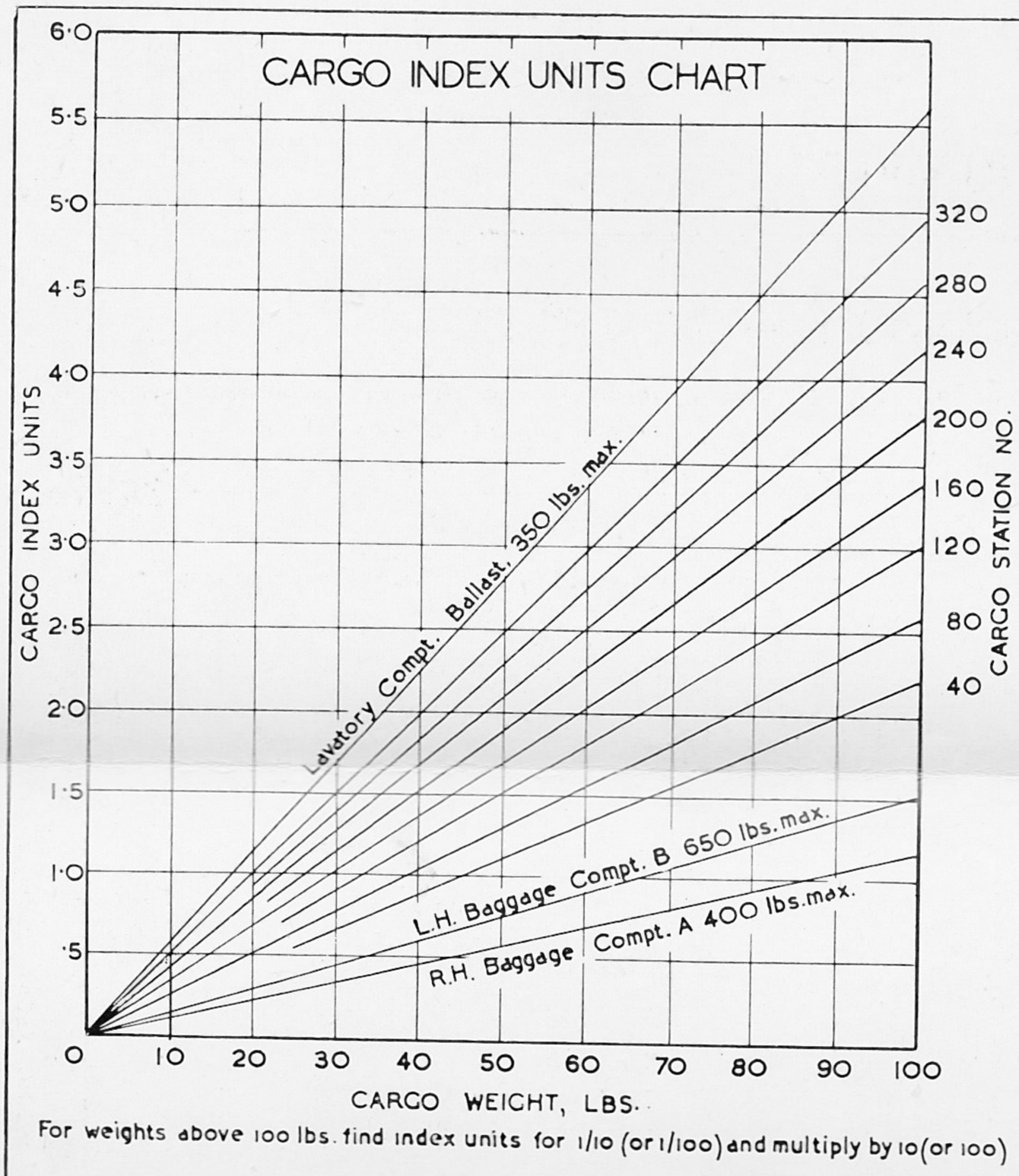
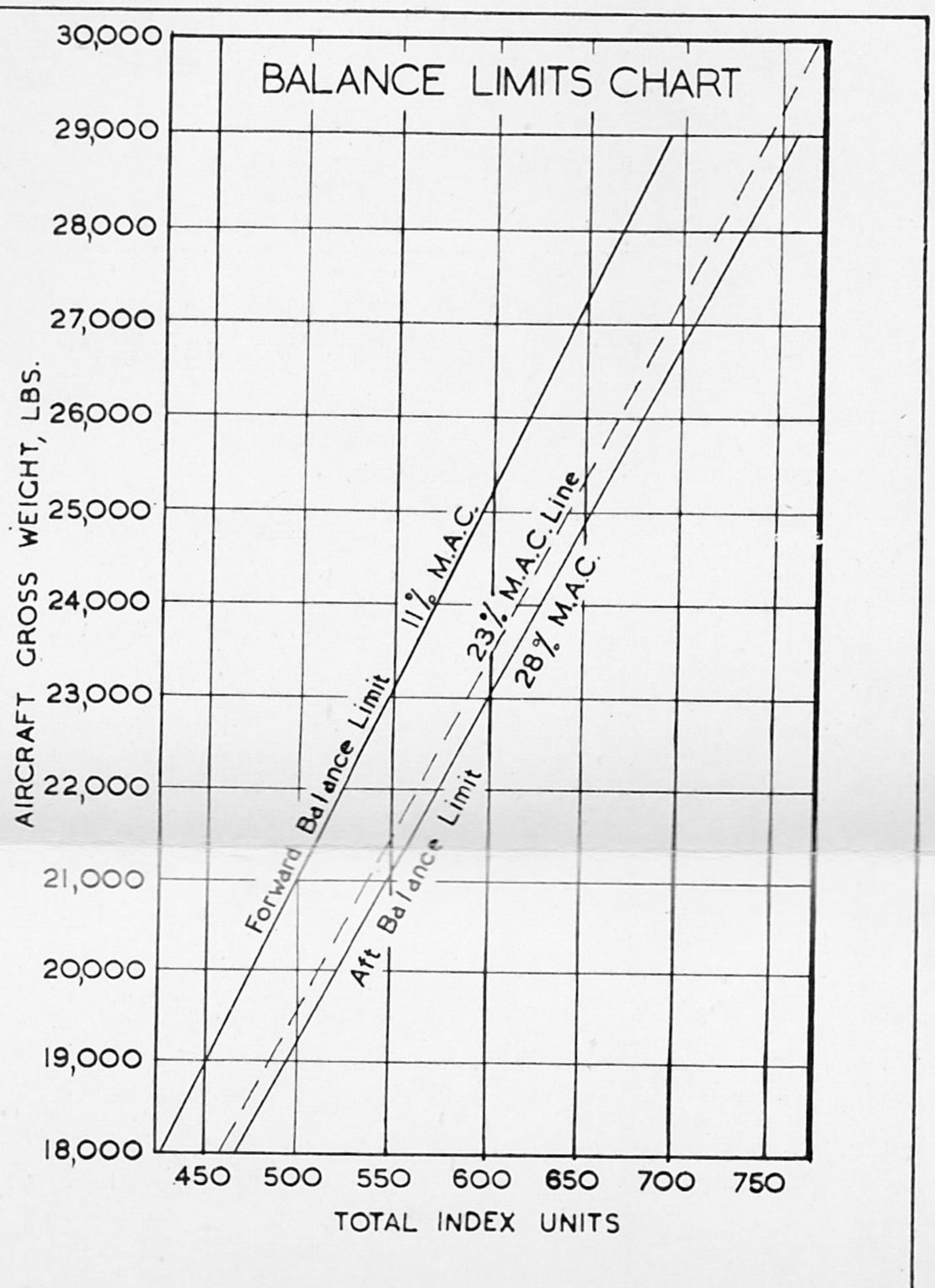


FIG. 6A

FIG. 6A



For weights above 100 lbs. find index units for 1/10 (or 1/100) and multiply by 10 (or 100)



INDEX UNITS = WEIGHT X DISTANCE FROM NOSE ÷ 10,000

INSTRUCTIONS

A. For Checking Gross Weight:

1. To "Fixed Sub-Total" Weight add weights of all other items of load including fuel.

B. For Checking Balance:

1. To "Fixed Sub-Total" add weights and index units of all other items of load EXCEPT FUEL IN WING TANKS.

2. Plot value thus obtained on "Balance Limits Chart". Point must fall between Limit Lines. This indicates that aircraft will balance properly for ANY wing fuel load. (If long-range fuselage tanks are carried, these must be considered as cargo.)

3. If desired, an accurate balance for take-off may be determined by adding Weight and Index Units for wing fuel (from table) to sub-total found in Instruction B.1. It is suggested that the value thus obtained, when plotted on the Balance Limits Chart, be made to fall as closely as possible to the 23% MAC line to give best flying condition.

4. Instruction B.3 is for supplementary information only and MAY NOT BE SUBSTITUTED for Instruction B.1 and B.2.

FIG. 6B

FIG. 6B

(1468) Wt.8183/N956 2,500 7/44 C.P. Ltd. Gp. 9.8.2.