

PART I
DESCRIPTIVE

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

- (a) Words in capital letters indicate the actual markings on the controls concerned.
- (b) The numbers quoted in brackets after items in the text refer to the illustrations in Part VI.
- (c) Unless otherwise stated all airspeeds and Mach numbers quoted are "Indicated."
- (d) These notes are based on aircraft subsequent to VZ778. Earlier aircraft may not be modified to this extent. Where information is available as regards the modification state of later aircraft the *approximate* production embodiment aircraft serial number is quoted, e.g., (W.L876). Retrospective action will however be taken on all carrier-borne aircraft.

1. Introduction

- (i) The Wyvern S.4 is a single-seat Naval strike aircraft powered by a single Python 3 axial flow propeller-turbine engine, driving two four-bladed counter-rotating constant-speed propellers and developing 3,605 shaft horsepower plus 1,340 lb. static thrust at sea level.
- (ii) A Mk. 1B or Mk. 2B pilot ejection seat is fitted.

PART I—DESCRIPTIVE
FUEL AND OIL SYSTEMS

2. Fuel tanks

(i) Fuel is carried internally in three fuselage tanks, two inner wing tanks and two outer wing tanks. Except for the two outer wing tanks which form part of the wings structure, all tanks are of the flexible self-sealing type. Two wing drop tanks may also be carried; they may be jettisoned by means of the lever on the port side of the pilot's seat.

(ii) The capacities of the tanks, in gallons, are:

Main tank	...	...	...	...	67
Fuselage rear tank	...	...	...	...	106
Fuselage front tank	...	...	...	...	105*
Inner wing tanks (2 x 29)	...	...	...	...	58
Outer wing tanks (2 x 95)	...	...	...	...	190
Total (internal)					526
Drop tanks (2 x 90)					180
Total (all tanks)					706

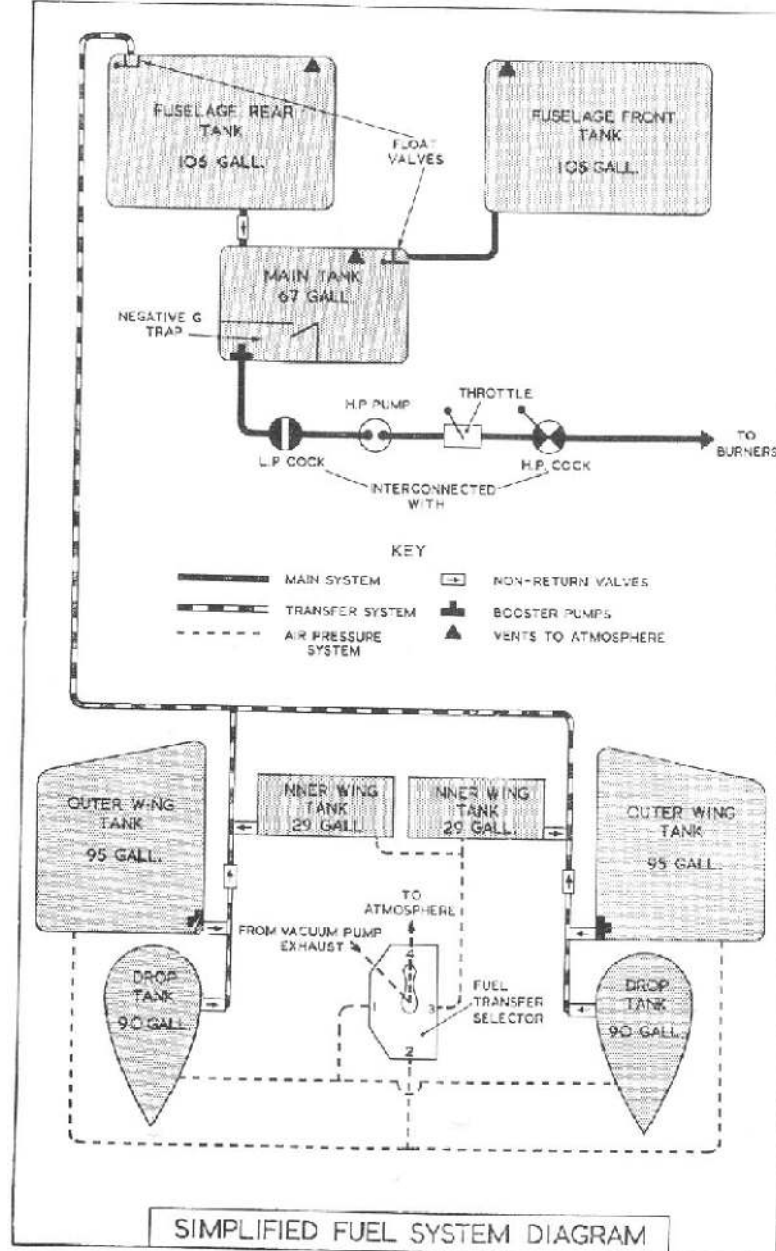
*When dual electric generators are fitted (WL882) a redesigned front tank of 95 gall. capacity is used. On such aircraft, therefore, the total fuel capacity above is reduced by 10 gallons.

(iii) A negative G trap is fitted in the main tank to permit at least 15 seconds inverted flight.

(iv) All fuselage tanks are vented to atmosphere.

3. Fuel transfer system.

(i) Fuel is transferred from the outer wing, inner wing and drop tanks to the fuselage rear tank by means of air pressure from the exhaust side of the vacuum pump, the air first passing through a four-way selector cock (14) on the port shelf. Transfer from the outer wing tanks is assisted by an electrically-operated booster pump in each



tank. These two pumps are switched on when the selector cock is set to OUTER WING.

- (ii) The four positions of the selector cock are:—
 DROP TANK, OUTER WING, INNER WING and FUSELAGE USE LAST. At FUSELAGE air pressure is vented to atmosphere.
- (iii) The fuselage rear and front tanks drain in that order by gravity to the main tank, which acts as a collector and from which fuel is fed to the engine.
- (iv) When less than approximately 245 gallons remain in the fuselage tank group a magnetic indicator (45) on the starboard side of the instrument panel shows white.

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4. Engine fuel system

- (i) From the main tank fuel is delivered by the submerged booster pump, which is switched on whenever the H.P. cock is moved fully open, through the L.P. cock to the engine-driven H.P. pump.
- (ii) To compensate for the tendency to temporary fuel starvation due to acceleration whilst catapulting, a recuperator provides a reserve of fuel to keep the H.P. pump supplied.
- (iii) A warning light, outboard of the fuel transfer cock, comes on when fuel pressure from the booster pump or recuperator falls below a safe minimum.
- (v) From the pump the high pressure fuel passes to the flow control unit (F.C.U.), which is in effect a combined throttle and barometric pressure control. This unit ensures a correct fuel supply for varying conditions of altitude, forward speed and throttle setting. From the F.C.U. fuel is fed to the combined H.P. cock and burner pressure valve.

5. Fuel contents gauges

Three electric fuel contents gauges (42) on the starboard side of the instrument panel indicate the contents of the

- Fuselage tank group
- Inner wing tanks
- Outer wing tanks

Some aircraft have separate gauges for each outer wing tank one of which replaces that for the inner wing tanks.

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6. H.P. cock control lever

- (i) Movement of the lever (8), on the inboard side of the throttle quadrant, in addition to operating the H.P. cock also controls the:—
- L.P. fuel cock
 - Main tank booster pump
 - Propeller reverse torque circuit (see para. 10)
 - Propeller (un)feathering and braking (see para. 11)
 - Propeller fine pitch stop safety cut-out switch
 - Inverters which supply A.C. to the Mk.4B Compass and j.p.t. warning circuit.

- (ii) The lever should only be used when starting or stopping the engine and must always be moved through its full travel to ensure correct operation of the various services which it controls.

7. Oil system

- (i) An oil tank, holding nine gallons of oil with a three-gallon airspace, is situated on the starboard side forward of the fire wall. Provision is made for an immersion heater to be fitted in very low temperatures. A negative G valve is also incorporated to maintain a constant oil supply during negative G flight conditions.
- (ii) Two oil coolers are provided, one in each wing leading edge. Cooling is controlled automatically by electrically-operated two-position shutters which are set to operate at oil temperatures between 40° and 60°C.
- (iii) Oil pressure and temperature gauges are located on the starboard side of the instrument panel.
- ~~(iv) The propeller accessories have a separate 1/2 pint oil system.~~

- (v) An electrically-operated feathering pump is fitted.

ENGINE CONTROLS

8. Throttle control lever

- (i) The throttle lever moves in a quadrant, marked GROUND IDLING, FLIGHT IDLING (gated) and TAKE-OFF (gated), on the cockpit port wall. A friction damper (9) is mounted on the inboard side of the quadrant.
- (ii) The throttle lever gives complete control over the engine and propeller through the flow control unit, the propeller control unit and, ~~when operating~~, the anticipator.
- (iii) The propeller control unit acts as a constant-speed unit, controlling propeller pitch to maintain constant r.p.m. under all conditions of power and airspeed. In the air, engine speed is maintained at 7,800 r.p.m. between FLIGHT IDLING and TAKE-OFF. At TAKE-OFF engine speed is maintained at 8,000 r.p.m.
- (iv) The anticipator is designed to operate only during a change in engine power output resulting from a variation of throttle setting. During such a variation the anticipator causes the P.C.U. to momentarily ^{over}underspeed r.p.m. to absorb the power change.

9. Propeller blade stops

- (i) Two fine-pitch stops are provided on the propeller, one fixed at 8° pitch and the other, the removable flight fine-pitch stop (F.F.P.S.) set at 28° pitch.
- (ii) The F.F.P.S. is a safety device preventing the blades fining off in flight to an angle of dangerously high drag ~~and low thrust~~ in the event of P.C.U. failure. It is also the minimum setting to give adequate thrust to maintain altitude if the P.C.U. fails.

- (iii) The F.F.P.S. is removable, since for conditions combining low airspeed and power, and for ground running, a finer angle than 28° is required. In the air this finer angle (8°) is required to maintain constant speeding r.p.m. and on the ground it is required to provide the least possible resistance to the idling turbine, and to reduce idling thrust to a minimum.
- (iv) The F.F.P.S. is manually controlled by a switch (3) on the port shelf. The three positions are:—

NORMAL The stop is removed when the undercarriage is lowered and engaged when it is retracted. During take-off, with the throttle fully open, the stop is also engaged through a switch on the throttle box. This prevents the blades fining off in the event of P.C.U. failure.

EMERGENCY The stop is positively engaged under all conditions. It is for use in the event of P.C.U. failure.

WITHDRAWN The stop is withdrawn. This is for use in low air-speed/power conditions with the undercarriage up.

10. Reverse torque system

NOTE.—This system is at present inoperative pending modification action.

- (i) Under conditions which may cause the propeller to drive the turbine, e.g., engine failure, the automatic system comes into operation to coarsen the propeller pitch, the P.C.U. being assisted by the feathering pump. This is indicated by a red warning light (38) on the instrument panel.
- (ii) In the event of complete engine failure, the blades will move almost to the feathered position to reduce drag to a minimum. To complete the feathering operation it is necessary to close the H.P. cock and press the propeller starting pitch button.

11. Propeller braking

- (i) The starting pitch control button (10) on the port shelf is used in conjunction with the H.P. cock lever to operate the feathering pump and to apply the propeller parking brake.
- (ii) When the H.P. cock lever is ON, pressing the button starts the feathering pump which causes the propellers to move to fully fine.
- (iii) When the H.P. cock lever is CLOSED, pressing the push-button starts the feathering pump which causes the blades to feather and finally the parking brake is applied. The brake is fitted to reduce engine running-down time and to prevent windmilling. When the H.P. cock lever is moved from the CLOSED to the middle position pressing the feathering pump button will unfeather the propeller, the parking brake remaining ON; this is to prevent the propeller windmilling prior to engine starting in a high wind. When the H.P. cock lever is moved fully to ON the brake is released.

12. Engine instruments

- (i) These are grouped on the starboard side of the instrument panel and consist of a tachometer, jet pipe temperature gauge, oil pressure and temperature gauges, a torquemeter gauge, and a fuel distributor pressure gauge (37).
- (ii) The torquemeter gauge (36) registers the oil pressure in the torquemeter system and gives an indication of the shaft horsepower developed by the engine.
At 8,000 r.p.m. S.H.P. = 11.25 x Torquemeter pressure
At 7,800 r.p.m. S.H.P. = 11 x Torquemeter pressure
- (iii) There is no workable relation between fuel distributor pressure and fuel consumption. The instrument is primarily intended for ground test use.

13. Engine starter controls

- (i) The starter motor may be operated by means of one of two electrically-fired cartridges, selected by a two position switch (22) on the port side of the instrument

panel. When the adjacent shielded pushbutton (21) is pressed the cartridge is fired and the ignition is automatically tripped on.

- (ii) Compressed air, which may be used alternatively for starting, is fed via a quick release coupling forward of the port oil cooler. The ignition switch, on the port side of the instrument panel, is tripped up to START and down to OFF, being spring-loaded to the central position.
- (iii) The ignition switch (24), whether tripped on automatically or manually controls the supply of current to the igniters and to the starting and fuel bleed solenoid valves. When the switch has been set to START it will return to central but the circuit will remain energised until automatically switched off when approximately 2,700 r.p.m. are reached. A green warning light (23) adjacent to the switch remains on as long as the circuit is energised.
- (iv) When the circuit is in operation the torch igniters are energised, the starting valve allows fuel to flow to the starting atomisers and the bleed valve returns surplus fuel to the inlet side of the H.P. pumps. When the circuit is switched off, either by the automatic cut-out or when the ignition switch is set to OFF, the torch igniters are switched off, the bleed valves closed and all available fuel is fed to the burners.

14. J.p.t. warning bell (VZ778)

The j.p.t. warning bell is designed to operate whenever the maximum permitted j.p.t. ~~(600°C)~~ *during starting* is exceeded by a predetermined amount. (60°-100°C)

MAIN SERVICES**15. Electrical system (24 volt)**

NOTE.—On aircraft subsequent to WL882, two generators, two circuit breakers and two warning lights are fitted.

- (i) A single 3,000-watt engine-driven generator supplies the whole of the electrical system and charges two 12-volt aircraft batteries connected in series.
- (ii) A resettable generator field circuit breaker (64) on the cockpit starboard shelf protects the generator circuit. It should normally be in.
- (iii) A generator failure red warning light (35) on the upper starboard side of the instrument panel, indicates whenever the generator is not supplying power.
- (iv) A Ground/Flight switch (58) is on the cockpit starboard shelf. If in flight it is desired to isolate all electrical services from the batteries, e.g., in the event of a crash landing, it should be set to GROUND. At this position only the fire-extinguisher inertia switch is in circuit.
- (v) The external ground starter battery socket is inside the port fuselage door aft of the wing.

16. Hydraulic system

- (i) Two engine-driven hydraulic pumps connected in parallel operate the:—
 - Airbrakes
 - Arrester hook
 - Flaps
 - Undercarriage
 - Wing folding mechanism
- (ii) A hydraulic accumulator is fitted for the operation of the arrester hook only. It enables the hook to be lowered and raised once when hydraulic power is not available.
- (iii) A handpump, at the port side of the pilot's seat, is primarily provided for ground test operation of all services.
- (iv) For emergency lowering of the undercarriage and for full lowering of the inner flaps respectively, two air cylinders

having a common charging point are incorporated. They are charged before flight to a pressure of 1,800 lb./sq. in.

17. Pneumatic system

- (i) An engine driven compressor charges an air bottle to a pressure of 450 to 470 lb./sq. in. for the operation of the wheel brakes. The main pressure, and the pressure at each wheel brake (150 lb./sq. in. max.) is indicated on the triple pressure gauge (44) on the instrument panel.
- (ii) A ground charging valve for the air bottle is situated below the front fuselage.
- (iii) The wheel brakes are controlled by a lever at the forward side of the control column handgrip. Differential control is effected by movement of the rudder pedals. The brakes are applied automatically while the undercarriage is being raised.

18. Vacuum system

- (i) An engine-driven vacuum pump operates the gyro-driven flight instruments. No vacuum gauge is fitted.
- (ii) The exhaust side of the pump provides pressure for the operation of the fuel transfer system.

AIRCRAFT CONTROLS

19. Flying controls

- (i) The flying controls are conventional. The rudder pedals can be adjusted for reach by a central foot-operated wheel.
- (ii) The ailerons and the port elevator incorporate torsion-bar operated spring tabs.

20. Stick breaking

- (i) The upper portion of the control column is designed to spring forward automatically when the ejection seat blind handle is pulled (irrespective of the mark of seat).
- (ii) If the folding mechanism fails to operate, ejection will still take place.

21. Flying controls locking gear*(i) Internal locking*

The seat should first be fully lowered and the rudder bar centralised. The ailerons and elevator controls are then locked by means of two rods, attached to a clamp which engages with the control column handgrip. The other ends of the rods are clipped respectively to the cockpit starboard wall and to the side of the ejection seat port thigh guard. The rudder is locked by inserting a pin, attached by wire to the handgrip clamp, through a hole in the cockpit floor immediately aft of the rudder bar.

(ii) External locking

Built-in locks are provided for the ailerons. They are operated by special keys, which have warning pennants attached, and which can only be removed from the locks when the ailerons are unlocked. Clamps are provided for locking the rudder and elevator.

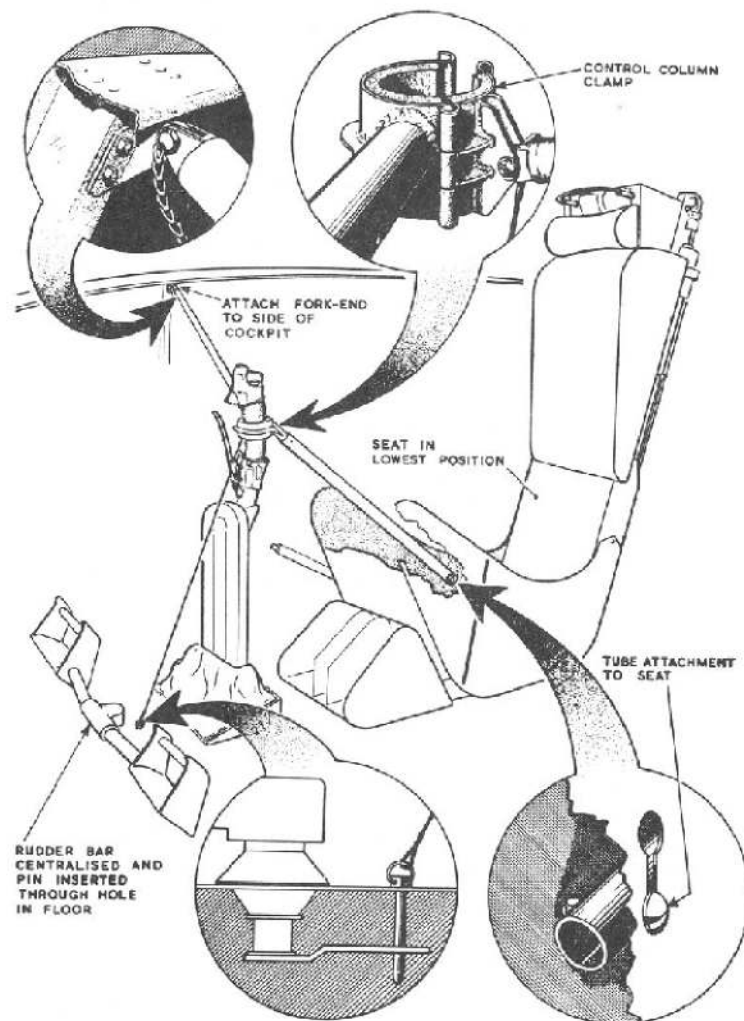
(iii) Locking gear stowage

When not in use all internal and external locking devices are stowed in the fuselage rear compartment.

22. Trimming tab controls

- (i) The rudder and aileron trim tabs are controlled electrically by spring-loaded switches (4) (5) on the cockpit port shelf. A single combined indicator (25) is provided on the port side of the instrument panel.

- (ii) The elevator trim tab is controlled by a handwheel (1) on the side of the cockpit port shelf. An indicator is inset aft of the wheel.



FLYING CONTROLS LOCKING GEAR

23. Undercarriage controls and position indicator

- (i) The undercarriage UP and DOWN pushbuttons (30) on the port side of the instrument panel, when firmly pressed select electrically the hydraulic valves for the operation of the undercarriage. The UP pushbutton is shielded by a LIFT to PRESS flap, there being no other safeguard against inadvertent operation.
- (ii) Safety locks are provided, for use when the aircraft is on the ground. These, when not in use, should be stowed in the fuselage rear compartment.
- (iii) The standard indicator (28) is on the port side of the instrument panel. The tailwheel light may show red temporarily when the flaps are being operated.

24. Undercarriage emergency operation

The main wheels may be lowered, irrespective of the selector pushbutton position, by forcing fully down the yellow U/C EMERGENCY release pedal (47). This action admits compressed air to the locks and jacks. A mechanical linkage between the emergency pedal and the tailwheel up-lock frees the tailwheel, which then drops due to gravity and air loads. The hydraulic fluid in the up lines of all wheels is vented to atmosphere, thus precluding re-use of the main system.

25. Tailwheel control

The control (2) on the port side of the cockpit between the seat and the shelf is spring-loaded to up, to lock the tailwheel when it is in the central position. When unlocking the wheel the control should be pushed down and turned through 90°.

26. Flaps control

- (i) The inner flaps form the trailing edge of the centre plane, and the outer flaps form the trailing edge of the

outer planes between the ailerons and the wing-fold joints.

NOTE.—The outer flaps are inoperative on aircraft restricted to shore-based use.

- (ii) The flap setting is infinitely variable and follows the movement of the selector lever (19) on the inboard face of the port shelf. Four positions UP, MANOEUVRE, TAKE-OFF, and DOWN are specifically marked on the quadrant. When settings between UP and MANOEUVRE are selected only the inner flaps are lowered. When larger flap angles than these are selected both the inner and the outer flaps are lowered.
- (iii) An electrical position indicator (26) on the port side of the instrument panel shows the setting of the *inner flaps only*.

27. Flaps emergency operation

Operation of the yellow painted handle (20) immediately forward of the main control, after releasing the locking catch supplies compressed air to the flap jacks to lower the *inner flaps* fully down only.

28. Airbrakes control

- (i) The airbrake installation comprises two flush fitting plates, on the upper surface of each outer mainplane, the lower half of which also forms the outer landing flaps. On later aircraft (WL885) two additional flaps are fitted, forward of the inner landing flaps.

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- (ii) Two positions only, OPEN (aft) and CLOSED (forward), can be selected by means of the lever (16) forward of the flaps selector lever, or on later aircraft, by a switch on the throttle lever.
- (iii) Warning that the airbrakes are not locked closed is given by a visual indicator on the upper surface of each airbrake.

29. Arrestor hook control

- (i) The control lever on the inboard face of the cockpit port shelf should be pulled aft to lower the hook. A green light (27) below the undercarriage position indicator comes on when the hook is more than two-thirds down.
- (ii) When the hook is lowered and the undercarriage is locked down, the navigation and attitude lights come on.
- (iii) When the training switch just above the control lever is switched ON it simulates the action of the arrestor hook, but does not lower the hook.

30. Arrestor hook emergency operation

Should the undercarriage and flaps have to be lowered by the emergency system the arrestor hook may still be lowered by means of the normal selector lever. Sufficient pressure should be available in the hydraulic accumulator for one complete raising and lowering only.

31. Wing folding control

NOTE.—On aircraft subsequent to VZ791, the outer wing tips do not fold.

- (i) The wing folding control box is mounted at the starboard side of the seat.
- (ii) To fold the wings, with the engine running or by hand-pump, the MASTER CONTROL lever must be set aft to

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ON: GROUND USE ONLY, before the interconnected port and starboard selector levers can be moved. The levers are normally used together but if independent operation is required a central catch should first be raised. The selector levers move upwards through NEUTRAL to FOLD. The spreading can be arrested at any position by setting the selector lever(s) to NEUTRAL.

- (iii) When folding has begun and electrical power is available, a red warning light comes on and protrudes through a recess in the upper surface of each inner wing. A third red warning light on the upper surface of the starboard inner wing indicates whenever the master control lever is set at ON: GROUND USE ONLY.
- (iv) The pilot should ensure, when the wings are spread prior to take-off, that all warning lights are extinguished and recessed and that the master control lever is at OFF: TAKE-OFF AND FLIGHT. In this position the selector levers are locked.
- (v) Jury struts are provided which may be stowed in the fuselage rear compartment and must be fitted when the aircraft is parked with the wings folded.

COCKPIT EQUIPMENT

32. Entry to aircraft

A fixed footstep is fitted to the forward edge of each undercarriage leg, to enable the pilot to mount the wing via the leading edge. Two footsteps are provided on the fuselage port side below the cockpit.

33. Hood operation

- (i) The sliding hood may be opened or closed by means of the winding handle (55) on the cockpit starboard wall. The hood can be locked in any intermediate position by locking the handle. In the fully open position the hood

engages a locking catch at the rear of the cockpit. Operation of the handle to close the hood disengages the catch.

- (ii) Operation from outside is effected by pulling the hood back by means of a hand recess provided in the port side of the moulding.

34. Hood jettisoning

- (i) The hood may be jettisoned in flight by pushing down. through about 90° travel, the yellow painted HOOD JETTISON lever (12) on the cockpit port wall. This action also jettisons the rails which carry the hood.
- (ii) An external flush fitting yellow painted lever is fitted on the fuselage port side. It should be lifted and pushed upwards to free the hood, which may then be lifted clear manually.

35. Cockpit ventilation

- (i) A ventilating louvre in the cockpit starboard wall is operated by a push-pull control (46) adjacent to the oxygen regulator. The control is pulled out and turned to lock in the open position. An additional louvre, resettable only on the ground, is fitted on the port side. A catch below this louvre must be pushed down before its position can be changed.
- (ii) A ram air ventilating louvre (VZ778) is fitted in the cockpit floor to supply air to the vicinity of the pilot's feet.
- (iii) No heating system is fitted.

36. Windscreen de-icing

- (i) The de-icing system for the windscreen consists of an ON/OFF cock (48), an adjacent pump and flow regulator and a tank containing the de-icing fluid.
- (ii) The spray nozzle is forward of the windscreen.

37. Windscreen wiper (WL885)

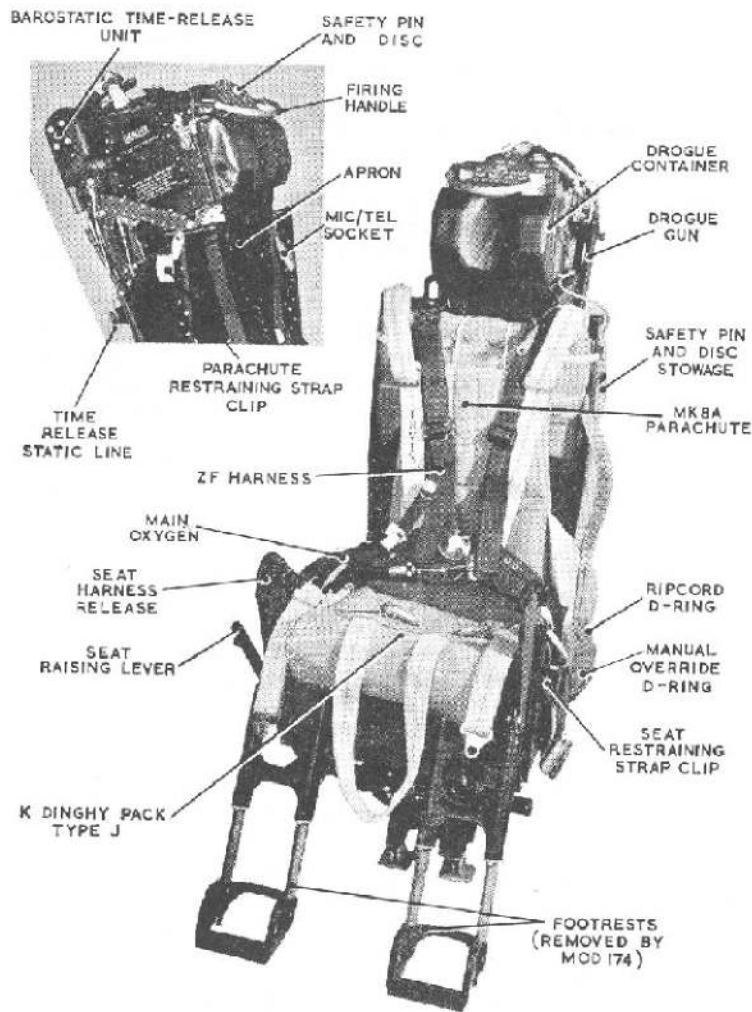
A windscreen wiper, operated from the main hydraulic supply, is controlled by a three-position ON-OFF-PARK control on the port side of the instrument panel.

THE WIPER WILL NOT WORK ON A DRY OR NEARLY DRY WINDSCREEN.

38. Ejection seat Mk. 1B or Mk. 2B

WARNING.—The firing handle must always be locked against the possibility of accidental withdrawal whenever the aircraft is on the ground. A fabric safety strap, attached to the front edge of the drogue container, should be passed through the firing handle and secured by a spring safety pin. It is the pilot's responsibility to lock the handle after landing and to ensure that the pin is removed and stowed on the port side of the drogue container prior to take-off. All personnel must ensure that the firing handle is locked before entering the cockpit.

- (i) Either a Mk. 1B or Mk. 2B pilot ejection seat may be fitted. Both seats incorporate a type ZD harness, a container to support the weight of the Mk. 3A (1B seat) or Mk. 8A (2B seat) back-type parachute and a seat well in which is carried the K dinghy pack type J and emergency oxygen supply.
- (ii) On both seats the harness release lever is on the outboard side of the starboard thigh guard and the seat adjustment lever (49) is on the starboard side of the seat.
- (iii) The Mk. 2B seat is fitted with fully automatic facilities which after ejection separate the occupant from the seat and open his parachute. After ejection, at heights of 10,000 ft. and below, a barostat causes the automatic cycle to commence; after 5 seconds the seat harness is released, as are the face screen, firing handle and head-rest pad. An apron attached to the seat drogue then pitches the pilot head first out of the seat at the same time opening his parachute. A manual override D-ring is fitted, over the rip-cord D-ring and when pulled disconnects the parachute from the seat. In this event it is



EJECTION SEAT MK.2B.

subsequently necessary manually to release the seat harness and pull the ripcord D-ring.

39. Oxygen system

- (i) Provision is made for the carriage of three 750-litre oxygen cylinders in the fuselage rear compartment; normally one cylinder only is carried. The supply is coupled to a Mk. 11C regulator (43) on the starboard side of the instrument panel. From the regulator oxygen flows via a Mk. 3 economiser to the pilot's oxygen mask.
- (ii) The cylinders may be charged "in situ" by means of a charging valve on the port side of the compartment.

40. Emergency oxygen system

- (i) The emergency oxygen supply is carried in a bottle forward of the dinghy pack in the seat well. With the locking pin withdrawn, the supply is automatically brought into operation when the ejection seat is operated, but should it be required in any other circumstances a release control is fitted on the starboard side of the seat.
- (ii) The duration of the supply is 12 minutes only.

41. Cockpit lighting

(i) Floodlamps

Four red floodlamps and two ultra-violet floodlamps illuminate the cockpit instruments. They are controlled from a panel (59) on the cockpit starboard wall. The master switch must be ON before operating the relevant dimmer switches.

(ii) Emergency lamp

A single emergency lamp beneath the G.G.S. is intended for use in the event of failure of the main lighting system. It is powered by a separate 2-volt battery stowed beneath

the cockpit starboard shelf and is controlled by a switch on the lighting panel (59). When fully charged the battery will last for two hours.

42. External lighting

(i) Navigation lights

These are controlled by an ON/OFF and a BRIGHT/MED./DIM switch at the upper forward position on the external lighting panel (56) on the cockpit starboard wall.

(ii) Identification lights

These are controlled by two STEADY/MORSE/OFF switches, one for the upward and one for the downward lights, adjacent to the navigation lights switches. A single RED/GREEN/AMBER colour selection switch is fitted for the downward lights only.

(iii) Resin lights

A single ON/OFF switch is fitted at the lower forward position on the external lighting panel.

(iv) Formation lights

A STEADY/MORSE/OFF and a BRIGHT/MED./DIM switch are provided adjacent to the resin lights switch.

(v) Morse pushbutton

A single pushbutton (57) is fitted above the lighting panel for use with the identification lights or the formation lights.

(vi) Attitude lights

Two attitude lights are fitted. One illuminates the port wheel and comes on when the undercarriage is down and locked. The other, inside the arrester hook fairing, comes on when the arrester hook is lowered or the train-

ing switch is operated irrespective of the undercarriage position.

43. Pressure head heater

(i) A relay connected to the undercarriage automatically switches the heater element on when the wheels are up and locked, irrespective of the position of the ON/OFF switch. It is switched off again when the wheels are lowered.

(ii) An ON/OFF test switch is on the cockpit starboard shelf.

44. Ventilated suit system (VZ778)

The supply of air is taken from the engine compressor and is piped via an air conditioning unit to a connection into which the ventilated suit (Mk. 1) is plugged. An ON/OFF cock which controls the supply is positioned on the port shelf.

45. Signal pistol

A signal pistol (60) is carried in a hinged stowage on the cockpit starboard wall. A spring plunger forward of the stowage should be tripped to enable the pistol to swing forward to the firing position. A stowage for two spare cartridges is on the inboard side of the starboard shelf.

46. Fire warning lights and extinguisher pushbuttons

(i) Two separate fire warning and extinguishing systems are fitted, one for the engine bay and one for the jet pipe zone. Two extinguisher pushbuttons (41) marked FIRE and JET PIPE operate the respective systems. A warning light (39) (40) adjacent to each button indicates a fire or fire hazard, in the respective zone.

(ii) The jet pipe fire warning light is at present operated by non-resetting flame switches, which cause the light to

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come on and stay on irrespective of whether the fire is subsequently extinguished or not. Later aircraft will have resetting switches, which, if the fire is satisfactorily extinguished, cause the light to go out.

- (iii) The engine fire warning light is at present operated by a mixture of resetting and non-resetting flame switches. Since the latter operate at a lower temperature than the resetting type, once the light has given warning it will remain on irrespective of subsequent action. Later aircraft will be fitted with all resetting switches.
- (iv) An inertia switch operates the engine fire-extinguishers in the event of a crash landing.

NAVIGATION EQUIPMENT

47. ADRIS

An air mileage unit, AMU Mk. 4, is carried in the fuselage rear compartment. The API Mk. 2 and its control unit (17) are situated on the side of the cockpit port shelf and cockpit starboard wall respectively.

48. Compasses

(i) *Mk. 4B compass*

The compass/DG switch (51) is mounted on the starboard shelf. The inverters are controlled by the H.P. cock. At the commencement of its travel from closed the main inverter is switched on and when the H.P. cock is fully open the standby inverter is in circuit. If the main inverter fails, automatic changeover to the standby will ensure the correct functioning of the compass. A magnetic indicator shows white after changeover. Should the standby inverter fail, the indicator will revert to black. Inverter changeover occurs one way only, i.e. main to standby.

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(ii) *E2a compass*

A standby E2a compass is fitted at the top of the wind-screen starboard frame.

49. Chartboard

The chartboard is stowed below the G.G.S. and has a restraining catch to lock it in the fully stowed position for catapulting. A chart stowage is provided on the side of the cockpit starboard shelf.

OPERATIONAL EQUIPMENT

50. Radio controls

NOTE.—All installations are carried in the fuselage rear compartment.

(i) *V.H.F. relay (A.R.I.5491)*

The twin TR.1934/1935 sets controller (50) is on the cockpit starboard shelf and the press-to-transmit push-button (13) is incorporated in the top of the throttle lever.

(ii) *External intercommunication*

A socket is fitted in the port undercarriage outer fairing door.

(iii) *Beacon homing (A.R.I.5307)*

The ZBX beacon homing control unit and BEACON/MIX/RT switch are on the cockpit starboard shelf.

(iv) *Beam approach (A.1271)*

The beam approach master signal amplifier ON/OFF switch is on the cockpit starboard shelf. The system is deleted on aircraft subsequent to WL876.

51. **Radar controls**

NOTE.—All installations are carried in the fuselage rear compartment.

(i) *Radio altimeter*

The altimeter (32) is on the port side of the instrument panel, the limit switch is on the starboard shelf and the limit warning lights (33) are on the left of the G.G.S.

(ii) *I.F.F. (AN/APX-1)*

The auxiliary control panel (62) is on the cockpit starboard shelf.

(iii) *Radar range (ASV.16)*

The switch panel and controller (65) are on the cockpit starboard shelf. The aerial is in the outer gun fairing on the port outer wing.

(iv) *Tail warning system (AN/APS 13)*

On early aircraft the control switches (63) are on the starboard shelf. Subsequent to VZ798 this system is deleted.

52. **Contacting altimeter**

The contacting altimeter (31) is mounted on the port side of the instrument panel. The green warning light (34) is mounted above the centre instrument panel.

ARMAMENT EQUIPMENT

53. **Gyro gunsight Mk. 4E**

- (i) The G.G.S. is mounted above the centre of the instrument panel. When the master switch to the left of the sight is

ON, the G.G.S. carriage rises to lock in the combat position. At the same time the G.G.S. circuit is energised making the sight available for immediate use.

- (ii) A RETRACTION TEST switch is fitted on the cockpit starboard wall. It enables the retraction circuit to be tested without energising the sight gyro.
- (iii) The ranging control is incorporated in the throttle lever twist-grip; the selector dimmer is on the starboard side of the instrument panel and the RP/GUNS selector is on the armament selector panel on the cockpit port wall.

54. **Gyro gunsight emergency lowering**

- (i) If electrical power is available, the G.G.S. will automatically be retracted when the hood is jettisoned.
- (ii) If the electrical system fails, the G.G.S. may be lowered manually by striking the red knob below the sight a hard blow. Normally this action will be sufficient to lower the sight but it may be necessary to push the sight manually to the retracted position.

55. **G45 camera and camera recorder**

- (i) The G45 cine-camera is installed in the inner starboard wing and the camera recorder may be mounted above the G.G.S.
- (ii) The camera master switch must be on before the cameras can be operated. It is on the starboard shelf together with the heater switch and CLOUDY/SUNNY aperture switch. The camera operating button is on the control column.
- (iii) When the master switch is on, the cameras are also operated when the RP's or the guns are fired.

56. **F46 camera**

A single F46 torpedo marking camera may be fitted in place of the G45 camera. It is controlled as indicated in the previous paragraph.

57. F24 cameras

- (i) Provision is made for the carriage of two fuselage-mounted vertical F24 cameras or one oblique F24 camera. In addition two forward facing F24 cameras may be carried, one at each wing bomb station.
- (ii) The cameras selector switch, heater switch and container switches (54) are all on the cockpit starboard side.
- (iii) Provision is made for automatic jettisoning of the covers when the cameras are selected.

58. Gun controls

- (i) The G.G.S. RP/GUNS selector switch is on the armament selection panel on the cockpit port wall.
- (ii) The knurled safety catch on the control column handgrip has two positions, FIRE in the aft position and SAFE in the forward position.
- (iii) The gun-firing trigger is on the forward side of the control column handgrip. It simultaneously operates the cine cameras if they are switched on.
- (iv) A switch attached to the port oleo leg automatically prevents RP gun or camera operation when the weight of the aircraft is on the undercarriage. In order that guns and cameras may be ground tested, the BUTT TEST switch in the starboard wheel bay should be set to ON when required.

59. RP controls

- (i) The G.G.S. RP/GUNS switch and the RP/BOMBS selector switch (11) are on the armament selection panel on the cockpit port wall together with the RP/PAIRS/SALVO and auto selector switches.
- (ii) The RP/bombs firing button is on the control column handgrip. It simultaneously operates the cameras if they are switched on.

- (iii) When the undercarriage is extended it is impossible to fire the inner pair of RP's on each side, irrespective of the position of the BUTT TEST switch.
- (iv) The wings can be folded when RP's are loaded.

60. Bomb controls

- (i) A 100/1,000 lb. bomb carrier may be carried at the outboard end of each inner plane, and a 1,000/2,500 lb. bomb/torpedo carrier may be used beneath the fuselage. A light series carrier may be suspended from each of the wing carriers to accommodate flares, marine markers or smoke floats.
- (ii) The RP/BOMBS selector switch is on the cockpit port wall and the selector, distributor and fuzing switches are on the cockpit starboard shelf.
- (iii) The bombs/RP release pushbutton is on the control column handgrip.
- (iv) The bomb and SCI jettison switches are on the cockpit starboard shelf, while the bomb and carrier manual jettison levers are on the cockpit floor at the port side of the seat.

61. Torpedo controls

- (i) A single torpedo may be carried beneath the fuselage.
- (ii) The depth-setting control (6) and the director master switch and gyro angling control unit (7) are all on the cockpit port shelf.
- (iii) Release is effected through the bomb/RP release pushbutton.

62. Flare container control

The flare container door control switch, and a warning light which indicates when the doors are open, are on the cockpit starboard shelf.

63. "Window" launcher

- (i) The "window" containers are carried on the bomb racks. The launcher speed control unit is carried in the fuselage rear compartment and should be pre-set as required before flight.
- (ii) Two ON/OFF control switches and warning lights which indicate when "window" is being launched are fitted on the cockpit starboard shelf.

64. R.A.T.O.G. and catapult gear

- (i) The R.A.T.O.G. master switch is on the cockpit starboard shelf, the jettison pushbutton is on the port shelf (15) and the firing pushbutton (29) is on the port side of the instrument panel.
- (ii) Two hooks are provided for the catapult stop, one in each oil cooler fairing below the fuselage. An attachment for the hold back gear is fitted on the tailwheel leg.

65. Bombs and torpedo jettisoning

The bomb carriers and torpedo carrier may be jettisoned in straight and level flight by operating the appropriate jettison lever at the port side of the pilot's seat.

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