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AIR PUBLICATION 2014A
Pilot's Notes

PILOT'S NOTES
THE KITTY HAWK I AEROPLANE
ALLISON V-1710 F.3.R. ENGINE

B. A. C. 9-41 C. W. CORP.

A. P. 2014A FRONTISPIECE

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AMENDMENT CERTIFICATE

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Amendt. List No.										
Prelimry. matter										
Introdcn.										
Section 1										
Section 2										
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Section 1										
Section 2										
Date of incorpn.										

LIST OF SECTIONS

INTRODUCTION

LIST OF CONTENTS

INTRODUCTION

1. General:- The Kitty Hawk I (H87A) is a single-seater, low wing, monoplane of all metal construction with a retractable landing gear and enclosed cockpit. The airplane is powered with a 12-cylinder liquid-cooled Allison engine (V-1710-F3-R) which drives a Curtiss multi-position, constant speed, electrically operated tractor propeller. The following are the main dimensions:

Span 37 ft. 3½ ins., Overall length 31 ft. 8-23/32 ins.
Overall height with tail down 10 ft. 9 ins.

2. Cockpit:- The cockpit is completely enclosed. The windscreen is composed of five sections. The sides are non-shatterable laminated glass 21/64" thick. The two top sides are plexiglas 1/4" thick. The front section is bullet resistant glass 1-1/2" in thickness.

On later aircraft (subsequent to AK720 approx.) the center section consists of a flat 10-inch wide section of glass 5/16 inches thick, just aft of which is a panel of non-shatterable, transparent, bullet resistant 1-1/2 inch thick plate glass. A lever on the forward starboard side of the windscreen releases warm air to pass between the double windscreen to act as a defroster.

The transparent cockpit cover is glazed with plexiglas, and slides fore and aft for entry and exit purposes. The complete cover may be released in flight in case of an emergency. In the event of a turnover the left side panel may be pushed out, permitting an emergency exit. The structure behind the pilot is of sufficient strength to withstand a turnover landing. Two pieces of armor plate are provided; one piece (large) behind the pilot which is 5/16" thick, and a small piece forward of the pilot which is 3/8" thick.

3. Main Plane:- The main plane is a cantilever multi-spar, stressed-skin type. It is constructed in four separate units, right and left wing panels, and right and left wing tips. The right and left hand panels are bolted together at the centerline with a series of bolts. The joint where the two wing sections are connected will serve as a skid in case of an emergency landing with the wheels retracted. The panels contain two fuel tanks located near the centerline so their loads are concentrated near the center of gravity. Circular recesses are provided in the lower surface of the wing to provide housings for the wheels when in the retracted position. Duck canvas throw-over strips are provided to protect the wing during servicing of the airplane and loading of the ammunition boxes. There are no fixed walkways.

The ailerons are of fabric covered aluminum alloy structure. They are statically, dynamically and aerodynamically balanced. The ailerons are operated by the conventional stick control. The electrically controlled trim tab on the left-hand aileron is controllable by the pilot. On the right-hand aileron a fixed type trim tab is provided and adjustable on the ground.

The flaps are of the all metal, split trailing edge type extending from the aileron to near the centerline of the aircraft. They are operated hydraulically and through a range of 45° from the lower surface of the wing.

4. Wing Guns:- On aircraft Nos. AK571 to AK590 inclusive, a four (4) gun installation is used. On aircraft Nos. AK591 and subsequent, a six (6) gun installation is used. All guns are of .50 caliber. Ammunition boxes hold 615 rounds per gun (4-gun installation) and 235 rounds per gun (6-gun installation).

5. Fuel Tanks:- The fuel is carried in three tanks. Two tanks are carried in the center of the wing and one in the fuselage aft of the pilot. The total capacity of the three tanks is 123 imperial gallons. All fuel tanks have gun fire protection by internal rubber bags.

6. Oil Tank:-10.7 gallons of oil are carried in a tank in the forward part of the fuselage. The oil tank is protected with an inner covering of Linatex and an outer covering of Steerhide.

7. Oil and Coolant Cooling Systems:- Air passes through the coolant radiators and oil cooler and exhausts through a common exit duct. Temperature control is accomplished by controllable flaps at the exit of the radiator air duct for the coolant system, and an automatic thermostatic or viscosity valve temperature control provided in the oil cooler. The coolant expansion tank is located on the front of the firewall and is protected from gun fire by armour plate.

8. Fuselage:- The fuselage is all metal, semi-monocoque, stressed-skin construction. It is attached to the wings by means of bolts. The engine mount is comprised of welded steel tube and steel forged links. Access and inspection doors are provided throughout the fuselage.

9. Battery:- The 24-volt, 34 A.H. battery is encased and sealed in a molded, rubber-lined, leak-proof case vented by tubing to the atmosphere outside the fuselage. The battery is accessible through the fuselage access door.

10. Undercarriage:- The undercarriage is equipped with oleo-pneumatic shock struts and is hydraulically retracted by rotating backward about a trunnion at the top of each strut. During retraction the strut is rotated 90° about its longitudinal axis by gears, so that the wheel lies flush in the wing. The gear is locked in both the up and down positions by hydraulically operated mechanical locks. The upper half of the strut has members attached to take side and drag loads and is attached to the lower half of the strut through a scissors to take torque. The undercarriage is equipped with 30-inch, eight-ply, smooth contour tires and puncture proof tubes. The wheels are 30-inch with 12 x 3-1/4 inch hydraulic brakes. Towing rings and jack pads are provided on the gear itself.

11. Tail Wheel:- The tail wheel assembly consists of a standard steerable knuckle oleo strut, retracting strut and a 12½-inch wheel with a smooth contour, self-earthing tire. The steering mechanism disengages at approximately 30° deflection from the longitudinal axis and when disengaged will swivel through 360°. The tail wheel is fully retractable into the fuselage with doors so constructed as to close the opening when the wheel is drawn into the fuselage. A visual indicator shows the position of the tail wheel at all times.

12. Tail Unit:- The cantilever tail plane and fin are of all metal construction attached in fixed alignment to the fuselage. The rudder and elevators are aluminum alloy construction, fabric covered. They are dynamically, aerodynamically, and statically balanced. The rudder and elevators are equipped with trim tabs controlled from the cockpit by means of hand wheels located on the port side of the cockpit. The rudder tab is also of the automatic servo type which acts to relieve the pilot of some of the operating load. Rudder and elevators are controlled by the conventional pedals and stick.

13. Additional Equipment:- In addition to the armament (see para. 4) the aeroplane is equipped with a signal discharger, oxygen, map case, wireless, engine and cockpit covers, and parking harness. The lighting system comprises landing light; navigation, identification and formation lights; fluorescent cockpit light and cockpit flood lights. It should be noted that the electrical circuits are not fused in the conventional manner; circuit breakers are employed instead (see Section 1, para. 22).

SECTION I

PILOT'S

CONTROLS AND EQUIPMENT

-*-

FUEL, OIL, HYDRAULIC AND COOLANT DIAGRAMS

-*-

COCKPIT PHOTOGRAPHS

SECTION I

LIST OF CONTENTS

Operational Equipment (Cont'd.)

- * -

Diagrams

- * -

Photographs

SECTION I
PILOT'S
CONTROLS AND EQUIPMENT

Introduction:- This section gives the location and, where necessary, explains the function of the controls and equipment in the pilot's cockpit.

Hood, Seat, Etc.

1. Cockpit Hood:- The sliding hood is operated by a crank mounted on the upper starboard longeron. A pin on the crank engages holes in the drum and locks the cabin in the full back, full forward and intermediate position.

An emergency hood release is fitted and is a lever located in the top forward frame of the cabin roof. In case of an emergency, while in flight, the entire enclosure may be released from the fuselage by pulling on this lever. In the event of a turnover on the ground, pull the kick out panel release lever on the port side of the cabin and push the port cabin panel out.

The cabin may be locked from the outside with a padlock by means of a lever on which an eye is provided. This lever is located on the rear port side of the cabin.

In case of an emergency which necessitates a rapid opening of the cabin hood, the control handle may be bent back to disengage the pin which allows the cabin hood to be pushed back by hand and eliminates winding.

A ventilator for the cockpit is operated by a push pull control located below the electric control panel on the starboard side. When the control is pulled out (twist to lock) hot air is admitted to two vents permitting hot air to enter directly into the cockpit.

2. Seat:- The seat is adjusted vertically by a lever on the starboard side of the seat. The lever is moved upward and to the rear, permitting the seat to be raised manually. Rubber assist cords are attached to the back of the seat to assist the pilot in raising the seat. A release lever controlling the position of the Sutton harness is provided on the port side of the seat. To operate, push button on top of lever and move lever to rear locking position. This permits free movement of the pilot in a fore and aft position. A pilot's relief tube is suspended from the bottom of the seat.

Airplane Controls

3. Control Column:- The control column is of the conventional design and has two switches; a landing gear switch just below the grip and a trigger switch on the grip which operates the firing of the guns.

4. Rudder Pedals:- The rudder pedals are of conventional design. They are adjustable for leg reach by means of the lever on lower inboard side of the pedal support. Pull lever outward to disengage pin so that the pedal may be moved fore and aft.

5. Brakes:- These are operated by the toe pedals and the parking brake pull is located on the port side of the cockpit forward of the throttle quadrant. The brakes may be engaged by pulling back on the parking brake pull when the pedals are depressed. It is automatically disengaged when the pedals are again depressed.

6. Trim Tabs:- The control wheels for the adjustable trim tabs on the rudder and elevators are located on the port side of the cockpit aft of the throttle quadrant and work in the same plane as the controls. concerned. The elevator wheel has a crank handle for rapid adjustment. Dials at the hand wheel indicate the positions of the tabs. The electric trim tab located on the port aileron is controlled by a switch on the electric control panel. The switch must be held "On" for the desired "Up" or "Down" position. A limit switch automatically shuts off the motor when the trim tab has reached the limit of travel.

7. Retractable Undercarriage:- The operation of the landing gear is accomplished by the hydraulic system. To retract the landing gear- slide the safety latch bolt on the control handle forward and raise the handle to the "Up" position. Then operate the hydraulic pump switch below the control column hand grip until retraction is complete. Operate the switch a few seconds after the indicator on the instrument panel shows "Up" or "Down" to insure a positive lock.

To lower the landing gear - place control handle in the "Down" position and operate the hydraulic pump switch, hold a few seconds after the indicator and warning horn indicate that the gear is down at which time the position locks will be engaged. If a further check is desired move the auxiliary hydraulic hand pump lever in a fore and aft motion. If a high load is required to move this lever the operator can be certain that the gear is locked down. The control handle may be left in the "Down" position but it is advisable to return the handle to the neutral position. The safety latch is designed to prevent the accidental raising of the handle beyond the neutral position. An operating instruction plate is located on the port side of the cockpit above the hydraulic control valve.

Emergency Operation - If the electrical system should fail the landing gear can be raised or lowered by operating the auxiliary hand pump located on the starboard (outboard) side of the cockpit. If this does not function owing to complete failure of the main hydraulic system then as a last resort, the landing gear may be lowered by using the emergency hand pump located on the starboard (inboard) side of the cockpit. Open both right and left hand valves on the floor of the cockpit and transfer hand pump from outboard pump to inboard pump by means of the release lever at base of handle. The emergency system will lower the landing gear with the control lever in any position.

Warning - Tail wheel will not lower with emergency system. Land tail high.

An indicator on the instrument board (see para. 9) indicates the position of the landing gear whenever the battery switch is turned "On". A warning klaxon which operates when the throttle is closed with the wheels retracted, is only connected to the locks and consequently will sound when the wheels are down if the locks are not engaged.

This klaxon circuit is controlled through a toggle switch which is mounted just ahead of the throttle quadrant and is actuated by a cam mounted on the throttle rod. This cam may be pulled out to turn the klaxon off temporarily during a throttled dive with the wheels retracted. It engages automatically when the throttle is opened to the stop.

A red blinker light on the instrument board shows red if the landing gear is down and not locked.

Warning - Never operate pump with selector lever in "Up" position when airplane is resting on its wheels.

8. Wing Flaps:- The wing flaps are operated hydraulically by either the hand pump or an electrically operated pump. The selector lever is located on the port side of the cockpit beside the pilot's seat and moves fore and aft; forward for "Down", aft for "Up" and neutral for "Off". When the lever has been placed in the desired position, the switch mounted on the control column below the hand grip is held "On" until the position indicator shows the desired position. The flaps may be operated manually by the hand operated hydraulic pump. A back and forth motion is used to raise or lower the flaps after the "Up" or "Down" position has been selected with the flap lever. The flaps are operated manually in order that partial setting may be obtained more easily. With air loads on the flaps they will close automatically as soon as the selector is moved to the "Up" position. (See Section II)

Note: Instruction Plate is located above the hydraulic control valve on longeron.

9. Undercarriage and Flap Position Indicator:- The position indicator is located on the lower port side of the instrument board. The wheel and flap images simulate the actual position of the landing wheels, tail wheel and flaps. The images disappear from view when the electrical power is "Off" thereby indicating failure of the instrument or open battery, or generator circuit. The battery switch must be "On" to maintain operation of the indicator. The battery switch should be "Off" before leaving the airplane.

Engine Controls

10. Throttle Quadrant:- The throttle, mixture, and propeller controls are on the throttle quadrant located on the fore port side of the cockpit. The throttle moves forward for "Open" and aft for "Closed". A spring stop is provided to restrict the pilot from exceeding normal operation limits. The mixture control in forward position locates the "Idle cut-off" in the aft position "Full rich". Approximately the last 10° movement of the "lean" mixture is the engine "idle cut-off" position. There is a spring stop included to prevent mixture control from entering the "Idle cut-off" position when normal pressure is applied. The propeller control moves forward for "Increase R.P.M." and aft for "Decrease R.P.M.".

11. Airscrew Operation:- Airscrew controls consist of a Master Safety Switch which is kept in the "On" or "Up" position, and a Position Selector Switch, together with a hand operated governor control fitted to the throttle quadrant.

When on "Automatic Control", that is, the Selector Switch (the right-hand switch) in the "Up" or "Automatic" position, a selected engine speed is held constant by an engine driven governor and R.P.M. alteration is secured by adjustment of the control on the throttle quadrant.

If "Manual Selection" control is required, the Selector Switch should be depressed to the "Hand Control" position, and this will enable the pilot to control the R.P.M. by the depression of the switch to either the "Increase R.P.M." or "Decrease R.P.M." position, but no control will be available through the lever on the throttle quadrant.

These latter circuits are independent of the governor so that if the governor fails, the propeller can be used as a controllable propeller, by use of the Manual Selector Switch.

General Operation - Automatic Control:- Set Master Safety Switch to "On" position (up). Set Selector Switch to "Automatic" position (up). Control is then obtained through throttle quadrant C.P. lever.

(If switches throw out, reset by turning to the "Off" position, and then to "On". Successive throwing out will probably indicate short circuit or over-load, and switches should be left in "Off" position as much as possible, and pitch changed only if absolutely necessary.)

Manual Selection:- Depress Selector Switch (right-hand switch) from the "Automatic Control" position to "Hand Control". This cuts out throttle quadrant lever and changing R.P.M. must be made by operating this switch to "Increase" or "Decrease".

12. Fuel Cock:- is located on the port side of the cockpit below the throttle quadrant and is marked to show the tanks and capacities.

13. Fuel Quantity Gauges:- The gauge for the fuselage tank is located on the port side of the instrument board. The gauges for the front and rear wing tanks are located on the cockpit floor.

14. Carburetor Air Heat Control:- is a push pull control located on the starboard forward side of the cockpit. The carburetor air intake is a scoop built into the top of the engine cowl. A butterfly valve controlled from the cockpit is located immediately above the carburetor air screen and permits either cold or warm air or a mixture of both to enter. Warm air for the carburetor is taken from inside the engine compartment. The carburetor air screen is installed to prevent the passage of any foreign matter into the carburetor. The carburetor air control should always be in the cold position when starting the engine.

15. Engine Primer:- is located on a bracket below the electric control panel.

16. Starter:- A foot operated electric inertia starter is provided and installed on the cockpit floor. The foot treadle operates a starter switch and is marked for the "Energize" and "Engage" positions. When the treadle is pushed back, the starter switch allows a direct flow of current from the battery to the starter motor. When the starter has reached the desired speed, the foot treadle is pushed forward actuating a starter meshing solenoid and a booster coil, also by the same movement of the foot treadle the starter switch contact is broken. The first few impulses of the engine in starting will automatically disengage the starter.

In case of battery failure, the starter may be cranked by hand with the crank and extension provided for this purpose, both being located in the rear access compartment. The starter is operated by turning the crank handle which is inserted in the spiral slot provided in the end of the crank extension, on starboard side of engine. Turn the crank with gradual increasing speed until a fairly good rate of speed is obtained. Remove the crank handle and extension. The engagement of the starter will then be accomplished by a pull on the hand starter control adjacent to the crank.

Caution: Starter crank and extension must be removed immediately after cranking and before starter pull.

17. Oil Dilution Control:- (See Section 2 for operating instructions.)

18. Hand Fuel Pump Control:- is located on the port side of the cockpit forward of the throttle quadrant. The hand fuel pump will be replaced with an auxiliary electric fuel pump on later aircraft (AK722).

19. Auxiliary Electric Fuel Pump Control:- is a switch located on the electric control panel.

20. Radiator Flap Control:- is located on the starboard side of the cockpit near the floor. It consists of a long lever and a rack. The latter is provided with a stop at each end and may be set for "Full Open" (handle fully down), "Full Closed" (handle fully up) or any intermediate position.

Note: Filling points for:
Wing fuel tanks through port wing fillet.
Fuselage fuel tank through port side of fuselage at the slanting bulkhead.
Oil tank through inspection door, top port side of fuselage cowl.
Coolant tank through inspection door, top rear of engine cowl.
Windscreen defroster tank; remove port side engine cowl.
Hydraulic auxiliary tank; remove starboard side of engine cowl.

Operational Equipment

21. Gun Firing Switch and Charging Handles:- The guns are charged hydraulically by means of three valves (2 valves for four (4) gun installation) located below the main switch box in front of the pilot. To charge guns, turn handle clockwise 140°; then push. To safety or lock the guns, match the point of the handle with red marks and then push. The two inboard guns in the left panel are changed by the upper left-hand valve, the two inboard guns in the right panel are charged by the right-hand valve, and the two outboard guns are charged by the lower left-hand valve. A wrench for the removal of the guns is located in a case on the gun access door of the port panel just below the guns.

NOTE: The landing gear and flap controls should be in neutral when operating the gun charging valves.

22. Switches and Rheostats:- are located on the electric control panel below the instrument board. Care must be taken to insure that all rheostats are in the extreme "Off" position when not in use, as they are equipped with integral switches. All switches are clearly marked "On" and "Off". Circuit breakers are located on the starboard side of the electric control panel. The circuit breaker switches should be set to the "On" (up) position at all times. If the switch throws out it may be reset to "On"; successive throwing out will probably be an indication of short circuit or overload and the switch should be left "Off".

23. Landing Lamp:- A landing light is fitted to the underside of the port wing and operated by a switch on the electric control panel.

24. Navigation Lights:- are installed in the upper and lower surfaces of each wing tip and both sides of the vertical stabilizer.

25. Identification Lights:- A streamline light is installed on the top side of the fuselage aft of the cabin. The downward light is located in the lower surface of the starboard wing fillet. A control switch and signalling key are mounted on the starboard side of the cockpit.

26. Formation Lights:- are located in each side of the fuselage forward of the cockpit and are used for lighting the upper surface of the wing. The color of the lens is blue. A rheostat controls the formation lights.

27. Fluorescent Light assembly is mounted on a semi-flexible extension located beneath the electric control panel. This method of mounting permits adjustment of the lamp for illumination of any portion of the instrument panel. This lamp assembly is designed to permit either fluorescent light for instrument illumination or white light for general illumination. The knurled knob on the end of the lamp assembly controls the type of light emitted. The lamp is controlled by a switch on the electric control panel.

28. Cockpit Floodlights are located one on each side of the cockpit. The floodlight on the starboard side of the cockpit has a hole in the casing to direct light upon the oxygen regulator.

29. Undercarriage Warning Light has interchangeable heads for either day or night operation.

30. Signal Discharger - A bracket for mounting the damped rate control is provided on the starboard side of the cockpit. This control actuates the signal discharger mounted on brackets near the top of the rear fuselage, accessible through fuselage access door.

31. Oxygen - Two oxygen bottles are carried in supports in the aft part of the fuselage and are accessible through the fuselage access door. The oxygen regulator and bayonet outlet are located on the starboard side of the cockpit.

32. Map Case - is fastened to the starboard side of the cockpit.

33. Wireless - Provisions have been made for the various units as follows:

Power Unit - Aft part of fuselage
Transmitter and Receiver - Aft part of fuselage
R.3003 - Forward of fuselage access door
Electric Controller - Port side of cockpit
Microphone - Starboard side of cockpit
Control Unit - Starboard side of cockpit
Remote Contactor - Starboard side of cockpit

Provision is made for the installation of R.3003 (see also para. 34) and either T.R. 9D or T.R. 1133A.

34. Special Switch - Push buttons, for operating the Graviner type switch associated with the R.3003 radio, are located on the lower starboard side of the cockpit.

35. Camera Gun - On aircraft AK671 and subsequent aircraft provision is made for installing a G.45 camera gun underneath the starboard main panel in a streamline fairing. The camera control switch is located on the electric control panel. The footage and exposure indicator is mounted on a wedge plate on the port side of cockpit below the trim tab controls.

36. Windscreen Defroster Pump is installed in the cockpit below the electric control panel. A priming motion charges a Glycol spray upon the windshield.

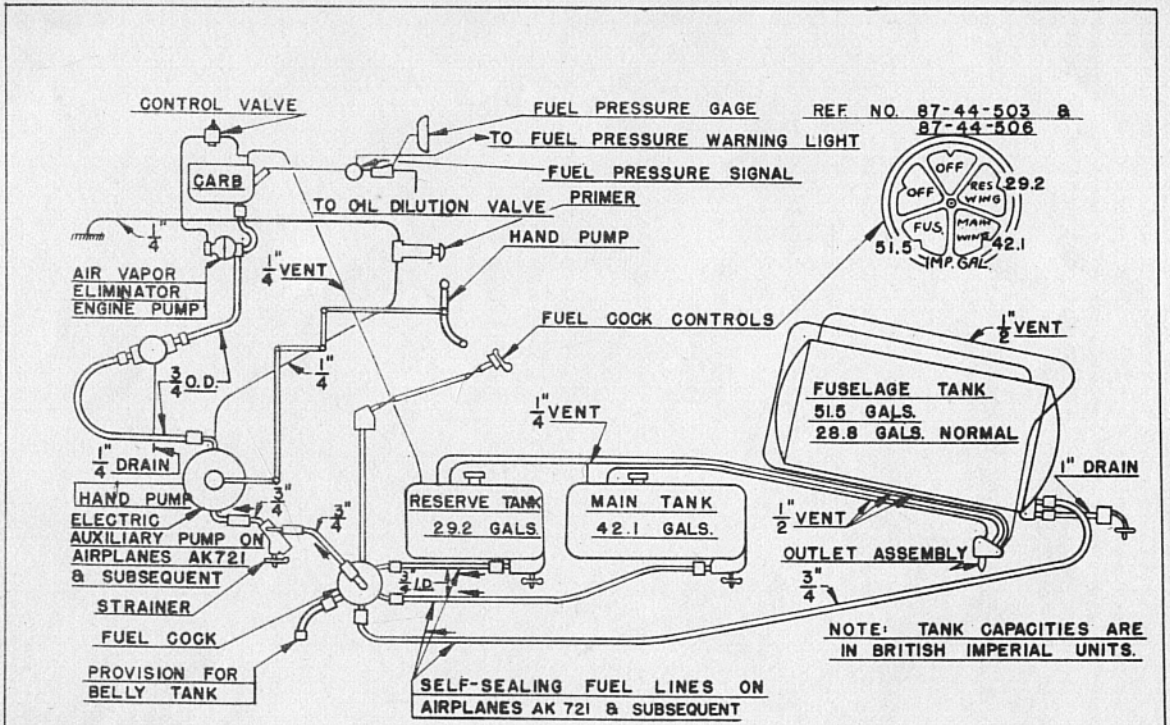
37. Gun Heating - The gun compartments are heated by directing hot air from the exit air duct aft of the coolant radiators and oil cooler.

38. Rear View Mirror is an adjustable mirror located externally at the top center of the windscreen.

39. Picketting Rings are located inboard of the wing tips on the underside of the wing and marked "Tie Down".

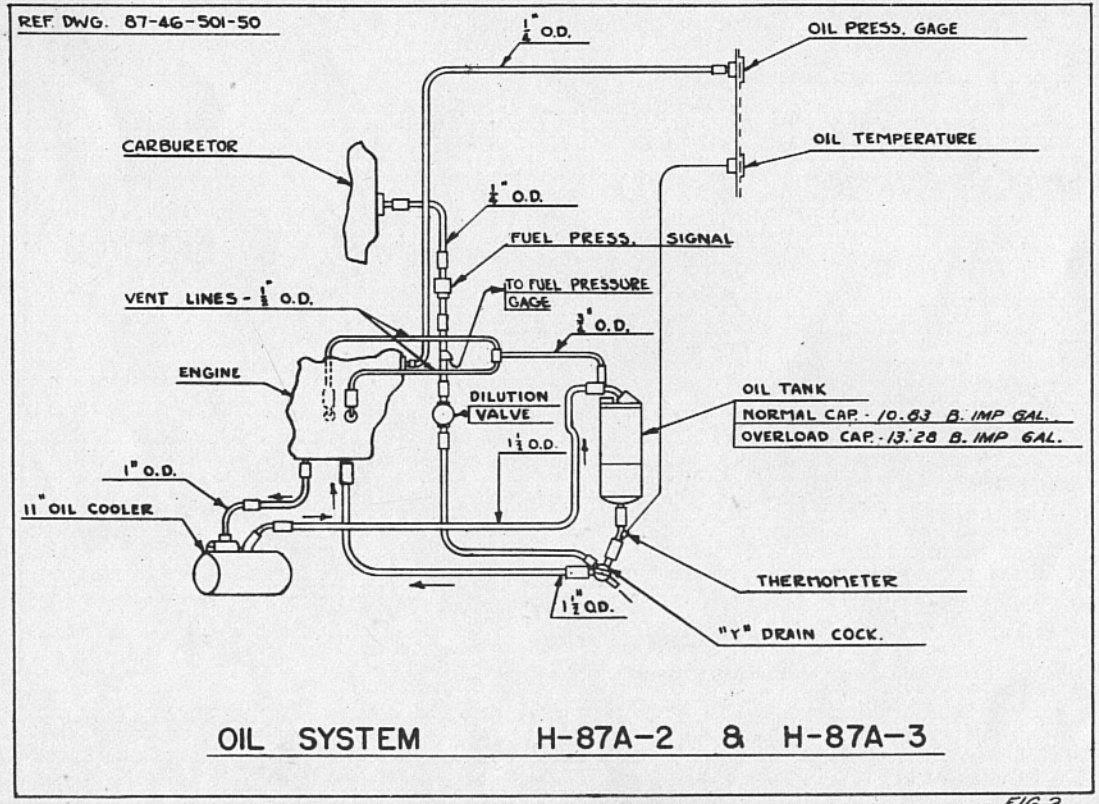
40. Desert Equipment - A specially designed removable bag for desert equipment is provided. Desert equipment can be completely removed so the bag may be used to carry other equipment. A section is attached to the bag for the stowage of necessary tools and other small articles.

41. First Aid Kit - is located on the fuselage access door.



FUEL SYSTEM H-87A-2 & H-87A-3

FIG. 1



OIL SYSTEM H-87A-2 & H-87A-3

FIG. 2

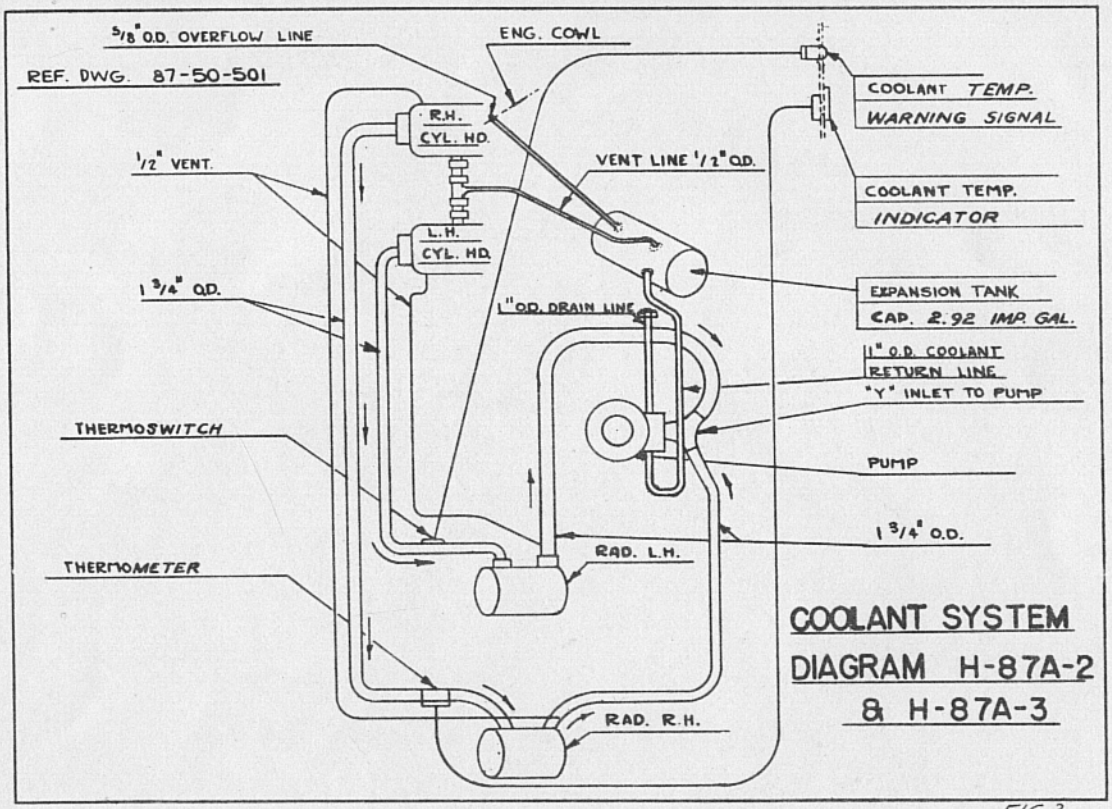

5/8" O.D. OVERFLOW LINE
REF. DWG. 87-50-501
ENG. COWL
R.H. CYL. HD.
1/2" VENT.
VENT LINE 1/2" O.D.
L.H. CYL. HD.
1 3/4" O.D.
1" O.D. DRAIN LINE
THERMOSWITCH
THERMOMETER
RAD. L.H.
RAD. R.H.
COOLANT TEMP. WARNING SIGNAL
COOLANT TEMP. INDICATOR
EXPANSION TANK CAP. 2.92 IMP. GAL.
1" O.D. COOLANT RETURN LINE "Y" INLET TO PUMP
PUMP
1 3/4" O.D.
COOLANT SYSTEM DIAGRAM H-87A-2 & H-87A-3

FIG. 3

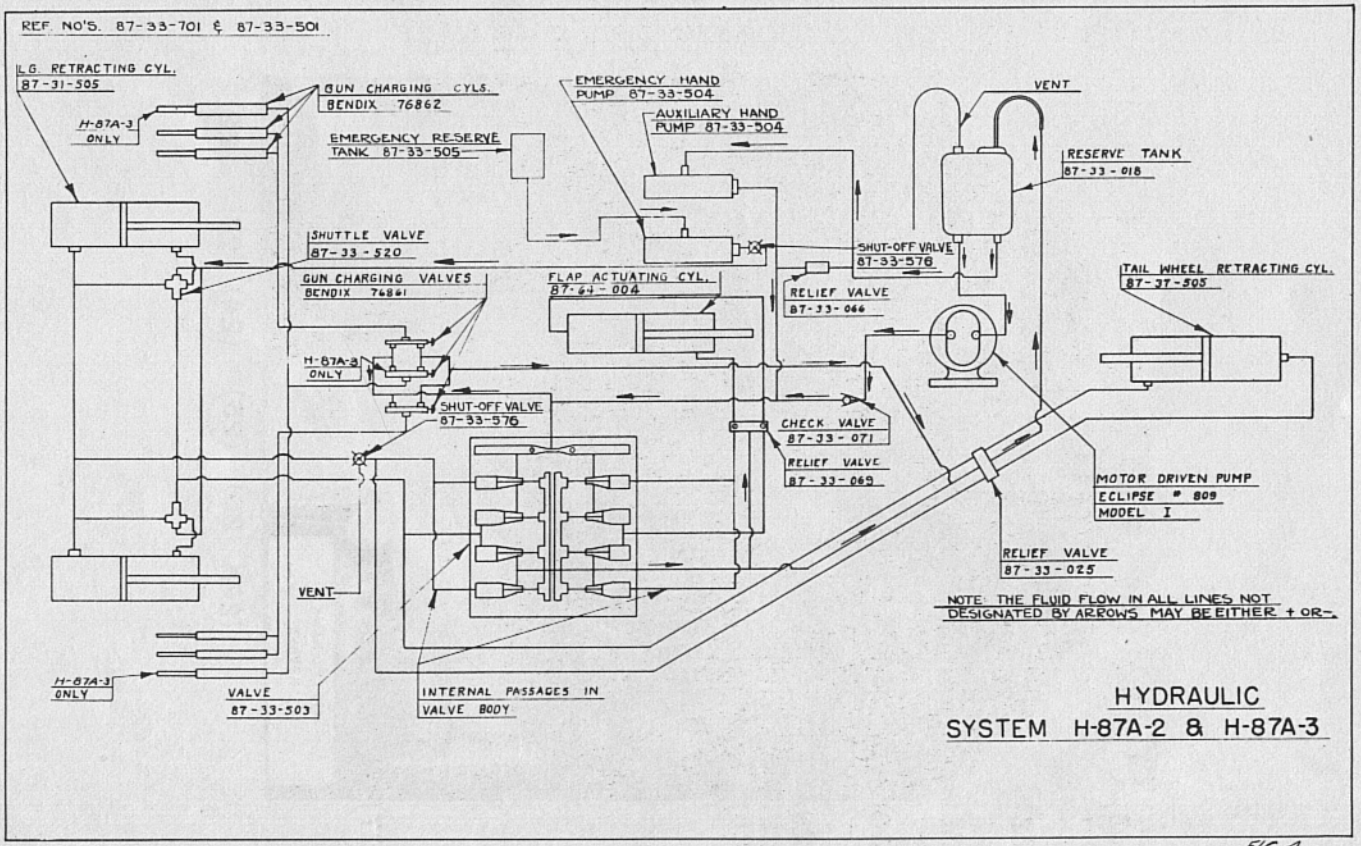
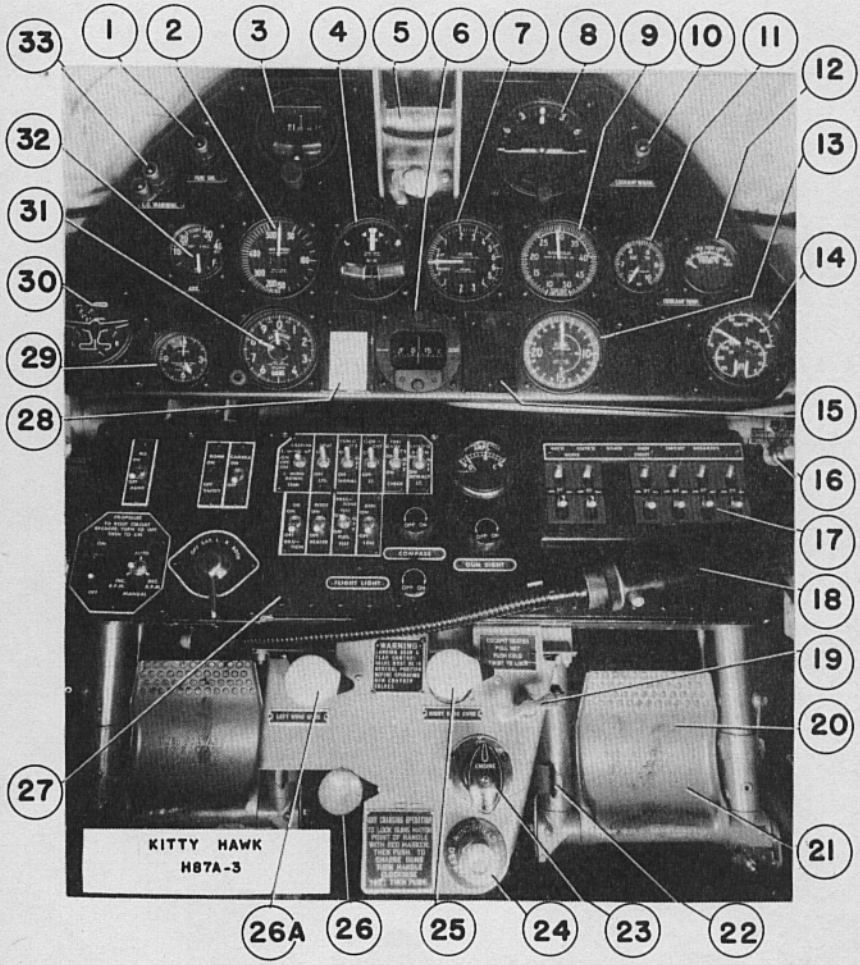

REF. NO'S. 87-33-701 & 87-33-501
L.G. RETRACTING CYL. 87-31-505
GUN CHARGING CYLS. BENDIX 76862
H-87A-3 ONLY
EMERGENCY RESERVE TANK 87-33-505
EMERGENCY HAND PUMP 87-33-504
AUXILIARY HAND PUMP 87-33-504
VENT
RESERVE TANK 87-33-018
SHUTTLE VALVE 87-33-520
SHUT-OFF VALVE 87-33-576
GUN CHARGING VALVES BENDIX 76861
FLAP ACTUATING CYL. 87-44-004
RELIEF VALVE 87-33-066
TAIL WHEEL RETRACTING CYL. 87-37-505
H-87A-3 ONLY
SHUT-OFF VALVE 87-33-576
CHECK VALVE 87-33-071
RELIEF VALVE 87-33-069
MOTOR DRIVEN PUMP ECLIPSE # 809 MODEL I
RELIEF VALVE 87-33-025
VENT
NOTE: THE FLUID FLOW IN ALL LINES NOT DESIGNATED BY ARROWS MAY BE EITHER + OR -
H-87A-3 ONLY
VALVE 87-33-503
INTERNAL PASSAGES IN VALVE BODY
HYDRAULIC SYSTEM H-87A-2 & H-87A-3

FIG. 4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22
23
24
25
26
26A
27
28
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33
KITTY HAWK
H87A-3

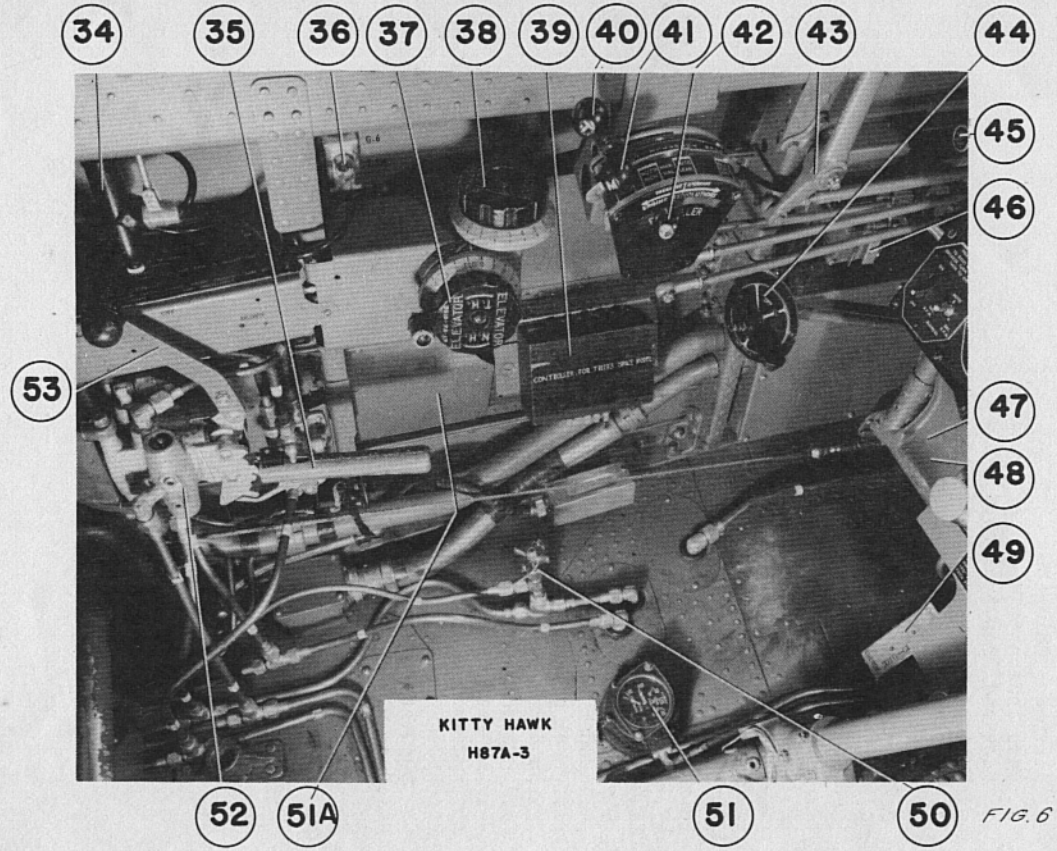
FIG. 5

Index to Items on Instrument Board

1. Fuel signal warning light.
2. Airspeed indicator.
3. Turn indicator.
4. Bank and Trun indicator.
5. Optical gun sight mount.
6. Compass.
7. Climb indicator.
8. Flight indicator.
9. Manifold pressure gage.
10. Coolant warning light.
11. Suction gage.
12. Coolant temperature gage.
13. Tachometer.
14. Engine gage unit.
15. Altimeter correction card holder.
16. Carburetor air control.
17. Cicruit breakers.
18. Fluorescent light.
19. Cockpit heater control.
20. Rudder pedals.
21. Wheel brakes tredle.
22. Rudder pedal adjustment lever.
23. Engine primer.
24. Windshield defroster pump.
25. Hydraulic gun charging valve for starboard wing guns.
26. Hydraulic gun charging valve for starboard and port outboard guns.

26a. Hydraulic gun charging valve for port wing guns.

27. Electric control panel.
28. Compass correction card holder.
29. Clock.
30. Landing gear and flap position indicator.
31. Altimeter.
32. Fuselage fuel tank gage.
33. Landing gear warning light with interchangeable day and night lens.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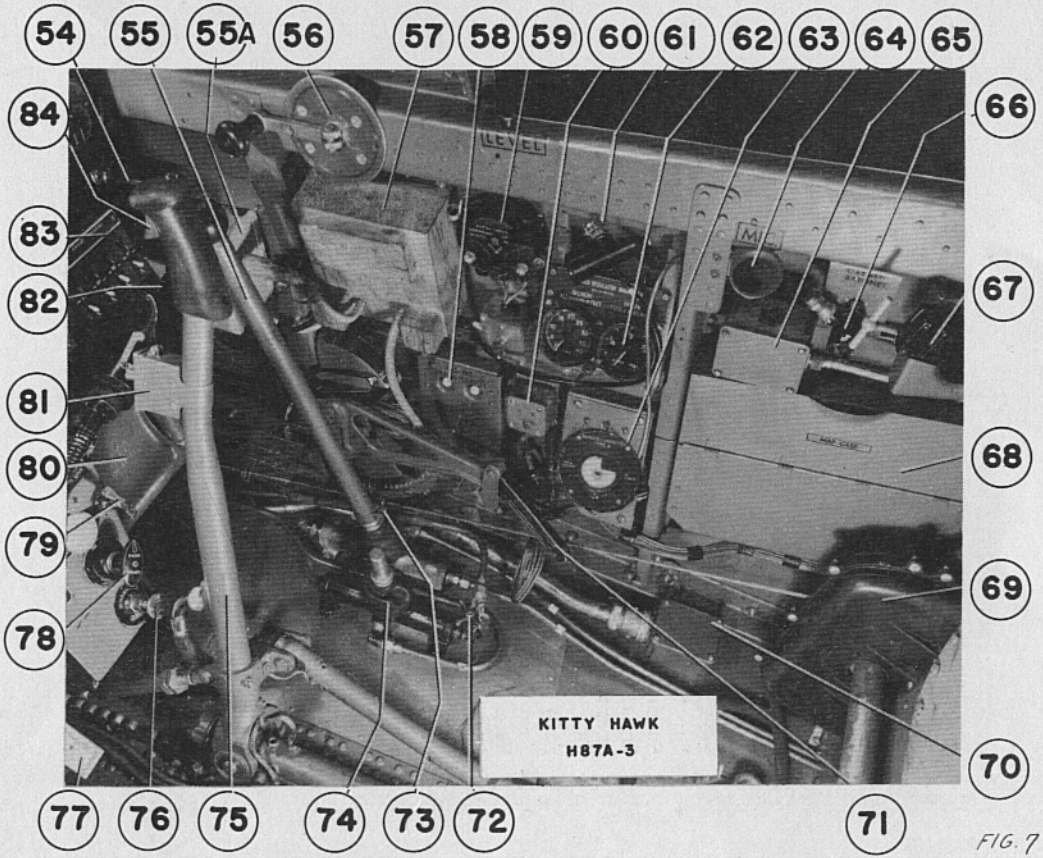
KITTY HAWK
H87A-3

FIG. 6

Index to Items on Port Side of Cockpit

34. Cockpit spot light.
35. Landing gear control valve lever.
36. Spare cockpit lamps.
37. Elevator trim tab control.
38. Rudder trim tab control.
39. Radio controller for TR133 radio set.
40. Throttle control.
41. Mixture control.
42. Propeller control.
43. Hand fuel pump.
44. Fuel tank selector valve.
45. Parking brake lever-pull.
46. Throttle switch for landing gear warning horn.
47. Rudder pedal.
48. Wheel brakes treadle.
49. Starter switch.
50. Control valve for emergency landing gear system.
51. Wing tank fuel gage.
51.a Footage and exposure indicator.
52. Hydraulic control valve.
53. Flap control lever.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KITTY HAWK
H87A-3

FIG. 7

Index to Items on Starboard Side of Cockpit

54. Carburetor air heat control.
55. Auxiliary hydraulic hand pump.
55.a Inverter for fluorescent light.
56. Cabin control.
57. Control unit for R-3003 radio set.
58. Fire crash switch for R-3003 radio set.
59. Key switch - Identification lights.
60. Stowage plug for R-3003 radio set.
61. Cockpit floodlight (modified type).
62. Oxygen regulator.
63. Remote contactor for TR1133A radio set.
64. Funnel for Tel-mic disconnect plug.
65. Junction box for Tel-mic.
66. Oxygen low pressure bayonet outlet.
67. Damped rate control for recognition device.
68. Map Case.
69. Guard for elev. control horns on jackshaft.
70. Panel disconnect plug. R.H. panel.
71. Radiator flap control.
72. Control valve for emergency landing gear system.
73. Release for removal of the hyd. hand pump handle.
74. Emergency hydraulic hand pump.
75. Control column.
76. Windshield defroster pump.
77. Starter switch.
78. Engine primer pump.
79. Cockpit heater control.
80. Rudder pedal.
81. Landing gear electric switch.
82. Fluorescent light - Instrument panel.
83. Circuit breakers.
84. Gun trigger switch.

SECTION 2

HANDLING AND FLYING NOTES FOR PILOT

LIST OF CONTENTS

SECTION 2

HANDLING AND FLYING NOTES FOR PILOT

INTRODUCTORY NOTES

1. Full details of the equipment of the aircraft are given in Section 1. The pilot should be acquainted with these before flying the aircraft.

FITNESS OF AIRCRAFT FOR FLIGHT

2. Ensure that the total weight and disposition of the load are in accordance with the Loading and C.G. diagram (A.P.2014 A, Vol. I, Section 4). C. G. position should be determined by the data provided, and the loading so adjusted as to bring the C. G. within the range notified in the loading and C. G. diagram.

> WARNING:- The attention of pilots is drawn to the fact that when the fuselage tank is full, the C. G. of the aircraft is liable to be at its maximum position. With the C. G. fully aft, the aircraft will be unstable during climb and level flight and the stick loads on turns will tend to be light, or in extreme cases, negative, and great care must be taken to avoid subjecting the aircraft to high acceleration loads during a turn.
>
> As the fuel from this tank becomes exhausted, however, the C. G. moves forward and stability becomes normal. If the fuselage tank is filled, this tank must be used first.

PRELIMINARIES

3. On entering the cockpit, make the following preparations and check that:

(i) Undercarriage and flap levers are in NEUTRAL.

(ii) Brakes are ON.

(iii) Controls are FREE.

Then

(iv) Switch ON main battery switch, taking care not to switch on magnetos.

(v) Switch ON the four circuit breaker switches.

(vi) Switch ON propeller control safety switch and propeller selector switch to "AUTOMATIC".

(vii) Switch ON generator.

(viii) Check fuel contents and turn fuel to desired tank. If fuselage tank has been filled this tank MUST be used first.

STARTING ENGINE AND WARMING UP

4. (i) If engine has been standing, turn over by hand.

(ii) Close Radiator shutters.

(iii) Propeller control to FINE PITCH.

(iv) Mixture control to IDLE CUT-OFF.

(v) Build up fuel pressure with wobble pump to approximately 5-lbs.

(vi) Dope as required. DO NOT OVER DOPE. Screw doper home.

(vii) Mixture control to RICH; throttle OPEN to give 800 r.p.m.

(viii) Switch ON both magnetos.

(ix) Energize starter and engage.

(x) When engine fires, and not before, mixture control to AUTO RICH.

(xi) As soon as engine runs evenly, open up to 1000 r.p.m.

TESTING ENGINE AND INSTALLATION

5. (i) Warm up at approximately 1000 r.p.m.

(ii) Minimum oil temperature before running up, over 40°C. - Maximum 85°C.

(iii) Oil pressure 60-80 lbs.

(iv) Radiator temperature, Minimum 80°C. – Maximum 125°C. Open radiator as necessary.

(v) Whilst warming up, check flap operation.

(vi) Check functioning of engine and magnetos at 2200 r.p.m. (with propeller switch in "MANUAL") and 27" Hg. boost. Do not exceed 2600 r.p.m. on the ground, normal drop in r.p.m. approximately 50 r.p.m.

(vii) Check functioning of pitch control by moving control back until a drop in revs is shown; then move forward to FULLY FINE.

TAXYING

6. Brakes are released by depressing the brake pedals. The tail wheel is steerable through a limited arc of its travel, but once this arc is exceeded the rudder pedals no longer control it, and the tail is free to castor through the remainder of its travel.

In certain conditions, therefore, particularly when taxying with full load and with C. G. in the aft position, it is possible to cause the tail wheel to travel through its steerable arc into the non-steerable condition, and, as a result, difficulty may be encountered in controlling the aircraft at slow speeds. Care must always be exercised in this connection, and should a swing develop it is advisable to stop the aircraft immediately by application of both brakes rather than to try to control the swing by the application of opposite brake and rudder.

The forward view when taxying is poor, and the aircraft must be swung from side to side in order to see ahead. Always clear the engine against the brakes before taking off.

ACTIONS PRIOR TO TAKE-OFF

7. Prior to the actual take-off, check the following points by means of some suitable reminder such as T – M – P – FLAPS – RADIATOR.

(i) T – Trim tabs should be NEUTRAL.

(ii) M – Mixture AUTO RICH (See para. 9).

(iii) P - Pitch control forward to FULLY FINE. Check that airscrew master switch is ON and that MANUAL SELECTION SWITCH is UP - i. e. in AUTOMATIC.

(iv) FLAPS - Flaps should be used for take-off and should be depressed approximately 1/4 of their travel. In order to get accurate positioning for the flaps, select DOWN on flap lever, then pump flaps DOWN by means of hand pump until desired position is maintained, THEN RETURN FLAP LEVER TO NEUTRAL. (If this is not done, flaps will be depressed when undercarriage is raised.)

(v) RADIATOR - OPEN as required.

TAKE-OFF

8. At normal loadings the take-off is straight forward, but when fully loaded with C. G. in the aft position, the aircraft will tend to swing to the left as the engine is opened out, and brake and rudder should be used to counteract this, as necessary. Care must be taken not to exceed permissible manifold pressure or engine revolutions. (See para. 28.)

ACTIONS AFTER TAKE-OFF

9. (i) Once clear of the ground, raise undercarriage. (Hold switch until undercarriage is fully up and check by operating hand pump.)

(ii) Whilst undercarriage is coming up, reduce r.p.m. to the required revolutions.

(iii) Whilst undercarriage is coming up, reduce boost to the required climbing boost.

(iv) Climb at 150 I.A.S.

(v) When undercarriage is fully up, and not below 500', raise flaps.

NOTE:- The raising of the undercarriage tends to make the aircraft tail heavy, but the raising of the flaps has no noticeable effect on trim.

(vi) Re-trim if necessary.

(vii) If take-off was made in FULL RICH, mixture to AUTOMATIC RICH. (Unless this is done petrol consumption will be excessive.)

(viii) If fuselage is full, always set fuel cock to drain that tank first. (See para. 2, Section 2.)

ENGINE FAILURE DURING TAKE-OFF

10. If the engine should fail during take-off, put the nose of the aircraft down and maintain flying speed. Ensure that the undercarriage has commenced to come up, and continue to hold the operating switch. Select the DOWN position for flaps. Switch off magnetos, but NOT battery unless the undercarriage is fully retracted and flaps are fully down. Land straight ahead.

CLIMBING

11. The best climbing speed of the aircraft for normal loads is 150 I.A.S.

For engine limitations, see para. 28.

Right rudder is needed during climb, and the aircraft should be trimmed accordingly. When C. G. is in the fully aft position, the aircraft will be unstable in the climb.

CRUISING

12. Engine limitations in level flight are given in paragraph 28, and attention is drawn to paragraph 31.

GENERAL FLYING

13. The general flying characteristics of this aircraft are satisfactory, but it is noisy with the hood open. The lateral control is particularly good. Fore and aft control tends to become unduly light when the aircraft is loaded to the aft C. G. position, and care must be exercised to avoid straining the aircraft by subjecting it to high acceleration loads on turns. This instability will remain so long as there is over 20 gallons in the fuselage tank, but exhaustion of fuel from this tank tends to improve stability, and when filled it must always be used first.

It will be found that the aircraft tends to yaw as speed and horsepower output vary, but this yaw is easily controllable through the Servo rudder tab, and only small movements of the rudder tab adjustment wheel are needed to remove all load from the rudder pedals, even in a dive.

NOTE:

(i) Flaps must not be lowered in excess of 140 I.A.S.

(ii) Undercarriage must not be lowered in excess of 175 I.A.S.

(iii) The lowering of the undercarriage tends to make the aircraft nose heavy, and raising the undercarriage makes it tail heavy.

(iv) The shutting of the radiator tends to make the aircraft nose heavy, and should not be operated at high speeds.

(v) The tab controls tend to become stiff at high altitudes.

WARNING: On aircraft No. AK571 to aircraft No. AK771 the emergency hood operation will not operate over 200 I.A.S. and these aircraft will carry a warning notice to this effect.

INSTRUMENT FLYING

14. On account of the aforementioned instability and the tendency for the aircraft to yaw as speed is altered, care must be exercised when flying on instruments.

STALLING

15. The stalling characteristics of the aircraft are satisfactory. At minimum speeds the stall is gentle and the subsequent dropping of the wing shows no tendency to result in an incipient spin.

Stalling speeds are as follows:

Undercarriage up and flaps up - 92 I.A.S.
Undercarriage down, flaps up - 94 I.A.S.
Undercarriage up, flaps down - 80 I.A.S.
Undercarriage down, flaps down - 82 I.A.S.

NOTE:- The above stalling speeds are subject to plus or minus 2 m.p.h., depending on load.

SPINNING

16. Intentional spinning is prohibited. If a spin develops, normal methods of recovery must be applied at once, and at normal loadings and C. G. positions these will be effective within two turns. The spin itself is extremely violent.

GLIDING

17. Owing to good lateral control, gliding and gliding turns may be carried out at comparatively low speeds, although a high rate of sink will be apparent below 100 m.p.h. The glide itself is very flat, and even with flaps and undercarriage down, the view forward is poor.

(i) Best gliding speeds -
Undercarriage and flaps up - 115-125 I.A.S.

(ii) Best gliding speeds -
Undercarriage and flaps down - 110-115 I.A.S.

(iii) Engine assisted glide
Undercarriage and flaps down - 95-105 I.A.S.

NOTE:- An engine assisted glide or approach is not recommended owing to the poor forward view.

SIDE SLIPPING

18. The aircraft can be skidded satisfactorily, and side-slip turns can be done without undue gain of forward speed. (See para. 21)

DIVING

19. The maximum permissible diving speed is 460 I.A.S.
The maximum permissible diving revs are 3120

As speed increases, the aircraft tends to yaw to the right and it is necessary to overcome this by the application of rudder bias. The lateral trim also tends to change during the dive, depending on the position of the aileron tab.

With the C. G. in the aft position, there is no appreciable change in fore and aft trim as speed increases, and stick loads during the first part of the recovery are very heavy. Tab may be used to help overcome this, but if this is done the greatest care must be exercised to avoid pulling out too quickly during the final recovery and thereby exerting undue strain on the aircraft.

Before commencing a dive -

(i) Propeller into COARSE pitch.

(ii) Throttle to be set approximately 1/4 OPEN.

AEROBATICS

20. The lightness of the lateral control and the powerful elevator controls make the aerobatic qualities of this aircraft exceptionally good, and all normal aerobatics may be carries out with the following exceptions:

(i) Spinning.

(ii) Inverted spinning or inverted loops.

(iii) Flick rolling.

Care must be taken to see that ample height is left for recovery from any maneuver, for the acceleration during a dive is very rapid and the initial pull-out inclined to be heavy at high speeds.

APPROACH AND LANDING (GENERAL)

21. Approach and landing of this aircraft are normal, but the view during the final glide in is inclined to be poor owing to the flat angle of glide, even with flaps down. For this reason, particular care must be exercised when approaching strange Aerodromes or emergency fields, and when experience has been gained on the aircraft, side-slip turns are recommended if the approach is to be made over obstacles. Landings must always be made with flaps down.

PRELIMINARY APPROACH

22. Reduce speed during the initial circuit to approximately 140 I.A.S. and open the hood, then -

(i) Ensure mixture control is back to AUTO RICH.

(ii) Close radiator as necessary.

(iii) Lower undercarriage.

(iv) Put propeller in FINE pitch and check switches on propeller switch panel.

(v) When in suitable position lower flaps.

(vi) Check flaps and undercarriage position on the indicator. and check by operating hydraulic hand pump.

NOTE:- Flaps must not be lowered at over 140 I.A.S. and undercarriage must not be lowered at over 175 I.A.S.

FINAL APPROACH

23. It is recommended that an engine off approach be done whenever possible, as with the engine on, the glide is very flat and the view of the landing area is obscured by the nose. The following approach speeds are recommended:

Engine "Off"	-	110 I.A.S.
Engine "On"	-	95-105 I.A.S.

Once the boundary of the Aerodrome has been crossed, the "engine off" speed may be reduced to 100 I.A.S.

LANDING

24. The aircraft has a high angle of attack when on the ground, and as the tail comes down the whole of the area ahead is obscured by the nose.

WARNING:- At full load and with C. G. in the aft position, this aircraft tends to swing to the right as soon as the wheels touch the ground, and care must be taken to keep the machine straight both then, and during the ensuing landing run. This swinging tendency is accentuated, if, during a landing with full load the machine is flattened out too high, as it is liable to drop a wing, often the left, and then swing sharply to the right. Attention is drawn to Para. 6, Section 2.

At the conclusion of the landing run -

(i) Raise the flaps.

(ii) Open the radiator, as necessary.

When landing at night, the angle of approach makes it hard to see the landing area, and care must be exercised in order to land straight down the flare path. For the same reason, it is also recommended that the minimum of engine be used when approaching at night.

FORCED LANDINGS

25. In the event of a forced landing, the pilot must decide whether or not it is advisable to lower the undercarriage or whether the landing should be made with undercarriage retracted.

(i) If in doubt, land with undercarriage UP.

(ii) Turn off petrol - switch off engine only.

(iii) Lower flaps.

(iv) Switch off battery.

(v) Land with as high an angle of attack as possible.

(vi) In the event of a forced landing on water, undercarriage must be up - safety harness must be done up, parachute harness should be released, and hood must be open.

FLYING IN RAIN OR BAD VISIBILITY

26. Flying in rain or bad visibility should be done at approximately 120-130 I.A.S., and the following should be observed:

(i) Hood OPEN.

(ii) Flaps 1/4 DOWN.

(iii) Airscrew to give 2600 r.p.m.

(iv) Check radiator temperature.

POSITION ERROR TABLE

27. The corrections for position error are as follows:

At	60 mph I.A.S. reading subtract	3.5 mph
	80 mph I.A.S. reading subtract	2.0 mph
	100 mph I.A.S. reading subtract	.5 mph

120 mph I.A.S. reading add	1.0 mph
140 mph I.A.S. reading add	3.5 mph
160 mph I.A.S. reading add	5.0 mph
180 mph I.A.S. reading add	6.0 mph
200 mph I.A.S. reading add	8.0 mph
220 mph I.A.S. reading add	8.5 mph
240 mph I.A.S. reading add	9.0 mph
260 mph I.A.S. reading add	10.5 mph

NOTES ON THE ALLISON V-1710-F3R ENGINE

28.

	R.P.M.	Boost in.Hg.	°C Oil Inlet	
			Winter	Summer
Take-off 3 Mins. Limit	2800	44.5	70	85
Climbing (1/2 hr. limit)	2600	37	70	85
Cruising RICH MIXTURE	2600	37	70	85
Cruising WEAK MIXTURE	2300	30	70	85
Emergency 5 Mins. Limit	3000	42.0	75	95

Oil Pressure Lbs./sq.in.

Normal 60' Emergency Minimum (5 Mins.) 50

FUEL TANK CAPACITIES

29. FUEL:

Total	122.8 Imp. Gallons
Front Wing Tank	29.1 Imp. Gallons
Rear Wing Tank	42.1 Imp. Gallons
Fuselage Tank	51.5 Imp. Gallons
OIL:	10.75 Imp. Gallons

OIL DILUTION

30. The oil dilution is operated by a switch on the electric control panel below the instrument board.

(a) Before stopping the engine when a cold weather start is anticipated, hold the oil dilution control switch "ON" for approximately four minutes at 800 r.p.m. and stop the engine by moving the mixture control "IDLE CUT OFF" position, continuing to hold the dilution control switch "ON" until the engine stops. Turn the dilution switch and fuel cock "OFF".

(b) In starting the engine, a normal start should be made. After starting the engine, if a heavy viscous oil is indicated by oil pressure that is too high or by oil pressure that fluctuates or falls back when the engine r.p.m. is increased, the dilution valve should be held "ON" to dilute the oil and correct this condition. Over dilution will result in a steady low oil pressure and should be avoided if possible.

(c) If the engine heat is excessive when operating the oil dilution control, the heat may evaporate the fuel out of the oil and leave the normal high viscosity oil in the engine. When this condition is encountered, the engine should be shut off and allowed to cool for fifteen minutes then re-started, and the instructions outlined in paragraph (a) followed in preparing the engine for cold weather starting.

(d) Take-off may be made four minutes after starting the engine, if there has been enough rise in oil temperature (40°C. minimum), the engine holds its oil pressure, and if the engine runs smoothly, or the take-off may be made as soon after four minutes as these conditions are obtained.

NOTES ON MIXTURE CONTROL

31. The engine is fitted with a Bendix-Stromberg carburetter. Instead of the usual two-position mixture control, as fitted to British engines, the mixture control has the following 4 main positions:

(i) FULL RICH: In this position there is no automatic compensation for altitude and temperature.

(ii) AUTOMATIC RICH: This is the position for the richest mixture which is automatically maintained by the compensating device.

(iii) AUTOMATIC LEAN: This is the normal position for weak mixture. The automatic device maintains the mixture at this setting also.

(iv) IDLE CUT-OFF: For stopping the engine and while priming during engine starting operations.

Furthermore, the mixture strength can be progressively weakened by moving the lever from the AUTOMATIC RICH position towards the IDLE CUT-OFF position, the weakening being effective also in the region beyond the AUTOMATIC LEAN position up to the point where the IDLE CUT-OFF operates (at the extreme end of the travel). At any point in this range the automatic compensating device is in operation.

Although placing the mixture control in the AUTOMATIC LEAN position gives a considerable reduction in fuel consumption, it is possible to obtain a consumption of about 5% lower by adjusting the mixture control as follows:

(v) Obtain the desired engine cruising conditions.

(vi) Change the airscrew control from AUTOMATIC to MANUAL

(vii) Set the mixture control to the position determined by weakening the mixture until a drop of 40 to 50 R.P.M. is indicated. The position may possibly be between AUTOMATIC LEAN and IDLE CUT-OFF.

(viii) Return the airscrew control to AUTOMATIC.

If changes in altitude or cruising conditions are made, this setting should be checked by repeating the above operations.