MATERIALAMT DER LUFTWAFFE

GAF T.O. 1L-P149D-1

FLIGHT MANUAL

P149D

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PUBLISHED UNDER AUTHORITY OF THE BUNDESMINISTER DER VERTEIDIGUNG
– FÜHRUNGSSTAB DER LUFTWAFFE –
– (Fü L) –

RFB 220

1. MARCH 1969
CHANGE 5 – 1. JULY 1983

LIST OF EFFECTIVE PAGES

Note: Whenever information of the text affected has been changed it will be indicated by a vertical line in the outer margin of the page. Changes to illustrations are indicated by a miniature pointing hand.

Dates of issue for original and changed pages are:

Original. . . .0. . . 1 March 1969
Change. . . .1. . 1 August 1970
Change. . . .2. . . . . 1 July 1972
Change. . . .3. . . . . 1 July 1973
Change. . . .4. . . . 1 April 1975
Change. . . .5. . . . . 1 July 1983

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 140 CONSISTING OF THE FOLLOWING:

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* 1-18	5	8-1	0		
1-19 thru 1-25	0	8-2 Blank	0		
* 1-26 and 1-27	5	* 9-1	5		
1-28	0	9-2	1		
* 1-29	5	9-3	3		
1-30	1	9-4 Blank	0		

APPLICABLE FLIGHT CREW CHECKLIST

GAF T.O. 1L-P149D-1CL-1

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SCOPE. This Manual contains all the information necessary for safe and efficient operation of the P 149 D. These instructions do not teach basic flight principles, but are designed to provide you with a general knowledge of the aircraft, its flight characteristics and specific normal and emergency procedure. Your flying experience is recognized; therefore, elementary instructions have been avoided.

SOUND JUDGMENT. The instructions in this Manual are designed to provide for the needs of a crew inexperienced in the operation of this aircraft. This book provides the best possible operating instructions under most circumstances, but it is a poor substitute for sound judgment. Multiple emergencies, adverse weather, terrain, etc. may require modification of the procedures described herein.

PERMISSIBLE OPERATIONS. This Flight Manual takes a "positive approach" and normally tells you only what you can do. Any unusual operation or configuration (such as asymmetrical loading) is prohibited unless specifically covered in the Flight Manual. Clearance must be obtained from the Flight Manual manager before any questionable operation is attempted which is not specifically covered in the Flight Manual.

HOW TO BE ASSURED OF HAVING THE LATEST DATA. Refer to Index GAF T.O. 0-1-1A, which lists all current Flight Manuals, Safety Supplements, Operational Supplements and Flight Crew Checklists. Its frequency of issue (every 2 months) and brevity ensures an accurate, up-to-date listing of these publications.

STANDARDIZATION AND ARRANGEMENT. Standardization assures that the scope and arrangement of all Flight Manuals are identical. The Manual is divided into ten fairly independent sections to simplify reading it straight through or using it as a reference manual. The first three sections must be read thoroughly and fully understood before attempting to fly the aircraft. The remaining sections provide important information for safe and efficient mission accomplishment.

SAFETY SUPPLEMENTS AND OPERATIONAL SUPPLEMENTS. Safety Supplements are issued as an expeditious means of reflecting safety information when hazardous or safety conditions exist. These supplements contain operational, precautionary and restrictive instructions that affect safety and safety modifications. Operational Supplements are issued as an expeditious means of reflecting information when mission essential operational procedures are involved. Supplements are issued by teletype (interim) or by printed copy (formal) depending upon the urgency. Interim supplements are normally replaced by formal printed supplements at an early date. Formal printed supplements are identified by red letters "SS" for Safety Supplements and black letters "OS" for Operational Supplements printed around the borders of the title pages. The currency of Safety and Operational Supplements affecting your aircraft and Flight Manual can be determined by referring to Index GAF T.O. 0-1-1A; also, the latest safety or operational status page. The title block of each supplement should be checked to determine the effect they may have on existing supplements.

CHECKLISTS. The Flight Manual contains amplified normal and emergency procedures. Checklists contain these procedures in abbreviated form and are issued as separate technical orders. Line items in the Flight Manual and checklists are identical with respect to the arrangement and item number. Whenever a Safety or Operational Supplement affects the abbreviated checklist, an interim change to the checklist with the revised procedures will be issued simultaneously ("quick change" checklist program). This will keep handwritten entries of supplement information in your checklist to a minimum.

HOW TO GET PERSONAL COPIES. Each flight crew member is entitled to personal copies of the Flight Manual, Safety Supplements, Operational Supplements and Flight Crew Checklists. The required quantities should be ordered before you need them to assure their prompt receipt. Check with your supply personnel; it is their job to fulfil your Technical Order requests.

WARNINGS, CAUTIONS, AND NOTES. For your information, the following definitions apply to the "Warnings", "Cautions", and "Notes" found throughout the Manual.

WARNING

Operating procedures, techniques, etc., which will result in personal injury or loss of life if not carefully followed.

CAUTION

Operating procedures, techniques, etc., which, if not strictly observed, will result in damage to equiment.

NOTE

An operating procedure, condition, technique, etc., which is considered essential to emphasize.

ILLUSTRATION CHANGES. To help you more easily find changes on illustrations that might otherwise be inconspicuous, the following identifier may be used instead of a vertical line in the outer margin of the page.

YOUR RESPONSIBILITY – TO LET US KNOW. Every effort is made to keep the Flight Manual up-to-date. Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the Manual. However, we cannot correct an error unless we know of its existence. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this Manual or any phase of the Flight Manual Program are welcomed and should be forwarded to

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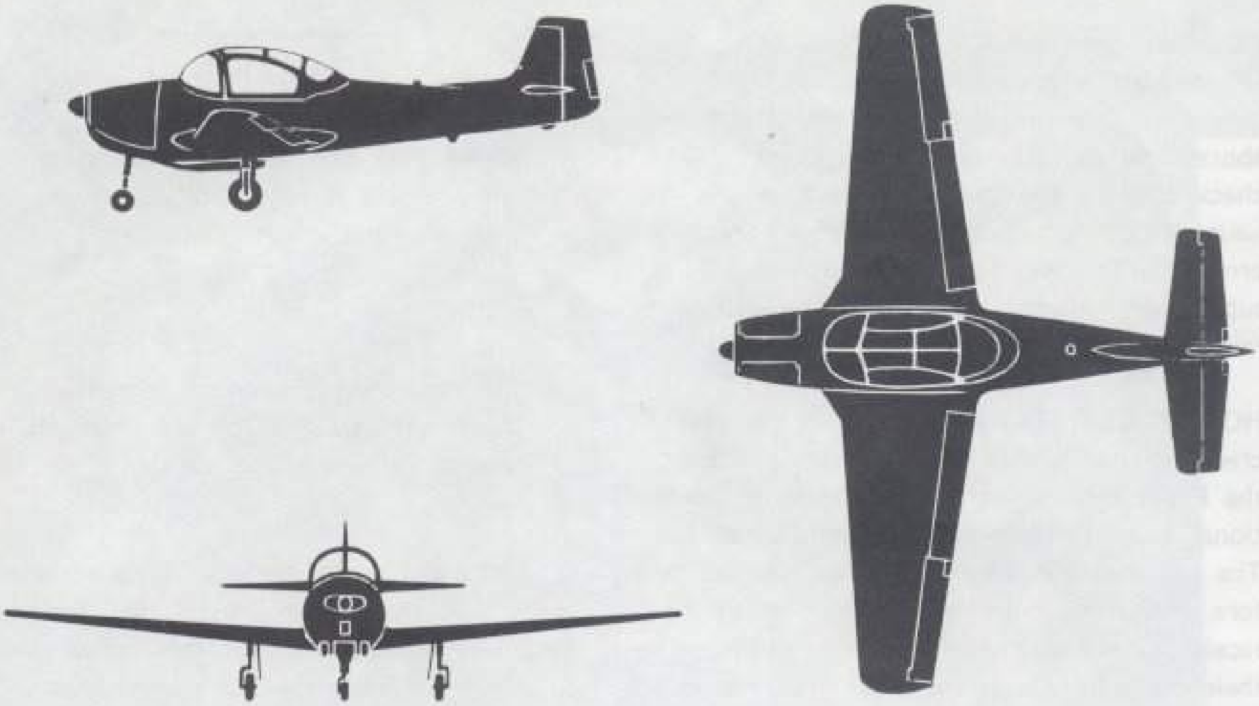
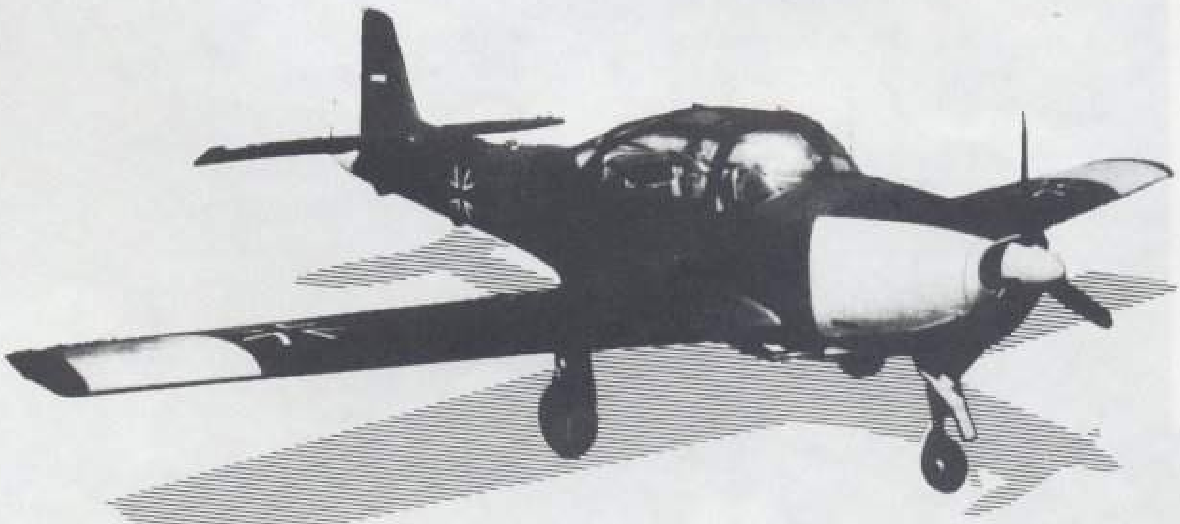


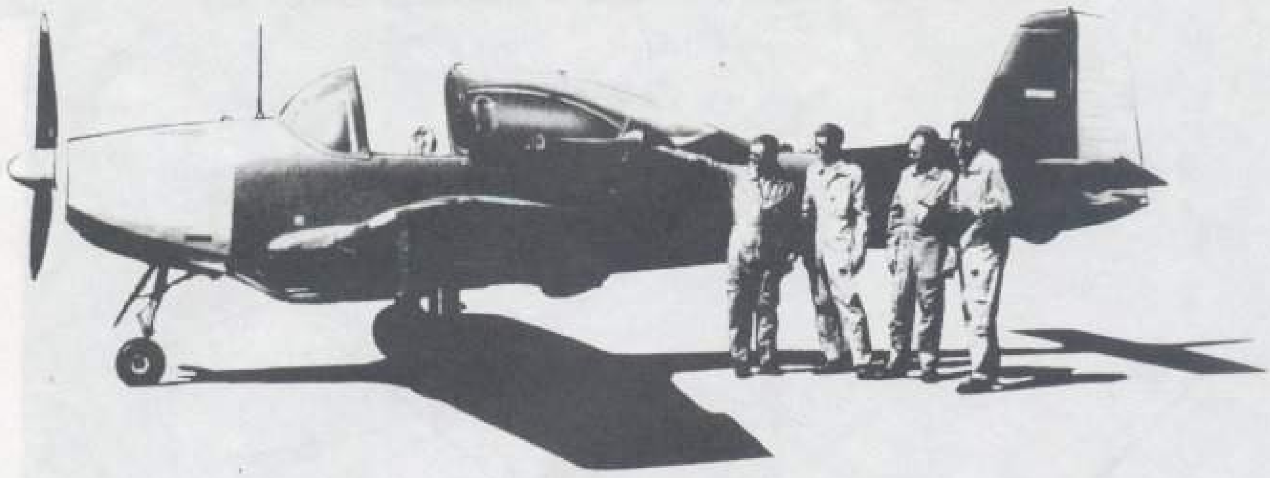
P 149 D



LIST OF TERMS USED

AIRCRAFT-HANDBOOK MARKINGS

Akku	– Battery
Anlasserknopf	– Starter button
Auftreten verboten	– No step
Aus	– Off or Down
Behälter für Bremsflüssigkeit	– Brake fluid reservoir
Beide Beh.	– Both tanks
Belüftung kalt	– Cabin ventilation cold
Bordspannung	– Aircraft voltage
Bordsprech	– Interphone
Brandhahn	– Fuel shutoff knob
Drücken „AUF"	Push „OPEN"
Ziehen „ZU"	Pull „CLOSED"
Drücken	– Push
Ein	– On or Up
Einspritzung	– Priming
Elt. Kraftstoff-Hilfspumpe	– Electrical auxiliary – pump
Empfang (EMPF)	– Receiving
Erdmagnetfeldgeber	– Detector unit
Fahrwerk	– Landing gear
Fahrwerk Warnleuchte	– Landing gear warning light
Federbein	– Compression strut
Fest	– Locked
Frei	– Unlocked
Funkbetrieb	– Transceiving
Gemischregler	– Mixture control
Generator Warnung	– Generator warning
Höhe	– Altitude
Kabinenheizung	– Cabin heat
Kopfhörer	– Headset
Kopf-Lastig	– Nose low
Kraftstoff-Druck	– Fuel pressure
Kraftstoffvorrat	– Fuel quantity
Kreisel Instrumente	– Gyro Instruments
Lautstärke	– Volume
L. Beh.	– L/H tanks
Leerlauf	– Idling
Linker Landescheinwerfer	– L/H landing light
Liter	– Litre
Luftdruck	– Air pressure
Luftschraube	– Propeller
Max. Drehzahl	– Max. RPM
Mikrofon dynamisch	– Mike dynamic
Mikrofon kristall	– Mike crystal
Min. Umdrz.	– Min. RPM
Notabwurf	– Emergency jettison
Öl-Druck	– Oil pressure
Öl-Temp.	– Oil temperature
Offen	– Open
Park-Bremse	– Parking brake
Pos. Lampen	– Position light
Potentiometer U. V. Licht	– Ultraviolet light rheostat
R. Beh.	– R/H tanks
Reifendruck	– Tire pressure
R. Landescheinwerfer	– R/H landing light
Rundumwarnleuchten	– Anticollision lights
Schnellstop	– Stopcock
Schwanz-Lastig	– Nose high
Seitenr. Trimmung	– Rudder trim
Sicherungen	– Fuses
Sichtsch. Beheizung	– Windshield defrost
Stat. Druckabtlg. nicht berühren	– Static pressure don't touch
Staurohr-Heizung	– Pitot heat
U. V. Licht	– Ultraviolet light
Vollgas	– Full power
Warmluft f. Vergaser	– Carburetor heat
Ziehen	– Pull
Zu	– Closed
Zündmagnetschalter	– Ignition switch



DESCRIPTION SECTION I

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THE AIRCRAFT.

The P 149 D was developed and manufactured by Piaggio & Co, Genova, Italy. Designated FW P 149 D, this aircraft was manufactured under license by Focke-Wulf GmbH (now Vereinigte Flugtechnische Werke) Bremen, Federal Republic of Germany.

The P 149 D is a four-seater, low-wing, all-metall aircraft powered by one reciprocating engine. For military applications it is used as a trainer and liaison aircraft.

Characteristic features include dual flight controls and retractable tricycle landing gear. The nose gear is steerable. The aircraft is powered by a Lycoming engine equipped with an injection type carburetor, sound suppressor system (modified aircraft only) and a three-blade constant speed propeller.

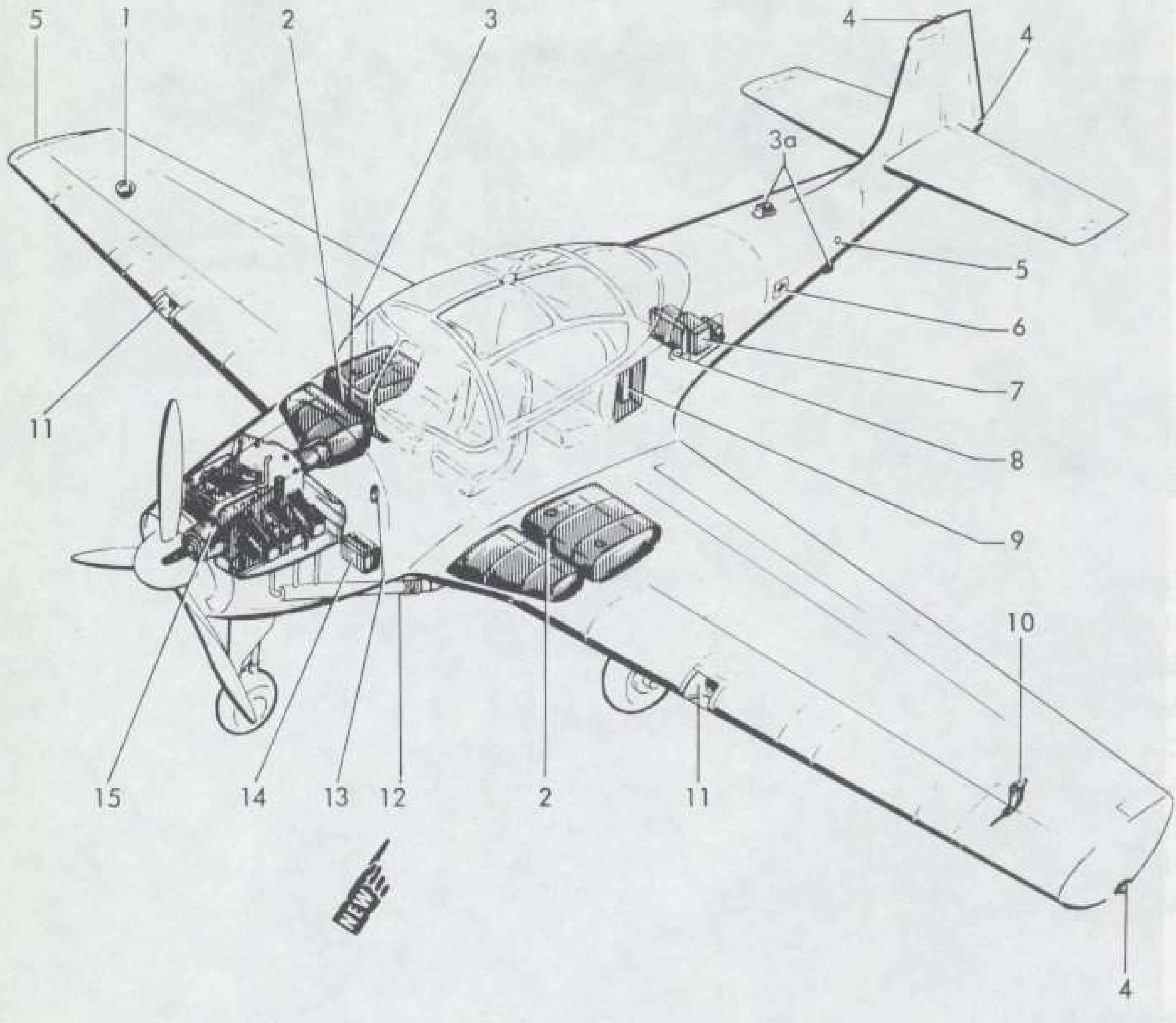
AIRCRAFT DIMENSIONS

The overall dimensions of the aircraft are as follows:

Wing span	11.12 m
Length	8.78 m
Height	3.00 m

GENERAL ARRANGEMENT

(Typical)



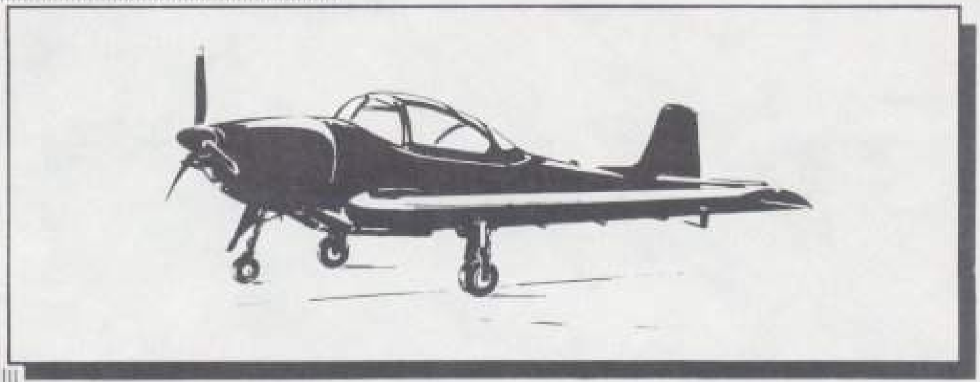
1 DETECTOR UNIT (MAGNETIC DIRECTIONAL TRANSMITTER)
2 FUEL TANKS
3 RADIO COMPASS ANTENNA
3a ANTICOLLISION LIGHTS (modified aircraft)
4 POSITIONS LIGHTS
5 STATIC PORTS
6 FIRST AID KIT
7 RADIO COMMUNICATION SET
8 EXTERNAL POWER RECEPTACLE
9 BAGGAGE COMPARTMENT (LOOSE EQUIPMENT STOWAGE)
10 PITOT TUBE
11 LANDING LIGHTS
12 SOUND SUPPRESSOR (modified aircraft)
13 RESERVOIR FOR BRAKE FLUID
14 BATTERY (2 BATTERIES 12 V EACH)
15 PROPELLER GOVERNOR

Figure 1-1

AIRCRAFT GROSS WEIGHT

THE MAXIMUM GROSS WEIGHT OF THE AIRCRAFT FULLY LOADED IS SHOWN BELOW

CRUISE FLIGHT	**1820 kp**
ACROBATIC FLIGHT	**1470 kp**



AIRCRAFT EMPTY WEIGHT
SEE SECTION V-OPERATING
LIMITATIONS LOADING CHART

Figure 1 – 2

INSTRUMENT PANEL (TYPICAL)

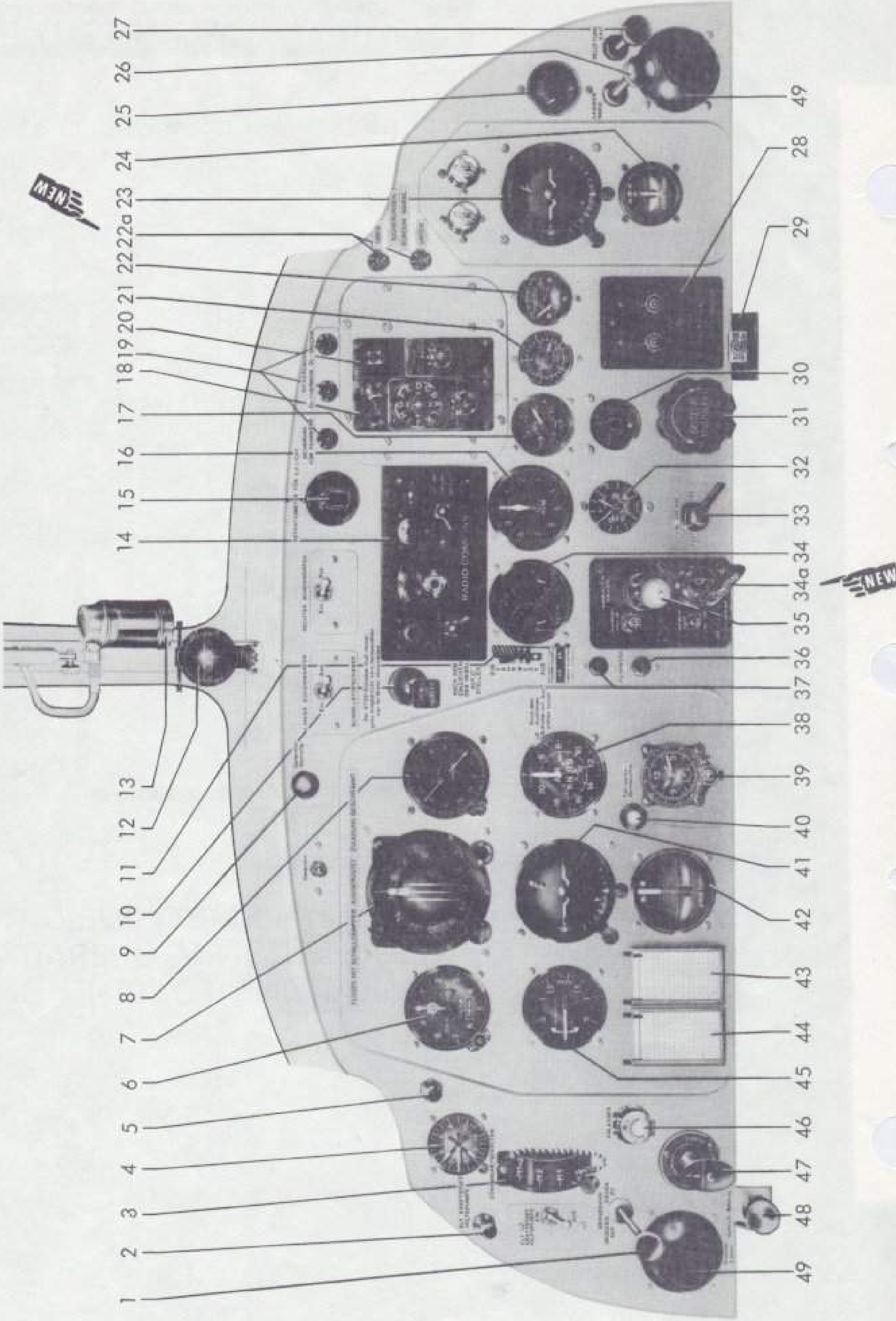


Figure 1-3 (Page 1 of 2)

Beachte OS 5-8

1 FUEL SHUT-OFF KNOB
2 ELECTRICAL FUEL PUMP CONTROL LIGHT
3 IGNITION SWITCH
4 G-METER
5 FIRE WARNING LIGHT
6 ALTIMETER
7 DIRECTIONAL INDICATOR
8 RADIO COMPASS INDICATOR
9 GENERATOR WARNING LIGHT
10 STOPCOCK
11 LANDING GEAR SWITCH
12 MAGNETIC COMPASS
13 ULTRAVIOLET LIGHT
14 RADIO COMPASS CONTROL PANEL
15 ULTRAVIOLET LIGHT RHEOSTAT
16 RPM-INDICATOR
17 MANIFOLD PRESSURE GAGE
18 COMMAND RADIO CONTROL PANEL
19 FUSES
20 INTERPHONE CONTROL PANEL
21 FUEL PRESSURE GAGE
22 CYLINDER HEAD TEMPERATURE GAGE
22a FUSES
23 ATTITUDE INDICATOR
24 STANDBY TURN-AND-SLIP INDICATOR
25 VOLTMETER
26 CABIN HEAT CONTROL KNOB
27 CABIN VENTILATION CONTROL KNOB
28 DIRECTIONAL INDICATOR CORRECTOR PANEL
29 STANDBY TURN-AND-SLIP INDICATOR SWITCH
30 RUDDER TRIM TAB POSITION INDICATOR
31 RUDDER TRIM TAB WHEEL
32 FUEL QUANTITY GAGE
33 PARKING BRAKE HANDLE
34 OIL PRESSURE AND TEMPERATURE GAGE
34a COWL-FLAP HANDLE
35 CARBURETOR HEAT CONTROL KNOB
36 MAIN GEAR POSITION INDICATOR
37 NOSE GEAR POSITION INDICATOR
38 AIRSPEED INDICATOR
39 CLOCK
40 LANDING GEAR WARNING LIGHT
41 ATTITUDE INDICATOR
42 TURN-AND-SLIP INDICATOR
43 RADIO COMPASS CORRECTION CARD
44 MAGNETIC COMPASS CORRECTION CARD
45 VERTICAL SPEED INDICATOR
46 STARTER BUTTON
47 PRIMER
48 WINDSHIELD DEFROST KNOB
49 ADJUSTABLE FRESH AIR INLET

Figure 1-3 (Page 2 of 2)

ENGINE.

The aircraft is powered by a Lycoming six-cylinder, air-cooled, opposed-cylinder engine, model GO-480-B1 A6. The engine develops approx. 270 HP at 3400 RPM. The engine is equipped with an updraft pressure-injection type carburetor, and a direct-cranking starter an a sound suppressor system (modified aircraft only).

CARBURETOR

The Bendix-Stromberg carburetor of the updraft pressure-injection type incorporates automatic altitude mixture control. A single-diaphragm, vacuum-operated accelerator pump acts through forward movement of the throttle. Supplying the engine with abrupt power, the fuel mixture will be enriched by the accelerator pump.

THROTTLE

Engine power is controlled by one throttle on the L/H engine control box, and one throttle on the center engine control box (2, figure 1-4, figure 1-5). The throttles are connected with a common torsion tube to ensure simultaneous movement. Movement of the throttle is transmitted to the carburetor by a Teleflex control cable. Retarding the throttle to a position corresponding to approx. 0.3 ata manifold pressure with the landing gear not fully extended, actuates a micro-switch and completes a circuit to the landing gear warning horn and warning light. The warning light will illuminate and a warning signal will be audible. The engine is idled with the throttle in the fully retarded position. A microphone button is incorporated in each throttle.

FRICTION KNOB

A friction knob provided on the engine control box prevents creeping of the throttle and propeller control levers. Turning the knob clockwise increases friction.

STOPCOCK

A stopcock located on the instrument panel is connected to the carburetor by a Teleflex cable. When completely pushed in, the stopcock provides for automatic fuel-air mixture control at various altitudes. With the handle in the Cut-Off position (fully out), the fuel flow is shut off at the carburetor, stopping the engine. During flight, the stopcock has to remain in the fully "In-position".

CAUTION

Owing to fire hazard, the stopcock must remain in the Cut-Off position when the engine is shut down.

CARBURETOR HEAT CONTROL KNOB

A carburetor heat control knob (35, figure 1-3) is located on the instrument panel below the circuit breakers of the landing gear and landing gear indicator. The carburetor heat control knob is connected through a Teleflex cable with a flapper assembly in the carburetor outside air and heated air duct. When the knob is completely pulled out (heated air position), outside air is shut off and heated engine compartment air flows to the carburetor. Intermediate positions provide a mixture of heated and cold air to the carburetor. Operation of carburetor heating is indicated by momentary fluctuations of engine RPM and changes of manifold pressure readings when actuating the carburetor heat control knob.

IGNITION SYSTEM

The engine has a dual ignition system independent of the aircraft electrical power supply system. The ignition system includes two Bendix Scintilla magnetos which are controlled individually by a single magneto switch (ignition switch). Each magneto supplies high voltage to one of two spark plugs in each cylinder.

IGNITION SWITCH

The ignition switch (3, figure 1-3) is located on the left side of the instrument panel. The switch positions are shown in 3, figure 1-3 too. The M1 and M2 positions are used to check the magnetos, and the M1 position is used for starting. The switch is retained in the "M1+2" position for normal operation.

STARTER BUTTON

The starter button (45, figure 1-3), located on the left side of the instrument panel, receives power from the electrical system. The starter button is protected by a circuit breaker switch on the overhead circuit breaker panel (figure 1-9 and figure 1-10)

Note

External electrical power should be used whenever possible to save battery power.

PRIMER

Engine priming is accomplished by means of a push-pull handle (47, figure 1-3) located on the left side of the instrument panel. The primer pumps fuel from the fuel manifold directly into the four aft cylinders to aid in starting. For priming, the pump handle must be pushed in, and turned to the left for unlocking. Priming is accomplished by push-pull movement of the handle. When not in use, the handle should be pushed in and turned to the right for locking. A knurled friction nut prevents inadvertent unlocking of the primer.

SOUND SUPPRESSOR SYSTEM(modified aircraft)

The exhaust gas is led from the exhaust manifold through two pipes and two mufflers into the free air. The mufflers, designated as "Frankfurter Topf FTF 60", are attached to the bottom of the fuselage(see 12a, figure 1-1).

ENGINE COMPARTMENT COOLING

To cool the engine and the associated accessories two air inlets are provided, which allow the outside air to flow into the engine compartment. The heated air is automatically released through two thermostat-controlled cowl-flaps, which are installed one each in the left and right engine cowlings.

To adjust the airflow for increased cooling two additional cowl-flaps are mounted left and right of the nose-wheel well. They are manually controlled by the cowl-flap handle.

COWL-FLAP HANDLE

The cowl flap handle (34a, figure 1-3) is located on the instrument panel below the carburetor heat control knob. After turning horizontally it can be set to five different positions from full closed (pushed in) to full open (pulled out). It will be set to maintain the proper cylinder head temperature.

ENGINE INSTRUMENTS

MANIFOLD PRESSURE GAGE

The manifold pressure gage is located on the instrument panel (17, figure 1-3). The absolute-pressure type instrument indicates the pressure of the fuel-air mixture entering the engine cylinders. The indicator scale is graduated from 0.3 ata to 2.1 ata. This instrument is a direct-reading indicator.

CYLINDER HEAD TEMPERATURE GAGE

The cylinder head temperature gage is located on the instrument panel (22, figure 1-3). Temperature of No. 5 cylinder is indicated. A bayonet-type thermocouple is connected with the instrument by a lead. The temperature gage scale is graduated in centigrades from 0 $^{\circ}$C to 300 $^{\circ}$C.

OIL PRESSURE AND TEMPERATURE GAGE

This gage is a dual indicating instrument and consists of the following:

OIL PRESSURE GAGE

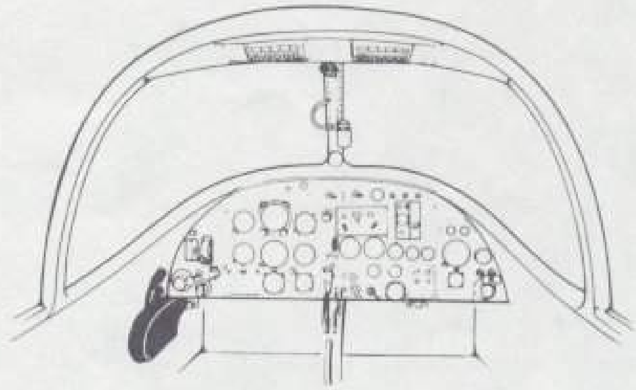
The oil pressure gage (33, figure 1-3) is connected with the aircraft electrical power supply. The gage is protected by a circuit breaker switch on the circuit breaker (overhead) panel. Pressures from 0 to 14 kp/cm^2 are indicated. Signals from a pressure sensing element in the oil pressure system are fed to the direct-reading pressure indicator.

OIL TEMPERATURE GAGE

The oil temperature gage (34, figure 1-3) is connected to the aircraft electrical power supply. The gage is protected by a circuit breaker switch on the circuit breaker (overhead) panel. The indicator scale is graduated in centigrades from 0 $^{\circ}$C to 120 $^{\circ}$C. Signals from a temperature sensing element in the oil sump are fed to the direct-reading indicator.

L/H ENGINE CONTROL BOX

1 MICROPHONE BUTTON
2 THROTTLE
3 PROPELLER CONTROL LEVER



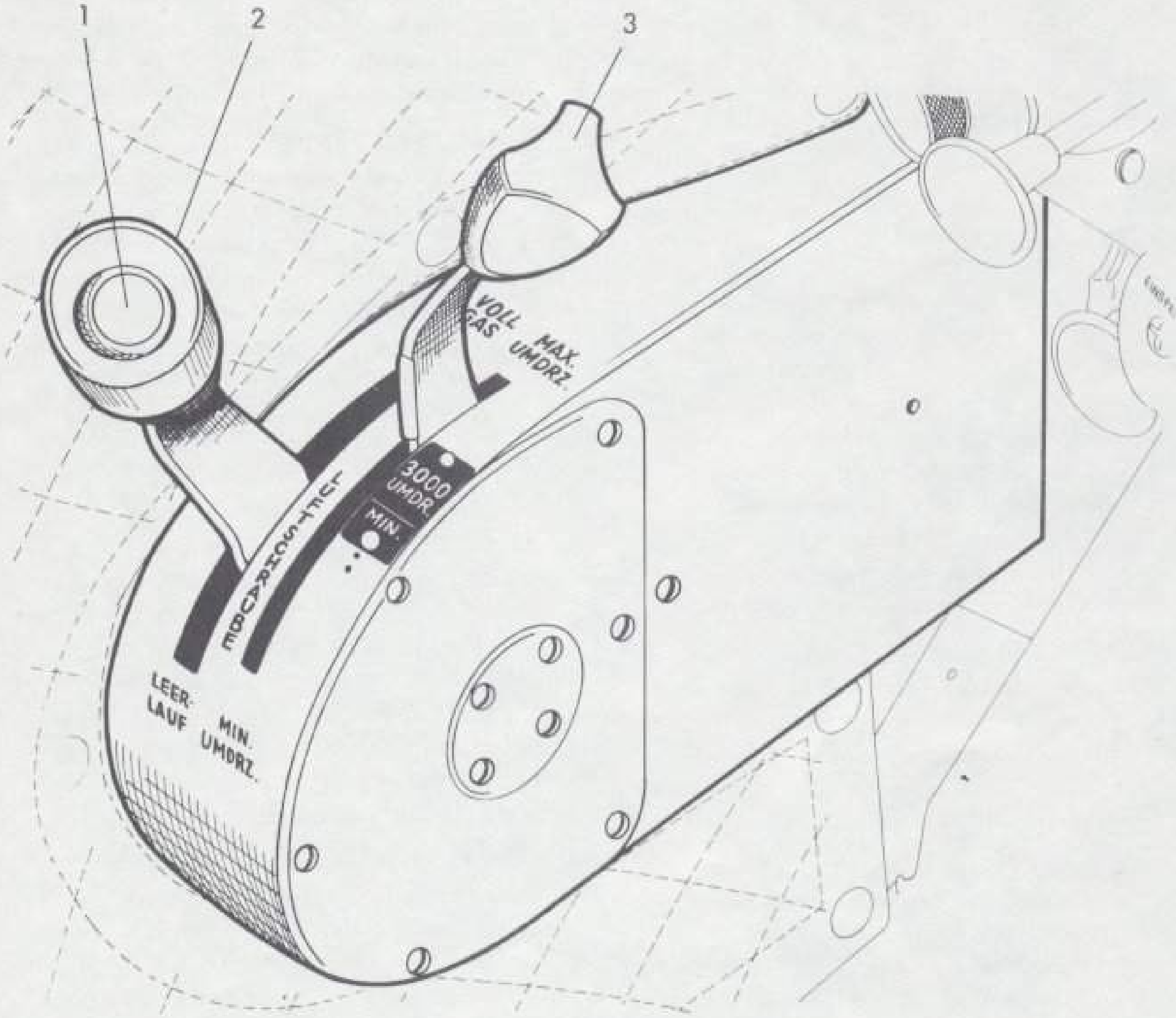
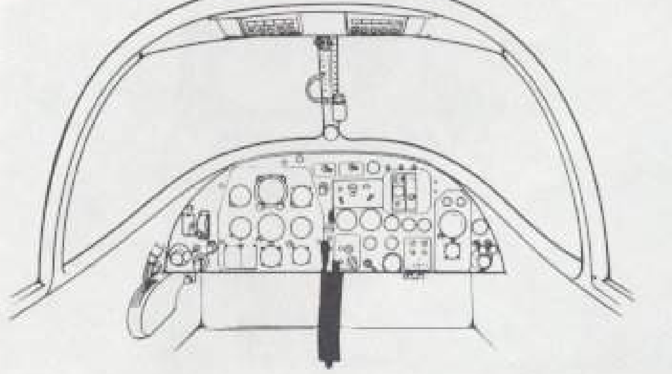
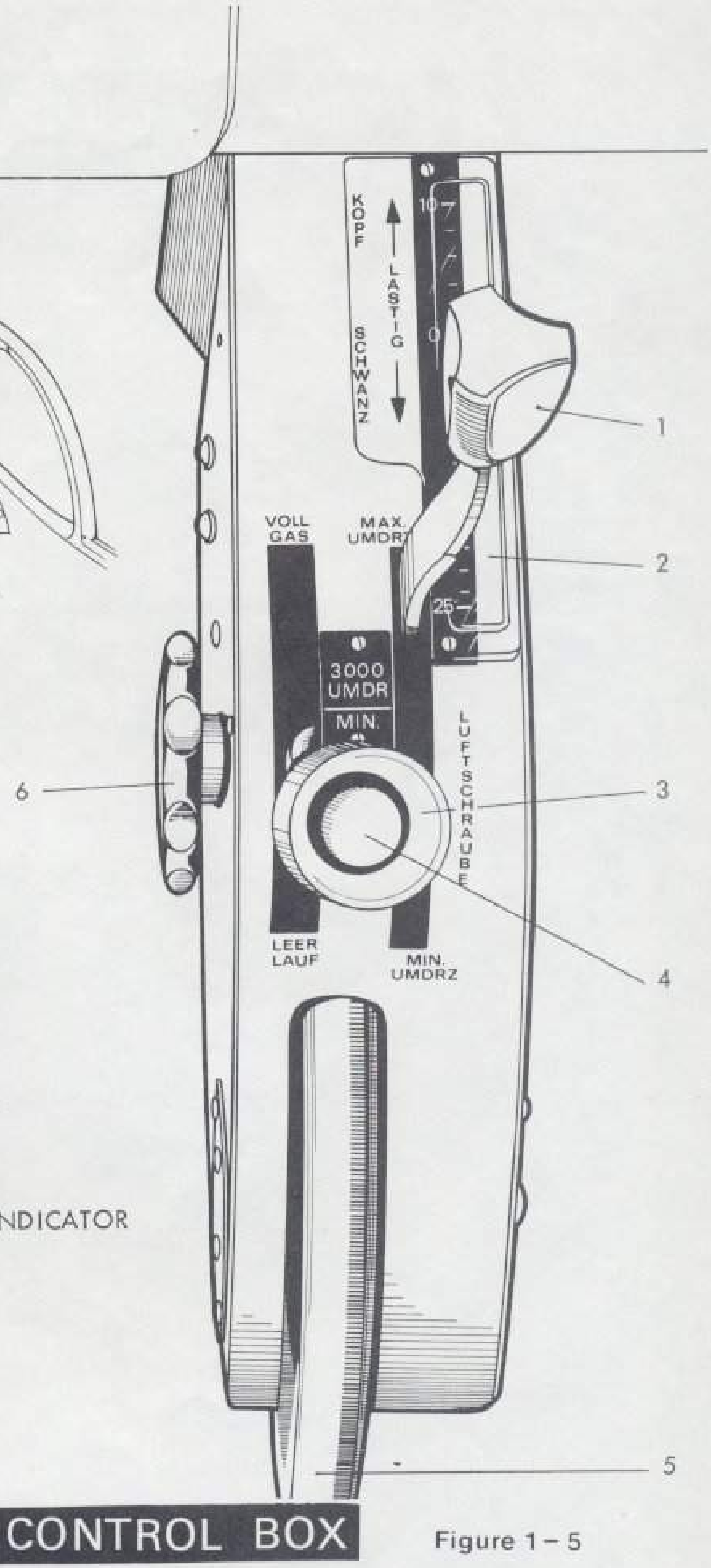


Figure 1-4



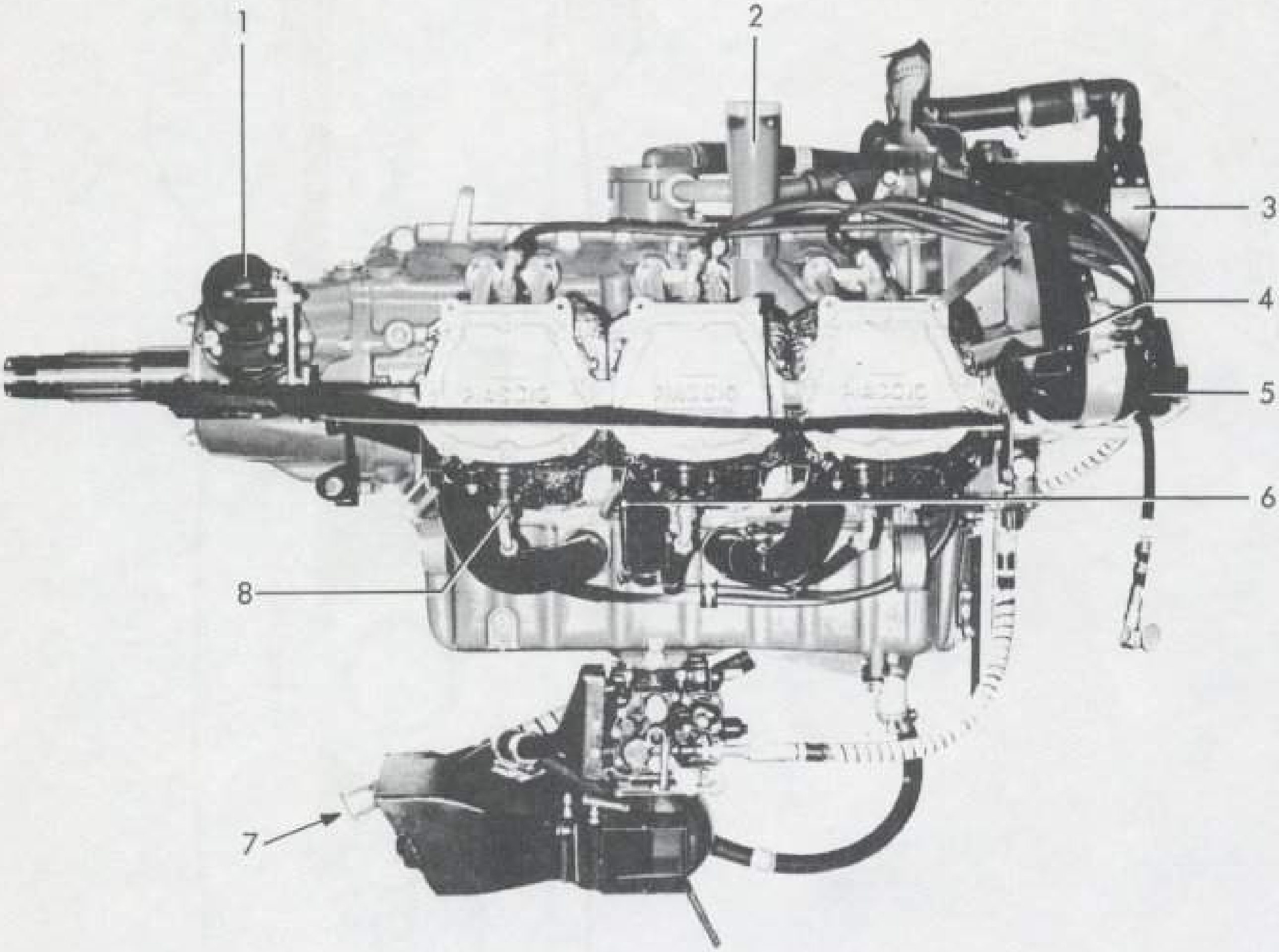


1 PROPELLER CONTROL LEVER
2 ELEVATOR TRIM POSITION INDICATOR
3 THROTTLE
4 MICROPHONE BUTTON
5 ELEVATOR TRIM TAB WHEEL
6 FRICTION KNOB

CENTER ENGINE CONTROL BOX

Figure 1 – 5

ENGINE - LEFTSIDE VIEW



1 PROPELLER GOVERNOR
2 OIL FILLER NECK
3 GENERATOR
4 MAGNETOS (TWO)
5 STARTER
6 PRIMER LINE
7 CARBURETOR AIR INLET
8 SPARK PLUGS
(EACH CYLINDER TWO PLUGS)

Figure 1-6

FUEL PRESSURE GAGE

Operation of the fuel pressure gage (21, figure 1-3) is similar to that of the oil pressure gage. The indicator scale is graduated in increments of 0.1 kp/cm^2 from 0 to 2.1 kp/cm^2. Signals of a pressure sensing element in the fuel pressure line are fed to the direct-reading pressure indicator.

RPM-INDICATOR

The RPM - indicating system provides indications of engine RPM. The indicator has two pointers, and the dial is marked "RPM HUNDRED" and "RPM THOUSAND". It reads from 0 to 9.9 (9900 RPM). A tachometer generator, geared to the accessory drive, produces alternating current when driven by the engine. This current is supplied to the tachometer rotor whose speed is directly proportional to the engine speed.

PROPELLER.

The aircraft is equipped with a Piaggio three-blade constant-speed variable-pitch propeller. Constant speed is maintained by a governor mounted in the engine nose section. The governor routes engine oil to an actuating cylinder in the propeller hub. Pressure applied to the piston reduces the blade pitch while centrifugal forces originating from counterweights increase the blade pitch. In case of a failure of the mechanical connection with the governor, the propeller will move into maximum pitch position.

PROPELLER CONTROL LEVER

Propeller blade pitch is adjusted by two propeller control levers mounted on the center engine control box and the L/H engine control box. The levers are interconnected by torque tubes to ensure simultaneous movement. The governor setting is adjusted by the propeller control lever through a Teleflex cable. The propeller control lever may be placed at any intermediate position between "DECREASE" (MIN. UMDRZ.) and "INCREASE" (MAX. UMDRZ.), depending on the engine RPM desired. To enable maximum rated horsepower to be obtained for take-off, the pitch lever is positioned to full INCREASE RPM.

OIL SUPPLY SYSTEM.

Engine oil is supplied from the engine oil sump which also serves as oil tank. With the thermostatic by-pass valve closed, a gear type oil pump provides oil flow from the oil sump through a filter element to the lubrication points. At operating temperature conditions, the oil passes through an oil cooler before entering the oil sump. The oil cooler is located in front of the engine in the engine compartment. High-pressure hoses connect the oil cooler with the engine sump. The oil quantity may be checked by a dipstick located in the crankcase between cylinders No. 4 and No. 6.

Note

> To obtain correct oil level indications, the engine must be shut down for at least 5-10 minutes prior to the check. This permits engine oil to drain out of the engine oil passages into the oil sump.

FUEL SUPPLY SYSTEM.

The fuel system (figure 1-7) incorporates four wing fuel tanks with a total capacity of 236 liters.
The forward L/H and R/H wing tanks are located forward of the main wing spar and have a capacity of 43 liters each. The aft L/H and R/H wing tanks are located aft of the main spar and have a capacity of 75 liters each. Fuel is supplied to the induction system by an electrical fuel booster pump and an engine-driven fuel pump. Refer to Sections II and III for recommended use of the fuel booster pumps. Other components of this system are a three-way selector valve, a fuel manifold, a fuel shutoff valve, and a fuel filter. The primer is connected to the fuel manifold by a separate line. For fuel grade and specification see figure 1-19.

FUEL SYSTEM CONTROLS

FUEL SHUTOFF KNOB

A control knob for the fuel shutoff valve is located on the L/H side of the instrument panel (1, figure 1-3). In the pulled-out position

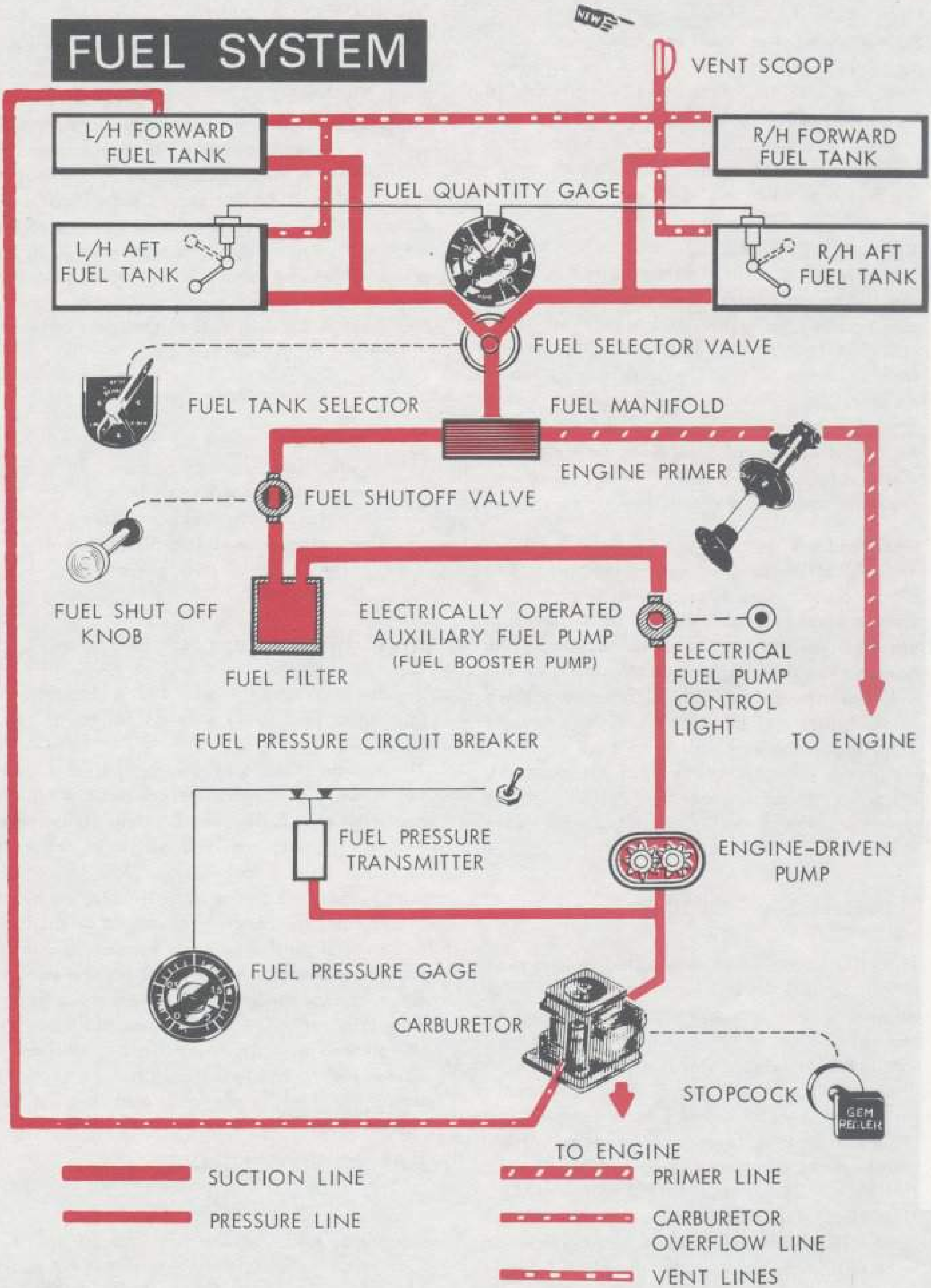

FUEL SYSTEM
VENT SCOOP
L/H FORWARD FUEL TANK
R/H FORWARD FUEL TANK
FUEL QUANTITY GAGE
L/H AFT FUEL TANK
R/H AFT FUEL TANK
FUEL SELECTOR VALVE
FUEL TANK SELECTOR
FUEL MANIFOLD
ENGINE PRIMER
FUEL SHUTOFF VALVE
FUEL SHUT OFF KNOB
FUEL FILTER
ELECTRICALLY OPERATED AUXILIARY FUEL PUMP
(FUEL BOOSTER PUMP)
ELECTRICAL FUEL PUMP CONTROL LIGHT
TO ENGINE
FUEL PRESSURE CIRCUIT BREAKER
FUEL PRESSURE TRANSMITTER
ENGINE-DRIVEN PUMP
FUEL PRESSURE GAGE
CARBURETOR
STOPCOCK
TO ENGINE
SUCTION LINE
PRESSURE LINE
PRIMER LINE
CARBURETOR OVERFLOW LINE
VENT LINES

Figure 1-7

FUEL QUANTITY DATA

Note

Multiply liters by 0,72 to obtain kilogramm of gasoline (Standard Day only)

TOTAL FUEL WEIGHT
170 KILOGRAMM

TANKS	NO.	USABLE FUEL IN LEVEL FLIGHT		FULLY SERVICED		EXPANSION SPACE	TANK VOLUME	
		LITERS	U.S.GALL.	LITERS	U.S.GALL		LITERS	U.S.GALL
L WING TANKS	2	115	30,4	118	31,2	0	118	31,2
R WING TANKS	2	115	30,4	118	31,2	0	118	31,2
TOTAL	4	220	60,8	236	62,4	0	236	62,4

Figure 1 – 8

the fuel shutoff valve is closed. In the pushed-in position the fuel shutoff valve is open.

Note

In case of engine fire, the fuel shutoff valve must be closed.

FUEL TANK SELECTOR

The fuel tank selector (figure 1-7) is located on the cockpit floor forward of and between the front seats. The fuel tank selector is linked to the fuel selector valve. The fuel tank selector has three positions, "L/H Tanks", "R/H Tanks", and "Both Tanks".

FUEL QUANTITY GAGE

A fuel quantity gage is located on the instrument panel. The dial is graduated in liters. The dual gage indicates the fuel quantity in the L/H and R/H tanks. A fuel quantity transmitter installed in the aft tanks of each wing and wired to the gage supplies fuel quantity information to the gage.

The fuel quantity gage circuits operate on power supplied by the aircraft power supply system. A circuit breaker in the overhead panel (figure 1-10) protects the circuits. A low-level warning device is not provided.

ELECTRICAL POWER SUPPLY SYSTEM.

The aircraft electrical power supply system is a single-phase DC system. The engine-driven generator supplies approx. 28 volt operating voltage to the system. Two 12-volt lead storage batteries are installed on the L/H and R/H side in front of the fire wall and serve as a stand-by power source to supply current to the DC system when the generator is inoperative or when generator voltage is insufficient to close the reverse current relay. The generator supplies current to the electrical power system when the engine speed reaches or exceeds 1250 RPM. The generator is connected to the busbar of the aircraft power supply system. This circuit is protected by a 60 amp. push-to-reset type circuit breaker (figure 1-10). A voltage regulator and a reverse current relay are provided in the generator circuit. A relay energizes and supplies power to the busbar when the battery circuit breaker is switched to "ON". During stationary ground operation, direct current can be supplied to the aircraft by an external power source.

EXTERNAL POWER RECEPTACLE

An external power receptacle is located on the L/H side of the fuselage near the access door of the communication equipment compartment. The external power source should be used whenever possible to save the battery.

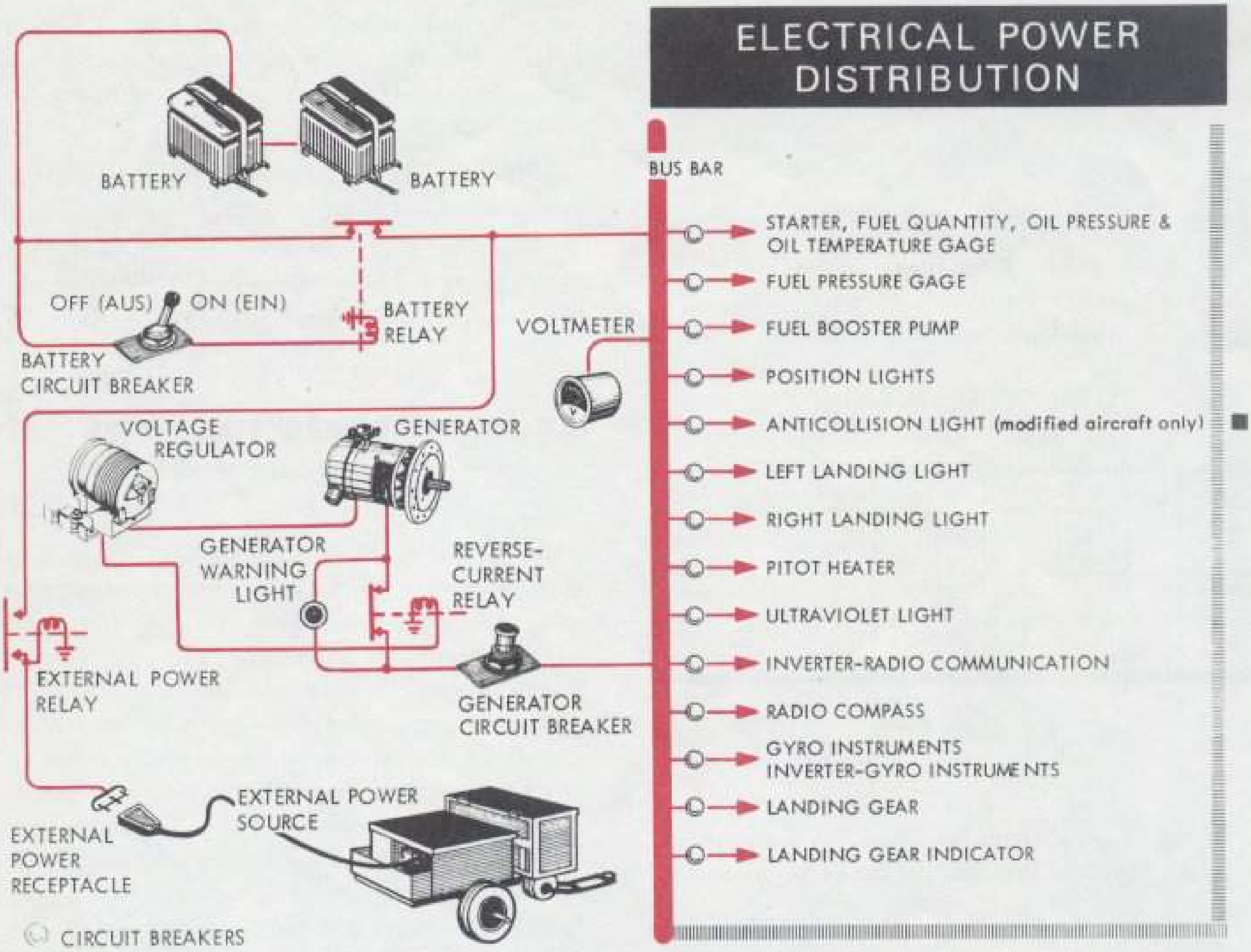


Figure 1 – 9

GENERATOR CIRCUIT BREAKER

The generator push-to-reset type circuit breaker is located on the instrument panel (figure 1-10). In case of a short circuit in the generator circuit, the circuit breaker trips. The engine will continue to run on the independent magneto-powered ignition system.

ELECTRICAL POWER SUPPLY SYSTEM INDICATORS

VOLTMETER

A voltmeter (25, figure 1-3) is mounted on the extreme R/H side of the instrument panel. The voltmeter indicates generator voltage output (approx. 28 volts). If the generator fails, or if the generator circuit breaker is in the OFF position and the battery switch is on, the instrument will indicate battery voltage (approx. 24 volts).

GENERATOR WARNING LIGHT

The generator warning light illuminates to indicate that the reverse current relay has switched to the batteries and that the generator is not feeding into the electrical system. The warning light should go out when engine speed reaches 1250 RPM.

Note

The generator warning light will not illuminate when the generator circuit breaker is in the OFF position.

CIRCUIT-BREAKER PANELS

(Typical)

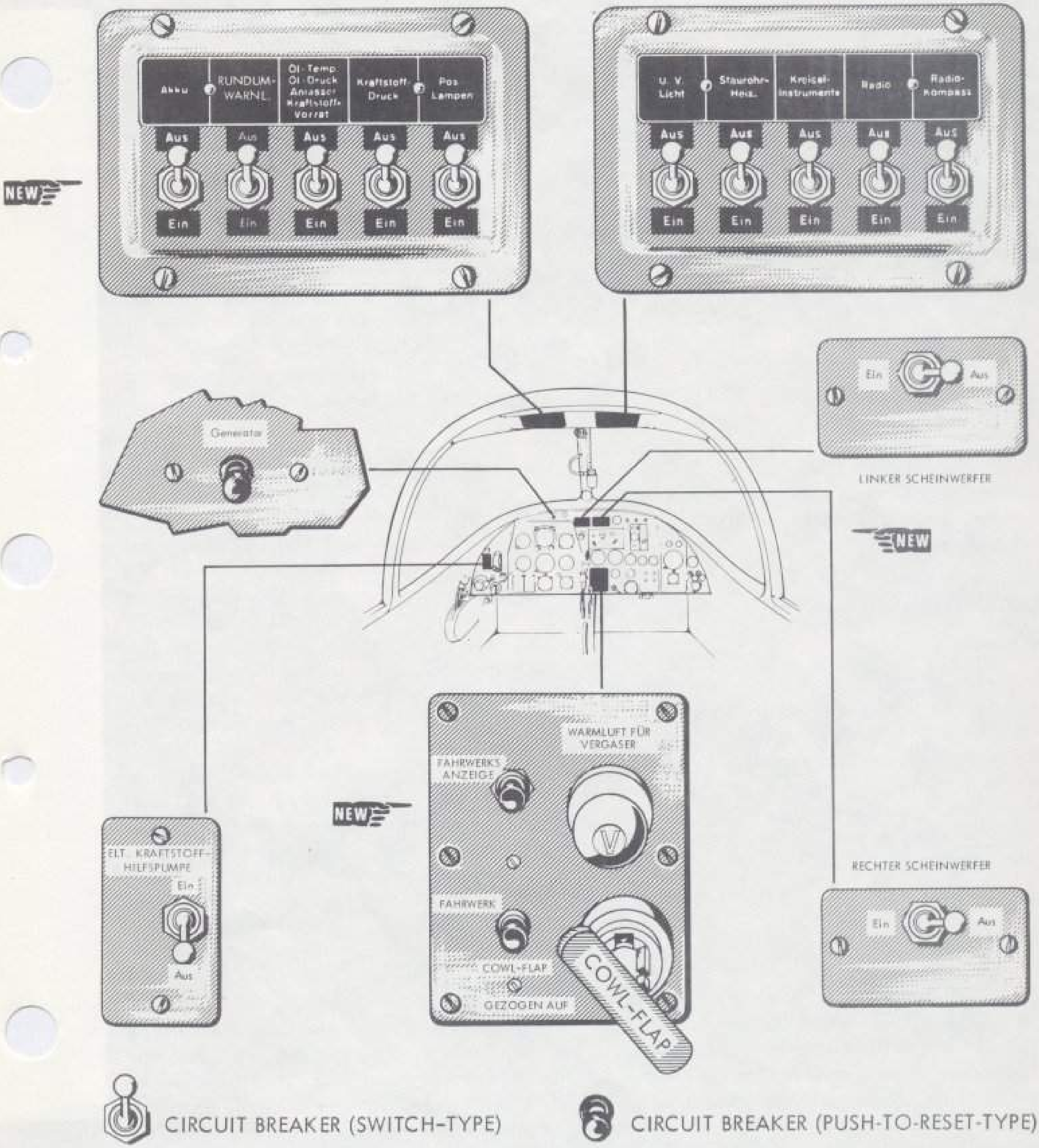


Figure 1-10

FLIGHT CONTROL SYSTEM.

The primary flight control surfaces (ailerons, rudder, and elevator) are controlled by dual control sticks and rudder pedals through a conventional cable system. The rudder pedals are also used for actuating the wheel brakes and for nose wheel steering. Trim tabs on the elevator and rudder are mechanically operated from the center engine control box and instrument panel (refer to trim tab controls).
The aileron trim tabs are adjustable on the ground only. A flight controls lock is provided on the L/H control stick and the L/H rudder pedals (figure 1-11).

FLIGHT CONTROLS

CONTROL STICK

The conventional dual control sticks are arranged in parallel. The R/H control stick can be removed from the guide sleeve and spring detent assembly.

RUDDER PEDALS

Two sets of rudder pedals are provided to operate the rudder through a cable system. The pedals are interconnected. The wheel brakes are actuated by applying toe pressure to the rudder pedals (refer to brake system). Rudder pedal movement also controls the nose wheel steering system (refer to nose wheel steering system).

TRIM TAB CONTROLS

Rudder and elevator trim tab controls are provided. The rudder trim tab control knob (31, figure 1-3) is located on the instrument panel. The elevator trim tab control wheel is located on the center engine control box. Trim tab position indication is provided at each trim control location (30, figure 1-3 and figure 1-5). With the pointers at zero, the tabs are in neutral position.

WING FLAPS.

Mechanically operated conventional wing flaps on each wing extend are located between ailerons and fuselage. The wing flaps are actuated by a flap control lever over a range of 43 degrees to the full down position. An emergency flap actuation system is not provided.

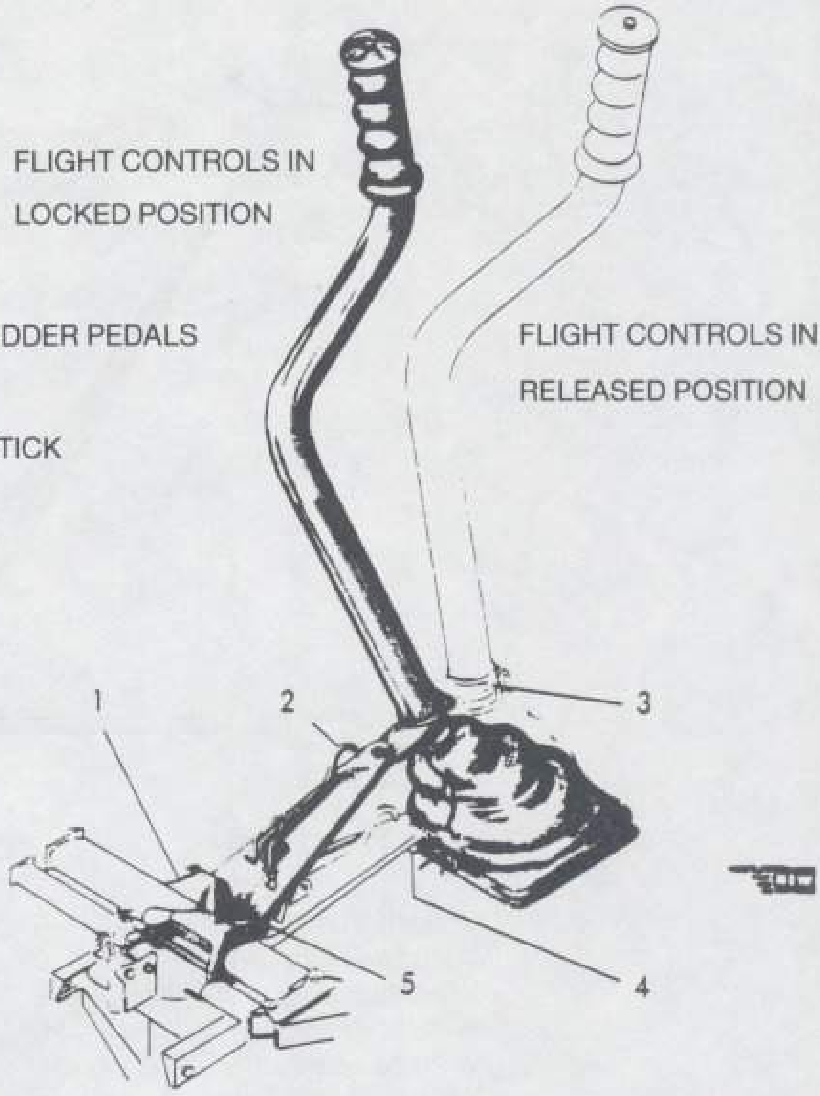
WING FLAP LEVER

The wing flap lever (figure 1-12) is installed between the front seats and is mechanically linked to the wing flaps. The lever can be moved into six arrest positions in a ratchet. The lever is locked in the desired position by a spring-loaded pawl. To unlock the lever, a thumb-button on the upper end is depressed and the pawl cleans the ratchet.

LANDING GEAR SYSTEM.

The landing gear is of the fully retractable tricycle type with a steerable nose wheel and two main wheels. Supplied with power from the aircraft electrical system, a single reversible electrical motor actuates the landing gear through a gearbox and linkage consisting of push-pull rods and bellcranks. Up and down limit switches in the system automatically deenergize the motor when the fully up or fully down position is reached. A toggle switch on the instrument panel (11, figure 1-3) controls the extension and retraction cycles. A safety microswitch on the R/H shock strut opens whenever the weight of the aircraft acts on the strut, thus preventing accidental retraction of the landing gear on the ground. The extension cycle from the fully retracted position is completed in approx. 2 seconds. Approx. 4 seconds are required for the retraction cycle. Position indicators, a warning light, and a warning horn provide visual and audible gear position indications to the pilot. The landing gear can be manually extended by means of an emergency handcrank provided adjacent to the front seat's. A push-to-reset type circuit breaker (figure 1-10) on the instrument panel protects the landing gear motor

FLIGHT CONTROLS LOCK



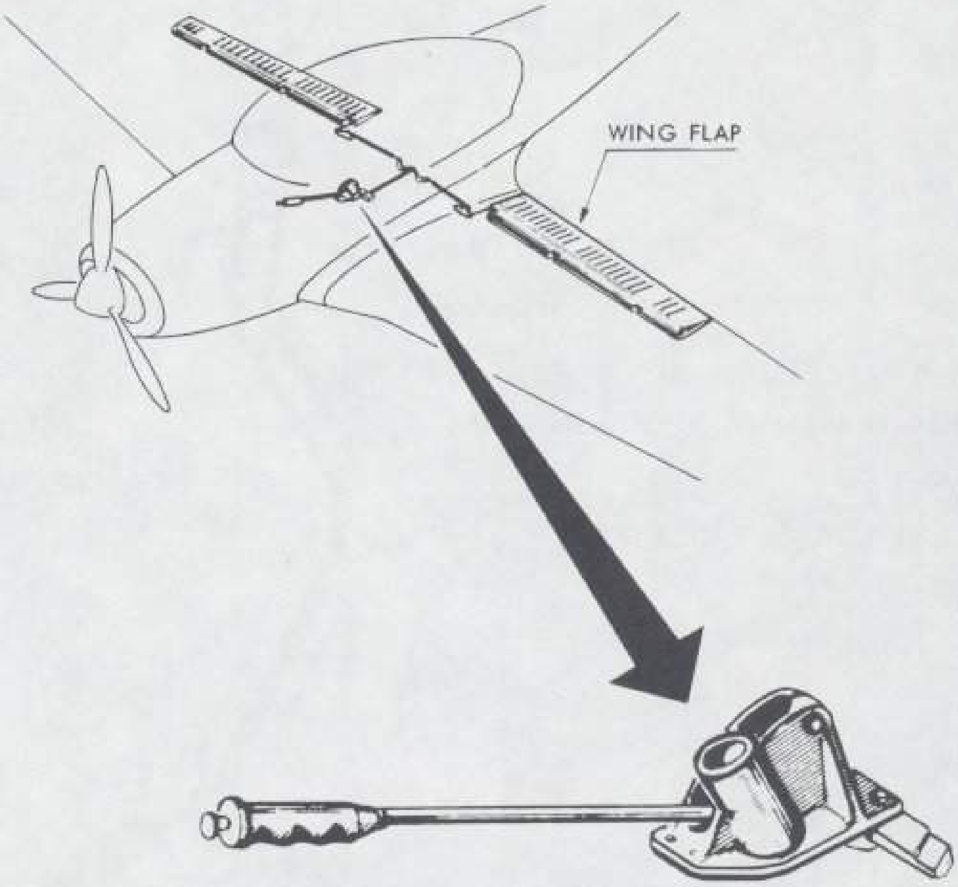
1 LOCKING CAM ON PILOT'S RUDDER PEDALS
2 RETAINING HOOK
3 CLAMP ON PILOT CONTROL STICK
4 LOCKING PIN
5 TENSION SPRING

Note

The rudder pedals and control stick can be locked only when the rudder is in neutral position.

Figure 1-11

WING FLAPS

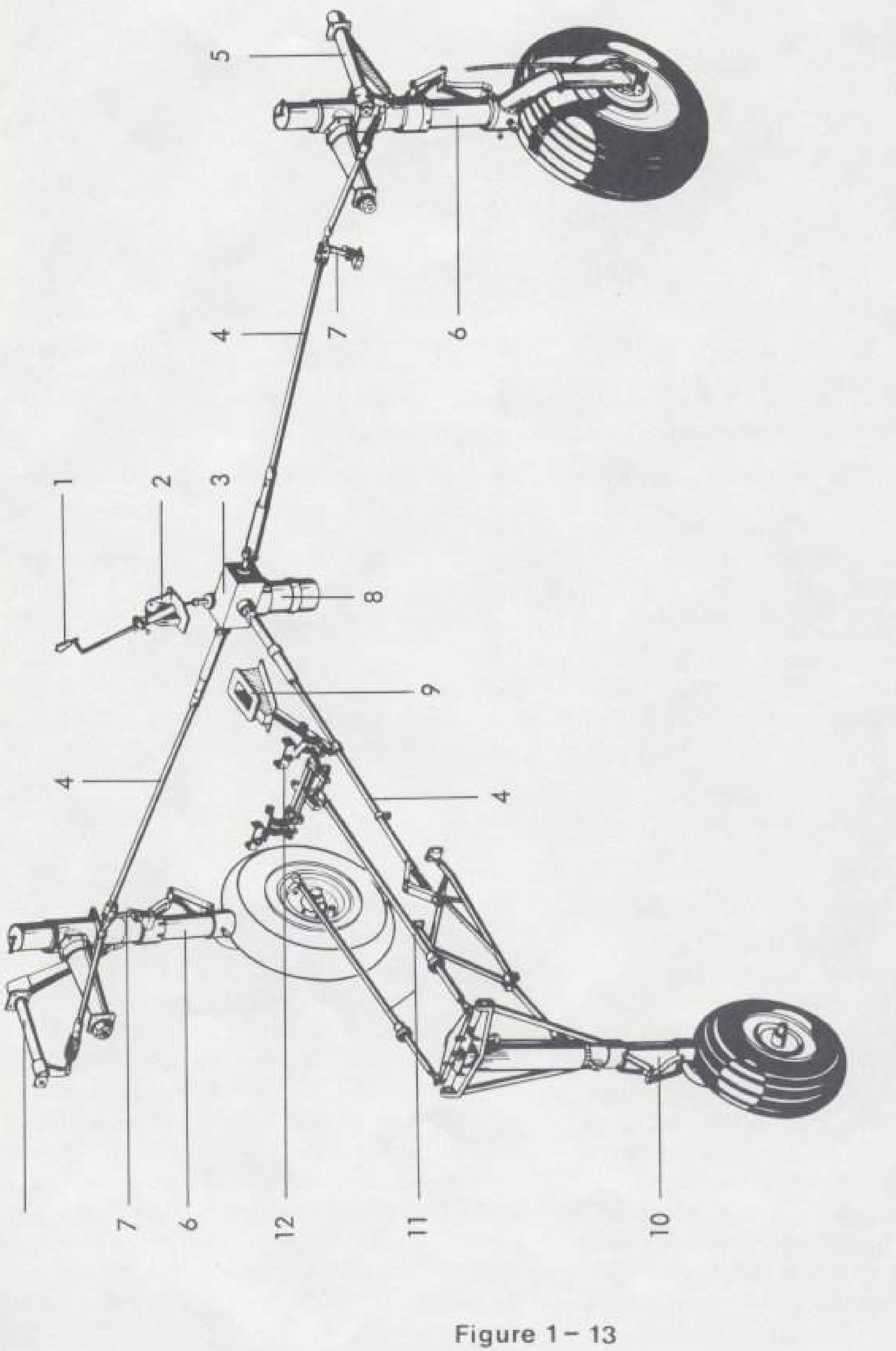


WING FLAP LEVER

Wing flap position I – Rest 0 – 0° (flaps up)
Wing flap position II – Rest 1 – 9°
Wing flap position III – Rest 2 – 18°
Wing flap position IV – Rest 3 – 26°
Wing flap position V – Rest 4 – 35°
Wing flap position VI – Rest 5 – 43° (flaps down)

Figure 1-12

LANDING GEAR SYSTEM



1 EMERGENCY HANDCRANK
2 CRANK HOUSING
3 GEAR BOX
4 PUSH-PULL ROD
5 TORQUE TUBE
6 MAIN GEAR SHOCK STRUT
7 BELLCRANK
8 LANDING GEAR MOTOR
9 MECHANICAL POSITION INDICATOR
10 NOSE GEAR SHOCK STRUT
11 NOSE WHEEL STEERING LINKAGE
12 PILOT'S RUDDER PEDALS

Figure 1-13

LANDING GEAR POSITION INDICATORS

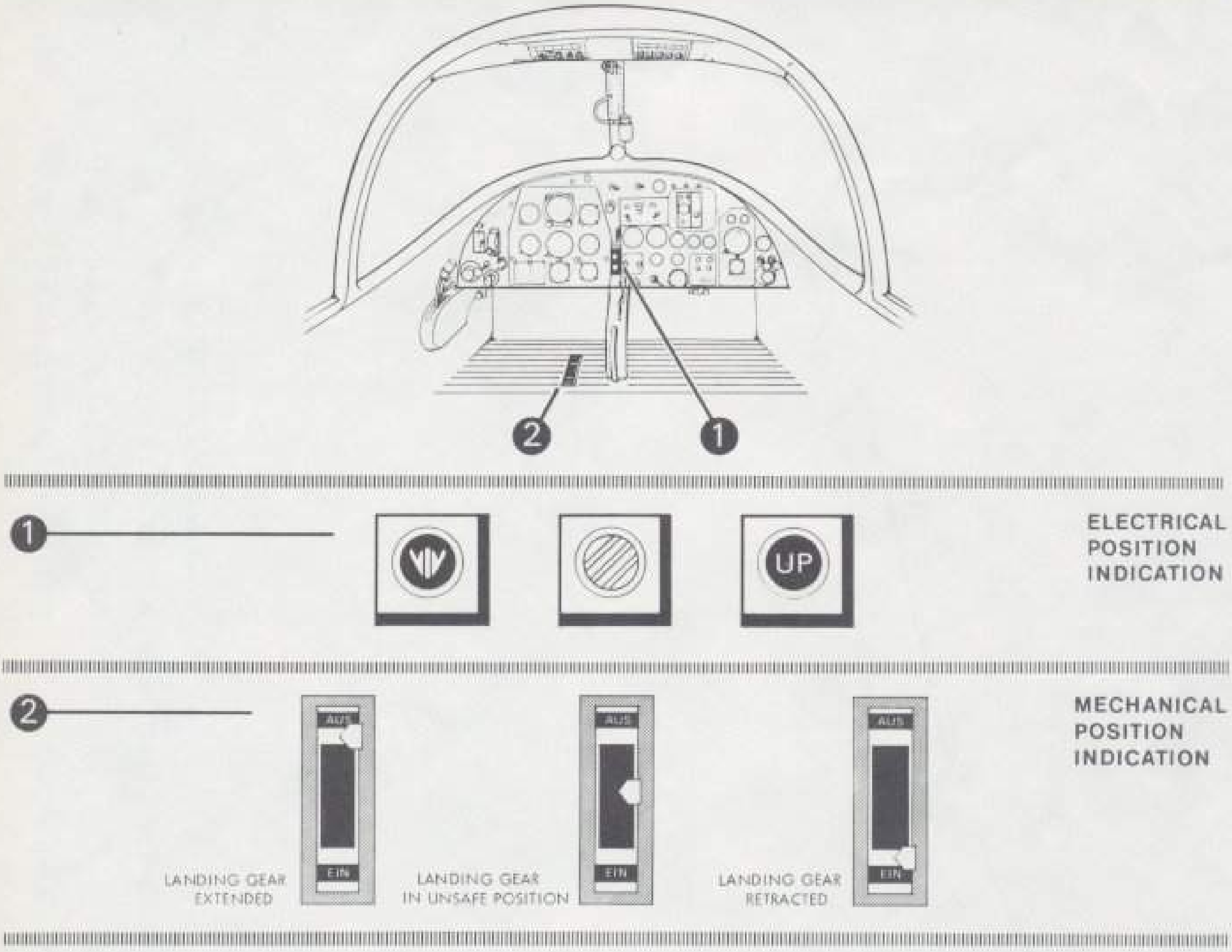


Figure 1 – 14

against overload.

LANDING GEAR SWITCH

The landing gear toggle switch (11, figure 1-3) is located in the lower center section of the instrument panel. The switch positions are UP, NEUTRAL and DOWN. When the switch is in the NEUTRAL position the landing gear motor circuit is open. The switch should be placed in the DOWN position when extending the landing gear manually. When the switch is placed in the UP position, electrical power is routed from the busbar through a limit switch and solenoid switch to the landing gear motor, and the nose and main gears retract simultaneously.

Note

After retraction, the landing gear switch will be placed into the NEUTRAL position.

When the landing gear is fully retracted, an up-limit switch on the actuating gearbox disconnects the electrical power from the motor. When the landing gear switch is placed in the DOWN position, the landing gear circuit is energized and the nose and main gears extend simultaneously. When the extension cycle is completed the actuating linkage locks in an over-center position and a down limit switch cuts off electrical power to the motor.

LANDING GEAR POSITION INDICATORS

Landing gear position (figure 1-14) is indicated by two electrically operated indicators on the instrument panel, one for the nose gear and one for the L/H main gear (36-37, figure 1-3). When the landing gear is fully extended, two miniature wheels with vertically arranged black and white stripes are displayed on the annunciators. When the landing gear is in an unsafe position diagonal red and green stripes are indicated. When the landing gear is fully retracted the letters "UP" appear on the landing gear position indicators. In addition, a pointer - driven by a push-pull rod of the nose gear to the mechanical indicator - shows the position of the nose gear. The indicator range is limited by two end markings UP and DOWN in luminescent paint. The landing gear is fully extended when the pointer is aligned with the end marking "DOWN".

EMERGENCY HANDCRANK

An emergence handcrank is installed between the front seats. The emergency handcrank is used for manual operation of the landing gear in case of landing gear motor failure. When not in use the handcrank is folded into a stowed position.

If the use of the handcrank is required, it is unfolded from the stowed condition and rotated forward until it locks in position. A mechanical linkage disengages the actuator gearbox from the landing gear motor and engages it with the handcrank mechanism. During manual extension of the gear, the landing gear switch must be in the DOWN position and the gear action and indicator circuit breakers must be pulled OUT. When the handcrank is turned, the actuator gearbox is operated by a mechanical linkage. The handcrank is stowed by pulling the lock release knob and folding the handle back.

CAUTION

In stowed position the emergency handcrank must be firmly locked in the bracket. Ensure that the handcrank shaft actuates the microswitch. Failure to comply with this requirement will result in an open landing gear control circuit. Use the emergency handcrank only to extend, never to retract the landing gear, as excessive loads may cause wear on the mechanism.

LANDING GEAR WARNING HORN AND WARNING LIGHT

The landing gear warning horn and warning light are controlled electrically by the throttle and will sound and illuminate if the throttle is retarded below approx. 0.3 ata of manifold pressure while the landing gear is not in the down position.

CAUTION

The warning horn and the warning light are connected through the down limit switch and will cease sounding and illuminating only when both gears are down. In case of a landing gear malfunction, the absence of the landing gear warning horn and warning light does not necessarily mean the landing gear is down.

EXTERIOR GEAR POSITION INDICATOR LIGHTS

To aid in determining gear position from the ground at night, a busbar-powered white light is installed in each main wheel well. Each light comes on when the landing gear is in down position and the safety switch (microswitch) on the right shock strut is closed.

STEERING SYSTEM.

The nose wheel is steerable with the rudder pedals up to 15° either right or left of the neutral position (figure 2-2) (turning radius of the aircraft).

Note

Unless absolutely necessary, do not turn the aircraft with one wheel locked as this will result in tire scuffing and wear.

EMERGENCY HANDCRANK

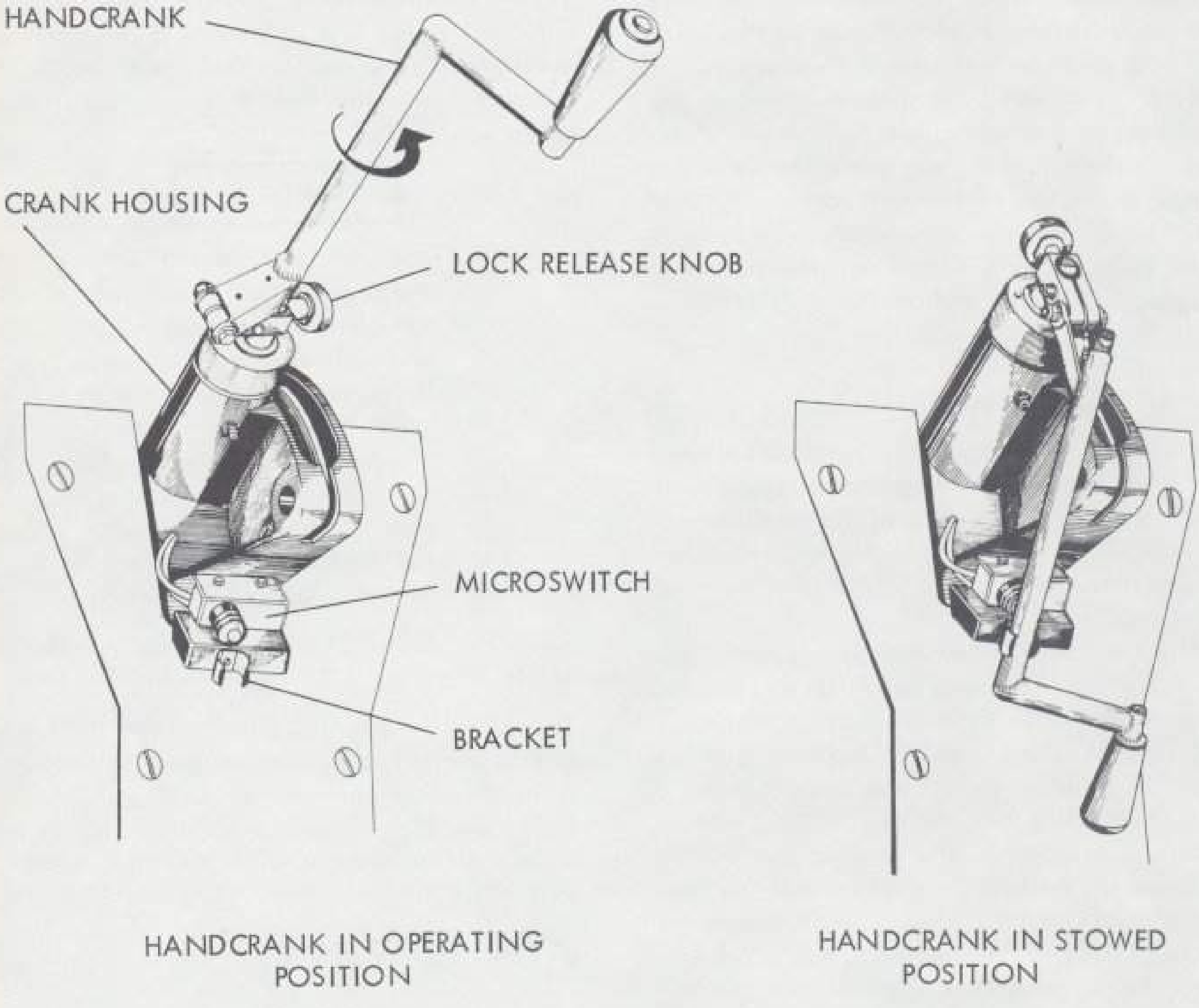


Figure 1 – 15

Upon initiating the retraction cycle, the steering linkage automatically disconnects from the nose wheel. During retraction the nose wheel is automatically brought into neutral position.

BRAKE SYSTEM.

The main wheel hydraulic brakes are operated by applying toe pressure to the pilot's or copilot's rudder pedals. Brake pressure is generated in the brake master cylinders. From the master cylinders pressure is transmitted to the shuttle valves and from there to the brakes. For parking the aircraft the brakes are hydraulically locked by depressing one pedal pair and moving the parking brake handle (figure 1-16) - located on the instrument panel - to the "LOCKED" position. To release the parking brake, the handle is returned to the "UNLOCKED" position. There is no emergency brake system installed in the aircraft.

BRAKE PEDALS

Conventional toe-type pedals (figure 1-16) consist of the upper part of the pilot's and copilot's rudder pedals. Hydraulic brake cylinders are directly connected to both rudder pedal pairs.
Mechanical linkage between pilot's and copilot's rudder pedals is not provided. Operation of the pilot's or copilot's brake pedals actuates the brake cylinders and hydraulic power is routed to the main wheel brake cylinders. Refer to section VII "BRAKE OPERATION".

FLIGHT INSTRUMENTS.

For information regarding instruments which are an integrated part of a particular system, refer to applicable paragraphs in this Section and Section IV.

PITOT STATIC SYSTEM

The airspeed indicator, altimeter, and vertical speed indicator receive air data from the pitot static system. This system measures the difference between ram air pressure entering the pitot tube, mounted on the left wing and the ambient air pressure prevailing at the static ports on the left side of the fuselage. The airspeed indicator is connected to the pressure and static side of the system. The altimeter and vertical speed indicator are connected to the static ports. Whenever the aircraft is parked, a cover must be placed over the pitot head to prevent foreign matter from entering the system.

AIRSPEED INDICATOR

The airspeed indicator (38, figure 1-3) consists of a pitot static operated mechanism which moves a pointer on a dial to indicate airspeed. The airspeed indicator dial has two scales. Graduations on the outer scale are provided for each five and ten knots. The inner scale has graduation marks for each ten knots.

ALTIMETER

The altimeter (6, figure 1-3) is essentially a barometer graduated to indicate atmospheric pressure in terms of altitude in feet. The altimeter dial ranges from minus 1 000 feet to plus 50 000 feet. Two pointers are provided on the dial face, one indicates in hundreds of feet and the other in thousands of feet. A center disk with warning stripes appears at altitudes below 10 000 feet. The disk is visible through a window on the right side of the dial. A barometric scale is visible through a window in the lower center of the dial and is adjustable by a knob on the front side of the instrument.

VERTICAL SPEED INDICATOR

The vertical speed indicator (45, figure 1-3) indicates rate-of-climb or descent in feet per minute or gives an indication of level flight.

ATTITUDE INDICATOR

The attitude indicator (41, figure 1-3) shows

HYDRAULIC BRAKE SYSTEM

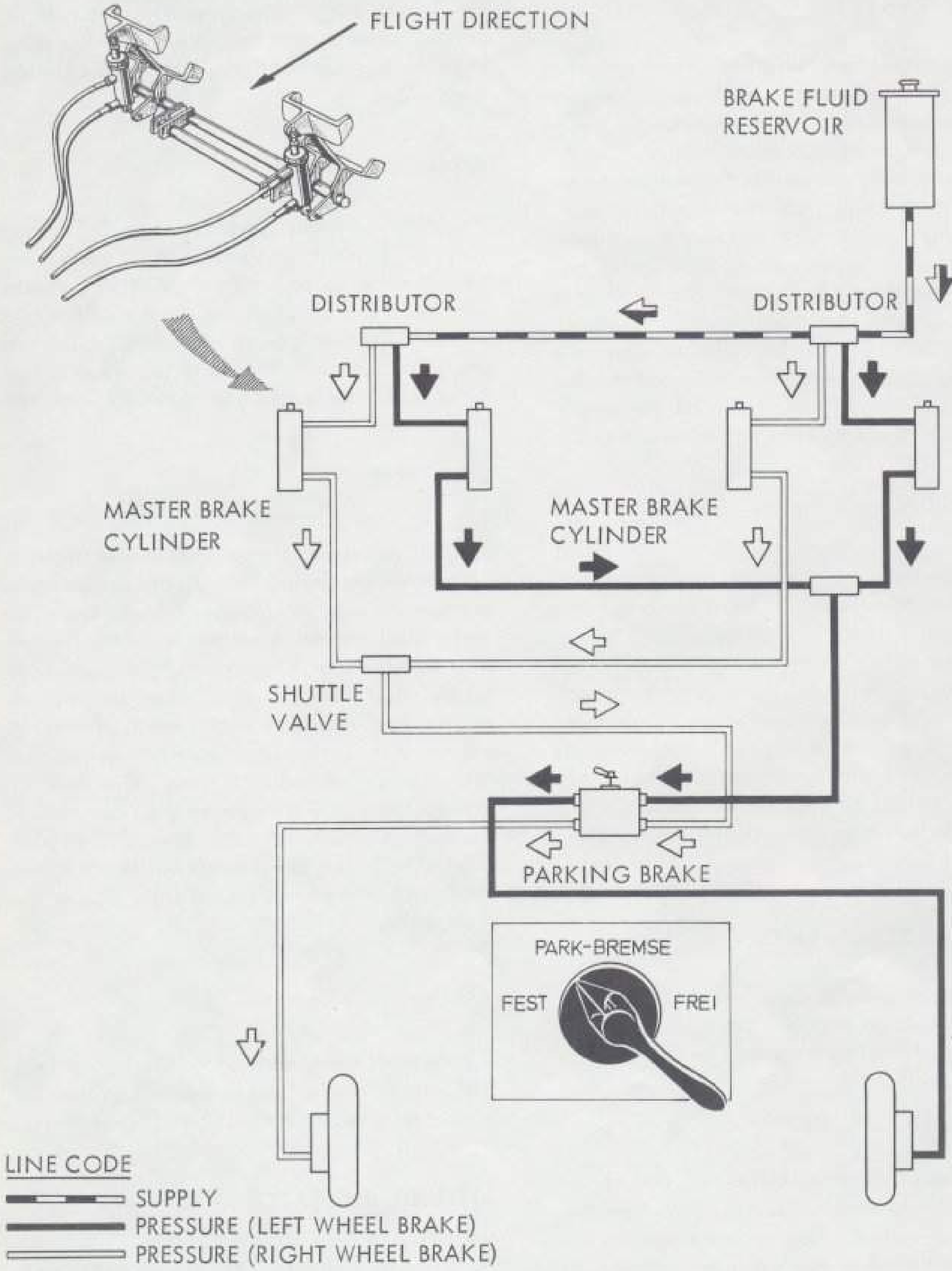


Figure 1 – 16

the attitude of the aircraft in relation to the horizon. The indicator contains a sphere which is affixed to an electrically driven gyro. When in operation, the gyro assembly remains vertical to the horizon regardless of the position of the indicator case. The relative position of a miniature aircraft on the sphere and the attitude bar on the face of indicator show the attitude of the aircraft. The attitude indicator is limited to 100 degrees of bank and 70 degrees of pitch. The "PITCH DATUM" knob in the lower center of the indicator raises or lowers the miniature aircraft to compensate for a nose-down flight condition. The "FAST ERECTION" knob (PUSH LEVEL FLIGHT ONLY) is used to stabilize the gyro. After the attitude indicator has been switched on it will require approximately 15 seconds for the gyro to reach operating speed. The instrument error during acceleration and deceleration is negligible. The flag alarm indication ("OFF"), at the top of the dial, warns of insufficient electrical power to maintain required gyro speed. The gyro operated on 115 volt, 400 cycles. 3 phase AC power which is supplied by an alternate inverter.

A standby attitude indicator (23, figure 1-3) is located on an additional small shock-mounted panel on the R/H side of the instrument panel. The standby attitude indicator is similar in operation to the attitude indicator.

DIRECTIONAL INDICATOR

The directional indicator (7, figure 1-3) provides magnetic heading information for the pilot. By means of a moving compass card, it provides a self-synchronizing, non-ambiguous dead-beat indication, free from turning and acceleration errors and gyro drift. Provisions are made for course setting. The dial is graduated from 0 to 36, which corresponds to 0-360°. A D.G. switch is provided in the upper L/H corner of the indicator. When turning the switch to the left, the "DG" or "KK" annunciator flap appears on the annunciator in the upper R/H corner of the indicator. When D.G. is selected, the detector unit monitoring signal is cut off and the instrument functions as a directional gyro. Changes of aircraft attitude about the longitudinal and lateral axes up to 85 degrees will induce only a negligible indication error. When turning the switch to the right, "COMPASS" is selected, the directional indicator is monitored by the detector unit and functions as a directional gyro synchronized to the earth's magnetic field. The cross or dot markings which appear on the annunciator must be adjusted with the synchronizing knob in the lower R/H corner of the indicator, so that "×" or "●" is partially visible. During flight, annunciator indication changes continuously from the cross to the dot. this shuttle action results from the gimbal suspension of the detector, which responds to all aircraft movements. After prolonged turns, al slight error in indication is possible; therefore do not resynchronize sooner than 1 minute after termination of the turn. The "SET HEADING" knob is located in the lower L/H corner of the indicator. The corrector control box contains the system fuse and two potentiometers for compensation in the north-south and the east-west axes. The directional gyro is operated by 28-volt DC power provided by the busbar, and by 115 volt, 400 cycles, 3-phase AC power, which is supplied by an alternate inverter. The directional gyro system is protected by a circuit breaker switch, located on the circuit breaker (overhead) panel.

MAGNETIC COMPASS

A conventional magnetic compass (12, figure 1-3) suspended from the center windshield divider, is provided for navigation in case of instrument or electrical system failure. The magnetic compass correction card is located on the lower L/H side of the instrument panel.

TURN-AND-SLIP INDICATOR

The turn-and-slip indicator (42, figure 1-3) is of the four-minute type and is basically two instruments in one, a gyro turn indicator and an inclinometer. The turn indicator contains an electrically-driven gyro mounted in a gimbal. Any change of direction during flight causes the gyro to precess and move the needle. When the needle is aligned with either the left or right turn rate scale, it indicates a

CANOPY HANDLE

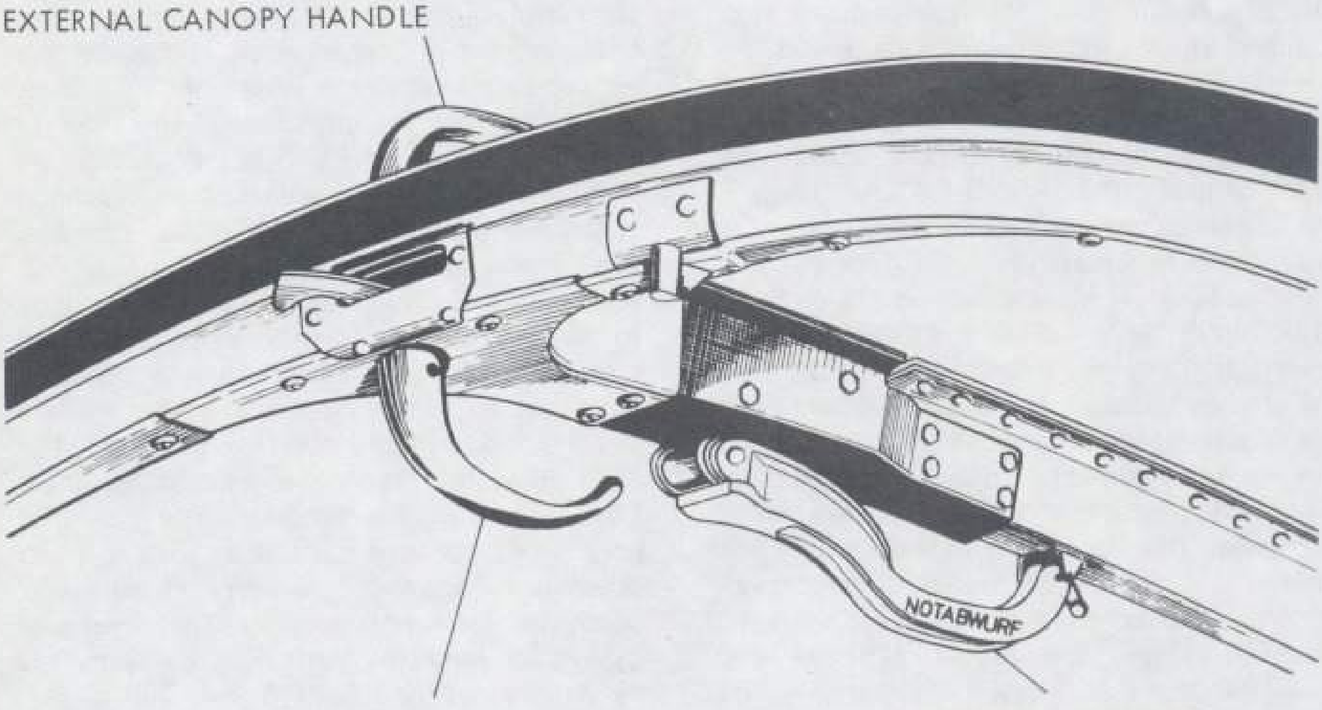


Figure 1-17

standard rate turn. The inclinometer consists of a black glass ball moving within a liquid-filled tube and acts as a pendulum responding to lateral movements of the aircraft. During straight flight the ball responds to gravity and indicates a level condition. During a turn, the ball responds to a combination of gravity and centrifugal force to indicate correct bank corresponding to the rate of turn. The gyro operates on 115 volt, 400 cycles, 3-phase AC power which is supplied by an alternate inverter. The circuit breaker switch is on the circuit breaker (overhead) panel. A standby turn-and-slip indicator (24, figure 1-3) is installed in an additional small shockmounted panel on the R/H side of the instrument panel and is powered by a flashlight battery in a bracket below the instrument panel.

G-METER

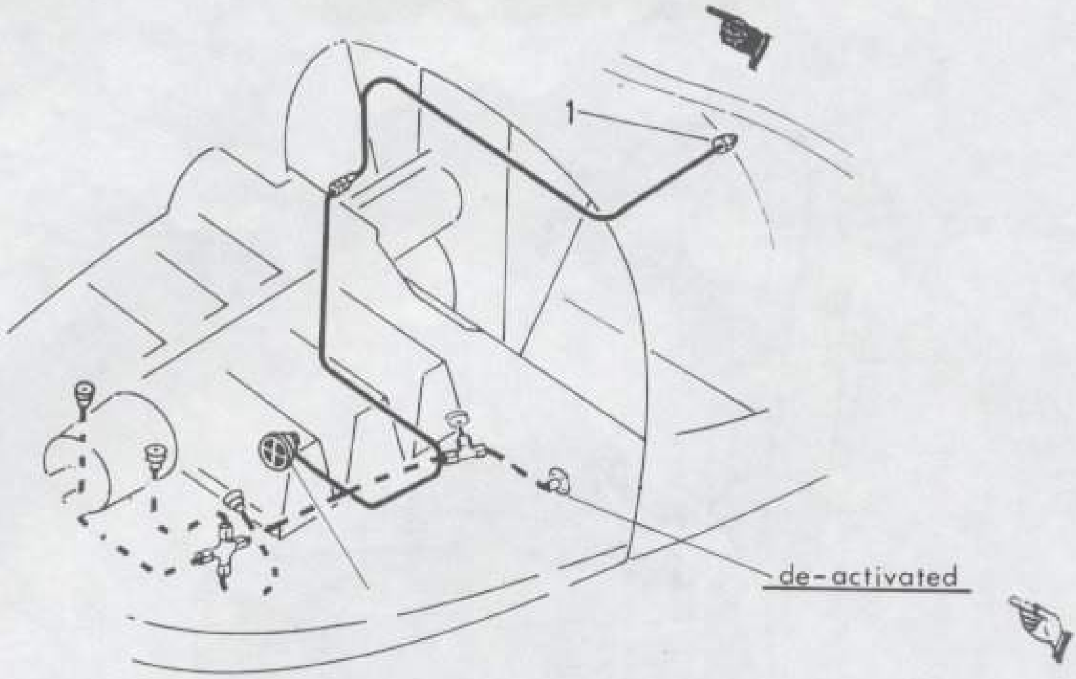
A three-pointer G-Meter (4, figure 1-3) indicates positive and negative G loads. Two recording pointers (one for positive G loads and one for negative G loads) follow an indicating pointer to the point of maximum deflection. The recording pointers remain at the maximum deflection position of the indicating pointer, thus providing a record of maximum G loads encountered. A "PUSH-TO-SET" knob is provided on the lower left corner of the instrument to return the recording pointers to the normal (1 G) position.

EMERGENCY EQUIPMENT.

ENGINE FIRE DETECTION SYSTEM

A fire detection circuit is installed in the engine compartment to detect any engine fire or overheat condition. The fire and overheat

FIRE WARNING SYSTEM



1 – FIRE WARNING LIGHT
2 – FIRE DETECTION SWITCH

Figure 1-18

detection system is controlled by a sensing switch near the carburetor and is connected to the aircraft power supply system. When fire or overheat conditions occur, a red warning light (5, figure 1-3) located on the left side of the instrument panel will illuminate.

WARNING

The fire extinguisher system has been de-activated by removing the fire extinguisher and the extinguisher line to the fire wall.
When a fire occurs in the engine compartment, proceed as described in Section III

FIRST AID KIT

A first aid kit (6, figure 1-1), stowed in a first aid kit compartment on the L/H side of the fuselage, is provided for emergency use. Access to the first aid kit compartment is only through an outside door secured with quick lock fasteners. The access door is marked with a red cross.

CANOPY.

The canopy is locked and released by operating an internal and external handle (figure 1-17) respectively. To open the canopy from the outside the handle is turned counter-clockwise. To open the canopy from the inside, the handle is turned clockwise. To enter the aircraft the canopy slides back on rails. A bad weatherwindow, which can be opened during flight, is provided in the plexiglass pane on both sides of the canopy. This devices prevents fogging of the canopy. The window also serves

FRONT SEAT

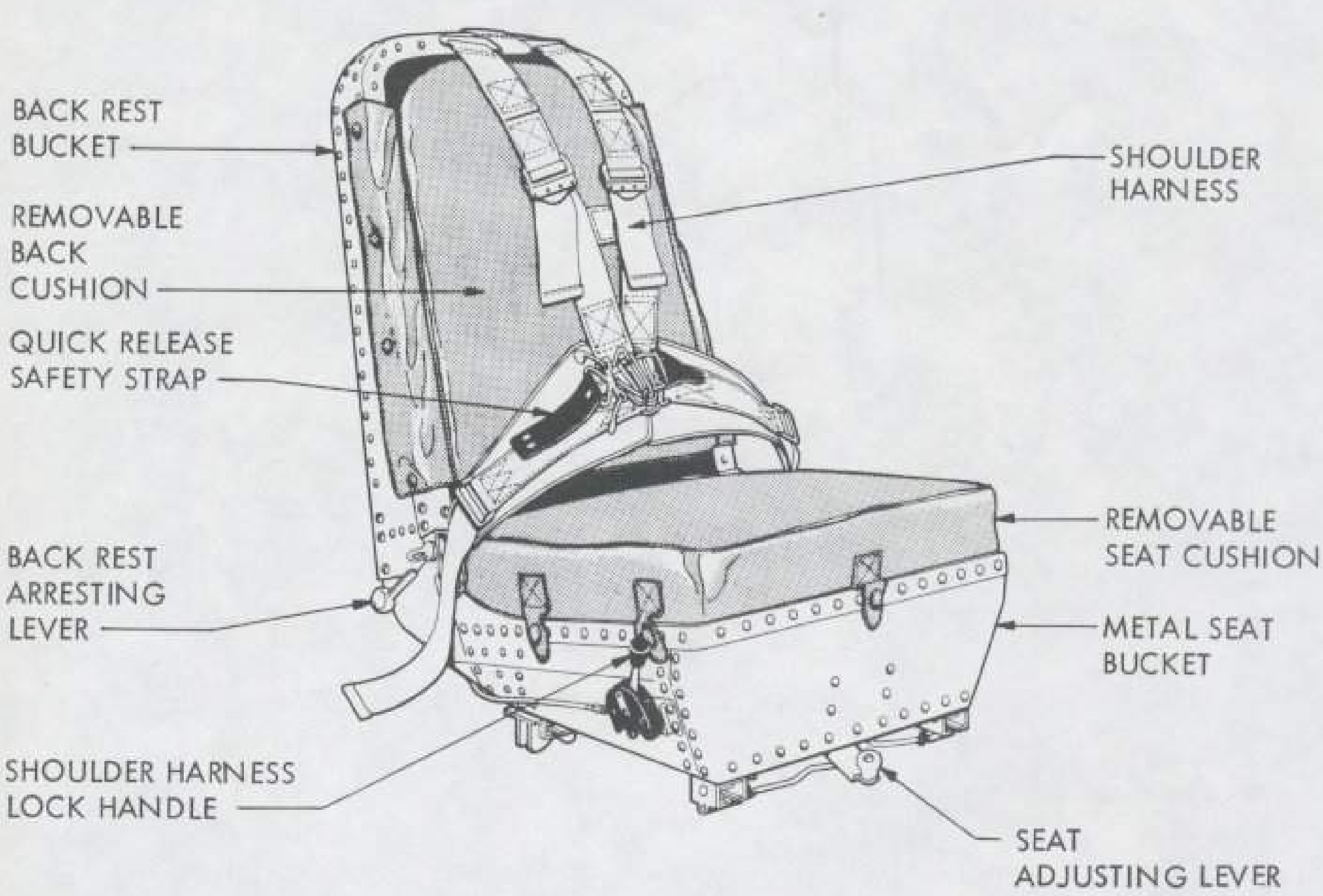


Figure 1—19

to drop messages or fire signal cartridges. The canopy may be jettisoned in emergencies. The canopy jettison actuating lever is installed on the canopy and safetied with a lead seal. The lever is painted red with white lettering spelling "Emergency Jettision". The jettison actuating lever is within easy reach of the front and passengers seats.

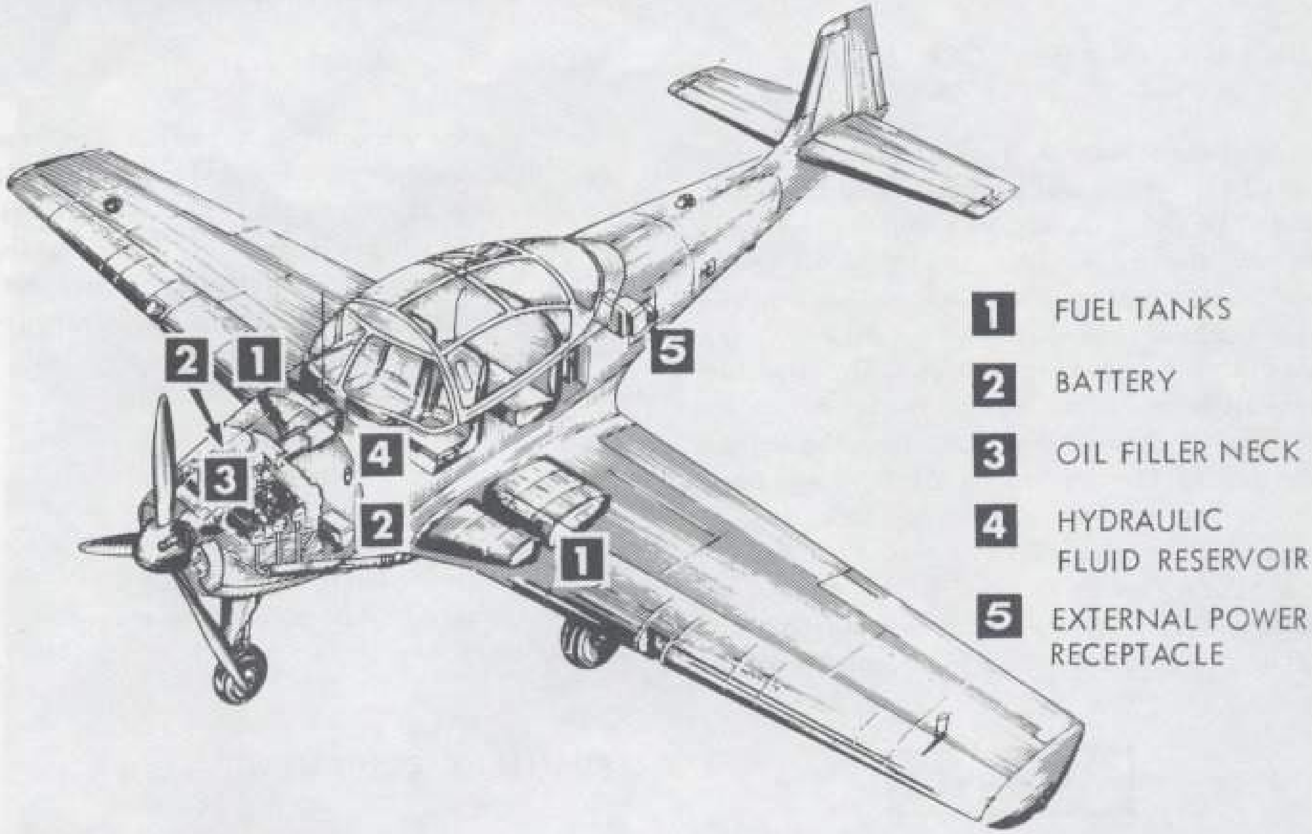
WARNING

For emergency canopy jettisoning pull jettison handle only. Do not operate the internal canopy handle before pulling the emergency jettison handle.

SEATS.

The front seats are arranged in parallel and are individually adjustable fore and aft by operating the adjusting lever (figure 1-19) below the seat edge. A removable seat bucket cushion can be replaced by a seat-pack parachute. The back-rest is released and tilted forward by operating the arresting lever (figure 1-19) for ease of passenger access to the rear seat. The arresting mechanism will engage automatically when the back rest is brought into the original position. The rear seat can accommodate two passengers. The back rest is secured with two guide pins at the lower sides and two spring detents at the upper edges. This type of fastening permits the back-rest to betilted forward and to be removed. For this purpose leather loops are provided. The back cushion is re-

SERVICING DIAGRAM



SPECIFICATIONS

		SPECIFICATION	NATO CODE
FUEL	PRIMARY	MIL - G - 5572 AVGAS 100, 100L, 100LL GRADE 100/130 OKTAN	F - 18
FUEL	ALTERNATE	MIL - G - 5572 AVGAS 100/30 GRADE 115/145 OKTAN	F - 22
OIL		9150-12-140-3271	O - 125
HYDRAULIK FLUID		MIL - H 5606E 9150-12-124-5030	H - 515

ELECTRICAL REQUIREMENTS

APU: 28 Volt DC

Figure 1-20

movable if back - type parachutes are to be used.

SHOULDER HARNESS LOCK HANDLE

A shoulder harness lock handle (figure 1 - 19), which can be positioned to "Lock" and "Unlock" is located on the left side or on the right side of the front seats. An inertia reel provided on the back of the seat bucket is connected by a cable to the shoulder harness center strap. The shoulder harness is locked by moving the handle to the forward (Lock) position. To unlock the harness the handle is moved to the aft (Unlock) position. The harness should be locked (only manually operated locks on this shoulder harness) during maneuvers and flight in rough air as an additional safety precaution during take-off and landing and in case of a forced landing.

CAUTION

All switched not readily accessible with the harness locked should be actuated before the harness lock handle is moved forward to the lock position.

To prevent entangling of the harness with the control stick, the harness is secured when the right front seat is not occupied.

BAGGAGE COMPARTMENT

The baggage compartment behind the rear (passenger) seat (9, figure 1-1) is accessible on ground or during flight. The two back rest bucket guide pins are pulled out of their spring detent bores for access to the baggage compartment. Tie-down straps in the baggage compartment secure the tool kit and any baggage.

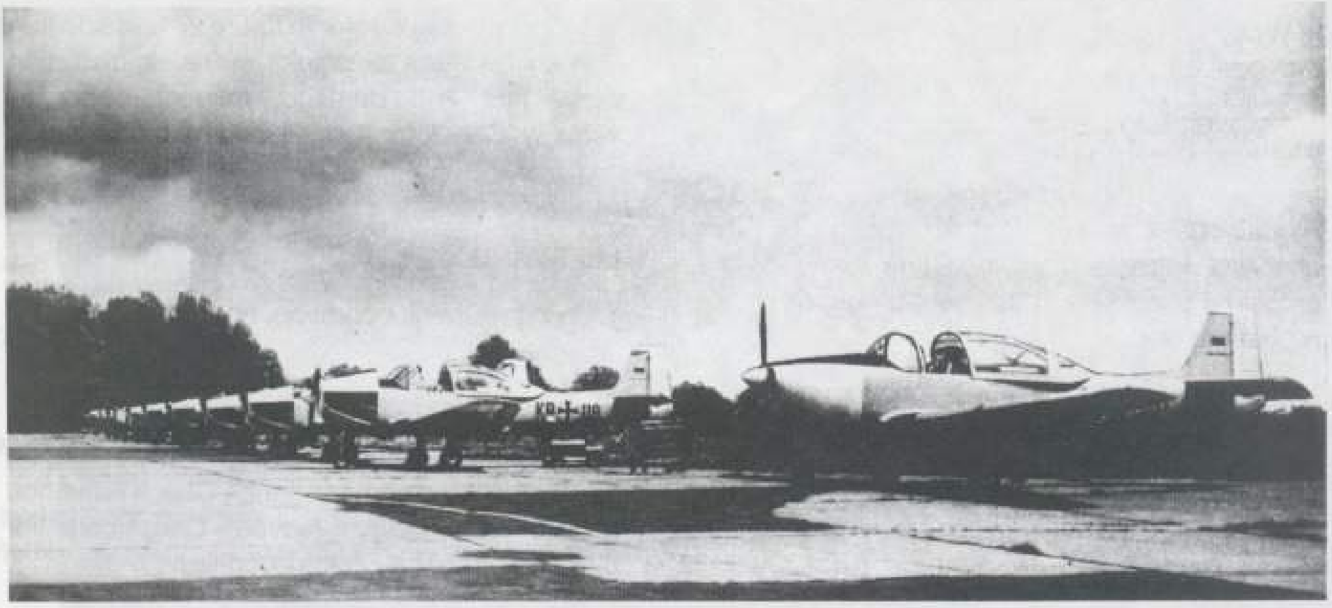
Note

The baggage compartment load is limited to 70 kg. Baggage and tool kit must alsways be securely tied down.

AUXILIARY EQUIPMENT.

Section IV contains all information pertaining to the description and operation of auxiliary equipment. Included in Section IV are the heating and ventilating systems, communication equipment, lighting equipment, and miscellaneous equipment.

Beachte OS 5-9



NORMAL PROCEDURES SECTION II

TABLE OF CONTENTS PAGE

PREPARATION FOR FLIGHT

FLIGHT RESTRICTIONS

For operating limitations applying to the aircraft refer section V of this Flight Manual.

FLIGHT PLANNING

Pre-flight planning data, such as required fuel, airspeed, power setting, takeoff, climb, cruise and landing should be determined, using the operating data contained in Appendix I of this Flight Manual. The operating data will enable you to properly plan your flight so as to obtain the best possible aircraft performance.

WEIGHT AND BALANCE

For weight and balance limitations refer to section V. Before each mission make the following checks:

1. Check takeoff and anticipated landing gross weight and balance
2. Make sure fuel, oil, and special equipment carried is sufficient for the mission to be accomplished.

CHECKLISTS

The term "CLIMATIC" as used in the checklists indicates equipment operation or control settings which may be necessary depending on the prevailing conditions.

In practice, the response to these items will be the required switch- or control position.

To prevent undue complication, this section includes normal operating procedures only. A separate abbreviated checklist, GAF T.O. 1L-P149D-1CL-1 is provided for the pilots. This checklist repeats numbered line items of the amplified checklists in this section but does not repeat the amplifications.

Mandatory Checklists cover phases of action that shall be performed in conjunction with reference to the appropriate checklist. Non-Mandatory checklists cover phases of action which cannot be performed safely in conjunction with reference to a checklist. The pilots are required to review Non-Mandatory Checklists before entering the indicated phase of action, such as Takeoff Checklist, or to use them for "Clean-UP" purposes after an emergency procedure has been completed.

ENTRANCE

The cabin is accessible from the L/H and R/H sides of the aircraft. To enter the aircraft use the wing walk areas. To open the canopy turn handle counter-clockwise and move canopy backwards.

PREFLIGHT CHECK

BEFORE EXTERIOR INSPECTION

1. AFTO-Form 781 – Check A/Cstatus
2. Ignition key – OUT
3. Battery switch – OFF
4. All circuit breakers – OFF
5. Flight controls – LOCKED
6. Elevator and rudder trim tabs – NEUTRAL
7. Flap lever – REST 1
8. Landing gear switch – DOWN
9. Oil quantity – CHECK
   Oil filler cap – CLOSE
10. Fuel quantity – CHECK
    Filler caps of both tanks – CLOSE

EXTERIOR INSPECTION

Perform exterior inspection at left wing and proceed clockwise around the aircraft. For entire exterior inspection refer to figure 2-1. In addition, check all surface for cracks, wrinkles, distortion, looserivets and damage. Inspect doors for security. Check for fuel, oil, and hydraulic leaks.

LEFT WING

1. Wing – Check condition, no skin wrinkles and leakages
2. Flap – Check condition, hinges secured
3. Aileron and trim tab – Check condition, rods and hinges secured.
4. Wing tip and position light – Check condition
5. Pitot tube – cover removed – Check condition
6. Landing light – Check condition

LEFT LANDING GEAR

1. Wheel – CHOCKED
2. Wheel and tire – Check condition, slippage marks and tire pressure
3. Landing gear strut – Check for damage and extension (approx. 5.5. cm)
4. Electrical cables and micro switch – Check for damage
5. Brake and hydraulic lines – Check for leakage x)
6. Landing gear and landing gear fairing – Check condition

x) The inspection pin, indicating brake wear, must protrude.

NOSE WHEEL

1. Wheel and tire – Check condition, slippage marks and tire pressure
2. Landing gear strut – Check for damage and extension (approx. 10 cm)
3. Landing gear and fairing – Check condition

POWER PLANT SECTION

1. Propeller – Check for excessive play, oil leaks, nicks
2. Governor linkage – SECURED
3. Engine cowling – SECURED
4. Intake ducts and exhaust – CLEAR
5. Power plant – Check for oil and fuel leakages

EXTERIOR INSPECTION

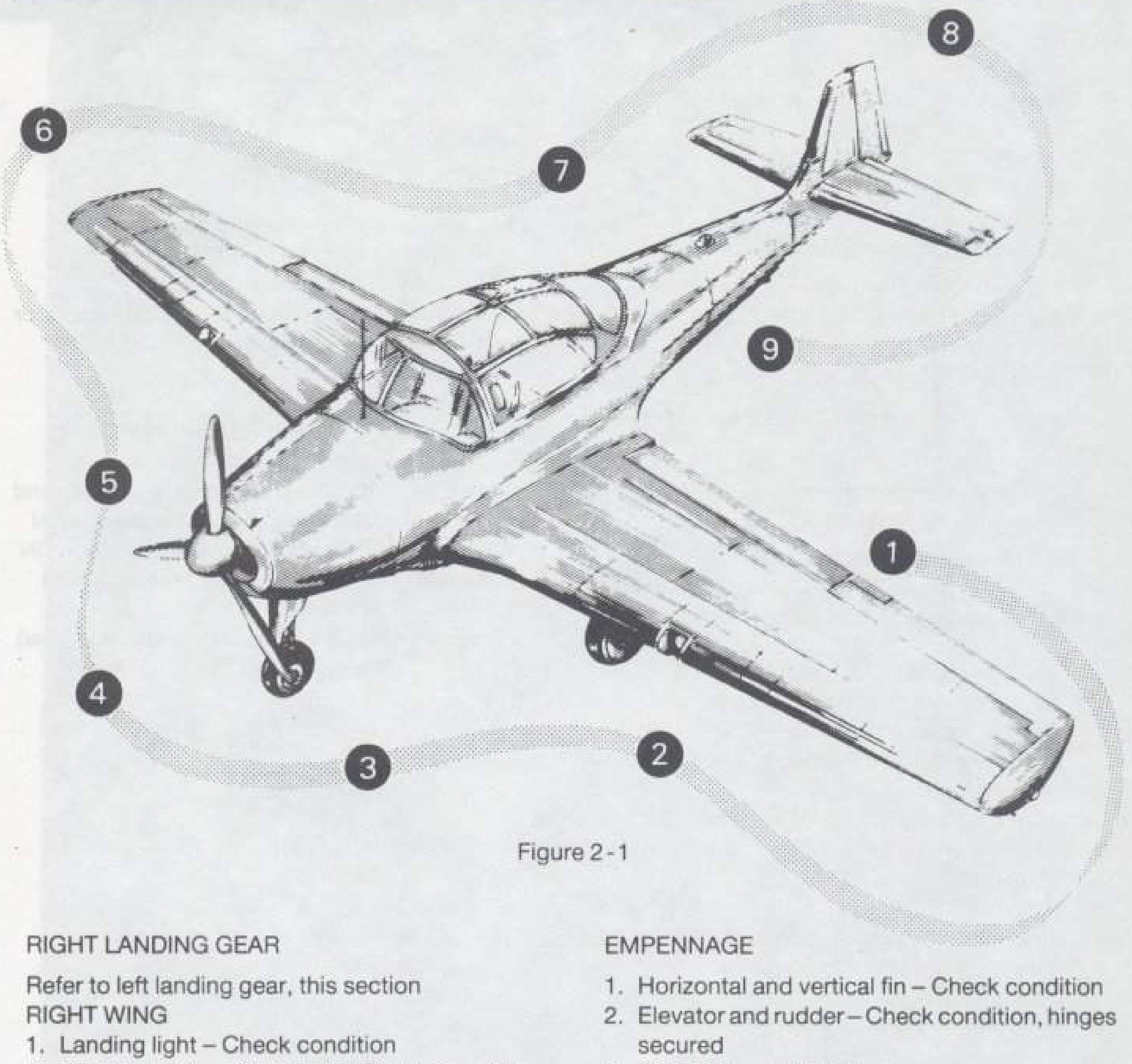


Figure 2-1

RIGHT LANDING GEAR

Refer to left landing gear, this section

RIGHT WING

1. Landing light – Check condition
2. Wing tip and position light – Check condition
3. Aileron and trim tab – Check condition, hinges secured
4. Flap – Check condition, hinges secured
5. Wing – Check condition, no skin wrinkles and leakage

FUSELAGE (RIGHT SIDE)

1. Fuselage – Check general condition
2. Inspection doors – CLOSED
3. Fuel vent – CLEAR
4. Loop antenna housing – Check condition
5. Anticollision lights – Check condition

EMPENNAGE

1. Horizontal and vertical fin – Check condition
2. Elevator and rudder – Check condition, hinges secured
3. Trim tabs – NEUTRAL
4. Tail position light – Check condition

FUSELAGE (LEFT SIDE)

1. Fuselage – Check general condition
2. Anticollision lights – Check condition
3. Static ports – CLEAR
4. First aid kit – ABOARD
5. Radio communication system crystals – CHECK
6. Radio access door – CLOSE
7. Antenna and loop antenna housing – Check condition

BEFORE NIGHT FLIGHT

If a night flight is intended, perform the following additional checks:

1. Battery switch – ON
2. UV-light – ON, adjust
3. Flashlight – Aboard
4. Stby turn-and-slip indicator – Check
5. Check in turn:
   - Anticollision lights – ON, check function
   - Position lights – ON, check function
   - Landing lights – Check function

See night flight Section IX, Page 9-2

INTERIOR INSPECTION

Perform the following checks prior to starting the engine.

WARNING

Do not enter or leave the aircraft with engine running.

1. Cockpit – Check for loose objects
2. Baggage compartment for loose objects – Baggage secured
3. Canopy emergency jettison handle – safety wired, check seal intact
4. Flight controls – UNLOCK, check for free and proper movement
5. Parking brake – SET
6. Seat – ADJUST
7. Shoulder harness – FASTEN, check for locking and unlocking function
8. Ignition key – INSERT
9. Fuel shutoff knob – IN
10. Landing gear circuit breaker – IN
11. Landing gear position indicator circuit breaker – IN
12. Carburetor heat control knob – COLD
13. Cowl-flap handle – Rest "3"
14. Stopcock – OUT
15. Landing light switches – OFF
16. Fuses/caps – TIGHT
17. Cabin heat and ventilation system – CLIMATIC
18. Trim system – Check full travel
19. Fuel tank selector – L/H TANK

20a. Flap lever – Check all 6 rests
   b. Flap lever – REST 0

21. Landing gear emergency handcrank – STOWED, safety wired, and seal intact.

Note

Make sure that the handcrank is fully down and the microswitch is depressed.

STARTING ENGINE

1. Fireguard – Posted, prop clear
2. Propeller control lever – FULL FINE
3. Throttle – OPEN 1/10
4. External power source – Connected or Battery switch – ON
5. Voltmeter – 24 V

5a. Anticollision lights – ON

6. Fire warning light – PRESS TO TEST
7. Generator circuit breaker – IN
8. Starter and fuel quantity, oil pressure, and oil temperature gages circuit breaker – ON
9. Fuel pressure indicator circuit breaker – ON
10. Landing gear position indication – DOWN
11. Fuel – Check quantity
12. Primer – Actuate 3 to 5 times (relock primer)
13. Electrical fuel pump – ON

Note

Fuel pressure indication must be within the green range.

14. Propeller – CLEAR
15. Ignition switch – "M1"
16. Starter button – PRESS
17. Immediately after the engine has fired:
   - Stopcock – fully IN
   - Ignition switch – "M1 + 2"

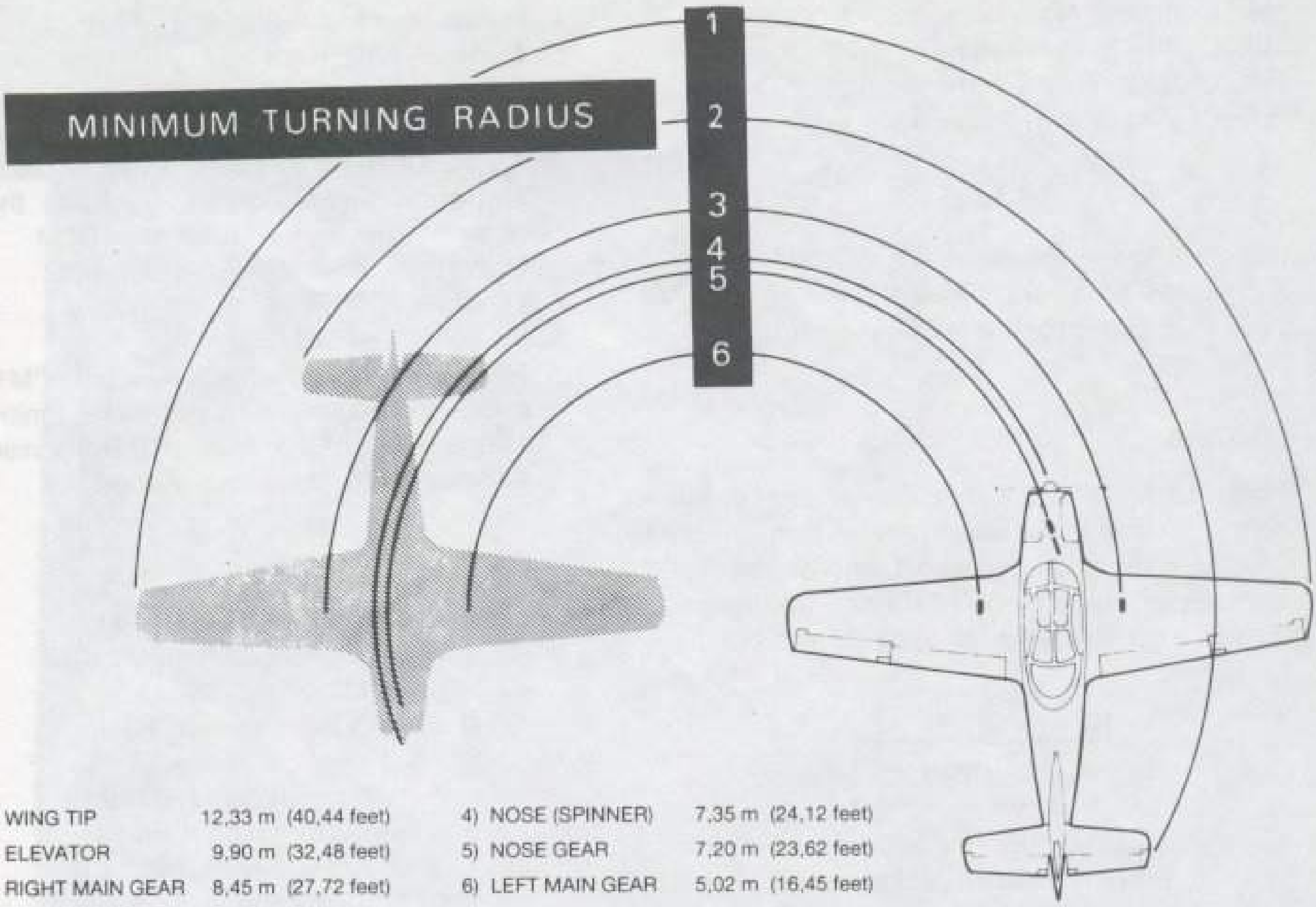
Note

If engine stops, stopcock – Immediately OUT.

18. Throttle – 1200 to 1500 RPM
19. Oil pressure – within limits

CAUTION

If oil pressure is not indicated within 30 seconds, stop the engine and determine the reason.



1) WING TIP	12,33 m (40,44 feet)	4) NOSE (SPINNER)	7,35 m (24,12 feet)
2) ELEVATOR	9,90 m (32,48 feet)	5) NOSE GEAR	7,20 m (23,62 feet)
3) RIGHT MAIN GEAR	8,45 m (27,72 feet)	6) LEFT MAIN GEAR	5,02 m (16,45 feet)

Figure 2-2

20. Electrical fuel pump – OFF, check pressure
21. If external power is used:
    - APU – disconnect
    - Battery switch – ON

BEFORE TAXIING

1. Throttle – 1200 to 1500 RPM
2. Gyro instrument circuit breaker – ON
3. Communication and navigation equipment – ON
4. Altimeter – Set to field elevation
5. Clock – wind up and check running
6. Ground out check – Perform (700 RPM) Switch off the ignition switch momentarily. If engine does not cease firing completely when the switch is OFF, the magnetos are not grounded. Shut down engine and warn personnel to remain clear of propeller until difficulty has been remedied.

CAUTION

Perform ground out check as rapidly as possible, to prevent severe backfire in the exhaust system when switch is again switched to M 1 + 2.

7. Landing lights – Check
8. Electrical system – Check
    - Advance throttle to 1500 RPM, generator should cut in at approx. 1250 RPM
    - (Generator warning light – OUT)
    - Check voltmeter indication of 24-28,5 V
9. Carburetor heat – Check, watch RPM drop
10. Directional indicator – Set, compare with magnetic compass
11. Attitude indicator – erect/adjust
12. Navigation equipment – Check
13. Communication equipment – Check operation – Check intercom – Obtain taxi clearance

14. Altimeter – Note instrument error
15. Clock – Set to twr time
16. Chocks – Removed
17. Parking brake – Release

Note

Power increase above 1500 RPM is not allowed at oil temperature below 50° C.

TAXIING

Refer to figure 2-2 for minimum turn radius. Primary controls for taxiing the aircraft are the throttle, steerable nose wheel, and brakes. Coordinate these controls for easy taxiing and observe the following instructions and precautions:

CAUTION

Avoid abrupt movements to prevent sudden acceleration and deceleration which will decrease the life and reliability of the engine.

1. Allow the aircraft to roll straight ahead, check brakes with throttle closed. Apply brake pressure evenly and firmly
2. Check operation of all turning instruments during taxiing
3. The nose wheel is steerable by means of the rudder pedals and provides ample control of the a/c under all normal taxiing conditions.
4. With the throttle you can control the taxi speed most efficiently. Most taxiing can be accomplished with it in the idle or slightly open position. Keep brake usage to a minimum.

RUNUP CHECK

After taxiing to runup position, head into the wind, and make the following aircraft and engine checks:

1. Parking brake – SET
2. Throttle – 1500 RPM
3. Engine instruments – IN THE GREEN
   - Oil temperature – 50° C min
4. Propeller control lever – FULL FINE
5. Throttle – 3000 RPM
6. Governor check
   a) RPM with propeller control lever – Reduce to 2800 RPM
   b) Throttle forward, (max. 0,85 ata) then slightly back – watch constant RPM
   c) Propeller control lever – FULL FINE
7. Throttle – 2200 RPM
8. Mag check – PERFORM
   Throttle – 2200 RPM, ignition switch – "M1", check for engine RPM decrease. Ignition switch – "M1 + 2" (to stabilize RPM). Ignition switch – "M2", check engine RPM.

Note

- Max. RPM drop – 150 RPM
- Max. difference M1 to M2 – 30 RPM

If above values are not within limits it may be necessary to retard the throttle to 1700 RPM and to wait for an oil temperature of 70° C (optimal 80° C) before repeating mag check.

9. Throttle – 1900-2000 RPM
10. Pitot heat – Check operation
11. Idling – Check 700-800 RPM
    Turn pitot heat switch ON, have ground personnel check operation, or observe decrease in voltmeter reading; the return switch to OFF.

Note

Do not exceed max 245° C cylinder head temperature.

BEFORE TAKEOFF

1. Flight controls – Check for free and proper movement
2. Rudder trim – 6,5° to the right
3. Elevator trim – Set for takeoff
4. Flap lever – REST 2
5. Shoulder harness – LOCK
6. Canopy – CLOSED
7. Canopy handle – LOCK
8. Electrical fuel pump – ON
9. Pitot heat – CLIMATIC.

TAKEOFF AND INITIAL CLIMB (Typical)

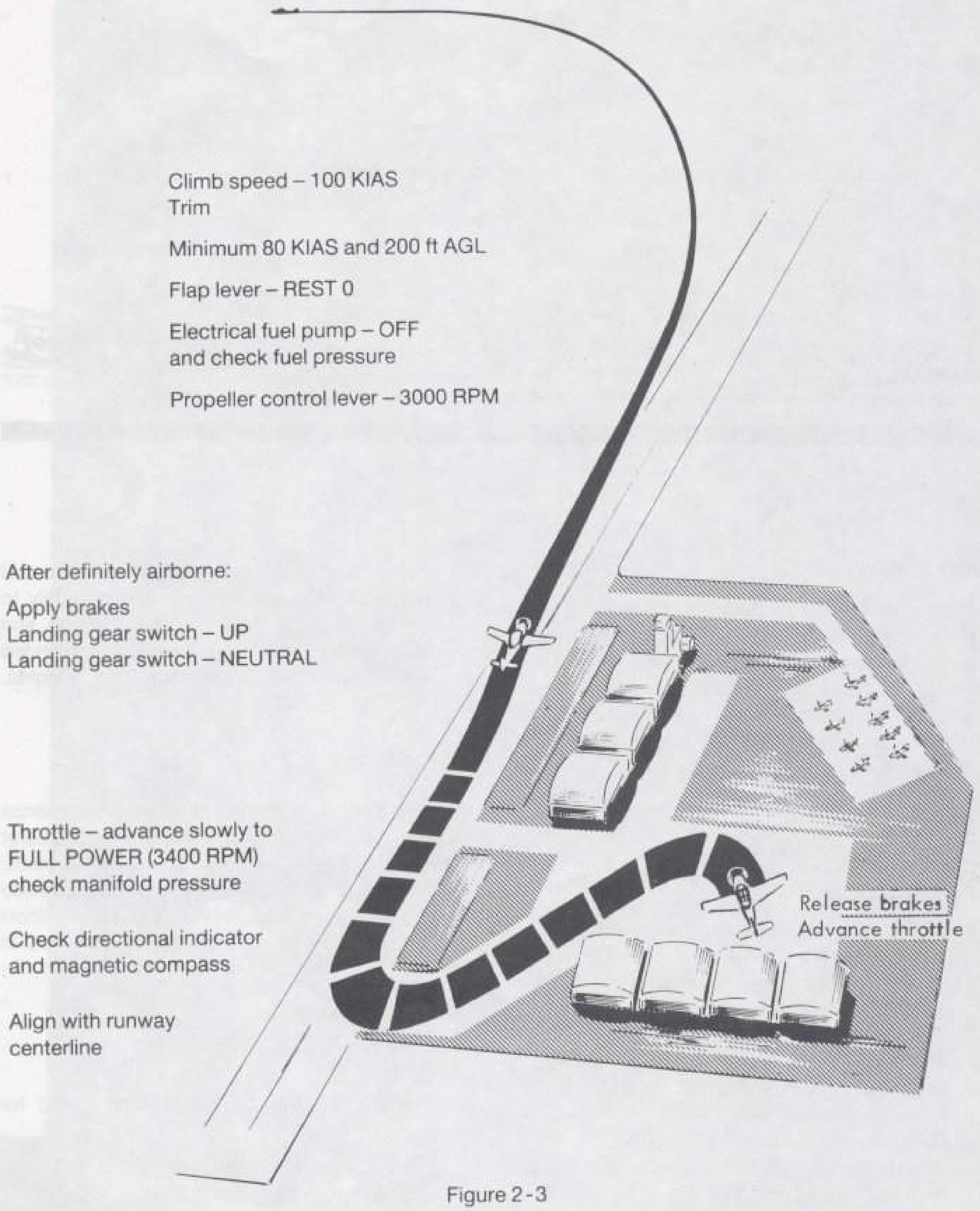


Figure 2-3

SHORT FIELD TAKEOFF (Typical)

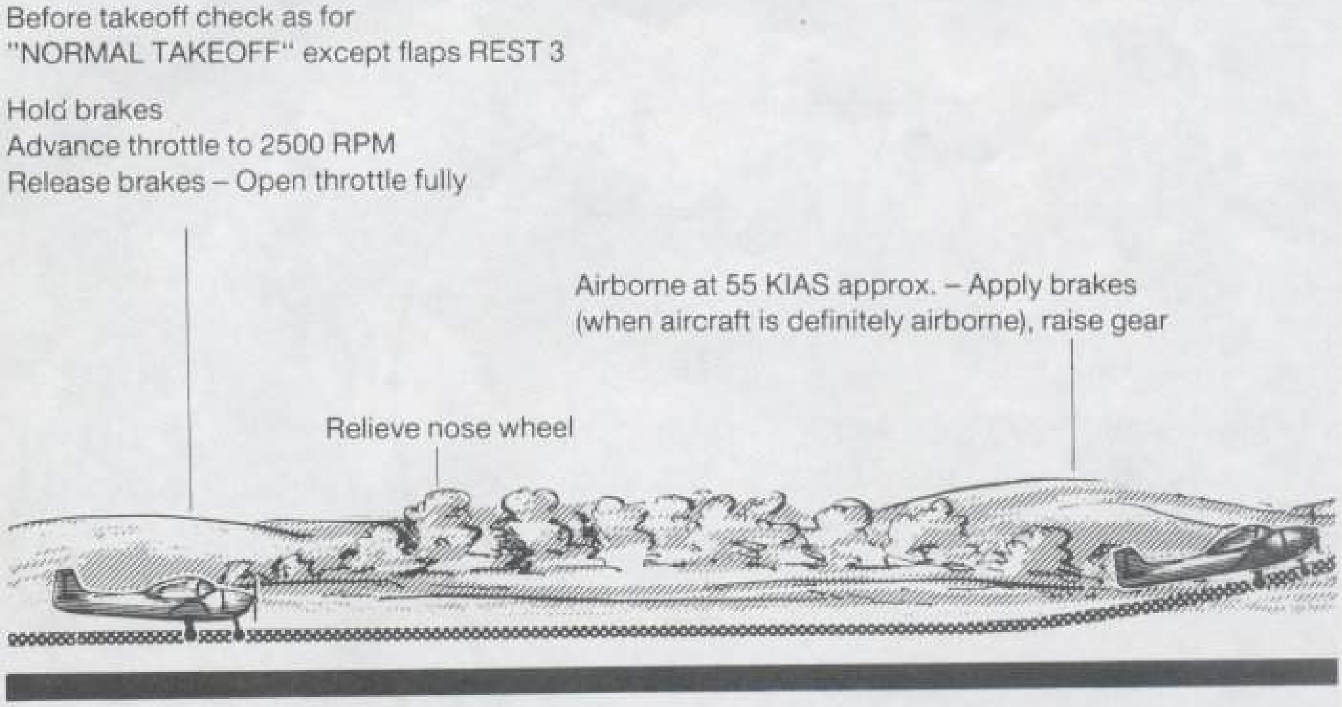


Figure 2-4
(Page 1 of 2)

TAKEOFF

Plan your takeoff according to the following variable takeoff technique: aircraft gross weight, wind, air density and outside air temperature, lenght and condition of runway and total distance to clear an obstacle and obstacle heigh. For takeoff distance to clear a 50 ft. obstacle refer to figure A 9-4.

NORMAL TAKEOFF

Refer to appendix I for Takeoff Charts and Performance Data.

1. Taxi to takeoff position and align aircraft with runway centerline
2. Check mag compass and directional indicator with runway heading
3. Throttle – advance slowly to FULL POWER (3400 RPM)
4. Manifold pressure – CHECK
5. Maintain directional control with steerable nose wheel and rudder.
   The rudder should become effective for directional control during power application.

As airspeed increases and elevator control becomes effective, lift the nose smoothly to takeoff attitude. Maintain this attitude and allow the aircraft to lift itself off. Recommended takeoff speed is 60 KIAS for all gross weights.

SHORT FIELD TAKEOFF

A short field takeoff is a maximum performance maneuver with the aircraft near stalling speed at liftoff. It is directly related to slow flying stalls; consequently, you should be familiar with these maneuvers before attempting to make a short field takeoff. Follow the procedure outlined in figure 2-4 for a short field takeoff.

CROSS-WIND TAKEOFF

The following procedure is recommended for cross-wind takeoff:

1. Advance throttle to takeoff power setting and maintain directional control with rudder.

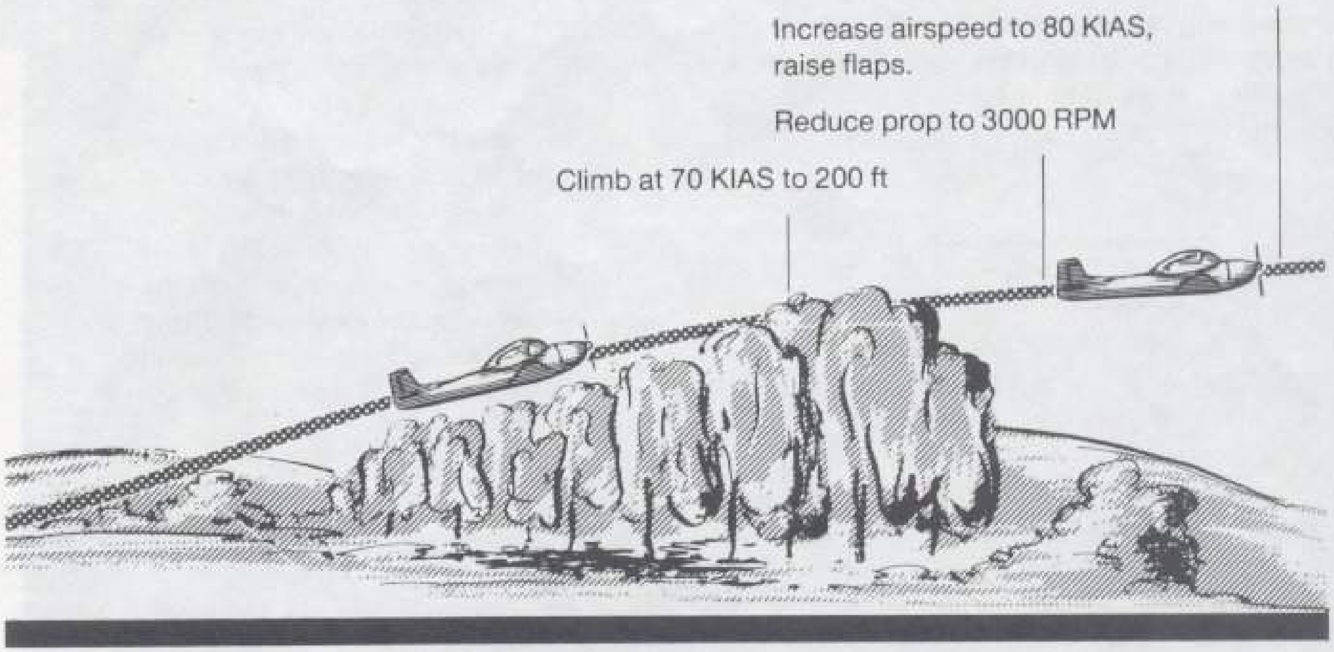


Figure 2-4
(Page 2 of 2)

2. Continue as in a normal takeoff, applying sufficient aileron control to keep the wings level. As airspeed increases, compensate for the increase in aileron effectiveness and perform a normal takeoff.
3. Leave nose wheel on the ground till reaching takeoff speed to avoid skipping.
4. Make a positive break with the ground
5. After becoming airborne lead the nose into the wind to maintain direction.

AFTER TAKEOFF AND CLIMB

When definetely airborne perform the following checks:

1. Brakes – APPLY
2. Landing gear switch – UP
3. Landing gear switch – NEUTRAL after gear is fully retracted.
4. Propeller control lever – reduce to 3000 RPM
5. Throttle – FULL POWER
6. Flap lever – REST 0 (at 80 KIAS and 200 ft AGL min.)
7. Electrical fuel pump – OFF Fuel pressure – Check
8. Climb speed – 100 KIAS
9. Trim

LEVEL-OFF AND CRUISE

1. Maintain desired altitude
2. Cruising speed is approx. 120 KIAS
3. Set manifold pressure to 0.72 ata
4. Adjust propeller control lever (2500 RPM)
5. Trim
6. Fuel tank operation:
   - When the fuel quantity indicator reading is 90 liter for the L/H tanks, position fuel tank selector on R/H tanks.
   - After a flying time of 10 to 15 minutes reposition on both tank groups.

FLIGHT CHARACTERISTICS

For information on flight characteristics fefer to section VI.

DESCENT

Descending with throttle closed, gear and flaps up, the aircraft can cover a long distance with a comparatively small loss of altitude. Lowering either the flaps or landing gear greatly steepens the gliding angle and increases the rate of descent.

CAUTION

Since the engine cools rapidly during a descent with the throttle retarded, clear the engine approximately every 30 seconds by opening the throttle slowly and smoothly to prevent spark plug fouling. Avoid that cylinder head temperature drops below 100° C.

BEFORE LANDING

LANDING-PATTERN CHECK

Landing pattern procedures and checks are shown in figure 2-5.

LANDING

FINAL APPROACH AND TOUCHDOWN

In order to obtain the results stated in the landing distances chart, accomplish the approach and landing procedures outlined in figure 2-5. In addition, observe the following precautions and techniques: Shortly before touchdown, start the round-out for landing. Use smooth, continuous back pressure on the stick to obtain a tail-low attitude for landing. Touchdown on the main gear first, at the recommended airspeed. (Refer to the landing distances chart in Appendix I for recommended touchdown speeds at various gross weights.) Hold the nose wheel off with back stick pressure, but lower the nose slowly while there is still elevator control, to prevent abruptly dropping the nose to runway, which may cause damage to the aircraft.

CAUTION

Do not apply brakes until nose wheel is on the runway. Use the rudder for directional control and, if possible, take advantage of runway length to save the brakes. Test brakes carefully before you use them and apply them soon enough to avoid the need for abrupt braking. Refer to "Brake Operation" in section VII for additional information on use of wheel brakes.

CROSS-WIND LANDING

Use the wing-low method for landing under cross-wind conditions.

1. Allow for drift while turning on to final approach so that you will not overshoot or undershoot the approach leg.
2. Establish drift correction on final approach as soon as drift is detected.
3. Velocity and direction of the wind determine the amount of flaps used for the landing.

Note

Since an aircraft acts like a weather vane, it attempts to swing into the wind. Flaps aid this weather-vaning tendency, so use a minimum degree of flaps in a cross wind.

4. Use rudder as necessary to counteract a wing-low condition during round-out and touch-down.
5. At touchdown neutralize the rudder.
6. After touchdown lower the nose as soon as possible and retract the flaps.

SHORT FIELD LANDING

Refer to the landing distances chart in Appendix I for landing ground roll distances and recommended approach speed. To perform a minimum-

LANDING PATTERN (Typical)

(1) ENTRY
Fuel – fullest tank
Propeller control lever – 3000 RPM
Carburetor heat – CLIMATIC
Maintain 100 KIAS
Altitude 1000 ft above runway level

(2) DOWNWIND LEG
Landing gear switch – DOWN
Check gear indicators (electrical and mechanical)
Perform brake check
Electrical fuel pump – ON
Landing lights – ON
Shoulder harness – LOCKED

(3) BASE LEG
Maintain 100 KIAS
Landing gear down-recheck

(4) KEY POINT
Throttle – retard to Idle
Airspeed – 90 KIAS Glide
Flap lever – REST 2
Trim as required

(5) FINAL
Airspeed 80-85 KIAS
Flaps as required
Throttle – Idle

(6) TOUCHDOWN POINT

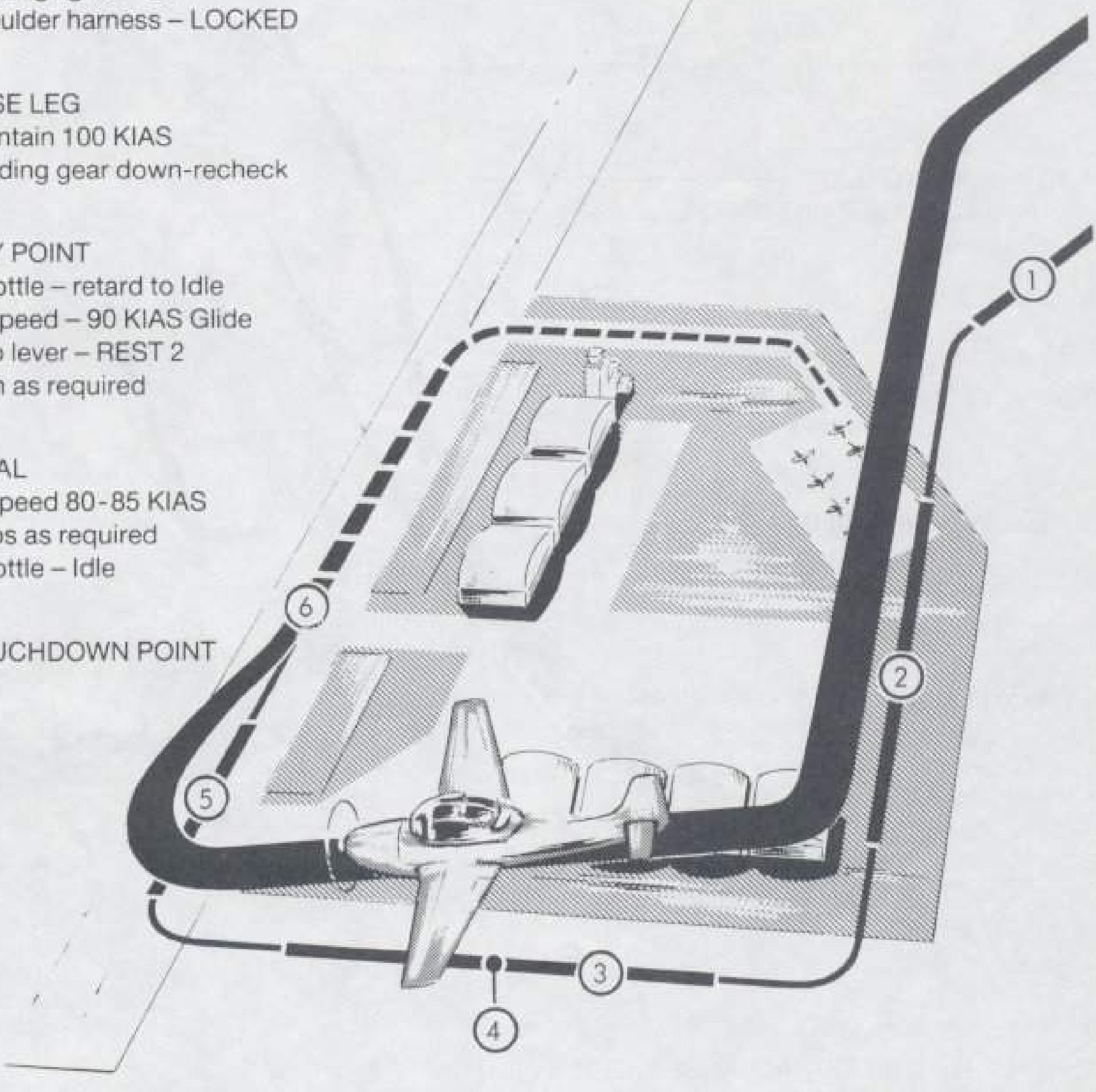


Figure 2-5

GO-AROUND (Typical)

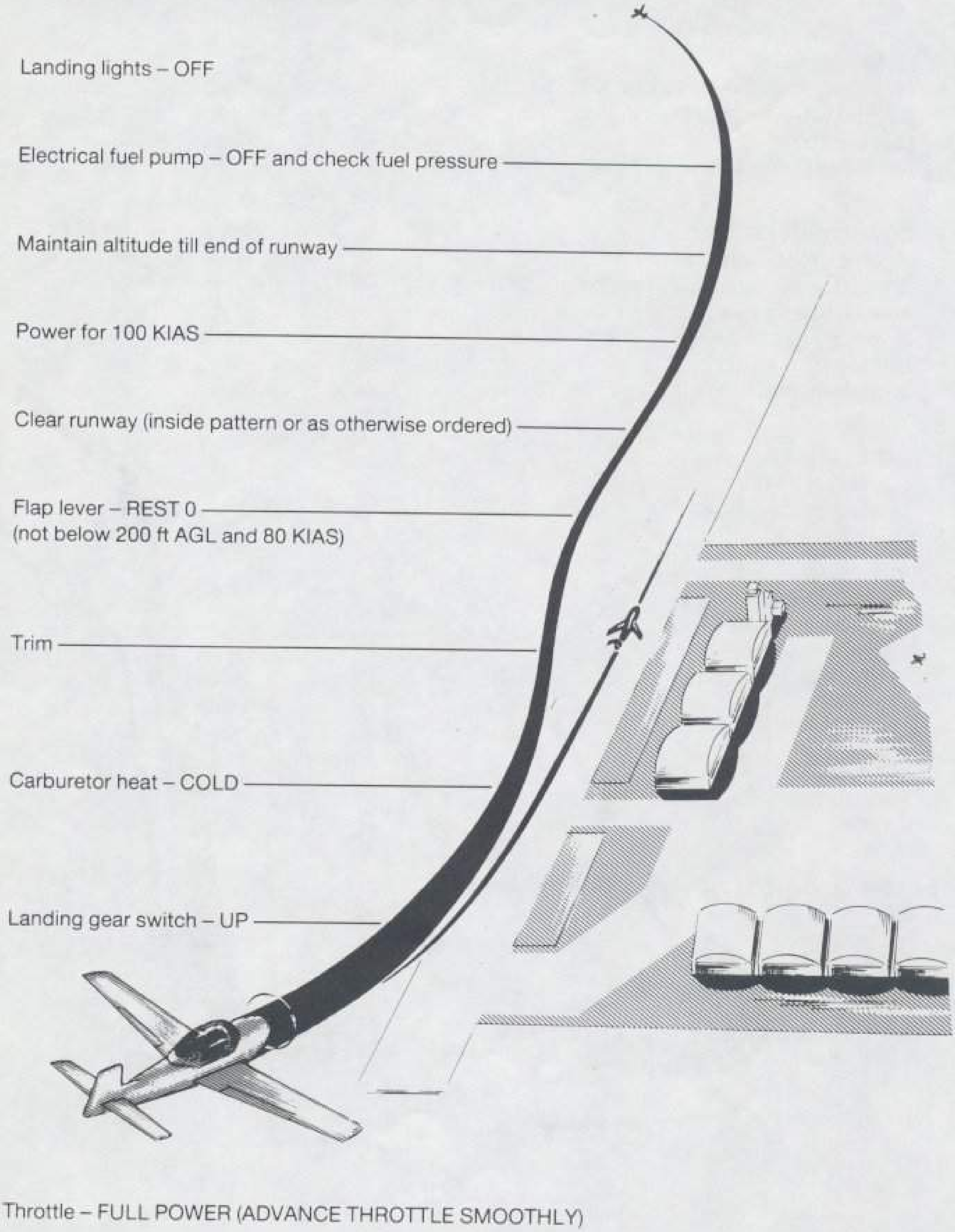


Figure 2-6

run landing, observe the following recommendations. Determine the correct approach speed according to gross weight from the landing distances chart in Appendix I. Lower the wing flaps fully and, on the final approach, position propeller control lever to FULL FINE. Adjust aircraft attitude and power to obtain proper approach speed and rate of descent, maintain power until wheels touch runway. Lower nose wheel smoothly and apply brakes.

GO-AROUND

A typical go-around is shown in figure 2-6. Decide early in the approach whether it is necessary to go around.

AFTER LANDING

After completing landing roll, clear runway and perform the following checks:

1. Electrical fuel pump – OFF
2. Landing lights – OFF
3. Propeller control lever – FULL FINE
4. Wing flap lever – Rest "0"
5. Trim tabs – NEUTRAL
6. Pitot heat – OFF
7. Carburetor heat – COLD.

ENGINE SHUTDOWN

Shut down engine as follows:

1. Brakes – HOLD
   – Parking brakes – SET
2. Throttle – 800 to 1200 RPM for 1 minute
3. Communication and navigation equipment – OFF
4. Throttle – IDLE
5. Ground out check – PERFORM (700 RPM)
6. Stopcock – OUT
7. Ignition switch – OFF
8. Ignition key – REMOVE
9. All circuit breakers – OFF, beginning at the R/H side.

BEFORE LEAVING AIRCRAFT

Make the following checks before leaving aircraft:

1. Flap lever – REST 1
2. Flight controls – LOCK
3. Fuel tank selector – L/H tank
4. Cowl-flap handle – fully IN
5. Form 781 – complete
6. Canopy – CLOSED
7. Pitot cover – INSTALL

CAUTION

Make appropriate entries in the Form 781 covering any limits in the Flight Manual that have been exceeded during the flight. Entries must also be made when, in the pilot's judgement, the aircraft has been exposed to unusual or excessive braking action during aborted take-offs, long and fast landings, etc.

PASSENGER BRIEFING

Note

The pilot in command is responsible for the safe and orderly conduct of the flight. As a part of his responsibility, he insures that all occupants or participants are adequately informed on items, which may affect safety or mission completion.

A. Subjects of Information

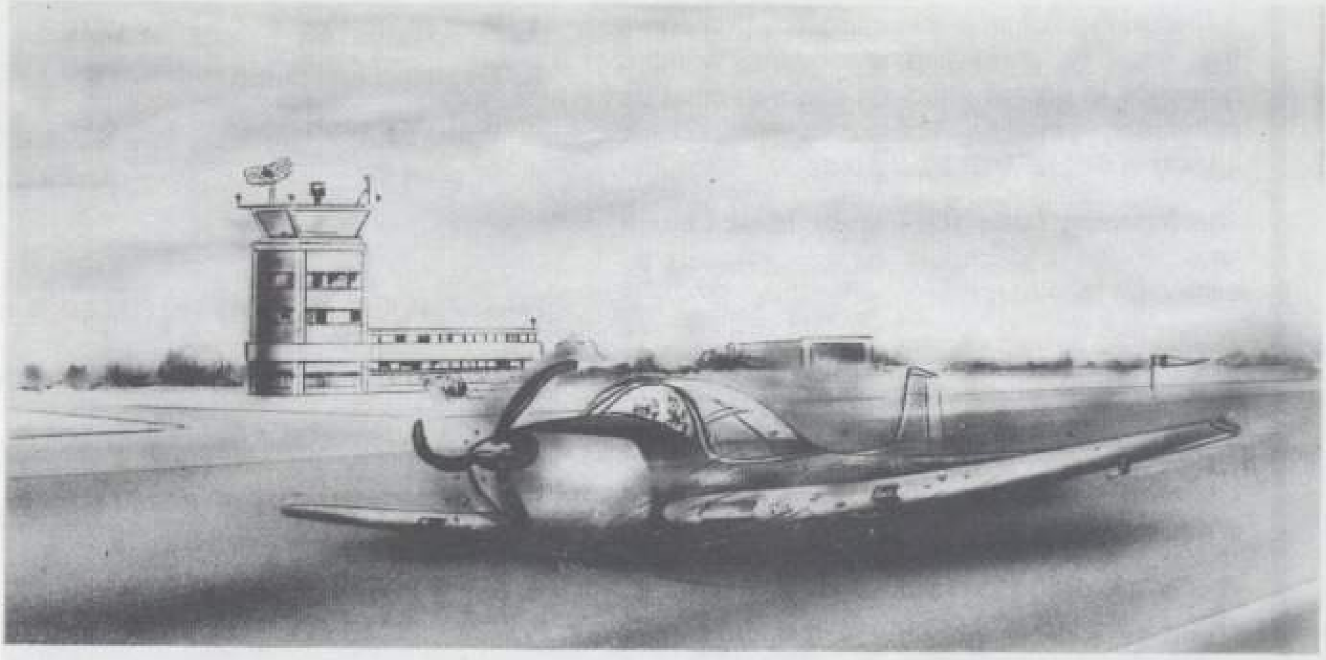
1. Names and duties of the flight crew
2. Destination
3. Flight route and intermediate landings
4. Flying time
5. Weather

B. Subjects of Briefing

1. Procedures to be followed in the event of an emergency
2. Use and operation of life support systems and equipment
3. Precautions and restrictions to be observed:

a) Explain how to use safety belts. Safety belts will be securely fastened at all times

b) Taking photographs is prohibited
c) Smoking is prohibited
d) Operation of portable electrical equipment is prohibited
e) Behavior in case of airsickness



EMERGENCY PROCEDURES SECTION III

TABLE OF CONTENTS PAGE

INTRODUCTION

The procedures are arranged in the most desirable sequence for the majority of cases; therefore, the steps should be performed in the listed sequence unless a good reason for deviation can be determined.

Multiple emergencies, adverse weather and other peculiar conditions may require modification of these procedures. A thorough knowledge of the correct procedures and aircraft systems is essential to analyse the situation correctly and determine the best course of action.

A Critical Procedure is an emergency procedure that must be performed immediately without reference to printed checklist and that must be committed to memory. These critical procedures appear in BOLDFACE capital letters.

The following basic rules apply to all aircraft emergencies and should be remembered by each crew member:

1. Maintain aircraft control.
2. Analyse the situation and take proper action.
3. Land as soon as possible.

The term "Land as soon as possible" is used in this section.

The term is defined as follows:

"Land as soon as possible (ASAP) – Landing should be accomplished at the nearest suitable airfield considering the severity of the emergency, weather conditions, field facilities, ambient lighting aircraft gross mass and command guidance.

GROUND OPERATION

ENGINE EMERGENCY SHUTDOWN

The following shutdown procedure is adopted in many of the critical-action emergency procedures in this section. For procedures with a step requiring an engine emergency shutdown, proceed as follows:

1. Stopcock – OUT
2. Ignition switch – OFF ("O")
3. Fuel shutoff knob – OUT
4. Battery switch and generator circuit breaker – OFF

ENGINE FIRE DURING STARTING

If a fire occurs during an engine start, it will be noticed from the outside by the ground crew or in the cockpit by means of the fire warning light on the instrument panel. To combat the fire, proceed as follows:

1. **Fuel shutoff knob – OUT**
2. **Electrical fuel pump – OFF**
3. **Battery switch – OFF**
4. **Aircraft – Abandon**

ENGINE/FUSELAGE FIRE ON GROUND

If an engine or fuselage fire occurs after the engine is started, proceed as follows:

1. Accomplish engine emergency shutdown.
2. If fire persists – Signal ground crew to extinguish fire.
3. Leave aircraft as soon as possible.

TAKEOFF

ENGINE FAILURE DURING TAKEOFF (BEFORE BECOMING AIRBORNE)

In case of engine failure take action immediately. The great number of different conditions under which an engine might fail make it impossible to give a remedy applicable to all cases. However, a thorough knowledge of the aircraft behavior and of the procedures to be performed in case of emergency will enable the pilot to automatically react in the correct manner.

If the engine fails during the takeoff run, proceed as follows:

1. Throttle – Retard to idle
2. Brakes – Apply (as necessary)
3. Accomplish engine emergency shutdown.

ENGINE FAILURE AFTER TAKEOFF

Engine failure after takeoff may occur at different altitudes and flight conditions which dictate the procedure to be applied. These factors as well as the conditions prevailing on the runway permit formulation of general safety regulations which are the only ones to be adhered to for a safe landing without engine power. If the engine fails after takeoff at low altitude, proceed as follows:

1. Lower nose immediately and fly straight ahead.

Note

If altitude and airspeed permit, slight directional changes are possible.

IN FLIGHT OPERATION

ENGINE FAILURE

If complete engine failure is encountered, proceed as follows:

1. Glide – 90 KIAS
2. Attempt engine airstart

AIRSTART

The following procedure should be used, when time and altitude permit the engine airstart procedure.

1. **Fuel pump** – **On**
2. **Tanks** – **Change**
3. **Carburetor heat control** – **Warm**
4. **Glide** – **90 KIAS**
5. Fuel shutoff knob – Check in
6. Ignition switch – M1 + 2
7. Stopcock – Check in

If engine is not windmilling:

8. Prop control lever – Full fine
9. Throttle – Open 1/10
10. Primer – Actuate
11. Starter button – Press
12. Fuel pump – Remains ON
13. Land ASAP

ENGINE FIRE DURING FLIGHT

Generally, the cause of an engine fire during flight is a failure within the engine or of an engine system. In most cases, cracks in the fuel or oil system tubing can be determined by means of engine instrument readings. Most engine fires are fed by fuel or oil. Cut off the fuel system if it seams to be the cause.

Perform the following actions:

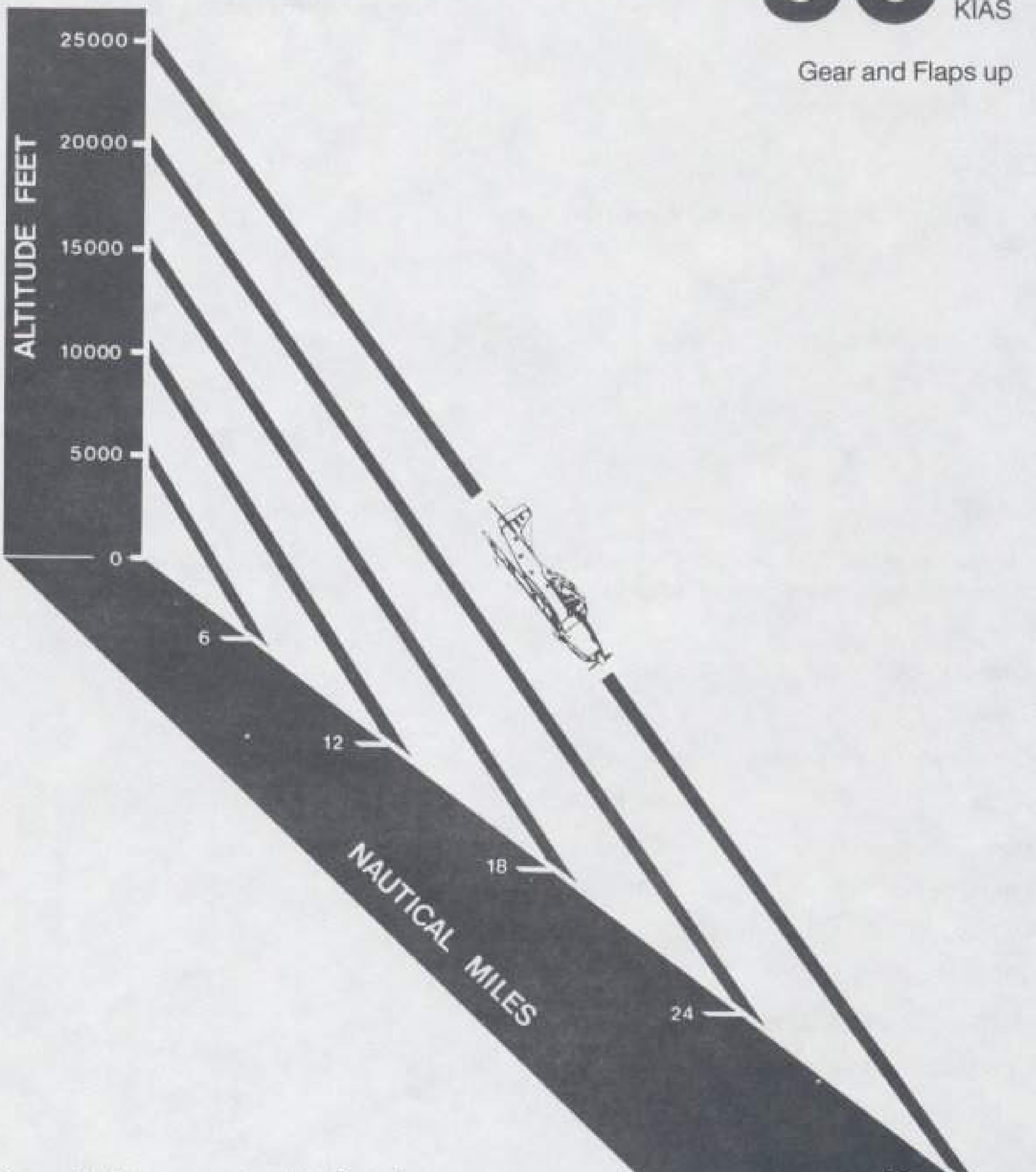
1. **Fuel shutoff knob** – **OUT**
2. **Prepare for forced landing or bail out**

MAXIMUM GLIDE

BEST POWER - OFF GLIDE SPEED TO OBTAIN **MAXIMUM DISTANCE**

90 KIAS

Gear and Flaps up



You will glide approximately 6 nautical miles for each 5000 feet of altitude lost by holding 90 knots. No wind condition.

Figure 3-1

FORCED LANDING
DEAD ENGINE

1. Shoulder harness – **Lock**
2. Gear – **Up**

Note

Gear DOWN only if a safe landing on a prepared airfield is assured.

3. **Select landing field**
4. **Call mayday**

Note

Transmit MAYDAY if time and altitude permit. Actions to be taken will always depend on the prevailing circumstances and conditions. Do not neglect any steps necessary for safe performance of the required actions.

5. Glide – 90 KIAS
6. Fuel shutoff knob – OUT
7. Ignition switch – OFF
8. Stopcock – OUT
9. All circuit breakers – OFF
10. After touchdown – Jettison canopy

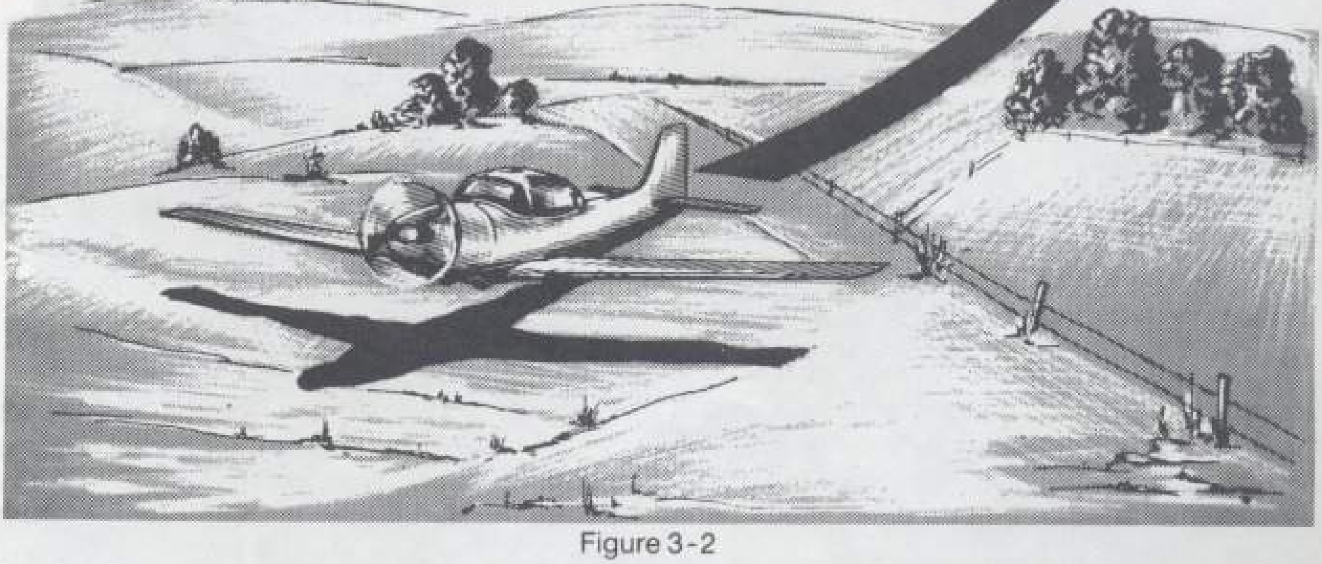


Figure 3-2

CAUTION

Do not jettison canopy if altitude is too low for a bail-out. If pilot's vision is obstructed by thick smoke, sideslip the aircraft to obtain clear field of view. Keep canopy closed.

FUSELAGE FIRE DURING FLIGHT

If a fuselage fire occurs during flight, proceed as follows:

1. Airspeed – Reduce immediately
2. Battery and generator circuit breakers – OFF
3. If the fire is extinguished, make a forced landing.
4. If the fire is not extinguished, shut down engine and bail out.

WING FIRE DURING FLIGHT

If a fire starts in the wing:

1. Gyro instruments and position lights – OFF
2. Pitot heater and fuel quantity gage – OFF
3. Sideslip aircraft away from flame.

Note

Sideslipping the aircraft away from the flame will aid in extinguishing the fire.

4. If the fire is extinguished, make a forced landing.
5. If the fire is not extinguished, shut down engine and bail out.

PROPELLER FAILURE – HIGH PITCH AT LOW RPM

If the propeller governor fails and the propeller goes to high pitch at low RPM, proceed as follows:

1. Throttle – Adjust to lowest manifold pressure to maintain flight.
2. Move propeller control lever to increase RPM, then to decrease RPM several times.
3. Land ASAP

PROPELLER RUNAWAY

In case of a propeller runaway during flight, proceed as follows:

1. Throttle – Retard
2. Airspeed – Reduce below 100 KIAS
3. Adjust RPM by means of throttle.
4. Land ASAP

PROPELLER LOSING OIL

1. Manifold pressure – Reduce to approx. 0,60 – 0,65 ata
2. Propeller control lever – Full coarse (Low RPM)
3. Land ASAP

MAXIMUM GLIDE

For maximum glide distance with IDLE engine, the best airspeed is 90 KIAS with a clean aircraft, landing gear and wing flaps up and propeller control lever at full coarse to minimize drag. See figure 3-1 for maximum glide distance.

FORCED LANDING

See figure 3-2 for forced landing procedure.

Forced landing with gear down

If time and altitude permit, and sufficient battery power is available (all other circuit breakers off), a normal landing on a prepared landing strip is possible.

BAIL-OUT

If altitude and time permit, direct the aircraft before bail-out toward an unpopulated area, reduce airspeed, lower the wing flaps, and trim the aircraft slightly nose down.

1. Call – Mayday

Note

Transmit MAYDAY if time and altitude permit. Actions to be taken will always depend on the prevailing circumstances and conditions. Do not neglect any steps necessary for safe performance of the required actions.

2. **Order crew and passenger to bail out**
3. **Canopy – Jettison**
4. **Safety belts – Release**
5. **Bail out**

Note

Trim for straight and level flight 80 to 90 KIAS. Roll out of the cockpit, attempt to get clear of aircraft over wing trailing edge.

6. **When clear of aircraft – pull d-ring**

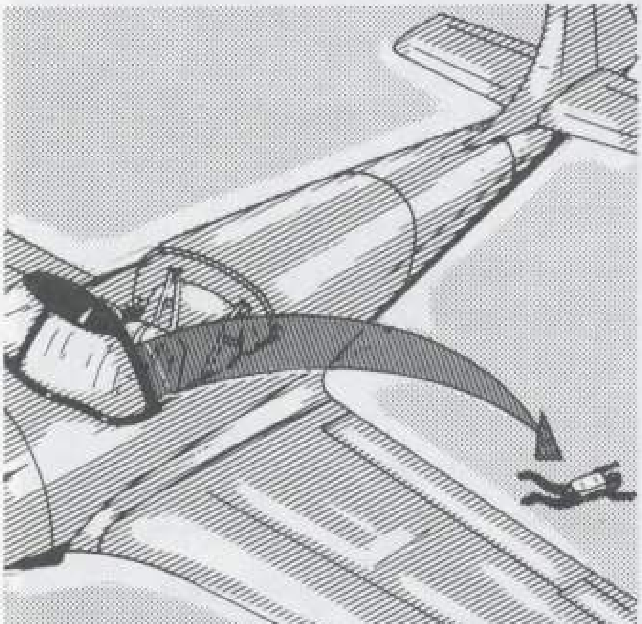


Figure 3-3

DITCHING

The aircraft should be ditched only as a last resort. Because all emergency equipment is carried by the pilots, there is no advantage inriding the aircraft down. However, if ditching is unavoidable, proceed as follows:

1. Safety belt must be tight and securely fastened, and shoulder harness locked
2. Landing gear – UP
3. Flap lever – Rest 2
4. Use power if available.
5. Reduce speed to just above stall.
6. Maintain level altitude.
7. If wind is blowing, head into wind, attempt to touch down just after a wave crest has passed. In case of light winds head aircraft parallel to any swells that may be running. Try to touch down just below the crest on falling side of swell.

ELIMINATION OF SMOKE OR FUMES

If smoke or fuel fumes enter the cabin, proceed as follows:

1. Fire warning light – CHECK
2. Cabin heat and ventilation – OFF
3. Check for electrical fire

CAUTION

Jettison canopy only in case of urgent emergency. Jettisoned canopy may damage the empennage and impair maneuverability.

4. Land ASAP

ELECTRICAL FIRE

1. Battery switch and generator circuit breaker – OFF
2. All electrical equipment – OFF
3. Battery switch – ON
4. Defective circuit – Identify
5. Defective circuit – OFF
6. Generator circuit breaker – ON

Probability of fires in the aircraft electric system is very low since the voltage regulator prevents the generator from supplying excessive voltages and each circuit is protected against overload by a circuit breaker.

LANDING

LANDING GEAR EMERGENCY EXTENSION (ELECTRIC LANDING GEAR SYSTEM FAILS)

If electric system fails or if landing gear fails to extend, proceed as follows:

1. Landing gear switch – DOWN
2. Circuit breaker for landing gear and landing gear position indicator – OFF
3. Insert hand crank for landing gear emergency extension.
4. Turn crank 240 revolutions counter-clockwise until mechanical indication shows – OUT.
5. Stow hand crank.
6. Land with special care.

CAUTION

Do not switch on circuit breakers for landing gear and landing gear position indicator after emergency extension.

MISCELLANEOUS

ELECTRICAL FAILURE

The aircraft electric system is sufficiently protected by circuit breakers. At the first sign of a malfunctioning circuit, check applicable circuit breakers.

GENERATOR FAILURE

1. Check that generator is ON.
2. All electric systems – OFF (Except battery and gyros)
3. Battery switch – OFF
4. Voltmeter reading – CHECK

Note

If there is no reading on the voltmeter, the generator is defective.

5. Generator circuit breaker – OFF
6. Batterie switch – ON

Note

Reduce electric power consumption to a minimum.

CARBURETOR ICING

1. Carburetor heat control – Warm
2. Manifold pressure – Observe Manifold pressure must increase after ice has melted
3. Increase manifold pressure to the power setting before icing was encountered
4. Carburetor heat control – Climatic

INDICATIONS:

Rough running engine
Fluctuating RPM
Decreasing manifold pressure

BRAKE FAILURE

If the brake system fails, proceed as follows:

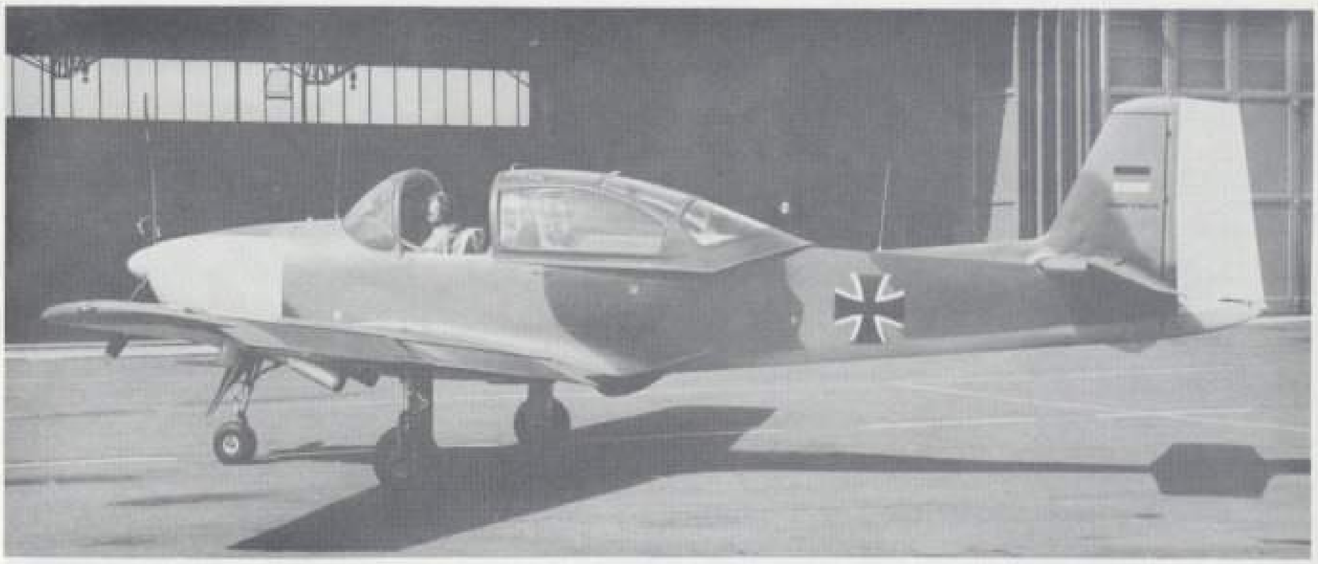
1. Use nose wheel for aircraft steering.
2. Clear taxistrip or runway if possible.
3. Engine – SHUT DOWN

CANOPY EMERGENCY OPERATION

See figure 1-17 for procedure for opening the canopy from inside in an emergency.

WARNING

For emergency canopy jettisoning pull jettison handle only. Do not operate the internal canopy handle before the emergency jettison handle.



AUXILIARY EQUIPMENT SECTION IV

TABLE OF CONTENTS PAGE

CABIN AND WINDSHIELD HEATING SYSTEM

For schematic diagram see figure 4-1.
Ram air entering through an air scoop in the engine cowling nose is fed to the heat exchanger and to the heating air spill valve by means of flexible tubing. Dependent on the spill valve position, heated ram air is either routed through a manifold into the cabin interior or is bled overboard through the nose wheel well. The spill valve position is selected by the cabin heat control knob. Hot air for windshield heating is taken from the manifold at the copilot´s station. To supply an adequate hot air flow to the windshields the manifold on the copilot´s side can be closed by means of the windshield defrost knob.

CABIN HEAT CONTROL KNOB

The cabin heat control knob (26, figure 1-3) is located on the R/H side of the instrument panel. By means of this control knob the hot air flow into the cabin can be regulated or shut off. In pushed-in position of the control knob heating is ON, in fully pulled-out position heating is OFF.

WINDSHIELD DEFROST KNOB

The windshield defrost knob (48, figure 1-3) is mounted on an angle attached at the L/H side below the instrument panel. In pulled-out position windshield heating is ON, in fully pushed-in position windshield heating is OFF.

Note

The windshield heating is operating only when cabin heating is ON.

CABIN AND WINDSHIELD HEATING SYSTEM

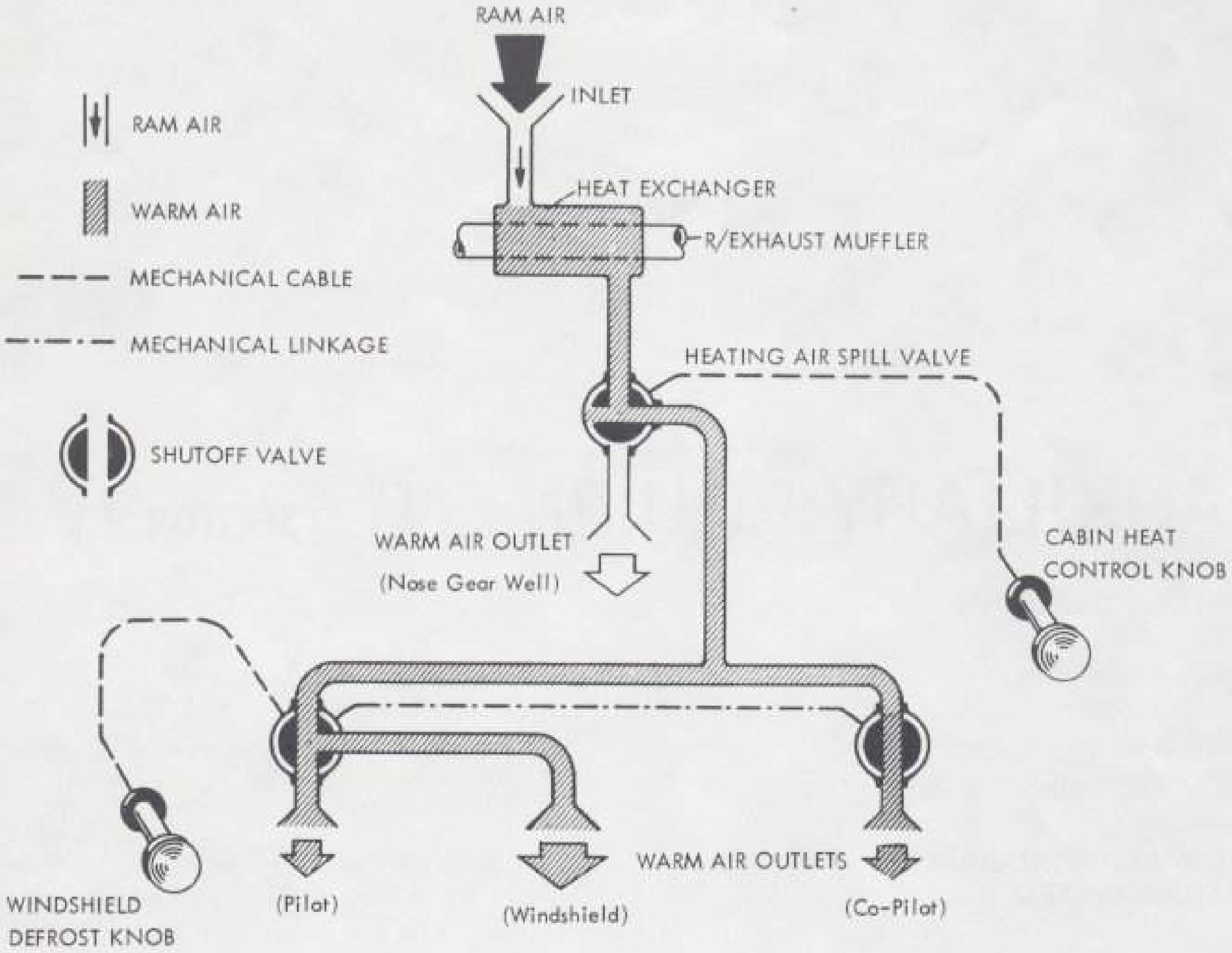


Figure 4 - 1

CABIN VENTILATION SYSTEM

For schematic diagram see figure 4-2. Ram air entering through an air scoop in the fuselage skin on the R/H side is routed by tubing to four adjustable fresh air outlets in the cabin.

CABIN VENTILATION CONTROL KNOB

The cabin ventilation control knob (27, figure 1-3) is located in the extreme R/H corner of the instrument panel. By means of this control knob the fresh air flow into the cabin can be regulated or shut off. In pushed-in position of the control knob cabin ventilation is ON, in fully pulled-out position cabin ventilation is OFF.

ADJUSTABLE FRESH AIR OUTLETS

Two adjustable fresh air outlets are installed at the L/H and R/H sides of the instrument panel (49, figure 1-3) for the convenience of both pilots. These "eyeball" type outlets are adjustable spherical units that can be positioned to direct the air flow in any direction

CABIN VENTILATION SYSTEM

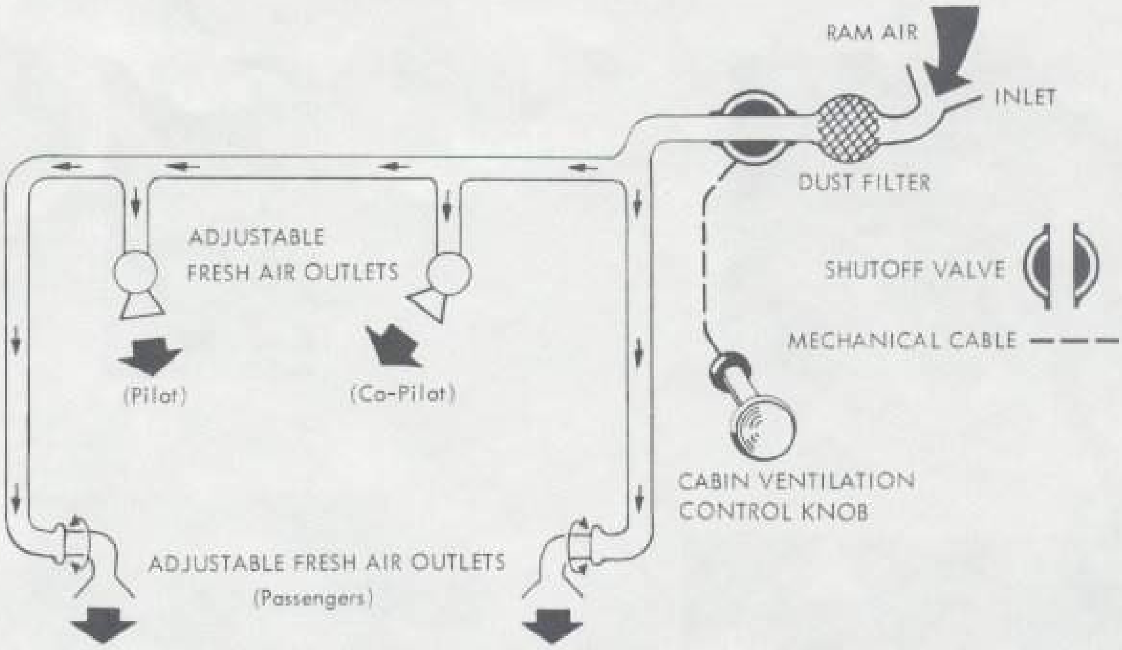


Figure 4 - 2

desired. A knurled ring around the opening can be rotated to regulate the volume of air. The ring is turned clockwise to close the opening, or counterclockwise to open it. For the passengers, air scoops are installed on the L/H and R/H sides forward of the seat. These openings are adjustable in vertical direction only and have no means of air flow regulation. The fresh air flow for the passengers can be regulated and shut off by means of the cabin ventilation control knob only (27, figure 1-3).

ANEMOSTAT

The anemostat is located in the canopy, aft of the emergency jettison handle. Air flow regulation is performed by means of a rotatable slotted disk. By turning the disk clockwise, the anemostat is opened to permit stale air to vent overboard.

PITOT HEATER

The pitot tube is protected against ice accumulation by a heating element. The heating element is connected to the aircraft bus bar through a circuit breaker (figure 1-10). To actuate the pitot heater move circuit breaker to ON position.

CAUTION

The pitot heater must not be operated continuously while the aircraft is on the ground.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

TABLE OF COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

See figure 4-3

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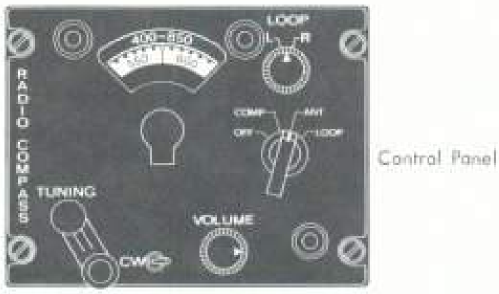
COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

UHF Command Radio
BENDIX ARC-45

VHF Command Radio
SARAM 5-52

Radio Compass
LEAR ADF 14-D



Radio Compass
LEAR ADF 100

TYPE	DESIGNATION	FUNCTION	RANGE	LOCATION
UHF COMMAND RADIO	BENDIX ARC 45	TWO-WAY COMMUNICATION	30 MILES AT 1000 FEET 135 MILES AT 10 000 FEET	INSTRUMENT PANEL
INTERPHONE	SB-329/AR (ARC 45)	INTERCOCKPIT COMMUNICATION	NOT APPLICABLE	INSTRUMENT PANEL
VHF COMMAND RADIO	SARAM 5-52	TWO-WAY COMMUNICATION	30 MILES AT 1000 FEET 135 MILES AT 10 000 FEET	INSTRUMENT PANEL
INTERPHONE	(SARAM 5-52)	INTERCOCKPIT COMMUNICATION	NOT APPLICABLE	INSTRUMENT PANEL
RADIO COMPASS	LEAR ADF 14-D	POSITION FINDING, APPROACH FLIGHT, RECEPTION OF VOICE AND CODE COMMUNICATION	50 TO 100 MILES FOR RANGE SIGNALS 100 TO 200 MILES FOR BROADCAST SIGNALS	INSTRUMENT PANEL
RADIO COMPASS	LEAR ADF-100	POSITION FINDING, APPROACH FLIGHT, RECEPTION OF VOICE AND CODE COMMUNICATION	50 TO 100 MILES FOR RANGE SIGNALS 100 TO 200 MILES FOR BROADCAST SIGNALS	INSTRUMENT PANEL

Figure 4-3

Note These systems are not applicable for all aircraft configurations (Differences see text).

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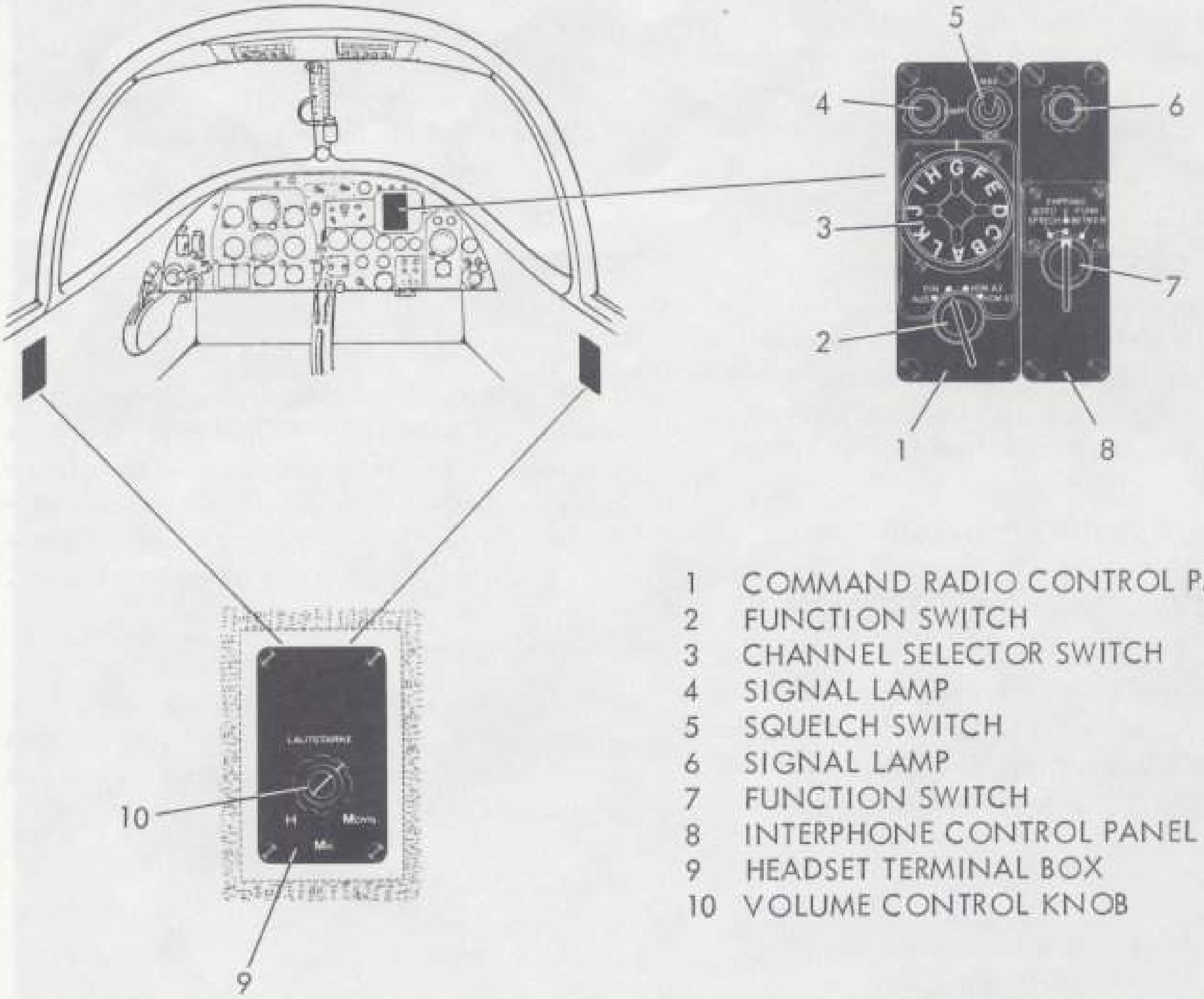
VHF COMMAND RADIO/SARAM 5-52



1 COMMAND RADIO CONTROL PANEL
2 FUNCTION SWITCH
3 CHANNEL SELECTOR SWITCH
4 SIGNAL LAMP
5 SQUELCH SWITCH
6 SIGNAL LAMP
7 FUNCTION SWITCH
8 INTERPHONE CONTROL PANEL
9 HEADSET TERMINAL BOX
10 VOLUME CONTROL KNOB

Figure 4 -4

CONFIGURATIONS

Figures 4-4 and 4-6 show the typical control panel installation for the radio command and navigation systems SARAM 5-52 VHF command radio /LEAR ADF 14-D radio compass. Alternatively, electronic equipment consists of BENDIX ARC-45 command radio /LEAR ADF 14 - D radio compass or BENDIX ARC - 45 command radio/LEAR ADF-100 radio compass.

VHF COMMAND RADIO — SARAM 5-52

The SARAM 5-52 VHF COMMAND RADIO provides air-to-air and/or air-to-ground communication and interphone capabilities. It operates in the 100 to 160 megacycle range through 12 preset selectable channels. The system is amplitude modulated and is equipped with a squelch control. The transceiver is installed in a shock-mounted rack in the electronic compartment (7, figure 1-1). The inverter for this radio set is also installed in

Beachte OS 5-8

the electronic compartment. The controls for the SARAM 5-52 system are located on the command radio control panel and the interphone control panel. The headset is connected by a phone jack on a loose cable end to the impedance matching unit and the headset terminal box. The impedance matching unit serves to adapt the headset to the system.

COMMAND RADIO CONTROLS

The command radio controls are located on the instrument panel (see figure 4-4). One each headset terminal box is located at the cabin wall beside the pilots´seats. A loose microphone cable with a phone jack at its end provides the connection for the headset.

COMMAND RADIO CONTROL PANEL

FUNCTION SWITCH (OFF/ON, HOM.A2/ HOM.A1)

The function switch is a four-position rotary switch (2, figure 4-4). ON, HOM.A1, and HOM.A2 are operating positions. In the OFF position the equipment deenergizes.

Note

The system requires 30 seconds to warm up.

CHANNEL SELECTOR SWITCH AND SCALE

The selector switch (3, figure 4-4) is a 12-position rotary switch. The scale rotates as the knob is turned. The scale is a round disk featuring fluorescent letters from A to L identifying the 12 channels.

SIGNAL LAMP

During channel selection the lamp (4, figure 4-4) is out to illuminate again when a channel is selected and the unit is again ready for operation. Signal lamp brightness can be adjusted by rotating the outer ring of the signal lens.

SQUELCH SWITCH (NOR/MAX)

(Squelch switch see 5, figure 4-4)

The squelch circuit is used for noise suppression. In NOR position, noise is suppressed and only signals above background noise level are audible. In MAX position the squelch circuit is cut out to permit reception of weak signals.

INTERPHONE CONTROL PANEL

FUNCTION SWITCH (INTERPHONE/REC / RADIO)

(Function switch see 7, figure 4-4).

In INTERPHONE position, intercommunication operation is possible. In REC position, operators can receive and intercommunicate simultaneously. In RADIO position, receiver and transmitter are energized with the co-operator being able to listen in on the interphone system.

SIGNAL LAMP

The signal lamp (6, figure 4-4) illuminates when the system is ON. Signal lamp brightness can be adjusted by rotating the outer ring of the signal lens.

HEADSET TERMINAL BOX

(Headset terminal box, see 9, figure 4-4)

Phone jack receptacle C is provided for the earphone plug and phone jack receptacle M for the microphone plug. These two receptacles cannot be used for the double-function headset plug. These two phone jacks are inoperative.

VOLUME CONTROL KNOB

The volume control knob (10, figure 4-4) simultaneously controls receiver volume and interphone volume. Rotating the knob clockwise increases earphone volume.

OPERATION OF COMMAND RADIO — SARAM 5-52

1. Function switch on command radio control panel - ON, HOM. A1 or HOM. A2

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2. Channel selector switch - FREQUENCY DESIRED

Note

The channel selector mechanism requires a certain time to engage on the selected channel.When the channel has been locked on the signal lamp illuminates again.

3. Squelch switch - NOR.or, if required , - MAX.
4. Function switch on interphone control panel - INTERPHONE-RECEIVER - or RADIO,as required
5. Microphone button - PRESS TO TALK (Pilot or Copilot)
6. Volume control knob on headset terminal box - ADJUST
7. Function switch - OFF

MICROPHONE BUTTON

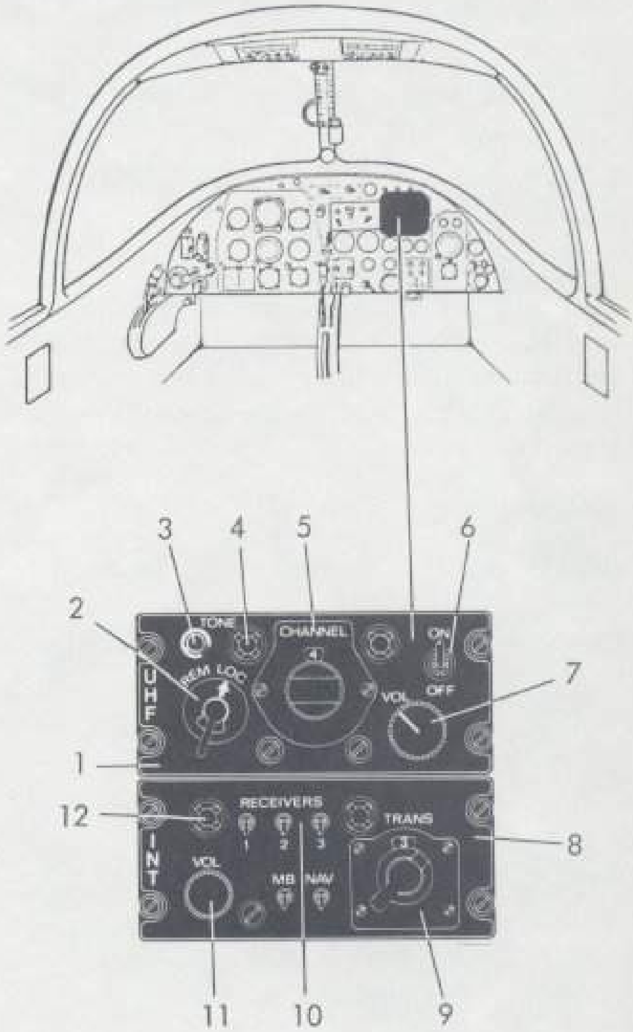
Microphone buttons (figures 1-4 and 1-5) are installed in pilot's and copilot's throttle levers. In pressed-down position, the receiver is disconnected and the transmitter is ready for operation or,in INTERPHONE mode communication with the co-operator is provided.

UHF COMMAND RADIO — ARC-45

The ARC-45 UHF command radio system provides air-to-air and air-to-ground intercommunication means. It operates in the 225.0 to 399.9 megacycle range through 12 preset selectable channels with a channel spacing of 100 kilocycles. The system is amplitude modulated and is designed to transmit - if required - a 4 00 cycle sound-modulated signal. The transceiver and the applicable inverter are installed in a shock-mounted rack in the electronic compartment. The electronic compartment access door is identified by INTERCOMMUNICATION (7, figure 1-1).

The controls for the ARC-45 UHF command radio are located on the command radio control panel and the interphone control panel.

UHF COMMAND RADIO
ARC - 45



1 COMMAND RADIO CONTROL PANEL
2 REMOTE/LOCAL SWITCH
3 TONE BUTTON
4 FRONT PLATE ILLUMINATION
5 CHANNEL SELECTOR SWITCH
6 POWER SWITCH
7 VOLUME CONTROL KNOB
8 INTERPHONE CONTROL PANEL
9 TRANSMITTER SELECTOR SWITCH
10 RECEIVER SELECTOR SWITCH
11 VOLUME CONTROL KNOB
12 FRONT PLATE ILLUMINATION

Figure 4-5

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COMMAND RADIO CONTROLS

The command radio controls are located on the instrument panel (see figure 4-5). For headset connection, a loose microphone cable with a phone jack at its end is located at the cabin wall beside the pilots' seats.

COMMAND RADIO CONTROL PANEL

POWER SWITCH (ON/OFF)

In ON position, the power switch (6, figure 4-5) connects the transceiver to the inverter. In the OFF position, the equipment deenergizes.

REMOTE/LOCAL SWITCH

This rotary switch (2, figure 4-5) has two positions. In REM position, remote control is selected (2nd control panel), in LOC position, local control is selected.

CHANNEL SELECTOR SWITCH

The channel selector switch (5, figure 4-5) is a 12-position rotary-type switch for selection of one of the 12 channels. The selected channel appears in an indicator window above the channel selector switch.

TONE BUTTON

In pressed position, the push-button type tone switch (3, figure 4-5) energizes the transmitter. The transmitted carrier frequency is modulated by a 400 cycle signal. During transmission, the 400-cycle tone shall be audible in the headset (transmission monitoring)

VOLUME CONTROL KNOB (VOL)

The volume control knob (7, figure 4-5) regulates receiver output volume. Turning the knob clockwise increases the volume.

FRONT PLATE ILLUMINATION

The front plate is edge-lighted by two lamps (4, figure 4-5).

INTERPHONE CONTROL PANEL

TRANSMITTER SELECTOR SWITCH (TRANS)

The transmitter selector switch (9, figure 4-5) permits selection of one of three possible transmitter systems (1, 2 or 3) or the interphone system (INT). In No. 2 position, the ARC-45 transmitter is switched on. No. 1 and 3 positions have no function in this equipment configuration. The selected transmitter appears in an indicator window above the channel selector switch.

RECEIVER SELECTOR SWITCH (RECEIVERS)

These 5 toggle switches (10, figure 4-5) connect the output of different receivers to the earphone amplifier without regard to the transmitter selector switch position. Toggle switches 1, 3 and MB have no function in this equipment configuration. Toggle switch 2 connects the ARC-45 receiver output and toggle switch NAV connects the radio compass output to the earphone amplifier.

Note

In up-position, toggle switches are ON.

VOLUME CONTROL KNOB (VOL)

The volume control knob (11, figure 4-5) regulates earphone volume. Turning the knob clockwise increases the volume.

FRONT PLATE ILLUMINATION

The front plate is edge-lighted by two lamps (12, figure 4-5).

OPERATION OF COMMAND RADIO — ARC-45

INTERPHONE OPERATION

1. Transmitter selector switch on interphone control panel - INT

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2. Microphone button - PRESS TO TALK (pilot or copilot)
3. Earphone volume - ADJUST

TRANSCEIVER OPERATION

1. Power switch on command radio control panel - ON
2. Remote/Local switch - LOC
3. Channel selector switch - Select channel
4. Transmitter selector switch on interphone control panel - 2
5. Receiver switch No. 2 - ON (UP)
6. Receiver volume - ADJUST
7. Microphone button - PRESS TO TALK (pilot or copilot)
8. Power switch - OFF

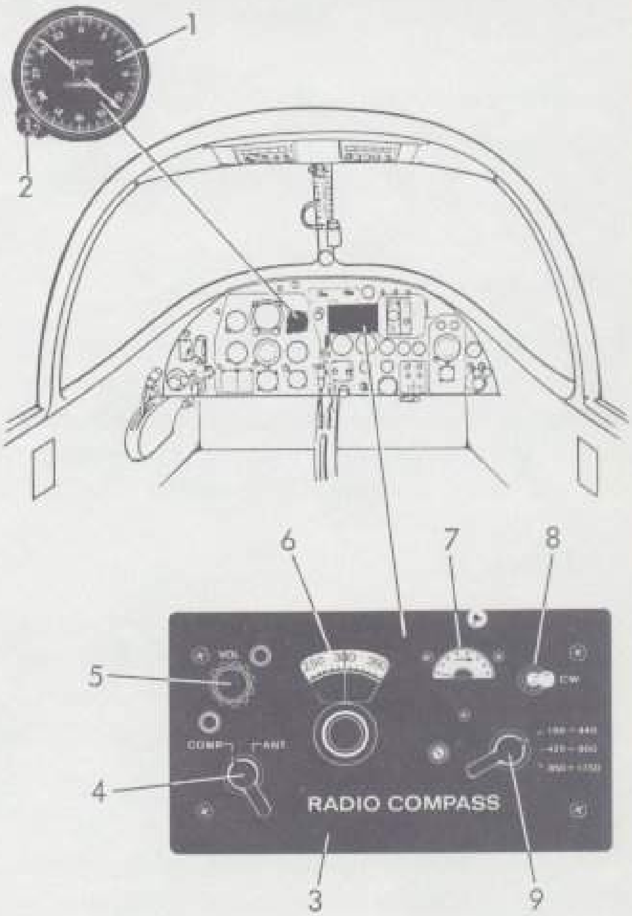
RADIO COMPASS — LEAR ADF 14-D

The ADF 14-D radio compass is used for position finding (cross bearing), for homing approach or as an additional communication receiver in the long and medium frequency range. The receiver frequency range of 190 to 1750 kilocycles is sectioned into 3 bands. The set is equipped with valves. For reception of A1-signals this unit is provided with a built-in oscillator. The system comprises a loop antenna and a sênse antenna, a radio compass control panel, a radio compass indicator with adjustable compass card and an amplifier. The amplifier is installed in the radio compartment. The disconnectable loop and the sense antennas are mounted on the aircraft outer skin (figure 4-8)

RADIO COMPASS CONTROLS

The radio compass control panel (figure 4-6) and the radio compass indicator with adjustable compass card are located on the instrument panel with the indicator in the shock-mounted portion. The system is protected by a circuit breaker (figure 1-10).

RADIO COMPASS LEAR ADF 14-D



1 RADIO COMPASS INDICATOR
2 COMPASS CARD SETTING KNOB
3 RADIO COMPASS CONTROL PANEL
4 MODE SELECTOR SWITCH
5 VOLUME CONTROL KNOB
6 TUNER AND SCALE
7 FIELD INTENSITY METER
8 CONSTANT-WAVE OSCILLATOR SWITCH
9 BAND SWITCH

Figure 4—6

RADIO COMPASS CONTROL PANEL

MODE SELECTOR SWITCH (ANT/COMP)

The mode selector switch (4, figure 4-6) is a 2-position rotary-type switch. In ANT position, the system operates as a normal receiver through the sense antenna. Approaching a four-course radio range should be done with the switch in this position. In COMP position, the system operates as an automatic radio compass.

BAND SWITCH

(Band switch, see 9, figure 4-6).
Frequency bands, i.e. 190 to 440 kilocycles, 420 to 900 kilocycles and 850 to 1750 kilocycles.

TUNER AND SCALE

The frequency selected by means of the tuner (6, figure 4-6) is indicated on a scale marked in kilocycles. To select a lower frequency, turn the tuner clockwise, to select a higher frequency, turn it counterclockwise.

FIELD INTENSITY METER

The field intensity meter (7, figure 4-6) indicates the signal reception intensity from the station selected. Optimum tuning is achieved at maximum meter reading.

CONSTANT-WAVE OSCILLATOR SWITCH (CW)

By means of this switch (8, figure 4-6) unmodulated (A1) signals are made audible. In CW position the oscillator is energized, in the unmarked position the oscillator is off.

VOLUME CONTROL KNOB

When turned clockwise, the volume control knob (5, figure 4-6) increases audio gain and RF sensitivity simultaneously.

RADIO COMPASS INDICATOR

The radio compass indicator (1, figure 4-6) is equipped with a compass card for true-course setting. Compass card markings are fluorescent, one scale mark representing 2 degrees.

COMPASS CARD SETTING KNOB (VAR)

This knob (2, figure 4-6) is used for setting the compass card. Turning the knob counterclockwise increases the number of degrees displayed.

RADIO COMPASS OPERATION — LEAR ADF 14-D

RECEPTION/BEARING PREPARATIONS

1. Mode selector switch - ANT
2. Band switch - select frequency band
3. Tuner - select frequency (coarse tuning)

Note

Check IDENTIFICATION of signal received.

4. Volume control knob - ADJUST for optimum sensitivity
5. Field intensity meter - ADJUST for maximum reading (fine tuning)

BEARING

CAUTION

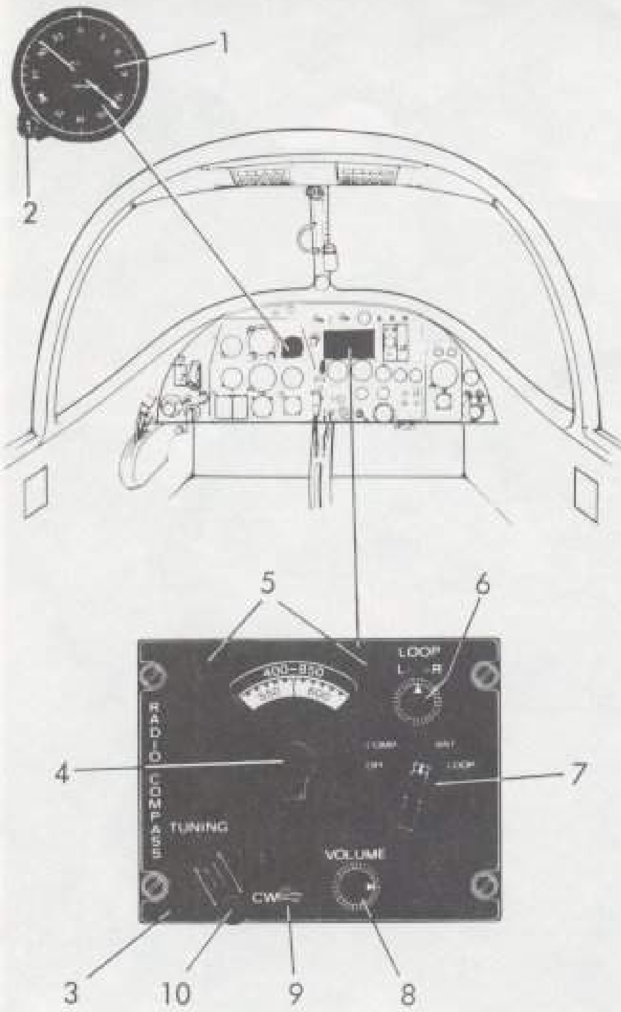
For bearing, use a non-fading, non-superimposed signal and observe bearing inaccuracies which sometimes occur.

6. Mode selector switch - COMP
7. Radio compass indicator - RELATIVE BEARING
8. Radio compass circuit breaker - OFF

RADIO COMPASS — LEAR ADF 100

The LEAR ADF 100 radio compass serves the same purposes as the LEAR ADF 14, with the essential design difference that the ADF 100 receiver is fully transistorized and does not require any warm-up time. Bearing can be performed automatically or manually (minimum tuning). For minimum tuning the sense antenna is switched off. Receiver frequency

RADIO COMPASS LEAR ADF-100



1 RADIO COMPASS INDICATOR
2 COMPASS CARD SETTING KNOB
3 RADIO COMPASS CONTROL PANEL
4 BAND SWITCH
5 SCALE AND FRONT PLATE ILLUMINATION
6 LOOP CONTROL KNOB
7 MODE SELECTOR SWITCH
8 VOLUME CONTROL KNOB
9 CONSTANT-WAVE OSCILLATOR SWITCH
10 TUNER CRANK

Figure 4–7

range is 190 to 1700 kilocycles sectioned into 3 bands. For reception of A1 signals the system is equipped with a built-in oscillator. The system comprises a loop antenna and a sense antenna, a radio compass control panel, a radio compass indicator with adjustable compass card and the receiver set. The receiver set is installed in the radio compartment. Loop and sense antennas are mounted on the aircraft outer skin. (figure 4-8).

RADIO COMPASS CONTROLS

The radio compass control panel (3, figure 4-7) and the radio compass indicator (1, figure 4-7) with adjustable compass card are located on the instrument panel with the indicator in the shock-mounted portion.

RADIO COMPASS CONTROL PANEL

MODE SELECTOR SWITCH (OFF/COMP/ ANT/LOOP)

The mode selector switch (7, figure 4-7) is a four-position switch. In COMP position, the unit operates as an automatic radio compass, in ANT position, it serves as a normal receiver (with the sense antenna connected only) and in LOOP position, the unit operates through the loop antenna, the bearing criterion being the volume minimum.

Note

The loop antenna can be directed by means of the LOOP control knob.

(Band switch, see 4, figure 4-7).
Frequency bands, i.e. 190 to 450 kilocycles, 400 to 850 kilocycles and 800 to 1700 kilocycles. The band selected is indicated in an indicator window.

TUNER CRANK AND SCALE

Exact tuning is performed by means of the tuner crank (10, figure 4-7) with the selected frequencies indicated on a scale marked in kilocycles.

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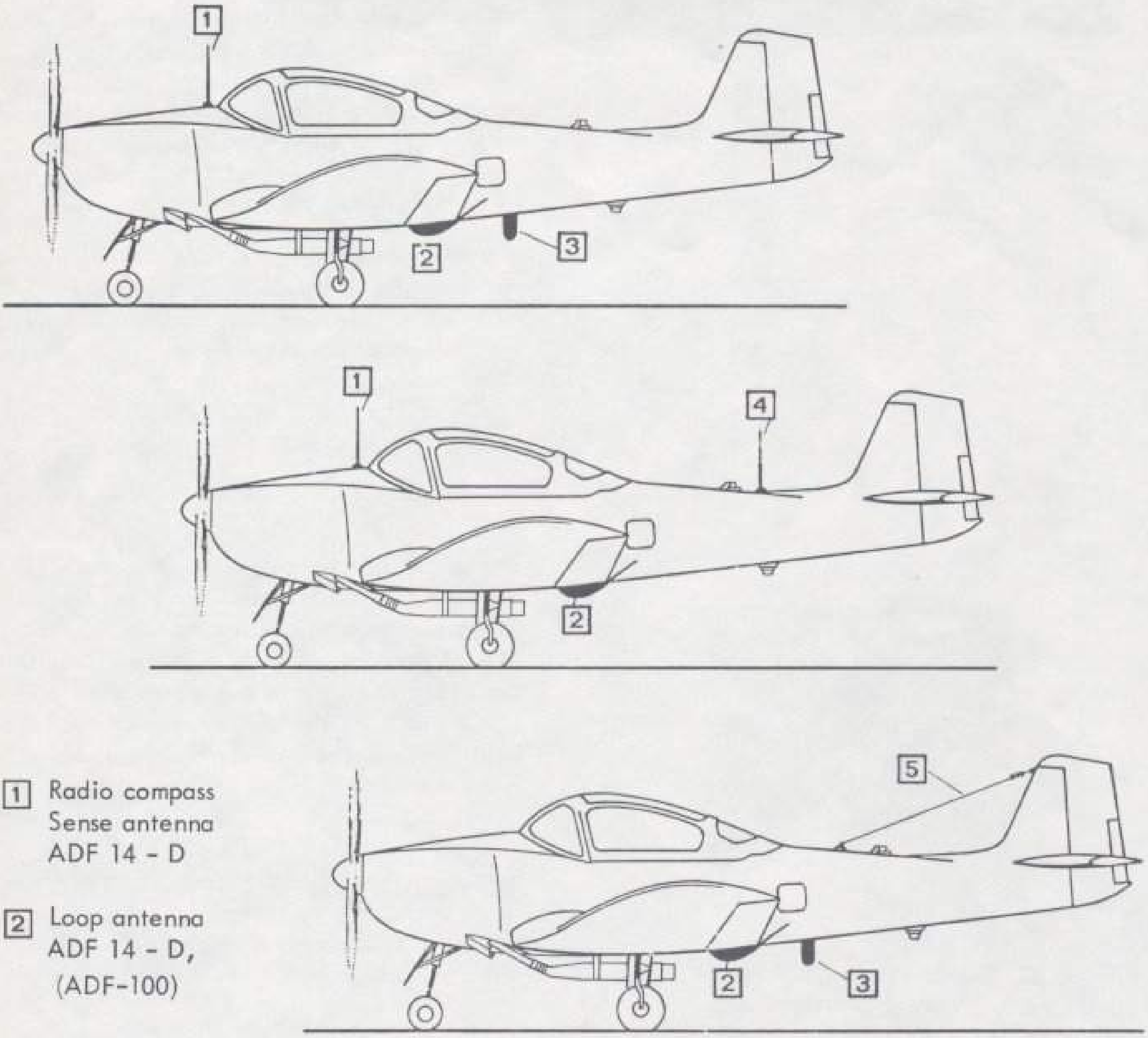
ANTENNA LOCATIONS



1 Radio compass Sense antenna ADF 14 - D

2 Loop antenna ADF 14 - D, (ADF-100)

3 Command radio antenna UHF / ARC-45

4 Command radio antenna VHF/SARAM 5-52

5 Radio compass Sense antenna ADF - 100

Figure 4–8

CONSTANT-WAVE OSCILLATOR SWITCH (CW)

By means of this switch (9, figure 4-7) unmodulated (A1) signals are made audible. In CW position the oscillator is energized, in the unmarked position the oscillator is off.

VOLUME CONTROL KNOB

When turned clockwise, the volume control knob (8, figure 4-7) increases audio gain and RF sensitivity simultaneously.

LOOP CONTROL KNOB

By means of this loop control knob (6, figure 4-7) the loop antenna can be turned in both directions. To turn the loop to the right (R), rotate the knob clockwise. To turn it to the left (L), rotate counterclockwise. Turning the knob slightly from its center position results in a slow antenna movement and turning the knob to the limit results in a fast antenna movement.

Note

The loop control knob is operative only with the mode selector switch in LOOP position.

SCALE AND FRONT PLATE ILLUMINATION

The scale is edge-lighted by two lamps (5, figure 4-7) and the front plate by one lamp.

RADIO COMPASS INDICATOR

The radio compass indicator (1, figure 4-7) is equipped with a compass card for true-course setting. Compass card markings are fluorescent, one scale mark representing 2 degrees.

COMPASS CARD SETTING KNOB (VAR)

This knob (2, figure 4-7) is used for setting the compass card. Turning the knob counterclockwise increases the number of degrees displayed.

OPERATION OF RADIO COMPASS — LEAR ADF 100

RECEPTION/BEARING PREPARATIONS

1. Mode selector switch - ANT
2. Band switch - select frequency band
3. Tuner - select frequency (coarse tuning)
4. Volume control knob - ADJUST for optimum sensitivity

BEARING

CAUTION

For bearing, use a non-fading, non-superimposed signal and observe bearing inaccuracies which sometimes occur.

5. Mode selector switch - COMP

Note

At extreme static charging of the aircraft the LOOP mode of operation will ensure optimum reception.

6. Radio compass indicator - RELATIVE BEARING

MINIMUM BEARING

7. Mode selector switch - LOOP
8. Loop control knob - Minimum Volume (Headset)

   Radio compass indicator - CHECK for RELATIVE BEARING INDICATION

Note

For this type of bearing a second bearing is required since two minimum readings occur, differing 180 degrees in bearing.

9. Mode selector switch - OFF

LIGHTING EQUIPMENT

EXTERIOR LIGHTS

Four position lights, two landing lights and two exterior gear position indicator lights are provided. One position light each is located on the L/H and R/H wing tips, one at the bottom and one at the top of the vertical fin. The landing lights are nonadjustable and installed into the L/H and R/H wing leading edges. The exterior light circuits are protected by circuit breakers (figure 1-10).

ANTICOLLISION LIGHTS (modified aircraft)

One anticollision light (3a, figure 1-1) each is fixed to the top and to the bottom of the fuselage.

EXTERIOR GEAR POSITION INDICATOR LIGHTS

For detailed description refer to SECTION 1.

POSITION LIGHT CIRCUIT BREAKER

This circuit breaker is located on the L/H circuit breaker panel near the windshield (figure 1-10). Power is supplied by the busbar. In IN position, all position lights are on.

R/H LANDING LIGHT CIRCUIT BREAKER and L/H LANDING LIGHT CIRCUIT BREAKER

These two circuit breakers are located on the upper center instrument panel (figure 1-10). In ON position, the landing lights are energized.

ANTICOLLISION LIGHTS CIRCUIT BREAKER

This circuit breaker is located on the L/H circuit breaker panel near the windshield (Figure 1-10).
Power is supplied by the busbar. In EIN position, the anticollision lights are on.

INTERIOR LIGHT

If required, the instrument panel can be illuminated by an ultraviolet light (13, figure 1-3) turnable in all directions. Its brightness is adjustable by means of the ultraviolet light rheostat (15, figure 1-3). The circuit is protected by the ultraviolet light circuit breaker (figure 1-10).

ULTRAVIOLET LIGHT RHEOSTAT

The ultraviolet light rheostat for adjusting ultraviolet light brightness is located on the instrument panel (13, figure 1-3). To fire the ultraviolet lamp turn the rheostat clockwise until a stop is reached, then gradually increase turning pressure until the stop is cleared. After the lamp has fired release the rheostat which will return to the position of the stop. To dim, turn rheostat counterclockwise.

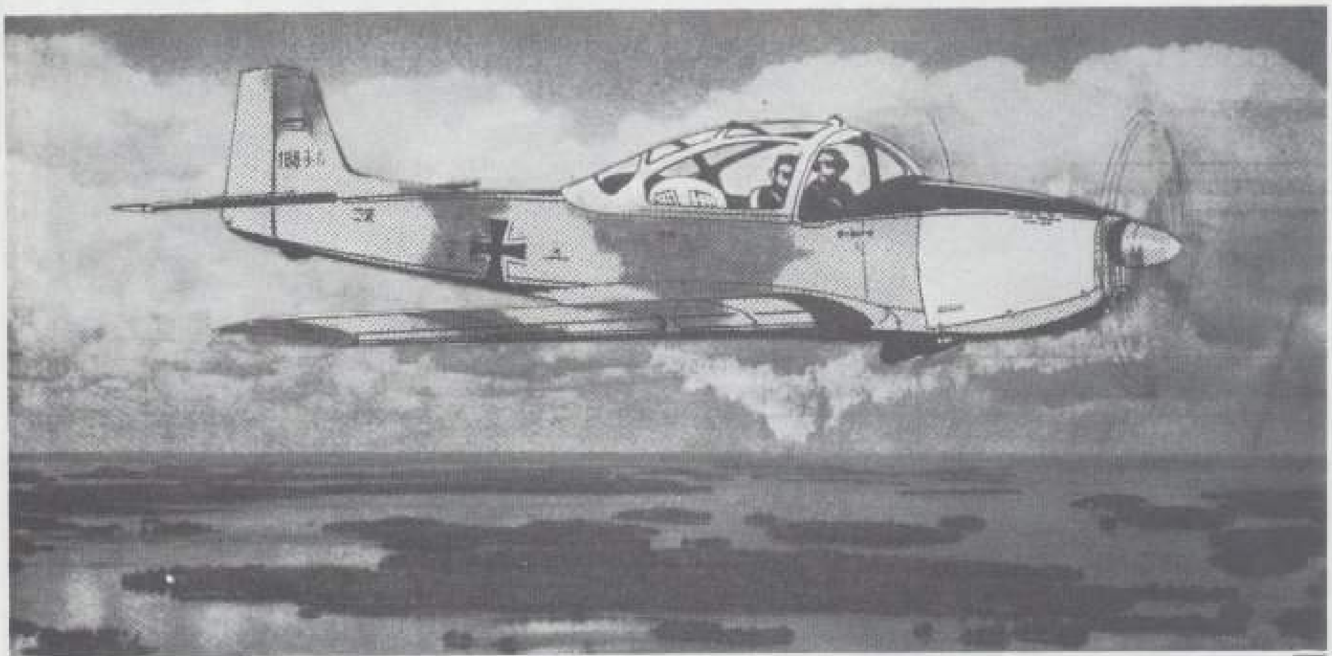
MISCELLANEOUS EQUIPMENT

DOCUMENT POCKETS

One document pocket each is installed in the aircraft inner lining beside the front seats.

CANVAS COVER BAG

This bag contains covers for canopy, propeller and pitot tube.



OPERATING LIMITATIONS V

TABLE OF CONTENTS PAGE

INTRODUCTION

Operating limitations are established to ensure safety of flight and to enable the pilot to operate the aircraft at optimum power settings. The operating limitations are derived from extensive flight testing and operational experience; they are, however, subject to changes due to new operational developments. Operating data requiring detailed explanations or which are subject to further limitations with respect to operational procedures, acrobatics, and air craft loading are given in the following paragraphs.

MINIMUM CREW REQUIREMENTS

The minimum crew requirement for this aircraft is one pilot on the left seat.

INSTRUMENT MARKINGS

Special attention should be given to the instrument markings in figure 5-1, since these limitations are not necessarily repeated under their respective sections.

The instrument markings are used to indicate to the flight crew at a glance, that flight operation is being accomplished in a desirable, cautionary or unsafe region. The instrument marking system consists of four colors and intermediate blank spaces. Red, if used as a minimum limit marking, usually indicates a dangerous condition exists during operation below this marking which requires special attention. When used as a maximum marking, red prohibits operation above this marking. Green indicates the region for continuous or desirable operation. Yellow indi-

INSTRUMENT MARKINGS

BASED ON FUEL F 12 GRADE 80/87

Fuel Pressure

- (red) 0.63 kp/cm² – MIN.
- (green) 0.63 - 1.05 kp/cm² – NORMAL
- (red) 1.05 kp/cm² – MAX.

Manifold Pressure

- (green) 0.55 - 1.0 ata (kp/cm²) NORMAL

Cylinder Head Temperature

- (green) 100 - 245 °C – NORMAL
- (red) 245 °C – MAX. TEMPERATURE

G - Meter

- (red) + 6g MAX. 1470 kp ACROBATIC FLIGHT
- (red) + 4g MAX. 1820 kp NORMAL
- (red) – 3g MAX. 1470 kp ACROBATIC FLIGHT
- (red) – 2g MAX. 1820 kp NORMAL

Figure 5-1 (Page 1 of 2)

Voltmeter

24 - 28.5 V NORMAL GENERATOR

Airspeed Indicator

60 - 80 KNOTS CAUTION

80 - 150 KNOTS
NORMAL AIRSPEED

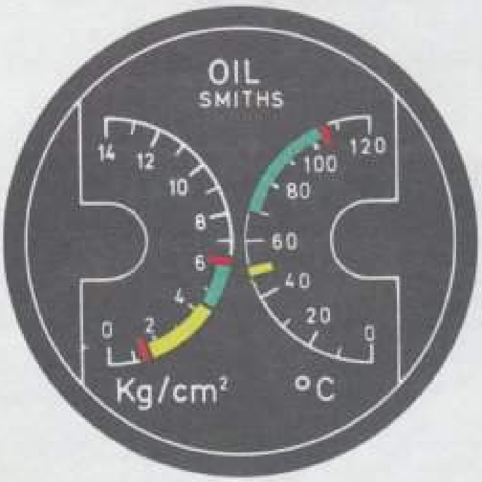
150 - 172 KNOTS CAUTION
(INCREASED ATTENTION)

172 KNOTS MAX. AIRSPEED, GROSS
WEIGHT 1820 kp (DO NOT EXCEED)

204 KNOTS MAX. AIRSPEED, GROSS
WEIGHT 1470 kp (DO NOT EXCEED)

Engine RPM

2600 - 3000 RPM – NORMAL
3000 - 3400 RPM – CAUTION
3400 RPM – MAX. 5 MIN.



Oil Pressure

1.75 kp/cm² – MINIMUM
1.8 - 4.6 kp/cm² – CAUTION
4.6 - 6.0 kp/cm² – NORMAL
6.0 kp/cm² – MAX.

Oil Temperature

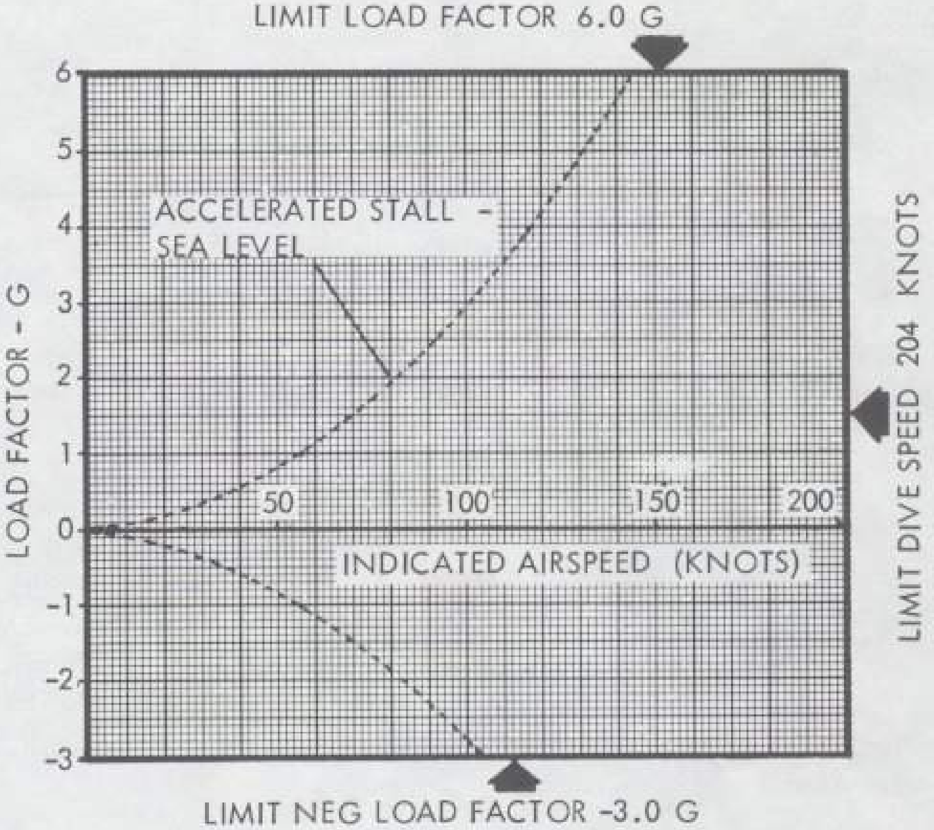
50 °C – CAUTION
70 - 107 °C – NORMAL
107 °C – MAX.

Figure 5-1 (Page 2 of 2)

OPERATING FLIGHT LIMITS

Configuration: Flaps - UP
Gear - UP

BASED ON DESIGN GROSS WEIGHT 1470 kp



BASED ON DESIGN GROSS WEIGHT 1820 kp

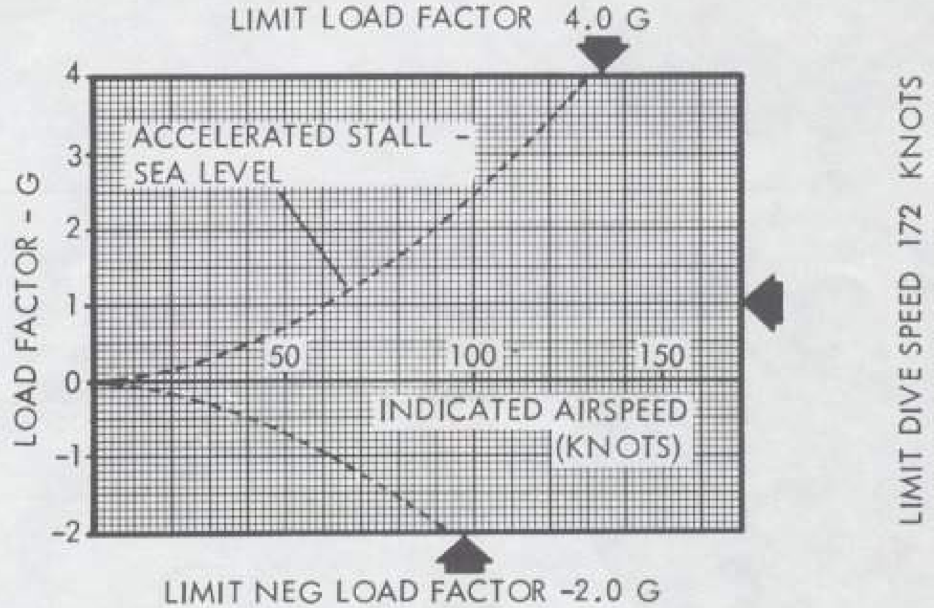


Figure 5–2

cates caution or that danger may exist in this region under certain conditions. Blank spaces indicate regions to be avoided or regions in which operation is limited. Instrument markings are further explained by the use of legends under the instrument caption in figure 5-1. Care should be taken not to exceed these limits as damage can result to both equipment and aircarft.

ENGINE LIMITATIONS

For normal engine operating limits refer to fig. 5-1; for detailed instructions refer to the following paragraphs and fig. A-7 ENGINE OPERATING LIMITS CURVE, page A-12.

ENGINE OVERSPEED

Note

Magnitude and duration of any engine overspeed condition and its reason, if known, shall be entered into form 781 to initiate an engine inspection.

If engine has exceeded 3400 to 3600 RPM, engine inspection must be perform prior to next flight. If engine has exceeded 3600 RPM, must be remove engine for overhaul.

CAUTION

If engine overspeed occurs in flight, the aircraft should be landed as soon as practicable to determine if the engine has been damaged.

ENGINE OVERBOOST

No engine overboost limitations applicable since the carburetor of the Lycoming GO 480-B1A6 engine is equipped with an automatic mixture control.

FUEL LIMITATIONS

The primary fuel for this aircraft is grade 100/130 gasoline (refer to figure 1-20, page 1-29). The performance charts in Appendix I are based on grade 80/87 but may be used for grade 100/130 gasoline without any corrections being applied. The alternate fuel is grade 115/145 gasoline. Mixing is permissible.

PROPELLER LIMITATIONS

No operating limitations except those imposed on the engine itself. Whenever engine RPM exceeds 3600, requiring removal and overhaul of the engine, the propeller must be inspected in the prescribed manner.

AIRSPEED LIMITATIONS

For aircraft gross weight 1820 kp maximum airspeed readings, refer to figure 5-1 (page 2 of 2). For gross weight 1470 kp. maximum permissible airspeed is 204 KIAS at sea level. Do not exceed this airspeed under any circumstances. The yellow mark represents the cautionary aircraft airspeed area. The green range represents normal airspeed.

LANDING GEAR LIMITATIONS

Maximum airspeed with landing gear extended for all aircraft gross weights is 113 KIAS.

Maximum airspeed during landing gear extension for all aircraft gross weights is 108 KIAS.

Minimum airspeed with landing gear extended is 60 KIAS.

FLAP LIMITATIONS

Maximum airspeed with flaps REST 5 position (43°) for all aircraft gross weights is 95 KIAS.

Maximum airspeed with flaps REST 2 position (18°) for all aircraft gross weights is 113 KIAS.

Minimum airspeed with all flap positions is 60 KIAS.

PROHIBITED MANEUVERS

CAUTION

Acrobatic flights with aircraft of more than 3000 hours of flying time are prohibited.

The P 149 D model aircraft are subject to flight maneuver limitations to prevent damage and failures. The aircraft is approved for acrobatics only at a maximum gross weight of 1470 kp and only with a crew of one or two on the front seats.

WARNING

Engine oil sump location restricts acrobatic flight inasmuch as no negative G-forces may result (inverted flying and forward loop).

CAUTION

Forward loop is strictly prohibited. Negative accelerations in excess of 3 g are not permitted. Whip stall is strictly prohibited.

VERSION A2-A6/A9

EXAMPLE:	A2-A6	A9
BASIC WEIGHT AND VARIABLE LOAD FOR MAX. GROSS WEIGHT	1175 kp ± 17	1193.8 kp ± 17
BASIC WEIGHT INCLUDING		
RADIO COM SYSTEM, FIRE EXTINGUISHING SYSTEM, BRAKE FLUID, BATTERIES, RADIO COMPASS, TRAPPED FUEL AND OIL		
ADDITIONAL INSTALLATIONS (INSTRUMENTS)	15 kp	
BASIC WEIGHT INCLUDING ADDITIONAL INSTALLATIONS	1190 kp	1208.8 kp
VARIABLE (EXPENDABLE) LOAD		
FUEL 236 l	170 kp	
OIL 11,36 l	10 kp	
TWO PILOTS AND PARACHUTES	190 kp	
TWO PASSENGERS AND PARACHUTES	190 kp	
LUGGAGE HOLD (TOOLS, COVERS, LUGGAGE)	70 kp	51.2 kp
MAX. GROSS WEIGHT	1820 kp	1820 kp

A2-A6	Basic weight
A9	Basic weight and sound suppressor FTF 60 and anticollision lights

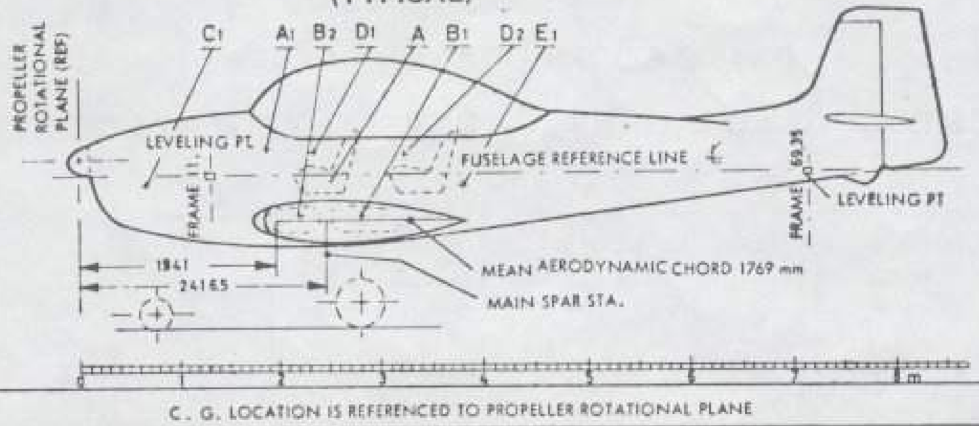
Note

- The C. G. tolerances for configuration A-9 is also 19.3 thru 31.9 percent mean aerodynamic wing chord.
- The chart for permissible C. G. location tolerances for configuration A2-A6 is also for configuration A-9

Figure 5-3

LOADING CHART, CONFIG. A2 – A6

(TYPICAL)



C. G. LOCATION IS REFERENCED TO PROPELLER ROTATIONAL PLANE

BASIC WEIGHT AND VARIABLE LOAD FOR MAX. GROSS WEIGHT

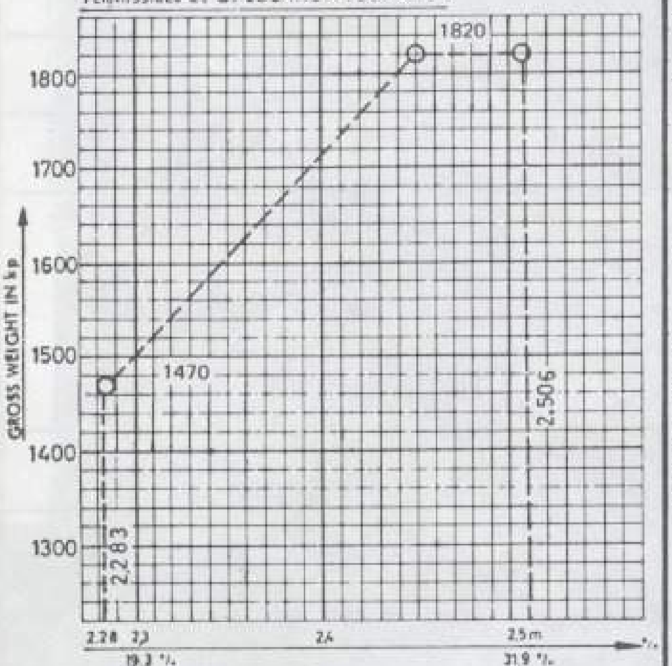
BASIC WEIGHT INCLUDING RADIO COM SYSTEM, FIRE EXTINGUISHING SYSTEM, BRAKE FLUID, BATTERIES, RADIO COMPASS, TRAPPED FUEL AND OIL	1175
ADDITIONAL INSTALLATIONS (INSTRUMENTS)	15 kp
BASIC WEIGHT INCLUDING ADDITIONAL INSTALLATIONS	1190 kp
VARIABLE (EXPENDABLE) LOAD	
FUEL 236 l	170 kp
OIL 11,36 l	10 kp
TWO PILOTS AND PARACHUTES	190 kp
TWO PASSENGERS AND PARACHUTES	190 kp
LUGGAGE HOLD (TOOLS, COVERS, LUGGAGE)	70 kp
MAX. GROSS WEIGHT	1820 kp

AIRCRAFT GROSS WEIGHT SHALL NOT EXCEED 1820 kp.

WEIGHTS AND DISTANCES "X" FOR EQUIPMENT

	WEIGHTS	DISTANCES "X"
RADIO SET	16.5 to 20 kp	4.394 m
BATTERIES	24 to 27 kp	1.231 m
FIRE EXTINGUISHING ASSY. MINIMAX CB 2	4.75 kp	2.214 m

PERMISSIBLE C. G. LOCATION TOLERANCES



C. G. DISTANCES FROM REFERENCE PLANE IN m AND IN PERCENT MEAN AERODYNAMIC WING CHORD

TABLE, C. G. DETERMINATION

C. G. DISTANCE FROM PROPELLER ROTATIONAL PLANE IS CALCULATED USING THE EQUATION

$$X = \frac{\text{TOTAL MOMENT}}{\text{GROSS WEIGHT}}$$

C. G. TOLERANCES

C. G. DISTANCE FROM PROPELLER ROTATIONAL PLANE MAY VARY FROM

X = 2.283 m TO X = 2.506 m

OR FROM 19.3 TO 31.9 PERCENT MEAN AERODYNAMIC WING CHORD

EXAMPLE, C. G DETERMINATION

(2 PILOTS, 1 PASSENGER, FULLY SERVICED FUEL TANKS)

		WEIGHTS IN kp	DISTANCES "X" IN m	MOMENTS IN m/kp
BASIC WEIGHT	A	1175	2.320	2726.00
ADDITIONAL INSTALLATIONS	A1	15	1.816	27.24
FUEL, REAR TANKS	B1	109	2.804	305.64
FUEL, FORWARD TANKS	B2	61	2.164	132.00
OIL	C1	10	0.706	7.06
PILOTS	D1	190	2.374	451.06
PASSENGER	D2	95	3.184	302.48
TOOLS & COVERS (IN LUGGAGE HOLD)	E1	34	3.714	126.28
LUGGAGE (IN LUGGAGE HOLD)	E1	36	3.714	133.70
	GROSS WEIGHT	1725	TOTAL MOMENTS	4211.46

C. G. LOCATIONS $\frac{4211.46}{1725}$ = 2.441 m (FULLY SERVICED FUEL TANKS)

Note

In the calculation - example the center - of - gravity distance "X" has been established as 2.320 m in order to indicate the tolerance according to the state of production and basic equipment. For the actual basic weight and the respective center - of gravity distance see - Handbook of Weight and Balance Data T.O. 1-1B-40, Form 365 C -.

C. G. LOCATION, FUEL TANKS EMPTY	WEIGHTS IN kp	DISTANCES "X" IN m	MOMENTS IN m/kp
FUEL, REAR TANKS	3	2.804	8.41
FUEL, FORWARD TANKS	2	2.164	4.33
GROSS WEIGHT	1560	TOTAL MOMENT	3786.56

C. G. LOCATION $\frac{3786.56}{1560}$ = 2.426 m (FUEL TANKS EMPTY)

Figure 5-4

P 149 D CONFIGURATIONS A2 - A6

PERMISSIBLE C. G. LOCATIONS FOR DIFFERENT FLIGHT CONDITIONS

(TYPICAL)

BASIC WEIGHT AND VARIABLE LOAD WITH BASIC WEIGHT a		ACROBATIC VERSION						GENERAL VERSION											
		I		IIa		IIb		III		IVa		(WITH MIN. WEIGHT FOR PILOT) IVb		V		VI			
LOAD	DISTANCE FROM PROP. ROT. PLANE	2 PILOTS FUEL TANKS AS STATED		1 PILOT FUEL TANKS AS STATED		1 PILOT FUEL TANKS EMPTY		2 PILOTS FUEL TANKS FULL		1 PILOT 2 PSGRS FUEL TANKS FULL		1 PILOT 2 PSGRS FUEL TANKS FULL		2 PILOTS 1PSGR FUEL TANKS FULL		2 PILOTS 2 PSGRS FUEL TANKS FULL			
	d	W	dW	W	dW	W	dW	W	dW	W	dW	W	dW	W	dW	W	dW	W	dW
BASIC WEIGHT FORWARD C. G. LOC.	2.294	1175	2695.4	1175	2695.4	1175	2695.4	1175	2695.4	—	—	—	—	—	—	—	—		
BASIC WEIGHT REAR C. G. LOC.	2.346	—	—	—	—	—	—	—	—	1175	2756.5	1175	2756.5	1175	2756.5	1175	2756.5		
ADDITIONAL INSTALLATION (INSTRUMENTS)	1.816	15	27.24	15	27.24	15	27.24	15	27.24	15	27.24	15	27.24	15	27.24	15	27.24		
FUEL: REAR TANKS	2.804	50.67	142.08	112.90	316.57	3	8.41	109	305.64	109	305.64	109	305.64	109	305.64	109	305.64		
FUEL: FORWARD TANKS	2.164	29.33	63.47	62.10	134.38	2	4.33	61	132.0	61	132.0	61	132.0	61	132.0	61	132.0		
OIL	0.706	10	7.06	10	7.06	10	7.06	10	7.06	10	7.06	10	7.06	10	7.06	10	7.06		
PILOT & PARACHUTE	2.374	190	451.06	95	225.53	95	225.53	190	451.06	95	225.53	70 min. weight	166.18	190	451.06	190	451.06		
PSGRS & PARACHUTES	3.184	/	/	/	/	/	/	/	/	190	604.96	190	604.96	95	302.48	190	604.96		
LUGGAGE HOLD: TOOLS & CANAVAS COVER	3.714	/	/	/	/	/	/	34	126.26	34	126.28	34	126.28	34	126.28	34	126.28		
LUGGAGE HOLD: ADDITIONAL LUGGAGE	3.714	/	/	/	/	/	/	36	133.70	36	133.70	36	133.70	36	133.70	36	133.70		
LUGGAGE HOLD: GROSS WEIGHT	/	1470	/	1470	/	1300	/	1630	/	1725	/	1700	/	1725	/	1820	/		
C. G. LOCATIONS: MOMENT ABOUT REF. POINT (d · W)		3386.31		3406.18		2967.07		3878.38		4318.91		4259.56		4241.96		4544.44			
C. G. LOCATIONS: DISTANCE FROM REF. POINT $a = \frac{d \cdot W}{W}$		2.304		2.317		2.283		2.379		2.504		2.506		2.459		2.497			
C. G. LOCATIONS: DISTANCE FROM WING L. E. MEAN AERO DYN. CHORD		0.363		0.376		0.342		0.438		0.563		0.565		0.518		0.556			
C. G. LOCATIONS: PER CENT MEAN AERODYNAMIC WING CHORD		20.52 %		21.25 %		Fwd. C. G. location 19.3 %		24.8 %		31.8 %		Aft C. G. location 31.9 %		29.2 %		31.4 %			

d = DISTANCE FROM PROP. ROT. PLANE IN m

W = WEIGHT IN kp

dW = MOMENTS IN mkp

NOTE C. G. LOCATION MOVES FORWARD AS FUEL IS DEPLETED

MEAN AERODYNAMIC CHORD 1769 mm

Figure 5-5

P 149 D CONFIGURATIONS A9

PERMISSIBLE C. G. LOCATIONS FOR DIFFERENT FLIGHT CONDITIONS

(TYPICAL)

BASIC WEIGHT AND VARIABLE LOAD WITH BASIC WEIGHT a		ACROBATIC VERSION						GENERAL VERSION											
		I		IIa		IIb		III		IVa		(WITH MIN. WEIGHT FOR PILOT) IVb		V		VI			
LOAD	DISTANCE FROM PROP ROT. PLANE	2 PILOTS FUEL TANKS AS STATED		1 PILOT FUEL TANKS AS STATED		1 PILOT FUEL TANKS EMPTY		2 PILOTS FUEL TANKS FULL		1 PILOT 2 PSGRS FUEL TANKS FULL		1 PILOT 2 PSGRS FUEL TANKS FULL		2 PILOTS 1PSGR FUEL TANKS FULL		2 PILOTS 2 PSGRS FUEL TANKS FULL			
	d	W	dW	W	dW	W	dW	W	dW	W	dW	W	dW	W	dW	W	dW	W	dW
BASIC WEIGHT FORWARD C. G. LOC.	2.300	1193.8	2745.74	1193.8	2745.74	1193.8	2745.74	1193.8	2745.74	—	—	—	—	—	—	—	—		
BASIC WEIGHT REAR C. G. LOC.	2.351	—	—	—	—	—	—	—	—	1193.8	2806.62	1193.8	2806.62	1193.8	2806.62	1193.8	2806.62		
ADDITIONAL INSTAL-LATION (INSTRUMENTS)	1.816	15	27.24	15	27.24	15	27.24	15	27.24	15	27.24	15	27.24	15	27.24	15	27.24		
FUEL REAR TANKS	2.804	38.76	108.68	100.77	282.56	3	8.41	109	305.64	109	305.64	109	305.64	109	305.64	109	305.64		
FUEL FORWARD TANKS	2.164	22.44	48.56	55.43	119.95	2	4.33	61	132.0	61	132.0	61	132.0	61	132.0	61	132.0		
OIL	0.706	10	7.06	10	7.06	10	7.06	10	7.06	10	7.06	10	7.06	10	7.06	10	7.06		
PILOT & PARACHUTE	2.374	190	451.06	95	225.53	95	225.53	190	451.06	95	225.53	70 min. weight	166.18	190	451.06	190	451.06		
PSGRS & PARACHUTES	3.184	/	/	/	/	/	/	/	/	190	604.96	190	604.96	95	302.48	190	604.96		
LUGGAGE HOLD: TOOLS & CANAVAS COVER	3.714	/	/	/	/	/	/	34	126.28	34	126.28	34	126.28	34	126.28	34	126.28		
LUGGAGE HOLD: ADDITIO-NAL LUGGA-GE	3.714	/	/	/	/	/	/	36	133.70	36	133.70	36	122.56	36	133.70	36	63.88		
LUGGAGE HOLD: GROSS WEIGHT	/	1470	/	1470	/	1318.8	/	1648.8	/	1743.8	/	1715.8	/	1743.8	/	1820	/		
C. G. LOCATIONS: MOMENT ABOUT REF. POINT (d W)		3388.34		3408.08		3018.31		3926.72		4369.03		4298.54		4292.08		4524.74			
C. G. LOCATIONS: DISTANCE FROM REF. POINT $a = \frac{d\ W}{W}$		2.305		2.318		2.288		2.382		2.505		2.505		2.461		2.486			
C. G. LOCATIONS: DISTANCE FROM WING L. E. MEAN AERO DYN. CHORD		0.364		0.377		0.347		0.441		0.564		0.564		0.520		0.545			
C. G. LOCATIONS: PER CENT MEAN AERODYNAMIC WING CHORD		20.57 %		21.31 %		Fwd. C. G. location 19.3 %		24.92 %		31.88 %		Aft C. G. location 31.9 %		29.39 %		30.8 %			

d = DISTANCE FROM PROP. ROT. PLANE IN m
W = WEIGHT IN kp
dW = MOMENTS IN mkp

NOTE C. G. LOCATION MOVES FORWARD AS FUEL IS DEPLETED
MEAN AERODYNAMIC CHORD 1769 mm

Figure 5-6

ACCELERATION LIMITATIONS

Acceleration limitations are imposed on this aircraft for either structural or aerodynamic reasons. The structural limitations apply at all altitudes but may be less restrictive than the aerodynamic limits. The operating flight limits diagrams (figure 5-2) show the symmetrical maneuvering envelopes for two loading conditions.

Note

The dashed line indicates G loads at which aircraft stalls at various airspeeds.

LANDING LIMITATIONS

No landing speed limitations specified. Landing speed is variable and should be selected according to the aircraft gross weight.

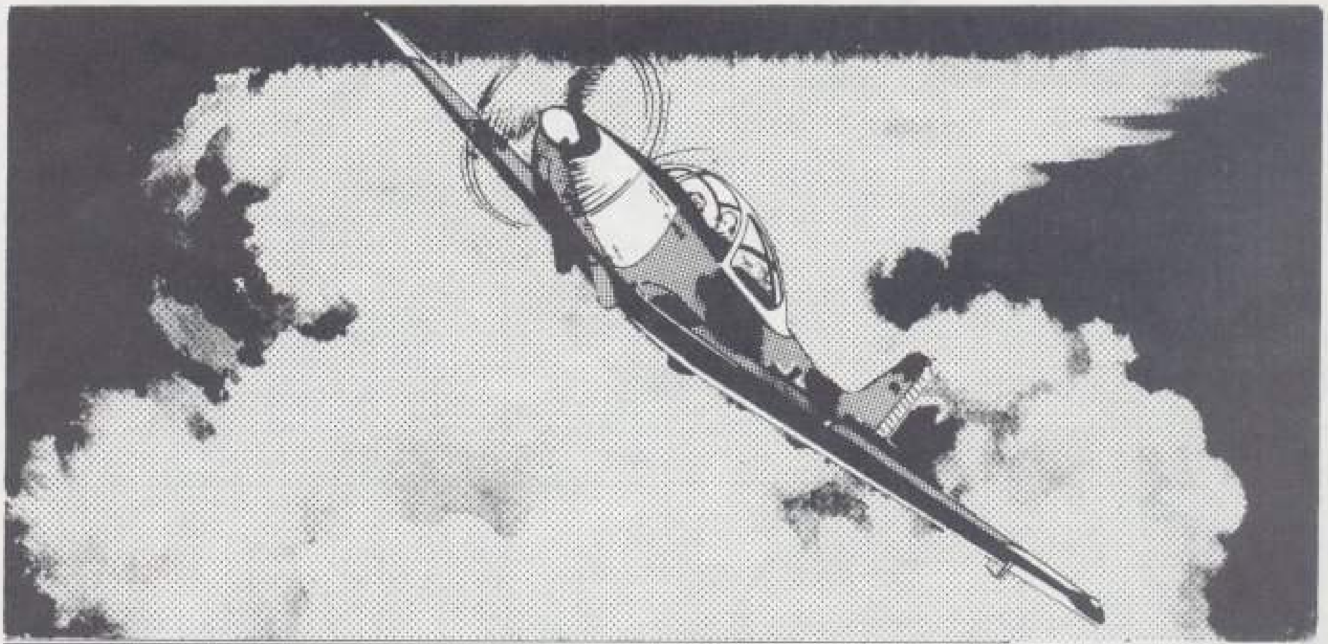
WEIGHT LIMITATIONS

The aircraft miximum gross weight must not be exceeded (figure 1-2). The load in the baggage compartment must not exceed the specified value of 70 kp.

Note

Acrobatic flight are not allowed with cargo in the baggage compartment.

For permissible load in the baggage compartment see loading chart. For weight and balance informations refer to Handbook of Weight and Balance Data, T. O. 1-1B-40.



FLIGHT CHARACTERISTICS SECTION VI

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INTRODUCTION

The aircraft is stable around all axes. Aircraft flight control is excellent in all flight attitudes. At low airspeed the angle of attack may be quickly reduced. Trim changes induced by throttle, landing gear or wing flap movements are easily compensated. Rudder and elevator trim capability is sufficient; even at incorrect trim settings caused by maladjustments or malfunctions, the forces applied can be easily controlled due to the limited trim range. The aircraft is easily controllable at all flight attitudes up to the point of stall without any control reversal becoming effective.

STALLS

For stalling speeds at different aircraft configurations and gross weights refer to fig.6-1.

POWER-OFF STALLS

The aircraft can be easily stalled in the power-off condition. Two to three knots prior to the actual stall, the aircraft gives a stall warning in the form of a mild vibration going through the aircraft. During a stall the aircraft pitches into a nose-down attitude of approximately 10 degrees below horizon. Slight yaw and roll movements are easily corrected.

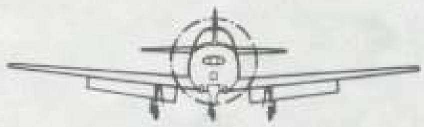
POWER-ON STALLS

In the power-on condition, too, the aircraft can be stalled relatively easily. During a power-on stall wing level and heading are maintained by rudder movements.

Note

The landing gear position has no

STALL SPEEDS



GROSS WEIGHT kp	FLAPS UP - GEAR UP POWER OFF	FLAPS DOWN - GEAR DOWN POWER OFF
	SPEEDS ARE GIVEN IN KNOTS (IAS)	
1470	53	46
1560	56	48
1820	61	51

Figure 6-1

appreciable effect on the stalling characteristics.

STALL RECOVERY

For this aircraft, recovering from stall is normal and should be effected as follows:

1. Drop nose immediately by releasing back pressure on the stick at full power.
2. Use rudder as required to regain straight and level attitude.
3. After the nose has been lowered, speed increases rapidly. When you attain safe flying speed, raise nose with steady back pressure.
4. Retard throttle to cruising power.

PRACTICE STALLS

For familiarization with the aircraft stall characteristics under various flight conditions, perform the following practice stalls. All practice stalls, with the exception of landing gear-down and flap-down stalls, shall be continued from the point of an abrupt dive pull-out to an actual stall. Do not increase the stalling condition by continuously pulling the control stick. Coordinate control surface deflections. Do not execute excessive aileron deflections. If a wing starts to drop, apply opposite rudder.

PRACTICE STALL
GEAR AND FLAPS UP, POWER OFF,
STRAIGHT AHEAD

This stall condition is less violent and forms a stalling basis for comparison with other modes of stall. Start the practice stall in level flight, retard throttle to IDLE, pull the aircraft nose-up above horizon level and maintain this flight attitude. As soon as the stalling condition is reached, watch lessening of control force, observe flight attitude and engine sound. Observe how stall warning vibrations start 2 to 3 knots prior to actual stall. As the actual stall occurs, recover according to specified method.

PRACTICE STALL
GEAR AND FLAPS UP, POWER ON,
STRAIGHT AHEAD

Perform initiation of, and recovery from, stall in the same way as mentioned in the foregoing practice stall. Consider that application of power results in a nose-up attitude and an increase in stalling speed.

PRACTICE STALL
GEAR AND FLAPS UP, POWER ON OR OFF,
20-DEGREE BANK

Fly a coordinate climbing turn at a 20-degree bank attitude. Pull the aircraft several degrees nose-up above horizon level and maintain this flight attitude until a stall occurs. Perform a standard recovery with a coordinated roll out of the turn and dive. Observe increasing airspeed during a stall at a bank attitude. This stalling speed increase is the result of a wing load build-up due to centrifugal acceleration.

PRACTICE STALL
GEAR DOWN, FLAPS UP, POWER OFF,
STRAIGHT AHEAD

Practice this stall in anticipation of a forced flaps-up landing. Retard throttle and attempt a normal glide at 100 KIAS. Pull up aircraft nose and proceed in landing attitude until stall occurs. Note that gear-down condition does not increase rate of sink and causes aircraft to lose speed more rapidly. Use normal stall recovery.

PRACTICE STALL
GEAR AND FLAPS DOWN, POWER OFF,
STRAIGHT AHEAD

This stalling practice procedure is basically a power-off landing. Simulate a traffic pattern and make standard landing checks. Turn on final approach, make final checks, and set up approach speed of 90 KIAS. Flare at simulated runway altitude, pull nose up to landing attitude, and hold until stall occurs. At this point, observe flight characteristics of aircraft. Note how stalling speed is reduced by wing flaps application.

PRACTICE STALL
GEAR AND FLAPS DOWN, POWER ON,
STRAIGHT AHEAD

This stalling practice procedure is also applied for landings. Simulate a complete traffic pattern as in preceding practice stall. Since this stall occurs at the lowest airspeed of any of the stall series, it effectively demonstrates the lowest airspeed at which the aircraft can be flown.

SPIN

The aircraft has satisfactory spin characteristics. For safe spin performance the altitude at which spin is initiated shall be selected so that the aircraft will be recovered from spin at 5000 ft AGL. Loss of altitude for each spin revolution is approximately 500 ft. When initiating spin, reduce engine power to a minimum and decrease airspeed to 60 KIAS by slowly pulling back the control stick. Full rudder must be held in the direction of the spin, and the stick must be held full back to maintain the spin. Aileron position does not materially affect spin characteristics.

Note

The procedures mentioned above shall be performed speedily to cause the aircraft to spin and to maintain spinning.

After several spin revolutions the aircraft spin motion changes and the aircraft pitch attitude approaches the horizontal plane.

SPIN RECOVERY

To obtain spin recovery, leave ailerons neutral, apply and maintain full opposite rudder. Maintain this position for approximately 2 seconds. Smoothly push control stick fully forward. Hold flight controls in this position until spin-rotation stops (after approx. one revolution). Neutralize rudder. Slowly pull control stick aft to take the aircraft out of the dive.

CAUTION

Initiate the spin recovery procedure after a maximum of two revolutions, including the spin initiation revolution.

FLIGHT CONTROL EFFECTIVENESS

All flight controls are very effective throughout the normal speed range, and only moderate stick movement is required to maneuver the aircraft. At high speeds, the aircraft response to control movement is greater than at cruise speeds, and abrupt movement of the controls must be avoided to prevent exceeding the G-limit of the aircraft.

AILERON CONTROL

Aileron deflection stick forces are proportionate to airspeed and rate of roll. Aileron characteristics are normal throughout the entire speed range.

ELEVATOR CONTROL

After the aircraft has been trimmed properly at a given airspeed, only light stick forces are required for any longitudinal change. Changing from one configuration to another (as from a clean aircraft to landing gear and flaps down) without a corresponding change in trim does not impose excessive elevator stick forces.

RUDDER CONTROL

Rudder control is satisfactory for all maneuvers including sideslips and cross-wind landings.

TRIM TAB CONTROLS

Trim tabs are very effective on the aircraft. The rudder, elevator, and aileron trim have full response throughout the entire speed range of the aircraft. All trim tabs except the aileron trim tab are adjustable from the cockpit, by use of the trim tab controls (31, figure 1-3 and 5, figure 1-5). The aileron trim tabs are adjustable on the ground.

LEVEL-FLIGHT CHARACTERISTICS

The aircraft has good stability and control characteristics and, when properly trimmed, it will maintain level flight. The aircraft has no undesirable characteristics throughout the entire speed range from stalling speed to maximum speed.

MANEUVERING FLIGHT CHARACTERISTICS

Rapid aircraft response to flight control movement during the normal speed range provides good aircraft characteristics.

CAUTION

Do not trim the aircraft during any acrobatic maneuvers in an attempt to reduce stick forces, as only small elevator stick forces will be required to exceed the structural limits for the aircraft.

DIVES

In dives to limit airspeed, the handling characteristics of the aircraft are good. All control movement is easy and effective, and the aircraft responds immediately and normally. Use the following procedure in a dive:

1. If necessary, pull the carburetor heat knob.
2. Do not exceed maximum airspeed during dive. Refer to "Airspeed Limitations" in Section V.

CAUTION

During dives there is danger of undercooling the engine. Ensure that cylinder head and oil temperatures are maintained within limitations.

SYSTEMS OPERATION SECTION VII

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INTRODUCTION

For safe and easy handling all levers, handles and switches for the control of engine, propeller, engine supply systems, control surfaces and other equipment are positioned within the pilots'reach. They are located on the instrument panel, on the floor, in the center engine control box and in the L/H engine control box.

USE OF MAXIMUM POWER

Maximum power of 270 horsepower at 3400 rpm must not be used except for takeoff and in cases of emergency and not for more than 5 minutes. Extended use of maximum power will cause damage to the engine.

DETONATION

The fuel-air mixture shall burn uniformly and calmly at flame front velocities of 20 to 40 m/sec. At a certain pressure and temperature level in the cylinder a critical point is reached where the entire fuel-air mixture in the cylinder explodes instantaneously. Although combustion pressure increases considerably, engine power decreases since maximum pressure occurs prior to the piston reaching its top dead center.

Note

> Detonation is an instantaneous combustion of the entire unburned part of the fuel mixture after the normal combustion.

The pressure waves move at sound velocity and may cause damage to the combustion chamber interior (e.g. broken piston rings, damaged pistons and valves). A detonation condition can be determined by a considerable increase in cylinder head temperature and a blackened exhaust with red-hot sparks or a short light orange flame coming from the exhaust.

Remedy:

a) Use correct fuel
b) Reduction of intake air temperature.

Note

Retard throttle as an instantaneously effective and safe means to eliminate detonation.

PREIGNITION

Preignition and detonation are two different types of uncontrolled combustion. Preignition or autoignition occurs prior to normal ignition. It is caused mostly by an exceedingly high pressure near the end of the compression stroke and is initiated by hot spots in the combustion chamber, e.g. a red-hot spark plug electrode, hot valves or smouldering oil carbon particles. In this case the greatest damage is caused by a temperature increase at the cylinder heads.

Note

Preignition and detonation are often caused one by the other.

STOPCOCK

Fuel mixture is controlled by means of automatic mixture control in the PS-5BD BENDIX-STROMBERG carburetor. The automatic mixture control operates independently of and in parallel to the manual mixture control to automatically correct for the enriching mixture as altitude increases.

CAUTION

Do not set mixture control manually. Leave stopcock on RICH when engine is running.

The stopcock (fig. 1-3) must be in RICH position even if the engine is not running to relieve the pressure bellows. The stopcock is fully pulled only to cut off the engine by shutting-off fuel flow to the carburetor.

SPARK PLUG FOULING

The spark plug produces a high-voltage spark (approx. 20 000 volt) between two electrodes (body electrode and center electrode). For reasons of safety and for faster ignition of the fuel-air mixture and thus faster combustion each cylinder is equipped with two spark plugs. The spark plug is highly stressed by mechanical, electrical and especially by thermic loads. Proper functioning of the spark plugs is often fully or partially obstructed by oil carbon deposits formed during engine starting or by oil or humidity. Therefore it is essential to keep the temperature between the center electrode and the insulator between 550 and 800°C. At this temperature, the oil carbon deposits burn completely. Therefore this temperature is called the spark plug self cleaning temperature. In IDLE or partial power setting, the mean spark plug temperature decreases to 150 to 200°C. At this temperature, the spark plugs operate satisfactorily too, but at these conditions no oil penetration into the cylinder is permissible and the mixture should not be too rich.

CAUTION

Use IDLE setting as little as possible.

The spark plug self cleaning temperature of 800°C should not be substantially exceeded since detonations may occur at temperatures above 880°C and the electrodes are more affected by lead or sulphur oxides and therefore burn down more quickly.

INDUCTION SYSTEM ICING

The aircraft is not equipped with a de-icing system. Only the pitot tube is heated to prevent icing. In addition, the carburetor can be supplied with hot air from the engine compartment for anti-icing.

There are three different types of ice formation at the carburetor:

- Ice penetrating from the outside, formed by snow, hail or water undercooled in the atmosphere;
- Ice formation at the throttle caused by the cooling effect of the narrowed passages in the air filter;
- Ice formation caused by the cooling effect of fuel evaporating during the atomization at the air intake.

Under certain atmospheric conditions ice may form in the carburetor with air temperature being considerably above freezing (0°C). A carburetor icing condition is indicated by the following: decrease in compression and hence decrease in engine power; change in fuel-air mixture to lean or rich which can be noticed by rough engine running; ice formation at other aircraft components. To prevent ice formation check for sufficient hot air flow to the carburetor. Ice already formed must be thawed by means of hot air by opening the carburator heat control or by descending to an altitude where no icing conditions prevail.

ENGINE PRIMING

For starting, the carburetor does not supply fuel-air mixture to the cylinders which, for this reason, must be primed. Primer fuel is injected into the engine manifold system, where it is mixed with carburetor air and fed to the cylinder intakes. During engine motoring, the fuel-air mixture is ignited by a spark from the ignition unit. As the engine starts, an air flow is produced at the intakes and the carburetor comes up to operating pressures. The fuel quantity required for engine starting depends on outside air temperature and engine temperature. If the engine is still warm, an amount of fuel sufficient to start the engine may still be left in the intake unit; in this case no priming is required. Under all other conditions priming is required.

EXCESSIVE PRIMING

By injecting excessive amounts of fuel, the cylinders are over-filled and starting will be difficult. Indications for excessive fuel priming injections are a weak ignition and thick black smoke coming from the exhaust. In extreme cases, fuel can wash the oil film from cylinder walls, pistons and piston rings. Without the lubrication film there is danger of pitting in the cylinder wall or piston seizing. This condition is indicated by a screeding noise of the pistons when motoring the engine. When this condition occurs do not attempt to start the engine prior to removing spark plugs and spraying oil into the cylinders. If the engine does not start after an excessive injection and no creaking noise and/or evidence of a liquid lock is noticed, motor the engine with the ignition in OFF and the stopcock in CUT OFF position. Repeat starting with little or no priming.

WARNING

Over - priming can cause fire in the exhaust system.

INSUFFICIENT PRIMING

Insufficient priming is indicated by failure of the engine to start, rough running, weak ignition at insufficient engine power output, white smoke and/or back firing. If one of the above-mentioned conditions occurs check position of fuel tank selector and ensure sufficient injection pressure. Proceed with care when injecting additional priming fuel.

FUEL PRESSURE

Refer to figure 1-7, section I (Schematic Diagram of Fuel System). An engine-driven LEAR ELECTRONIC RG9080C fuel pump feeds fuel to the carburetor. An electrically operated fuel pump (fig. 1-7) is provided to ensure sufficient fuel flow during engine start and during takeoff and landing. During engine operation the fuel pressure range shall be 0.63 to 1.05 kp/cm^2. Fuel pressure is normally set to 0.9 to 1.05 kp/cm^2. The fuel pressure prevailing depends on the mixture setting of the respective engine.

BRAKE OPERATION

To reduce aircraft accidents and maintenance problems caused by tire, wheel and wheel brake failure, the following precautions must be observed as far as is practicable.

a. Make full advantage of the length of the runway, utilizing aerodynamic braking to stop the aircraft, so that brakes can be used as little and as lightly as possible.

b. Use extreme care when applying brakes immediately after touchdown, or at any time when there is considerable lift on the wings, to prevent skidding and excessive wear of the tires. Heavy brake pressure will lock the wheels more easily immediately after touchdown than when the same pressure is applied after the full weight of the airplane is on the tires. A wheel once locked in this manner immediately after touchdown will not become unlocked as load increases, as long as brake pressure is maintained. Brakes can stop the wheels from turning, but stopping the aircraft depends on the frictional force between the tires and the runway. As the load on the tires increases, the frictional force increases, giving better braking action. During a skid, the frictional force is reduced, thus requiring more distance to stop.

c. When a short landing roll is required, a single smooth application of the brakes with constantly increasing pedal pressure will result in optimum braking.

d. During a series of successive landings, a minimum of 15 minutes should elapse between landings where the landing gear remains in the slip stream, and a minimum of 30 minutes with the landing gear retracted between landings, to allow adequate cooling time between brake applications. This time restriction is not applicable to touch-and-go landings when no brake application is involved.

e. The brakes should not be dragged while taxiing, and should be used as little as possible for turning the aircraft on the ground.

f. At the first indication of brake malfunction, or if brakes are suspected to be in an overheated condition after excessive use, the aircraft should be maneuvered off the active runway and stopped. Overheated wheels and brake must be cooled before the aircraft is subsequently towed or taxied. Peak temperatures in the wheel and brake assembly are not attained until 5 minutes after a maximum braking operation is completed. In an extreme case, heat build-up can cause the wheel and tire to fail with explosive force or be destroyed by fire if proper cooling is not effected. Taxiing at low speeds to obtain air cooling of over-heated brakes will not reduce temperatures adequately and can actually cause additional heat build-up.

SECTION VIII

CREW DUTIES

Not applicable to this aircraft

ALL-WEATHER OPERATION SECTION IX

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INTRODUCTION

Except where repetition is necessary from emphasis, clarity or continuity of thought, this section contains only those procedures that differ from, or are in addition to, the normal operating instructions covered in Section II.

INSTRUMENT FLIGHT PROCEDURES

WARNING

The aircraft is certified for flights under VFR conditions only.

Navigation can be effected by the existing radio compass system. For detailed information on radio communication and radio compass system refer to section IV.

ICE

WARNING

Do not attempt to fly under icing conditions. The aircraft is not equipped with a de-icing system.

Only the pitot tube is heated to ensure air speed indication under unavoidable icing conditions. In addition, hot air can be supplied to the carburetor from the engine compartment to prevent ice formation.

WARNING

Switch ON pitot tube heating as soon as the aircraft is under icing conditions. Pull carburetor heat control knob. Descend to altitudes where no icing conditions prevail or land as soon as possible.

Do not attempt to fly the aircraft if it is covered by snow or ice, since snow and ice will adversely affect the aerodynamic characteristics and structural strength of the aircraft. Takeoff, landing and control characteristics as well as stalling speed will be impaired. Therefore, carefully remove snow and ice. Take care that at takeoff the aircraft is absolutely dry.

CAUTION

During taxiing sludge may enter the wheel well and freeze there after takeoff. This condition may cause trouble when extending the landing gear.

CARBURETOR ICING

Carburetor icing may occur when carburetor air temperature is between −10° C and + 15° C. The indications are:

- Rough running engine
- Fluctuating RPM indication
- Decreasing manifold pressure

To clean the carburetor, pull the carburetor heat control knob to the WARM position. This will cause at first a further drop of manifold pressure, and power has to be added.

As soon as the ice has melted the indications will be normal and the carburetor heat control knob should stay in the WARM position.

TURBULENCE AND THUNDERSTORMS

Because of the aircraft relatively slow speed, and the difficulty of handling in turbulent weather conditions, thunderstorms must be avoided. Make a thorough analysis of the general weather conditions to determine Thunderstorm areas and a flight plan that will avoid these areas.

Do not attempt a takeoff at wind velocities in excess of 35 KIAS. Adhere to normal procedures. For information refer to TAKEOFF AND LANDING CROSSWIND CHART in Appendix I.

NIGHT FLYING

Night flying procedures do not differ considerably from normal flight procedures as described in section II.

During taxiing use landing lights alternately to prevent landing light over-heating. Switch ON ultraviolet light to illuminate the cabin. Adjust brightness by means of the ultraviolet light rheostat. Ultraviolet light is reflected by the flourescent paint on dials and indicators of instruments and controls. This permits satisfactory reading and operation of all instruments and controls. To increase safety during training flights, control lights are installed in the wheel wells to indicate to ground personnel that the landing gear is properly extended.

"Switch ON positions lights. Switch ON landing lights for landing and taxiing, as required".

BEFORE NIGHT FLIGHT

Information before night flight see section II page 2-4.

NIGHT TAKEOFF

A night takeoff shall be performed as described under NORMAL TAKEOFF. The night takeoff requires a thorough knowledge of the location of switches and controls. The following additional checks are recommended for a night takeoff.

1. Turn on ultraviolet light as necessary.
2. Tune radio carefully and turn up the volume, as it will fade during takeoff and flight.
3. Hold aircraft steady on a definite reference point during the takeoff.

NIGHT LANDING

The same techniques and procedures used for day landing will be applied. Do not turn on the landing lights at too high an altitude and avoid using them at all if landing in fog, smoke or thick haze, as reflection from the lights impedes vision and may distort depth perception. Alternate the use of landing lights while taxiing after landing.

COLD-WEATHER PROCEDURES

The aircraft is not provided with cold-weather engine starting equipment. If, in cold weather, the engine has not been operated for an extended period of time, crank the engine approximately 10 times by means of the propeller.

WARNING

Switch OFF ignition when cranking the engine.

This cranking is used to overcome the high initial friction of the moving engine parts in thickened lubricants.
Start the engine according to the instructions in section II.
If the engine does not start the first time, repeat starting procedure. If again the engine does not start, the cylinders may be flooded with fuel.

If the starter is energized by external power, proceed as follows:

1. Cowl-flap handle - fully IN
2. Ignition switch - OFF
3. Throttle - slowly to FULLY OPEN
4. Motor the engine.
5. Limit priming fuel to half the previous amount.
6. Repeat starting procedure.

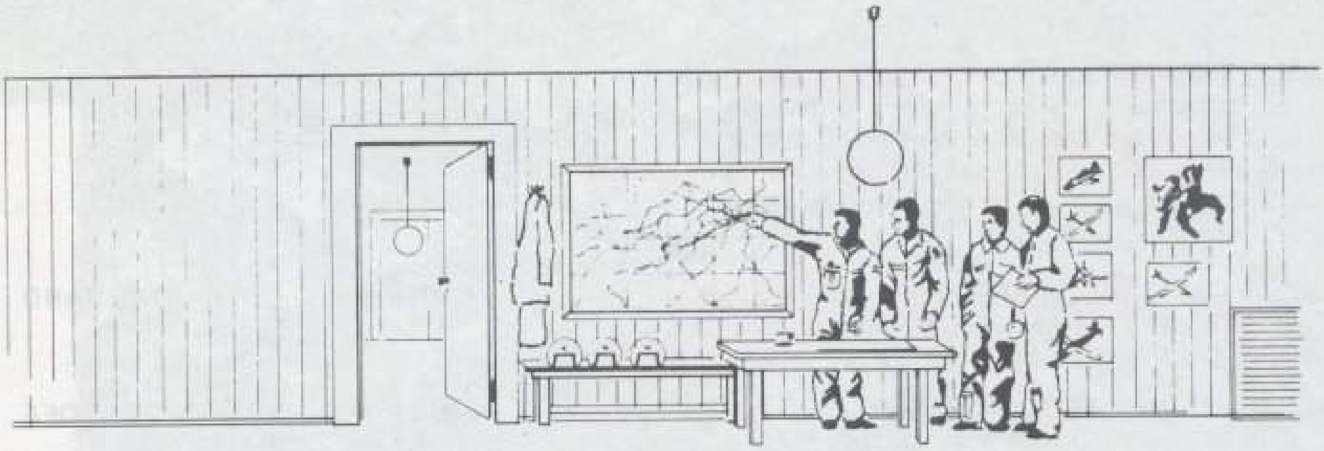
If no external power is used, proceed as follows:

1. Colw-flap handle - fully IN
2. Ignition switch - OFF
3. Throttle - slowly to FULLY OPEN
4. Crank the engine 10 times by means of the propeller.
5. Limit priming fuel to half the previous amount.
6. Repeat starting procedure.

For engine warmup, ground check, taxiing and takeoff procedures refer to section II.

HOT-WEATHER AND DESERT PROCEDURES

In hot weather, first of all check maximum oil temperature and cylinder head temperature. In addition, continuously check fuel pressure. If gas bubbles have formed in fuel lines or fuel tanks, switch ON electric fuel pump, until fuel pressure is stabilized. For all other procedures refer to section II. The aircraft is not equipped for desert operation.



PERFORMANCE DATA APPENDIX I

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ABBREVIATIONS, SYMBOLS AND DEFINITIONS

IAS = INDICATED AIRSPEED = Indicated airspeed, airspeed indication uncorrected for instrument error. Where this symbol is used on the performance charts, mechanical error is assumed to be zero.

CAS = CALIBRATED AIRSPEED = IAS corrected for position error (CAS = IAS ± Δ V_i)

EAS = EQUIVALENT AIRSPEED = CAS corrected for compressibility (EAS = CAS - Δ V_c)

TAS = TRUE AIRSPEED = EAS corrected for atmospheric density (TAS = EAS x $1/\sqrt{\sigma}$)

TMN = TRUE MACH NUMBER

Δ V_i = airspeed position error correction

Δ V_c = airspeed compressibility correction

Hi = INDICATED ALTITUDE = indication of the altimeter

H_c = CORRECTED ALTITUDE = Hi corrected for the influence of the position error on the altitude indication (H_c =Hi± H)

H = ALTIMETER POSITION ERROR CORRECTION

SL = SEA LEVEL

RPM = REVOLUTIONS PER MINUTE

OAT = OUTSIDE AIR TEMPERATURE

MAP = MANIFOLD ABSOLUTE PRESSURE

ata = MANIFOLD PRESSURE

°C = DEGREES CENTIGRADES

cm = CENTIMETER

ft = FOOT/FEET

G = ACCELERATION

hr = HOURS

kp = KILOPOND

kts = KNOTS

km = KILOMETER

lb = POUND

ltr = LITER

m = METER

nm = NAUTICAL MILES

ηk = FLAP DEFLACTION

μ = ROLLING RESISTANCE COEFFICIENT

a/c = AIRCRAFT

R/C = RATE OF CLIMB in feet per minute (ft/min)

PA = PRESSURE ALTITUDE

BHP/ENG. = BRAKE HORSEPOWER/ ENGINE

Standard day = INTERNATIONAL STANDARD ATMOSPHERE (ISA)

Refusal speed = SPEED UP TO WHICH TAKEOFF CAN BE ABORTED

DESCRIPTION AND USE OF CHARTS

INTRODUCTION

APPENDIX I contains all necessary performance data for flight planning.

Note

The primary fuel is grade – 100/130. All performance data and operating weights are based on fuel grade 80/87 with a fuel density (spec. gravity) of 0.72 kp/ltr. Due to the manufacturing tolerances, tolerances in engine performance other fuel grades and the variances within the P149D series, some variance in performance may be expected.

FIGURE A 1 –
AIRSPEED MACH NUMBER CURVE

This curve shows the relationship between calibrated airspeed, true airspeed and true mach number for various pressure altitudes in the standard atmosphere. See sample on chart.

FIGURE A 2 –
DENSITY ALTITUDE CHART

This chart is used in determining the density altitude and the corresponding $1/\sqrt{\sigma}$ for any pressure altitude and ambient temperature.

FIGURE A 3 –
STANDARD ATMOSPHERE TABLE

This table presents the most important parameters of the standard atmosphere; density ratio, $1/\sqrt{\sigma}$ air temperature, speed of sound, air pressure and pressure ratio are tabulated for thousands of feet. Self-explanatory.

FIGURE A 4 –
AIRSPEED POSITION ERROR CORRECTION

This chart is a representation of indicated airspeed versus calibrated airspeed due to the position error of the pitot-static system.

FIGURE A 5 –
TAKEOFF AND LANDING CROSS-WIND CHART

This chart shows the head-wind and cross-wind components for various wind velocities and wind directions.

FIGURE A 6 –
AIRCRAFT WEIGHT

This chart represents different aircraft weights depending on fuel and number of passengers on board. The gross weight is increased by the weight of the additional equipment. (See GAF T.O. 1L - P149D-1, Figure 1-2)

FIGURE A 7 –
ENGINE OPERATING LIMITS CURVE

This curve shows the maximum available manifold pressure and engine brake horsepower over the operating range for various engine RPM and altitudes, and the maximum permissible RPM and engine horsepower and various RPM-settings with the respective MAP for different altitudes up to max. continuous power for cruise operation.

TAKEOFF

The takeoff data include airfield altitudes from sea level through 6000 ft at temperatures from ISA through ISA+20°C and head-tailwind components. All data are for hard dry surface.

FIGURE A 8-1 –
TAKEOFF RUN

The takeoff run is the distance required from the start of the takeoff run to accelerate to takeoff speed. The chart represents the distance along ground in feet and meters with respect to airfield altitude, ambient temperature, takeoff weight and head-tailwind components.

FIGURE A 8-2 –
ACCELERATE-STOP DISTANCE

This chart shows the accelerate-stop distances (in feet and meters) for engine failure at refusal speed.

FIGURE A 8-3 –
REFUSAL SPEED

This chart shows the refusal speeds at various takeoff weights.

FIGURE A 8-4 –
TAKEOFF DISTANCE

This chart shows the takeoff distance required to clear at 50 ft obstacle in relation to airfield altitudes, ambient temperatures, takeoff weights and head-tailwind components.

FIGURE A 8-5 –
TAKEOFF RUN CORRECTION FACTORS

This chart shows the takeoff run correction factors for other than hard dry surface runways. The takeoff run correction factors are based on various takeoff weights versus the rolling resistance coefficient μ. A table is attached to this chart showing the μ-values for several runway surface conditions. See sample on chart.

CLIMB

The four charts CLIMB DISTANCE, CLIMB TIME, CLIMB FUEL and RATE OF CLIMB comprise all pertinent CLIMB data. Airspeed during climb is assumed to be 100 KIAS with engine RPM 3000 under zero wind conditions.

FIGURE A 9-1 –
CLIMB DISTANCE

This chart shows the climb distance in km and NM with respect to various altitudes and initial climb weights.

FIGURE A 9-2 –
CLIMB TIME

This chart shows the climb time in minutes with respect to various altitudes and initial climb weights.

FIGURE A 9-3 –
CLIMB FUEL

This chart shows the fuel consumption in liters (LTR) during climb at various altitudes and initial climb weights.

FIGURE A 9-4 –
RATE OF CLIMB

This chart shows the rate of climb in ft/min with respect of altitude, plotted for three different initial climb weights.

FIGURE A 10 –
ENGINE PERFORMANCE

Charts are provided for SL, 5 000 ft and 10 000 ft. (Figs. A 11-1, A 11-2 and A 11-3). They are used to determine engine brake horsepower for various engine RPM manifold pressures and outside air temperatures.

FIGURE A 11 –
ENGINE FUEL FLOW

This chart shows the engine fuel flow in liters per hour with varying engine manifold pressure and engine RPM.

FIGURE A 12-1 –
FLIGHT ENVELOPE

This chart shows all the maximum cruising speed in knots TAS and knots CAS for various gross weights and altitudes under standard day conditions. The diagram is based on engine operated at 3000 RPM and manifold pressure according to figure A-7, ENGINE OPERATING LIMITS CURVE.

FIGURE A 12-2 –
A 12-3 –
A 12-4 –
SPECIFIC RANGE

These three charts show all specific ranges for various cruising speeds and gross weights at sea level, 6000 ft and 12000 ft in relation to nautical miles per liter of fuel. Diagrams are based on standard day, engine operated at 2750 RPM and manifold pressure as necessary for the desired airspeed.

FIGURE A 13-1 –
MISSION PROFILE

The mission profile chart presents the level flight cruise under maximum range conditions. The chart gives the time and fuel required to fly a given distance under no wind conditions at any cruising altitude from sea level to 15000 ft.

A mission sequence of takeoff, climb and maximum range cruise is assumed. A fuel allowance of 6,3 ltr. has been included for ground maneuver, takeoff and acceleration to climb speed.

The effect of nonstandard free air temperature on level flight cruise range is small if the recommended CAS schedule is maintained so that fuel economy is substantially unchanged. Wind will influence the flight time for a given range in relationship to the difference between groundspeed and true airspeed.

FIGURE A 13-2 –
MAXIMUM ENDURANCE

Maximum endurance is obtained by flying the aircraft in level flight with airspeed 80 knots CAS at 2600 RPM and MAP as required for airspeed. This results in minimum fuel flow.

LANDING

All landing data are contained in the following five charts. All data are for hard dry surface runways.

FIGURE A 14-1 –
LANDING DISTANCE η k 18°

This chart shows in meters (M) and feet (FT) the total landing distance to clear a 50 ft obstacle with flaps at ηk 18° for various airfield altitudes, landing weights and head-tailwind components. The distances are based on application of maximum braking after the nose wheel has touched the runway until the aircraft stops. Ground roll distances can be figured out by subtracting 285 feet from landing distances.

FIGURE A 14-2 –
LANDING DISTANCE η k 43°

Same as figure A 14-1 but flaps at η k 43°

FIGURE A 14-3 –
LANDING FIELD LENGTH η k 18°

This chart shows the landing field length for destination and alternate airfields. At destination the landing distance must not exceed 60 % of the landing field length available, at the alternate 70 %.

Distances are presented in relation to various airfield altitudes, landing weights, with flaps ηk = 18° and head- tailwind components.

FIGURE A 14-4 –
LANDING FIELD LENGTH η k 43°

Same as figure A 14-3 but flaps at η k 43°

FIGURE A 14-5 –
LANDING REFERENCE SPEED

Landing speed to clear a 50 ft obstacle.

FLIGHT PLANNING

Flight planning is normally carried out as follows:

1. Determine aircraft takeoff weight using AIRCRAFT WEIGHT chart. (Fig. A-6)

   Sample:
   Given: Fuel on board 200 ltr plus pilot and two passengers
   Result: Takeoff weight 1630 kp

2. Determine aircraft takeoff run (flaps 18°) using TAKEOFF RUN chart. (Fig. A 8-1).

   Sample:
   Given: Airfield altitude 3 000 ft; ambient temperature ISA + 5 °C ; takeoff weight 1600 kp; tailwind 10 kts
   Result: Takeoff run 1716 ft; 525 m

3. Determine accelerate-stop distance using ACCELERATE-STOP DISTANCE chart (Fig. A 8-2).

   Sample:
   Given: Airfield altitude 1 000 ft; ambient temperature ISA + 10 °C; takeoff weight 1450 kp; tailwind 10 kts
   Result: Accelerate-stop distance 2687 ft, 820 m

4. Determine refusal speed using REFUSAL SPEED chart (Fig. A 8-3).

   Sample:
   Given: Takeoff weight 1820 kp
   Result: Refusal speed 64 KIAS

5. Determine climb distance using CLIMB DISTANCE chart. (Fig. A 9-1).

   Sample:
   Given: Initial climb weight 1560 kp; climb from SL to altitude 10 000 ft.
   Result: Climb Distance 40 km; 21.65 NM

6. Determine climb time using CLIMB TIME chart. (Fig. A 9-2)

   Sample:
   Given: Initial climb weight 1560 kp; climb from SL to altitude 10000 ft
   Result: Climb time 11'24"

7. Determine nautical miles per liter of fuel using the SPECIFIC RANGE chart (Fig. A 12-3)

   Sample:
   Given: Gross weight 1600 kp
   Find: Maximum NM/ltr, CAS, TAS
   Result: 0,28 NM/ltr
   CAS 100 kt
   TAS 111 kt

8. Determine time and fuel consumed for a given distance cruising at a given altitude using the MISSION PROFILE chart (Fig. A 13-1).

   Sample:
   Given: Distance to cruise 325 NM
   Pressure altitude 6000 ft
   Result: Time 2 : 45 hr
   Fuel used 140 ltr

9. Determine landing distance (Flaps 18°) using LANDING DISTANCE chart. (Fig. 14-1)

   Sample:
   Given: Airfield altitude 2 000 ft; landing weight 1500 kp; headwind 10 kts
   Result: Landing distance 530 m; 1683 ft

10. Determine landing field length (flaps 18°) using LANDING FIELD LENGTH chart. (Fig. 14-3)

    Sample:
    Given: Airfield altitude 2 000 ft, landing weight 1700 kp; tailwind 5 kts
    Result: Required Landing field length:
    Destination 1080 m
    Alternate airfield 950 m

11. Determine landing reference speed using LANDING REFERENCE SPEED chart. (Fig. 14-5)

    Sample:
    Given: Landing weight 1450 kp
    Result: Landing reference speed 60.3 KIAS