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HEATING SYSTEM

The heating system utilizes heat extracted from the engine exhaust system through the medium of a heat exchanger built around the exhaust tail pipe of each engine. In flight, ram air which enters the two muff-type heat exchangers is heated by the engine exhaust and then ducted to the air mixing chambers. Here, heated air, as well as cold air entering through scoops at the belly of the fuselage are mixed in the proportion necessary to regulate the temperature of the ventilating air flowing into the airplane. Two emergency spill valve outlets one in each nacelle, can be used to bypass the heated air to the aircraft exterior if the temperature rises excessively or exhaust fumes are detected, indicating a leak in the heat exchanger.

In some airplanes as illustrated in the schematic diagrams the heated air from the left engine is ducted to cabin and that from the right engine ducted to cockpit, and in other airplanes, the two systems may be crossfeed allowing the heated air to go to both systems, even when one engine is not operating.

1. Heating is provided by a _____ around the exhaust _____ of each engine.	
2. Ram air passed through the heat exchanger and via a _____ valve to a _____.	heat exchanger tail pipe
3. The mixing chamber has a _____ air and a _____ air inlet with a mixing valve to regulate the amount of operable from the _____ position.	spill mixing chamber
4. The mixing chamber has an outlet ducted to the _____ outlets.	cold heated; FRO
5. The spill valves are for the purpose of venting _____ with there is no demand for heat in the cabin.	cabin & cockpit
6. In some A/C, the right heat exchanger is ducted to the _____ and the left to the _____.	heated air overboard
7. Some A/C have a _____ system permitting either source to supply hot air to _____.	cockpit cabin
	crossfeed either side

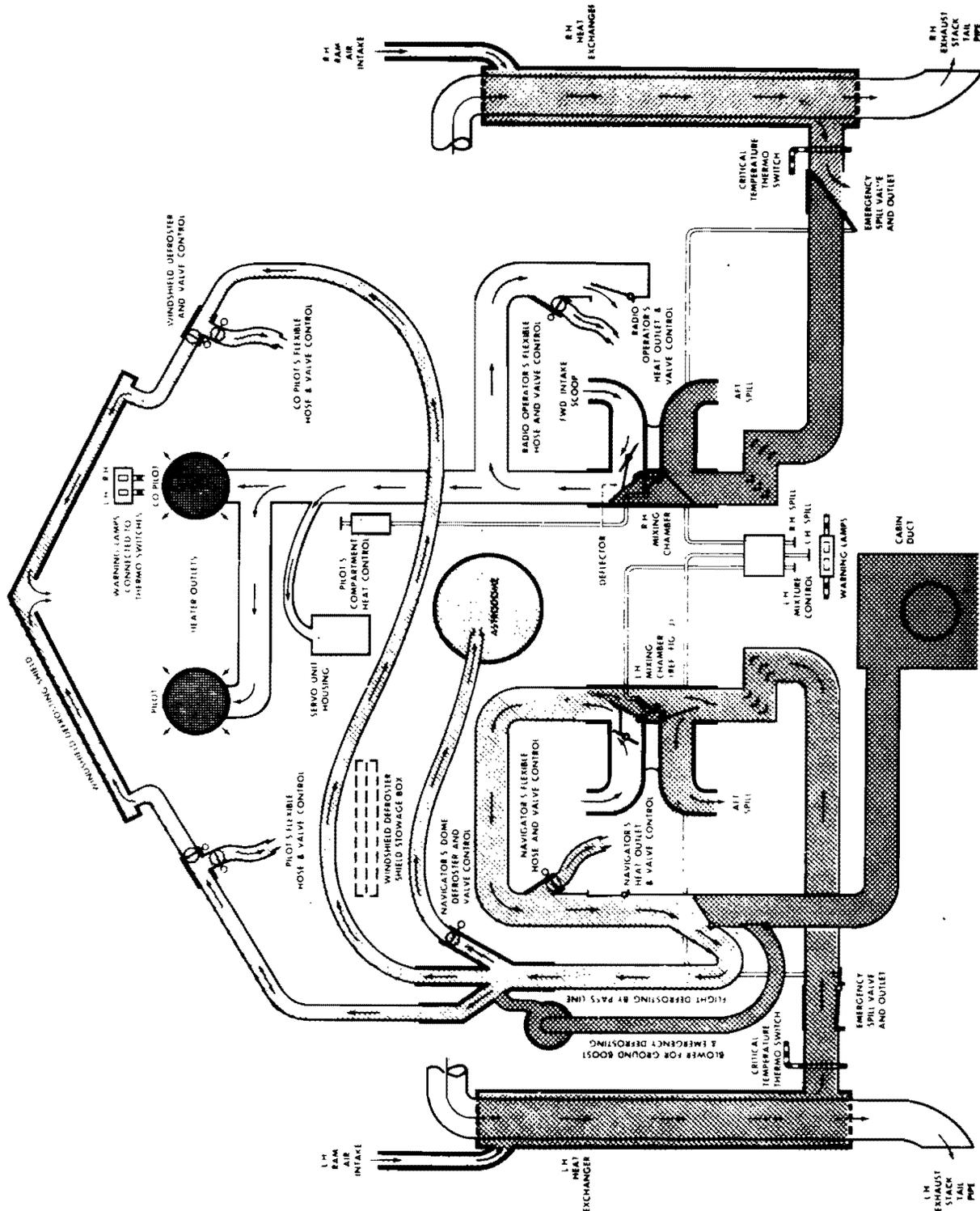
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Hot Air System

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AUTO PILOT

GENERAL

The autopilot is a gyroscopically controlled, hydraulically actuated mechanism which maintains the airplane in lateral and longitudinal attitude, and in directional flight by operating the flight control surfaces. The system consists of three interrelated systems. An air vacuum system which operates two gyroscopic control units and simultaneously controls the hydraulic fluid pressure system, which operates the control surfaces by servo units inserted in the flight control cables of the rudder, ailerons, and elevators; and a mechanical follow up cable system which restrains the hydraulic servo action and prevents overcontrol. Each of the three systems depends upon the other two for proper operation. The gyroscopic control units (one for rudder directional control and the other for bank and climb) are mounted behind and viewed through openings in the main instrument panel.

Hydraulic pressure for operation of the autopilot is supplied from the main hydraulic system through a pressure reducing valve system. The hydraulic shutoff valve, fluid filter, drain trap, exhaust check valve, drain check valves, and servo units complete the autopilot hydraulic fluid system. A hydraulic pressure gage is tapped into the autopilot hydraulic pressure manifold to register pressure in the system.

1. The auto pilot is _____ controlled and _____ actuated.	
2. There are three interrelated systems: an air _____ system to operate the gyroscopic control unit, a hydraulic _____ mechanism, and a mechanical _____ system.	gyroscopically hydraulically
3. Each system depends upon the _____ for proper operation.	vacuum; servo; follow up
4. The gyroscopic control unit is located on the instrument _____ panel.	other two
5. Hydraulic pressure for operation of the autopilot is from the main hydraulic system through a _____ valve.	center
6. A pressure gage should indicate _____ psi, and is located on the _____.	pressure reducing
	120 ± 10 instrument panel

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AUTOPILOT SYSTEM CONTROL UNITS

Two gyroscopic control units are installed in a mounting independently supported on the airplane structure by vibration insulating units; the special mounting unit is attached to the rear of the pilot's instrument panel. Balanced fluid valves for each control unit, as well as pulleys for the follow up cable system, are located at the rear of the mounting unit.

BANK-AND-CLIMB GYRO CONTROL UNIT

The bank-and-climb gyro control unit contains the gyro which supplies the lateral and longitudinal reference for both automatic and manual control of the ailerons and elevators. The caging knob on the unit is provided to lock the gyro gimbals (pivoted rings). The elevator and aileron control knobs on the bank-and-climb unit are used to trim the airplane laterally or longitudinally, or to allow the human pilot to control the airplane while the autopilot is in operation. The control knobs are also used to ground test the operation of the auto-pilot. The alignment and follow up index markings on the face of the instrument indicate the position of the control surfaces when the autopilot is in operation.

NOTE: The alignment and followup indexes for each control must be matched before the autopilot is engaged.

A suction gage installed on the bank-and-climb gyro control unit indicates the vacuum pressure being supplied to the gyros, which normally is $4 \pm .25$.

DIRECTIONAL GYRO CONTROL UNIT

The directional gyro control unit provides the directional rudder reference for both manual and automatic flight control. The caging knob on the unit is provided to lock the gyro gimbals and to establish the desired heading. The directional gyro unit is equipped with two circular cards graduated in 360 degrees of azimuth. The lower, or directional card, may be set to any desired heading by pushing in and turning the caging knob located beneath the dial. The upper, or rudder follow-up card, may be set by turning the rudder trimmer knob located at the top of the unit. In flight, the rudder trimmer knob is used to trim the airplane manually or to alter the course. The rudder trimmer knob also can be used to ground test the operation of the system.

NOTE: Readings of the directional and followup cards coincide to obtain automatic control of the airplane to a selected heading. The cards also must be matched before the autopilot is engaged.

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1. The gyroscopic control unit on the instrument panel actuates the servo by means of _____ valves for each control unit, and by pulleys for the _____ cable system.

2. These are located at the _____ of the mounting unit.

balanced fluid
followup

3. The autopilot servo is normally turned on by the valve at the base of the _____.

back

4. Before engaging the autopilot, the _____ indexes for each control must be _____ on the control dials.

control pedestal

5. A suction gage in the line supplying the gyro control unit should register _____ " Hg.

alignment and followup
matched

6. The vacuum operated gyro control unit consists basically of a _____ and a _____.

4 ± .25

D/G
Horizon

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HYDRAULIC PRESSURE REDUCER SYSTEM

The pressure reducer system consists of two separate units - a pressure reducer valve proper, and a relief valve. The reducer valve meters the pressure of the main hydraulic system from between 800 to 1000 psi to a regulated operating pressure of 120 ± 10 psi for the autopilot. The output of the reducer valve passes through the relief valve, preset to about 150 psi to relieve any excessive pressure buildup that might result from a malfunctioning reducer valve, before passing to the autopilot. The reducer valve is not adjustable in the field. The relief valve adjustment is sealed and should not normally be adjusted in the field since an accurate setting cannot be made without special hookup.

HYDRAULIC SHUTOFF VALVE

The hydraulic shutoff valve is a 3-way valve. The ON-position directs 120 psi pressure flow from the reducer valve system output to the autopilot control units. The OFF-position shuts off pressure flow coming from the reducer valve system and connects the pressure line going to the autopilot control units with the return line back to the reservoir. The OFF-position of the shutoff valve thus allows free circulation of return system fluid throughout the autopilot system. A varying amount of back pressure of up to 30 psi may be present in the hydraulic return system at all times due to line friction. This back pressure would register on the autopilot hydraulic gage when the hydraulic shutoff is positioned OFF. Because the return system fluid is freely circulating within the autopilot system, this positive back pressure does not have any adverse effect on freedom of movement of the flight controls when the autopilot is disengaged.

The hydraulic shutoff valve should be left in OFF-position at all times except when the autopilot is engaged or being bled, so as not to dissipate the main hydraulic system from which the autopilot system obtains its pressure supply.

HYDRAULIC FLUID FILTER

A hydraulic filter is installed between the hydraulic shutoff valve and the autopilot hydraulic pressure manifold to remove foreign matter from the fluid prior to its entry into the balanced oil valves and the servo units.

AUTOPILOT HYDRAULIC CHECK VALVES

Three check valves are used in the autopilot hydraulic fluid system to maintain the flow of fluid in one direction only. One check valve is located in the balanced oil valve return line, and the other two are at the drain trap drain-line connection to each hydraulic pump fluid supply line.

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SERVO UNIT

The unit consists of three cylinders cast together and mounted on the center line of the fuselage beneath the crew compartment floor. Each cylinder contains a piston with a rod at each end to which the elevator, aileron, and rudder control cables are attached. Two overpower relief valves are provided on each cylinder so that the pilot can overcome the autopilot if necessary. A bypass is installed in each cylinder to offer free circulation of fluid between both chambers of each unit as well as to the system return when the autopilot is disengaged. The bypass valves are controlled by a single shaft passing through all three cylinders. A bellcrank located on the end of the shaft is connected by cables to the autopilot engaging lever installed on the pilot's control pedestal. The autopilot servo unit ON-OFF control on the pedestal should be used in conjunction with the hydraulic shutoff control on the hydraulic control panel during engagement and disengagement of the autopilot.

HYDRAULIC FLUID DRAIN TRAP

The hydraulic fluid drain trap collects fluid leakage from the balanced valves and periodically releases the collected fluid into the hydraulic pump suction line through the float-controlled valve inside the trap. A vent line which supplies air to the drain trap extends upward in the nose of the airplane to a height above that of the balanced oil valves.

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1. The gyro pilot servo hydraulic system includes a relief or safety valve adjusted to _____ psi.	
2. The autopilot can be _____ by the pilot in flight.	150 ± 10
3. Before takeoff the autopilot should be _____ from the cockpit by working all controls through their _____ several times, to ensure proper operation _____.	overpowered
4. In its ON position the servo valve on the pedestal directs _____ hydraulic pressure to the servo unit.	bled of air full travel of the autopilot
5. In its OFF position, pressure is shut off from the servo and is directed to the _____ to the reservoir, thus allowing _____ of the flight controls.	120 psi
6. The servo unit consists of _____ in a single casting mounted on the center line of the _____, below the _____.	return line free movement
7. Each cylinder contains a piston with a rod _____ to which the _____, _____ and _____ control cables attached.	three cylinders fuselage cockpit floor
8. A _____ valve is provided on each end of each cylinder to allow the pilot to _____ the servo if necessary.	at each end elevator; aileron rudder
9. There is a bypass valve in each cylinder to allow _____ between both ends and to the system _____ when the autopilot is disengaged.	relief overpower
10. These bypass valves are controlled by a single shaft passing through _____ which is controlled by the autopilot engaging lever on the _____.	free circulation of fluid; return line
11. The autopilot emergency hydraulic shutoff valve on the hydraulic control panel is normally left ON but is turned off in case of _____ in the autopilot hydraulic system.	all three cylinders pedestal
	malfunction or leakage

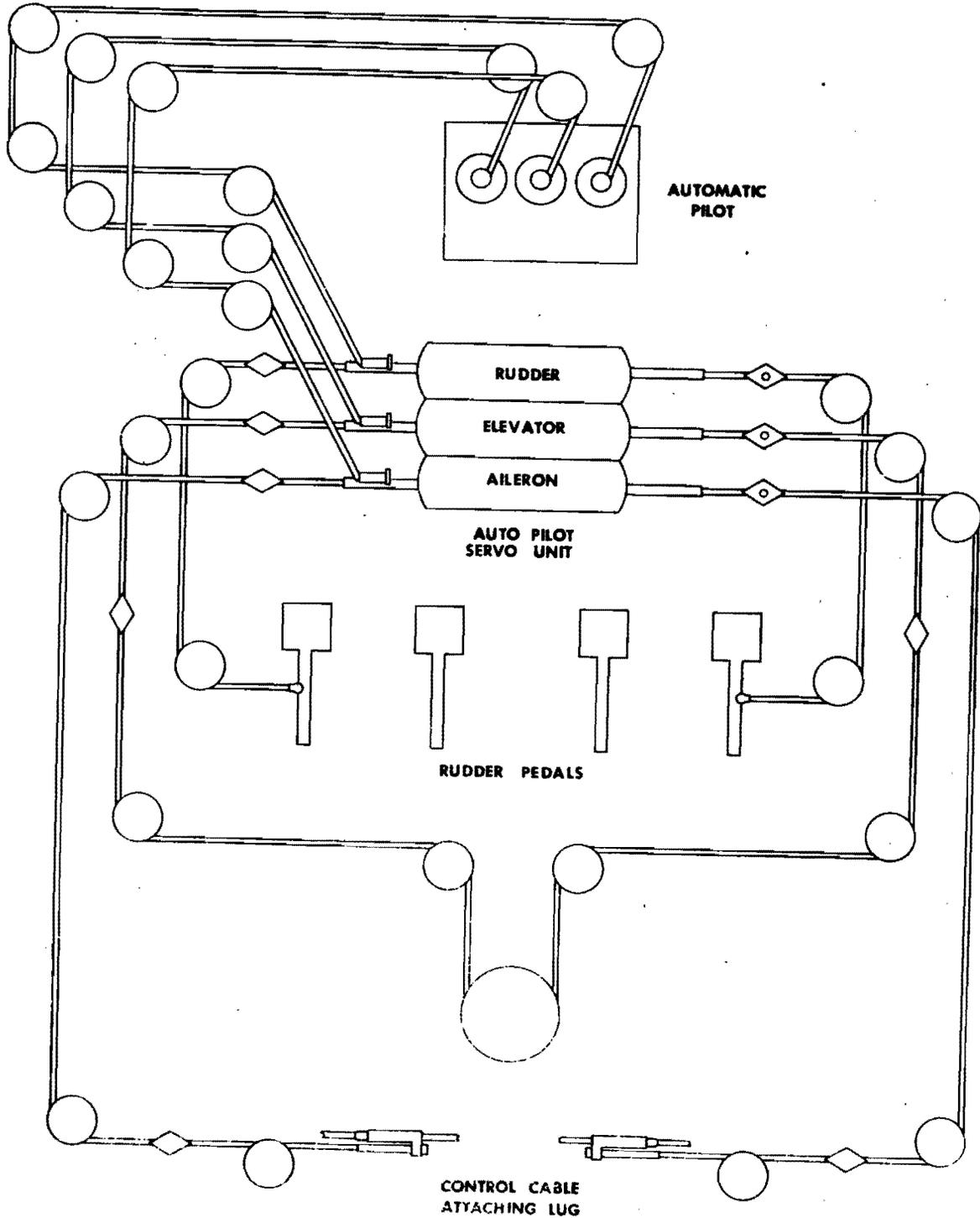
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Automatic Pilot Control and Follow-Up Cables

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RADIO AND RADAR

GENERAL

Radio equipment installed on C-47 airplanes includes communication equipment and radio navigation, and the necessary antennas, control panels, etc. Principal units are as follows:

Communication Equipment

Two VHF Communications Systems
Dual HF Communications Systems

Navigation Equipment

Dual Automatic Radio Compass System ADF-1 (RED); ADF-2 (GREEN)
One Loran Receiver (APN-9) - Rack and Cable Installed
One Distance Measuring Equipment (APN-2)

Power Distribution

DC Power - The basic radio power supply is the ship's 28V system.
AC Power - The ship's inverters supply the AC power for the ADF.

Radio Master Switch - is located at the left end of the radio junction box above receiver BC-348 at the radio operator's position.

Circuit Breakers and Fuses - are located in the main radio junction box with spare fuses provided.

1. Communications equipment consists of _____ and _____ systems.	
2. Navigation equipment consists of _____ (red) and _____ (green); provisions for one _____ receiver (APN-9) including rack and cable installation, 1 _____ (APN-2).	2 VHF dual HF
3. 28 V dc is supplied direct from the _____ system, and 115 V dc from the _____.	ADF-1; ADF-2; Loran; DME
4. A radio master switch is located at the left end of the _____ at the _____ position.	electrical inverters
5. Circuit breakers and fuses, with spare fuses, are located in the _____.	radio junction box FRO
	main radio junction box

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HF Communications System

General - Two separate HF communications systems are provided. One is designated HF-1 (Liaison) which consists of one transmitter, type ART-13 and one receiver, type AR-144. The other is designated HF-2 (command) which consists of a transmitter-receiver unit, type RTA-1B.

Transmitter - ART-13

Frequency range - 2.0 to 18.1MC.

Channel - 40 crystal control with crystal VFO selection at transmitter front panel.

Antenna - Top mounted long wire antenna mast at the right side of the cockpit behind the Copilot's position and the upper section of the vertical stabilizer.

Transmitter Power - 100 Watts.

Power Supply - Dynamotor on main radio rack.

Receiver - AR-144

Channel - 144.

Power Input - 2.8 AMPS at 28 V dc.

1. There are two separate HF communications systems, one designated ____ (liaison) consisting of an ____ transmitter and a ____ receiver.

2. HF-2 consists of a ____ transmitter-receiver unit.

HF-1; ART-13; AR-144

3. The ART-13 has an output of ____ watts.

RTA-1D

4. The ART-13 transmitter has ____ crystal controlled channels reaching from ____ to ____ mc.

100

5. The ART-13 power supply is a ____ on the ____.

40; 2.0; 18.1

6. The HF antenna extends from a mast behind the ____ to a fitting on the top of the ____.

dynamotor;
main radio rack

7. The AR-144 HF-1 receiver has ____ crystal controlled channels and a power input of ____ amps at ____ V dc.

copilot
vertical stabilizer

144; 2.8; 28

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CONTROLS

The HF-1 (Liaison) system has its control unit located on the overhead panel of the cockpit. The control unit provides a channel selector switch, an ON and OFF emission switch, a volume control knob and a Beat Frequency Oscillator knob.

The HF-1 (Liaison) system can be turned ON or OFF by the Emission switch on its respective control unit.

The channel selector switches consist of a large circular outer knob, a small concentric inner knob located above the large knob, and a window in which the channel number/letter combination (2A, 4C, etc.) appears. The outer knob selects the number, the small knob the letter.

A placard giving the HF channel numbers, letters and frequencies is provided on the overhead panel in the cockpit and on the front panel of the transmitter.

Jack Box Control - Switch to LIA position to operate the HF-1 (Liaison) system.

1. The HF-1 (Liaison) system is controlled from the _____.	
2. The controls include a _____ selector switch, and OFF-ON switch, a _____ control knob and a _____ knob.	overhead panel
3. The HF channel numbers, letters, and frequencies are listed on a placard on the _____ and on the front panel of the _____.	channel volume BFO
4. To operate the HF-1 (Liaison), switch to _____ on the jack-box control.	overhead panel transmitter
	LIA

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LIA-VHF audio switch - In order to parallel the audio outputs of VHF and HF-1 (Liaison) sets for pilots to guard VHF and HF simultaneously, a two-way switch is installed in the overhead panel between the VHF-COM microphone switch and the HF-1 (Liaison) control box.

Upon hearing a call, the pilot on guard should turn the LIA-VHF audio switch to SEP (separate) position immediately and determine whether the selector switch of the jack box has been set at the right position or not. When received signal comes from the VHF and the selector switch of the jack box has been set at the Liaison position, no signals will be heard until the selector switch is set to COM position. This applies to both HF-1 and HF-2 reception.

Transmitter-Receiver RTA-1B (HF-2 Command) - Located in the main radio rack.

Frequency Range 2.5 - 13 MC

Channel - 10 crystal control

Antenna - top mounted long wire antenna which is suspended between an antenna mast on top of the cockpit and the lower section of the vertical stabilizer.

Transmitter Power - is 50 Watts.

Power Source - Dynamotor built - in with the set.

1. A LIA-AUDIO switch is located on the overhead panel, which should be turned to _____ for HF-1 and HF-2 reception.	
2. The HF-2 command transmitter-receiver _____ is located on the _____.	COM
3. The RTA-1B has _____ crystal controlled frequencies, from _____ to _____ mc.	RTA-1B main radio rack
4. The antenna is above the fuselage suspended between a mast on top of the _____ and the _____ section of the vertical stabilizer.	ten 2.5 13
5. The RTA-1B transmitter has _____ watts output.	cockpit; lower
6. This transmitter receives it power from a _____.	50
	built-in dynamotor

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CONTROLS

This HF-2 (Command) system has its control unit located on the overhead panel of the cockpit. The control unit provides a channel selector switch, a two-way master switch, a transmitter switch, and a volume control knob.

The HF-2 (Command) system can be turned ON or OFF by the two-way master switch on the control unit.

The Frequency Selector Switch is turned to the desired channel.

The Transmitter Switch is turned ON, and the microphone Press-To-Talk is pressed to transmit.

A placard giving the HF channel numbers and frequencies is provided on the overhead panel in the cockpit and also on the front panel of the set.

Jack Box Control - Switch to COMM position to operate the HF-2 system. A VHF-COMM microphone switch for controlling the transmission of either the VHF or the COMM and transmitter is located in the overhead panel next to the radio control units.

1. The HF-2 Command control unit, on the _____, includes a channel _____ switch, a master switch, a _____ switch, and a _____ control.

2. The HF-2 can be turned ON or OFF by the _____ switch.

overhead panel
selector
transmitter
volume

master

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ADF RECEIVERS

General

Two separate automatic radio compass systems are provided. One is designated ADF-1 (Red), the other ADF-2 (Green).

Both receivers (ARN-7) are located in the main radio rack.

Frequency Range 100-1750 KC in 4 bands. Bands are 100-200, 200-410, 410-850, 850-1750 Kcs.

Antenna - Each receiver is provided with a loop antenna and a sense antenna located on the lower forward portion of the fuselage.

Power Source - 29 V DC is supplied by the ship's 28 V system, and 115 V AC is supplied by the inverters.

Controls - Both control units are located on the overhead panel of the cockpit. The ADF-1 (Red) control unit is above the pilot's position and the ADF (Green) control unit is above the Copilot's position.

Jack Box Control - Switch to COMP position to operate both ADFs.

Indicator - One dual radio compass azimuth indicator is provided at the Captain's side of the flight instrument panel. The indicator has two pointers; one for ADF-1 (Red) and the other for ADF-2 (Green). The pointers are marked in accordance with their respective ADF sets.

1. Each of the 2 ADF receivers _____, which are located in the main radio rack, is controlled from the _____.	
2. Each has a frequency range of from _____ to _____ kc in four bands.	(ARN-7) overhead panel
3. The bands are _____, _____, _____, and _____ kcs.	100; 1750
4. Each ADF receiver has a _____ antenna and a _____ antenna below the lower forward fuselage.	100-200; 200-410; 410-850; 850-1750
5. Power for the ADF receivers is from the _____ electrical system and _____ from the inverters.	loop sense
6. There is one dual radio compass _____ indicator on the _____ flight instrument panel.	28V DC 155V AC
7. The indicator has two pointers, _____ and _____.	azimuth; Captain's
8. The ADF receivers provide visual and aural bearing _____ indication, and oral reception of _____ or _____ signals in the _____ frequency range.	ADF-1 (Red) ADF-2 (Green)
	voice; range; L/MF

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A 4-position ("OFF - ADF - ANT - LOOP") function selector switch, located on the respective ADF control panels, permits selection of the following functions:

"OFF" POSITION

Permits turning off each ADF, however during flight the switch should be left in one of the operating position.

"ADF" POSITION

Provides automatic visual bearing indication and, if signals are voice or tone modulated, aural reception.

Each receiver utilizes a motor-driven directional loop antenna (to sense the directions of the signal) and a nondirectional sense antenna (to resolve the 180 degree ambiguity of the loop antenna). The visual bearing indication is presented on the dual azimuth card indicates bearings produced by the captain's receiver, and the double barred pointer indicates bearings produced by the F/O receiver. It should be remembered that the receiver cannot automatically discriminate between multiple signals received, but may indicate a visual bearing which is the vectorial sum of desired and interfering signals and may be ambiguous.

"ANT" POSITION

Provides aural reception only of voice or tone modulated signals, using the non-directional sense antenna. This position normally should be used during standard range approach (or any aural utilization of range stations).

NOTE: When precipitation static exists, aural reception may be improved by using the "loop" position.

"LOOP" POSITION

Provides aural reception of voice or tone modulated signals using only the loop antenna. Visual bearing indicators can be obtained by using the "loop rotator" to rotate the loop antenna to the signal's aural-null position. Bearings obtained in this manner are subject to 180 degrees ambiguity (which can only be resolved by standard methods of orientation).

NOTE: Aural radio range signals received over loop antenna only must be used with caution. Generally such signals are accurate only when flying straight with wings level, and in smooth air.

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<p>1. There is a four position function selector switch on each ADF control panel marked _____, _____, _____, and _____.</p>	
<p>2. The ADF position provides automatic _____ bearing indication and aural _____ reception.</p>	<p>OFF; ADF; ANT; LOOP</p>
<p>3. Each ADF receiver has a motor-driven directional loop antenna and a non-directional sense antenna (to resolve the _____ of the loop).</p>	<p>visual signal</p>
<p>4. In the ANT position, reception of voice or tone signals is provided using the _____ antenna.</p>	<p>180° ambiguity</p>
<p>5. When precipitation static exists, aural reception may be improved by using the _____ position instead of the _____.</p>	<p>non-directional sense</p>
<p>6. In the LOOP position, aural reception of voice or tone signals is from the _____.</p>	<p>LOOP ANT</p>
<p>7. In the LOOP position, bearings are obtained by rotating the loop antenna with the _____ switch, to obtain an _____.</p>	<p>loop antenna only</p>
<p>8. When in the LOOP position, the aural null obtained is subject to a _____.</p>	<p>manual oral null</p>
<p>9. When using the ADF in the LOOP position, it should be remembered that bearings obtained in this configuration are accurate only when _____ and in _____.</p>	<p>180° ambiguity</p>
	<p>flying straight and level; smooth air</p>

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VHF and HF Communications

1. Due to design characteristics, there is a 2 minute delay before operation is possible when the HF system is initially turned on.
2. When selecting a new HF frequency channel, wait approximately 30 seconds to allow shift mechanism to complete cycle before attempting transmission.
3. When transmitting on HF, wait approximately 2 seconds after pressing microphone button (to allow dynamotor to reach operating speed) before speaking. Hold face of microphone vertically, square to lips, no more than $\frac{1}{2}$ inch away, and speak directly into microphone.
4. Precipitation static can be reduced appreciably by reducing airspeed. (The rate of accretion of a static charge varies with the cube of the airspeed) A static charge sometimes can be dissipated temporarily as follows:
 - a. Transmitter selector - HF position.
 - b. Press microphone button 2-3 seconds. Reception should be improved for a few seconds.
 - c. Repeat as necessary.
5. In case the transmitter stays "on the air" after releasing the mike button, it is possible that the mike button, or the mike cord has shorted out (pull mike plug) or a relay in the equipment has stuck closed. In the latter case, shut off appropriate circuit breaker.
6. The following chart may be assumed to be based on normal radio conditions for HF:

<u>Distance</u>	<u>Night</u>	<u>Day</u>
50 miles	Use any frequency	Use any frequency
300 miles	Use 3000-5000 KC	Use 4000-7000 KC
1000 miles	Use 5000-7000 KC	Use 6000-10000 KC
3000 miles	Use 7000-9000 KC	Use 9000-16000 KC

Transmission on either HF system interrupts LORAN reception until transmission stops. It is recommended that the LORAN set be switched OFF when HF transmission takes place.

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<p>1. When the HF system is initially turned on, you should allow approx _____ warmup period before attempting to operate.</p>	
<p>2. When selecting a new HF frequency, there is a delay of approx _____ before the new channel can be used.</p>	<p>2 minutes</p>
<p>3. When transmitting on HF, there is a delay of _____ after pressing the microphone button for the dynamotor to reach operating speed (approx _____ rpm), before transmission is possible.</p>	<p>30 seconds</p>
<p>4. Precipitation static can be reduced by _____.</p>	<p>2 to 4 seconds; 8000</p>
<p>5. Under normal conditions, the best HF frequencies for a range of 300 miles is _____ kc night and _____ kc day.</p>	<p>reducing airspeed</p>
<p>6. Best frequencies for 1000 miles are _____ kcs night and _____ kcs day.</p>	<p>3000-5000 4000-7000</p>
<p>7. For a distance of 3000 miles, _____ night and _____ kc day.</p>	<p>5000-7000</p>
	<p>7000-9000 9000-16000</p>

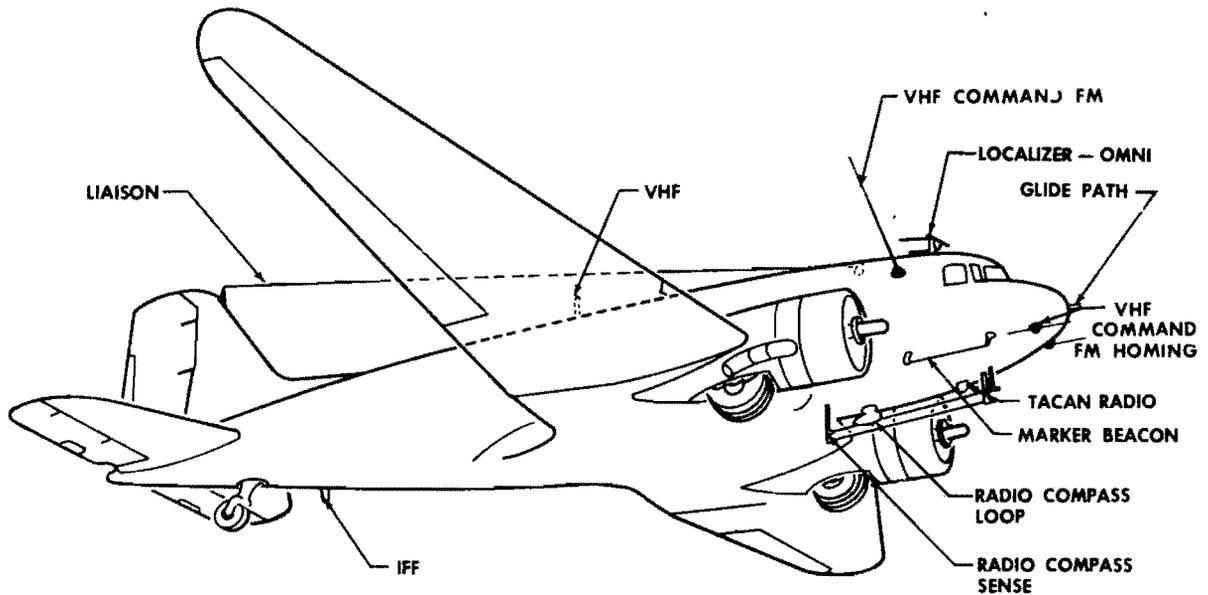
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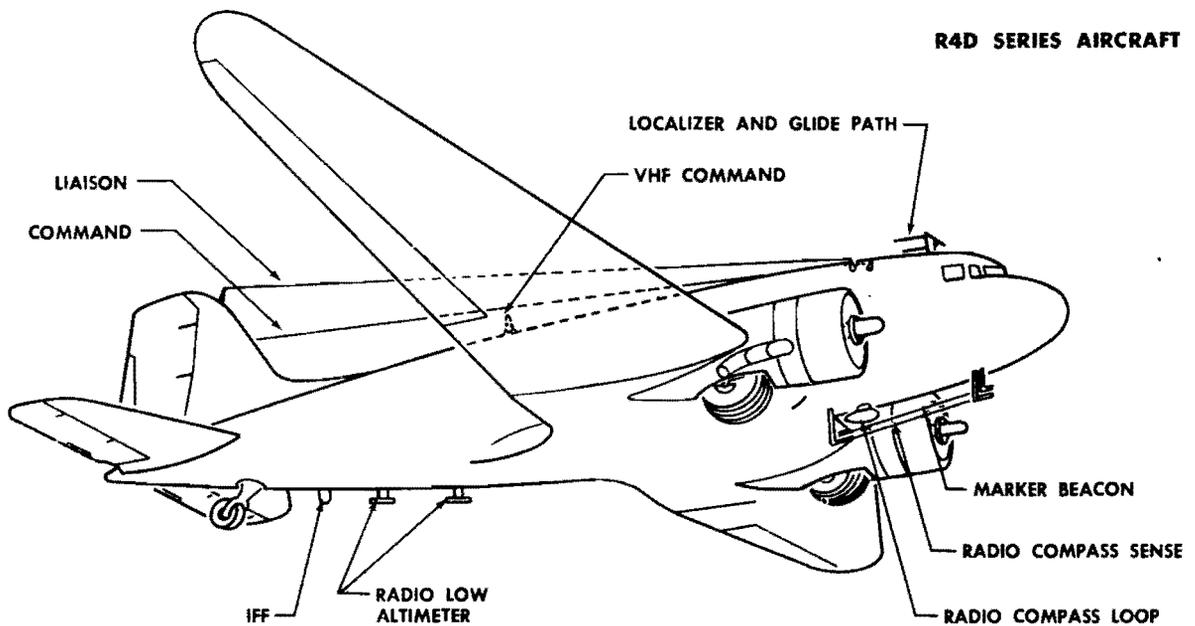
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ANTENNA LOCATIONS



R4D SERIES AIRCRAFT

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ELECTRICAL

GENERAL

Electric Power Supply consists of two 30 volt 100 amp. generators and two 12 volt 88 amp/hr batteries connected into a series system.

Generators are mounted one on each engine and are of the shunt-wound type. Normally the generators will be switched into the system by the reverse current relays between 1250-1500 RPM. This tolerance of RPM is governed by the differential of voltage between the generators and batteries. Actual output between these RPMs will vary from 35 to 80 per cent. Maximum output is obtained at approximately 1800 RPM. The generator is capable of building up enough voltage to normally "cut-in" (actuate reverse current relay) at approximately 1300 RPM. However, higher voltage is not normally reached until approximately 1700 RPM. At 1700 RPM the generators are normally producing standard 28 volts, but will not carry heavy electrical loads. Generators can satisfactorily carry rated loads at rated voltage at approximately 1800 RPM.

Generator check shall be conducted at 1800 RPM. Engine feathering check shall be conducted at 1800 RPM. Both engine throttles should be advanced simultaneously at 1800 RPM for generator check and both remain at 1800 RPM when propeller check is being conducted simultaneously after propeller checked (decrease-increase), and feathering check conducted individually. Never perform both engine feathering check simultaneously.

With both generators operating at the same engine RPM (1800 RPM) producing rated load at rated voltage, an accurate reading and check can be made on the generator output gages (Ammeters). Any unbalance should be disregarded if load is less than 40 Amperes total per generator, for example - if you have 30 Amperes total load, and one generator takes 5 Amperes, and the other 25 Amperes, no cause exists for discrepancy write-up. On the other hand, with a reasonable load on the generator, the difference of approximately 25 Amperes between the loads carried between the individual generator is allowable.

Batteries

Batteries are connected in series to the main bus resulting in a terminal voltage of 24.8 volts, fully charged.

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<p>1. Electric power is supplied basically by _____ with a capacity of _____ volts and _____ amps each, connected in _____, and _____ V, _____ amp hour batteries connected in _____.</p>	
<p>2. The two batteries are connected in _____ with the generators to the main bus, and produce _____ V at _____ amp hours when fully charged.</p>	<p>2 generators; 30; 100; parallel; 2-12; 88; series</p>
<p>3. One generator is mounted on each engine and is of the _____ type.</p>	<p>parallel 24; 88</p>
<p>4. The generator output is switched into the system when it exceeds battery voltage, at approx _____ to _____ rpm.</p>	<p>shunt-wound</p>
<p>5. Actual voltage output in this rpm range varies from _____ of capacity.</p>	<p>1250</p>
<p>6. Maximum generator output is at approx _____ rpm.</p>	<p>35 to 80%</p>
<p>7. Although the generators cut in normally at approx 1300 rpm, higher voltage is not usually reached until _____ at approx _____ rpm.</p>	<p>1800</p>
<p>8. At 1700 rpm, the output is normally _____ V but _____ carry heavy electrical loads.</p>	<p>1300 1700</p>
<p>9. Satisfactory generator output for rated load requires approx _____ rpm or more.</p>	<p>28 will not</p>
<p>10. Generator check, propeller check, and feathering check should be made at _____ rpm.</p>	<p>1800</p>
<p>11. In flight, with both generators operating, there is a tolerance of _____ amperes imbalance between the output of the two generators.</p>	<p>1800</p>
	<p>25</p>

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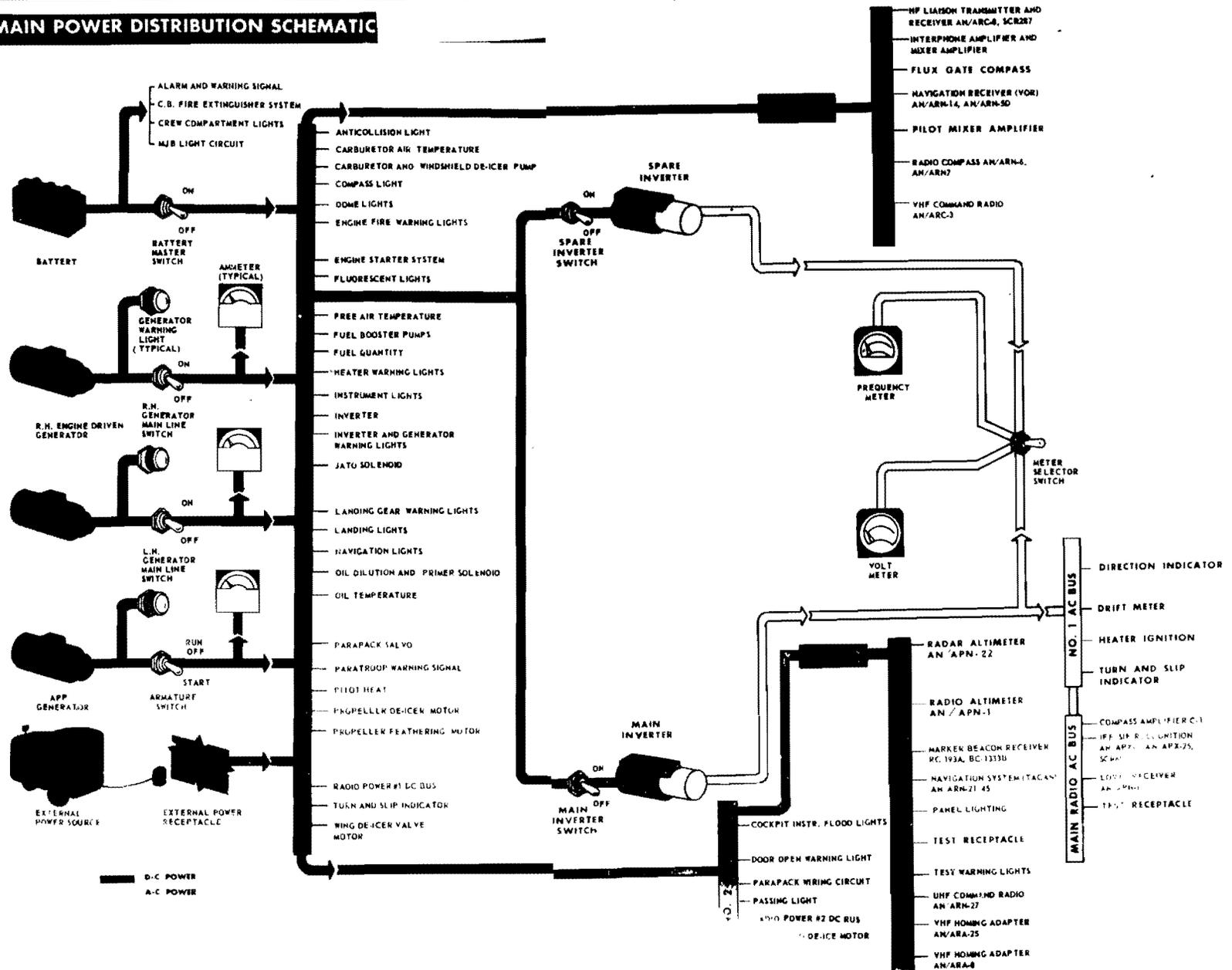
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MAIN POWER DISTRIBUTION SCHEMATIC



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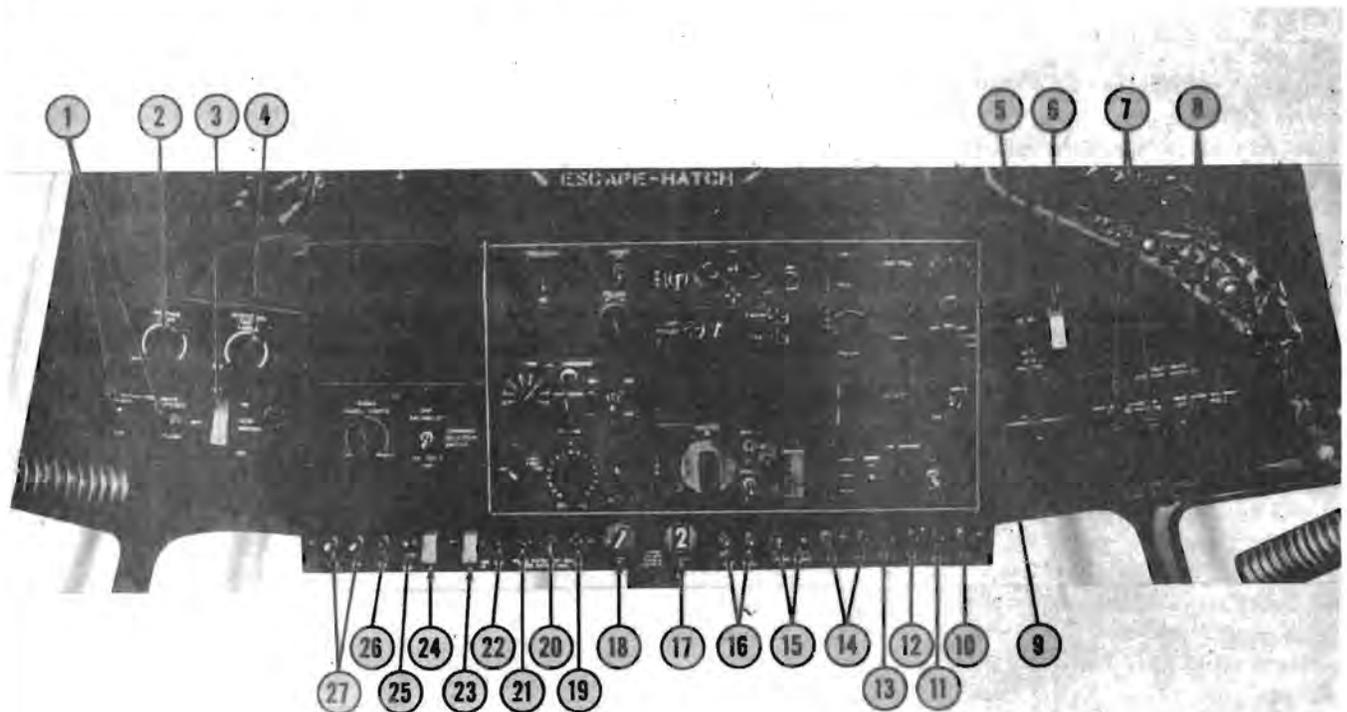
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ELECTRICAL CONTROL PANELS — TYPICAL



1. NAVIGATION LIGHTS SWITCH
2. COMPASS LIGHT RHEOSTAT
3. JATO MASTER SWITCH
4. ELECTRICAL PANEL LIGHTS RHEOSTAT
5. HEATER OVERHEAT WARNING LIGHT
6. JATO RELEASE SWITCH
7. MAIN INVERTER FAIL WARNING LIGHT
8. GENERATOR FAILURE WARNING LIGHTS
9. RADIO CONTROL PANEL
10. AFT PITOT HEATER SWITCH
11. FORWARD PITOT HEATER SWITCH
12. PROP DEICER SWITCH
13. CARB. AND WINDSHIELD DEICER SWITCH
14. BOOSTER PUMP SWITCHES

15. OIL DILUTION AND ENGINE PRIMER SWITCHES
16. STARTER SWITCHES
17. RIGHT ENGINE PROP FEATHERING SWITCH
18. LEFT ENGINE PROP FEATHERING SWITCH
19. BATTERY MASTER SWITCH
20. EMERGENCY POWER SWITCH
21. COCKPIT LIGHTS SWITCH
22. ANTI-COLLISION LIGHT SWITCH
23. PARAPACK SALVO SWITCH
24. BAILOUT WARNING SWITCH
25. JUMP WARNING SWITCH
26. PASSING LIGHTS SWITCH
27. LANDING LIGHTS SWITCHES

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REVERSE CURRENT RELAYS

Reverse current relays are provided to prevent current flowing from the batteries to the generators. At any time the battery voltage is 4.0 volts greater than the generators, the reverse current relay will open and remove the generator from the circuit.

1. The function of the reverse current relays is (a) to prevent current flowing from the _____ to the _____, when the generator output voltage is _____ the battery voltage, and (b) to connect the generators to the bus and the batteries when the output voltage _____ that of the batteries.

2. At any time that battery voltage exceeds the generator output voltage by _____ volts or more, the reverse current relay will _____ the circuit, removing the generator from the _____.

battery
generator
below
exceeds

4.0
open
bus

AMMETERS AND VOLTMETER

Two AMMETERS are provided on the co-pilot's electrical panel. VOLTMETER is also provided at the left side of the main junction box with a selector switch to obtain reading from left generator or right generator.

1. There are two ammeters on the _____.

2. There is a voltmeter on the _____ side of the _____ with a selector switch for either right or left generator.

copilot's electrical
panel

left
MJB

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FUSES AND/OR CIRCUIT BREAKERS

Are located in the main junction box near the front exit door. Because of the difference in types and various modifications the locations of these protectors will vary in each aircraft; however, each one is marked as to its particular circuit.

1. Fuses and circuit breakers are located in the _____ adjacent to the _____.

2. Each circuit breaker and fuse is marked _____.

MJB
front exit door

as to its circuit

SYSTEM VOLTAGE

System voltage is controlled by two carbon pile regulators connected in the generator circuit. The regulated mean voltage at the bus bar is 28.0 volts with an allowable tolerance of 27.8 to 28.1 volts. It is very important that the bus voltage should not exceed 28.1 volts since excessive voltage causes overheated batteries.

1. The MJF contains the two _____ voltage regulators, one for each generator.

2. The voltage regulators act as an _____ in the generator _____ circuit.

carbon pile

automatic variable
rheostat;
field

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Generator Switches

Generator Switches are located on the R.H. overhead electrical panel. Circuit Breakers when installed, are of the thermal type. If one should trip out due to overload, reasonable time for cooling should be allowed before resetting. If the circuit breaker trips again, then the overload still exists and the circuit should remain "OFF" until the trouble can be determined.

Circuits Not Fused are feathering, battery relay and starter. The electrical power system is considered to be a parallel system wherein the output of both generators is equal. However, exactly equal output is not necessary. Temperature changes at the generators and regulators cause variations in output. So long as the variations remain within established tolerances (20% of total load difference between generators) then the system is considered to be parallel and satisfactory. Output during maintenance on the ground are held within 10%.

1. The generator switches are located on the right _____ panel.	
2. Circuit breakers are of the _____ type, and if one should trip due to overload it can not be reset for approx _____ seconds.	overhead electrical
3. If a circuit breaker is reset and trips again, it should _____ a second time until the trouble can be determined.	thermal 90
4. Normally, circuit breakers are used for _____ circuits and fuses are used for _____ circuits.	not be reset
5. The 3 circuits which are not protected by circuit breakers or fuses are: _____, _____, and _____.	dc ac
6. The electrical system is known as a single wire _____ type, the A/C structure serving as the _____.	prop feathering battery relay starter
	ground return ground

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VACUUM SYSTEM

The vacuum system consists of a vacuum gage, two engine-driven pumps, two vacuum relief valves, two check valves, a vacuum manifold, two air filters, and the connecting tubing.

The system provides for the operation of the autopilot, the turn-and-bank indicator, the directional indicator, and the attitude indicator.

1. The vacuum system actuates the _____ indicator, the _____, the _____ and the _____ control unit.

2. There are _____ engine-driven vacuum pumps, _____ on each engine.

turn, D/G; horizon, autopilot

two, one

Downstream from each vacuum pump is a relief valve that has a slotted adjustment screen on the top of the unit to permit vacuum pressure adjustments. Proper vacuum setting is $4\text{''Hg} \pm 1/4\text{''}$.

1. Downstream from each pump is a _____ valve set to regulate pressure at _____ in.Hg.

relief, $4\text{''} \pm 1/4\text{''}$

Downstream from each relief valve one way check valves are installed to prevent reverse pressure from damaging the vacuum instruments in case of engine backfire or reversed rotation of the pump. Another function of the check valves is to isolate a failed or inoperative vacuum pump on either engine.

1. Downstream from the relief valves are _____ valves.

2. These check valves will _____ a failed vacuum pump on either side.

one way check

isolate

One or two vacuum air filters are installed between the relief valve and the manifold to filter out impurities and are located on the bulkhead forward of the main instrument panel. These are checked and cleaned at regular scheduled maintenance intervals.

1. Air filters are installed between the _____ and _____ to filter out impurities.

relief valve, manifold

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A vacuum manifold is installed forward of the instrument panel to distribute vacuum pressure to the appropriate instruments and the auto-pilot.
 A vacuum system pressure indicator graduated in inches of mercury, is located on the auto-pilot control unit slightly above the auto-pilot attitude indicator. This instrument registers manifold vacuum available to all instruments except the turn and slip indicator. A reducing valve is installed in the turn and slip indicator to reduce the vacuum pressure from $4" \pm 1/4$ to $2" \pm 1/10$.

1. The vacuum manifold is located _____ of the _____.	
2. The pressure indicator is located on the _____.	forward, instrument panel
3. This instrument shows _____.	auto-pilot control unit
4. A reducing valve is incorporated in the _____ to reduce vacuum to _____.	manifold, vacuum
	turn and slip, $2" \pm 1/10$

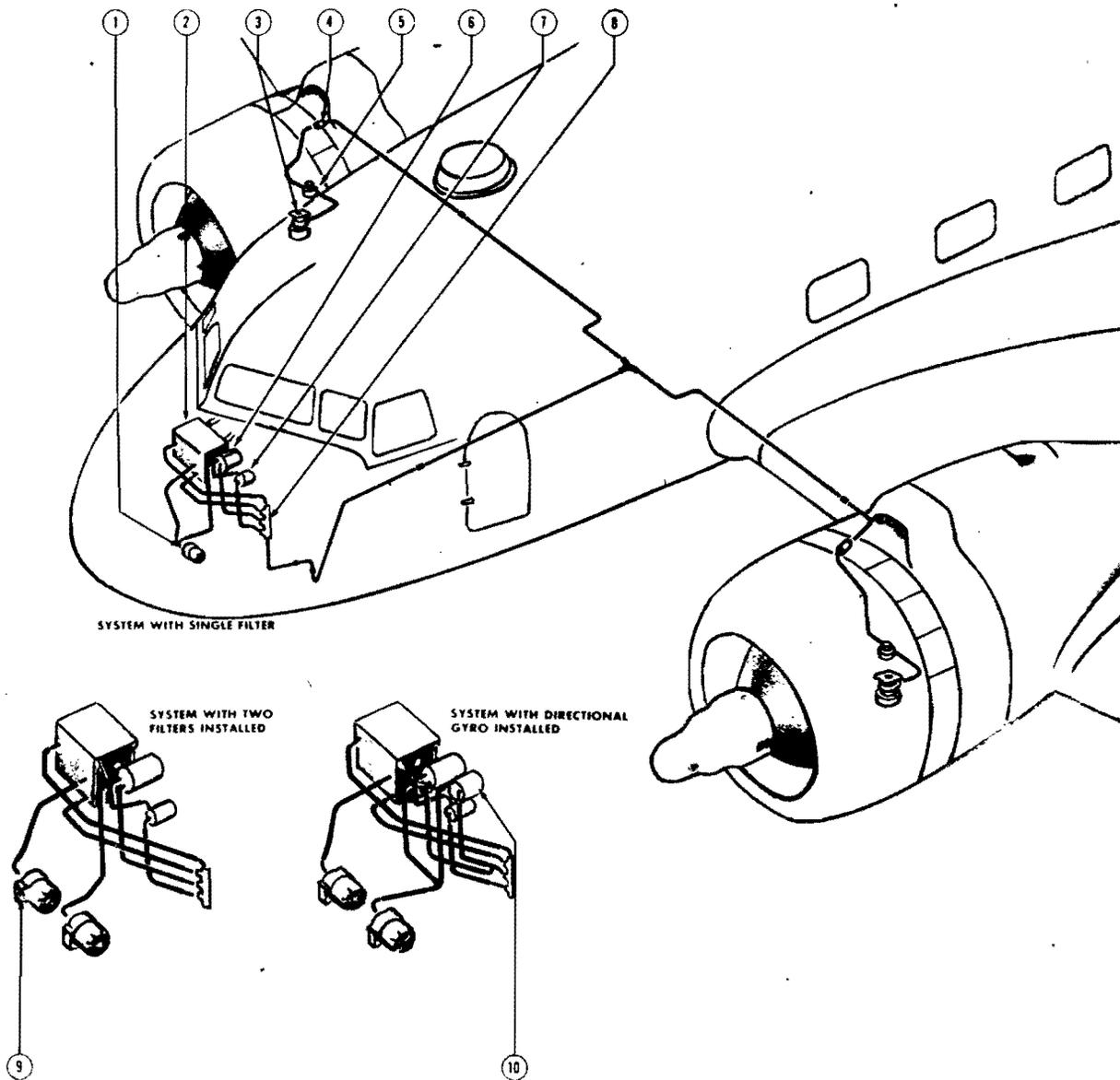
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Vacuum System for Instruments and Automatic Pilot

- | | |
|----------------------------------|-------------------------------|
| 1. Vacuum Air Filter | 6. Gyro Horizon Indicator |
| 2. Automatic Pilot Mounting Unit | 7. Turn and Bank Indicator |
| 3. Vacuum Pump | 8. Vacuum Instrument Manifold |
| 4. Eclipse Check Valve | 9. Vacuum Air Filter |
| 5. Eclipse Vacuum Relief Valve | 10. Directional Gyro |

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INDUCTION

The C-47 induction system consists of three different types, Ram, Ram Filtered and Ram Non Ram.

1. RAM TYPE

The ram or scoop type, on C-47 and some C-47A airplanes, consists of a small duct or scoop located on the top forward edge of the engine accessory cowling. This small duct routes the air directly to the carburetor.

This direct ram type duct is riveted to the accessory cowling and the duct is not removable. A door-like valve in the air-intake throat directly above the carburetor may be opened to permit hot air to be drawn into the carburetor from around the exhaust collector ring. This valve is controlled by the carburetor hot air control levers on the engine control pedestal. When the hot air door is opened, the ram air entrance is closed so that the ram air is by-passed through the side of the scoop.

1. There are _____ types of C-47 induction systems.

2. They are the _____ and _____.

three

3. The valve that directs air into the carburetor is controlled by _____ on the _____ pedestal.

Ram, Ram Filtered,
Ram Non Ram

4. The RAM type directs either _____ RAM air or _____
_____ to the carburetor.

levers,
engine control

straight,
hot air

2. RAM FILTERED TYPE

The second type, ram filtered, on C-47 and some C-47A airplanes, consists of the same type small duct but, in addition, extends a filter duct, a detachable unit, to the leading edge of the anti-drag ring to introduce filtered ram air to the carburetor.

This ram filtered type is the direct ram type with a fairing added to house a filter. It is larger than the scoop described above, extending forward to the leading edge of the anti-drag ring. The additional length allows room for an air filter which is installed in the front end of the duct. The filter housing is removable, being fastened to the anti-drag ring with Dzus fasteners. The carburetor hot air control valve and its operation is the same as the ram type.

1. The RAM FILTERED system similar to the RAM system with the addition of a _____.

2. The filter housing is _____.

filter, housing

3. Carburetor heat is directed to the carburetor by the same _____ as the RAM system.

removable

control valve

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3. RAM NON RAM TYPE

The third type, ram-non ram filtered ("non ram"), consists of three designs. The first design, used on some late C-47A airplanes, contains hydraulically operated doors. The second design, used on 300 early C-47B airplanes, contains electrically operated doors. The third design, used on other C-47B airplanes, contains manually operated doors. The fairing of these designs extends from the leading edge of the engine accessory cowling to approximately halfway back on the top of the nacelle. Ram air is introduced through the front opening of the fairing and filtered non ram air is introduced through the opening near the top aft end of the fairing.

1. The RAM NON RAM doors are operated _____ or _____, depending on aircraft modification.

2. The fairing extends the _____ of the accessory cowling to _____ back of the top of the nacelle.

hydraulically, electrically, manually

leading edge, halfway

The ram non ram ("non ram") type air scoop extends from the leading edge of the accessory cowling to approximately halfway back on top of the nacelle. The front opening in the scoop provides the direct, or "ram" air. The opening on top aft end of the duct together with the air filter provides the non ram feather. Flow of air through the carburetor air scoop is controlled by the ram door inside the front opening of the scoop and the aft butterfly door located farther back at the end of the non ram channel. These two doors are connected by linkage and are operated simultaneously by a hydraulic actuating cylinder mounted in the wall of the scoop. When the hydraulic cylinder is "EXTENDED", the ram door is "OPEN" and the aft butterfly door is "CLOSED". This allows ram air to be supplied directly to the carburetor. When the hydraulic cylinder is "RETRACTED", the opposite action takes place. That is, the ram door is "CLOSED" and the aft butterfly door is "OPEN", allowing filtered air to enter the carburetor. The hydraulic actuating cylinder that operates these two doors is controlled by a valve located on the bulkhead behind the pilot's seat. This valve is marked on early installations "NON RAM AIR FILTER" and has three positions: "OPEN", "CLOSED" and "OFF". On some airplanes these positions are "FILTERED", "UNFILTERED" and "LOCKED". Carburetor heat is controlled by the operation of a valve door in the air-intake throat, just above the carburetor. The carburetor hot air door is operated by controls on the engine control pedestal. The carburetor heat rise is registered on the carburetor air temperature indicator located on the right-hand instrument panel in the pilots' compartment. When this door is "OPEN" the heated air from the shrouded area of the collector ring is allowed to enter the induction system. Simultaneously, the cool ram and non ram air flow is shut off.

1. The front opening in the scoop provides the _____

2. The opening on _____ end of duct together with the air filter provides the _____ air.

direct ram air

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3. Two doors incorporated in the scoop provide the directional air flow and operate _____.

top aft,
NON RAM

4. The control valve for the operation of the doors is located on the bulkhead behind _____.

simultaneously

5. The control valve is marked _____, _____ and _____ on early installations.

the pilot's seat

6. On some installations the valve is marked _____, _____ and _____.

OPEN, CLOSED,
OFF

filtered,
unfiltered,
locked

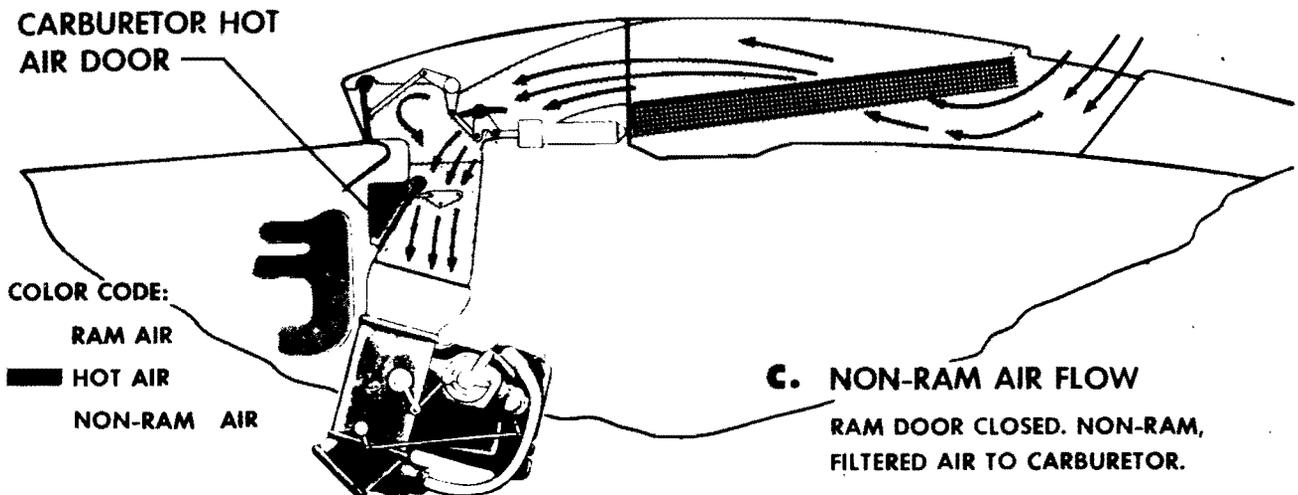
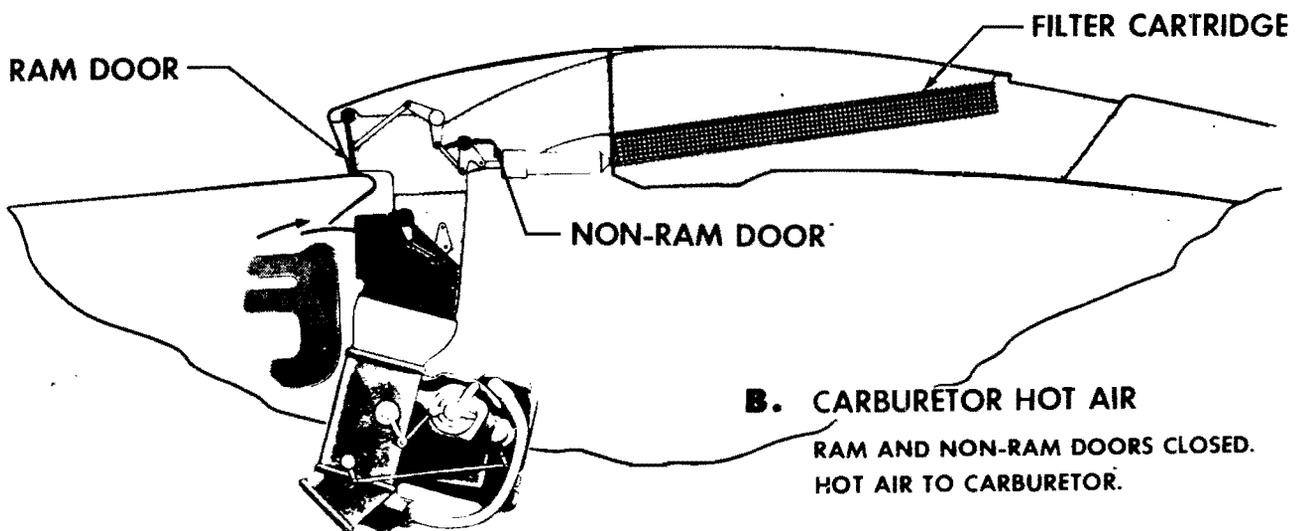
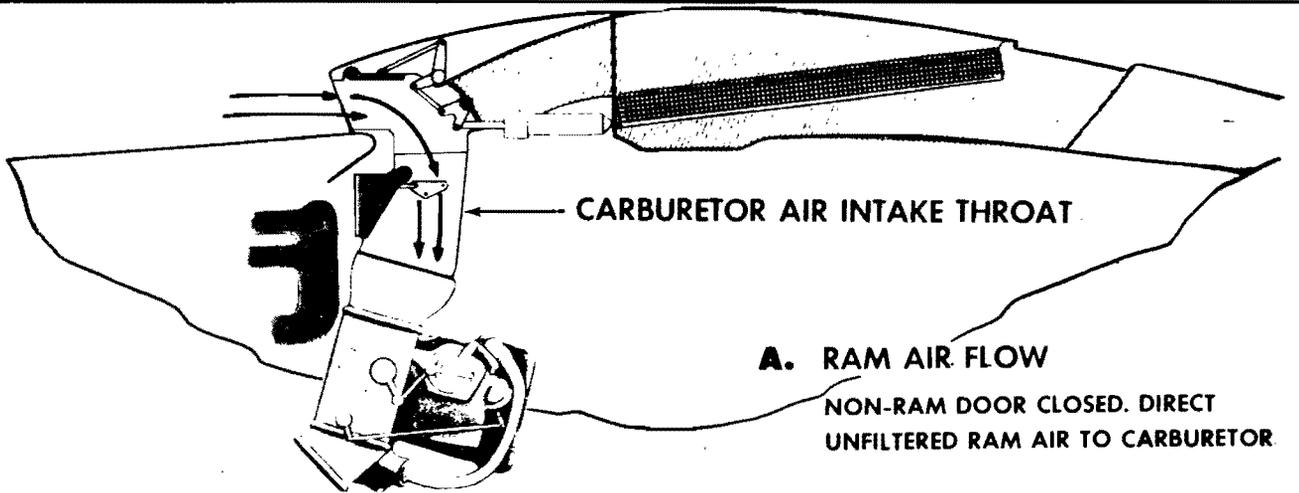
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-Principle of Hydraulically Operated Ram Non Ram Air Induction System

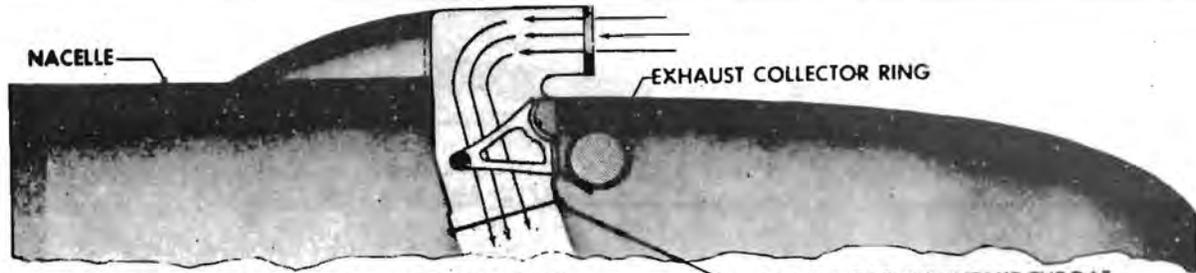
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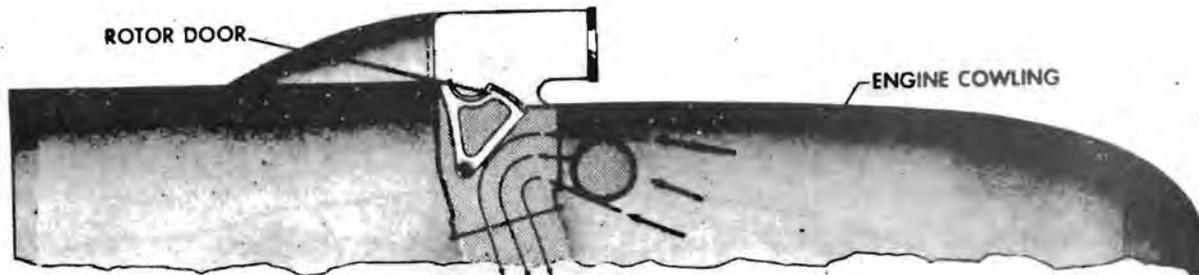
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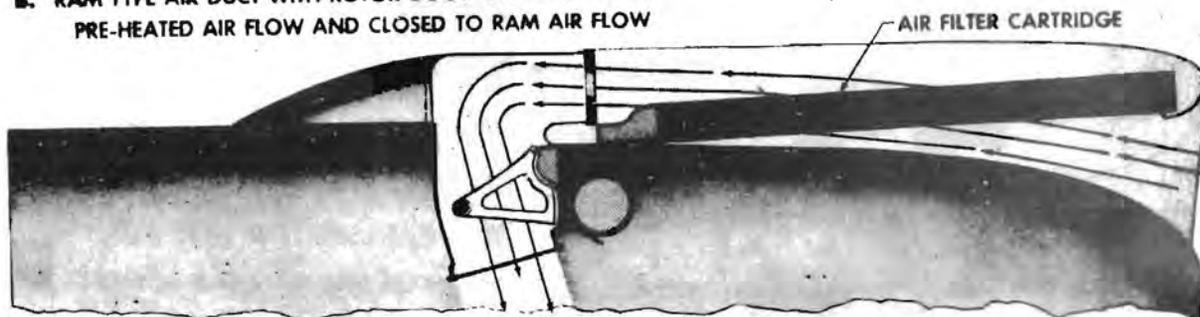
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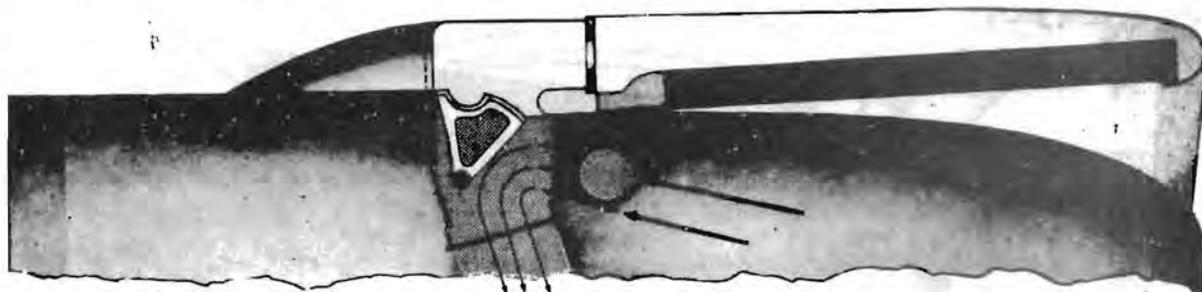
A. RAM TYPE AIR DUCT WITH ROTOR DOOR CLOSED TO PRE-HEATED AIR FLOW AND OPEN TO RAM AIR FLOW



B. RAM TYPE AIR DUCT WITH ROTOR DOOR OPEN TO PRE-HEATED AIR FLOW AND CLOSED TO RAM AIR FLOW



C. FILTERED RAM TYPE AIR DUCT WITH ROTOR DOOR OPEN TO FILTERED RAM AIR FLOW AND CLOSED TO PRE-HEATED AIR FLOW



D. FILTERED RAM TYPE AIR DUCT WITH ROTOR DOOR CLOSED TO FILTERED RAM AIR FLOW AND OPEN TO PRE-HEATED AIR FLOW

COLOR CODE :

RAM AIR

HOT AIR

-Principle of the Ram and Filtered Ram Air Induction System

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ICE ELIMINATION

GENERAL

The anti-icing system employed in C-47 aircraft is comprised of three systems: carburetor, propeller, and windshield anti-icing systems.

An 8 gallon tank installed at the copilot's side aft of station 86 supplies isopropyl alcohol to both carburetors and the windshield. An 8 GPH pump is used to pump the fluid under pressure to the carburetors. In between the carburetors and the pump, two check valves are provided to prevent back flow of the fluid to an inoperative pump.

Another 2 GPH pump is used to pump the fluid from the same tank to the windshields. Three control valves are installed near the windshield to regulate the rate of flow.

A second tank installed forward of station 86, just behind the pilot's seat, has a capacity of 4.2 gallons. It supplies alcohol to the slinger rings of both left and right propellers through a 5 GPH pump.

There are three switches located in the cockpit. Each controls a pump. In the propeller anti-icing switch circuit there is also a rheostat providing variable flow control.

The de-icer system used to eliminate ice of the C-47 aircraft employs de-icer boots which consist of a rubber sheet, containing spanwise inflatable air chambers, stretched and attached at their outer margins to the leading edges of wings and stabilizers. Ice is removed by the mechanical action of inflation and deflation of the boots after ice has formed on their surfaces. Operation of the boots produces enough distortion and stretch to crack and peel the ice. Once loosened, the ice will be carried away by the air stream. Therefore, the best results will be obtained by waiting until the ice has accumulated about 1/8 inch thick before operating the de-icer boots, instead of operating the boots continuously. In the latter case, the accumulated ice may cover the boots in a shape as if the boots were inflated, rendering the action of the boots ineffective.

The de-icer boots are inflated and deflated in a definite sequence by air under pressure. Two vacuum pumps, one installed on each engine, supply the necessary air under pressure, which is then distributed to the air chambers of the de-icer boots by a distributor valve. As the distributor valve rotates, the various sections of the boots are alternately connected to air pressure and exhaust.

An oil separator located in each engine accessory section separates the oil which is in suspension in the air and drains it back into the accessory case. An air check valve in each nacelle isolates each pump circuit from the other should one pump become inoperative. An oil separator which embodies an adjustable pressure regulating valve is located in the wing center section adjacent to the distributor valve. This separator further removes any remaining oil in the air and regulates the air pressure to a desired operating range. A motor switch on the distributor

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valve, controllable manually by the pilot, switches the de-icer system ON or OFF as desired.

NOTE: In tropical operations the de-icer boots and the distributor valve are normally removed and are not considered standard equipment, and the alcohol tanks and pumps are also removed.

The pitot static tubes are protected from ice by electrical heaters which are built into the tubes and controlled from the cockpit. During heavy rain when temperatures are well above 0°C , it is not necessary to turn these heaters on. The tubes do not become hot enough to boil any water out of the system, and the heat level is only slightly above outside air due to the amount of cold air rushing past the tube heads. Thus there is no advantage to turning the element on, and in the event that you forget to turn them off, the elements will burn out quickly on the ground.

1. There are 3 anti-icing systems provided in the C-47 A/C which are: _____, _____, and _____.	
2. Since icing conditions are not encountered in our operations in SEA, the anti-icing systems which normally employed isopropyl alcohol _____ in our A/C.	carburetor propeller windshield
3. The C-47 is equipped for deicer boots, which have been _____.	have been deactivated
4. The pitot static tubes are provided with _____ heaters controlled from the cockpit.	removed from our A/C
5. During heavy rain or other met conditions when temperatures are well above 0°C , pitot heat has _____ and there is _____ in turning it on.	electrical
6. If pitot heat is left on during ground operation, the elements will _____ in a short while.	no beneficial effect; no advantage
	burn out

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CARBURETOR ANTI-ICING

Carburetor Preheat

Partial preheat, when applied correctly and in advance of the entering of moisture laden air, will be sufficient to prevent ice formation in the carburetor throat and induction system. If ice is permitted to form, full preheat is available for ice removal. The most evident indication of carburetor ice formation is a drop in manifold pressure.

Carburetor preheat shall be used on all engines as a preventative measure against an icing condition, rather than as a cure, and should be applied prior to and during operation in known moisture-laden air of 5°C (40°F) or below.

Under Conditions Conducive to Carburetor Icing

1. Taxiing - Carburetor heat full cold.
2. Run-up - Check briefly full preheat + 40°C then full cold.
3. Holding prior to take-off - use 15°C to 40°C preheat.
4. Immediately prior to take-off apply full heat for a brief period (5 to 10 seconds should be sufficient for any icing condition).
5. Take-off (or other situations requiring maximum power) carburetor heat full cold.
6. Climb & cruise - use preheat 15°C to 40°C.
7. Descent and holding at reduced power - use preheat as necessary within normal limits.
8. Landing - use preheat as necessary within normal limits.

NOTE: During cruise operation, place mixtures in auto-rich before applying or removing carburetor heat. Allow several minutes for automatic mixture controls to stabilize, and then reset mixtures.

Emergency Preheat For Ice Removal

If ice has already formed as indicated by drop in manifold pressure:

1. Mixture controls - "Auto-Rich".
2. Apply full preheat and hold for maximum of 30 seconds - then return to normal preheat.

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3. If lost power is not restored - again use full preheat for period necessary to remove ice. Reduce from full preheat as soon as possible but continue to maintain sufficient preheat to avoid further icing.
4. If icing has caused excessive leaning - with mixture in auto-rich - as evidenced by low power in conjunction with engine roughness, use engine primer (in conjunction with carburetor preheat) as long as required.

To Obtain Maximum Carburetor Heat

To obtain maximum available carburetor heat when full preheat is applied for emergency ice removal:

Increase power (RPM and Manifold pressure) and take action to avoid the critical icing conditions.

1. The formation of ice in the carburetor throat and induction system is prevented or eliminated by _____.	
2. Carburetor preheat is used as a _____ measure against icing, and should be applied prior to operation in moisture laden air in _____ degrees centigrade or below.	induction heat
3. On engine runup, carb heat increase should be briefly checked to _____ °C, then full cold.	preventative +5
4. In holding prior to T/O in conditions conducive carb icing, use _____ to _____ °C preheat.	+40
5. Immediately prior to T/O apply _____ heat briefly (_____ seconds).	15 40
6. For T/O, and whenever full power is applied, carb heat is _____.	full 5 to 10
7. For climb and cruise, use carb heat _____ °C.	full cold
	15 to 40

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8. For descent and holding at reduced power use preheat _____ within normal limits.

9. For landing, use preheat _____ within normal limits.

as necessary

10. During cruise, put mixtures in _____ before applying or removing carb heat and allow several minutes for auto mixture to _____, then reset mixtures to _____.

as necessary

11. If carb ice has already formed, as indicated by a drop in _____ put mixtures to _____, apply full carb heat for a maximum of _____ seconds, and then return to normal preheat.

AUTO RICH
stabilize
AUTO LEAN

12. If lost power is not restored, again use _____ for a period necessary to remove ice with mixtures in _____.

AMP
AUTO RICH
30

13. Return to normal preheat as soon as normal power is restored and return mixtures to _____.

full preheat
AUTO RICH

14. If when using preheat to eliminate icing, engine roughness occurs with loss of power, use the _____ in conjunction with preheat as long as required.

AUTO LEAN

15. Maximum carb heat is obtained by _____ with carb heat control in _____ position.

engine primer

increasing rpm and MAP
full hot

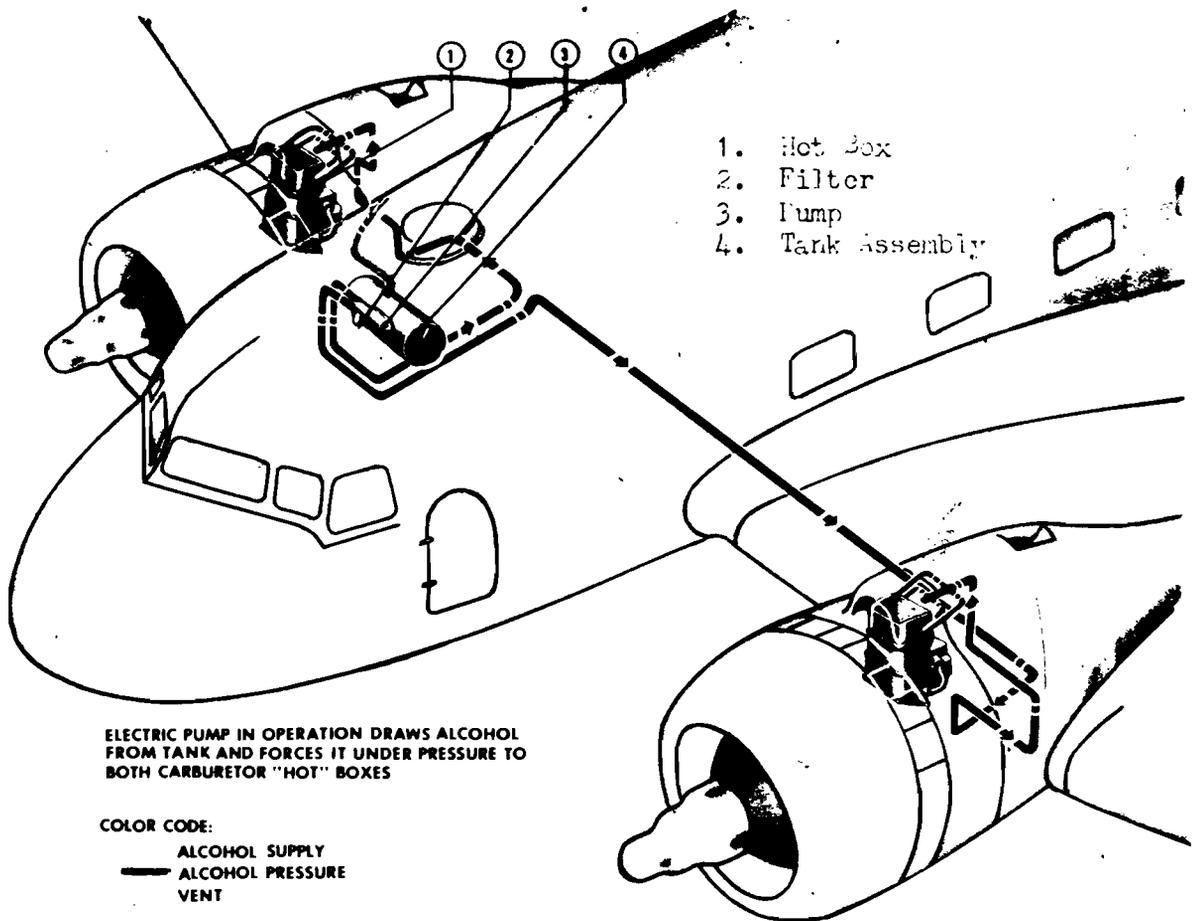
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-Carburetor Anti-Icer System

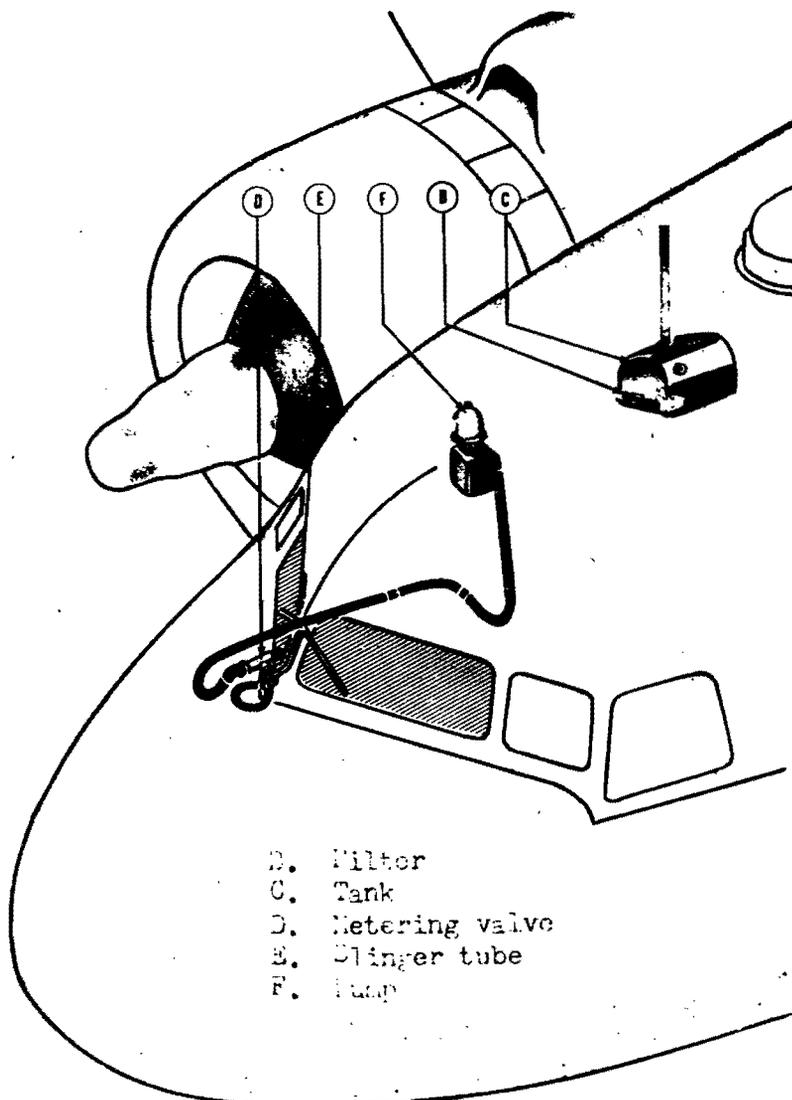
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COLOR CODE:

■ ALCOHOL SUPPLY

■ PRESSURE.

○ VENT

ELECTRIC PUMP IN OPERATION DRAWS ALCOHOL FROM TANK AND EJECTS IT UNDER PRESSURE ON BOTH FRONT WINDSHIELDS

-Windshield Anti-Icer System

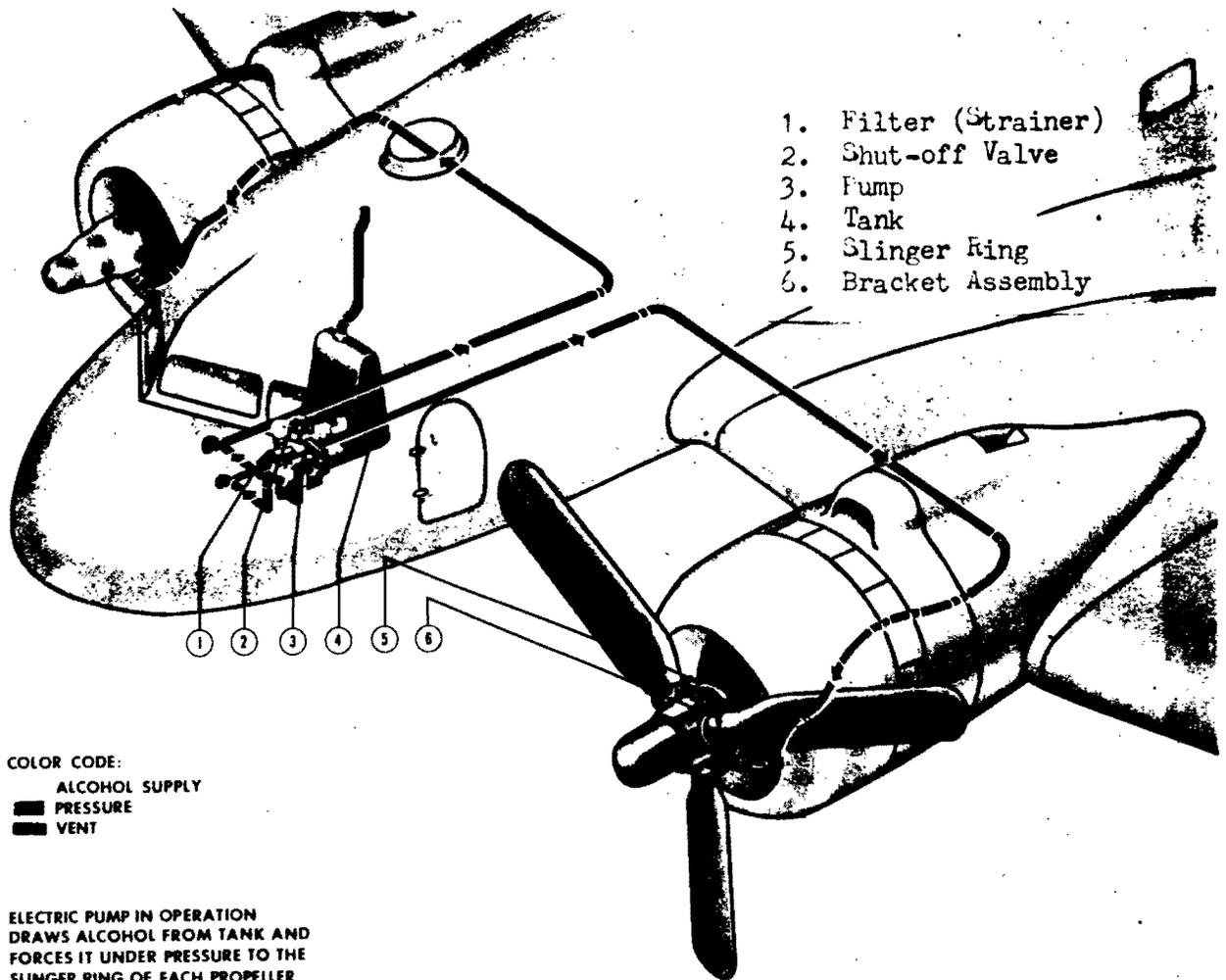
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Propeller Anti-Icer System

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INSTRUMENTS

GENERAL

Essentially the flight and navigation instruments are vacuum or pitot static pressure operated, while the engine and miscellaneous systems instruments are actuated by impulses transmitted electrically or through fluid medium.

Electrical

28 Volt DC Electric Instruments and Equipment

- a. Carburetor Air Temperature
- b. Engine Oil Temperature
- c. Outside Air Temperature
- d. Fuel Quantity Indicators
- e. All Radio and Navigational Equipment. (ADF units require both AC and DC Power)
- f. All Warning Lights and Warning Horn

115 Volt Electric Equipment

- a. AC Radio Circuits (Both ADF Units)

Self-Energized Electrical Instruments

- a. Engine Cylinder Head Temperature Gauges
- b. Engine Tachometers

1. The flight and navigation instruments are _____ and _____ operated.

2. The engine instruments are either _____ or _____ actuated.

pitot-static
vacuum

3. Instruments operated from the 28 V dc system include: _____, _____, oil _____, fuel _____; all radio and Nav equipment, all _____ lights and warning _____.

direct reading
electrically

4. AC radio circuits, including both ADF units, work from _____ system.

CAT; OAT; Temp.;
quantity; warning; horn

5. Self energized electrical instruments include the _____ gages, and engine _____.

115 V ac

CHT
tachometers

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Direct Operated Pressure Instruments

System Pressure Gauges

- a. Hydraulic System Pressure
- b. Landing Gear Down Line
- c. Engine Oil Pressure
- d. Fuel Pressure
- e. Auto-Pilot Pressure
- f. Vacuum Gauge

Vacuum Instruments

- a. Turn and Bank
- b. Directional Gyro
- c. Artificial Horizon

Absolute Pressure Instruments

- a. Engine Manifold Pressure
- b. Altimeters

1. Direct reading instruments include the _____ gages, hydraulic _____ pressure, landing gear _____ pressure, engine oil _____, system _____, and turn indicator _____.

2. Vacuum instruments include the _____, _____, _____.

MAP; system; down line pressure; vacuum; vacuum

3. MAP gage and the altimeters are known as _____ instruments.

turn indicator; DG; Horizon

absolute pressure

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Differential Pressure Instruments

- a. Airspeed Indicators
- b. Rate of Climb Indicators
- c. Vacuum Gauge

NOTE: Two airspeed indicators, one on each flight instrument panel, are provided. The indicators are calibrated in knots.

The face of each indicator has conventional color markings showing various limitations and approved operating ranges - in true indicated airspeeds - as follows:

Red Radial - Shows maximum never exceed speed.

Yellow Arc. - Shows caution range extending from V_c up to V_{ne} . The point where the yellow and green arcs meet is V_c .

Green Arc. - Shows normal operating range extending from stalling speed (at maximum take-off weight with gear and flaps up) up to V_c .

White Arc. - Extends from stalling speed (at maximum landing weight gear down and full flaps) up to maximum flap extension speed for full flaps

1. The air speed indicators, rate of climb indicator, and vacuum gage are known as _____ instruments.

2. The instruments which utilize pitot-static pressure are the _____ indicators, calibrated in _____.

3. The instruments utilizing static pressure are the _____ indicators, the _____, and the _____ indicator.

4. The A/S indicators are marked with a red radial to indicate _____, yellow arc from _____ to _____, green arc from _____ speed (at max TOGW clean) up to _____, white arc from _____ to _____ (max flap extension speed).

differential pressure

two airspeed
knots

2-A/S
altimeter
rate of climb

V_{ne} ; V_{no} ; V_{ne} ;
stalling
 V_{no} ; V_{so} ; V_{fe}

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Altimeters

Ground Check - Set both pilot instrument panel altimeters (Captain's and F/O) to current local "Altimeter Setting"; lightly tap rim of each instrument to assure settled reading. Both altimeters shall indicate published field elevation plus or minus 50 feet at sea level to 2000 feet. If either altimeter is not within limit specified above, it must be entered in airplane log book and required corrective action must be taken prior to take-off.

1. When set to the correct altimeter setting for any airport, both altimeters should indicate the published _____ \pm 50 feet, at sea level to _____ feet altitude.

2. If the altimeters are not within tolerance, it should be entered._____.

field elevation
2000

in the A/C log

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OXYGEN EQUIPMENT

NOTE: All oxygen equipment has been removed from company aircraft.

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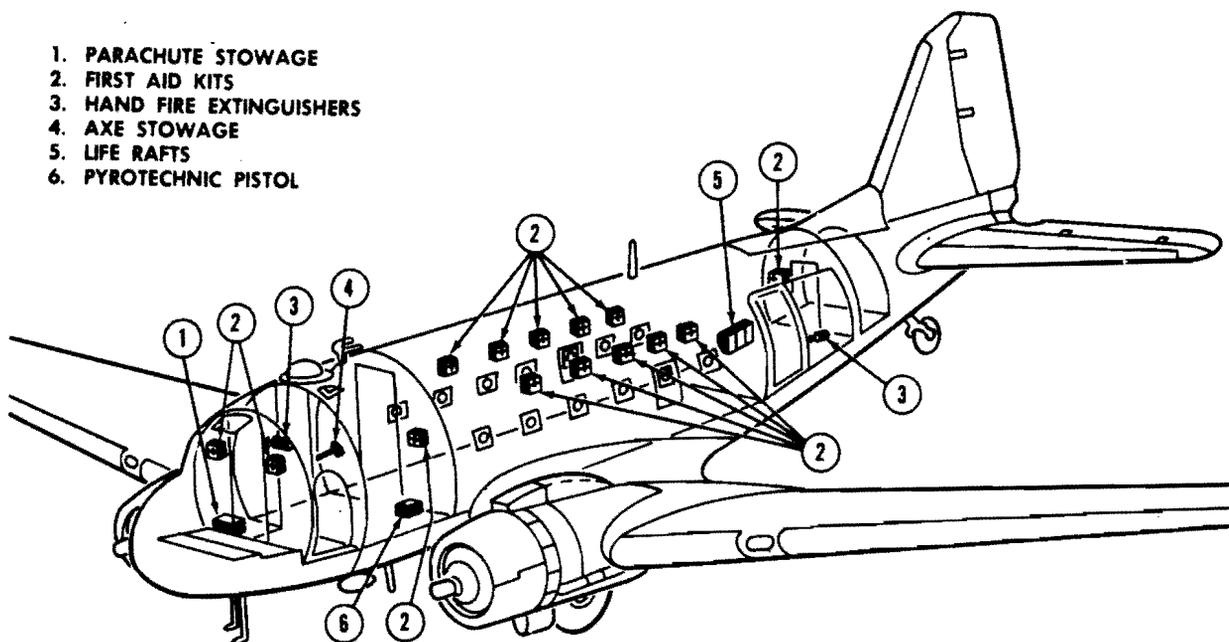
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EMERGENCY EQUIPMENT

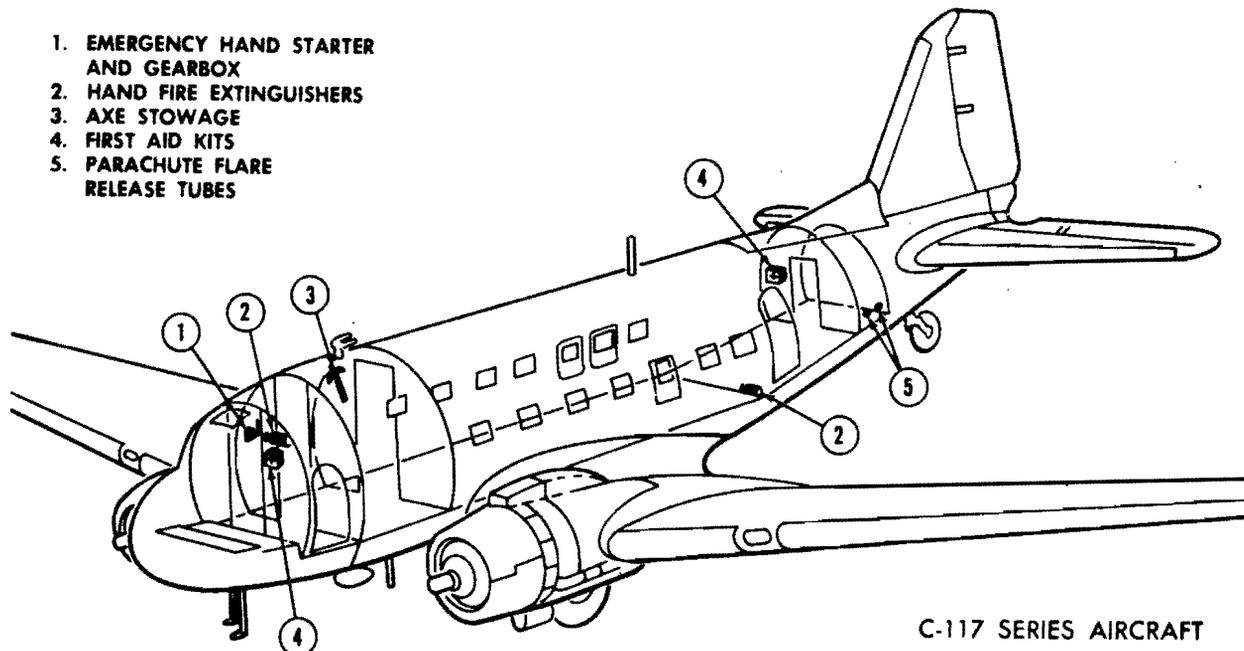
C-47 AND R4D SERIES AIRCRAFT

1. PARACHUTE STORAGE
2. FIRST AID KITS
3. HAND FIRE EXTINGUISHERS
4. AXE STOWAGE
5. LIFE RAFTS
6. PYROTECHNIC PISTOL



MISCELLANEOUS EMERGENCY EQUIPMENT

1. EMERGENCY HAND STARTER
AND GEARBOX
2. HAND FIRE EXTINGUISHERS
3. AXE STOWAGE
4. FIRST AID KITS
5. PARACHUTE FLARE
RELEASE TUBES



C-117 SERIES AIRCRAFT

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1. Parachute stowage is located behind the _____ seat.

2. First aid kits are installed at _____ and throughout the _____.

3. _____ hand fire extinguishers are installed in the _____ and on the main _____ respectively.

4. A fire axe is installed in the _____.

5. When required, life rafts are installed in the _____ opposite the main _____.

first officer's

each crew position,
cabin

two, crew compartment,
cabin door

crew compartment

cabin,
cabin door