NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-564 (Rev 05-15)**

STUDENT HANDOUT BOOKLET

T-44C SYSTEMS COURSE

2015

DEPARTMENT OF THE NAVY
CHIEF OF NAVAL AIR TRAINING
250 LEXINGTON BLVD SUITE 102
CORPUS CHRISTI TX 78419-5041

CNATRA P-564
N713
28 Jul 15

CNATRA P-564 (rev 05-15)

Subj: STUDENT HANDOUT BOOKLET, T-44C SYSTEMS COURSE

1. CNATRA P-564 (Rev 05-15) PAT, "Student Handout Booklet, T-44C Systems Course," is issued for information, standardization of instruction, and guidance for all T-44C flight instructors and students in the Naval Air Training Command.

2. This publication will be used as a guide for completion of T-44C Advanced Multi-Engine Flight Training curricula for all student pilots.

3. Recommendations for changes should be submitted to CNATRA N7 via TCR.

4. CNATRA P-564 (New 04-10) PAT is hereby cancelled and superseded.

C. J. HAYDEN
By direction

Distribution:
CNATRA Website

STUDENT HANDOUT BOOKLET

FOR

T-44C SYSTEMS

LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:
Original...0…12 Jan 11 (this will be the date issued)
Revision…1…28 Jul 15

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 170 CONSISTING OF THE FOLLOWING:

Page No.	Change No.	Page No.	Change No.
COVER	0		
LETTER	0		
iii - xii	0		
1-1 – 1-11	0		
1-12 (blank)	0		
2-1 – 2-19	0		
2-20 (blank)	0		
3-1 – 3-18	0		
4-1 – 4-15	0		
4-16 (blank)	0		
5-1 – 5-17	0		
5-18 (blank)	0		
6-1 – 6-11	0		
6-12 (blank)	0		
7-1 – 7-15	0		
7-16 (blank)	0		
8-1 – 8-19	0		
8-20 (blank)	0		
9-1 – 9-13	0		
9-14 (blank)	0		
10-1 – 10-12	0		

INTERIM CHANGE SUMMARY

The following changes have been previously incorporated in this manual:

CHANGE NUMBER	REMARKS/PURPOSE

The following interim changes have been incorporated in this Change/Revision:

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

INTRODUCTION

THIS STUDENT BOOKLET IS NOT INTENDED TO REPLACE THE T-44C NATOPS. THE STUDENT BOOKLET MAY BE USED IN CONJUNCTIONS WITH THE T-44C SYSTEMS FAMILIARIZATION COURSE.

NOT INTENDED FOR INFLIGHT USE!

TABLE OF CONTENTS

TABLE OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

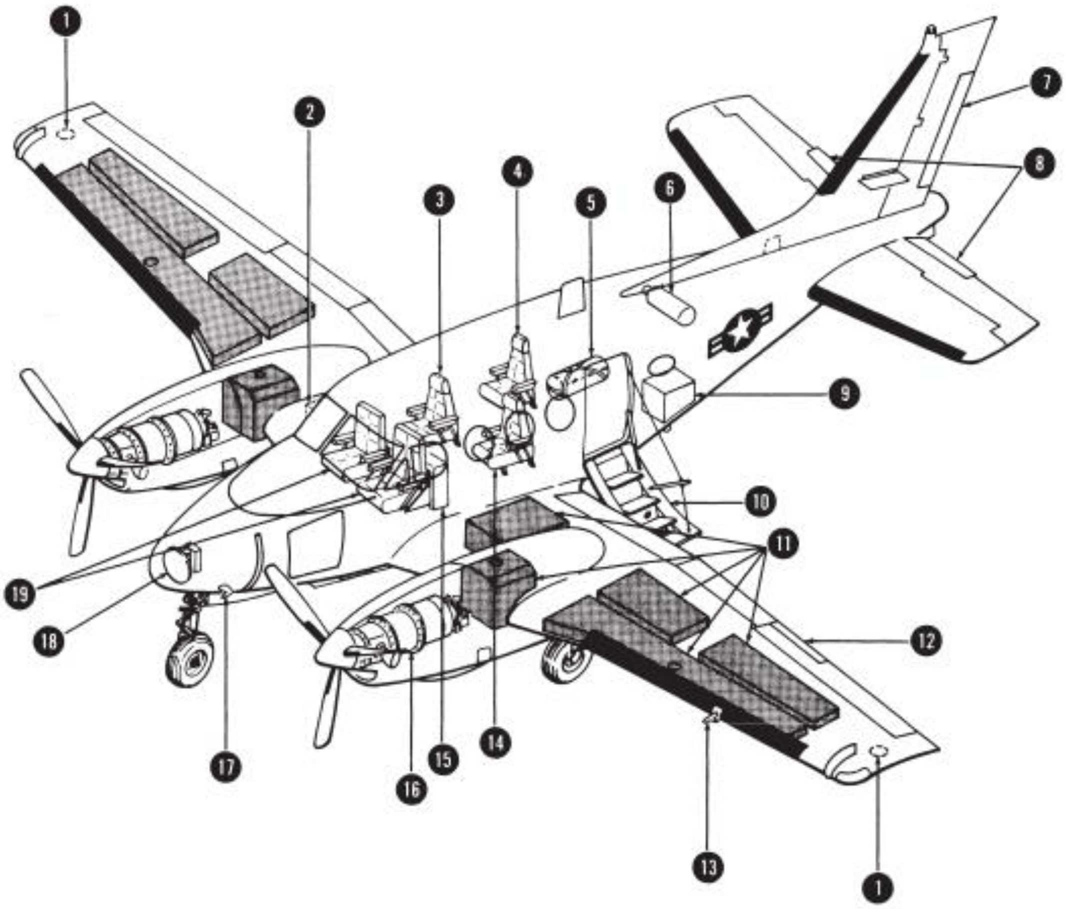
CHAPTER ONE
GENERAL AIRCRAFT

100. OBJECTIVES

At the end of this lesson, you should be able to...

1. State the type and manufacturer of the T-44C aircraft.
2. State the mission of the T-44C aircraft.
3. List the features of the T-44C aircraft.
4. State the dimensions of the T-44C aircraft.
5. State the maximum weight limitations for the T-44C aircraft.
6. State the airspeed limitations for the T-44C aircraft.
7. State the acceleration limitations for the T-44C aircraft.
8. State the altitude limitations for the T-44C aircraft.
9. State the landing limitations for the T-44C aircraft.
10. State the maximum cabin pressure differential.
11. List the prohibited maneuvers for the T-44C aircraft.
12. State the crew limitations for the T-44C aircraft.
13. Describe the personnel equipment provided in the T-44C aircraft.
14. List and describe the rescue equipment aboard the T-44C aircraft.
15. Describe the location and operation of the T-44C hand-held fire extinguishers.
16. Describe the location and removal procedure for the T-44C first-aid kit.
17. Describe the location and operation of the T-44C emergency locator transmitter.
18. Describe how to check that the main cabin door is properly locked.
19. Describe the location and operation of the emergency exit.

NOTES



1. FLUX DETECTORS
2. BATTERY BOX
3. COCKPIT OBSERVERS SEAT
4. PASSENGER SEAT
5. LIFE RAFT
6. OXYGEN SUPPLY CYLINDER
7. RUDDER TRIM TAB
8. ELEVATOR TRIM TABS
9. LAVATORY
10. AIRSTAIR DOOR
11. FUEL SUPPLY TANKS
12. AILERON TRIM TAB (LEFT WING ONLY)
13. AOA TRANSMITTER VANE
14. PASSENGER SEAT
15. STORAGE CABINET AND MAP CASE
16. PT6A-34B ENGINE
17. PILOTS PITOT MAST
18. WEATHER RADAR ANTENNA
19. PILOTS SEATS (2)

T44A-F002

Figure 1-1 General Arrangement

101. T-44C AIRCRAFT DESCRIPTION

Manufacturer

Beech Aircraft Corporation in Wichita, Kansas

Mission

The primary mission of the T-44C is to train student aviators to fly multi-engine turboprop aircraft. The secondary mission of the T-44C is to transport passengers and/or cargo.

Features

Deicing/anti-icing system, instrumentation, and navigation equipment which allow flight under instrument and icing conditions.

Interior seats for instructor pilot, student pilot, student observer and up to two additional passengers. (More than 3 seats can be added but a new Weight and Balance form must be completed.)

Student observer audio control panel allows the student observer to monitor all radio communications.

Non-flushing toilet with privacy curtain and relief tube.

Dimensions

Length = 35 feet 6.0 inches

Height = 14 feet 2.6 inches

Prop to ground clearance = 11.5 inches

Cabin door width = 26.75 inches

Cabin door height = 51.5 inches

Wing span = 50 feet 2.9 inches

Prop arc = 7 feet 9.0 inches

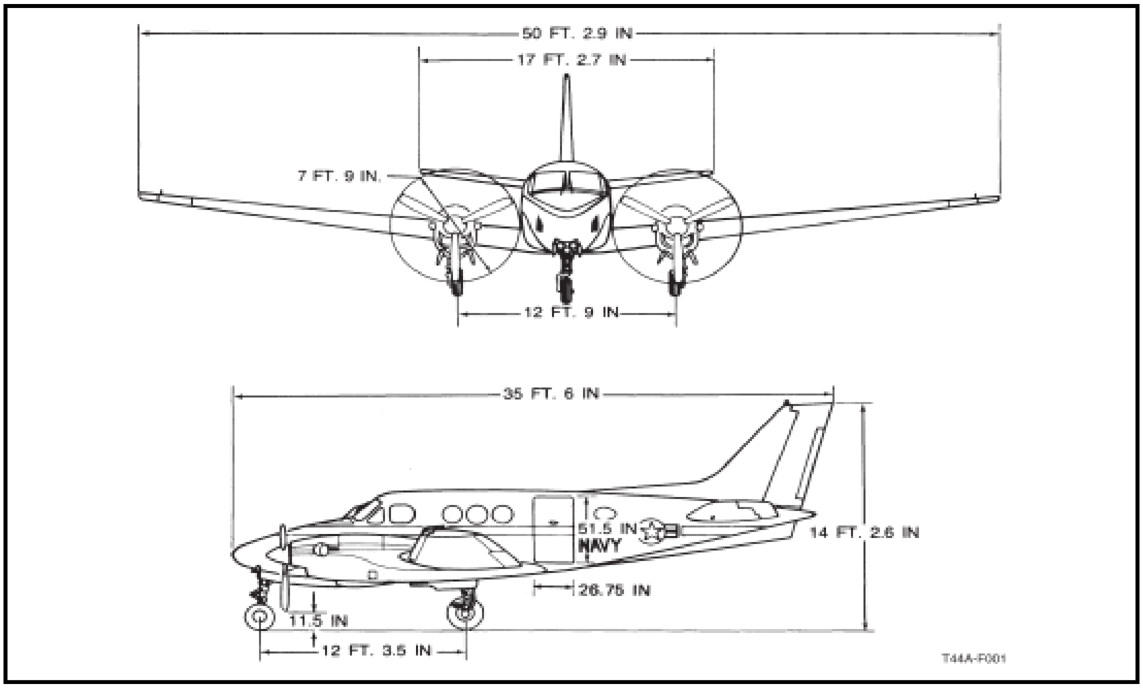


Figure 1-2 Aircraft Dimensions

102. T-44C AIRCRAFT LIMITATIONS

Weight Limitations

Maximum ramp weight: 9710 lbs.

Maximum take-off weight: 9650 lbs.

Maximum landing weight: 9168 lbs.

Airspeed Limitations

Maximum dive/maximum level flight (V_{MO}) = 227 KIAS

Decreasing 4 KIAS per 1000 feet above 15,500 feet MSL

Maneuvering speed (V_A) = 153 KIAS

Maximum gear extension/extended (V_{LE}) = 155 KIAS

Maximum gear retraction speed (V_{LO}) = 145 KIAS

Maximum airspeed for extended flaps (V_{FE}) depends on the flap position

Maximum flaps approach (flaps extended 35%) = 174 KIAS

Maximum full flap (flaps extended 100%) = 140 KIAS

Minimum safe one engine inoperative (V_{SSE}) = 91 KIAS

Minimum controllable airspeed (V_{MCA}) = 86 KIAS

One engine inoperative best rate of climb (V_{YSE}) = 110 KIAS

One engine inoperative best angle of climb (V_{XSE}) = 102 KIAS

Landing Limitations

Flared landings only

Maximum sink rate at ground contact of 600 FPM

Maximum crosswind component of 20 knots

Prohibited Maneuvers

Intentional spins

Aerobatics

103. CREW AND PERSONAL EQUIPMENT

Crew Limitations

Minimum crew for the T-44C is a pilot in command (left seat when not training) and a copilot.

Minimum crew when carrying passengers is an aircraft commander and one of the following: second pilot, instructor under training, pilot under instruction, or student aviator.

Personal Equipment

The NATOPS lists seats and headsets as personal equipment in the T-44C aircraft.

Pilot and Copilot Seats

The pilot and copilot seats are adjustable fore and aft using the inboard handle.

The pilot and copilot seats are vertically adjustable using the outboard handle.

The armrests stow up for easier access to the seats.

Passenger Seats

Up to three passenger seats can be installed in the T-44C without completing a new weight and balance form. More than three passenger seats require a new weight and balance form. These seats are easily removed to make room for additional cargo.

Passenger seats are adjustable fore and aft BY MAINTENANCE PERSONNEL ONLY.

The backs of the passenger seats recline for individual comfort.

WARNING

THE SEATBACKS MUST BE IN THE FULLY UPRIGHT POSITION FOR TAKEOFF AND LANDING.

Headsets

Headsets with boom mikes are provided for the pilot, copilot and observer.

Pilot and copilot phone jacks are located on the respective sides of the instrument panel.

The observer has a phone jack on the right sidewall by the observer audio panel.

Water Survival Equipment

The T-44C has two types of water survival equipment:

1. Life Preservers

2. Life Raft

Pilot and Copilot Life Preservers

One AV-8 life preserver is provided with each pilot and copilot seat. They are stored in the seatback pockets.

Passenger Life Preservers

Passenger life preservers are stored under the passenger seats. The handle on the life preserver is placarded “Life Vest Pull.”

Life Raft

The type II seven man life raft is located on the seat tracks across from the main cabin door. To release the raft press the “T” fitting.

Emergency Equipment

The NATOPS lists three kinds of emergency equipment found on the T-44C.

1. Hand-held Fire Extinguisher

2. First-Aid Kit

3. Emergency Locator Transmitter

Fire Extinguishers

The T-44C has two hand-held fire extinguishers. They contain 2.5 pounds of Halon 1211. One extinguisher is stored beneath the copilot seat. The other extinguisher is stored on the seat riser, just forward of the main cabin door.

First-Aid Kit

The aircraft first-aid kit is stored on the forward side of the partition in the aft cabin.

Emergency Locator Transmitter

The Emergency Locator Transmitter (ELT) in AFC 20 aircraft is located in the lower right rear section of the fuselage, aft of the pressure bulkhead.

The ELT is designed to transmit a beeping tone on the emergency frequencies, 121.5 (VHF) and 243.0 (UHF), whenever the aircraft contacts the ground with a preset force.

A self-contained battery powers the ELT. The ELT will transmit continually for at least 48 hours.

Aircraft with AFC 20 with Change 1 have an instrument panel - mounted switch and the ELT communicates with the COPAS / SARSAT satellite system and the aircraft's GPS.

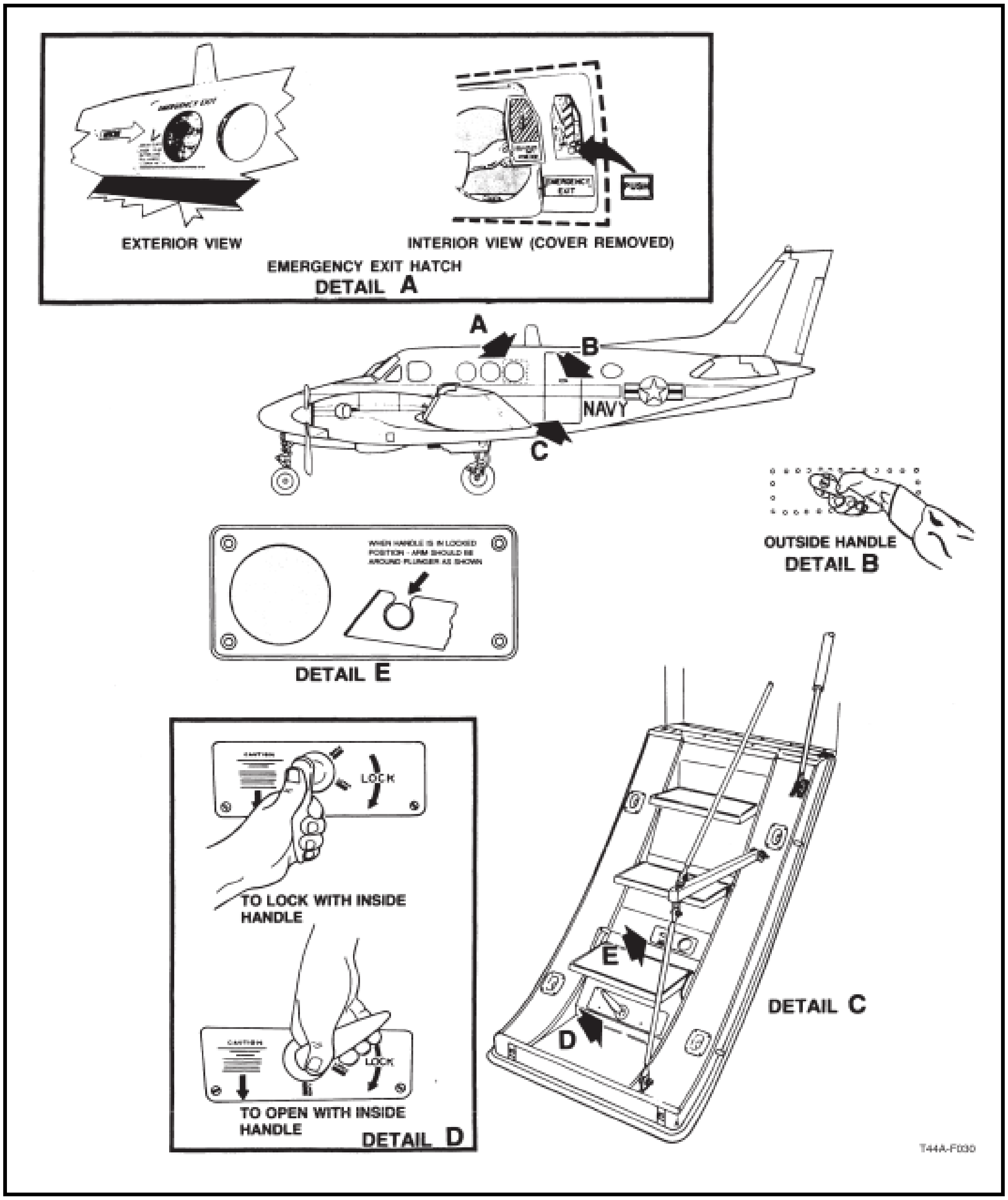


Figure 1-3 Entrance and Exit Procedures

104. AIRCRAFT EXITS

The T-44C has two exits:

1. Main Entrance Door

2. Emergency Exit Hatch

Main Cabin Door

The main cabin door is a swing-down door, hinged at the bottom. This configuration provides positive cabin security when the aircraft is in flight, and it provides a stairway for normal and emergency entrance or exit.

A plastic-encased cable provides a stop support for the door in the open position and an easy pull for closing the door.

An inflatable rubber seal expands to seat the door in flight. Engine bleed air provides the source of pressure to inflate the seal.

When the handle is rotated, two latches hook the door to the frame at the top, and two lock bolts on each side of the door frame lock into the side frame.

When the door is locked, two micro switches are closed and the red CABIN DOOR OPEN light on the annunciator panel in the cockpit is extinguished.

Emergency Exit Hatch

The emergency exit hatch is located at the third cabin window on the right side of the fuselage.

Adjacent to the hatch is a striped access door. Inside the door is a flush-mounted handle that can be pulled to open the hatch.

Instructions for opening the hatch are placarded on the access door.

CAUTION

DO NOT OPEN THE EMERGENCY EXIT HATCH WHILE THE AIRCRAFT IS PRESSURIZED.

GENERAL AIRCRAFT SYSTEMS QUIZ

1. Complete the following statements concerning the landing limitations for the T-44C.

   a. You should make _______________ landings in the T-44C.
   b. The maximum sink rate at ground contact is _______FPM.
   c. The maximum crosswind component is __________knots.

2. The minimum crew for flight is a _________________and a ___________________. The minimum crew when carrying a passenger is an _________________________ and a ____.

3. The prohibited maneuvers in the T-44C are ________________ and _______________.

4. The hand held fire extinguishers contain ______ lbs. of __________________________ and are located ____ and ____.

5. The emergency locator transmitter (ELT) is located on the __________ side of the fuselage aft of the pressure bulkhead. The ELT will transmit continuously for ______ hours on both the UHF guard frequency of _________ Mhz. and the VHF guard frequency of ________ Mhz. The ELT is powered by a ___________ ____________ battery. In aircraft with AFC - 20 with change 1, the ELT also interfaces with the __________ and communicates with the ____________ system.

6. The T-44 aircraft is manufactured by ________________ Aircraft Corporation, located in Wichita, Kansas.

7. The primary mission of the T-44C is to train student aviators to fly ___________ turboprop aircraft.

8. The second student/observer audio control panel has the capability to transmit on the V/UHF radio.

   TRUE FALSE

9. Fill in the following:

   a. Max ramp weight _________
   b. Max altitude _____________
   c. G-limits ________________
   d. Maneuver speed __________
   e. Vmca __________________
   f. Max takeoff weight _________________
   g. Max gear extended speed ____________
   h. Max speed at approach flaps _________
   i. Max speed at full flaps ______________
   j. Decel Gs to lock shoulder harness _____

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER TWO
ELECTRICAL SYSTEM

200. OBJECTIVES

At the end of this lesson, you should be able to...

1. Describe the function and characteristics of the four (4) DC power supplies.

2. Label and describe the functions of DC gauges.

3. Label and describe the function of the DC busses and their components.

4. Describe the function of the inverters.

5. Label and describe the functions of the AC gauges.

6. Label and describe the function of the AC system.

7. Label and describe the function of the annunciator panel and its components.

8. Label and describe the function of the interior lighting controls.

9. Label and describe the function of the exterior lighting controls.

10. Recognize the indications and potential results of a generator malfunction.

11. State the emergency procedure to be used during a single or dual-generator failure.

12. Recognize the indications and potentials results of a current limiter failure.

13. Recognize the indications and potential results of an inverter malfunction.

14. State which circuit breakers are essential and may be reset and which circuit breakers must never be reset.

NOTES

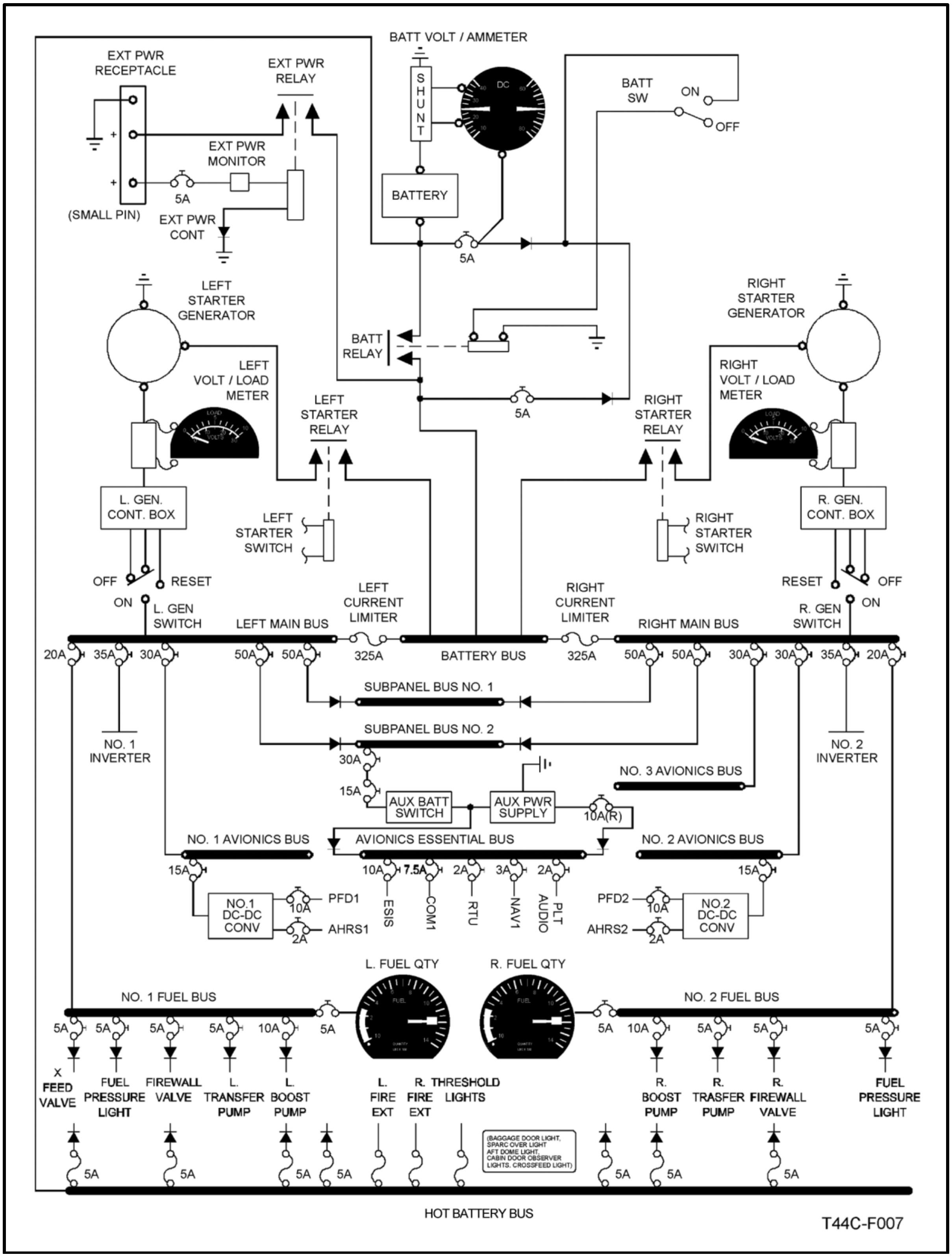


Figure 2-1 DC Electrical System

201. DC ELECTRICAL SYSTEM

DC Generators

The DC Electrical System supplies the basic power for the T-44C. DC power energizes most of the aircraft's circuits.

The four sources of DC power are:

1. 24-volt, 42 amp hour lead acid battery

2. 250 ampere starter-generator (left)

3. 250 ampere starter-generator (right)

4. 24-volt, 5 amp hour auxiliary battery

One starter-generator is mounted on the accessories section of each engine.

Each generator provides 28 Vdc and has a rated output of 250 amps.

Generator Control Switches

On the Control Pedestal, there are two (2) generator control switches, GEN NO. 1 and GEN NO. 2.

These are three position switches: ON, OFF and RESET.

To bring a generator on line, set the appropriate switch to OFF, RESET momentarily, then ON.

To take a generator off-line, set the appropriate switch to OFF.

Engine Start Switches

The IGN & ENG START switches are on the control pedestal. When activated, the Left and Right Starter switches will de-energize the respective generator.

The starters are limited to an operating period of 40 seconds on, 60 seconds off for two cycles. Then, 40 seconds on, 30 minutes off following the third attempt.

Generator Control Boxes

Each generator has a generator control box located under the cabin floor just aft of the main wing spar in the center aisle.

Each control box provides:

1. Voltage regulation at 28.25 +/- 0.8 Vdc

2. Automatic paralleling

3. Overvoltage protection at 31 Vdc

4. Undervoltage protection at 18 Vdc

5. Reverse current protection

Generator Loadmeters

The generator output is displayed on the left or right generator voltmeters. These meters are located on the pilots subpanel.

The current load is measured as a percentage of total output. Thus, 1.0 on the meter equals a 100% load (or 250 amps).

Generally the load should indicate 0.3 to 0.6.

Spring loaded pushbuttons below the generator voltmeters allow bus voltage to be displayed when manually depressed.

Normal bus voltage will be 28.25 +/- 0.8 volts.

Generator Warning Lights

There are two lights LH GEN OUT or RH GEN OUT on the annunciator panel. These lights will illuminate when the respective generator is offline. A FAULT WARN light will flash with the illumination of either LH GEN OUT or RH GEN OUT light.

Battery

The battery is a 24 volt lead acid battery mounted in the right wing root and is controlled by a switch located on the control pedestal.

The battery can supply power to all the DC powered equipment.

The three (3) functions of the battery are to:

1. Provide emergency power.

2. Provide power to start the engines.

3. Act as a damper by absorbing power surges.

Auxiliary Battery

The 24 volt, 5 amp-hour auxiliary battery (aux battery) is located in the avionics bay and is capable of powering the Avionics Essential Bus for 30 minutes with a loss of both generators and the main battery.

On interior preflight, press the AUX BATT switch to test for 5 seconds and the AUX TEST light should remain illuminated throughout the test. The aux battery can also be tested on the exterior preflight, by pressing the test button located on the aux battery in the avionics bay.

DC External Power

External DC power can be applied by an auxiliary power unit (APU) to the aircraft through an external power receptacle in the right-engine nacelle. The APU must NOT exceed 28 volts DC and must be capable of delivering a continuous load of 300 amperes and surge loads up to 1,000 amperes for 0.1 second, if required.

1. 22 volts are required for a battery start.
2. 20 volts are required for an APU start.
3. 18 volts are required to allow the APU to charge the battery.
4. If voltage is below 18, the battery must be replaced.

DC Busses

There are a total of fifteen (15) DC buses, they are:

1. Battery Bus
2. Subpanel Bus No. 1
3. Subpanel Bus No. 2
4. Left Main Bus
5. Right Main Bus
6. No. 1 Avionics Bus
7. No. 2 Avionics Bus
8. No. 3 Avionics Bus

9. Avionics Essential Bus

10. No. 1 Fuel Bus

11. No. 2 Fuel Bus

12. Hot Battery Bus (Battery Emergency Bus)

13. PLT 5V Lighting Bus

14. CPT 5V Lighting Bus

15. PED 5V Lighting Bus

Hot Battery Bus

Items powered exclusively by the Hot Battery Bus are considered singularly powered. These items are:

1. LH and RH fire extinguishers

2. Baggage door light

3. Threshold light

4. Spar cover light

5. Aft dome light

6. Cabin door observer light

Dual Powered Items

Items powered by the Hot Battery Bus and their respective fuel bus are considered dual powered. These items include:

1. LH and RH boost bumps

2. LH and RH firewall shut-off valves

3. Crossfeed valve and crossfeed annunciator light

Current Limiters

The Current Limiters are sometimes called “bus ties.” They connect the Left and Right Main Busses to the Battery Bus.

Should one of the generators malfunction, the Current Limiters allow the busses to receive power from the remaining generator.

Another important function of the Current Limiters is to isolate a major short from the rest of the system.

Each current limiter is rated as a 325 amp slow-blow fuse.

202. AC ELECTRICAL SYSTEM

Inverters

Aircraft Incorporating AFC 20 with Change 1

AC electrical power is supplied by two 400 volt-ampere, single-phase inverters. These inverters convert 28Vdc power to 26Vac power for the torquemeters.

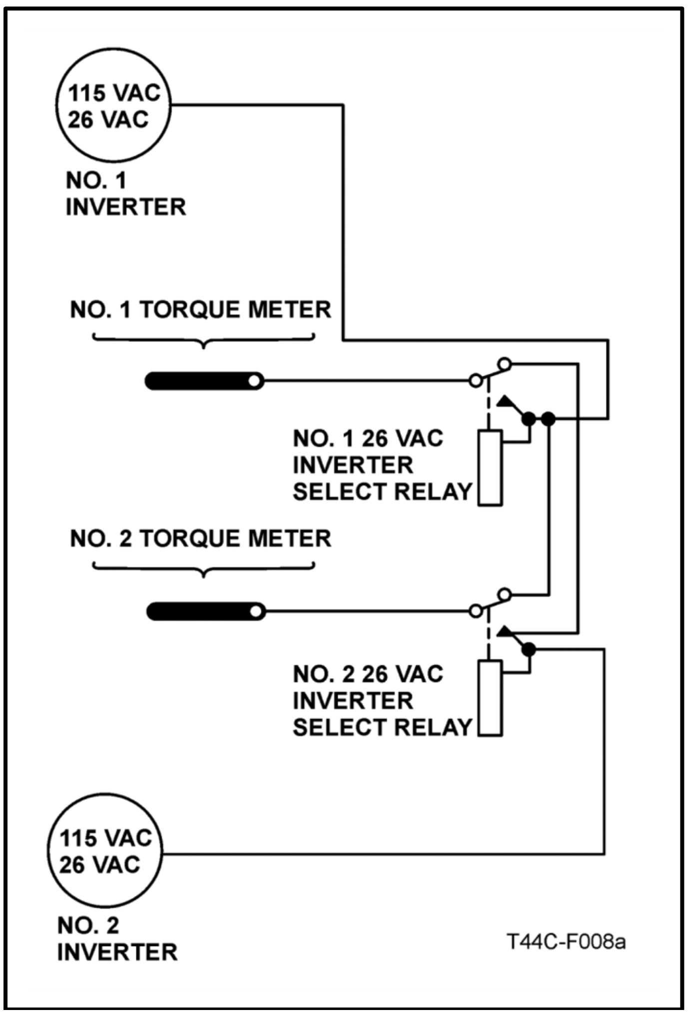


Figure 2-2 AC Electrical System (Aircraft incorporating AFC 20 with Change 1)

Inverter Select Relays

When both inverters are functioning, the No. 1 Inverter supplies the AC Bus No. 1 and the No. 2 Inverter supplies the AC Bus No. 2.

However, if a total or partial inverter failure occurs, the Inverter Select Relays adjust the electrical flow so that both AC busses and both torquemeters are energized by the opposite inverter.

AC Bus Meters

Aircraft having AFC-20 with Change 1 do not have AC bus meters.

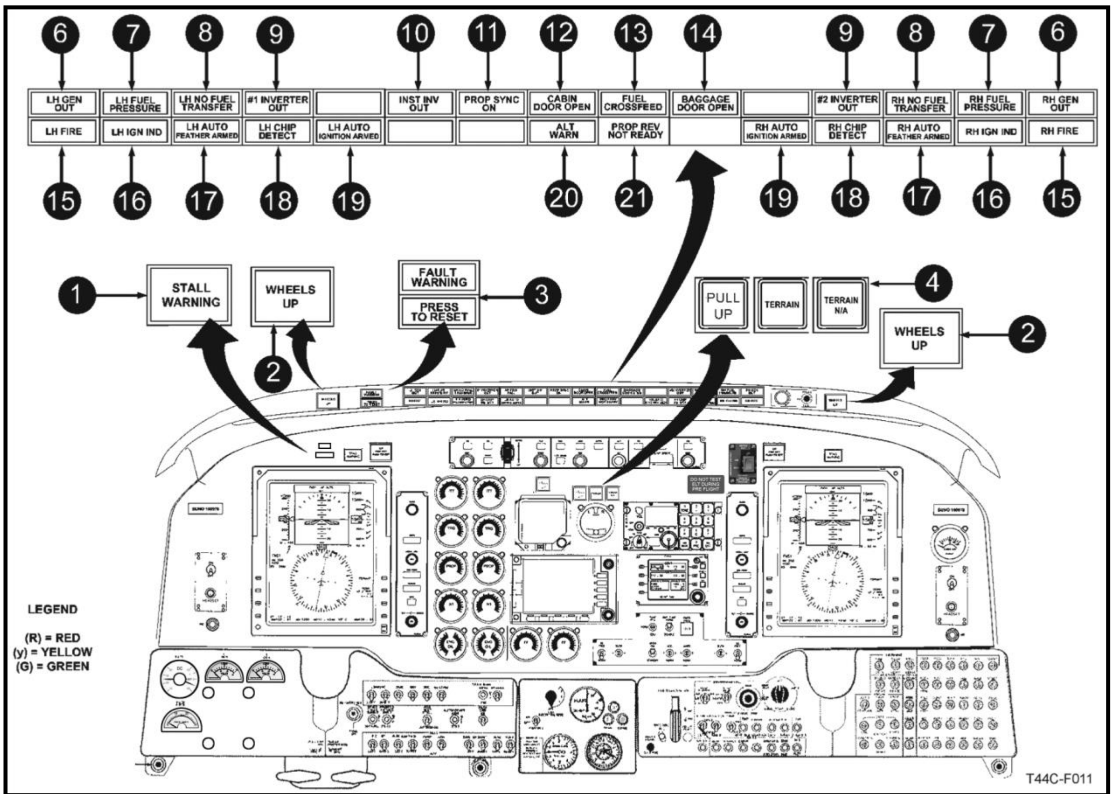


Figure 2-3 Caution/Annunciator Lights

203. LIGHTING SYSTEMS

Annunciator Panel

The annunciator panel is mounted across the top of the instrument panel and provides a visual monitor for all the critical functions of the aircraft and indicates conditions for which corrective action must be taken.

The lights are color coded as follows:

Red = critical fault lights (warning), ***Yellow*** = cautionary lights, ***Green*** = advisory lights
The FAULT WARN light flashes for all critical faults. The FAULT WARN may be reset by pressing it. Resetting the FAULT WARN does not also cancel the critical annunciator.

When the FAULT WARN illuminates, the annunciator defaults to maximum brightness. When the FAULT WARN light is reset, all lights will dim to the previous level set by the dim control. The annunciator lights Press-to-Test switch tests all the annunciator panel lights as well as the "Terrain," "Pull up," "Terrain N/A," EMER 121.5 lights and will also cause the fault warning light to flash.

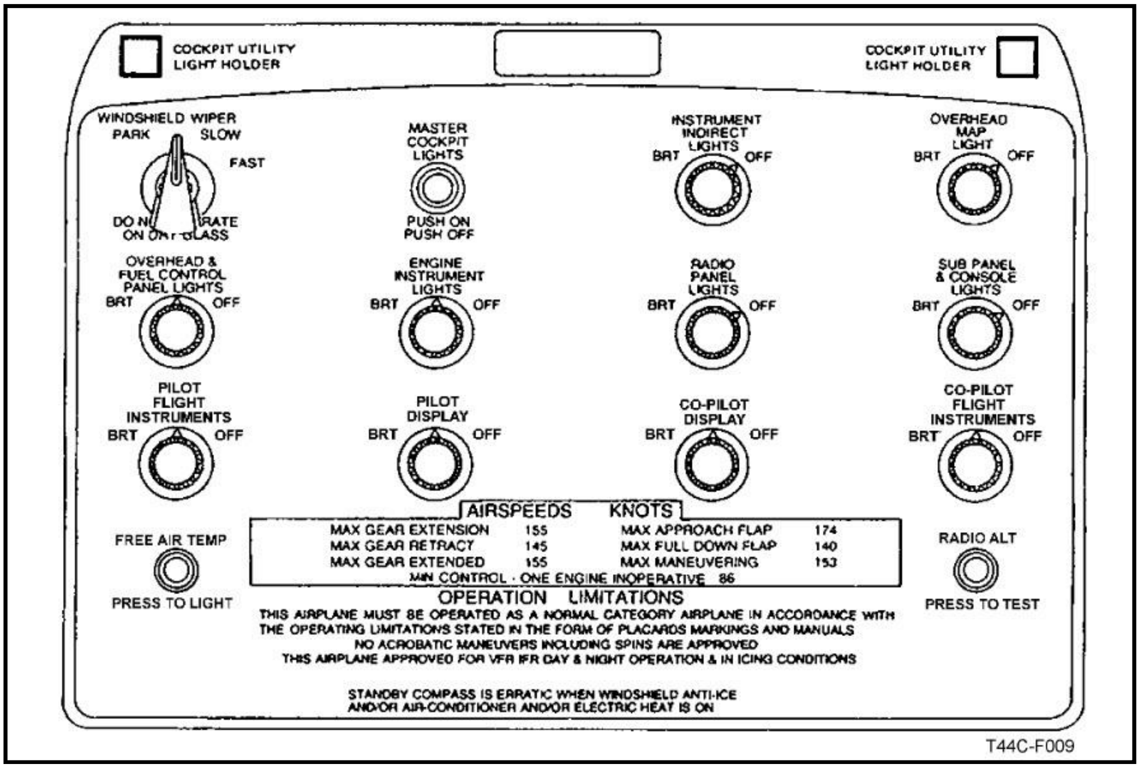


Figure 2-4 Overhead Control Panel

Interior Lights

The aircraft interior lights are controlled by either rheostats or press-to-light switches located on the Overhead Control Panel.

The Master Cockpit Lights switch controls ON/OFF for all of the interior lights except:

1. Indirect instrument lighting

2. Cockpit utility lights

3. Cabin reading lights

4. Threshold/Spar Cover lights

5. Cabin door locking mechanism observation light.

6. Fasten Seatbelt/ No Smoking sign

7. Aft compartment lights

8. Pilot & Copilot Display (PFDs) intensity

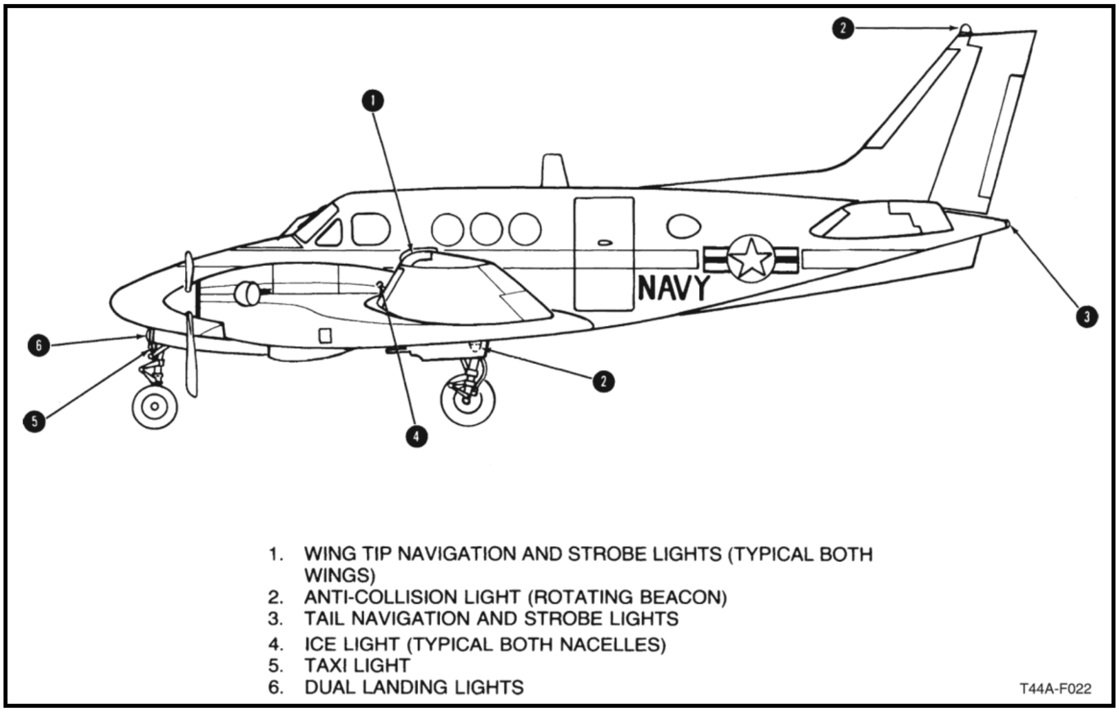


Figure 2-5 Exterior Lighting

Exterior Lights

All exterior lights are controlled by a series of ON/OFF circuit breaker switches located on the pilot's right subpanel.

1. Navigation Lights

2. Strobe Lights

3. Anti-collision Lights

4. Ice Lights

5. Taxi Lights

6. Landing Lights

In the event the landing and taxi lights are inadvertently left on, they will automatically be switched off when the landing gear is retracted. This automatic function is intended as a backup system to prevent heat damage.

204. ABNORMAL CONDITIONS

Generator Malfunctions

The first indication you will have that the left or right generator has malfunctioned is the illumination of a LH GEN OUT or RH GEN OUT with a flashing FAULT WARN.

Single Generator Failure

In the event of a single generator failure, you will turn the generator off and attempt a reset. If unsuccessful, you will turn the generator off and perform a current limiter check (remembering that the airborne current limiter check is different from the on-deck check).

NOTE

> Normal voltage in the RESET position indicates a failure of the generator control rather than the generator.

Dual Generator Failure

If both GEN OUT lights turn on, then you may have a dual generator failure and, if neither generator will reset, the aircraft is operating on battery power exclusively.

Refer to the NATOPS and ensure AUX BATT is in the on/armed position. Consideration should be given to reducing the load on the battery.

The main battery will provide power for approximately 42 amp hours, which could be as few as 10 minutes unless loads are reduced.

Current Limiter Failure

If the LH or RH fuel quantity gauge on your fuel management panel indicates zero, with both generators off and battery on, then the respective current limiter is bad. This failure assumes the Fuel bus circuit breakers (20A) and the fuel quantity circuit breakers (5A) are set, the fuel gauges are operative, and the aircraft is fueled.

With both generators online, a current limiter failure may be indicated by a loadmeter split of 0.1 or greater. (Normal heat and air-conditioning obtains power from the left main bus.) The higher load would typically be higher on the left main bus, assuming the air conditioning or the electric heater is operating.

Dual Current Limiter Failure

All equipment will still be powered with both current limiters failed, as long as the respective generators are functioning normally. A split in the loadmeters may occur depending on what equipment is operating. The main battery is not being charged and the battery voltmeter will read 24V (the battery voltmeter reads 28V when the battery is charging).

Generator Failure with Opposite Side Current Limiter Failure

No equipment is lost initially, but the battery is being discharged. It may be necessary to secure the battery switch to conserve battery power. Consult NATOPS for specific procedures.

Generator Failure with Same Side Current Limiter Failure

The buses and equipment associated with the failed side are inoperative and will remain so. The battery is not being discharged. Monitor the operating generator electrical load. A same side current limiter failure results in the loss an inverter and respective main, fuel and avionics busses.

Inverter Malfunction

An inverter failure is indicated by a FAULT WARN accompanied by either the #1 INVERTER OUT or #2 INVERTER OUT annunciator.

When an inverter fails:

1. Turn the failed inverter OFF

2. Check that the AC Bus has switched over (in aircraft with AFC 20 with change 1 this is done by noting both torquemeters are working).

Only one inverter is required to power both torquemeters.

The INST INV OUT annunciator light indicates loss of all 26Vac and should only illuminate when both inverters are lost.

Circuit Breakers

A blown circuit breaker may indicate a short.

If an essential circuit breaker blows during flight, the circuit breaker may be reset once.

Do ***NOT*** reset these circuit breakers:

1. Subpanel Feeder Circuit Breakers (labeled Feeder Bus Circuit Breakers in the aircraft)
2. Non-essential Circuit Breakers

ELECTRICAL SYSTEM QUIZ

1. In the T-44C, DC power is produced by two engine-driven 28-Vdc __________-amp starter-generators.

2. To obtain generator voltage readings you need to depress the spring-loaded switch on the Load Meter.

TRUE FALSE

3. The T-44C main aircraft battery is rated at ____ and ____.

a. 28 volts and 38 amp hours
b. 24 volts and 42 amp hours
c. 28 volts and 34 amp hours
d. 34 volts and 24 amp hours
e. 34 volts and 28 amp hours

4. Which of the following is NOT provided by the generator control panel?

a. Overvoltage protection
b. Reverse current protection
c. Current limiting
d. Automatic paralleling

5. A loadmeter reading of 0.4 would indicate an output current of _________________.

a. 40 amps
b. 100 amps
c. 28 amps
d. 42 amps

6. During an interior preflight you notice that the battery voltage reads 20 volts. What is your best course of action?

a. Notify maintenance to replace the battery
b. Notify maintenance to bring an APU to charge the battery
c. Notify maintenance to bring an APU to assist with starting the engines
d. No action is required for a normal engine start

7. While flying on a night mission a LH GEN OUT light illuminates full bright and the FAULT WARN light starts flashing. In order to dim the LH GEN OUT light, you should first ____.

8. The external power can be applied through a receptacle in the _______ wing just outboard of the nacelle.

9. Which of the following DC busses are always powered if the battery is connected?

a. Left Main Bus
b. Right Main Bus
c. Battery Bus
d. Hot Battery Bus
e. Subpanel Bus No. 1

10. Which of these items on the Hot Battery Bus are NOT dual powered?

a. Crossfeed Valve
b. RH Firewall Valve
c. RH Fire Extinguisher
d. RH Boost Pump
e. LH Firewall Valve

11. The FAULT WARN light will flash _______.

a. Only when a green annunciator light illuminates
b. Only when a yellow annunciator light illuminates
c. Only when a red annunciator light illuminates
d. Only when a yellow or red annunciator light illuminates
e. When any annunciator light illuminates

12. Which of the following interior lights would extinguish if the MASTER COCKPIT LIGHTS switch was set to the OFF position?

a. Radio Panel Lights
b. Threshold Lights
c. Indirect Instrument Lights
d. Pilot and Copilot Display (PFDs)
e. Cabin Reading Light

13. Which of the following exterior lights are NOT installed on the T-44C?

a. Anti-Collision Lights
b. Strobe Lights
c. Landing Lights
d. Running Lights
e. Navigation Lights

14. If the AVIONICS MASTER switch fails, pulling the MASTER POWER circuit breaker will bypass the switch energizing the avionics busses.

TRUE FALSE

15. The T-44C Auxiliary Battery is rated at ____________ & _____________.

    a. 28V, 24 amp-hours
    b. 24V, 24 amp-hours
    c. 24V, 5 amp-hours
    d. 24V, 42 amp-hours
    e. 28V, 5 amp-hours

16. List the items available on the Avionics Essential Bus.

    _______________, ___________________, __________________, ______________, & _______________.

17. A blown current limiter would _____________.

    a. Prevent the two generators from operating in parallel
    b. Illuminate a CURR LMTR OUT light
    c. Cause a loss of the main bus on that side
    d. Prevent the starter on that side from operating

18. Given a LH GEN OUT light illuminated and a normal generator voltage is displayed while holding the generator switch in the RESET position, a __________ failure is indicated.

    a. Generator
    b. Generator Control
    c. Battery
    d. Current Limiter

19. List the functions of the battery.

    ____
    ____
    ____

20. List the functions of the generator control panel.

    ____
    ____
    ____
    ____
    ____

21. Following a generator failure, you notice a slight charge (5 amps) on the battery volt/ammeter and no other equipment failures are noted. This indicates ____________.

a. Both current limiters are failed
b. Both current limiters are intact
c. The current limiter opposite the failed generator is blown
d. The current limiter on the failed generator side is blown

22. Given a left generator load of 0.8, a right generator load of 0.4, and the air conditioning in AUTO, which statement is most correct?

a. Abnormal generator paralleling exists
b. One of the current limiters has failed
c. This is a normal indication
d. Either A or B is possible

23. A generator has failed and will not reset. No other failures are noted. You notice that the battery volt/ammeter is showing a slight (5 amp) charge. What is the status of the current limiters? ____

What is powering the boost pumps? ____

24. A generator has failed and will not reset. No other failures are noted. You notice that the battery volt/ammeter is showing a discharge. What is the status of the current limiters?

____

What is powering the boost pumps? ____

25. The battery is located in the __________ __________ center section and is accessible through a panel on the top of the wing.

26. The right generator is turned on after starting the right engine to charge the battery. Why is it secured prior to starting the left engine? ____________________________________

____

The right generator is turned on again during the start of the left engine and then off again after the left engine start is complete. Why?

____

27. What is the minimum battery voltage for a battery start of the right engine?

____

For an APU start? ____. For APU charging? ___.

28. Subpanel feeder circuit breakers should never be reset in flight.

    TRUE FALSE

29. Essential circuit breakers may be reset a maximum of __________ time(s) in flight.

30. List the items powered by both the fuel bus and the hot battery bus.

31. List the items that would work following a failure of both generators and the main battery.

THIS PAGE INTENTIONALL LEFT BLANK

CHAPTER THREE
POWER PLANT AND RELATED SYSTEMS

300. OBJECTIVES

At the end of this lesson, you should be able to...

1. State the PT6A-34B engine characteristics.

2. Label and describe the function of the reduction gear box and its components.

3. State any limitations for the reduction gear box and its components.

4. Label and describe the function of the combustion chamber and its components.

5. Label and describe the function of the compressor and its components.

6. Label the fuel control system.

7. Label and describe the function of the fuel drain collector system and its components.

8. Label and describe the functions of the engine instruments.

9. Label and describe the function of the starter system and its components.

10. Label and describe the function of the autoignition system and its components.

11. State any limitations for the engine starter system and its components.

12. Label and describe the operation of the power levers.

13. Label and describe the operation of the condition levers.

14. Label and describe the function of the oil system and its components.

15. Label and describe the operation of the components of the fire detection and extinguishing system.

NOTES

301. ENGINES

At the end of this topic you should be able to describe the characteristics of the PT6A-34B engines. You should be able to describe the location and function of the compressor, combustion chamber, turbine section, reduction gear box, fuel control system, and fuel drain collector system.

302. ENGINE OPERATION

The T-44C has two (2) Pratt and Whitney PT6A-34B turboprop engines. Each is rated at 550 shp (shaft horsepower). The PT6A-34B engine is a reverse flow, free turbine type engine, employing a three stage axial and a single stage centrifugal compressor.

Flow through the Engine

Air enters through the cowling air intake.

Passes the ice vanes which, when extended, prevent supercooled water droplets and snow from collecting on the engine screen.

Flows through a plenum chamber around the engine compressor section, through the screen into the engine.

Directed to the 3-stage axial compressor.

Then directed to the centrifugal compressor. A compressor progressive bleed valve, in the bottom of the compressor section, progressively opens as power is reduced below 75% N1 in order to bleed air out of the compressor section into the engine compartment to prevent compressor stall at low N1 RPM.

Forced through diffuser vanes.

Turned 90 degrees into the combustion chamber.

Once in the combustion chamber, the air is mixed with fuel and ignited by igniter plugs that operate during engine start or during autoignition. After start, combustion continues as long as the fuel-to-air ratio is correct.

Expanding, the burning gases are reversed through nozzle guide vanes.

Through compressor turbine blades to drive the axial and centrifugal compressors.

Then through power turbine blades to drive the reduction gearbox.

Expelled as exhaust.

Compressor

The compressor section is comprised of a 3-stage axial compressor and a single stage centrifugal compressor. The compression ratio is 7:1.

N1, or gas generator, compresses the air and drives the accessories section.

When the N1 gauge reads 100%, the gas generator/compressor speed is 37,500 rpm.

When the N1 gauge reads 101.5%, the gas generator/compressor speed is 38,000 rpm.

Combustion Chamber

The combustion chamber is located forward of the compressor section.

In the combustion section, high pressure air is mixed with fuel to form a combustible gas. Approximately 25% of the intake air is mixed with fuel and burned.

It is comprised of a circular chamber with 14 fuel nozzles (10 primary and 4 secondary) and 2 igniter plugs. The 14 fuel nozzles provide a symmetrical fuel spray pattern for efficient combustion.

Turbine Section

The turbine section is located forward of the combustion section. The two turbines (N1, N2) are driven by the exhaust gasses from the combustion chamber.

The compressor turbine drives the compressors and accessories case.

The power turbine drives the reduction gear box which in turn drives the prop governors through their spline gears. The compressor and power turbines are independent of each other.

They are NOT physically connected together.

303. REDUCTION GEAR BOX

The reduction gear box is located forward of the turbine section and is directly connected to the power turbine. It is comprised of a two stage planetary reduction gearbox system.

The reduction gear box provides a 15:1 reduction ratio from the power turbine to the propeller.

When the power turbine is turning at 33,000 rpm, the reduction gear box reduces this to a propeller speed of 2200 rpm.

When the power turbine is turning at 28,500 rpm, the reduction gearbox reduces this to a propeller speed of 1900 rpm

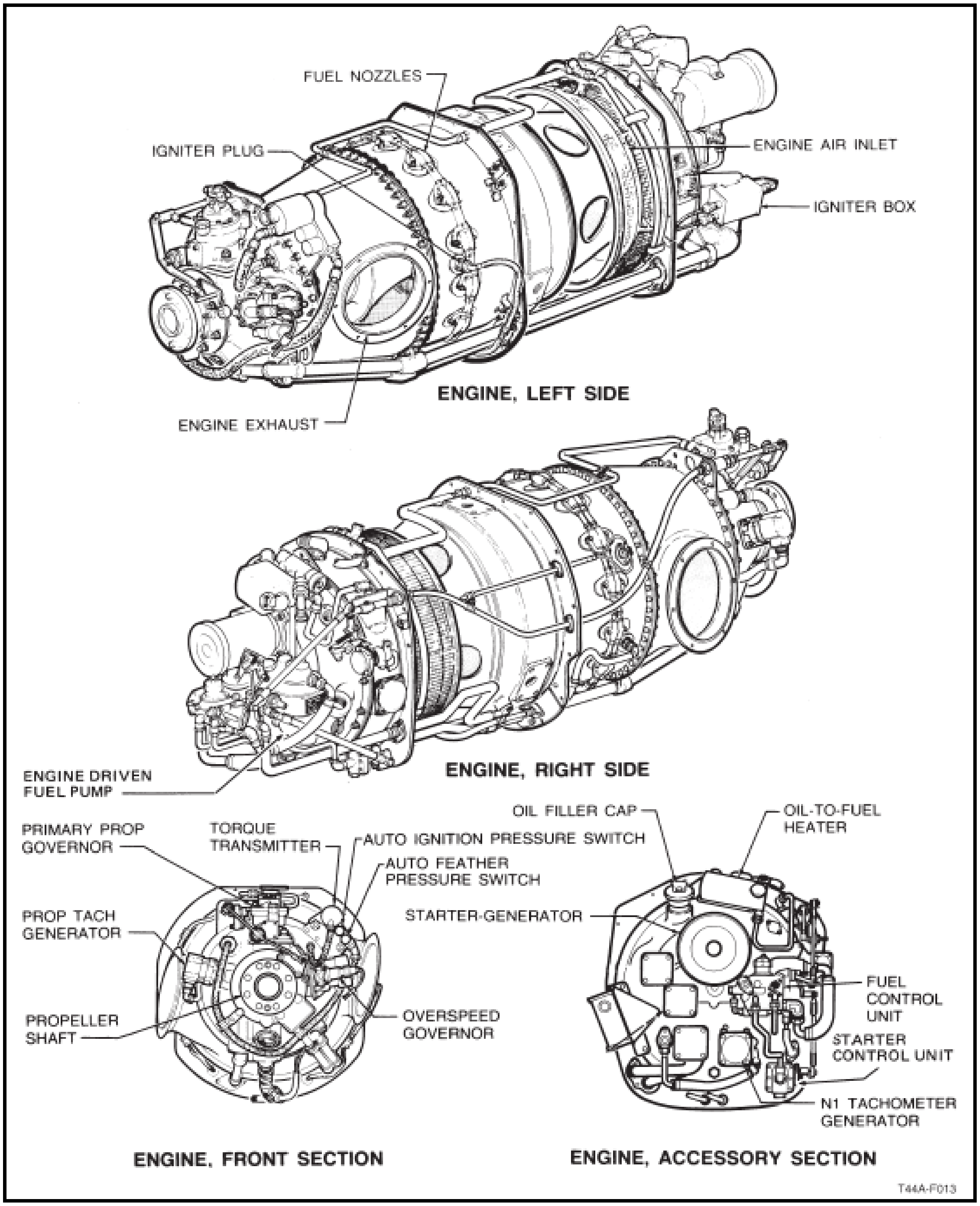


Figure 3-1 PT6A-34B Engine

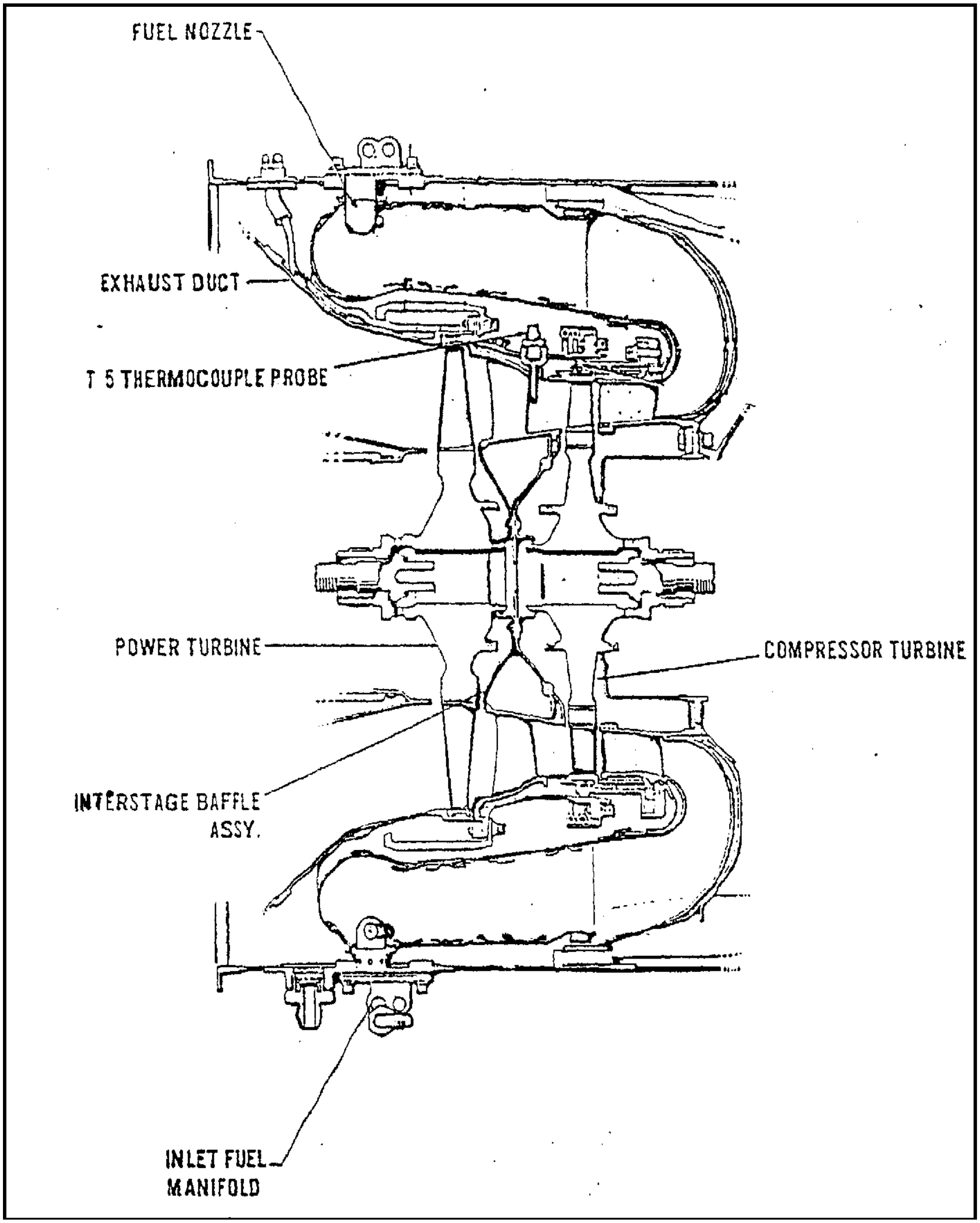


Figure 3-2 Compressor and Power Turbine – Cross Section

304. ENGINE FUEL COMPONENTS

Most of the fuel system components are located in the accessory section of the engine and is composed of the engine driven fuel pump, fuel control unit, start control unit, fuel nozzles, oil to fuel heater, and fuel drain collector system.

Engine-Driven Fuel Pump

The engine-driven fuel pump is mounted on the accessory section of the engine. This pump operates anytime the compressor is turning. This pump is required for engine operation and a failure results in a flameout.

Fuel Control Unit

The fuel control unit is located in the accessory section of the engine. Using engine inlet temperatures and relative position of the power levers, it computes and meters the proper fuel flow to the engine. Adjusting the fuel flow allows the control unit to adjust the compressor (N1) speed which in turn controls the amount of power produced by the engine.

Start Control Unit

The start control unit is a mechanical fuel control valve operated by the condition levers. As the levers move out of the FUEL CUTOFF position, the valve opens allowing fuel to enter the primary fuel manifold. When the levers are in the FUEL CUTOFF position, the valve closes cutting off fuel to the fuel manifold. A diagonal rod from this unit to the FCU allows for idle RPM adjustment using the condition levers (see Fig. 3-3).

Fuel Spray Nozzles

Fourteen (14) fuel spray nozzles are located in the combustion chamber. They provide a symmetrical fuel spray pattern for efficient combustion.

Oil to Fuel Heater

The oil-to-fuel heater is located on the top of the accessory section and uses heat from engine oil to preheat the engine fuel.

A fuel temperature sensing bypass valve allows oil to flow into the heater core when the fuel temperature is low. When fuel temperature increases to 70° F the valve begins to close and restricts the amount of oil entering the core. At 90° F the valve closes completely and the oil bypasses the heater core.

305. FUEL DRAIN COLLECTOR SYSTEM

The fuel collector system is also located in the accessories section and is composed of a tank and a pump.

Fuel Collector Tank

The fuel collector tank collects residual fuel from the flow divider. The tank is located below the engine accessory section.

Fuel Drain Collector Pump

The pump automatically transfers residual fuel back to the nacelle tank. The fuel drain collector pump is powered by the No. 1 or No. 2 Subpanel Feeder Buses.

306. PURGE VALVE

The purge valve is a solenoid valve in the fuel return line along the right side of each nacelle.

The purge valve allows fuel vapor and excess residual fuel to be purged from the fuel control and high-pressure engine driven fuel pump through a small valve opening to prevent premature starts. This purged vapor/fuel is directed to the nacelle fuel tank.

The purge valve is electronically connected to the ignition system and is open when the igniters are operated, either during engine start via the start and ignition switch or through the auto-ignition system. The purge valve is spring loaded closed when the igniters are not in use.

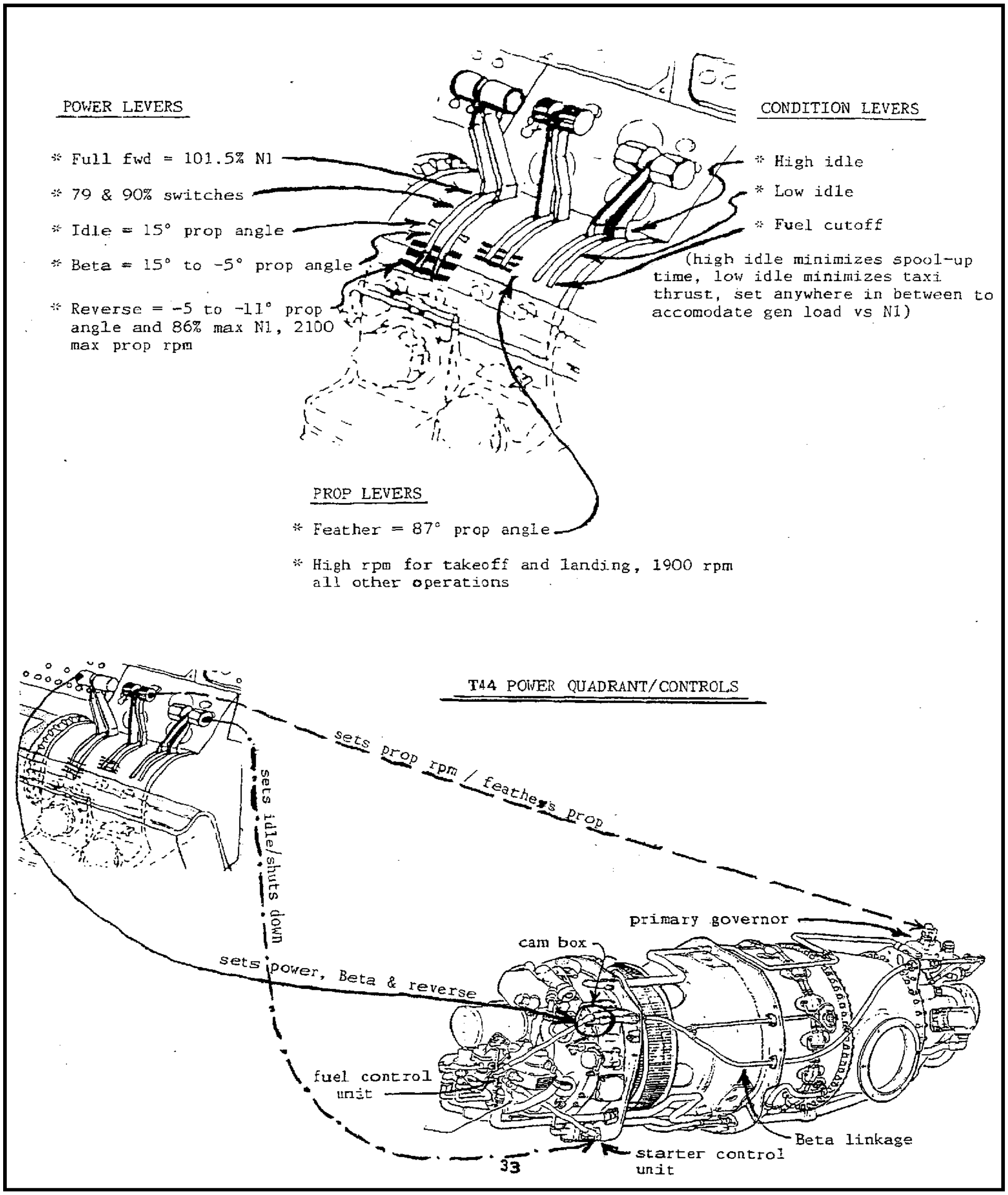


Figure 3-3 Power Quadrant Controls

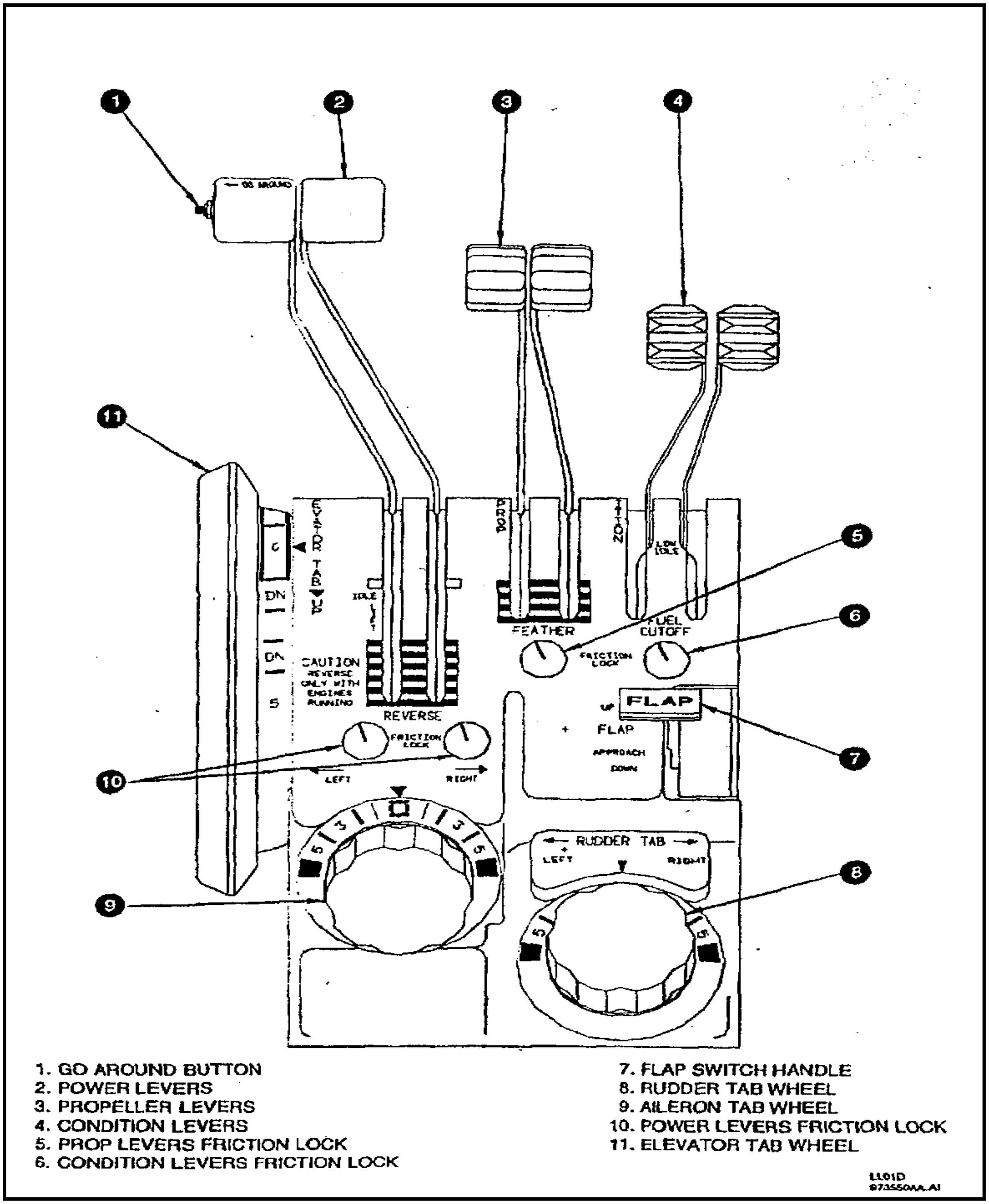


Figure 3-4 Control Pedestal

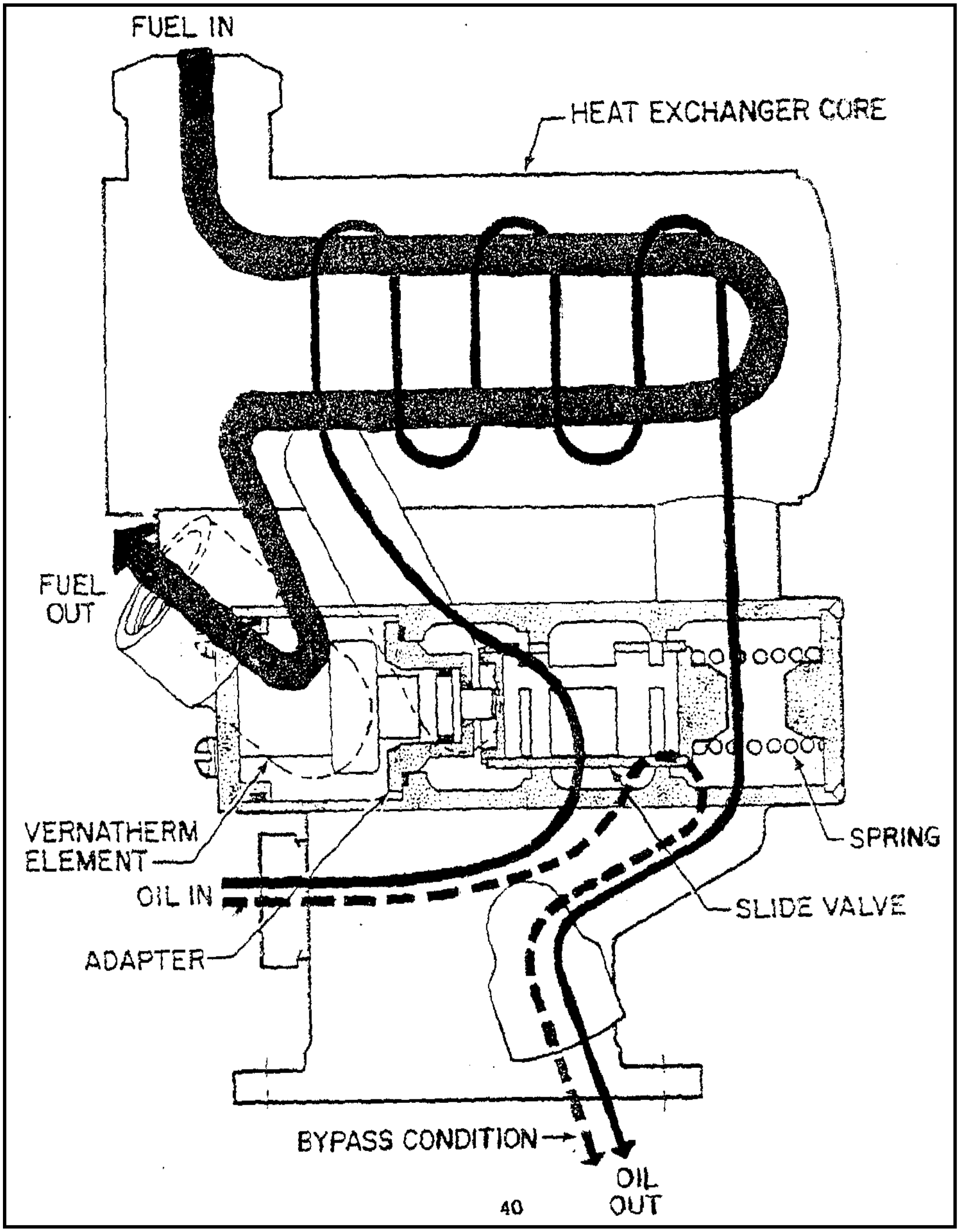


Figure 3-5 Oil-to-Fuel Heater

OPERATING CONDITION	OPERATING LIMITS: MAX TIME	★TORQUE FT LB (9): RPM 2,200	RPM 1,900	★MAX OBSERVED ITT	(5) N_1%	• N_2 RPM (PROP)	(3) OIL PRESS PSI	OIL TEMP °C
MAX. ALLOWABLE	5 MINUTES	1,315		790	101.5	2,200	85 - 100	10 - 99
MAX. CONTINUOUS (8)	CONTINUOUS	1,315	1,520	790	101.5	2,200	85 - 100	10 - 99
CRUISE CLIMB	CONTINUOUS	1,315	1,520	765	101.5	2,200	85 - 100	10 - 99
CRUISE	CONTINUOUS	1,315	1,520	740	101.5	2,200	85 - 100	10 - 99
HI-IDLE (1)	CONTINUOUS	---	---	---	---	---	---	-40 - 99
LO-IDLE (2)	CONTINUOUS	---	---	685 (6)	---	--- (10)	40 (MIN)	-40 - 99
STARTING	40 SECONDS	---	---	1,090 (4)	---	---	Indication	-40 (MIN)
ACCELERATION (7)	2 SECONDS	2,100		850	102.6	2,420	---	10 - 99
MAX. REVERSE	1 MINUTE	---	---	790	86	2,100	85 - 100	10 - 99

Engine torque and ITT limits are determined by ambient temperature. During operations requiring maximum engine performance, be aware o whether torque, or ITT limits govern. Remember, cold temperature or low altitude - torque limited, hot temperature or high altitude is ITT limited.

★ Each column is a separate limitation. The stated limits do not necessarily occur simultaneously.

• The limit values within the N_2 RPM (PROP) column are not propeller limitations.
These values specify propeller RPMs which correspond to stress limits of the engine power section.

(1) N_1 70-73%.

(2) N_1 51-54%. Ground operations above 3,500-foot pressure altitude (PA) may produce idle speeds as high as 83-percent N1 with condition levers at low idle.

(3) Normal oil pressure is 85-100 PSIG at power settings above 27,000 RPM (72%) N_1, oil pressure below 85 PSIG is undesirable, and may be used only for completion of a flight, and then at a reduced power setting. Low oil pressure should be corrected prior to next light. During ground operations, oil pressures below 40 PSIG require engine shutdown; during flight, oil pressure below 40 PSIG is unsafe and requires either engine shutdown or use of minimum power until a landing can be made.

(4) This value is time limited to two seconds. If ITT is likely to exceed 925°C, discontinue start.

(5) For every 10°C below -30°C ambient temperature, reduce maximum allowable N_1 by 2.2%.

(6) High ITT may be decreased by reducing accessory load and/or increasing N_1 speed.

(7) High generator loads at low N_1 speeds may cause the ITT acceleration temperature limit to be exceeded. Observe the generator load limits.

(8) This power rating is intended for emergency use at the discretion of the pilot.

(9) Torque limits between 1,900 and 2,200 RPM vary linearly between 1,315 and 1,520 ft-lbs.

(10) If propeller RPM does not read between 900 and 1,100 RPM with the power levers at idle and condition levers at low idle, perform a low pitch torque check to ensure propeller flight idle stops are correctly adjusted.

GENERATOR LOAD VS MINIMUM N_1

GENERATOR LOAD	GROUND OPERATION	5000 FT	25,000 FT	30,000 FT
.0 to .25	50%	50%	58%	60%
.25 to .5	50%	60%	67%	70%
.5 to .75	57%	65%	74%	78%
.75 to .9	60%	68%	78%	82%
.9 to 1.0	63%	69%	80%	85%

Figure 3-6 Engine Operating Limits

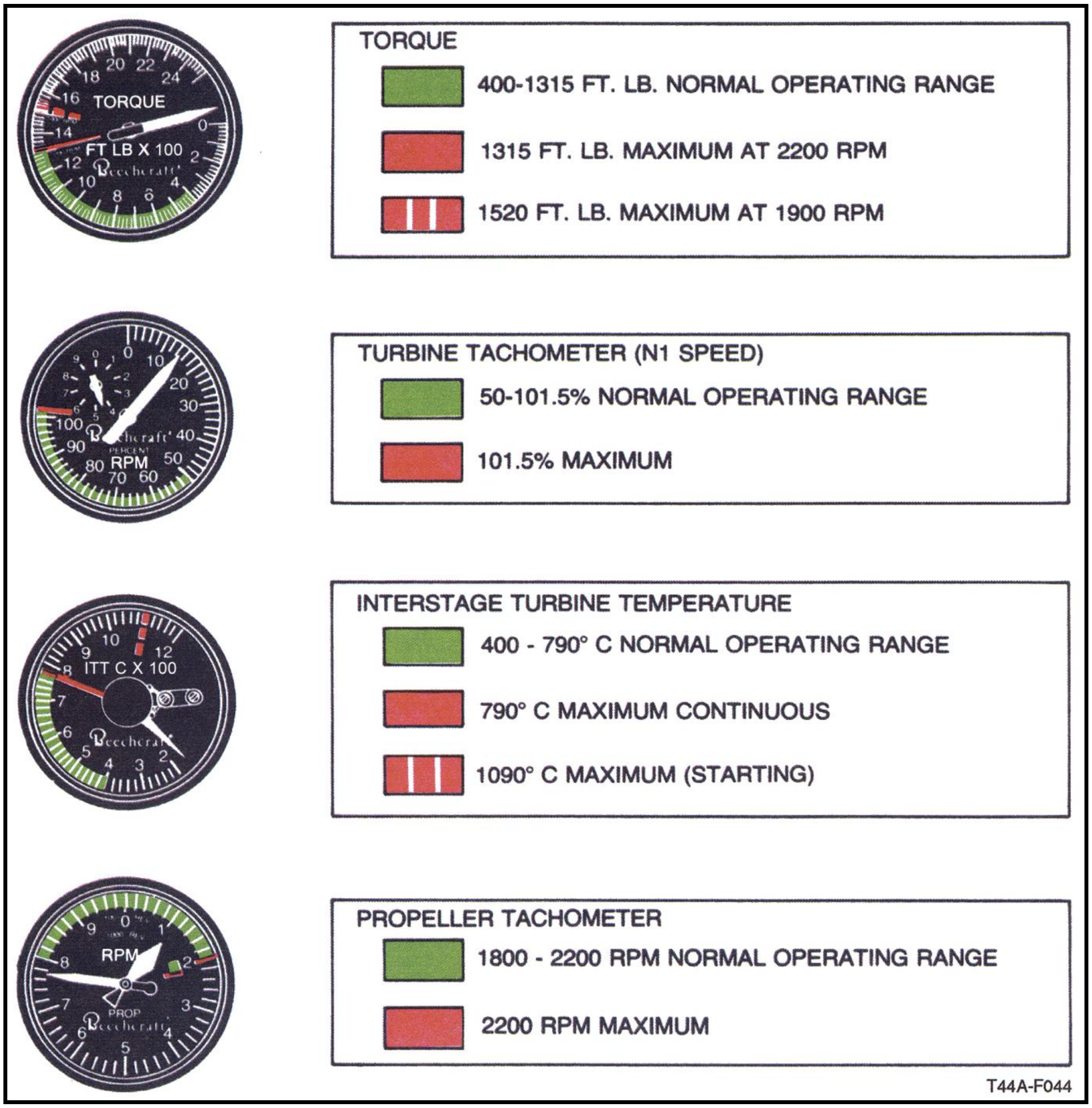


Figure 3-7 Instrument Markings 1

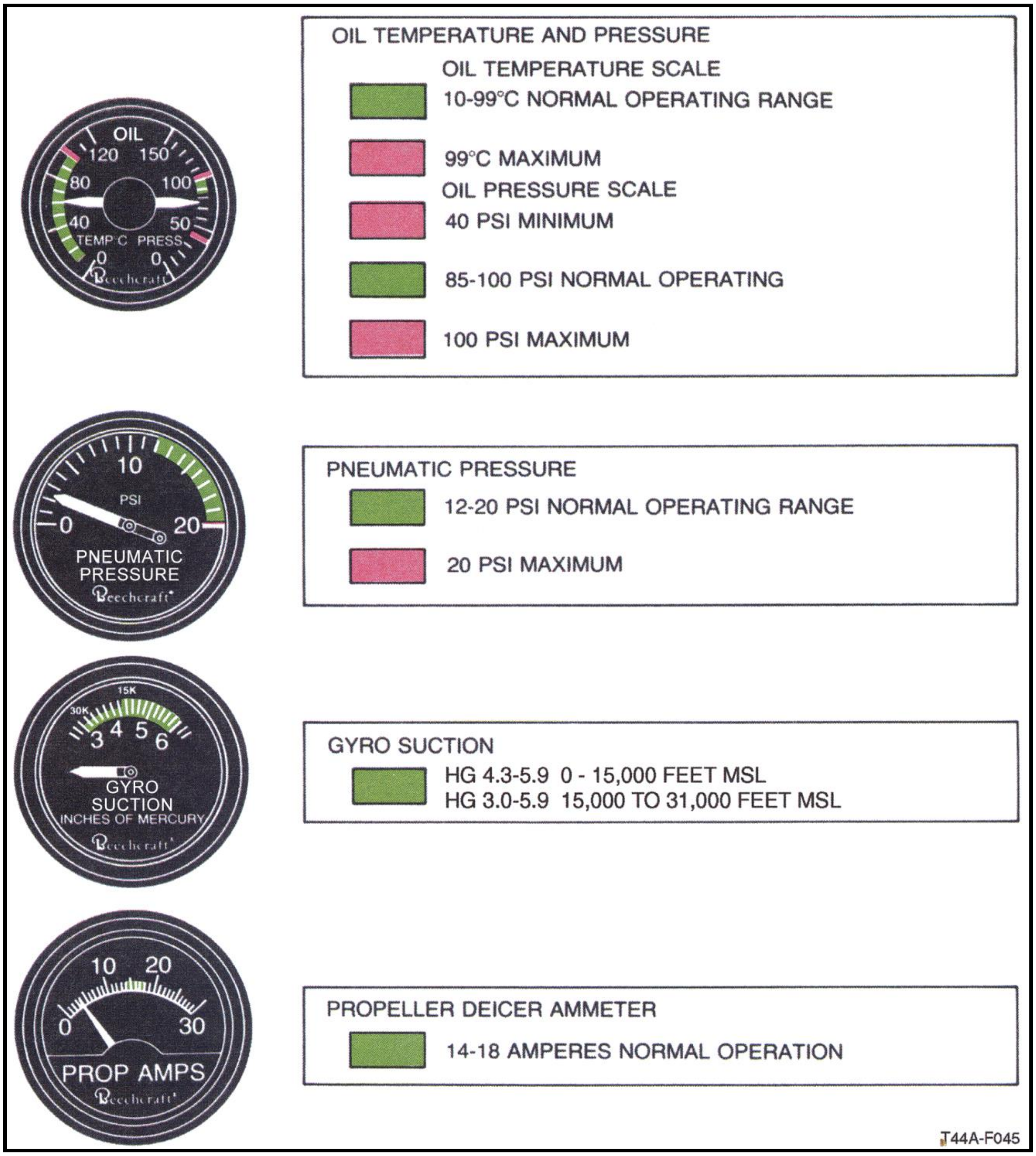


Figure 3-8 Instrument Markings 2

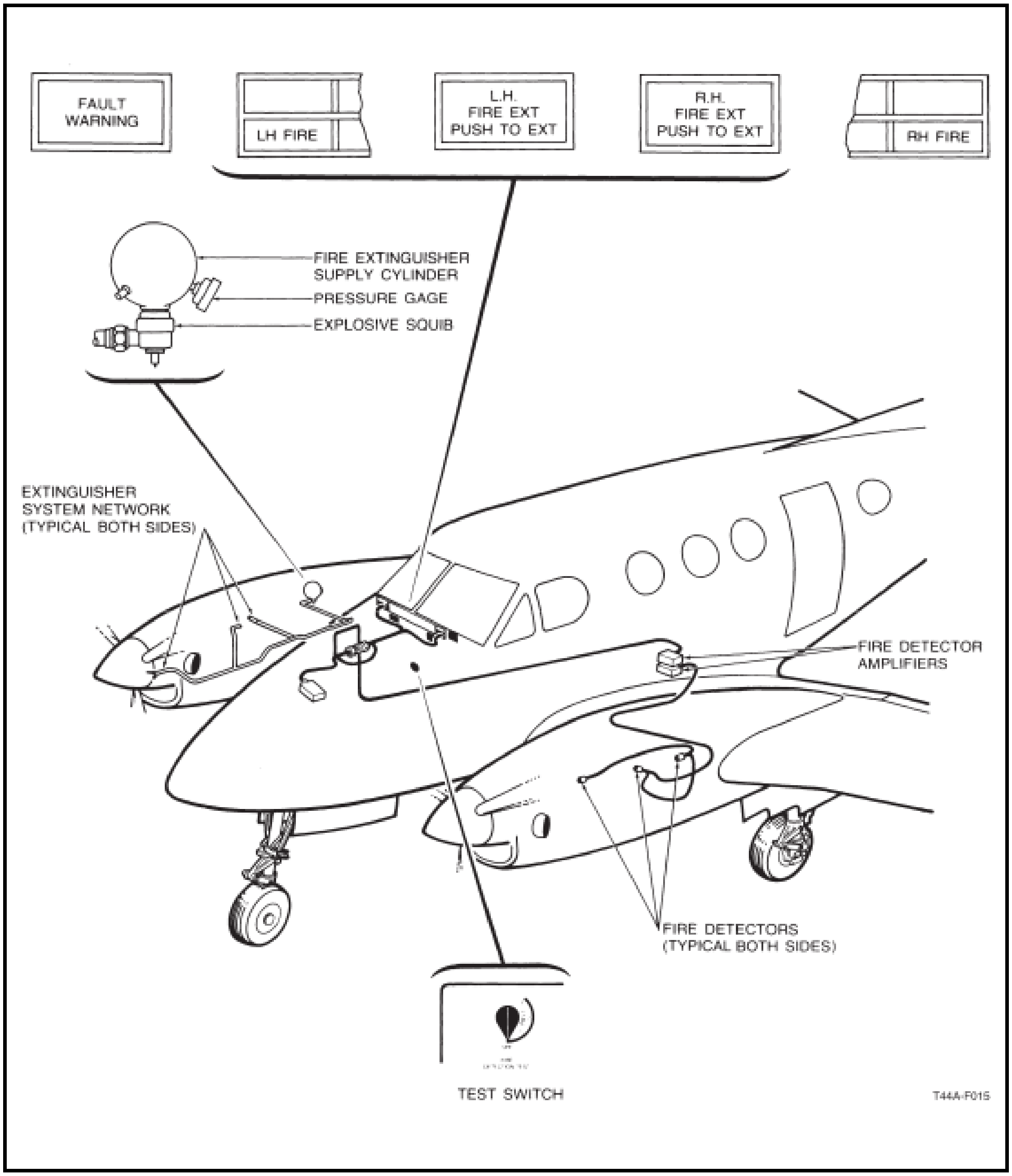


Figure 3-9 Engine Fire Detection / Extinguisher System

POWER PLANT QUIZ

1. The PT6A-34B Engine is rated at _________ shp.

2. The compressor is connected to the power turbine by a common shaft.

   TRUE FALSE

3. The compressor section is comprised of a ______ stage axial compressor and a _____ stage centrifugal compressor.

   a. 4 and 2
   b. 3 and 1
   c. 1 and 3
   d. 2 and 4
   e. 1 and 4

4. The speed of the compressor is _______ rpm at 100%.

   a. 28,500
   b. 33,000
   c. 37,500
   d. 38,000
   e. 38,500

5. The combustion chamber contains ____ fuel spray nozzles.

   a. 10
   b. 11
   c. 12
   d. 13
   e. 14

6. The power turbine is directly connected to the reduction gear box, which turns the propeller.

   TRUE FALSE

7. With the prop rotating at 2200 rpm the speed of the power turbine is _____ rpm.

   a. 28,500
   b. 33,000
   c. 37,500
   d. 38,000
   e. 38,500

8. The reduction gear box uses a _______stage planetary type reduction system.

9. The reduction gear box provides a reduction ratio of ___:___.

   a. 13:1
   b. 14:1
   c. 15:1
   d. 16:1
   e. 17:1

10. Which of the following fuel control system components acts as a shutoff valve for the fuel entering the fuel manifold?

   a. Engine driven fuel pump
   b. Engine start control unit
   c. Fuel control unit
   d. Purge solenoid valve
   e. Fuel drain collector pump

11. The oil to fuel heater senses the fuel temperature and starts to bypass the oil at 70° F, at 90° F the oil totally bypasses the heater core.

   TRUE FALSE

12. The fuel collector pump returns fuel to the nacelle tank any time ________.

   a. there is fuel in the fuel drain collector tank
   b. the fuel drain collector tank is full
   c. electrical power is on
   d. Both a & c
   e. Both b & c

13. The fuel drain collector system collects residual fuel from the fuel manifold flow divider after engine shutdown.

   TRUE FALSE

14. The minimum voltage required for a battery start is _______________ volts.

15. The PT6A-34B turboprop engine is rated at __________ SHP and this is obtained with _______ ft-lbs of torque at 2200 prop rpm and _________ft-lbs of torque at 1900 prop rpm.

16. The power lever is connected to the ____________ box which is connected to the ________________ unit and the ________________ linkage.

17. The condition levers adjust ________ N1 rpm. Low idle at sea level is ______ to ______ % N1. High idle is ______ to _______ % N1. Idle rpm is adjusted during ground operations to accommodate high generator _________, and prior to flight to control engine _________________ time.

18. Normally, on takeoff at Navy Corpus the first engine limitation reached as you advance the power levers will be _____________. As you climb the engine will become_____________ limited.

19. A compressor progressive bleed valve stuck in the open position could result in ________.

a. a compressor stall at high N1 RPM
b. the inability to develop a high power setting
c. a compressor stall at low N1 RPM
d. an N1 overspeed

CHAPTER FOUR
PROPELLER SYSTEM

400. OBJECTIVES

At the end of this lesson, you should be able to...

1. Label the components of the propeller system.

2. Label and describe the function of the propeller control system and its components.

3. State the three (3) RPM limitations on the propeller governors.

4. Recognize the indications and potential results of a propeller governor failure.

5. Recognize the indications and potential results of a propeller linkage failure.

6. Label and describe the function of the overspeed governor and related controls.

7. Label and describe the function of the autofeather system and its components.

8. Label and describe the function of the synchrophaser system and its components.

NOTES

401. PROPELLER SYSTEM

At the end of this topic, you should be able to label and describe the operation of the components of the propeller system and its limitations.

402. SYSTEM COMPONENTS & OPERATION

Each prop lever sets the rpm for its respective propeller by adjusting the speeder spring tension on top of the primary governor. The prop system is hydraulically controlled, constant speed, full-feathering, and reversible. Engine oil provides the hydraulic control in the propeller system. It is driven through the primary governor by the governor pump.

The primary governor controls the prop rpm for the entire normal range of rpm by sensing the flyweight rotation against the speeder spring and metering oil through the pilot valve.

If a primary governor malfunctions and the prop exceeds 2200 rpm by more than 4%, the overspeed governor limits high pressure oil to maintain propeller speed at 2288 rpm +/- 40.

A pneumatic section of the primary governor acts as a fuel topping governor if the overspeed governor fails and propeller speed exceeds 2332 rpm.

Attached to the overspeed governor is the autofeather solenoid which automatically dumps oil to feather the propeller in the event of a severe power loss.

The propellers consist of three aluminum blades with over-center bladeshank counterweights. The blades are twisted to maintain even thrust.

The feathering spring and bladeshank counterweights will normally feather the propeller any time there is loss of boosted propeller governor oil pressure.

Blade Angles

Typical blade angles are given below:

Feather at 87°

Low Pitch Stop at 15°

Zero Thrust at -5°

Reverse at -11°

Approx. Cruise at 25 to 35 degrees

Propeller Levers

The primary governors are controlled by two propeller levers located on the control pedestal between the power control and condition levers. The levers are placarded PROP. The full forward position is placarded TAKEOFF, LANDING AND REVERSE, and HIGH RPM. The full aft position is placarded FEATHER.

Each propeller lever controls a primary governor that regulates propeller speeds within normal operating range 1800-2200 rpm.

At HIGH RPM, the propeller may attain an rpm of 2200.

At FEATHER, the propeller will feather.

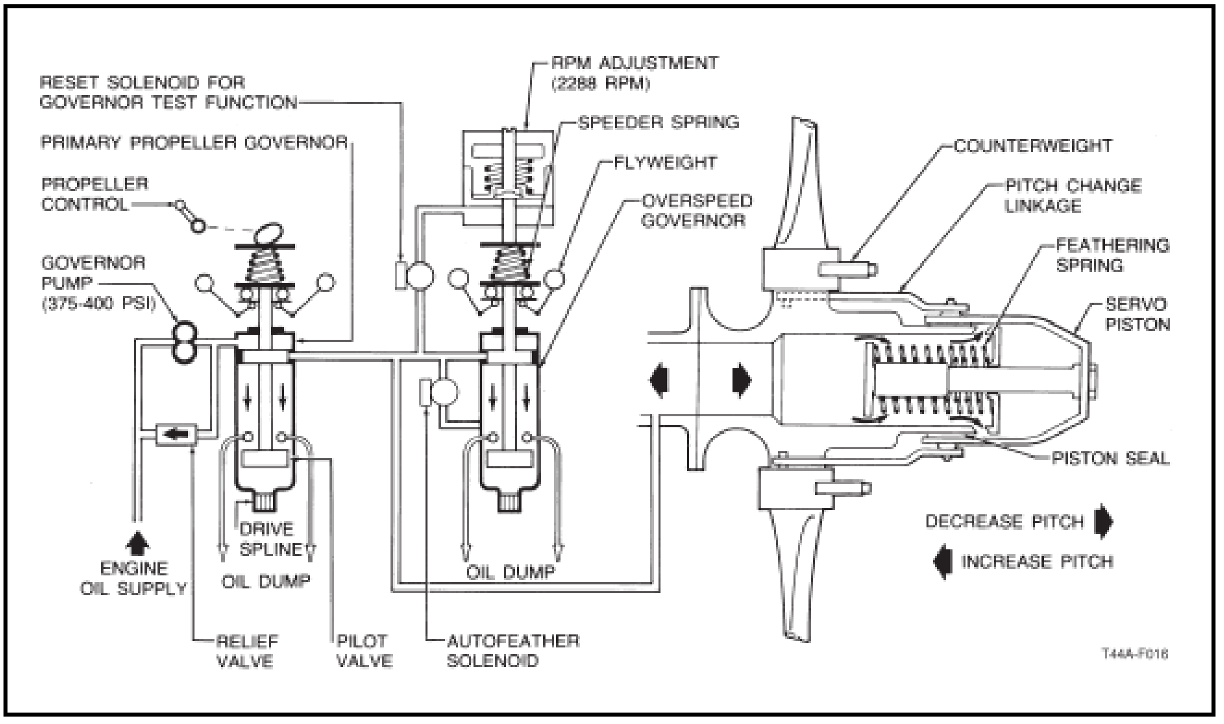


Figure 4-1 Propeller Control System

403. PRIMARY GOVERNOR

Each propeller is controlled by two governors, the Primary Governor and the Overspeed Governor. The pitch and speed of each propeller are controlled by engine oil, boosted by a governor pump (375-400 psi) acting through the engine driven Primary Governor. Higher oil pressure decreases the blade angle. A loss of oil pressure results in the propeller feathering.

404. OVERSPEED GOVERNOR

In the event of primary governor malfunction, the overspeed governor cuts in and dumps oil from the propeller dome to prevent rpm from exceeding safe limits. Primary governor failure can be detected by propeller N2 speeds of 2288 +/- 40 (overspeed), or uncommanded propeller feather.

Propeller Governor Test Switch

The PROP GOV TEST switch is located on the pilot subpanel. The PROP GOV TEST switch provides an operational test of the overspeed propeller governor. In the TEST position, the switch resets the overspeed governor to maintain between 1900 to 2100 rpm.

405. FUEL TOPPING GOVERNOR

The primary governor incorporates a pneumatic section which has an air line connected to the fuel control unit. If propeller rpm exceeds 2332, this governor reduces power to prevent rpm exceeding 2332.

406. PROPELLER REVERSING

To reverse the propellers, position the propeller control levers at HIGH RPM.

Then lift the power control levers aft, over the IDLE detent to REVERSE with the engine running.

Propeller blade angles can be reversed up to a maximum of -11° blade angle

In reverse, prop rpm will be limited by the pneumatic section of the primary governor to 2100 rpm.

CAUTION

> Moving the power levers aft of IDLE without the engine running will result in damage to the reverse linkage mechanism. To prevent damage to reversing linkage, propeller levers must be in HIGH RPM position prior to propeller reversing.

Propeller Reverse Not-Ready Annunciator Light

One yellow caution light placarded PROP REV NOT READY, on the annunciator panel, alerts the pilot NOT to reverse the propellers. It illuminates when the landing gear selector handle is down and the propeller levers are NOT at the HIGH RPM position.

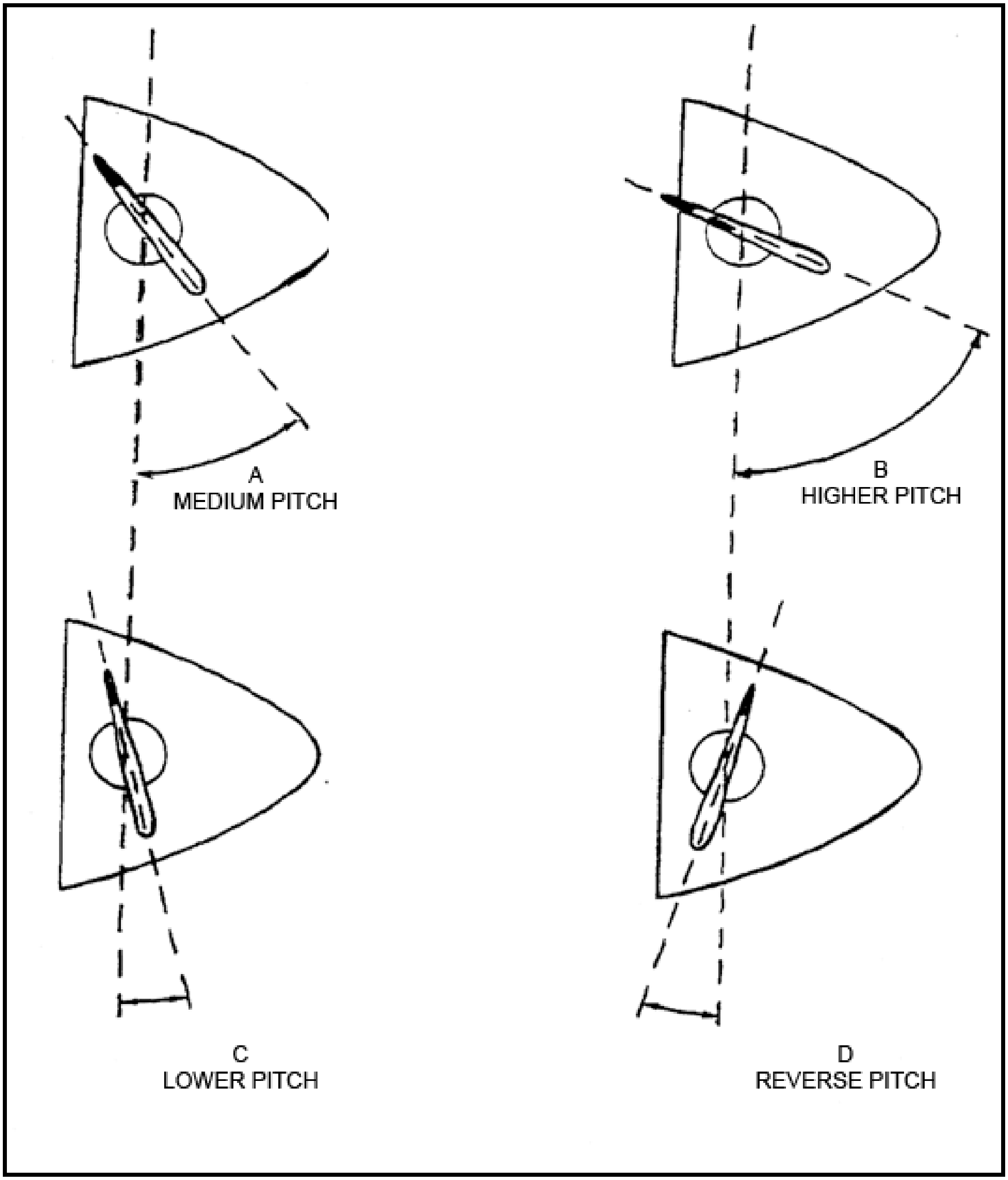


Figure 4-2 Typical Propeller Blade Angles

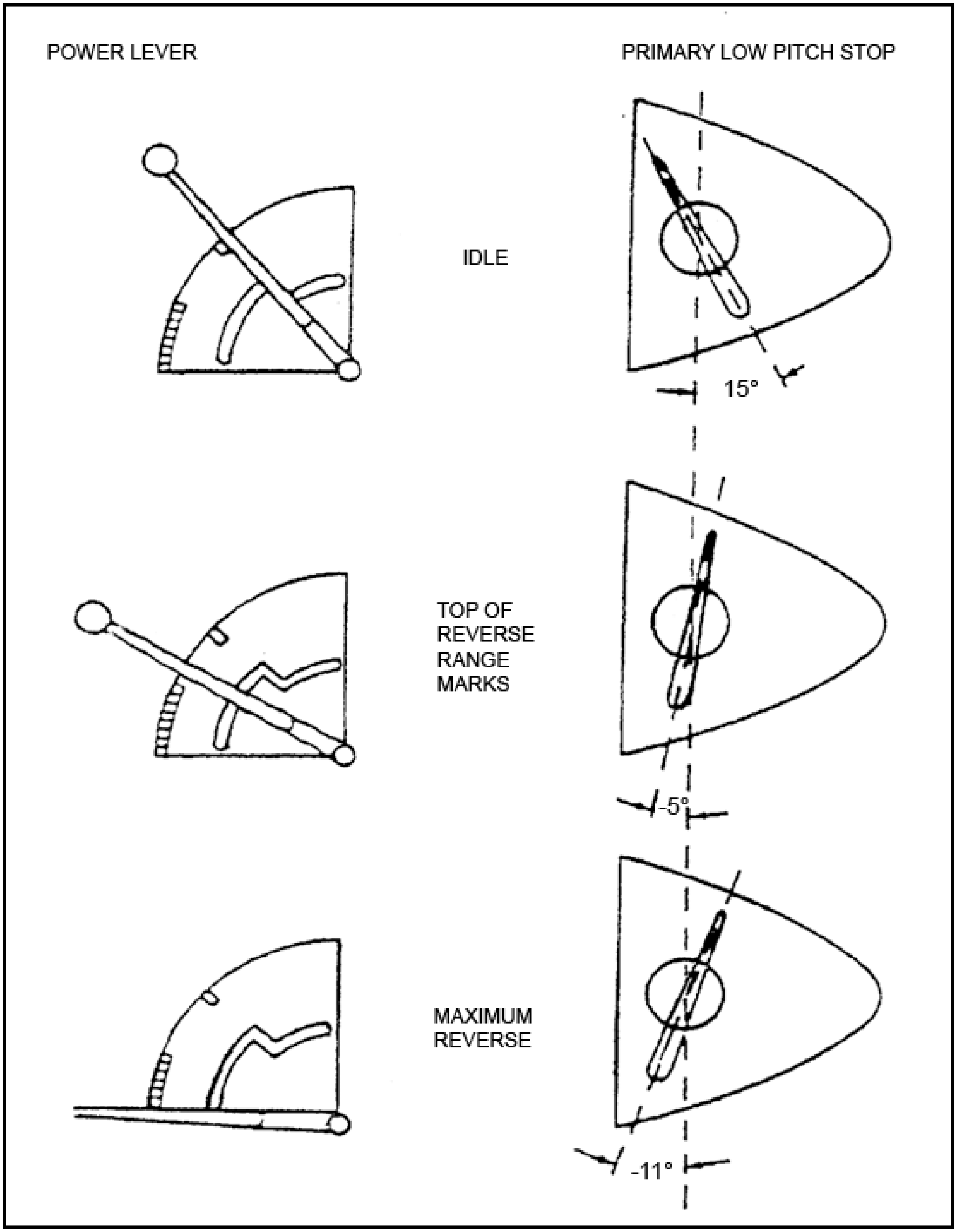


Figure 4-3 Specific Blade Angles

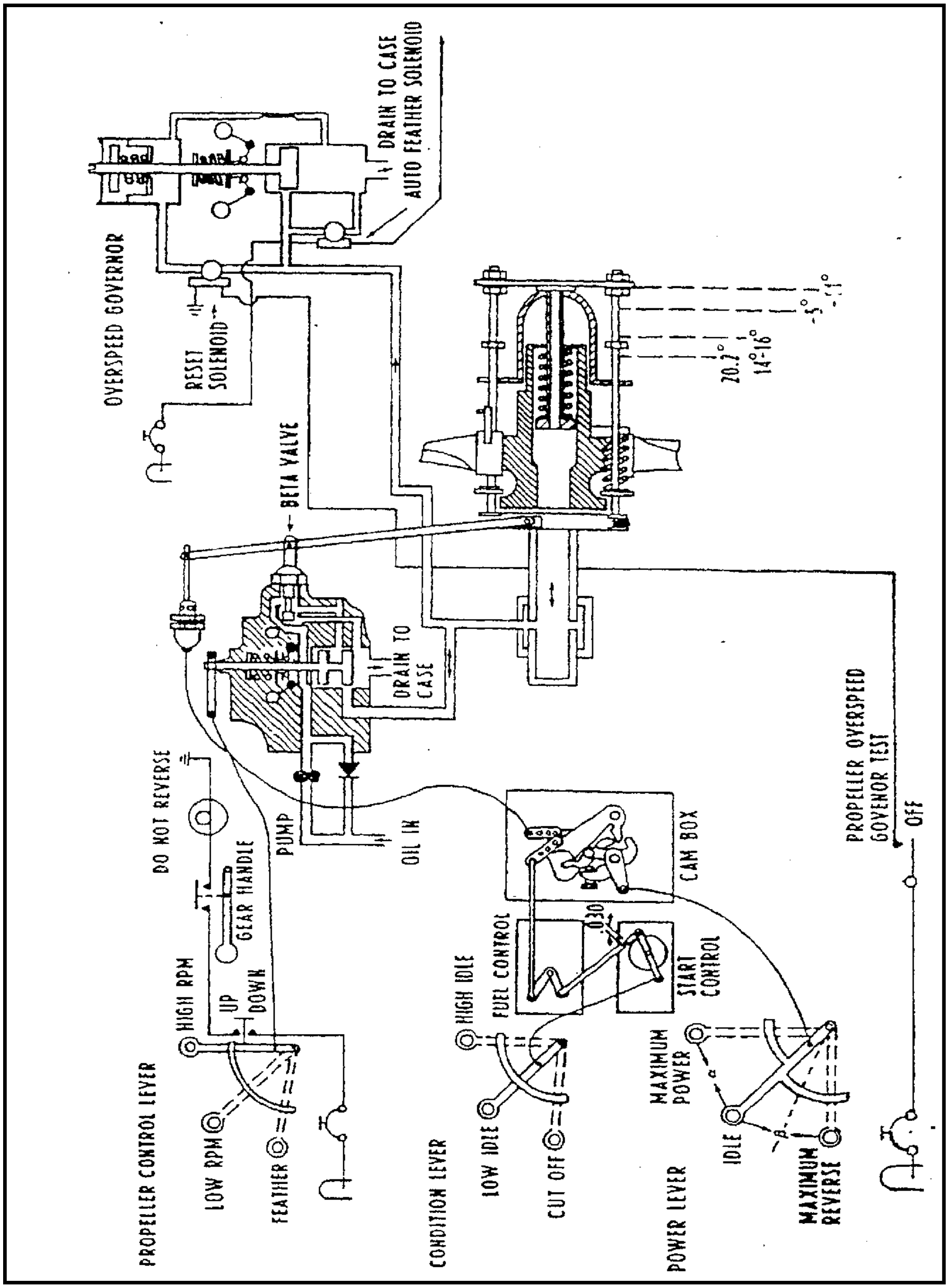


Figure 4-4 Propeller Reversing Schematic

407. AUTOFEATHER SYSTEMS

The autofeather system provides rapid prop feathering in the event of an engine power loss on takeoff or wave off.

If an engine loses power, with the system armed and the power levers at or above a position corresponding to 90 (+/-2) percent N1, two torque-sensing switches are actuated resulting in the affected engine's propeller feathering.

NOTE

> With the autofeather switch in the ARMED position, retarding one or both power levers below the 90% position will completely disengage the autofeather system.

When the affected engine drops below 410 (+/- 50) ft-lbs. torque, the first torque sensing switch turns off the autofeather system for the opposite engine and deenergizes the opposite engine's autofeather light.

When the affected engine drops below 260 (+/- 50) ft-lbs. torque, the second torque sensing switch causes the autofeather system to activate, completing the circuit to the solenoid.

Autofeather is normally used in the terminal area, on low levels, and as an alternate means to feather the prop in an emergency.

Propeller Autofeather Switch

Autofeathering is controlled by a propeller AUTOFEATHER switch on the pilot subpanel. This switch is a three position switch placarded ARM, OFF, and TEST.

The ARM position is used during takeoff, landing, and when required by the mission.

The TEST position of the switch allows the pilot to check the readiness of the autofeather system. The TEST position of the autofeather system allows the 90% N1 power lever micro-switch to be bypassed to facilitate ground testing of the autofeather system.

Autofeather Lights

Two green annunciator lights LH AUTO and RH AUTO indicate that the autofeather system is armed.

408. SYNCHROPHASER SYSTEM

The Synchrophaser System is designed only for inflight use. The system reduces the interior noise level and minimizes stress on the fuselage.

The Synchrophaser System provides two functions:

1. One function is to synchronize the propellers to the same prop rpm read on the gauge. This lowers the ambient noise level in the cabin.

2. The other function is to phase the blades so that no two blades pass the fuselage at the same time, which reduces airframe stress.

The left propeller is the master and the right propeller is the slave. Both props have a magnetic speed pickup mounted in their overspeed governor and three magnetic phase pickups mounted on their de-ice slip ring which transmits electronic pulses to a control unit. The control unit converts any pulse rate differences into correction commands and these correction commands are then transmitted to an actuator motor mounted on the right engine. The actuator motor then trims the right propeller governor assembly to match the left propeller rpm while leaving the left propeller control lever position constant.

The synchrophaser is limited to +/- 30 rpm from the normal governor setting. This limit is to prevent the slave propeller from losing excessive rpm if the master propeller is feathered while the synchrophaser system is on.

Propeller Synchronization Switch

The synchrophaser system is controlled by a two-position switch located on the control quadrant and is placarded PROP SYNC ON-OFF. The switch completes the circuit for propeller synchronization.

When the propeller sync switch is OFF, the propeller synchrophaser actuator will recenter and this may take six seconds.

PROP SYNC ON Annunciator Light

If the synchrophaser system is in use and the right landing gear is extended, a yellow annunciator light placarded PROP SYNC will illuminate.

The right propeller may not fully feather with the propeller sync switch on.

** PLUS OR MINUS 30 RPM IS THE LIMIT OF THE ACTUATOR AUTHORITY

** INPUTS TO THE ACTUATOR:

PHASING OF BLADE POSITION – DEICER SLIP RING SCREW LOCATION RT AND LT ⟶

SYNCHRONIZING RPM – OVERSPEED GOVERNOR MAG TACH INFO RT AND LT - - - →

** OUTPUT FROM THE ACTUATOR:

LINKAGE GOING TO THE RIGHT PRIMARY GOVERNOR (LT PROP IS MASTER, RT IS THE SLAVE) ⟶

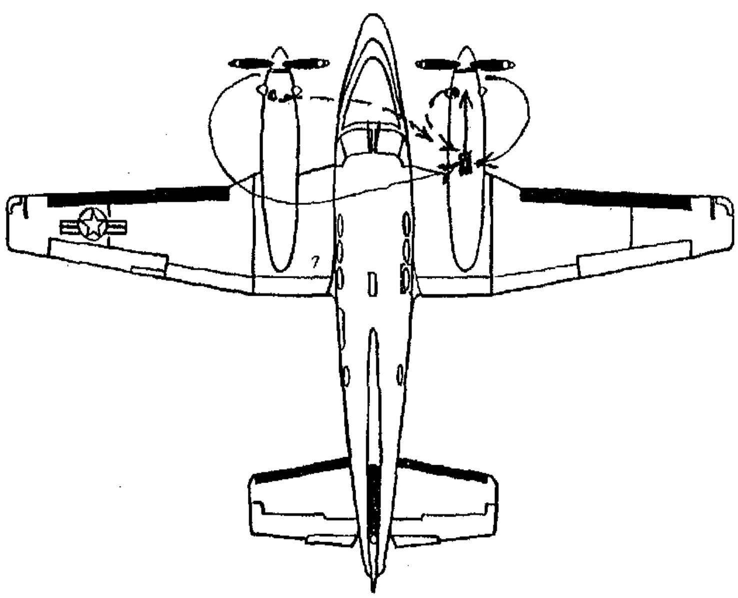


Figure 4-5 T44 Synchrophaser System

409. ABNORMAL CONDITIONS

Prop Governor Failure

If the propeller governor fails, the propeller will either feather or overspeed. For example, an uncommanded and uncontrollable propeller rpm greater than 2200 rpm indicates failure of the primary governor.

If a primary governor malfunctions and its respective propeller exceeds 2200 rpm, then the overspeed governor limits prop rpm to 2288 +/- 40 rpm dumping oil from the propeller to prevent rpm from exceeding safe limits. If the primary governor fails in the feather mode, torque will increase and prop rpm will decrease.

If a propeller sticks or moves too slowly during a transient condition (like a rapid increase of power), and the propeller speed exceeds 2332 rpm, then the over speed governor has failed, and the pneumatic section of the primary governor will act as fuel topping governor. To accomplish fuel topping, the pneumatic section limits the fuel flow into the engine, thereby reducing the power driving the propeller.

WARNING

Propeller rpm exceeding 2420 may result in reduction gearbox failure and/or N2 turbine damage.

NOTE

The engine with the disabled propeller may be operated to provide electrical power. The right propeller may not fully feather with the propeller sync on.

If propeller rpm is out of the normal governing range, you will manipulate the propeller lever to attempt to regain normal operation. If unable, you will bring the power lever to idle and feather the propeller.

Prop Linkage Failure

If the propeller governor control linkage fails, the affected propeller will remain at its current setting or increase to 2200 rpm. Again, you will manipulate the propeller lever to attempt to regain normal operation. If unable, you will match the opposite propeller rpm with the uncontrollable one and land as soon as practical.

CAUTION

Reversing without the propellers being in high rpm may damage the reversing linkage.

PROPELLERS QUIZ

1. If the primary governor fails the propeller will either feather or remain at the current rpm setting.

TRUE FALSE

2. If the propeller linkage fails the propeller will

a. Overspeed
b. Feather
c. Advance to 2200 rpm
d. Remain at the current rpm
e. Answers c or d are correct

3. Which propeller system components drive the propeller toward feather pitch?

a. Flyweights
b. Bladeshank counterweights
c. Feathering spring
d. Both b and c
e. Increased oil pressure in the propeller dome

4. The propellers are hydraulically controlled _________ speed, full-feathering, and reversible.

5. While on short final for landing, the pilot advances the propeller levers to the full forward position. Which of the following statements is most correct?

a. Oil pressure will be released from the propeller dome and blade angle will decrease
b. Oil pressure will be increased in the propeller dome and blade angle will decrease
c. Oil pressure will be released from the propeller dome and blade angle will increase
d. Oil pressure will be increased in the propeller dome and blade angle will increase

6. The full aft position on the propeller levers is placarded FEATHER and positions the propeller to __________ degree(s) of blade angle.

7. The PROP GOV TEST switch resets the overspeed propeller governor to maintain rpm from 1900 to 2100 for test purposes.

TRUE FALSE

8. During flight the right propeller rpm increases to 2332 rpm. This indicates a failure of which of the following?

a. Primary governor
b. Overspeed governor
c. Fuel topping governor
d. Both a and b
e. All of the above

9. The normal operating range for the propeller is from _______ to _______ rpm.

10. The pneumatic section of the primary governor begins to act as a fuel topping governor when the propeller rpm exceeds?

a. 2420
b. 2200
c. 2288
d. 2332

11. Which condition is not a requirement for the autofeather system to feather an inoperative engine's propeller?

a. The propeller levers full forward.
b. Power on the inoperative engine must be below 260 +/- 50 ft/lbs torque.
c. The autofeather switch must be in the ARM position.
d. The power levers must be above the 90 % N1 position.

12. The TEST position of the autofeather switch allows which of the following switches to be bypassed?

a. 410 +/- 50 ft/lb
b. 260 +/- 50 ft/lb
c. 79 % N1
d. 90 % N1
e. Main cabin door

13. The_________ propeller may not fully feather with the propeller sync switch on.

14. The propeller synchrophaser actuator will re-center when?

a. The propeller rpm’s are matched to within +/- 30 rpm’s
b. The actuator will automatically re-center when it reaches the maximum travel limit
c. The propeller sync switch is moved to the OFF position
d. The propeller sync switch is moved to the ON position

15. The three unique items on the overspeed governor are

____
____
____

16. If the primary governor fails, the propeller will

____
____

17. The propeller can be feathered by ____

18. List the steps required for the autofeather system to be fully armed.

____
____

Then, if an engine loses power, the 410 +/- 50 ft lbs. torque switch de-arms the ________________ engine's autofeather system. And the 260 +/- 50 ft lbs. torque switch activates the autofeather solenoid on the failed engine's __________ governor.

19. Propeller RPM exceeding 2420 RPM may result in _________________________ failure and/or __________________________ damage.

THIS PAGE INTENTIONALLY LEFT BLANK

\

CHAPTER FIVE
FUEL SYSTEMS

500. OBJECTIVES

At the end of this lesson, you should be able to...

1. Label the components of the fuel system.

2. List the approved fuels for the T-44C aircraft.

3. Describe the functions of all system components that assist fuel flow from the tanks into the engine.

4. Recognize the indications and potential results of a transfer pump malfunction.

5. Recognize the indications and potential results of a boost pump malfunction.

6. State two limitations for using suction lift.

7. Label and describe the operation of the crossfeed system and its components.

NOTES

501. FUEL SYSTEM

At the end of this topic, you should be able to label and describe the operation of the components of the fuel system. You should also be able to list the approved fuels for the T-44C.

502. FUEL SYSTEM COMPONENTS & OPERATION

The fuel system consists of two identical systems sharing a common fuel management panel and a continuous stainless steel crossfeed line.

The components of the fuel system are:

1. Wing Tanks (outboard and inboard)
2. Nacelle Tanks
3. Fuel Transfer Pumps
4. Boost Pumps
5. Purge Valves
6. Fuel Tank Sump Drains
7. Fuel Vents
8. Firewall Shutoff Valves
9. Fuel Crossfeed Valve

Approved Fuels

There are five (5) fuels approved for use on the T-44C:

1. Jet A1
2. Jet B
3. Jet 4
4. JP-5
5. JP-8

Jet A and F42 are alternate fuels.

AVGAS grades 80/87/100LL through 115/145 may also be used (Emergency Use Only). However, continuous use of AVGAS is limited to 150 hours between overhaul periods. Reference NATOPS Servicing and Handling for specifics.

CAUTION

JP-8 +100 shall never be used in the T-44C as it can clog the fuel filter.

503. WING TANKS

Wing tanks are of the rubberized bladder type, snapped into place and interconnected to each other for supplying fuel or venting of the tanks.

Fuel is gravity fed into the fuel tanks through four fuel filler caps: one on each wing and one on each nacelle.

Fuel is gravity fed from outboard tanks to the center section (inboard) tank.

1. The fuel capacity of the wing tanks is 132 gallons.

2. The fuel capacity of the nacelle tanks is 61 gallons.

3. The total fuel capacity is 387.6 gallons of which 384 gallons are usable.

504. FUEL TRANSFER SYSTEM

The fuel transfer pump is located in the center section tank and pumps fuel from the inboard wing tank to the nacelle tank at a rate of 1 1/4 GPM or 500 PPH (approx. 75 GPH).

The transfer pump can be electronically controlled from the fuel management panel to run continuously (OVERRIDE position), or it can be automatically controlled (AUTO position) by float switches in the nacelle tank.

In the **AUTOMATIC** mode, each transfer pump is controlled by three float switches: upper-level, middle-level, and lower-level.

1. The lower-level switch is set at approximately 42 gallons (turns pump on).

2. The middle-level switch is set at approximately 51 gallons (turns pump off).

3. The upper-level switch is set at approximately 59 gallons (turns pump off if the 51 gallon switch fails).

Normally, the fuel in the nacelle tank will drop to 42 gallons as the engine consumes fuel. Then the transfer pump will activate to fill the nacelle tank to the 51-gallon level at which point it cuts off. This cycle continues until the fuel in the center section tank is depleted.

The float switch operation is automatic and requires no action by the pilot.

If fuel transfer fails with fuel still in the wing tanks, fuel will flow by gravity from the inboard wing tank into the nacelle tank when the nacelle tank drops to 3/8 full (about 160 pounds of JP-5). However, the last 28 gallons will be trapped in the inboard wing tank (cannot gravity feed).

In the OVERRIDE mode, the transfer pump runs continuously, and the float switches are bypassed.

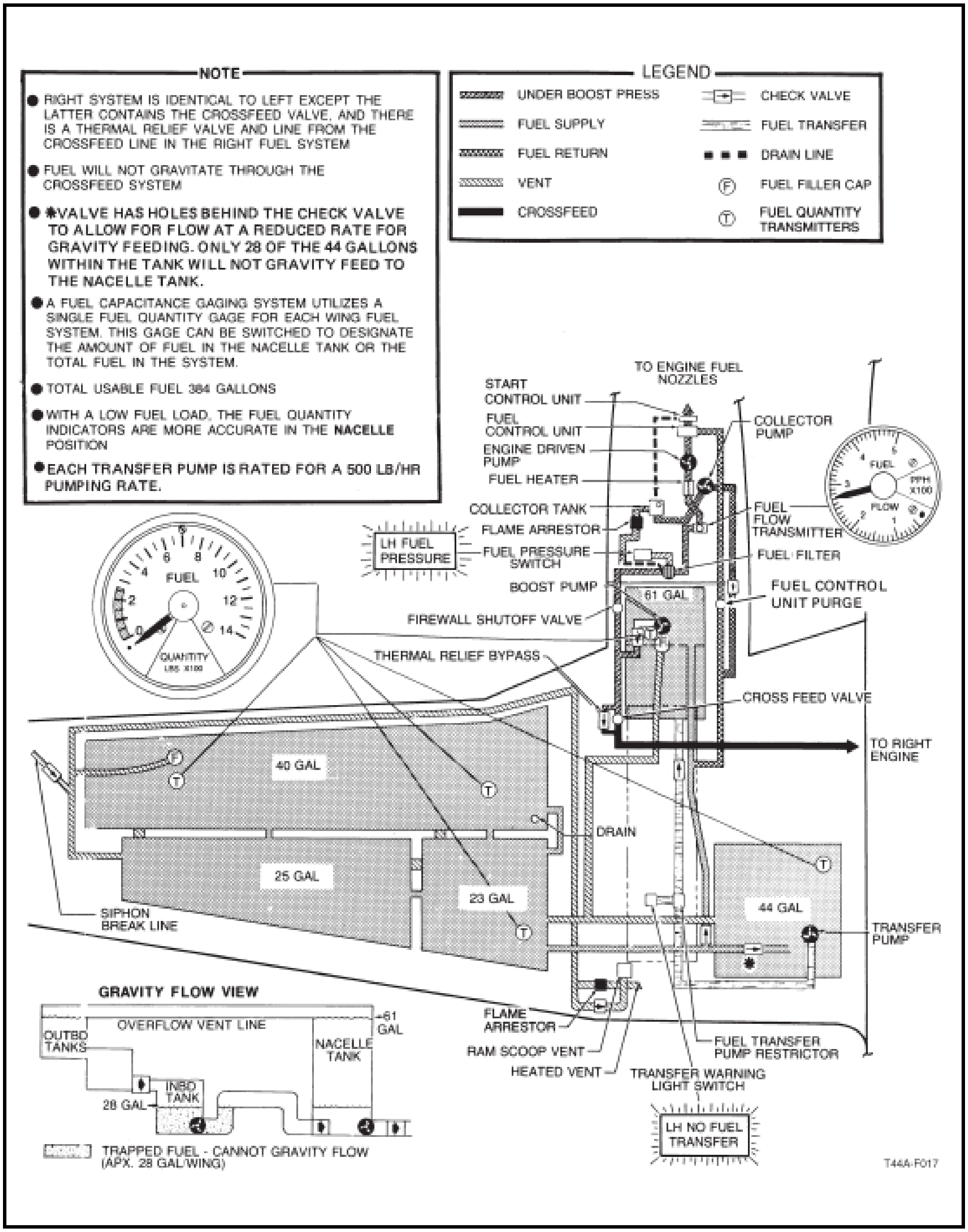


Figure 5-1 Fuel System

505. FUEL TRANSFER SYSTEM MALFUNCTIONS

If the RH/LH NO FUEL TRANSFER light illuminates (transfer pump switch in auto): Check total fuel and nacelle fuel quantities.

1. If total fuel quantity equals nacelle fuel quantity, then no fuel remains in the wing tanks to transfer. Turn transfer pump off.

2. If total fuel quantity is greater than nacelle fuel quantity, then determine if the 28 gallons of trapped fuel are necessary.

   a. If the 28 gallons are necessary then position transfer pump switch to override.

      i. If the NO FUEL TRANSFER annunciator extinguishes, the pump is operable and pump operation may continue in override mode.

      ii. If the NO FUEL TRANSFER annunciator does not extinguish, the pump has failed. Turn transfer switch to off. A maximum of 28 gallons of fuel will be unusable in the respective wing tank.

   b. If the 28 gallons are not necessary, do not use override and turn the pump off. Gravity flow will begin once the nacelle drops to 3/8 full.

In both cases, land as soon as practicable.

3. If there is fuel in the wings but the nacelle quantity is in the yellow arc, and there is no associated annunciator light, the one of the following may have occurred.

   a. Transfer pump switch could be in the off position.

   b. Transfer pump circuit breaker is out. Pump operation and annunciator light operation will be inhibited.

   c. 42 gal float switch is inoperative. Select override and monitor fuel quantity.

NOTES

1. When the transfer pump switch is in the AUTO position, power will automatically be removed from the pump when the NO FUEL TRANSFER light illuminates.

2. Unlike boost pump warnings, transfer pump warning circuit logic involves not just a simple pressure switch; otherwise, the pilot would be warned every time the float switch turns off the pump automatically. The warning occurs if the pressure switch detects < 3 psi for 30 seconds ***and*** the pump is told to run.

506. BOOST PUMPS

The fuel boost pumps are located in the left and right nacelle tanks. The boost pumps provide approximately 30 psi head pressure fuel to the engine-driven high pressure pump inlet and provide fuel pressure for crossfeeding during continued single engine operations.

The boost pumps are dual powered by their respective fuel busses and the hot battery bus.

When a boost pump fails, the respective FUEL PRESSURE light flickers and the CROSSFEED annunciator remains illuminated because the crossfeed valve will open automatically (if in AUTO position). The crew must then close the crossfeed valve to determine which boost pump has failed. Then a decision must be made to crossfeed or to suction lift the fuel. Crossfeed operation is used if range is not a factor. Suction lift is used if range is critical.

NOTE

For descent for landing, crossfeed should be selected to guarantee boosted pressure in case of waveoff.

CAUTION

Engine-Driven fuel pump operaton without boost pump fuel pressure (suction lift) is limited to 10 hours.

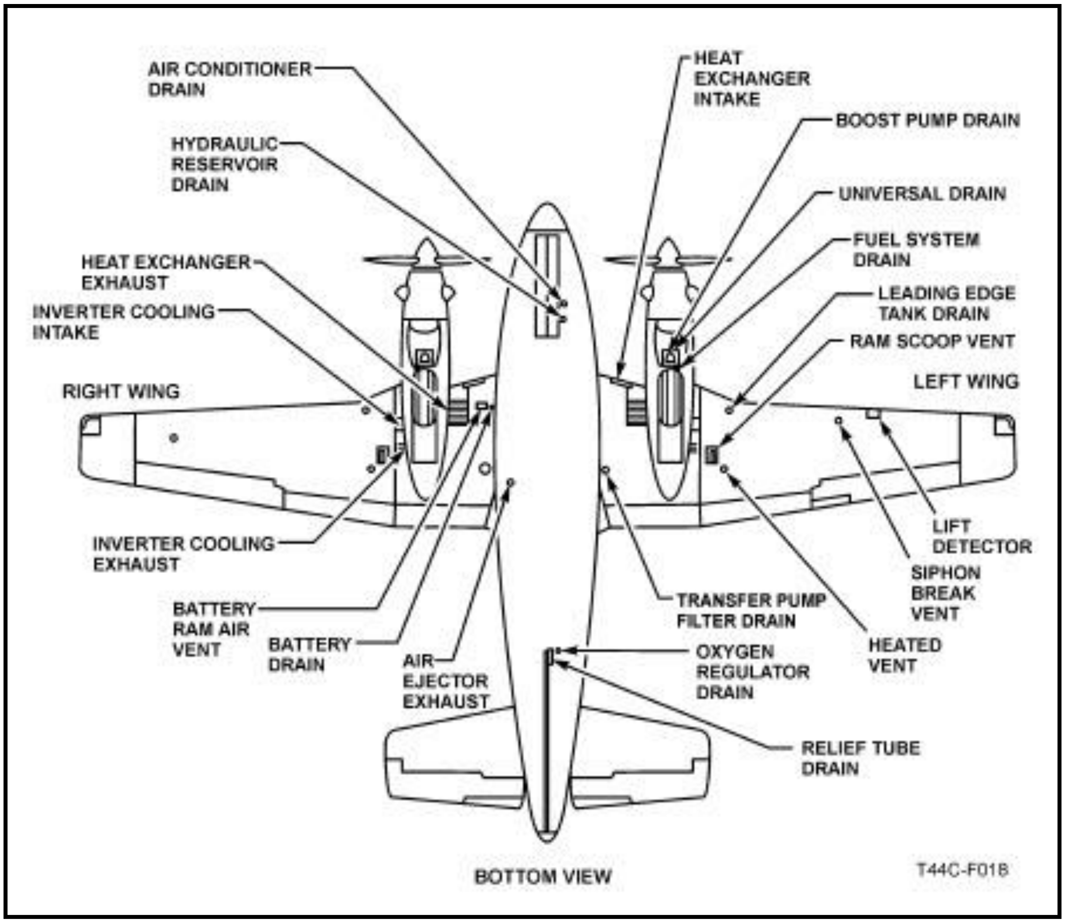


Figure 5-2 Aircraft Vents and Drains

507. SUMP DRAINS

The ***fuel tank sump drains*** drain moisture and sediment at the fuel system low points on the nacelle tanks, wing tanks, wheel well sumps, transfer pumps, and at the fuel strainers in the engine compartment.

There are four sump drains and one filter drain in each wing.

1. The ***leading edge tank sump*** is located on the underside of the outboard wings just forward of the main spar.
2. The ***boost pump sump drain*** is located at the bottom center of the nacelle, forward of the wheel well.
3. The ***transfer pump sump drain*** is just outboard of the wing root, forward of the flap.
4. The ***low point fuel drain*** is inside of the wheel well, which is the lowest point in the fuel system.

5. The ***firewall fuel filter drain*** is opened by pulling the ring on the engine firewall located under the cowling.

508. FUEL VENT SYSTEM

The fuel system is vented through a heated extended vent that is coupled to a recessed ram scoop vent. The vents are located on the underside of the wing, adjacent to the nacelle. The recessed ram scoop acts as a backup vent should the heated extended vent become blocked.

Both vents are connected to the same vent line and provide ram air pressure to prevent the tanks from collapsing as they lose fuel to the engines.

The extended (external) vent is electrically heated by a wrapped wire coil.

The fuel vent system incorporates a siphon-break valve feature, which opens when a negative pressure is sensed in the vent system. Introducing air into the vent system breaks the siphoning action. Thermal expansion is normal as fuel is warmed and to prevent fuel tank rupture, the fuel will vent through the vent system and flow overboard out of the heated vent.

509. FIREWALL SHUTOFF VALVES

The last component of the fuel system is the firewall shutoff valves. These valves are on the firewall between the nacelle fuel tank and the engine. These valves are to be closed only in the event of an emergency.

The firewall shutoff valves receive power from the No. 1 and No. 2 Fuel Buses, respectively; however, in the event of a fuel bus failure, the firewall shutoff valves are also powered by the hot battery bus.

The firewall shutoff valve circuitry is protected by the FIREWALL VALVE circuit breaker located on the fuel management panel and a fuse on the hot battery bus.

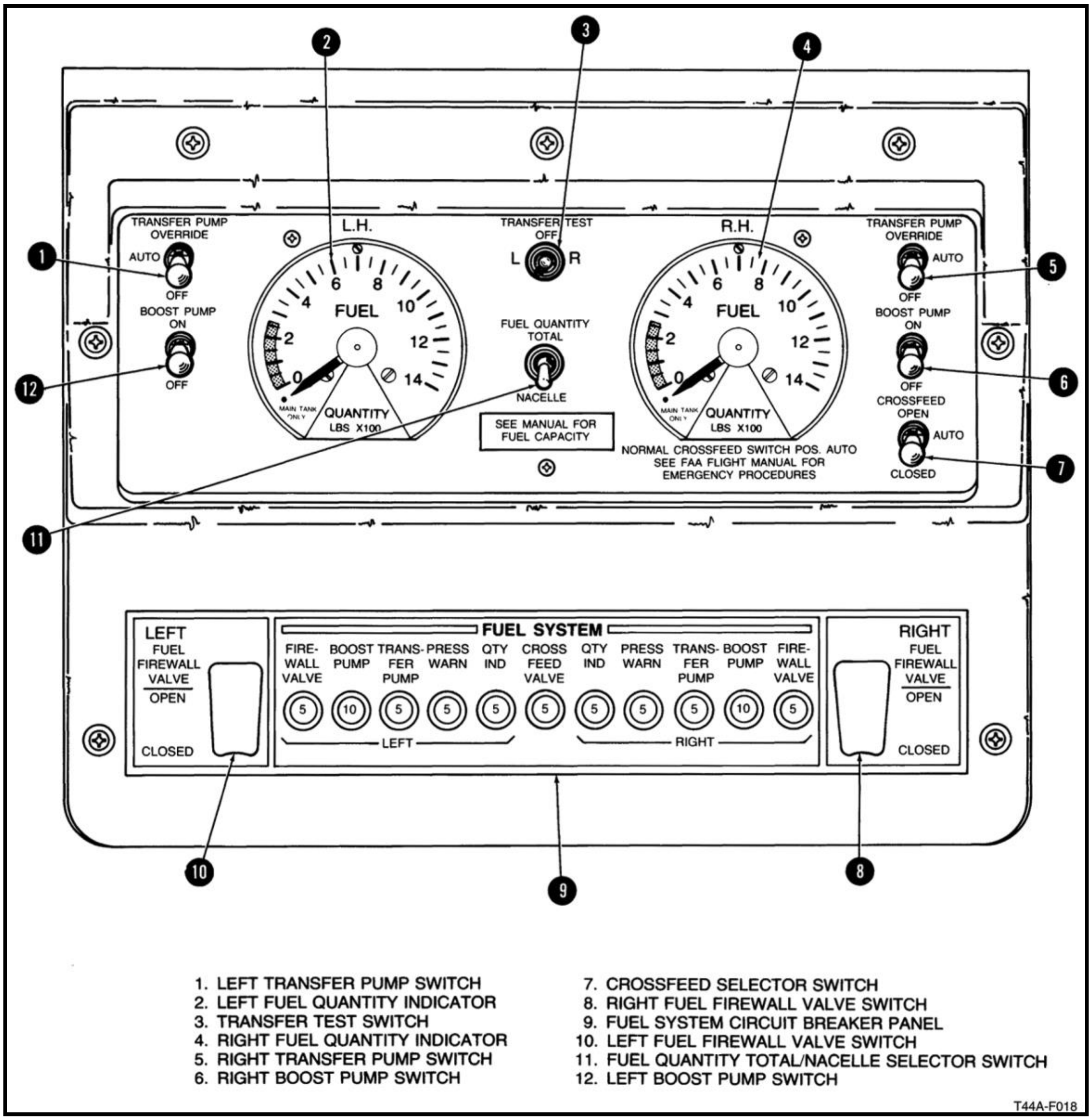


Figure 5-3 Fuel Management Panel

The fuel system is monitored and controlled from the cockpit through the fuel management panel. The fuel management panel is located to the left of the pilot. On this panel you will find:

Fuel Quantity Indicators

There are two (2) fuel quantity indicators, one for each engine. Each indicator is calibrated from 0 to 14 in hundreds of pounds with a yellow arc marked to indicate 265 pounds.

There are five capacitance-type probes on each side extending into the fuel to measure the quantity.

Fuel Quantity Total/Nacelle Selector Switch

Between the fuel quantity indicators is the fuel quantity total/nacelle selector switch placarded TOTAL and NACELLE.

With the selector switch set to TOTAL, the indicators display the fuel quantity located in the nacelle and wing tanks.

With the selector switch set to NACELLE, the indicators display the fuel quantity in only the nacelle tanks.

Transfer Test Switch

Above the fuel quantity selector switch is the transfer test switch. This switch allows the pilot to check the operation of either the left or right fuel transfer pump.

The transfer pump test switch labeled TRANSFER TEST is a three-position toggle unit spring-loaded to the center OFF position.

Transfer Pump Switches

From the cockpit, the pilot can control the transfer pump through transfer pump switches. The left and right transfer pump switches are located on the upper corners of the fuel management panel. Each has three positions: OFF, AUTO and OVERRIDE.

Fuel transfer from the center section tank to the nacelle tank is initiated when the TRANSFER PUMP switches are placed in the AUTO position unless the tank is full.

Automatic transfer cycles will then maintain the nacelle quantity between 42 and 51 gallons until all wing fuel is depleted.

When all wing tank fuel has been used, a pressure sensing switch will sense the drop in fuel pressure in the transfer line and, after a 30-second delay, will terminate transfer pump operation, and a red NO FUEL TRANSFER annunciator light will illuminate.

The NO FUEL TRANSFER light also functions as an operation indicator for the transfer pump. If the light should illuminate before the wing fuel is depleted, the transfer pump has stopped transferring fuel to the nacelle tank. Extinguishing the NO FUEL TRANSFER light is accomplished by placing the transfer switch to OFF.

In the OVERRIDE position, the transfer pump is continuously energized. The float switches in the nacelle tank are bypassed and the 3 psi pressure switch is reset.

Boost Pump Switches

The boost pump switches located on the fuel management panel control the boost pumps. The boost pump switches are two position, toggle and lever-lock type switches. The switches are placarded BOOST PUMP ON and OFF. During normal operations both boost pump switches are set to ON.

When the boost pump switches are set to OFF, the engines use suction lift to pull fuel from the nacelle tank into the engine.

Fuel System Circuit Breaker Panel

The circuit breaker panel is located immediately below the fuel management panel and contains all associated circuit breakers and switches for the fuel system:

1. Fire Wall Valves
2. Boost Pumps
3. Transfer Pumps
4. Pressure Warning Light
5. Quantity Indicators
6. Crossfeed Valve

Firewall Shutoff Valve Switches

The firewall shutoff valve switches are two guarded switches located on the fuel management panel and give the pilot an electrical fuel shutoff capability at each engine firewall.

Each firewall shutoff valve switch is a two position switch controlling the corresponding valve located aft of the engine firewall. In the CLOSED position, fuel flow to its respective engine is completely cut off.

During normal operation, the firewall shutoff valve switch is in the OPEN position to allow fuel to reach the engine from the fuel tanks.

A hinged, red-colored guard prevents the switch from being inadvertently moved from the OPEN to CLOSED position.

CAUTION

Do NOT use the fuel firewall shutoff valve to shut down an engine except in an emergency. The engine-driven high pressure fuel pump obtains essential lubrication from fuel flow. When an engine is operating, this pump may be severely damaged while cavitating if the firewall valve is closed before the condition lever is moved to FUEL CUTOFF position.

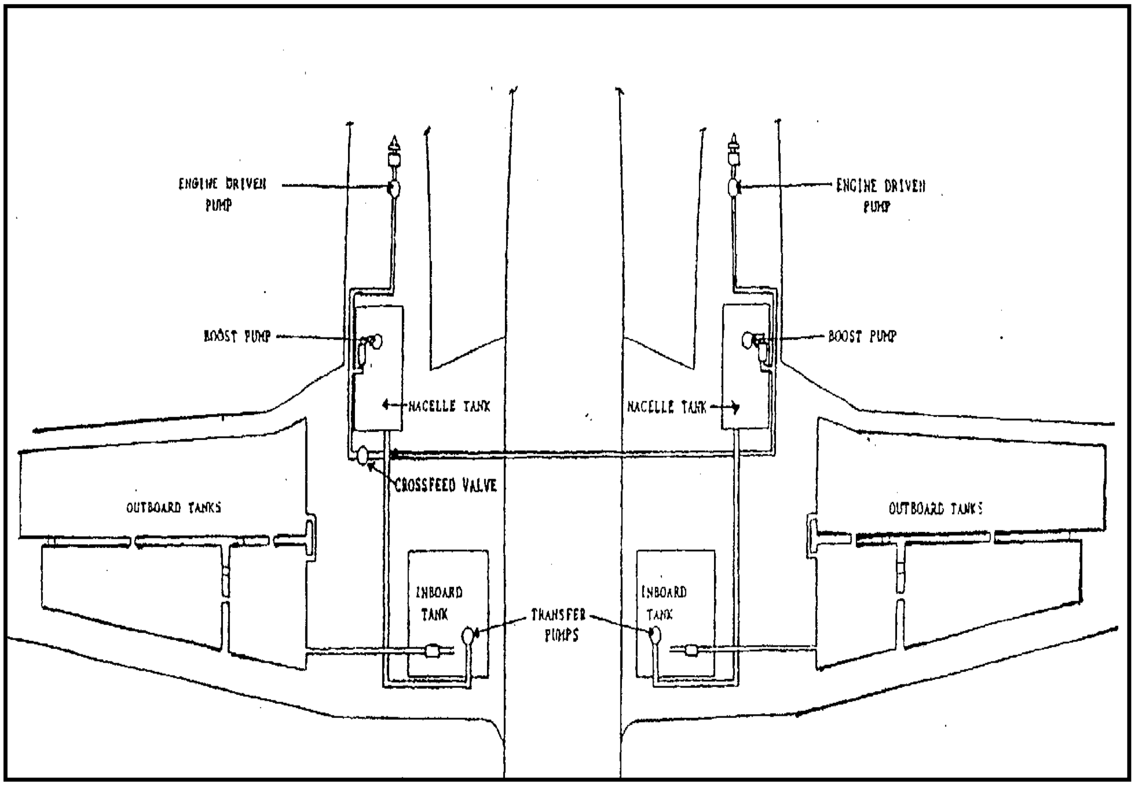


Figure 5-4 Crossfeed Section

510. CROSSFEED SYSTEM

The crossfeed system is used to crossfeed fuel from fuel tanks on one side of the aircraft to the engine on the opposite side of the aircraft. The crossfeed system cannot be used to transfer fuel from one nacelle to the other nacelle. Generally, crossfeeding is used when a boost pump fails or an engine fails.

Crossfeed Valve

The crossfeed valve is located on the outboard side of the left wheel well.

The crossfeed valve is dual powered. It normally receives electrical power from the No. 1 fuel bus; however, the crossfeed valve is also connected to the hot battery bus.

The crossfeed valve circuit is protected by a circuit breaker placarded CROSSFEED VALVE located on the fuel management panel.

Normally, in the AUTO position the crossfeed valve is automatically controlled by a pressure sensor in the fuel supply line; however, the crossfeed valve can also be manually opened or closed by a switch on the fuel management panel.

Crossfeed Switch

From the cockpit, the Crossfeed Switch located on the fuel management panel controls the crossfeed valve. It is a three-positioned toggle-type switch placarded OPEN, CLOSED, and AUTO.

With the crossfeed switch in the OPEN position, the crossfeed valve is open.

With the crossfeed switch in the CLOSED position, the crossfeed valve is closed.

Under normal flight the valve is closed and the switch is left in AUTO position.

With the crossfeed switch in the AUTO position, the crossfeed control circuitry is connected to the boost pump pressure sensing switches. If these sensing switches detect a pressure drop from a nominal 30 psi to below 5 psi, the system automatically opens the crossfeed valve.

Do not fly with the crossfeed valve open under normal conditions as the strongest boost pump will feed both engines and an imbalance will occur.

Loss of a boost pump and an engine on the same side will result in the fuel on that side being unusable.

FUEL SYSTEM QUIZ

1. Which of the following fuel system components are not dual powered?

   a. Boost pumps
   b. Transfer pumps
   c. Crossfeed valve
   d. Firewall shutoff valves

2. The total fuel system capacity is ________ gallons, of which_______ gallons are usable.

3. Which of the following float switches will deenergize the transfer pump?

   a. 42 gallon
   b. 51 gallon
   c. 59 gallon
   d. 61 gallon
   e. Both b and c

4. The transfer pump is located in the nacelle tank and transfers fuel from the center section tank to the nacelle tank.

   TRUE FALSE

5. Which of the following actions does not occur when the transfer pump switch is placed in the OVERRIDE position?

   a. Power is continuously supplied to the transfer pump
   b. The float switches in the nacelle are bypassed
   c. The 3 psi pressure switch is reset
   d. The output rate of the pump is increased
   e. All of these actions will occur

6. The purge valve opens to purge air and excess fuel any time the starter switch is placed in the IGNITION and START position.

   TRUE FALSE

7. How many fuel drains are on each wing?

   a. 2
   b. 3
   c. 4
   d. 5
   e. 6

8. The boost pumps provide a pressure of approximately __________psi to the engine driven high pressure pump.

9. The boost pump is used to ___________________ & _______________________.

10. The transfer pump is used to ____.

11. What are the cockpit indications if the transfer pump is NOT transferring fuel?

____

12. How is a transfer pump failure noted?

____

13. How do you turn off the no fuel transfer light?

____

14. The steps for the single engine crossfeed procedure are

(bp) ____
(tp) ____
(xf) ____
(bp) ____

15. If the transfer pump circuit breaker pops, what light (s) will illuminate on the annunciator panel?

____

16. If the transfer pump is inoperative, how many gallons of fuel are unavailable?

____

17. What items on the left fuel bus are operational if the fuel panel circuit breaker is popped?

____
____
____

18. Can you crossfeed from the left nacelle tank to the right engine with the left firewall valve closed?

____

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER SIX
FLIGHT CONTROLS

600. OBJECTIVES

At the end of this lesson, you should be able to...

1. Label and describe the operation of the primary flight controls.
2. State the items incorporated on the control wheel.
3. Describe the rudder pedal functions.
4. Describe the operation of the nose wheel steering system.
5. State the function of the elevator trim system.
6. Describe the operation of the manual elevator trim tab.
7. Describe the operation of the electric elevator trim system.
8. Describe the operation of the aileron trim tab system.
9. Describe the function of the aileron trim control knob.
10. Describe the operation of the rudder trim tab system.
11. State the function of the rudder trim tab control knob.
12. List all of the components of the flight control lock system.
13. State the function of the flap motor.
14. Match flap positions to the percentage of travel.
15. Describe the selection of flap positions.

NOTES

601. FLIGHT CONTROLS

At the end of this topic, you should be able to label and describe the operation of the primary flight controls of the T-44C aircraft.

602. PRIMARY FLIGHT CONTROLS

The primary flight control system consists of the following control surfaces:

1. Rudder

2. Elevator

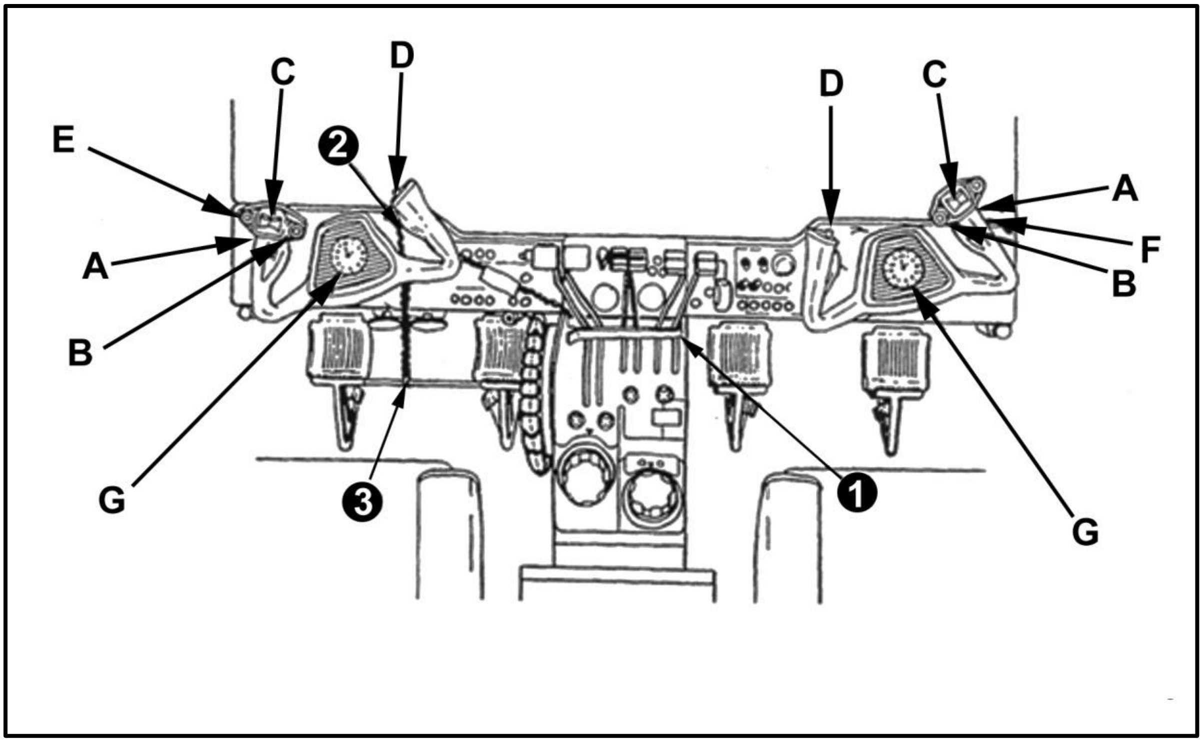
3. Ailerons

The pilot or copilot manually operates them from the cockpit through mechanical linkages.

The control wheel controls the ailerons and elevator.

The adjustable rudder/brake pedals control the rudder.

Trim control for the rudder, elevator, and ailerons is accomplished through a manually actuated cable-drum system for each set of control surfaces. These controls are discussed in the section on secondary flight controls.



1. ENGINE CONTROL LOCK
2. AILERON ELEVATOR LOCK PIN
3. RUDDER LOCK PIN

PILOTS CONTROL WHEEL

A. MICROPHONE SWITCH
B. AP/YD TRIM DISCONNECT SWITCH
C. ELEVATOR TRIM SPLIT THUMB SWITCH
D. MAP LIGHT SWITCH
E. PITCH SYNC/CWS SWITCH
G. EIGHT DAY CLOCK

CO-PILOTS CONTROL WHEEL

A. MICROPHONE SWITCH
B. AP/YD TRIM DISCONNECT SWITCH
C. ELEVATOR TRIM SPLIT THUMB SWITCH
D. MAP LIGHT SWITCH
F. GO AROUND SWITCH
G. EIGHT DAY CLOCK

Figure 6-1 Flight Controls

Control Wheel

The elevator and aileron control surfaces are manually controlled through the pilot or copilot control wheel. The control wheel contains the following:

1. Microphone Switch

2. AP/YD/Trim Disconnect Switch

3. Elevator Trim Split-Thumb Switch

4. Map Light Switch

5. Pitch Sync Switch

6. Go Around Switch (copilot yoke only) and Eight Day Clock

Rudder Pedals

The aircraft rudders and nosewheel steering are controlled with the pilot or copilot rudder pedals.

603. CONTROL LOCK

The control lock is a removable lock assembly consisting of two (2) pins and an elongated U-shaped strap interconnected by a chain.

The control lock ensures positive locking of the rudder, elevator, aileron control surfaces, and engine controls including power levers, propeller levers and condition levers.

To install the control lock:

1. Insert the strap over the aligned engine control levers from the copilot's side.

2. Insert the aileron elevator locking pin through the guide hole in the top of the pilot's control column assembly. This locks the control wheels in a forward left aileron position.

3. Insert the large pin horizontally through both of the pilot's rudder pedals. This locks the rudder pedals in the neutral position.

CAUTION

> ***DO NOT*** tow the aircraft with the rudder control lock installed as serious steering linkage damage can result.

604. SECONDARY FLIGHT CONTROLS

Secondary flight controls consist of trim tabs and wing flaps.

605. TRIM

Trim tabs are provided for all flight control surfaces on the aircraft and are manually activated and mechanically controlled by a cable-drum and jackscrew actuator system. The purpose of the trim tabs is to minimize control forces.

Elevator Trim

Elevator trim helps control rotational forces about the pitch axis.

Normally, the pilot or copilot controls elevator trim with the electric elevator trim switches and a trim disconnect switch on the pilot and copilot control wheels; however, elevator trim can also be controlled manually using the elevator trim wheel. The electric elevator trim motor is powered via the PITCH TRIM circuit breaker on the copilot right outboard subpanel.

The elevator trim tab is a little different from other trim tabs. It incorporates an anti-servo action. That is, as the elevator is displaced from the neutral position, the trim tab moves in the same direction as the applied control surface. This increases the effective control surface area and the manual force required to further deflect the elevator.

Electric Elevator Trim Switches

The electric elevator trim switches are dual element, thumb switches.

The left seat electric elevator trim switch takes priority over the right seat should both be simultaneously activated.

Trim Disconnect Switches

The trim disconnect switch is a bi-level, momentary push-type switch located on the outboard grip of the each control wheel.

Push the switch to the first level to disconnect the autopilot and yaw damper.

Push and hold the switch to the second level to disconnect the electric trim system. To permanently remove power, the pitch trim circuit breaker must be pulled.

Manual Elevator Trim Wheel

The manual elevator trim wheel controls the trim tab for each elevator. The elevator trim tab control wheel is placarded ELEVATOR TAB UP or DOWN.

A position arrow on the control wheel indicates the amount of elevator tab deflection in degrees from neutral.

Aileron Trim

The aileron trim tab helps to reduce control forces on the roll axis.

The ailerons are controlled with the pilot or copilot control wheels.

Aileron Trim Tab Control

The aileron trim tab deflects the left aileron trim tab from a neutral setting. A position arrow on the aileron trim tab control indicates the relative deflection. The wheel is NOT marked in degrees.

Full travel of the aileron trim tab (six units) is equal to 15 degrees of up and down movement. Once adjusted to a new position the aileron trim tab stays in its adjusted position.

Rudder Trim

The rudder trim helps to reduce control forces about the yaw axis.

You control the rudder through the pilot and copilot rudder pedals; however, you can fine tune the rudders using the rudder trim tab.

Rudder Trim Tab Control

The rudder trim tab control located on the far right side of the control pedestal. A position arrow on the rudder trim tab control indicates the amount of rudder trim tab deflection in degrees from neutral.

Once adjusted to a new position, the rudder trim tab stays in the adjusted position.

Turning the rudder trim tab control to the right will deflect the trim tab to the left side of the rudder. Turning the rudder trim tab control to the left will deflect the trim tab to the right side of the rudder.

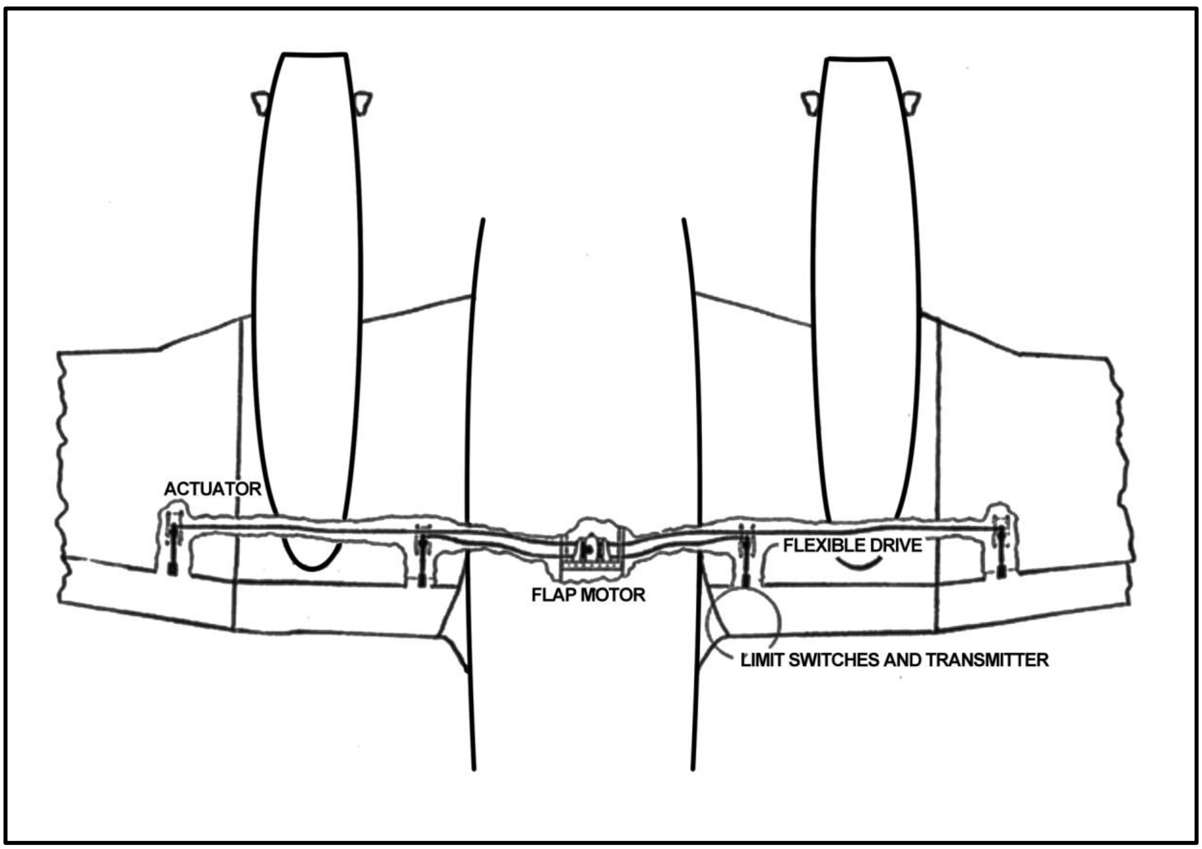


Figure 6-2 Wing Flap System

606. WING FLAPS

The purpose of the wing flaps is to increase lift allowing the aircraft to be flown at a slower speed.

The wing flaps are all-metal, slot-type, and are electrically operated.

The flaps consist of two sections for each wing; however, they are operated as a single unit during extension or retraction.

A separate jackscrew actuator actuates each section. The actuators are driven through flexible shafts by a single reversible electric motor mounted on the forward side of the rear spar. The motor incorporates a dynamic braking system through the use of two sets of motor windings.

Flap Switch Handle

The flap switch controls flap operations. The flap switch is a three-position lever, with a flap-shaped handle on the control pedestal and is placarded UP, APPROACH, and DOWN.

Flap Position Indicator

Flap position is noted in percent of travel from 0 to 100 percent. The indicator is shown on the Flap Position Indicator, placarded FLAPS, and located on the panel above the power control quadrant.

The flap positions are as follows:

When the flaps are set to UP, the flap indicator reads 0% and the flaps are extended 0 degrees.

When the flaps are set to APPROACH, then the flap indicator reads 35% and the flaps are extended 15 degrees.

When the flaps are set to DOWN, then the flap indicator reads 100% and the flaps are extended 43 degrees.

Flap Control & Motor Circuit Breakers

The flap position indicator and flap control circuits are protected by a circuit breaker placarded FLAP located on the copilot right outboard subpanel.

The flap motor is protected by a circuit breaker on the center console placarded WING FLAP MOTOR. If either of these circuit breakers pop, the flap motor will be inoperative.

FLIGHT CONTROLS QUIZ

1. Which of the following flight controls is NOT a primary flight control?

   a. Ailerons
   b. Elevator
   c. Rudder
   d. Wing flaps
   e. These are all primary flight controls

2. The primary flight controls are normally ___________ operated but can also be operated by electric servo motors in the autopilot/yaw damping mode.

   MECHANICALLY HYDRAULICALLY

3. Which of the following switches can ONLY be found on the copilot's yoke?

   a. Microphone switch
   b. Map light switch
   c. Go-around switch
   d. AP/YD/Trim disconnect switch
   e. Elevator trim split thumb switch

4. A go-around button is located on both the pilot's and the copilot's yokes.

   TRUE FALSE

5. The nosewheel is steered with the ________.

   a. Steering wheel
   b. Rudder pedals
   c. Yoke
   d. Nothing (nosewheel steering is NOT provided)

6. Which of the following secondary controls are NOT installed on the T-44C?

   a. Spoilers
   b. Wing flaps
   c. Rudder trim tab
   d. Aileron trim tab
   e. Elevator trim tabs

7. The rudder pedals are adjustable to an infinite number of positions to accommodate any size pilot.

   TRUE FALSE

8. On the T-44C, wing flaps are considered a secondary flight control.

TRUE FALSE

9. The elevator trim tab incorporates ________ action to increase the effective surface area thereby increasing the manual force required to deflect the elevator.

a. Servo
b. Anti-servo
c. Neutral
d. Fixed
e. Reverse polar

10. In the event that both electric trim switches are activated simultaneously which switch would take priority?

Left Seat Right Seat

11. Aileron trim tabs are located on both ailerons to reduce the control pressure in the roll axis.

TRUE FALSE

12. The aileron trim tab is adjusted by the trim wheel on the control pedestal with the amount of deflection indicated in relative units. Full travel of the control wheel is equivalent to _________degrees of up and down tab movement.

13. With the left engine inoperative, which direction should the rudder trim control wheel be turned?

LEFT RIGHT

14. When the rudder trim control wheel is turned to the left which side of the rudder will the trim tab move to?

LEFT RIGHT

15. The two circuit breakers required to be in for operation of the flaps are

____

____

16. The APPROACH position on the flap handle is equivalent to _____ percent of flap travel.

a. 15
b. 35
c. 45
d. 55
e. 65

17. The DOWN position on the flap handle is equivalent to _____ degrees.

a. 13
b. 33
c. 43
d. 53
e. 63

18. The aircraft should never be towed with the _____________control lock installed as serious steering linkage damage can result.

19. Which of the following items is NOT positively locked by the flight control lock?

a. Ailerons
b. Elevator
c. Rudder
d. Wing flaps
e. Condition levers

20. The motor for the flap system is _______Vdc.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER SEVEN
LANDING GEAR SYSTEMS

700. OBJECTIVES

At the end of this lesson, you should be able to...

1. Label and describe the operation of the landing gear and its components.

2. Label and describe the operation of the landing gear control switch.

3. Label and describe the operation of the wheels-up warning system and its components.

4. Label and describe the operation of the squat switches.

5. Label and describe the operation of the downlock and uplock switches.

6. Label and describe the operation of the components of the emergency landing gear system.

7. Label and describe the operation of the rudder brake system.

NOTES

701. LANDING GEAR

At the end of this topic, you should be able to label and describe the operation of the landing gear, its components and its controls. You should also be able to locate and describe the operation of the squat switches, downlocks, uplocks, and motor limit switches.

702. LANDING GEAR SYSTEMS

The landing gear is a retractable, tricycle type system. Located forward on the main wing spar and under the copilot seat is the landing gear motor (a single, split-field, reversible, 28-Vdc motor) that operates the landing gear.

A dynamic braking system and motor limit switches prevent coasting and over travel of the gear during extension/retraction. Limit switches are located forward of the main wing spar and under the pilot seat.

Torque shafts drive the main gear actuators. The duplex-chains drive the nose gear actuator.

Spring-loaded locks secure the main gear in the down position, while the jackscrew in the actuator secures the nose gear in an over center down position.

A jackscrew in each actuator, along with the dynamic brake holds the gear in the up position.

The landing gear system is protected by three (3) circuit breakers. The LANDING GEAR MOTOR CB located on the control pedestal circuit breaker panel, the LDG GR CB located adjacent to the gear handle, and the indicator CB placarded GEAR on the copilot's subpanel.

Landing Gear Control Handle

The Landing Gear Control Handle located on the copilot left subpanel controls landing gear system operation. The landing gear control handle is a manually actuated wheel shaped switch placarded LDG GEAR CONTROL UP and DOWN.

Gear retraction time is 5 to 7 seconds.

Gear extension time is 4 to 6 seconds.

Landing Gear Indicator Lights

When the landing gear is down, the three green landing gear down indicator lights illuminate. These indicator lights are located on the center subpanel, above the power quadrant.

Landing Gear Warning Lights

Located inside the plastic grip of the landing gear control handle are two red bulbs. If the two red bulbs illuminate, they indicate one of the following:

1. Gear is in transit.

2. The HD LT TEST switch is depressed

3. The Wheels Warning system is activated

Landing Gear Warning Lights Test Switch

Located on the copilot left subpanel, the landing gear warning lights test switch is placarded HD LT TEST. Press the test switch to test the two bulbs in the landing gear handle and the landing gear warning circuitry.

703. WHEELS UP WARNING SYSTEM

The warning horn, located behind the instrument panel, will sound intermittently, the red WHEELS UP light on each side of the glareshield will flash, and the red lights in the landing gear handle will illuminate when any of the three landing gear struts are not down and locked and either:

1. Both power levers retarded below a position which normally corresponds to 79% (+/-2%) N1 rpm position.

2. Flaps are extended beyond the approach position.

Landing Gear Warn Horn Silence Button

The WARN HORN SILENCE button is located on the copilot left subpanel and will function only when the flaps are up.

WARNING

The landing gear warning horn shall NOT be overridden in the traffic pattern or during final segment of an instrument pattern/approach where the intent or potential for landing exists.

NOTE

Cancellation of the wheels warning horn shall be at the direction of the pilot flying.

IF YOU ARE AIRBORNE WITH GEAR UP			
AND YOUR POWER LEVER POSITIONS ARE:	FLAPS UP <79%	APPROACH FLAPS <79%	BELOW APPROACH FLAPS ANYWHERE
YOU WILL GET GEAR WARNINGS:	WHEELS UP	HORN	GEAR HANDLE
WHICH CAN BE ELIMINATED BY:	• SILENCE BUTTON • WHEELS AND HORN ONLY GEAR HANDLE REMAINS • POWER > 79% POSITION • WHEELS DOWN	• POWER > 79% POSITION • WHEELS DOWN	• WHEELS DOWN

Figure 7-1 Wheels Warning

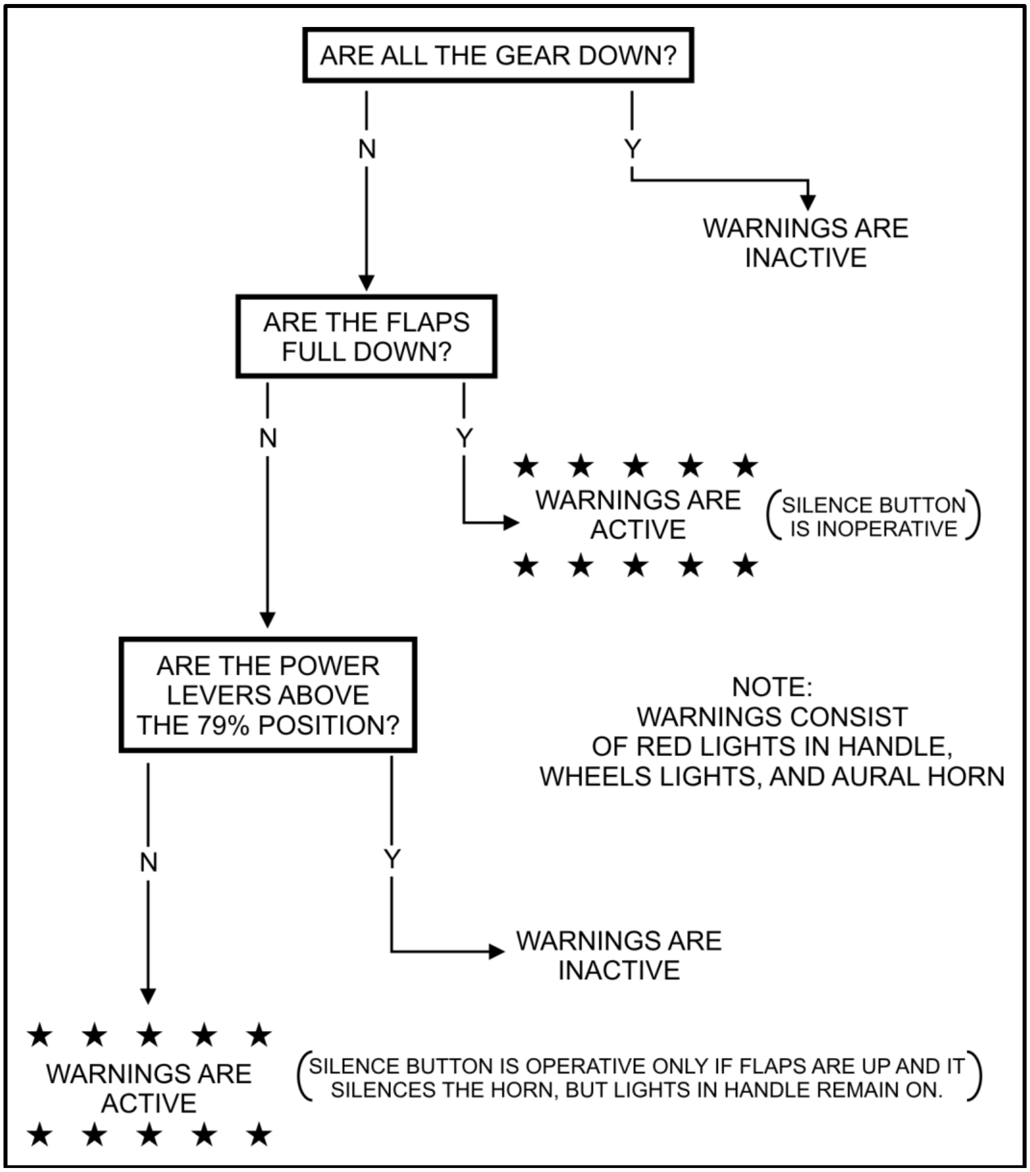


Figure 7-2 Landing Gear Warning System Logic Tree

704. LANDING GEAR SQUAT SWITCHES

A squat switch on each main landing gear shock strut controls the operation of various aircraft systems that function only during flight or only during ground operations.

These switches are mechanically actuated whenever the main landing gear shock struts are extended after takeoff or compressed after landing.

Right Squat Switch (HOTSHOTS)

When the right strut is compressed (weight on wheels), the right squat switch causes the

1. Flight ***h***our meter to be inoperative

2. Landing gear circuit to be in***o***perative

3. ***T***ransponder to be inhibited (standby)

4. ***S***tall warning to be deactivated

5. Right engine inlet lip boot ***h***eat to be inoperative

6. ***O***peration of some functions of the AHRS/DCU/GPS to be inhibited

7. ***T***AS & Radar to go to STBY

8. ***S***tall warning heat to go to 14V (if turned on)

WARNING

During runway operations, the landing gear handle downlock J-hook may NOT prevent you from raising the handle because of insufficient weight on the right main landing gear squat switch.

Left Squat Switch (LEAP)

When the left strut is compressed (weight on wheels), the left squat switch causes the

1. ***L***eft-engine inlet lip heat to be inoperative.

2. ***E***lectric heater to work in ground max mode

3. ***A***mbient air solenoid to close

4. ***P***ressurization controls (safety valve, door seal, preset solenoid, etc.) to go to non-operational mode.)

705. LANDING GEAR DOWNLOCK & UPLOCK SWITCHES

Downlock Switches

Each landing gear strut/wheel assembly has a downlock switch that is closed when the strut/wheel assembly reaches its fully extended position.

As each downlock switch is closed, the GEAR DOWN light for the corresponding landing gear illuminates. When all three downlock switches are closed, the wheels up warning system is deactivated and the red lights in the gear handle extinguish.

Uplock Switches

Each landing gear strut has an uplock switch that is closed when each strut is fully retracted.

If one or more of the wheel assemblies does not retract fully, the red light in the gear handle will not extinguish.
The crew may use the uplock switches to troubleshoot landing gear position.

Check the right gear by checking the PROP SYNC light. If the right uplock is closed (the right gear is fully retracted) the PROP SYNC light will remain extinguished when the prop sync switch is activated.

Check the nose gear by checking the landing lights. If the nose wheel uplock is closed, the landing lights will not illuminate. If the generator load does not increase after turning on the landing/taxi lights they are not illuminated, thus the nose gear must be closed.

Check the left gear by checking the electric heater. Normally, when the left uplock switch closes the electric heater will prevent the use of the 4 additional heater elements. To check the left uplock switch in the air, set the electric heater to NORM and note the generator loading. Then set the heater to GRD MAX while monitoring the generator loading. If the loading only fluctuates slightly or shows no significant difference, the left uplock switch is closed and the left gear is fully retracted. If the generator load increases with the electric heater switch set to GRD MAX the left landing gear assembly is NOT fully retracted.

706. LANDING GEAR MOTOR LIMIT SWITCHES

Two limit switches are located on the landing gear drive train assembly underneath the floor of the cabin and, in concert with dynamic braking action, prevent over travel of the gear during extension/retraction.

Up Limit

1. Deactivates the motor.

2. Activates the g-meter when the gear is retracted.

Down Limit

1. Deactivates the motor.

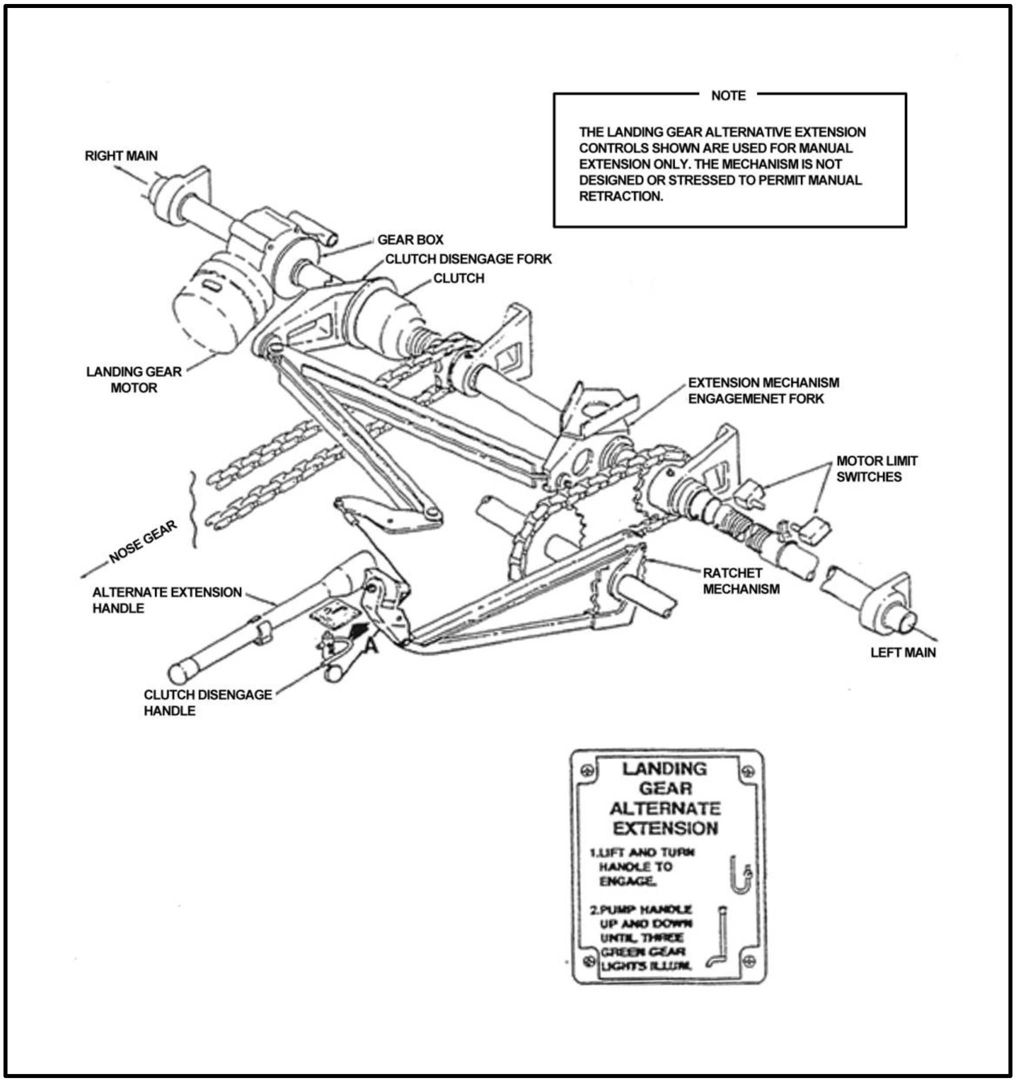


Figure 7-3 Landing Gear Alternate Extension Control

707. ALTERNATE EXTENSION SYSTEM

The landing gear may be manually extended if the electrical mechanism should fail; however, the gear CANNOT be manually retracted and no provision is made for gear extension with a mechanical linkage failure.

CAUTION

If a mechanical malfunction is known or suspected, do NOT attempt a manual gear extension.

The landing gear alternate extension handle is located on the cockpit floor to the right of the pilot seat. It is used to manually extend the landing gear.

Next to the alternate extension handle is the clutch disengage handle. During manual extension, the landing gear motor must be disengaged from the landing gear drive mechanism. To disengage the motor, you must lift the clutch handle up and turn it clockwise. Then pump the handle until the gear are down. See the NATOPS manual for details.

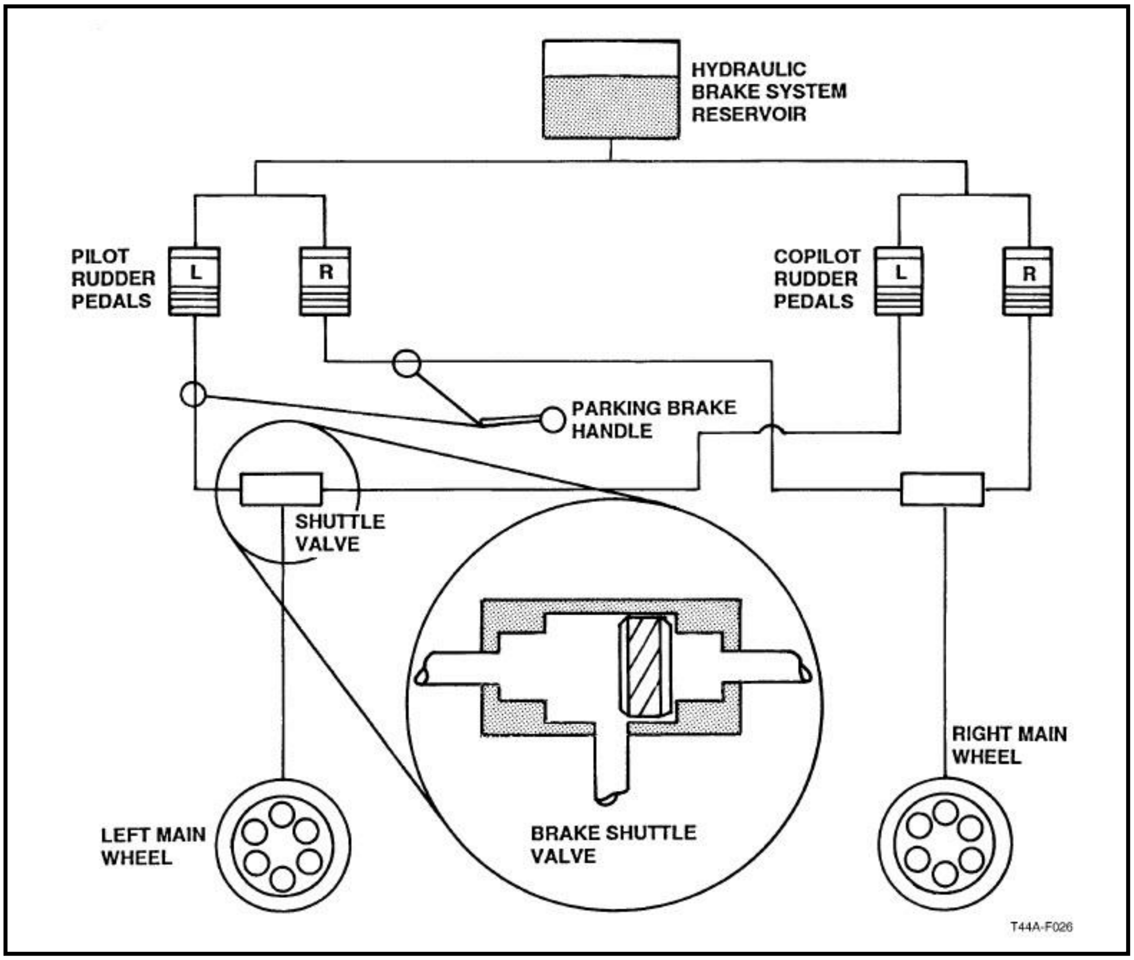


Figure 7-4 Brake System

708. BRAKE SYSTEM

The main landing wheels are equipped with multi-disc hydraulic brakes actuated by master cylinders and attached to the pilot and copilot rudder pedals.

A shuttle valve, adjacent to each set of pedals, permits braking action change over from one set of pedals to the other.

Dual parking brake one-way check valves are installed adjacent to the rudder pedals between the master cylinders of the pilot brake pedals and the wheel brakes.

Brake fluid is supplied to the system from the hydraulic brake system reservoir in the nose compartment.

The toe brake sections of the rudder pedals are connected to the master cylinders which actuate the system for the corresponding wheels.

NO emergency brakes are provided.

Parking Brake Handle

The Parking Brake Handle is located on the pilot right subpanel and is placarded PARKING BRAKE.

Pulling the handle full OUT sets the check valves in the system and any pressure subsequently applied by the pilot's (left seat) toe brakes is maintained.

Pushing the handle IN releases the parking brakes.

The parking brakes CANNOT be set using the copilot brake pedals.

CAUTION

The parking brake shall NOT be set during flight.

Wheel Brake Failure

In the event of a wheel brake failure:

1. Maintain directional control with rudder, nosewheel steering or differential power.

2. Use propeller reverse or beta to assist in deceleration.

3. If possible, maneuver into an open area and allow the aircraft to stop. Do NOT attempt to taxi.

A brake shuttle valve occasionally sticks which results in a loss of a brake on one side. After the aircraft has stopped, attempt to reset the shuttle valve by pulling aft on the top of the brake pedal.

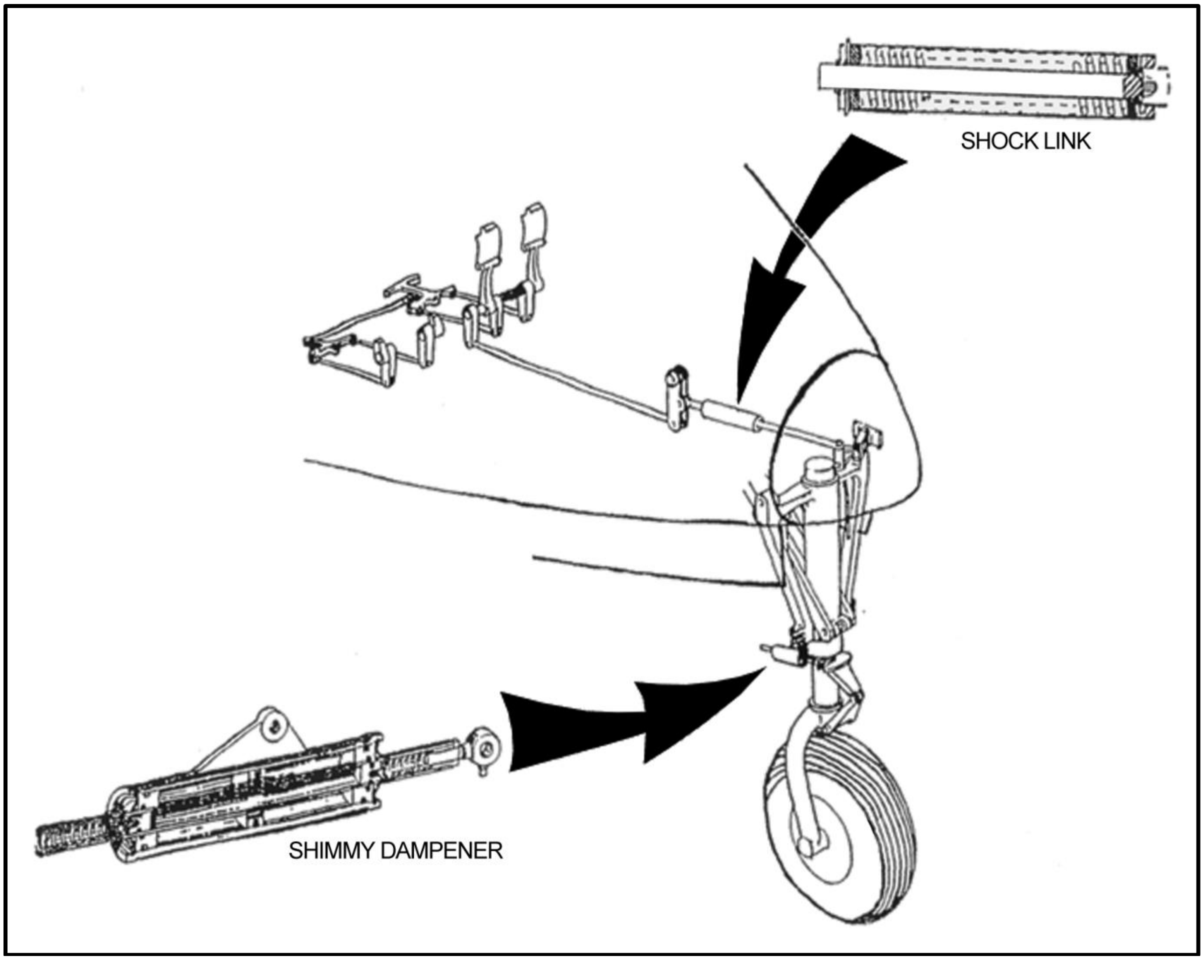


Figure 7-5 Nose Wheel Steering

709. NOSE WHEEL STEERING

The aircraft can be maneuvered on the ground by the steerable nose wheel system. Direct linkage from the rudder pedals to the nose wheel steering linkage allows the nose wheel to be turned 12 degrees left of center and 14 degrees right.

When rudder pedal action is augmented by main wheel braking action, the nose wheel can be deflected up to 48 degrees either side of center.

Retraction of the landing gear automatically centers the nose wheel and disengages the steering linkage.

LANDING GEAR QUIZ

1. The recommended airspeed for manually extending the landing gear is________ KIAS.

2. The landing gear system is retractable, tricycle type and __________ operated.

   HYDRAULICALLY ELECTRICALLY

3. To prevent coasting and over travel of the landing gear, the T-44C uses which of the following?

   a. Mechanical braking
   b. Dynamic braking
   c. Limit switches
   d. Both b and c
   e. All of the above

4. Which of the following situations will NOT illuminate the two red bulbs in the landing gear control handle?

   a. Landing gear is in transit
   b. Power levers above the 79% switches, gear up, and approach flaps
   c. HD LT TEST switch depressed
   d. Activation of the landing gear warning system
   e. Power levers above the 79% switches, gear up, and full flaps

5. Normal landing gear extension time is_______ to _______ seconds.

6. Under which of the following conditions will the red WHEELS UP light and the light in the gear handle illuminate simultaneously?

   a. Both power levers below the 79% N1 switch with the gear up
   b. Flaps extended beyond the approach position with the gear up
   c. HD LT TEST button is depressed
   d. Both a and b
   e. All of the above

7. Which of the following switches prevents the landing gear from being retracted on the ground?

   a. Left squat switch
   b. Right squat switch
   c. Landing gear downlock switches
   d. Landing gear uplock switches
   e. Landing gear motor limit switches

8. Which of the following switches open the ambient air solenoids in flight and allow the cabin to pressurize?

a. Left squat switch
b. Right squat switch
c. Landing gear downlock switches
d. Landing gear uplock switches
e. Landing gear motor limit switches

9. If the PROP SYNC annunciator light illuminates when the propeller sync switch is placed to the ON position, which landing gear switch is OPEN?

a. Right main uplock switch
b. Right main downlock switch
c. Left main uplock switch
d. Left main downlock switch
e. Nose gear uplock switch

10. While holding the electric heater switch in the GRD MAX position, the generator load remains the same as the generator load with the switch in the NORM position. This is an indication of the left main gear in the up position.

TRUE FALSE

11. The landing gear up limit switch does which of the following functions?

a. Illuminates the PROP SYNC annunciator light
b. Disables the GRD MAX position of the electric heater switch
c. Deactivates the g-meter when the landing gear is extended
d. Deactivates the landing gear motor and prevents over travel during extension

12. The landing gear down limit switch does which of the following functions?

a. Illuminates the PROP SYNC annunciator light
b. Disables the GRD MAX position of the electric heater switch
c Deactivates the landing gear motor and prevents over travel during extension
d. Deactivates the g-meter when the landing gear is extended
.

13. With a loss of brakes while attempting to taxi the pilot should activate the emergency air brake system to bring the aircraft to a stop.

TRUE FALSE

14. The amount of nose wheel steering available by using the rudder pedals only (no brakes) is _______ degrees left and ______ degrees right.

15. Which of the following steps is NOT a proper procedure to be performed in the event of a wheel brake failure?

a. Maintain directional control with the rudders and nose wheel steering
b. Activate the emergency braking system
c. Use propeller reversing or beta as required
d. Do NOT attempt to taxi
e. Pull aft on the top of the affected rudder pedal after the aircraft has stopped

16. While in flight, pressing the rudder pedals will move the nose wheel slightly within the wheel well.

TRUE FALSE

17. The motor for the T-44C landing gear is _______Vdc.

18. The two circuit breakers required to be in for the operation of the landing gear are
______________________________, ______________________________.

19. With the gear up, power levers below 79% N1 position, and the flaps in the approach position, what cockpit indications will be seen and heard?

______________________, ___________________, _______________________

20. How can you silence the landing gear warning horn in the above question?

_______________________________, ___________________________________

21. When does the red light in the landing gear handle illuminate?

______________________, ____________________, _______________________

22. List the items on the squat switches.

Left

L ________________________
E ________________________
A ________________________
P ________________________

Right

H ________________________
O ________________________
T ________________________
S ________________________
H ________________________
O ________________________
T ________________________
S ________________________

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER EIGHT
ENVIRONMENTAL SYSTEM

800. OBJECTIVES

At the end of this lesson, you should be able to...

1. Label the components of the environmental system.

2. Label and describe the operations of controls that affect cabin temperature.

3. List three (3) items which, when turned on, turn on the electric heater lockout system.

4. Label and describe the operation of the flow control unit.

5. Label and describe the operation of the controls which affect cabin pressure.

6. Label and describe the operation of the anti-icing and de-icing system and its components.

7. Label and describe the operation of the oxygen system and its components.

8. List five (5) items that, when in use, cause the wet compass to be erratic.

NOTES

801. PRESSURIZATION CONTROL SYSTEM

The pressurization control system of the T-44C aircraft is strictly to allow high altitude flying without use of an oxygen mask.

Components

The components, which affect cabin pressure, are:

1. Cabin Pressure Controller
2. Dual Cabin Altimeter
3. Cabin Rate of Climb Indicator
4. Outflow Valve
5. Safety Valve
6. Flow Control Unit

Cabin Pressure Controller

The cabin pressure controller is located on the center console, and pneumatically controls the outflow of air from the cabin.

The cabin pressure control switch is a three-position toggle switch:

In the DUMP position, opens safety valve completely to relieve all pressure differential.

In the TEST position, the safety valve closes giving control of the outflow valve to the controller.

The PRESS position is the normal position for this switch. When the LH squat switch is up (airborne, not activated) and the pressure control switch is set to PRESS, power is removed from a NORMALLY OPEN (N.O.) preset solenoid and a NORMALLY CLOSED (N.C.) safety (dump) solenoid. This action allows the cabin to begin pressurizing at the rate selected on the controller via vacuum forces through the preset solenoid.

The controller has two knobs, a rate knob and an altitude knob.
The rate knob allows you to control cabin rate of climb from approximately 50 fpm to 2,000 fpm.

The altitude knob allows you to select the desired cabin pressure altitude from 1,000 feet below sea level to 10,000 feet mean sea level (msl).

To avoid landing pressurized, you will adjust the cabin altitude knob so that the aircraft will be unpressurized from 500 ft AGL to touchdown. See NATOPS fig. 2-23 Pressurization Controller Setting for Landing.

The cabin altimeter and differential pressure gauge is located on the center instrument subpanel.

The long (big) needle indicates actual cabin altitude and the short (small) needle indicates pressure differential.

Cabin Rate of Climb Indicator

Next to the dual cabin altimeter is the cabin rate of climb indicator. The cabin rate of climb indicator displays actual cabin rate of climb or descent from 0 to 6,000 fpm.

Altitude Warning Annunciator Light

A pressure sensor switch is mounted on the forward pressure bulkhead. When that switch senses that the cabin altitude is at 9,500 to 10,000 ft. MSL, it completes the circuit, which illuminates the ALT WARN annunciator light.

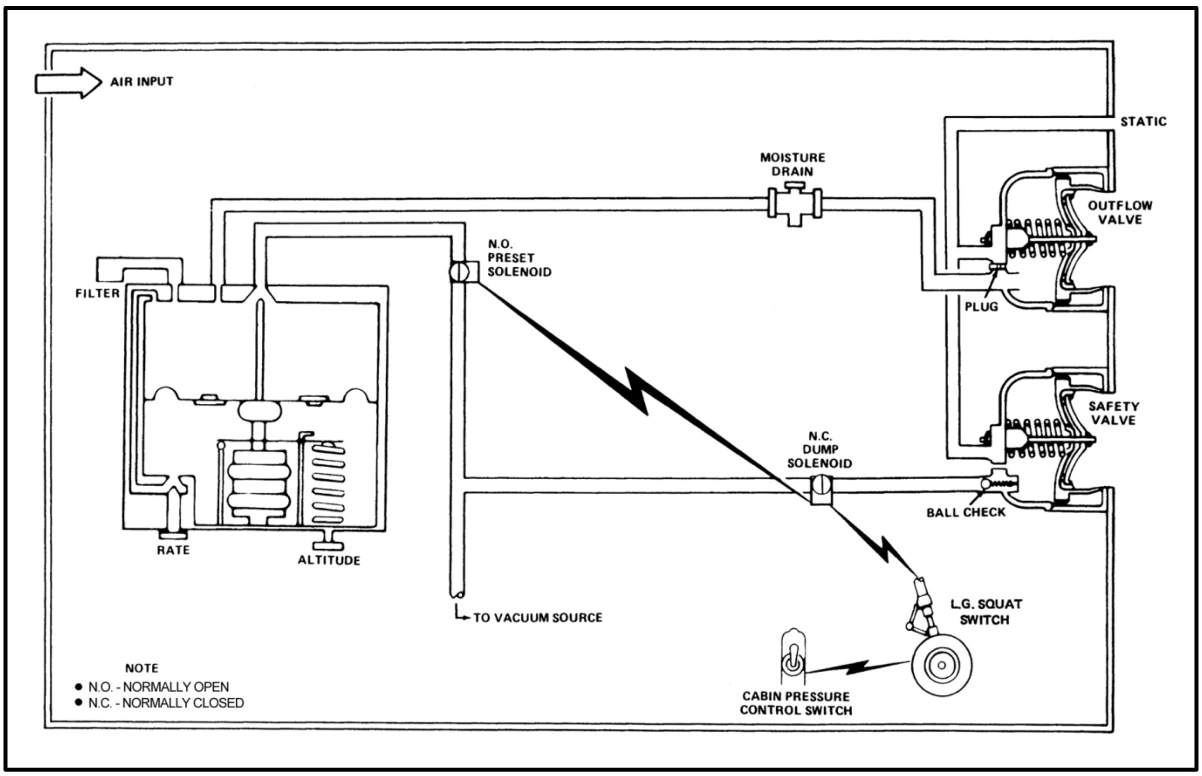


Figure 8-1 Pressurization Control

Outflow Valve

The outflow valve is located on the aft pressure bulkhead and does three (3) things:

1. Meters the outflow of cabin air in response to vacuum control forces from the controller.

2. Contains a pre-adjusted relief valve set to ensure that the cabin differential does not exceed 4.7 PSID.

3. Incorporates a negative pressure differential relief diaphragm which prevents the pressure differential from becoming negative. (This means, the cabin altitude cannot be higher than the aircraft altitude.)

Safety Valve

The safety valve is also located on the aft pressure bulkhead near the outflow valve.

The safety valve is connected to the cabin pressure control switch and is wired through the left landing gear squat switch.

When the control switch is set to DUMP (or the LH squat switch is down and the switch is set to PRESS), the safety valve serves as a dump valve, meaning it completely opens to relieve the entire pressure differential between the external air pressure and the cabin air pressure.

A second function of the safety valve is to back up the outflow valve. The safety valve also contains a pre-adjusted relief valve. This valve is set to ensure that differential pressure does not exceed 4.9 psi. *(Careful, this is easy to confuse with the pre-adjusted valve in the outflow valve.)*

It also incorporates a negative pressure differential relief diaphragm, which prevents the pressure differential from becoming negative. The cabin altitude cannot be higher than the aircraft altitude.)

The safety valve will close when the:

1. landing gear strut extends (at rotation)

2. cabin pressure switch is set to TEST

3. vacuum source is lost

4. electrical power is lost

Flow Control Unit

A flow control unit is located forward of the firewall in each nacelle. The flow control unit has two functions:

1. Controls the bleed air from the engine to make it usable for pressurization, heating, and ventilation.

2. Draws ambient air into a venturi to mix with the bleed air.

Operation

Before takeoff with the engines not running, the safety valve is closed, the outflow valve is closed, and cabin altitude equals aircraft altitude.

After the engine(s) are started, the compressor bleed air is tapped off the manifold at a T-fitting as pneumatic air and passed through a venturi to produce a low pressure vacuum. This vacuum holds the safety valve open until take off.

On take-off, the dump solenoid closes and releases the compressor bleed air vacuum, which closes the safety valve. The preset solenoid opens and a time delay relay is actuated which allows the left engine to commence pressurization sequencing six seconds before the right. The time delay prevents an excessive pressure bump. (A pressure bump occurs when the aircraft pressurizes too quickly.)

The flow control unit then mixes engine bleed and ambient air.

The mixture of engine bleed and ambient air will go through (to cool) or by-pass (for heat retention) a heat exchanger in the wing center section before entering the cabin.

As the aircraft climbs, the outflow valve begins modulating outflow of air in accordance with the cabin pressure controller to maintain the selected rate of climb and cabin altitude until the maximum cabin differential of 4.7 psid is reached.

Once the maximum cabin pressure differential is reached, the outflow valve will release air to maintain the maximum cabin differential rather than the setting of the cabin pressure controller. After this point, the cabin altitude begins to climb at approximately the same rate as the aircraft.

Heating System Components

1. Compressor Bleed Air

2. Ambient Air

3. Flow Control Unit

4. Heat Exchanger
5. Electric Heater
6. Duct Work
7. Outlets

Air-Conditioner (16,000 BTU)

Cooling System Components

The components of the cooling system are:

1. Compressor Bleed Air
2. Ambient Air
3. Flow Control Unit
4. Heat Exchanger
5. Condenser
6. Receiver Dryer
7. Evaporator
8. Vent Blower
9. Duct Work
10. Cabin Ceiling Outlet

Controls

The controls for the heating and cooling systems are located on the environmental control panel**.** These controls include:

1. Bleed Air Valve Switches
2. Vent Blower Switch
3. Electric Heat Switch
4. Manual Temperature INCR/DECR Control

5. Cabin Temperature Control Switch

6. Cabin Temperature Mode Selector Switch

Bleed Air Valve Switches

Bleed air is the warm, compressed air from the compressor section of the engine and is the primary source of environmental air.

The bleed air valve switches are placarded BLEED AIR VALVES OPEN - CLOSED. The switches actuate the electric solenoids in the flow control units of their respective engine to send bleed air from the engine to the cabin. A failure of both generators and the main battery will cause the cabin to depressurize as the bleed air valves are electrically held open. Since no more air is coming in and all aircraft will leak, the cabin will slowly depressurize.

Vent Blower Switch

The vent blower switch is placarded VENT BLOWER HIGH - LOW - AUTO and controls blower fan speed.

Electric Heat Switch

The electric heat switch is placarded ELEC HEAT. The switch has three (3) positions: GRD MAX, NORM, and OFF.

When in the GRD MAX position and the aircraft is on the ground, the system uses eight (8) heating elements to provide the maximum amount of electrical heat. This setting is used to initially warm up the cabin.

However, the switch is solenoid held in the GRD MAX position. Once the aircraft takes off, the switch will automatically drop to NORM because the left squat switch de-energizes the solenoid on liftoff.

In the NORM position, up to four (4) heating elements are automatically turned on and off in conjunction with the cabin thermostat to supplement bleed air heating.

In the OFF position, all electric heat is turned off and cabin heating is solely provided by bleed air.

Cabin Temperature Mode Selector Switch

The cabin temperature mode selector switch has three positions: AUTO, MANUAL HEAT, and MANUAL COOL.

In the AUTO position, the temperature sensing units in the cabin initiate heat or cool commands to bring the cabin environment to the desired temperature as set by the cabin temperature control switch.

In the MANUAL HEAT position, cabin temperature is manually controlled by the pilot through the manual temperature INCR/DECR control.

In the MANUAL COOL position, cabin temperature is manually controlled by the pilot through the manual temperature INCR/DECR control.

Manual Temperature INCR/DECR Control

Manual temperature INCR/DECR control is a spring loaded switch placarded MANUAL TEMP INCR - DECR. Whenever the cabin temperature mode selector switch is set to MANUAL HEAT or MANUAL COOL, the INCR/DECR switch controls the motor-driven bypass valves in the wing center sections.

Cabin Temperature Control Switch

When the cabin temperature mode selector switch is set to AUTO, the cabin temperature control switch allows you to set the cabin temperature level. The switch works with the temperature sensing units in the cabin to automatically initiate heating or cooling commands to reach the designated cabin temperature. The temperature control switch is marked in units.

If the automatic temperature control box malfunctions, the CABIN TEMP mode switch can be placed in the MANUAL position and the temperature may be regulated with the INCR/DECR switch. INCR/DECR switch does not operate when the CABIN TEMP mode switch is in AUTO.

Operation

After generators are operating (or an APU of sufficient capacity is connected), the CABIN TEMP mode switch is set to AUTO, and the cabin temperature control is set to a comfortable temperature.

With the vent blower switch set to AUTO, the vent blower automatically begins continuous operation.

With the electric heat switch set to NORM, the air-conditioner or electric heater will function as needed, based on the cabin temperature control switches commands to the bypass valve.

After the air enters the cabin, it is distributed though the duct system and is recirculated.

Operation of Heating System

On a very cold day, the best heating can be obtained by:

1. Setting the electric heat switch to GND MAX.

2. Setting the vent blower switch to HIGH.

3. Open Bleed Air Valves.

4. Closing all overhead outlets.

5. Turn the CABIN TEMP knob from Full Cold to INCR Heat.

6. Setting the CABIN TEMP MODE to AUTO.

7. This will force all the air through the heater.

Operation of Cooling System

On a hot day, the maximum cooling occurs by:

1. Closing both bleed air valves.

2. Setting the cabin temp switch to full decrease.

3. Setting the vent blower switch to HIGH.

4. Setting the CABIN TEMP MODE to AUTO.

5. Opening all overhead air outlets.

6. This will allow cool air conditioning air to cool top down. If the overhead outlets remain closed, cool air will be vented through the lower heat vents.

The air conditioner evaporator is mounted in the nose. The evaporator is electrically driven and has a rated capacity of (16,000) BTU. The air conditioner uses freon.

Electric Heater Lockout

To prevent electrical system overload, the electric heater is locked out when any one of the following items is turned on:

1. Windshield Heat

2. Prop De-ice

3. Engine Lip Boot Heat

802. OXYGEN SYSTEM

At the end of this topic, you should be able to label and describe the operation of the oxygen system and its components.

Components

The oxygen system is designed primarily as an emergency use system, but may also be used to provide supplemental oxygen at cabin altitudes above 10,000 feet.

The oxygen system consists of:

1. Oxygen Supply Cylinder
2. Pressure Regulator Control Valve
3. Oxygen Supply Pressure Gauges
4. Outlets
5. Oxygen Masks

Oxygen Supply Cylinder

The 49 cu.ft. oxygen supply cylinder is installed behind the aft bulkhead. A full cylinder contains oxygen at a pressure of 1850 psi +/- 50 psi at a temperature of 70 degrees Fahrenheit.

Pressure Regulator Control Valve

Connected to the oxygen supply cylinder is the pressure regulator control valve. This valve is controlled by a remote push-pull knob located on the overhead panel in the cockpit.

Oxygen Supply Pressure Gauges

An OXYGEN SUPPLY PRESSURE gauge is located on the oxygen service panel on the right side of the fuselage. The gauge is next to the filler valve.

In the cockpit, you can monitor the oxygen cylinder pressure through the OXYGEN SUPPLY PRESSURE gauge on the copilot right side panel.

Oxygen Masks

Diluter-Demand Oxygen Masks are available for the pilot, copilot and observer.
The oxygen masks are diluter-demand/100% regulator masks. They provide the proper dilution of oxygen with cabin air to conserve oxygen at lower altitudes. A visor is also provided on the mask.

Each diluter-demand mask has a pressure detector/indicator in the oxygen system line to provide a visual indication of oxygen flow.

A green signal indicates adequate oxygen flow.

A red signal in the window of the detector indicates low or no oxygen flow.

Diluter Control Lever

The diluter control lever allows you to control the mix of oxygen and air in the mask.

In the NORMAL position, the regulator automatically schedules a proportional increase in oxygen as the altitude increases.

In the 100% position, 100% oxygen will be provided upon inhalation, regardless of altitude.

At cabin altitudes below 20,000 ft., the lever should be placed in the NORMAL position to conserve oxygen if used for supplemental O2.

When not in use, the masks should be stowed with the diluter lever in the 100% position.

EMER control setting, provides 100% oxygen at a positive pressure to the mask and will purge the mask and visor.

Microphone

Each diluter-demand mask has a microphone incorporated in the mask assembly.
To use the microphone while wearing the mask, set the MIC switch on the audio panel from “BOOM” to “MASK”.

803. ANTI-ICE/DE-ICE SYSTEM

At the end of this topic, you should be able to label and describe the operation of the anti-icing and de-icing system and its components. You will also be able to list five (5) items that cause the wet compass to be erratic.

Components

The anti-ice and the de-ice system includes:

1. Windshield Wiper System

2. Windshield Anti-ice

3. Power Plant Ice Protection System (lip boot and ice vanes)

4. Fuel System Anti-ice

5. Propeller Electrothermal De-icer System

6. Pitot and Stall Warning Anti-ice Systems

7. Surface De-icer System

Windshield Wiper System

The windshield wiper system has two electrically operated windshield wipers that are provided for flight and ground operations.

CAUTION

Do not operate on dry glass.

Windshield Anti-ice

To prevent the formation of ice on the windshields, windshield heat is provided for both the pilot and copilot windshields. A controller with a temperature sensing unit maintains the temperature on the windshield surface at 95 degrees Fahrenheit.

Windshield heat is controlled with the windshield anti-ice switch located on the pilot subpanel. The switch is placarded WSHLD ANTI-ICE BOTH, OFF, PILOT.

An electric heater lockout will disable the electric heater when windshield heat is in use.

CAUTION

Unreliable operation of the magnetic compass will occur during use of windshield anti-ice.

Power Plant Ice Protection System

Anti-ice protection for each engine is provided by two systems: the mechanically activated engine ice vanes and the electrical lip boot heat.

Engine Ice Vanes

The mechanical system consists of an adjustable push-pull handle for each engine located directly under the pilot's control column. When pushed in the inertial ice vane is retracted in the up position for flight under normal conditions. When pulled out, the vane is extended and locked in the down position.

When potential icing conditions are encountered, the pilot can extend the vanes by pulling the two controls placarded: PULL FOR ENGINE ICE PROTECTION, LEFT ENG, RIGHT ENG.

When the movable vane is extended, lighter air turns abruptly to enter the engine plenum while heavier air (snow, water, ice) rushes past the plenum entrance and is discharged through the bypass duct.

1. Engine Torque decreases approximately 40-60 ft.-lbs.

2. ITT may increase

3. Range will be reduced 10-12%

Engine Lip Boot Heat

The electrical anti-ice system consists of an electrothermal boot attached to the air intake lip of each engine.

Engine lip boot heat is controlled by respective switches on the pilot subpanel placarded ENG LIP BOOT.

Fuel System Anti-Ice

The fuel system is protected from ice in three areas:

1. With the fuel additive PRIST

2. With the oil-to-fuel heater which automatically heats the fuel

3. Electrical heating elements (or jackets) protect the external fuel vent from ice. This fuel vent is located below each wing and serves both the nacelle and wing tanks.

The pilot controls the fuel vent, electrical heat jackets with the FUEL VENT switches on the pilot subpanel.

The pilot controls the fuel control unit pneumatic line, electrical heat jackets with the FUEL CONTROL switches on the pilot subpanel.

The fuel line heaters are powered by the No. 1 and No. 2 Subpanel Buses.

CAUTION

> To prevent overheat damage to electrically heated anti-ice jacket, FUEL VENT HEAT and FUEL CONTROL HEAT switches should NOT be turned ON unless cooling air will soon pass over the jackets.

Propeller Electrothermal De-Ice System

To remove ice from the propellers, electrothermal deicing boot**s** are attached to each propeller blade.

Each thermal boot consists of one outboard heating element and one inboard heating element.

The boots receive electrical power through the de-ice timer, slip ring and brush block.

The pilot controls the propeller deicing boots with the propeller heat switch. The switch is placarded PROP and is located on the right hand pilot subpanel.

The pilot monitors current consumption through the propeller ammeter on the left hand pilot subpanel.

Propeller De-Icer Timer

The propeller de-ice timer cycles power to the heating elements in this order:

1. ***RH*** propeller, outboard segments (all 3 blades)

2. ***RH*** propeller, inboard segments (all 3 blades)

3. ***LH*** propeller, outboard segments (all 3 blades)

4. ***LH*** propeller, inboard segments (all 3 blades)

All above segments are heated 34 +/-6 seconds. Normally, this requires more than two minutes to complete all four segments of one cycle.

Each propeller blade boot draws approximately 5 to 6 amps of current. Thus, with three blades drawing power, the propeller amperage should read between 14 to 18 amps.

Pitot and Stall Warning Anti-Ice Systems

To prevent icing, the pitot tubes and stall warning have electrical heating elements.

On the deck, electrical power to the stall heating elements is reduced to 28 Vdc to 14 Vdc.

Pitot heat can be used on the deck for short periods to check their operation. Prolonged heating on the deck would cause damage to the pitot tubes.

The pilot controls these heating elements through the PITOT and STALL SYS switches located on the anti-ice/de-ice control panel

In the event of an electrical overload, the circuit breaker will disconnect the heating circuit and trip the toggle switches to the down position.

CAUTION

Except during takeoff roll, pitot heat should NOT be used while the aircraft is on the ground. Overheating because of lack of cooling airflow will damage the heating elements.

Surface De-Ice System

De-ice boots protect the leading edges of each wing, both horizontal stabilizers and the vertical stabilizer. They are pneumatically actuated and flex to break ice accumulation on these surfaces.

Engine bleed air, from the engine compressor, is used to supply air pressure to inflate the de-ice boots and to supply a vacuum through the distribution valve to hold the boots down during flight.

The de-ice boots are controlled by the three position DEICE CYCLE switch.

In the SINGLE position, the de-ice boots inflate for 7 to 8 seconds and then automatically return to the deflated position.

In the MANUAL position, the de-ice boots inflate for as long as the switch is in the MANUAL position.

In the OFF position, the de-ice boots are deflated.

Standby Compass

The wet (standby) compass will give erratic reading when any of the following are activated:

1. Windshield Anti-ice
2. Windshield Wipers
3. Air-conditioner
4. Electric Heat
5. Vent Blower

ENVIRONMENTAL SYSTEM QUIZ

1. How many heating elements are activated inflight with the Electric Heat Switch in the NORM position?

a. 2
b. 4
c. 6
d. 8
e. 10

2. The switch that actuates a solenoid in the flow control unit of the engine to bring warm compressed air to the cabin is?

a. Mode Selector switch
b. Vent Blower switch
c. Cabin Pressure Control switch
d. Bleed Air Valve switch
e. Temperature INCR/DECR switch

3. With the Cabin Temp Mode Selector switch in the AUTO position, moving the manual cabin temperature INCR/DECR switch will have no effect on the cabin temperature.

TRUE FALSE

4. On a very cold day, maximum heating while on the ground may be obtained by positioning the electric heat switch to which of the following positions?

a. AUTO
b. NORM
c. GRD MAX
d. OFF
e. INCR

5. While operating on a cold winter morning with the electric heat on, your aircraft encounters icing conditions. Which of the following items, when turned on, will secure the electric heater?

a. Pitot heat
b. Surface deicer system
c. Windshield heat
d. All of the above

6. To prevent electrical system overload from occurring, the Electric Heater will be locked out if either the windshield heat, prop deice, or engine lip boot heat are operated simultaneously with the electric heater.

TRUE FALSE

7. When not in use the diluter demand regulator masks should be stowed with the regulator lever in which of the following positions?

a. Normal
b. 100%
c. Off
d. On
e. Oxygen

8. Air used to pressurize the main cabin is taken from which of the following areas?

a. Ambient outside air
b. Bleed air from the compressor section and ambient air from the engine compartment
c. Engine exhaust air
d. Bleed air from the turbine section
e. Oxygen bottles

9. Which of the following components contain a preadjusted valve to ensure that the cabin pressure differential does not exceed 4.9 PSID?

a. Cabin pressure controller
b. Outflow valve
c. Safety valve
d. Flow control unit
e. Rate of climb indicator

10. Which of the following components incorporate a negative relief valve to ensure that the cabin pressure differential remains positive or zero?

a. Cabin pressure controller
b. Outflow valve
c. Safety valve
d. Flow control unit
e. Both b and c are correct

11. Moving the cabin pressure controller switch to the DUMP position will open the safety valve and completely relieve all cabin pressure.

TRUE FALSE

12. The rate knob on the cabin pressure controller allows the operator to control the cabin rate of climb from ________ fpm to _______ fpm.

13. Prior to takeoff, with both engines operating, the safety valve is in the ______ position, and the outflow valve is in the ______ position.

a. Closed, Closed
b. Closed, Open
c. Open, Closed
d. Open, Open

14. To avoid excessive pressure bump after takeoff, the _____ Landing Gear Squat Switch opens to remove electrical power from the Preset and Safety Valve Solenoid and actuates a time delay relay.

LEFT RIGHT

15. Which of the following indications will you notice on the engine instruments when the ice vanes are extended in flight?

a. Increase in torque, increase in ITT
b. Increase in torque, decrease in ITT
c. Decrease in torque, increase in ITT
d. Decrease in torque, decrease in ITT
e. No noticeable change will occur

16. During the propeller deice ground test, you notice during the third cycle that the deice amperage is 6 amps. Assuming that the first cycle powered the RH propeller outboard segments, which of the following statements is correct?

a. 1 outboard segment on the LH prop is inoperative
b. 2 inboard segments on the LH prop are inoperative
c. 1 outboard segment on the RH prop is inoperative
d. 2 inboard segments on the RH prop are inoperative
e. 2 outboard segments on the LH prop are inoperative

17. When the windshield heat is activated, a controller will maintain a windshield surface temperature of _______ degrees Fahrenheit.

18. Which of the following items when activated will NOT cause the standby compass to display invalid magnetic headings?

a. Propeller de-ice
b. Windshield anti-ice
c. Windshield wipers
d. Air conditioner
e. Electric heat

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER NINE
FLIGHT INSTRUMENTS

900. OBJECTIVES:

At the end of this lesson, you should be able to...

1. Label and describe the operation of the primary flight displays (PFD).

2. Label and describe the operation of the flight guidance panel (FGP).

3. Label and describe the operation of the display control panel (DCP).

4. Label and describe the operation of the air data computers (ADC).

5. Label and describe the operation of the attitude heading reference systems (AHRS).

6. Label and describe the operation of the reversionary panel.

7. Label and describe the operation of the pitot-static system.

8. Label and describe the operation of the electronic standby instrument system (ESIS).

9. Label and describe the operation of the turn and slip indicator.

10. Label and describe the operation of the standby compass.

11. Label and describe the operation of the radio altimeter.

12. Label and describe the operation of the stall warning system.

13. Recognize the indications and potential results of a loss of DC power to the flight instruments.

NOTES

901. FLIGHT INSTRUMENTATION

The flight instrumentation can be divided into primary, emergency, and hazard alert.

902. PRIMARY FLIGHT INSTRUMENTS

At the end of this topic, you should be able to describe the operation of the PFD, FGP, DCP, ADC, AHRS, reversionary panel, and the pitot-static systems.

PFD

The pilot and copilot PFDs are DC powered respectively through the No. 1 and No. 2 avionics buses.

They provide the pilot and copilot with attitude, navigation, altitude, airspeed, radio altimeter, vertical speed, selected flight director modes and hazard avoidance including weather radar and TAS displays.

The top portion displays an attitude director indicator as well as airspeed and altitude tapes.

The bottom portion contains the horizontal situation indicator (HSI) and hazard displays.

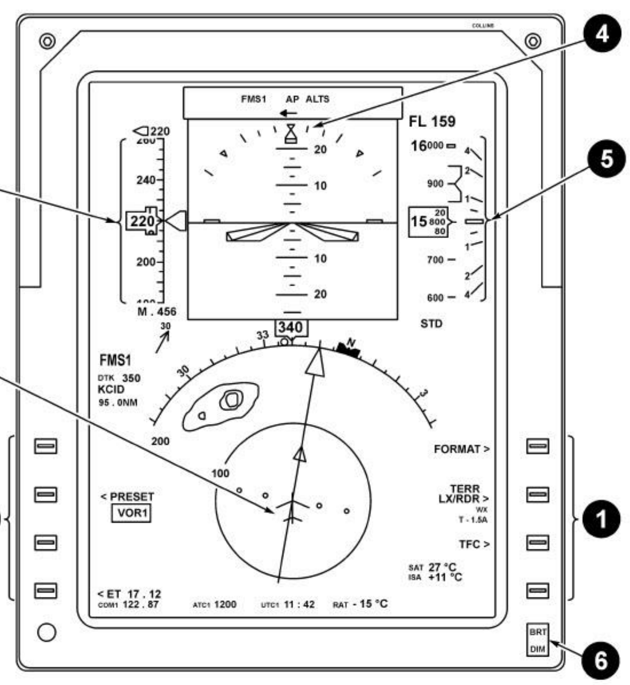
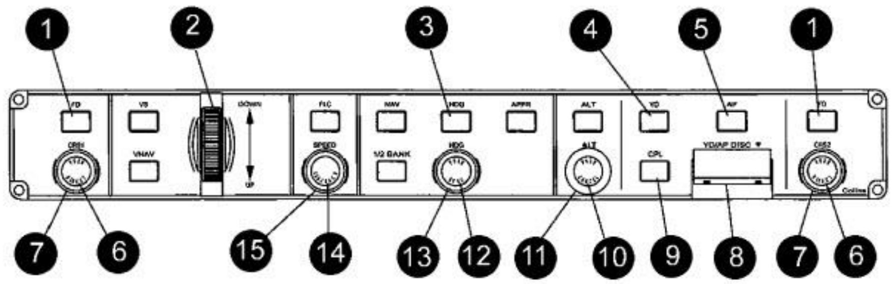


Figure 9-1 Primary Flight Display

FGP

The FGP provides the crew with the ability to set the flight director and autopilot modes. It is also used to set pre-selected altitude, airspeed, heading, and course on the PFDs.



1. Flight Director Buttons
2. V/S Pitch Wheel
3. Mode Buttons (8)
4. YD Engage Button
5. AP Engage Button
6. CRS Direct Buttons
7. CRS Knobs
8. YD/AP Disconnect Bar
9. Couple Button
10. ALT Alert Cancel Button
11. Altitude Preselect Knob
12. Push SYNC Button
13. Heading Knob
14. IAS/MACH Button
15. Speed Knob

T44C-F098

Figure 9-2 Flight Guidance Panel

DCP

The pilot and copliot DCPs are used to select altimeter settings, navigation needles, and weather radar modes.

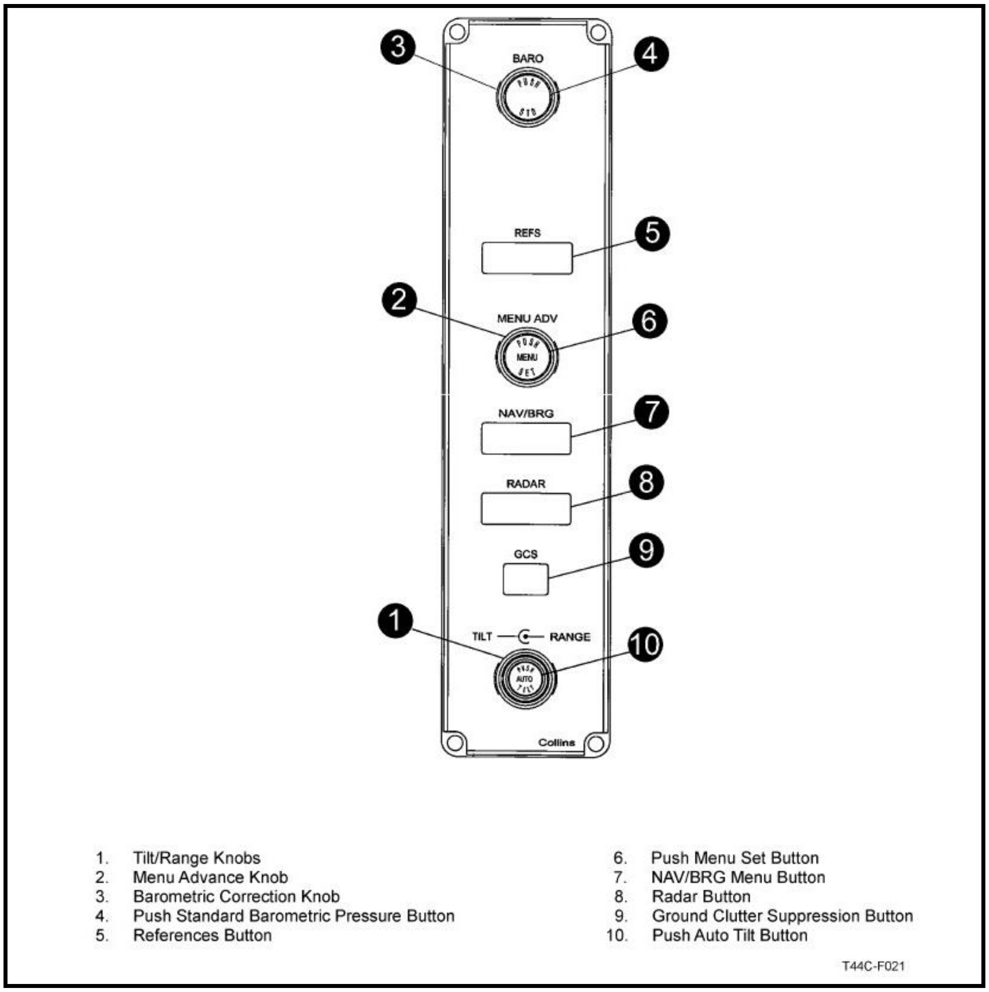


Figure 9-3 Display Control Panel

ADC

There are three air data computers on the T-44C: one each for the pilot and copilot PFDs and one internal to the ESIS. The computers process the pilot-static inputs to provide a digital display of airspeed, altitude and vertical speed.

AHRS

There are two attitude heading reference computers that send information to the pilot (AHRS1) and copilot (AHRS2) primary flight displays, and the ESIS heading tape (AHRS1).

Reversionary Panel

The Reversionary Panel provides the crew with the ability to select alternate ADC and AHRS sources in the event of a failure. The panel also contains two switches that select the COM/NAV input source (RTU or CDU) that should be selected to normal. If the switches are in any other position you will lose the ability to tune to through both sources.

Pitot Static System

The pitot static air system provides two (2) separate sources of static and ram air to the ADCs displaying airspeed, altitude, and vertical speed on the PFDs.

The Pitot-Static System includes:

1. Two internally heated pitot masts mounted on either side of the nose.

2. Four static air pressure ports, two on the aircraft exterior skin on each side of the aft fuselage.

The port pitot tube provides a reference for ADC1 and the ESIS ADC.

The starboard pitot tube provides a reference for ADC2.

Alternate Static Air Source

An alternate static air source terminates aft of the rear pressure bulkhead and provides static air to the pilot instruments and ESIS if the normal source of static air should fail.

A control valve on the right side panel is placarded PILOTS EMERGENCY STATIC AIR SOURCE NORMAL ALTERNATE.

When the normal source of static air becomes blocked, an alternate static air source is required. Static air may be obtained from the alternate source by turning the control valve to ALTERNATE.

WARNING

> Instrument error may be significant with emergency static air selected. Refer to the altimeter charts in NATOPS Chapter 25.

Radio Altimeter

The radio altimeter provides accurate above ground level (AGL) altitude indications anytime the aircraft is below 2500 AGL. The crew can input desired settings using the DCP and when the aircraft descends to that setting, a "MIN" annunciator will illuminate next to the VSI display on the PFDs and an aural cue will be heard.

To test the radalt:

Press the button on the overhead panel. A radio altitude of 50 +/- 5 ft will be displayed, the MIN box will illuminate, and the radalt bar will come up to 50 +/- 5 ft.

Stall Warning

The stall warning system consists of a lift detector unit on the left wing, a stall warning annunciator, and a warning horn.

To test the stall warning:

Activate the stall test switch on the pilot subpanel which will illuminate the annunciator and sound the horn**.**

903. EMERGENCY FLIGHT INSTRUMENTS

The emergency flight instruments include the ESIS, turn and slip indicator, and standby compass.

ESIS

The ESIS is powered by the avionics essential bus which in an emergency can be powered by a 24Vdc, 5 amp-hr auxiliary battery. It receives heading information from AHRS1 and has its own ADC and 3 axis inertia sensor for pitch, roll, and slip/skid. It is capable of providing attitude, heading, airspeed, VSI, altitude, and VOR or ILS course guidance from NAV1.

WARNING

> If AHRS1 fails a "DG" warning will appear above the heading tape and heading is now subject to precession error. A “set heading” option will now be available on the ESIS menu allowing manual updates to the ESIS heading tape.

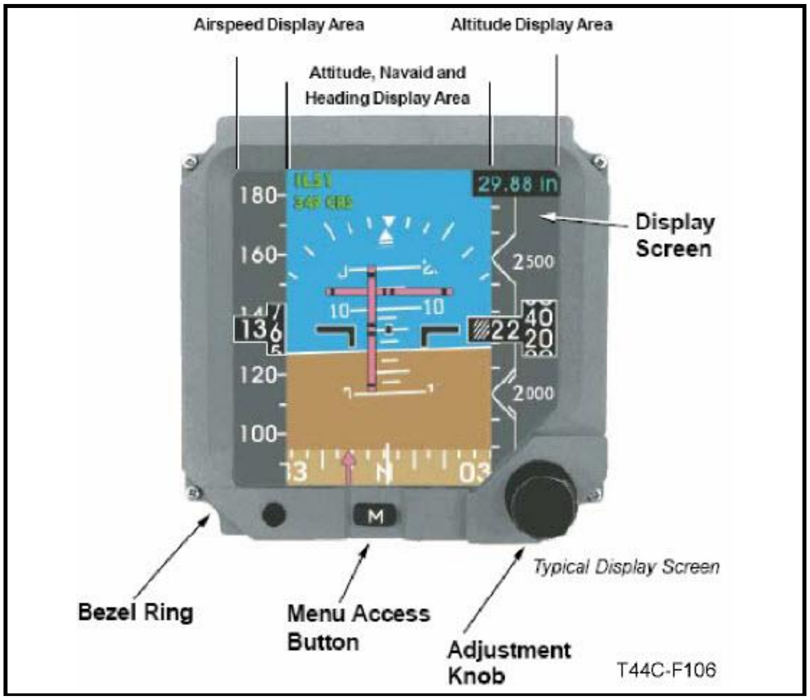


Figure 9-4 ESIS

Turn and Slip Indicator

The turn and slip indicator is vacuum operated using pneumatic air.

One needle width on the turn and slip indicator indicates a standard rate turn.

Standby Magnetic Compass

The standby compass is located on top of the windshield divider. The standby magnetic compass can be used in the event of complete AHRS failure or AHRS1 failure during ESIS operation.

NOTE

> When using the standby compass turn off windshield anti-ice, windshield wipers, air-conditioner, electric heat, and vent blower.

904. ABNORMAL CONDITIONS

Loss of DC Power

If you lose DC power the NATOPS will direct you to ensure the AUX/BATT is armed. This will ensure power to the Avionic Essential Bus which powers the following:

1. ***C***OM1
2. ***R***TU
3. PLT ***A***UDIO
4. ***N***AV1
5. ***E***SIS

The CRANE acronym may be used to remember these items.

FLIGHT INSTRUMENTS QUIZ

1. Which of the following is not displayed on the PFDs?

   a. Attitude
   b. Heading
   c. Angle of Attack
   d. Airspeed

2. Aircraft vertical speed (VSI) can be read on the

   a. Left side of either PFD
   b. Right side of either PFD
   c. ESIS only
   d. None of the above

3. How does the pilot change the altitude assignment in the pre-select window?

   a. From the ALT knob on the DCP
   b. From the DOWN/UP wheel on the FGP
   c. From the reference menu on the PFD
   d. From the ALT knob on the FGP

4. What occurs when the attitude indicator exceeds +30 degrees nose up or -20 degrees nose down?

   a. The gyro could tumble
   b. The stick shaker will activate
   c. Excessive pitch chevrons will appear on the attitude indicator
   d. An alarm will be heard indicating a critical attitude

5. MDA or DA for an instrument approach can be set using the

   a. Pilot's PFD
   b. Copilot's PFD
   c. Either DCP
   d. None of the above

6. Which of the following are displayed on the ESIS?

   a. Pitch, roll, slip/skid, airspeed, vertical speed, and NAV1 information
   b. Pitch, roll, skid only, airspeed, vertical speed, and NAV1 information
   c. Pitch, roll, slip/skid, airspeed, heading, and NAV2 information
   d. Pitch, roll, slip only, airspeed, vertical speed, and TACAN information

7. A bird strike has rendered the left side pitot tube inoperative. Which of the following statements is true?

   a. No capability has been lost
   b. No capability has been lost provided the ADC switch is set to the "2" position
   c. No capability has been lost provided the ADC & AHRS switches are set to the "2" position
   d. Some ESIS capability has been lost

8. When the alternate static air source is selected, where must the pilot look to find out what type of instrument errors can be expected?

   a. The placard under the alternate static air source
   b. The placard under the standby compass
   c. NATOPS chapter 2
   d. NATOPS chapter 25

9. The pitot tube on the left side of the aircraft provides an input to which of the following:

   a. Pilot's ADC
   b. Copilot's ADC
   c. ESIS ADC
   d. A and C only
   e. All of the above

10. When the ALTERNATE position is selected on the pilot's emergency static air selector, the aircraft will be flying lower and slower than indicated on the pilot's instruments.

    TRUE FALSE

11. What does the trend vector show on the airspeed tape?

    a. The airspeed the aircraft will be at in approximately 15 seconds
    b. The airspeed the aircraft will be at in approximately 10 seconds
    c. The airspeed the aircraft will be at in approximately 5 seconds
    d. The aircraft's current speed

12. It will take 4 minutes to complete a 360 degree turn while holding one needle width on the turn and slip indicator.

    TRUE FALSE

13. The airspeed tape automatically adjusts for and shows the Vmo/Mmo airspeed for the current altitude.

    TRUE FALSE

14. The radio altimeter indicators work from _______feet to touchdown.

15. Which of the following is required for the turn and slip indicator to function properly?

a. DC power
b. 14 VAC power
c. 26 VAC power
d. Pitot static air
e. Pneumatic system vacuum

16. You have just taken off and lose an engine at 100'. What airspeed are you looking to obtain and what color is this line on the airspeed tape?

a. 110 knots marked with a blue line
b. 86 knots marked with a blue line
c. 110 knots marked with a red line
d. 86 knots marked with a red line

17. The airspeed tape has four fixed airspeed references that do not change. From the list below, select two airspeeds.

a. Vmo/Mmo
b. Vref
c. Vfe App
d. Vfe Dn

18. What is the significance of the bar under the triangle on top of the attitude indicator?

a. It is a slip/skid indicator
b. It is a turn needle
c. It is a CDI
d. It marks the longitudinal axis of the aircraft

19. When does the de-clutter function occur on the PFD?

a. When the pitch exceeds +30 degrees
b. When the pitch exceeds -20 degrees
c. When roll exceeds 65 degrees
d. A & B
e. A, B, & C

20. The green circle on the HSI represents a drift angle pointer that shows the pilot the aircraft's track across the ground.

TRUE FALSE

21. What does the yellow line (comparator warning) under the altimeter setting indicate?

    a. After power up, when the current altimeter is not set
    b. That particular altimeter setting has been set for over an hour and needs updating
    c. An error has been detected in the pilot static system
    d. The pilot & copilot altimeter settings on each respective PFD differ by more than .02 in Hg

22. To enter V speeds into the PFD for display on the airspeed tape, push the _______ button to bring up the menu.

23. What can be selected as a bearing source for the double needle on the HSI?

    a. NAV1
    b. NAV2
    c. ADF
    d. None of the above

24. How does the pilot bring up the CDI and glide slope indicator on the ESIS?

    a. It is automatic when an ILS is tuned to the NAV1 receiver
    b. It is selected from the menu when the "M" button is pushed
    c. The pilot cannot fly an ILS approach with the ESIS, only a VOR or LOC
    d. The menu "M" button is pushed twice

25. How does the pilot know when the ESIS has failed a test?

    a. A red warning annunciator will illuminate
    b. An amber caution annunciator will illuminate
    c. The AUX TEST light illuminates
    d. An error message or code will appear on the identification screen after power up

26. The wind arrow on the PFD appears when _______________.

    a. The wind is a headwind
    b. The wind is significant
    c. The wind is at least 7kts, disappearing at 5kts
    d. Requested on the DCP
    e. b and c

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER TEN
AVIONICS

1000. OBJECTIVES

At the end of this lesson, you should be able to...

1. Label and describe the operation of the flight management system (FMS).

2. Label and describe the operation of the radio tuning unit (RTU).

3. Label and describe the operation of the V/UHF.

4. Label and describe the operation of the TACAN, VORs, DME, ADF, FMS, and Comm radios.

5. Label and describe the operation of the components of the audio control panels.

6. Label and describe the function of the flight guidance system (FGS).

7. Label and describe the Hazard Avoidance Systems (MFD) and weather radar.

8. Recognize the indications and potential results of a loss of DC power to the COMM/NAV equipment.

1001. FMS

The Flight Management System is comprised of the Control Display Unit (CDU) and the FMS computer. The system blends inputs from the VORs, DME, and GPS to compute present position.

Control Display Unit

The Control Display Unit (CDU) receives power from Avionics Bus No. 2 and is located on the forward right portion of the center pedestal. The CDU allows pilot to enter and modify flight plans and tune most Com/Nav equipment. The most commonly used keys are:

TUN- allows the crew to remotely tune and select modes for the COM1, NAV1, NAV2, DME HOLD, ATC, & ADF. (NAV1&2 receive VOR and LOC frequencies only)

IDX- allowed the crew to access the GPS CTL (for deselecting satellites and checking RAIM), HOLD, and ROUTE MENU (for stored Seagull and Low level routes)

FPLN- displays the primary and secondary flight plan pages

LEGS- displays the flight plan points and is used to modify the route in flight

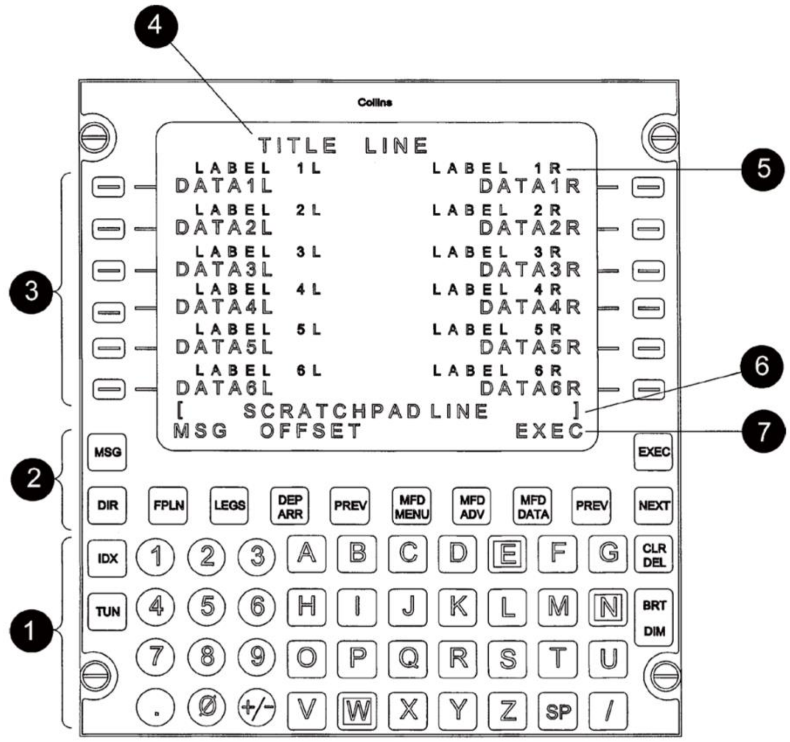
DEP ARR- allows the crew to enter departures and arrivals (SID, STAR, and IAP)

PERF- allows the crew to select cruise altitude

MFD MENU- selects the desired display on the PFDs such as airports, navaids, and ETA This function is not available in the T-44C.

FMS Computer

The FMS computer provides the blended solution for navigation and provides remote tuning. To identify the current Nav solution press IDX, then STATUS.



1. Alphanumeric Keys
2. Function Keys
3. Line Select Keys (12)
4. Title Line
5. Label/Data Line Pairs
6. Scratchpad Line
7. Annunciator Line

T44C-F034

Figure 10-1 FMS Computer

1002. RADIO TUNING UNIT

The radio tuning unit (RTU) is powered by the Avionics Essential Bus and is located on the center instrument panel. The RTU provides the crew the ability to tune and select modes for the following: COM1, NAV1, NAV2, ATC, ADF.

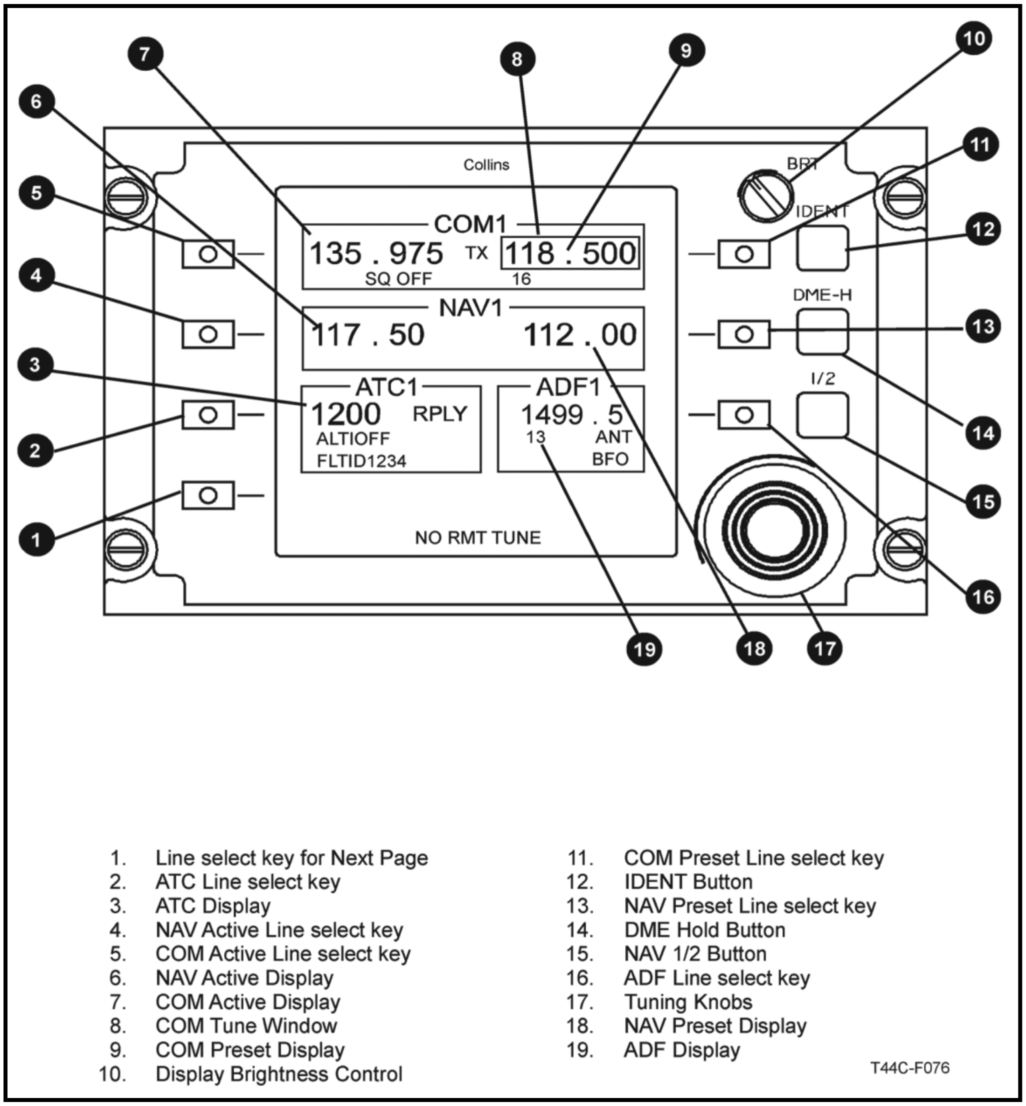


Figure 10-2 RTU

1003. V/UHF

The V/UHF is powered by the Avionics Bus No. 2 and is located on the center instrument panel above the RTU. The V/UHF is used to tune 1 of 20 UHF presets channels or to manually enter VHF and UHF frequencies.

In normal operation the bottom of the display should read "U↑Am" which means that UHF Guard is monitored, high power output, and AM plain mode.

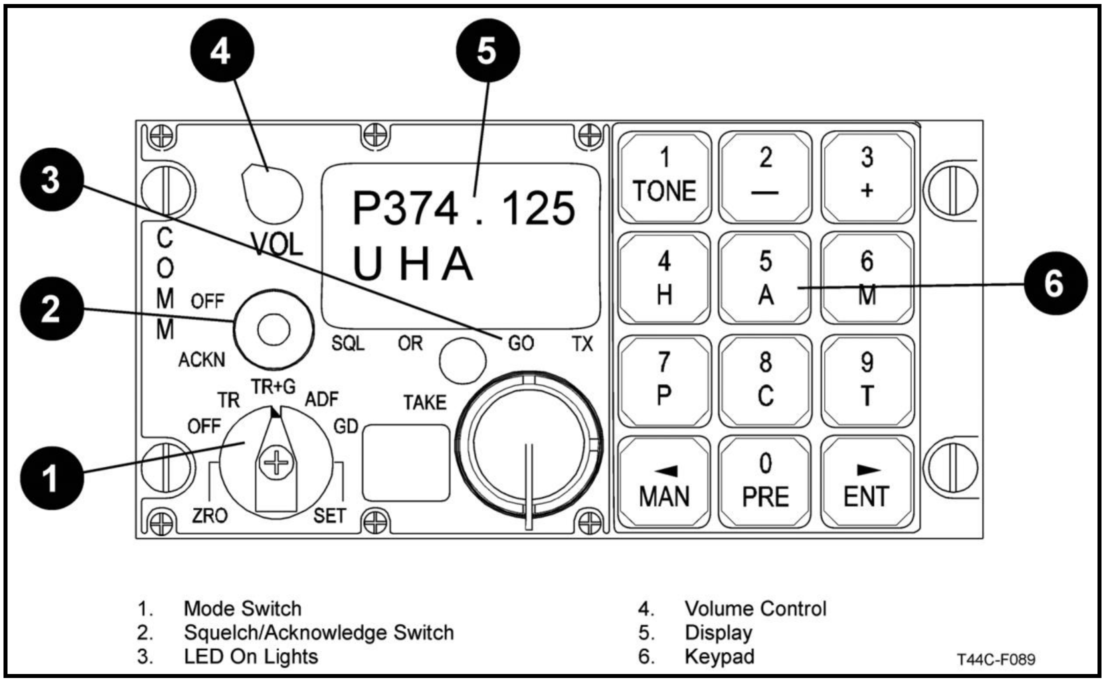


Figure 10-3 V/UHF

1004. TACAN, VOR, DME, ADF, FMS AND COMM RADIOS

TACAN Controls and Indicators

The TACAN is powered by the Avionics Bus No. 1 and is tuned through the TACAN Control Panel on the center pedestal using the channel selector knobs and the "X/Y" switch. The AA/AG switch (air to air or air to ground) is normally in the A/G position unless mission dictates (formation and air refueling).

1005. ACP

There are three audio control panels; one each for the pilot, copilot, and observer. They are powered by the Avionics Buses 1, 2, & 3 respectively. The observers ACP does not provide transmit capability.

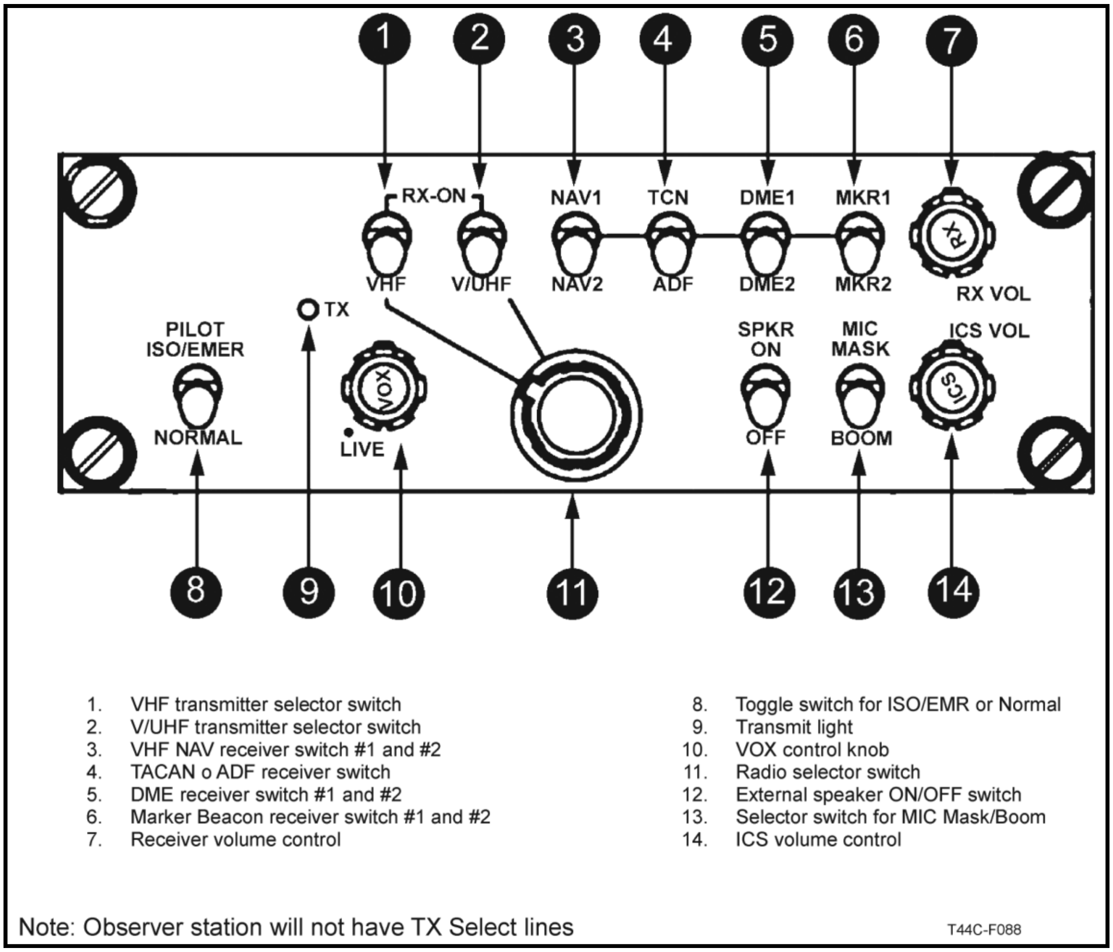


Figure 10-4 Audio Control Panel

1006. FLIGHT GUIDANCE SYSTEM

The Flight Guidance System (FGS) is comprised of two Flight Guidance Computers (FGC), a Flight Guidance Panel (FGP), and four servos. The FGS provides the crew with autopilot, flight director, and electric pitch trim.

Flight Director

The flight director (FD) provides pitch and roll guidance based on crew inputs on the FGP. To engage the FD select the desired mode on the FGP. Ensure that the FD is coupled to the PF's side using the CPL key which will display ← or → on the ADI. Commonly used modes:

HDG- Used to capture and maintain selected heading.

NAV- Used to capture the primary nav source on the coupled side.

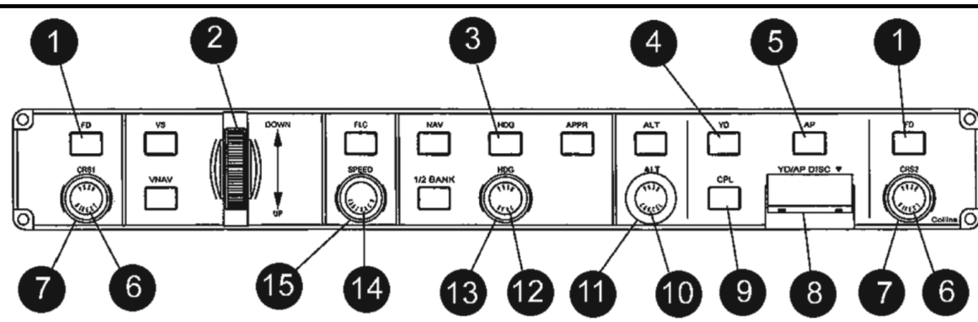
APPR- Used to capture the final approach course and glideslope (ILS) or glidepath (LNAV/VNAV) on a precision approach.

ALT- Used to preselect the desired altitude. Push the knob in and turn for 100 ft increments.

FLC- Captures the current IAS and directs a climb or descent to the preselected altitude. Normally climb at 150KTS below 10,000 ft. and descent speed is at pilot discretion.

VS- Commands a constant VSI as set on the VS pitch wheel.

VNAV- Enables vertical navigation modes.



1. Flight Director Buttons
2. V/S Pitch Wheel
3. Mode Buttons (8)
4. YD Engage Button
5. AP Engage Button
6. CRS Direct Buttons
7. CRS Knobs
8. YD/AP Disconnect Bar
9. Couple Button
10. ALT Alert Cancel Button
11. Altitude Preselect Knob
12. Push SYNC Button
13. Heading Knob
14. IAS/MACH Button
15. Speed Knob

T44C-F098

Figure 10-5 Flight Guidance Panel

Autopilot

The autopilot servos position the aircraft control surfaces in response to steering commands from the FGS. The autopilot also drives the pitch trim system and can be engaged by putting the YD/AP DISC switch bar in the up position and pressing the AP button on the FGP.

The autopilot may be engaged at 400AGL on departure, 1000AGL at cruise, and shall be disengaged by 180AGL on approach. The autopilot should be disengaged by the red AP/YD switch on the control yoke or by putting the YD/AP DISC switch bar in the down position to ensure that the yaw damper is also disengaged.

1007. HAZARD AVOIDANCE SYSTEMS

MFD

The MFD is powered by the Avionics No. 3 bus and receives position information from the GPS which enables it to display:

1. Moving map

2. Enhanced Ground Proximity Warning System (EGPWS)

3. TAS information

Weather Radar (WX) key is disabled on the MFD.

TAS

The traffic advisory system, powered by the Avionics No. 3 bus, includes a processor and antennas, allowing traffic alert and information from aircraft equipped with transponders to be displayed on the MFD and both PFDs.

An open white diamond- Indicates non-threat traffic (greater than +/- 1200' or 5NM.)
A filled white diamond- Indicates traffic in the proximity (within +/- 1200' and 5NM)
A filled yellow circle- Indicates a traffic advisory (TA) (flight paths intersecting within 15-30 sec)

All three symbols incorporate an altitude tag displaying relative attitude in 100's of feet if the relative mode is selected.

Relative altitude modes:

1. Normal: +/- 2700'

2. Below: -9000' to +2700'

3. Above: -2700' to +9000'

4. Unrestricted: +/- 10000'

To display the TAS on the PFD the TFC overlay must be selected.

EGPWS

The enhanced ground proximity warning system has three annunciators:

1. PULL UP Warning: flight path within 30 seconds of terrain

2. TERRAIN Caution: continuing current flight path could result in terrain impact

3. TERRAIN N/A: no position reference

See NATOPS Chapter 15 for Terrain Warning Procedures

Weather Radar

The T-44C is equipped with a Turbulence Weather Radar powered by the Avionics No. 3 Bus and can only be displayed on the PFD. The weather radar antenna is located in the nose of the aircraft and can detect precipitation (WX mode) up to 300NM and turbulence (WX+T mode) up to 50NM. To display the radar: the PFD must be in 120 or 120 map mode and the RDR overlay selected.

1008. ABNORMAL CONDITIONS

Loss of DC Power

If you lose both generators the NATOPS will direct you to ensure the AUX/BATT is armed. Arming the AUX/BATT will ensure power to the Avionic Essential Bus which powers the following:

1. ***C***OM1
2. ***R***TU
3. PLT ***A***UDIO
4. ***N***AV1
5. ***E***SIS

AVIONICS QUIZ

1. The RTU provides control over all of the following except _________.

   a. COM1
   b. COM2
   c. TACAN
   d. ADF
   e. Both b & c
   f. Both c & d

2. In order to change a frequency in the RTU the frequency must be in a tune box.

   TRUE FALSE

3. Select the best statement.

   a. The V/UHF transceiver is the primary VHF radio
   b. The V/UHF is the only UHF transceiver and serves as the backup VHF radio
   c. The V/UHF is the primary UHF radio
   d. The V/UHF is the backup UHF and VHF radio

4. What does the PRE key do on the V/UHF radio?

   a. Starts the preflight test
   b. Puts the radio in a preflight warm-up phase
   c. Puts the radio in preset mode
   d. Used by MX to load preset frequencies

5. With a dual generator failure, which of the following items would not be available?

   a. Transponder
   b. Copilot's PFD
   c. V/UHF transceiver
   d. TACAN
   e. All of the above would be available

6. When would a pilot utilize the DME hold function on the RTU?

   a. When an ILS DME is from a co-located VORTAC
   b. Anytime the pilot wants the DME readout to appear on the PFD
   c. Anytime the pilot wants to activate the DME portion of a VOR/DME
   d. Anytime the pilot needs to use DME

7. When using the audio control panel from the observer's seat, the student must be careful not to inadvertently transmit over the radios when talking on ICS.

TRUE FALSE

8. Which of the following will disconnect the autopilot?

a. Gang bar in the off position
b. Manually lower the YD/AP DISC bar on the FGP
c. Push the AP/YD disconnect button on the yoke
d. Select the go-around switch on the left power lever or copilot's yoke
e. All of the above

9. What does the YD green annunciator above the ADI mean?

a. Yaw damper is on
b. Yaw damper is off
c. An error has been detected in the yaw damper
d. The yaw damper has not passed its self test

10. When an arrow above the ADI points to the left, this indicates that the pilot's FGC is controlling the autopilot.

TRUE FALSE

11. The FD can be used without the autopilot engaged.

TRUE FALSE

12. How do you access the GPS CTL page to check the RAIM availability?

a. FPLN key
b. MFD MENU key
c. IDX key
d. None of the above

13. The ELT should be tested by the flight crew prior to every flight.

TRUE FALSE

14. What are the vertical modes of the FD?

a. NAV and VNAV
b. FLC, VS, VNAV, PITCH, and Glideslope
c. APPR, NAV, and HDG
d. VNAV only

15. List the altitude limitations associated with the autopilot.

________________, _____________________, ______________________

16. What button on the CDU allows the crew to select an instrument approach?

a. DEP ARR
b. FPLN
c. LEGS
d. MFD MENU
e. IDX

17. In the WX mode, the radar will detect weather out to __________NM and in the WX+T mode the detection range is ______________NM.

a. 600, 300
b. 300, 600
c. 600, 50
d. 300, 50

18. Using the moving map on the MFD, how can the pilot obtain addition airport data?

a. By turning the inner control knob to bring up the Airport Information Page
b. By turning the outer control knob to bring up the Airport Information Page
c. By using the joystick and selecting the airport displayed on the moving map
d. All of the above

19. How does the pilot know if the Terrain Inhibit switch is engaged?

a. A green advisory light will display TERR INH on the caution panel
b. An audio voice will say "terrain inhibited"
c. The message "warnings inhibited" will be displayed on the MFD
d. The picture of a mountain on the available functions label will be black and white instead of in color

20. The TAS has the capability of detecting all aircraft within the range selected by the pilot.

TRUE FALSE

21. From the list below, select the system that is not displayed on the MFD.

a. Weather radar
b. Moving map
c. TAS
d. EGPWS