NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-307 (Rev 06-03)**

WORKBOOK

AIRCRAFT SYSTEMS FAMILIARIZATION T-34C

2003

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

CNATRA P-307
N315
23 JUN 2003

CNATRA P-307 (Rev. 06-03)

Subject: WORKBOOK, AIRCRAFT SYSTEMS FAMILIARIZATION T-34C

1. CNATRA P-307 (Rev. 06-03) PAT, "Workbook, Aircraft Systems Familiarization, T-34C" is issued for information, standardization of instruction and guidance of all flight instructors and student aviators within the Naval Air Training Command.

2. This publication shall be used to implement the academic portion of the T-34C Aircraft Systems Familiarization Course.

3. Recommendations for changes shall be submitted via CNATRA TCR form 1555/19 in accordance with CNATRAINST 1550.6E.

4. CNATRA P-307 (Rev. 04-02) PAT is hereby cancelled and superseded.

R.E. Bird

R.E.BIRD
Assistant Chief of Staff for
Training and Operations

Distribution:

CNATRA N31	(5)	Plus Original
CNATRA N62	(1)	
COMTRAWING FOUR	(300)	
COMTRAWING FIVE	(400)	

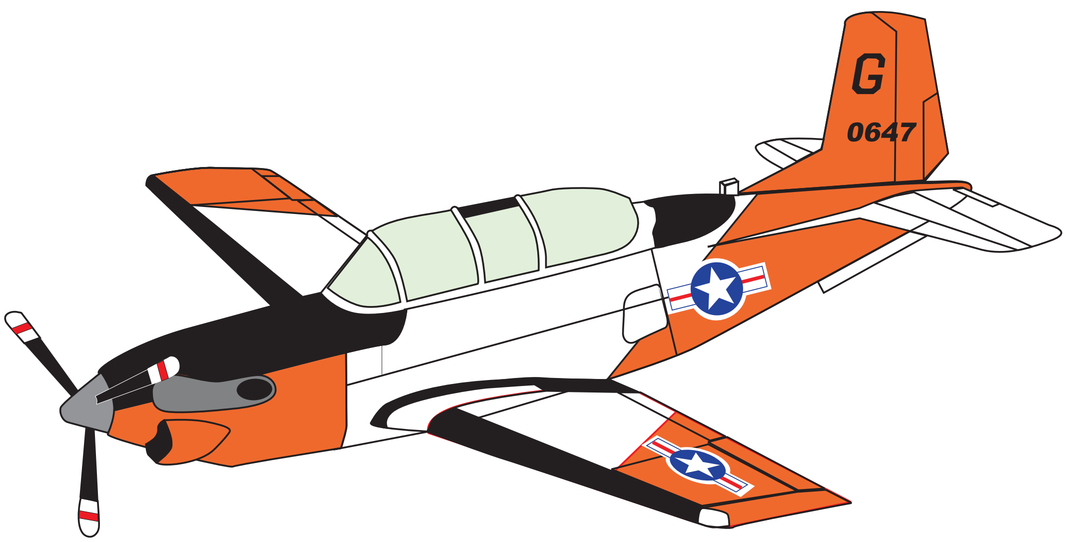
WORKBOOK

FOR

AIRCRAFT SYSTEMS FAMILIARIZATION

T-34C

Q-2A-0108



FOREWORD

Course Objective: To provide the student naval aviator with a level of T-34C Aircraft Systems knowledge prerequisite to his/her learning, understanding and performance in ground, flight and emergency procedures that are taught in the follow-on stages of flight training.

Specific Instructional Objective: Upon completion of this course of instruction, the student will demonstrate his/her knowledge of the T-34C Aircraft Systems by completing the end-of-course examination with a minimum of 80% accuracy.

Instructional Procedures:

1. Each lesson topic will contain the Terminal Objective, Enabling Objectives, description of the subject area and sample questions as well as required amplifying illustrations.

2. The student workbook is designed to reinforce instructors' lectures and demonstrations. It is to be used in conjunction with the NATOPS Manual and not to be considered an all-inclusive study guide. It is yours to keep because it will remain a valuable reference throughout the T-34C flight phase.

3. Study the NATOPS reading assignment and the workbook study assignment prior to coming to class. The NATOPS questions and reading assignments will be specified by your instructor. This procedure will enable you to follow the instructor's presentation more easily and will point out areas in which you need more explanation and clarification. Be sure to ask questions if any of your instructional material is not clearly understood.

Reference Materials

1. NAVAIR 01-T34AAC-1, T-34C NATOPS Manual

2. Beechcraft T-34C Maintenance Manual

3. Beechcraft Familiarization/Maintenance Course for the T-34C

HOW TO USE THIS STUDENT GUIDE

This Student Guide provides the lesson objectives and chapter information necessary to augment the instructor presentations. The course outline and note-taking spaces have been left out deliberately. The instructor will make a daily reading assignment from both the NATOPS Manual and this student guide. He/she will also assign questions to be answered from the NATOPS Evaluation Question Bank (if appropriate). The student is responsible for completing the review questions at the end of the Instruction Sheets. The Enabling Objectives are listed in the same order as they appear in the Instructor Guide. Therefore, the student can use the list of objectives as an informal lesson outline.

NOTE

> References from specific Beechcraft operation and maintenance manuals are not normally available for student study. They are used by the curriculum developers to develop the Information Sheets in the Student Guide.

SAFETY

Students will not operate the panels or mockup equipment unless directed to do so and under the supervision of the instructor. The panels contain electrical components capable of producing electrical shock hazards. Some of the mockups have been constructed from salvaged materials and are not totally reliable in their operation.

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LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:
Original...0...30 Apr 02 (this will be the date issued)
Change…1…14 July 03
Change…2…25 Oct 04
Change…3…12 Jan 07

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 198 CONSISTING OF THE FOLLOWING:

Page No.	Change No.	Page No.	Change No.
COVER	0	9-9	0
LETTER	0	9-10	0
iii – v	0	10-1 – 10-8	0
vi (blank)	0	11-1 – 11-8	0
vii - ix	0	11-9	0
x	1	11-10 – 11-18	1
xi - xv	0	12-1 – 12-2	0
xvi (blank)	0	12-3	0
1-1 – 1-2	0	12-4 – 12-8	0
2-1 – 2-6	0	13-1 – 13-6	2
3-1 – 3-4	0	14-1 – 14-5	0
3-5	2	14-6	0
3-6	3	15-1 – 15-8	1
3-7	0	16-1 –16-2	0
3-8	2	16-3	0
4-1 – 4-4	0	16-4 – 16-6	0
4-5	2	16-7 (blank)	2
4-6 - 4-8	0	16-8	0
4-9 (blank)	0	17-1 – 17-12	0
4-10	0	18-1 –18-3	3
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5-6	0	19-1 – 19-10	3
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6-2	1	21-1 – 21-6	0
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7-1 – 7-4	0	22-7 (blank)	0
7-5	3	22-8	0

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9-1 – 9-4	0		
9-5	1		
9-6	3		
9-7	1		
9-8	0		

INTERIM CHANGE SUMMARY

The following Changes have been previously incorporated in this manual:

CHANGE NUMBER	REMARKS/PURPOSE
1	Changes made per transmittal letter (07-14-03)
2	Changes made per transmittal letter (10-25-04)
3	Changes made per transmittal letter (01-12-07)

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

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

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TABLE OF FIGURES

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CHAPTER ONE
NATOPS FAMILIARIZATION

100. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C NATOPS program. The NATOPS manual contains information on all aircraft systems, performance data, and operating procedures required for safe and effective operation.

101. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

1.0 Upon completion of this chapter, the student will demonstrate knowledge of the NATOPS program and the structure of the NATOPS Manual.

Enabling Objectives

1.1 State the purpose of the NATOPS program.

1.2 Identify the structure of the NATOPS Manual.

1.3 State the definition of WARNING, CAUTION, and NOTE.

1.4 State the method of submitting NATOPS change recommendations.

1.5 State the NATOPS compliance requirement.

102. NAVAL AIR TRAINING AND OPERATING PROCEDURES STANDARDIZATION

The Naval Air Training and Operating Procedures Standardization (NATOPS) Program was developed out of a need to decrease the Navy's aircraft mishap rate and increase combat readiness. The program, which officially began 8 May 1961, endeavored to standardize the training and operating procedures between aircraft squadrons and ships, a condition which was basically nonexistent even following the lessons learned in World War II and the Korean conflict. Since its inception, the program has seen a tremendous decrease in the loss of human life and aircraft.

The NATOPS Manual has a structure that may be unusual to the first-time user. The T-34C NATOPS Manual has eleven parts and thirty-three chapters. A page number in a NATOPS Manual has a two-section number identifying the chapter and chapter page number. For example, page 22-12 is the 12th page in Chapter 22. A student checking that page would find the NATOPS Evaluation Question Bank, which is referenced for self-testing at the completion of most lessons in this book.

Of particular importance to a pilot are the WARNINGS, CAUTIONS, and NOTES found throughout the manual.

WARNING

> An operating procedure, practice, or condition, that may result in injury or death if not carefully observed or followed.

CAUTION

> An operating procedure, practice, or condition, that may result in damage to equipment if not carefully observed or followed.

NOTE

> An operating procedure, practice, or condition, essential to emphasize.

Obviously, WARNINGS, CAUTIONS, and NOTES must be read closely and adhered to completely.

Since the NATOPS Program must be dynamic and responsive to need for change, a system is provided for submitting changes to the NATOPS Manual. A specific command is assigned the responsibility for ensuring the manual has current procedures and information. Responsibility for the T-34 is assigned to Commander, Training Air Wing FIVE, NAS Whiting Field. Anyone may submit change recommendations to the NATOPS Manual.

Compliance with NATOPS is **MANDATORY!**

CHAPTER TWO

BASIC ENGINE CONSTRUCTION

200. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the PT6A-25 basic engine construction. You must also become familiar with the location and operation of various components of the engine for a better understanding of how the engine performs.

201. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

2.0 Upon completion of this chapter, the student will demonstrate knowledge of the PT6A-25 engine's basic construction.

Enabling Objectives

2.1 State the type and shaft horsepower of the PT6A-25 engine.

2.2 State the purposes of the engine.

2.3 Describe the compressor section of the engine.

2.4 Explain the characteristics of the combustion section of the engine.

2.5 Describe the characteristics of the turbine section of the engine.

2.6 Describe the exhaust section of the engine.

2.7 State the purpose and location of the accessory gearbox on the engine.

2.8 Explain the operation of the engine.

202. BASIC ENGINE CONSTRUCTION

The T-34C aircraft is powered by a PT6A-25 turboprop engine, built by Pratt and Whitney. It is a reverse-flow type with inverted flight capabilities. This engine is flat rated at a maximum of 550 shaft horsepower (SHP) (1315 ft-lbs. torque), however, normal NATOPS operation is limited to 425 SHP (1015 ft-lbs. torque).

The primary purpose of the engine is to provide the motive force to turn the propeller through the reduction gearbox. The secondary purpose is to supply power to drive the engine-driven accessories. The PT6A-25 has four main sections: compressor, combustion, turbine, and exhaust.

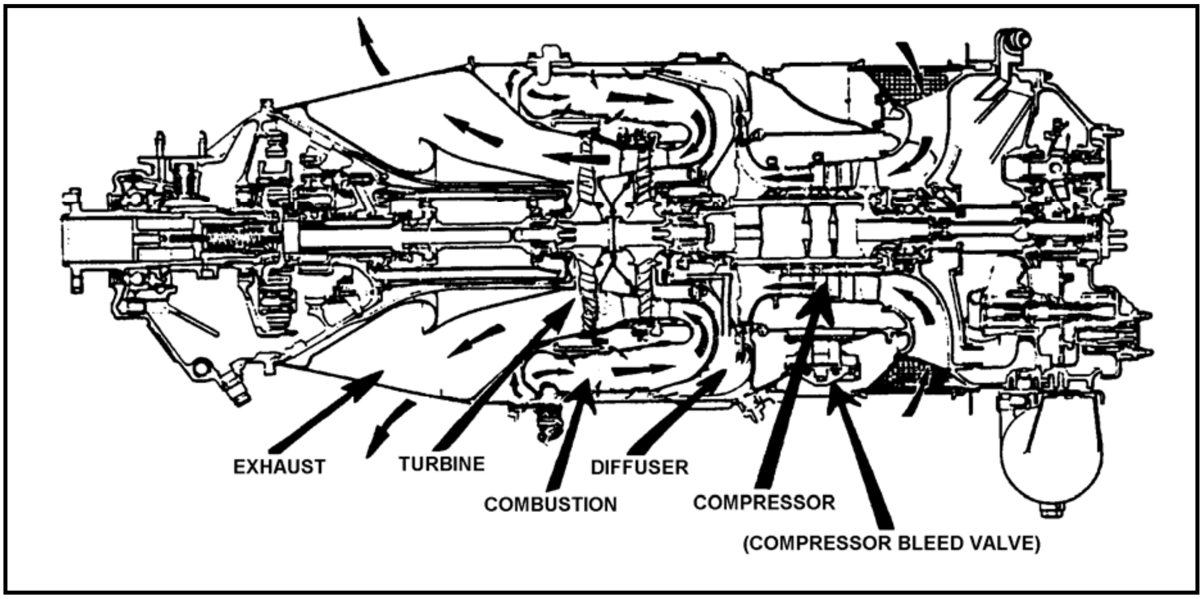

Figure 2-1 Basic Engine Construction

Compressor Section

The compressor section consists of the compressor inlet case, compressor, and diffuser. The compressor inlet case directs outside air to the compressor. A circular foreign objective damage (FOD) screen to prevent foreign object ingestion covers the entrance. The air is then compressed at a 7:1 ratio by a three-stage axial compressor and a single-stage centrifugal compressor. These compressors are assembled as an integral unit and driven by the compressor turbine.

The air leaves the compressor via diffuser vanes (pipes) and enters the diffuser where the pressure is further increased. This high pressure air is then delivered to the combustion chamber. Through tap-offs the diffuser also provides P_3 fuel control reference air and bleed air for cockpit heating.

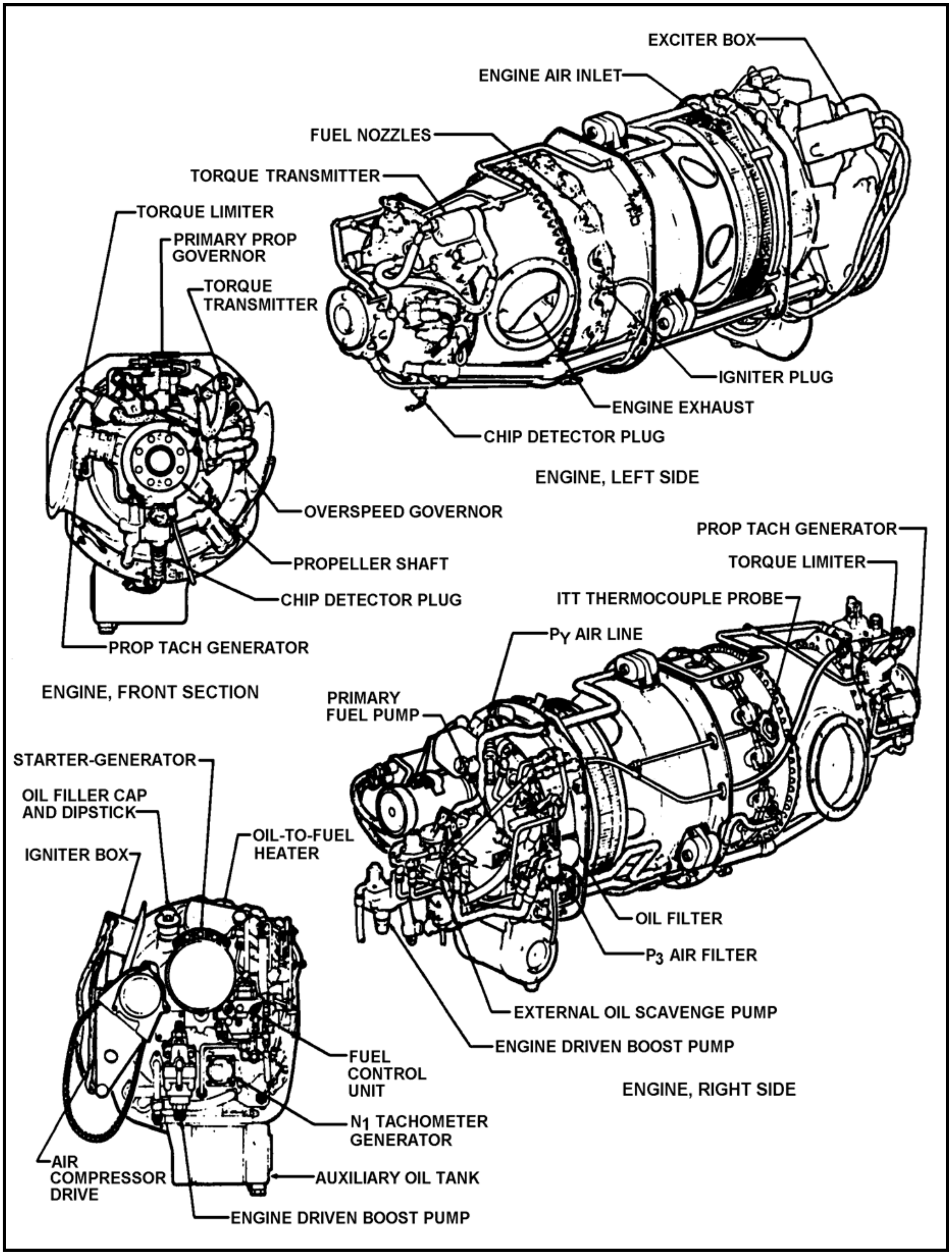

Figure 2-2 PT6A-25 Engine

A compressor bleed valve, located in the compressor section at the 7 o'clock position, automatically opens a port to spill interstage compressor air to provide anti-stall characteristics.

Combustion Section

The combustion chamber is an annular, reverse flow type. Fuel is sprayed into the combustion chamber by fourteen nozzles and combined with air from the diffuser to form a combustible mixture. During engine start, the mixture is ignited by two igniter plugs. Thereafter, ignition is self-sustaining as long as the proper fuel-air ratio is supplied. The process changes a high-pressure gas to a high velocity gas which is delivered to the turbine section.

Turbine Section

The turbine section consists of two, independently shafted, single-stage turbines that change high velocity gas flow to rotating mechanical energy. The compressor turbine (also called the N_1 turbine) rotates counterclockwise, rotating the axial and centrifugal compressors and driving the accessory gearbox. At 101.5%--maximum allowed (as indicated by the N_1 gauge), the compressor turbine will be rotating at 37,000 RPM. The power turbine (also called the N_f turbine) rotates clockwise and imparts torque to the propeller shaft via a two-stage reduction gear system. With the propeller set at maximum RPM, the power turbine will be rotating at 33,000 RPM. Between the two turbine wheels are eight temperature-sensing probes called thermocouples which provide an indication of interstage-turbine temperature (ITT).

Exhaust Section

After passing through the power turbine, the expanding gases are discharged, via the exhaust duct, to the outside atmosphere through two exhaust stacks (also called exhaust nozzles). One is located on each side of the engine compartment.

Accessory Gearbox

The accessory gearbox, located at the rear of the engine, provides the mount and drives for engine-driven accessories. This gearbox is driven by the compressor turbine shaft.

STUDY QUESTIONS

1. The T-34C aircraft is powered by a _______________ engine and its air flow is ____________-____________ type. Maximum shaft horsepower is ________ SHP, ________ ft-lbs. torque; NATOPS (normal) operation is limited to ________ SHP, ________ ft-lbs. torque.

2. The primary purpose of the engine is to rotate the _______________ through the _______________ gearbox.

3. The compressor inlet case directs ____________ ____________ to the compressor.

4. The engine has a ________:________ compression ratio and uses a three-stage ____________compressor and a ________ stage centrifugal compressor.

5. Two air sources are derived from tapoffs on the diffuser: ____________ and ___________.

6. The combustion chamber is an ____________, ____________-____________ type. Combustion results from fuel injected by ________ fuel nozzles and ignited by ________ igniter plugs.

7. Once the engine is started, there is no further need to continue ignition with the igniters; i.e., the engine combustion is self-sustaining. ____________(True/False)

8. The compressor turbine is also called the ________ turbine and has a maximum rotation speed of________ RPM which is rated at ________% N_1.

9. The power turbine is also called the ____________ turbine and has a maximum rotation speed of____________ RPM.

ANSWERS TO STUDY QUESTIONS

1. Turboprop, reverse-flow; 550, 1315; 425, 1015
2. Propeller, reduction
3. Outside air
4. 7:1, axial, single-
5. P_3 fuel control reference, bleed air
6. Annular, reverse-flow; 14, 2
7. True
8. N_1, 37,000, 101.5
9. N_f, 33,000

CHAPTER THREE
PT6A-25 AIR/OIL/IGNITION SYSTEMS

300. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the PT6A-25 air, oil, and ignition systems. You must also become familiar with the location and operation of various components related to the PT6A-25 engine to ensure your capability to operate the aircraft safely and efficiently.

301. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

3.0 Upon completion of this chapter, the student will demonstrate knowledge of the PT6A-25 air, oil, and ignition systems characteristics.

Enabling Objectives

3.1 State the location and purpose of the engine air intake.

3.2 Describe the characteristics of the inertial separator.

3.3 Describe the location and purpose of the accessory air inlet.

3.4 State the purpose of the lubrication system.

3.5 Describe the method of lubricating the gears and bearings.

3.6 Describe the characteristics of the main oil tank.

3.7 State the location and purpose of the oil/fuel heater.

3.8 Describe the location and purpose of the auxiliary oil tank.

3.9 Describe the location, purpose, type and operation of the main oil pump.

3.10 Describe the location, purpose, type and operation of the oil scavenge pump.

3.11 Describe the location, purpose and characteristics of the oil filter.

3.12 State the location and purpose of the oil breather.

3.13 Describe the location, purpose and method of operation of the oil cooler.

3.14 State the location and purpose of the oil pressure and oil temperature transmitters.

3.15 State the oil pressure/temperature gauge limitations.

3.16 State the purpose of the ignition system.

3.17 Describe the location, purpose and method of operation of the components of the ignition system.

3.18 Describe the location and purpose of the ignition annunciator light.

3.19 State the purpose of the auto-ignition system.

3.20 Identify the components of the auto-ignition system and state their characteristics.

3.21 Describe the operation of the auto-ignition system.

302. AIR INDUCTION SYSTEM

The engine receives ram air for combustion from an engine air intake located in the lower right front of the engine cowling. The air is ducted to the compressor inlet case. Located within the engine air intake duct is an inertial separator which prevents freezing precipitation from collecting on the engine FOD screen. A manually operated door allows solid particles to be separated from the inlet air and vented overboard. This door is controlled by a T-handle located on the right subpanel in the front cockpit only, and placarded ENGINE AIR INLET BYPASS DOOR. The T-handle is mechanically linked to the door and is pulled to open the door and pushed to close it. During normal operation the separator door is closed.

The accessory air inlet is located in the lower left front of the engine cowling. This duct directs cooling air to the oil cooler, starter/generator, engine-driven accessories, and the cockpit.

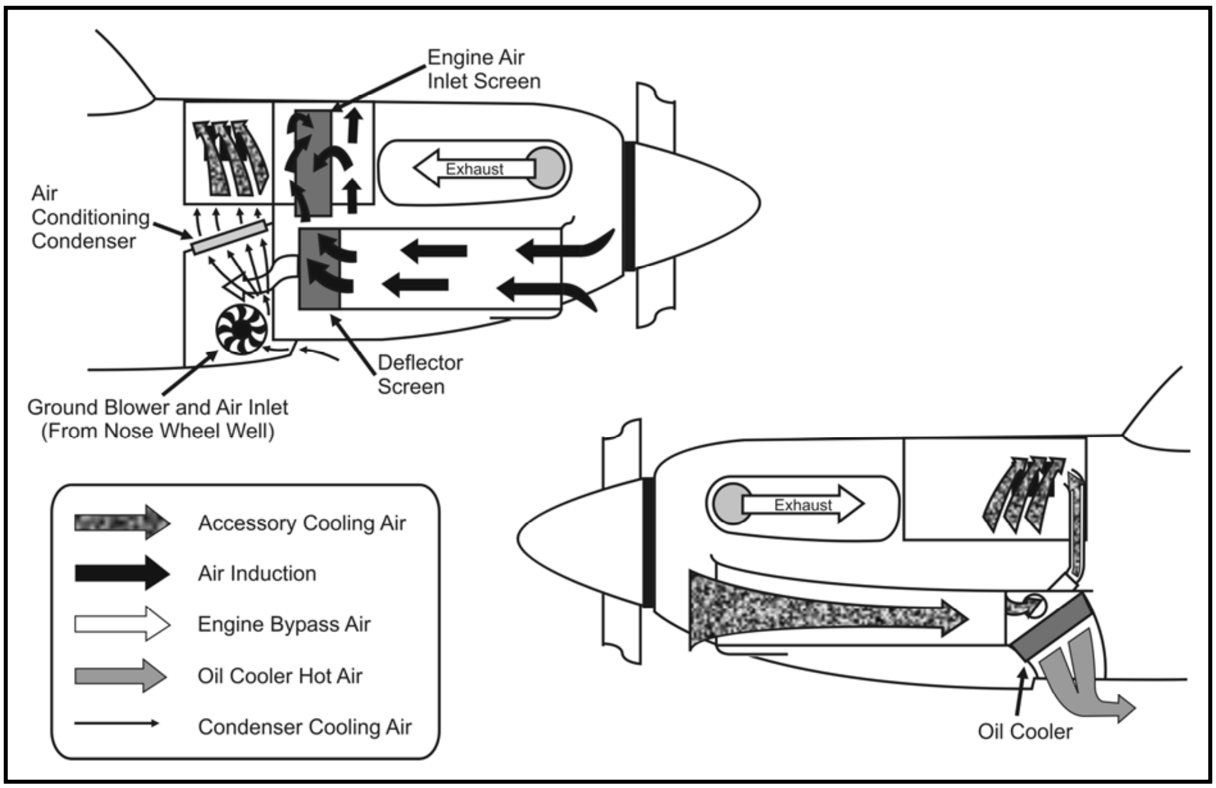

Figure 3-1 Air Induction/Accessory Cooling

303. ENGINE OIL SYSTEM

The engine oil system is a pressure type system providing a constant supply of clean oil to cool and lubricate the engine during its operation. Within the engine, all bearings are lubricated by the pressure method, while the accessory gearbox and reduction gearbox are lubricated by the pressure and "splash and spray" method.

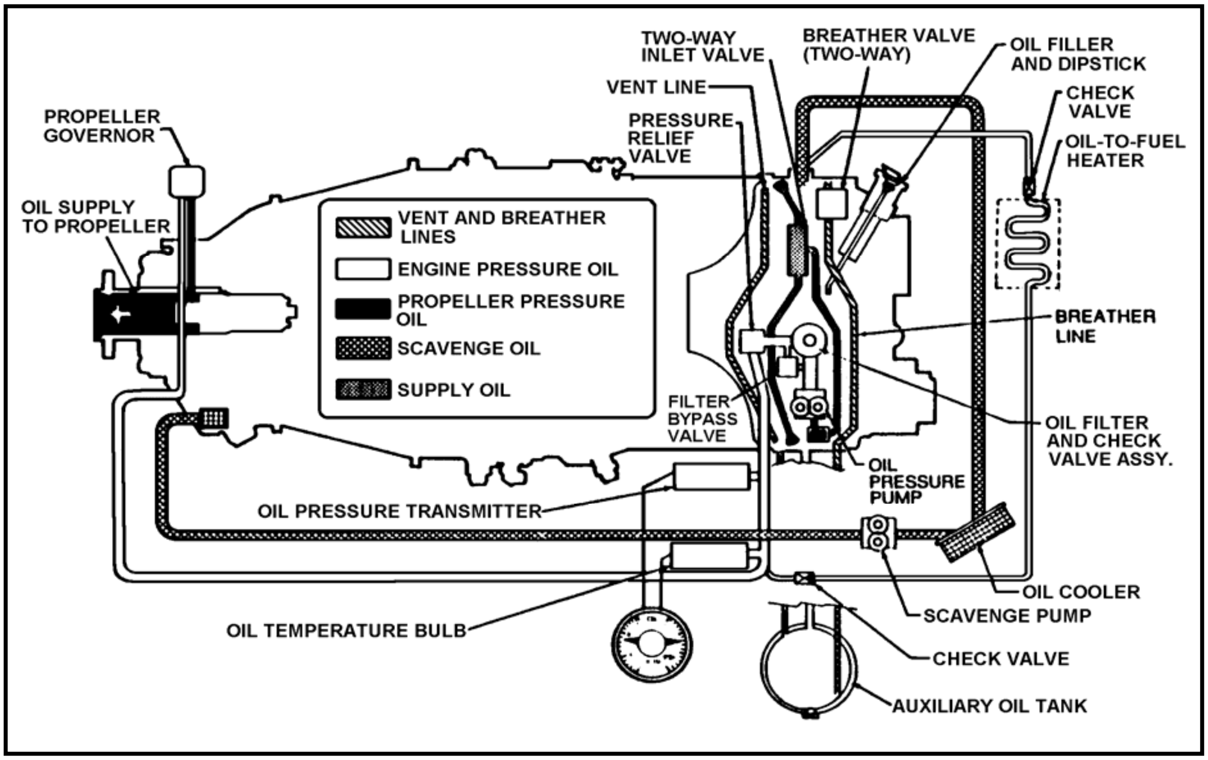

Figure 3-2 Engine Oil System

The main oil tank is an integral part of the engine casing. It is located in the area between the accessory gearbox and compressor inlet casing. The system includes an auxiliary oil tank, which is attached to the bottom of the accessory gearbox and contains one quart of oil, necessary for inverted flight. The oil system capacity is 4.4 U.S. gallons. The oil tank filler neck is located on the accessory gearbox. The oil filler cap is a yellow locking type cap in which the tab on top must be in the down position to lock the cap for flight. A dipstick is attached to the filler cap and indicates the "acceptable for flight" oil quantity between a minimum and maximum mark in either the hot or cold range. (Note: dipstick graduated in quarts.)

The oil to fuel heater assembly, located on the accessory gearbox, is essentially a heat exchanger which uses heat from the engine oil system to preheat the fuel prior to its entering the primary fuel pump. The fuel temperature is maintained between 70 and 90 degrees Fahrenheit.

The main oil pump (known in NATOPS as the oil pressure pump) is located in the lower part of the main oil tank and is used to supply oil under pressure to engine components. It is a gear type pump driven by a shaft from the accessory gearbox. Oil enters the pump through a pipe with a two-way inlet valve. This valve has a pickup tube at the top and bottom of the tank to ensure an oil supply during normal and inverted operations.

There are two dual-element, gear type scavenge pumps; one is located inside the accessory gearbox, and the other mounted externally on the accessory gearbox. They both return oil through the oil cooler to the main oil tank. The internal scavenge pump is driven by the same shaft that drives the main oil pump. It removes oil from the compressor bearings and the bottom of the accessory gearbox. The external scavenge pump draws oil from the reduction gearbox and the power turbine shaft bearings.

After leaving the main oil pump, the oil is cleaned by a metal screen type oil filter located inside the oil tank. A bypass valve allows the oil to be rerouted if the filter becomes clogged.

The oil breather is located inside the main oil tank and it vents air from the tank overboard. It incorporates a two-way, gravity-operated valve to accommodate inverted flight.

Cooling of engine oil is accomplished by utilizing a radiator type heat exchanger located in the accessory air intake duct. Air passing through the oil cooler removes heat from the oil and then exits through a square opening on the lower left side of the engine cowling. There is a temperature-sensitive bypass valve on the oil cooler that controls oil flow through the cooler.

A combination oil pressure and oil temperature indicator is located on the instrument panel in both cockpits. The indicator uses DC power to display the pressure and temperature of the oil as it leaves the main oil pump. It receives its signals from the oil pressure transmitter, located on the right engine support frame and the temperature transmitter on the right side of the accessory gearbox. The temperature portion of the gauge is graduated in 10º C increments, while pressure is in 10 PSI increments.

NOTE

Gauge is rotated 90º for ease of reading.

OIL TEMPERATURE	LIMITATIONS	OIL PRESSURE
-40º C	Minimum	40 PSI @ idle (62-65% N_1)
10 - 99º C	Normal	65 - 85 PSI (above 75% N_1)
100º C	Maximum	100 PSI

(The NATOPS limit for minimum oil temperature is -40º C, but the gauge only reads to a minimum of 0º C)

304. IGNITION SYSTEM

The ignition system provides initial ignition (during engine start) for the fuel/air mixture in the combustion chamber. There are two igniter plugs that protrude into the combustion chamber to provide the spark. They receive power through two shielded ignition cables, from an exciter box (also known as a spark igniter box). The exciter box is an electrical capacitor which changes the aircraft nominal DC current to approximately 1400 volts pulsating DC current. It is located at the 10 o'clock position on the engine support frame. When operating, the exciter box produces stray voltage which will be seen on the fuel flow indicator as an increase in fuel flow, i.e., a false reading.

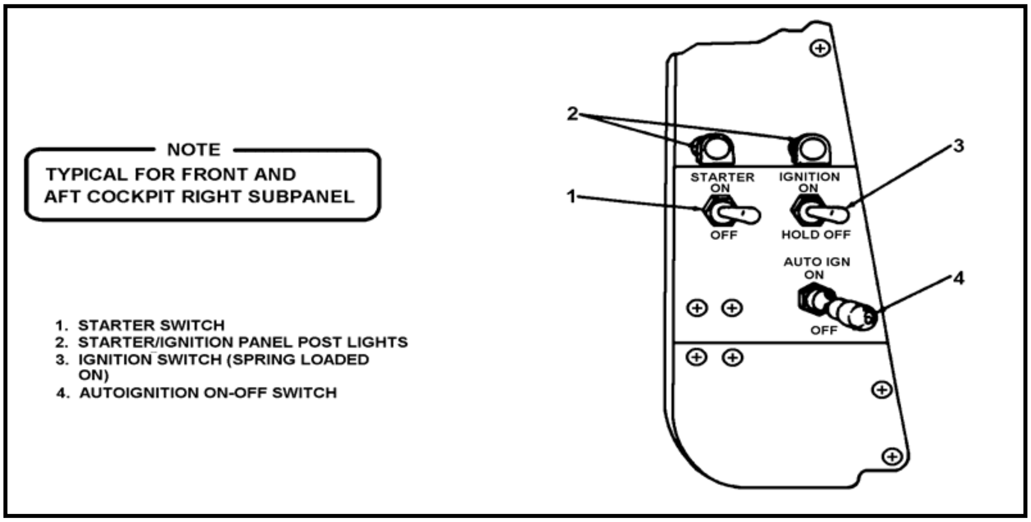

Figure 3-3 Ignition System

There is an ignition switch located on the right subpanel of each cockpit which is labeled IGNITION ON/HOLD OFF. The switch is spring-loaded to the ON position, allowing current flow to the exciter when the starter switch is turned on. The HOLD OFF position momentarily interrupts current to the exciter, allowing the engine to be motored without initiating combustion. The starter switch, also on the right subpanel of each cockpit, is labeled STARTER ON/OFF. This switch, which is not spring loaded, allows power (battery or GPU) to actuate the ignition system. A green IGNITION annunciator light located on the annunciator panel in both cockpits illuminates to indicate when the exciter is energized.

The autoignition system automatically provides a spark for combustion in the event of an engine "flameout." The system is normally armed prior to any aerobatic flight maneuvers or during flight in foul weather conditions. The autoignition switch located adjacent to the ignition switch is a two-position switch and, when turned on, arms the system. The normal position is OFF because the system is not essential to normal engine operation. Located on the reduction gearbox is an autoignition sense switch, which allows current flow to the exciter if engine output power drops into the 300 - 180 ft-lbs. range. Therefore, with the system armed, once the system is triggered to an operating condition, the igniters will fire continuously until torque is increased above the 180 - 300 ft-lbs. range. A green AUTO IGN annunciator light in each cockpit illuminates when the system is armed. When the system changes to an operating condition, the AUTO IGN light extinguishes and the IGNITION light illuminates.

STUDY QUESTIONS

1. What is the purpose of the engine air inlet bypass, and who activates it?

2. The accessory air inlet provides cooling air to what four items/areas?

3. Where is the main oil pump?

4. What does the auxiliary oil tank do?

5. Where are the internal and external oil scavenge pumps?

6. What are the indications on the dipstick?

7. The oil/fuel heater maintains a ____ to ___ fuel temperature.

8. What are the locations of the oil pressure and oil temperature transmitters?

9. What are the minimum, normal, and maximum limitations for oil pressure and temperature?

10. What switch in the cockpit actuates the ignition system?

11. What are the components of the ignition system?

12. Explain the purpose of the ignition system.

13. What is the purpose of the autoignition system and when will it work?

ANSWERS TO STUDY QUESTIONS

1. It allows solid particles to be separated from the inlet air and vented overboard. It is activated by the front cockpit pilot.

2. The oil cooler, the starter/generator, the engine-driven accessories, and the cockpit.

3. In the main oil tank.

4. It provides additional oil for inverted flight.

5. The internal pump is inside the accessory gearbox. The external pump is mounted externally on the accessory gearbox.

6. Minimum and maximum in hot and cold range and cold range in quart increments.

7. 70º F, 90º F

8. Oil pressure - right engine support strut; oil temperature - right side of accessory gearbox.

9. What are the minimum, normal, and maximum limitations for oil temperature and pressure?

Oil Temperature	Limitations	Oil Pressure
-40º C	Minimum	40 PSI @ idle (62-65% N_1)
10 - 99º C	Normal	65 - 85 PSI (above 75% N_1)
100º C	Maximum	100 PSI

10. The starter switch.

11. The starter switch, the two igniter plugs, the ignition switch, and the exciter box.

12. It provides initial ignition during engine start.

13. It automatically provides a spark for combustion in the event of an engine flameout. It operates when engine output power drops into the 300 - 180 ft-lbs. range.

CHAPTER FOUR
FUEL SYSTEM

400. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C fuel system. You must also become familiar with the location and purpose of various fuel system components as well as system operation and limitations.

401. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

4.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C PT6A-25 fuel system characteristics.

Enabling Objectives

4.1 Identify approved fuels for the T-34C aircraft.

4.2 State the total and usable fuel system capacities.

4.3 Describe the characteristics of the fuel tanks.

4.4 Describe the location, purpose and indications of operation of the fuel quantity indicators.

4.5 Describe the location and method of operation of the fuel quantity sensors.

4.6 Describe the location, purpose and method of operation of the low fuel warning system.

4.7 Describe the location, purpose and method of operation of the standby electric fuel boost pump.

4.8 Describe the location, purpose and method of operation of the fuel shutoff valve.

4.9 Describe the location and operation of the engine-driven fuel boost pump.

4.10 Describe the location and method of operation of the firewall fuel filter.

4.11 Describe the location and method of operation of the boost pressure-sensing switch.

4.12 Describe the location, purpose and method of operation of the fuel flow transmitters.

4.13 Describe the location, power requirements and indications of operation of the fuel flow indicators.

4.14 Describe the location, purpose and operating limits of the primary fuel pump.

4.15 Describe the location and purpose of the oil-to-fuel heater.

4.16 Describe the location, purpose and explain the operating modes of the fuel control unit.

4.17 State the location and method of operation of the fuel flow divider.

4.18 State the location and purpose of the manifold dump valve.

4.19 Describe the location, purpose and method of operation of the primary and secondary fuel nozzles.

4.20 Explain the location, purpose and method of operation of the fuel scavenge system.

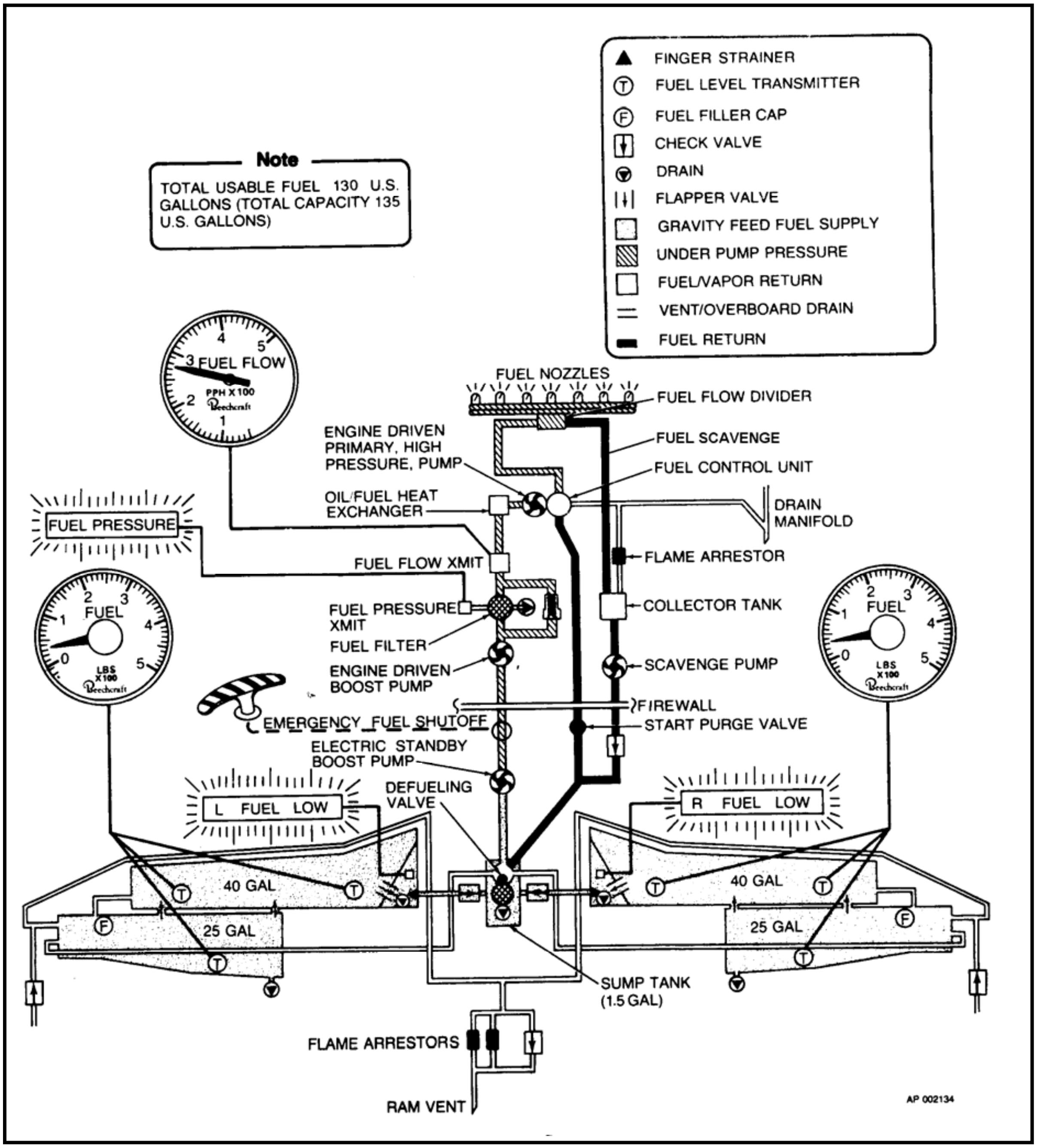

Figure 4-1 The Fuel System

402. FUEL SYSTEM

The T-34C aircraft uses JP-5/Jet A as the primary fuel with JP-4/Jet B and JP-8/A1 as alternates. The fuel capacity for the aircraft is 135 gallons total, but only 130 gallons is usable.

The fuel system consists of an interconnected bladder type 40-gallon fuel tank and 25-gallon fuel tank in each wing. The aircraft is gravity fueled through the filler neck incorporated on top of each 25-gallon tank with a tab lock type red cap. An anti-siphoning flapper valve is located in each filler neck to retain fuel if the fuel cap is lost in flight.

The fuel gravity-feeds from the 25-gallon tank into the 40-gallon tank, then through one-way check valves into a 1.5-gallon fuel sump tank in the fuselage center section. Each 40-gallon tank is equipped with a baffle and flapper valve at the inboard end to prevent the fuel from being drawn away from the outlets during hard turns or other maneuvers.

The sump tank is a rigid metal container which provides a common pickup point for the fuel flowing from both wing tanks. Check valves are incorporated to prevent fuel from flowing back to the wings and a gravity-operated vent valve prevents fuel from entering the vent system when inverted. Since the sump tank is the lowest point of the fuel system, a defueling valve is located on the bottom of the tank to allow the system to be drained.

All five tanks are vented to the atmosphere to prevent over or under-pressure situations. There are "siphon break" valves located in each wing vent line to prevent fuel siphoning action if fuel expands due to heat. To allow for draining sediment and water, there is a snap type drain at the low point of each tank.

The weight of the fuel in the wing tanks is measured by capacitance type fuel quantity sensors. These sensors send the information to the fuel quantity indicators in both cockpits to indicate usable fuel in pounds. The face of each indicator has a yellow range (no takeoff) and a red range (fuel is critical for flight). The power for the quantity indicating system is 28-Volt Direct Current (VDC).

There are two yellow lights on the annunciator panels, L FUEL LOW and R FUEL LOW. These visually indicate approximately 90 pounds of usable fuel remaining in that tank upon initial illumination. The lights receive their input from a thermistor located in the baffled portion of each 40-gallon tank. When the thermistor is covered with fuel, it remains cool and there is no current flow to the light. Once it is exposed to the air, there is a 28-VDC current flow and illumination of the fuel low lights.

Once the fuel leaves the sump tank, it will be under pressure throughout the remaining part of the system. There is an electrically powered (28V DC) standby boost pump mounted forward of the fuel sump tank which delivers fuel under pressure to the primary pump in the event that the engine-driven boost pump fails. This standby pump is controlled by a two-position circuit breaker toggle switch located on the right console of the front cockpit only.

The fuel passes next through a fuel shutoff valve located aft of the firewall. It secures the flow of fuel for emergencies and maintenance functions. This valve is manually operated by pulling a yellow and black striped T-handle, located at the aft end of the left console in the front cockpit. When pulled on the ground it shall be reset by maintenance personnel only.

The fuel then reaches the engine-driven boost pump, where during normal operation, it draws fuel from the sump tank and delivers it under pressure to the primary pump. The engine-driven boost pump is mounted to and driven by the external oil scavenge pump on the accessory gearbox.

On the discharge side of this boost pump is a fuel filter located on the left side of the firewall. A handle to drain the filter is located on the firewall near the filter. In the event this filter becomes clogged, there is a bypass valve to prevent a "flameout" due to fuel starvation. Also, a loss of boosted fuel pressure as sensed by the boost pressure sense switch (Fuel Pressure Transmitter), located on top of the fuel filter, will cause the steady illumination of a yellow FUEL PRESS light on each annunciator panel and a flashing MASTER CAUTION LIGHT. Activation of the electric standby boost pump should restore boosted fuel pressure and extinguish the light.

NOTE

> Due to a time limit on solitary (unboosted) operation of the engine-driven primary fuel pump, the pilot is required to log the amount of time the FUEL PRESSURE light is illuminated and report it to Maintenance.

The fuel flow transmitter, located next to the fuel filter, senses and converts fuel flow rate to a 26-Volt Alternating Current (VAC) signal and sends it to the fuel flow indicator in each cockpit.

Prior to entering the primary fuel pump, the fuel is heated with warm oil in an oil-to-fuel heat exchanger in the range of 70 – 90 degrees Fahrenheit.

The primary fuel pump is a positive displacement gear type pump mounted on and driven by the accessory gearbox. The pump supplies fuel under high pressure to the fuel control unit. Fuel enters the pump through a micron inlet screen and exits through a pump outlet filter. Failure of the primary pump results in flameout.

The fuel control unit (FCU) is a hydro-pneumatic-mechanical control device mounted on the primary fuel pump and it meters the amount of fuel supplied to the combustion section according to engine performance and power control lever position. The FCU uses P_3 air as a reference to monitor engine performance and control fuel output. Just prior to entering the FCU, this air line has a P_3 air filter on the right side of the engine accessory section. The power control lever (PCL) is mechanically linked to the FCU through a cam box assembly. Another mechanical input to the FCU is the condition lever which, when moved forward out of the OFF position, opens the fuel OFF and ON valve, allowing fuel flow to the fuel nozzles. Full aft movement of this lever secures fuel flow to the fuel nozzles. In response to the various input conditions, the fuel control unit controls fuel flow to:

1. Set engine power, according to the position of the PCL or Emergency Power Lever (EPL).

2. Provide or shut off engine fuel, according to the position of the condition lever.

3. Maintain a proper fuel-air mixture.

The output of the FCU enters the fuel flow divider and then the fuel manifold, which consists of the fuel nozzles and their connecting lines. There are 14 fuel nozzles that atomize the fuel for optimum ignition in the combustion chamber. Ten of the nozzles are called primary nozzles and are utilized for starting. The four secondary nozzles augment the primary nozzles after engine start.

The fuel flow divider is the device that limits fuel flow to only the 10 primary nozzles during engine start. As engine speed increases during start, fuel pump pressure increases, moving a one-way check valve to allow fuel flow to the secondary nozzles (approximately 40% N_1). There is a manifold dump valve located within the fuel flow divider to purge the manifold of residual fuel upon engine shutdown. This residual fuel is collected in a fuel scavenge tank located on the right side bottom of the firewall and covered by the air conditioning condenser. When the tank is full, an internal float switch energizes an electric (28-VDC) scavenge pump which returns the fuel to the sump tank.

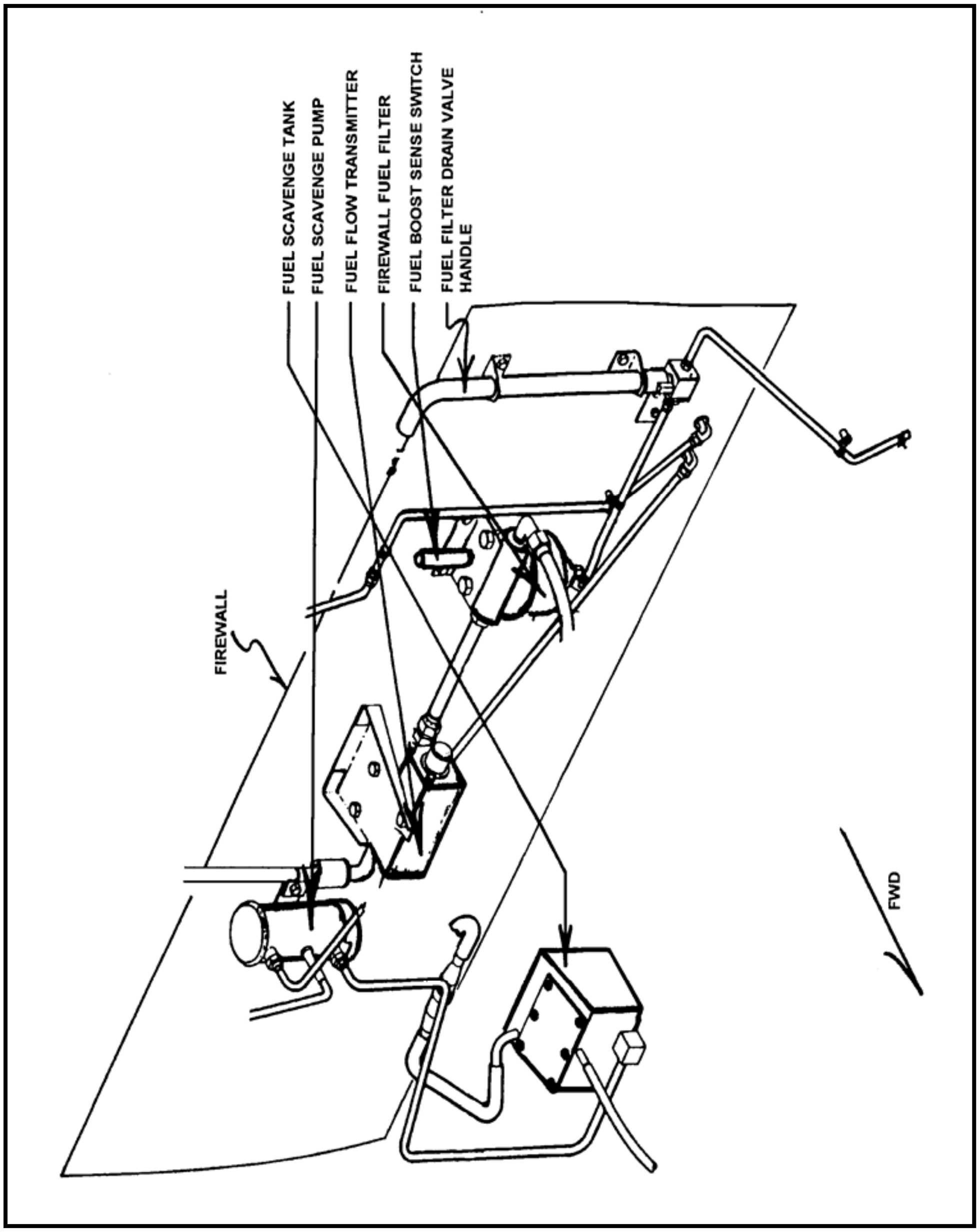

Figure 4-2 Fuel System Components

STUDY QUESTIONS

1. Primary fuel for the T-34C is ____________ and alternates are ____________ or____________.

2. The total fuel capacity is ____________ ____________ of which ____________ ____________ are usable.

3. The fuel quantity indicators provide fuel quantity in gallons. ____________(True/False)

4. Illumination of either FUEL LOW indicator indicates approximately ____________ ____________ of usable fuel in that respective tank/wing.

5. Illumination of a steady yellow FUEL PRESS light indicates possible failure of the ____________ driven ____________ ____________ pump. Activate the ____________ standby ____________ pump by turning on the switch in the ____________ cockpit.

6. If the Fuel Shutoff "T" handle in the front cockpit is pulled while the aircraft is on the ground, you may reset the "T" handle. ____________(True/False)

7. The engine-driven fuel boost pump is mounted to and driven by the ____________ oil ____________ ____________.

8. If the primary fuel pump fails, the engine continues to run. ____________(True/False)

9. The fuel scavenge pump is mounted on the ____________ side of the firewall.

10. With illumination of the green ignition light a false increase will be seen on the ______________________ indicator due to spurious input from the excitor.

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ANSWERS TO STUDY QUESTIONS

1. JP-5/Jet A; JP-4/Jet B; JP-8/A1

2. 135 gallons; 130 gallons

3. False

4. 90 pounds

5. Engine-, fuel boost; electric, boost, front

6. False

7. External, scavenge pump

8. False

9. Right

10. Fuel flow

CHAPTER FIVE
ENGINE INSTRUMENTATION AND FIRE DETECTION SYSTEMS

500. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C instrumentation and fire detection system. You must also become familiar with the location and operation of various components in order to ensure your capability to operate the aircraft safely and efficiently.

501. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

5.0 Upon completion of this chapter, the student will demonstrate knowledge of the PT6A-25 instrumentation and fire detection systems characteristics.

Enabling Objectives

5.1 State the purpose of the interstage turbine temperature (ITT) sensing system.

5.2 Describe the location and purpose of the interstage turbine temperature sensing system, indicators and system limitations.

5.3 Describe the location, purpose and display indications of the turbine tachometer.

5.4 Explain the compressor turbine (N_1) limitations.

5.5 Explain the purpose of the fire detection system.

5.6 Describe the location and method of operation of the components of the fire detection system.

502. ENGINE INSTRUMENATION

Interstage Turbine Temperature

The ITT sensing system provides an accurate indication of engine operating temperature. Eight thermocouples are attached to a harness in the engine interior and protrude into the area between the compressor and power turbines. Each thermocouple is a bi-metallic metal probe that creates an electrical current proportional to the temperature detected. The current operates the ITT indicator in each cockpit.

The ITT indicators, located on the instrument panels in both cockpits, are powered by the electrical signal from the thermocouples. The gauge is graduated in 20º C increments between 200 and 1200 degrees Centigrade.

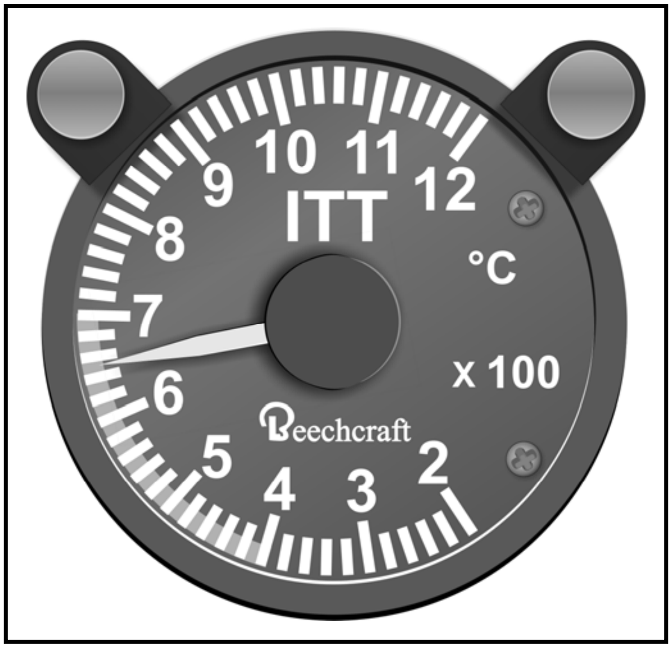

Figure 5-1 ITT Indicator

ITT Limitations

1. Normal operating range 400 – 695 degrees Centigrade.

2. Maximum (continuous) 695º C

3. Maximum starting 1090º C (925º C for two seconds)

4. Maximum acceleration 825º C (two seconds)

However, during start, if the ITT rate of increase appears likely to exceed 925º C (hot start), comply with NATOPS emergency procedures.

Compressor Speed (N_1)

The turbine tachometer (N_1) indicates the RPM of the compressor and compressor turbine in percent of the designed maximum. There is an indicator on the instrument panel in each cockpit displaying two dials. The large outer dial is used to obtain the "10's" digit and the small inner dial is used to obtain the "units" digit. The system is limited to 62-65 percent at idle power and 101.5% (37,000 RPM) at maximum power. The indicator receives its input from the N_1 tachometer-generator mounted on the accessory gearbox.

NOTE

N_1 below 62%, but no lower than 60% will allow one-time flight. With N_1 below 60% or above 65% flight is prohibited.

Figure 5-2 Turbine Tachometer (N_1 Speed)

503. FIRE DETECTION SYSTEM

The engine fire detection system is a flame surveillance system installed in the engine compartment to provide a visual warning to the pilot. Three infrared-sensitive detectors monitor the compartment.

Normal engine heat will not be sensed by these detectors. One detector monitors the top of the engine above the combustion chamber housing, a second monitors the upper accessory area, and a third the lower accessory area. Infrared radiation from a fire (or sunlight) will be sensed by a detector and will cause a 28-VDC current to be transmitted to the red flashing FIRE warning light in both cockpits. The fire warning test switch is a four-position rotary switch, located on the front instrument panel only, which allows the pilot to test the fire warning system. Both warning lights should be flashing in all three numbered positions, and be off in the OFF position. The fire warning light cannot be dimmed or reset by pushing and will return to the standby state when a fire is no longer present.

STUDY QUESTIONS

1. Write the purpose of the interstage turbine temperature sensing system.

2. Normal ITT operating range is ____________ to ____________ and maximum continuous temperature is ____________.

3. There are ____________ thermocouples providing inputs to the ITT indicators.

4. Idle RPM on the turbine tachometer (N_1) is ____________ to ____________.

5. The N_1 turbine tachometer receives its input from the ____________ - ____________ mounted on the____________ gearbox.

6. High temperature in the engine compartment will be sensed by the three infrared detectors and cause the "FIRE" light to illuminate. ____________ (True/False)

7. The engine fire detection system is a ____________ ____________ system that provides a ____________ warning of a(n) ____________ compartment fire.

8. The fire warning light will _______________ when a fire is no longer present.

9. The ITT indication is internal to the engine, while the fire warning light relates to what area?

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ANSWERS TO STUDY QUESTIONS

1. It provides an accurate indication of engine operating temperature.

2. 400° C, 695° C, 695° C

3. 8

4. 62%, 65%

5. Tachometer-generator, accessory

6. False

7. Flame surveillance, visual, engine

8. Extinguish

9. Engine compartment

CHAPTER SIX
REDUCTION GEARBOX

600. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C reduction gearbox. You must also become familiar with the location and purpose of various reduction gearbox components as well as system operation and limitations.

601. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

6.0 Upon completion of this chapter, the student will demonstrate knowledge of the PT6A-25 reduction gearbox characteristics.

Enabling Objectives

6.1 State the location and purpose of the reduction gearbox.

6.2 Describe the characteristics of the two sections of the reduction gearbox.

6.3 Describe the location, purpose, and method of operation of the magnetic chip detector.

6.4 Explain the location and purpose of the components of the torque indicating system.

6.5 Explain the location, purpose, and method of operation of the components of the propeller RPM indicating system.

602. REDUCTION GEARBOX

Because the power turbine (N_f) operates at high speeds, it is necessary to reduce that rotational speed to one that is usable by the propeller. This is done through the reduction gearbox, which is bolted to the front flange of the exhaust duct and driven by a shaft extending from the power turbine. The gearbox also provides a mounting and drive for the propeller and certain propeller-related accessories. All prop-driven accessories are driven at the same speed by the propeller shaft. The rear half of the gearbox contains a two-stage reduction gear system that reduces the power turbine RPMs at a 15:1 ratio. The propeller shaft extends from the front half of the reduction gearbox. This shaft is hollow to allow passage of high pressure oil for propeller pitch control.

Magnetic Chip Detector

A magnetic chip detector is located at the bottom of the reduction gearbox to provide the pilot with a warning signal for metal particles in the oil and possible engine failure. The chip detector is a dual-element probe with one probe magnetized and connected to a DC potential and a second element comprised of an insulated wire to the fault circuit. The detector is exposed to the oil flow, and functions as a normally open switch. If a large metal chip or mass of small metal particles bridges the detector gap, a circuit is completed, illuminating the flashing MASTER CAUTION light and a yellow CHIP light on the annunciator panel.

Torque Indicating System

One of the propeller-related accessories is the torque indicating system. The torquemeter, located inside the first stage of the reduction gear housing, provides an indication of engine power output to the propeller shaft. It is a hydromechanical device which meters a given quantity of oil based on the amount of torque applied to the reduction gearbox. The torquemeter oil pressure is routed to three power plant accessories: the torque limiter, autoignition sense switch, and torque transmitter. The torque transmitter, located on the reduction gearbox flange, converts the torquemeter oil pressure to a 26 VAC electrical signal to operate the torque indicators in the cockpits. There is a torque indicator on each instrument panel which is graduated in 50 ft-lbs. increments. The maximum torque is 1315 ft-lbs. (550 SHP); however, NATOPS restricts the maximum allowable torque to 1015 ft-lbs. (425 SHP), which is indicated by a red line on the torque indicator.

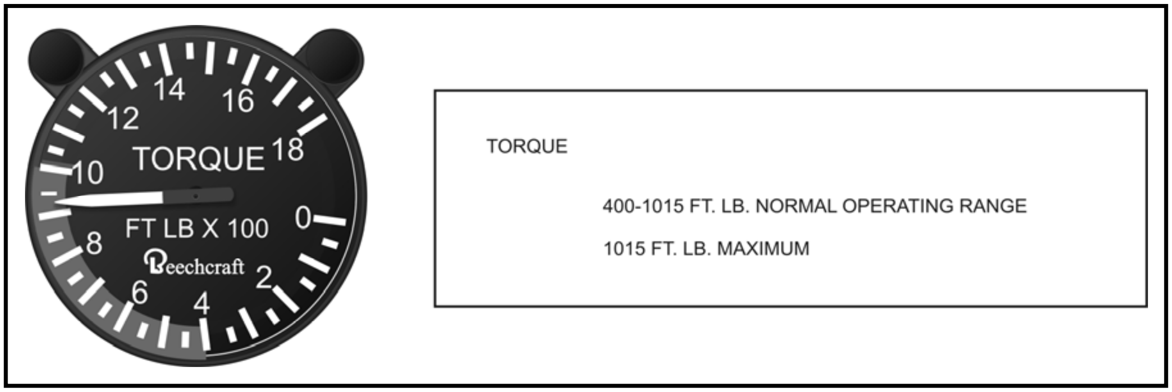

Figure 6-1 Torque Indicator

Propeller Tachometer-Generator

Another propeller-related accessory is the propeller tachometer-generator, located on the reduction gearbox. Turning at the same speed as the propeller, this tachometer-generator provides the electrical signal to operate the propeller RPM indicator. Located on the instrument panel in both cockpits, the propeller RPM indicator is graduated in 50-RPM increments from 0 to 2500 RPM. The normal governed operating range of the propeller is 1800-2200 RPM with a maximum allowable of 2200 RPM. For normal T-34C operations, the condition lever will be at full increase and the propeller rotating at 2200 RPM.

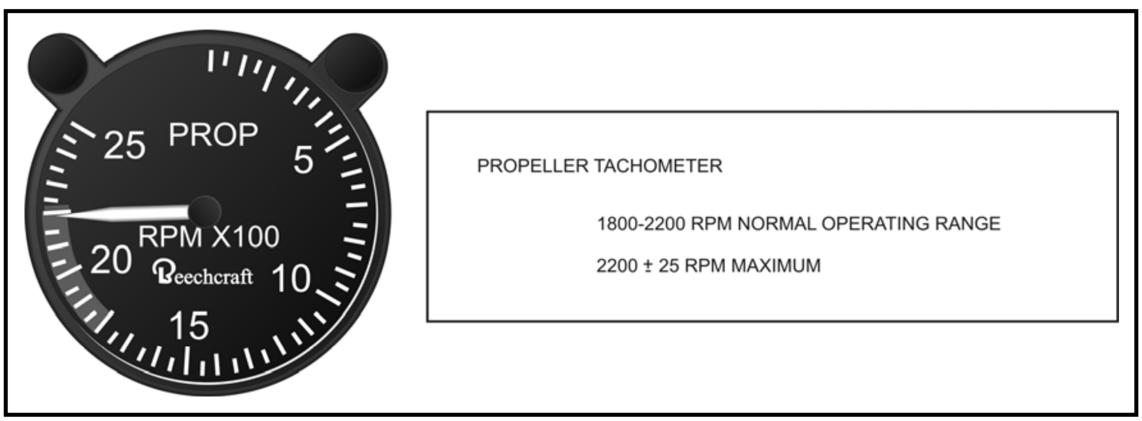

Figure 6-2 Propeller-Tachometer

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STUDY QUESTIONS

1. Another name for N_f turbine is ____________ turbine.

2. The magnetic chip detector is located where?

3 What would indicate to the pilot metal particles in the reduction gearbox?

4. The maximum torque is ____________ which equates to ________ SHP.

5. The maximum NATOPS torque is _______ which equates to _______ SHP.

6. The propeller ____________-____________ located on the reduction gearbox provides input to the propeller RPM indicator in each cockpit.

7. The reduction gearbox reduces power turbine (N_f) speed at a ________:________ratio to the propeller speed.

ANSWERS TO STUDY QUESTIONS

1. Power

2. At the bottom of the reduction gearbox

3. The yellow CHIP light and flashing MASTER CAUTION light

4. 1315 ft-lbs., 550

5. 1015 ft-lbs., 425

6. Tachometer-generator

7. 15:1

CHAPTER SEVEN

PROPELLER

700. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C propeller. You must also become familiar with the location and operation of various propeller components and forces to be capable of operating the T-34C propeller safely and effectively. This lesson demonstrates propeller operation on the ground.

701. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

7.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C propeller characteristics.

Enabling Objectives

7.1 Describe the propeller used on the T-34C aircraft.

7.2 Describe the major components of the propeller.

7.3 Describe the components of the pitch change assembly.

7.4 Define propeller blade angle.

7.5 Explain the three basic blade angles.

7.6 Explain the relationship between blade angle and propeller RPM.

7.7 Identify the forces that drive the propeller to a high blade angle.

7.8 Identify the forces that drive the propeller to a low blade angle.

7.9 Describe the location, purpose, and operation of the beta valve.

7.10 Describe the correct condition lever position to select BETA.

7.11 Explain the "beta" condition and the forces which cause it.

7.12 State the conditions required to select beta with the PCL.

702. PROPELLER MAJOR COMPONENTS

The T-34C uses a three-bladed aluminum propeller. The propeller is hydraulically controlled, constant-speed, full-feathering, and reversible. It measures 7 feet, 6 inches in diameter and rotates clockwise. A spinner, bolted to the front flange at the propeller shaft, encloses the pitch-change mechanism and helps to reduce drag.

The major components of the propeller are the blades, hub, and pitch change assembly. The blades are attached to the hub, which is the central attaching point for all components. The blades are installed into the hub, and the hub is then attached to the propeller shaft. The pitch change assembly is comprised of the servo piston and connecting links, feathering spring and retainer cup, counterweights, and beta feedback ring. All four components work together to control prop blade angle, which is sometimes referred to as pitch.

Blade angle is the angle between the plane of rotation of the propeller and the chord line of the blade (Figure 7-1). The T-34C has three basic blade angle stops (Figure 7-2).

Feather	87.5°
Low pitch stop (idle)	17.5°
Maximum beta (reverse)	-5°

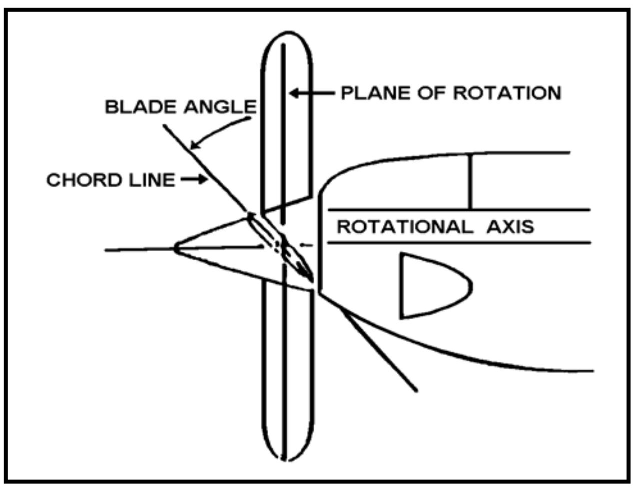


Figure 7-1 Blade Angle

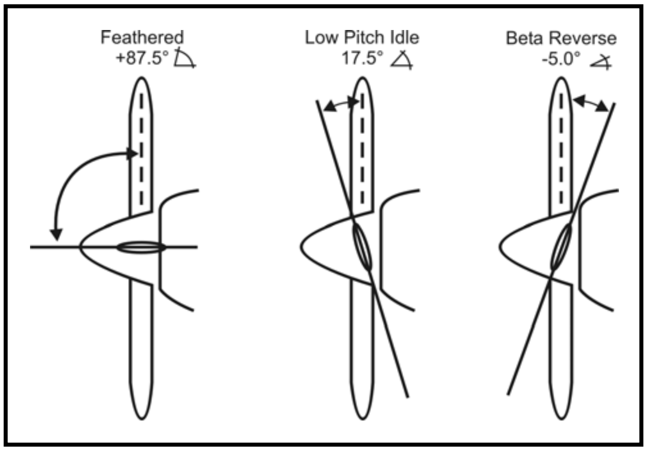


Figure 7-2 The Three Basic Blade Angle Stops

Blade angle directly affects the speed of the propeller. A high blade angle causes low prop speed. Conversely, a low blade angle causes high prop speed.

In event of engine failure it is desirable that the blades go toward feather or low drag position in order to maximize glide distance.

Pitch Change Assembly

Change of blade angle is accomplished through the pitch change assembly. The feathering spring, located inside the hollow prop shaft, moves the blades to high blade angle. The counterweights, attached to the base of each blade, assist the feathering spring in setting high blade angle when the propeller is rotating. Low blade angle results when the servo piston is moved forward by high-pressure oil. Connecting links, between the piston and the base of each blade, transmit the fore and aft motion of the piston to rotate the blades. The beta feedback ring assists in controlling blade angle from 17.5 to –5 degrees.

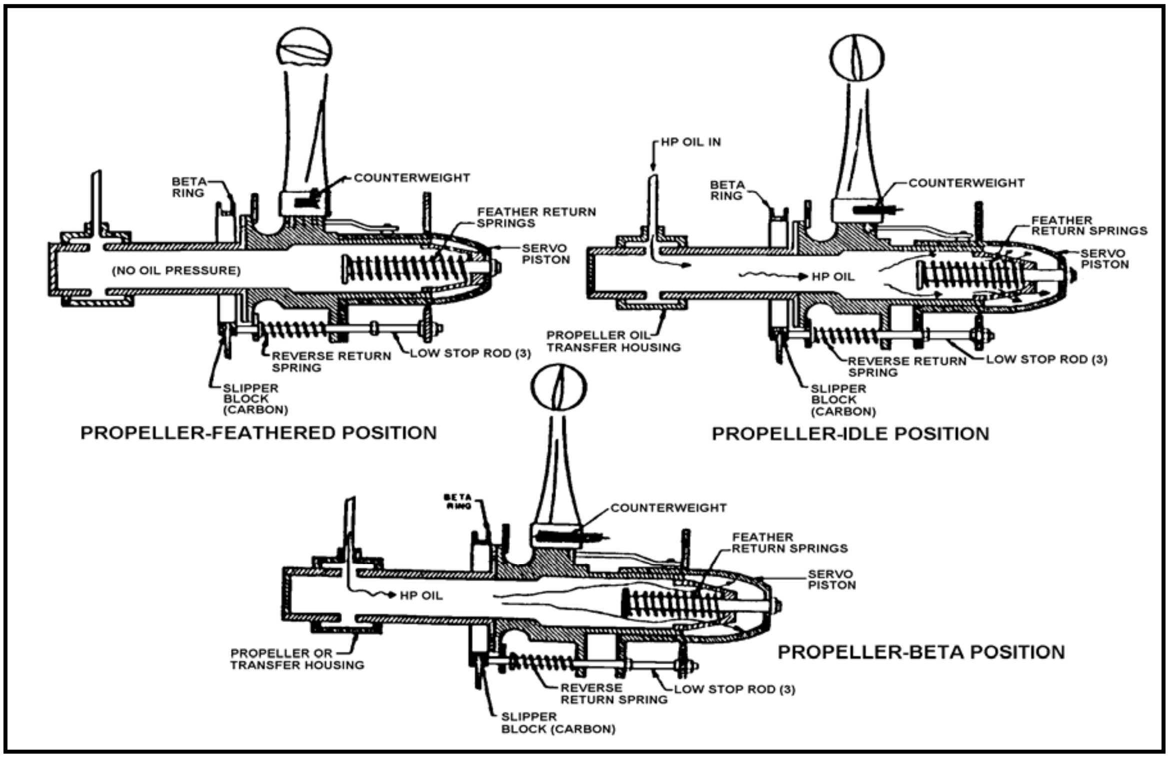


Figure 7-3 Pitch Change Assembly

Blade Angle Forces

Control of propeller blade angle is achieved through the interaction of two opposing forces within the pitch change assembly: feathering spring/counterweight versus high-pressure oil. The "relaxed" state of the propeller is the low drag-maximum glide feather (FTHR) condition. Without high-pressure oil, the feathering spring and counterweights will hold the piston aft and the blades will remain in the feather position. When high-pressure oil flows into the pitch change assembly via the hollow prop shaft and retainer cup, the servo piston moves forward and the prop blades rotate to a low blade angle. Control of blade angle is then achieved by controlling oil flow to and from the pitch change assembly: increase oil flow to decrease blade angle and decrease oil flow to increase blade angle. With no change in oil flow (steady state), equilibrium exists and blade angle remains constant. In flight, propeller blade angle will be determined by such factors as power setting, altitude, and airspeed. The pilot will not know the exact blade angle.

However, there are three times on the ground when the pilot knows the propeller blade angle: feather (87.5°), idle low pitch stop (17.5°), and maximum beta (-5°). Spring and counterweight sets 87.5°. High oil pressure sets both 17.5° and –5°.

Beta Operation

Beta operation provides propeller reverse thrust. The beta valve, located on the front face of the propeller governor (Figure 8-2), controls the flow of oil to the servo piston at 17.5° (low pitch stop) and in the beta range to a maximum of -5°. The beta valve is controlled by the propeller reversing lever, which is attached at one end to the beta feedback ring and at the other end to the cam box assembly through a push-pull control. Movement at either end moves the beta valve. At low engine power settings on the ground, the prop governor is not operating at sufficient speed to control oil flow to the servo piston. The tendency of the propeller would be to stabilize at 0° blade angle, an undesirable condition. The beta valve prevents this by maintaining a positive blade angle (17.5°) until the pilot chooses to select propeller reversing. When the PCL is moved into the BETA range, the beta valve is repositioned to allow oil to flow to the servo piston and rotate the blades to an angle between 17.5 and –5 degrees. The beta feedback ring repositions the beta valve to stop oil flow when the desired blade angle is reached. Selecting BETA with the propeller feathered will result in damage to the pitch change assembly. Additionally, do not select BETA when the engine is not operating.

CAUTION

Do not select BETA unless the engine is running and the condition lever is in the RPM range.

Selection of BETA while airborne is prevented by the beta lockout mechanism, which is located on the left sidewall between the cockpits.

To select BETA three conditions must be met:

1. DC power available to operate a solenoid.
2. The nose landing gear strut compressed (aircraft on the ground).
3. The beta switch on top of the PCL depressed.

When BETA is selected, a pin, which blocks the rearward movement of the PCL, is removed by solenoid action.

The movement of the PCL within the BETA range progressively resets the low pitch stop and allows the prop to hold any blade angle in the beta range to a maximum of -5º.

STUDY QUESTIONS

1. Complete the following statement:

The propeller on the T-34C is a __________-speed, _________controlled___________ - ____________, ____________ type.

2. Select, by circling the preceding letter(s), the components of the pitch change assembly.

   a. Oil dome

   b. Spring and retainer cup

   c. Valve housing

   d. Piston and connecting links

   e. Counterweight

   f. Beta retainer

   g. Beta feedback ring

3. Define blade angle.

4. Match each blade angle numerical valve to its description.

NUMERICAL VALVE	DESCRIPTION
a. 87.5°	_____ BETA
b. 17.5°	_____ feather
c. -5°	_____ idle low pitch stop

5. Complete the following statement:

To set the highest blade angle/feather (87.5°), ____________ force pulls the servo piston aft. The servo piston is connected to each blade by ___________ so that all blades rotate to higher angle simultaneously. The force of the ____________ assist to turn the blades to feather when the propeller is rotating.

6. Select the statement(s) pertaining to setting the propeller to a low blade angle.

   a. Unpressurized engine oil is routed to the pitch change assembly.

   b. High pressure oil is routed to the servo piston through the prop shaft.

c. Oil pressure overcomes counterweight force moving the servo piston aft and all blades rotate to a lower angle.

d. Oil pressure overcomes spring tension driving the servo piston forward and all blades rotate to a lower angle.

7. Complete the following statement:

BETA corresponds to ____________ in that the propeller blades are rotated to a ____________ angle and reverse thrust occurs.

8. Select the statement(s) pertaining to setting the propeller to maximum beta condition.

a. Blades rotate through neutral into a negative angle.

b. Blade rotates through feather to a high positive angle.

c. Beta set by spring and counterweights.

d. Beta set by oil pressure.

9. List the conditions required to select BETA with the PCL.

10. State the proper position of the condition lever to select BETA.

ANSWERS TO STUDY QUESTIONS

1. Constant, hydraulically, full-feathering, reversible

2. b., d., e., g.

3. The angle between the plane of rotation of the propeller and the chord line of the blade

4.
    1. feather
    2. idle low pitch stop
    3. beta

5. Spring, connecting links, counterweights

6. b., d.

7. Reverse, negative

8. a., d.

9. DC power available to operate the solenoid
   The nose landing gear strut compressed
   The BETA switch on top of the PCL depressed

10. In RPM range:

CHAPTER EIGHT
POWER PLANT CONTROL SYSTEM

800. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C power plant control system. You must also become familiar with the location, purpose, and function of various controls to be capable of operating the power plant in a safe and efficient manner during both normal and emergency situations. This lesson demonstrates propeller operations in the air.

801. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

8.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C power plant control devices and their characteristics.

Enabling Objectives

8.1 Describe the location and purpose of the power plant control quadrant.

8.2 Describe the two ranges of the PCL.

8.3 Describe the three ranges of the condition lever.

8.4 State the location, purpose and function of the propeller governor.

8.5 Describe the components of the propeller governor.

8.6 Describe the operation of the propeller governor.

8.7 Describe the location, purpose and operation of the overspeed governor.

8.8 Describe the function of the overspeed governor test button.

8.9. State the purpose and method of operation of the fuel topping/N_f governor.

8.10 State the location, purpose and method of operation of the torque limiter.

8.11 Describe the purpose, location and operation of the Emergency Power Lever.

802. POWER PLANT CONTROL SYSTEM

Power Plant Control Quadrant

The power plant control quadrant, located on the left sidewall of each cockpit, provides control of engine power output and selection of propeller speed and condition. Three moveable levers, the outboard PCL, the center condition lever, and the inboard EPL are partially enclosed within a triangular-shaped housing. The levers in each cockpit are connected by push-pull rods. A friction lock knob is located on the inside face of the front cockpit quadrant only. A fuel cutoff stop release lever is located at the rear of both quadrants.

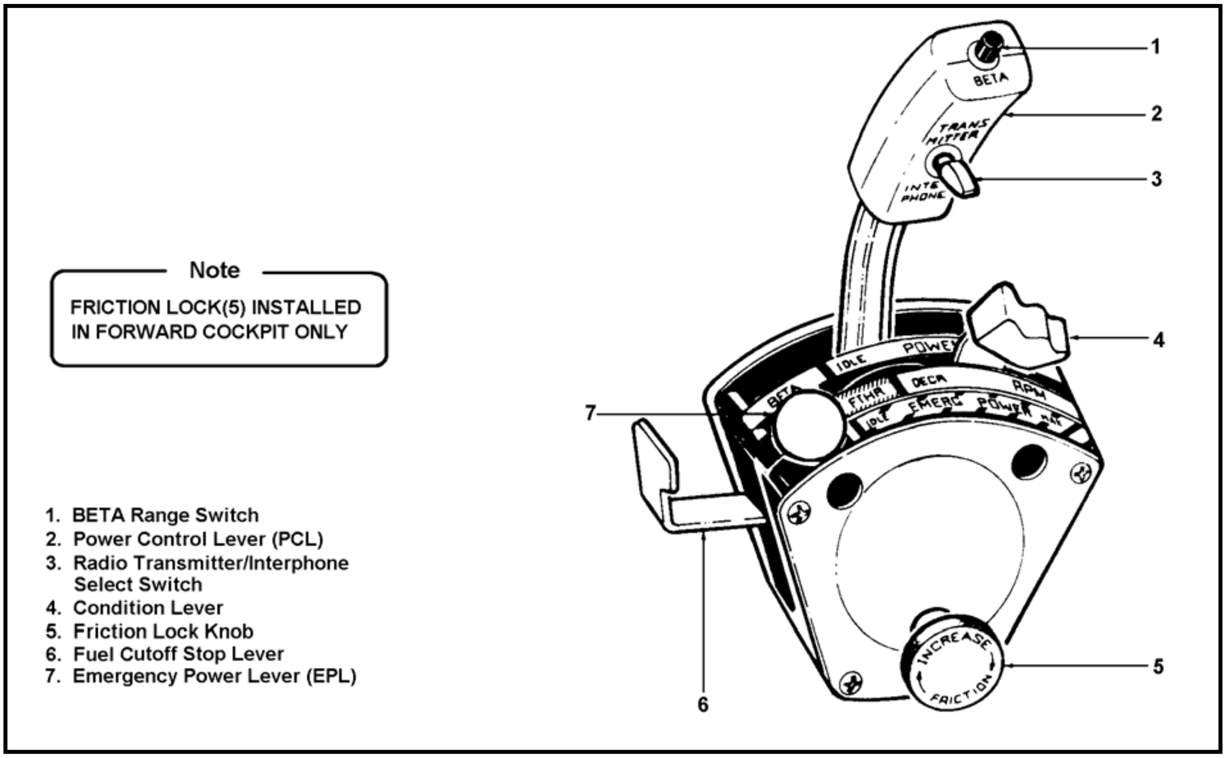


Figure 8-1 Power Plant Control Quadrant

Power Control Lever

The Power Control Lever (PCL) controls engine power output and propeller reverse thrust. The PCL operates in two ranges: POWER and BETA. The PCL in the front cockpit is connected to the cam box assembly located on the right side of the accessory gearbox. The cam box assembly allows the PCL to operate the FCU in the POWER range and the beta valve in the BETA range. In the POWER range, the PCL controls power from IDLE to MAX. Advancing the PCL increases fuel flow and power output increases. Retarding the PCL decreases fuel flow and power output decreases. Retarding the PCL aft to the IDLE position sets idle engine speed of 62-65% N_1.

Condition Lever

The condition lever allows control of fuel OFF/ON valve and propeller speed functions. The condition lever has three ranges: FUEL OFF, FTHR (feather) and RPM. The FUEL range gives control of the ON-OFF valve on the FCU. Movement of the condition lever from FUEL OFF to FTHR allows fuel to flow to the combustion chamber fuel nozzles. In the RPM range, advancing the lever increases propeller speed and retarding the lever decreases propeller speed. At the DECR position, the lever contacts a spring detent which prevents inadvertent propeller feathering. Pulling the lever through the spring detent into the FTHR range will feather the propeller. Moving the lever from FTHR to FUEL OFF secures fuel flow and shuts down the engine. Accidental fuel shutoff is prevented by a positive stop. The condition lever contacts the stop in the FTHR range and prevents further rearward movement. Raising the fuel cutoff stop lever at the rear of either quadrant removes the positive stop and allows the condition lever to select FUEL OFF.

Friction Lock Knob

The friction lock knob, located on the side of the front control quadrant, adjusts friction drag against the PCL and condition lever to prevent creeping of the levers when set by the pilot. Clockwise rotation of the knob increases friction.

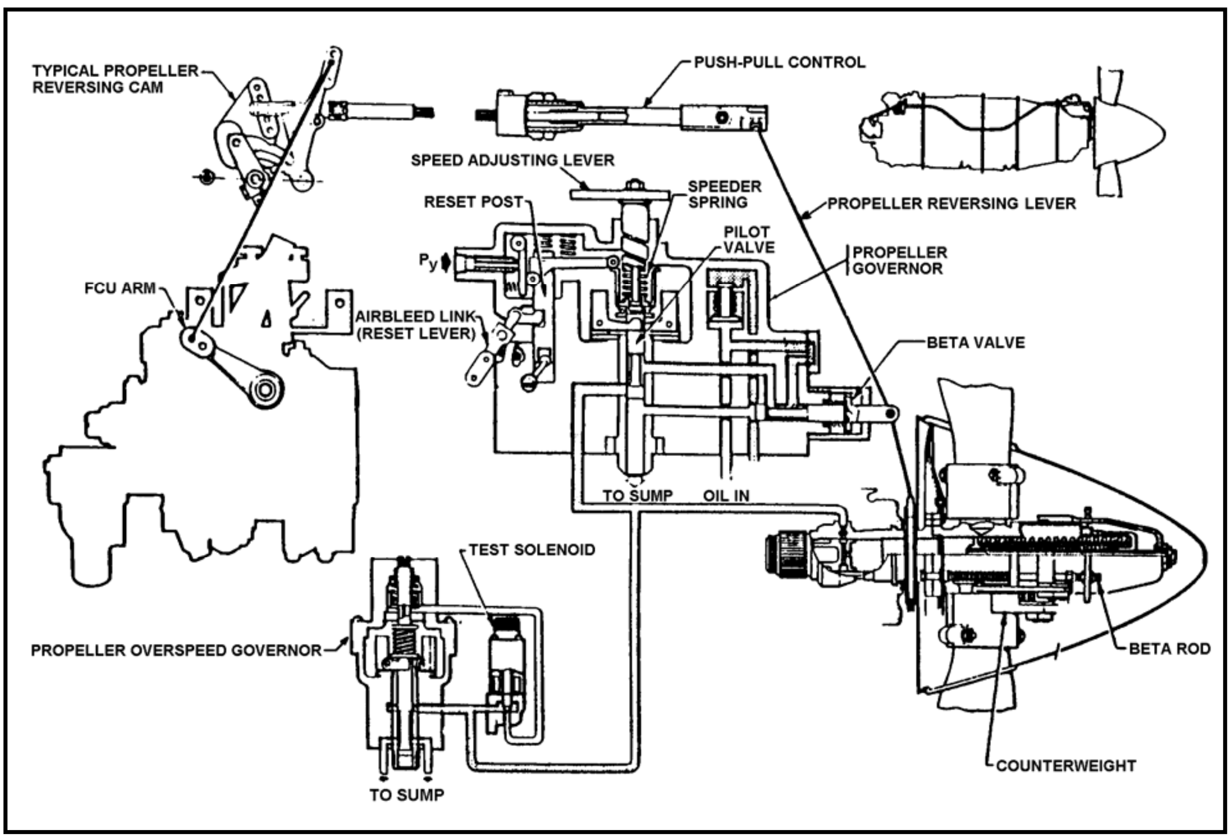


Figure 8-2 Propeller Control Schematic

803. PRIMARY PROPELLER GOVERNOR

The primary propeller governor, located at the 12 o'clock position on the reduction gearbox, is driven by gears from the propeller shaft and maintains the propeller speed and condition (feathered or thrust-producing) as selected by the pilot. The propeller governor performs three functions:

1. Boosts engine oil pressure to the pressure level required to operate the pitch change assembly.

2. Senses speed of the propeller.

3. Controls the flow of the high pressure oil to and from the propeller.

These functions are achieved through the operation of four components within the propeller governor: a gear type pump, flyweight assembly, speeder spring, and pilot valve. High pressure oil comes from a gear type oil pump which is inside the base of the governor. The pump receives engine oil from the main oil pump and raises it to the pressure necessary to operate the pitch change assembly. The flyweight assembly rotates at the same speed as the propeller and immediately senses any change in propeller speed. A pilot valve controls the flow of high pressure oil to and from the propeller, and is positioned by the interaction of the speeder spring and the flyweight assembly. The tension on the spring is adjusted by the condition lever in the RPM range to establish the desired propeller RPM. The two opposing forces then move the pilot valve up and down to uncover openings which allow high pressure oil flow from and to the servo piston in the pitch change assembly.

The propeller governor's purpose during flight is to maintain a desired constant speed. With the propeller turning at that speed, a state of equilibrium exists between the flyweight assembly and the speeder spring force and no oil flows to or from the servo piston. If the pilot adds power with the PCL, an overspeed condition is created, the flyweights move outward and overcome speeder spring tension to raise the pilot valve and allow high pressure oil to drain back to the reduction gearbox. The feathering spring and counterweights INCREASE propeller blade angle, which causes the propeller load to increase and slows the propeller back to an on-speed condition. If the pilot reduces power with the PCL, an underspeed occurs, the flyweights move inward and speeder spring tension overcomes the flyweights to lower the pilot valve and increase the flow of high pressure oil to the servo piston and DECREASE blade angle. The load on the propeller is reduced and the propeller speeds up back to an on-speed condition.

Moving the condition lever within the RPM range adjusts the speeder spring tension to establish an on-speed condition from 1800 RPM at DECR to 2200 RPM at INCR. The T-34C NATOPS prescribes using 2200 RPM for all normal operations in flight.

804. PROPELLER OVERSPEED GOVERNOR

The propeller overspeed governor is located on the reduction gearbox (Figure 8-2). It limits propeller RPM should the primary propeller governor fail. Constructed in the same manner as the primary governor with speeder spring, flyweight assembly, and pilot valve, and driven by gears from the propeller shaft, the overspeed governor constantly monitors propeller RPM. Should the primary propeller governor fail and the prop begin to overspeed, the overspeed governor will ACTIVATE at 2332 RPM by detouring high pressure oil back to the reduction gearbox. The overspeed governor should then govern the propeller at 2332 RPM. Ground test of the overspeed governor is provided by a test valve actuated by a 28-VDC solenoid. A push-button, located on the TEST panel at the bottom of the instrument panel in each cockpit, activates the solenoid and opens the test valve, allowing high pressure oil to reset the normal overspeed setting to 10% below normal. A properly functioning overspeed governor is indicated during ground test by the propeller RPM stabilizing at 1950-2150 RPM with engine torque at approximately 400-500 ft-lbs. Releasing the TEST button resets the overspeed governor to normal operation and the propeller RPM rises toward the normal governing RPM of 2200.

Fuel Topping

The fuel topping section of the primary propeller governor is located in a chamber at the rear of the governor. Its purpose is to control power turbine overspeed should there be a failure or malfunction of the propeller pitch change assembly. A P_y air line from the FCU connects to a valve in the fuel topping section. The valve is spring-loaded to the closed position. Mechanical linkage from the primary propeller governor flyweight assembly opens the valve when the propeller reaches 2398 RPM. The resulting drop in P_y air pressure causes the FCU to reduce fuel flow to the combustion chamber and turbine RPM decreases. Surging of propeller RPM may occur until corrective action by the pilot is taken.

Torque Limiter

The torque limiter is located on the reduction gearbox. The torque limiter limits engine power output to 550 SHP (1315 ft-lbs. of torque). An air line from the FCU routes P_y air to one side of a shuttle valve inside the torque limiter. The valve is spring-loaded to shut off the P_y air line. Torquemeter oil pressure from the torquemeter in the reduction gearbox is routed to the other side of the shuttle valve. When torquemeter oil pressure corresponds to 1315 ft-lbs. torque, the valve is moved to open an orifice which bleeds P_y air pressure and reduces fuel flow. Engine power output decreases back to 1315 ft-lbs. torque and the spring closes the valve. Surging of propeller RPM may occur until corrective action is taken by the pilot.

Emergency Power Lever

The emergency power lever allows manual control of the FCU in the event of a pneumatic (P_3/P_y) air line leak, called "rollback." Should a leak occur, the drop in air pressure will cause the engine to decelerate to below idle RPM and the FCU will no longer respond to the PCL. The EPL mechanically forces the FCU to deliver fuel regardless of the pneumatic input. The normal position for the EPL is DISCONNECT, where it is held in a detent by a spring. When pulled up and moved forward into the EMERG POWER range to engage, the EPL provides a direct mechanical linkage to the bellows and fuel metering pin in the FCU, thereby bypassing the pneumatic function and scheduling fuel to the combustion chamber fuel nozzles. Since the FCU will no longer have its normal fuel scheduling capability, the EPL must be moved forward cautiously to prevent an overtemp, as no safety controls are operational.

STUDY QUESTIONS

1. Complete the following statement.

The power plant control quadrant provides the pilot control of engine ____________ ____________, and selection of propeller ____________ and ____________. One is mounted on the ____________ sidewall of each cockpit.

2. Match the list of power plant controls with the correct statements concerning the characteristics of each.

CONTROLS	CHARACTERISTICS
a. ______ ______ Power control lever	1. Allows the PCL to operate the FCU in the Power range and the beta valve in the BETA range.
b. ______ ______ Cam box assembly	2. Front and rear power levers inter-connected by push-pull rods.
	3. Located in both cockpits.
	4. Located on the right side of the accessory gearbox.

3. List the two ranges of the PCL.

4. List the three ranges of the condition lever.

5. Complete the following statement.

The propeller governor is located on the top of the____________ gearbox.

6. Select the correct statements of the functions of the propeller governor.

   a. Senses speed of propeller

   b. Senses speed of engine

   c. Boosts engine oil pressure to a level required to operate the propeller pitch change assembly

   d. Provides overspeed protection for the propeller

7. Match each propeller governor component with true statements pertaining to each.

COMPONENTS		STATEMENTS
a. ______ ______	Flyweight assembly	1. Housed inside the base of the governor.
b. ______ ______	Pilot valve	2. Rotates at the speed of the propeller.
c. ______ ______	Oil pump	3. Raised by action of the flyweights.
		4. Raises oil pressure to operate the propeller pitch change assembly.
		5. Controls flow of high pressure oil to the propeller.
		6. Driven by a hollow shaft that extends into the gearbox and is driven by the propeller shaft.

8. Complete the following statement.

When the pilot increases power with the PCL, he/she causes an ____________ condition in the governor causing ____________ ____________ ____________ to drain back to the ____________ ____________ and the propeller blade angle to ____________.

9. Select the true statement(s) describing the feather condition.

a. The PCL is moved aft to FTHR.

b. No high pressure oil is in pitch change assembly.

c. The feathering spring brings the servo piston aft.

10. Write the location and purpose of the propeller overspeed governor.

11. Complete the following statement.

The overspeed governor operates in parallel with the propeller governor and becomes functional at ____________ propeller RPM. High pressure oil, enroute to the propeller shaft, will be diverted into the reduction gearbox, allowing spring force to adjust the propeller to a ____________ blade angle.

12. A properly functioning overspeed governor during ground test will stabilize prop RPM ______to ______ with torque at ______ to ______ ft-lbs.

13. Write the purpose of the fuel topping section of the primary propeller governor.

14. Select the correct statement(s) pertaining to the fuel topping function(s) by circling the correct letters.

a. Bleeds HP oil from prop shaft if propeller RPM reaches 2332

b. Increases blade angle to slow propeller RPM

c. Bleeds P_y air causing fuel flow decrease in order to protect the power turbine

d. Bleeds P_3 air in the event of an overtorque condition

15. Correctly complete the following statement.

The torque limiter is mounted on the ____________ gearbox and is used to limit engine output power to ____________ by bleeding ____________ air.

16. Write the location and purpose of the EPL.

ANSWERS TO STUDY QUESTIONS

1. power output, speed, condition, left

2. 2, 3
   1, 4

3. Power and beta

4. Fuel off, feather, RPM

5. reduction

6. a., c.

7. 6, 2
   3, 5
   1, 4

8. overspeed, high pressure oil, reduction gearbox, increase

9. b., c.

10. It is located on the reduction gearbox; it limits propeller RPM should the primary propeller governor fail.

11. 2332; higher

12. 1950, 2150, 400, 500

13. To control power turbine overspeed should there be a failure or malfunction of the propeller pitch change assembly.

14. c.

15. reduction, 550 SHP (1315 ft-lbs.), P_y air

16. On the power control quadrant, the EPL provides a direct mechanical linkage to the bellows and metering pin in the FCU.

CHAPTER NINE

ELECTRICAL SUBSYSTEMS

900. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C electrical system. You must also become familiar with the location, operation, and purpose of various components to be capable to operate the T-34C electrical system safely and effectively. This lesson covers normal, emergency, and external power systems.

901. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

9.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C basic electrical system characteristics.

Enabling Objectives

9.1 Describe the characteristics of the circuit breakers, relays and buses used in the T-34C aircraft.

9.2 State the location and purpose of the battery.

9.3 Describe the characteristics of the battery.

9.4 Explain the method of recharging the battery.

9.5 Describe the battery compartment vent and drain system.

9.6 State the location, purpose and operation of the battery switch.

9.7 Identify the minimum voltage required for a battery start.

9.8 Identify the aircraft requirements for acceptance of external power.

9.9 State the location and purpose of the DC generator.

9.10 Identify the characteristics of the DC generator.

9.11 Describe the location, purpose and operation of the generator switch.

9.12 State the purpose of the generator control panel.

9.13 Describe the three functions of the generator control panel.

9.14 Describe the location and significance of an illuminated generator fault light.

9.15 State the purpose of external power.

9.16 State the location of the aircraft external power receptacle.

9.17 State the location and purpose of the volt/ammeter.

9.18 Identify the DC power source applied to the DC bus with various volt/ammeter indications.

9.19 Describe the location and purpose of the utility bus switches.

9.20 Describe the location and purpose of the inverters.

9.21 Describe the location and purpose of the inverter switch.

9.22 State the indication and corrective action to be taken for an inverter failure.

9.23 State the location, purpose and describe the operation of the command control transfer switch.

9.24 State the location, purpose and characteristics of the command indicator light.

902. ELECTRICAL POWER SUPPLY SYSTEM

The electrical power supply system consists of a nominal 28-VDC system and a 26-volt/115-VAC inverter system. The DC system is comprised of a battery and an engine-operated generator. On the ground, the DC system can be powered by an external power unit. The AC power is provided by two inverters which change DC power to AC power. Control of the electrical system is provided through various circuit breakers, relays, buses, and switches.

903. BASIC CIRCUIT COMPONENTS

A circuit breaker protects an electrical circuit from overload. It is constructed of a bi-metallic strip with each metal having a different expansion rate when exposed to heat. Should a piece of electrical equipment malfunction causing the circuit to overheat, the bi-metallic strip bends and causes the circuit breaker to "pop," thereby creating an "open" circuit and interrupting electrical power to the faulty equipment.

A relay is used to control a large amount of current flow with a small amount of current flow. Activated by a remotely controlled switch, it allows a small amount of current flow to the relay electromagnetic coil. The relay "closes" and provides a complete circuit to the system component requiring high current (for example, the engine starter). Relays, therefore, allow the use of small switches in the cockpit to control large electrical loads. Interruption of current to the relay "opens" the relay and current flow to the electrical load ceases.

A bus is an electrical power distribution point. A bus can receive electrical power from the battery, generator, external power unit, or inverters. It then distributes the electrical power to various electrical loads (i.e., lights, motors, instruments, etc).

904. DC POWER SYSTEM

The DC power is supplied by the battery, the generator, or an external power unit. Controls for the DC system are located on the electrical control panel on the right console in both cockpits.

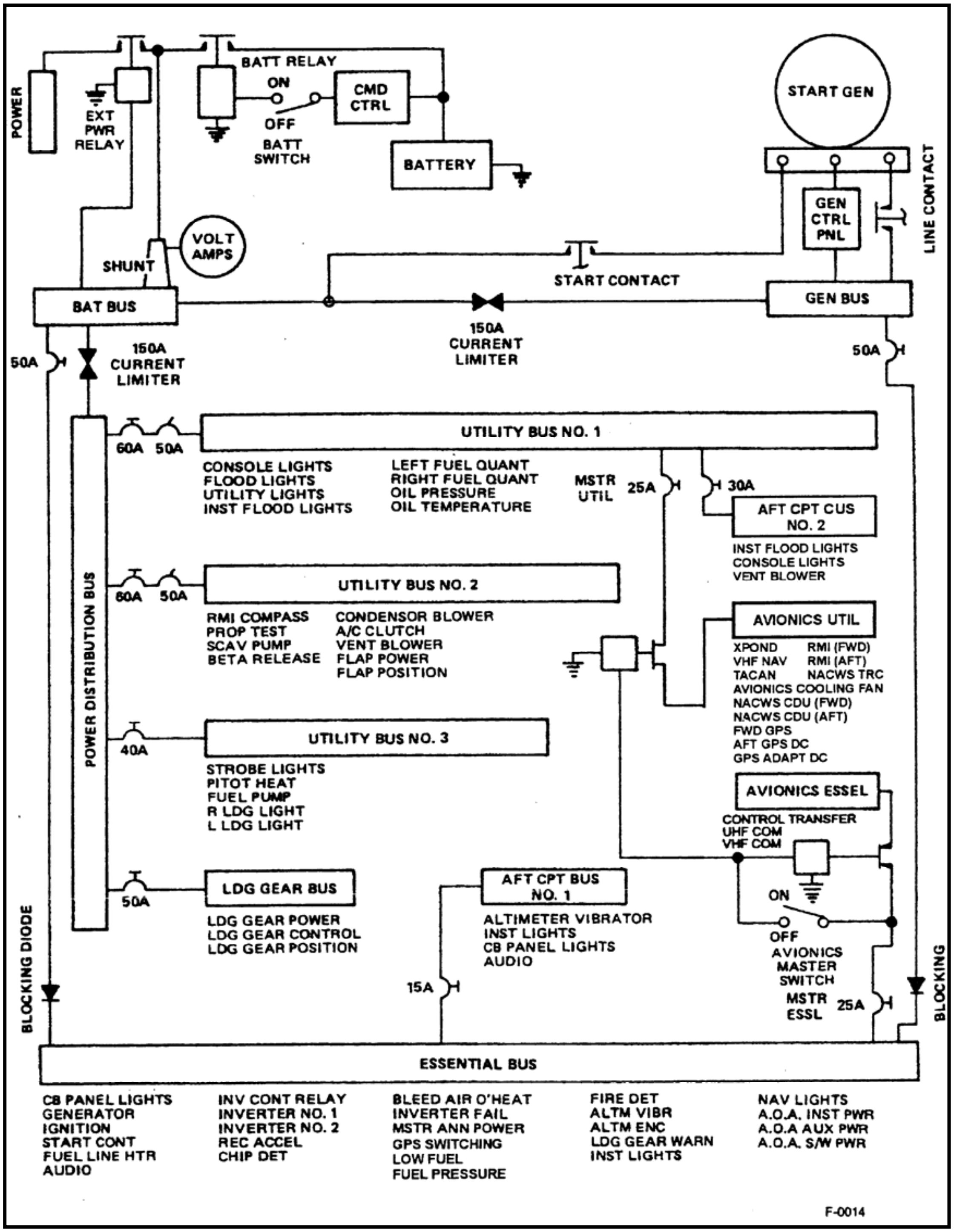


Figure 9-1 DC Power System

Battery

The battery in the T-34C provides the emergency DC power source. It is a 24-volt, 24-ampere-hour sealed valve regulated (SLA/VRLA) lead acid battery that is located in a compartment on the right side of the fuselage forward of the canopy. Either the generator or the external power unit recharges the battery.

The operating life of the battery will be affected by the battery charge, temperature of the environment, and the electrical load. Charging and discharging of the battery produces two undesirable elements, heat and hydrogen gas. Heat is removed through the battery compartment vent system. Air enters the compartment through an air intake scoop in front of the windshield and exits through an exhaust vent on the battery compartment door. The air from the air intake scoop also enters a hose attached to the back of the battery case and flows through the battery case vent system to remove the hydrogen gas. The air exits via a plastic hose which is attached to the front of the battery case and extends out the bottom of the fuselage. The SLA/VRLA battery is maintenance free and will not leak or spill in any attitude.

Battery Switch

A two-position switch, labeled BATT, ON and OFF on the electrical control panel controls the battery relay. Placing the switch to the ON position applies power directly to the essential and power distribution buses. The switch must be on for engine starting, external power to enter the system, and for the battery to be recharged.

Normal Start

Current operating procedure recommends the use of an external (ground) power unit on all starts if available. The minimum voltage allowed for a battery start is 22 volts. A battery start below 22 volts is likely to cause overtemperature damage to the engine. Less than 22 volts requires use of the external power unit. If the battery voltage is less than 18 volts, an external power relay prevents external power from entering the DC system. This is a safety feature which prevents overheating of the battery and possible explosion due to an excessively high charging rate. If below 18 volts, the battery must be replaced before the engine can be started.

Generator

The generator is located on the accessory gearbox at the 12 o'clock position and is driven by the accessory gearbox. Cooling air comes from the accessory air inlet duct through a hose connected to the rear of the generator. The generator is the primary DC power source, and it is rated at 30 volts and 200 amps. The generator switch, located on the Electrical Control Panel, is labeled GEN, ON, OFF and controls the generator relay. The switch is spring-loaded to the center GEN position with momentary actuation to the ON and OFF positions. Momentary actuation to the ON position closes the generator relay and applies power directly to the essential and power distribution buses. Momentary actuation to OFF disconnects the generator from the buses.

Generator Control Panel

Monitoring and control of the generator is provided through the generator control panel. It operates automatically to regulate the generator output voltage 27.0 to 29.5 volts, to provide reverse current protection in the event of generator failure (output below 25-VDC), and provide overvoltage protection should the regulator portion of the panel fail and generator output increase to 34 volts. The voltage regulator is adjusted to provide a normal output of 28 volts.

Should a reverse current or overvoltage situation occur, a flashing MASTER CAUTION light and the GENERATOR fault light illuminating will notify the pilot. The light will illuminate when system voltage is below approximately 27.5 to 25-VDC. Depending on the setting of the low voltage sensor, illumination of the generator light may indicate only low voltage output.

External (Ground) Power Unit

The external power unit is used to conserve the battery during maintenance functions and engine start. A cable from the external power unit plugs into the aircraft on the right side of the fuselage forward of the wing. For the aircraft to accept ground power, the battery switch must be ON and battery voltage 18 volts or above. With external power applied, the GENERATOR fault light will go out. If an external power unit is used to start the engine, the generator will not automatically start operating when external power is disconnected, and the generator switch must be pushed to the ON position to bring the generator into operation.

Volt/Ammeter

A volt/ammeter, located on the right side of the instrument panel in each cockpit, is a dual indicator. The left side is the voltmeter, which indicates the highest voltage present on the DC buses. The voltmeter scale reads 0 to 30 volts in two-volt increments. The right side is the ammeter, which indicates the rate of current flow to and from the battery. The ammeter scale reads battery amperes in a range of +60 to 0 to -60. With the pointer in the plus range the battery is charging. In the minus range the battery is discharging, with one exception: With the external power unit connected, a discharge is indicated even though the battery is being charged. This is due to a design characteristic of the system.

Utility Bus Switches

Utility bus switches are located on the top row of the front cockpit circuit breaker panel. They permit quick removal of nonessential loads from the DC power source by deenergizing utility bus no. 1 and utility bus no. 2.

905. AC POWER SYSTEM

The AC power system provides alternating current to various indicating systems. The source of AC power is the inverters.

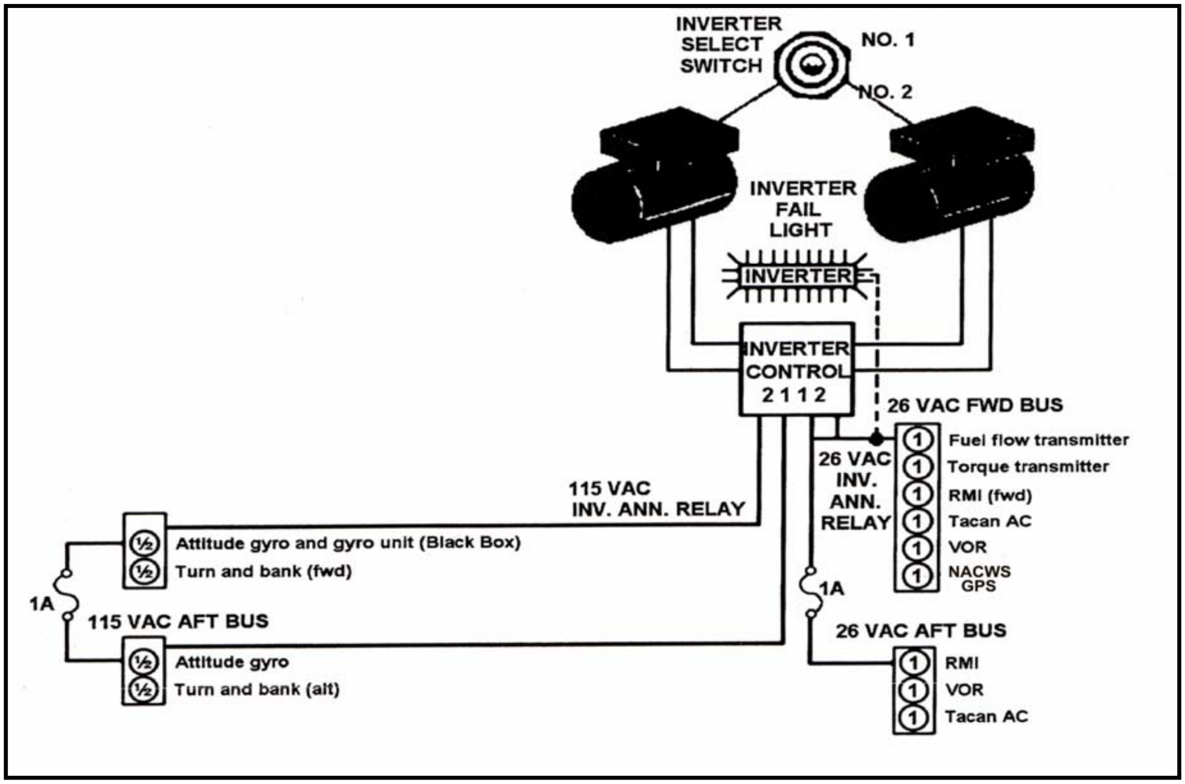


Figure 9-2 AC Power System

Inverters

An inverter changes DC power to AC power. The inverters in the T-34C are located on the deck on the left side of the front cockpit. Each inverter operates independently to receive DC power and change it to 26 VAC and 115 VAC. Selection of the inverter is provided by a switch labeled No. 1, INV, No. 2, located on the electrical control panel in each cockpit. The switch selects either inverter for operation. Failure of the operating inverter is identified by illumination of the flashing MASTER CAUTION light and the INVERTER fault light in each cockpit.

906. COMMAND CONTROL TRANSFER SYSTEM

A momentary actuated toggle switch located on the electrical control panel in both cockpits allows either pilot to take control of the AC and DC power supply systems. The switch is labeled TAKE COMMAND and CONT TRANS, and is spring-loaded to the CONT TRANS position. To transfer control from one cockpit to the other, the toggle switch is momentarily held to the TAKE COMMAND position. Command of the system is verified by illumination of the green command light.

A green press-to-test command indicator light, located next to the control transfer switch, indicates possession of electrical command when illuminated. The light has a rotate-to-dim feature which allows the pilot to regulate light intensity. The press-to-test function provides a check of the light bulb in the indicator.

The control transfer switch is always powered, therefore, the battery switch need NOT be on to transfer command, although the green command light will not illuminate until the battery switch is ON. When electrical power is secured, i.e., aircraft shutdown, electrical control will remain in the cockpit which last had control.

STUDY QUESTIONS

1. Select the minimum voltage allowed for a battery start.

    a. 18V

    b. 24V

    c. 22V

    d. 20V

2. Select the correct statements regarding the generator control panel.

    a. Can be manually adjusted by either pilot.

    b. Provides reverse current protection if the generator output drops below 34V.

    c. Provides overvoltage protection if generator output exceeds 34V.

    d. Maintains generator output to 27-29.5 volts.

3. The utility bus switches permit quick removal of ____________ loads from the DC power source.

4. Select the correct statements about the T-34C battery.

    a. 24 VAC, 24 amp-hour.

    b. 24 VDC, 24 amp-hour.

    c. Produces explosive hydrogen gas.

    d. Is a sealed, valve regulated lead acid battery.

5. If the generator fails inflight, the pilot will see a ____________ light and a ____________ light.

6. Inverter failure is indicated by a Master Caution light and a/an ____________ annunciator light.

7. What switch in your cockpit will always be powered?

ANSWERS TO STUDY QUESTIONS

1. c.
2. c., d.
3. nonessential
4. b., c., d.
5. flashing Master Caution, generator
6. inverter
7. electrical control transfer

CHAPTER TEN
ELECTRICAL SUBSYSTEMS

1000. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C electrical subsystems. You must also become familiar with the location, operation, and purpose of the various components to be able operate the T-34C electrical subsystems safely and effectively. This lesson covers the starter and all interior and exterior lighting.

1001. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

10.0 Upon completion of this chapter, the student will demonstrate knowledge of the various electrical subsystems characteristics.

Enabling Objectives

10.1 State the purpose of the engine starting system.

10.2 State the location and purpose of the engine starter switches.

10.3 Describe the purpose and characteristics of the engine starter.

10.4 Identify the engine starter limitations.

10.5 Identify the electrical power requirements for the interior lighting system.

10.6 Describe the location and purpose of the Master Caution light.

10.7 State the location and purpose of the fault lights.

10.8 State the location and purpose of the function lights.

10.9 State the location and purpose of the annunciator test button.

10.10 Describe the location and purpose of the cockpit lights.

10.11 Describe the location and operation of the interior lights control panel.

10.12 Describe the location and operation of the circuit breaker panel lights.

10.13 Describe the location and operation of the utility lights.

10.14 Identify the electrical power requirements for the exterior lighting system.

10.15 Describe the location and operation of the landing light system.

10.16 Describe the location and operation of the navigation lights.

10.17 Describe the location and operation of the anticollision lights.

10.18 Describe the location and purpose of the wing tip glareshields.

1002. ENGINE START SYSTEM

The engine start system provides engine rotation and ignition for engine start. A two-position manual toggle switch labeled STARTER, ON, OFF is located on the starter/ignition control panel, right-hand subpanel in each cockpit. Placing the switch to the ON position causes operation of the igniters and engine starter, providing air and spark. The switch must be manually turned OFF, otherwise the generator will not energize. Electrical command is not required to activate either cockpit starter switch. Accidental selection of ON with the generator running will disconnect the generator and cause the MASTER CAUTION and GENERATOR lights to illuminate. The starter is a 28-VDC, 800-amp motor, located within the same housing as the generator, but having a separate set of electrical windings. The starter provides initial rotation of the compressor for engine start and is normally limited to 40 seconds use. Since the starter develops damaging heat while rotating the compressor, the starter is limited to three 40-second attempts with a 60-second cooling off period after the first two, and a 30-minute cooling off period after the third attempt (40 seconds ON, 60 seconds OFF, 40 seconds ON, 60 seconds OFF, 40 seconds ON, 30 minutes OFF).

1003. LIGHTS

Warning, Caution, and Advisory Lights

The warning, caution, and advisory lights provide a visual warning of malfunctions of aircraft equipment, unsafe operating conditions, or notice that a particular system is in operation. A test switch provides for a check of the light bulbs in each indicator. All lights are powered by 28 VDC.

LIGHT	MEANING
INVERTER	•Loss of 115 AC or 26 VAC power.
	•Failure of the 115 VAC, 1-amp CB with Inverter No. 1 selected
GENERATOR	Starter Switch – ON, low voltage output or generator failure.
L FUEL LOW **R FUEL LOW**	Respective wing fuel quantity below approximately 90 lbs. usable.
FUEL PRESS	Low pressure output from engine-driven fuel boost pump.
CHIP	Metal particles present in oil system.
LDG LIGHT	Gear retracted with one or both LDG lights ON.
BLEED AIR	Cockpit heating (bleed) air overtemperature condition exists.
IGNITION	Engine igniters energized by starter switch or auto-ignition.
AUTO IGN	Autoignition switch ON, system armed.

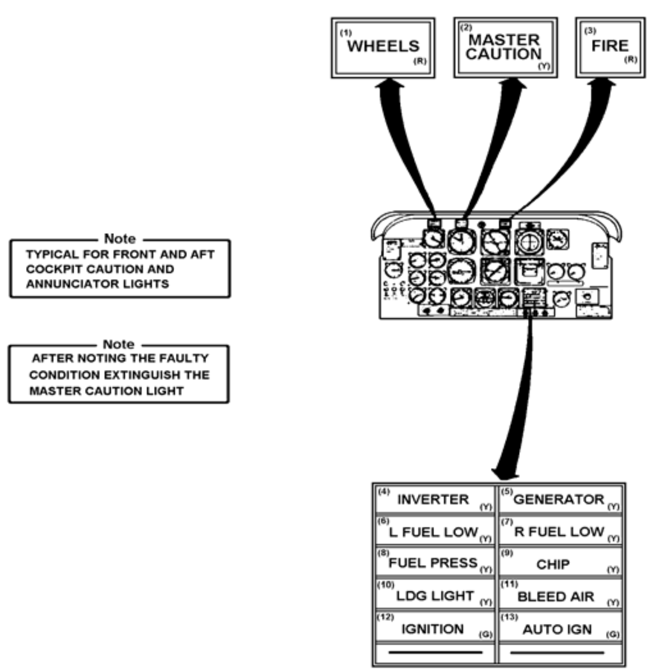


Figure 10-1 Warning/Caution/Annunciator Lights Fault Lights

Fault lights are steady illumination, yellow lights located on the annunciator panel at the bottom of the instrument panel in both cockpits. The panel consists of two columns of four lights that visually identify the existence of a specific fault. The individual lights are labeled INVERTER, GENERATOR, L FUEL LOW, R FUEL LOW, FUEL PRESS, CHIP, LDG LIGHT, and BLEED AIR. A fault light will extinguish only when the condition that caused the light to illuminate is corrected.

Master Caution Light

The master caution light is located at the top of the instrument panel above the airspeed indicator in each cockpit. It is a yellow flashing light that illuminates the words MASTER CAUTION. When flashing, the light alerts the pilot to scan the annunciator panel for an illuminated fault light. The master caution light can be extinguished by correcting the fault that caused it to illuminate or by depressing the face of the light.

Function Lights

Function lights are steady-illumination, green lights that visually identify the existence of a specific function. They are located beneath the fault lights on each annunciator panel and labeled IGNITION and AUTO IGN. When illuminated, the IGNITION light indicates that the ignition system is operating and the AUTO IGN light indicates that the autoignition system is armed. The function lights do not activate the MASTER CAUTION light.

Annunciator Test Switch

The annunciator test switch is located below the annunciator panel in the center of the TEST panel in each cockpit. It is a push-button type switch that tests the illumination of the landing gear handle, WHEELS, MASTER CAUTION, inboard gear door position indicator, fault and function lights. The WHEELS and MASTER CAUTION lights flash while the landing gear handle, inboard gear door position indicator, fault and function lights do not. The switch tests the lights only in the respective cockpit.

Interior Lighting

The interior lighting system consists of individual instrument post lights, utility lights, console lights, instrument and console flood lights. All interior lighting is white with the exception of the utility light, which has optional red lighting. All interior lighting is operated by DC power.

Instrument Lights

All instruments are lighted externally by post lights located on the upper left and right corner of each instrument, and instrument floodlights located beneath the glare-shield in each cockpit. The lights are controlled by individual rheostats located on the interior lights control panel, right console, both cockpits. The rheostats have a group labeled INST with individual labels LTS (post) and FLDT (floodlights). Each rheostat is rotated clockwise from OFF to BRT to brighten the lights to full intensity at the full clockwise position. When moving the INST rheostat out of the OFF detent the annunciator lights, master caution light, wheels light, and AOA indexer will dim.

Console Lights

The left and right side console panels in both cockpits are backlighted by individual panel interior lights and left and right side console floodlights located on each sidewall. The interior lighting is controlled by a rheostat labeled LTS under the CONSOLE group label on the interior lights control panel, and the floodlights are controlled by the rheostat labeled FLDT. Both rheostats control the lighting from OFF to BRT by clockwise movement of the respective rheostat. Full clockwise rotation to the BRT position gives full intensity.

Utility Lights

Each cockpit is provided with a special multipurpose utility light. This light is designed to selectively provide either red or white illumination utilizing a narrow spotlight beam or a wider floodlight beam. Attached by a curl cord, this moveable light has two snap-in permanent mounting bases on the right sidewall and may be detached by simply pulling the light straight out of the base. Selection of white spot, white flood, red flood, or red spot is possible. The color may be changed on some models by unlocking a lock on top of the light while turning the front section and on newer models by a slide type switch. The light has a dimming rheostat for controlling beam intensity and an override push-button which provides instantaneous full lamp brilliance regardless of rheostat setting.

Circuit Breaker Panel Lights

The circuit breaker panels in either cockpit may be individually backlighted as desired with a two-position circuit breaker type switch on the circuit breaker panels. The switches are labeled PANEL LTS and control the interior lighting on the respective circuit breaker panel. These lights are constant brilliance lights; therefore, no dimming feature is provided.

1004. EXTERIOR LIGHTING

The exterior lighting system consists of the landing, navigation, and anticollision lights. All exterior lighting is DC-powered and controlled from the front cockpit ONLY (with the exception of the landing gear external position indicators, which are activated by the landing gear system).

Landing Lights

The left and right landing lights, located on the main landing gear struts, are individually operated by two circuit breaker type switches labeled LANDING LIGHTS, LEFT/RIGHT, ON and OFF, located directly below the landing gear handle on the left subpanel of the front cockpit ONLY.

Navigation Lights

The navigation lights, red on the left wing tip, green on the right wing tip, and white on the tail cone, are controlled by a three-position switch labeled NAV LTS, BRIGHT, DIM, OFF located on the right console in the front cockpit ONLY.

Anticollision (Strobe) Lights

Three high-intensity white strobe lights, one on each wing tip and one on the tail cone, are controlled by a two-position circuit breaker type switch on the right console in the front cockpit. These high-intensity flashing lights are visible for greater distances than the conventional rotating beacon. Typically the strobe lights will be on prior to propeller rotation and until the propeller stops.

Wing Tip Glareshields

Wing tip glareshields prevent the strobe lights from shining in the pilots' eyes. Each glareshield has two holes which allow both pilots to check the illumination of the navigation lights.

STUDY QUESTIONS

1. The starter system provides both ____________ ____________ and ____________ for start.

2. The starter is limited to ________ seconds' use.

3. Normal operating times for the starter are ____________ on, ____________ off; ____________ on, ____________ off; ____________ on, and ________ ____________ off.

4. Which lights are tested upon actuation of the ANN test button?

5. The ANN test button actuates lights in both cockpits. ____________ (True/False)

6. What is the purpose of the flashing yellow MASTER CAUTION light?

7. Match the correct items.

a. landing gear handle ______ ______	1. white
b. wheels light ______ ______	2. yellow
c. fault lights ______ ______	3. green
d. function lights ______ ______	4. red
e. instrument lights ______ ______	5. steady
	6. flashing

8. Which lighting rheostat will dim assorted lights when moved out of the OFF position?

9. The utility light gives a choice of what kinds of lighting?

10. With one exception, all exterior lights are controlled from the ____________ cockpit.

11. The landing lights will automatically extinguish when the landing gear is raised. ____________ (True/False)

12. The function lights actuate the MASTER CAUTION lights. ____________ (True/False)

13. How do you extinguish the fault light? The MASTER CAUTION light?

14. What are the respective colors of the navigation lights?

15. Can the starter switch be activated regardless of electrical command?

ANSWERS TO STUDY QUESTIONS

1. engine rotation, ignition

2. 40

3. 40 seconds, 60 seconds, 40 seconds, 60 seconds, 40 seconds, 30 minutes

4. Landing gear handle, wheels, master caution, inboard gear door position indicator, fault and function lights in the respective cockpits

5. False

6. It alerts the pilot to scan the annunciator panel for an illuminated fault light.

7. a. 4, 5

   b. 4, 6

   c. 2, 5

   d. 3, 5

   e. 1, 5

8. The instrument lights (INST LTS)

9. Red or white

10. front

11. False

12. False

13. Correct the condition that caused the light to illuminate. correct the fault that caused the light to illuminate or depress the face of the light.

14. Red on the left wing tip, green on the right wing tip, and white on the tail cone

15. Yes

CHAPTER ELEVEN
AVIONICS

1100. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C avionics system. You must also become familiar with the location and operation of various system components to be capable of operating your avionics equipment with maximum efficiency. This lesson covers the interphone communications system (ICS) and all other communication and navigation equipment.

1101. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

11.0 Upon completion of this chapter, the student will demonstrate knowledge of the various avionics systems characteristics.

Enabling Objectives

11.1 State the purpose of and describe the cockpit interphone system.

11.2 State the location and describe the function of the components of the audio control panel.

11.3 State the purpose and describe the function of the components of the avionics control transfer system.

11.4 State the purpose and identify the characteristics of the ultra-high frequency (UHF) radio.

11.5 Identify the location of the components of the UHF radio.

11.6 Describe the function of the UHF control panel switches.

11.7 Identify the requirements for operating the UHF radio.

11.8 State the purpose and identify the characteristics of the very-high frequency (VHF) radio.

11.9 Identify the location of the components of the VHF radio.

11.10 Describe the function of the VHF control panel switches.

11.11 Identify the requirements for operating the VHF radio.

11.12 State the purpose and describe the characteristics of the visual omnidirectional range (VOR) receiver.

11.13 State the location of the components of the VOR receiver.

11.14 Describe the function of the VOR control panel components.

11.15 Explain the operation of the VOR receiver.

11.16 Describe the components of the TACAN receiver.

11.17 Describe the function of the TACAN control panel components.

11.18 Explain the operation of the TACAN/DME.

11.19 State the purpose and describe the characteristics of the GPS unit.

11.20 Identify the location of the components of the GPS unit

11.21 Describe the function of the NAV/GPS source control button

11.22 Explain the purpose and location of the Course Deviation Indicator (CDI), IND-350.

11.23 State the purpose and describe the components of the transponder system.

11.24 Describe the function of the transponder control panel switches.

11.25 Explain the operation of the transponder.

11.26 Explain the purpose and describe the Emergency Locator Transmitter (ELT).

11.27 Explain the operation of the ELT.

11.28 Explain the purpose and symbology of the NACWS.

11.29 Identify the location of the components of the NACWS.

1102. AVIONICS SYSTEM

This section discusses communication, navigation, transponder, collision avoidance, and emergency locator transmitter (ELT) systems.

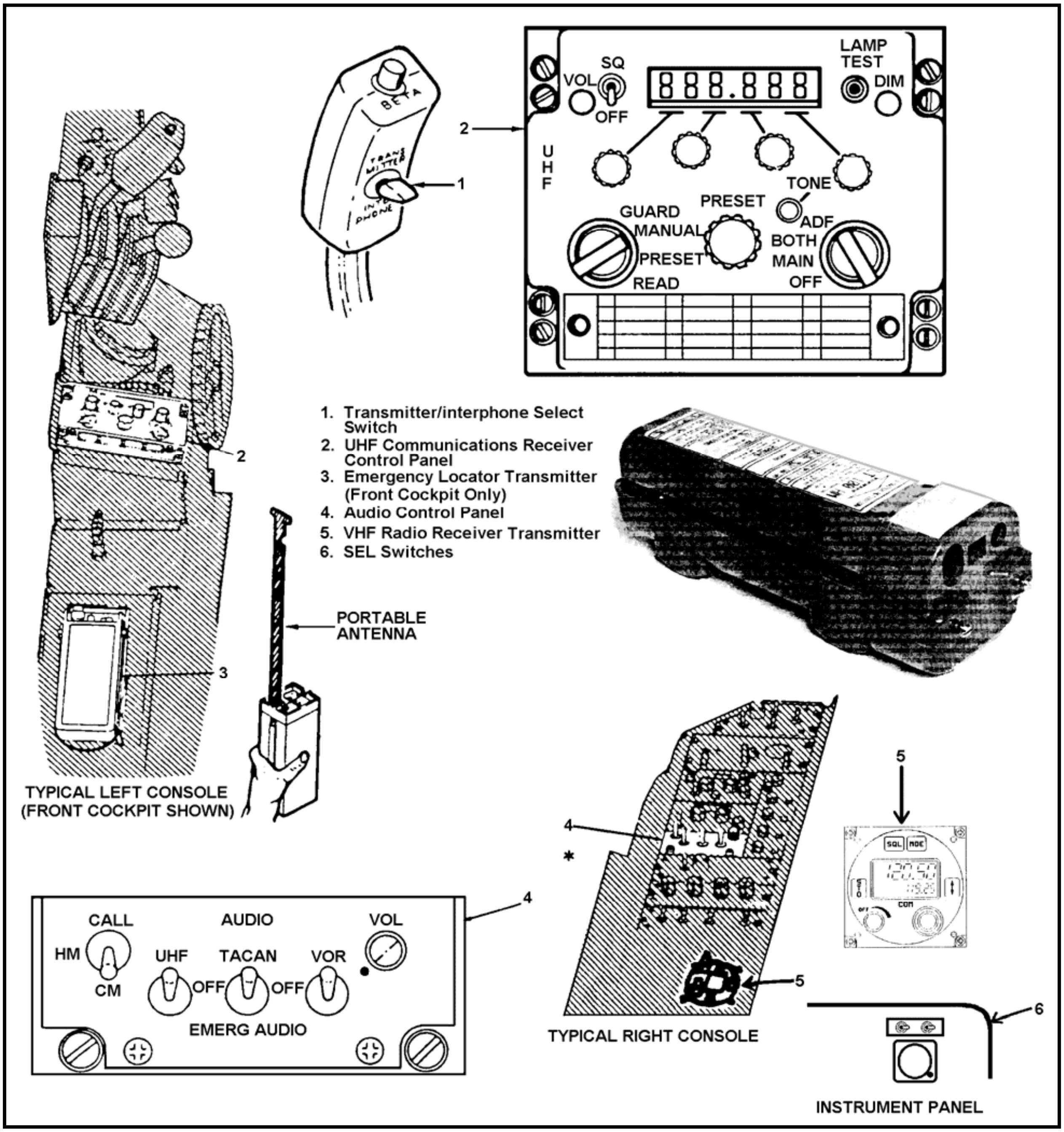


Figure 11-1 Communications Equipment

Cockpit Interphone Communication System

The Cockpit ICS allows communication between the two crewmembers. It is operable any time the DC system is powered and is normally the first thing checked after the battery is turned on. The Radio TRANSMITTER/INTERPHONE select switch, located on the inner face of the PCL, permits communication to the other cockpit on the ICS or transmissions to other aircraft or ground facilities on the UHF or VHF radio.

Two modes of operation are possible--the Manual mode (COLD MIKE - CM) in which the toggle switch on the PCL must be depressed downward to utilize the ICS, or the automatic mode (HOT MIKE - HM) in which a "hands-off" operation is possible. Selection of these two modes is done from the audio control panel on the multifunction panel located on the right console (Figure 11-1). Audio volume adjustment for that cockpit is made with the VOLUME knob. A third operation is possible by holding the interphone function switch forward in the CALL position - all other audio signals are reduced, the ICS volume is increased and both cockpit microphones are automatically in "HOT MIKE."

Avionics Control Transfer System

An avionics control transfer system (Figure 11-2) is incorporated in the T-34C to allow one cockpit to control all the communication and navigation equipment, except the ICS, VHF radio, NACWS, and GPS. (This system also transfers control of the compass switches.) The avionics master switch controls the electrical power to operate the avionics systems and is located only on the front cockpit avionics control panel. The avionics master switch must also be on for operation of the RMI. Once the pilot in front has turned the avionics master switch on, a green indicator light will illuminate, indicating that avionics command is in the front cockpit (Figure 11-3). Transfer of avionics command may now take place with the pilot in the aft cockpit pushing his control transfer switch momentarily to the TAKE COMMAND position. The green indicator light in the aft cockpit will now illuminate and the front cockpit light will be extinguished. Avionics control may be taken, but not given.

AVIONICS TRANSFER

TRANSFERRED	NOT TRANSFERRED (GIVN)
UHF	GPS
TACAN	ICS
VOR	VHF
TRANSPONDER	NACWS
COMPASS SWITCHES	

Figure 11-2 Avionics Transfer

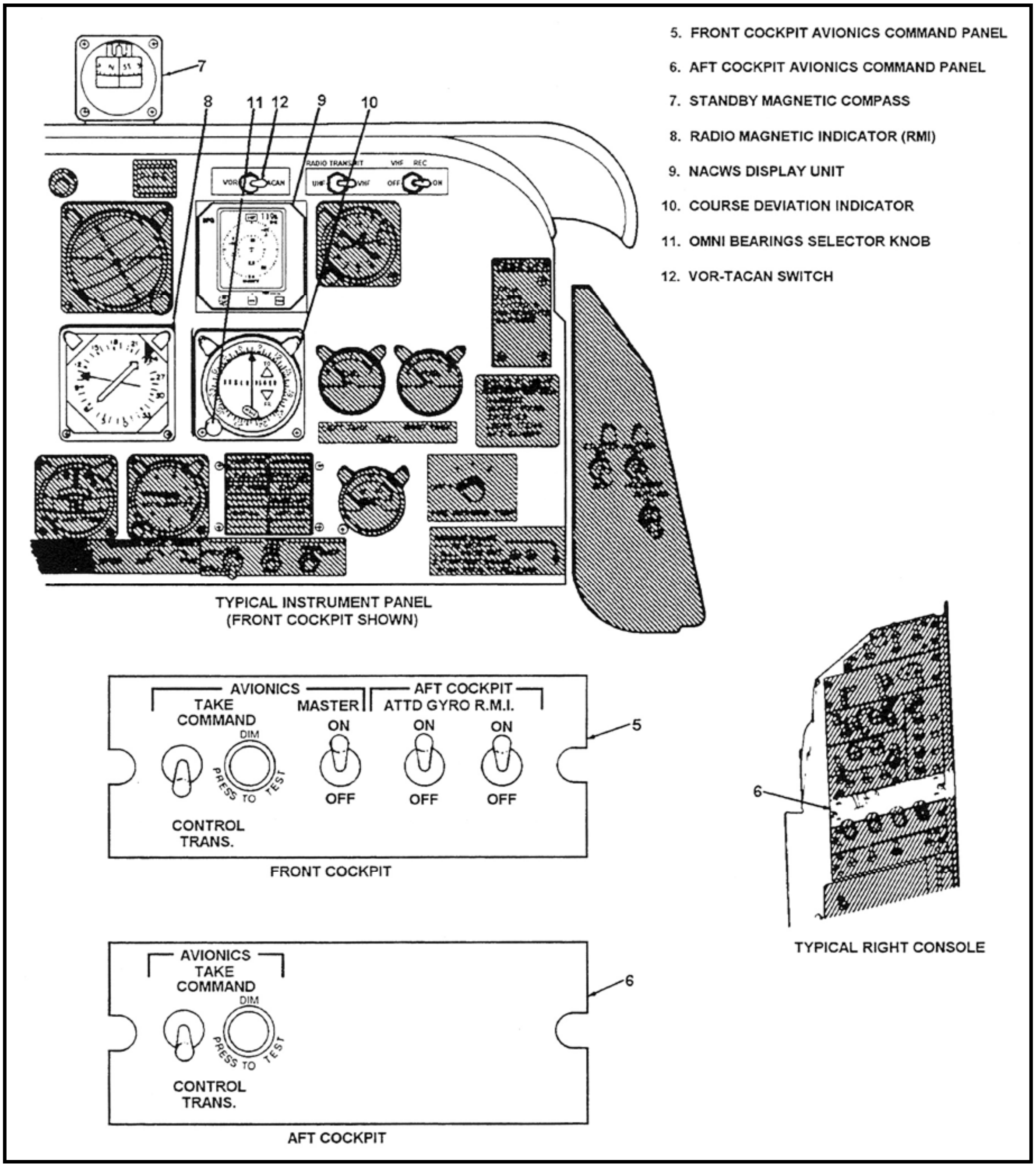


Figure 11-3 Cockpit Equipment

UHF Radio

The T-34C communications radio, also referred to as a UHF transceiver, provides line-of-sight transmission and reception of radio signals in the UHF range of 225.0 to 399.95 Megahertz (MHz). Communication can cover a distance of approximately 50 NM, but it works on a "line-of-sight" basis (which means you cannot communicate over the horizon).

The components include the transceiver located in the avionics compartment, the blade type antenna on the top of the fuselage just aft of the aft cockpit, the control panel on each left console, and the transmit switch on each PCL (Figure 11-1). On the control panel, the FUNCTION selector switch is used to select MAIN or BOTH for normal operations. This will allow the pilot to transmit (using the toggle switch on the PCL) and receive on any selected frequency in the UHF range. The BOTH position provides the additional capability of "monitoring" (listening to) GUARD (emergency frequency 243.0 MHz) and is the normal position for flight.

Selection of the desired frequency is done by using a combination of the mode selector knob and manual frequency selectors or preset channel selector knobs. With the Mode Selector in MANUAL, the frequency/channel indicator (light emitting diodes - LED readout) will indicate the frequency selected using the four Manual Frequency Selectors. If PRESET is chosen, the frequency/channel indicator will display a number - "1" to "20" - representing a commonly used selectable preset frequency. The READ position displays the frequency of the selected preset channel. The GUARD position automatically sets the UHF radio to transmit and receive on the emergency frequency 243.0 MHz.

Additional switches on the panel include a VOLume knob, SQuelch ON switch to remove static, LAMP TEST button to check the LED filaments, a DIM control, and a TONE button to confirm operation.

The radio will operate on the frequency/channel of the control panel in the cockpit having avionics control and both front and aft cockpit indicators will display that frequency or channel. The pilot not possessing avionics command can still transmit or receive, alter his/her own volume, and use the TONE and LAMP TEST buttons. Simply put, the pilot possessing avionics command will control the transceiver in the avionics compartment and both cockpit panels serve as repeaters of the transceiver.

The automatic direction finding (ADF) position is not functional.

VHF Radio

In 1998, the T-34C added a VHF transceiver as a second means of communication (Figure 11-4). Located in the front cockpit map case, this radio works in the VHF frequency range between 118.000 and 136.975 MHz, and has a range in distance of approximately 50 miles. The VHF antenna is a wire antenna located on the bottom of the fuselage between the forward and after transponder antennas.

The pilot in the front cockpit has ON/OFF, volume control, and frequency selection capabilities. Once set up in front, either pilot may employ this radio using the VHF selector switches located above the clock in each cockpit regardless of which cockpit has avionics command. The radio transmit switch (the left switch) chooses which radio (UHF or VHF) transmits when the PCL toggle switch is pushed up. The VHF receive switch (the right switch) acts as the "mixer" switch for the VHF audio signal. The ON position allows that cockpit to receive the selected VHF signal. The OFF position turns off the VHF audio signal to that cockpit.

Figure 11-4 VHF Transceiver

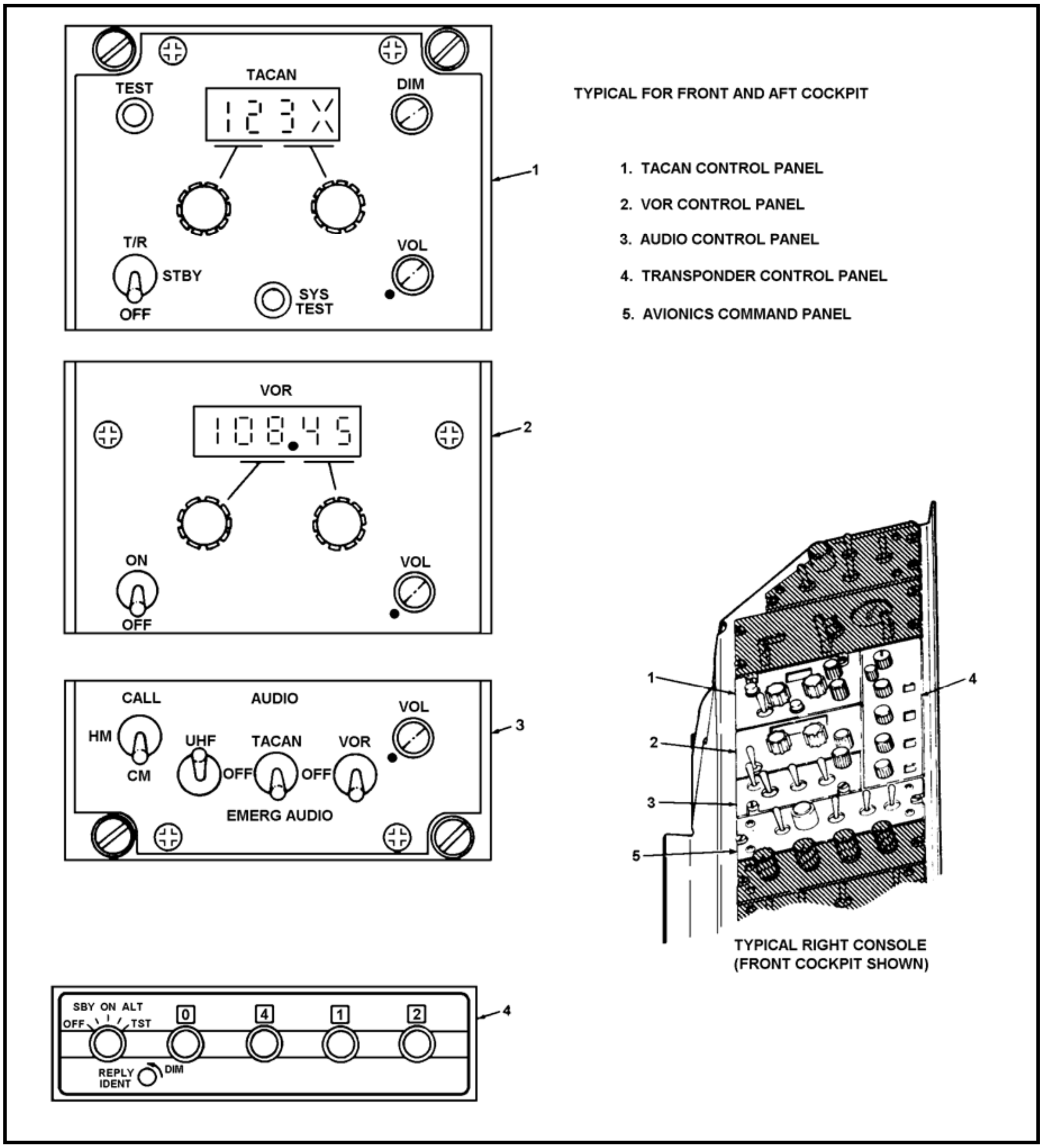


Figure 11-5 Navigation Equipment

VOR Navigational Receiver

The VOR is a receiver designed to receive and interpret VHF omnidirectional (any direction) signals from a navigational aid in a frequency range of 108.0 to 117.95 MHz. It has a maximum range of 120 miles and works on a "line-of-sight" restriction.

The components include the receiver in the avionics compartment, a rigid "V"-shaped wire antenna on the top of the vertical stabilizer and the control panel on the multifunction panel of each right console (Figure 11-5).

When the power switch is placed ON, the pilot can select the desired frequency using the manual frequency selectors and the frequency indicator. If a reliable signal is received, the VOR needle on the RMI will indicate the magnetic bearing to the selected station. (If the VOR has not locked onto a good signal, it will park the needle at the 3 o'clock position on the RMI.) To verify that the correct station is tuned, select the VOR position with the VOR audio mixer switch on the audio panel, adjust the volume on the VOR control panel and listen to the Morse Code Identifier.

TACAN Navigational Receiver

The TACAN is a navigational receiver that provides the pilots with azimuth and line-of-sight distance information to a selected navigational aid. It has a range of approximately 290 NM.

The components include the transceiver and bearing adapter in the avionics compartment, a blade type antenna on the underside of the fuselage just forward of the ventral fins, and the control panel on the multifunction panel on each right console (Figure 11-5).

When the mode selector is placed in the STBY position, only bearing information is received. When the mode selector is placed in the T/R position, it allows reception of bearing and distance information. The channel selectors allow selection of 126 "X" band and 126 "Y" band preset channels. (The "X" band channels are normally the only channels used.) The selected channel is displayed on the channel indicator.

Two buttons are located on the TACAN panel to ground check the operation of the TACAN and VOR. When the TEST button is depressed, 188X will be shown in the TACAN display and 188.88 in the VOR display. When the SYS TEST button is depressed, the TACAN needle on the RMI will point to 180º (± 3.5º), the VOR needle will point to 000 – 005 degrees, and the DME will show .0 or .1 on the Naval Aircraft Collision Warning System (NACWS) display unit (Figure 11-10).

Global Positioning System (GPS)

The KLN900 is a satellite based, long range navigation system. It is used for IFR enroute, terminal, and nonprecision approach operations. The system incorporates two panel mounted, eight channel receiver/control/display units (Figure 11-6), both located on the left side of the instrument panel in each cockpit. Each unit includes a battery for stored flight plans and other user data. Both AC and DC power are required for operation.

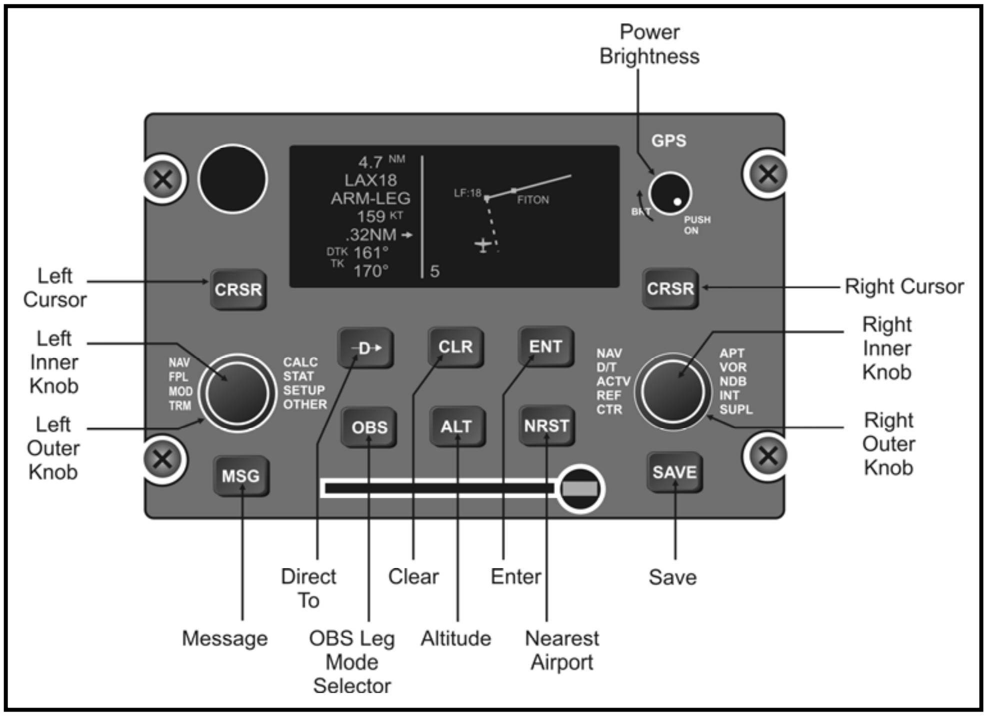


Figure 11-6 KLN900 GPS

NOTE

The front unit must be on and functioning properly for either unit to be used for navigation. The last input from either cockpit has priority for system control.

The KLN900 system includes two KLN900 display /control panels, two KA41 Annunciator/Control Panels (Figure 11-7), one KA90 slaving accessory, one blind cockpit encoding altimeter, and one GPS antenna. The slaving accessory is located on the top shelf in the avionics compartment. The GPS antenna is mounted adjacent to the NACWS GPS antenna on top of the fuselage behind the rear cockpit. The blind encoding altimeter is located in the front cockpit, mounted aft of the inverters on the left kick panel.

The NAV and GPS annunciators of the KA41 annunciator/control panel indicate the slaving source for the double needle on the RMI and CDI. The white NAV light indicates the double needle on the RMI is slaved to the TACAN and the CDI is slaved according to the position of the VOR/TACAN toggle switch. The green GPS light indicates the double needle and CDI are slaved to the KLN900. The GPS/NAV button, below the lights, is used to select either navigation source.

The KLN900 allows you to control and view your flight plan data. The power/brightness control is located in the upper right corner of the unit. It is a pull-off/push-on control for power and rotate for brightness type control.

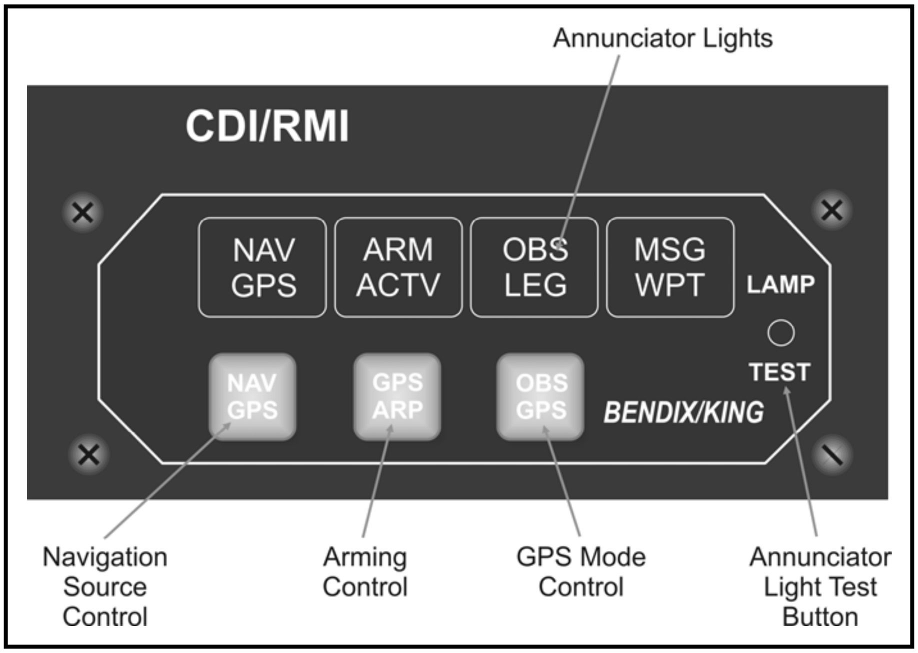


Figure 11-7 Annunciator/Control Panel

Audio Panel

The audio panel has an amplifier located beneath the panel face. It amplifies the audio from the ICS and the UHF, TACAN, and VOR receivers. The amplifier is energized immediately when DC power is applied to the aircraft. Power to the amplifier is not affected by the AVIONICS MASTER switch or the avionics control transfer system. Audio switches (sometimes called "mixer switches"), located in the center of the audio panel, enable either normal or emergency reception. When forward (ON) in the UHF, TACAN, and VOR position, audio from each radio is amplified and sent to the respective headset. The center OFF position allows no audio to the headset. The aft EMER AUDIO position is used only if the audio panel amplifier fails, in which case the amplifier is bypassed. The resulting loss of volume can be compensated for by adjusting the VOL knobs on the individual UHF, TACAN, and VOR control panels. The VOL knob on the audio panel adjusts the volume of the amplified ICS, UHF, TACAN, and VOR audio. The VOL knob is the only control for the individual pilot's ICS volume. Imbalance between ICS and the UHF, TACAN, and VOR audio can be corrected by adjusting the VOL knobs on the individual control panels (Figure 11-1).

Course Deviation Indicator (IND-350)

The course deviation indicator (CDI), located on the right side of the instrument panel in both cockpits, is a secondary navigational instrument in the VOR/TACAN system. It assists the pilot in interpreting the RMI and in maintaining a desired flight course. The OBS knob sets the selected course. The CDI (deviation bar) indicates deviation from course. The TO-FROM indicator shows whether the selected course will take you to or from the station. The VOR/TACAN switch located above the CDI (or GPS cockpit - below the altimeter) allows display of either TACAN or VOR information in the CDI (Figure 11-3).

Transponder

A transponder is located in both cockpits on the right console outboard of the multifunction panel. Each transponder is identical and operates independently of the other. The operating transponder will be in the cockpit having possession of avionics command. When interrogated by ground search radar, the transponder automatically provides the ground controller with identification, position tracking, altitude, and emergency identification information. The system is comprised of the two transponders with their integral control panels and two antennas, i.e., there are no components in the avionics compartment. The blade type antennas are on the bottom of the fuselage with one beneath each cockpit. A function selector in the upper left corner of the control panel is labeled OFF, SBY, ON, ALT and TST and has the following functions (Figure 11-5).

Position	Function
OFF................	No power to transponder.
SBY	Warmup. Set inoperable. Selection of ON, ALT or TST not allowed for 20 seconds.
ON	Transmits identification and position tracking, but no altitude information.
ALT	Transmits identification, position tracking and altitude information.
TST................	Illumination of REPLY lamp confirms transponder operation.

Four code selector switches allow the setting of 4096 possible codes. Each selector can set any number 0-7. The code assigned by Air Traffic Control system will identify your aircraft. A push-button switch with an integral green light is labeled REPLY, IDENT, DIM. The green REPLY light flashes on and off automatically in response to ground radar interrogation when ON or ALT is selected. If the button is depressed, the IDENT function activates. The requirement for IDENT is initiated by the ground controller to assist in identifying your aircraft. When depressed, the REPLY lamp goes to steady illumination for 20 seconds and a distinct reply appears on the ground radar scope. At the end of the 20 seconds, normal response to interrogation resumes. The DIM feature controls the intensity of the REPLY lamp.

Emergency Locator Transmitter

The ELT, located at the rear of the left console in the front cockpit, transmits a location homing signal in time of emergency usually associated with a downed aircraft. Operation of the ELT is controlled by a function switch labeled OFF, ON. The ON position turns the set on and emergency transmissions are started. With OFF selected, the ELT will transmit only when activated by a rapid deceleration force. When activated, the ELT transmits a line-of-sight signal on 121.5 and 243.0 MHz. Batteries provide power for a minimum of 48 hours (Figure 11-1.)

Naval Aircraft Collision Warning System

NACWS monitors a volume of airspace around your aircraft to alert the aircrew to the presence of potential traffic conflicts. The system uses the transponder replies of other aircraft to compute the responding aircraft's range, bearing, altitude, and closure rate. NACWS can track up to 50 transponder-equipped aircraft out to a maximum distance of 20 NM, and display the closest 20. The system can operate in either passive or active mode.

WARNING

NACWS provides no warning against aircraft that do not have an operating transponder, therefore, vigilant see-and-avoid procedures are still required.

NACWS issues an initial traffic advisory (TA) (6 tones in 2 seconds) when an aircraft is within 20 seconds of penetrating the protection zone. An urgent TA (12 tones in 2 seconds) is issued when it is within 10 seconds.

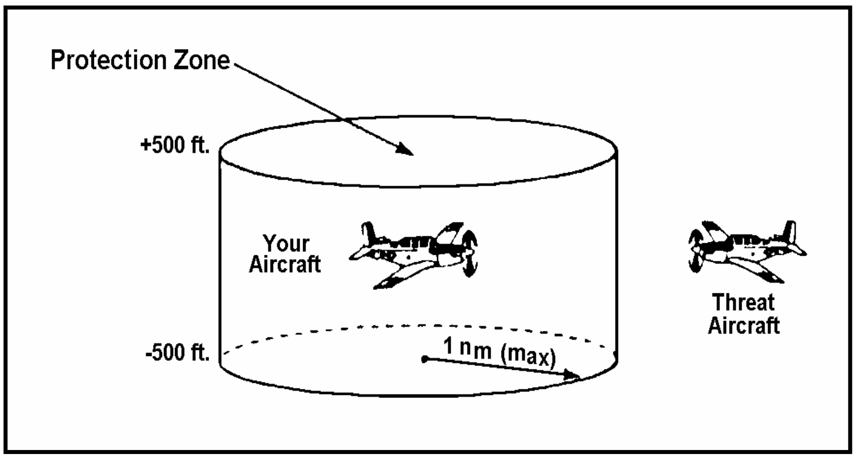


Figure 11-8 Protection Zone

In addition to warning of threat aircraft, the system allows you to display nearby, nonthreat aircraft within a selected proximity zone (20, 10, 5, 3, and 1½ NM).

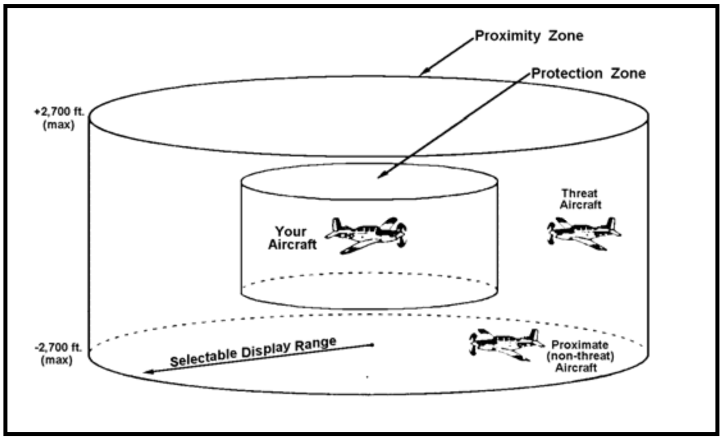


Figure 11-9 Proximity/Protection Zone

The following symbols and shapes are used for the NACWS displays.

Own aircraft:		Traffic above (within 2700 feet):	
Traffic on altitude ±400 feet:		Traffic below (within 2700 feet):	
Traffic - unknown altitude:		Data Tag (included if traffic is 400-900 feet above or below):	

Traffic signals will flash when a TA exists.

Figure 11-10 Proximity Screen/Test

In the absence of any threat aircraft, NACWS will display the DME screen. This screen displays aircraft heading, DME, date, time, selected range and aircraft latitude/longitude.

Figure 11-11 Proximity Screen

Figure 11-12 Primary Screen

The NACWS consists of a transmitter/receiver computer (TRC) located in the avionics compartment, a cockpit control display unit in both front and rear cockpits, a global positioning system receiver antenna on the top of the fuselage behind the rear cockpit, and two omnidirectional L-band antennas mounted on top and bottom of the aircraft, which receive ground radar interrogation signals and airborne transponder replies.

T-34C Antennas

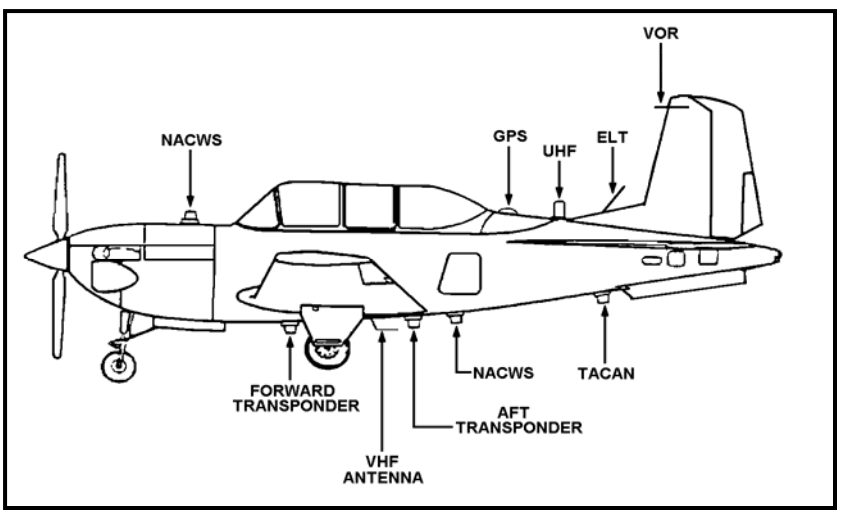


Figure 11-13 T-34C Antennas

STUDY QUESTIONS

1. How does the pilot turn on the power for the ICS system?

2. The toggle switch on the PCL must be held up to utilize the ICS. ____________(True/False)

3. Placing the mode selector in the GUARD position automatically sets the UHF to transmit and receive on emergency frequency. ____________(True/False)

4. The pilot not having avionics command can control what items on his/her UHF panel?

5. Does the VOR panel display channels or frequencies? ___________

6. When the TACAN mode selector is placed in the STBY position ____________ information is received.

7. Power to the audio panel amplifier is affected by the avionics master switch.____________ (True/False)

8. When is the EMER AUDIO position of the audio panel used?

9. When the transponder function selector is placed in the ALT position the radar controller reads altitude only. ____________(True/False)

10. Can the ELT be used outside of the aircraft?

11. Can the NACWS warn of collision threat with nontransponder equipped aircraft?

12. Either cockpit can transmit/receive on the VHF radio regardless of which cockpit has command. ____________ (True/False)

13. With the front cockpit GPS unit turned off, the rear cockpit GPS unit may be used for navigation purposes. ____________ (True/False)

14. Assuming both cockpit GPS units are turned on, which cockpit has priority for system control?

15. Illumination of the green GPS light indicates the double needle of the RMI and CDI are slaved to the GPS. ___________. (True/False)

ANSWERS TO STUDY QUESTIONS

1. By switching on the battery
2. False
3. True
4. Volume, tone and lamp intensity/test
5. frequencies
6. bearing
7. False
8. When the audio panel amplifier fails
9. False
10. Yes
11. No
12. True
13. False
14. The last input from either cockpit has priority for system control
15. True

CHAPTER TWELVE
GYRO AND STANDBY COMPASS SYSTEM

1200. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C gyro compass system. You must also become familiar with the location, operation, and purpose of various components to be able to operate the T-34C gyro compass system effectively. Your understanding of this lesson will enhance your ability to interpret cockpit instruments and navigate safely.

1201. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

12.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C gyro compass and standby magnetic compass systems characteristics.

Enabling Objectives

12.1 State the location and purpose of the Radio Magnetic Indicator (RMI).

12.2 Describe the RMI system components.

12.3 Describe the location and purpose of the slaving accessory.

12.4 State the location and purpose of the flux detector.

12.5 Describe the location, purpose and function of the directional gyro.

12.6 Describe the function of the slaving accessory.

12.7 Describe the location and purpose of the failure flag.

12.8 Identify the gyro compass system electrical power requirements.

12.9 Describe the location and purpose of the compass switches.

12.10 Explain the operating characteristics of the compass slave switch.

12.11 Explain the operating characteristics of the slave left-right switch.

12.12 Describe the location and purpose of the RMI disable switch.

12.13 Explain the purpose and location of the magnetic compass.

12.14 Describe the magnetic compass and its limitations.

1202. GYRO COMPASS SYSTEM

The gyro compass system consists of four components: Radio Magnetic Indicator (RMI), slaving accessory, flux detector, and directional gyro.

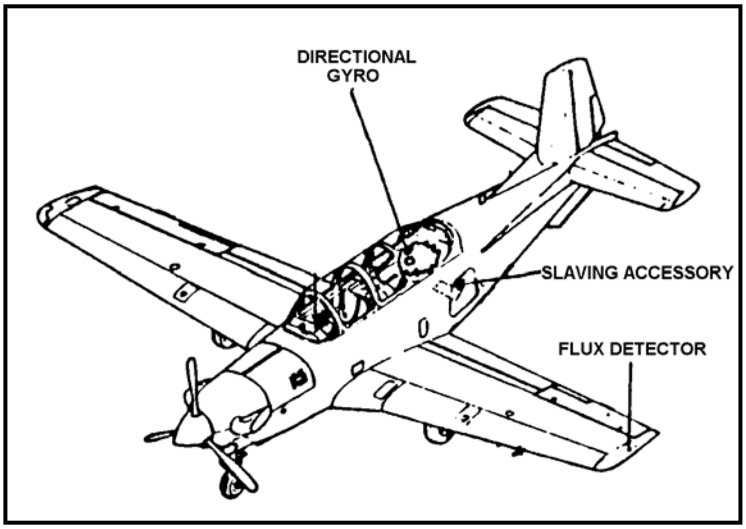
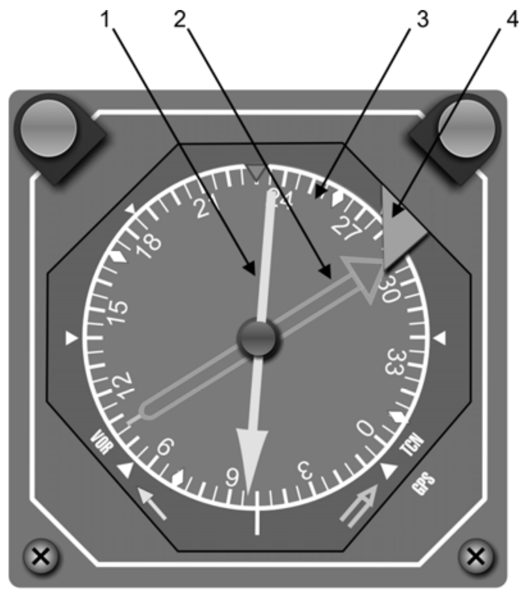


Figure 12-1 Gyro Compass System

RMI

Each cockpit has an RMI located in the center of the instrument panel. The purpose of the RMI is to provide an indication of aircraft magnetic heading and radio bearing information. The RMI contains a heading index, compass card, two needle pointers, and a red flag.



RADIO MAGNETIC INDICATOR (RMI)

1. Single Needle Pointer
2. Double Needle Pointer
3. Compass Card
4. Warning Flag

Figure 12-2 Radio Magnetic Indicator

The heading index is a stationary triangular-shaped reference mark located at the top of the RMI. The compass card rotates during aircraft heading changes and is graduated in 5º increments. Aircraft magnetic heading is read under the heading index. A single needle provides bearing information to a VOR station if the VOR system is in use. A double needle provides bearing information to a TACAN station if the TACAN is in use. The RMI requires both 26 VAC and 28 VDC.

Slaving Accessory

The slaving accessory, located in the avionics compartment, receives inputs from a flux detector and a directional gyro and sends a heading signal to both RMI cards. The slaving accessory requires 26 VAC.

Flux Detector

The flux detector is a 28-VDC electromagnetic compass located in the port wing tip that sends magnetic heading signals to the slaving accessory. While accurate, it has an inherent instability that gives the flux detector a $\pm$ 2° tolerance.

Directional Gyro

The directional gyro, located in the avionics compartment, is powered by 115 VAC and provides stabilization of the magnetic heading signal received by the slaving accessory from the flux detector.

Failure Flag

A red triangular failure flag will appear on the RMI whenever the RMI is not providing accurate heading information, when manually slaving, or when no electrical power is available.

Slaving Accessory Operation

The slaving accessory computes the error, which exists between the flux detector heading and directional gyro and sends a correction signal which aligns the directional gyro with the flux detector. This process, called slaving, then sends an accurate, gyro-stabilized, magnetic heading signal to both RMI compass cards. A fast slave mode is initiated the moment electrical power is applied in order to rapidly align the directional gyro/compass cards with the flux detector. Accurate gyro compass system operation requires 28 VDC, 26 VAC, 115 VAC and the avionics master switch ON.

Compass Switches

Compass switches are located on the lower left portion of both instrument panels and are used to manually fast slave the RMI compass card or to disconnect the flux detector if it becomes unreliable. Compass switches in the respective cockpits are operative only when possessing avionics command. The switch on the left side of the panel is the compass slave switch and the one on the right side is the slave left-right switch.

Compass Slave Switch

The compass slave switch is a three-position switch labeled FAST SLAVE, SLAVE and DG. The SLAVE position is the center position which allows normal operation. Heading information from the flux detector is stabilized by the directional gyro through the slaving accessory, resulting in accurate heading information on the RMI. The FAST SLAVE position is a momentary, spring-loaded (must be held up) position and is used to correct for gyro error (precession) which might be induced by aerobatic flight. This position rapidly aligns both compass cards and the directional gyro to the flux detector. To effect alignment, hold the compass slave switch up until the compass cards stop rotating (Note: The failure flag will drop into view while fast slaving.) Fast slaving should only be accomplished with the aircraft in an unaccelerated level flight attitude. The DG position (free gyro mode) will occur when the switch is in the down position (not spring-loaded). This disables automatic slaving and enables manual slaving of the RMI. This position is used when the flux detector becomes inaccurate. It activates the SLAVE LEFT-RIGHT switch, which allows the pilot to turn the directional gyro and compass cards left or right for proper alignment.

RMI Disable Switch

The RMI disable switch is located on the front cockpit avionics panel and is labeled AFT CKPT, RMI, ON, and OFF. Placing this switch in the OFF position removes the electrical power to the aft cockpit RMI. This switch is used only for training purposes during instrument training flights.

Standby Magnetic Compass

The standby magnetic compass, located on top of both instrument panel glareshields, indicates the aircraft's approximate magnetic heading. It is a standby or backup compass for navigation in case of gyro compass system failure. It is a self-contained instrument comprised of a nonferrous, liquid-filled bowl which contains a compass card, visible through a window in the bowl. Heading is determined by reference of the lubberline on the window to the compass card. Its accuracy is greatly affected by maneuvering of the aircraft.

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STUDY QUESTIONS

1. Match:

CHARACTERISTICS	COMPONENTS
a. Originates magnetic heading information ______	1. RMI
b. Located in port wing tip ______	2. Slaving accessory
c. Requires 26 VAC and 28 VDC ______	3. Flux detector
d. Requires 28 VDC ______	4. Directional gyro
e. Requires 26 VAC ______	
f. Requires 115 VAC ______	
g. Indicates magnetic heading ______	
h. Receives signals from two sources ______	

2. You must have avionics command in order to operate any of the compass switches. ____________(True/False)

3. The normal position of the compass slave switch is FAST SLAVE. ____________(True/False)

4. The slave left-right switch will operate any time you have avionics command. ___________(True/False)

5. To align compasses inflight you must be in level, unaccelerated flight. ____________(True/False)

ANSWERS TO STUDY QUESTIONS

1. a. 3

   b. 3

   c. 1

   d. 3

   e. 2

   f. 4

   g. 1

   h. 2

2. True

3. False

4. False

5. True

CHAPTER THIRTEEN

ATTITUDE, TURN AND SLIP, AND ACCELEROMETER SYSTEMS

1300. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C attitude, turn and slip, and accelerometer indicating systems. You must also become familiar with the location, operation, and purpose of various components to be able to operate and interpret these systems effectively. Understanding the operation and limitations of these systems is essential to safe visual and instrument navigation.

1301. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

13.0 Upon completion of this chapter, the student will demonstrate a knowledge of the T-34C attitude, turn and slip, and accelerometer indicating systems characteristics.

Enabling Objectives

13.1 Describe the location, purpose and operating characteristics of the attitude indicators.

13.2 Describe the attitude indicator.

13.3 State the purpose, location and operating characteristics of the attitude gyroscope.

13.4 Explain the purpose of the power OFF flag.

13.5 Explain the purpose, location and operation of the aft cockpit attitude indicator disable switch.

13.6 Describe the location and method of operation of the turn and slip indicator.

13.7 Explain the location and purpose of the recording accelerometer.

13.8 Describe the interpretation of the recording accelerometer.

1302. ATTITUDE SYSTEM

Attitude Indicator

The attitude indicator provides the pilot with a visual reference of the aircraft's attitude during all types of flight, including aerobatic and inverted flight. Attitude indicators are in the center top of both instrument panels and receive attitude signals from a single 115 VAC gyro located in the aft cockpit aft of the left console. The indicators are accurate through 360° roll and ± 82° pitch. Pitch and roll are shown by motion of the indicator's sphere in relation to a miniature aircraft. The horizon of the sphere is a white line. The upper half of the sphere, labeled CLIMB, is gray while the lower half, labeled DIVE, is black. Horizontal graduation lines are 5° apart. A bank angle pointer is used in conjunction with a bank angle index and scale to indicate roll attitude. Both the gyro and indicators receive 115 VAC when either inverter is turned on.

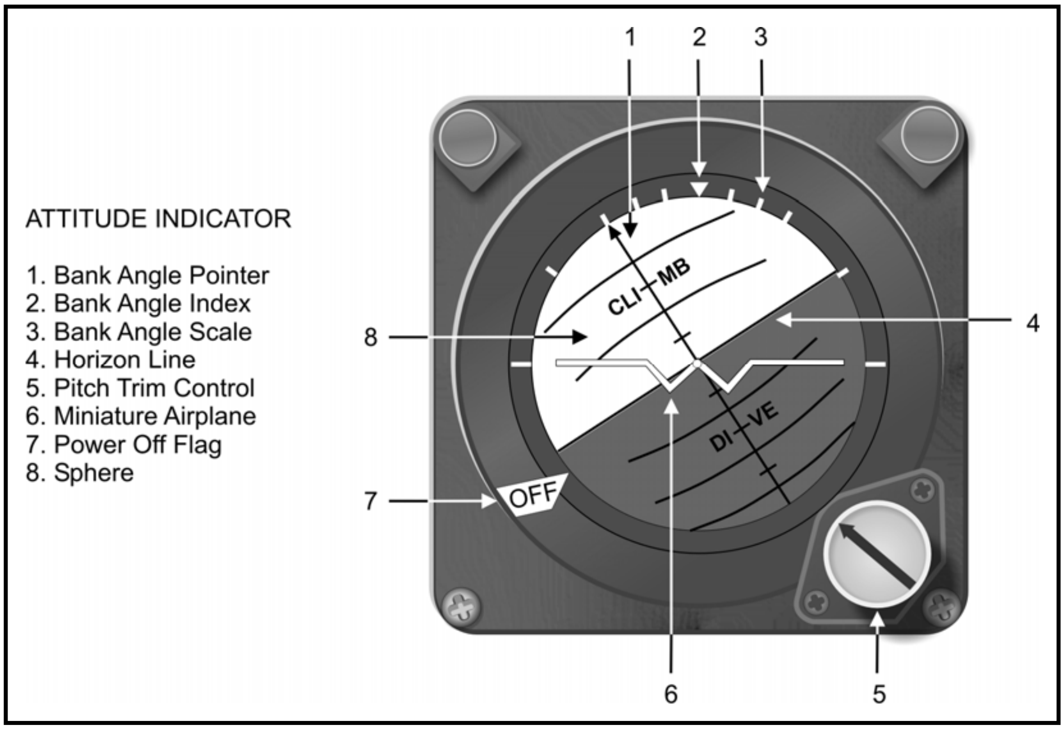

Figure 13-1 Attitude Indicator

Fast Erect

Above the upper left corner of each attitude indicator is a red button labeled FAST ERECT. To correct for gyro precession while airborne, press and hold the FAST ERECT button. This will apply a higher voltage to the torque motor, accomplishing what automatically takes place when AC power is initially applied. When in flight, fast erect shall only be accomplished when level and not accelerating.

Pitch Trim Knob

A pitch trim knob located on the lower right face of the indicator is used to correct for individual pilot height by raising or lowering the sphere's horizon line in relation to the miniature aircraft.

Power Failure Flag

A red power failure flag displaying the word OFF will be visible if AC power is lost or if selecting fast erect.

AFT Cockpit Attitude Indicator Disable Switch

For training purposes, the aft cockpit attitude indicator may be disabled. The disable switch is located on the front cockpit avionics panel and is labeled AFT CKPT, ATT GYRO, ON and OFF. A red power failure flag will be visible in the aft cockpit attitude indicator whenever the aft cockpit attitude gyro switch is placed to the OFF position.

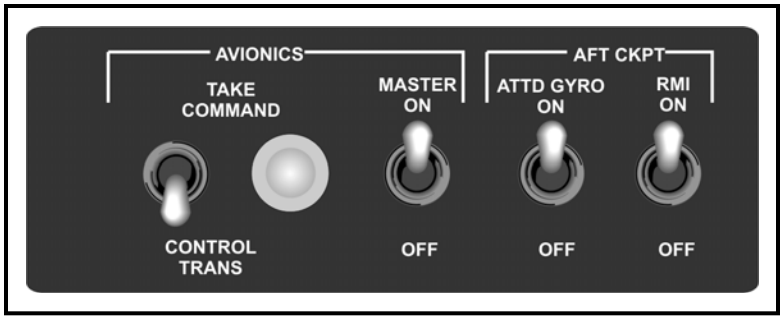

Figure 13-2 Aft Cockpit Attitude Indicator Disable Switch

1303. TURN AND SLIP INDICATOR

A turn and slip indicator, located in the lower center of the instrument panel in each cockpit, is comprised of a self-contained electrically powered 115 VAC gyro linked to a mechanical pointer needle, and an inclinometer consisting of a glass ball freely moving in a curved liquid-filled tube.

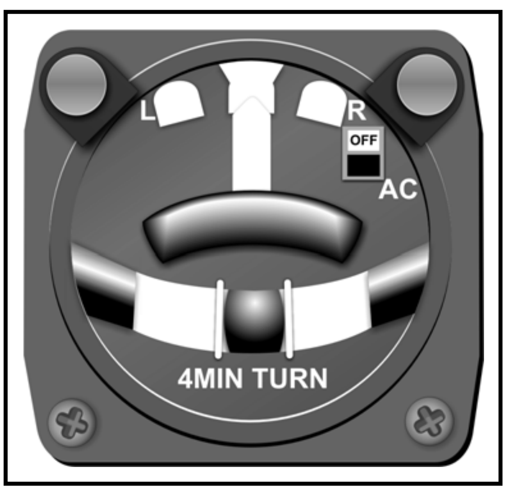

Figure 13-3 Turn and Slip Indicator

The pointer needle indicates the direction and the rate of turn. The normal rate of turn in instrument flying conditions, indicated by a two-needle width deflection, is known as a standard rate turn (SRT) and results in 360° of turn in two minutes. A one-needle width deflection is known as a one-half-standard rate turn and will result in 360° of turn in four minutes. A red power failure flag labeled OFF will be displayed on the instrument face if electrical power to the gyro is lost.

The ball in the inclinometer indicates the relationship between the angle-of-bank and the rate of turn by its position in relation to two white vertical lines (the center). In a practical aerodynamic sense, the balance ball shows directly the longitudinal alignment of the aircraft. Uncoordinated control inputs will cause the aircraft to fly in an unbalanced condition. This will cause the balance ball to move left or right of center, indicating a slip or skid.

1304. RECORDING ACCELEROMETER

Both cockpits have recording accelerometers which are "powered" by "G" force and are located at the bottom of the instrument panel. Their purpose is to continuously indicate positive and negative "G" loads on the aircraft, as well as recording maximum positive and negative Gs. Each instrument has three pointers. The indicating pointer (the longest) indicates presently applied "G" load, while the positive and negative pointers follow the indicating pointer to its maximum travel. These recording pointers remain at the maximum load imposed and can only be reset by depressing the reset knob in the lower left corner of the instrument. In the Naval Air Training Command the reset knobs are actuated by authorized maintenance personnel only. The T-34C limits are +4.5 and -2.3 Gs.

Figure 13-4 Recording Accelerometer

STUDY QUESTIONS

1. What are the limits of the attitude indicator?

2. Where is the attitude gyro located? What is its power source?

3. What does a red OFF flag in the front cockpit attitude indicator indicate?

4. The pitch trim knob can adjust the sphere left or right.____________(True/False)

5. What is the purpose and power of the turn indicator?

6. What is the purpose and power of the slip indicator?

7. What is the definition of a standard rate turn? A one-half standard rate turn?

8. The accelerometer requires electrical power to operate. (True/False).

ANSWERS TO STUDY QUESTIONS

1. 360º roll, ± 82º pitch
2. In the aft cockpit aft of the left console; 115 VAC
3. AC power to the gyro has been lost.
4. False
5. It indicates the direction and rate of turn. 115 VAC
6. It shows the longitudinal alignment of the aircraft, nose to tail. Gravity powered
7. SRT = 3º/second; ½ SRT = 1½º/second
8. False

CHAPTER FOURTEEN
PITOT STATIC SYSTEM

1400. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C pitot static system. You must also become familiar with the location, operation, and purpose of various components to be able to interpret the pitot static instruments correctly. The pitot static instruments consist of the airspeed indicator, altimeter, and vertical speed indicator (VSI).

1401. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

14.0 Upon completion of this chapter, the student will demonstrate a knowledge of the T-34C pitot static system characteristics.

Enabling Objectives

14.1 Identify the air inputs to the pitot static indicators.

14.2 State the location and purpose of the pitot tube.

14.3 Describe the purpose and operation of the pitot heater.

14.4 Identify the precautions to be observed with the use of the pitot heater.

14.5 State the location and purpose of the static ports.

14.6 State the location, purpose and control of the alternate static air source.

14.7 State the location, description and purpose of the airspeed indicator.

14.8 State the location, description and purpose of the altimeters.

14.9 Explain the purpose and operation of the altimeter internal vibrator.

14.10 Explain the encoding feature of the front cockpit altimeter.

14.11 State the location, description and purpose of the vertical speed indicator.

1402. PITOT STATIC SYSTEM

The pitot and static pressure systems supply pitot (impact) air pressure and atmospheric (static) pressure to various instruments and components.

Pitot

An electrically heated pitot tube on the leading edge of the left wing supplies pitot pressure to the airspeed indicators in both cockpits. The heating element is powered by 28 VDC, is activated by a switch in the front cockpit, aft end of right console and is used to prevent airflow restriction under icing conditions. Caution should be used if it is necessary to touch the pitot as burn injury potential exists. Pitot heat should not be used on the ground except immediately prior to takeoff as required. Overheating due to lack of cooling airflow will damage the unit.

Static

Static ports on the left and right sides of the aft fuselage supply static or atmospheric pressure. Pressure from the static ports is transmitted to the airspeed indicators, altimeters, and vertical speed indicators.

Alternate Static Air Source

An alternate static air source is available for the front cockpit static instruments only and is designed to provide a source of static pressure to the instruments from inside the fuselage should the outside static air ports become blocked. A guarded switch in the front cockpit below the parking brake handle allows the pilot to select either NORMAL or ALTERNATE static air.

Airspeed Indicator

Two airspeed indicators are provided, one on each instrument panel. They are pitot static instruments and are calibrated to show indicated airspeed from 40 to 400 kias. In addition, a maximum allowable airspeed (MAAS) pointer continuously indicates the maximum allowable airspeed.

Figure 14-1 Airspeed Indicator

Maximum Allowable Airspeed

280 KIAS .... 0 - 20,000 feet
245 KIAS .... 20,000 - 25,000 feet

Altimeters

Altitude is displayed in both cockpit pressure altimeters by a 10,000 foot counter, a 1000 foot counter, and a 100 foot drum. A single pointer indicates hundreds of feet on a circular scale, with 50 foot center graduations. Below 10,000 feet a diagonal warning symbol appears on the 10,000 foot counter. At the right side of the altimeter face is the barometric pressure window, which is used to correct for variations in sea level barometric pressure by means of a knob on the lower left corner of the instrument.

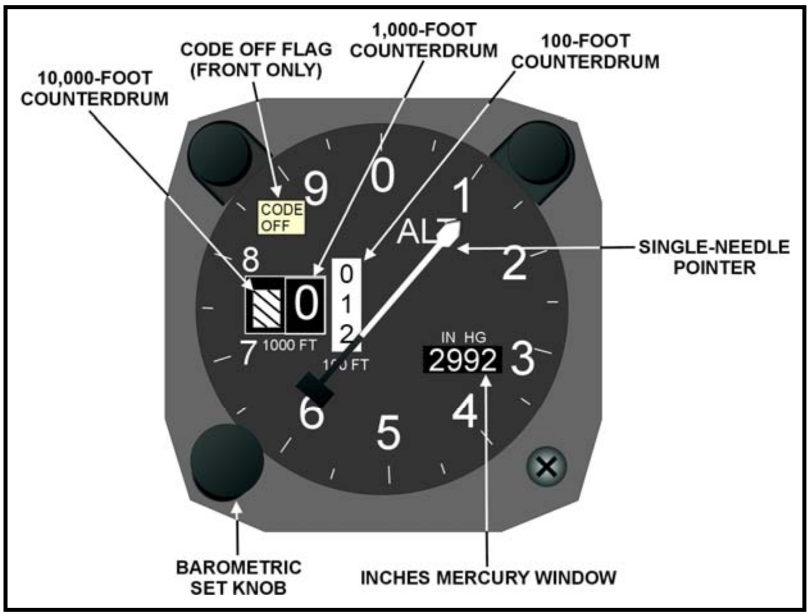

Figure 14-2 Altimeter

Altimeter Internal Vibrator

When each 1000-foot increment is completed, the counters abruptly index to the next digit. However, there is a noticeable pause or hesitation of the pointers caused by the additional friction and inertia loads involved in indexing the counters. The momentary pause is followed by a noticeable acceleration as the counters change. To minimize friction and to maximize the accuracy, a DC-powered vibrator in the altimeters is energized whenever aircraft power is on. The pause-and-accelerate behavior is most common in the 9-to-1 section of the scale, but if the internal vibrator is inoperative, this behavior may occur in the 8-to-2 section.

Altitude Encoder

The encoder (front cockpit) altimeter contains a DC-powered digital encoder which encodes altitude information for transmission by the altitude mode of the operating transponder. Altitude information is also sent to NACWS. If DC power to the encoder is lost, the altimeter will continue to operate as a pressure altimeter, but a red CODE OFF flag will indicate that no altitude signals are being provided to the transponders or NACWS. The aft cockpit altimeter is known as the barometric altimeter.

Altimeter Limits

When a field elevation check is made, the local barometric pressure is set into the window. For instrument flight (IFR) the altimeter should agree within 75 feet of the field elevation.

Vertical Speed Indicator

A VSI is installed on each instrument panel and indicates the rate of climb or descent of the aircraft based on the changes in atmospheric pressure. The indicator is calibrated with 100 foot divisions from 0 to 1000 feet and 500 foot increments from 1000 to 6000 feet.

Figure 14-3 Vertical Speed Indicator

STUDY QUESTIONS

1. The ____________ uses pitot/impact air.

2. Alternate static air is available to which cockpit(s)?

3. The altimeter in the ____________ cockpit is the encoder altimeter and the ____________ altimeter is in the ____________ cockpit.

4. For IFR flight the maximum allowable error in the altimeter is ________ feet.

5. The altimeter vibrator is designed to ____________ the friction and maximize the ____________.

6. The altitude encoder is located in the ____________ cockpit ____________, receives ____________ power, and sends altitude data to the ____________.

7. What indication would be seen if the altitude encoder were to fail?

ANSWERS TO STUDY QUESTIONS

1. airspeed indicator

2. front cockpit only

3. front, barometric, aft

4. ± 75

5. minimize; accuracy

6. front, only, 28 VDC, transponder and NACWS

7. red "code off" flag in front cockpit altimeter

CHAPTER FIFTEEN

ANGLE-OF-ATTACK SYSTEM

1500. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C angle-of-attack system. You must also become familiar with the location, operation, and purpose of various components. Correct interpretation of system indications is essential to conducting safe angle-of-attack approaches and landings.

1501. LESSON TOPIC LEARNING OBJECTIVES

TERMINAL OBJECTIVE

15.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C AOA system characteristics.

ENABLING OBJECTIVES

15.1 State the location and purpose of the AOA indicator.

15.2 Describe the AOA indicator.

15.3 State the purpose of the special indexes.

15.4 State the location and purpose of the AOA probe.

15.5 State the method of operation of the AOA probe.

15.6 Recall the requirements for accurate AOA display indications.

15.7 Describe the location and purpose of the AOA indexer.

15.8 Describe the indexer symbols and their interpretations.

15.9 State the location and purpose of the AOA test switch.

15.10 Describe the operation of the AOA test switch.

1502. ANGLE-OF-ATTACK SYSTEM

The AOA system provides accurate angle-of-attack information. During an AOA landing, the AOA system is the primary landing approach indicator. The system consists of an AOA probe, AOA electronic control unit, AOA indicator, AOA indexer, test switch, and stall warning rudder pedal shakers. The system will adjust for inherent stall angle differences resulting from two basic flap positions: zero flaps and full flaps. The system requires 28 VDC and is activated as soon as DC power is applied to the aircraft.

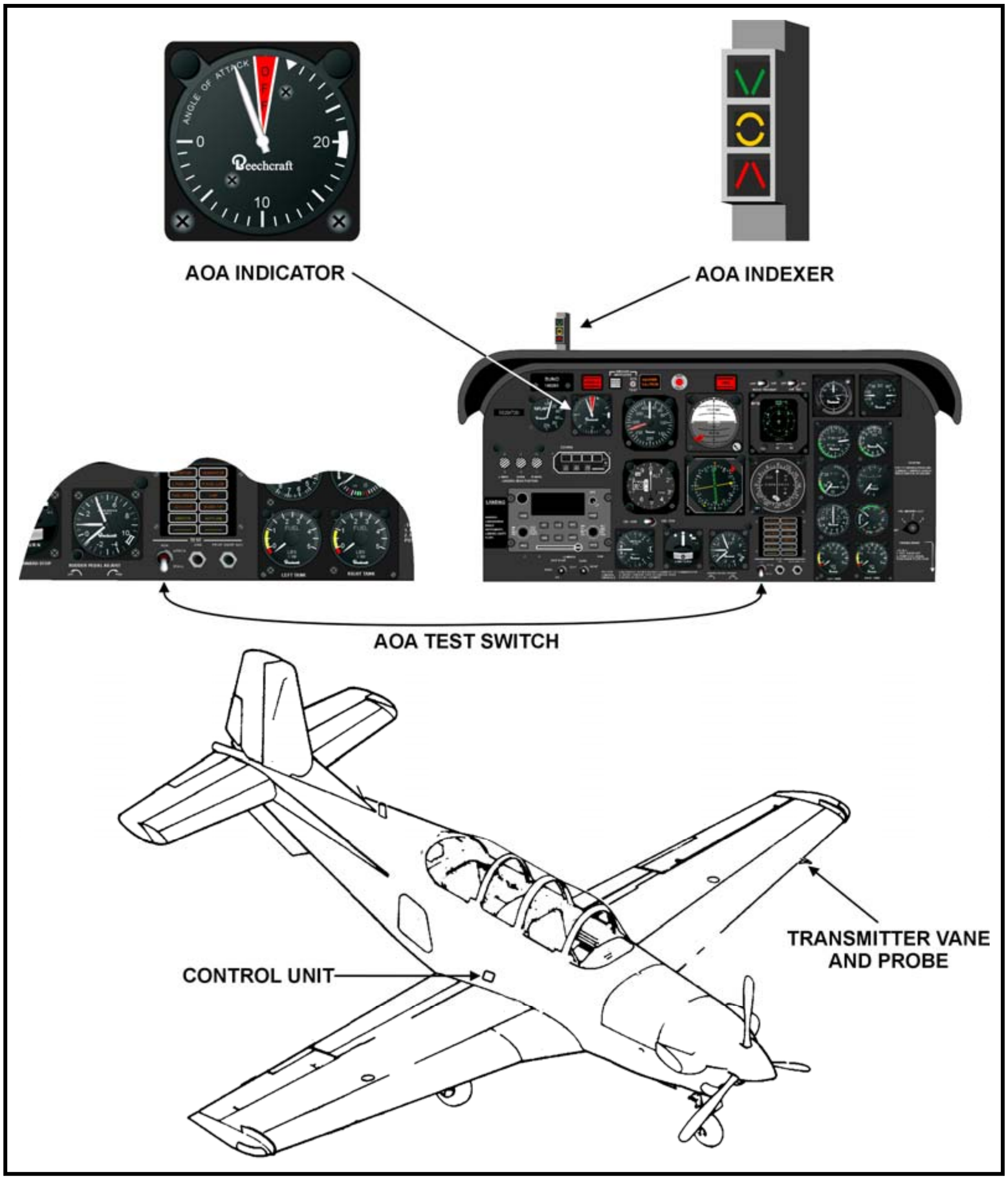

Figure 15-1 Angle-of-Attack System

AOA Probe

The AOA probe is located on the leading edge of the left wing. A rotary vane is attached to a potentiometer located within the probe body. The vane is positioned by the relative wind striking the leading edge of the wing. The potentiometer sends an electrical signal representative of the AOA to the AOA electronic control unit.

AOA Electronic Control Unit

The AOA electronic control unit is a white rectangular box located in the aft cockpit on the deck, right side. It is a solid-state electronic unit amplifying the AOA probe signal and sending it to the AOA indicator pointer and indexer for display.

Accurate Display Indication Requirements

To display valid AOA information the aircraft must be airborne and in the proper wing flap configuration; i.e., flaps full up (0%) or flaps full down (100%).

AOA Indicator

The AOA indicator is located in the upper left corner of the instrument panel in each cockpit. It displays accurate AOA information in the form of arbitrary units. The indicator aids a pilot in establishing the optimum aircraft wing AOA for a given airspeed. The display is comprised of a pointer and a scale. The scale is graduated from 0-29 units in one-unit increments. Three special indexes are marked on the scale at 20 units, 26½ units, and 29 units. The 20-unit index is the optimum approach index. This is the most important, since it is used in the early stage of the AOA landing approach to establish the aircraft on the correct airspeed at 20 units. In the T-34C this will be approximately 80 KIAS with flaps down and 95 KIAS with flaps up. The 26½ unit index is the stall warning index. The rudder pedal shakers, a physical stall warning feature, are activated only in flight at or above 26½ units. Activation indicates the aircraft is 5-10 KIAS above actual stall speed. On landing, the rudder pedal shakers are disabled by a safety switch located on the nose landing gear. At 29.0 units, the aircraft is fully stalled. Should the pointer move into the red OFF portion of the dial, it indicates the system has lost 28-VDC power. The pointer is operated by an electrical signal that is developed in the AOA probe.

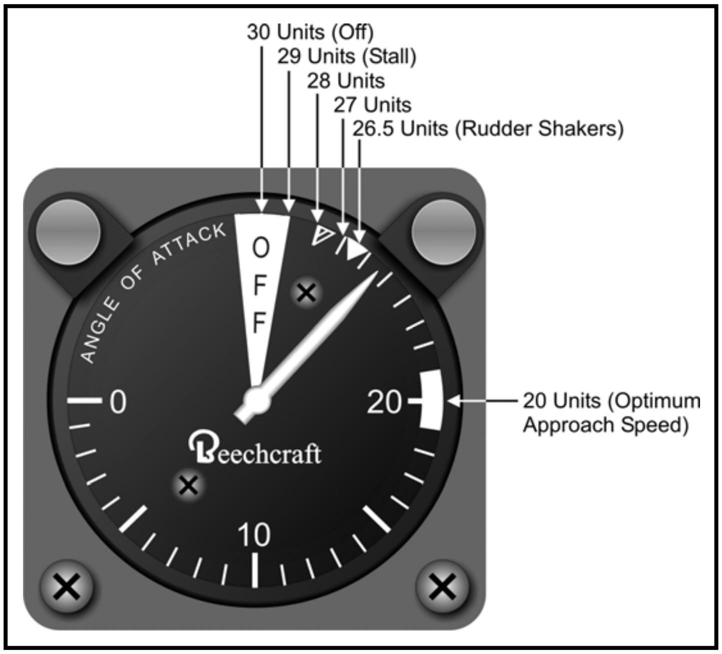

Figure 15-2 Angle of Attack Indicator

AOA Indexer

An AOA indexer is located at the top left side of the glareshield in each cockpit. The AOA indexer is an illuminated display of symbols. A green "V"-shaped chevron at the top, a yellow (amber) circle ("doughnut") in the middle, and a red inverted "V"-shaped chevron at the bottom. During a precise landing approach, the indexer identifies required nose attitude changes to maintain optimum approach airspeed. The symbols will illuminate individually or as two in combination, to provide five approach speeds and AOA conditions as shown below.

Symbol	Airspeed	AOA
Green (V)	Slow	High
Green (V) Yellow (O)	Slightly slow	Slightly high
Yellow (O)	OK	OK
Yellow (O) Red (Λ)	Slightly fast	Slightly low
Red (Λ)	Fast	Low

Except during ground test, the indexer operates only when the aircraft is in flight and the landing gear is extended. The indexer is activated by the down limit switch on the landing gear gearbox when the gear is extended, and deactivated on landing by the right landing gear safety switch.

AOA Test Switch

The AOA test switch is located on the TEST panel at the bottom of the instrument panel in both cockpits. It is labeled AOA, APRCH, and STALL and is used to test the AOA and stall warning systems. Selecting APRCH causes the indicator and indexer in both cockpits to display 20 units and a yellow circle (yellow doughnut). The STALL position causes the rudder pedal shakers to activate immediately and both cockpits to display 29 units and a green (V) chevron.

Rudder Pedal Shakers

Rudder pedal shakers, located on each aft rudder pedal, provide both pilots with a physical warning that the aircraft is approaching a stall. An eccentric metal mass is driven by an electric motor when activated by the AOA system to cause pedal vibrations in both cockpits when the aircraft is 5-10 KIAS above stall.

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STUDY QUESTIONS

1. Correctly complete the following statement;

   AOA indicator(s) is/are located in ____________ cockpit(s) in the ____________ corner of the ____________ panel, and is/are used to display angle-of-attack information in the form of ____________ units.

2. Match each AOA indication with the correct statement(s) concerning their meaning by writing the letter preceding the indication in the blank provided.

INDICATIONS	STATEMENTS
a. 29 units	1. ___ indicator graduations
b. 26½ units	2. ___ optimum approach angle
c. 20 units	3. ___ rudder pedal shakers
d. 0 to 29 units	4. ___ stall

3. List two requirements which must be met in order to read accurate information from the AOA indicator.

4. Select the correct power requirements for the AOA system.

   a. 28 VAC

   b. 26 VDC

   c. 115 VAC

   d. 28 VDC

5. Select the correct statement(s) concerning when the AOA indexer will operate.

   a. In flight with the landing gear retracted.

   b. During AOA system test.

   c. In flight with the landing gear extended.

   d. On the deck with the landing gear extended.

ANSWERS TO STUDY QUESTIONS

1. both, upper left, instrument, arbitrary

2. a. 4

   b. 3

   c. 2

   d. 1

3. Must be airborne and be in either full up flaps (0%) or full down flaps (100%)

4. d.

5. b., c.

CHAPTER SIXTEEN

BASIC FEATURES AND GROUND HANDLING

1600. INTRODUCTION

As student aviators, it is extremely important that you become familiar with the basic features and ground handling requirements of the T-34C. You must also become familiar with exterior dimensions and limitations of the aircraft. Compliance with limitations is essential to conducting safe ground and flight operations.

1601. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

16.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C basic features and ground handling.

Enabling Objectives

16.1 State the reasons why solo flight is permissible from the front cockpit only.

16.2 Recognize the exterior dimensions of the T-34C.

16.3 Recall the maximum allowable gross weight for takeoff and landing.

16.4 Select the maximum allowable airspeed above and below 20,000 feet.

16.5 Select the maximum allowable airspeeds for operation of the landing gear and flaps.

16.6 Identify the maximum allowable "G" loads at maximum gross weight.

16.7 State the maximum deflection of the nose gear and the reason for the limitation when towing the aircraft.

16.8 Describe normal weather securing procedures and tie-down points.

1602. BASIC FEATURES AND GROUND HANDLING

The T-34C aircraft is an unpressurized two-place, tandem cockpit, tricycle gear, low wing, single-engine monoplane manufactured by Beech Aircraft Corporation.

Solo Flight

Dual flight controls and instrumentation necessary for flight are provided in both cockpits. Solo flight shall be accomplished from the front cockpit only due to safety of flight items not present in the rear cockpit and adverse effect on weight and balance. The following list summarizes the differences between the two cockpits.

FRONT COCKPIT ONLY	REAR COCKPIT ONLY
Emergency Locator Transmitter	Attitude Gyro
Emergency Fuel Shutoff Handle	Oxygen Bottle
Friction Lock Knob	AOA Electronic Control Unit
Cockpit Environmental Control	Solo Flight Checklist
Windshield Defogger Control	Rudder Pedal Shakers
Landing Lights Switches	IFR Hood
Outside Air Temperature Gauge	AFT Cockpit Outside Air
Fire Warning Test Switch	First Aid Kit
Parking Brake Handle	
Engine Inlet Bypass Door Handle	
Pilot's Static Air Source Switch	
Landing Gear Manual Extension Handle	
Avionics Master Switch	
Aft Cockpit Attitude Gyro & RMI Disable Switches	
VHF Radio	
Oxygen Shutoff Handle	
Navigation and Strobe Light Switches	
Pitot Heat Switch	
Electronic Standby Boost Pump Switch	
Control Lock	

Exterior Dimensions

Overall dimensions of the aircraft are:

Wingspan	33 feet, 4 inches
Length	28 feet, 6 inches
Height (average)	9 feet, 7 inches

Maximum Gross Weight

Maximum ramp weight	4425 lbs.
Takeoff and landing weight	4400 lbs.

Maximum Allowable Airspeed

280 Knots Indicated Airspeed (KIAS)	0 - 20,000 feet
245 Knots Indicated Airspeed (KIAS)	20,000 - 25,000 feet

Landing Gear

Extend	150 KIAS
Flight	150 KIAS
Retraction	120 KIAS

Flaps

Extend	120 KIAS
Flight	120 KIAS
Retract	120 KIAS

Canopy Open

Normal	240 KIAS
Emergency	250 KIAS

NOTE

Always check airspeed before actuating gear, flaps, or canopy in flight.

Maximum Allowable "G" Loads (at 4400 lbs.)

2.3 Negative Gs 4.5 Positive Gs

Towing

Towing of the aircraft should be accomplished ideally with a Beech or suitable towbar. The propeller restraint must be installed before towing. Caution must be exercised so as not to exceed 30° nose gear limits either side of center line. Exceeding limits may result in strut structural damage.

Securing

The proper steps for securing the aircraft must be based on the time the aircraft will be left unattended, the aircraft weight, expected wind conditions, and the anticipated availability of personnel.

Normal weather:

- Control lock installed
- Chock main wheels fore and aft
- Propeller restraint installed
- Inlet duct plugs installed
- Tie-downs attached:
  - One under each wing
  - One under the empennage

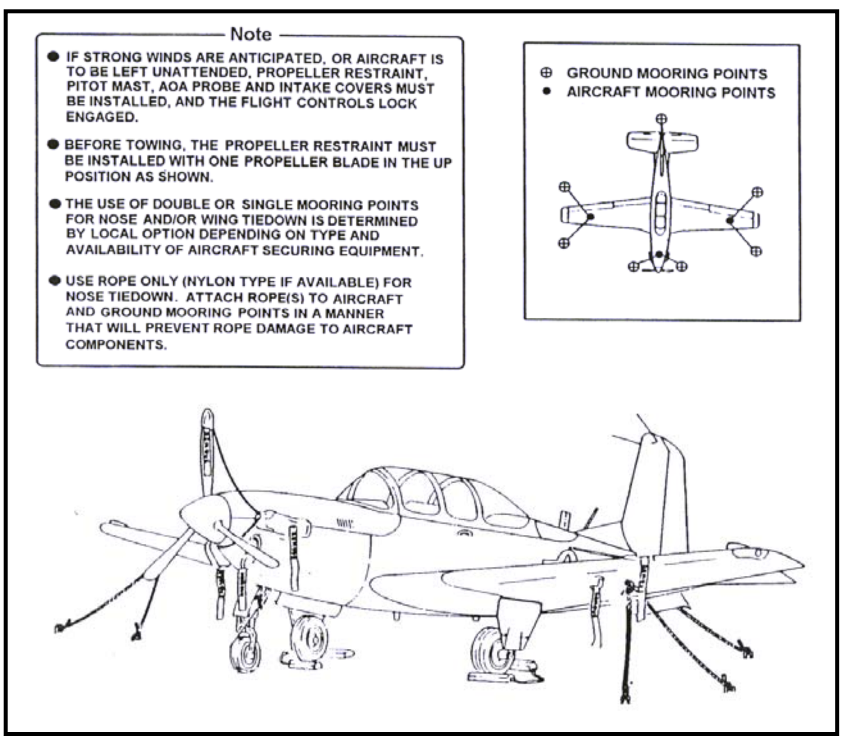

Figure 16-1 Tiedown/Securing Aircraft

STUDY QUESTIONS

1. Complete the following statement:

Solo flight is permissible from the____________ cockpit only, due to certain of ____________ ________ items not in the aft cockpit.

2. Complete the following:

   a. Wingspan ________

   b. Length ________

   c. Height average ________

3. Select the maximum allowable gross weight for takeoff and landing.

   a. 3003 lbs.

   b. 1297 lbs.

   c. 4000 lbs.

   d. 4400 lbs.

4. Write the maximum allowable airspeed of the T-34C:

   a. Below 20,000 feet

   b. Above 20,000 feet

5. Write the maximum allowable airspeed for operation of:

   a. Landing gear
      (1) Extend ________
      (2) Retract ________

   b. Flaps
      (1) Extend ________
      (2) Retract ________

6. Select the maximum allowable “G” loads which may be imposed on the T-34C:

   a. -4.5, +2.3

   b. +4.5, -2.3

   c. +4.3, -2.5

   d. -4.3, +2.5

7. Complete the following:

   The reason the nose gear must not be deflected an excessive amount when towing the aircraft is that possible structural damage will occur if ____________ is exceeded.

8. Write the location of the normal weather tie down points.

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ANSWERS TO STUDY QUESTIONS

1. front, safety, flight

2. a. 33 feet 4 inches

   b. 28 feet 6 inches

   c. 9 feet 7 inches

3. d.

4. a. 280 KIAS

   b. 245 KIAS

5. a. (1) 150 KIAS

      (2) 120 KIAS

   b. (1) 120 KIAS

      (2) 120 KIAS

6. b.

7. 30°

8. One under each wing

   One under the empennage

CHAPTER SEVENTEEN
CANOPY/COCKPIT FURNISHINGS

1700. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C canopy and cockpit furnishings. You must also become familiar with the location, and operation of various components, both on the canopy and in the cockpit. Essential safety of flight items are only in the front cockpit of the aircraft. Thorough knowledge of their operation may save your life.

1701. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

17.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C canopy and cockpit furnishings.

Enabling Objectives

17.1 Identify the three sections of the canopy.

17.2 Identify the side of the aircraft used for normal entrance and egress.

17.3 Describe the normal operation of the canopy.

17.4 Identify the components of the canopy emergency release system.

17.5 Describe the operation of the canopy emergency release system.

17.6 Describe the method of adjusting the pilot's seat.

17.7 Identify the components of and describe the adjustment and operation of the restraint harness.

17.8 State the location of the relief tube, first aid kit, Solo Flight Checklist, Landing Checklist, instrument hood, map case, and clock.

1702. CANOPY/COCKPIT FURNISHINGS

The canopy, exclusive of the windshield, is in three sections: a manually operated sliding section over each cockpit and a rigid center section. Each sliding section opens aft and can be operated independently.

Normal entrance into and egress from both cockpits is made from the left wing, since the locking handles are on the left side only.

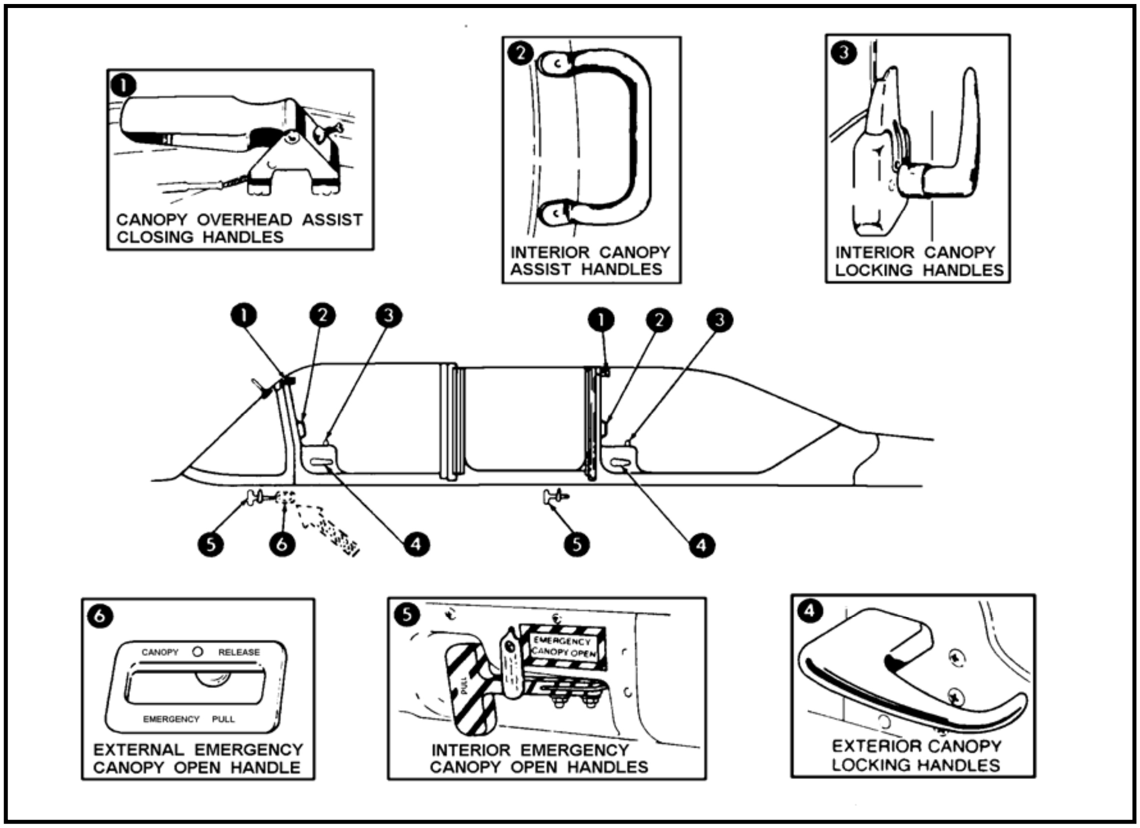


Figure 17-1 Canopy Handles

Normal Operations

Normal operation of the canopy is by use of locking handles located on the forward left side of each moveable section. Exterior/interior handles are mounted on a common shaft and are rotated forward to lock, aft to unlock. Each canopy must be manually locked closed, but automatically locks in the full open position. Each overhead assist handle unlocks the respective canopy from the open position only and is located on the forward center of the moveable section. Interior assist handles provide no lock/unlock action and are located on the right side of each moveable section.

WARNING

While closing front canopy, adjust seat height to ensure the canopy bow clears the helmet; otherwise, there exists the danger of the canopy bow striking the helmet during emergency operations.

Emergency Operation

The canopy emergency (pneumatic) system assures the occupants that in case of emergency the canopies may be opened simultaneously to permit escape from the aircraft. When actuated, the system high pressure nitrogen moves a cylinder assembly attached to the canopies by cables. The nitrogen storage bottle is mounted in the avionics compartment, right side, and is equipped with a temperature-compensated gauge, which can be viewed through a window on the right side of the fuselage aft of the wing. When the nitrogen is released from the bottle it is discharged into the pneumatic cylinder mounted on the ledge behind the aft cockpit seat. As the nitrogen forces a piston into the cylinder, the piston pulls cables attached to both canopy assemblies. Canopy emergency open handles are located on the right sidewall of each cockpit and on the exterior right side of the forward cockpit. All three emergency open handles are attached to a common cable which is attached to the nitrogen bottle valve.

To operate the emergency open system, pull any emergency open handle. Both canopies will open in 1-4 seconds to a position 2 inches less than when manually opened. The canopy will be locked open and cannot be closed.

Personnel Equipment

Seats in each cockpit are adjustable 5 inches vertically in 1-inch increments by pulling up on the spring-loaded handle on the right side of each seat (Figure 17-2). There are no horizontal adjustments of the seat.

The restraint harness holds the pilot in the seat by an integrated harness assembly consisting of a crotch strap, lap belts, and shoulder straps attached to an inertial reel lock that are all a part of the seat. All of the belts/straps lock into a common five-point rotary padded buckle. Release from the harness assembly is accomplished by turning the rotary buckle ⅛ turn in either direction. All belts/straps are adjustable. The shoulder harness inertia reel is locked or unlocked by movement of the lock handle (forward and aft movement) on the left of the seat. When unlocked (aft) the inertia reel allows pilot mobility, but will provide restraint in the event of rapid linear deceleration.

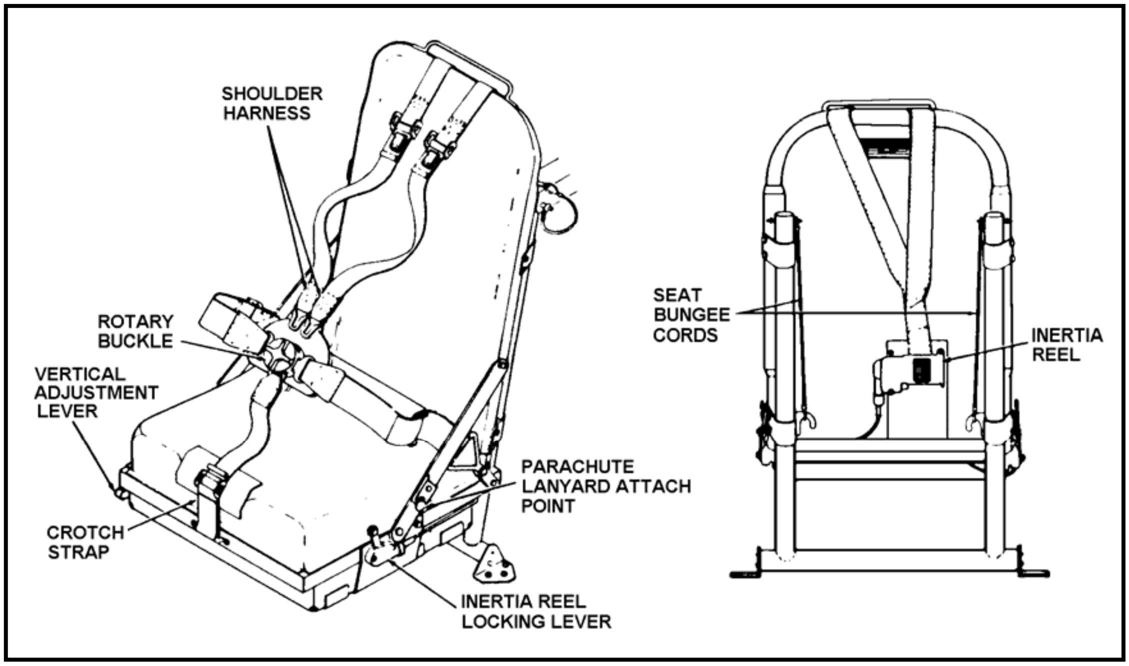
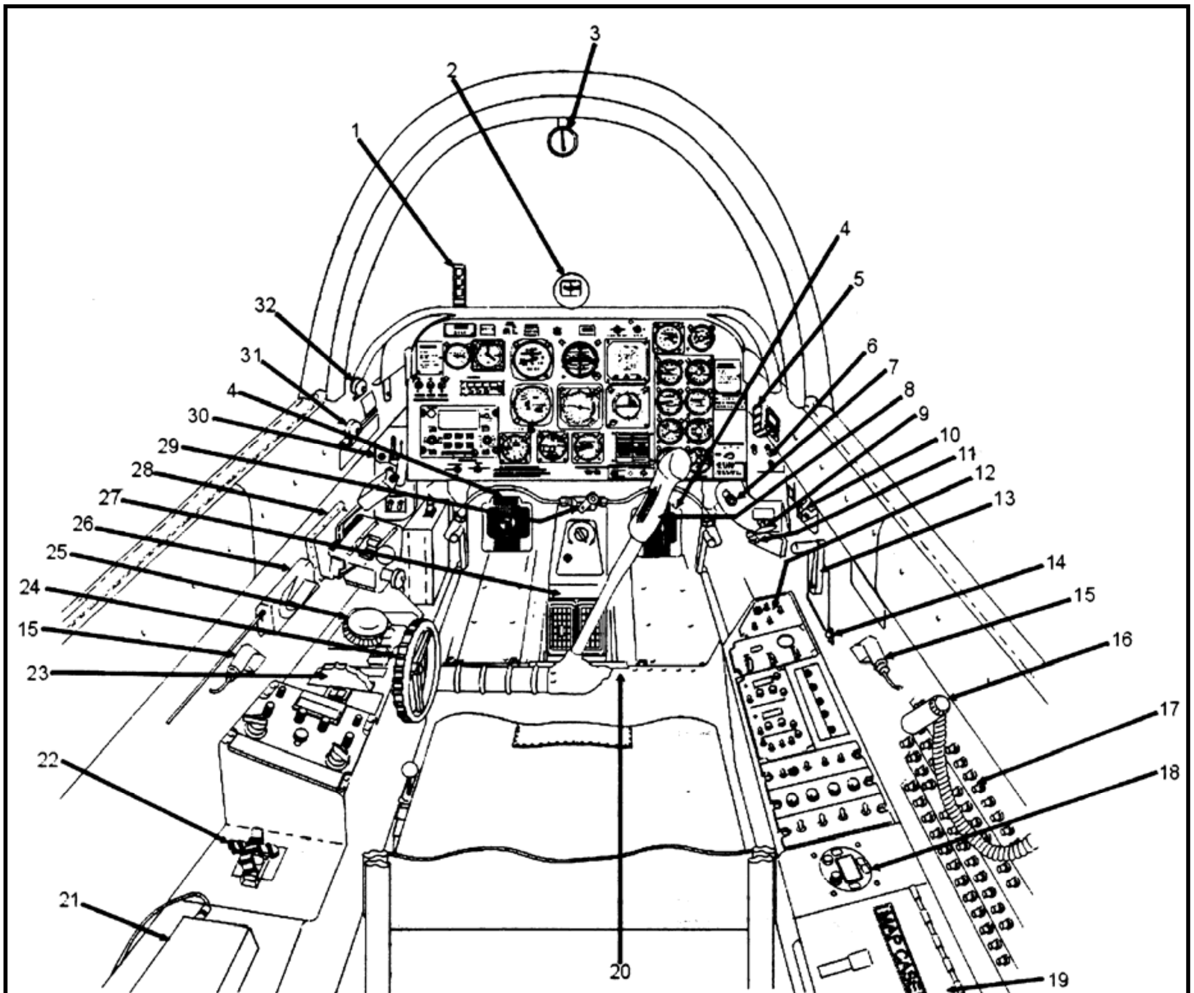


Figure 17-2 Seats and Restraint Harness

Miscellaneous Equipment

Map cases are in both cockpits on the aft end of the right consoles. Relief tubes are beneath each seat and connect to a common drain with a venturi on the exterior end. A low-pressure effect is induced when actuating a lever on each relief tube. A first aid kit is located on a shelf behind the aft seat. A Landing Checklist is located on the left side of each cockpit instrument panel. A Solo Flight Checklist is mounted on the right side of the instrument panel in the aft cockpit. The instrument flying hood is an accordion-like cloth hood that encloses the aft cockpit for instrument practice and is normally stowed behind the aft seat. When utilized, the forward edge attaches to the top of the glareshield with velcro strips. Each cockpit contains a spring-wound clock that incorporates a stop-watch feature.



1. AOA Indexer
2. Magnetic Standby Compass
3. Free Air Temperature Gage
4. Rudder Pedals
5. Emergency Canopy Open Handle
6. Starter/Ignition Control Panel
7. Parking Brake Handle
8. Control Stick
9. Engine Air Inlet Bypass
10. Oxygen Control Handle
11. Alternate Static Air Control
12. Electrical Control Command Panel
13. Emergency Landing Gear Extension Handle
14. Landing Gear Hand Crank Clutch Knob
15. Cockpit Flood Lights
16. Cockpit Utility Light
17. Circuit Breaker Panel
18. VHF Radio
19. Map Case
20. Flight Controls Lock Frame
21. Emergency Locator Transmitter (ELT)
22. Emergency Fuel Shut-off Handle
23. Aileron Trim Control
24. Elevator Trim Control
25. Rudder Trim Control
26. Flap Switch
27. Evaporator Unit
28. Engine/Propeller Control Quadrant
29. Rudder Adjustment Handle
30. Left Subpanel
31. Cockpit Environmental Control
32. Windshield Defogger Control

Figure 17-3 Front Cockpit Arrangement

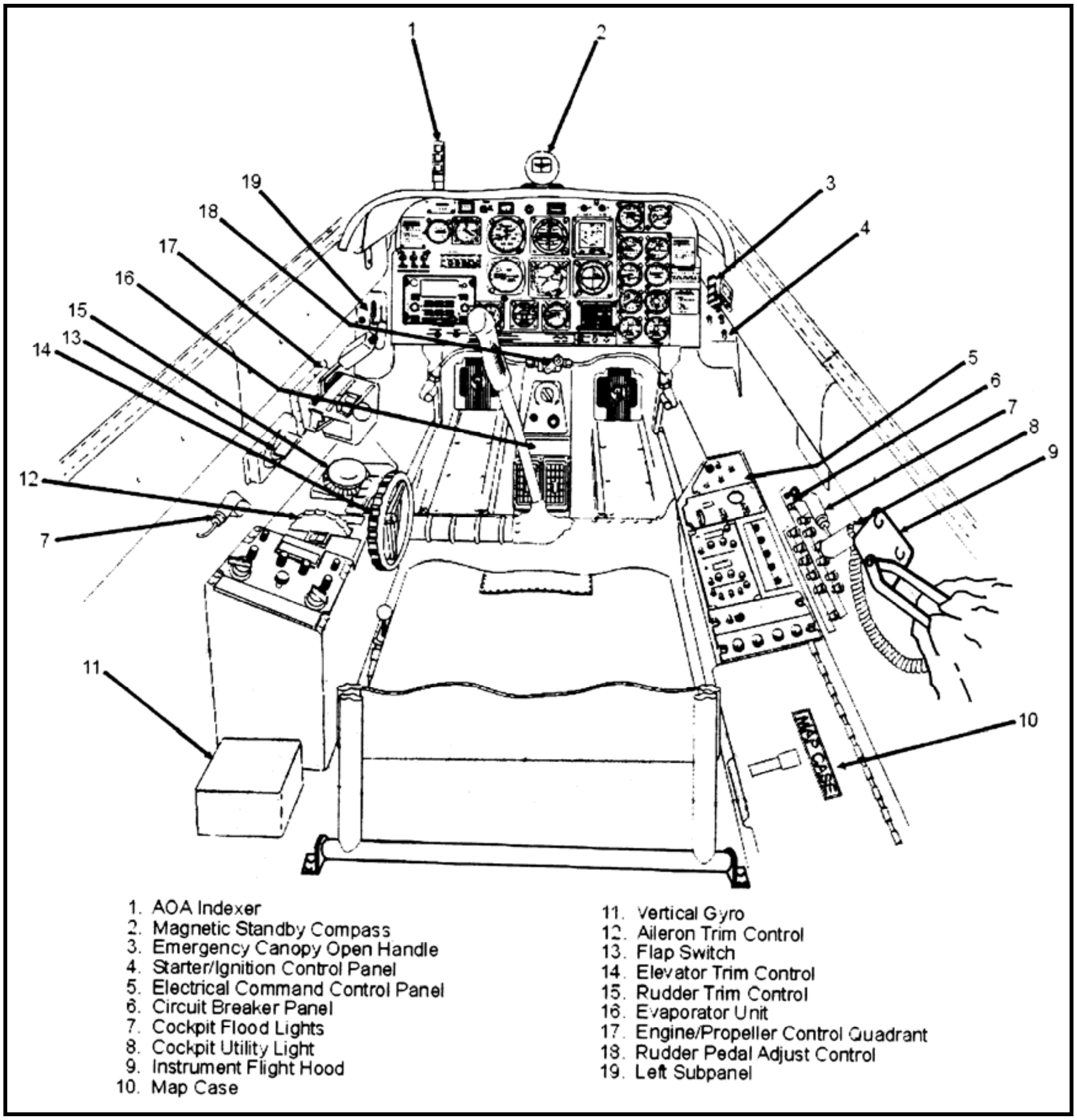


Figure 17-4 AFT Cockpit Arrangement

Figure 17-5 Front Cockpit Instrument Panel

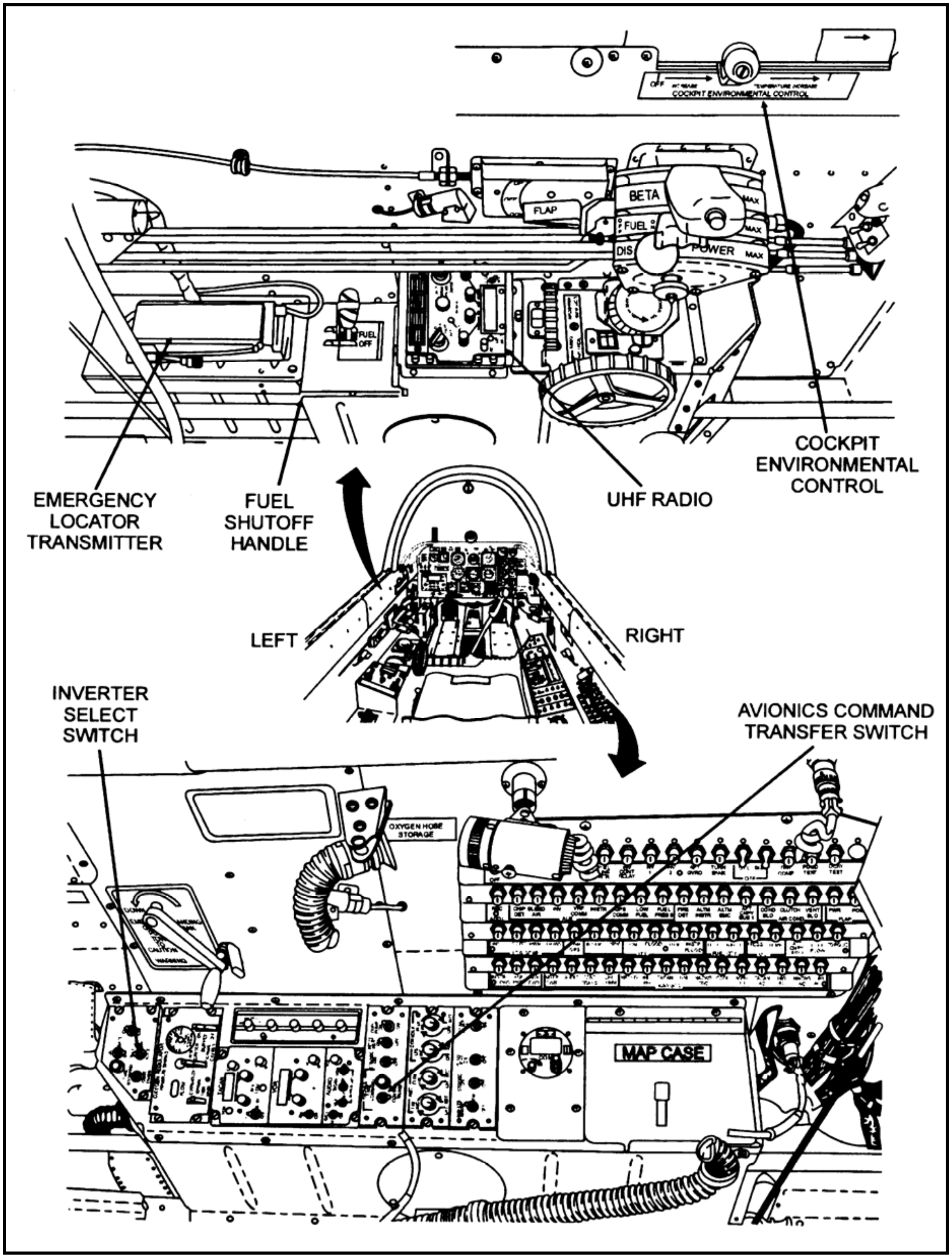


Figure 17-6 Front Cockpit Consoles

Figure 17-7 Aft Cockpit Instrument Panel

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STUDY QUESTIONS

1. Can the overhead assist handle unlock the canopy when in the forward and locked position?

2. Where is the temperature-compensated gauge viewed?

3. A rescuer can actuate the canopy emergency system from the left side of the aircraft.____________ (True/False)

4. Pulling ____________ emergency open handle(s) will open ____________ canopy(s) in 1-4 seconds, will open ____________ ____________ less than when manually opened, and will be ____________ ____________.

5. When unlocked, the inertial reel allows the pilot ____________, but will provide ____________ in the event of a ___________ ____________ deceleration.

6. What is the power source for the clock in each cockpit?

ANSWERS TO STUDY QUESTIONS

1. No
2. Through a window on the right side of the fuselage aft of the wing
3. False
4. any, both, 2 inches, locked open
5. mobility, restraint, rapid linear
6. spring-wound

CHAPTER EIGHTEEN
FLIGHT CONTROL SYSTEMS

1800. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C flight control system to be capable of controlling your aircraft in flight. As wheels of an automobile control the direction of movement of that automobile, so do the surfaces of the aircraft control the aircraft's direction of movement through the air.

1801. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

18.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C flight controls system characteristics.

Enabling Objectives

18.1 Describe the primary flight control system.

18.2 Describe the location, purpose, and method of control for each of the flight control surfaces.

18.3 State the location and purpose of the rudder pedals and control stick.

18.4 Describe the location, purpose, and method of operation of the flight control lock.

18.5 Identify the secondary flight controls.

18.6 State the purpose of and describe the trim tabs.

18.7 Describe the trim tab control quadrant and its method of operation.

18.8 Describe the location and method of operation of the elevator trim tabs.

18.9 Describe the location and method of operation of the rudder trim tabs.

18.10 Describe the location and method of operation of the aileron trim tabs.

18.11 State the purpose and characteristics of the wing flap system (auxiliary flight controls).

18.12 Describe the major components of the wing flap system.

18.13 State the location and method of operation of the flap lever.

18.14 State the location and purpose of the strakes and ventral fins.

1802. FLIGHT CONTROL SYSTEMS

The primary flight controls (rudder, elevators, and ailerons) provide the pilots a means of controlling the aircraft from either cockpit by a conventional stick and rudder system. All control surfaces are connected to the cockpit controls by cable/push-pull rods. There are no power-boosted controls. Trim tabs on all control surfaces (except the right aileron) are mechanically adjusted from either cockpit. Rudder pedals (which incorporate toe-actuated brakes) are suspended from the rudder pedal arms and are adjustable forward and aft.

The rudder is hinged to the aft edge of the vertical stabilizer, is controlled by the rudder pedals, and causes the aircraft to yaw around the vertical axis. The elevators are attached to the aft edge of the horizontal stabilizer, are controlled by the control stick and cause pitch by movements around the lateral axis. The elevator control horn has bobweights and springs, which provide stability and a positive feel (feedback) to the stick. The ailerons, located at the aft edge, outboard portion of each wing, are controlled by the control stick and cause roll around the longitudinal axis.

Pilot-Operated Controls

Movement of the rudder pedals results in nose movement (yaw) left or right, i.e., left pedal forward results in nose left movement (yaw). The rudder pedals are interconnected and move in opposition. The control stick is pivoted at the lower end on the cockpit floor and can be displaced any direction from vertical neutral. Movement left/right causes the aircraft to roll left/right and forward/back stick pressure causes nose down/up pitch.

Rudder Pedal Adjustment

The position of the pedals is adjustable to compensate for pilot height difference. A hand crank at the bottom of the instrument panel will adjust the pedals fore and aft without affecting the setting of the rudder.

Control Lock

The control lock, located in the front cockpit, is used to secure the control surfaces. It is a rectangular brace pivoted at two points forward and held against the floor by a spring-loaded latch assembly. To engage the lock, release the deck latch, center the stick and adjust the pedals slightly aft of full forward. Place the control lock on the hook on the forward side of the stick, and adjust the pedals forward. With the lock engaged, the rudder should be aligned with the vertical stabilizer, the elevators full down, and the ailerons neutral (both 2º down). To unlock, reverse the procedure.

1803. SECONDARY FLIGHT CONTROLS

Secondary flight controls consist of trim tabs, strakes, and ventral fins. They affect flight characteristics and may or may not be adjusted by the pilot.

Trim Tabs

Trim tabs allow the pilot to correct an unbalanced flight condition without exerting continuous pressure on the primary controls. They are small moveable tabs on the trailing edge of each primary control surface.

Trim Controls

Trim tab controls are located at the forward end of the left console in both cockpits. Position of the rudder trim knob, elevator control wheel and aileron control wheel present a logical display for use. Rotation of trim knob or wheels will effect movement of the trim tab through chain and cables and push-pull tubes and will move controls in both cockpits simultaneously. The rudder trim tab knob incorporates a numbered circular scale representing degrees of deflection. Elevator and aileron trim tab wheels utilize an adjacent plastic window indicating degrees of deflection.

Elevator Trim Tabs

Elevator trim tabs are designed to impart a clockwise rotation to the fuselage to offset torque effect or "left-turning tendency." On preflight with elevator trim set at "0" the right tab will be 4½º up and the left tab will be 4½º down. As the trim control is moved in the cockpit, the trim tabs will move up or down accordingly, but will remain with a 9° split between the two tabs. With movement of the control stick and elevator, the elevator tabs will remain in their adjusted position in relation to the elevator.

Rudder Trim Tab

When the rudder trim tab knob is set "0," the tab is aligned with the rudder. Rotating the trim tab knob deflects the trim tab and the rudder is deflected in the desired direction. Moving the rudders with the pedals causes the tab to move in the same direction, thereby creating artificial feedback or feel. This is referred to as antiservo action.

Aileron Trim Tabs

When the aileron trim tab wheel is set at "0," the left trim tab is aligned with the trailing edge of the left aileron. The right tab is set by the manufacturer or maintenance action, and is not adjustable. Both ailerons move due to mechanical connection. When moving the ailerons with the control stick each trim tab moves in the opposite direction (lag) of its aileron, acting as a lever to assist the aileron movement. This is referred to as servo action.

Strakes and Ventral Fins

The strakes are an extension of the horizontal stabilizer forward alongside the empennage. The ventral fins form a "V" beneath the empennage. The strakes and ventral fins limit the aircraft's spin turn rate.

1804. AUXILIARY FLIGHT CONTROLS

Wing flaps are high-lift devices used to increase lift during low speed flight. The T-34C utilizes slot type flaps which are attached to the trailing edge of the wing near the root. The flaps are operable from either cockpit and a flap position indicator labeled in percent is located on the left side on each instrument panel. The flaps will extend or retract electrically in approximately 10 seconds. A 28-volt DC flap motor is controlled by a three-position airfoil-shaped lever located on the left sidewall in both cockpits. Limit switches in the left wing cut power to the motor when the flaps are fully extended or fully retracted. Raising the lever to UP retracts the flaps, depressing the lever to DN extends them, and placing the lever in the center OFF position will stop flap travel at an intermediate position. (OFF is not normally used.) No emergency system is provided for flap operation in the event of a complete electrical failure.

The flap indicator located on the left side of the instrument panel will indicate the flaps' position as a percent of full flaps (30°). Full up = 0% and full down = 100%. Flap indication is taken from the left flap.

STUDY QUESTIONS

1. With the flight control lock engaged, the rudder is ____________ with the vertical stabilizer, the elevators are ____________ ____________, and both ailerons are neutral (________º ____________).

2. The flaps have an emergency electrical backup system. ____________(True/False)

3. The trim tabs allow the pilot to correct an unbalanced ____________ condition without exerting a continuous pressure on the ____________ controls.

4. The rudder trim tab provides ____________ ____________ action, while the aileron trim tabs provide ____________ action.

5. Which aileron trim tab can be adjusted by the pilot? ____________

6. The elevator trim tabs always have a 9° split. ____________(True/False)

ANSWERS TO STUDY ANSWERS

1. aligned, full down, (2º, down)

2. False

3. flight, primary

4. antiservo, servo

5. left

6. True

CHAPTER NINETEEN
LANDING GEAR SYSTEM

1900. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C landing gear system. You must also become familiar with the location and operation of various components of the landing gear system. Thorough knowledge of electrical and manual operation of the landing gear system is essential to conducting safe ground and flight operations.

1901. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

19.0 Upon completion of this chapter, the student will demonstrate a knowledge of the T-34C landing gear system characteristics.

Enabling Objectives

19.1 Describe the landing gear system and its operation.

19.2 Explain the location, purpose, and servicing requirements of the landing gear shock struts.

19.3 State the location and purpose of the scissors assembly.

19.4 State the location and purpose of the nose gear centering pin.

19.5 State the location and purpose of the shimmy dampener.

19.6 Describe the location, purpose, and physical features of the landing gear control handle.

19.7 Describe the location, purpose, and physical features of the landing gear motor.

19.8 State the location and purpose of the landing gear gearbox.

19.9 Describe the characteristics of the retract/push-pull rods, "V" braces and drag/side braces.

19.10 State the location and purpose of the landing gear doors.

19.11 Describe the operation of the inboard main landing gear doors.

19.12 Explain the purpose and method of operation of the landing gear downlocks.

19.13 State the purpose and describe the landing gear uplocks.

19.14 Explain the purpose and components of the landing gear warning system.
19.15 Explain the conditions that energize the warning system.

19.16 Describe the method of silencing the warning horn.

19.17 Explain the purpose of the landing gear safety switches.

19.18 State the location and purpose of the landing gear position indicators.

19.19 State the location and purpose of the external down indicators.

19.20 State the number, method of operation, and function of the landing gear position switches.

19.21 State the location and purpose of the inboard landing gear door warning system.

19.22 Describe the components and operation of the landing gear emergency extension system.

1902. LANDING GEAR SYSTEM

The landing gear system (Figure 19-1) is an electrically operated, fully retractable, tricycle type landing gear. The main gear retracts inboard into the wings and the nose gear retracts aft into the fuselage. The landing gear system is actuated by a single reversible DC motor and gearbox mechanism which is located under the front cockpit. Due to the high speed (10,500 RPM) of the motor, the gear will extend and retract in four seconds.

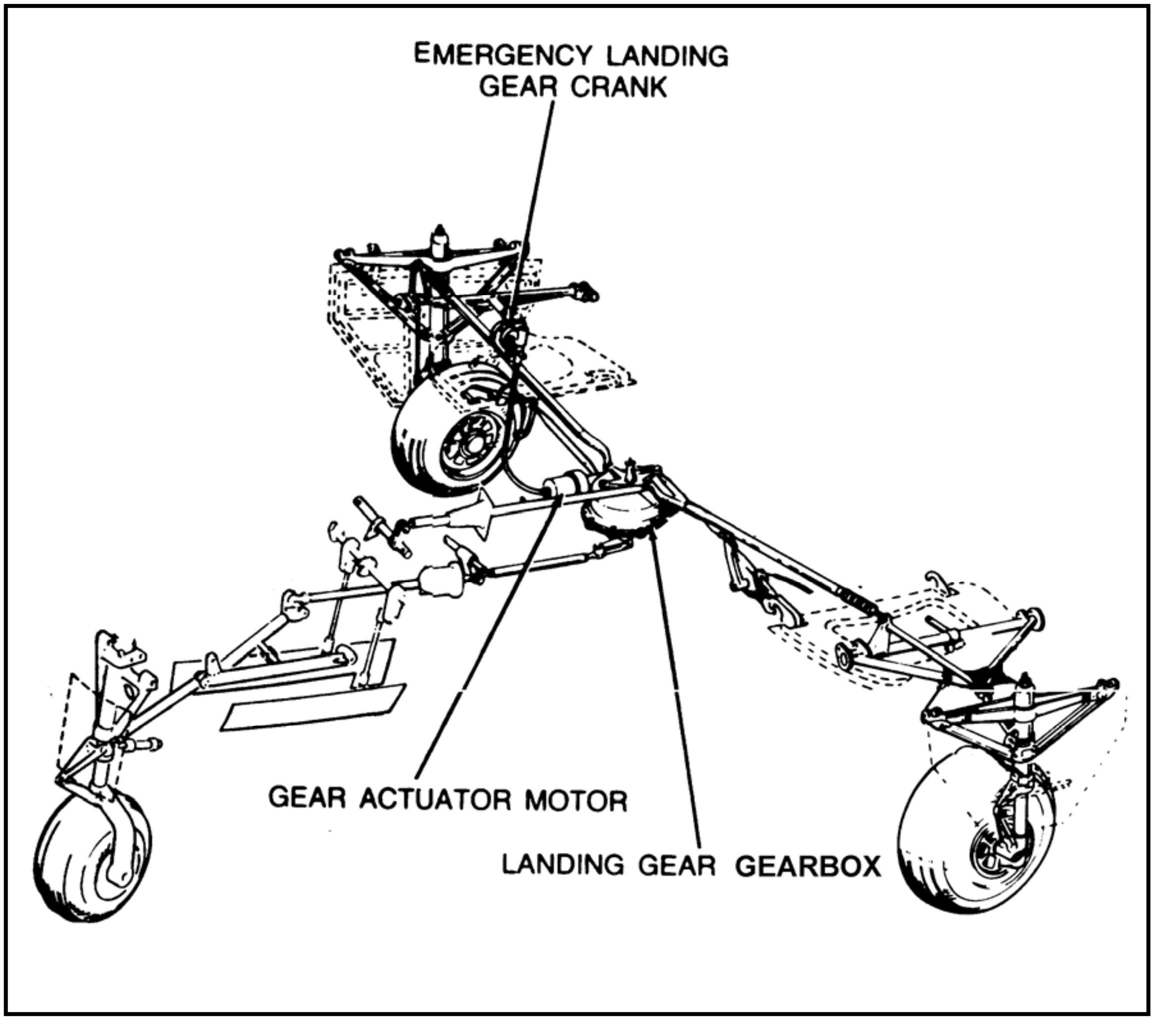


Figure 19-1 Landing Gear System

System Operation

When the landing gear handle is moved to the UP or DOWN position, motion of the gear is achieved by action of the DC motor and gearbox mechanism through a push-pull rod to each main gear V-brace and the nose gear V-brace. The V-braces further connect to a side brace on the main gear and a drag brace on the nose gear which then further connects to each landing gear shock strut. The gearbox, providing mechanical advantage to the DC motor, transmits motion to the linkage mechanism moving the gear to the extended or retracted position.

Limit Switches

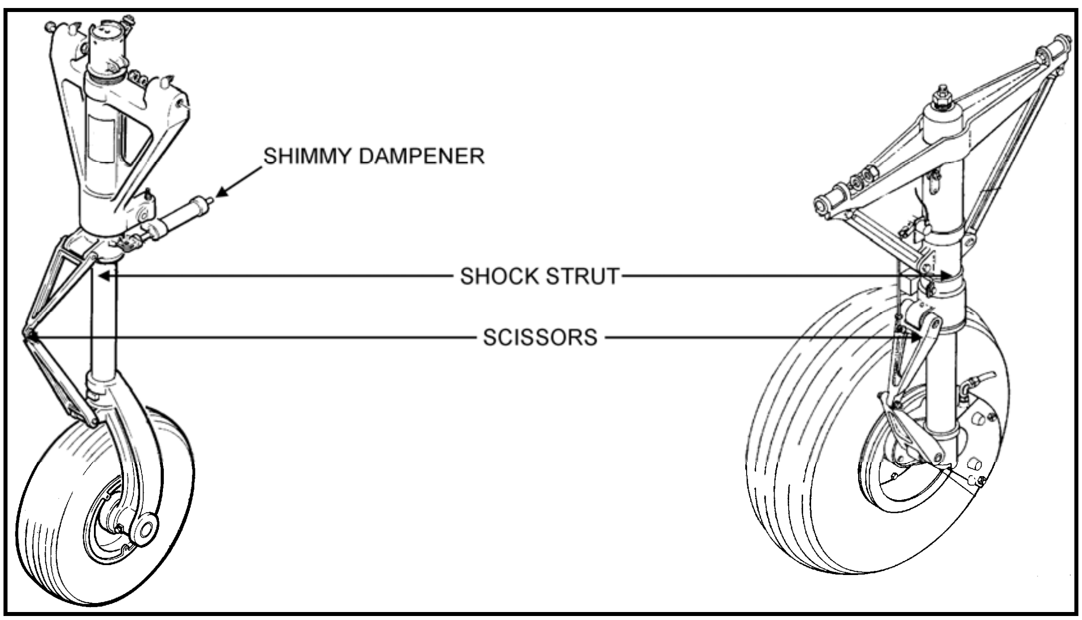
The landing gear limit switches are dual-function, micro type switches mounted on the landing gear gearbox located under the floor in the front cockpit. The switches are referred to as up-limit or down-limit switches, depending on their function. When the landing gear are up and the inboard gear doors are closed the up-limit switch cuts power to the electric gear motor. When the gear is down and the inboard gear doors are closed the down-limit switch cuts power to the landing gear motor.

Landing Gear Shock Struts

The landing gear shock struts are the hydraulic/pneumatic type using hydraulic fluid and nitrogen gas to cushion landing shocks. The main gear shock struts (Figure 19-2) should have 3 inches (approximately four fingers) of oleo showing, and the nose gear shock strut (Figure 19-2) should show 3-5 inches of oleo. These items should be checked on preflight with full fuel cells.

Scissors

Scissors extend forward and connect the inner barrel to the outer barrel on the main and nose gear struts. The main landing gear shock strut scissors keep the main wheels aligned with the aircraft's longitudinal axis (fore and aft). On the nose gear, the shock strut scissor connects to a collar that allows the nose strut to pivot when taxiing.



Nose Landing Gear Main Landing Gear

Figure 19-2 Landing Gear

Nose Gear Centering Pin

The nose gear centering pin, located on the right side of the nose landing gear shock strut returns the nose wheel to the center position as it is retracted, allowing the wheel to fit into the wheel well. It also keeps the nose wheel centered when the shock strut is extended and the aircraft is airborne to allow for a smoother touchdown upon landing. The centering pin only works when there is no weight on the nose wheel and the strut is extended.

Shimmy Dampener

The shimmy dampener (Figure 19-2) is a small shock absorber located on the left side of the nose landing gear shock strut that dampens out nose wheel vibrations during takeoff or landing.

Main and Nose Gear Fairing Doors

The main and nose gear fairing doors, which coincide with the gear movement, finalize the covering of the gear wheel wells when retracted to provide a smooth aerodynamic surface. When the gear is lowered actuating rods from the landing gear gearbox open the main gear inboard doors, the main gear extends into place, and the actuating rods close the doors. When the gear is raised, the reverse occurs. The main gear fairing doors attached to the strut move up and down with the strut. The nose gear fairing doors consist of a panel attached to the nose gear strut, and doors on the left and right side of the wheel well. These doors are closed by the movement of the nose strut itself, and opened by the opposing spring action of a torque tube as the strut begins to exit the wheel well.

Downlocks

Downlocks are located on both the nose and main landing gears to lock the landing gear in the extended position and prevent unintended retraction of the gear when the aircraft is on the ground. The nose gear is held down by mechanical advantage (locking action of gears in gearbox), and an over center pivot (joining of bottom of V-brace and top of side/drag brace). The main gear are held down by mechanical advantage, overcenter pivot, and positive downlocks. When the main gear is down, the lock is held in position by a cable attached to the main gear inboard door. When retracted, the positive downlock is removed by opposing spring action. A mechanical downlock is not needed on the nose gear, since it does not experience the large lateral forces sensed by the main gear on landing.

Uplocks

Uplocks are used to prevent unintended movement of the landing gear out of the wheel well (landing gear "sag" or "creep"). The nose and main gear are held in the retracted position by mechanical advantage and a positive uplock. On the main gear the positive uplock is held in position by a cable attached to the main landing gear inboard door and removed by opposing spring action. On the nose gear the uplock consists of an uplock receptacle (hole in an aft facing metal tab) at the bottom of the shock strut and a torque tube operated by the landing gear gearbox. When the gear retracts, the torque tube rotates a latch (hook) into the uplock receptacle, locking the nose gear in the up position. Initial movement of the gearbox when extending the gear removes the latch and allows the nose gear to move downward.

Landing Gear Handle

The landing gear handle (Figure 19-3), located on the left subpanel in each cockpit, is made of clear plastic formed in the shape of a wheel with a red warning light inside. The red warning light illuminates the entire handle any time the landing gear position does not agree with the position of the handle or an inboard main landing gear door is not securely latched. Moving the handle UP or DOWN activates a switch, which controls the reversible DC electric motor that retracts or lowers the landing gear. A one-second time delay is provided in the landing gear circuit to protect the actuating system from damage in the event of a reversal caused by moving the landing gear handle in the opposite direction while the gear is in transit.

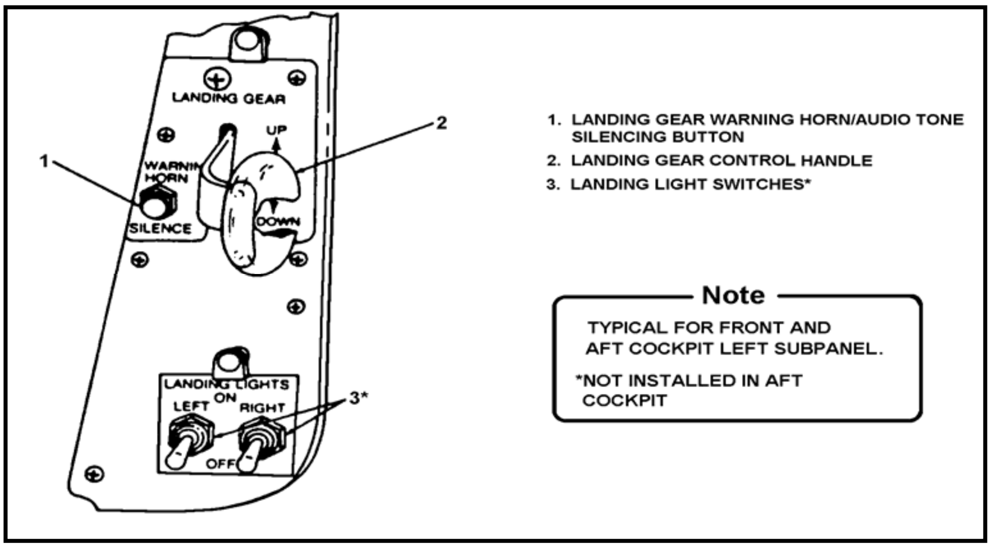


Figure 19-3 Landing Gear Handle

CAUTION

The pilot shall not move the landing gear handle in the opposite direction when the landing gear are in transit.

Safety Switches

A rotary type safety switch (Figure 19-2) is attached to each shock strut of the three landing gear. The switch located on the right main strut prevents the gear from accidentally being raised while the aircraft is on the ground. This switch, actuated by the weight of the aircraft compressing the strut, renders the gear up control circuit and the AOA indexer inoperative. The safety switch connected to the left main strut activates the audio gear warning system and illuminates the WHEELS light and the red light in the gear handle if the landing gear handle is moved to the UP position while on the ground. Additionally, the left safety switch disables the NACWS test when airborne. The safety switch on the nose strut enables the rudder shakers in flight and the beta release while on the ground.

Position Indicator Switches

Position indicator switches are micro type switches located in the wheel wells. These switches activate the gear position indicators in each cockpit and the external down position indicator lights. The left main landing gear UP position switch activates the air conditioner condenser blower any time the gear is not up and the air conditioner is operating. The nose landing gear UP position switch activates the landing light fault light and the master caution light when the gear is up and the landing lights are on.

1903. LANDING GEAR WARNING SYSTEM

The landing gear warning system consists of a horn behind the front seat, a 1000-Hz audio tone in the ICS, a steady red light in the landing gear handle and a flashing red landing gear WHEELS warning light on the instrument panel. This system is designed to alert the pilot of an unsafe condition and will be activated if any of the following conditions exist:

CONDITION	GEAR HANDLE LIGHT (steady)	WHEELS WARNING LIGHT (flashes)	WARNING HORN & AUDIO TONE
GEAR UP, FLAPS EXTENDED (any %)		✓	✓
GEAR UP, PCL BELOW 75% N_1 SET POINT *	✓	✓	✓ (S)
GEAR UP, PCL & EPL ABOVE 75% N_1 SET POINT	✓	✓	✓ (S)
GEAR HANDLE UP, AIRCRAFT ON GROUND	✓	✓	✓
HANDLE AND LANDING GEAR DO NOT AGREE	✓		

*Assumes normal operations, EPL disconnected

The warning horn and audio tone may be silenced, but only under certain power-off conditions--noted by "(S)" in the chart. When allowed, silencing is accomplished by depressing the button (Figure 19-3) labeled WARNING HORN SILENCE, adjacent to the landing gear handle. This does not affect the warning lights.

Position Indicator

The position of the landing gear is shown by three individual indicators, one for each gear, located on the instrument panel in both cockpits, lower left side, just to the right of the gear handle. Each indicator can display any one of following three conditions.

1. Cross-hatching (barber pole) related gear is in any unlocked position (gear in transit, not down and locked or not up and locked) or the electrical system is not energized.

2. The word UP displayed - related gear is up and locked.

3. A wheel symbol displayed - related gear is down and locked.

White lights installed just forward of each main gear wheel well and to the left of the nose gear wheel act as external gear down indicators and aid in determining gear position from outside the aircraft. They are activated by the DOWN position switch in each wheel well and illuminate only when the related gear is down and locked. As soon as the landing gear is retracted, the position switch opens a circuit and extinguishes the light.

Inboard Landing Gear Door Position Annunciator Lights

Inboard landing gear door position annunciator lights are located between the MASTER CAUTION light and the WHEELS warning light on the top left of the instrument panel in both cockpits. The system is designed to illuminate when the inboard landing gear doors are not in the closed position when the landing gear have completed their extension or retraction cycle.

Landing Gear Emergency Extension System

The landing gear can be manually lowered, if necessary, with the emergency landing gear crank (Figure 19-4) located on the right sidewall in the front cockpit. The crank, when engaged, drives the normal gear actuation system mechanically through a flexible shaft.

CAUTION

> The landing gear emergency extension system is designed and stressed only for extension and must NEVER be used to retract the gear.

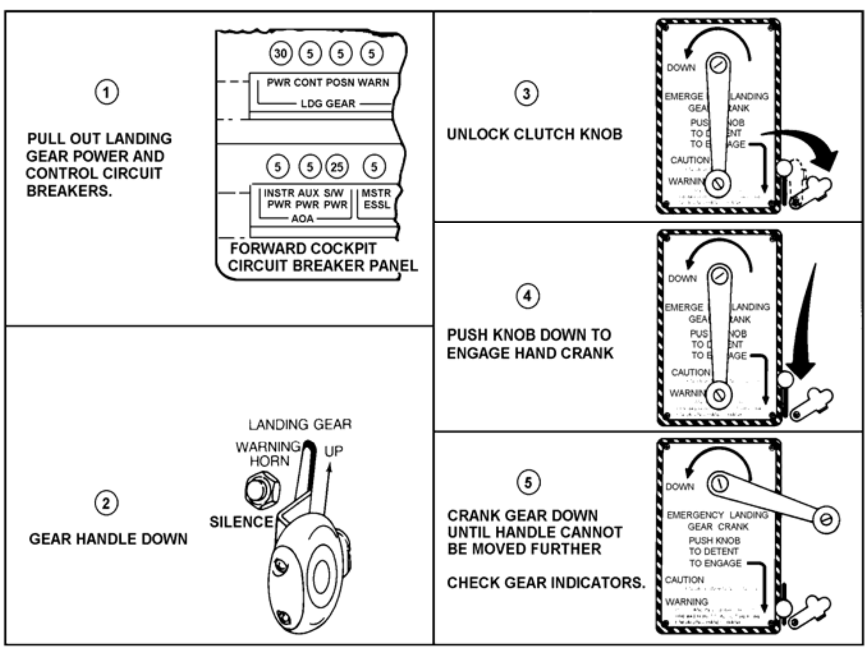


Figure 19-4 Emergency Landing Gear Extension

STUDY QUESTIONS

1. The landing gear is actuated by a ____________-speed reversible ____________ VDC motor.

2. The landing gear strut contains ____________ gas.

3. State the purpose of the shimmy dampener.

4. Each landing gear incorporates a rotary type safety switch that is activated when the strut is compressed or extended.

   a. When the aircraft is on deck the ____________ gear safety switch disables the gear up control circuit and the AOA indexer.

   b. The ____________ safety switch completes a circuit to a warning horn and to the flashing warning light.

   c. The ____________ safety switch disables the rudder shakers and prevents accidental selection of beta (reverse).

5. The pilot may move the landing gear handle in the opposite direction when the landing gear is in transit. ____________ (True/False)

6. The pilot may not retract the landing gear with the emergency extension system.____________ (True/False)

7. The main landing gear scissors keeps the main landing gear ____________ fore and aft.

ANSWERS TO STUDY QUESTIONS

1. single, 28
2. nitrogen
3. It dampens out nose wheel vibrations during takeoff or landing.
4. a. right

   b. left

   c. nose
5. False
6. True
7. aligned

CHAPTER TWENTY

COCKPIT HEATING, VENTILATING, AND WINDSHIELD DEFOGGING SYSTEMS

2000. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C cockpit heating, ventilating, and windshield defogging system. You must also become familiar with the location, and operation of various controls and components of the system in order to maintain a safe and comfortable environment inside the cockpit.

2001. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

20.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C cockpit heating, ventilating and windshield defogging system characteristics.

Enabling Objectives

20.1 State the purpose of the cockpit heating and ventilating systems.

20.2 Recall the sources of air for cockpit heating and ventilation.

20.3 Describe the location and purpose of the cockpit environmental control lever.

20.4 State the changes in cockpit environment that occur by varying the position of the environmental control lever.

20.5 Describe the location and purpose of the heating and ventilating system components.

20.6 Describe the results obtained in the heating and ventilating system by varying the position of the environmental control lever.

20.7 State the location and purpose of the air duct overtemperature warning system.

20.8 Describe the location, purpose, and method of operation of the aft cockpit ventilation system.

20.9 Describe the location, purpose, and method of operation of the windshield defog system.

2002. COCKPIT HEATING, VENTILATING AND DEFOGGING SYSTEMS

Cockpit heating, ventilating, and windshield defogging is provided through the cockpit environmental control system. The system provides heated and fresh outside (ambient) air for the comfort of both pilots.

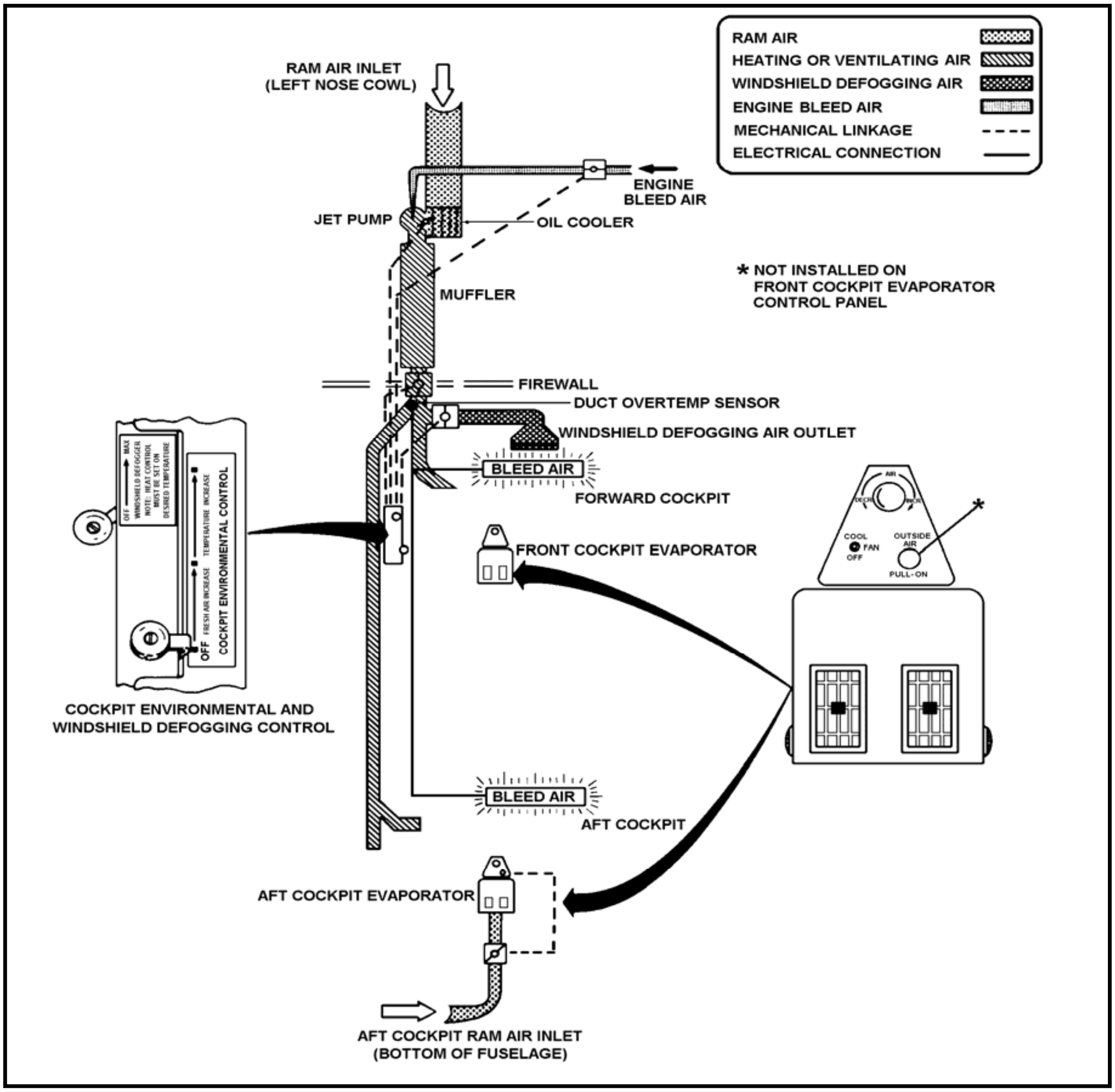


Figure 20-1 Heating/Ventilating/Defogging System

Air Sources

Bleed air drawn from the diffuser of the engine provides heated air for the system. Fresh outside air enters the system from the accessory air inlet duct located on the left side of the nose cowling.

Cockpit Environmental Control Lever

The cockpit environmental control lever is located in the front cockpit only on the upper forward portion of the left sidewall. It provides the pilot in the front cockpit with control of fresh and heated air flow in both cockpits. The control consists of a slide assembly and three individual control cables which control the bleed air regulator, the butterfly valve in the jet pump assembly and the firewall gate valve. The cockpit environmental control has an OFF position and two ranges--FRESH AIR INCREASE and TEMPERATURE INCREASE. In the OFF position, no fresh outside or heated air enters the cockpit. As the control is moved forward into FRESH AIR INCREASE, fresh air flow from the cockpit outlets increases. Movement into the TEMPERATURE INCREASE range progressively increases the temperature of the air from the cockpit outlets.

System Components

The engine bleed air regulator is located on the left side of the engine compartment. It provides volume control of engine (diffuser) bleed air flow. A corrugated metal tube carries bleed air from the bleed air tap-off on the engine to the top of the regulator. Bleed air departs the regulator and flows to the jet pump assembly located within the air duct on the left side of the engine compartment. The jet pump mixes bleed air with outside air. In the FRESH AIR INCREASE range, outside air only flows through the jet pump. In the TEMPERATURE INCREASE range, outside air mixes with bleed air which enters the jet pump through the sonic nozzle. Outside air enters the jet pump through the butterfly (outside fresh air) valve. The butterfly valve gives control of outside air only when the cockpit environmental control lever is in the TEMPERATURE INCREASE range. A firewall gate valve located on the left side of the firewall controls air flow from the jet pump and initially opens when the cockpit environmental control lever is moved forward out of the OFF position.

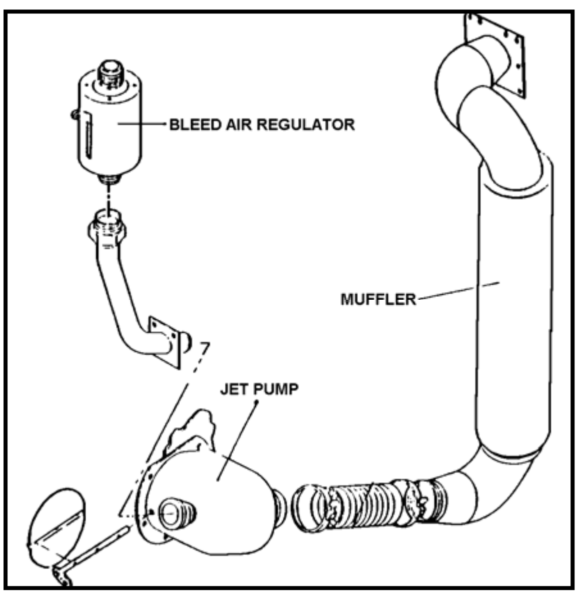


Figure 20-2 System Components

System Component Function

The function of each system component in each of the three control lever positions is illustrated in the table below.

Control Lever Position	Firewall Gate Valve	Butterfly Valve	Bleed Air Regulator
OFF	Closed	Full open	Closed
FRESH AIR INCREASE	Progressively opens	Full open	Closed
TEMPERATURE INCREASE	Full open	*Progressively closes	*Progressively opens

*With the cockpit environmental control lever in the full forward position in the TEMPERATURE INCREASE range, the butterfly valve is fully closed and the bleed air regulator is full open. The cockpit will be receiving only bleed air with no outside air mixed.

Overtemperature Warning System

An overtemperature sensor located in the air duct aft of the firewall provides a warning of overtemperature in the duct area. If the air duct temperature reaches 250° F, an electrical signal from the sensor will cause the MASTER CAUTION and BLEED AIR annunciator fault light in each cockpit to illuminate. Placing the environmental control lever in FRESH AIR INCREASE should extinguish the lights.

Aft Cockpit Ventilation

In addition to the ventilation provided by the cockpit environmental control system, the aft cockpit can receive additional outside fresh air via a ram air inlet on the underside of the fuselage (beneath the front cockpit) which directs ram air to the air outlets on the center console in the aft cockpit. Control of the system is provided through a push-pull knob on the aft cockpit center console labeled OUTSIDE AIR, PULL ON. With the knob pushed in, no air flows from the air outlets. Pulling the knob to ON opens a valve and air flows from the air outlets. Air flow and direction is controlled by the louvers on the air outlets. The center console also houses the evaporator for the air conditioning system. If the air conditioning system is on, the outside air entering this system is also cooled.

Windshield Defogging System

A WINDSHIELD DEFOGGER control lever located above the cockpit environmental control lever provides the pilot in the front cockpit with control of air flow to remove condensation from the inside surface of the windshield. The lever controls the defogger valve located aft of the firewall in the cockpit air ducting. In the OFF position the valve is closed and no air flows. Forward movement of the lever progressively toward MAX opens the valve to permit increasing air flow to the windshield. The most effective windshield defogging is achieved with the defogger control at MAX and the cockpit environmental control in the TEMPERATURE INCREASE range.

STUDY QUESTIONS

1. Write the sources of air for cockpit heating and ventilating.

2. Write the location and purpose of the cockpit environmental control lever.

3. In the blank provided in column "A" write the letter of the true statement from column "B" for each environmental control lever position.

	A			B
a.	_______	off	1.	Temperature of heated air increases progressively
b.	_______	fresh air increase	2.	No fresh or heated air
c.	_______	temperature increase	3.	Fresh outside air

4. Circle the letter of the true statement(s) about the bleed air regulator.

   a. Located on the left side of the engine compartment.

   b. Provides volume control of engine (diffuser) bleed air flow.

   c. Controls fresh air to both cockpits.

5. Write the location and purpose of the jet pump.

6. Ram air from a scoop under the fuselage may be directed into which cockpit?

7. From the given list, select the most effective cockpit environmental control lever/defog lever positions for windshield defogging.

   a. Off/On

   b. Ambient air/On

   c. Temperature increase/Max

ANSWERS TO STUDY QUESTIONS

1. Bleed air from the diffuser; fresh air from the accessory air inlet duct on the left side of the nose cowling

2. It is located on the upper forward position of the left sidewall in the front cockpit; it provides the pilot control of fresh and heated air flow in both cockpits.

3. a. 2

   b. 3

   c. 1

4. a. and b.

5. It is located within the air duct on the left side of the engine compartment. It mixes bleed air with outside air.

6. aft cockpit

7. c.

CHAPTER TWENTY-ONE
AIR CONDITIONING SYSTEM

2100. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C air conditioning system. You must also become familiar with the location and function of the pilot operated controls in order to adjust and maintain a comfortable cockpit temperature. Excessively high cockpit temperatures can lead to pilot dehydration.

2101. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

21.0 Upon completion of this chapter, the student will demonstrate a knowledge of the T-34C air conditioning system characteristics.

Enabling Objectives

21.1 State the purpose of the T-34C air conditioning system.

21.2 Describe the principles of operation of the air conditioning system.

21.3 Describe the location, purpose, and method of operation of the air conditioning system compressor and condenser.

21.4 Recall the sources of condenser cooling air.

21.5 Describe the location, purpose, and method of operation of the evaporator.

21.6 Describe the location and purpose of the pilot-operated controls.

21.7 State the location, purpose, and function of the system protective switches.

2102. AIR CONDITIONING SYSTEM

The T-34C air conditioning system provides a circulation of either refrigerated air or cockpit ambient air for the comfort of both pilots. Conditioned air flows from the center console air outlets.

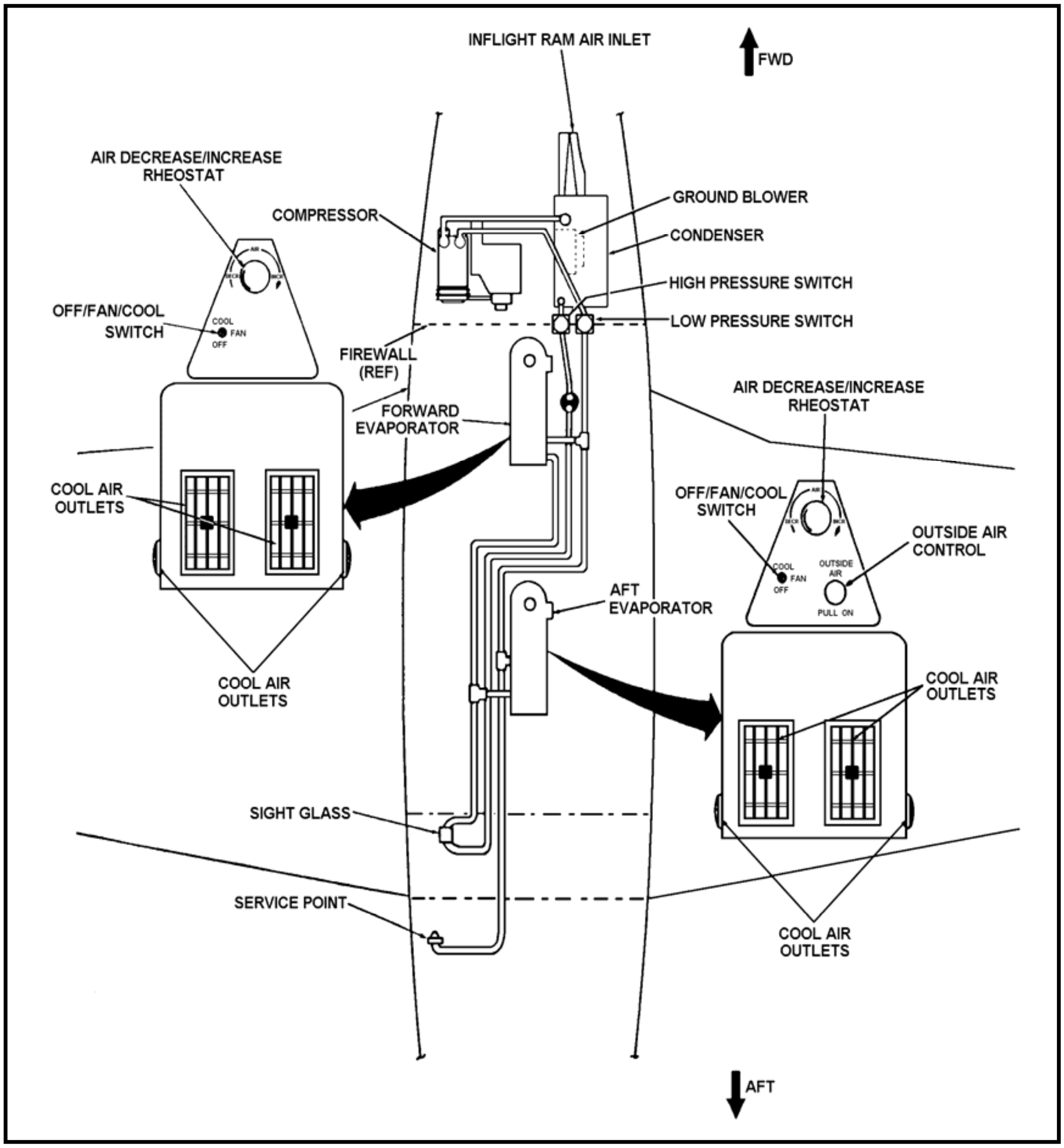


Figure 21-1 Air Conditioning System

The system operates on the vapor cycle principle in which a heat absorption agent, FR-22 refrigerant, is circulated through the system. FR-22 has a lubricating oil that provides lubrication for the bearings and pistons within the compressor.

Compressor

The compressor is a pump that circulates the refrigerant through the system. It is located on the engine accessory section, left side, and is driven by a belt from the accessory gearbox. A 28 VDC electrically operated clutch allows the pilot to operate the system by engaging or disengaging the clutch and provides automatic disengagement in the event of system overpressure or underpressure.

Condenser

A condenser located on the right side of the engine compartment is a heat-exchanging device used to remove heat from the refrigerant and condense it to a cold liquid. It operates as a radiator. The refrigerant is received from the compressor and enters the condenser as a high pressure vapor. Outside air flows through the condenser and removes the heat. The air comes from two sources; the V-shaped in-flight ram air inlet on the lower right side of the engine cowling, and a condenser blower inlet located on the right side of the nose landing gear wheel well. With the gear up, the ram air inlet supplies all required cooling air. With the gear down, the nose landing gear disrupts airflow into the inlet, resulting in insufficient airflow to the condenser. To compensate for this air loss, a condenser blower draws air through the screened condenser blower inlet in the nose landing gear wheel well and blows it through the condenser. The condenser blower is fan-driven by a 28 VDC motor, and is operated automatically through the left main gear uplock position switch. The switch closes as the left gear leaves the wheel well. Air from either source exits the engine compartment through louvers on the cowling.

Evaporators

The cold, liquid refrigerant flows from the condenser to the evaporators. The evaporators are located in the center console of each cockpit and operate in parallel to remove heat from the cockpit air. When the system is in operation, the refrigerant flows through each evaporator by the force of the compressor. Cockpit air flows over the coils by the force of a fan located within the center console. A drain in the bottom of each console carries away condensation via individual lines through the bottom of the fuselage.

System Operation

Control of the air conditioning system is provided by a toggle switch and a rheostat located on each center console. The toggle switch is labeled OFF/FAN/COOL and allows the pilot control of the fan in the respective cockpit, and the clutch on the compressor. In the OFF position, the console fan is inoperative and the compressor is disengaged. Selecting the FAN position turns the respective console fan on while the compressor remains disengaged. In the COOL position the fan continues to run and the compressor clutch engages. Selecting the COOL position in either cockpit will engage the compressor clutch. After a 7 to 15 second delay, refrigerated air will be delivered to each cockpit through the evaporator unit. With the landing gear extended the COOL position also activates the condenser blower. The AIR rheostat (console fan speed rheostat) controls the speed of the fan motor in the respective cockpit from minimum to maximum speed.

The air exiting the evaporator enters the cockpits through air outlets on the front and sides of the console. A louver assembly on the front of the console enables the pilot to adjust the direction and volume of the air. Outlets on the side of the console are not adjustable. Temperature in each cockpit can be maintained through adjustment of the console air outlets, controlling the fan speed with the AIR rheostat, or turning the toggle switch to OFF.

Protective Devices

Protection for the air conditioning system is provided through two pressure-sensing devices. A high-pressure (380 PSI) switch located in the engine compartment on the right side of the firewall senses the pressure of the refrigerant as it leaves the condenser. Should the pressure reach 380 PSI, a circuit breaker within the switch opens the electrical circuit and interrupts DC power to the compressor clutch, thereby protecting all system components from overpressure damage. The low pressure (3 PSI) switch is located in the engine compartment on the right side of the firewall immediately to the left of the high-pressure switch. This switch is sensitive to the refrigerant pressure entering the compressor. Should there be a loss of refrigerant (and its lubricating oil) and the pressure reaches 3 PSI, a fuse is blown, interrupting electrical power to the clutch and the clutch disengages. The compressor bearings and pistons are protected from damage due to loss of lubrication. The circuit breaker cannot be reset and the fuse cannot be replaced in flight.

STUDY QUESTIONS

1. Select the correct statement(s) describing the operating principles of the air conditioning system.

   a. Uses engine bleed air to drive the turbine.

   b. Operates on the vapor cycle principle.

   c. Refrigerant absorbs heat from the cockpit air.

   d. Operates on turbine cold air.

2. Select the correct statements concerning the location and purpose of the air conditioning compressor.

   a. Located on the left side of the engine accessory section.

   b. Circulates refrigerant through the system.

   c. Located on the right side of the engine accessory section.

   d. Removes heat from the cockpit air.

3. Complete the following statement:

The condenser is located on the ____________ side of the engine compartment and it ____________ heat from the refrigerant and____________ it back to a liquid.

4. Complete the following statement:

Cooling air to the condenser is routed from two sources: (1) a "V"-shaped opening on the ____________ side of the nose, and (2) through the ____________ ____________.

5. Match the list of air condition controls with the true statement(s) concerning each.

CONTROLS			STATEMENTS
a.	______ ______	Toggle switch	1. Controls speed of console fan
b.	______ ______	Rheostat	2. On each center console
			3. On right-hand console
			4. Electrically engages compressor clutch

ANSWERS TO STUDY QUESTIONS

1. b., c.

2. a., b.

3. right, removes, condenses

4. lower right, condenser blower

5. a. 2., 4.

   b. 1., 2.

CHAPTER TWENTY-TWO

T-34C OXYGEN SYSTEM

2200. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C oxygen system. You must also become familiar with the location and operation of various components and controls. Knowledge of limitations and hazards is essential to conducting safe flight operations.

2201. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

22.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C oxygen system characteristics.

Enabling Objectives

22.1 State the purpose and general description of the oxygen system used in the T-34C aircraft.

22.2 Describe the location and purpose of the major components of the oxygen system.

22.3 Describe the location and purpose of the miscellaneous components of the oxygen system.

22.4 State the location, purpose, and method of operation of the oxygen control "T" handle.

22.5 Explain the location, purpose, and method of operation of the components of the cockpit regulator control panel.

22.6 Recall the safety precautions that must be observed when operating the oxygen system.

22.7 Describe the location, purpose, and method of operation of the high pressure relief valve.

22.8 State the precaution that must be observed to prevent regulator contamination.

2202. OXYGEN SYSTEM

The oxygen system provides both pilots with a regulated supply of breathing oxygen. Oxygen is received from a gaseous, diluter-demand supply system which mixes the proper ratio of oxygen and cockpit air for any altitude.

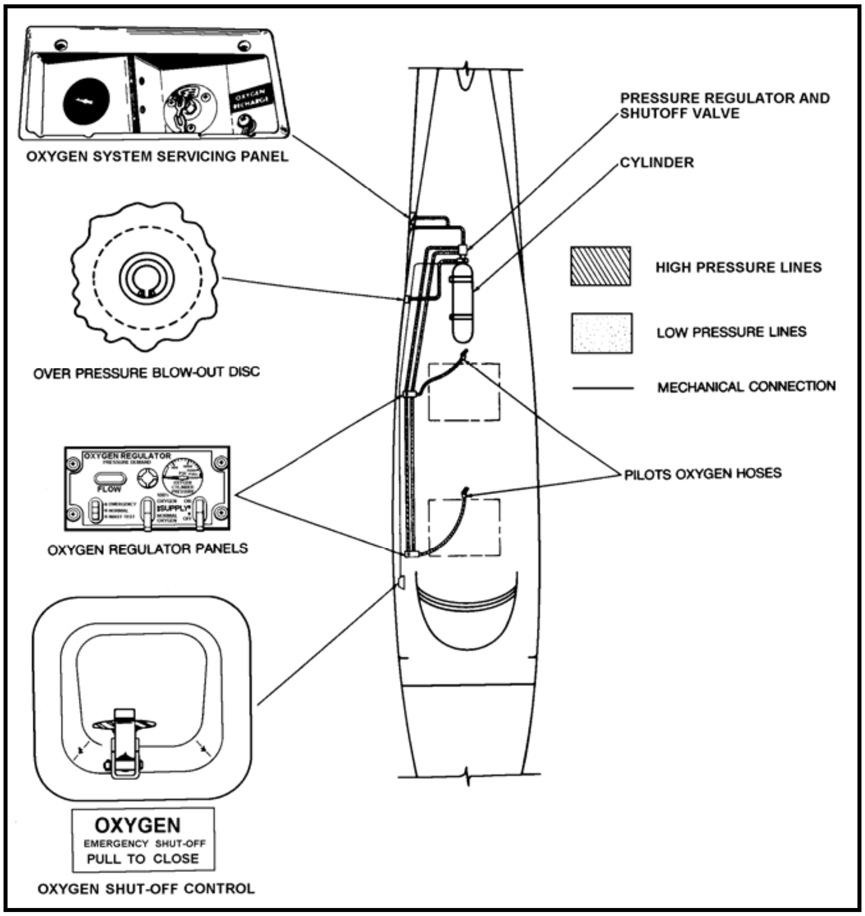


Figure 22-1 Oxygen System

Oxygen Supply Cylinder

An oxygen supply cylinder located beneath the deck of the aft cockpit serves as a storage tank for the oxygen. The cylinder has a capacity of 76 cubic feet and a maximum allowable charge of 1850 PSI.

Supply Cylinder Pressure Regulator

A supply cylinder pressure regulator is mounted on the neck of the oxygen supply cylinder. The pressure regulator reduces the cylinder pressure to 70 PSI and directs the low pressure oxygen through tubes to the individual cockpit regulators. In addition, the regulator provides ON/OFF control of the 70 PSI oxygen at the cylinder.

Diluter-Demand Oxygen Regulator

A diluter-demand oxygen regulator is located in the right-hand console of each cockpit. As it receives 70 PSI oxygen from the supply cylinder, it further reduces pressure and dilutes composition of the oxygen according to need.

Miscellaneous Components

An oxygen supply hose is located on the right side of each cockpit. It directs oxygen from the regulator to the pilot's oxygen mask. The oxygen mask then supplies oxygen flow to the pilot. A microphone is incorporated in the mask to enable communication while wearing the mask. A cord extending from the bottom of the mask connects into the phone jack cord located on the right side wall of each cockpit.

Oxygen Control "T" Handle

Oxygen cylinder supply is controlled by a yellow and black striped push-pull "T" handle located on the forward right side wall of the front cockpit only. The handle is placarded OXYGEN and provides on/off control of low pressure from the cylinder to the cockpit regulators. Pushing the handle in to the ON position opens the regulator, allowing oxygen to flow at 70 PSI to the cockpit regulator. When pulled to the OFF position, oxygen is shut off at the cylinder outlet and oxygen is not available to either cockpit regulator inlet.

Cockpit Regulator Control Panel

A cockpit regulator control panel is located on top of the diluter-demand regulator in each cockpit to provide each pilot with individually regulated control of the oxygen system. The panel features three control levers, a pressure gauge, and a flow indicator.

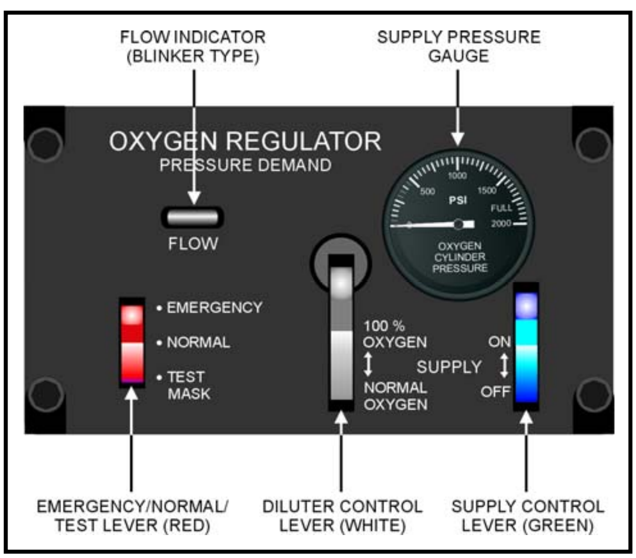


Figure 22-2 Oxygen Regulator Panel

The supply control lever is green and turns the regulator on and off. When aft in the OFF position, no oxygen enters the regulator; when forward in the ON position, low pressure (70 PSI) oxygen enters the cockpit regulator. The supply control lever should be "shear-wired" to the ON position (See Figure 2). The diluter control lever is white and labeled 100% OXYGEN and NORMAL OXYGEN. It selects 100% or diluted oxygen for delivery to the mask. When forward in the 100% OXYGEN position, the mask receives undiluted and unpressurized oxygen; when aft in the NORMAL OXYGEN position, the mask receives diluted and unpressurized oxygen. The emergency pressure control lever is red and labeled EMERGENCY, NORMAL, and TEST MASK. When forward in the EMERGENCY position, 100% oxygen is delivered to the mask under a safe positive pressure irrespective of the diluter control lever. In the aft TEST MASK position which must be held, 100% oxygen under positive pressure is delivered to the mask. In the center NORMAL position, the mask receives oxygen with a composition as selected by the diluter control lever.

A pressure gauge is located in the forward right corner of each control panel. Labeled OXYGEN CYLINDER PRESSURE, it indicates supply cylinder pressure. The scale reads 0 - 2,000 PSI in 100 PSI increments. Acceptable pressure for flight is 1000 - 1850 PSI.

A blinker type flow indicator is located in the forward left corner of the panel. It indicates oxygen is being released from the cockpit regulator to the mask. The blinker-vane will show either black or white: black when no oxygen is released and white when oxygen is released.

Safety Precautions

Aviators' breathing oxygen is 99.45% pure oxygen. Pure oxygen under pressure will ignite grease or oil spontaneously. Facial skin burn may result if oxygen and petroleum-based facial products come in contact. Also, do not smoke while oxygen is in use.

High Pressure Relief Valve

A high pressure relief valve is located at the cylinder outlet to protect the supply cylinder against damage caused by excessive pressure. At excessive pressure the relief valve opens and a plastic blowout disc located above the flap on the right side of the aircraft is blown out and all oxygen in the cylinder is dumped overboard. Absence of the disc provides a visual indication that the cylinder is empty.

Regulator Contamination

To prevent cockpit regulator contamination, the diluter control lever must be placed in the 100% OXYGEN position when the regulator is not in use.

STUDY QUESTIONS

1. Write the purpose of the oxygen system.

2. Select the correct statement(s) concerning the location, purpose and description of the oxygen supply cylinder.

    a. Located beneath the forward cockpit deck.

    b. Located beneath the aft cockpit deck.

    c. Storage tank for oxygen.

    d. 76 cubic foot cylinder with a maximum allowable pressure charge of 1850 PSI.

3. Write the location and purpose of the cockpit regulators.

4. Select the correct statements concerning the location and purpose of the oxygen control "T" handle.

    a. Located on the left side wall of the front cockpit.

    b. Provides on/off control of low pressure oxygen.

    c. Located on the right side wall of the front cockpit.

    d. Provides on/off control of high pressure oxygen.

5. Match the list of cockpit regulator control panel levers with the correct statements concerning the function of each.

LEVERS	STATEMENTS
a. ______ Supply lever	1. Selects 100% or diluted
b. ______ Emergency pressure control lever	2. On/Off control of oxygen
c. ______ Diluter control lever	3. Controls oxygen pressure to the mask

6. In the blank provided under indicators column, write the letter of the true statement(s) concerning oxygen system indicators.

INDICATORS	STATEMENTS
a. ______ ______ Pressure Gauge	1. Indicates supply cylinder pressure
b. ______ ______ Flow Indicator	2. Blinker type indicator
c. ______ Diluter Control Lever	3. Range 0 - 2000 PSI
	4. Oxygen released - white

7. Write the oxygen supply cylinder pressure range considered "acceptable for flight."

8. Write the precautions which must be taken to prevent contamination of the cockpit regulator control panel.

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ANSWERS TO STUDY QUESTIONS

1. It provides both pilots with a regulated supply of breathing oxygen.

2. b., c., d.

3. They are located in the right-hand console of each cockpit; they further reduce oxygen pressure and dilute composition of the oxygen according to need.

4. b., c.

5. a. 2.

   b. 3.

   c. 1.

6. a. 1., 3.

   b. 2., 4.

7. 1000 - 1850 PSI

8. The diluter control lever must be placed in the 100% oxygen position when the regulator is not in use.

CHAPTER TWENTY-THREE
WHEEL BRAKE SYSTEM

2300. INTRODUCTION

As student aviators, it is necessary for you to become familiar with the T-34C wheel brake system. You must also become familiar with the location and operation of various components in order to maneuver the aircraft safely and effectively on the ground.

2301. LESSON TOPIC LEARNING OBJECTIVE

Terminal Objective

23.0 Upon completion of this chapter, the student will demonstrate knowledge of the T-34C wheel brake system characteristics.

Enabling Objectives

23.1 Describe the type and purpose of the wheel brake system.

23.2 Describe the components of the wheel brake system.

23.3 Describe the operation of the wheel brake system.

23.4 Describe the components and operation of the parking brake system.

23.5 Explain the safety restriction placed on the parking brake system.

2302. T-34C WHEEL BRAKE SYSTEM

The main landing gear wheels are equipped with hydraulic brakes which stop and steer the aircraft. The brakes are unboosted, hydraulic, single-disc and can be actuated on either or both wheels. Forward toe pressure on the upper part of the rudder pedal(s) pressurizes the system hydraulic fluid through the action of the master cylinder located on each rudder pedal. Shuttle valves located between the front and aft master cylinders isolate the master cylinders not in use. A brake assembly on each main mount wheel is made up of a rotating disc attached to the wheel, and a nonrotating housing attached to the strut consisting of the wheel cylinder pistons and brake pads (pucks). Minimum pad thickness on preflight inspection is 1/10 inch. The cockpit that first applies the brakes has control; however, due to action of the shuttle valves, the pilot exerting the greatest amount of toe pressure on the brakes can "take control" of the brakes. If both pilots push with equal pressure, loss of braking may occur. The brakes do not have antilock devices. The system is serviced through a filler neck located forward of the windshield.

Parking Brake

The parking brake system is comprised of the normal brake system plus a parking brake handle and valve. A center lock button type parking brake handle is located in the front cockpit on the right subpanel. The parking brakes can only be set by the pilot in the front cockpit by first depressing the center lock button and pulling out the handle, then applying the toe brakes. Pulling the handle out sets a one-way check valve and any pressure subsequently applied by the front cockpit pedals to the brakes is held. Pushing the handle in unseats the check valve, thereby releasing the pressure. The center button must be depressed prior to setting or releasing the brake handle. Damage may occur if the parking brake is set when the brakes are overheated or in freezing ambient temperatures.

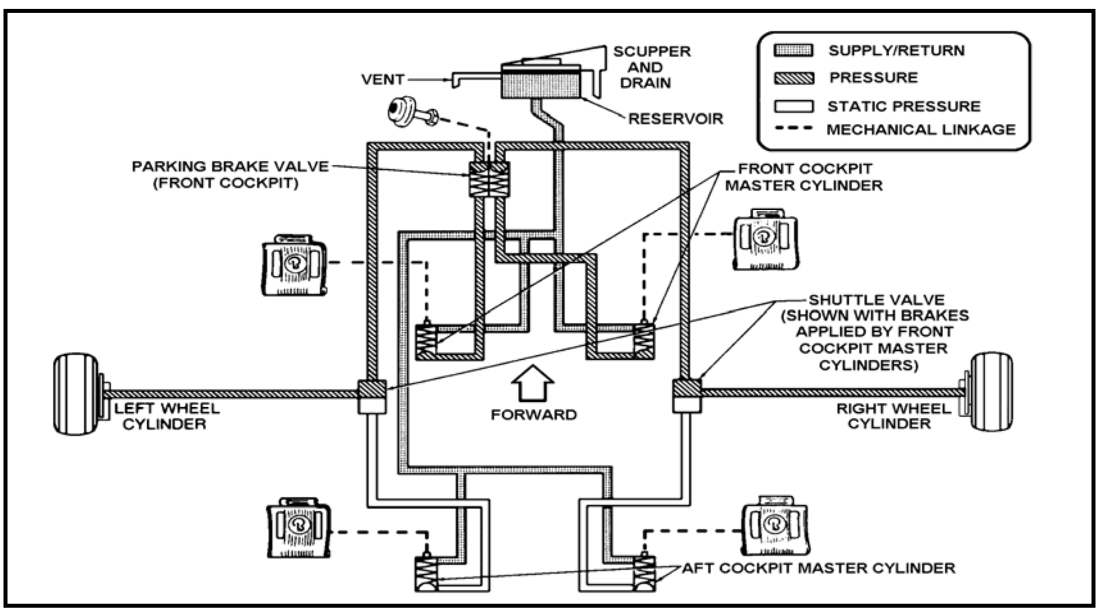

Figure 23-1 Wheel Brake System

STUDY QUESTIONS

1. Can either pilot set the parking brake?

2. What is the minimum brake pad thickness?

3. Which pilot will control the brakes?

4. Under which two conditions should the parking brake not be set?

5. What type of fluid is used in the brake system?

6. The center button on the parking brake handle must be depressed PRIOR to setting or releasing the handle.____________(True/False)

ANSWERS TO STUDY QUESTIONS

1. No, only the pilot in the front cockpit
2. 1/10 inch
3. The pilot exerting the greatest amount of toe pressure on the brakes
4. When brakes are overheated or in freezing ambient temperatures
5. hydraulic fluid
6. True