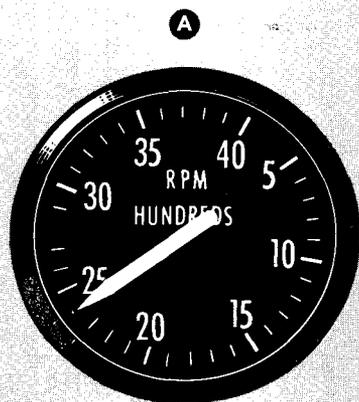


FUEL GRADE
115/145



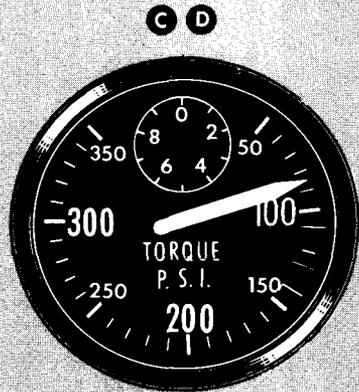
TACHOMETER

- 1400 to 2300 rpm Auto-lean
- 2300 to 2600 rpm Auto rich
- 2600 rpm METO (operation above this rpm limited to 5 min. at maximum power, 30 min. at military power.)
- 2800 (±25) rpm Maximum (wet or dry)



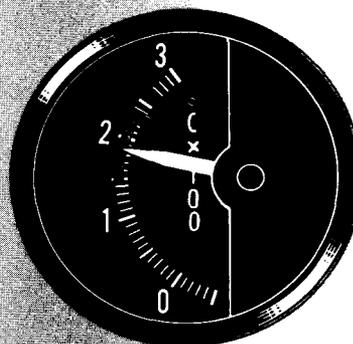
TACHOMETER

- 1400 to 2300 rpm Auto lean **B**
- Auto-lean or manual lean permitted **C D**
- Auto rich **B C D**
- Auto-rich or manual adjust. **B C D**
- dangerous vibration (at 30 in. and above)
- 2300 to 2500 rpm METO (operation above this rpm limited to 5 min. at maximum power, 30 min. at military power.)
- 2500 to 2700 rpm
- 2700 rpm
- 2800 (±25) rpm Maximum (wet or dry)



TORQUEMETER

- 110 psi METO (LOW BLOWER) (operation above this press limited to 5 min. at maximum power, 30 min. at military power.)
- 130 psi Maximum (dry)
- 141 psi Maximum (wet)



CYLINDER HEAD TEMPERATURE

- 150° to 232°C Continuous operation (150° to 205° desired)
- 232°C Maximum Auto-lean
- 260°C Maximum Manual-lean/Manual adjust **C D**
- Maximum Auto-rich

C-65295-2

Figure 5-1 (Sheet 2 of 7)

INSTRUMENT MARKINGS (TYPICAL)

FUEL GRADE
115/145



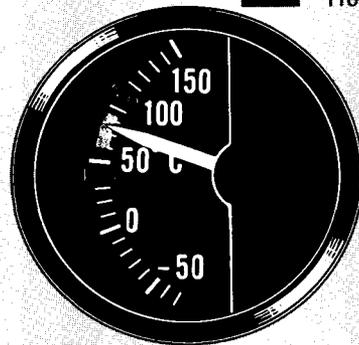
FUEL PRESSURE

- █ 19 psi Minimum
- █ 21 to 25 psi Continuous operation
- █ 26 psi Maximum



OIL PRESSURE

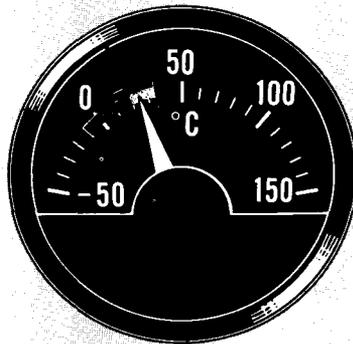
- █ 50 psi Minimum at 1400 rpm (25 psi permissible for idle)
- █ 60 to 100 psi Continuous operation
- █ 110 psi Maximum



OIL TEMPERATURE

- █ 40°C Minimum
- █ 60° to 85°C Continuous operation
- █ 100°C Maximum

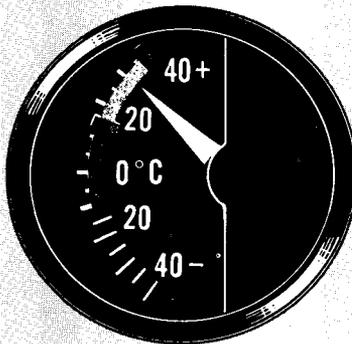
A B



CARBURETOR AIR TEMPERATURE

- █ -10° to +15°C Danger of icing Maximum-high blower (except below 1100 BHP during icing conditions)
- █ 15° to 38°C Continuous operation
- █ 38°C Maximum-low blower with carburetor heat.

C D

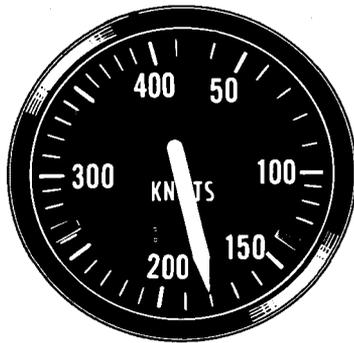


CARBURETOR AIR TEMPERATURE

- █ -10° to +15°C Danger of icing Maximum-high blower (except below 1200 BHP during icing conditions)
- █ 15° to 38°C Continuous operation
- █ 38°C Maximum-low blower with carburetor heat.

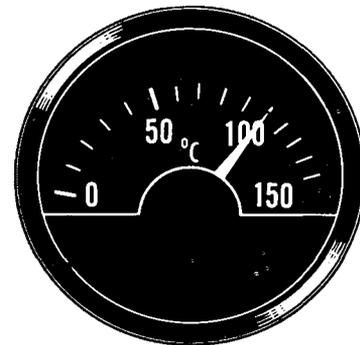
C-45295-3

Figure 5-1 (Sheet 3 of 7)



AIRSPEED

	141 knots	Full flaps (landing gear— 176 knots)
	266 knots	Maximum (sea level to 16,500 ft.)



WING AND TAIL TEMPERATURE

	150°C	Maximum with overheat limit switch in OVERRIDE
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WATER PRESSURE

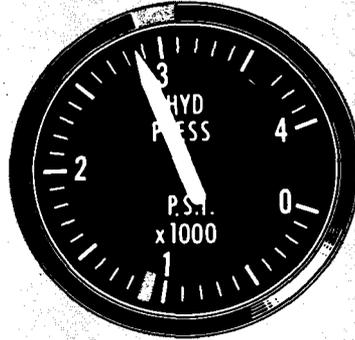
	18 psi	Minimum
	22 to 25 psi	Continuous operation
	30 psi	Maximum



WATER QUANTITY

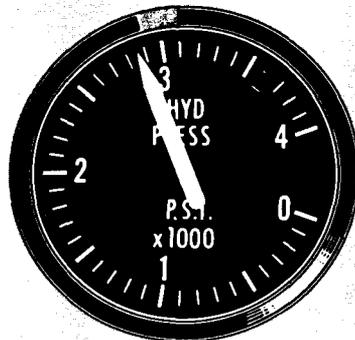
	9 to 25 gallons	Required for take-off
	3 to 6 gallons	Possibility of system cut-off due to slashing
	3 gallons	Injection system cut-off

INSTRUMENT MARKINGS (TYPICAL)



HYDRAULIC BRAKE PRESSURE

	1100 psi	One brake application remaining
	2900 to 3100 psi	Normal
	3600 psi	Maximum

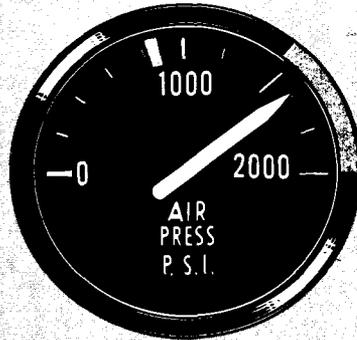


MAIN HYDRAULIC PRESSURE

	2900 to 3100 psi	Normal
	3600 psi	Maximum

C-45295-5

Figure 5-1 (Sheet 5 of 7)



AIR BRAKE PRESSURE
70° F

- | | | |
|-----|------------------|---------------------------------|
| — | 850 psi | One brake application remaining |
| ▬ | 1450 | Minimum |
| ▬▬ | 1450 to 2000 psi | Normal |
| ▬▬▬ | 2000 psi | Maximum |

B SOME **C**



NITROGEN PRESSURE ALTERNATOR AND GENERATOR HYDRAULIC SYSTEM ACCUMULATOR

▬ 105 psi Maximum

Refer to placard adjacent to gage for other information

SOME **C** ALL **D**



NITROGEN PRESSURE ALTERNATOR AND GENERATOR HYDRAULIC SYSTEM ACCUMULATOR

▬ 113 psi Maximum

Refer to placard adjacent to gage for other information

C-45254

Figure 5-1 (Sheet 6 of 7)

INSTRUMENT MARKINGS (TYPICAL)

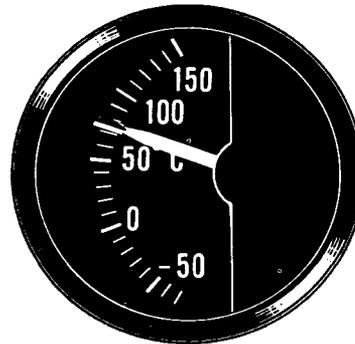
B C D



**HYDRAULIC DRIVE
ALTERNATOR-GENERATOR**

500 to 3000 psi Normal
3400 psi Maximum

B C D



**HYDRAULIC TEMPERATURE
ALTERNATOR-GENERATOR**

75°C Maximum

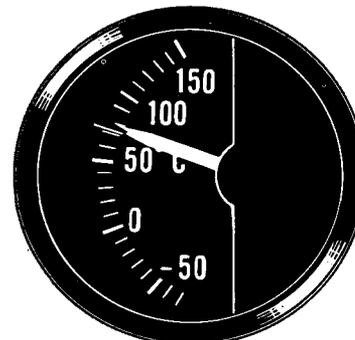
B C D



**HYDRAULIC DRIVE
CABIN COMPRESSOR**

500 to 2700 psi Normal
2900 psi Maximum

B C D



**HYDRAULIC TEMPERATURE
CABIN COMPRESSOR**

75°C Maximum

that value in flight. Conditions other than inflight may be specified where applicable.

Yellow Arc

The yellow arc indicates that danger may exist under certain specified conditions. These conditions are defined in figure 5-1 wherever the yellow arc appears.

Blue Arc

The blue arc is reserved for certain engine instruments and when so marked, indicates the permissible range of that instrument when operating with the carburetor mixture control in autolean or manual lean.

Green Arc

The green arc indicates the region for continuous operation. When used in conjunction with the blue arc, green takes on a special meaning requiring autorich or manual adjust operation when the pointer is in this region.

Upper Red Radial

The red radial having the highest numerical value on an instrument indicates that a dangerous condition would exist if the pointer should reach this point. Operation above this value is prohibited.

Unmarked Areas

Unmarked or blank areas between the lower and upper red radials indicate regions of undesirable operation or regions in which operation is limited. Operation in an unmarked area should be avoided.

Index Mark

A white index mark appears on all instruments having range markings on the glass. This mark appears on the joint between the glass and the case in an uncalibrated area. The mark is used to indicate any movement between the glass and the case and thus reveal any errors in the location of the markers caused by such movement.

MINIMUM CREW

The minimum crew requirements for this airplane are a pilot, a copilot, and a flight engineer. Additional crew members as required will be added at the discretion of the commander.

Note

Major commands may authorize operations with only a pilot and copilot when required for mission accomplishment.

ENGINE LIMITATIONS

Engine limitations are marked on the instruments. See figure 5-1. In addition, the following limitations should be observed:

Note

Takeoff in high blower is prohibited.

WARNING

On **B**, **C** and **D** airplanes, with 43E60-533 propellers installed, high power (30 in. MAP and above) engine operation at intermediate engine speeds between 2500 and 2700 RPM may cause propeller blade fatigue failure induced by resonant vibration stresses.

Cylinder head temperature:	
Maximum prior to takeoff roll	170°C
Minimum prior to takeoff roll	None (130°C Desired)
Maximum before stopping engines	200°C

Note

- If it is necessary to raise cylinder head temperature above 205°C in flight to provide adequate wing heat during auto/manual lean operation, engine power should not be allowed to exceed 1100 bhp for **A** and **B** airplanes and 1200 bhp for **C** and **D** airplanes.
- 232°C is the maximum CHT allowable for **C** and **D** models when manually adjusted to desired fuel flows between 1200 bhp and 1700 bhp.

Oil pressures:	
Minimum, 2500 to 2700 rpm (Oil temperature, 40° to 100°C)	70 psi
Minimum, idling	25 psi

Carburetor air temperatures:	
Maximum, low blower (when carburetor heat is used)	38°C

Note

There is no maximum limit when carburetor heat is not used.

Maximum, high blower above 1200 bhp	15°C
-------------------------------------	------

Note

In high blower cruise at 1100 bhp or less on **A** and **B** airplanes, or 1200 bhp or less on **C** and **D** airplanes, the limiting CAT can be increased to 30°C if icing conditions warrant, provided cylinder head temperatures are maintained below 205°C with not more than the recommended torque pressure drop from best power.

ENGINE OPERATING

A & B AIRPLANES

NORMAL FUEL GRADE OPERATING LIMITS 115/145 GRADE FUEL

STANDARD ATMOSPHERE

LOW BLOWER	BHP	RPM	MAP	MIXTURE	TORQUE	CAT
MAXIMUM (WET)	2400	2800	56.5 S.L. *56.5—1000 FT.	AUTO RICH	135	* *
MAXIMUM (DRY)	2100	2800	53.5 S.L. *52.5—3500 FT.	AUTO RICH	118	* *
METO	1800	2600 A	45.0 S.L. *44.0—6500 FT.	AUTO RICH	109 A	* *
		2700 B			105 B	

HIGH BLOWER	BHP	RPM	MAP	MIXTURE	TORQUE	CAT
METO	1600	2600 A 2500 B	46.5 8000 FT. *45.0—14,700 FT.	AUTO RICH	97 A 101 B	15°

MAP: IN HG
TORQUE: PSI
CAT: °C

- *MAXIMUM MANIFOLD PRESSURE PERMITTED AT CRITICAL ALTITUDE.
- **MAXIMUM CAT LIMIT IN LOW BLOWER IS 38°C WITH CARBURETOR HEAT APPLIED.
- OPERATION AT MAXIMUM POWER WET OR DRY LIMITED TO FIVE MINUTES.
- OPERATION AT MILITARY POWER LIMITED TO 30 MINUTES.
- MAXIMUM TORQUE PRESSURE PERMITTED IN AUTO LEAN IS 84 PSI IN LOW BLOWER AND 79 PSI IN HIGH BLOWER.
- THE SAME LIMITS APPLY WHEN USING 100/130 ALTERNATE GRADE FUEL.
- WHEN USING CABIN PRESSURIZATION, TORQUE PRESSURE FOR RIGHT ENGINE WILL BE 4.0 PSI LOWER.

C-45364-1

Figure 5-2

Maximum rpm in high blower:

- A** 2600 rpm
- B C D** 2500 rpm (propeller restriction limit)

MAXIMUM POWER LIMITATIONS

Maximum power (dry or wet) is limited to five minutes. Refer to INSTRUMENT MARKINGS, this Section, for all limits, and the Appendix for available power. Military power is the same as maximum power (dry) except that the time limit is 30 minutes. An airplane engine actually can be run continuously under overload conditions of power and speed for much longer periods than those permitted by the ratings. However, the period of reliable operation is thereby reduced to an unreasonably short time. By imposing a time limit on maximum and military power ratings, the cumulative effect of the overloads is distributed evenly over the period between

overhauls, and the useful life of the engine lengthened accordingly. When use of military power is absolutely required for longer than 30 minutes, a notation must be made on Form 781. METO power has no time limitation.

EXCESSIVE MANIFOLD PRESSURE (OVERBOOSTING)

When overboost occurs, combustion temperatures rise. If overboost of sufficient magnitude exists, detonation and pre-ignition may result and cause physical damage to the engine, possibly in a matter of seconds. If at Maximum Except Take-Off (METO) rpm or below, any MAP above METO power MAP limit (figure 5-2) is considered an overboost. If at takeoff rpm (2800 rpm), any MAP above the takeoff MAP limit (figure 5-2) is considered an overboost. The time limits for METO or takeoff overboost are the same and are shown in figure 5-2A.

LIMITS

C & D AIRPLANES

NORMAL FUEL GRADE OPERATING LIMITS 115/145 GRADE FUEL

STANDARD ATMOSPHERE

LOW BLOWER	BHP	RPM	MAP	MIXTURE	TORQUE	CAT
MAXIMUM (WET)	2500	2800	62.0 S.L. *61.0—3800 FT.	AUTO RICH	141	* *
MAXIMUM (DRY)	2300	2800	63.0 S.L. *62.5—3300 FT.	AUTO RICH	130	* *
METO	1900	2700	51.5 S.L. *50.0—8300 FT.	AUTO RICH	110	* *

HIGH BLOWER

METO	1600	2500	46.0—10,000 FT. *44.0—16,300 FT.	AUTO RICH	101	15°
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*MAXIMUM MANIFOLD PRESSURE PERMITTED AT CRITICAL ALTITUDE.

**MAXIMUM CAT LIMIT IN LOW BLOWER IS 38°C WITH CARBURETOR HEAT APPLIED.

- OPERATION AT MAXIMUM POWER WET OR DRY LIMITED TO FIVE MINUTES.
- OPERATION AT MILITARY POWER LIMITED TO 30 MINUTES.
- MAXIMUM TORQUE PRESSURE PERMITTED IN AUTO LEAN OR MANUAL LEAN IS 90 PSI IN LOW BLOWER AND 84 PSI IN HIGH BLOWER.
- WHEN USING CABIN PRESSURIZATION, TORQUE PRESSURE FOR RIGHT ENGINE WILL BE 4.0 PSI LOWER.

ALTERNATE FUEL GRADE OPERATING LIMITS 100/130 GRADE FUEL

LOW BLOWER	BHP	RPM	MAP	MIXTURE	TORQUE	CAT
MAXIMUM (WET)	2400	2800	59.5 S.L. *58.5—5000 FT.	AUTO RICH	135	* *
MAXIMUM (DRY)	1950	2800	54.5 S.L. *52.5—8400 FT.	AUTO RICH	110	* *
	2050	2700	56.0 S.L. *55.0—6000 FT.	AUTO RICH	120	* *
METO ALTERNATE (DRY)	1800	2700	49.5 S.L. *47.0—14,000 FT.	AUTO RICH	105	* *

HIGH BLOWER

METO (ALTERNATE DRY)	1550	2500	44.0—10,000 FT. *42.5—17,300 FT.	AUTO RICH	98	15°
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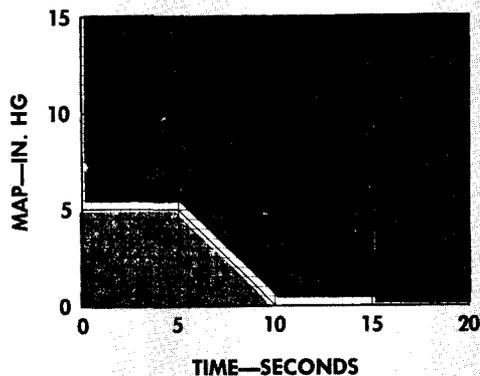
MAP: IN HG
TORQUE: PSI
CAT: °C

*MAXIMUM MANIFOLD PRESSURE PERMITTED AT CRITICAL ALTITUDE.

**MAXIMUM CAT LIMIT IN LOW BLOWER IS 38°C WITH CARBURETOR HEAT APPLIED.

- OPERATION AT MAXIMUM POWER WET OR DRY LIMITED TO FIVE MINUTES.
- OPERATION AT MILITARY POWER LIMITED TO 30 MINUTES.
- MAXIMUM TORQUE PRESSURE PERMITTED DURING AUTO LEAN OR MANUAL LEAN IS 87 PSI IN LOW BLOWER AND 81 PSI IN HIGH BLOWER.
- WHEN USING CABIN PRESSURIZATION, TORQUE PRESSURE FOR RIGHT ENGINE WILL BE 4.0 PSI LOWER.

OVERBOOST CHART



- NO ACTION REQUIRED.**
- MAINTENANCE ACTION REQUIRED. MAKE FORM 781 ENTRY.**
- MAINTENANCE ACTION REQUIRED. MAKE FORM 781. ENTRY. ENGINE REMOVAL PROBABLE.**

C-45620

Figure 5-2A

Overboost conditions represented by the yellow and red areas of figure 5-2A require maintenance actions and must be carefully recorded on Form 781 noting (if possible) the manifold pressure, rpm, carburetor air temperature, torque pressure, mixture setting, altitude, and duration of the overboost.

CAUTION

If overboost conditions represented by the yellow and red areas of figure 5-2A occur, do not takeoff, or if airborne, land as soon as practicable. Should mission requirements and flight safety dictate continued operation of the overboosted engine, consideration should be given to reduced power and a close surveillance maintained.

PROPELLER LIMITATIONS

Maximum speed with feathered propeller—190 KIAS.

Note

The propeller feathering stop is adjusted so that at 190 KIAS, the feathered propeller will not windmill.

To preclude overspeeding, do not unfeather propeller at airspeeds in excess of 130 KIAS. Hold the propeller speed control lever to DECREASE RPM until limit light comes on before starting to unfeather. If attempts to unfeather are unsuccessful, the pitch changing mechanism is defective; repeatedly trying to make it operate may lead to more serious trouble. Leave the propeller feathered and land as soon as practicable. Do not use tachometer for evidence of propeller unfeathering. Watch the propeller and release the feathering button when propeller rotations first starts. If unfeathering at night, use the wing inspection light to observe the propeller.

CAUTION

If engine overspeeding occurs, land at the nearest base. Note all conditions of overspeeding on Form 781.

AIRSPPEED LIMITATIONS

Note

All airspeeds are calculated. They contain corrections for position errors but do not contain corrections for instrument errors.

WING FLAP EXTENSION SPEED LIMITATIONS

To avoid imposing excessive airloads on the airplane structure do not exceed:

- 200 KIAS with flaps extended 12°
- 188 KIAS with flaps extended 15°
- 176 KIAS with flaps extended 20°
- 156 KIAS with flaps extended 30°
- 141 KIAS with flaps extended 39°

LANDING GEAR RETRACTION SPEED LIMITATION

Begin to retract landing gear before reaching 132 KIAS to avoid excessive stress to landing gear actuating mechanism.

LANDING GEAR EXTENSION SPEED LIMITATION

Do not exceed 176 KIAS with landing gear extended. The airplane structure is not designed to withstand the stresses imposed on the gear if extended at higher speeds.

LANDING LIGHT EXTENSION SPEED LIMITATION

To prevent damage by wind drag, do not exceed 176 KIAS with the landing lights extended.

SPEED LIMITATION WITH FULL AILERON DEFLECTION

To prevent damage to the ailerons and their controls, do not exceed 157 KIAS with full aileron deflection.

MAXIMUM DIVING SPEEDS

See figure 5-3.

EQUIPMENT LIMITATIONS**GENERATOR OUTPUT LIMITATION**

For continuous operation, a loadmeter reading in excess of 1.0 is not recommended. For a limited period, however, an overload up to 1.25 is permissible. Generally, the cooler the outside air, the longer an overload condition can be tolerated without serious injury to the generator. In no case should a loadmeter reading exceed 1.25.

MANEUVER LIMITATIONS**LIMITATIONS WITH USE OF TRAILING ANTENNA****A B C**

Restrict maneuvers to gentle turns and pullouts when the trailing antenna is extended. Retract antenna during level flight.

MAXIMUM BANK WHILE TURNING

In order to avoid structural damage to the airplane or an accelerated stall do not exceed 60° bank while turning.

PROHIBITED MANEUVERS

All acrobatics are prohibited.

1

2

3

4

5

6

7

8

9

MAXIMUM DIVING SPEEDS

ALTITUDE/FEET	IAS/KNOTS
S.L. to 16,500	266
18,000	258
20,000	248
25,000	223
30,000	198

C-45296

Figure 5-3

CENTER OF GRAVITY LIMITATIONS

The permissible center of gravity range for takeoff and landing is from 17% to 31% MAC. The permissible center of gravity range for climb and level flight is from 13% MAC to 33% MAC with the landing gear retracted.

WEIGHT LIMITATIONS

Weight, more than any other single factor, will determine the capability and performance of an airplane. An airplane is designed with sufficient strength to accomplish a certain basic mission without undue allowance for overloading or improper weight distribution. If these limitations are exceeded, a loss in the performance of the airplane is inevitable and structural failure is quite probable. When an airplane is loaded beyond the established limits, ceiling and range are decreased, control forces and stalling speeds become higher, and the rate of climb falls off rapidly as the gross weight is increased. The takeoff and landing rolls increase appreciably with an increase in gross weight. Likewise, the brakes are insufficient to brake the forward momentum of the airplane and the wings are more vulnerable to air loads during maneuvers or flight through turbulent air.

SPACE CAPACITY

The maximum weight of a fully loaded T-29 airplane with fuel, personnel and baggage for which space is normally provided is about 44,500 pounds.

WEIGHT AND LOADS

In any condition of static equilibrium during straight and level flight or at rest on the ground, the airplane is subjected to the pull of gravity, the

strength of which is spoken of as 1g. As fuel, crew, alternate load, and additional equipment are added in order that the airplane may accomplish a specific mission, the weight of the airplane correspondingly increases and the additional weight constitutes a force acting on the airplane structure. The weight of the airplane, or the force which gravity imposes on the airplane, may also be considered a load. On the ground this load must be sustained by the landing gear; in flight, by the wings. There is a limit to the load which the landing gear is capable of supporting during taxi, takeoff, and landing operations. There is also a limit to the load which the wings can sustain in flight. During maneuvering and flight through turbulent air, additional loads are imposed on the airplane. These loads, caused by acceleration of the airplane, are the result of forces which, in addition to that of gravity, act upon the total mass of the loaded airplane. Both of these forces tend to produce undesirable and potentially dangerous loads on the airplane structure. This is particularly true of the wings which must sustain the airplane in flight. When the weight of the airplane is increased, the wings become more vulnerable to the loads imposed by sudden changes in air currents or manipulation of the controls. The ultimate strength of the airplane structure is eventually exceeded by the combined forces of weight and air loads. When this condition occurs, structural failure results. As the maximum weight which the airplane can safely carry is dependent upon the distribution of the weight throughout the airplane and its capacity to sustain air loads in accelerated flight, an understanding of weight limitations is required to accomplish a mission successfully.

DISTRIBUTION OF LOAD

The maximum load that the airplane can carry also depends on the way the load is distributed in the airplane. The weight of an airplane in flight is supported largely by the wings; therefore, as the load carried in the fuselage is increased, the bending moment on the wings is increased. An airplane might safely carry 12,000 pounds if 5825 pounds were carried in the fuselage and 6175 pounds of fuel were in the wing. But, 12,000 pounds might be an unsafe load if the weight distribution were 10,000 pounds in the fuselage and 2000 pounds in the wings—due to the excessive bending moment imposed on the wings by the 10,000 pounds in the fuselage. The importance of correct weight distribution—fuselage cargo versus wing fuel—is reflected on the Weight Limitations Chart, figure 5-4. Depending on the wing load factor to be maintained, fuel and cargo can be loaded in a variety of combinations. If, for example, a wing load factor of 3.0g is to be maintained, the maximum cargo load that can be carried ranges from 9500 pounds when the wing tanks are empty to 5500 pounds when the wing tanks are full. These conditions are the two end points on the 3.0g line on the Weight Limitations Chart; however, there are any number of

A & B AIRPLANES

WEIGHT LIMITATIONS

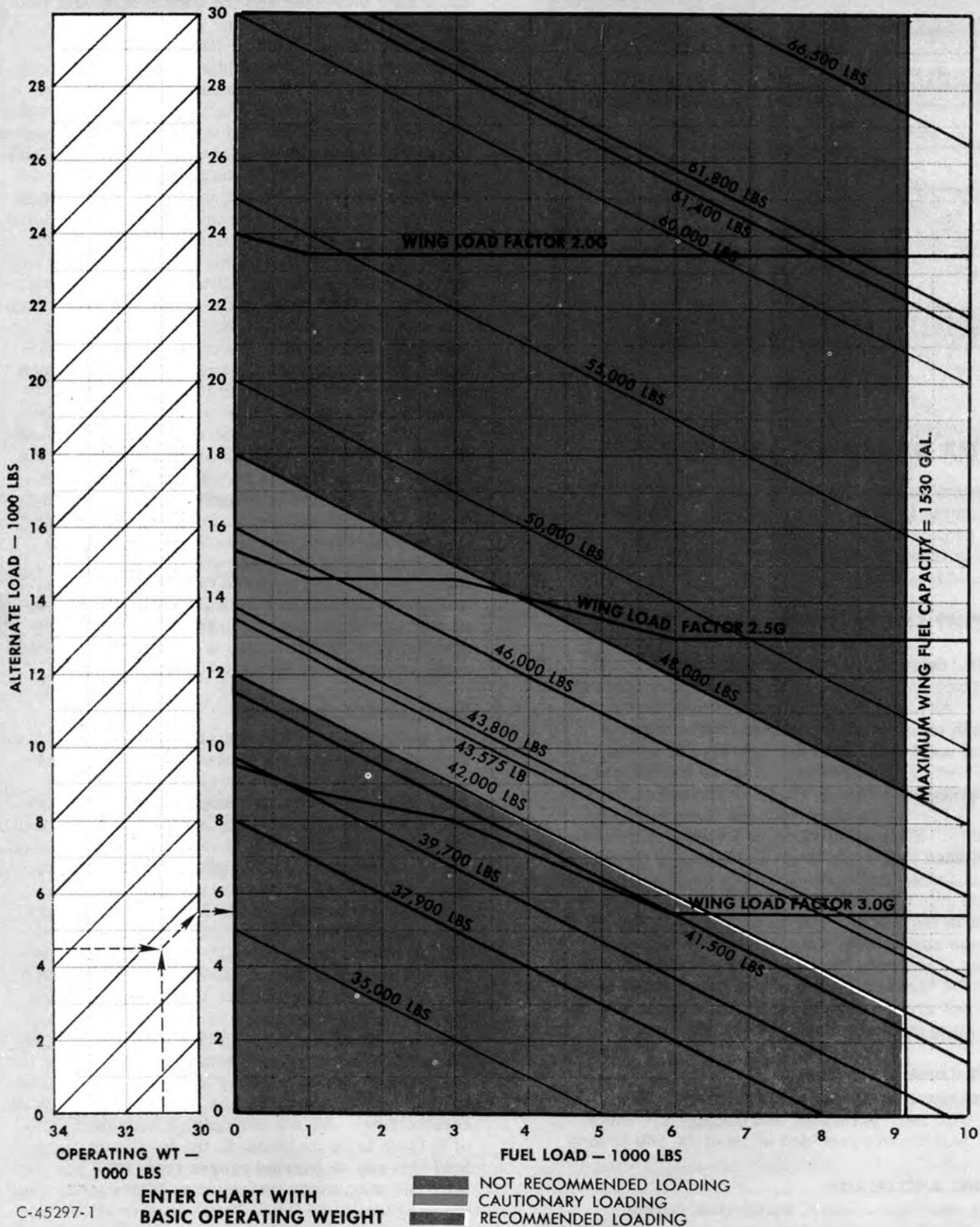


Figure 5-4 (Sheet 1 of 4)

CHART**37,900 LB**

100 ft/min rate of climb with wing flaps set at 24° (take-off), sea level, hot day (38°C, 100°F), one engine inoperative, propeller feathered, gear up, one engine operating at maximum dry power.

39,700 LB

100 ft/min rate of climb with flaps set at 24° (take-off), sea level, standard atmosphere, (15°C, 59°F), one engine inoperative, propeller feathered, gear up, operating engine at maximum dry power.

41,500 LB

Maximum landing gross weight at 10 ft/sec limit contact sinking speed.

42,000 LB

100 ft/min rate of climb with wing flaps set at 12° (take-off), sea level, hot day (38°C, 100°F), one engine inoperative, propeller feathered, gear up, one engine operating at maximum dry power.

43,575 LB

Design gross weight at 3.9G with full wing fuel.

43,800 LB

100 ft/min rate of climb with flaps set at 12° (take-off), sea level, standard atmosphere, (15°C, 59°F), one engine inoperative, propeller feathered, gear up, operating engine at maximum dry power.

46,000 LB

100 ft/min rate of climb with flaps set at 0° (take-off), sea level, hot day (38°C, 100°F), one engine inoperative, propeller feathered, gear up, one engine operating at maximum dry power.

48,000 LB

100 ft/min rate of climb, sea level, standard atmosphere, (15°C, 59°F), one engine inoperative, propeller feathered, gear and flaps up, one engine operating at maximum dry power.

50,000 LB

Estimated maximum landing weight at 8 ft/sec sinking speed.

61,400 LB

Take-off ground run of 8000 ft, sea level, standard atmosphere, (15°C, 59°F), flaps set at 0° (take-off), maximum wet power.

61,800 LB

500 ft/min rate of climb, sea level, standard atmosphere, (15°C, 59°F), gear and flaps up, METO power.

66,500 LB

Take-off ground run of 8000 ft, sea level, standard atmosphere, (15°C, 59°F), flaps set at 12° (take-off), maximum wet power.

NOTE

THE WEIGHT LIMITATION CHART IS INTENDED AS A GUIDE. FOR SPECIFIC PERFORMANCE LIMITS BASED ON EXISTING ATMOSPHERIC CONDITIONS, REFER TO THE APPENDIX.

C45297-2

Figure 5-4 (Sheet 2 of 4)

C & D AIRPLANES

WEIGHT LIMITATION

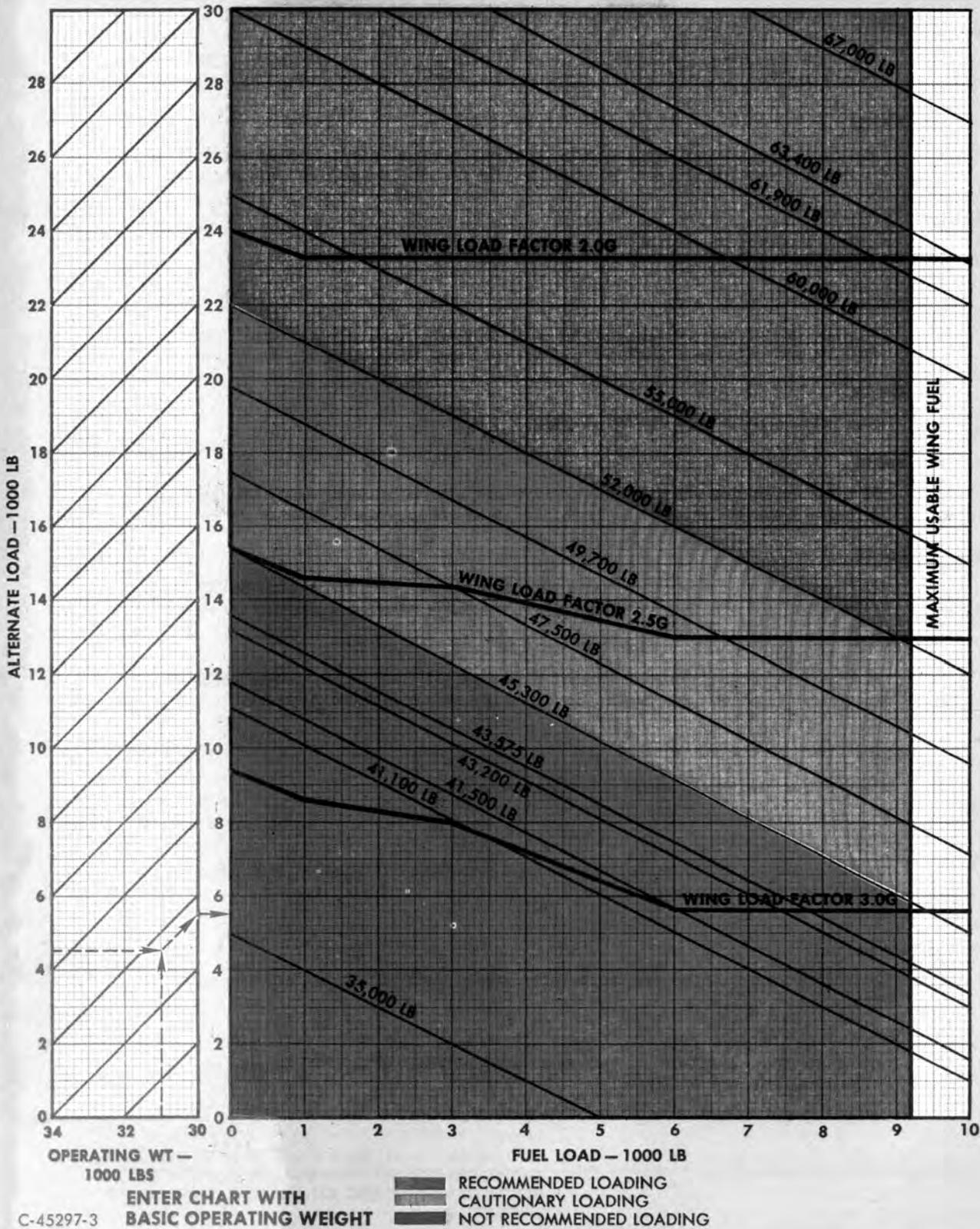


Figure 5-4 (Sheet 3 of 4)

CHART

41,100 LB

100 ft/min rate of climb with wing flaps set at 24° (takeoff), sea level, hot day (38°C, 100°F), one engine inoperative, propeller feathered, gear up, one engine operating at maximum dry power.

41,500 LB

Maximum landing weight at 10 ft/sec sinking speed.

43,200 LB

100 ft/min rate of climb with wing flaps set at 24° (takeoff), sea level, standard atmosphere, one engine inoperative, propeller feathered, gear up, one engine operating at maximum dry power.

43,575 LB

Design gross weight at 3.9G with full wing fuel.

45,300 LB

100 ft/min rate of climb with wing flaps set at 12° (takeoff), sea level, hot day (38°C, 100°F), one engine inoperative, propeller feathered, gear up, one engine operating at maximum dry power.

47,500 LB

100 ft/min rate of climb with wing flaps set at 12° (takeoff), sea level, standard atmosphere, one engine inoperative, propeller feathered, gear up, one engine operating at maximum dry power.

49,700 LB

100 ft/min rate of climb with wing flaps set at 0° (takeoff), sea level, hot day (38°C, 100°F), one engine inoperative, propeller feathered, gear up, one engine operating at maximum dry power.

50,000 LB

Estimated maximum landing weight at 8 ft/sec sinking speed.

52,000 LB

100 ft/min rate of climb, sea level, standard atmosphere, one engine inoperative, propeller feathered, gear and flaps up, one engine operating at maximum dry power.

61,900 LB

Takeoff ground run of 8000 ft, sea level, standard atmosphere, flaps set at 0° (takeoff), maximum wet power.

63,400 LB

500 ft/min rate of climb, sea level, standard atmosphere, flaps and gear up, METO power.

67,000 LB

Takeoff ground run of 8000 ft, sea level, standard atmosphere, flaps set at 12° (takeoff), maximum wet power.

NOTE

THE WEIGHT LIMITATION CHART IS INTENDED AS A GUIDE. FOR SPECIFIC PERFORMANCE LIMITS BASED ON EXISTING ATMOSPHERIC CONDITIONS, REFER TO THE APPENDIX.

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Figure 5-4 (Sheet 4 of 4)

intermediate points on the 3.0g line that define other cargo/fuel weight combinations. (For example, 8000 pounds of cargo and 3000 pounds of fuel.) Since the wing load factor lines do not parallel the constant weight lines, the gross takeoff weight will vary as the cargo/fuel loads vary for the same load factor.

LOAD FACTORS

Symmetrical Loading

A load factor is the ratio of the load imposed on the airplane when accelerated in any direction as compared with the load imposed on the airplane by gravity in any condition of static equilibrium. The load factor denotes the strength of the forces acting on the airplane due to the sudden changes in air currents and manipulation of the controls, and is expressed by the term g, which is the gravitational force. All airplanes at rest on the ground or in straight and level flight possess a load factor of 1g because the force acting upon the airplane under either of these conditions is merely that of gravity. When the airplane enters a region of turbulent air or the airplane is maneuvered, additional forces are imposed on the structure. The additional load on the wings resulting from these forces is expressed in relation to the gravitational force and referred to as 0.5g, 2.0g, 3.0g, etc., which means that the forces exerted on the wing structure and its members are 0.5, 2, or 3 times the force exerted by gravity. For example, if the normal weight of the airplane is 40,000 pounds and the load factor at any given moment of accelerated flight is 3.0g, the total force which the wings must sustain is 120,000 pounds or three times the normal weight of the airplane in straight and level flight.

Asymmetrical Loading

The load on the wings is not always symmetrically distributed, as in a rolling pullout maneuver. When the overall wing load becomes too unequally distributed, excessive shear stresses are applied to one side of the wing mounting structure. Thus, it becomes necessary to establish design criteria for specifying the extent of asymmetrical wing loading which the airplane must support. The T-29 airplane structure is capable of sustaining 100% of design stress on one wing while simultaneously sustaining not less than 85% on the other. For example, at the design gross weight of 43,575 pounds with a full fuel load, the design wing load factor is 3.9g. In level flight the load on each wing would amount to approximately 21,800 pounds. But if due to heavy turbulence or maneuvering flight, a 3.0g load factor is imposed on one wing, the total load on that wing becomes 65,400 pounds, or three times the normal amount. Then in order to avoid a dangerously unequal load distribution, the other wing must carry at least 85% of that amount or approximately 56,600 pounds.

MARGIN OF SAFETY

The margin of safety is the range of forces which exist between two points, one of which is the load

factor the airplane is sustaining at any given moment and the other is the load factor at which structural damage will occur. If, for example, the airplane is incapable of sustaining a load factor greater than 3.0g and during flight through turbulent air is subjected to a force of 1.5g, the margin of safety at this particular moment is 1.5g. When fuselage loads are increased, the margin of safety decreases. This is also true, to a lesser degree, when wing fuel is increased. This increase in weight actually becomes a component of the forces acting on the airplane, and, as such, lessens the capacity of the airplane to sustain further loads due to accelerated flight. For this reason it is advisable in loading an airplane to maintain a margin of safety which will never be exceeded during any period of flight.

Experience has shown that an airplane should never be overloaded to the point where it cannot make good a load factor of 2.0g, because almost any mission, even with ideal conditions, will subject the airplane at one time or another to load factors of at least 2.0g.

WEIGHT LIMITATION CHART

The weight limitation chart (figure 5-4) presents graphically the weight-carrying capabilities of the airplane as defined by the various criteria which provide limits for safe and efficient operation. Through the use of the chart, the flight planner is aided in recognizing the weight limitations which will restrict operation in a specific mission and in determining what margin of safety may be established.

Operating Weight

The operating weight on which the weight limitation chart is based is 30,000 pounds. This value is an approximate weight which includes the airplane basic weight shown in the Handbook Weight and Balance Data, T.O. 1-1B-40, plus the standard crew and full oil capacity. Since individual airplane basic weights will vary, it will be necessary to adjust the chart for a specific airplane. The chart includes a nomogram to permit adjustment for operating weights from 30,000 to 34,000 pounds.

Gross Weight

The diagonal lines on the weight limitation chart indicate the gross weight of the loaded airplane.

Note

The gross weight of the airplane should never exceed that required for the mission since unnecessary risk and wear of the equipment will otherwise result. Takeoff gross weights must also be considered in light of available runways, surrounding terrain, altitude, atmospheric conditions, mission requirements, and the urgency of the mission. It is of primary importance, therefore, that the performance data in the Appendix be used for preflight planning and the Weight Limitation Chart be used for a final check of limitations and margin of safety.

Landing Weight Limitation

The recommended maximum landing weight of 41,500 pounds is based on landing gear structural limitations. Although this figure allows a margin of safety for the occasional "hard" landing, landings in excess of 41,500 pounds will reduce landing gear life and reduce brake effectivity and life. Landings at gross weights above the recommended maximum should be made only in case of emergency and then with extreme care.

Performance Limitation

Generally, with two-engine airplanes, performance rather than structural limitations restrict the weight which the airplane can carry. Obviously, the gross weight must necessarily be limited by the ability of the airplane to take off within the available runway length and clear any obstacles. But the primary consideration is the ability of the airplane to fly with partial power. Single engine performance, then, is the major restrictive factor in the loading of the airplane. Note the gross weight lines on the chart, particularly those which separate the loading areas. Each of these lines defines a specific performance limitation. These performance limitations are based on the gross weight at which an adequate rate of climb can be maintained under various conditions of power, temperature, and configuration.

Recommended Loading Area

The green area on the chart represents the loading conditions that present no particular problem in regard to strength or performance of the airplane at normal takeoff flap setting of 12°. The area is defined by the gross weight diagonal which indicates a rate-of-climb at sea level of 100 feet per minute on a hot day with one propeller feathered, gear up, wing flaps at 12°, and maximum dry power on the operating engine.

Cautionary Loading Area

The yellow area on the chart represents loadings of progressively increasing risk as the red area is approached. Caution must be exercised because single-engine performance is marginal depending

upon configuration, altitude, and air temperature. This area is defined by the gross weight diagonal which indicates a rate-of-climb of 100 feet per minute at sea level on a standard day with one propeller feathered, gear and flaps up, and maximum dry power on the operating engine.

Loading Area Not Recommended

The red area on the chart represents loadings which are not recommended because the margin of safety from the standpoint of both performance and structural limitations is less than the most desirable or the best practical. Under conditions of extreme emergency when safety of flight is of secondary importance, the commander will determine whether the degree of risk warrants operation of the airplane at gross weights within the red zone.

USING THE CHART

For illustrative purposes, assume a mission calls for a 4500 pound alternate load and 8500 pounds of fuel. Operating weight is 31,000 pounds. Enter the chart at 4500 pounds on the alternate load scale on left. Proceed horizontally to basic weight of 31,000 pounds then parallel guide lines to enter main chart at 5500 pounds. Next proceed along the horizontal fuel load axis to 8500 pounds and project a line vertically to intersect the horizontal projection of the 5500 pound alternate load line. The intersection will indicate a gross weight of 44,000 pounds. This loading falls within the area where it is recommended that a wing flap setting of 15° or less be used to assure positive performance in the event of engine failure during takeoff.

Note

For practical operation, the selection of takeoff flap setting should be limited to either 12°, 6°, or 0°. Intermediate positions should be used only when one of these flap settings will not provide the required initial rate-of-climb and runway length combination as shown in the Appendix.

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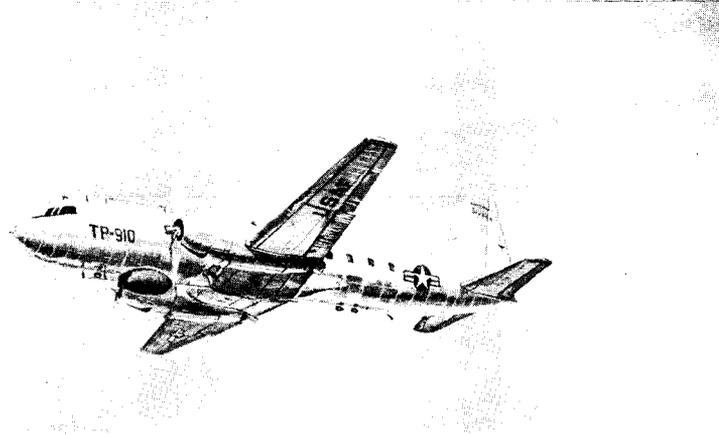
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9

FLIGHT CHARACTER



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FLIGHT CHARACTERISTICS

section VI

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INTRODUCTION

This airplane has no unusual flight characteristics.

STALLS

STALL CHARACTERISTICS

There are no unfavorable stall characteristics. Ample stall warning in the form of tail buffeting is given in the approach to the stall. If proper stall recovery technique is used, very little altitude will be lost during the recovery. Power-off stall speeds for level flight and banked turns are given in figure 6-1.

PRESTALL BUFFET

Buffeting is caused by a "burbled" or distorted air-flow over airfoil surfaces. The prestall warning is primarily evidenced by moderate airplane and control system buffet or shake and secondly by a change

in the elevator control characteristics. The changes in elevator control characteristics at the onset of the prestall buffet are such that considerable elevator position and force changes are necessary for completion of the stall. Airplane buffet is the best indication of proximity to the stall.

Note

Mild buffeting, which may be mistaken for the prestall warning buffet, can be induced by sludge, ice, or mud on surfaces of the airplane, dirty wing and tail surfaces, or excessive nacelle flap openings. To keep drag and buffeting to a minimum, nacelle flaps should not be opened past the midposition during flight.

POWER-OFF STALL CHART

GROSS WEIGHT (LBS)		GEAR UP Indicated Airspeed in Knots							GEAR DOWN Indicated Airspeed in Knots						
		DEGREES OF BANK	WING FLAP POSITION IN DEGREES						WING FLAP POSITION IN DEGREES						
			0°	12°	15°	20°	28°	39°	0°	12°	15°	20°	28°	39°	
34,000	0°	95	89	88	86	83	80	93	87	86	85	82	80		
	15°	97	91	89	87	84	81	94	88	87	86	83	81		
	30°	101	95	93	91	88	84	98	93	91	89	87	84		
36,000	0°	98	91	90	88	85	82	95	89	88	86	84	81		
	15°	99	93	91	89	86	83	96	90	89	88	85	82		
	30°	104	97	96	93	90	86	100	95	93	92	89	85		
38,000	0°	100	93	92	90	87	83	97	91	90	88	86	83		
	15°	101	95	93	91	88	84	98	92	92	89	87	84		
	30°	106	99	98	95	92	88	103	97	96	93	91	87		
40,000	0°	102	95	94	92	88	85	99	93	92	90	87	84		
	15°	104	97	95	93	90	86	100	94	93	91	88	85		
	30°	109	101	100	97	94	90	105	99	98	96	92	89		
42,000	0°	104	97	96	93	90	87	101	95	94	92	89	86		
	15°	106	99	97	95	91	88	102	96	95	93	90	87		
	30°	112	104	102	99	96	92	107	101	100	97	94	91		
44,000	0°	107	99	98	95	92	88	103	97	96	93	91	87		
	15°	108	101	99	97	93	89	105	98	97	95	92	88		
	30°	114	106	104	101	98	93	110	103	102	99	96	92		
46,000	0°	109	101	100	97	93	90	105	99	98	95	92	89		
	15°	111	103	101	98	95	91	107	100	99	97	93	90		
	30°	117	108	106	103	99	95	112	105	104	101	98	94		

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Figure 6-1

If buffet is unintentionally encountered while flying at cruise altitude, speed should be recovered by increasing power and lowering the nose until safe flying speed is established. In this case, when buffet is encountered, an increase in airspeed of 10 to 20 knots above the speed at which buffet commenced will be required to eliminate the condition. If buffeting is unintentionally encountered during low-altitude flight, a small extension of wing flaps and an increase in power will usually eliminate buffet. After buffet has been eliminated, the wing flaps may be retracted in increments as speed is increased.

POWER-ON STALLS

Power-on stalls will be preceded by a buffet warning which will occur approximately 13 knots above the stall speed with the airplane clean and four to five knots above the stall speed with full wing flaps. In some cases with the airplane at low gross weights without power, and in any weight configuration with power, a minimum control speed will be experienced before the actual stall. In this case the airplane will begin to turn and may roll during the stall. The roll is controllable, however. In most cases, the airplane will stall and break away clean.

POWER-OFF STALLS

Power-off stalls are very mild with no tendency to fall off; ailerons and rudder remain effective.

ACCELERATED STALLS

Accelerated stalls are caused by raising the stall speed due to imposing more than the normal pull of gravity on the airplane. This can be done by centrifugal force in a turn or a too abrupt pullout from a dive. The stall speed is increased by the square root of the g factor involved multiplied by the normal stalling speed. The airplane gives pronounced stall warning in the form of tail buffeting when this occurs. The secondary stall warning and buffet can be demonstrated in turns by applying excessive back pressure on the control column.

STALL RECOVERY

Use normal stall recovery technique. Permit the airspeed to build up through the buffet range, then start a normal recovery to level flight. If recovery is too abrupt, a secondary stall warning buffet may occur.

SPINS

Intentional spins are prohibited. If a spin should be entered accidentally, normal recovery procedure for two-engine airplanes is recommended; namely, power on the inside engine, opposite rudder, and elevator control for nose down.

FLIGHT CONTROLS

Aileron, elevator, rudder, and trim tab controls are normal throughout slow, cruising, and high-speed flight. Controls become more sensitive as

the speed increases; likewise, control forces become higher by a normal amount.

LEVEL FLIGHT CHARACTERISTICS

The airplane is stable under all normal flight conditions. Lateral stability at low airspeeds is improved by the use of an interconnect between rudder cables and aileron cables. The interconnect is accomplished by use of springs and operation of the rudder results in a synchronized, proportional operation of the ailerons, thus facilitating bank-and-turn control. Conversely, operation of the ailerons automatically results in corresponding deflection of the rudder. The rudder is extremely sensitive under cruise conditions and coordinated turns can be made with the aileron controls alone. The use of springs permits the interconnect to be overridden when it becomes necessary to cross-control the airplane.

MANEUVERING FLIGHT

Maneuvering flight within the category of acrobatics is prohibited. Normal maneuvers may be accomplished with moderate pilot effort as flight tabs on the rudder and left elevator make control forces relatively light. In a tight turn, control forces are normal. There are no conditions of normal maneuvering flight which will produce a reversal of control pressures.

DIVING

Use normal recovery methods from a dive. Do not exceed the maximum dive speeds (see figure 5-3).







SYSTEMS OPERATION
section VII

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ENGINE

Engine installation on the airplane differs from the usual installation in the use of augmentors, which are steel tubes about ten inches in diameter, open at each end. Two augmentors extend from just forward of the engine shroud aft through the nacelle to the wing trailing edge. The exhaust stacks of the engine extend to the forward end of each augmentor. Considerable open space remains around the stacks inside the mouth of the augmentor. When the engine is operating, exhaust gas is ejected from the stacks into the augmentors. The velocity of the exhaust creates a partial vacuum at the mouth of each augmentor, causing air that has entered the engine section round the propeller hub to rush into the augmentors. This action continuously draws cooling

air across the engine. The cooling effect, although not necessarily the maximum cooling possible, is most uniform when the engine area is not subjected to the diverting flow caused by open nacelle flaps. The pump action of the high-velocity exhaust gases through the augmentors gives a jet thrust effect as the mixture is forced out of the aft ends of the augmentors. This thrust is considered to be sufficient at low airspeeds and high power settings to provide some positive thrust power. At moderately high airspeeds and lower power settings, the thrust is considered to be sufficient at least to nullify cooling drag. The main advantages of the augmentor installation is in flow of cooling air over the engine automatically proportioned to the power setting at all times, due to the aspirating effect of the exhaust gases. Another advantage is that with this system

the cumbersome ring of conventional cowl flaps around each nacelle is eliminated. On **A** and **B** airplanes, two nacelle flaps are located on the top of each nacelle. On **C** and **D** airplanes, two nacelle flaps are located on the top and two on the bottom of each nacelle. The nacelle flaps are opened on the ground to allow heat to escape from the engines. When cylinder head temperatures need to be controlled in flight, the nacelle flaps are used in the same manner as ordinary cowl flaps. The augmentors conduct considerable heat and this is taken advantage of to provide heating air for the cabin heat exchanger and the wing and tail anti-icing system. A tube larger than the augmentor is installed as a sleeve over each augmentor. The forward end of the tube is open and air flows into it under moderate ram pressure from the engine section when the airplane is in flight. A muff collects the heating air at the aft end of the tube. A duct, joined to the muff by a heat valve, leads the heating air to the appropriate system. The inboard augmentor in each nacelle heats air for the cabin heat exchanger and for tail anti-icing. The outboard augmentor in each nacelle heats air for wing anti-icing. The temperature to which the air will be heated depends on air-speed, engine power setting, position of the nacelle flaps, and position of the augmentor vanes. The cylinder head temperature gages and the anti-icing temperature gages for the wing and tail leading edges provide the best indication of the heating air temperature. Use of augmentor heat collector muffs as the source of heating air eliminates the need for combustion heaters or electrical heat sources for cabin temperature control and wing and tail anti-icing.

CYLINDER HEAD TEMPERATURE CONSIDERATIONS

Normally, cylinder head temperature control is maintained by use of the nacelle flaps. During wing and tail anti-icing operation, vanes in the augmentors provide a means of restricting exhaust flow through the augmentors in order to raise the temperature of heated air for anti-icing operation. When the vanes are closed they restrict the flow of cooling air and exhaust gases through the augmentors. This reduced air flow results in a smaller volume of cooling air passing around the engines, and thus increases cylinder head temperatures. Trailing the augmentor vanes lowers cylinder head temperatures.

Note

During wing and tail anti-icing, close the augmentor vanes and control cylinder head temperature with the nacelle flaps. Reset the augmentor vanes to a lesser closure if nacelle flap **MID POSITION** does not maintain cylinder head temperatures within limits.

ENGINE TORQUEMETERS

Engine torquemeters provide an indication of the power being delivered to the propellers. The indi-

cators are sensitive type instruments with a 1-10 vernier scale, indicating torque in psi. Most **A** and **B** airplanes are equipped with torquemeters that do not have the 1-10 vernier scale. They are energized electrically by torque pressure transmitters. The torque meter circuit is powered by 26-volt regulated alternating current. The torque indication is originated by a master torque pressure piston and five subsidiary pistons installed in the forward accessory section of the engine in such a way that when power is transmitted to the propeller from the engine, the fixed reduction gear mounted on a spirally splined shaft tends to move forward on the splines. The forward face of the gear pushes against the pistons and compresses oil supplied at the other end of the piston by the oil pressure boost pump. This develops pressure through a static fluid tube against torque pressure plates which actuate the torque pressure transmitters. The torque indicated on the torque meter is therefore the torque applied to the propeller. Power delivered to auxiliary equipment and electrical equipment by the engine is not included in the torque meter indication. The indicated torque of the two engines will not necessarily be equal at any time, partly due to possible variation in accessory load and engine condition, but also because the tolerances of the installations allow a possible difference of 5 psi or more. The torque constant is 0.00632 and BHP may be calculated by using the following formula:

$$\text{BHP} = \text{Torque (psi)} \times \text{Torque Constant} \times \text{RPM}$$

The torque meters provide the best indication of power failure and power changes. If a carburetor should ice, the change in power as shown on the torque meter will usually be the first indication. If spark plugs begin to fail, or other failure begins, this power loss will be indicated by the torque meter. Torque meters are not to be used for setting power but should be used as a check only. Torque pressure will change if the carburetor begins to ice, if fuel pressure fluctuates or drops below operating limits, if the ignition system is defective, if cylinder head temperatures are too high or the mixture is too lean or too rich. In general, any condition which prevents the engine from developing all of the power it should develop at a given power setting will be reflected in low torque pressure indication.

DETONATION

Detonation is one of the principal hazards associated with the operation of a high-output engine. It is the result of sudden exploding of the charge in the cylinder head as contrasted to the steady release of energy in the progressive and relatively slow burning which occurs during normal combustion. Detonation is accompanied by severe pressure waves in the combustion chamber. Abnormal heat is developed. Damage to the engine will result from continuous or frequent detonation and in the worst instances detonation leads rapidly to complete

engine failure. Detonation in an automobile engine can be heard as a sharp knocking. If other sounds could be filtered out, knocking would be audible in an airplane engine in which detonation was occurring. A rapid increase in cylinder head temperature, however, is the pilots' only warning of detonation.

Detonation Factors

The following factors contribute to the tendency of an engine to detonate: (1) excessive manifold pressure; (2) insufficient cooling; (3) lean fuel-air mixtures; (4) excessive carburetor air temperatures; (5) faulty ignition system; and (6) fuel of low anti-knock value. The first four of these factors can be controlled from the flight compartment. If detonation should occur, the pilot can (1) reduce power, (2) open nacelle flaps and increase speed for better cooling, (3) enrich the mixture, or (4) reduce carburetor air temperature. If engines are operated within the specified limits on the recommended grade of fuel, and with carburetor and ignition system in normal condition, they will not detonate.

WATER (ANTI-DETONANT) INJECTION

As explained in DETONATION, this Section, engine operation at excessive manifold pressures and insufficient cooling contributes to detonation. A water-alcohol solution introduced with the fuel entering the engine acts as a detonation suppressant when operating with increased manifold pressure. The tendency to detonate is normally suppressed by enriching the mixture beyond best power to supply excess fuel for cooling. The volume of water injected replaces an equal volume of the fuel normally used as a coolant, thereby cooling the charge to prevent detonation. The consumption of ADI fluid at maximum power is approximately 1.5 gallons per minute for each engine. A full tank is sufficient to operate the system for approximately seven minutes for both engines or 14 minutes on one engine. It is important to check the water quantity prior to landing to determine if ADI fluid will be available for full power operation in the event of a go-around. A minimum quantity of nine gallons is required to assure a safe "water-on" go-around. If a go-around is necessary and the water injection system is not operating, do not exceed dry maximum power. Serious engine damage can result.

Note

On **C** and **D** airplanes (-99W engines) the manifold pressure limit for operation without water injection is higher than the limiting pressure with water (when using 115/145 grade fuel). This apparent discrepancy is explained by the preceding paragraph. An excess of fuel allows the use of high manifold pressure; however, power output is lower due to the rich mixture.

ALTERNATE FUEL GRADE MAXIMUM POWER SETTINGS **C** **D**

For detailed power settings, see figure 5-2. When using alternate fuel grade dry (100/130), an additional 100 horsepower can be obtained by using the 2700 rpm setting rather than the 2800 rpm setting. This is due to the fact that at 2700 rpm, the detonation range has been avoided and therefore manifold pressure and torque pressure may be increased to give an additional 100 bhp. To limit engine rpm to 2700, the propeller governor should be reset in the following manner prior to takeoff.

1. Face the airplane into the wind.
2. Advance the throttle to over 2700 rpm.
3. Decrease rpm to 2700 by use of the propeller speed control lever.
4. Repeat the above procedure on the other engine.

THROTTLE OPERATION

Power changes should be made smoothly and gradually. If throttles are jerked or moved rapidly, backfiring and torching, with serious damage to exhaust stacks and augmentors may result.

ENGINE BLOWERS

ENGINE BLOWER SHIFT CHECK

When making an engine blower shift check, pilots should make absolutely certain that blowers are back in low before takeoff. Should the blower shift actuator fail to shift from high back to low, and a takeoff be made in high blower, severe detonation caused by high compression and high temperature of the mixture might result in engine failure. To determine whether or not blowers have actually shifted, pilots may observe two indications: manifold pressure and oil pressure. When shifting from high back to low, a drop in manifold pressure and a fluctuation of oil pressure indicate that the blower has actually gone back into low position.

CAUTION

If a dc power failure should occur with the blowers operating in the high ratio, the blowers will automatically shift to the low ratio. To prevent inadvertent return to high ratio, or if continued operation in high ratio is not necessary, the blower switch should be placed in LOW position prior to reestablishing dc power.

ENGINE BLOWER SHIFT OPERATION

For a particular rpm and bhp condition, two factors govern engine blower shifting: (1) altitude, and (2) carburetor air temperature. The altitudes for

shifting blowers are given in the flight operation charts in the Appendix. These altitude values are determined from engine operating curves and the comparative fuel consumption for each blower ratio at the same engine power output. They are based on use of low blower whenever the desired power can be maintained at (1) the selected rpm with part or full throttle or (2) at an increased rpm, with full throttle, if the rpm does not exceed the maximum cruising engine speed. Carburetor air temperature as related to blower operation is of critical importance. Carburetor air temperature is measured before fuel is injected and before the fuel air mixture passes into the blower section. Due to the compressor action of the blower and other factors, considerable heat rise occurs in the fuel-air mixture before the charge is admitted to the cylinders. By controlling the carburetor air temperature to certain maximums, it is therefore possible to preclude detonation that originates from excessive carburetor heat. However, because of the high temperature rise through the superchargers when operating in high blower, carburetor air temperature must be restricted to a lower figure. Refer to ENGINE LIMITATIONS, Section V. The low blower critical altitude (full throttle) for normal climb bhp is usually reached in the range of 12,000 to 15,000 feet, depending upon existing atmospheric conditions and variations in engine condition.

Blower Shift Procedure

The shock associated with a blower shift will be minimized by reducing the pumping load on the supercharger through a momentary manifold pressure reduction to approximately 25 inches Hg while effecting the shift from low to high ratio. The shift from high to low ratio may be effected without reduction in manifold pressure as this shift reduces the pumping load on the supercharger. The use of auto-rich mixture during the engine blower shift operations is beneficial because the change in fuel/air ratio obtained in moving from manual lean to auto-rich, changes the temperature pattern within the combustion chambers and causes lead and carbon deposits to be carried out the exhaust, thus prolonging spark plug life. Use the following procedure when shifting from low to high blower:

1. After reaching low blower power limitations or full throttle, reduce manifold pressure to 25 inches Hg.
2. Place blower switch(es) in HIGH position.
3. Establish high blower climb power setting.

CAUTION

Do not shift to high blower if carburetor air temperature exceeds limits. High blower operation above these temperature ranges will cause excessively high mixture temperature and possible detonation.

CARBURETORS

CARBURETOR AIR TEMPERATURE

During low blower operation, carburetor air temperature may range safely to the maximum specified limits when using carburetor heat. The engines on this airplane require two different carburetor air temperature limits, one for low and one for high blower operation. Because of the higher temperature rise in the blower when operating in high ratio, carburetor heat must be held to a lower temperature. If this is not done, detonation may occur. The critical condition is in shifting to high blower when carburetor air temperature is above high blower limits. Detonation can be avoided when shifting to high blower by reducing rpm and manifold pressure to low cruising values and by placing the mixture control lever in AUTO RICH.

CARBURETOR MIXTURES

On **A** and **B** airplanes, the normal power settings and the average fuel flow for the airplane at various weights are given in the Appendix. On **C** and **D** airplanes, the carburetor setting used on the R2800-99W engines permits manual leaning of the fuel-air mixture strength for decreased fuel consumption and increased range. The mixture control mechanism of the carburetor provides for a wide adjustment between the AUTO LEAN position and the IDLE CUTOFF position. This allows a closer, more accurate, adjustment of the mixture ratio. Mixture strength is leaned manually on the basis of torque oil pressure drop from the best power position.

PROCEDURE FOR MANUAL LEANING **C D**

As automatic carburetor operation will not permit the attainment of maximum precision in the control of fuel flow and mixture strength, and since the AUTO LEAN mixture position is set to assure smooth engine operation rather than fuel economy, some method of manually leaning the cruise mixture is desirable. Basically, the manual leaning procedures which are outlined below provide for establishing the desired fuel-air ratio with as many factors as possible held constant, including airflow, cylinder head temperature, carburetor air temperature, manifold pressure and rpm. Only fuel flow is varied and the resultant changes in power follow closely the fundamental relationship existing between the fuel-air ratio and power. The following procedures for manually leaning the cruise mixture and setting up economical fuel flows is based on a torque pressure drop from the best power condition.

During Climb **C D**

Prior to reaching cruising altitude, determine the brake horsepower required to obtain the desired performance. Refer to the power schedule charts in the Appendix.

Note

For long engine durability, it is recommended that 1200 bhp or less be used for normal cruise.

Cruise

After climbing, accelerate to cruising speed at cruising altitude. As airspeed increases, adjust nacelle flaps to establish cylinder head temperature at desired value for cruise.

1. Mixture control in AUTO RICH.
2. Adjust manifold pressure and rpm to cruise settings as obtained from power schedule charts in the Appendix.

CAUTION

- Manual leaning is not permitted above 1200 bhp.
 - When using alternate fuel grade 100/130, do not exceed 1100 bhp in high blower.
3. After three to five minutes to allow for stabilization, move the mixture control levers (one at a time) toward AUTO LEAN until a maximum torque oil pressure reading is obtained. Assure that MAP is set to chart value. This is the best power mixture setting. Note the pressure.

Note

Due to manufacturing and maintenance tolerances, the best power position of the mixture control levers will vary from engine to engine and airplane to airplane. The position may be found at the AUTO RICH position or in a range of travel from AUTO RICH to a point slightly above AUTO LEAN position.

- 3A. If the best power peak cannot be determined or if the AUTO RICH is thought to be leaner than best power, it may be necessary to use prime to establish the setting. When prime is applied with mixture control in AUTO RICH, the following relationships apply (see figure 7-1):

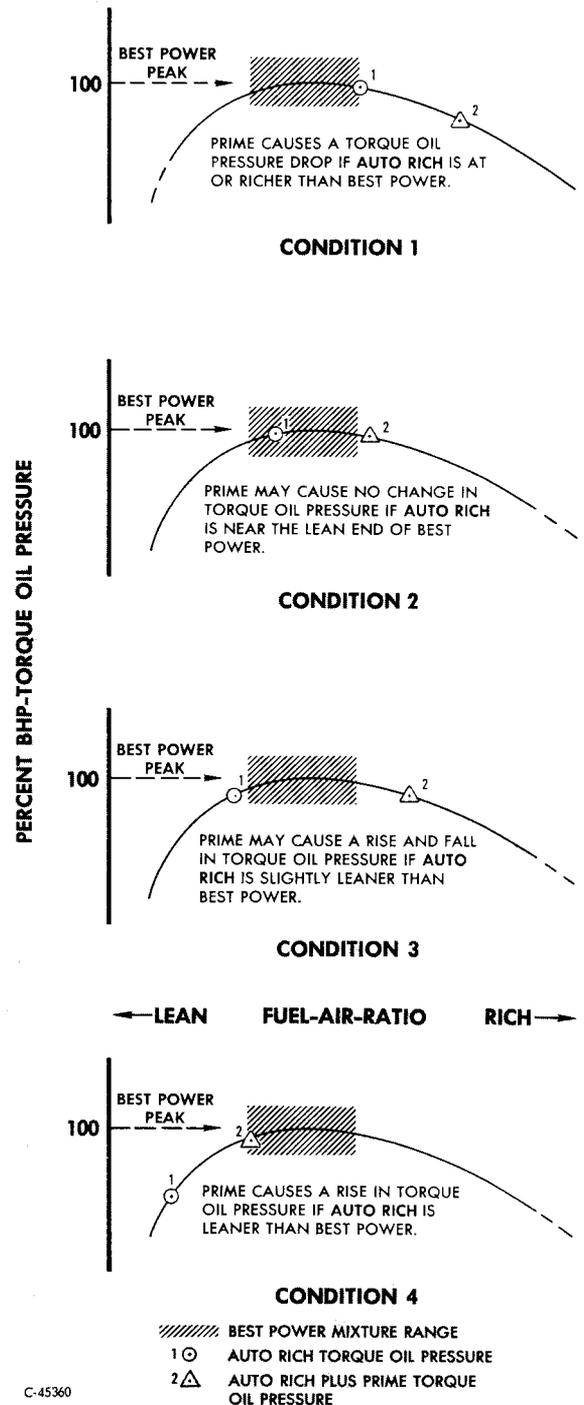
Note

Engage the engine primer and watch the torque oil pressure gage for a rise, drop, or steady indication. Note the maximum torque oil pressure reading and then disengage the primer.

- a. If torque oil pressure drops, AUTO RICH is at or richer than best power. the torque oil pressure will rise as the

EFFECT OF PRIME ON POWER AT VARIOUS AUTO RICH MIXTURES

C & D AIRPLANES



C-45360

Figure 7-1

mixture is manually leaned from AUTO RICH (figure 7-1, Condition 1).

- b. If the torque oil pressure does not change, AUTO RICH is near the lean end of the best power mixture range (figure 7-1, Condition 2).
 - c. If the torque oil pressure rises, or rises and then falls, AUTO RICH is leaner than best power (figure 7-1, Conditions 3 or 4).
4. Further retard the mixture control to obtain a seven psi drop from best power.

CAUTION

During manual leaning, care should be exercised when leaning below the AUTO LEAN position because the fuel flow may decrease rapidly below this point on some carburetors.

5. Periodically check that the mixture setting is the specified torque pressure drop below the best power setting.

Note

If a torquemeter is inoperative, set the specified rpm and manifold pressure and adjust the mixture control lever to obtain chart fuel flow.

This procedure of setting power places final reliance upon the manifold pressure gages and tachometers, but uses the torquemeter as a reference instrument. Further, the torquemeters are the primary instruments for setting cruise power mixtures. This method of setting cruise mixtures by a given torque pressure drop from best power will generally provide a power setting that is optimum for cruise. However, if the AUTO RICH setting is excessively lean (figure 7-1, Condition 4), this drop could result in a setting of less than best economy which might result in unsatisfactory engine operation. If any evidence of engine leanness (such as engine roughness, surging and/or a low cylinder head temperature) is encountered, enrich the mixture as required to attain smooth operation.

CHANGE TO POWER SETTINGS C D

Whenever changes are made to the power settings, it is advisable to check that the resulting torque pressure is the specified amount below the maximum reading. Under cruise power conditions, a one-inch change in manifold pressure or a 100 rpm change will not appreciably affect the relative mixture setting. However, since a change in airspeed, altitude or temperature may affect the metering characteristics of the carburetors, the mixture settings should be periodically checked enroute to ascertain that the torque pressure drop is the correct amount below the maximum reading.

MANUAL MIXTURE ADJUSTMENT C D

At powers from 1200 through 1500 bhp, mixtures may be adjusted to the desired fuel flow figure specified in the appropriate power schedule. Prior to making this adjustment, assure that MAP and rpm are set to chart values. The procedure for manual adjusting of the mixture controls is as follows:

1. Set rpm and manifold pressure for desired power.
2. Manually adjust the mixture control levers to desired fuel flow as specified on the fuel flow charts in the Appendix.

CAUTION

Engine roughness, detonation, and loss of power may result if fuel flow is below the minimum for the desired power setting.

CARBURETOR ICING

When icing conditions are anticipated, it is desirable to apply preventive carburetor heat rather than risk the possibility of having to employ the more drastic de-icing procedures once icing has occurred. A carburetor air temperature of 15-20°C is usually sufficient to prevent severe power loss when entering icing conditions, if applied several minutes prior to entry. The automatic mixture control requires three to five minutes to adjust to large temperature changes and may tend to overcompensate for temperatures appreciably above standard. Therefore, it is desirable to enrich the mixture prior to the application of carburetor heat and allow the automatic mixture control time to stabilize. New power and mixture settings should then be established for the existing carburetor air temperature.

Note

- When preventive preheat is applied, the maximum CAT limit in low and high blower is 38°C and 15°C, respectively. However, this limit has been extended to as high as 30°C for some cruise power combinations as defined in Section V. It is mandatory that these higher CAT limits in high blower—along with the specified BHP, RPM, T PSI, and CHT limits—not be exceeded. If any of these limits are exceeded, the maximum CAT limit reverts to 15°C.
- When preheating with the carburetor heat control in a fixed position, the CAT will fluctuate with changes in power, airspeed, nacelle flap opening, and particularly changes in the moisture content and temperature of the air. It is necessary, therefore, to monitor CAT to assure that sufficient heat for ice prevention is maintained and that the above limits are not exceeded.

The first indication of carburetor ice is normally a change in fuel flow and torque pressure which may or may not be accompanied by a decrease in manifold pressure. If ice forms in the air metering elements of the carburetor, a false decrease in airflow will be sensed and the carburetor will reduce fuel metering proportionally to the reduction in airflow indicated by this faulty sense. If this icing occurs during cruise when the mixture is already on the lean side of best power, it has the same effect as further leaning the mixture, thus effecting a further drop in torque pressure. Another less common type of carburetor icing may be encountered when descending through a warm, moist region with cold-soaked fuel in the tanks. The fuel, acting as a refrigerant, may cause ice to form in the bleeds between the air chambers of the carburetor, thus increasing the metering suction differential and fuel flow. If the mixture is adjusted to the lean side of best power when bleed ice occurs, torque pressure will reach a peak and decrease as the mixture enriches further. Throttle ice, screen ice or any induction ice that restricts airflow would be indicated directly by a loss of manifold pressure and a decrease in fuel flow corresponding to the reduction in airflow. This reduced airflow would also be indicated by a loss in torque pressure which, in all probability, would be the first sign noticed by the pilot. Should carburetor ice occur and be accompanied by a decrease in fuel flow, normal corrective action is to move the mixture control to AUTO RICH and apply full carburetor heat for 30 seconds. However, if icing has been allowed to reach an advanced state where engine power is greatly reduced, the preheat effectiveness of the engine will also be reduced so that it may be necessary to apply full preheat for a longer period of time. The carburetor heat control should then be moved slowly toward the cold position and a check made of fuel flow and torque pressure to assure that the ice has been removed. If determined that the carburetor is free of ice, the CAT should be readjusted to maintain a minimum of 15°C.

Note

Should icing conditions progress far enough to seriously impair engine power, it may be difficult to obtain enough preheat to de-ice the carburetor and engine induction system. In this condition the use of continuous primer may be useful in restoring enough engine power to reestablish a heat source.

When the fuel temperature is known to be well below freezing and bleed ice is encountered, as evidenced by an increased fuel flow, the following de-icing procedure should be used: Apply carburetor heat to maintain the maximum preheat permissible for that particular power combination. As much as five to 15 minutes or longer at maximum preheat temperature may be necessary to restore normal operation. If the carburetor has enriched sufficiently to bring about a severe loss in power, the mixture should be leaned to restore the desired fuel flow and torque

pressure. This leaning, however, should be practiced only in the cruise or climb power range, with the exception of emergency conditions which may dictate this procedure at higher powers. After leaning, fuel flow and torque power should be closely monitored because mixtures will tend to lean out rapidly as the ice is dispelled. With normal operation restored and the ice contributing condition still present, a carburetor air temperature of 15°C should be maintained.

SUBTEMPERATURE OPERATION

Operation at carburetor air temperatures below -10°C will not cause formation of excessive lead deposits. This engine will operate satisfactorily with carburetor air temperature as low as -55°C. The lowest carburetor air temperature at which this engine will operate satisfactorily depends on its condition and the ability to maintain warm cylinder head temperatures of approximately 200°C.

IGNITION SYSTEM

SPARK PLUG FOULING AND LEADING

Spark plug fouling is a principal cause of ignition trouble, which in turn is one of the most common engine maintenance and operating problems with aircraft engines using 115/145 or 100/130 grade fuel. These grades of fuel may contain a relatively high lead content. Such fouling might be defined as an accumulation of deposits which cause misfiring or prevent firing across the spark plug electrodes. The most common types of fouling are lead fouling and carbon fouling, with lead fouling the main troublemaker. Cause, prevention, and cure of spark plug fouling are all linked to the chemistry and physics of the combustion cycle, which in turn are subject to wide variation under different ground and flight engine operating conditions. A logical treatment of the problem involves separate discussion of each aspect of typical engine operation including ground running, takeoff, climb, cruise, and descent. Prevention is the most profitable line of attack on the problem.

IMPORTANT FACTORS

Tetraethyl lead is the most important basic cause of lead fouling. Scavenger agents, such as bromine in the tetraethyl lead, are provided to combine with the lead during combustion and remove it with the exhaust gases. However, under certain conditions of temperature and pressure, the lead will condense out on the spark plug insulator as lead oxide or lead bromide. In the presence of excess carbon as a reducing agent, these may form metallic lead particles. All such deposits can prevent ignition or firing. The best solution is to remove or reduce the lead compounds presently contaminating the fuels. Other pertinent factors which influence plug misfiring include the type of ignition system, spark plug characteristics and time, water injection operation (dry or wet takeoffs), general engine condition including the care and handling of spark plugs, the operating requirements and characteristics of the

particular engine installation and the specific engine operating conditions. In general, spark plug fouling involves a buildup of deposits through prolonged operation under a fixed set of conditions. Prevention and remedy for plug fouling, therefore, depend on taking action to vary these conditions, upset the chemistry of the fouling cycle, and restore good ignition.

CONTROLLED SPARK PLUG ANTI-FOULING PROCEDURES

The following procedures are for cleaning and controlling of spark plug fouling due to oil or excessively rich idle mixture. The importance of maintaining correct idle mixture setting and proper assembly of idle mixture linkage cannot be overemphasized as the most important factors to be considered in providing protection against carbonaceous spark plug fouling.

Ground Running

Prolonged periods of idling may lead to fouling of the spark plugs. "Clearing out" of the engine at ten-minute intervals is required. This is accomplished by placing the mixture in AUTO RICH and then setting the throttle at 35 inches Hg. Move the mixture to AUTO LEAN, allow cylinder head temperature (CHT) to reach 160°C and hold for 30 seconds. (Adjust nacelle flaps if required to obtain desired CHT.) Then return engine to desired power setting. "Clearing out" the engine is particularly pertinent during extended idling while awaiting runway clearance before takeoff.

Note

If unacceptable spark plug performance is experienced, use same procedures as above except, allow CHT to reach a minimum of 180°C and hold for one minute or until engine ignition analyzer indicates acceptable performance. Move mixture control to AUTO RICH. If spark plug performance is still unsatisfactory, repeat the above procedure. In the event a second attempt to clear spark plugs fails to produce satisfactory results, do not attempt to takeoff.

Takeoff

Operational conditions permitting, set brakes and advance throttles very slowly to field barometric pressure. Holding this power setting for 10 to 15 seconds should allow CHT to reach 130°C or stabilize. Release brakes and advance throttles slowly to maximum power. Rapid acceleration to maximum power may cause spark plugs to foul out and misfire. The most common symptoms of spark plug fouling include erratic torque pressure readings and low torque output.

Cruise

Cruise conditions usually generate lead fouling rather than carbon fouling. Conditions which are favorable to lead fouling include prolonged applica-

tion of a given set of powers which is typical of cruising flight. This is especially true of those powers involving very lean mixtures which are at or below best economy. Associated contributing factors include abnormally cool cylinder head temperatures and low manifold pressure. Common symptoms include torqueometer oscillation and backfiring or afterfiring.

Inflight Fouling Protection

A periodic change in engine conditions will usually forestall lead fouling. Here again, prevention is preferable to cure. A reduction in power followed by an increase appears to be the best approach to prevention. The desired results will be obtained by using the following procedure hourly during cruise operation below 875 bhp:

1. Place mixture control in AUTO LEAN.
2. Establish rpm setting for 1100 bhp (three to five seconds per 100 rpm change).
3. Move throttle slowly (three to five seconds per inch MAP change) until manifold pressure for 1100 bhp is established.
4. Hold 1100 bhp for five minutes.
5. Reset desired cruise power.

Note

Periodic fouling protection is not required when operating at or above 875 bhp.

Cure of Fouling

Cure is less certain and includes a wider variety of procedures than prevention. If fouling is detected soon enough, however, it can usually be eliminated or held to a minimum. Generally, plugs which are misfiring or completely fouled are apt to resume firing at lower power settings. Therefore, it is preferable to reduce power and then restore it, rather than attempt to reach a high power setting with malfunctioning plugs. High-power burnout procedures, either with or without water, could chemically change the fouling deposits to an extent that there could be no inflight remedy and the only cure would be to change spark plugs. High-power burnout procedures also introduce the possibility of destructive backfiring during the application of power. If rough engine operation is experienced due to misfiring spark plugs, the following procedure should be followed:

1. Place mixture control in AUTO LEAN.
2. Reduce power until smooth engine operation is obtained and operate at this power for at least one minute.

3. Establish rpm setting for 1100 bhp (three to five seconds per 100 rpm change).
4. Move throttle slowly (three to five seconds per inch MAP change) until manifold pressure 1100 bhp is established.
5. Hold 1100 bhp for five minutes.
6. Reset desired cruise power.

Descent

If a fouling problem is encountered in descent, it can usually be cured by clearing the engine during final approach—with gear down, approach flaps and rpm, and high power level set for one to two minutes prior to landing. When the cylinder head temperatures are up to the cruise range, the plugs will usually be clean and ready for any possible high power requirement.

FUEL SYSTEM

FUEL SYSTEM OPERATION

CAUTION

With sufficient downward fluctuation of fuel pressure, a power loss may occur. The propeller governor will adjust the blades to a flatter pitch in order to keep the engine rpm up to the setting of the governor. If full fuel flow is then suddenly restored, the engine may tend to overspeed before the propeller can return to higher pitch. Proper fuel booster pump operation will prevent this.

Additional information on operation of the fuel booster pumps and the crossfeed system in various unusual circumstances is provided in the following paragraphs. Refer to the Appendix for fuel consumption data.

FUEL BOOSTER PUMP OPERATION

In addition to using the booster pumps for starting, climb, crossfeed, takeoff, and landing, they should be used in flight whenever fuel pressure fluctuates within limits. Sometimes, at high altitudes or with high fuel temperatures, engines will surge because of "vapor lock." This may be brought about by "boiling" of the fuel at high temperatures or at high altitudes after rapid climb. The characteristics of the condition are oscillation of fuel pressure and fuel flow, and flickering of the fuel pressure-low warning light. Booster pumps correct this trouble by decreasing the tendency of the fuel to vaporize in the lines, thus preventing fuel pump cavitation. Fuel booster pumps should be turned on for climb and cruise operation above 10,000 feet. After level off at high altitudes, the booster pumps may be turned off. However, if fuel pressure fluctuates

after the booster pumps have been turned off, they must be turned back on. A momentary fluctuation in fuel pressure may be expected when the booster pumps are turned on or off.

WARNING

The fuel booster pump must not be turned on if fuel pressure drops below operation limits while the engine continues to operate normally. A fuel leak may be responsible for the pressure drop.

FUEL CROSSFEED OPERATION

When operating on crossfeed, the main fuel shutoff valve switch for the tank not being used must be turned to OFF. Unless this is done, fuel may be inadvertently transferred from tank to tank due to a difference in the relief valve settings of the booster pumps.

WARNING

Fuel should not be transferred intentionally from tank to tank. Should intentional or inadvertent transfer take place, pressure might build up in a tank to the extent that fuel would overflow through the vents or rupture the tank.

During the changeover from normal to crossfeed operation, or from crossfeed back to normal, it is very important to maintain constant fuel pressure at all times. If pressure is allowed to drop during the changeover, its resurgence will cause high pressure in the fuel system which might damage the carburetor diaphragm. To prevent this, maintain constant fuel pressure by adhering to the following procedure:

Two-Engine Operation

1. Normal to crossfeed:
 - a. Place both booster pump switches in the ON position.
 - b. Position the crossfeed handle to OPEN.
 - c. Place the main fuel shutoff switch for the unused tank in the OFF position.
 - d. Place the booster pump switch for the unused tank in the OFF position.
2. Crossfeed to normal:
 - a. Place both booster pump switches in the ON position.

- b. Place the main fuel shutoff switch for the unused tank in the ON position.
- c. Turn the crossfeed handle to the OFF position.
- d. Position the booster pump switches as required.

Single-Engine Operation

1. Normal to crossfeed:
 - a. Place both booster pump switches in the ON position.
 - b. Place both main fuel shutoff switches in the ON position.
 - c. Turn the crossfeed handle to the OPEN position.
 - d. Place the main fuel shutoff switch for the unused tank in the OFF position.
 - e. Place the booster pump switch for the unused tank in the OFF position.
2. Crossfeed to normal:
 - a. Place the booster pump switch for the unused tank in the ON position.
 - b. Check that both main fuel shutoff switches are in the ON position.
 - c. Turn the crossfeed handle to the OFF position.
 - d. Place the main fuel shutoff switch for the unused tank in the OFF position.
 - e. Place the booster pump switch for the unused tank in the OFF position.

OIL SYSTEM

RESERVE OIL SYSTEM OPERATION

The engine oil tanks should be reserviced to 20 gallons when the oil tank quantity gage indicates between 9 and 12 gallons during level flight. Reservicing should be started before the oil level in the engine tank falls to 9 gallons.

CAUTION

- The reserve oil system must not be used to reservice the engine oil tanks on the ground (or during flight when the oil level in the engine oil tanks is not critical). Excessive use of the system can cause overdilution of the reserve oil.

- Whenever the reserve oil transfer switch is intentionally or inadvertently released to OFF position, it must remain in OFF for a two-minute period to allow the pump to complete the reverse cycle. Switch actuation to either LH or RH position, while the pump is operating in reverse, will cause the oil transfer pump circuit breaker to pop out. In this event the circuit breaker must be reset to restore circuit power.

During the reverse cycle of the oil transfer pump a small amount of fluid will return to the reserve oil tank. The amount of return, as indicated on the reserve oil tank quantity gage, should not exceed one gallon. If the reserve oil tank continues to fill, a malfunction of the oil transfer pump is indicated. To stop the pump and prevent an overflow of the reserve oil tank, pull the oil transfer pump circuit breaker.

USE OF BRAKES

Brakes, themselves, can merely stop the wheel from turning, but stopping the airplane is dependent on the friction of the tires on the runway. Optimum braking occurs with approximately a 15 to 20% rolling skid; i. e., the wheel continues to rotate but has approximately 15 to 20% slippage on the surface. As the amount of skid increases, friction decreases because the first immediate action is to scuff the rubber, tearing off little pieces which act almost like rollers under the tire. The heat generated starts to melt the rubber and the molten rubber acts as a lubricant. Therefore, if one wheel is locked, during application of brakes, there is a very definite tendency for the airplane to turn away from that wheel. Further application of brake pressure will offer no corrective action. To minimize brake wear, the following precautions shall be observed when practicable:

1. Use extreme care when applying brakes immediately after touchdown, or at any time when there is considerable lift on the wings, to prevent excessive skidding of tires which will cause flat spots. A heavy brake pressure can result in locking the wheel more easily if brakes are applied immediately after touchdown than if the same pressure is applied after the full weight of the airplane is on the wheels. A wheel once locked in this manner immediately after touchdown will not become unlocked as the load is increased, as long as brake pressure is maintained. Proper braking action cannot be expected until the tires are carrying heavy loads.
2. The full landing roll and reverse thrust should be utilized to take advantage of aerodynamic braking and to use the brakes as little and as lightly as possible.

3. If maximum braking is required after touchdown, lift should first be decreased as much as possible by raising the flaps and dropping the nose before applying brakes. This procedure will improve braking action by increasing the frictional force between the tires and the runway.
4. For short landing rolls, a single smooth application of the brakes with constantly increasing pedal pressure is most desirable. This procedure applies equally well for operation of the emergency braking system.
5. If brakes are used excessively, as in performing a short field or brakes only landing, or steering with brakes, it is recommended that a minimum of 15 minutes elapse between landings if the landing gear remains extended in the slipstream, and a minimum of 30 minutes elapse between landings if the landing gear is retracted. This will allow adequate cooling time between brake applications. In a normal landing, utilizing reverse thrust and no brakes until after the airplane has lost nearly all its forward motion, brake use will not be excessive and a cooling period is not required.
6. The brakes should not be dragged while taxiing, and should be used as little as possible for turning the airplane on the ground.
7. At the first indication of brake malfunction, or if the brakes are suspected to be in an overheated condition after excessive use, the airplane should be maneuvered off the active runway and stopped. The airplane should not be taxied into a crowded parking area and the parking brakes should not be set. Overheated wheels and brakes shall be cooled before the airplane is subsequently towed or taxied. Peak temperatures in the wheel and brake assembly are not attained until some time

after a maximum braking operation is completed. In extreme cases, heat buildup can cause the wheel and tire to fail with explosive force or be destroyed by fire if proper cooling is not effected. Taxiing at low speeds to obtain air cooling of overheated brakes will not reduce temperatures adequately and can actually cause additional heat buildup.

LANDING GEAR SAFETY CIRCUIT

When the weight of the airplane compresses the landing gear shock struts, a microswitch on the left main landing gear shock strut actuates the landing gear safety circuit. The safety circuit provides the following regulations to certain systems:

1. Opens the solenoid-operated cabin pressure dump valve to prevent cabin pressurization on the ground and relieve cabin pressure upon landing. **B C D**
2. Energizes the solenoid-operated latch stops while on the ground so that throttles may be placed in the reverse thrust range; deenergizes the latch stops when airborne to prevent inadvertent propeller reversal.
3. Energizes the landing gear lever lock solenoid in the pedestal to prevent movement of the landing gear lever from the DOWN position while the airplane is on the ground.
4. Disarms the alternator-generator cooling scoops de-icing system so that it cannot be operated on the ground. **B C D**
5. Opens the refrigeration bypass valve to prevent operation of refrigeration unit while the airplane is on the ground. **B C D**

The landing gear safety circuit receives power from the dc main bus and is protected by the LG LOCK SOLENOID circuit breaker.

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CREW DUTIES
section VIII

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INTRODUCTION

In this Section, primary and alternate duties are discussed for the pilot, copilot and flight engineer who make up the basic flight crew.

Note

Major commands may authorize operation with only a pilot and copilot when required for the command mission accomplishment.

Duties relating to the pilot, copilot, and flight engineer do not include information already covered in Section II. Duties are also suggested for the following men, one or more of whom may be on board for any particular flight: radio operator, navigator, and navigator/bombardier. All duties connected with operating the airplane itself can be performed by the pilot, copilot, and flight engineer. Duties

suggested for other persons are related more to conduct of the mission than to operation of the airplane.

PILOT

You have overall responsibility for the airplane and for efficient performance of all duties. You must see to it that the other men on board understand their specific duties and know when they are to be performed. Also arrange to have all persons briefed on normal and emergency procedures and on correct use of equipment in accordance with passenger briefing checklist, this section. Make sure that instructors are thoroughly familiar with equipment that will affect their work. For example, automatic and manual operation of such equipment as the electrical load monitoring system, air-conditioning system, and autopilot turn control transfer should be made clear to the persons concerned. Before each flight, appoint one man to be in charge of the cabin. Before an over-water flight, assign ditching duties and responsibility for security.

COPILOT

As copilot, you must be able to substitute for the pilot in any of his duties. For that reason, you must be familiar with his duties as well as your own. In addition to your duties as copilot you will sometimes perform the following operations:

Engine starting and operation
Secondary flight control, including use of the autopilot
Instrument flight

FLIGHT ENGINEER'S DUTIES**Note**

HQ USAF (AFOMORO) letter, 28 Oct 69, "Utilization of Flight Engineer (A435XO)" names all aircraft that require a Flight Engineer (A435XO) as a crew member. T-29/C-131 aircraft are not listed as Flight Engineer aircraft but will now be authorized a Flight Mechanic (A431XO/1). Since the words Flight Engineer or the letters "FE" now occur throughout the entire flight manual, no attempt will be made to change over to Flight Mechanic or FM until the next revision of the flight manual.

When the airplane is away from its home base, you are responsible for the maintenance, servicing, inspection, and securing of the airplane on the ground, and for determining that all miscellaneous and emergency equipment is aboard the airplane and properly installed or stowed before flight. You will be called upon to perform such other duties as the pilot may direct.

BEFORE ENTERING THE AIRPLANE

Accompany the pilot and the copilot and assist them in making the exterior inspection.

ON ENTERING THE AIRPLANE

1. Read the check list and where applicable challenge crew members for the proper accomplishment of each item on the check list. If no response is given for a particular item, STOP and demand a response before continuing.
2. Supervise the loading of passenger equipment and aid the steward in seating of personnel in the cabin.

Note

The flight engineer should monitor radio communications during all takeoffs, descents and landings.

IN FLIGHT

1. Constantly monitor the engines and mechanical conditions of the airplane.
2. Make necessary entries in engine logs.

AFTER ENGINES ARE STOPPED

1. Open the entrance door.
2. Supervise the unloading of passenger equipment.

WHEN LEAVING THE AIRPLANE

1. Assist the pilot and copilot in inspecting the interior of the airplane for proper condition and stowage of equipment.
2. Check controls gust lock for locked position.
3. Close the entrance door from the outside.
4. Inspect the exterior of the airplane, checking that the wheel chocks are in place. Install pitot covers and landing gear ground lock pins.

RADIO OPERATOR'S DUTIES**A B C**

You are responsible for operating the communication equipment and for sending and receiving the necessary radio messages. You also have control over electrical power distribution to the training equipment in the cabin. Equipment which you are usually required to operate:

Cabin dome light breaker switches

Navigation radio switch (some airplanes) (connects and disconnects dc power to navigation and training equipment)

Pilot's radio altimeter

BEFORE ENTERING THE AIRPLANE

Inspect the exterior antennas, loop housings, and trailing antenna installation for security and cleanliness.

ON ENTERING THE AIRPLANE

1. Check Form 781 and the radio equipment to make sure that all equipment is aboard in its proper place and ready to function.
2. Determine that the spare trailing antenna is aboard and stowed.
3. Check radio circuit breaker panel.
4. Check radio fuse blocks to see that all fuses are in place and in good condition.
5. For night flight, turn on the cabin dome lights.

GROUND TEST

1. Check operation of interphone.
2. Get approval from the copilot to use electrical power for testing operation of the communication equipment.
3. Turn on and test the operation of all communication equipment.

CAUTION

Before placing the navigation radio switch ON, make sure that all radar equipment is off. Damage to radar equipment may result if the switch is operated while radar equipment is on.

DURING FLIGHT

1. Operate the communication equipment, except for voice communication from and to the pilots.

BEFORE LANDING

1. See that the trailing antenna is retracted.

BEFORE LEAVING THE AIRPLANE

1. Turn all switches to OFF.

**NAVIGATOR, NAVIGATOR/
BOMBARDIER'S DUTIES**

You are responsible for assisting the pilot in all matters pertaining to mission planning, navigation and any other related duties assigned by the pilot. You should know the position of the aircraft at all times, provide the necessary information for position reports, maintain an accurate record of the flight and keep the crew informed of flight progress.

Note

For purposes of this checklist, navigators, navigator/bombardiers and instructor personnel in these specialties will perform duties as outlined in the Navigator's Checklist. Equipment not utilized by a single rated navigator in his rated specialty (i. e. , K-3A equipment) need not be preflighted.

MISSION PREPARATION

1. Weather – Checked.
2. Flight plan – Completed.
This item should be coordinated with the pilot to assist him in completion of AF Form 175.
3. Time back – Obtained.
4. Professional equipment – As required.
All items deemed necessary for successful completion of the mission should be assembled.

EXTERIOR INSPECTION

1. Radome – Undamaged, drainhole clear.
2. Driftmeter – Secure and glass clean.
3. Trailing wire antenna – Fully retracted. **A B C**

INTERIOR INSPECTION (POWER OFF)

1. Form 781 – Checked.
2. Navigation radio switch – ON **A B C**
3. Circuit breakers – In.
Check gyro compass and filament circuit breakers on main C/B panel. Check other C/B's as applicable to the equipment that will be used.
4. Trailing wire antenna switch – OFF **A B C**
5. Emergency equipment – Aboard and stowed (Preflighted when applicable).
6. Oxygen equipment – Checked.
Check the portable oxygen bottles to insure they are charged to aircraft system pressure.
7. Loran sets – OFF.
8. SCR-718's – OFF.
9. Driftmeters – Caged, OFF and aligned to zero drift.

Accomplish check before placing power and function switches to STANDBY. If AC voltage is below 112, above 117, or fluctuating, do not turn set on.

2. Computer function switch-- STANDBY.
- **3. Radar power switch-- STANDBY.
- **4. Radar meter switch-- AC . . . AC MARKER
+26.5 . . . DC MARKER

Allow 5-minute warmup period prior to going to next item.

Note

A time delay relay controls a 5-minute warm-up period. When the warm-up period is completed the 5-mile lamp on the main indicator will go out and the 10-mile lamp on all indicators will light.

- **5. Radar power switch--SCAN FAST.

CAUTION

Do not operate above 50 NM range, in BEACON or SWEEP DELAY until the set has been on for at least 30 minutes.

6. Computer function switch--Search. Placing function switch in SEARCH will provide azimuth stabilization for true north orientation of presentation.
- **7. Radar meter switch--Check all readings.
 - a. MAG 4, 3-5.8 divisions. Adjust with auto transformer (VARIAC).
 - b. XTAL 5-10 divisions.
 - c. MOD HV Approx 8 divisions.
 - d. IND HV 9 - 11 divisions.
 - e. AC AC MARKER.
 - f. +26.5 DC MARKER.
 - g. -300 DC MARKER.
 - h. -105 DC MARKER.
 - i. +150 DC MARKER.
 - j. +300 DC MARKER.
 - k. +600 12-18 divisions.
- **8. Radar meter switch--Return to MAG.

- Δ9. Monitor voltmeter--Reference block after 30 minutes of operation.
10. Computer power supply meter switch--Check all readings.

Note

For each voltage check, depress LO sensitivity button first, then HI. Do not check HI sensitivity if meter reading on LO is off center more than one major division.

- a. +150 . . . LO (within one major division)
HI (within two major divisions)
- b. +300 . . . LO (within one major division)
HI (within two major divisions)
- c. -150 . . . LO (within one major division)
HI (meter should read on the scale)

11. Computer power supply meter switch--OFF.
12. True airspeed meter test switch--NORMAL.

Pedestal Amplitude, Focus & Sweep Centering

- **1. Bias--CW until sweep is just visible.
- **2. Video gain--Fully CW. Sweep should dim slightly and return to same intensity as control reaches full CW position. If necessary adjust pedestal amplitude.

Note

Adjust pedestal amplitude (SN-47) while video gain is positioned in full CW position. Use video balance controls (AM-425) to adjust pedestal amplitude on repeater indicators. Repeater indicators are numbered CW from position #7 **A B C**.

- a. Pedestal amplitude-- Adjusted.
- b. Video gain-- Mid-point.
- c. Bias-- Sweep just below visibility.
- **3. Brilliance mark-- CW as desired.
- **4. Focus-- Adjusted. Adjust for maximum sharpness of range marks.
5. Sweep length-- Checked and adjusted. Adjust sweep length until fourth range mark is clearly visible. (Adjustment located on SN-47.)

- 6. Sweep amplitude—Adjusted.
Adjust until end of sweep is visible on outer edge of scope.
- **7. Vertical and horizontal centering—Center sweep.
Recheck centering each time after focusing.

Tuning Procedure

- **1. Radar receiver gain—Optimum adjustment.
- **2. Radar tuning—Radar AFC.
If presentation is poor, switch to radar manual—tune for best presentation.
- **3. Tilt—Optimum adjustment.
Adjust for maximum returns along full length of sweep.
- **4. Video gain—Below blooming.
- **5. Radar contrast—As desired.
- **6. Altitude control—Set approximate radar altitude.

Note

This adjustment must be at cruising altitude and changed as necessary.

Long Range, Sweep Delay and Beacon



Do not operate above 50-mile range or in sweep delay until set has been on for at least 30 minutes.

- 1. Long range tuning:
 - a. Range As desired.
 - b. VARIAC Adjust MAG CURRENT:
 - 9.8 - 12.8 divisions over 50 to 100 mile range.
 - 10 - 12 divisions over 100 mile range
 - 10 - 12 divisions, sweep delay
 - 9.6 - 12.1 divisions, Beacon

Crosshairs Check

- 1. Range computer crosshair-range mark switch—CROSSHAIR.
- 2. Indicator scale illumination—As desired.

- 3. Computer control function switch—NAV or BOMB while holding one fix slew depressed. Azimuth marker should be at 360°, vertex of scanned sector should be at scope edge at 180°. Release fix slew before returning to SEARCH.
- 4. Function switch—SEARCH.

Tracking Handle Check

Tracking handle Pull increases N fix
Push decreases N fix
CW increases E fix
CCW decreases E fix

Wind Determination Check

- 1. Range computer fix slews—Return to N-10, E-0 (not driving).
- 2. Computer wind determination—START (green light extinguishes).
- 3. Computer tracking handle Pull increases N wind
Push decreases N wind
CW increases E wind
CCW decreases E wind
(check each dial individually for smooth operation; insure other dial does not move).
- 4. Computer wind determination—STOP (green light illuminates).
- 5. Ballistics computer wind slews—Set to ZERO or predicted wind.

Auxiliary Equipment

- **1. Radar pressurization—Checked.
Maintain pressure between 28.5 and 32.5 inches Hg.
- 2. Heading marker check (AZSTAB ON)—
Heading marker should read TH of aircraft. Heading marker can be adjusted with backlash or MAG VAR.
- 3. Heading marker check (AZSTAB OFF)—
Heading marker should read 360°. Some heading marker error can be removed using backlash.
- 4. True airspeed meter—NORMAL or HOLD.
Compute level flight TAS. If meter reading is within 5 knots of computed TAS, leave test switch at NORMAL, otherwise set in TAS computation and place test switch at HOLD.

- **5. Radar Voltages—Periodically recheck voltages, record discrepancies.

Turn Off

- **1. Radar meter switch—Check voltages, record discrepancies.
2. Radar receiver gain—Fully CCW.
3. Monitor voltmeter—Check needle position, record discrepancies.
4. Computer power supply meter switch—Check voltages, record discrepancies.
5. True airspeed meter test switch—OPERATE, set in 300K, then HOLD.
- Δ6. Indicator bias, video gain, brilliance marks—Fully CCW.
7. Applicable units illumination controls—Fully CCW.
- Δ8. Auto transformer—73 VOLT.
9. Computer control function switch—OFF.
10. Radar control power switch—OFF.

K-3A/APS-23 RADAR PREOPERATIONAL, TURN-ON, TUNING AND TURN-OFF PROCEDURES

Preoperational Check

1. RT unit—Cables secure.
2. Forward auxiliary scopes (2)—Bias & video gain full CCW.
3. J-379 junction box—Cables & fuses secure (3800 Series).
4. AM-425/APA-82 Synchronizer—Cables & locking nuts secure.
5. Airspeed & altitude variation transmitter—VA correction noted.
6. PP-352—Cables secure.
7. AM-193—Cables secure & STAB/UNSTAB switch in STAB.
8. PP-259(2)—Cables secure.
9. Modulator—Cables secure.
10. J-438—Cables secure & fuses in place (2300 series).
11. Tracking computer—CSM switch on & VA correction set.

12. Polar converter—Cables secure.
13. Bombing computer—Cables secure.
14. A-1 power supplies (2)—Secure.
15. SAU—By-Pass switch ON, cables, amplifiers & fuses secure (8800 series).
16. CAU—Cables, amplifiers & fuses secure (8600 Series).
17. Spare amplifier rack—Spares in place.
18. 0-15 camera—OFF.
19. Clamshell doors—Checked for operation & closed.
20. SN-57—Cables & fuses secure (3700 series) and CAC/OPER switch, OPER.
21. Auxiliary scope—Bias & gain CCW.
22. Periscope reticle intensity—CCW.
23. BAI (B-scope) intensity—CCW.
24. Periscope dc power switch—OFF (Right).
25. Polar nav unit
- a. Nav method switch—Normal.
- b. Polar Angle Dial—Zero.
- c. Hemisphere switch—As applicable.
26. Navigation power panel
- a. Circuit breakers—Set.
- b. Master power & inverter switches—OFF.
- c. Preheat switch—Normal.
27. Ballistics control
- a. Bomb mode switch—SYN.
- b. Ballistics—Set as required.
28. Bomb control panel—Set as required.
29. D-2 nav unit
- a. Ref. point switch—Planes POS.
- b. Lat. & long. counter set knobs—In detent.
30. Radar pressure control switch—Normal, ON.
31. Line of sight control, boresight switch—Normal.

- 32. PPI
 - a. Bias—CCW.
 - b. Range lights—CW.
 - c. Sector amplitude—CW (In detent).
 - d. Video gain—CCW.
 - e. Scale illuminator—CCW.
 - f. Brill marks—CW.
 - g. Backlash control—CCW.
- 33. Radar control unit
 - a. Power switch—OFF.
 - b. Meter switch—AC.
 - c. Contrast—CCW.
 - d. Receiver gain (RCO or STC)—CCW.
 - e. Anti-jam/HIRES/HIGAIN—OFF/HIRES.
 - f. Illumination—CW.
 - g. Tuning switch—RAD AFC.
 - h. Sweep delay—CCW & depressed.
 - i. Tilt—Zero.
 - j. Range knob—48 NM.
- 34. Primary control
 - a. Function switch—OFF.
 - b. Range mark/cross hair switch—Range marks.
 - c. PPI/OB switch—PPI.
 - d. Radar altitude switch—OFF.
 - e. Offset switch—Out.
 - f. Aux PPI or nav track switch—Normal (Down).
- 35. Turn control—In detent.
- 36. Variac—73 Divisions.

Turn On, Tuning, and Equipment Check

- 1. Aircraft power—Received from pilot.
- 2. Inverter switches—ON-MAIN.

- 3. Master power switch—Ship's power.
- 4. Power meter switches—Check voltages (115, ±5) and frequencies (400, ±20).
- 5. Function switch—STAB.
Wait two minutes before proceeding to next step. This prevents possible damage to the antenna tilt motor and to the azimuth computer.
- 6. Function switch—NAV.
- 7. Radar Power Switch—STANDBY.
Recheck unregulated AC for tolerance.
- 8. Test meter:

AC	AC Block
26.5	DC Block
- 9. Radar pressure—Checked in the green.
- 10. Latitude & longitude set knobs—Set coordinates of position. Check X_E and X_N nav. amplifiers.
- 11. Mag. var. knob—Rotate; A_T dial on TH Unit should change. Reset to correct variation. Check mag var, gyrosyn, and aero heading amplifiers.
- 12. Function switch—TRACK.
- 13. Memory point switch—MEMORY POINT.
- 14. Tracking control—Set metro wind.
- 15. Function switch—NAV.

Note

5-minute warmup period complete when 10 NM range light illuminated.

- 16. Radar power switch—SCAN FAST.



Do not operate above 50 NM range, nor on BEACON or SWEEP DELAY, until the set has been on for at least 30 minutes.

- 17. Test meter—Readings checked.
 - a. MAG 4.6 to 5.8 (adjust variac)
 - b. Mod HV . . . 8 divisions (adjust variac)
 - c. +600 10-18 divisions
 - d. +300 DC Block

- | | |
|---|--|
| <ul style="list-style-type: none"> e. +150 DC Block f. -105 DC Block g. -300 DC Block h. Ind Hi Volt . DC Block i. XTAL 5-10 divisions <ul style="list-style-type: none"> 18. Bias—CW until rotating sweep is visible, then CCW until sweep is just below visibility. 19. Video gain—CW to approximate mid-point. 20. Brilliance marks — CW until fixed range and heading marks are visible and of desired intensity. 21. Sweep length—Adjust until fourth fixed range mark is plainly visible. 22. Sweep amplitude—Adjust until end of sweep is visible on outer edge of scope. 23. Altitude correction knob—Set approx pressure altitude. 24. Brilliance marks — CCW. 25. Receiver gain—Optimum adjustment. 26. Video gain — Below blooming. 27. Contrast—As desired. 28. Tilt—As desired. 29. Brilliance marks — CW for desired intensity. 30. Bombing mode switch—LOS. 31. Boresight switch—SA or AZ. 32. Boresight light—<u>Must be on before proceeding.</u> Illumination of boresight light indicates BNS has passed first timing period. 33. Boresight Switch—Normal (after light on). 34. Bombing mode switch—SYN. 35. True heading—Apply variation to pilot's mag. heading; compare this value with AT dial and PPI heading marker. 36. Receiver gain—CCW. 37. Function switch—Track. 38. Tracking control—Set $X_E - 0$, $X_N - 10$ or more; insure that the vertex of the sector is at approximately 180° on periphery of scope | <p>and azimuth mark passes through center of scope. Set $X_E - 10$, or more, $X_N - 0$; insure that the vertex of sector is at approximately 270° on periphery of scope and azimuth mark passes through center of scope. If vertex is not on periphery of scope, adjust horizontal and vertical displaced center on SN-47.</p> <ul style="list-style-type: none"> 39. Range mark crosshair switch—Balance intensity of crosshairs using range and azimuth mark size adjustments on SN-47. The intensity of crosshairs and FRMs should be approximately the same. 40. Altitude switch—ON. Sector should be 50°; if not, adjust sector width on SN-57. 41. Altitude switch—OFF. 42. Periscope dc power—ON. 43. RAI intensity—CW until sweep just barely visible. 44. RAI focus—Adjust for maximum sharpness of crosshairs. 45. Forward sighting button—Depress and hold; periscope beta dial should read approximately 68°, azimuth dial 0°. 46. PPI/OB switch—OB. 47. Function switch—BOMB. Check that T_G is driving. To change T_G, move tracking control forward to increase; aft to decrease. Check T_{IV_A}, -L, T_I amplifier. 48. ATF knob — Check that T_G changes (check T_F amplifier). 49. Tracking control—Move right or left; PDI should respond. (Check A_R Amp.) Check that C-1 indicator follows. 50. PPI/OB switch—PPI. 51. Function switch—NAV. 52. Pedestal amplitude—Adjusted. |
|---|--|

Turn Off

- 1. Variac — 73.
- 2. Turn off:
 - a. Bias (all scopes) CCW
 - b. Video gain (all scopes) CCW

- c. Receiver gain CCW
- d. Range knob 40 NM
- e. B-scope intensity CCW
- f. Navigation method control NORMAL
- 3. Function switch—OFF.
- 4. Radar power switch—OFF.
- 5. Ship's power switch—OFF.
- 6. Inverters—Notify pilot that radar power is off; ready for landing.
- 7. Clamshell doors—Closed.

Note

For rapid turn off (airborne radar approach) Step 2 may be accomplished as the last item.

FLIGHT STEWARD'S DUTIES

Note

Some T-29 aircraft have been modified to the passenger configuration and the Flight Steward is an authorized crew member on these VT-29 aircraft.

As flight steward you are responsible for all activities in the cabin as directed by the pilot. The safety and comfort of the passengers is your prime responsibility. You will determine that all miscellaneous and emergency equipment installed in the cabin is aboard the airplane and properly installed or stowed before flight. You will determine that the lavatories and galley are properly cleaned, and proper supplies are aboard before flight. In flight, you may be called upon to perform such other duties as the pilot may direct.

BEFORE ENTERING THE AIRPLANE

Check with the pilot to ascertain the type of flight and the number of passengers aboard and equip the galley as deemed necessary for the flight.

ON ENTERING THE AIRPLANE

- 1. Inspect the interior of the cabin, cargo compartments, lavatories and galley.
- 2. Supervise loading of passengers and assist in loading of passenger baggage. Ensure that baggage and loose equipment is stowed and secured.
- 3. When all personnel are aboard, check that the rear service door is closed and latched.
- 4. Ensure that smoking rules are observed until the no smoking sign is turned off.

- 5. Prior to takeoff, check that all passenger seat belts are fastened and that seat backs are in upright position.
- 6. Complete passenger briefing.
- 7. Report to pilot - Cabin secured.
- 8. Take your position for takeoff with safety belt fastened.

DURING FLIGHT

- 1. Act as the pilot's safety agent in the cabin, keeping a constant alert for hazards to safety such as oil leaks, fuel leaks, smoke or fires.
- 2. Assure that seat belt and no smoking sign instructions are obeyed.
- 3. Endeavor to ensure the passengers a safe and comfortable flight by being constantly alert to their actions and needs.
- 4. Prepare and serve any required inflight meals. Dispense coffee/water, etc.
- 5. Inform the pilot immediately of any unusual conditions observed.

BEFORE LANDING

- 1. Latrines - Vacant.
- 2. Secure loose equipment.
- 3. Check that seat belts are fastened and that seat backs are in upright position.
- 4. Report to pilot - Cabin secured.

AFTER THE ENGINES ARE STOPPED

- 1. Supervise unloading and the safety of all passengers while deplaning.
- 2. Report aircraft discrepancies to pilot in command.

Note

Aircraft commander will delegate necessary duties to other crew members if a flight steward is not assigned as a crew member.

EMERGENCY PROCEDURES—FLIGHT STEWARD

Crash Landing

- 1. Supervise seating of passengers. Distribute the available pillows, blankets, etc. for cushioning head.
- 2. Instruct passengers to fasten safety belts tightly; loosen collars and ties; remove eye glasses, dentures and any sharp objects.
- 3. Caution passengers not to smoke.
- 4. Warn passengers not to open exits if fire exists outside.
- 5. Select able bodied passengers as assistants and instruct them on method of removal of emergency exits.

6. Remove forward tables in the passenger compartment. Supervise removal and jettisoning and/or securing of loose equipment.
7. Turn on impact lights if at night, and proceed to a vacant passenger seat. If none is available, use steward's seat and fasten safety belt just prior to landing.
8. After landing, open rear service door. Unload first aid kits and other emergency gear.
9. Direct evacuation of passengers and ascertain that all are accounted for after evacuation.
10. Assume responsibility for removal of the emergency transmitter.

Ditching

1. Direct and assist passengers to don life jackets (do not inflate).
2. Supervise seating of passengers. Distribute available pillows, blankets, etc., for cushioning head.
3. Instruct passengers to fasten safety belts tightly; loosen collars and ties; remove eye glasses, dentures, shoes, and any sharp objects.
4. Caution passengers not to smoke.
5. Warn passengers not to open exits if fire exists outside or if exit is below water level.
6. Select able bodied passengers as assistants and instruct them on method of removal of emergency exits.
7. Remove forward tables in passenger compartment. Supervise removal and jettisoning and/or securing of loose equipment.
8. Turn on impact lights if at night, and proceed to a vacant passenger seat. If none is available, use steward's seat and fasten safety belt just prior to landing.
9. After landing, open rear service door and aid flight engineer in launching life raft. Unload first aid kits and other emergency gear.
10. Direct evacuation of passengers and ascertain that all are accounted for after evacuation.
11. Assume responsibility for removal of the emergency transmitter.

PASSENGER BRIEFING CHECKLIST

PREDEPARTURE BRIEFING

1. Briefing crew members name.
2. Airplane commanders name.
3. Destination.
4. Flight altitude.
5. Estimated time enroute.
6. Demonstrate the use of oxygen equipment.
7. Demonstrate the use of parachutes (if applicable).
8. Demonstrate the use of seat belts.
9. Indicate location of emergency equipment.
10. Describe procedures to be used during an in-flight emergency.
11. Describe warning signals.
12. Caution passengers against the use of electronic equipment (portable radios, recorders, etc.).
13. Advise passengers of information cards.

OVERWATER BRIEFING

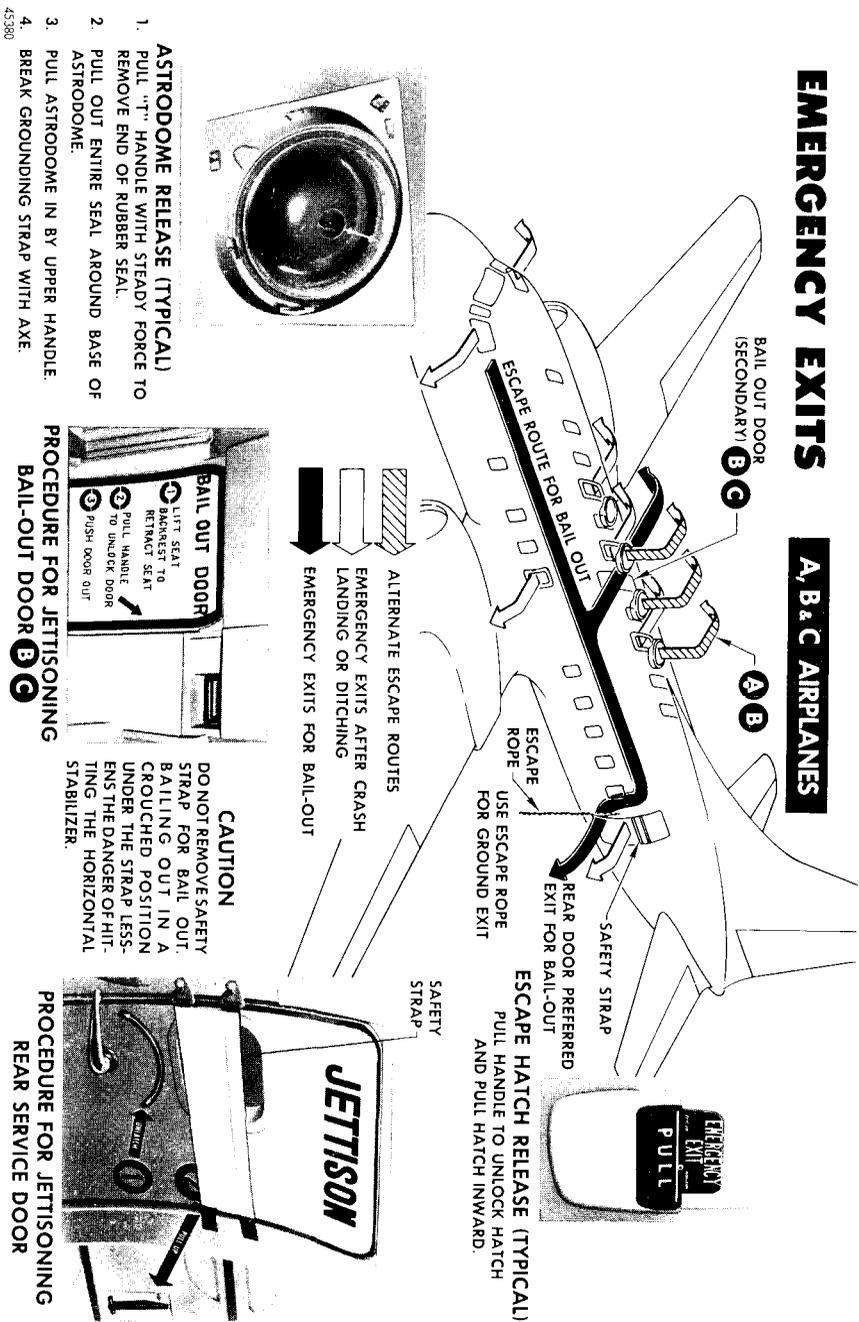
1. Describe applicable emergency equipment.
2. Describe ditching procedures.

ARRIVAL BRIEFING

1. Announce arrival time.
2. Caution passengers to observe seat belt and no smoking signs.
3. Provide any additional information as applicable.

The remaining pages in this Section contain passenger information and may be removed for local reproduction without destroying the continuity of this manual.

- The navigator's abbreviated checklist is contained in T. O. 1T-29A-1CL-2.
- The flight steward's abbreviated checklist is contained in T. O. 1T-29A-1CL-3.

EMERGENCY EXITS**A, B & C AIRPLANES**

- ASTRODOME RELEASE (TYPICAL)**
1. PULL "T" HANDLE WITH STEADY FORCE TO REMOVE END OF RUBBER SEAL.
 2. PULL OUT ENTIRE SEAL AROUND BASE OF ASTRODOME.
 3. PULL ASTRODOME IN BY UPPER HANDLE.
 4. BREAK GROUNDING STRAP WITH AXE.

PASSENGER INFORMATION

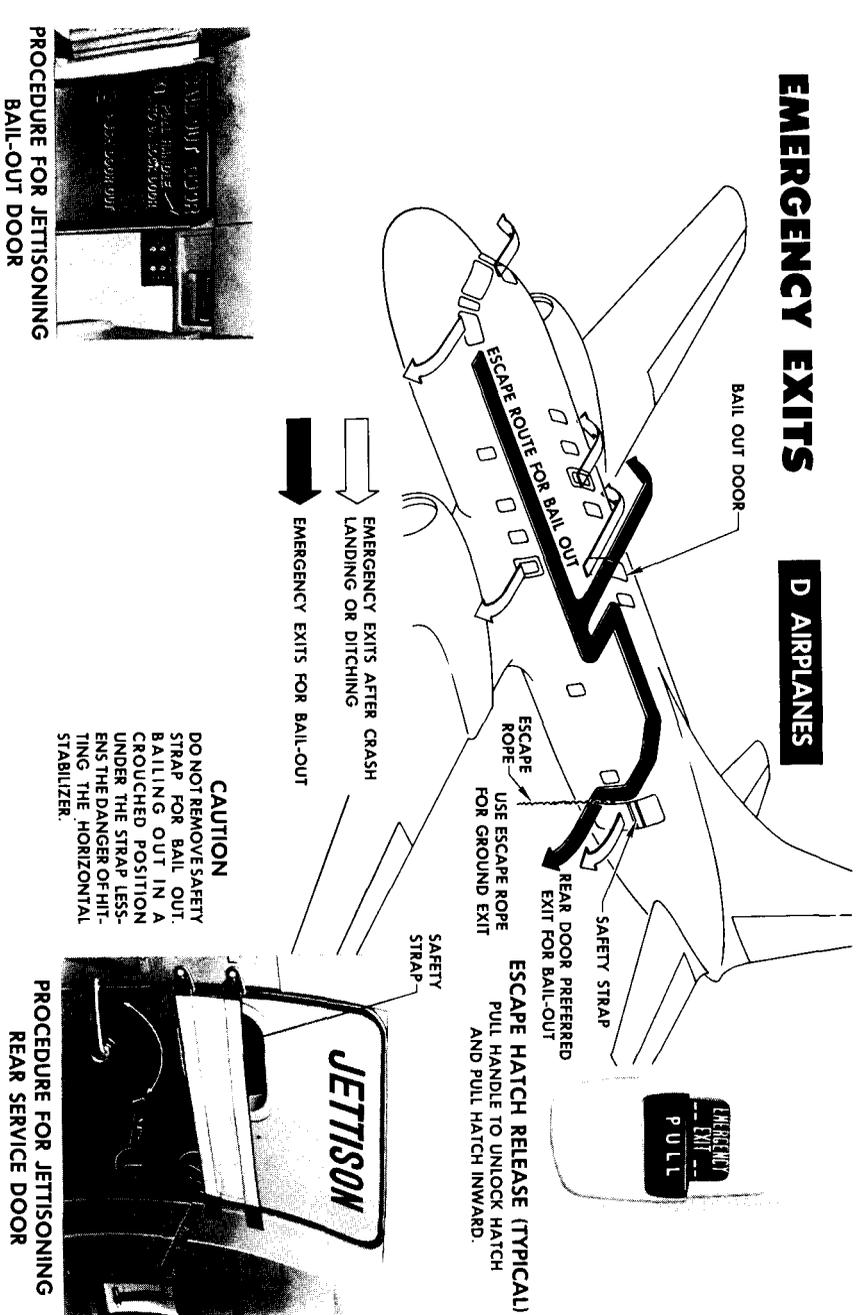
1. Please observe seat belt and no smoking signs. Seat belts will be fastened during takeoff and landing and at any time during flight as instructed by the pilot. Smoking is prohibited during all ground operations, during and immediately after takeoff and before landings, and at any time during flight as instructed by the pilot.
2. In the event of an inflight emergency, remain seated with the seat belt fastened and follow the pilot's or crew members instructions.
3. Emergency exits and escape routes are shown on the reverse side of this card.

BAIL OUT

1. If the pilot decides that the crew and passengers must bail out, he will alert the crew and passengers with three short rings on the alarm bell. If time and circumstances permit, the pilot will discuss the emergency situation over the interphone and public address system.
2. A crew member will instruct the passengers on bail out procedures, and held adjust the parachutes.
3. The pilot will give the bail out signal; one sustained ring of the alarm bell, and the crew will supervise bail out proceedings.

CRASH LANDING OR DITCHING

1. If a crash landing or ditching situation has developed, the pilot will alert the crew and passengers with six short rings of the alarm bell.
2. Fasten seat belt securely.
3. Remove cords, ties, straps; loosen collar, and parachute harness, don life vest (if applicable) but do not inflate.
4. A crew member will advise passengers which escape routes to use and aid in adjusting life vests.
5. If blankets or pillows are available, use to protect face.
6. Just prior to impact, the pilot will alert the crew and passengers with one long sustained ring of the alarm bell.
7. Brace for impact.
8. Hold crash landing positions until after the airplane has stopped moving.
9. Remove seat belt and follow the crews instructions for evacuation.

EMERGENCY EXITS**D AIRPLANES****PASSENGER INFORMATION**

1. Please observe seat belt and no smoking signs. Seat belts will be fastened during takeoff and landing and at any time during flight as instructed by the pilot. Smoking is prohibited during all ground operations, during and immediately after takeoff and before landings, and at any time during flight as instructed by the pilot.
2. In the event of an inflight emergency, remain seated with the seat belt fastened and follow the pilot's or crew members instructions.
3. Emergency exits and escape routes are shown on the reverse side of this card.

BAIL OUT

1. If the pilot decides that the crew and passengers must bail out, he will alert the crew and passengers with three short rings on the alarm bell. If time and circumstances permit, the pilot will discuss the emergency situation over the interphone and public address system.
2. A crew member will instruct the passengers on bail out procedures, and help adjust the parachutes.
3. The pilot will give the bail out signal; one sustained ring of the alarm bell, and the crew will supervise bail out proceedings.

CRASH LANDING OR DITCHING

1. If a crash landing or ditching situation has developed, the pilot will alert the crew and passengers with six short rings of the alarm bell.
2. Fasten seat belt securely.
3. Remove cords, ties, straps; loosen collar, and parachute harness, don life vest (if applicable) but do not inflate.
4. A crew member will advise passengers which escape routes to use and aid in adjusting life vests.
5. If blankets or pillows are available, use to protect face.
6. Just prior to impact, the pilot will alert the crew and passengers with one long sustained ring of the alarm bell.
7. Brace for impact.
8. Hold crash landing positions until after the airplane has stopped moving.
9. Remove seat belt and follow the crews instructions for evacuation.