SECTION VI
FLIGHT CHARACTERISTICS

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GENERAL.

The flight characteristics are normal for a twin-engine transport aircraft. The aircraft is very stable around all axes and is easily trimmed to fly *hands off*. Very minor trim changes are required to maintain the desired aircraft attitude. Control forces required for maneuvering throughout the speed range are normal. Rudder and aileron control is excellent and elevator forces are normal at high and low airspeeds.

STALLS.

The power-off stalling characteristics for this aircraft are normal. Stall warning comes in the form of a comparatively mild buffeting of the horizontal stabilizer. Stalling speed increases with the degree of bank and increase in gross weight, as shown in figure 6-1. The ailerons are effective up to the point of stall. No violent rolling action either precedes or accompanies the power-off stall under any flap setting. However, as in the case of most multi-engine aircraft, stall encountered with power on will probably cause violent rolling movements. The extended landing gear has no appreciable effect on the stalling characteristics. Recovery from a stall is normal and should be made by nosing the aircraft down and applying power. Apply power smoothly and avoid an abrupt pull-out.

PRACTICE APPROACH TO STALLS.

Practice approach to stalls at a safe altitude, applying the principles discussed in the above paragraph. Minimum altitude for practicing approach to stalls is 5000 feet above the terrain.

SPINS.

Intentional spins are prohibited. However, in case a spin is entered into accidentally, use normal spin recovery procedure to regain level flight. If the normal spin recovery procedure does not stop the spin, a *blast of power* on the inside engine may expedite the recovery. This is not a normal procedure, however, since the thrust from the blast of power may increase airspeed beyond the maximum design structure limits.

DIVING.

Placarded airspeed should not be exceeded in a dive. Recovery from a dive should be accomplished smoothly, and abrupt pull-outs avoided.

APPROXIMATE STALLING SPEEDS – POWER OFF

MPH AND KNOTS IAS

Note: The extended landing gear has no appreciable effect on the stalling characteristics.

	0 FLAP						1/4 FLAPS					
GROSS WEIGHT (POUNDS)	LEVEL KNOTS	FLIGHT MPH	30 DEG KNOTS	BANK MPH	45 DEG KNOTS	BANK MPH	LEVEL KNOTS	FLIGHT MPH	30 DEG KNOTS	BANK MPH	45 DEG KNOTS	BANK MPH
33,000	76	88	82	95	91	105	71	82	77	89	86	99
31,000	73	85	79	91	88	101	69	79	75	86	83	96
29,000	71	81	76	88	85	98	67	77	72	83	80	92
27,000	68	78	73	84	82	94	64	74	69	80	77	89
25,000	65	75	70	81	78	90	62	71	66	77	74	85
23,000	62	72	67	77	75	86	59	68	63	73	71	82
21,000	59	68	64	74	71	82	56	64	60	70	68	78

	1/2 FLAPS						FULL FLAPS					
GROSS WEIGHT (POUNDS)	LEVEL KNOTS	FLIGHT MPH	30 DEG KNOTS	BANK MPH	45 DEG KNOTS	BANK MPH	LEVEL KNOTS	FLIGHT MPH	30 DEG KNOTS	BANK MPH	45 DEG KNOTS	BANK MPH
33,000	68	78	73	83	81	92	65	75	70	81	79	90
31,000	65	75	70	81	78	89	63	72	68	78	76	87
29,000	63	72	68	78	75	86	61	70	66	76	73	84
27,000	61	70	65	75	72	83	59	67	63	73	70	81
25,000	58	67	62	72	69	79	56	65	60	70	68	78
23,000	55	64	60	69	66	76	53	62	58	69	64	74
21,000	53	61	57	65	63	72	51	59	55	63	61	71

Figure 6-1

SECTION VII
SYSTEMS OPERATION

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CARBURETOR ICING.

Immediately prior to beginning the take-off roll, advance the throttles sufficiently to make carburetor heat available. Hold the control column full back to prevent nose over. Set the carburetor air controls to FULL HOT to obtain temperatures within the continuous operating range as indicated by the instrument markings. Maintain this temperature for the time required to insure complete removal of any ice previously formed in the induction systems. The increase in CAT. will be accompanied by a drop in MP of an inch or two. If an appreciable quantity of ice has formed in the vicinity of the throttle valve, the MP will increase an inch or so as the ice is removed. If no rise in MP is observed, either no throttle icing existed or the ice has not yet melted. The pilot will have to decide which circumstance exists. Turn the carburetor alcohol deicer switch ON (the carburetor deicing control valve handle must also be ON). Observe that a drop in CAT. occurs. When satisfied that no ice remains in the induction system, move the carburetor air controls to the FULL COLD (RAM) position, and begin the take-off roll immediately. When the aircraft is airborne and power is reduced to climb settings, adjust the CAT as required to operate outside the probable carburetor icing range, as indicated by the instrument markings, and turn the carburetor deicing system OFF. A gradual loss of manifold pressure greater than that expected due to increase in altitude, without the throttles being moved, is an indication of carburetor icing. Apply carburetor deicing fluid as required until the ice has been eliminated, as indicated by recovery of the manifold pressure. Readjust the CAT to avoid further carburetor icing.

CAUTION

Conserve the carburetor alcohol supply for momentary use during flight, for use during landing, or for an emergency.

BACKFIRING.

To prevent backfiring during starting, movement of the mixture control from IDLE CUT-OFF to AUTO-RICH should occur slightly before ceasing to prime, in order to allow the carburetor to come up to operating pressures and start functioning in a normal manner. The transition should be smooth.

SPARK PLUG ANTI-FOULING PROCEDURES

GENERAL.

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 100/130 or 115/145 grade fuel. These grades of fuel may contain a relatively high lead content, up to 4.6 cc per gallon. 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 trouble-maker. 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 a separate discussion of each aspect of typical engine operation including ground running, takeoff, cruise, and descent. Prevention is the most profitable line of attack to the problem.

IMPORTANT FACTS.

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, removing 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. Other pertinent factors which influence plug misfiring include the condition of the ignition system, spark plug characteristics and age, general engine conditioning including the care and handling of spark plugs, the operating requirements and characteristics of the particular engine installation, and the specific engine operation 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, upsets the chemistry of the fouling cycle, and restore good ignition.

IDLE MIXTURE CHECK.

Idle mixture adjustment is one of the most important factors to be considered in providing protection against fouled spark plugs. When performing a postflight check, the pilot must check the idle mixture at minimum idle rpm and at the most commonly used ground idle rpm for a rise not to exceed 10 rpm. Too much emphasis cannot be placed on slow movement of the manual mixture lever during the check. Best power mixture must be obtained and held for at least five seconds. Best power is when a maximum rise in rpm is noted. Any further movement past this point will cause a drop in rpm; therefore, the pilot should move the mixture lever slowly until he has obtained maximum rpm and the rpm has started to decrease. The mixture lever should then be moved very slowly back to the point where the maximum rpm rise was obtained. After ascertaining that the best power mixture has been obtained and maximum rpm rise has been noted, return the mixture control to the appropriate setting. If no rpm rise was noted when slowly moving the mixture lever toward IDLE CUT-OFF, the mixture is too lean. If over a 10 rpm rise is noted, the mixture is too rich and the mixture should be manually leaned to obtain best power or maximum rpm. If the rpm rise was less than 10 rpm the mixture control may be placed in either the AUTO LEAN or AUTO RICH position. This condition will be noted on Form 781. It must be remembered that cylinder head temperature has a direct bearing upon the results obtained; therefore, the pilot must have a cylinder head temperature between 160°C and 180°C when performing an idle mixture check. When the aircraft is at the home station and the idle mixture is found to be out of adjustment, it is recommended that corrective maintenance be performed prior to releasing the aircraft for flight. Idle mixture strength does change with altitude changes. Therefore, when an aircraft is operating away from its home station, the idle mixture could be too rich and cause fouling of the spark plugs. Naturally, this will be noted by the pilot when he performs the idle mixture check. This will not be cause for rejection of the aircraft, as the mixture will be correct when the aircraft is returned to the home station. In these cases, the pilot will manually lean the mixture for any extended periods of ground operation. The mixture will be manually leaned to obtain maximum rpm, which will be best power mixture. Further, a minimum of 150°C cylinder head temperature should be maintained. The most critical fouling range for the R-1830 engine is between 900 and 1100 rpm.

SPARKPLUG CLEANOUT FOR GROUND OPERATION.

Whenever excessive rpm drop is noted during power and ignition check proceed as follows:

1. Propellers – FULL INCREASE.
2. Mixture – RICH.
3. Operate engine at Field Barometric Manifold Pressure until CHT reaches 180-200°C.

4. Advance power slowly to 5 inches above field barometric and hold for one minute.

5. Recheck ignition.

6. If spark plugs are not cleared after this procedure has been tried twice, corrective maintenance must be performed. During extended periods of ground idling it is recommended that mixtures be manually leaned to obtain maximum rpm. After each 10 minutes of ground operation at low rpm, the throttles shall be advanced slowly (3 to 5 seconds per 100 rpm) to a manifold pressure 5 inches above field barometric pressure. This power shall be held for one minute; however, maximum ground operating cylinder head temperature will not be exceeded.

NOTE

Another ignition check will be performed just prior to takeoff, when time since the last engine runup ignition check exceeds 10 minutes.

INFLIGHT PREVENTION.

A periodic change in engine conditions will usually prevent lead fouling during cruise. After each hour at cruise settings, one for the following procedures should be used to prevent fouling:

1. The use of auto-rich mixture for a two-minute period.

2. A change in power of 3 to 5 inches of manifold pressure or a change of 100 rpm. A reduction in the power level followed by an increase in the power level appears to the most effective approach to prevention of fouled spark plugs.

INFLIGHT DEFOULING.

If spark plug fouling occurs in flight the rich-mixture method of prevention should be tried first. If this is not effective reduce manifold pressure slowly until plugs resume firing and maintain this power for approximately one minute. Slowly increase power, and repeat the previous process until all plugs have resumed firing and manifold pressure has been increased to the desired cruise setting.

CAUTION

Whenever appreciable power changes are made it is important to cushion the high inertia loads on the master rod bearings which occur under these conditions. As a rule of thumb, each 100 rpm requires at least 1 inch Hg manifold pressure (for example, 23 inches Hg at 2300 rpm). Operation at high rpm and low manifold pressure should be kept at a minimum.

CHANGING POWER CONDITIONS DURING FLIGHT.

The most economical engine operation at low power can be obtained by operating at low engine rpm and high manifold pressure up to the maximum bmep limit (see Appendix).

To prevent excessive cylinder pressures when changing power conditions, use the following procedure:

INCREASING POWER.

1. Mixture controls – At the proper setting for the desired power condition.
2. Propeller controls – Adjust to obtain the desired engine rpm.
3. Throttles – Adjust to obtain the desired manifold pressure.

REDUCING POWER.

1. Throttles – Adjust to obtain the desired manifold pressure.
2. Propeller controls – Adjust to obtain the desired engine rpm.
3. Throttles – Readjust as necessary.
4. Mixture controls – Adjust to the proper setting for the desired cruising condition.

CAUTION

When maneuvering with low power or during descent with low power, it is important to cushion the high inertia loads on the master rod bearings which occur at high rpm and low manifold pressure. As a rule of thumb, each 100 rpm requires at least 1 inch Hg manifold pressure. Use high rpm and low manifold pressure only when necessary.

COWL FLAP OPERATION.

Full open cowl flaps create high drag which results in a reduction of the load-carrying capability of the aircraft, and, in addition, requires higher power settings to maintain the desired cruise speed. A reduction in cowl flap opening will result in improved performance as the drag is reduced. Under most conditions of flight, optimum performance will be obtained with the cowl flaps in the TRAIL position; however, the cowl flaps should be set, as required, to maintain inflight cylinder head temperatures.

SUPERCHARGER OPERATION (IF INSTALLED AND OPERATIVE).

When shifting from low to high blower, partially close the throttle to reduce manifold pressure 3 to 4 inches Hg and shift the supercharger control rapidly, without pausing to HI BLOWER position. With the blower control in HI BLOWER position, operate the engine essentially as a single-speed engine. If possible, avoid excessively high rates of change in engine rpm when operating in HI BLOWER position.

CAUTION

Do not exceed maximum allowable manifold pressure.

If the aircraft is being operated with the blower controls continuously in one position, shift the blower controls, at each odd hour of the clock, to the other position (either HI or LOW) until the engine instruments stabilize. This will serve to wash away any sludge which may have accumulated in the blower clutches.

FUEL SYSTEM MANAGEMENT.

FUEL TANK SELECTION.

When the engines are operated, the main fuel tanks or the auxiliary fuel tanks can be selected to supply fuel to a single engine or to both engines. During flight, the long-range fuel tanks (if installed) can be selected, through the shutoff valves at the front tanks, to supply fuel to either or both engines. The fuel tank selectors, used with fuel booster pumps, make selection from all tanks possible *(figure 7-1)*.

NORMAL FUEL TANK PROCEDURE.

When running fuel tanks empty in flight, keep a close check on the fuel pressure gage. It is advisable to switch to another tank as soon as the fuel pressure begins to drop. If a tank is allowed to run dry to the extent that the engine slows down, the throttle should be moved toward the CLOSE position before the fuel tank selector is moved, in order to prevent the engine from overspeeding. All take-offs and landings should be made with the fuel tank selector set to the fullest (main or auxiliary) tanks.

CAUTION

Unless the fuel is required to complete the mission, it is advisable to select a new fuel supply before running a tank empty (approximately 20 gallons remaining) in order to prevent engine failure because of fuel starvation.

Note

It is very important upon reaching a cruising altitude that fuel be consumed from main tanks first and auxiliary tanks last. This procedure is necessary, since the majority of the return flow will be routed to the main tanks. This procedure will also permit using a minimum amount of elevator tab to trim the aircraft.

LONG-RANGE FUEL TANK OPERATION (IF INSTALLED).

To prevent drawing air into the fuel supply lines, which will result in a fuel system air lock, take-off is not permitted with less than 25 gallons of fuel in each long-range tank.

CAUTION

Take-off is not permitted using fuel from the long-range fuel supply. The long-range shutoff valves must be turned OFF prior to take-off.

The long-range fuel tank shutoff valves *(figure 1-20)* will be turned to the OFF position in sufficient time to maintain a minimum of 25 gallons of fuel in each tank. Since the fuel booster pumps are installed downstream from the main, auxiliary, and long-range tanks, they have a tendency to pump air from the empty tanks or leaking valves; therefore, the fuselage tanks should not be permitted to run dry in flight unless the fuel is needed for emergency purposes.

Note

If the long-range fuel tanks run dry and the engines are allowed to slow down, move the throttles toward the CLOSE position before moving the right and the left fuel tank selectors from the OFF positions. This will prevent the engines from overspeeding. Turn ON the booster pumps until the engine runs smoothly.

In the event that air locks occur with the fuel boost pumps operating, the condition will in all probability be aggravated; however, a new fuel supply should be selected immediately. For long-range fuel tank operation, proceed as follows:

1. When cruising altitude has been reached, turn the long-range fuel shutoff valves ON.
2. Turn the right and left engine fuel tank selectors OFF.

3. When the fuel supply in the long-range fuel tanks becomes low, turn the left and right fuel tank selectors to the LEFT MAIN and the RIGHT MAIN positions respectively.
4. Turn the long-range fuel shutoff valves OFF.

CAUTION

Do not operate with both normal and long-range fuel systems on at the same time; turn OFF the long-range fuel system shutoff valves when operating on main or auxiliary tanks to prevent air locks. Do not climb at a steep angle when operating on the long-range fuel system and the fuel level is low in the tanks, since air locks will occur from fuel being trapped in the tanks.

FUEL BOOSTER PUMPS.

1. Operate the fuel system, using the fuel booster pumps if necessary, to obtain the desired fuel pressure.
   a. Turn the fuel booster pump switch ON for desired engine.
   b. Turn the fuel tank selector for the desired engine to the appropriate position: RIGHT MAIN, RIGHT AUX., LEFT MAIN, LEFT AUX. (or OFF, if using long-range fuel).
2. During climbs and flight, use the booster pumps whenever the engine-driven pumps alone do not supply adequate fuel pressure.
3. When the desired altitude has been reached, wait 3 or 4 minutes before turning the booster pumps OFF in order to allow the fuel tank internal pressure to become equalized with atmospheric pressures. The booster pumps should be turned OFF one at a time, and then only if the engine-driven pumps maintain sufficient pressure.
4. In switching from one tank to another, use the booster pumps to help displace any air that may have entered the system, and to assure sufficient fuel pressure.

FUEL SYSTEM MANAGEMENT.

FUEL TANK SELECTION.

Each engine is supplied independently by the tanks in the corresponding wing. The fuel may be supplied from the main tank, auxiliary tank or the outer wing tank but cannot be used from any tank to the opposite engine without using the cross-feed. It is advisable that both engines be operated from their respective wing tanks to maintain proper balance. Fuel management will vary with the mission to be flown, aircraft gross weight and distribution of the fuel load. When the normal fuel load is carried (204 gallons in each main tank, 50 in each auxiliary tank, and 200 gallons in each outer wing tank), the main tanks will be used for take-off, climb, and circumstances permitting, in cruise until 100 gallons remain in each main tank (figure 7-1).

CAUTION

Whenever possible maintain sufficient fuel in the main and auxiliary tanks to permit flight to an emergency landing field should the necessity arise to dump outer wing tank fuel.

When a mission requires more fuel than the normal fuel load, the outer wing tanks will be serviced to capacity before servicing the auxiliary wing tnaks.

NORMAL FUEL TANK PROCEDURE.

Should it be necessary to completely exhaust fuel in the outer wing and auxiliary tanks in order to consolidate fuel available in the main tanks, use fuel from the outer wing and auxiliary tanks until 50 gallons remain in each tank. Next, use fuel from the outer wing tank until 20 gallons remain in each outer wing tank. At this time place one selector on the main tank and continue using fuel from the outer wing tank for one engine. Note the time and monitor the fuel pressure on the engine using fuel from the outer wing tank. When a drop in pressure is noted switch the selector to the main tank position. When fuel pressure is again normal note the time and place the other selector to outer wing tank position. Monitor the fuel pressure on the engine on the outer wing tank and when a drop in fuel pressure is noted turn the selector to the auxiliary tank position again noting the time. When fuel pressure is again normal place the other fuel tank selector to the auxiliary position and repeat this procedure with the main and auxiliary tanks, when the fuel level reaches 20 gallons in the auxiliary tanks. By checking time to run tanks dry an accurate fuel consumption rate can be determined.

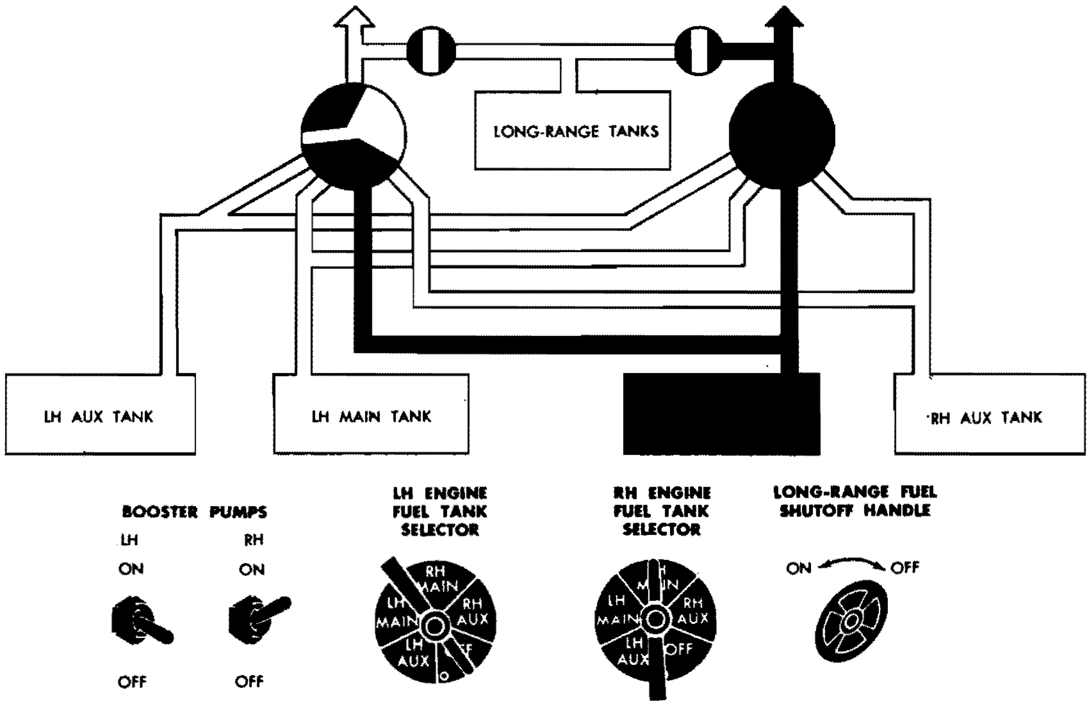
CAUTION

Do not completely exhaust fuel in any tank at less than 1000 feet above the terrain except when necessary.

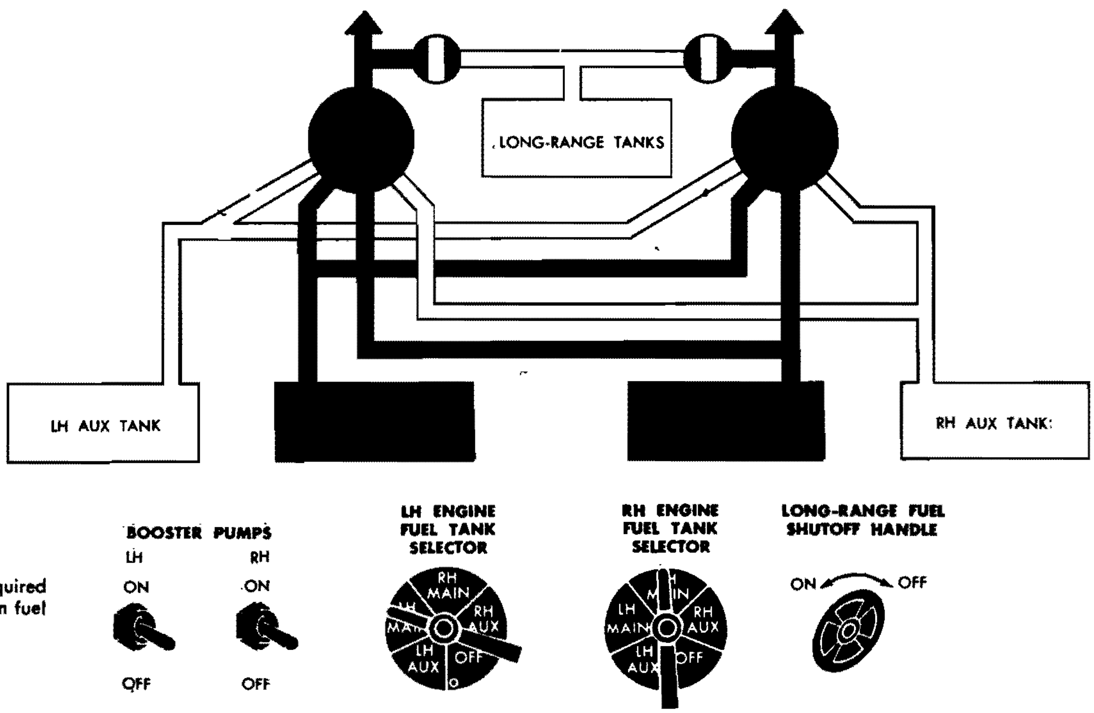
NOTE

If a tank is allowed to run dry to the extent the engine slows down, the throttle should be closed before the

FUEL SYSTEM MANAGEMENT



NORMAL ENGINE STARTING OPERATION.
BOOSTER PUMP ON TO ENGINE BEING STARTED.



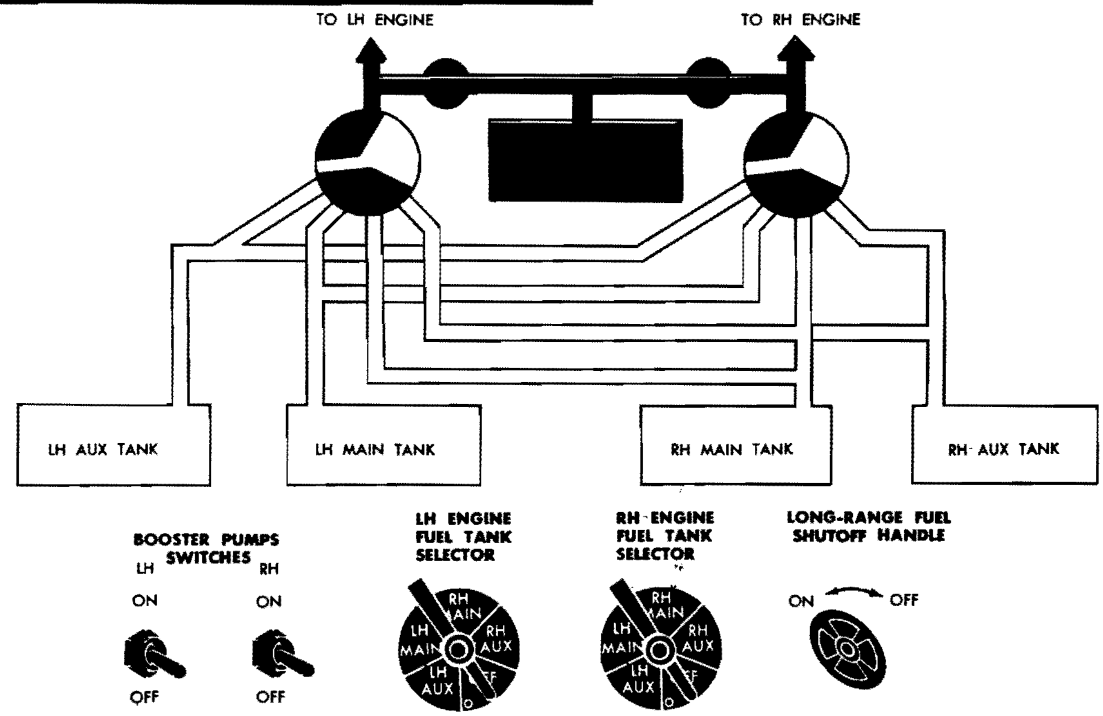
Note:
On as required to maintain fuel pressure.

TAKE-OFF, LANDING, AND GROUND OPERATION.
MAIN TANKS TO RESPECTIVE ENGINES.

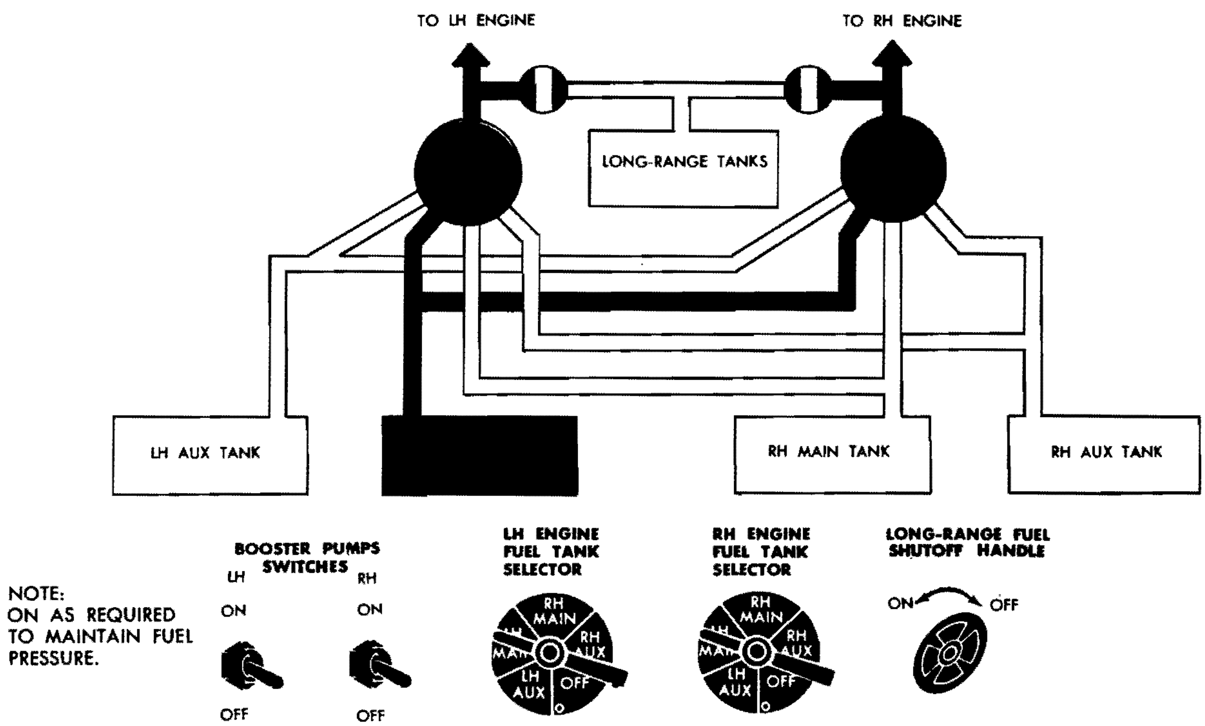
Note: If all tanks are full, use main tanks first.

Figure 7-1 (Sheet 1 of 2)

FUEL SYSTEM MANAGEMENT



CRUISE — LONG-RANGE TANK OPERATION.
LONG-RANGE TANKS SUPPLYING FUEL TO BOTH ENGINES.



ONE-TANK OPERATION.
LH MAIN TANK SUPPLYING FUEL TO BOTH ENGINES.

Figure 7-1 (Sheet 2 of 2)

tank selector is moved in order to prevent the engine from overspeeding. Operate fuel booster pump until the engine runs smoothly.

CROSSFEED SYSTEM.

The cross-feed system can be used to equalize the fuel load in each wing and in case of fuel system failure or damage. To use the cross-feed:

1. Select the tank from which fuel is to be used by both engines.

2. Turn the booster pump ON for the engine which is to receive fuel from the opposite side of the aircraft.

3. Turn the cross-feed valve ON, then return to NEUTRAL when the indicator light goes out.

NOTE

The cross-feed indicating light indicates when valve motor is energized in both opening and closing operation. The time lapse for either is one second.

4. Turn the fuel selector OFF for the engine which is to receive fuel from the opposite side of the aircraft.

5. Turn the booster pump OFF. When fuel has been consumed to the desired level:

   a. Turn the booster pump ON for the engine which is receiving fuel from the opposite side of the aircraft.

   b. Turn the fuel selector for the engine receiving fuel from the opposite side of the aircraft to the desired tank.

   c. Turn the cross-feed valve OFF then return switch to NEUTRAL when the indicator light has gone out.

   d. Turn the booster pump OFF.

FUEL DUMP.

The following procedure will be used to dump fuel from the outer wing tanks;

NOTE

Fuel dumping should be considered as an emergency procedure only, since the aircraft can be landed at weights up to 33,000 pounds if proper precautions are taken.

1. Select tanks other than outer wing tanks for engine operation.

2. Check the wing flaps UP.

CAUTION

Never dump fuel with flaps in DOWN position.

3. Reduce airspeed to 100 knots (115 mph).

NOTE

Best dumping rate is realized at an air speed below 100 knots (115 mph). At this air speed, entire outer wing fuel can be dumped in approximately 3½ minutes.

4. Place both dump switches in ON position.

5. Visually check dump opening to make sure valve is operating.

NOTE

Dumping can be discontinued at any time by placing the switches in the CLOSED (full down) position. After valve is CLOSED, turn switch to the OFF position.

BOOSTER PUMPS.

1. Operate the fuel system, using the booster pumps if necessary, to obtain the desired fuel pressure.

   a. Turn the booster pump switch ON for desired engine.

   b. Turn the fuel selector valve for the desired engine to the applicable position: RIGHT MAIN, RIGHT AUX, LEFT MAIN, LEFT AUX, RIGHT WING, LEFT WINGS.

2. During climbs and flight, use the booster pumps whenever the engine-driven pumps alone do not supply adequate fuel pressure.

3. The booster pumps should be turned OFF one at a time, and then left OFF only if the engine-driven pumps maintain sufficient pressure.

4. In switching from one tank to another, use the booster pumps to help displace any air that may have entered the system, and to assure sufficient fuel pressure.

JATO CHECK OUT PROCEDURES.

GENERAL.

The aircraft electrical firing and release circuit should be thoroughly inspected before departure on a mission requiring JATO. The manual release system should be checked out at this time. It should be determined that there is sufficient current and voltage to ignite the circuit. Insure that there is no electrical current in the firing circuit when the JATO master switch is OFF. JATO attaching fittings should also be tested before the mission, to determine the proper operation of the locking mechanism. Air crew member will arm the JATO units (plug igniter into aircraft) when the aircraft is in the take-off position.

PREFLIGHT OF JATO SYSTEM.

1. Check Manual JATO Bottle Release:

   a. Cock JATO racks (located under fuselage aft of wing trailing edge) by pulling rack lock hooks down and forward.

   b. Pull manual release cable, two handles located just forward of main cargo door on left wall at seat level (one handle for left inboard and one handle for left outboard bottle. The other two handles are located directly across the aircraft on the right hand side. These two handles release the right inboard and outboard bottles. If locking hooks have had little use, it may be necessary to push hooks to the rear lightly with a screwdriver at the same time manual release is operated.

2. Check Electrical JATO Bottle Release:

   a. Cock rack as in paragraph 1.a. above.

   b. Turn battery switch ON or APP to RUN.

   c. Move JATO release switch (located in the cockpit on the left side of the electrical control panel) up then down. Each action releases two JATO bottles. Aid release of hook with screwdriver as in paragraph 1.b. above, if necessary.

3. Check Electrical Firing Circuits:

   a. Turn battery switch ON or APP to RUN.

   b. Turn JATO master switch ON (located on left side of electrical control panel). A red light illuminates when the switch is in the ON position.

   c. Press JATO firing switch (on pilot's control wheel.)

NOTE

The firing switch will not operate unless the JATO master switch is ON.

   d. While the firing switch is depressed, check voltage through JATO igniter arming nipple (located between the JATO hooks on A/C). Meter should show the same voltage as in aircraft electrical system.

4. Electrical Residue Check:

   a. Leave battery or APP power ON, master JATO switch ON, and JATO firing switch OFF.

   b. Temporarily ground the JATO igniter arming nipple to the aircraft with a screwdriver.

   c. Use meter and check voltage thru nipple. The voltage reading should be zero.

WARNING

It is important that no voltage is detected in the circuit. Even very low voltage may be sufficient to initiate operation of the igniter.

5. Attaching JATO to Aircraft.

   a. If no stray voltage is found in system after check out as outlined in paragraph 4, attach bottles to aircraft.

   b. After bottles are attached, check for security locking by attempting to remove bottle by shaking. Two (2) men must handle bottles at all times.

NOTE

Approximate weight of each bottle is 185 pounds.

6. Installing Igniter to Bottle:

   a. Remove JATO igniter hole plug from bottle.

b. Remove igniter from packing container, put compound on threads and screw in where plug was removed.

CAUTION

Igniter contains black powder.

c. Leave igniter pig-tail on shorting plug of igniter until ready for arming.

d. Tighten igniter firmly in bottle.

7. Arming JATO:

a. Position aircraft in takeoff position on runway.

b. Have engines running, check for stray voltage as in paragraph 4 with JATO master switch ON and firing switch OFF.

c. After stray voltage check is completed, crew member will signal the pilot the circuit is satisfactory. The pilot will then insure that JATO master switch is OFF and fingers are off the firing button. The pilot will signal crew member that he is ready for JATO arming.

d. Remove end of igniter pig-tail from shorting plug of igniter and place on JATO firing circuit nipple. Push FIRMLY into place, remove red tag (this could cause pig-tail to come off).

e. Aircraft is now ready for JATO takeoff.

8. JATO Takeoff Away From Home Base:

a. JATO system should be checked out thoroughly before departure.

b. JATO bottle igniter plugs should be loosened and replaced before loading on cargo storage rack in aircraft. This will insure removal with the finger or a light tap with a screwdriver.

BRAKE OPERATION.

Use extreme care when applying brakes immediately after touchdown, or at any time when there is considerable lift on the wings, to prevent skidding the tires and causing flat spots. Heavy brake pressure can result in locking the wheel more easily immediately after touchdown, than when the same pressure is applied after the full weight of the aircraft 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.

Although brakes can stop the wheel from turning, stopping the aircraft is dependent on the friction of the tires on the runway. For this purpose, it is easiest to think in terms of coefficient of rolling friction which is the frictional force divided by the load on the wheel. It has been found that optimum braking occurs with approximately a 15 to 20 per cent rolling skid; i.e. the wheel continues to rotate, but has approximately 15 to 20 per cent slippage on the surface, so that the rotational speed is 80 to 85 per cent of the speed which the wheel would have were it in free roll. As the amount of skid increases beyond this amount, the coefficient of friction decreases rapidly so that, with a 75 per cent skid, the friction is approximately 60 per cent of the optimum and, with a full skid, becomes even lower.

There are two reasons for this loss in braking effectiveness with skidding. First, the immediate result of the skid is to scuff the rubber, tearing off little pieces which act almost like rollers under the tire. Second, the heat generated by the skid friction starts to melt the rubber, and the molten rubber acts as a lubricant.

NACA figures have shown that, for an incipient skid with an approximate load of 10,000 lbs per wheel, the coefficient of friction on dry concrete is as high as .8, whereas the coefficient is of the order of .5 or less with a 75 per cent skid. Therefore, if one wheel is locked during application of brakes there is a very definite tendency for the aircraft to turn away from that wheel and further application of brake pressure will offer no corrective action. Since the coefficient of friction goes down when the wheel begins to skid, it is apparent that a wheel, once locked, will never free itself until brake pressure is reduced so that the braking effect on the wheel is less than the turning moment remaining with the reduced frictional force.

The following procedures will apply for brake operation:

1. If maximum braking is required after touchdown, lift should first be decreased as much as possible by raising the flaps before applying brakes. This procedure will improve braking

action by increasing the frictional force between the tires and the runway.

CAUTION

Immediately following maximum braking while landing, little or no braking action may be available because of brake fade.

2. For short landing rolls, a single, smooth application of the brakes with constantly increasing pedal pressure is most desirable.
3. When the brakes are used to stop the aircraft, it is recommended that a minimum of 15 minutes elapse between landings where the landing gear remains extended in the slip stream, and a minimum of 30 minutes between landings where the landing gear has been retracted, to allow sufficient time for cooling between brake applications. Additional time should be allowed for cooling if brakes are used for steering, cross-wind taxiing operation, or a series of landings are performed.
4. The full landing roll should be utilized to take advantage of aerodynamic braking and to use the brakes as little and as lightly as possible.
5. After the brakes have been used excessively for an emergency stop, and are in the heated condition, the aircraft should not be taxied into a crowded parking area or the parking brakes set. Peak temperatures occur in the wheel and brake assembly from 5 to 15 minutes after a maximum braking operation. To prevent brake fire and possible wheel assembly explosion, the specified procedures for cooling brakes should be followed.
6. The brakes should not be dragged when taxiing, and should be used as little as possible for turning the aircraft on the ground.

NOTE

Taxiing with one engine inoperative is not recommended.

FUEL SYSTEM DIAGRAM - SOME SC-47 AIRCRAFT

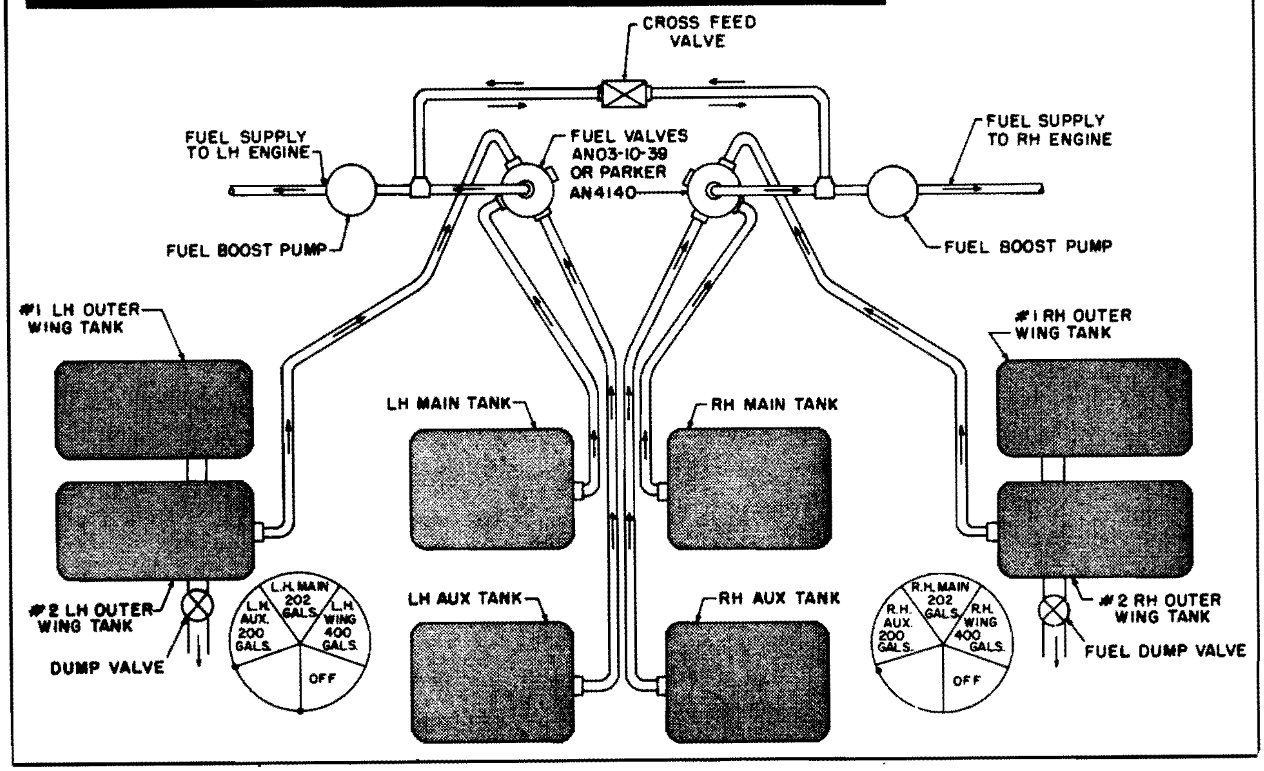


Figure 7-2

SECTION VIII
CREW DUTIES

TABLE OF CONTENTS

INTRODUCTION.

This section lists duties, other than primary functions, performed by crew members.

PILOT.

It will be the duty of the pilot to insure that a thorough inspection of the aircraft and all equipment it conducted before departure. The pilot will personally inspect all items of bail-out, ditching, and survival equipment. The check lists for the pilot are covered in detail in Section II and III.

CO-PILOT.

The co-pilot will aid the pilot, as directed, to accomplish the assigned mission.

FLIGHT MECHANIC / STEWARD.

The flight mechanic/steward will assist in all matters pertaining to the comfort and safety of the passengers and flight crew, and will perform any other duties assigned. He will also assist in the performance of preflight duties and perform the following:

FLIGHT MECHANIC'S/STEWARD'S INSPECTION.

PRIOR TO LOADING (POWER OFF).

1. Form 781 – CHECK.
2. Fuel, oil, alcohol oxygen quantities and servicing – Visually Checked.
3. Emergency Equipment – CHECK.
4. Passengers seats and equipment – CHECK.
5. Hat racks – Clean (unnecessary items removed).
6. Floor covering – In place and secured.
7. Emergency exits – Closed and Secured.
8. Buffet supplies – CHECK.

Food and equipment stowed.

9. Lavatory – CHECK. Check equipment and supplies.

10. Rear baggage compartment – CHECK.

Check for condition (equipment stowed).

PRIOR TO LOADING (POWER ON).

1. Cabin lighting – CHECK. Check dome and reading lights.

2. Buffet Operation – CHECK.

3. Lavatory lighting – CHECK.

4. No smoking – fasten seat belt sign – Check operation.

5. Oxygen system – CHECKED.

Check mask and regulator for proper operation.

AFTER LOADING.

1. Passenger manifest – CHECKED AND ABOARD.

2. Passenger briefing and seating – COMPLETED.

3. Baggage and loose equipment – SECURED.

4. Cabin entrance ladder – STOWED.

5. Passenger entrance door – CLOSED AND LOCKED.

6. Report readiness to pilot.

BEFORE TAKE-OFF.

1. Passengers – CHECKED.

Check that passengers are seated, safety belts fastened, and no smoking.

2. Seat Belt – FASTENED.

CRUISE.

1. Engine and Wings – CHECKED.

Periodically check engine and wings for any indication of malfunction.

2. Equipment operation – MONITOR.

Be on watch during flight for mechanical irregularties, and perform any duties indicated by the pilot.

3. Fuel Management – MONITOR.

Have a complete understanding of fuel management and monitor fuel tank usage during flight. Maintain Cruise Control Log when required.

BEFORE LANDING.

1. Passengers – CHECKED.

Check that passengers are seated, safety belts fastened, and no smoking.

2. Seat belt – FASTENED.

BEFORE LEAVING AIRCRAFT.

1. Off-load passengers and baggage – SUPERVISED AND CHECKED.

2. Form 781 – COMPLETE.

3. Inventory of equipment – COMPLETE.

4. Aircraft – CLEAN.

NAVIGATOR.

The navigator will be primarily responsible for directing the aircraft to its destination over preplanned routed. The navigator's basic responsibilities are outlined in the following checklist:

PREFLIGHT (POWER OFF).

1. Form 781 – CHECKED.

Check Form 781 for any write-ups which may affect navigation.

2. Personal navigation equipment – CHECKED.

3. FLIP and letdown charts – CHECKED. ..

4. Celestial tables and emergency map kits – CHECKED.

5. Airspeed calibration card – CHECKED.

6. Spare VHF crystals – ABOARD AS REQUIRED.

7. Aircraft Clocks – SET.

8. Standby compass cards – CHECK FOR CURRENCY.

9. Astrodome stand – CHECKED.

10. Astrodome – CHECKED.

11. Astrocompass and mount – CHECK ALIGNMENT ALL POSITIONS.

12. Driftmeter – OFF AND CAGED.

Check driftmeter lens for cleanliness and fogging due to moisture or dirt. Clean if required.

13. Driftmeter alignment card – CHECKED.
14. Altimeter – SET TO FIELD ELEVATION.
15. Oxygen system and equipment – CHECKED.
16. Flux gate compass – SET VARIATION ZERO.

PREFLIGHT (POWER ON).

1. Navigator's compartment lights – CHECKED.
2. Driftmeter – CHECK OPERATION AND ALIGNMENT.
3. Radio Compasses – CHECKED AND TUNED.
4. LORAN – CHECKED.
5. Fluxgate compass – CHECKED AGAINST STANDBY COMPASS.
6. Altimeter – CHECKED AND SET.
   a. Rotate the setting knob until the current altimeter setting appears in the kollsman window and compare the altimeter reading against the field elevation previously set. (max error – 75 feet).
   b. Apply this known altimeter error to all subsequent altimeter readings during the flight.

WARNING

The altimeter should be checked closely to assure that the 10,000 foot pointer is reading correctly. Due to previous setting of the altimeter, the setting knob could have been rotated until eventually the numbers reappear from the opposite side, thur indicating a 10,000 foot error.

7. Sextant – CHECK OPERATION AND LIGHTING.
8. Seat Belt and Shoulder Harness – FASTENED.
9. Interphone – ON STATION.

INFLIGHT.

NOTE

The navigator will occupy the navigator's station during all take-offs and landings and will monitor all instrument departures and approaches.

1. Over water position reports – Prepare as required.
2. Navigator's Log – Maintain as required.
3. Fuel Management – MONITOR.

The navigator will monitor fuel consumption during all over water flights and maintain the required charts.

4. Emergency landing fields – MONITOR WHILE ENROUTE.

BEFORE LANDING.

1. Interphone – ON STATION.
2. Navigation equipment – SECURE.
3. Seat belts and shoulder harness – FASTENED.

AFTER LANDING.

1. Radio compasses – OFF.
2. LORAN – OFF.
3. Driftmeter – OFF AND CAGED.
4. Fluxgate compass – ZERO VARIATION.
5. Navigation equipment – STOWED.
6. Navigator's log – COMPLETE.
7. Form 781. Complete as required.
8. Lights – OFF.

RADIO OPERATOR (WHEN ASSIGNED).

The radio operator must be proficient in the utilization of all radio equipment installed in the airplane and in addition, be current in the use of CW and voice procedures. He must be thoroughly familiar with emergency procedures as they pertain to his duties as radio operator.

MISSION PLANNING.

1. Communications Requirements – COMPLETE.

Complete requirements for briefed routes to be flown. Coordinates with crew members, as required, for reporting points, crystal and frequency requirements, alternate and emergency airfields, etc.

2. Applicable Pilot's Manuals – CURRENT AND COMPLETE.

Check applicable pilot's manuals (Enroute Charts, Enroute Supplements, Terminal Charts), for current and complete contents. Correct publications as required.

3. Communications Kit – COMPLETE.

Communication flimsy, forms, radio logs, frequency cards, crystals and tool kit (where applicable). ACP's (125B-1, 131 and 135).

EXTERIOR INSPECTION.

1. Antennas – CHECKED.

Inspect all antennas for security of mounts, cleanliness, grease spots for exhaust carbon on stub masts, cracks on base, ground wire secure on stub type.

2. Static Dischargers – CHECKED.

Check all static dischargers for length (at least six inches). Wick should be approximately one inch long and not frayed or ragged.

INTERIOR INSPECTION.

1. Personal Equipment – STOWED.

Stow all personal equipment not necessary for flight.

2. Oxygen System – CHECKED.

Check mask and regulator for proper operation.

3. Required Publications – STOWED.

Stow applicable pilot's manuals, mission data, and communications publications in the control cabin.

4. Form 781 – CHECKED.

Check for status of communications equipment.

5. Radio G-File – CHECKED.

Check for completeness and condition.

6. Frequency Charts – CHECKED.

Check the VHF/UHF/HF frequency charts for current frequency assignments and channelization.

7. VHF Radio Channelization – CHECKED.

Check for proper crystals and thumb wheel settings.

8. UHF Radio Channelization – CHECKED.

Check all channels for proper settings.

9. VHF radio Operation – CHECKED.

Check operation of transmitter and receiver, side-tone level, DF tone; and background noise.

10. UHF Radio Operation – CHECKED.

Check operation of transmitter and receiver, sidetone level and background noise.

11. Radio Compass – CHECKED.

Check control panel for proper alignment. Check operation of receiver on all bands and selector positions. Check indicator for proper operation on LOOP AND COMPASS position with local range station. Check operation of CW switch and panel lights.

12. VOR Receiver – CHECKED.

Tune in station by selecting the proper channel. Check the Bearing Indicator for proper homing. Set the reading indicated by the Bearing Indicator into the course set window of the course indicator. Check the CDI on the course indicator for centering and the TO/FROM window for a TO indication. Set the reciprocal reading, indicated by the Bearing Indicator, in the course set window. Check the CDI on the course indicator for centering and the TO/FROM window for a FROM indication.

13. Glide Slope Receiver – CHECKED.

Set the localizer frequency in the OMNI receiver. Check the glide path alarm pointer (red flag) and horizontal bar for movement.

14. TACAN – CHECKED.

Tune in station by selecting the proper channel. Check the Bearing Indicator for proper homing. Place the function selector switch to T/R and check the range indicator. Place the instrument select switch to TACAN and check the CDI on the course indicator for proper indication. Return the instrument select switch to VOR.

15. Marker Beacon Receiver – CHECKED.

Check background noise and push-to-test light.

16. Interphone Stations – CHECKED.

Check operation of all crew member interphone stations on both NORMAL AND CALL positions.

17. Liaison Receiver – CHECKED.

Place power switch to MVC. Check dial lights, crystal filter switch, beat frequency knob, CW OSC switch, antenna alignment and reception on all bands.

18. Liaison Transmitter – CHECKED.

Check channalization for mission requirement frequencies. Key transmitter and check PA Plate and Grid readings. Check operation with an Air-Ground station.

19. Emergency Radios – CHECKED.

Inspect the emergency radios for correct stowage and current inspection dates.

BEFORE TAKEOFF.

1. Preflight Inspection – COMPLETED.

2. Form 781 – COMPLETED.

Enter all discrepancies in the Form 781 and bring them to the attention of the pilot.

3. Radios – ON AS REQUIRED.

4. Radio Log – INITIATED.

Initiate radio log and monitor frequencies as required.

5. Safety Belt – FASTENED.

AFTER TAKEOFF AND CLIMB.

1. Radio Contact – established – AS REQUIRED.

Establish contact with and obtain primary and secondary frequencies from the ground station. Send departure report.

INFLIGHT.

1. Radio Log – MAINTAINED.

Set up the log in such a manner that events of the mission may be reconstructed.

2. Radios – MONITORED AS REQUIRED.

Monitor assigned frequencies as required.

3. Reports – TRANSMITTED AS REQUIRED.

When reporting is required, procedures will be as outlined in current directives and publications.

4. Emergency Communications – AS REQUIRED.

When circumstances require emergency transmissions, the pilot will authorize the type message required. Format and procedures will be as outlined in current directives and publications. Perform inflight maintenance, if possible, to maintain communications.

NOTE

No transmission will be made on emergency distress frequency channels except for emergency purposes in order to prevent transmission of messages that could be construed as actual emergency messages.

DESCENT AND BEFORE LANDING.

1. HF Radio Equipment – OFF.

Turn HF equipment off when not required for approach or landing communications.

2. Trailing Wire Antenna – CHECKED IN.

3. Off Watch – LOGGED.

Sign off watch if not required to operate radios for approach or landing.

4. Safety Belt – FASTENED.

AFTER LANDING AND POSTFLIGHT.

1. Form 781 – COMPLETED.

Enter all radio discrepancies in the Form 781.

2. Radio Log – COMPLETED.

Complete radio log and have it certified by the pilot.

3. Radio Operator's Station – CLEANED.

4. Radio Logs, Codes and Ciphers – TURNED IN.

Collect and turn in to the proper authority all logs, codes and ciphers.

LOADMASTER

PRIOR TO LOADING.

1. Cargo and Passengers – Preplan Loading.
2. Manifests – Prepare AS REQUIRED.
3. Form 365F and load adjuster – CHECK.
4. Special loading and aerial delivery equipment – CHECK.
5. Tie-Down Equipment – CHECK.
6. Static lines and extensions – CHECK.
7. Safety belts – Check number and condition.
8. Emergency and survival equipment – Check condition and stowage.
9. Oxygen system – CHECKED.

Check mask and regulator for proper operation.

10. Interphone and cabin lighting – CHECK.
11. Cabin and latrine – Clean and secure.
12. Assist flight mechanic – As required.

AFTER LOADING.

1. Cargo Tie-Down – CHECK.
2. Loose Equipment – SECURED.
3. Jettison Plan – COMPLETED.
4. Form 365F – COMPLETED.
5. Passengers – BRIEFED AND SEATED.

BEFORE TAKEOFF.

1. Main Cargo and Baggage Doors – CHECKED AND SECURE.
2. Passenger's seat belts – FASTENED.
3. Cabin Secure – Notify Pilot.

AFTER TAKEOFF.

1. Cargo Tie-Down – CHECK.
2. No smoking and fasten seat belt sign – AS REQUIRED.

AERIAL DELIVERY (PERSONNEL)

TWENTY MINUTE WARNING.

1. Alert – Relayed from Pilot.
2. Notify Jumpmaster.
3. Interphone – MONITOR.
4. Static lines – CHECK.
5. Jump door – REMOVED.
6. Static Line Buffer Bar – INSTALLED.
7. 20 Minute Check Complete – NOTIFY PILOT.

TEN MINUTE WARNING.

1. Notify Jumpmaster.
2. Safety Line – HOOK UP.
3. Ten Minute Check Complete – NOTIFY PILOT.

SIX MINUTE WARNING (RED LIGHT).

1. Notify Jumpmaster.
2. Red Light On – NOTIFY PILOT.

ONE MINUTE WARNING

1. Notify Jumpmaster.
2. Ready for Drop – NOTIFY PILOT.

JUMP.

1. Jump on Green Light.

AFTER JUMP.

1. Static Lines – RETRIEVE.
2. Static Line Buffer Bar – REMOVED.
3. Jump Door – REPLACE.
4. After Jump Check – COMPLETE (Notify Pilot).

AERIAL DELIVERY (EQUIPMENT)

TWENTY MINUTE WARNING.

1. Alert Relayed from Pilot.
2. Interphone – MONITOR.
3. Static Lines – CHECK.
4. Jump Door – REMOVED.

5. Static Line Buffer Bar – INSTALLED.
6. Parachutes Secured to Equipment – CHECKED.
7. 20 Minute Check Complete –NOTIFY PILOT.

TEN MINUTE WARNING.

1. Tie-Downs – LOOSEN (Vertical and Lateral).
2. Safety Line – HOOK UP.
3. 10 Minute Check Complete – NOTIFY PILOT.

SIX MINUTE WARNING.

1. Tie-Downs – REMOVE.
2. Cargo – Move to Drop Position.
3. Parachutes – Secured to Equipment.
4. Static Lines – HOOKED UP.
5. 6 Minute Check Complete – NOTIFY PILOT.

ONE MINUTE WARNING (RED LIGHT).

1. Prepared to Drop – NOTIFY PILOT.

DROP.

1. Ten Seconds Prior to Drop (Special Forces) — –GO– GREEN LIGHT.
2. On CARP (All Others) – GREEN LIGHT.
3. On Proper Signal – DROP CARGO.

AFTER DROP.

1. Static Lines – RETRIEVE.
2. Static Line Buffer Bar – REMOVED.
3. Jump Door – REPLACE.
4. After Drop Check – COMPLETE (Notify Pilot).

BEFORE LANDING.

1. Cargo Tie-Down – CHECKED.
2. No Smoking, Fasten Seat Belt Sign – AS REQUIRED.
3. Drop Equipment – SECURED.
4. Before Landing Check – COMPLETE (Notify Pilot).

AFTER LANDING.

1. Customs Form – COMPLETE AS REQUIRED.
2. Offload – AS REQUIRED.
3. Tie-Downs and Loose Equipment – STOWED.
4. Cabin and Latrine – CHECKED FOR CLEANLINESS.
5. Assist flight mechanic – AS REQUIRED.

SECTION IX

ALL-WEATHER OPERATION

TABLE OF CONTENTS

INTRODUCTION.

Except for some repetition necessary for emphasis, clarity, or continuity of thought, this section contains only those procedures that differ from, or are in addition to, the normal operating instructions covered in Section II. Discussions relative to systems operation are covered in Section VII.

Instrument Flight Procedures

The aircraft has excellent maneuverability characteristics for instrument flying. Stability in all axes is excellent. Maneuverability on Ground Control Approach and Instrument Landing System is very good. Before attempting any instrument flight, check that all radios, radio aids, and flight instruments are operating properly.

INSTRUMENT TAKE-OFF.

CAUTION

Take-off should be avoided when both temperature and dew point are within the area of 31° to 33°F and the runway is wet or rain or snow is falling. When the above conditions exist, ice may accumulate on the empennage during runup and take-off, and wing and carburetor icing may occur immediately after take-off.

Planning for instrument take-off should include the possibility of return to the field, and suitable precautions should be taken, including the monitoring of the take-off by GCA or other instrument facilities.

INSTRUMENT CLIMB.

Climbing airspeed and attitude are easily maintained. Banks in excess of 30° are not recommended.

CRUISING.

Cruising under instrument conditions does not differ from cruising under VFR conditions; however, the following checks should be made:

1. Check the directional indicators periodically with the standby compass.
2. Before entering known or suspected icing or visible moisture, turn on the pitot heat and be alert for propeller, wing, and carburetor ice. If ice starts to form on unheated parts of the windshield, it is an indication that ice is forming on the propeller. Turn on the propeller deicing system.

CAUTION

If deicer boots are used, do not operate them continuously, since this may result in ballooning the ice immediately over the boots and render them ineffective. Allow the ice to build up to approximately ¼ inch thickness, then turn the boots on to remove it. After the ice is removed, turn the boots off until the ice builds up again.

SPEED RANGE.

Stability and flight characteristics are good throughout the full range of speed, and instrument flight should be conducted in accordance with the power charts (see Appendix).

DESCENT.

To descend from altitude, use the same procedure as during VFR flight to the minimum instrument altitude for the range being used and in accordance with instructions received from Air Traffic Control.

HOLDING.

Hold with the landing gear and wing flaps up, and use enough power to maintain an IAS of 105 knots (121 mph).

INSTRUMENT APPROACHES.

The general qualities and capabilities of the aircraft are excellent for instrument approaches. A study of all approach procedures must be made before starting the initial approach. Complete the prelanding checks before final approach, so that full attention can be given to flying during the approach.

RADIO RANGE APPROACH.

See Figure 9-1. For detailed instrument approach procedures, see AFM 51-37.

GROUND CONTROLLED APPROACH (GCA).

There is very little difference between a GCA and range approach. The approach is accomplished by reference to basic instruments and execution of instructions issued by a ground controller (figure 9-1).

INSTRUMENT LANDING SYSTEM (ILS).

An ILS differs from a GCA only in that the required procedures must be interpreted from instrument presentation (figure 9-1).

AUTOMATIC DIRECTION FINDER (ADF) APPROACH. (See figure 9-1.)

OMNI-RANGE (VOR) APPROACH.
(See figure 9-1.)

TACAN APPROACH.
(See figure 9-1.)

Ice and Rain

Rain without icing conditions presents no particular problems other than restricted visibility. When icing conditions are encountered, the following procedure will apply:

1. Known regions of severe icing will be avoided.
2. Before entering an icing region, turn on the pitot heaters and check deicer system pressure.

NOTE

Climb or cruise at 10 to 15 knots above normal during icing conditions; reducing the angle of attack minimizes the accumulation of ice on under surfaces.

VFR & IFR RANGE, ADF, VOR, ILS, GCA, AND TACAN APPROACH PROCEDURE.

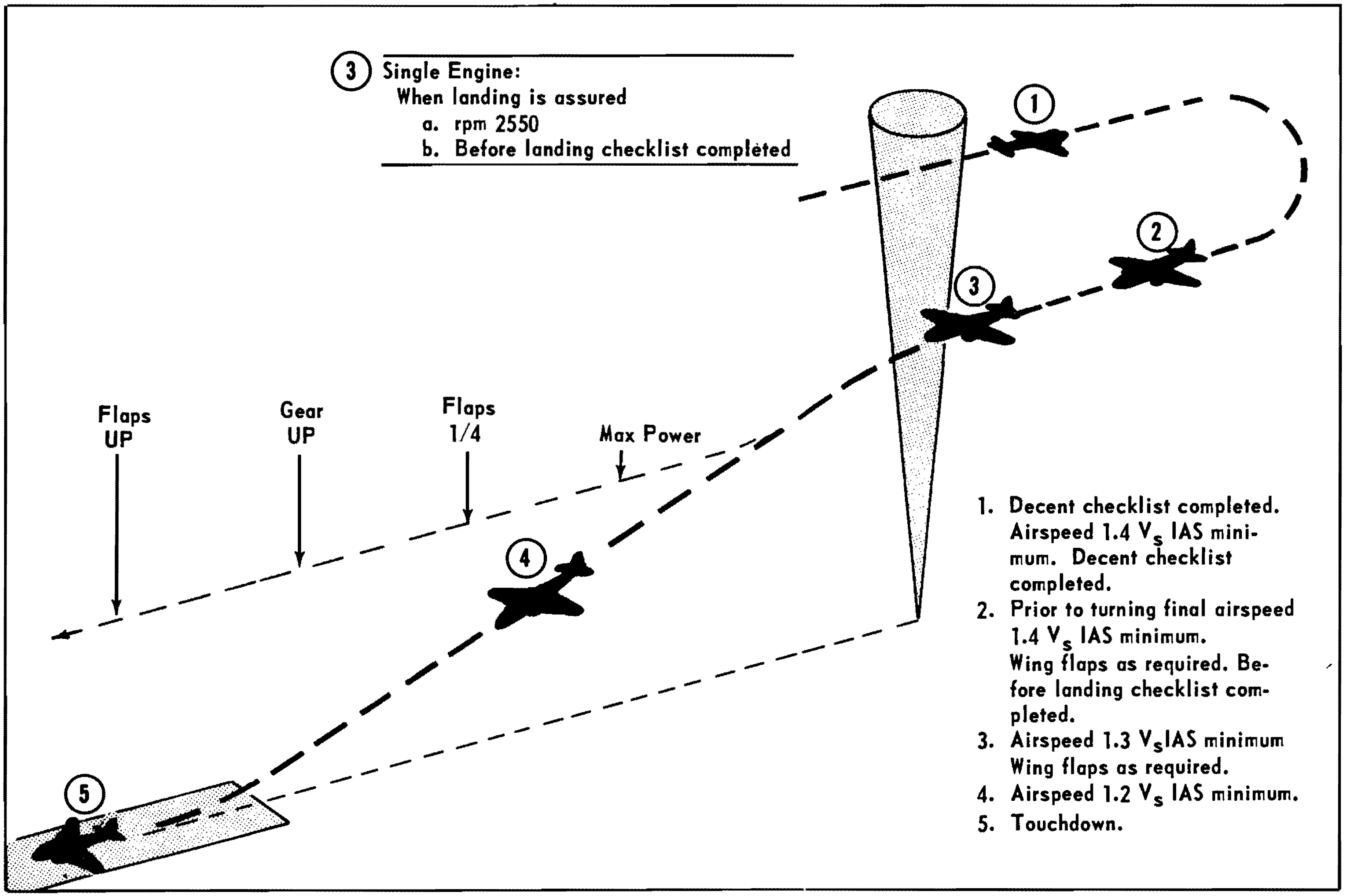


Figure 9-1

3. Regulate carburetor heat to maintain CAT within limits and adjust the cowl flaps as required to maintain proper CHT during flight through the icing region.

4. Operate the wing and empennage deicer system as required (see the paragraph on Wing and Empennage Deicing System Operation, Section IV).

5. If ice forms on the wing area aft of the deicer boots, change the flight path and leave icing region.

WARNING

Ice accumulation on the aircraft will result in higher stall speeds due to the change in aerodynamic characteristics and increased weight of the aircraft due to ice build-up. Approach and landing speeds must be increased accordingly.

Flight in Turbulence and Thunderstorms

WARNING

Flight through a thunderstorm or clear air turbulence should be avoided if at all possible. However, should circumstances force a flight into a zone of severe turbulence, the desired penetration airspeed of the aircraft, which is 60 mph above the stalling speed for its gross weight, should be established before entering the storm. The following recommended techniques aid in reducing structural strain to the aircraft.

Power settings and propeller pitch are the keys to proper flight technique in turbulent air. (Severe turbulence is defined as a condition of sufficient disturbance to make the safety of the aircraft and its occupants the pilot's primary concern.) In selecting a speed for operation in severe turbulence, a compromise must be made between the desire to keep the speed low enough to permit the structure to withstand the greatest possible gusts and the desire to keep the speed high enough to prevent closely approaching the stalling point.

APPROACHING STORM.

It is imperative that the aircraft be prepared as follows before entering the zone of turbulence (if the storm cannot be seen, its proximity may be detected by radio crash static).

1. Disengage the autopilot.
2. Reduce airspeed as required.
3. Mixture controls – AUTO-RICH.
4. Propeller controls – 2350 rpm.
5. Pitot heater switch – ON.
6. Carburetor heat – As required.
7. Throttles – As required.
8. Check the power source and gyro stabilized instruments settings.
9. Safety belt (and shoulder harness if installed)– Tightened. (Check with crew members.)
10. Turn off any radio equipment rendered useless by static.
11. Turn the cockpit lights full bright to minimize the blinding effect of lighting.

CAUTION

Do not lower the flaps or gear, since structural damage may occur.

PENETRATING STORM.

Penetrate the storm as follows:

1. Maintain the power and pitch settings established before entering the storm to hold the airspeed constant, regardless of an erratic airspeed indication caused by heavy rain partially blocking the pitot heads.
2. Devote full attention to flying the aircraft. Concentrate principally on holding a level attitude by reference to the attitude indicator and maintaining as constant an altitude as possible.

CAUTION

Do not chase the airspeed indicator or altimeter since undue stress might be imposed on the aircraft.

3. The altimeter is unreliable in severe turbulence because of differential barometric pressures. A gain or loss of several thousand feet may be expected, and allowance for this error must be made in determining minimum safe altitude.

Note

Altitudes nearest the freezing level are usually the most turbulent.

4. Do not attempt to keep up with the airspeed indicator, which may be off as much as 60 knots as a result of heavy rain partially blocking the pitot heads.
5. Use as little elevator control as possible in maintaining attitude in order to minimize the stresses imposed on the aircraft.

Night Flying

On aircraft not equipped with landing light shields, a glare from the landing lights will be noticed in the cockpit.

Cold-Weather Procedures

The following operating instructions are written to supplement the instructions in Section II and should be complied with when cold weather conditions are encountered. The success of extreme weather operation depends greatly on the preparation made during engine shutdown as outlined in this section; upon this depends the success of the next day's starting operation. Most cold weather operating difficulties are encountered on the ground. The most critical periods in the operation of the aircraft are the postflight and preflight periods. Proper diligence on the part of crew members concerning ground operation is the most important factor in successful cold weather operation.

WARNING

To prevent engine oil starvation due to congealed oil in the engine oil tanks, the procedures for oil preheat and oil dilution must be strictly adhered to. Oil in the tank must be heated to −12°C (+10°F) or above before starting engines.

BEFORE ENTERING AIRCRAFT.

WARNING

All ice, frost, and snow must be removed before flight is attempted.

Apply external heat to the engines and accessory sections. Preheat the engine nacelle until cylinder head temperatures reach 4°C. The time requirements on the following list are rough estimates for engine heating at various temperatures. These requirements will vary with wind velocities and percentage of engine oil dilution. The tabulation below is based on an oil dilution of approximately 25 per cent and no wind.

—6.7° to —18°C (20° to 0°F)............ ½ hour (approx)

—18° to —32°C (0° to —25°F)................ ½ to 1 hour

—32° to —40°C (—25° to —40°F)....1½ to 2½ hours

Check the oil drains for oil flow. If no oil flow is obtainable, continue preheat until oil flow is readily obtained. In addition to external heating, oil immersion heaters may be used; however, no special fittings are provided in the oil tanks for immersion heaters on some aircraft. If the immersion heaters are to be effective in keeping the oil warm during the night, they should be placed in the oil tanks immediately after landing. Use a portable heater to heat the flight instruments, defrost the windshields, and warm the radios, the dynamotors, the inverter, and other equipment within the aircraft. Remove all external coverings, pitot head covers, wing covers, etc. Clean the shock struts and landing gear actuating cylinders of ice and dirt, and check the struts for proper inflation. The hydraulic system is limited to —40°C (—40°F) and will not operate below this temperature. Check for engine stiffness periodically to determine when sufficient heat has been applied. Generally, if an engine is stiff enough to require more than three men to move a propeller, it is considered too stiff to start.

ON ENTERING AIRCRAFT.

1. Operate all the flight control surfaces and tabs through full travel three or four times to check ease of operation. When lowering flaps during normal preflight, the flaps should be lowered in approximately 10-degree increments to check ease of operation.
2. Check functioning of those instruments that can be checked without engine operation.

WARNING

In cold weather, make sure all instruments have warmed up sufficiently to insure normal operation. Check for sluggish instruments during taxiing.

3. Exert light pressure on the brake pedals several times before setting parking brakes to assure adequate pressure for parking brake operation.

BEFORE STARTING ENGINES.

Before starting the engines, perform the following:

1. Remove the oil immersion heaters.
2. Remove the ground heater ducts.
3. Remove the engine nacelle shields (or covers, if installed).
4. Pull the propellers through 15 blades by hand.

STARTING ENGINES.

1. Open the cowl flaps.

CAUTION

Do not close cowl flaps to expedite engine warmup.

2. If the oil pressure is not within limits after 30 seconds running, or if the pressure drops below limits after a few minutes of ground operation,

   shut down and check for blown lines or coolers and recheck for congealed oil or ice at the drains.

   Note

   Oil congealing in a radiator produces unusual and often misleading indications. The usual indication is high oil temperature together with a reduction in pressure, often followed by a sudden drop in oil temperature accompanied by high pressure as the congealed oil is forced into the system.

3. Carburetor air preheat (not to exceed carburetor air temperature limits), should be applied immediately after starting in order to assist vaporization and combustion.
4. Check all instruments for proper operation.
5. Operate the wing flaps at least once.
6. When warming up an engine after an oil dilution operation, it is preferable to allow the oil temperature to rise above 60°C (140°F) and to increase the engine speed during the runup to dissipate as much of the fuel as possible to allow the oil to return to its normal viscosity. Below this temperature and at low engine speeds, very little fuel will be dissipated from the oil.

WARM-UP AND GROUND TESTS.

Use the procedure under Engine Runup, Section II.

TAKE-OFF.

Carburetor heat may be required so that the fuel will vaporize properly at extremely low temperature. Monitor and regulate the carburetor heat to maintain carburetor air temperature within the proper limits during engine runup, climb and cruise (see the paragraph on Carburetor Icing, Section VII).

The heating system should be operating so that the windshield defrosting can be utilized during take-off, if necessary, and so that the flight instruments will not cool and give erroneous indications. Pitot heaters should be ON if precipitation is encountered or if icing conditions are anticipated immediately after take-off. Remember that the flight indicators are not very reliable at temperatures below —43°C (—45°F) and that all flight instruments should be cross-checked.

CAUTION

Do not use surface de-icers during take-off because of resultant disturbance of air flow spoiling the lift of the wing.

AFTER TAKE-OFF.

After take-off, cycle the gear several times to remove slush and snow and to prevent the gear from freezing in the retracted position.

DURING FLIGHT.

Periodically exercise prop controls to provide a supply of warm oil in the prop dome.

APPROACH AND LANDING.

Follow normal prelanding procedures. Apply carburetor heat as required, to prevent carburetor icing and to keep engine running smoothly. At extremely low temperatures it would be wise to use a power-on approach, thus helping keep the cylinder head temperature from becoming critically low. Whenever carburetor heat is used, allowance must be made for the power reduction associated with application of heat. Drain the water supply systems.

ENGINE SHUTDOWN.

Oil dilution is preferred, if the expected minimum temperature is below 4°C (40°F), in order to minimize the requirement for preheat prior to the next engine start.

OIL DILUTION PROCEDURE.

The aircraft is equipped with an engine oil dilution system to facilitate cold weather starting. When a cold weather start is anticipated, the engine oil should be diluted with fuel before the engines are stopped, provided that the engine oil temperature is maintained below 50°C (122°F). Above this temperature, dilution is not effective, since the fuel introduced into the system will vaporize.

When the oil temperature exceeds 50°C (122°F) during the dilution period, stop the engine and wait until oil temperatures have fallen below 40°C (104°F) before again starting the engine and resuming the dilution operation. During conditions of extremely low OAT, it may be necessary to break the dilution period up into two or more short periods because of oil temperature limits for dilution.

If it is necessary to service the engine section oil tanks, the oil dilution period must be divided so that part of the dilution is accomplished before the oil tanks are serviced and the remainder after the tanks are serviced.

If the oil tank is full and more than 3 minutes dilution time is required, some oil should be drained from the tank to prevent overflowing during the dilution period of subsequent engine run.

Perform the oil dilution operation as follows (operation of the oil dilution system is indicated by a drop in fuel pressure, followed later by a drop in oil pressure):

1. Operate each engine at 1000 to 1200 rpm.
2. Maintain oil temperatures below 50°C (122°F), stopping an engine for a short period if the temperature exceeds this limit.
3. Turn booster pumps (wobble pump) ON.
4. Operate the oil dilution solenoid switches for the following periods for indicated anticipated temperatures:

   4° to —12°C (40° to 10°F) .... 2 minutes

   —12° to —29°C (10° to —20°F) ...... 4 minutes

   —29° to —46°C (20° to —50°F) ...... 7 minutes
5. Move the propeller controls from INCREASE to DECREASE three times to dilute oil in the propeller domes. The time required to actuate the propeller controls from INCREASE RPM to DECREASE RPM three times should not exceed 1 minute total time. This 1 minute will be dilution time in addition to the time required to dilute for each anticipated ambient temperature.
6. To dilute oil in the propeller feathering system, push right feathering button and allow for 200 RPM drop, then pull out feathering button. Dilute oil in left propeller feathering system using same procedures.
7. A short acceleration period of approximately 10 seconds at the end of the dilution run will usually clear the spark plugs of any fouling condition resulting from the prolonged idling.

After the oil has been diluted as specified above, and the propeller feathering system checked out during dilution, position the carburetor mixture controls to IDLE CUT-OFF, and continue to hold the oil dilution switch ON until the propeller stops turning.

Desert Procedures

Wind-blown sand is the main concern of operation in the desert. Many of the malfunctions which occur will be found to originate from improper care on the ground. Since most of the procedures given in Section II apply as well to Desert Procedures, only specific information for care of the aircraft during ground and flight operation will be given in this section. Carburetor air filters may be required for all operations.

Unless absolutely necessary do not take off during sand or dust storms.

HIGH ALTITUDE PROCEDURES.

The following procedures are recommended when operating from fields with an elevation that results in density altitudes of approximately 6000 to 16,000 feet.

STARTING.

The engine is more prone to flooding upon starting at density altitudes above 6000 feet, due primarily to reduction in density of the air flowing through the carburetor. The following techniques should be employed when starting at these altitudes.

1. Use larger throttle openings when starting.
2. Start in low blower.
3. When bringing in the mixture, move it to the AUTO-LEAN position.

TAXIING.

Above 6000 feet density altitude, taxiing should be done at 1200 rpm in AUTO-LEAN. If necessary, manually lean mixtures to achieve a smooth idle.

ENGINE RUNUP.

Normal runup procedures will be used at altitudes below 10,000 feet density altitude. At altitudes above 10,000 feet, where high blower will be used for takeoff, eliminate normal sequence of high blower check. Shift to high blower at 1700 rpm, just prior to advancing throttles for takeoff.

TAKEOFF.

At altitudes below 10,000 feet, use low blower and normal takeoff procedures. Above 10,000 feet altitude, high blower should be used.

APPROACH AND LANDING.

Normal low altitude traffic patter, approach and threshold-indicated airspeeds are recommended; however, bear in mind that true airspeed increases with altitude for the same indicated airspeed and consequently, the landing ground roll will be appreciably extended at high elevations. Another factor to consider is the decrease in ground cushioning effect during the flare out. Close adherence to the recommended approach speeds and flap settings are mandatory for the successful completion of either a landing or go-around. After touchdown place mixture in AUTO-LEAN and blowers in LOW.

APPENDIX
PERFORMANCE DATA

TABLE OF CONTENTS

PART ONE
INTRODUCTION

TABLE OF CONTENTS

LIST OF CHARTS

GENERAL INFORMATION.

The information in the Appendix is presented to assist operating personnel to a better understanding of the performance capabilities and limitations of the aircraft. The objective of the Appendix is to provide specific performance values in graphical form covering all reasonable conditions under which the aircraft will be operated to enable operating personnel to utilize the aircraft efficiently.

DISCUSSION OF CHARTS.

The take-off charts are presented in such a manner that performance may be determined for any set of atmospheric conditions. The climb data is presented for standard day and hot day atmospheric conditions. Range performance may be determined for any atmospheric temperature condition by considering the altitude specified in the charts as density altitude. The performance charts are identified according to their type and condition of operation by colored page borders conforming to the following code:

Normal Operation ....Plain Corner
Emergency Operation .... Red Corner
Hot Day Operation .... Yellow Corner

DEFINITION OF TERMS

AIRSPEED – the speed of the aircraft relative to the air through which it is moving.

AMBIENT CONDITIONS – conditions of the air surrounding the aircraft at any given time under consideration.

AUTO-LEAN – the mixture control lever at the lean detent.

AUTO-RICH – the mixture control lever at the rich detent.

BMEP DROP – a loss in BMEP due to a manual adjustment of the mixture control.

CALIBRATED AIRSPEED – indicated airspeed corrected for instrument and position error.

COMPRESSIBILITY ERROR – an error in the airspeed indicator reading and the outside air temperature indicator reading caused by air being slightly compressed by the moving aircraft.

DENSITY ALTITUDE – the altitude obtained from a standard density altitude chart for any given pressure altitude and temperature or for any density ratio factor ($1/\sqrt{\sigma}$).

DEW POINT – the temperature at which consensation occurs in a cooling mass of air.

DRY BULB TEMPERATURE – the air temperature as indicated by a thermometer with a dry bulb (true air temperature).

EFFECTIVE WIND (HEAD OR TAILWIND) – The component of the existing wind condition which acts opposite to or in the direction of travel. For takeoff or landing, this component will be computed from the take-off and landing crosswind chart.

EQUIVALENT AIRSPEED – calibrated airspeed corrected for compressibility.

INCHES HG – a measure of air pressure which compares it to the weight of a column of mercury.

INDICATED AIRSPEED – airspeed indicator reading uncorrected (assuming the mechanical error in the instrument is negligible).

LOW BLOWER – the engine supercharger in low gear ratio.

NAUTICAL MILES PER POUND – the number of nautical miles traveled while consuming a pound of fuel.

OPERATING WEIGHT EMPTY – the weight of the aircraft and its contents, not including payload, fuel or regular engine oil, when the aircraft is equipped with all provisions necessary to complete a mission.

POSITION ERROR – the error in the airspeed indicator reading and the altimeter reading caused by the inability of the static orifices to experience the true ambient air pressure.

PRESSURE ALTITUDE – the altitude obtained from a standard atmosphere table, for any given value of air pressure (measured in inches Hg). This is the altitude that an altimeter will show (after correcting for position error) when set to 29.92 inches Hg.

RAM – the increase in air pressure at the entrance to an airscoop due to the speed of the aircraft.

RECOMMENDED LONG RANGE CRUISE SPEED – the speed at which it is recommended to fly the aircraft when long range is of more concern than high speed.

REFUSAL DISTANCE – the distance required to accelerate to the refusal speed.

REFUSAL SPEED – maximum speed to which the aircraft can accelerate and then stop in the available runway length.

RELATIVE HUMIDITY – the ratio of the amount of water vapor in a given mass of air to the maximum amount of water vapor that the mass of air could hold at the same temperature.

SPECIFIC HUMIDITY – the ratio of the amount of water vapor in a given mass of air to the mass of dry air, measured in pounds.

SPECIFIC RANGE – nautical miles per pound of fuel.

STANDARD ATMOSPHERIC CONDITIONS – an arbitrarily selected set of atmospheric conditions chosen to approximate the average atmosphere of the world.

STANDARD DAY – a day on which standard atmospheric conditions are assumed to exist.

THRESHOLD SPEED – the speed at which the aircraft crosses the end of the runway during a normal landing (120 percent of the stall speed for wing flaps in the landing position).

TOUCHDOWN SPEED – the speed at which the aircraft comes in contact with the runway during a normal landing (110 percent of the stall speed for wing flaps in the landing position).

TRUE AIRSPEED – the true speed of the aircraft relative to the air through which it is moving (equal to EAS time $1/\sqrt{\sigma}$).

TRUE ALTITUDE – altitude above sea level.

VAPOR PRESSURE – the partial pressure of water vapor existing in the air.

$V_{L/D}$ – the speed for maximum lift to drag ratio.

V_{SO} – the zero thrust stalling speed with wing flaps in the landing configuration.

Vto – takeoff speed (110 percent of the stalling speed with the wing flaps in the takeoff configuration).

WET BULB TEMPERATURE – the temperature indicated by a thermometer whose bulb has been kept moist with water and which has been circulated in the air. This temperature, along with the dry bulb temperature, is used in conjunction with a psychrometric chart to determine the degree of humidity.

LIST OF ABBREVIATIONS

Alt.	Altitude
BHP	Brake horsepower
BMEP	Brake mean effective pressure
°C	Degrees Centigrade
CAS	Calibrated airspeed
CAT	Carburetor air temperature
CHT	Cylinder head temperature
Crit.	Critical
EAS	Equivalent airspeed
Eng.	Engine
°F	Degrees Fahrenheit
Fld.	Field
Ft.	Feet
Hg.	Mercury
IAS	Indicated airspeed
ICAO	International Civil Aviation Organization
In.	Inch
Kts.	Knots
Lbs.	Pounds
MP	Manifold pressure
METO	Maximum except takeoff
Min.	Minute
OAT	Outside air temperature
PSI	Pounds per square inch
Pt.	Point
RPM	Revolutions per minute
S. L.	Sea level
Std.	Standard
T	Absolute temperature
TAS	True airspeed
V_{CO}	Climbout speed
$V_{L/D}$	Speed for maximum lift to drag ratio
V_{MC}	Minimum control speed
V_{NE}	Maximum dive speed
V_{NO}	Maximum speed for normal operation
V_R	Refusal speed
V_S	Stalling speed
V_{SO}	Stalling speed with zero thrust and wing flaps in landing configuration
V_{TO}	Takeoff speed
Wt.	Weight
δ	Delta; ratio of ambient air pressure to standard sea level air pressure
σ	Sigma; ratio of ambient air density to standard sea level air density

AIRSPEED TERMINOLOGY

Airspeed terminology used in this Appendix is defined as follows:

TERM	ABBREVIATION	DEFINITION
Indicated Airspeed	IAS	*Airspeed Indicator reading uncorrected.
Calibrated Airspeed	CAS	Indicated airspeed corrected for position error.
Equivalent Airspeed	EAS	Calibrated airspeed corrected for compressibility.
True Airspeed	TAS	TAS $\doteq$ EAS X $1/\sqrt{\sigma}$

*IAS is used in this Appendix as though the mechanical error in the instrument is zero.

All airspeeds of importance in takeoff and landing procedures are shown in this Appendix as indicated airspeed (IAS).

All airspeed data relating to take-off and landing procedures are given as indicated airspeed. Indicated airspeed for ground run is based on an estimated position error equal to zero. Since all cruise and climb data is given as calibrated airspeed, the airspeed position error charts are included to obtain the corresponding indicated airspeed. The characteristic take-off speeds chart and the characteristic landing speeds chart give indicated airspeed based on inflight calibrations. The take-off performance--ground run chart and the take-off performance--refusal speed chart give indicated airspeed based on negligible ground run position error.

AIRSPEED POSITION ERROR CORRECTION.

This chart (figure A1-1) shows the correction that must be applied to the indicated airspeed to determine the calibrated airspeed.

CALIBRATED AIRSPEED CORRECTION FOR COMPRESSIBILITY.

The calibrated airspeed correction for compressibility chart (figure A1-2) is used in determining EAS from CAS. A sample problem on the chart illustrates its use.

TEMPERATURE CORRECTION FOR COMPRESSIBILITY CHART.

This chart (figure A1-3) shows the correction that must be subtracted from the outside air temperature indicator reading to determine the true outside air temperature. For example, assume that the airplane is cruising at 125 knots CAS (point A) at an altitude of 10,000 feet (point B). The chart shows that the correction is 2.5°C (point C). This amount must be subtracted from the indicated air temperature to determine the outside air temperature. If the instrument read 6°C, then the outside air temperature would be 6-2.5, or 3.5°C. If the instrument read −12°C, then the outside air temperature would be −12-2.5, or −14.5°C.

DENSITY ALTITUDE CHART.

The density altitude chart (figure A1-4) is used in determining the density altitude and the value $1/\sqrt{\sigma}$ for any pressure altitude and ambient temperature. A sample problem on the chart illustrates its use.

ICAO STANDARD ATMOSPHERE TABLE.

The ICAO standard altitude table (figure A1-5) presents the density altitude factor tabulated for thousands and hundreds of feet; and the values of sigma (σ), the density ratio of ambient air to standard sea level air, tabulated for thousands of feet. The value $1/\sqrt{\sigma}$ is chiefly used in obtaining the true airspeed (TAS) from equivalent airspeed (EAS) by the relationship, TAS $\doteq$ EAS X $1/\sqrt{\sigma}$

TEMPERATURE CONVERSION CHART.

The temperature conversion chart (figure A1-6) is provided to facilitate the conversion of either Fahrenheit temperatures to Centigrade, or Centigrade temperatures to Fahrenheit.

PSYCHROMETRIC CHART.

The Psychrometric Chart (Figure A1-8) graphically relates the various measures of water vapor in the atmosphere. Although it is the dew point which is commonly furnished the pilot, occasionally humidity may be available as wet and dry bulb temperatures, and less often, as relative humidity. To meet all such situations the psychrometric chart provides a means of converting from one variable to another.

Three examples for obtaining specific humidity are given below which differ as to which quantities are known.

Example 1:

Given: Pressure altitude = 5000 ft.

Dew Point = 54.5°F

Find: Specific humidity

1. Locate 54.5°F dew point temperature on curved line for 100% relative humidity (point B). This point can be found either by interpolation between 50°F and 60°F along curved line or by entering at 54.5°F on dry bulb temperature scale (point A) and projecting vertically upward to curved line for 100% relative humidity.

2. From point B, proceed horizontally to left base line and then follow along curved path interpolated between guide lines to 5000 ft. pressure altitude (point C).

3. Project horizontally to specific humidity scale at extreme left (point D) and read .0108.

4. If vapor pressure is desired, project horizontally from point B to extreme right (point E) and read 0.425 inches Hg.

Example 2:

Given: Pressure altitude = 5000 ft.

Wet bulb temperature = 17°C

Dry bulb temperature = 26°C

Find: Dew point and specific humidity

1. Enter with 26°C dry bulb temperature (point F) and proceed vertically upward to intersection with imaginary slant line for 17°C wet bulb temperature (point G). Note that the 17°C wet bulb temperature line can be located by interpolation between the 15°C and 20°C wet bulb lines for 5000 ft. altitude. To assist interpolation, the upper end of this line can be located by entering the dry bulb temperature scale at 17°C (point H) and projecting vertically upward to the 100% relative humidity line (point I). Draw slant line through point I parallel to 5000 ft. wet bulb dashed lines to intersection (point G) with vertical projection of point F.

2. From point G, project horizontally to left to dew point scale (point B) and read dew point, 54.5°F.

3. Continue left as in Example 1 (points C and D) to obtain a specific humidity of .0108.

4. From point G, project horizontally to right to obtain 0.425 inches Hg vapor pressure (point E).

Example 3:

Given: Relative humidity = 43%

Dry bulb temperature = 26°C

Find: Dew point and specific humidity

1. Enter dry bulb temperature scale at 26°C (point F) and proceed vertically upward to intersection with 43% relative humidity line, interpolated between 40% and 60% (point G).

2. Project horizontally to the left to the dew point scale (point B) and read dew point, 54.5°F.

3. To obtain specific humidity project horizontally to left base line and continue as in example 1 (points C and D) to read .0108.

4. From point G project horizontally to right to obtain 0.425 inches Hg vapor pressure (point E).

FUEL DENSITY TABLE.

The fuel density table (figure A1-9) presents variations in fuel density of 100/130 and 115/145 grades fuel as related to variations in temperature.

AIRSPEED POSITION ERROR CORRECTION

(NO INSTRUMENT ERROR INCLUDED)

BASED ON: FLIGHT TEST DATA
DATA AS OF: 11 JULY 1957

MODEL(S): C-47, C-117 AND R4D

ENGINE(S): (2) A-1830-90C (HIGH BLOWER INOPERATIVE) -90D AND -92

THIS CHART APPLIES TO ALL FLAP AND LANDING GEAR CONFIGURATIONS

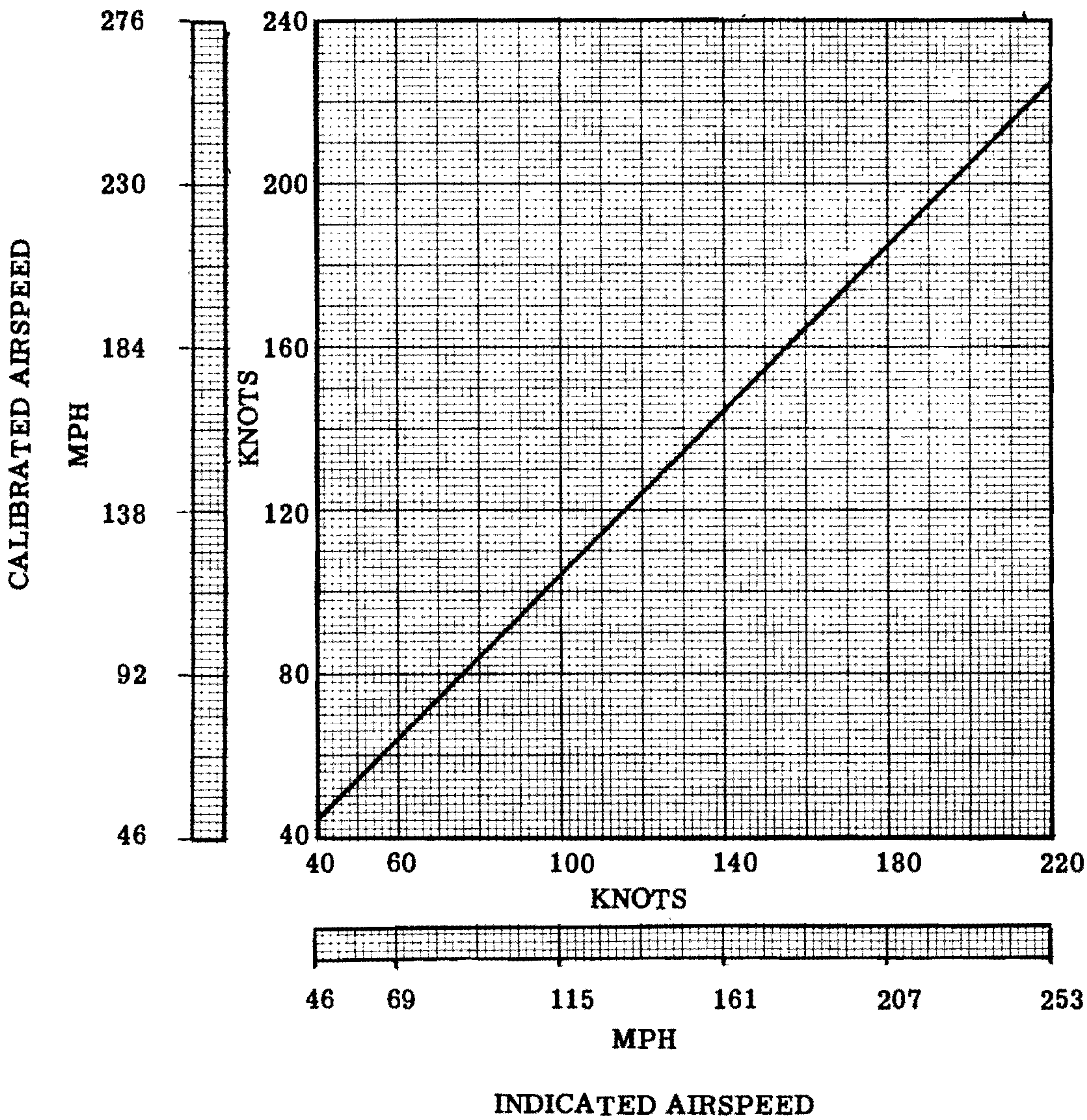


Figure A1-1. Airspeed Position Error Correction.

CALIBRATE AIRSPEED CORRECTION FOR COMPRESSIBILITY

NOTE
SUBTRACT CORRECTION FROM CALIBRATED AIRSPEED TO OBTAIN EQUIVALENT AIRSPEED

SAMPLE PROBLEM

GIVEN: PRESSURE ALTITUDE = 15000 FEET
CALIBRATED AIRSPEED = 120 KNOTS

A = ENTER CHART AT 120 KNOTS
B = AT 15000 FEET READ CORRECTION
C = CORRECTION = 0. 6 KNOTS OR MPH

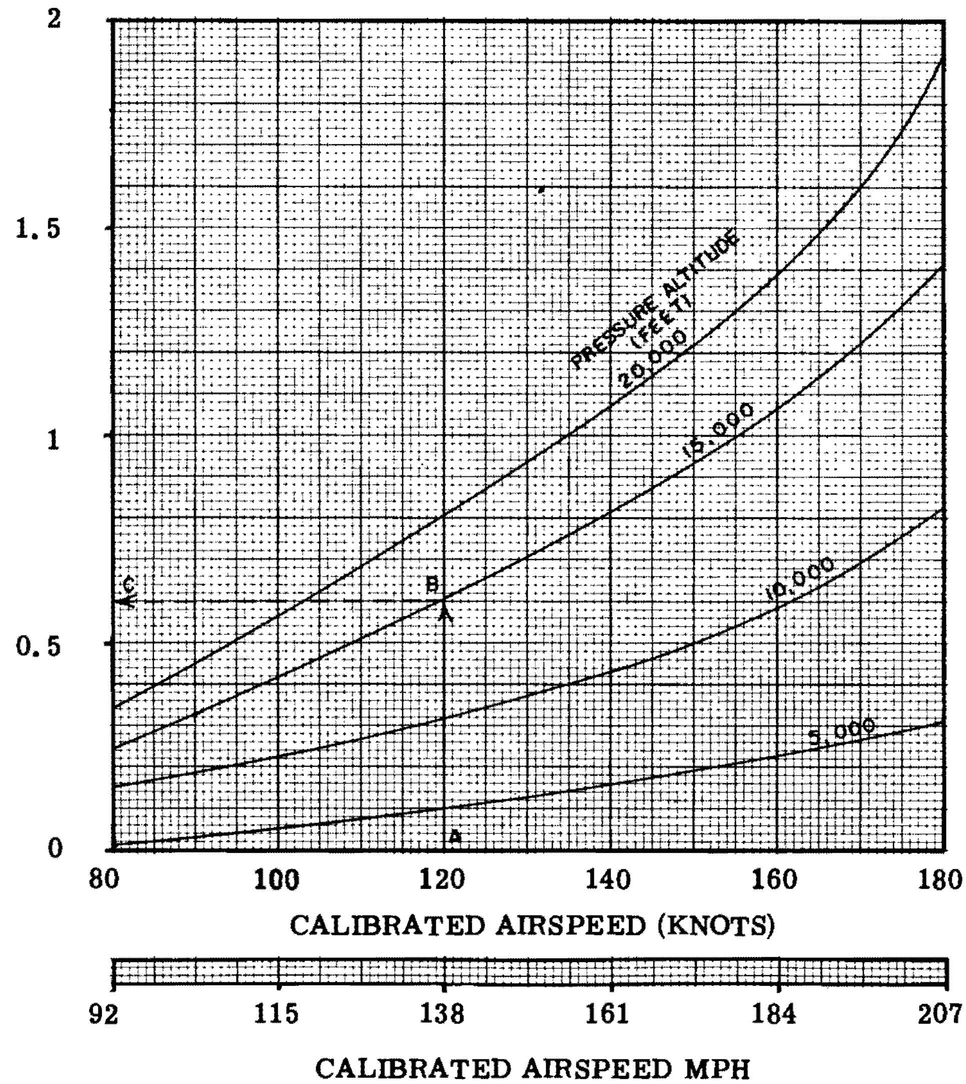


Figure A1-2. Calibrate Airspeed Correction For Compressibility.

TEMPERATURE CORRECTION FOR COMPRESSIBILITY

NOTE:

A SUBTRACT CORRECTION FROM INDICATED AIR TEMPERATURE TO OBTAIN FREE AIR TEMPERATURE °C OR °F

B TEMPERATURE RECOVERY COFFICIENT 80%

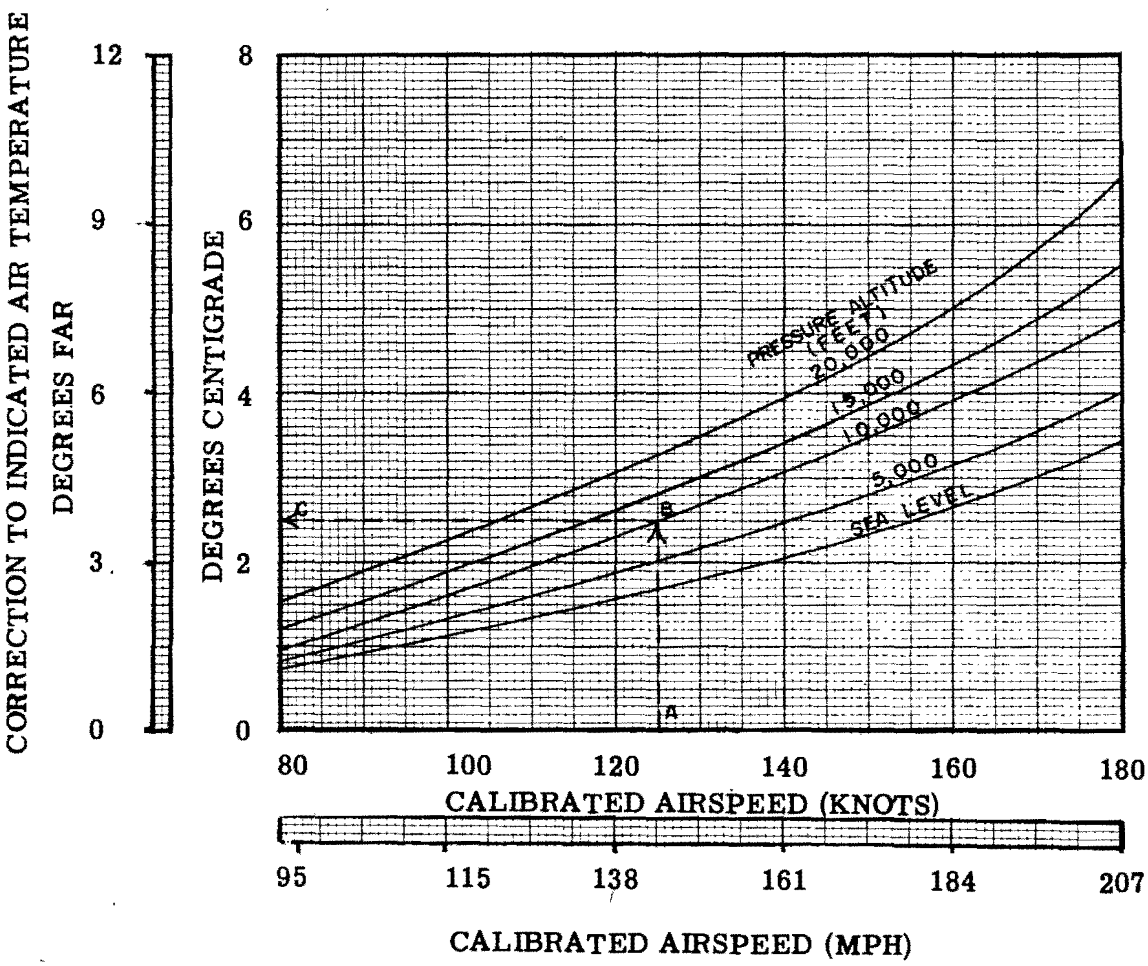
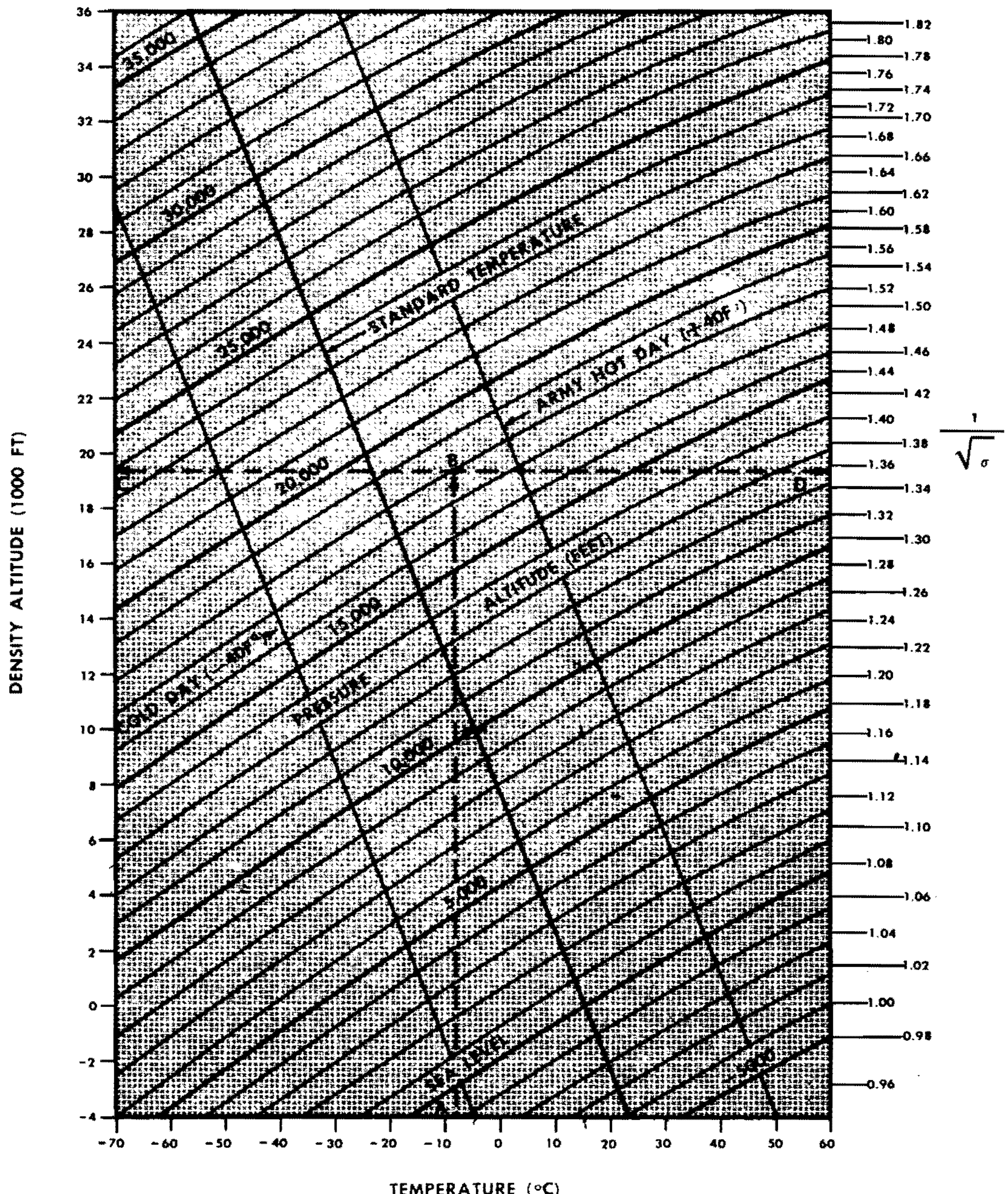


Figure A1-3. Temperature Correction For Compressibility.

DENSITY ALTITUDE CHART



SAMPLE PROBLEM:

(A) Free air temperature −8 °C
(B) Pressure altitude 18,000 ft
(C) Density altitude 19,400 ft
(D) $1/\sqrt{\sigma}$ 1.356

Figure A1-4. Density Altitude.

ICAO STANDARD ATMOSPHERE TABLE

STANDARD S. L. CONDITIONS:

Temperature = 15°C (59°F)
Pressure = 29.921 In. Hg (2116.216 psf)
Density = .0023769 slugs/cu ft
Speed of sound = 1116.89 fps (661.7 knots)

CONVERSION FACTORS:

1 In. Hg = 70.727 psf
1 In. = 0.49116 psi
1 Knot = 1.151 mph
1 Knot = 1.688 fps

Altitude Feet	*Density Ratio* σ	$\frac{1}{\sqrt{\sigma}}$	*Temperature* °C	*Temperature* °F	*Speed of Sound (Knots)*	*Pressure In. Hg*	*Pressure Ratio* δ
0	1.000	1.0000	15.000	59.000	661.7	29.921	1.0000
1000	.9711	1.0148	13.019	55.434	659.5	28.856	.9644
2000	.9428	1.0299	11.038	51.868	657.2	27.821	.9298
3000	.9151	1.0454	9.056	48.302	654.9	26.817	.8962
4000	.8881	1.0611	7.076	44.735	652.6	25.842	.8637
5000	.8617	1.0773	5.094	41.169	650.3	24.896	.8320
6000	.8359	1.0938	3.113	37.603	648.7	23.978	.8014
7000	.8106	1.1107	1.132	34.037	645.6	23.088	.7716
8000	.7860	1.1279	−0.850	30.471	643.3	22.225	.7428
9000	.7620	1.1456	−2.831	26.905	640.9	21.388	.7148
10,000	.7385	1.1637	−4.812	23.338	638.6	20.577	.6877
11,000	.7155	1.1822	−6.793	19.772	636.2	19.791	.6614
12,000	.6932	1.2011	−8.774	16.206	633.9	19.029	.6360
13,000	.6713	1.2205	−10.756	12.640	631.5	18.292	.6113
14,000	.6500	1.2403	−12.737	9.074	629.0	17.577	.5875
15,000	.6292	1.2606	−14.718	5.508	626.6	16.886	.5643
16,000	.6090	1.2815	−16.699	1.941	624.2	16.216	.5420
17,000	.5892	1.3028	−18.680	−1.625	621.8	15.569	.5203
18,000	.5699	1.3246	−20.662	−5.191	619.4	14.942	.4994
19,000	.5511	1.3470	−22.643	−8.757	617.0	14.336	.4791
20,000	.5328	1.3700	−24.624	−12.323	614.6	13.750	.4595
21,000	.5150	1.3935	−26.605	−15.889	612.1	13.184	.4406
22,000	.4976	1.4176	−28.587	−19.456	609.6	12.636	.4223
23,000	.4800	1.4424	−30.568	−23.022	607.1	12.107	.4046
24,000	.4642	1.4678	−32.549	−26.588	604.6	11.597	.3876
25,000	.4481	1.4938	−34.530	−30.154	602.1	11.103	.3711
26,000	.4325	1.5206	−36.511	−33.720	599.6	10.627	.3552
27,000	.4173	1.5480	−38.492	−37.286	597.1	10.168	.3398
28,000	.4025	1.5762	−40.474	−40.852	594.6	9.725	3250
29,000	.3881	1.6052	−42.455	−44.419	592.1	9.297	.3107
30,000	.3741	1.6349	−44.436	−47.985	589.5	8.885	.2970
31,000	.3605	1.6654	−46.417	−51.551	586.9	8.488	.2837
32,000	.3473	1.6968	−48.398	−55.117	584.4	8.106	.2709
33,000	.3345	1.7291	−50.379	−58.683	581.8	7.737	.2586
34,000	.3220	1.7623	−52.361	−62.249	579.2	7.382	.2467
35,000	.3099	1.7964	−54.342	−65.816	576.6	7.041	.2353
36,000	.2981	1.8315	−56.323	−69.382	574.0	6.712	.2243
36,089	.2971	1.8347	−56.500	−69.700	573.7	6.683	.2234
37,000	.2843	1.8753	−56.500	−69.700	573.7	6.397	.2138
38,000	.2710	1.9209	−56.500	−69.700	573.7	6.097	.2038
39,000	.2583	1.9677	−56.500	−69.700	573.7	5.811	.1942
40,000	.2462	2.0155	−56.500	−69.700	573.7	5.538	.1851
41,000	.2346	2.0645	−56.500	−69.700	573.7	5.278	.1764
42,000	.2236	2.1148	−56.500	−69.700	573.7	5.030	.1681
43,000	.2131	2.1662	−56.500	−69.700	573.7	4.794	.1602
44,000	.2031	2.2189	−56.500	−69.700	573.7	4.569	.1527
45,000	.1936	2.2728	−56.500	−69.700	573.7	4.355	.1455

Figure A1-5. ICAO Standard Atmosphere Table (Sheet 1 of 2).

ICAO STANDARD ATMOSPHERE TABLE

ALTITUDE IN 100-FOOT INCREMENTS AND $\frac{1}{\sqrt{\sigma}}$

Altitude Feet	$\frac{1}{\sqrt{\sigma}}$	*Altitude Feet*	$\frac{1}{\sqrt{\sigma}}$	*Altitude Feet*	$\frac{1}{\sqrt{\sigma}}$	*Altitude Feet*	$\frac{1}{\sqrt{\sigma}}$	*Altitude Feet*	$\frac{1}{\sqrt{\sigma}}$
100	1.0015	6100	1.0955	12,100	1.2030	18,100	1.3269	24,100	1.4704
200	1.0029	6200	1.0971	12,200	1.2049	18,200	1.3291	24,200	1.4729
300	1.0044	6300	1.0988	12,300	1.2069	18,300	1.3313	24,300	1.4755
400	1.0059	6400	1.1005	12,400	1.2088	18,400	1.3335	24,400	1.4781
500	1.0074	6500	1.1022	12,500	1.2107	18,500	1.3358	24,500	1.4807
600	1.0088	6600	1.1039	12,600	1.2127	18,600	1.3380	24,600	1.4833
700	1.0103	6700	1.1056	12,700	1.2146	18,700	1.3403	24,700	1.4860
800	1.0118	6800	1.1073	12,800	1.2166	18,800	1.3425	24,800	1.4886
900	1.0133	6900	1.1090	12,900	1.2185	18,900	1.3448	24,900	1.4912
1000	1.0148	7000	1.1107	13,000	1.2205	19,000	1.3470	25,000	1.4938
1100	1.0163	7100	1.1124	13,100	1.2224	19,100	1.3493	25,100	1.4965
1200	1.0178	7200	1.1141	13,200	1.2244	19,200	1.3516	25,200	1.4991
1300	1.0193	7300	1.1158	13,300	1.2264	19,300	1.3539	25,300	1.5018
1400	1.0208	7400	1.1175	13,400	1.2284	19,400	1.3561	25,400	1.5045
1500	1.0223	7500	1.1193	13,500	1.2303	19,500	1.3584	25,500	1.5071
1600	1.0238	7600	1.1210	13,600	1.2323	19,600	1.3607	25,600	1.5098
1700	1.0253	7700	1.1227	13,700	1.2343	19,700	1.3630	25,700	1.5125
1800	1.0269	7800	1.1245	13,800	1.2363	19,800	1.3653	25,800	1.5152
1900	1.0284	7900	1.1262	13,900	1.2383	19,900	1.3677	25,900	1.5179
2000	1.0299	8000	1.1279	14,000	1.2403	20,000	1.3700	26,000	1.5206
2100	1.0314	8100	1.1297	14,100	1.2423	20,100	1.3723	26,100	1.5233
2200	1.0330	8200	1.1314	14,200	1.2444	20,200	1.3746	26,200	1.5260
2300	1.0345	8300	1.1332	14,300	1.2464	20,300	1.3770	26,300	1.5287
2400	1.0360	8400	1.1350	14,400	1.2484	20,400	1.3793	26,400	1.5315
2500	1.0376	8500	1.1367	14,500	1.2504	20,500	1.3817	26,500	1.5342
2600	1.0391	8600	1.1385	14,600	1.2525	20,600	1.3840	26,600	1.5370
2700	1.0407	8700	1.1403	14,700	1.2545	20,700	1.3864	26,700	1.5397
2800	1.0422	8800	1.1420	14,800	1.2565	20,800	1.3888	26,800	1.5425
2900	1.0438	8900	1.1438	14,900	1.2586	20,900	1.3911	26,900	1.5453
3000	1.0454	9000	1.1456	15,000	1.2606	21,000	1.3935	27,000	1.5480
3100	1.0469	9100	1.1474	15,100	1.2627	21,100	1.3958	27,100	1.5508
3200	1.0485	9200	1.1492	15,200	1.2648	21,200	1.3983	27,200	1.5536
3300	1.0501	9300	1.1510	15,300	1.2668	21,300	1.4007	27,300	1.5564
3400	1.0516	9400	1.1528	15,400	1.2689	21,400	1.4031	27,400	1.5592
3500	1.0532	9500	1.1546	15,500	1.2710	21,500	1.4055	27,500	1.5620
3600	1.0548	9600	1.1564	15,600	1.2731	21,600	1.4079	27,600	1.5649
3700	1.0564	9700	1.1582	15,700	1.2752	21,700	1.4103	27,700	1.5677
3800	1.0580	9800	1.1600	15,800	1.2773	21,800	1.4128	27,800	1.5705
3900	1.0595	9900	1.1618	15,900	1.2794	21,900	1.4152	27,900	1.5734
4000	1.0611	10,000	1.1637	16,000	1.2815	22,000	1.4176	28,000	1.5762
4100	1.0627	10,100	1.1655	16,100	1.2836	22,100	1.4201	28,100	1.5791
4200	1.0643	10,200	1.1673	16,200	1.2857	22,200	1.4225	28,200	1.5819
4300	1.0659	10,300	1.1692	16,300	1.2878	22,300	1.4250	28,300	1.5848
4400	1.0676	10,400	1.1710	16,400	1.2899	22,400	1.4275	28,400	1.5877
4500	1.0692	10,500	1.1729	16,500	1.2921	22,500	1.4299	28,500	1.5906
4600	1.0708	10,600	1.1747	16,600	1.2942	22,600	1.4324	28,600	1.5935
4700	1.0724	10,700	1.1766	16,700	1.2963	22,700	1.4349	28,700	1.5964
4800	1.0740	10,800	1.1784	16,800	1.2985	22,800	1.4374	28,800	1.5993
4900	1.0757	10,900	1.1803	16,900	1.3006	22,900	1.4399	28,900	1.6022
5000	1.0773	11,000	1.1822	17,000	1.3028	23,000	1.4424	29,000	1.6052
5100	1.0789	11,100	1.1840	17,100	1.3049	23,100	1.4449	29,100	1.6081
5200	1.0806	11,200	1.1859	17,200	1.3071	23,200	1.4474	29,200	1.6110
5300	1.0822	11,300	1.1878	17,300	1.3093	23,300	1.4499	29,300	1.6140
5400	1.0838	11,400	1.1897	17,400	1.3115	23,400	1.4525	29,400	1.6170
5500	1.0855	11,500	1.1916	17,500	1.3136	23,500	1.4550	29,500	1.6199
5600	1.0871	11,600	1.1935	17,600	1.3158	23,600	1.4576	29,600	1.6229
5700	1.0888	11,700	1.1954	17,700	1.3180	23,700	1.4601	29,700	1.6259
5800	1.0905	11,800	1.1973	17,800	1.3202	23,800	1.4627	29,800	1.6289
5900	1.0921	11,900	1.1992	17,900	1.3224	23,900	1.4652	29,900	1.6319
6000	1.0938	12,000	1.2011	18,000	1.3246	24,000	1.4678	30,000	1.6349

Figure A1-5. ICAO Standard Atmosphere Table (Sheet 2 of 2).

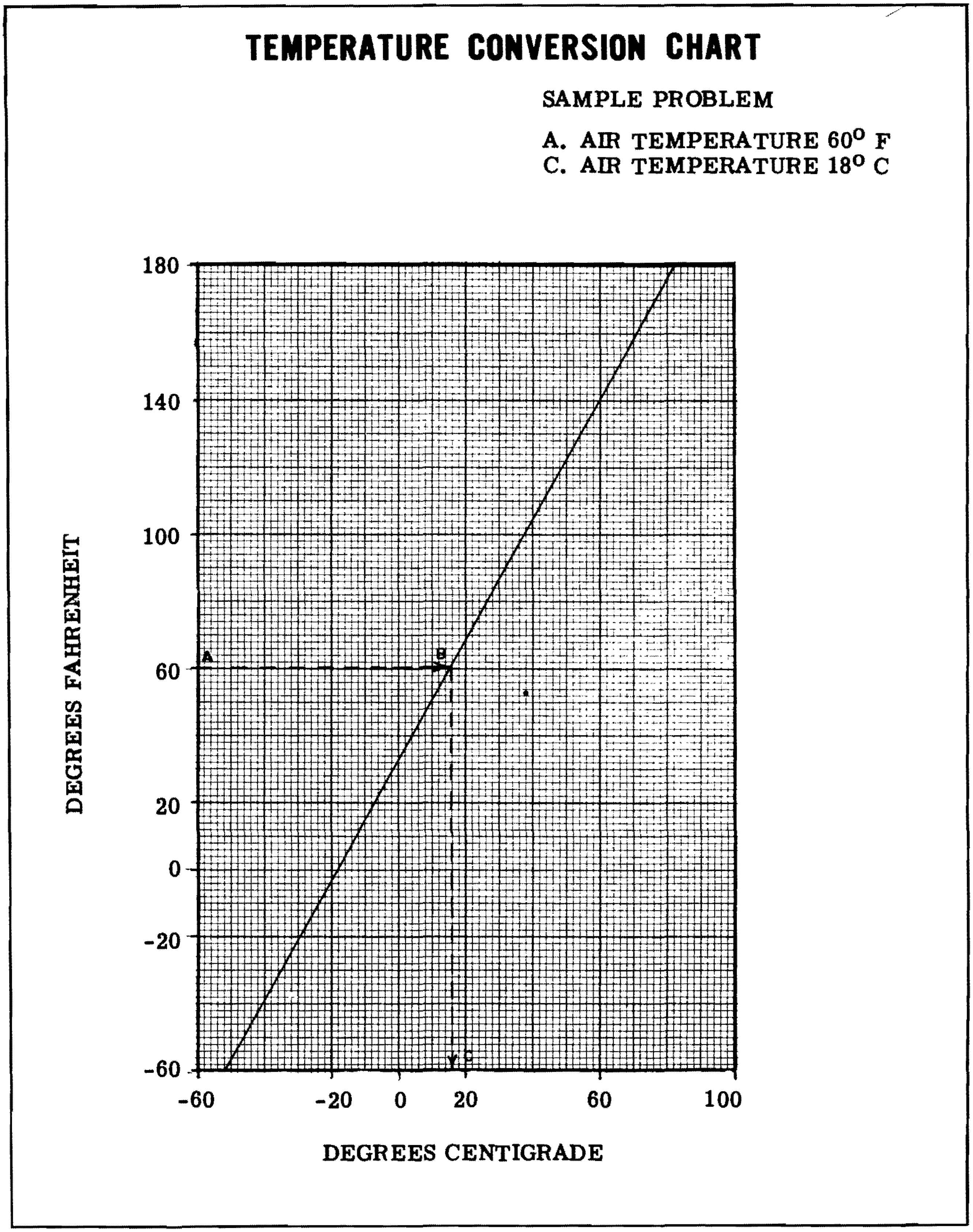


Figure A1-6. Temperature Conversion.

MPH - KNOTS CONVERSION CHART

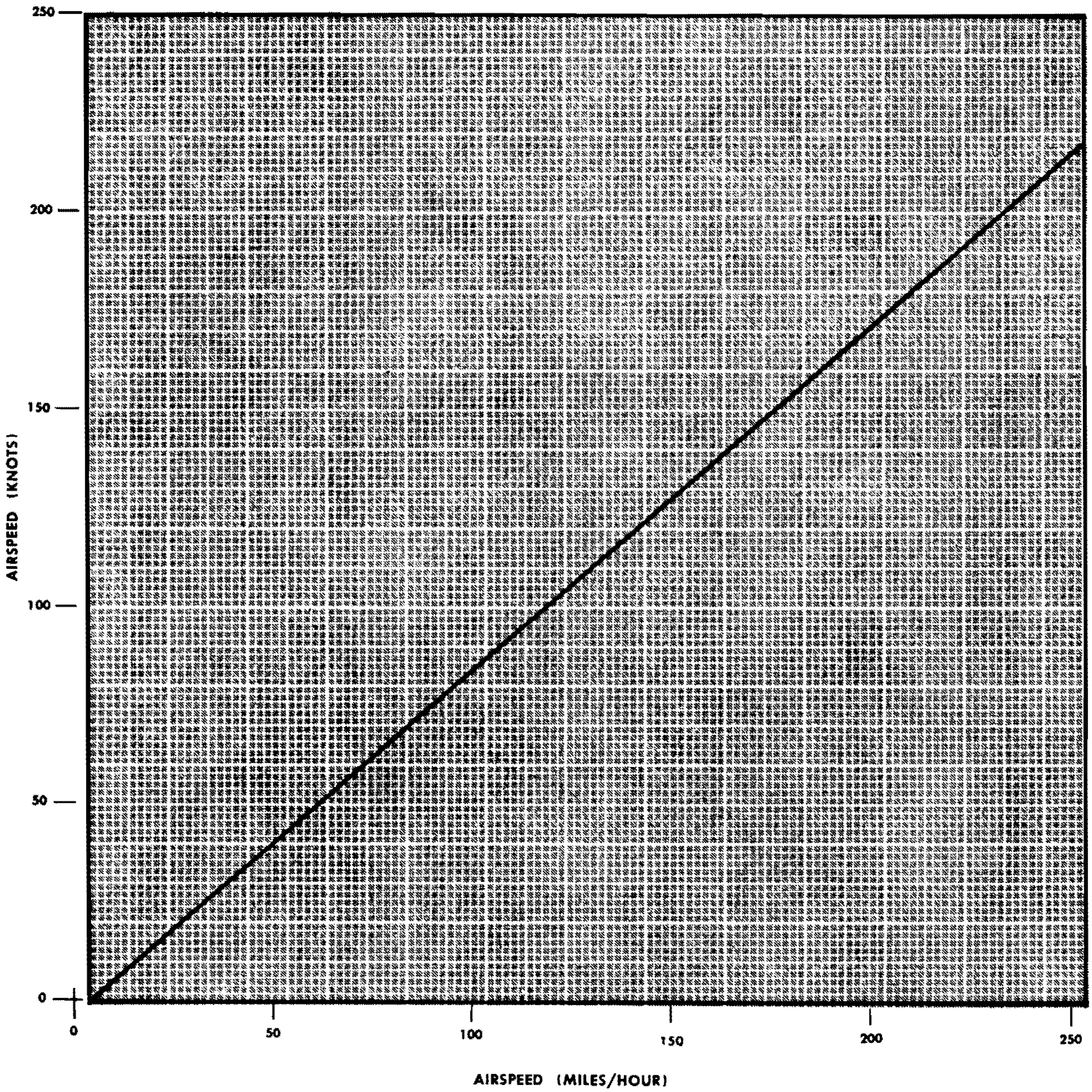


Figure A1-7. MPH - Knots Conversion.

PSYCHROMETRIC CHART

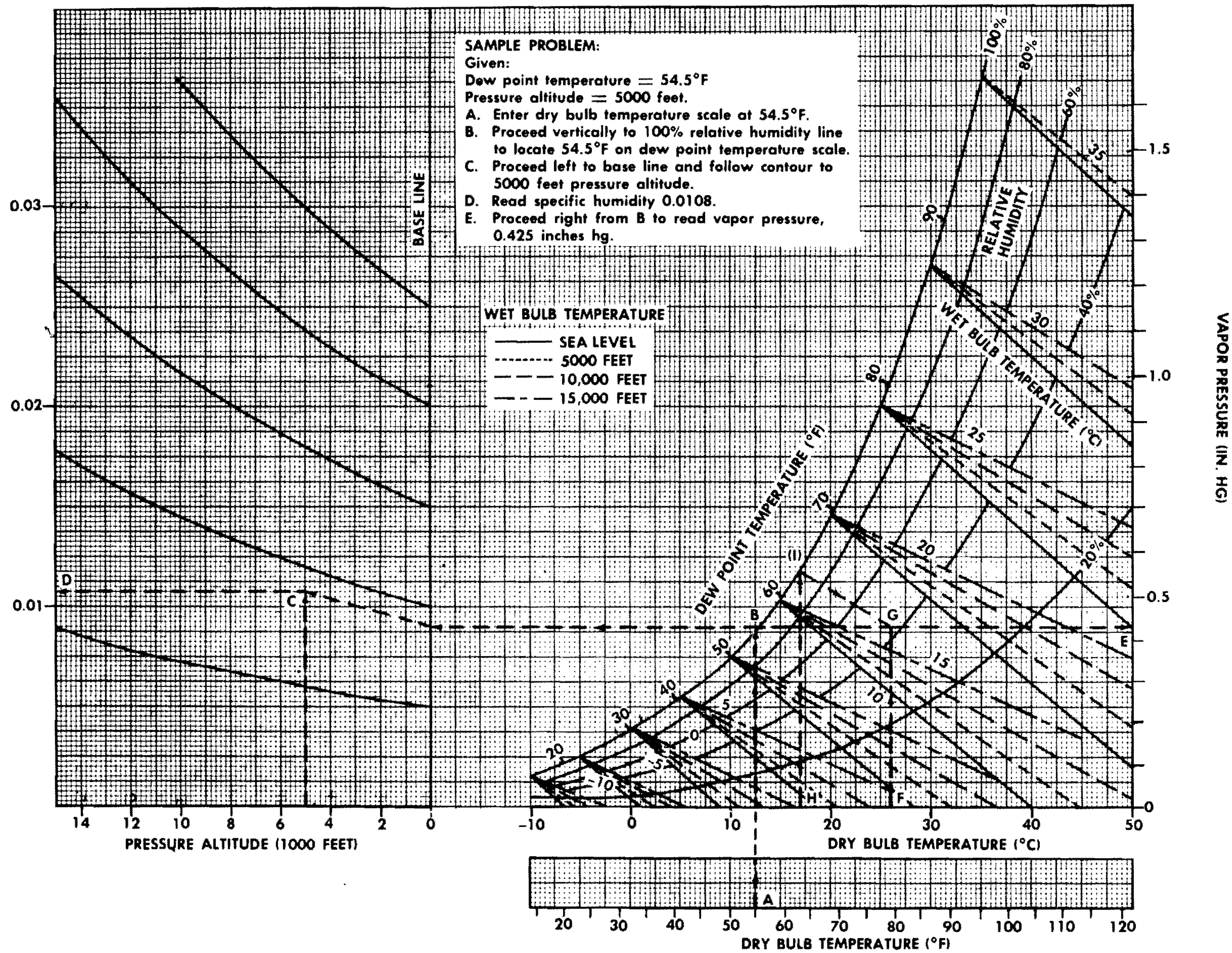


Figure A1-8. Psychrometric Chart.

FUEL DENSITY TABLE 100/130 AND 115/145 GRADE FUEL		
FUEL TEMPERATURE		FUEL DENSITY
°C	°F	LB/GAL
50	122	5.67
40	104	5.73
30	86	5.80
20	68	5.87
10	50	5.93
0	32	6.00
−10	14	6.07
−20	−4	6.14
−30	−22	6.21
−40	−40	6.27
−50	−58	6.34

Figure A1-9

PART TWO
ENGINE DATA

TABLE OF CONTENTS

LIST OF CHARTS

DISCUSSION OF CHARTS.

Engine characteristics are presented in the engine calibration curve charts (figures A2-12 and A2-13) for the "no ram" condition. Recommended rpm and manifold pressure settings for desired cruising power are given on the constant cruise power setting charts. These settings are based on standard atmospheric conditions.

Manifold pressure (MP) is intake manifold pressure given in inches Hg. absolute (based on zero pressure).

All performance charts specify engine operation with auto rich or auto lean with 100/130 grade fuel.

All flight performance is based on the carburetor air levers remaining in the COLD position. If carburetor heat is applied at a constant manifold pressure, engine power will be decreased because of the higher carburetor air temperature. In addition, the normal air induction system is partially restricted and the carburetor air is taken from a location behind the cylinders. This air, having passed over the engine section, has less ram energy remaining, so that lower manifold pressures will be obtained with a fixed throttle setting.

The power looses attributable to atmospheric conditions may be estimated. The effect of temperature on brake horsepower can be approximated by the following equations, where T_1 and T std are absolute temperatures:

$$\frac{bhp\ std}{bhp T_1} = \sqrt{\frac{T_2}{T_{std}}}$$ For part throttle constant manifold pressure operation

$$\frac{bhp\ std}{bhp T_1} = \frac{T_1}{T_{std}}$$ For full throttle operation

Absolute temperature = ambient temperature (degrees centigrade) + 273.

The following rules of thumb may be used to quickly approximate the effect of temperature on power:

1. For part throttle, constant manifold pressure operation, a 10°C temperature increase above standard results in approximately 1.7 percent power loss. Similarly, a 10°C temperature decrease below standard results in approximately 1.7 percent power gain.

2. For full throttle operation, a 10°C temperature increase above standard results in approximately 3.5 percent power loss. Similarly, a 10°C temperature decrease below standard results in approximately 3.5 percent power gain.

3. The variation in manifold pressure with temperature in order to maintain constant power is approximately 1/2-inch Hg increase for every 10°C above standard OAT. In order to maintain constant power for cold day cruise operation, the manifold pressure should be decreased approximately 1/2-inch Hg for every 10°C below standard OAT. During take-off under cold temperature conditions, when overpowering is possible, reduce manifold pressure approximately 1 inch Hg for every 10°C below standard OAT.

$$MP_{corr} = MP_{std} \sqrt{\frac{\text{CAT absolute Temperature}}{\text{Std. Absolute Temperature}}}$$

The effect of humidity on engine power output is as follows:

1. Effective pressure and density altitudes are increased because of the presence of vapor pressure.

2. Fuel-air ratio is increased because fuel is metered on total flow through the venturi, and the total flow includes water vapor as well as air.

3. The thermal efficiency of the combustion process is reduced because of the presence of water vapor. The effect of humidity on power output for take-off is shown on figure A2-1.

4. For cruise operation, the bhp loss associated with humidity is normally cancelled out by the gain in bhp due to increased ram effect with airspeed; therefore, although the engine calibration charts are labeled zero ram, data obtained will approximate actual performance.

NOTE

> On all charts in the Appendix, the term METO (Maximum Except Take-Off) is substituted for normal rated power and the term MAXIMUM for take-off power.

POWER SETTINGS

Various permissable combinations of manifold pressure, and rpm settings for pressure altitudes from sea level to 20,000 feet and carburetor air temperatures from −20°C to 20°C are presented in the constant cruise power settings charts (figures A2-4 through A2-11), the METO power settings chart (figure A2-2), and the climb power settings chart (figure A2-3). The constant cruise power settings charts are based on auto lean operation and the METO power settings and climb power settings charts are based on auto rich operation. Resultant bmep, and resultant fuel flow in pounds per hour for one engine and for two engines are also indicated on the charts.

Enter the chart with the given altitude and carburetor air temperature to determine the correct manifold pressure. Without crossing the guide lines, proceed to the right of the chart to obtain the corresponding RPM, BMEP, and fuel flow.

ENGINE CALIBRATION CURVE

The engine calibration curve charts (figure A2-12 and A2-13) are presented in facing pairs of charts, and provide the necessary information to calculate manifold pressure, brake horsepower, RPM and/or critical altitude (the maximum altitude that may be reached with a given manifold pressure and rpm). A pair of charts is included for both the auto-lean and auto-rich condition.

These charts are the basis for take-off, climb, and cruise data shown throughout the Appendix. They are intended to provide a graphic presentation of the two types of engine power limitations; those imposed by the engine manufacturer to prevent detonation and other effects of overboosting, and those due to the decreasing density of air with increasing altitude. From these charts, power and altitude conditions, not covered in Part 4 CLIMB, or Part 5 RANGE, may be found.

The first chart of each pair (Sheet 1 of 2) shows the variation of BHP with manifold pressure for the range of operating rpm's for sea level calibration.

The second chart (Sheet 2 of 2) shows the variation of BHP and manifold pressure with altitude for operating RPM when maintaining full throttle. On both charts, the upper end of each RPM line is terminated at the BHP limit for that RPM. This altitude is known as the critical altitude for that particular RPM, MP, mixture setting, and atmospheric condition.

The problems which involve the use of operating curves fall generally into one of two types, A– The calculation of BHP, when manifold pressure, RPM, and altitude are known and B– The calculation of manifold pressure, when BHP, RPM and altitude are known.

NOTE

In the interest of clarity sample problem "A" is shown on figure A2-12 and sample problem "B" is shown on figure A2-13. However, both problems can be applied to either chart.

SAMPLE PROBLEM "A":

Given:

1. Manifold pressure = 27.2 in. Hg

2. RPM = 2000

3. Altitude = 9000 feet

To Find:

BRAKE HORSEPOWER

Solution:

1. Locate the intersection of the given RPM and manifold pressure lines on the sea level calibration curve (Point A).

2. Project this intersection (Point A) horizontally to the BHP scale and read 500 BHP (Point B).

3. Enter the altitude calibration curve with this value (Point C).

4. Locate the intersection (Point D) of the full throttle, constant RPM line and the full throttle constant manifold pressure line, corresponding respectively to the given RPM (2000) and manifold pressure (27.2 in. Hg).

5. Connect C and D with a straight line.

6. Locate the intersection of the line CD with the given altitude line – 9000 feet (Point E).

7. Project this intersection horizontally to the BHP axis (Point F). The required BHP is 560.

EXPLANATION:

The engine's sea level BHP at the given combination of RPM and manifold pressure is found from the sea level calibration curve at B. The BHP at the full throttle critical altitude for the same combination is found from the altitude calibration curve at D. The line CD is, therefore, the part throttle, constant RPM, constant manifold pressure line for the given combination of RPM and manifold pressure. The BHP for any altitude between sea level and critical altitude is then determined by the location of the intersection of the given altitude line with the part throttle line, CD.

SAMPLE PROBLEM "B":

Given:

1. Brake horsepower = 750

2. RPM = 2200

3. Altitude = 9000 feet

FIND:

MANIFOLD PRESSURE

Solution:

1. Locate the intersection of the given altitude and BHP lines on the altitude calibration chart (Point A).

2. Select any constant manifold pressure line (33 in Hg) estimated to be close to the required answer, and locate its intersection with the full throttle, constant RPM line corresponding to the given RPM line (Point B).

3. Transfer these values (33 in Hg manifold pressure and 2200 RPM) to the sea level calibration curve, and locate this intersection (Point C).

4. Project this intersection horizontally to the BHP scale and read 730 BHP (Point D).

5. Enter the altitude calibration curve with this value (Point E).

6. Construct line EB.

7. Through Point A draw line FG parallel to line EB.

8. Locate the intersection of line FG and the full throttle constant (2200) RPM line (Point H). The required manifold pressure is 32.2 inches Hg.

EXPLANATION:

Since all part throttle, constant RPM, constant manifold pressure lines are approximately parallel, it follows that, if we determine the slope of one such line, EB, we can draw the corresponding line, FG, through the given BHP—altitude point, A. Inasmuch as manifold pressure is constant at all points on the line, FG, its value may be found at that point, H, where the part throttle, constant RPM, constant manifold pressure line, intersects (or, better, terminates in) the full throttle, constant given RPM line. The more closely we can estimate the desired manifold pressure, the more accurate will be our construction; and in this case experience might have suggested that we use 32 in. Hg for our preliminary estimate of manifold pressure instead of 33 in.

FUEL FLOW PER ENGINE

The fuel flow per engine chart (figure A2-14) is used to determine fuel consumption for various brake horsepower settings when using either auto lean or auto rich mixture settings. Fuel flow may be determined in either pounds per hour or gallons per hour. Since fuel consumption is dependent on RPM as well as BHP, the values shown on this chart are average.

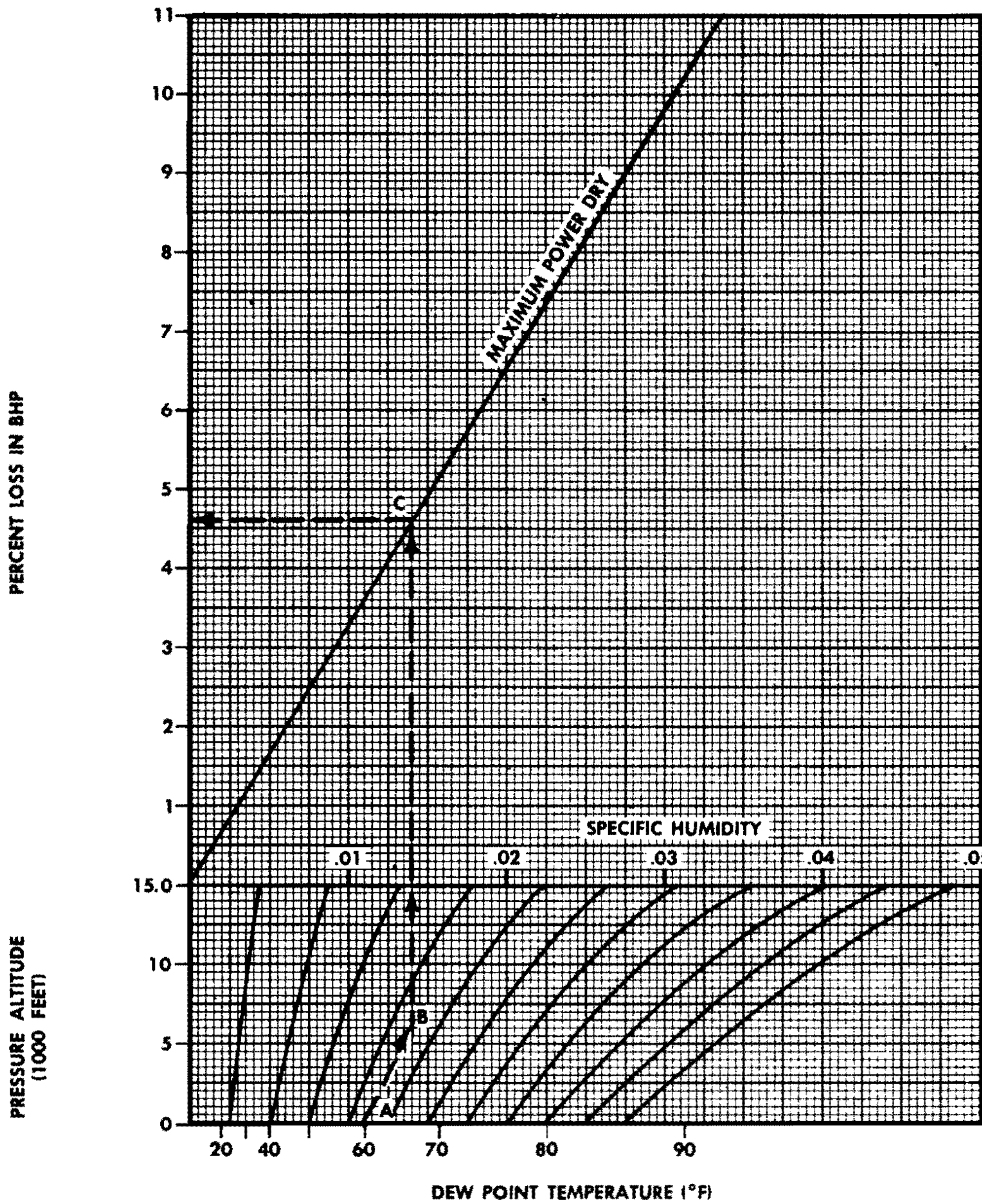
EFFECT OF HUMIDITY ON POWER OUTPUT

MODEL: C-47, C-117,
AND R4D

ENGINE(S): (2) R-1830-90C
(*HIGH BLOWER INOPERATIVE)
-90D, AND -92

SAMPLE PROBLEM:

A. Dew point temperature = 60°F.
B. Pressure altitude = 6000 feet.
C. Effect of humidity on maximum power is a 4.6% loss in power.



Note:
This chart shows the percent loss in BHP for any given manifold pressure. However, it is permissible to regain some of this loss by increasing manifold pressure by an amount equal to the water vapor pressure present in the air, up to a limit of 1.5 inches Hg.

BASED ON: ESTIMATED DATA
DATA AS OF: 11 JULY 1957

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

Figure A2-1. Effect of Humidity on Power Output.

MODEL: C-47, C-117
AND R4D

BASED ON P & W INST 72
DATA AS OF: 25 OCTOBER 1962

METO POWER SETTINGS

1060 BRAKE HORSEPOWER PER ENGINE

AUTO RICH

ENGINE(S): (2) R-1830-90C
(HIGH BLOWER INOPERATIVE)
-90D AND -92

FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

PRESSURE ALTITUDE (FEET)	MANIFOLD PRESSURE (IN Hg) AT CARBURETOR AIR TEMPERATURE (°C)						RPM	FUEL FLOW LB/HR	
	-20°	-10°	0°	+ 10°	+ 20°	+ 30°		PER ENG	2 ENG
20,000									
19,000									
18,000									
17,000									
16,000									
15,000									
14,000									
13,000									
12,000									
11,000									
10,000									
9,000									
8,000									
7,000	39.4	40.2	40.9						
6,000	39.3	40.1	40.9	41.6	42.3				
5,000	39.5	40.3	41.1	41.8	42.6	43.3			
4,000	39.7	40.5	41.3	42.0	42.8	43.5			
3,000	39.9	40.7	41.5	42.2	43.0	43.7			
2,000	40.0	40.8	41.6	42.3	43.1	43.8	2550	735.00	1470.00
1,000	40.0	40.8	41.6	42.3	43.1	43.8			
0	40.0	40.8	41.6	42.3	43.1	43.8			

Figure A2-2. METO Power Settings.