

SECTION VI – ALL-WEATHER OPERATION

TABLE OF CONTENTS

Turbulence and Thunderstorms	6-1
Cold Weather Operation	6-2
Hot Weather and Desert Operation	6-5

TURBULENCE AND THUNDERSTORMS

Flight through a highly turbulent area or thunderstorm should be avoided if at all possible. Routine flight operations, however, will encounter a certain amount of this type flying since it is not always possible to avoid a storm area. At night it is especially difficult to locate the clear areas. When a flight operation is to be conducted into a zone of suspected or known turbulence, a penetration speed must be established. A usable speed can be found by adding 60 knots to the power on stall speed for the weight and configuration being flown. The power setting and pitch attitude for this speed should be established prior to entering an area of turbulence, and if maintained will result in a near constant average airspeed, regardless of any false airspeed indications.

APPROACHING TURBULENT AIR

Prior to actual storm or turbulent air entry, the aircraft should be prepared as follows:

1. LOOSE EQUIPMENT - Secure
2. AUTOPILOT - DISENGAGED (RC-45J only)
3. AIRSPEED - AS REQUIRED to maintain 60 knots above stall speed for weight and configuration being flown
4. PITOT HEAT - ON
5. MIXTURES - RICH
6. MANIFOLD HEAT - AS REQUIRED
7. VACUUM and GYRO INSTRUMENTS - Check
8. SAFETY BELTS - FASTENED (check with all personnel)
9. Turn OFF any radio equipment rendered useless by static.

10. Turn pilots compartment lights to full bright and turn ON pilot's compartment white dome lights to minimize blinding effect of lightning (during night operations).

CAUTION

Do not extend landing gear or lower wing flaps as they merely decrease aircraft aerodynamic efficiency.

11. NAVIGATION LIGHTS - ON
12. Select fullest fuel tank; preferably a MAIN tank.

FLIGHT IN TURBULENT AIR

Penetrate turbulent air as follows:

1. Maintain attitude by reference to the attitude indicators.

NOTE

Maintain power settings and pitch attitude (establish prior to entering the storm or turbulent air) throughout the storm.

2. Maintain original heading. Do not make any turns unless absolutely necessary.
3. Use as little elevator control as possible in maintaining attitude in order to minimize stresses imposed on the aircraft.
4. If heavy precipitation is encountered, close cowl flaps to prevent engines from cooling too rapidly.

COLD WEATHER OPERATION

Normally, cold weather operations and the applicable procedures are considered to be in effect at ambient temperatures of 0°C or less. The following discussions, operating techniques, and procedures are supplemental to the information contained in Section III, Normal Procedures and should be complied with when cold weather conditions are encountered.

CARBURETOR ICING

Carburetor icing is most probable under two common atmospheric conditions; visible freezing or subfreezing moisture, or high humidity conditions. During these conditions, moisture either in the form of ice particles or liquid enters the engine induction system where either due to its already solid state it causes a restriction, or due to the refrigeration effect of the carburetor, it is formed into ice which also causes a restriction. This restriction in carburetor air flow, if allowed to progress to a critical state, will be difficult, if not near impossible to remove with manifold heat. For this reason, preventative action rather than remedial action is emphasized.

CARBURETOR ICING INDICATION

Carburetor ice can usually be detected by a gradual loss of manifold pressure. Normally, ice formation is a relatively slow process, and for this reason, as power decreases slightly, the pilot may advance the throttles gradually by slight increments before realizing ice is being formed. There are extreme icing conditions when ice can form very rapidly. Such conditions, however, are usually rare local instances. Being alert to atmospheric conditions favorable to icing and the early use of manifold heat will normally eliminate ice formations.

CARBURETOR HEAT USE

If it is suspected that carburetor ice has already formed, use the following procedure:

1. MIXTURES - RICH (if below 5,000 feet)
2. MANIFOLD HEAT - HOT (down)
3. Check repeatedly to see if manifold pressure is restored by slowly returning the manifold heat lever to the COLD (up) position. If the rise in manifold pressure from full hot to full cold is consistent during several momentary cycles from HOT to COLD, the ice is gone.

NOTE

If heavy icing has occurred, the loss of power will be accompanied by a loss in manifold heat capacity so that full manifold heat may be required for longer periods. The effectiveness of manifold heat in eliminating the ice may be sharply reduced.

4. Adjust manifold heat levers to maintain carburetor mixture temperatures within the normal operating range.

CARBURETOR ICE PREVENTION

Prior to entering an area of known icing conditions, proceed as follows:

1. Change altitude or course if possible and practical.
2. MANIFOLD HEAT - HOT (down) at least 15 minutes, if possible, before entering icing conditions
3. Since some icing conditions are not as obvious as others, due to temperature, visible moisture, etc., a normal procedure would be to carry enough manifold heat to keep the induction system temperature a few degrees warmer than normal during any flight condition when possible icing may occur.

PREFLIGHT INSPECTION (EXTERIOR)

1. Check for removal of all snow, ice, and frost accumulations from wings, empennage, control surfaces and hinges, propellers, pitot tubes, and fuel and oil tank caps and vents. If hot air has been used, make sure that the areas are dry and ice-free.

CAUTION

Hot water should not be used to remove frost or ice unless the aircraft is sheltered in a warm area, as additional ice may form to aggravate the situation.

2. Check the oil Y-drains and oil tank sumps for free oil flow. If no oil flow is obtainable, preheat the engine, accessory section, and oil flow lines until oil flow is readily obtained.
3. Check the landing gear struts, slide tubes, actuating mechanism, wheels and brakes for freedom from snow, ice, mud, frost, etc. Check landing gear safety switch for freedom from ice. A coating of hydraulic fluid should be applied to the landing gear shock struts and retraction slide tubes.
4. Tires and landing gear shock struts for specified inflation.
5. Check all flight controls for freedom of movement. Check that the drain hole in the bottom of the elevator cone is open. If this hole is plugged, water may collect and freeze in the cone restricting or even blocking elevator travel.
6. Check for engine stiffness to determine when sufficient ground heat has been applied. When one man can rotate the propeller freely the engine is warm enough to start.
7. Check that external power is applied. All cold weather starts should be made with the assistance of an auxiliary power unit.
8. Complete the normal Preflight Preparation procedures established in Section III, Normal Procedures.

BEFORE STARTING ENGINES

Perform the following before starting the engines.

1. Check operation of all instruments which will function without engine operation.

2. Remove all ground heater ducts, engine covers etc. (if installed).
3. Pull the propellers through at least 10 blades by hand.
4. Complete the normal Pre-Start Checks established in Section III, Normal Procedures.

STARTING ENGINES

Except for the following variations, make cold weather starts, using the same procedure as used for normal starts.

NOTE

If a battery start must be made, reduce the electrical load to a minimum.

1. Set throttles approximately 1/8th open or less (approximately 800 rpm) to decrease backfiring tendency.
2. MANIFOLD HEAT - COLD (up)

CAUTION

Use of manifold heat during starting may result in serious damage and fire if the engine backfires. Manifold-heat levers will tend to move into HOT position during backfiring. Return levers to Cold but do not hold or lock in position.

3. OIL BY PASS - HOT (out)
4. Prime the engine immediately before starting and after the propeller starts to rotate. If primed prematurely, the gasoline will not vaporize. In extreme cold, operate the primer intermittently until regularity of engine firing results. It may be necessary to continue priming for a short time after starting to maintain smooth engine operation.

NOTE

If the engine fires and quits several times, ice is likely to form on the spark plug electrodes. When this is suspected, remove several front plugs and heat and dry the points before attempting a restart.

5. If there is no oil pressure after thirty seconds running or if pressure drops after a few minutes of ground operation, shut down and check for blown oil lines or radiators and for congealed oil or ice at Y-drain or oil tank sump drain.

NOTE

Oil pressure will be abnormally high immediately after starting. This is an allowable situation; but as oil temperature increases, the oil pressure should drop rapidly to normal. Do not increase engine rpm until oil temperature and pressure are within limits.

6. MANIFOLD HEAT - HOT (down) when engine is firing evenly. Return to COLD (up) when engine will operate smoothly
7. COWL FLAPS - OPEN at least 2/3rds to prevent overheating in engine accessory section

ENGINE WARM-UP

Warm up the engines as follows:

1. Oil shutters - HOT (down)
2. ENGINE SPEED - 1000 RPM until oil temperature reaches 40°C. Do not exceed oil pressure limits (use decreased engine RPM if necessary)
3. MANIFOLD HEAT - AS REQUIRED to improve fuel vaporization and prevent backfiring

NOTE

When subjected to excessive drain, storage batteries deteriorate rapidly in cold weather; therefore, none but essential electrical equipment should be used until generators are supplying current.

4. Check instrument operation.
5. Exercise propellers from low pitch (high rpm) to high pitch (low rpm) and back to low pitch several times to circulate warm oil through the propeller governing system.
6. When oil temperature reaches 20°C, move oil by-pass T-handle to COLD (in) position very slowly since congealed oil in radiator may block the flow and result in radiator failure. When the oil temperature reaches 20°C, the by-pass valve will be warmed sufficiently to allow oil to automatically by-pass the radiator if the radiator is blocked by congealed oil.

TAXI

Taxi the aircraft as follows:

1. Avoid taxiing through gater, slush, mud, etc if possible.
2. Use the same precautions regarding propeller wash as used during engine warm-up.
3. Watch for formation of frost on the wings.

BEFORE TAKE-OFF

Perform the following before take-off

1. Check control surfaces and trim tabs for full unrestricted travel.
2. FLAPS - CYCLE (to insure correct operation)
3. Check engine operating pressures and temperatures for normal indications.
4. Exercise propellers from low pitch (high rpm) to high pitch (low rpm) and back to low pitch several times to circulate warm oil through the propeller governing system.
5. PITOT HEAT - ON (for take-off)
6. DEICER BOOTS - CYCLE (to insure correct operation)

7. If deep or heavy snow interferes with take-off run but permits taxiing, move slowly up and down the take-off course several times to pack down the runway before attempting actual take-off.

8. TAILWHEEL - LOCKED, check with wheel brakes (frozen slush may prevent locking pin from engaging)

TAKE-OFF

Perform the following during take-off:

1. Run up engines using manifold heat to eliminate any carburetor ice.

NOTE

Manifold heat levers should be in the COLD (up) position for take-off.

2. Abort take-off immediately if full power is not developed.

3. After take-off from a snow or slush covered field, leave the landing gear extended for a few minutes until slush or moisture is either blown off or dries, then operate through several cycles to prevent freezing of the doors, actuator slide tube, etc.

DURING FLIGHT

During flight perform the following:

1. Use manifold heat as required to prevent formation of carburetor ice since prevention is more advisable than removal. Some carburetor heat should be used at all times if compatible with engine power requirements. Rough operation may occur at high power settings when full manifold heat is applied. Manifold heat temperature should be regulated between +10°C and +38°C.

2. Periodically move throttle and manifold heat levers to prevent their freezing in one position.

NOTE

Should the carburetor air doors become frozen by ice, turn the propeller anti-icer on full flow. This will allow sufficient alcohol from the propeller blades to enter the induction system and loosen the ice accumulation.

3. Use anti-icing systems as required to prevent formation of ice on the windshield, propeller blades, and pitot heads.

CAUTION

Do not activate the deicer boots until at least 1/4 inch of ice has formed on the surfaces. Cycle the boots until all residual ice is removed.

4. Unusual stiffness of controls may indicate freezing of moisture in control hinges. If possible descend or climb into a warmer layer of air or move the controls frequently to prevent freezing.

5. Cycle the propeller periodically between 1600 and 2300 rpm to prevent oil from congealing in the propeller dome and either complicating or preventing propeller feathering.

NOTE

If propeller feathering is required and the feathering button "pops out" before the propeller is feathered, do not manually depress the button and hold. Excess pressure, due to the thick cold oil, is causing premature feathering button release followed by a tendency for the propeller to unfeather. Depress the button, let it release and then depress it again. Continue this procedure until the propeller is feathered. When feathering an engine, restart the engine before the oil temperature drops below +40°C (if a restart is planned). Temperatures below this limit will prevent the use of the engine for power until a significant warm-up period has lapsed.

APPROACH AND LANDING

Accomplish the following during approach and landing:

1. During descent, observe engine temperatures closely. Maintain cylinder head temperatures above 100°C by maintaining power and regulating cowl flaps. Use manifold heat to assure good fuel vaporization.

NOTE

Extend landing gear and lower partial flaps prior to approach, to check operation (while altitude remains). This will also permit use of more engine power which will reduce the possibility of carburetor ice.

2. DEICER BOOTS - OFF

3. If the aircraft is heavily iced, make approach at a higher than normal speed.

4. Turn off all electrical equipment possible at least one minute before final approach to save batteries when engine rpm is reduced below generator cut-in speed.

5. Use carburetor heat during landing so that if acceleration is necessary, heat will be available for fuel vaporization, regardless of cylinder head temperature. If full power is required for a go-around, be prepared to return the manifold heat levers to the COLD (up) position.

NOTE

When landing on runways covered with slush or large puddles, avoid using wing flaps. Heavy sprays of slush or water kicked up during landing might impose an excessive load on the flaps if they are extended. The use of wing flaps will not be necessary since the added resistance from the water will assist in braking airplane.

6. Use brakes sparingly and not until absolutely necessary during landing roll.
7. Turn OFF any anti-icing systems no longer required.
8. MANIFOLD HEAT - HOT (down, while taxiing).

PARKING

When the aircraft is to be parked for a period of time such as over night or longer when the temperature varies between thawing and hard freezing, place a double layer of paper, fabric, or other suitable insulation material under the wheels to prevent their freezing to the surface.

ENGINE SHUTDOWN

1. Normal engine shut down procedures apply.
2. If aircraft is to remain parked overnight, leave either of the pilot's compartment windows partially open to provide air circulation within the aircraft, otherwise windows may frost over on the inside of the aircraft.
3. Drain fuel and oil tank sumps and oil Y-drains to remove any water condensate before it freezes.
4. Remove any dirt and ice from the landing gear shock struts and actuator slide tubes.
5. Install any aircraft protective covering.
6. Approximately 30 minutes after engine shut-down, redrain fuel and oil tank sumps and oil Y-drains.

HOT WEATHER AND DESERT OPERATION

The main concern in hot weather and desert type climates is usually associated with aircraft ground operations. These difficulties are poor engine cooling, overheating of brakes, longer take-off and landing rolls (due to the less dense air), and the maintenance problems associated with blowing sand and dust and the general destructive effect of heat on the aircraft's systems. In addition to the normal procedures given in Section III, the following steps should be observed:

BEFORE ENTERING AIRCRAFT

1. Inspect landing gear shock struts, landing gear actuator slide tubes, and tires for cleanliness and/or proper inflation (landing gear actuator slide tubes for cleanliness). Use a dry cloth to remove sand and dust.
2. Carburetor air intake covers removed and any accumulations of dust and sand removed.
3. Check for fuel, oil and hydraulic fluid leaks.

ON ENTERING AIRCRAFT

1. Operate all movable flight control surfaces.
2. Clean any excessive dust accumulations on or around instrument dials, movable controls, or switches.

ENGINE WARM-UP AND GROUND TESTS

Keep engine ground operation time to a minimum. Complete all ground checks but accomplish this as rapidly as possible. Observe cylinder head and carburetor air temperatures. Do not exceed limits. If run-up area is dusty, make run-up so propeller wash is away from personnel, other aircraft, or ground installations.

TAKE-OFF

Take-off distances will be longer and acceleration will be slower. Observe the cylinder head temperatures and carburetor air temperatures closely in order to avoid exceeding limits.

CAUTION

Loss of power from detonation will probably occur if carburetor mixture temperature exceeds 15°C.

LANDING

Be alert for ground turbulence. The landing ground roll will be longer.

BEFORE LEAVING AIRCRAFT

1. Install wheel chocks and immediately release the brakes to prevent possible warping of the brake discs.
2. When engines have cooled, install protective covers.
3. If blowing sand or dust is not a hazard, leave windows and doors open to permit air circulation.

CAUTION

If the fuel tanks are to be completely filled, fuel expansion may cause fuel overflow thereby creating a fire hazard.