Area of Operation **V** - Task **C**

Engine Start

Content

Key References:

- Airplane Flying Handbook
- Pilot's Handbook of Aeronautical Knowledge
- POH/AFM

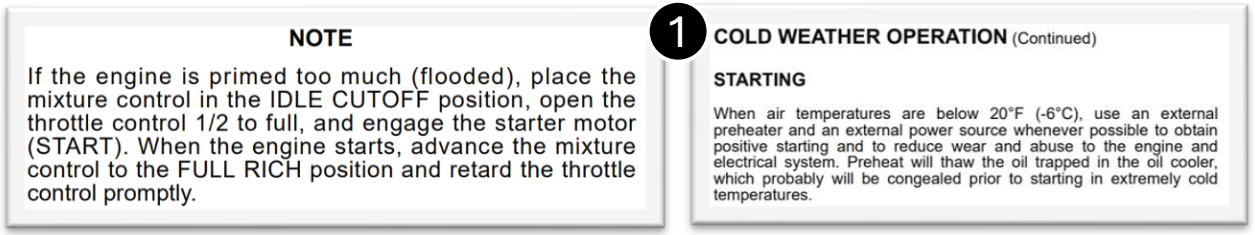
1. Introduction & Safety

- **What**: Conditions which affect engine starts. Different ways to start the engine. Safety precautions necessary when starting the engine
- **Why**: Proper engine starting is necessary for the safety of people and property, and to prevent engine damage
- **Safety Precautions and Preventing Aircraft Movement**:
  - Proper use of checklist (Normal, Hot, Cold, Flooded)
  - Final walk-around (e.g. ensure no tow bar)
  - Ensure the area around the airplane is clear
  - Prior to any start, turn on the Anti-Collision lights (+position lights at night)
  - Always call "CLEAR" and wait for a response
  - Ensure the parking brake is set and/or hold the brakes firmly
  - Periodically look outside for movement (own airplane, other aircraft/people)
  - Keep one hand on the throttle all the time

- **Adjust Engine Controls**
  - Monitor oil pressure (needs to be in the green quickly)
  - Avoid excessive RPM, lean the mixture, check temperature rising (it will be slow)

2. Atmospheric Conditions

- **Cold Weather**
  - Preheat the engine(s) if possible (hangar, cowl heaters, etc.) ➔ Do not leave the aircraft unattended
  - Cold Weather Starting Problems – Congealed oil, Tendency to over prime, Iced sparkplugs
  - ❶ Prime the engine ➔ not too much to avoid flooding (risk of fire)
  - Follow the POH procedures for a cold start and allow the engine to warm (*do not keep it on idle*)
    - *POH advises to turn propeller by hand several times to loosen the oil (opposite direction for safety)*
    - *The oil temperature indicator may not be in the green band prior to takeoff if very cold*
    - *After 2-5 minutes at 1000 RPM, accelerate the engine to higher RPM ➔ if smooth and oil pressure normal, ok to go*
- **Hot Weather**
  - Normal start procedures. Avoid prolonged engine operations on the ground
    - *It is facilitated by advancing the mixture promptly to 1/3 open when starts ➔ then smoothly full rich*
  - Vapor Lock: Engine heat + outside heat can boil the fuel out of the lines creating vapor
    - *No priming is needed if less than 30min after shutdown*



NOTE

If the engine is primed too much (flooded), place the mixture control in the IDLE CUTOFF position, open the throttle control 1/2 to full, and engage the starter motor (START). When the engine starts, advance the mixture control to the FULL RICH position and retard the throttle control promptly.

❶ **COLD WEATHER OPERATION** (Continued)

STARTING

When air temperatures are below 20°F (-6°C), use an external preheater and an external power source whenever possible to obtain positive starting and to reduce wear and abuse to the engine and electrical system. Preheat will thaw the oil trapped in the oil cooler, which probably will be congealed prior to starting in extremely cold temperatures.

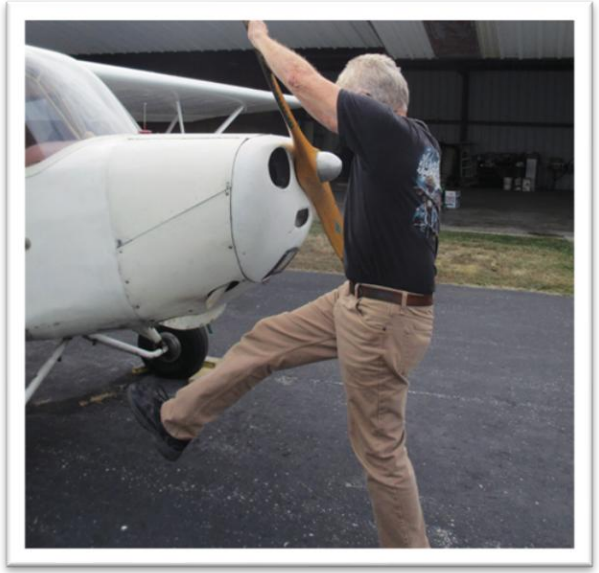
3. External Power

- **Before Engine Start**
  - Master (Alt+Batt) OFF before connecting
  - Avionics OFF (if need them “on”, a 28V DC filtered unit is required)
  - Check unit’s connection, proper voltage, switch on and lights on
  - Follow the procedures outlined in the POH (Chapter 4)
- **After Engine Start**
  - Continue following the checklist
  - Ensure ground crew disconnects it properly
  - Increase power to 1500 RPM for several minutes to charge battery
  - Internal power check ❶
    - *If M BATT doesn’t show positive charge → Service the battery*
  - Be extremely cautious of people and equipment nearby

❶

1. MASTER Switch (ALT and BAT) - OFF
2. TAXI and LAND Light Switches - ON
3. Throttle Control - REDUCE TO IDLE
4. MASTER Switch (ALT and BAT) - ON (with taxi and landing lights turned on)
5. Throttle Control - INCREASE (to approximately 1500 RPM)
6. Main Battery (M BATT) Ammeter - CHECK (Battery charging, Amps Positive)
7. LOW VOLTS Annunciator - CHECK (Verify annunciator is not shown)

4. Hand Propping



- **Requires 2 people ➔ do not hand prop unless both are familiar**
  - One at the controls, one pulling the propeller
- **Rule One: The guy handling the propeller is the boss**
- **Rule Two: Take precautions. Secure the aircraft w/ chocks/tiedowns**
- **Rule Three: Practice safe prop-swinging**
  - Don't prop an aircraft while standing on slippery surfaces
  - Ensure area doesn't have tripping hazards
  - Don't wear loose clothing that could snag on a blade
  - Don't stand too far away and don't lean toward the propeller (*ideal less than an arm's length away*)
- **If the procedure is described in the POH, follow it**
  - Person outside says, and Person inside do: "Mixture Rich, Ignition Off, Throttle Closed, Brakes Set"
  - Person outside pulls the airplane (to check the brakes), and calls "Brakes and Contact"
  - Person inside checks brakes again and move to Ignition ON
  - Person outside swings down the props with the Palms of their hands as hard/rapidly as possible
    - *If does not start, move ignition OFF before moving the prop again*

5. Engine Start Procedure (C172S)

- Follow POH/Checklist (Chapter 4)

Before Starting the Engine

1.	Passenger Briefing	PERFORM
2.	Seats & Seat Belts	ADJUST & LOCK
3.	Parking Brake	SET
4.	Circuit Breakers	CHECK IN
5.	Electrical Equipment	OFF
6.	Avionics Power Switch	OFF
7.	Fuel Selector Valve	BOTH
8.	Fuel Shutoff Valve	ON (PUSH FULL IN)

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RECOMMENDED STARTER DUTY CYCLE

Operate the starter motor for 10 seconds followed by a 20 second cool down period. This cycle can be repeated two additional times, followed by a ten minute cool down period before resuming cranking. After cool down, operate the starter motor again, three cycles of 10 seconds followed by 20 seconds of cool down. If the engine still does not start, try to find the cause.

Starting the Engine

1.	Standby Battery	TEST 20 SEC THEN ON
2.	Engine Instruments	CHECK PARAMETERS
3.	Bus E Volts	CHECK MIN 24V
4.	Bus M Volts	CHECK 1.5V OR LESS
5.	Battery S Amps	CHECK DISCHARGE
6.	Standby Battery Annunciator	CHECK
7.	Master Switch	ON
8.	Beacon	ON
9.	Throttle	OPEN ¼ INCH
10.	Mixture	IDLE CUTOFF
11.	Aux Fuel Pump (omit for warm)	ON
12.	Mixture (omit warm start)	RICH 3-5 SEC THEN OFF
13.	Aux Fuel Pump (omit for warm)	OFF
14.	Prop Area	CLEAR
15.	Magnetos Switch	START 1
16.	Mixture	ADVANCE AS ENGINE STARTS
17.	Throttle	1000 RPM
18.	Mixture	LEAN AS REQUIRED
19.	Oil Pressure	CHECK GREEN
20.	Amps (M Battery & S Bat)	CHECK POSITIVE
21.	Low Volts Annunciator	CHECK OFF

6. Common Errors

1. Failure to properly use the appropriate checklist
2. Failure to use safety precautions related to starting
3. Improper adjustment of engine controls during start
4. Failure to assure proper clearance of the propeller

Questions?