

# **Multiengine Pilot Course of Instruction Training Drills**

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## ***General complex aircraft check on final:***

### **GUMP check**

Regardless of what you have done with the checklist, always do the following check:

At 500 feet AGL (VFR) or Final Approach Fix/Procedure Turn inbound (IFR),

- **Gas**
  - fuel selectors to fullest tanks (or as specified in Aircraft Flight Manual)
  - boost pumps on (or as specified for takeoff)
- **Undercarriage**
  - down and locked
- **Mixtures**
  - to takeoff setting
- **Propellers**
  - to takeoff setting

## ***Single Engine Drills:***

### **Principal Engine failure drill:**

- Mixtures
- Props
- Throttles
- Flaps
- Gear
- Throttle
- Propeller
- Mixture

That is,

***On takeoff/climb-out (after liftoff),***

- Assure maintenance of VMC  
*THEN,*
- Mixtures: to takeoff setting
- Propellers: to takeoff setting
- Throttles: to takeoff setting
- Flaps: to climb setting
- Gear: retract (or not)
  - IF climb is in doubt, and the aircraft may settle back to the ground, leave the gear down.
  - IF airspeed is close to VMC, gear extended may provide some additional directional stability.
- Throttles: retard for inoperative engine.
  - Dead Engine/Dead Leg
  - Retarding the throttle BEFORE feathering prevents feathering the good engine.
- Propellers: feather inoperative engine (assume the engine cannot be trusted so secure).
- THEN,*
- Maintain VMC at all costs while at takeoff and climb power (this is the single greatest priority).
- Climb at V<sub>YSE</sub> or V<sub>XSE</sub> (as appropriate).
- Gear up once climb is assured.
- Continue with securing as below as practicable.

***In flight,***

- Mixtures: to appropriate setting for altitude (or to full rich if in doubt)
- Propellers: to climb setting
- Throttles: to climb setting
- THEN*
- Assure maintenance of VMC  
*THEN* (and continuing airspeed maintenance)
- Fix OR Feather the inoperative engine
  - Dead engine/Dead leg
  - Conditions permitting,
    - if carbureted engine,
      - Carburetor Heat on full
    - Mixture: Adjust to see if engine responds
      - Full rich; Lean for altitude; variously lean, enrich; etc.
    - Boost Pump: On (generally; or, if it was already on, try Off)
    - Fuel Valve: On; Switch tanks; Crossfeed on/off
    - Magnetos: Cycle Left/Right/Both
    - Throttle: Adjust (advance/retard) to see if engine responds.

**If the engine restarts:**

- Divert as soon as practicable:
  - Once an engine fails in flight it cannot be trusted,
  - Unless something really obvious caused the problem, e.g.,
    - Carburetor ice
    - Fuel valve on empty tank

**If the engine Fails to Start or it is Impracticable to Troubleshoot:**

***Securing the inoperative engine,***

- Propeller to Feather
- THEN*
- Mixture to Idle/Cut Off
- Boost Pump Off
- Magnetos Off
- Fuel Selector Off
- Carb Heat Off (if carbureted engine)
- Cowl Flaps Closed
- Electrical System
  - Alternator off
  - Minimize Electrical Load while on single alternator

***AFTER THE ENGINE IS SECURED,***

- Divert immediately
  - The airplane is neither certificated nor designed for extended flight with an engine inoperative.

## Engine restart after feather:

- Cowl Flaps    Should be closed: leave them closed.
- Alternator    On
- Fuel Selector    On
- Magnetos    On
- Fuel Pump    On (or as otherwise specified in Aircraft Flight Manual)
- Mixture    Rich (or as otherwise specified in Aircraft Flight Manual)
- Throttle    Open (generally about one-half inch)
- Prop    Fwd To Cruise/Climb/Takeoff (as specified in Aircraft Flight Manual)
  - If the prop is not windmilling within five to seven seconds,
    - Engage Starter briefly (two to three seconds),
    - Continue to engage starter until propeller comes out of feather.
  - If prop will not come out of feather, secure and land immediately.

### *WHEN ENGINE STARTS,*

- Throttle    Reduce Until Engine Is Warm
- Carb Heat    On (if carbureted engine)

### *AFTER WARM-UP,*

- Throttle    Advance to cruise
- Carb Heat    Off (if carbureted engine)
- Cowl flaps    Open
- Mixture    Lean as appropriate

### *IF ENGINE FAILS TO START,*

- Engine may start after priming (with primer or boost pump as appropriate)
- If engine will not start, re-feather and secure, land immediately.

## ***Performance Notes***

### **Ceiling and Climb:**

Single-engine service ceiling and single-engine climb may be less than specified in the manual: do not count on these, and remember that maintenance of V<sub>MC</sub> is the most important element to single-engine flight, even if altitude or climb cannot be maintained.

### **Normally Aspirated versus Turbocharged Engines:**

While a normally aspirated engine will lose power as altitude increases, turbocharged engines can typically maintain full power up to their certificated ceiling. While V<sub>MC</sub> is formally established at full power, normally aspirated aircraft will not have that full power above sea level, and the actual speed at which control would be lost is accordingly lower than V<sub>MC</sub>; turbocharged engines, however, should be assumed to not have a drop-off from their certificated V<sub>MC</sub>.

### **Airspeed versus Altitude:**

V<sub>MC</sub> is the most important consideration a multiengine pilot has during an engine failure. It is imperative to maintain control of the aircraft, even if the aircraft is losing altitude, even if it is settling into the ground, which is not possible if the airspeed, at high power, falls below V<sub>MC</sub> and the airplane rolls inverted. Always remember Bob Hoover's advice:

If you're faced with a forced landing, *fly the thing as far into the crash as possible.*

(Quoted on the AOPA website, [http://www.aopa.org/asf/publications/inst\\_reports2.cfm?article=5764](http://www.aopa.org/asf/publications/inst_reports2.cfm?article=5764), the very last line in the article [retrieved 1/2015].)