



# Engine Troubleshooting Guide

## Shortcuts to Costly Engine Diagnostics

Includes Sections on:

- Low Power and Uneven Running
- High Oil Temperature
- Excess Oil Consumption
- Engine Stops
- High Cylinder Head Temperature
- Engine Misses
- Causes of Excessive Carbon Deposit
- A "Too-Rich Mixture"
- A "Too-Lean Mixture"
- and many others





**ENGINE COMPONENTS INTERNATIONAL**

## **Engine Troubleshooting Guide**

### **Shortcuts to Costly Engine Diagnostics**

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For installation eligibility, visit our website at [www.eci.aero](http://www.eci.aero)

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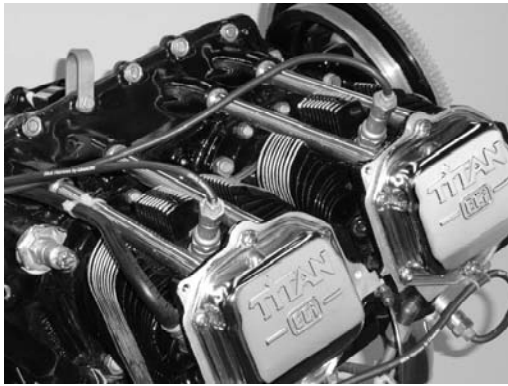
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## Failure of Engine to Start

27 points

1. Lack of fuel
2. Ignition switch off
3. Under-priming or over-priming
4. Incorrect throttle setting
5. Cold oil
6. Defective battery (battery ignition systems)
7. Dirty or defective spark plugs
8. Water in magneto
9. Wet ignition harness
10. Wrong grade of fuel
11. Spark advance retarded too far
12. Vapor in fuel system
13. Water in carburetor
14. Defective ignition wiring
15. Booster magneto defective
16. Incorrect valve and/or ignition timing
17. Defective magneto
18. Broken impulse coupling
19. Magneto breaker points defective
20. Incorrect valve clearance
21. Defective priming system
22. Internal trouble in carburetor
23. Intake manifold air leaks
24. Broken, shredded or defective camshaft
25. Internal engine failure
26. Spark plug wires crossed
27. Miscellaneous (turn engine over slowly by hand with the master & magneto switch off and note any unusual condition, particularly low compression.

## Low Power and Uneven Running

29 points

1. Mixture too rich or too lean
2. Leaks in induction system
3. Defective or fouled spark plugs and loose plug connections
4. Improper fuel grades
5. Wet or defective ignition wiring
6. Engine overheating
7. Defective magneto breaker points
8. Dirty or broken carbon brushes in magneto
9. Improper valve and/or ignition timing
10. Propeller out of track, or hub nut loose
11. Carburetor heat control malfunction
12. Cracked engine mount or loose mount bolts
13. Foreign matter in induction system or fuel lines
14. Incorrectly adjusted carburetor control linkage
15. Fuel feed valve leaking or not operating properly
16. Warped or burned valves or valve seats
17. Broken valve springs
18. Worn or sticking pistons or cylinders
19. Cracked pistons or cylinders
20. Bent pushrods
21. Cylinder gaskets blown
22. Magneto ground wire loose and grounding
23. Carburetor icing
24. Fluctuating fuel pressure
25. Defective rocker arms or bearings
26. Defective valve guides
27. Bent crankshaft
28. Crosswind on propeller during ground operation
29. Spark plug wires crossed



## High Oil Temperature

12 points

1. Insufficient oil supply
2. Defective oil temperature gauge
3. Airflow through oil cooler blocked
4. Oil cooler bypass valve malfunction
5. Cylinder baffles missing or insecure
6. Poor airflow around oil tank
7. Clogged oil lines or screens
8. Overheated bearings
9. Dirty or improper grade of oil
10. Improper grade of fuel
11. Improper ignition timing
12. Main bearing shifting in crankcase bearing bore.

## Excess Oil Consumption

9 points

1. Improper grade of oil
2. Improper venting of oil system
3. Piston rings worn, broken or incorrectly installed
4. Breather line exiting in low pressure area and blocked or missing vacuum break hole on breather line
5. Cracked pistons
6. Defective supercharger seal
7. Piston oil drain holes clogged
8. Oil pressure too high
9. Too much clearance between intake valve and guide

## **Low Oil Pressure**

**18 points**

1. Insufficient oil supply
2. Oil pump not primed
3. Improper setting of pressure relief valve
4. Foreign matter in relief valve
5. Defective pressure gauge, or clogged gauge line
6. Improper grade of oil
7. High oil temperature
8. Leak in suction lines
9. Dirt in oil screens
10. Foaming in oil tank
11. Oil congealed in intake line
12. Excessively diluted oil
13. Broken oil line
14. Excessive cam follower to crankcase clearance
15. Excessive bearing clearance or wrong undersize bearings
16. Crankshaft plugs leaking or missing
17. Worn oil pump gears
18. Broken oil pump gears or drive shaft

## **High Oil Pressure**

**8 points**

1. Improper grade of oil
2. Pressure relief valve stuck closed or improperly adjusted
3. Oil cold or frozen
4. Oil pipe bent or crushed
5. Defective pressure gauge
6. Insufficient bearing clearance
7. Oil Screen or filter clogged
8. Bearing tight due to engine overheating

## Improper Engine Acceleration

11 points

1. Incorrectly adjusted carburetor
2. Defective accelerating pump
3. Cold oil
4. Defective tachometer
5. Improper propeller pitch or warped propeller
6. Improper throttle or mixture control linkage adjustment
7. Fuel valve leaking or not operating properly
8. Improper spark adjustment
9. Improper engine timing
10. Internal carburetor trouble, or pressure-type carburetor in gravity fuel system
11. Air leaks or restriction in induction system

## Failure of Engine to Idle Properly

20 points

1. Carburetor control linkage improperly adjusted
2. Loose spark plug connectors
3. Water or oil in magnetos
4. Burned or pitted contact breaker points
5. Improper magneto timing
6. Defective ignition harness
7. Improper grade of fuel
8. Incorrect idling speed adjustment
9. Throttle valve closing too far
10. Idling jet restricted
11. Air leaks in induction system
12. Vapor in fuel system
13. Improper fuel pressure
14. Internal carburetor trouble
15. Partial obstruction in fuel lines
16. Fuel valve leaking or not operating properly
17. Defective primer valve
18. Improper valve clearance
19. Low cylinder compression
20. Excessive play in carburetor control linkage

## **Failure of Engine to Develop Full Power**

### **29 points**

1. Carburetor control linkage improperly adjusted
2. Mixture too lean or too rich
3. Throttle valve not fully open
4. Improper grade of fuel
5. Air leak in carburetor
6. Incorrect fuel pressure
7. Improper valve clearance
8. Improper grade of oil
9. Oil too hot or too cold
10. Rocker arms not properly lubricated
11. Incorrect valve or ignition timing
12. Defective spark plugs
13. Weak magneto magnets
14. Burned or pitted contact breaker points
15. Excessive carbon and pre-ignition
16. Intake manifold too cold
17. Pressure type carburetor in gravity system
18. Weak or broken valve springs
19. Low cylinder compression
20. Valve seats scored or worn
21. Bent pushrods
22. Excessive back pressure from exhaust manifold
23. Engine stiff or tight
24. Incorrect propeller setting, or warped propeller blades
25. Engine overheating
26. Carburetor venturi too small
27. Carburetor icing
28. Improper grade of fuel
29. Defective supercharger

## Engine Stops

12 points

1. Magnetos grounded
2. Out of fuel
3. Carburetor jets restricted
4. Air or vapor lock in fuel line
5. Fuel lines partially obstructed
6. Foreign object in induction system
7. Water in fuel
8. Broken fuel lines
9. Sheared timing gears
10. Internal structural failure
11. Propeller contacts solid object
12. Air vent or fuel tank obstructed

## Engine Vibrates Excessively

11 points

1. Propeller out of balance or out of track
2. Bent crankshaft
3. Unequal valve clearance
4. Defective spark plugs
5. Engine loose on mount
6. Propeller hub nut loose
7. Carburetor icing
8. Incorrect carburetor setting
9. Engine too cold
10. Improper ignition timing
11. Worn dynamic dampner bushings or pins

## **Engine Continually Throws Alternator Belt**

**3 points**

1. Bent pulley
2. Alternator bearings or armature
3. Worn dynamic dampner bushings or pins

## **Engine Overheats**

**15 points**

1. Retarded spark or spark timed late
2. Defective water circulation
3. Defective oil circulation
4. Thin oil
5. Lean Mixture
6. Camshaft out of time
7. Idling engine too long
8. Running air cooled engine on ground too long
9. Insufficient oil cooling
10. Insufficient oil supply
11. Running engine with radiator or cowling shutters closed
12. Excessive carbon
13. Engine improperly cowled
14. Overheated bearing
15. Tight bearings or pistons out of line

## **High Cylinder Head Temperature**

**15 points**

1. Mixture too lean
2. Improper grade of fuel
3. Air leaks in induction system
4. High carburetor air inlet temperature
5. Magnetos improperly timed
6. Damaged cylinder baffles, fins, or restrictions in airflow

7. Incorrect valve operation or clearance
8. Restrictions in exhaust system
9. Temperature gauge defective
10. Thermocouple wires too close to exhaust manifold
11. Spark retarded
12. Pre-ignition through carbon or defective spark plugs
13. Warped valves
14. Loose valve seats and guides
15. Worn valve guides

## **Engine Won't Stop When Switch is Turned Off**

**4 points**

1. Magneto ground wires loose or broken
2. Faulty magneto switch
3. Engine excessively hot
4. Incandescent carbon in cylinders

## **Carburetor Leaks Fuel**

**6 points**

1. Leaky or stuck float
2. Excessive fuel supply pressure
3. Poor seating of needle valve
4. Worn float fulcrum pin
5. Improper float level
6. Loose needle valve seat

## **Engine "Spits Back" in Carburetor**

**13 points**

1. Cold engine or cold mixture
2. Lean mixture
3. Air leaks in manifold
4. Air leaks around intake valve stems
5. Weak valve springs

6. Sticking valves
7. Spark plug wires crossed or incorrectly connected
8. Ignition out of time or retarded
9. Camshaft out of time
10. Overheating
11. Carbon
12. Improper grade of fuel
13. Water in gasoline

## **Engine Misses Intermittently**

**13 points**

1. Incorrect mixture
2. Improper grade of fuel
3. Water in fuel
4. Air leaks in induction system
5. Slow valve action
6. Defective magnetos or ignition harness
7. Distributor points or contact breaker points dirty or pitted
8. Carburetor air heater defective
9. High oil temperature
10. Defective spark plugs
11. Improper timing
12. Carburetor icing
13. Magneto ground wire swinging and periodically grounding

## **Engine Misses Regularly**

**6 points**

1. Fouled spark plug
2. Defective spark plug
3. Broken or grounded spark plug wire
4. Improper valve clearance
5. Low compression on one or more cylinders
6. Damaged magneto distributor head



## Scattering Misfire

12 points

1. Lean mixture
2. Rich mixture
3. Water in gasoline
4. Air leak in intake manifold
5. Intake valve holding open
6. Sticky valve guides
7. Weak valve springs
8. Excessive breaker point clearance
9. Weak breaker arm spring
10. Excessive rotor contact gap clearance
11. Moisture on distributor block
12. Faulty spark

## Single Cylinder Miss at High Speed

6 points

1. Short circuited spark plugs
2. Short circuited spark plug wire
3. Short circuited distributor block
4. Spark plug gap too wide
5. Weak exhaust valve springs
6. Insufficient valve tappet clearance

## Single Cylinder Miss at Low Speed

7 points

1. Short circuited spark plug
2. Short circuited spark plug wire
3. Short circuited distributor block
4. Wrong spark plug gap
5. Weak compression
6. Air leak around intake valve stem
7. Weak exhaust valve spring

## **Causes of Pre-Ignition**

**5 points**

1. Carbon
2. Overheating
3. Excessively rich mixture
4. Ignition out of time
5. Spark plug wires crossed or connected to wrong cylinder

## **Causes of Excessive Carbon Deposit**

**5 points**

1. Engine flooded with oil
2. Worn piston rings
3. Inferior quality of engine oil
4. Rich mixture
5. Engine operated for long period without cleaning carbon

## **Magneto Fails to Deliver any Spark**

**4 points**

1. Primary circuit grounded or open
2. Secondary circuit grounded or open
3. Ground wire or switch grounded
4. Condenser circuit open or shorted, or condenser punctured

## **Crankcase Fills with Oil (Dry-sump System)**

**6 points**

1. Scavenger pump has lost its prime
2. Scavenger pump screen stopped up
3. Scavenger suction or pressure lines stopped up
4. Air leak in suction side of scavenger pump
5. Broken scavenger pump drive
6. Scavenger pump badly worn

## Engine Pumps Oil

10 points

1. Piston rings poor fit in piston grooves
2. Piston rings poor fit in cylinder
3. Broken piston rings
4. Scored cylinder walls
5. Excessive piston clearance
6. Excessive oil pressure
7. Thin oil
8. Improper grade of oil
9. Excessive bearing clearance
10. Faulty scavenger pump

## Faulty Spark

19 points

1. Breaker point clearance incorrect
2. Breaker points burned or dirty
3. Collector brush worn out or dirty
4. Distributor brush worn out or dirty
5. Distributor segments/rotor contact corroded or burnt
6. Collector ring short circuited or dirty
7. Distributor rotor short circuited or dirty
8. Incorrect E-gap
9. Primary winding short circuited or dirty
10. Secondary winding short circuited or burned out
11. Condenser short circuited or punctured
12. Magnets weak or crossed
13. Loose or corroded connection within the magneto
14. Ground wire or switch short circuited
15. Moisture within the magneto
16. Armature touches pole pieces
17. Foreign material collected on armature
18. Defective spark plugs
19. Carbon tracks resulting from flashover caused by moisture.

## Mixture Analysis by Exhaust Flame

4 points

1. Rich Mixture: Long deep blue flame with red tip, black smoke.
2. Lean Mixture: Short irregular light blue flame with yellow tip.
3. Proper Mixture: Quick blue flame without yellow tip.
4. Oil pumping is shown by blue exhaust smoke.

### A “Too-Rich Mixture” may be caused by:

6 points

1. High fuel pressure
2. Oil in cylinders
3. Carburetor float valve seating improperly
4. Float leaking air
5. Jet gaskets of improper thickness or out of shape
6. Float level too high (these troubles would be responsible for the carburetor flooding and a rich mixture, particularly at low speeds)

### A “Too-Lean Mixture” may be caused by:

9 points

1. Insufficient fuel in tank
2. Partially clogged fuel line
3. Insufficient air pressure in pressure fuel tank
4. Air vent on fuel tank clogged
5. Fuel filter or jets clogged
6. Carburetor float level too low
7. Water in carburetor or system
8. Air leaks in induction system
9. Sticking valves



## ECi<sup>®</sup> Technical Reference Materials

### **Break-in Instructions** (Booklet #M101)

Oil Talk for Dummies • Suggested Precautions for New and Remanufactured Engines • Run-in vs. Break-in • Lubrication for Run-in and Break-in • Break-in Procedures • Lubrication for Normal Operation • Cylinder Replacement • Oil Filtration • Break-in Record.

### **Class Reference Manual** (Booklet #M108)

Cross-referencing sections include: Lycoming & Continental Engine Models to ECi Cylinder Stud Assembly Class Number to LY/TCM Cylinder, Piston, Ring, Valve, Guide, Seat, etc. Reference • Radial Engine Manufacturers & Model to ECi Cylinder Stud Assembly Class Numbers • Cylinder Stud Assembly Class Number Differentiations • Continental Cylinder Class Differences • Lycoming Core P/N in Ascending Order to ECi Cylinder Class Number • Continental Core P/N in Ascending Order to ECi Cylinder Class Number.

### **Cross Reference Parts List** (Booklet #M157)

ECi Part Numbers to Lycoming, TCM & SAP  
ECi Part Numbers to PMA Supplement number

### **PMA Supplements**

#### **Service Publications**

Piston Ring Sets • Instructions for AEL65102 Cylinders • Plasma Faced Piston Rings • Instructions for AEL320 & 360 Crankshafts • ECi Cyl for TCM 470-520-550 • Color Codes on Cylinders • Continuing Airworthiness Data and Installation Eligibility of ECi Crankcases • and many others.

### **TITAN<sup>®</sup> Cylinder Assemblies**

#### **Features & Benefits: What You Should Know** (Booklet #M105)

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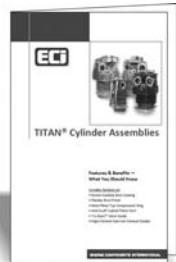
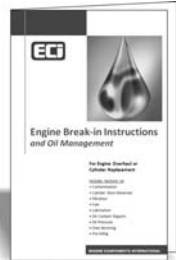
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