MSFS 2024

PRIVATE PILOT LIFE

CESSNA 152 · MSFS AND WBSIM

Aircraft Manual. The Cessna 152 as Private Pilot Life models it, with its procedures, its preflight, every failure one by one, and its maintenance prices.



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CHAPTER 1

THE C152 IN PRIVATE PILOT LIFE

The limits you need to respect, then each of the airplane's systems: how it ages, how it gets damaged, and what you'll see.

TWO CESSNA 152S: THE MSFS DEFAULT AND THE WBSIM

This manual covers both supported Cessna 152s: the one that **ships with MSFS 2024** (nothing to buy) and the **WBSim C152** (a free third-party aircraft). Limits, procedures, preflight, maintenance and nearly every failure are the same. The differences come down to what each airplane lets Private Pilot Life read: the WBSim exposes more of its cockpit and simulates several failures on its own (Chapter 7, "WBSim and Private Pilot Life: who does what").

Item	MSFS C152	WBSim C152
Windows, doors, cabin heat, cabin air	Set them on the app's **Cabin** screen (the cockpit doesn't pass them on to Private Pilot Life)	Read straight from the cockpit
Circuit breakers	7 breakers (COM 1, COM 2, landing light, NAV, STROBE, BCN, panel lights), checked and reset on the Cabin screen	13 breakers, in the cockpit
Oil level	Tracked by Private Pilot Life (consumption, leaks, effects)	Tracked by the airplane, supplemented by Private Pilot Life
Engine wear	Private Pilot Life takes the power away itself	The WBSim limits power based on the wear counter Private Pilot Life feeds it
Alternator failure	Not available	Yes
Voltage spike at engine start	Not available (the avionics switch can't be read)	Yes
Pitot cover, insect nest, chocks, engine cover	Standard MSFS behavior	Yes
Failures simulated by the airplane itself (fouled plugs, flooded engine, engine fire on start, cold oil, iced static port…)	No	Yes (Chapter 7)

Everything else works the same: engine and oil, icing, fuel and water, fuel gauges, airframe, flaps, wheels and brakes, vacuum pump, blocked pitot, human factors, preflight, maintenance shop and money.

MONITORED LIMITS

Limit	Value	If you exceed it
VNE (never exceed)	149 kt	Structural damage; the further and longer you go past it, the worse the damage.
VNO (max structural cruising)	111 kt	Yellow arc: in rough air, risk of damage and airframe wear.
VFE (flaps extended)	85 kt	Flaps jam, then get damaged; the faster and longer the overspeed, the sooner it happens.
Load factor	+4.0 / −3.2 g clean +2.8 / −2.4 g flaps extended	Structural damage; the harder and longer you exceed the limit, the worse the damage.
RPM	2,550 RPM	Engine wear (overspeed).
Oil temperature	245 °F	Engine wear; the oil breaks down much faster.
Oil quantity	4 qt minimum	Wear accelerates sharply, oil pressure drops.
Landing	600 ft/min	Hard landing: the airplane is grounded until it's inspected.
Starter	Short cranking	Keep cranking and it overheats and may burn out; let it cool between attempts.
Tires	21 psi (mains) 30 psi (nose)	Underinflated: pulls to one side and goes flat more easily. Overinflated: weaker braking and more likely to blow out.
Altitude	10,000 ft	Hypoxia, which sets in faster the higher you go.
Open window	Cruise speed	Window torn off.

THE ENGINE

Wear

The engine has a **time** (hours since new or since overhaul, against a 2,400-hour TBO) and a **wear** level (its mechanical condition). Only wear affects performance. Time makes the engine less forgiving of abuse and less reliable; a fresh engine shrugs off a brief exceedance far better than one near TBO. A well-maintained engine reaches TBO with moderate wear.

Wear creeps up a little with every minute of running, and a lot faster when you mistreat the engine. Abuse comes in degrees: a slight exceedance wears the engine noticeably faster, and extreme abuse can destroy it in a few minutes. The factors are oil quantity, oil pressure and temperature, cylinder head temperature, overspeed, shock cooling (chopping the power on descent), carb heat pulled at full power, and oil that's overdue for a change.

> **WHAT YOU'LL NOTICE**
>
> Nothing at first. A worn engine loses power, its mag drop at run-up gets bigger, it's harder to start, it runs hotter, its oil pressure drops and it burns more oil.

> **TOO LATE**
>
> Once it's completely worn out, the engine quits for good. In the shop, a top overhaul fixes the wear without making the engine any younger; only a major overhaul also resets its time to zero.

Oil

The engine burns oil, more so when it's worn or has been overheated. A leak (gasket, hose, crankcase) is rare; an oil cap left open at preflight also loses oil, and the WBSim adds leaks of its own if you push an engine with cold oil. Below 4 qt, wear accelerates until the engine seizes. The oil temperature gauge follows

power, airspeed, cylinder head temperature, carb heat and oil quantity.

Carburetor icing

Moist air forms ice in the carburetor, especially at reduced power. Private Pilot Life uses the real humidity (from the METAR) and the standard carburetor icing probability chart. The RPM slowly decreases, the engine runs rough, then it quits. The fix is full carb heat.

Magnetos

Each magneto's timing drifts a little more with every hour. The engine loses a bit of power as a result, and you may notice a slight loss well before the 100-hour inspection. On the run-up mag check, the mag that's out of time drops noticeably more than the other. The 100-hour inspection retimes them, or you can have the shop retime them as a separate job.

Starter and propeller

The starter is built for short bursts. Crank it too long in one go and it may burn out, leaving you with nothing but a "click" when you turn the key. A worn engine is hard to start, which tempts you to keep cranking, so the two problems feed each other. In a dive with the throttle open, the fixed-pitch prop overspeeds and the RPM quickly goes past the red line.

FUEL

Float-type fuel gauges are only a rough guide. They sit on F as long as the float is submerged, drop faster near the bottom of the tank (showing E while there's still a little fuel left), have a small calibration error, react to pitch attitude, and a float can stick after the airplane has sat for a long time (Chapter 6). Like the gauges, the WBSim tablet and the MSFS fuel menu show the indicated quantity, not the actual quantity. Fueling through MSFS or the tablet during a session is recognized, and the quantity you pick becomes the actual quantity. But when MSFS reloads the airplane with its default fuel load at startup, Private Pilot Life restores the quantity from your last flight. The fuel never left the airplane.

Miscalibrated fuel gauge: electrical wear, more common on a high-time airplane or after an impact. The error shows mostly around mid-scale. A fuel gauge check at the shop will find it.

Fuel leaks: a fuel cap that isn't properly secured (fuel siphoning in flight, especially with a full tank), a dripping quick-drain, a worn seal that leaks more and more, an impact on landing. One gauge drops faster than the other, and fuel burn no longer matches flight time (about 6 gal/h).

Water in the fuel: condensation while parked (tanks not full), contaminated fuel, rain getting in through an open cap. It collects at the bottom and heads for the engine once the airplane starts moving, causing roughness, then engine failure. Sumping the tanks and draining the fuel strainer at preflight gets rid of it.

Fuel exhaustion: part of each tank is unusable (0.75 gal per the POH), so the engine quits before the tanks are bone dry.

ELECTRICAL SYSTEM

Alternator: its voltage regulator ages with the hours and eventually lets the voltage climb. The ALT breaker pops, and pops again after every reset. You're now flying on the battery.

Circuit breakers: every now and then, with the battery switch ON, a piece of equipment pops its breaker. Momentary overload or real fault? One reset will tell you.

Battery: it loses health with the hours and with deep discharges. A badly worn battery won't crank the engine anymore.

INSTRUMENTS

Vacuum pump: it ages, then fails. Suction drops to zero, the heading indicator freezes, the attitude indicator tumbles within a few minutes, and the autopilot disconnects.

Pitot: it ices up in cloud below 0 °C, in freezing rain or freezing drizzle, and in wet snow, unless the pitot heat is powered. Once it's blocked, the airspeed indicator drops to zero.

AIRFRAME

Ice: MSFS models few of its effects, so Private Pilot Life adds noticeable drag (airspeed bleeds off) and,

above all, an early stall with no warning, well above the usual stall speed with a heavy layer of ice.

Structure: load factor, VNE, and the yellow arc in rough air. Depending on severity, the result is an inspection (airplane grounded once it lands), a damaged control surface (vibration, control pulling to one side), or a separated control surface. **Airframe wear** builds up above VNO in rough air and never goes back down; it lowers the limits, and once it maxes out, a serious failure is certain.

Hard landing: once you've stopped, the parking brake sets itself and stays set until the inspection. An impact can also crack a fuel tank or throw a fuel gauge out of calibration.

Weight and balance: Private Pilot Life recomputes it with the arms from the C152 POH and the load you set in MSFS, actual fuel included (max weight 1,670 lb, CG range 31.0 to 36.5 in, with the forward limit moving aft as weight increases). When it's overweight, the airplane handles load factors and firm landings less well, and every touchdown fatigues the structure and the landing gear. With a forward CG, the airplane is nose-heavy: you have to hold back pressure or trim nose-up, and you run out of elevator in the flare. With an aft CG, pitch becomes very sensitive.

WHEELS AND BRAKES

Wheel effects don't show in the cockpit. The airplane slows down and pulls to one side without your pedals moving.

Tires: each one has its own pressure, which slowly drops. The softer it gets, the more likely it is to go flat on touchdown, under heavy braking, or when you taxi on a nearly flat tire. Gravel and coral are much harder on tires.

Brakes: they heat up with heavy braking, riding the brakes while taxiing, or taxiing with the parking brake set. Hot brakes don't stop you as well, and the hotter they get, the worse it is.

Soft ground: on sand especially, the wheels dig in if the nose is down or you're braking. The result can be a bent nosewheel, a prop strike and, if you're going too fast with the brakes on, a nose-over.

THE WBSIM AND PRIVATE PILOT LIFE: WHO DOES WHAT

The WBSim C152 already simulates several failures in its own way. Private Pilot Life doesn't duplicate them; it lets them play out (they stay active) and adds its own. Oil is a joint effort: Private Pilot Life's consumption, temperature, leaks and oil changes come on top of what the WBSim does. So an oil leak can come from the WBSim (pressure too high, cold oil) just as well as from Private Pilot Life (worn gasket, forgotten cap).

System	Failure	Who	Details
Engine	**Engine wear**	Both	The WBSim limits the power of a worn engine; Private Pilot Life adds the abuse (oil, cylinder heads, overspeed, shock cooling, carb heat, old oil).
Engine	**Fouled spark plugs**	WBSim	Long idling with a rich mixture, flooded start: roughness, mag drop; cleared at high power with the mixture leaned.
Engine	**Flooded engine, hard starting, vapor lock**	WBSim	Too much priming, engine too cold or too hot (vapor on the ground after a flight): the engine won't start. Private Pilot Life adds the hard starting of a worn engine.
Engine	**Engine fire on start**	WBSim	Flooded engine, throttle and mixture open while cranking.
Engine	**Magneto timing**	Private Pilot Life	Timing drifts with the hours: power loss, retimed at the 100-hour inspection.
Engine	**Burned-out starter**	Private Pilot Life	Cranking too long.
Engine	**Carburetor icing, water in the fuel**	Private Pilot Life	See the failure descriptions.
Oil	**Consumption**	Both	WBSim: normal consumption; Private Pilot Life adds what a worn engine, an overheat and old oil burn.
Oil	**Pressure**	Both	The WBSim computes it; it also drops with low oil quantity, very hot oil, a worn engine or old oil.
Oil	**Cold oil (pressure too high)**	WBSim	Full throttle with cold oil: intermittent roughness and, occasionally, an oil leak or an engine failure. Warm up on the ground.
Oil	**Oil leak**	Both	WBSim: after excessive pressure. Private Pilot Life: rare leak (gasket, hose, crankcase) and oil cap left open at preflight.
Oil	**Oil temperature gauge**	Private Pilot Life	The WBSim gauge responds; Private Pilot Life fills in the rest.
Oil	**Oil starvation, seizure**	Both	WBSim: pressure too low for too long, then permanent failure. Private Pilot Life: below 4 qt, wear accelerates sharply and pressure drops.
Oil	**Oil changes, oil aging**	Private Pilot Life	Due every 50 hours.
Fuel	**Imbalance in a slip**	WBSim	Ball off center: only one tank feeds.
Fuel	**Gauges, leaks, fuel exhaustion**	Private Pilot Life	See the failure descriptions.
Electrical	**Battery**	Both	WBSim: charge carried over from one flight to the next, recharged from the tablet. Private Pilot Life: aging (reduced capacity).
Electrical	**Circuit breakers**	Both	WBSim: a few random trips. Private Pilot Life: equipment faults (one reset, never two) and overvoltage.
Electrical	**Alternator**	Private Pilot Life	Aging voltage regulator.
Instruments	**Blocked static port**	WBSim	Heavy airframe ice: use the alternate static source.

Instruments	**Pitot**	Both	WBSim: insect nest if the airplane sat for several days without a pitot cover. Private Pilot Life: icing without pitot heat.
Instruments	**Vacuum pump**	Private Pilot Life	Age of the pump.
Airframe	**Chocks, covers, doors**	WBSim	Chocks and covers must be removed; doors close automatically as soon as the airplane picks up speed (no door popping open in flight).
Airframe	**Structure, flaps, hard landing, weight and balance, wheels and brakes**	Private Pilot Life	See the failure descriptions.
Pilot	**Hypoxia, carbon monoxide, cabin temperature**	Private Pilot Life	See the failure descriptions.

CHAPTER 2

NORMAL PROCEDURES

The C152 checklist items that matter in Private Pilot Life. They supplement the POH checklists; they don't replace them. The next chapter explains the reason for each step. **Never use them in a real airplane!**

PREFLIGHT

1. Circuit Breakers ..... **ALL IN**
2. Fuel Quantity Indicators ..... **READ, MASTER ON**
3. Fuel Quantity ..... **CHECK WITH DIPSTICK**
4. Fuel Caps ..... **CLOSED AND LOCKED**
5. Fuel Sumps and Strainer ..... **DRAINED**
6. Oil ..... **CHECK QUANTITY AND COLOR**
7. Oil Filler Cap ..... **SECURE**
8. Tires ..... **21 / 30 PSI**
9. Exhaust, Alternator Belt ..... **CHECK**
10. Propeller, Empennage ..... **CHECK**
11. Flaps and Flight Controls ..... **CHECK FULL TRAVEL**
12. Preheater (Cold Weather) ..... **UNPLUGGED, STOWED**

STARTING ENGINE

1. Starter ..... **10 SECONDS MAXIMUM**
2. If Engine Does Not Start ..... **PAUSE**
3. Repeated Attempts ..... **ALLOW STARTER TO COOL**
4. Oil Pressure ..... **CHECK WITHIN 30 SECONDS**
5. Ammeter ..... **CHARGING**

TAXIING

1. Brakes ..... **CHECK, THEN RELEASE**
2. Speed ..... **WALKING PACE**
3. Parking Brake ..... **OFF**

On soft ground (sand, dirt, tall grass):

4. Control Wheel ..... **AFT (NOSEWHEEL LIGHT)**
5. Brakes ..... **AS LITTLE AS POSSIBLE**
6. Stop ..... **ON FIRM SURFACE ONLY**

RUN-UP

1. Oil Temperature ..... **IN GREEN ARC**
2. Throttle ..... **1,700 RPM**
3. Magnetos **CHECK (NOTE DROP AND DIFFERENCE)**
4. Carburetor Heat ..... **CHECK**
5. Suction Gauge ..... **IN GREEN ARC**
6. Ammeter ..... **CHARGING**
7. Carburetor Heat ..... **COLD**

BEFORE TAKEOFF

1. Windows ..... **CLOSED**
2. Flight Controls ..... **FREE, FULL TRAVEL**
3. Pitot Heat ..... **AS REQUIRED**
4. Wing Flaps ..... **0° TO 10°**

CLIMB AND CRUISE

1. Engine RPM ..... **BELOW RED LINE**
2. Engine Temperatures ..... **MONITOR**
3. Wing Flaps ..... **UP**
4. Fuel Endurance ..... **MONITOR BY TIME**
5. Airspeed in Turbulence ..... **BELOW VNO**
6. Altitude ..... **BELOW 10,000 FT**

DESCENT AND APPROACH

1. Carburetor Heat ..... **ON BEFORE REDUCING POWER**
2. Power ..... **REDUCE GRADUALLY**
3. RPM in a Dive ..... **BELOW RED LINE**
4. Wing Flaps ..... **EXTEND BELOW 85 KIAS**
5. Windows ..... **CLOSED**

LANDING AND SHUTDOWN

1. Sink Rate at Touchdown ..... **LESS THAN 600 FT/MIN**
2. Brakes ..... **AS REQUIRED, SMOOTHLY**
3. Carburetor Heat ..... **COLD**
4. Engine ..... **SHUT DOWN ON THE RAMP**
5. End Flight (app) ..... **CLICK**

CHAPTER 3

NORMAL PROCEDURES EXPLAINED

Why each checklist item matters, and what can happen if you skip it.

PREFLIGHT INSPECTION

The preflight is your one chance to see what the instruments won't tell you: black oil, a soft tire, a blue fuel stain under the wing, a cracked muffler. You only see what you actually go and look at, and everything you check is recorded for the flight debrief.

Pay special attention to the caps. You have to open the fuel cap to stick the tank; leave it off and your fuel siphons away in flight. Leave the oil cap off, and the engine throws its oil overboard.

In cold weather, the electric preheater warms the oil so it flows freely at engine start. Unplug the cord and stow it before you touch the key.

ENGINE START

The starter is a powerful electric motor, and it heats up fast. One long, continuous crank takes it to its limit, and then it needs a good long rest to cool down. Keep cranking past that point and you risk burning it out.

> **WHAT YOU'LL NOTICE**
>
> Burned-out starter: just a "click" when you turn the key, and the prop barely moves. The airplane stays parked until it goes to the shop.

A worn engine is harder to start, and that's exactly when you're tempted to keep cranking. Short attempts with a rest in between protect the starter.

TAXI

Riding the brakes while taxiing heats them up, and so does taxiing with the parking brake set. Hot brakes don't stop you as well, and you often find that out on the next landing. They cool faster on a wet runway and more slowly in hot weather.

On soft ground, the wheels dig in deeper the more weight is on the nose and the harder you brake. Soft-field technique takes the weight off the nosewheel: yoke back, no brakes, and stop only on firm ground. Once you're stuck, it takes full power with the yoke all the way back to get out.

RUN-UP

The run-up is a real diagnostic check. At 1,700 RPM, the **mag drop** on a healthy engine is modest (125 RPM max, with no more than 50 RPM difference between magnetos, per the POH). It grows as the engine wears, so a drop that gets bigger from one flight to the next is a warning sign. Applying **carburetor heat** should bring the RPM down; if it then climbs back above where it started, there was already ice. The **suction gauge** and the **ammeter** will give away a vacuum pump or an alternator on its last legs.

TAKEOFF AND CLIMB

Close the windows before takeoff. At cruise speed, an open window can be torn off. The WBSim closes the doors by itself as soon as the airplane picks up speed, but not the windows.

In the climb, the engine works hard at low airspeed, so it doesn't cool as well. Watch the oil temperature; past the red line, wear speeds up and the oil breaks down much faster.

CRUISE

Keep track of fuel by time, at about 6 gal/h, starting from the dipstick reading before departure. The gauges back you up; they don't have the final say.

The yellow arc is for smooth air only. In turbulence, every minute above VNO wears the airframe, and the risk of damage climbs quickly as you approach VNE. That wear never goes away.

Above 10,000 ft, hypoxia creeps up on you without warning. The C152 carries no oxygen, so keep any time at those altitudes short.

DESCENT

Carb heat before you reduce power. With the power back, the nearly closed throttle plate ices up easily, and an idling engine makes too little heat for the carb heat to melt the ice. Pull it before you reduce power, while the engine is still putting out heat.

Reduce power gradually. Chopping the power cools the cylinder heads too fast. That's shock cooling, and it counts toward engine wear.

Watch the RPM in a dive. The fixed-pitch prop speeds up with airspeed; in a fast descent with the throttle open, the RPM quickly goes past the red line.

APPROACH AND LANDING

Extend the flaps below 85 kt. Above that, they can jam and then get damaged, and the faster and longer the overspeed, the sooner it happens.

A touchdown at more than 600 ft/min is a hard landing. Once you've stopped, the parking brake sets itself and the airplane stays put until it's inspected. The impact can also crack a fuel tank or throw a fuel gauge out of calibration, and an underinflated tire goes flat more easily on touchdown.

AFTER THE FLIGHT

Clicking **End Flight** in the app saves everything. If anything needs fixing, your next flight starts at the maintenance shop, then with the preflight.

CHAPTER 4

EMERGENCY PROCEDURES

Short checklists to keep handy. They're simplified and adapted to the simulator; the next chapter explains the reason for each step. **Never use them in a real airplane!**

LOSS OF POWER IN FLIGHT

1. Airspeed ..... **60 KIAS**
2. Carburetor Heat ..... **ON**
3. Fuel Shutoff Valve ..... **ON**
4. Mixture ..... **FULL RICH**
5. Ignition Switch ..... **BOTH**
6. Primer ..... **IN AND LOCKED**
7. Fuel Gauges and Oil Pressure ..... **CHECK**

If engine does not restart:

8. Landing Site ..... **SELECT**
9. Power-Off Landing ..... **PREPARE**

CARBURETOR ICING

Gradual loss of RPM and engine roughness with throttle unchanged:

1. Carburetor Heat ..... **FULL HOT**
2. Throttle ..... **FULL OPEN**
3. RPM ..... **MONITOR**

RPM drops at first (meltwater passing through the engine), then recovers. When the engine runs smoothly:

4. Carburetor Heat ..... **COLD**
5. Carburetor Heat in Descent **ON BEFORE REDUCING POWER**

AMMETER SHOWS DISCHARGE

Ammeter shows discharge, ALT circuit breaker popped:

1. ALT Circuit Breaker ..... **RESET ONCE**

If it pops again:

2. ALT Circuit Breaker ..... **DO NOT RESET**
3. Nonessential Equipment ..... **OFF**
4. Land ..... **AS SOON AS POSSIBLE**

POPPED CIRCUIT BREAKER

1. Affected Equipment ..... **IDENTIFY**
2. Circuit Breaker ..... **RESET ONCE**

If it pops again:

3. Circuit Breaker ..... **LEAVE OUT**
4. Flight ..... **CONTINUE WITHOUT THAT EQUIPMENT**

CARBON MONOXIDE

CO detector spot darkening, vision narrowing, less precise control inputs:

1. Cabin Heat ..... **OFF**
2. Windows ..... **OPEN**
3. Airspeed (Windows Open) ..... **REDUCE**
4. Land ..... **AS SOON AS POSSIBLE**
5. Exhaust System ..... **HAVE INSPECTED AT SHOP**

HYPOXIA

Above 10,000 ft with vision narrowing and delayed control inputs:

1. Descend ..... **BELOW 10,000 FT**
2. Control Inputs ..... **SLOW AND SMOOTH**
3. Cruise Altitude ..... **AS LOW AS PRACTICAL**

AIRSPEED INDICATOR READING ZERO IN FLIGHT

1. Pitot Heat ..... **ON**
2. BCN / PITOT Circuit Breaker ..... **IN**
3. Aircraft Control ..... **FLY PITCH AND POWER**

ATTITUDE OR HEADING INDICATOR DRIFTING

1. Suction Gauge ..... **CHECK**
2. Heading **CROSS-CHECK WITH MAGNETIC COMPASS**
3. Aircraft Control ..... **FLY PARTIAL PANEL**

CHAPTER 5

EMERGENCIES EXPLAINED

For each situation: what causes it, what you'll notice, why you take those actions, and when it's too late. Read this on the ground, not in flight.

CARBURETOR ICING

As air rushes through the carburetor venturi, it expands and the fuel vaporizes, and the temperature can drop by tens of degrees. If the air is humid, the water vapor freezes on the throttle plate and narrows the passage. The risk is highest at **reduced power**, with the throttle plate nearly closed, as in a descent or on approach, and it can happen even on a mild, clear day.

The risk depends on the real humidity (from the METAR of the nearest airport), the temperature at your altitude and the throttle position, read off the standard carburetor icing probability chart.

In the climb, the air gets more and more humid up to the cloud base. Above a cloud layer it is usually much drier: once you've climbed out of the top, well clear of the last clouds, the risk goes down. Between clouds, it stays that of humid air. A METAR reporting no clouds also limits the humidity aloft.

> **WHAT YOU'LL NOTICE**
>
> RPM slowly dropping with the throttle unchanged, then roughness. When you pull the carb heat, the RPM **drops at first** (the ice melts and the water goes through the engine), then climbs back above where it started.

Carb heat isn't very effective at idle, because the engine isn't making much heat. That's why you pull the carb heat **before** you reduce power, not once the engine is already choking.

> **TOO LATE**
>
> Too much ice and the engine quits. And carb heat left on at full power makes the engine run hot and can cause detonation, which adds to engine wear.

WATER IN THE FUEL

Water doesn't burn, and since it's heavier than fuel, it settles at the bottom of the tanks. It comes from condensation in the empty part of the tanks, contaminated fuel, or rain getting in past a loose fuel cap. As long as the airplane sits still, the water stays at the bottom; once the airplane starts moving around (taxi, rotation, climb, turbulence), it gets drawn toward the engine.

> **WHAT YOU'LL NOTICE**
>
> The engine coughs and runs rough and the RPM wanders, often shortly after takeoff. With a lot of water, the engine quits, sometimes while you're still taxiing. If the prop is still windmilling, it may sputter back to life once the water has passed through.

Your protection is sumping. Before the first flight of the day and after every fueling, drain both wing tanks and the fuel strainer until the sample comes out clean.

> **TOO LATE**
>
> With a lot of water in a tank, the tank outlet sits in water and nothing but water reaches the engine. It won't restart until the fuel system has been completely drained.

ALTERNATOR AND OVERVOLTAGE

On the C152, the voltage regulator keeps the voltage in check. As it ages, it can let the voltage run away, and the ALT breaker pops to protect the system. The older the alternator, the more likely the failure.

WHAT YOU'LL NOTICE

The ammeter shows a discharge and the ALT breaker has popped. Reset it, and it pops again almost immediately.

One reset tells you whether it was just a glitch. If it pops again, the failure is real, and every further reset sends another voltage surge through the system. You're now flying on the battery, which won't last forever, so turn off everything you don't need and land.

TOO LATE

Resetting the ALT breaker over and over during the failure can fry a radio. Golden rule: one reset, never two.

POPPED CIRCUIT BREAKER

A faulty piece of equipment (a short circuit, a tired flap motor) pops its breaker. The radio goes silent, the flaps won't move, a light goes out. Sometimes it's just a momentary overload, and one reset brings everything back. If the breaker pops again shortly afterward, the fault is real.

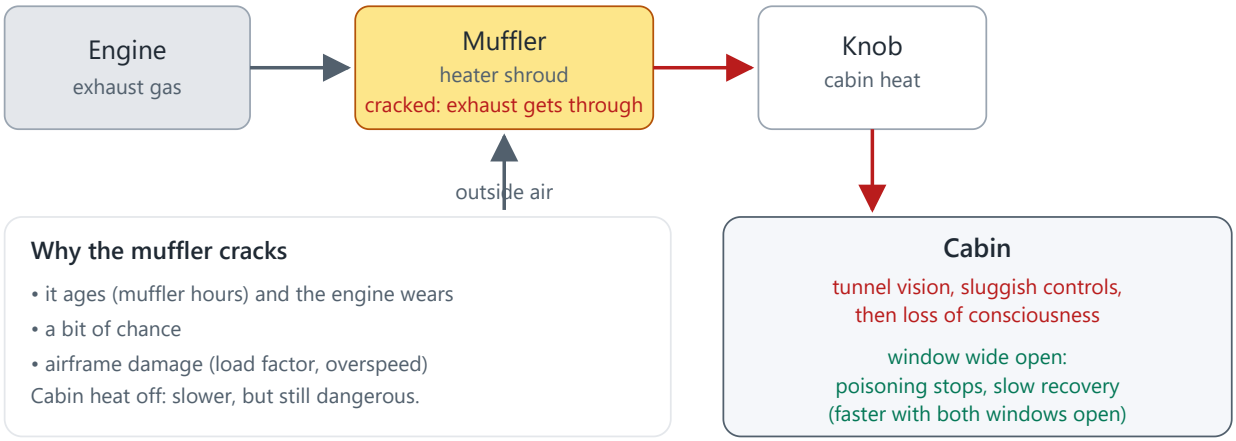
TOO LATE

Resetting a real fault a second time burns out the equipment and overheats the wiring. That means a repair and an inspection at the shop.

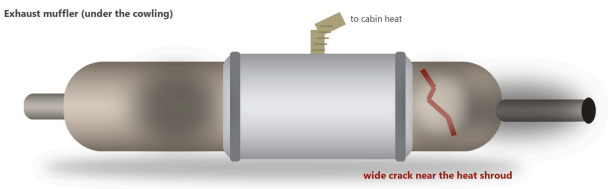
CARBON MONOXIDE

Cabin heat is outside air warmed around the muffler, inside a heater shroud. If the muffler cracks, exhaust gases loaded with carbon monoxide find their way into the cabin. The gas is invisible and odorless; only the CO detector (a spot that turns dark) can warn you. An old muffler, a worn engine or structural damage make a crack more likely.

Where carbon monoxide comes from, and how to get rid of it



Cabin heat draws its air from around the muffler: a crack lets exhaust gases through.



At preflight: a crack near the heater shroud, with soot deposits.

With the cabin heat full on, a major leak knocks you out within a few minutes, a small one a little later. With the heat off, it takes longer. Opening the windows slows the poisoning down, and with them wide open you'll slowly recover.

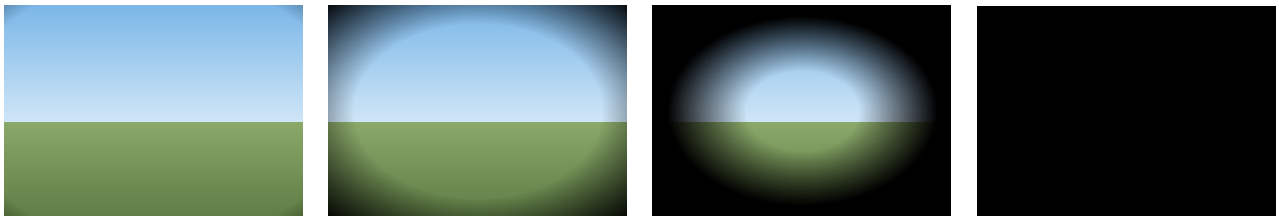
TOO LATE

At cruise speed, an open window can get torn off. And a prolonged loss of consciousness is fatal.

HYPOXIA

The higher you go, the less oxygen you get. Above 10,000 ft, hypoxia sets in faster the higher you climb: slowly just above 10,000 ft, within a few minutes much higher up. Carbon monoxide makes it worse.

What you see at each stage



Stage 1: almost nothing | Stage 2: dark edges | Stage 3: tunnel vision | Stage 4: blackout

Illustration: real screenshots will replace these drawings.

Four stages: almost nothing, darkened edges, tunnel vision, black screen.

It's dangerous because it's insidious. At the first stage, you barely feel a thing. Then your inputs lag and lose precision, and your vision narrows. As you descend, you recover: your vision comes back first, and your inputs regain their precision a bit later, faster the lower you go.

> **TOO LATE**
>
> Loss of consciousness: black screen, controls centered. A prolonged loss of consciousness is fatal.

PITOT ICING

In cloud below 0 °C, in freezing rain or freezing drizzle, or in wet snow (even on the ground), ice gradually blocks the pitot tube unless the pitot heat is on. Once it's blocked, the airspeed indicator drops to zero. Pitot heat only works if it has power (battery, alternator, BCN / PITOT breaker). Without an airspeed indicator, fly known pitch attitudes and power settings.

VACUUM PUMP

The attitude indicator and heading indicator are driven by suction from an engine-driven vacuum pump. The C152 has no warning light. When the pump fails, the suction gauge drops to zero, the heading indicator freezes almost immediately and the attitude indicator tumbles within a few minutes. The trap is trusting the attitude indicator. Cross-check it against the ball, altimeter, vertical speed indicator and compass. That's partial-panel flying.

CHAPTER 6

THE C152 PREFLIGHT

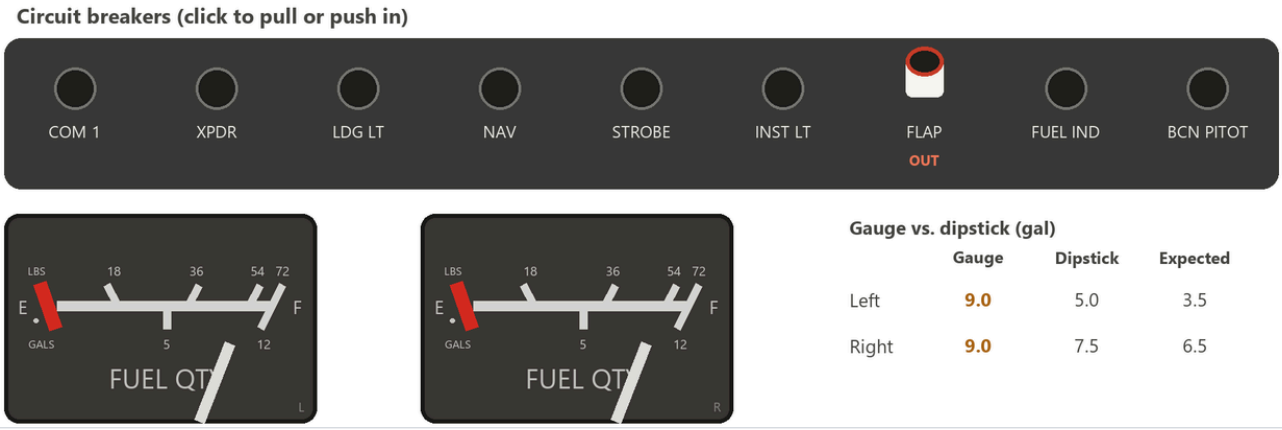
The walkaround, just like at your flying club: what you can really see, what you can fix yourself, and what has to go to the shop.

THE PREFLIGHT SCREEN

The screen itself (airplane views, color-coded items, checklist, press-and-hold buttons) is described in Chapter 5 of the Private Pilot Life User Manual. This chapter goes through the C152's fifteen inspection items and what each one can reveal.

THE CABIN

The cabin is linked live to the cockpit. The circuit breakers are labeled, and a visible white collar means a breaker has popped. One click pulls it or pushes it back in, just like in the airplane.



Flap breaker popped, and fuel gauges compared with the dipstick reading: both needles show 9 gal, but there are actually 5 gal on the left and 7.5 on the right.

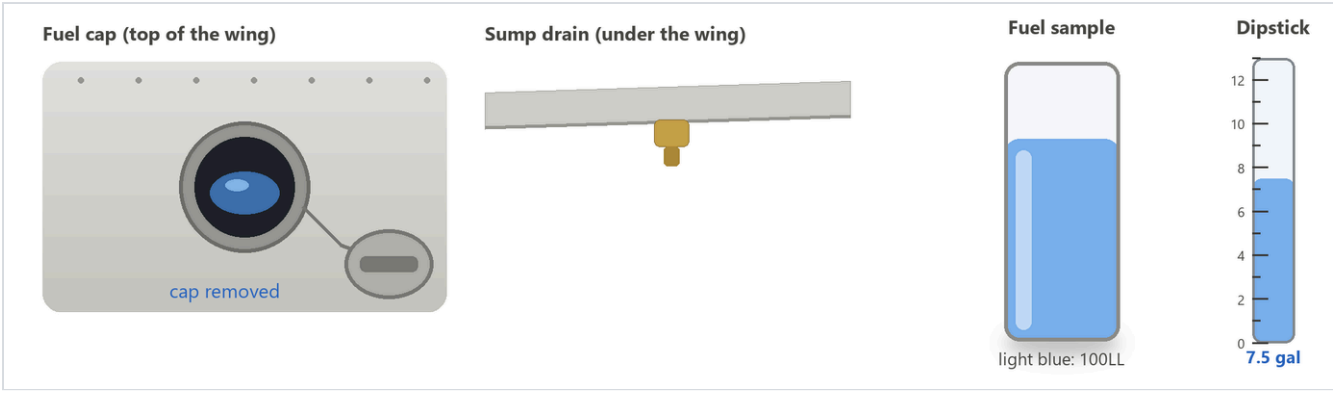
The fuel gauges only come alive with the **battery switch ON** and the FUEL IND breaker pushed in. With the battery off, the panel keeps showing their last reading.

FUEL: DON'T TRUST THE GAUGES

The C152's fuel gauges use a float. They're inaccurate by nature, and Private Pilot Life reproduces that:

- with full tanks, the float is submerged, so the needle sits on F for quite a while; around half, it's roughly right; near the bottom, it drops faster and touches E while there's still a little fuel left;
- each gauge has its own small calibration error;
- nose up, the fuel flows toward the float. At half tank, the needle rises noticeably in a sustained climb and drops in a steep descent; nothing with full tanks, almost nothing near empty. On the ramp, the airplane doesn't sit perfectly level, and that counts too;
- a gauge can drift out of calibration with age or after an impact, and a float can stick after the airplane has sat for a long time: the needle stops moving, even after fueling.

The only reliable measurement is **sticking the tank**. Click the fuel cap to open it, click the open filler neck to dip the stick, and read the quantity. Then click the cap lying next to it to **put it back on and lock it**. In the cabin, the panel compares each gauge, in gallons, with what a healthy gauge would show for the dipstick reading; a clear difference shows up in orange.



Fuel cap off, fuel sample in the tester (light-blue 100LL) and dipstick reading: 7.5 gal.

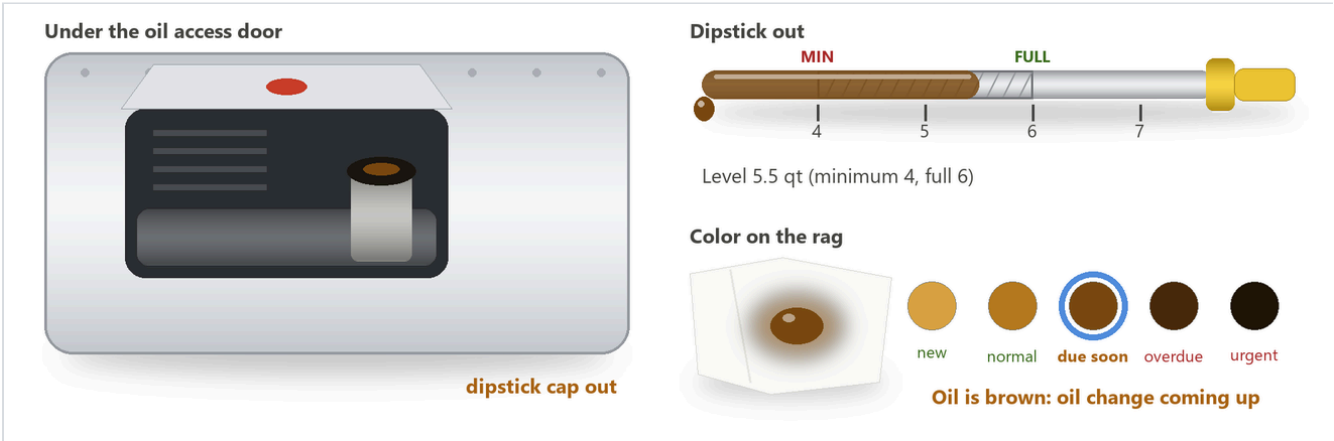
> **FORGOTTEN FUEL CAP**
>
> A cap left off lets fuel siphon out in flight, especially with a full tank. A cap that wasn't properly secured gives itself away at preflight with a blue stain under the wing.

On each wing, you work right on the drawing: **one click on the fuel cap** opens it or puts it back on (locked), **one click on the quick-drain** fills a fuel sampler. 100LL avgas is light blue; water, heavier and colorless, settles at the bottom in a clearly separate layer. Keep sampling until the fuel comes out clean, and don't forget the **fuel strainer** (the fuel filter under the engine), drained from the **Engine Oil** item through the oil access door, just as on the real C152. Every day the airplane sits, condensation forms in the empty part of the tanks; filling up at the end of the day keeps it to a minimum.

With the cap off, hold **Fill**; hold **Drain via Quick-Drain** to take fuel out. As with the tire pump, the **fuel pump** only shows what's been added (amount, volume in gallons and liters), never what's in the tank, and it stops by itself when the tank is full. Fuel you add costs $12 a gallon and is entered in the logbook. Engine off only; stick the tank again afterward.

OIL

You can't see anything until the cap is open and the dipstick is out. Everything happens on the drawing, under the cowling's oil access door: **one click on the yellow cap** opens it, **one click on its handle** pulls out the dipstick. The dipstick then shows the level (MIN and FULL marks), and a drop wiped on a white rag shows the oil's color; a small color chart explains each shade, from light (fresh) to black (oil change overdue). Streaks on the lower cowling give away a leak.



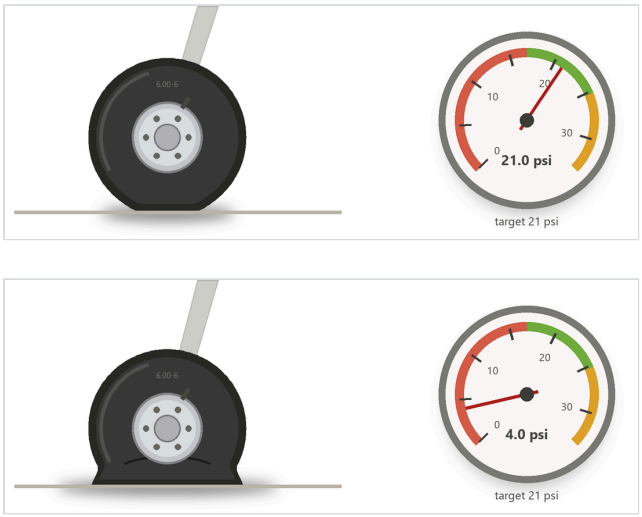
Dipstick out: 5.5 qt (4 qt minimum) and brown oil. An oil change is coming due.

Hold **Add Oil** or **Drain Oil** (engine off). Adding fresh oil refreshes the old oil in proportion; a complete drain and refill gives you all-new oil. To finish, **one click on the dipstick** puts it back and closes the cap.

> **FORGOTTEN OIL CAP**
>
> With the engine running, oil sprays out of the filler and the level drops fast. The windshield won't tell you, but the dipstick will.

TIRES

Each tire is drawn at its actual pressure, with a pressure gauge (21 psi on the mains, 30 psi on the nose). Hold **Inflate** or **Deflate**: the pressure changes gradually. A flat tire won't hold air; it has to be replaced in the shop.

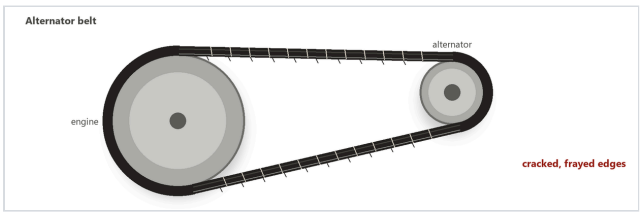


Top: tire at its proper pressure. Bottom: nearly flat, with the sidewall bulging out on the ground.

MSFS doesn't model tire pressure: an underinflated tire doesn't show on the airplane in the outside view, only in the preflight and in how the airplane behaves (it pulls to one side, brakes poorly).

ENGINE, PROPELLER, AIRFRAME

Look for soot and cracks on the muffler, cracking on the alternator belt, a damaged blade tip on the propeller, and tail rivets worn by airframe fatigue. None of these can be fixed on the ramp; they're a job for the shop.



Cracked alternator belt: the alternator is nearing the end of its life.

PITOT, DOORS, FUEL STRAINER

At the **Pitot** item (under the left wing), once the cover is off, **Look Into the Pitot Tube** shows you its opening. An airplane that sat on the ramp for several days without a pitot cover may have an insect nest in there, and the airspeed indicator will stay at zero on the takeoff roll. To test the pitot heat: battery ON, **Pitot Heat** ON, then **Touch the Pitot Tube**. If it's hot, it works; if it's cold, it's off, unpowered or burned out. Turn it off right away. Left on for long on the ground, it will burn out.

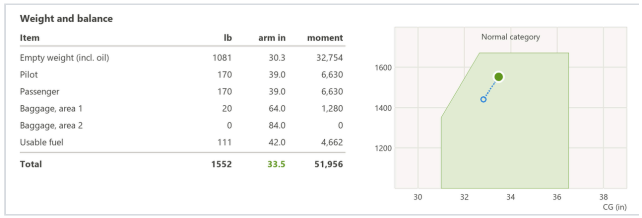
In the cabin, **Check Door Latches** keeps a door from popping open on takeoff and reveals a worn latch. When you drain the fuel strainer, sediment at the bottom of the sampler means the strainer screen is clogging up. Have the shop clean it.

CONTROL SURFACES AND TAIL

At the **Flaps and Controls** item, a control surface damaged by a structural exceedance no longer travels all the way: it stops short on one side (red hatched area), its neutral position is off (orange mark), or it doesn't respond at all. At the tail and on each wing, **Move ... by Hand** lets you feel for free play, a binding point or a broken fitting; the tail also shows the wrinkled skin and "smoking" rivets of a structure that's been overstressed.

WEIGHT AND BALANCE

Set passengers and baggage in the MSFS payload menu, then open the **Weight and Balance** item. It shows the POH loading form (weight, arm, moment) and the CG envelope with your loading (a green dot inside the limits, orange outside) and, as a dotted line, the path the CG follows as fuel burns off. Fix an orange dot on the ground, not in the air.



Two 170 lb people, 20 lb of baggage and 20 gal: within limits.

COLD-WEATHER PREHEAT

Cold oil is thick oil. At startup it doesn't circulate well, and at full throttle its pressure climbs too high (the engine then runs rough). Below 0 °C, plug in the electric preheater (**Engine Preheat** item) for 30 min, 1 h, 2 h or 3 h: the engine is warmed up right away, as if

that much time had passed, and stays warm as long as it's plugged in. Below −12 °C, it's mandatory.

> **THE CORD**
>
> Unplug the preheater and stow the cord before starting the engine. Starting or taxiing with the cord plugged in rips it out, and the airplane stays on the ground until the plug and wiring have been inspected.

FLAPS AND FLIGHT CONTROLS

Turn on the battery, then hold the flap switch to extend or retract the flaps. With the battery OFF, the flap lever moves (shown dotted) but the flaps don't. Then move the yoke and rudder pedals to their stops on each side; every control surface should reach **100%**. Incomplete travel points to a badly calibrated axis or a damaged control.

FINISHING UP

Finish Preflight saves what you looked at and any problems you found. What you checked, or forgot to check, goes into the flight debrief.

CHAPTER 7

C152 FAILURES

One card per failure: what causes it, what you'll see, what to do about it, when it's too late, and what the repair costs. First, though, a look at who does what between the WBSim C152 and Private Pilot Life.

WBSIM AND PRIVATE PILOT LIFE: WHO DOES WHAT

This split only applies to the WBSim C152. With the MSFS default Cessna 152, anything marked "WBSim" below doesn't exist, and anything marked "Both" is handled by Private Pilot Life alone (see Chapter 1).

The WBSim C152 already simulates a number of failures its own way. Private Pilot Life doesn't duplicate them; it lets them play out and adds its own. Oil is the one area where the two work together. What Private Pilot Life does (consumption, temperature, leaks, oil changes) comes on top of what WBSim does. So an oil leak can come from WBSim (pressure too high, cold oil) just as well as from Private Pilot Life (worn gasket, cap left off).

System	Failure	Who	Details
Engine	**Engine wear**	Both	WBSim cuts the power of a worn engine. Private Pilot Life keeps track of the engine's time and its actual wear (oil, cylinder heads, overspeed, shock cooling, carb heat, old oil) and passes that wear on to WBSim.
Engine	**Fouled spark plugs**	WBSim	Long idling with a rich mixture, or starting a flooded engine: rough running, bigger mag drop. Clear them with high power and a leaned mixture.
Engine	**Flooded engine, hard starting, vapor lock**	WBSim	Too much priming, an engine that's too cold or too hot (vapor on the ground after a flight). Private Pilot Life adds the hard starting of a worn engine.
Engine	**Engine fire on start**	WBSim	Flooded engine, with throttle and mixture open while cranking.
Engine	**Magneto timing and magneto failure, starter, carburetor icing, water, fuel strainer, oil temperature sensor**	Private Pilot Life	See the cards.
Oil	**Consumption**	Both	WBSim: normal consumption of a healthy engine. Private Pilot Life adds what a worn engine, overheating and old oil burn.
Oil	**Pressure**	Both	WBSim computes it; Private Pilot Life changes it when the level is low, the oil is very hot, the engine is worn or the oil is old.
Oil	**Cold oil (pressure past the red line)**	WBSim	Full throttle on cold oil: intermittent misfiring, and occasionally an oil leak or engine failure. Warm up on the ground.
Oil	**Oil leak**	Both	WBSim: after excessive pressure. Private Pilot Life: a rare leak (gasket, hose, crankcase), or the oil cap left off during the preflight.
Oil	**Oil temperature gauge**	Private Pilot Life	WBSim's needle barely moves; Private Pilot Life brings the oil temperature to life.
Oil	**Oil starvation, engine seizure**	Both	WBSim: very low pressure for too long, then a permanent engine failure. Private Pilot Life: below the minimum level, wear accelerates sharply and pressure drops.
Oil	**Oil changes, aging oil**	Private Pilot Life	Due every 50 hours.
Fuel	**Fuel imbalance in a slip**	WBSim	Ball off center: only one tank feeds the engine.
Fuel	**Gauges, leaks, water, fuel exhaustion**	Private Pilot Life	See the cards.
Electrical	**Battery**	Both	WBSim: charge carried over from one flight to the next, recharging on the tablet. Private Pilot Life: aging (reduced capacity).
Electrical	**Circuit breakers**	Both	WBSim: a few random trips. Private Pilot Life: equipment faults, worn breakers, overvoltage, a radio fried at engine start.

Electrical	**Alternator**	Private Pilot Life	Aging voltage regulator.
Instruments	**Blocked static port**	WBSim	Heavy airframe ice: use the alternate static source.
Instruments	**Pitot**	Both	WBSim: an insect nest if the airplane sits for a long time without a pitot cover. Private Pilot Life: icing without pitot heat, burned-out pitot heat, an insect nest depending on where the airplane is parked.
Instruments	**Vacuum pump**	Private Pilot Life	Age of the pump.
Airframe	**Chocks, covers, doors**	Both	WBSim: chocks and covers to remove, doors closed automatically as soon as the airplane picks up speed. Private Pilot Life: a door not properly latched that pops open on takeoff, a forgotten aircraft cover.
Airframe	**Structure, flaps, hard landing, weight and balance, wheels and brakes**	Private Pilot Life	Replaces MSFS damage (Aircraft Stress Damage turned off). See the cards.
Pilot	**Hypoxia, carbon monoxide, cabin temperature**	Private Pilot Life	See the cards.

HOW TO READ A CARD

Every card follows the same layout: **what causes it**, **what you'll notice**, **what to do**, **too late**, **repair**, and the Training mode **test command** when there is one (full list in Chapter 9).

The **Maintenance** line tells you whether the failure is:

- **Grounding**: the airplane is no longer airworthy. The item is checked automatically on the estimate. If you take off anyway, the logbook records it as a **flight in an unairworthy aircraft**. Insurance won't cover an accident on that flight, and the airplane loses 10% of its value;
- **Can wait**: you can keep flying without fixing it right away. It isn't checked automatically.

Prices are for an experienced mechanic using new parts. A junior mechanic costs 35% less, overhauled exchange parts are 40% cheaper, and used serviceable parts 70% cheaper (Chapter 8).

> **WEAR IS ONLY KNOWN THROUGH INSPECTION**
>
> Engine wear and airframe wear are never shown directly. The app only shows the last measurement taken by a mechanic, with its date and the hours flown since. To update it, order an engine inspection, an airframe inspection, or a 100-hour inspection, which includes both.

> **VIBRATION**
>
> A coughing engine (water, heavy carburetor ice, a clogged fuel strainer), a dead magneto or a prop strike makes the airplane vibrate at any speed. A damaged control surface or flap, an open door or window, or a window torn off shakes it harder the faster you go.

ENGINE AND OIL

Engine wear

Maintenance: not really a failure; see top overhauls and engine overhaul below.

Time and wear. The engine has a **time** (hours since new or since the last major overhaul, with a 2,400-hour TBO) and a **wear** level (its mechanical condition). Only wear affects performance. Time makes the

engine less forgiving of abuse and less reliable, and it speeds up wear. A new engine forgives a lot; one near or past TBO forgives almost nothing. A high-time engine is also more likely to have a dead magneto, an oil leak or a cracked exhaust, and its magneto timing drifts faster.

What causes it. A little with every minute of running time, and above all abuse: oil level below 4 qt, oil pressure or temperature past the red line (245 °F), cylinder heads too hot, overspeed beyond 2,550 RPM, shock cooling (chopping the power on descent), carb heat pulled at full power, and oil overdue for a change. The harder and longer the abuse, the more it costs. A minor exceedance wears the engine a little faster, while extreme abuse can wreck it in a few minutes. A well-maintained engine reaches TBO with moderate wear.

What you'll notice. Nothing at first. A worn engine gives you less power, a bigger mag drop at run-up (the C152 POH allows 125 RPM maximum, with no more than 50 RPM between magnetos), harder starts, hotter oil, lower oil pressure and rising oil consumption.

What to do. Respect the red lines, reduce power gradually on descent, keep an eye on the oil, and have the wear measured from time to time.

Too late. Worn all the way out, the engine quits for good.

Repair. Engine wear inspection (compression test and borescope, $275). After a 100-hour inspection, if the measured wear is high, the shop offers a partial top overhaul ($5,500, reduces wear) or a top overhaul ($16,500, wear back to new); engine time doesn't change. A major overhaul ($33,000) resets both wear and time to zero.

Test. `h 3` (very low oil level).

Low oil and oil leaks

Maintenance: oil leak is **grounding**, $330.

What causes it. Not checking the level before flight; consumption that rises with wear and overheating; the oil cap left off during the preflight (oil gets thrown all over the cowling); a rare leak from a gasket, a hose or the crankcase, more likely on a high-time engine, sometimes slow, sometimes fast.

What you'll notice. Oil pressure dropping, oil temperature climbing. The dipstick (preflight or tablet) shows the actual level, which goes down from one flight to the next.

What to do. Reduce power and divert.

Too late. Below 4 qt, wear accelerates until the engine seizes.

Repair. The leak persists from flight to flight until the airplane goes to the shop. The mechanic only finds it during an inspection (50-hour or 100-hour).

Test. `f`.

Overdue oil change

Maintenance: routine maintenance, oil change $275 (or 50-hour inspection).

What causes it. More than 50 hours since the last oil change. Oil that has often gone past the 245 °F red line oxidizes and ages much faster.

What you'll notice. It comes on gradually: slightly hotter oil, lower pressure (lower still, with sludge, if you put it off a long time), rising oil consumption and faster engine wear.

What to do. Change the oil on time. Fresh oil added during the preflight freshens the oil a little, but it's no substitute for an oil change.

Repair. An oil change on its own, or a 50-hour inspection.

Oil temperature

WBSim's stock needle barely moves. Private Pilot Life brings the oil temperature to life. It depends on power, airspeed, cylinder heads, carb heat and the amount of oil. Very hot oil means lower pressure and more wear. **Test:** `t 250` (very hot oil).

Failed oil temperature sensor

Maintenance: grounding, $200.

What causes it. Age of the sensor, at random.

What you'll notice. The needle stays frozen no matter what. The real temperature keeps changing, though, so you can no longer see the oil heating up.

What to do. Be suspicious of a needle that never moves. Watch oil pressure, reduce power and land.

Too late. The oil overheats without your knowing it, and the engine wears faster.

Repair. The sensor is replaced at the shop.

Test. r6.

Carburetor icing

Maintenance: nothing to repair.

What causes it. Humid air and no carb heat, especially at reduced power (descent, approach). Private Pilot Life uses real-world weather (the METAR from the nearest station) and the standard carburetor icing chart (shown again in the METAR tab of the preflight). The more humid the air, the faster ice builds: almost none in very dry air, slowly in moderately humid air, quickly in humid air, and very quickly near saturation (mist, cloud, drizzle).

What you'll notice. RPM slowly dropping with the throttle unchanged. With more ice, the engine runs rough (vibration you might mistake for turbulence), then misfires, and finally quits. In cruise in humid air, ice builds slowly but steadily, so keep an eye on the tachometer.

What to do. Full carb heat. RPM drops at first (meltwater passing through the engine), then comes back up. Pull carb heat before reducing power for the descent.

Too late. Too much ice and the engine stops. At idle, carb heat isn't very effective, and with the engine stopped in flight it gives no heat at all.

> CAUTION
>
> Carb heat pulled at full power causes detonation and overheating, and that means engine wear.

Test. g 50 (a lot of ice all at once).

Magneto timing

Maintenance: routine maintenance, $200 (included in the 100-hour inspection).

What causes it. As the breaker points wear, each magneto's timing gradually drifts, usually toward retard. Some magnetos, with a cam that wears out early, drift noticeably faster than others.

What you'll notice. Nothing while the drift is small; after that, a slight loss of power that grows with the drift. You may feel it before 50 hours, and it becomes obvious around the 100-hour inspection. On a single magneto, only that magneto's own drift matters, and it matters more (only one spark plug firing per cylinder), so the mistimed magneto drops noticeably more than the other one. If both have drifted the same way, the drops look alike, but RPM is lower for the same throttle setting. It's easy to add throttle without realizing it, so hold the throttle still during the run-up.

What to do. Have the magneto timing checked regularly.

Repair. Magneto Timing or a 100-hour inspection; the mechanic logs the drift found.

Test. o1 (both retarded), o2 (left one badly retarded), o0 (timing reset).

Dead magneto

Maintenance: grounding, $1,000.

What causes it. Age (condenser, coil, breaker points), more often when its timing has drifted a lot or on a high-time engine.

What you'll notice. During the mag check, on the dead magneto alone, the engine dies. On BOTH, it runs on the good one only: same RPM as on that magneto alone, and a slightly rough engine (light vibration in flight).

What to do. Don't fly. In flight, stay on BOTH and land.

Repair. The magneto is replaced at the shop.

Test. r4 (dead left magneto).

Burned-out starter

Maintenance: grounding, $1,000.

What causes it. Cranking too long without letting the starter rest. It heats up while cranking and needs several minutes to cool down; keep at it and it burns out. A worn engine is hard to start, which tempts you to keep cranking, so the two problems feed each other.

What you'll notice. Just a "click" when you turn the key, and the prop barely moves.

What to do. Crank in short bursts and rest between attempts. If the engine won't catch after a few tries, look for the cause (flooded engine, mixture, priming) instead of grinding away.

Repair. The starter is replaced at the shop.

Test. k.

Propeller overspeed

With a fixed-pitch prop, diving with the throttle open pushes RPM past the red line (2,550 RPM), and the faster you go, the higher it climbs. WBSim hardly models this; Private Pilot Life adds it. **What to do:** pull the throttle back in a fast descent. Overspeed counts toward engine wear.

Ripped-out preheater cord

Maintenance: can wait, $165.

What causes it. Starting the engine or taxiing with the electric preheater (the **Engine Preheat** item in the preflight) still plugged in.

What you'll notice. The cord hangs loose, ripped out; the plug and wiring need to be inspected at the shop.

What to do. Unplug the preheater before starting, then start without delay (the engine is cooling down).

FUEL

The gauges: an indication, nothing more

Just like on the real C152, the fuel gauges don't tell you exactly what's in the tanks. Like the gauges, the WBSim tablet and the MSFS fuel menu show the indicated quantity, not the actual quantity.

Actual quantity per tank	Full	Nearly full	Three quarters	Half	One third	Nearly empty
Needle	F	F	just below F	around 1/2	around 1/4	E

- **Tank shape**: when the tank is full, the float is submerged and the needle stays on F for quite a while. Near the bottom of the tank it falls faster and reaches E while there's still a little fuel left.
- **Calibration**: each gauge has its own small error, mostly in the middle of the dial.
- **Pitch attitude**: no effect when full. At half tanks, the needle rises noticeably in a sustained climb and drops in a steep descent; it takes a few seconds to move.

The only reliable measurement is a **dipstick reading** during the preflight. If you refuel in MSFS or on the tablet during a session, Private Pilot Life picks it up and the quantity you chose becomes the actual quantity. At startup, if MSFS has reloaded the airplane with its default fuel load, Private Pilot Life restores the quantity from your last flight.

Miscalibrated fuel gauge

Maintenance: grounding, $330; found by a **fuel gauge check** ($100) or a 100-hour inspection.

What causes it. Electrical wear in the indicator or its sender, more common on an airplane that has flown a lot; a hard landing or airframe damage raises the risk. Only one gauge at a time.

What you'll notice. Nothing, unless you compare the dipstick reading with the gauge: a clear difference in the middle of the dial, one way or the other. With a nearly full tank, the needle sits on F and you can't see it.

What to do. Trust the dipstick and your flight time (about 6 gal/h), and ask the shop for a fuel gauge check.

Too late. Fuel exhaustion while the needle still shows fuel.

Test. n1 (left gauge reads high), n2 (right gauge reads low); try it with a half-empty tank.

Stuck float

Maintenance: grounding, $330; found by a **fuel gauge check** ($100) or a 100-hour inspection.

What causes it. The airplane sitting unused for a long time, until the float sticks. Rare after a few weeks, more and more likely when the airplane goes months without flying.

What you'll notice. The needle stays frozen where it was on the ramp. It doesn't rise after refueling (even through the MSFS menu), and doesn't move in a climb or as fuel burns off. During the preflight, the cabin table highlights the difference in orange.

What to do. Trust the dipstick and your flight time.

Test. n3 (stuck left float).

Empty tank

Maintenance: nothing to repair.

What causes it. Poor fuel management. The engine quits when only unusable fuel is left (1.5 gal total on the C152).

What you'll notice. The engine quits.

What to do. Run the Loss of Power in Flight checklist and prepare for a power-off landing.

Test. c.

Fuel leak

Maintenance: grounding, $275.

What causes it.

- **fuel cap not properly closed** (or left off during the preflight): in flight, the wing siphons the fuel out, a lot when the tank is full, less and less afterward, and nothing once the tank is well down;
- **leaking quick-drain** after sumping: a constant drip;
- **worn seal or fitting**, more likely on an airplane that has flown a lot: slow at first, then heavier and heavier;
- **impact**: a hard landing or airframe damage, causing a steady leak.

What you'll notice. One gauge drops faster than the other, and fuel burn no longer matches flight time.

What to do. Watch the gauges, work out your remaining endurance, and divert.

Too late. Fuel exhaustion.

Repair. The leak persists from flight to flight until the airplane goes to the shop.

Test. l1 (fuel cap), l2 (quick-drain), l3 (seal), l4 (impact), left tank.

Water in the fuel

Maintenance: complete draining $22 (included in inspections).

What causes it.

- **condensation** while parked, in the empty part of the tanks: more in humid weather, with nearly empty tanks, and with the airplane tied down outside rather than in a hangar; none with full tanks. That's why you top off at the end of the day;
- **contaminated fuel**: once in a while, a fuel load brings in a good amount of water;
- **rain** getting in through an open or loose fuel cap.

What happens. Water sinks to the bottom. A small amount sits below the tank outlet without causing trouble. Any more than that heads for the engine, only a little when the airplane is steady, much more when it's moving around (taxiing, rotation, climb, turbulence). With a lot of water, nothing but water comes out. The fuel strainer catches some of it.

What you'll notice. Misfiring, often during the initial climb. With a lot of water, the engine quits, sometimes while you're still taxiing.

What to do. During the preflight, sump both wings and the fuel strainer until the sample comes out clean (water is clear and sits at the bottom, under the blue fuel). In flight, run the Loss of Power in Flight checklist.

Too late. With the tank outlet flooded, the engine won't restart until the water has been drained.

Test. b1 (a little water: misfiring in the climb), b2 (a lot of water: engine failure), left tank.

Clogged fuel strainer

Maintenance: can wait; cleaning $65, suggested once clogging becomes significant, included in inspections.

What causes it. Contaminants in the fuel build up in the strainer, much faster when water sits in it (skipped sumping). An overdue inspection lets it get dirtier.

What you'll notice. Nothing at reduced cruise power. At full throttle, power tops out and the engine misfires, giving you a low static RPM and a sluggish climb.

What to do. Sump at every preflight (sediment at the bottom of the strainer sample gives it away). In flight, ease the throttle back a bit to get the engine running smoothly again.

Test. r3 (badly clogged strainer).

ELECTRICAL

Failed alternator voltage regulator

Maintenance: grounding, alternator $1,300.

What causes it. Age of the alternator: rare on a new one, more and more frequent on an old one, with a bit of bad luck thrown in.

What you'll notice. The ALT circuit breaker pops, and pops again shortly after each reset. The ammeter shows a discharge.

What to do. Reset it once only. If it pops again, leave it alone, shed electrical load (turn off anything you don't need) and land on battery power.

Too late. Resetting the ALT breaker again during the failure can fry a radio (overvoltage).

Repair. The alternator is replaced.

Test. a.

Popped circuit breaker

Maintenance: can wait, except for the fuel gauge breaker (FUEL IND), which is **grounding**. Burned-out equipment is charged at its replacement price (COM1 radio $1,650, transponder $2,000, flap motor $1,300…); a simple fault costs half that.

What causes it. A faulty piece of electrical equipment, at random, with the battery switch ON. It's rare.

What you'll notice. The equipment stops working (dead radio, flaps that won't move, lights out), and its circuit breaker has popped.

What to do. Reset it once only. If it was a temporary overload, one reset is enough and everything works again. If it's a real fault, the breaker pops again shortly afterward; leave it out.

Too late. Resetting a real fault again burns out the equipment.

Test. j (random) or j1 to j9 (specific equipment; j7 = flaps).

Worn circuit breaker

Maintenance: can wait (except on the fuel gauges), $130.

What causes it. The age of the airplane. The equipment is fine; the breaker itself is wearing out.

What you'll notice. A breaker pops. Once reset, it holds for a few seconds or a few minutes, then pops again.

What to do. You may reset it; if it keeps popping, leave it out.

Test. j0.

Radio fried at engine start

Maintenance: can wait; COM1 radio $1,650, transponder $2,000.

What causes it. A radio left on while cranking the engine: the voltage sags, then spikes back up. It doesn't break every time, but every start with the radios on is a gamble.

What you'll notice. The radio won't turn on anymore, and its breaker pops again and again.

What to do. Radios off before starting, on afterward.

Test. r2.

Aging battery

Maintenance: replacement recommended when the mechanic finds it weak (after a 100-hour inspection), $385.

Its health declines with hours and deep discharges. It never fully recharges again and runs down faster. A badly worn battery can no longer crank the engine. After replacing it, recharge it on the WBSim tablet.

INSTRUMENTS AND PITOT

Failed vacuum pump

Maintenance: can wait, $1,000.

What causes it. Age of the pump: rare on a new pump, more and more likely as it gets older, with some bad luck thrown in.

What you'll notice. The C152 has no warning light. Suction drops to zero; the heading indicator freezes almost immediately, the attitude indicator tumbles within a few minutes, and the autopilot disconnects.

What to do. Cross-check with the compass and the ball, fly partial panel, and stay in visual conditions.

Test. s.

Pitot icing

Maintenance: nothing to repair.

What causes it. Not using pitot heat in cloud below 0 °C, in freezing rain or freezing drizzle, in wet snow (even on the ground), or when the airframe is icing up.

What you'll notice. When ice blocks the pitot tube, the airspeed indicator drops to zero. It clears once enough ice has melted, which happens fairly quickly in air above 0 °C.

What to do. Pitot heat on. It only works if it has power (circuit breaker, battery, alternator). In the meantime, fly by pitch and power.

Test. p.

Burned-out pitot heat

Maintenance: can wait, $500.

What causes it. Leaving it on too long on the ground, with no airflow to cool it: the longer you leave it on, the more likely it is to burn out. There's also a small random risk that grows with its operating hours.

What you'll notice. Nothing on the ground. In icing conditions, the pitot tube ices up even though the switch is ON.

What to do. On the ground, turn it on for a few seconds only (in the preflight, **Touch the Pitot Tube**; it's cold if the heater is burned out), and turn it on just before takeoff.

Test. r1.

Insect nest in the pitot tube

Maintenance: grounding, $90.

What causes it. Leaving the airplane parked without a pitot cover: the risk grows with every day it sits. Much more common on a tie-down than in a hangar; the aircraft cover protects the pitot tube.

What you'll notice. The airspeed indicator stays at zero from the start of the takeoff roll.

What to do. Put the pitot cover back on whenever you park, and during the preflight use **Look Into the Pitot Tube**. If there's no airspeed on the takeoff roll, **abort the takeoff**.

Test. r0.

AIRFRAME ICING

Ice on the airframe

Maintenance: nothing to repair.

What causes it. Flying in cloud or precipitation below 0 °C (MSFS ice).

What you'll notice. Airspeed and RPM dropping (drag, which grows with the thickness of the ice), and above all **an earlier stall, with no warning**. With a lot of ice, the airplane stalls well above its usual stall speed.

What to do. Get out of icing conditions, keep your speed up, and avoid high angles of attack.

Test. i 60 (forced ice), i 0 to go back to MSFS ice only.

STRUCTURE, FLAPS, LANDING

Flap overspeed

Maintenance: can wait, $650 (you can fly with the flaps stuck).

What causes it. Flaps extended above VFE (85 kt). You may get away with a brief exceedance, but the risk builds faster the faster you go and the longer you stay there.

What you'll notice. The flaps won't move anymore.

What to do. Plan your approach with the flaps where they are, and never extend them above 85 kt.

Test. v.

Damaged or separated flap

Maintenance: grounding; damaged $2,750, separated $6,600 (a separated flap is an accident covered by insurance). The airplane is grounded once it's on the ground.

What causes it. Flaps extended well above their limit speed, even if they're already stuck: **damaged** when you push well beyond VFE, **separated** when you go much faster still or stay there too long.

What you'll notice. Damaged: flaps stuck, vibration, and the airplane rolls toward the damaged side (you have to hold aileron, more so the further the flaps are extended). Separated: the ailerons go to the stop toward the side that lost its flap, whatever you do, and **the airplane is uncontrollable**.

What to do. Damaged: hold opposite aileron, slow down, leave the flaps alone, and land promptly.

Too late. Separated: there's nothing left to do. Your only defense is never extending the flaps above 85 kt.

Test. v1 (damaged), v2 (separated).

Worn flap limit switch

Maintenance: can wait, $330.

What causes it. Wear of the limit switch, depending on how many times the flaps have been cycled.

What you'll notice. The flaps no longer stop at the setting you picked; they run all the way down to full. You can still retract them.

What to do. Check the flap position indicator every time you move the flaps; if they run to full when you didn't want them to in a climb, retract them.

Test. r9.

Door opening on takeoff

Maintenance: can wait; worn latch $275.

What causes it. A door that wasn't properly latched (rare, and never if you checked the latch during the preflight), or a worn latch (then it pops open often until the shop fixes it; the preflight reveals it).

What you'll notice. During the takeoff roll, the door pops ajar: a draft, vibration that grows with speed, and a slightly slower airplane.

What to do. It's not an emergency. **Fly the airplane first**. To close the door in flight, slow down well (approach speed) and open the window on the same side wide; the door shuts after a few seconds. Otherwise, finish the pattern and land.

Test. r8 (on the ground: the door will pop open on the next takeoff).

Hard landing

Maintenance: grounding, inspection $440.

What causes it. A really firm touchdown (high sink rate), which comes sooner when you're overweight. Bounces count: the landing is judged on the hardest contact.

What you'll notice. Once you've stopped, the parking brake sets itself again and the airplane is grounded until it's inspected. The impact can also crack a tank or throw a fuel gauge out of calibration.

What to do. Fly a stabilized approach; if you bounce, go around rather than forcing it on.

Test. d.

Structure: load factor, overspeed, turbulence

Maintenance: grounding; minor $1,100, moderate $5,500, severe $16,500, structural failure $33,000, destruction $66,000 (covered by insurance from severe up).

What causes it. Load factor beyond the limits (+4 / −3.2 g flaps up, +2.8 / −2.4 g flaps down); airspeed above VNE (149 kt); the yellow arc (above VNO, 111 kt) in turbulence, riskier the faster you go and the rougher the air. You may get away with a very brief exceedance; the longer or harder it is, the more likely and the more serious the damage.

What you'll notice.

- **minor**: nothing in flight; the airplane needs an inspection and is grounded once it's on the ground;
- **moderate**: one control surface (elevator, ailerons or rudder) is damaged, causing vibration, and the control pulls to one side;
- **severe**: it pulls harder and responds poorly;
- **structural failure** (limits or VNE far exceeded): one control surface separates and its control goes to the stop (usually the elevator, nose down): **the airplane is uncontrollable**;
- **destruction** (an even more extreme exceedance, or holding a speed far above VNE after a structural failure): two or three control surfaces separate.

What to do. Stay out of the yellow arc in turbulence, never exceed VNE, and pull out of dives gently. With a damaged control surface, slow down, hold the controls and land.

Too late. Structural failure or destruction: the airplane ends up on the ground, and the MSFS crash takes

over from there.

Test. x1 (inspection), x2 (damaged control surface), x3 (badly damaged), x4 (separated control surface), x5 (destruction).

Airframe wear

Maintenance: airframe inspection $330; airframe repair (structure and landing gear) $4,400, recommended when the measured wear becomes significant.

What causes it. Flying above VNO in turbulence, overweight operations, and time spent parked (slowly in a hangar, faster on a tie-down, a little less with an aircraft cover). It never goes back down on its own.

What you'll notice. Nothing directly. A worn structure gives way sooner, before the usual limits. During the preflight, look for smoking rivets (black streaks).

Too late. Worn all the way out, the structure eventually gives way: a severe failure.

Weight and balance

Maintenance: nothing to repair in itself. Airframe and landing gear wear call for an airframe repair; a bent nosewheel (worn-out gear) is $880 and **grounding**.

What causes it. The load set in MSFS (pilot, passenger, two baggage areas) and the actual fuel on board, checked against the C152 POH envelope: 1,670 lb maximum; CG between 31.0 in (up to 1,350 lb, 32.65 in at 1,670 lb) and 36.5 in; baggage 120 lb maximum, of which no more than 40 lb in the aft area.

What you'll notice.

- **overweight**: the structure tolerates less load factor, a hard landing comes sooner, and the structure and landing gear wear with every touchdown; worn-out gear eventually bends;
- **forward CG**: the airplane is nose-heavy, so you have to hold back pressure or trim nose-up, and you run out of elevator in the flare;
- **aft CG**: a more sensitive elevator, increasingly so the further aft the CG is.

What to do. Work out the weight and balance during the preflight (the **Weight and Balance** item) and offload before you go.

Test. z1 (overweight), z2 (CG too far aft), z3 (too far forward), z0 (back to normal); these tests don't change the load in MSFS.

Forgotten aircraft cover

Maintenance: can wait, new aircraft cover $330, **fixed price** (a simple purchase: neither the mechanic nor the parts quality makes any difference).

What causes it. Starting the engine with the Private Pilot Life aircraft cover still on (airplane on a tie-down).

What to do. Remove it during the preflight, at the **Cabin** item, just before the flight.

WHEELS AND BRAKES

Wheel effects don't show in the cockpit. The airplane slows down and pulls to one side without your brake pedals moving.

Tire pressure and flat tires

Maintenance: flat tire is **grounding**, $200; adding air $22.

What causes it. Each tire (21 psi mains, 30 psi nose) slowly loses pressure over time (faster on a tie-down) and a little with every firm touchdown, and it can develop a leak at random. The softer a tire, the more likely it is to go flat: on touchdown, under heavy braking, or rolling on it while it's nearly flat. The surface matters too. Grass is a little easier on tires; gravel and coral are very hard on them.

What you'll notice. Soft tire: the airplane pulls slightly toward that side. Flat: it pulls hard and drags. Overinflated: less effective braking and a higher chance of a blowout.

What to do. Check the tires on every preflight and inflate them to the correct pressure.

Test. w1 / w2 / w3 (left / right / nose tire flat), w5 (left tire half deflated).

Overheated brakes

Maintenance: nothing to repair.

What causes them. Heavy braking at speed, riding the brakes while taxiing, taxiing with the parking

brake set. They heat up less on a wet or icy runway, and cool down more slowly in hot weather.

What you'll notice. Reduced braking, and much weaker braking still if they're very hot.

What to do. Let them cool down.

Too late. Every overheat can cook the seals, leaving you with a leaking brake.

Test. w4.

Leaking brake

Maintenance: grounding, $385.

What causes it. Seals cooked by overheating (every overheat is a risk), or age.

What you'll notice. That brake only gives a small part of its normal stopping power, so the airplane pulls the other way when you brake.

What to do. Test the brakes as you start to taxi, and brake gently.

Test. r7 (left brake).

Getting stuck and nose-over

Maintenance: grounding; bent nosewheel $880, prop strike $13,000 (engine teardown), nose-over $44,000 (the last two covered by insurance).

What causes it. Soft ground: mostly sand, and to a lesser degree dirt and tall grass, all worse when wet. The wheels dig in when you roll with the nose down or when you brake.

What you'll notice. The airplane slows down sharply and struggles to get moving again; once stopped, the wheels stay dug in. Possible damage: a bent nosewheel (the airplane pulls to one side), a prop strike (power loss, vibration), or a nose-over if you brake hard while still fast. After any damage, the airplane is grounded.

What to do. Use soft-field technique: land and taxi with the nose high, without braking; to get going again, full throttle with the yoke all the way back.

Test. w6 (wheels dug in, simulated sand for a while).

THE PILOT

These failures don't affect the airplane; they affect **you**. Their effects build up gradually, in four stages, and the effects of hypoxia and carbon monoxide add together.

Stage	Vision	Controls
1 Insidious	barely affected	almost nothing
2 Impairment	darkened edges	slightly delayed, drifting
3 Difficult control	tunnel vision	noticeably delayed
4 Loss of consciousness	black screen	controls centered

> **PROLONGED LOSS OF CONSCIOUSNESS**
>
> The pilot dies and never wakes up, even if the airplane descends. The screen stays black for a while, then the overlay clears to give you back the MSFS menus.

Hypoxia

What causes it. Altitude. Above 10,000 ft (pressure altitude), the effects build steadily until you lose consciousness, and the higher you are, the faster they come:

Altitude	How fast effects build toward loss of consciousness
10,000 ft	very slowly: a long flight at this level eventually catches up with you
12,000 ft	slowly: the first effects easily go unnoticed
14,000 ft	much faster: it only takes tens of minutes
18,000 ft	fast: a few minutes
22,000 ft	very fast

What to do. Descend below 10,000 ft. The lower you go, the faster you recover. After a loss of consciousness, your vision comes back first; the controls stay a little imprecise for longer.

Too late. Staying a long time between 12,000 and 14,000 ft can lead to loss of consciousness.

Test. `y 2`, `y 3`, `y 4` (stage forced for a while, then normal progression).

Carbon monoxide (cracked exhaust)

Maintenance: grounding, muffler $1,650.

What causes it. The C152's cabin heat draws air warmed around the exhaust muffler. If the muffler is cracked, exhaust gas gets into the cabin. Cracks come from an aging muffler and engine wear, a bit of bad luck, or airframe damage.

Leak	Cabin heat full on	Cabin heat off
Major	loss of consciousness within minutes	somewhat slower
Small	slower, but certain	slower still

What you'll notice. The same effects as hypoxia; the CO detector darkens.

What to do. Open a window wide (one barely cracked open isn't enough; opening both speeds up recovery), shut off the cabin heat and land. Recovery is slow; expect it to take a long time before your vision and controls are back to normal.

Too late. Passing out with the windows closed is almost always fatal.

Test. `m1` (small leak), `m2` (major leak).

Window torn off

Maintenance: grounding, $770; the airplane is grounded once it's on the ground.

What causes it. A window open at high speed: the faster you go, the more likely it is to be torn off, and the sooner.

What you'll notice. The window won't close; there's wind noise, drag and vibration, and the airplane wants to roll (WBSim's open-window effect, which grows with speed).

What to do. Slow down, hold opposite aileron, and land.

Test. `m3` (left), `m4` (right).

Stuck cabin heat

Maintenance: can wait, $220.

What causes it. Once in a while, the cable or the heater valve jams when you work the knob; it's more common on an older airplane.

What you'll notice. The knob moves, but the cabin no longer changes. Stuck open, the cabin heats up (and a cracked exhaust would fill it with fumes); stuck closed, it stays cold.

What to do. Ventilate through the windows and watch the CO detector.

Test. `r5` (stuck open).

Cabin temperature

Maintenance: nothing to repair.

MSFS doesn't provide a cabin temperature, so Private Pilot Life works it out from the outside air temperature, the sun, the cabin heat (only with a warm engine) and the cabin air vents. In winter without heat, the cabin is nearly as cold as outside; full heat makes it comfortable; on the ground in full summer sun, it turns into an oven.

Cold: numb fingers, and the yoke and rudder pedals no longer reach their stops, the elevator even less than the rest. The colder it is and the longer the flight, the less control travel you have.

Heat: the same limit on control travel, plus drowsiness. Your eyelids close in from the top and bottom of the screen, halfway at first and then all the way, more and more often.

The effects set in gradually, over a good fifteen minutes or more, and take a while to wear off.

> **CAUTION**
>
> The cold tempts you to turn up the heat… and an open cabin heat makes a carbon monoxide leak worse.

Test. `u1` (cold cabin), `u2` (very hot cabin), `u0` (back to normal).

CHAPTER 8

MAINTAINING THE C152

The numbers specific to this airplane: inspections, shop prices, engine aging, parking, insurance and budgets. They're ballpark figures from a maintenance shop in France, converted to US dollars.

INSPECTIONS

This table shows the two scheduled inspections and what each one covers. They're counted in flight hours since the last inspection, and the flight debrief reminds you when one is overdue.

Inspection	Due every	Price	Includes
50-hour	50 h	$500	Oil and filter change, spark plugs, tires inflated, fuel sumped, fuel strainer cleaned. May turn up a small oil leak.
100-hour	100 h	$1,750	Everything in the 50-hour, plus magneto timing, engine and airframe inspection (wear measured), parts age, battery health, fuel gauge calibration. Finds a miscalibrated fuel gauge or a stuck float.

A 100-hour inspection also counts as a 50-hour. If an inspection is more than 10 hours overdue, your insurance no longer covers you.

MECHANIC AND PARTS

You make these two choices at the top of the estimate. They change both the price and the quality of the work.

Choice	Price	Trade-off
Experienced mechanic	standard	Finds everything and measures wear accurately.
Junior mechanic	−35%	Sometimes misses a hidden defect; a repair may fail soon after; an engine top overhaul isn't always complete; measurements are rough.
New parts	standard	Normal failure risk.
Overhauled exchange	−40%	Slightly higher failure risk.
Used serviceable	−70%	Unknown age, much higher failure risk, sometimes defective right out of the box.

REPAIR PRICES

This table lists the price of each repair with an experienced mechanic and new parts. "G" marks a grounding squawk (the airplane isn't airworthy).

Repair	Price
Hard landing inspection (G)	$440
Flat tire (G)	$200
Alternator (G)	$1,300
Alternator belt only	$100
Starter (G)	$1,000
Magneto, overhauled exchange (G)	$1,000
Cracked muffler (G)	$1,650
Oil leak (G)	$330
Fuel leak (G)	$275
Miscalibrated fuel gauge or stuck float (G)	$330
Oil temperature sensor (G)	$200
Leaking brake (G)	$385
Insect nest in the pitot tube (G)	$90
Window torn off (G)	$770
Jammed flaps	$650
Damaged flap (G)	$2,750
Separated flap (G)	$6,600
Vacuum pump	$1,000
Pitot heat	$500
Flap limit switch	$330
Door latch	$275
Cabin heat control	$220
Preheater plug (ripped-out cord)	$165
Worn circuit breaker	$130
Torn aircraft cover (fixed price: just a purchase)	$330
Any other failure	$330

Electrical Equipment

Prices for a unit that burned out behind its circuit breaker; a simple fault (wiring, connector) costs half as much. Only a fuel gauge fault grounds the airplane.

Equipment	Burned out	Fault
COM1 radio	$1,650	$825
Transponder	$2,000	$1,000
Flap motor	$1,300	$650
Strobe lights	$440	$220
Beacon and pitot heat	$385	$195
Fuel gauges (G)	$330	$165
Nav lights and dome light	$220	$110
Landing light	$165	$80
Instrument lighting	$165	$80

Airframe and Landing Gear

Prices depend on how bad the damage is. Insurance covers the airframe from the severe level up, and the landing gear from a prop strike up.

Airframe	Price
Minor (inspection)	$1,100
Moderate (damaged control surface)	$5,500
Severe	$16,500
Structural failure (separated control surface)	$33,000
Destroyed	$66,000
Nose gear	**Price**
Bent nosewheel	$880
Prop strike (engine teardown)	$13,000
Nose-over	$44,000

ROUTINE MAINTENANCE

This work doesn't fix a failure; it prevents one.

Work	Price
Oil change only (due every 50 h)	$275
Magneto timing	$200
Fuel strainer screen cleaning	$65
Sumping the tanks	$22
Tire inflation	$22
Battery replacement	$385
Airframe inspection (wear measured)	$330
Fuel gauge check (floats, calibration)	$100
Airframe and landing gear repair	$4,400

YOUR MECHANIC'S RECOMMENDATIONS

When a part is nearing the end of its life, the mechanic recommends replacing it or working on it. (Part ages and health are only known after a 100-hour inspection.)

Item	When
Vacuum pump	high time
Alternator	high time
Muffler	high time
Alternator belt	visible cracking; automatically if it's split
Battery	poor health
Tires	well below normal pressure
Fuel strainer screen	dirty
Airframe, landing gear	high measured wear
Engine: top overhaul	high measured wear
Engine: major overhaul	approaching TBO (2,400 h)

THE ENGINE

The Lycoming O-235 has a **2,400-hour TBO**. Engine time (hours since new or since overhaul) and engine wear (its mechanical condition) are tracked separately, and only an inspection tells you how worn it is.

Work	Price	Effect
Engine wear inspection	$275	Measures wear (compression test, borescope).
Partial top overhaul	$5,500	Significantly reduces wear; engine time stays the same.
Top overhaul	$16,500	Wear back to zero; engine time stays the same.
Major overhaul	$33,000	Wear and engine time back to zero.

The next table shows how engine time affects the engine. *Abuse*: the effect of exceeding a limit (oil, cylinder heads, overspeed…). *Failures*: the risk of a dead magneto, an oil leak, a cracked exhaust or the magneto timing drifting. *Normal wear*: the wear from one flight hour with no abuse.

Engine time	Abuse	Failures	Normal wear
New (0 h)	shrugged off easily	very rare	low
600 h	handled well	rare	low
1,200 h (mid-time)	normal effect	normal	normal
1,800 h	more noticeable	more frequent	higher
2,400 h (TBO)	much more noticeable	frequent	high
3,000 h and up	very pronounced	very frequent	very high

A well-maintained engine that's never been abused reaches TBO with **moderate wear**.

> **MEASUREMENTS AREN'T PERFECT**
>
> An experienced mechanic is off by a little, a junior mechanic by quite a bit more. The application shows the latest measurement, its date and the flight hours since.

FUEL AND OIL

What you pay when you fill up during the preflight (amounts rounded to the dollar and recorded in the logbook).

Product	Price	For reference
100LL avgas	about $12/gal	full tanks (26 gal) about $310; one flight hour (6 gal/h) about $75
Oil	$17/qt	usual level 6.5 qt, minimum 4 qt

PARKING

Where you park the airplane affects how fast it ages, even when it isn't flying.

	Hangar	Tie-down	Tie-down with cover
Price per month	$350	$65	$65
Condensation water	low	high	fairly high
Nest in an uncovered pitot tube	rare	common	never
Tires losing pressure	slowly	faster	faster
Airframe wear	very slow	noticeable	moderate

Start the engine with the cover still on and the prop shreds it: $330.

INSURANCE

It only covers **serious accidents**: severe airframe damage or structural failure, a prop strike, a nose-over, a separated flap. Never maintenance, wear or an engine overhaul. Pick your deductible:

Deductible	Premium per month
$825	$230
$1,650	$185
$3,300	$145
$6,600	$110

Each claim raises your premium by 25% for one year; each claim-free year lowers it by 5% (up to 30%). You're not covered if the premium wasn't paid, if an inspection is more than 10 hours overdue, or for a flight in an unairworthy airplane. As a charter operator, insurance costs 1.5 times as much (you're carrying passengers).

BUDGETS

What each career gives you to keep this C152 flying.

Level	Aircraft owner (per month)	Club member (per month)	Charter operator (starting capital)
Easy	$4,600	$5,050	$13,000
Normal	$3,100	$3,350	$6,600
Hard	$2,400	$2,500	$4,400
Expert	$1,750	$1,700	$2,750

As an owner, a flight hour costs **$130** on average (fuel, oil, inspections, parts, and an engine overhaul reserve of $14 per hour), so the Normal level gives you about 20 hours a month.

Flying Club Member

Item	Amount
Flight hour (tach time, fuel and oil included)	$165
Annual dues	$440 per year
Blocks of prepaid hours	10 h −5%, 25 h −10%, 50 h −15%
Damage you cause	30% of the repair, $1,650 max
Taking off with a known grounding squawk	$220 fine

Charter Operator

Job	Price
Discovery flight	$265 per scheduled hour (30 min: $130)
Charter flight	$4.40 per nautical mile requested (40 to 150 NM)

Prices vary with your reputation (from −30% to +30%) and the level (+50% on Easy, −35% on Expert).

AIRCRAFT VALUE

What the airplane is worth when you sell it (or when it's repossessed).

Item	Value
Airframe	$33,000 in good condition; down by up to 40% if the airframe (or landing gear) is 100% worn
Engine	$33,000 fresh from overhaul, in proportion to the time left to TBO (nothing at 2,400 h); cut by up to half depending on wear
Open squawks	their repair cost is deducted
Inspections current	+5%
Unairworthy flight in the logbook	−10%

OVERDRAFT AND REPOSSESSION

You can be overdrawn down to −$5,500 (1% interest per month), and the shop will refuse any work that would take you past that. Stay below −$5,500 for 30 days, or drop below −$11,000, and the airplane is repossessed and sold at 70% of its value. Your career ends there.

CHAPTER 9

C152 TRAINING COMMANDS

The short Training mode commands that trigger every failure of this C152 on demand, so you can see what it looks like or practice the procedure without waiting for it to happen.

How to start Training mode and type a command is covered in the Private Pilot Life User Manual, Chapter 11 (Training Mode). Type a command in the field on the **Training** screen, then press Enter.

With the MSFS Cessna 152, commands for failures this airplane doesn't have (alternator, voltage spike at startup, insect nest) do nothing, and "j" only picks among its 7 circuit breakers.

> **THESE FAILURES ARE REAL**
>
> A forced failure is saved like any other. It stays with the airplane from one flight to the next until you take it to the shop (the debrief marks it as a "test"). e0 repairs everything on the spot so you can run test after test.

ENGINE AND OIL

Command	Effect
h 3	Sets the oil level to 3 qt (any other number works too)
f	Oil leak
t 250	Oil at 250 °F
g 50	Carburetor ice at 50%
k	Burned-out starter
o1	Both magnetos out of time (lower RPM at the same throttle setting; don't touch the throttle during the run-up)
o2	Left magneto way out of time (its drop is clearly bigger than the right one's)
o0	Magnetos retimed
r4	Dead left magneto
r6	Oil temperature sensor stuck

FUEL

Command	Effect
c	Fuel exhaustion (tanks emptied)
l1	Left tank leak: fuel cap not secured (siphoning in flight)
l2	Leak: dripping quick-drain
l3	Leak: worn seal, getting steadily worse
l4	Leak: impact damage (cracked tank)
b1	A little water in the left tank. Nothing at first, then the engine runs rough, especially in the climb. For a quick test, use b2
b2	A lot of water in the left tank (engine quits)
r3	Badly clogged fuel strainer
n1	Left gauge reads high
n2	Right gauge reads low
n3	Left gauge float stuck

With n1 and n2, you won't see the error with a nearly full tank (the needle is already on F). Drain the tank down to about half during the preflight first.

ELECTRICAL

Command	Effect
a	Failed alternator voltage regulator (ALT breaker keeps popping)
j	Circuit breaker on a random piece of equipment
j0	Worn circuit breaker (pops, holds for a while, pops again)
r2	Radio burned out at startup

Real fault on a specific piece of equipment (the list is also shown at startup):

Command	Equipment
j1	COM1 radio
j2	Transponder
j3	Landing light
j4	Navigation lights and dome light
j5	Strobe lights
j6	Instrument lighting
j7	Flap motor
j8	Fuel gauges
j9	Beacon and pitot heat

j10 to j13 (COM2, ADF, DME, autopilot) target equipment this C152 doesn't have, so they're of no use here.

INSTRUMENTS AND PITOT

Command	Effect
s	Failed vacuum pump
p	Iced pitot: blocked immediately, clears once the ice melts (quickly above 0 °C)
r0	Insect nest in the pitot tube
r1	Burned-out pitot heat

ICING

Command	Effect
g 50	Carburetor ice at 50%
i 60	Airframe ice at 60% (earlier stall, with no warning)
i 0	Back to MSFS icing only

STRUCTURE, FLAPS, LANDING

Command	Effect
v	Flaps jammed (overspeed)
v1	Damaged flap (vibration, airplane pulls to one side)
v2	Separated flap (ailerons hard over: uncontrollable)
r9	Worn flap limit switch (flaps run all the way down)
d	Hard landing
x1	Structure: inspection required
x2	Damaged control surface (vibration, control pulls)
x3	Badly damaged control surface
x4	Separated control surface, jammed hard over: uncontrollable
x5	Destruction: several control surfaces separated
r8	Door that will pop open on the next takeoff (on the ground)

WHEELS AND BRAKES

Command	Effect
w1	Left tire flat
w2	Right tire flat
w3	Nose tire flat
w4	Severely overheated brakes
w5	Left tire half deflated
w6	Wheels dug in, simulated sand for a while
r7	Leaking left brake

WEIGHT AND BALANCE

Command	Effect
z1	Heavily overweight
z2	CG well aft of limits
z3	CG well forward of limits (nose-heavy)
z0	Back to the actual weight and balance

These commands only change Private Pilot Life's calculation, not the airplane's weight in MSFS.

PILOT AND CABIN

Command	Effect
y 2, y 3, y 4	Hypoxia at the chosen stage for a while (4 = unconscious)
m1	Cracked exhaust: small carbon monoxide leak
m2	Cracked exhaust: major leak (after m1, the leak becomes major)
m3	Left window torn off
m4	Right window torn off
r5	Cabin heat stuck open
u1	Cabin at 0 °C (frozen fingers)
u2	Cabin at 40 °C (drowsiness)
u0	Back to the normal calculation

REPAIR AND MONITOR

Command	Effect
e0	Puts everything right on the spot: failures repaired, controls restored, tires reinflated, brakes cooled, wheels freed, lack of oxygen and carbon monoxide cleared. Natural structural and flap damage is suspended for a few moments so you can get the airplane back under control. Carburetor ice stays; pull the carb heat.
e	Detailed airplane status
q	Stop the failure simulator (same as the End Flight button)

GOOD TO KNOW

To try a failure without damaging your regular airplane, finish the test with e0, or have it repaired at the shop right afterward. Each failure is described in detail in Chapter 7.