Next WingNuts Chapter Meeting: ***Sat. July 9, 2022 12:00 PM – Hunter International Air-Field2***

Next VMC Club Meeting: ***Tues. July 26, 2022 6:00 PM - Hunter International Air-Field***

Chapter 1321 / South Middle Tennessee

Our Chapter Home Page: https://chapters.eaa.org/eaa1321

INSIDE THIS ISSUE

PRESIDENTS CORNER:

Hi everyone, first I would like to apologize for the discrepancy in our last month's newsletter about when our meeting time is. As some of you may have noticed the time was stated as 1:00 PM, when we actually meet at 12:00 PM. Luckily this mistake only affected a few of our members but still that is something I hated to have happened. By the time I was made aware of the problem it was to late to make any corrections. So in the future please remember we always meet at noon unless explicitly agreed upon ahead of time and communicated to everyone in a timely manner. An example would be like our meeting in May when we met at Lewisburg and our meeting was from 10 – 2. So, remember we meet on the second Saturday of the month at 12:00 PM (noon). That means we will be getting together Saturday July 9th at 12:00 PM this time.

Oshkosh is July 25 thru July 31, if you're going I know you'll enjoy it! However many of us that usually go, have decided to stay home this year mainly due to gas prices. If you pull a trailer or have an RV the high prices has really had a negative effect. Plus, many of us run generators while we're there which adds to that cost even more.

Maybe we can have a little get together at Hunter Field to make up for missing Oshkosh. I know it's not even close, but a cookout or something would be fun.

Something to discuss at our next meeting.

Glen Smith
President

The Aviation Consumer®

Hot Starting: Science and Art

Hot starting problems can be minimized by monitoring ignition system health and controlling vapor in fuel lines. Aftermarket devices can help.

By Rick Durden -

It's long been recognized that an effective way of staring a fight in a bar catering to pilots is to innocently ask about procedures for hot starting big-bore Lycoming or Continental engines and then step back. The chairs will start flying.

That's about what happened when we started the research for this piece. We heard it all. Being either foolish or fearless, we immersed ourselves in the subject to see if we could come up with information as to why hot starting is a problem, find recommendations for maintenance and operating technique that can minimize the problem and see if there are aftermarket devices that can help. We did, we did and there are.

Hot start issues can be boiled down to two causes:

Inadequate spark from the ignition system

and

Fuel vapor that prevents liquid fuel from reaching the injector nozzles.

The Problem

Hot starting difficulties for piston-engine general aviation airplanes tend to be limited to fuel-injected engines that do not have some sort of computer-controlled ignition and/or fuel injection system. That means almost all higher-horsepower engines.

The classic "it won't run" situation occurs on a warm or hot day, some 15-45 minutes after landing. The pilot tries to start the engine. It will catch, run briefly and then quit.

Further attempts may or may not result in the engine firing at all. If it does, it will usually only run a few seconds before reciprocation ceases.

Ignition

According to Mike Busch, founder of Savvy Aircraft Maintenance Management, during a hot start, the **mags, impulse coupling(s), ignition wiring harness and spark plugs have to be in good condition to generate adequate spark because the fuel mixture in the cylinders may be less than ideal.**

Busch told us that while the magneto manufacturers recommended 500-hour interval for inspection and replacement of components as needed (IRAN) is not required for a Part 91 operator, he strongly recommends it. We agree. In our May 2016 issue, we looked at magnetos in detail and found that within 500 hours of operation it's not unusual for plastic components to wear or fail and for carbon tracking to induce arcing, throwing off mag timing and/or internal E-gap timing, leading to hard starting issues.

As would be expected, dirty or improperly gapped spark plugs will cause hard starting in general.

Another cause of weak spark is high resistance in the spark plugs. Each plug has a resistor that reduces the voltage from the magneto to an appropriate value for the spark that ignites the fuel/air mixture. Normal resistance for a new plug is 1000 to 2000 ohms. Plug manufacturers state that resistance may climb in service. The question is how much is too much. Tempest publishes guidelines recommending replacement once resistance exceeds 5000 ohms. Our research did not elicit consistent recommendations on the subject. Nevertheless, **it's our opinion that if you're having starting issues, check plug resistance and replace any that are showing a level above 5000 ohms.**

Many Continental engines are equipped with a "shower of sparks" system to multiply the number of sparks from each plug per activation of a magneto's impulse coupling. The system has been around since the Ford Model T because it works. A vibrator switch triggers a rapid firing sequence that causes there to be nine to 12 sparks from the impulse coupling rather than one—creating a longer spark sequence that helps ease hot (and cold) starting.

We have gotten good feedback from users on **Champion's SlickStart,** an aftermarket ignition enhancer that can be thought of as a computerized approach to the shower of sparks concept. **The $829 box was designed for Slick magnetos,** but versions are available for some Bendix mags. It creates a long, powerful voltage for low-speed starting, increasing the length of the starter sequence and increasing the electrical energy to the plugs by up to 340 times that of an impulse-coupled spark.

Fuel Vapor

The underlying reason is that the fuel lines downstream of the fuel control unit through the distributor valve and to the individual cylinders are positioned so that they absorb the heat after engine shutdown.

The fuel in the lines vaporizes—so liquid fuel is not getting to the fuel injector nozzles and the cylinder doesn't get the appropriate fuel mixture for ignition. The problem is made worse by unresolved maintenance issues in the ignition system.

The sour spot for a hot start attempt is 15 to 45 minutes after engine shutdown.

George Braly and his team at General Aviation Modifications Inc. **(GAMI)** instrumented some airplanes with big-bore, fuel-injected Continental engines to track post-shutdown temperatures in the cowling. What they found was that **in addition to vaporizing the fuel in the lines above the engine itself, much of the residual heat was concentrated in the engine-driven fuel pump. The fuel vaporizes in it and the pump won't pump**.

During a starting attempt, the pilot runs the boost (primer) pump to prime the engine and then hits the starter. **The engine starts on the fuel from the primer, uses it up and quits because all the cylinders then receive nothing but vapor.**

There are a number of preventative steps that can be taken, including heat shielding the fuel lines, which—according to Mike Busch—pays big dividends.

> **In addition, on airplanes with an oil access door on top of the cowling, opening it after shutdown allows much of the heat that would be trapped above the engine to escape. **
>
> **If the airplane has cowl flaps, parking it facing downwind, with the cowl flaps open, helps drive the heat out of the front of the cowling.**

The solution for fuel-vapor induced hot starting problems is to get rid of the vapor in the engine-driven fuel pump and the fuel lines above the engine. Our research indicated this can be accomplished by **following what is in most POHs** for the airplanes.

Technique

We think we've heard every hot starting technique known to pilots including **"go to McDonald's, get a burger and by the time you get back it'll start right up."**

We do not recommend the technique of intentionally flooding the engine by running the boost pump with the throttle wide open and the mixture rich and then attempting a start with the mixture at idle cutoff while moving the throttle slowly until the correct mixture is reached and enrichening the mixture when the engine fires.

Intentionally flooding the engine means running fuel onto the ground under the engine—creating a very real fire risk. When the engine is overprimed, it's not unusual to get a long gout of flame out of the exhaust stack when the engine fires. It usually, but not always, wraps upwards around the cowling and happens so fast that the pilot doesn't notice it during daylight hours. That can—and has—ignited a puddle of fuel under the engine.

We recommend following the aircraft manufacturer's technique in the POH.

For most Continental engines it involves what Mike Busch refers to as a forced purge. That starts with pulling the mixture to idle cutoff, advancing the throttle to the stop and running the boost pump on high for a minimum of 45 seconds. With the mixture at idle cutoff, no fuel will get past the fuel control unit—unless it is improperly adjusted, a problem in its own right. Relatively cool fuel from the wing tank is circulated through the lines, to the FCU, driving the hot fuel back to the fuel tank and cooling down the fuel lines upstream of the FCU. The only hot fuel is between it and the cylinders.

Slick Start

Once the boost pump is shut off, the mixture is set at full rich, the throttle for slightly over 1200 RPM and the boost pump used briefly to prime the engine. Immediately engage the starter. The engine may turn several blades before firing. Be ready with the boost pump when it fires as the engine is likely to quit once the small amount of vapor in the lines between the FCU and cylinders gets to the injector nozzles. If the engine stumbles or quits, turn the boost pump to high until it starts running again. It may be necessary to do that a second or third time. Once the RPM settles down—it may take 30 seconds—slowly reduce power to the desired idle RPM.

For Lycoming engines the solution is similar. Do the forced purge. Then go to full rich and prime the engine with the boost pump for two to four seconds. Pull the mixture to idle cutoff and set the throttle about one inch above idle. Engage the starter. When the engine fires, slide the mixture to rich over a few seconds and be ready with the boost pump if the engine stumbles or quits.

Starters

In researching this article we heard from an Aerostar owner who said he'd solved his hot start problems by **replacing the slow-turning factory starters on his engines with much faster turning Sky-Tec starters.**

Of course, that got our attention, so we followed up and learned that while a faster turn rate is beneficial because there is prop momentum carrying the crankshaft through uneven cylinder firing, there is a point of diminishing returns.

Magneto impulse couplings disengage at an RPM as low as 180 and Sky-Tec's starters will turn up at about 120-140 RPM—so there's not a lot of room for improvement. A faster turning starter may help, but it's not a panacea.

We also learned that one of the unsung victims of difficult hot starting is starters.

> **Virtually every aircraft starter has a cranking limitation and cool down requirement. The rule of thumb is that for every 30 seconds of cranking, the starter must cool down for 90 seconds.**

Conclusion

Hot starting challenges can be minimized by assuring that all components of the ignition system are in good operating order and following a starting technique that recognizes and deals with fuel vapor in the fuel lines above the engine.

We also urge pilots to remember that if a hot start attempt is not going well, **they may be frying an expensive starter. Maybe it is time to go to McDonald's and let things cool off.**

ASI Safety Tip: Hot Starts

In this video, we help demystify hot start procedures, and give you a peek at what's happening under the hood – in your airplane's fuel delivery system.

https://www.youtube.com/watch?v=8frPSeHJWkk

Hot Starting TIPS:
Opening the cowling and facing the airplane into the wind helped a lot to cool it off.

With a fuel injected Lyc, before shutting down the engine, run it up to 1200 RPM, and then pull the mixture. After the engine stops, DON'T TOUCH the engine controls. When you go to start the engine, DON'T TOUCH the engine controls. Just crank the engine and when it starts, advance the mixture. I have never had a hot start problem in 30+ years.

IO550 method never fails. Taught to me by Mark Wages, and he calls it the Wages Method. There is a YouTube video he made. SIMPLE: Mixture full, throttle cracked slightly more than would be for a normal start. Headphones off your ear. Turn on electric fuel pump with hand on ignition key. Listen to fuel pump. You an hear the frequency drop when it loads up, meaning the injector lines are full. Now turn key and engage starter. It will start every time.

Here is Something New for this Month: Aviation Related Parody Videos

"Taildragger Ground Loop Blues"
An aviation parody inspired by Johnny Cash's 'Folsom Prison Blues'.

Click the Link Below to view the video

https://www.youtube.com/watch?app=desktop&v=5ZGliZUd_gg

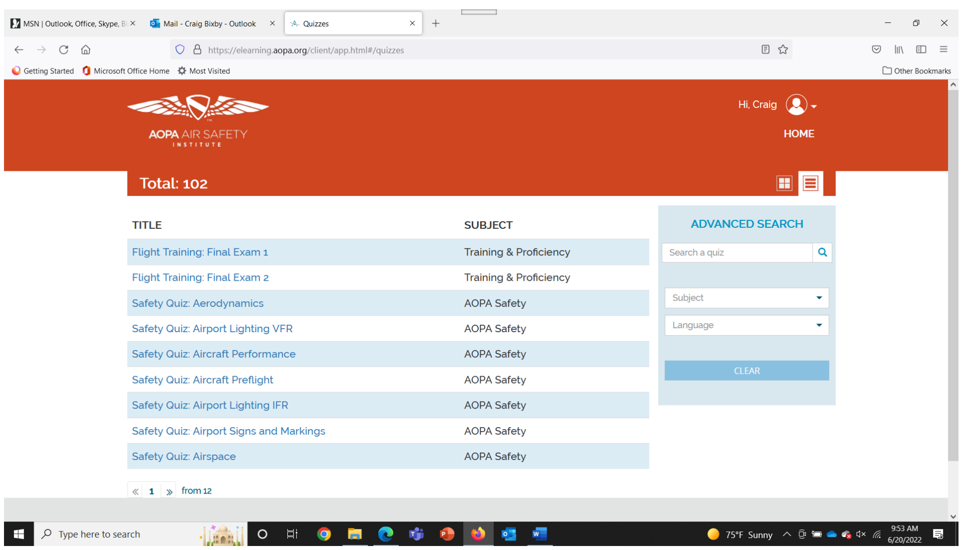
“Sky King” written by Kris Kristofferson, During his days in the army as a Helicopter Pilot. Sang to the tune of Big Bad John by Jimmie Dean

Click the Link Below to view the video

https://www.youtube.com/watch?v=i458ZzwpE3w&t=4s

As most are aware, AOPA provides many services, but you may not know that within AOPA's "Air Safety Institute" there are Quizzes available that will test your knowledge on numerous subjects

[***https://elearning.aopa.org/client/app.html#/quizzes***](https://elearning.aopa.org/client/app.html#/quizzes)



One of these quizzes, tests your knowledge of what is a reportable accident/incident per NTSB 830.5 and what isn't

If your aircraft is damaged, do you know what, if anything, you're required to do?

With the exception of certain UAS accidents, "aircraft accidents" and "serious incidents" require reporting to the NTSB (but not to the FAA).

49 CFR § 830 contains the relevant definitions and reporting requirements. As required by § 830.5, aircraft accidents and 12 different "serious incidents" must be immediately reported to the NTSB.

An incident that doesn't meet the NTSB's definition of an aircraft accident and is not one of the 12 "serious incidents" listed in this rule is not required to be reported to the NTSB.

Put your knowledge of these rules to the test by determining whether the following scenarios must be reported to the NTSB.

Click the Link to take the - PPS NTSB Accident Incident Quiz

https://elearning.aopa.org/client/app.html#/quizzes/passing/100169?quizResultId=481858

To brush up,

Check out this article What's the difference between an accident and an incident? - Legal & Medical Services (PPS) | AOPA

or

Listen to this podcast.

https://cms.megaphone.fm/channel/AOPA6473278867?selected=AOPA2860838491

Editors Note: During June's VMC Meeting we discussed "what would you do" in a scenario involving Smoke in the airplane that a passenger identified as coming from a piece of baggage.

Our discussions prompted me to think it would be a good topic for the Newsletter. So, here is some related information I found on the intranet about aircraft fire and smoke emergencies and the best responses. I included the web addresses of those sources

https://www.aopa.org/news-and-media/all-news/1998/june/flight-training-magazine/aircraft-fires

https://www.aopa.org/news-and-media/all-news/2012/september/flight-training-magazine/technique--emergency-descent

https://www.aopa.org/news-and-media/all-news/2020/february/24/aircraft-maintenance-fighting-a-cockpit-fire

https://www.aviationsafetymagazine.com/features/get-down-right-now/

https://www.aviationsafetymagazine.com/safety_analysis/cockpit-smoke/

https://www.boldmethod.com/learn-to-fly/aerodynamics/emergency-descent-aerodynamics-how-to-fly-them-safely-high tolow/#:~:text=An%20emergency%20descent%20is%20usually%20a%20result%20of,descent%2C%20begin%20to%20plan%20how%20you%27ll%20level%20off

https://www.sportys.com/blog/which-fire-extinguisher-right-pilots/

Aircraft Fire and Smoke Emergencies

When was the last time you practiced the emergency procedures for dealing with fire/smoke, either on the ground or in the air?

Prevention, Is The Best Preventative
The best insurance against an aircraft fire is professional maintenance and a thorough preflight inspection. Always look for evidence of fuel, oil, and hydraulic leaks, and use your nose as well as your eyes. Carefully check under the cowl for bird nests, windblown debris, and misplaced rags. Check the exhaust stacks for security and cracks, and look for loose or leaking fittings on the brakes.

Fire Basics
A fire needs three ingredients - fuel, air, and an ignition source (heat).

> There is actually a fourth essential element: the chemical reaction that allows the other three to combust.
>
> Without the chemical reaction of the three other elements, heat, fuel and oxygen will happily coexist without starting to burn.

Pilots can face four types of aircraft fires - fires during engine start, electrical fires, in-flight engine fires, and post-crash fires. It's important that you understand the proper checklist procedures for each type and the reasons behind the checklist items.

Fire During Engine Start
Perhaps the most common type of aircraft fire is one that erupts during engine start. Excess fuel makes its way into the carburetor intake, then the engine backfires through the carburetor, igniting the fuel along with the dirty air filter.

The book says to keep cranking the engine if this happens. This should suck the flames back through the carburetor and extinguish the blaze, and if the engine starts, let it run for a minute or so, then shut it down and inspect the damage.

Detecting a fire on the ground isn't always easy. Sometimes the carburetor contains the blaze. Or the fire partially burns the inlet air filter - then the engine starts and snuffs it out.

Engine Fire In Flight

Detecting an in-flight engine fire may not be as easy as we might think. A drop in fuel pressure or a fluctuating fuel pressure reading may suggest a broken fuel line - a common precursor to an engine fire. A rough-running engine might be caused by a cracked cylinder, which can leak oil or hot gas and ignite a blaze.

Black smoke usually signals an oil fire, and fuel usually burns bright orange. By the time you get the "hot-foot" symptom, the fire is already blazing on the other side of the firewall.

The checklists for engine fires vary, but usually **the first step is to pull the mixture to idle-cutoff, shut off the fuel selector, Ignition Switch off, and shut off the cabin heat.**

Electrical Fires

Electrical power from alternators, generators, and batteries constitutes another potential heat source for starting fires. Cabin Insulation, adhesives, and fabrics make great fuel for fire, as does the insulation on the wiring itself.

In most instances an electrical fire in the cockpit can be detected before it really gets going. **The first clue might be an over-voltage warning light, a higher than normal electrical load, or a popped circuit breaker. The acrid smell of hot insulation or visible bluish white smoke are also common indicators.**

It is important that immediate action be taken before the electrical fire reaches a self-sustaining point. Once ignited, the heat from the energized electrical wiring or component that caused the fire might sustain it.

For this reason, **your first step if you have an electrical fire is to cut the power by turning off the master switch**. By isolating the battery and alternator/generator, we remove the ignition source, and the fire should extinguish.

Next, turn off the switches to all of the electrically powered devices. Some manuals suggest pulling the circuit breakers at this point.

> **Note: If a circuit breaker is hot, that is probably the offending device. Don't push it back in.**

If the fire is already burning hot, cutting the power won't be enough. **You may need to use an extinguisher to squelch the flames**

Once the fire is out, some checklists suggest that **we try to restore power and isolate the circuit that caused it by -**

Turning the master switch - Back On

Then turn on essential components one at a time, waiting to see if the smoke or smell returns

With any luck, a non-critical item will be the culprit, and we can continue on to land at the nearest airport.

Because re-energizing the circuits might recreate the situation that caused the fire in the first place, this might not be the best option.

Baggage Fires

Which brings us to our VMC Discussion concerning "Smoke in the Aircraft." In that scenario a passenger was able to turn around and discovered that the smoke was coming from a bag in the back.

Some of the comments in the meeting were –

Throw it out
Divert to nearest airport
Land anywhere

Throwing it out was determined to present its own set of problems. Could the bag be reached by the passenger? If the pilot was by himself, could he have reached it? Once the bag was retrieved from the back, could the aircraft door or window even be opened enough to through it out? Would throwing the bag out the door violate FAR's for dropping objects from an aircraft?

So, it seems that the best way to deal with bag issues is to prevent them from occurring in the first place!!!!

As the Pilot-In-Command, be certain that the cargo does not contain any hazardous material that might readily ignite. Don't trust passengers to know what is proper for loading into baggage. If an item or product is on the Airlines list of DO NOT CARRY Items, then they probably should not be allowed on your aircraft.

Managing the Smoke

Smoke in the cockpit is more common than you might believe in general aviation aircraft. One article mentioned there were 82 smoke-in-the-cockpit accidents in general aviation aircraft in the NTSBs database

Nearly a quarter of those apparently incapacitated the pilot before the aircraft could safely land. This is clearly a situation where seconds count. No matter its source, dealing with smoke is an important part of dealing with an emergency.

Opening the pilot's vent window could be a mistake because it might pull the smoke right in front of the pilot, obscuring his vision. Opening another vent, if available, or cracking a door might be a better option.

In some aircraft, even a minor change in flap setting can alter the flow of air around the aircraft, which may affect how well windows and vents can clear cockpit smoke.

Venting the smoke may improve breathing and vision - but it can also fan the fire's flames with fresh air. If this happens we have no option but to close the vents.

If, you suspect the air you are breathing is contaminated, consider having/using an emergency O2 back-up. If you don't have one, they're cheap, consisting of a small 10-minute bottle with an attached mask.

Be sure to read the pilot's operating handbook for every aircraft you fly - and make sure you thoroughly understand the proper procedures for each.

Take Emergency Action

At the first hint of an emergency, take immediate action. Be spring-loaded to assume the worst if you even think you feel some abnormal heat coming through the fire wall or see smoke. Don't wait to see if it gets any worse.

Click the Link for a video demonstrating an Emergency Descent

https://www.youtube.com/watch?v=pqSSepTwfUU

You must get onto the ground as quickly as possible! Before you become incapacitated, or the fire causes structural damage and airframe failure

Either at the nearest airport, if possible

OR

Make an off-airport landing

Emergency Descents

If you haven't previously tried making an emergency descent with an instructor, It may be a learn-as-you-go situation. Such as, choosing which technique will get you on the ground the quickest!!

Keeping the nose straight ahead in a High-Speed Descent that could also blow out the flames of a fire

OR

Performing a Circling Descent with flaps and gear extended along with Slipping to improve forward visibility.

Slipping the aircraft can not only aid in a fast descent, it may also help keep the fire away the cockpit.

Emergency descent training is hardly routine. But everyone should try it at least once!!

Obviously, the point of an emergency descent is to get on the ground immediately, albeit with the wings still intact.

Don't delay even five seconds if you detect smoke or fire. Immediately try to extinguish the fire and begin an emergency descent. **Even if you think you have extinguished the fire, get the aircraft on the ground right away.**

The only safe place is on the ground and outside the aircraft.

So, where to go? One thing I like about GPS aids is that you can find the nearest airport at the push of a single button and, with some units, quickly load an approach.

If you've had a fire, the best choice for a divert airport is one that has rescue and fire fighting. That usually means at least a Class D or larger airport.

If you have electrical power, communicate your intentions with ATC right away and use the word emergency and request to have the ARFF unit waiting for your arrival

What if there's no ARFF airport nearby? **The extra few minutes in the air to reach the larger airport is not worth the risk!** Land at the nearest safe field!!!

What Action/s to Take

You should be familiar with any Emergency Descent Procedure contained in the aircraft's POH. But, General aviation manufacturers vary on their recommendations for quick descents; some are even silent on the subject.

POHs without a recommended emergency descent procedure leave you with two ***(Three)*** choices:

Descend with the throttle at idle in the clean configuration-flaps and gear retracted

Or

Slow down, dirty up and then pick an airspeed out of the hat ***(Hint: Top of the White Arc – VFE, Max Flap Extend Speed)***

What is the third you ask?

Throw a brick out the window and Follow it Down

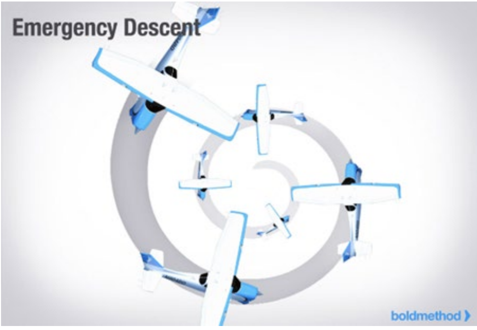
Which procedure do you think will produce the fastest descent?
Use the link to view a video demonstrating both procedures.

GOING DOWN FAST - Emergency Descents are the fastest way to get an airplane out of the sky. - YouTube

Here is a general procedure for descending in the **"Dirty Configuration"**

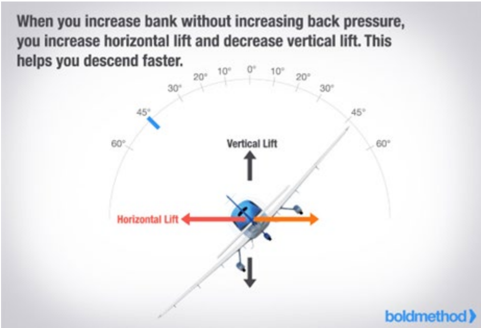
Reduce the Power to Idle

Reduce Lift



According to the FAA's Airplane Flying Handbook, "when initiating the descent, a bank of approximately 30 to 45 degrees should be established

NOTE: ***It is Important to "maintain positive load factors (G forces) on the airplane. When pushing the nose over and in the turn"***



This bank angle reduces your vertical component of lift, which helps you achieve a rapid descent. **If you roll into a turn using only ailerons (without applying back-pressure), your vertical lift decreases and your horizontal lift increases.**

An airplane tends to descend during aileron-only turns.

Maximize Drag

Extend the landing gear and flaps as recommended by individual manufacturers.

If equipped with a constant speed propeller, the prop "should be placed in the low pitch (or high rpm) position. This allows the propeller to act as an aerodynamic brake to help prevent an excessive airspeed buildup during the descent"

Slip the aircraft to the maximum amount of Rudder available.

The goal is to fly the most rapid descent possible without excessive airspeed

Here is a simple checklist you can copy for your use

Dirty Descent - Generic Step by Step Guide

1. Slow down—Pull the throttle to idle.

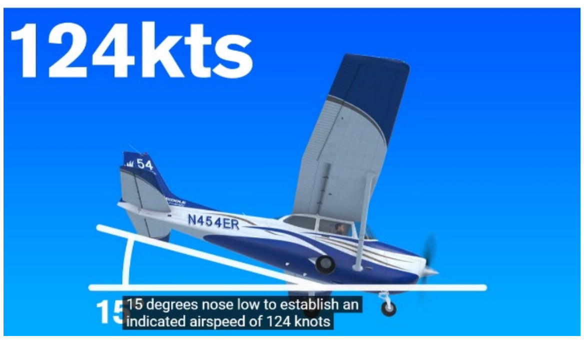
2. Add drag—When within the flap operating speed, add full flaps. If in a retractable-gear airplane, lower the gear.

3. Start down—Push the nose to VFE, or the maximum speed with full flaps extended. ***Maintain POSITIVE G's DO NOT Push the nose over so abruptly that it would result in NEG G's***

4. Circle—In order to stay within a fairly confined area, to add further drag, and to look for traffic below, bank the airplane 30 degrees in either direction and stay in that position until you are ready to roll out.

Here is a general procedure for descending in the **"Clean Configuration"**

For a Steep Straight-Ahead Descent



It seems contrary to our instincts, but you must point the nose 15 – 20 degrees below the horizon to achieve your selected airspeed and land at the closest survivable location.

It may be uncomfortable pushing the nose over to 20 degrees below the horizon. It's an awfully steep attitude, but that's what's necessary and it may seem to be an eternity before you get on the ground.

Remember In the previous Video above, the demonstrator recommended using VNO Normal Operating Speed (maximum structural cruising speed) when descending in the clean configuration

VNO Speed is marked by the beginning of the yellow arc, or caution range.

CAUTION: VNO should only be exceeded in exceptional circumstances and in smooth air. This speed can be hazardous if unexpected turbulence is encountered.

Don't forget about Va, or maneuvering speed, either. If descending through turbulent air, you should slow to Va or slower to prevent overstressing your airframe.

Unless circumstances are dire indeed, its best to respect the aircrafts structural envelope by some margin.

Here is a simple checklist you can copy for your use

Generic Step by Step Guide – Clean Descent

1. Pull the throttle to idle

2. Start down—Push the nose down 15 – 20 degrees
   Maintain POSITIVE G's DO NOT Push the nose over so abruptly that it would result in NEG G's

3. Allow the speed to increase to VNO

Control Speed

No matter which procedure you choose, A critical part of flying safe emergency descents is speed management.

In theory, a FAR Part 23 aircraft has a small margin from Vd, the maximum diving speed, which is the **highest speed that an** aircraft is designed to be capable of diving to (in very smooth air) and be free of flutter, control reversal or buffeting

During a Clean Descent

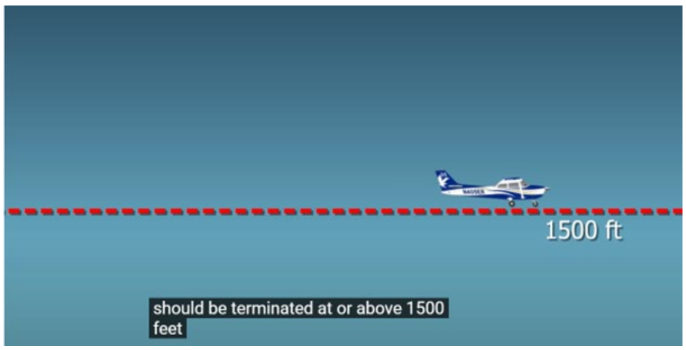
Generally, speaking Airspeed should not exceed VNO.
You should never exceed Vne, structural never-exceed speed.

During a Dirty Descent

Take into account maximum landing gear extension speed (Vle) and maximum flaps extended speed (Vfe) marked by the top of the White Arc.

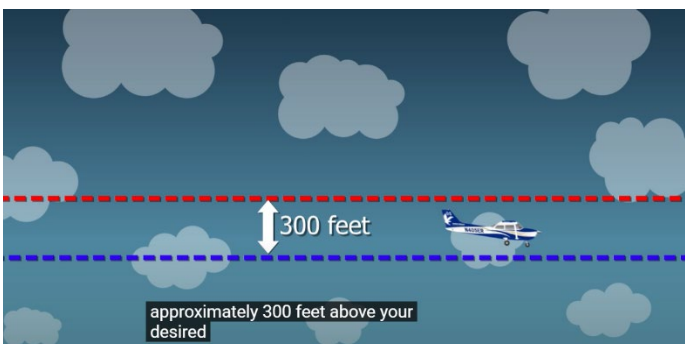
Once you have lost the Altitude – It is Time to Choose Your Recovery Altitude
There may not be time to fully plan out a recovery altitude. Once you've configured the airplane, followed the checklist, and are flying the descent, **begin to plan how/when you'll level off.**

You should initiate recovery at an altitude high enough to ensure a safe recovery back to level flight, for a precautionary landing.



Plan to level out your descent at 1500 feet AGL.

To bleed off the speed, you might need to lower the flaps and gear, even if you're above the speed limit for doing so.



As a guide, begin leveling off at 10% of your Rate of Descent.

Example:
If descending at 3,000 fpm begin leveling off 300 feet above your desired altitude

As you reduce the rate of descent, Remember to Level the Wings and pull out smoothly to prevent an Accelerated Stall.

Once Leveled out, The name of the game is to keep flying the aircraft until it comes to a complete stop.

Finally, Everything you wanted to know about Fire Extinguishers

One thing is for sure: regular household extinguishers are *not* suitable for aviation use.

To begin, here is a review of the "Types of Fires" and the different "Fire Extinguisher Ratings"

A		Ordinary Combustibles	Wood, Paper, Cloth, Etc.
B		Flammable Liquids	Grease, Oil, Paint, Solvents
C		Live Electrical Equipment	Electrical Panel, Motor, Wiring, Etc.
D		Combustible Metal	Magnesium, Aluminum, Etc.
K		Commercial Cooking Equipment	Cooking Oils, Animal Fats, Vegetable Oils

Fires are classified by type: A, B, C, D, or K.

A is for normal combustibles, such as cloth or paper.
B is for a liquid or gasoline fire
C is for electrical fires
D is for flammable metals
K is for grease fires.

Fire Extinguishers are rated by

How many square feet it can cover

and

The type of Fire it can used on

Example

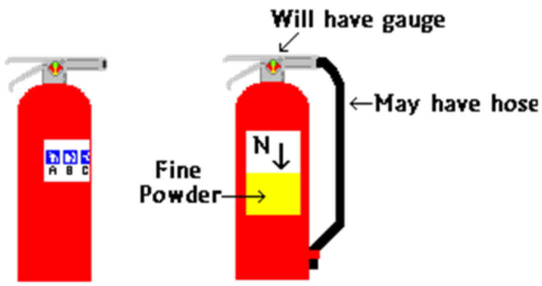
5B:C indicates that the extinguisher can cover 5 square feet and can be used on B and C Fires

2B indicates that the extinguisher would cover 2 square feet and can only be used on B Fires.

Typically, a 2B would work fine for your normal 1-4 seat aircraft.

It's important to understand the different types of "Extinguishing Agent" used in Fire Extinguishers. They each have different characteristics, and some are better suited to particular situations than others.

Dry Chemical Extinguishers



Inexpensive and Versatile, they can extinguish
Class A
Class B
Class C

They are filled with a fine yellow powder composed of monoammonium phosphate. Nitrogen is used to pressurize the extinguishers.

How they Work

Dry chemical extinguishers put out fire by coating the fuel with a thin layer of dust, separating the fuel from the oxygen in the air. The powder also works to interrupt the chemical reaction of fire, so these extinguishers are extremely effective at putting out fire.

Best used For

For A, B, C Fires in open areas

Drawbacks from use in Aircraft

Dry chemical extinguishers aren't the best choice for engine fires. If the engine ingests the chemical, it can caramelize on the valves and result in engine damage or failure.

Because you need to apply the chemical directly to the flames, putting out an electrical fire behind the instrument panel can be difficult.

The agent can flow into minute structural cracks where may combine with moisture to form phosphoric acid, a chemical that is highly corrosive to aluminum.

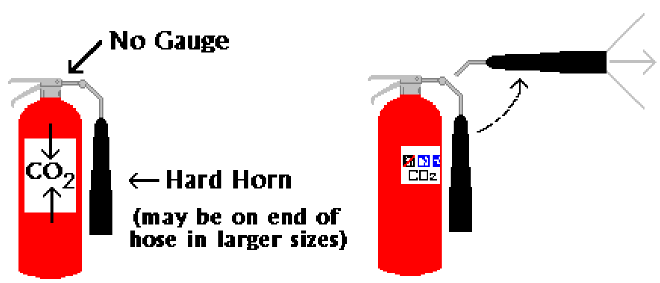
The residue is extremely difficult to clean up and failure to completely clean the agent from the aircraft will, over time, result in corrosion that could compromise the integrity of the aircraft.

Using a dry chemical extinguisher in the cockpit during flight can have serious side effects.

Flying powder from a short burst can cloud the cockpit and your vision, making it difficult, if not impossible, to read the instruments or control the aircraft.

Some dry chemical extinguishers pose potential toxicity concerns

Carbon Dioxide - CO2 - Fire Extinguishers



Used to combat class B and C fires.

Carbon Dioxide extinguishers are filled with non-flammable carbon dioxide gas under extreme pressure

How they Work

The CO2 exits the nozzle at about minus 100?F, forming fine particles of dry ice that condense moisture from the air, then quickly melt in the presence of a fire

They extinguish a fire by displacing the oxygen needed for combustion.

Best For

CO2 extinguishers work well to douse engine fires on the ground, and are sometimes used in built-in engine fire suppression systems.

Drawbacks from use in Aircraft

CO2 extinguishers don't work well on cockpit fires.

CO2s may be ineffective at extinguishing Class A fires because they may not be able to displace enough oxygen to successfully put the fire out. Allowing the fire to smolder and re-ignite.

CO2 will Displace the oxygen needed by an air-breathing human

The extremely cold CO2 can damage electrical components, and the particles and condensation can severely reduce cockpit visibility and corrode the airframe

Halon and Halotron

The best friend a pilot can have in the cockpit is a Halon/Halotron Extinguisher

Both are in a liquid/gas form, so they do not create clouds of blinding dust

They're safe for use in a cockpit as they do not leave a residue, do not corrode metal, and do not damage electronics or instruments.

Both Halotron and Halon agents are able to fight not only to type C fires, but also A and B

Does not create a residue when it evaporates. The key benefit is its ability to extinguish a fire without damaging the assets it is protecting.

They do not cause thermal shock so they won't damage electronics or instruments by a sudden change in temperature, and they do not cling to or linger around the cockpit

How Do they Work?

The liquefied gas discharges as a vapor that disrupts the combustion chemical process.

Best For

Ideal for volatile gas-related fires
Electrical equipment

Halon Fire Extinguishers

Are recommended by the FAA for use in a cockpit.

Pound for pound, they are nearly twice as efficient at killing fires compared to Halotron extinguishers.

Several characteristics of Halon make it attractive for fighting cockpit fires. Halon is a colorless gas that reacts chemically to extinguish fires.

It will not cause collateral damage and wont cloud your vision.

It works quickly, and at concentrations that are non-lethal to humans.

Halon leaves no residue and doesn't damage sensitive electronic equipment.

Drawback

Halon was deemed an ozone-depleting product in 1994 and is no longer produced. Luckily for us, the material is recyclable so it is still available and Halon is legal for use in aviation.

Limited supply means prices are slowly rising

Halon is not as effective for fighting a deep-seated class A fire

Health effects of Halon

NOTE: There is a lot of conflicting information concerning safety of Halon

PRO

https://www.aviationconsumer.com/safety/fire-extinguishers-halon-not-dry-chem/

Because it is so effective in small quantities, halon is considered safe for use in human-occupied spaces such as passenger cabins and flight decks.

Discharging Halon and Halon-alternative extinguishers pose little risk to occupants. The FAA put it bluntly in Advisory Circular AC 120-80, **"The toxic effects of a typical aircraft seat fire, for example, far outweigh the potential toxic effects of discharging a Halon fire extinguisher."**

CON

See the Link to a "Safety Data Sheet"

Reminder, SDS's are written to address the worst case conditions. I.E. Discharged in an Enclosed Area with no ability to Vent the Halon Overboard. Exposure for a Prolonged Periods Of Time, etc

119_1.pdf

Prolonged Exposure to Halon Can Be Toxic

It may, make you nauseous

When halon is used on fires, it produces such decomposition byproducts as hydrogen chloride, hydrogen bromide, etc

Health effects reported in some quarters associated with Halon extinguishers includes:

Asphyxiation, frostbite, burns to the skin, as well as skin and eye irritation.

Inhaling halon compounds in high concentrations can cause central nervous system disorders including dizziness, unconsciousness and tingling in the arms and legs.

Halotron Fire Extinguishers

Were created as a **clean agent replacement for Halon** when production ceased. The cost-effective chemical can do everything that Halon can do, and is safe for airplanes.

Approved as environmentally safe

When comparing prices, Halotron is around half the price of Halon.

Drawback

The downside is that the weight and size of the extinguisher will usually be double that of its Halon counterpart in order to achieve the same amount of coverage.

Fire Extinguisher Buyer's Guide

FIRE EXTINGUISHERS	SMALL HALON FIRE EXTINGUISHER	SMALL HALOTRON FIRE EXTINGUISHER	LARGE HALON FIRE EXTINGUISHER	LARGE HALOTRON FIRE EXTINGUISHER
AGENT	Halon	Halotron	Halon	Halotron
SAFE FOR ELECTRONICS	✓	✓	✓	✓
RATING	2B:C	2B:C	5B:C	5B:C
SIZE	10" x 2⅞"	13" x 3¾"	14½" x 4½"	16¾" x 4¼"
CAPACITY	1.3 lbs.	2.5 lbs.	2.5 lbs.	5.5 lbs.
TOTAL WEIGHT	2.5 lbs.	5.5 lbs.	4.9 lbs.	10 lbs.
REQUIRED MAINTENANCE	6 years	6 years	6 years	6 years
BRACKET INCLUDED	✓	✓	✓	✓
EXPERT ADVICE	Smallest extinguisher of the group with good coverage	Most cost effective with good coverage	Top of the line, great coverage, but expensive	Good value, but larger size
PRICE	$249.00	$119.95	$349.00	$179.95
ITEM NUMBER	2207A	21325A	3540A	21359A

Which extinguisher is best for me?

The right fire extinguisher depends on your personal preferences and needs.

Each type has its own advantages and disadvantages.

Though Halon is recommended by the FAA, that does not mean that Halotron is not a capable agent as well.

Either one is much better than nothing and far safer than cheap grocery store extinguishers.

If you want to save some money and you have plenty of space in your cockpit (and you prefer an eco-friendly agent), a Halotron extinguisher will work for you perfectly.

If you have a tighter cockpit with less room and your budget can support it, a Halon extinguisher might be a better option.

It's up to you to decide which one matches your needs. Hopefully you never need to use your fire extinguisher but having one in the cockpit will provide peace of mind and buy you precious time in an emergency.

To Ensure the Extinguisher works when you most need it, you should include your fire extinguisher on your preflight checks.

Don't just notice that it's there

Properly secured in an accessible place

Ensure it is charged to its normal pressure by looking at its gauge and make sure it's in the green

Check to make certain there is no damage to the handle, that the pin is in place and not bent

The fire/smoke drill in most light airplanes goes something like this:

Check for the source of the fire

If an engine fire is present, switch the fuel selector or the fuel shutoff valve to off

Close the throttle, then move the mixture to idle-cutoff

Electric fuel boost pumps, OFF

Heater and defroster, OFF

You may need to open the cabin vents to clear the smoke from the cockpit.

Choose a suitable field, crack the door open, and prepare for the emergency landing.

Using a Extinguisher

Having a fire extinguisher is only half the battle - when it comes to putting out a fire, technique is everything.

Think of the acronym PASS

Pull the pin
Aim the fire nozzle
Squeeze the trigger or handle
Sweep the source and base of the fire

Laughs of the Day

Doesn't everyone need a set of these?

Here is a Decision Making Tool that can be made at Home

Below is a very early means of Forecasting the Weather

Editor's Note: Everything you wanted to know about Exhaust Valves

Articles by Mike Busch A&P/IA

Opinion: (What we have here is a) failure to rotate

Piston aircraft engines have a lot of moving parts. Way too many if you ask me. The thought of thousands of separate metal parts reciprocating, rotating, wiggling, wobbling, and rubbing against one another thousands of times a minute ought to make you nervous—it sure does me. It's something I try hard not to think about while airborne, mainly because I fly a lot better when not distracted.

Of those thousands of moving parts, two kinds are the most worrisome:

The ones most likely to blindside you with a costly, premature, unbudgeted-for engine overhaul or replacement

And

The ones most likely to make you fall out of the sky (or at least soil your undies).

The biggest offender in the safety-of-wallet category is the camshaft—and for Lycoming's, the cam followers (aka tappets)—which presents by far the leading cause of premature engine teardowns.

In the safety-of-flight category, hands-down the most-wanted villains are exhaust valves. Exhaust valves can ruin your day in at least two different ways: They can stick or they can burn. Although these problems can occur in any piston aircraft engine,

Sticking is much more common in Lycoming's
and
Burning is more common in Continentals.

Note: I'll post Mike's discussion on "Why Valves Stick" in next month's Newsletter — hint: the answer is "leaded avgas"

This column will focus on what we've learned about burned valves.

Don't blame the pilot

After I purchased my first airplane in 1968—a new Cessna 182 Skylane powered by a Continental O-470-R—it didn't take long for me to recognize that exhaust valves were the most vulnerable components of my engine. Burned exhaust valves were the principal reason cylinders flunked the annual compression test.

In the past, Mechanics invariably blamed burned exhaust valves on pilot mismanagement of the powerplant, and **warned us not to lean our engines aggressively so we wouldn't overheat the valves and cause them to burn.** The standard A&P mantra was "fuel is cheaper than engines."

Single-probe exhaust gas temperature (EGT) gauges were just coming into vogue then, and we were taught that the best way to prevent exhaust valve problems was to avoid operating at excessive EGTs. **The implication was that EGT was a good proxy for exhaust valve temperature, and that keeping EGTs cool would assure that exhaust valves wouldn't overheat.**

This all sounded logical and convincing at the time, and most of us believed it. But it turned out to be complete hogwash.

BUT, If high EGTs were the cause of exhaust valve burning, then low-compression engines like the O-470-R in my Skylane would suffer more burned exhaust valves than high-compression engines like the IO-520-K in the Bellanca Viking I owned after I sold the Skylane.

After all, a high-compression engine inherently has much lower EGTs than a low-compression engine does, because the high-compression engine is more efficient at converting the heat energy liberated during combustion into mechanical energy (horsepower) and so wastes less heat energy out the exhaust. That wasted heat energy is what we see in the cockpit as EGT, and it's inversely correlated with compression ratio.

There is no statistically significant correlation between EGT and exhaust valve burning. It's a myth.

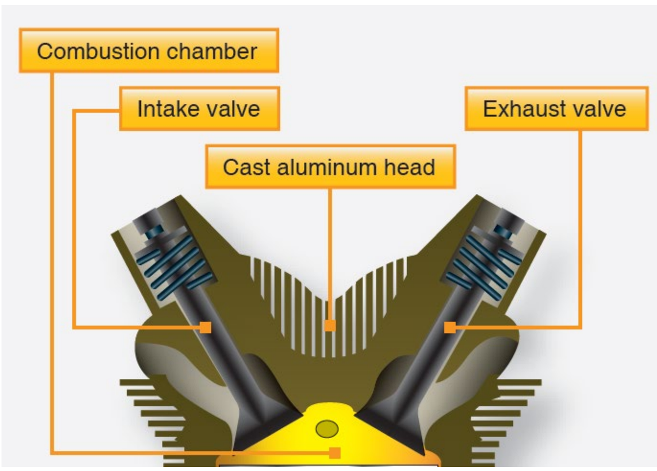
Nor is aggressive leaning the culprit. In the 3,300 hours that I put on the 12 cylinders of the Continental TSIO-520-BBs in my Cessna Turbo 310 before finally retied them, **I never suffered a single burned exhaust valve—not one—and those engines were always leaned aggressively, almost exclusively lean-of-peak except for takeoff and initial climb.**

No, when an exhaust valve burns, it's almost never the fault of the pilot. This turns out to be just another myth.

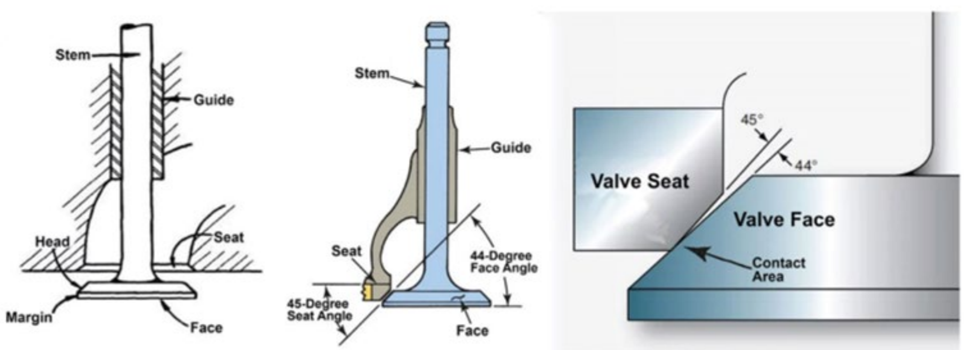
But if it's not the pilot's fault, whose fault is it?

The short answer is that it's generally the fault of the hardware. And that's where the story really starts to get interesting.

Editor Note: Here is a review of a cylinder's "hardware"



The Intake and Exhaust Valves are located in the cylinder head



Each Valve consists of a

Valve Head *which is usually ground to an angle of either 30° or 45°*

Valve Face *which is the ground portion of the Valve Head*

Valve Stem *which rides in the Valve Guides*

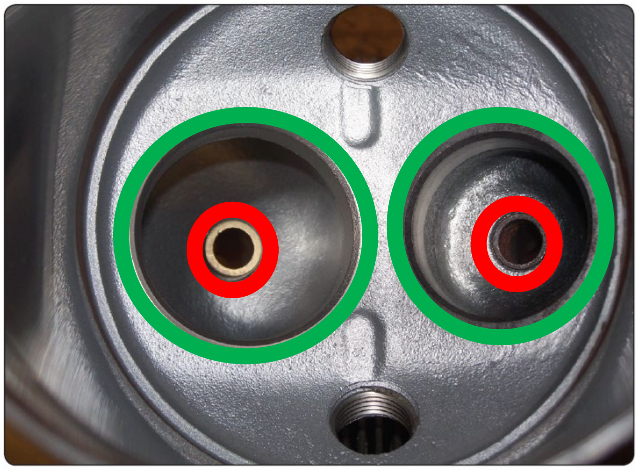


Figure 1-21. *View of valve guide installed on a cylinder head.*

When the valve is installed,

The valve stem passes through the "Valve Guide." (Red)

The valve face rests against a circular ring of hardened metal that protect the relatively soft metal of the cylinder head, known as the "Valve Seats" (Green)

Survival strategies

Exhaust valves must survive in an atmosphere of incredibly hot and corrosive gas whose temperature can reach 4,000 degrees Fahrenheit at the peak pressure point of the combustion event. **To make matters worse, the valve stem must oscillate smoothly through a valve guide without benefit of lubrication (since the stem runs so hot that engine oil would just carbonize).** It's a miracle that these valves last as long as they do.

Key to the exhaust valve survival, is the valve's ability to shed this intolerable heat by transferring it to the cylinder head, which acts like a giant heat sink for the valve.

There are two ways the valve can transfer its heat to the cylinder head:

Via contact between the valve's head and the valve seat (when the valve is closed)

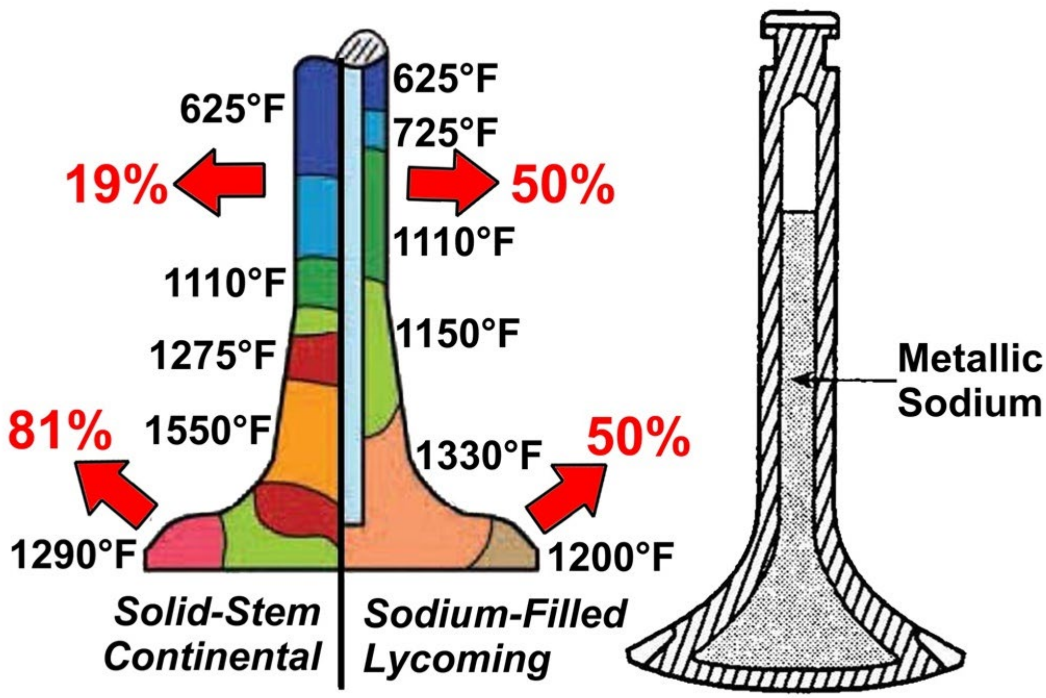
and

Via contact between the valve's stem and the valve guide (constantly).

Continental and Lycoming employ subtly different construction and heat-sinking strategies for their exhaust valves.

Continental valves have solid stems and heads made of an exotic nickel-chromium superalloy called Nimonic known for its high-temperature, low-creep characteristics.

Lycoming valves are made of not-so-exotic stainless steel but have hollow stems partially filled with metallic sodium that has the consistency of toothpaste at room temperature, an unusually low melting point (208 degrees F) and high boiling point (1,621 degrees F), plus exceptional thermal conductivity. The sodium liquifies as the valve starts to heat up, sloshes back and forth inside the hollow valve stem, and greatly improves transfer of heat from the head of the valve to the stem.



Continental's solid-stem exhaust valves dissipate heat quite differently than Lycoming's sodium-filled valves.

As the graphic indicates,

Continental's solid-stem exhaust valves shed their heat predominantly through contact between the valve head and the valve seat,

while heat dissipation of Lycoming sodium-filled valves is split evenly between the head-to-seat interface and the stem-to-guide interface.

That's why a **close-tolerance fit between the stem and guide is essential to the survival of Lycoming valves,** while **Continental valves can usually cope with sloppy-fitting guides so long as the head of the valve makes firm, leak-free contact with the seat throughout its entire 360-degree circumference when the valve is closed (which it is about two-thirds of the time).**

Threats to engine survival

Exhaust valves burn when the heat transfer path from the valve to the cylinder head is compromised. If the valve loses its heat sink, it can overheat and start to warp and possibly start to crack around the edges. This causes it to lose its seal with the valve seat, allowing extremely hot combustion gas to leak past the valve during the hottest part of the combustion event when the valve is supposedly closed. The escape of this extremely hot gas results in metal erosion and warping, which increases the leakage of hot gas past the valve.

Sometimes this is baked into the cake when the cylinder leaves the factory or the engine shop. For example, if the valve guide and valve seat are not perfectly concentric, the valve won't seal perfectly around its entire 360-degree circumference.

Grinding the valve so it makes proper contact with the seat is harder than it sounds. The overhaul manual calls for the face of the valve to be ground at a slightly different angle than the seat angle in order to provide a narrower contact footprint that will seal better. It turns out that this is tricky business. If the contact area is too wide the valve won't seal well, but if it's too narrow, the heat transfer path from the valve face to the seat is compromised.

Valve and seat grinding is as much of an art as a science, and some engine shops do it better than others. Doing it right is particularly important for Continental valves because they are so dependent on face-to-seat heat transfer.

Lycoming sodium-filled valves are more dependent on the stem-to-guide heat transfer path, so worn guides that have a sloppy fit to the valve stems can lead to burned valves. This is one reason that Lycoming recommends regular "wobble testing" (Service Bulletin No. 388C) to check for play in the stem-to-guide interface. This is much less important for Continental engines, which tolerate worn guides far better.

Failure to rotate

Rotation is also essential to exhaust valve survival. Most Continentals and Lycomings employ exhaust valve rotators — that cause the valve to rotate a fraction of a degree each time the valve opens. **At typical cruise rpm, the valve typically rotates a full 360 degrees each minute.**

Lycoming calls them "rotator caps"
Continental calls them "rotocoils"

Click the Link for a Video explaining Continental's Valve Rotation
https://www.youtube.com/watch?app=desktop&v=_UUvIDaWChA

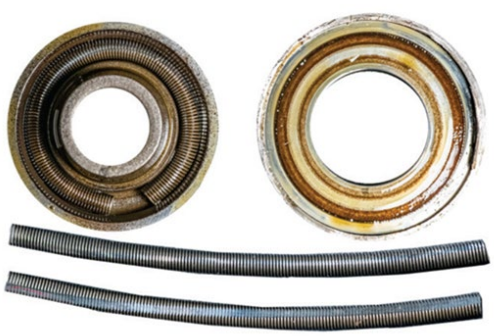
Exhaust valve rotation accomplishes two things:

It ensures that the heat load is spread evenly and symmetrically across the face of the valve and prevents the development of hot spots that can cause the valve to warp and then to burn.

Rotation also helps prevent the formation of deposits on the valve seat that can interfere with the valve's ability to seal properly.

In recent years at Savvy Aviation, we've been **finding an increasing number of burned valves caused by failure of the rotator**, particularly in Continental engines.

The Continental rotocoil contains a garter spring that gets laterally "squished" every time the valve opens, and it's the squishing of the spring that produces the rotation.

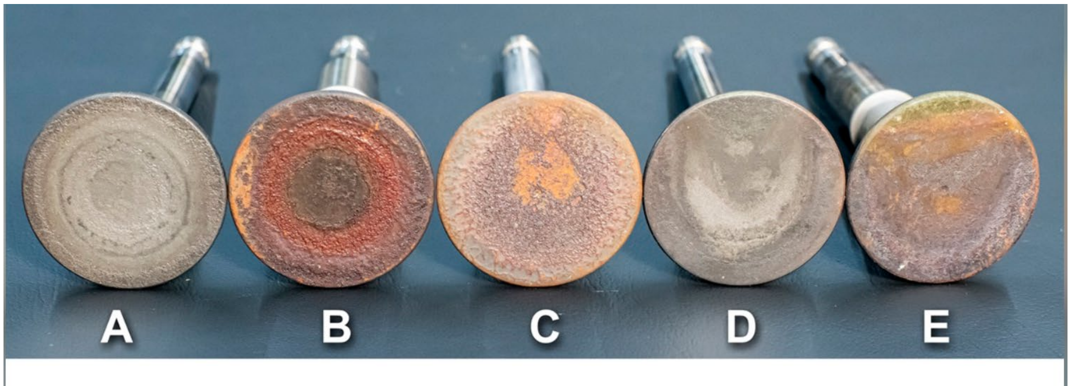


Continental rotocoil disassembled, showing the garter spring (Top)

Two Garter Springs, one in good shape, the other badly worn (Bottom)

Unfortunately, this squishing action also causes the spring to wear and eventually it wears enough that the rotocoil stops rotating the valve. Once that happens, it doesn't take long for the non-rotating valve to develop a hot spot and eventually burn beyond salvation.

The good news is that it's pretty easy to detect exhaust valves that have stopped rotating simply by inspecting them with a borescope.



Lineup of five Continental exhaust valves. The left ones look healthy, the right ones don't.

A valve that is rotating properly will have a symmetrical appearance the way valves A and B do.

Valve A is cleaner because it has been operated mostly lean of peak (LOP), while valve B has more deposit buildup because it has been operated mostly rich of peak (ROP), but both are symmetrical and healthy-looking.

Valve C exhibits subtle signs of asymmetry, probably because its rotocoil has started to fail.

Valve D is profoundly asymmetric and definitely not rotating, though it hasn't burned yet and might just need a new rotocoil.

Valve E is also not rotating and has started to burn, though there's a good chance the valve could be saved by lapping in place and installing a new rotocoil.

What about Lycoming's?

Lycoming exhaust valves use a completely different style of rotator and we don't see them fail nearly as often, but it does happen occasionally. The Lycoming rotator is a small cap that sits on top of the valve stem.

Most rotation is done via geometry at the rocker/valve stem interface. The Lycoming caps have a parallel bottom and top and therefore can't produce any rotation in and of themselves

Here are the key takeaways:

Burned valves aren't your fault, they're almost always a hardware problem.

If you inspect your cylinders frequently (at least every 100 hours, 50 would be even better), you can catch valve issues early and avoid the need for cylinder removal.

The borescope will show whether the valve is a viable candidate for lapping in place. Always replace the rotator when you do this.

A follow-up borescope inspection 10 to 25 hours later will hopefully confirm you dodged the bullet. Pulling the jug should always be treated as the last resort.

SAVVY MAINTENANCE

WHY VALVES STICK: HOW YOU CAN AVOID ENGINE DAMAGE AND POWER LOSS

By Mike Busch

Click the link for M Busch Article on Sticky Intake Valves
https://www.aopa.org/news-and-media/all-news/2020/july/pilot/savvy-maintance-valves

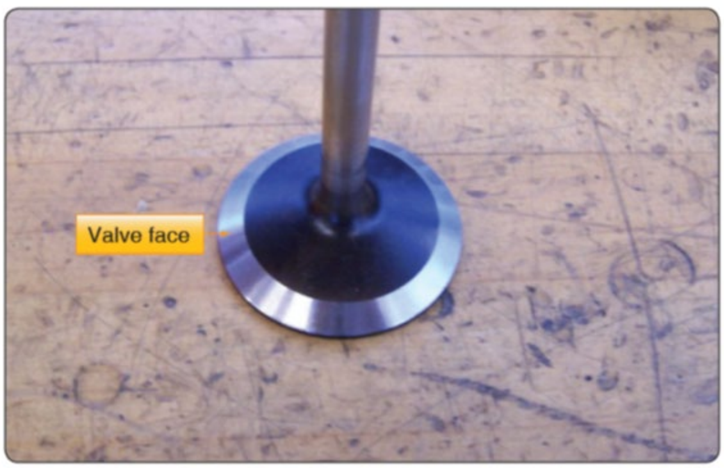


Figure 10-15. *Valve face surface.*

Click the link for Video of Mike Busch discussing exhaust valve failures

https://www.youtube.com/watch?v=KOExs_PC0L8

Airmanship – All in the Family

Editor's Note: Airshows may not be for everyone. But, to most immersed in Aviation, our introduction to aviation and some of our early Recollections, and Experiences may have been at an airshow.

Unless you are a true airshow aficionado, you may not be aware that there are several instances where Performing in Airshows "Runs in the Family." Sometimes, even Two families!

An example is the Younkin and Franklin Families

Younkin Airshows

Bobby Younkin and his son Matt

Franklin Airshows

Jimmy Franklin in the Jet Waco with his son, Kyle, standing on the wing

Kyle Franklin as "Ben Whabnoski"

Kyle Franklin and his Wife Amanda – Bobby Younkin's Daughter

I came across this documentary "Artistry In the Air." It highlights the history of the Younkin family and their interconnection with the Franklin family. I thought I would share it with the Chapter.

Click the Link for the video

https://youtu.be/kutnKTtnq_k

EARLY EXPERIMENTAL AIRCRAFT

Click the link to watch a silent film short assembled for the U.S. Army Air Corps from various newsreel clips, show some of the more ridiculous attempts by man to fly.

https://www.youtube.com/watch?v=SNtA1cbIUSA

Editor Contact Info:

Cell: 317-523-3824
Email: n3165e@hotmail.com

Interesting and useful websites on the Internet:

NOTE: You may have to copy and paste the address into your browser if the link doesn't work

I have added a few that I use.

If anyone knows of other interesting websites let me know and I will add them to the list

Our Chapter Home Page:
https://chapters.eaa.org/eaa1321

Why We Fly
www.whywefly.org

EAA: Home Page
http://www.eaa.org/eaa

FAA Safety Team FAAST
https://www.faasafety.gov/

FAA Safety Briefing
http://www.faa.gov/news/safety_briefing/

Regular links To Check out:
www.barnstormers.com

www.groundspeedrecords.com

AVweb News:
http://www.avweb.com/

This site also provides daily Newsletters that you can sign up for

Aero News Network:
http://aero-news.net/

Just for Fun Sites:
http://tailwheelersjournal.com/

Weather and flight planning sites:

https://www.lmfsweb.afss.com/Website/home#!/
http://www.fltplan.com/
www.avweather.com
www.skyvector.com
www.airnav.com
www.runwayfinder.com
www.flightaware.com

Travel:

http://www.socialflight.com/search.php
www.funplacestofly.com
www.placestofly.com
www.wheretofly.com
www.100dollarhamburger.com
www.airjourney.com

Little known & Lost airfields:

www.airfields-freeman.com/index.htm

Plane Dealing (Want-Ads, Lost & Found & Notices)