

TWO MILES HIGH

Driving in the Rocky Mountains means driving FAR ABOVE the 20.9% oxygen rich ambient air, and FAR ABOVE the heavy 30.57 lb/sq/in and fat pressures normally found at sea level. Much less air will be pressing to get into your now open throttle. Driving in Colorado will present a host of challenges to both vintage and newer Saabs. Safe driving means a refresher in **altitude situational awareness** that I strongly recommended for all SOC 2009 participants.

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While the bulk of this article contains information on brakes, oils, gasoline and brake fluid, this article also includes engine tuning settings & adjustment actions that are suggested for vintage Saabs. The goal is to drive to Colorado and return with a increasingly rare and very unique, fun to drive, power unit. V4's and the B-Motor are modern motors, but because two-strokes fire on every stroke, care must be given to the pistons as petrooil provides precious little lubrication.

Ok! Now that I have got your attention, my recommendations are to make some simple and prudent altitude adjustments and changes. There is no magic answer, nor specific settings for regaining sea level power! One must be careful with all oil issues either 4 stroke or strokers.

Be realistic, your v-Saab's can only perform with less vigor at 10,000 feet, but you and your Saab will arrive at Cooper Mountain SOC 2009 just fine! **I urge you to be cautious and do not over-adjust and ask a "bit more" from tune specification.** Over adjusting will do **actual harm to your engine**, and also cost you plenty in delays, breakdowns and towing expenses. Every fellow Saab conventioneer wants you to arrive safely, on schedule and certainly not hot and irritated from unnecessary expensive roadside repairs.

B motor, V/4 motor Recommendations

Pre-1980 RECOMMENDATIONS 5,000 feet & above (not done again at 10,000 feet!)

Gentle leaning of mixtures

Mild advances of timing

Keep rpm's high

PLUS: General info following safe & time proven tips for high altitude mountain travel.

Mile Hi Body Shop (303 595 4646) and other Saab repair shops in Denver offer a tune check for those heading up to the Rocky Mountains. It is usually necessary to make an appointment, and there is usually a small charge for adjustments if needed. Your sea level tune settings will work okay up to the mile high elevation of Denver. But if you are heading from Denver up to SOC.....

CAUTION/WARNING: W leaving 5,000 feet & Re Tune to stock settings low altitude Is vital that leaving 5,000 ft. YOU MUST reset tune specs to standard sea level specifications.

General Recommendations for Mountainous Conditions

Brakes and Brake Fluid

Good brakes are essential for mountain driving! The old adage "what goes up, must come down", has never been more important. Besides adequate pads and shoes, there are two other components of the brake system that will need to be in top form. Some grades in the Rocky Mountains will be over ten miles long with grades of 8% or more. With the tremendous length and steepness of the descent, everyone's brakes will get extremely hot, cars and trucks alike. I guarantee you will see smoke and smell the damaged pads and overheated rotors of others who imprudently ride the brakes and develop problems with overheated brakes. Here are some tips:

1. Total brake heat is affected by the rate you slow down in, so be easy on all braking you do. Total brake heat is also affected by highest speed you start slowing down from, so don't allow initial speeds to build. Downshift and spare the brakes on the really steep grades, cool brakes by using third gear to allow some 30 second rests between brake applications. Warning: **DO NOT USE STEADY lite brake pressure**, as this lite use will never let the brakes cool between heavier usages. Use 3rd gear and no brake for at 20-30 second intervals or longer OFTEN
2. Flush your brake system with a DOT-4 Castrol fluid, stem to stern, to avoid boiling of the brake fluid if your brake fluid is 4 or more years old. Brake fluid is hygroscopic and water will boil an "air pocket" in your brake system, especially at altitude, because the boiling point of water is now 187 F Not 212F. Do not upgrade to silicone DOT-5 unless all seals and cylinder are new! You will spring seeps at most containment seals due to seal shrinkage reacting to silicone.

If you chose to renew your brake fluid, owners who use the pedal pump method to bleed are now asked to limit stroke by placing a small block of wood under the pedal. This method will

avoid trashing the seals mucking through the grunge that resides in this unused end of the Master Cylinder bore, if you just cram the pedal to the floor when bleeding.

Also for mountain use, measure your brake rotors for overall thickness. The safety issue here is to have enough metal mass to store excessive heating that mountain use will bring. Again you will be traveling DOWN ten miles of 8% grade! Replace your rotors if they are deeply worn, or overly turned on a lathe. Spend a few minutes with a MM Micrometer and measure against factory specifications. Thin rotors will turn red hot and the pads will not grip the burning, smoking, thin, rotors. Runaway ramps are for trucks having emergencies, not Saab owners!

Also, do not neglect to bleed the clutch system, especially on 96, and 99 models. I have received more complaints of dead clutch pedal syndrome from cars on the continental divide than all other complaints combined. The reason is after a 55 minute pull to 10,000 ft., engine heat given up by the radiator, all penetrate the trans case and boil the often neglected brake fluid still residing in the slave cylinder.

All Vintage Saabs need to also go DOWN the hills in the same gear that you went up the hill in. EXCEPT FOR: Pre-mix 2- stroke: They must only use 4-th gear only on interstates and remember to pull the choke out to wet the insides of the motor with oil every 20 to 30 seconds or so. Drum brake 96's need to pull over often for extra cooling, minimum 10 minutes, or consider spraying the steel wheels with water from a garden sprayer to help cool the drum brakes.

Fuels and Fuel Delivery

Fuels sold in Colorado and other high altitude states in the West, are generally 2 points lower in octane. Simply buy the same grade of fuel you were used to buying at low altitude. For example, if you had 87,89, 93, octane available in New Jersey, your choices in Colorado now are 85,87,91. For example, if you were okay with middle grade 89 octanes, your choice in Colorado will now be the middle grade 87 octane.

Engine cooling:

Two factors will combine to create higher engine temp. Obvious is the continuous pull up hill, and second is the lower air mass that will decrease the amount of heat convected away through the radiator. Your temp needle will rest much closer to the hot area and this is ok provided the needle is not in the red and does not radically raise or lower in less than one minute. Running of the A/C is debatable provided you can spare the 5 horsepower. If you need a bit more engine cooling on hills, turn on the heater and open the windows. If you have any doubt that your engine is too near the red, immediately seek the advice in your owner's

manual or seek technical advice. Do carry some spare antifreeze, and/or use the new coolant "wettters."

4 stroke ALTITUDE (5,000 feet or above) TUNE ADJUSTMENTS *

Pre-1979 Saab 99, and all V-4 models including Sonnets.

Note! Do not make these changes until 5,000 feet above sea level (1 Mile High).

Reverse these settings under 5,000 feet!

Ignition Timing

Mixture and fuel

Ignition Timing

*** WARNING: Do not exceed these values!!!**

In general, timing specifications can be advanced a few degrees beyond factory spec. It is extremely important to remember that no one "advance law" will fit all versions of Saab Engines. If you could generalize ignition advance recommendations, they would be: Above 2,000 feet, one degree advance for every two thousand ft. of altitude increase... TO A POINT! Once you get above 8 thousand feet the physics involved are too great to adjust around. Do not add more than four degrees under any circumstance. The theory of altitude advance is to give the lower oxygen mixture a better chance to burn by beginning the ignition process earlier, and more power is developed. Timing specifications will also increase manifold vacuum. This also is a good volumetric efficiency and cylinder filling with beneficial side benefit.

The following specs are for idle, with vacuum advance plugged & disconnected, using a strobe timing light. If at any time you hear or suspect detonation, cut by half any timing change, or return to stock settings.

Model:	Factory timing	Altitude Timing
All V-4 models:	6 degrees*	10 degrees*
99 models:		
Carb w/1.7L & 1.85L eng.	10 degrees*	14 degrees*
EFI w/1.85L Triumph eng.	6 degrees*	10 degrees*
Carb w/2.0L "B" eng.	14 degrees*	18 degrees*
EFI w/Saab "B" eng.	12 degrees*	15 degrees*
CIS w/Saab "B" or "H" eng	14 degrees*	16 degrees*

***THESE TIMING VALUES ARE AT 800 RPM AND VACUUM DISCONNECTED**

ALL TURBO MODELS ARE ONLY SET TO FACTORY SETTINGS

**ALL TURBO MODELS WITH VACUUM ADVANCE ARE ALSO PRESSURE RETARD
ENSURE VACUUM DIAPHRAGM IS INTACT & TIMING RETARDS UNDER PRESSURE**

You will notice a trend here as engine and fuel management systems evolve, timing advance recommendations become less. Modern fuel management systems with Oxygen Sensors, all models after 1980, have vastly improved mixtures will need even less timing advance. It is wise to know "knock sensor" motors will benefit from higher octane numbers. Your fuel choice will be assisting the computer with keeping the timing optimized. Poor fuel octane will degrade engine performance as ping will negate and erase "advances" in computer spark mappings.

SAAB TURBO MODELS SHOULD NOT RECEIVE ANY TIMING ADVANCES.

Turbocharged engines are pressurizing the intake charge AT 10,000 FEET as if at sea level! When the stuffed cylinder is then compressed by the piston the risk is VERY high for pre detonation due to boost aided compression factors alone. **Use premium fuel only.**

VINTAGE(pre1980) Mixture and Fuel system mixture and idle speed adjustments

This section will discuss important carb design and discuss fuel adjustment limitations! 4-stroke Carbureted engines suffer the most when driving at high altitude. High altitude air movements in a carburetor will more resemble the unstable air flow around an aircraft wing when it encounters stall speeds. The chambers in the venturi were designed with shapes and spaces that would be effective in mixing liquid fuel with air at sea level. The long and short of this discussion is that little can be done to give great air/fuel ratios at altitude. The advice is as follows: keep RPMs up to increase air velocities within the carburetor to "normalize" the mixing fuel and air flows. A second benefit to partial throttle settings, and high RPMs, will be the creation of a secondary fuel atomizing area around & below the throttle plate.

To provide optimal amounts of air to the engine, a new filter is imperative. Also make sure air offered is cool as possible. If you still have original metal snorkel on the early V-4 or Pre 72 99, split the end opening on the bottom and widen this restricted air inlet. Also ensure that the fuel system filter is new, and that all fuel hoses are not cracked (suction and pressure) and the pump is good and hopefully new. If you don't actually replace the fuel pump consider at least pack new one along, and you could even carry a spare electric pump along. The reduced atmospheric pressure can cause fuel vapor lock, but not always in the carburetor! Vapor lock

is often in the pull side from the tank. Electric pumps can be mounted near the tank, greatly reducing the chances of fuel delivery vapor lock.

All carbs will need the idle setting increased, and the idle mixture thinned out, by turning the idle mixture screw in. On V/4 models Do not change the main or pilot jets to anything less than stock values. Remember that you will be flooring the motor flat out, at high speeds for 10-15 minutes or longer. Please do not burn your valves or pistons doing the impossible by re-jetting your carbs lean! Standard jets sizes only. Hopefully at sea level you were running the jets a little fatter than specified for better power. Stromberg carburetors need only idle speed adjustments and idle air trim adjustments (screw adjuster out) to increase air bleed and lean idle. Do not play with needle position or main jet position. The Stromberg carb will self adjust better than the fixed venturi carburetor. Do carry a spare piston diaphragm along, as would this diaphragm develop a tear, you are completely stopped.

EFI systems, 1970-1974, tend not to respond well to adjustments, and the parts are now old and fuel pressure and manifold sensor diaphragms are brittle and weak. RIGHT NOW, if you have good drivability and good gas mileage, consider leaving well enough alone. Only if your mileage on a highway is below 24 MPG at 60 MPH, should you seek information or a technician to lean out the mixture. Or, if your highway mileage is above 32 MPG at 60 MPH, seek information or a technician to richen the mixture. CO gas analyzers do an ok job informing the technician of relative CO changes, but consider actually performing a true 30 mile highway mileage test. Lean surge was often mistaken for throttle switch deficiencies, but unwittingly you may be running far too lean. You could have the unfortunate experience of burning a valve. Do the mileage test out on the road to where you can drive at 60 mph for the majority of the miles specified. True technocrats could weld threads for an O2 sensor in the front pipe, and help the technician get road readings.

CIS systems WITHOUT Oxygen Sensor, 1975-1979 Federal States version

Continuous fuel injection is very accurate in metering fuel in proportion to manifold vacuum and does "ok" with altitude gain. Less manifold vacuum will lift the air sensor plate less so fuel delivered is less also. Let's say that your CO was at 2% at sea level, it would now measure 5% at 8,000 ft. This value is not as "off" as it may seem, as CO is still combusted fuel that could have benefited from more air to bond with carbon to form CO₂. Look at the other side of the fuel equation, 95 % of the carbon did bond with air to form CO₂. At altitude, adjustments, your power and mileage may still suffer and you will not have gained a lot from CO adjustments

Section TWO: Two-Stroke Recommendations

Fuel and carburetion: Use the best available grade of Premium fuel for all models, plus additions of octane boosters for all Monte-Carlo's above 5, 000 ft. When the Stroker gets in the middle of its power curve, combustion temps and cylinder pressures **are high performance!**

Monte Carlo carb jets:

Mains: 120, 135, 120

Pilots: 55 (no 45's)

Emulsion air jet: 200's, on carbs #1 and #3 and a 180 jet in middle carb (NO-220's)

Pre-mix tri-carb jets:

Mains: 125, 135, 125

Pilots: 55, or 60

Emulsion air jet: 150 All three (to 5 K.) and then fit 180's all three carbs at altitude

Story on Today's Two-stroke Oils

As the temperature of the piston rises to high values, climbing the Loveland Pass in a stroker at full throttle for 10-15 miles, the minimal oil offered by the **Petroil** can turn directly into power robbing friction. Worst case is the complete seizure of the piston in the cylinder bore. All information discussed below are vital in protecting the two-stroke motor against the damages caused by heat and friction from running wide open mile after mile after mile.

High quality (2x better than 1960's oils) two-stroke oils are still readily available and value priced in gallons at your local motorcycle shop or personal water craft dealers. There are two types of two stroke oil available, PREMIX and INJECTOR. Generally the older stroker use premix oils that are of a heavier viscosity, like 30 wt oil and is mixed directly in the gas tank.

The premix is then re separated in the manifold then centrifuged by the rotating crank and the oil is re-deposited by the abrupt movement of the fuel vapor column, and when the charge of vapor passes up the transfer ports, just the oil is left behind on the piston skirts and rod and main bearings and other internal engine parts.

Injector oil and semi synthetic and full synthetic stroker oils are a somewhat less viscous formula more like 10-30 oil, These premix oils were developed in the mid sixties and seventies motorcycles experimenting with separate oil tanks and automatic oiling systems. These first "injector oils" actually delivered oil in a small orifice just past the venturi and before the throttle plate. A small pipe "dispersed stroker oil" in the air stream just after the carburetor throttle plate: **it needs to be thinner to catch the wind**. Basically due to modern superior modern oils, both types are listed as suitable for both and both formulas are available in standard or synthetic form.

Generally all current two-stroke oils carry the API rating of TC-W3, and are fine for all pre-mix (oil in gas tank) two-stroke motors. Saab manuals in the past specified premix oils because of the heavier size oil molecules. The total lubrication quality of today's oils are so far superior, that the advice Saab gave for "thicker oil in pre mix" is no longer true. Mix the oil to gas ratios as specified in your Saab owner's manuals for high speed driving (more oil). Be aware the modern motorcycle - watercraft oil you purchased may call for lesser amounts of oil. If you are confused follow directions for the new standard TC-W3 oil and add 20% more oil to the same amount of specified gasoline. This basic two-stroke oil costs about \$20.00 a gallon. New on the market are part synthetic blends and are priced only a few dollars more for the same gallon amount. 100% synthetic oils are available but have a significantly higher cost, around \$ 40.00 a gallon.

Blended or full synthetics should be used in slightly heavier amounts 10% above directed amounts listed on the package label. I would highly recommend the part synthetic blended or pure synthetic two- stroke oils for all Saab motors. Do not use additives with synthetic oils, they are very sensitive to disruption or stratifying. I do not recommend plain TC-W3 oil for Monte-Carlos as their minimized oil supply should only be of maximum oil quality. If you must economize, use Yamaha 2-S blend or equivalent. Because Saab's oil pump injection will "pipe" the oil directly to the cylinder wall and engine bearings, synthetic lubrication will be less viscous but more stable and total oil consumption will remain about the same. The best benefit of synthetic oils will markedly reduced smoking, because more oil is staying inside the engine, having less propensity to "burn away " till 200 degree above the burn temperature of standard non synthetic premix oils.

Interstate Stroker Pre mix Phenom called "whicking"

Cruising a pre mix stroker steadily above 3,000 rpm could cause a condition where the friction consumption of lubricating oil can exceed the amount delivered by part throttle fuel **oil** delivery at steady cruise conditions. This is our typical flat interstate driving which was inconceivable to Sweden in the 1950's. When this engine prowled the roads in its prime, then 45 mph was the top posted speed for fast roads. The Germans with high speed autobahns, also fancied the Saab motors, and developed a process of wicking the oil (up to the pistons) by running with generous oil ratio's and fat carb jets. Saab also was concerned with inadequate lubrication on overrun downhill situations. Why? Because with no throttle open, no **Petroil** was admitted to the crank/piston area, yet the engine was at high rpm with engine braking. Saab's answer was to free-wheel the gear box, dropping to idle where fuel and oil and friction loads all balanced out. On any hill, you open the throttle enough to admit adequate oil, and, on downhill's, you should let your engine idle. The real danger of a wicking condition is on flat-land, high speed cruising where you have very little throttle applied. The pistons literally dry out because friction losses consume more oil than what is deposited there from the fuel.

Primarily, your best and most effective strategy is to mix more oil (than listed) with the gasoline, run prudent speeds, with a slightly de-tuned motor. The goal is to have a doggy motor that you will have your "foot into" a bit more to deposit more oil inside it. Secondly, also consider using these "wicking" strategies for pre-mix motors: choke engine briefly, while engine is still at speed, once per 2-3 minutes; allow engine to idle occasionally/ for 20-30 seconds every 2 -3 minutes. This procedure is easier if you think to let your speed on the level interstate slow from 60 mph to 50 mph in neutral, then resume speed. Oil injected M/Carlo oil pump motors can use benefit from the additional oil put in the gas tank at half listed ratios.

Saab two-Stroke motors are extremely high performance motors and they required premium fuel. Monte-Carlo, and standard motors suffered from detonation in the 1960's and do now the with gasoline formulations of 2009. Detonation is devastating because of the extra piston heat incurred going up, and going down will quickly begin to melt the pistons. Detonation sounds like a lite wispy crackle primarily between 2,800 and 4,200 RPM with 30-70% throttle openings. You can proof this noise as detonation by pulling out the choke half way, briefly; when you think you may be hearing ping. "Ping" is a hard to hear and all windows must be closed and no radio on. Literally most drivers never hear two stroke pings as it is of a higher frequency and lower volume than you might expect. Also ping is not heard every time because heat build-up has to first occur. The hill has to be 45 seconds long or more and you must be extracting full power, but not necessarily floored throttle.

Two Stroke Ignition Timing

To retain health for your two stroke motor, set all Saab two-strokes at slightly retarded timing specifications when at sea level, and a little above specification at altitude. When on the interstate cruising at 4,000-5,000 rpm all day long, disconnect and plug the vacuum advance line to the distributor (if equipped) Again slightly retarded timing is due to the fuel octane being lower than in the old days, and the really cold plugs are obsolete. The best you can get are NGK A-8's and these are generally recommended for all speeds with all stroker models. The other factor to help stop detonation is lower coolant temperatures. Other overlooked sources of ping is to test for low fuel level in the carb bowl. Generally one carb tends to have a fuel level low enough to upset the amount of fuel delivered. Poor engine cooling can also cause detonation so read on for tips to lower coolant temperatures, primarily re coring the radiator.

Sea level timing: just below (retarded) full adv. mark at 3,000 rpm,

On Road: DO NOT USE VAC ADV.

Altitude timing: advance 3 deg. (1/8 th. IN. or thickness of match head) above full adv. mark at 3,000 rpm

Cooling

Adequate cooling for 1964 and earlier 96's will depend on radiators having an extra core run added (4 instead of 3) and cardboard baffles refitted below the radiator area . These baffles are imperative for the development of a low pressure area behind the radiator for good air flow. Also consider using "coolant wetting" agents that will cause coolant to give up heat more efficiently. The same coolant advice goes for 1965 and up "long nose" 96's. Have the radiator re-cored with one more row of runs added. Make sure you have working temperature gages, good hoses and radiator caps and carry an extra h2o pump along. Consider blocking off the extra space on either side of the radiator to let the entire wind stream pass through the radiator at highway speeds. Remember to turn on the heat if you start to overheat on long pulls in the mountains. If you get a hot runner and did not get this sorted out before leaving, consider hanging a junk yard heater core under the hood. Remove the original heater hoses at the head and return pipe, let them hang, and add new hoses to the spare heater core and duct air to it with clothes drier vent tubing. This alone can low temps around 15 F. You can easily remove this apparatus for the concurs part of the convention. A new electric H2O pump is available for emergency pump failures.

Lastly if you do have a 62-64 Sport Motor with the original air cleaner, three little filters, no new filters are available. You can scrounge and use the later Darth Vader 65&up air cleaner assembly for which new filters are available. Notch cut and fold back a 1 inch wide flat (half inch deep.)in the area where the rear upright fan bracket hits. If you have the individual carbs 62-64, be sure to use a VW bug inline fuel filter and piece of hose to act a source of filtered air for the idle circuit. Exhaust pipes tend to close off with the carbon and un burnt oil

and will close off, restricting engine breathing. Remove the rear muffler and look inside both ways, to the front and in the muffler. If buildup is 1/4 in. or more, replace pipe or muffler as necessary. V-4 rear mufflers are available, as are pipes ft. to rear for the V/4, which will fit the 2-stroke. A rear half section is available. See instructions for modifications of these parts to fit your two-stroke. Lastly, tyre pressure will increase with altitude. The 30 lbs. of "dense air" you put in your cars' tires at sea level will now represent 40lbs. at Keystone.

Spare Parts

Emergency electric fuel and spare mechanical water pump

2-stroke spark plugs

Bosch 240's

NGK A-8

Safety on the Interstate Highway

All slow Stokers are recommended to purchase and use a bike strobic warning lite to set in the back window. Your stoker will not maintain 45 MPG above Georgetown to Silver Plume

Safety on I-70 will depend on safely sharing the road with faster and slower cars, and trucks. Most cars will be traveling 70 MPH up-hill in the left lane, you are pushing 3rd and holding on to 40-50 mph, in the right lane when up ahead a steel truck is grinding up the mountain at 18 mph. You either slow to 18 mph or merge to the left to "pass" at a whopping 38 MPH, which by the time you decided your new speed of 36 mph is now just below your power curve and 3rd gear will no longer hold this speed. Here comes 2nd gear and 35 mph, and the traffic behind is not immune to "road rage" . Which brings us back to your little red strobic bike lite. This flashing information will be just enough for most people to figure your situation out as a special slow (especially slow) vehicle, and they will possible display more graciousness and courtesy. Georgetown to Silverplume is the steepest 2 mile segment on I-70. It is here that you will have only one shot to hold third gear. There is no shame to using second gear. If you get caught behind traffic; make the safe choice and slow down. There will be another shot at third gear and that will hold till about a mile from the Eisenhower Tunnel.

Telephone numbers for advice:

Don Wollum: 919-644-2149, 8:00 PM to 9:00 PM Eastern Time (donwollum@nc.rr.com)

Bud Clark: 714-282-7378, 9:00 AM to 5:00 PM Pacific Time

Jerry Danner, Mile Hi Body Shop, 303-595-4646, 1-800-757-7222 8 to 5 Mountain Time