

Emissions Research

This Information has been pulled from many sources, most off the net, a few from books, others word of mouth. In each case, the source has been identified so that you can decide how trustworthy the idea is on your own. Uncredited entries are from the author's experience (or he just can't remember where he heard them!).

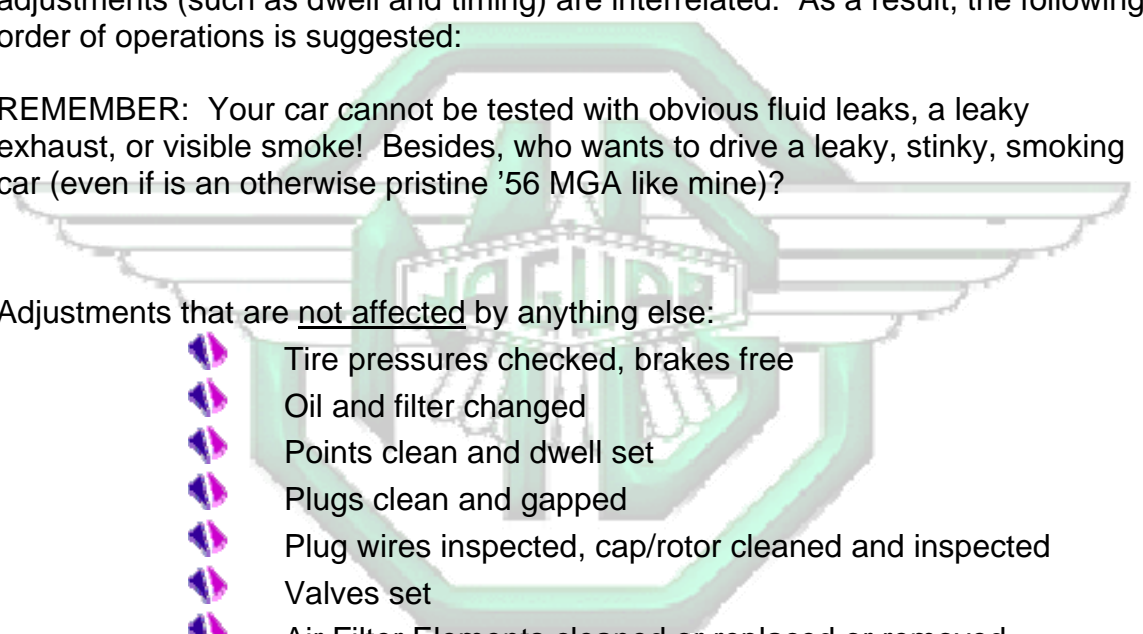
In ALL cases, you should **start with a Tune-Up as per the factory manual**. This document might help improve things from that base.

Although this document was compiled primarily to help get MGs and Jaguars through AirCare, many ideas will apply equally to other cars.

Some adjustments on your car are made independently of all other adjustments (for example tire pressure and oil). On the other hand though, many adjustments (such as dwell and timing) are interrelated. As a result, the following order of operations is suggested:

REMEMBER: Your car cannot be tested with obvious fluid leaks, a leaky exhaust, or visible smoke! Besides, who wants to drive a leaky, stinky, smoking car (even if is an otherwise pristine '56 MGA like mine)?

Adjustments that are not affected by anything else:

- 
- ▶ Tire pressures checked, brakes free
 - ▶ Oil and filter changed
 - ▶ Points clean and dwell set
 - ▶ Plugs clean and gapped
 - ▶ Plug wires inspected, cap/rotor cleaned and inspected
 - ▶ Valves set
 - ▶ Air Filter Elements cleaned or replaced or removed

Adjustments affected by other adjustments:

- Timing, affected by dwell (Set dwell first)
- Carb Synchronization (set Valves First)
- Carb Mixture (set EVERYTHING ELSE first)

Good tuning!

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For those of you who want to cut to the chase, here are the basic findings at a glance. Please read the more detailed research sections as well, because sometimes contradictory suggestions have come to light (e.g. Fuel choice).

TUNE TO FACTORY SETTINGS FIRST, then modify to suit!

<p>Ignition: Retard several degrees from factory. 11 clicks to one degree on the microadjuster</p>	<p>Air Filters: Take out your elements for the test, or else buy K&Ns and forget about them.</p>
<p>Spark Plugs: Regular NGK plugs properly gapped</p>	<p>Catalytic Converters: get them hot on the highway before testing.</p>
<p>Air Pump and Emissions: Hook them up, check they work</p>	<p>Tires and chassis: tire pressures equal, brakes free. Pressures?</p>
<p>Valves: Set lash LOOSE, maybe even 10 thou or more OVER factory for an aggressive cam.</p>	<p>Oil: Clean, fresh, thick synthetic, with a new filter.</p>
<p>Fuel: Run a tank of premium through for the cleaning additives, then test on lower octane, ethanol mix fuel.</p>	<p>Temperature: A cooler thermostat can be good for Nox</p>
<p>Fuel Additives: The US government tests say don't bother with most of them.</p>	<p>Carbs, Idle speed, Vacuum leaks: Tune carbs last, set idle to 1050RPM, Make sure blower motor and lights are on before setting idle speed.</p>

1. Retard the spark timing a bit. From a performance standpoint, many cars respond well to advanced spark timing. Unfortunately, this is not good for either HC or NOx emissions. Retarding the spark timing up to 4 degrees will usually help both. Keep in mind that this trick may hurt CO emissions.

<http://home.att.net/~CapriClubChicago/tips/SmogFaq5.html>

If the valves are in good shape, compression is even and you have no vacuum leaks, you may retard the timing to effect a change in HC emissions. However, in California, you may only reduce the ignition timing 2 degrees either side of the manufacturers specifications.

<http://h-body.org/library/hbodyfaq/hbodyfaq-2.html#2.3>

Ignition timing - Retarding ignition timing will usually reduce emissions somewhat. However, once you start nearing 0 degrees the idle quality will go down so much that you will produce more emissions due to misfires. Also, if the idle timing is checked, you may fail for having it set wrong.

<http://www.mr2.com/TEXT/SmogCheck.html>

While working at European Sports cars, I would like to share a problem I would often come across with engine misfires on

MGs. Of course, I had the luxury of a Sun 2000 engine scope, to show me where the bad spark pattern was occurring. On a few occasions, I found that the tachometer, as it was wired into the ignition, was causing a disruption in the spark pattern and causing an engine misfire. Just pull the black and white wire off the back of the tachometer (or if yours has two white wires with connectors on the ends, pull them off and connect them together - PK) to see if there is any improvement in the spark pattern. The black and white wire (or the white wires) are routed into the ignition system. Of course on the very old MGs (up through about 1965 - PK) you will not have this problem, as the tachometers are cable driven, and have nothing to do with the ignition system.

<http://www.svmgcc.org/misfires.htm>

Distributor - In good mechanical condition. (rotates freely without shaft wobble, advance mechanism(s) working correctly) - Adjusted correctly (points and timing)
- In good electrical condition (cap, rotor, points, low tension lead, insulation)
Coil and Wires- Coil output (best checked with an oscilloscope)

- Wires of correct type and in good condition
- Good, solid electrical connections
- Correct coil polarity

Retard the ignition timing about 3 degrees to help reduce the NOX emissions.

<http://www.torontotriumph.com/article4.htm>

MGA IGNITION TIMING: The manual asks for 5 to 7 degrees BTDC. This equals about 20 degrees BTDC at "tickover" which is about 800 rpm. The micro-adjuster on the distributor allows field-testing. Advance until you can get it to ping -- then back it off so it doesn't. **Eleven clicks to one degree.**

<http://www.mgcars.org.uk/namgbr/techtips.htm>

Consider removing and plugging off the vacuum line to the distributor. This retards the timing at idle to reduce HC considerably. NOTE: HC and CO are in a balance, so reducing one usually increases the other. You will then have to increase your idle again.

-Vancouver Auto-shop teacher Dave Louden

(NOTE ALSO that some of our cars use "Ported" vacuum advance, i.e. from the carb body, while others are "Manifold" vacuum advance, e.g. from the manifold. As there is no appreciable ported vacuum at idle, this will have little effect at idle on Ported Vacuum cars.)

Spark Plugs

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- Correct type: reach, heat range ("reach" is the length of the threaded shank, heat range refers to the spark plug's ability to transfer heat - Not how "hot" the spark is)

- Clean and correctly gapped
- Sealing washer in good condition

<http://www.chicagolandmgclub.com/techtips/550.html>

2.) Put in a new set of spark plugs, gapped at .032".

Our dyno shop swears by NGK plugs.

<http://www.grmotorsports.com/stock%20tips.html>

The June '99 issue of Consumer Reports has an article (p. 9) on the Bosch Platinum+4 spark plugs. They tested 'em on a high-mileage Honda and made a series of timed acceleration runs and their standard fuel-economy tests, which combine city and highway driving. They ran the tests with a new set of standard NGK spark plugs recommended in the Accord's owner's manual, then again with the Platinum+4 plugs. They found ". . . no meaningful difference between the regular plugs and the Platinum+4s. " They do prefer platinum-tipped single-prong spark plugs ". . . because they last longer - typically 100,000 miles between changes instead of about 30,000."

http://dodgeram.org/tech/gas/spark_plugs/spark_plugs.htm

Platinum is used as a conductor because it is a dense element and current theory of energy transfer in an ignition system holds that for every spark a small amount of electrode material is transferred, hence electrode wear. Because Platinum is so dense, the center electrode can be smaller and will hold the square edges needed to promote easy spark initiation and this will result in less misfires in the service life of the plug.

This is very important that the principle of sharp edges be understood. You simply cannot regap a worn spark plug and expect new performance. Filing the electrodes is marginally better because the gap will still need to be closed down to the point that only one edge of the electrodes will be used—the edges closest to each other. Split fire plugs get their advantage by having more sharp edges to erode and that is the "magic" that allows them to last longer with more consistent performance. I have yet to see an ad where someone took an engine, tuned it with new parts, replaced the parts with someone's super parts and then showed an advantage in anyway.

<http://www.hardlink.net/~mikep/tuning.htm>

I recently had my car dyno'd at a shop in Mt. View CA, and during the dyno runs I tried a change in plugs. My car is a '95 M Edition with 44k miles. I made 2 runs with the platinum SplitFires and then installed the Bosch Platinum+4 plugs. There was no increase in horsepower or torque over the SplitFires, and drivability seems to be unchanged. Now I am not quite sure where the advantage is to a \$5.99 sparkplug as far as performance goes, but after long discussions about my net horsepower gains, I would recommend a standard NGK copper core plug and save yourself considerable money. I'll be returning the Bosch plugs to Pep Boys for a refund, as advertised.

This is a follow up to my review following removal of the plugs.

Since my initial review, I returned the Bosch+4 plugs and replaced them with standard copper core NGK's. Several of us got together about 4 weeks later for a Dyno Day in Mt. View. The dyno did not lie. A 3 horsepower improvement over the Bosch and Splitfire plugs. The Consumer Reports June '99 magazine did a field test on the Bosch Platinum+4 plugs and their results showed no appreciable improvement over standard plugs for their test Honda. Beware of claimed improvements.

<http://www.miata.net/products/perform/boschplugs.html>

"Split-Fire" plugs? The US FTC says don't bother, they don't do anything special. www.ftc.gov/os/1997/9705/c3737cmp.pdf

I personally have had THREE sets of platinum plugs fail in my MGs (to the point where the car simply wouldn't start), after less than a year of driving on each. I spoke to a Bosch rep about the two sets of Bosch that had failed, and I spoke to an NGK rep about the set of NGKs that failed. In BOTH cases, the reps told me I should not be running platinum plugs in my MG.

The NGK guy suggested that the MG engine is burning the platinum off of the tip of the plug, because it is such a long-style plug and the newer materials in the plug don't transfer heat as well as the old copper core did. Strangely, he couldn't explain why a simple change of heat range wouldn't cure the problem. The NGK rep was adamant that the simple copper core BP6ES was the plug we want.

The Bosch guy was also certain that the style of engine was wrong for the plug, in fact he said he wouldn't recommend platinum plugs for ANY engine older than about 1975. Again, none of the reasons he gave me made technical sense! The

Bosch rep suggested we would be very happy with the Bosch Silver plugs, which would provide longer service life and better performance than the basic Bosch plug.

Although the technical explanations for their recommendations made little sense, both the Bosch and NGK reps were certain that platinum plugs are a wrong for old cars.

Air Pump and Emissions Equipment

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5.) Make sure all the correct smog equipment is there and working, particularly the PCV diaphragm, as you won't get by the machine without it.

<http://www.torontotriumph.com/article4.htm>

Next, the smog pump is a very important component. To check it is very simple, just remove the hose from the air injection rail at the cylinder head and with the engine running, put your thumb over the pump outlet hose and make sure you have good air pressure from the pump. When I was performing smog checks at European Sports Cars, I would check many an MG that had the smog pump turning but being that it was worn out had no air pressure. Always check to make sure there are no carbon deposits blocking the air injection rail and injection ports inside the cylinder head.

<http://www.svmgcc.org/smog.htm>

Check your EGR valve as per manual

Valves/Cam Timing

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4.) Adjust the valves looser by .005 from normal settings. This one is a little more difficult to understand, but about .005" degrees of valve clearance on the ramps of the camshaft converts to about 20 degrees less cam Tuning at the base of the ramp where a good deal of the pollution occurs as liquid fuel that has puddled in the manifold runs past the partially closed valve at high vacuum.

<http://www.torontotriumph.com/article4.htm>

Adjust the Valves. If you have already failed the smog test because of high HC, try lashing all your valves .002"-.004" looser, e.g., if the shop manual calls for .014", use a .016" or .018" feeler gage. This will, in effect, slightly reduce valve overlap. Reduced overlap reduces exhaust residuals in the combustion chamber, which results in a more complete burn, and hence, lower HC emissions. In the unlikely event that you have failed because of high NOx, try lashing all your valves .001"-.002" tighter. In the example above, use a .013" or .012" feeler gage instead of .014". This will, in effect, slightly increase valve overlap. Increased overlap increases exhaust residuals in the combustion chamber. (internal EGR) These residuals dilute the air/fuel mixture, which slows down the burn and lowers combustion temperatures, and hence, lower NOx emissions. Tighter lash will also slightly reduce effective compression and combustion temperature. In case you are wondering, changing valve lash ALWAYS reduces one exhaust constituent (HC or NOx) and ALWAYS increases the other.

IT IS NOT RECOMMENDED THAT THE LASH BE REDUCED BY MORE THAN .002".

<http://home.att.net/~CapriClubChicago/tips/SmogFaq5.html>

Adjusting the valve clearances wider than the recommended setting. The camshaft used on the MGB was the same from 1963-1974 1/2 with an emission effect camshaft being introduced in 1975. Other than these factory OEM camshafts, we find many MGBs have a variety of aftermarket camshafts fitted and usually have greater intake/exhaust valve open duration. The end result being increased valve open overlap periods which increase the HC and CO exhaust emission content and possibly into the "gross polluter" region, therefore, even with the OEM 1963-1974 1/2 camshaft and aftermarket camshafts, it may be necessary to adjust the exhaust valves to as much as .025" so as to reduce the exhaust emissions. We do not recommend driving your vehicle with the exhaust valve clearances set at .025", however, you might test drive your MGB and make a note of how your vehicle performs with this valve setting. What might surprise you is the engine's responsiveness at the lower and mid-range RPMs. In actual fact, you may say it runs better under all conditions including higher engine RPMs, due to improved thermal expansion which can be explained as follows: setting the exhaust valve clearance at .025" over the OEM recommended .013" results in .012" great clearance. With every .001" increase, we have approximately 2 deg. change in exhaust valve open duration. This change takes place on both sides of the cam lobe, thereby effectively delaying exhaust valve opening by 12 deg. and accelerating the exhaust valve closing by 12 deg.

<http://www.mgbmga.com/tech/mgb5.htm>

Fuel

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Choose ethanol blended gasoline -- Ethanol blended gasoline can reduce GHG emissions by 4% to 10%.

<http://www.climatechangesolutions.com/english/individuals/opportunities/transport/list2.htm>

*Run a tank full of premium gasoline through your car. The high detergent content will help clear out carbon from the engine, as will a long highway drive. Then, I suggest using Sunoco ethanol-enhanced gasoline for the test--which cuts CO output by 30 per cent and reduces unburned hydrocarbons. These fuels carry Environment Canada's EcoLogo designation, in recognition of their environmental benefits.

<http://www.consumersource.net/emissions.html>

2.Run until tank is almost empty then fill-up with high test/high octane.

<http://www.mbz.org/info/articles/misc/smog/>

****NOTE:** Filling up with premium seems good for cleaning things out, but read on and fuel up with lower octane for the actual test!**

Oxygenates that are added to gasoline function in two ways. They can replace **high-octane aromatics in the fuel, which are responsible for disproportionate amounts of carbon monoxide and unburned hydrocarbon exhaust emissions**. Oxygenates also cause engines without sophisticated engine management systems to move to the lean side of stoichiometry (the theoretically correct air-fuel ratio), thus reducing these emissions. Two percent oxygen can reduce CO by 16% and HC by 10%.

<http://www.chicagolandmgclub.com/techtips/562.html>

6. Run the engine on regular gas. Use the lowest-octane fuel that will not make the engine ping. Low-octane fuel burns easier and more completely, resulting in potentially cleaner readings on the smog test.

<http://www.4wheeloffroad.com/techarticles/78918/index1.html>

3. Run a half tank of new fuel at high speed to blow it out.

<http://www.mbz.org/info/articles/misc/smog/>

Ethanol has been used in gasoline since the 1970s, when it was used as a gasoline extender during times of gasoline shortages. These blends were known as gasohol. After that, it has been used as an octane booster, and most recently, as a means of reducing CO emissions. A blend containing 10% ethanol by volume will show an increase in pump octane of 2.5 to 3 octane numbers. Ethanol has the advantage of being easy to produce, and is a renewable energy source produced by fermentation of agricultural products, primarily corn.

<http://www.mgcars.org.uk/namqbr/techtips.htm>

10.) Run the fuel tank down as far as possible and refill it just before the test. Fuel has a 'half-life' and it does not burn well if it has been in the tank for 90 days or more. <http://www.torontotriumph.com/article4.htm>

Don't overfill your gas tank. When filling your tank, resist the impulse to get just a little bit more into the tank after the nozzle clicks off. This excess gasoline has nowhere to expand so it saturates a part of the emissions control system resulting in increased emissions.

<http://www.aircarecolorado.com/toptips.htm>

Fuel Additives

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Bad news here! I could not find objective research into these products, until I stumbled onto gold. According to US law, the EPA has to test any product

that claims to significantly reduce emissions or fuel consumption! As you can see from their summary (scroll to the bottom of the report), *the EPA did not find a single product that significantly reduced emissions*. That was all I needed to hear about fuel tank “snake oil”, but if you want to look for other information on this topic, the EPA list of “devices” will give you a raft of names to start with.

<http://www.epa.gov/orcdizux/consumer/devices.pdf>

This is a better-organized presentation of the EPA’s info.

<http://www.smartcarfinder.com/articles/gas/04.htm>

Air Filters

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5.NEW air filter

<http://www.mbz.org/info/articles/misc/smog/>

Something as simple as a dirty air filter can also cause CO levels to be too high

<http://ca.autos.yahoo.com/010815/11/8ymx.html>

9.) Use a low-restriction air cleaner set. Hellings has one about 1/2" thick with metal wire for a filtering medium. it will only filter out large rocks, but it flows very freely. <http://www.torontotriumph.com/article4.htm>

Consider installing K&N air filter elements, so you’ll never have to touch them again!

http://www.aptfast.com/Main_Index_Page.htm

- Clean and unrestricted air filter (a dirty/clogged air filter will dramatically enrich your air/fuel mixture)

<http://www.chicagolandmgclub.com/techtips/550.html>

There was an article in Hot Rod Magazine a decade or so ago on how to pass a California Emissions Test. It suggested **removing your air filter element for the duration of the test**. Remember, this type of decision happens BEFORE tuning the carbs.

Make sure your air filters and gaskets DO NOT cover the “balancing ports.” SU carbs have two holes just above, and slightly outside, where the air enters the engine. If these are covered, CO will go up (as seen on Doug Gale’s MGB).

Catalytic Converter and Exhaust

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Have no exhaust leaks in the engine compartment. A leak from either end of the exhaust manifold plays havoc with the emissions when the bonnet’s down and the car’s been idling a minute or so! (as seen on Doug Gale’s MGB)

Even if you think your vehicle is running fine, you should prepare it for emissions testing by taking it for a run on the highway. Depending upon your vehicle condition, this may take only a few minutes or it could take up to an hour. Driving at higher speeds tends to clean out sparkplugs, clear carbon off oxygen sensors, and burn residue out of the catalytic converter
<http://ca.autos.yahoo.com/010815/11/8ymx.html>

7. Take it for a half hour run on the hi-way to ensure that the emission system is good and hot. This will allow the cat. converter to operate at its normal temperature
<http://www.mbz.org/info/articles/misc/smog/>

One other cause of high HC production is a faulty Catalytic Converter. Check exhaust pipe temperature in front of and behind the Cat. You should have several hundred degrees higher temperature behind the Cat compared to your reading in front of the Cat. An example would be 350 degrees in front and 600 degrees after the Cat." . <http://h-body.org/library/hbodyfaq/hbodyfaq-2.html#2.3>

First of all, a really critical component on these MGs is the catalytic converter. To check that the ceramic material is still inside the converter, take a small wrench and gently tap the outside of the converter, if you get a hollow ringing noise, then the ceramic is no longer inside the converter. An empty converter is 0% effective on tailpipe emissions. <http://www.svmgcc.org/smog.htm>

Whenever you fit a new catalytic converter, do make sure that the carburetion is 100% correct, an over rich mixture will soon burn out a new converter.
<http://www.svmgcc.org/smog.htm>

Tires and Chassis

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Make sure your tires are properly inflated. Tires that are unevenly inflated, under-inflated or mismatched make the vehicle difficult to test on the dynamometer, and may cause the vehicle to be rejected from testing.

<http://www.aircarecolorado.com/toptips.htm>

Interestingly, I have recently learned that AirCare changes the dyno resistance for every car (based on weight, I understand). I have also learned through experimentation that MY CAR had lower CO readings with more load on the dyno during the driving test. As a result, my car might benefit from equally under inflated tires (to increase the tyre's rolling resistance) during the test. Your car? Depending on your SU needle profile at speed, it might prefer/dislike more load during the test!

Oil

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1. Change oil just before the test. <http://www.mbz.org/info/articles/misc/smog/>

Hint: A heavier-grade motor oil -- 20W50 instead of 10W30 -- will help a higher-mileage car pass emissions. The heavier oil helps seal the engine better, but don't keep 20W50 weight in the crankcase during cold weather -- it may make your car hard to start.

<http://tms.ecol.net/newcars/strt0911.htm>

4. Change the oil. We're not 100 percent sure why this works, but it does. Some have speculated that with cleaner oil, the oil that blows by the piston rings will burn more cleanly. Dave Wells' current mechanic claims it was an old trick of his, however Dave had discovered it himself some years earlier, somewhat accidentally, with his 1973 2000 OHC. He failed New Jersey's inspection, changed his oil, and then passed! (go figure!) Changing the oil seems to benefit hydrocarbon emissions the most. If it's close to your next oil change interval, go ahead and do it. If you've never had an oil change interval, get one quick. It can add years to the life of your engine. The PCV (positive crank ventilation) system of your vehicle is designed to allow your engine to breath fumes located in oil compartments (oil pan, etc.). The fumes are then burned through the combustion process. If the oil in your engine is contaminated due to inadequate oil changes, it may very well cause your vehicle to fail the inspection. Contaminated oils are high in Hydrocarbons and will present a rich mixture to the engine chambers (too much fuel). So, avoiding oil changes not only causes pre-mature engine wear but can also cause your vehicle to fail the smog inspection. Change the oil.

http://smogtips.com/six_things.html

Get your oil changed. Contaminants in old oil may affect emissions.

<http://www.consumersource.net/emissions.html>

.) Change the engine oil just before you go to test. Fresh 20/50 seals better than any oil with 50 or more miles on it. The idea is to reduce hydrocarbons (HC), and with the TR250/6's very poor bore to stroke ratio it needs all the help it can get.

<http://www.torontotriumph.com/article4.htm>

Our MG engines also have a long stroke, like the TR250. A long stroke limits RPM but increases torque (and hence drivability). It can also increase hydrocarbon emission.

Temperature and NOx

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NOx emissions are produced when the temperature of combustion is very high. A cooler engine will produce fewer NOx emissions, so according to Hot Rod Magazine, a cooler thermostat can help. NOx limits are VERY lenient for our older cars, but any cars with a working EGR valve should have little trouble with NOx. NOx can also be reduced with a slightly richer mixture, if you have some HC room to spare!

Carburetors

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Before tuning the carbs on charcoal canister-equipped cars, check that the engine is airtight! The following **MUST** be airtight:

oil cap	dipstick
valve cover	all hoses
fuel pump blanking plate	tappet covers
vacuum advance diaphragm	

These engines are supposed to draw a **small** amount of air filtered through the Charcoal Canister into the carbs. This was covered in MGA!, December 2003 I think, and Colin at Octagon reminds us that this helps keep our oil clean! If the engine is not airtight however, the carbs can draw **unfiltered air** into the engine from elsewhere and affect the mixture.

Even badly worn valve guides can be a vacuum leak at idle.

-Haynes "Zenith-Stromberg Carburetor Repair Manual"

Make sure the heat shield behind the carbs has all of the insulation on it. It seems that without the insulation, the gas can boil in the float bowls at idle, causing the mixture to change. As the mixture changes, emissions vary too!

Carburetion: - Good mechanical condition (clean; linkages free, but without excess looseness; throttle shafts unworn; fuel, vent, and overflow fittings and connections tight and unobstructed; no vacuum leaks)

- Properly adjusted (mixture, float height, slow idle, fast idle, choke, synchronization of multiple carbs.)

- Correct amount and type of oil in SU and Zenith-Stromberg dashpots (the heavier the oil, the richer the mixture on acceleration).

<http://www.chicagolandmgclub.com/techtips/550.html>

Set the idle mixture with engine fully warmed up. When adjusting for "best idle" (see below) turn the screw(s) in very small increments (about 1/16 of a turn at a time), and **allow about 15 sec** for each change to affect idle speed, on either carb. Raise the idle speed slightly. If you know what the allowable (by the state) upper limit is for your engine shoot for about 50 rpm below that with engine fully warmed up and distributor adjusted properly.

<http://home.att.net/~CapriClubChicago/tips/SmogFaq5.html>

Idle speed - The allowance for idle speed of the car is quite high. This helps quite a bit in reducing emissions. If the car has high overlap cams, the idle will be quite rough at the stock idle speed of 800 RPM and the HC and CO levels will be significantly higher. As the engine speed increases the idle becomes smoother and emissions fall. Setting the idle speed to 1200 RPM will usually produce a

significant decrease in HC and CO levels, as well as smoother idle and allow you to lean the mixture out more if you have installed larger sized injectors.

<http://www.mr2.com/TEXT/SmogCheck.html>

Note that I once received “Sample Dilution- cannot test” error message during my AirCare test, with a 700rpm idle. At a 1050rpm idle (no other changes), I had no such error message during the test. To “reset” the idle for AirCare, simply wrap the throttle connection shaft (under the arm our throttle cable attaches to) with about 5” of electrician’s tape. This temporarily holds the throttle off idle WITHOUT affecting synchronization! I will always speed the idle to maximum from now on!

One AirCare customer service manager explained that sometimes a “reversion” will take place, wherein your exhaust pulses can alternately blow exhaust out and suck fresh air in. This dilutes your sample!

We are allowed 1150RPM by AirCare in B.C.

Set your idle speed with the heater blower and headlights on. The generator/alternator adds load to the engine, so you can open the throttle a bit more without exceeding 1150RPM. This has made a very significant difference in my testing!

. The best way of getting the mixture right without a meter is to use a very accurate RPM meter. Keep leaning out the mixture until the idle drops about 50 RPM under the best idle you can normally get.

I have also found that watching the movement of the motor while leaning out the mixture can be used to tell when you have gone too lean and are getting misfires. When there are no or few misfires, the engine will have very little side-to-side motion (side to side meaning intake to exhaust direction). Every misfires causes the motor to rock noticeably front to back and there is a very obvious increase in this as the idle mixture leans out too much.

If the car has high overlap cams it will be tough to accurately measure RPM or watch the rocking motion. Your best bet is to adjust the cams for less overlap (and smoother idle) or increase the idle speed as high as you can get and still stay in the allowed test range.

<http://www.mr2.com/TEXT/SmogCheck.html>

7.) Adjust the carbs lean enough so That the engine should die when you lift a carb piston with a knife about 1/32 to 1/16 of an inch.

<http://www.torontotriumph.com/article4.htm>

Set Float height and consider a new needle and seat if you’re having irregular mixture-related problems. If worn, a needle can occasionally stick, allowing the float level to vary too high or too low!

If you have a car with a ported vacuum source (in the “bridge” area of our SUs), you can disconnect this to lean the mixture at speed. Of course, you might have to adjust idle, but a ported source draws more air with more speed, so it barely affects idle.
-Vancouver Auto-shop teacher Dave Loudon

My 1973 HIF4 SUs have no ported vacuum source. Some earlier cars did. Check this MG site about vacuum advance to check if your car has ported or manifold vacuum.

http://www.teglerizer.com/mgstuff/advance_curves.htm

Inside each air cleaner on the MGB there is an aluminum “stub stack” that gives the airflow a smooth radius into the mouth of the carb. According to dyno testing, with the K&N versions, stub stacks increase airflow (and hence power: 2hp throughout the curve over no stacks) and “the dyno’s sniffer showed a smoother air/fuel ratio.” Why not make sure they’re in your car too? They are available for the A as well.

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Test Day Procedures and Results

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Use your heater blower and lights to fine-tune the idle at the last second. Running slower? Turn off the blower or the lights. Over 1150? Turn on the blower and/or the lights.

There are several things you can do to help pass emission tests.

8.) Drive it on the freeway at approximately 60 mph for about 10 miles before you go to the test in order to be sure that the engine is at full operating temperature.

<http://www.torontotriumph.com/article4.htm>

6. Take it for inspection on a rainy/foggy day.

<http://www.mbz.org/info/articles/misc/smog/>

. During the emissions test, the technician will measure hydrocarbons(HC), carbon monoxide (CO), and oxides of nitrogen (NOx). HC(hydrocarbons) are mostly composed of unburned fuel. A misfiring cylinder will cause the HC levels to be high. CO is produced as a normal by-product of combustion but high levels can be controlled with careful fuel management and the use of a catalytic converter. If the fuel mixture going into the engine is on the rich side (too much fuel) then the CO levels will be high. Something as simple as a dirty air filter can also cause CO levels to be too high. NOx is created when combustion temperatures are high. It is often controlled by engine design, or the use of Exhaust Gas Recirculation (EGR) to lower cylinder temperatures, and the catalytic converter. Incorrect ignition timing can cause cylinder temperatures to rise and NOx emissions to skyrocket. So can a lean fuel mixture. <http://ca.autos.yahoo.com/010815/11/8ymx.html>

Robert (twelve_second_vega), a licensed California Smog Technician, writes: "When an engine is producing too much "CO's" it is ingesting too much fuel. High

"HC's" indicate how the engine is burning the fuel. Common causes of high HC's are Engine Miss, Burnt Valve or a Vacuum Leak. <http://hbody.org/library/hbodyfaq/hbodyfaq-2.html#2.3>

HC, hydrocarbons, basically unburned and partially burned fuel.

CO, carbon monoxide, a product of combustion, poisonous in high concentrations. Pre-catalyst CO level varies directly with air/fuel mixture and is commonly used to adjust the idle mixture. Proper pre-catalyst levels for cars vary from 2% for a 70's era car to .5% for modern lean-burn cars. Required post-catalyst levels are usually under 0.5%.

CO₂, carbon dioxide, also a byproduct of combustion, used to verify that you are not diluting or leaking your exhaust before it exits the tailpipe. A common trick in the early emission days was to rig cars with air injection pumps to push clean outside air into the exhaust system and thus dilute the exhaust to the point of passing.

Since CO₂ is produced during combustion and by the catalyst reducing CO and HC, true exhaust will have a much higher level of CO₂ than air. A MINIMUM limit is set on measured CO₂, if you produce less than the limit, you fail. Typical is 8%.

ballpark <http://www.mr2.com/TEXT/SmogCheck.html>

In BC, the combined CO and CO₂ numbers must be at least 6%, or else sample dilution is indicated and the test stops.

<http://www.aircare.ca/inspinfo-desc-asm.php>

Cleaner Running, the Positive Side of Emission Control

Emission control, once dirty words to many automobile enthusiasts, is now accepted as a necessary fact of life. Even those of us who drive pre-pollution control cars can do our part to minimize our cars' adverse effects on the air we breathe, and, at the same time, have our engines run better and last longer. It's not magic that is needed to accomplish this, but rather a thorough and accurate tune-up, followed by simple by-the-book maintenance. On cars equipped with emission controls, if everything is working properly, and is in proper condition, the car will pass an emissions test. If it does not pass, something on the car isn't functioning properly.

All cars work better and pollute less when brakes are not dragging, wheel bearings are properly adjusted and lubricated, and when driven sensibly.

Even wheel alignment makes its contribution
Compression:

An important factor is equal power output from each cylinder. This is largely governed by equal compression in all cylinders (assuming proper carburetion and ignition).

- Valves (clearance, seating, timing)
- Piston rings
- Head gasket
- Valve guides (not worn)
- Pushrods (not bent, correct length)
- Rocker arms and shaft (not worn)

Venting:

- Engine (crankcase breather)
- Carbs. (dashpots, overflow)
- Gearbox and Differential

Venting of assemblies is vital to their proper operation. A plugged differential vent, for example, can cause oil to be blown out past the oil seals - dangerous to the differential, a mess on your car, and polluting to the environment.

<http://www.chicagolandmgclub.com/techtips/550.html>

Solution Table

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This part of the paper is reactive. If you know what your car is doing (emission-wise), you can target exhaust gas components more specifically. This is where your AirCare report is valuable. If your car fails the AirCare emissions test, you will receive a printout detailing which exhaust gas component was over the limit. This table suggests ways to lower the three exhaust gas components tested. Note that there are usually balances between exhaust gas components! For example, richen the mixture and your NOx count goes down, but your HC and CO will increase!

To lower HC	To lower CO	To lower NOx
<ul style="list-style-type: none"> <input type="checkbox"/> Retard Timing <input type="checkbox"/> Ensure Carbs are lean BUT not lean enough to misfire! <input type="checkbox"/> Loosen Valves <input type="checkbox"/> Unplug a small Manifold Vacuum hose to lean idle <input type="checkbox"/> Unplug a small Ported Vacuum source to lean cruise <input type="checkbox"/> Have ethanol in the fuel <input type="checkbox"/> Replace a suspect Catalytic Converter 	<ul style="list-style-type: none"> <input type="checkbox"/> Remove Air Filter <input type="checkbox"/> Advance timing a few degrees <input type="checkbox"/> Lean Carbs Slightly <input type="checkbox"/> You need a minimum of 6% CO + CO2 in your exhaust, or the testing machine registers "Sample Dilution" and you fail! 	<ul style="list-style-type: none"> <input type="checkbox"/> Confirm your EGR is working. <input type="checkbox"/> Tighten Valves <input type="checkbox"/> Retard Timing <input type="checkbox"/> Richen Mixture