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Chapter 1 : Understanding Oxygen Sensors to Diagnose Fault Codes

Volume II covered the Nitrogen and Ambient Oxygen Testing, Test Series C, D, and 1. This volume, Volume III, is supposed to report on the testing with 4(X)'F oxygen turbine drivc which will duplicate the expected operating conditions!

O2 Sensor Test Information Rick Kirchoff not a member In response to several requests for more information about oxygen O2 sensors, perhaps the following information will help. These procedures are only for self powered conventional sensors. Some very new cars are using a different style sensor that is powered. Many oxygen sensors are replaced that are good to excellent. They routinely last 50, or more miles, and if the engine is in good shape, can last the life of the car. What does the O2 sensor do? It is the primary measurement device for the fuel control computer in your car to know if the engine is too rich or too lean. The O2 sensor is active anytime it is hot enough, but the computer only uses this information in the closed loop mode. Closed loop is the operating mode where all engine control sensors including the oxygen sensor are used to get best fuel economy, lowest emissions, and good power. Should the O2 sensor be replaced when the sensor light comes on in your car? Probably not, but you should test it to make sure it is alive and well. This assumes that the light you see is simply an emissions service reminder light and not a failure light. A reminder light is triggered by a mileage event , miles usually or something like key start cycles. EGR dash lights usually fall into the reminder category. Consult your owners manual, auto repair manual, dealer, or repair shop for help on what your light means. How do I know if my O2 sensor may be bad? If your car has lost several miles per gallon of fuel economy and the usual tune up steps do not improve it. This is not a pointer to O2 failure, it just brings up the possibility. Vacuum leaks and ignition problems are common fuel economy destroyers. As mentioned by others, the on board computer may also set one of several failure "codes". If the computer has issued a code pertaining to the O2 sensor, the sensor and its wiring should be tested. Usually when the sensor is bad, the engine will show some loss of power, and will not seem to respond quickly. What will damage my O2 sensor? Home or professional auto repairs that have used silicone gasket sealer that is not specifically labeled "oxygen sensor safe", "Sensor safe", or something similar, if used in an area that is connected to the crankcase. This includes valve covers, oil pan, or nearly any other gasket or seal that controls engine oil. Leaded fuel will ruin the O2 sensor in a short time. If a car is running rich over a long period, the sensor may become plugged up or even destroyed. Just shorting out the sensor output wire will not usually hurt the sensor. This simply grounds the output voltage to zero. Once the wiring is repaired, the circuit operates normally. See how does an oxygen sensor work. Will testing the O2 sensor hurt it? Almost always, the answer is no. As noted by other posters, a cheap voltmeter will not be accurate, but will cause no damage. Resistance measurements send voltage into a circuit and check the amount returning. How does an O2 sensor work? An oxygen sensor is a chemical generator. It is constantly making a comparison between the oxygen inside the exhaust manifold and air outside the engine. If this comparison shows little or no oxygen in the exhaust manifold, a voltage is generated. The output of the sensor is usually between 0 and 1. All spark combustion engines need the proper air fuel ratio to operate correctly. For gasoline this is When the engine has more fuel than needed, all available oxygen is consumed in the cylinder and gasses leaving through the exhaust contain almost no oxygen. This sends out a voltage greater than 0. If the engine is running lean, all fuel is burned, and the extra oxygen leaves the cylinder and flows into the exhaust. In this case, the sensor voltage goes lower than 0. Usually the output range seen seen is 0. The sensor does not begin to generate its full output until it reaches about degrees F. Prior to this time the sensor is not conductive. It is as if the circuit between the sensor and computer is not complete. The mid point is about 0. This is neither rich nor lean. In many cars, the computer sends out a bias voltage of 0. If the sensor is not warm, or if the circuit is not complete, the computer picks up a steady 0. Since the computer knows this is an "illegal" value, it judges the sensor to not be ready. It remains in open loop operation, and uses all sensors except the O2 to determine fuel delivery. Any time an engine is operated in open loop, it runs somewhat rich and makes more exhaust emissions. This translates into lost power, poor fuel economy and air pollution. The O2 sensor is constantly in a state of transition between high and low voltage. Manfucturers call this crossing of the 0. The higher the number of O2 cross counts, the better the sensor and other parts of the computer control system are working. It is important to remember that the O2 sensor is comparing the amount of oxygen inside and outside the engine. If the outside of the sensor should become blocked, or coated with oil, sound insulation, undercoating or antifreeze among other things , this comparison is not possible. How can I test my O2 sensor? They can be tested both in the car and out. If you have a high impedence volt meter, the procedure is fairly simple. It will help you to have some background on the way the sensor does its job. Read, "How does an O2 sensor work?

Chapter 2 : O2 Sensor Test Information & Resetting the Light

f testing occurred during exercise, the record must show improvement of the saturation level with oxygen I al records must be complete, legibly signed, and dated with the physician's name clearly indicated 5.

Health and lung problems Foreign body in eye Cause of accident in construction? Erection equipment failure 2. Falling of persons from height 3. Non stop working by worker 6. Up safe work methods 7. Collapsing of earth during trench excavation 8. Failure of use safety equipment 9. Working a height without safety belt 51 General safety precautions in construction? Adequate first aid equipment should be kept ready 2. Adequate fire fighting equipment should be available 3. All general electrical rules should be followed 4. Work men at height should be wear safety belts 6. Work men handling cement should be provided with goggles, rubber gloves and rubber boots by nose mask. The moving parts of grinding machines used construction site should be covered with guards 8. The moving parts of grinding machines used construction site should be covered with guards 9. Excavated material should not kept near the excavated Very short duration of work red flags must be hoisted and more duration red banners must be stretched Defective tools should not be used The worker should not carry tools in his hands when climbing a ladder Excavation should be guarded by suitable fencing How to erect scaffolding? It should be erected on levels firm ground 2. It is constructed using metal pipes and wooden boards 4. It should be design and constructed from good and sound material 5. Not to be erected on loose earth 6. Clamps should fixed 8. Sole plate is necessary the base of vertical pipe Safety precaution of scaffold? Wooden board not be painted 2. Wooden board should not to any cracks 3. Clamps should fixed and good quality 5. Boards thickness should be 3. The construction must be rigid, properly based 7. Use of good and sound materials 8. The wooden bellies has not joints 9. Vertical poles should not be more than 6 feet Chains, ropes used for the suspension of scaffoldings Never throw any materials from height Use safety harness while working at above 6 feet Properly ties to be arrangement 54 What control measures area necessary in confined space? Enter with air line BA sets 2. Use 24v flame proof hand lamps 3. A hole watch to be kept near man hole 4. Keep fire fighting equipment ready 5. Gas test to be done to check for oxygen level 6. Use ropes and harness 9. The spaces clean before entry Use non sparking tools it there is any risk of flammable vapors being present. Safety rules when using ladders? The foot wear is not greasy, oily and muddy and has a good grip on the rungs. When climbing or coming down a ladder should be face the ladder side and had on with both hand. Carry light tools in pockets in a shoulder bag. Hold on with at least new hand if use of both hands then, use safety belt 5. Never climb higher than the third rung from the top on straight or second tired from the top on extension ladder. Step ladder must be fully open and the divider locked 7. Metal ladder shall not be used near electrical equipments. Metal ladder shall not be place on firm footing and at angle of 75 9. Any ladder found defect in any way should be marked do not use Ladder shall not be placed on a box or drum. Rubber protection on head and heel of a ladder is necessary. Safety rules insuring oxygen cylinders? Oxygen cylinders should not be kept near combustible materials. Oxygen cylinders should not be handled with grassy hands or gloves. Oxygen cylinders and their fittings should not be tested with oil based soap solution. Oxygen cylinders and other combustible gas cylinders should not be stored together. The top cover of the cylinder should be kept in position and screwed safety when not in use. Cylinders should not be used as rollers for moving materials 7. Oxygen must not be use for ventilating confined spaces. Safety rules in using compressed air? Only authorized persons should used compressed air. The body or clothes should not be cleaned with compressed air. Compressed air hose pipes should not be placed across passage ways 4. Leakage of compressed air should not be tested with hands. While working with tools run by compressed air safety shoes are to be used. The tools should not be kept on position when not in use. Handling of compressed gas cylinders? They are not to be dragged or dropped 2. They should be stored in dry and well ventilated places 3. Chins and slings should not be used for lifting cylinders. Cylinders should not be stored near hot sources 6. Acetylene cylinders should not be stored horizontally 7. Empty cylinders and fully cylinders should be stored separately 8. Leakage cylinders removed to open space and release the gas without getting ignited. Storage of gas cylinders. Cylinders should stored in a safe, dry and well ventilated store 2. Oxygen cylinders should be stored horizontally and acetylene cylinders shall be stored vertically. The standing cylinders should be secured properly avoid falling. Flammable gas shall be stored at least 50 feet away from another building 5. Oxygen cylinder shall never be stored necessary flammable gas cylinder 6. Empty cylinder shall be identified by marking with a chalk MT and checked for damage before returning to suppliers. Cylinders should not be kept as supports. Give a brief note about crane and LE? Only authorized and competent person should operated cranes 2. The correct sling must be used for the load to be lifts 3. Lifting equipment must be certified from competent authority and mark with its SWL 4. Never be used for loads excess of its SWL 5. Cables and slings must be padded when passing over sharp edges of equipments 6.

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Chapter 3 : Go Portable Oxygen â€“ Portable Oxygen Concentrator Reviews and Deals

Synthetic basestocks (Group V Oils) have oxidation rates that vary because of varying structures. Alkylaromatics, for example, contain aromatic rings, and hence oxidize faster.

This is especially true in smaller, shallower streams. In larger, deeper rivers, some vertical stratification of dissolved oxygen might occur. The DO levels in and below riffle areas, waterfalls, or dam spillways are typically higher than those in pools and slower-moving stretches. If you wanted to measure the effect of a dam, it would be important to sample for DO behind the dam, immediately below the spillway, and upstream of the dam. Since DO levels are critical to fish, a good place to sample is in the pools that fish tend to favor or in the spawning areas they use. An hourly time profile of DO levels at a sampling site is a valuable set of data because it shows the change in DO levels from the low point just before sunrise to the high point sometime in the midday. However, this might not be practical for a volunteer monitoring program. It is important to note the time of your DO sampling to help judge when in the daily cycle the data were collected. Percent saturation is the amount of oxygen in a liter of water relative to the total amount of oxygen that the water can hold at that temperature. DO samples are collected using a special BOD bottle: You can fill the bottle directly in the stream if the stream is wadable or boatable, or you can use a sampler that is dropped from a bridge or boat into water deep enough to submerse the sampler. Samplers can be made or purchased. Dissolved oxygen is measured primarily either by using some variation of the Winkler method or by using a meter and probe. Winkler Method The Winkler method involves filling a sample bottle completely with water no air is left to bias the test. The dissolved oxygen is then "fixed" using a series of reagents that form an acid compound that is titrated. Titration involves the drop-by-drop addition of a reagent that neutralizes the acid compound and causes a change in the color of the solution. The point at which the color changes is the "endpoint" and is equivalent to the amount of oxygen dissolved in the sample. The sample is usually fixed and titrated in the field at the sample site. It is possible, however, to prepare the sample in the field and deliver it to a lab for titration. Dissolved oxygen field kits using the Winkler method are relatively inexpensive, especially compared to a meter and probe. Replacement reagents are inexpensive, and you can buy them already measured out for each test in plastic pillows. You can also buy the reagents in larger quantities, in bottles, and measure them out with a volumetric scoop. The advantage of the pillows is that they have a longer shelf life and are much less prone to contamination or spillage. The advantage of buying larger quantities in bottles is that the cost per test is considerably less. The major factor in the expense of the kits is the method of titration they use eyedropper, syringe-type titrator, or digital titrator. Eyedropper and syringe-type titration is less precise than digital titration because a larger drop of titrant is allowed to pass through the dropper opening and, on a micro-scale, the drop size and thus the volume of titrant can vary from drop to drop. A digital titrator or a buret which is a long glass tube with a tapered tip like a pipet permits much more precision and uniformity in the amount of titrant that is allowed to pass. If your program requires a high degree of accuracy and precision in DO results, use a digital titrator. A kit that uses an eye dropper-type or syringe- type titrator is suitable for most other purposes. The lower cost of this type of DO field kit might be attractive if you are relying on several teams of volunteers to sample multiple sites at the same time. Meter and Probe A dissolved oxygen meter is an electronic device that converts signals from a probe that is placed in the water into units of DO in milligrams per liter. Most meters and probes also measure temperature. The probe is filled with a salt solution and has a selectively permeable membrane that allows DO to pass from the stream water into the salt solution. The DO that has diffused into the salt solution changes the electric potential of the salt solution and this change is sent by electric cable to the meter, which converts the signal to milligrams per liter on a scale that the volunteer can read. DO meters are expensive compared to field kits that use the titration method. You can also measure the DO levels at a certain point on a continuous basis. The results are read directly as milligrams per liter, unlike the titration methods, in which the final titration result might have to be converted by an equation to milligrams per liter. However, DO meters are more fragile than field kits, and repairs to a damaged meter can be costly. This means that only one team of samplers can sample DO and they will have to do all the sites. With field kits, on the other hand, several teams can sample simultaneously. Laboratory Testing of Dissolved Oxygen If you use a meter and probe, you must do the testing in the field; dissolved oxygen levels in a sample bottle change quickly due to the decomposition of organic material by microorganisms or the production of oxygen by algae and other plants in the sample. This will lower your DO reading. If you are using a variation of the Winkler method, it is possible to "fix" the sample in the field and then deliver it to a lab for titration. This might be preferable if you are sampling under adverse conditions or if you want to reduce the time spent collecting samples. It is also a little easier to titrate samples in the lab, and more quality control is possible because the same person can do all the titrations. How to collect and analyze samples The procedures for collecting and analyzing samples for dissolved oxygen consist of the following tasks: In addition to the standard sampling equipment and apparel, when sampling for dissolved oxygen, include the following equipment: Operating manual for the meter and probe Extra membranes and electrolyte solution for the probe Extra batteries for the meter Extension pole Data sheet for dissolved oxygen to record results TASK 2 Confirm that you are at the proper location The directions for sampling should provide specific information about the exact point in the stream from which you are to sample; e. The most common sizes are milliliters mL and 60 mL. Be sure that you are using the correct volume for the titration method that will be used to determine the amount of DO. There is usually a white label area on the bottle, and this may already be numbered. If so, be sure to record that number on the field data sheet. If your bottle is not already numbered, place a label on the bottle not on the cap because a cap can be inadvertently placed on a different bottle and use a waterproof marker to write in the site number. If you are collecting duplicate samples, label the duplicate bottle with the correct code, which should be determined prior to sampling by the lab supplying the bottles. Use the following procedure for collecting a sample for titration by the Winkler method: Remember that the water sample must be collected in such a way that you can cap the bottle while it is still submerged. That means that you must be able to reach into the water with both arms and the water must be deeper than the sample bottle. Carefully wade into the stream. Stand so that you are facing one of the banks. Collect the sample so that you are not standing upstream of the bottle. Remove the cap of the BOD bottle. Slowly lower the bottle into the water, pointing it downstream, until the lower lip of the opening is just submerged. Allow the water to fill the bottle very gradually, avoiding any turbulence which would add oxygen to the sample. Keep the bottle under water and allow it to overflow for 2 or 3 minutes to ensure that no air bubbles are trapped. Cap the bottle while it is still submerged. Lift it out of the water and look around the "collar" of the bottle just below the bottom of the stopper. If you see an air bubble, pour out the sample and try again. Remove the stopper and add the fixing reagents to the sample. Immediately insert the stopper so air is not trapped in the bottle and invert several times to mix. This solution is caustic. Rinse your hands if you get any solution on them. An orange-brown flocculent precipitate will form if oxygen is present. Wait a few minutes until the floc in the solution has settled. Again invert the bottle several times and wait until the floc has settled. This ensures complete reaction of the sample and reagents. The sample is now fixed, and atmospheric oxygen can no longer affect it. If you are taking the sample to the lab for titration, no further action is necessary. You can store the sample in a cooler for up to 8 hours before titrating it in a lab. If you are titrating the sample in the field, see Task 4: Cap underwater when full. Using a DO Meter If you are using a dissolved oxygen meter, be sure that it is calibrated immediately prior to use. Check the cable connection between the probe and the meter. Make sure that the probe is filled with electrolyte solution, that the membrane has no wrinkles, and that there are no bubbles trapped on the face of the membrane. Or, you can measure a water sample that is saturated with oxygen, as follows. You can also use this procedure for testing the accuracy of the Winkler method. Fill a l-liter beaker or bucket of tap water. You may want to bring a gallon jug with water in it for this purpose. Mark the bottle number as "tap" on the lab sheet. Pour this water back and forth into another beaker 10 times to saturate the water with oxygen. Use the meter to measure the water temperature and record it in the water temperature column on the field data sheet. Find the water temperature of your "tap" sample in Table 5. Use the meter to compare the dissolved oxygen concentration of your sample with the maximum concentration at that temperature in the table. Your sample should be within 0. Once the meter is turned on, allow 15 minute equilibration before calibrating. After calibration, do not turn the meter off until the sample is analyzed. Once you have verified that the meter is working properly, you are ready to measure the DO levels at the sampling site. You might need an extension pole this can be as simple as a piece of wood to get the probe to the proper sampling point. Simply secure the probe to the end of the extension pole. To use the probe, proceed as follows:

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Chapter 4 : o2-sensor-testing

coke with hot oxygen injection corresponds to an added saving of $, or more annually at the coke oven. The capital and installation costs for a tpd furnace is estimated at $ million.

The sensors must provide accurate information otherwise driveability problems, increased fuel consumption and emission failures can result. One of the key sensors in this system is the oxygen sensor. The first O2 sensor was introduced in on a Volvo Federal emission laws made O2 sensors virtually mandatory on all cars and light trucks built since And now that OBD-II regulations are here and newer vehicles , many vehicles are now equipped with multiple O2 sensors, some as many as four! The O2 sensor is mounted in the exhaust manifold to monitor how much unburned oxygen is in the exhaust as the exhaust exits the engine. Monitoring oxygen levels in the exhaust is a way of gauging the fuel mixture. It tells the computer if the fuel mixture is burning rich less oxygen or lean more oxygen. A lot of factors can affect the relative richness or leanness of the fuel mixture, including air temperature, engine coolant temperature, barometric pressure, throttle position, air flow and engine load. Consequently, any problems with the O2 sensor can throw the whole system out of whack. This produces a corresponding change in the O2 sensor reading. The result is a constant flip-flop back and forth from rich to lean which allows the catalytic converter to operate at peak efficiency while keeping the average overall fuel mixture in proper balance to minimize emissions. When no signal is received from the O2 sensor, as is the case when a cold engine is first started or the 02 sensor fails , the computer orders a fixed unchanging rich fuel mixture. This is referred to as "open loop" operation because no input is used from the O2 sensor to regulate the fuel mixture. A bad coolant sensor can also prevent the system from going into closed loop because the computer also considers engine coolant temperature when deciding whether or not to go into closed loop. How it Works The O2 sensor works like a miniature generator and produces its own voltage when it gets hot. Inside the vented cover on the end of the sensor that screws into the exhaust manifold is a zirconium ceramic bulb. The bulb is coated on the outside with a porous layer of platinum. Inside the bulb are two strips of platinum that serve as electrodes or contacts. The outside of the bulb is exposed to the hot gases in the exhaust while the inside of the bulb is vented internally through the sensor body to the outside atmosphere. Older style oxygen sensors actually have a small hole in the body shell so air can enter the sensor, but newer style O2 sensors "breathe" through their wire connectors and have no vent hole. Venting the sensor through the wires rather than with a hole in the body reduces the risk of dirt or water contamination that could foul the sensor from the inside and cause it to fail. The difference in oxygen levels between the exhaust and outside air within the sensor causes voltage to flow through the ceramic bulb. The greater the difference, the higher the voltage reading. An oxygen sensor will typically generate up to about 0. When the O2 sensor reading goes lean low voltage , the computer reverses again making the fuel mixture go rich. This constant flip-flopping back and forth of the fuel mixture occurs with different speeds depending on the fuel system. The transition rate is slowest on engines with feedback carburetors, typically once per second at rpm. Engines with throttle body injection are somewhat faster 2 to 3 times per second at rpm , while engines with multiport injection are the fastest 5 to 7 times per second at rpm. The oxygen sensor must be hot about degrees or higher before it will start to generate a voltage signal, so many oxygen sensors have a small heating element inside to help them reach operating temperature more quickly. The heating element can also prevent the sensor from cooling off too much during prolonged idle, which would cause the system to revert to open loop. Heated O2 sensors are used mostly in newer vehicles and typically have 3 or 4 wires. Older single wire O2 sensors do not have heaters. When replacing an O2 sensor, make sure it is the same type as the original heated or unheated. On V6 or V8 engines with dual exhausts, this means up to four O2 sensors one for each cylinder bank and one after each converter may be used. This includes keeping an eye on anything that might cause emissions to increase. The OBDII system compares the oxygen level readings of the O2 sensors before and after the converter to see if the converter is reducing the pollutants in the exhaust. If it sees little or no change in oxygen level readings, it means the converter is not working properly. Sensor Diagnosis O2 sensors are amazingly rugged considering the operating environment they live in. But O2 sensors do wear out and eventually have to be replaced. The performance of the O2 sensor tends to diminish with age as contaminants accumulate on the sensor tip and gradually reduce its ability to produce voltage. This kind of deterioration can be caused by a variety of substances that find their way into the exhaust such as lead, silicone, sulfur, oil ash and even some fuel additives. The sensor can also be damaged by environmental factors such as water, splash from road salt, oil and dirt. This happens because the flip-flopping of the fuel mixture is slowed down which reduces converter efficiency. The effect is more noticeable on engines with multiport fuel injection MFI than electronic carburetion or throttle body injection because the fuel ratio changes much more rapidly on MFI applications. If the sensor dies altogether, the result can be a fixed, rich fuel mixture. Default on most fuel injected applications is mid-range after three minutes. This causes a big jump in fuel consumption as well as emissions. And if the converter overheats because of the rich mixture, it may suffer damage. The only way to know if the O2 sensor is doing its job is to inspect it regularly. A good time to check the sensor is when the spark plugs are changed. You can use the graphing features to watch the transitions of the O2 sensors voltage. A good O2 sensor should produce an oscillating waveform at idle that makes voltage transitions from near minimum 0. Making the fuel mixture artificially rich by feeding propane into the intake manifold should cause the sensor to respond almost immediately within milliseconds and go to maximum 0. If the O2 sensor circuit opens, shorts or goes out of range, it may set a fault code and illuminate the Check Engine or Malfunction Indicator Lamp. If additional diagnosis reveals the sensor is defective, replacement is required. But many O2 sensors that are badly degraded continue to work well enough not to set a fault code-but not well enough to prevent an increase in emissions and fuel consumption. The absence of a fault code or warning lamp, therefore, does not mean the O2 sensor is functioning properly. Sensor Replacement Any O2 sensor that is defective obviously needs to be replaced. But there may also be benefits to replacing the O2 sensor periodically for preventive maintenance. Replacing an aging O2 sensor that has become sluggish can restore peak fuel efficiency, minimize exhaust emissions and prolong the life of the converter. Unheated 1 or 2 wire wire O2 sensors on through early s vehicles can be replaced every 30, to 50, miles. Heated 3 and 4-wire O2 sensors on mids through mids applications can be changed every 60, miles. Testimonials I love the look of the program. The idea of using Wizards for some of the most common tasks that people would use it for was a stroke of genius. It is one of the best investments that I have ever made when it comes to my autos! Two thumbs up AND five stars! I am so happy with both your product and your service. Once again than you very much.

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Chapter 5 : Dissolved Oxygen and Biochemical Oxygen Demand | Monitoring & Assessment | US EPA

In this video I'll go over in detail how an Oxygen Sensor works and operates, also how you can diagnose and replace a bad oxygen sensor, using nothing but a basic multimeter.

S1, mk1, mk4, T3 "free candy" edition DIY: Oxygen Sensor Testing 1 Hi guys, Just wanted to post a link of a website that is very informative when i comes to diagnosing O2 sensors in our cars. I know its been mentioned before. At this point, the search query will turn this thread up quicker than the other links i have found. Oxygen Sensor Information In response to several requests for more information about Oxygen O2 sensors, perhaps the following information will help. These procedures are only for self powered conventional sensors. Some very new cars are using a different style sensor that is powered. They routinely last 50, or more miles, and if the engine is in good shape, can last the life of the car. What does the O2 sensor do? It is the primary measurement device for the fuel control computer in your car to know if the engine is too rich or too lean. The O2 sensor is active anytime it is hot enough, but the computer only uses this information in the closed loop mode. Closed loop is the operating mode where all engine control sensors including the Oxygen sensor are used to get best fuel economy, lowest emissions, and good power. Should the O2 sensor be replaced when the sensor light comes on in your car? Probably not, but you should test it to make sure it is alive and well. This assumes that the light you see is simply an emissions service reminder light and not a failure light. A reminder light is triggered by a mileage event , miles usually or something like key start cycles. EGR dash lights usually fall into the reminder category. Consult your owners manual, auto repair manual, dealer, or repair shop for help on what your light means. How do I know if my O2 sensor may be bad? If your car has lost several miles per gallon of fuel economy and the usual tune up steps do not improve it. Vacuum leaks and ignition problems are common fuel economy destroyers. As mentioned by others, the on board computer may also set one of several failure "codes". Usually when the sensor is bad, the engine will show some loss of power, and will not seem to respond quickly. What will damage my O2 sensor? Home or professional auto repairs that have used silicone gasket sealer that is not specifically labeled "Oxygen sensor safe", "Sensor safe", or something similar, if used in an area that is connected to the crankcase. This includes valve covers, oil pan, or nearly any other gasket or seal that controls engine oil. Leaded fuel will ruin the O2 sensor in a short time. If a car is running rich over a long period, the sensor may become plugged up or even destroyed. Just shorting out the sensor output wire will not usually hurt the sensor. This simply grounds the output voltage to zero. Once the wiring is repaired, the circuit operates normally. See how does an Oxygen sensor work. Will testing the O2 sensor hurt it? Almost always, the answer is no. As noted by other posters, a cheap voltmeter will not be accurate, but will cause no damage. Resistance measurements send voltage into a circuit and check the amount returning. How does an O2 sensor work? An Oxygen sensor is a chemical generator. It is constantly making a comparison between the Oxygen inside the exhaust manifold and air outside the engine. If this comparison shows little or no Oxygen in the exhaust manifold, a voltage is generated. The output of the sensor is usually between 0 and 1. All spark combustion engines need the proper air fuel ratio to operate correctly. For gasoline this is When the engine has more fuel than needed, all available Oxygen is consumed in the cylinder and gasses leaving through the exhaust contain almost no Oxygen. This sends out a voltage greater than 0. If the engine is running lean, all fuel is burned, and the extra Oxygen leaves the cylinder and flows into the exhaust. In this case, the sensor voltage goes lower than 0. Usually the output range seen seen is 0. Prior to this time the sensor is not conductive. It is as if the circuit between the sensor and computer is not complete. The mid point is about 0. This is neither rich nor lean. In many cars, the computer sends out a bias voltage of 0. If the sensor is not warm, or if the circuit is not complete, the computer picks up a steady 0. Since the computer knows this is an "illegal" value, it judges the sensor to not be ready. It remains in open loop operation, and uses all sensors except the O2 to determine fuel delivery. Any time an engine is operated in open loop, it runs somewhat rich and makes more exhaust emissions. This translates into lost power, poor fuel economy and air pollution. The O2 sensor is constantly in a state of transition between high and low voltage. Manfucturers call this crossing of the 0. The higher the number of O2 cross counts, the better the sensor and other parts of the computer control system are working. It is important to remember that the O2 sensor is comparing the amount of Oxygen inside and outside the engine. If the outside of the sensor should become blocked, or coated with oil, sound insulation, undercoating or antifreeze, among other things , this comparison is not possible. How can I test my O2 sensor? They can be tested both in the car and out. If you have a high impedence volt meter, the procedure is fairly simple. Read how does an O2 sensor work first. Testing O2 sensors that are installed The engine must first be fully warm. If you have a defective thermostat, this test may not be possible due to a minimum temperature required for closed loop operation. Attach the positive lead of a high impedence DC voltmeter to the Oxygen sensor output wire. This wire should remain attached to the computer. You will have to back probe the connection or use a jumper wire to get access. The negative lead should be attached to a good clean ground on the engine block or accessory bracket. Cheap voltmeters will not give accurate results because they load down the circuit and absorb the voltage that they are attempting to measure. Most if not all digital voltmeters meet this need. Few if any non-powered analog needle style voltmeters do. Check the specs for your meter to find out. Set your meter to look for 1 volt DC. Many late model cars use a heated O2 sensor. These have either two or three wires instead of one. Heated sensors will have 12 volts on one lead, ground on the other, and the sensor signal on the third. If you have two or three wires, use a 15 or higher volt scale on the meter until you know which is the sensor output wire. When you turn the key on, do not start the engine. You should see a change in voltage on the meter in most late model cars. If not, check your connections. You should run the engine above rpm for two minutes to warm the O2 sensor and try to get into closed loop. Closed loop operation is indicated by the sensor showing several cross counts per second. It may help to rev the engine between idle and about rpm several times. The computer recognizes the sensor as hot and active once there are several cross counts. You are looking for voltage to go above and below 0. If you see less than 0. If the voltage is near the middle, you may not be hot yet. Run the engine above rpm again. If the reading is steady low, add richness by partially closing the choke or adding some propane through the air intake. Be very careful if you work with any extra gasoline, you can easily be burned or have an explosion. If the voltage now rises above 0. If the voltage is steady high, create a vacuum leak. You can also use the power brake vacuum supply hose. If this drives the voltage to 0.

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Chapter 6 : Part 1 -How to Test the Oxygen Sensors (Ford L, L)

When the bulb of the O2 sensor is exposed to hot exhaust, the difference in oxygen levels across the bulb creates a low voltage somewhere between and volts. For this test you will need a.

Click to Get Book Here By Mandy Concepcion The O2 sensor measures the oxygen content of the exhaust. In other words, if the oxygen content is low it produces a high voltage 0. Although theoretically the O2 sensor should cycle between 0. A GM O2 sensor signal stuck at mV is an indication of an open O2 sensor circuit signal wire or faulty O2 signal ground. The mV value GM is called a bias voltage and it is not the same for all manufacturers. Some manufacturers employ a dedicated O2 sensor ground. Such a ground lead is attached to the engine block or chassis and feeds an ECM O2 ground pin only. The O2 circuit is then grounded through the inside of the ECM electronic board by this ground wire. A loss of this ground would also put the O2 sensor signal at around mV, which also makes it look like an open circuit. The same holds true for Chrysler, but these use a different O2 bias voltage, which is usually 2. In other words, they tend to shift their cycling to the upper side or rich side of the voltage scale. The O2 sensor cycle is a direct result of the ECM response to the changes in the mixture. The catalytic converter needs the O2 sensor cycling at its proper amplitude and frequency for it to function at its maximum efficiency. An EGR valve problem will send the O2 signal high as well. A big misconception among technicians trying to understand O2 sensors is that they cycle by themselves. Excess oxygen in the form of regular ambient air will send the O2 sensor voltage signal low under 0. A stuck open EGR valve will create a lack of oxygen in the exhaust, since the re-circulating exhaust has all its oxygen already burnt. So, be aware of the fact that a vehicle might be running lean because the ECM sees a rich O2 signal due to a defective stuck open EGR valve. After an engine has ran through its warm up period O2 sensor has no effect on engine operation while the engine is cold , the ECM then looks for the O2 value. If the signal is on the rich side above 0. The amount of injector pulse correction is proportional to the voltage seen by the ECM at the O2 sensor signal wire. The higher the voltage the more the ECM reduces on-time to the injector. The lower the voltage the more the ECM increases the injector on-time. The ECM is constantly doing exactly just that, slightly increasing and decreasing injector pulsation. The constant adjustment is what gives the O2 sensor signal the switching appearance sine wave on the scope screen. The fact that the O2 sensor signal is switching rich-lean-rich-lean also reveals that the ECM is controlling the injector pulsation and therefore that the system is in close loop mode. The O2 sensor not only has to cycle, it also has to cycle fast enough proper frequency and wide enough proper amplitude. At least one cycle per second 1 Hz must be seen at the signal wire in order for the O2 to be considered good not lazy. A one cycle per second will make the scope trace go across the 0. A slow O2 sensor will have a damaging effect on the catalytic converter and release excessive amounts of emissions to the atmosphere. A cycle are the complete rich and lean crests of the O2 sensor signal, while crossing the 0. The higher the voltage seen at the O2 signal line the more the ECM reduces pulsation to the injectors. The lower the voltage seen at the O2 signal line the more the ECM increases injector pulsation. This is the reason why an O2 sensor that is not reading the mixture properly, at full amplitude and frequency, will actually misguide the ECM into a wrong fuel control pattern. The post catalytic O2 sensor was originally responsible for only monitoring catalytic converter efficiency. On most systems, the post converter O2 sensor signal should never mimic or follow the pre-cat O2 signal. That would indicate a defective or low oxygen storage capability at the converter. On early OBD II systems, the post-cat O2 sensor should show little or no voltage fluctuations on a scope waveform, since all the mixture fluctuations are being absorbed by the catalytic converter. With an LOC, the pre and post O2 sensors cycle at the same rate. These converters are tested by measuring the lag-time between the two signals. These simple steps should be followed whenever testing O2 sensors. Scan the vehicle for any O2 sensor codes and analyze the data stream PID. O2 sensor voltage should cycle normally with proper amplitude and frequency. An O2 sensor stuck at a fixed bias voltage is an indication of an open O2 circuit or lack of O2 sensor dedicated ground. If possible use a graphing multi-meter to analyze the O2 sensor data to determine any possible problems. While reading the scan values, goose the throttle and observe for O2 sensor minimum and maximum values 0. Although this is not a conclusive evidence of correct O2 sensor operation, it serves as a preliminary indication of proper operation. Some automotive manufacturers employ a dedicated O2 sensor ground wire that is grounded somewhere at the engine block or chassis. A loss or rupture of this ground wire will render the O2 sensor useless. The main engine ground does not feed this type of O2 sensor circuit. Verify the O2 sensor wire integrity. Most O2 sensors are biased and an open signal wire will give a reading of whatever the bias voltage is. Finally, verify for correct O2 sensor operation with a scope or graphing multi-meter. Check for proper amplitude and frequency. Remember that the scanner O2 sensor readings are only interpreted values and may not show the real voltage reading. This is the reason for doing this final manual test.

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Chapter 7 : What the Home Mechanic Needs to Know about O2 Sensors

In other words, if the oxygen content is low it produces a high voltage (Volts - Rich mixture) and if the oxygen content is high it produces a low voltage (Volts - Lean mixture). Although theoretically the O2 sensor should cycle between volts and volts, in reality it cycles between volts and volts.

I would like to try and diagnose the problem myself instead of just paying for the dealer to guess. Also, when determined which sensor has the problem, the scan tool refers to Sensor 2 Bank 1 or Sensor 2 Bank 2. Which sensor are they referring to? Can I just remove the oxygen sensors and plug the holes? These sensors, or inputs, send information to the vehicle computer microprocessor which processes the information, then the computer will determine what action should be taken and sends a signal to several output devices to change or control functions of the engine, transmission, ride, or any other operations. Oxygen sensors act as low-voltage producers, such as how a microphone uses piezoelectric generation to produce an electrical voltage signal from mechanical vibration. An example of this is an oxygen sensor O2 , which acts like a miniature generator and produces its own voltage when it gets hot. The first oxygen sensor was used on a Volvo in California vehicles started using oxygen sensors in , and by federal emission laws made O2 sensors virtually mandatory on all cars and light trucks. The O2 sensors are always located in the exhaust and monitor how much unburned oxygen is present in the exhaust. The O2 sensor used in most vehicles is a voltage generating sensor. The tip of the sensor, which is inserted into the exhaust, has a bulb that is coated with zirconium ceramic on the inside and a porous platinum on the outside. Inside the bulb are two strips of platinum that serve as electrodes, or contacts. The inside of the bulb is vented through the sensor housing to the outside atmosphere. The O2 sensors are constantly measuring the oxygen content inside the exhaust flow and comparing it to the air outside of the exhaust. When the bulb of the O2 sensor is exposed to hot exhaust, the difference in oxygen levels across the bulb creates a low voltage somewhere between 0. For this test you will need a scanner to read the oxygen sensor voltage. We will be using an affordable Actron scanner that can be purchased at any local parts store. If the fuel mixture is burning rich, less oxygen will be present in the exhaust and the voltage will be above 0. If the fuel mixture is burning lean, more oxygen will be present in the exhaust and the voltage will be below 0. This is difficult for the engine controller to achieve. On a normal operating O2 sensor you should see the voltage bounce around quite a bit from rich to lean. A simple test using the scanner to see if the O2 sensor is capable of reading correctly while monitoring the O2 voltage is to make the fuel mixture artificially rich by feeding propane into the intake manifold or tapping the accelerator several times quickly. You should see the O2 voltage go high, or rich. Oxygen sensors containing three or more wires are called heated O2 sensors. They will warm up and reach operating temperature faster, which allows the engine controller to go into closed loop faster to help reduce emissions sooner. If you have a fault code for an O2 heater circuit failure on one of these multiple wire sensors, usually the sensor is defective. If an O2 sensor failure occurs in the sensor or its wiring, it can prevent the system from going into closed loop causing a constant rich fuel condition. When diagnosing the system, if you are monitoring loop status using your scanner, remember only three things will keep a system from going into closed loop: Contaminants will accumulate on the sensor tip and over time gradually reduce its ability to produce voltage. The sensor can become sluggish and take longer to react to oxygen changes in the exhaust, causing emissions and fuel consumption to rise. A sensor can become contaminated and destroyed by several outside elements that can accidently be introduced into the exhaust system such as coolant from a leak, lead from the wrong kind of fuel, using the wrong type of RTV Room Temperature Vulcanization sealant, phosphorus from oil burning, etc. Corvettes having four O2 sensors are using the two mounded post catalytic converter downstream O2 sensors to monitor catalytic converter efficiency. These O2 sensors operate just like the low-voltage O2 sensors mounted in or near the exhaust manifolds. Some Corvette owners complain that a fault code is always present after installing an aftermarket exhaust with high-flow catalytic converters. The fault code is caused because the exhaust is flowing faster and cooler than the factory O2 sensor is programmed for. A power programmer or chip can help eliminate this problem. Another alternative to a power programmer or chip is to install a spark plug fouler in the post catalytic converter O2 sensor locations. This will require you to drill the existing hole in the spark plug fouler large enough to accommodate the O2 sensor. Then install the original O2 sensor into the spark plug fouler. In some cases this will help eliminate the fault code, but this method should only be used for off road applications as it will not meet federal emissions requirements. Also, this method will not work on every application. Brian, the questions I am asked most often about O2 sensors is how do you know what is Bank 1 or Bank 2, which O2 sensor is Sensor 1 or Sensor 2. Bank One is always the bank where cylinder number one is located. On the Corvette it will always be the driver side. Bank Two is the passenger side. Sensor 1 on Corvettes is always the sensor that is closest to the exhaust port of the engine. Bank Two is post catalytic converter. Bank 1 Sensor 1 - Driver side before converter front Bank 1 Sensor 2 - Driver side after converter rear Bank 2 Sensor 1 - Passenger side before converter front Bank 2 Sensor 2 - Passenger side after converter rear Some of the symptoms of a bad oxygen sensor include a noticeable decrease in fuel economy along with a rich mixture. This does not automatically indicate that the sensor has failed. Be sure to check all vacuum hoses for leaks as well as the ignition system for any problems. Remember, the O2 sensor is only giving you a reading after the combustion process. The oxygen sensor is an item in a vehicle that gets replaced due to the fault of another component. Use the following information to help diagnose the underlying problem. For Lean O2 Sensor Readings A common mistake when reading O2 sensor voltage using your scanner is if the engine is running rough and has developed a misfire, the O2 sensor will read a low-voltage lean condition. Remember, an oxygen sensor reads oxygen not fuel. If an engine is misfiring there will be an abundance of unburned oxygen in the exhaust. The O2 sensor will think the engine is running lean and tell the engine controller, which in turn will add more fuel. Another common reason to see a low-voltage or lean condition is when a fuel pump starts losing fuel pressure, a fuel filter becomes restricted, or a fuel pressure regulator is stuck open. All of these can cause a lower than normal volume of fuel causing a lean condition. If you think this could be your problem, check fuel pressure and fuel volume. Clogged injectors can cause a false lean condition. Flushing the fuel injectors may repair this problem, however, replacement may be necessary. Check the O2 sensor wire for a bare wire. A visual inspection of the wiring should indicate any insulation missing from the wire or a pinched wire causing the wire to become grounded or cut. A grounded or cut wire will cause a false lean signal. The MAF sensor may need to be cleaned to achieve the proper reading. Water contamination can cause a lean condition. Exhaust leaks can cause oxygen sensor to send a false lean reading. High fuel pressure can cause a rich condition. Also check for a leaking fuel pressure regulator or leaking injectors. To test for a leaking fuel pressure regulator, remove the vacuum hose from the regulator and inspect for any fuel. None should be present. A contaminated or malfunctioning canister purge system can put fuel into the intake manifold. To test this, disconnect the canister purge vapor hose and monitor the O2 voltage using your scanner. It is possible a canister purge fault may be set during this test and will need to be cleared. Check the MAP sensor hose for cracks or a broken vacuum hose. A high throttle position sensor TPS signal can cause a rich condition. The TPS is a potentiometer, so while monitoring the TPS voltage using your scanner, the voltage with the key on, the ignition off, and your foot off of the throttle should start below 1. The first step in diagnostics is to install a scan tool and go to the data stream page on your scanner. If the numbers are plus 10 or higher for the Short Term Fuel Trim and Long Term Fuel Trim, the engine is running lean the engine is not getting enough fuel. If the values for both the Short Term Fuel Trim and Long Term Fuel Trim are both minus 10 or more, the engine is running rich the engine is getting too much fuel. The Integrator is the same idea, only for short-term adjustments. The Block Learn Multiplier value can range from 0 to with a value of being ideal, because it is the center point between 0 and If the numbers are or higher for the Block Learn Multiplier, the engine is running lean the engine is not getting enough fuel. If the numbers for the Block Learn Multiplier are lower than the engine is running rich the engine is getting too much fuel. If the injectors are restricted and more fuel is needed, the computer will adjust the amount of fuel coming from the injectors by adding fuel using the long-term fuel trim function. If the injectors are getting too much fuel or leaking fuel, the computer will adjust the amount of fuel coming from the injectors by subtracting fuel using the long-term fuel trim function. An oxygen sensor fault code is one of the most time-consuming fault codes to diagnose. As you have found out, sometimes it is even hard for a seasoned automotive technician to pinpoint the problem. Got a

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burning tech question? Email us at vette sorc.

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Chapter 8 : calendrierdelascience.com - DIY: Oxygen Sensor Testing

We all need to breathe the Oxygen (O 2) in air to calendrierdelascience.com is made up of several different gases including calendrierdelascience.com ambient air contains an Oxygen concentration of % v/calendrierdelascience.com the Oxygen level falls below % v/v, the air is considered calendrierdelascience.com concentrations below 16% v/v are considered unsafe for humans.

Liquid content of the material and gas must not completely fill the container at The containers must be packed in strong outer packagings. Except as provided in paragraph a 5 vi of this section, each container must be subjected to a test performed in a hot water bath. No leakage or permanent deformation of a container is permitted except that a plastic container may be deformed through softening provided that it does not leak. As an alternative to the hot water bath test in paragraph a 5 v of this section, testing may be performed as follows: A Pressure and leak testing before filling. This must be at least two-thirds of the design pressure of the container. If any container shows evidence of leakage at a rate equal to or greater than 3. Prior to filling, the filler must ensure that the crimping equipment is set appropriately and the specified propellant is used before filling the container. Once filled, each container must be weighed and leak tested. The leak detection equipment must be sufficiently sensitive to detect at least a leak rate of 2. Any filled container that shows evidence of leakage, deformation, or excessive weight must be rejected. Limited quantities of compressed gases except Division 2. Additional exceptions for certain compressed gases in limited quantities and the ORM -D hazard class are provided in paragraph i of this section. However, the pressure of the contents in the container may not be greater than psig at Plastic containers may only contain Division 2. Metal or plastic containers must be capable of withstanding, without bursting, a pressure of at least one and one-half times the equilibrium pressure of the contents at Plastic containers must only contain Division 2. Containers must be of such design that they will hold pressure without permanent deformation up to psig and must be equipped with a device designed so as to release pressure without bursting of the container or dangerous projection of its parts at higher pressures. This exception applies to shipments offered for transportation by refrigerated motor vehicles only. Plastic containers may only contain 2. The capacity of each container may not exceed 35 cubic inches The pressure in the container may not exceed psig at One completed container out of each lot of or less, filled for shipment, must be heated, until the pressure in the container is equivalent to equilibrium pressure of the contents at There must be no evidence of leakage, distortion, or other defect. The container must be packed in strong outer packagings. Each refillable inside container must be designed and fabricated with a burst pressure of not less than five times its charged pressure at These valves must be closed prior to and during transportation. Reconditioned used refrigerating machines UN , Div. A Permanently affixed to a steel base structure, B Permanently affixed to a trailer, or C Manufactured with a rigid internal structure designed for transportation and stacking conditions such that they do not leak and do not deteriorate, distort, or become damaged in a manner that could adversely affect their safety or reduce their strength in transportation, cause instability in stacks of refrigerating machines, or cause damage to these machines in a way that is likely to reduce safety in transportation. The following applies to accumulators, which are hydraulic accumulators containing nonliquefied, nonflammable gas , and nonflammable liquids or pneumatic accumulators containing nonliquefied, nonflammable gas , fabricated from materials which will not fragment upon rupture. Out of each lot not to exceed 1, successively produced accumulators per day of the same type, accumulators must be tested, in lieu of the testing of paragraph f 2 iii of this section, as follows: A One 1 accumulator must be tested to the minimum design burst pressure; B Two 2 accumulators, one at the beginning of production and one at the end must be tested to at least two and a half times the charge pressure without evidence of leakage or distortion; C If accumulators fail either test, an additional four 4 sets of accumulators from the lot may be tested. If any additional accumulators fail, the lot must be rejected; iv Accumulators must be packaged in strong outer packaging. A copy of the quality assurance program must be maintained at each facility at which the accumulators are manufactured. Water pump system tanks charged with compressed air or limited quantities of nitrogen to not over 40 psig for single-trip shipment to installation sites are excepted from labeling transportation by air not authorized and the specification packaging requirements of this subchapter when shipped under the following conditions. Safety relief devices not required. Test pressure must be permanently marked on the tank.