

State of California - Engine Change Guidelines

The California Air Resources Board (CARB) and the Bureau of Automotive Repair (BAR) have jointly developed the following engine change guidelines with the focus on maintaining air quality for all Californians while also providing a reasonable pathway for the occurrence of engine changes on California vehicles. State and federal anti-tampering laws specifically prohibit any modification to the vehicle's original emission control system configuration as certified by the manufacturer. One such law is California Vehicle Code Section 27156 which states that no person shall disconnect, modify, or alter any required motor vehicle pollution control device. In addition, Section 3362.1 of the California Code of Regulations states, "An automotive repair dealer shall not make any motor vehicle engine change that degrades the effectiveness of a vehicle's emission control system. Nor shall said dealer, in the process of rebuilding the original engine or while installing a replacement engine, effect changes that would degrade the effectiveness of the original emission control system and/or components thereof". In summary, these laws prohibit any engine change that degrades the effectiveness of the vehicle's original emission control system.

Engine changes can present problems and challenges to vehicle owners, inspectors, and technicians. Our recommendation is to rebuild and reinstall the original engine, transmission, and emission control system configuration, use a California certified engine, or use a CARB exempted engine package. Exempted emissions compliant engine packages are restricted to specific applications and must not be installed in vehicle applications that are not included in the exemption. Check the Executive Order for details, which can be viewed at, <https://www.arb.ca.gov/msprog/aftermkt/devices/amquery-091517.php> by choosing *Select Device Type: Engine Modification / Engine Change*. It is important to remember that the guidelines in this document are for performing engine changes, and are not exemption procedures. All vehicles with engine changes must pass an inspection by a BAR Referee, and must have a BAR Referee label affixed to the vehicle inside the engine compartment. After the initial referee inspection, the vehicle will remain subject to **ALL** the same recipient vehicle requirements for future Smog Check inspections.

I. Non-OBD-II¹ certified vehicles receiving an OBD-II certified engine must meet the following:

1. The donor engine must be in a stock certified configuration, and support **ALL** the certified OBD-II functionality
2. Modifications of the intake and exhaust system are permissible only if necessary to accommodate the packaging of the vehicle and only if they do not affect the functionality of the systems. Any changes must not modify the stock functional design of the components (i.e. the intake air box must not be modified, EGR valves still properly mounted, etc.)
3. The transmission and evaporative systems will be allowed to remain in the recipient vehicle configuration, but must function appropriately (see 9 below)
4. **ALL** of the requirements (1-9) listed below for "All model year vehicles"

II. Vehicles originally equipped with OBD-II must receive an OBD-II certified engine and meet the following:

1. All emission system configurations must be in the original emission control system configuration as the donor vehicle, including, but not limited to, the transmission, evaporative system, exhaust, and intake
2. **ALL** of the requirements (1-9) listed below for "All model year vehicles"

III. Electric vehicle conversions must meet the following:

1. Vehicles converted to 100% electric drive, with power supplied exclusively by on-board batteries, are considered in compliance with the engine change requirements provided:
 - a. All fuel system components are removed prior to inspection, including the fuel tank, lines and evaporative system
 - b. No fuel-fired heater is installed on the vehicle
2. None of the requirements (1-9) listed below for "All model year vehicles" apply to electric vehicle conversions

IV. All model year vehicles (gasoline, diesel, hybrid, CNG, LNG, LPG, etc.) must meet the following:

1. **Model Year** - The installed engine must be of the same model year or newer than the model year of the recipient vehicle
2. **Engine Classification** - Vehicle and engine classifications of the donor and recipient vehicles must be the same based on Gross Vehicle Weight Rating (GVWR). Classification examples include passenger car, light-duty truck (LDT1, LDT2), light-heavy-duty truck (LHD1, LHD2), medium-duty vehicle (MDV), etc. For example, a heavy-duty truck engine may not be installed in a light-duty truck even if they have the same displacement. Non-emissions controlled engines, such as industrial and off-road-use-only engines, and non-certified "crate engines", **MAY NOT** be installed in any emission-controlled vehicle
3. **Certification Type** - The certification type (California or Federal certification) of the engine and recipient vehicle must be the same or, if not, the engine must adhere to the more stringent standard. For example, a California certified engine may be installed in a Federal vehicle but a Federal engine may not be installed in a California vehicle. Proof of the certification type from the manufacturer or CARB EO of the donor engine must be provided at the time of the engine change inspection at the Referee

¹ OBD-II was phased in, and generally applies to model years 1996 and newer for gasoline vehicles, and 1998 and newer for diesel vehicles. The Vehicle Emission Control Information label for the vehicle will indicate if it is OBD-II certified.

4. **Smog Check Tests** - The vehicle must pass **ALL** of the following Smog Check tests (regardless of model year) using the donor vehicle Smog Check test type requirements:
 - a. BAR-97 tailpipe test (this item does not apply to diesel and hybrid vehicles). Acceleration Simulation Mode (ASM) test unless the vehicle is not compatible with dynamometer testing. In such cases, the Two Speed Idle (TSI) test shall apply. Emission standards appropriate for the model year of the donor vehicle will be applied. Note that Smog Check program area test types do not apply to engine changes i.e. Basic area vehicles will receive an ASM test
 - b. BAR-OIS test when an On-Board Diagnostics (OBD-II) certified donor engine is installed (**ALL** Smog Check program areas)
 - c. Malfunction Indicator Light (MIL) ("CHECK ENGINE" light) must pass the bulb check, and full OBD functionality. This includes donor engines equipped with OBD-I (1995 and older OBD equipped engines) capabilities
 - d. Visual inspection of all emissions control systems
 - e. Functional tests when applicable for the donor vehicle (this item does not apply to diesel or hybrid vehicles), including:
 - i. Ignition Timing Test
 - ii. EGR System Functional Test
 - iii. Low Pressure Fuel Evaporative Test (LPFET)
 - iv. Fuel Cap Integrity Test
 - f. Visible Smoke Test (this item does not apply to hybrid vehicles)
 - g. Liquid Fuel Leak (this item does not apply to diesel vehicles)
 5. **Exhaust System** - All exhaust after-treatment devices (catalytic converters, Diesel Particulate Filters (DPF), Diesel Oxidation Catalysts (DOC), Selective Catalytic Reduction (SCR), etc.) the donor vehicle was certified to use must be present and positioned under the vehicle in the same linear position within the exhaust stream as measured from the exhaust manifold outlet. If the device is integrated with the exhaust manifold, it must remain that way. Tolerances for this measurement as are follows:
 - a. On the close-coupled end (nearest the engine), within 6 inches, and no closer than the stock configuration
 - b. On the other devices (rear catalyst, DPF, DOC, SCR, etc.) within 12 inches of the stock configurationNo other exhaust system changes are allowed, unless they occur downstream of the last emissions control device i.e. (Oxygen sensor (O₂), NO_x sensor, etc.). For example, the muffler location(s) may be modified.
 6. **Exhaust Sensors** - All required after-treatment sensors including Oxygen (O₂) sensor(s) must:
 - a. Be within 1 inch of the original location (relative to the associated after-treatment device)
 - b. Have bungs properly welded into the exhaust pipes and must be oriented in the exhaust stream identically to the original configuration
 7. **OBD-II System** - Any vehicle with a replacement engine from a donor vehicle that was originally equipped with an OBD-II system must support all OBD-II functionality from the donor vehicle:
 - a. Calibration Identification (CalID) and Calibration Verification Number (CVN) must match a certified configuration for the donor engine
 - b. **ALL** supported OBD readiness monitors must be in a ready (complete) condition. Vehicle owners may need to work with the manufacturer, dealer or repair shop with necessary tools and expertise to get potentially difficult monitors to be ready (complete)
 - c. Readiness monitors must clear and reset properly
 - d. The Original Equipment Manufacturer Diagnostic Link Connector (DLC) must be accessible and fully functional. No devices may be plugged into the DLC at the time of inspection. If more than one DLC is located on the vehicle, then the DLC for the engine must be labeled as "ENGINE DLC". The label must be robust, permanent, clearly readable, and highly visible
 - e. All sensors, switches, and wiring harnesses needed to make the system fully functional must be properly connected
 - f. MIL must be in a visible location on the vehicle's instrument cluster and be clearly labeled as a MIL and functioning
 8. **Aftermarket Parts** - All non-OEM configurations or aftermarket components installed on the recipient vehicle or donor engine must adhere to BAR's Aftermarket Parts Verification Guidelines located in the Smog Check Reference Guide, Appendix G https://www.bar.ca.gov/pdf/Smog_Check_Reference_Guide.pdf. CARB's list of approved aftermarket parts with Executive Orders (EO's) can be found at <https://www.arb.ca.gov/msprog/aftermkt/devices/amquery.php>
 9. **Emissions Systems** - All emissions systems (including the evaporative system monitoring) from the donor vehicle must be installed and fully functional. For example, the evaporative system components, i.e. plumbing, canister, tanks, valves, etc. must be present and functioning. If a non-OBD II certified vehicle is receiving an OBD II certified replacement engine, the transmission and fuel storage/evaporative system from the recipient vehicle may still be used. However, these components and systems must be integrated with the engine's OBD II system such that the OBD system's transmission and evaporative system monitoring strategies remain operational.
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