

UPDATED INFORMATIVE DIGEST

ADOPTION OF EXHAUST AND EVAPORATIVE EMISSION CONTROL REQUIREMENTS FOR SMALL OFF-ROAD ENGINES LESS THAN OR EQUAL TO 19 KILOWATTS AND EQUIPMENT THAT USE SUCH ENGINES

Sections Affected: Adoption of sections 2405.1, 2405.2, and 2405.3, 2750, 2751, 2752, 2753, 2754, 2755, 2756, 2757, 2758, 2759, 2760, 2761, 2762, 2763, 2764, 2765, 2766, 2767, 2768, 2769, 2770, 2771, 2772, and 2773, title 13, California Code of Regulations (CCR). Adoption of the incorporated "California Exhaust Emission Standards and Test Procedures for 2005 and Later Small Off-Road Engines," and the incorporated "Small Off-Road Engine Evaporative Emission Test Procedures, TP-901 and TP-902" and "Small Off-Road Engine Evaporative Emissions Control System Certification Procedures, CP-901 and CP-902." Amendments to sections 2400, 2401, 2403, 2404, 2405, 2407, 2408, and 2409, title 13, CCR. Amendments to the incorporated "California Exhaust Emission Standards and Test Procedures for 1995 and later Small Off-Road Engines," as last amended January 28, 2000, title 13, CCR.

Background: Health and Safety Code sections 43013 and 43018 direct the ARB to set emission control requirements for off-road mobile source categories. These categories include marine vessels, locomotives, utility engines, off-road motorcycles, and off-highway vehicles. The small engine category is covered by this mandate.

Small off-road spark-ignition engines run on gasoline or an alternative fuel such as liquefied petroleum gas (LPG) or compressed natural gas (CNG), and are rated at or below 19 kilowatts (25 horsepower). Small off-road engines are used to power a broad range of lawn and garden equipment including lawn mowers, leaf blowers, and lawn tractors, as well as generators and other small industrial equipment.

In December 1990, the Board approved exhaust emission control regulations for small off-road engines. (See title 13, CCR, sections 2400-2409 and the documents incorporated therein). The small off-road engine category was the first off-road category subject to emission control regulations because its emissions impact was significant and because a court order required Board action on the category by January 1991. The small off-road engine regulations apply to engines produced on or after January 1, 1995. On July 5, 1995, the United States Environmental Protection Agency (U.S. EPA) approved California's authorization request; approval allows the state to enforce the regulations.

The small off-road engine regulations include exhaust emission standards, test procedures, and provisions for warranty and production engine compliance programs. The regulations as amended in 1998 consist of two tiers of emission

standards. Tier 1 standards became effective in 1995, and Tier 2 standards began implementation with the 2000 model year. Exhaust emission standards were established for hydrocarbons (HC), oxides of nitrogen (NOx), carbon monoxide (CO), and particulate matter (PM) (for two-stroke engines only). Additionally, the 1998 amendments separated small engines into three displacement categories: up to and including 65 cubic centimeters (cc), between 65 and 225 cc, and 225 cc and above. Engines 65 cc and below are typically used in handheld applications, such as chainsaws and trimmers. Because of their unique operation, engine weight and size limitations, these engines are allowed to comply with a less stringent set of emission standards. Engines above 65 cc are typically used in nonhandheld applications, such as lawn mowers and portable generators. These engines meet more stringent emission levels due to the engine designs and available emission control systems.

Description of Regulatory Action: The Board amended the existing California exhaust emission regulations for small off-road spark-ignition engines to include more stringent exhaust standards as well as adopted new regulations to control evaporative emissions from small engine equipment.

Prior to this regulatory action, the small off-road engine regulations applied to engines below 25 horsepower (hp). The Board revised the regulations to harmonize with the U.S. EPA unit power designation adopting the use of kilowatt (kW) as the unit of power for small off-road engines. Thus, the result is that the small off-road engine regulations now apply to engines that produce a gross power at or below 19 kW.

The original 65 cc engine class cut point was based upon the product line and market demands for handheld engines at the time the displacement categories were proposed (i.e., 1998). However, the natural progression of the product for handheld engines is moving toward larger displacement handheld engines. To address this market shift, the Board modified the upper boundary of this smaller engine class to include engines up to and including 80 cc, beginning in 2005.

The Board adopted a new set of exhaust emission standards for new small off-road spark-ignition engines. The new standards further limit exhaust emissions and are based on available engine designs and the most technologically feasible and cost-effective control strategies.

In March 2000, the U.S. EPA finalized new federal exhaust emission standards for handheld small off-road engines. The federal rule for handheld small engines includes a HC+NOx emission standard for engines below 50 cc that becomes more stringent over several years and, beginning with the 2005 model year, is more stringent than the current California HC+NOx emission standard for these same engines. As a result, the Board adopted the federal HC+NOx exhaust emission standard for engines below 50 cc, beginning with the 2005 model year.

The Board also adopted new exhaust emission standards for engines above 80 cc. These new exhaust emission standards reduce HC+NO_x emissions on the order of 35%. The new standards may be met with the use of low to medium efficiency catalytic converters or improvements in engine design. Implementation begins with the 2007 model year for engines between 80 and 225 cc, and with the 2008 model year for engines 225 cc and above.

The new 2005 and later exhaust emissions standards are presented in Table 1.

Table 1
Exhaust Emission Standards for Spark-Ignition Engines
grams per kilowatt-hour

Model Year	Displacement Category	Durability Periods (hours)	Hydrocarbon plus Oxides of Nitrogen ⁽¹⁾⁽³⁾	Carbon Monoxide	Particulate
2005 and Subsequent	<50 cc	50/125/300	50	536	2.0 ⁽²⁾
	50-80 cc, inclusive	50/125/300	72	536	2.0 ⁽²⁾
2005	>80 cc - <225 cc Horizontal-shaft Engine	125/250/500	16.1	549	
	>80 cc - <225 cc Vertical-shaft Engine	NA	16.1	467	
	≥225 cc	125/250/500	12.1	549	
2006	>80 cc - <225 cc	125/250/500	16.1	549	
	≥ 225 cc	125/250/500	12.1	549	
2007	>80 cc - <225 cc	125/250/500	10.0	549	
	≥ 225 cc	125/250/500	12.1	549	
2008 and Subsequent	>80 cc - <225 cc	125/250/500	10.0	549	
	≥ 225 cc	125/250/500/1000	8.0	549	

(1) The Executive Officer may allow gaseous-fueled (i.e., propane, natural gas) engine families, that satisfy the requirements of the regulations, to certify to either the hydrocarbon plus oxides of nitrogen or hydrocarbon emission standard, as applicable, on the basis of the non-methane hydrocarbon (NMHC) portion of the total hydrocarbon emissions.

(2) Applicable to all two-stroke engines.

(3) Engines used exclusively to power products which are used exclusively in wintertime, such as snowthrowers and ice augers, at the option of the engine manufacturer, need not certify to or comply with standards regulating emissions of HC+NO_x or NMHC+NO_x, as applicable. If the manufacturer exercises the option to certify to standards regulating such emissions, such engines must meet such standards. If the engine is to be used in any equipment or vehicle other than an exclusively wintertime product such as a snowthrower or ice auger, it must be certified to the applicable standard regulating emissions of HC+NO_x or NMHC+NO_x as applicable.

In addition to new exhaust emission requirements, the Board adopted new regulations to control evaporative emissions from small off-road equipment less than or equal to 19 kW. Prior to the adoption of the regulations, there were no regulations controlling evaporative emissions from small off-road equipment. Had the Board not adopted the regulations, it is estimated that the statewide

evaporative emissions from all small off-road equipment would have been 52 tons per day of HC in 2010. Implementation of the new evaporative emission standards will reduce HC emissions by 32 tons per day in 2020. The new evaporative emission standards are presented in Table 2 below.

Table 2
Evaporative Emission Standards for Small Off-Road Engines and Equipment

	Performance Requirements Section 2754(a) ⁽¹⁾	Design Requirements Section 2754(b)		
Effective Date Model Year	Diurnal Standard Grams HC/day	Fuel Hose Permeation Grams ROG/m ² /day	Fuel Tank Permeation ⁽²⁾ Grams ROG/m ² /day	Carbon Canister ⁽³⁾ Equivalent Butane Working Capacity Grams HC
Displacement Category: Walk-Behind Mowers >80 cc - <225 cc				
2006	None	15	None	None
2007 and 2008	1.3	N/A	N/A	N/A
2009	1.0	N/A	N/A	N/A
Displacement Category: Non Walk-Behind Mowers > 80 cc - < 225 cc				
2006	None	15	None	None
2007 through 2011	1.20 + 0.056*tank vol. (liters)	15	2.5	Specified in TP-902
2012	0.95 + 0.056*tank vol. (liters)	15	1.5	Specified in TP-902
Displacement Category: >225 cc				
2006 and 2007	None	15	None	None
2008	1.20 + 0.056*tank vol. (liters)	15	2.5	Specified in TP-902
2010 ⁴	None	15	None	Specified in TP-902
2013	1.20 + 0.056*tank vol. (liters)	15	1.5	Specified in TP-902

(1) For model year 2006 only, all engines and equipment with displacements between 80 cc and 225 cc must comply with the fuel hose permeation design requirement in section 2754(a)(1)(C). Engines and equipment with displacements greater than or equal to 225 cc must comply with the fuel hose permeation design requirement in section 2754(a)(1)(C) for model years 2006 and 2007 only.

(2) Permeation emissions as determined by TP-901. Permeation emissions must be measured to two significant figures. Reactive Organic Gas (ROG)

- (3) Canister design requirements and the procedure for determining butane working capacity are specified in TP-902. The Executive Officer may designate technology equivalent to carbon canisters on a case by case basis as part of the certification process per section 2767.
- (4) Applies to small production volume tanks exempted pursuant to section 2766.

The regulations establish performance and design standards for engines and equipment. The regulations set a permeation performance standard applicable to fuel tanks on all small off-road engines and equipment less than or equal to 80 cc. The regulations also set performance and design standards for small off-road engines and equipment with displacements greater than 80 cc. The evaporative regulations include:

- compliance options that allow engine or equipment manufacturers to certify evaporative emission control systems to performance or design standards;
- labeling requirements to allow for the quick identification of equipment subject to the proposed regulations; and
- test methods that ARB and industry would use to determine compliance with the permeation and diurnal evaporative emission performance standards.

To encourage the use of lower emitting engines that go beyond regulatory emission standards, the Board adopted voluntary optional low exhaust and evaporative emission standards for small off-road engines. An engine certified to these standards will be classified as a "Blue Sky Series" Engine.

The ARB and U.S. EPA each have exhaust emissions test procedures in place which manufacturers must adhere to when certifying to the applicable State or federal exhaust emission standards for small engines. In order to simplify the certification of engine families to both the federal and California emission standards, the Board adopted new test procedures for 2005 and later model year engines when certifying to California's exhaust emission standards. The new test procedures are closely harmonized with the federal small engine test procedures (40 Code of Federal Regulations, part 90, subparts A, B, D, and E and corresponding appendices). The 1998 amendments to the small engine exhaust emission regulations require that manufacturers conduct a durability demonstration as part of the certification process. For each engine family, manufacturers are able to choose an emissions durability period of either 125, 250, or 500 hours for the larger (nonhandheld) engines. The federal rule also includes a 1000 hour durability option for nonhandheld engines greater than or equal to 225 cc, and in the spirit of alignment, the Board adopted the 1000 hour durability option. Also, the federal rule requires manufacturers to report emission-related defects. The Board adopted a similar requirement such that a manufacturer must report to ARB emission-related defects affecting a given class or category of engines. If ARB determines that a substantial number of any class or category of engines do not conform to the regulations when in actual use, ARB will notify the manufacturer and require the manufacturer to submit a plan to resolve the nonconformity of the engines.

The Board also adopted other non-substantive modifications to the small engine exhaust emission regulations and test procedures to clarify or simplify existing language.

COMPARABLE FEDERAL REGULATIONS

The U.S. EPA has exhaust emission control regulations for small off-road engines (Title 40, Code of Federal Regulations, Part 90). Those regulations are similar to the California regulations that predated them. The Board has made every effort to minimize conflicts with the current U.S. EPA rule, while retaining specific features needed by California. Those efforts include aligning the structure of the exhaust emission test procedures wherever justifiable. However, the adopted rule includes several differences from the current U.S. EPA regulations, including more stringent exhaust emissions standards, and evaporative emission standards.

The Board's analysis of the adopted regulations indicates that they will reduce emissions from ozone precursors in a cost-effective manner, beyond what would be accomplished by the existing federal regulations. Thus, the cost of the separate California program is justified by the benefit to human health, public welfare, and the environment. In addition, Health and Safety Code sections 43013 and 43018 authorize the differences from the federal program.