

Spark-Ignition Marine Engine and Boat Regulations

WORKSHOP

Air Resources Board
March 18, 2008

California Environmental Protection Agency

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Outline

- Background
- Proposed Amendments
 - Standards
 - Relief provisions
 - Diagnostics
 - Voluntary Standards
 - Miscellaneous
- Contact Information



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Regulatory Timelines

Background

1998	ARB adopts Outboard and Personal Watercraft requirements
2001	ARB adopts Sterndrive and Inboard (SD/I) requirements
2005	ARB adopts optional start date for SD/I requirements, but maintains 5.0 g/kW-hr HC+NOx standard for all engines
2007 / 2008	Engines \leq 373 kW began complying with the 5.0 g/kW-hr (catalyst-based) HC+NOx standard
2009	High performance engines $>$ 373 kW are required to comply with the 5.0 g/kW-hr (catalyst-based) HC+NOx standard

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Current Outboard / PWC Requirements

Background

NMHC+NO_x Emission Standards [grams per kilowatt-hour]

MODEL YEAR	$P_{tx} < 4.3 \text{ kW}$	$P_{tx} \geq 4.3 \text{ kW}$	FEL Cap
2001 -2003	81.00	$(0.25 \times (151+557/P_{tx}^{0.9})) + 6.0$	N/A
2004 - 2007	64.80	$(0.20 \times (151+557/P_{tx}^{0.9})) + 4.8$	80
2008 and later	30.00	$(0.09 \times (151+557/P_{tx}^{0.9})) + 2.1$	44

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Current Sterndrive / Inboard Requirements

Background

Exhaust and Evaporative Standards

MODEL YEAR	RATED POWER [kilowatts]	COMPLIANCE OPTION	DURABILITY [hours / years]	EXHAUST STANDARD		COUNTER MEASURE
				NMHC+NO _x [grams per kilowatt-hour]	TYPE	
2003 - 2006	kW ≤ 373	N/A	N/A	16.0	AVE	None
2007	kW ≤ 373	OPT 1	N/A	16.0 (55%)	AVE	None
			480 / 10	5.0 (45%)	FIXED	
		OPT 2	N/A	14.0	FIXED	Permeation
2008	kW ≤ 373	OPT 1	N/A	16.0 (25%)	AVE	None
			480 / 10	5.0 (75%)	FIXED	
		OPT 2	480 / 10	5.0	FIXED	Permeation
2009 and later	kW ≤ 373	N/A	480 / 10	5.0	FIXED	Continue previous measure
	373 < kW ≤ 485		150 / 3		AVE	
	kW > 485		50 / 1		AVE	

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Sterndrive & Inboard HC+NO_x Emissions

Background

2007



387 TPD

2010



312 TPD

2020



267 TPD



Inboard & Sterndrives



Other Off-Road Gasoline Engines

All estimates use annual average units

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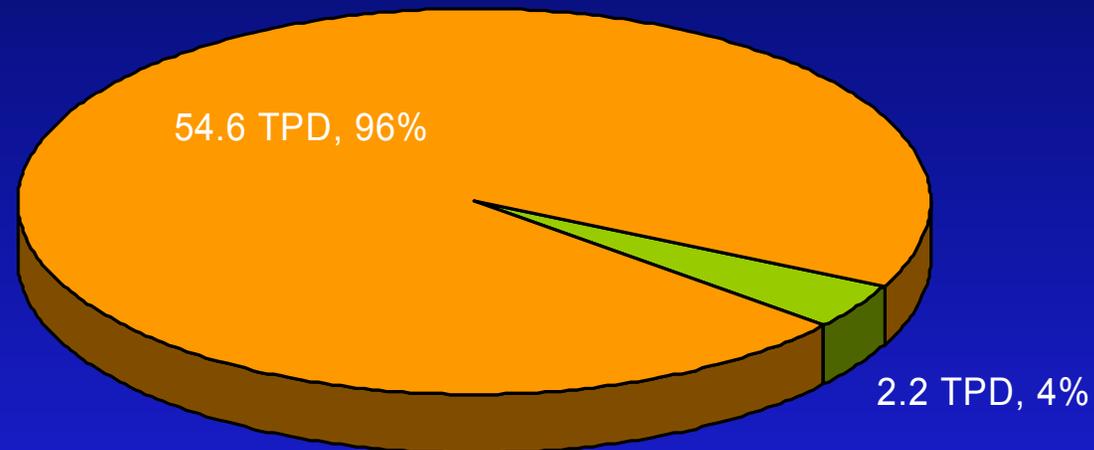


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High Performance SD/I HC+NO_x Reductions

Background

High Performance vs. Standard Performance SD/I Emission Reduction Contributions



All estimates use summer weekend units

56.8 tons per day (TPD) total reduction of HC+NO_x in 2020

-  High Performance Engines > 373 kW (500 HP)
-  Standard Performance Engines ≤ 373 kW

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Proposed Carbon Monoxide (CO) Standards

Proposed Amendments

ENGINE CATEGORY	MODEL YEAR	MAXIMUM POWER [kilowatts]	CO STANDARD [grams per kilowatt-hour]	TYPE
OB/PWC	2009 and later	$\text{kW} \leq 40$	$500 - 5 \times P$	Average
		$\text{kW} > 40$	300.0	Average
$\text{kW} \leq 373$		$75.0 / *$	Fixed	
$\text{kW} > 373$		350.0	Fixed	
SD/I				

* Staff requests comment on an optional CO standard that would exclude emissions at wide open throttle (mode 1 on the E4 certification test cycle)

High Performance (HP) SD/I Standards

Proposed Amendments

Revised Exhaust & Evaporative Standards for High Performance SD/I Engines and Boats

MODEL YEAR	MAXIMUM ENGINE POWER [kilowatts]	HC+NO _x STANDARD [grams per kilowatt-hour]	CO STANDARD [grams per kilowatt-hour]	PERMEATION STANDARDS [grams per square meter per day]		DIURNAL STANDARD [grams per gallon per day]
				Hose	Tank	
2009 - 2010	373 < kW ≤ 485	16.0	350.0	15.0	1.5	0.16 *
	kW > 485	25.0				
2011 and later	373 < kW ≤ 485	16.0				
	kW > 485	22.0				

* Trailerable boats may optionally meet a 0.4 grams per gallon per day diurnal standard

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Certification Requirements for HP Engines

Proposed Amendments

- Emissions testing will still be required
- OBD-M will still be required
- Staff would consider the use of portable emissions measurement equipment so long as accuracy is shown to be on a par with dynamometer accuracy
- Staff is open to assigned deterioration factors, but data are needed to support reasonable limits
- Staff requests comment on who should be eligible to use assigned deterioration factors

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SD/I Single Family Averaging Relief Provision

Proposed Amendments

- One engine family (or grouping) per year may be certified above the standards
 - Three year carry-over (four years altogether)
 - FEL caps would apply
- Gives manufacturers extra time to address problem engines or supplier issues
- Supports effective enforcement
- Ensures that existing clean technology will not be rolled back
- Maintains level playing field

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General Hardship Relief Provision

Proposed Amendments

- ARB's Executive Officer would have the authority to issue additional temporary relief to engine or boat manufacturers in cases of extreme hardship
- The following will be considered by the EO in determining whether or not to grant relief:
 - Proof that the hardship was beyond the control of the engine or boat manufacturer
 - All existing relief provisions have been exhausted
 - The manufacturer has a plan to make up for any lost emission benefits.

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Mandatory OBD-M Misfire Monitoring in 2010

Proposed Amendments

- Misfire monitoring is only required if misfire is a significant factor in catalyst degradation
- The majority of certified OBD-M systems already have misfire detection capability
- Mandatory misfire monitoring should not require any additional development efforts
- Misfire detection capability makes OBD-M a robust means of production line testing

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Voluntary Standards

Proposed Amendments

5 STAR Voluntary Standards

HC+NO _x STANDARD [grams per kilowatt-hour]	CO STANDARD [grams per kilowatt-hour]	PERMEATION STANDARDS [grams per square meter per day]		DIURNAL STANDARD [grams per gallon per day]
		Hose	Tank	
2.50	50.0	15.0	1.5	0.4

- Total Hydrocarbon Standard
- OBD-M Compliant w/ Misfire Monitoring

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Proposed 5 STAR Label

Proposed Amendments



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Proposed Jet Boat Requirements

Proposed Amendments

- New definition for “Sterndrive/Inboard Engines” requires jet boat engines to comply with the 5.0 / 75.0 g/kW-hr HC+NOx / CO standards
- Jet boat engine families previously certified as PWC engine families may continue to be certified to the PWC standards until 2012
- Beginning in 2010, newly introduced jet boat engine families must comply with the sterndrive requirements upon introduction, but may use same-year PWC offsets to comply through averaging until 2012

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Miscellaneous Amendments

Proposed Amendments

- Adopt total hydrocarbon standards
- Adopt harmonized Not-To-Exceed (NTE) limits as proposed by U.S. EPA
- Revise replacement engine provision to permit less stringent engines as necessary
- Adopt harmonized engine rebuilding practices as proposed by U.S. EPA
- Adopt new Hang Tag durability requirements
 - Lamination
 - Reinforced grommet
 - Or otherwise durable for at least 2 years

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Questions and Comments

Contact Information

- Board Hearing scheduled for July 24, 2008 in Sacramento, CA
- Please send comments or inquiries to:

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