

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Draft Staff Report

**Proposed Amended Rule 1193 – Clean On-Road Residential and
Commercial Refuse Vehicles**

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SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

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ATTACHMENT

1. PROPOSED AMENDMENT RULE LANGUAGE

EXHIBITS

1. CARB Executive Order for Engine Family 1PSXH0629E6K.
2. CARB Executive Order for Engine Family 2PSXH0629E6K.
3. CARB Executive Order For Engine Family 1WFSH0912XAC

Introduction

Rule 1193 is one of seven fleet rules adopted by the AQMD Governing Board between June 2000 and April 2001. The AQMD Governing Board adopted Rule 1193 on June 16, 2000 requiring fleets with 15 or more refuse collection vehicles (refuse trucks) operating in the District to acquire alternative-fueled or dual-fuel powered vehicles when procuring or leasing these vehicles. This rule applies to refuse collection vehicles operated by government agencies as well as privately owned refuse collection fleets that collect solid wastes, yard waste, or otherwise discarded recyclable materials. For the purposes of Rule 1193, refuse collection vehicles are heavy-duty vehicles that collect solid waste, yard wastes, or otherwise discarded recyclable materials from residential or commercial establishments, and private or publicly owned transfer stations.

Background

A sunset provision of July 1, 2002 is provided in Rule 1193 relative to the purchase or leasing of dual-fuel curbside collection vehicles. At the time of rule development, information on first generation dual-fuel engines operating in a “stop-and-go” duty cycle indicated that the engines do not operate primarily on the alternative fuel. The manufacturer/developers of dual-fuel engine technology indicated that they were in the process of developing next generation engines that would operate primarily on the alternative fuel. For the 2001 and 2002 model years, specific dual-fuel engine models were certified by California Air Resources Board (CARB) that were designed by the engine developer to maintain alternative-fuel operation during a “stop-and-go” duty cycle (see Exhibits 1 and 2). For this reason, staff is recommending amendments of Rule 1193 to, among other things, delete the sunset provision for dual-fuel engines.

Vehicle Purchase Requirements

Rule 1193 requires that beginning July 1, 2001, public and affected private operators of fleets consisting of 50 or more solid waste collection vehicles or 15 or more combined rolloff and transfer vehicles, and beginning July 1, 2002, for all other public and private operators with a combined total of 15 or more rolloff, transfer, or solid waste collection vehicles, when adding or replacing a heavy-duty refuse truck to their fleets, to purchase or lease an alternative-fuel heavy-duty refuse trucks. In addition, the rule provides the option of purchasing or leasing any solid waste collection vehicle having a dual-fuel engine that has been CARB-certified to meet an optional NOx standard and a particulate emissions level equivalent to an alternative-fuel engine. Rule 1193 does not permit the purchase of dual-fuel vehicles for use as a solid waste collection vehicles on or after July 1, 2002. Note that this date could be extended by one year if the fleet operator retrofits its existing 1995 and

subsequent model year refuse fleet with certified particulate control devices that achieve a 71 percent or greater reduction in particulate matter (PM) emissions.

Proposed Amendment to Rule 1193

A significant operational issue with dual-fuel engines has been the greater use of diesel fuel during engine idle and accelerations, and corresponding potential loss of PM and NO_x emission benefits. This fuel use should be contrasted with the 85 percent natural gas and 15 percent diesel fuel use that has been reported for these engines. Of particular concern is that refuse vehicles used in solid waste collection vehicle applications experience significant idle time and accelerations when utilized in door-to-door refuse collection vehicle applications.

This concern also surfaced as part of CARB implementation of the Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program), where CARB was considering the application of a discount factor that would otherwise reduce the emission benefits attributable to dual-fuel engine operation in this application.

To address CARB's concerns the engine manufacturer demonstrated for a specific dual-fuel engine design that approximately 85 percent alternative fuel use would be maintained for a door-to-door refuse collection vehicle application and a discount factor would not be needed. The engine manufacturer subsequently obtained a specific CARB certification of an engine family of this design for the 2001 and 2002 model years (1PSXH0629E6K and 2PSXH0629E6K). See Exhibits 1 and 2. In addition to the two CARB-certified dual-fuel engine families, Westport Fuel Systems recently certified a "dual-fuel" engine using a "high-pressure direct injection" or HPDI system using diesel fuel as an igniter of the alternative fuel (Executive Order A-343-1, see Exhibit 3).

Staff is proposing a rule amendment to remove the sunset date of July 1, 2002 under subparagraph (d)(1)(B) of Rule 1193, allowing the continued future use of dual-fuel engines in solid waste collection vehicles. This recommendation is based on the current demonstration within the framework of the Carl Moyer Program and separate certification of an engine family to substantiate 85 percent alternative fuel use for solid waste collection vehicles. In addition to the preceding, existing rule language associated with the July 1, 2002 sunset date is proposed for deletion that extends the July 1, 2002 sunset date by one year provided that fleet operators retrofit existing 1995 and subsequent model-year refuse fleet vehicles with particulate matter control devices. The proposed amendment also modifies the definition of dual-fuel heavy-duty vehicle to specify that (1) dual-fuel vehicles meet applicable optional NO_x or combined NO_x plus non-methane hydrocarbons (NMHC) emission levels, which are considered to be comparable with corresponding emission levels found in alternative-fueled vehicles, and (2) PM emission reduction levels for dual-fuel engines used in solid waste collection vehicles be as clean as their diesel counterpart when a CARB verified PM control device is installed. These modifications to the definition are being proposed to take advantage of the successful certification of the dual-fuel engine families to an optional NO_x emission standard, verification of PM control devices for a

substantial number of diesel heavy-duty engine models, including the diesel engines that dual-fuel engines are based upon, to a minimum 85 percent PM reduction efficiency, and successful demonstration to CARB that alternative fuel use for dual-fuel engines powering solid waste collection vehicles is consistent with corresponding fuel use during engine certification. Finally, a definition of “Approved Control Devices” is being added to ensure that these devices are CARB approved and properly installed. This is to ensure that real and durable emission reductions result from the use of these devices in refuse vehicle applications.

The amendment to Rule 1193 is being proposed at this time because of the near term expiration of the sunset date for the use of dual-fuel engines in solid waste collection vehicles, as well as the continued interest in the use of these engine for this particular vehicle application. It should be noted that projects approved by the Governing Board on September 21, 2001 for the latest Carl Moyer Program includes 152 dual-fuel engine equipped solid waste collection vehicles.

[Since rule-compliant dual-fuel engines have been meeting optional NO_x standards similar to almost all dedicated alternative fuel engines, there would not be any emission reductions foregone with the proposed amendment. However, in-use emission levels of specific engines may show differences among dual-fuel engines and dedicated alternative-fuel engines.](#)

PUBLIC COMMENTS

The following summarizes public comments and staff responses regarding the development of Proposed Amended Rule 1193 – Clean On-Road Residential and Commercial Refuse Vehicles. These comments were received at the public workshop held on March 27, 2002 and written comments received by April 19, 2002. The AQMD received comments from representatives of affected fleet operators, engine manufacturers, and environmentalists.

PAR 1193 Comments and Responses

- Comment 1. Insufficient information for fuel use under stop-and-go conditions is available to justify the elimination of the July 1, 2002 sunset date for the use of dual-fuel engines in solid waste collection vehicles. If AQMD decides to pursue this rule amendment, the sunset date should be set at July 1, 2003 to allow for a one year evaluation of natural gas and corresponding diesel fuel use for dual fuel engines under stop-and-go conditions.
- Response 1. AQMD staff is in discussions with CARB staff regarding testing and fuel use information utilized as part of the Carl Moyer Program to verify the fuel use and emission reduction benefits of dual-fuel engines as part of this program. From a consistency standpoint, since CARB staff considers

that dual-fuel engine technology has similar emission benefits compared with dedicated natural gas engines in solid waste collection vehicles, we believe it is appropriate to remove the sunset date for the use of dual-fuel engines in these vehicles. AQMD staff will monitor the fuel usage in dual fuel engine equipped solid waste collection vehicles, and if necessary, propose appropriate rule amendments to ensure the emission reduction benefits of the rule.

- Comment 2. Pending federal legislation recognizes a 90 percent natural gas and 10 percent diesel fuel combination as an alternative fuel. The definition of alternative fuel in Rule 1193 should be amended to recognize this fuel combination as an alternative fuel as well.
- Response 2. Staff believes that this expansion of the definition of alternative fuel is unnecessary since a vehicle powered by an engine utilizing this specific combination of fuels would be addressed by the existing definition of dual-fuel heavy-duty vehicle.
- Comment 3. The sunset date for the use of dual-fuel engines in solid waste collection vehicles should not be rescinded because dual-fuel engine emissions are always higher on NOx and particulate matter (PM) emissions than alternative fuel engines, regardless of the operating cycle. In addition, with dual-fuel engines, there is always the possibility of 100 percent diesel fuel usage for even higher emission levels.
- Response 3. Based on input from CARB staff, emission levels from dual-fuel or dedicated natural gas-powered solid waste collection vehicles are expected to be similar (see response to Comment #1). With regard to the possibility of 100 percent diesel fuel usage in dual fuel vehicles, this could only legally occur for a very short period of time when there is a malfunction with the dual-fuel engine control system. Other than this situation, operating the dual fuel engine on 100 percent diesel fuel would be considered tampering and enforceable to CARB certification of this engine design.
- Comment 4. Rescinding the sunset date for the use of dual-fuel engines in solid waste collection vehicles will reduce future competition in the alternative fuel engine marketplace. This will result in higher costs for fleets since a reduction in the variety of dedicated alternative fuel engines is expected as well as reduced technological development.
- Response 4. Staff believes that making market-based predictions on the future commercial viability, cost, and technological development of the universe of alternative fuel heavy-duty engines is uncertain, due to the complex nature of such predictions. Nevertheless, we believe that any potentially negative economic effects of the sunset date removal will be minimized since the use of dual-fuel engines in solid waste collection vehicles is only one of many applications where dedicated and dual-fuel engines compete

for use. Based on the latest projects that have been approved under the Carl Moyer program, substantial numbers dedicated alternative and dual fuel projects have been funded, and the overall choice to use a specific engine technology does not follow a predictable pattern.

- Comment 5. The proposed rule amendment incorporates a refuse collection duty cycle as part of the engine certification requirements. This duty cycle should not be included in the proposed amendment, since this requirement would entail significant additional costs incurred by engine manufacturers in obtaining approval to sell a specific engine model in California. This situation would likely cause all manufacturers of diesel and/or alternative fuel engines to abandon the SCAQMD market because of the cost of developing and certifying to a completely different and unique set of criteria. If the SCAQMD decides to implement such a new test procedure, it must do so “across the board” and apply it to all manufacturers.
- Response 5. This comment relates to the proposed modification to the definition of dual-fuel heavy-duty vehicles, where it specifies that a dual-fuel engine must be certified by CARB to meet an applicable optional nitrogen oxide exhaust emission standard when operating under a waste collection duty cycle as defined by CARB. AQMD staff understands that CARB is unlikely to develop and approve such a duty cycle as part of their engine certification requirements. As a result, the refuse collection duty cycle specification has been removed from the proposed rule language.
- Comment 6. The proposed definition of approved control device does not need to specify low sulfur (15 ppm) diesel fuel for all heavy-duty vehicles equipped with an approved control device. Heavy-duty vehicles equipped with a catalyzed particulate trap and powered by a dual-fuel engine do not require low sulfur diesel fuel for the proper operation of the particulate trap. An application for verification of a catalyzed particulate trap without the use of low sulfur diesel fuel is in the process of being submitted to CARB for verification approval.
- Response 6. In response to this comment, the low-sulfur diesel fuel requirement has been removed from the proposed rule language. However, low-sulfur diesel fuel must be used for these particulate traps for these that have been verified by CARB to require such usage. In addition, the use of low-sulfur diesel fuel will provide some minimal air quality benefits compared to current diesel fuel use.
- Comment 7. The deletion of the July 1, 2002 sunset date for the use of dual-fuel engines in solid waste collection vehicle should be implemented since dual-fuel engines provide a transition technology for the eventual use of dedicated alternative-fuel heavy-duty engines. There are currently concerns about the reliability of dedicated alternative-fuel heavy-duty engines.

- Response 7. AQMD staff agrees that dual-fuel engine technology is a transition technology that can provide fleet operators with needed compliance and infrastructure flexibility options. Notwithstanding, AQMD staff believes that the current generation of reliability of dedicated alternative fuel heavy-duty engine technology has compared to the first generation engines improved and significantly will continue to improve over time as engine manufacturers improve their alternative fuel engine product offerings.
- Comment 8. The current and proposed rule language does not make clear whether a heavy-duty vehicle powered by a dual-fuel engine can be operated without a particulate trap, if one has not been verified by CARB.
- Response 8. A heavy-duty vehicle powered by a dual-fuel engine can be operated without a particulate trap if there is no particulate trap verified by CARB for that engine model. Once verification has been attained, the fleet operators must install approved emission control devices (particulate traps) on dual-fuel engine equipped refuse vehicles.
- Comment 9. The proposed rule amendments do not address the issue of lower VOC and NO_x emissions coming from diesel powered heavy-duty vehicles versus corresponding natural gas powered vehicles, as indicated in SAE Technical Paper #2002-01-0432.
- Response 9. Because this proposed rule amendment focuses on the deletion of the dual-fuel engine sunset date for solid waste collection vehicles, the issue of VOC and NO_x emissions for diesel versus natural gas powered heavy-duty engines is not within the scope of the proposed amendment to Rule 1193. The technical paper cited in the comment provides emissions information on school buses, grocery trucks, and transit buses, tested on various types of diesel fuel and natural gas. Apparently, natural gas engines tested as part of this technical paper were optimized for low PM emissions at the expense of NO_x emissions. AQMD staff understands that West Virginia University, which was one of the co-authors of this technical paper, will be conducting specific diesel and natural gas refuse truck emission testing.
- Comment 10. The least polluting dedicated natural gas engines emit at about 1.5 g/bhp-hr NO_x and 0.01 g/bhp-hr PM. The AQMD should implement a level playing field approach by requiring dual fuel engines to meet these emission levels.
- Response 10. AQMD staff's intent is to include dual-fuel engines for rule compliance purposes to ensure that vehicles powered by these engines emit at levels which are commensurate with corresponding dedicated natural gas powered vehicles. In staff's view, this means requiring dual-fuel engines to meet an optional NO_x (or NO_x plus NMHC) emission standard and be

- equipped with a particulate trap to provide PM emission reductions achieved by its trap equipped diesel counterpart.
- Comment 11. A straight-up technological assessment is needed to determine how the emissions from diesel powered vehicles and corresponding alternative-fueled vehicles compare, in an effort to improve the determination of emission benefits for alternative fueled vehicles in refuse collection applications.
- Response 11. AQMD staff agrees with this comment and is working with appropriate government agencies and emission testing organizations to facilitate the generation of this information. See response to Comment 9.
- Comment 12. The cost of servicing natural gas vehicles is a concern to fleet operators.
- Response 12. Staff recognizes the potential cost impacts associated with training existing diesel mechanics for the repair of alternative-fueled engines. In particular, AQMD is currently working with the Community College System to develop a curriculum and course materials to train mechanics for the repair of heavy-duty natural gas engines. This should serve to lower the overall cost of providing community college based training to affected fleets. In addition, there are currently alternative fuel course offerings available, incurring low community college fees. The following Internet site, www.ngv.org, contains relevant training information. It should be noted that the proposed amendment to Rule 1193 would not directly impact the cost of training mechanics for the repair of alternative-fueled engines.
- Comment 13. New refuse trucks cost significantly more than used trucks. For fleets that buy used trucks exclusively due to monetary constraints, the alternative-fuel vehicle acquisition requirements present an undue financial burden since rule compliant vehicles are only available as new trucks.
- Response 13. Staff recognizes that the supply of natural gas refuse trucks, which are expected primarily to be the trucks that fleets acquire for rule compliance purposes, are only available as new trucks at the current time. As more natural gas powered refuse trucks are purchased by affected fleets in the District, it is expected that a market will evolve for used natural gas powered refuse trucks. Staff as well as other interested parties, such as the natural gas industry, should be available to assist fleets in locating used rule compliant vehicles as they become available for purchase. It should be noted that the proposed rule amendment is not expected to negatively affect the potential supply of used rule compliant refuse trucks in the future.
- Comment 14. Insufficient alternative fuel refueling infrastructure will be available to support the implementation of Rule 1193.

- Response 14. Developing sufficient refueling infrastructure to support rule compliance is a high priority implementation issue. As a result, the AQMD is committed to help coordinate and fund new refueling stations at strategic locations to maximize alternative fuel availability now and in the near future. The AQMD has already allocated significant funding assistance to expand the existing CNG, LCNG, and LNG refueling infrastructure, as well as LNG production facilities.
- Comment 15 Dual-fuel engine technology has been improved by incorporating an “idle on gas” optimization strategy. This improvement further reduces emissions and assures that natural gas is utilized throughout the operating range in door-to-door refuse collection duty cycles. Therefore, the sunset provisions in the Rule 1193 should be unconditionally removed and this should be aggressively communicated to all parties affected by Rule 1193.
- Response 15. Staff generally agrees with this comment, and is proposing elimination of the sunset date with appropriate additions and modifications to the rule language to ensure that rule compliance vehicles powered by dual-fuel engines achieve comparable emission characteristics with dedicated alternative fuel engines. Staff will undertake appropriate steps if necessary to communicate rule language modifications subsequent to approval by the Governing Board. It should be noted that the public process utilized to notify affected parties about the proposed rule amendment serves this purpose to a significant extent.
- Comment 16. Based on the product development efforts and certifications/verifications achieved, all “discount factors” that have been applied to Dual-Fuel products should be immediately and unconditionally eliminated.
- Response 16. Current rule language and the proposed amendment do not include any discount factors which would affect Rule 1193 compliance through the purchase of a vehicle powered by a dual-fuel engine.
- Comment 17. The Cummins Westport HPDI fuel system engine, which is fueled by natural gas and diesel, should be classified as a dedicated alternative fuel engine since less than 10 percent of its fuel requirements are supplied by diesel fuel.
- Response 17. Staff acknowledges this comment. However, from a definition standpoint, we believe that the HPDI fuel system engine is another form of a dual-fuel engine since both diesel and an alternative fuel are simultaneously combusted in the engine, with a minimal amount of diesel fuel being used to enable compression ignition.

Summary and Draft Findings

Summary

These findings are being made in compliance with state law requirements.

Draft Findings Required by the California Health and Safety Code

Health and Safety Code Section 40727 requires the AQMD to adopt written findings of necessity, authority, clarity, consistency, non-duplication and reference.

Necessity - The emission reductions associated with Proposed Amended Rule 1193 are needed for the following reasons:

- a) State and federal health-based ambient air quality standards for particulate matter and ozone are regularly and significantly violated in the South Coast Air Basin. The reduction of particulate matter and nitrogen dioxide emissions from diesel powered vehicles from Proposed Amended Rule 1193 is needed to meet federal and state air quality standards.
- b) By exceeding state and federal air quality standards, the health of people within the South Coast Air Basin is impaired.
- c) By exceeding state and federal air quality standards, the quality of life is reduced in the South Coast Air Basin in numerous respects.
- d) The California Clean Air Act (CH&SC Section 40910 et seq.) requires that the air districts make every effort to attain federal and state ambient air quality standards as soon as practicable. Proposed Amended Rule 1193 makes progress toward that goal.
- e) About 71 percent of cancer risk from air toxics is attributed to diesel particulate emissions, which would be reduced by the proposed rule.

Authority - The AQMD Board obtains its authority to adopt, amend, or repeal rules and regulations from Health & Safety Code Sections 40000, 40001, 40440, 40441, 40463, 40702, 40725 through 40728, and 40910 through 40920.

Clarity - The AQMD Board determines that Proposed Amended Rule 1193 is written or displayed so that its meaning can be easily understood by persons directly affected by it.

Consistency - The AQMD Board determines that Proposed Amended Rule 1193 is in harmony with, and not in conflict with or contradictory to, existing federal or state statutes, court decisions, or regulations.

Non-Duplication - Proposed Amended Rule 1193 does not impose the same requirements as any existing state or federal regulation and is necessary and proper to execute the powers and duties granted to, and imposed upon, the AQMD.

Reference - In adopting this Proposed Amended Rule 1193, the Board references the following statutes which the AQMD hereby implements, interprets or makes specific: H&S Code Sections 40001 (rules to achieve ambient air quality standards), 40440(a) (rules to carry out AQMP), and 40447.5(a) (rules to require fleets of 15 or more vehicles operating substantially in the AQMD to purchase vehicles powered by methanol or other equivalently clean burning alternative fuel when adding or replacing vehicles), 40919(a)(4).

ATTACHMENT 1

PROPOSED AMENDED RULE LANGUAGE

**PROPOSED AMENDED RULE 1193 IS PROVIDED IN AN EARLIER
PART OF THE BOARD PACKAGE AND WILL BE INSERTED HERE
UPON ADOPTION BY THE AQMD GOVERNING BOARD**

EXHIBIT 1

CARB Executive Order For Engine Family 1PSXH0626E6K

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER A-326-17
Relating to Certification of New Heavy-Duty Motor Vehicle Engines

POWER SYSTEMS ASSOCIATES

Pursuant to the authority vested in the Air Resources Board by Sections 43100, 43102 and 43103 of the Health and Safety Code; and

Pursuant to the authority vested in the undersigned by Sections 39515 and 39516 of the Health and Safety Code and Executive Order G-45-9; and

Pursuant to the December 15, 1998 Settlement Agreement between the Air Resources Board and Caterpillar, Inc. and any modifications to the Settlement Agreement;

IT IS ORDERED AND RESOLVED: That the following engine and emission control system produced by the manufacturer are certified for use in motor vehicles with a manufacturer's gross vehicle weight rating (GVWR) over 14,000 pounds:

Model-Year: 2001

Fuel Type: Compressed Natural Gas (CNG) plus Diesel multi-fuel, or Liquefied Natural Gas (LNG) plus Diesel multi-fuel, or Diesel-only (default operation)

<u>Engine Family</u>	<u>Engine Displacement Liters (Cubic Inches)</u>	<u>Exhaust Emission Control Systems and Special Features</u>
1PSXH0629E6K (C-10 Refuse)	10.3 (629)	Turbocharger Charge Air Cooler Engine Control Module (Diesel) Engine Control Module (CNG/LNG) Direct Diesel Injection

Engine models and codes are listed on attachments.

The following are the certification exhaust emission standards for this engine family in grams per brake horsepower-hour: (The standards in parentheses are for diesel-only default operation.) (Title 13, California Code of Regulations, Sections 1956.8(a)(1) Footnote T and 1956.8(a)(3))

<u>Non-Methane (Total) Hydrocarbons</u>	<u>Carbon Monoxide</u>	<u>Nitrogen Oxides</u>	<u>Particulate Matter</u>
1.2 (1.3)	15.5 (15.5)	2.5 (4.0)	0.10 (0.10)

The following are the certification exhaust emission values for this engine family in grams per brake horsepower-hour: (The values in parentheses are for diesel-only default operation.)

<u>Non-Methane (Total) Hydrocarbons</u>	<u>Carbon Monoxide</u>	<u>Nitrogen Oxides</u>	<u>Particulate Matter</u>
1.0 (0.2)	5.3 (1.1)	2.3 (3.7)	0.05 (0.08)

BE IT FURTHER RESOLVED: That for the listed engine models, the manufacturer has submitted the materials to demonstrate certification compliance with the Board's emission control system warranty provisions (Title 13, California Code of Regulations, Section 2035 et seq.).

BE IT FURTHER RESOLVED: That the aforementioned engine family has been conditionally certified subject to the following conditions:

1. The Settlement Agreement (with Caterpillar, Inc.) is in effect.
2. Caterpillar, Inc. is in compliance with all applicable certification requirements of the Settlement Agreement.

Engines certified under this Executive Order must conform to all applicable California emission regulations and to all applicable terms and conditions of the Settlement Agreement.

The Bureau of Automotive Repair will be notified by copy of this order and attachments.

Executed at El Monte, California this 3RD day of May 2001.


FOR
R. B. Summerfield, Chief
Mobile Source Operations Division

EXHIBIT 2

CARB Executive Order For Engine Family 2PSXH0629E6K

3.21.02

 AIR RESOURCES BOARD	POWER SYSTEMS ASSOCIATES, LLC	EXECUTIVE ORDER A-326-0021 New On-Road Heavy-Duty Engines
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Pursuant to the authority vested in the Air Resources Board by Health and Safety Code (HSC) Division 26, Part 5, Chapter 2; and pursuant to the authority vested in the undersigned by HSC Sections 39515 and 39516 and Executive Order G-45-9;

IT IS ORDERED AND RESOLVED: That the engine and emission control systems produced by the manufacturer are certified as described below for use in on-road motor vehicles with a manufacturer's gross vehicle weight rating (GVWR) over 14,000 pounds. Production engines shall be in all material respects the same as those for which certification is granted.

MODEL YEAR	ENGINE FAMILY	ENGINE SIZE (liter)	FUEL TYPE (CNG/LNG=compressed/liquefied natural gas; LPG=liquefied petroleum gas)	STANDARDS & TEST PROCEDURE	INTENDED SERVICE CLASS (L/M/H HD=light/medium/heavy heavy-duty; (HD) diesel; UB=urban bus; NDC=HD Otto)
2002	2PSXH0629E0K	10.3	- Multi Fuel: CNG or LNG and Diesel - Diesel Only (default operation)	Diesel	HHDD
SPECIAL FEATURES & EMISSION CONTROL SYSTEMS			ENGINE MODELS / CODES (rated power in horsepower, hp)		
DDL MFI (CNG or LNG), TC, CAC, ECM(2)			DUAL-FUEL C-10 / 1 (315 hp)		
<small> TWC=three-way oxidizing catalyst WU (pretit) warm-up cat. O2S=Oxygen sensor HO2S=heated O2S TB=throttle body fuel injection MFM=multifuel injection SF=sequential MPI DD=direct diesel injection TC=Turbocharger CAC=charge air cooler EO=exhaust gas recirculation AIR=secondary air injection PA=port fuel injection SFL=ramuse puff sensor ECM/PCM=engine (powertrain) control module EM=engine modification 2 (prefix)parallel (2) (suffix)in series </small>					

The following are the exhaust emission standards (CERT), or family emission limit(s) (FEL) as applicable, and certification levels (CERT) in grams per brake horsepower-hour (g/bhp-hr) for this engine family for hydrocarbon (HC) or non-methane HC (NMHC), oxides of nitrogen (NOx), or NMHC+NOx, carbon monoxide (CO) [except that "diesel" CO certification compliance may have been demonstrated pursuant to Code of Federal Regulations, Title 40, Part 85, Subpart A, Section 86.091-23(c)(2)(i) in lieu of testing], particulate matter (PM), and formaldehyde (HCHO) under the "Federal Test Procedure" (FTP) (Title 13, California Code of Regulations, (13 CCR) Section 1956.1 (urban bus) or 1956.8 (other than urban bus)); (For flexible- and dual-fueled engines, the CERT values in brackets [] are those when tested on conventional test fuel. For multi-fueled engines, the STD and CERT values for default operation permitted in 13 CCR Section 1956.1 or 1956.8 are in parentheses.)

* = not applicable	[g/bhp-hr]	HC	NMHC	NOx	NMHC+NOx	CO	PM	HCHO
(DIRECT) STANDARD		1.3 (1.3)	*	2.5 (4.6)	*	16.5 (15.5)	0.15 (0.10)	*
CORPORATE AVERAGE STANDARD		*	*	*	*	*	*	*
FAMILY EMISSION LIMIT (FEL)		*	*	*	*	*	*	*
CERTIFICATION LEVEL		1.0 (0.2)	*	2.3 (3.7)	*	9.3 (1.1)	0.05 (0.08)	*

BE IT FURTHER RESOLVED: That certification to the FEL(s) listed above, as applicable, is subject to the following terms, limitations and conditions. The FEL(s) is the emission level declared by the manufacturer and serves in lieu of an emission standard for certification purposes in any averaging, banking, or trading (ABT) programs. It will be used for determining compliance of any engine in this family and compliance with such ABT programs.

BE IT FURTHER RESOLVED: That the listed engine models have been certified to the FTP optional NOx, or NMHC+NOx as applicable, reduced emission standard(s) listed above pursuant to 13 CCR Section 1956.1 or 1956.8.

BE IT FURTHER RESOLVED: That for the listed engine models, the manufacturer has submitted the materials to demonstrate certification compliance with 13 CCR Sections 1965 (emission control labels), and 2035 et seq. (emission control warranty).

Engines certified under this Executive Order shall conform to all applicable California emission regulations.

The Bureau of Automotive Repair will be notified by copy of this Executive Order.

Executed at El Monte, California on this 18TH day of March 2002.


 Allen Lyons, Chief
 New Vehicle / Engine Programs Branch

LARGE ENGINE MODEL SUMMARY

Manufacturer: **POWER SYSTEMS ASSOCIATES, LLC**

Process Code: **New Submission**

EPA Engine Family: **2PSXH0629E6K**

Manufacturer Family Name: **Dual-Fuel C-10 Refuse***

1. Engine Code: **2** Engine Model: **DUAL-FUEL C-10** 3.BHP@RPM (SAE Gross): **315 @ 1800** 4. Fuel Rate: mm³/stroke @ peak HP (for diesel only): **20.0 (diesel) 140 mg (gas)** 5. Fuel Rate: (lb/hr) @ peak HP (for diesels only): **12 (diesel) 100 (gas)** 6. Torque @ RPM (SEA Gross): **1050 @ 1400** 7. Fuel Rate: mm³/stroke@peak torque: **18.0 (diesel) 145 mg (gas)** 8. Fuel Rate: (lb/hr)@peak torque: **8.4 (diesel) 80.4 (gas)** 9. Emission Control Device Per SAE J1930: **ECM-2,DI,CAC,TC**

1. Engine Code	2. Engine Model	3. BHP@RPM (SAE Gross)	4. Fuel Rate: mm ³ /stroke @ peak HP (for diesel only)	5. Fuel Rate: (lb/hr) @ peak HP (for diesels only)	6. Torque @ RPM (SEA Gross)	7. Fuel Rate: mm ³ /stroke@peak torque	8. Fuel Rate: (lb/hr)@peak torque	9. Emission Control Device Per SAE J1930
I	DUAL-FUEL C-10	315 @ 1800	20.0 (diesel) 140 mg (gas)	12 (diesel) 100 (gas)	1050 @ 1400	18.0 (diesel) 145 mg (gas)	8.4 (diesel) 80.4 (gas)	ECM-2,DI,CAC,TC ECM-2,DI,CAC,TC

(DPI, GFI, ECM2)
CAC,TC

ATTACHMENT

EXHIBIT 3

CARB Executive Order For Engine Family 1WFSH0912XAC

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER A-343-1
Relating to Certification of New Heavy-Duty Engines and Vehicles

WESTPORT FUEL SYSTEMS INC.

Pursuant to the authority vested in the Air Resources Board at Sections 43100, 43101, and 43102 of the Health and Safety Code; and

Pursuant to the authority vested in the undersigned at Sections 39515 and 39516 of the Health and Safety Code and Executive Order G-45-9; and

IT IS ORDERED AND RESOLVED: That the following engines and emission control systems produced by the manufacturer are certified for use in motor vehicles with a manufacturer's gross vehicle weight rating (GVWR) over 14,000 pounds:

Model Year: 2001

Fuel Type: Bi-Fuel Engine [Compressed Natural Gas (CNG) or Liquefied Natural Gas (LNG)] and Diesel

<u>Engine Family</u>	<u>Displacement</u>		<u>Exhaust Emission Control Systems and Special Features</u>
	<u>Liters</u>	<u>Cubic Inches</u>	
1WFSH0912XAC	14.9	912	Turbocharger Charge Air Cooler Powertrain Control Module Direct Diesel/Gaseous Fuel Injection

Engine models and codes are listed on the attachments.

BE IT ORDERED AND RESOLVED: That the following are the certification exhaust emission standards (Title 13, California Code of Regulations, Section 1956.8) and certification emission levels for this engine family in grams per brake horsepower-hour (g/bhp-hr) under the Federal Test Procedure ("FTP"):

	<u>Non-Methane Hydrocarbons</u>	<u>Carbon Monoxide</u>	<u>Nitrogen Oxides</u>	<u>Particulate Matter</u>
Standards	1.2	15.5	2.5	0.10
Certification	0.4	2.0	2.4	0.05

BE IT FURTHER RESOLVED: That the listed engine models are certified to the optional lower-emission NOx standard pursuant to Title 13, California Code of Regulations, Section 1956.8(a)(1).

BE IT FURTHER RESOLVED: That for the listed engine models, the manufacturer has submitted the materials to demonstrate certification compliance with the Board's emission control system warranty provisions (Title 13, California Code of Regulations, Sections 2035 *et seq.*).

Engines certified under this Executive Order must conform to all applicable California emission regulations.

The Bureau of Automotive Repair will be notified by copy of this order and attachments.

Executed at El Monte, California this 22nd day of February 2001.



R. B. Summerfield, Chief
Mobile Source Operations Division

Engine Model Primary Form

Manufacturer: Westport Fuel Systems Inc.
 Engine category: On-highway HDDE
 EPA Engine Family: 1WFSH0912XAG
 Mfr Family Name: N/A
 Process Code: New Submission

1.Engine Code	2.Engine Model	3.BHP@RPM (SAE Gross)	4.Fuel Rate: mm ³ /stroke @ peak HP (for diesel only)	5.Fuel Rate: (lb/hr) @ peak HP (for diesels only)	6.Torque @ RPM (SEA Gross)	7.Fuel Rate: mm ³ /stroke@peak torque	8.Fuel Rate: (lb/hr)@peak torque	9.Emission Control Device Per SAE J1950
N/A	ISX 400 HPDI	435@1800	6.6 (diesel) 304 (gas*)	3.5 (diesel) 103 (gas*)	1450@1200	4.1 (diesel) 271 (gas*)	1.8 (diesel) 109 (gas*)	PCM, TC, CAC DPi

* diesel equiv.
 energy basis
 diesel - 43MJ/kg
 CNG - 49 MJ/kg

Part Number Summary Form

Manufacturer: Westport Fuel Systems Inc.
 Engine category: On-highway HDDE
 EPA Engine Family: 1WFSH0912XAC
 Mr Family Name: N/A
 Process Code: New Submission

Engine Code	Engine Model	Injection Pump	Injector	Turbo Charge	Electronic Control Module	Alter Treatment Device (Specify)	Smoke Puff Limiter	Description	Sensor Assemblies Part Number
N/A	ISX 400 HPDI		J31-INJ-100	3592545	3681405			In Mild	3417183
								Engine Speed	4001902
								Coolant Temp	3865346
								Ambient Press.	3331044
								CNG Press.	SM 200

ATTACHMENT

LARGE ENGINE MODEL SUMMARY

A-326-17

Manufacturer: POWER SYSTEMS ASSOCIATES, LLC Process Code: New Submission

EPA Engine Family: 1PSXH0629E6K

Manufacturer Family Name: Dual-Fuel C-10 Refuse

1.Engine Code	2.Engine Model	3.BHP@RPM (SAE Gross)	4.Fuel Rate: mm/stroke @ peak HP (for diesel only)	5.Fuel Rate: (lbs/hr) @ peak HP (for diesels only)	6.Torque @ RPM (SEA Gross)	7.Fuel Rate: mm/stroke@peak torque	8.Fuel Rate: (lbs/hr)@peak torque	9.Emission Control Device Per SAE J1930
1	DUAL-FUEL C-10	315 @ 1800	20.0 (diesel) 140 mg (gas)	12 (diesel) 100 (gas)	1050 @ 1400	18.0 (diesel) 145 mg (gas)	8.4 (diesel) 80.4 (gas)	ECM-2,DI,CAC,TC ECM-2,DI,CAC,TC

ECM-2 } ECM(Diesel)
ECM(CNG/CNG