

16005 - Air Quality Compliance Report

PREPARED FOR:

STATE OF ALASKA

**ALASKA ENERGY AUTHORITY/
RURAL ENERGY GROUP**

PREPARED BY:



**Mailing Address - P.O. Box 111405
Anchorage, AK 99511-1405
(907) 349-0100 349-8001 FAX**



November 4, 2016

INDEX

Index	Page i
Overview.....	Page 1
Regulatory Review.....	Page 1
Tier 4 Engine Survey	Page 2
Regulatory Summary	Page 3
RICE NESHAP	Page 3
NSPS	Page 4
Prime Power Genset Engine Data	Appendix A
Prime Power Engine Selection Data.....	Appendix B
NSPS & RICE NESHAP Regulatory Citations	Appendix C
John Deere Tier 4 Engine Data	Appendix D

16005 - Air Quality Compliance Report

OVERVIEW

The Alaska Energy Authority (AEA) contracted with Gray Stassel Engineering, Inc. (GSE) to prepare this Air Quality Compliance study. The purpose of this Study is to compile and evaluate EPA air quality regulations that apply to diesel engines in stationary prime power applications in remote areas of Alaska.

Diesel generation provides nearly 90% of all electricity in rural Alaska. Due to the immensity and complexity of EPA air quality rules, this Study focused primarily on diesel engines less than 800 horse power (550 kW electric prime power), located in rural Alaska utilities that consume less than 330,900-gallons of diesel/year. This classification applies to more than 500 prime power diesel gensets located in over 170 communities located in remote areas of Alaska.

The effort consists of three tasks:

- review current EPA air quality regulations
- obtain available information on final Tier 4 engines in prime power applications
- prepare a report that summarizes the information obtained and provide a matrix of pertinent regulations and how they apply to engines in prime power applications

There are a variety of makes and models of prime power diesel engines in service throughout rural Alaska. However, John Deere, Detroit Diesel, and Caterpillar make up the majority of these engines less than 800 HP. Although there is overlap in manufacturer and horsepower, in general terms the market share of diesel engines can be categorized as follows:

- John Deere: 35 kW to 200+ kW
- Detroit Diesel: 200 kW to 350 kW
- Caterpillar (CAT): over 350 kW

The information in this report applies to utilities with larger gensets and that consume more than 330,900-gallons/year of diesel, but these utilities are subject to additional air quality permit rules, including additional reporting and other compliance requirements, that affect the application of the information in this study, and that need to be evaluated on a case by case basis.

Regulatory Review

Many EPA rules apply to stationary prime power applications, but the two main rules are:

40 CFR 60, Subpart IIII, New Source Performance Standards (NSPS), and

40 CFR 63, Subpart ZZZZ, Reciprocating Internal Combustion Engine, National Emissions Standards for Hazardous Air Pollutants (RICE NESHAP).

NSPS applies to 2007 model year and newer engines, while RICE NESHAP applies to 2006 and older engines. In general terms, NSPS applies to "Tier" certified engines, while RICE NESHAP applies to non-certified engines. In addition to these two rules, other rules are referenced in both NSPS and RICE NESHAP. As part of this study, the most recent editions of the following federal regulations were reviewed:

- 40 CFR 60: NSPS - Tier certified engines
- 40 CFR 63: RICE NESHAP - non-certified engines
- 40 CFR 80: Fuel Regulations
- 40 CFR 89: Marine Tier 1 & 2
- 40 CFR 279.11: Used Oil Specifications
- 40 CFR 1039: Nonroad Tier 4
- 40 CFR 1042: Marine Tier 3 & 4
- 40 CFR 1068: Highway, Stationary, Non-Road Compliance (flex/TPEM, Rebuild, Tampering)

Tier 4 Engine Survey:

A combination of exhaust treatments are used to meet final Tier 4 emissions requirements. The most commonly used are diesel oxidation catalyst (DOC), diesel particulate filter (DPF) and selective catalytic reduction (SCR). Although there is a variety of different DOC/DPF/SCR technologies available, all rely on Ultra Low Sulfur Diesel (ULSD) fuel to prevent contamination of the exhaust filtration devices.

A DOC uses a catalyst to remove (oxidize) Hydrocarbons (HC) and Carbon Monoxide (CO). A DPF can both remove and trap (filter) Particulate Matter (PM). A DOC can be used upstream of a DPF to provide NO₂ to reduce the exhaust temperature needed to passively regenerate (oxidize) PM in a DPF. Although a DPF can passively regenerate, it must be manually cleaned periodically to maintain proper operation and prevent excessive exhaust backpressure. Selective Catalytic Reduction (SCR) injects a solution of water and urea into the exhaust stream to reduce NO_x emissions.

There is limited information available for commercially available Tier 4 prime power engines under 800 HP. To date, GSE has only received technical data from John Deere for final Tier 4 engines.

John Deere has several models of Tier 4 certified engines ranging from 30 kW to 369 kW, prime power. The smallest engines are equipped with a wastegated turbocharger and combination Diesel Oxidation Catalyst / Diesel Particulate Filter (DOC/DPF). Larger engines are equipped with series fixed and variable geometry turbochargers, cooled exhaust gas recirculation (EGR), DOC/DPF filters, and Selective Catalytic Reduction (SCR). All engines are air-to-air aftercooled, equipped with high pressure common rail fuel systems, and engine and emissions equipment is managed by the engine control unit (ECU).

Neither CAT nor MTU/Detroit Diesel manufacture a final Tier 4 prime power engine package under 800 HP, but do offer Tier 2 or Tier 3 engines with third party aftertreatment including DOC/DPF and SCR to meet final Tier 4 emissions requirements.

Maintenance requirements for final Tier 4 engines in prime power applications are presently uncertain, as there are no final Tier 4 engines with exhaust aftertreatment reported in operation in Alaska or the U.S.

Since there are no final Tier 4 prime power applications reported in operation, information on failures or reliability issues is unavailable. However, commonly reported issues associated with final Tier 4 engines in the non-road (heavy equipment) mobile source market include failures of the EGR valve, variable geometry turbochargers, and the equipment going into "limp" mode – due to the DPF not regenerating properly. When this occurs, a factory trained technician is required to reset the engine to normal operation.

The effect of final Tier 4 compliance on reliability and maintenance costs is not available for prime power applications. However, one vendor used the term "3x" to imply it cost three times as much to service or repair a final Tier 4 engine, compared to an engine without exhaust aftertreatment, due to the time required to remove the exhaust components to access the actual engine, as well as the additional cost associated with maintaining the exhaust after treatment equipment.

Unlike earlier tier diesel engines, Tier 4 engine fuel efficiency is variable, as fuel is consumed to increase the exhaust temperature high enough for filters to regenerate. The amount of additional fuel consumed for regeneration varies depending on a number of factors, including engine load and type of exhaust after treatment used. Published fuel efficiency data for John Deere Tier 4 engines is included in the following section.

The effect of final Tier 4 compliance on heat recovery also varies. John Deere Final Tier 4 gensets come equipped with a skid mounted radiator, which do not support heat recovery. CAT and MTU Tier 4 compliant gensets are equipped with third party exhaust after treatment equipment, and can be cooled with remote radiators. There is no information currently available on the affect heat recovery may have on exhaust equipment regeneration, but if the heat recovery system overcools the engine and lowers the exhaust temperature, problems are likely to occur with the exhaust after treatment equipment.

REGULATORY SUMMARY:

There are two primary EPA regulations that apply to stationary diesel engines in prime power applications in remote areas of Alaska:

- RICE NESHAP – 40 CFR 63 ZZZZ (Reciprocating Internal Combustion Engine National Emissions Standards for Hazardous Air Pollutants)
- NSPS – 40 CFR 60 IIII (New Source Performance Standards)

These rules apply to stationary diesel engines throughout the United States. During the rule making process, the state of Alaska worked with EPA to address specific, unique circumstances that pertain to rural Alaska villages. As a result, EPA provided regulatory relief to remote areas of Alaska under both RICE NESHAP and NSPS.

RICE NESHAP and NSPS define “Remote Areas of Alaska” as:

- (1) Areas of Alaska that are not accessible by the Federal Aid Highway System (FAHS), or
- (2) Areas of Alaska that meet all of the following:
 - (i) The only connection to the FAHS is through the Alaska Marine Highway System (AMHS), or is within an isolated grid not connected to the Alaska Railbelt Grid.
 - (ii) At least 10 percent of the power generated on an annual basis is used for residential purposes.
 - (iii) The generating capacity is less than 12 megawatts, or is used exclusively for backup power for renewable energy.

RICE-NESHAP

RICE-NESHAP applies to stationary diesel engines manufactured on or before April 1, 2006 (non-certified engines). For those engines that are located in Remote Areas of Alaska, Owner's and Operator's are responsible for compliance by meeting the Management Practices listed below:

MANAGEMENT PRACTICES

- a. Change oil and filter every 1,000 hours of operation or annually, whichever comes first;
- b. Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first, and replace as necessary;
- c. Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.
- d. Minimize the engine's time spent at idle and minimize the engine's startup time at startup to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes.

New Source Performance Standards

NSPS applies to stationary diesel engines manufactured after April 1, 2006, and Manufacturer's are responsible for producing certified (tier) engines that comply with the rule. Owner's and Operator's comply by purchasing a tier-certified engine, and document that certified engines are operated and maintained in accordance with the manufacturers emissions-related written instructions.

NSPS prohibits stockpiling earlier tier engines for installation in later years:

- a **new** engine greater than or equal to 75 HP and less than 175 HP may not be installed after December 31, 2013 unless it meets 2012 model year requirements (i.e., *Non-Road Interim Tier 4 or Marine Tier 2*)
- a **new** engine greater than or equal to 175 HP and less than 750 HP may not be installed after December 31, 2012 unless it meets 2011 model year requirements (i.e., *Non-Road Tier 3 or Marine Tier 2*)

The following NSPS provisions apply only to engines located in Remote Areas of Alaska:

(b) Except as indicated in paragraph (c) diesel engines located in remote areas of Alaska may meet the requirements of 40 CFR parts 94 or 1042 - for marine engines (see 40 CFR 60.4216(b));

(c) Diesel engines located in remote areas of Alaska may choose to meet the emission standards for emergency engines (Nonroad Tier 3), except that MY14 and later engines must meet final Tier 4 PM standards, or install an exhaust filter that reduces PM emission by 85 percent (see 40 CFR 60.4216(c));

(d) pre-2014 model year stationary diesel engines located in remote areas of Alaska are not required to use ULSD fuel (see 40 CFR 60.4216(d));

(f) diesel engines located in remote areas of Alaska may mix fuel with used lubricating oil, in volumes of up to 1.75 percent of the total fuel. The used oil sulfur content must be less than 200 ppm, and meet the on specification requirements for used oil in 40 CFR 279.11 (see 40 CFR 60.4216(f)).

The following sections of this report include information on John Deere Tier 4 engine fuel efficiency and exhaust aftertreatment technologies, an engine selection matrix, as well as pertinent NSPS and RICE NESHAP regulatory citations.

APPENDIX A

Prime Power Genset Engine Data

- **AEA Genset Table**
- **Genset Fuel Efficiency**
- **Jacket Water Heat Rejection**

	Model #	Model Year	EPA Tier Rating	Prime rating without Fan 0.8PF (kW)	rpm	Fuel Efficcy at 75% load (kWh/gal)	Turbo cooling	Marine Manifold	Jacketwater Heat at PRIME RATING (Btu/kWh)	Particulate filter required?	Urea required?	Availability
John Deere	3029HFG89	MY14+	NR-IT4	38	1800	14.2	ATAC	N	1923	N	N	1, 2, 3
John Deere	4045TFM75	<MY13	M-T2	67	1800	12.6	NONE	Y	3155	N	N	1, 2, 3
John Deere	4045TFM85	MY13+	M-T3	68	1800	11.9	NONE	Y	4013	N	N	1, 2, 3
John Deere	4045AFM85	MY13+	M-T3	101	1800	12.9	JWAC	Y	4159	N	N	1, 2, 3
John Deere	RG6081AFM75	<MY13	M-T2	179	1800	13.2	JWAC	Y	3223	N	N	1, 2, 3
John Deere	RG6081HF070	<MY06	NR-T2	210	1800	13.7	ATAC	N	1400	N	N	1, 2, 3
John Deere	6090AFM75	<MY14	M-T2	210	1800	13.5	JWAC	Y	3382	N	N	1, 2, 3
John Deere	6090AFM85	MY14+	M-T3	210	1800	13.7	JWAC	Y	3984	Y	N	1, 2, 3
Detroit Diesel	Series 60 (12.7L)	<2006	NONE	220	1200	15	ATAC	N	1376	N	N	5
Detroit Diesel	Series 60 (12.7L)	<2006	NONE	200	1200	14.8	ATAC	Y	1950	N	N	5
Detroit Diesel	Series 60 (12.7L)	<2006	NONE	355	1800	15.2	ATAC	N	1220	N	N	5
Detroit Diesel	Series 60 (12.7L)	<2006	NONE	355	1800	15.2	ATAC	Y	1945	N	N	5
Caterpillar	3456	<2006	Low BSFC	476	1800	15.7	ATAC	N	1160	N	N	4
Caterpillar	3456	<2006	Low BSFC	476	1800	15.7	ATAC	Y	3000	N	N	4
Caterpillar	3508B	<2006	Low BSFC	550	1200	14.8	JWAC	N	2053	N	N	4
Caterpillar	3508B	<2006	Low BSFC	1030	1800	14.4	JWAC	N	2425	N	N	4
Caterpillar	3512B	<2006	Low BSFC	1050	1200	14.8	SCAC	N	1745	N	N	4
Caterpillar	3512C	MY07+	NR-T2	1050	1200	14.7	SCAC	N	1344	N	N	4
Caterpillar	3516B	<2006	Low BSFC	1285	1200	14.8	JWAC	N	2230	N	N	4
Caterpillar	3516B	<2006	Low BSFC	1322	1200	15.7	SCAC	N	1402	N	N	4
Scania	DI13075M	<MY14	M-T2	400	1800	15.3	SCAC	Y	2482	N	N	3

Notes:

Minimum recommended load varies by engine manufacturer. Typical minimum sustained load is 30% of prime rating. Verify load requirements for your application

Model Year: <2006 and <MY06 are 2006 and older, MY07+ is a 2007 or newer, <MY13 is older than 2013, MY13+ is 2013 and newer, <MY14 is older than 2014, MY14+ is 2014 and newer

EPA Tier Rating: NR-IT4 is Non-Road Interim Tier 4, M-T3 is Marine Tier 3, M-T2 is Marine Tier 2, NR-T2 is Non-Road Tier 2, Low BSFC is optimum fuel economy, NONE is non-certified

Turbo Cooling: ATAC is Air-to-Air Aftercooled, JWAC is Jacket Water Aftercooled, SCAC is Separately Cooled Aftercooler, NONE is no turbocharger cooling

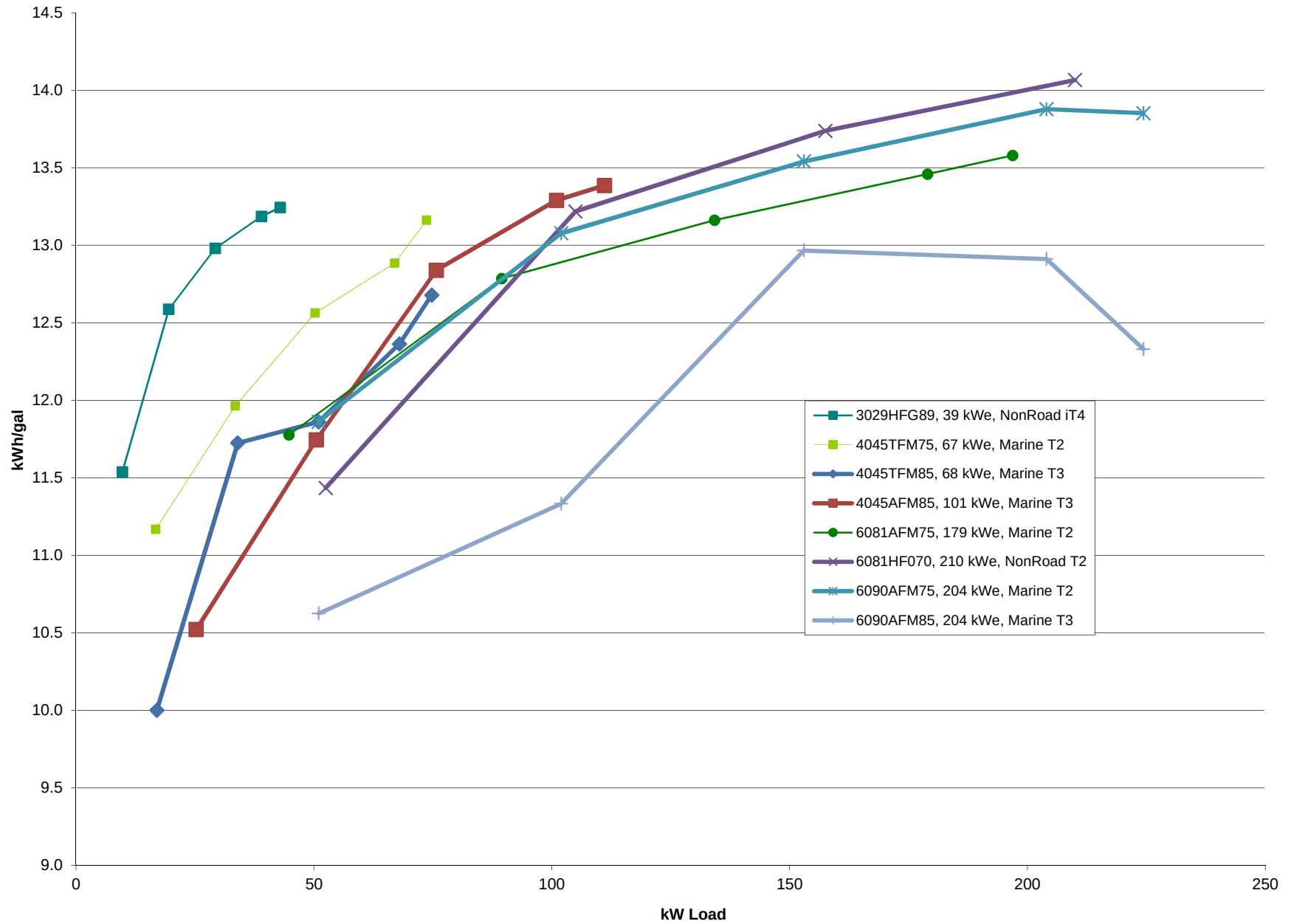
Fuel Efficiency at 75%: is fuel consumption, in kW/gallon, at 75% of prime rated kW load - **REFER TO ATTACHED FUEL CURVES FOR ADDITIONAL INFORMATION**

Jacket Water Heat: is heat rejected in, Btu/kW-hour, from the jacket water to the cooling system at prime rated kW load - **REFER TO ATTACHED HEAT REJECTION CURVES**

Availability: below are some local vendors that provide engines and engine parts

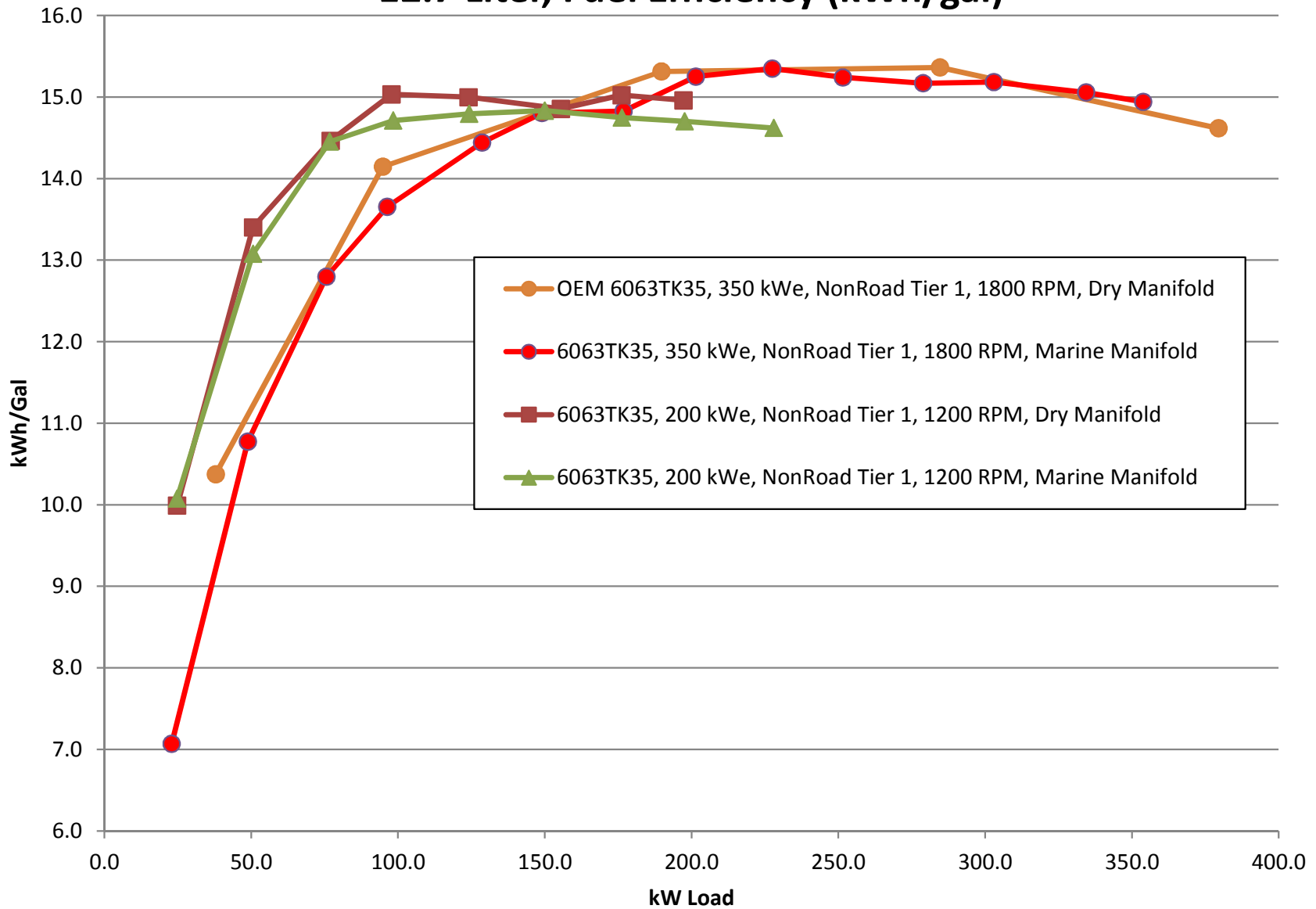
- 1) Airport Equipment Rentals, Anchorage, AK 907-646-4317
- 2) Craig Taylor Equipment, Anchorage, AK 907-276-5050
- 3) Marsh Creek, Anchorage, AK 907-258-0050
- 4) NC Power Systems, Anchorage, AK 907-561-1766
- 5) Pacific Power Group, Anchorage, AK 907-522-3434

John Deere Fuel Efficiency

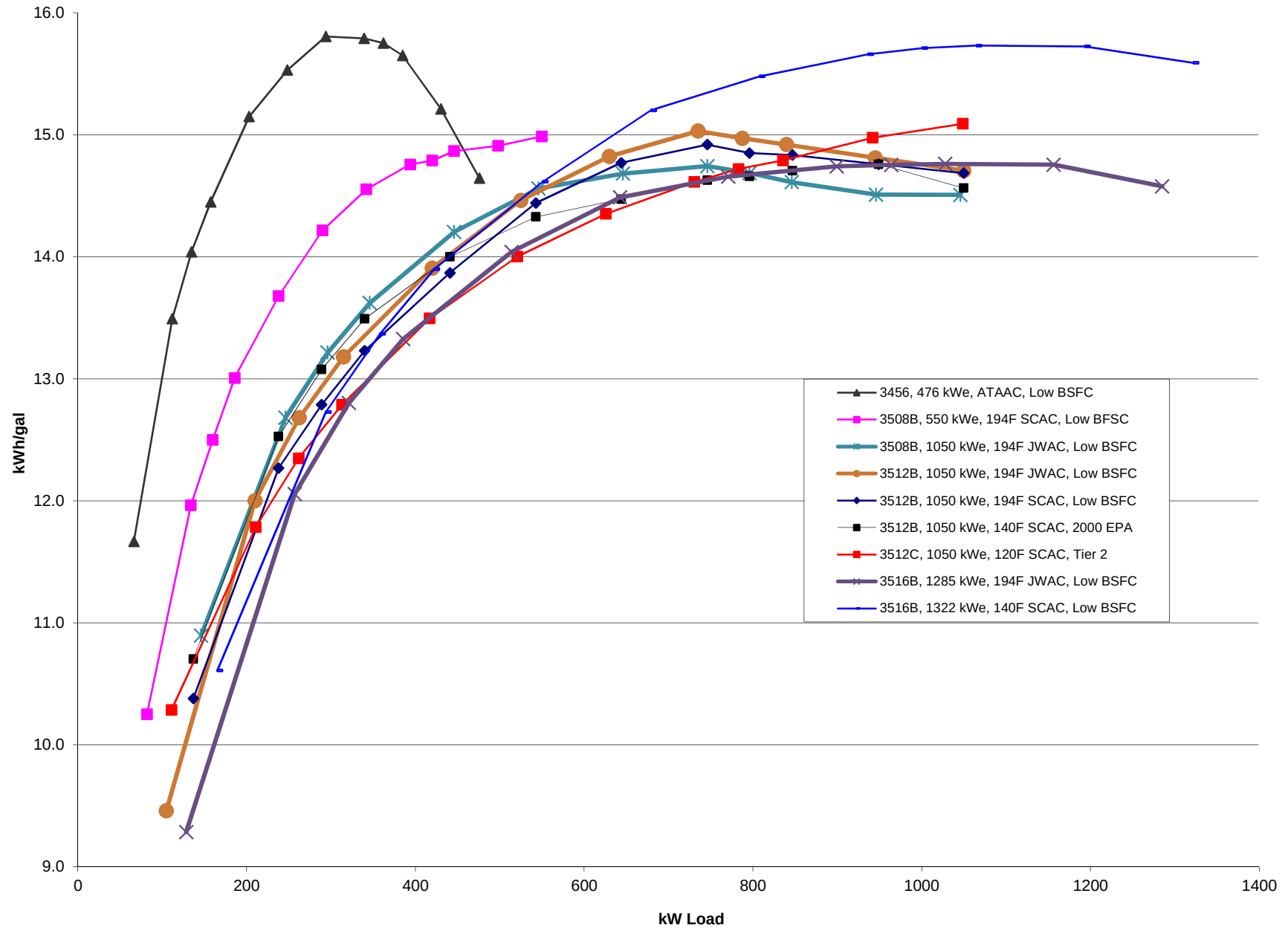


Detroit Diesel, Series 60 DDEC4 - 1800 & 1200 RPM

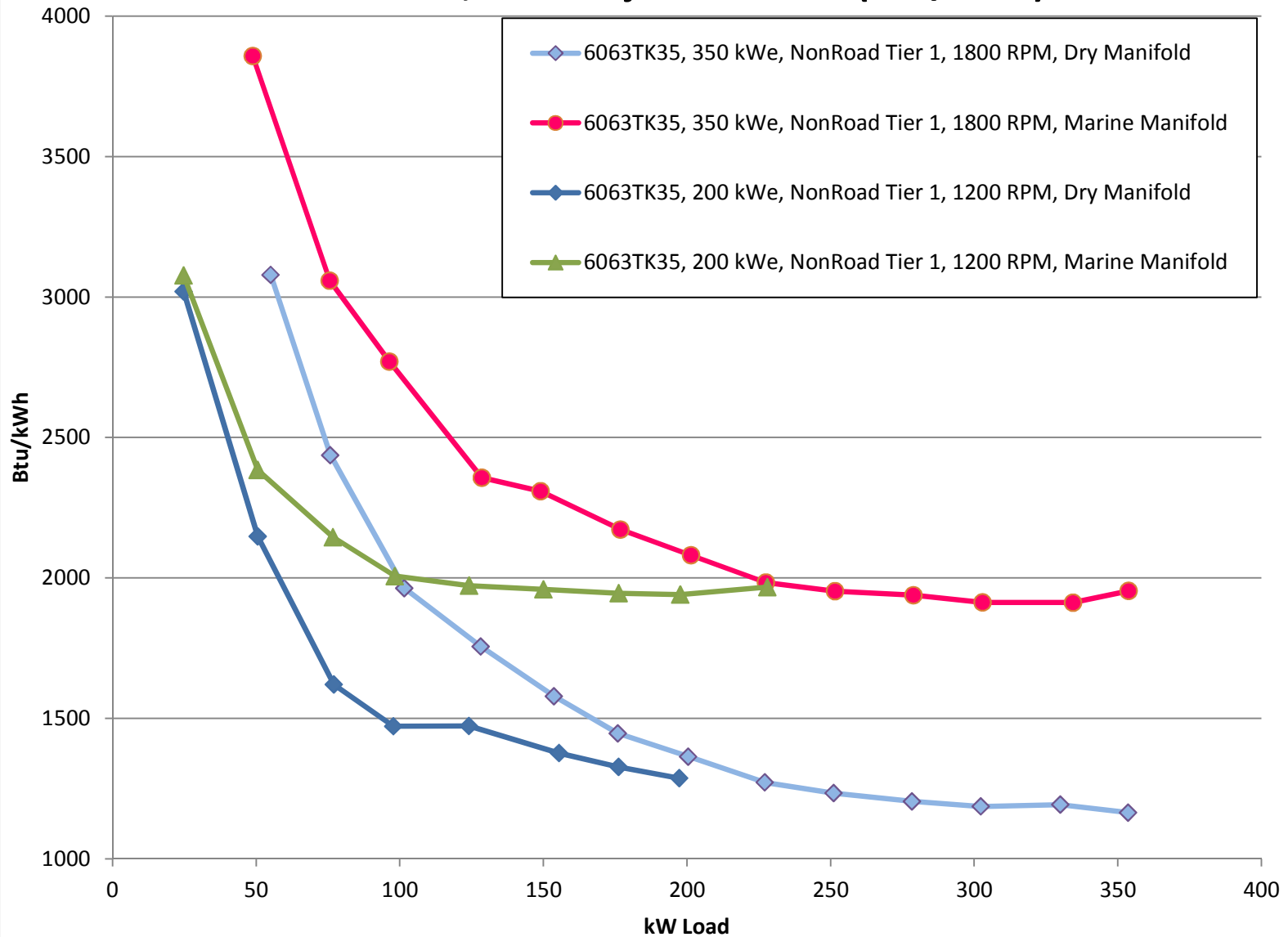
12.7 Liter, Fuel Efficiency (kWh/gal)



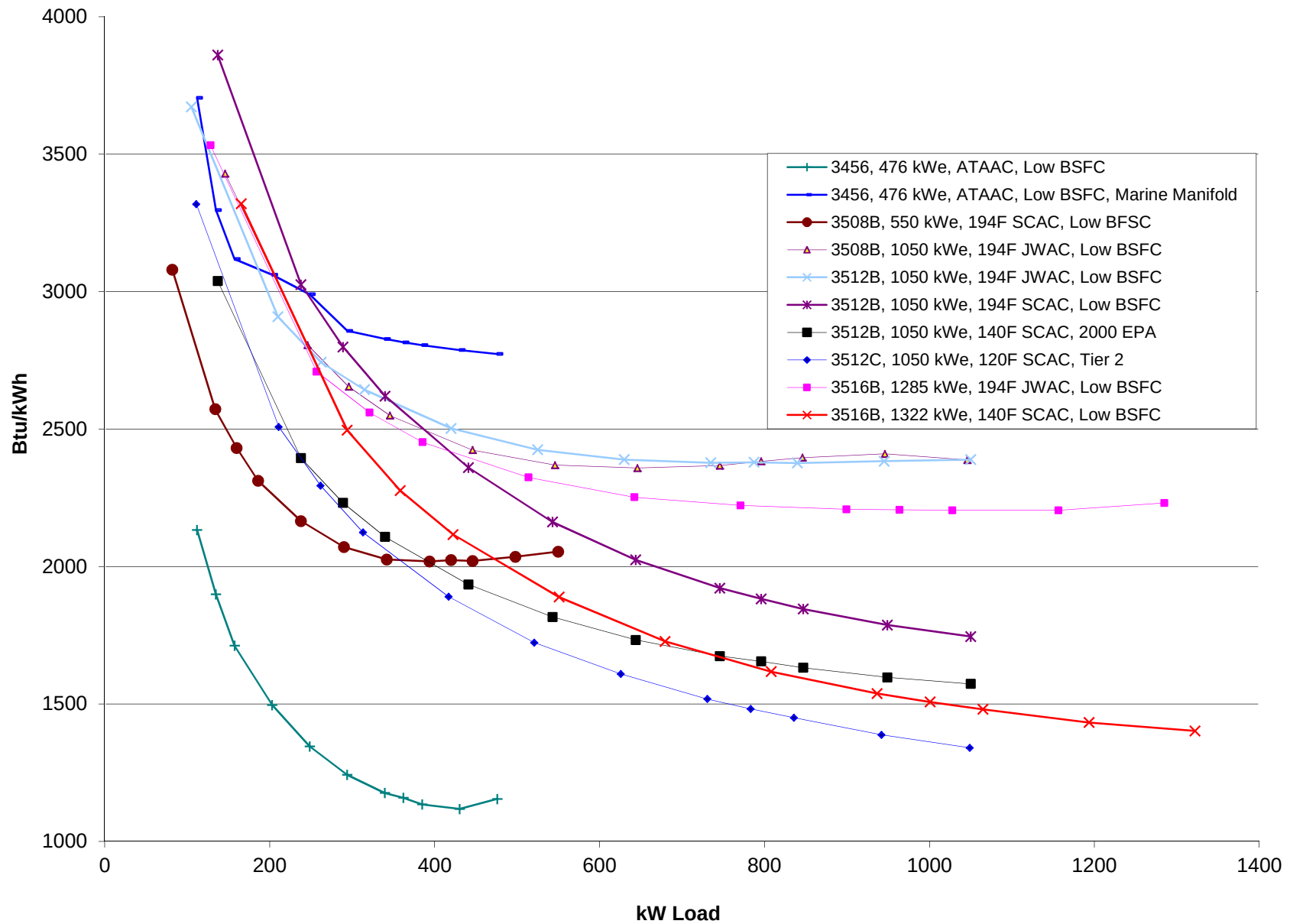
CAT Fuel Efficiency



Detroit Diesel, Series 60 DDEC4 - 1800 & 1200 RPM 12.7 Liter, Heat Rejected to JW (Btu/kWh)



CAT Heat Rejected to Jacket Water



APPENDIX B

Prime Power Genset Engine Selection Data

- **Alaska Prime Power Genset Matrix**
- **Matrix Application Notes**

ALASKA PRIME POWER GENSET ENGINE SELECTION MATRIX < 800 HP – SEPTEMBER 2016

(Applies to Remote Areas of Alaska - 40 CFR 60.4219)

ENGINE CATEGORY	Purchase a New Diesel Engine (40 CFR 60.4200)	Purchase a Replacement Engine (40 CFR 60.4211(i)) (40 CFR 1068.240)	Purchase a Remanufactured Engine		Purchase a Used Engine		Rebuild <u>your</u> existing Engine	
			RICE NESHAP (non-certified)	NSPS (certified)	RICE NESHAP (non-certified)	NSPS (certified)	RICE NESHAP (non-certified)	NSPS (certified)
YEAR OF MANUFACTURE	2014 and newer	This is a brand new engine, using a new block, built to earlier Tier emissions requirements.	Date of engine block manufacture: on or before April 1, 2006 (40 CFR 60.4200)	Date of engine block manufacture: after April 1, 2006 (40 CFR 60.4200)	Date of engine block manufacture: on or before April 1, 2006 (40 CFR 60.4200)	Date of engine block manufacture: after April 1, 2006 (40 CFR 60.4200)	Date of engine block manufacture: on or before April 1, 2006 (40 CFR 60.4200)	Date of engine block manufacture: after April 1, 2006 (40 CFR 60.4200)
HOW DOES CAPITAL COST AFFECT ENGINE TIER REQUIREMENT	Not Applicable	Not Applicable	If cost of remanufactured engine is greater than 50% of cost of comparable new engine, must meet Tier 1 requirements (40 CFR 63.2) (40 CFR 60.15)	50% cost rule does not affect certified (Tier) engines	Converting a nonroad or other non-stationary engine to stationary use does not change date of manufacture (40 CFR 60.4219)		If cost to rebuild engine is greater than 50% of cost of comparable new engine, must meet Tier 1 requirements (40 CFR 63.2) (40 CFR 60.15)	50% cost rule does not affect certified (Tier) engines
			Deadlines for installing prior model year engines do not apply to engines that have been removed from one existing location and reinstalled at another location (40 CFR 60.4208(i))					
			If the cost of the remanufactured engine is greater than 75% of cost of comparable new engine, must meet Tier 4 emission requirements (40 CFR 60.4219 – Reconstructed)		The capital cost of a used engine does NOT affect the date of manufacture or change the engine Tier requirement – as long as engine is not Modified or Reconstructed (40 CFR 60.4219 – Reconstructed) (40 CFR 63.2 – Construction)		If the cost to rebuild engine is greater than 75% of cost of comparable new engine, must meet Tier 4 emission requirements (40 CFR 60.4219 – Reconstructed)	
HOW DOES AGE OF BLOCK AFFECT ENGINE TIER REQUIREMENT	Must be current certified engine: Final Tier 4 or Marine Tier 3	New Block = new engine, which must meet Tier 4	block must be “ used ”, and at least one additional engine component remanufactured, or engine must meet Tier 4 requirements (40 CFR 60.4219 – Reconstructed)		on or before April 1, 2006 (40 CFR 60.4200)	after April 1, 2006 (40 CFR 60.4200)	Recommend rebuild engine to same or cleaner configuration	Must rebuild engine to same or cleaner certified configuration (40 CFR 1068.120)
WHAT ARE MY OPERATIONS, MAINTENANCE, AND RECORD REQUIREMENT	requires ULSD, Tier 4 likely includes DOC/DPF/SCR Marine Tier 3: Requires DPF Operate and Maintain IAW Manufacturers written emissions instructions (40 CFR 60.4211)	limited options for use, as OEM vendor must certify and document no other certified engine available with comparable performance as engine being replaced “Replacement” engine rule unlikely to be used for prime power applications in rural Alaska	Management Practices: Inspect air cleaner, change oil & filter @ 1000-hrs, Inspect hoses & belts @ 500-hrs, Operate & Maintain engine IAW Mfrs instructions or Owner mtc plan Keep Records (40 CFR 63.6603)	Operate and Maintain IAW Manufacturers written emission instructions (40 CFR 60.4211) ULSD fuel: MY14 and newer engines require ULSD fuel (40 CFR 60.4216d)	Management Practices: Inspect air cleaner, change oil & filter @ 1000-hrs, Inspect hoses & belts @ 500-hrs, Operate & Maintain engine IAW Mfrs instructions or Owner mtc plan Keep Records (40 CFR 63.6603)	Operate and Maintain IAW Manufacturers written emission instructions (40 CFR 60.4211) ULSD fuel: MY14 and newer engines require ULSD fuel (40 CFR 60.4216d)	Management Practices: Inspect air cleaner, change oil & filter @ 1000-hrs, Inspect hoses & belts @ 500-hrs, Operate & Maintain engine IAW Mfrs instructions or Owner mtc plan Keep Records (40 CFR 63.6603)	Operate and Maintain IAW Manufacturers written emissions instructions (40 CFR 60.4211) ULSD fuel: MY14 and newer engines require ULSD fuel (40 CFR 60.4216d)

DEADLINE FOR INSTALLING NEW ENGINES (40 CFR 60.4208)

- a new engine greater than or equal to 75 HP and less than 175 HP **may not be installed after December 31, 2013** unless it meets 2012 model year (*Non-Road Interim Tier 4 or Marine Tier 2*) req's
- a new engine greater than or equal to 175 HP and less than 750 HP **may not be installed after December 31, 2012** unless it meets 2011 model year (i.e., *Non-Road Tier 3 or Marine Tier 2*) requirements

This genset engine selection chart applies to:

- prime power diesel engines less than 800 horse power
- operating under a Pre-approved Emissions Limit (PAEL), <330,900 gallons/year
- located in Remote Areas of Alaska

What diesel engine may I use?

- Will the diesel engine replace an existing engine?
 - o Yes, continue
 - o No, consult ADEC regulations

A. Replace or repower an existing genset:

1. NEW ENGINES: A new engine is an engine that has never been placed into service, regardless of the when the engine was originally manufactured:

- a. 40 CFR 60.4219 – Requirements for engines used in Alaska
 - i. Remote areas of Alaska
 1. stationary diesel engines located in remote areas of Alaska may use Non-road Tier 3 and Marine Tier 3 engines, except that 2014 model year and later engines must meet Tier 4 particulate matter emissions limits or install a particulate filter that reduces particulate matter by 85 percent.
 2. 2014 model year and later engines must use ULSD fuel
- b. 40 CFR 60.4208 - NSPS deadline for installing prior model year engines
 - i. a new engine greater than or equal to 175 HP and less than 750 **HP may not be installed after December 31, 2012** unless it meets 2011 model year requirements (*Non-Road Tier 3 or Marine Tier 2*)
 - ii. a new engine greater than or equal to 75 HP and less than 175 HP **may not be installed after December 31, 2013** unless it meets 2012 model year requirements (*Non-Road Interim Tier 4 or Marine Tier 2*)
 - iii. a new engine greater than or equal to 750 HP **may not be installed after December 31, 2016** unless it meets 2015 model year requirements (*Non-Road Tier 4 or Marine Tier 3 or 4*)
- c. Document engine model year, Tier certification, verify correct engine EPA label, operate and maintain in accordance with manufacturers recommended instructions

2. USED ENGINES: A used engine is an existing engine that is not new, and that:

- a. has been removed from one existing location and reinstalled at another location (relocated)
- b. is rebuilt, or remanufactured
 - i. **Relocated engine:**
 1. Can be a gen-drive, non-road, marine auxiliary, or marine propulsion engine
 2. The capital cost of a used engine does not change the engine Tier
 - a. An existing non-road, marine auxiliary, or marine propulsion engine may be converted to a stationary engine, does not affect engine Tier

ii. Rebuilt or Remanufactured engines:

1. For an existing engine that is a RICE NESHAP, non-certified engine (engine manufacture date is on or before April 1, 2006),
 - a. If cost of rebuilt/reman engine is greater than 50% of cost of final Tier 4 engine, engine must meet Tier 1 emissions requirements (Tier 1 engine)
 - b. If cost of rebuilt/reman engine is greater than 75% of cost of final Tier 4 engine, engine must meet Tier 4 emissions requirements (Tier 4 engine)
 - c. A rebuilt/reman block must be “used”, and at least one additional engine component must be remanufactured, or engine must be Tier 4
 - d. Document engine manufacture date on or before 4/06, maintain maintenance records, operate per RICE NESHAP “Management Practices”
2. For an existing engine that is an NSPS, tier certified engine (engine manufacture date after April 1, 2006 – *but prior to MY14*),
 - a. A tier certified engine must be rebuilt or remanufactured to the same or higher Tier as the Tier of the original engine block
 - i. *The block must be an appropriate model year for the Tier that engine is rebuilt or remanufactured to*
 - ii. *Restore the engine to its original certified configuration*
 - iii. *May update to operate like newer certified model*
 - iv. *Must have a reasonable technical basis*
 - b. If cost of rebuilt/reman engine is greater than 75% of cost of final Tier 4 engine, engine must meet Tier 4 emissions requirements (Tier 4 engine)
 - c. A rebuilt/reman block must be “used” and at least one additional component must be remanufactured, or engine must be Tier 4
 - d. document engine model year, Tier certification, verify correct engine EPA label, and operate and maintain in accordance with manufacturers recommended instructions

B. Diesel Fuel Requirements

1. All 2014 model year and later engines require ULSD fuel
2. ULSD has been in use in prime power plants in southeast Alaska, Kodiak, and the Aleutians since 2010 due to highway and marine diesel fuel market forces.
3. ULSD #1 and ULSD Jet-A are available throughout rural Alaska
4. ULSD is compatible with prime power diesel engines
5. Cost for ULSD #1 is virtually the same as higher sulfur HF#1 & Jet-A.
6. may mix diesel fuel with used lubricating oil, in volumes up to 1.75% of the total fuel, where the sulfur content of the used oil is less than 200 ppm and meets the used oil specification in 40 CFR 279.11 (on-spec).

APPENDIX C

NSPS and RICE NESHAP Regulatory Citations

Definitions:

RICE NESHAP – on or before April 1, 2006 (owner/operator responsible = operations/mtc)

NSPS - after April 1, 2006 (manufacturer responsible = certified engines, Oper/mtn IAW mfrs instr's)

Accessible to FAHS – NSPS/RICE NESHAP – currently separate but may be aligned

Reconstruct – 50% and 75% thresholds – 40 CFR 60.15 & 60.4219

Modify – 40 CFR 60.14; increase emissions, does not include increase in operating hours or load

Remanufactured / Rebuilt – 40 CFR 1068.120

Penalties –

- 40 CFR 89.1006 - \$2,750/day to \$32,500/day;
- 40 CFR 1068.101 - \$3,750/day to \$37,500/day

CFR Citations:

40 CFR 60 = NSPS (after April 1, 2016)

40 CFR 63 = NESHAP (on or before April 1, 2016)

40 CFR 80 = Fuel Regulations

40 CFR 89 = Nonroad Tier 1 - 3

40 CFR 94 = Marine Tier 1 & 2

40 CFR 279.11 = Used Oil Specifications

40 CFR 1039 = Nonroad Tier 4

40 CFR 1042 = Marine Tier 3 & 4

40 CFR 1068 = Highway, Stationary, NR Compliance (flex/TPEM, Rebuild, Tampering)

40 CFR PART 63 – NESHAP for SOURCE CATEGORIES

§ 63.2 Definitions - The terms used in this part are defined in the Act or in this section as follows:

Construction means the on-site fabrication, erection, or installation of an affected source. **Construction does not include the removal of all equipment comprising an affected source from an existing location and reinstallation of such equipment at a new location.** Removal and reinstallation may be reconstruction if it satisfies the criteria for reconstruction defined in this section. The costs of replacing minor ancillary equipment must be considered in determining whether the existing affected source is reconstructed.

Existing source means any affected source that is not a new source.

Reconstruction, unless otherwise defined in a relevant standard, means the replacement of components to such an extent that:

- (1) The fixed capital cost of the **new** components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable **new source**; and
- (2) Upon reconstruction, an existing diesel engine is subject to relevant *standards for new sources*, including compliance dates.

40 CFR 63 Subpart ZZZZ - RICE NESHAP

§ 63.6585 Am I subject to this subpart?

You are subject to this subpart if you own or operate a stationary diesel engine

§ 63.6590 What parts of my plant does this subpart cover?

- (a) any **existing, new, or reconstructed** stationary diesel engine.
 - (iv) A change in ownership of an existing stationary diesel engine does not make that engine new or reconstructed.
- (c) **Stationary RICE subject to 40 CFR Part 60 (NSPS).**
 - (1) **A new or reconstructed stationary diesel engine** must meet the requirements of 40 CFR part 60 subpart IIII (NSPS). *No further requirements apply under this part.*

§ 63.6603 What requirements must I meet if I own or operate an existing stationary diesel engine at an area source?

- (b) Existing stationary non-emergency diesel engines located at an area source in either (b)(1) or (2), below, must meet the management practices shown in Table 2d of this subpart.
 - (1) The diesel engine is in an area of Alaska not accessible by the Federal Aid Highway System (FAHS).
 - (2) The diesel engine is located where:

- (i) The only connection to the FAHS is through the Alaska Marine Highway System (AMHS), or is not connected to the Alaska Railbelt Grid.
- (ii) At least 10 percent of the power generated on an annual basis is used for residential purposes.
- (iii) The generating capacity is less than 12 megawatts, or is used exclusively for backup power for renewable energy.

§ 63.6675 What definitions apply to this subpart?

Alaska Railbelt Grid means the service areas of the six regulated public utilities that extend from Fairbanks to Anchorage and the Kenai Peninsula. These utilities are Golden Valley Electric Association; Chugach Electric Association; Matanuska Electric Association; Homer Electric Association; Anchorage Municipal Light & Power; and the City of Seward Electric System.

Backup power for renewable energy means an engine that provides backup power to a facility that generates electricity from renewable energy resources, as that term is defined in Alaska Statute 42.45.045(l)(5).

§ 63.6604 What fuel requirements must I meet if I own or operate a stationary diesel engine?

- (d) Existing stationary diesel engines located at area sources in Alaska that meet either § 63.6603(b)(1) or § 63.6603(b)(2) are exempt from the requirements of this section - *ULSD is not required!*

§ 63.6625 What are my monitoring, installation, collection, operation, and maintenance requirements?

- (e) ..you must operate and maintain the stationary diesel engine and after-treatment control device (if any) according to the manufacturer's emission-related written instructions...

**Table 2d
MANAGEMENT PRACTICES**

- a. Change oil and filter every 1,000 hours of operation or annually, whichever comes first;
- b. Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first, and replace as necessary;
- c. Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.

Minimize the engine's time spent at idle and minimize the engine's startup time at startup to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes.

40 CFR PART 60 – Standards of Performance Standards for New Sources

§ 60.14 Modification.

any physical or operational change which results in an increase in any regulated pollutant. Upon modification, an existing facility is subject to the standard for each pollutant for which there is an increase in the emission rate.

- (e) The following shall not, by themselves, be considered modifications under this part:
 - (1) Maintenance, repair, and replacement which is routine, so long as the engine is not Reconstructed (§ 60.15)
 - (2) An increase in production rate of an existing facility, if that increase can be accomplished without a capital expenditure on that facility.
 - (3) An increase in the hours of operation.
 - (6) The relocation or change in ownership of an existing facility.

§ 60.15 Reconstruction.

- (a) Upon reconstruction, an existing facility (engine) is subject to NSPS.
- (b) “Reconstruction” means the replacement of components of an existing facility (engine) such that the fixed capital cost of the **new** components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility (Tier 4),
- (c) “Fixed capital cost” means the capital needed to provide all the depreciable components.

40 CFR 60 Subpart IIII - New Source Performance Standards (NSPS)

§ 60.4200 Am I subject to this subpart?

- (2) Owners and operators of stationary diesel engines that are:
 - (i) Manufactured after April 1, 2006...
- (3) Owners and operators of stationary diesel engines modified or reconstructed after July 11, 2005, and any person that modifies or reconstructs any stationary diesel engine after July 11, 2005.

§ 60.4204 What emission standards must I meet for non-emergency engines if I am an owner or operator?

- (a) Owners and operators of pre-2007 model year non-emergency stationary diesel engines must comply with the emission standards in table 1, **(Tier 1)**.
- (b) Owners and operators of 2007 model year and later non-emergency stationary diesel engines must comply with the emission standards for new diesel engines, **(Tiers 1 – 4)**.
- (e) Owners and operators of any modified or reconstructed non-emergency stationary diesel engine must meet the emission standards applicable to the model year, maximum engine power, and displacement of the modified or reconstructed engine that are specified in paragraphs (a) and (b) of this section.

§ 60.4208 What is the deadline for importing or installing a stationary diesel engine produced in previous model years?

- o a new engine greater than or equal to 175 HP and less than 750 HP may not be installed after December 31, 2012 unless it meets 2011 model year requirements (*Non-Road Tier 3 or Marine Tier 2*)
- o a new engine greater than or equal to 75 HP and less than 175 HP may not be installed after December 31, 2013 unless it meets 2012 model year requirements (*Non-Road Interim Tier 4 or Marine Tier 2*)
- o a new engine greater than or equal to 750 HP may not be installed after December 31, 2016 unless it meets 2015 model year requirements (*Non-Road Tier 4 or Marine Tier 3 or 4*)

60.4211 What are my compliance requirements if I am an owner or operator of a stationary diesel engine?

(a) you must...

- (1) Operate and maintain the stationary diesel engine and control device according to the manufacturer's emission-related written instructions;
- (2) Meet the requirements of 40 CFR parts 89, 94, and/or 1068, as they apply to you.

(c) If you are an owner or operator of a 2007 model year and later stationary diesel engine ..., you must comply by purchasing a tier certified engine. *The engine must be installed and configured according to the manufacturer's emission-related specifications.*

§ 60.4216 What requirements must I meet for engines used in Alaska?

(b) Except as indicated in paragraph (c) diesel engines less than 10 liters per cylinder located in remote areas of Alaska may meet the requirements of 40 CFR parts 94 or 1042 - for marine engines.

(c) Diesel engines located in remote areas of Alaska may choose to meet the emission standards for emergency engines (Nonroad Tier 3), except that MY14 and later engines must meet final Tier 4 PM standards, or install an exhaust filter that reduces PM emission by 85 percent.

(d) pre-2014 model year stationary diesel engines located in remote areas of Alaska are not required to use ULSD fuel.

(f) diesel engines located in remote areas of Alaska may mix fuel with used lubricating oil, in volumes of up to 1.75 percent of the total fuel. The used oil sulfur content must be less than 200 ppm, and meet the on specification requirements for used oil in 40 CFR 279.11.

§ 60.4219 What definitions apply to this subpart?

Alaska Railbelt Grid means the service area of the six regulated public utilities that extend from Fairbanks to Anchorage and the Kenai Peninsula. These utilities are Golden Valley Electric Association; Chugach Electric Association; Matanuska Electric Association; Homer Electric Association; Anchorage Municipal Light & Power; and the City of Seward Electric System.

Remote areas of Alaska means areas of Alaska that meet either paragraph (1) or (2) of this definition.

- (1) Areas of Alaska that are not accessible by the Federal Aid Highway System (FAHS).
- (2) Areas of Alaska that meet all of the following criteria:
 - (i) The only connection to the FAHS is through the Alaska Marine Highway System, or the stationary CI ICE operation is within an isolated grid in Alaska that is not connected to the statewide electrical grid referred to as the Alaska Railbelt Grid.
 - (ii) At least 10 percent of the power generated by the stationary CI ICE on an annual basis is used for residential purposes.
 - (iii) The generating capacity of the source is less than 12 megawatts, or the stationary CI ICE is used exclusively for backup power for renewable energy

Date of manufacture means one of the following things:

- (1) For freshly manufactured engines and modified engines, date of manufacture means the date the engine is originally produced.
- (2) For reconstructed engines (50% rule), date of manufacture means the date the engine was originally produced, except as specified in paragraph (3), below.
- (3) Reconstructed engines are assigned a new date of manufacture if the **fixed capital cost of the new and refurbished components exceeds 75 percent of the fixed capital cost of a comparable entirely new facility**. If an engine is produced from a previously used engine block using all new components except for the engine block, the date of manufacture is the date the new engine is produced (*must meet final Tier 4*).

Freshly manufactured engine means an engine that has not been placed into service. An engine becomes freshly manufactured when it is originally produced.

Installed means the engine is placed and secured at the location where it is intended to be operated.

Model year means the calendar year in which an engine is manufactured, except as follows:

- (1) Model year means the annual new model production period of the engine manufacturer in which an engine is manufactured
- (2) For an engine that is **converted to a stationary engine** after being placed into service as a nonroad or other nonstationary engine, model year means the calendar year or new model production period in which the engine was manufactured.

§89.130 Rebuild Practices – applies to Tiers 1-3 (§1039.100 applies to Tier 4)

(40 CFR 60.4211(a)(3): meet part 89 requirements)

The provisions of 40 CFR 1068.120 apply to rebuilding of engines subject to the requirements of this part 89, except Tier 1 engines rated at or above 37 kW.

§1068.120 What requirements must I follow to rebuild engines?

(a) For maintenance or service that is not “rebuilding” you do not need to keep any records.

(b) The term “rebuilding” refers to a rebuild or major overhaul that significantly increases the service life of the engine. Rebuilding does not normally include the following:

(1) Scheduled emission-related maintenance, such as replacing fuel injectors

(2) Unscheduled maintenance, such as replacing a water pump.

(d) If you rebuild an engine, you must have a reasonable technical basis for knowing that the rebuilt engine's emission control system performs as well or better than in its certified configuration. Identify the model year of the resulting engine configuration. You have a reasonable basis if you meet two main conditions:

(1) Install new, used, or rebuilt parts - so a person familiar with engine design and function would reasonably believe that the engine with those parts will control emissions of all pollutants to at least to the same degree as with the original parts.

(2) Adjust parameters or change design elements only according to the original engine manufacturer's instructions. If you differ from these instructions, you must have data or some other technical basis to show you should not expect in-use emissions to increase.

(e) If the rebuilt engine is used in the same piece of equipment, you must rebuild it to the original configuration, except as allowed by this paragraph. **You may rebuild it to a different certified configuration of the same or later model year. You may also rebuild it to a certified configuration from an earlier model year as long as the earlier configuration is as clean or cleaner than the original configuration,** “as clean or cleaner” means one of the following:

(1) For engines not certified with a Family Emission Limit for calculating credits for a particular pollutant, this means that the same emission standard applied for both model years. This includes supplemental standards such as Not-to-Exceed standards.

(2) For engines certified with a Family Emission Limit for a particular pollutant, this means that the configuration to which the engine is being rebuilt has a Family Emission Limit for that pollutant that is at or below the standard that applied to the engine originally, and is at or below the original Family Emission Limit.

(f) A rebuilt engine may replace another certified engine if the engine was rebuilt to an equivalent or more stringent certified emission configuration standard. The following examples illustrate these provisions:

(1) You may use a rebuilt Tier 2 engine to replace a Tier 1 engine or Tier 2 engine.

(2) You may use a rebuilt Tier 1 engine to replace a Tier 2 engine if the Tier 1 engine has emission levels below the Tier 2 standards or if the Tier 2 engine was certified with a Family Emission Limit for calculating emission credits.

(3) You may use a rebuilt engine that originally met the Tier 1 standards without certification, as provided under 40 CFR 1068.265, to replace a certified Tier 1 engine. This may occur for engines produced under a Transition Program for Equipment Manufacturers such as that described in 40 CFR 1039.625.

(4) You may not replace a certified engine with an engine rebuilt to a configuration that does not meet EPA emission standards.

(g) Do not erase or reset emission-related codes without diagnosing and addressing its cause. Clear all codes from diagnostic systems when you return the rebuilt engine to service.

(h) check, clean, adjust, repair, or replace all emission-related components (listed in Appendix I) IAW original manufacturer's recommended practice, unless you have a reasonable technical basis for believing these components do not need replacement.

(i) If you are installing an engine that someone else has rebuilt, check all emission-related components listed in Appendix I of this part IAW original manufacturer's recommended practice.

(j) Keep at the following records:

(1) hours of operation at the time of rebuild. These may be noted as approximate values if the engine has no hour meter.

(2) Identify the work done on the engine and emission-related control components. Include a list of parts used.

(3) Describe any engine parameter adjustments.

(4) Identify any emission-related codes or signals responded to and reset.

(k) Keep records for at least two years after rebuilding an engine, in any format that allows easy review.

(1) You do not need to keep information that is not reasonably available through normal business practices.

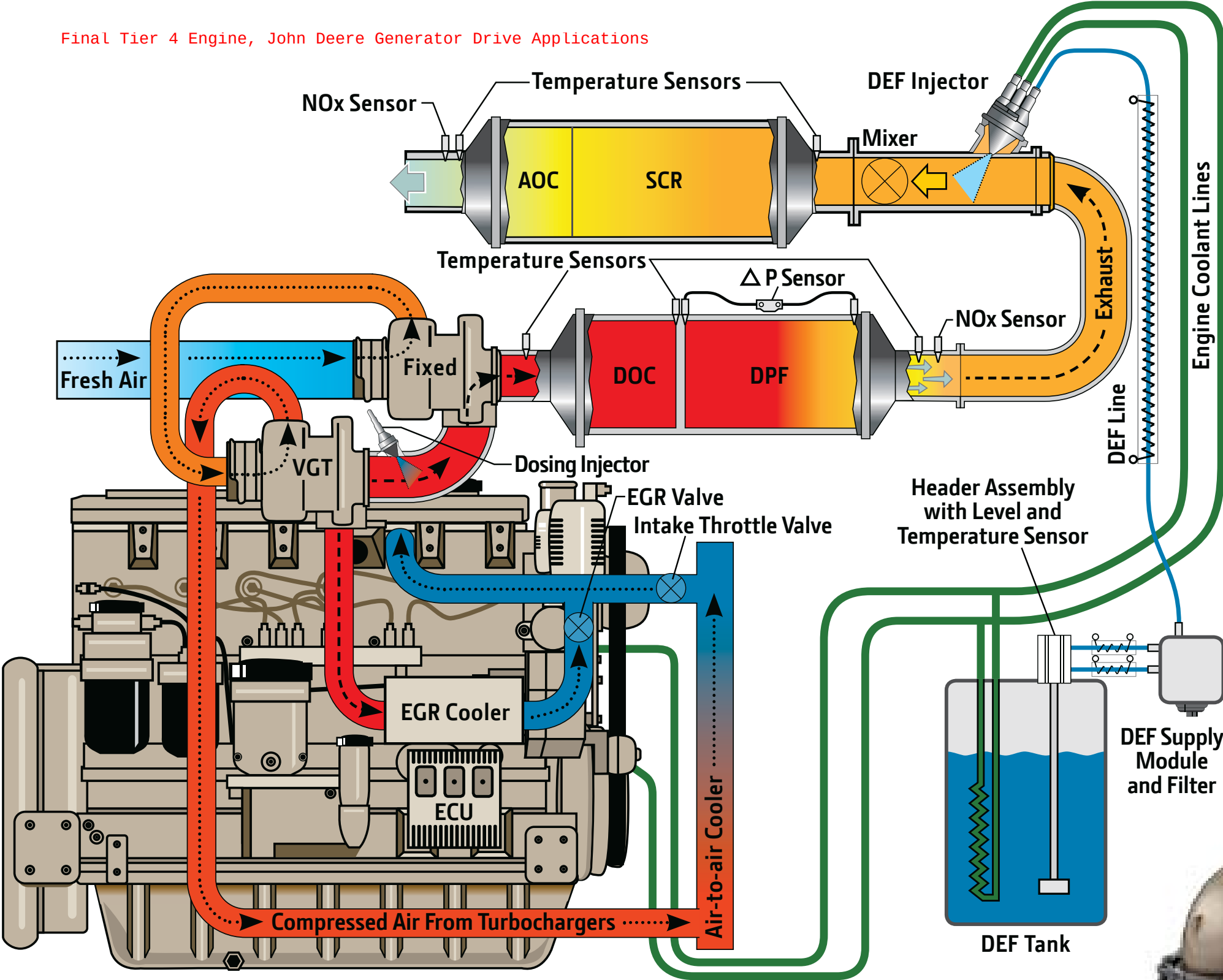
(2) You do not need to keep records of what other companies do.

APPENDIX D

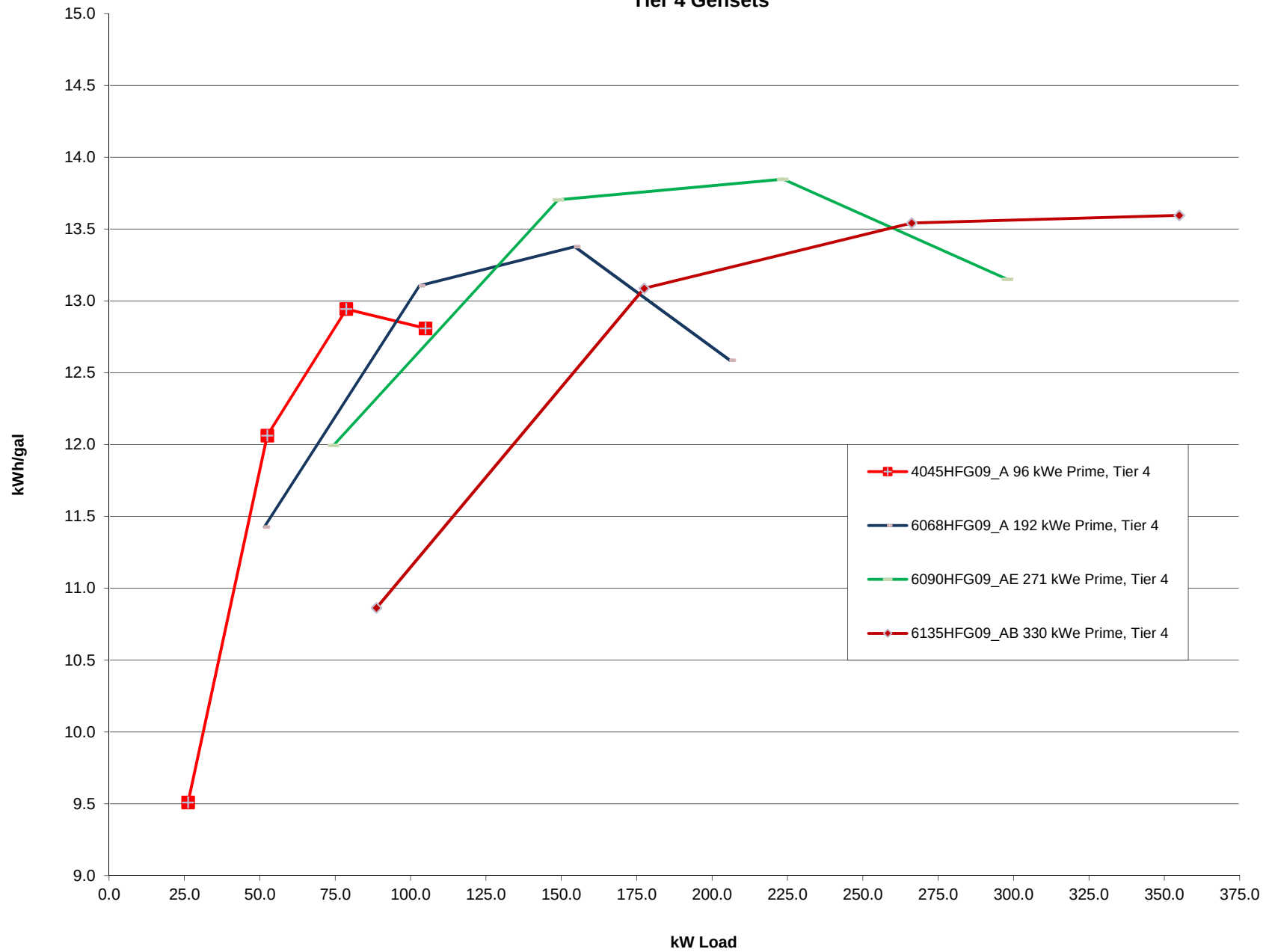
John Deere Tier 4 Engine Data

- **Engine Emissions Equipment**
- **Fuel Efficiency Graph**
- **Exhaust Aftertreatment Table**

Final Tier 4 Engine, John Deere Generator Drive Applications



John Deere Fuel Efficiency Tier 4 Gensets



**John Deere Final Tier 4
Engine Exhaust Aftertreatment**

<u>Model #</u>	<u>HP Standby</u>	<u>Tier IV Certified?</u> <u>Y/Preliminary</u>	<u>Exhaust Filter</u> <u>(Y/N)</u>	<u>SCR Catalyst</u> <u>(Y/N)</u>	<u>ERG Cooler</u> <u>(Y/N)</u>
4045HFG09_B	141	Y	Y	Y	Y
4045HFG09_A	166	Y	Y	Y	Y
4045HFG06_A	172	Y	N	Y	Y
6068HFG08_B	200	Y	Y	Y	Y
6068HFG08_A	241	Y	Y	Y	Y
6068HFG09_B	289	Y	Y	Y	Y
6090HFG09_AD	318	Y	Y	Y	Y
6068HFG09_A	322	Y	Y	Y	Y
6090HFG06_C	366	Y	N	Y	Y
6090HFG09_AC	366	Y	Y	Y	Y
6090HFG09_AB	398	Y	Y	Y	Y
6090HFG06_B	437	Y	N	Y	Y
6090HFG09_AA	437	Y	Y	Y	Y
6090HFG09_AE	463	Y	Y	Y	Y
6135HFG09_AC	477	Y	Y	Y	Y
6135HFG09_AB	551	Y	Y	Y	Y
6135HFG06_A	634	Y	N	Y	Y
6135HFG09_AA	634	Y	Y	Y	Y