COLUMBIA GENERATING STATION

Order No. 873

Statement of Basis

On January 8, 1996, the Energy Facility Site Evaluation Council adopted Regulatory Order No. 672 approving owner-requested limiting conditions for air emissions from the Washington Public Power Supply System's Nuclear Project No. 2 (WNP-2), now known as the Columbia Generating Station. By following the provisions of Order No. 672 limiting the potential to emit (PTE) below the tonnage thresholds defined in Washington Administrative Code (WAC) 173-401, the Supply System was not required to obtain an Air Operating Permit.

During a recent review of Order 672, it was determined the PTE was set on an annual fuel usage. The Environmental Protection Agency (EPA) considers an enforceable PTE limit must be on a rolling monthly basis, at a minimum. The Supply System, now known as Energy Northwest (ENW), was informed of the need to modify the Order to meet regulatory compliance. To meet the new requirements, EFSEC Administrative Order No. 873 was prepared to replace Order No. 672.

The primary differences between Order No. 672 and Order No. 873 are:

1. Changing the calculation for compliance of the diesel generators from gallons of fuel used to hours of operations. Volumetric usage has the potential for more clerical and process errors in calculated compliance than hours of operation. Volumetric readings relied upon estimates of volume remaining in the main tank, volumes in secondary tanks, volume delivered, etc… By using non-resettable hour meters on the generators, compliance can be determined by comparing the current meter reading with past documented readings.
2. Changing the calculation of the annual run time limit from an annual basis to a rolling monthly basis. This change will provide better and more current information to determine if CGS is exceeding the imposed yearly limits on operation. By calculating usage month-by-month, determination of compliance will occur monthly and not once per year.
3. The addition of a new diesel generator operating at 100 hours per year as part of a comprehensive flexible "FLEX" response strategy being implemented by CGS and industry wide to enhance nuclear plant safety. The FLEX response strategy was developed by the nuclear industry to address the major challenges encountered at the Fukushima Daiichi power station following the 2011 earthquake and tsunami.
4. The addition of the new diesel generator increased emissions above the CGS self-imposed 90% threshold of the Clean Air Act's Title V program limits. To stay at the 90% threshold, the diesel fuel usage of the auxiliary boiler was reduced from 780,000 gallons in Order No. 672 to 730,000 gallons in Order No. 873. The reduced capacity is still significantly greater than historical fuel usage and was proposed by CGS.

Proposed Order No. 873 complies with the air discharge requirements in the CGS Site Certification Agreement article no. IV.C.1.

Attachments:

1. Energy Northwest Request to Update EFSEC Regulatory Order No. 672.
2. Proposed Run Time Limit Calculations for Diesel Generators.
3. Potential to Emit Calculation Spreadsheets.

ORDER 873

STATEMENT OF BASIS

ATTACHMENT 1

Robert A. Dutton
General Counsel
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Richland, WA 99352-0968
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May 13, 2014
GO2-14-080

EFSEC Manager
Energy Facility Site Evaluation Council
P.O. Box 43172
Olympia, WA 98504-3172

Subject: **COLUMBIA GENERATING STATION**
REQUEST TO UPDATE EFSEC REGULATORY ORDER NO. 672

Reference: EFSEC Regulatory Order No. 672, dated January 8, 1996

Energy Northwest intends to acquire and install a 400-kW emergency diesel generator set at Columbia Generating Station (Columbia). Accordingly, Energy Northwest requests that the Energy Facility Site Evaluation Council (EFSEC) revise Regulatory Order No. 672 to include the new diesel generator (DG5). Please find attached proposed changes to Regulatory Order No. 672 for your consideration.

The EFSEC Council adopted Regulatory Order No. 672 approving limiting conditions for air emissions from Columbia (Reference). Regulatory Order No. 672 limits Columbia emissions to less than major source thresholds and exempts Energy Northwest from the requirements to obtain an operating permit. Energy Northwest acknowledges that Columbia has the potential to emit pollutants that exceed major source thresholds. However, Energy Northwest desires to limit air emission pollutants to the extent possible and respectfully requests that EFSEC consider the proposed limiting conditions for Columbia. The primary proposed changes to Regulatory Order No. 672 include the addition of DG5 and replacing the annual diesel fuel limitation with emergency power generator run time limitations.

The DG5 diesel generator set will be for emergency use and is part of a comprehensive flexible "FLEX" response strategy that is being implemented by CGS and the nuclear industry to enhance nuclear plant safety. Please find attached specification and emissions information for the new diesel generator set.

Energy Northwest appreciates the support from EFSEC and its compliance contractor to update Regulatory Order No. 672. If you have any questions concerning this information, please contact BC Barfuss at (509) 377-4541.

Sincerely,

Robert A. Dutton
General Counsel

Attachments (2)

cc: J La Spina, EFSEC
J Ayres, Ecology
P Gent, Ecology

Order No. ---
Date: ---

STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL
P. O. BOX 43172
OLYMPIA, WASHINGTON 98504-3172

In the Matter of Compliance By Energy Northwest with Section 70.94.161 RCW, Operating Permits for Air Contaminant Sources, and the rules and regulations of the Energy Facility Site Evaluation Council	)))))))	**EFSEC ORDER No. ---**

I.

Jurisdiction

This Order is issued pursuant to the authority of Revised Code of Washington (RCW) 70.94.141, RCW 70.94.331, RCW 80.50, Washington Administrative Code (WAC) 173-400-091, WAC 173-401-300, and WAC 463-78.

II.

Legal Authority

II.1. RCW 80.50.040, Energy facility site evaluation council – Powers enumerated, states in part:

"The council shall have the following powers:

(12) To issue permits in compliance with applicable provisions of the federally approved state implementation plan adopted in accordance with the Federal Clean Air Act, as now existing or hereafter amended, for the new construction, reconstruction, or enlargement or operation of energy facilities: PROVIDED, That such permits shall become effective only if the governor approves an application for certification and executes a certification agreement pursuant to this chapter: AND PROVIDED FURTHER, That all such permits be conditional upon compliance with all provisions of the federally approved state implementation plan which apply to energy facilities covered within the provisions of this chapter…"

II. 2. WAC 173-401-300(7), Federally Enforceable Limits, states in part:

"Any source which is defined as a chapter 401 source solely because its potential to emit exceeds the annual tonnage thresholds defined in WAC 173-401-200 shall be exempt from the requirement to obtain an operating permit when federally enforceable conditions which limit that source's potential to emit to levels below the relevant tonnage thresholds have been established for that source."

"In applying for an exemption under this subsection, the owner or operator of the source shall demonstrate to the permitting authority that the source's potential to emit, taking into account any federally enforceable restrictions assumed by the source, does not exceed the tonnage thresholds defined in WAC 173-401-200. Such demonstrations shall be in accordance with WAC 173-401-520 and shall contain emissions measurement and monitoring data, location of monitoring records, and other information necessary to support the source's emission calculations."

"Permitting authorities may use the following approaches to establish federally enforceable limitations: (i) Regulatory orders… WAC 173-400-091 (ii) Notice of construction approvals… (iii) General permits…."

II.3. WAC 173-400-091(1) states:

"Upon request by the owner or operator of a new or existing source or stationary source, the permitting authority with jurisdiction over the source shall issue a regulatory order that limits the potential to emit any air contaminant or contaminants to a level agreed to by the owner or operator and the permitting authority with jurisdiction."

II.4. By limiting the potential to emit levels below the tonnage thresholds defined in WAC 173-401-200(19) by following the provisions of the Order, Energy Northwest (EN) will not be required to obtain an Operating Permit in accordance with Chapter 173-401 WAC, Operating Permit Regulation.

III.

Findings of Fact

The Energy Facility Site Evaluation Council (EFSEC) makes the following Findings of Fact:

III.1 EN is the operator of the Columbia Generating Station (CGS), an electric generating plant located on the Hanford Site in Benton County, Washington.

III.2 That CGS has multiple diesel-fired combustion units to provide steam and emergency power.

III.3. That the combustion units have the potential to emit nitrogen oxides and carbon monoxide pollutants that exceed the threshold given in WAC 173-401-300, Applicability, and therefore, would be required to obtain an Operating Permit in accordance with WAC 173-401, Operating Permit Regulation.

III.4 That EN has requested EFSEC limit the combustion units' potential to emit nitrogen oxides and carbon monoxide, pollutants to levels agreed to by the EN and EFSEC.

IV.

Order

THEREFORE, IT IS ORDERED by EFSEC in relation to the above that EN's CGS combustion units be subject to the following conditions:

IV.1 That the run time for each of the emergency power generators (DG1, DG2, DG3, and DG5) on an annual basis shall not exceed the following hours.

Emergency Power Generator	12-month Rolling Sum Limit (Hours)
Diesel Generator 1	484 Hours
Diesel Generator 2	484 Hours
Diesel Generator 3	484 Hours
Diesel Generator 5	100 Hours

IV.2 That the emergency power generator run times shall be reported on a 12-month rolling sum basis using run time hour meters.

IV.3 The total emergency power generator run times on a 12-month rolling basis shall be reported within sixty days of the end of the fiscal year. The reported values will include values for each month as well as the calculation of the 12-month rolling total for each month.

IV.4 The above cap is based upon calculative methods. A 90 ton per year emissions target was used for the cap to allow for a 10 ton per year buffer between the calculated emissions and the operating permit emissions threshold of 100 tons per year. Adjustments to the cap that will exceed the 90 ton per year emissions target may be made by issuing another separate Order in accordance with WAC 173-400-091. Issuing another separate Order in accordance with WAC 173-400-091 may be done if more refined calculation or testing is conducted or justification is made that 100 tons per year would not be exceeded. A Notice of Construction will not be required for this instance if this is the sole reason for requesting a change to the terms of the Order.

IV.5 If EN determines that it no longer wants to limit emissions below the 100 tons per year threshold, it must submit an operating permit application in accordance with WAC 173-401. Until an operating permit is issued, Energy Norwest will continue to be bound by this Order.

Any application form, report, or compliance certification submitted pursuant to this Order shall contain certification by a responsible official of truth, accuracy, and completeness.

Nothing is this Order alters the facility's obligation to comply with other laws, including air laws and regulations, except that EN's application for, receipt of, and compliance with this order exempts EN from the requirements to obtain an Operating Permit. Any violation of such rules and regulations or of the terms of this approval, including but not limited to exceedances of emissions limits demonstrated by source testing or emissions calculations, shall be subject to the sanctions provided in Chapter 70.94 RCW.

The provisions of this authorization are severable and, if any provision of this authorization, or application of any provisions of this authorization to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this authorization, shall not be affected thereby.

Any person feeling aggrieved by this ORDER may obtain review thereof by application, within thirty (30) days of receipt of this ORDER to the Energy Facility Site Evaluation Council, P. O. Box 43172, Olympia, Washington 98504-3172. These procedures are consistent with the provisions of Chapter 43.21B RCW and the rules and regulations adopted thereunder.

DATED at Olympia, Washington this _____ day of _____, ____.

FOR THE WASHINGTON STATE ENERGY FACILITY SITE EVALUATION COUCIL.

_____
Phil Gent
Washington State Department of Ecology

_____
Bill Lynch
EFSEC Chairman

ATTEST:

_____
Stephen Posner
EFSEC Manager

DIESEL GENERATOR SET

Image shown may not reflect actual package.

STANDBY
400 ekW 500 kVA
60 Hz 1800 rpm 480 Volts

Caterpillar is leading the power generation marketplace with Power Solutions engineered to deliver unmatched flexibility, expandability, reliability, and cost-effectiveness.

FEATURES

FUEL/EMISSIONS STRATEGY

- EPA Certified for Stationary Emergency Application (EPA Tier 3 emissions levels)

DESIGN CRITERIA

- The generator set accepts 100% rated load in one step per NFPA 110 and meets ISO 8528-5 transient response

UL 2200 / CSA – Optional

- UL 2200 Listed packages
- CSA Certified

Certain restrictions may apply.

Consult with your Cat® Dealer.

FULL RANGE OF ATTACHMENTS

- Wide range of bolt-on system expansion attachments, factory designed and tested
- Flexible packaging options for easy and cost effective installation

SINGLE-SOURCE SUPPLIER

- Fully prototype tested with certified torsional vibration analysis available

WORLDWIDE PRODUCT SUPPORT

- Cat dealers provide extensive post sale support including maintenance and repair agreements
- Cat dealers have over 1,800 dealer branch stores operating in 200 countries
- The Cat S•O•S℠ program cost effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products

CAT C15 ATAAC DIESEL ENGINE

- Utilizes ACERT™ Technology
- Reliable, rugged, durable design
- Field-proven in thousands of applications worldwide
- Four-stroke-cycle diesel engine combines consistent performance and excellent fuel economy with minimum weight
- Electronic controlled governor

CAT GENERATOR

- Matched to the performance and output characteristics of Cat engines
- UL 1446 Recognized Class H insulation
- CSA Certified

CAT EMCP 4 CONTROL PANELS

- Simple user friendly interface and navigation
- Scalable system to meet a wide range of customer needs
- Integrated Control System and Communications Gateway
- Integrated Voltage Regulation

SEISMIC CERTIFICATION

- Seismic Certification available
- Anchoring details are site specific, and are dependent on many factors such as generator set size, weight, and concrete strength.

  IBC Certification requires that the anchoring system used is reviewed and approved by a Professional Engineer
- Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, IBC 2012, CBC 2007, CBC 2010

FACTORY INSTALLED STANDARD & OPTIONAL EQUIPMENT

System	Standard	Optional
Air Inlet	• Disposable air filter	[ ] Canister type, dual element [ ] Heavy duty air cleaner
Cooling	• Package mounted radiator	
Exhaust	• Exhaust flange outlet	[ ] Industrial [ ] Residential / Critical
Fuel	• Primary fuel filter with integral water separator • Secondary fuel filters • Fuel priming pump	
Generator	• Matched to the performance and output characteristics of Cat engines • IP23 Protection	[ ] Permanent magnet excitation (PMG) [ ] Anti-condensation space heater [ ] Internal excitation (IE) [ ] Coastal insulation protection
Power Termination	• Power terminal strips	[ ] Circuit breakers – 100% rated assembly, UL Listed [ ] SUSE (Suitable for use as service equipment)
Control Panels	• EMCP 4.2	[ ] EMCP 4.3 [ ] EMCP 4.4 [ ] Local and remote annunciator modules [ ] Remote monitoring software
Mounting	• Rubber vibration isolators	
Starting/Charging	• 24 volt starting motor & charging alternator • Batteries	[ ] Battery chargers [ ] Oversize batteries [ ] Jacket water heater
General	• Paint - Caterpillar Yellow except rails and radiators gloss black • Narrow skid base	The following options are based on regional and product configuration: [ ] Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, IBC 2012, CBC 2007, CBC 2010 [ ] UL 2200 Listed package [ ] CSA Certified [ ] Wide skid base [ ] Sound attenuated enclosure [ ] Weather protective enclosure [ ] Integral dual wall UL Listed 8 hr fuel tank [ ] Sub-base dual wall UL Listed 24 hr fuel tank [ ] Sub-base dual wall UL Listed 48 hr fuel tank

STANDBY 400 ekW 500 kVA
60 Hz 1800 rpm 480 Volts

SPECIFICATIONS

STANDARD CAT GENERATOR	
Frame size	LC6114B
Excitation	Self Excitation
Pitch	0.6667
Number of poles	4
Number of bearings	Single bearing
Number of leads	12
Insulation	UL 1446 Recognized Class H with tropicalization and antiabrasion
IP Rating	IP23
Alignment	Pilot shaft
Overspeed capability (%)	125
Wave form deviation (%)	2
Voltage regulator	Three phase sensing
Voltage regulation	+/- 0.25% (steady state)
– Consult your Cat dealer for other available voltages	
CAT DIESEL ENGINE	
C15 ATAAC, I-6, 4-Stroke Water-cooled Diesel	
Bore	137.20 mm (5.4 in)
Stroke	171.40 mm (6.75 in)
Displacement	15.20 L (927.56 in^3)
Compression ratio	16.1:1
Aspiration	Air-to-air aftercooled
Fuel system	MEUI
Governor type	Caterpillar ADEM control system

CAT EMCP 4 SERIES CONTROLS

EMCP 4 controls including:
- Run / Auto / Stop Control
- Speed and Voltage Adjust
- Engine Cycle Crank
- 24-volt DC operation
- Environmental sealed front face
- Text alarm/event descriptions

Digital indication for:
- RPM
- DC volts
- Operating hours
- Oil pressure (psi, kPa or bar)
- Coolant temperature
- Volts (L-L & L-N), frequency (Hz)
- Amps (per phase & average)
- ekW, kVA, kVAR, kW-hr, %kW, PF (4.2 only)

Warning/shutdown with common LED indication of:
- Low oil pressure
- High coolant temperature
- Overspeed
- Emergency stop
- Failure to start (overcrank)
- Low coolant temperature
- Low coolant level

Programmable protective relaying functions:
- Generator phase sequence
- Over/Under voltage (27/59)
- Over/Under Frequency (81 o/u)
- Reverse Power (kW) (32) (4.2 only)
- Reverse reactive power (kVAr) (32RV)
- Overcurrent (50/51)

Communications:
- Four digital inputs (4.1)
- Six digital inputs (4.2 only)
- Four relay outputs (Form A)
- Two relay outputs (Form C)
- Two digital outputs
- Customer data link (Modbus RTU) (4.2 only)
- Accessory module data link (4.2 only)
- Serial annunciator module data link (4.2 only)
- Emergency stop pushbutton

Compatible with the following:
- Digital I/O module
- Local Annunciator
- Remote CAN annunciator
- Remote serial annunciator

STANDBY 400 ekW 500 kVA
60 Hz 1800 rpm 480 Volts

TECHNICAL DATA

Open Generator Set - - 1800 rpm/60 Hz/480 Volts	DM8151	
EPA Certified for Stationary Emergency Application (EPA Tier 3 emissions levels)		
Generator Set Package Performance		
Genset power rating @ 0.8 pf	500 kVA	
Genset power rating with fan	400 ekW	
Fuel Consumption		
100% load with fan	120.6 L/hr	31.9 gal/hr
75% load with fan	97.5 L/hr	25.8 gal/hr
50% load with fan	72.0 L/hr	19.0 gal/hr
Cooling System[1]		
Air flow restriction (system)	0.12 kPa	0.48 in. water
Air flow (max @ rated speed for radiator arrangement)	639 m³/min	22566 cfm
Engine Coolant capacity with radiator/exp. tank	50.3L	13.3 gal
Engine coolant capacity	20.8 L	5.5 gal
Radiator coolant capacity	29.5 L	7.8 gal
Inlet Air		
Combustion air inlet flow rate	38.8 m³/min	1370.2 cfm
Exhaust System		
Exhaust stack gas temperature	487.7°C	909.9°F
Exhaust gas flow rate	103.5 m³/min	3655.1 cfm
Exhaust flange size (internal diameter)	152.4 mm	6.0 in
Exhaust system backpressure (maximum allowable)	10.0 kPa	40.2 in. water
Heat Rejection		
Heat rejection to coolant (total)	165 kW	9384 Btu/min
Heat rejection to exhaust (total)	463 kW	26331 Btu/min
Heat rejection to aftercooler	111 kW	6312 Btu/min
Heat rejection to atmosphere from engine	81.0 kW	4606 Btu/min
Heat rejection to atmosphere from generator	29.2 kW	1660.6 Btu/min
Alternator[2]		
Motor starting capability @ 30% voltage dip	880 skVA	
Frame	LC6114B	
Temperature rise	150°C	270°F
Lubrication System		
Sump refill with filter	60.0 L	15.9 gal
Emissions (Nominal)[3]		
NOx g/hp-hr	3.49 g/hp-hr	
CO g/hp-hr	0.35 g/hp-hr	
HC g/hp-hr	0.04 g/hp-hr	
PM g/hp-hr	0.034 g/hp-hr	

[1] For ambient and altitude capabilities consult your Cat dealer. Air flow restriction (system) is added to existing restriction from factory.

[2] Generator temperature rise is based on a 40° C (104° F) ambient per NEMA MG1-32. Some packages may have oversized generators with a different temperature rise and motor starting characteristics.

[3] Emissions data measurement procedures are consistent with those described in EPA CFR 40 Part 89, Subpart D & E and ISO8178-1 for measuring HC, CO, PM, NOx. Data shown is based on steady state operating conditions of 77°F, 28.42 in HG and number 2 diesel fuel with 35° API and LHV of 18,390 btu/lb. The nominal emissions data shown is subject to instrumentation, measurement, facility and engine to engine variations. Emissions data is based on 100% load and thus cannot be used to compare to EPA regulations which use values based on a weighted cycle.

RATING DEFINITIONS AND CONDITIONS

Applicable Codes and Standards:
AS1359, CSA C22.2 No100-04, UL142,UL489, UL869, UL2200, NFPA37, NFPA70, NFPA99, NFPA110, IBC, IEC60034-1, ISO3046, ISO8528, NEMA MG1-22,NEMA MG1-33, 72/23/EEC, 98/37/EC, 2004/108/EC.

Standby – Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO3046 standard conditions.

Fuel Rates are based on fuel oil of 35° API (16°C or 60°F) gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 29°C (85°F) and weighing 838.9 g/liter (7.001 lbs/U.S. gal.).

Additional Ratings may be available for specific customer requirements. Consult your Cat representative for details.

ENCLOSURES

Picture shown may not reflect actual package.

C15 / C18 SOUND ATTENUATED ENCLOSURES

US Sourced 60 Hz

FEATURES

ROBUST / HIGHLY CORROSION RESISTANT CONSTRUCTION

- Factory installed on skid base
- Environmentally friendly, polyester powder baked paint
- 14 gauge steel
- Zinc plated or stainless steel fasteners
- Internally mounted super critical exhaust silencing system
- Designed and tested to comply with UL 2200 Listed generator set package
- Compression door latches providing solid door seal

EXCELLENT ACCESS

- Large cable entry area for installation ease
- Accommodates side mounted single or multiple breakers
- Three doors on both sides
- Vertically hinged allow 180° opening rotation and retention with door stays
- Lube oil and coolant drains piped to the exterior of the enclosure base
- Radiator fill cover

SECURITY AND SAFETY

- Lockable access doors which give full access to control panel and breaker
- Cooling fan and battery charging alternator fully guarded
- Fuel fill, oil fill, and battery can only be reached via lockable access
- Externally mounted emergency stop button
- Designed for spreader bar lifting to ensure safety
- Stub-up area is rodent proof

TRANSPORTABILITY

These enclosures are of extremely rugged construction to withstand outdoor exposure and rough handling common on many construction sites.

OPTIONS

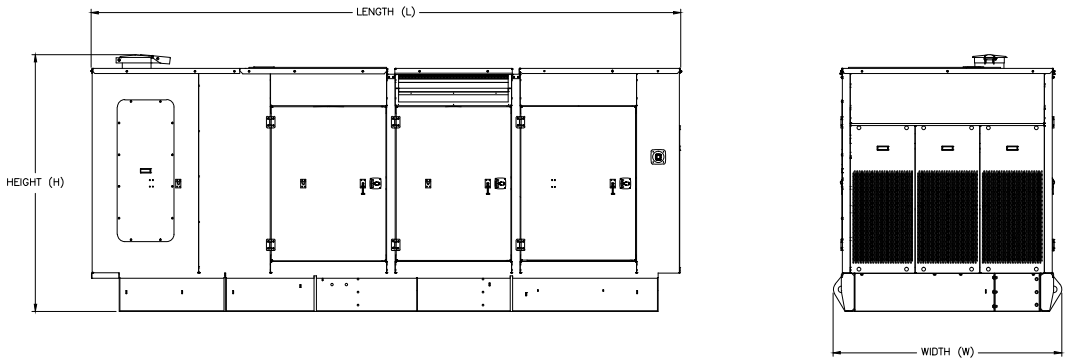
- Caterpillar yellow or white paint
- Control panel viewing window
- UL Listed 8 hour integral fuel tank
- UL Listed 24 or 48 hour sub base fuel tanks
- Seismic certification per applicable building codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, IBC 2012, CBC 2007, CBC 2010
- IBC Certification for 90 mph wind loading
- Anchoring details are site specific and are dependent on many factors such as generator set size, weight, and concrete strength. IBC Certification requires that the anchoring system used is reviewed and approved by a professional engineer.

Sound Attenuated Enclosure Sound Levels

Sound Attenuated Enclosure		Cooling Air Flow Rate		Ambient Capability*		Sound Pressure Levels (dBA) at					
						1m (3.3 ft)		7m (23 ft)		15m (49 ft)	
Model	Standby ekW	m^3/s	cfm	°C	°F	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load
C15	350	10.4	22072	59	138	83.5	82.9	72.5	72.4	69.8	69.2
	400	10.4	22072	51	124	84.0	84.0	73.0	73.1	70.0	69.5
	450	10.4	22072	46	115	84.7	83.5	74.2	72.5	70.5	69.8
	500	12.5	26415	48	118	86.7	86.0	75.3	74.1	71.6	70.7
C18	550	8.1	17234	45	113	87.3	86.9	75.3	74.2	72.6	71.9
	600	8.1	17234	43	109	87.6	87.1	75.4	74.8	72.8	72.0

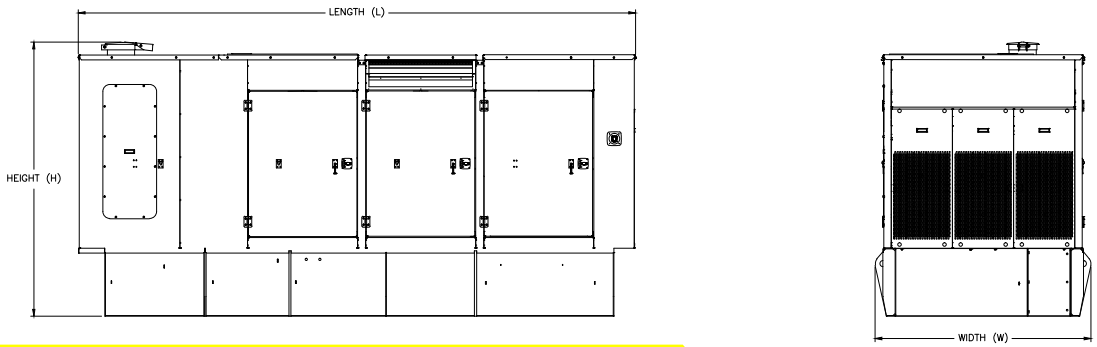
* Cooling system performance with sound attenuated enclosure restriction

Sound Attenuated Enclosure Weights and Dimensions



Sound Attenuated on Skid Base

Model	Rating ekW	Length "L" mm	Length "L" in	Width "W" mm	Width "W" in	Height "H" mm	Height "H" in	Weight kg	Weight lb
C15	350	4948	194.8	2014	79.3	2320	91.3	4842	10675
	400								
	450								
	500								
C18	550	5194	204.5	2014	79.3	2262	89.1	5367	11832
	600								



Sound Attenuated on a UL Listed Integral Fuel Tank Base

Model	Rating ekW	Length "L" mm	Length "L" in	Width "W" mm	Width "W" in	Height "H" mm	Height "H" in	Weight kg	Weight lb
C15	350	4948	194.8	2014	79.3	2619	103.1	5857	12912
	400								
	450								
	500								
C18	550	5194	204.5	2014	79.3	2557	100.7	6427	14169
	600								

Image shown may not reflect actual package.

C15 / C18 Integral and Sub-Base Fuel Tanks

US Sourced Diesel Generator Set 320 – 600 kW 60 Hz

FEATURES

- UL listed for United States (UL 142) and Canada (ULC S601)
- Compliant with NFPA 30, 37 & 110 and CSA C282-09 & B139-09 standards.
- Dual wall
- Lockable fuel fill cap, 4" (101.6mm) NPT
- Fuel fill drop tube with in 6" (152mm) from bottom of tank
- Low fuel level warning standard, customer configurable warning or shutdown
- Primary tank leak detection switch in containment basin
- Tank design provides capacity for thermal expansion of fuel
- Fuel supply dip tube is positioned so as not to pick up fuel sediment
- Fuel return and supply dip tube is separated by an internal baffle to prevent immediate re-supply of heated return fuel
- Pressure washed with an iron phosphate solution
- Interior tank surfaces coated with a solvent-based thin-film rust preventative
- Heavy guage steel gussets with internal lifting rings
- Primary and secondary tanks are leak tested at 20.7 kPa (3 psi) minimum
- Compatible with open packages and enclosures
- Gloss black polyester alkyd enamel exterior paint
- Welded steel containment basin (minimum of 110% of primary tank capacity)
- Direct reading fuel gauge with variable electrical output
- Emergency vents on primary and secondary tanks are sized in accordance with NFPA 30

DESCRIPTION – Sub Base

- The sub-base fuel tank mounts below the generator set wide base

DESCRIPTION – Integral

- Integral diesel fuel tank is incorporated into the generator set base frame
- Robust base design includes linear vibtration isolators between tank base and engine generator

OPTIONS

- Audio/visual fuel level alarm panel
- 5 gal (18.9 L) spill containment
- Overfill prevention valve

INTEGRAL & SUB-BASE FUEL TANK BASE USEABLE CAPACITIES with Fuel Tank Dimensions & Weights
Integral – Width (W) 2014 mm (79.3 in)
Sub-base – Width (W) 2056 mm (81 in)
OPEN SET & WEATHER PROTECTIVE ENCLOSURE

C15 Tank Design	Minimum Run Time (100% Load)	Total Capacity		Useable Capacity		Feature Code	TANK ONLY						TANK AND PACKAGE			
							Dry Weight		Height 'H'		Length 'L'		Open Pgs Height		Enc. Pgs Height	
		Liter	Gallon	Liter	Gallon		kg	lb	mm	in	mm	in	mm	in	mm	in
Integral	8hr	1261	333	1215	321	FTDW002_I	1015	2,237	635	25	3814	150.1	2426	95.5	3200	126.0
Sub-Base	24hr	3922	1036	3793	1002	FTDW005_I	1659	3,657	635	25	5550	218.5	2766	108.9	3537	139.3
Sub-Base	48hr	7192	1900	7022	1855	FTDW006_I	1875	4134	889	35	6184	243.5	3020	118.9	3793	149.3

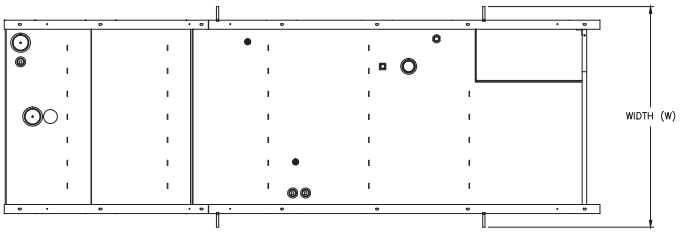
C18 Tank Design	Minimum Run Time (100% Load)	Total Capacity		Useable Capacity		Feature Code	TANK ONLY						TANK AND PACKAGE			
							Dry Weight		Height 'H'		Length 'L'		Open Pgs Height		Enc. Pgs Height	
		Liter	Gallon	Liter	Gallon		kg	lb	mm	in	mm	in	mm	in	mm	in
Integral	8hr	1457	385	1401	370	FTDW004_I	1060	2,337	635	25	3814	150.1	2400	94.5	3200	126.0
Sub-Base	24hr	3922	1036	3793	1002	FTDW005_I	1659	3,657	635	25	5550	218.5	2740	107.9	3537	139.3
Sub-Base	48hr	8385	2215	8177	2160	FTDW007_I	2150	4740	889	35	7073	278	2994	117.9	3793	149.3

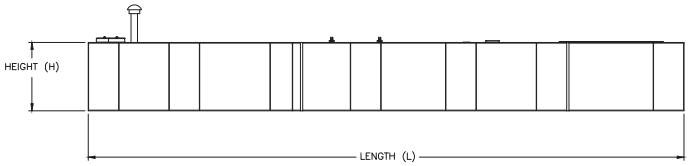
INTEGRAL & SUB-BASE FUEL TANK BASE USEABLE CAPACITIES with Fuel Tank Dimensions & Weights
Integral – Width (W) 2014 mm (79.3 in)
Sub-base – Width (W) 2056 mm (81 in)
SOUND ATTENUATED ENCLOSURE

C15 Tank Design	Minimum Run Time (100% Load)	Total Capacity		Useable Capacity		Feature Code	TANK ONLY						TANK AND PACKAGE			
							Dry Weight		Height 'H'		Length 'L'		Open Pgs Height		Enc. Pgs Height	
		Liter	Gallon	Liter	Gallon		kg	lb	mm	in	mm	in	mm	in	mm	in
Integral	8hr	1261	333	1215	321	FTDW001_I	1015	2,237	635	25	4753	187	NA	NA	2619	103.1
Sub-Base	24hr	3922	1036	3793	1002	FTDW005_I	1659	3,657	635	25	5550	218.5	NA	NA	2955	116.3
Sub-Base	48hr	7192	1900	7022	1855	FTDW006_I	1875	4134	889	35	6184	243	NA	NA	3209	126.3

C18 Tank Design	Minimum Run Time (100% Load)	Total Capacity		Useable Capacity		Feature Code	TANK ONLY						TANK AND PACKAGE			
							Dry Weight		Height 'H'		Length 'L'		Open Pgs Height		Enc. Pgs Height	
		Liter	Gallon	Liter	Gallon		kg	lb	mm	in	mm	in	mm	in	mm	in
Integral	8hr	1457	385	1401	370	FTDW003_I	1060	2,337	635	25	4753	187	NA	NA	2557	100.7
Sub-Base	24hr	3922	1036	3793	1002	FTDW005_I	1659	3,657	635	25	5550	218.5	NA	NA	2897	114.1
Sub-Base	48hr	8385	2215	8177	2160	FTDW007_I	2150	4740	889	35	7073	278	NA	NA	3151	124.1

ATTACHMENTS





The heights listed above do not include lumber used during manufacturing and shipping.
Tanks with full electrical stub-up area include removable end channel. Tanks with RH/LH stub-up include stub-up area directly below the circuit breaker or power terminal strips. Dimensions include weather-protective enclosure exhaust system.

Dual wall sub-base tanks are UL listed and constructed in accordance with Underwriters Laboratories Standard UL142 “Steel Aboveground Tanks for Flammable and Combustible Liquids” and Canada ULC S601 “Shop Fabricated Steel Aboveground Tanks for Flammable and Combustible Liquids.”

Fuel tanks comply with the following United States NFPA Codes:
NFPA 30 – Flammable and Combustible Liquids Code
NFPA 37 – Standard for Installation and Use of Stationary Combustible Engine
NFPA 110 – Standard for Emergency and Standby Power Systems

Fuel tanks comply with the following Canadian Codes:
CSA C282-09 – Emergency Electrical Power Supply for Buildings
CSA B139-09 – Installation Code for Oil-Burning Equipment

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Materials and specifications are subject to change without notice.
The International System of Units (SI) is used in this publication.

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EMCP 4

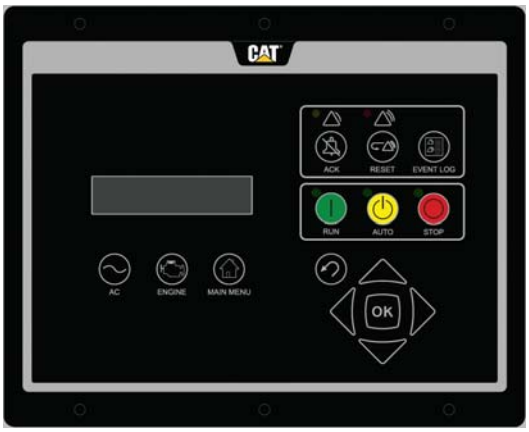


Image shown may not reflect actual package

EMCP 4.2 GENERATOR SET CONTROLLER

Caterpillar is leading the power generation market place with power solutions engineered to deliver unmatched performance, reliability, durability and cost-effectiveness.

FEATURES

GENERAL DESCRIPTION

The Cat® EMCP 4.2 offers fully featured power metering, protective relaying and engine and generator control and monitoring. Engine and generator controls, diagnostics, and operating information are accessible via the control panel keypads; diagnostics from the EMCP 4 optional modules can be viewed and reset through the EMCP 4.2.

FULL RANGE OF ATTACHMENTS

- Wide range of system expansion attachments, designed specifically to work with the EMCP 4.
- Flexible packaging options for easy and cost effective installation.

WORLD WIDE PRODUCT SUPPORT

- Cat dealers provide extensive pre and post sale support.
- Cat dealers have over 1,600 dealer branch stores operating in 200 countries.

FEATURES

- A 33 x 132 pixel, 3.8 inch, graphical display denotes text alarm/event descriptions, set points, engine and generator monitoring, and is visible in all lighting conditions.
- Textual display with support for 28 languages, including character languages such as Arabic, Chinese, and Japanese.
- Advanced engine monitoring is available on systems with an electronic engine control module.
- Integration with the Cat Digital Voltage Regulator (CDVR) provides enhanced system performance.
- Fully featured power metering, protective relaying, engine and generator parameter viewing, and expanded AC metering are all integrated into this controller.
- Real-time clock allows for date and time stamping of diagnostics and events in the control's logs as well as service maintenance reminders based on engine operating hours or calendar days.
- Up to 40 diagnostic events are stored in the non-volatile memory.
- Ability to view and reset diagnostics on EMCP 4 optional modules via the control panel removes the need for a separate service tool for troubleshooting.
- Set points and software stored in non-volatile memory, preventing loss during a power outage.
- Reduced power mode offers a low power state to minimize battery power requirements.
- Three levels of security allow for configurable operator privileges.
- Selectable units
  - Temperature: °C or °F
  - Pressure: psi, kPa, bar
  - Fuel Consumption: Gal/hr or Liter/hr

STANDARDS

- UL Recognized
- CSA C22.2 No.100,14, 94
- Complies with all necessary standards for CE Certification
  98/37/EC Machinery Directive
  – BS EN 60204-1 Safety of Machinery
  89/336/EEC EMC Directive
  – BS EN 50081-1 Emissions Standard
  – BS EN 50082-2 Immunity Standard
  73/23/EEC Low Voltage Directive
  – EN 50178 LVD Standard
- IEC529, IEC60034-5, IEC61131-3
- MIL STND 461

STANDARD FEATURES

Generator Monitoring	• Voltage (L-L, L-N) • Current (Phase) • Average Volt, Amp, Frequency • kW, kVAr, kVA (Average, Phase, %) • Power Factor (Average, Phase) • kW-hr, kVAr-hr (total) • Excitation voltage and current (with CDVR) • Generator stator and bearing temp (with optional module)
Generator Protection	• Generator phase sequence • Over/Under voltage (27/59) • Over/Under frequency (81 O/U) • Reverse Power (kW) (32) • Reverse Reactive Power (kVAr) (32RV) • Overcurrent (50/51)
Engine Monitoring	• Coolant temperature • Oil pressure • Engine speed (RPM) • Battery voltage • Run hours • Crank attempt and successful start counter • Enhanced engine monitoring (with electronic engines)
Engine Protection	• Control switch not in auto (alarm) • High coolant temp (alarm and shutdown) • Low coolant temp (alarm) • Low coolant level (alarm) • High engine oil temp (alarm and shutdown) • Low, high, and weak battery voltage • Overspeed • Overcrank
Control	• Run / Auto / Stop control • Speed and voltage adjust • Local and remote emergency stop • Remote start/stop • Cycle crank
Inputs & Outputs	• Two dedicated digital inputs • Six programmable digital inputs • Six programmable form A dry contacts • Two programmable form C dry contacts • Two digital outputs
Communications	• Primary and accessory CAN data links • RS-485 annunciator data link • Modbus RTU (RS-485 Half duplex)
Language Support	Arabic, Bulgarian, Chinese, Czech, Danish, Dutch, English, Estonian, Finnish, French, German, Greek, Hungarian, Icelandic, Italian, Latvian, Lithuanian, Japanese, Norwegian, Polish, Portuguese, Romanian, Russian, Slovak, Slovene, Spanish, Swedish, Turkish
Environmental	• Control module operating temperature: -40°C to 70°C • Display operating temperature: -20°C to 70°C • Humidity: 100% condensing 30°C to 60°C • Storage temperature: -40°C to 85°C • Vibration: Random profile, 24-1000 Hz, 4.3G rms

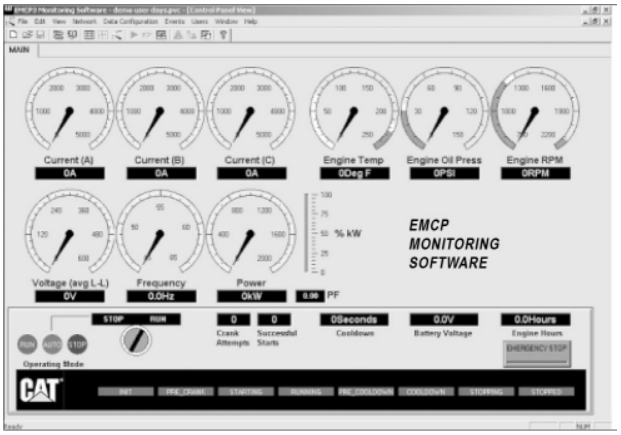
OPTIONAL MODULES

CAN ANNUNCIATOR

The EMCP 4 CAN Annunciator serves to display genset system alarm conditions and status indications. The annunciator has been designed for use on the accessory communication network and may be used in either local (package mounted) or remote (up to 800 feet) application. A maximum of three annunciators may be used with a single EMCP 4.2.

RS-485 ANNUNCIATOR

The EMCP 4 RS-485 Annunciator serves to display genset system alarm conditions and status indications. The annunciator has been designed for use on the long distance annunciator datalink and is used for remote (up to 4000 feet) application.



REMOTE MONITORING SOFTWARE

The EMCP 4 remote monitoring software package is a PC based program which allows the user to monitor and control a generator set, and is capable of running on a Windows based operating system. The remote monitoring software allows the user to configure data monitoring and data acquisition processes for monitoring, graphing, and logging of genset data.

Print

Systems Data

Reference Number: DM8151

CATERPILLAR®

March 21, 20
For Help Desk Phc
Numbers Click He

AIR INTAKE SYSTEM		
THE INSTALLED SYSTEM MUST COMPLY WITH THE SYSTEM LIMITS BELOW FOR ALL EMISSIONS CERTIFIED ENGINES TO ASSURE REGULATORY COMPLIANCE.		
MAXIMUM ALLOWABLE INTAKE RESTRICTION WITH CLEAN ELEMENT	15	IN-H20
MAXIMUM PRESSURE DROP FROM COMPRESSOR OUTLET TO MANIFOLD INLET (OR MIXER INLET FOR EGR)	4.4	IN-HG
COOLING SYSTEM		
MAXIMUM ALLOWABLE JACKET WATER OUTLET TEMPERATURE	219	DEG F
REGULATOR LOCATION FOR JW CIRCUIT	OUTLET	
MAXIMUM UNINTERRUPTED FILL RATE	5.0	G/MIN
ENGINE SPEC SYSTEM		
CYLINDER ARRANGEMENT	INLINE	
NUMBER OF CYLINDERS	6	
CYLINDER BORE DIAMETER	5.4	IN
PISTON STROKE	6.7	IN
TOTAL CYLINDER DISPLACEMENT	928	CU IN
CRANKSHAFT ROTATION FROM FLYWHEEL END	CCW	
CYLINDER FIRING ORDER	1-5-3-6-2-4	
NUMBER 1 CYLINDER LOCATION	FRONT	
STROKES/COMBUSTION CYCLE	4	
EXHAUST SYSTEM		
THE INSTALLED SYSTEM MUST COMPLY WITH THE SYSTEM LIMITS BELOW FOR ALL EMISSIONS CERTIFIED ENGINES TO ASSURE REGULATORY COMPLIANCE.		
MAXIMUM ALLOWABLE SYSTEM BACK PRESSURE	40	IN-H20
FUEL SYSTEM		
MAXIMUM FUEL FLOW FROM TRANSFER PUMP TO ENGINE	69.2	G/HR
MAXIMUM ALLOWABLE FUEL SUPPLY LINE RESTRICTION	8.9	IN-HG
MAXIMUM ALLOWABLE FUEL TEMPERATURE AT TRANSFER PUMP INLET	140	DEG F
MAXIMUM ALLOWABLE FUEL RETURN LINE RESTRICTION	8.0	IN-HG
NORMAL FUEL PRESSURE IN A CLEAN SYSTEM	90.1	PSI
MAXIMUM TRANSFER PUMP PRIMING LIFT WITHOUT PRIMING PUMP	9.8	FT
LUBE SYSTEM		
CRANKCASE VENTILATION TYPE	TO ATM	
STARTING SYSTEM		
LOWEST AMBIENT START TEMPERATURE WITHOUT AIDS	32	DEG F

PERFORMANCE DATA[DM8151]

March 21, 2014

Performance Number: DM8151 **Change Level: 03**

SALES MODEL:	C15	**COMBUSTION:**	DI
ENGINE POWER (BHP):	619	**ENGINE SPEED (RPM):**	1,800
GEN POWER WITH FAN (EKW):	400.0	**HERTZ:**	60
COMPRESSION RATIO:	16.1	**FAN POWER (HP):**	31.4
APPLICATION:	PACKAGED GENSET	**ASPIRATION:**	TA
RATING LEVEL:	STANDBY	**AFTERCOOLER TYPE:**	ATAAC
SUB APPLICATION:	STANDARD	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
PUMP QUANTITY:	1	**INLET MANIFOLD AIR TEMP (F):**	120
FUEL TYPE:	DIESEL	**JACKET WATER TEMP (F):**	192.2
MANIFOLD TYPE:	DRY	**TURBO CONFIGURATION:**	SINGLE
GOVERNOR TYPE:	ELEC	**TURBO QUANTITY:**	1
CAMSHAFT TYPE:	STANDARD	**TURBOCHARGER MODEL:**	GTA5518BS-56T-1.58
IGNITION TYPE:	CI	**CERTIFICATION YEAR:**	2006
INJECTOR TYPE:	EUI	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,025.0
REF EXH STACK DIAMETER (IN):	6		
MAX OPERATING ALTITUDE (FT):	6,562		

General Performance Data

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	BRAKE MEAN EFF PRES (BMEP)	BRAKE SPEC FUEL CONSUMPTN (BSFC)	VOL FUEL CONSUMPTN (VFC)	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP
EKW	%	BHP	PSI	LB/BHP-HR	GAL/HR	IN-HG	DEG F	DEG F	IN-HG	DEG F
400.0	100	619	294	0.359	31.7	65.6	119.6	1,209.5	46.1	908.6
360.0	90	557	264	0.363	28.9	60.9	118.8	1,178.8	41.3	893.5
320.0	80	497	236	0.378	26.8	57.6	116.5	1,153.7	39.1	879.9
300.0	75	467	221	0.385	25.7	55.3	114.7	1,140.9	37.6	873.1
280.0	70	437	207	0.392	24.5	52.4	112.8	1,126.7	35.5	866.2
240.0	60	378	179	0.405	21.8	45.6	108.3	1,094.2	30.9	852.2
200.0	50	319	152	0.416	19.0	37.4	103.2	1,055.6	25.7	837.7
160.0	40	263	125	0.418	15.7	26.7	96.9	995.2	19.3	808.5
120.0	30	208	98	0.420	12.4	16.4	91.2	915.4	13.4	764.8
100.0	25	179	85	0.423	10.8	11.9	88.8	867.9	10.7	737.3
80.0	20	151	72	0.433	9.3	8.3	87.1	812.7	8.6	701.0
40.0	10	92.2	44	0.501	6.6	3.9	85.6	674.5	6.0	593.1

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP	WET INLET AIR VOL FLOW RATE	ENGINE OUTLET WET EXH GAS VOL FLOW RATE	WET INLET AIR MASS FLOW RATE	WET EXH GAS MASS FLOW RATE	WET EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)	DRY EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)
EKW	%	BHP	IN-HG	DEG F	CFM	CFM	LB/HR	LB/HR	FT3/MIN	FT3/MIN
400.0	100	619	69	385.1	1,370.6	3,629.1	5,963.6	6,185.6	1,304.1	1,192.5
360.0	90	557	63	364.0	1,298.7	3,379.0	5,631.7	5,834.1	1,227.7	1,125.4
320.0	80	497	60	353.5	1,265.1	3,249.5	5,479.3	5,667.0	1,192.7	1,096.8
300.0	75	467	58	346.5	1,241.1	3,168.3	5,370.2	5,550.2	1,168.8	1,076.4
280.0	70	437	55	336.4	1,206.1	3,058.6	5,211.4	5,382.8	1,134.3	1,046.0
240.0	60	378	48	311.2	1,118.6	2,796.7	4,818.9	4,972.0	1,048.1	969.0
200.0	50	319	40	278.4	1,005.9	2,472.7	4,318.1	4,451.2	937.1	868.2
160.0	40	263	29	230.5	845.4	2,033.6	3,618.1	3,728.2	788.4	731.9
120.0	30	208	18	182.8	688.4	1,596.0	2,936.4	3,023.5	640.8	596.0
100.0	25	179	14	160.9	618.2	1,393.0	2,632.1	2,708.0	572.2	532.6
80.0	20	151	10	142.7	561.7	1,219.0	2,387.9	2,453.3	516.4	481.6
40.0	10	92.2	5	117.3	490.4	957.1	2,080.5	2,126.7	447.0	421.0

Heat Rejection Data

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	REJECTION TO JACKET WATER	REJECTION TO ATMOSPHERE	REJECTION TO EXH	EXHUAST RECOVERY TO 350F	FROM OIL COOLER	FROM AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY
EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
400.0	100	619	9,356	4,272	26,284	14,668	3,625	6,340	26,246	68,058	72,499
360.0	90	557	8,773	3,911	24,231	13,431	3,304	5,531	23,635	62,033	66,081
320.0	80	497	8,344	3,685	22,984	12,687	3,064	5,202	21,066	57,528	61,282
300.0	75	467	8,120	3,607	22,252	12,251	2,938	4,984	19,795	55,159	58,758
280.0	70	437	7,871	3,539	21,338	11,710	2,797	4,668	18,527	52,517	55,944
240.0	60	378	7,340	3,401	19,275	10,502	2,498	3,915	16,022	46,893	49,953
200.0	50	319	6,749	3,223	16,871	9,112	2,171	3,030	13,547	40,761	43,420
160.0	40	263	6,057	3,171	13,607	7,154	1,797	1,936	11,169	33,738	35,940
120.0	30	208	5,351	2,804	10,399	5,228	1,422	1,077	8,800	26,690	28,431
100.0	25	179	5,003	2,471	8,941	4,361	1,239	760	7,608	23,266	24,784
80.0	20	151	4,542	2,241	7,636	3,566	1,067	532	6,398	20,041	21,349
40.0	10	92.2	3,608	1,907	5,399	2,113	755	265	3,911	14,167	15,091

Emissions Data

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		EKW	400.0	300.0	200.0	100.0	40.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	619	467	319	179	92.2
TOTAL NOX (AS NO2)		G/HR	2,312	1,138	697	701	442
TOTAL CO		G/HR	411	1,351	1,614	602	524
TOTAL HC		G/HR	51	71	89	65	113
PART MATTER		G/HR	43.6	42.1	56.1	40.2	35.7
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	1,704.8	1,020.8	873.2	1,570.8	1,452.3
TOTAL CO	(CORR 5% O2)	MG/NM3	303.9	1,231.2	1,967.5	1,195.3	2,121.2
TOTAL HC	(CORR 5% O2)	MG/NM3	32.6	57.0	96.4	134.3	393.9
PART MATTER	(CORR 5% O2)	MG/NM3	27.1	32.8	59.4	76.7	117.9
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	830	497	425	765	707
TOTAL CO	(CORR 5% O2)	PPM	243	985	1,574	956	1,697
TOTAL HC	(CORR 5% O2)	PPM	61	106	180	251	735
TOTAL NOX (AS NO2)		G/HP-HR	3.76	2.45	2.19	3.92	4.81
TOTAL CO		G/HP-HR	0.67	2.91	5.08	3.37	5.70
TOTAL HC		G/HP-HR	0.08	0.15	0.28	0.37	1.23
PART MATTER		G/HP-HR	0.07	0.09	0.18	0.22	0.39
TOTAL NOX (AS NO2)		LB/HR	5.10	2.51	1.54	1.55	0.97
TOTAL CO		LB/HR	0.91	2.98	3.56	1.33	1.15
TOTAL HC		LB/HR	0.11	0.16	0.20	0.14	0.25
PART MATTER		LB/HR	0.10	0.09	0.12	0.09	0.08

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITH FAN		EKW	400.0	300.0	200.0	100.0	40.0
PERCENT LOAD		%	100	75	50	25	10
ENGINE POWER		BHP	619	467	319	179	92.2
TOTAL NOX (AS NO2)		G/HR	2,141	1,054	646	649	409
TOTAL CO		G/HR	220	722	863	322	280
TOTAL HC		G/HR	27	38	47	35	60
TOTAL CO2		KG/HR	313	253	186	105	63
PART MATTER		G/HR	22.3	21.6	28.8	20.6	18.3
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	1,578.5	945.1	808.6	1,454.5	1,344.7
TOTAL CO	(CORR 5% O2)	MG/NM3	162.5	658.4	1,052.1	639.2	1,134.3
TOTAL HC	(CORR 5% O2)	MG/NM3	17.3	30.1	51.0	71.1	208.4
PART MATTER	(CORR 5% O2)	MG/NM3	13.9	16.8	30.5	39.3	60.5
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	769	460	394	708	655
TOTAL CO	(CORR 5% O2)	PPM	130	527	842	511	907
TOTAL HC	(CORR 5% O2)	PPM	32	56	95	133	389
TOTAL NOX (AS NO2)		G/HP-HR	3.49	2.27	2.03	3.63	4.45
TOTAL CO		G/HP-HR	0.36	1.56	2.72	1.80	3.05
TOTAL HC		G/HP-HR	0.04	0.08	0.15	0.19	0.65
PART MATTER		G/HP-HR	0.04	0.05	0.09	0.12	0.20
TOTAL NOX (AS NO2)		LB/HR	4.72	2.32	1.42	1.43	0.90
TOTAL CO		LB/HR	0.48	1.59	1.90	0.71	0.62
TOTAL HC		LB/HR	0.06	0.08	0.10	0.08	0.13
TOTAL CO2		LB/HR	689	557	411	231	138
PART MATTER		LB/HR	0.05	0.05	0.06	0.05	0.04
OXYGEN IN EXH		%	10.1	11.2	12.0	12.7	14.6
DRY SMOKE OPACITY		%	0.6	0.7	1.0	1.2	1.1
BOSCH SMOKE NUMBER			0.31	0.38	0.66	0.79	0.75

Regulatory Information

EPA TIER 3		2005 - 2010		
GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 89 SUBPART D AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THE "MAX LIMITS" SHOWN BELOW ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE NON-ROAD REGULATIONS.				
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	NON-ROAD	TIER 3	CO: 3.5 NOx + HC: 4.0 PM: 0.20

EPA EMERGENCY STATIONARY		2011 - ----		
GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 60 SUBPART IIII AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THE "MAX LIMITS" SHOWN BELOW ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE EMERGENCY STATIONARY REGULATIONS.				
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	STATIONARY	EMERGENCY STATIONARY	CO: 3.5 NOx + HC: 4.0 PM: 0.20

Altitude Derate Data

ALTITUDE CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	30	40	50	60	70	80	90	100	110	120	130	140	NORMAL
ALTITUDE (FT)													
0	619	619	619	619	619	619	619	619	619	619	619	619	619
1,000	619	619	619	619	619	619	619	619	619	619	619	619	619
2,000	619	619	619	619	619	619	619	619	619	619	619	619	619
3,000	619	619	619	619	619	619	619	619	619	619	619	619	619
4,000	619	619	619	619	619	619	619	619	619	619	619	613	619
5,000	619	619	619	619	619	619	619	619	619	609	599	589	619
6,000	619	619	619	619	619	619	618	607	596	586	576	566	619
7,000	619	619	619	619	616	605	594	583	573	563	554	544	619
8,000	619	619	615	604	592	581	571	560	551	541	532	523	615
9,000	615	603	591	580	569	558	548	538	529	520	511	502	595
10,000	591	579	567	556	546	536	526	517	508	499	490	482	575
11,000	567	555	544	534	524	514	505	496	487	479	471	463	556
12,000	544	533	522	512	503	493	484	476	467	459	451	444	537
13,000	521	511	501	491	482	473	464	456	448	440	433	426	519
14,000	500	490	480	471	462	453	445	437	429	422	415	408	501
15,000	479	469	460	451	442	434	426	419	411	404	397	391	483

Cross Reference

Engine Arrangement			
Arrangement Number	Effective Serial Number	Engineering Model	Engineering Model Version
2729743	FSE00001	GS282	-
2864922	FSE00001	GS282	-
2864922	FTE00001	GS282	-

Test Specification Data						
Test Spec	Setting	Effective Serial Number	Engine Arrangement	Governor Type	Default Low Idle Speed	Default High Idle Speed
0K6279	PP5608	FSE00001	2729743	ELEC		
0K6279	PP5608	FTE00001	2864922	ELEC		

Performance Parameter Reference

Parameters Reference:DM9600-05

PERFORMANCE DEFINITIONS

PERFORMANCE DEFINITIONS DM9600

APPLICATION:
Engine performance tolerance values below are representative of a typical production engine tested in a calibrated dynamometer test cell at SAE J1995 standard reference conditions. Caterpillar maintains ISO9001:2000 certified quality management systems for engine test Facilities to assure accurate calibration of test equipment. Engine test data is corrected in accordance with SAE J1995. Additional reference material SAE J1228, J1349, ISO 8665, 3046-1:2002E, 3046-3:1989, 1585, 2534, 2288, and 9249 may apply in part or are similar to SAE J1995. Special engine rating request (SERR) test data shall be noted.

PERFORMANCE PARAMETER TOLERANCE FACTORS:

Power	+/- 3%
Torque	+/- 3%
Exhaust stack temperature	+/- 8%
Inlet airflow	+/- 5%
Intake manifold pressure-gage	+/- 10%
Exhaust flow	+/- 6%
Specific fuel consumption	+/- 3%
Fuel rate	+/- 5%
Heat rejection	+/- 5%
Heat rejection exhaust only	+/- 10%

Torque is included for truck and industrial applications, do not use for Gen Set or steady state applications.

On C7 - C18 engines, at speeds of 1100 RPM and under these values are provided for reference only, and may not meet the tolerance listed.

These values do not apply to C280/3600. For these models, see the tolerances listed below.

C280/3600 HEAT REJECTION TOLERANCE FACTORS:

Heat rejection	+/- 10%
Heat rejection to Atmosphere	+/- 50%
Heat rejection to Lube Oil	+/- 20%
Heat rejection to Aftercooler	+/- 5%

TEST CELL TRANSDUCER TOLERANCE FACTORS:

Torque	+/- 0.5%
Speed	+/- 0.2%
Fuel flow	+/- 1.0%
Temperature	+/- 2.0 C degrees
Intake manifold pressure	+/- 0.1 kPa

OBSERVED ENGINE PERFORMANCE IS CORRECTED TO SAE J1995 REFERENCE AIR AND FUEL CONDITIONS.

REFERENCE ATMOSPHERIC INLET AIR

FOR 3500 ENGINES AND SMALLER
SAE J1228 reference atmospheric pressure is 100 KPA (29.61 in hg) and standard temperature is 25 (77) at 60% relative humidity.

FOR 3600 ENGINES
Engine rating obtained and presented in accordance with ISO 3046/1 and SAE J1995 JAN90 standard reference conditions of 25, 100 KPA 30% relative humidity and 150M altitude at the stated aftercooler water temperature.

MEASUREMENT LOCATION FOR INLET AIR TEMPERATURE
Location for air temperature measurement air cleaner inlet at stabilized operating conditions.

REFERENCE EXHAUST STACK DIAMETER
The Reference Exhaust Stack Diameter published with this dataset is only used for the calculation of Smoke Opacity values displayed in this dataset. This value does not necessarily represent the actual stack diameter of the engine due to the variety of exhaust stack adapter options available. Consult the price list, engine order or general dimension drawings for the actual stack diameter size ordered or options available.

REFERENCE FUEL

DIESEL
Reference fuel is #2 distillate diesel with a 35API gravity;
A lower heating value is 42,780 KJ/KG (18,390 BTU/LB) when used at 29 (84.2), where the density is 838.9 G/Liter (7.001 Lbs/Gal).

GAS
Reference natural gas fuel has a lower heating value of 33.74 KJ/L (905 BTU/CU Ft). Low BTU ratings are based on 18.64 KJ/L (500 BTU/CU FT) lower heating value gas. Propane ratings are based on 87.56 KJ/L (2350 BTU/CU Ft) lower heating value gas.

ENGINE POWER (NET) IS THE CORRECTED FLYWHEEL POWER (GROSS) LESS EXTERNAL AUXILIARY LOAD
Engine corrected gross output includes the power required to drive standard equipment; lube oil, scavenge lube oil, fuel transfer, common rail fuel, separate circuit aftercooler and jacket water pumps. Engine net power available for the external (flywheel) load is calculated by subtracting the sum of auxiliary load from the corrected gross flywheel out put power. Typical auxiliary loads are radiator cooling fans, hydraulic pumps, air compressors and battery charging alternators.

ALTITUDE CAPABILITY
Altitude capability is the maximum altitude above sea level at standard temperature and standard pressure at which the engine could develop full rated output power on the current performance data set. Standard temperature values versus altitude could be seen on TM2001.

Engines with ADEM MEUI and HEUI fuel systems operating at conditions above the defined altitude capability derate for atmospheric pressure and temperature conditions outside the values defined, see TM2001. Mechanical governor controlled unit injector engines require a setting change for operation at conditions above the altitude defined on the engine performance sheet. See your Caterpillar technical representative for non standard ratings.

REGULATIONS AND PRODUCT COMPLIANCE
TMI Emissions information is presented at 'nominal' and 'Potential Site Variation' values for standard ratings. No tolerances are applied to the emissions data. These values are subject to change at any time. The controlling federal and local emission requirements need to be verified by your Caterpillar technical representative. Log on to the Technology and Solutions Divisions (T&SD) web page (https://pdgt.cat.com/cda/layout) for information including federal regulation applicability and time lines for implementation. Information for labeling and tagging requirements is also provided.

NOTES:
Regulation watch covers regulations in effect and future regulation changes for world, federal, state and local. This page includes items on the watch list where a regulation change or product change might be pending and may need attention of the engine product group. For additional emissions information log on to the TMI web page.

Additional product information for specific market application is available.
Customer's may have special emission site requirements that need to be verified by the Caterpillar Product Group engineer.

HEAT REJECTION DEFINITIONS:
Diesel Circuit Type and HHV Balance : DM9500

EMISSIONS DEFINITIONS:
Emissions : DM1176

PERFORMANCE DATA[DM8151]

SOUND DEFINITIONS:
Sound Power : DM8702

Sound Pressure : TM7080

RATING DEFINITIONS:
Agriculture : TM6008

Fire Pump : TM6009

Generator Set : TM6035

Generator (Gas) : TM6041

Industrial Diesel : TM6010

Industrial (Gas) : TM6040

Irrigation : TM5749

Locomotive : TM6037

Marine Auxiliary : TM6036

Marine Prop (Except 3600) : TM5747

Marine Prop (3600 only) : TM5748

MSHA : TM6042

Oil Field (Petroleum) : TM6011

Off-Highway Truck : TM6039

On-Highway Truck : TM6038

Date Released : 11/23/11

ORDER 873

STATEMENT OF BASIS

ATTACHMENT 2

EFSEC Order No. 672 Revision:
Proposed Run Time Limit for Diesel Generators

The current EFSEC Regulatory Order No. 672 diesel fuel use limit is 780,000 gallons per year. However, if all 780,000 gallons of diesel fuel were to be used in the diesel generators in one given year, the major source threshold for nitrogen oxides would be exceeded. Accordingly, Energy Northwest and Department of Ecology concluded that Order No. 672 needed to be updated and that fuel limitations needed to be set for both the DGs and auxiliary boiler. The total annual fuel use limit for the DGs and auxiliary boiler, in order to maintain 90% or less of the 100 ton per year major source limit, is 365,000 & 730,000 gallons per year respectively. Note: Energy Northwest wants to keep the fuel ratio at 2-to-1 for the boiler and DGs. EFSEC, Department of Ecology, and Energy Northwest decided the best method to demonstrate compliance would be to replace the annual diesel fuel limitation with DG run time limitations. The following information describes how the 484 hour per year limitation was derived.

Historical Data (Based on Diesel Generator Operating Logs from 2006-2013):

Table 1: Total Run Times per Year (2006-2013)

Year	Total Run Time (hr)			
	DG1	DG2	DG3	All DGs
2006	65.2	64.2	68.3	197.7
2007	74.3	90.0	47.4	211.7
2008	46.3	50.4	72.6	169.3
2009	54.2	59.0	40.0	153.2
2010	83.1	76.5	86.7	246.3
2011	107.2	50.0	35.9	193.1
2012	54.7	57.1	83.6	195.4
2013	112.2	68.6	57.3	238.0
max	112.2	90.0	86.7	246.3
average	74.6	64.5	61.5	200.6

Table 2: Total Load Times at 100% Load per Year (2006-2013)

Year	Total Load Time (hr)		
	DG1	DG2	DG3
2006	46.8	34.6	47.1
2007	48.0	60.5	24.1
2008	28.9	26.6	51.6
2009	32.2	26.9	19.0
2010	52.3	50.8	51.8
2011	80.7	20.6	16.7
2012	29.5	31.7	48.8
2013	68.0	43.9	29.5
max	80.7	60.5	51.8
average	48.3	37.0	36.1

Table 3: 100% Load Time/Run Time Ratios (2006-2013)

Year	Load Time/Run Time		
	DG1	DG2	DG3
2006	0.72	0.54	0.69
2007	0.65	0.67	0.51
2008	0.62	0.53	0.71
2009	0.59	0.46	0.47
2010	0.63	0.66	0.60
2011	0.75	0.41	0.47
2012	0.54	0.56	0.58
2013	0.61	0.64	0.51
max	0.75	0.67	0.71
average	0.64	0.56	0.57

Fuel Consumption Rates at 100% Load:

Table 4: Fuel Consumption Rates at 100% Load

Diesel Generator	Fuel Consumption Rate (gal/hr)
DG1	325.8
DG2	336.5
DG3	200.2
DG5	31.9

Table 4 References:

- ME-02-92-234, Calculation for On Site Diesel Fuel Storage for the Emergency Diesel Generators DG-1, DG-2, and DG-3, page 3
- LEHE0475-00 CAT Diesel Generator Set, page 4 (DG-5)

Fuel Consumption Rate for DG1 and DG2 at Various Loads:

At 100% Rating: 340 gal/hr
At 50% Rating: 180 gal/hr
At 0% Rating: 80 gal/hr

Reference: SD000200 Revision 11, Columbia Generating Station System Description - Diesel Generator, February 2014, page 61

Assumptions:

- Based on historical data for DG1, DG2 and DG3, the maximum 100% load time/run time ratio is 0.75.

- Conservatively assume the fuel consumption rate for each DG when not at 100% load is equivalent to 50% of the fuel consumption rate at 100% load.

Calculation:

Total Fuel Consumption Rate for all DGs = (325.8 + 336.5 + 200.2) gal/hr = 862.5 gal/h

Proposed run time limit per DG per year =

[Yearly Fuel Use Limit for all DGs, 365,000 gal/yr] / [(0.75 x (Total Fuel Consumption Rate for all DGs at Full Load, 862.5 gal/hr)) + (0.25 x 0.50 x (Total Fuel Consumption Rate for all DGs at Full Load, 862.5 gal/hr))] = 483.64 hr/yr → **484 hr/yr/DG**

Check:

Total amount of fuel used if each DG1, DG2, and DG3 ran for 484 hr/yr:

DG1: (0.75*484 hr/yr)(325.8 gal/hr) + (0.25*484 hr/yr)(0.5*325.8 gal/hr) = 137,976.3 gal/yr

DG2: (0.75*484 hr/yr)(336.5 gal/hr) + (0.25*484 hr/yr)(0.5*336.5 gal/hr) = 142,507.8 gal/yr

DG3: (0.75*484 hr/yr)(200.2 gal/hr) + (0.25*484 hr/yr)(0.5*200.2 gal/hr) = 84,784.8 gal/yr

Total fuel use = 365,268.8 gal/yr

ORDER 873

STATEMENT OF BASIS

ATTACHMENT 3

Potential To Emit Calculations For Columbia's Plant DG's, Aux Boiler, and new DG5
Prepared by Brad Barfuss
Date: May 1, 2014

Given	Value		
	8760	Hours per year	
	137000	Btu/gal	Per AP-42, Table 3.4-1 footnote a
	140000	Btu/gal	Per AP-42, Page 1.3-8
	1000000	mm	
	0.0005	tons/lb	
	7555500	gallons/yr	
	250000	gallons - maximum annual DG fuel use, 1995 AOP application pg. 5	
	500000	gallons - maximum annual Aux Boiler fuel use, 1995 AOP application pg. 5	
	780000	gallons - EFSEC Order No. 672 annual fuel use limit	
	61814000	btu/hr - max boiler heat input, 1979 boiler source test	

DG Fuel Consumption Tests 618140000

	Fuel Consumption 1992 Test (gph)	Fuel Consumption 2008 Test (gph) ME-02-92-234
DG-1 (2 engines)	310	325.8
DG-2 (2 engines)	333	336.5
DG-3 (1 engine)	186	200.2
Total	829	862.5

Recommended New Limits for 90% of 100 ton limit

DG1, DG2, DG3

Pollutant	Emission Factors (lb/mmBTU)	Source Document	PTE (tons) for 250,000 gals diesel fuel	PTE (tons) for 365,000 gals diesel fuel	PTE (tons) for 780,000 gals diesel fuel	Maximum PTE (tons) for 365 days	Notes
NOx	3.2	AP-42, Table 3.4-1	54.80	80.01	170.98	1656.17	NOx emissions have a PTE >100 ton per years
SO2	0.01	AP-42, Table 3.4-1	0.12	0.17	0.37	3.55	Assumes that all sulfur in the fuel is converted to SO2
PM	0.07	AP-42, Table 3.4-2	1.20	1.75	3.74	36.23	
CO	0.85	AP-42, Table 3.4-1	14.56	21.25	45.42	439.92	CO emissions have a PTE >100 tons per year

Aux Boiler

Pollutant	Emission Factors (lb/mmBTU)	Source Document	PTE (tons) for 500,000 gals diesel fuel	PTE (tons) for 730,000 gals diesel fuel	PTE (tons) for 780,000 gals diesel fuel	Maximum PTE (tons) for 365 days	
NOx	0.2	1979 source test	7.00	10.22	10.92	54.15	Running boiler for 365 days doesn't exceed major source limit
SO2	0.007	AP-42, Table 1.3-1	0.25	0.36	0.38	1.91	Assumes that all sulfur in the fuel is converted to SO2
PM	0.015	AP-42, Table 1.3-6	0.51	0.75	0.80	3.95	2.0 lbs per 1000 gals, divided by 137MMBTU per 1000 gals
CO	0.036	AP-42, Table 1.3-1	1.28	1.86	1.99	9.88	5 lbs per 1000 gals, divided by 137MMBTU per 1000 gallons

Cumulative (DG & Aux Boiler)

NOx	61.80	**90.23**	181.90	1710.31	90 tons is 90% of the 100 ton per year major source threshold
SO2	0.36	0.53	0.75	5.46	
PM	1.71	2.50	4.54	40.18	
CO	15.83	23.12	47.41	449.80	

DG5

Pollutant	100% load (g/hp-hr)	Source Document	100 Hrs PTE (tons)	200 Hrs PTE (tons)	300 Hrs PTE (tons)	484 Hrs PTE (tons)	DG5 total hours of operation per year
NOx	3.49	LEHE0475-00	0.24	0.48	0.71	1.15	100 hours per year adds a nominal amount of NOx
CO	0.35	LEHE0475-00	0.02	0.05	0.07	0.12	
HC	0.04	LEHE0475-00	0.003	0.005	0.008	0.01	
PM	0.034	LEHE0475-00	0.002	0.005	0.007	0.01	

Proposed EFSEC Order 672 Limits:

Diesel Gen No.	12-Month Rolling Sum Limit
DG1	**484**
DG2	**484**
DG3	**484**
DG5	**100**

Auxiliary Boiler

Given:

Operations Systems Study Guide

Auxiliary Boiler EPN: AS-BLR-1

Cleaver-Brooks, Model DL-68

Rating 50,000 lbm/hr at 200 psig

Fuel Use 458 gal/hr when operating at rated capacity

Notes:

Evaporator A normally provides sealing steam when the plant is operating

Evaporator B normally provides heating steam when required when the plant is operating

The Auxilliary Boiler can be lined up to provide both seal steam & heating steam when the evaporators are not available during startup

Estimate Fuel Use:

Ratings (lbm/hr)	Percent Input (%)	Heat Input (BTU/hr)	Fuel Use (gal/hr)	30 Day Fuel Use (gal)	60 Day Fuel Use (gal)	90 Day Fuel Use (gal)	120 Day Fuel Use (gal)	150 Day Fuel Use (gal)	Notes:
	33%	21,150,000	151	108,821	217,642	326,462	435,283	544,104	Low fire
39,000	80%	49,495,000	366	263,808	527,616	791,424	1,055,232	1,319,040	
50,000	100%	61,814,000	458	329,760	659,520	989,280	1,319,040	1,648,800	Rated efficiency is 81%

Example of 12-month rolling total

Month	DG1 Total Run Time (Hours)	12-Month Rolling Total (Hours)
December	3	
January	6	
February	1	
March	4	
April	24	
May	5	
June	12	
July	8	
August	4	
September	9	
October	3	
November	4	83
December	8	88
January	6	88
February	12	99
March	4	99
April	24	99
May	5	99
June	12	99

CY Total	88	
Maximum		99