



TAMPA ELECTRIC

October 31, 2011

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DIVISION OF AIR  
RESOURCE MANAGEMENT

Jeffrey F. Koerner, Program Administrator  
Florida Department of Environmental Protection  
Division of Air Resource Management  
Office of Air Permitting and Compliance  
2600 Blair Stone Road, M.S. 5505  
Tallahassee, Florida 32399-2400

Via FedEx  
Airbill No. 797682548772

**Re: Tampa Electric Company - Big Bend Power Station  
Title V Permit Number 0570039-045-AV  
Amendment No. 2 to Permit Application No. 2982-1  
Facility No. 0570039**

Dear Mr. Koerner:

Tampa Electric Company (TEC) is submitting an additional request to the Florida Department of Environmental Protection (Department) to amend the air permit application No. 2982-1. This request includes revisions to testing requirements, modifications to permit conditions and administration corrections. The details of these changes are discussed below (additions are underlined and deletions are struck out).

**Black Start Testing Provision**

Tampa Electric (TEC) is requesting a provision in the permit to allow black start testing up to 8 hours pursuant to Rule 62-210.700(5), F.A.C. Under this Rule, the Department may adjust maximum and minimum factors to provide reasonable and practical regulatory controls consistent with the public interest. TEC believes performing a black start test is consistent with adjusting the factors consistent with the public interest.

The purpose of the test is to demonstrate TEC's ability to restart Big Bend Power Station after a catastrophic event such as a hurricane, tornado, grid failure and other unforeseeable events. The Simple Cycle Combustion Turbines (SCCTs) black start emergency generator will be used to initially startup the SCCTs. The SCCTs will supply a low load power (1 to 8 MW) to energize the auxiliary equipment and startup transformers during the test. The operation of the SCCTs at low load prevents the use of the water injection for NO<sub>x</sub> control and will likely result in exceeding the allowable limits during the testing period.

**Revisions to Emission Units (EUs-018, -019, -027)**

Fly Ash Silos Nos. 1, 2, and 3 previously operated to store and load fly ash to trucks for delivery to STL, Inc. Annual VE tests are required to load trucks from Silo No. 1 (EU-018), Silo No. 2 (EU-019) and Silo No. 3 (EU-027) pursuant to Conditions D.9 and E.9.

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During the SCR improvements for Units Nos. 1 to 4, the transfer lines from each silo were constructed to pneumatically convey fly ash directing to STL, Inc. Since the completion of these projects, fly ash is no longer loaded into trucks except during emergency situations such as pluggages or line failures. The requested revisions to Conditions D.9 and E.9 are shown below.

D.9 Annual Compliance Test. During each federal fiscal year (October 1st to September 30th), Emissions Unit ID Nos. ~~-008, -018, and -009 and -019~~ shall be tested to demonstrate compliance with the emission limitations and standards for VE. Truck loading (EUs-018,-019) shall be used during emergency situations. These units shall be tested once every 5 years prior to renewal or at the next available opportunity, if not operated in the 5 year period. [Rule 62-297.310(7), F.A.C.]

E.9. Annual Compliance Test. Except as specified in Specific Condition ~~E.12.~~, during each federal fiscal year (October 1st to September 30th), Emissions Unit ID Nos. ~~-014 and -027~~ shall be tested to demonstrate compliance with the emission limitations and standards for VE. Truck loading (EU-027) shall be used during emergency situations. This unit shall be tested once every 5 years prior to renewal or at the next available opportunity, if not operated in the 5 year period. [Rules 62-297.310(7) and 62-213.440(1)(b)1.b. (Periodic Monitoring), F.A.C.]

### **VE Testing Revisions**

A provision to exempt VE testing based on the number of operating hours is requested. Permit Condition J.13 states annual VE testing is not required for units operating less than 400 hours per year [See Specific Condition TR7, Rule 62-297.310(7)(a)4., F.A.C.]. TEC believes the exemption is applicable to all emission units with an annual VE requirement pursuant to Condition J.13 and TR7. The requested revisions to Condition TR7 are shown below.

TR7. Frequency of Compliance Tests. The following provisions apply only to those emissions units that are subject to an emissions limiting standard for which compliance testing is required.

#### *a. General Compliance Testing.*

(11) VE Testing Not Required. By this permit, annual emissions compliance testing for VE is not required for emissions units operating less than 400 hours per year [Condition J.13; Rule 62-297.310(7)(a)4., F.A.C.].

### **Petroleum Coke and Normal Fuel Operation Revisions**

The facility has made substantial upgrades to improve emissions as part of the \$1.2 billion consent order and final consent judgment. The facility has no prior operating issues with vanadium emissions, particulate emissions, or any formal complaints as a result of burning petroleum coke (petcoke).

TEC believes the vanadium (2,660 ppm) and ash content (0.76%) requirements are no longer applicable since the facility is fully controlled and is subject to a 20% petcoke by weight fuel blending limitation. Furthermore, vanadium is not a listed NESHAPs air pollutant, it is not federally enforceable, and oxidation of the SO<sub>2</sub> into SAM, a regulated pollutant, is minimal. In

fact, the presence of vanadium provides an additional benefit of oxidizing and thereby enhancing mercury removal in existing control devices.

The suggested revisions to Conditions A.4 and B.4 are shown below.

A.4 Methods of Operation.

a. Fuels - Normal Operation. ~~The fuels permitted to be burned in Unit Nos. 1, 2 and 3 shall consist of coal, coal/petroleum or coal blends with fuel additives and supplemental fuels approved by the Department or allowed by Florida Statutes. The petroleum coke content of any fuel blend shall not exceed 20% by weight. The only fuels allowed to be burned in Unit Nos. 1, 2 and 3 shall consist of coal, or a coal/petroleum coke blend containing a maximum of 20% petroleum coke by weight, or coal blended with coal residual generated from the Polk Power Station, or a coal/petroleum coke blend further blended with coal residual generated from the Polk Power Station. In any case, the petroleum coke content of any fuel blend shall not exceed 20% by weight. The vanadium content of the petroleum coke fired shall not exceed 2660 ppm vanadium. The ash content of the petroleum coke fired shall not exceed 0.76% by weight on a dry basis.~~

~~f. Other Operation - Magnesium Oxide. Supplemental injection of liquid magnesium oxide as needed to reduce upper furnace pluggage.~~

fg. Daily Log. The permittee shall maintain a daily log of the amounts and types of fuels used and copies of fuel analyses containing information on sulfur content, ash content and heating values. [Rules 62-4.160(2), 62-210.200, 62-213.410, 62-213.440(1) and 62-4.070(1) & (3), F.A.C.; and, Permit No. 0570039-012-AC.]

B.4 Methods of Operation.

a. Fuels - Normal Operation. ~~The fuels allowed to be burned in Unit No. 4 shall consist of coal, coal/petroleum or coal blends with fuel additives and supplemental fuels approved by the Department or allowed by Florida Statutes. The petroleum coke content of any fuel blend shall not exceed 20% by weight. The only fuels allowed to be burned in Unit No. 4 shall consist of coal, or a coal/petroleum coke blend containing a maximum of 20% petroleum coke by weight, or coal blended with coal residual generated from the Polk Power Station, or a coal/petroleum coke blend further blended with coal residual generated from the Polk Power Station. In any case, the petroleum coke content of any fuel blend shall not exceed 20% by weight. The vanadium content of the petroleum coke fired shall not exceed 2660 ppm vanadium. The ash content of the petroleum coke fired shall not exceed 0.76% by weight on a dry basis. Coal shall not be burned in Unit No. 4 unless both the electrostatic precipitator and the limestone scrubber are operating properly.~~

~~f. Other Operation - Magnesium Oxide. Supplemental injection of liquid magnesium oxide as needed to reduce upper furnace pluggage.~~

fg. Daily Log. The permittee shall maintain a daily log of the amounts and types of fuels used and copies of fuel analyses containing information on sulfur content, ash content and heating values.

[Rules 62-4.160(2), 62-210.200, 62-213.410, 62-213.440(1) and 62-4.070(1) & (3), F.A.C.; PSD-FL-040; Permit Nos. 0570039-012-AC and 0570039-016-AC; and, Power Plant Siting Certification PA 79-12.]

**Material Handling in Enclosed Buildings**

Material handling and conveyance operations in enclosed buildings are not considered emissions sources. Conveyors L1 and L2 to M1 & M2, and Conveyors M1 and M2 to Coal Bunkers (FH-059 - FH-062) are located inside an enclosed building. Similarly, conveyors Q1 and Q2 to blending bins are also located inside the enclosed portion of the fuel blending bins. Based on communication with Jon Holtom of the Department, material handling activities inside of an enclosed building are not considered emission sources. Therefore, TEC requests that these material handling operations be excluded from the permit.

The annual operation reports (AOR) have reported emissions from these conveyors in EU-010. Based on the review of previous AORs, approximately 8.6 tons of particulate emissions were estimated from these conveyors during the period 2002 to 2010 (see table below). TEC requests these transfer points, FH-059 - FH-062 (conveyors L1 & L2 to fuel bunkers), be excluded from the permit. Furthermore, the previous AORs should be revised accordingly to properly account for the enclosure of these emission sources.

AOR Year	Conveyors Q1 and Q2 to Blending Bins (TPY)	Conveyors L1 & L2 to Fuel Bunkers (TPY)
2002	0.447	0.447
2003	0.457	0.457
2004	0.488	0.488
2005	0.454	0.454
2006	0.232	0.232
2007	0.227	0.227
2008	0.236	0.236
2009	0.210	0.210
2010	1.57	1.57
<b>Total</b>	<b>8.64</b>	

TEC requests that conveyors L1 & L2 to fuel bunkers be removed from the permit (page 42). The suggested revisions to the permit are shown below.

The emissions unit contained in this subsection is comprised of the following emissions points:

EU-010: Solid Fuel Unloading and Handling Operations	
Point ID	Description of Emissions Point
<i>Coal Conveying Operations</i>	
<del>FH-059 - FH-062</del>	<del>Conveyors L1 and L2 to M1 &amp; M2, and Conveyors M1 and M2 to Coal Bunkers</del>

### SCR Operation Clarifications

TEC requests the following modifications to clarify the operation of the SCR units:

- A.8 Selective Catalytic Reduction (SCR) System. The permittee shall operate and maintain the selective catalytic reduction (SCR) systems for nitrogen oxides (NO<sub>x</sub>) control on Unit Nos. 1, 2 and 3. ~~Unit Nos. 3 and 2.~~ [Permit Nos. 0570039-022-AC (amended by 0570039-035-AC) and 0570039-024-AC.]

~~{Permitting Note: Selective catalytic reduction (SCR) systems have been or are being installed under the following schedule:~~

~~Unit No. 3 started up on April 24, 2008, as authorized by Permit No. 0570039-022-AC;~~

~~Unit No. 2 started up on April 30, 2009, as authorized by Permit No. 0570039-024-AC; and,~~

~~Unit No. 1 to be installed in 2010, as authorized by Permit No. 0570039-024-AC.}~~

- A.9 SCR System. The permittee shall operate and maintain each SCR system in accordance with the SCR system supplier's recommendations to comply with the allowable emission rate. Operation outside of the supplier's recommendations is allowed provided the allowable 30-day rolling average emission rates are not violated, ~~including operating the SCR between minimum and maximum operating temperatures.~~ [Rule 62-4.070(1) & (3), F.A.C.; and, Permit Nos. 0570039-022-AC (amended by 0570039-035-AC) and 0570039-024-AC.]

Circumvention. The owner or operator shall not operate the SCR system equipment nor circumvent the air pollution control equipment in such a manner which would violate allowable emission rates, ~~stated herein, notwithstanding the SCR system supplier's recommendations.~~

- B.12 SCR System. The permittee shall operate and maintain each SCR system in accordance with the SCR system supplier's recommendations to comply with the allowable emission rate. Operation outside of the supplier's recommendations is allowed provided the allowable 30-day rolling average emission rates are not violated, ~~including operating the SCR between minimum and maximum operating temperatures.~~ [Permit No. 0570039-020-AC (amended by 0570039-026, -031 & -036-AC).]

- B.6 Circumvention. The owner or operator shall not operate the SCR system equipment nor circumvent the air pollution control equipment in such a manner which would violate allowable emission rates, ~~stated herein, notwithstanding the SCR system supplier's recommendations.~~

Circumvention. The owner or operator shall not circumvent the air pollution control equipment nor operate the SCR system equipment in such a manner which would violate allowable emission rates ~~stated herein, notwithstanding the SCR system supplier's recommendations.~~

**Revisions to Appendix BOP**

**Best Operation Practices for Startup and Shutdown**

II. Units 1 – 4 SCR Systems

~~Note: Unit Nos. 1 to 4 are currently equipped with SCR control systems. Note: Units 3 and 4 are currently equipped with SCR control systems. SCR control systems will be installed on Units 1 and 2 in 2010 and 2009, respectively.~~

A. Startup

~~Once all permissives are met, ammonia injection is manually initiated by the operator. Operation of the SCR control system begins with the injection of ammonia once the SCR catalyst reaches its minimum effective operating temperature of approximately 625°F.~~

B. Shutdown

~~Once all the permissives are met, ammonia injection ceases and the SCR is no longer in operation. Once the SCR catalyst drops below its minimum effective operating temperature of approximately 625°F, ammonia injection ceases and the SCR control system is no longer in use.~~

**Black Start Diesel Generator Administrative Correction**

An administrative correction to black start diesel generator (EU-043) is requested. This generator is currently used to startup the Simple Cycle Combustion Turbines (SCCTs) and is not a black start generator. This generator should be referenced as the “CT black start emergency diesel generator.” The permit also incorrectly references this generator as a caterpillar generator rated at 800 ekW. The existing generator is a Kohler Model 1000REOZDC rated at 1,000 ekW and 1,495 mBHP (see catalog sheet attached). The permit should be revised to correct these errors shown on pages 3, 56 and 57 of the permit. Specifically, the table on page 56 should be revised as shown below.

Identification	In-service date	Manufacturer Name	Power (HP)	Applicable Requirement(s) for Compression Ignition Type Engines
<del>CT Black Start Emergency Diesel Generator, 1,000 ekW Black Start Generator, 800kW</del>	08/2009	<del>Kohler Caterpillar</del>	1,495	40 CFR 63, Subparts A and ZZZZ; 40 CFR 60, Subparts A and IIII; This generator is a “new unit.”
Coal Field Diesel Generator	<del>1999</del> 10/2009	Caterpillar	349	40 CFR 63, Subparts A and ZZZZ; Manufacture date 1999; purchased 10/2009. 40 CFR 60, Subparts A and IIII; This generator is a “new unit.”

**Miscellaneous Corrections**

In addition, TEC is requesting the following modifications to the Title V permit:

- Cooling Tower Permit Correction and Notification letter request, dated 08/10/2011.
- SCCT Permit Limit Correction (EUs-041,-042) letter request, dated 08/12/2011.
- The startup period in Condition O.15a and O.15b should be revised from 10 minutes to 15 minutes. There have been several incidents where the SCCT units could not be started up in the allotted 10 minute period due to unforeseen conditions, which required the units to be shutdown and restarted one or more times. This actually creates more CO and NO<sub>x</sub> emissions even though startup and shutdown are allowed in the current permit. TEC believes this revision will minimize startup and shutdown periods and reduce unnecessary emissions to the environment.
- The pressure monitoring in Condition L.13 should be changed to quarterly monitoring consistent with Conditions E.3 and F.17.

Table 1 - Summary of Air Pollution Standards and Terms and Table 2 - Summary of Compliance Requirements contains several administration errors that should be revised pursuant to Rule 62-210.360 F.A.C. The emission unit's identification numbers, referenced permit conditions, regulatory references should be checked to ensure that are accurate and correct. The following is a list the administrative errors including, but limited to the following:

- Condition O.1 (page 59) references USLD but should reference ULSD as ultra-low sulfur diesel.
- Subparts D, E, F, and K. The rule references 62-297.620(4) to allow VE testing instead of PM testing for emissions units equipped with baghouses. It is requested the Department determine the appropriate applicability of using Rule 62-296.711(3)(c) F.A.C. versus 62-297.620(4) F.A.C.
- Table 1 – Summary of Air Pollution Standards and Terms
  - Combustion Turbine No. 1 (EU-007). This unit was removed from service on 10/26/2010. This unit should be deleted and reserved for future reference.
  - Fly Ash Silos No. 1 and 2. EUs-008,-009, -018, -019, -026 should be referenced in the title. Rule 62-296.711(2)(b) F.A.C. should be referenced instead of Rule 62-297.620(4) F.A.C.
  - Solid Fuel Yard (EU-010,-029,-030). EUs-029, -030 reference the 0.03 gr/dscf standard in Condition P.5. The PM testing requirement should be waived based on the proposed revision to Condition P.5. The VE testing in EU-010 should reference confined emission units.
  - Limestone Handling and Storage. EUs-011, -012, -013, -023, -025 should be referenced in the title.
  - Fly Silo No. 3 The title should be reference “Flyash Handling and Storage Silo No. 3” not “Fly Silo No. 3.”
  - Coal Bunkers with Roto-Clones. EUs-015,-016, -017, -039 should be referenced in the title.
  - Lime Silo for Wastewater Treatment Plant with one Baghouse (EU-022). The reference to 2.4 lb/hr and 0.99 tons per year is not included in Subsection L and should be deleted. The permit should also reference Conditions L.3 not Condition M.3.

- EU-041 and-042. The title should reference “Simple Cycle Combustion Turbines” not “Coal Residual Storage and Transfer from the Polk Power Station.”
- EU-046. The title should reference “Transloading and off-site Transfer” not “Coal Residual Storage and Transfer from the Polk Power Station.”
- EU-047. The title should reference “Railcar Unloading and Conveying” not “Coal Residual Storage and Transfer from the Polk Power Station.” The permit should reference Condition R.7 not Q.7.
  
- Table 2 – Summary of Compliance Requirements
  - Combustion Turbine No. 1 (EU-007). This unit is no longer on site and should be deleted.
  - Solid Fuel Yard (EU-010,-029,-030). EUs-029, -030 should reference the PM testing requirement as waived based on the proposed revisions to Condition P.5. The VE testing in EU-010 should reference confined emission units.
  - Limestone Handling and Storage. EUs-011, -012, -013, -023, -025 should be referenced in the title.
  - Fly Silo No. 3 The title should be reference “Flyash Handling and Storage Silo No. 3” not “Fly Silo No. 3.”
  - Coal Bunkers with Roto-Clones. EUs-015,-016, -017, -039 should be referenced in the title.
  - EUs-041 and-042. The title should reference “Simple Cycle Combustion Turbines” not “Coal Residual Storage and Transfer from the Polk Power Station.”
  - EU-046. The title should reference “Transloading and off-site Transfer” not “Coal Residual Storage and Transfer from the Polk Power Station.”
  - EU-047. The title should reference “Railcar Unloading and Conveying” not “Coal Residual Storage and Transfer from the Polk Power Station.”

TEC requests the Department include these changes to air permit application No. 2982-1 as Addendum No. 2. Furthermore, TEC is requests that these changes supersede the Amendment No. 1 letter request, dated, September 9, 2011. Please contact me at (813) 228-1282 or Robert Velasco at (813) 228-4232, if you have any questions regarding this request.

Sincerely,



Byron T. Burrows, P.E., BCEE  
Manager, Air Programs  
Environmental, Health & Safety

EHS/rfk/RAV118

Enclosure

c/enc: Cindy Zhang-Torres, DEP SW District  
Diana Lee, EPCHC

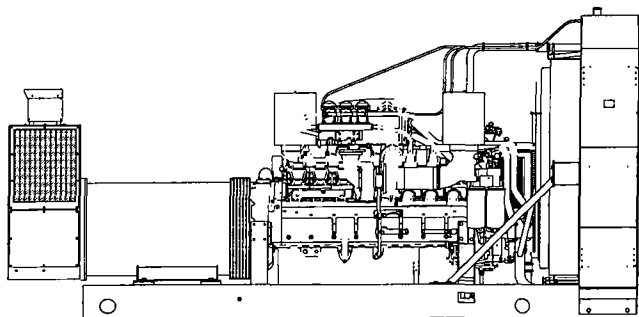




**Ratings Range**

60 Hz

<b>Standby:</b>	<b>kW</b>	945-1000
	<b>kVA</b>	1181-1250
<b>Prime:</b>	<b>kW</b>	860-910
	<b>kVA</b>	1075-1138



**Standard Features**

- Kohler Co. provides one-source responsibility for the generating system and accessories.
- The generator set and its components are prototype-tested, factory-built, and production-tested.
- The 60 Hz generator set offers a UL 2200 listing.
- At 60 Hz, the generator set accepts rated load in one step.
- The 60 Hz generator set meets NFPA 110, Level 1, when equipped with the necessary accessories and installed per NFPA standards.
- The generator set complies with ISO 8528-5, Class G3, requirements for transient performance.
- The 60 Hz generator set engine is certified by the Environmental Protection Agency (EPA) to conform to Tier 2 nonroad emissions regulations.
- A one-year limited warranty covers all systems and components. Two-, five-, and ten-year extended warranties are also available.
- Alternator features:
  - The pilot-excited, permanent-magnet (PM) alternator provides superior short-circuit capability.
  - The brushless, rotating-field alternator has broadrange reconnectability.
- Other features:
  - Controllers are available for all applications. See controller features inside.
  - The low coolant level shutdown prevents overheating (standard on radiator models only).
  - The generator set-to-skid mounting options are either integral vibration isolation or direct mounting with spring isolators.
  - An electronic, isochronous governor delivers precise frequency regulation.
  - Electronic engine controls and a generator set microprocessor controller combine to deliver one of the most advanced control systems in today's market.

**Generator Set Ratings**

Alternator	Voltage	Ph	Hz	150°C Rise Standby Rating		130°C Rise Standby Rating		125°C Rise Prime Rating		105°C Rise Prime Rating	
				kW/kVA	Amps	kW/kVA	Amps	kW/kVA	Amps	kW/kVA	Amps
5M4044	240/416	3	60	1000/1250	1735	975/1219	1691	910/1138	1579	890/1113	1544
	277/480	3	60	1000/1250	1504	1000/1250	1504	910/1138	1368	910/1138	1368
	220/380	3	60	945/1181	1795	945/1181	1795	860/1075	1633	860/1075	1633
7M4046	240/416	3	60	1000/1250	1735	1000/1250	1735	910/1138	1579	910/1138	1579
	277/480	3	60	1000/1250	1504	1000/1250	1504	910/1138	1368	910/1138	1368
7M4170	220/380	3	60	1000/1250	1899	1000/1250	1899	910/1138	1728	910/1138	1728
7M4282	347/600	3	60	1000/1250	1203	1000/1250	1203	910/1138	1095	910/1138	1095
7M4284	347/600	3	60	1000/1250	1203	1000/1250	1203	910/1138	1095	910/1138	1095

**RATINGS:** All three-phase units are rated at 0.8 power factor. *Standby Ratings:* Standby ratings apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. There is no overload capability for this rating. Ratings are in accordance with ISO-3046/1, BS 5514, AS 2789, and DIN 6271. *Prime Power Ratings:* Prime power ratings apply to installations where utility power is unavailable or unreliable. At varying load, the number of generator set operating hours is unlimited. A 10% overload capacity is available for one hour in twelve. Ratings are in accordance with ISO-8528/1, overload power in accordance with ISO-3046/1, BS 5514, AS 2789, and DIN 6271. For limited running time and base load ratings, consult the factory. Obtain the technical information bulletin (TIB-101) on ratings guidelines for the complete ratings definitions. The generator set manufacturer reserves the right to change the design or specifications without notice and without any obligation or liability whatsoever. **GENERAL GUIDELINES FOR DERATION:** *Altitude:* Derate 1.0% per 100 m (328 ft.) elevation above 400 m (1312 ft.). *Temperature:* Derate 3.0% per 5.0°C (9°F) temperature above 40°C (104°F).

# Alternator Specifications

Specifications	Alternator
Type	4-Pole, Rotating-Field
Exciter type	Brushless, Permanent-Magnet Pilot Exciter
Leads: quantity, type	10, Reconnectable
Voltage regulator	Solid-State, Volts/Hz
Insulation:	NEMA MG1
Material	Class H, Synthetic, Nonhygroscopic
Temperature rise	130°C, 150°C Standby
Bearing: quantity, type	1, Sealed
Coupling	Flexible Disc
Amortisseur windings	Full
Rotor balancing	125%
Voltage regulation, no-load to full-load (with < 0.5% drift due to temp. variation)	3-Phase Sensing, ±0.25%
One-step load acceptance	100% of Rating
Unbalanced load capability	100% of Rated Standby Current
Peak motor starting kVA:	(35% dip for voltages below)
480 V      5M4044 (4 bus bar)	3900
480 V      7M4046 (4 bus bar)	3900
380 V      7M4170 (4 bus bar)	2600
600 V      7M4282 (4 bus bar)	1850
600 V      7M4284 (4 bus bar)	3200

- NEMA MG1, IEEE, and ANSI standards compliance for temperature rise and motor starting.
- Sustained short-circuit current of up to 300% of the rated current for up to 10 seconds.
- Sustained short-circuit current enabling downstream circuit breakers to trip without collapsing the alternator field.
- Self-ventilated and dripproof construction.
- Superior voltage waveform from two-thirds pitch windings and skewed stator.
- Digital solid-state, volts-per-hertz voltage regulator with ±0.25% no-load to full-load regulation.
- Brushless alternator with brushless pilot exciter for excellent load response.

## Application Data

### Engine

Engine Specifications	
Manufacturer	Detroit Diesel/MTU
Engine: model	16V2000 G84 R163-8A36
Engine: type	4-Cycle, Turbocharged, Intercooled
Cylinder arrangement	16-V
Displacement, L (cu. in.)	31.84 (1943)
Bore and stroke, mm (in.)	130 x 150 (5.12 x 5.91)
Compression ratio	16.0:1
Piston speed, m/min. (ft./min.)	540 (1772)
Main bearings: quantity, type	9, Precision Half Shells
Rated rpm	1800
Max. power at rated rpm, kWm (BHP)	1115 (1495)
Cylinder head material	Cast Iron
Crankshaft material	Forged Steel
Valve (exhaust) material	Austenitic Steel
Governor: type, make/model	ADEC Electronic Control
Frequency regulation, no-load to-full load	Isochronous
Frequency regulation, steady state	±0.25%
Frequency	Fixed
Air cleaner type, all models	Dry

### Engine Electrical

Engine Electrical System	
Battery charging alternator:	
Ground (negative/positive)	Negative
Volts (DC)	24
Ampere rating	70
Starter motor rated voltage (DC)	24
Battery, recommended cold cranking amps (CCA):	
Qty., CCA rating each	Two, 1150
Battery voltage (DC)	12

### Fuel

Fuel System	
Fuel supply line, min. ID, mm (in.)	12 (0.5)
Fuel return line, min. ID, mm (in.)	6 (0.25)
Max. fuel flow, Lph (gph)	480 (127)
Min./max. fuel pressure at engine supply connection, kPa (in. Hg)	-30/50 (-8.8/14.8)
Fuel filter: quantity, type	1, Secondary
Recommended fuel	#2 Diesel

### Lubrication

Lubricating System	
Type	Full Pressure
Oil pan capacity dipstick mark max., L (qt.)	88 (93)
Oil pan capacity, initial filling, L (qt.)	102 (108)
Oil filter: quantity, type	2, Cartridge
Oil cooler	Water-Cooled

### Exhaust

Exhaust System	
Exhaust flow at rated kW, m <sup>3</sup> /min. (cfm)	210 (7416)
Exhaust temperature at rated kW, dry exhaust, °C (°F)	560 (1040)
Maximum allowable back pressure, kPa (in. Hg)	8.5 (2.5)
Exh. outlet size at eng. hookup, mm (in.)	See ADV drawing

# Application Data

## Cooling

Radiator System	
Ambient temperature, °C (°F)	40 (104)
Engine water capacity, L (gal.)	150 (40)
Radiator system capacity, including engine, L (gal.)	291 (77)
Engine jacket water flow, Lpm (gpm)	833 (220)
Charge cooler water flow, Lpm (gpm)	258 (68)
Heat rejected to cooling water at rated kW, dry exhaust, kW (Btu/min.)	440 (25022)
Heat rejected to charge cooling water at rated kW, dry exhaust, kW (Btu/min.)	290 (16492)
Water pump type	Centrifugal
Fan diameter, including blades, mm (in.)	1524 (60)
Fan, kWm (HP)	43 (58)
Max. restriction of cooling air, intake and discharge side of radiator, kPa (in. H <sub>2</sub> O)	0.125 (0.5)

## High Ambient Radiator System

Ambient temperature, °C (°F)	50 (122)
Engine jacket water capacity, L (gal.)	150 (40)
Radiator system capacity, including engine, L (gal.)	341 (90)
Engine jacket water flow, Lpm (gpm)	833 (220)
Charge cooler water flow, Lpm (gpm)	258 (68)
Heat rejected to cooling water at rated kW, dry exhaust, kW (Btu/min.)	440 (25022)
Heat rejected to charge cooling water at rated kW, dry exhaust, kW (Btu/min.)	290 (16492)
Water pump type	Centrifugal
Fan diameter, including blades, mm (in.)	1524 (60)
Fan, kWm (HP)	63 (84)
Max. restriction of cooling air, intake and discharge side of radiator, kPa (in. H <sub>2</sub> O)	0.125 (0.5)

## Remote Radiator System\*

Exhaust manifold type	Dry
Connection sizes:	
Water inlet/outlet, mm (in.)	77 (3)
Intercooler inlet/outlet, mm (in.)	51 (2)
Static head allowable above engine, kPa (ft. H <sub>2</sub> O)	149 (50)

\* Contact your local distributor for cooling system options and specifications based on your specific requirements.

## Operation Requirements

### Air Requirements

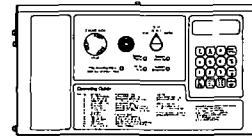
Radiator-cooled cooling air, m <sup>3</sup> /min. (scfm)†	1161 (41000)
High ambient radiator-cooled cooling air, m <sup>3</sup> /min. (scfm)†	1334 (47100)
Cooling air required for generator set when equipped with city water cooling or remote radiator, based on 14°C (25°F) rise, m <sup>3</sup> /min. (scfm)†	391 (13800)
Combustion air, m <sup>3</sup> /min. (cfm)	81 (2860)
Heat rejected to ambient air:	
Engine, kW (Btu/min.)	45 (2559)
Alternator, kW (Btu/min.)	64 (3640)

† Air density = 1.20 kg/m<sup>3</sup> (0.075 lbm/ft.<sup>3</sup>)

## Fuel Consumption

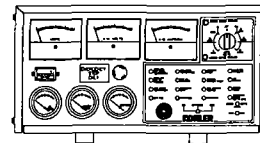
Diesel, Lph (gph) at % load	Standby Rating
100%	269.9 (71.3)
75%	211.3 (55.8)
50%	139.5 (36.9)
25%	77.3 (20.4)
Diesel, Lph (gph) at % load	Prime Rating
100%	248.8 (65.7)
75%	195.4 (51.7)
50%	127.4 (33.6)
25%	71.5 (18.9)

## Controllers



### Decision-Maker™ 550 Controller

Audiovisual annunciation with NFPA 110 Level 1 capability. Programmable microprocessor logic and digital display features. Alternator safeguard circuit protection. 12- or 24-volt engine electrical system capability. Remote start, remote annunciation, and remote communication options. Refer to G6-46 for additional controller features and accessories.



### Decision-Maker™ 3+, 16-Light Controller

Audiovisual annunciation with NFPA 110 Level 1 capability. Microprocessor logic, AC meters, and engine gauge features. 12- or 24-volt engine electrical system capability. Remote start, prime power, and remote annunciation options. Refer to G6-30 for additional controller features and accessories.

**Additional Standard Features**

- Alternator Protection (standard with 550 controller)
- Oil Drain Extension
- Operation and Installation Literature
- Radiator Duct Flange

**Available Accessories**

**Open Unit**

- Exhaust Silencer, Critical (kits: PA-354880 qty. 2, or PA-354898 qty. 1)
- Exhaust Silencer, Hospital (kits: PA-354905 qty. 2, PA-361619 qty. 1, or PA-354912 qty. 1)
- Flexible Exhaust Connector, Stainless Steel

**Cooling System**

- Block Heater (recommended for ambient temperatures below 15°C [60°F])
- High Ambient Radiator
- Remote Radiator Cooling

**Fuel System**

- Flexible Fuel Lines
- Fuel Filter
- Fuel Pressure Gauge

**Electrical System**

- Battery
- Battery Charger, Equalize/Float Type
- Battery Heater
- Battery Rack and Cables

**Engine and Alternator**

- Air Cleaner, Heavy Duty
- Air Cleaner Restriction Indicator
- Alternator Strip Heater
- Bus Bar Kits (standard on 7M alternators, 380-600 volt only)
- Direct Mounting
- Integral Vibration Isolation Mounting
- Line Circuit Breaker (NEMA type 1 enclosure)
- Line Circuit Breaker with Shunt Trip (NEMA type 1 enclosure)
- NFPA 110 Literature
- Optional Alternators
- Rated Power Factor Testing
- Safeguard Breaker (not available with 550 controller)
- Spring Isolators

**Paralleling System**

- Reactive Droop Compensator
- Remote Speed Adjust Control
- Voltage Adjust Control
- Voltage Regulator Relocation Kit

**Maintenance**

- General Maintenance Literature Kit
- Overhaul Literature Kit
- Production Literature Kit

**Controller**

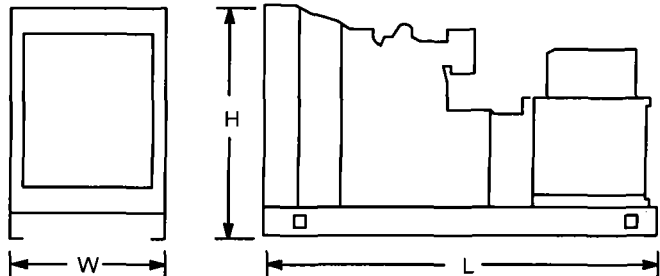
- Common Failure Relay Kit
- Communication Products and PC Software (550 controller only)
- Customer Connection Kit
- Dry Contact Kit (isolated alarm)
- Prime Power Switch (550 controller only)
- Remote Annunciator Panel
- Remote Audiovisual Alarm Panel
- Remote Emergency Stop Kit
- Remote Mounting Cable
- Run Relay Kit

**Miscellaneous Accessories**

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**Dimensions and Weights**

Overall Size, max., L x W x H, mm (in.): 4863 x 1853 x 2365 (191.5 x 73.0 x 93.1)  
 Weight, radiator model, max. wet, kg (lb.): 7348 (16200)



NOTE: This drawing is provided for reference only and should not be used for planning installation. Contact your local distributor for more detailed information.

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