Q. Please provide a complete copy of the contract to supply and lease the diesel units.

A. Please see DD-NLH-001 Attachment 1.

Copy of record

2054158

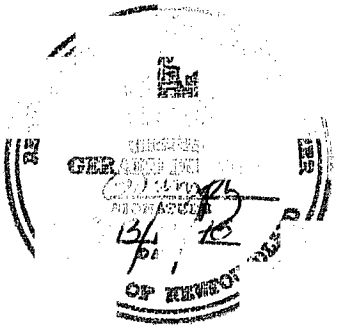
NEWFOUNDLAND AND LABRADOR HYDRO

CONTRACT

FOR

Install Holyrood Blackstart Capability

2013-56865 AB

Seal of Engineer with Primary Responsibility	Electrical
	Mechanical
	Civil
	Protection & Control
	Transmission & Distribution
	Telecontrol
	System Planning

Approved for Release

2013/12/20
Date

CONTRACT AGREEMENT

PROJECT TITLE: Install Holyrood Blackstart Capability

CONTRACT

THIS CONTRACT made as of the 10 day of December , 2013

BETWEEN: NEWFOUNDLAND AND LABRADOR HYDRO, a corporation constituted by statute and an agent of Her Majesty the Queen in right of the Province of Newfoundland and Labrador and having its head office at Hydro Place, St. John's, in the said Province (hereinafter called "Owner") of the one part;

AND Tormont CAT Power Systems
(hereinafter called "Contractor") of the other part.

C 1 Contract Documents

.1 The following documents, sometimes referred to the Contract Documents, form part of this Contract:

Schedule A – TENDER SUBMISSION
Schedule B – GENERAL CONDITIONS
Schedule C – SPECIAL CONDITIONS
Schedule D – PAYMENT
Schedule E – SPECIFICATIONS

.2 Execution by Owner and by Contractor of this Contract shall constitute acceptance and approval by the parties of all the provisions, terms and conditions of all of the Contract Documents as if each had been executed by both parties.

C 2 Work

.1 The Contractor hereby undertakes to perform and complete the Work as described in this Contract.

.2 Contractor, for and in consideration of the payment to be made to Contractor as hereinafter provided, agrees to furnish all labour, Material and Plant necessary or required for the performance of the Work, unless specified elsewhere in the Contract.

C 3 Price and Payment

.1 Owner, in consideration of the performance of the Contract by Contractor, agrees to pay Contractor in accordance with the rates and prices set forth in the Schedule A - TENDER SUBMISSION, Schedule of Prices, subject to any additions or deductions provided for elsewhere in the Contract Documents. Such payment shall be made in accordance with the procedures set forth in Schedule D - PAYMENT.

C 4 Interpretation

.1 The Contract embodies the entire agreement between the parties with respect to the subject matter hereof. Reference should be made to the Definitions set out in Schedule B - GENERAL CONDITIONS.

.2 The Contract Documents are intended to be correlative and complementary and any Work required by one document and not mentioned in another shall be executed as though required by all documents.

.3 The Contract is intended to cover all the Work to be done by Contractor; and, unless expressly excluded in the Contract, any and all Material, Plant and labour not indicated herein but which may be necessary or required to complete any part of the Work in a proper, substantial and workmanlike manner shall be furnished by Contractor.

.4 If Contractor, in the course of the Work, discovers any discrepancy between the Specifications and the physical conditions of the Site or finds any error, omission or ambiguity in the Contract Documents, Contractor shall immediately apply in writing to Owner for clarification. Owner will promptly clarify such matters and so inform Contractor. Any part of the Work affected by any or all such discoveries which is performed by Contractor prior to clarification by Owner shall be done at Contractor's risk and Contractor shall be liable for any loss, damage or expense which Owner may incur, suffer or be put to as a result of Contractor's failure to obtain such clarification.

.5 In case of conflict between the Contract Documents, the said documents shall be considered in the following order of precedence, unless otherwise provided: the executed CONTRACT, GENERAL CONDITIONS, SPECIAL CONDITIONS, SPECIFICATIONS (drawings of a larger scale shall govern over a smaller scale), TENDER SUBMISSION,PAYMENT.

.6 In the Contract Documents all references to dollar amounts and all references to any other money amounts are, unless specifically otherwise provided, expressed in terms of currency of Canada.

.7 Words in the Contract Documents importing the singular number shall include the plural and vice versa and words importing the masculine gender shall include the feminine and neuter genders.

.8 Where a word is defined anywhere in the Contract Documents, other parts of speech and tenses of the same word have a corresponding meaning.

.9 Wherever in the Contract Documents a number of days is prescribed for any purpose, the days shall be reckoned exclusively of the first and inclusively of the last.

.10 Whenever the Contract Documents require either a notice to be given or a request to be made, and the time within which any right will lapse or expire shall terminate on a Saturday,

Sunday or legal holiday, such time will continue to run until the next succeeding normal business day.

.11 In the Contract Documents the headings and any tables of contents and indexes attached thereto are inserted for convenience of reference only and shall not affect the construction or interpretation thereof.

.12 Any reference in any Contract Document to an article, a clause, a subclause, a paragraph or a schedule shall, unless the context otherwise specifically requires, be taken as a reference to an article, a clause, a subclause, a paragraph of or schedule to that Contract Document.

.13 This Agreement may be executed in two or more counterparts, each of which when so executed shall be deemed to be an original, but all of such counterparts together shall constitute one and the same instrument.

.14 The rights and recourses of Owner contained in the Contract Documents are cumulative and not in the alternative. The exercise of any such rights or recourses shall not constitute a waiver or renunciation of any other rights or recourses.

C 5 Assignment

.1 Neither Owner nor Contractor may assign or otherwise transfer any rights or interests created under the Contract without the prior written consent of the other, provided always that Owner may assign its rights and interests under the Contract to an Affiliate of Owner without the consent of Contractor.

C 6 Waiver

.1 No act or failure to act or delay in the enforcement of any right by either party hereto constitutes a waiver of any right under the Contract, and any such act, failure to act or delay does not constitute an approval of or acquiescence in any breach or continuing breach under the Contract except as expressly agreed to in writing and no waiver of any breach of any provision of the Contract constitutes a waiver of any preceding or succeeding breach of such provision or of any other provision of the Contract.

C 7 Severability

.1 In the event that any provision of the Contract, or part thereof, is determined to be invalid, void or otherwise unenforceable, the remaining provisions of the Contract are to be construed (provided the Contract remains capable of completion in all material respects as contemplated hereunder) as if such invalid, void or unenforceable provision, or part thereof, was omitted and the Contract continues in full force and effect without being impaired or invalidated in any way, and the parties hereto agree to be bound by and perform the same as thus modified.

C 8 Law and Jurisdiction

.1 The Contract is governed by and is to be construed in accordance with the local domestic laws of the Province of Newfoundland and Labrador, Canada (including the laws of Canada applicable therein) without reference to its conflict of law rules. With respect to any action or proceeding to which the parties do not consent to mediated negotiation or arbitration as provided for in the Contract, the parties agree to and each of them do hereby exclusively submit to the jurisdiction of the Courts of the Province of Newfoundland and Labrador, Canada.

C 9 Notices

.1 Any written notice provided for herein to be given to one party by the other party shall be deemed properly given and received if:

(a) delivered to the receiving party's designated representative at the Site; or

(b) either:

i. being mailed by prepaid registered mail; or

ii. transmitted by electronic methods;

to the receiving party's address as either stated in this Article or as changed through written notice to the other party.

.2 Any notice which is sent by prepaid registered mail or transmitted by electronic methods shall be deemed to be given and received forty-eight (48) hours after mailing or transmission, as applicable; provided that if such time expires on a Saturday, Sunday or legal holiday, the notice shall be deemed to be given and received on the next normal business day.

.3 Addresses of parties are:

Owner: NEWFOUNDLAND AND LABRADOR HYDRO
P.O. Box 12400
Supply Chain Management
4th Level, Hydro Place
St. John's, Newfoundland and Labrador
A1B 4K7

Attention: Ashley Billiard
Title: Supply Chain
FAX: 709-737-4643

Contractor: _____

_____

_____.

_____.

Phone: _____.

FAX: _____.

C 10 Survival of Covenants

.1 All covenants, warranties, obligations, indemnities and provisions of the Contract which expressly or by their nature require observance and/or performance by Contractor after the expiration or other termination of the Contract, howsoever caused or arising, continue in full force and effect subsequent to, and notwithstanding, such expiration or other termination of the Contract until they are satisfied in full or by their nature expire.

C 11 Binding Effect

.1 The Contract enures to the benefit of and is binding upon the parties hereto and their respective successors and permitted assigns.

IN WITNESS WHEREOF, the parties hereto have executed this Contract by the hands of their duly authorized representatives as of the day and year first above written.

Signed and delivered in the presence of:

NEWFOUNDLAND AND LABRADOR HYDRO
(Owner)

(Witness)

BY: (Sgd)
(Name)

VP - NLH
(Title)

Seal

(Witness)

AND: (Sgd)
(Name)

Corporate Secretary
(Title)

Signed and delivered in the presence of:

Tormont CAT Power Systems
(Contractor)

(Witness)

BY: Darrell Lambert
(Name)

Engine Territory Manager
(Title)

(Witness)

AND:
(Name)

(Title)

Toromont CAT Power Systems

82 Kenmount Road
St. John's, NL A1B 3S2
709-722-5660 tel
709-722-2290 fax

December 17, 2013

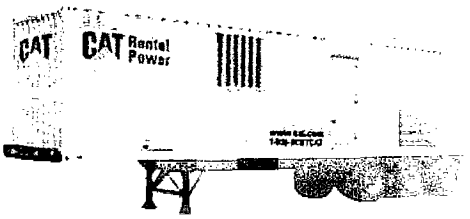
Phillip Hollett
Nalco Energy
St John's, Newfoundland

Re: 16 MW – Holyrood
Temporary Power Solution

Dear Phil;

We've reviewed the subject opportunity and timelines thoroughly. We can confirm that, on the strength of any resulting contract, Toromont is prepared to invest accordingly and hereby offer this solution. Please accept this letter as a basic summary of an analysis we've conducted to conclude this indicative proposal.

Option



8 Caterpillar XQ2000 Reciprocating Engine Generators each stand-by rated 2.0 MW @ 25°C for a total installed capacity of 16 MWe (ISO conditions) at each station.

Item		Recips
1.	Make	Caterpillar
2.	Model	XQ2000
3.	Quantity	8
4.	Output voltage	480 Volts Transformed to 4.16 kV
5.	Fuel LHV	42,780

Item		Recips
6.	Running Capacity (N)	16.0 MWe @ -12C 16.0 MWe @ -1.6C 16.0 MWe @ +15C 16.0 MWe @ +32C
7.	Heat Rates (@ ISO conditions) 100% Load	9456 kJ/kWe-hr
8.	Start times (@ ISO conditions) Purge Ignition & warm-up Acceleration Parallel	 0 secs 10 secs 5 secs 30 secs
9.	Load up time (ramp 0-100%)	30 secs.
10.	No load run time limits	30 mins.
11.	Load rejection limits	No limit

Pricing Basis – Nalcor requested that we consider a rental term of six months with an option to extend to eighteen months.

Toromont Cat is pleased to quote you on the rental of equipment for the Holyrood project. Following are the monthly rental rates for the XQ2000's.

Rental Option:
Standby rental rate for the 8 - XQ2000's based on 40 hours per month = **$200,000/month/40hrs.**

Single Shift rental rate for 8 - XQ2000's based on 160 hours per month = **$268,000/month/160hrs.**

Double Shift rental rate for 8 - XQ2000's based on 320 hours per month = **$400,000/month/320hrs.**

Triple shift rental rate for 8 - XQ2000's based on 672 hours per month = **$532,400/month/672hrs.**

Transformer rental for 8 transformers is **$40,000/month.**

Low Voltage and High Voltage cable rental based on 60ft is **$250,000**

Freight is **$350,000**

Engineering and Field Service will be **$175,000**

NGR's for 8 units will be $80,000

Equipment Placement $15,000

Purchase Price for 1 - XQ2000, Transformer and Cable will be $1.2M. 80% of the rental rate per XQ2000 will be credited against the purchase price plus 1% interest per month.

As per contract # 2013-56865AB and assuming the project will be for 6 months on standby. **If in the event the units have to run for an outage the appropriate rate will be charged.** The standby rate for the XQ2000's will be for the 6 month period $200,000/month/40hrs. X 6 = **$1,200,000.**

The cable rental will be for the **low voltage** cable and the **high voltage** cable based on 60ft runs. **The cable will be installed by Toromont/ Hydro**. The rate for the 6 months will be **$250,000.**

The 8 transformers for the 6 month period will be **$240,000**

The freight will be **$350,000.**

Engineering and Field Service will be **$175,000.**

Resistive and Reactive Load Bank Rentals for performing testing of system will be **$50,000**

NGR's will be **$80,000**

Equipment Placement **$15,000**

The total cost for the 6 month rental will be $2,360,000 +

To extend the contract for an additional 12 months will cost the following in addition to the 6 month contract.

The 8 - XQ2000's will cost **$2,400,000.**

The transformers will cost an extra **$480,000.**

The total cost for extending the contract for an additional 12 months will be $2,880,000. +

Note:

- The Customer will be responsible for insurance of the units while on rent. If this is a problem for Hydro then Toromont could arrange for insurance but it would be an extra cost.
- Customer will be responsible for fuel.
- Customer will be responsible for security on site.
- The set up and tear down will be in conjunction with Hydro personal.
- Hydro will be responsible for servicing of the units while on site (ie: oil and filter changes) or arrangements can be made with Toromont to look after this at an extra cost. The units will come serviced and will not need oil/filter changes for 500 hours of usage.
- Shore power to power up things like Jacket Water Heaters and Battery Chargers will be Hydro. Control wiring between gensets will be Toromont/Hydro. Special cable ends for the High Voltage cable will be by Toromont/Hydro.
- The delivery times for the XQ2000's will be as per the contract.

If you have any questions please don't hesitate to call.

Yours Truly;

Darrell Lambert
Toromont Cat Power Systems
Direct: 709-722-5660
Cell: 709-682-1358

SP 4 Transformer Specification

Each generating until will include a padmount transformer located outside and behind the diesel unit. Pad mount transformers PAD1283-S and PAD1289-S are acceptable solutions with the following general specifications:

Configuration wye – wye
Primary Voltage: 480V
Secondary Voltage: 4160V
Impedance: 5% – 6%

Any other padmount transformer must be approved by the customer prior to acceptance.

Vendor will supply appropriately rated cables and terminations for cables leading from the Diesel generators to the 480V side of the padmount transformers. Vendor will supply appropriately rated cables to connect from the 4160V side of the transformer to the riser pole. These cables must be a minimum of 60' long. Vendor to supply the connections from the cables to the 4160V side of the transformer.

SP 5 Information to be Supplied With Bid

INFORMATION TO BE SUPPLIED WITH BID

E.1 TECHNICAL PARTICULARS

Bidder shall submit Drawings and design data as per Article B.2.1 of Appendix B – General Conditions with each copy of its Proposal. It shall also give details of the equipment it proposes to supply, including, but not limited to, the following data.

.1 Reference Users

The Bidder shall demonstrate previous proven experience in Canada. Each tendered generating set or identical model shall have been installed in Canada and operated at the design and operating requirements as specified in this Specification. Bidder shall submit details listing for whom each unit was supplied, the date it was supplied and a contact person.

.2 **Servicing of Equipment**

Location of nearest service personnel and facilities _____

.3 **Equipment Data**

Bidder shall complete all of the following equipment data, for each generating unit rating tendered:

(a) Exhaust flow (100%NPR)

_____ m^3/min

(b) Exhaust gas temperature at exhaust manifold exit as follows:

25% of engine NPR

°C

50% of engine NPR

°C

75% of engine NPR

°C

100% of engine NPR

°C

(c) Engine emission data as follows:

Engine Load	25%NPR	50% NPR	75% NPR	100% NPR	
Exhaust Flow Rate					m^3/min
Exhaust Mass					kg/hr
Carbon Monoxide (CO)					g/hr
Carbon Dioxide (CO_2)					g/hr
NO + $N0_2$ (NO_x)					g/hr
Sulphur Dioxide (SO_2)					g/hr
Particulate					g/hr
Carbon in Particulate					%

(d) Load Pick Up

(i) Load pick up capability in % of NPR with a maximum 2% engine speed decrease

%

(ii) If load pick up must be staged, the following are the % loads which shall be applied to the unit at five (5) second intervals.

First load pick up

%

Second load pick up

%

Third load pick up

%

Fourth load pick up

%

(e) Generator Data as follows:

(i) Manufacturer Caterpillar

(ii) Rated Full Load Current 3125.1 A

(iii) Exciter Field Resistance [illegible] Ω

(iv) Excitation Current at No Load [illegible] A

(v) Excitation Voltage at No Load [illegible] V

(vi) Excitation Current at Full Load (0.8 pf) [illegible] A

(vii) Excitation Voltage at Full Load (0.8 pf) [illegible] V

(viii) PMG Output Frequency [illegible] Hz

(ix) PMG Output Voltage [illegible] V

(x) Generator efficiency as follows:

25% of engine NPR 92.5 %

50% of engine NPR 95.5 %

75% of engine NPR 96.[illegible] %

100% of engine NPR 96.[illegible] %

(xi) Generator Load Losses as follows:

25% of engine NPR [illegible] W

50% of engine NPR [illegible] Kw W

75% of engine NPR [illegible] Kw W

100% of engine NPR [illegible] Kw W

(xii) Generator P.U. reactances as follows:

Direct axis saturated synchronous (X_d) 2.39[illegible] p.u.

Direct axis transient (X_d') 0.[illegible] p.u.

Direct axis sub-transient (X_d'') 0.10[illegible]

p.u.

Leakage (X_1) N/A

p.u.

Negative sequence (X_2)

p.u.

Zero sequence (X_0)

p.u.

(f) Switchgear and Transformer Data

Fault Current Rating	2.5 MVA
Continuous Current Rating	1.2 A
Winding Configuration HV	
Winding Configuration LV	
Voltage Rating HV	4 kV
Voltage Rating LV	0.4 kV

E.2 SCHEDULE

For each event below the dates entered by the Bidder in Column 2 shall agree with the dates required by Purchaser Column 1. These shall be subsequently agreed to by the Purchaser, and become the approved schedule. This schedule shall be submitted for each proposal.

EVENT	DATE REQUIRED BY PURCHASER	DATE CONFIRMED BY VENDOR
Delivery of equipment to Holyrood Thermal Plant	Jan 17, 2014	
Installation and commissioning of equipment.	Feb 21, 2014	

Failure to guarantee or meet delivery dates outlined may result in rejection of bid.

E.3 GUARANTEES

Bidder shall provide the following performance data.

These values shall be guaranteed under the specified operating conditions and shall be binding on Vendor. Cost data shall be consistent with prices being charged Vendor in the current calendar year. Inconsistencies may result in rejection of proposal.

.1 Performance Data

(a) Prime ISO Power Rating at 0.8 P.F. kWe — 1825

(b) Overload Power Rating at 0.8 P.F. kWe — 2000

(c) All fuel performance guarantees are based on specified fuel as per Article C.4 - Fuel Specification of Appendix C – Genset Specifications — ___ YES ✓ NO

(d) Lower Heating Value of Fuel on which the Specific Fuel Consumption values are based kJ/kg

(e) Guaranteed Specific Fuel Consumptions, corrected to standard ISO conditions at 0.8 P.F:

25% of engine NPR	g/kWhe
50% of engine NPR	g/kWhe
75% of engine NPR	g/kWhe
100% of engine NPR	g/kWhe

(f) Engine light loading capability as follows:

Minimum recommended light load
kWe
Duration light load can be applied
hrs

.2 **Technical Support**

Location of on-call technical support
Guaranteed emergency response time-to-site
hrs

Buchans	
English Hr. West	
St. Anthony	

hrs

hrs

SP 6 Additional Work

.1 Scope

Vendor shall supply:

- Engineering and Field Service
- The cable rental will be for the low voltage cable and the high voltage cable based on 60ft runs. The cable will be installed by Hydro
- Resistive and Reactive Load Bank Rentals for performing testing of system

Additional Work to be done under this Clause SP 4 shall comprise the supply of all labour, construction plant and materials and the performance of all Work not included in scope of Contract but deemed necessary for completion of the Project.

.2 General

The Contractor shall notify the Owner of any additional Work required. All, if any, Work shall be performed as directed and scheduled by Owner. Cost of such Work shall be considered during Tender Evaluation.

Scope of Work shall be agreed upon by Contractor and Owner or Owner's site representative. The Contractor shall submit copies of material pricing, labor and rental rates to the Owner to substantiate the cost of additional Work.

SP 7 Drawings

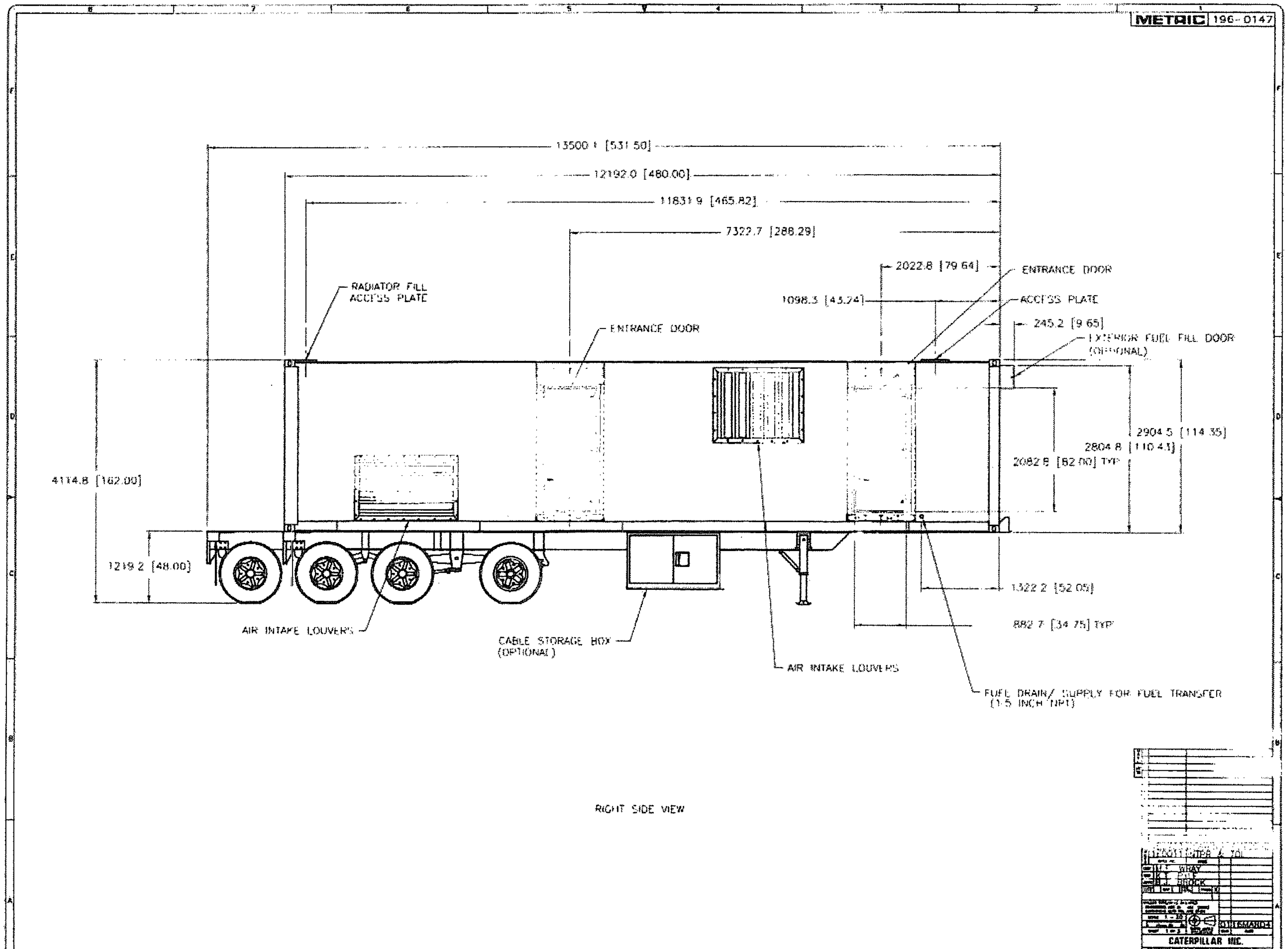
.1 Contractor shall perform the Work in strict accordance with Drawings.

STREETSIDE VIEW

STREETSIDE VIEW INTERIOR LAYOUT

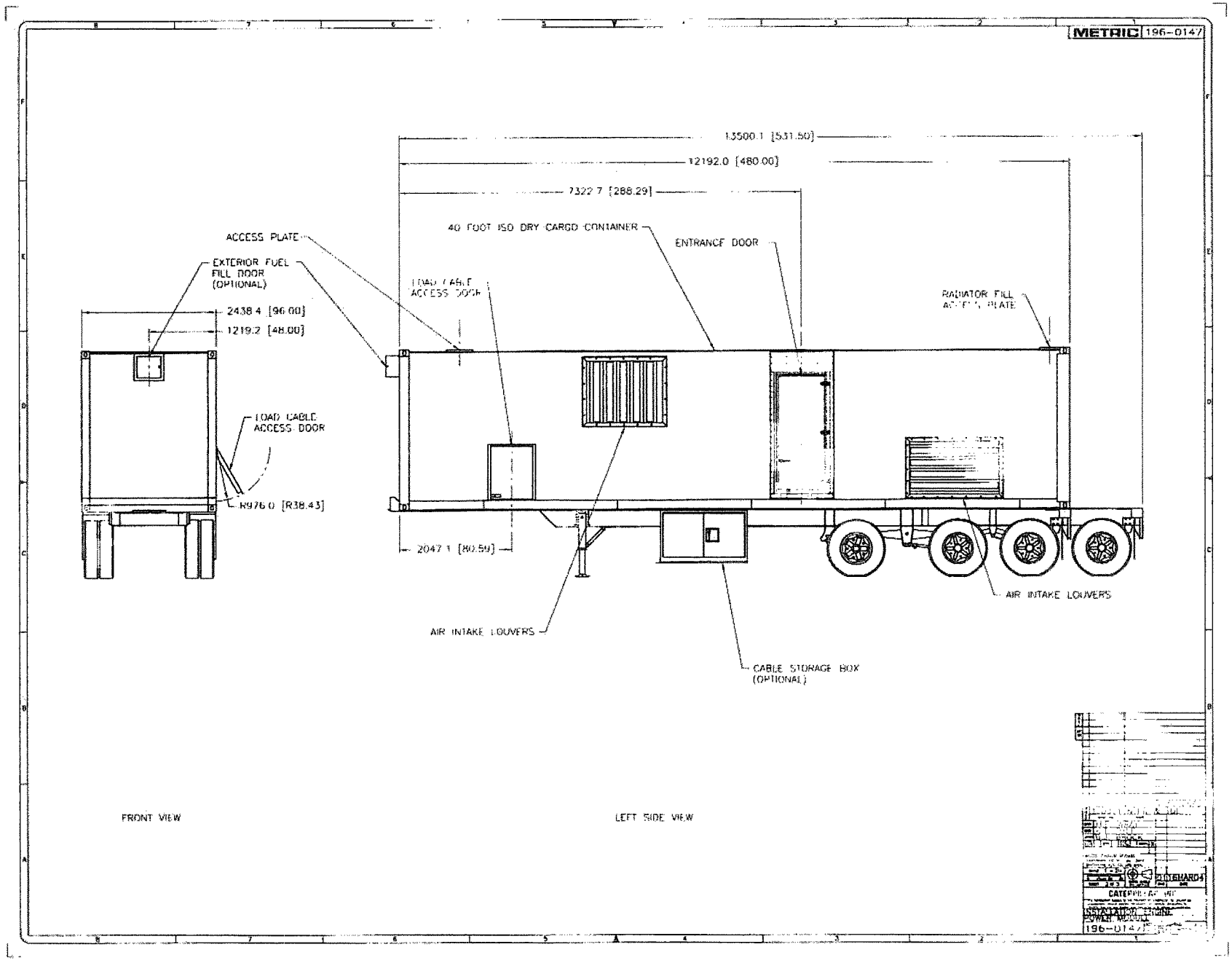
FRONT VIEW

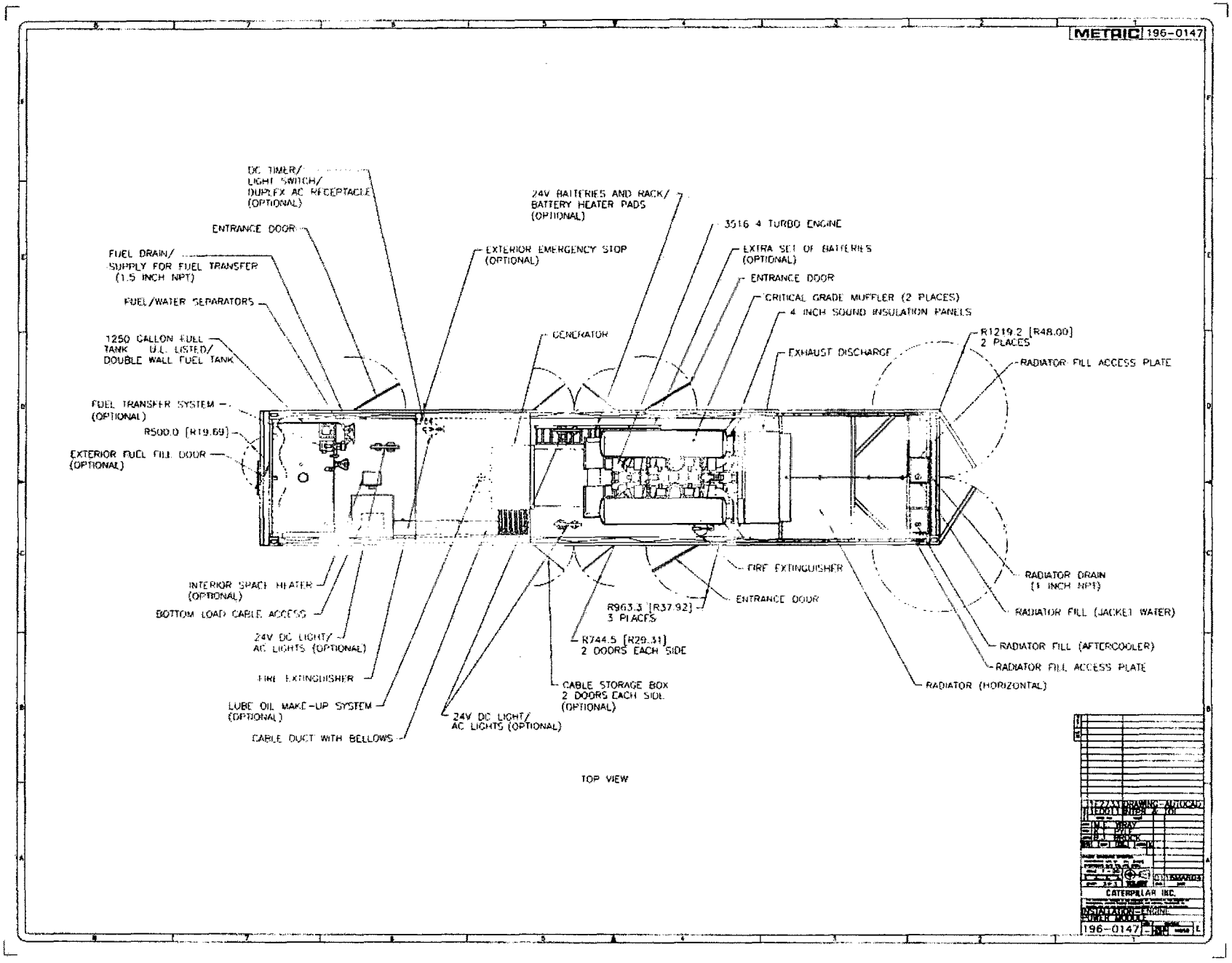
TOP VIEW INTERIOR LAYOUT



RIGHT SIDE VIEW

MODEL	TYPE	PRICING AR	ENGINEERING MODEL
3516	J	LA-3460 CHG 35	PS005


METRIC 196-0147
13500.1 [531.50]
12192.0 [480.00]
7322.7 [288.29]
40 FOOT ISO DRY CARGO CONTAINER
ENTRANCE DOOR
ACCESS PLATE
EXTERIOR FUEL FILL DOOR (OPTIONAL)
LOAD CABLE ACCESS DOOR
RADIATOR FILL ACCESS PLATE
2438.4 [96.00]
1219.2 [48.00]
LOAD CABLE ACCESS DOOR
R976.0 [R38.43]
2047.1 [80.59]
AIR INTAKE LOUVERS
AIR INTAKE LOUVERS
CABLE STORAGE BOX (OPTIONAL)
FRONT VIEW
LEFT SIDE VIEW


METRIC 196-0147
DC TIMER/ LIGHT SWITCH/ DUPLEX AC RECEPTACLE (OPTIONAL)
ENTRANCE DOOR
FUEL DRAIN/ SUPPLY FOR FUEL TRANSFER (1.5 INCH NPT)
FUEL/WATER SEPARATORS
1250 GALLON FUEL TANK U.L. LISTED/ DOUBLE WALL FUEL TANK
FUEL TRANSFER SYSTEM (OPTIONAL)
R500.0 [R19.69]
EXTERIOR FUEL FILL DOOR (OPTIONAL)
INTERIOR SPACE HEATER (OPTIONAL)
BOTTOM LOAD CABLE ACCESS
24V DC LIGHT/ AC LIGHTS (OPTIONAL)
FIRE EXTINGUISHER
LUBE OIL MAKE-UP SYSTEM (OPTIONAL)
CABLE DUCT WITH BELLOWS
24V BATTERIES AND RACK/ BATTERY HEATER PADS (OPTIONAL)
EXTERIOR EMERGENCY STOP (OPTIONAL)
GENERATOR
24V DC LIGHT/ AC LIGHTS (OPTIONAL)
R963.5 [R37.92] 3 PLACES
R744.5 [R29.31] 2 DOORS EACH SIDE
CABLE STORAGE BOX 2 DOORS EACH SIDE (OPTIONAL)
3516 4 TURBO ENGINE
EXTRA SET OF BATTERIES (OPTIONAL)
ENTRANCE DOOR
CRITICAL GRADE MUFFLER (2 PLACES)
4 INCH SOUND INSULATION PANELS
EXHAUST DISCHARGE
FIRE EXTINGUISHER
ENTRANCE DOOR
R1219.2 [R48.00] 2 PLACES
RADIATOR FILL ACCESS PLATE
RADIATOR DRAIN (1 INCH NPT)
RADIATOR FILL (JACKET WATER)
RADIATOR FILL (AFTERCOOLER)
RADIATOR FILL ACCESS PLATE
RADIATOR (HORIZONTAL)
TOP VIEW
CATERPILLAR INC.
196-0147

XQ2000 RENTAL

CATERPILLAR®

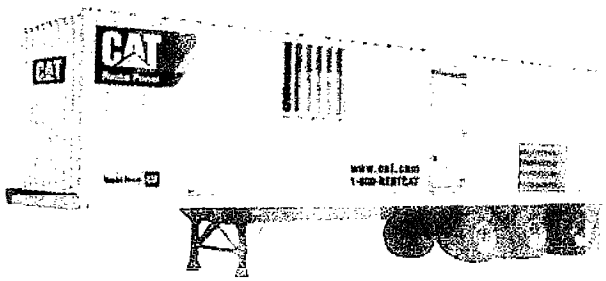


Image shown may not reflect actual package

STANDBY 2000 kW PRIME 1825 kW POWER MODULE

50/60 Hz

Frequency	Voltage	Standby kW (kVA)	Prime kW (kVA)
60	480/277V	2000 (2500)	1825 (2281)
50	400V	1440 (1800)	1310 (1638)

FEATURES

EPA TIER 2 and CARB certified for non-road mobile applications. Factory designed, certified prototype tested with torsional analysis. Production tested and delivered in a package that is ready to be connected to your fuel and power lines. Supported 100% by your Caterpillar® dealer with warranty on parts and labor. Extended warranty available in some areas. The generator set is designed and manufactured in an ISO 9001:2000 compliant facility. Generator set and components meet or exceed the following specifications: AS1359, AS2789, ABGSM TM3, BS4999, DIN6271, DIN6280, EGSA101P, JEM1359, IEC 34/1, ISO3046/1, ISO8528, NEMA MG1-22

CATERPILLAR SR4B GENERATOR

Single bearing, wye-connected, static regulated, brushless permanent magnet excited generator designed to match the performance and output characteristics of the Caterpillar diesel engine driving it.

RELIABLE, FUEL EFFICIENT DIESEL ENGINE

The compact, four-stroke-cycle diesel engine combines durability with minimum weight while providing dependability and economy. The fuel system operates on a variety of fuels.

CATERPILLAR COOLING SYSTEM

Sized compatible to rating with energy efficient fan and core.

CATERPILLAR SWITCHGEAR

Provides single unit and/or multi-unit/utility paralleling components. Standby, load sense/load demand, import, export, and base load modes. Comes standard with Basler Utility Multi-function Relay IPS-100.

EXCLUSIVE CATERPILLAR DIGITAL VOLTAGE REGULATOR (CDVR)

Three-phase sensing and adjustable Volts-per-Hertz regulation give precise control, excellent block loading, and constant voltage in the normal operating range.

ENVIRONMENTALLY FRIENDLY

110% spill containment of onboard engine fluids.

SOUND ATTENUATED CONTAINER

For ease of transportation and protection. Meets 75 dB(A) at 50 ft or below per SAE J1074 measurement procedure at 110% prime load.

XQ2000 RENTAL

CATERPILLAR®

FACTORY INSTALLED STANDARD EQUIPMENT

SYSTEM	STANDARD EQUIPMENT
Engine	EPA approved Tier 2 3516C Caterpillar engine Heavy duty air cleaner with service indicator 60-Amp charging alternator Fuel filters – primary and duplex secondary with integral water separator and change-over valve Lubricating oil system with spin-on, full flow oil filters and water cooled oil cooler Oil drain lines routed to engine rail Jacket water heater Fuel cooler and priming pump Electronic ADEM™ A3 controls 24V electric starting motors with battery rack and cables
Generator	SR-4B brushless, permanent magnet excited, three-phase with Caterpillar digital voltage regulator (CDVR), space heater, 6-lead design, Class H insulation operating at Class F temperature for extended life, winding temperature detectors and anti-condensation space heaters (120/240V 1.2 kW)
Containerized Module	40' ISO high cube container, CSC certified 3-axle, 40' ISO container chassis Seven (7) sound attenuated air intake louvers and 4 lockable personnel doors with panic release Side bus bar access door, external access load connection bus bars Shore power connection via distribution block connections for jacket water heater, battery charger, space heaters, and generator condensate heaters Standard lighting 3 AC/4 DC, one (1) single duplex service receptacle, 2 external break-glass emergency stop push buttons 1,250 gal fuel tank, UL listed, double wall, 9 hr runtime @ prime rating Sound attenuated 75 dB(A) @ 50 ft Spill containment 110% of all engine fluids Four (4) oversized maintenance-free batteries, battery rack and 20-Amp battery charger Hospital grade, internally insulated, rectangular exhaust silencer with vertical discharge Vibration isolators, corrosion resistant hardware and hinges External drain access to standard fluids Fire extinguishers (Qty 2) Standard Cat rental decals and painted standard Cat power module white Interior walls and ceilings insulated with 100 mm of acoustic paneling Floor of container insulated with acoustic glass and covered with galvanized steel
Cooling	Standard cooling provides 43° C ambient capability (60 Hz) at prime +10% rating Vertically mounted, separate ATAAC and JW cores with vertical air discharge
Generator Paralleling Control	Custom switchgear control with EMCP 3.3 genset mounted controller and wall mounted paralleling controls Automatic start/stop with cool down timer Protections: 25, 27/59, 40, 32, 81 O/U Utility multi-function relay protections: 25,27/59, 32, 47, 50/51, 62, 67, 81 O/U UMR is IEEE1547-2003 compliant in most applications Reverse compatibility module provided for interface to legacy power modules Touch screen controls with event log Multi-mode operation (island, multi-island and utility parallel), load sharing (multi-unit only) Import & export control (utility parallel only), manual and automatic paralleling capability Touch screen display (status and alarms) Metering display: voltage, current, frequency, power factor, kW, WHM, kVAR, and synchroscope
Quality	Standard genset and package factory tested UL, NEMA, ISO and IEEE standards O&M manuals

XQ2000 RENTAL

CATERPILLAR®

SPECIFICATIONS

CAT SR4B GENERATOR

Frame Size 825
Pitch 0.6667
No. of poles 4
Excitation ..... Static regulated brushless PM excited
Constructions ..... Single bearing, close coupled
Insulation ..... Class H
Enclosure ..... Drip proof IP22
Alignment ..... Pilot shaft
Overspeed capability – % of rated ..... 125% of rated
Voltage regulator ..... 3 phase sensing with Volts-per-Hertz
Voltage regulation ..... Less than ± ½% voltage gain
Adjustable to compensate for engine speed droop and line loss
Wave form deviation ..... Less than 5% deviation
Telephone Influence Factor (TIF) ..... Less than 50
Harmonic Distortion (THD) ..... Less than 5%

CAT 3516C DIESEL ENGINE

3516C, 4-Stroke diesel
Bore – mm (in) 170 (6.7)
Stroke – mm (in) 190 (7.5)
Displacement – L (cu in) 69 (4,210)
Compression ratio 15:1
Aspiration ..... ATAAC
Fuel system ..... EUI
Governor type ..... Caterpillar ADEM™ A3 Control System

TECHNICAL DATA

Materials and specifications are subject to change without notice.

Generator Set Technical Data		50 Hz		60 Hz	
	Units	Prime	Standby	Prime	Standby
Performance Specification		DM8754		DM8264	
Power Rating	kW (kVA)	1310 (1637)	1440 (1800)	182 (281)	2000 (2500)
Lubricating System					
Oil pan capacity	L (gal)	401.3 (106)		401.3 (106)	
Fuel System					
Fuel Consumption					
100% load	L (gal)	350.1 (92.5)	372.9 (98.5)	483.2 (127.6)	525.7 (138.9)
75% load	L (gal)	281.9 (74.5)	302.8 (80)	380 (100.4)	408.2 (107.8)
50% load	L (gal)	205.5 (54.3)	350.1 (92.4)	270.5 (71.5)	294.2 (77.7)
Fuel tank capacity	L (gal)	4731 (1,250)		4731 (1,250)	
Running time @ 75% rating	Hours	16.7	15.6	12.5	11.5
Cooling System					
Radiator coolant capacity including engine	L (gal)	630 (166)		630 (166)	
Air Requirements					
Combustion air flow	m^3/min (cfm)	114.8 (4052)	118.1 (4173)	174.7 (6169)	180.3 (6367)
Maximum air cleaner restriction	kPa (in H_2O)	6.2 (24.9)		6.2 (24.9)	
Generator cooling air	m^3/min (cfm)	140 (5,933)		168 (4,995)	
Exhaust System					
Exhaust flow at rated kW	m^3/min (cfm)	311.3 (10,993)	320.8 (11,335)	404 (14,260)	428.6 (15,137)
Exhaust stack temperature at rated kW – dry exhaust	°C (°F)	502.1 (935.8)	513.1 (955.6)	387 (728)	405 (762)
Noise Rating (with enclosure)					
@ 7 meters (23 feet)	dB(A)	77	78	78	79
@15 meters (50 feet)	dB(A)	73	74	74	75

Model	Length mm (in)	Width mm (in)	Height mm (in)	Weight	
				With Lube Oil and Coolant kg (lb)	With Fuel, Lube Oil and Coolant kg (lb)
XQ2000 w/o Chassis	12 192 (480)	2438 (96)	2896 (114)	34 019 (75,000)	38 102 (84,000)
XQ2000 w/Chassis	12 192 (480)	2438 (96)	4267 (168)	38 102 (84,000)	42 184 (93,000)

RATING DEFINITIONS

Standby – Applicable for supplying continuous electrical power (at variable load) in the event of a utility power failure. No overload is permitted on these ratings. The generator on the generator set is peak prime rated (as defined in ISO8528-3) at 30° C (86° F).

Prime – Applicable for supplying continuous electrical power (at variable load) in lieu of commercially purchased power. There is no limitation to the annual hours of operation and the generator set can supply 10% overload power for 1 hour in 12 hours.

XQ2000 RENTAL

CATERPILLAR®

STANDARD FEATURES

GENERATOR SET EMCP 3.3 LOCAL CONTROL PANEL

- Generator mounted EMCP 3.3 provides power metering, protective relaying and engine and generator control and monitoring.
- Provides MODBUS datalink to paralleling control for monitoring of engine parameters.
- Convenient service access for Caterpillar service tools (not included).
- Integration with the CDVR provides enhanced system monitoring.
- Ability to view and reset diagnostics of all controls networked on J1939 datalink.
- Network modules via the control panel removes the need for a separate service tool for troubleshooting.
- Real-time clock allows for date and time stamping of diagnostics and events.

EMCP 3.3 ENGINE OPERATOR INTERFACE

- Graphical display with positive image, transflective LCD, adjustable white backlight/ contrast.
- Two LED status indicators (1 red, 1 amber).
- Three engine control keys and status indicators (Run/Auto/Stop).
- Lamp test key.
- Alarm acknowledgement key.
- Display navigation keys.
- Two shortcut keys: Engine Operating Parameters and Generator Operating Parameters.
- Fuel level monitoring and control.

CIRCUIT BREAKER

- 3000A fixed type, 3 poles, genset mounted, electrically operated, insulated case circuit breaker.
- Solid state trip unit for overload (time overcurrent) and fault (instantaneous) overcurrent protection.
- Includes DC shunt trip coil activated on any monitored engine or electrical fault, 100 KA-interrupting capacity at 480 VAC.

VOLTAGE REGULATION AND POWER FACTOR CONTROL CIRCUITRY

- Generator mounted automatic voltage regulator, microprocessor based.
- Manual raise/lower voltage adjust capability and VAR/power factor control circuitry for maintaining constant generator power factor while paralleled with the utility.
- Includes RFI suppression, exciter limiter and exciter diode monitoring.
- Voltage and power factor adjustments are performed on the setting screen of the HMI touch screen.

FUEL TANK

- UL Listed 1250 gallon double walled.
- Fuel transfer system

CURRENT TRANSFORMERS

- CT's rated 3000:5 with secondaries wired to shorting terminal strips.

POTENTIAL TRANSFORMERS

- 4:1 ratio with primary and secondary fuse protection.

BUS BARS

- Three phase, plus full rated neutral, bus bars are tin-plated copper with NEMA standard hole pattern for connection of customer load cables and generator cables.
- Bus bars are sized for full load capacity of the generator set at 0.8 power factor.
- Includes ground bus, tin-plated copper, for connection to the generator frame ground and field ground cable.

AC DISTRIBUTION

- Provides 240 VAC for all module accessories.
- Includes controls to de-energize jacket water heaters and generator space heater when the engine is running.

SHORE POWER TWO (2)

- One (1) shore power connection distribution block for jacket water heaters.
- One (1) for generator space, battery charger, and fuel pump.

INTERNAL LIGHTING

- Four (4) internal DC lights with one (1) timer and two switches installed at each side of the container door.
- Three (3) internal AC lights.
- One (1) single duplex service receptacle.

BATTERY CHARGER AND BATTERIES

- 24 VDC/20A battery charger with float/equalize modes and charging ammeter.
- Maintenance free batteries.

EMERGENCY STOP PUSHBUTTON

- Two external ESPs located near each access door.

MODES OF OPERATION

Caterpillar utility paralleling controls are intended for automatic or manual paralleling with a utility power source as a load management system, with provisions for standby operation feeding an isolated load network. Load management operation involves microprocessor-based automatic loading controls with soft loading, base load, Import/Export control and soft unloading. For Standby operation, the generator operates as an isochronous machine isolated from the utility supply. The controls allow for automatic operation, initiated locally or remotely by the customer's SCADA system. Detailed modes of operation are listed below:

SINGLE UNIT ISLAND AND MULTI-UNIT ISLAND OPERATION

1. Utility Standby Mode (Normal)
   a. The utility is providing power for the plant loads.
   b. The Power Module Generator breaker is open.
   c. The pm is in automatic standby mode to respond to a utility failure.
2. Emergency Mode (Emergency)
   a. Utility Failure
      1) The customer protective relaying senses a utility abnormal condition.
      2) A run request is sent to the Power Module Generator plant.
      3) The first Power Module Generator reach rated to voltage and frequency is closed to the bus.
      4) In Multi-Unit Island Mode, the remaining Power Module Generators are paralleled to the bus as they reach rated voltage and frequency. This function is performed via the ModBus Plus data link connected between the Power Modules.
      5) Plant load is transferred to the Power Modules, which share load equally via ModBus Plus data link.
      6) The system is now in Emergency Mode.

GENERATOR DEMAND PRIORITY CONTROL

The System Controls include a Generator Demand Priority Control function to automatically match the on-line Power Module Generator capacity to the loads in order to avoid unnecessary operation of all the Power Module Generators when the plant loads are low.

The following controls are provided for each Power Module Generator:

a. User-settable Generator Priority Selector
b. Status indicator for the Generator Priority selected
c. Status indicator for Power Module Generator on-line or off-line
d. Generator Demand Priority Control Switch (On/Off)
e. User-settable Generator Remove Level (% as a function of single generator capacity)
f. User-settable Generator Remove Time Delay
g. User-settable Generator Add Level (% as a function of single generator capacity)
h. User-settable Generator Add Time Delay

Upon entrance into Emergency Mode, all generators will be started and paralleled to the bus. After the Remove Time Delay, Power Module Generators will be removed from the bus as a function of the generator percentage loading. Generators will be removed from the bus in descending priority order.

Should the generator percentage loading increase to the user-selected Generator Add Level after the user-selected Generator Add Time Delay, the next priority generator will be started, synchronized and paralleled to the bus. Should the Power Module Generator plant ever reach 100% loading, the next priority generator will be started and added to the bus, bypassing the Generator Add Time Delay.

MODES OF OPERATION (continued)

SINGLE UNIT IMPORT, EXPORT OR BASE LOAD OPERATION

During periods of peak demand the system may be placed in operation using the operator interface panel on the front of the switchgear.

1. Entry – Local
   a. The operator places the System Control Switch into Load Management.
   b. The operator selects Import, Export or Base Load Operation.
   c. The Load Management Setpoint is the amount of power Imported, Exported or Base-Loaded. A 4-12-20mA signal is provided by the customer and is linearly proportional to the utility load, with 12mA equaling 0 kW. The 4-12-20mA utility load signal is wired to one and only one Power Module. If the Power Module selected for Load Management is not available, the 4-12-20mA signal will be routed to a different Power Module.
   d. The operator sets the Load Management Setpoint and Power Factor Setpoint.
   e. A Run request signal is received by the Single Unit Power Module.
   f. The Power Module Generator is started and will run for a predetermined warm-up time before it is synchronized and paralleled to the utility.
   g. When the generator is on the bus, it is soft-ramp-loaded until the generator output reaches the Load Management Setpoint.
   h. The generator output is dynamically adjusted to maintain the Load Management Setpoint.
   i. Should the utility fail during Load Management Operation, the Protective Relay will cause the Paralleling Circuit Breaker 52G to open and be locked out until the Lockout Relay is manually reset by an operator on site. The generator is allowed to run for the duration of the cooldown time.
2. Exit – Local
   a. The Run Request signal is removed from the power module.
   b. The generator is soft-ramp-unloaded until the plant load is fully supported by the utility.
   c. The Paralleling Circuit Breaker 52G is opened.
   d. The generator is allowed to run for the duration of the cooldown time.

STANDARD PARALLELING CONTROL

GENERATOR PARALLELING CONTROLS

The switchgear includes:

- Single unit island mode.
- Multiple unit island mode.
  - Includes Load Sense/Load Demand control.
  - Load sharing capability is provided via network communication.
- Single unit utility parallel mode.
  Selectable for Import/Export control.
  If import or export control is selected a 4-12-20mA signal is required (provided by others) scalable to the utility contribution.
- 6 inch black and white HMI touch screen.
- Reverse compatibility module provided for interface to legacy designed Power Module Switchgear. Includes PLC, load share and voltage droop.

Incoming Utility Breaker Status Circuit – Circuit to accept customers contact from remote utility disconnect device. Customer to provide a normally open form 'a' contact to indicate when the local load network is connected to the utility grid.

Utility Transfer Trip Circuit – Circuit accepts input (normally open dry contact) from customer's system protective relay(s) or other controlling device. Operation of contacts causes tripping of the generator circuit breaker via the generator (software) 86 lock-out function and places the engine in cooldown mode. Circuit is disabled when operating in single unit or multiple unit island.

GENERATOR PARALLELING CONTROLS OPERATOR INTERFACE

Graphical mimic one line diagram that shows generator with its respective circuit breaker in a one-line representation of the system. The graphics utilize black and white indicators and bar graphs while actively displaying the following information:

- Utility CB Open/Closed. Input contacts provided by others.
- Utility kW 4-12-20mA signal required and provided by customer that is scalable to the utility contribution.
- Generator CB Open/Closed/Tripped.
- Generator Volts/Amps/kW/Frequency.
- Engine Stopped/Running/Cooldown/Pre-Alarm/Shutdown.
- Engine ECS Position Stop/Auto/Run.
- Utility Output kW.
- System Summary Alarm.

Event logging is also included with up to 500 stored events.

GENERATOR METERING AND PROTECTION

Generator metering that will graphically display 3Ø Voltage, 3Ø Current, Frequency, Power Factor, kW, kVAR and a Synchroscope Display of EMCP 3.3 faults, CDVR or ADEM 3 will be provided via Modbus RTU interface to EMCP 3.3.

Generator/Intertie Protective Relaying including:

- Device 27/59 – Under/Over Voltage.
- Device 81O/U – Under/Over Frequency.
- Device 40 – Loss of Excitation.
- Device 32 – Reverse Power.
- Device 25 – Synchronizing Check.
- Device 15 – Auto Synchronizer.
- Device 65 – Governor Load Sharing, Soft Loading Control.
- Device 90 – VAR/PF and Cross Current Compensation Controller.

PROGRAMMING AND DIAGNOSTICS

Includes field programmable set points for engine control and monitoring variables and self-diagnosis of the EMCP 3.3 system component and wiring failures.

ENGINE CONTROL SWITCH

Keypad selectable, four (4) positions – Off, Auto, Man, Cool:

- Off for engine shutdown and resetting faults.
- Auto for local or remote automatic operation when initiated by switch operation or contact closure.
- Man for local starting and manual paralleling.
- Cool for normal engine shutdown with timed cool-down cycle.

CIRCUIT BREAKER CONTROL SWITCH

Heavy duty, three- (3) position spring return to center with momentary trip and close position and slip contacts for automatic closing. Includes circuit breaker position indicating lamps.

EMERGENCY STOP PUSHBUTTON

- Mushroom head, twist to reset, causes engine shutdown and tripping of the generator circuit breaker. Prevents engine starting when depressed.

XQ2000 RENTAL

CATERPILLAR®

STANDARD PARALLELING CONTROL (continued)

ELECTRONIC LOAD SHARING GOVERNOR

- Includes speed adjustment, and auto load share capability when in parallel with legacy power modules.

ALARM MODULE

- Dedicates annunciator screens for warning and shutdown faults. Includes external mounted horn and acknowledge push-button.

AUTOMATIC/MANUAL PARALLELING

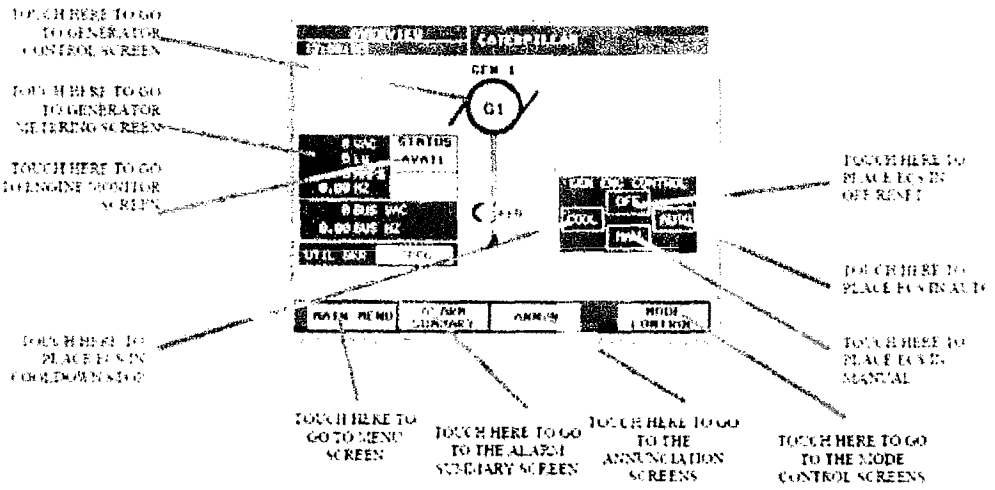
- Automatically synchronizes and parallels the generator with another power source.
- Includes provisions for manual permissive paralleling.

HUMAN MACHINE INTERFACE (HMI) HIGHLIGHTS

- Engine/Generator function is performed thru the 6" HMI touch screen interface.

Overview Screen (Typical)

Shows the generator status, generator metering data, bus metering data, ECS position, and generator/utility breaker status.



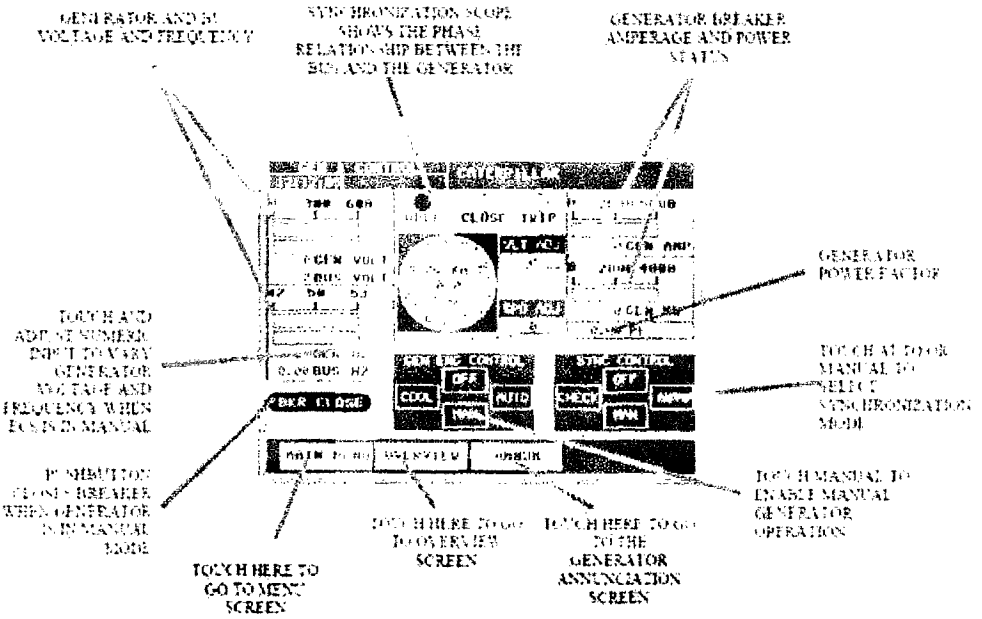
XQ2000 RENTAL

CATERPILLAR®

STANDARD PARALLELING CONTROL (continued)

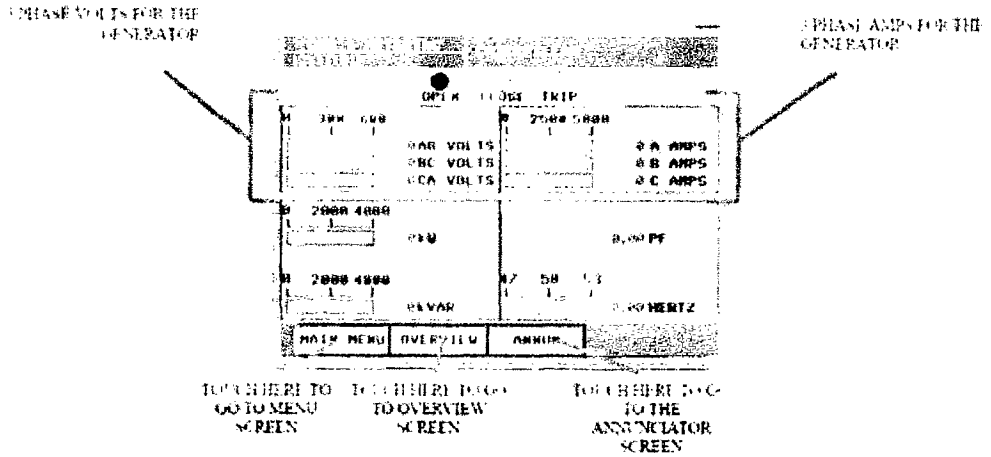
Generator Control Screen (Typical)

It allows the operator to observe the automatic synchronization and transfer of the load to and from the generator. Engine control allows the operator to run the engine in manual, or switch to automatic modes. Voltage and frequency offset adjustment allows the operator to control generator frequency and voltage.



Generator Metering Screen (Typical)

Allows the operator to view three phases of voltage and amperage for the bus and the generator.



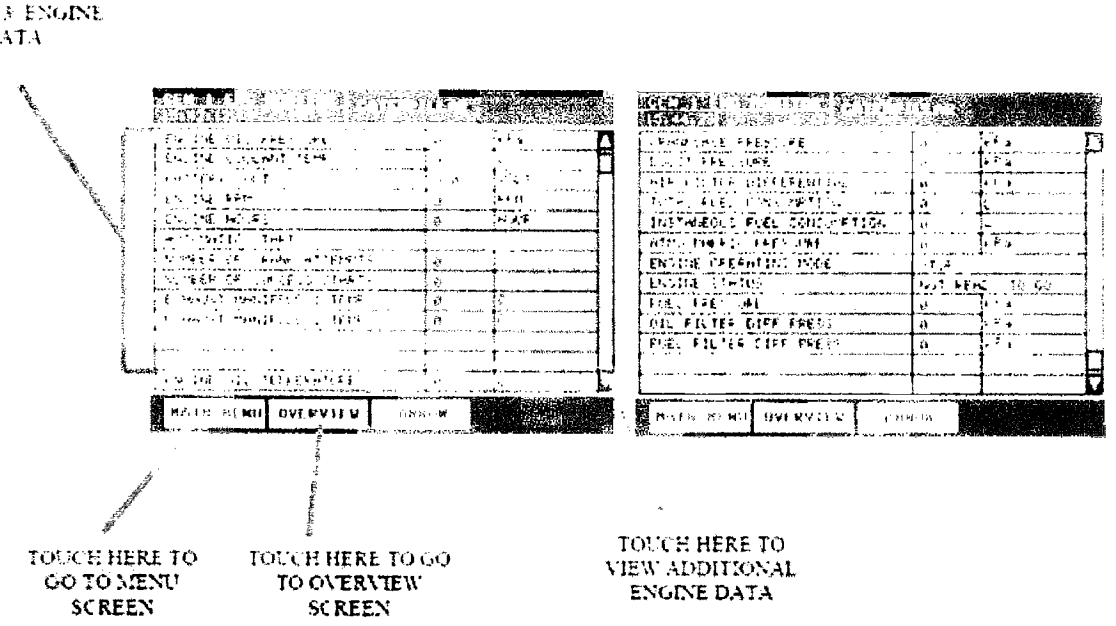
XQ2000 RENTAL

CATERPILLAR®

STANDARD PARALLELING CONTROL (continued)

Engine Monitoring Screen (Typical)

Engine status is obtained directly from the EMCP 3. Engine starts and total hours can be used by the operator to determine when regular preventive maintenance is required. Other metering includes engine battery and oil filter health.



PERFORMANCE DATA [MHB00436]

(MHB00436)-ENGINE (NAM00282)-GENSET (G5Y00544)-GENERATOR

DECEMBER 16, 2013

For Help Desk Phone Numbers Click here

Perf No: DM8454 **Change Level: 01**

General | Heat Rejection | Emissions Regulatory | Altitude Derate | Cross Reference | General Notes | Supplementary Data | Perf Param Ref

View PDF

SALES MODEL:	3516C	**COMBUSTION:**	DI
ENGINE POWER (BKW):	2,030.0	**ENGINE SPEED (RPM):**	1,800
GEN POWER WITH FAN (EKW):	1,825.0	**HERTZ:**	60
COMPRESSION RATIO:	14.7	**FAN POWER (KW):**	108.0
APPLICATION:	PACKAGED GENSET	**ASPIRATION:**	TA
RATING LEVEL:	PRIME	**AFTERCOOLER TYPE:**	ATAAC
SUB APPLICATION:	STANDARD	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
PUMP QUANTITY:	2	**INLET MANIFOLD AIR TEMP (C):**	49
FUEL TYPE:	DIESEL	**JACKET WATER TEMP (C):**	99
MANIFOLD TYPE:	DRY	**TURBO CONFIGURATION:**	PARALLEL
GOVERNOR TYPE:	ADEM3	**TURBO QUANTITY:**	4
ELECTRONICS TYPE:	ADEM3	**TURBOCHARGER MODEL:**	GTA5518BN-56T-1.12
CAMSHAFT TYPE:	STANDARD	**CERTIFICATION YEAR:**	2008
IGNITION TYPE:	CI	**CRANKCASE BLOWBY RATE (M3/HR):**	76.2
INJECTOR TYPE:	EUI	**FUEL RATE (RATED RPM) NO LOAD (L/HR):**	52.0
FUEL INJECTOR:	2664387	**PISTON SPD @ RATED ENG SPD (M/SEC):**	11.4
REF EXH STACK DIAMETER (MM):	305		
MAX OPERATING ALTITUDE (M):	1,200		

General Performance Data Top

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	%	BKW	KPA	G/BKW-HR	L/HR	KPA	DEG C	DEG C	KPA	DEG C
1,825.0	100	2,029	1,960	201.0	486.2	251.8	48.9	582.5	227.2	387.7
1,642.5	90	1,827	1,765	203.5	443.3	235.8	48.1	560.1	209.3	372.7
1,460.0	80	1,631	1,576	207.5	403.4	218.7	47.4	540.6	191.8	361.9
1,368.8	75	1,535	1,483	209.7	383.8	209.7	47.1	531.0	183.1	357.4
1,277.5	70	1,440	1,391	211.8	363.6	199.7	46.7	521.4	173.6	353.1
1,095.0	60	1,252	1,209	215.7	321.8	176.0	46.0	502.4	151.7	345.7
912.5	50	1,066	1,029	217.4	276.1	144.0	45.0	481.0	124.2	341.9
730.0	40	881	851	217.5	228.4	107.5	44.1	454.4	94.2	339.5
547.5	30	695	672	223.6	185.3	76.7	43.6	422.6	70.5	334.0
456.2	25	601	581	229.4	164.4	63.4	43.4	403.2	60.6	328.9
365.0	20	506	489	237.9	143.5	51.2	43.2	380.9	51.8	321.8
182.5	10	310	300	272.7	100.9	30.6	42.8	315.3	37.0	283.8

ENGINE WET ENGINE ENGINE

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP	WET INLET AIR VOL FLOW RATE	OUTLET WET EXH GAS VOL FLOW RATE	INLET AIR MASS FLOW RATE	WET EXH GAS MASS FLOW RATE	OUTLET WET EXH VOL FLOW RATE (0 DEG C AND 101 KPA)	OUTLET DRY EXH VOL FLOW RATE (0 DEG C AND 101 KPA)
EKW	%	BKW	KPA	DEG C	M3/MIN	M3/MIN	KG/HR	KG/HR	M3/MIN	M3/MIN
1,825.0	100	2,029	266	224.3	177.5	406.1	12,341.1	12,748.6	167.8	155.6
1,642.5	90	1,827	249	211.6	172.1	381.9	11,918.6	12,290.0	161.5	150.3
1,460.0	80	1,631	232	199.3	165.6	359.9	11,432.4	11,770.2	154.8	144.5
1,368.8	75	1,535	222	193.3	161.9	348.4	11,160.2	11,482.3	150.9	141.2
1,277.5	70	1,440	212	186.8	157.7	336.0	10,848.2	11,153.6	146.6	137.3
1,095.0	60	1,252	188	171.5	146.8	307.7	10,063.5	10,333.6	135.8	127.5
912.5	50	1,066	155	150.7	130.9	271.0	8,931.5	9,163.1	120.4	113.2
730.0	40	881	116	126.0	111.8	229.3	7,588.9	7,780.6	102.2	96.3
547.5	30	695	84	103.4	95.4	193.3	6,445.9	6,601.1	87.0	82.1
456.2	25	601	70	93.0	88.2	176.7	5,946.8	6,084.6	80.1	75.8
365.0	20	506	58	83.0	81.5	160.5	5,487.3	5,607.7	73.7	69.9
182.5	10	310	36	65.1	70.0	128.8	4,703.5	4,788.2	63.2	60.4

Heat Rejection Data Top

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	REJECTION TO JACKET WATER	REJECTION TO ATMOSPHERE	REJECTION TO EXH	EXH RECOVERY TO 177C	FROM OIL COOLER	FROM AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERG
EKW	%	BKW	KW	KW	KW	KW	KW	KW	KW	KW	KW
1,825.0	100	2,029	724	130	1,664	784	258	609	2,029	4,848	5,164
1,642.5	90	1,827	677	124	1,525	699	235	547	1,827	4,420	4,708
1,460.0	80	1,631	633	119	1,406	631	214	487	1,631	4,022	4,285
1,368.8	75	1,535	611	117	1,348	600	204	458	1,535	3,826	4,076
1,277.5	70	1,440	588	115	1,288	568	193	426	1,440	3,625	3,861
1,095.0	60	1,252	539	110	1,159	503	171	354	1,252	3,208	3,417
912.5	50	1,066	483	106	1,008	436	147	266	1,066	2,752	2,932
730.0	40	881	422	100	846	364	121	174	881	2,277	2,426
547.5	30	695	364	94.8	702	298	98.4	107	695	1,848	1,968
456.2	25	601	334	92.1	633	265	87.3	81.8	601	1,639	1,746
365.0	20	506	303	89.3	564	232	76.2	60.3	506	1,431	1,524
182.5	10	310	235	82.9	415	145	53.6	27.1	310	1,006	1,072

Emissions Data Top

Units Filter: All Units

RATED SPEED POTENTIAL SITE VARIATION: 1800 RPM

GENSET POWER WITH FAN		EKW	1,825.0	1,368.8	912.5	456.2	182.5
ENGINE POWER		BKW	2,029	1,535	1,066	601	310
PERCENT LOAD		%	100	75	50	25	10
TOTAL NOX (AS NO2)		G/HR	16,211	8,787	5,621	4,219	3,018
TOTAL CO		G/HR	1,310	758	1,119	1,803	1,832
TOTAL HC		G/HR	463	490	508	414	450
PART MATTER		G/HR	100.3	99.7	149.3	256.4	204.4
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	3,031.7	2,151.1	1,936.1	2,415.5	2,867.1
TOTAL CO	(CORR 5% O2)	MG/NM3	237.1	174.2	373.5	931.1	1,712.5
TOTAL HC	(CORR 5% O2)	MG/NM3	73.4	97.2	140.5	198.7	377.7
PART MATTER	(CORR 5% O2)	MG/NM3	15.6	20.0	46.6	122.2	158.8
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,477	1,048	943	1,177	1,397
TOTAL CO	(CORR 5% O2)	PPM	190	139	299	745	1,370

TOTAL HC	(CORR 5% O2)	PPM	137	181	262	371	705
TOTAL NOX (AS NO2)		G/HP-HR	5.99	4.29	3.95	5.24	7.26
TOTAL CO		G/HP-HR	0.48	0.37	0.79	2.24	4.40
TOTAL HC		G/HP-HR	0.17	0.24	0.36	0.51	1.08
PART MATTER		G/HP-HR	0.04	0.05	0.10	0.32	0.49
TOTAL NOX (AS NO2)		LB/HR	35.74	19.37	12.39	9.30	6.65
TOTAL CO		LB/HR	2.89	1.67	2.47	3.97	4.04
TOTAL HC		LB/HR	1.02	1.08	1.12	0.91	0.99
PART MATTER		LB/HR	0.22	0.22	0.33	0.57	0.45

RATED SPEED NOMINAL DATA: 1800 RPM

GENSET POWER WITH FAN		**EKW**	**1,825.0**	**1,368.8**	**912.5**	**456.2**	**182.5**
ENGINE POWER		**BKW**	**2,029**	**1,535**	**1,066**	**601**	**310**
PERCENT LOAD		**%**	**100**	**75**	**50**	**25**	**10**
TOTAL NOX (AS NO2)		G/HR	13,509	7,322	4,684	3,516	2,515
TOTAL CO		G/HR	728	421	622	1,002	1,018
TOTAL HC		G/HR	348	368	382	311	339
TOTAL CO2		KG/HR	1,261	998	717	426	259
PART MATTER		G/HR	71.6	71.2	106.6	183.1	146.0
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	2,526.5	1,792.6	1,613.4	2,012.9	2,389.2
TOTAL CO	(CORR 5% O2)	MG/NM3	131.7	96.8	207.5	517.3	951.4
TOTAL HC	(CORR 5% O2)	MG/NM3	55.2	73.1	105.6	149.4	284.0
PART MATTER	(CORR 5% O2)	MG/NM3	11.1	14.3	33.3	87.3	113.4
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,231	873	786	981	1,164
TOTAL CO	(CORR 5% O2)	PPM	105	77	166	414	761
TOTAL HC	(CORR 5% O2)	PPM	103	136	197	279	530
TOTAL NOX (AS NO2)		G/HP-HR	4.99	3.57	3.29	4.37	6.05
TOTAL CO		G/HP-HR	0.27	0.21	0.44	1.24	2.45
TOTAL HC		G/HP-HR	0.13	0.18	0.27	0.39	0.81
PART MATTER		G/HP-HR	0.03	0.03	0.07	0.23	0.35
TOTAL NOX (AS NO2)		LB/HR	29.78	16.14	10.33	7.75	5.55
TOTAL CO		LB/HR	1.60	0.93	1.37	2.21	2.24
TOTAL HC		LB/HR	0.77	0.81	0.84	0.69	0.75
TOTAL CO2		LB/HR	2,781	2,199	1,581	939	570
PART MATTER		LB/HR	0.16	0.16	0.24	0.40	0.32
OXYGEN IN EXH		%	11.4	12.6	13.5	14.3	15.8
DRY SMOKE OPACITY		%	0.4	0.5	1.8	3.8	3.1
BOSCH SMOKE NUMBER			0.18	0.23	0.60	1.25	1.14

Regulatory Information Top

EPA TIER 2 **2006 - 2010**

GASEOUS EMISSIONS DATA MEASUREMENTS ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 89 SUBPART D AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. GASEOUS EMISSIONS VALUES 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 2	CO: 3.5 NOx + HC: 6.4 PM: 0.20

EPA EMERGENCY STATIONARY **2011 - ----**

GASEOUS EMISSIONS DATA MEASUREMENTS ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 60 SUBPART IIII AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. GASEOUS EMISSIONS LIMIT VALUES 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	STATIONARY	EMERGENCY STATIONARY	CO: 3.5 NOx + HC: 6.4 PM: 0.20

Altitude Derate Data Top

ALTITUDE CORRECTED POWER CAPABILITY (BKW)

AMBIENT OPERATING TEMP (C)	10	15	20	25	30	35	40	45	50	NORMAL
ALTITUDE (M)										
0	2,030	2,030	2,030	2,030	2,030	2,030	2,030	2,030	2,030	2,030
250	2,030	2,030	2,030	2,030	2,030	2,030	2,030	2,030	2,030	2,030
500	2,030	2,030	2,030	2,030	2,030	2,030	2,030	2,030	2,030	2,030
750	2,030	2,030	2,030	2,030	2,030	2,030	2,030	2,014	1,983	2,030
1,000	2,030	2,030	2,030	2,030	2,030	2,015	1,982	1,951	1,921	2,030
1,250	2,030	2,030	2,030	2,017	1,984	1,952	1,920	1,890	1,861	2,030
1,500	2,030	2,021	1,987	1,954	1,921	1,890	1,860	1,831	1,802	2,013
1,750	1,992	1,957	1,924	1,892	1,860	1,830	1,801	1,773	1,745	1,961
2,000	1,928	1,895	1,862	1,831	1,801	1,772	1,744	1,716	1,690	1,909
2,250	1,866	1,834	1,803	1,772	1,743	1,715	1,687	1,661	1,635	1,858
2,500	1,806	1,774	1,744	1,715	1,687	1,659	1,633	1,607	1,582	1,808
2,750	1,747	1,716	1,687	1,659	1,632	1,605	1,579	1,555	1,531	1,759
3,000	1,689	1,660	1,632	1,604	1,578	1,552	1,527	1,503	1,480	1,711
3,250	1,633	1,605	1,578	1,551	1,526	1,501	1,477	1,454	1,431	1,664
3,500	1,579	1,551	1,525	1,499	1,475	1,451	1,427	1,405	1,383	1,618
3,750	1,526	1,499	1,473	1,449	1,425	1,402	1,379	1,358	1,337	1,573
4,000	1,474	1,448	1,423	1,400	1,376	1,354	1,333	1,312	1,291	1,528
4,250	1,423	1,399	1,375	1,352	1,329	1,308	1,287	1,267	1,247	1,485
4,500	1,374	1,350	1,327	1,305	1,283	1,263	1,242	1,223	1,204	1,442

Cross Reference Top

Engine Arrangement

Arrangement Number	Effective Serial Number	Engineering Model	Engineering Model Version
2903313	MHB00001	PS017	-
3395408	KEN00001	PS017	-

Test Specification Data

Test Spec	Setting	Effective Serial Number	Engine Arrangement	Governor Type	Default Low Idle Speed	Default High Idle Speed
0K8521	LL6011	MHB00001	2903313	ADEM3		
0K9250	LL6076	KEN00001	3395408	ADEM3		

General Notes Top

DM8454 - 01

SOUND PRESSURE DATA FOR THIS RATING CAN BE FOUND IN PERFORMANCE NUMBER - DM8779

Supplementary Data Top

Type	Classification	Performance Number
CONVERTIBLE SECONDARY FREQUENCY	50HZ	DM8754
SOUND	SOUND PRESSURE	DM8779

Performance Parameter Reference Top

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

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

GENERATOR DATA

DECEMBER 16, 2013

For Help Desk Phone Numbers Click here

Selected Model

Engine: 3516	**Generator Frame:** 825	**Genset Rating (kW):** 1825.0	**Line Voltage:** 480
Fuel: Diesel	**Generator Arrangement:** 3123144	**Genset Rating (kVA):** 1825.0	**Phase Voltage:** 277
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 1.0	**Rated Current:** 2195.1
Duty: PRIME	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 40400 /40308 /39714 /7345

Spec Information

Generator Specification

Frame: 825 **Type:** SR4B	**No. of Bearings:** 1
Winding Type: FORM WOUND	**Flywheel:** 21.0
Connection: SERIES STAR	**Housing:** 00
Phases: 3	**No. of Leads:** 6
Poles: 4	**Wires per Lead:** 8
Sync Speed: 1800	**Generator Pitch:** 0.6667

Generator Efficiency

Per Unit Load	kW	Efficiency %
0.25	456.3	92.5
0.5	912.5	95.5
0.75	1368.8	96.3
1.0	1825.0	96.5
1.1	2007.5	96.5

Reactances	Per Unit	Ohms
SUBTRANSIENT - DIRECT AXIS X''_d	0.1077	0.0136
SUBTRANSIENT - QUADRATURE AXIS X''_q	0.0982	0.0124
TRANSIENT - SATURATED X'_d	0.1743	0.0220
SYNCHRONOUS - DIRECT AXIS X_d	2.3985	0.3028
SYNCHRONOUS - QUADRATURE AXIS X_q	1.1779	0.1487
NEGATIVE SEQUENCE X_2	0.1030	0.0130
ZERO SEQUENCE X_0	0.0063	0.0008

Time Constants	Seconds
OPEN CIRCUIT TRANSIENT - DIRECT AXIS T'_{d0}	6.6330
SHORT CIRCUIT TRANSIENT - DIRECT AXIS T'_d	0.4643
OPEN CIRCUIT SUBSTRANSIENT - DIRECT AXIS T''_{d0}	0.0074
SHORT CIRCUIT SUBSTRANSIENT - DIRECT AXIS T''_d	0.0064
OPEN CIRCUIT SUBSTRANSIENT - QUADRATURE AXIS T''_{q0}	0.0057
SHORT CIRCUIT SUBSTRANSIENT - QUADRATURE AXIS T''_q	0.0050
EXCITER TIME CONSTANT T_e	0.2225
ARMATURE SHORT CIRCUIT T_a	0.0438

Short Circuit Ratio: 0.53 | Stator Resistance = 0.0015 Ohms | Field Resistance = 1.003 Ohms

Voltage Regulation

Voltage level adustment: +/-	5.0%
Voltage regulation, steady state: +/-	0.5%
Voltage regulation with 3% speed change: +/-	0.5%
Waveform deviation line - line, no load: less than	3.0%
Telephone influence factor: less than	50

Generator Excitation

	No Load	Full Load, (rated) pf	
		Series	Parallel
Excitation voltage:	7.94 Volts	20.08 Volts	Volts
Excitation current	2.09 Amps	4.35 Amps	Amps

Selected Model

Engine: 3516 **Generator Frame:** 825 **Genset Rating (kW):** 1825.0 **Line Voltage:** 480
Fuel: Diesel **Generator Arrangement:** 3123144 **Genset Rating (kVA):** 1825.0 **Phase Voltage:** 277
Frequency: 60 **Excitation Type:** Permanent Magnet **Pwr. Factor:** 1.0 **Rated Current:** 2195.1
Duty: PRIME **Connection:** SERIES STAR **Application:** EPG **Status:** Current

Version: 40400 /40308 /39714 /7345

Generator Mechanical Information

Center of Gravity

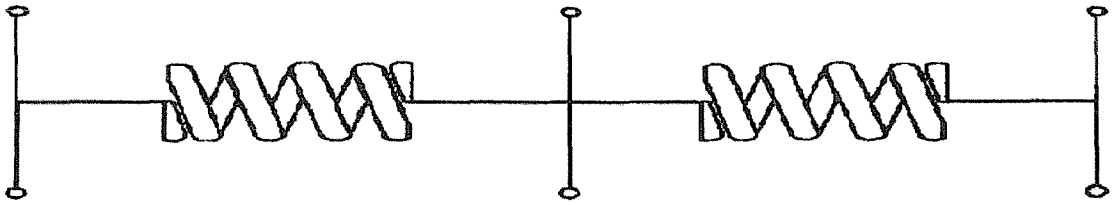
Dimension X	-906.8 mm	-35.7 IN.
Dimension Y	0.0 mm	0.0 IN.
Dimension Z	0.0 mm	0.0 IN.

- "X" is measured from driven end of generator and parallel to rotor. Towards engine fan is positive. See General Information for details
- "Y" is measured vertically from rotor center line. Up is positive.
- "Z" is measured to left and right of rotor center line. To the right is positive.

Generator WT = 4330 kg * Rotor WT = 1541 kg * Stator WT = 2789 kg
9,546 LB 3,397 LB 6,149 LB

Rotor Balance = 0.0508 mm deflection PTP
Overspeed Capacity = 150% of synchronous speed

Generator Torsional Data



J1 = Coupling and Fan **J2 = Rotor** **J3 = Exciter End**
TOTAL J = J1 + J2 + J3

K1 = Shaft Stiffness between J1 + J2 (Diameter 1)
K2 = Shaft Stiffness between J2 + J3 (Diameter 2)

J1	K1	Min Shaft Dia 1	J2	K2	Min Shaft Dia 2	J3
23.1 LB IN. s^2	265.5 MLB IN./rad	6.2 IN.	456.1 LB IN. s^2	57.5 MLB IN./rad	3.8 IN.	2.3 LB IN. s^2
2.608 N m s^2	30.0 MN m/rad	157.5 mm	51.534 N m s^2	6.5 MN m/rad	96.5 mm	0.257 N m s^2

Total J
481.5 LB IN. s^2
54.399 N m s^2

Selected Model

Engine: 3516	**Generator Frame:** 825	**Genset Rating (kW):** 1825.0	**Line Voltage:** 480
Fuel: Diesel	**Generator Arrangement:** 3123144	**Genset Rating (kVA):** 1825.0	**Phase Voltage:** 277
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 1.0	**Rated Current:** 2195.1
Duty: PRIME	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 40400 /40308 /39714 /7345

Generator Cooling Requirements - Temperature - Insulation Data

Cooling Requirements:		**Temperature Data: (Ambient 40 ^{0}C)**	
Heat Dissipated:	66.2 kW	**Stator Rise:**	80.0 ^{0}C
Air Flow:	168.0 m^3/min	**Rotor Rise:**	80.0 ^{0}C

Insulation Class: H

Insulation Reg. as shipped: 100.0 MΩ minimum at 40 ^{0}C

Thermal Limits of Generator

Frequency:	60 Hz
Line to Line Voltage:	480 Volts
B BR 80/40	1893.0 kVA
F BR -105/40	2281.0 kVA
H BR - 125/40	2500.0 kVA
F PR - 130/40	2500.0 kVA

Selected Model

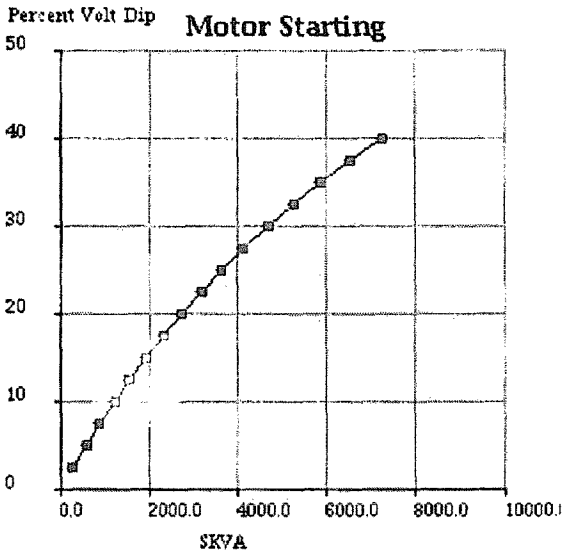
Engine: 3516 **Generator Frame:** 825 **Genset Rating (kW):** 1825.0 **Line Voltage:** 480
Fuel: Diesel **Generator Arrangement:** 3123144 **Genset Rating (kVA):** 1825.0 **Phase Voltage:** 277
Frequency: 60 **Excitation Type:** Permanent Magnet **Pwr. Factor:** 1.0 **Rated Current:** 2195.1
Duty: PRIME **Connection:** SERIES STAR **Application:** EPG **Status:** Current

Version: 40400 /40308 /39714 /7345

Starting Capability & Current Decrement

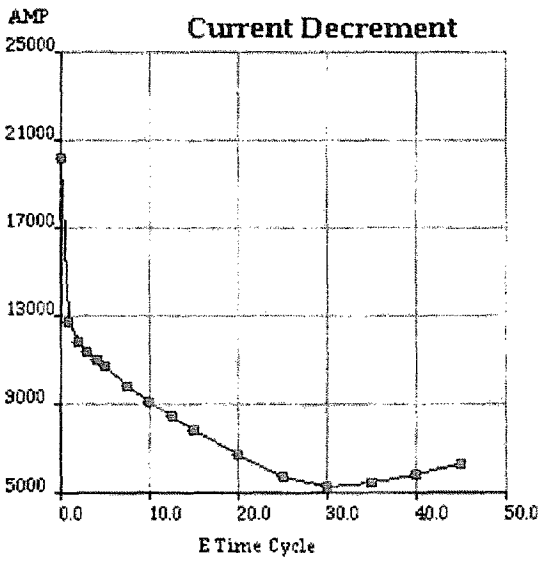
Motor Starting Capability (0.4 pf)

SKVA	Percent Volt Dip
280	2.5
574	5.0
884	7.5
1,212	10.0
1,558	12.5
1,925	15.0
2,314	17.5
2,727	20.0
3,167	22.5
3,636	25.0
4,137	27.5
4,675	30.0
5,252	32.5
5,873	35.0
6,545	37.5
7,272	40.0



Current Decrement Data

E Time Cycle	AMP
0.0	20,213
1.0	12,753
2.0	11,824
3.0	11,407
4.0	11,039
5.0	10,687
7.5	9,862
10.0	9,107
12.5	8,417
15.0	7,786
20.0	6,683
25.0	5,760
30.0	5,247
35.0	5,485
40.0	5,852
45.0	6,230



Instantaneous 3 Phase Fault Current: 20213 Amps **Instantaneous Line - Line Fault Current:** 17909 Amps
Instantaneous Line - Neutral Fault Current: 30076 Amps

Selected Model

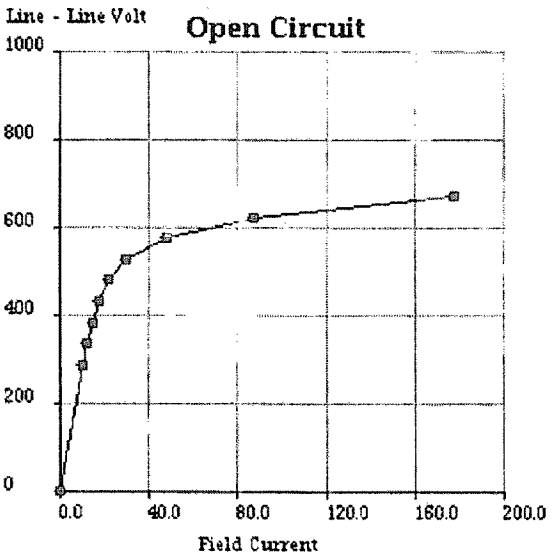
Engine: 3516	**Generator Frame:** 825	**Genset Rating (kW):** 1825.0	**Line Voltage:** 480
Fuel: Diesel	**Generator Arrangement:** 3123144	**Genset Rating (kVA):** 1825.0	**Phase Voltage:** 277
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 1.0	**Rated Current:** 2195.1
Duty: PRIME	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 40400 /40308 /39714 /7345

Generator Output Characteristic Curves

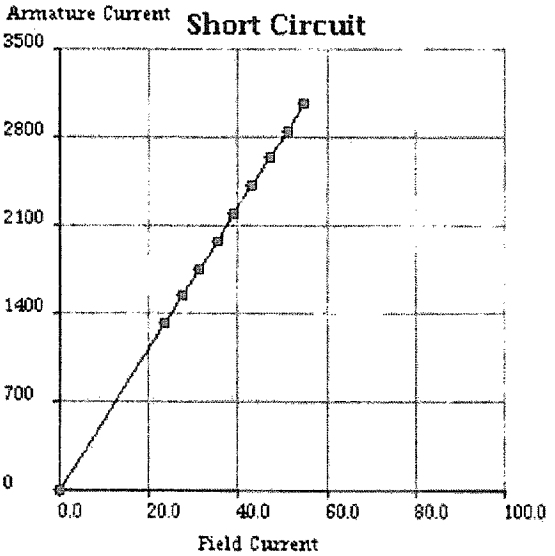
Open Circuit Curve

Field Current	Line - Line Volt
0.0	0
10.1	288
12.0	336
14.2	384
17.1	432
21.7	480
30.2	528
48.0	576
87.5	624
177.7	672



Short Circuit Curve

Field Current	Armature Current
0.0	0
23.6	1,317
27.5	1,537
31.5	1,756
35.4	1,976
39.3	2,195
43.3	2,415
47.2	2,634
51.2	2,854
55.1	3,073



Selected Model

Engine: 3516	**Generator Frame:** 825	**Genset Rating (kW):** 1825.0	**Line Voltage:** 480
Fuel: Diesel	**Generator Arrangement:** 3123144	**Genset Rating (kVA):** 1825.0	**Phase Voltage:** 277
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 1.0	**Rated Current:** 2195.1
Duty: PRIME	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 40400 /40308 /39714 /7345

General Information

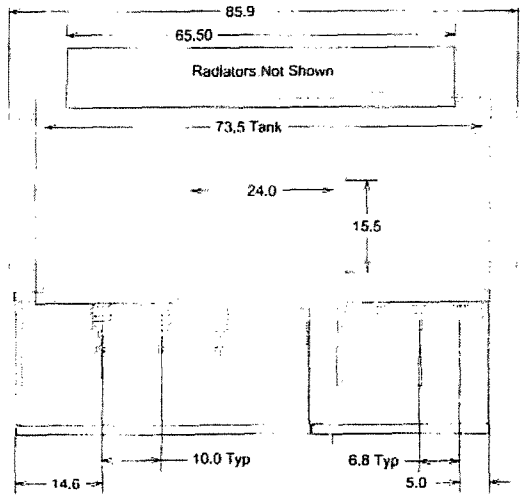
DM7824 Caterpillar SR4B Generators (50 Hz, 60 Hz)
Data for 360s, 440s, 450s, 490, 590, 660, 690, 820 and 860 frames.
Caterpillar SR4B generators built by Leroy Somer-USA(& predecessors).

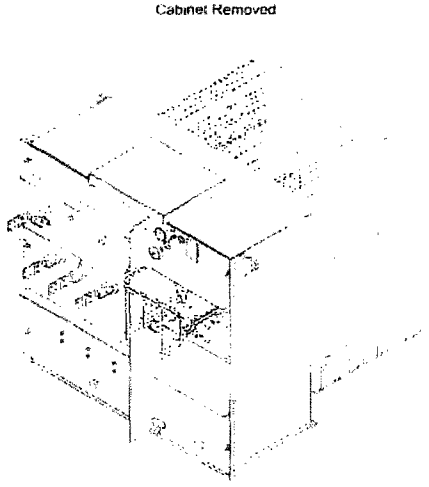
Refer to DM7821 for explanation of all generator data in Technical Marketing Information (TMI) except generator efficiency for which the explanation is given below.

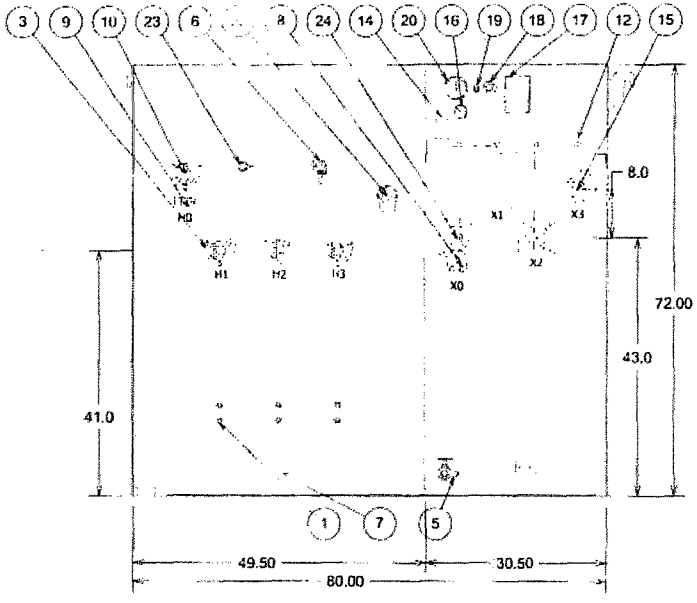
GENERATOR EFFICIENCY
Generator efficiency is the percentage of engine flywheel (or other prime mover) power that is converted into electrical output. The generator efficiency shown is calculated by the summation of all losses method, and is determined in accordance with the IEC Standard 60034. The efficiency considers only the generator. There is no consideration of engine or parasitic losses here.

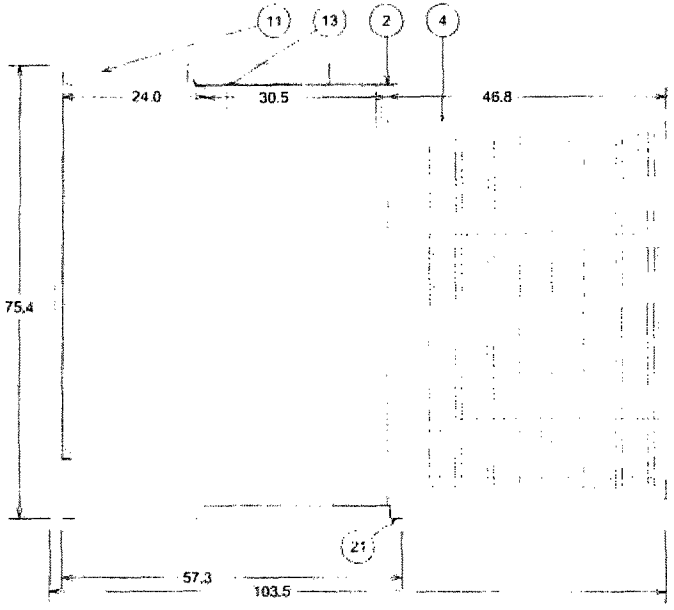
00017A66KCAA
REVISIONS

ITE	DESCRIPTION
1	Arrester Mounting Provision
2	Bolted Cover w/ Handhole w/ Lifting Eyes
3	15kV 600 Amp Porcelain HV Bushing w/ 4 Hole Spade
4	Cooling Radiators
5	Drain Valve with Sampler
6	Dual Voltage Switch
7	Ground Pad .50-13 Tap
8	Ground Strap and Pad
9	Ground Strap and Pad
10	H0 Bushing
11	High Security Cabinet w/ Pentahead Door Bolts
12	LV Bushing Support
13	Lifting Lugs
14	Liquid Temperature Gauge
15	1.2kV LV Bushing w/12 Hole Spade Supported
16	Magnetic Oil Level Gauge
17	Nameplate
18	One Inch Upper Press. Conn. and Fill Plug
19	Pressure Relief Valve
20	Pressure Vacuum Gauge
21	Tank Base w/ Jacking and Rolling Facilities
22	Tap Changer
23	Delta Wye Switch
24	X0 Bushing









3PH Padmount Transformer 60Hz
2500.0 kVA ONAN 65 AWR Oil
HV 2400/4160Y/2400X7200/XAL 95 BIL
LV 480Y/277 30 BIL
5.76 %IZ
Maximum Pad Opening 21.0 X 77.0
Munsell Green Topcoat
Mild Steel Construction

MATERIAL:

ALL DIMENSIONS ARE IN INCHES

ALL TOLERANCES UNLESS OTHERWISE SPECIFIED ARE +/- 0.25"
ANGULAR +/- 2 DEG

THIS DRAWING HAS been GENERATED FROM A 3D MODEL.

SUNBELT Transformer
1-800-433-3128
www.sunbeltusa.com

TITLE: Distribution Transformer Outline Drawing
SUBJ: Three-Phase Pad-mounted Compartmental Type

DWG:	DATE:	REF:	SHEET #	SCALE:	REV:
OCM	12/6/2012	P3D V03R01M08	1 OF 1		02

00017A66KCAA

SUNBELT Transformer

KVA	2500	65°C	60Hz
MFR SER			
CAT	00017A66KCAA		
Δ	2400D/4160Y/2400 X 7200D/12470Y/7200	ONAN	
Y	480Y/277	5.76 %IZ @85°C	MFG DATE

HV KV BIL	95
HV NEUTRAL KV BIL	95
LV KV BIL	30
HV/LV CONDUCTOR	AL / AL

PCB CONTENT LESS THAN 1 PPM AT TIME OF MANUFACTURE
CAUTION - READ INSTRUCTION MANUAL S210-17-1
TC CAN BE IN ANY POS. FOR LV OPERATION

1189608A3611-00

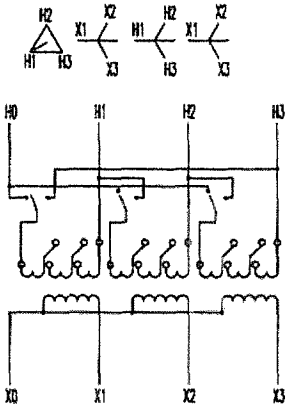
APPROX. WEIGHT IN LBS.	
CORE & COIL UNTANKING	5616
TANK & FIT	4731
FLUID: OIL GALLONS: 568	4232
TOTAL	14579

DV SWITCH POSITION	
1	2400/4160Y/2400
2	7200/12470Y/7200

DELTA-WYE SWITCH	
POS 1	DELTA
POS 2	WYE

TAP	VOLTAGE	MAX AMPS	VOLTAGE	MAX AMPS
A	8314	174	14400	100
B	7970	181	13800	105
C	7620	189	13200	109
D	7200	200	12470	116
E	6928	208	12000	120

MAX AMPS AT 2500 KVA
%IZ AT BASE KVA AND RATED VOLTAGE
STEP-UP TRANSFORMER



NOTES: 1) ACTUAL PLATE IS A NEGATIVE OF THE ABOVE DRAWING.
2) ACTUAL %IZ TO BE STAMPED IN AFTER TESTING.

NAMEPLATE MATERIAL: ALUMINUM

202892831,20

1189608A3611
REVISIONS

MATERIAL:

ALL DIMENSIONS ARE IN INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
ONE PLACE DECIMAL ± .1
TWO PLACE DECIMAL ± .06
THREE PLACE DECIMAL ± .030
* CRITICAL DIMENSION ANGULAR ±2°

SUNBELT Transformer
1-800-433-3128
www.sunbeltusa.com

TITLE: LASER NAMEPLATE
SUB: 00017A66KCAA

DWG.	DATE:	REF.	SHEET #	SCALE	REV.
OCM	12/6/2012		1 of 1	1=1	00

1189608A3611

SCHEDULE B
PURCHASING TERMS AND CONDITIONS

(This will become Schedule B to the Contract)

nalcor energy

1. GENERAL

- Time is of the essence.
- An incomplete, conditional, unbalanced, obscure, altered or irregular tender may be rejected. Tender may be rejected for failure to provide specifications or catalogue information, or both, for a product offered as an equivalent.
- Tenders shall be irrevocable for the tender validity period, and the lowest or any Tender or part thereof will not necessarily be accepted.
- Written Addenda will be used to amend or clarify tendering Specifications.
- Agreement includes Purchase Order, these Terms and Conditions, Specifications, Drawings and Vendor/Contractor's Tender, with document precedence in the order named.
- Owner means the issuer of the Purchase Order and includes its agents.
- Vendor/Contractor means the Vendor/Contractor named on the Purchase Order and includes its subcontractors and agents.
- Goods mean supply of specified manufactured articles.
- Work means supply of specified labour, equipment, materials, Goods and services.
- Work Site means all places where Work is to be performed.
- Communications and documentation shall be in English.
- Measurement units shall comply with Specifications.
- Work shall be governed by the laws of Newfoundland and Labrador and any action or proceeding arising from the Work shall be determined exclusively by a court in Newfoundland and Labrador
- Agreement binds and benefits both parties, successors and permitted assigns.

2. TENDER CLOSING AND LATE RECEIPT OF TENDERS

Tender closing time is clearly stated on the Request for Quotation form or in a tender document. Tender responses must be received prior to the closing time. Unless otherwise specified, tenders are accepted by fax. In the event that due to extenuating circumstances, such as a postal or transportation labour dispute or inclement weather, a tender is received late, the decision as to whether the tender will be accepted will be at the sole discretion of Nalcor

3. TENDER EVALUATION

a) Evaluation will be based on total analysis including, but not limited to, price, quality, delivery, Tenderer's past performance and its ability to meet Specifications, and legal, technical and financial considerations relevant to cost-effective delivery.

b) If no tender meets Specifications, tenders may be evaluated on the basis of that which most closely meets Specifications and is most cost-effective, except where not permitted by the Public Tender Act.

4. CONTRACTOR'S INVESTIGATIONS

Contractor acknowledges that it has fully informed itself in regard to the conditions of the Site and in regard to the local and other conditions affecting the performance of the Work

5. PRICING AND PAYMENT TERMS

a) Prices should be in Canadian currency, payable at par in St. John's, Newfoundland. Unless otherwise provided in Specifications, payment shall be net thirty (30) days from invoice date, subject to receipt of Goods in apparent proper working condition and free from defects.

b) Vendor/Contractor's acceptance of final payment, releases Owner from claims of and liability to Vendor/Contractor for Owner's acts, omissions or neglect.

c) Invoices shall separately identify the amounts of federal GST/HST.

6. PURCHASE ORDER CHANGES

Changes shall be made by duly authorized written Change Order.

7. GOODS AND EQUIVALENTS

a) Goods shall meet Specifications, be of standard proven contemporary design (not prototype) and be new, unless otherwise approved by Owner in writing.
b) Equivalents approved by Owner in writing are acceptable.

8. DELIVERY

Vendor/Contractor shall arrange design, manufacturing and shipping so that Goods or components thereof shall arrive at F.O.B. Point in accordance with the date stipulated. Delivery occurs when Owner signs for receipt.

9. SHIPPING AND INSURANCE

Vendor/Contractor shall adequately protect Goods against damage until delivery, and bear costs of loss or damage. Itemized packing slip shall accompany each shipment.

10. INSURANCE

Vendor/Contractor shall provide insurances as per Specifications.

11. ENVIRONMENTAL PROTECTION

Owner uses an Environmental Management System (EMS) registered to the ISO 14001 Standard. Owner has an environmental policy that commits to compliance with legal and other requirements, prevention of pollution and continual improvement. Vendor/Contractor must be aware of actual or potential impacts associated with Goods or Work provided. Vendor/Contractor shall protect the environment of the areas where the WORK is located. Work shall be subject to inspection by Owner and relevant provincial and federal governments. Specific matters relating to environmental protection shall be dealt with between Vendor/Contractor and Owner.

12. HAZARDOUS OR CONTROLLED PRODUCTS

Vendor/Contractor shall not deliver or use a hazardous or controlled product as defined by the Hazardous Products Act unless such product has a WHMIS label attached and is supplied with a Material Safety Data Sheet (MSDS). Vendor/Contractor shall inform workers of all information concerning use, storage and handling of, or working in proximity to, hazardous or controlled products.

13. PERMITS

Unless otherwise provided for in Specifications, Vendor/Contractor shall obtain and pay for all permits and licences and shall give all notices necessary or required for lawful performance of Work.

14. WORKMANSHIP

Vendor/Contractor shall employ competent and skilful workers and provide best workmanship.

15. WORKER'S COMPENSATION

If applicable, prior to starting work, Vendor/Contractor shall provide a Letter of Good Standing from the Workplace Health, Safety and Compensation Commission.

16. OCCUPATIONAL HEALTH AND SAFETY

Contractor shall comply with all occupational health and safety requirements required by Law, and the Owner's Corporate Safety and Health Program and Contractor Safety Management Program (CSMP).

17. INSPECTION AND ACCEPTANCE

Goods shall be subject to inspection and test by Owner during manufacture, if specified, and upon delivery, if specified. If Specifications are not met, Goods may be rejected and returned at Vendor/Contractor's expense.

18. TITLE AND WARRANTY

- Vendor/Contractor shall provide Owner with good and clear title to Goods and shall indemnify and save harmless OWNER from and against any and all claims, damages, loss, costs and expenses arising from any title dispute.
- Unless otherwise specified in the Specifications, Goods shall be guaranteed as to compliance with Specifications for a period of twelve (12) months following Owner's acceptance. Vendor/Contractor agrees to promptly remedy defects and deficiencies and to restore Goods to satisfactory operating condition, and including freight charges, all without cost to Owner. Restored parts of Goods shall be guaranteed for a further period equal to the original guarantee period and commencing from date of restoration. This guarantee shall be in addition to Owner's other rights.

19. PATENTS

Vendor/Contractor shall indemnify and save harmless Owner from all claims, costs and damages arising from Owner's use of Goods provided by Vendor/Contractor resulting from or contributed to by infringement, or alleged infringement, upon any patent, trademark or copyright.

20. PERFORMANCE

Vendor/Contractor shall perform Work as an independent Vendor/Contractor and not as an employee or agent of Owner.

21. SUBCONTRACTS AND ASSIGNMENTS

Vendor/Contractor shall not assign this order and shall supply Goods and render invoice, unless otherwise authorized by Owner. Vendor/Contractor shall be responsible for payment of all assessments for levies relating to WORK performed by employees, agents or subcontractors of Vendor/Contractor.

22. NO WAIVER

Agreement provisions may only be waived by Owner, in writing.

23. DUTIES AND TAXES

- Tendered prices shall include all duties and taxes except federal GST/HST. Unless otherwise provided for in Specifications, Owner will be the importer of record.
- If applicable, Non-Resident Withholding Tax will apply, unless Vendor/Contractor has provided a waiver from CCRA.

24. FORCE MAJEURE

Neither party to the contract shall be considered in default in performance of its obligations hereunder to the extent that performance of such obligations is delayed, hindered or prevented by Force Majeure. "Force Majeure" means acts of God, acts of public enemies, acts of a competent governmental authority and includes any other cause which could not have been avoided by the exercise of reasonable human foresight and skill.

25. TERMINATION

- Owner shall have the right, in its sole discretion, upon written notice to Vendor/Contractor, to terminate the contract in whole or in part without being subject to a claim for damages for such termination.
- Vendor/Contractor's obligations as to Work performed and bona fide obligations assumed prior to termination shall continue after termination; and as full compensation, Vendor/Contractor will be paid for Work performed to OWNER's satisfaction prior to termination and cancellation expenses judged necessary by Owner. Total payments shall not exceed the Contract Price.

26. MECHANICS' LIEN ACT

Prior to release of any Mechanics' Lien holdback, if required, Vendor/Contractor shall provide a Release from All Liabilities in a form acceptable to Owner.

27. CONFIDENTIALLY OF INFORMATION

During the performance of the Contract, Vendor/Contractor may have access to Confidential Information. Contractor acknowledges that Confidential Information is, as between the parties hereto, the sole and exclusive property of Owner or its Affiliates, as the case may be, and Vendor/Contractor will not make, or enable, authorize, permit or acquiesce in any other person making, any copy or abstract of any Confidential Information unless (i) such copying or abstracting is done strictly in accordance with the Contract and for the sole purpose of undertaking the Work in accordance with the Contract, or (ii) with the prior written consent of Owner.

SCHEDULE D
PAYMENT

(This will become Schedule D to the Contract)

CONTRACT TITLE: Install Holyrood Blackstart Capability

Page

Terms of Payment

P 1 General

.1 Subject always to the provision that Contractor's overall performance of the Work is in accordance with the Contract and Contractor continues to satisfy Owner that all aspects of the Work are being advanced so as to permit completion of the Work within the times set out in the Contract Documents, including approved extensions thereto, then, in the above event, and subject to Owner's approval for the Work shall be due and payable to Contractor for the amounts and at the times set out hereunder.

P 2 Submittal of Billings

.1 Contractor's progress billings shall be submitted promptly as provided herein and as agreed with Owner and shall be in such form and supported by such documentation as Owner may require to facilitate verification of the amounts billed therein. All billings shall include Contractor's registration number for the Goods and Services Tax / Harmonized Sales Tax (HST) and shall separately identify the amounts of HST, for which Contractor shall be reimbursed. Payments shall be due and payable thirty (30) days following receipt of an acceptable billing by Owner, provided that the amounts so billed are correct and properly payable under the Contract.

P 3 Delayed Payment

.1 Delay by Owner in making a payment when it becomes due and payable, shall not be deemed to be a breach of the Contract by Owner, but, except where specifically otherwise provided for, such a delay will, (if the delay continues for more than fifteen (15) days beyond the date upon which the payment is due and payable), entitle Contractor to interest on the amount overdue at the prime lending rate of the Owner's bank.

P 4 Payment for Materials

.1 Payment shall not be made in respect of Material delivered to the Site which has not been incorporated in the Work other than payments for Material ordered specifically for Change Orders approved by Owner or unless otherwise provided by Owner in the Contract Documents.

P 5 Diary Payments

.1 Payment of the tendered lump sum price for term of contract shall be made in equal monthly instalments, prorated for the number of months of the contract term within such year. Each payment shall be due and payable on the 28th of the month. Where Contractor is a Registrant under the Federal Goods and Services Tax/Harmonized Sale Tax, all invoices

shall include Contractor's Registration Number and shall separately identify the amounts of HST, for which Contractor will be reimbursed.

.2 The acceptance by Contractor of the final payment under the Contract shall operate as, and shall be, a release to Owner and its agents from any and all claim of and liability to Contractor for anything done in relation to this Contract. If required by Owner, Contractor shall, prior to final payment under this Contract, execute a Release from all Liabilities in a form acceptable to Owner.

.3 Payment shall be due and payable thirty (30) days following receipt by Owner of an acceptable billing. Where equal monthly payments apply, diary payments will be setup. Diary Payment requires that the contractor submit the first invoice to Accounts Payable. Payments for the term of the contract will be automatically generated based on the start and end date of the contract.

	Terms of Payment-		6 month lease				Additional 12 month lease		
1	XQ2000	months	6	200,000.00	1,200,000.00		12	200,000.00	2,400,000.00
2	LV Cable	months	6	41,666.67	250,000.00		12	40,000.00	480,000.00
3	Transformers	months	6	40,000.00	240,000.00				
4	freight	ls	1	350,000.00	350,000.00				
5	eingineering Service	ls	1	175,000.00	175,000.00				
6	Resistive & Reactive Load Bank	ls	1	50,000.00	50,000.00				
7	NGR's	ls	1	80,000.00	80,000.00				
8	Equipment Placement	ls	1	15,000.00	15,000.00				
9	Estimated 2 months double shift rental rate		320	1,250.00	400,000.00				
	Monthly Payment Option 1	**Total**	**6**	**393,333.33**	2,360,000.00		12	240,000.00	2,880,000.00
	Monthly Payment Option 2	**Monthly Payment**	**6**	**281,666.67**	**1,690,000.00**		**12**	**240,000.00**	**2,880,000.00**
		LS Payment	**1**	**670,000.00**	**670,000.00**				
					2,360,000.00				2,880,000.00
		Total Contract Value							5,240,000.00

Monthly Payment Option 1: Contractor agrees to 6 equal monthly payments to include items 1 thru 8 listed above.
Monthly Payment Option 2: Contractor agrees to 6 equal monthly payments for lease items 1 thru 3 listed above and a lump sum payment of one time charges items 4 thru 8 listed above.

Item 9 listed above is based on additional hours if required to be invoiced and approved as required.

SCHEDULE E
SPECIFICATIONS
(This will become Schedule E to the Contract)

CONTRACT TITLE: Supply of Diesel Generators for Holyrood Blackstart

Page

SP 1 Project Technical Conditions

Contractor shall supply and assist in the commissioning and installation of the following equipment for an eighteen month rental period

- Eight XQ2000 Diesel Generators rated at 1,825KWe, complete with a 2 ohm neutral grounding resistor.
- Eight wye - wye transformers as detailed in this technical specification
- All low voltage (480VAC and below) wiring and connectors required for operation.
- High voltage wiring, with connectors for connection to the supplied transformers.
- Resistive and Reactive Load Bank Rentals (1MW resistive and 3 MVA Load bank reactive capability) suitable for performing testing of system
- Engineering and Field Services for installation, setup, commissioning and training during set-up and commissioning
- Also required is a 50/5A relay accuracy CT and a neutral protective relay with tap range of 1A to 10A and multiple timing selection as well as a trip contact wired to the diesel generator breaker.
- Connect the eight diesel units with required low voltage control wiring as specified by Contractor for operation of the eight units.
- Connect wiring between each individual diesel unit and its transformer. Connect wires to the high side of the transformer.

After an initial 6 month rental period, the Owner may choose to rent fewer than eight units and associated equipment for the duration of the contract. Rental prices shall be adjusted at that time to reflect this change. Contractor to indicate the discount per unit removed.

The Owner may choose to purchase one or more of the diesel units and associated transformer with wiring. Based on a lease to own option as provided in Contractors proposal for each diesel unit at the site.

The Owner requires equipment delivery to site by January 17, 2014. Unit installation and commissioning shall be completed by Feb 21, 2014.

B.1 General

.1 Each mobile unit shall be supplied in a sound attenuated, standard ISO container, complete with undercarriage. Sound levels shall be in the low 70s dBA at a distance of seven metres. The package shall be designed to survive in rugged environment with minimal maintenance, supplied with lockable doors.

.2 Each mobile unit shall be serviced, tested and ready for immediate connection to Owner's power system. Standard equipment on the mobile shall include, but not be limited to air cleaner with service indicator, fuel filter with service indicator, control panel, engine running hour meter, generator with voltage regulator, radiator, electronic governor, fan and belt guards, alternator, maintenance free starting batteries c/w heavy duty charger, crankcase emissions absorber, and copies of the O&M manuals c/w AC/DC schematics for the engine and switchgear.

.3 Contractor shall arrange for the receipt, and placement (under direction of a HYDRO site representative) of each generating unit and associated equipment in final position at each site.

.4 The equipment being supplied shall be capable of operating under the following general site conditions:

(a) Outside ambient air temperature +40^{O}C to -40 ^{O}C.

(b) Maximum operating altitude 20 m above sea level;

(c) Maximum relative humidity of 100% in a sea-coast marine environment containing sulphur and salt elements;

(d) Maximum wind speed of 130 km/hr; and,

(e) The unit power rating shall be specified based on fuel as per Article C.4 – Fuel Specification of Appendix C – Genset Specifications.

Vender shall supply each engine so that it provides the rated kWe based on the worst case conditions for site, including ambient air pressure, temperature, relative humidity, and site specific fuel specifications, in accordance with ISO 3046 standards. In addition, all other critical performance data used in the calculation of ISO 3046 shall be considered.

.5 Contractor shall perform all necessary scheduled or preventive maintenance such as oil and filter changes prior to delivery.

.6 Contractor shall provide a maintenance schedule and consumables required to maintain the units during the rental period.

.7 Contractor shall have service personnel, spare parts warehouse and repair facilities in Atlantic Canada or be able to provide a comparable level of service. Inability to comply with this requirement may result in rejection of Tender.

Contractor shall have on-call service personnel stationed on the East Coast of Newfoundland and indicate a guaranteed time-to-site in response to loss of generation.

B.2 Operation and Maintenance Manuals

.1 The following typical Drawings and design data, where all dimensions shall be in mm, shall be furnished along with each copy of the Proposal:

(a) Typical outline and wiring Drawings showing overall and envelope dimensions, general plan and profile of each mobile generating unit;

(b) External connection and terminations Drawings;

(c) Control schematics (where applicable);

(d) Weights;

.2 Two weeks after receiving order, Contractor shall furnish two (2) copies of the following documents for Owner's review and acceptance, for each generating unit and associated equipment, including external switchgear and transformers:

(a) Outline and dimensional Drawings of complete enclosures and transformers indicating weights, and centre of gravity;

(b) Electrical schematic diagrams;

(c) Shipping information;

(d) External connection Details;

(e) DC circuit schematics;

(f) List of recommended site commissioning tests. Bidder shall submit an itemized list of tests to be conducted for final commissioning. This list shall reference the applicable codes and standards for such tests and be inclusive to confirm all guaranteed values of this Tender;

(g) Detailed technical literature;

(h) Any other information and Drawings in sufficient detail to enable Owner to finalize the general arrangement, placement details, bus work and schematics for the station wherein the equipment will be located and operated; and

(i) All documents described above shall be certified that the design work on these has been frozen and that these documents are applicable to this Specification.

Owner reserves the right to request additional information, Drawings or other data, deemed necessary by the Owner. Such requests shall be promptly complied with and no additional cost shall be payable for this unless such requests can be proven to be unreasonable. Owner shall reject Drawings deemed of unsuitable standard and these shall be redrawn by the Contractor within the specified schedule at no extra cost to the Owner.

.3 Contractor shall furnish two (2) copies of the Operation and Maintenance, and Service manuals with the unit(s), to be returned with units at the end of the rental period. The manuals shall include the following information:

(a) All applicable Drawings, circuit diagrams and component lists;

(b) Equipment specifications;

(c) Operating parameters;

(d) Equipment operating procedures and troubleshooting guides;

(e) Control schematics (where applicable); and,

(f) Generating unit service manual(s).

SP 2 Genset Specifications

GENSET SPECIFICATIONS

The following comprises Owners current standard of acceptance for the supply of diesel gensets. Proposals that do not meet these specifications may be rejected at Owners discretion.

C.1 Standards

Unless otherwise stated in this Specification, all diesel gensets shall be designed, manufactured, tested,

and supplied in accordance with the latest edition of all applicable codes and standards as listed. In case of any conflict between codes, between standards, or between codes and standards, such conflict shall be brought to the attention of Owner for clarification and determination.

.1 International Standard Organization (ISO)

ISO 3046/1	Reciprocating Internal Combustion Engines; Performance Part 1:Standard Reference Conditions, Declarations of Power, Fuel and Lubricating Oil Consumptions and Test Methods
ISO 3046/2	Reciprocating Internal Combustion Engines; Performance Part 2: Test Methods
ISO 3046/3	Reciprocating Internal Combustion Engines; Performance Part 3: Test Measurements
ISO 3046/4	Reciprocating Internal Combustion Engines; Performance Part 4: Speed Governing
ISO 3046/5	Reciprocating Internal Combustion Engines; Performance Part 5: Torsional Vibrations
ISO 3046/6	Reciprocating Internal Combustion Engines; Performance Part 6: Overspeed Protection
ISO 3046/7	Reciprocating Internal Combustion Engines; Performance Part 7: Codes for Engine Power
ISO 9001	Quality Systems; Model for Quality Assurance in Design, Development, Production, Installation and Servicing

.2 Canadian Standards Association (CSA)

CSA C22.1	Canadian Electrical Code Part 1
CSA C22.2 No.0.4	Bonding and Grounding of Electrical Equipment
CSA C22.2 No.41	Grounding and Bonding Equipment
CSA C22.2 No.100	Motors and Generators
CSA C22.2 No.127	Equipment Wires

.3 American National Standards Institute (ANSI)

ANSI/IEEE C37	Circuit Breakers, Switchgear, Relays and Fuses
ANSI/IEEE STD.112	Standard Test Procedure for Polyphase Induction Motors and Generators
ANSI/IEEE C50.13	Requirements for Synchronous Generators

.4 American Society for Testing and Materials (ASTM)

D 240-76	Test for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter

C.2 Engine and Skid

.1 Engine

Each engine shall be a heavy duty compression ignition type operating at 1200 or 1800 rpm and delivering an ISO power as specified. Each engine shall be turbocharged and aftercooled.

The scope of supply for each unit shall include the equipment as listed below and any other

accessories normally provided or required for the safe, reliable and environmentally compliant operation of each generating unit:

(a) Four cycle, heavy duty, cold start compression ignition engine c/w auxiliaries, to run on No. 2 diesel fuel;

(b) AC synchronous generator, 60 Hz star winding configuration with a Permanent Magnet Generator (PMG) providing power for the automatic voltage regulator;

(c) Engine protective devices as specified in Appendix D - Protection and Control;

.2 General Features

Each generating unit shall be equipped with the following features and auxiliary equipment:

(a) Crank case emission absorber(s) that shall drain all recovered oil back to the engine sump and prevent the release of gaseous emissions to the environment;

(b) Air intake filter(s), heavy duty dry type with replaceable filter element(s) and indicator(s) to show when filter element changes are required;

(c) Individual electronically governed fuel injection system;

(d) Local instrument panel displaying fuel pressure, lube oil pressure, and jacket water temperature;

(e) Fuel priming pump on fuel system inlet to prime generating unit after servicing;

C.3 Fuel Supply System

Each engine fuel supply system shall include:

(a) UL/ULC listed, double walled, internal day tank with sufficient capacity to provide eight hours of operation at 100% load. Day tank shall have access for filling both inside and outside the container and provide for filling from outside while the genset is in operation. The fill pipes shall be a minimum of two inches in diameter to accept a standard tank truck hose nozzle.

(b) Engine mounted, engine driven fuel pump, built-in type, equipped with a pressure operated bypass valve.

(c) Fuel filter housing(s) equipped with a pressure operated bypass valve, provisions for bleeding and purging fuel system.

(d) Suitable protection in all areas where leaking fuel could come into contact with a surface temperature of 150 °C or higher.

C.4 Fuel Specification

Each engine shall be suitable for the continuous use of No. 2 diesel fuel as specified in National Standard of Canada, CAN/CGSB-3.517-2007.

C.5 Engine Sound and Power Levels

(a) Sound power levels exterior to the enclosure shall be in the low 70s dBA at a distance of seven metres.

C.6 Synchronous Generator

(a) Each AC synchronous generator shall be continuous prime power duty at the kWe unit rating specified, 60 Hz., 0.8 pf., 3-phase, 4-wire and designed for ungrounded or grounded system operation. It shall have a minimum efficiency of 94% at 0.9 P.F. for the load range 50% to 100% of nameplate rating and an overload capability of 10% for two (2) hours.

(b) Each generator shall be open drip-proof, permanently lubricated two bearing design. Each generator shall be coupled to the diesel engine housing using a standard SAE adaptor, and to the flywheel using a flexible coupling (less pilot shaft).

(c) Each generator shall be a brushless design with full damper windings for parallel operation with other diesel generating units.

(d) Each generator shall be capable of continuous operation with a 30% load unbalance between highest and lowest phases without exceeding the allowable temperature rise, causing any harmful vibration, or inducing the generation of harmonic voltages.

(e) Each generator terminal box shall be provided with insulated bus bars for each phase and neutral connection. Generator leads shall have heavy-duty compression type connectors securely bolted to the bus bar. Each bus bar shall be of sufficient size to accommodate the Owner's power cable connections (standard 2-bolt NEMA type). The star point of each generator shall connect to the neutral bus bar and not be grounded prior to this point. Exciter field leads shall terminate in the engine junction box as per the drawings.

(f) Each exciter shall be direct coupled to the generator shaft. Each exciter shall be of an approved brushless type compatible with the Basler SSR automatic voltage regulator.

(g) Each generator design shall incorporate a single phase PMG pilot exciter. The PMG exciter shall provide AC input power to the automatic voltage regulator to maintain alternator voltage out to 200% load and 300% or more short circuit current. The PMG voltage shall be of such value that the automatic voltage regulator output can drive the generator exciter to its ceiling voltage, or saturation voltage.

(h) Include at 2ohm neutral grounding resistor on the generator.

C.7 Protection and Control

Protection and control shall comply with Appendix D.

SP 3 Protection and Control Specifications

PROTECTION AND CONTROL SPECIFICATIONS

D.1 P&C: GENSET SPECIFICATIONS

The protection and control design guidelines for a prime power diesel fuelled, generating unit takes into account all critical electrical and mechanical operating conditions and sets alarm and trip points above normal engine and generator parameters. The type of automatic control and monitoring implemented is based on HYDRO's standard equipment designs, including approved equipment types and manufacturers.

.1 PURPOSE

The purpose of the standard is to provide minimum acceptable protection and control design guidelines for a prime power diesel fuelled generating unit with a nominal voltage rating of either 480V, 600V or 4160 volts.

.2 SCOPE

This standard covers the operational aspects of the engine and switchgear units as well as their complementary control schemes such as start up and synchronizing and the requirements of the DC system as it applies to individual generating units.

.3 ENGINE PROTECTION

The engine shall be protected with both primary as well as secondary backup protection systems.

.3.1 Primary Protection System

The primary engine protection system shall utilize the engine manufacturer's standard protection devices and shall comprise the following minimum equipment, hard wired to the unit start and stop circuits:

(1) High Jacket Water Temperature Sensor
(2) Lubricating Oil Pressure Sensor
(3) Low Coolant Level Sensor
(4) Engine Speed Sensor
(5) Combustion air intake shut off valve(s)

Note: Spare auxiliary Form C contacts shall also be available for the first three (3) engine sensor devices listed above.

.3.2 Secondary Backup Protection System

The secondary backup engine protection system shall utilize analog 4-20 ma transmitters, resistance temperature detectors (RTDs), thermocouple(s) and discrete inputs wired to a programmable electronic controller. This system will provide the secondary backup engine protection while giving the operator enhanced engine information and diagnostics. This system comprises the following minimum equipment, hard wired to the programmable electronic controller I/O:

(1) Coolant Temperature Sensor c/w Transmitter (engine jacket)
(2) Coolant Temperature Sensor c/w Transmitter (engine inlet)
(3) Coolant Level Sensor (discrete)
(4) Exhaust Gas Temperature Thermocouple Sensor c/w Transmitter
(5) Lubricating Oil Pressure Transducer
(6) Fuel Pressure Transducer
(7) Turbo Boost Pressure Transducer (if applicable)
(8) Engine Speed Sensor (flywheel)

These sensor inputs will be processed by the programmable electronic controller which in turn provides a single contact closure output to the engine trip and lockout circuits.

.3.3 Starting System

An electric starting system shall include an engine mounted 24 VDC electric starting motor c/w heavy duty electric starter solenoid interwired to the engine start circuit. The starting circuit shall be de-energized via a speed switch when the engine has started and via a timer in the event of over cranking i.e. failure of the engine to start. For an engine with a pneumatic starting system a 24 VDC solenoid shall be provided. Oil pressure sensing will be disabled until the unit has reached crank disconnect speed, which shall be 33 % of rated speed.

.3.4 Governing System

The governing system shall consist of a proportional control actuator or electronic fuel control installed on the engine, as well as an electronic load sharing and/or speed control device installed in the switchgear control panel. The following auxiliary devices, necessary to make the governing system function in parallel with other units shall be supplied:

(1) Dedicated speed sensor
(2) Metering accuracy current transformers (CTs)
(3) Metering accuracy potential transformers (PTs)
(4) Idle/Rated speed control switch
(5) Droop/Isochronous control switch

.3.5 Engine Control System

The engine-mounted control system shall contain the following equipment:

(1) Local Emergency Stop Pushbutton
(2) Local Start Pushbutton

(3) Local Stop Pushbutton

Note: The term 'Local' refers to a control function at the engine location.

.4 GENERATOR PROTECTION

.4.1 Winding Temperature

The generator shall have two (2) temperature sensing devices installed on each stator phase winding.

.4.2 Voltage Regulation

One (1) automatic voltage regulator (AVR) shall be installed in the switchgear control panel. Power for the AVR shall be supplied by a permanent magnet generator, which shall be a single phase design rated 700 VA (min.), 120 V, 120 Hz. (max.). The voltage regulator shall utilize either droop or cross current compensation circuits for parallel operation of two (2) or more units. A multi-turn potentiometer shall be provided at the switchgear control panel for voltage adjust.

.5 SWITCHGEAR CONTROL PANEL

The front of the switchgear control panel shall have two (2) compartments, one at the top with a hinged door for the protection, metering and control devices and wiring, and another at the bottom, also with a hinged door, for a drawout type circuit breaker and PTs. The rear compartment, accessible via a removable plate, shall contain insulated bus bars, and the CTs.

.5.1 Digital Metering Unit

The digital metering unit shall be a multi-function device, semi-flush mounted and located on the top panel door. The power parameters displayed by the digital metering unit shall include but not be limited to AC amps, volts, frequency, watts, vars, power factor, KWH, and kW demand.

An elapsed time meter, as well as DC ammeter and voltmeter are individual metering devices which shall also be mounted on the top panel door.

.5.2 Control Switches

Control switches shall be provided for the following operating duty:

(1) Governor Mode (Droop/Isoch)
(2) Engine Speed Mode (Idle/Rated)
(3) Breaker Control (Trip/Close)
(4) Synchronizing Mode (Auto/Manual)
(5) Supervisory Control (Manual/PLC) (if applicable)
(6) Engine Start Push Button
(7) Engine Stop Push Button
(8) Emergency Stop Push Button

.5.3 Annunciation System

A hard wired annunciation system shall be provided.

.5.4 Unit Breaker

A drawout type air circuit breaker shall be provided complete with the following minimum design features:

(1) Motor mechanism for spring charging.
(2) DC closing solenoid for electrical closing.
(3) DC trip solenoid for electrical tripping.
(4) Four (4) spare sets of 'a' and 'b' breaker auxiliary contacts.
(5) Anti-pumping feature.
(6) Safety shutters and arc chute covers.
(7) Terminal shield and interphase barriers.
(8) Trip free opening feature.
(9) Lock out preventing closing feature.
(10)Open and close pushbuttons for manual operation.

Horizontal breaker terminals, both top & bottom shall also be provided to enable the extension of these terminals using high voltage insulated bus bars.

.5.5 Protective Relay

A multi-function protective relay mounted on the unit control panel door shall provide the following unit protection:

(1) Reverse Power
(2) 3-Phase Overcurrent c/w selectable trip curves
(3) Undervoltage and Overvoltage
(4) Underfrequency and Overfrequency
(5) Synchronizing Check c/w dead bus feature
(6) Generator Excitation
(7) Generator Differential (if applicable)

All unit protection parameters listed above would trip the unit breaker, except for the generator differential which would trip the unit breaker and shut down the engine.

.5.6 Current and Potential Transformers

All current and potential transformers shall be mounted in the switchgear control panel, except for those required for generator differential protection which would be mounted in the generator connection box.

The current transformer (CT) ratio chosen shall provide adequate secondary current for unit control panel electrical devices. All CTs shall be of metering accuracy and have a nominal secondary rating of 5 amps.

CTs shall be provided in the switchgear control panel for the following electrical devices and functions:

(1) Automatic voltage regulator cross current compensation
(2) Electronic governor or load sharing module
(3) Digital metering
(4) Protective relay

The potential transformer (PT) primary rating chosen shall provide a nominal secondary voltage of 120 volts for control panel electrical devices. All PT's shall be of metering accuracy and sized according to the connected burden.

PT's shall be provided in the switchgear control panel for the following electronic devices:

(1) Automatic Voltage Regulator
(2) Electronic Governor or Load Sharing Module
(3) Digital Metering
(4) Protective Relay
(5) Automatic Synchronizer
(6) Synchroscope

.5.7 Synchronizing

Diesel unit synchronizing shall be provided by an automatic synchronizer mounted in the unit control panel and is interwired to the electronic governor or load sharing module. The automatic synchronizer shall also have a system check feature for troubleshooting purposes.

The synchronizing check including dead bus feature of the multi-function protective relay shall be used for verification of all synchronizing control which includes manual closure of the unit breaker under dead bus conditions.

Each diesel generator shall be able to synchronize with the grid, or another diesel generator supplied as part of this contract.

.5.8 Programmable Electronic Controller

A programmable electronic controller c/w digital display shall be provided at the switchgear control panel to monitor and display the various discrete and analog sensing points on the diesel generating unit. The controller shall provide programmable output contacts for alarm and trip functions including annunciation.

All programmable controller alarm and trip functions shall be considered as secondary backup protection to the engine manufacturer's analog and/or discrete sensing devices, which provide primary engine protection.

.6 UNIT DC SYSTEM

The unit DC system shall comprise of the following minimum components:

(1) A wall mounted battery charger of sufficient capacity to charge the 24 VDC diesel engine starting batteries.

(2) A set of maintenance free batteries with sufficient capacity to handle all starting, and associated unit control circuits.

The unit DC system shall provide sufficient capacity for engine cranking during multiple start attempts, as well as a regulated DC supply for the control equipment in the switchgear control panel.

D.2 P&C: SWITCHGEAR SET SPECIFICATIONS

The switchgear set, transformer and breaker combination set to be used in conjunction with the generator set shall conform to the following specifications in addition to other requirements as noted on the applicable electrical reference drawing.

.1 Switchgear Cabinet

All equipment shall be total enclosed with no energized equipment exposed including bushings.

The cabinet shall be weather proof with lockable hinged doors. HV and LV cable entry shall be through the bottom.

It shall conform to CSA standards.

.2 Transformer

The transformer shall be sized to accommodate the capacity of the generating unit and meet the voltage and winding configuration as specified on the drawings

D.3 P&C: REFERENCES

.1 REFERENCE DRAWING

Equipment configuration shall conform to Figure D-1 "Mobile Diesel Generating Unit and Switchgear – Single Line Protection Diagram" Dwg # DG-14-002-D1

.2 REFERENCE STANDARD

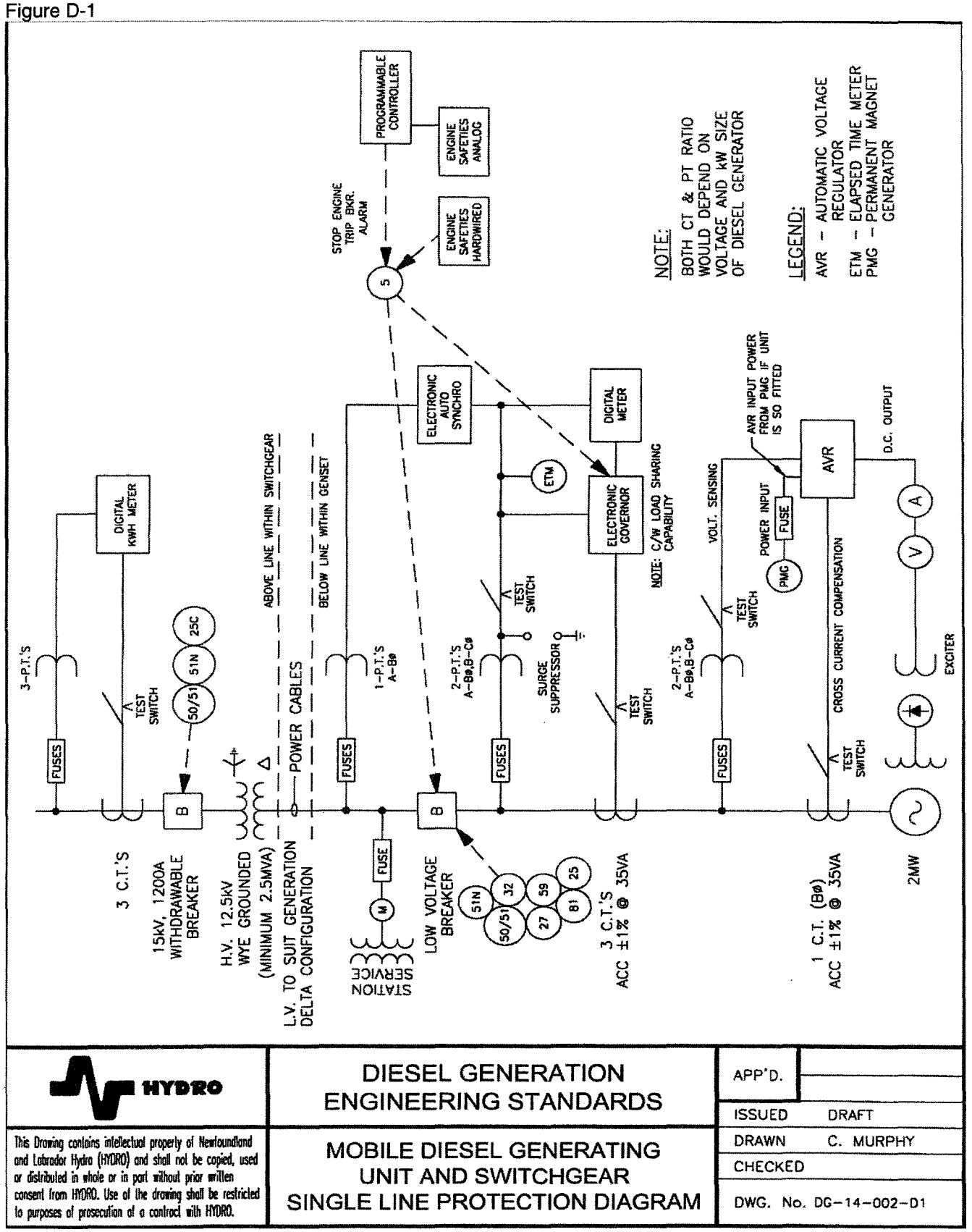
Unless otherwise stated in this Specification, all equipment shall be designed, manufactured, tested, and supplied in accordance with the latest edition of all applicable codes and standards as listed. In case of any conflict between codes, between standards, or between codes and standards, such conflict shall be brought to the attention of Owner for clarification and determination.

.2.1 Recognized Standards Organizations

CSA - Canadian Standards Association
EEMAC - Electrical Equipment Manufacturers Association of Canada
ANSI - American National Standards Institute
NEMA - National Electrical Manufacturers Association
IEC - International Electromechanical Commission

In case of conflict between CSA and other standards, CSA shall prevail.

Figure D-1



HYDRO	DIESEL GENERATION ENGINEERING STANDARDS	APP'D.
		ISSUED DRAFT
This Drawing contains intellectual property of Newfoundland and Labrador Hydro (HYDRO) and shall not be copied, used or distributed in whole or in part without prior written consent from HYDRO. Use of the drawing shall be restricted to purposes of prosecution of a contract with HYDRO.	MOBILE DIESEL GENERATING UNIT AND SWITCHGEAR SINGLE LINE PROTECTION DIAGRAM	DRAWN C. MURPHY
		CHECKED
		DWG. No. DG-14-002-D1

SP 4 Transformer Specification

Each generating until will include a padmount transformer located outside and behind the diesel unit. Pad mount transformers PAD1283-S and PAD1289-S are acceptable solutions with the following general specifications:

Configuration wye – wye
Primary Voltage: 480V
Secondary Voltage: 4160V
Impedance: 5% – 6%

Any other padmount transformer must be approved by the Owner prior to acceptance.

Contractor will supply appropriately rated cables and terminations for cables leading from the Diesel generators to the 480V side of the padmount transformers. Contractor will supply appropriately rated cables to connect from the 4160V side of the transformer to the riser pole. These cables must be a minimum of 60' long. Contractor to supply the connections from the cables to the 4160V side of the transformer.

SP 5 Information to be Supplied With Bid

INFORMATION TO BE SUPPLIED WITH BID

E.1 TECHNICAL PARTICULARS

Bidder shall submit Drawings and design data as per Article B.2.1 of Appendix B – General Conditions with each copy of its Proposal. It shall also give details of the equipment it proposes to supply, including, but not limited to, the following data.

.1 Reference Users

The Bidder shall demonstrate previous proven experience in Canada. Each tendered generating set or identical model shall have been installed in Canada and operated at the design and operating requirements as specified in this Specification. Bidder shall submit details listing for whom each unit was supplied, the date it was supplied and a contact person.

_____

_____

_____

_____

_____

_____

.2 **Servicing of Equipment**

Location of nearest service personnel and facilities _____

.3 **Equipment Data**

Bidder shall complete all of the following equipment data, for each generating unit rating tendered:

(a)Exhaust flow (100%NPR) _____ m^3/min

(b)Exhaust gas temperature at exhaust manifold exit as follows:

25% of engine NPR _____ °C
50% of engine NPR _____ °C
75% of engine NPR _____ °C
100% of engine NPR _____ °C

(c)Engine emission data as follows:

Engine Load	25%NPR	50% NPR	75% NPR	100% NPR	
Exhaust Flow Rate					m^3/min
Exhaust Mass					kg/hr
Carbon Monoxide (CO)					g/hr
Carbon Dioxide (CO_2)					g/hr
NO + $N0_2$ (NO_x)					g/hr
Sulphur Dioxide (SO_2)					g/hr
Particulate					g/hr
Carbon in Particulate					%

(d)Load Pick Up

(i) Load pick up capability in % of NPR with a maximum 2% engine speed decrease

%

(ii) If load pick up must be staged, the following are the % loads which shall be applied to the unit at five (5) second intervals.

First load pick up _____ %
Second load pick up _____ %
Third load pick up _____ %
Fourth load pick up _____ %

(e)Generator Data as follows:

(i) Manufacturer _____

(ii) Rated Full Load Current _____ A

(iii) Exciter Field Resistance _____ Ω

(iv) Excitation Current at No Load _____ A

(v) Excitation Voltage at No Load _____ V

(vi) Excitation Current at Full Load (0.8 pf) _____ A

(vii) Excitation Voltage at Full Load (0.8 pf) _____ V

(viii) PMG Output Frequency _____ Hz

(ix) PMG Output Voltage

V

(x) Generator efficiency as follows:

25% of engine NPR _____ %
50% of engine NPR _____ %
75% of engine NPR _____ %
100% of engine NPR _____ %

(xi) Generator Load Losses as follows:

25% of engine NPR _____ W
50% of engine NPR _____ W
75% of engine NPR _____ W
100% of engine NPR _____ W

(xii) Generator P.U. reactances as follows:

Direct axis saturated synchronous (X_d) _____ p.u.
Direct axis transient (X_d') _____ p.u.
Direct axis sub-transient (X_d'') _____ p.u.
Leakage (X_1) _____ p.u.
Negative sequence (X_2) _____ p.u.
Zero sequence (X_0) _____ p.u.

(f)Switchgear and Transformer Data

Fault Current Rating _____ MVA
Continuous Current Rating _____ A
Winding Configuration HV _____
Winding Configuration LV _____
Voltage Rating HV _____ kV
Voltage Rating LV _____ kV

E.2 SCHEDULE

For each event below the dates entered by the Bidder in Column 2 shall agree with the dates required by Owner Column 1. These shall be subsequently agreed to by the Owner, and become the approved schedule. This schedule shall be submitted for each proposal.

EVENT	DATE REQUIRED BY OWNER	DATE CONFIRMED BY CONTRACTOR
Delivery of equipment to Holyrood Thermal Plant	Jan 17, 2014	_____
Installation and commissioning of equipment.	Feb 21, 2014	_____

Failure to guarantee or meet delivery dates outlined may result in rejection of bid.

E.3 GUARANTEES

Bidder shall provide the following performance data.

These values shall be guaranteed under the specified operating conditions and shall be binding on Contractor. Cost data shall be consistent with prices being charged Contractor in the current calendar year. Inconsistencies may result in rejection of proposal.

.1 Performance Data

(a) Prime ISO Power Rating at 0.8 P.F. _____ kWe

(b) Overload Power Rating at 0.8 P.F. _____ kWe

(c) All fuel performance guarantees are based on specified fuel as per Article C.4 - Fuel Specification of Appendix C – Genset Specifications ___ YES ___ NO

(d) Lower Heating Value of Fuel on which the Specific Fuel Consumption values are based _____ kJ/kg

(e) Guaranteed Specific Fuel Consumptions, corrected to standard ISO conditions at 0.8 P.F:

25% of engine NPR	_____ g/kWhe
50% of engine NPR	_____ g/kWhe
75% of engine NPR	_____ g/kWhe
100% of engine NPR	_____ g/kWhe

(f) Engine light loading capability as follows:

Minimum recommended light load _____ kWe
Duration light load can be applied_____ hrs

.2 **Technical Support**

Location of on-call technical support _____
Guaranteed emergency response time-to-site Holyrood _____hrs

SP 6 Additional Work

.1 Scope

Contractor shall supply:

- Engineering and Field Service
- The cable rental will be for the low voltage cable and the high voltage cable based on 60ft runs. The cable will be installed by Hydro
- Resistive and Reactive Load Bank Rentals for performing testing of system

Additional Work to be done under this Clause SP 4 shall comprise the supply of all labour, construction plant and materials and the performance of all Work not included in scope of Contract but deemed necessary for completion of the Project.

.2 General

The Contractor shall notify the Owner of any additional Work required. All, if any, Work shall be performed as directed and scheduled by Owner. Cost of such Work shall be considered during Tender Evaluation.

Scope of Work shall be agreed upon by Contractor and Owner or Owner's site representative. The Contractor shall submit copies of material pricing, labor and rental rates to the Owner to substantiate the cost of additional Work.

SP 7 Drawings

.1 Contractor shall perform the Work in strict accordance with Drawings.

.2 Drawings shall be referenced by a Drawing and revision number.

.3 Contractor's and Manufacturer's Drawings and revisions thereof shall be subject to review by Owner. Such review shall in no respect relieve Contractor of its responsibility and liability under the Contract. Fabrication, shipping or erection of Material and Construction Plant or any parts thereof shall not start prior to Owner's review of such Drawings.

.4 Drawings bearing reference to the Project or Owner shall not be used by Contractor for any other purpose without prior written approval of Owner.

.5 Owner, in its sole discretion, may make reasonable use or reuse of Drawings as required in Owner interest.

.6 Contractor shall supply Drawings as follows:

(a) by email in the latest version of AutoCad (.dwg extension).
(b) by email – PDF files must be stamped and signed by engineer.
(c) Original paper drawings must be stamped and signed by engineer.

Drawings shall be in B1 or A1 size formats with a minimum character height of 2 mm.

.7 Contractor shall submit Drawings for review by Owner in accordance with the Approved Construction Schedule and, where required, the APEGN Act, RSNL 1990, Chapter E-12, as amended.

.8 Drawings shall be provided for, but not be limited to, the following:

(a) parts embedded in concrete;
(b) parts to be connected to equipment supplied by others;
(c) piping;
(d) wiring diagrams;
(e) parts in which adjustment has been allowed or which are subject to wear;
(f) assemblies showing plans and cross sections of the complete equipment components being supplied;
(g) erection and lifting devices;
(h) layout and dimensional Drawings;
(i) bills of materials;
(j) characteristic curves, such as
    i. curves;
    ii. current transformer magnetization curves; and
    iii. similar performance curves for equipment.

.9 Details on Drawings and Data shall be sufficient to allow Owner to independently assess performance of all parts. Such details shall include, but not be limited to, material designations, welding specifications, part numbers, dimensions, fits, tolerances and surface finishes for all machined parts.

.10 Contractor shall allow fifteen (15) working days (from date of receipt to date of return dispatch) for Owner to advise Contractor of review results.

.11 Contractor shall, upon receipt of review comments, promptly modify and resubmit or issue Drawings as required. Modification and resubmission shall continue until such time as Contractor is advised that review is complete.

.12 Owner's review shall not relieve Contractor of any contractual responsibilities.

.13 Two weeks prior to shipping, Contractor shall forward one (1) complete set of the latest revisions of related Drawings.

.14 After Commissioning Acceptance, Contractor shall forward one (1) complete set of Drawings, stamped "Final - As Built", which incorporate modifications made during erection, commissioning and testing.

.15 Contractor's Drawings shall be clearly marked as follows:

(a) NEWFOUNDLAND AND LABRADOR HYDRO

(b) **Install Holyrood Blackstart Capability**

(c) The title block of all Drawings shall have the following information clearly indicated:
   i. description of Drawing content;
   ii. name of major equipment or system of which Drawing content is part;
   iii. Contractor's Drawing number;
   iv. revision number and date of revision;
   v. date drawn;
   vi. Owner's Drawing number from list forwarded to Contractor by Owner.

.16 Schematic and wiring diagrams shall use ANSI standard drafting symbols and ANSI device function designation systems.

.17 Drawings shall enable Owner to prepare and organize interfacing with the work of its own, or other contractors', forces.

DRAWINGS

PREAMBLE

The Work shall be carried out in accordance with the Drawings listed below and any additional Drawings issued at a later date by Owner.

All Drawings are marked "For Tender Purposes Only" to identify them as Tender Drawings. The listed Drawings will be "Approved for Construction" and issued to Contractor within two (2) weeks of the acceptance of the Tender.

"Approved for Construction" Drawings may be revised by Owner during the progress of the Work to incorporate changes to design detail.

List of Drawings

Drawing No.	Title	Revision Number	Date