

GPS Stock Project 2016



Technical Specification

and

Scope of Supply

**MTU 12V2000 DS800
DG12V2000A3N**

MTU Project: 390211083



Selection Criteria for the Scope of Supply

<i>Criteria</i>	<i>Selection</i>	<i>for Product No.</i>
Frequency	60 Hz	1,
Voltage for starters	480 V	1,
Phase	3 Phase	1,
Unit Specification	UL2200	1,
Temp Rise	130°	1,
Power Output	800 kW	1,
Exhaust Emissions (EPA)	EPA Tier 2	1,
Radiator Design Temperature	50°C	1,
Circuit Breaker Options	Single Circuit Breaker	1,
Breaker Wire Color Scheme	Standard Breaker Wire Color Scheme	1,
Control Panel	With Control Panel	1,
Paralleling	No Paralleling Operation	1,
OPU/HSD	Weatherproof Enclosure	1,
Fuel Tank	with tank	1,
Acceptance testing	Factory Acceptance Testing	1,
Publications	Standard Publications (English)	1,
Country of operation / Flag state	USA / Canada	1,



Scope of Supply

	valid for product no.
1 SYSTEM CONFIGURATION	1,
1.1 System Description	1,
Model: DG12V2000A3N	1,
Application 60 Hz Standby	1,
1.2 Cooling Package	1,
50 Deg C Cooling System	1,
<ul style="list-style-type: none"> • Closed loop, liquid cooled, with radiator factory mounted on engine-generator set mounting frame and integral engine-driven coolant pump 	
1.3 Circuit Breaker	1,
Single Circuit Breaker	1,
Standard Circuit Breaker	1,
1200 Amp 3 Pole 100% CB Powerbreak SSF16G216	1,
Circuit Breaker Accessories	1,
ENTELEGUARD TRIP UNIT: GB216L5XXXFXXXX - GROUND FAULT INDICATION ONLY	
CB Auxiliary Switch 1200-4000A 100% Powerbreak	1,
CB Shunt Trip 1200-4000A 24V 100% Powerbreak	1,
Circuit Breaker Factory Mounted	1,
Circuit Breaker Mounted Right Side	1,
Standard breaker wire scheme:	1,
<ul style="list-style-type: none"> • Phase 1 (A) is Black label "L1" • Phase 2 (B) is Red label "L2" • Phase 3 (C) is Blue label "L3" • Neutral is White label "NEU" 	
1.4 Starting Aids	1,
Battery Rack Only	1,
<ul style="list-style-type: none"> • Shipped with Battery Rack only (no battery included) 	
Battery Charger: NRG 22-20-RCLS	1,
Battery Charger Mounted & DC Wired	1,
Block Heater	1,
20 Deg F Block Heater (208V 1PH - 6000W)	



valid for
product no.

Model: CSM10608-000

1.5	Genset Enclosure	1,
	Weather Proof Enclosure	1,
	Steel with Internal Exhaust	1,
	Weather Proof Sound Attenuation	1,
	AC Interior Lights	1,
1.6	Vibration Isolation	1,
	Pad Isolators	1,
2	ENGINE CONFIGURATION	1,
2.1	Engine System	1,
	EPA Certification Tier Level: Tier 2	1,
	Engine Model: MTU 12V2000	1,
	Note Emission Compliance	1,
	– Please note that the engines and systems (only) comply with the country or region specific emission requirements and have appropriate emission certification(s) which are explicitly stated in respective RRPS/MTU defined technical specifications. Any Export / Import / Operation of the engine in countries or regions with different applicable emission law requirements is therefore at your own responsibility	
2.2	Exhaust System	1,
	Internal Critical Grade Silencer	1,
2.3	FUEL SYSTEM	1,
	24 Hr/1390 Gallon Extended Fuel Tank W Stub-Up	1,
	Fuel Water Separator Single (Wire-Braid Reinforced Hose)	1,
2.4	Air Intake System	1,
	Air Filter (Standard)	1,
3	GENERATOR CONFIGURATION	1,
3.1	Generator Specification	1,
	4 Wire	1,
	Generator Model Number: 574/4038	1,
3.2	Generator accessories	1,
	PMG Standard	1,



valid for
product no.

4	CONTROL PANEL CONFIGURATION	1,
4.1	Control panel	1,
	MGC-2020 Control Panel	1,
	Control Panel Mounted Left Side	1,
	Control Panel Mounted Left Side	1,
	High Fuel Level Pre-Alarm	1,
	Critical Low Fuel Level Alarm	1,
	(4) Relay Option	1,
	<ul style="list-style-type: none"> • The 4-relay board includes (4) 10 amp form C relays customizable for user defined functionality requirements. Standard outputs as follows: <ol style="list-style-type: none"> 1. Engine Run 2. Engine Fail 3. Minor Alarm 4. Spare 	
	Modbus RTU-TCP Gateway	1,
5	SERVICES AND AFTER SALES SUPPLY	1,
5.1	Warranty	1,
	2 Year/3000 Hour Basic Standby Limited Warranty (Standard)	1,
6	PAINTING	1,
6.1	Painting	1,
	Paint Color: ANSI 61 Gray	1,
7	MISCELLANEOUS	1,
7.1	Documentation	1,
	English	1,
	1 CD Format	1,
	English	1,
	2 Flash Drive	1,
8	FUNCTIONAL TESTING	1,
8.1	Acceptance Testing	1,
	Standard Commercial Test	1,

DIESEL GENERATOR SET

MTU 12V2000 DS800

800 kWe / 60 Hz / Standby
208 - 4160V

Reference MTU 12V2000 DS800 (725 kWe) for Prime Rating Technical Data



SYSTEM RATINGS

Standby

Voltage (L-L)	208V**	240V**	380V	480V**	600V**	4160V
Phase	3	3	3	3	3	3
PF	0.8	0.8	0.8	0.8	0.8	0.8
Hz	60	60	60	60	60	60
kW	800	800	800	800	800	800
kVA	1000	1000	1000	1000	1000	1000
Amps	2779	2408	1521	1204	963	138
skVA@30%						
Voltage Dip	1800	1800	1850	2500	2825	2600
Generator Model*	741RSL4045	741RSL4045	575RSL4044	574RSL4038	574RSS4280	742FSM4364
Temp Rise	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C
Connection	12 LEAD LOW WYE	12 LEAD HI DELTA	4 BAR WYE	4 LEAD WYE	4 LEAD WYE	6 LEAD WYE

* Consult the factory for alternate configuration.

** UL 2200 Offered

CERTIFICATIONS AND STANDARDS

// Emissions – EPA Tier 2 Certified

// Generator set is designed and manufactured in facilities certified to standards ISO 9001:2008 and ISO 14001:2004

// UL 2200 / CSA – Optional

- UL 2200 Listed
- CSA Certified

// Performance Assurance Certification (PAC)

- Generator Set Tested to ISO 8528-5 for Transient Response
- Verified product design, quality and performance integrity
- All engine systems are prototype and factory tested

// Power Rating

- Accepts Rated Load in One Step Per NFPA 110
- Permissible average power output during 24 hours of operation is approved up to 85%.

STANDARD FEATURES*

- // MTU Onsite Energy is a single source supplier
 - // Global Product Support
 - // 2 Year Standard Warranty
 - // 12V 2000 Diesel Engine
 - 23.9 Liter Displacement
 - Electronic Unit Pump Injection
 - 4-Cycle
 - // Complete Range of Accessories
- // Generator
 - Brushless, Rotating Field Generator
 - 2/3 Pitch Windings
 - PMG (Permanent Magnet Generator) supply to regulator
 - 300% Short Circuit Capability
 - // Digital Control Panel(s)
 - UL Recognized, CSA Certified, NFPA 110
 - Complete System Metering
 - LCD Display
 - // Cooling System
 - Integral Set-Mounted
 - Engine Driven Fan

STANDARD EQUIPMENT*

// Engine

Air Cleaners
 Oil Pump
 Oil Drain Extension & S/O Valve
 Full Flow Oil Filter
 Closed Crankcase Ventilation
 Jacket Water Pump
 Inter Cooler Water Pump
 Thermostats
 Blower Fan & Fan Drive
 Radiator - Unit Mounted
 Electric Starting Motor - 24V
 Governor - Electronic Isochronous
 Base - Structural Steel
 SAE Flywheel & Bell Housing
 Charging Alternator - 24V
 Battery Box & Cables
 Flexible Fuel Connectors
 Flexible Exhaust Connection
 EPA Certified Engine

// Generator

NEMA MG1, IEEE and ANSI standards compliance for temperature rise and motor starting
 Sustained short circuit current of up to 300% of the rated current for up to 10 seconds
 Self-Ventilated and Drip-Proof
 Superior Voltage Waveform
 Digital, Solid State, Volts-per-Hertz Regulator

No Load to Full Load Regulation
 Brushless Alternator with Brushless Pilot Exciter
 4 Pole, Rotating Field
 130 °C Maximum Standby Temperature Rise
 1 Bearing, Sealed
 Flexible Coupling
 Full Amortisseur Windings
 125% Rotor Balancing
 3-Phase Voltage Sensing
 ±0.25% Voltage Regulation
 100% of Rated Load - One Step
 5% Maximum Total Harmonic Distortion

// Digital Control Panel(s)

Digital Metering
 Engine Parameters
 Generator Protection Functions
 Engine Protection
 CANBus ECU Communications
 Windows®-Based Software
 Multilingual Capability
 Remote Communications to RDP-110 Remote Annunciator
 Programmable Input and Output Contacts
 UL Recognized, CSA Certified, CE Approved
 Event Recording
 IP 54 Front Panel Rating with Integrated Gasket
 NFPA110 Compatible

* Represents standard product only. Consult Factory/MTU Onsite Energy Distributor for additional configurations.

APPLICATION DATA

// Engine

Manufacturer	MTU
Model	12V 2000 G85 TB
Type	4-Cycle
Arrangement	12-V
Displacement: L (in ³)	23.9 (1,457)
Bore: cm (in)	13 (5.1)
Stroke: cm (in)	15 (5.9)
Compression Ratio	16:1
Rated RPM	1,800
Engine Governor	Electronic Isochronous (ADEC)
Maximum Power: kWm (bhp)	890 (1,193)
Speed Regulation	±0.25%
Air Cleaner	Dry

// Liquid Capacity (Lubrication)

Total Oil System: L (gal)	77 (20.3)
Engine Jacket Water Capacity: L (gal)	110 (29.1)
After Cooler Water Capacity: L (gal)	20 (5.3)
System Coolant Capacity: L (gal)	316 (83.5)

// Electrical

Electric Volts DC	24
Cold Cranking Amps Under -17.8 °C (0 °F)	2,800

// Fuel System

Fuel Supply Connection Size	#12 JIC 37° Female 3/4" NPT Adapter Provided
Fuel Return Connection Size	#4 JIC 37° Female 1/4" NPT Adapter Provided
Maximum Fuel Lift: m (ft)	3 (10)
Recommended Fuel	Diesel #2
Total Fuel Flow: L/hr (gal/hr)	480.7 (127)

// Fuel Consumption

At 100% of Power Rating: L/hr (gal/hr)	218.8 (57.8)
At 75% of Power Rating: L/hr (gal/hr)	164.6 (43.5)
At 50% of Power Rating: L/hr (gal/hr)	111.3 (29.4)

// Cooling - Radiator System

Ambient Capacity of Radiator: °C (°F)	50 (122)
Maximum Restriction of Cooling Air, Intake, and Discharge Side of Rad.: kPa (in. H ₂ O)	0.12 (0.5)
Water Pump Capacity: L/min (gpm)	833 (220)
After Cooler Pump Capacity: L/min (gpm)	257 (68)
Heat Rejection to Coolant: kW (BTUM)	315 (17,913)
Heat Rejection to After Cooler: kW (BTUM)	270 (15,354)
Heat Radiated to Ambient: kW (BTUM)	84.5 (4,805)
Fan Power: kW (hp)	38 (51)

// Air Requirements

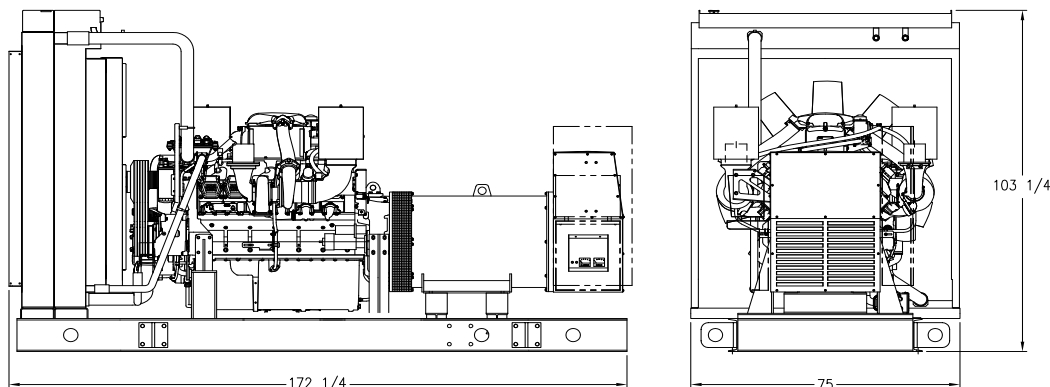
Aspirating: *m ³ /min (SCFM)	66 (2,331)
Air Flow Required for Rad.	
Cooled Unit: *m ³ /min (SCFM)	1,164 (41,090)
Remote Cooled Applications; Air Flow Required for Dissipation of Radiated Gen-set Heat for a Max of 25 °F Rise: *m ³ /min (SCFM)	307 (10,840)

* Air density = 1.184 kg/m³ (0.0739 lbm/ft³)

// Exhaust System

Gas Temp. (Stack): °C (°F)	580 (1,076)
Gas Volume at Stack	
Temp: m ³ /min (CFM)	174 (6,145)
Maximum Allowable Back Pressure: kPa (in. H ₂ O)	8.5 (34.1)

WEIGHTS AND DIMENSIONS



Drawing above for illustration purposes only, based on standard open power 480 volt generator set. Lengths may vary with other voltages. Do not use for installation design. See website for unit specific template drawings.

System	Dimensions (LxWxH)	Weight (less tank)
Open Power Unit (OPU)	4,375 x 1,905 x 2,623 mm (172.25 x 75 x 103.25 in)	5,737 kg (12,648 lb)

Weights and dimensions are based on open power units and are estimates only. Consult the factory for accurate weights and dimensions for your specific generator set.

SOUND DATA

Unit Type	Standby Full Load
Level 0: Open Power Unit dB(A)	88.9

Sound data is provided at 7 m (23 ft). Generator set tested in accordance with ISO 8528-10 and with infinite exhaust.

EMISSIONS DATA

NO _x + NMHC	CO	PM
4.66	0.45	0.01

All units are in g/hp-hr and shown at 100% load (not comparable to EPA weighted cycle values). Emission levels of the engine may vary with ambient temperature, barometric pressure, humidity, fuel type and quality, installation parameters, measuring instrumentation, etc. The data was obtained in compliance with US EPA regulations. The weighted cycle value (not shown) from each engine is guaranteed to be within the US EPA Standards.

RATING DEFINITIONS AND CONDITIONS

- // Standby ratings apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. No overload capability for this rating. Ratings are in accordance with ISO 8528-1, ISO 3046-1, BS 5514, and AS 2789. Average load factor: ≤ 85%.
- // Deration Factor:
 - Altitude:** Consult your local MTU Onsite Energy Power Generation Distributor for altitude derations.
 - Temperature:** Consult your local MTU Onsite Energy Power Generation Distributor for temperature derations.

C/F = Consult Factory/MTU Onsite Energy Distributor
 N/A = Not Available

1.3 ADEC – Functions

Control functions

Following engine functions are controlled:

- Engine start
- Engine stop
- Sequences when “Override” feature is activated (safety system override), engine start with start interlock interrogation deactivated (“emergency start”).
- Nominal speed switching between two set values (optional operation as 50 Hz or 60 Hz genset).
- Injection quantity as a function of engine loading and speed.
- Torque regulation

Engine start

The starting sequence is controlled by the software integrated in the engine governor as follows.

Starting sequence activation

The SAM takes a few seconds to boot up. It signals operational availability on the CAN bus by an appropriate PV. Only then may starting be initialized. Under normal operating conditions both the SAM and the engine governor are constantly switched on (standby mode).

Start request

The engine is started by a so-called “non-stored start”, i.e. the start signal must be applied until the engine has reached idling speed. The actual starting sequence itself is executed automatically.

Furthermore, starting can be requested via the CAN bus. There are correspondingly three CAN receive variables. The start requests are OR operations.

Stop request

Starting is terminated if an external (manual) or internal (automatic) stop request from another part of the software is received. A stop request resets the start interlock time thus allowing immediate restarting in case of internal start termination providing that the engine is at a standstill and no other start request was active.

Coolant temperature monitoring – Start termination

The engine may suffer mechanical damage if started at too low a temperature. The coolant temperature is used to determine the engine temperature.

Excessively low coolant temperature is indicated by a lamp. Indication by the lamp is independent of any alarm signal. Usually the alarms “LO T-Preheat” (for the first limit value) or “SS T-Preheat” (for the second limit value) are tripped when the corresponding limits are violated; even when the engine is at a standstill.

When the second limit value is violated the internal “Stop starting sequence” signal is set providing that Override is not active. This trips a stop and the engine does not start.

The alarm is reset again when the coolant limit value is reached (plus hysteresis).

Starting

The starter is activated via engine governor binary output TOP 4. The engine runs up to starting speed on the starter within a configurable period. If this is not the case starting is terminated and the “SS Starter Speed Not Reached” alarm is output. The starter disengages and a new starting sequence is automatically attempted after a configurable pause.

The starter disengages when the disengagement speed (300 rpm) is reached. The start button may be released once the disengagement speed has been reached. Pressing the start button has no effect from this point on and only takes effect again when the engine has come to a standstill. The “SS Starter Speed Not Reached” alarm is set if the disengagement speed is not reached within a set time and “terminate start” is activated. Starting is also terminated if the starting signal is no longer received.

Engine start with Override (“emergency start”)

Various configurable start interlock criteria are bypassed when override is active on starting the engine:

Engine stop

An engine stop is tripped by interrupting the 24V supply at the binary input of the engine governor or by the engine protection system. Fuel is no longer injected as injector activation is disrupted.

Any starting procedure which has been initiated is interrupted.

Override (safety system bypass)

The “Override” feature is used to bypass safety functions tripped by limit value violations or sensor faults and to bypass start interlocks (see above).

Operating states which would normally lead to engine shutdown are ignored when the “Override” function is activated. The following operational data can be configured to trip engine shutdown in case of limit value violation even in Override mode:

- Coolant level
- Coolant temperature
- Coolant pressure
- Charge air coolant level
- Lube oil pressure
- Lube oil temperature

50 Hz/60 Hz switching on bifrequency engines

To increase the genset application scope the network frequency can be adjusted prior to engine start. The nominal speed is set as follows:

- Network frequency 50 Hz: Nominal speed 1500 rpm
- Network frequency 60 Hz: Nominal speed 1800 rpm

Caution!

Switching is only possible when the engine is at a standstill! Switching requires programming of corresponding performance maps and parameters in the governor and appropriate engine hardware.

Monitoring functions

The engine management system fulfils the following monitoring tasks:

- Control of analog instruments;
 - Engine lube oil pressure
 - Engine coolant temperature
- Transmission of all measurands, warnings and alarms to monitoring system via CAN bus.
- Automatic shutdown in case of limit value violations.

Refer to the measuring-point list for order-specific configuration data.

Engine monitoring can basically be divided into two different areas:

- Engine protection system, monitors the engine during operation,
- Safety system, generates automatic engine shutdown in case of limit value violation.

These two functional areas are constantly monitored by the internal “Integral Test System (ITS)” to ensure operational availability.

Oil priming pump option

An optional oil priming pump may be integrated in the system. The pump is activated manually via a binary input on the SAM.

Closed-loop control functions

Closed-loop engine control functions:

- Speed regulation
- Injection control with mapped commencement of injection.
- Two adjustable speed droops.
- Setpoint speed regulation
 - Analog or binary speed demand on CAN bus, CANopen and SDE J1939
 - Analog speed setting 0 V to 10 VDC / 0 V to 5 VDC / 4 mA to 20 mA.
 - Binary speed demand via Up/Down signal
 - Frequency speed setting.
- HP fuel governor.
- Torque control

Speed - injection control

Functions of the closed-loop engine speed control integrated in the engine governor:

- Maintaining the desired engine speed under changing load conditions.
- Adjusting the engine speed when the setting is changed by the operator.

Fuel quantity control during engine start

The quantity of fuel injected during engine start increases along a time ramp from a set initial value to a specified value. This ensures that the engine starts reliably. This fuel quantity control is effective until idling speed has been reached.

Desired speed handling

The desired speed is the command variable for the engine speed control loop.

Providing that speed demand is set by Up/Down signals, the engine runs up to an internally programmed nominal speed when started (for 50 Hz network frequency: 1500 rpm, for 60 Hz network frequency: 1800 rpm). The engine runs up to the set value in case of analog speed demand.

The starting sequence is completed when idling speed has been reached ("open-loop control" mode) and switching over to "closed-loop control" mode is effected.

The following speed setting variants are possible:

- Desired speed setting via an analog input:

The setpoint speed may be adjusted within a (configurable) range around the preset synchronous speed (depending on the set network frequency) (relative speed control, the voltage/current or frequency controls the speed window only).

Absolute speed control is also possible (the voltage/current or frequency can cover the entire speed range).

The internal setpoint speed follows the applied speed setting value along a configurable acceleration/deceleration curve (speed ramp). The setting value last applied is maintained or the engine is set to a default speed should the applied signal fail.

The response can be configured as desired:

- Speed setting via CAN bus.
- Speed setting via an analog speed setting input (0 V to 10 V).
- Speed setting via an analog speed setting input (4 mA to 20 mA).
- Frequency input.
- Setpoint processing via binary inputs "Setpoint speed up"/"Setpoint speed down":

The setpoint speed can be adjusted within a (configurable) range around the preset synchronous speed (depending on the set network frequency). Briefly actuating the appropriate optocoupler input for less than 0.3 s increases or decreases the setpoint speed by 1 rpm.

The setpoint speed is automatically adjusted at a configurable rate if the input is activated for longer than 0.3 seconds.

Speed droop

Speed droop calculation

Speed droop influences the effective setpoint speed depending on engine power. Maximum, speed-dependent engine power is limited by the MCR curve. The setpoint speed is not influenced by speed droop at 100% power. The effective setpoint speed increases at lower power. This allows power to be balanced when operating a number of engines in a network.

Switchable speed droop

Two different speed droop settings can be selected at the engine governor.

The speed droop is selected by a binary input at the engine governor.

Speed droop is required to balance the load of coupled prime movers. Speed droop can be adjusted to meet plant requirements via the dialog unit.

Quantity limitations

Dynamic quantity limitation

Dynamic quantity limits protect the engine against overloading and optimize exhaust emission values. The engine governor determines the maximum injection quantity based on preset and stored engine performance maps.

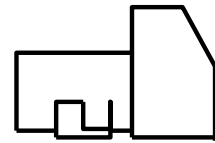
Fuel quantity is limited as a function of speed (DBR).

Fixed quantity limitation

Fixed quantity limitations are used for power limitation and power reduction to protect the engine from sustained overload sustained overload.

MARATHON ELECTRIC GENERATORS

TYPICAL DYNAMIC CHARACTERISTICS

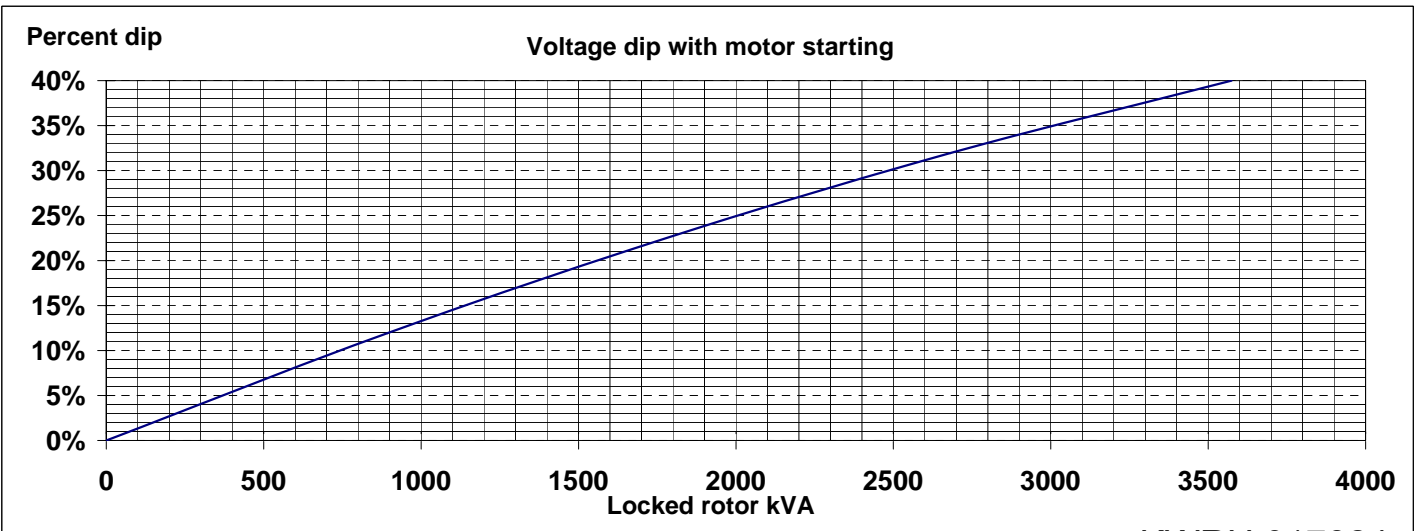
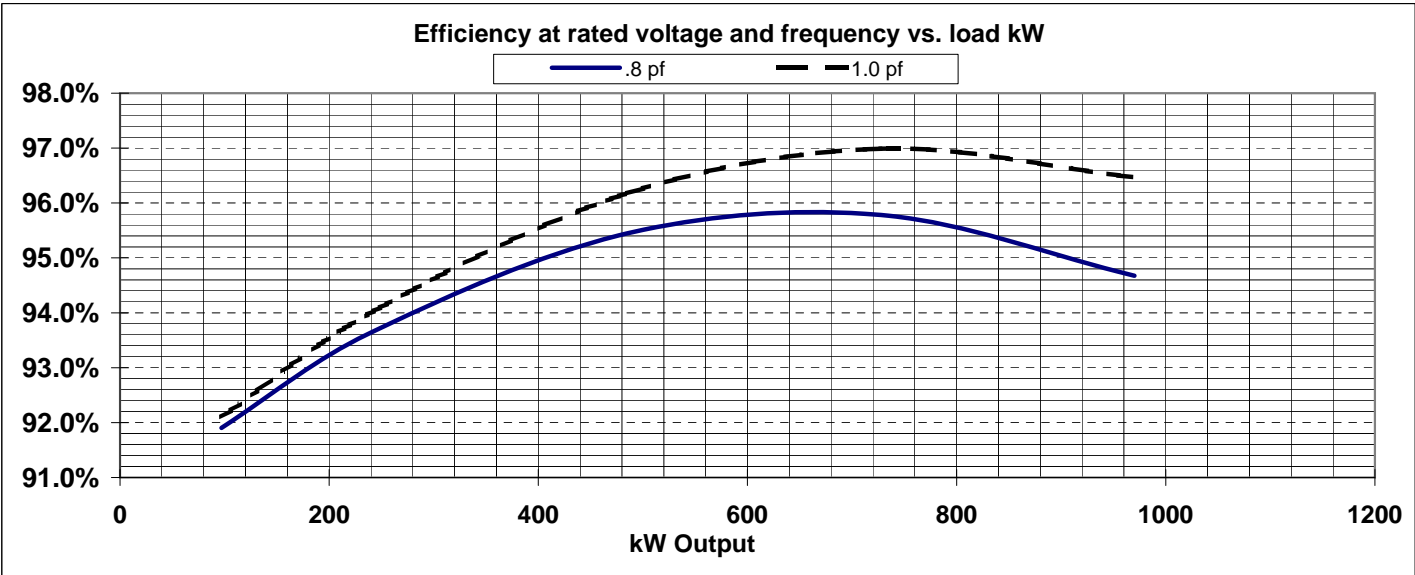
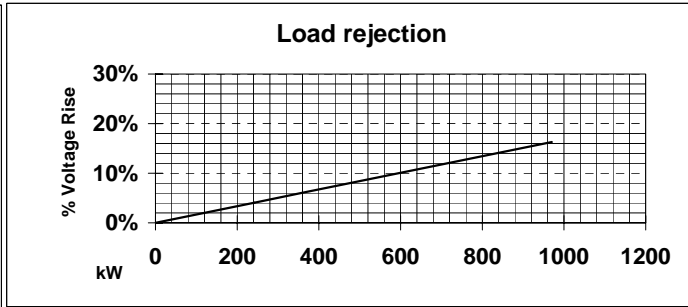
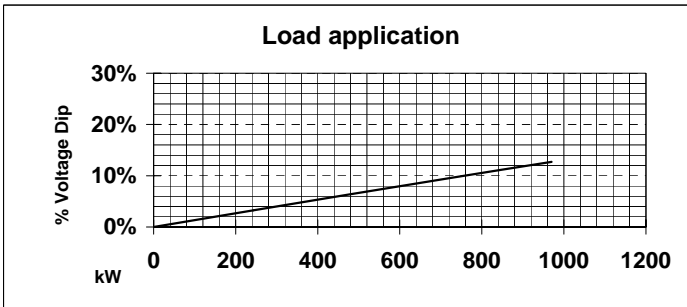
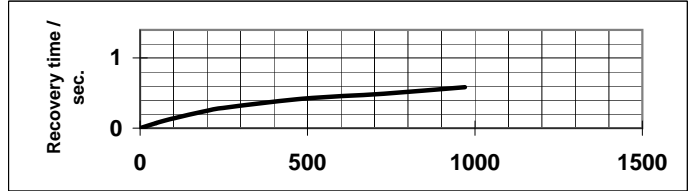
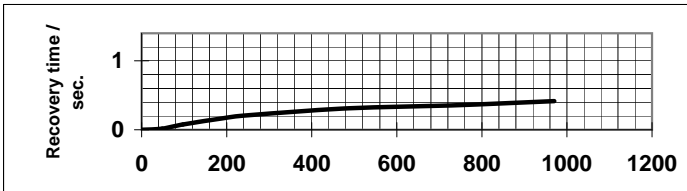


MODEL : 574RSL4038

BASE MODEL: 574RSL4038

Winding H-SG570069

Submittal Data: 480 Volts*, 920 kW, 1150 kVA, 0.8 P.F., 1800 RPM, 60 Hz, 3 Phase

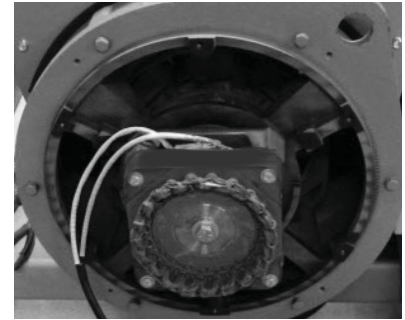


PERMANENT MAGNET GENERATOR (PMG) Data Sheet



DESCRIPTION

A permanent magnet generator (PMG) is standard on 450 kW and larger units and is available as an optional accessory on most units smaller than 450 kW. The PMG is an improved method of supplying power to the voltage regulator and adds distinct advantages over the alternative shunt type power supply.



FEATURES

Improved Transient Response

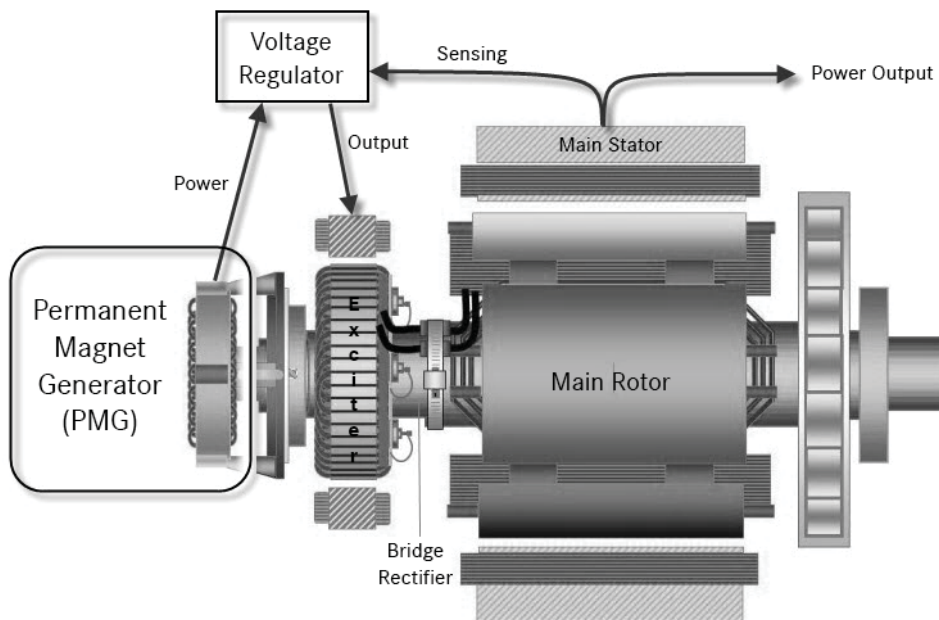
When a generator is subject to a large step load, the generator's terminal voltage experiences a sudden voltage dip. With a shunt style regulator, reduced voltage means the regulator's ability to increase excitation is reduced and voltage recovery will take longer. Power from a PMG is only dependent on the speed of rotation so voltage regulator power, and therefore excitation power, is not compromised during a load step.

300% Short Circuit Capability

The PMG enables the generator to provide up to 300% short circuit current for 10 seconds. This is important when a fault occurs to ensure current continues to flow long enough for downstream breakers to trip and clear the fault. When a fault occurs with a shunt type regulator, the sudden drop in voltage indicates the regulator has no power to increase excitation to keep current flowing. Without current flow, the downstream breakers may not trip.

Resistant to the Effects of Harmonics

A PMG is also beneficial in applications with harmonic producing loads. When rectifier-type loads are present and cause voltage wave form notching, the disrupted voltage wave form can affect voltage regulator operation on shunt powered regulators. Unlike a shunt regulator, the PMG supplies the regulator with a power source which is isolated from the electrical system.



Generator Equipped with PMG

© MTU Onsite Energy. Subject to alteration due to technological advances. 2014-01

Circuit Breakers, Insulated Case Circuit Breakers

Product #: SSF16G216

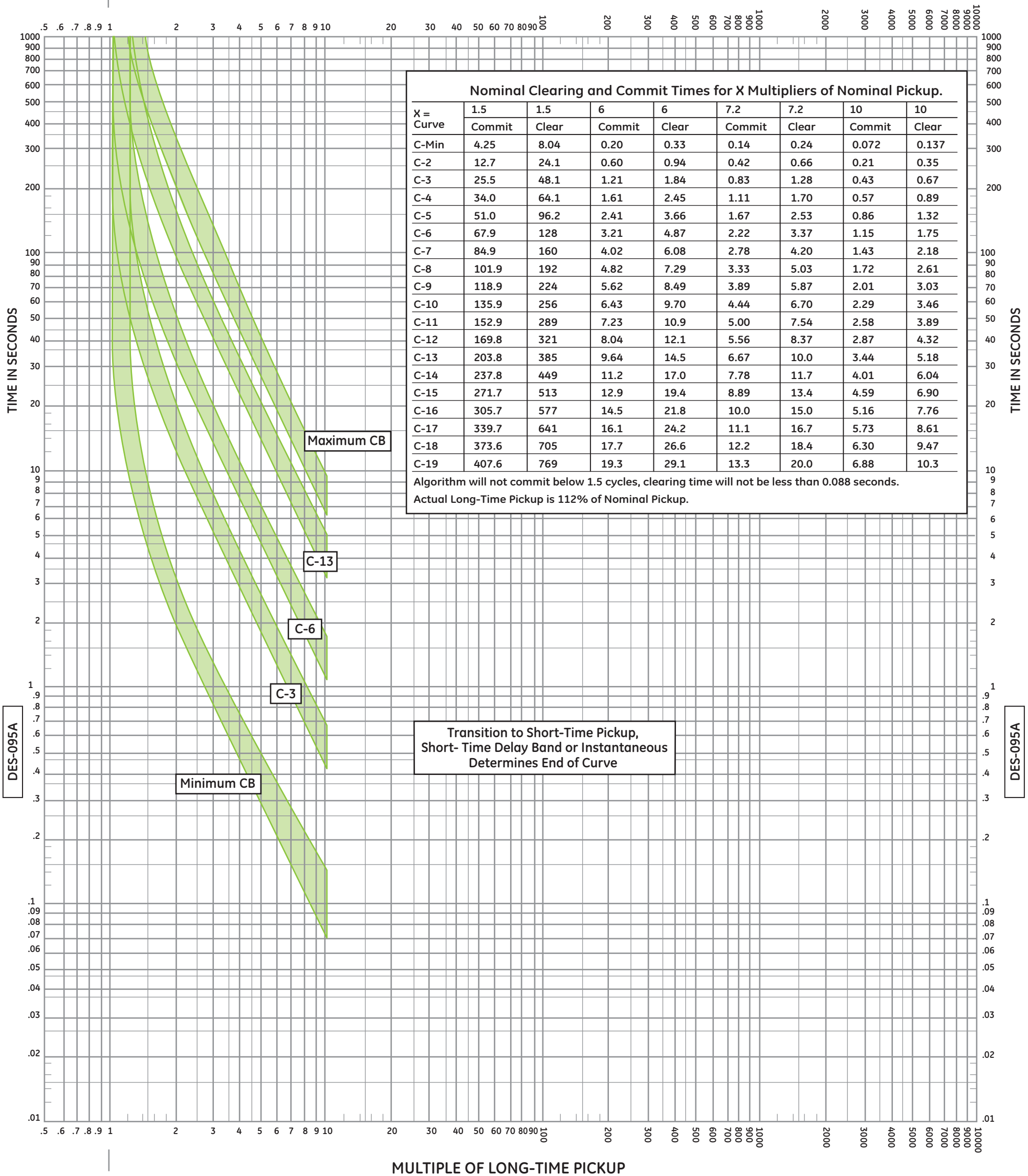
Short Description: PBII STD BREAK 1600A

SPECIFICATIONS

Category	Power Break™ II
Frame Type	Power Break™ II
Amperage	1000A , 1100A , 1200A , 1600A , 800A
System Voltage	240 Vac, 277 Vac, 480 Vac, 600 Vac
Poles	3
Trip Indication Target	Optional
Continuous Current Rated	100%
240 Vac Interrupting Rating	85 KAIC
277 Vac Interrupting Rating	65 KAIC
480 Vac Interrupting Rating	65 KAIC
600 Vac Interrupting Rating	50 KAIC
Suitable for Reverse Feed	Yes
Product Line	Power Break II
Lugs	TPLUG408
UL File #	E11592
CSA File#	LR10263
Long Time	Adjustable
Short Time	Adjustable
Instantaneous	Adjustable
Ground Fault	Optional
GSA Compliance	No



MULTIPLE OF LONG-TIME PICKUP



Low-Voltage Circuit Breakers

DES-095A

Frames 800-5000A AKR & WavePro
Frames 800-4000A PowerBreak & PowerBreak II

EntelliGuard TU Trip Unit for PowerBreak, PowerBreak II, AKR and WavePro Circuit Breakers
UL489 and UL1066 Stored Energy Mechanism Circuit Breakers

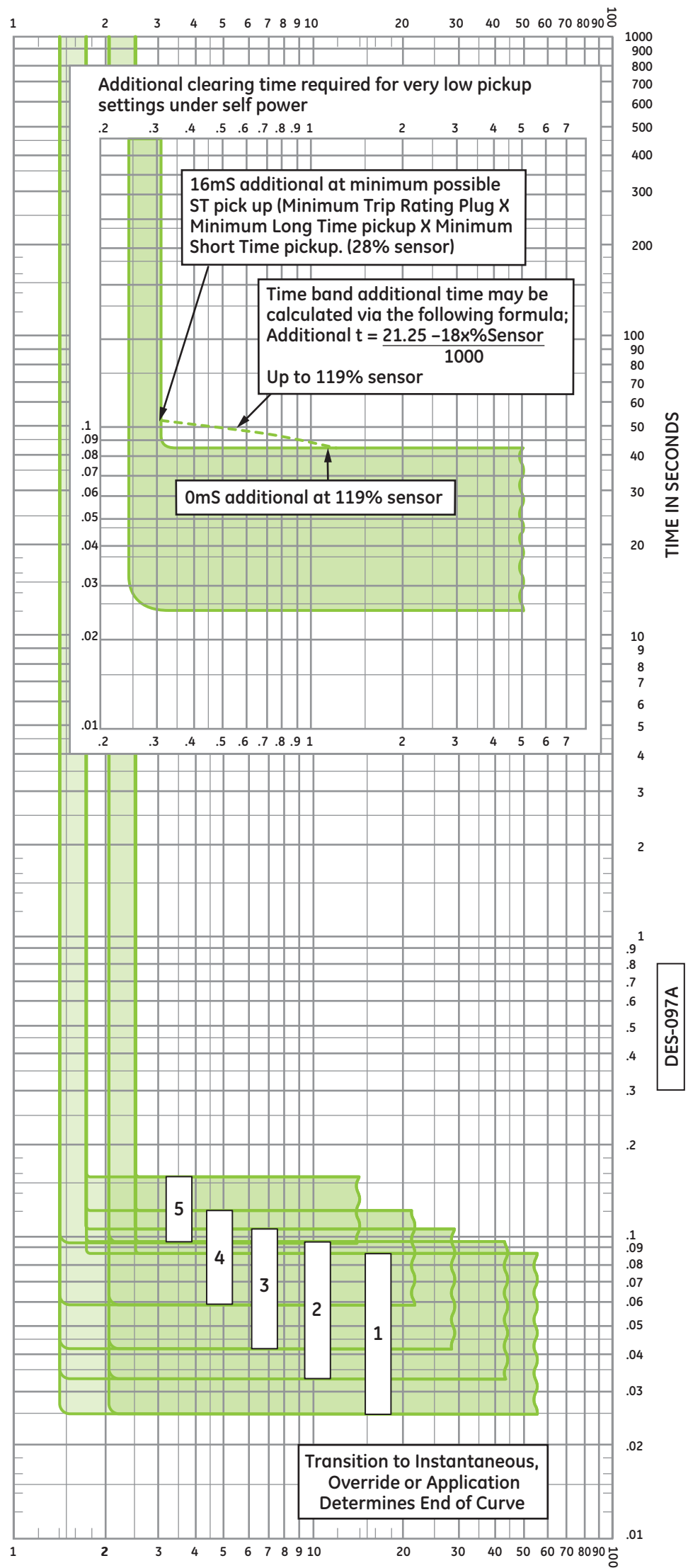
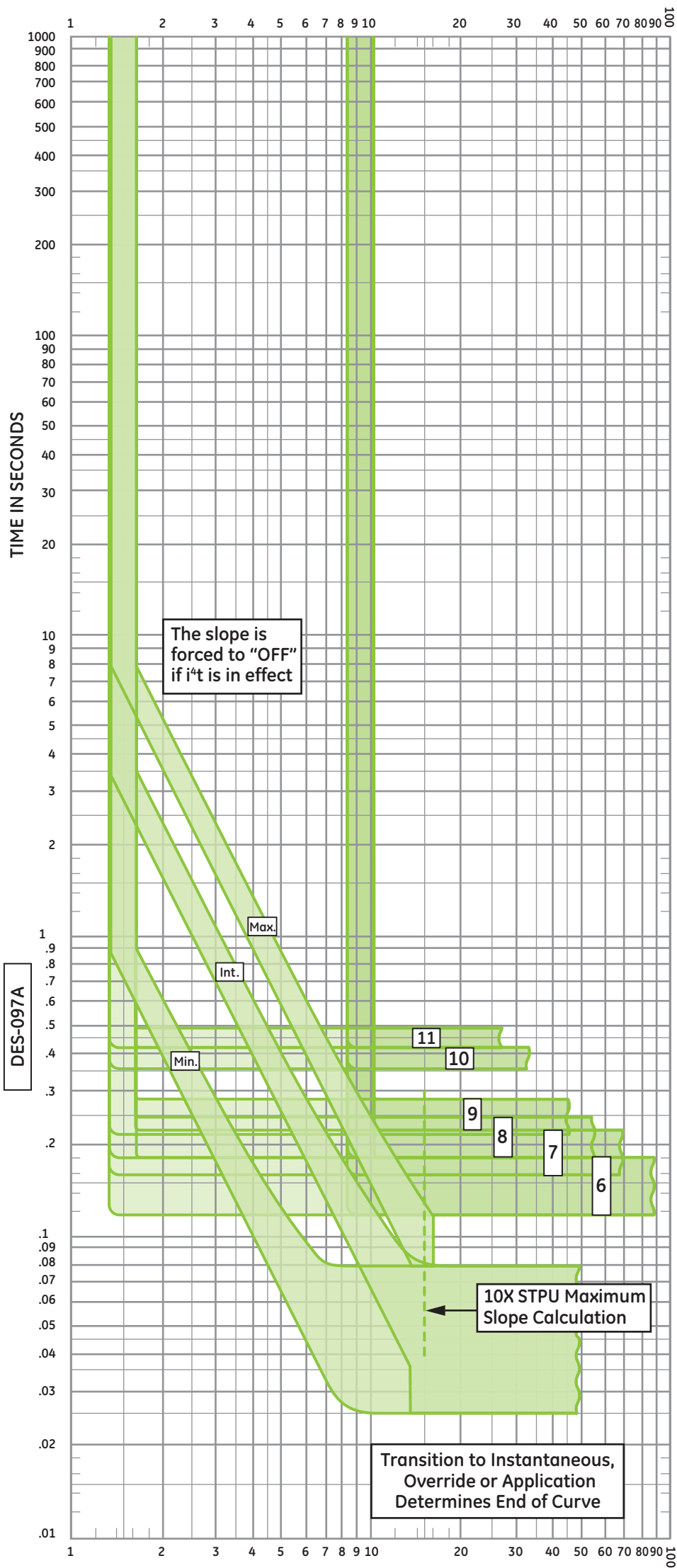
Pickup Range
0.5X-1.0X Trip Rating Plug

All Voltages: 600 Vac and below

Long-Time CB Characteristics

Curves apply at 60 Hertz and from -20°C to 55°C circuit breaker ambient temperature.

MULTIPLE OF LONG-TIME PICKUP



MULTIPLE OF LONG-TIME PICKUP



Low-Voltage Circuit Breakers

Frames	800-5000A	AKR & WavePro
		PowerBreak &
Frames	800-4000A	PowerBreak II

EntelliGuard TU Trip Unit for PowerBreak, PowerBreak II, AKR & Wavepro Circuit Breakers
UL489 and UL1066 Stored Energy Mechanism Circuit Breakers

Short-Time Pickup and Delay Bands

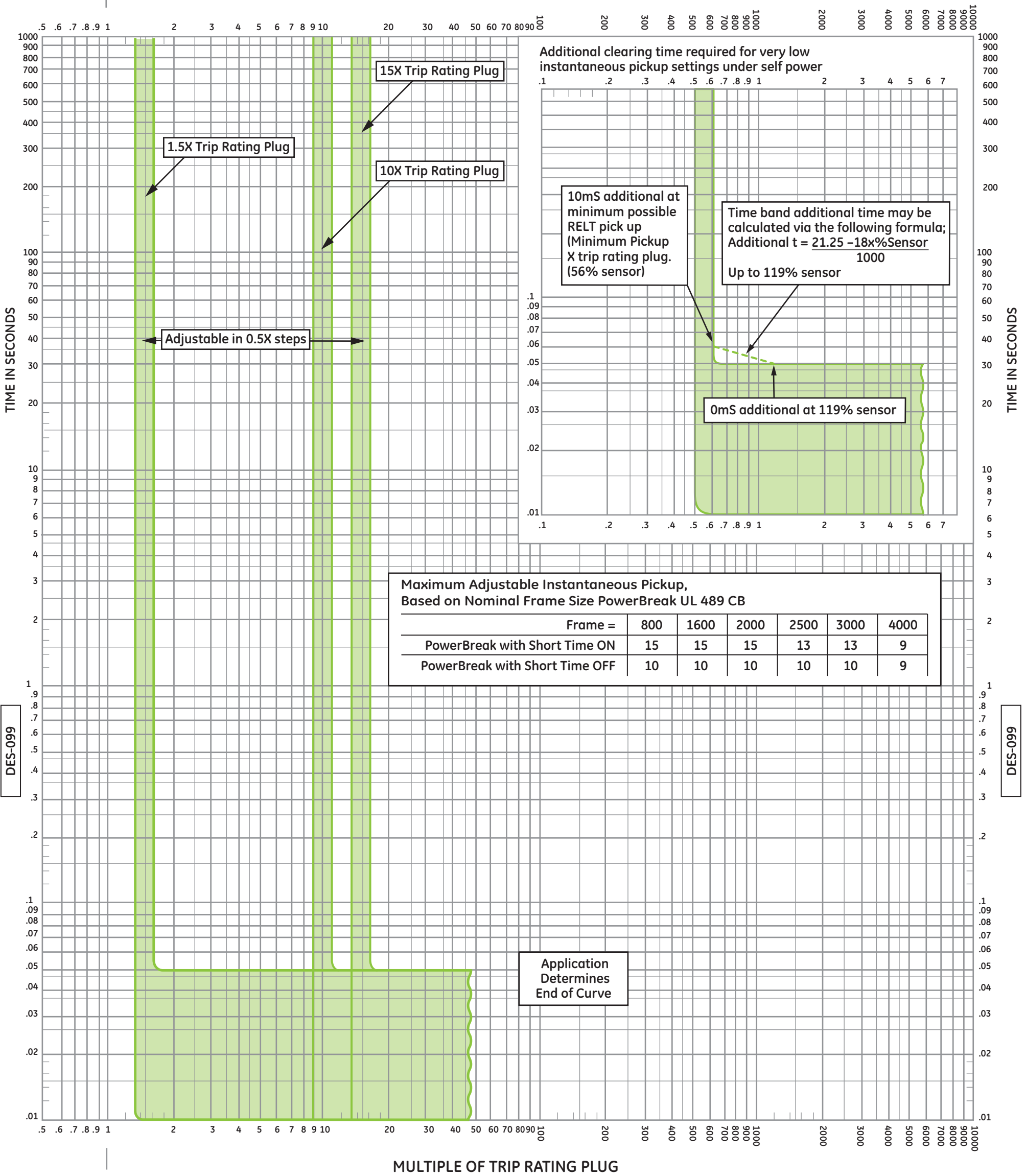
Curves apply at 60 Hertz and from -20°C to 55°C circuit breaker ambient temperature.

DES-097A

Pickup Range
1.5X - 9X up to 4000A Frames
1.5X - 7X 5000A AKR and WavePro

All Voltages: 600 Vac and below

MULTIPLE OF TRIP RATING PLUG



Low-Voltage Circuit Breakers

DES-099

Frames 800-4000A PowerBreak

EntelliGuard TU Trip Unit for PowerBreak Circuit Breaker UL 489 Stored Energy Mechanism Circuit Breakers

Minimum Pickup 1.5X Maximum per frame

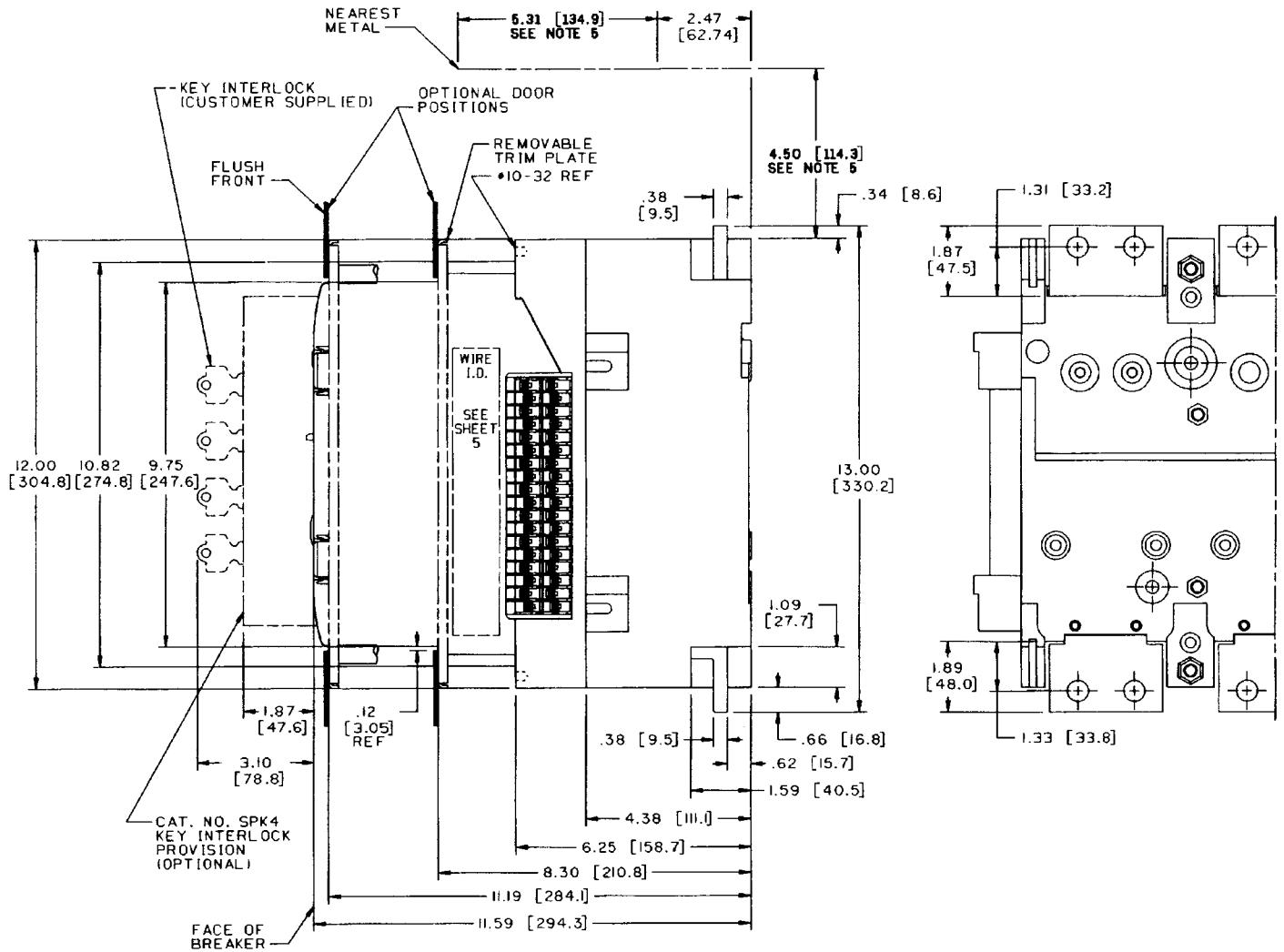
All Voltages: 600 Vac and below

Instantaneous trip

Curves apply at 60 Hertz and from -20°C to 55°C circuit breaker ambient temperature.

Physical Data

Power Break® II 1600-2000-Amp Stationary



1. ¼ - 20 mounting bolts to be furnished by customer.
2. To prevent heating, do not mount breaker to magnetic steel back support.
3. All outline dimensions are the same for manually and electrically operated devices.
4. Dimensions in brackets are in [millimeters].
5. 4.50 [114.3] minimum distance above breaker to metal in an area 5.31 x 16.00 [134.9 x 406.4] due to arc chamber venting.

GE CIRCUIT BREAKERS

Lugs Data Sheet



DESCRIPTION

The table below contains lug information for GE circuit breakers represented in the circuit breaker cross reference tables on the MTU Business Portal.

Lugs Data for GE Circuit Breakers

Lug Product Number	Max Rating (Amperes)	Max Cables Per Pole	Wire Range (kcmil Cu/Al)	Notes
TCAL 12	15 - 60	1	14 - 3 Cu, 12 - 1 Al	-
TCAL 12A	70 - 90	1	6 - 2/0 Cu, 4 - 2/0 Al	-
TCAL 14	15 - 30	1	14 - 8	-
TCAL 15	100 - 150	1	3 - 3/0 Cu, 1 - 3/0 Al	-
TCAL 29	70 - 250	1	8 - 350	-
TCAL 43	125 - 400	1 or 2	(1) 6-600, (2) 2/0-250	-
TCAL 47	125 - 400	1	750	-
TCAL 63	450 - 600	2	250-350 Cu, 300-500 Al	-
TCAL 81	300 - 800	3	3/0 - 500	Not suitable for 100A Al conductor
TCAL125	600 - 1200	4	250 - 500	-
TCLK365	125 - 600	1	8 - 600 Cu, 6 - 600 Al	-
TPLUG108	2000	6	3/0 - 800	Requires adapter kit SPLUGA20
TPLUG408	1600	4	500 - 800	-
TSLUG25	2500	7	3/0 - 800	-
TSLUG30	3000	9	3/0 - 800	-

© MTU Onsite Energy. Subject to alteration due to technological advances. 2014-01

DIGITAL GENERATOR SET CONTROLLER

MGC-2000 Series Data Sheet



MTU Onsite Energy Generator Set Controllers (MGC Series) are highly advanced integrated digital generator set control systems. The MGC-2000 Series is perfectly focused, combining rugged construction and microprocessor technology to offer a product that will hold up to almost any environment and is flexible enough to meet your application's needs. The MGC-2000 Series provides generator set control, transfer switch control, metering, protection, and programmable logic in a simple, easy-to-use, reliable, rugged, and cost effective package.



PRODUCT HIGHLIGHTS

- Three-phase generator metering
- Engine metering
- Generator set control
- Engine protection
- Generator protection
- Var sharing over Ethernet
- BESTCOMSP^{Plus}[®]
 - Windows[®]-based software for optional remote operation (Software can be downloaded at www.mtuonsiteenergy.com)
 - Programming and setup software
 - Intuitive and powerful
 - Remote control and monitoring
 - Programmable logic
 - USB communications
- Automatic transfer switch compatible
- Exercise timer
- Suitable for use on rental generator sets with high/low line sensing, single or three phase sensing override, and wye/delta/grounded delta
- SAE J1939 Engine Control Unit (ECU) communications
- Automatic generator configuration detection
- Selection of integrating reset of instantaneous reset characteristics for overcurrent protection
- Multilingual capability
- Remote annunciation to RDP-110
- Extremely rugged, fully potted design
- 16 programmable contact inputs, 12 programmable contact outputs
- ModBus[™] communications with RS-485 (optional)
- UL recognized, CSA certified, CE approved
- Highly Accelerated Life Tests (HALT) tested
- IP 54 front panel rating with integrated gasket
- NFPA-110 compatible
- Microprocessor based
- Complete system metering
- Expandable to meet customer needs

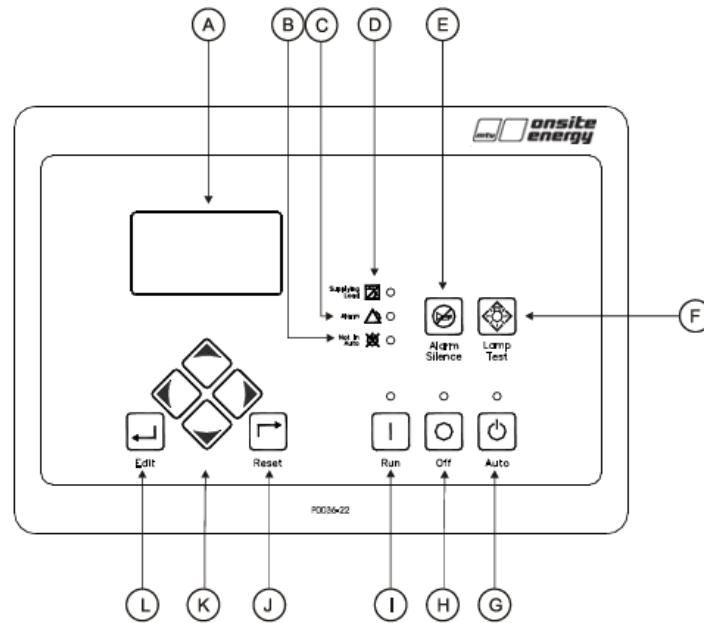
*Please refer to the MGC Series Controller Comparison Data Sheet for available configured options.

DIGITAL GENERATOR SET CONTROLLER

MGC-2000 Series Data Sheet



DIAGRAM



Front Panel Descriptions

- Liquid Crystal Display (A)
- Not in Auto Indicator (B)
- Alarm Indicator (C)
- Supplying Load Indicator (D)
- Alarm Silence Pushbutton (E)
- Lamp Test Pushbutton (F)
- Auto Pushbutton and Mode Indicator (G)
- Off Pushbutton and Mode Indicator (H)
- Run Pushbutton and Mode Indicator (I)
- Reset Pushbutton (J)
- Arrow Pushbuttons (K)
- Edit Pushbutton (L)

FUNCTIONS

Generator Set Protection

Generator ANSI Codes

- Overvoltage (59)
- Overfrequency (81O)
- Reverse Power (32)
- Undervoltage (27)
- Underfrequency (81U)
- Loss of Excitation (40Q)
- Phase Imbalance (47)
- Overcurrent (51) (optional)
- Vector Shift (78) (optional)
- Rate of Change of Frequency (ROCOF) (81R) (optional)

All generator set protection features are programmable as alarms, pre-alarms, status, or not used.

Alarms (Shutdowns)

- Low Oil Pressure
- High Coolant Temperature
- Low Coolant Level
- Overspeed
- Overcrank
- Coolant Temp Sender Fail (non-ECU engines)
- Oil Pressure Sender Fail (non-ECU engines)
- Emergency Stop
- Critical Low Fuel Level (optional)

DIGITAL GENERATOR SET CONTROLLER

MGC-2000 Series Data Sheet



FUNCTIONS, Generator Set Protection, continued:

Pre-Alarms (Warnings)

- Low Oil Pressure
- High Coolant Temperature
- Low Coolant Temperature
- Battery Overvoltage
- Weak Battery Voltage
- AEM Comms Failure
- Breaker Open Failure
- CEM Comms Failure
- Generator Reverse Rotation
- Engine kW Overload (three levels)
- Loss of Sensing
- Checksum Failure
- ECU Comms Fail
- Low Fuel Level
- High Fuel Level
- Active Diagnostic Trouble Codes (DTC)
- Breaker Close Failure
- Low Battery Voltage

All alarms and pre-alarms can be enabled or disabled via the BESTCOMSPi^{us}® PC software or the front panel. Additional custom alarms and pre-alarms are available upon request.

Generator Set Metering

- Generator parameters include voltage, current, real power (watts), apparent power (VA), and power factor (PF).
- Engine parameters include oil pressure, coolant temperature, battery voltage, speed, fuel level, engine load, coolant level (from ECU), ECU specific parameters, and run-time statistics.

Engine Control

- Cranking Control: Cycle or Continuous (Quantity and Duration fully programmable)
- Engine Cooldown: Smart Cooldown function saves fuel and engine life
- Successful Start Counter: Counts and records successful engine starts
- Timers:
 - Engine Cooldown Timer
 - Engine Maintenance Timer
 - Pre-Alarm Time Delays for Weak/Low Battery Voltage
 - Alarm Time Delay for Overspeed
 - Alarm Time Delay for Sender Failure
 - Arming Time Delays after Crank Disconnect:
 - Low Oil Pressure
 - High Coolant Temperature
 - Pre-Crank Delay
 - Continuous or Cycle Cranking Time Delay
 - Programmable Logic Timers

DIGITAL GENERATOR SET CONTROLLER

MGC-2000 Series Data Sheet



FUNCTIONS, continued:

Event Recording

The MGC-2000 Series has an event recorder that provides a record of alarms, pre-alarms, engine starts, engine runtime loaded, engine runtime unloaded, last run date, and many other events that are all date and time stamped to help the user determine the cause and effect of issues related to the generator set. Contains 30 event records each retaining up to 99 occurrences in memory. Time, date, and engine hour detail is available for the most current 30 occurrences within each event record.

Transfer Switch Control (Mains Failure)

The MGC-2000 Series has the ability to detect a mains failure via a single- or three-phase bus input. A mains failure is established when any one of the following conditions are met:

- Any phase of bus voltage falls below the dead bus threshold
- Any phase of bus voltage is unstable due to overvoltage or undervoltage
- Any phase of bus voltage is unstable due to overfrequency or underfrequency

When conditions are met, the MGC-2000 Series will start the generator set and, when ready, will send generator and mains breaker commands to apply power to the load from the generator set. The MGC-2000 Series implements open or closed breaker transitions to and from the mains. When the mains returns and is considered stable, the MGC-2000 Series will transfer the load back to the mains and stop the engine.

ModBus™ RTU

When utilized, the user can send and receive information from the MGC-2000 Series via the RS-485 communications port and ModBus™ RTU protocol. This feature allows the MGC-2000 Series controlled generator set to be fully integrated into the building management system. Please see the *MGC-2000 Series Controller Manual* for the ModBus™ register list.

Programmable Logic

The MGC-2000 Series offers a very powerful, yet easy-to-use, programmable logic scheme, BESTlogic™Plus, for custom programming of the various inputs, outputs, alarms, and pre-alarms. It allows these elements to be integrated into a complete logic scheme so that the user can meet even the most complex specification. The programmable logic control includes the selection of logic gates and timers, with drag-and-drop technology to make it fast and simple.

Remote Display Panel Annunciation

The MGC-2000 Series can communicate to a remote display panel, Model RDP-110. This requires only two wires to annunciate all of the alarms and pre-alarms required by NFPA-110 Level I and II. External power is required.

External Modem Interface

The MGC-2020 and MGC-2050 controllers include an external modem interface permitting an external modem to be connected to the MGC controller via RS-232. A dial-out modem enables remote control, monitoring, and setting of the MGC-2000 Series. When an alarm or pre-alarm condition occurs, the MGC-2000 Series can dial up to four telephone numbers in sequence until an answer is received and the condition is annunciated.

Note: Only an external modem interface is provided. The external modem must be provided by a third party. The external modem is only available on the MGC-2020 and MGC-2050 controller configurations of the MGC-2000 Series.

DIGITAL GENERATOR SET CONTROLLER

MGC-2000 Series Data Sheet



FUNCTIONS, continued:

SAE J1939 Communications

SAE J1939 CANBus communications allows the MGC-2000 Series to communicate with the ECU to gather critical engine information like oil pressure, engine coolant temperature, RPM, battery voltage, and much more. By utilizing the ECU, the addition of analog engine senders is no longer required. This can save substantial money for the installer. It also eliminates any errors or discrepancies between the ECU data and the data displayed on the MGC-2000 Series that may be present due to analog sender inaccuracies or incompatibility. An additional benefit is access to the ECU's diagnostic troubleshooting codes (DTCs). The DTCs provide information about the engine's operating conditions and communicates these, via SAE J1939, to the MGC-2000 Series, eliminating the need for hand-held service tools to diagnose simple engine issues.

SPECIFICATIONS

Operating Power

- Nominal: 12 or 24 VDC
- Range: 6 to 32 VDC
- Power Consumption:
 - Sleep Mode: 5W with all relays non-energized
 - Normal Operational Mode: 7.9W - Run mode, LCD heater off, six relays energized
- Battery Ride-Through: Withstands cranking ride-through down to 0 V for 50 ms, starting at 10 VDC.

Current Sensing (5 A CT Inputs)

- Continuous Rating: 0.1 to 5.0 Aac
- One Second Rating: 10 Aac
- Burden: 1 VA

Voltage Sensing

- Range: 12 to 576 V rms, line-to-line
- Frequency Range: 10 to 72 Hz
- Burden: 1 VA
- One Second Rating: 720 V rms

Input Contacts

Contact sensing inputs include one emergency stop input and 16 programmable inputs. The emergency stop input accepts normally closed, dry contacts. The remote emergency stop is limited to 75 ft. standard. Extended runs are available with optional relay. All programmable inputs accept normally open, dry contacts. The factory utilizes up to three of these inputs.

Engine System Inputs

- Fuel Level Sensing Resistance Range: 0 to 250 Ω nominal
- Coolant Temperature Sensing Resistance Range: 10 to 2,750 Ω nominal
- Oil Pressure Sensing Resistance Range: 0 to 250 Ω nominal
- Engine Speed Sensing:
 - Magnetic Pickup or CANBus
 - Magnetic Pickup Voltage Range: 3 to 35 V peak (6 to 70 V peak to peak)
 - Magnetic Pickup Frequency Range: 32 to 10,000 Hz
 - Generator Frequency (alternate or redundant)
 - Voltage Range: 12 to 576 V rms

DIGITAL GENERATOR SET CONTROLLER

MGC-2000 Series Data Sheet



SPECIFICATIONS, continued:

Output Contacts

- (15) Total Programmable Outputs: (3) 30 A @ 28 VDC and (12) 2 A @ 30 VDC
- The factory utilizes the following on each generator set which can be reprogrammed as needed:
 - (3) 30 A @ 28 VDC for Pre-start, Start, and Run
 - (12) 2 A @ 30 VDC for General Purpose

Metering

- Generator and Bus Voltage (rms)
 - Metering Range: 0 to 576 VAC (direct measurement); up to 9,999 VAC (with appropriate voltage transformer)
 - Accuracy: $\pm 1\%$ of programmed rated voltage of ± 2 VAC (subject to accuracy of voltage transformer when used)
- Generator Current (rms)
 - Generator current is measured at the secondary windings of 5 A CTs.
 - Metering Range: 0 to 5,000 Aac
 - CT Primary Range: 1 to 5,000 Aac, in primary increments of 1 Aac
 - Accuracy: $\pm 1\%$ of programmed rated current or ± 2 Aac (subject to accuracy of CTs)
- Generator and Bus Frequency
 - Metering Range: 10 to 72 Hz
 - Accuracy: $\pm 0.25\%$ or 0.05 Hz
- Apparent Power
 - Indicates total kVA and individual line kVA (four-wire, line-to-neutral or three-wire, line-to-line).
 - Accuracy: $\pm 3\%$ or the full-scale indication or ± 2 kVA
- Power Factor
 - Metering Range: 0.2 leading to 0.2 lagging
 - Accuracy: ± 0.02
- Real Power
 - Indicates total kW and individual line kW (four-wire, line-to-neutral or three-wire, line-to-line)
 - Accuracy: $\pm 3\%$ of the full-scale indication or ± 2 kW
- Oil Pressure
 - Metering Range: 0 to 150 psi or 0 to 1,034 kPa
 - Accuracy: $\pm 3\%$ of actual indication or ± 2 psi or ± 12 kPa (subject to accuracy of sender)
- Coolant Temperature
 - Metering Range: 0 °C to 204 °C (32 °F to 410 °F)
 - Accuracy: $\pm 3\%$ of actual indication or $\pm 2^\circ$ (subject to accuracy of sender)
- Fuel Level
 - Metering Range: 0 to 100%
 - Accuracy: $\pm 2\%$ (subject to accuracy of sender)
- Battery Voltage
 - Metering Range: 6 to 32 VDC
 - Accuracy: $\pm 3\%$ of actual indication or ± 0.2 VDC
- Engine RPM
 - Metering Range: 0 to 4,500 rpm
 - Accuracy: $\pm 2\%$ of actual indication or ± 2 rpm

DIGITAL GENERATOR SET CONTROLLER

MGC-2000 Series Data Sheet



SPECIFICATIONS, Metering, continued:

- Engine Run Time
 - Engine run time is retained in non-volatile memory.
 - Metering Range: 0 to 99,999 h; Update Interval: 6 min
 - Accuracy: $\pm 1\%$ of actual indication or ± 12 min
- Maintenance Timer
 - Maintenance timer indicates the time remaining until generator set service is due. Value is retained in non-volatile memory.
 - Metering Range: 0 to 5,000 h; Update Interval: 6 min
 - Accuracy: $\pm 1\%$ of actual indication or ± 12 min

Generator Protection Functions

- Overvoltage (59) and Undervoltage (27)
 - Pickup Range: 70 to 576 VAC
 - Activation Delay Range: 0 to 30 s
- Overfrequency (81O) and Underfrequency (81U)
 - Pickup Range: 45 to 66 Hz
 - Pickup Increment: 0.1 Hz
 - Activation Delay Range: 0 to 30 s
- Reverse Power (32)
 - Pickup Range: -50 to 5%
 - Pickup Increment: 0.1%
 - Hysteresis Range: 1 to 10%
 - Hysteresis Increment: 0.1%
 - Activation Delay Range: 0 to 30 s
 - Activation Delay Increment: 0.1 s
- Loss of Excitation (40Q)
 - Pickup Range: -150 to 0%
 - Pickup Increment: 0.1%
 - Hysteresis Range: 1 to 10%
 - Hysteresis Increment: 0.1%
 - Activation Delay Range: 0 to 30 s
 - Activation Delay Increment: 0.1 s
- Overcurrent (51)
 - Pickup Range: 0.18 to 1.18 Aac (1 A current sensing)
 - Time Dial Range: 0
- Phase Imbalance (47)
 - Pickup Range: 5 to 100 VAC
 - Pickup Increment: 1 VAC
 - Activation Delay Range: 0 to 30 s
 - Activation Delay Increment: 0.1 s
- ROCOF (81R) (optional)
 - Pickup Range: 0.2 to 10 Hz/s
 - Pickup Increment: 0.1 Hz/s
 - Activation Delay Range: 0 to 10,000 ms
 - Activation Delay Increment: 1 ms
 - Accuracy: 0.2 Hz/s

DIGITAL GENERATOR SET CONTROLLER

MGC-2000 Series Data Sheet



SPECIFICATIONS, Generator Protection Functions, continued:

- Vector Shift (78) (optional)
 - Pickup Range: 2 to 90°
 - Pickup Increment: 1°
 - Accuracy: ±1°

Environmental

- Temperature
 - Operating: -40 °C to 70 °C (-40 °F to 158 °F)
 - Storage: -40 °C to 85 °C (-40 °F to 185 °F)
- Humidity: IEC 68-2-38
- Salt Fog: ASTM B 17-73, IEC 68-2-11 (tested while operational)
- Ingress Protection: IEC IP54 for front panel
- Shock: 15 G in three perpendicular planes
- Vibration:
 - 5 to 29 to 5 Hz at 1.5 G peak for 5 min.
 - 29 to 52 to 29 Hz at 0.036" DECS-A for 2.5 min.
 - 52 to 500 to 52 Hz at 5 G peak for 7.5 min.
- Swept over the above ranges for 12 sweeps in each of three mutually perpendicular planes with each 15 minute sweep.

Agency Approvals

- UL/CSA Approvals: "cURus" approved to UL 6200 and CSA C22.2 No.14
- NFPA Compliance: Complies with NFPA Standard 110, Standard for Emergency and Standby Power
- CE Marked: Complies with applicable EC Directives

ADDITIONAL SPECIFICATIONS

Battery Backup for Real Time Clock

The MGC-2000 Series provides a real-time clock with an internal backup battery. The battery will maintain timekeeping for approximately 10 years (depending on conditions) after power is removed from the controller. The clock is used by the event recorder and sequence of events functions to time-stamp events, and the exercise timer is used to start and stop the generator set when the exercise feature is utilized.

Breaker Management

The MGC-2000 Series is capable of controlling the generator breaker and the mains breaker. The status of the breakers is determined by using BESTlogic™Plus programmable logic to set up the GENBRK and MAINSBRK logic blocks. These logic blocks have outputs that can be configured to energize an output contact and control a breaker, as well as inputs for breaker control and status. The MGC-2000 Series will attempt to close a breaker only after verifying that it can be closed. If the breaker cannot be closed, the close request will be ignored. Only one breaker can be closed at a time. Synchronization is required before closing the breaker to a live bus. Closure to a dead bus can be performed after meeting dead bus threshold and timing requirements set by the user.

~~OPTIONAL ACCESSORIES~~

~~Analog Extension Module 2020 (AEM-2020)~~

~~The optional AEM-2020 is a remote auxiliary device that provides additional MGC-2000 Series analog inputs and outputs. Its features include:~~

- ~~• Eight Analog Inputs: The AEM-2020 provides eight analog inputs that are user-selectable for 4 to 20 mA or 0 to 10 VDC. Each analog input has under/over thresholds that can be configured as status only, alarm, or pre-alarm. When enabled, an out of range alarm alerts the user of an open or damaged analog input wire. The label text of each analog input is customizable.~~

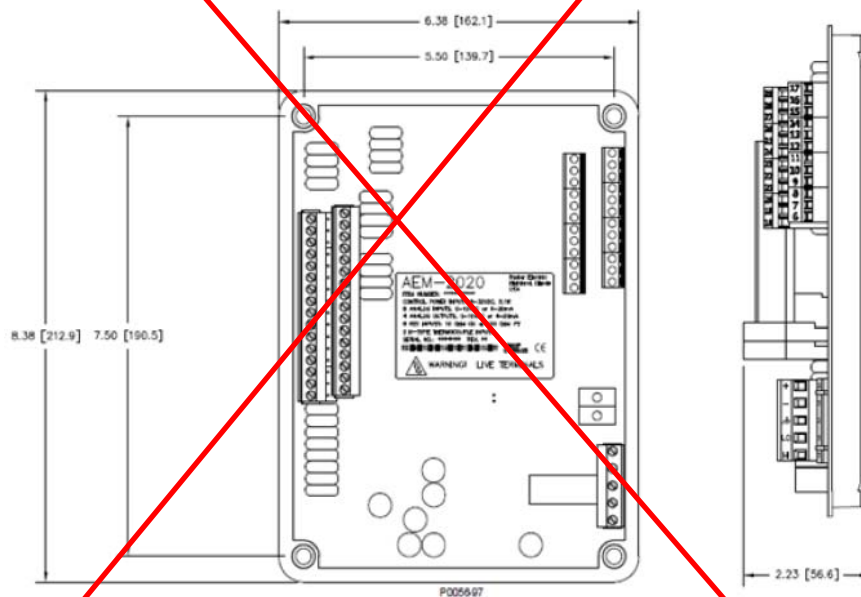
DIGITAL GENERATOR SET CONTROLLER

MGC-2000 Series Data Sheet



OPTIONAL ACCESSORIES, AEM-2020, continued:

- Eight Resistance Temperature Detector (RTD) Inputs: The AEM-2020 provides eight user-configurable RTD inputs for monitoring generator set temperature. Each RTD input can be configured as status only, alarm, or pre-alarm to protect against high or low temperature conditions. When enabled, an out-of-range alarm alerts the user of an open or damaged RTD input wire. The label text of each RTD input is customizable.
- Two Thermocouple Inputs: The AEM-2020 provides two thermocouple inputs for monitoring generator set temperature. Each thermocouple input can be configured as status only, alarm, or pre-alarm to protect against high or low temperature conditions. When enabled, an out-of-range alarm alerts the user of an open or damaged thermocouple input wire. The label text of each thermocouple input is customizable.
- Four Analog Outputs: The AEM-2020 provides four analog outputs that are user-selectable for 4 to 20 mA or 0 to 10 VDC. A wide selection of parameters including oil pressure, fuel level, generator voltage, and bus voltage can be configured as analog outputs. Refer to *Section 4, BESTCOMSPi[®] Software* of the *MGC-2000 Series Controller Manual*, for a full list of parameter selections.
- Communications via CANBus: A Control Area Network (CAN) is a standard interface that enables communication between the AEM-2020 and the MGC-2000 Series.



Input and Output Terminals

Contact Expansion Module 2020 (CEM-2020)

The CEM-2020 is a remote device that provides additional MGC-2000 Series contact inputs and outputs, giving the user flexibility to use the same model MGC-2000 Series generator set controller for simple or complicated applications that require contact functionality or duplication of contacts for remote annunciation. Its features include:

- 10 Contact Inputs: The CEM-2020 provides 10 programmable contact inputs with the same functionality as the contact inputs on the MGC-2000 Series.
- 24 Output Contacts: The CEM-2020 provides 24 Form C programmable output contacts with the same functionality as the output contacts on the MGC-2000 Series. The output ratings of the Form C contacts are:

DIGITAL GENERATOR SET CONTROLLER

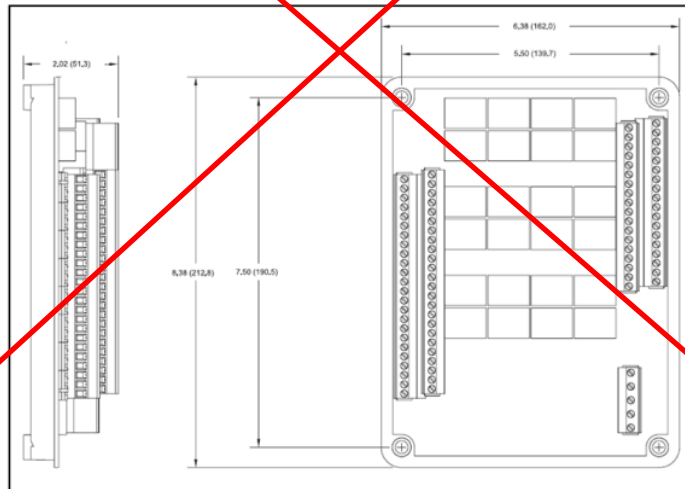
MGC-2000 Series Data Sheet



OPTIONAL ACCESSORIES, CEM-2020, continued:

Output No.	Rating (Cont.)	Additional Information
13-24	1 A @ 30 VDC	This is a gold flash contact for low current circuits.
25-36	4 A @ 30 VDC	

- Communications via CANBus: The CEM-2020 communicates to the MGC-2000 Series via SAE J1939 CANBus communications and allows the user to program the functionality of these inputs and outputs in the BESTCOMSPlus® software.
- The user can add labels for the inputs and outputs that appear in BESTCOMSPlus®, show up on the front panel, and in programmable logic. All the functionality can be assigned to these inputs and outputs as if they were an integrated part of the MGC-2000 Series. The CEM-2020 module has all of the environmental ratings of the MGC-2000 Series, including a model for UL Class1 Div2 applications. The CEM-2020 terminals accept a maximum wire size of 12 AWG, while the chassis ground requires 12 AWG wire. Flexibility is one of the benefits of the MGC-2000 Series, and this add-on module enhances that benefit even further.



CEM-2020 Overall Dimensions

© MTU Onsite Energy. Subject to alteration due to technological advances. 2015-12

100 Power Drive / Mankato, MN 56001 / 800-325-5450

MTU Onsite Energy
A Rolls-Royce Power Systems Brand

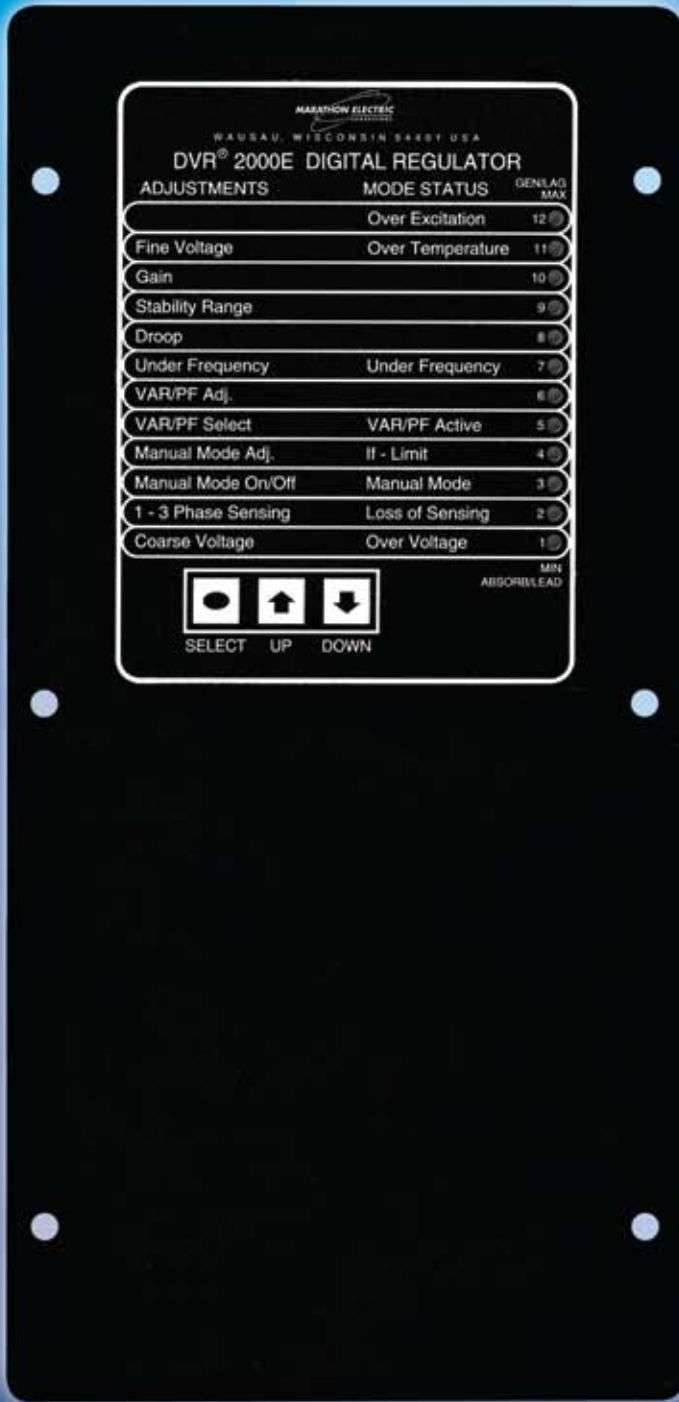
www.mtuonsiteenergy.com

// Page 10 of 10

KWRU 017842

DVR[®] 2000E

Enhanced Digital Technology Voltage Regulator



Advanced Features:

True RMS Sensing – One or Three Phase

Connect the sensing mode you prefer. Senses 95 to 600 volts \pm 10% at 50/60 hertz. Patented circuitry senses true RMS voltage rather than average for superior load regulation.

Soft-Start Ramp on Initial Start-Up

Controlled increase to rated voltage. Limits overshoot of voltage during voltage build-up.

Engine Unloading

Monitors the rate of frequency change during transient conditions. Provides additional voltage dip during speed drop to allow engine to recover faster.

Overvoltage Shutdown

Provides generator protection during sustained overvoltage. The overvoltage default point is 120% of generator setpoint voltage (adjustable from 105% to 120% via MARATHON-DVR2000E-32 software only) with a non-adjustable timeout of 0.75 seconds.

VAR/PF Controller (DVR2000EC Only)

Provides VAR or Power Factor control when paralleling to utility power.

Encapsulated Design

Maximum protection against moisture or abrasive contamination, which can lead to early regulator failure. Tested to MIL-STD-705, Method 711.1C. Salt fog tested to MIL-STD-810E.

Auto/Manual Mode

Exciter field current can be controlled by the regulator or manually set at a fixed value.

CSA Approved

Solid State Voltage Build-Up eliminates voltage build-up relays with contacts that arc and fail.



KWRU 017843
ISO 9001:2000 Certified

DVR[®] 2000E

Regulator Specifications

Voltage Regulation. 0.25% for precise voltage control on most applications. Voltage drift less than 0.5% for 40°C ambient temperature change (15 to 70°C range).

Output Power. 3.0 ADC, 75 VDC, 225 watts, maximum continuous rating; 7.5 ADC, 150 VDC, 1125 watts forcing for one (1) minute.

Exciter Field DC Resistance. Nominal hot resistance 18 to 25 ohms.

Voltage Adjustment. Minimum of $\pm 10\%$ of nominal voltage range. Remote adjustment can be made up to 150 feet from voltage regulator.

50 or 60 Hz Operation. No reconnection required for frequency change.

Power Input. 180–240 volts AC, 200–360 hertz PMG supply.

Wide Operating Temperature Range. -40°C to +70°C covers all normal operating environments. Regulator “latches” off when +70°C is exceeded.

Loss of Sensing Shutdown. Protects the generator against uncontrolled voltage output when the sensing circuit to the regulator is opened. Regulator shuts down when the sensing circuit to the regulator does not find continuity. Regulator also shuts down when voltage unbalance exceeds 20% for a specified duration, adjustable by the user.

Overexcitation Shutdown. Protects the generator against damage caused by prolonged field forcing.

Paralleling Mode. Paralleling for multiple generator setups is standard. Simply add 5 VA current transformers for parallel operation in “droop” or “cross current” compensation.

Shock. Withstands up to 20 Gs in each of three (3) perpendicular planes.

Vibration. Withstands 0.036 inch peak, 27–52 Hz; 1 G from 5–26 Hz and 5.0 Gs from 53–500 Hz.

Multiple Use of Current Transformers. The same current transformers can be used for multiple functions. The voltage regulator does not require separate transformers for paralleling or metering.

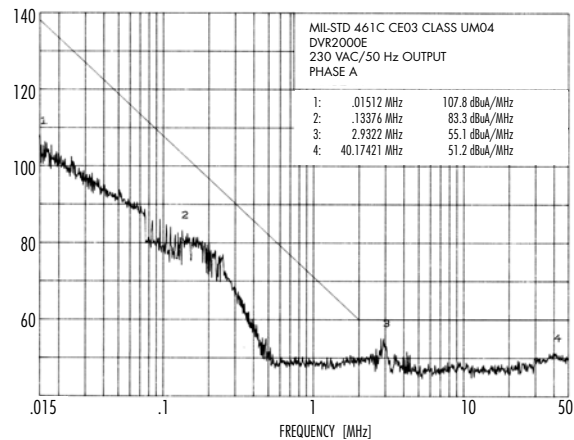
Ease of Use. All regulator adjustments and LED indicators are located on one side for easy use and adjustment. Push button controls allow adjustment of the various regulator functions.

External Device Port. PC or Palm connectivity allows access to enhanced operational features using custom software available from our website or upon request.

Volts-per-Hertz Operation. Protects the generator during underspeed operation and aids the prime mover during 100% block load pickup. Adjustable transition between flat regulation and volts-per-hertz ramp adjustable from 40 to 65 Hz. Provides selectable slope of 1 to 3 times PU volts/hertz.

Accessory Input. ± 1 VDC creates a $\pm 10\%$ adjustment for AVR, FCR, and VAR. ± 1 VDC creates a ± 0.1 PF adjustment in the PF mode (adjusts only the active regulation mode).

EMI Suppression. Internal electromagnetic interference filter meets MIL-STD-461C, Part 9 for radiated and conducted emissions susceptibility when mounted in the MAGNAMAX^{DVR} generator connection box.



**Your Independent Power Source
for the 21st Century!**

100 E. Randolph Street • P.O. Box 8003
Wausau, WI 54402-8003 USA

www.marathonelectric.com

Phone: 715-675-3359
Fax: 715-675-8026

GPN023 6463J/100/07-09/NP/FORMS



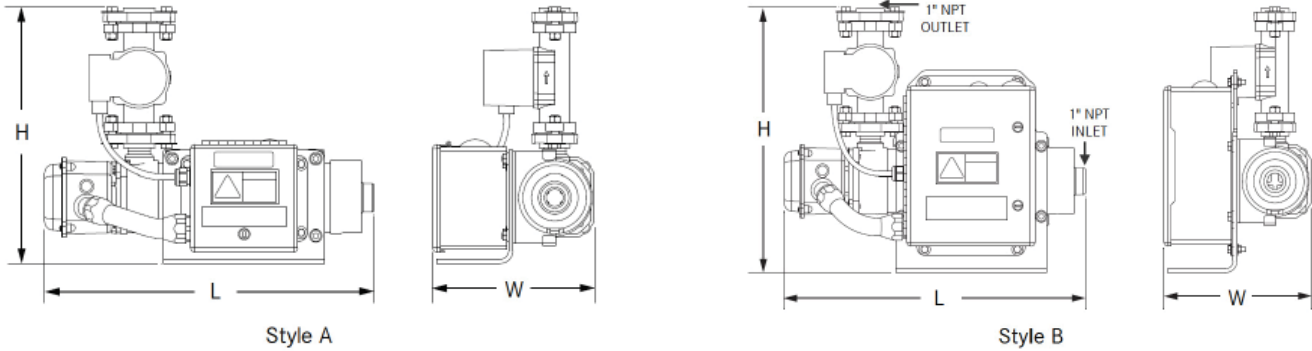
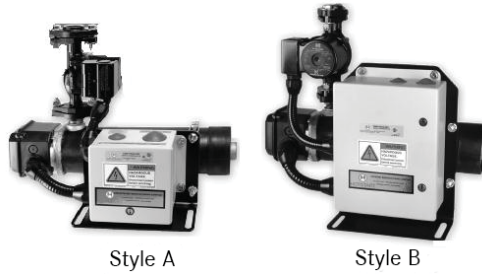
KWRU 017844

WATER HEATER

CSM Series Data Sheet



The CSM model is designed to preheat diesel and gas engines in generator set applications. The CSM heating system features a coolant preheater with thermostat, heating engines ranging in size from 15L to 100L displacement, pump, and all required controls. Forced circulation of the coolant delivers uniform heating throughout the entire engine, extends element life, and offers a significant reduction in electrical consumption.



CERTIFICATIONS AND STANDARDS

- c-UL-us Listed (60 Hz)
- CE Compliant (Style B)

SPECIFICATIONS

	<u>Style A</u>	<u>Style B</u>
Height:	383 mm (15 in)	434 mm (17 in)
Length:	493 mm (19.4 in)	493 mm (19.4 in)
Width:	242 mm (9.5 in)	242 mm (9.5 in)
Weight:	16.8 kg (37 lb)	24.5 kg (54 lb)
Heating Fluid:	Engine coolant (50% glycol/50% water)	
Power:	3, 6, 9, 10.5, and 12 kW	
Rated Voltage:	1 or 3 Phase, 120-690V (50 or 60 Hz)	
Fixed Thermostat:	38-49 °C (100-120 °F)	
Flow:	2.2 m ³ /hr (10 gpm) at 3 mWc (10 ft/head)	
Max Pressure:	860 kPa (125 psi)	
Pressure Loss:	1.5 kPa (0.2 psi)	
Inlet / Outlet:	1" NPT / 1" NPT	
Main Control Box		
Ingress Protection:	NEMA 4 (IP66)	
Motor Ingress Protection:	IP44 (50 Hz), NEMA 2 (60 Hz)	

WATER HEATER

CSM Series Data Sheet



Model Number	MTU Onsite Energy Part Number	Watts	Volts	Phase	Hz	Amps	Style
CSM10302-000	SUA95187	3,000	240	1	60	13.1	A
CSM10308-000	SUA85631	3,000	208	1	60	15.1	A
CSM1060C-000	SUA85778	6,000	220	1	50	26	A
CSM10602-000	SUA85269	6,000	240	1	60	25.6	A
CSM10604-000	SUA87941	6,000	480	1	60	12.8	B
CSM10608-000	SUA86669	6,000	208	1	60	29.6	A
CSM1090C-000	SUA101813	9,000	220	1	50	41.5	A
CSM10902-000	SUA86156	9,000	240	1	60	38.1	A
CSM10904-000	SUA85170	9,000	480	1	60	19.1	B
CSM10908-000	SUA86157	9,000	208	1	60	44	A
CSM11202-000	SUA86158	12,000	240	1	60	50.6	B
CSM11204-000	SUA87538	12,000	480	1	60	25.3	B
CSM11208-000	SUA84406	12,000	208	1	60	58.4	B
CSM3060A-000	SUA88779	6,000	400	3	50	8.9	B
CSM30604-000	SUA88350	6,000	480	3	60	7.4	B
CSM30608-000	SUA88168	6,000	208	3	60	17.1	B
CSM3090A-000	SUA106952	9,000	400	3	50	13.2	B
CSM30904-000	SUA85254	9,000	480	3	60	11	B
CSM30908-000	SUA87710	9,000	208	3	60	25.4	B
CSM31204-000	SUA90111	12,000	480	3	60	14.6	B
CSM31208-000	SUA88155	12,000	208	3	60	33.7	B

© MTU Onsite Energy. Subject to alteration due to technological advances. 2015-05

BATTERY CHARGER

NRG Intelligent Engine Start Data Sheet



The Smart Choice for Mission-Critical Engine Starting:

- Fast, accurate, mission-critical charging gives best starting reliability
- 4-rate, temperature-compensated output offers longest battery life
- Replace nearly any charger without planning ahead
- Industry-first battery-fault alarm helps dispatch service early
- Lasting reliability – field MTBF > 1 million hours with industry-best warranty
- IBC seismic certification meets latest building codes, no installation delays
- Optional OSHPD pre-approval



BENEFITS AND FEATURES

Failure to start due to battery problems is the leading cause of inoperable engine generator sets.

The NRG battery charger maximizes starting system reliability while slashing generator set servicing costs:

- One NRG replaces almost any charger without extra site visits. Installers can select or change at any time 120, 208, or 240 volts AC input, 12 or 24-volt battery and output settings optimized for nearly any lead-acid or nickel cadmium battery.
- Easy to understand user interface provides state-of-the-art system status including digital metering, NFPA 110 alarms, and a battery fault alarm that can send service personnel to the site before failure to start.
- Batteries charged by NRG give higher performance and last longer. In uncontrolled environments, precision charging increases battery life and watering intervals 400% or more.
- NRG meets all relevant industry standards – including UL, NFPA 110, and CE. Seismic Certification per International Building Code (IBC) 2000, 2003, 2006. All units are C-UL listed. 50/60 Hz units add CE marking to UL agency marks.

EnerGenius reliability technology built into every charger includes:

- All-electronic operation with generous component de-rating
- Disconnected/reversed/incorrect voltage battery alarm and protection
- Protection of connected equipment against load dump transients
- Widest temperature rating and overtemperature protection
- Superior lightning and voltage transient protection
- Demonstrated field MTBF > 1 million hours
- MTU Onsite Energy standard warranty terms apply

BATTERY CHARGER

NRG Intelligent Engine Start Data Sheet



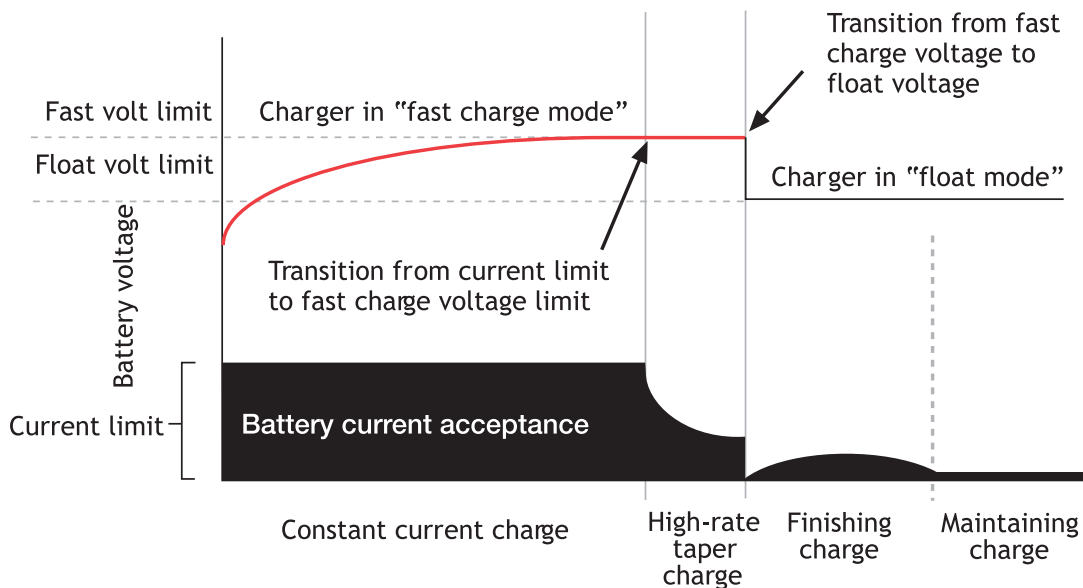
SPECIFICATIONS

AC Input

Voltage	110-120/208-240 VAC, ±10%, single phase, field selectable
Input current	10A charger: 6.6/3.3 amps maximum 20A charger: 12.6/6.3 amps maximum
Frequency	60 Hz ±5% standard; 50/60 Hz ±5% optional
Input protection	1-pole fuse, soft-start, transient suppression

Charger Output

Nominal voltage rating	12/24 volt, field selectable
Battery settings	Six discrete battery voltage programs - Low or high S.G. flooded - Low or high S.G. VRLA - Nickel cadmium 9, 10, 18, 19 or 20 cells
Regulation	±0.5% (1/2%) line and load regulation
Current	10 or 20 amps nominal
Electronic current limit	105% rated output typical—no crank disconnect required
Charge characteristic	Constant voltage, current limited, 4-rate automatic equalization
Temperature compensation	Enable or disable anytime, remote sensor optional
Output protection	Current limit, 1-pole fuse, transient suppression



Standard Four (4) Rate Charging

BATTERY CHARGER

NRG Intelligent Engine Start Data Sheet



Agency Standards

Safety	c-UL-us Listed to UL 1236 and CSA standard 22.2 no. 107.2. UL file E109740 CE: 50/60 Hz units DOC to EN 60335
Agency marking	60 Hz: c-UL-us Listed 50/60 Hz: c-UL-us Listed plus CE marked
EMC	Emissions: FCC Part 15, Class B; EN 50081-2 Immunity: EN 61000-6-2
NFPA standards	NFPA 70, NFPA 110. (NFPA 110 requires Alarms "C")
Optional agency compliance	OSHPD pre-approval

Construction

Material	Non-corroding aluminum enclosure
Dimensions	See <i>Diagrams and Dimensions</i> section of this document
Printed circuit card	Surface mount technology, conformal coated
Cooling	Natural convection
Protection degree	Listed housing: NEMA-1 (IP20). Optional IP21 drip shield. Optional NEMA 3R enclosure
Damage prevention	Fully recessed display and controls
Electrical connections	Compression terminal blocks

Warranty

Standard warranty	MTU Onsite Energy standard warranty terms apply
-------------------	---

Optional Features

Input	Input frequency, 50/60 Hz
Remote temp comp sensor	Recommended where battery and charger are in different locations
Drip shield meets s/b (IP21)	Protects from dripping water
NEMA 3R housing	Enables outdoor installation (remote temp sensor recommended)

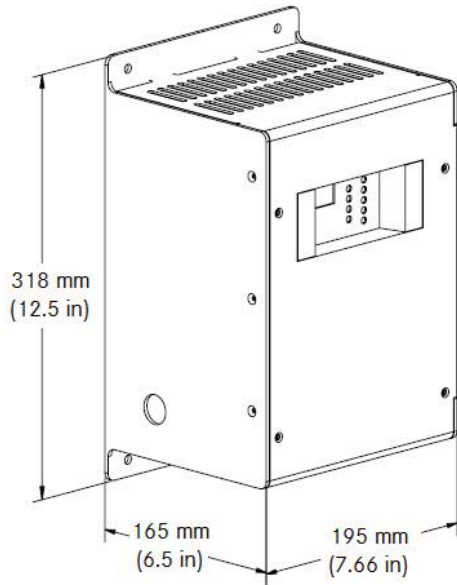
BATTERY CHARGER

NRG Intelligent Engine Start Data Sheet

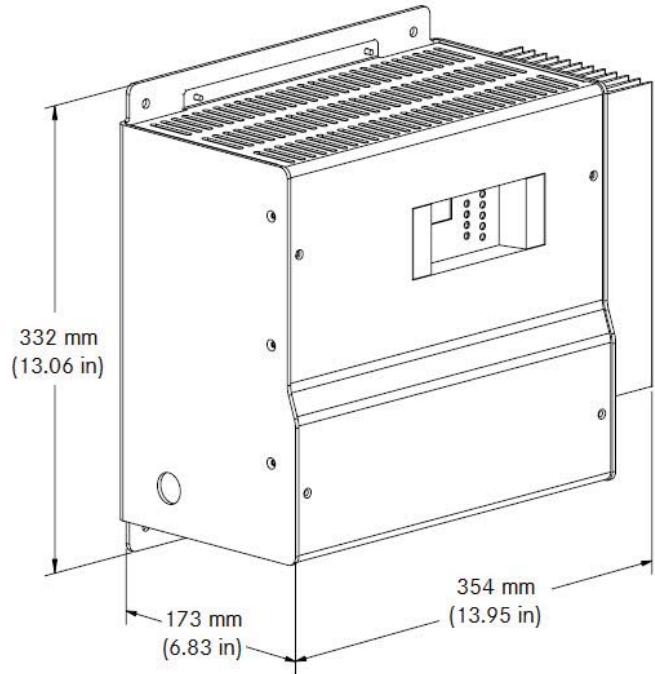


DIAGRAMS AND DIMENSIONS

10A Chargers



20A Chargers



NRG Ordering Information						
Output Volts	Output Amps	Frequency	Model	Available Configurations	NFPA 110 Alarms	Weight kg (lbs)
12/24	10	60 Hz	SUA83187	Enclosed	Yes	10.4 (23)
12/24	20	60 Hz	SUA90170	Enclosed	Yes	19.1 (42)
12/24	10	50/60 Hz	SUA89983	Enclosed	Yes	10.4 (23)
12/24	20	50/60 Hz	SUA94705	Enclosed	Yes	19.1 (42)

All models offer field-selectable input 120/208-240 volts.



© MTU Onsite Energy. Subject to alteration due to technological advances. 2014-11

MTU Onsite Energy
A Rolls-Royce Power Systems Brand

www.mtuonsiteenergy.com

// Page 5 of 5

KWRU 017851

Engine data


	Genset	Marine	O & G	Rail	C & I
Application	x				
Engine model	12V2000G85 TB				
Emission Stage	EPA2 (EPA2 parameter-setting/D2-Cycle)				
Optimisation					
Application group	3D				
Date	07.03.2012				
fuel sulphur content [ppm]	5				
mg/mN ³ values base on residual oxygen value of [%]	measured				

Engine raw emissions*

Cycle point	[-]	n1	n2	n3	n4	n5	n6	n7	n8
Power (P/PN)	[-]	1	0,75	0,50	0,25	0,10			
Power	[kW]	890	668	445	223	89			
Speed (n/nN)	[-]	1	1	1	1	1			
Speed	[rpm]	1800	1800	1800	1800	1800			
Exhaust temperature after turbine	[°C]	534	470	424	352	245			
Exhaust massflow	[kg/h]	4718	4238	3242	2134	1613			
Exhaust back pressure	[mbar]	32	23	13	5	2			
NOx	[g/kWh]	6,2	5,1	5,0	5,9	13,5			
	[mg/mN ³]	1702	1110	964	868	1007			
CO*	[g/kWh]	0,6	0,5	0,6	1,2	3,4			
	[mg/mN ³]	159	103	119	175	256			
HC	[g/kWh]	0,04	0,09	0,20	0,45	1,29			
	[mg/mN ³]	11	19	38	65	97			
O2	[%]	8,2	10,2	11,5	13,2	15,6			
Particulate measured	[g/kWh]	0,02	0,03	0,07	0,17	0,20			
	[mg/mN ³]	6	7	13	24	15			
Particulate calculated	[g/kWh]	-	-	-	-	-			
	[mg/mN ³]	-	-	-	-	-			
Dust (only TA-Luft)	[mg/mN ³]	-	-	-	-	-			
FSN	[-]	0,2	0,2	0,5	0,7	0,1			
NO/NO2**	[-]	-	-	-	-	-			
CO2	[g/kWh]	663,3	674,7	682,0	735,7	945,3			
	[mg/mN ³]	178552	150249	130908	105958	71038			
SO2	[g/kWh]	0,002	0,002	0,002	0,002	0,003			
	[mg/mN ³]	0,6	0,5	0,4	0,3	0,2			

* Emission data measurement procedures are consistent with the respective emission evaluation process. Noncertified engines are measured to sales data (TVU/TEN) standard conditions. These boundary conditions might not be representative for detailed dimensioning of exhaust gas aftertreatment, in this case it is recommended to contact the responsible department for more information. Measurements are subject to variation. The nominal emission data shown is subject to instrumentation, measurement, facility, and engine-to-engine variations. All data applies to an engine in new condition. Over extended operating time deterioration may occur which might have an impact on emission. Exhaust temperature depends on engine ambient conditions.

** No standard test. To be measured on demand

					Benennung/Title	
					Emissionsdatenblatt Emission Data Sheet	
				MTU Friedrichshafen GmbH	Zeichnungs-Nr./Drawing No.	
				Bearbeiter/Drawn by	Datum/Date	Name/Name
					07.03.2012	Lenhof
				Geprüft/Checked	07.09.2012	Peitz
					EDS 2000 0136	
Buchstabe/ Revision	Änderung Modifikation	Datum Date	Name Name	Org.-Einheit/Dept.	TKV	Schmitz

Vers. 1.0

Fuer diese technische Unterlage behalten wir uns alle Rechte vor. Sie darf ohne unsere Zustimmung weder vervielfaeltigt, noch Dritten zugaenglich gemacht, noch in anderer Weise missbraeuchlich verwertet werden

We reserve all rights to this technical document. Without our prior permission it shall not be reproduced, made available to any third party or otherwise misused in any way whatsoever.

KWRU 017852



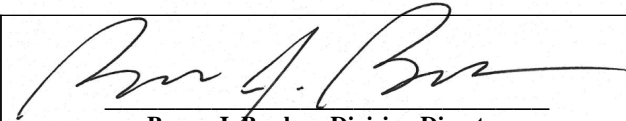
**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2016 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT**

**OFFICE OF TRANSPORTATION
AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105**

Certificate Issued To: MTU America, Inc.
(U.S. Manufacturer or Importer)
Certificate Number: GMDDL35.8GRR-003

Effective Date:
11/03/2015

Expiration Date:
12/31/2016


Byron J. Bunker, Division Director
Compliance Division

Issue Date:
11/03/2015
Revision Date:
N/A

Model Year: 2016
Manufacturer Type: Original Engine Manufacturer
Engine Family: GMDDL35.8GRR

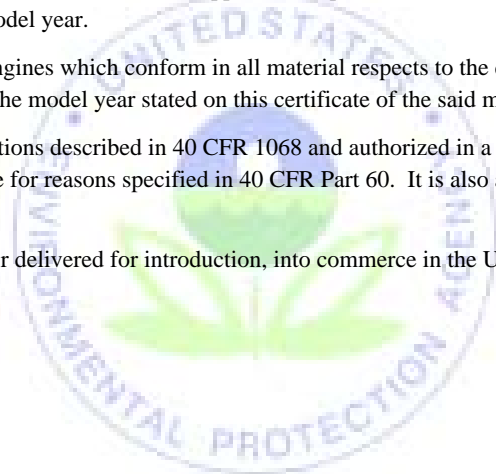
Mobile/Stationary Indicator: Stationary
Emissions Power Category: 560<kW<=2237
Fuel Type: Diesel
After Treatment Devices: No After Treatment Devices Installed
Non-after Treatment Devices: Electronic Control

Pursuant to Section 111 and Section 213 of the Clean Air Act (42 U.S.C. sections 7411 and 7547) and 40 CFR Part 60, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following engines, by engine family, more fully described in the documentation required by 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new compression-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 60.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 60. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 60.

This certificate does not cover engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.



KWRU 017853



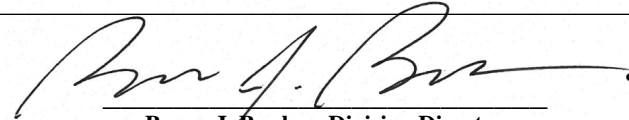
**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2016 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT**

**OFFICE OF TRANSPORTATION
AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105**

Certificate Issued To: MTU America, Inc.
(U.S. Manufacturer or Importer)
Certificate Number: GMDDL35.8GRR-003

Effective Date:
11/03/2015

Expiration Date:
12/31/2016


Byron J. Bunker, Division Director
Compliance Division

Issue Date:
11/03/2015

Revision Date:
N/A

Model Year: 2016
Manufacturer Type: Original Engine Manufacturer
Engine Family: GMDDL35.8GRR

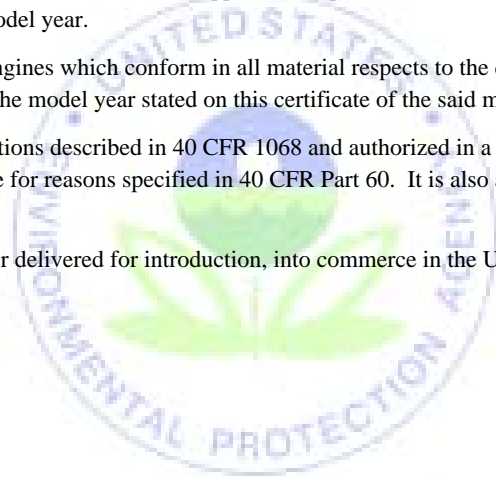
Mobile/Stationary Indicator: Stationary
Emissions Power Category: 560<kW<=2237
Fuel Type: Diesel
After Treatment Devices: No After Treatment Devices Installed
Non-after Treatment Devices: Electronic Control

Pursuant to Section 111 and Section 213 of the Clean Air Act (42 U.S.C. sections 7411 and 7547) and 40 CFR Part 60, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following engines, by engine family, more fully described in the documentation required by 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new compression-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 60.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 60. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 60.

This certificate does not cover engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.



KWRU 017854



South Coast Air Quality Management District

21865 Copley Drive, Diamond Bar, CA 91765-4178
(909) 396-2000 • www.aqmd.gov

December 16, 2015

Mr. Saeed Abolhasani
MTU America, Inc.
39525 MacKenzie Drive
Novi, MI 48377

Dear Mr. Abolhasani:

The South Coast Air Quality Management District (SCAQMD) has extended to December 31, 2016 the Certified Equipment Permits (CEPs) for the stationary emergency internal combustion (IC) engine models listed in the attached table. However, please be reminded that many of these certified diesel-fueled IC engines may not meet Rule 1470 requirements if installed near a sensitive receptor or near school grounds and, therefore, may require an aftertreatment system such as a diesel particulate filter in the exhaust stream.

Please note that the SCAQMD does not endorse or warrant any specific equipment or manufacturer. Modification of the equipment listed here will void this certification.

If you have additional questions or need further clarification on the CEP program, please feel free to contact Rizaldy Calungcagin at (909) 396-2315 or at rcalungcagin@aqmd.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "William C. Thompson".

William C. Thompson, P.E.
Senior Manager/Web Deputy
Engineering and Compliance

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
Certified ICE-Emergency Generators

MTU AMERICA, INC.

Engine Mfr.	Model	Engine Rating	Application No.
MTU America	10V1600G80S	752 BHP	578846
MTU America	18V2000G76S	1839 BHP	578847
Tognum America	10V1600G80S	752 BHP	551793
Tognum America	12V2000G45TB	1045 BHP	551794
Tognum America	12V2000G85TB	1193 BHP	551795
Tognum America	16V2000G45TB	1354 BHP	551796
Tognum America	16V2000G85TB	1495 BHP	551797
Tognum America	16V4000G83L	3674 BHP	551792

12/16/2015



CERTIFIED EQUIPMENT PERMIT (CEP)
(NOT A PERMIT TO CONSTRUCT OR OPERATE)

Granted on July 26, 2013

ID 174372

**Legal Owner
or Operator:**

TOGNUM AMERICA, INC.
39525 MACKENZIE DR
NOVI, MI 48377
ATTN: ALAN PITTEL

Equipment Location: SAME AS ABOVE

The equipment described below and as shown on the approved plans and specifications are subject to the special condition or conditions listed.

Equipment Description

INTERNAL COMBUSTION ENGINE, TOGNUM AMERICA MODEL NO. 12V2000G85TB, 1193 BHP (890 KWm), 12 CYLINDERS, TURBOCHARGED, DIESEL-FUELED, DRIVING AN EMERGENCY ELECTRICAL GENERATOR.

Manufacturer Condition

1. **THIS CERTIFIED EQUIPMENT PERMIT (CEP) IS NOT A PERMIT TO CONSTRUCT OR OPERATE.** THE PERSON CONSTRUCTING, INSTALLING OR OPERATING THE EQUIPMENT AT EACH SPECIFIC SITE SHALL OBTAIN ALL NECESSARY PERMIT(S) TO CONSTRUCT AND PERMIT(S) TO OPERATE AND COMPLY WITH ANY OTHER DISTRICT RULES AND REGULATIONS INCLUDING THE REQUIREMENTS OF REGULATION XIII.

End User Conditions

1. OPERATION OF THIS EQUIPMENT SHALL BE CONDUCTED IN ACCORDANCE WITH ALL DATA AND SPECIFICATIONS SUBMITTED WITH THE APPLICATION UNDER WHICH THIS PERMIT IS ISSUED UNLESS OTHERWISE NOTED BELOW.
2. THIS EQUIPMENT SHALL BE PROPERLY MAINTAINED AND KEPT IN GOOD OPERATING CONDITION AT ALL TIMES.
3. A NON-RESETTABLE TOTALIZING TIMER SHALL BE INSTALLED AND MAINTAINED TO INDICATE THE ENGINE ELAPSED OPERATING TIME.
4. THIS ENGINE SHALL NOT OPERATE MORE THAN 200 HOURS IN ANY ONE YEAR, WHICH INCLUDES NO MORE THAN 50 HOURS IN ANY ONE YEAR FOR MAINTENANCE AND TESTING PURPOSES.
5. AN ENGINE OPERATING LOG OF ENGINE OPERATIONS SHALL BE KEPT AND MAINTAINED DOCUMENTING THE TOTAL TIME THE ENGINE IS OPERATED EACH MONTH AND THE SPECIFIC REASON FOR OPERATION SUCH AS:

ORIGINAL

KWRU 017857



**CERTIFIED EQUIPMENT PERMIT (CEP)
(NOT A PERMIT TO CONSTRUCT OR OPERATE)**

- A. EMERGENCY USE
- B. MAINTENANCE AND TESTING
- C. OTHER (BE SPECIFIC)


IN ADDITION, FOR EACH TIME THE ENGINE IS MANUALLY STARTED, THE LOG SHALL INCLUDE THE DATE OF ENGINE OPERATION, THE SPECIFIC REASON FOR OPERATION, AND THE TOTALIZING HOUR METER READING (IN HOURS AND TENTHS OF HOURS) AT THE BEGINNING AND THE END OF THE OPERATION.

- 6. ON OR BEFORE JANUARY 15TH OF EACH YEAR, THE OPERATOR SHALL RECORD IN THE ENGINE OPERATING LOG:
 - A. THE TOTAL HOURS OF ENGINE OPERATION FOR THE PREVIOUS CALENDAR YEAR, AND
 - B. THE TOTAL HOURS OF ENGINE OPERATION FOR MAINTENANCE AND TESTING FOR THE PREVIOUS CALENDAR YEAR.
- 7. ENGINE OPERATION LOG(S) SHALL BE RETAINED ON SITE FOR A MINIMUM OF THREE CALENDAR YEARS AND SHALL BE MADE AVAILABLE TO THE EXECUTIVE OFFICER OR REPRESENTATIVE UPON REQUEST.
- 8. OPERATION BEYOND THE 50 HOURS PER YEAR ALLOTTED FOR ENGINE MAINTENANCE AND TESTING SHALL BE ALLOWED ONLY IN THE EVENT OF A LOSS OF GRID POWER OR UP TO 30 MINUTES PRIOR TO A ROTATING OUTAGE, PROVIDED THAT: (A) THE UTILITY DISTRIBUTION COMPANY HAS ORDERED ROTATING OUTAGES IN THE CONTROL AREA WHERE THE ENGINE IS LOCATED OR HAS INDICATED THAT IT EXPECTS TO ISSUE SUCH AN ORDER AT A CERTAIN TIME; AND (B) THE ENGINE IS LOCATED IN A UTILITY SERVICE BLOCK THAT IS SUBJECT TO THE ROTATING OUTAGE. ENGINE OPERATION SHALL BE TERMINATED IMMEDIATELY AFTER THE UTILITY DISTRIBUTION COMPANY ADVISES THAT A ROTATING OUTAGE IS NO LONGER IMMINENT OR IN EFFECT.
- 9. THIS ENGINE SHALL COMPLY WITH ALL APPLICABLE REQUIREMENTS OF RULES 431.2, 1470 (AND 1472).

Please notify Rizaldy Calungcagin at (909) 396-2315 (rcalungcagin@aqmd.gov) when SCAQMD information packets are needed or if you have any questions concerning the Certification/Registration Program.

This Certified Equipment Permit is based on the plans, specifications, and data submitted as it pertains to the release of air contaminants and control measures to reduce air contaminants. No approval or opinion concerning safety and other factors in design, construction or operation of the equipment is expressed or implied.

This Certified Equipment Permit will become invalid if this application is canceled. THIS PERMIT SHALL EXPIRE ON December 31, 2013 unless an extension is granted by the Executive Officer.

By 
DAVID DE BOER
Program Supervisor



GENSET

Part list number

Genset Drawings

Wiring number

Description

Project template with IEC identifier structure

+TNK/J27

			Date			Project template with IEC identifier structure		Cover sheet	Drawing No.	KWRU017859 / EAA /		
			Editor	KJ Black					<small>Client No.</small> 1317805	<small>Department</small> 1317805		
			Appr									Page 1
Modification	Date	Name	Norm		Customer Description	Project Description			Project template with identifier structure to IEC 81346			

Table of contents

MTU_Global F06 V00

Page Structure				Page	Page description	Date	Edited by
		EAA		1	Cover sheet	9/22/2016	C. W. Sturm
		EAB		2	Table of contents	9/26/2016	KJ Black
		EAB		10	Table of contents	9/26/2016	KJ Black
		EDB		3	Document/Function/Location Table	9/23/2016	C. W. Sturm
		EDB		4	Drawing Line and Color Definition	9/23/2016	C. W. Sturm
		EDB		5	Wire Color Definition	9/23/2016	C. W. Sturm
CPL	EFA	CON		6	Power & Ground	9/26/2016	KJ Black
CPL	EFA	CON		7	Back Panel Layout	9/26/2016	KJ Black
CPL	EFA	PLC		8	MGC Controller	9/26/2016	KJ Black
GEN	EFS	EKW		9	Generator	9/26/2016	KJ Black
GEN	EFS	EKW		10	Generator Accessories	9/26/2016	KJ Black
GCB	EFS	EKW		11	Breakers	9/26/2016	KJ Black
ENG	EFS	MkW		13	Engine ECU Plug -X1 -X3	9/26/2016	KJ Black
ENG	EFS	MkW		14	Engine Accessories	9/26/2016	KJ Black
BSF	EFS	MkW		15	Jacket Water Heaters	9/26/2016	KJ Black
BSF	EFS	STR		16	Starter & Battery	9/26/2016	KJ Black
CPL	EFS	CON		17	Door / Emergency stop	9/23/2016	C. W. Sturm
CPL	EFS	CON		18	Alarm/Pre-Alarm	9/26/2016	KJ Black
CPL	EFS	COM		24	Com. Bus-overview	9/26/2016	KJ Black
TNK	EFS	FUL		25	Fuel Tank	9/26/2016	KJ Black
GEN	ECL			1	Connection list : L0 - ENG_HARN-9G	9/26/2016	KJ Black
ENG	ECL			1	Connection list : - -X3-(242)	9/26/2016	KJ Black
BSF	ECL			1	Connection list : JMP - ENG_HARN-48	9/26/2016	KJ Black
CPL	ECL			1	Connection list : (2) - (9F)	9/26/2016	KJ Black
GCB	ECL			1	Connection list : 1 - 9	9/26/2016	KJ Black
TNK	ECL			1	Connection list : (98) - (57)	9/26/2016	KJ Black
	ECL			9	Connection list : 9 - 9	9/26/2016	KJ Black
OTB	ECL			1	Connection list : (36) - ENG_HARN-48C	9/26/2016	KJ Black
DC_LIGHT_BOX	ECL			3	Connection list : 125C - 9	9/26/2016	KJ Black
CPL	ETL			16	Legende	9/26/2016	KJ Black
GEN	EMA			11	Terminal diagram	9/26/2016	KJ Black
GEN	EMA			12	Terminal diagram	9/26/2016	KJ Black
GEN	EMA			13	Terminal diagram	9/26/2016	KJ Black
GEN	EMA			14	Terminal diagram	9/26/2016	KJ Black
GEN	EMA			15	Terminal diagram	9/26/2016	KJ Black
GEN	EMA			16	Terminal-overview	9/26/2016	KJ Black
GEN	EMA			17	Terminal-overview	9/26/2016	KJ Black
GEN	EMA			18	Terminal-overview	9/26/2016	KJ Black
GEN	EMA			19	Terminal-overview	9/26/2016	KJ Black

1

3

Table of contents

MTU_Global F06 V00

Page Structure			Page	Page description	Date	Edited by
GEN	EMA		20	Terminal-overview	9/26/2016	KJ Black
ENG	EMA		15	Terminal diagram	9/26/2016	KJ Black
ENG	EMA		16	Terminal-overview	9/26/2016	KJ Black
CPL	EMA		25	Terminal diagram	9/26/2016	KJ Black
CPL	EMA		26	Terminal diagram	9/26/2016	KJ Black
CPL	EMA		27	Terminal diagram	9/26/2016	KJ Black
CPL	EMA		28	Terminal diagram	9/26/2016	KJ Black
CPL	EMA		29	Terminal diagram	9/26/2016	KJ Black
CPL	EMA		30	Terminal-overview	9/26/2016	KJ Black
CPL	EMA		31	Terminal-overview	9/26/2016	KJ Black
CPL	EMA		32	Terminal-overview	9/26/2016	KJ Black
CPL	EMA		33	Terminal-overview	9/26/2016	KJ Black
CPL	EMA		34	Terminal-overview	9/26/2016	KJ Black
CPL	EMA		35	Terminal-overview	9/26/2016	KJ Black
GCB	EMA		12	Terminal diagram	9/26/2016	KJ Black
GCB	EMA		13	Terminal diagram	9/26/2016	KJ Black
GCB	EMA		14	Terminal-overview	9/26/2016	KJ Black
GCB	EMA		15	Terminal-overview	9/26/2016	KJ Black
TNK	EMA		26	Terminal diagram	9/26/2016	KJ Black
TNK	EMA		27	Terminal-overview	9/26/2016	KJ Black
	EMA		6	Terminal diagram	9/26/2016	KJ Black
	EMA		7	Terminal-overview	9/26/2016	KJ Black
EXT	EMA		1	Terminal diagram	9/26/2016	KJ Black
EXT	EMA		2	Terminal-overview	9/26/2016	KJ Black
DC_LIGHT_BOX	EMA		1	Terminal diagram	9/26/2016	KJ Black
DC_LIGHT_BOX	EMA		2	Terminal-overview	9/26/2016	KJ Black
ENG	EMB		17	Harness-overview	9/26/2016	KJ Black
ENG	EPC		18	Bill of material	9/26/2016	KJ Black
CPL	EPC		36	Bill of material	9/26/2016	KJ Black
GCB	EPC		16	Bill of material	9/26/2016	KJ Black
	EPC		8	Bill of material	9/26/2016	KJ Black

9

+OTB/1

TECHNICAL DATA AND CONSTRUCTION DETAILS

IEC 61355

Description	Document types (&)
Document	information content
& EAA	Electrical cover sheet
& EAB	Electrical table of contents
& ECL	Electrical connection list
& EDB	Description
& EFF	Electrical function diagram
& EFQ	Fuse rotation
& EFS	Wiring diagram
& EFA	Wiring diagram overview
& ETL	Layout
& ETC	Manufacturing Dokuments
& EMA	Electrical terminal diagram
& EMB	Electrical cable plan
& EPC	Bill of material

Description	Function (=)
Function	information content
= EKW	Electrical power supply
= MKW	Mech.power-cooling/heating
= CON	Control voltages
= EES	Engine emergency stop
= MES	Manual emergency stop
= PLC	PLC or genset controller
= MPD	Monitoring and protection devices
= COM	Communication
= LUB	Lube oil system
= STR	Engine starting
= MCC	Mixture cooling circuit
= ECC	Engine/jacket water cooling circuit
= HWC	Heating water circuit
= DCC	Dump/emergency engine cooling
= ERV	Engine room ventilation
= FUL	Fuel supply
= EXH	Exhaust system
= MSC	Miscellaneous

Description	Mounting locations (+)
Location	information content
+ BSF	Base frame
+ ENG	Engine
+ GEN	Generator incl. terminal box
+ OTB	Outlet box enclosure
+ CPL	Other control panel enclosure
+ MIP	Motor-interface panel
+ MMC	MTU Module control enclosure
+ GCB	Generator circuit breaker
+ CCB	CHP Coupupling breaker enclosure
+ MCB	Mains circuit breaker
+ ATS	Automatic transfer switch enclosure
+ AUX	Auxillary drives enclosure
+ MCS	MTU Control system enclosure
+ FAN	FAN control enclosure
+ ACB	Accessory box enclosure
+ DPL	Distribution panel enclosure
+ TNK	Tank
+ ENC	Enclosure/Container
+ GST	Gas train
+ HRM	Heat recovery module
+ HTB	Heat recovery module terminal box
+ PIP	Piping system
+ GBX	Gear box
+ EXT	Devices & enclosures outside any other enclosure, not delivered by MTU
+ CUS	Customer page

Description	Higher level function (==)
Function	information content
== CHPx	Used for when a system contains multiple engine units in one project

TECHNICAL DATA AND CONSTRUCTION DETAILS

Line and color definition for potential tracing

(Colors are only visible if you use colored print out)

Supply, Line and measure voltage	L1, L2, L3 (120V, 230V, 400V ,690V, ...)	
Supply, Line and measure voltage	N (120V, 230V, 400V ,690V, ...)	
Protective earth	Ground	
Control voltage + 24VDC, 12VDC	VDC+	
Control voltage - 0VDC	VDC-	
Shield	SH	
Starter battery cabling +24V, 12V	Batt+	
Starter battery cabling -24V, 12V	Batt-	

Line and color definition for potential tracing

(Colors are only visible if you use colored print out)

Control voltage 24VAC 24VAC L		
Control voltage 24VAC 24VAC N		
External source voltage		
Analog signals	QSOLL+, QSOLL-	
Current transformer	L1-CT, L2-CT, L3-CT	
Emergency stop	L+	
All other connections EPLAN standard		

TECHNICAL DATA AND CONSTRUCTION DETAILS

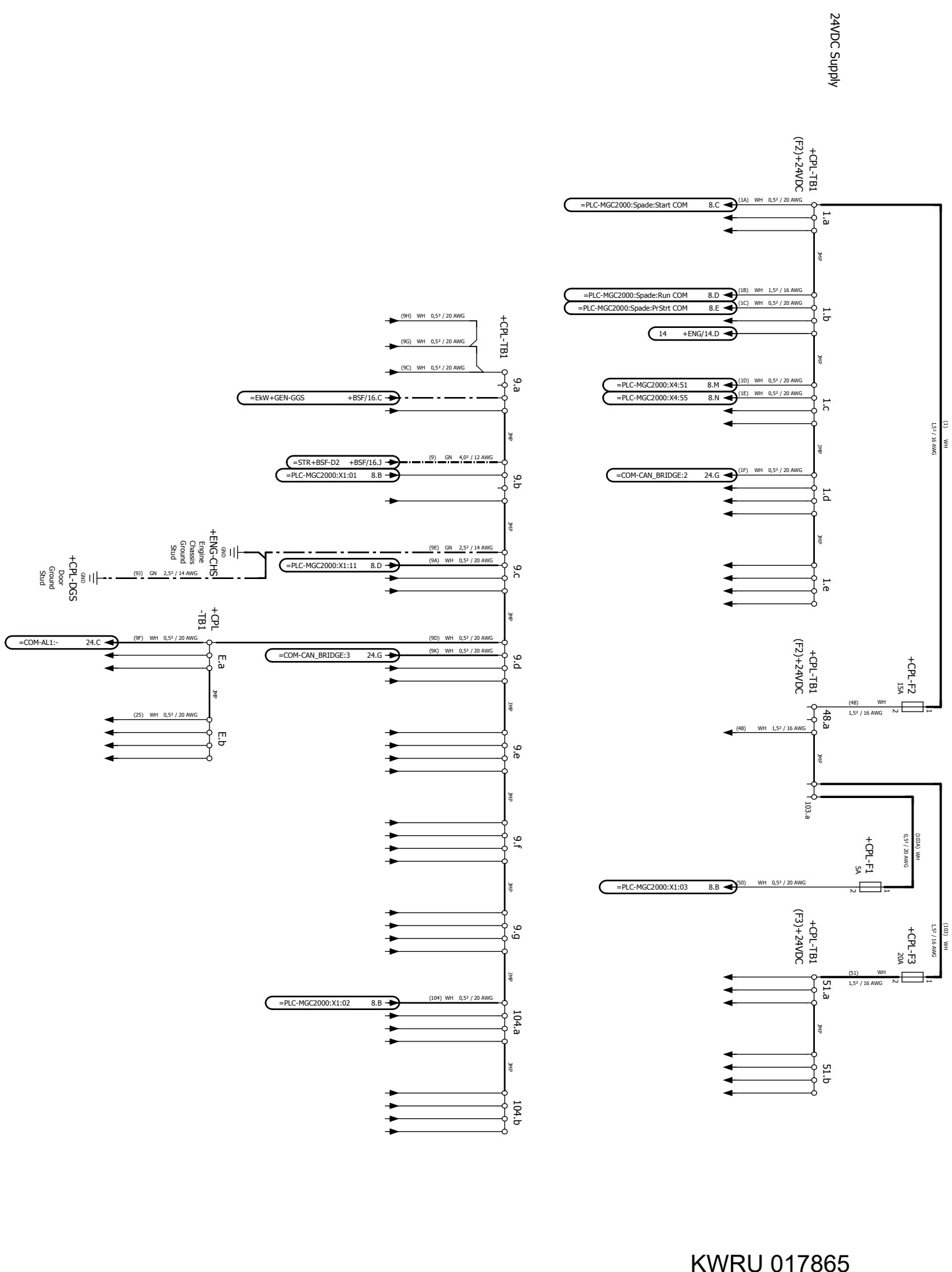
Wire colors within enclosure

According to
IEC EN 60204-1

Rated voltage	Above 48VAC	Black
Neutral wire	N	Light Blue
Protective earth	PE	Green/Yellow
Control voltage	24-240V AC	Red
	0V AC	Red/White
	24-110V DC	Dark Blue
	0V DC	Grey
PLC-Controller		White
Measuring technique		Grey
wires before Mainswitch		Orange

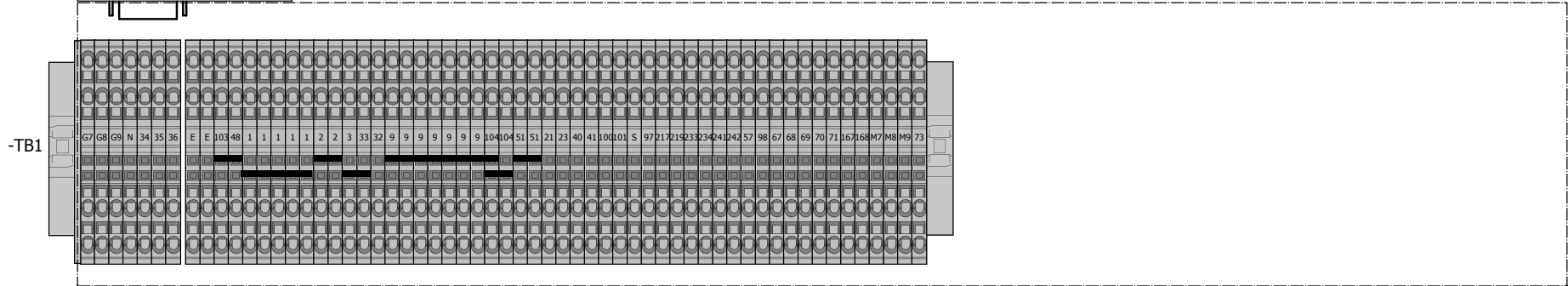
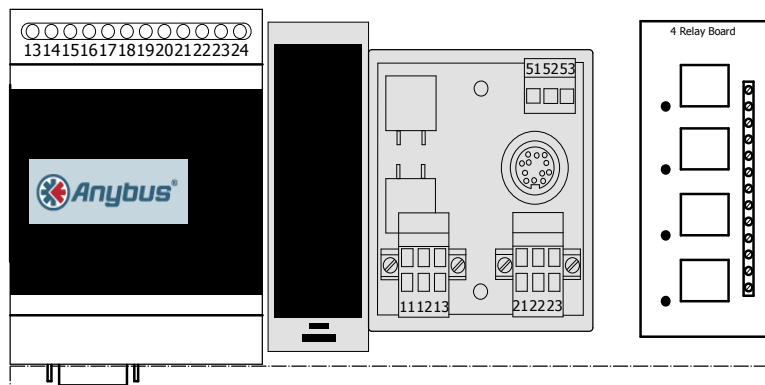
Main power before main switch		L1 - L2 - L3
Main power main switch on		1L1 - 1L2 - 1L3
Neutral wire		N
Protective conductor		PE
Power supply	400VAC	-XD01
Power supply	230VAC	-XD02
Auxiliary drives		-XD03
Emergency stop		-XD06
Module signals digital		-XD10
Module signals analog		-XD11
Supply DC	24VDC	-XDL+
Supply DC	0VDC	-XDL-
Signals external DC		-XD100.x
Harness W010-ECU7 / W011-ECU9 Digital		-1XD01
Harness W010-ECU7 / W011-ECU9 Analog		-1XD02
Harness W020 Engine		-2XD01
Harness W030 Generator signal		-3XD01/-3XD02/-3XD03
Harness W031 Generator PT100		
_____ Option _____		
Harness W050 Power panel		-5XD01
Control cable WD06.1 Generator circuit breaker		-6XD01
Control cable WD07.1 Mains circuit breaker		-7XD01
Control cable WD08.1 Fan control enclosure		-8XD01
Control cable WD09.1 Fuel control		-9XD01

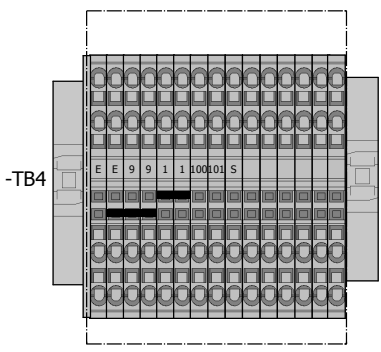
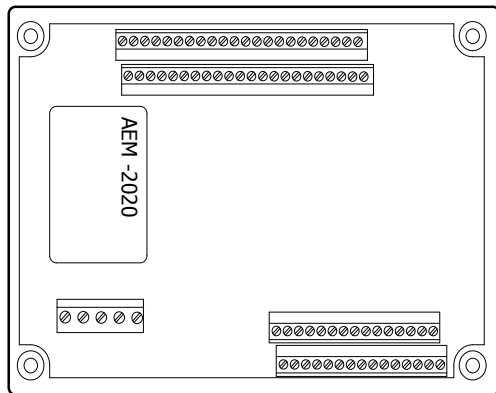
CAN bus		-XF01
MOD bus		-XF02



Modification	Date	Name	Date	Editor	Appr	Norm	Customer Description	Project Description	Power & Ground	Drawing No.	Order No.	Department	Page
				KI Back			Project template with IEC Identifier	Project template with IEC Identifier			1317806	1317806	6

S2000 or S4000
MGC-2000

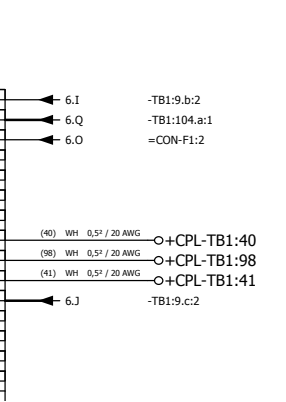




		Date				Project template with IEC identifier structure		Handy Box Layout		Drawing No.		KWRU017867		CPL / EFA / CON	
		Editor		KJ Black						Client No.		1317806		Department	
		Appr								Department		1317806			
Modification	Date	Name	Norm	Customer Description	Project Description									Page 7.a	
														Project template with identifier structure to IEC 81346	

Functional Text	+Location /Page	=Function +Location -DT Connected to
Start	+BSF/16.L	=STR+ENG-SMC;#10
Start		
Run	+BSF/16.P	=STR+BSF-D3
Run		
Pre-Start	+ENG/13.G	-N.O.
Pre-Start		

Functional Text	+Location /Page	=Function +Location -DT Connected to
Chassis GND		
Batt +		
Batt -		
RDP PWR +		
RDP PWR -		
RDP TxD +		
RDP TxD -		
Oil Pressure		
Fuel Level		
Coolant Temp.		
Sensor GND		
RS-485B	-MEC:14 /24.E	
RS-485A	-MEC:13 /24.D	
/DI16		



No.	Slot
1	X1 Terminal 01-15; Power supply, Remote Panel, Analog Senders
2	X2 Terminal 16-30; Digital Inputs
3	X3 Terminal 31-45; MPU, Gen. Voltage Sensing, Bus 1 Voltage Sensing
4	X4 Terminal 46-60; E-Stop, CAN, Outputs
5	X5 Terminal 61-75; Outputs, Current Sensing
6	X6 Terminal Bus 2 Voltage Sensing
7	X7 Terminal Pre, Run, Start



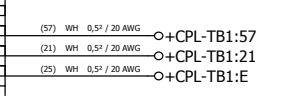
Mini-B USB

MGC 2000 Series Genset Controller

MGC-2000 Connection Overview
MGC-2000 Instruction Manual

Functional Text	+Location /Page	=Function +Location -DT Connected to
E-Stop		
E Stop		
J1939 CAN (LO)		
J1939 CAN (HI)		
J1939 CAN SHD		
Com. DO52-54		
Horn		
Global Pre-Alarm		
Global Alarm		
Com. DO56-58		
Not in Auto		
Engine Running		
Open Gen. Brkr		
Com. DO60-62		
Close Gen. Brkr		

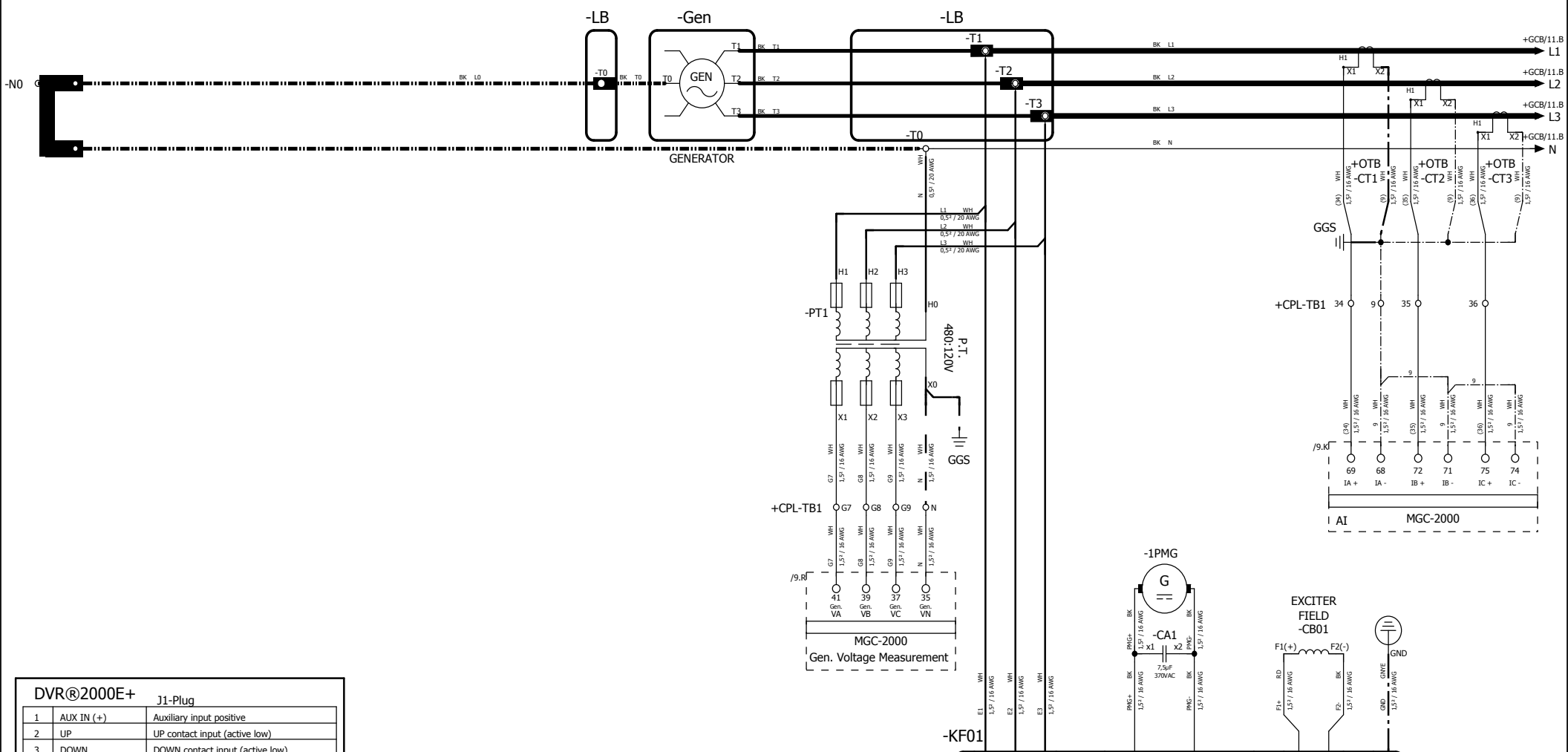
Functional Text	+Location /Page	=Function +Location -DT Connected to
/DI15		
Key Switch		
Battle Override		
Lube (DIFF)		
Fuel (DIFF)		
Crankcase Pres.		
Fuel Filtr Plugged		
Water in Fuel		
Lube Oil Level		
Gen. Brkr Closed		
Charger Fail		
Brkr GND Fault	+GCB+CPB-TB1:73	+GCB/11.O
Fuel Leak		
Low Coolant	+CLG-FL1	+ENG/14.C
Remote Start		



Functional Text	+Location /Page	=Function +Location -DT Connected to
Left Starter Lock		
Right Starter Lock		
Com. DO64-66		
DO10/		
DO11/		
DO12/		
Gen. IA -	+GEN/9.S	-TB1:9
Gen. IA +	+GEN/9.S	-TB1:34
Gen. IB -	+GEN/9.T	-MGC2000:X5:68
Gen. IB +	+GEN/9.T	-TB1:35
Gen. IC -	+GEN/9.U	-MGC2000:X5:71
Gen. IC +	+GEN/9.T	-TB1:36

Functional Text	+Location /Page	=Function +Location -DT Connected to
Mag Pickup +		
Mag Pickup -		
Gen. VN	-TB1:N	+GEN/9.M
Gen. VC	-TB1:G9	+GEN/9.M
Gen. VB	-TB1:G8	+GEN/9.L
Gen. VA	-TB1:G7	+GEN/9.L
Bus VB		
Bus VA		

Functional Text	+Location /Page	=Function +Location -DT Connected to
Bus VA	+CPL-TB1:M70	(M7) WH 1.5 / 16 AWG
Bus VB	+CPL-TB1:M80	(M8) WH 1.5 / 16 AWG
Bus VC	+CPL-TB1:M90	(M9) WH 1.5 / 16 AWG



DVR@2000E+ J1-Plug

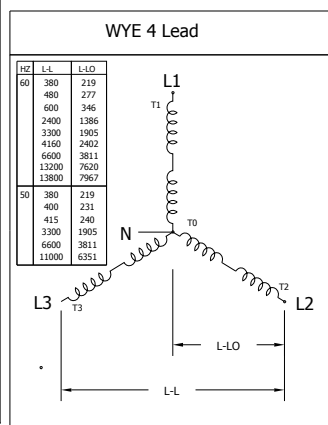
1	AUX IN (+)	Auxiliary input positive
2	UP	UP contact input (active low)
3	DOWN	DOWN contact input (active low)
4	CGND	Input common
5	AUX_LOOP	Auxiliary current loop jumper
6	CONTACT 1	Contact output
7	CONTACT 2	Contact output
8	AUX_LOOP	Auxiliary current loop jumper
9	VAR PF OFF	VAR/PF Enable
10	DROOP_OFF	Droop disable contact input (active low)
11	EXCIT_OFF	Excitation disable contact input (active low)
12	AUX IN (-)	Auxiliary input negative

Quick Connect Terminals

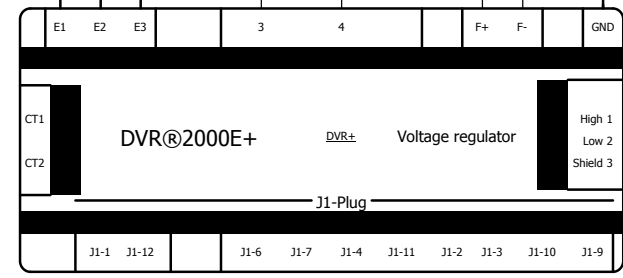
GND	Protective earth ground
4	PMG - terminal 1
3	PMG - terminal 2 (Fused)
E1	Generator armature - Phase A
E2	Generator armature - Phase B
E3	Generator armature - Phase C
F-	Exciter stator field (-)
F+	Exciter stator field (+)
CT1	Generator Phase B CT (X1)
CT2	Generator Phase B CT (X2)

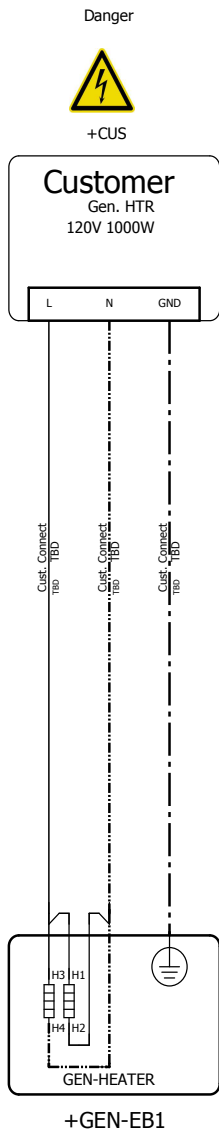
J3-Plug

1	CAN High
2	CAN Low
3	CAN Shield

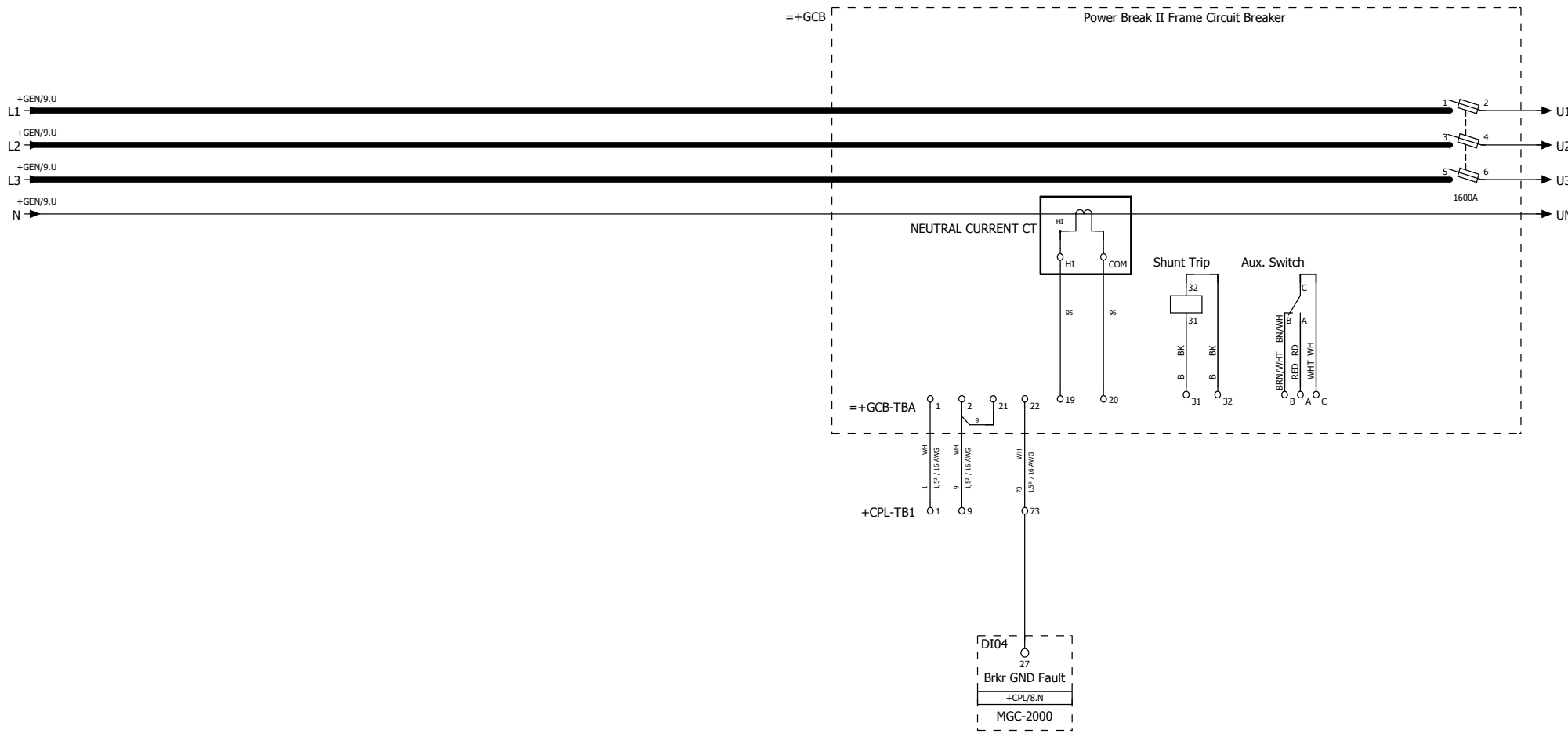


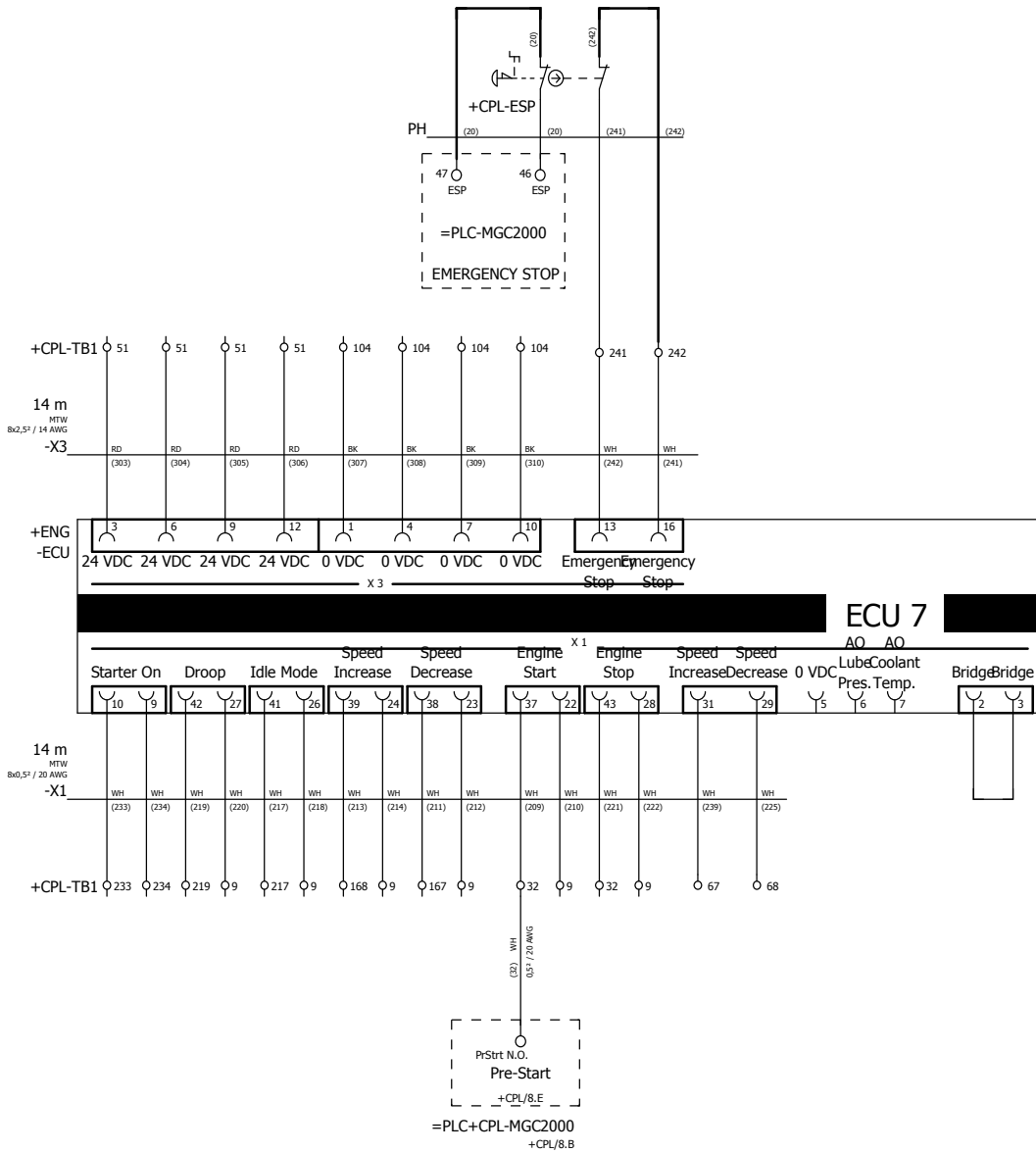
DANGER
 Dangerous Voltage
 make sure before
 starting work, that the
 system is disconnected
 from the mains! Disregard
 may result in serious or
 deadly injuries.





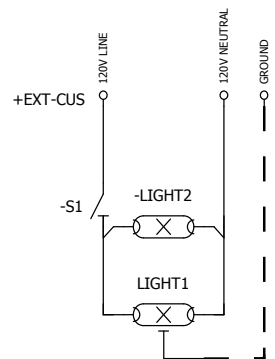
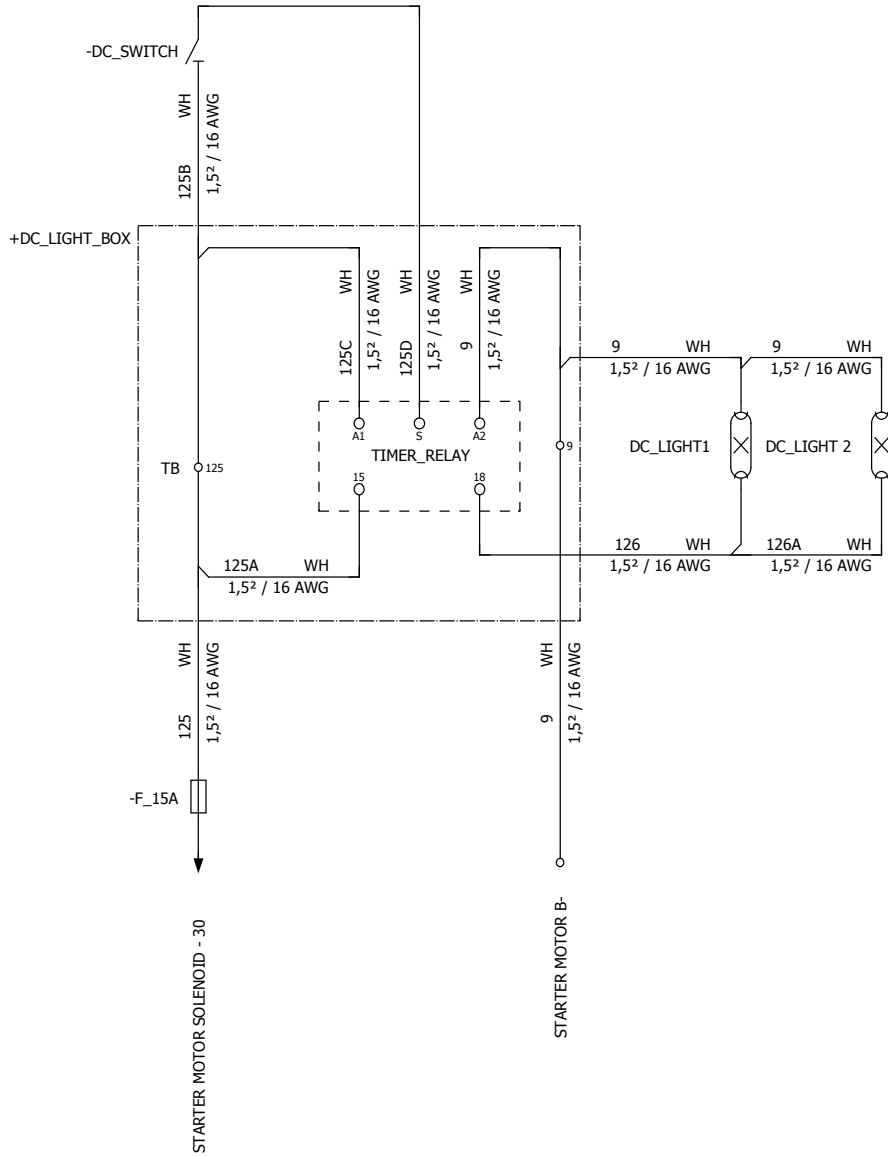
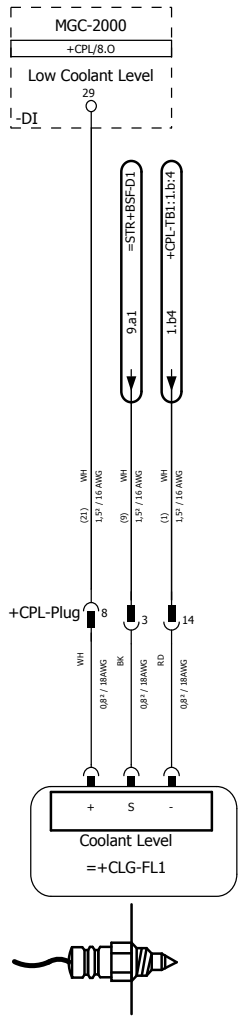
			Date			Project template with IEC identifier structure		Generator Accessories	Drawing No.	KWRO17870	GEN / EFS / EKW	
			Editor	KJ Black					Client No.	1317805	Department	1317805
			Appr									
Modification	Date	Name	Norm		Customer Description	Project Description						Page 10
Project template with identifier structure to IEC 81346												





Cable harness X1/X3 Engine Control Unit (ECU)

Terminal	Wire No.	Wire Size	Signal Name	Color	Notes	Terminal	Notes
X1-19	201	0,5 ² /20	CAN1_HI	Cable	(HIGH)	MAU 11	
X1-35	202	0,5 ² /20	CAN1_LO	Cable	(LOW)	MAU 12	
X1-20	203	0,5 ² /20	CAN1_GND	Cable	(GND)	MAU 13	
X1-33	205	0,5 ² /20	CAN2_HI	Cable	(HIGH)	MAU 21	
X1-18	206	0,5 ² /20	CAN2_LO	Cable	(LOW)	MAU 22	
X1-34	204	0,5 ² /20	CAN2_GND	Cable	(GND)	MAU 23	
X1-37	209	0,5 ² /20	START_ENGINE	S	(+24V) (PRE)	TB1 32	
X1-22	210	0,5 ² /20	START_ENGINE	S	(-GND)	MAU 9	
X1-38	211	0,5 ² /20	SPEED - DOWN	S	(+24V)	MAU 167	
X1-23	212	0,5 ² /20	-----"	S	(-GND)	MAU 9	
X1-39	213	0,5 ² /20	SPEED - UP	S	(+24V)	MAU 168	
X1-24	214	0,5 ² /20	-----"	S	(-GND)	MAU 9	
X1-41	217	0,5 ² /20	IDLE - MODE	S	(+24V)	MAU 217	
X1-26	218	0,5 ² /20	-----"	S	(-GND)	MAU 9	
X1-42	219	0,5 ² /20	SWITCH - DROOP	S	(+24V)	MAU 219	
X1-27	220	0,5 ² /20	-----"	S	(-GND)	MAU 9	
X1-43	221	0,5 ² /20	STOP ENGINE	S	(+24V)	MAU 32	
X1-28	222	0,5 ² /20	-----"	S	(-GND)	MAU 9	
X1-31	239	0,5 ² /20	SPEED DEMAND VOLTAGE	S	(+24V)	MAU 67	
X1-29	225	0,5 ² /20	-----"	S	(-GND)	MAU 68	
X1-10	233	0,5 ² /20	STARTER ON	S	(+24V)	MAU 233	
X1-9	234	0,5 ² /20	-----"	S	(-GND)	MAU 234	
X1-2			BRIDGE	J			
X1-3			BRIDGE	J			
X1-5			LOW 0V				
X1-6	P		OUTPUT 0..10V				
X1-7	T		OUTPUT 0..10V				
X3-13	242	0,5 ² /20	EMERGENCY STOP	S	(IN)	TB1 242	
X3-16	241	0,5 ² /20	EMERGENCY STOP	S	(+24V)	MAU 241	
X3-3	303	2,5 ² /14	BATTERY		(+24V)	TB1 51	
X3-6	304	2,5 ² /14	BATTERY		(+24V)	MAU 51	
X3-9	305	2,5 ² /14	BATTERY		(+24V)	MAU 51	
X3-12	306	2,5 ² /14	BATTERY		(+24V)	MAU 51	
X3-1	307	2,5 ² /14	BATTERY		(-GND)	TB1 104	
X3-4	308	2,5 ² /14	BATTERY		(-GND)	MAU 104	
X3-7	309	2,5 ² /14	BATTERY		(-GND)	MAU 104	
X3-10	310	2,5 ² /14	BATTERY		(-GND)	MAU 104	

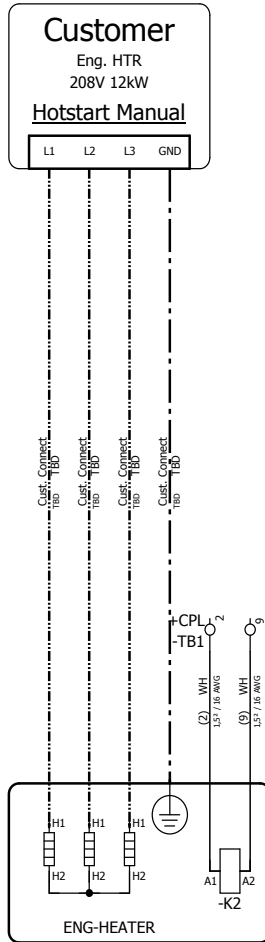


				Date	Project template with IEC identifier structure		Drawing No.		KWRU017873	
				Editor	KJ Black		1317805		Department 1317805	
				Appr					ENG / EFS / MKW	
Modification	Date	Name	Norm	Customer Description	Project Description	onsite energy		Project template with identifier structure to IEC 81346		Page 14

Danger

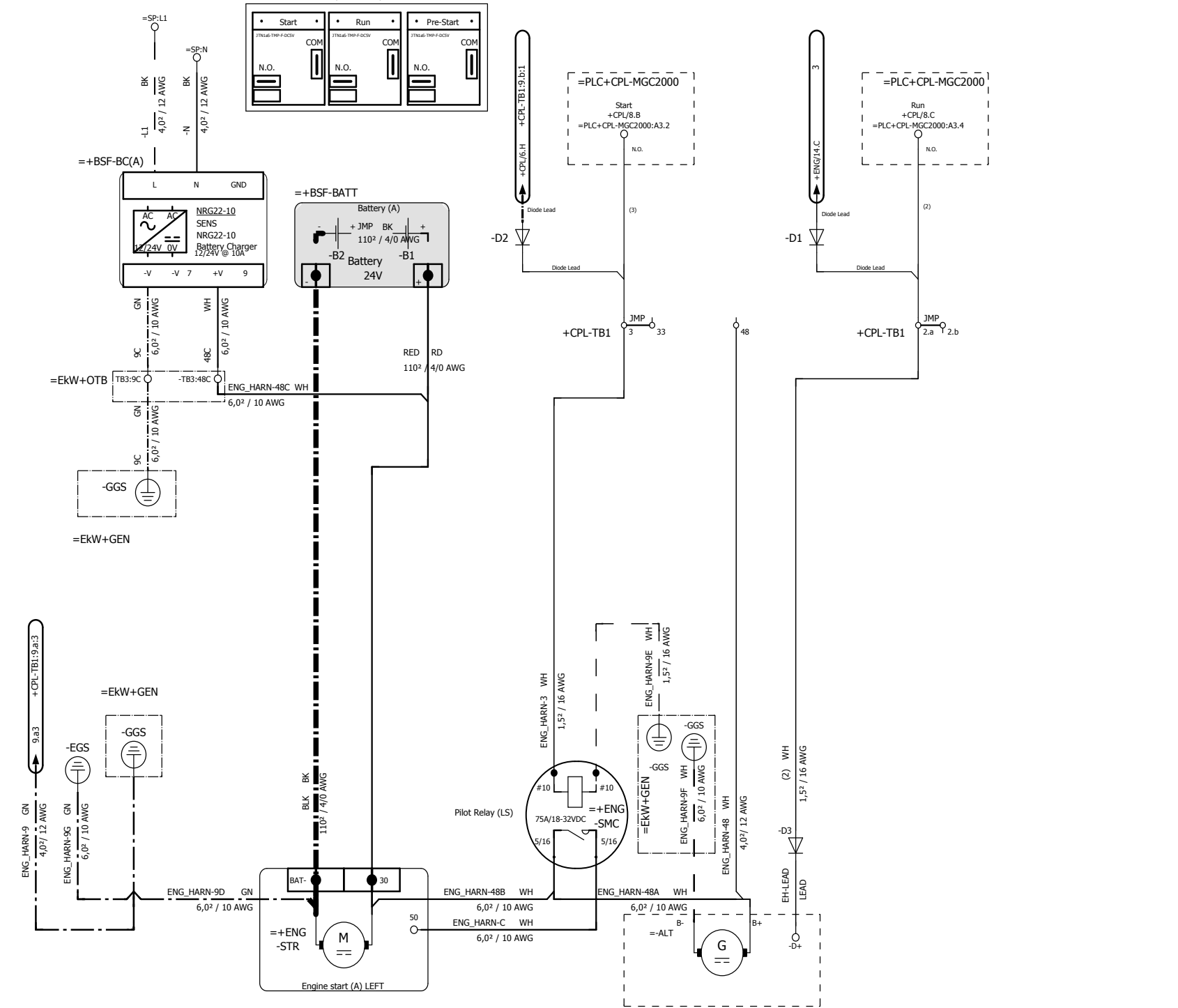


+CUS



				Project template with IEC identifier structure		onsite energy		Jacket Water Heaters		Drawing No. KWRU017874		Department 1317805		BSF / EFS / MKW		Page 15	
Modification				Date		Name		Norm		Customer Description		Project Description		Project template with identifier structure to IEC 81346			

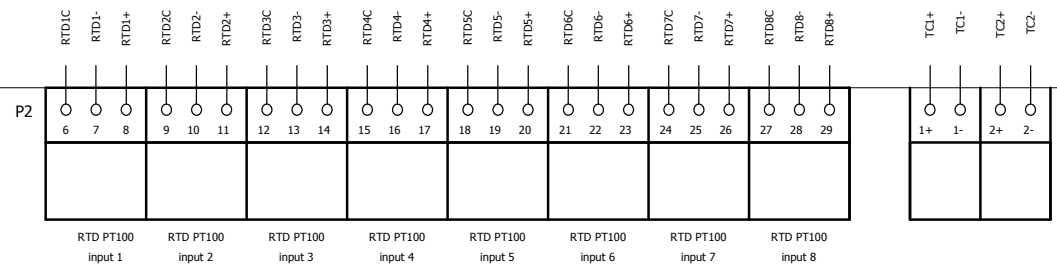
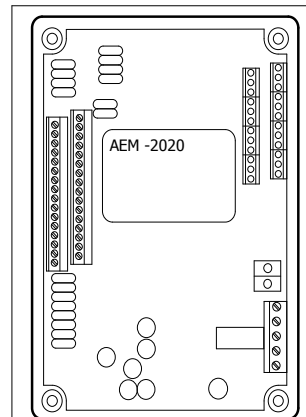
2D Graphical Representation



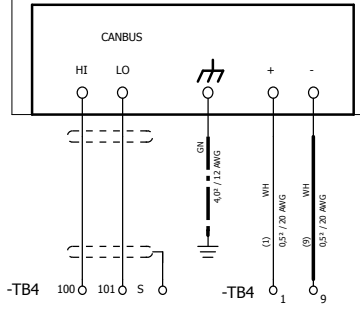
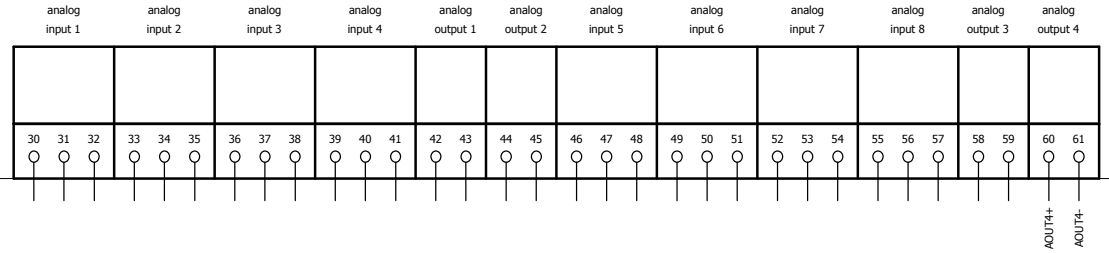
				Project template with IEC identifier structure				Starter & Battery		Drawing No. KWRU017875		Department BSF / EFS / STR	
				Project Description						1317805		1317805	
				Customer Description								Page 16	
Project template with identifier structure to IEC 81346													

+CPL
-AEM

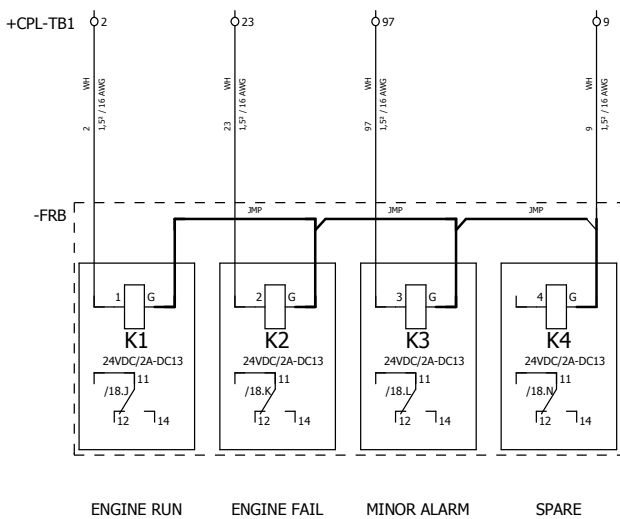
Analog
Expansion
Module



AEM 2020



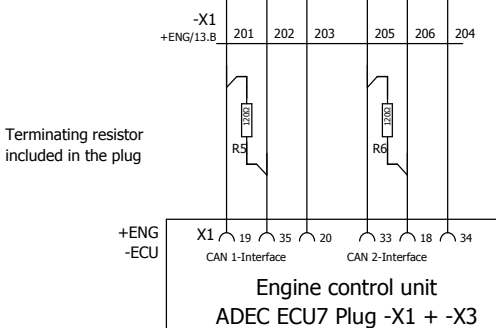
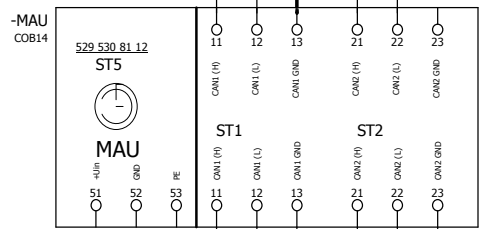
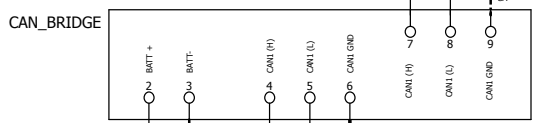
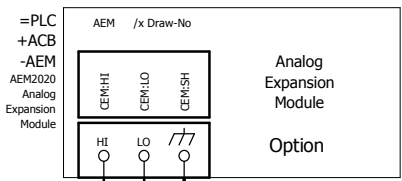
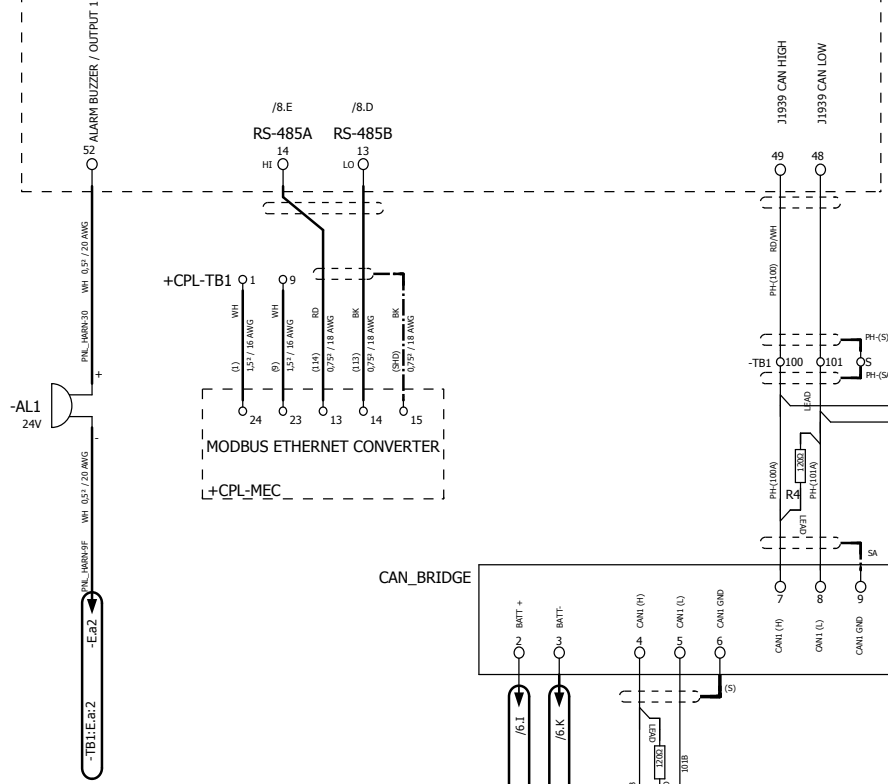
				Project template with IEC identifier structure		onsite energy		AEM		Drawing No.		KWRU017876		CPL / EFS / CON	
				Editor KJ Black								1317805		1317805	
				Appr										Page 17.a	
Modification Date Name Norm				Customer Description		Project Description								Project template with identifier structure to IEC 81346	



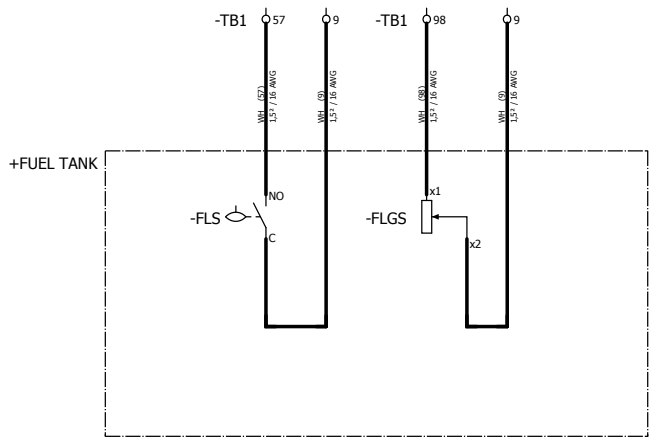
17.a

		Date		Project template with IEC identifier structure		Drawing No.		KWRU017877		CPL / EFS / CON	
		Editor		KJ Black				1317805		1317805	
		Appr									
Modification	Date	Name	Norm	Customer Description	Project Description	onsite energy				Page 18	
				Project template with identifier structure to IEC 81346							

=PLC-MGC2000



Modification		Date	Name	Norm	Customer Description	Project Description	onsite energy	Com. Bus-overview	Drawing No.	KWRU017878	Department	CPL / EFS / COM	Page	24
													Project template with identifier structure to IEC 81346	



				Date		Project template with IEC identifier structure		Drawing No.		KWRO17879		TNK / EFS / FUL	
		Editor		KJ Black		Project template with IEC identifier structure		1317805		1317805			
		Appr				onsite energy		Fuel Tank				Page 25	
Modification		Date		Name		Norm		Customer Description		Project Description		Project template with identifier structure to IEC 81346	

ENCLOSURE AND SOUND DATA SHEET - DIESEL
 60 Hz: 650-2,000 kW Standby / 615-1,800 kW Prime
 60 Hz: 1,250-2,000 Data Center Continuous Power (DCCP)



Weatherproof Enclosure (pictured)*

ENCLOSURE LEVEL IDENTIFICATION	
Weatherproof Enclosure (WPE)	Weatherproof enclosure constructed of heavy gauge steel or aluminum with fixed stormproof panels. Enclosure consists of a bolted and welded construction with factory-mounted external silencer or internal silencer where applicable. Hinged, lockable double-door access on both sides of the enclosure.
Weatherproof (WPE) with Sound Attenuation Kit	Weatherproof enclosure with UL 94 HF-1 compliant, 1.5" thick sound attenuated foam insulation installed inside enclosure walls.
Ultra Quiet Enclosure (UQE)	Weatherproof foamed enclosure with additional air intake and exhaust scoops for redirecting noise and air flow upward.

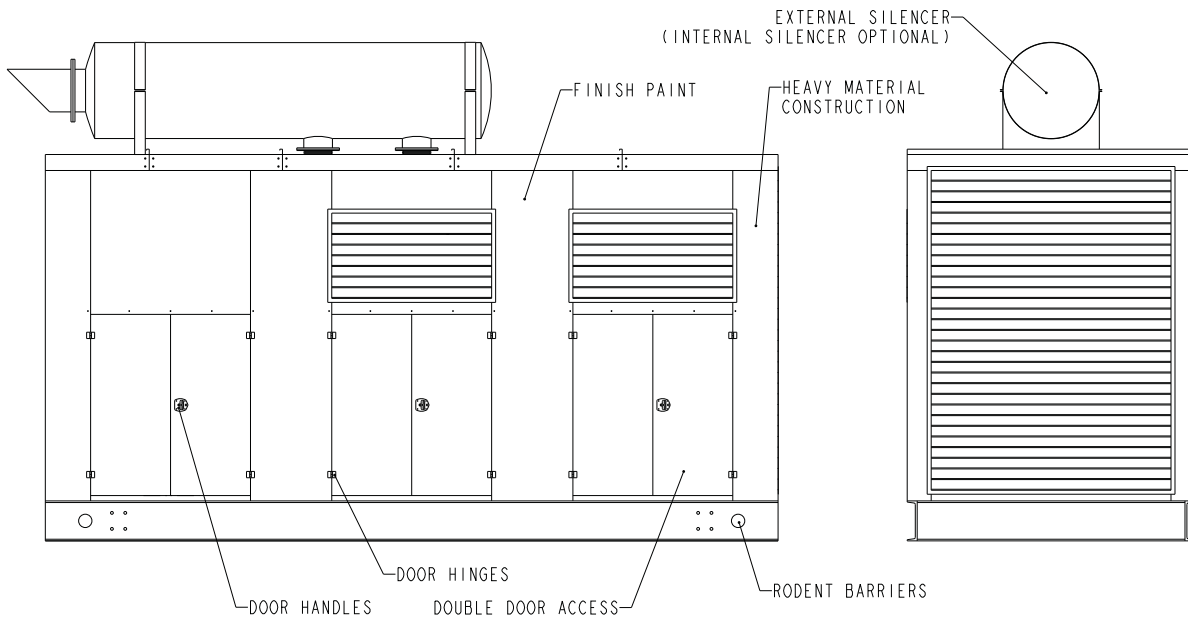
CERTIFICATIONS AND STANDARDS

- UL 2200
- CSA

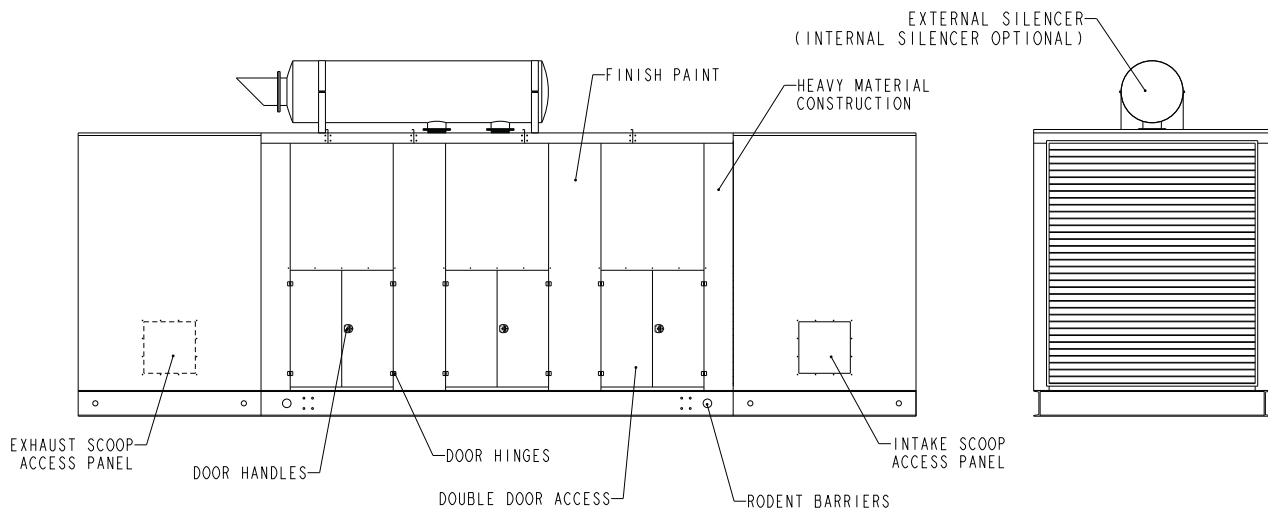
STANDARD FEATURES FOR ALL LEVELS

- Heavy material construction
 - Steel Enclosure: 1.9 mm (0.075 in) - 14 gauge or greater thickness
 - Aluminum Enclosure: 2.3 mm (0.09 in) or greater thickness
- Service access
 - Double door access gives ease of service to all components
- Rain shroud and rain cap
- Rodent barriers
- Scoop access panels
- Hardware
 - Powder coated hinges with stainless steel pins
 - Key-lockable and pad-lockable powder coated door handles
- Finish Paint: ANSI 61 Grey standard
 - Custom colors available upon request
- External silencer (Industrial grade or better)
 - Stainless steel flexible exhaust connections (where applicable)

ENCLOSURE AND SOUND DATA SHEET - DIESEL
 60 Hz: 650-2,000 kW Standby / 615-1,800 kW Prime
 60 Hz: 1,250-2,000 Data Center Continuous Power (DCCP)



Weatherproof Enclosure (pictured)*



Ultra Quiet Enclosure (pictured)*

OPTIONAL FEATURES

- Door restraints
- AC or DC light package
- Motorized / gravity louvers (where available)
- Internal silencer (Critical grade or better)
 - Insulated silencers
 - Stainless steel flexible exhaust connections (where applicable)
- For other custom options, please consult factory.

ENCLOSURE AND SOUND DATA SHEET - DIESEL
60 Hz: 650-2,000 kW Standby / 615-1,800 kW Prime
60 Hz: 1,250-2,000 Data Center Continuous Power (DCCP)



SOUND RATINGS dB(A) AT 7 METERS

Application	Model	Power Node	Weatherproof Enclosure (WPE)	Weatherproof (WPE) with Sound Attenuation Kit	Ultra Quiet Enclosure (UQE)	
Standby	MTU 12V2000 DS650	650 kW	89	86.4	71.9	
	MTU 12V2000 DS750	750 kW	89	86.4	71.9	
	MTU 12V2000 DS800	800 kW	86.1	82	76	
	MTU 16V2000 DS900	900 kW	89.5	86.5	80.5	
	MTU 16V2000 DS1000	1,000 kW	93	91.7	81.5	
	** Includes Data Center Continuous Power (DCCP) ratings	MTU 12V4000 DS1250**	1,250 kW	C/F	88	75.9
	MTU 12V4000 DS1500**	1,500 kW	C/F	89.2	76.2	
	MTU 12V4000 DS1750**	1,750 kW	C/F	90.2	77.2	
	MTU 16V4000 DS2000**	2,000 kW	C/F	91.8	84	
Prime	MTU 12V2000 DS650	615 kW	C/F	C/F	C/F	
	MTU 12V2000 DS750	680 kW	C/F	C/F	C/F	
	MTU 12V2000 DS800	725 kW	86	82.1	C/F	
	MTU 16V2000 DS900	800 kW	C/F	C/F	C/F	
	MTU 16V2000 DS1000	900 kW	C/F	C/F	C/F	
	MTU 12V4000 DS1250	1,125 kW	C/F	C/F	C/F	
	MTU 12V4000 DS1500	1,400 kW	C/F	C/F	C/F	
	MTU 12V4000 DS1750	1,600 kW	C/F	C/F	C/F	
	MTU 16V4000 DS2000	1,800 kW	C/F	C/F	C/F	

NOTE:

- Aluminum enclosure sound levels are approximately 2 dB(A) higher than listed sound levels for steel enclosures
- Sound pressure levels subject to instrumentation, measurement, installation, and generator set variability
- Sound power levels per ISO 8528-10 and ANSI S1.13-2005
- Sound data measured with:
 - Full-rated load
 - Standard radiator package
 - Infinite exhaust connection

Refer to the MTU Business Portal *Acoustics Data* for exhaust noise ratings.

C/F = Consult Factory

* **Note:** Visual appearance may differ between power nodes.

© MTU Onsite Energy. Subject to alteration due to technological advances. 2016-08

FUEL SYSTEM

Sub-Base Tank Data Sheet



MTU Onsite Energy's sub-base fuel tanks are manufactured and listed per UL142 and ULC-S601 standards for steel above-ground tanks. These certifications assure that our tanks meet the structural and mechanical integrity requirements for mounting generator sets directly on top, providing our customers with a safe and efficient fuel storage system. These tanks are suitable for above-ground storage of non-corrosive, stable, flammable, or combustible liquids that have a specific gravity not exceeding that of water. They are intended for installation and use in accordance with the codes referenced in the *Certifications and Standards* section. The secondary containment construction consists of a steel tank within a closed steel containment dike that is capable of being monitored for leakage.



STANDARD FEATURES

- Fuel fill drop tube
- Normal vent
- Emergency vent
- Manual fill
- Lockable fill cap
- Level alarm
- Basin drain (plugged)
- Removable supply and return dip tubes
- Leak detection
- Black paint finish
- Secondary containment
- Electrical stub-up area: Provides space for generator set electrical connections and internal wiring capabilities
- Baffles: Separates cold engine supply fuel from hot returning fuel (additional baffling as required for structural integrity)
- Fuel level gauge: A direct-reading fuel level gauge with electric sender

OPTIONAL FEATURES

- High fuel pre-alarm and low fuel level shutdown
- Five-gallon spill/fill containment box with lockable hatch
- Fuel tanks to meet local jurisdictions/codes
- IBC Certification 2006, 2009, and 2012

FUEL SYSTEM

Sub-Base Tank Data Sheet



CERTIFICATIONS AND STANDARDS

United States

- UL 142
- NFPA 30
- NFPA 37
- NFPA 110
- International Fire Code

Canada

- ULC-S601
- Part 4: National Fire Code of Canada
- CSA B139
- CSA C282
- CCME PN 1326

OPTIONAL REGIONAL CODE KITS

MTU Onsite Energy offers pre-engineered kits that can be added to sub-base fuel tanks on 30-600 kW generator sets. These kits meet the regional codes for listed counties and states. Reference the table on page 3 for the contents of each code kit.

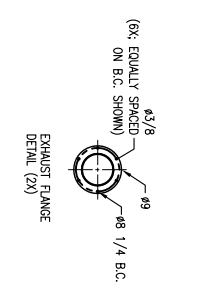
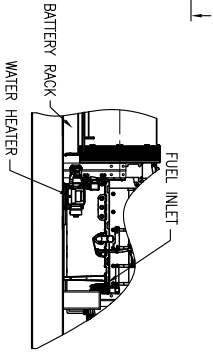
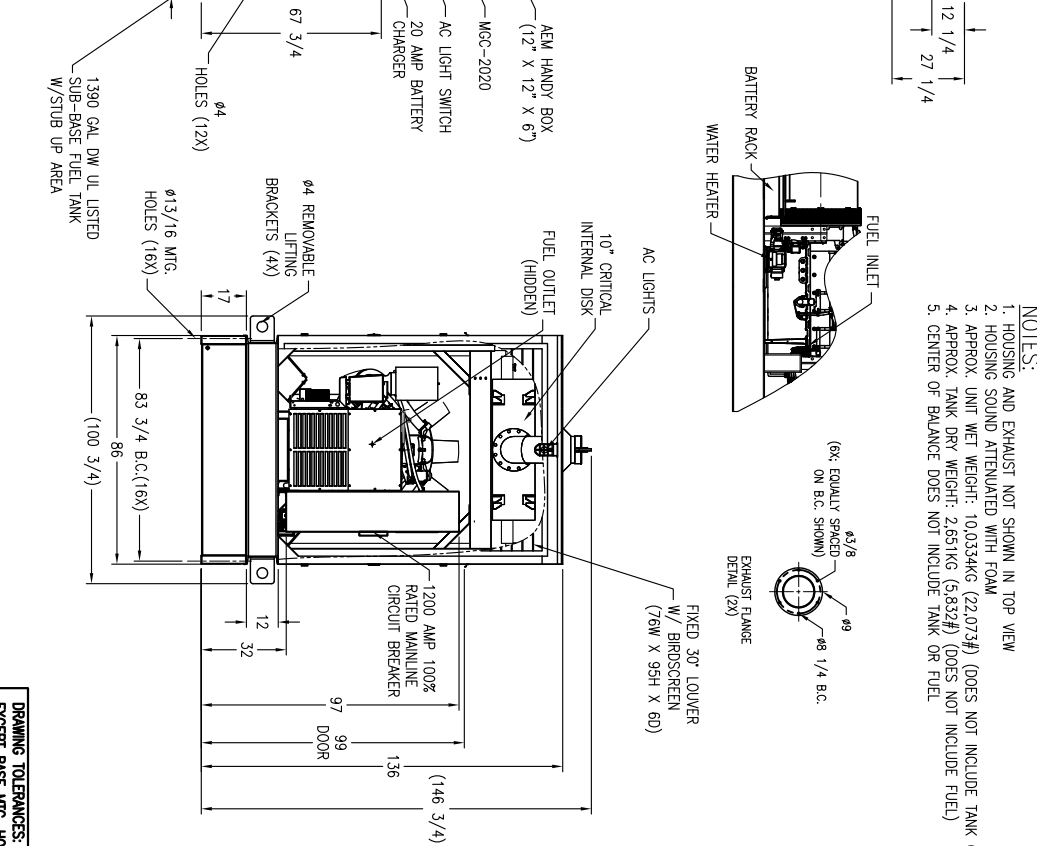
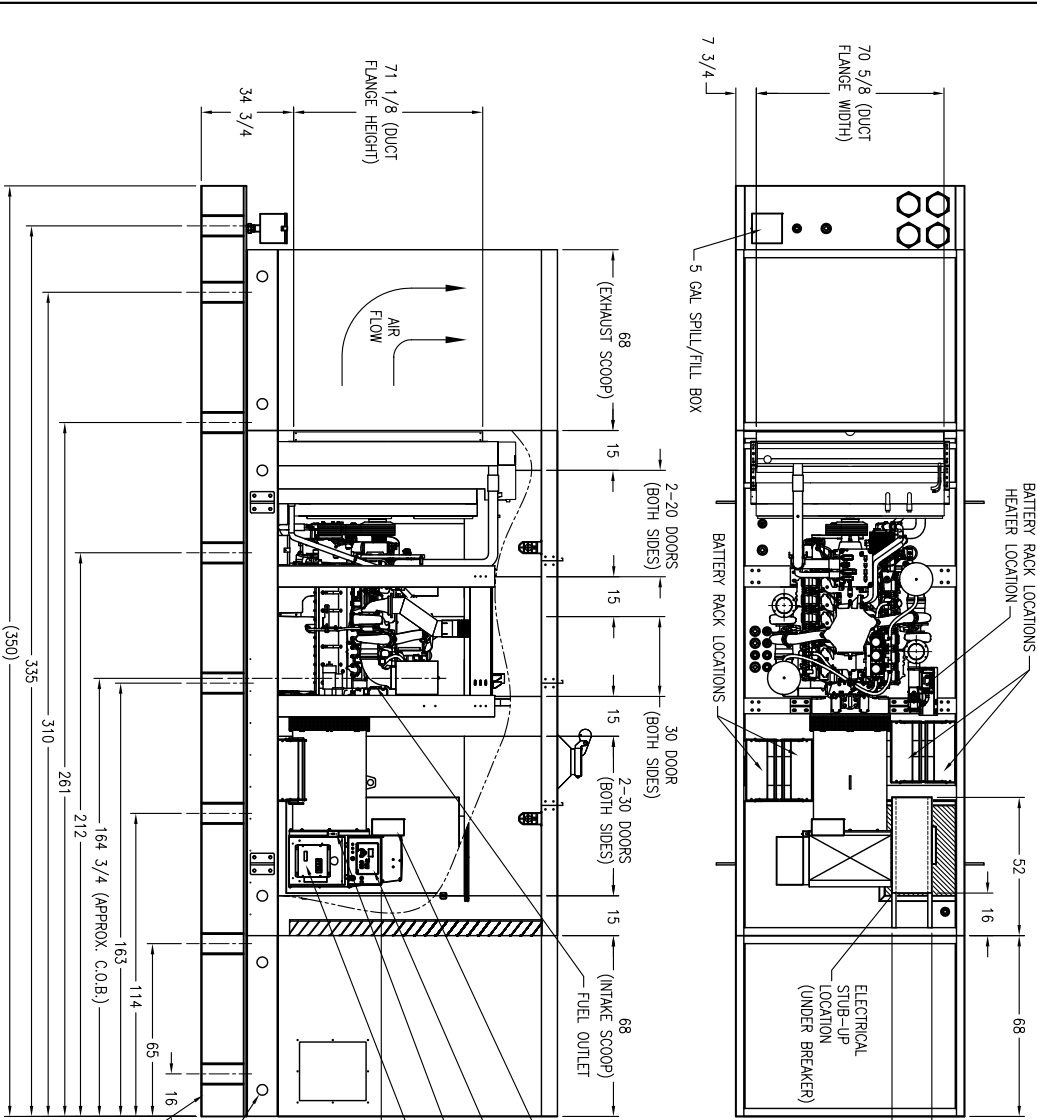
FUEL SYSTEM

Sub-Base Tank Data Sheet



Code Jurisdiction	Code Kit Contents																	
	Low Fuel Switch (50%)	High Fuel Switch (90%)	Critical High Switch (95%)	Fuel Alarm Panel	Fuel Fill Spill Containment (5 Gallon)	Overfill Prevention Valve (OPPV)	Fire Rated Fuel Lines	Camlock Fill	Hazmat Label	Vent Whistle	Regional Labeling	Fuel Fill Drop Tube	Fuel Supply Check Valve	Fuel Supply Ball Valve	Tank Risers*	Extended Vents (12 ft above grade)	Fuel Leak Switch	IBC (Optional)
California	X	X		X	X	X		X	X			X	X			X	X	X
Colorado	X	X		X	X	X		X	X			X	X		X	X	X	X
Dallas, TX		X		X	X	X						X	X			X	X	X
Denver, CO	X	X		X	X	X		X	X			X	X			X	X	X
Florida (FDEP)		X		X	X	X		X	X		X	X			X	X	X	X
Georgia	X	X		X	X	X		X	X			X	X			X	X	X
Georgia (GEFA)	X	X		X	X	X		X	X			X	X			X	X	X
IFC 2003 / 2006 / 2009	X	X		X	X	X		X	X			X	X			X	X	X
Iowa	X	X			X							X	X				X	X
King County, WA	X	X	X	X	X	X		X	X			X	X			X	X	X
Maryland	X	X		X	X	X		X	X			X	X			X	X	X
Massachusetts	X	X			X							X	X			X	X	X
Michigan		X		X	X	X		X	X		X	X			X	X	X	X
Montana		X		X	X	X						X	X		X	X	X	X
Nassau, NY	X	X		X	X	X		X	X			X	X		X	X	X	X
Nebraska	X	X			X							X	X			X	X	X
New Hampshire			X	X	X	X						X	X	X		X	X	X
North Carolina	X	X				X		X	X			X	X			X	X	X
Ohio	X	X		X	X	X		X	X			X	X			X	X	X
Oklahoma	X	X	X	X	X	X		X	X			X	X		X	X	X	X
Ontario	X	X			X	X		X	X	X		X	X			X	X	X
Phoenix, AZ	X	X				X		X	X			X	X			X	X	X
San Francisco, CA	X	X		X	X	X		X	X			X	X			X	X	X
Suffolk, NY	X	X		X	X	X		X	X			X	X		X	X	X	X
Washington	X	X		X	X	X		X	X			X	X			X	X	X
Wisconsin	X	X		X	X	X		X	X			X	X			X	X	X

* Risers meet minimum code requirements.
Note: Verify regional code requirements prior to specification.



- NOTES:
1. HOUSING AND EXHAUST NOT SHOWN IN TOP VIEW
 2. HOUSING SOUND ATTENUATED WITH FOAM
 3. APPROX. UNIT WET WEIGHT: 10,033.4KG (22,073#) (DOES NOT INCLUDE TANK OR FUEL)
 4. APPROX. TANK DRY WEIGHT: 2,651.1KG (5,832#) (DOES NOT INCLUDE FUEL)
 5. CENTER OF BALANCE DOES NOT INCLUDE TANK OR FUEL

DWG. #: 800RXC6012(R1238A35)UOE-MB-141

KWRU017886

<p>REVISION</p> <p>A 9/26/16 INITIAL RELEASE TO SALES AND ENGINEERING (ORDER: 1317806)</p> <p>REVISION DESCRIPTION</p>		<p>INITIALS</p> <p>KR</p>															
<p>GEN-SET INFORMATION</p> <table border="0"> <tr> <td>ENGINE: R1238A39</td> <td>ENCLOSURE: 103-351</td> </tr> <tr> <td>GENERATOR: 574/4038</td> <td>BREAKER: 1200 AMP</td> </tr> <tr> <td>RADIATOR: 101800 (SK7886)</td> <td>TANK: X3536400002</td> </tr> <tr> <td>RADIATOR AMBIENT: 50C</td> <td>FILTER: 10 CRITICAL</td> </tr> <tr> <td>DUCT FLANGE: 105-6460</td> <td>TRAILER: VA</td> </tr> <tr> <td>CONTROL PANEL: MGC-2020</td> <td>ISOLATORS: PAS5</td> </tr> <tr> <td>BASE: 102-3163</td> <td></td> </tr> </table>				ENGINE: R1238A39	ENCLOSURE: 103-351	GENERATOR: 574/4038	BREAKER: 1200 AMP	RADIATOR: 101800 (SK7886)	TANK: X3536400002	RADIATOR AMBIENT: 50C	FILTER: 10 CRITICAL	DUCT FLANGE: 105-6460	TRAILER: VA	CONTROL PANEL: MGC-2020	ISOLATORS: PAS5	BASE: 102-3163	
ENGINE: R1238A39	ENCLOSURE: 103-351																
GENERATOR: 574/4038	BREAKER: 1200 AMP																
RADIATOR: 101800 (SK7886)	TANK: X3536400002																
RADIATOR AMBIENT: 50C	FILTER: 10 CRITICAL																
DUCT FLANGE: 105-6460	TRAILER: VA																
CONTROL PANEL: MGC-2020	ISOLATORS: PAS5																
BASE: 102-3163																	
<p>DIMENSIONAL LAYOUT</p> <p>ALL DIMENSIONS ARE IN INCHES</p> <p>DATE: 9/26/16</p> <p>DRAWN BY: KR</p> <p>DWG. #: 800RXC6012(R1238A35)UOE-MB-141</p>																	
<p>DRAWING TOLERANCES: ±1/4"</p> <p>EXCEPT BASE MFG. HOLES: ±1/8"</p>																	

DIESEL FUEL WATER SEPARATOR

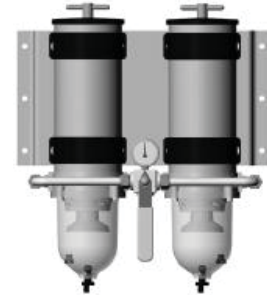
75 1000FHX Data Sheet



MTU Onsite Energy filter assemblies are designed of heavy duty construction and three-stage filtration using 10 or 30 Micron filter element(s). High capacity water separation (99% water removal efficiency) and fuel filtration process protects engine components from dirt, rust, algae, asphaltines, varnishes, and especially water, which is prevalent in engine fuels. These filters are easy to service with clear collection bowl(s) and self-venting water drain(s).

SPECIFICATIONS

Racor Model Number: 751000FHX
 MTU Onsite Energy Part Number (10 Micron): SUA100602
 MTU Onsite Energy Part Number (30 Micron): SUA95297
 Generator Set Model Power Range (Standby): 350 - 1000 kW
 Generator Set Model Power Range (Prime): 325 - 900 kW

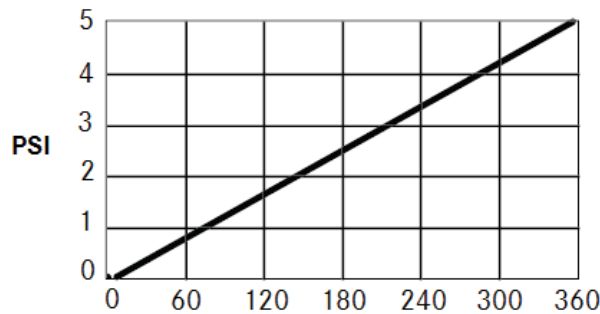


Height: 55.9 cm (22 in)
 Depth: 27.9 cm (11 in)
 Width: 47.8 cm (18.8 in)
 Weight (dry): 13.6 kg (30 lb)

Maximum Flow Rate:
 (one unit online) 681 lph (180 gph)
 (two units online) 1,363 lph (360 gph)
 Port Size: 7/8 in - 14 UNF (SAE J514 male threads)

Minimum Service Clearance:
 (above assembly) 25.4 cm (10 in)
 (below assembly) 5.1 cm (2 in)

Clean Pressure Drop: 25.5 kPa (3.7 psi)
 Maximum Pressure: 1.03 bar (15 psi)
 Water In Bowl Capacity (per bowl): 305 ml (10.3 oz)
 Operating Temperature: -40 °C to 124 °C / -40 °F to 255 °F



SAE J905 Fuel Flow Restriction
 Flow in Gallons Per Hour

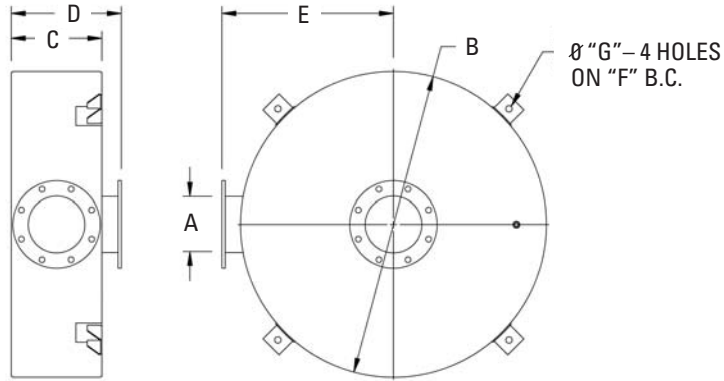
Note: Controlled lab tests. Field results may vary.

© MTU Onsite Energy. Subject to alteration due to technological advances. 2014-08



“DCK2” DISK - CRITICAL GRADE SILENCER
TYPICAL ATTENUATION - 22 TO 36 dB(A)

This disk silencer is designed for equipment operating in relatively quiet environments that require a high level of silencing. Its low profile lends itself towards projects with space limitations. Applications include stationary, marine, mobile, etc.



	Part Number	A (Size)	B (Dia.)	C	D	E	F	G	WT
Carbon Steel	DCK2-04-200751	4	27	8	11	16.5	30.5	1.00	147
	DCK2-05-200752	5	30	10	13	18.0	33.5	1.00	200
	DCK2-06-200753	6	33	12	15	19.5	36.5	1.00	252
	DCK2-08-200754	8	47	14	17	26.5	50.5	1.00	446
	DCK2-10-200755	10	53	16	19	29.5	56.5	1.00	687
	DCK2-12-200756	12	62	18	21	34.0	66.5	1.25	966
	DCK2-14-200757	14	66	24	27	36.0	70.5	1.25	1164
	DCK2-16-200758	16	74	26	29	40.0	78.5	1.25	1432
	DCK2-18-200759	18	85	28	31	45.5	89.5	1.25	1816

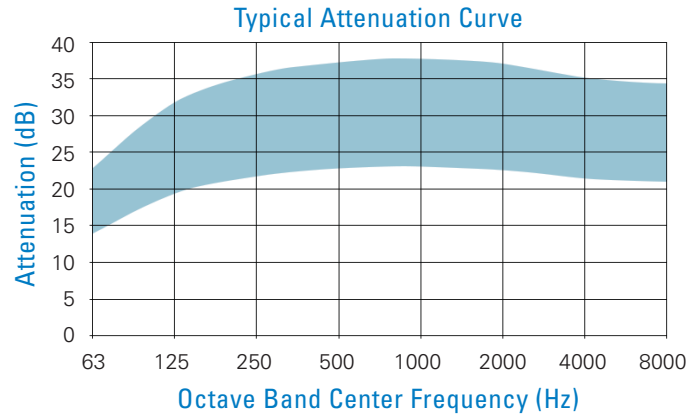
Dimensions are in inches. Weight is in pounds and is approximate.

STANDARD CONSTRUCTION

- Shell packed with 2” of fiberglass insulation to absorb high frequency sound waves and reduce outer surface temperature
- Constructed with carbon steel
- Coated with satin black paint rated to 1200°F
- Connections: 125/150# ANSI flanges
- Mounted with 4 bottom brackets
- Stainless steel available along with additional inlet/outlet and mounting options – Contact factory for details

CUSTOMIZATION

- Chart refers to standard product offering
- Custom configurations, materials, connections, overall dimensions, etc.
- Contact factory with your project’s design requirements and specifications



SPRING ISOLATOR

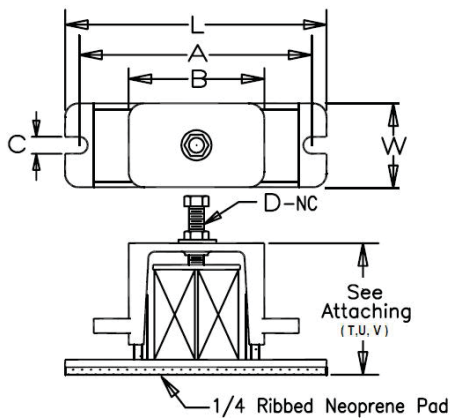
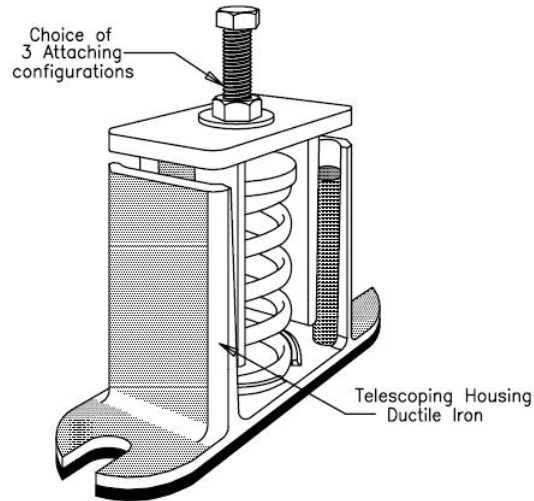
TJ Shatter Proof Ductile Iron Data Sheet



PRODUCT HIGHLIGHTS

Protection for:

- Compressors
- Pumps
- Blowers
- Boilers
- Generators
- Air Handling Units
- Mills



<p>T External Load Transfer Bolted Attaching</p> <p>Most commonly used. "T" must be approximately 4 inches or greater.</p>	<p>U Internal Load Transfer Gravity Attaching</p> <p>Usually used under concrete blocks or flat bottomed equipment.</p>	<p>V Internal Load Transfer Stud Attaching</p> <p>Used when clearance over hole is as little as 2 inches. Allows preset to speed installation.</p>
---	--	---

DIMENSIONS						
Product Type	A mm (in)	B mm (in)	C mm (in)	D mm (in)	L mm (in)	W mm (in)
TJB	136.53 (5.375)	112.73 (4.438)	14.3 (0.563)	12.7 (0.5)	168.28 (6.625)	50.8 (2)
TJC	304.8 (12)	117.8 (7)	15.88 (0.625)	15.88 (0.625)	330.2 (13)	60.33 (2.375)
TJE	304.8 (12)	117.8 (7)	17.48 (0.688)	15.88 (0.625)	330.2 (13)	117.48 (4.625)

SPRING ISOLATOR

TJ Shatter Proof Ductile Iron Data Sheet

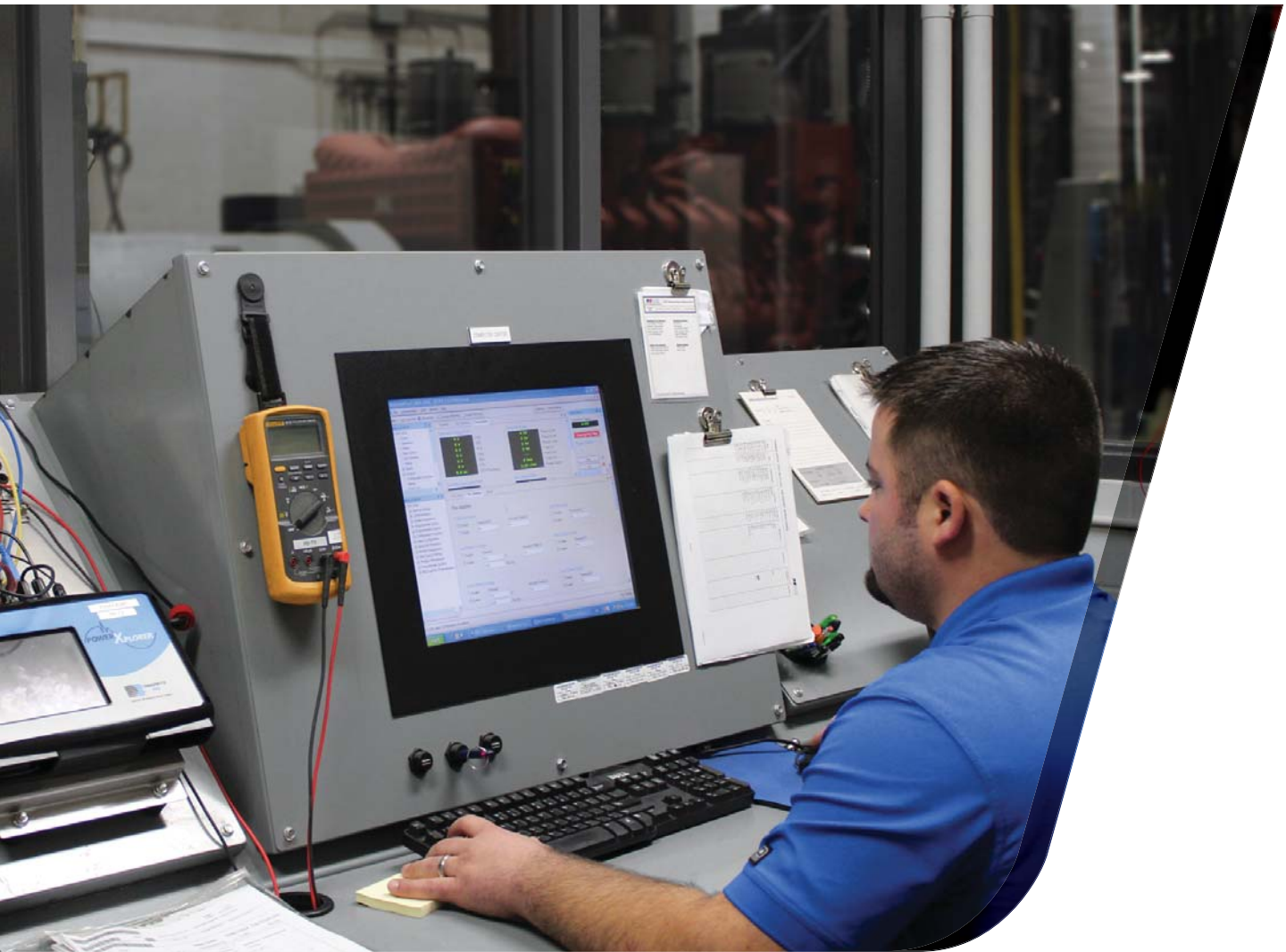


TYPE TJB – 1 SPRING			TYPE TJC – 2 SPRINGS		
Max Load kg (lb)	Max. Defl. mm (in)	Spring Rate kg/mm (lb/in)	Max Load kg (lb)	Max. Defl. mm (in)	Spring Rate kg/mm (lb/in)
9.53 (21)	28.7 (1.13)	0.321 (18)	19.05 (42)	28.7 (1.13)	0.643 (36)
24.95 (55)	28.7 (1.13)	0.875 (49)	49.9 (110)	28.7 (1.13)	1.75 (98)
35.83 (79)	28.7 (1.13)	1.25 (70)	71.67 (158)	28.7 (1.13)	2.5 (140)
48.08 (106)	28.7 (1.13)	1.679 (94)	96.16 (212)	28.7 (1.13)	3.357 (188)
54.43 (120)	58.42 (2.3)	0.929 (52)	108.86 (240)	58.42 (2.3)	1.857 (104)
70.31 (155)	55.88 (2.2)	1.25 (70)	140.61 (310)	55.88 (2.2)	2.5 (140)
84.82 (187)	28.7 (1.13)	2.947 (165)	169.64 (374)	28.7 (1.13)	5.893 (330)
110.68 (244)	28.7 (1.13)	3.857 (216)	221.35 (488)	28.7 (1.13)	7.715 (432)
144.242 (318)	28.7 (1.13)	5.018 (281)	288.49 (636)	28.7 (1.13)	10.036 (562)
179.17 (395)	45.72 (1.8)	3.929 (220)	358.34 (790)	45.72 (1.8)	7.858 (440)
231.786 (511)	38.1 (1.5)	6.090 (341)	463.57 (1,022)	38.1 (1.5)	12.179 (682)
324.32 (715)	33.02 (1.3)	9.822 (550)	648.64 (1,430)	33.02 (1.3)	19.644 (1,100)
480.81 (1,060)	25.4 (1)	18.929 (1,060)	961.62 (2,120)	25.4 (1)	20.001 (1,120)
689.46 (1,520)	19.81 (0.78)	34.823 (1,950)	1,378.92 (3,040)	19.81 (0.78)	69.646 (3,900)
889.04 (1,960)	19.81 (0.78)	44.913 (2,515)	1,778.08 (3,920)	19.81 (0.78)	89.826 (5,030)

TYPE TJE – 4 SPRINGS		
Max Load kg (lb)	Max. Defl. mm (in)	Spring Rate kg/mm (lb/in)
38.1 (84)	28.7 (1.13)	1.286 (72)
99.79 (220)	28.7 (1.13)	3.5 (196)
143.34 (316)	28.7 (1.13)	5 (280)
192.32 (424)	28.7 (1.13)	6.715 (376)
217.72 (480)	58.42 (2.3)	3.714 (208)
281.23 (620)	55.88 (2.2)	5.036 (282)
339.29 (748)	28.7 (1.13)	11.822 (662)
442.71 (976)	28.7 (1.13)	15.429 (864)
576.97 (1,272)	28.7 (1.13)	20.072 (1,124)
716.68 (1,580)	45.72 (1.8)	15.715 (880)
927.14 (2,044)	38.1 (1.5)	24.358 (1,364)
1,297.27 (2,860)	33.02 (1.3)	39.29 (2,200)
1,923.23 (4,240)	25.4 (1)	75.718 (4,240)
2,757.84 (6,080)	19.81 (0.78)	139.292 (7,800)
3,556.16 (7,840)	19.81 (0.78)	179.651 (10,060)

TYPICAL CALLOUT		
Type	Max Load kg (lb)	Attaching
TJB	110.68 (244)	T

© MTU Onsite Energy. Subject to alteration due to technological advances. 2014-01



PERFORMANCE ASSURANCE CERTIFICATION



PROTOTYPE TEST PROCEDURES AND METHODS

MTU Onsite Energy has been producing superior engine-generator sets for more than six decades. We understand the importance of reliable cost-effective products, and have developed industry-leading test procedures to ensure we exceed this criteria. Our testing program confirms that our customers will receive products of the highest quality.

The Performance Assurance Certification provided by MTU Onsite Energy certifies that every engine-generator set undergoes rigorous prototype testing including the following:

Prototype test procedures

// Rated Load (NFPA 110)

MTU Onsite Energy certifies that all engine-generator set models will produce the name-plated load within the design tolerance of the generator set.

// Extended-run Testing

MTU Onsite Energy certifies that all engine-generator set prototypes have been subjected to extended run-time testing.

// Transient Response Analysis (ISO 8528-5)

MTU Onsite Energy certifies that all new generator set models have undergone transient response analysis per ISO 8528-5.

// Torsional Analysis

MTU Onsite Energy certifies that all engine-generator-set models have undergone torsional stress analysis.

// Engine Cooling System

MTU Onsite Energy certifies that all generator set models will cool sufficiently within the ambient design conditions per each model.

// Anticipatory Alarms and Shutdowns

MTU Onsite Energy certifies that the pre-alarms and alarms function appropriately to protect the engine-generator set from any foreseen unnecessary failures.

// Vibrational Analysis (ISO 8528-9)

MTU Onsite Energy certifies that all new engine-generator-set models have undergone vibration analysis to ensure that each engine-generator coupling is balanced and that there is no destructive resonant vibration.

// Noise Analysis (ISO 8528-10)

MTU Onsite Energy certifies that all engine-generator sets undergo airborne noise analysis using the enveloping surface method.

Test standards

MTU Onsite Energy engine-generator sets are compliant with many different codes and standards. MTU Onsite Energy's validation philosophy and performance are regularly reviewed to ensure continuity with these codes and standards: *UL2200, CSA, EPA, NFPA 99–Health Care Facilities, NFPA 70–National Electrical Code, NFPA 110–Standard for Emergency and Standby Power Systems, Department of Labor and Industry, NEMA MG 1–Motors and Generators, and MIL-STD-705-c.*

FACTORY ACCEPTANCE TESTING PROCEDURES

MTU Onsite Energy's factory testing is performed with the same extreme diligence and attention to detail that is given to the prototype testing process. Every engine-generator set receives a complete factory acceptance test that certifies and ensures that the set will function in accordance to every specific application.

Test metering will have an accuracy of 1.3% or better. This metering is calibrated a minimum of once per year and is directly traceable to the Bureau of Standards.

Factory acceptance testing procedures:

- // **Insulation Resistance Inspection** (301.1c)*
- // **High Potential Test** (302.1b)*
- // **Alternator Overspeed** (1 min.)*
- // **Engine Inspection**
- // **Generator Inspection**
- // **Resistances Inspection** (401.1b)
 - Exciter Field Stator
 - Alternator Armatures
- // **Mounting and Coupling Inspection**
- // **Engine Fuel Oil System Inspection**
- // **Engine Lube Oil System Inspection**
- // **Engine Cooling System Inspection**
- // **DC Charging System Inspection**
- // **Circuit Breaker Inspection**
- // **Anticipatory Alarms and Shutdowns Inspection**
(505.2b, 515.1b, 515.2b)
- // **Optional Equipment Inspection** (513.2a)
- // **Load Test Inspection**
 - Full Name-plate Rated Load
 - Regulator Range Test (511.1d)
 - No Load Inspection
 - MAX Load @ 1.0 P.F. (640.1d)
 - MAX Load @ 0.8 P.F.
 - Block Loads @ 0-25%, 0-50%, 0-75%, 0-100%
- // **Phase Balance and Sequence Inspection**
(507.1d, 508.1d, 516.1a)

* Performed by Alternator OEM

Rating Tolerance

MTU Onsite Energy certifies that all generator set models will produce the name-plated load at the standard conditions within the design tolerance (see table below) of the generator set.

Diesel Genset Product Family	Rating Tolerance
MTU 3R0096 DS30 to MTU 6R0120 DS200	+/- 5%
MTU 6R1600 DS230 to MTU 12V1600 DS600	+/- 2%
MTU 12V2000 DS650 to MTU 20V4000 DS3250	+/- 2%

Gas Genset Product Family	Rating Tolerance
MTU 4R0075 GS30 to MTU 8V0071 GS60	+/- 5%
MTU 10V0068 GS75 to MTU 10V0068 GS125	+/- 3%
MTU 6R0135 GS150 to MTU 12V0183 GS400	+/- 5%

OPTIONAL TEST PROCEDURES

Extended-run factory acceptance testing:

In some cases, extended-run testing may be requested. Unless specified otherwise, extended-run testing will be performed in the following manner.

- // Full name-plate rated load
- // Standard readings taken every 15 minutes

STANDARD READINGS RECORDED DURING LOAD TEST INSPECTION

// Run Time	// Frequency
// AC Voltage	// Exciter Field Voltage
// AC Amperage	// Exciter Field Current
// kVA	// Lube Oil Pressure
// kWe	// Engine Coolant Temperature
// Power Factor	// Ambient Temperature

Witnessed factory acceptance testing

Witnessed factory tests must be scheduled and approved at least four weeks prior to the engine-generator set's scheduled shipping date. Any requests for witnessed factory testing after this four-week period must be approved by the Regional Sales Manager and are subject to additional fees.

Witnessed extended-run factory acceptance testing

Witnessed extended-run tests must be scheduled and approved at least four weeks prior to the engine-generator set's scheduled ship date. Any requests for witnessed extended-run testing after this four-week period must be approved by the Regional Sales Manager and are subject to additional fees.

Additional factory acceptance testing

Additional testing is available upon request. The following is a list of supplementary tests which can be performed on MTU Onsite Energy engine-generator sets. Non-standard testing is subject to additional charges.

Additional test methods:

- // Start and Stop Test (MIL-STD-705c 503.1c)
- // Remote Start and Stop Test (MIL-STD-705c 503.2c)
- // Overspeed Protective Device Test (MIL-STD-705c 505.2b)
- // Circulating Current Test (MIL-STD-705c 505.2b)
- // Insulation Resistance Test (MIL-STD-705c 301.1c)*
- // Open Circuit Saturation Curve Test (MIL-STD-705c 410.1b)
- // Temperature Rise Test (MIL-STD-705c 680.1c)
- // Frequency Range Adjust Test (MIL-STD-705c 511.2c)
- // Low Oil Pressure Protective Device Test (MIL-STD-705c 515.1b)
- // Over-temperature Protective Device Test (MIL-STD-705c 515.2b)
- // Controls, Direction, and Rotation Test (MIL-STD-705c 516.1a)
- // Frequency and Voltage Regulation, Stability, and Transient Response (MIL-STD-705c 608.1b)
- // Voltage and Frequency Regulation (MIL-STD-705c 614.1b)
- // Voltage Dip and Rise for Rated Load Test (MIL-STD-705c 619.2c)
- // Maximum Power Test (MIL-STD-705c 640.1d)
- // Fuel Consumption Test
- // Vibration and Mechanical Balance Test (ISO 8528-9)
- // Sound Test (ISO 8528-10)

* Testing conducted by generator OEM



A Rolls-Royce Power Systems Company

MTU Onsite Energy Corporation / 100 Power Drive / Mankato / Minnesota 56001
Phone 507 625 7973 / Fax 507 625 2968 / Toll Free 800 325 5450

www.mtuonsiteenergy.com



CERTIFICATE OF COMPLIANCE

Certificate Number 20140815-AU3559
Report Reference AU3559-20020923
Issue Date 2014-AUGUST-15


Issued to: MTU ONSITE ENERGY CORP
100 POWER DR
MANKATO MN 56001

This is to certify that ENGINE GENERATORS
representative samples of See Addendum Page

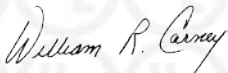
Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL 2200, Stationary Engine Generator Assemblies
Additional Information: See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Listing Mark should be considered as being covered by UL's Listing and Follow-Up Service.

The UL Listing Mark generally includes the following elements: the symbol UL in a circle:  with the word "LISTED"; a control number (may be alphanumeric) assigned by UL; and the product category name (product identifier) as indicated in the appropriate UL Directory.

Look for the UL Listing Mark on the product.



William R. Carney, Director, North American Certification Programs
UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at www.ul.com/contactus



CERTIFICATE OF COMPLIANCE

Certificate Number 20140815-AU3559
Report Reference AU3559-20020923
Issue Date 2014-AUGUST-15

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

Stationary engine generator assemblies (diesel fueled) for Outdoor Use and Indoor Use, models as follows:

Model Series D followed by a number ranging from 250 to 3250, followed by F, followed by R,P,J,N or G, followed by X, followed by 4. May be followed by additional prefix or suffix letters or numbers.

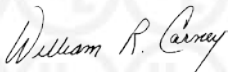
Model Series D followed by a number ranging from 250 to 3250, followed by R,P,J,N or G, followed by X, followed by 6, Followed by T, followed by 2 or 3. May have additional prefix or suffix letters or numbers.

Model Series 220-3250, followed by R,P,J, N or G, followed by X, followed by C or S, followed by 6, followed by D, followed by T, followed by 2 or 3. May have additional prefix or suffix letters or numbers.

Model Series D, followed by S or P, may be followed by one or two zeroes, followed by a number ranging from 220 to 3250, followed by D, followed by 6, followed by C or S, followed by R, P, J, N or G, followed by A or W, followed by H, followed by 2, 4 or 5, followed by 48 or 57, followed by 3 or 4. May have additional prefix or suffix letters or numbers.

Models D, followed by G, followed by 12, 16, or 20, followed by V, followed by 2000 or 4000. May have additional prefix or suffix letters or numbers.

Models 12, 16, or 20, followed by V, followed by 2000 or 4000, followed by D, followed by S, followed by a number ranging from 650 to 3250. May have additional prefix or suffix letters or numbers.



William R. Carney, Director, North American Certification Programs
UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at www.ul.com/contactus



STANDBY LIMITED WARRANTY

Two (2) Year / 3,000 Hour Basic



LIMITED WARRANTY

Your MTU Onsite Energy product has been manufactured and inspected with care by experienced craftspeople. If you are the original consumer, MTU Onsite Energy warrants, for the limited warranty period indicated below, each product will be free from defects in materials and workmanship, and will perform under normal use and service from valid start-up performed by MTU Onsite Energy. This Limited Warranty shall apply only when the product has been properly installed, serviced, and operated in accordance with the applicable MTU Onsite Energy instruction manuals. If this Limited Warranty applies, the liability of MTU Onsite Energy shall be limited to the replacement, repair, or appropriate adjustment of the product, at MTU Onsite Energy's option. This Limited Warranty does not apply to malfunctions caused by normal wear and tear, or by damage, unreasonable use, misuse, repair, or service by unauthorized persons.

LIMITED WARRANTY PERIOD

Engine Generator Set: Parts and labor for twenty-four (24) months will begin with the first commissioning of the product(s). In all cases, the warranty period will expire not later than thirty-six (36) months from the date of shipment ex-works MTU Onsite Energy or after 3,000 operation hours, whichever occurs first. Accessories: Parts and labor for one (1) year from date of shipment. For a description of accessories and items excluded from this Limited Warranty, review the listings below.

LIMITED WARRANTY CONDITIONS

Before there is any protection under this Limited Warranty, the distributor must: (1) complete the MTU Onsite Energy Warranty and the Start-Up Validation and Pre-Inspection form, and return them to MTU Onsite Energy within 60 days of the start-up date, and (2) complete the engine registration form and return it to the manufacturer as stated in the instructions with engine registration form (when applicable). In addition, this Limited Warranty is not valid or enforceable unless: (1) all supporting maintenance records are kept on file with the end user and made available upon request from factory, (2) the generator set is routinely exercised in accordance with operating instructions, and (3) the installation meets the general guidelines, standards, recommendations (as laid out in the Installation Guide provided with the product), and all local standards and codes applicable in the location of installation.

Engine generator sets that are stored by Owner / Buyer longer than 180 days from date of shipment are subject to special requirements. Contact MTU Onsite Energy's Service Center for instructions.

TO OBTAIN WARRANTY SERVICE

Warranty service may only be performed by MTU Onsite Energy authorized service providers. **Service provided by unauthorized persons will void this Limited Warranty. Non-MTU Onsite Energy replacement part(s) will void this Limited Warranty.** Contact your nearest MTU Onsite Energy Service Representative to obtain warranty service. For assistance in locating your nearest authorized service representative, see contact information at the bottom of this page.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED. NO WARRANTIES SHALL BE IMPLIED OR OTHERWISE CREATED UNDER THE UNIFORM COMMERCIAL CODE, INCLUDING BUT NOT LIMITED TO A WARRANTY OF MERCHANTABILITY OR A WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

MTU ONSITE ENERGY SHALL NOT BE LIABLE FOR ANY CLAIM GREATER IN AMOUNT THAN THE PURCHASE PRICE OF THE PRODUCT AT ISSUE, AND IN NO EVENT SHALL MTU ONSITE ENERGY BE LIABLE

STANDBY LIMITED WARRANTY

Two (2) Year / 3,000 Hour Basic



FOR ANY SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES. STATE LAWS REGARDING THE RIGHTS OF CONSUMERS MAY VARY FROM STATE TO STATE.

1. The following items are not considered nor will they be covered under this Limited Warranty. If there are questions as to coverage under this Limited Warranty, it is advisable to contact the factory in advance of filing a claim.
 - a. Battery or batteries of any type or kind. The battery manufacturer's warranty, if any, is the only warranty that applies to batteries. Any warranty claim should be handled with the manufacturer according to its policies.
 - b. Adjustments to fuel systems or governor system at time of start-up or any time after. A warranty claim for such adjustments is acceptable only when a defective part has been replaced, returned to the factory, and approved as defective.
 - c. Normal maintenance costs, including but not limited to adjustments, loose and/or leaking fittings or clamps, and tune-ups performed during start-up or anytime thereafter.
 - d. Due to shipping, manufacturer is not responsible for loose connections. All connections must be checked at time of start-up.
 - e. Non-MTU Onsite Energy replacement part(s) will void this Limited Warranty.
 - f. Products that are modified in any form without the written consent of MTU Onsite Energy will void this Limited Warranty.
 - g. Shipping damage of any type.
 - h. Any installation errors or damage of the equipment when shipped as ordered.
 - i. Any overtime travel or labor to make repairs under warranty.
 - j. Any special access fees required to gain access to MTU Onsite Energy equipment, including but not limited to any training or safety policy requirements to gain access.
 - k. Additional costs associated with inaccessible installations, including but not limited to removal and reinstallation of the generator set.
 - l. Rental equipment used during warranty work including but not limited to generators, rigging equipment such as a crane or boom truck, load banks, and special test equipment above factory requirements.
 - m. Excess mileage charges. Any authorized service provider may perform warranty service anywhere, but will only be paid for mileage expenses from the nearest service center and limited to 400 miles / 644 Kilometers round-trip.
 - n. Any equipment not factory approved and engineered for use on MTU Onsite Energy products. This includes but is not limited to aftermarket items such as special fuel systems, enclosures, exhaust systems, or switch gear that had been sought out and quoted by a third party to be included in billing of the MTU Onsite Energy equipment.
 - o. Misuse or abuse during installation and thereafter.
 - p. Normal wear and tear, maintenance, and consumable items that are not required as part of a warranty repair. Consumable items include but are not limited to belts, hoses, coolant, oil, filters, and fuses.
 - q. Acts of nature or acts of God such as lightning, wind, flood, tornado, hurricane, or earthquake.
 - r. Any damage due to situations beyond the control of the manufacturing of the product or workmanship of the product.
 - s. Installation or operation outside the guidelines as stated in the Installation Guide and Owner's Manual.
 - t. Diesel engine "Wet Stacking" due to lightly loaded diesel engines.
 - u. Misapplication of the equipment such as usage outside the original design parameters as stated on the nameplate of the equipment.
 - v. Travel expense on portable equipment.
 - w. Trailer lights, wiring, and brakes.

STANDBY LIMITED WARRANTY

Two (2) Year / 3,000 Hour Basic



- x. More than one trip to the job site because a service vehicle was not stocked with normal service parts.
 - y. Lodging expense of person(s) performing service, unless approved in advance by factory.
 - z. Engine fluids.
 - aa. Units purchased at the standby power rating that are being used in a prime power application.
 - ab. Any repair labor time that is determined to be excessive, e.g., two or more people performing a one-person job.
 - ac. Any expenses associated with investigating performance complaints in which no defect is found.
 - ad. Any associated costs for replacing components that are found not to be defective.
 - ae. Any adjustments covered in the start-up and inspection forms that are to be completed during start-up.
2. The accessories that are limited to one (1) year parts and labor from date of shipment include but are not limited to:
- a. Cords, receptacles, and cord reels
 - b. Gas flex pipes
 - c. Housing lights, space heaters, and associated equipment

100 Power Drive / Mankato, MN 56001 / 800-325-5450