Engineering Data and Proposal
This proposal has been prepared specifically for:

DS1000

It contains all the necessary literature, drawings and component information for the following equipment:

MTU 16V2000 DS1000 Generator

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1 Generator Specification Sheets

1 Bill of Materials
2 Contractor Worksheet
3 Initial Start-Up Validation Form
4 Generator Spec Sheet
5 Generator Controller Spec Sheet
6 Alternator Data Sheets
7 Voltage Regulator Spec Sheet
8 Strip Heater Spec Sheet
9 Circuit Breaker Spec Sheet
10 Circuit Breaker Enclosure Spec Sheet
11 Battery Charger Spec Sheet
12 Redundant Starting System Spec Sheet
13 Water Heater Spec Sheet
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15 Sub-Base Fuel Tank Spec Sheet
16 Fuel Water Separator Spec Sheet
17 Factory Testing Procedures
18 Prototype Test Report
19 Emissions Data
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2 Generator Drawings & Wiring Diagrams

22 Generator Mechanical Drawing
23 Generator AC Wiring Diagram
24 Generator DC Wiring Diagram
25 Generator PP Wiring Diagram

BILL OF MATERIALS

MODEL:	MTU 16V2000 DS1000
QUANTITY:	1
OUTPUT:	1,000kW, 1,250kVA, 1,504 Amps
RATINGS:	Emergency Standby Duty, UL 2200
VOLTAGE:	480 Volt, 3 Phase, 12 Wire, 0.8 Power Factor
ENGINE:	60 Hz, Diesel, 1800 RPM Engine Model: MTU 16V2000G86S EPA Certified Single Stage Air Cleaner Electronic Isochronous Governor Vibration Isolators
ALTERNATOR:	2/3 Pitch, PMG Excitation, 130C Temperature Rise, Class H Insulation D510C Voltage Regulator, Generator Strip Heater
COOLING SYSTEM:	Unit Mounted Radiator, 50C/122F
CONTROL PANEL:	MGC 3010 Digital Control Panel with Microprocessor based controls. 4 Relay Package, Ground Fault Indication
CIRCUIT BREAKER :	1,600 Amp, 100% Rated, LSI Trip, Shunt Trip, Auxiliary Contact
BATTERY:	Without Batteries Redundant Starter
BATTERY CHARGER:	24 Volt, 10 Amp (Mounted and Wired AC/DC) 120V
BLOCK HEATER:	9,000 Watt with Isolation Valves, Mounted and Wired 208V 1-Phase
FUEL TANK:	24 Hour/2,200 Gallon Sub-Base Fuel Tank, 5 Gallon Spill Fill Containment
ENCLOSURE:	Weatherproof, Sound Attenuated Enclosure, 74.7 dB(A) @ 23’ 130 MPH Wind Rated Steel, Vertical Exhaust Discharge
SILENCER:	Internal Critical Grade Exhaust Silencer
WARRANTY:	Two Year/3,000hr Basic Factory Warranty
MANUALS:	(1) O&M Manual Electronic Copy, (1) O&M Manual Hard Copy

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Generator Data Sheet

Project Name	Stock DS1000					Date:	4/5/2022
Model	16V2000 DS1000						
Voltage	480	VAC					
Power Output	1000	kW					
Number of Phases	3						
Dimensions & Weights	Length	Width	Height	Weight		Notes:	
Base / Tank	346.02"	116.7"	22"	9,691	Pounds	Empty Tank Weight	
Generator	283.82"	107.09"	99.42"	27,568			
Enclosure	346.02"	107.09"	175.19"	4,931			
Fuel				15,620			
Total	346.02"	116.9"	209.45"	57,810			
Recommended Pad Dimensions	370"	131"					
Remote Radiator	N/A	N/A	N/A	N/A			
Remote Fuel Tank	N/A	N/A	N/A	N/A			
Number of Shipped Pieces:			3				
		Volts	Phase	Ampacity	# of Circuits		
Main Breaker #1	☑	480	3	1600		**Pull all Stranded Wire**	
Main Breaker #2	☐						
Main Breaker #3	☐						
Load Center	☐						
Convenience Outlet	☐						
A/C Light Package	☐						
Battery Heater	☐						
Block Heater	☑	208	1	44	1		
Battery Charger	☑	120	1	6.6	1		
Generator Heater Strip	☑	120	1	5	1		
Powered Louvers	☐						
Generator Connected to BMS	☐	MODBUS ☐		Ethernet ☐			
Remote Generator Kill Switch	☐						
Generator Start Signal	☑	3- Wires; 14 Gauge Stranded					
Remote Annunciator Panel	☐						
Annunciator cable type / qty of conductors							
Fuel Tank Size	2200	Gallons					
Fuel Required for Testing	1100	Gallons					

Note: If this form does not appear with fillable fields, navigate to *Edit* > *Preferences* > *Documents* > *PDF/A View Mode*. In the **View documents in PDF/A mode** drop-down list, select **Never**. Click **OK**.

Form A - Engine Generator Set Request for Start-Up

Requested Date: _____

☐ First Visit ☐ Follow-Up Visit

Instructions

This form must be completed and signed by the customer/client to ensure proper installation of the generator set prior to scheduling a start-up date and to request start-up service from an authorized MTU distributor or regional service center.

Applicant Contact Details

Company: _____

Name: _____

Telephone: _____

Email: _____

Project Details

Project Name: _____

Project Number: _____

Site Address: _____

_____

Engine Generator Set Nameplate

Model Number: _____

Serial Number: _____

Rating: _____

Hz: _____ kW: _____

kVA: _____ Volts: _____

Phase: _____ Amps: _____

Engine

Model Number: _____

Serial Number: _____

Power: _____ RPM: _____

Fuel Type

☐ Diesel ☐ NG ☐ LP Vapor ☐ Liquid LP ☐ Other

ATS (☐ Yes ☐ No)

Manufacturer: _____

Model Number: _____

Serial Number: _____

Voltage: _____ Current: _____

Poles: _____

Utility Service

Volts: _____ Phase: _____

Phase Rotation: _____

Load Bank (☐ Yes ☐ No)

Capacity: _____

Pre-Start-Up Validation Checklist

	Yes	No	N/A
Unit set in final location	☐	☐	☐
Radiator ducted to air discharge louvers	☐	☐	☐
Intake and discharge air louvers installed and wired	☐	☐	☐
Unit filled with oil to proper level	☐	☐	☐
Unit filled with coolant to proper level	☐	☐	☐
Battery filled and fully charged	☐	☐	☐
Battery charger mounted with AC and DC wiring	☐	☐	☐
Block heater wired to correct AC power supply	☐	☐	☐
Switch gear/transfer switch connections made	☐	☐	☐
All other AC and DC electrical connections made	☐	☐	☐
Fuel inlet and return lines run between the unit and fuel storage system	☐	☐	☐
Fuel storage system filled with sufficient quantity for commissioning	☐	☐	☐
Exhaust system properly installed and supported	☐	☐	☐
Radiator and engine generator set room is free of debris	☐	☐	☐
Permission for use of site load or request load bank	☐	☐	☐
Other: _____	☐	☐	☐

NOTE: If the tasks on this checklist are not adequately completed upon arrival of the authorized MTU technician or for reasons beyond the control of MTU, an additional start-up charge may be incurred. Please resubmit this form when items are addressed.

Additional Comments/Notes:

_____

_____

_____

_____

Completed by (signature): _____

Print Name: _____

Company: _____

Date: _____

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Diesel Generator Set

mtu 16V2000 DS1000

1,000 kWe/60 Hz/Standby/208 - 4,160V

System ratings

Voltage (L-L)	480V † ‡
Phase	3
PF	0.8
Hz	60
kW	1,000
kVA	1,250
Amps	1,504
skVA@30% voltage dip	2,830
Generator model*	LSA 49.1 L11
Temp rise	130 °C/40 °C
Connection	6 LEAD WYE

* Consult the factory for alternate configuration.
† UL 2200 offered
‡ CSA offered

Certifications and standards

- Emissions
  - EPA Tier 2 certified
  - South Coast Air Quality Management District (SCAQMD)
- Generator set is designed and manufactured in facilities certified to standards ISO 9001:2008 and ISO 14001:2004
- UL 2200 - optional (refer to *System ratings* for availability)
- 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%.

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Standard features*

- Single source supplier
- Global product support
- Two (2) Year/3,000 Hour Basic Limited Warranty
- 16V2000 diesel engine
  - 35.7 liter displacement
  - Common rail fuel injection
  - 4-cycle
- Complete range of accessories
- Cooling system
  - Integral set-mounted
  - Engine-driven fan
- Generator
  - Brushless, rotating field generator
  - 2/3 pitch windings
  - AREP supply to regulator
  - 300% short circuit capability
- Digital control panel(s)
  - UL recognized, NFPA 110
  - Complete system metering
  - LCD display

Standard equipment*

Engine

- Air cleaners
- Oil pump
- Oil drain extension and shut-off valve
- Full flow oil filter
- Closed crankcase ventilation
- Jacket water pump
- Inter cooler water pump
- Thermostats
- Blower fan and fan drive
- Radiator - unit mounted
- Electric starting motor - 24V
- Governor - electronic isochronous
- Base - structural steel
- SAE flywheel and bell housing
- Charging alternator - 24V
- Battery rack and 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
- 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 no load to full load
- 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
- Communications to remote annunciator
- Programmable input and output contacts
- UL recognized,
- Event recording
- IP 54 front panel rating with integrated gasket
- NFPA 110 compatible

* Represents standard product only. Consult the factory/***mtu*** Distributor for additional configurations.

Application data

Engine

Manufacturer	***mtu***
Model	16V2000G86S
Type	4-cycle
Arrangement	16-V
Displacement: L (in³)	35.7 (2,179)
Bore: cm (in)	13.5 (5.3)
Stroke: cm (in)	15.6 (6.1)
Compression ratio	16:1
Rated rpm	1,800
Engine governor	electronic isochronous (ADEC)
Maximum power: kWm (bhp)	1,371 (1,839)
Steady state frequency band	± 0.25%
Air cleaner	dry

Liquid capacity

Total oil system: L (gal)	114 (30.1)
Engine jacket water capacity: L (gal)	70 (18.5)
After cooler water capacity: L (gal)	25 (6.6)
System coolant capacity: L (gal)	188 (50)

Electrical

Electric volts DC	24
Cold cranking amps under -17.8 °C (0 °F)	2,800
Batteries: group size	8D
Batteries: quantity	4

Fuel system

Fuel supply connection size	#12 JIC 37° male
Fuel return connection size	#12 JIC 37° male
Maximum fuel lift: m (ft)	5 (16)
Recommended fuel	diesel #2
Total fuel flow: L/hr (gal/hr)	1,500 (396)

Fuel consumption

At 100% of power rating: L/hr (gal/hr)	276 (73)
At 75% of power rating: L/hr (gal/hr)	211 (56)
At 50% of power rating: L/hr (gal/hr)	146 (38)

Cooling - radiator system

Ambient capacity of radiator: °C (°F)	50 (122)
Maximum restriction of cooling air: intake and discharge side of radiator: kPa (in. H_2O)	0.12 (0.5)
Water pump capacity: L/min (gpm)	783 (207)
After cooler pump capacity: L/min (gpm)	258 (68)
Heat rejection to coolant: kW (BTUM)	444 (25,272)
Heat rejection to after cooler: kW (BTUM)	293 (16,677)
Heat radiated to ambient: kW (BTUM)	91 (5,289)
Fan power: kW (hp)	49 (65.7)

Air requirements

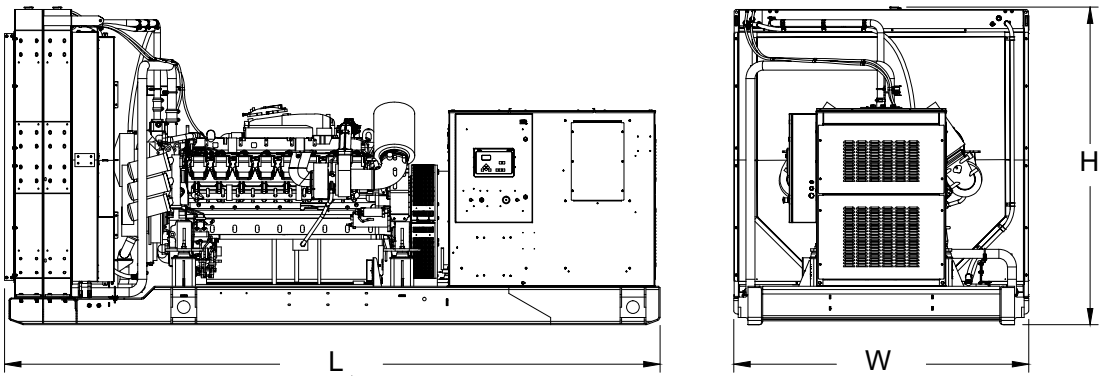
Aspirating: *m³/min (SCFM)	102 (3,602)
Air flow required for radiator cooled unit: *m³/min (SCFM)	1,709 (60,350)
Remote cooled applications; air flow required for dissipation of radiated generator set heat for a maximum of 25 °F rise: *m³/min (SCFM)	338 (11,925)

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

Exhaust system

Gas temperature (stack): °C (°F)	505 (941)
Gas volume at stack temperature: m³/min (CFM)	270 (9,535)
Maximum allowable back pressure at outlet of engine, before piping: kPa (in. H_2O)	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.

Emissions data

NO_x + NMHC	CO	PM
5.88	0.01	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%.
— Nominal ratings at standard conditions: 25 °C and 300 meters (77 °F and 1,000 feet).
— Deration factor:
  - Consult your local ***mtu*** Distributor for altitude derations.
  - Consult your local ***mtu*** Distributor for temperature derations.

Digital Generator Set Controller Data Sheet

MGC-3000 Series

The MGC-3000 Series controllers include the following models which are described throughout this document.*
— MGC-3010

mtu Generator Set Controllers (MGC Series) are rugged, reliable, all-in-one digital generator set control and load share systems. The MGC-3000 Series is designed to be a high end controller that is well suited for mains fail, paralleled units, and systems with multiple buses. The MGC-3000 Series has all of the necessary items for complete generator set control, protection, and metering with a massive, but easy-to-use, programmable logic system.

PRODUCT HIGHLIGHTS

- Three-phase generator metering
- Up to two buses with three-phase voltage metering
- Three dedicated generator CTs with up to four auxiliary CTs
- Engine metering
- Generator set control
- Generator protection
- Residual current - Equipment Ground Fault Protection (EGFP) certified to UL 1053
- BESTCOMS*Plus*®
  - Windows®-based software for optional remote operation (Software can be downloaded at www.mtu-solutions.com)
  - Programming and setup software
  - Intuitive and powerful
  - Remote control and monitoring
  - Programmable logic
  - USB communications
- Automatic transfer switch compatible
- Resistor sender inputs for oil pressure and coolant pressure (option for analog senders available)
- Dual CAN bus ports [one for each SAE J1939 Engine Control Unit (ECU) and expansion modules]
- Dual Ethernet ports
- Load sharing capabilities of kW and kVARs over Ethernet
- Load share line compatibility (0-10 VDC)
- Zero power transfer capabilities
- Two analog inputs
- Governor and AVR bias outputs (reprogrammable to general analog outputs)
- 16 programmable contact inputs, 12 programmable contact outputs
- Three programmable LEDs for customized annunciation
- Connects to up to four AEM-2020s and four CEM-2020s
- Configurable protection with up to 371 different parameters
- Configurable elements for customizable alarms
- Real time analysis feature
- UL recognized
- Multilingual capability
- Remote annunciation with RDP-110
- NFPA-110 compatible
- Microprocessor based
- Expandable to meet customer needs

*Please refer to the last page of this data sheet for available MGC-3000 Series configuration options. The MGC Series Controller Comparison Data Sheet is available as a reference for all MGC Series configuration options.

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DIAGRAM

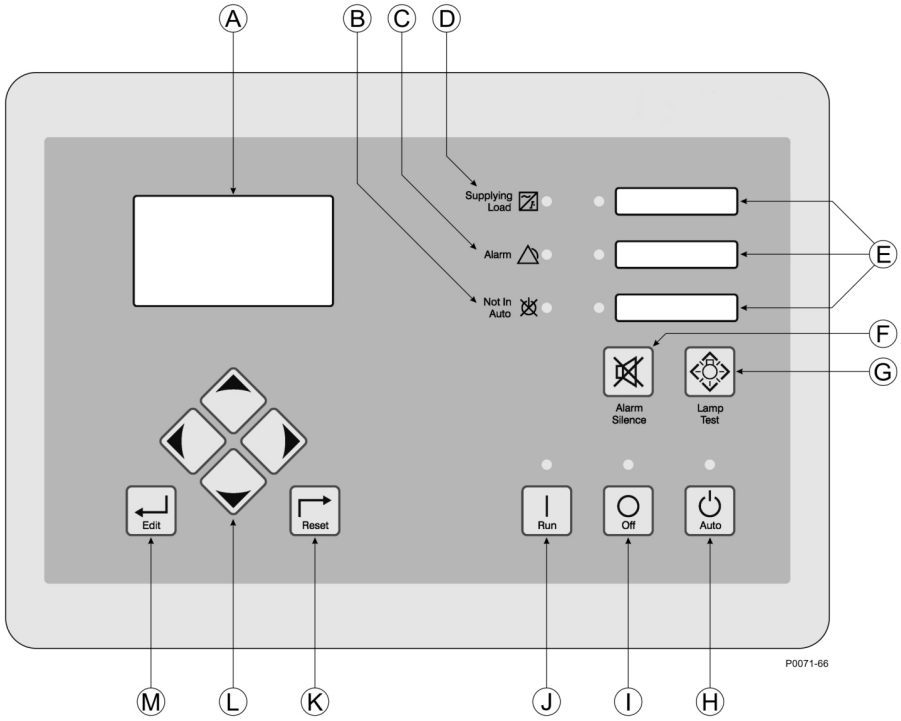

Figure 1: MGC-3000 Front Panel

A. Liquid crystal display
B. Not in Auto indicator
C. Alarm indicator
D. Supplying load indicator
E. Programmable indicators
F. Alarm Silence pushbutton
G. Lamp Test pushbutton
H. Auto pushbutton and mode indicator
I. Off pushbutton and mode indicator
J. Run pushbutton and mode indicator
K. Reset pushbutton
L. Arrow pushbuttons
M. Edit pushbutton

FUNCTIONS

Generator set protection

Generator ANSI codes

- Overvoltage (59)
- Overfrequency (81O)
- Reverse and forward power (32)
- Phase voltage imbalance (47)
- Vector shift (78)
- Undervoltage (27)
- Underfrequency (81U)
- Loss of excitation (40Q)
- Overcurrent (51)
- Rate of change of frequency (81R)

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

FUNCTIONS, continued:

Residual current - Equipment Ground Fault Protection (EGFP)

The MGC-3000 Series controller offers residual current (ground-strap) equipment ground fault protection when utilized with a ground current transformer and a shunt trip equipped service disconnect (if tripping is required). The main bonding jumper that connects the equipment ground bus to the generator neutral passes through the center of the ground current transformer to allow for detection of ground fault currents. The MGC-3000 series controller may be configured for either ground fault indication only (GFI) or ground fault indication and trip (GFIT).

This method is suitable for the following application:

NFPA 70, National Electric Code (NEC) 215.10 specifies that each feeder disconnect rated 1,000 amperes or more and installed on solidly grounded wye electrical systems of more than 150 volts to ground, but not exceeding 600 volts phase-to-phase, shall be provided with ground fault protection of equipment in accordance with the provisions of NEC 230.95.

Figure 2: Ground Fault Protection

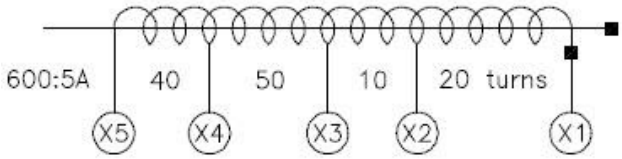

Figure 3: Ground Fault Protection Circuit

The MGC-3000 Series controller ground fault protection circuit complies with the applicable requirements of UL1053, as required by UL6200, and is also listed under ***mtu*** UL file AU3559.

During normal operating conditions, there should be little to no ground return current flowing from the equipment ground bus, through the main bonding jumper, and back to the generator set neutral. The generator set circuit breaker will be closed, and actual ground return current should be below the trip/indication threshold in the MGC-3000 Series controller. Therefore, the controller will not activate the shunt trip.

The MGC-3000 Series controller ground fault protection system utilizes a GE ITI 115-601MR, multi-ratio, relay class C50, current transformer that allows the EGFP system to be finely tuned and sensitized for the level of ground current expected.

Ratios	Tap
50:5	X2 - X3
100:5	X1 - X2
150:5	X1 - X3
200:5	X4 - X5
250:5	X3 - X4
300:5	X2 - X4
400:5	X1 - X4
450:5	X3 - X5
500:5	X2 - X5
600:5	X1 - X5

Table 1: 600:5

The MGC-3000 Series controller ground fault protection may be utilized in non-separately and separately derived systems. Please refer to Figures 4 and 5 below.

FUNCTIONS, Residual current - Equipment Ground Fault Protection (EGFP), continued:

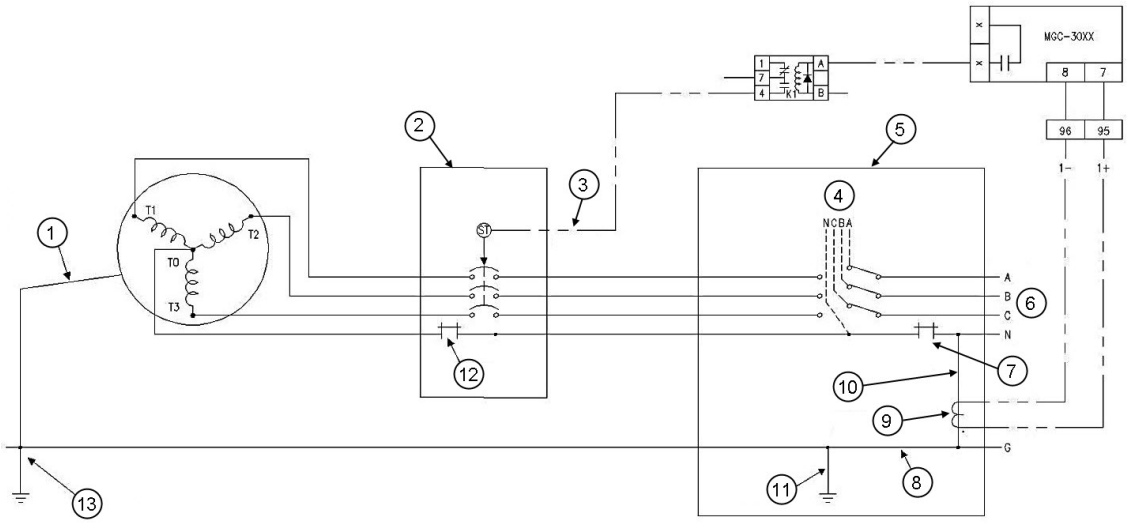

Figure 4: Residual Equipment Ground Fault Protection - Non-Separately Derived System

1. Conductor from generator frame to grounding electrode
2. 3-pole generator set circuit breaker
3. Shunt trip
4. Load
5. Service enclosure
6. Utility
7. Neutral disconnect link
8. Equipment ground bus
9. Current transformer
10. Main bonding jumper
11. Grounding electrode
12. Neutral disconnect link
13. Grounding electrode

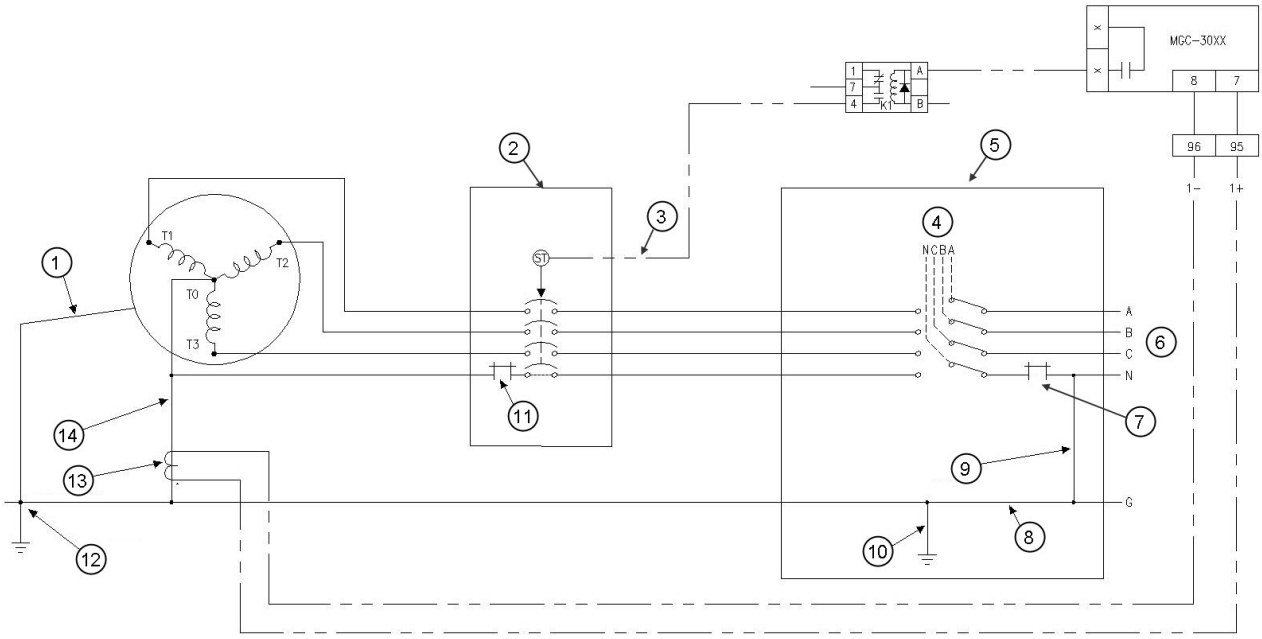

Figure 5: Residual Equipment Ground Fault Protection - Separately Derived System

1. Conductor from generator frame to grounding electrode
2. 3- or 4-pole generator set circuit breaker
3. Shunt trip
4. Load
5. Service enclosure
6. Utility
7. Neutral disconnect link
8. Equipment ground bus
9. Main bonding jumper
10. Grounding electrode
11. Neutral disconnect link
12. Grounding electrode
13. Current transformer
14. Main bonding jumper

FUNCTIONS, continued:

Generator set protection, continued:

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 (Refer to *Configuration Options*.)

Pre-alarms (Warnings)
- Low oil pressure
- High coolant temperature
- Low coolant temperature
- Battery overvoltage
- Weak battery voltage
- AEM1 through AEM4 comms failure
- Breaker open failure
- CEM1 through CEM4 comms failure
- Generator reverse rotation
- ID missing
- Intergenset communication failure
- Loss of voltage sensing
- Checksum failure
- ECU comms fail
- Low fuel level
- High fuel level
- Active Diagnostic Trouble Codes (DTC)
- Breaker close failure
- Bus 1 and bus 2 reverse rotation
- Ethernet 1 and Ethernet 2 link lost
- High battery voltage
- ID repeat
- Low battery voltage
- Synchronizer failure

All alarms and pre-alarms can be enabled or disabled via the BESTCOMS*Plus*® PC software or the front panel. Additional custom alarms and pre-alarms are available upon request.

Generator and bus protection and metering
- Multifunction protection guards against overvoltage, undervoltage, excessive forward and reverse power, underfrequency, and overfrequency. Overcurrent, phase imbalance, and loss of mains are available as options. Each protection function has an adjustable pickup and time delay setting. 16 inverse time curves, in addition to user-programmable curves, enable the MGC-3000 Series to offer overcurrent protection in a variety of applications. Each protective element can be assigned to the generator, bus 1, or bus 2.
- Metered generator and bus parameters include voltage, current, real power (watts), apparent power (VA), and power factor (PF).

Engine protection and metering
- Engine protection features include oil pressure and coolant temperature monitoring, overcrank protection, ECU-specific protection elements, and diagnostic reporting.
- Metered engine parameters include oil pressure, coolant pressure, 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

FUNCTIONS, continued:

Load sharing

The MGC-3000 Series provides analog outputs to the power system in the form of analog bias signals to the voltage regulator and speed governor. When the generator breaker is closed and load sharing is enabled, the MGC-3000 Series shares the real power load proportionally with other generators in the system. Load sharing can be implemented on the Analog Load Share Line or through Ethernet communications. Reactive power (kVAR) sharing is accomplished through Ethernet communications.

Event recording

A history of system events are logged in non-volatile memory. The MGC-3000 Series retains records for 128 unique types of events. Each record tracks the number of times that an event has occurred and records a time stamp of the first and last occurrences.

A Sequence of Events (SER) log is also available. This log tracks the internal and external status of the MGC-3000 Series. Events are scanned at five millisecond intervals with 1,023 events stored per record. All changes of state that occur during each scan are time- and date-stamped. SER reports are available through BESTCOMS*Plus*®. Over 1,000 records can be retained in non-volatile memory. When the SER memory becomes full, the oldest record is replaced by the latest one acquired.

Transfer switch control (Mains failure)

The MGC-3000 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-3000 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-3000 Series implements open or closed breaker transitions to and from the mains. When the mains returns and is considered stable, the MGC-3000 Series will transfer the load back to the mains and stop the engine. During closed breaker transitions, the Auto Synchronizer can synchronize the generator to the mains before transferring the load from generator power to utility power.

ModBus™ RTU

MGC-3000 Series controllers can be monitored and controlled via a polled network using the ModBus™ protocol. The RS-485 port supports a user-selectable baud rate of 1,200, 2,400, 4,800, 9,600, 19,200, 38,400, 57,600, or 115,200. Seven or eight data bits per character can be selected. Odd, even, or no parity is supported. One or two stop bits are selectable. Please see the *MGC-3000 Series Controller Manual* for the ModBus™ register list.

Ethernet

Ethernet ports provide communications between the MGC-3000 Series and a PC via BESTCOMS*Plus*® or other MGC-3000 Series controller(s) in a network. An Ethernet connection to a PC running BESTCOMS*Plus*® provides remote metering, setting, annunciation, and control of the MGC-3000 Series. Ethernet communication between MGC-3000 Series controller(s) allows for generator sequencing on an islanded system.

MGC-3000 Series controllers can be monitored and controlled via Ethernet using the ModBus™ TCP/IP.

Programmable logic

The MGC-3000 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

(Refer to Configuration Options.)

The MGC-3000 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.

FUNCTIONS, continued:

External modem interface

The MGC-3000 Series includes 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-3000 Series. When an alarm or pre-alarm condition occurs, the MGC-3000 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.

CAN

MGC-3000 Series controllers have two separate CAN ports: CAN 1 and CAN 2. CAN 1 communicates solely with expansion modules. This port accommodates up to four AEM-2020s and up to four CEM-2020s simultaneously. CAN 2 is dedicated for communication with ECU and related devices.

SAE J1939 communications

SAE J1939 CANBus communications allows the MGC-3000 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-3000 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 communicate this information via SAE J1939 to the MGC-3000 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
  - Normal operational mode: For specific power consumption scenarios, refer to generator set manual.
  - Battery ride-through: withstands cranking ride-through down to 0 VDC for 50 ms (typical)

Current sensing (5 Amp CT inputs)

- Continuous rating: 0.1 to 7.5 Aac
- One second rating: 50 Aac
- Burden: 1 VA

Voltage sensing

- Range: 12 to 576 V rms, line-to-line
- Frequency range: 10 to 90 Hz
- Burden: 1 VA
- One second rating: 720 V rms

Input contacts

- Contact sensing inputs include one emergency stop input and 15 additional 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 an optional relay. All programmable inputs accept normally open, dry contacts. The factory may utilize up to three contact inputs.

Engine system inputs

- Fuel level sensing resistance range: 5 to 250 Ω nominal
- Coolant temperature sensing resistance range: 5 to 2,750 Ω nominal
- Oil pressure sensing resistance range: 5 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

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 purposes

SPECIFICATIONS, continued:

Metering

Generator voltage (rms)
- Metering range: 0 to 576 VAC (direct measurement); up to 9,999 VAC (with appropriate voltage transformer)
- Accuracy: ±1% of programmed rated voltage or ±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: ±1% of programmed rated current or ±2 Aac (subject to accuracy of CTs)

Generator frequency
- Metering range: 10 to 90 Hz
- Accuracy: ±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: ±2% of the full-scale indication or ±2 kVA

Power factor
- Metering range: 0.2 leading to 0.2 lagging
- Accuracy: ±0.01

Real power
- Indicates total kW and individual line kW (four-wire, line-to-neutral or three-wire, line-to-line)
- Accuracy: ±2% of the full-scale indication or ±2 kW

Oil pressure
- Metering range: 0 to 145 psi or 0 to 1,000 kPa
- Accuracy: ±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: ±2% of actual indication or ±2° (subject to accuracy of sender)

Fuel level
- Metering range: 0 to 100%
- Accuracy: ±2% (subject to accuracy of sender)

Battery voltage
- Metering range: 6 to 32 VDC
- Accuracy: ±2% of actual indication or ±0.2 VDC

Engine RPM
- Metering range: 0 to 4,500 rpm
- Accuracy: ±2% of actual indication or ±2 rpm

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: ±1% of actual indication or ±12 min

Generator protection functions

Overvoltage (59) and undervoltage (27)
- Pickup range: 0 to 576 VAC
- Activation delay range: 0 to 600 s

Overfrequency (81O) and underfrequency (81U)
- Pickup range: 37.5 to 66 Hz
- Pickup increment: 0.01 Hz
- Activation delay range: 0 to 600 s

Reverse and forward power (32)
- Pickup range: 0 to 200%
- Pickup increment: 0.1%
- Activation delay range: 0 to 600 s
- Activation delay increment: 0.1 s

Loss of excitation (40Q)
- Pickup range: –150 to 0%
- Pickup increment: 0.1%
- Activation delay range: 0 to 600 s
- Activation delay increment: 0.1 s

Phase voltage imbalance (47)
- Pickup range: 5 to 150 VAC
- Pickup increment: 1 VAC
- Activation delay range: 0 to 600 s
- Activation delay increment: 0.1 s

Overcurrent (51)
- Pickup range: 0.9 to 7.75 Aac (5 A current sensing)
- Time dial range: 0 to 7,200 s (fixed time curve), 0 to 9.9 (inverse curve time multiplier)
- Inverse time curves: 16: Selectable time overcurrent characteristic curves.

SPECIFICATIONS, continued:

Generator protection functions, continued:

Vector shift (78)
- Pickup range: 2 to 90°
- Pickup increment: 1°
- Accuracy: ±1°

ROCOF (81R)
- 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

Environment
- 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: IEC 60068
- Ingress protection: IEC IP56 for front panel
- Shock: 15 G in 3 perpendicular planes
- Vibration: 3 to 25 Hz at 1.6 mm (0.063 in) peak amplitude
  25 to 2,000 Hz at 5 G

Agency approvals
- UL approval: “cURus” approved to UL 6200
- NFPA compliance: complies with NFPA Standard 110, standard for emergency and standby power

ADDITIONAL SPECIFICATIONS

Battery backup for real time clock
The MGC-3000 Series provides a real-time clock with an internal backup battery. The battery will maintain timekeeping for approximately five 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
MGC-3000 Series units are capable of controlling the generator breaker and the mains breaker. Once it is determined that a breaker close request is valid, the MGC-3000 Series attempts to operate the breaker. The user can choose to control only the generator breaker, both breakers, or none at all. Breaker management settings can be configured using BESTCOMS*Plus*® or using the front panel interface.

Synchronizer
The MGC-3000 Series has an integrated automatic synchronizer to perform synchronization. The controller monitors the voltages, frequencies, and phase relationships of both the generator and the bus. It then sends a signal to the governor to increase or decrease the speed of the engine to match the generator frequency and phase angle to the bus frequency and phase angle. It also sends a signal to the voltage regulator to match the voltage levels. Once all of these conditions are met, the controller sends a breaker close signal to the generator circuit breaker.

There are two types of automatic synchronizers available. A phase lock type of automatic synchronizer controls the frequency of the generator and brings it into the predetermined phase angle window. When a time delay expires while in the window, the close signal is given to the generator circuit breaker. The anticipatory style of automatic synchronizer controls the slip frequency between the generator and the bus. The synchronizer calculates the timing of the closing signal to allow the generator breaker to be closed when the phase angle between the two sources is at zero degrees. This calculation takes into account the slip rate, the generator breaker closing time, and the phase angle difference.

ADDITIONAL SPECIFICATIONS, continued:

Multigen Management

Enabling sequencing on a networked group of load share units allows these units to manage load by starting and stopping appropriate units based on a factor of load demand and available capacity. The mode of operation is used to determine the order in which each generator in a group will contribute to the system's power production upon a demand start/stop request.

Modes of operation include:

- Staggered service time
- Balanced service time
- Largest size first
- Smallest size first
- Smallest unit ID

CONFIGURATION OPTIONS

Generator protection

	MGC-3010
Standard	
Phase Imbalance (47)	✓
Overcurrent (50)	
Overvoltage (59)	✓
Undervoltage (27)	✓
Underfrequency (81U)	✓
Overfrequency (81O)	✓
Reverse Power (32)	✓
Loss of Excitation (40Q)	✓
Enhanced	
Overcurrent (51)	✓
Vector Shift (78)	✓
Rate of Change of Frequency (81R)	✓
Ground Fault	✓

Table 2: Generator Protection

Inputs

	MGC-3010
Controller	
Digital	16
Analog (Dedicated)	3
Analog	2

Table 3: Inputs

Outputs

	MGC-3010
Controller	
Digital Form A, 30 Amp	3
Digital Form A, 5 Amp	-
Digital Form A, 2 Amp	12
Analog	2

Table 4: Outputs

Communication

	MGC-3010
ModBus RTU (RS-485)	✓
ModBus TCP-IP	✓
RDP-110	✓
CANBus	✓
Modem Interface (RS-232)	✓
Ethernet	✓

Table 5: Communication

Metering

	MGC-3010
Bus 1 Voltage	
Single Phase	✓
Three Phase	✓
Bus 2 Voltage	
Single Phase	
Three Phase	
Current Transformers	
Generator	3
Auxiliary	1

Table 6: Metering

ELECTRIC POWER GENERATION

INDUSTRIAL, CUSTOM-ENGINEERED AND SPECIAL ALTERNATORS FOR ALL APPLICATIONS

LEROY-SOMER™
KATO ENGINEERING™

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GENERATING

A POWERFUL FUTURE

Leroy-Somer Electric Power Generation is the global leader for alternators from 10kW to 25MW. We provide alternators for generator set manufacturers and power producers worldwide.

Every day, our products help secure access to power for thousands of people, for the safety and peace of mind of everyone.

We offer solutions for all standby and prime applications, from pioneer industrial outposts and ships to busy commercial zones and lively neighborhoods.

With over 3500 employees and a global footprint in over 40 countries, we're never far from you.

TWO STRONG BRANDS:
LEROY-SOMER & KATO ENGINEERING

INDUSTRIAL ALTERNATORS
FOR GENERATOR SETS

CUSTOM GENERATORS
FOR ALL POWER GENERATION PROJECT TYPES

DEDICATED SOLUTIONS
FOR OIL & GAS, MARINE, RAIL AND MORE

WORLDWIDE
SERVICE NETWORK

NIDEC CORPORATION

FOR EVERYTHING THAT SPINS AND MOVES

GLOBAL #1 IN ELECTRIC MOTORS

Founded in 1973 by President & Chief Executive Officer Shigenobu Nagamori, Nidec has worked its way up to become the world's No.1 manufacturer of small precision motors. In the process, Nidec has gradually expanded its product lineup to include a variety of small to large motors, application products for machinery, and electronic and optical components.

€10 BILLION SALES

107 062 EMPLOYEES WORLDWIDE

Today, Nidec products are used in a wide range of applications and devices including information and telecommunications equipment, office equipment, home appliances, automobiles, industrial equipment, and environmental energy.

«For Everything that Spins and Moves», the Group is creating next-generation drive technologies to meet the needs of the society.

LEROY-SOMER™

TRUSTED POWER GENERATION EXPERTS

Since 1919, Leroy-Somer has grown to become the world's preferred provider of industrial alternators for generator sets.
At the source of this tremendous achievement is our continuous commitment towards technical excellence and customer empowerment.
We strive not just for you satisfaction, but also for your own business development.
This is the Leroy-Somer difference.

INDUSTRIAL ALTERNATORS FOR GENERATOR SETS MANUFACTURERS

CUSTOM-ENGINEERED MEDIUM AND HIGH VOLTAGE GENERATORS

DEDICATED TEAMS FOR HYDRO AND WIND POWER

DEEP KNOWLEDGE OF NUCLEAR EMERGENCY POWER

GRID CODE COMPLIANT PRODUCT RANGE AND EXPERTISE

KATO ENGINEERING™

DEPENDABLE POWER GENERATION FOR PIONEERING INDUSTRIES

At Kato Engineering, we are proud of our 83-year tradition of design and manufacturing excellence and innovation. We employ about 400 people in our 250,000 sq-foot facility in Mankato, Minnesota, with in-house research & development, and design engineering. Our ruggedly constructed generators have survived the harshest environments, and our commitment to meeting customer needs has made the Kato name synonymous with dependable power generation worldwide.

Custom-engineered alternators for standard & specialized applications

Extensive oil & gas capabilities

Traction alternators for rail and hauler trucks

Motor-generator sets for power conversion and stability

Solutions for marine and Navy ships

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KATO ENGINEERING
LEROY-SOMER

Kato Engineering-Leroy Somer, 2075 Howard Dr. W., N. Mankato, MN 56003
507-345-4011

Model:		LSA 49.1 L11				
Data Sheet Base Rating	KW	1000	kVA	1250	Temperature Rise	125
	Voltage	480	Frequency	60	Excitation	PMG
	FLA	1504	RPM	1800	Enclosure	IP-23
	Connection	Wye	Connection Type	4 Bus Bar	Base Z	0,184
	Lead	6	Altitude	1000m	Pitch	0,67

Ratings		380	400	416	440	480
Application	Rise/ by Resistance @ Ambient	kW	KW	kW	kW	kW
Prime Power-Class B Rise	80°C / 40°C	640	666	691	733	800
Prime Power-Class F Marine	90°C / 50°C	634	660	685	726	793
Prime Power-Class F Rise	105°C / 40°C	720	752	784	832	912
Prime Power-Class H Rise	125°C / 40°C	800	832	864	916	1000
Standby-Class F Rise	130°C / 40°C	800	832	864	916	1000
Standby-Class H Rise	150°C / 40°C	832	870	908	960	1048

Efficiency - %	kW Load	0.8 PF	1.0 PF	Heat Rejection (BTU/HR)
110	1100	95,4%	96,7%	181025
100	**1000**	**95,5%**	**96,8%**	**160822**
75	750	95,7%	96,7%	115015
50	500	95,5%	96,2%	80411
25	250	93,5%	93,9%	59317

			Saturated	Unsaturated
Reactances - PU on Gen	Direct Axis	X_d	2,860	3,600
Base KW = 1000kW	Transient Direct Axis	X'_d	0,172	0,215
	Subtransient Direct Axis	X''_d	0,137	0,171
	Quadrature Axis	X_q	1,460	1,840
	Subtransient Quadrature Axis	X''_q	0,188	0,151
	Negative Sequence Reactance	X_2	0,144	0,180
	Zero Sequence Reactance	X_0	0,006	0,007
	Leakage Reactance	Xl	0,850	0,966
Time Constants-seconds	D-Axis, 3PH, SC Transient	T'_d	0,126	
	D-Axis, 3PH, SC Sub-Transient	T''_d	0,01	
	Arm Ckt	T_a	0,015	
	D-Axis, OC Transient	T'_{do}	2,11	
Short Circuit Ratio			0,35	
BIL			3465	
X/R Ratio			9,309	

Sequence Resistance			Actual	Percent
	Zero Sequence R0		0,0013	0,70
	Negative Sequence R2		0,0207	3,10

Short Circuit Current	Type	Instantaneous/Symmetrical		Instantaneous/Asymmetrical	
		P.U.	Amps	P.U.	Amps
	3 Phase	7,1	10744	11,4	17158
	Line to Line	6,1	9192	N/A	N/A
	Line to Neutral	10,4	15589	N/A	N/A

Cooling Air Required	m3/sec (cfm)	—
Resistance-ohms 25°C	Main Stator/Phase	0,00434
	Main Rotor	0,505
	Exciter Stator	11,54
	Exciter Rotor	0,08
Bearing Size	DE	N/A
Bearing Size	NDE	6320
Weight	Kg/(Lbs.)	1945(4288)
Voltage Regulation	Standard Voltage Regulator	D510C
Overload	%	10% Per NEMA MG-1 Guidelines
Insulation System	Class	H
Power Quality	THD - %	≤ 5%
All Values @ L - L, N.L	SHD - %	≤ 3%
	THF - %	≤ 2.5%
	TIF	≤ 50
Deviation Factor	%	≤ 10
Insulation Resistance		
Hi Potential Test Volt A.C.	Main Stator	1960
	Main Rotor	1500
	Exciter Stator	1500
	Exciter Rotor	1500
Overspeed		Rated RPM + 25%
Phase Sequence		CCW, A-B-C

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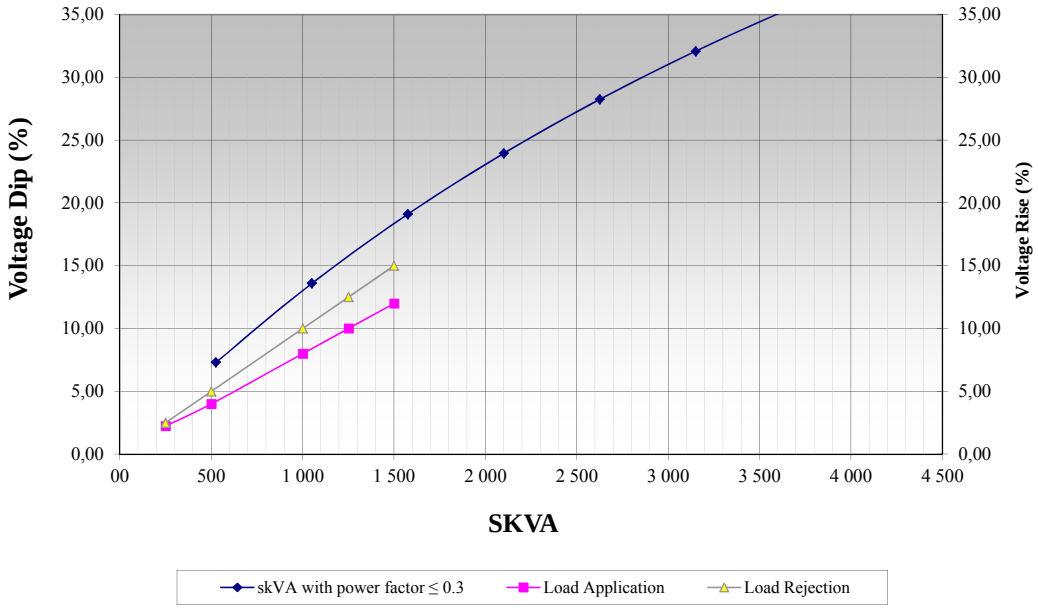
KATO ENGINEERING
LEROY-SOMER

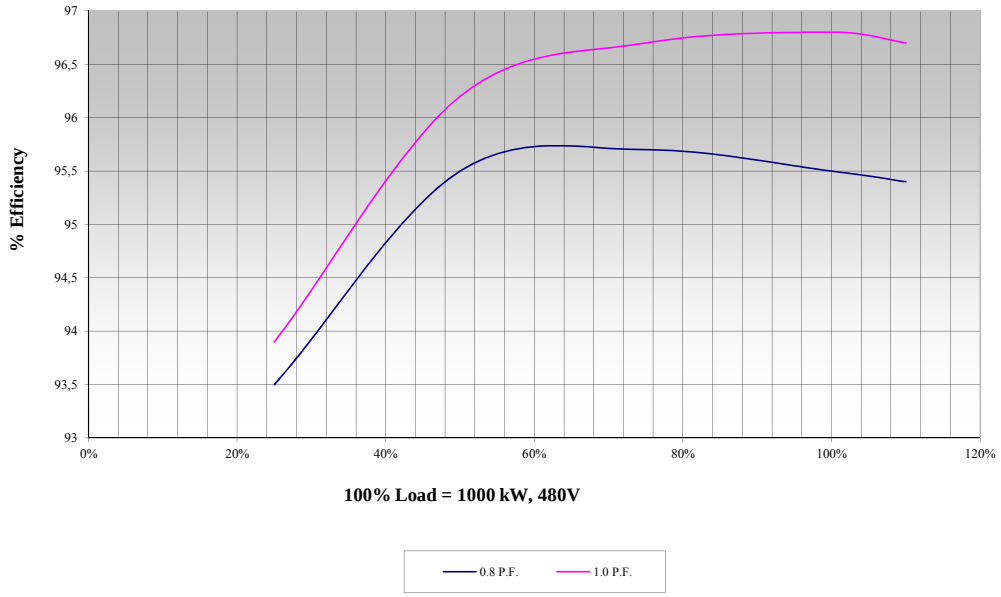
Kato Engineering-Leroy Somer, 2075 Howard Dr. W., N. Mankato, MN 56003
507-345-4011

Model:		LSA 49.1 L11				
Data Sheet Base Rating	KW	1000	kVA	1250	Temperature Rise	125
	Voltage	480	Frequency	60	Excitation	PMG
	FLA	1504	RPM	1800	Enclosure	IP-23
	Connection	Wye	Connection Type	4 Bus Bar	Base Z	0,184
	Lead	6	Altitude	1000m	Pitch	0,67

Motor Starting; Load Application and Rejection at Rated PF



Generator Efficiency, 0.8PF and 1.0PF



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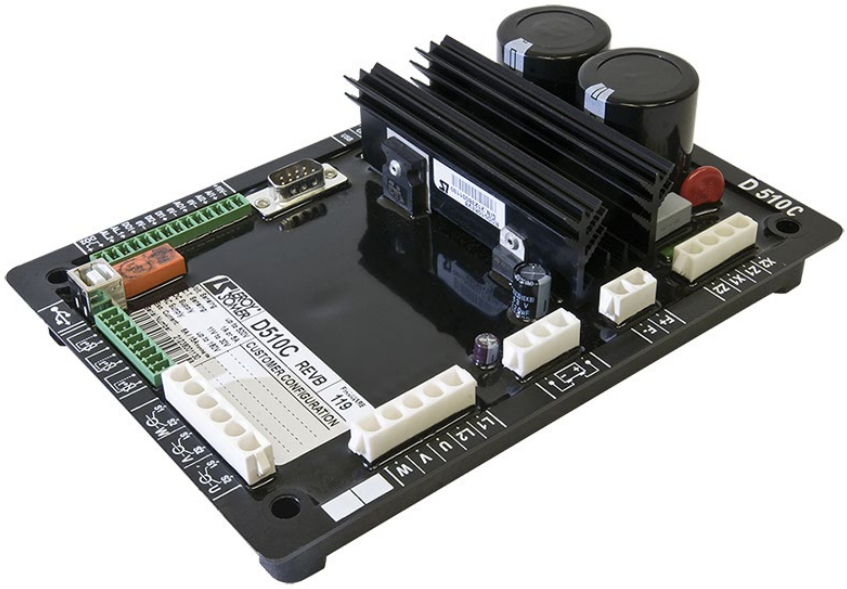
LEROY-SOMER™

DATASHEET

D 510C A.V.R.

FOR SHUNT - AREP or PMG excitation



The D510C is a digital voltage regulator, which monitors and regulates the alternator output voltage. It is designed for alternators with SHUNT, AREP or PMG excitation.

The D510C is an AVR which can be configured using the Easyreg® software.

- There are 4 possible regulation modes : Voltage, P.F., kVA, manual
- The I/O can be configured:
  - 2 x I : analog
  - 1 x O: analog
  - 2 x I : digital
  - 3 x O : digital
- 1 dry contact
- 1 USB port
- DB9 plug for CAN

It complies fully with the requirements of IEC standard 60034-1 and UL 708 and CSA certifications.

CHARACTERISTICS

- Voltage regulation : ± 0.25%
- Function: regulation of voltage, PF, kVAR and manual regulation.
- Response time depending on PID settings.
- Rated field current : 6 A.
- Maximum field current : 15 A/10 s.
- Power supply range for voltage sensing: up to 530 V.
- Protection:
  - Short-circuit / Loss of voltage reference / Overvoltage / Overexcitation / High Temperature /
  - Speed drop / Diode fault / Stator current unbalance / Current limitation
- Engine assistance
  - Soft start : 0 - 100 s
  - U/F adjustable from 0.5 to 3 in increments of 0.1
  - LAM : 0 to 30%
  - Gradual increase : 0.1 to 30 s/Hz
- Grid code function

CONNEXION AND SETTING

The AVR is set using the Easyreg® software.

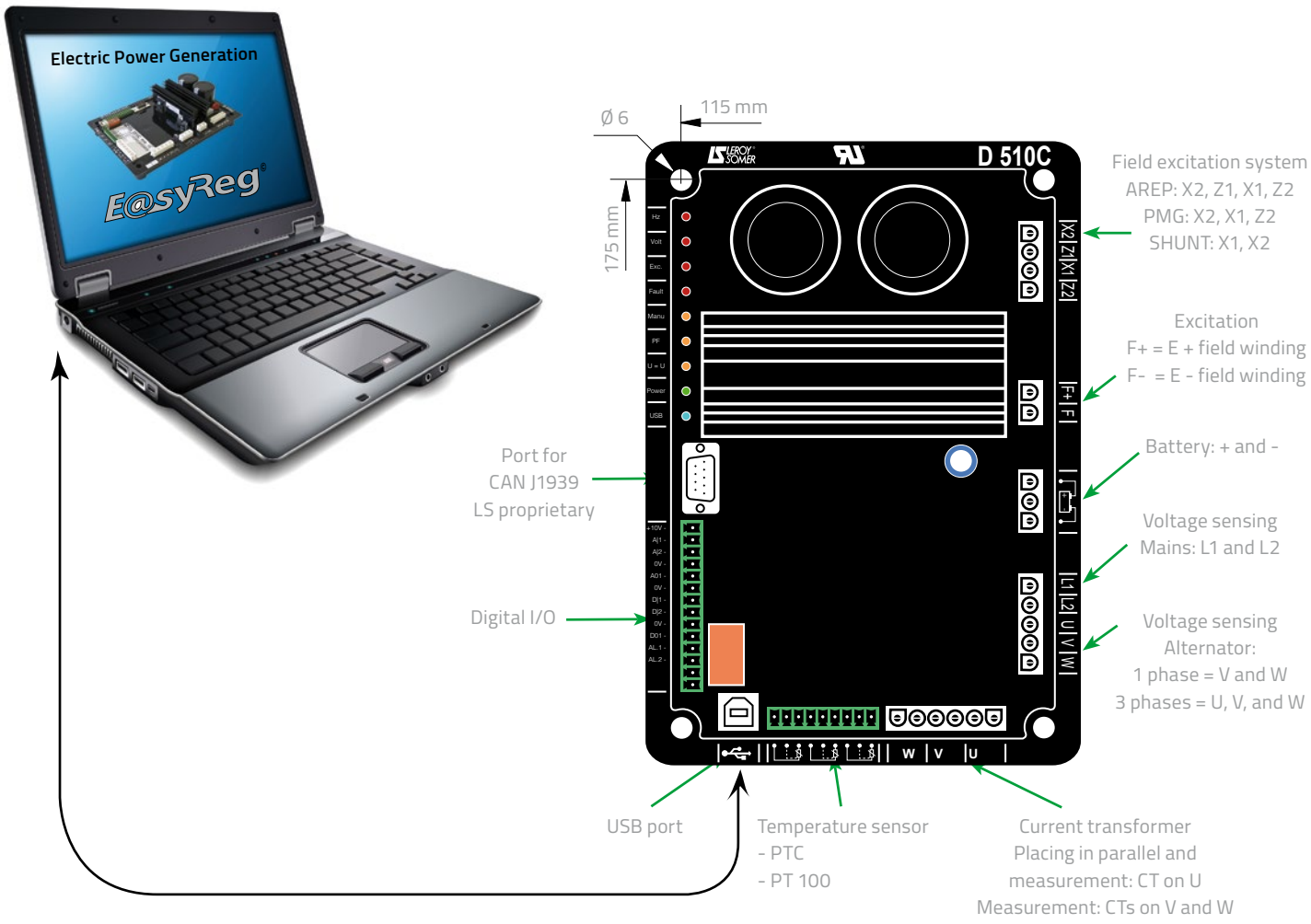
- This can be used to:
  - Set the AVR parameters
  - Configure the inputs and outputs
  - Display faults and parameter measurements.

OPERATION CONDITIONS

- Operating temperature:
  - 40°C to + 65°C
- Storage temperature: - 55°C to + 85°C.
- Shocks on the base : 9 g depending on the 3 axes.
- Vibrations:
  - Less than 10 Hz : 2 mm half-peak amplitude.
  - 10 Hz to 100 Hz : 100 mm/s.
  - Above 100 Hz : 8 g.

OPERATION RANGE

	LSA 40	42,3	44,3	46,3	47,2	49,3	50,2	51,2	53,1	54
SHUNT AREP OU PMG	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



Strip Heater Data Sheet

Leroy Somer Generator

DESCRIPTION

Strip heaters are used when engine generator sets are installed in cold temperature or high humidity climates. The heater maintains the generator windings at a suitable temperature to prevent corrosion due to condensation.

FEATURES

— Rugged, dependable construction
— Minimum maintenance cost
— High-emissivity black oxide finish

SPECIFICATIONS

— Operational to 600-700 °C (1,112-1,292 °F)
— Supply voltage: 120 V, 60 Hz

Generator Frame	Watts	Length	Width	Height
49	250	217 mm (8.5 in)	25 mm (0.98 in)	50 mm (1.97 in)

* Two strip heaters required per generator set

CERTIFICATIONS AND STANDARDS

— UL listed

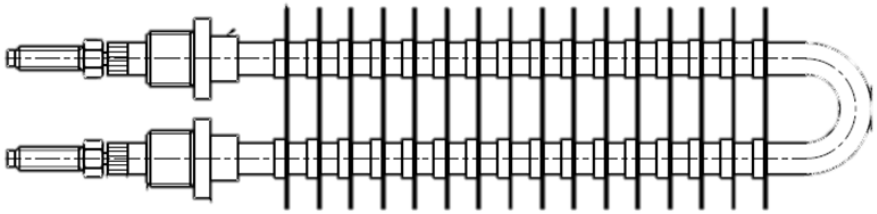


Figure 1: 49, 50 Frame Diagram

Note: Visual appearance may vary depending on frame size.

A Rolls-Royce solution

Product data sheet
Characteristics

RGF36160CU33A
MOLDED CASE CIRCUIT BREAKER 600V 1600A

Main

Product or component type	Circuit breaker
Range of product	PowerPact R
Trip unit technology	Electronic standard Micrologic 5.0 LSI

Complementary

[Ie] rated operational current	1600 A
System Voltage	600 V AC
Mounting mode	Unit mount
Poles description	3P
Breaking capacity	65 kA at: 240 V AC 35 kA at: 480 V AC 18 kA at: 600 V AC
[Ics] rated service short-circuit breaking capacity	100 %
Breaking capacity code	G
Electrical connection	Busbar connection load Busbar connection line
Height	16.24 in
Width	16.53 in
Depth	14.49 in

Environment

Product certifications	UL listed IEC

Ordering and shipping details

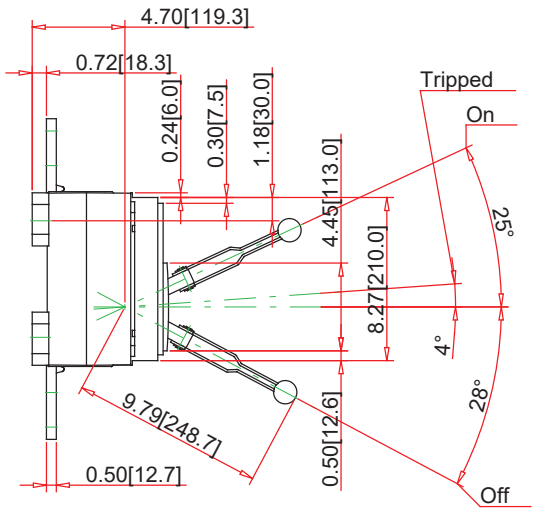
Category	01245 - RG,H,J,K,L,N UNIT MT BREAKERS
Discount Schedule	DE2
GTIN	00785901848912
Nbr. of units in pkg.	1
Package weight(Lbs)	52
Returnability	Y
Country of origin	US

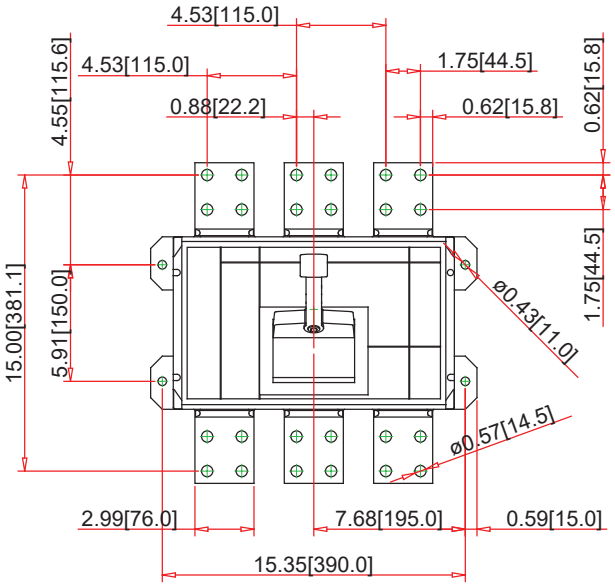
Offer Sustainability

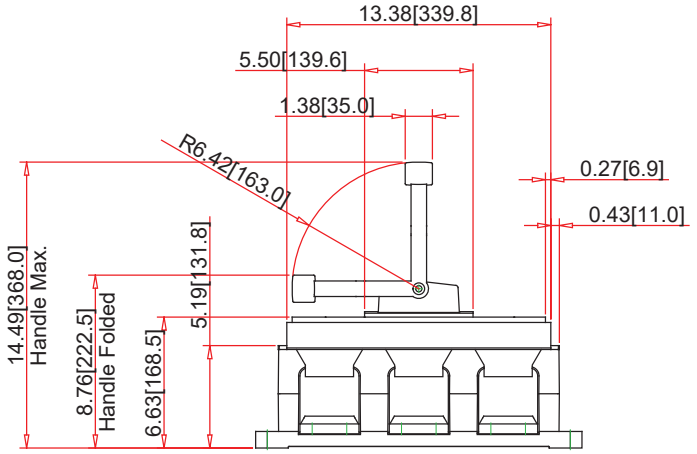
Sustainable offer status	Green Premium product
RoHS (date code: YYWW)	Compliant - since 1323 - Schneider Electric declaration of conformity Schneider Electric declaration of conformity
REACh	Reference not containing SVHC above the threshold Reference not containing SVHC above the threshold
Product environmental profile	Available
Product end of life instructions	Available

Contractual warranty

Warranty period	18 months







Note:
- Drawings Not To Scale
- Drawings Subject to Change Without Notice
- Dimensions are inches next to [Millimeters]

Part No.:

RGF36160CU33A

SQUARE D by Schneider Electric

Schneider Electric United States
North American Division
Boston One Campus
800 Federal Street
Andover, MA 01810, USA
Phone:+1 8773425173
Email: CCC@us.schneider-electric.com

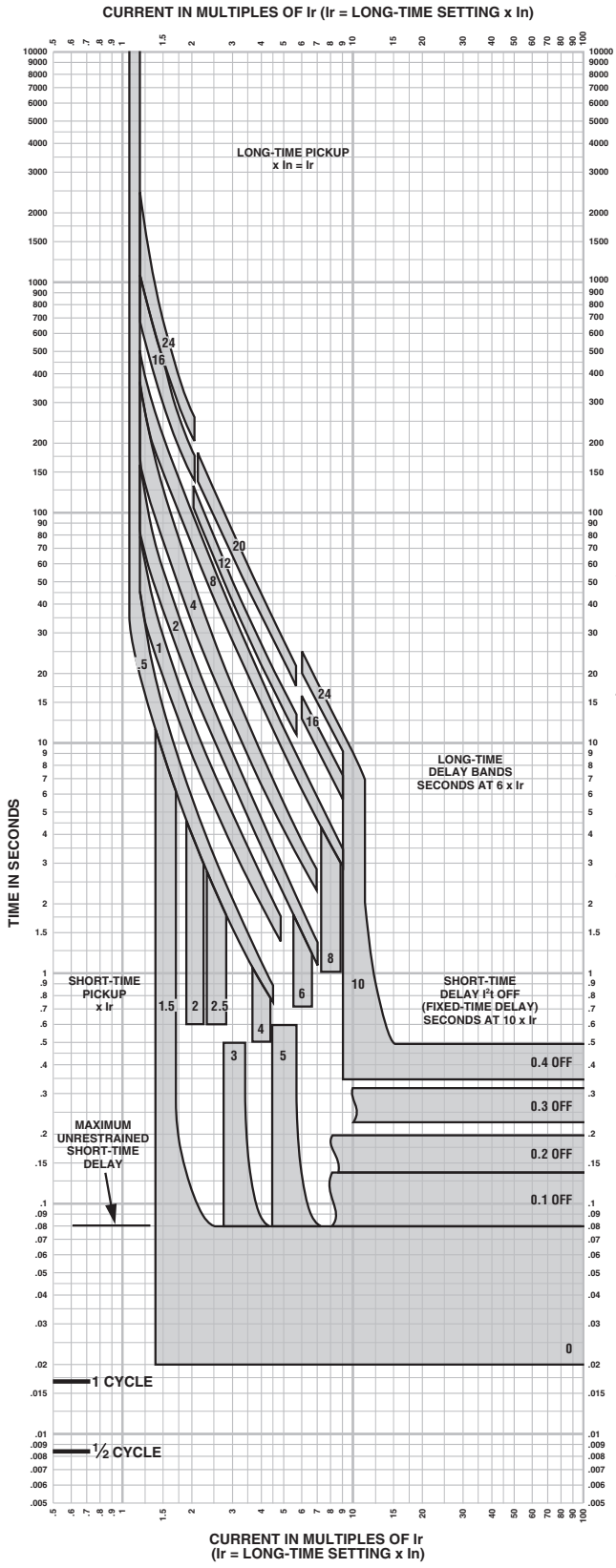
Technical Information:

General Application:	Provides overload and short circuit protection
For Use With:	Industrial Enclosures and Switchboards
Approvals:	UL Listed IEC Rated
Mounting Type:	Unit Mount
Terminal Type:	Bus Connection - Line: terminal - Load: terminal
Wire Size:	
Weight:	52
Depth:	14.49
Height:	16.24
Width:	16.53
Mounting Height:	

Specification:

Description:	PowerPact R-frame Molded Case Circuit Breaker
Number of Poles:	3-Pole
Ampere Rating:	1600A
Voltage Rating:	600VAC
Interrupting Rating:	65kA at 240VAC - 35kA at 480VAC - 18kA at 600VAC
Circuit Breaker Rating:	100% Rated
Fixed AC Magnetic Trip:	

Micrologic 5.0/6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Unit Characteristic Trip Curve



Micrologic 5.0/6.0 A/P/H Trip Units Characteristic Trip Curve No. 613-4

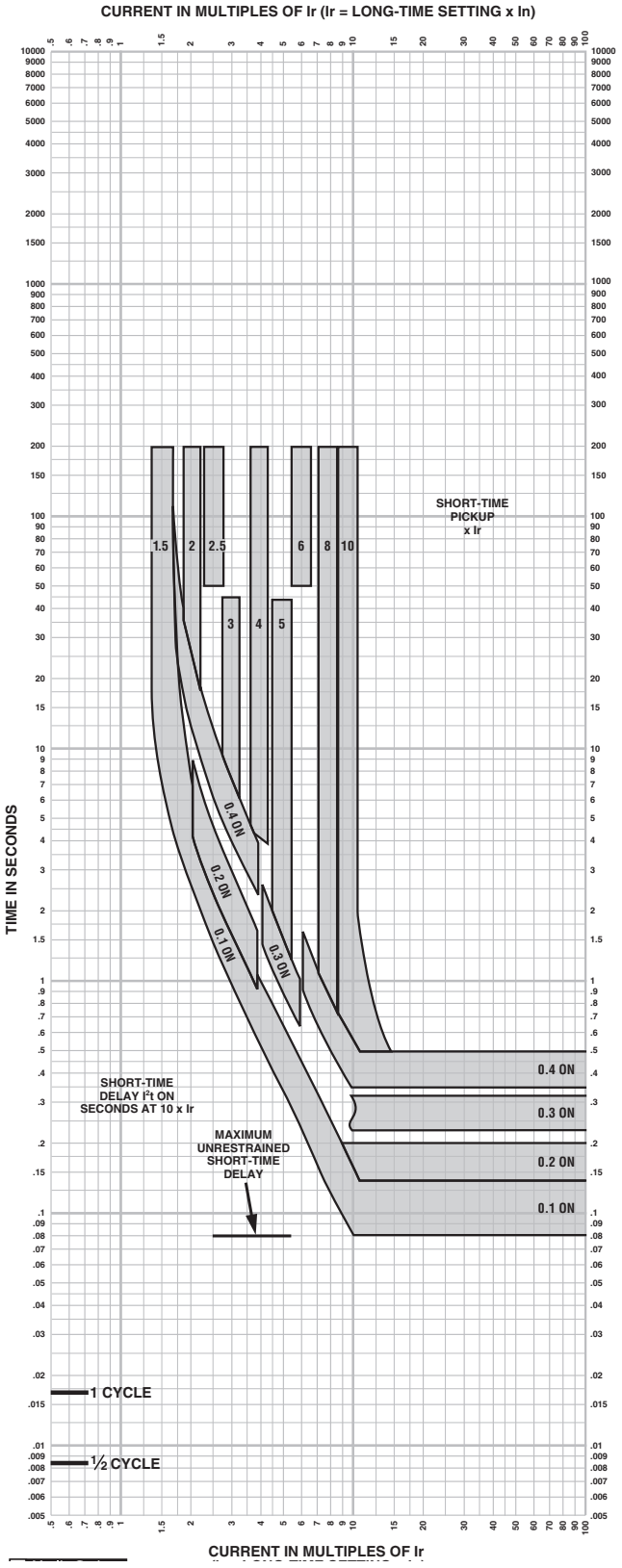
Long-Time Pickup and Delay
Short-Time Pickup and I^2t OFF Delay

The time-current curve information is to be used for application and coordination purposes only. Curves apply from -25°C to +70°C (-13°F to +158°F) ambient temperature.

Notes:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. With zone-selective interlocking ON, short-time delay utilized, and no restraining signal, the maximum unrestrained short-time delay time band applies regardless of the setting.
4. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of the current.
5. For a withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 on page 178 for instantaneous trip curve. See table on page 182 for instantaneous override values.
6. Overload indicator illuminates at 100%.

Micrologic 5.0/6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Units Characteristic Trip Curve



Micrologic 5.0/6.0 A/P/H Trip Units Characteristic Trip Curve No. 613-5

Short-Time Pickup and I^2t ON Delay

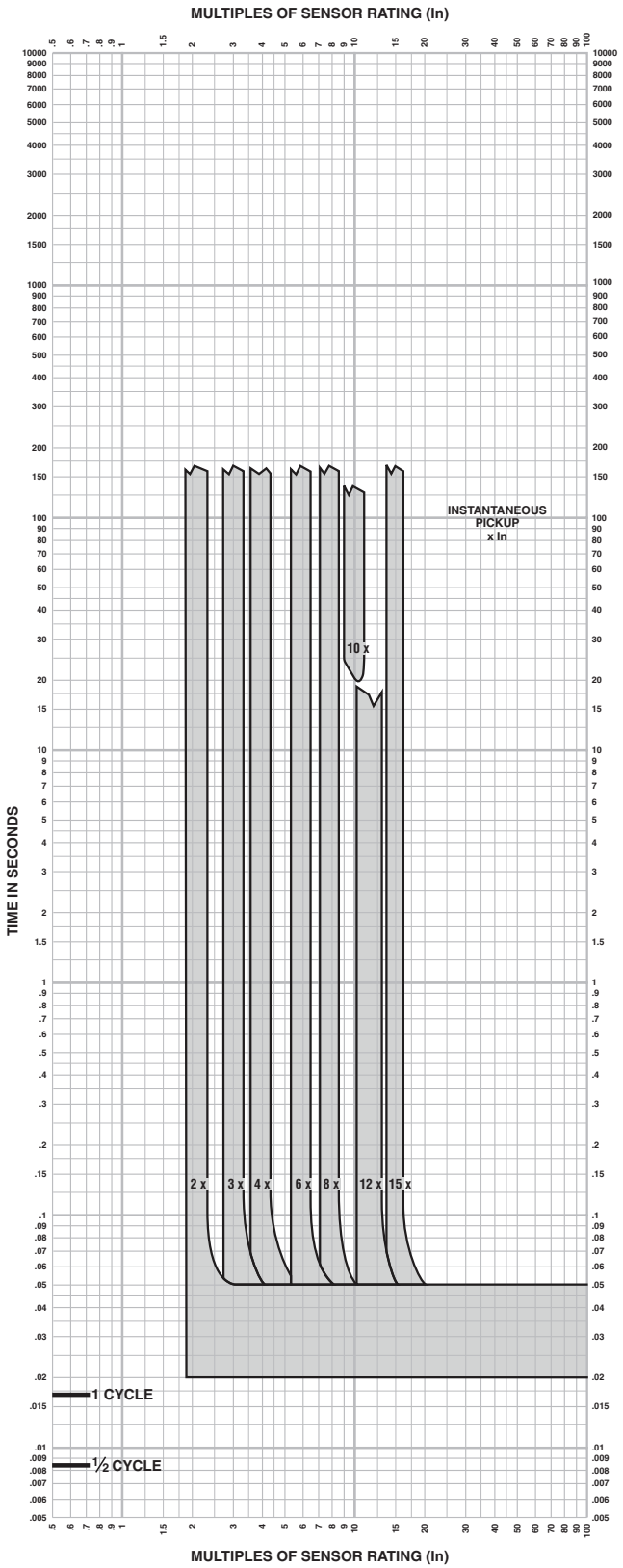
The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -25°C to +70°C (-13°F to +158°F) ambient temperature.

Notes:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. With zone-selective interlocking ON, short-time delay utilized, and no restraining signal, the maximum unrestrained short-time delay time band applies regardless of the setting.
4. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
5. For withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 on page 178 for instantaneous trip curve. See table on page 182 for instantaneous override values.
6. See Trip Curve 613-4 on page 176 for long-time pickup and delay trip curve.

Micrologic 5.0/6.0 P-Frame, R-Frame and NS630b–NS3200 A/P/H Trip Units Characteristic Trip Curve



Micrologic 5.0/6.0 Trip Units Characteristic Trip Curve No. 613-7

Instantaneous Pickup, 2X to 15X and OFF

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

Notes:

1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
3. The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.
4. For a withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 on page 178 for the instantaneous trip curve. See table on page 182 for the instantaneous override values.
5. See trip curve 613-4 on page 176 and trip curve 613-5 on page 177 for long-time pickup, long-time delay, short-time pickup and short-time delay trip curves.

Circuit Breaker Enclosure Data Sheet - Diesel

750-1,250 kW Standby

DESCRIPTION

This circuit breaker enclosure data sheet is used in conjunction with dimensional drawings to assist with submittal documentation, specification requirements, and installation. This document summarizes the enclosure dimensions and mounting positions for the ***mtu*** 12V2000 DS750, ***mtu*** 12V2000 DS800, ***mtu*** 16V2000 DS1000, and ***mtu*** 16V2000 DS1250 circuit breakers, including single, dual, and triple enclosures. The dimensional drawings will govern and should be referenced for installation.

BREAKER LAYOUT

- Left side controls shown. Right side controls optional.
- Reference Figure 2 and Table 2 for available breaker mounting positions.

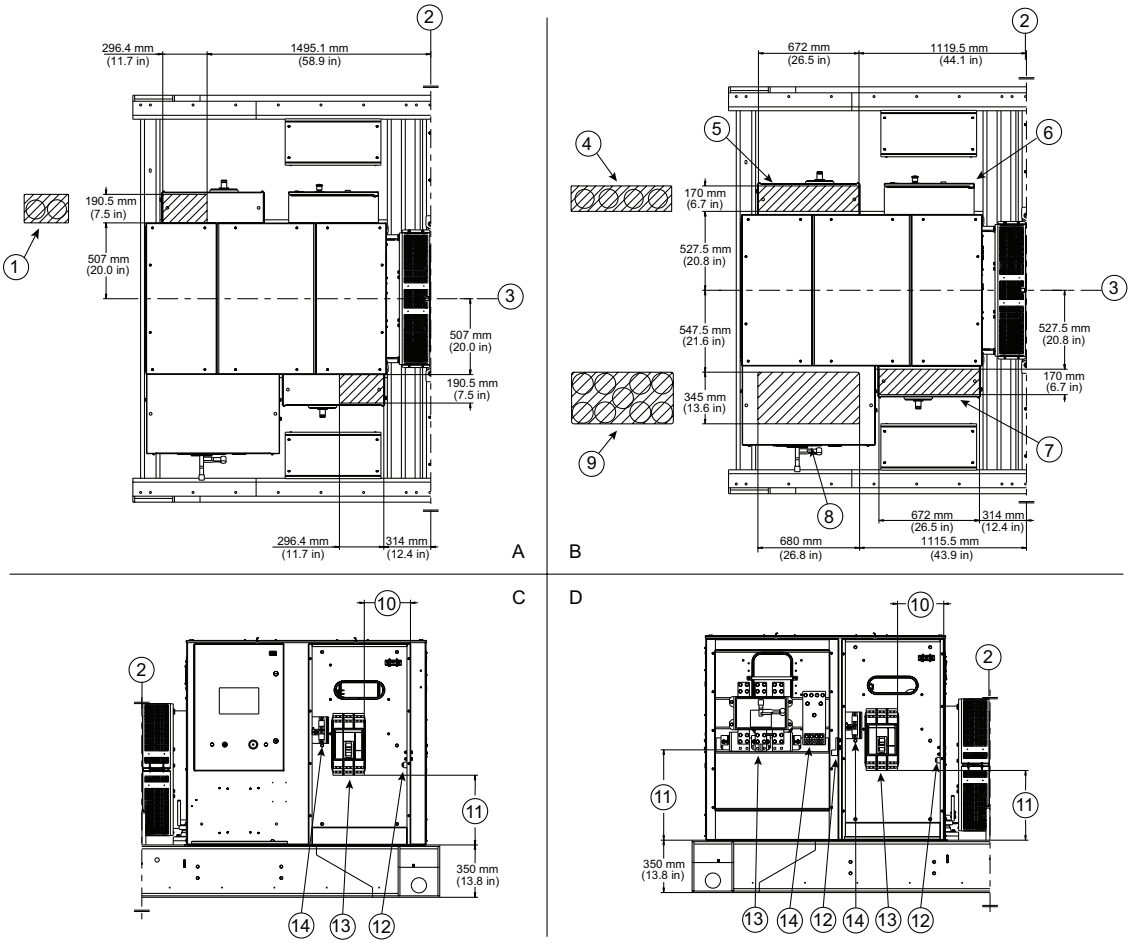


Figure 1: Enclosure

A. Top view, top entry conduit area
B. Top view, bottom entry conduit area
C. Left view, breaker enclosure detail (enclosure cover not shown)
D. Right view, breaker enclosure detail (enclosure cover not shown)

1. Two conduit maximum (top entry)
2. Rear face of flywheel housing
3. Generator centerline
4. Four conduit maximum (bottom entry, ≤1200 amp enclosure)
5. Breaker postion 2 (≤1200 amp enclosure shown)
6. Controls position
7. Breaker postion 3 (≤1200 amp enclosure shown)
8. Breaker position 1 (>1200 amp enclosure shown)
9. Nine conduit maximum (bottom entry, >1200 amp enclosure)
10. Dimension B
11. Dimension A
12. Equipment ground terminal wire binding torque: 500 lb-in
13. Customer connect end breaker wire binding torque: 50 lb-in (H-Frame breaker) 225 lb-in (J-Frame Breaker) 442 lb-in (L, M, P-Frame breaker) 46 lb-ft (NW, R-Frame breaker)
14. Neutral wire binding torque: 375 lb-in (≤1200 amp) 46 lb-ft (>1200 amp)

A Rolls-Royce solution

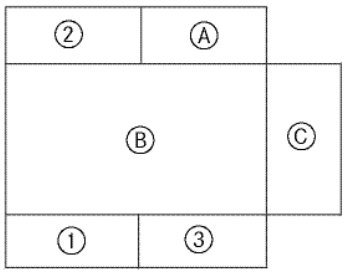
Circuit Breaker Enclosure Data Sheet - Diesel
750-1,250 kW Standby

Available Circuit Breakers		Enclosure Data				
Breaker Frame	Amperage	Output Wire Range 90 °C Cu (wires per lug)	Wire Bending Space[1] Dimension A mm (in)	Wire Gutter Space[1,2] Dimension B mm (in)	Conduit Quantity	Conduit Size[3] in
R/NW-Frame	1,600-2,500	(8) 1/0-750	604 (23.78)	N/A	8	4

[1] Meets or exceeds NFPA 70, NEC 312.6(A), and NEC 312.6(B)
[2] Top entry only available for breakers rated for 600 amps and below.
[3] Based on flexible metal conduit at 40% fill using THHN wire

NOTE: Equipment grounding terminal wire range: 2 AWG - 600 kcmil

Table 1: Enclosure Data



Top View - Left Side Controls

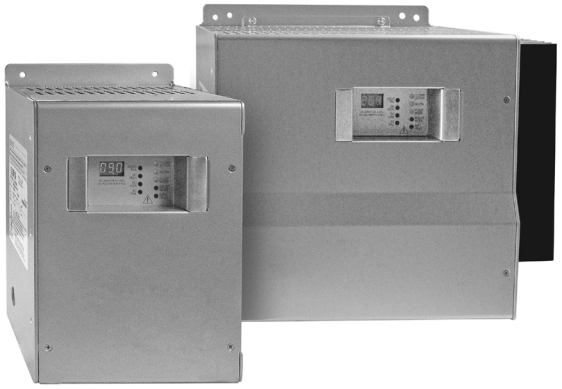
Figure 2: Available Breaker Mounting Positions

A. Controls
B. Outlet box
C. Alternator
1. Position 1
2. Position 2
3. Position 3

Battery Charger Data Sheet

NRG Intelligent Engine Start Battery Charger

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



BENEFITS AND FEATURES

Failure to start due to battery problems is the leading cause of inoperable 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. All units are C-UL listed.

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

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% 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

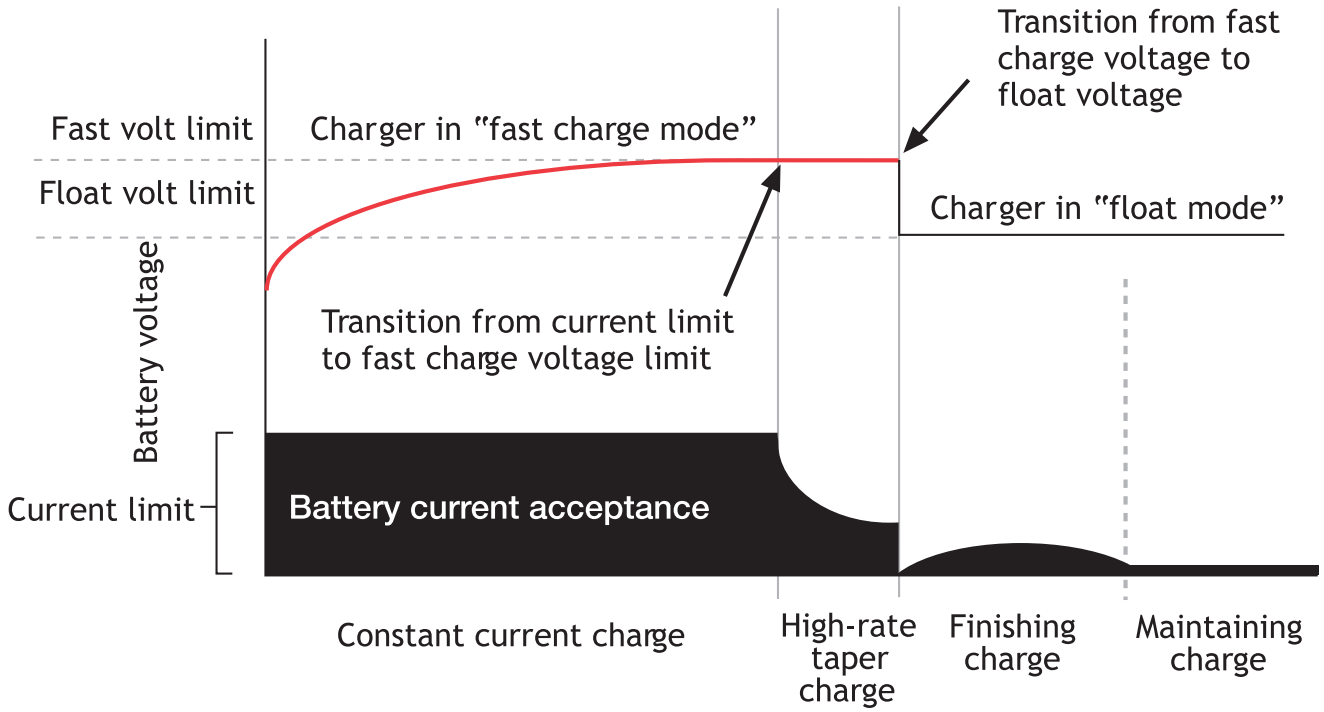


Figure 1: Standard Four (4) Rate Charging

SPECIFICATIONS, continued:

User Interface, Indication and Alarms

— Digital meter: automatic meter alternately displays output volts, amps[1]
— Accuracy: ±2% volts, ±5% amp
— Alarms: LED and Form C contact(s) per table:

	Alarm Code "C" (meets requirements of NFPA 110)
AC good	LED
Float mode	LED
Fast charge	LED
Temp comp active	LED
AC fail	LED and Form C contact[2]
Low battery volts	LED and Form C contact[2]
High battery volts	LED and Form C contact[2]
Charger fail	LED and Form C contact[2]
Battery Fault	LED and Form C contact[2]

Front panel status display

[1] Three-position jumper allows user to select from three display settings: alternating volts / amps (normal), constant volts, or constant amps
[2] Contacts rated 2A at 30 VDC resistive

Table 1: Alarm Code "C", LED and Form C contacts

Controls

— AC input voltage select: field-selectable switch
— 12/24-volt output select: field-selectable two-position jumper
— Battery program select: field-selectable six-position jumper
— Meter display select: field-selectable three-position jumper
— Fast charger enable/disable: field-selectable two-position jumper
— Temp compensation enable: standard, can be disabled or re-enabled in the field
— Remote temp comp enable: connect optional remote sensor to temp comp port

Simple field adjustments

Environmental

— Operating temperature: -20 °C to 60 °C, meets full specification to 45 °C
— Over temperature protection: gradual current reduction to maintain safe power device temperature
— Humidity: 5% to 95%, non-condensing
— Vibration (10A unit): UL 991 Class B (2G sinusoidal)
— Transient immunity: ANSI/IEEE C62.41, Cat. B, EN50082-2 heavy industrial, EN 61000-6-2

NRG Intelligent Engine Start Battery Charger Data Sheet

Agency Standards

- Safety
  - C-UL Listed to UL 1236 (required for UL 2200 gensets),
  - UL Category BBGQ

- Agency marking
  - 60 Hz: c-UL-us listed

- 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”)

Construction

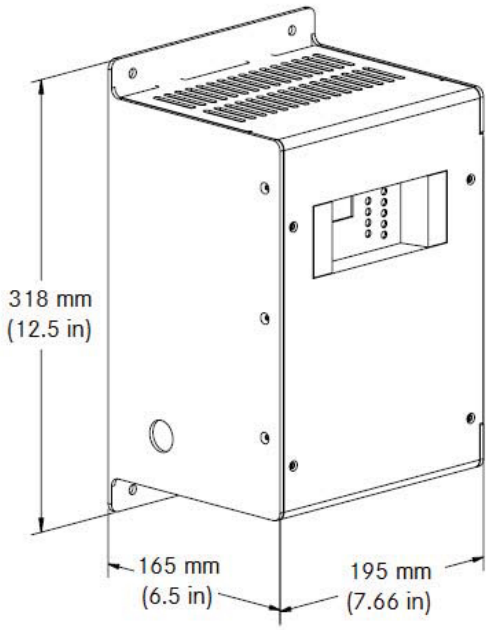
- Material: non-corroding aluminum enclosure
- Dimensions: see Diagrams and Dimensions section of this document
- Printed circuit card: Surface mount technology, conformal coated
- Cooling: natural convection
- Protection degree
  - Listed housing: NEMA-1 (IP20)

- Damage prevention: fully recessed display and controls
- Electrical connections: compression terminal blocks

Warranty

Standard warranty: standard warranty terms apply

DIAGRAMS AND DIMENSIONS



10A Chargers

Figure 2: Charger Dimensions

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)

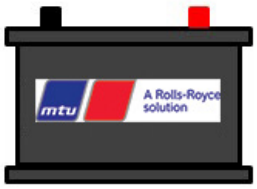
All models offer field-selectable input 120/208-240 volts.

Starting System Data Sheet

Optional Starting Systems

DESCRIPTION

The following starter package is available for ***mtu*** Series 1600, ***mtu*** Series 2000, and ***mtu*** Series 4000 generator sets. In addition to the standard system, a redundant starting system is also offered to provide seamless operation in case of a starter failure. This optional starting system is both factory-configurable and field-installable.



STARTER OPTIONS

Standard Starter

- Consists of one or two starters that are required to start the unit (product-dependent)
- Default crank cycle: 3 x 15C x 15R (15 seconds crank/15 seconds rest)
- Minimum requirement with a low-cost design based on engineering economics (cost-effective solution)
- Standard equipment on all ***mtu*** generator sets

Redundant (Alternating) Starter

The optional redundant starting system is designed to function in an alternating configuration using logic programmed in the ***mtu*** generator set controller. For ***mtu*** Series 1600 and ***mtu*** Series 2000, a second starter of the same model as the standard starter is added to the generator set. For ***mtu*** Series 4000, the dual 9kW starters are replaced with dual 15kW starters. The ***mtu*** generator set controller cycles relays to control each starter independently through crank and rest states according to the specifications of the selected starting system.

- The redundant starter option requires two starters, and will alternate between the two starters

Note: Some redundant starting options on the ***mtu*** Series 4000 generator sets may not fulfill the NFPA 110 type 10 requirements.

Crank Cycle	Functionality	Availability
– Modified crank cycle: 3 x 15C x 15R (15 seconds crank/15 seconds rest) – Rest time between starters prevents starter engagement while engine is spinning down. – See **Figure 1: Scenario with Alternating Starters**	– Only one starter is needed to start the unit. – Starters engage and crank independently. – Starters alternate with each crank cycle. – If starter failure occurs, the controller will wait through the remaining crank cycle of the failed starter and rest cycle. The controller will then engage the alternate starter for the next crank cycle. – If both starters fail, the alarm will occur after the third crank attempt of the cycle.	– ***mtu*** Series 1600 – ***mtu*** Series 2000 – ***mtu*** Series 4000

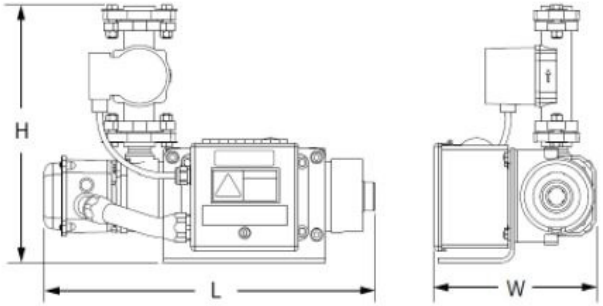
Water Heater Data Sheet

CSM Series

DESCRIPTION

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.

Style A



Style A

CERTIFICATIONS AND STANDARDS

— c-UL-us Listed (60 Hz)

SPECIFICATIONS

	Style A
Height:	383 mm (15 in)
Length:	493 mm (19.4 in)
Width:	242 mm (9.5 in)
Weight:	16.8 kg (37 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)

A Rolls-Royce solution

SPECIFICATIONS, continued

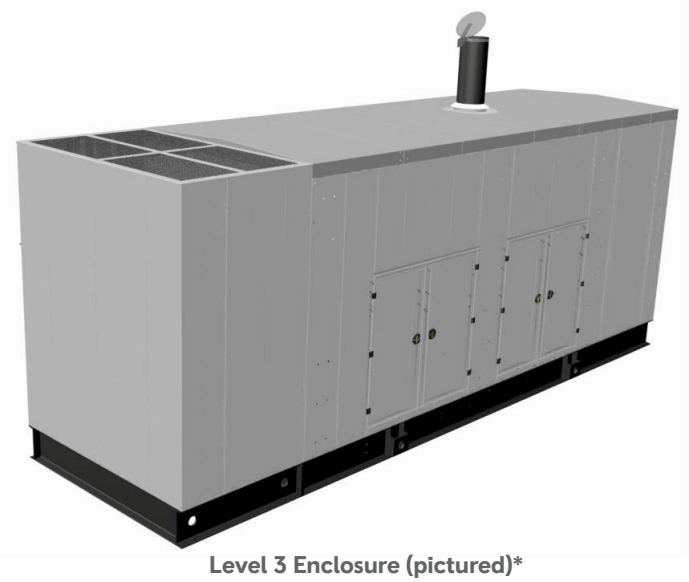
Flow:	2.2 m^3/hr (10 gpm) at 3 mWc (10 ft/head)
Max Pressure:	860 kPa (125 psi)
Pressure Loss:	1.5 kPa (0.2 psi)
Inlet / Outlet:	1" NPT / 1" NPT
Main Control Box	
Ingress Protection:	NEMA 4 (IP66)
Motor Ingress Protection:	IP44 (50 Hz), NEMA 2 (60 Hz)

Model Number	*mtu* Part Number	Watts	Volts	Phase	Hz	Amps	Style
CSM10908-000	SUA86157	9,000	208	1	60	44	A

Subject to change. | WT00043031 | 2021-07

Enclosure and Sound Data Sheet - Diesel, Open Field

60 Hz: 1,000-1,250 kW Standby



Level 3 Enclosure (pictured)*

Enclosure Level Identification	
Level 1	Weatherproof enclosure constructed of heavy gauge steel or aluminum with fixed stormproof panels. Enclosure consists of a bolted and welded construction with factory-mounted internal silencer. Hinged, lockable access doors on both sides of the enclosure.
Level 2	Weatherproof enclosure with UL 94 HF-1 compliant, 1.5" thick sound attenuated foam insulation installed inside enclosure walls.
Level 3	Weatherproof, foamed enclosure with additional air intake baffles and exhaust scoop redirecting noise and air flow upward.

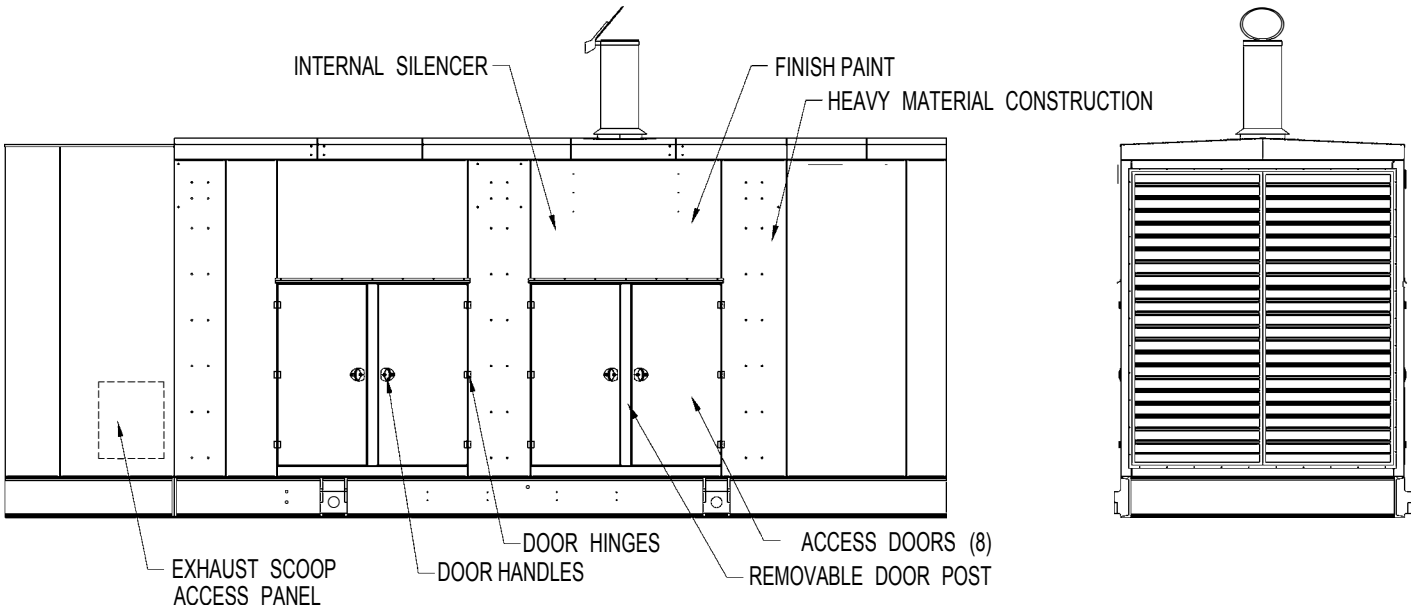
CERTIFICATIONS AND STANDARDS

— UL 2200

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
— 130 mph wind rating
— Service access
  - Access doors with removable door posts give ease of service to all components.
— Heavy-duty door gasket
— Door restraints
— Rain shroud and rain cap
— Exhaust scoop access panel (where applicable)
— Hardware
  - Powder coated hinges with stainless steel pins
  - Key-lockable and pad-lockable powder coated door handles
— Finish paint: RAL 7001 Silver Grey standard
  - Custom colors available upon request
— Internal silencer (hospital grade) for all levels
  - Stainless steel flexible exhaust connections (where applicable)

Enclosure and Sound Data Sheet - Diesel, Open Field
60 Hz: 1,000-1,250 kW Standby



Level 3 Enclosure (pictured)*

ENCLOSURE SOUND RATINGS dB(A) AT 7 METERS

				7 Meters
Application	Model	Power Node		Level 3
Standby	***mtu*** 16V2000 DS1000 (G06)	1,000 kW		74.7

[1] Undampened engine exhaust noise

[2] Measurement with infinite exhaust connection

NOTE:
- Measurement includes exhaust noise.
- Aluminum enclosure sound levels are approximately 2 dB(A) higher than listed sound levels for steel enclosures.
- For installation within 50 miles of the coast, aluminum enclosures are recommended to prevent accelerated corrosion.
- Sound pressure levels subject to environment, instrumentation, measurement, installation, and generator set variability.
- Generator set is tested on level ground without spring isolators installed.
- Sound power levels per ISO 8528-10 and ANSI S1.13-2005
- Sound data measured with:
  - Full-rated load
  - Standard radiator package

* Note: Visual appearance may differ between power nodes.

Diesel Fuel System Data Sheet

Sub-Base Tank

DESCRIPTION

The sub-base fuel tanks used with ***mtu*** generator sets are manufactured and listed per UL142 and ULC-S601 standards for steel above-ground tanks. These certifications ensure 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

- Normal vent
- Emergency vent
- Manual fill
- Cam lockable fill cap
- 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: Separate 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

CERTIFICATIONS AND STANDARDS

United States
UL 142

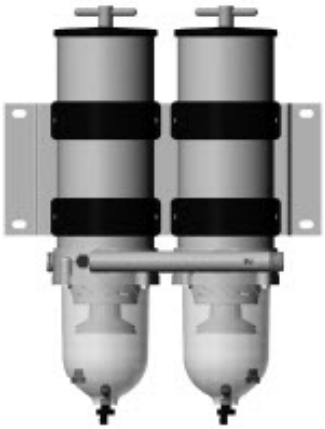
In addition, this equipment is compatible with the following certifications when properly installed in accordance with all applicable codes, standards, regulations, and laws pertaining to the installation and application of the product. Reference the prevailing codes for installation requirements.

United States
NFPA 30
NFPA 37
NFPA 110
International Fire Code

Diesel Fuel Water Separator Data Sheet

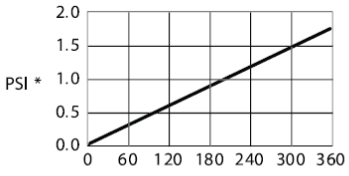
731000FH (Non-Switchable)

Filter assemblies are designed of heavy duty construction and three-stage filtration using 10 Micron filter element(s). High capacity water separation (99% water removal efficiency) and fuel filtration processes protect 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).

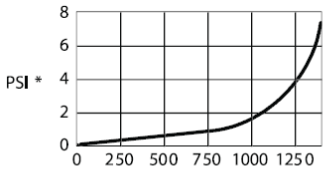


SPECIFICATIONS

Racor Model Number:	731000FH
mtu Part Number:	SUA101091
Generator Set Model Power Range (Standby):	750-1,250 kWe
Generator Set Model Power Range (Prime):	680-1,000 kWe
Height:	55.9 cm (22 in)
Depth:	30.5 cm (12 in)
Width:	41.9 cm (16.5 in)
Weight (dry):	11.8 kg (26 lb)
Maximum Flow Rate: (two units online)	1,363 lph (360 gph)*
Port Size:	3/4 in – 14 NPT (SAE J476 male threads)
Minimum Service Clearance:	
(above assembly)	25.4 cm (10 in)
(below assembly)	5.1 cm (2 in)
Clean Pressure Drop:	11.7 kPa (1.7 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



SAE J905 Solids Capacity
(using SOFT-2A; 2020TM Element)

*This value may increase based on application-specific installation.

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Power Generation

PERFORMANCE ASSURANCE CERTIFICATION

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TESTING PROCEDURES

Prototype

We have been producing superior generator sets for more than six decades. Understanding the importance of reliable, cost-effective products, we 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.

Our Performance Assurance Certification (PAC) certifies that every MTU generator set undergoes rigorous prototype testing including the following:

Prototype Test Procedures

- **Rated Load (NFPA 110)**
  All generator set models will produce the nameplate-rated load within the design tolerance of the generator set.
- **Extended-run Testing**
  All generator set prototypes have been subjected to extended run-time testing.
- **Transient Response Analysis (ISO 8528-5)**
  All new generator set models have undergone transient response analysis per ISO 8528-5.
- **Torsional Analysis**
  All generator set models have undergone torsional stress analysis.
- **Engine Cooling System**
  All generator set models will cool sufficiently within the ambient design conditions per each model.
- **Anticipatory Alarms and Shutdowns**
  The pre-alarms and alarms function appropriately to protect the generator set from any foreseen unnecessary failures.
- **Vibrational Analysis (ISO 8528-9)**
  All new 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)**
  All generator sets undergo airborne noise analysis using the enveloping surface method.

Prototype Test Standards

MTU generator sets are compliant with many different codes and standards. Our 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

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

Test metering has 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 Nameplate-Rated Load
  - 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*

Prototype Test Summary (PTS)

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Prototype testing is administered to validate the electrical and mechanical design integrity of the generator set. The results indicated below summarize testing performed on the prototype of the specified generator set model. This form of testing is only conducted on standard factory prototype generator sets. *Results may vary.*

GENERATOR SET MODEL(S):	***mtu*** 16V2000 DS1000

Rep. Prototype Model:	***mtu*** 16V2000 DS1000	**Test Date:**	08/17/2017
kW:	1,000	**kVA:**	1,250
Voltage:	480	**Hz:**	60

ENGINE/GENERATOR

Engine Manufacturer:	***mtu***	**Engine Model:**	16V2000G86S
Engine Fuel:	Diesel		
Generator Manufacturer:	Leroy-Somer	**Generator Model:**	LSA 50.2L8
Voltage Regulator Model:	D510	**PMG Equipped:**	☒ Yes ☐ No

OPTIONS

Enclosure Level:	Level 3	**Silencer:**	Hospital Oval Internal
Air Filtration:	Standard		

TEST SUMMARY

TEST	TEST RESULT
Transient Performance *Certifies that the engine generator-set model has undergone transient response analysis per ISO 8528-5*	**NFPA-110 One Step:** ☒ 100% ☐ Other. Specify: ____ % **Full Load Acceptance:** Voltage Dip: 33.1 % Recovery Time: 3.3 seconds Frequency Dip: 10.9 % Recovery Time: 3.1 seconds
Steady State Performance *Certifies that voltage deviation and harmonics are within acceptance tolerance range per ISO-8528-5 at full load*	**Frequency Regulation:** 0.08 +/- % Regulation Overall 60.37 Maximum Hz 60.27 Minimum Hz **Voltage Regulation:** 0.19 +/- % Regulation Overall 481.8 Maximum AC Volts 480 Minimum AC Volts
Torsional Analysis *Certifies that the generator set has undergone torsional stress analysis and is not subjected to torsional stresses that could be harmful to the unit*	☒ Complete
Cooling System *Certifies that all generator set models will cool sufficiently within the ambient design conditions per each model at referenced enclosure level*	50 °C (122 °F) Maximum Ambient Temperature 1,709 m^3/min (60,350 SCFM) Radiator Air Flow
Sound Data *Certifies that sound data is within the acceptable tolerance range per ISO 8528-10 at referenced enclosure level*	74.7 dBA @ 7 m (23 ft) at full rated load *The sound value is representative of the specified prototype at the time of testing and is subject to alteration due to technological advances. Please contact your **mtu** representative for the most recent enclosure and sound data.*
Vibrational Analysis *Certifies that new generator set models have undergone vibration analysis to ensure that each generator coupling is balanced and there is no destructive resonant vibration per ISO 8528-9*	☒ Complete

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2022 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT

OFFICE OF TRANSPORTATION AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: **Rolls-Royce Solutions America Inc**
(U.S. Manufacturer or Importer)

Certificate Number: NMDDL40.1GNR-004

Effective Date: 11/15/2021

Expiration Date: 12/31/2022

Byron J. Bunker, Division Director
Compliance Division

Issue Date: 11/15/2021

Revision Date: N/A

Model Year: 2022
Manufacturer Type: Original Engine Manufacturer
Engine Family: NMDDL40.1GNR

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.

CERTIFICATE OF COMPLIANCE

Certificate Number	20190516-AU3559
Report Reference	AU3559-20190510
Issue Date	2019-MAY-16
Issued to:	MTU America Inc 100 Power Dr Mankato MN 56001-4790
This certificate confirms that representative samples of	ENGINE GENERATORS See addednum page
	Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	UL 2200 - Safety for Stationary Engine Generators CAN/CSA C22.2 No. 100-14 - Motors and Generators
Additional Information:	See the UL Online Certifications Directory at https://iq.ulprospector.com for additional information.

This *Certificate of Compliance* does not provide authorization to apply the UL Mark. Only the UL Follow-Up Services Procedure provides authorization to apply the UL Mark.

Only those products bearing the UL Mark should be considered as being UL Certified and covered under UL's Follow-Up Services.

Look for the UL Certification Mark on the product.

Bruce Mahrenholz, Director North American Certification Program

UL LLC

CERTIFICATE OF COMPLIANCE

Certificate Number	20190516-AU3559
Report Reference	AU3559-20190510
Issue Date	2019-MAY-16

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

USL, CNL - Stationary engine generator assemblies, Diesel Fueled, for outdoor use and indoor use, models as follows:

Nomenclature: Example: Model 12V2000 DS750

12	V	2000		D	S	750
I	II	III	Space	IV	V	VI

I	Number of Engine Cylinders: 12 - 12 Cylinders 16 – 16 Cylinders
II	Cylinder Arrangement: R – In-line V – V-Block
III	MTU engine series: 2000 – Series 2000
	Space
IV	Fuel Type: D- Diesel
V	Equipment Type: S - System - Engine Generator Set
VI	Nominal Standby Power Node: 750 - 1250 kW

Bruce Mahrenholz, Director North American Certification Program

UL LLC

MTU AMERICA INC.

Two (2) Year / 3,000 Hour Basic Limited Warranty
Standby (3D) / Prime (3B) / Data Center Continuous Power (3F)

MTU America Inc. issues the following express Limited Warranty subject to the following terms, conditions, and limitations:

An original consumer ("Owner") who purchases an MTU engine generator set ("Product") is entitled to coverage under this Limited Warranty. MTU America Inc. warrants to the Owner that the Product is free of defects in material and workmanship and will perform under normal use and service from valid start-up performed by MTU America Inc. Any nonconformity to the foregoing is defined as a Warrantable Defect. This Limited Warranty applies to Product shipped by MTU America Inc. after January 1, 2014.

1. Limited Warranty Periods

Limited Warranty Period. The Limited Warranty Period for a Warrantable Defect in the Product is twenty-four (24) months after the first commissioning of the Product. In all cases, the Limited Warranty period will expire not later than thirty-six (36) months from the date of shipment from the MTU America Inc. Mankato, MN facility or after 3,000 operation hours, whichever occurs first.

Accessories Coverage Period. The Accessories Coverage Period for a Warrantable Defect in cords, receptacles, cord reels, gas flex pipes, housing lights, space heaters, and associated equipment ("Accessories") is twelve (12) months from the date of shipment from MTU America Inc. Mankato, MN facility.

MTU America Inc. warranty obligations under this Limited Warranty are contingent upon distributor completing the following:

(a) The MTU America Inc. warranty and the *Start-Up Validation and Pre-Inspection Form*. Return both to MTU America Inc. within sixty (60) days of the start-up date; and
(b) The engine registration form (when applicable). Return to the manufacturer as stated in the engine registration form instructions.

2. MTU America Inc. Responsibilities

If a Warrantable Defect is found during the Limited Warranty Period and/or the Accessories Coverage Period, and provided the Owner has complied with its obligations under Section 3, MTU America Inc. will, during normal working hours, through an MTU authorized distributor, dealer, or service outlet, perform some or all of the following:

(a) Repair or replace, at the sole election of MTU America Inc., the defective part with a new or remanufactured replacement part;
(b) Provide reasonable or customary labor needed to correct the Warrantable Defect;
(c) Provide technician travel time of 400 miles to and from the closest MTU authorized distributor, dealer, or service outlet to the Product location;
(d) Part removal and re-installation, if necessary and as solely determined by MTU America Inc.

The obligation to repair or replace defective parts by MTU America Inc. does not include responsibility for reimbursement of incidental or consequential costs. If MTU America Inc. repairs or replaces an Accessory, part, or Product under this Limited Warranty, the repaired or replaced Accessory, part, or Product assumes the unexpired portion of the warranty period remaining from the original Accessory, part, or Product. Repair or replacement of an Accessory, part, or Product will not extend the term of the original Limited Warranty Period or Accessories Coverage Period. Parts or Product replaced shall become the property of MTU America Inc.

Failure of MTU America Inc. to enforce any of the terms or conditions stated herein shall not be construed as a waiver of such provision or of any other terms and conditions of this Limited Warranty.

3. Owner Responsibilities

During the Limited Warranty Period and Accessories Coverage Period, the Owner is responsible for, and MTU America Inc. will not reimburse for the following:

(a) Battery;
(b) Premium or overtime labor costs;
(c) Labor and material costs for Product removal and reinstallation;
(d) Any special access fees required to gain access to MTU equipment, without limitation, training or safety policy requirement to gain access;
(e) Transportation costs or travel expenses related to delivery of the Product to the designated distributor, dealer, or service outlet;
(f) Incidental and consequential costs, damages, or administrative expenses of whatever nature;
(g) Non-Product repairs, vehicle damage, "downtime" expenses, cargo damage, fines, lost income, any business costs of any kind, Owner's travel expenses, and other losses resulting from a Warrantable Defect;
(h) Shipping charges for replacement parts/Products in excess of those which are usual and customary; or
(i) Local taxes, if applicable.

In addition, Owner must:

(a) Operate, use, and maintain the Product in accordance with the applicable Owner's manual and/or any other manuals specified by MTU America Inc., including without limitation handling, inspection, servicing, or operating instructions;
(b) Promptly notify MTU America Inc. or its authorized representative of a Warrantable Defect and make the Product available for repair;
(c) Comply with MTU America Inc. or its authorized representative's reasonable directions regarding the timing, sequence, and location of warranty repairs and make the Product available for inspection;
(d) Perform all required maintenance and maintain and provide proof that all required maintenance has been performed;
(e) Use MTU specified parts, components, and consumables;
(f) Promptly return to MTU America Inc. all parts replaced under this Limited Warranty;
(g) Comply with MTU America Inc. long term storage guidelines, if applicable, and maintain and provide proof of compliance;
(h) Routinely exercise the Product in accordance with operating instructions;
(i) Install the Product in accordance with the installation guide provided; and
(j) Reimburse MTU America Inc. for all costs incurred in providing warranty service where, following examination, the request or claim for warranty coverage proves to be unfounded or excluded, as well as all incidental costs including those incurred investigating the claim.

4. Limitations

MTU America Inc. is not responsible, and this Limited Warranty is not available under any circumstances, for any of the following:

(a) Failure of Owner to fulfill its obligations under Section 3;
(b) Failure of Owner to follow MTU America Inc. instructions for Product stored by Owner longer than 180 days from date of shipment from the MTU America Inc. Mankato, MN facility;
(c) Defects caused by adjustments made by Owner to the fuel system or governor system;

(d) Defects which were obvious or capable of being identified by reasonable inspection and were not reported to MTU America Inc. within a reasonable time;
(e) Rental equipment used during warranty work;
(f) Defects caused or potentially caused by service work performed by non-MTU authorized service providers and/or the use of non-genuine MTU parts;
(g) Defects resulting from natural wear and tear, external action, negligence, natural disasters, accidents, incorrect use, improper handling or storage, inadequate corrosion-proofing, incorrect assembly or installation, or modification of the Product;
(h) Defects resulting from abuse or neglect, including unauthorized modifications to the Product;
(i) Repair or any use or installation which MTU America Inc., in its sole discretion, determines to be improper;
(j) Defects caused by incorrect maintenance;
(k) Defects resulting from Owner's delay in making the Product available after being notified of a potential problem or Owner's failure to take immediate measures to avoid or mitigate damage;
(l) Damage caused by shipping;
(m) Repair of parts sold by MTU America Inc. that are warranted directly to the Owner by the respective part's manufacturer;
(n) Misapplication of the Product;
(o) Diesel engine "wet stacking" due to lightly loaded diesel engines;
(p) Acts of nature or acts of God;
(q) Any failure, other than those resulting from a defect in material or factory workmanship of the Product;
(r) Use of the Product for purposes other than those for which it was intended, including without limitation use of the Product under extraordinary operating conditions not made known to MTU America Inc. in writing at the time of the order; or
(s) Material provided by or a design specified by the Owner.

5. **Software Warranty.** Where software is included in the Product, MTU America Inc. warrants to the Owner that 1) the software will be substantially free from material program errors and material defects in material and workmanship, and that 2) it shall function substantially in accordance with MTU America Inc. specification at the time of dispatch from the MTU America Inc. manufacturing facility. MTU America Inc. does not warrant that the software is error-free or free from "bugs" as commonly categorized by the computer industry. MTU America Inc. shall, during the Limited Warranty Period, endeavor to remedy at its cost, in its sole discretion, by repair or replacement of any material program errors or material defects of which Owner has promptly notified MTU America Inc. MTU America Inc., at its option, may elect to provide the most current software at no cost, and in such case MTU America Inc. will not cover the cost to install the applicable updated software. MTU America Inc. shall have no obligation with respect to any nonconformities resulting from unauthorized modifications to the software or any Owner interfacing.

6. **Emissions Warranty.** The Product may be covered under an emissions warranty specified by the U.S. Environmental Protection Agency and/or the California Air Resources Board. The terms of the warranty, if applicable, may be accessed by following the link: https://www.mtu-solutions.com/eu/en/technical-information/emissions-warranty.html. Any such Emissions Warranty is incorporated herein by reference in its entirety to the extent and with the same force as if fully set forth herein. The Product, if certified, may only be certified to comply with the required country or region-specific emission regulations. Where applicable, the Product is only certified to those specific emission regulations/standards which are clearly stated in the respective MTU America Inc. defined technical specifications. IT IS THE OWNER'S SOLE RESPONSIBILITY TO ENSURE THAT THE EXPORT/IMPORT, INSTALLATION, AND USE OF THE PRODUCT(S) COMPLIES WITH THE APPLICABLE EMISSION REGULATIONS IN THE COUNTRY OR REGION WHERE THE PRODUCT(S) WILL BE USED.

7. Disclaimers

LIMITATION OF WARRANTIES: THIS LIMITED WARRANTY IS GIVEN EXPRESSLY AND IN PLACE OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE, FREEDOM FROM INFRINGEMENT OR THIRD PARTY INTELLECTUAL PROPERTY RIGHTS, OR ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE OR USAGE OF TRADE. THERE ARE NO UNDERSTANDINGS, AGREEMENTS, REPRESENTATIONS, OR WARRANTIES NOT SPECIFIED HEREIN.

THIS LIMITED WARRANTY, THE OBLIGATIONS OF MTU AND THE RIGHTS AND REMEDIES OF THE OWNER SET FORTH IN THIS LIMITED WARRANTY ARE EXCLUSIVE AND ARE EXPRESSLY IN LIEU OF, AND THE OWNER HEREBY WAIVES AND RELEASES ALL OTHER OBLIGATIONS, WARRANTIES (INCLUDING WARRANTY AGAINST REDHIBITORY DEFECTS), REPRESENTATIONS OR LIABILITIES, EXPRESS OR IMPLIED, ARISING BY LAW IN CONTRACT, TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE, INCLUDING BUT NOT LIMITED TO ANY CLAIMS ARISING OUT OF, CONNECTED WITH OR RESULTING FROM THE PERFORMANCE OF THIS LIMITED WARRANTY OR FROM THE DESIGN, MANUFACTURE, SALE, REPAIR, LEASE OR USE OF THE PRODUCT, ANY COMPONENT THEREOF AND SERVICES DELIVERED OR RENDERED HEREUNDER OR OTHERWISE.

IN NO EVENT, WHETHER AS A RESULT OF BREACH OF CONTRACT OR WARRANTY, ALLEGED NEGLIGENCE, OR OTHERWISE, SHALL MTU BE SUBJECT TO LIABILITY FOR INCIDENTAL, CONSEQUENTIAL, INDIRECT, SPECIAL OR PUNITIVE DAMAGES OF ANY KIND, INCLUDING WITHOUT LIMITATION, DAMAGE TO THE PRODUCT, OR OTHER PROPERTY, COMMERCIAL LOSSES, LOST PROFITS, LOSS OF USE, INCONVENIENCE, LOSS OF TIME, COST OF CAPITAL, COST OF SUBSTITUTE EQUIPMENT, DOWNTIME, OR CLAIMS OF CUSTOMERS.

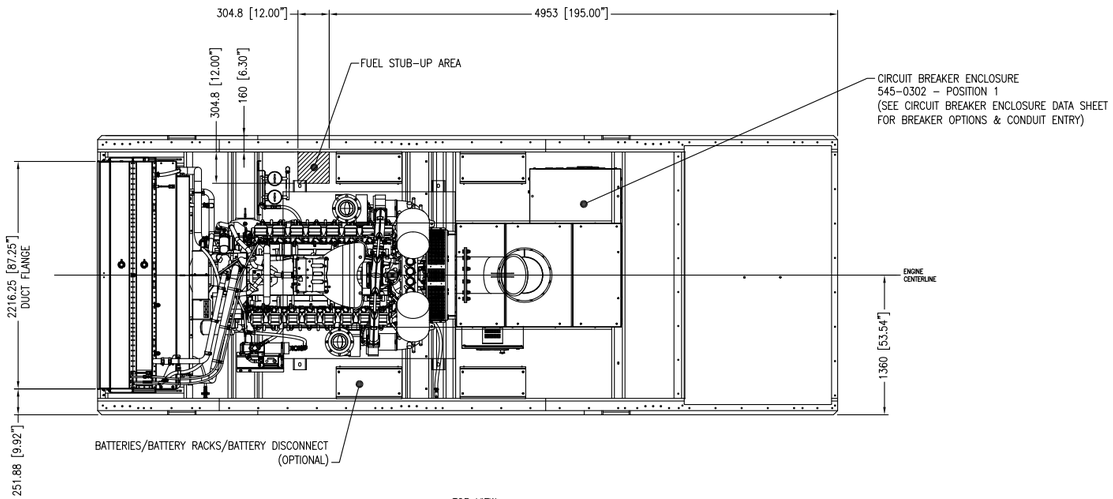
MTU AMERICA INC. SHALL NOT BE LIABLE FOR ANY CLAIM GREATER IN AMOUNT THAN THE PURCHASE PRICE OF THE PRODUCT.

8. The Owner is entitled to rectify the defect or to have it rectified by third parties only in urgent cases where operational safety is at risk or in order to prevent disproportionately extensive damage; provided that Owner has informed MTU America Inc. and obtained prior written consent from MTU America Inc. In such cases, MTU America Inc. shall, in its sole discretion, reimburse the costs incurred by the Owner up to an amount equivalent to the costs MTU America Inc. would have incurred had it remedied the defect itself.

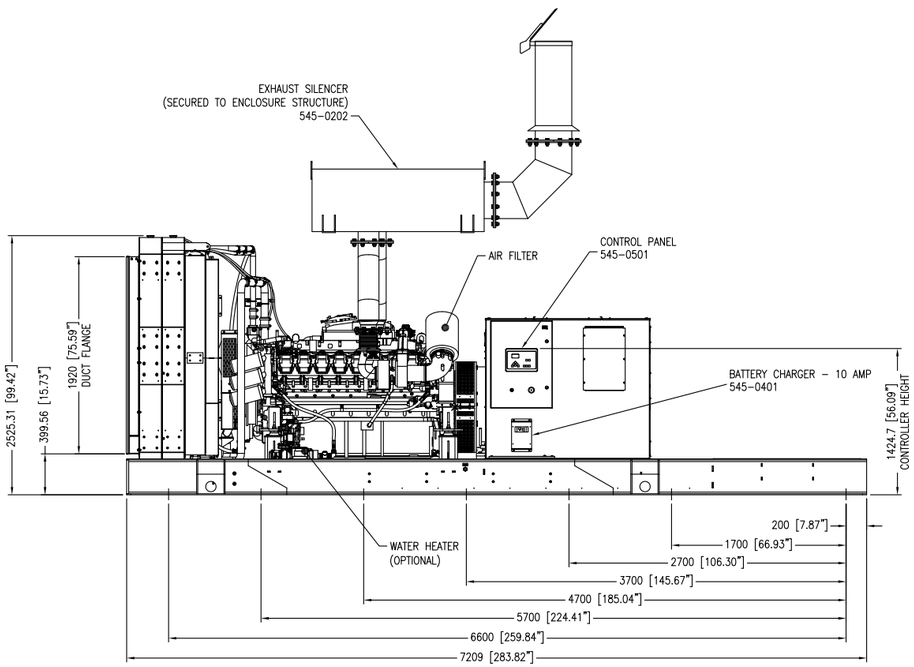
9. This Limited Warranty gives the Owner specific legal rights, and the Owner may also have other rights, which vary from state to state. Some states do not allow warranty duration limitations and/or certain exclusions or limitation of incidental or consequential damages. Therefore, the previously expressed exclusion(s) may not apply to Owner. If any one or more of the provisions contained in this Limited Warranty shall be invalid, illegal, or unenforceable in any respect, the validity, legality, or enforceability of the remaining provisions contained therein shall not in any way be affected or impaired thereby.

10. This Limited Warranty is governed by the laws of the State of Minnesota without regard to its conflicts of law principles and excluding the United Nations Convention for the International Sale of Goods.

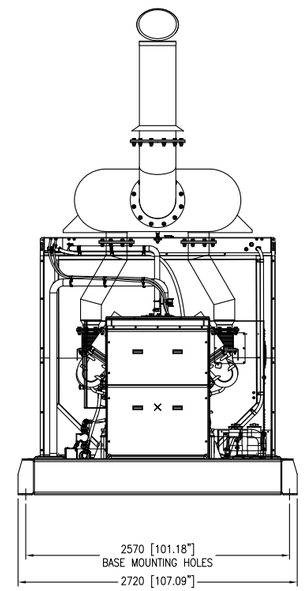
11. In order to obtain performance of an MTU America Inc. warranty obligation, the Owner should contact the nearest MTU authorized distributor, dealer, or service outlet for instructions. To find the location of the nearest MTU authorized distributor, dealer, or service outlet call 800-325-5450 or write to: MTU America Inc. Warranty Department, 100 Power Drive, Mankato, MN 56001.



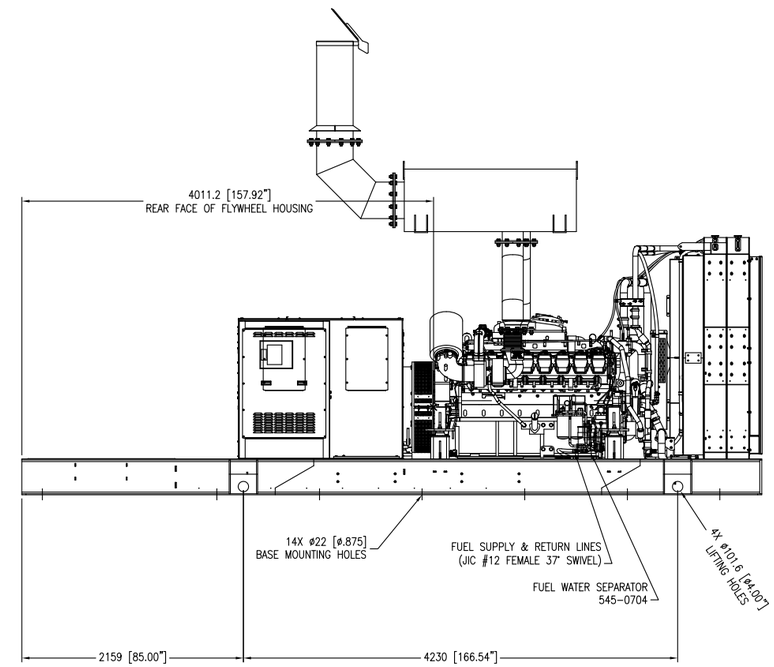
TOP VIEW



LEFT VIEW



REAR VIEW



RIGHT VIEW

REVISION	DATE	DESCRIPTION
A	2020-04-15	UPDATED TITLE BLOCK

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APPLICABLE MODELS:

MTU 16V2000 DS1000
MTU 16V2000 DS1250

THIRD ANGLE PROJECTION

DRAWN TO SCALE
DIMENSIONS: MM [INCH]

DATE CREATED: 2017-08-29

DIMENSIONAL LAYOUT

DESCRIPTION: 1000-1250kW Genset, Housed Std. Base

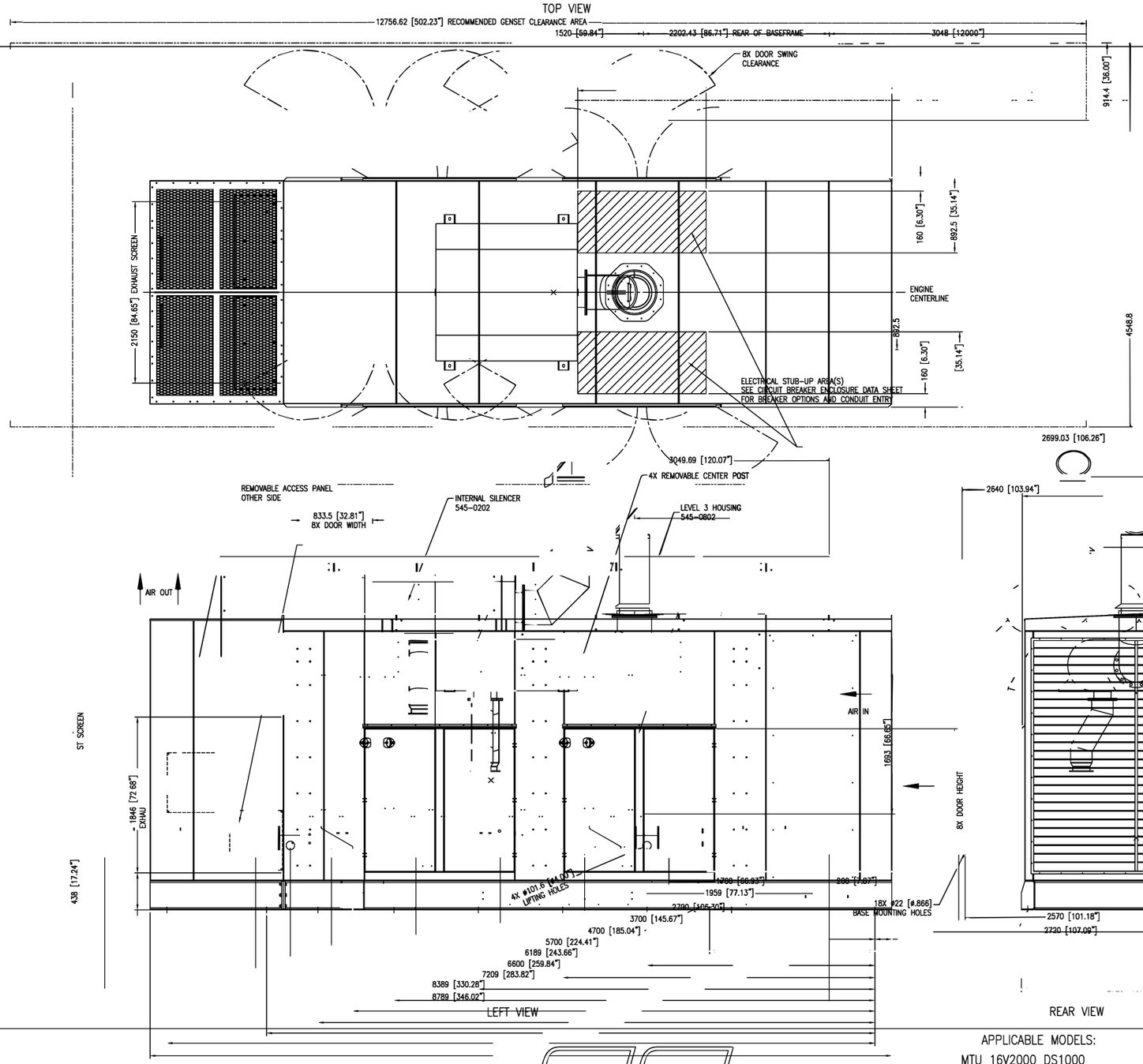
ENGINE: MTU 16V2000G06TB

WEIGHT (MIN-MAX): 9225-11494 KG 20337-25340 LB

DRAWING NUMBER: XZ54500100024

SHEET: 1 of 2

TOP VIEW



Reference the Drawing Options table and within the Layer Properties turn on/off the Drawing Codes that may or may not apply to your configuration.

Note: Some options may not be referenced. Only options which visibly change the drawing are selectable.

DRAWING OPTIONS
16V2000

GROUP	DRAWING CODE	DESCRIPTION	SELECTED OPTIONS
RECOMMENDED GENSET CLEARANCE AREA	545-0801	~~Level 1/Level 2 Housing~~	
	545-0802	Level 3 Housing	✓
Housing Options, Exterior	545-0803	Level 1/Level 2 Housing IBC Certified	
	545-0804	Level 3 Housing IBC Certified	
	545-0805	Gravity Exhaust Louver	
	545-0806	Motorized Intake Louver	
Housing Options, Interior	545-0902	Interior LED lights	
	545-0903	Interior Space Heater	
	545-0202	Internal Mounted Silencer	✓
Vibration Isolation [39.09"]	545-0602	Non-Seismic Springs, Std. Base, L1/L2	
	545-0603	Non-Seismic Springs, Std. Base, L3	
	545-0605	Seismic Springs, Std. Base, L1/L2	
	545-0606	Seismic Springs, Std. Base, L3	
	545-0608	IBC Springs, IBC Base, L1/L2	
	545-0609	IBC Springs, IBC Base, L3	

REVISION	DATE	DESCRIPTION
B	2020-12-17	ADDED ENCLOSURE DOOR DIMENSIONS TO ALL OFFERINGS
A	~~2020-04-15~~	~~UPDATED TITLE BLOCK~~

A Rolls-Royce solution

APPLICABLE MODELS:
MTU 16V2000 DS1000
MTU 16V2000 DS1250

DIMENSIONAL LAYOUT

THIRD ANGLE PROJECTION

DESCRIPTION: 1000-1250 kW Genset, Housing

DRAWN TO SCALE

DIMENSIONS: MM [INCH]

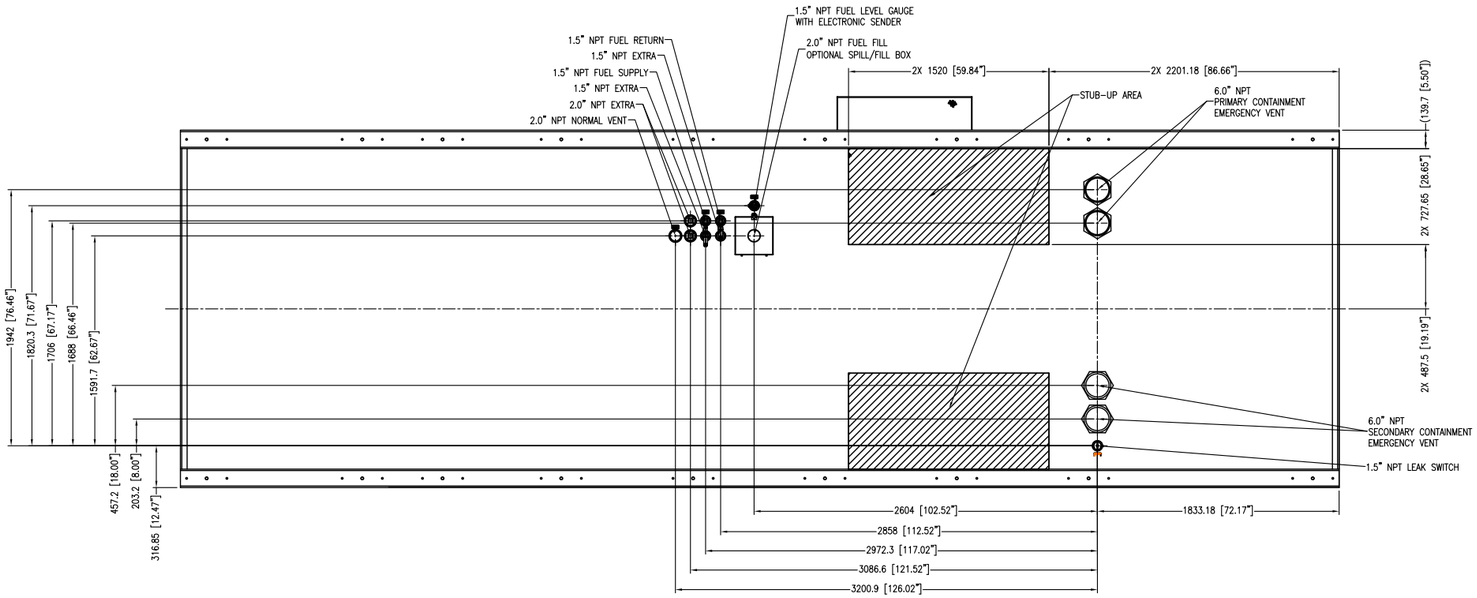
ENGINE: MTU, 16V2000

WEIGHT (MIN-MAX): ~~10942 18036 KG~~ 24123-39763 LB

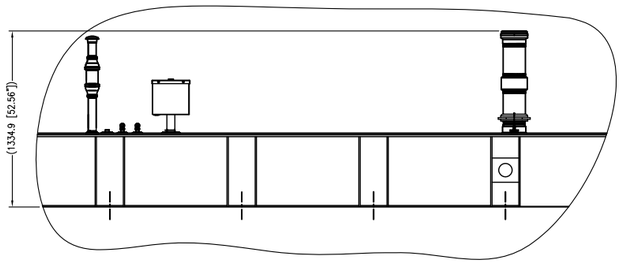
DATE CREATED: 2017-08-22

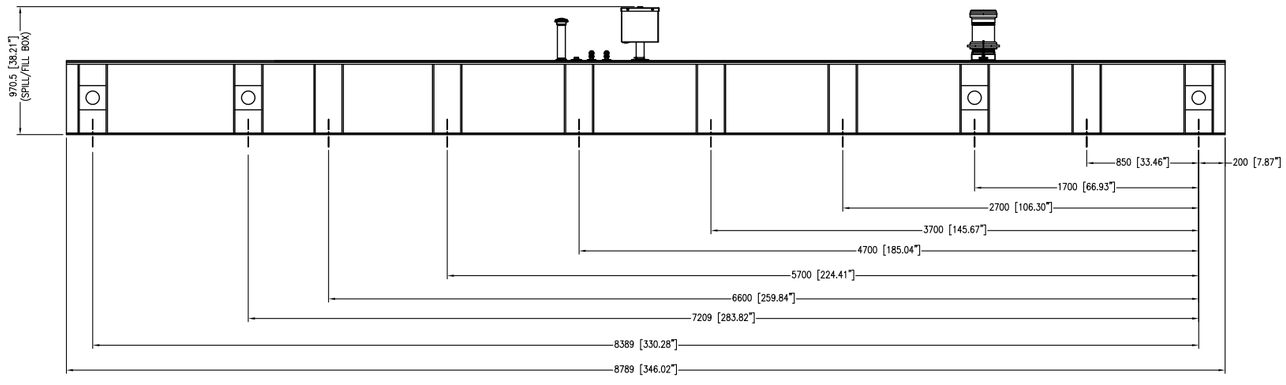
DRAWING NUMBER: XZ54500100026

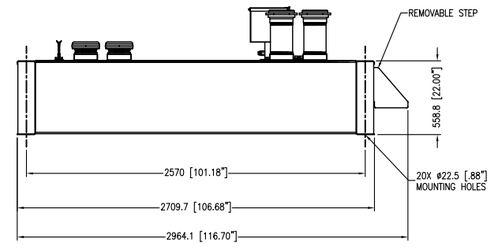
SHEET: 1 of 1



IBC VENT LAYOUT







REVISION	DATE	DESCRIPTION
A	2020-04-15	UPDATED TITLE BLOCK

A Rolls-Royce solution

APPLICABLE MODELS:
MTU 16V2000 DS1000
MTU 16V2000 DS1250

THIRD ANGLE PROJECTION

DRAWN TO SCALE
DIMENSIONS: MM [INCH]

DATE CREATED: 2017-08-25

DIMENSIONAL LAYOUT

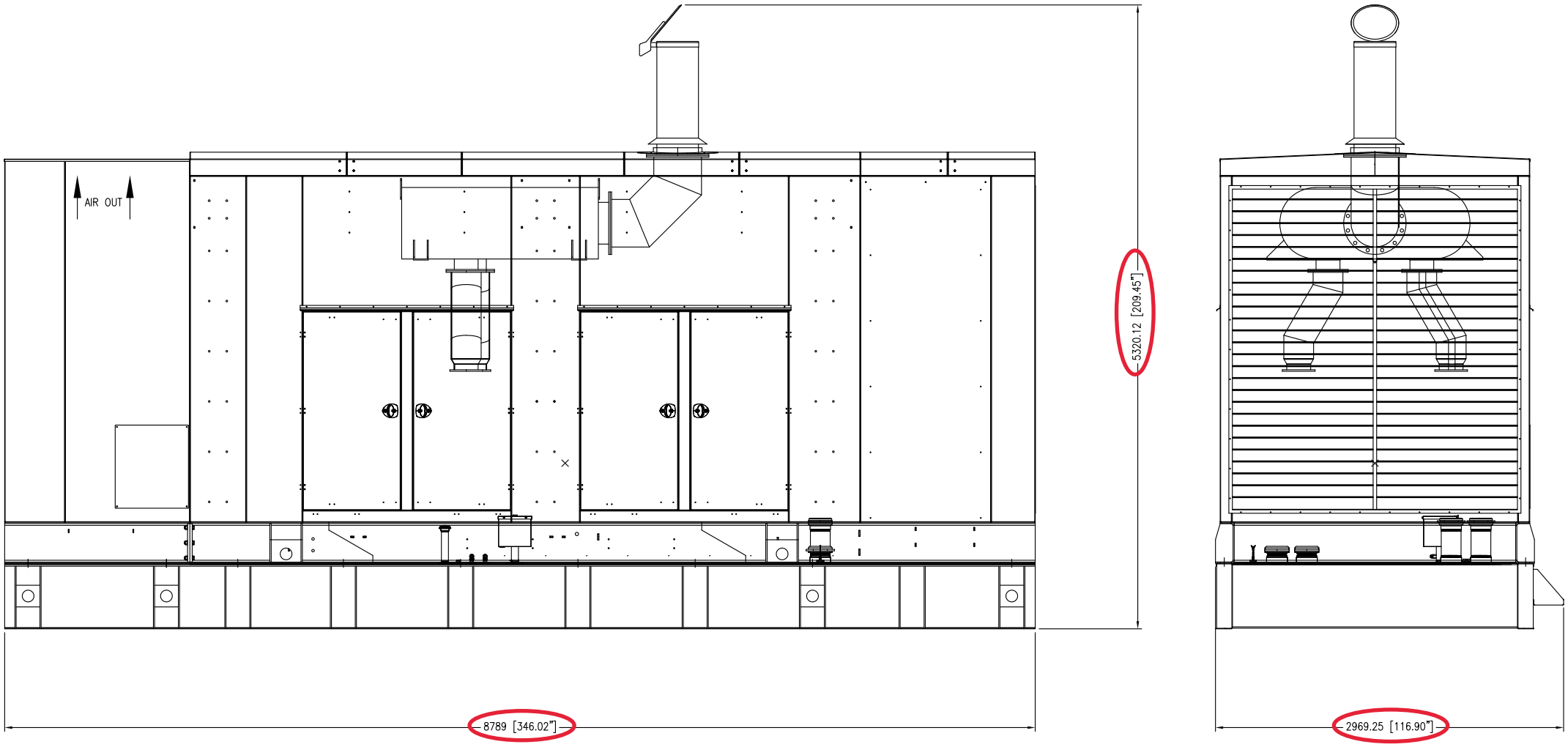
DESCRIPTION: 1000-1250kW 24Hr 2200Gal Narrow Flng Tank

ENGINE: MTU, 16V2000

WEIGHT (MIN-MAX): 3683 KG 8120 LB

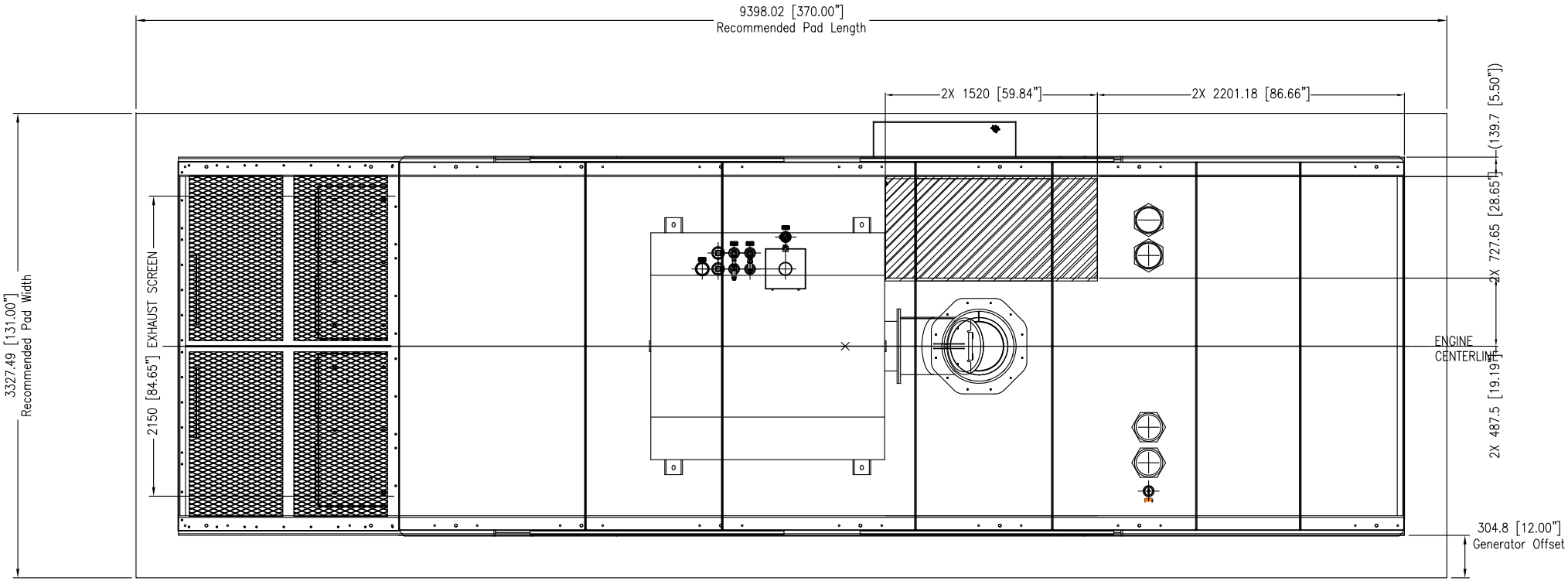
DRAWING NUMBER: XZ54500100027

SHEET: 5 of 21



LEFT VIEW

REAR VIEW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2X 2201.18 [86.66"]
3327.49 [131.00"]
Recommended Pad Width
2150 [84.65"] EXHAUST SCREEN
(139.7 [5.50"])
2X 727.65 [28.65"]
ENGINE
CENTERLINE
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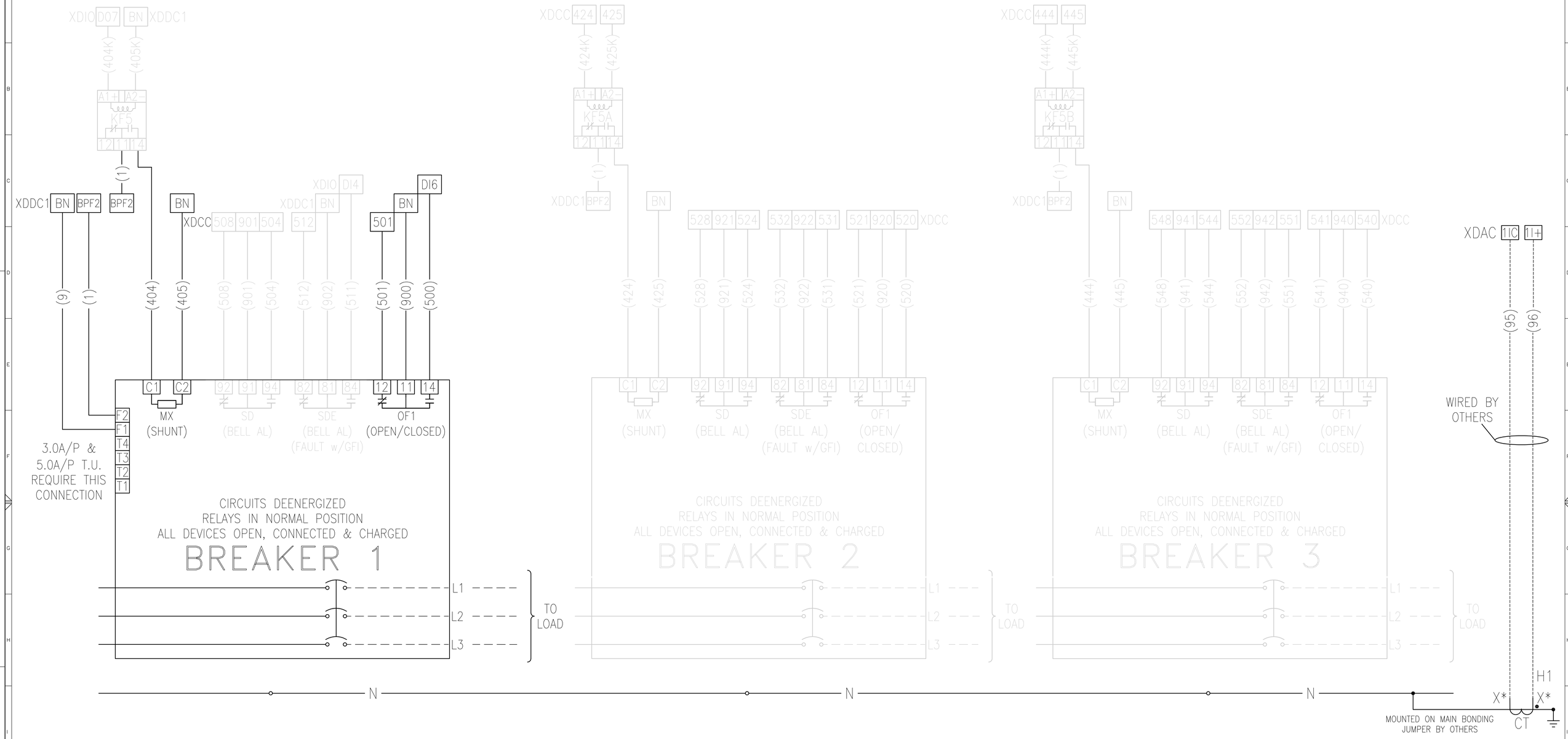
304.8 [12.00"]
Generator Offset

Pad Detail



WARNING

BEFORE OPERATING THIS GENERATOR SET, ENSURE THAT THE GROUND FAULT CURRENT TRANSFORMER IS INSTALLED IN THE CORRECT LOCATION ACCORDING TO SYSTEM NEUTRAL–GROUND BONDING METHOD AND THE MTU "RESIDUAL EQUIPMENT GROUND FAULT PROTECTION SYSTEM–TESTING INSTRUCTIONS."REFER TO LOCAL CODES AND AUTHORITIES HAVING JURISDICTION TO ENSURE INSTALLATION MEETS ALL REQUIREMENTS.

INCORRECT INSTALLATION OF THIS CURRENT TRANSORMER CAN RENDER THE GROUND FAULT PROTECTION SYSTEM INOPERABLE AND MAY RESULT IN DAMAGE TO EQUIPMENT AND/OR PERSONAL INJURY.

NFPA 70, NATIONAL ELECTRIC CODE (NEC) 215.10 SPECIFIES THAT EACH FEEDER DISCONNECT RATED 1,000 AMPERES OR MORE AND INSTALLED ON SOLIDLY GROUNDED WYE ELECTRICAL SYSTEMS OF MORE THAN 150 VOLTS TO GROUND, BUT NOT EXCEEDING 600 VOLT PHASE–TO–PHASE, SHALL BE PROVIDED WITH GROUND FAULT PROTECTION OF EQUIPMENT IN ACCORDANCE WITH THE PROVISIONS OF NEC 230.95(C) SPECIFIES PERFORMANCE TESTING OF THE GROUND FAULT PROTECTION SYSTEM WHEN FIRST INSTALLED ONSITE.

LEGEND

XDAC	TERMINAL STRIP AC POWER
XDCAN	TERMINAL STRIP CANBUS
XDCC	TERMINAL STRIP CUSTOMER CONNECTIONS
XDDC1	TERMINAL STRIP DC CONNECTIONS
XDIO	TERMINAL STRIP INPUTS/OUTPUTS
KF5	SHUNT TRIP RELAY BREAKER #1
KF5A	SHUNT TRIP RELAY BREAKER #2
MX	SHUNT TRIP
BN	BATTERY NEGATIVE
OF1	AUX SWITCH
SD	BELL ALARM SWITCH
SDE	BREAKER FAULT SWITCH

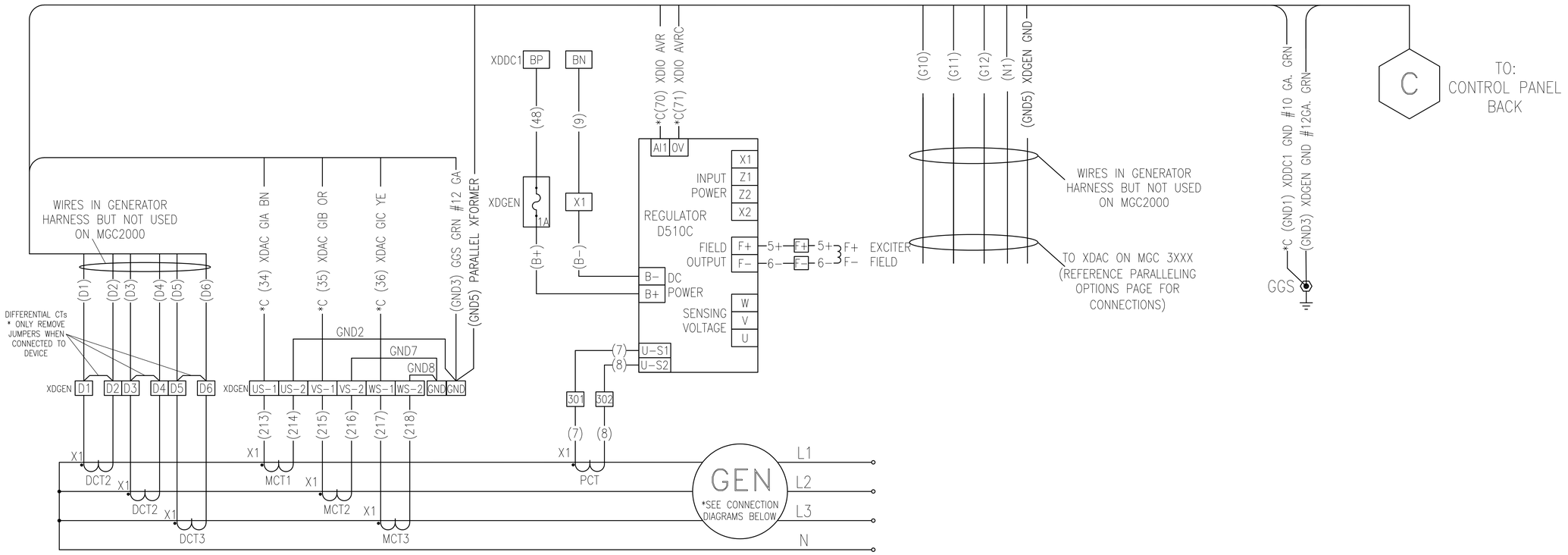
NOTE:

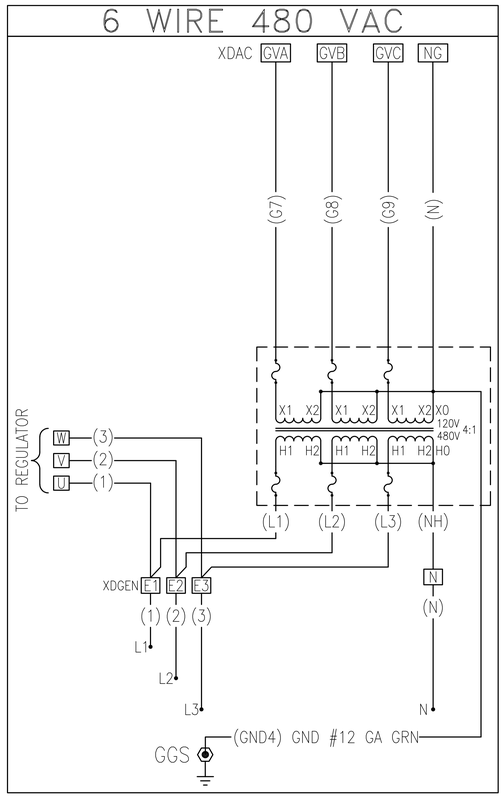
1. WIRE NUMBERS ARE IN PARENTHESIS
2. SHORT DASHED LINES (------) INDICATE CUSTOMER CONNECTION
3. BREAKER ACCESSORIES ARE SHOWN IN THE TRIPPED OR OPEN POSITION

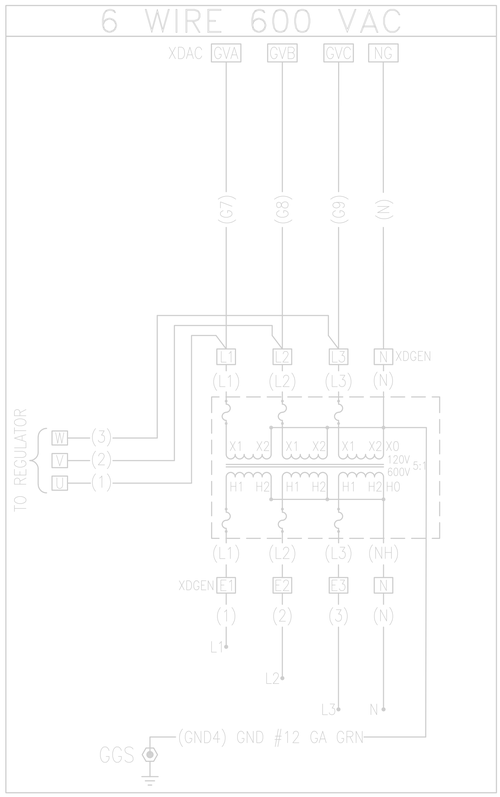
GROUND FAULT CT WIRING CONNECTIONS

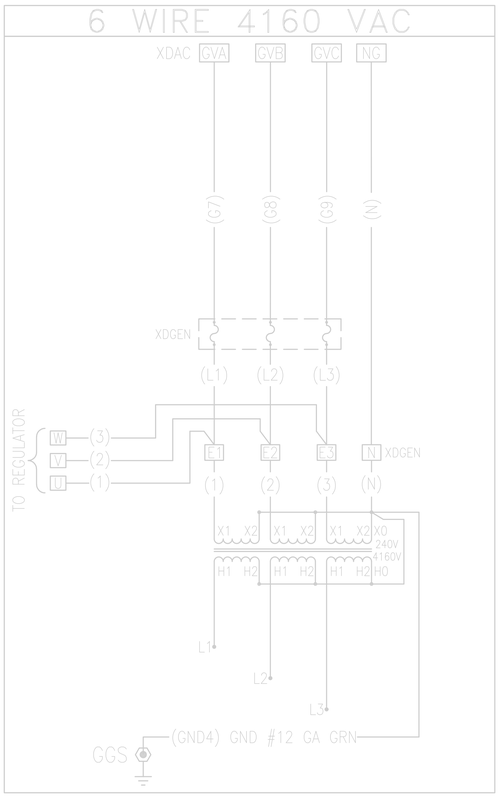
CB RATING	CT RATIO	*CT CONNECTIONS
30–230A	50:5	X2–X3
250–450A	100:5	X1–X2
500–700A	150:5	X1–X3
750–900A	200:5	X4–X5
1000–1200A	250:5	X3–X4
1500–1750A	400:5	X1–X4
2000A	450:5	X3–X5
2250A	500:5	X2–X5
2500A	600:5	X1–X5

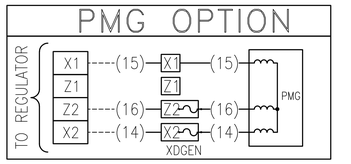
DUE TO NUMBER OF OPTIONS ORDERED AND LIMITED SPACE WITHIN THE CONTROL PANEL, THERE ARE NO DEDICATED LOCATIONS FOR NEEDED BREAKER RELAYS AND TERMINAL BLOCKS. THE ADDED RELAYS AND TERMINAL BLOCKS WILL BE PLACED WHERE SPACE ALLOWS.





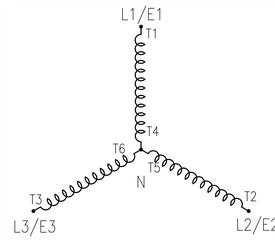






WYE 6 WIRE

HZ	L-L	L-LO
60	380	219
	480	277
	600	346
	2400	1386
	3300	1905
	4160	2402
	6600	3811
	13200	7620
	13800	7967
50	380	219
	400	231
	415	240
	3300	1905
	6600	3811
	11000	6351



LEGEND

DVR	DIGITAL VOLTAGE REGULATOR
GGS	GENERATOR GROUND STUD
XDGEN	GENERATOR TERMINAL BLOCKS

NOTE:

1. WIRE NUMBERS ARE IN PARENTHESIS
2. WIRING IS #20 GA. UNLESS OTHERWISE SPECIFIED
3. S2000 USES SINGLE BEARING RTD

*X	(X)	XXX	X

*X	DRAWING DESTINATION
(X)	WIRE NUMBER
XXX	DESTINATION
X	DESTINATION TERMINAL

Massstab/Scale | Masse/Mass | kg Format/Size A

Werkstoff / Material

Halbzeug,Modell,Generik / Semifinished Product, Pattern,Die

Material-Nr./Material-No. XZ54530900060

Benennung/Title

GENERAL ARRANGE DWG
S2000 GENERATOR 6 WIRE
S2000 GENERATOR 6 WIRE

	ACAD	Datum/Date	Name
Erstellt/Drawn		07.05.2020	shaik farh
Gepr./Checked		07.05.2020	shaik farh
Norm		19.05.2020	siebert jo
Freig./Released		19.05.2020	siebert jo

Zeichnungs-Nr./Drawing No. CAD03148365

Beschreibung/Description 6 WIRE GENERATOR

Blatt/Sheet 1/1

Aenderungsbeschreibung/Description of revision
UPDATED GROUND WIRES GND 4, GND5, GND7, GND8 WIRES

kommt vor/Frequency

Buchst./Rev.Ltr. b.2

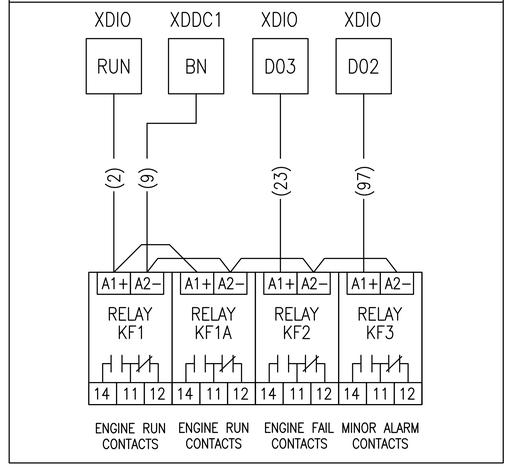
Aenderungs-Nr./Revision Notice No. PR057399

Bearbeitungsstatus/Lifecycle Released

Massmass Fit | Kontrolle im Gemeinsam

onsite energy

4 RELAY OPTION



LEGEND

XDDC1	TERMINAL STRIP DC CONNECTIONS
XDIO	TERMINAL STRIP INPUTS/OUTPUTS
XDCAN	TERMINAL STRIP CANBUS
ESP	EMERGENCY STOP

NOTE:

1. WIRE NUMBERS ARE IN PARENTHESIS

Aenderungsbeschreibung/Description of revision: TERMINAL NUMBERS UPDATED ON RTD'S; LED LIGHT HOUSING WIRES UPDATED

komm. vor/Frequency

Buchst./Rev.Ltr.: c.3 | Aenderungs-Nr./Revision Notice No.: ---- | Bearbeitungsstatus/Lifecycle: Released

Passmass Fit / Abmass ist Deviation (um)

Allgemeintoleranzen / General Tolerances ISO 2768-mK
Tolerierung / Tolerancing ISO 8015
Auslieferung u. Lieferung / Tech. Charcteristics: ----
Oberflaechenschutz / Surface Protection: ----
Verwendbar fuer Typ / Applicable to Model: ----
Projekt-/Auftrags-Nr. / Project-/Order No.: ----
Referenz-Nr./Ref.No.: ----
Emission ID: ----

Masse / Size ISO 14405
Oberflaechenangaben nach MTN0033 / Surface Specification per MTN0033
Allgemeine Fertigungsvorschriften nach MMN 332 / Production Specification per MMN 332
---- ----
---- ----

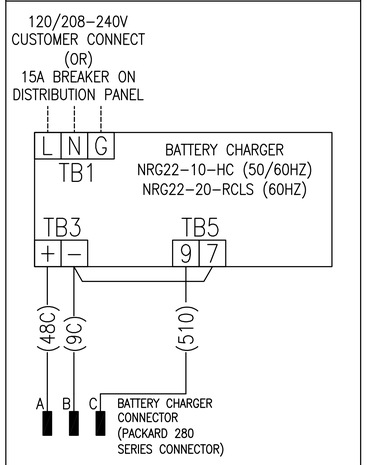
	Name	Datum/Date
ACAD		
Ersteller/Drawn	jayanath	07.11.2019
Aenderung/Change	jayanath	12.12.2019
Norm. visi.	----	----
Gepr./Checked	----	----

Massstab/Scale: ----
Masse/Mass: ---- kg
Format/Size: A
Werkstoff / Material: ----------
Halbzeug,Modell,Generik / Semifinished Product, Pattern,Die: ----
Material-Nr./Material-No.: XZ54530900064
Benennung/Title: ---- ----
---- ----
GENERAL ARRANGE DWG _S2000_OPTIONS
S2000 OPTIONS

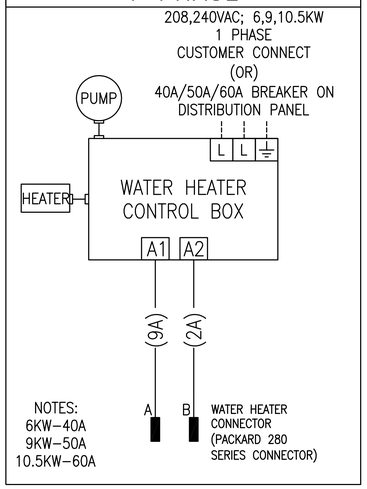
onsite energy

Zeichnungs-Nr./Drawing No.: CAD03148419
Beschreibung/Description: OPTIONS
Blatt / Sheet: 1/6

BATTERY CHARGER 15 AMP

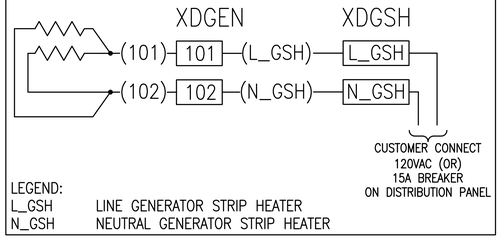


WATER JACKET HEATER 1 PHASE



GENERATOR STRIP HEATER

CUSTOMER CONNECTIONS



LEGEND:

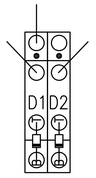
L_GSH	LINE GENERATOR STRIP HEATER
N_GSH	NEUTRAL GENERATOR STRIP HEATER

LEGEND

XDDC1	TERMINAL STRIP DC CONNECTIONS
XDCAN	TERMINAL STRIP CANBUS
XDGEN	GENERATOR TERMINAL BLOCKS
XDGSH	TERMINAL STRIP GEN STRIP HEATER
KFLM	LOUVER MOTOR RELAY
KFEH	ENCLOSURE HEATER RELAY

NOTES:

1. WIRE NUMBERS ARE IN PARENTHESIS.
2. PLUG/SOCKET SYMBOLS PER IEC 60617.



Aenderungsbeschreibung/Description of revision	komm. vor/Frequency
TERMINAL NUMBERS UPDATED ON RTD'S; LED LIGHT HOUSING WIRES UPDATED	

Buchst./Rev.Ltr.	Aenderungs-Nr./Revision Notice No.	Bearbeitungsstatus/Lifecycle
c.4	----	Released

Passmass Fit / Abmass ist Deviation um

Allgemeintoleranzen / General Tolerances ISO 2768-mK
Toleranzing / Tolerancing ISO 8015
Ausfaehrung u. Lieferung Tech. Charakteristics ----
Oberflaechenschutz Surface Protection ----
Verwendbar fuer Typ Applicable to Model ----
Projekt-/Auftrags-Nr. Project/Order No. ----
Referenz-Nr./Ref.No. ----
Emission ID ----

Masse / Size ISO 14405
Oberflaechenangaben nach MTN0033 Surface Specification per MTN0033
Allgemeine Fertigungsvorschriften nach MMN 332 Production Specification per MMN 332
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---- ----

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ACAD	Datum/Date	Name
Ersteller prep.	07.11.2019	jayanath
Change	12.12.2019	jayanath
Norm. std.	----	----
Gepr. Checked	----	----

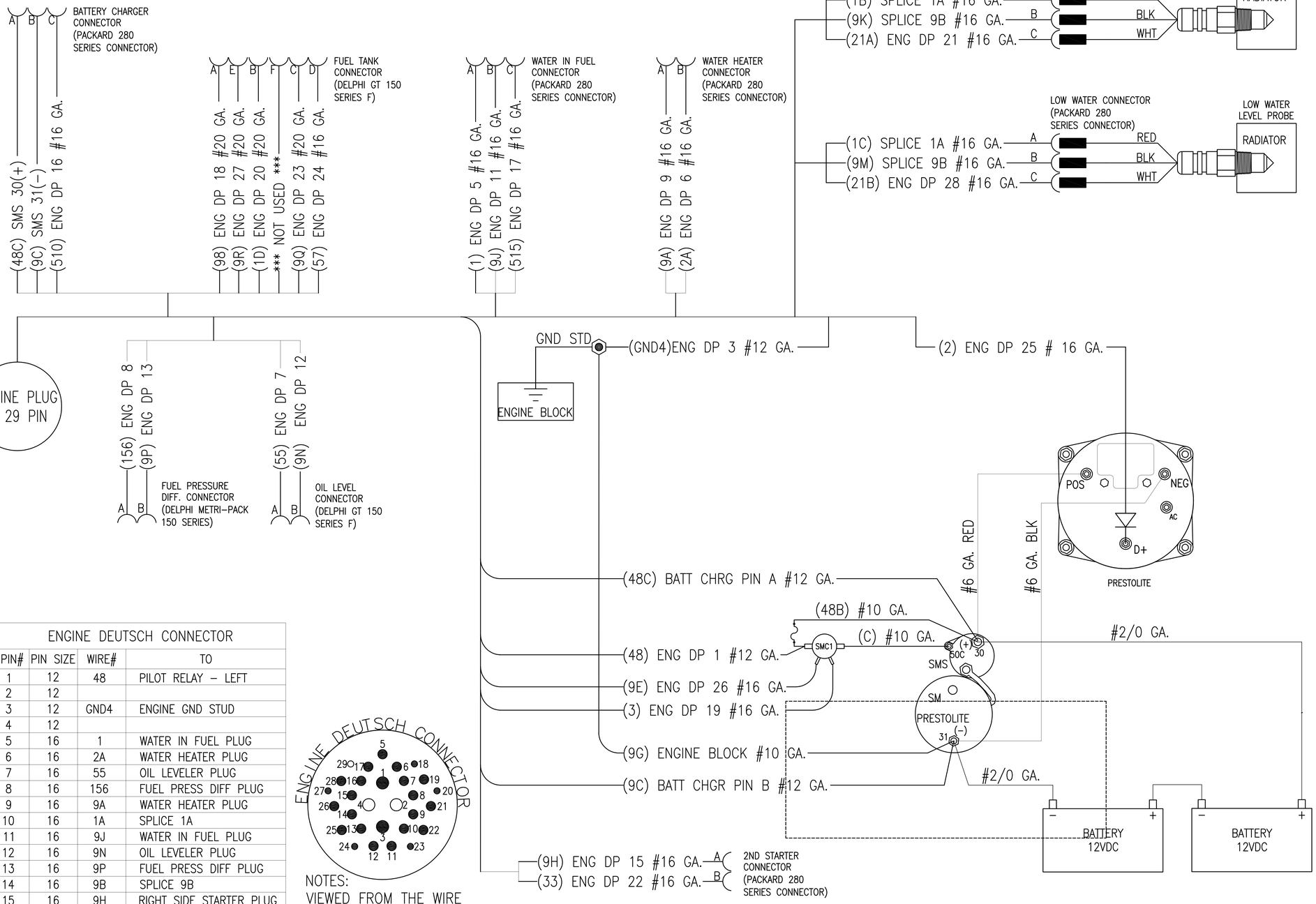
Massstab/Scale ----
Masse/Mass ---- kg
Format/Size A

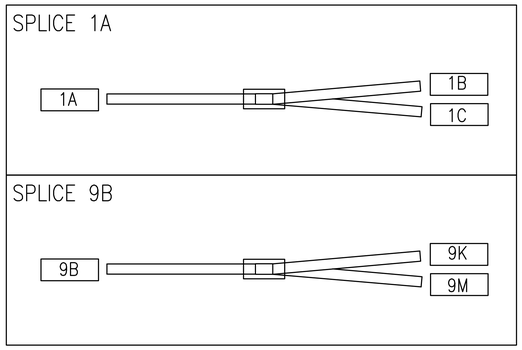
Werkstoff Material ----------
Halbzeug,Modell,Generik Semifinished Product, Pattern,Die ----
Material-Nr./Material-No. XZ54530900064

Benennung/Title ---- ----
---- ----
GENERAL ARRANGE DWG
_S2000_OPTIONS
S2000 OPTIONS

onsite energy

Zeichnungs-Nr./Drawing No. CAD03148425
Beschreibung/Description OPTIONS
Blatt Sheet 3/6





LEGEND:

ALT	ENGINE ALTERNATOR
SM	STARTER MOTOR
SMC	STARTER MOTOR COIL
SMS	STARTER MOTOR SOLENIOD

NOTES:

1. WIRE NUMBERS ARE IN PARENTHESIS.
2. WIRING IS #20 GA. UNLESS OTHERWISE SPECIFIED.
3. SHORT DASHED LINES (------) INDICATE OPTIONAL EQUIPMENTS WIRING.
4. PLUG/SOCKET SYMOBLS PER IEC 60617.

ENGINE DEUTSCH CONNECTOR			
PIN#	PIN SIZE	WIRE#	TO
1	12	48	PILOT RELAY – LEFT
2	12		
3	12	GND4	ENGINE GND STUD
4	12		
5	16	1	WATER IN FUEL PLUG
6	16	2A	WATER HEATER PLUG
7	16	55	OIL LEVELER PLUG
8	16	156	FUEL PRESS DIFF PLUG
9	16	9A	WATER HEATER PLUG
10	16	1A	SPLICE 1A
11	16	9J	WATER IN FUEL PLUG
12	16	9N	OIL LEVELER PLUG
13	16	9P	FUEL PRESS DIFF PLUG
14	16	9B	SPLICE 9B
15	16	9H	RIGHT SIDE STARTER PLUG
16	16	510	BATTERY CHARGER PLUG
17	16	515	WATER IN FUEL PLUG
18	20	98	FUEL LEVEL/LEAK PLUG
19	16	3	PILOT RELAY – LEFT
20	20	1D	FUEL LEVEL/LEAK PLUG
21	16	21A	LOW WATER LEVEL PLUG
22	16	33	RIGHT SIDE STARTER PLUG
23	20	9Q	FUEL LEVEL/LEAK PLUG
24	20	57	FUEL LEVEL/LEAK PLUG
25	16	2	ALTERNATOR
26	16	9E	PILOT RELAY – LEFT
27	20	9R	FUEL LEVEL/LEAK PLUG
28	16	21B	LOW WATER LEVEL PLUG
29	20		

NOTES:
VIEWED FROM THE WIRE INSERTION END

● POPULATED AND WIRED

○ UNPOPULATED

*X (X) XXX X	
*X	DRAWING DESTINATION
(X)	WIRE NUMBER
XXX	DESTINATION
X	DESTINATION TERMINAL

Änderungsbeschreibung/Description of revision	kommt vor/Frequency
UPDATED INPUT AND OUTPUT NOMENCLATURE ON BATTERY DISCONNECT	

Buchst./Rev.Ltr.	Aenderungs-Nr./Revision Notice No.	Bearbeitungsstatus/Lifecycle
a.3	PR050176	Released

Allgemeintoleranzen / General Tolerances ISO 2768-mK
Tolerierung / Tolerancing ISO 8015
Ausführung u. Lieferung Tech. Charcteristics
Oberflaechenschutz Surface Protection
Verwendbar fuer Typ Applicable to Model
Projekt-/Auftrags-Nr. Project/Order No.
Referenz-Nr./Ref.No.
Masse / Size ISO 14405
Oberflaechenangaben nach MTND033 Surface Specification per MTND033
Allgemeine Fertigungsvorschriften nach MAN 332 Production Specification per MAN 332
Emission ID

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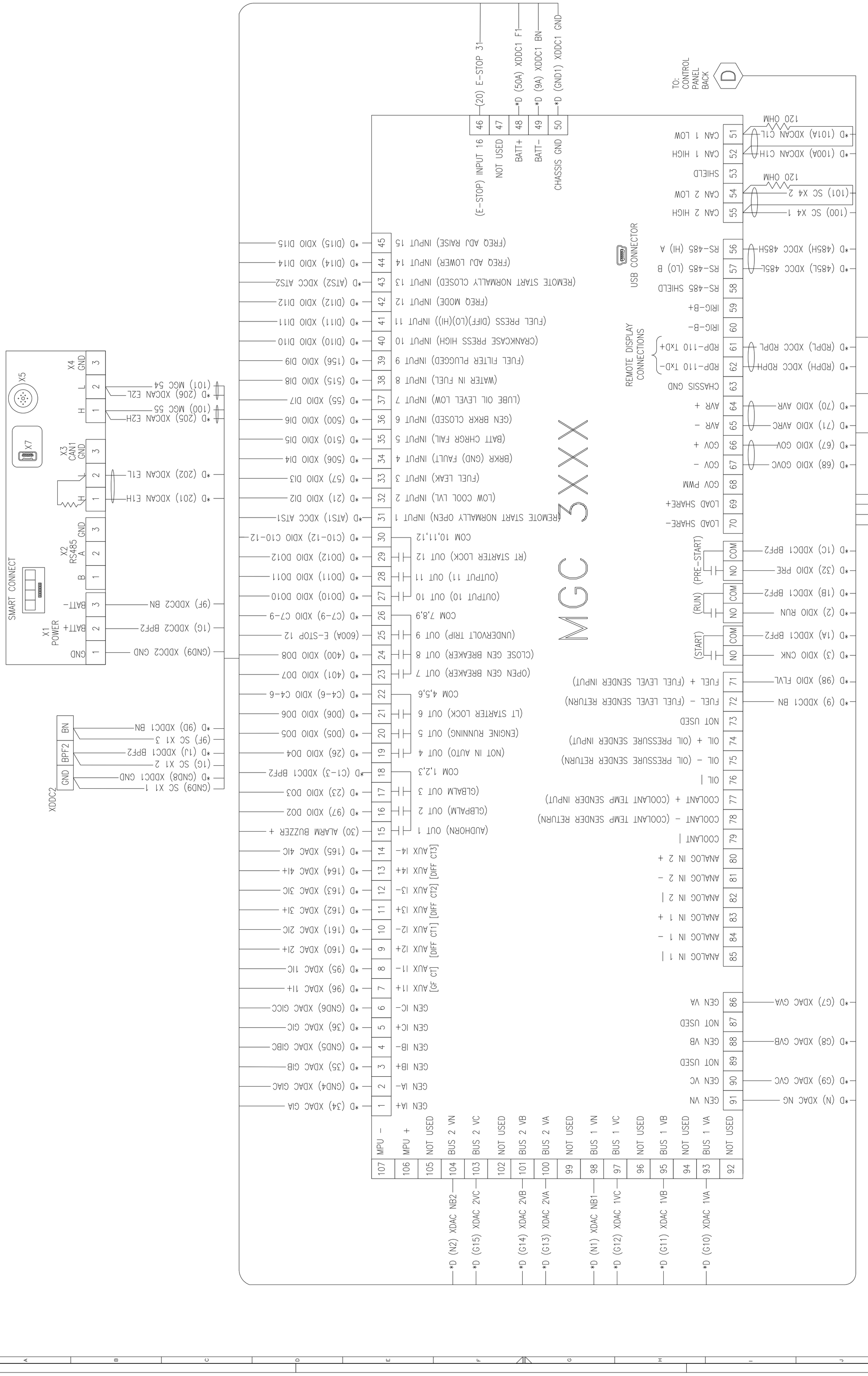
	Datum/Date	Name
Ersteller Created	07.11.2019	jayanath
Bearb. Change	11.11.2019	jayanath
Norm. Std.	11.11.2019	carsten_l
Gepr. Checked	11.11.2019	carsten_l

Massstab/Scale
Masse/Mass kg
Format/Size A
Werkstoff Material
Halbzeug,Modell,Gerenk Semifinished Product, Pattern,Die
Material-Nr./Material-No. XZ54530900048
Benennung/Title
GENERAL ARRANGE DWG
S2000 ENGINE W/ SINGLE SRTR MO
S2000 ENGINE W/ SINGLE SRTR MOTO
Zeichnungs-Nr./Drawing No. CAD03128908
Blatt Sheet 1/1
Beschreibung/Description

onsite energy



Allgemeintoleranzen / General Tolerances ISO 2768-mK
Toleranzang. / Tolerancing ISO 8015
Tech. Charakteristics
Oberflächenschutz
Vernetzung / Interlock
Projekt-/Auftrags-Nr. Project/Order No.
Referenz-Nr./Ref.No.
Emission ID
Maße / Size ISO 14405
Werkstoff / Specification nach MTNQ0333
Surface Specification per MTU 013
Allgemeine Fertigungsvorschriften nach MAN 332
Production Specification per MAN 332
Material-Nr./ Material-No. XZ54530900101
Maßstab/Scale
Masse/Mass
kg
Format/Size A
Werkstoff Material
Halbzeug,Modell,Gesenk Semifinished Product, Pattern,Die
Name
Datum/Date
ACAD
Erstellt
Zeichn.
Geprüft
Norm.
Gen.
16.10.2020 shtolk /orh
16.10.2020 shtolk /orh
26.10.2020 carsten jd
26.10.2020 carsten jd
Benennung/Title
ARRANGEMENT DRAWING
16V S2000 CP MGC 3XXX
SYSTEM DRAWING
Zeichnungs-Nr./Drawing No.
CAD06781895
Beschreibung/Description
PANEL FRONT
Blatt Sheet 1/2
Änderungsbeschreibung/Description of revision
INITIAL RELEASE
Buchst./Rev.Ltr. -.2
Änderungs-Nr./Revision Notice No. PR062840
Datum Name Änderung im Index
Bearbeitungsstatus/Lifecycle
Released
kommt von/Frequency
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ADD FOR ENGINE
WITH DUAL STARTERS

LEGEND

XDAC	TERMINAL STRIP AC POWER
XDCAN	TERMINAL STRIP CANBUS
XDCC	TERMINAL STRIP CUSTOMER CONNECTIONS
XDDC1	TERMINAL STRIP DC CONNECTIONS
XDDC2	TERMINAL STRIP CANBUS DC POWER
XDIO	TERMINAL STRIP INPUTS/OUTPUTS
XDKF	TERMINAL STRIP RELAYS
XDGEN	GENERATOR TERMINAL STRIP CONNECTIONS
KF8	E-STOP RELAY
KF8A	IGNITION RELAY
KF11	ALTERNATE STARTER RELAY LEFT
KF12	ALTERNATE STARTER RELAY RIGHT
BPGS	BACK PLATE GROUND STUD
AVR	VOLTAGE ADJUST
AVRC	VOLTAGE ADJUST COMMON
DRP	DROOP CONTROL
DRPC	DROOP CONTROL COMMON
VAR	VAR CONTROL
VARC	VAR CONTROL COMMON
GOV	SPEED CONTROL
GOVC	SPEED CONTROL COMMON

LEGEND

SPMD	SPEED MODE
IDLE	IDLE MODE
HZUP	ENGINE SPEED UP
HZDN	ENGINE SPEED DOWN
IGN	ECU IGNITION CONTROL
IGNC	ECU IGNITION CONTROL COMMON
ECU DP	ECU DEUTSCH 48 PIN PLUG
ENG DP	ENGINE DEUTSCH 29 PIN PLUG
FLVL	FUEL LEVEL
GOVS	GOVERNOR SHIELD
AVRS	REGULATOR SHIELD
TDO	STARTER ON
TDOC	STARTER GND
LSBP	LEFT STARTER BATTERY POSITIVE
RSBP	RIGHT STARTER BATTERY POSITIVE
BP	BATTERY POSITIVE
BN	BATTERY NEGATIVE
ATS 1/2	AUTOMATIC TRANSFER SWITCH
ATSC	AUTOMATIC TRANSFER SWITCH COMMON
RESP	REMOTE E-STOP
RDPH	REMOTE DISPLAY PANEL HIGH
RDPL	REMOTE DISPLAY PANEL LOW

*X (X) XXX X

*X	DRAWING DESTINATION
(X)	WIRE NUMBER
XXX	DESTINATION
X	DESTINATION TERMINAL

ECU DEUTSCH CONNECTOR

PIN#	PIN SIZE	WIRE#	TO
1	20	201A	XDCAN–E1H
2	20	202A	XDCAN–E1L
3	20	203A	XDCAN–E1S
4	20	205A	XDCAN–E2H
5	20	206A	XDCAN–E2L
6	20	204A	XDCAN–E2S
7	20	209	XDIO–PRE
8	20	210	XDDC1–BN
9	20	167	XDIO–HZDN
10	20	212	XDDC1–BN
11	20	168	XDIO–HZUP
12	20	214	XDDC1–BN
13	16		
14	16		
15	16		
16	12	GND 10	XDDC1–GND
17	12		
18	20		
19	16		
20	20		
21	12	51A	XDDC1–BPF3
22	12	51B	XDDC1–BPF3
23	12	51C	XDDC1–BPF3
24	12	51D	XDDC1–BPF3

ECU DEUTSCH CONNECTOR

PIN#	PIN SIZE	WIRE#	TO
25	12	9H	XDDC1–BN
26	12	9J	XDDC1–BN
27	12	9K	XDDC1–BN
28	12	9L	XDDC1–BN
29	16		
30	16		
31	16		
32	12		
33	12		
34	16		
35	16		
36	16		
37	20	217	XDIO–IDLE
38	20	218	XDDC1–BN
39	20	219	XDIO–SPDM
40	20	220	XDDC1–BN
41	20	221	XDIO–PRE
42	20	222	XDDC1–BN
43	20	68A	XDIO–GOVC
44	20	67A	XDIO–GOV
45	20	233	XDIO–TDO
46	20	234	XDIO–TDOC
47	20	241B	XDIO–IGN
48	20	242B	XDIO–IGNC

TO: GENERATOR

TO: CONTROL PANEL DOOR

BPGS *D (GND3) DCS (GND2) XDDC1 GND

ENGINE DEUTSCH CONNECTOR

PIN#	PIN SIZE	WIRE#	TO
1	12	48A	XDDC1–BP
2	12		
3	12	GND11	XDDC1–GND
4	12		
5	16	1M	XDDC1–BPF2
6	16	2A	XDIO–RUN
7	16	55A	XDIO–DI7
8	16	156A	XDIO–DI9
9	16	9N	XDDC1–BN
10	16	1L	XDDC1–BPF2
11	16	9M	XDDC1–BN
12	16	9Q	XDDC1–BN
13	16	9P	XDDC1–BN
14	16	9S	XDDC1–BN
15	16	9U	XDDC1–BN
16	16	510A	XDIO–DI5
17	16	515A	XDIO–DI8
18	20	98A	XDIO–FLVL
19	16	3A	XDIO–CNK–L
20	20	1N	XDDC1–BPF2
21	16	21A	SPLICE 21
22	16	33	XDIO–CNK–R
23	20	9V	XDDC1–BN
24	20	57A	XDIO–DI3
25	16	2B	XDIO–RUN
26	16	9T	XDDC1–BN
27	20	9R	XDDC1–BN
28	16	21B	SPLICE 21
29	20		

WHEN PARALLELING WITH NON MTU COMPONENTS. WIRES 67A,68A,70&71 MOVED TO XDCC AS SHOWN ON BLOCK 2. FOR DETAILED VIEW, REFERENCE PARALLELING PAGE

NOTE:
1. WIRE NUMBERS ARE IN PARANTHESIS
2. REFERENCE BELOW FOR TERMINAL POSITIONS

REMOVE JUMPER WHEN DUAL STARTER MOTOR OPTION IS SELECTED

REMOVE JUMPERS WHEN DIFFERENTIAL CT'S ARE INSTALLED

REMOVE JUMPERS WHEN CT'S ARE INSTALLED

REMOVE JUMPER WHEN REMOTE E-STOP IS INSTALLED

REFERENCE GENERATOR DRAWINGS FOR CONNECTIONS

ECU DEUTSCH CONNECTOR

NOTES:
- ● POPULATED AND WIRED
- ○ UNPOPULATED

ENGINE DEUTSCH CONNECTOR

ENGINE PLUG 29 PIN

ECU PLUG 48 PIN

Allgemeintoleranzen / General Tolerances ISO 2768–mK		Maßstab/Scale	Masse/Mass kg Format/Size
Tolerierung / Tolerancing ISO 8015		Masse / Size ISO 14405	---- A
Ausführung in Lieferung / Tech. Characteristics ----		Oberflächenangaben nach MTN0033	Werkstoff / Material ----
Oberflächenschutz / Surface Protection ----		Surface Specification per MTN0033	
Verwendbar fuer typ / Applicable to Model ----		Allgemeine Fertigungsvorschriften nach MAN 332	Halbzeug,Modell,Gesenk / Semifinished Product, Pattern,Die ----
Projekt-/Auftrags-Nr. / Project/Order No. ----		Production Specification per MAN 332	Material-Nr./Material-No.
Referenz-Nr./Ref.No. ----	Emission ID ----	sandhurst 26.10.2020	XZ545309009101

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	Ersteller / Creator	06.10.2020	shaik farh	---- ----
	Gepr. / Checked	13.10.2020	shaik farh	ARRANGEMENT DRAWING
	Norm. / Std.	26.10.2020	carsten jd	16V S2000 CP MGC 3XXX
	Gen. / Released	26.10.2020	carsten jd	SYSTEM DRAWING
	Zeichnungs-Nr./Drawing No.			CAD06781897
	Beschreibung/Description			BACK PANEL

Blatt / Sheet 2/2

Aenderungsbeschreibung/Description of revision	komm vor/Frequency
INITIAL RELEASE	

Buchst./Rev.Ltr.	Aenderungs-Nr./Revision Notice No.	Bearbeitungsstatus/Lifecycle
-.3	PR062840	Released

Passmass Fit / Abmass in Deviation µm