



Department of Environmental Protection

2600 Blair Stone Road • Tallahassee, Florida 32399-2400

DEP Form: 62-762.901(9)
Form Title: Storage Tank Equipment
Registration Form
Effective Date: July 2019
Incorporated in Rule 62-762.851, F.A.C.

Storage Tank System Equipment Registration Form

Fill out completely

General Information

Company Name: Penske Logistics Contact Name: Jody Cope
Company Address: 100 Sunport Lane City, State: Orlando Zip: 32809-7892
E-mail: environmental@penske.com Contact Number: 610-223-7164
Product Name: Rolls Royce
Model Number(s): Sub-based Product Type: Belly tank for Generator
Rule(s) citation that registration is being requested within Chapter 62-761 (UST), and/or 62-762 (AST), F.A.C.: 62-762

Write a brief description of equipment registration request including product limitations:

Tank is exclusive to the back-up emergency generator and is not to be used or interchangeable with any other equipment on site. UL-142 certified

Information Checklist (Choose Yes, No, or N/A - Not Applicable):

	Yes	No	N/A
1. Third-party Certification by a Nationally Recognized Testing Laboratory? (Required)	☒	☐	☐
2. Documentation of third-party evaluation that the equipment meets DEP Rules?	☒	☐	☐
3. Documents included about the qualifications of the Nationally Recognized Testing Laboratory?	☐	☐	☒
4. Technical information and drawings included?	☒	☐	☐
5. Installation instructions included?	☐	☒	☐
6. Annual Operability Testing Requirements (Rules 62-761.500, 62-762.501, & 62-762.502 F.A.C.)?	☐	☐	☒
7. Integrity Testing Requirements (Rules 62-761.700, 62-762.701, & 62-762.702, F.A.C.)?	☒	☐	☐
8. Compatible with fuel blends containing >10% ethanol or >20% biodiesel?	☒	☐	☐
9. Has the product been approved or registered in other countries or states? (If so provide list)	☐	☒	☐
10. Any requirements for company-certified installers or trainers?	☐	☐	☒
11. Was this product(s) previously approved or registered by the Department? If yes, EQ-_____	☐	☒	☐
12. Any changes or modifications to the equipment since the last submittal to DEP?	☐	☐	☒

Document Information: Provide supporting documents indicated as "Yes" above including this form via email to Tanknotify@floridadep.gov, or documents can be sent to FDEP, Division of Waste Management, 2600 Blair Stone Road, MS 4560, Tallahassee, FL 32399.

Write a brief description of equipment installation and performance in the U.S.:

Emergency Generator installed at warehouse facility for back-up power. Other than normal usage, generator will be powered for normal maintenance time periods.

Equipment Registration Certification:

To the best of my knowledge and belief, all information submitted on this form is true, accurate and complete.

Jody Cope, Director, Environmental Compliance
Printed Name and Title

Signature (right click to sign)

03/25/2026
Date

For Department Use Only:

Date Application Received: 03/25/2026

Application complete:

Yes: ☒ No: ☐

EQ- 1048 Date of complete or incomplete letter sent: 03/25/2026

Date Equipment Requires Renewal: 03/26/2031

Storage tank system equipment requires renewal every 5 years in accordance with subsection 62-762.851(2), F.A.C.

RECORD SUBMITTAL MANUAL

800KW DIESEL GENERATOR SET

PROJECT

PENSKE LOGISTIC
100 SUNPORT LAND SUITE 400
ORLANDO, FL 32809-7892

CUSTOMER

LUCA ELECTRIC
4575 BROWNSVILLE ROAD
POWDER SPRINGS, GA 30127



PRESENTED BY: LISA HALLMON
PREPARED BY: ANGELA BREWER
THE W.W. WILLIAMS COMPANY, LLC
PROJECT NO: CPQ 19846
DATE: FEBUARY 8, 2024



W.W. Williams
POWER SOLUTIONS

Review and Sign For Approval

Signature: _____

Company: _____

Date: _____

			 W.W. Williams POWER SOLUTIONS	ATTACHED TOOLS		DRAWN BY: _____ CHECKED BY: _____ DATE: _____	REVISIONS: _____ DATE: _____	PROJECT: _____ DRAWING NO.: _____	TITLE: _____ SCALE: _____	SHEET NO.: _____ TOTAL SHEETS: _____

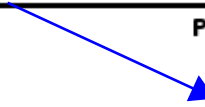
CONTACT INFORMATION

PROJECT MANAGEMENT

Angela Brewer, Project Manager
The W.W. Williams Co. LLC, Power Generation Division
2849 Moreland Avenue Southeast
Atlanta, GA 30315
abrewer@wwwilliams.com
(m) 404-369-7573

SALES

Lisa Hallmon, Generator Sales Representative
2849 Moreland Avenue Southeast
Atlanta, GA 30315
lhallmon@wwwilliams.com
(m): 470-989-5682

PLEASE RETURN SUBMITTAL TO:	
Angela Brewer abrewer@wwwilliams.com	
COMMENTS Please review drawings and sign the front of the record submittal. Return to abrewer@wwwilliams.com 	  W.W.Williams® Consider It Done. ☐ Approved ☐ Approved As Noted ☒ Release for Build ☐ Hold for Release ☐ Revise and Resubmit ☐ Rejected Signature: _____ Company: _____ Date: _____



W.W. Williams
CONSIDER IT DONE.

TABLE OF CONTENTS

Section 1

Bill of Material

Section 2

Generator Data Sheet
MGC Control
Alternator Data
Digital Voltage Regulator
Prototype Test Summary
UL2200 Certificate
Emissions Certificate

Section 3

Engine Starting Battery
Battery Charger
Jacket Water Heater
Circuit Breakers
Remote Annunciator
Remote E-Stop
Vibration Pad Isolators

Section 4

Enclosure Data Sheet
Fuel Tank Data Sheet

Section 5

Automatic Transfer Switch Data and Drawings

Section 6

Assembly Layout Drawing
Reference Pad Layout
Open Unit Drawing
Fuel Tank Drawings
Electrical Drawings

Section 7

Generator Warranty



A Rolls-Royce
solution

Section 1

Bill of Material

Project: Penske Logistics 800KW Quote#: CPQ 19846

BILL OF MATERIAL

Page 1 of 5

MTU A Rolls-Royce Solution 800kW/1000kVA UL2200 Generator Set**One (1) MTU Diesel Engine Driven Generator Set, Standby rated at 0.8 Power Factor, 480Y/277 Volt 3 Phase, equipped as follows for OUTDOOR application:****Engine:**

- DS800 MTU 12V 2000 G85 TB, 23.9L, EPA Tier 2 Certified
- **MTU Standby Rating Average Load Factor = 85% (other engine manufacturers only allow 70%)**
- Engine Coolant 50/50 Mix, and Engine Oil

Cooling System:

- Unit Mounted Radiator, 50°C (122°F) Capability
- Qty. One (1), Engine Jacket Water Heater, -20°F Block Heater, 5000W, with ball type isolation valves. (120V 1PH input)

Starting System, Qty One (1):

- Electric Starting Motor, 24VDC
- Battery Charging Alternator
- Qty. Two (2), Battery Sets, 24VDC Lead Acid type with battery rack and cables.
- Qty Two (2), MicroGenius 10 amp Battery Charger, NFPA 110. Mounted and Wired. 120VAC input required.

Instrumentation & Controls:

- Isochronous Electronic Governor (frequency reg. +/- .25%)
- MGC 2020 Control Panel, Unit Mounted

MTU Digital Genset Controller MGC-2000 series integrated genset control system providing genset control, transfer switch control, metering, protection, and programmable logic in one package.

- **MGC 2020 Standard Features:** Phase Imbalance (47), Overvoltage (59), Undervoltage (27), Underfrequency (81U), Overfrequency (81O), Reverse Power (32), Loss of Excitation (40Q), Overcurrent (51), Vector Shift (78), Rate of Change of Frequency (81R), 16 Digital Inputs, 3 Dedicated Analog Inputs; Outputs: 3 Digital Form A 30- amp, 12 Digital Form A 2-amp

BESTCOMSPlus® - Windows®-based software for optional remote operation is included and can be downloaded at www.mtuonsiteenergy.com.

The following optional features are included:

- High Fuel Level Pre-Alarm
- Critical Low Fuel Level Alarm
- (4) Relay Option: The 4-relay board includes (4) 10-amp form C relays customizable for user defined functionality requirements.
- Modbus TCP/IP: ModBus RTU provides Ethernet communication transmission.
- Qty. One (1), Remote Annunciator Panel – NFPA 110 (Shipped Loose)
- Remote E-Stop Break Glass Station (Shipped Loose)

Generator (Alternator):

- Brushless, 2/3 Pitch, **Permanent Magnet Generator (PMG)** Alternator rated for **800kW/1000kVA** at **130°C** temp rise.

The W.W. Williams Company, LLC • 2849 Moreland Ave SE • Atlanta, GA 30315A Rolls-Royce
solution

Project: Penske Logistics 800KW Quote#: CPQ 19846

BILL OF MATERIAL

Page 2 of 5

PMG Standard Voltage Regulator: $\pm 0.25\%$ regulation. Includes Voltage adjust rheostat, EMI filter, Under- speed protection, and Over-excitation protection. Fully encapsulated construction.

Circuit Breaker:

- Factory Mounted
 - 1200 Amp 3 Pole, 100% Rated, LSI
 - Auxiliary Contact
 - Shunt Trip

Generator Enclosure:

- Level 2 Basic Sound Attenuated Enclosure
- Steel Construction
- Wind Rated at 130 mph
- Vibration Isolators: Pad Isolators (Standard)
- Exhaust Louver: Fixed
- Intake Louver: Fixed

Exhaust System:

- Internal Critical Grade Silencer with Stainless Steel Flex, Elbow and Rain cap.

Fuel System:

24-Hour/ 1515 Gallon UL 142 Sub-Base Tank with Electrical Stub-Up

Standard Features:

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

sender. Optional Features:

- Fuel Fill Spill Containment (5 gallon)
- Standard Vents
- Standard Leak Switch
- Fuel Water Separator
- Standard Vents

The W.W. Williams Company, LLC • 2849 Moreland Ave SE • Atlanta, GA 30315A Rolls-Royce
solution

Project: Penske Logistics 800KW Quote#: CPQ 19846

BILL OF MATERIAL

Page 3 of 5

Warranty:

- 2 Yr/3000 Hour Basic Standby Limited Warranty from MTU
(MTU A Rolls-Royce Solution manufacturer's warranty commences on the date that W.W. Williams completes generator start-up.)

Instruction Manuals:

- O-M Manuals, Electronic Copy

Factory Testing:

- Standard Factory Test at 0.8 Power Factor

Onsite Services:

NFPA 110 Start-up inspection includes One (1) Trip with Four (4) hour load bank test using portable resistive load bank, to be completed during normal business hours, Monday thru Friday (excluding holidays). Additional trips or hours onsite, due to construction or other delays beyond our control, will be billed at extra cost at prevailing rates. Generator sets not started up within six months of shipment may require preservation at additional cost.

- Training of operating personnel

Simulated power outage test using available site loads during start-up.

Shipping Data:

Generator Set

Assembly Dimensions: 300"L x 109"W x 132"H
Assembly Weight: 26,510 lbs. (Excludes Fuel)

The W.W. Williams Company, LLC • 2849 Moreland Ave SE • Atlanta, GA 30315A Rolls-Royce
solution

Project: Penske Logistics 800KW Quote#: CPQ 19846
BILL OF MATERIAL

Page 4 of 5

TERMS AND CONDITIONS

These Terms and Conditions apply to all sales transactions with The W.W. Williams Company, LLC, including quotations, purchase orders, service orders, sales orders, or similar documents:

1. **Terms Exclusive.** These Terms and Conditions and the applicable quotation, purchase order, service order, sales order or similar document constitute the complete, exclusive and final agreement (collectively, the "Agreement") of the buyer ("Buyer") and The W.W. Williams Company, LLC ("Williams"). All other additional or conflicting terms or conditions which may now or in the future appear on Buyer's acknowledgment, purchase order, or other similar document are expressly objected to by Williams without future notification and shall be null and void. These Terms and Conditions may only be modified, superseded or altered in writing signed by both parties. Buyer's acceptance of any performance by Williams shall be taken as Buyer's acceptance of these Terms and Conditions.
2. **Prices.** Prices are subject to change or withdrawal without notice. Unless otherwise stated in the Agreement, prices may be adjusted to and invoiced at Williams's price list in effect at the time of the shipment of goods or furnishing of the services. Unless otherwise stated in the Agreement, prices are exclusive of applicable taxes, excises, duties, quotation fees or other governmental impositions which Williams may be required to pay or collect on behalf of Buyer.
3. **Payment Terms; Security Interest.** Extensions of credit by Williams are subject to credit approval by Williams in its sole discretion, which may be modified or revoked by Williams at any time. Unless otherwise stated in the Agreement, payment shall be due and payable in full and without setoff within 15 days following delivery of the goods or completion of the services. Any payment not made when due shall be subject to a carrying charge of one and one-half percent (1 ½%) per month on the unpaid balance until paid in full. Buyer expressly grants to Williams a security interest in any goods, or a mechanic's or garage keeper's lien, as applicable, in respect of any services, to secure payment of the purchase price therefore and any other amounts or charges owed by Buyer to Williams. Buyer authorizes Williams (but Williams is not obligated) to file a financing statement or take such action as Williams deems advisable to evidence and perfect its security interest.
4. **Delivery; Force Majeure.** Unless otherwise stated in the Agreement, delivery of the goods, and services, if any, shall be F.O.B. point of shipment. Any delivery date specified is approximate only. Acceptance of shipment by a common carrier shall constitute tender of delivery. Upon tender of delivery, risk of loss shall pass to Buyer. Title shall pass to Buyer when the full price has been paid. Partial shipments may be made and payments therefore shall become due in accordance with the terms hereof as shipments are made and invoices rendered. If Williams is not able to meet the delivery date specified by reason of any force majeure event beyond Williams's control, including (but not limited to) war, governmental requests, restrictions or regulations, fire, flood, casualty, accident, or other acts of God, strikes or other difficulties with employees, supplier delays, delay or inability to obtain goods, labor, equipment, material and service through Williams's usual sources, failure, refusal or delay of any carrier to transport materials, or any other similar event, Williams shall not be liable therefor and may, in its discretion without prior notice to Buyer, postpone the delivery date(s) under this Agreement for a time which is reasonable under all the circumstances. Acceptance of the goods or services shall constitute a waiver of all claims for damages.
5. **Standard Limited Warranty; Limitations of Liability.** The Williams Standard Limited Warranty and the limitations of liability contained therein, attached as Exhibit A hereto, shall apply to the purchase and sale of goods and services under this Agreement.
6. **Indemnification.** Buyer shall indemnify, defend, and hold harmless Williams, its directors, officers, employees and their respective affiliates against any claim, demand, complaint, liability, loss, cost, damage and/or expense (including attorneys' fees, costs and expenses of litigation and settlements) incurred by Williams arising out of or as a result of this Agreement, except to the extent caused by the negligence of Williams.
7. **Claims.** Unless otherwise stated in the Agreement, claims respecting the condition of goods, compliance with specifications, or any other matter affecting goods shipped or services provided to Buyer, must be made promptly and in no event later than twenty (20) days after receipt of the goods by Buyer or the furnishing of the services by Williams. Failure of Buyer to make a claim within such 20-day period shall be deemed an unqualified acceptance of the goods or services by Buyer. Buyer shall set aside, protect, and hold such goods (without charge to Williams) without further processing until Williams has an opportunity to inspect and advise of the disposition, if any, to be made of such goods. In no event shall any goods be returned, reworked, or scrapped by Buyer without the express written authorization of Williams.
8. **Default and Williams's Remedies.** If Buyer fails to make timely payment on any sale of goods or services from Williams to Buyer, Williams, in addition to any other remedies available to it, may at its option, (a) defer further shipment or services until such payments are made and satisfactory credit arrangements are reestablished or (b) cancel the balance of any order, and Buyer shall not have any cause of action or be entitled to any offset, counterclaim, or recoupment against Williams by reason of such action. In the event of Buyer's default, Williams may exercise any and all remedies set forth in this Agreement, any other agreement between the parties, and applicable law, all of which rights and remedies are cumulative.
9. **Collection Costs and Attorney Fees.** Buyer agrees to pay all of Williams's costs and expenses incurred in collecting payments due from Buyer (including without limitation reasonable attorney fees and costs and expenses of any collection agency).
10. **Return Policy.** Returns must be accompanied by this invoice and in the original, unopened box or packaging. A 15% restocking charge will be applied to all returned items. No returns on electrical items. No returns on special order items. No returns after 30 days from invoice date.
11. **Technical Assistance.** Unless otherwise stated in the Agreement: (a) any technical advice provided by Williams with respect to the use of goods or services furnished to Buyer shall be provided as a courtesy without charge and without warranty; (b) Williams assumes no obligation and disclaims all liability for any such advice or for any results occurring as a result of the application of such advice; and (c) Buyer shall have sole responsibility for selection and specification of the goods and services appropriate for the end use of such goods or services.
12. **Miscellaneous.** This Agreement will be governed by the laws of the State of Ohio. The exclusive venue for any dispute related to this Agreement shall be the federal and state courts located in Columbus, Ohio. If any of the provisions hereof shall be held invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall in no way be affected or impaired thereby. The individual rights and remedies of Williams reserved herein shall be cumulative and additional to any other or further remedies provided in law or equity. Waiver by Williams of performance or inaction with respect to Buyer's breach of any provision hereof, or failure of Williams to enforce any provision hereof which may establish a defense or limitation of liability, shall not be deemed a waiver of future compliance therewith or a course of performance modifying such provision, and such provision shall remain in full force and effect as written.
13. **Entire Agreement.** This Agreement, including without limitation the Terms and Conditions and any other document incorporated herein by reference, constitutes the sole and entire agreement between Buyer and Williams with respect to any order or sale of goods or furnishing of services to Buyer, superseding completely any prior or contemporaneous oral or written communications.

The W.W. Williams Company, LLC • 2849 Moreland Ave SE • Atlanta, GA 30315

 A Rolls-Royce
 solution

EXHIBIT A**W.W. Williams**
CONSIDER IT DONE.**The W.W. Williams Company, LLC****Standard Limited Warranty*****Limited warranty for parts and equipment:***

The sole warranty provided for any part or equipment sold by The W.W. Williams Company, LLC (“Williams”) is to assign the warranty offered by the manufacturer or supplier to the Buyer. WILLIAMS MAKES NO REPRESENTATION OR WARRANTY TO THE EFFECTIVENESS OR EXTENT OF SUCH MANUFACTURER OR SUPPLIER WARRANTY. WILLIAMS EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, and does not assume or authorize any other person to assume for it any liability in connection with the sale.

Limited warranty for services:

Williams warrants its workmanship for a period of ninety (90) days from the date the services are performed (the “Warranty Period”). This warranty covers defects in Williams’s workmanship that are discovered during the Warranty Period. Buyer’s sole remedy, and Williams’s only liability, for Williams’s breach of its service warranty shall be, at Williams’s option, (i) reperforming the defective services; or (ii) refunding the purchase price paid for the defective services. WILLIAMS EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, and does not assume or authorize any other person to assume for it any liability in connection with the sale.

Limitations of Liability:

IN NO EVENT SHALL WILLIAMS BE LIABLE FOR ANY PUNITIVE, INDIRECT, INCIDENTAL, CONSEQUENTIAL, SPECIAL OR UNKNOWN DAMAGES, INCLUDING BUT NOT LIMITED TO, LOSS OF PROPERTY OR EQUIPMENT, LOSS OF DATA, LOSS OF USE, LOSS OF TIME, LOSS OF REVENUE, LOSS OF PROFIT, OR LOSS OF INCOME, WHETHER THE DAMAGES BE IN CONTRACT OR TORT.

WILLIAMS’S TOTAL LIABILITY FOR ANY PARTS, EQUIPMENT, OR SERVICES SOLD SHALL NOT EXCEED THE AMOUNT PAID TO WILLIAMS FOR SUCH PARTS, EQUIPMENT, OR SERVICES CAUSING THE LIABILITY.



Section 2

Generator Data Sheet

MGC Control

Alternator Data

Digital Voltage Regulator

Prototype Test Summary

UL2200 Certificate

Emissions Certificate



Diesel Generator Set

mtu 12V1600 DS800

800 kWe/60 Hz/Standby/208 - 600V

Reference **mtu 12V1600 DS800 (730 kWe)** for
Prime Power for Stationary Emergency Rating Technical Data



System ratings

Voltage (L-L)	208V [†]	240V [†]	380V [†]	480V [†]	600V
Phase	3	3	3	3	3
PF	0.8	0.8	0.8	0.8	0.8
Hz	60	60	60	60	60
kW	800	800	800	800	800
kVA	1,000	1,000	1,000	1,000	1,000
Amps	2,775	2,405	1,519	1,202	962
skVA@30% voltage dip	2,375	2,375	2,675	2,575	3,600
Generator model	LSA 49.3 L10	LSA 49.3 L10	LSA 49.3 L9	LSA 49.3 M8	LSA 49.3 L9
Temp rise	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C
Connection	12 LEAD WYE	12 LEAD DELTA	6 LEAD WYE	6 LEAD WYE	6 LEAD WYE

[†] UL 2200 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
- Seismic certification – optional
 - 2021 IBC certification
 - HCAI pre-approval
- UL 2200 - optional (refer to *System ratings* for availability)
- CSA - optional
 - CSA C22.2 No. 100
 - CSA C22.2 No. 14
- 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%.



A Rolls-Royce
solution

Standard features*

- Single source supplier
- Global product support
- Two (2) Year/3,000 Hour Basic Limited Warranty
- 12V1600 diesel engine
 - 22.44 liter displacement
 - Common rail fuel injection
 - 4-cycle
- HVO and GtL fuels meeting fuel specification EN15940
- Engine-generator resilient mounted
- Complete range of accessories
- Cooling system
 - Integral set-mounted
 - Engine-driven fan
- Generator
 - Brushless, rotating field generator
 - 2/3 pitch windings
 - Permanent Magnet Generator (PMG) supply to regulator
 - 300% short circuit capability
- Digital control panel(s)
 - UL recognized, CSA certified, 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
- Thermostats
- Blower fan and fan drive
- Radiator - unit mounted
- Electric starting motor - 24V
- Governor - electronic isochronous
- Base - formed steel
- SAE flywheel and bell housing
- Charging alternator - 24V
- Battery box and cables
- Flexible fuel connectors
- Flexible exhaust connection
- EPA certified engine

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, CSA certified, CE approved
- Event recording
- IP 54 front panel rating with integrated gasket
- NFPA 110 compatible

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
- 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
- $\pm 0.25\%$ voltage regulation no load to full load
- 100% of rated load - one step
- 5% maximum total harmonic distortion

Application data

Engine

Manufacturer	mtu
Model	12V1600G81S
Type	4-cycle
Arrangement	12-V
Displacement: L (cu in)	22.44 (1,369)
Bore: cm (in)	12.6 (4.96)
Stroke: cm (in)	15 (5.91)
Compression ratio	15.89:1
Rated rpm	1,800
Engine governor	electronic isochronous (ADEC)
Maximum power: kWm (bhp)	890 (1,193)
Steady state frequency band	± 0.25%
Air cleaner	dry

Liquid capacity

Total oil system: L (gal)	73 (19.3)
Engine jacket water capacity: L (gal)	65 (17.2)
System coolant capacity: L (gal)	109 (28.8)

Electrical

Electric volts DC	24
Cold cranking amps under -17.8 °C (0 °F)	1,050
Batteries: group size	4D
Batteries: quantity	2

Fuel system

Fuel supply connection size	-10 JIC 37° female
Fuel return connection size	-6 JIC 37° female
Maximum fuel lift: m (ft)	3 (10)
Recommended fuel	diesel #2/HVO
Total fuel flow: L/hr (gal/hr)	344.1 (90.9)

Fuel consumption

At 100% of power rating: L/hr (gal/hr)	206.7 (54.6)
At 75% of power rating: L/hr (gal/hr)	153 (40.4)
At 50% of power rating: L/hr (gal/hr)	108.8 (28.7)

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 ₂ O)	0.2 (0.8)
Water pump capacity: L/min (gpm)	517 (137)
Heat rejection to coolant: kW (BTUM)	305 (17,345)
Heat rejection to after cooler: kW (BTUM)	235 (13,364)
Heat radiated to ambient: kW (BTUM)	75.4 (4,290)
Fan power: kW (hp)	29 (38.9)

Air requirements

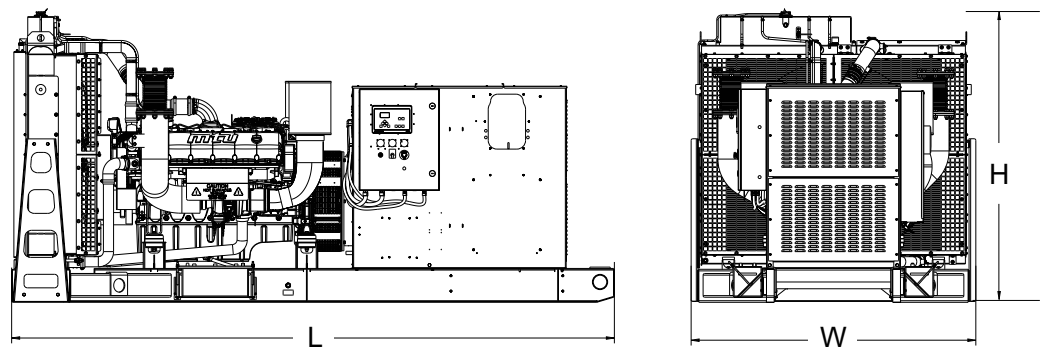
Aspirating: *m ³ /min (SCFM)	70.8 (2,500)
Air flow required for radiator cooled unit: *m ³ /min (SCFM)	1,007 (35,579)
Remote cooled applications; air flow required for dissipation of radiated generator set heat for a maximum of 25 °F rise: *m ³ /min (SCFM)	276 (9,796)

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

Exhaust system

Gas temperature (stack): °C (°F)	497 (927)
Gas volume at stack temperature: m ³ /min (CFM)	171 (6,039)
Maximum allowable back pressure at outlet of engine, before piping: kPa (in. H ₂ O)	8.5 (34.1)

Weights and dimensions



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

System	Dimensions (L x W x H)	Weight
Open Power Unit (OPU)	4,521 x 2,135 x 2,179 mm (178 x 84.1 x 85.8 in)	4,774-5,829 kg (10,524-12,850 lb)

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

Sound data

Unit type	Standby full load
Level O (OPU): dB(A)	94.2

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

Emissions data

NO _x + NMHC	CO	PM
8.01	0.95	0.04

- 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.

C/F = Consult Factory/**mtu** Distributor



Digital Generator Set Controller Data Sheet

MGC-2000 Series

The MGC-2000 Series controllers include the following models which are described throughout this document.*

- MGC-2010
- MGC-2020
- MGC-2050

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



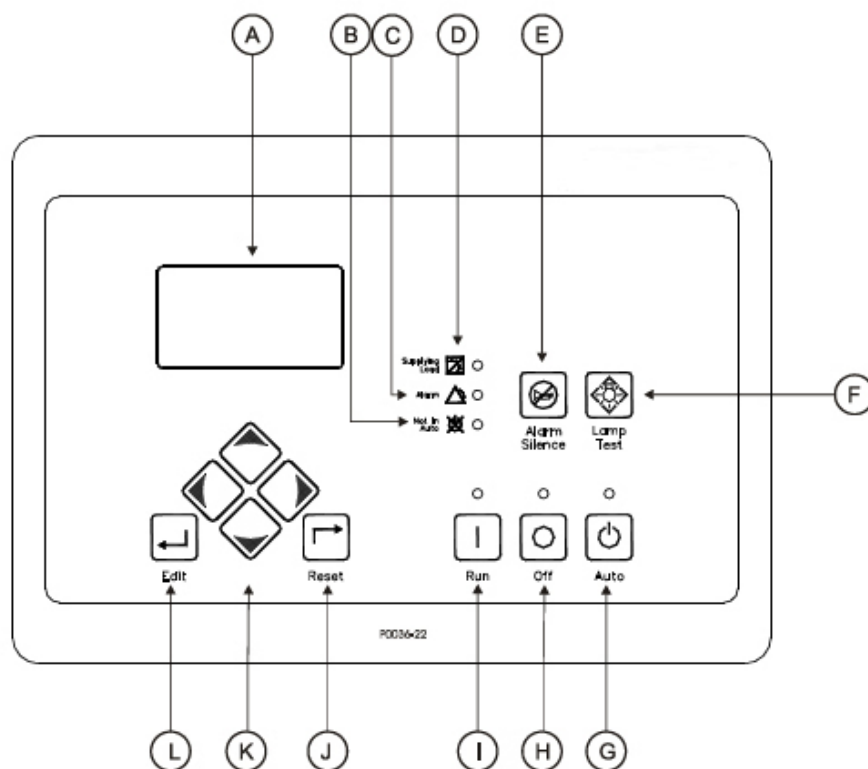
PRODUCT HIGHLIGHTS

- Three-phase generator metering
- Engine metering
- Generator set control
- Engine and generator protection
- Var sharing over Ethernet
- BESTCOMSPlus®
 - 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
- Exercise timer
- Suitable for use on rental generator sets with high/low line sensing, single or three phase sensing override, and wye/delta/grounded delta
- SAE J1939 Engine Control Unit (ECU) communications
- Automatic generator configuration detection
- Selection of integrating reset of instantaneous reset characteristics for overcurrent protection
- Multilingual capability
- Remote annunciation to RDP-110
- Extremely rugged, fully potted design
- 16 programmable contact inputs, 12 programmable contact outputs
- ModBus™ communications with RS-485 (Refer to *Configuration Options*.)
- UL recognized, CSA certified, CE approved
- Highly Accelerated Life Tests (HALT) tested
- IP 54 front panel rating with integrated gasket
- NFPA-110 compatible
- Microprocessor based
- Complete system metering
- Expandable to meet customer needs

*Please refer to the last page of this data sheet for available MGC-2000 Series configuration options. The MGC Series Controller Comparison Data Sheet is available as a reference for all MGC Series configuration options.

MGC-2000 Series Digital Generator Set Controller Data Sheet

DIAGRAM



Front Panel Descriptions

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

FUNCTIONS

Generator set protection

Generator ANSI codes

- Overvoltage (59)
 - Overfrequency (81o)
 - Reverse power (32)
 - Undervoltage (27)
 - Underfrequency (81u)
 - Loss of excitation (40q)
 - Phase imbalance (47)
 - Overcurrent (51) (optional)
 - Vector shift (78) (optional)
 - Rate of change of frequency (ROCOF) (81R)
- (Refer to *Configuration Options*.)

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*.)

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

FUNCTIONS, continued:

Generator Set Protection, continued:

Pre-alarms (Warnings)

- Low oil pressure
- High coolant temperature
- Low coolant temperature
- Battery overvoltage
- Weak battery voltage
- Aem comms failure
- Breaker open failure
- Cem comms failure
- Generator reverse rotation
- Engine kw overload (three levels)
- Loss of sensing
- Checksum failure
- Ecu comms fail
- Low fuel level
- High fuel level
- Active diagnostic trouble codes (DTC)
- Breaker close failure
- Low battery voltage

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

Generator set metering

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

Engine control

- Cranking control: cycle or continuous (quantity and duration fully programmable)
- Engine cooldown: smart cooldown function saves fuel and engine life
- Successful start counter: counts and records successful engine starts
- Timers:
 - Engine cooldown timer
 - Engine maintenance timer
 - Pre-alarm time delays for weak/low battery voltage
 - Alarm time delay for overspeed
 - Alarm time delay for sender failure
 - Arming time delays after crank disconnect:
 - Low oil pressure
 - High coolant temperature
 - Pre-crank delay
 - Continuous or cycle cranking time delay
 - Programmable logic timers

Event recording

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

Transfer switch control (Mains failure)

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

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

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

ModBus™ RTU

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

Programmable logic

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

MGC-2000 Series Digital Generator Set Controller Data Sheet

FUNCTIONS, continued:

Remote display panel annunciation

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

External modem interface

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

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

SAE J1939 communications

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

SPECIFICATIONS

Operating power

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

Current sensing (5 A CT inputs)

- Continuous rating: 0.1 to 5.0 Aac
- One second rating: 10 Aac
- Burden: 1 VA

Voltage sensing

- Range: 12 to 576 V rms, line-to-line
- Frequency range: 10 to 72 Hz
- Burden: 1 VA
- One second rating: 720 V rms

Input contacts

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

Engine System Inputs

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

Output contacts

- (15) total programmable outputs: (3) 30 A @ 28 VDC and (12) 2 A @ 30 VDC
- The factory utilizes the following on each generator set which can be reprogrammed as needed:
 - (3) 30 A @ 28 VDC for pre-start, start, and run
 - (12) 2 A @ 30 VDC for general purpose

SPECIFICATIONS, continued:

Metering

Generator and bus voltage (rms)

- Metering range: 0 to 576 VAC (direct measurement); up to 9,999 VAC (with appropriate voltage transformer)
- Accuracy: $\pm 1\%$ of programmed rated voltage of ± 2 VAC (subject to accuracy of voltage transformer when used)

Generator current (rms)

- Generator current is measured at the secondary windings of 5 A CTs.
- Metering range: 0 to 5,000 Aac
- CT primary range: 1 to 5,000 Aac, in primary increments of 1 Aac
- Accuracy: $\pm 1\%$ of programmed rated current or ± 2 Aac (subject to accuracy of CTs)

Generator and bus frequency

- Metering range: 10 to 72 Hz
- Accuracy: $\pm 0.25\%$ or 0.05 Hz

Apparent power

- Indicates total kVA and individual line kVA (four-wire, line-to-neutral or three-wire, line-to-line).
- Accuracy: $\pm 3\%$ or the full-scale indication or ± 2 kVA

Power factor

- metering range: 0.2 leading to 0.2 lagging
- Accuracy: ± 0.02

Real power

- Indicates total kW and individual line kW (four-wire, line-to-neutral or three-wire, line-to-line)
- Accuracy: $\pm 3\%$ of the full-scale indication or ± 2 kW

Oil pressure

- Metering range: 0 to 150 psi or 0 to 1,034 kPa
- Accuracy: $\pm 3\%$ of actual indication or ± 2 psi or ± 12 kPa (subject to accuracy of sender)

Coolant temperature

- Metering range: 0 °C to 204 °C (32 °F to 410 °F)
- Accuracy: $\pm 3\%$ of actual indication or $\pm 2^\circ$ (subject to accuracy of sender)

Fuel level

- Metering range: 0 to 100%
- Accuracy: $\pm 2\%$ (subject to accuracy of sender)

Battery voltage

- Metering range: 6 to 32 VDC
- Accuracy: $\pm 3\%$ of actual indication or ± 0.2 VDC

Engine RPM

- Metering range: 0 to 4,500 rpm
- Accuracy: $\pm 2\%$ of actual indication or ± 2 rpm

Engine run time

- Engine run time is retained in non-volatile memory.
- Metering range: 0 to 99,999 h; update interval: 6 min
- Accuracy: $\pm 1\%$ of actual indication or ± 12 min

Maintenance timer

- Maintenance timer indicates the time remaining until generator set service is due. Value is retained in non-volatile memory.
- Metering range: 0 to 5,000 h; update interval: 6 min
- Accuracy: $\pm 1\%$ of actual indication or ± 12 min

Generator protection functions

Overvoltage (59) and undervoltage (27)

- Pickup range: 70 to 576 VAC
- Activation delay range: 0 to 30 s

Overfrequency (81O) and underfrequency (81U)

- Pickup range: 45 to 66 Hz
- Pickup increment: 0.1 Hz
- Activation delay range: 0 to 30 s

Reverse power (32)

- Pickup range: -50 to 5%
- Pickup increment: 0.1%
- Hysteresis range: 1 to 10%
- Hysteresis increment: 0.1%
- Activation delay range: 0 to 30 s
- Activation delay increment: 0.1 s

Loss of excitation (40Q)

- Pickup range: -150 to 0%
- Pickup increment: 0.1%
- Hysteresis range: 1 to 10%
- Hysteresis increment: 0.1%
- Activation delay range: 0 to 30 s
- Activation delay increment: 0.1 s

MGC-2000 Series Digital Generator Set Controller Data Sheet

SPECIFICATIONS, continued:

Generator protection functions, continued:

Phase imbalance (47)

- Pickup range: 5 to 100 VAC
- Pickup increment: 1 VAC
- Activation Delay Range: 0 To 30 S
- Activation Delay Increment: 0.1 S

ROCOF (81R) (optional)

- Pickup range: 0.2 to 10 Hz/s
- Pickup increment: 0.1 Hz/s
- Activation delay range: 0 to 10,000 ms
- Activation delay increment: 1 ms
- Accuracy: 0.2 Hz/s
-

Overcurrent (51)

- Pickup range: 0.18 to 1.18 Aac (1 A current sensing)
- Time dial range: 0

Vector shift (78) (optional)

- Pickup range: 2 to 90°
- Pickup increment: 1°
- Accuracy: $\pm 1^\circ$

Environmental

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

Agency approvals

- UL/CSA approvals: "cURus" approved to UL 6200 and CSA C22.2 No.14
- NFPA compliance: complies with NFPA Standard 110, standard for emergency and standby power
- CE marked: complies with applicable EC directives

ADDITIONAL SPECIFICATIONS

Battery backup for real time clock

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

Breaker management

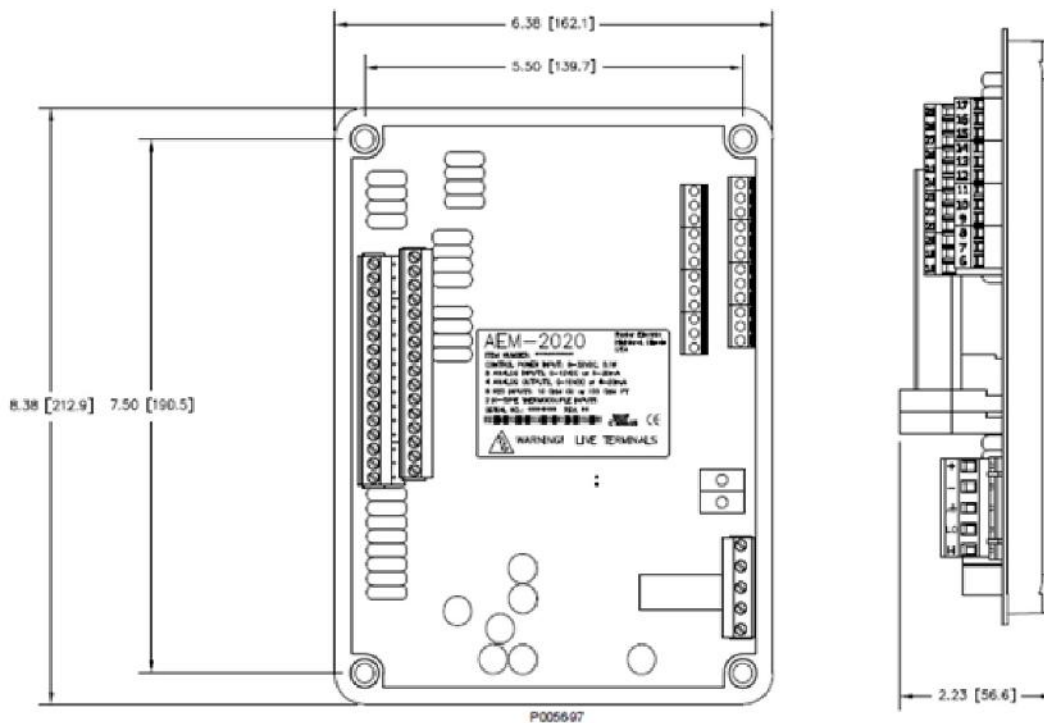
The MGC-2000 Series is capable of controlling the generator breaker and the mains breaker. The status of the breakers is determined by using BESTlogic™Plus programmable logic to set up the GENBRK and MAINSBRK logic blocks. These logic blocks have outputs that can be configured to energize an output contact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

OPTIONAL ACCESSORIES

Analog Extension Module 2020 (AEM-2020)

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

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



Input and Output Terminals

MGC-2000 Series Digital Generator Set Controller Data Sheet

OPTIONAL ACCESSORIES, CEM-2020, continued

Contact Expansion Module 2020 (CEM-2020)

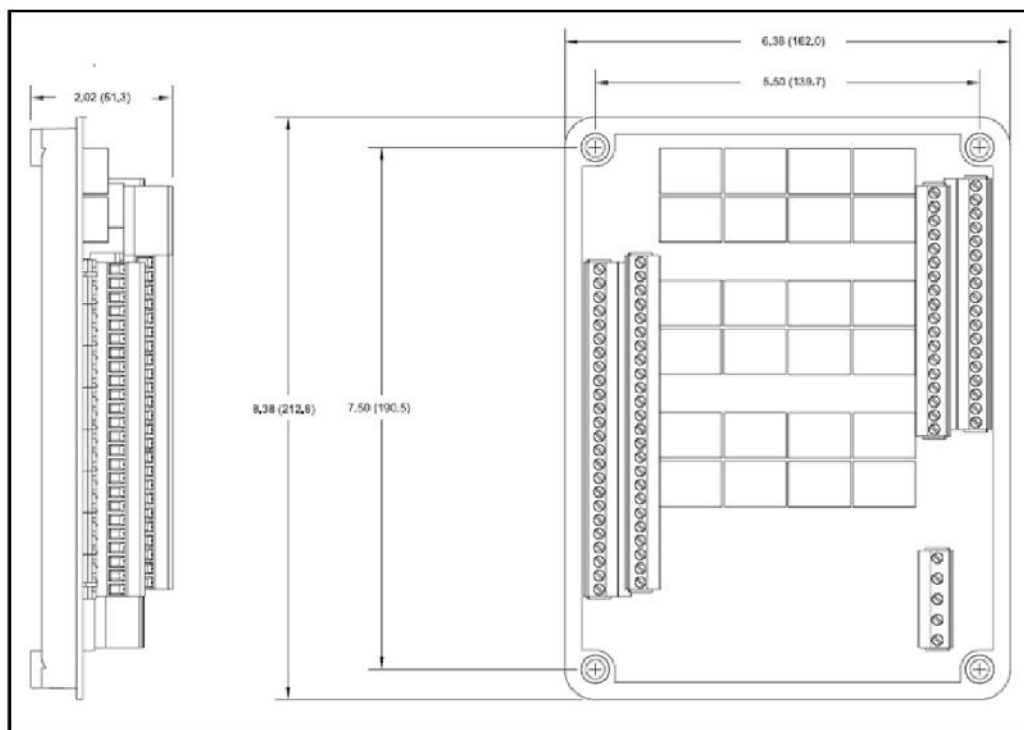
The CEM-2020 is a remote device that provides additional MGC-2000 Series contact inputs and outputs, giving the user flexibility to use the same model MGC-2000 Series generator set controller for simple or complicated applications that require contact functionality or duplication of contacts for remote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

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

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

- **Communications via CANBus:** The CEM-2020 communicates to the MGC-2000 Series via SAE J1939 CANBus communications and allows the user to program the functionality of these inputs and outputs in the BESTCOMSPlus® software.
- The user can add labels for the inputs and outputs that appear in BESTCOMSPlus®, show up on the front panel, and in programmable logic. All the functionality can be assigned

to these inputs and outputs as if they were an integrated part of the MGC-2000 Series. The CEM-2020 module has all of the environmental ratings of the MGC-2000 Series, including a model for UL Class1 Div2 applications. The CEM-2020 terminals accept a maximum wire size of 12 AWG, while the chassis ground requires 12 AWG wire. Flexibility is one of the benefits of the MGC-2000 Series, and this add-on module enhances that benefit even further.



CEM-2020 Overall Dimensions

MGC-2000 Series Digital Generator Set Controller Data Sheet

CONFIGURATION OPTIONS

Generator protection	MGC-2010	MGC-2020	MGC-2050
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			

Inputs	MGC-2010	MGC-2020	MGC-2050
Controller			
Digital	16	16	16
Analog (Dedicated)	3	3	3
Analog	-	-	-
CEM			
Digital	10	10	10
AEM			
Analog	8	8	8
TC	2	2	2
RTD	8	8	8

Outputs	MGC-2010	MGC-2020	MGC-2050
Controller			
Digital Form A, 30 Amp	3	3	3
Digital Form A, 5 Amp	-	-	-
Digital Form A, 2 Amp	12	12	12
Analog	-	-	-
CEM			
Digital Form C, 4 Amp	12	12	12
Digital Form C, 1 Amp	12	12	12
AEM			
Analog	4	4	4
External to Controllers / (CEM)			
Digital Form C, 10 Amp (Interposing Relay)	10	10	10

Communication	MGC-2010	MGC-2020	MGC-2050
ModBus RTU (RS-485)	✓	✓	✓
ModBus TCP-IP			
RDP-110	✓	✓	✓
CANBus	✓	✓	✓
Modem Interface (RS-232)		✓	✓
Ethernet			

Metering	MGC-2010	MGC-2020	MGC-2050
Bus 1 Voltage			
Single Phase	✓	✓	✓
Three Phase	✓	✓	✓
Bus 2 Voltage			
Single Phase			
Three Phase			
Current Transformers			
Generator	3	3	3
Auxiliary	-	-	-

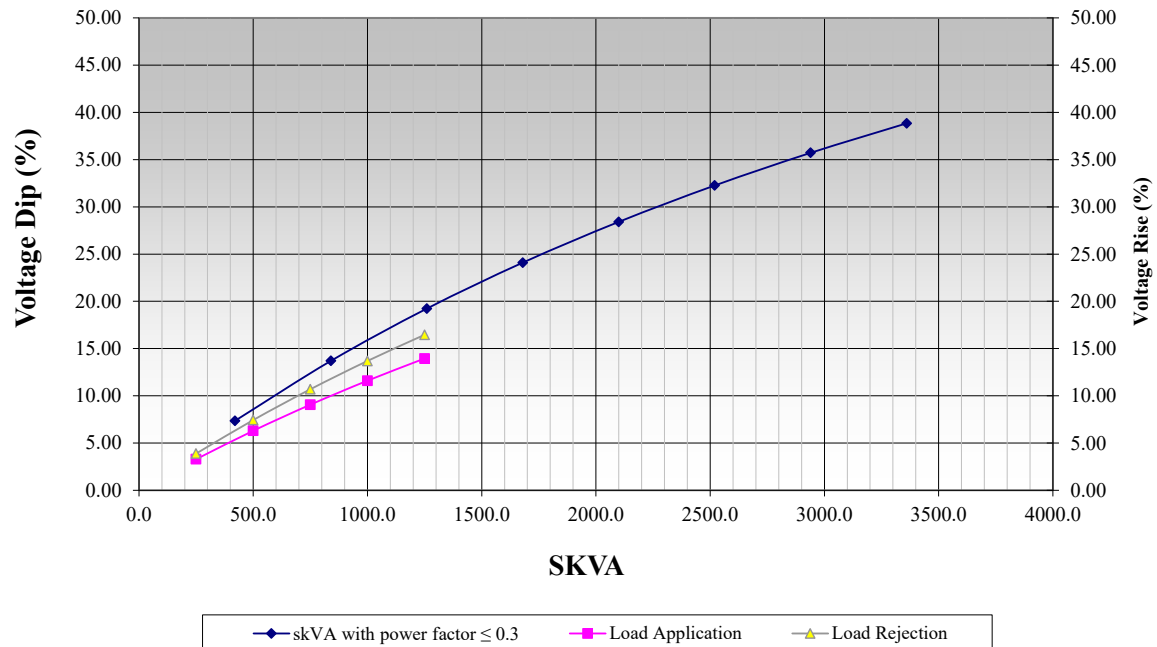
Subject to change. | WT00032340 | 2021-03

Kato Engineering-Leroy Somer, 2075 Howard Dr. W., N. Mankato, MN 56003						
507-345-4011						
41192901						
Model: LSA 49.3 M8						
Data Sheet Base Rating	KW	800	kVA	1000	Temperature Rise	130
	Voltage	480	Frequency	60	Excitation	PMG
	FLA	1203	RPM	1800	Enclosure	IP-23
	Connection	WYE	Connection Type	4 Bus Bar	Base Z	0.230
	Lead	6	Altitude	1000m	Pitch	0.67
Ratings		Voltage	480			
Application	Rise/ by Resistance @ Ambient	kW				
	Prime Power-Class B Rise	80°C / 40°C	656			
	Prime Power-Class F Marine	90°C / 50°C	681			
	Prime Power-Class F Rise	105°C / 40°C	740			
	Prime Power-Class H Rise	125°C / 40°C	820			
	Standby-Class F Rise	130°C / 40°C	820			
	Standby-Class H Rise	150°C / 40°C	872			
Efficiency - %	kW Load	0.8 PF	1.0 PF	Heat Rejection (BTU/HR)		
125	1000	94.1%	95.5%	214409		
100	800	94.7%	96.3%	153400		
75	600	95.1%	96.3%	105494		
50	400	95.1%	96.3%	70596		
25	200	93.3%	94.8%	48673		
				Saturated	Unsaturated	
Reactances - PU on Gen	Direct Axis		X _d	3.062	3.764	
	Transient Direct Axis		X' _d	0.167	0.189	
Base KW = 800kW	Subtransient Direct Axis		X'' _d	0.127	0.150	
	Quadrature Axis		X _q	1.395	1.792	
	Subtransient Quadrature Axis		X'' _q	0.149	0.175	
	Negative Sequence Reactance		X ₂	0.138	0.163	
	Zero Sequence Reactance		X ₀	0.006	0.007	
	Leakage Reactance		X _l	0.066	0.075	
Time Constants-seconds	D-Axis, 3PH, SC Transient		T' _d	0.161		
	D-Axis, 3PH, SC Sub-Transient		T'' _d	0.02		
	Arm Ckt		T _a	0.018		
	D-Axis, OC Transient		T' _{do}	2.093		
Short Circuit Ratio				0.327		
BIL				3465		
X/R Ratio				9.3		
Sequence Resistance				Actual	Percent	
	Zero Sequence R0			0.0076	3.30	
	Negative Sequence R2			0.0120	5.22	
Short Circuit Current	Type	Instantaneous/Symmetrical		Instantaneous/Asymmetrical		
		P.U.	Amps	P.U.	Amps	
	3 Phase	7.9	9451	13.6	16370	
	Line to Line	6.5	7849	11.3	13595	
	Line to Neutral	11.0	13292	19.1	23024	
Cooling Air Required	m3/sec (cfm)		—			
Resistance-ohms 25°C	Main Stator/Phase		0.00252			
	Main Rotor		0.4468			
	Exciter Stator		12.43			
	Exciter Rotor		0.083			
Bearing Size	DE		#N/A			
Bearing Size	NDE		#N/A			
Weight	Kg/(Lbs.)		#N/A			
Voltage Regulation	Standard Voltage Regulator		D700			
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		1000			
	Main Rotor		1500			
	Exciter Stator		1500			
	Exciter Rotor		1500			
Overspeed			Rated RPM + 25%			
Phase Sequence			CCWFDE, A-B-C			

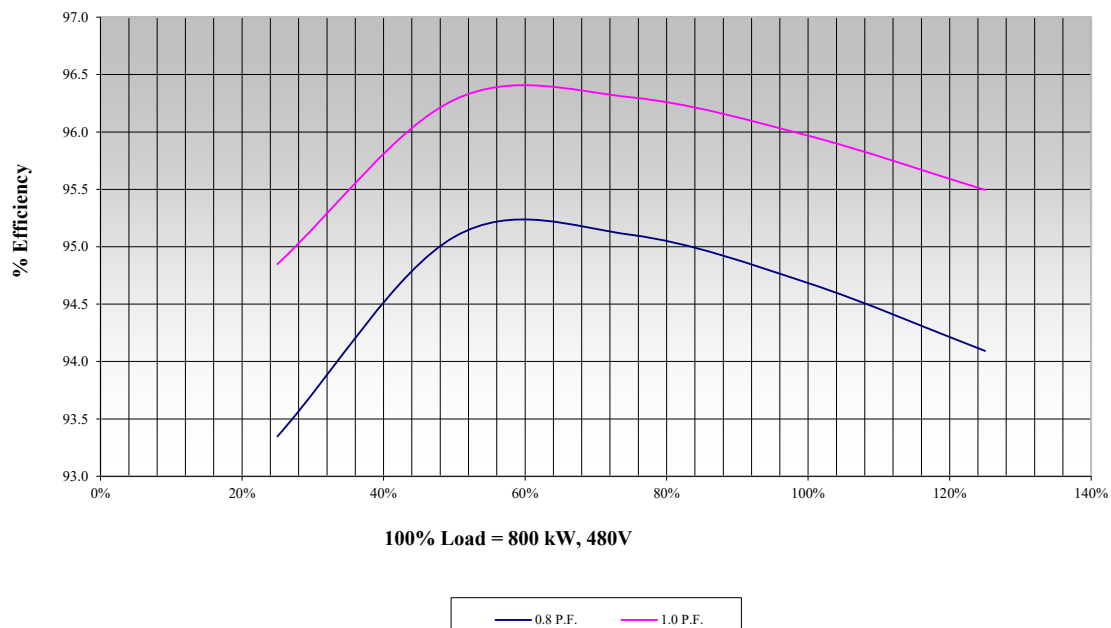
Kato Engineering-Leroy Somer, 2075 Howard Dr. W., N. Mankato, MN 56003
507-345-4011

Model: LSA 49.3 M8						
Data Sheet Base Rating	KW	800	kVA	1000	Temperature Rise	130
	Voltage	480	Frequency	60	Excitation	PMG
	FLA	1203	RPM	1800	Enclosure	IP-23
	Connection	WYE	Connection Type	4 Bus Bar	Base Z	0.230
	Lead	6	Altitude	1000m	Pitch	0.67

Motor Starting; Load Application and Rejection at Rated PF

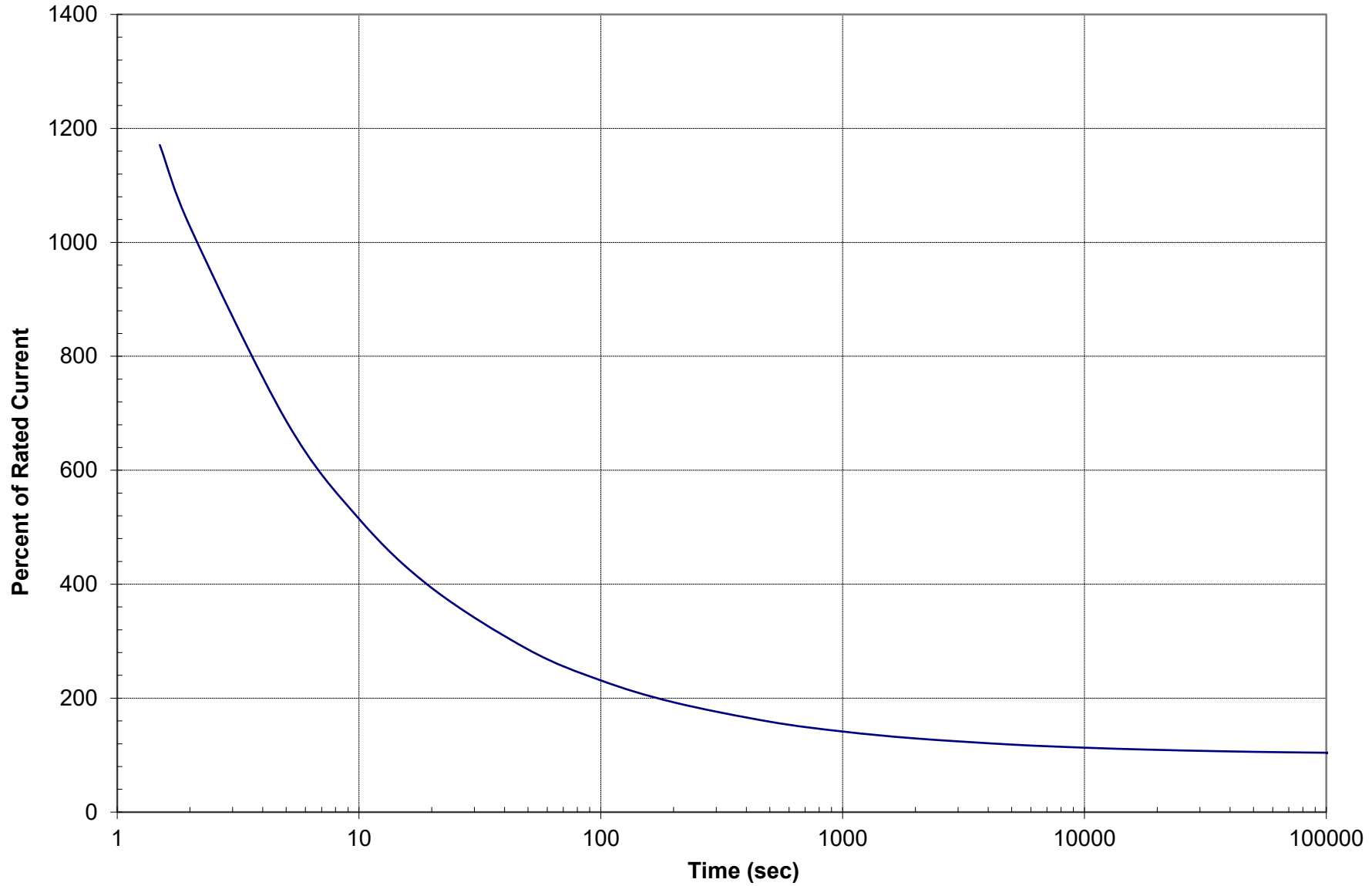


Generator Efficiency, 0.8PF and 1.0PF



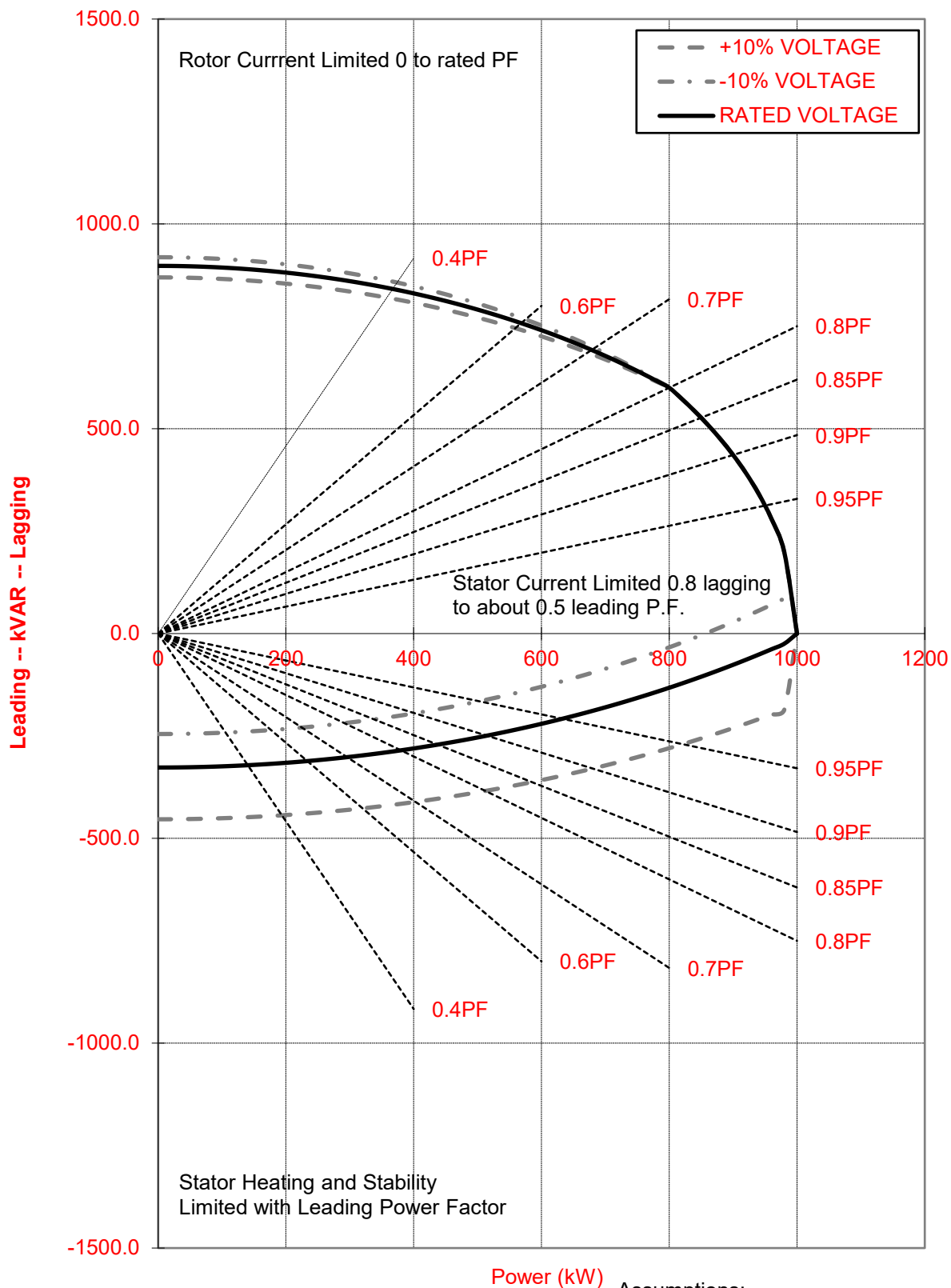
STATOR DAMAGE CURVE

CLASS H RISE, CLASS H INSULATION



REACTIVE CAPABILITY CURVE

49.3 M8 800KW 1000KVA 480V 60HZ

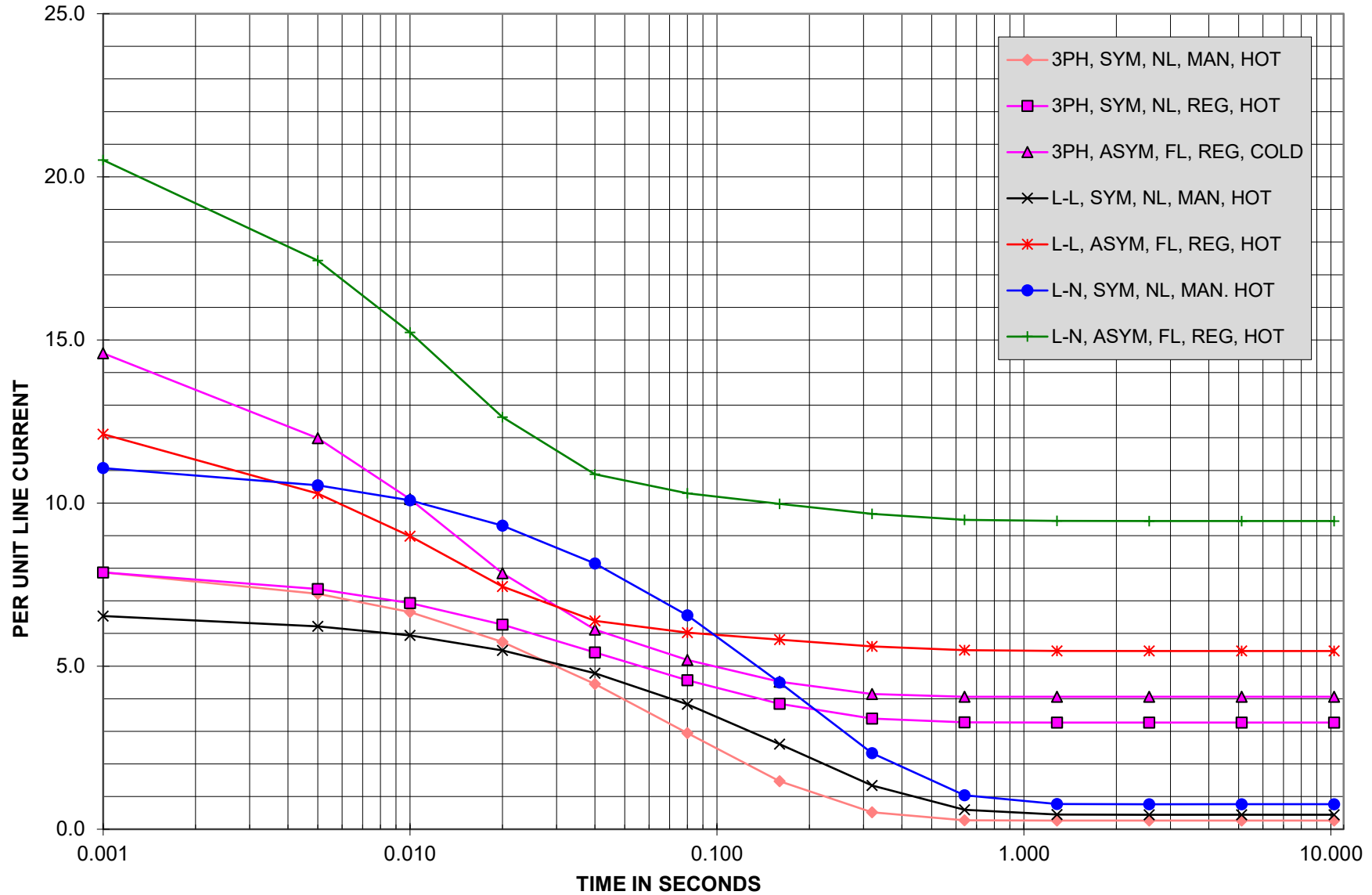


Assumptions:

1. System reactance is 0.4 P.U.
2. Regulator stability limit is not included
3. Curve is based on linear reactive loading

SHORT CIRCUIT DECREMENT CURVES

49.3 M8 800KW 1000KVA 480V 60HZ





Generator System Data Sheet

Permanent Magnet Generator (PMG)

DESCRIPTION

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



Permanent Magnet Generator*

FEATURES

Improved transient response

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

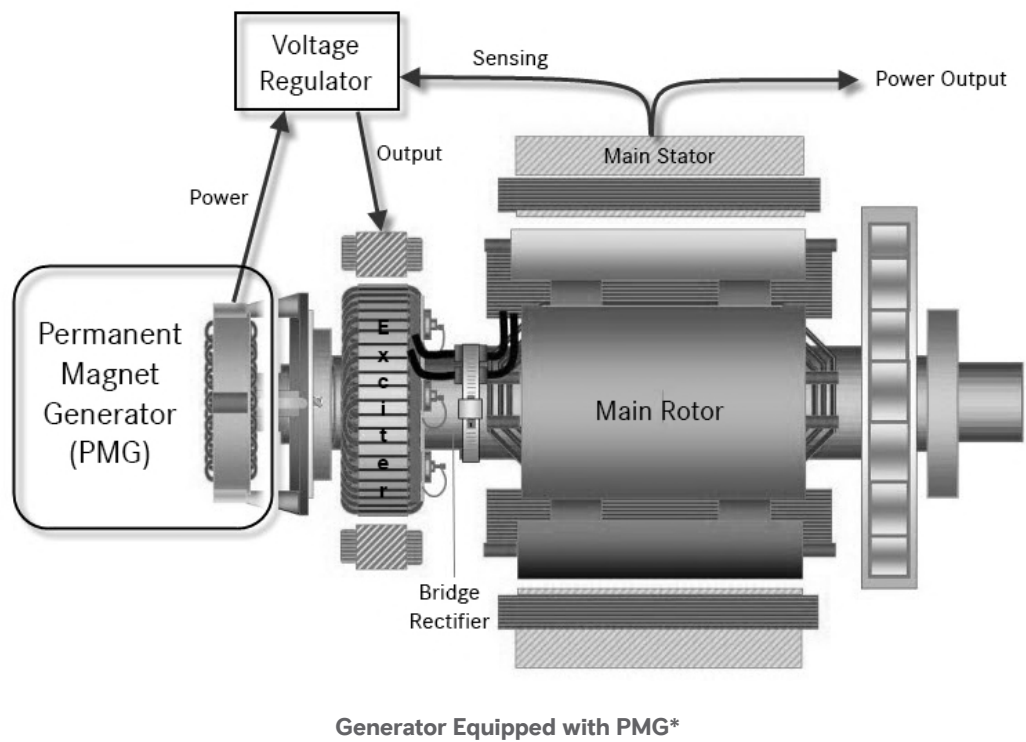
300% short circuit capability

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

Resistant to the effects of harmonics

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

Permanent Magnet Generator (PMG) Data Sheet



EXCITATION SYSTEM COMPARISON CHART

	Auxiliary Winding	Permanent Magnet Generator (PMG)
Motor starting capability	High	High
Short circuit current capability	300% at 60 Hz	300% at 60 Hz
Susceptibility to non-linear loads	Minimum	Minimum
Number of components	Minimum	Maximum
Retrofitability	No	Yes
Generator length	Minimum	Maximum
Stator design	Special	Standard with PM attachment
Voltage buildup	Uses residual magnetism and permanent magnet inserts on some frames	Positive from permanent magnets

* Note: Visual appearance may vary.

Prototype Test Summary (PTS)

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 12V1600 DS750, <u>mtu 12V1600 DS800</u> , mtu 12V1600 DS900
--------------------------------	---

Rep. Prototype Model:	mtu 12V1600 DS900	Test Date:	7/26/2021
kW:	900	kVA:	1125
Voltage:	480	Hz:	60

ENGINE/GENERATOR

Engine Manufacturer:	mtu	Engine Model:	12V1600G91S
Engine Fuel:	Diesel		
Generator Manufacturer:	Leroy-Somer	Generator Model:	LSA 49.3 L9
Voltage Regulator Model:	D550	PMG Equipped:	☒ Yes ☐ No

OPTIONS

Enclosure Level:	Level 3	Silencer:	Hospital
Air Filtration:	Standard		

TEST SUMMARY

TEST	TEST RESULT
Transient Performance <i>Certifies that the engine generator-set model has undergone transient response analysis per ISO 8528-5</i>	NFPA-110 One Step: ☒ 100% ☐ Other. Specify: ____ % Full Load Acceptance: Voltage Dip: <u>46.2</u> % Recovery Time: <u>6.5</u> seconds Frequency Dip: <u>22.3</u> % Recovery Time: <u>6.1</u> seconds
Steady State Performance <i>Certifies that voltage deviation and harmonics are within acceptance tolerance range per ISO-8528-5 at full load</i>	Frequency Regulation: Voltage Regulation: <u>0.1</u> +/- % Regulation Overall <u>0.24</u> +/- % Regulation Overall <u>60.16</u> Maximum Hz <u>481.14</u> Maximum AC Volts <u>60.04</u> Minimum Hz <u>478.86</u> Minimum AC Volts
Torsional Analysis <i>Certifies that the generator set has undergone torsional stress analysis and is not subjected to torsional stresses that could be harmful to the unit</i>	☒ Complete
Cooling System <i>Certifies that all generator set models will cool sufficiently within the ambient design conditions per each model at referenced enclosure level</i>	<u>50</u> °C (<u>122</u> °F) Maximum Ambient Temperature <u>1025</u> m ³ /min (<u>36,220</u> SCFM) Radiator Air Flow
Sound Data <i>Certifies that sound data is within the acceptable tolerance range per ISO 8528-10 at referenced enclosure level</i>	<u>74.9</u> dBA @ 7 m (23 ft) at full rated load <i>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.</i>
Vibrational Analysis <i>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</i>	☒ Complete

CERTIFICATE OF COMPLIANCE

Certificate Number UL-US-L3559-3111-81200102-1
Report Reference AU3559-20100218
Date 9-Sep-2021

Issued to: Rolls-Royce Solutions America Inc
100 Power Dr Mankato, MN
United States 56001-4790

This is to certify that FTSR - Engine Generators
representative samples of See Addendum Page for Product Designation(s).

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

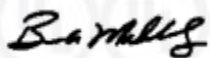
Standard(s) for Safety: UL 2200, 2nd Ed., Issue Date: 2012-06-01, Revision Date:
2015-07-29

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

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

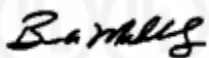


CERTIFICATE OF COMPLIANCE

Certificate Number UL-US-L3559-3111-81200102-1
Report Reference AU3559-20100218
Date 9-Sep-2021

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

Model	Category Description
6, 8, 10 or 12, followed by R or V, followed by 1600, followed by D, followed by S, followed by a number ranging from 230 to 900. May have additional prefix or suffix letters or numbers.	Engine generators
D, followed by G, followed by 06, 08, 10 or 12, followed by R or V, followed by 1600, may have additional prefix or suffix letters or numbers.	Engine generators



Bruce Mahrenholz, Director North American Certification Program

UL LLC



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



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2024 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: RMDDL22.4ZWR-001

Effective Date:

10/17/2023

Expiration Date:

12/31/2024

Byron J. Bunker, Division Director
Compliance Division

Issue Date:

10/17/2023

Revision Date:

N/A

Model Year: 2024

Manufacturer Type: Original Engine Manufacturer

Engine Family: RMDDL22.4ZWR

Mobile/Stationary Indicator: Stationary

Emissions Power Category: kW>560

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.

Section 3

Engine Starting Battery

Battery Charger

Jacket Water Heater

Circuit Breakers

Remote Annunciator

Remote E-Stop

Vibration Pad Isolators



Starting System Data Sheet

Commercial Battery

Extra ruggedness and resistance to vibration, heat, chemicals, and physical abuse are built into every commercial battery provided with an **mtu** generator set. The battery design features the latest in power storage technology for lead-acid batteries, as well as incorporates proven designs developed with the most experience in the business.

PRODUCT FEATURES

- **Case Design:** Tough, high-impact reinforced polypropylene case is heat sealed under extreme pressure to withstand heavy commercial service usage. This helps to prevent electrolyte leakage, improves reliability, and reduces breakage.
- **Internal Design:** Full-frame power path grids avoid sharp wires protruding through separators and directs the power straight to the lug for low resistance and higher cranking amps.
- **Terminals:** Standard terminals are solidly built preventing porosity, corrosion, black post, and harmful acid leaks.
- **Power Density:** Extra heavy-duty batteries deliver more cranking amps per pound.
- **Maintenance:** The battery uses pure de-mineralized electrolytes for reduced water loss, reduced gassing, longer battery life, and low maintenance.
- **Reliability:** Narrow ribs reduce separator corrosion to protect against shorts while deep-pocket envelopes dramatically improve reliability and extend service life.
- **Quality:** Over 250 quality control checks, combined with computer-aided design technology, provide a tough, durable battery in each commercial battery provided with an **mtu** generator set.

						Overall Dimension			
BCI Group Size	Terminal Type	mtu Part Number	Volt	Cranking Performance	Reserve Capacity	Length mm (in)	Width mm (in)	Height mm (in)	Weight (Wet) kg (lbs)
				CCA (Cold Cranking Amps) -18° C / 0° F					
24	Post	SUA102538	12	650	115	273 (10.75)	171 (6.75)	229 (9)	18.1 (40)
31	Post	SUA120299	12	950	175	330 (13)	171 (6.75)	241 (9.5)	25.7 (56.5)
4D	Post	SUA102493	12	1,050	290	527 (20.75)	216 (8.5)	258 (10.125)	45.2 (99.5)
8D	Post	SUA102492	12	1,400	430	527 (20.75)	279 (11)	254 (10)	59.3 (130.5)



Battery Charger Data Sheet

MicroGenius Battery Charger

BENEFITS AND FEATURES

Designed for mission-critical applications, the MicroGenius® 2, MicroGenius S2, and MicroGenius S4 battery charger packs advanced technology charging into a small, lightweight, and rainproof package. MicroGenius is the only charger that delivers high-performance charging while prolonging useful life of batteries and significantly reducing risk of sudden battery failure. Rigorous worst-case analysis design processes and extensive abuse testing ensure reliable operation in adverse environments.

- Dynamic Boost™ Charge safely recharges batteries faster than competing products
- HELIX™ technology increases battery life and cuts risk of sudden battery failure
- Field-selectable 12/24 volt output
- Hardened switchmode powertrain delivers first-class abuse resistance and state-of-the-art energy efficiency
- Small, lightweight, water-resistant, and rugged
- Standard J-1939 and Modbus communications



SPECIFICATIONS

AC input

	MicroGenius 2	MicroGenius S2	MicroGenius S4
VAC, Hz	90-265 VAC, 47-63 Hz		
Protection	Supplementary overcurrent protection fuse, transient protected to EN61000-4-5 level 4		
Power factor and efficiency	PF > 0.95 typical; efficiency to 93%; meets CEC Title 20 Efficiency Regulations; standby AC draw < 3W		

MicroGenius® Battery Charger Data Sheet

SPECIFICATIONS, continued

DC output

	MicroGenius 2	MicroGenius S2	MicroGenius S4
Volts	12V / 24V		
Amps	MicroGenius 180: 10A/6A MicroGenius 300: 10A MicroGenius 450: 15A MicroGenius 600: 20A	20A	45A
Charging modes	Multi-stage, including float, boost, and commissioning charge modes		
Current limit	Factory set at 100% of rating. Field adjustable w/optional keypad or from PC ¹		
Charging characteristic	Constant voltage, current limited; patented Dynamic Boost control		
Line and load regulation	± 0.5%		
Output ripple	< 30 mVrms with or without battery. Delivers fast-responding, stable, well-filtered DC without battery.		
Battery temperature compensation	Standard. Optional remote battery temperature probe ²		
Output protection	Current limit, supplementary overcurrent protection fuse, transient protected		
Dead battery charge	Starts into and recharges zero volt battery without user intervention		
Parallel operation	Two or more chargers operate with all modes synchronized for increased current or fault tolerance ³		

Adjustment and controls

	MicroGenius 2	MicroGenius S2	MicroGenius S4
Charge mode control	Fully automatic patented Dynamic Boost system. Manual boost and battery commissioning available from keypad.		
Adjustments	12 or 24 volt; battery type program; fine voltage setting, alarm setpoints; alarm relay mapping		
Battery type programs	Flooded lead-acid, Ni-Cd, VRLA, ultracapacitor, lithium ⁴		
Field voltage adjustment	Three methods: jumper pins, from front panel keypad (requires that model number digit 12 be F), or from PC ¹	Two methods: from front panel keypad or from PC ¹	

Status display

	MicroGenius 2	MicroGenius S2	MicroGenius S4
LEDs	Two multi-color front panel status LEDs		
Metering and status display	Voltmeter accurate to + 2%; ammeter to + 5%. 20-character display of status and alarm messages		

SPECIFICATIONS, continued

Alarms

	MicroGenius 2	MicroGenius S2	MicroGenius S4
Alarms	Factory set and field reconfigurable. Standard generator set configuration includes summary, AC fail, charger fail, high DC volts, low DC volts, low cranking volts.		
Form C contact alarms	MicroGenius 180 (X00A42500005): N/A MicroGenius 180 (XG3042500013)/300/450/600: Two Form C contacts, each rated 30V, 2A resistive, assignable. Standard configuration includes summary, AC fail, charger fail, high DC volts, low DC volts and discharging battery.	Five Form C contacts, each rated 30V, 2A resistive, assignable. Standard configuration includes summary, AC fail, charger fail, high DC volts, low DC volts and discharging battery.	

Networking

	MicroGenius 2	MicroGenius S2	MicroGenius S4
J-1939 communications	CAN 2.0 extended ID on RJ-45 port		
Modbus communications	Modbus RS-485 on RJ-45 port or Modbus TCP/IP on RJ-45 port.		Uses only Modbus TCP/IP. Do not use Modbus RS-485 for serial port communication.
SENSbus	Proprietary bus for connection of paralleled chargers and SENS accessories		

Environmental

	MicroGenius 2	MicroGenius S2	MicroGenius S4
Operating temp ⁵ (convection cooled)	MicroGenius 180: Meets full specification from -40 °C to +60 °C (-40 °F to +140 °F) MicroGenius 300/600: Meets full specification from -40 °C to +50 °C (-40 °F to +122 °F) MicroGenius 450: Meets full specification from -40 °C to +40 °C (-40 °F to +104 °F)	Meets full specification from -40 °C to +40 °C (-40 °F to +104 °F)	
Humidity	5% to 95%, non-condensing		
Ingress protection	IP 22; NEMA 3R; UL Listed "Rainproof"	IP 20; NEMA 1. Optional drip shield for IP 22/NEMA 3R rating.	
Vibration	Swept Sine (EN60068-2-6); 4G, 18-500 Hz, 3 axes. Random: 20-500 Hz, 0.01G2/Hz		
Shock	EN 60068-2-27 (15G)		
Electrical transient	ANSI/IEEE C62.41 and EN 61000-4-12 on power terminals		

MicroGenius® Battery Charger Data Sheet

SPECIFICATIONS, continued

Abuse protection

	MicroGenius 2	MicroGenius S2	MicroGenius S4
Reverse polarity	Charger self-protects without fuse clearing. Indication via LED and optional LCD.	Charger self-protects without fuse clearing. Indication via LED and LCD.	Charger self-protects without output protective device clearing. Indication via LED and LCD.
Wrong voltage battery	Charger-battery voltage mismatch shuts down charger. Indication via LED and LCD		
Overvoltage shutdown	Selective: Shutdown only operates if charger causes the overvoltage condition		
Overtemp protection	Gradual output power reduction if heatsink temperature becomes excessive		

Regulatory compliance

	MicroGenius 2	MicroGenius S2	MicroGenius S4
North America	C-UL Listed for US and Canada: UL 1236 categories BBGQ, BBHH, BBJY and QWIR ⁶ , CSA 22.2, No. 107.2. Certified to UL 1236 supplements SB (marine), SC (fire pump) and SE (emergency generator)		
	NFPA-70, NFPA-1107 Note: MicroGenius 2 180 (X00A42500005) meets NFPA-70 only.		
	FCC Part 15, Class B	FCC Part 15, Class A	
	Seismic: Rigid and non-structure wall mount; max SDS of 2.5G. IBC 2000-2015, Calif. BC 2007-2016		
	American Bureau of Shipping, type approved		
European Union (CE)	EMC: 2014/30/EU (EN 61000-6-2 and EN 61000-6-4)		
	LVD: 2014/35/EU (EN 60335-1 and EN 60335-2-29)		
	RoHS 2: 2011/65/EU (EN 50581)		

Construction

	MicroGenius 2	MicroGenius S2	MicroGenius S4
Housing/Configuration	Die-cast aluminum heatsink base with stainless steel covers and fasteners	Aluminum with powder coated finish	
Connections	AC and DC terminal blocks: 20 to 10 AWG J-1939 and Modbus-485: RJ-45.	AC and DC terminal blocks: 20 to 2 AWG J-1939 and Modbus: RJ-45.	AC and DC terminal blocks: 14 AWG to 2/0 AC and DC breakers < 50A (optional): 14 to 2 AWG AC to DC breakers, ≥ 50 A (optional): 12 AWG to 2/0 J-1939 and Modbus: RJ-45
	Form C alarms: 28 to 16 AWG	Form C alarms: 28 to 16 AWG	Form C alarms: 28 to 16 AWG

1 Requires optional computer-to-charger adapter. To order, contact **mtu** Parts Department.

2 Remote battery temp sensor is optional. To order, contact **mtu** Parts Department.

3 Requires standard RJ-45 network cable to connect paralleling bus. To order, contact **mtu** Parts Department.

4 Contact factory to determine compatibility with the battery management system (BMS) of your lithium battery.

5 At 65 °C (149 °F) and above, the LCD display may be unreadable and display life will be reduced.

6 Except 180 W unit in 24-V configuration, which is not listed to QWIR

7 All chargers equipped with an alarm/display board meet NFPA-110 requirements. For chargers without an alarm/display board to meet NFPA-110, charger performance and alarm data available on the J-1939 port must be annunciated by the generator set control panel.

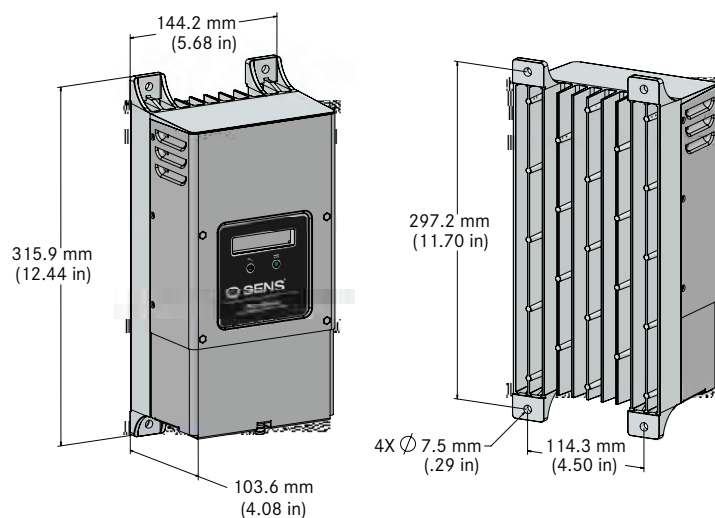
MICROGENIUS ORDERING INFORMATION

Battery charger	mtu part #	Output volts	Output amps
MicroGenius 2 180*	X00A42500005	12/24 Volts	10/6 Amps
MicroGenius 2 180**	XG3042500013	12 Volts	10 Amps
MicroGenius 2 300**	X54942500005	24 Volts	10 Amps
MicroGenius 2 450**	XG3042500014	24 Volts	15 Amps
MicroGenius 2 600**	XG4842500003	24 Volts	20 Amps
MicroGenius S2	X54942500003	12/24 Volts	20 Amps
MicroGenius S4	X54942500002	12/24 Volts	45 Amps

*Meets NFPA-70 only.

Includes **mtu-specific programming

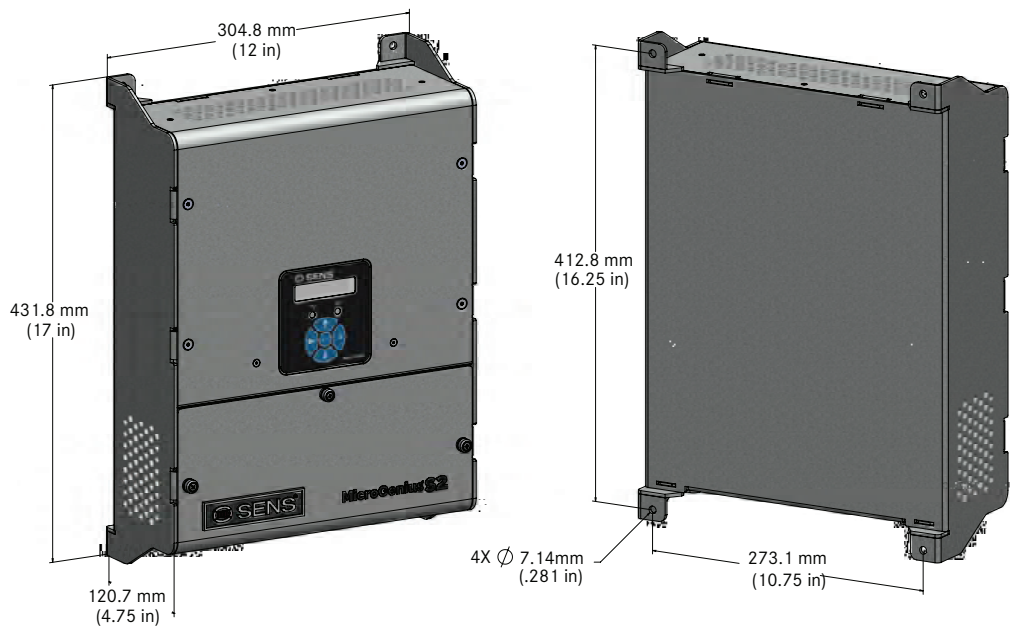
DIAGRAMS AND DIMENSIONS



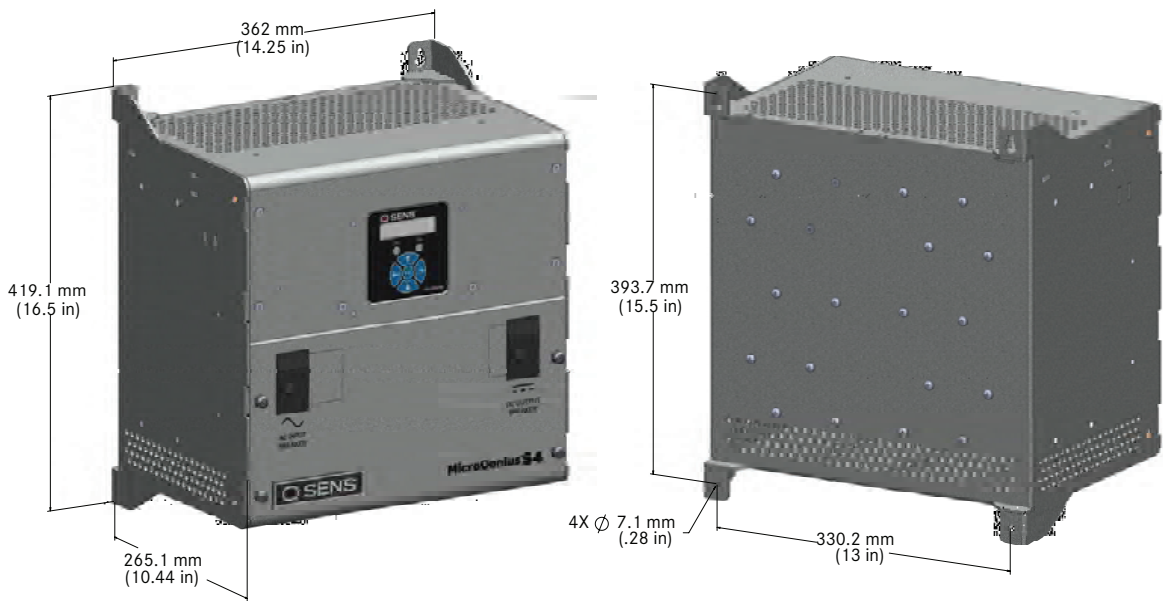
MicroGenius 2 Dimensions

MicroGenius® Battery Charger Data Sheet

DIAGRAMS AND DIMENSIONS, continued



MicroGenius S2 Dimensions



MicroGenius S4 Dimensions

Subject to change. | WT00038096 | 2023-09



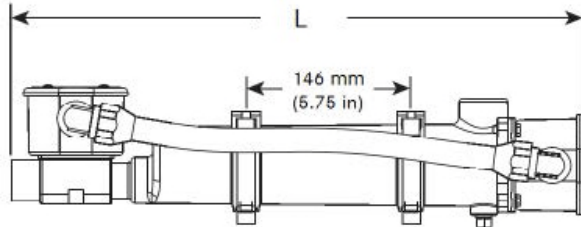
Water Heater Data Sheet

CB, CL, and WL Series

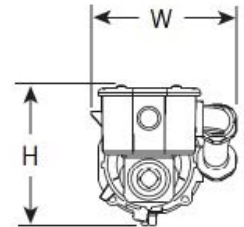
The CB, CL, and WL tank-style engine heaters are designed to preheat diesel and gas engines in generator set applications. With easy start-up regardless of ambient temperature, they feature a built-in thermostat and heat engines from 6L to 25L displacement. Thermosiphon circulation of the coolant delivers heat throughout the entire engine for optimum performance.



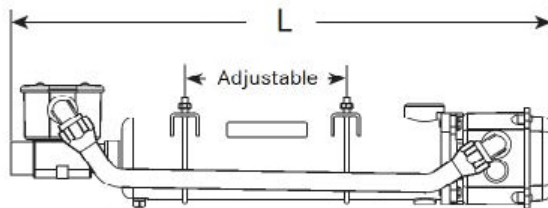
CB Model with Thermostat



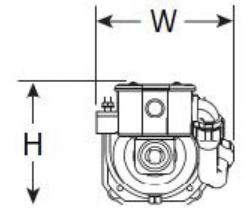
CB Model



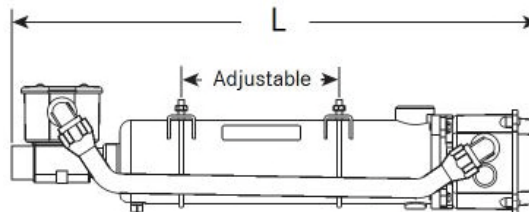
CL Model with Thermostat



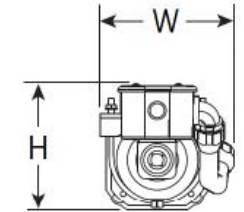
CL Model



WL Model with Thermostat



WL Model



CERTIFICATIONS AND STANDARDS

- CB and CL Models: c-UL-us Listed, CSA Certified, and CE Compliant
- WL Model: CE Compliant

SPECIFICATIONS

	CB Model	CL Model	WL Model
Height:	132 mm (5.2 in)	147 mm (5.8 in)	147 mm (5.8 in)
Length:	510 mm (20.1 in)	597 mm (23.5 in)	597 mm (23.5 in)
Width:	129 mm (5.1 in)	158 mm (6.2 in)	158 mm (6.2 in)
Weight:	3 kg (6.9 lb)	4.5 kg (10 lb)	4.5 kg (10 lb)

Water Heater Data Sheet

CB, CL, and WL Series

SPECIFICATIONS, continued

- Heating Fluid: Engine coolant (50% glycol/50% water)
- Power: 1.5, 2, 2.5, 3, 4, and 5 kW
- Rated Voltage: 120V – 575V
- Phase: 1 and 3
- Enclosure: IP44
- Fluid Capacity:
 - CL and WL Models: 2 L (0.5 gal)
 - CB Models: 1.2 L (0.3 gal)
- Max Pressure: 8.61 bar (125 psi)
- Inlet / Outlet: 1" NPT Male / 1" NPT Female
- Thermostat Range:
 - On: 38 °C (100 °F)
 - Off: 49 °C (120 °F)

Model Number	mtu Part Number	Watts	Volts	Phase	Hz	Amps
CB115410-200	SUA98952	1,500	480	1	60	3.1
CB120210-200	SUA98996	2,000	240	1	60	8.3
CB120410-200	SUA98953	2,000	480	1	60	4.2
CB120810-200	SUA98404	2,000	208	1	60	9.6
CB125210-200	SUA96723	2,500	240	1	60	10.4
CB125410-200	SUA90334	2,500	480	1	60	5.2
CB125810-200	SUA96727	2,500	208	1	60	12
CL130410-200	SUA97791	3,000	480	1	60	6.3
CL140210-200	SUA99109	4,000	240	1	60	16.7
CL140410-200	SUA52741	4,000	480	1	60	8.3
CL140810-200	SUA99110	4,000	208	1	60	19.2
CL150210-200	SUA98913	5,000	240	1	60	20.8
CL150212-200	SUA82416	5000	240	1	60	20.8
CL150412-200	SUA83334	5000	480	1	60	10.4
CL150810-200	SUA96725	5,000	208	1	60	24
WL325410-200	SUA96568	2,500	480	3	60	3
WL325810-200	SUA97254	2,500	208	3	60	6.9
WL340410-200	SUA96787	4,000	480	3	60	4.8
WL340810-200	SUA99286	4,000	208	3	60	11.1
WL350410-200	SUA98951	5,000	480	3	60	6
WL350810-200	SUA92800	5,000	208	3	60	13.9



Main

Product or component type	Circuit breaker
Range of product	PowerPact P
Current sensor rating range	1200 A
Breaking capacity code	G
Trip unit technology	Electronic standard Micrologic 5.0 LSI
Device short name	A

Complementary

Line Rated Current	1200 A
Product certifications	UL listed CSA IEC
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 %
Electrical connection	Lugs load Lugs line
AWG gauge	AWG 3/0...500 kcmil (aluminium/copper) 4
Height	16.26 in
Depth	8.07 in
Width	8.27 in

Ordering and shipping details

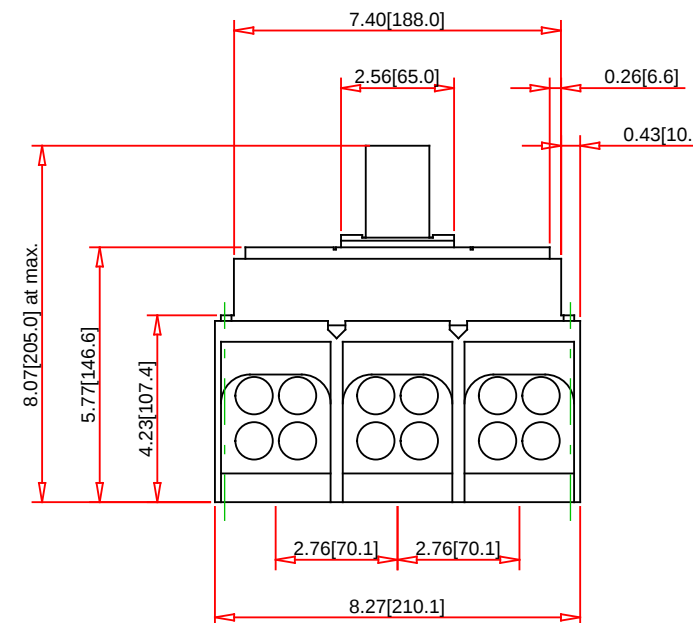
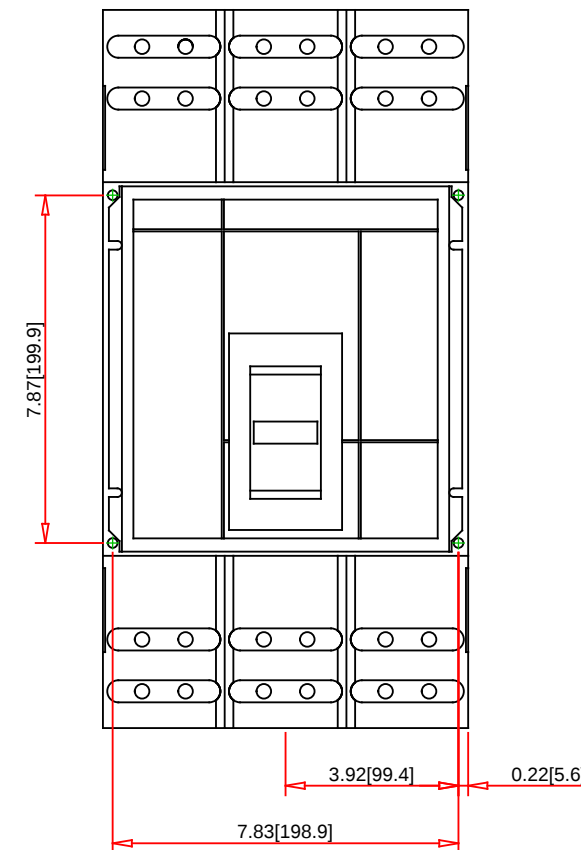
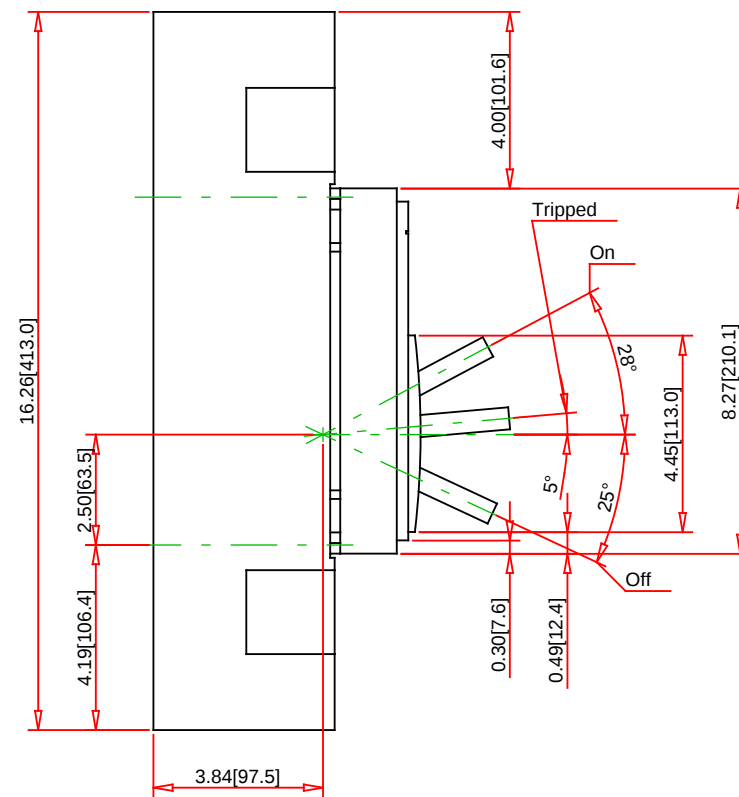
Category	01215 - PG,H,J,K,L,N UNIT MT BREAKERS
Discount Schedule	DE2
GTIN	00785901571278
Nbr. of units in pkg.	1
Package weight(Lbs)	32
Returnability	Y
Country of origin	US

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.:

PGL36120CU33A



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:	Panelboards and Switchboards
Approvals:	UL Listed - CSA Certified - IEC Rated
Mounting Type:	Unit Mount
Terminal Type:	Lugs (ON and OFF ends)
Wire Size:	#3/0-500 AWG/kcmil(Al/Cu)
Weight:	32 Pounds
Depth:	8.07 Inches
Height:	16.26 Inches
Width:	8.27 Inches

Description:

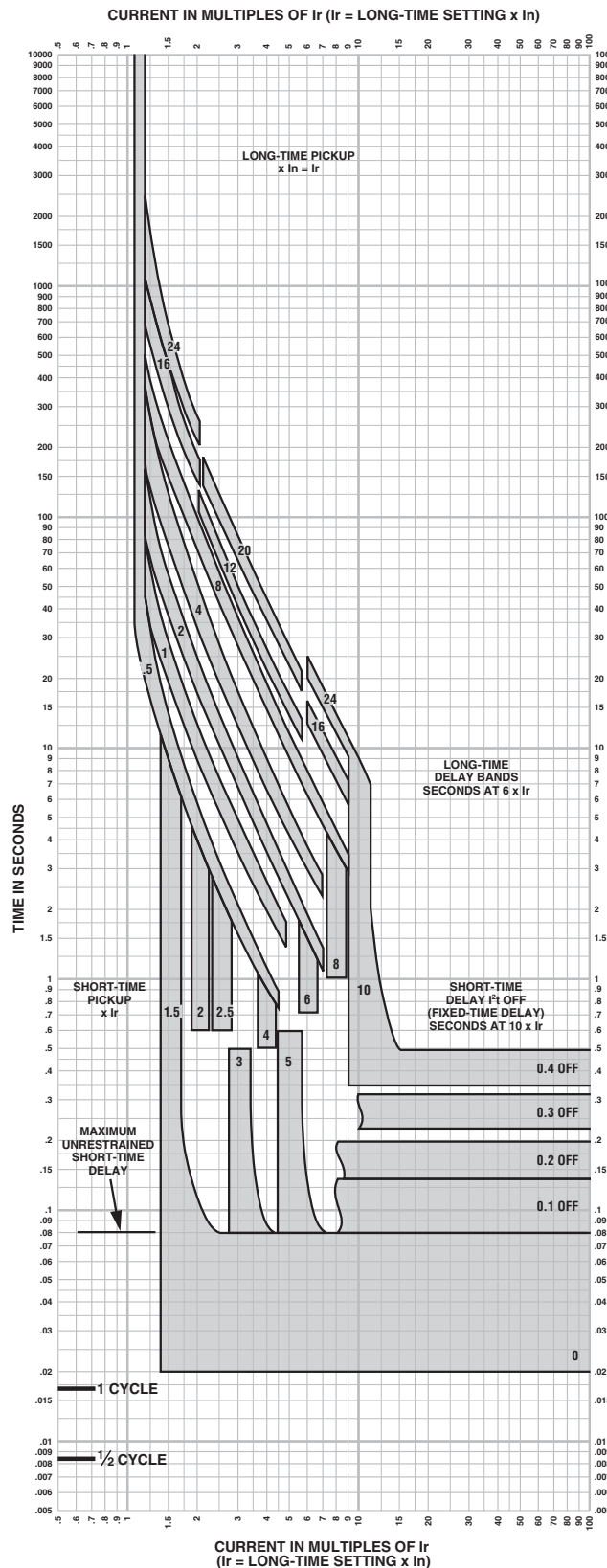
Description:	Power Act 1 Frame Electronic Trip Circuit Breaker
Number of Poles:	3-Pole
Sensor Rating:	1200A
Voltage Rating:	600VAC
Interrupting Rating:	65kA at 240VAC - 35kA at 480VAC - 18kA at 600VAC
Circuit Breaker Rating:	100% Rated
Electronic Trip Unit:	Micrologic Standard Trip Unit (5.0)
Trip Function:	LSI
Installed Rating Plug:	Type A
Rating Plug Range:	0.4A to 1A

Specification:

PowerPact P-frame Electronic Trip Circuit Breaker
3-Pole
1200A
600VAC
65kA at 240VAC - 35kA at 480VAC - 18kA at 600VAC
100% Rated
Micrologic Standard Trip Unit (5.0)
LSI
Type A
0.4A to 1A

PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

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

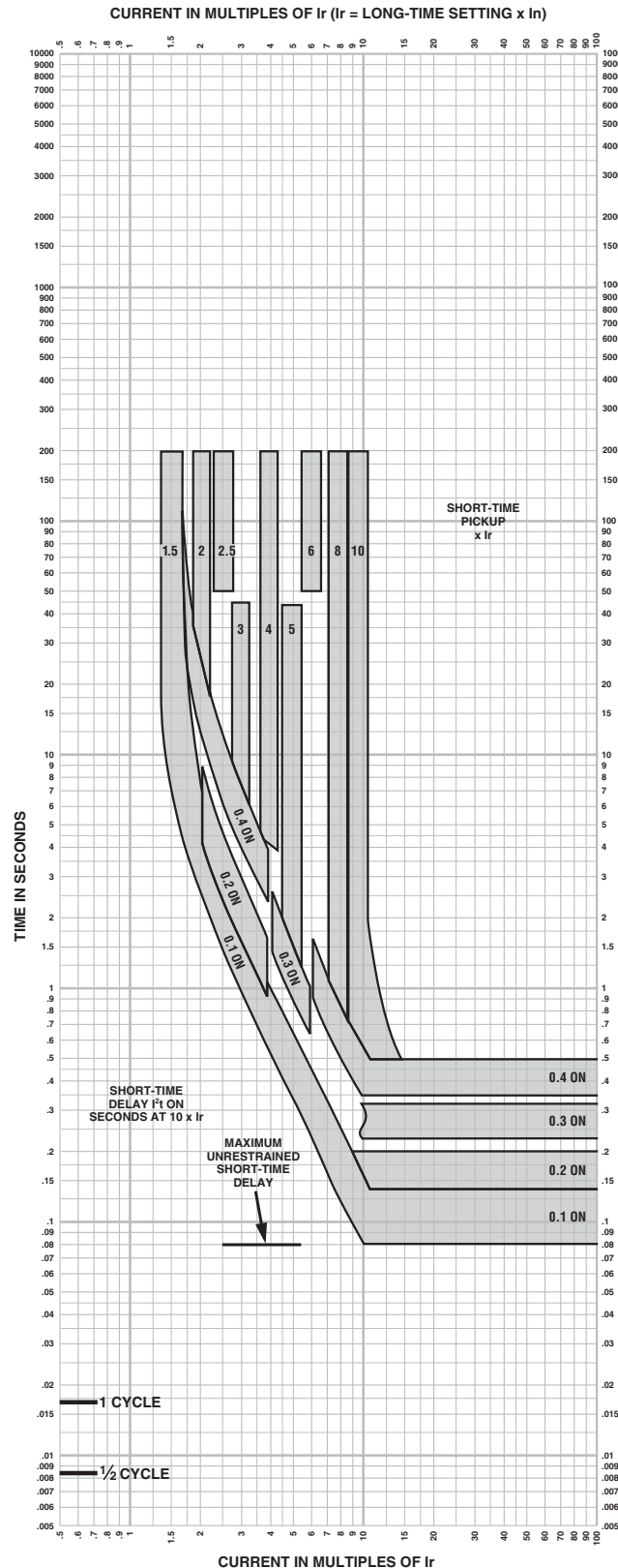
Long-Time Pickup and Delay
Short-Time Pickup and I^2t OFF Delay

The time-current curve information is to be used for application and coordination purposes only. Curves apply from -25°C to $+70^{\circ}\text{C}$ (-13°F to $+158^{\circ}\text{F}$) 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.

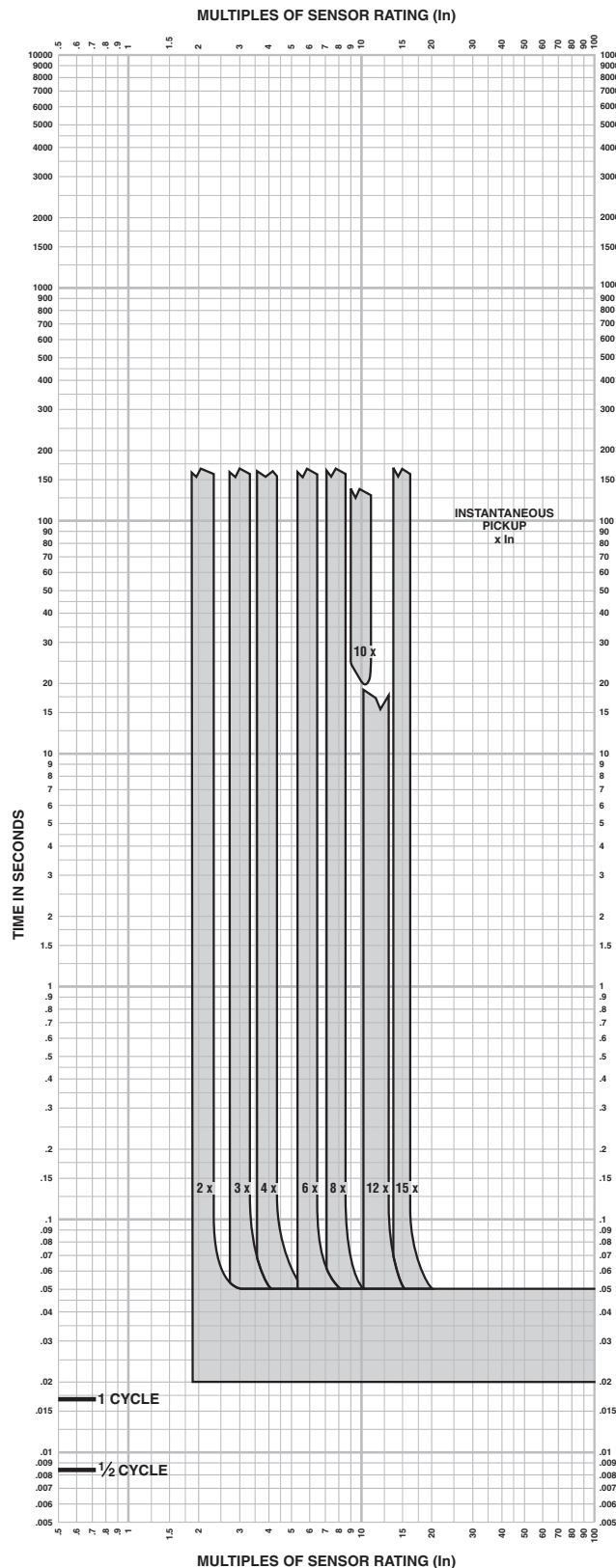
Curves apply from -25°C to $+70^\circ\text{C}$
(-13°F to $+158^\circ\text{F}$) ambient temperature.

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.

PowerPact™ M-, P- and R-Frame, and Compact™ NS630b–NS3200 Circuit Breakers

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.



Remote Display Panel Data Sheet

RDP-110C Annunciator

DESCRIPTION

The RDP-110C is a remote annunciation device used in conjunction with digital generator set controllers to provide remote annunciation of the emergency standby generator system. This panel allows for two programmable alarms, two programmable pre-alarms, and is compatible with NFPA 110. The digital generator set controller detects an alarm or pre-alarm condition and communicates via RS-485 to the RDP-110C. The RDP-110C is available with a universal configuration that can be surface- or semi-flush-mounted.

HIGHLIGHTS

- Annunciation of eight alarms and seven pre-alarms as detected by the digital generator set controller
- Four programmable LEDs via BESTlogic™ Plus
- RS-485 communications reduces the number of interconnection wires to four
- Interconnect distance up to 1,219 m (4,000 ft)
- UL Listed
- CSA Certified

STANDARD FEATURES

- Eight LED alarms
 - Low coolant level
 - Low oil pressure
 - Engine overspeed
 - Fuel leak*
 - High coolant temperature
 - Engine overcrank
 - Emergency stop activated
 - Sender failure*
- Seven LED Pre-Alarms
 - High coolant temperature
 - Low oil pressure
 - Battery overvoltage*
 - Battery charger failure*
 - Low coolant temperature
 - Low fuel level
 - Weak battery
- Three LED operating conditions
 - Switch not in auto
 - EPS supplying load
 - Display panel on
- Audible alarm horn rated at 90 dB (from a distance of two feet)
- Lamp test and alarm silence
- Power supply inputs for 12 VDC or 24 VDC
- Surface- or semi-flush-mounted
- Conduit box included
- Designed for use in harsh environments
- Interconnect distance up to 1,219 m (4,000 ft)
- UL Listed
- CSA Certified



Image for illustration purposes only.
Refer to dimensional drawings on page 3.

* Pre-configured, but can be reprogrammed and relabeled to match the function of the indicator.

RDP-110C Annunciator Remote Display Panel Data Sheet

SPECIFICATIONS

Ordering Information

mtu part number: X00A30900392

Power Input

- DC voltage: 8 to 32 VDC (2W)

Environmental and Physical

- Operating temperature: -40 °C to 70 °C (-40 °F to 158 °F)
- Storage temperature: -40 °C to 85 °C (-40 °F to 185 °F)
- Salt fog: qualified to ASTM 117B-1989
- Vibration: The device withstands 2 g in each of the three mutually perpendicular planes, swept over the range of 10 to 500 Hz for a total of six sweeps, 15 minutes each sweep, without structural damage or degradation of performance.
- Shock: 15 g
- Weight: 1.04 kg (2.3 lb)

Agency Approvals

- NFPA 110 Level 1 compliant
- UL Listed to UL 6200, file E97035
- CSA Certified to CSA C22.2 No. 14, file LR 23131

Connections

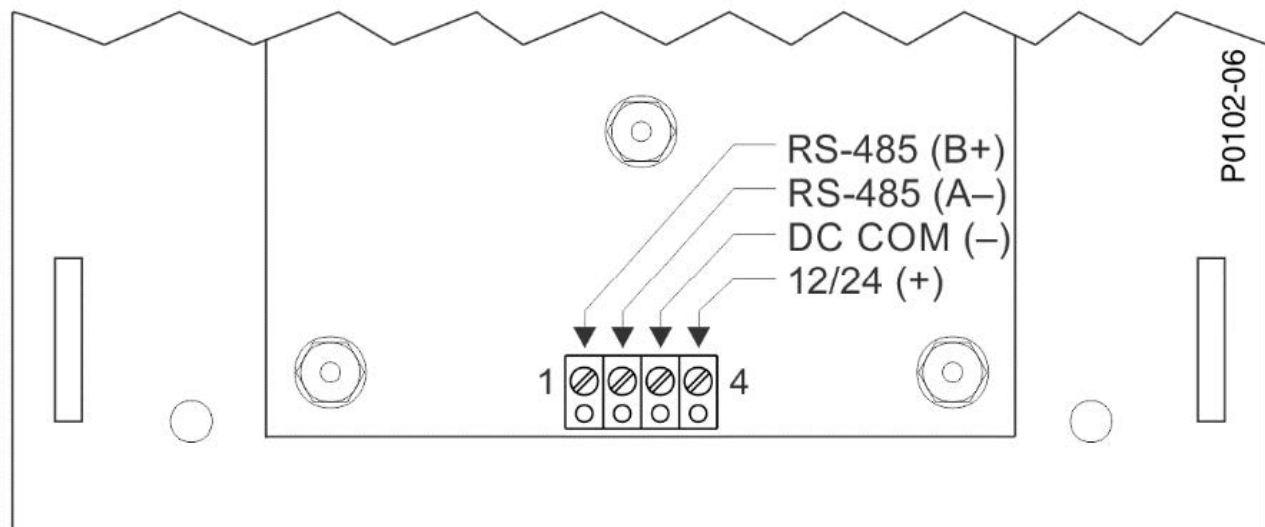


Figure 1: RDP-110C Circuit Board Connections

RDP-110C Annunciator Remote Display Panel Data Sheet

DIMENSIONS

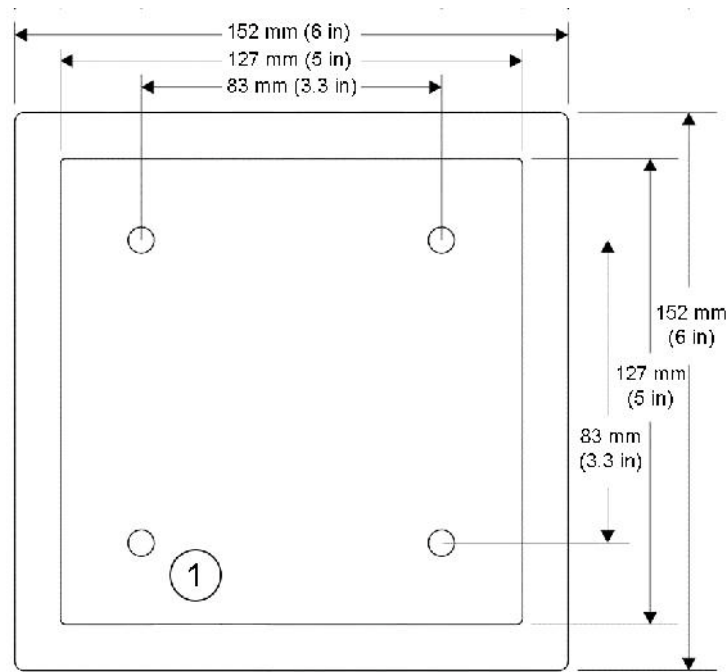


Figure 2: RDP-110C Mounting Dimensions (Rear Panel)

1. Mounting hole diameter (4 places, on rear wall of enclosure) is 7 mm (0.281 in).

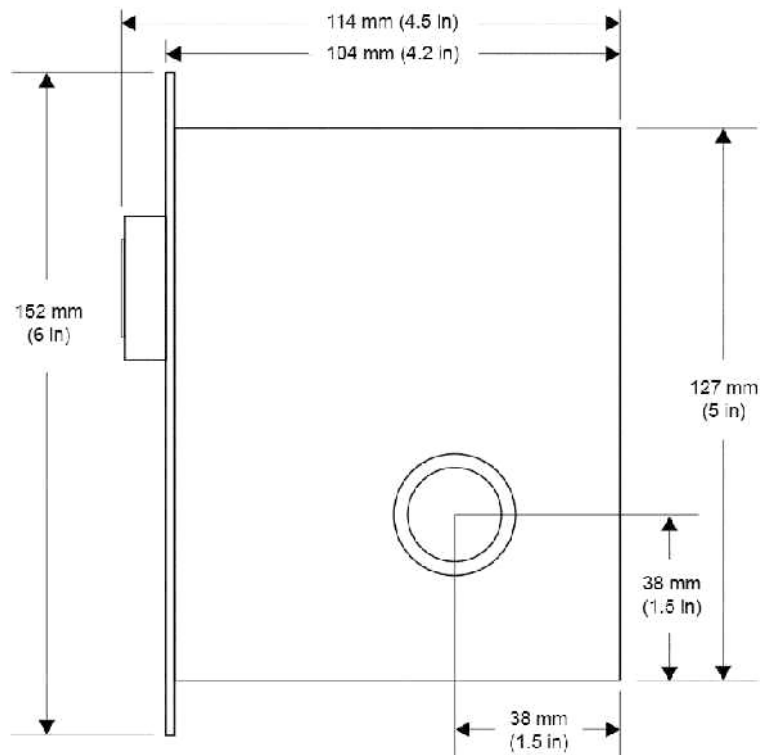


Figure 3: RDP-110C Mounting Dimensions and Knockout Locations (Left Side)

RDP-110C Annunciator Remote Display Panel Data Sheet

PANEL DISPLAY

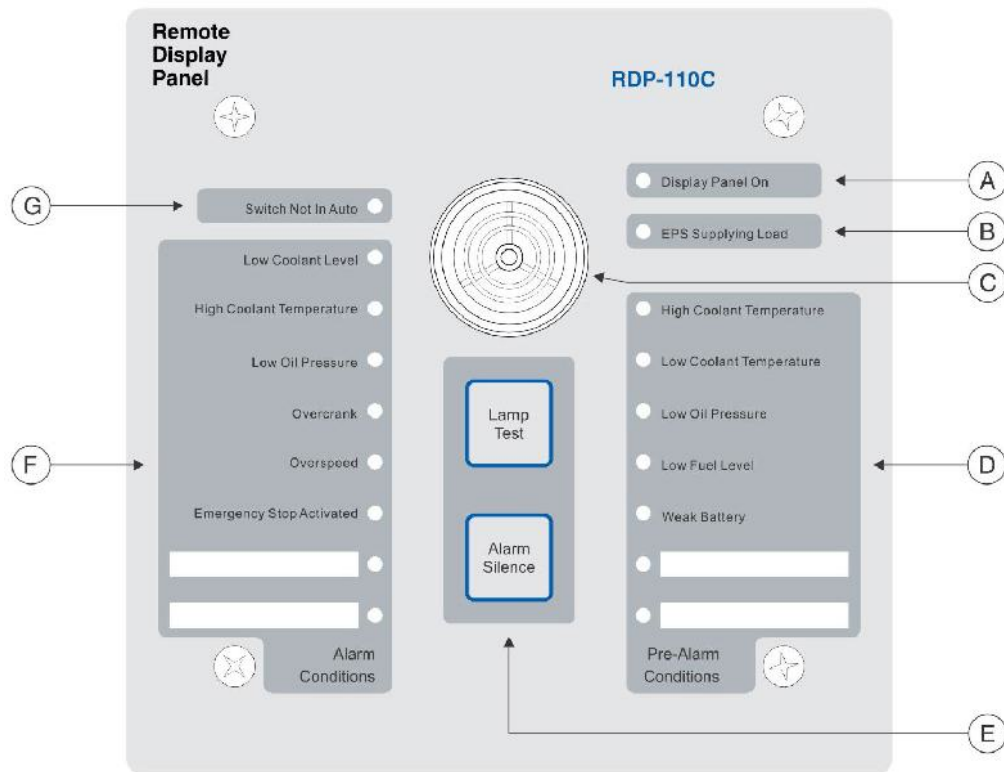


Figure 4: RDP-110C Front Panel Controls and Indicators

- | | | |
|---|---|--|
| <p>A. Green LED lights when power is applied to the RDP-110C.</p> <p>B. Green LED lights when the generator set is supplying more than 2% of rated load.</p> <p>C. The horn sounds when an alarm or pre-alarm exists or the connected digital generator set controller is not operating in Auto mode.</p> | <p>D. Amber Pre-Alarm LEDs light when the corresponding pre-alarm setting is exceeded.</p> <p>E. RDP-110C controls consist of two push-buttons. The Alarm Silence pushbutton silences the horn. The Lamp Test pushbutton can be used to verify operation of all RDP-110C LEDs and the horn.</p> | <p>F. Red Alarm LEDs light when the corresponding alarm setting is exceeded.</p> <p>G. Red LED lights when the digital generator set controller is not operating in Auto mode.</p> |
|---|---|--|



Control Station Data Sheet

Break Glass Pushbutton

DESCRIPTION

The break glass pushbutton control station is designed for special applications in the emergency shutdown of electric circuits. The pushbutton is depressed, and the contacts are closed while the glass disc is in place. When the glass is broken with the hammer, the button returns to a normal extended position, opening the contacts. This action prevents the flow of the electric circuit during emergency shutdowns.

This control station with operators includes control station enclosure, emergency break glass pushbutton operator, hammer, and five glass discs.



FEATURES

- Heavy-duty indoor/outdoor constructed enclosure
- One or two snap-action contact blocks
- “STOP” legend

SPECIFICATIONS

- **mtu** Part Number: SUA35133
- Enclosure Material: Die cast zinc (painted red)
- Weight: 1.47 kg (3.25 lbs)
- Size: 30 mm (1.18 in)
- Contact Configuration: 1 N.O. / 1 N.C.
- Terminal Type: Screw clamp
- Enclosure Rating: NEMA 3/4/13
- Maximum Voltage Rating: 300 V
- Ampere Rating: 10 Amps
- Ratings: UL Listed, CE Marked, CSA Certified

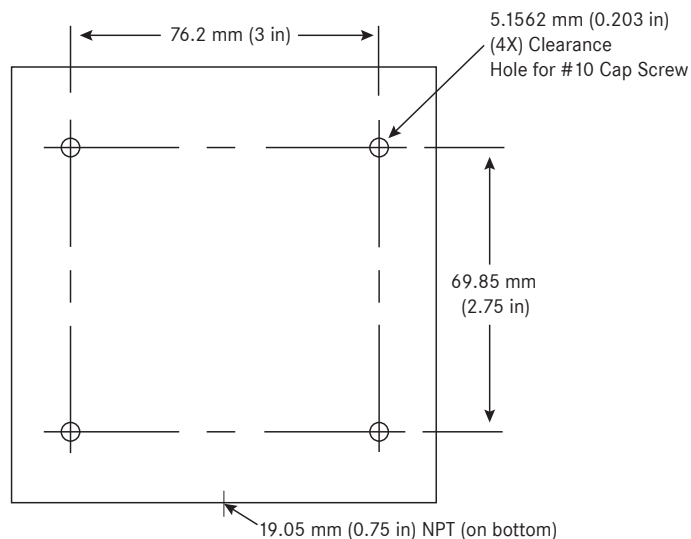


Figure 1: Mounting Dimensions



Isolator Pad Data Sheet

DESCRIPTION

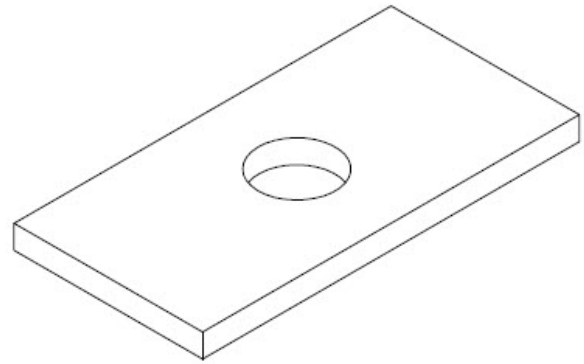
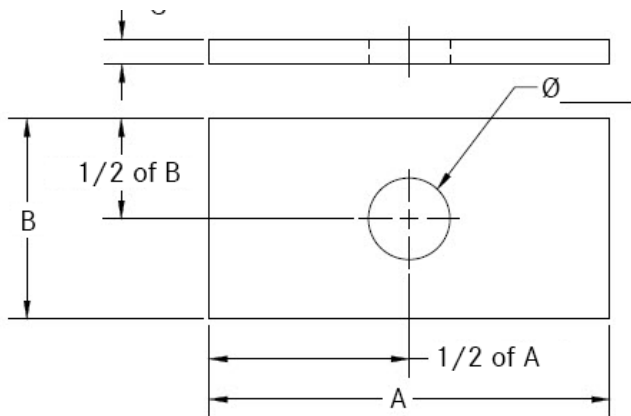
These square-molded, neoprene pads can be used to compensate for inconsistencies in the mounting surface between the generator set base frame and the installation surface, or between the sub-base fuel tank and the installation surface, if applicable. They can be easily cut to any desired shape and can be used in multiple layers to increase deflection.

NEOPRENE TYPICAL PHYSICAL PROPERTIES

Hardness: 40A-90A
Tensile Strength: 500
Elongation: 200
Tear Value: 50
Thermal Conductivity (K Factor): 0.30

Heat Resistance @ 100 °C (212 °F) after 70 Hours:

Change in Hardness: 10
Change in Tensile: -16%
Change in Elongation: -60%
Compression Set: 50%
Lowest Working Temperature: -40 °C (-40 °F)
Highest Working Temperature: 90.6 °C (195 °F)



mtu Part Number	Dim. A mm (in)	Dim. B mm (in)	Dim. C mm (in)	Hole Diameter mm (in)	Durometer
SUA46904	101.6 (4)	50.8 (2)	6.35 (0.25)	20.638 (0.813)	50
SUA46905	152.4 (6)	50.8 (2)	6.35 (0.25)	20.638 (0.813)	50
SUA46906	254 (10)	50.8 (2)	6.35 (0.25)	20.638 (0.813)	50
SUA46907	457.2 (18)	63.5 (2.5)	6.35 (0.25)	20.638 (0.813)	50
SUA46908	457.2 (18)	76.2 (3)	6.35 (0.25)	20.638 (0.813)	50
SUA46909	457.2 (18)	457.2 (18)	6.35 (0.25)	Not Required	50
SUA63015	203.2 (8)	76.2 (3)	6.35 (0.25)	20.638 (0.813)	50
SUA77843	101.6 (4)	50.8 (2)	19.05 (0.75)	20.638 (0.813)	60
SUA86147	457.2 (18)	76.2 (3)	6.35 (0.25)	20.638 (0.813)	70
SUA95672	304.8 (12)	50.8 (2)	6.35 (0.25)	20.638 (0.813)	50
SUA102408	457.2 (18)	76.2 (3)	6.35 (0.25)	26 (1.024)	50
X54599100330	381 (15)	76.2 (3)	6.35 (0.25)	22.225 (0.875)	50

Section 4

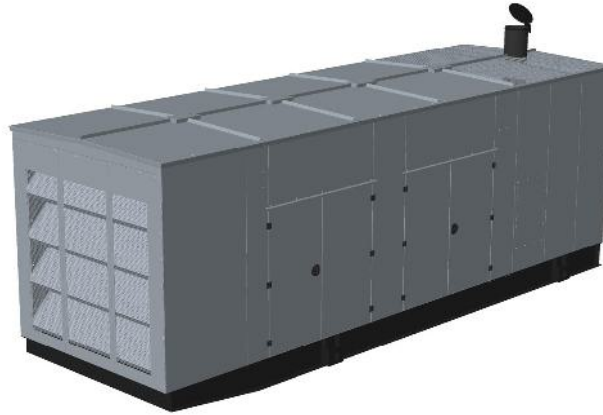
Enclosure Data Sheet

Fuel Tank Data Sheet



Enclosure and Sound Data Sheet - Diesel, Open Field

60 Hz: 750-900 kW Standby / 690-820 kW Prime Power for
Stationary Emergency / 690-820 kW Data Center Continuous Power



Level 1, 2, and 3 Enclosure (pictured)*

Enclosure Level Identification

Level 1	Weather-protective enclosure constructed of heavy gauge steel or aluminum with fixed storm-proof panels. Enclosure consists of a bolted construction with an internally-mounted exhaust silencer. Hinged, lockable double-door access on both sides of the enclosure.
Level 2	Level 1 enclosure with UL 94 HF-1 compliant, 1.5" sound attenuating foam insulation installed inside enclosure walls.
Level 3	Level 2 enclosure with attenuating air intake baffles
Level 3+	Level 3 enclosure with additional sound attenuating air intake baffles and sound attenuated foam insulation installed on enclosure roof

CERTIFICATIONS AND STANDARDS

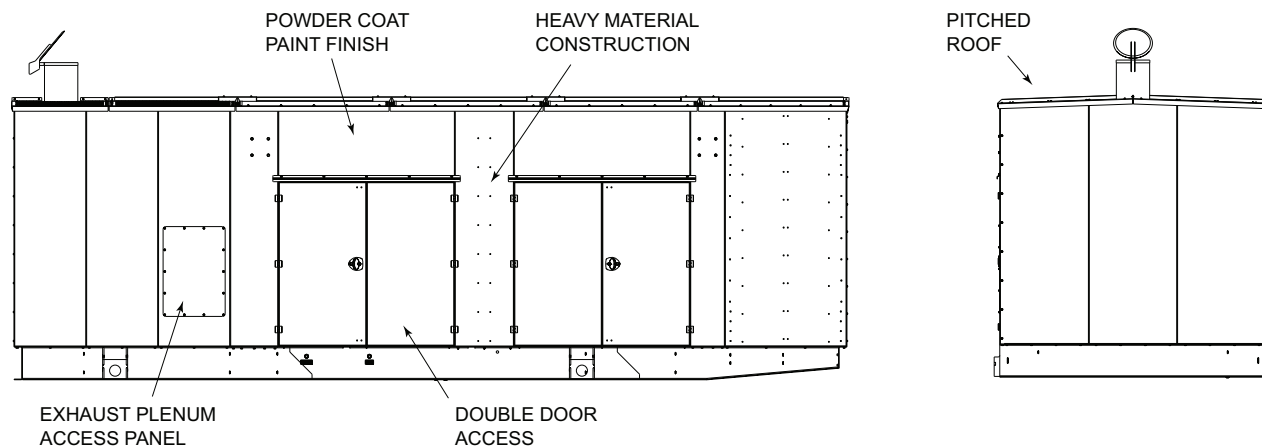
- UL 2200
- CSA C22.2 No. 100
- CSA C22.2 No. 14

STANDARD FEATURES FOR ALL LEVELS

- Heavy material construction
 - Steel enclosure: 14 gauge or greater thickness
 - Aluminum enclosure: 0.09 in or greater thickness
- 130 mph wind rating
- Service access
 - Double door access gives ease of service to all components
- Pitched roof
- Exhaust rain cap
- Scoop access panels
- Hardware
 - Powder coated hinges with stainless steel pins
 - Key-lockable and pad-lockable powder coated door handles
- Powder coat finish paint: RAL 7001 Silver Grey standard
 - Custom colors available upon request
- Internally-mounted silencer (Hospital grade)
 - Insulated exhaust pipes

Enclosure and Sound Data Sheet - Diesel, Open Field

60 Hz: 750-900 kW Standby / 690-820 kW Prime Power for Stationary Emergency /
690-820 kW for Data Center Continuous Power



Level 1, 2, and 3 Enclosure (pictured)*

OPTIONAL FEATURES

- AC or DC LED light package
- Motorized intake louver
- Gravity exhaust louver
- Space heater
- IBC certification
- 190 mph wind rating
- For other custom options, please consult factory.

Enclosure and Sound Data Sheet - Diesel, Open Field

60 Hz: 750-900 kW Standby / 690-820 kW Prime Power for Stationary Emergency /
690-820 kW for Data Center Continuous Power

ENGINE EXHAUST SOUND RATINGS dB(A) AT 1 METER

OPU SOUND RATINGS dB(A) AT 1 METER

ENCLOSURE SOUND RATINGS dB(A) AT 7 METERS

Application	Model	Power Node	1 Meter		7 Meters			
			Engine Exhaust ⁽¹⁾	OPU ⁽²⁾	Level 1	Level 2	Level 3	Level 3+
60 Hz Standby	<i>mtu</i> 12V1600 DS750	750 kW	112.6	104.5	81.7	77.2	74.1	74
	<i>mtu</i> 12V1600 DS800	800 kW	113.2	104.2	82.4	77.2	74.4	73.8
	<i>mtu</i> 12V1600 DS900	900 kW	114.6	104.3	82.2	78	74.9	73.9
Application	Model	Power Node	Engine Exhaust ⁽¹⁾	OPU ⁽²⁾	Level 1	Level 2	Level 3	Level 3+
60 Hz PPSE	<i>mtu</i> 12V1600 DS750	690 kW	111.4	104.7	81.9	76.9	73.9	73.2
	<i>mtu</i> 12V1600 DS800	730 kW	111.8	104.8	81.8	77.1	73.9	73.7
	<i>mtu</i> 12V1600 DS900	820 kW	113	104.5	82.1	77.2	74.5	74.2
Application	Model	Power Node	Engine Exhaust ⁽¹⁾	OPU ⁽²⁾	Level 1	Level 2	Level 3	Level 3+
60 Hz DCCP	<i>mtu</i> 12V1600 DS750	690 kW	111.4	104.7	81.9	76.9	73.9	73.2
	<i>mtu</i> 12V1600 DS800	730 kW	111.8	104.8	81.8	77.1	73.9	73.7
	<i>mtu</i> 12V1600 DS900	820 kW	113	104.5	82.1	77.2	74.5	74.2

⁽¹⁾ Undampened engine exhaust noise

⁽²⁾ Measurement with infinite exhaust connection

NOTE:

- Measurements include exhaust noise.
- Aluminum enclosure sound levels are approximately 2 dB(A) higher than listed sound levels for steel enclosures.
- For installations 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

C/F = Consult Factory

* 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

OPTIONAL FEATURES

- Fuel fill drop tube
- Level alarm
- High fuel pre-alarm and low fuel level shutdown
- Five-gallon spill/fill containment box with lockable hatch
- Optional selectable accessories to meet regional codes/ jurisdictions
- IBC certification 2012, 2015, and 2018

Fuel System Data Sheet

Sub-Base Tank

CERTIFICATIONS AND STANDARDS

United States	Canada
UL 142	ULC-S601

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	Canada
NFPA 30	Part 4: National Fire Code of Canada
NFPA 37	CSA B139
NFPA 110	CSA C282
International Fire Code	CCME PN 1326

SUGGESTED REGIONAL CODE REQUIREMENTS

Pre-engineered accessories can be added to sub-base fuel tanks on 30-1,250 kW generator sets to meet regional codes/jurisdictions. Reference the table on page 3 for available options.

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

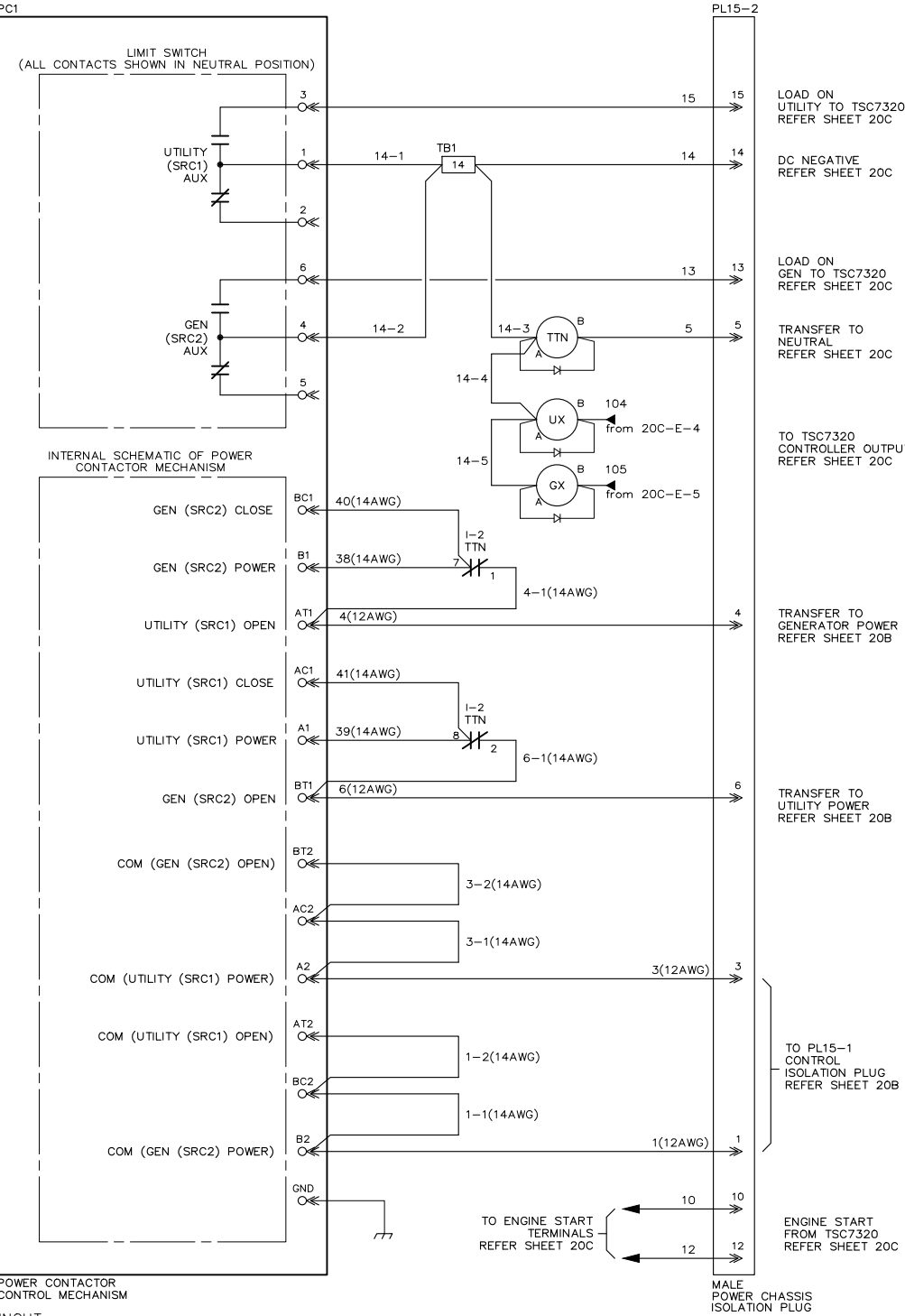
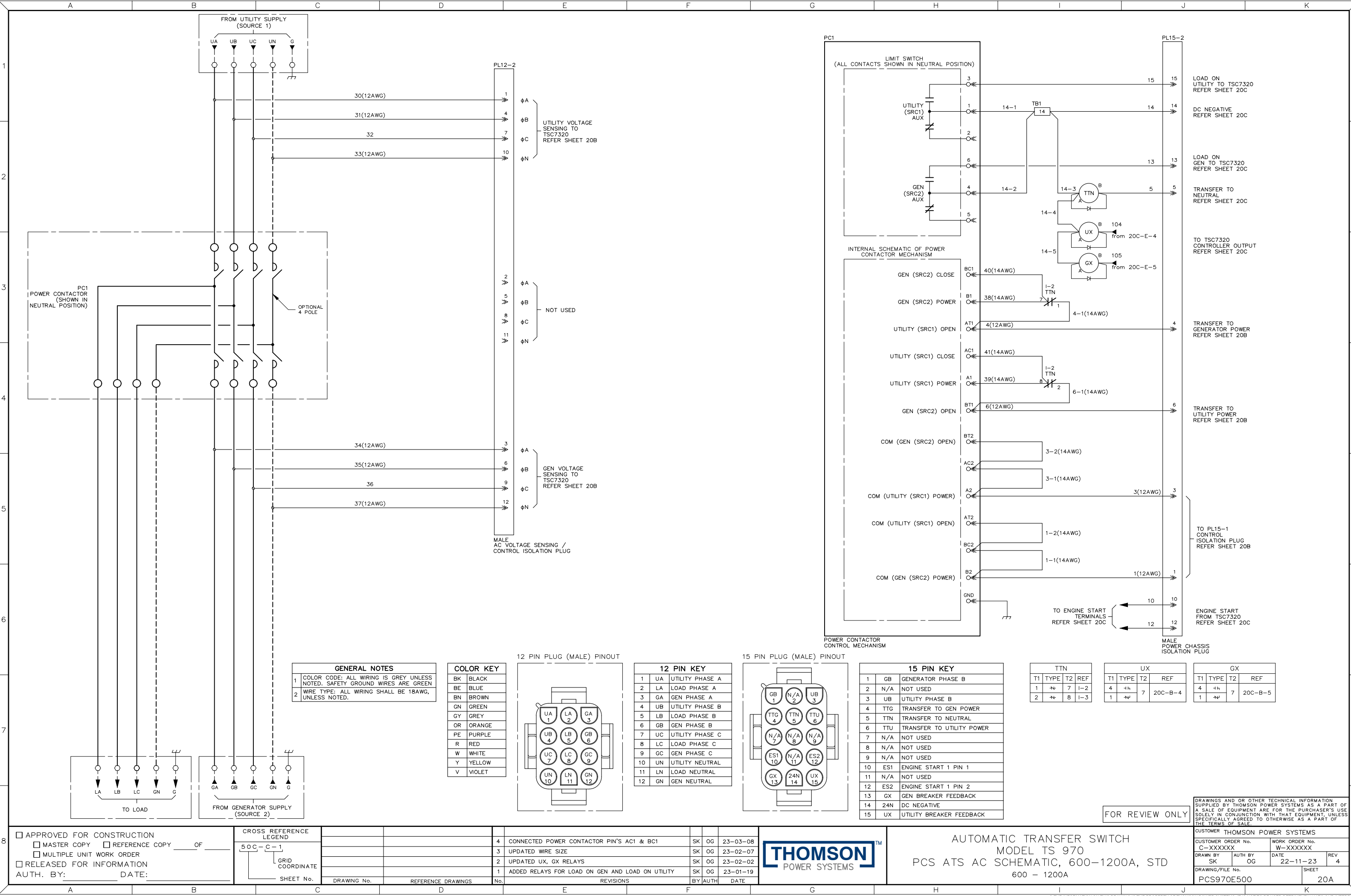
* Percentage may vary due to tank construction.

** Risers meet minimum code requirements.

Note: Verify regional code requirements prior to specification.

Section 5

Automatic Transfer Switch Data and
Drawings



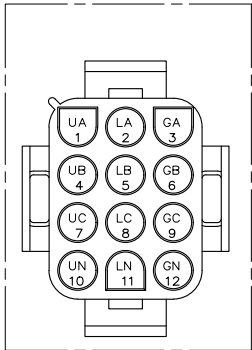
GENERAL NOTES

1 COLOR CODE: ALL WIRING IS GREY UNLESS NOTED. SAFETY GROUND WIRES ARE GREEN

2 WIRE TYPE: ALL WIRING SHALL BE 18AWG, UNLESS NOTED.

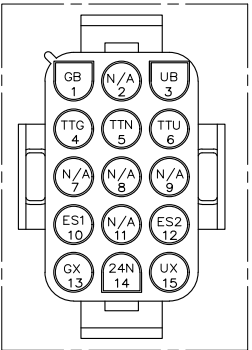
COLOR KEY	
BK	BLACK
BE	BLUE
BN	BROWN
GN	GREEN
GY	GREY
OR	ORANGE
PE	PURPLE
R	RED
W	WHITE
Y	YELLOW
V	VIOLET

12 PIN PLUG (MALE) PINOUT



12 PIN KEY		
1	UA	UTILITY PHASE A
2	LA	LOAD PHASE A
3	GA	GEN PHASE A
4	UB	UTILITY PHASE B
5	LB	LOAD PHASE B
6	GB	GEN PHASE B
7	UC	UTILITY PHASE C
8	LC	LOAD PHASE C
9	GC	GEN PHASE C
10	UN	UTILITY NEUTRAL
11	LN	LOAD NEUTRAL
12	GN	GEN NEUTRAL

15 PIN PLUG (MALE) PINOUT



15 PIN KEY		
1	GB	GENERATOR PHASE B
2	N/A	NOT USED
3	UB	UTILITY PHASE B
4	TTG	TRANSFER TO GEN POWER
5	TTN	TRANSFER TO NEUTRAL
6	TTU	TRANSFER TO UTILITY POWER
7	N/A	NOT USED
8	N/A	NOT USED
9	N/A	NOT USED
10	ES1	ENGINE START 1 PIN 1
11	N/A	NOT USED
12	ES2	ENGINE START 1 PIN 2
13	GX	GEN BREAKER FEEDBACK
14	24N	DC NEGATIVE
15	UX	UTILITY BREAKER FEEDBACK

TTN			
T1	TYPE	T2	REF
1	TT	7	I-2
2	TT	8	I-3

UX			
T1	TYPE	T2	REF
4	UX	7	20C-B-4

GX			
T1	TYPE	T2	REF
4	UX	7	20C-B-5

FOR REVIEW ONLY

DRAWINGS AND/OR OTHER TECHNICAL INFORMATION SUPPLIED BY THOMSON POWER SYSTEMS AS A PART OF A SALE OF EQUIPMENT ARE FOR THE PURCHASER'S USE SOLELY IN CONJUNCTION WITH THAT EQUIPMENT, UNLESS SPECIFICALLY AGREED TO OTHERWISE AS A PART OF THE TERMS OF SALE.

CUSTOMER THOMSON POWER SYSTEMS			
CUSTOMER ORDER No. C-XXXXXX		WORK ORDER No. W-XXXXXX	
DRAWN BY SK	AUTH BY OG	DATE 22-11-23	REV 4
DRAWING/FILE No. PCS970E500			SHEET 20A

☐ APPROVED FOR CONSTRUCTION

☐ MASTER COPY ☐ REFERENCE COPY OF

☐ MULTIPLE UNIT WORK ORDER

☐ RELEASED FOR INFORMATION

AUTH. BY: DATE:

CROSS REFERENCE LEGEND

50C-C-1

GRID COORDINATE

SHEET No.

DRAWING No.	REFERENCE DRAWINGS	No.
4	CONNECTED POWER CONTACTOR PIN'S AC1 & BC1	SK OG 23-03-08
3	UPDATED WIRE SIZE	SK OG 23-02-07
2	UPDATED UX, GX RELAYS	SK OG 23-02-02
1	ADDED RELAYS FOR LOAD ON GEN AND LOAD ON UTILITY	SK OG 23-01-19
REVISIONS		
BY	AUTH	DATE



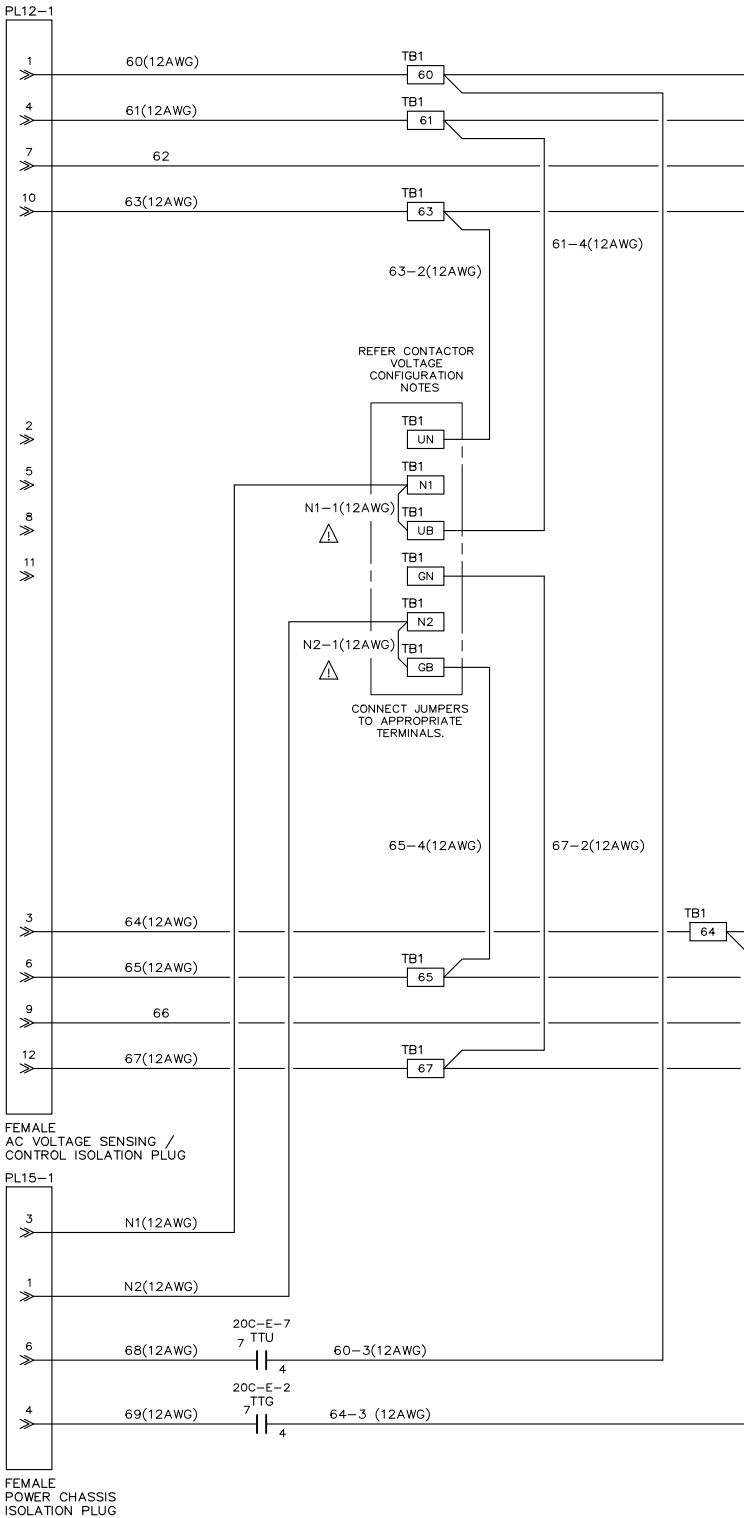
AUTOMATIC TRANSFER SWITCH
MODEL TS 970
PCS ATS AC SCHEMATIC, 600-1200A, STD
600 - 1200A

FROM PL12-2
VOLTAGE SENSING
FROM UTILITY
REFER SHEET 20A

NOT USED

FROM PL12-2
VOLTAGE SENSING
FROM GENERATOR
REFER SHEET 20A

FROM PL15-2
POWER SWITCHING
DEVICE CONTROL
REFER SHEET 20A



PT VOLTAGE CONFIGURATION (X DENOTES HIGH POLARITY MARKER)						
PT TAP	208	240	380	400	416	480/600
H1	X	X	X	X	X	X
H2	X	X	X	X	X	X
H3	X	X	X	X	X	X
H4	X	X	X	X	X	X
H5	X	X	X	X	X	X

JUMPERS FOR CONTACTOR VOLTAGE CONFIGURATION	
1	120/240V CONFIGURATION, JUMPER TB1-UB TO TB1-N1, TB1-GB TO TB1-N2
2	277/480V CONFIGURATION, JUMPER TB1-UN TO TB1-N1, TB1-GN TO TB1-N2
3	FOR 480V 3P, 3W SYSTEMS, JUMPER TB1-UB TO TB1-N1, TB1-GB TO TB1-N2. REFER SHEET 30A FOR DELTA KIT CONNECTION.

GENERAL NOTES	
1	CONTROL TRANSFORMER IS RATED FOR 100VA FOR MCS ATS & 200VA FOR ATS MECHANISM USING TRIP & CLOSE COILS
2	100VA CONTROL TRANSFORMER DOES NOT INCLUDE A 2ND 120VAC SECONDARY WIRING (X3/X4)
3	COLOR CODE: ALL WIRING IS GREY UNLESS NOTED. SAFETY GROUND WIRES ARE GREEN
4	WIRE TYPE: ALL WIRING SHALL BE 18AWG UNLESS NOTED.
5	REFER COVER PAGE / SELECTED OPTION LIST FOR PROJECT SPECIFIC DETAILS

COLOR KEY	
BK	BLACK
BE	BLUE
BN	BROWN
GN	GREEN
GY	GREY
OR	ORANGE
PE	PURPLE
R	RED
W	WHITE
Y	YELLOW
V	VIOLET

☐ APPROVED FOR CONSTRUCTION
☐ MASTER COPY ☐ REFERENCE COPY ____ OF ____
☐ MULTIPLE UNIT WORK ORDER
☐ RELEASED FOR INFORMATION
AUTH. BY: _____ DATE: _____

CROSS REFERENCE
LEGEND

50C-C-1

GRID
COORDINATE

SHEET No.

DRAWING No.	REFERENCE DRAWINGS	No.	REVISIONS	BY	DATE
3	UPDATED WIRE NUMBERS	SK	OG	23-02-08	
2	UPDATED WIRE SIZE	SK	OG	23-02-07	
1	ADDED RELAYS FOR LOAD ON GEN AND LOAD ON UTILITY	SK	OG	23-01-19	

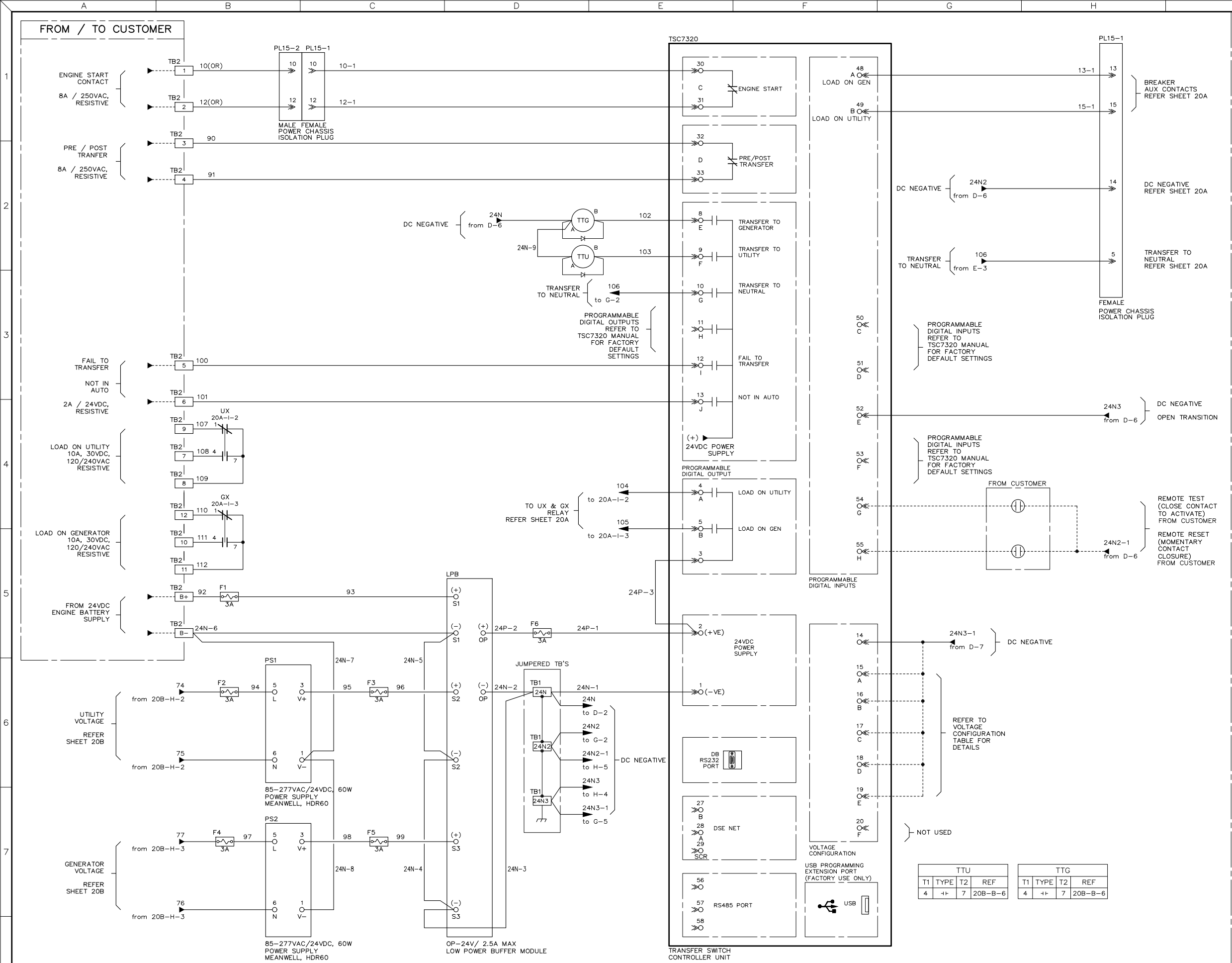


AUTOMATIC TRANSFER SWITCH
TSC7320 TRANSFER SWITCH CONTROLLER
ATS AC CONTROL SCHEMATIC
600-1200A

FOR REVIEW ONLY

DRAWINGS AND OR OTHER TECHNICAL INFORMATION
SUPPLIED BY THOMSON POWER SYSTEMS AS A PART OF
A SALE OF EQUIPMENT ARE FOR THE PURCHASER'S USE
SOLELY IN CONJUNCTION WITH THAT EQUIPMENT, UNLESS
SPECIFICALLY AGREED TO OTHERWISE AS A PART OF
THE TERMS OF SALE.

CUSTOMER THOMSON POWER SYSTEMS			
CUSTOMER ORDER No. C-XXXXXX	WORK ORDER No. W-XXXXXX	DATE 22-11-23	REV 3
DRAWN BY SK	AUTH BY OG	SHEET TSC700E104	20B



TSC7320 FACTORY DEFAULT SETTINGS		
NOTE : REFER TO OPTION DRAWINGS FOR APPLICABLE CHANGES TO FACTORY DEFAULT SETTINGS		
PARAMETER	DEFAULT	RANGE
GENERATOR (SOURCE 2) START DELAY	3 SEC	0-60 SEC
GENERATOR (SOURCE 2) WARM UP DELAY	2 SEC	0-3600 SEC
GENERATOR (SOURCE 2) COOL DOWN DELAY	300 SEC	0-3600 SEC
UTILITY (SOURCE 1) RETURN DELAY	300 SEC	0-3600 SEC
TRANSFER NEUTRAL DELAY	3 SEC	0-120 SEC
TRANSFER FAIL DELAY	30 SEC	0-120 SEC
EXERCISE TIMER	PROG.	PROG.
GENERATOR (SOURCE 2) UNDER VOLTAGE DELAY	3 SEC	0-10 SEC
GENERATOR (SOURCE 2) UNDER FREQUENCY DELAY	5 SEC	0-10 SEC
GENERATOR (SOURCE 2) UNDER VOLTAGE PICK UP	90%	75-100%
GENERATOR (SOURCE 2) UNDER VOLTAGE DROP OUT	85%	70-95%
UTILITY (SOURCE 1) UNDER VOLTAGE DELAY	1 SEC	0-10 SEC
UTILITY (SOURCE 1) UNDER VOLTAGE PICK UP	90%	75-100%
UTILITY (SOURCE 1) UNDER VOLTAGE DROP OUT	85%	70-95%

ALL SETTINGS ARE FIELD ADJUSTABLE UNLESS NOTED. REFER TO THE DSC7320 MKII MANUAL FOR A COMPLETE LISTING OF ALL TSC7320 SETTINGS.

VOLTAGE CONFIGURATION		
I-#	INPUT FUNCTION	VOLTAGE CONFIGURATION
I-14	DEFAULT	480V, 3PH 4W
I-15	INPUT A	120/240V, 1PH 3W
I-16	INPUT B	208V, 3PH 4W
I-17	INPUT C	240V, 3PH 4W
I-18	INPUT D	600V, 3PH 4W (NOT USED)
I-19	INPUT E	110V, 1PH 2W

PLEASE REFER TO THE TSC970 OPERATING MANUAL FOR THE TSC7320 CONTROLLER

GENERAL NOTES	
1	COLOR CODE: ALL WIRING IS GREY UNLESS NOTED. SAFETY GROUND WIRES ARE GREEN
2	WIRE TYPE: ALL WIRING SHALL BE 18AWG UNLESS NOTED.
3	REFER COVER PAGE / SELECTED OPTION LIST FOR PROJECT SPECIFIC DETAILS
4	ANALOG INPUT GROUND CONNECTIONS MUST BE ON THE ENGINE BLOCK AND MUST BE TO THE SENSOR BODIES.

COLOR KEY	
BK	BLACK
BE	BLUE
BN	BROWN
GN	GREEN
GY	GREY
OR	ORANGE
PE	PURPLE
R	RED
W	WHITE
Y	YELLOW
V	VIOLET

FOR REVIEW ONLY

DRAWINGS AND OR OTHER TECHNICAL INFORMATION SUPPLIED BY THOMSON POWER SYSTEMS AS A PART OF A SALE OF EQUIPMENT ARE FOR THE PURCHASER'S USE SOLELY IN CONJUNCTION WITH THAT EQUIPMENT, UNLESS SPECIFICALLY AGREED TO OTHERWISE AS A PART OF THE TERMS OF SALE.

CUSTOMER THOMSON POWER SYSTEMS			
CUSTOMER ORDER No.	W-XXXXXX	WORK ORDER No.	W-XXXXXX
DRAWN BY	AUTH BY	DATE	REV
SK	OG	22-11-23	3
DRAWING/FILE No.			SHEET
TSC700E103			20C

☐ APPROVED FOR CONSTRUCTION
☐ MASTER COPY ☐ REFERENCE COPY OF
☐ MULTIPLE UNIT WORK ORDER
☐ RELEASED FOR INFORMATION
AUTH. BY: DATE:

CROSS REFERENCE
LEGEND
50C-C-1
GRID
COORDINATE
SHEET No.

DRAWING No.	REFERENCE DRAWINGS	No.
3	UPDATED VOLTAGE CONFIGURATION DETAILS	SK OG 23-01-30
2	UPDATED 24VDC NEGATIVE WIRE NUMBERS & UX, GX RELAYS	SK OG 23-01-24
1	ADDED RELAYS FOR LOAD ON GEN AND LOAD ON UTILITY	SK OG 23-01-19

REVISIONS	BY	DATE
3	SK OG	23-01-30
2	SK OG	23-01-24
1	SK OG	23-01-19



AUTOMATIC TRANSFER SWITCH
TSC7320 TRANSFER SWITCH CONTROLLER
ATS DC CONTROL SCHEMATIC

100 - 1200A



SERIES TS 970 • 100 - 1200 AMP AUTOMATIC TRANSFER SWITCHES

TSC 7320 CONTROLLER

COMMERCIAL & INDUSTRIAL

REGAL[®]

THOMSON POWER SYSTEMS TS 970 AUTOMATIC TRANSFER SWITCHES OFFER THE FOLLOWING:

POWER CONTACTOR SWITCHING UNITS

- 100% Continuous Current Ratings for use with all load types
- High Short Circuit Withstand Ratings
- Three Position Power Contactor with programmable neutral delay position
- Single Coil Power Contactor Design for reliable operation
- Jumper configurable control voltage. No need to change solenoids
- Electrical and Mechanical Interlocked mechanism prevents simultaneous closure between Utility and Generator sources

SUPERIOR SERVICEABILITY

- Plug-in Control Devices allow field serviceability
- Enclosed Power Contacts for safe operation and maintenance
- All control wires and power cable connections are front accessible
- Plug-in TSC 7320 Transfer Switch Controller

CONTROL FEATURES

- TSC 7320 microprocessor based controller with 2.3" back-lit LCD display and programmable inputs/outputs
- Isolation plug permits disconnecting control circuits from all power sources
- Fast Open Transition with In-Phase Transfer

PRODUCT DATA

- Models from 100 - 1200A continuous current
- 3 or 4 pole
- All models 50/60Hz rated
- Voltage 208 - 480VAC
- 3 phase, 3 or 4 wire systems (3 wire, 480V requires option kit)
- Mechanically interlocked Open Transition
- Rust resistant, Satin-Coated enclosure (galvannealed)

QUALITY ASSURANCE

- ISO 9001 Registered

SEISMIC CERTIFICATION

TS 970 ATS is certified for installation and operation per the following requirements:

- Standards: IBC 2018, ASCE7 - 16, ICCES - AC156 - 2015
- Maximum Design Loads, $S_{ds}(g)=2.5$, $I_p=1.5$, $F_p/W_p=1.88$

SAFETY STANDARDS

- UL 1008 Automatic Transfer Switches for use in Emergency Systems
- CSA C22.2 No. 178 Automatic Transfer Switches
- NFPA 110 Standard for Emergency and Standby Power Systems

WARRANTY

- 2 year limited warranty included

Thomson Power Systems TS 970 Automatic Transfer Switches employ a power contactor switching unit and the TSC 7320 controller to automatically start a generator and transfer system load in the event of a utility supply failure. System load is then automatically re-transferred back to the utility supply following restoration of the utility power source to within normal operating limits. All load transfer sequences are "Open Transition" (i.e. "break-before-make") with in-phase transfer detection, or with adjustable neutral position delay to ensure adequate voltage decay for preventing out of phase transfers.

TS 970 Automatic Transfer Switches are certified to UL 1008 & CSA 178 Standards for use in Emergency Power System applications.

All TS 970 Transfer Switch models have been 3 cycle withstand current tested in accordance with UL 1008 & CSA 178. Additionally, they can withstand 6 times overload for 10 cycles. The standard TS 970 Automatic Transfer Switch is rated for 100% system load. All TS 970 Automatic Transfer Switch utilize the TSC 7320 microprocessor based controller which provides all necessary control functions for fully automatic operation. The controller is equipped with 2.3" back-lit LCD display which provides operating status and controls. All parameters and configurations are entered without opening the front door.

STANDARD FEATURES

- 2.3" back-lit LCD text display for monitoring 3 Phase Utility/Generator voltage, system frequency, operation status and alarms
- Five key menu navigation
- Front panel editing with PIN protection
- Customizable status screens
- Load on Utility & Load on Generator indication
- Utility & Generator Source available indication
- 3 Phase Voltage sensing on Utility & Generator Sources
- Generator AC frequency sensing
- Utility under voltage control setpoint 50 - 95% (adjustable)
- Generator under voltage control setpoint 50 - 95% (adjustable)
- Generator under frequency control setpoint 70 - 95% (adjustable)
- Engine warmup timer 0-60 min. (adjustable)
- Utility return timer 0-60 min. (adjustable)
- Engine start (Mains transient) delay timer 0-30 sec. (adjustable)
- Engine cooldown timer 0-60 min. (adjustable)
- Neutral position delay timer 0-120 sec. (adjustable)
- Load Disconnect Contact (LDC) for pre/post transfer control to signal external building systems such as elevators during transfer operations
- Up to 16 different date and time schedules for On-load or Off-load Generator exercising
- Real-time clock provides accurate event logging
- Data logging
- Ten outputs total. Two programmable outputs are rated at 2A, 24VDC resistive, two user programmable outputs rated 15A, 24VDC resistive, and One programmable relay output rated at 8A, 250VAC resistive. Remaining contacts are for ATS functionality. The user programmable outputs can be changed to 20 different functions including: Load on Utility, Load on Gen, Load Disconnect Contact (LDC), Fail to Transfer (FTT), Utility Power Available (UPA), Generator Power Available (GPA), Utility Power Fail, ATS Not in Auto, and ATS in Auto.
- The Transfer Switch controller is pre-programmed with the following outputs enabled:
 - Load on Utility
 - Load on Gen
 - Load Disconnect Contact (LDC)
 - Fail to Transfer (FTT)
 - ATS Not in Auto
- Local and remote utility power fail simulation test
- Engine start contact (8A, 120/250VAC resistive max.)
- Automatic force transfer to alternate supply if load voltage becomes de-energized
- 24VDC control power
- Remote Load Test/Peak Shave Input
- NEMA 1 Enclosure
- Solid Neutral on 4 Wire Systems
- Configurable System Voltage Type (3 wire delta or 4 wire Wye capable without additional sensing transformers)
- ATS Load Bus Power Metering Capability (Amp, Volt, Freq, kW, kVA, PF)*
- Under/Over Frequency Protection - Utility and Generator Sources
- 3 Phase Over Voltage Protection - Utility and Generator Sources
- Phase Sequence and Phase Rotation Protection between Utility and Generator Sources
- Voltage Phase Loss/Unbalance Protection
- Programmable Inputs (Quantity 8 Digital Input-voltage free input)
- Optional Remote Input module DSE2130 (Quantity 8 Digital inputs)
- Optional Remote Output module DSE2157 (Quantity 8 relay contacts)
- RS485 Modbus Remote Communication Port (Modbus™ Serial RTU)
- Optional Ethernet Modbus Remote Communication Port DSE855 (Modbus™ TCP)
- Optional Remote Annunciator DSE2548
- Support up to Three Remote Display Units DSE 2520
- Serviceable Plug-in Connectors



**Power Metering requires Current Transformer Option Kit*

WITHSTAND CURRENT RATINGS (ALL MODELS)

MODEL	RATED CURRENT (AMPS)	MAX VOLTAGE (VAC)	WITHSTAND CURRENT RATING AMPS (RMS) ¹			
			WCR 50mS (RMS SYM)	WCR 17mS (RMS SYM)	SPECIFIC BREAKER (RMS SYM)	WCR HRC FUSE (RMS SYM)
TS 973A0100A	100A	480	5,000	5,000	35,000	200,000
TS 973A0150A	150A	480	14,000	14,000	65,000	200,000
TS 973A0200A	200A	480	14,000	14,000	65,000	200,000
TS 973A0250A	250A	480	14,000	14,000	65,000	200,000
TS 973A0400A	400A	480	14,000	14,000	65,000	200,000
TS 973A0600A	600A	480	35,000	85,000	200,000	200,000
TS 973A0800A	800A	480	42,000	100,000	100,000	200,000
TS 973A1000A	1000A	480	42,000	100,000	100,000	200,000
TS 973A1200A	1200A	480	50,000	100,000	100,000	200,000

¹ Refer to product O&M Manual for complete list of circuit breakers.

ENCLOSURE DIMENSIONS/CABLE TERMINALS (ATS ONLY) (NEMA 1, ASA #61 GRAY)

AMPERAGE	No. OF POLES	NEMA DIMENSIONS ¹			SHIPPING WEIGHT lbs (kg)	TERMINAL RATING ²	
		HEIGHT INCHES (mm)	WIDTH INCHES (mm)	DEPTH INCHES (mm)		QTY (PER PHASE)	RANGE
100A	3	31.15" (800)	22.15" (572)	12.0" (305)	114 lbs (52)	1	#6 - 300 mcm
100A	4	31.15" (800)	22.15" (572)	12.0" (305)	124 lbs (56)	1	#6 - 300 mcm
150A	3	31.15" (800)	22.15" (572)	12.0" (305)	140 lbs (64)	1	#6 - 300 mcm
150A	4	39.2" (996)	26.15" (664)	12.5" (318)	148 lbs (67)	1	#6 - 300 mcm
200A	3	31.15" (800)	22.15" (572)	12.0" (305)	140 lbs (64)	1	#6 - 300 mcm
200A	4	39.2" (996)	26.15" (664)	12.5" (318)	148 lbs (67)	1	#6 - 300 mcm
250A	3	39.2" (996)	24.15" (613)	12.5" (318)	170 lbs (77)	1	#6 - 300 mcm
250A	4	39.2" (996)	26.15" (664)	12.5" (318)	175 lbs (80)	1	#6 - 300 mcm
400A	3	39.2" (996)	24.15" (613)	12.5" (318)	170 lbs (77)	2	4/0 - 500 mcm
400A	4	39.2" (996)	26.15" (664)	12.5" (318)	175 lbs (80)	2	4/0 - 500 mcm
600A	3	73.58" (1869)	29.2" (742)	28.08" (713)	638 lbs (289)	4	#4 - 600 mcm
600A	4	73.58" (1859)	29.2" (739)	28.08" (713)	657 lbs (298)	4	#4 - 600 mcm
800A	3	73.58" (1869)	29.2" (742)	28.08" (713)	638 lbs (289)	4	#4 - 600 mcm
800A	4	73.58" (1859)	29.2" (739)	28.08" (713)	657 lbs (298)	4	#4 - 600 mcm
1000A	3	73.58" (1869)	29.2" (742)	28.08" (713)	638 lbs (289)	4	#4 - 600 mcm
1000A	4	73.58" (1869)	29.2" (739)	28.08" (713)	657 lbs (298)	4	#4 - 600 mcm
1200A	3	73.58" (1869)	29.2" (742)	28.08" (713)	673 lbs (305)	4	#4 - 600 mcm
1200A	4	73.58" (1869)	29.2" (739)	28.08" (713)	697 lbs (316)	4	#4 - 600 mcm

Optional NEMA 3R class enclosures available — consult Thomson Power Systems.

¹ Enclosure dimensions are for reference (NOT FOR CONSTRUCTION). 100A - 400A mounting flanges not included in overall dimensions

² All cable connections suitable for copper or aluminum.

ORDERING INFORMATION

When placing an order, specify the following 21 digit ATS MODEL CODE as per the features and applications described below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
T	S		9	7																

1-3. SERIES

TS - TRANSFER SWITCH

13. OPERATION TYPE

1 - OPEN TRANSITION

16. CONTROLLER

5 - TSC 900 c/w GHC Graphic Display
6 - TSC 7320 c/w LCD Text Display

4 & 5. MODEL

97 - 970 SWITCH

14. SAFETY STANDARDS

C - UL 1008 / CSA 178

17. ENCLOSURE TYPE

A - NEMA1, ASA #61 GRAY
D - NEMA3R SD, ASA #61 GRAY

6. POLES

3 - 3 POLE
4 - 4 POLE

15. VOLTAGE⁴

1Ø 3 WIRE
D - 120/240¹

18. UTILITY SWITCHING DEVICE

J - POWER CONTACTOR

7. CONFIGURATION TYPE

A - ATS

3Ø 4 WIRE (GROUNDED NEUTRAL)

E - 120/208¹
F - 127/220¹
G - 120/240¹ (DELTA)
H - 220/380^{1,2}
S - 230/400^{1,2}
J - 240/416¹
K - 254/440¹
M - 277/480¹
Z - MULTIVOLTAGE (STOCK SWITCHES ONLY)¹

19. GENERATOR SWITCHING DEVICE

J - POWER CONTACTOR

8 - 11. AMPERAGE

0100
0150
0200
0250
0400
0600
0800
1000
1200

20. POWER CONNECTIONS

A - STANDARD

21. ATS CONNECTION CONFIGURATION

A - STANDARD

12. APPLICATION

A - STANDARD

3Ø 3 WIRE

P - 208
Q - 220
R - 240
V - 480³ (DELTA OPTION)

NOTES

¹ MULTI-VOLTAGE CAPABLE (208 - 480V)

² FOR 50 Hz APPLICATION

³ REQUIRES OPTION KIT

⁴ 208V-240V MUST BE AVAILABLE PHASE TO PHASE

AVAILABLE IN STOCK

The following standard ATS models are available from stock:

AMPERAGE	3 POLE	SOLID NEUTRAL	TSC 7320 CONTROLLER	NEMA 1 ENCLOSURE	NEMA 3R ENCLOSURE OPTION	8 PROGRAMMABLE OUTPUT CONTACTS (2A, 240VAC)	MODBUS™ RTU REMOTE COMM. PORT (SERIAL RS 485)
100A	■	■	■	■	■	■	■
150A	■	■	■	■	■	■	■
200A	■	■	■	■	■	■	■
250A	■	■	■	■	■	■	■
400A	■	■	■	■	■	■	■
600A	■	■	■	■	■	■	■
800A	■	■	■	■	■	■	■
1000A	■	■	■	■	■	■	■
1200A	■	■	■	■	■	■	■

■ Standard

■ Available Option in Stock

OPTIONAL FEATURES (Specify separately from ATS MODEL CODE when ordering)

CODE	DESCRIPTION
AUXILIARIES:	
KOTS-DSE	Key Operated Test Switch - Auto/Off/Engine Start/Test – includes the DSE2130 module
RO2157	Programmable Relay Output Expansion Module - Includes QTY 8, 2A Resistive 30VDC rated relays - 4 NO and 4 Form C Contacts.
COMMUNICATION:	
EMB-TCP/IP (DSE855)	Ethernet Modbus™ Remote Communication (Modbus™ TCP)
RA7320 (DSE2548)	Remote Annunciator with eight configurable LEDs. Works up to 0.6 miles from the TSC7320. Up to 10 modules can be daisy-chain (Refer to the DSE2548 Datasheet)
RD7320 (DSE2520)	Remote Display. Up to three display modules can be connected to TSC7320 (Refer to the DSE2510-20 Datasheet)
ENCLOSURE:	
LCK	Pad Lockable Door
TS-H1	Enclosure Strip Heater c/w Thermostat (120VAC external power source required)
TS-H2	Enclosure Strip Heater c/w Thermostat (internally powered from ATS load)
FUNCTION:	
LDS	Load Shed, 4 Stage *Requires LPM and CTK Option, available from 100A - 400A
480VDELTA	Field Modkit to add Control Transformers for 480V Delta Systems without Neutral Connection (3 Phase, 3 Wire)
METERING:	
LPM-DSE	Transfer Switch Generator Power Metering CT Kit (Amp, Volt, Freq, kW, kVA, PF) **Requires CT Kit
CTKxxxx	Current Transformer Kit for LPM (xxxx -Specify CT Size 0100, 0150, 0250, 0400) **Requires LPM option
POWER:	
SPD	Surge Protection Device
OTHER:	
3YR	Additional 12 Month Parts & Labour Warranty
5YR	Additional 36 Month Parts & Labour Warranty

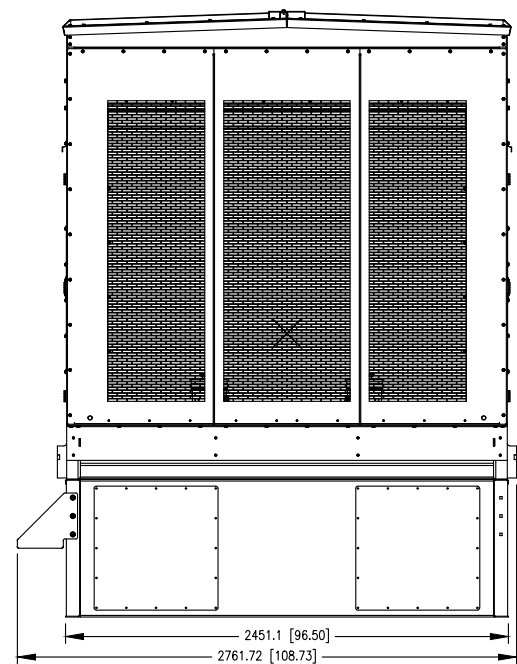
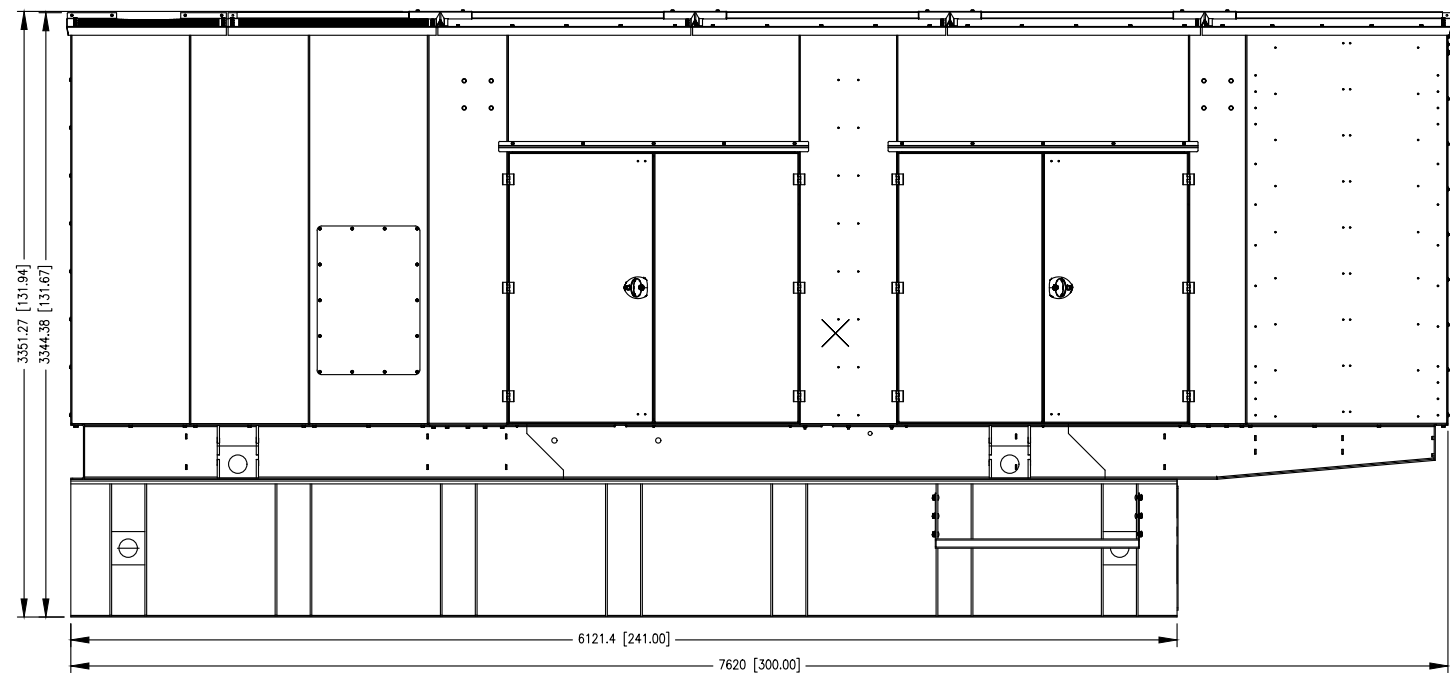
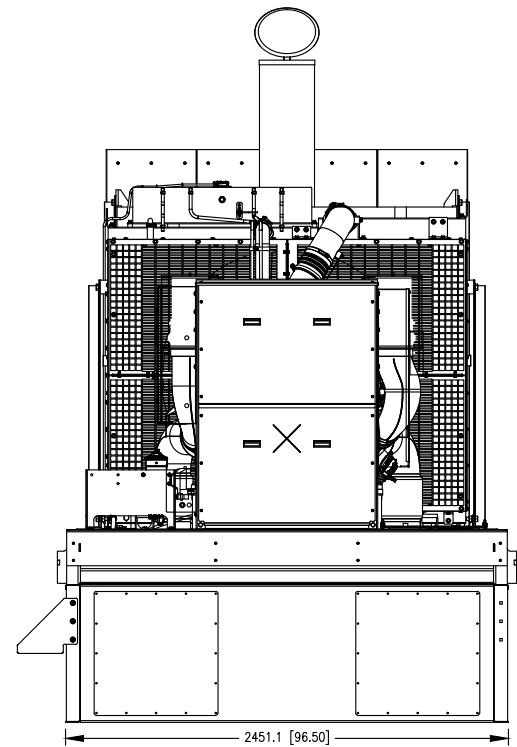
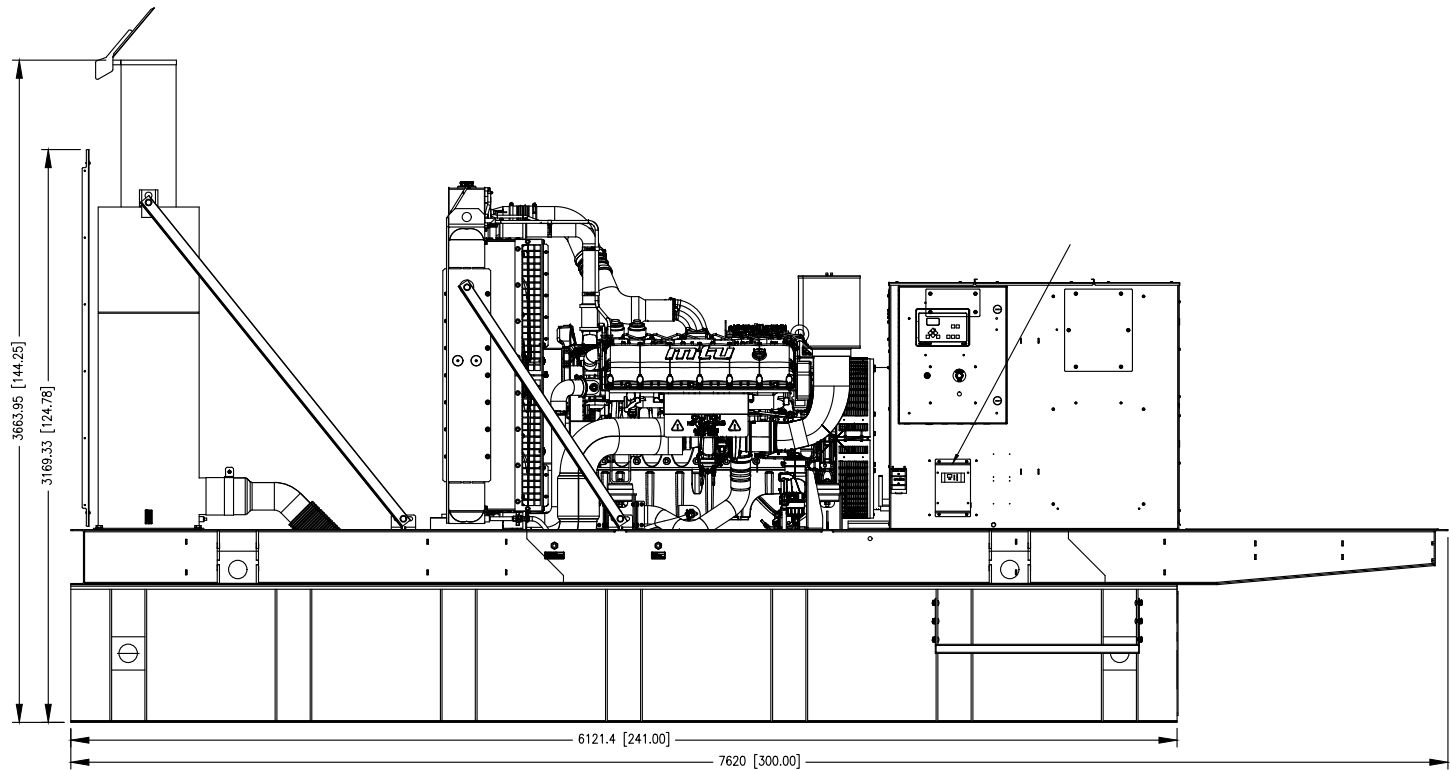
Section 6

Assembly Layout Drawing

Reference Pad Layout

Open Unit Drawing

Fuel Tank Drawings



REVISION	DATE	DESCRIPTION



W.W. Williams
POWER SOLUTIONS

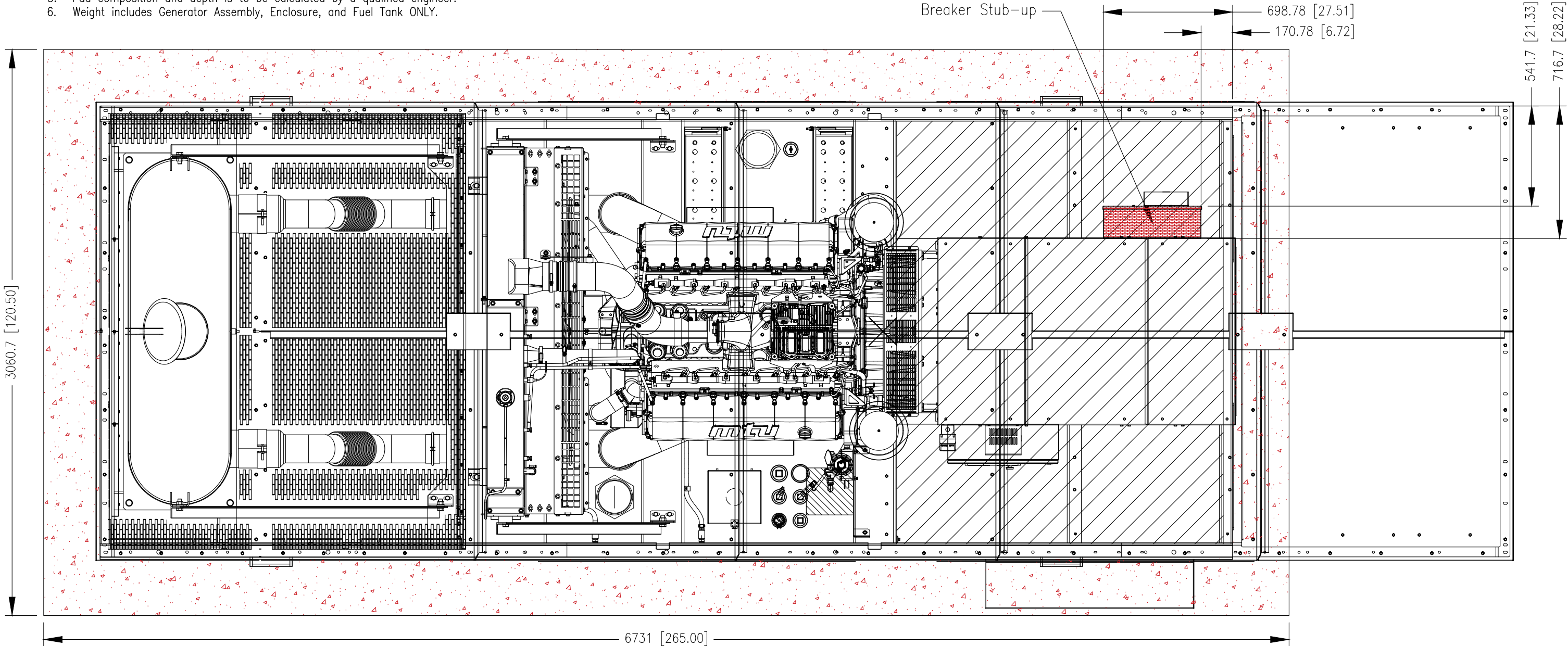
THIS DRAWING IS PROPERTY OF W.W. WILLIAMS POWER SOLUTIONS AND CANNOT BE USED EXCEPT IN CONNECTION WITH W.W. WILLIAMS POWER SOLUTIONS PROJECTS.
ANY THIRD PARTY MODIFICATION MAY VOID THIS DRAWING. W.W. WILLIAMS RESERVES ALL RIGHTS OF THIS DRAWING.

APPLICABLE MODELS:	DRAWN BY: KTIPPER	Assembly Drawing	
	DESCRIPTION:	Penski Logistics	
	DRAWN TO SCALE DIMENSIONS: MM [INCH]	ENGINE: MTU 12V1600 DS800	WEIGHT: 12,024.73 kg 26,510.00 lbs
	DATE CREATED: 1-24-24	DRAWING NUMBER: 011	SHEET: 1 of 1

NOTES:

- 1. Concrete pad should be a minimum 12” wider and 12” longer than unit base. (This increase is shown below)
- 2. Stub-up dimensions are referenced from Generator footprint.
- 3. Enclosure detail removed for reference clarity.
- 4. Anchors should be drilled and anchored after equipment is in place. (Refer to equipment submittal for recommended anchoring hardware.)
- 5. Pad composition and depth is to be calculated by a qualified engineer.
- 6. Weight includes Generator Assembly, Enclosure, and Fuel Tank ONLY.

SUGGESTED PAD LAYOUT DRAWING IS FOR REFERENCE ONLY. TO OBTAIN FULL FUEL CAPACITY, PAD SHOULD BE SLOPED NO MORE THAN 1/4”.
ACTUAL PAD DESIGN IS TO BE ACCORDING TO PLANS, SPECS, & APPLICABLE JURISDICTIONAL AUTHORITIES.



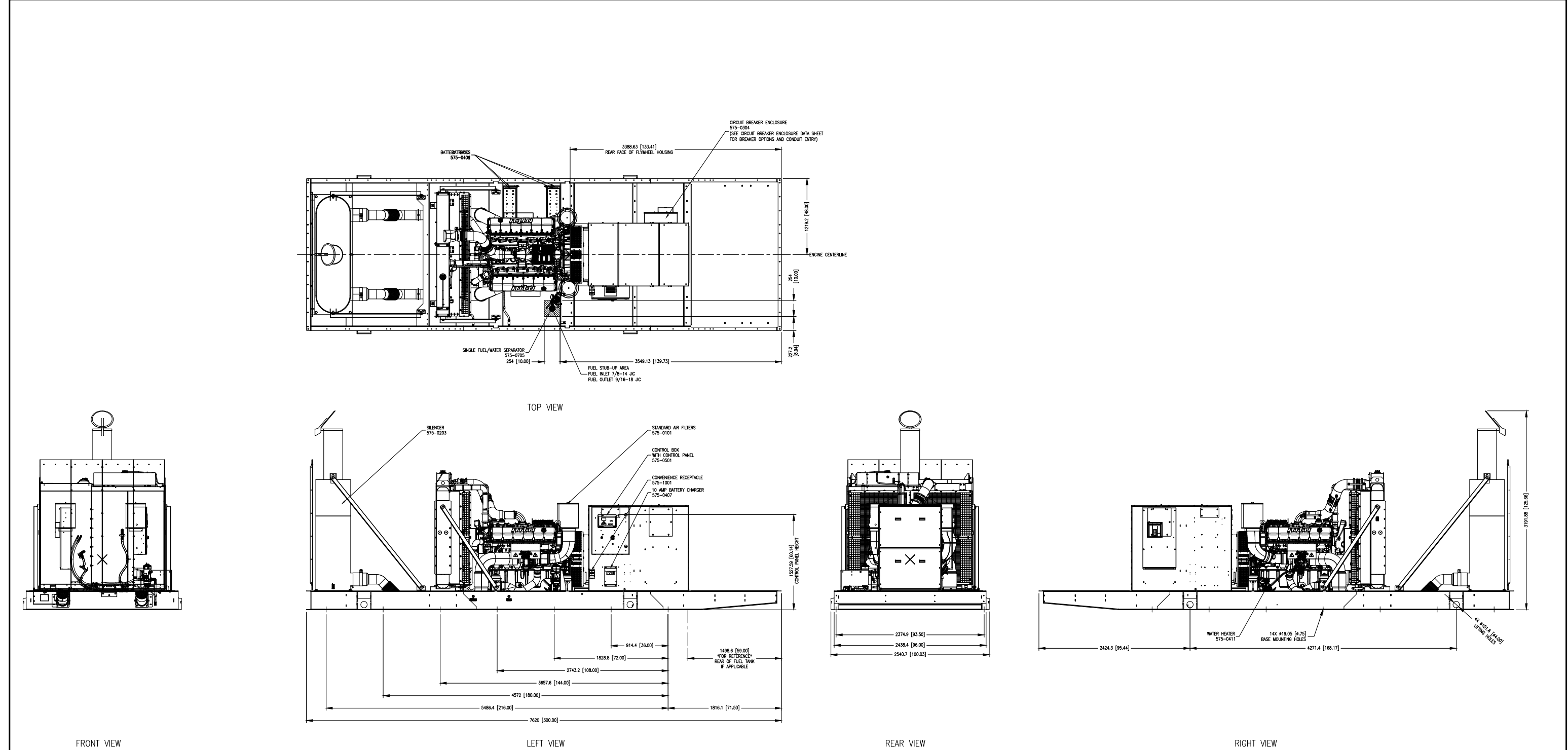
REVISION	DATE	DESCRIPTION



W.W. Williams
POWER SOLUTIONS

THIS DRAWING IS PROPERTY OF W.W. WILLIAMS POWER SOLUTIONS AND CANNOT BE USED EXCEPT IN CONNECTION WITH W.W. WILLIAMS POWER SOLUTIONS PROJECTS.
ANY THIRD PARTY MODIFICATION MAY VOID THIS DRAWING. W.W. WILLIAMS RESERVES ALL RIGHTS OF THIS DRAWING.

APPLICABLE MODELS:	DRAWN BY: KTIPPER	Reference Pad Layout	
	DESCRIPTION:	Penski Logistics	
	DRAWN TO SCALE DIMENSIONS: MM [INCH]	ENGINE: MTU 12V1600 DS800	WEIGHT: 12,024.73 kg 26,510.00 lbs
	DATE CREATED: 1-24-24	DRAWING NUMBER: 021	SHEET: 1 of 1



			 W.W. Williams POWER SOLUTIONS THIS DRAWING IS PROPERTY OF W.W. WILLIAMS POWER SOLUTIONS AND CANNOT BE USED EXCEPT IN CONNECTION WITH W.W. WILLIAMS POWER SOLUTIONS PROJECTS. ANY THIRD PARTY MODIFICATION MAY VOID THIS DRAWING. W.W. WILLIAMS RESERVES ALL RIGHTS OF THIS DRAWING.	APPLICABLE MODELS:	DRAWN BY:	KTIPPER	Open Unit Drawing		
							DESCRIPTION:		
							Penski Logistics		
							DRAWN TO SCALE DIMENSIONS: MM [INCH]	ENGINE: MTU 12V1600 DS800	WEIGHT: 12,024.73 kg 26,510.00 lbs
							DATE CREATED: 1-24-24	DRAWING NUMBER: 031	SHEET: 1 of 1
REVISION	DATE	DESCRIPTION							



REVISION	DATE	DESCRIPTION

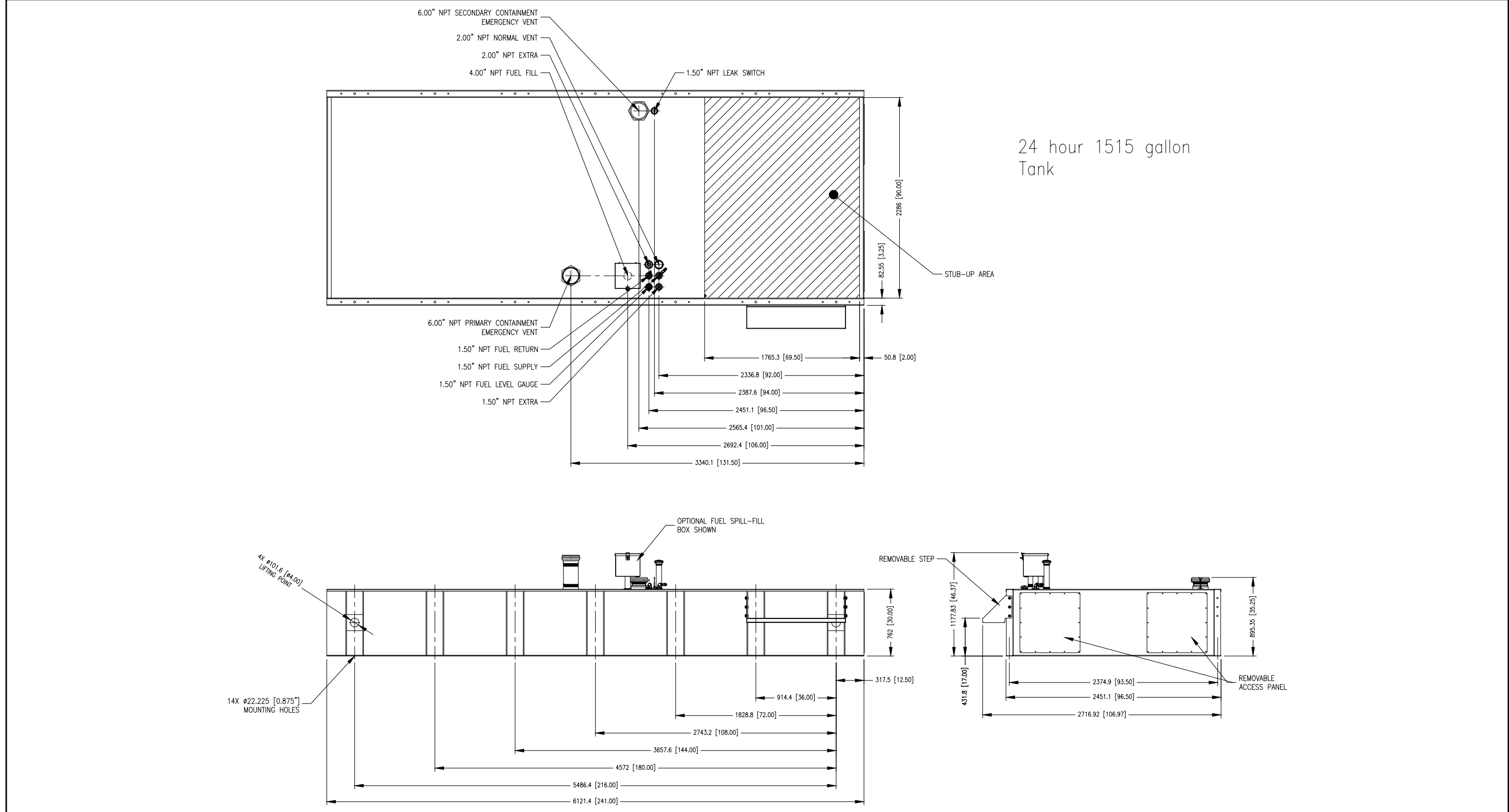


W.W. Williams

POWER SOLUTIONS

THIS DRAWING IS PROPERTY OF W.W. WILLIAMS POWER SOLUTIONS AND CANNOT BE USED EXCEPT IN CONNECTION WITH W.W. WILLIAMS POWER SOLUTIONS PROJECTS.
ANY THIRD PARTY MODIFICATION MAY VOID THIS DRAWING. W.W. WILLIAMS RESERVES ALL RIGHTS OF THIS DRAWING.

APPLICABLE MODELS:	DRAWN BY:	KTIPPER	Enclosure Drawing	
	DESCRIPTION:			
	Penski Logistics			
	DRAWN TO SCALE DIMENSIONS: MM [INCH]		ENGINE: MTU 12V1600 DS800	WEIGHT: 12,024.73 kg 26,510.00 lbs
	DATE CREATED: 1-24-24	DRAWING NUMBER: 041	SHEET: 1 of 1	



REVISION	DATE	DESCRIPTION



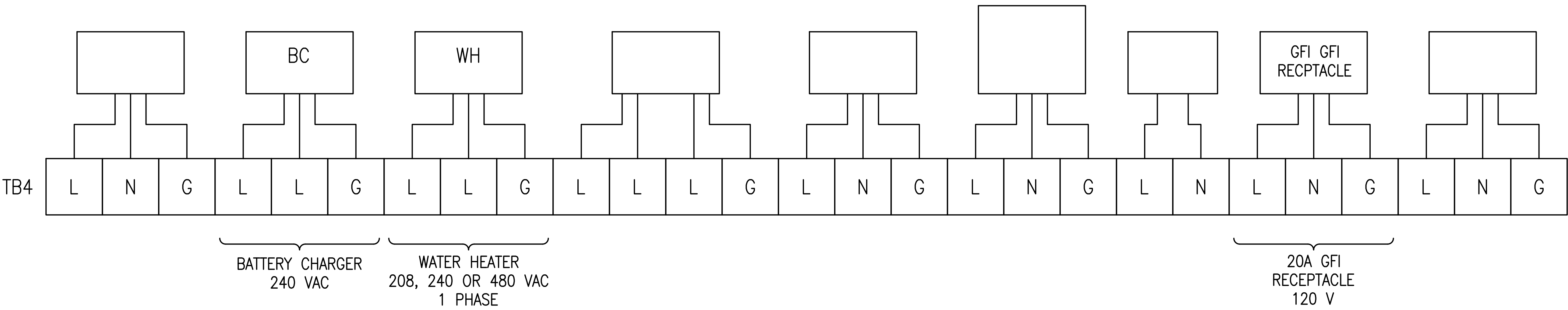
W.W. Williams
POWER SOLUTIONS

THIS DRAWING IS PROPERTY OF W.W. WILLIAMS POWER SOLUTIONS AND CANNOT BE USED EXCEPT IN CONNECTION WITH W.W. WILLIAMS POWER SOLUTIONS PROJECTS. ANY THIRD PARTY MODIFICATION MAY VOID THIS DRAWING. W.W. WILLIAMS RESERVES ALL RIGHTS OF THIS DRAWING.

APPLICABLE MODELS:	DRAWN BY:	KTIPPER	Tank Drawing		
	DESCRIPTION:				
	Penski Logistics				
	DRAWN TO SCALE DIMENSIONS: MM [INCH]		ENGINE: MTU 12V1600 DS800	WEIGHT: 12,024.73 kg 26,510.00 lbs	
	DATE CREATED: 1-24-24		DRAWING NUMBER: 051		SHEET: 1 of 1

AC OPTIONS

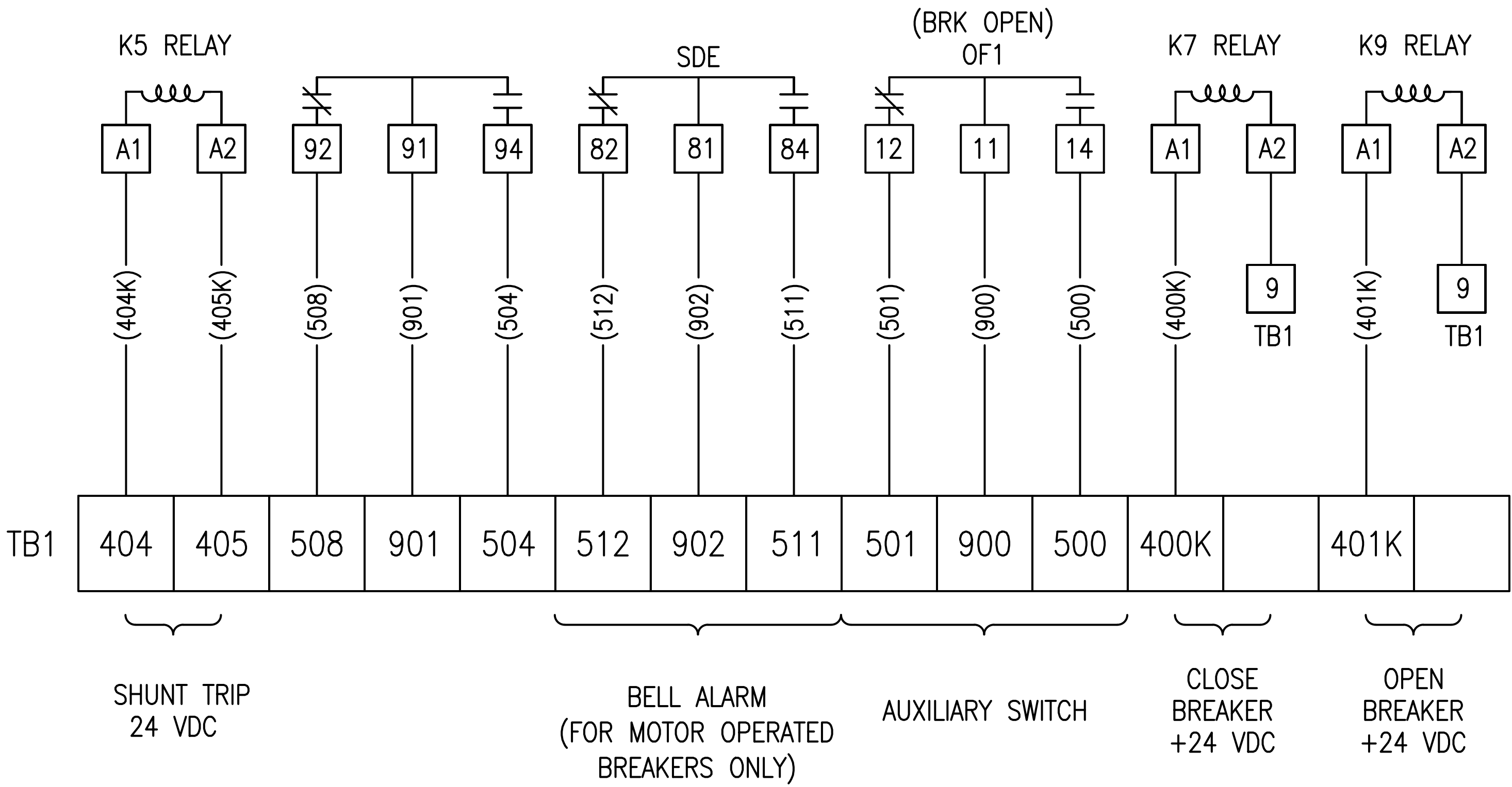
NO DISTRUBUTION PANEL



CUSTOMER CONNECTIONS

CUSTOMER CONNECTIONS
BREAKER OPTIONS

SD = BELL ALARM (ALARM SWITCH)
SDE = BELL ALARM (OVERCURRENT TRIP SWITCH)
OF1 = AUX SWITCH

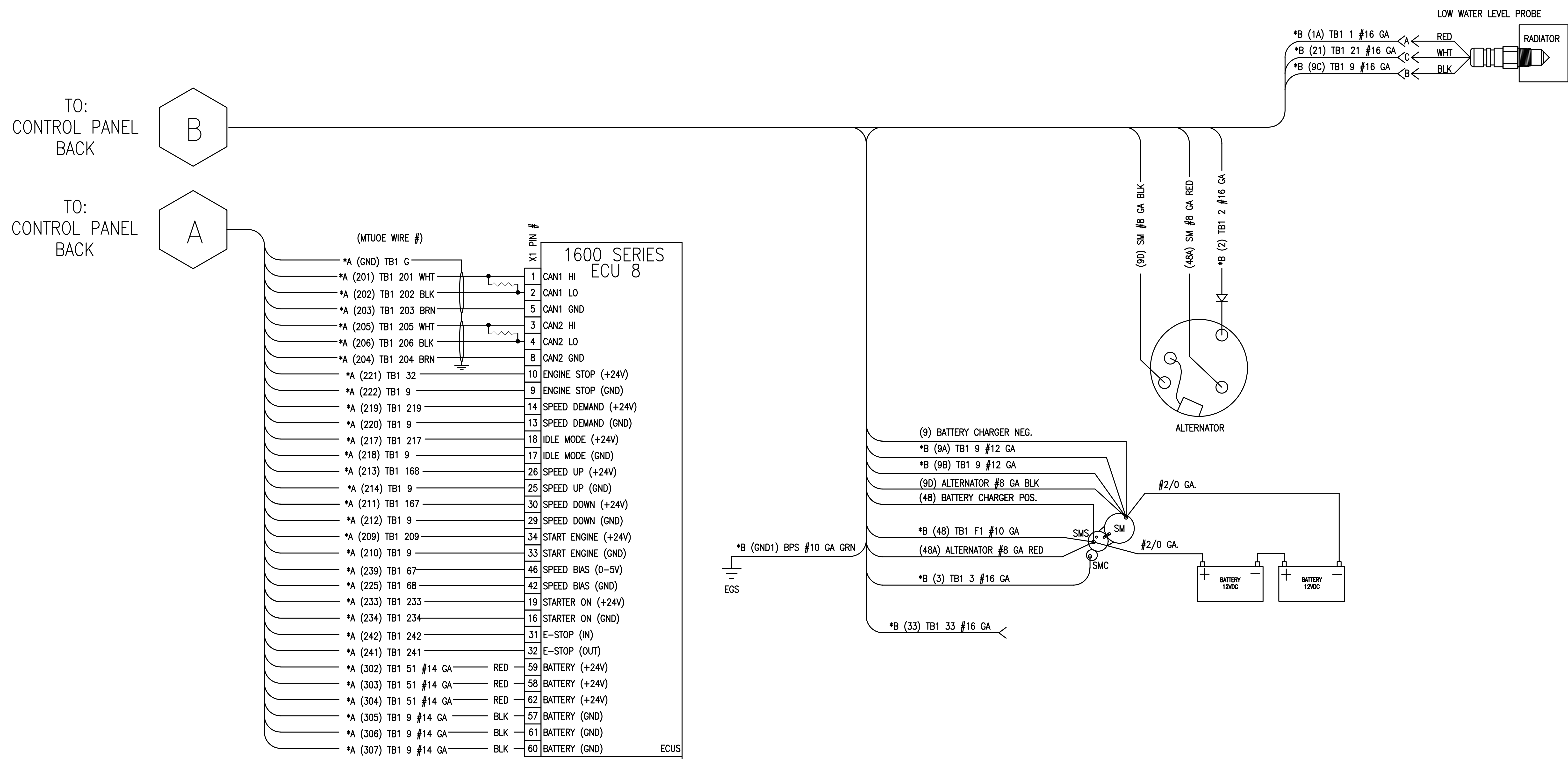
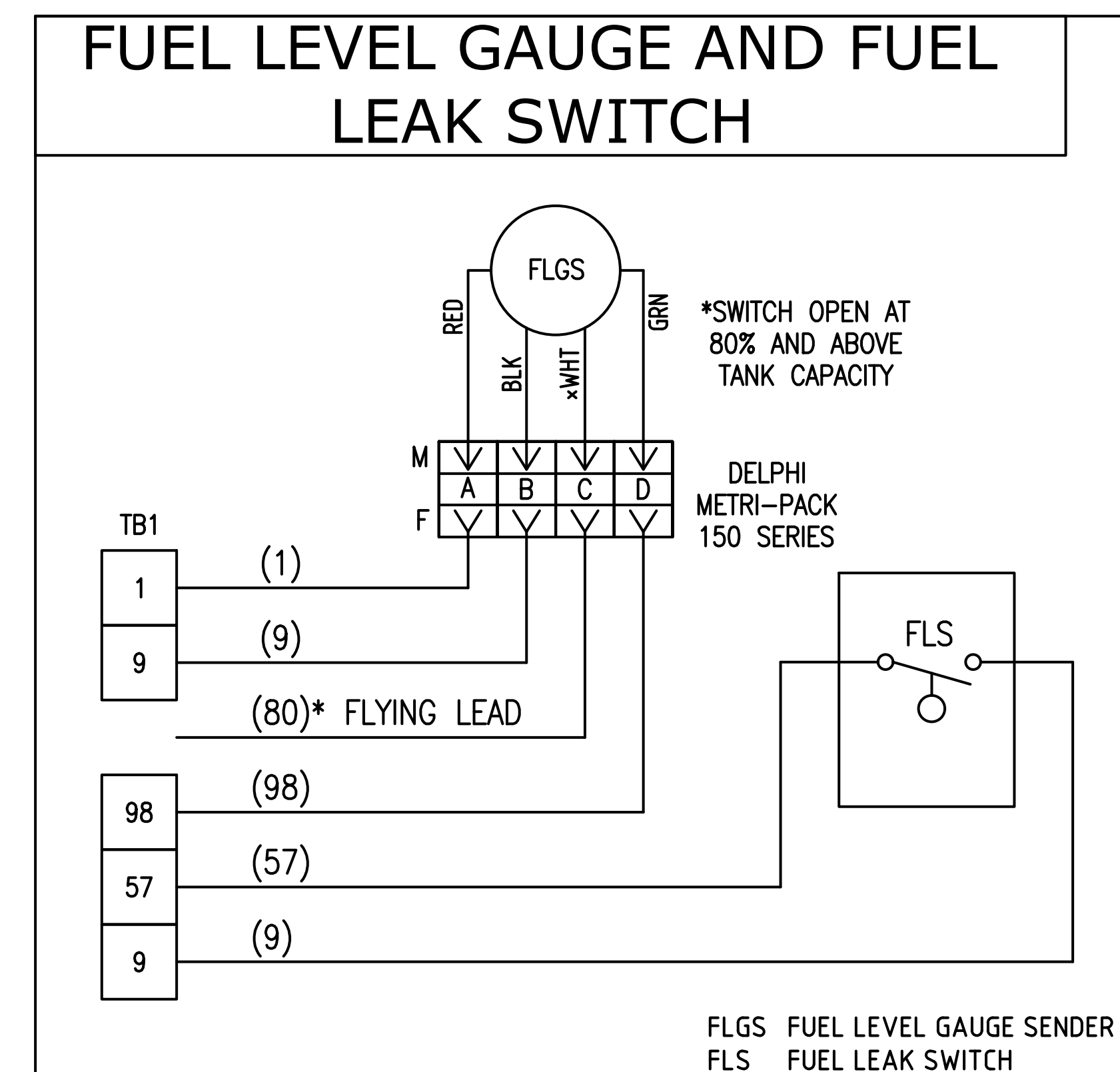
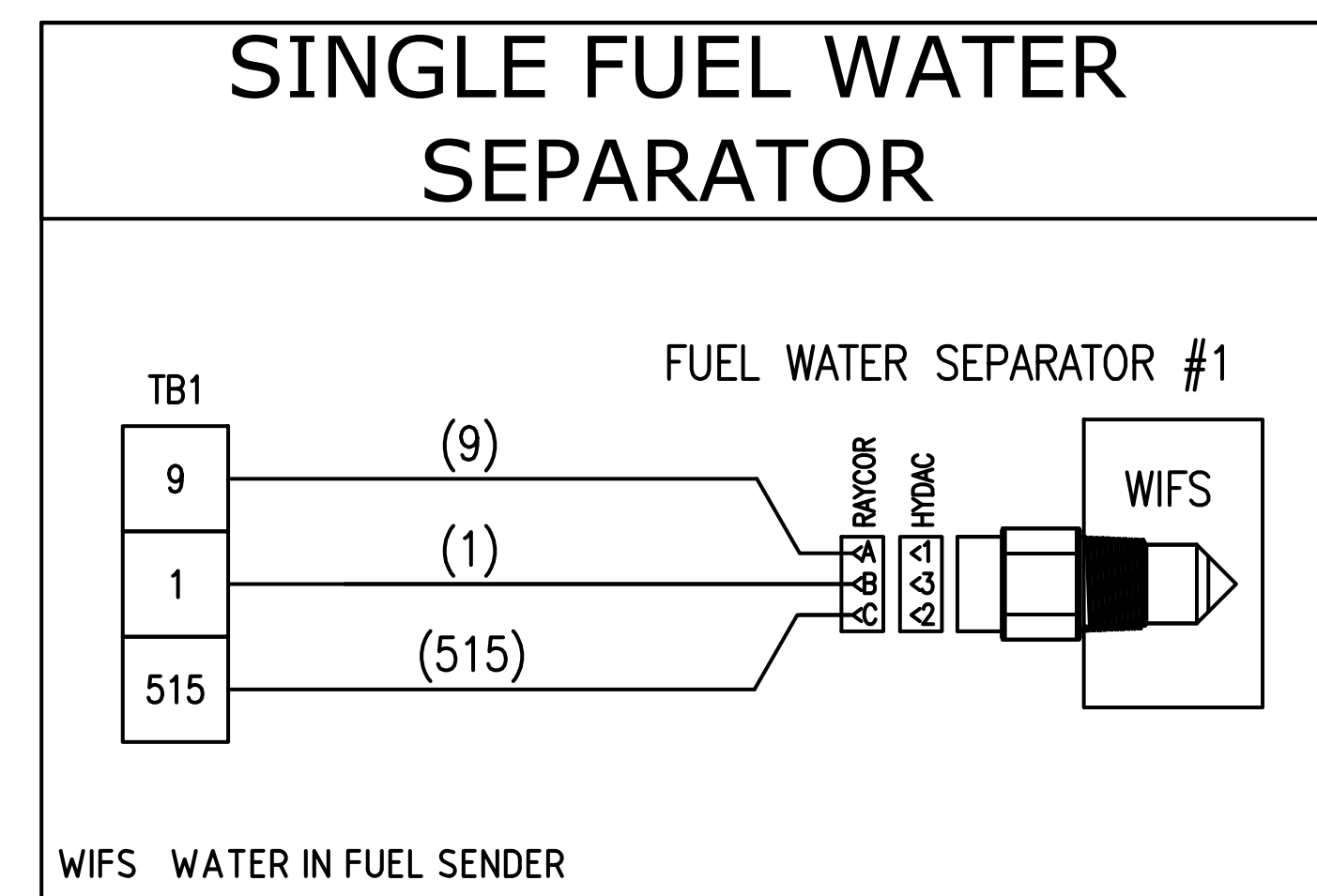


1ST BREAKER

NOTES:

- WIRE NUMBERS ARE IN PARENTHESIS.
- SHORT DASHED LINES (-----) INDICATE CUSTOMER CONNECTION OR OPTIONAL EQUIPMENT.

Änderungsbezeichnung/Description of revision REVISE TITLE BLOCK				Kommt von/Frequency KOMMT_VON				Rechte an der Zeichnung oder an den Materialien, die Zeichnung nach Herstell- oder Verfahrenrecht geschützt sind, werden nicht übertragen. Zweitanwender verschaffen sich Schaden. All industrial property rights reserved. Disclaimers regarding use for any other purpose is prohibited unless an express permission has been given. Any infringement results in liability for damages.				Drucker Printer 24.08.2021 24.08.2021 10.10.2021 10.10.2021 grünrot rammredy grünrot rammredy				ARRANGEMENT DRAWING			
Buchst./Rev.Ltr. c.2		Erh.-Antrags-Nr./Promotion Request No. PR077798		Änderungs-Nr./Change Notice No. CN028775		Bearbeitungsstatus/Lifecycle Released		 RAI-Solutions RAI-Solutions Solutions GmbH		Zeichnungs-Nr./Drawing No. FDH00000000001204593		Blatt Sheet 1/1							
Beschreibung/Description 450-900 kW																			



- LEGEND:

ALT	ENGINE ALTERNATOR
BC	BATTERY CHARGER
F6	FUSE ATO 5A
MGC	DIGITAL GENSET CONTROLLER
ECUS	ENGINE CONTROL UNIT STUD
EGS	ENGINE GROUND STUD
FLS	FUEL LEVEL GAUGE SENDER
FLS	FUEL LEAK SWITCH
FWS	FUEL WATER SEPARATOR
R1~3	RESISTOR 120 OHM ½ W
SMR	STARTER MOTOR RIGHT STANDARD
SML	STARTER MOTOR LEFT REDUNDANT
SMC	STARTER MOTOR COIL
SMS	STARTER MOTOR SOLENOID
TB1	TERMINAL BOARD 1 (CONTROL PANEL)
TB4	TERMINAL BOARD 4 (AC CONNECT BOX)

NOTES:

1. WIRE NUMBERS ARE IN PARENTHESIS.
2. WIRING IS #20 GA. UNLESS OTHERWISE SPECIFIED.
3. SHORT DASHED LINES (-----) INDICATE OPTIONAL EQUIPMENTS WIRING.

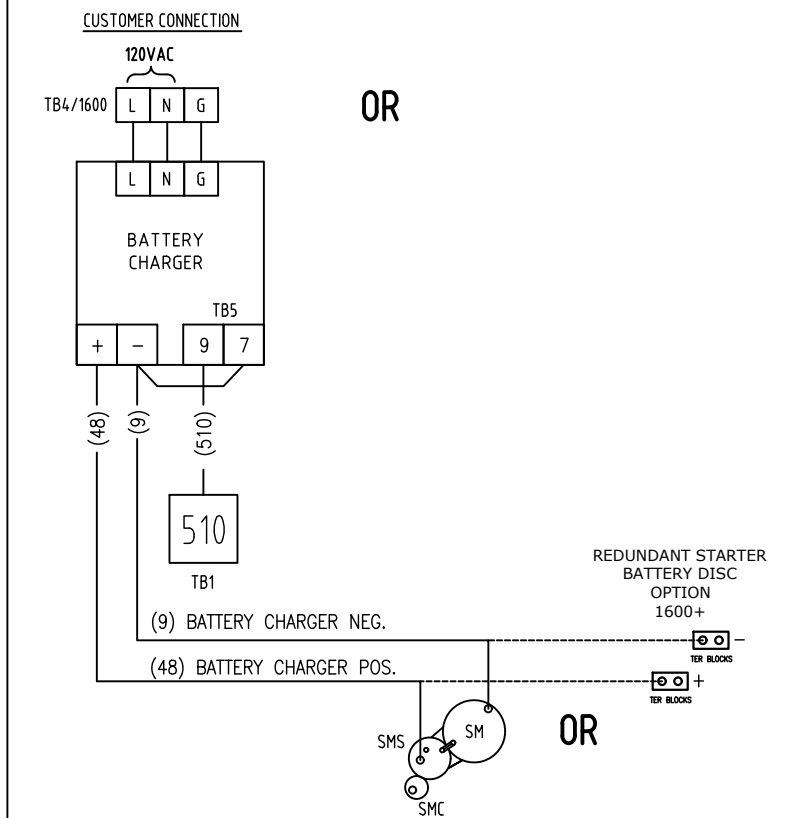
*X	(X)	XXX	X
----	-----	-----	---

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

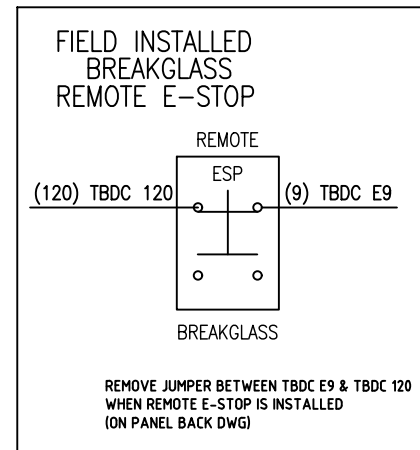
12v 1600

[illegible]

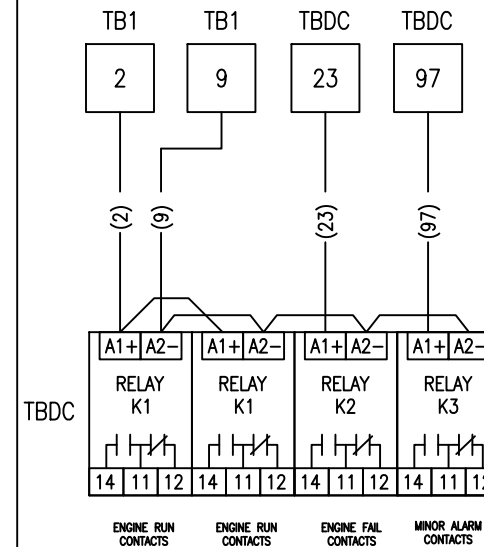
BATTERY CHARGER



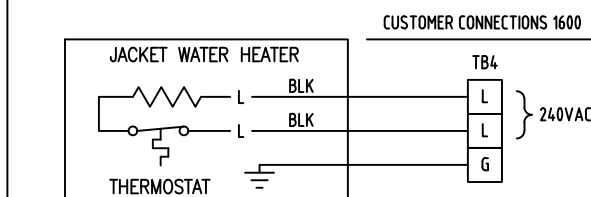
REMOTE E-STOP



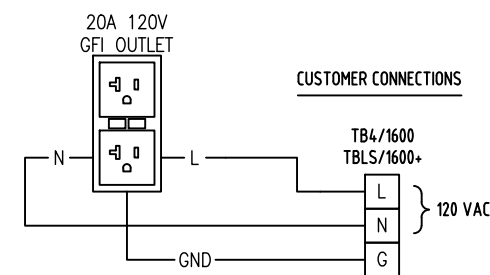
4 RELAY OPTION



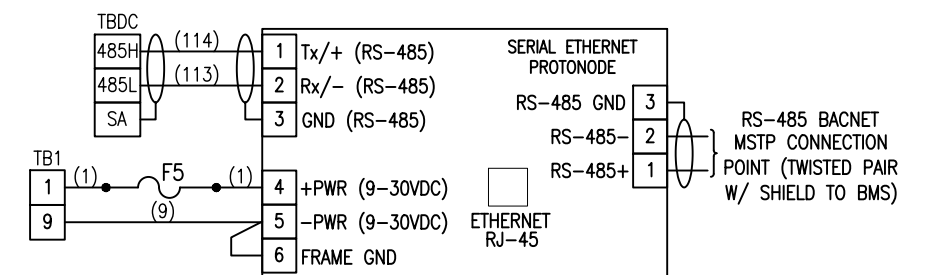
JACKET WATER HEATER



CONVENIENCE RECEPTACLE



BACKNET CONVERTOR

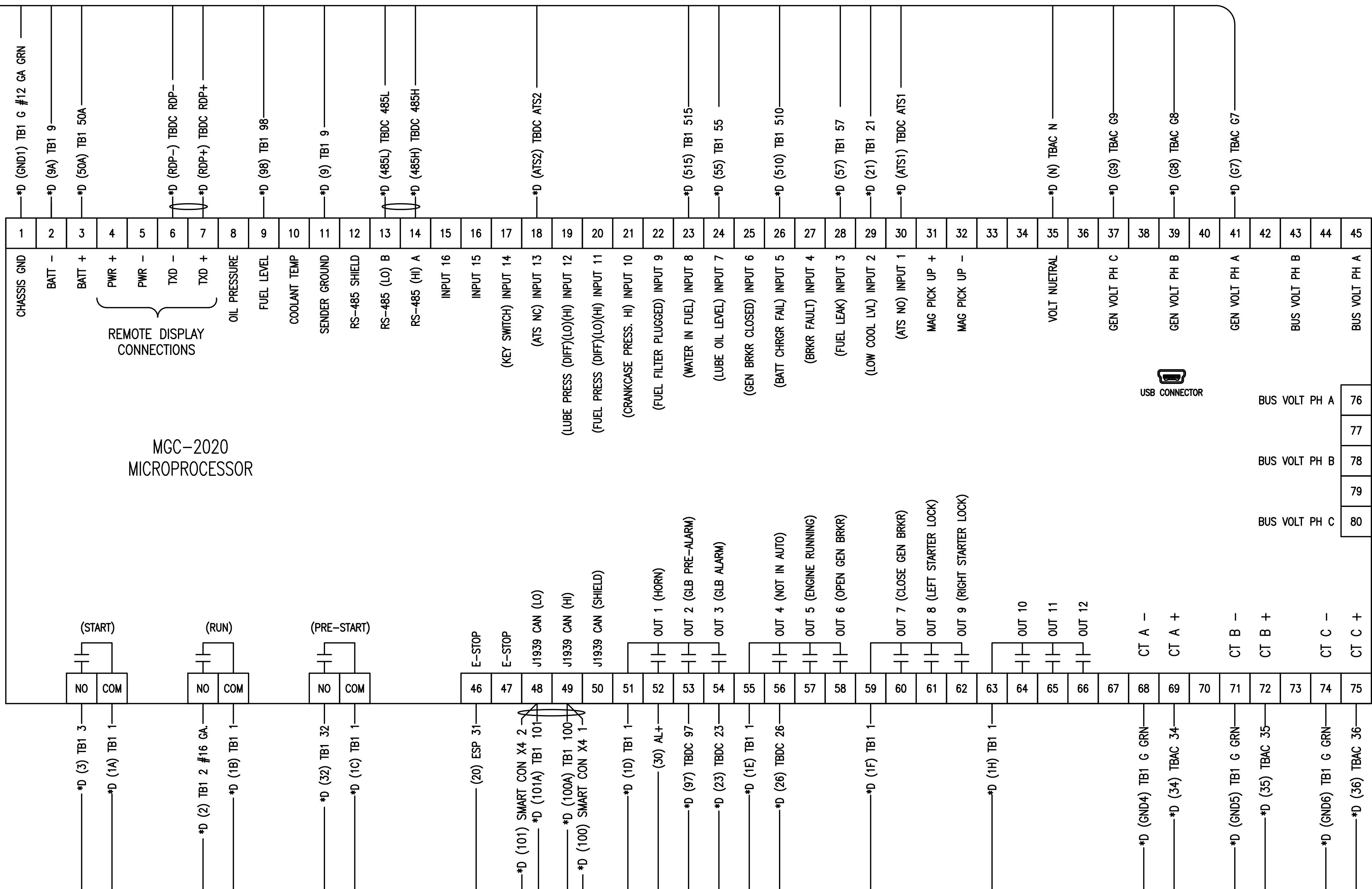


LEGEND:

D1	DIODE 1
D2	DIODE 2
D3	DIODE 3
ESP	EMERGENCY STOP PUSHBUTTON
F4	FUSE ATO 3A
F5	FUSE ATO 3A
SM	STARTER MOTOR
TBAC	TERMINAL BLOCK AC
TBDC	TERMINAL BLOCK DC
TBLS	LS TERMINAL STRIP CUSTOMER CONNECT
TBLSI	LS TERMINAL STRIP INTERNAL
TBOB	TERMINAL STRIP OUTLET BOX MARATHON
TB1	TERMINAL BLOCK 1
TB4	TERMINAL BLOCK 4
MCP	MASTER CONTROL PANEL

[illegible]

TO:
CONTROL PANEL
BACK



LEGEND

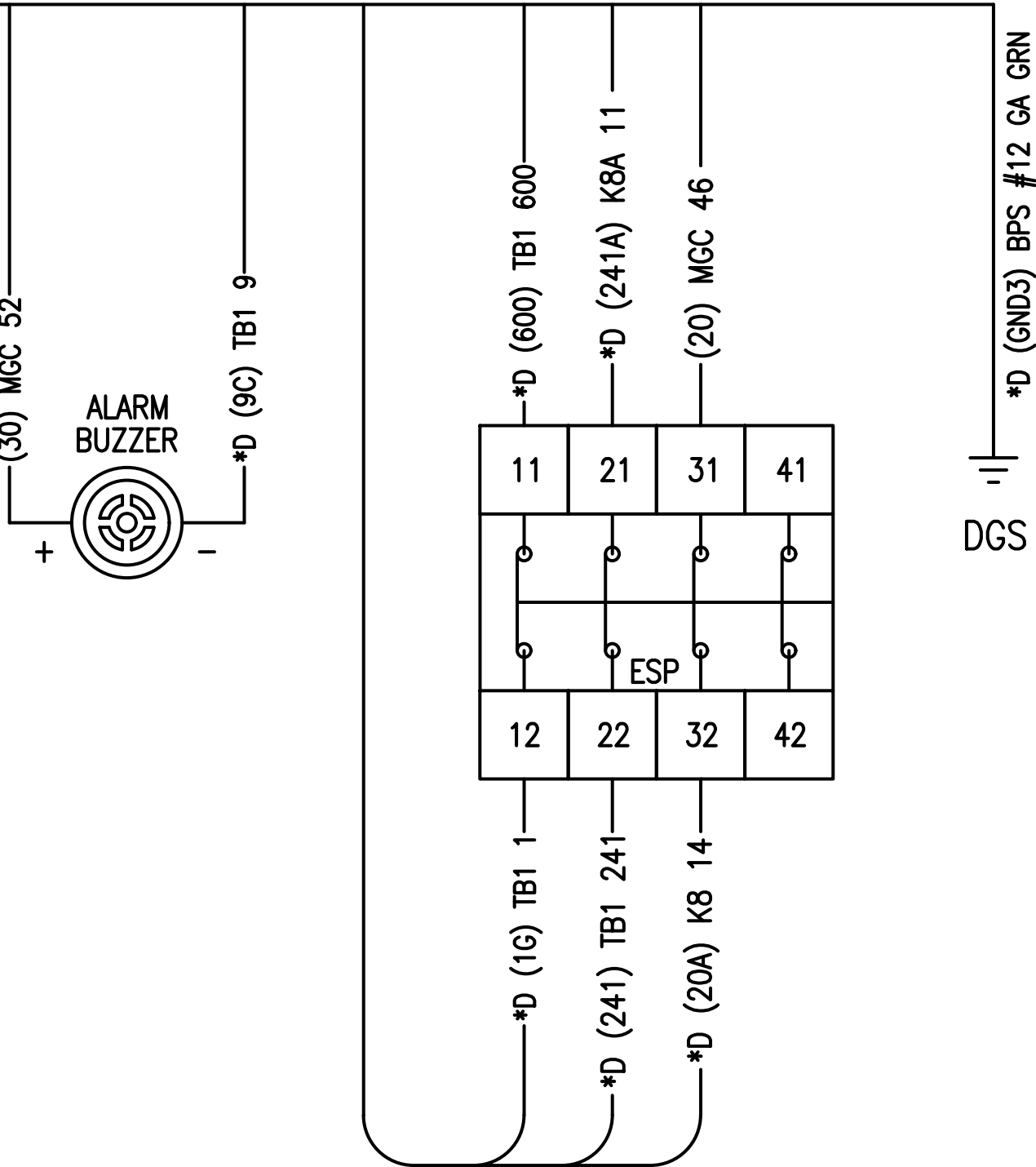
AL ALARM BUZZER
AEM ANALOG EXPANSION MODULE
BOS BATTLE OVERRIDE SW
BPS BACK PLATE STUD
CEM CONTACT EXPANSION MODULE
DGS DOOR GROUND STUD
ESP EMERGENCY STOP BUTTON
F1 PANEL FUSE ATO 5A
F2 PANEL FUSE ATO 15A
F3 PANEL FUSE ATO 20A
FLGS FUEL LEVEL GAUGE SENDER
FLS FUEL LEAK SWITCH
GGG GENERATOR GROUND STUD
K1 ENGINE RUN RELAY
K10 ENGINE RUN RELAY
K2 ENGINE FAIL RELAY
K3 MINOR ALARM RELAY
K6 LOUVER MOTOR RELAY
K8 REMOTE EMERGENCY STOP RELAY
LWL LOW WATER LEVEL PROBE
MGC MTU GENERATOR CONTROLLER
MEC MODBUS/ETHERNET CONVERTER
R1 120 OHM 1/8 1% RESISTOR
SAT SPEED (FREQ) ADJUST TOGGLE
TB1 TERMINAL (CONTROL PANEL)
VAT VOLTAGE ADJUST TOGGLE

NOTE:

- WIRE NUMBERS ARE IN PARENTHESIS
- WIRING IS #20 GA. UNLESS OTHERWISE SPECIFIED
- SHORT DASHED LINES (-----) INDICATE CUSTOMER CONNECTION
- S2000 USES SINGLE BEARING RTD AND S4000 USES DOUBLE BEARING RTDS

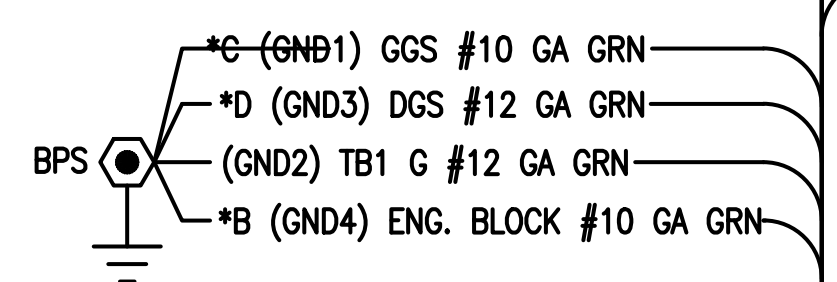
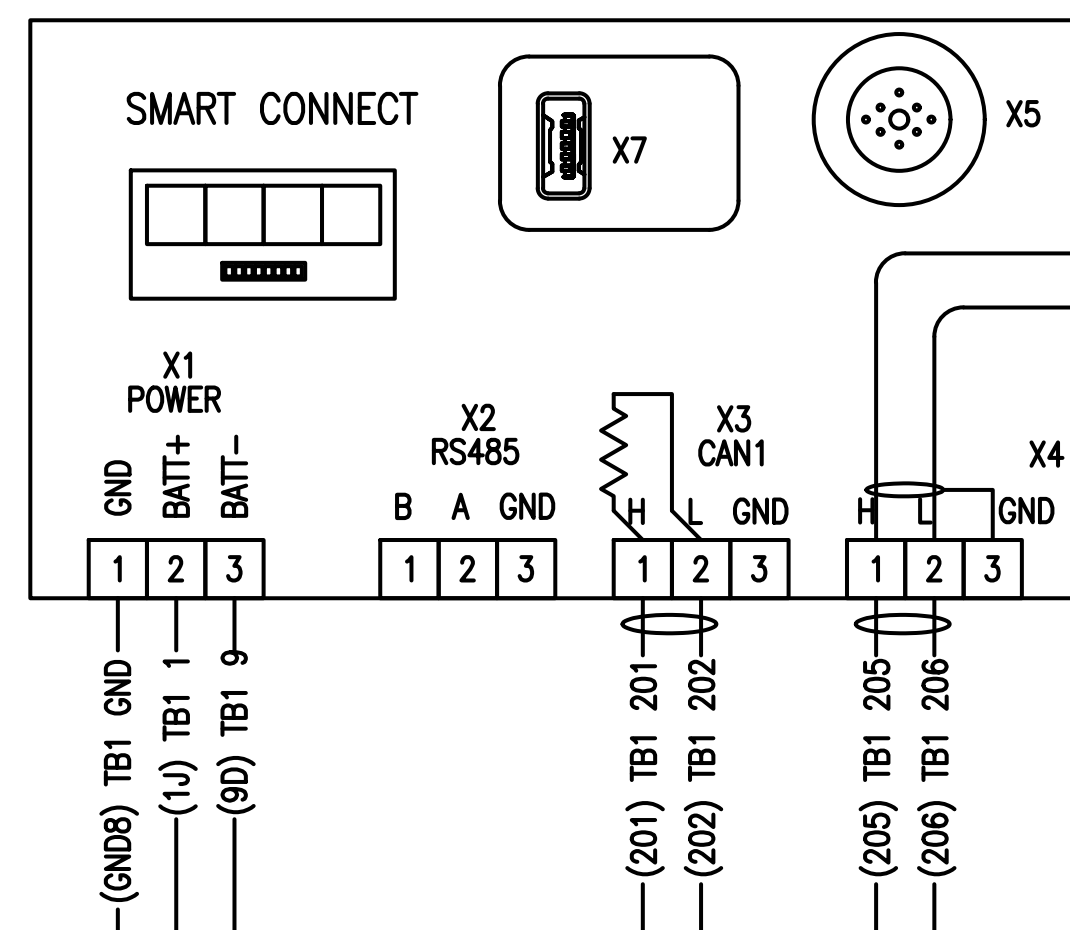
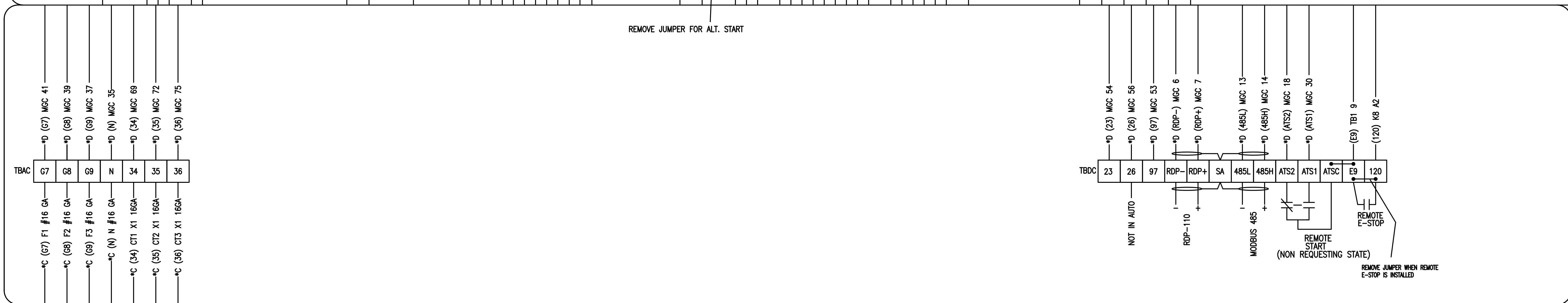
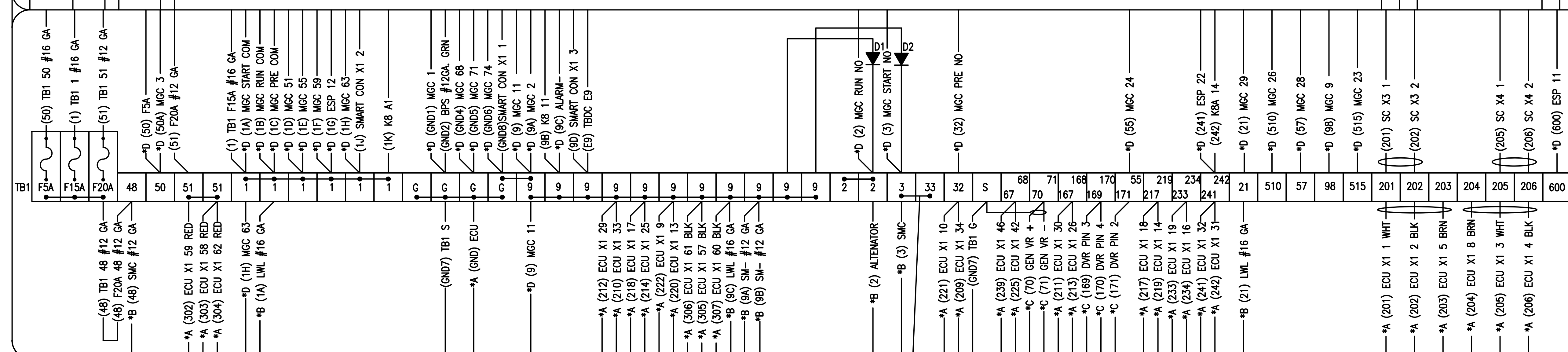
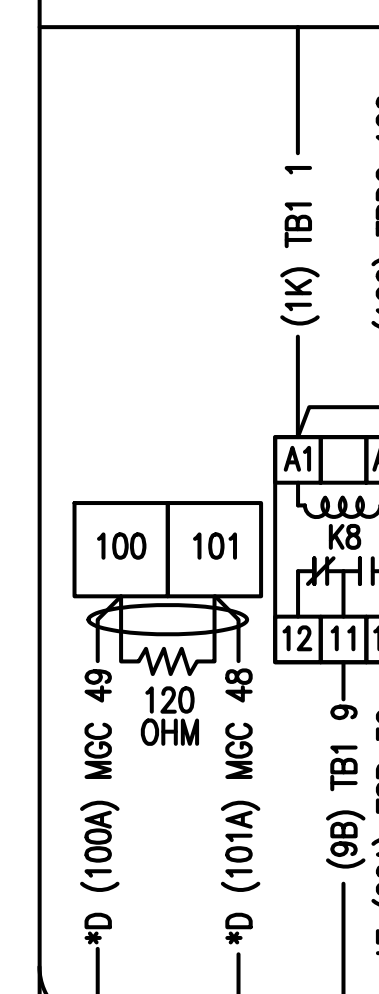
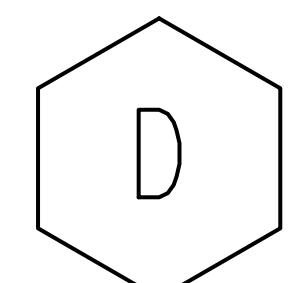
*X (X) XXX X

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



Änderungsbeschreibung/Description of revision		Revised Title Block	
Buchst./Rev. Nr.	Ähr.-Antrags-Nr./Promotion Request No.	Änderungs-Nr./Change Notice No.	Bearbeitungsstatus/Lifecycle
0.5	PR077798	CN028775	Released

Allgemeintoleranzen / General Tolerances ISO 2768-mK		Masse / Size ISO 14405 ⑤	
MGC 2000 S1600/1600+		Masse/Mass	
Anfertigung u. Lieferung / Tech. Characteristics		1:1	
Oberflächenschutz /Surface Protection		Material	
Verwendbar fuer Typ / Applicable to Model		Material-Nr./Material-No.	
Projekt-/Auftrags-Nr. / Project/Order No.		XZ57464400001	
Referenz-Nr./Ref.No.		ANORDNUNGSZEICHNUNG	
ACAD Datum/Date		ARRANGEMENT DRAWING	
Alle Rechte an Schutzrechtsanmeldungen, Erfindungen, Marken, Verbriefungen oder sonstige Verwertung ohne Zustimmung des Erfinders sind vorbehalten. Nachdruck, Vervielfältigung und Verbreitung, auch auszugsweise, ist ohne schriftliche Genehmigung der RAL-ROBEY Solutions GmbH.		Zeichnungs-Nr./Drawing No.	
CAD 01.10.2021		CAD06919414	
Rolle-Royce Solutions GmbH		450-900 kW	



TO: ENGINE X1
HARNESS

TO: ENGINE HARNESS

TO: GENERATOR HARNESS

TO: ENGINE ACCESSORIES

LEGEND:	
AE	ANALOG EXPANSION MODULE
AL	ALARM BUZZER
ALT	ENGINE ALTERNATOR
BC	BATTERY CHARGER
BPS	BACK PANEL STUD
CEM	CONTACT EXPANSION MODULE
D6C	DIGITAL GENSET CONTROLLER
D6S	DOOR GROUND STUD
DVR	DIGITAL VOLTAGE REGULATOR
ECUS	ENGINE CONTROL UNIT STUD
ESP	EMERGENCY STOP BUTTON
F4-10	FUSES 15 AMP
F5A	FUSE 5 AMP
F15A	FUSE 15 AMP
F20A	FUSE 20 AMP
FLG5	FUEL LEVEL GAUGE SENDER
FLS	FUEL LEAK SWITCH
FWS	FUEL WATER SEPARATOR
GB	GENERATOR BREAKER
GF	GROUND FAULT
GG5	GENERATOR GROUND STUD
K1	ENGINE RUN RELAY
K2	ENGINE FAIL RELAY
K3	MINOR ALARM RELAY
K4	UNDER VOLTAGE TRIP RELAY
K5	SHUNT TRIP RELAY
K6	LOUVER MOTOR RELAY
K7	CLOSE BREAKER RELAY
K8 & K8A	E-STOP RELAY
K9	OPEN BREAKER RELAY
LSM	LOAD SHARE MODULE
MMM	MOTOR MECHANISM MODULE
MN	UNDERVOLTAGE SHUNT TRIP(NC)
MX	SHUNT TRIP (NO)
OF	BREAKER AUX SWITCH
R1-3	RESISTOR 120 OHM ½ W
SAT	SPEED (FREQ) ADJUST TOGGLE
SC	SMART CONNECT
SDE	BELL ALARM
SM	STARTER MOTOR
SMC	STARTER MOTOR COIL
TB1	TERMINAL (CONTROL PANEL)
TBAC	AC CONNECTION TERMINAL
TBCC	DC CONNECTION TERMINAL
TU	MIRCO-LOGIC TRIP UNIT
VAT	VOLTAGE ADJUST TOGGLE
WH	WATER HEATER

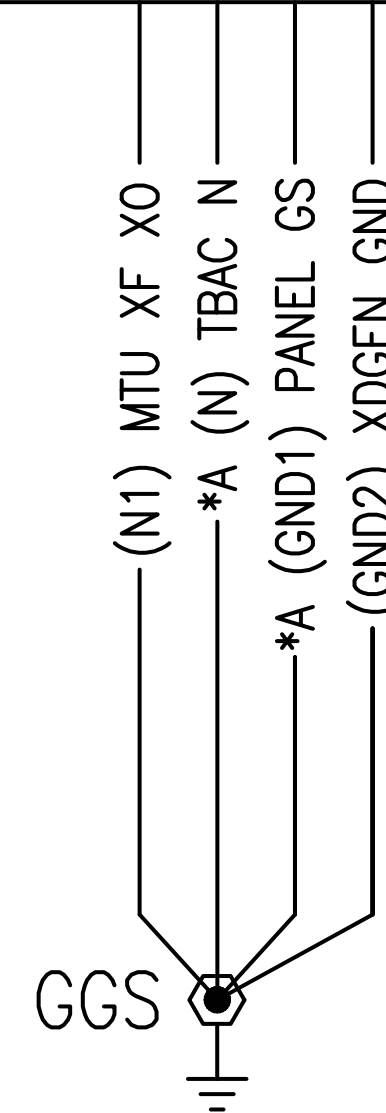
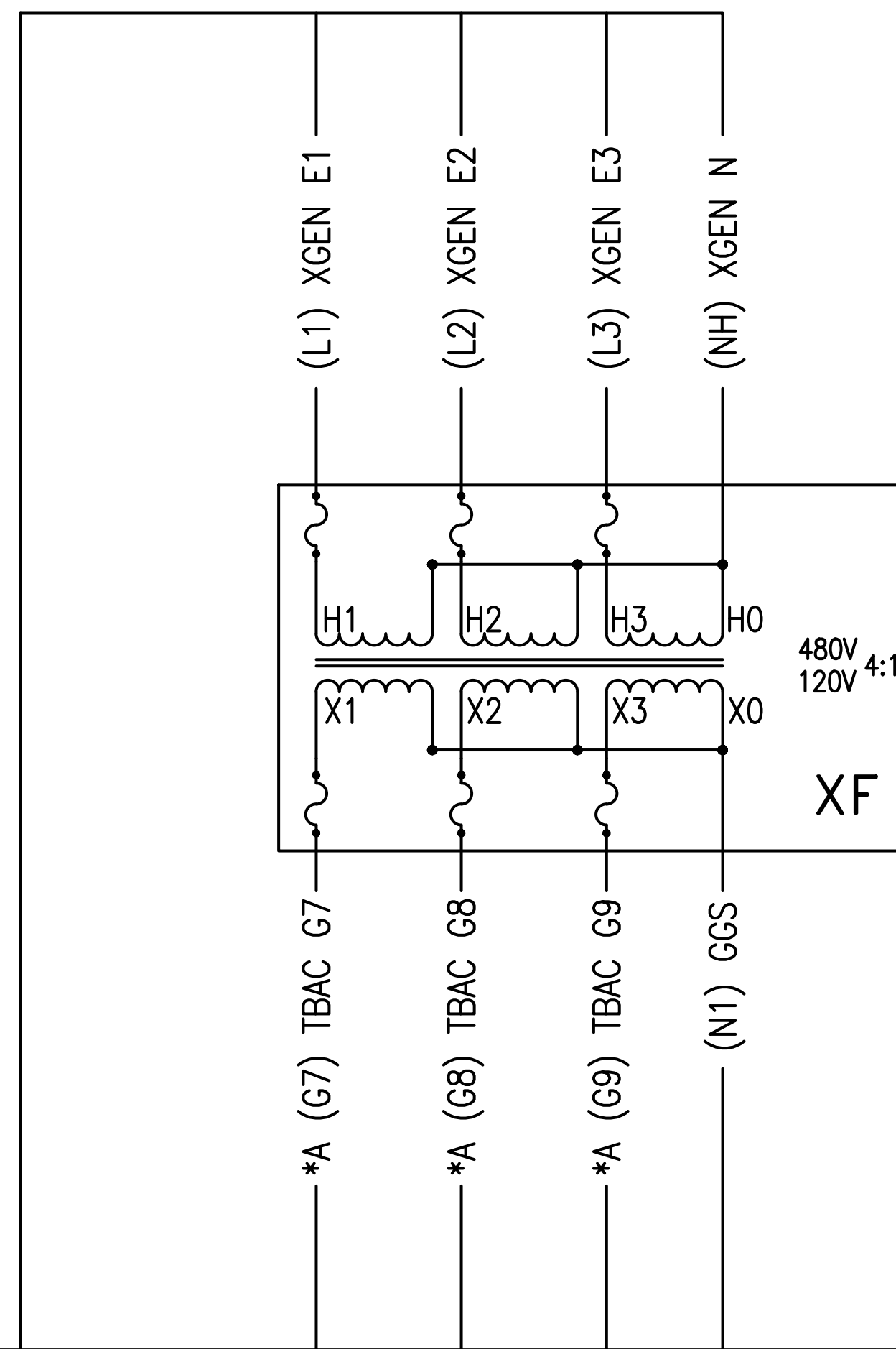
NOTES:

1. WIRE NUMBERS ARE IN PARENTHESIS.
2. WIRING IS #20 GA. UNLESS OTHERWISE SPECIFIED.
3. CONTROL PANEL WIRING IS #20 GA. UNLESS OTHERWISE SPECIFIED.
4. SHORT DASHED LINES (-----) INDICATE OPTIONAN EQUIPMENTS WIRING.
5. TOP NUMBER INDICATES TOP DECK, BOTTOM NUMBER INDICATES BOTTOM DECK.

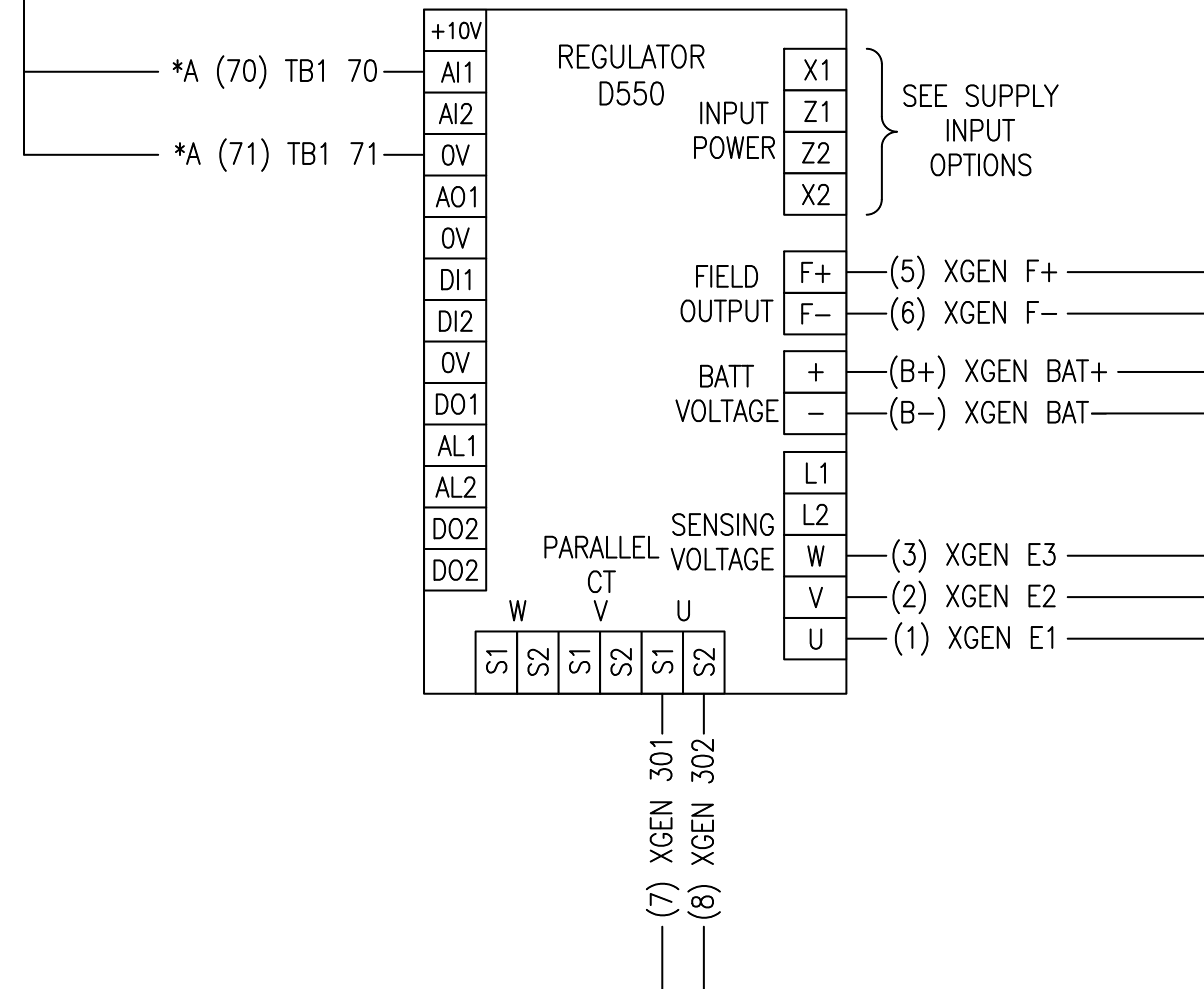
*X	(X)	XXX	X
----	-----	-----	---

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

The diagram shows a transformer with a TBB bus at the top. The bus has four terminals: L1, L2, L3, and N. Below the bus, there are three vertical lines representing the secondary windings, labeled (H1), (H2), and (H3). These are connected to the bus terminals L1, L2, and L3 respectively. The bottom terminal of the bus is N, which is connected to a common ground (N1) labeled GGS. The secondary windings are also connected to a common ground (H0, H1, H2, H3) labeled X0. The primary windings are labeled X1, X2, and X3, and are connected to a common ground (G10, G11, G12) labeled TBAC. The transformer is labeled 480V 120V 4:1 and XFC.



TO:
CONTROL PANEL
BACK

[illegible]

The diagram shows the PMG (Permanent Magnet Generator) connection option. It features a 4-pin connector on the left labeled 'TO REGULATOR'. The pins are connected as follows: Pin 1 (top) to X1, Pin 2 to Z1, Pin 3 to Z2, and Pin 4 (bottom) to X2. The X1 and Z1 pins are connected to a common terminal labeled (15). The Z2 and X2 pins are connected to a common terminal labeled (16). These two common terminals are connected to the PMG, which is represented by a rectangular box with two internal windings. The label 'PMG' is placed to the right of the box. Below the X2 pin, the text 'XDGEN' is written.

WYE 6 WIRE

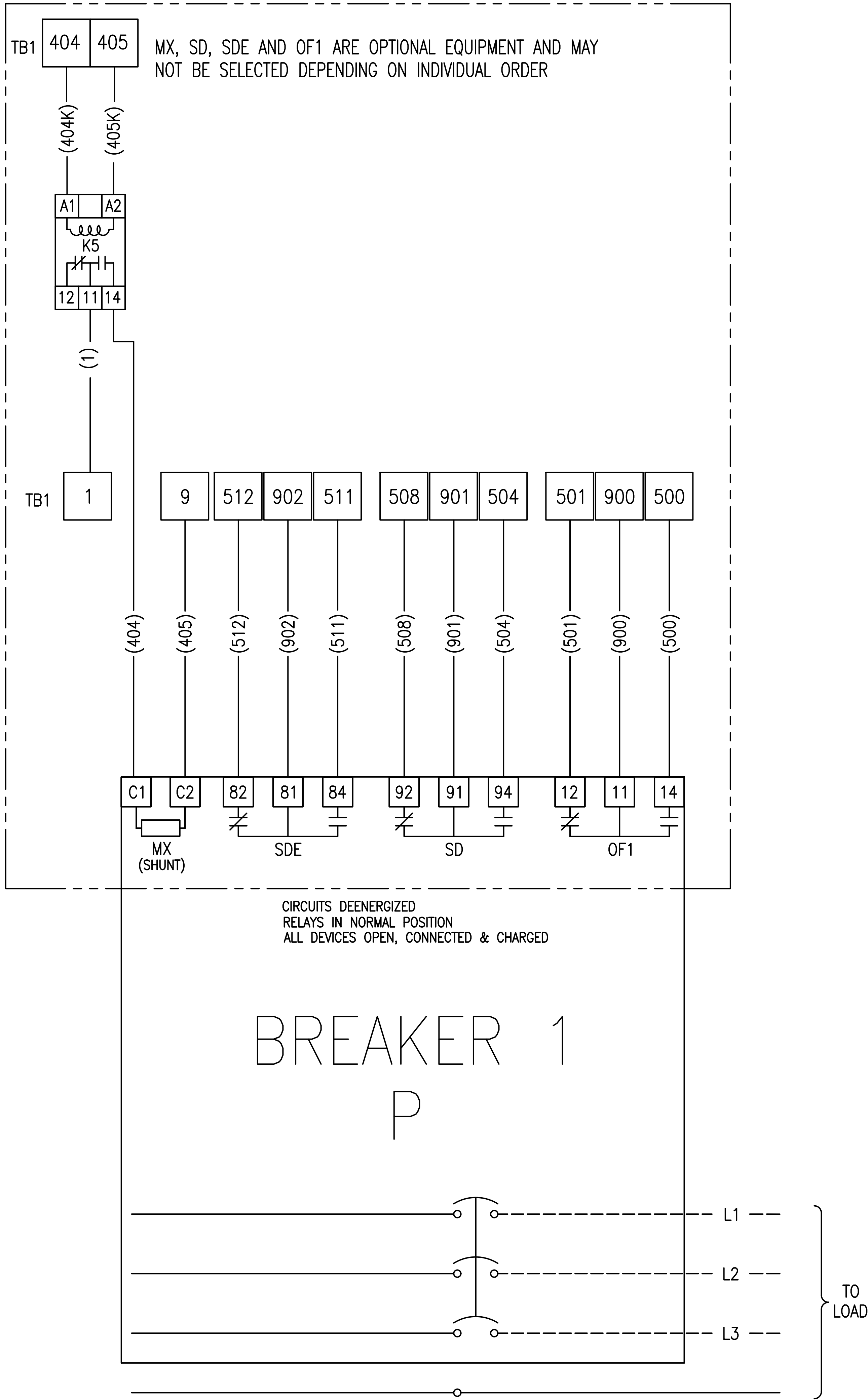
HZ	L-L	L-L0
60	380	219
	480	277
	600	346
	2400	1386
	3300	1905
	4160	2402
	6600	3811
	13200	7620
13800	7967	
50	380	219
	400	231
	415	240
	3300	1905
	6600	3811
	11000	6351

Diagram illustrating a WYE 6 WIRE system configuration. The system shows a central neutral point (N) connected to six phase conductors (T1, T2, T3, T4, T5, T6) in a star configuration. The conductors are labeled L1/E1, L2/E2, L3/E3, L4/E4, L5/E5, and L6/E6. The neutral point is labeled N.

GCS	GENERATOR GROUND STUD
TBB	TERMINAL BOARD BREAKER ENCLOSURE
XDGEN	LS GENERATOR TERMINAL BLOCKS
XF	TRANSFORMER – CONTROL VOLTAGE
XFC	TRANSFORMER – CUSTOMER BUSS

[illegible]

BREAKER 1



LEGEND

GGS	GENERATOR GROUND STUD
K4	GB UNDERVOLTAGE TRIP RELAY
K5	GB SHUNT TRIP RELAY
K7	GB CLOSE RELAY
K9	GB OPEN RELAY
MN	UNDERVOLTAGE TRIP
MX	SHUNT TRIP
OF1	AUXILIARY SWITCH
SD	ALARM SWITCH
SDE	OVERCURRENT TRIP SWITCH
TB1	TERMINAL BLOCK 1 (PANEL BACK)
TBAC	TERMINAL BLOCK AC (PANEL BACK)

GROUND FAULT CT WIRING CONNECTIONS MODEL 115-601MR CURRENT TRANSFORMER

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

GROUND FAULT CT WIRING CONNECTIONS MODEL 115-122MR CURRENT TRANSFORMER

CB RATING	CT RATIO	*CT CONNECTIONS
3000A	600:5	X2-X4
4000A	800:5	X1-X4

Anderungsbeschreibung/Description of revision INITIAL RELEASE		Kommt von/Frequency KOMMT VON	
Buchst./Rev. Nr. -10	Erh.-Antrags-Nr./Promotion Request No. PR077798	Anderungs-Nr./Change Notice No. ----	Bearbeitungsstatus/Lifecycle Released
Zustimmung/Approval Rolle-Royce Solutions GmbH		Zeichnungs-Nr./Drawing No. CAD08628070	
Beschreibung/Description 11600+ ARRANGEMENT DRAWING ELECTRICAL SYSTEM DRAWING		Blatt Sheet 1/6	



MTU Installation and Operation Manual Excerpt

The location of the generator set is influenced by factors such as ventilation, exhaust piping, electrical service, fuel supply and accessibility for maintenance and service.

Before selecting the location for your generator set, consider the following:

- Supporting structure must be adequate for the generator set and accessories. For information on mounting on an inertia pad, see Section 4. For any other set-up, consult a structural engineer for an appropriate design.
- Area should be clean, dry and not subject to flooding.
- Ventilation should be available in the area with a minimum amount of duct work
- Exhaust gas must be piped away from the structure and any ventilation intakes. Piping must incorporate large radius, low restriction elbows.
- An adequate supply of fuel should be available at all times to sustain operation.
- The main diesel fuel supply should be as close as possible to the unit. If the main fuel tank is installed underground, an auxiliary pump and day tank are necessary to transfer fuel from the main tank to the day tank.
- Vibration should be effectively isolated and dampened to reduce transmission of vibration and prevent fatigue fractures of connected systems.
- Area should provide easy access for maintenance and repair. A minimum clearance of 3 feet between an installed generator set and adjacent walls or other electrical equipment should be maintained on 3 sides of the generator set. Clearance of 5 feet should be maintained at the rear of the generator set to facilitate removal, should it become necessary.
- Applicable fire rating codes and standards must be met.
- When an open bottom base is used, the stationary engine generator assembly is to be installed over noncombustible materials. It should be located such that it prevents combustible materials or loose debris from accumulating under or inside the generator set.

Local weather conditions will have a direct influence on location of the unit and the type of accessory equipment required to assure reliable operation. Extreme ambient temperature variations should be avoided. For ambient temperatures below 60 degrees, starting aids such as jacket water heaters and lubricating oil heaters will ensure dependable starting. Anti-condensation or strip heaters are available for control panels and generators to maintain a temperature above the dew point to prevent condensation of moisture.

Standard transfer switches located indoors in heated facilities are enclosed in NEMA 1 enclosures. Various other NEMA enclosures may be needed. If the generator set is located outside, heaters are needed below 32 degrees Fahrenheit.

Consider preventive maintenance issues when selecting a generator set location. See Section 9 for a list of service points that should be accessible.

Disclaimer: W.W. Williams is providing the MTU Installation and Operation Manual excerpt as a reference guide and not as specifications for mounting the gen-set. Due to variable site conditions, including but not limited to: seismic stability, concrete and/or soil composition, gravel base, etc., W.W. Williams can not be responsible for improper mounting. The site engineer should be consulted for location and inertia pad specifications.



WEIGHT

The weight of the generator set and accessories will determine the type and design of the support structure. Generator set weight can be found in the specification sheet for your particular model. Be sure that the weight of accessory items and fuel (if a sub-base tank is used) are added to the total requirements.

INERTIA PAD/BASE

Your generator set must be mounted on a substantial inertia pad or base. The composition of the inertia pad should follow standard practice for the required loading. Common specifications call for 2500 psi concrete reinforced with 8-gage wire mesh or number 6 reinforcing bars on 12-inch (30-cm) centers.

To determine the depth of the inertia pad, the following formula can be used:

BASE	W_u
DEPTH =	$d * w * l$

Where W_u = engine-generator set weight in pounds
 d = concrete density (usually 145 lbs per cubic foot)
 w = foundation width in feet
 l = foundation length in feet

The inertia pad should be a minimum of 12 inches wider and 12 inches longer than the unit base. The inertia pad may be constructed higher than the floor level by 3 to 8 inches for ease of maintenance.

To reduce the amount of unit vibration transmitted, you must isolate your inertia pad from the foundation. One method for isolating the inertia pad from the foundation is to use 8 to 10 inches of wet gravel or sand as a bed in the inertia pad pit. For other methods, consult a qualified structural engineer.

To allow settlement of the inertia pad from the foundation, expansion joints should be incorporated between the inertia pad and the foundation.

VIBRATION ISOLATION

Vibration is a normal by-product of the operation of any generator set. Vibration transmitted to surrounding areas will increase the noise level and if severe, can cause structural damage. To minimize this risk, all generator sets should have vibration isolation between the generator base and inertia pad.

All fuel, coolant, exhaust and electrical connections must have flexible sections to isolate vibration. Leaks or fractures can develop rapidly without vibration isolation and there is a danger of eventual total failure.

For generator sets enclosed within a building, where maximum vibration isolation is required, spring mounts provide vibration isolation between the generator base and the structure.

Check state and local codes for such requirements.

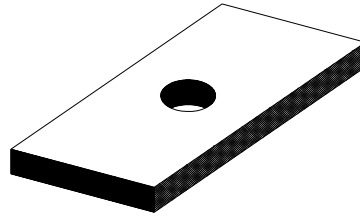


Figure 4-1: Typical pad type vibration

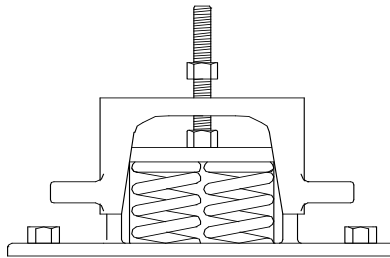


Figure 4-2: Spring mount vibration isolator

Anchor bolts should be loosened and double nipped after installation to avoid base distortion caused by unlevel inertia pads.

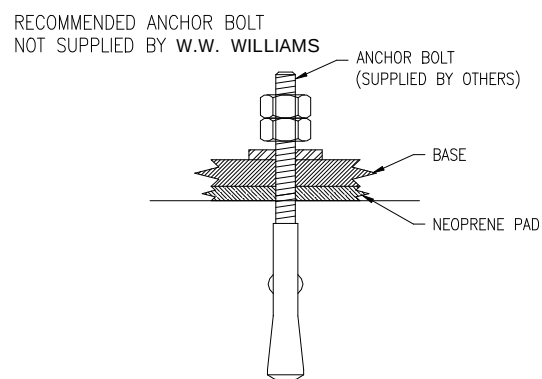
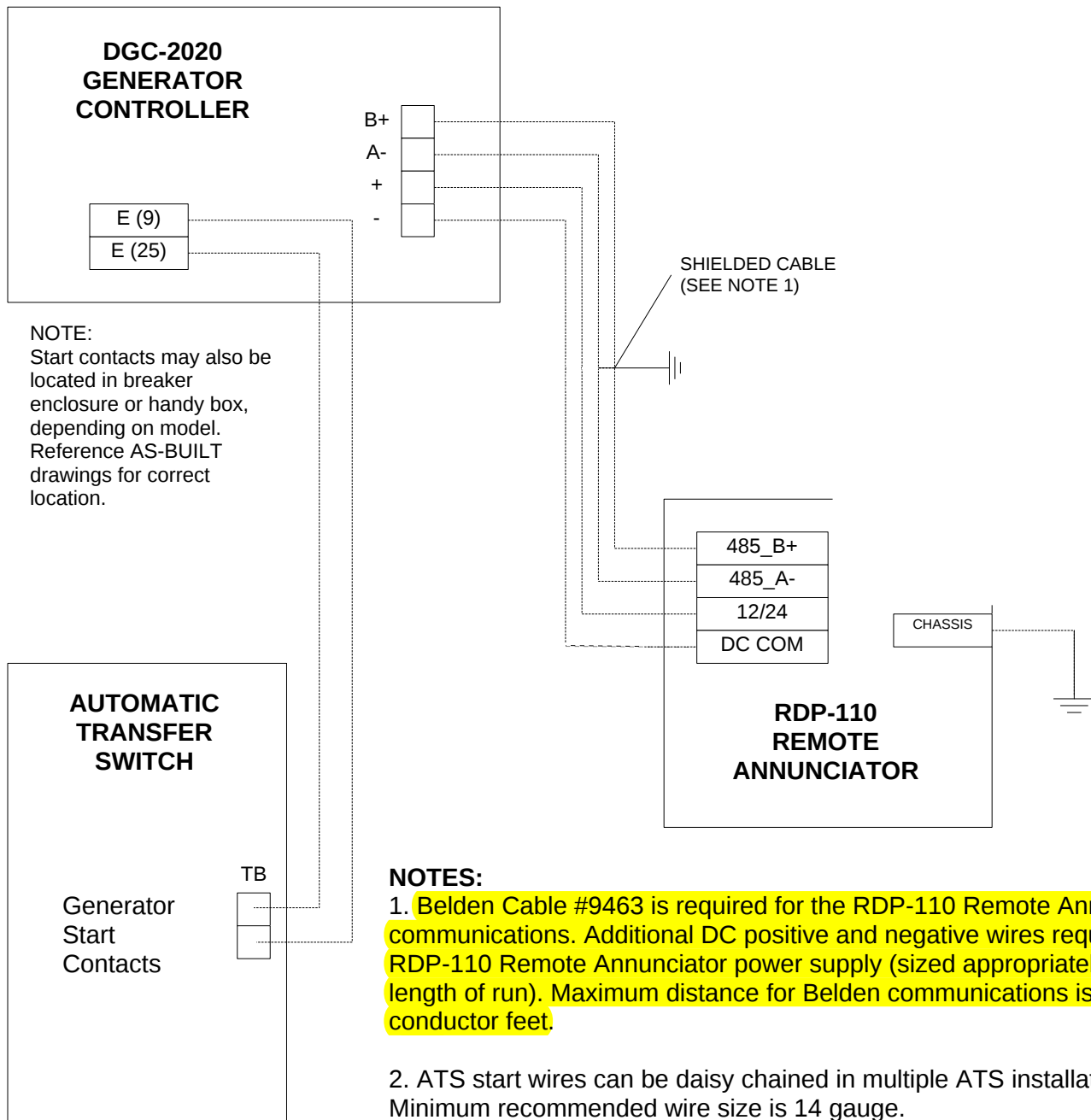


Figure 4-3: Recommended anchor bolt

BASIC INTERCONNECT DRAWING FOR DGC-2020 CONTROLLER, RDP 110 REMOTE ANNUNCIATOR AND AUTOMATIC TRANSFER SWITCH



Section 7

Generator Warranty



ROLLS-ROYCE SOLUTIONS AMERICA INC.

Two (2) Year / 3,000 Hour Basic Limited Warranty

Standby (3D) / Prime (3B) / Data Center Continuous Power (3F)

Rolls-Royce Solutions America Inc. ("RRSA") issues the following express Limited Warranty subject to the following terms, conditions, and limitations:

An original consumer ("Owner") who purchases an RRSA engine generator set ("Product") is entitled to coverage under this Limited Warranty. RRSA 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 RRSA. Any nonconformity to the foregoing is defined as a Warrantable Defect. This Limited Warranty applies to Product shipped by RRSA after January 1, 2014.

1. 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 RRSA 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 RRSA 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.

RRSA'S AGGREGATE TOTAL LIABILITY RELATING TO THE SYSTEM AND/OR PRODUCT UNDER THIS LIMITED WARRANTY OR UNDER ANY OTHER CLAIM (IN CONTRACT, TORT, OR OTHERWISE) MADE IN CONNECTION WITH THE SALE OR USAGE OF THE SYSTEM AND/OR PRODUCT IS LIMITED TO THE DOLLAR AMOUNT OF THE OWNER'S ORIGINAL PAYMENT MADE FOR THE SYSTEM AND/OR PRODUCT.

2. 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 RRSA 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 RRSA Mankato, MN facility.

RRSA warranty obligations under this Limited Warranty are contingent upon distributor completing the following:

Rolls-Royce Solutions America Inc. Two (2) Year / 3,000 Hour Basic Standby Limited Warranty Standby (3D) / Prime (3B) / Data Center Continuous Power (3F)

- (a) The RRSA warranty and the *Start-Up Validation and Pre-Inspection Form*. Return both to RRSA 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.

3. RRSA 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 4, RRSA will, during normal working hours, through an RRSA authorized distributor, dealer, or service outlet, perform some or all of the following:

- (a) Repair or replace, at the sole election of RRSA, 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 RRSA authorized distributor, dealer, or service outlet to the Product location;
- (d) Part removal and re-installation, if necessary and as solely determined by RRSA.

The obligation to repair or replace defective parts by RRSA does not include responsibility for reimbursement of incidental or consequential costs. If RRSA 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 RRSA.

Failure of RRSA 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.

4. Owner Responsibilities

During the Limited Warranty Period and Accessories Coverage Period, the Owner is responsible for, and RRSA 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 RRSA 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 RRSA, including without limitation handling, inspection, servicing, or operating instructions;

Rolls-Royce Solutions America Inc. Two (2) Year / 3,000 Hour Basic Standby Limited Warranty Standby (3D) / Prime (3B) / Data Center Continuous Power (3F)

- (b) Promptly notify RRSA or its authorized representative of a Warrantable Defect and make the Product available for repair;
- (c) Comply with RRSA 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 RRSA specified parts, components, and consumables;
- (f) Promptly return to RRSA all parts replaced under this Limited Warranty;
- (g) Comply with RRSA 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 RRSA 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.

5. Limitations

RRSA 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 4;
- (b) Failure of Owner to follow RRSA instructions for Product stored by Owner longer than 180 days from date of shipment from the RRSA 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 RRSA within a reasonable time;
- (e) Rental equipment used during warranty work;
- (f) Defects caused or potentially caused by service work performed by non-RRSA authorized service providers and/or the use of non-genuine RRSA 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 RRSA, 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 RRSA 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 RRSA in writing at the time of the order; or
- (s) Material provided by or a design specified by the Owner.

- 6. Software Warranty.** Where software is included in the Product, RRSA 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

Rolls-Royce Solutions America Inc. Two (2) Year / 3,000 Hour Basic Standby Limited Warranty Standby (3D) / Prime (3B) / Data Center Continuous Power (3F)

function substantially in accordance with RRSA specification at the time of dispatch from the RRSA manufacturing facility. RRSA does not warrant that the software is error-free or free from “bugs” as commonly categorized by the computer industry. RRSA 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 RRSA. RRSA, at its option, may elect to provide the most current software at no cost, and in such case RRSA will not cover the cost to install the applicable updated software. RRSA shall have no obligation with respect to any nonconformities resulting from unauthorized modifications to the software or any Owner interfacing.

7. **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 RRSA 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.
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 RRSA and obtained prior written consent from RRSA. In such cases, RRSA shall, in its sole discretion, reimburse the costs incurred by the Owner up to an amount equivalent to the costs RRSA 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 Michigan without regard to its conflicts of law principles and excluding the United Nations Convention for the International Sale of Goods. Any and all disputes between the parties that may arise pursuant to the sale or use of the Product shall be heard and determined before an appropriate state of federal court located in Oakland County, Michigan. The Owner acknowledges that such court has the jurisdiction to interpret and enforce the provisions herein, and Owner waives any and all objections that it may have as to personal jurisdiction or venue in any of the above courts.
11. In order to obtain performance of an RRSA warranty obligation, the Owner should contact the nearest RRSA authorized distributor, dealer, or service outlet for instructions. To find the location of the nearest RRSA authorized distributor, dealer, or service outlet call +1 248-560-8000 or write to: Rolls-Royce Solutions America Inc. Warranty Department, 39525 MacKenzie Drive, Novi, MI 48377.



Power Generation

PERFORMANCE ASSURANCE CERTIFICATION



A Rolls-Royce
solution

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*

OPTIONAL TESTING

Factory Acceptance

Extended-run factory acceptance testing

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

- Full nameplate-rated load
- Standard readings taken every 15 or 30 minutes

Standard readings recorded during load test inspection

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

Witnessed factory acceptance testing

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

Witnessed extended-run factory acceptance testing

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

Additional factory acceptance testing

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

Additional testing procedures

- Start and Stop Test (MIL-STD-705c 503.1c)
- Remote Start and Stop Test (MIL-STD-705c 503.2c)
- Overspeed Protective Device Test (MIL-STD-705c 505.2b)
- Insulation Resistance Test (MIL-STD-705c 301.1c)*
- Open Circuit Saturation Curve Test (MIL-STD-705c 410.1b)
- Temperature Rise Test (MIL-STD-705c 680.1c)
- Frequency Range Adjust Test (MIL-STD-705c 511.2c)
- Low Oil Pressure Protective Device Test (MIL-STD-705c 515.1b)
- Over-temperature Protective Device Test (MIL-STD-705c 515.2b)
- Controls, Direction, and Rotation Test (MIL-STD-705c 516.1a)
- Frequency and Voltage Regulation, Stability, and Transient Response (MIL-STD-705c 608.1b)
- Voltage and Frequency Regulation (MIL-STD-705c 614.1b)
- Voltage Dip and Rise for Rated Load Test (MIL-STD-705c 619.2c)
- Regulator Range Test (511.1d)
- Maximum Power Test (MIL-STD-705c 640.1d)
- Fuel Consumption Test
- Vibration and Mechanical Balance Test (ISO 8528-9)
- Sound Test (ISO 8528-10)

* Testing conducted by generator OEM



International
Organization for
Standardization

