

# SHOP DRAWING REVIEW

<b>SHOP DRAWINGS:</b>	Generator Rev2		
<b>SUBMITTAL NO.:</b>			
<b>PROJECT:</b>	Forestside Towns	<input type="checkbox"/> Reviewed	<input type="checkbox"/> Not Reviewed
		<input checked="" type="checkbox"/> Reviewed as Noted	<input type="checkbox"/> Revise and Resubmit
<b>PROJECT NO.:</b>	1120-0200.100	Review of this submittal is for compliance with the general intent of the contract. This review does not relieve the sub-contractor/vendor of responsibility for errors or omissions or for meeting all requirements of the contract documents. Any deviation from the contract initiated by the sub-contractor/vendor shall be at its sole risk. Verification of quantities and field dimensions are the responsibility of the sub-contractor/vendor. Review is of acoustic aspects only.	
<b>REVIEWED BY:</b>	Sam Du		
<b>DATE:</b>	August 9, 2021		

## COMMENTS:

- Note 2 on Page 19 of the shop drawing indicates that “sound data based with remote cooled generator sets are without cooling package and engine driven cooling fan”.

This should be confirmed that the installation at the subject site is the same as the generator used in the sound level tests.

Based on the sound level data on Page 19 of the shop drawing, our analysis indicates that silencers with insertion losses significantly greater than those in the Acoustic Design Report will be needed for the generator room (i.e., cooling air intake and exhaust openings). The required silencer insertion losses are summarized below.

Silencer/Louver Location	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Generator Room Exhaust Air Opening	15	36	36	35	35	33	28	23
Generator Room Intake Air Opening	15	33	33	32	30	30	25	200

This should be coordinated with the mechanical/electrical engineers on the project to ensure there is enough space in the generator room to accommodate the silencers.

\SD

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## SHOP DRAWING TRANSMITTAL

**(REVISED)**

**Date: July 21, 2021**

**Customer: Campoli Electric**

**Project: Forest Side Towns**

**Consultant/Engineer: United Engineering**

**ORDER #: 229076**

The equipment meets the following standards: CSA282-15, IEC 34-1, British Standards (BS) 4999 & 5000, and ISO3046. The generating set is manufactured to ISO 9001, Engine is latest EPA certified

**APPENDIX A: CSA & UL220 Generator Compliance and certification certificates (Pages 1-2)**

CSA certification for Motors and Generators Stationary Assemblies

UL220 certification for Stationary Engine Generator Assemblies

**APPENDIX B: Gaseous Fuel Factory Recommended Installation Requirements (Pages 3-6)**

Typical factory recommended natural gas generator fuel installation and fuel piping calculation based on fuel consumption and distance between the main gas meter and generator location.

**APPENDIX C: Model# TG200 Natural Gas Sound Open Skidded Generator Specification (Pages 7-10)**

\*\*Rated Standby: 200kW, 250 KVA, 0.8PF

Voltage: 3 phase 347/600V, 60HZ, Speed: 1800RPM

**APPENDIX D: Generator Dimensional Outline Drawings (Page 11)**

TG200 Natural Gas Open Skidded Generator Dimensional Drawing with flex connector DWG #TG200 OPEN UNIT

**APPENDIX E: Engine Specification Sheet (Pages 12-13)**

PSI Heavy Duty 11.1L HO 4 Cycle Natural Gas Engine Technical Data Sheet

**APPENDIX F: Emissions and Sound Data Testing Reports (Page 14-16)**

EPA Emissions Certification Test Report.

TG200 Sound Data Test Report for open skidded genset with engine driven cooling fan. (Revised)

**APPENDIX G: Muffler/Flex Specification Sheet and Drawing (Page 17-19)**

EI Williams Hospital Grade Generator Exhaust Silencer Technical Data Specification and Drawing (Revised)

Taylor Engine Flex Drawing included for indoor installation (Revised)

**APPENDIX H: Engine/Alternator Isolation Mounts Specification Sheet (Page 20-21)**

LF4-2800 Engine/Alternator Isolation Mounts Technical Data Specification

**APPENDIX I: Generator Spring Type Seismic Specification Sheet (Page 22-24)**

SMSR-BT-409, 2-inch deflection Seismic Restrained Spring Mounts for a Total 6 Generator Spring Isolators (3 on each side of the frame of the generator) Technical Data Specification. Manufacturer recommended for this specific generator. (Revised)

**APPENDIX J: Alternator Specification Sheet (Page 25-34)**

Stamford Newage UCDI274J Winding 17, 262 kW 4 Pole, 4 Lead, 347/600V, Three Phase Alternator Technical Data Specification and MX321 Automatic Voltage Regulator

**APPENDIX K: Engine Coolant Heater Specification Sheet (Page 35-36)**

KIM Hotstart CB125200 2500 Watt Natural Gas Engine coolant Technical Data Specification

**APPENDIX L: Control Panel and Wiring Diagram Specification Sheet (Page 37-43)**

DGC-2020 Generator Digital Control Panel Technical Data Specification and wiring diagram

**APPENDIX M: Battery Specification Sheet (Page 44)**

TG200-TG450 24VDC 1355CCA Generator Battery Technical Data Specification

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395 Second Road East, Stoney Creek, Ontario, L8J 2X9

PHONE: (289)700-5858

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www.LMRpowersystem.net

**APPENDIX N: Battery Charger Specification Sheet (Page 45-50)**

SENS Micro 22-10-RC 2 10-amp Battery Charger Technical Data Specification

**APPENDIX O: Generator Breaker Specification Sheet (Page 51-56)**

SQ D 100% rated 250-amp 600V 100% rated LI Electronic Trip Generator Protection Breaker Technical Data Specification JDL36250CU31X

**PLEASE IDENTIFY LUG SIZE AND QUANTITY FOR EACH BREAKER:**

**CABLE SIZE:** \_\_\_\_\_ **NUMBER OF CABLES PER PHASE:** \_\_\_\_\_

**APPENDIX P: Taylor Power Standard 2 Year 1500-hour Warranty Statement (Page 57-59)**

Taylor Power Systems Inc. 2-year warranty statement

**APPENDIX Q: ABB (Formerly GE/ZENITH) TRANSFER SWITCH Specifications and Drawings (Page 60-68)**

TS-#1 Life Safety- 400-amp 347/600 Volt 3 phase 3 pole solid neutral Single Sided Bypass Automatic Transfer Switch drawings and wiring diagrams

**PLEASE IDENTIFY LUG SIZE:**

**Normal Side Lugs:**

**CABLE SIZE:** \_\_\_\_\_ **NUMBER OF CABLES PER PHASE:** \_\_\_\_\_

**Load Side Lugs:**

**CABLE SIZE:** \_\_\_\_\_ **NUMBER OF CABLES PER PHASE:** \_\_\_\_\_

**Generator Side Lugs:**

**CABLE SIZE:** \_\_\_\_\_ **NUMBER OF CABLES PER PHASE:** \_\_\_\_\_

Please have this submittal cover page returned with estimated delivery dates so the generator and automatic transfer switches can be entered into the earliest production slots.

Generator Estimated Delivery Date: \_\_\_\_\_

ATS Estimated Delivery Date: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

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395 Second Road East, Stoney Creek, Ontario, L8J 2X9

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FAX: (905)664-5782

www.LMRpowersystem.net

After the submittal package is reviewed and upon acceptance, please return 1 electronic copy to [Lukas@LMRpowersystems.net](mailto:Lukas@LMRpowersystems.net), attention Engineering Manager, releasing the equipment into production with your requested date of delivery for both the generator and ATS to site. Equipment will not be scheduled for production until a signed release form is returned to LMR Power Systems Inc. Present factory lead time for generator production is 20-22 weeks after approved submittals and release.

Should you have any questions regarding this submittal package, please contact me directly.

*Lukas Rimac*

Lukas Rimac  
Senior Application Engineering and Service Manager  
Direct Phone: (905)975-9195  
Email: [Lukas@LMRpowersystems.net](mailto:Lukas@LMRpowersystems.net)

## Product Description

<b>Title:</b>	MOTORS & GENERATORS
<b>Company:</b>	TAYLOR POWER SYSTEMS INC. - Clinton, MS USA
<b>Product Information:</b>	Trade Name(s): Taylor Power Systems.  Diesel Engine Standby Generators, Model Nos. TD9, TD13, TD20, TD28, TD30, TD55.  Diesel Engine Standby Generators, Model Nos. TD60,TD80,TD100,TD125,TD140,TD150,TD175,TD200,TD250, TD275, TD300,TD350,TD400,TD450,TD500,TD550,TD600, TD800, TD1000, TD1250,TD1600,TD2000.  Diesel Engine Standby Generators, Model Nos. TD followed by 9, 13, 20, 28, 30, 55, 60, 80, 100, 125, 140, 150, 175, 200, 275, 300, 350, 400, 450, 500, 550, 600, 800, 1000, 1250, 1600, 2000.  Gas Engine Standby Generators, Model Nos. TG30, TG40, TG50, TG60, TG80, TG100, TG125, TG150, TG200, TG250, TG350, TG400.  Gas Engine Standby Generators, Model Nos. TG30, TG40, TG50, TG60, TG80,TG100, TG125, TG150,TG200, TG250, TG350, TG400.
<b>Evaluated to the following:</b>	A representative sample of the listed devices have been tested, investigated and found to comply with the requirements of the Standard(s) for Motors & Generators (CAN/CSA-C22.2 No. 100) and CSA 282 are identified with the cETL Listed Mark.

## Contact Us

ETL listed products that are in doubt or for products that do not appear in the directory, please request a verification of certification.  
Americas+1-888-347-5478  
(or +1-847-660-7407)  
Email  
[etldirectory@intertek.com](mailto:etldirectory@intertek.com)

## Product Description

**Title:** STATIONARY ENGINE GENERATOR ASSEMBLIES

**Company:** TAYLOR POWER SYSTEMS INC. - Clinton, MS USA

**Product Information:** Diesel Engine Standby Generators, Model Nos. TD9, TD13, TD20, TD28, TD30, TD55. Model Nos. TD60, TD80, TD100, TD125, TD140, TD150, TD175, TD200, TD250, TD275, TD300, TD350, TD400, TD450, TD500, TD550, TD600, TD800, TD1000, TD1250, TD1600, TD2000.

Gas Engine Standby Generators, Model Nos. TG30, TG40, TG50, TG60, TG80, TG100, TG125, TG150, **TG200**, TG250, TG350, TG400.

**Evaluated to the following:** A representative sample of the listed devices have been tested, investigated and found to comply with the requirements of the Standard(s) for Stationary Engine Generator Assemblies (**UL-2200**) and are identified with the ETL Listed Mark.

## Contact Us

ETL listed products that are in doubt or for products that do not appear in the directory, please request a verification of certification.  
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## Gaseous Fuel

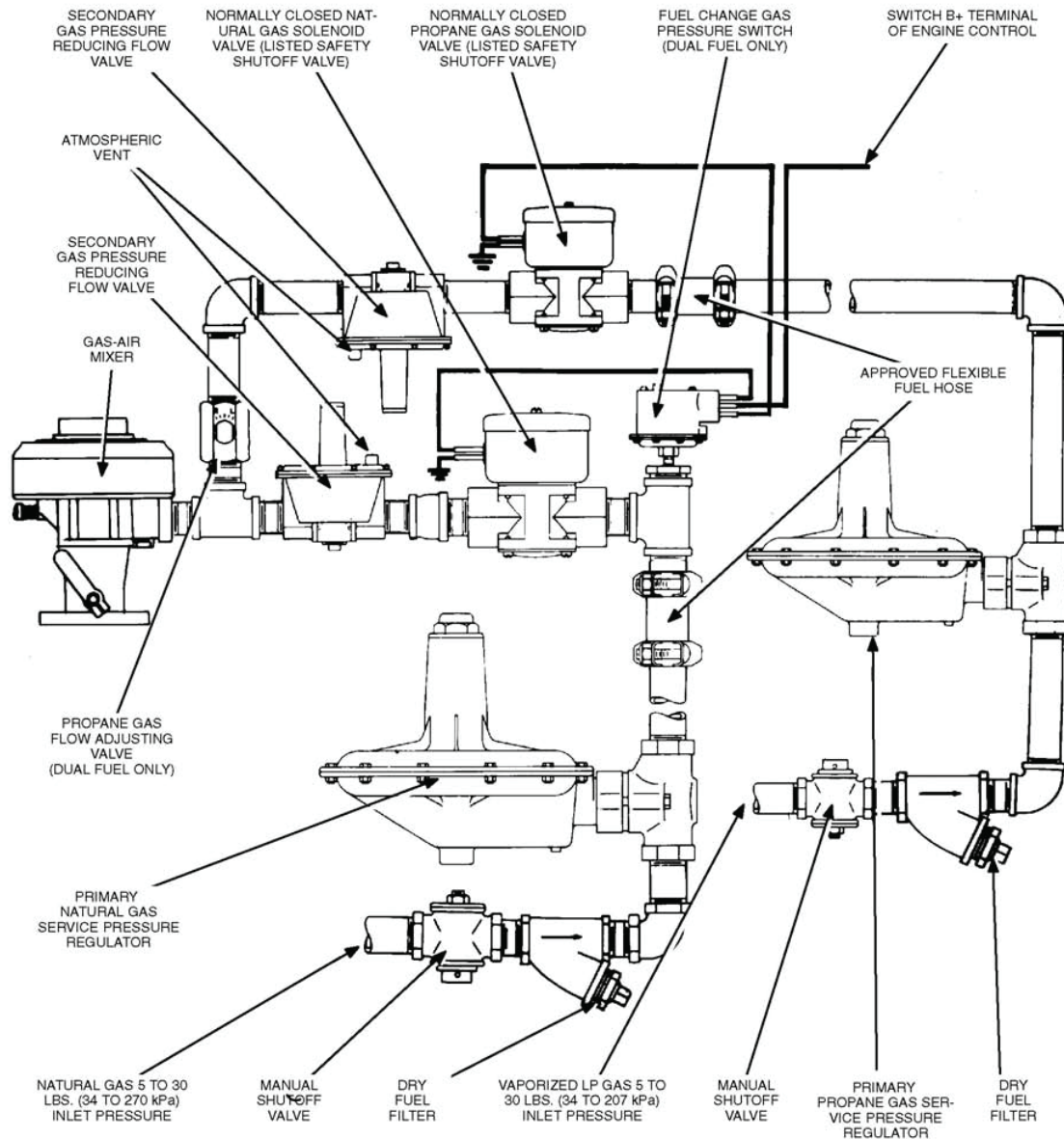
Figure 34 illustrates the typical gas line components in an automatic-transfer, dual-fuel system (natural gas and LPG). It is also representative of single fuel systems and the natural gas or LPG fuel components used when the alternate fuel is gasoline. When natural gas or LPG is used in combination with gasoline, the gas-air mixer is mounted on the air horn of the gasoline carburetor. Not shown is the LPG vaporizer supplied with Taylor Power Systems generator sets equipped for liquid withdrawal of LPG (engine-mounted on outdoor sets only). The service pressure regulator(s), dry gas filter(s) and manual shutoff valve(s) are typically provided by the installer.

Natural gas generator sets are tested and rated using natural gas having a heating value of approximately 1,000 BTU/ft<sup>3</sup> (3724 MJ/m<sup>3</sup>). With proper fuel mixture adjustments (see the generator set Service Manual), fuel gases of lower heating value can be used with good results but with less maximum power output. Depending on the fuel, deratings will be necessary.

The following should be considered when installing a natural gas and/or LPG fuel system:

- Gaseous-fuel supply system design, materials, components, fabrication, assembly, installation, testing, inspection, operation and maintenance must comply with the applicable codes. See NFPA Standards No. 30, No. 37, No. 54 and No. 58.
- The layout and sizing of the gas supply piping must be adequate for supplying the volume of gas required at full load as indicated on the generator set Specification Sheet while maintaining at least the minimum required supply pressure, typically 10 Inches (254 mm) WC (water column). See the example pipe sizing calculation below and associated pipe sizing tables (Tables 14 and 15). Final determination of pipe sizes must, however, be based upon the method approved by the authority having jurisdiction (see NFPA No. 54).
- Most installations will require a service gas pressure regulator. Typically gas supply pressure should not exceed 20 inches (508 mm) WC at the Inlet to the generator set. Depending on distribution gas pressure, more than one stage of pressure regulation may be required. High-pressure gas piping is not permitted inside buildings. Gas pressure regulators must be vented to the out-of-doors according to code.
- Approved flexible fuel hose must be used for connections at the engine to take up generator set movement and vibration. Some Taylor Power Systems generator set models are equipped with flexible hoses that are connected to bulkhead fittings on the skid where solid pipe connections can be made by the installer.
- Most codes require both manual and electric (battery-powered) shutoff valves ahead of the flexible fuel hose(s). The manual valve should be of the indicating type.
- A dry fuel filter should be installed in each line as shown in Figure 34 to protect the sensitive pressure regulating components and orifices downstream from harmful foreign substances carried along in the gas stream (rust, scale, etc.).
- An LPG fuel supply system must be dedicated for the emergency power system if it is the required alternate fuel.





\* THE GAS PRESSURE SWITCH CAUSES THE NATURAL GAS SOLENOID VALVE TO CLOSE AND THE PROPANE GAS SOLENOID VALVE TO OPEN UPON LOSS OF NATURAL GAS SUPPLY PRESSURE TO CONTINUE GENERATOR SET OPERATION WITHOUT INTERRUPTION. RETURN TO NATURAL GAS IS AUTOMATIC WHEN SUPPLY PRESSURE IS RESTORED.

**FIGURE 34. TYPICAL GASEOUS FUEL SYSTEM**



- An LPG vaporizer heated by engine coolant is factory installed on Taylor Power Systems generator sets equipped for a liquid-withdrawal of LPG. Because high pressure gas piping (liquid or vapor) is not permitted inside buildings, generator sets equipped for liquid withdrawal of LPG must not be installed inside the building. Weather protective housings for outdoor installation are available for most models.
- Ambient temperature affects the rate of vaporization in an LPG supply tank. In colder climates, a way to compensate for the reduced rate of vaporization is to install a larger supply tank. Table 13 can be used as a quick reference for sizing the propane tank to account for expected low ambient temperatures.
- The required rate of vaporization can also be obtained by means of a burner-type or engine coolant-type LPG vaporizer located just outside the building.

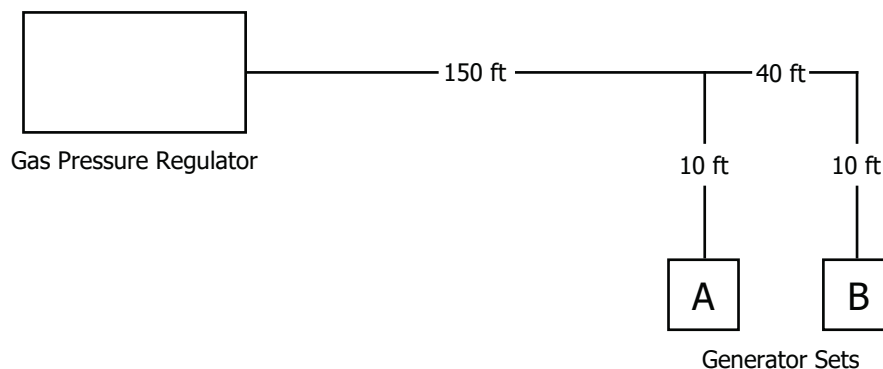
**TABLE 13. MINIMUM PROPANE TANK SIZE IN GALLONS (LITERS)  
FOR REQUIRED VAPORIZATION**

WITHDRAWAL RATE (Tank must be at least half full)	LOWEST AVERAGE WINTER TEMPERATURE					
	32° F (0°C)	20°F (-7°C)	10°F (-12°C)	0°F (-1°C)	-10°F (-23°C)	-20°F (-29°C)
100 cfh (3 m <sup>3</sup> /hr)	100 (378)	150 (568)	200 (757)	250 (946)	400 (1514)	650 (2461)
200 cfh (6 m <sup>3</sup> /hr)	250 (946)	300 (1136)	400 (1514)	600 (2271)	1000 (3785)	2000 (7571)
300 cfh (9 m <sup>3</sup> /hr)	400 (1514)	600 (2271)	700 (2650)	1100 (4164)	1800 (6814)	3600 (13,627)
400 cfh (11 m <sup>3</sup> /hr)	600 (2271)	900 (3407)	1200 (4542)	1700 (6435)	2700 (10,221)	4500 (17,034)
500 cfh (14 m <sup>3</sup> /hr)	900 (3407)	1300 (4921)	1600 (6057)	2500 (9464)	3600 (13,627)	7500 (28,931)
600 cfh (17 m <sup>3</sup> /hr)	1100 (4164)	1600 (6057)	2000 (7571)	3000 (11,356)	5000 (18,927)	10,000 (37,854)
700 cfh (20 m <sup>3</sup> /hr)	1500 (5678)	2000 (7571)	2500 (9464)	4000 (20,820)	6000 (22,712)	13,000 (49,210)

### Example Gas Pipe Sizing Calculations

An application calls for two natural gas generator sets. The sets could be run concurrently. The full-load fuel consumption indicated on the generator set Specification Sheet for the model selected is 890 cfh (cubic feet per hour). The two sets will be supplied by a service pressure regulator adjusted to maintain 14 inches (356 mm) WC (water column). The service pressure regulator will not serve any other load. Figure 35 illustrates the gas piping arrangement.

**FIGURE 35. GAS PIPING LAYOUT FOR A TWO-GENERATOR INSTALLATION**



Determine minimum pipe sizes as follows:

1. Add up the length of pipe to the generator set farthest from the source, which is generator set B.

Total length of pipe for Set B = 150 ft + 40 ft + 10 ft = 200 ft

2. The length of pipe to the farthest set will be the only length used when referring to Tables 14 and 15. In this case, refer to the 200 ft column in Table 14 (natural gas).
3. The 50 foot length of pipe serving generator set B alone, supplies 890 cfh of gas. This section will therefore have to be 2-1/2 inch pipe.
4. The 10 foot length of pipe serving generator set A alone, supplies 890 cfh of gas. This section will also have to be 2-1/2 inch pipe.
5. The 150 foot length of pipe serving both generator sets supplies 1780 cfh of gas. This section will therefore have to be 3 inch pipe.
6. When piping is sized on this basis, the pressure loss should not be more than 0.5 inches (13 mm) WC.

*This procedure can be used when other types of equipment, such as the building heating boilers, are also supplied by the service pressure regulator supplying the generator sets. Note that Tables 14 and 15 cover gas supply pressures not greater than 1/2 psig. See NFPA 54 for gas pipe capacity tables for higher gas supply pressures (1, 5, 10, 20 and 50 psig).*

**TABLE 14. NATURAL GAS PIPE CAPACITY-CUBIC FEET OF GAS PER HOUR**

NOMINAL IRON PIPE SIZE (INCHES)	LENGTH OF PIPE IN FEET													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
3/4	360	250	200	170	151	138	125	118	110	103	93	84	77	72
1	680	465	375	320	285	260	240	220	205	195	175	160	145	135
1 1/4	1400	950	770	660	580	530	490	460	430	400	360	325	300	280
1 1/2	2100	1460	1180	990	900	810	750	690	650	620	550	500	460	430
2	3950	2750	2200	1900	1680	1520	1400	1300	1220	1150	1020	950	850	800
2 1/2	6300	4350	3520	3000	2650	2400	2250	2050	1950	1850	1650	1500	1370	1280
3	11000	7700	6250	5300	4750	4300	3900	3700	3450	3250	2950	2650	2450	2280
Based on 0.5 inch (13 mm) WC pressure drop, 0.60 specific gravity gas and nominal 1/2 psig (3.4 kPa) pressure														

**TABLE 15. LPG GAS PIPE CAPACITY-CUBIC FEET OF GAS PER HOUR**

NOMINAL IRON PIPE SIZE (INCHES)	LENGTH OF PIPE IN FEET											
	10	20	30	40	50	60	70	80	90	100	125	150
3/4	227	157	126	107	95	87	78	74	69	65	58	53
1	428	293	236	201	179	164	151	138	129	123	110	101
1 1/4	882	598	485	416	365	333	308	289	207	252	230	204
1 1/2	1323	920	743	624	567	570	472	434	409	390	346	315
2	2488	1732	1386	1197	1058	958	882	819	768	724	642	598
Based on 0.5 inch (13 mm) WC pressure drop and nominal 11 inch (280mm) WC pressure at inlet												

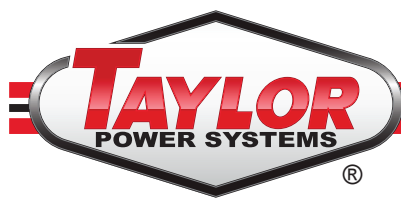


APPENDIX "C"



EPA Certified / Stationary Emergency

OUTPUT POWER OPTIONS					Natural Gas		LP Vapor		sKVA		
					125°C STANDBY	105°C CONTINUOUS	125°C STANDBY				
Make	Voltage	Alternator	Phase	Hertz	kW/kVA	Amps	kW/kVA	Amps	kW/kVA	Amps	30% Voltage Dip
Marathon	277/480	431CSL6206	3	60	200/250	301	174/218	262	130/163	196	664
	120/208	431CSL6206	3	60	200/250	695	174/218	604	130/163	452	498
	120/240	431CSL6206	3	60	200/250	602	174/218	524	130/163	391	498
	120/240	431CSL6206	1	60	166/166	692	150/150	625	130/130	542	185
	120/240	432PSL6228	1	60	200/200	833	174/174	725	130/130	542	370
Marathon	277/480	431CSL6208	3	60	200/250	301	176/220	265	130/163	196	695
	120/208	431CSL6208	3	60	200/250	695	176/220	611	130/163	452	522
	120/240	431CSL6208	3	60	200/250	602	176/220	530	130/163	391	522
	120/240	431CSL6208	1	60	166/166	692	150/150	625	130/130	542	185
Stamford	277/480	UCDI274J311	3	60	200/250	301	174/218	262	130/163	196	840
	120/208	UCDI274J311	3	60	200/250	695	174/218	604	130/163	452	625
	120/240	UCDI274J311	3	60	200/250	602	174/218	524	130/163	391	625
	120/240	UCDI274J311	1	60	161/161	671	91/91	379	130/130	542	610
	600	UCDI274J17	3	60	200/250	241	174/218	210	130/163	157	1140

**Engine Data**

Manufacturer	Doosan	
Model	11.1L	
Aspiration	Turbocharged	
Arrangement	In-line, 4-Cycle	
Firing Order	1-5-3-6-2-4	
Displacement: L (in. <sup>3</sup> )	11.1 (673)	
Bore: mm (in.)	123 (4.84)	
Stroke: mm (in.)	155 (6.1)	
Compression Ratio	10.5:1	
BMEP: psi (kPa)	Natural Gas	197 (1358.3)
	LP Vapor	136 (937.7)
Gross Horsepower: Natural Gas	288	
	LP Vapor	194
Rated RPM	1800	
Governor	Isochronous	
Speed Regulation	±0.5%	

**Engine Liquid Capacity**

Oil system: qt. (L)	26.5 (25.0)
Cooling System Capacity: gal (L)	32.8 (149.0)

**Engine Electrical**

Electric Volts: DC	24
Cold Cracking Amps	2200
Battery(s) Required	2

**Fuel System**

Fuel Type	Natural Gas, LP Vapor or Dual Fuel	
Fuel Supply Inlet:		
	Natural Gas	2" NPT
	LP Vapor	2" NPT
Fuel Supply Pressure: in. H <sub>2</sub> O (kPa)		
	Natural Gas	7-11 (1.74-2.74)
	LP Vapor	5-11 (1.24-2.74)

**Filters and Quantity**

Air Cleaner Quantity	1
Oil Filter(s) Quantity	1

**Air Requirements**

Air Filter(s) Type	Dry
Air Flow: CFM (m <sup>3</sup> /min)	22,300 (631)
Max Air Intake Restriction: in. H <sub>2</sub> O (kPa)	
Clean	5.00 (1.24)
Dirty	15.00 (3.74)
Combustion Air: CFM (m <sup>3</sup> /min)	400.0 (11.7)

**Exhaust System**

Gas Temperature: °F (°C)	1112 (600)
Gas Flow: CFM (m <sup>3</sup> /min)	1425.0 (40.3)
Max Exhaust Back Pressure: in. H <sub>2</sub> O (kPa)	40.9 (10.2)

**Sound Level**

Open Unit: dBA 3.2 ft (1M)	93.2
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**Cooling System**

Heat Rejection per CAC: kW (BTUM)	25.7 (1460)
Heat Rejection to Coolant: kW (BTUM)	195 (11,071)
Coolant Flow: gal/min (L/min)	82 (310)

**Fuel Consumption Natural Gas - 130°C**

At 100% of Power Rating: CFH (m <sup>3</sup> /hr)	2115 (59.89)
At 75% of Power Rating: CFH (m <sup>3</sup> /hr)	1649 (46.69)
At 50% of Power Rating: CFH (m <sup>3</sup> /hr)	1158 (32.79)
At 25% of Power Rating: CFH (m <sup>3</sup> /hr)	706 (19.99)

**Fuel Consumption Natural Gas - 105°C**

At 100% of Power Rating: CFH (m <sup>3</sup> /hr)	1893 (53.6)
At 75% of Power Rating: CFH (m <sup>3</sup> /hr)	1473 (74.7)
At 50% of Power Rating: CFH (m <sup>3</sup> /hr)	1049 (29.7)
At 25% of Power Rating: CFH (m <sup>3</sup> /hr)	622 (17.6)

**Fuel Consumption LP Vapor - 130°C**

At 100% of Power Rating: CFH (m <sup>3</sup> /hr)	704 (19.94)
At 75% of Power Rating: CFH (m <sup>3</sup> /hr)	600 (16.99)
At 50% of Power Rating: CFH (m <sup>3</sup> /hr)	406 (11.50)
At 25% of Power Rating: CFH (m <sup>3</sup> /hr)	254 (7.19)

**GENERAL GUIDELINES FOR DERATION:** Altitude: Derate 0.5% per 100m (328 ft.) Elevation above 1000m (3279 ft.) Temperature: Derate 1.0% per 10°C (18°F) temperature above 25°C (77°F)

**RATINGS:** All three-phase units are rated at 0.8 power factor. All single-phase units are rated at 1.0 power factor.

**125° RATINGS:** 125° apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. There is no overload capability for this rating. Ratings are in accordance with ISO-3046/1, BS 5514, AS 2789, and DIN 6271.

**105° RATINGS:** 105° ratings apply to installations where utility power is unavailable or unreliable. At varying load the number of generator set operating hours is unlimited. A 10% overload capacity is available for one hour in twelve. Ratings are in accordance with ISO-8528/1, overload power in accordance with ISO-3046/1, BS5514, AS2789, and DIN 6271. For limited running time and base load ratings consult the factory. The generator set manufacturer reserves the right to change the design or specifications without notice and without any obligation or liability whatsoever.

## Alternator Data

Manufacturer	Marathon
Type	PMG
Insulation NEMA Rise/Temp	NEMA H/125°C
Hertz	60
Phase	3
RPM	1800
Leads	12
Amortisseur Windings	Full
CFM Cooling Required	1200
Voltage Regulator	PM500
Sensing	Three Phase
Voltage Regulation, No Load - Full Load	0.5%

Optional 0.25% Regulation DVR2000E+ Available

## Features

- NEMA MG1-32, BS5000, and IEC 34-1 compliant; CE & CSA Certified and UL Listed
- Self-ventilated and drip proof construction
- Two-thirds pitch stator and skewed rotor
- Wet wound, epoxied field windings
- Designed to withstand overspeeds of up to 125%
- Hybrid analog/digital voltage regulator
- Under frequency protection
- Under frequency indication light
- Less than one cycle response time
- Over excitation protection
- Over excitation indication light
- Easy access front-panel adjustments
- Over voltage protection shutdown
- Analog input for paralleling

## Alternator Data

Manufacturer	Stamford
Type	PMG
Insulation NEMA Rise/Temp	NEMA H/125°C
Hertz	60
Phase	3
RPM	1800
Leads	12
Amortisseur Windings	Full
CFM Cooling Required	1463
Voltage Regulator	MX341
Sensing	Single Phase
Voltage Regulation, No Load - Full Load	1.0%

## Features

- BS EN 60034, BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, and AS1359 complaint
- IP23 enclosure
- Dynamically balanced to exceed BS6861:Part 1 Grade 2.5 vibration standard
- Quality assurance to BS EN ISO 9001
- Self-ventilated and drip proof construction
- Two-thirds pitch stator and skewed rotor
- Heavy duty bearings
- Fully guarded
- Overexcitation protection
- Under frequency protection
- Analog input
- Overvoltage protection
- Paralleling compatible
- Single-phase sensing



## DGC2020 Digital Controller

- Integrated engine-genset control, protection, and metering
- Microprocessor allows for exact measurement, setpoint adjustment, and timing functions
- Front panel 3 position controls and indicators enable quick and simple operation
- Emergency stop push button and an Alarm Horn with silence button
- A wide temperature-range liquid crystal display (LCD) with backlighting
- SAE J1939 Engine ECU communications
- Remote RS-485 communications for Optional RDP-110 Remote Annunciator
- 4 programmable contact inputs and 10 contact outputs (2 ADC rated)
- Modbus Communications with RS-485, Battery Backup for Real Time Clock, UL recognized, CSA certified, CE approved, HALT (Highly Accelerated Life Tests) tested
- IP 54 Front Panel rating with integrated gasket and NFPA 110 Level 1 Compatible.
- Manual Override Keyswitch



## Analog Controller with Emergency Bypass Key Switch

- Automatic CANBUS Engine Control
- Oil Pressure, Water Temperature, Battery Voltage and RPM Gauges
- Automatic Gauge Zeroing on Shutdown
- AC Voltage, Frequency, Percent of Load, and Run-Time Metering
- 3-Position Auto-Off-Manual Control Switch
- LED Status Lights: Low Oil Pressure, High Temperature, Overcrank, Overspeed, & Engine Start





## Standard Features:

### Warranty

2 Year Standard

5 Year Comprehensive

- Heavy Duty Steel Base
- Vibration Isolators
- Oil Drain Valve with Extension
- Battery Rack & Cables
- High Ambient Unit Mounted Radiator
- Battery Charging Alternator
- Factory Powder Coating
- Factory Test
- Owner's Manual

### Controller Options

DGC-2020HD Controller
Fiber Optic Ethernet (DGC-2020HD)
RS-232 Port & Generator Protection (DGC-2020)
Flush or Surface Mount Remote Annunciator
Remote Mount Break Glass E-Stop Switch

### Miscellaneous Options:

- Battery Charger
- Coolant Drain Kit
- Block Heater
- Line Circuit Breaker
- Pad Type Battery Heater
- Battery Heater Blanket w/Thermostat
- Oil Pan Heater
- Generator Strip Heater

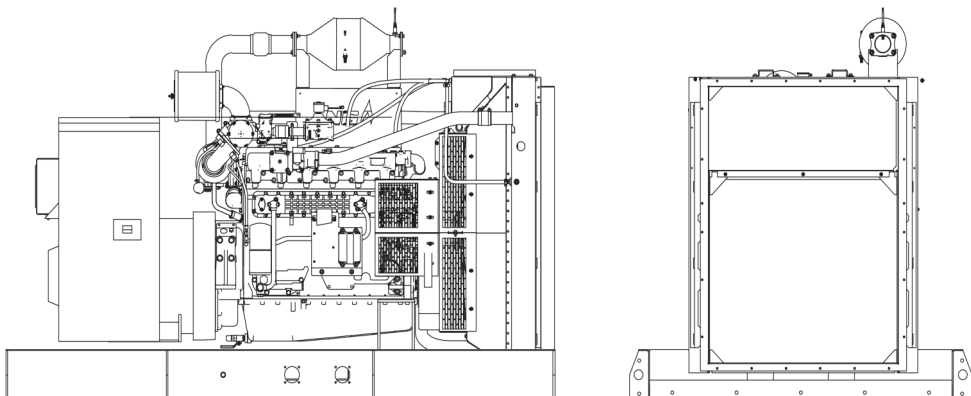
## Narrow Skid Base Open Unit

### Options:

- Radiator Duct Flange
- Flex Exhaust
- Critical Silencer
- Wide Skid Base

OVERALL SIZE: 120"L x 56"W x 80"H  
Approximate Weight: 6,000 lbs.

*Note: Dimensions and weights reflect standard open unit with no options and are subject to change.*



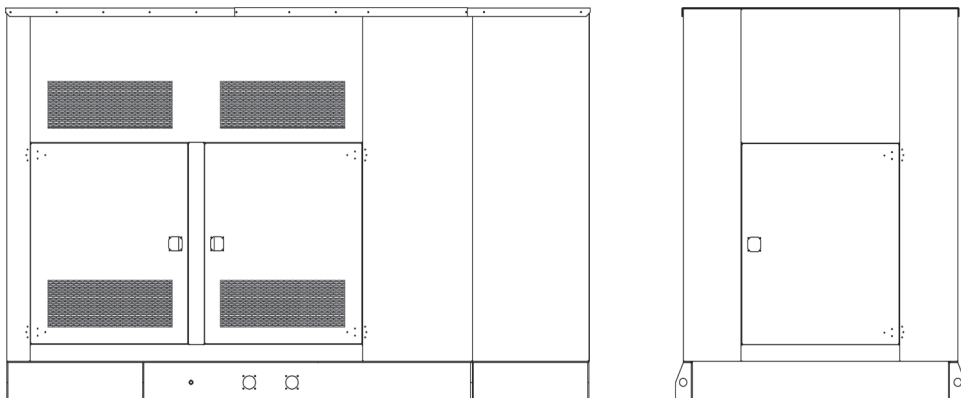
## Standard Enclosed Unit

### Options:

- Sound Attenuated Enclosure
- Load Center, Lights & GFI Receptacle

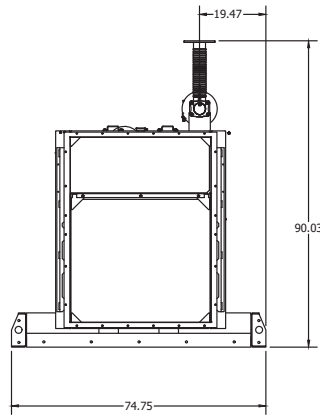
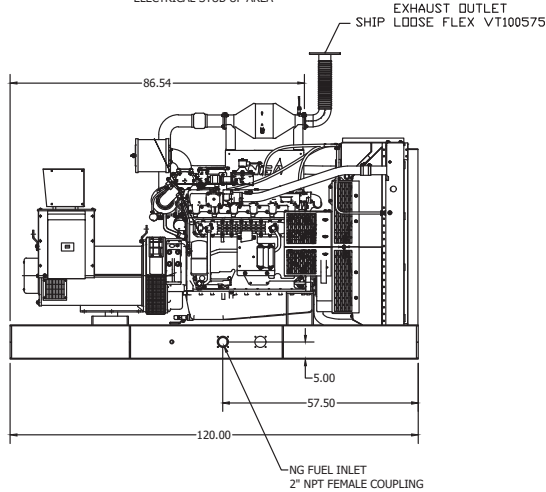
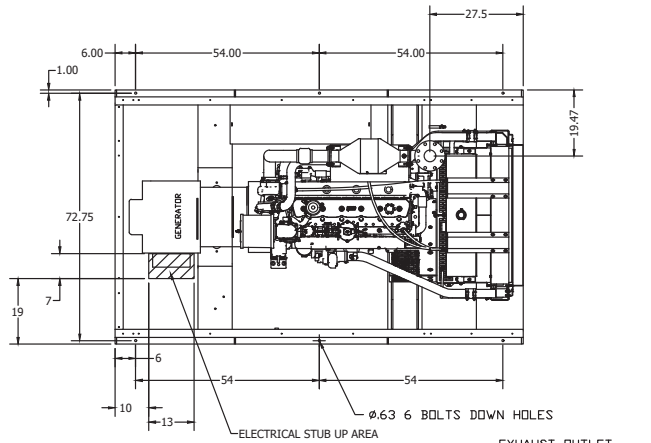
OVERALL SIZE: 150"L x 75W x 102"H  
Approximate Weight: 7,750 lbs.

*Note: Dimensions and weights reflect standard enclosed unit with no options and are subject to change.*



**Note: The above drawings are provided for reference only and should not be used for planning installation.  
Contact your local distributor for more information.**

## APPENDIX "D"



CUSTOMER APPROVAL SIGNATURE	APPROVAL DATE	COMMENTS	
INCLUDED FEATURES		PART #	WEIGHT
ENGINE: DOOSAN (NG) (radiator through flywheel)		D111L	2695 Lbs. WET
ALTERNATOR: STAMFORD UC1274		UC1274J	1415 Lbs.
SUB-BASE: STRUCTURAL STEEL		VT087806	1092 Lbs.
ISOLATORS: (4) LF21000		VTLF21000	12 Lbs.
BLOCK HEATER			MISC.
FUEL SYSTEM:			MISC.
OIL DRAIN EXTENSION: WITH VALVE ROUTED TO SKID			MISC.
(2) BATTERIES: 8D 24V SYSTEM RACK AND CABLES FOR BATTERY Note: Rack is integral to the skid		VT8D	150 Lbs.
CONTROL PANEL: Digital Auto Start Basler DGC2020			MISC.
CIRCUIT BREAKER: ABB ABB ENCLOSURE			MISC. MISC.
WEIGHT SUBTOTAL			5,364 Lbs.
MISC. WEIGHT: 5% of subtotal			268 Lbs.
TOTAL WEIGHT:			5,632 Lbs.



DRAWN John	1/5/2017	TAYLOR POWER SYSTEMS	
CHECKED		TITLE	
QA		TG200 OPEN UNIT	
MFG			
APPROVED			
		SIZE C	DWG NO TG200 OPEN UNIT
		SCALE	REV
			SHEET 1 OF 1





# HEAVY-DUTY

## 11.1L ENGINE

APPENDIX "E"

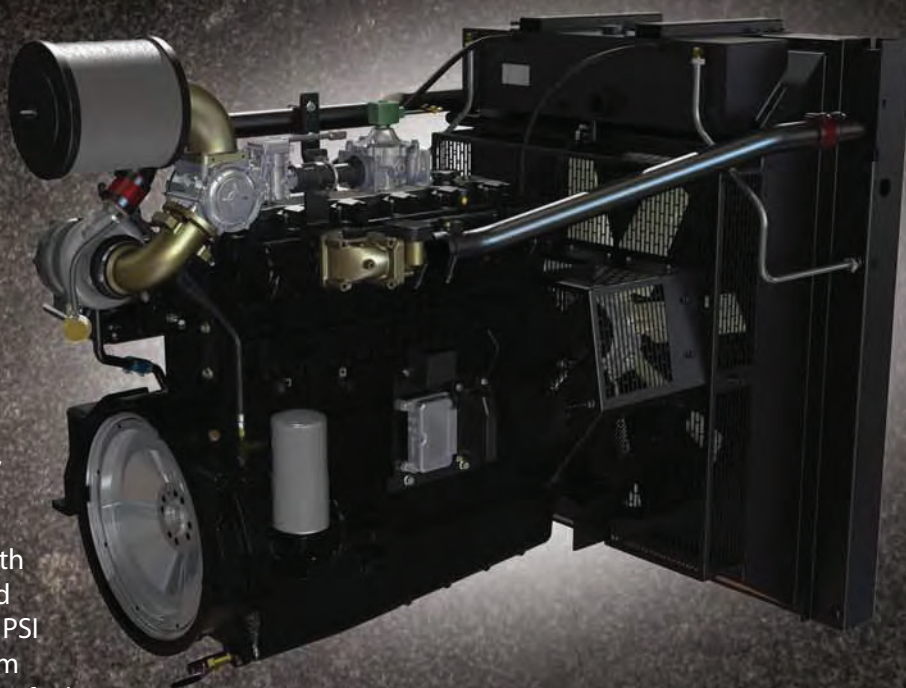
### INDUSTRIAL STATIONARY

## Product Overview

The PSI HD 11.1L is a U.S. EPA-certified natural gas and propane engine developed from the block up to be a reliable and durable power unit. Built upon a proven marine-diesel grade block, the 6-cylinder in-line, turbocharged and after-cooled engine features replaceable wet liners and water-cooled exhaust.

Superior engine performance is provided by an ECU that integrates and coordinates all critical functions including: Governor, Variable Ignition Timing, Air Fuel Ratio Control, Knock Suppression and Engine Protection.

The PSI HD product lineup has six models with displacements of 8.1L, 11.1L, 14.6L, 18.3L and 21.9L. These engines are an extension of the PSI product line, which is based upon blocks from 650cc to 8.8L. All PSI engines feature the same fuel systems and controls, simplifying your application development and support.



### FEATURES

- U.S. EPA-Certified and CARB-Compliant
- Dual Fuel with Automatic Change-Over
- 50C Ambient Cooling Capacity
- 3-Way Catalytic Converter
- Air Filtration
- UL2200-Compliant or Listed Components
- MasterTrak Telematics service (included for 1 year)

**MAXIMUM  
PERFORMANCE  
NO COMPROMISES**

**POWER & PERFORMANCE**



**EMISSION-CERTIFIED**



**FUEL-FLEXIBLE**



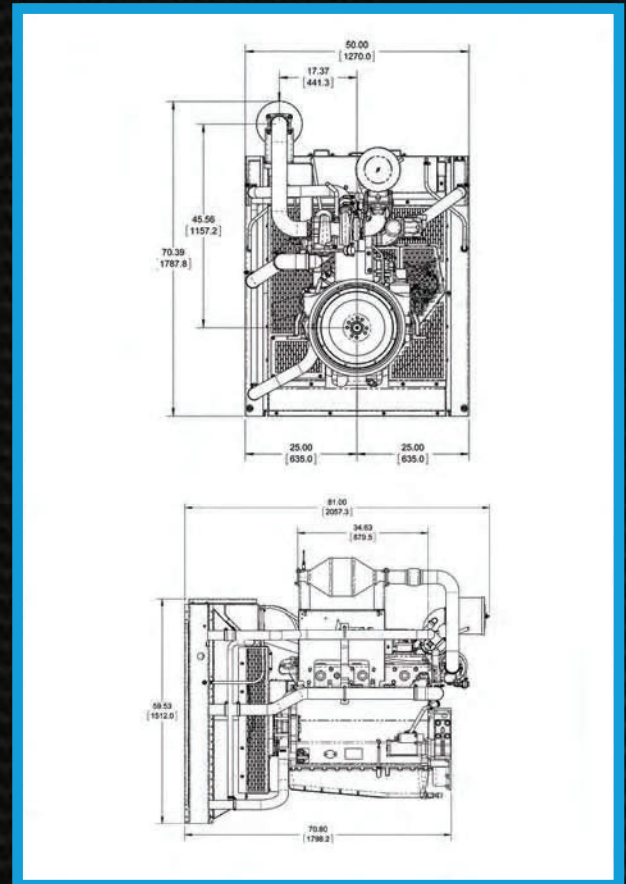


### 11.1L Industrial Stationary Engine

Displacement	673 cid	11,030 cc
Compression Ratio	10.5:1	
Bore & Stroke	4.84 in x 6.1 in	123 mm x 155 mm
kWe	200 @ 1,800 rpm (Natural Gas)	175 @ 1,500 rpm (Natural Gas)
Emission-Certified	EPA, CARB – Industrial Stationary	
Fuel Types	Natural Gas / Propane	

#### GENERAL DATA

- Water-cooled, turbo-charged, air-to-air inter-cooled, stoichiometric, replaceable wet cylinder liners
- Cast iron block & heads, 10.5:1 compression ratio, overhead valve/2V configuration
- Crankshaft gear-driven oil system with cartridge-type filter, belt-driven centrifugal water pump
- Full ECU engine control including: coil-on-plug variable timing ignition, electronic governor and fuel-air ratio control
- Engine protection for oil pressure, coolant level, coolant temperature, fuel pressure, over-speed
- Complete fuel system for single fuel (NG/LP) operation with closed-loop control
- Alternator (45A/24VDC)
- Starter (24VDC)
- CANBUS J1939 interface



Power shown is gross engine power and has been corrected to SAE J1995. Actual installed power levels may vary depending on the application and OEM supplied components.



**APPENDIX "F"**  
**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**  
**2017 MODEL YEAR**  
**CERTIFICATE OF CONFORMITY**  
**WITH THE CLEAN AIR ACT**

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

**Certificate Issued To:** Power Solutions International, Inc.

(U.S. Manufacturer or Importer)

**Certificate Number:** HPSIB11.1NGP-011

**Effective Date:**

12/01/2016

**Expiration Date:**

12/31/2017

Byron J. Bunker, Division Director  
Compliance Division

**Issue Date:**

12/01/2016

**Revision Date:**

N/A

**Manufacturer:** Power Solutions International, Inc.

**Engine Family:** HPSIB11.1NGP

**Mobile/Stationary Certification Type:** Mobile and Stationary

**Fuel :** LPG/Propane  
Natural Gas (CNG/LNG)

**Emission Standards :**

Mobile Part 1048

HC + NOx ( g/kW-hr ) : 2.7

CO ( g/kW-hr ) : 4.4

NMHC + NOx ( g/kW-hr ) : 2.7

Part 60 Subpart JJJ Table 1

VOC ( g/Hp-hr ) : 0.7

CO ( g/Hp-hr ) : 2.0

NOx ( g/Hp-hr ) : 1.0

**Emergency Use Only :** N

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR Part 60, 40 CFR Part 1048, 1065, 1068, and 60 ( stationary only and combined stationary and mobile ) 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 nonroad engines, by engine family, more fully described in the documentation required by 40 CFR Part 60, 40 CFR Part 1048 and produced in the stated model year.

This certificate of conformity covers only those new nonroad spark-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, 40 CFR Part 1048 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 60, 40 CFR Part 1048. This certificate of conformity does not cover nonroad engines imported prior to the effective date of the certificate.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068.20 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, 40 CFR Part 1048. 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, 40 CFR Part 1048.

This certificate does not cover large nonroad 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.



## SOUND TEST REPORT

**Date:** March 25, 2013

**Model:** TG200

**Enclosure:** N/A

**Silencer:** Critical Grade

**Overall Average Sound Pressure Level @ 23ft.** 87.5 dB(a)

**Test performed by:** Harley Hollingsworth

**Signed:** *Harley Hollingsworth*

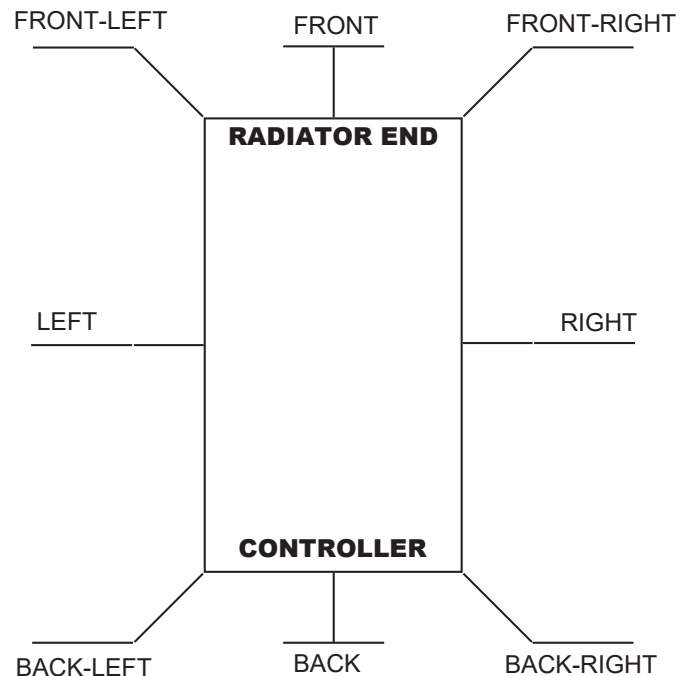
**Test Location:** TMW Test Site

**Temperature:** 47°F

**Humidity:** 76%

**Bar Pressure:** 29.7 in.

**Wind Speed/Dir.:** 7.3 MPH W





				Sound Pressure Levels dB(A)								
Load	Distance, m (ft.)		Measurement Position	Octave Band Center Frequency (Hz)								Overall Level
				63	125	250	500	1000	2000	4000	8000	
100% Load	7 (23)	Open Unit, Isolated Exhaust	Right	44.1	58.6	69.2	80.3	80.7	82.6	79.7	73.1	87.2
			Front-Right	41.1	59.0	68.6	79.2	80.7	82.1	79.4	73.2	86.8
			Front	46.4	59.9	70.9	81.4	80.4	82.3	79.6	70.1	87.3
			Front-Left	45.5	64.6	69.5	83.0	82.2	86.3	83.3	73.9	90.2
			Left	49.1	67.1	71.3	76.6	80.9	83.4	79.9	72.7	87.2
			Back-Left	45.3	62.5	70.1	82.5	82.5	83.7	80.7	75.0	88.8
			Back	45.6	61.4	69.3	78.3	75.8	74.4	70.2	63.9	81.9
			Back-Right	44.2	57.5	68.9	78.4	80.2	82.8	79.7	72.9	86.9
			8-pos. log avg.	45.7	62.5	69.8	80.4	80.8	83.0	80.0	72.7	87.5

			Sound Pressure Levels dB(A)								
Load	Distance, m (ft.)	Exhaust	Octave Band Center Frequency (Hz)								Overall Level
			63	125	250	500	1000	2000	4000	8000	
100% Load	1 (3.3)	Raw Exhaust (No Silencer)	56.0	82.6	85.6	96.1	95.2	95.3	90.8	83.3	101.1

**NOTES:**

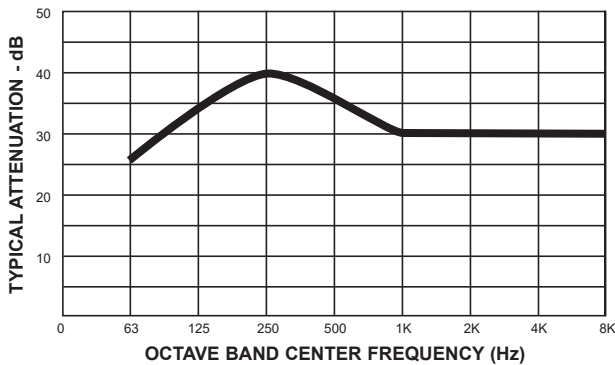
1. Sound pressure data is the logarithmic average of eight perimeter measurement points at a distance of 7 meters (23 feet), except Raw Exhaust data which is a single measurement point at 1 meter (3.3 feet) from the mouth of a straight pipe exhaust.
2. Sound data based with remote cooled generator sets are without cooling package and engine driven cooling fan.
3. Sound power levels measured per ISO 3744 and ISO 8528-10 as applicable.
4. Sound power levels calculated per ISO 3744 and ISO 8528-10 as applicable.
5. Sound pressure level is subject to instrumentation, measurement, installation and manufacturing variability.

# SPECIFICATIONS

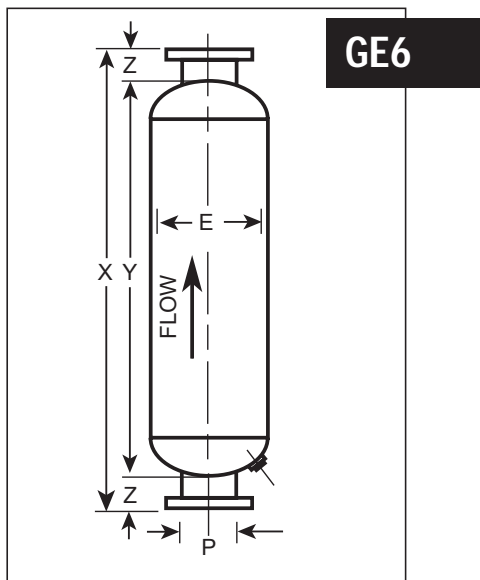
## APPENDIX "G"

### GE 6 SERIES CHAMBER CONSTRUCTION HOSPITAL GRADE SILENCERS

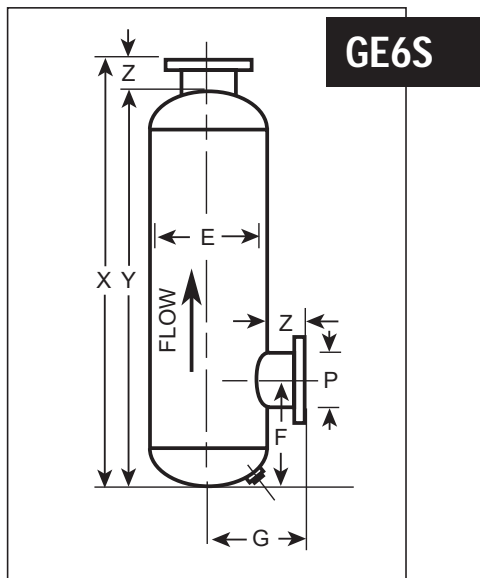
TYPICAL ATTENUATION CURVE



GE 6 Series chamber construction super critical or hospital grade silencers are recommended for use in noise sensitive locations such as hospitals, residential schools, hotels etc. where ambient noise level is extremely low and silencing requirements are maximum. The design consists of a multi-chamber, multi-tube arrangement to effectively reduce pulsations, and can be installed in horizontal or vertical position. The standard construction is sturdy, heavy duty, all welded carbon steel sheet and plates. The units 6" and above are provided with flanged connections drilled to 125 lbs. ANSI specifications. The external surfaces are painted with high heat black paint to ensure a longer service life. Custom designs available to suit specific nozzle orientations. The optional features include dual inlets or outlets, inspection openings, mounting brackets, support gussets, lifting lugs, special material of construction such as aluminized steel or stainless steel and special paint.



MODEL	PIPE SIZE P	E	X	Y	Z	WT.
GE6 - 1	1	6 1/2	28	24	2	17
GE6 - 1 1/2	1 1/2	8	33	29	2	25
GE6 - 2	2	10	34	28	3	35
GE6 - 2 1/2	2 1/2	12	40	34	3	50
GE6 - 3	3	12	46	40	3	65
GE6 - 3 1/2	3 1/2	14	59	53	3	90
GE6 - 4	4	16	71	65	3	150
GE6 - 5	5	18	84	78	3	200
GE6 - 6	6	22	92	86	3	300
GE6 - 8	8	26	111	103	4	450
GE6 - 10	10	30	136	128	4	800
GE6 - 12	12	36	138	130	4	1100
GE6 - 14	14	36	168	160	4	1300
GE6 - 16	16	42	193	185	4	1800
GE6 - 18	18	48	213	205	4	2800
GE6 - 20	20	54	202	192	5	3200
GE6 - 22	22	60	228	218	5	3900
GE6 - 24	24	60	278	268	5	5000



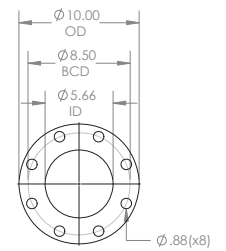
MODEL	PIPE SIZE P	E	X	Y	Z	G	F		WT.
							MIN.	MAX.	
GE6S - 1	1	6 1/2	26	24	2	SIDE CONNECTION AVAILABLE ON REQUEST FOR SIZES UP TO 2".			17
GE6S - 1 1/2	1 1/2	8	31	29	2				25
GE6S - 2	2	10	31	28	3				35
GE6S - 2 1/2	2 1/2	12	37	34	3	9	6	16	50
GE6S - 3	3	12	43	40	3	9	6	18	65
GE6S - 3 1/2	3 1/2	14	56	53	3	10	7	20	90
GE6S - 4	4	16	68	65	3	11	8	24	150
GE6S - 5	5	18	81	78	3	12	9	28	200
GE6S - 6	6	22	89	86	3	14	10	32	300
GE6S - 8	8	26	107	103	4	17	11	36	450
GE6S - 10	10	30	124	128	4	19	13	45	800
GE6S - 12	12	36	134	130	4	22	15	46	1100
GE6S - 14	14	36	164	160	4	22	17	58	1300
GE6S - 16	16	42	189	185	4	25	19	68	1800
GE6S - 18	18	48	209	205	4	28	21	80	2800
GE6S - 20	20	54	197	192	5	32	23	82	3200
GE6S - 22	22	60	223	218	5	35	25	86	3900
GE6S - 24	24	60	273	268	5	35	27	98	5000

#### Std. fittings

- up to 3 1/2" size - Male thread nipples
- 4" & 5" sizes - optional - male thread nipples or flanges
- 6" & above - 125 lbs. ANSI flange drilling

- Dimensions and weights are approximate and may change slightly with production models.
- Dimension in inches.
- Weight in lbs.



**We specialize in custom designs and also provide various nozzle orientations to suit your specific requirements.**



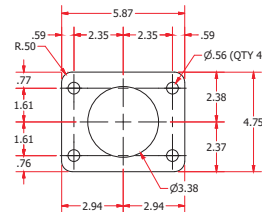
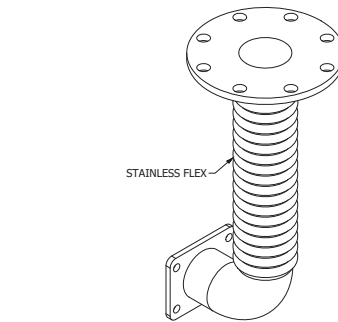
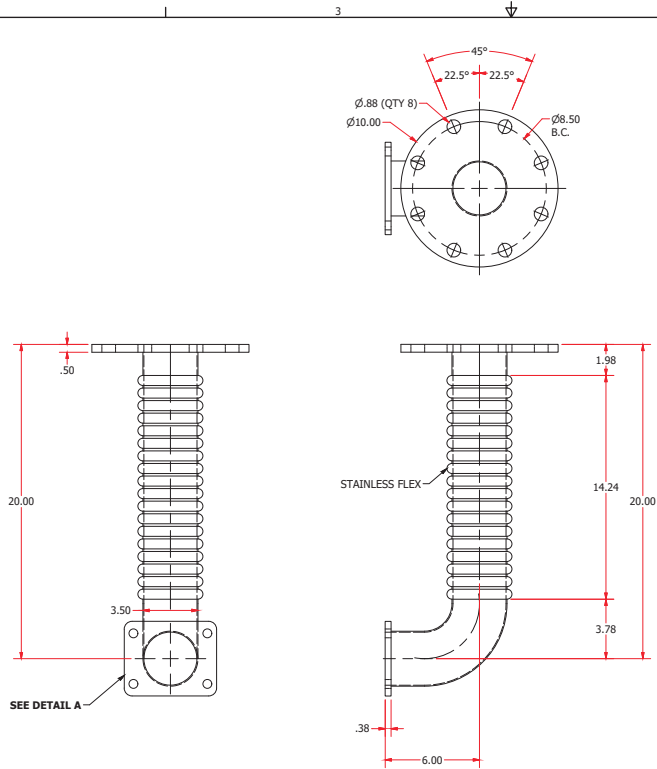
**Detail F-5**  
5" ANSI 150# FLANGE (x2)

**Notes:**  
All Dimensions are in Inches


REV	DESCRIPTION	DATE (MM/DD/YY)	DRAWN BY CHECKED BY

MATERIAL: CARBON STEEL CONSTRUCTION		PAINT: HIGH HEAT BLACK	APPROX. HEIGHT (FED): 200
UNLESS OTHERWISE NOTED 1. REMOVE ALL BURRS AND SHARP EDGES 2. DOWNGRADES ARE IN BRACKETS DIMENSIONS 0.8 x 10.0 0.005 x 10.0 0.000 x 10.00		 <b>E. I. WILLIAMS INDUSTRIES INC.</b> Building Sound Solutions	264 FARALL STREET, A.JAX, CHICAGO, CANADA L1S 1M6 T: 905-428-0960 F: 905-428-8343 <a href="http://WWW.EI.WILLIAMS.COM">WWW.EI.WILLIAMS.COM</a>
CUSTOMER:	APPLICATION:		
TITLE:	PROJECT:		
MODEL #	DRAWN BY:		
GE65-5	Amr Elziny		DATE: 6/15/2020
HOSPITAL GRADE SILENCER		REV: 0	





# CARBON STEEL CONSTRUCTION

DRAWN	Prentiss James	1/4/2021	 <b>TAYLOR POWER SYSTEMS, INC.</b> Phone: 800-748-9980 Fax: 601-922-8503 947 Industrial Park Drive Clinton, Mississippi 39056 <a href="http://www.taylorpower.com">www.taylorpower.com</a>	
CHECKED				
APPROVED				
REVISION DESCRIPTION			TITLE	
1			FLEX EXHAUST TO SILENCER	
2			SIZE: DWG NO	
3			C	VT101092
SCALE			3" = 1'-0"	REV 0
			SHEET 1 OF 1	



## LOW FREQUENCY ISOLATION MOUNTS

LF Series are low frequency, elastomeric shock and vibration isolation mounts used in a variety of applications where space and weight are restricted – vehicle cabs, engines, engine gensets, marine equipment, and shipping containers. The series offer a low natural frequency that is ideal for isolating structure-borne noise in these mobile applications.

The LF Series provides a low profile, rugged, all-bonded construction that includes corrosion-resistant coating on all metal surfaces. The structural sections are made of steel for excellent strength and durability.

The elastomeric element resists oils, ozone and most solvents – providing optimum resilience in nearly all environments. The operating temperature range of -20°F to +180°F offers continuous operation in all weather conditions. At a maximum size of just 3.25", the LF Series offers installation in numerous portable machinery and equipment applications. For special elastomeric compounds contact the VMC Engineering department.

## FEATURES & BENEFITS

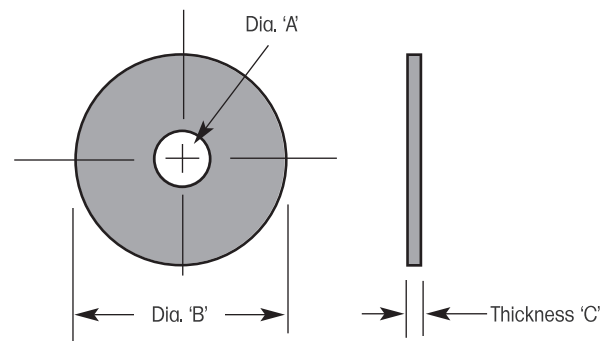
- Static load range from 40-2800 lbs. offers a wide range of application flexibility.
- Low profile provides installation in space-restricted applications.
- Low natural frequency of 10 Hz at maximum load provides structure-borne noise attenuation in even the most challenging applications.
- 1:1 axial to radial stiffness ratio.
- Rugged, all-bonded construction provides durability in extreme conditions.
- Failsafe design problems when used in conjunction with snubbing washer for mobile and all-attitude use.
- Typical damping ratio  $C/C_c = 0.1$  transmissibility approximately 5:1 at resonance.

## TECHNICAL

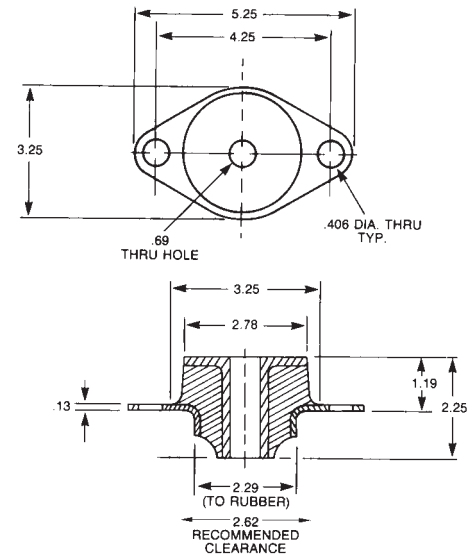
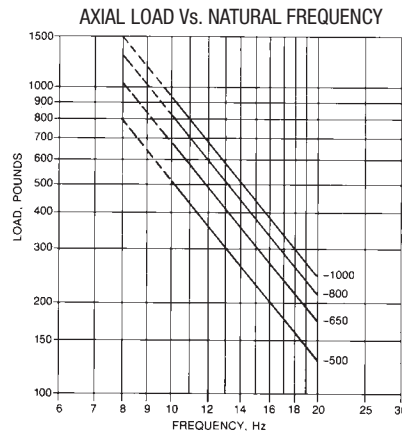
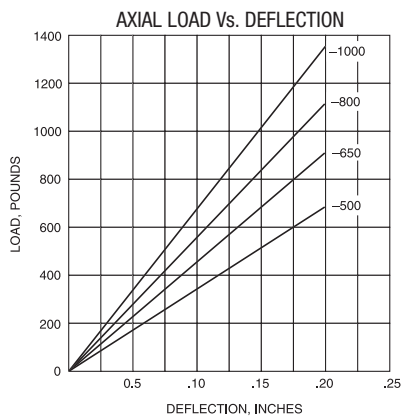
LF SERIES SNUBBING WASHERS\* DIMENSIONS

TYPE	DIA. 'A', ins.	DIA. 'B', ins.	THICKNESS 'C', ins.	MODEL #
LF1 Series	0.45	2.00	0.13	148099-5
LF1.5 Series	0.51	2.00	0.13	148099-18
LF2 Series	0.64	2.25	0.15	148099-6
LF3 Series	0.76	2.50	0.18	148099-7
LF4 Series	1.01	3.25	0.25	148099-17

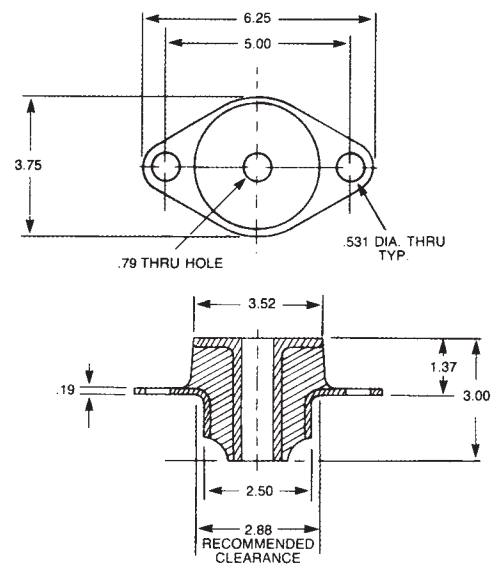
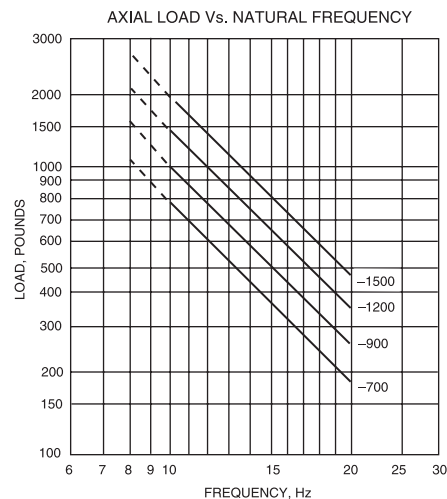
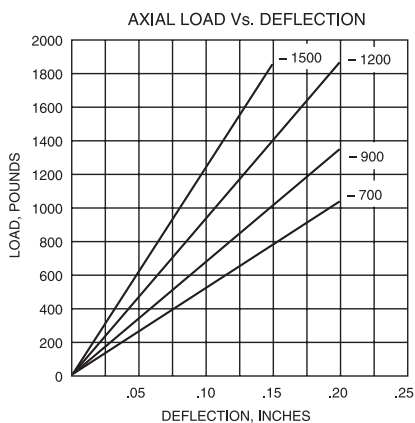
\* Zinc Plated Carbon Steel



TYPE LF2		
MODEL #	AXIAL STATIC LOAD, MAX., lbs.	RADIAL STATIC LOAD, MAX., lbs.
LF2 - 500	500	330
LF2 - 650	650	430
LF2 - 800	800	530
LF2 - 1000	1000	660



TYPE LF3		
MODEL #	AXIAL STATIC LOAD, MAX., lbs.	RADIAL STATIC LOAD, MAX., lbs.
LF3 - 700	700	450
LF3 - 900	900	600
LF3 - 1200	1200	800
LF3 - 1500	1500	1000



## APPENDIX "I" 1" & 2" DEFLECTION SEISMIC RESTRAINED OPEN SPRING MOUNTS

SMSR-B/BF/BT mounts are designed to provide efficient isolation from critical vibrations and all-directional restraint from vertical and horizontal forces, as well as from forces due to seismic activities and high wind loads. Vibrasystems isolators are tested and certified to ASHRAE 171-2017 for wind and seismic load resistance.

There are three available configurations:

SMSR-B: top with a bracket and inside leveling adjustment feature

SMSR-BF: flat top and inside leveling adjustment feature

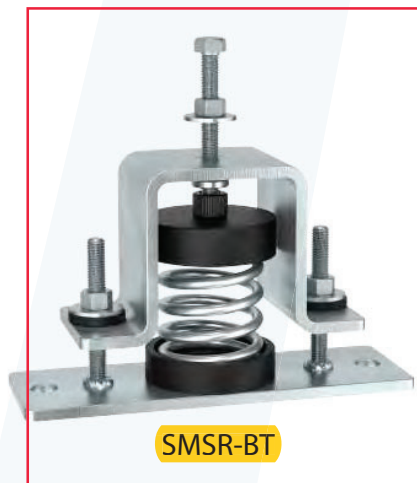
SMSR-BT: bolt top with leveling adjustment feature



SMSR-B



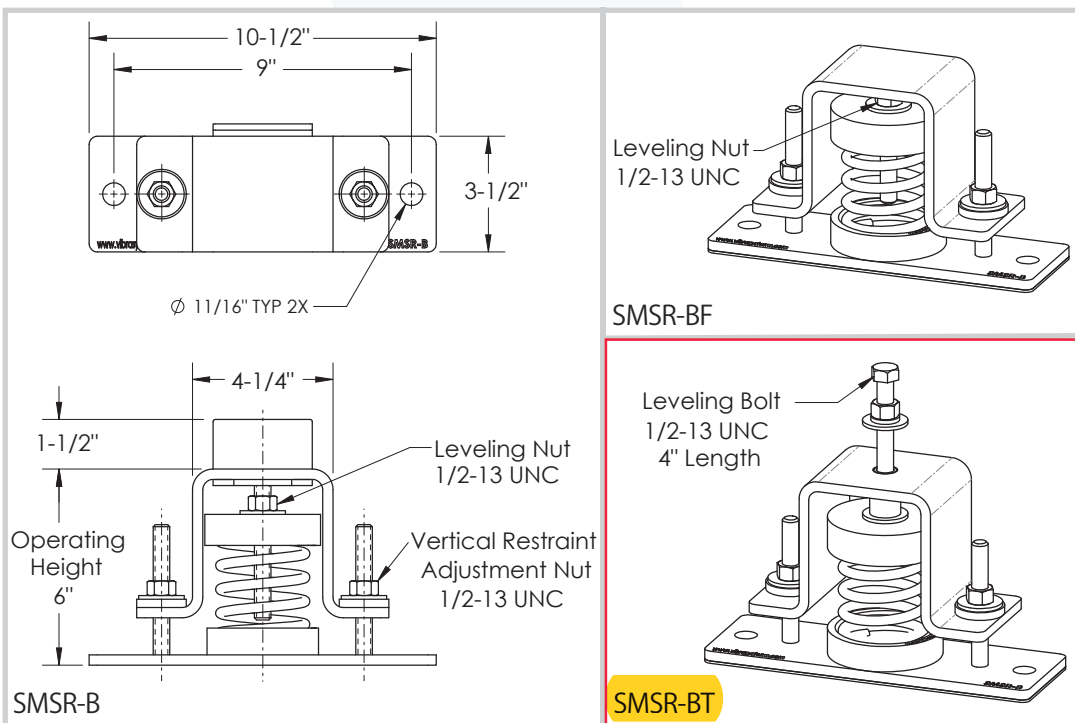
SMSR-BF



SMSR-BT

### Recommended for:

HVAC equipment, fan air circulation systems, compressors, pumps, chillers, AC units, cooling towers, inertia bases, etc.

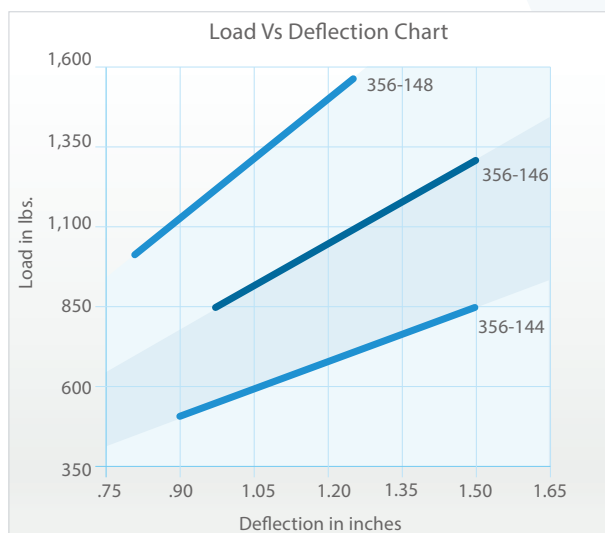
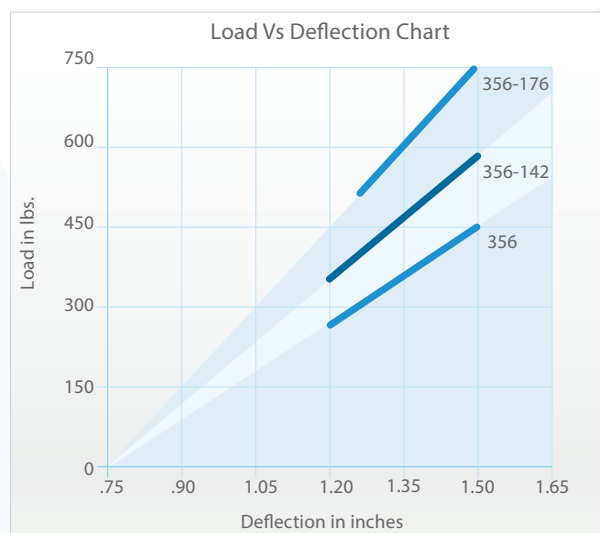
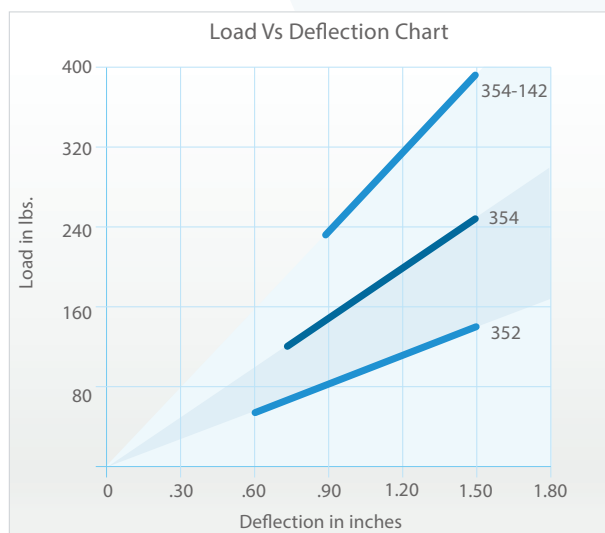


### Features:

- ✓ All springs at rated loads have 50% additional travel to solid load.
- ✓ All mounts' elements are safe at solid load.
- ✓ Safety Factor - Springs will accommodate 50% extra load from rated load to solid load.
- ✓ Recommended load range: from 50% of rated load to rated load.
- ✓ Certified ASHRAE 171-2017.
- ✓ Zinc plates housings and springs provide good corrosion resistance.
- ✓ Elastomer spring base cap provides better vibration isolation, load distribution and noise reduction.
- ✓ Springs are color coded and easily replaceable.
- ✓ Rugged welded steel housing designed to withstand seismic and high wind forces.

## 1" DEFLECTION SEISMIC RESTRAINED SPRING MOUNTS

Model			Rated Load (lbs)	Deflection at Rated Load (lin)	Spring Rate (lbs/in)	Max. Vertical G Rating	Max. Horizontal G Rating	Spring Color
SMSR-B-352	SMSR-BF-352	SMSR-BT-352	140	1-1/2	93	54.9	3	Yellow
SMSR-B-354	SMSR-BF-354	SMSR-BT-354	250	1-1/2	166	30.7	1.7	Purple
SMSR-B-354-142	SMSR-BF-354-142	SMSR-BT-354-142	385	1-1/2	256	19.9	1.1	Purple/Blue
SMSR-B-356	SMSR-BF-356	SMSR-BT-356	450	1-1/2	300	17.1	0.9	Black
SMSR-B-356-142	SMSR-BF-356-142	SMSR-BT-356-142	585	1-1/2	390	13.1	0.7	Black/Blue
SMSR-B-356-176	SMSR-BF-356-176	SMSR-BT-356-176	750	1-1/2	500	10.2	0.6	Black/Black
SMSR-B-356-144	SMSR-BF-356-144	SMSR-BT-356-144	850	1-1/2	567	9	0.5	Black/Brown
SMSR-B-356-146	SMSR-BF-356-146	SMSR-BT-356-146	1,300	1-1/2	867	5.9	0.3	Black/Yellow
SMSR-B-356-148	SMSR-BF-356-148	SMSR-BT-356-148	1,575	1-1/4	1,260	4.9	0.3	Black/Green

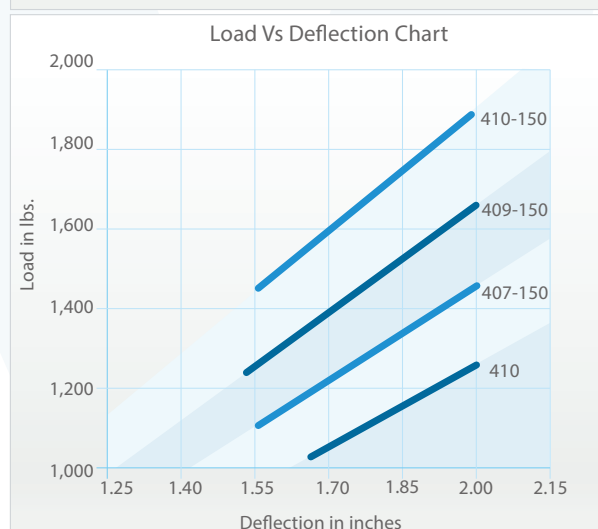
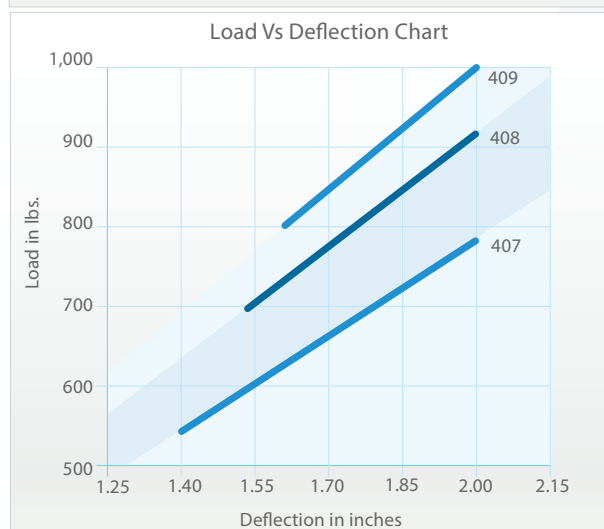
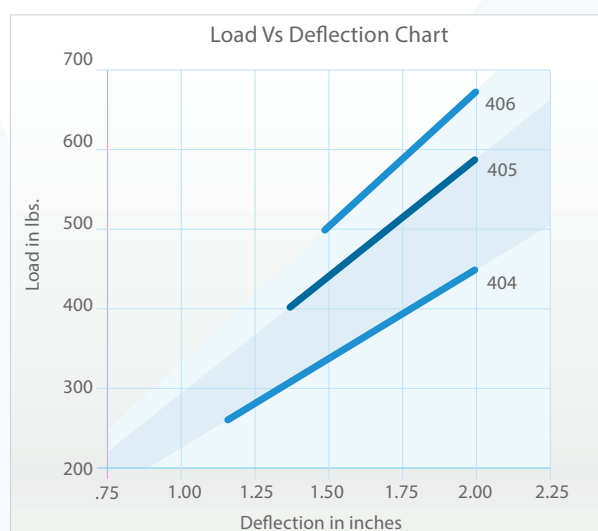
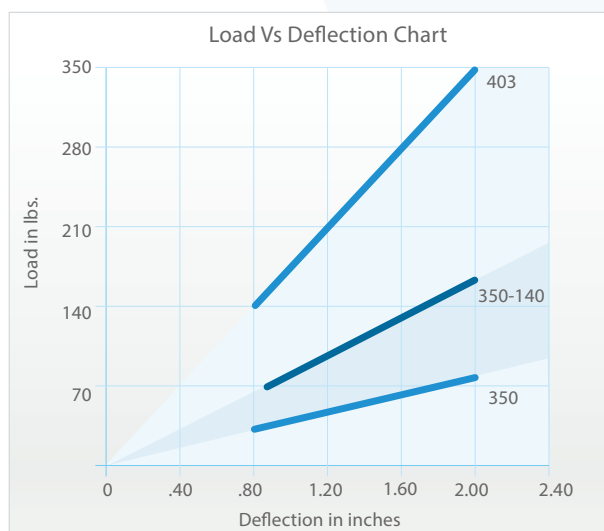


### Notes:

- Vibrasystems isolators are tested and certified to ASHRAE 171-2017 for wind and seismic load resistance. Wind and Seismic Certification Compliance Report 1701502-CR-001-R1 is available upon request.
- 350 Spring: 3" Outside diameter x 5" Free Length.
- 140 Spring & 170 Spring: 2" Outside diameter x 5" Free Length.
- 400 Spring: 3" Outside diameter x 5.75" Free Length.
- 150 Spring: 2" Outside diameter x 5.75" Free Length.
- Rated load is the maximum load recommended.
- Anti-skid rubber acoustical Pad can be provided upon request.

## 2" DEFLECTION SEISMIC RESTRAINED SPRING MOUNTS

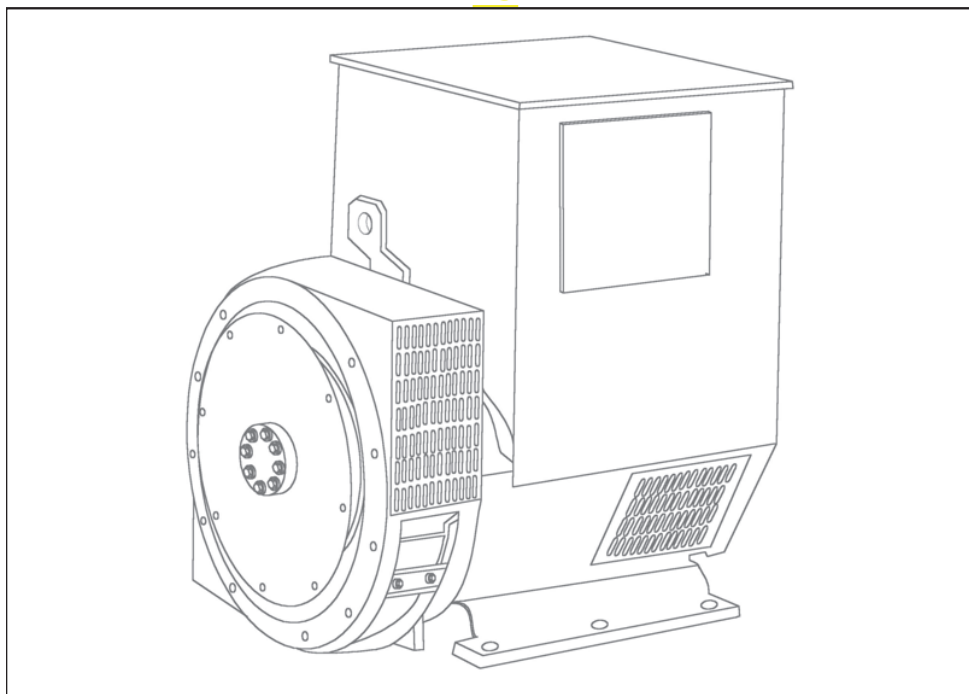
Model			Rated Load (lbs)	Deflection at Rated Load (lin)	Spring Rate (lbs/in)	Max. Vertical G Rating	Max. Horizontal G Rating	Spring Color
SMSR-B-350	SMSR-BF-350	SMSR-BT-350	80	2	40	96	5.3	Red
SMSR-B-350-140	SMSR-BF-350-140	SMSR-BT-350-140	160	2	80	48	2.6	Red/Black
SMSR-B-403	SMSR-BF-403	SMSR-BT-403	348	2	174	22.1	1.2	Black
SMSR-B-404	SMSR-BF-404	SMSR-BT-404	453	2	226	17	0.9	Blue
SMSR-B-405	SMSR-BF-405	SMSR-BT-405	590	2	295	13	0.7	Red
SMSR-B-406	SMSR-BF-406	SMSR-BT-406	676	2	338	11.4	0.6	Orange
SMSR-B-407	SMSR-BF-407	SMSR-BT-407	787	2	393	9.8	0.5	Green
SMSR-B-408	SMSR-BF-408	SMSR-BT-408	918	2	459	8.4	0.5	White
SMSR-B-409	SMSR-BF-409	<b>SMSR-BT-409</b>	<b>1,000</b>	<b>2</b>	<b>500</b>	<b>7.7</b>	<b>0.4</b>	<b>Brown</b>
SMSR-B-410	SMSR-BF-410	SMSR-BT-410	1,250	2	625	6.1	0.3	White
SMSR-B-407-150	SMSR-BF-407-150	SMSR-BT-407-150	1,437	2	718	5.3	0.3	Green/Grey
SMSR-B-409-150	SMSR-BF-409-150	SMSR-BT-409-150	1,650	2	825	4.7	0.3	Brown/Grey
SMSR-B-410-150	SMSR-BF-410-150	SMSR-BT-410-150	1,900	2	950	4	0.2	White/Grey



# STAMFORD<sup>®</sup>

## UCDI274J - Winding 17

### Technical Data Sheet





## SPECIFICATIONS &amp; OPTIONS

## STANDARDS

Stamford industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, AS1359.

Other standards and certifications can be considered on request.

## VOLTAGE REGULATORS

## SX460 AVR - STANDARD

With this self excited control system the main stator supplies power via the Automatic Voltage Regulator (AVR) to the exciter stator. The high efficiency semiconductors of the AVR ensure positive build-up from initial low levels of residual voltage. The exciter rotor output is fed to the main rotor through a three phase full wave bridge rectifier. This rectifier is protected by a surge suppressor against surges caused, for example, by short circuit.

## AS440 AVR

With this self-excited system the main stator provides power via the AVR to the exciter stator. The high efficiency semiconductors of the AVR ensure positive build-up from initial low levels of residual voltage.

The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling.

The AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

## MX341 AVR

This sophisticated AVR is incorporated into the Stamford Permanent Magnet Generator (PMG) control system.

The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.

An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.

If three-phase sensing is required with the PMG system the MX321 AVR must be used.

We recommend three-phase sensing for applications with greatly unbalanced or highly non-linear loads.

## MX321 AVR

The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, three-phase rms sensing, for improved regulation and performance.

Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

## WINDINGS &amp; ELECTRICAL PERFORMANCE

All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th ...) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches, when in parallel with the mains. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low waveform distortion.

## TERMINALS &amp; TERMINAL BOX

Standard generators are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

## SHAFT &amp; KEYS

All generator rotors are dynamically balanced to better than BS6861:Part 1 Grade 2.5 for minimum vibration in operation.

## INSULATION/IMPREGNATION

The insulation system is class 'H'.

All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

## QUALITY ASSURANCE

Generators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

## DE RATES

All values tabulated on page 6 are subject to the following reductions

5% when air inlet filters are fitted.

3% for every 500 metres by which the operating altitude exceeds 1000 metres above mean sea level.

3% for every 5 C by which the operational ambient temperature exceeds 40 C.

Note: Requirement for operating in an ambient exceeding 60 C must be referred to the factory.

*NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.*

*Front cover drawing typical of product range.*

# UCDI274J

**STAMFORD**

## WINDING 17

CONTROL SYSTEM	SEPARATELY EXCITED BY P.M.G.		
A.V.R.	MX321	MX341	
VOLTAGE REGULATION	± 0.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES (page 5)		

CONTROL SYSTEM	SELF EXCITED		
A.V.R.	SX460	AS440	
VOLTAGE REGULATION	± 1.5 %	± 1.0 %	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	SERIES 4 CONTROL DOES NOT SUSTAIN A SHORT CIRCUIT CURRENT		

INSULATION SYSTEM	CLASS H		
PROTECTION	IP23		
RATED POWER FACTOR	0.8		
STATOR WINDING	DOUBLE LAYER CONCENTRIC		
WINDING PITCH	TWO THIRDS		
WINDING LEADS	12		
STATOR WDG. RESISTANCE	0.017 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED		
ROTOR WDG. RESISTANCE	2.08 Ohms at 22°C		
EXCITER STATOR RESISTANCE	20 Ohms at 22°C		
EXCITER ROTOR RESISTANCE	0.091 Ohms PER PHASE AT 22°C		
R.F.I. SUPPRESSION	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. refer to factory for others		
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%		
MAXIMUM OVERSPEED	2250 Rev/Min		
BEARING NON-DRIVE END	BALL. 6310-2RS (ISO)		
	1 BEARING		
WEIGHT COMP. GENERATOR	727 kg		
WEIGHT WOUND STATOR	304 kg		
WEIGHT WOUND ROTOR	271.9 kg		
WR² INERTIA	2.3744 kgm²		
SHIPPING WEIGHTS in a crate	740 kg		
PACKING CRATE SIZE	123 x 67 x 103(cm)		
TELEPHONE INTERFERENCE	THF<2%		TIF<50
COOLING AIR	0.69 m³/sec 1463 cfm		
VOLTAGE SERIES STAR	600V		
VOLTAGE PARALLEL STAR	300V		
VOLTAGE SERIES DELTA	346V		
kVA BASE RATING FOR REACTANCE VALUES	305		
Xd DIR. AXIS SYNCHRONOUS	2.01		
X'd DIR. AXIS TRANSIENT	0.12		
X''d DIR. AXIS SUBTRANSIENT	0.07		
Xq QUAD. AXIS REACTANCE	0.92		
X''q QUAD. AXIS SUBTRANSIENT	0.11		
X <sub>L</sub> LEAKAGE REACTANCE	0.06		
X <sub>2</sub> NEGATIVE SEQUENCE	0.09		
X <sub>0</sub> ZERO SEQUENCE	0.04		
REACTANCES ARE SATURATED		VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED	
T'd TRANSIENT TIME CONST.	0.045s		
T''d SUB-TRANSTIME CONST.	0.015s		
T'do O.C. FIELD TIME CONST.	1.27s		
Ta ARMATURE TIME CONST.	0.03s		
SHORT CIRCUIT RATIO	1/Xd		

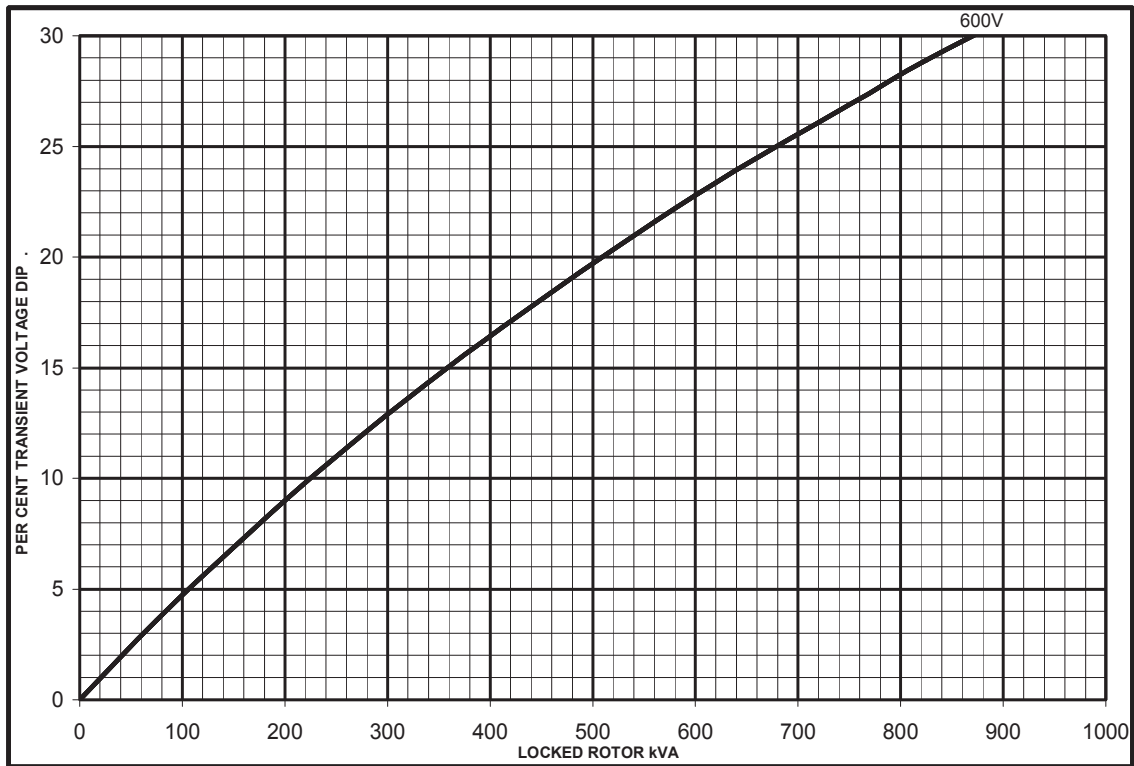
**UCDI274J**

**STAMFORD**

Winding 17

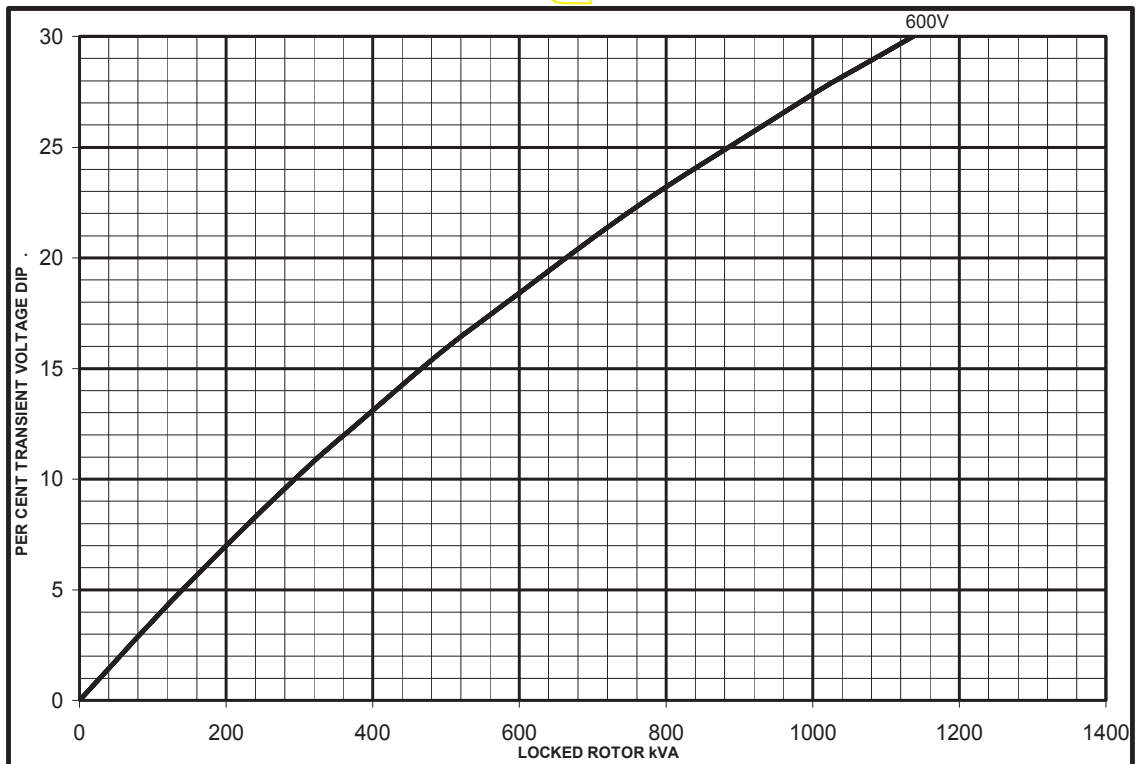
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**Locked Rotor Motor Starting Curves**

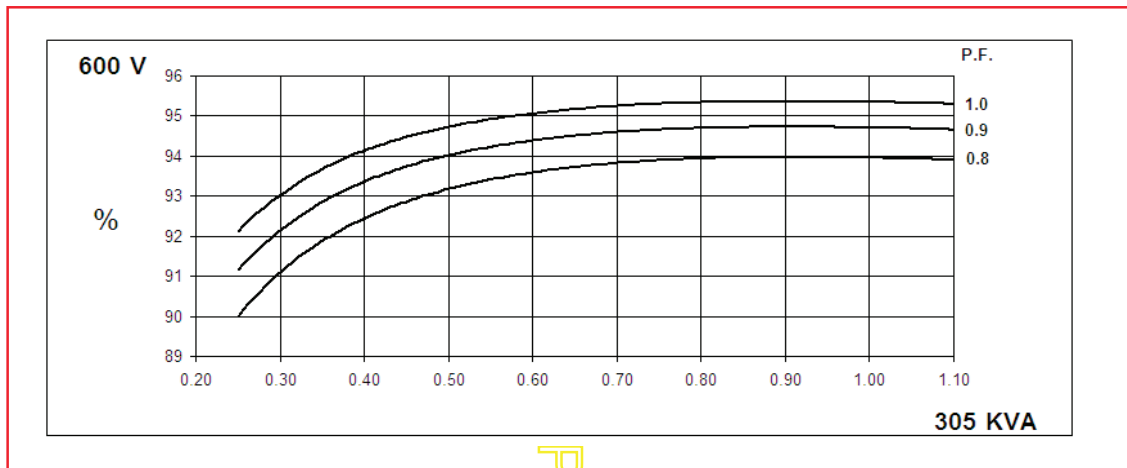


**MX**

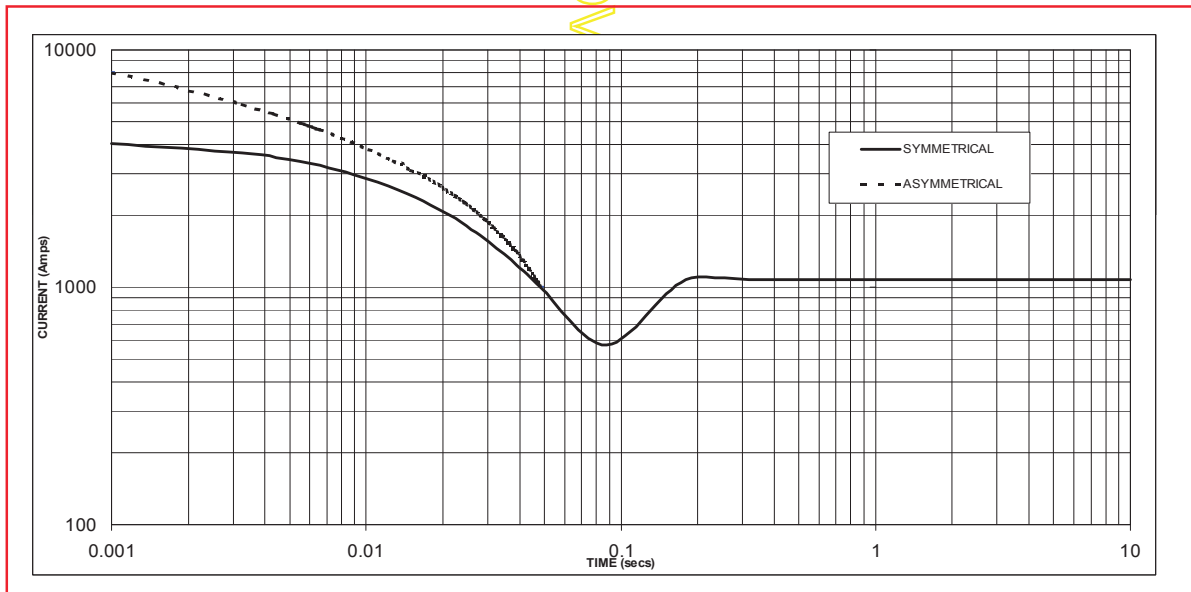
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## THREE PHASE EFFICIENCY CURVES



Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed  
Based on star (wye) connection.



Sustained Short Circuit = 1075 Amps

**Note**

The following multiplication factor should be used to convert the values from curve for the various types of short circuit :

	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

# UCDI274J

**STAMFORD**

Winding 17 / 0.8 Power Factor

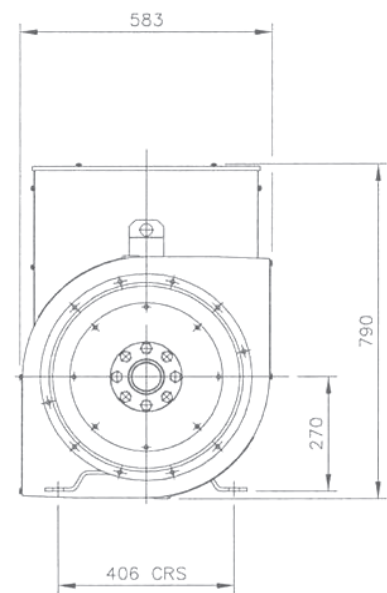
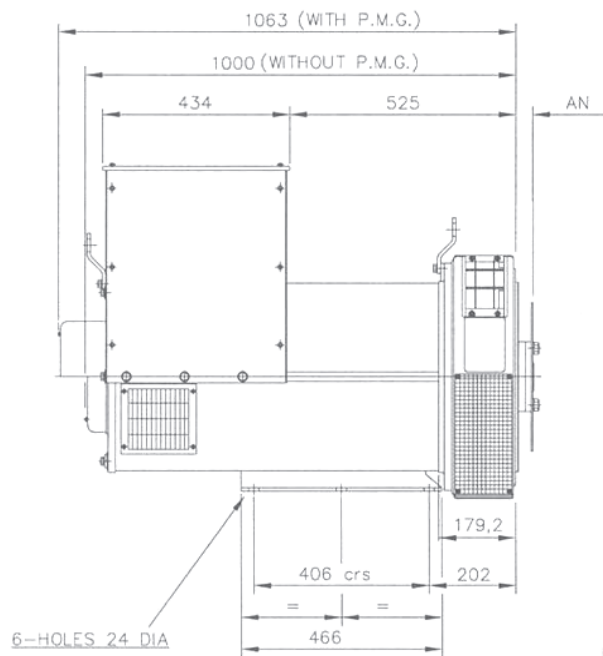
**60Hz**

## RATINGS

Class - Temp Rise	Cont. F - 105/40°C	Cont. H - 125/40°C	Standby - 150/40°C	Standby - 163/27°C
Series Star (V)	600	600	600	600
Parallel Star (V)	300	300	300	300
Series Delta (V)	346	346	346	346
kVA	281.0	305.0	328.0	334.0
kW	224.8	244.0	262.4	267.2
Efficiency (%)	94.0	94.0	93.9	93.9
kW Input	239.2	259.7	279.4	284.6

APPROVED

## DIMENSIONS



COUPLING DISC	AN
SAE 11,5	39,68
SAE14	25,4

# STAMFORD®

## MX341 AUTOMATIC VOLTAGE REGULATOR (AVR)

### SPECIFICATION, INSTALLATION AND ADJUSTMENTS

#### General description

MX341 is a two phase sensed Automatic Voltage Regulator and forms part of the excitation system for a brush-less generator. Excitation power is derived from a three-phase permanent magnet generator (PMG), to isolate the AVR control circuits from the effects of non-linear loads and to reduce radio frequency interference on the generator terminals. Sustained generator short circuit current is another feature of the PMG system.

The AVR senses the voltage in the main generator winding and controls the power fed to the exciter stator and hence the main rotor to maintain the generator output voltage within the specified limits, compensating for load, speed, temperature and power factor of the generator.

Soft start circuitry is included to provide a smooth controlled build up of generator output voltage.

A frequency measuring circuit continually monitors the shaft speed of the generator and provides under-speed protection of the excitation system by reducing the generator output voltage proportionally with speed below a pre-settable threshold. A further enhancement of this feature is an adjustable volts per Hertz slope to improve engine recovery time on turbo charged engines. Soft start circuitry is included to provide a smooth controlled build up of generator output voltage.

Uncontrolled excitation is limited to a safe period by internal shutdown of the AVR output device. This condition remains latched until the generator has stopped.

Provision is made for the connection of a remote voltage trimmer, allowing the user fine control of the generator's output.

An analogue input is provided allowing connection to a STAMFORD Power Factor controller or other external devices with compatible output.

The AVR has the facility for droop CT connection, to allow parallel running with other similarly equipped generators.

#### Technical specification

##### SENSING INPUT

Voltage	190-264V ac max, 1 phase, 2 wire
Frequency	50-60 Hz nominal

##### POWER INPUT (PMG)

Voltage	140-220V ac max, 3 phase, 3 wire
Current	3A/phase
Frequency	100-120 Hz nominal

##### OUTPUT

Voltage	max 120V dc
Current	continuous 2.7 A Intermittent 6A for 10 secs.
Resistance	15 ohms minimum

##### REGULATION

+/- 1% (see note 1)

##### THERMAL DRIFT

0.03% per °C change in AVR ambient (note 2)

##### SOFT START RAMP TIME

3 seconds

##### TYPICAL SYSTEM RESPONSE

AVR Response	10 ms
Filed current to 90%	80 ms
Machine Volts to 97%	300 ms

##### EXTERNAL VOLTAGE ADJUSTMENT

+/-10% with 1 k ohm 1 watt trimmer (see note 3)

##### UNDER FREQUENCY PROTECTION

Set point	95% Hz (see note 4)
Slope	170% down to 30 Hz

##### UNIT POWER DISSIPATION

12 watts maximum

##### ANALOGUE INPUT

Maximum input	+/- 5V dc (see note 5)
Sensitivity	1v for 5% Generator Volts (adjustable)
Input resistance	1k ohm

##### QUADRATURE DROOP INPUT

10 ohms burden	
Max. sensitivity:	0.07 A for 5% droop 0PF
Max. input:	0.33 A

##### OVER EXCITATION PROTECTION

Set point	75 V dc
Time delay	10 seconds (fixed)

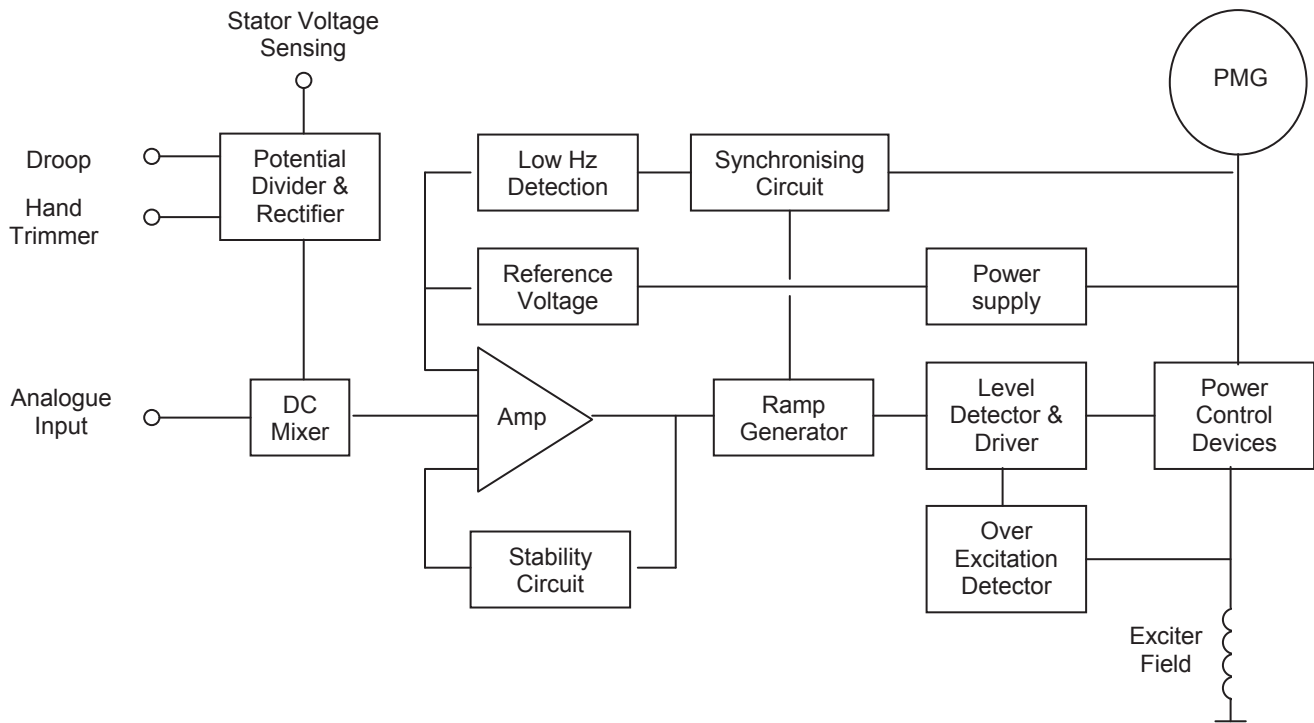
##### ENVIRONMENTAL

Vibration	20-100 Hz	50mm/sec
	100Hz – 2kHz	3.3g
Operating temperature		-40 to +70°C
Relative Humidity	0-70°C	95% (see note 6)
Storage temperature		-55 to +80°C

##### NOTES

1. With 4% engine governing.
2. After 10 minutes.
3. Applies to Mod status D onwards. Generator de-rate may apply. Check with factory.
4. Factory set, semi-sealed, jumper selectable.
5. Any device connected to the analogue input must be fully floating (galvanically isolated from ground), with an insulation strength of 500V ac.
6. Non condensing.

## DESIGN DETAIL



The main functions of the AVR are:

Potential Divider and Rectifier takes a proportion of the generator output voltage and attenuates it. The potential divider is adjustable by the AVR Volts potentiometer and external hand trimmer (when fitted). The output from the droop CT is also added to this signal. An isolating transformer is included allowing connection to various winding configurations. A rectifier converts the a.c. input signal into d.c. for further processing.

The DC Mixer adds the Analogue input signal the Sensing signal.

The Amplifier (Amp) compares the sensing voltage to the Reference Voltage and amplifies the difference (error) to provide a controlling signal for the power devices. The Ramp Generator and Level Detector and Driver infinitely control the conduction period of the Power Control Devices, and hence provide the excitation system with the required power to maintain the generator voltage within specified limits.

The Stability Circuit provides adjustable negative ac feedback to ensure good steady state and transient performance of the control system.

The Low Hz Detector measures the period of each electrical cycle and causes the reference voltage to be reduced approximately linearly with speed below a presettable threshold. A Light Emitting Diode gives indication of underspeed running.

A further enhancement of this feature is the variable DIP adjustment, which provides greater voltage roll off to aid the recovery of turbo charge engines taking large impact loads.

The Synchronising circuit is used to keep the Ramp Generator and Low Hz Detector locked to the Permanent Magnet Generator waveform period.

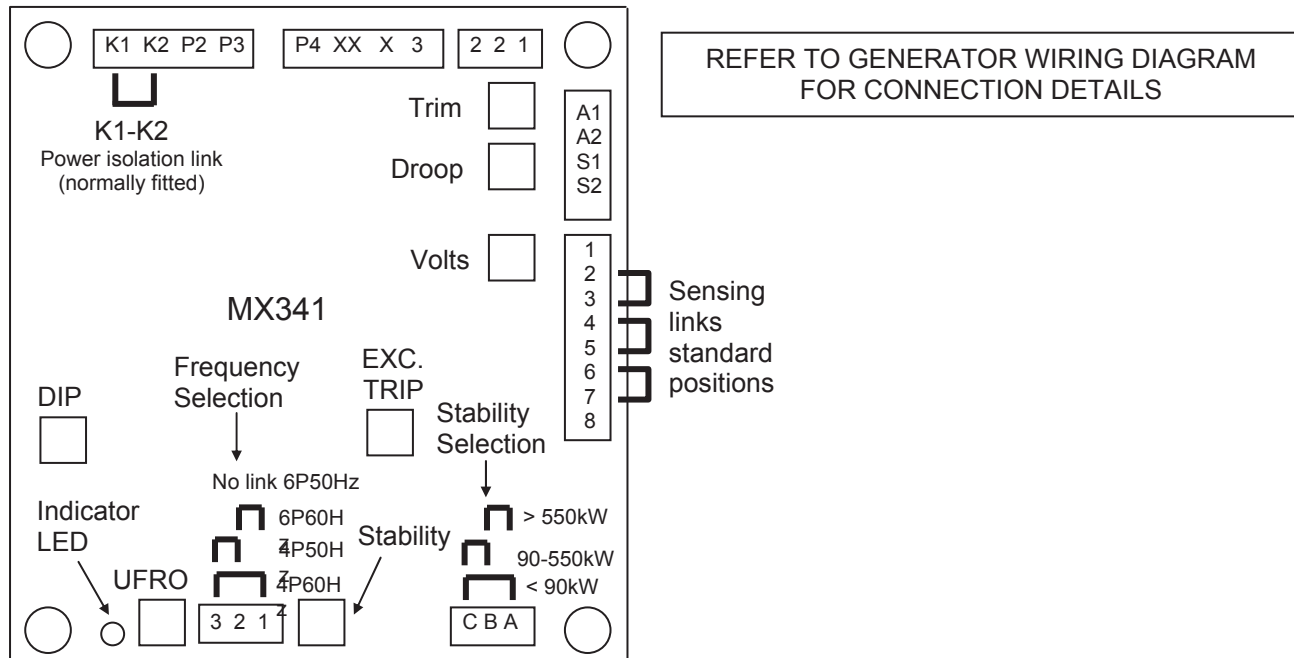
Power Control Devices vary the amount of exciter field current in response to the error signal produced by the Amplifier.

The Over Excitation Detector continuously monitors the exciter field voltage and provides signals, to shut down the power device if an over excitation condition persists for the specified time period.

The Power Supply provides the required voltages for the AVR circuitry.



## FITTING AND OPERATING



SUMMARY OF AVR CONTROLS		
CONTROL	FUNCTION	DIRECTION
Volts	To adjust generator output voltage	Clockwise increases output voltage
Stability	To prevent voltage hunting	Clockwise increase the damping effect
Ufro	To set the ufro knee point	Clockwise reduces the knee point frequency
Droop	To set the generator droop to 5% at 0pf	Clockwise increases the droop
Vtrim	To optimise analogue input sensitivity	Clockwise increases the gain or sensitivity
Exc trip	To set the over excitation cut off level	Clockwise increase the cut off level
Dip	To set the frequency related voltage dip	Clockwise increases the voltage dip

## ADJUSTMENT OF AVR CONTROLS

### VOLTAGE ADJUSTMENT

The generator output voltage is set at the factory, but can be altered by careful adjustment of the VOLTS control on the AVR board, or by the external hand trimmer if fitted. Terminals 1 and 2 on the AVR will be fitted with a shorting link if no hand trimmer is required.

**CAUTION!** Do not increase the voltage above the rated generator voltage. If in doubt, refer to the rating plate mounted on the generator case.

**CAUTION!** Do not ground any of the hand trimmer terminals, as these could be above earth potential. Failure to observe this could cause equipment damage.

If a replacement AVR has been fitted or re-setting of the VOLTS adjustment is required, proceed as follows:

### CAUTION!

1. Before running generator, turn the VOLTS control fully anti-clockwise.
2. Turn remote volts trimmer (if fitted) to midway position.
3. Turn STABILITY control to midway position.
4. Connect a suitable voltmeter (0-300V ac) across line to neutral of the generator.
5. Start generator set, and run on no load at nominal frequency e.g. 50-53Hz or 60-63Hz.
6. If the red Light Emitting Diode (LED) is illuminated, refer to the Under Frequency Roll Off (UFRO) adjustment.
7. Carefully turn VOLTS control clockwise until rated voltage is reached.
8. If instability is present at rated voltage, refer to stability adjustment, then re-adjust voltage if necessary.
9. Voltage adjustment is now completed.

## FITTING AND OPERATING

### STABILITY ADJUSTMENT

The AVR includes a stability or damping circuit to provide good steady state and transient performance of the generator.

The correct setting can be found by running the generator at no load and slowly turning the stability control anti-clockwise until the generator voltage starts to become unstable.

The optimum or critically damped position is slightly clockwise from this point (i.e. where the machine volts are stable but close to the unstable region).

### OPTIMUM RESPONSE SELECTION

The stability selection 'jumper' should be correctly linked, A-B, B-C or A-C at the bottom of the board for the frame size of the generator, (see drawing).

### UNDER FREQUENCY ROLL OFF (UFRO) ADJUSTMENT

The AVR incorporates an underspeed protection circuit which gives a volts/Hz characteristic when the generator speed falls below a presettable threshold known as the "knee" point.

The red Light Emitting Diode (LED) gives indication that the UFRO circuit is operating.

The UFRO adjustment is preset and sealed and only requires the selection of 50 / 60Hz, 4 pole / 6pole using the jumper link (see diagram). Adjustment of the UFRO potentiometer will only be necessary if the AVR is being fitted to a 6 pole generator to replace an AVR of an earlier type.

For optimum setting, the LED should illuminate as the frequency falls just below nominal, i.e. 47Hz on a 50Hz system or 57Hz on a 60Hz system.

### DROOP ADJUSTMENT

Generators intended for parallel operation are fitted with a quadrature droop C.T. which provides a power factor dependent signal for the AVR. The C.T. is connected to S1, S2 on the AVR.

The DROOP adjustment is normally preset in the works to give 5% voltage droop at full load zero power factor.

Clockwise increases the amount of C.T. signal injected into the AVR and increases the droop with lagging power factor ( $\cos \phi$ ). With the control fully anti-clockwise there is no droop.

### TRIM ADJUSTMENT

An analogue input (A1 A2) is provided to connect to a STAMFORD Power Factor Controller or other devices. It is designed to accept dc signals up to  $\pm 5$  volts.

**CAUTION!** Any devices connected to this input must be fully floating and galvanically isolated from ground, with an insulation capability of 500 Vac. Failure to observe this could result in equipment damage.

The dc signal applied to this input adds to the AVR sensing circuit. A1 is connected to the AVR 0 volts. Positive on A2 increases excitation. Negative on A2 decreases excitation.

The TRIM control allows the user to adjust the sensitivity of the input. With TRIM fully anti-clockwise the externally applied signal has no effect. Clockwise it has maximum effect.

Normal setting is fully clockwise when used with a STAMFORD Power Factor Controller.

### DIP ADJUSTMENT

The DIP adjustment allows some control over the generator voltage dip upon the application of load. This feature is mostly used, when the generator is coupled to turbo charged engines with limited block load acceptance and operates only when the speed is below the UFRO knee point, (LED illuminated).

With the DIP potentiometer fully anticlockwise, the generator voltage characteristics will follow the normal V/Hz line as the speed falls below nominal. Turning the DIP potentiometer more clockwise increases the V/Hz slope, providing a greater voltage dip and aiding engine recovery. The DIP potentiometer can be set at any desired position to suit a particular engine type.

### OVER EXCITATION (EXC TRIP) ADJUSTMENT

The adjustment is set and sealed in the works and should not be altered.

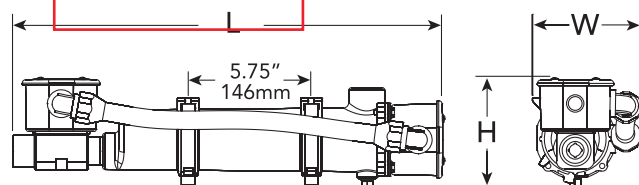
An over excitation condition is indicated on the common LED which also indicates under speed running. The generator must be stopped to reset an over excitation condition.

### CB CL WL Tank Style Engine Heater

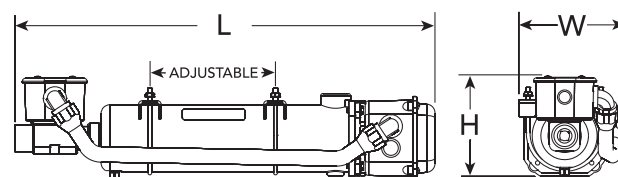
HOTSTART tank style engine heaters heat engine coolant to allow for easy engine start-up regardless of ambient temperature. These heaters are designed to heat engines from 6L to 25L displacement. The heaters are available with static and adjustable thermostats to accommodate specific heating needs and to reduce energy consumption.



#### CB Model



#### CL/WL Models



### APPLICATION

HOTSTART tank style engine heaters were developed to pre-heat diesel and gas engines for stationary land power, heavy duty mobile equipment, marine and offshore equipment.








### SPECIFICATIONS

- Heating Fluid: Engine coolant
- Heat Power: 1.5, 2, 2.5, 3, 4 and 5 kW
- Voltage Range: 120V – 575V
- Phase: 1 or 3 phase
- Fixed Thermostat: 100°-120°F (38°-49°C)
- Ingress Protection: IP44
- Fluid Capacity: CB - 0.3 gal (1.2 L)  
CL/WL - 0.5 gal (2.0 L)
- Maximum Pressure: 125 psi (850 KPa)
- Inlet/Outlet Plumbing: 1.0" NPT Male/1.0" NPT female

### FEATURES

- UL-C/US listed
- CE Compliant
- Various temperature settings available, including adjustable thermostat 90°-130°F (32°-54°C)
- 1 phase heaters 1.5-5 kW include hi-limit safety thermostat 205°F (95°C)

### DIMENSIONS & WEIGHT

	CB Model	CL Model	WL Model
kW	1.5 - 2.5	3 - 5	2.5 - 5
Phase	1~	1~	3~
Length	20.1" 510mm	23.5" 597mm	23.5" 597mm
Height	5.2" 132mm	5.8" 147mm	5.8" 147mm
Width	5.1" 129mm	6.2" 158mm	6.2" 158mm
Weight	6.9 lbs 3 kg	10.0 lbs 4.5 kg	10.0 lbs 4.5 kg
Approvals	  	  	

# Industrial Tank Heaters

CB, CL Series  
Conduit Connection  
Weathertight  
Single Phase

1500-5000 Watts



CB Model without thermostat



CB Model assembled with thermostat



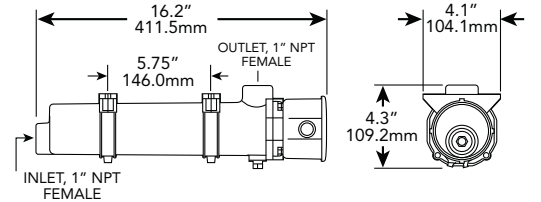
CL Model without thermostat



CL Model assembled with thermostat

Engine Displacement	Model Number without Thermostat	Model Number with Thermostat see chart 1	Volts	Watts	Phase	Amps
350 - 500cid 5.7 - 8.2L	CB115100-000	CB1151XX-200	120	1500	1	12.5
	CB115800-000	CB1158XX-200	208	1500	1	7.2
	CB115200-000	CB1152XX-200	240	1500	1	6.3
	CB115700-000	CB1157XX-200	277	1500	1	5.4
	CB115300-000	CB1153XX-200	380	1500	1	3.9
	CB115400-000	CB1154XX-200	480	1500	1	3.1
500 - 600cid 8.2 - 9.8L	CB120100-000	CB1201XX-200	120	2000	1	16.7
	CB120800-000	CB1208XX-200	208	2000	1	9.6
	CB120200-000	CB1202XX-200	240	2000	1	8.3
	CB120300-000	CB1203XX-200	380	2000	1	5.3
	CB120400-000	CB1204XX-200	480	2000	1	4.2
600 - 800cid 9.8 - 13.1L	CB125100-000	CB1251XX-200	120	2500	1	20.8
	CB125800-000	CB1258XX-200	208	2500	1	12.0
	CB125200-000	CB1252XX-200	240	2500	1	10.4
	CB125700-000	CB1257XX-200	277	2500	1	9.0
	CB125300-000	CB1253XX-200	380	2500	1	6.6
	CB125400-000	CB1254XX-200	480	2500	1	5.2
800 - 1000cid 13.1 - 16.4L	CL130100-100	CL1301XX-200	120	3000	1	25.0
	CL130800-100	CL1308XX-200	208	3000	1	14.4
	CL130200-100	CL1302XX-200	240	3000	1	12.5
	CL130700-100	CL1307XX-200	277	3000	1	10.8
	CL130300-100	CL1303XX-200	380	3000	1	7.9
	CL130400-100	CL1304XX-200	480	3000	1	6.3
1000 - 1350cid 16.4 - 22.1L	CL140800-100	CL1408XX-200	208	4000	1	19.2
	CL140200-100	CL1402XX-200	240	4000	1	16.7
	CL140700-100	CL1407XX-200	277	4000	1	14.4
	CL140300-100	CL1403XX-200	380	4000	1	10.5
	CL140400-100	CL1404XX-200	480	4000	1	8.3
1350 - 1650cid 22.1 - 27.0L	CL150800-100	CL1508XX-200	208	5000	1	24.0
	CL150200-100	CL1502XX-200	240	5000	1	20.8
	CL150700-100	CL1507XX-200	277	5000	1	18.1
	CL150300-100	CL1503XX-200	380	5000	1	13.2
	CL150400-100	CL1504XX-200	480	5000	1	10.4

## CB Model



## CHART 1

### Heaters with Thermostats

To specify temperature range of thermostat, insert numerical code from chart in place of the XX in model number.

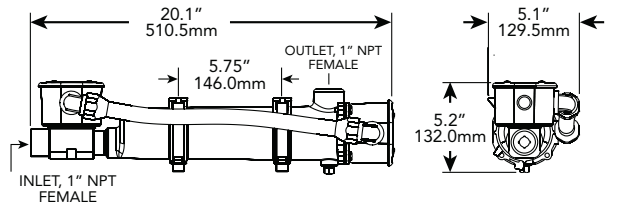
#### Example:

Desired Temp. Range: 100° - 120°F

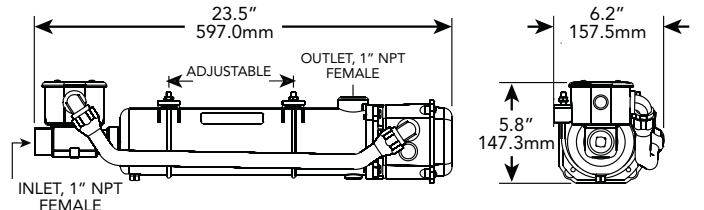
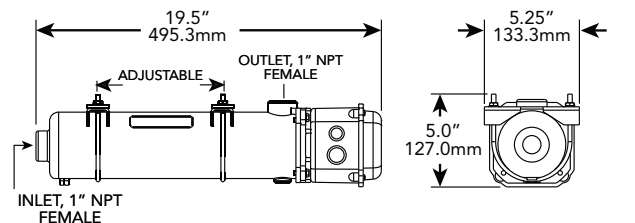
Model Number: CB1151XX-200

Order as: CB115110-200

Temperature Range		Numerical Code
ON	OFF	
80°F (27C)	100°F (38C)	08
100°F (38C)	120°F (49C)	10
120°F (49C)	140°F (60C)	12
Adjustable 90° - 130°F (32° - 54°C)		A3



## CL Model





## DGC-2020 DIGITAL GENSET CONTROLLER

Basler Electric's Digital Genset Controller (DGC-2020) is a highly advanced integrated genset control system. The DGC-2020 is perfectly focused, combining rugged construction and microprocessor technology to offer a product that will hold up to almost any environment and flexible enough to meet your application's needs. This device provides genset control, metering, protection and programmable logic in a simple, easy to use, reliable, rugged, and effective package.

Program the DGC-2020 with easy to use front panel navigation keys and the large LCD display or with our enhanced BESTCOMSPlus PC software. Either way, the easy to follow menus make setup and configuration fast and simple. Within BESTCOMSPlus, we have provided a very powerful user-friendly programmable logic program that allows the user to meet specifications that previously would have required an additional PLC to meet. BESTCOMSPlus is included at no additional cost and provides for remote communications, file transfer, and file management. It is one of the most intuitive software programs available for genset controllers.

## FEATURES

- Generator Metering
- Engine Metering
- Genset Control
- Engine Protection
- Generator Protection (27, 59, 81O, 81U)
- BESTCOMSPlus (included with every DGC-2020 at no additional cost)
  - Programming and setup software
  - Intuitive and powerful
  - Remote control and monitoring
  - Programmable Logic
  - USB communications
- Suitable for use on rental gensets with
  - Hi/Lo line sensing
  - Single or three phase sensing override
- SAE J1939 Engine ECU communications
- Multilingual capability
- Remote communications to our RDP-110 Remote Annunciator
- Battery Backup for Real Time Clock
- LCD Heater
- Extremely rugged, fully encapsulated design
- 16 programmable contact inputs
- 2 Contact outputs: (1) 30 Adc Gen. Run (1) Programmable 2 Adc rated contacts
- Wide Ambient Temperature range
- Additional (8) Programmable 2 Adc contacts (optional)
- Remote Dial-out and Dial-in capability with Internal Modem (optional)
- Enhanced Generator Protection 51 and 47 available (optional)
- Modbus Communications with RS-485
- Expandable I/O capability via J1939 CANBUS (optional)
- UL recognized, CSA certified, CE approved
- HALT (Highly Accelerated Life Tests) tested
- IP 54 Front Panel rating with integrated gasket
- NFPA110 Level Compatible

DESCRIPTION

The DGC-2020 is a microprocessor based generator set controller that incorporates advanced technology and features into a value added, user friendly, rugged design. This device is encapsulated and is the most rugged genset controller found anywhere. It provides front panel and PC programmability. It can sense engine parameters directly via analog senders, or it can communicate with the engine's ECU using SAE J1939 CANBUS communications. This device offers programmable inputs and outputs and programmable logic to allow the user to easily customize the operation of the DGC-2020 as desired.

The DGC-2020 can be configured to have eight additional output contacts, an internal RS-485, an internal industrial modem for remote communications and dialing out to a pager when the DGC-2020 detects trouble. The DGC-2020 also has optional features for enhanced generator protection.

FUNCTIONS

GENSET PROTECTION

Generator (Standard Protection)

Undervoltage (27)      Underfrequency (81U)  
Overvoltage (59)      Overfrequency (81O)

All Generator Protection features are programmable as Alarms or Pre-alarms.

Enhanced Generator Protection (Optional)

Phase Imbalance (47)  
Generator Overcurrent (51)

Engine

Alarms (Shutdowns)

Low Oil Pressure  
High Coolant Temperature  
Low Coolant Level  
Overspeed  
Overcrank  
Engine Sender Unit Failure  
Fuel Leak/Fuel Sender Failure  
Emergency Stop  
Battery Charger Failure

Pre-Alarms (Warnings)

Low Oil Pressure      Engine kW Overload  
High Coolant Temperature      Maintenance Interval Timer  
Low Coolant Temperature      Low Coolant Level  
Battery Overvoltage      High Fuel Level  
Weak Battery      Low Fuel Level  
Battery Charger Failure      Fuel Leak Detect  
Engine Sender Unit Failure

All Alarms and Pre-Alarms can be enabled or disabled via the BESTCOMSPlus PC software or the front panel.

GENSET METERING

- Metered generator parameters include voltage, current, Hz, real power (watts), apparent power (VA), and power factor.
- Metered engine parameters include oil pressure, coolant temperature, RPM, battery voltage, fuel level, engine runtime, and various J1939 supported parameters.

ENGINE CONTROL

Cranking Control: Cycle or Continuous (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

EVENT RECORDING

The DGC 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.

BATTERY BACKUP FOR REAL TIME CLOCK

A ten-year (typical life) lithium battery is used to provide long term maintenance of the real time clock setting. This battery is serviceable by removing the rear cover. Please note that the settings, programming, and event records are save in non-volatile memory and do not require battery backup.



## FUNCTIONS, continued

### PROGRAMMABLE LOGIC

The DGC-2020 offers a very powerful, yet easy to use, programmable logic scheme for custom programming of the various inputs, outputs, alarms, and pre-alarms. It allows these elements to be integrated into a complete logic scheme so that the user can meet even the most complex specification. The Programmable Logic control includes the selection of logic gates and timers with drag-and-drop technology to make it fast and simple.

### REMOTE DISPLAY PANEL ANNUNCIATION

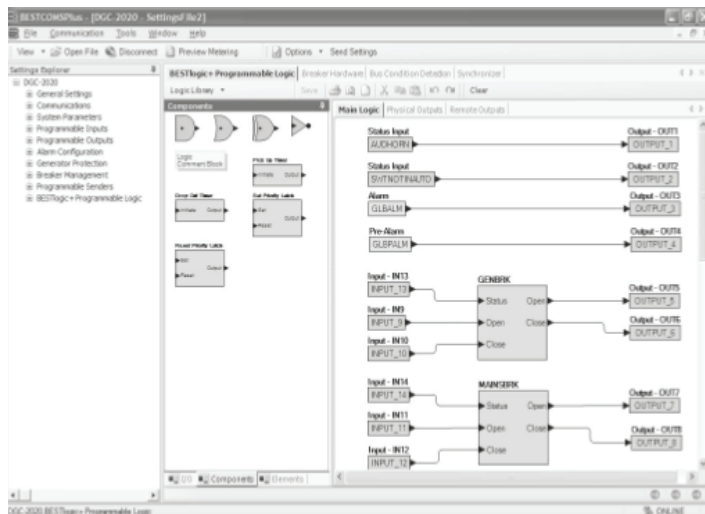
The DGC-2020 can communicate to a remote display panel, Basler Model RDP-110. This requires only two wires to annunciate all of the alarms and pre-alarms required by NFPA-110 Level I and II.

### MODEM (Optional)

A dial-out modem enables remote control, monitoring, and setting of the DGC-2020. When an alarm or pre-alarm condition occurs, the DGC-2020 can dial up to four telephone numbers, in sequence, until an answer is received and the condition is annunciated.

### RS-485 (Modbus)

The user can send and receive information from the DGC-2020 via the RS-485 communications port and Modbus protocol. This feature allows the DGC-2020 controlled genset to be fully integrated into the building management system. Please see the Instruction Manual for Modbus register list.



### J1939 COMMUNICATIONS

J1939 CANBUS communications allows the DGC to communicate to the engine's ECU (Engine Control Unit) to gather critical engine information like oil pressure, engine coolant temperature, RPM, battery voltage, and many more. By utilizing the ECU, adding analog engine senders is no longer required. It also eliminates any errors or discrepancies between the ECU data and the data displayed on the DGC that may be present due to analog sender inaccuracies or incompatibility. A total of 47 engine parameters can be obtained via the ECU. You also can derive the added benefit of having access to the ECU's diagnostic troubleshooting codes, or DTCs. The DTCs provide information about the engine's operating conditions and communicates these via J1939, to the DGC, thus eliminating the need for hand-held service tools to diagnose simple engine issues. With the optional modem, the DTCs can be accessed remotely, and valuable service time can be saved by remote diagnostics and taking the right parts to fix the problem the first time.

## SPECIFICATIONS

### Operating Power

Nominal: 12 or 24 Vdc

Range: 6 to 32 Vdc

### Power Consumption:

Sleep Mode: 5W with all relays non-energized

Typical Operational Mode:

14.2W - Run mode, LCD heater on,

6 relays energized

### Battery Ride Through:

Withstands cranking ride-through down to 0 V for 50 ms (typical).

### Current Sensing

5 Aac Current Sensing      1 Aac Current Sensing

Continuous Rating: 0.1 to 5.0 Aac      0.02 to 1.0 Aac

1 Second Rating: 10 Aac      2 Aac

Burden: 1 VA      1 VA

### Voltage Sensing

Range: 12 to 576 V rms, line-to-line

Frequency Range: 10 to 72 Hz for 50/60 style and  
10 to 480 Hz for 400 Hz style

Burden: 1 VA

1 Second Rating: 720 V rms

### Contact Sensing

Contact sensing inputs include 1 emergency stop input and 16 programmable inputs. The emergency stop input accepts normally closed, dry contacts. All programmable inputs accept normally open, dry contacts.

### Engine System Inputs

Fuel Level Sensing Resistance Range:

33 to 240  $\Omega$  nominal

Coolant Temperature Sensing Resistance Range:

62.6 to 637.5  $\Omega$  nominal

Oil Pressure Sensing Resistance Range:

34 to 240  $\Omega$  nominal

Engine Speed Sensing:

Magnetic Pickup

Voltage Range: 3 to 35 V peak (6 to 70 V peak-peak)

Frequency Range: 32 to 10,000 Hz

Generator Voltage

Range: 12 to 576 V rms

Stated accuracies are subject to the accuracy of the senders used.

## SPECIFICATIONS, continued

### Output Contacts

Fuel Solenoid, Engine Crank, Pre-Start Relays Rating:  
30 Adc at 28 Vdc-make, break, and carry  
Programmable Relays (up to 12) Rating:  
2 Adc at 30 Vdc-make, break, and carry

### Metering

#### Generator Voltage (rms)

Metering Range:  
0 to 576 Vac (direct measurement)  
577 to 9,999 Vac (through VT using VT ratio setting)  
Accuracy:  $\pm 1.0\%$  of programmed rated voltage or  $\pm 2$  Vac

#### Generator Current (rms)

Generator current is measured at the secondary windings of user-supplied 1 A or 5 A CTs.  
Metering Range: 0 to 5,000 Aac  
CT Primary Range: 1-5,000 Aac, in primary increments of 1 Aac  
Accuracy:  $\pm 1.0\%$  of programmed rated current or  $\pm 2$  Aac

#### Generator Frequency

Metering Range: 10 to 72 Hz (50/60 Hz)  
10 to 480 (400 Hz)  
Accuracy:  $\pm 0.25\%$  or 0.05 Hz

#### Apparent Power

Indicates total kVA and individual line kVA (4-wire, line-to-neutral or 3-wire, line-to-line).  
Accuracy:  $\pm 3\%$  or the full-scale indication or  $\pm 2$  kVA

#### Power Factor

Metering Range: 0.2 leading to 0.2 lagging  
Accuracy:  $\pm 0.02$

#### Real Power

Indicates total kW and individual line kW (4-wire, line-to-neutral or 3-wire line-to-line)  
Accuracy:  $\pm 3\%$  of the full-scale indication or  $\pm 2$  kW

#### Oil Pressure

Metering Range: 0 to 145 psi or 0 to 1,000 kPa  
Accuracy:  $\pm 3\%$  of actual indication or  $\pm 2$  psi or  $\pm 12$  kPa (subject to accuracy of sender)

#### Coolant Temperature

Metering Range: -40 to 410°F or -40 to 210°C  
Accuracy:  $\pm 3\%$  or 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  $\pm 0.2$  Vdc

#### Engine RPM

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

#### Engine Run Time

Engine run time is retained in nonvolatile memory.  
Metering Range: 0 to 99,999 h  
Update Interval: 6 min  
Accuracy:  $\pm 1\%$  of actual indication or  $\pm 12$  min

#### Maintenance Timer

Maintenance timer indicates the time remaining until genset service is due. Value is retained in nonvolatile memory.

Metering Range: 0 to 5,000 h  
Update Interval: 6 min  
Accuracy:  $\pm 1\%$  or actual indication or  $\pm 12$  min

### Generator Protection Functions

#### Overvoltage (59) and Undervoltage (27)

Pickup Range: 70 to 576 Vac  
Activation Delay Range: 0 to 30 s

#### Underfrequency (81U) and Overfrequency (81O)

Pickup Range: 45 to 66 Hz (50/60 Hz nominal)  
360 to 440 Hz (400 Hz nominal)  
Pickup Increment: 0.1 Hz (50/60 Hz nominal)  
0.1 Hz (400 Hz nominal)  
Activation Delay Range: 0 to 30 s

#### Overcurrent (51) (Optional)

Pickup Range: 0.18 to 1.18 Aac (1 A current sensing)  
0.9 to 7.75 Aac (5 A current sensing)  
Time Dial Range: 0 to 30 s (fixed time curve)  
0 to 9.9 (inverse curve time multiplier)

#### Inverse Time Curves:

17 selectable Time Overcurrent Characteristic Curves

#### Phase Imbalance (47) (Optional)

Pickup Range: 5 to 100 Vac  
Pickup Increment: 1 Vac  
Activation Delay Range: 0 to 30 s  
Activation Delay Increment: 0.1 s

### Environmental

#### Temperature

Operating: -40 to 70°C (-40 to 158°F)

Storage: -40 to 85°C (-40 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 3 perpendicular planes

Vibration: 5 to 29 to 5 Hz: 1.5 G peak for 5 min.  
29 to 52 to 29 Hz: 0.036" DECS-A for 2.5 min.  
52 to 500 to 52 Hz: 5 G peak for 7.5 min.

Swept over the following ranges for 12 sweeps in each of three mutually perpendicular planes with each 15-minute sweep.

### HALT (Highly Accelerated Life Testing)

Halt Testing is a method used by manufacturers concerned about high quality to prove that their products will provide the user with many years of reliable service. Halt testing subjects the device to extremes in temperature, shock, and vibration to simulate years of operation, but in a much shorter time span. Halt testing allows Basler to evaluate all possible design elements that will add to an increase in the life of this device. As an example of some of the extreme testing conditions, the DGC-2020 was subjected to Temperature Tests (tested over a temperature range of -100°C to +115°C), Vibration Tests (swept over a frequency of 5 to 50G at +20°C), and Temperature/Vibration Tests (tested at 40G over a temperature range of -80°C to +90°C). Please note that the vibration and temperature extremes noted here are specific to HALT testing and do not reflect recommended operation level.

# SPECIFICATIONS, continued

## Agency Approvals

### UL/CSA Approvals

"cURus" approved to UL 508 R and CSA C22.2 No.14

### NFPA Compliance

Complies with NFPA Standard 110, Standard for Emergency and Standby Power.

## CE Compliance

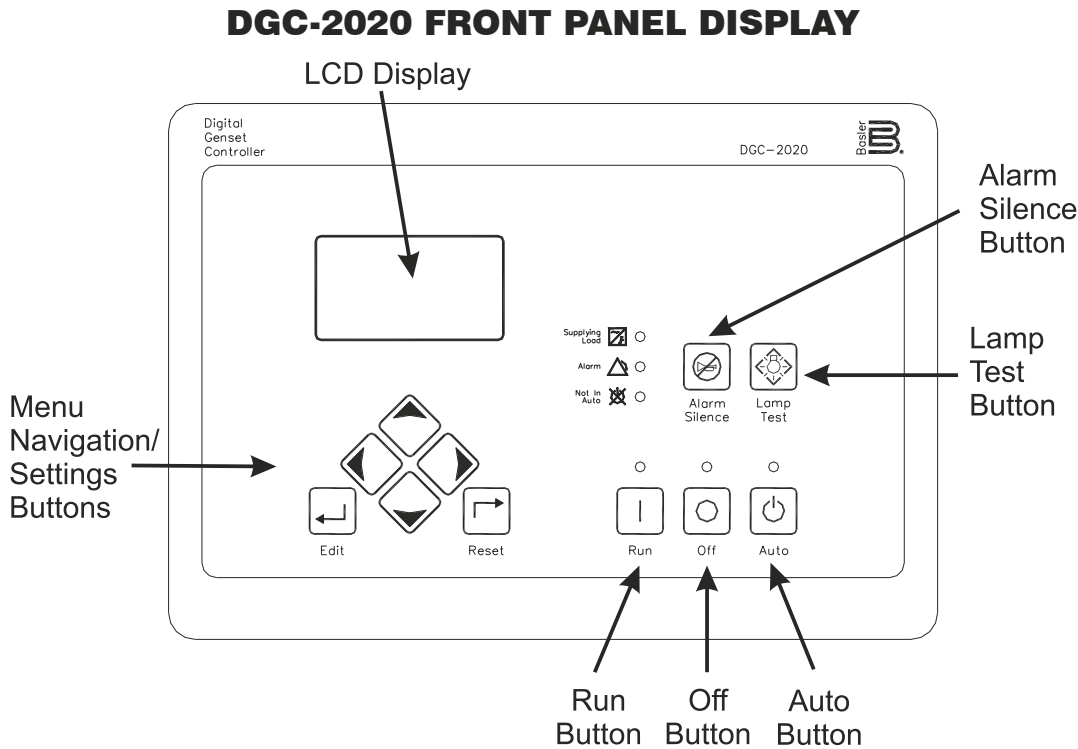
This product complies with the requirements of the following EC Directives:

- Low Voltage Directive (LVD) - 73/23/EEC as amended by 93/68/EEC

- Electromagnetic Compatibility (EMC) - 89/336/EEC as amended by 92/31/EEC and 93/68/EEC
- EN 50178:1997 - Electronic Equipment for use in Power Installations
- EN 61000-6-4:2001 - Electromagnetic Compatibility (EMC), Generic Standards, Emission Standard for Industrial Environments
- EN 61000-6-2:2001 - Electromagnetic Compatibility (EMC), Generic Standards, Immunity for Industrial Environments

## Physical

Weight: 2 kg (4.4 lb)



**Figure 1 - Front Panel HMI (Human Machine Interface)**

## FRONT PANEL LED INDICATORS

Run:	Green - Indicates the DGC is in the RUN mode.
Off:	Red - Indicates the DC is in the OFF mode.
Auto:	Green - Indicates the unit is in the AUTO mode of operation.
Supplying Load:	Green - Indicates the system is supplying current to a connected load.
Alarm:	Red - Indicates an alarm situation by continuous illumination. Indicates a Pre-alarm by flashing.
Not in Auto:	Red - Indicates unit is not in the AUTO mode.

## PACKAGING

DGC-2020 offers a complete system of environmental hardening. Its design utilizes advanced engineering and design techniques to allow it to operate in the harshest environments. The DGC-2020 uses encapsulated construction that has been successfully proven on hundreds of thousands of voltage regulators built by Basler. We have included an integrated gasket to seal the front panel to an IP54 rating, and we included a protective cover on the rear of the DGC-2020.

## **OPTIONAL FEATURES**

The DGC-2020 has been designed to provide maximum functionality at a minimum price. You only need to buy what you need. We have selected options to help maximize the value provided by the DGC-2020.

### **Additional Contact Outputs**

For those applications where more output contacts are needed, the DGC-2020 can be adapted to include 8 additional 2 A dc rated dry contact outputs. These are real contacts and not the solid-state type that require additional external circuitry to properly operate. These contacts are fully programmable via the easy-to-use BESTCOMSPlus PC software and can be assigned for numerous user-defined functions.

### **Auto-Synchronizer**

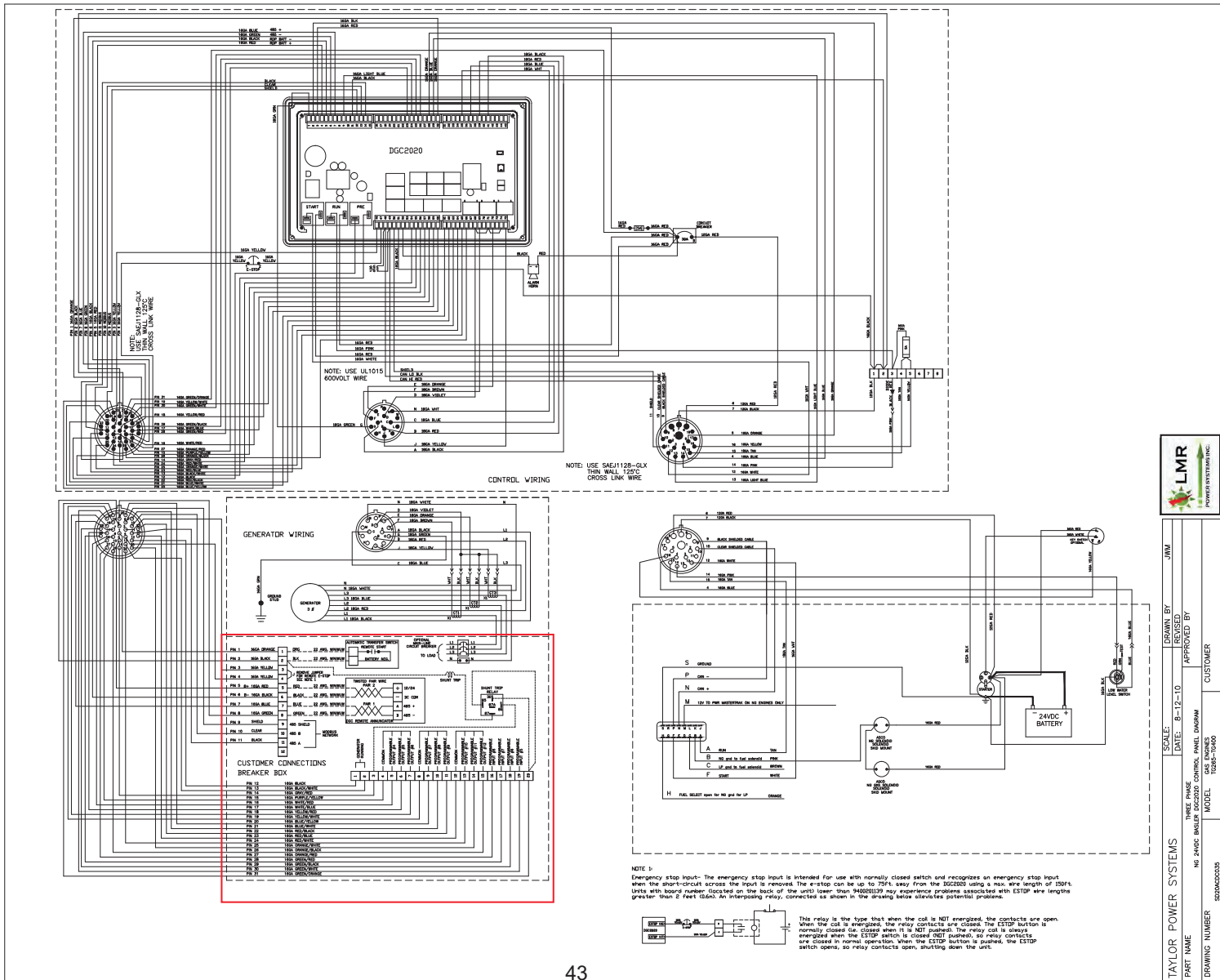
When the DGC-2020 is configured with this option, the user can select between two types of autosynchronizer, phase lock or anticipatory style. In both methods, the DGC-2020 adjusts generator frequency and voltage to match that of the bus (mains) via contact outputs, then connects the generator to the bus by closing the connecting breaker.

### **RS-232 Communication Port**

An optional RS-232 communication port uses the ASCII protocol to communicate with a user-supplied external modem. The optional external dial-out modem enables remote control, monitoring, and setting of the DGC-2020. When an alarm or pre-alarm condition occurs, the DGC-2020 can dial up to four telephone numbers, in sequence, until an answer is received and the condition is annunciated.

### **Enhanced Generator Protection**

In addition to the standard generator protection (27, 59, 81O, 81U), the DGC-2020 also can be equipped with a more sophisticated generator protection system. This option provides an overcurrent element (51) with 17 selectable time current characteristic curves and a voltage phase balance protection function (47).



**TAYLOR POWER SYSTEMS**

DRAWN BY: JWM

DATE: 8-12-10

THREE PHASE

NO JMW BUILT IN SYSTEMS

DRAWING NUMBER: 002040000035

REVISOR: JWM

DATE: 8-12-10

APPROVED BY: JWM

THREE PHASE

NO JMW BUILT IN SYSTEMS

MODEL: T0400-10400

**LMR**

POWER SYSTEMS

CUSTOMER



# Battery Specifications

Taylor Power Systems sources batteries to exceed the engine manufacturer's specifications and to comply with NFPA 110 requirements for engine cranking cycles

Maintenance free, top post design with polypropylene case & cover can withstand long periods of downtime and the harshest environments

GENERATOR MODEL	VOLTAGE	COLD CRANKING AMPS		RESERVE CAPACITY MINUTES
		0°F	32°F	
TD9 - TD30 TG25	12V	450	565	85
TG40 - TG150	12V	950	1170	175
TD55 - TD200	12V	950	1170	175
TD250 - TD600	24V	1100	1355	325
TG200 - TG450	24V	1100	1355	325
TD800 - TD2000	24V	1100	1355	325



# MicroGenius<sup>2</sup>

## Intelligent Battery Charger



Model	Power	12V Output	24V Output
MicroGenius 180	180 watts	10 amps	6 amps

**Small. Powerful. Rugged.**

**Patented Dynamic Boost™ Charge** - safely recharges batteries faster than competing products

**HELIX™ technology** - significantly increases battery life and cuts risk of sudden battery failure

**Field selectable 12/24 volt output** - simplifies inventory management & field service

**Hardened switchmode powertrain** - delivers first-class abuse resistance & state-of-the-art energy efficiency

**Small, lightweight, water resistant package** - allows installation in nearly any location

**Standard J-1939 and Modbus communications** - easily enable genset, workboat & building integration



**MicroGenius<sup>2</sup>**

**Intelligent Battery Charger**

## MicroGenius 2 Charger Combines **Breakthrough Technologies** With **Robust Reliability**

Designed for mission-critical applications, **MicroGenius 2** battery chargers pack advanced technology charging into a small, lightweight and rainproof package. **MicroGenius 2** is the only charger that delivers high performance charging while prolonging useful life of batteries and significantly reducing risk of sudden battery failure.

Designed and assembled in Colorado, SENS employs rigorous worst-case analysis design processes and extensive abuse testing to ensure reliable operation in adverse environments. State-of-the-art automation in assembly, test and burn-in processes provide unmatched levels of consistency and quality for years of trouble-free service.

Four unique technologies that together make **MicroGenius 2** the most advanced battery charger available include:

**Patented Dynamic Boost™ Charge** safely recharges batteries faster than competing products

**HELIX™ technology** significantly increases genset battery life and cuts risk of sudden battery failure

**Class-leading energy efficiency** that saves money and exceeds energy efficiency regulation requirements

**Cool-running, water & corrosion-resistant design** that is rainproof UL® listed, ABS type approved

## MicroGenius 2 Chargers Deliver **Significant Benefits** to Mission-Critical Users

- Longer-lasting batteries cut risk of end user application downtime
- Lower chance of catastrophic battery failure cuts safety risks for personnel and facilities
- Energy efficiency savings can more than pay for the charger over its lifetime
- Engineered-in reliability reduces service cost and risk of charger failure



**Emergency Generator  
Battery Charging**



**Reliable Switchgear  
Power**



**Stationary Battery  
Charging & DC Power**



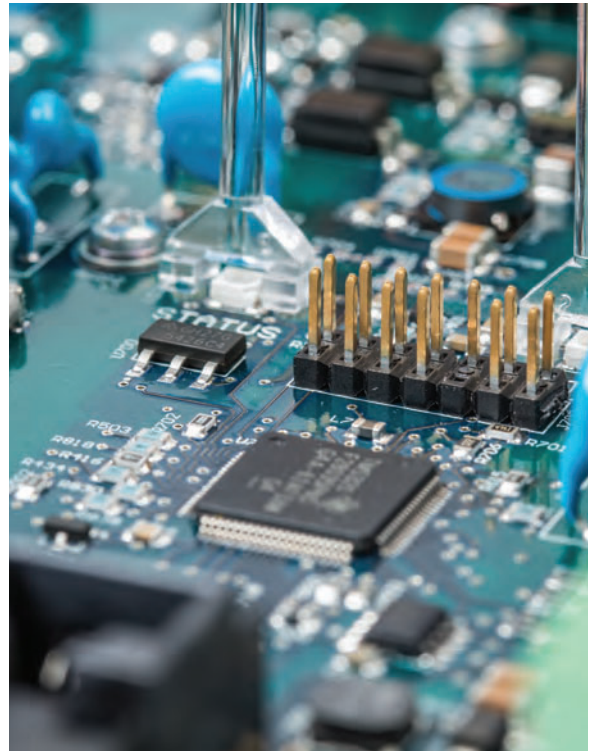
**Marine Battery  
Charging & DC Power**

# What's Inside? Advanced Battery Charging Technologies

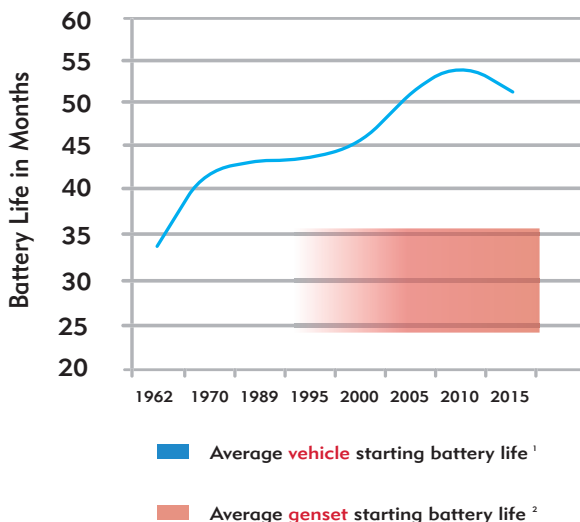
**Dynamic Boost™** enables fast recharging while minimizing risk of overcharge.

It is well understood that boost charging at elevated voltage is the fastest way to charge batteries. When the battery nears full charge, however, voltage must be reduced to prevent overcharge. The right time to make this transition varies with depth of discharge, fixed DC loads, battery health, and the relationship of battery to charger size. Until SENS created Dynamic Boost, no charger was able to determine the correct time to spend at boost voltage.

Patented Dynamic Boost™ charging technology automatically determines, for each discharge cycle, the optimal time to shift from boost to float charging mode. Dynamic Boost enables **MicroGenius 2** to charge batteries faster and more completely than similarly rated conventional chargers, but with significantly lower risk of overcharge.



Average Starting Battery Life, in Months



1. BCI Technical Subcommittee Report on Battery Failure Modes, May 2015

2. Life range from 24 to 36 months, based on typical PM service replacement

**HELIX™** charging technology saves batteries and energy.

Lead-acid starting batteries used in gensets are replaced nearly twice as often (every 2-3 years) as identical batteries used for vehicle starting (~ every 4-5 years). And in genset applications these batteries too often fail catastrophically, instead of gradually as they do in vehicle applications.

By enabling genset batteries to last as long as vehicle batteries, revolutionary HELIX (High Efficiency, Life-eXtending) technology from SENS reduces risk of early battery failure. HELIX also cuts risk of catastrophic battery failure at end of life. These improvements deliver significantly better genset starting reliability and user safety.



# What's inside? Class-leading Energy Efficiency & Advanced Thermal Management

## Class-leading energy efficiency & sustainability

Running 24/7, other battery chargers waste a lot of energy. Energy efficiency standards from the California Energy Commission mandate high efficiency operation of all single-phase input chargers as of January 1, 2017.

Achieving outstanding power conversion efficiency of up to 93%, **MicroGenius 2** consumes less than 3 watts in Eco-float. The most efficient charger in its class, MicroGenius with HELIX technology surpasses all known efficiency standards.



**Large heat sink ensures cool running**

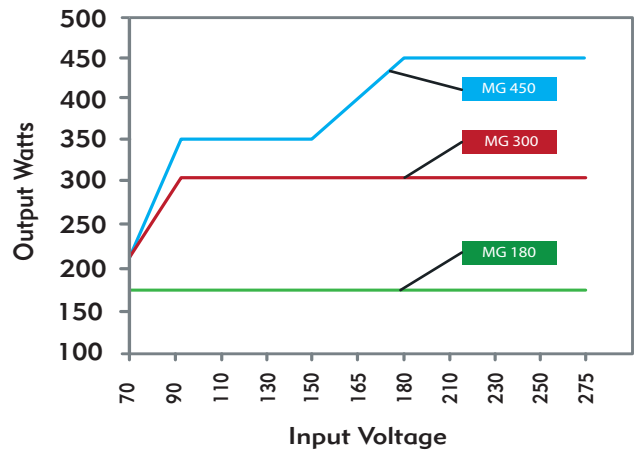
## Cool running, water and corrosion-resistant package

Other chargers in hot, damp genset and marine environments rely on failure-prone fans or generous open venting that allows water onto charger components.

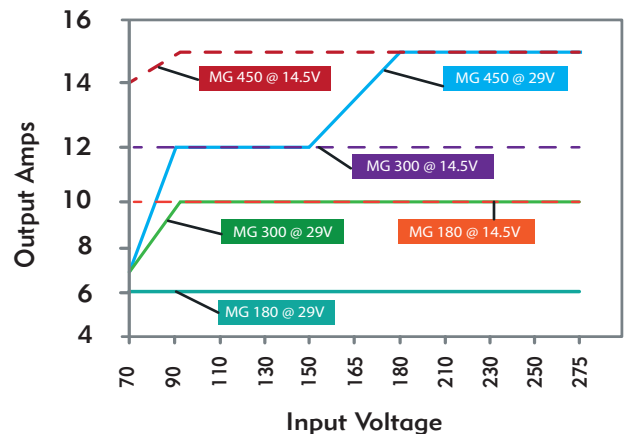
The **MicroGenius 2** heat sink delivers such effective convection cooling that only small side vents are required for operation in the hottest environments. Conformal coating on all electronics provides additional corrosion protection. **MicroGenius 2** is rated "rainproof" by UL, and conforms to ABS and Coast Guard marine requirements without the need for a drip shield.



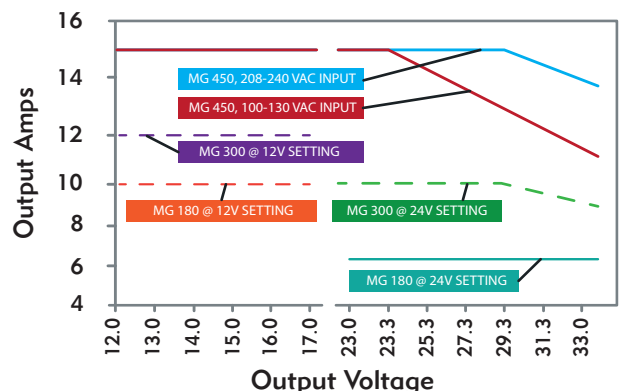
**Output Power vs Input Voltage**



**Output Current Limit vs Input Voltage**



**Output Current Limit vs Output Voltage**



AC Input	VAC, Hz	90-265 <sup>1</sup> VAC, 47-63 Hz
	Protection	Supplementary overcurrent protection fuse, transient protected to EN61000-4-5 level 4
	Efficiency	Up to 93%; meets CA Energy Commission Title 20 Appliance Efficiency Regulations; standby AC draw < 3W
	Power factor	>.95 typical
DC output	Voltage	12/24 V nominal, field selectable, adjustable from 0-34V using computer to charger cable <sup>2</sup>
	MicroGenius 180	Selectable 12/24 volt nom., 10/6 amps. 180W max.
	MicroGenius 300	Selectable 12/24 volt nom., 12/10 amps. 300W max.
	MicroGenius 450	Selectable 12/24 volt nom., 15/15* amps, 450W max. (*24V, 12A max below 170 VAC input voltage)
	Charging modes	Float voltage, boost voltage. Two additional HELIX charging voltages in flooded lead-acid battery program
	DC power supply operation	Delivers fast-responding, stable, well-filtered DC without battery
	Current limit	100% current capability subject to temperature limits shown on charts (previous page). Field adjustable
	Charging characteristic	Constant voltage, current limited; patented Dynamic Boost control
	Line & load regulation	±0.5%
	Output ripple	< 100 mV wideband
	Battery temp. compensation	Standard. Optional remote battery temperature probe <sup>3</sup>
	Output protection	Current limit, supplementary overcurrent protection fuse, transient protected
	Overvoltage protection	Self-resetting and selective (shutdown only operates if charger causes the overvoltage condition)
Adjustment & Controls	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 <sup>4</sup>
	Charge mode control	Fully automatic patented Dynamic Boost system
	Internal adjustments	12 or 24-volt; Battery type program; fine voltage setting
	Battery type programs	Flooded lead-acid, AGM or Ni-Cd for engine starting; VRLA for reserve power; ultracapacitor
	Factory adjustment	All charger adjustments factory set to customer specifications. Field reconfigurable
	Field voltage adjustment	3 manually selectable voltage settings. Infinite adjustment using computer to charger cable <sup>2</sup>
Status Display	Computer adjustment	Change or customize settings from computer using computer to charger cable <sup>2</sup>
	Keypad adjustment	Enable or change all settings from front panel <sup>5</sup>
	LEDs	Two multi-color front panel status LEDs
Alarms	Digital metering	Voltmeter accurate to ±2%; ammeter to ±5% <sup>6</sup>
	Status messages	20-character display of status & alarm messages
	Alarms	Factory set and field reconfigurable. Standard genset configuration includes summary; AC fail; charger fail; high DC volts, low DC volts, low cranking volts. Other alarm conditions <sup>7</sup> are available to replace, or be summed with the standard values. Contact SENS to request different factory alarm profile.
	Alarm: Output via network	All alarms available via either J-1939 or Modbus ports
Networking	Alarms: Form C contacts	Two Form C contacts, each rated 30V, 2A resistive, assignable <sup>8</sup>
	Alarm: Output via network	Five Form C contacts, each rated 30V, 2A resistive, assignable <sup>9</sup>
	J-1939 communications	CAN 2.0 extended ID on RJ-45 port
	Modbus communications	Modbus RS-485 on RJ-45 port
Environmental	SENSbus	Proprietary bus for connection of paralleled chargers and future SENS accessories
	Operating temp: 180	-40C to +70C; meets full specification from -40C to +60C, natural convection cooled <sup>10</sup>
	Operating temp: 300	-40C to +70C; meets full specification from -40C to +50C, natural convection cooled
	Operating temp: 450	-40C to +70C; meets full specification from -40C to +40C, natural convection cooled
	Storage temperature	-40C to +85C
	Humidity	5% to 95%, non-condensing
	Water ingress	IP 22; NEMA 3R
	Vibration	Swept Sine (EN60068-2-6): 4G, 18-500 Hz, 3 primary axes. Random: 20-500Hz, .01G <sup>2</sup> /Hz
	Shock	EN 60068-2-27 (15G)
Abuse Protection	Electrical transient	ANSI/IEEE C62.41 & EN 61000-4-12 on power terminals
	Reverse polarity	Charger self-protects without fuse clearing. Indication via LED & optional LCD
	Wrong voltage battery	Charger-battery voltage mismatch shuts down charger. Indication via LED & optional LCD
	Overtemp protection	Gradual output power reduction if heatsink temperature becomes excessive
Regulatory Compliance	North America	C-UL Listed for US & Canada: UL 1236 categories BBGQ, BBHH, BBJY and QWIR <sup>11</sup> ; CSA 22.2, No. 107.2
		Certified to UL 1236 supplements SB (marine), SC (fire pump) and SE (emergency generator)
		NFPA-70, NFPA-110 <sup>12</sup>
		FCC Part 15, Class B
	European Union (CE)	Seismic: Rigid & non-structure wall mount; max S <sub>DS</sub> of 2.5G. IBC 2000-2012, Calif. BC 2007-2010
		American Bureau of Shipping, type approved
		EMC: 2014/30/EU (EN 61000-6-2 & EN 61000-6-4)
Construction	LVD: 2014/35/EU (EN 60335-1 & EN 60335-2-29)	
	RoHS 2: 2011/65/EU (EN 50581)	
	Housing/configuration	Die-cast aluminum heatsink base with stainless steel covers & fasteners
	Dimensions & Weight	See drawings, dimensions & weight section on last page
Connections	Weight	6.0 lbs; 2.7 Kg
	Connections	AC & DC terminal blocks: 14 to 10 AWG. J-1939 and Modbus-485: RJ-45. Form C alarms: 28 to 16 AWG

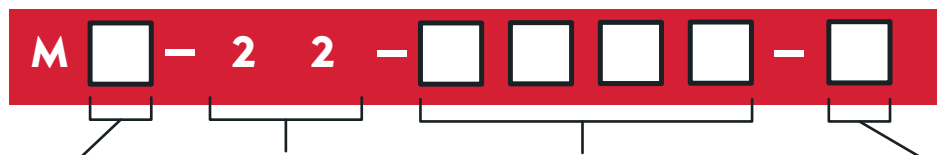
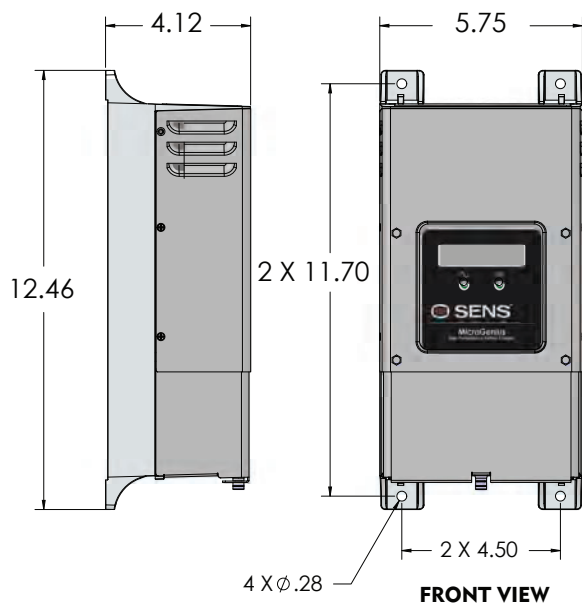
<sup>1</sup> Output power derates below 100 VAC input; full 15A output of 450W available only above 170 VAC input <sup>2</sup> Requires optional computer to charger adapter SENS p/n 209254 plus free SENS software available at [www.sens-usa.com](http://www.sens-usa.com) <sup>3</sup> Remote battery temp sensor is optional. Order SENS p/n 209481 <sup>4</sup> Requires standard RJ-45 network cable to connect paralleling bus. Order SENS p/n 208118-72 (72-inch length) or 208118-180 (180-inch length) <sup>5</sup> Requires that digit 12 of the model number be F or G <sup>6</sup> Requires that digit 12 of the model number be D, E, F or G <sup>7</sup> Overvoltage shutdown, reverse polarity battery, incompatible battery, invalid settings, I/O bus inactive, thermal fold back, no temperature probe, current limiting, ground fault, low current <sup>8</sup> Models with E or G as digit 12 of the model number include 2 ea. Form C alarm contacts <sup>9</sup> Models with D or F as digit 12 of the model number include 5 ea. Form C alarm contacts <sup>10</sup> At 65 deg. C and above the LCD display may be unreadable and display life will be reduced <sup>11</sup> Except 180W unit in 24V configuration, which is not listed to QWIR <sup>12</sup> 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 genset control panel.

## Dimensions & Weight

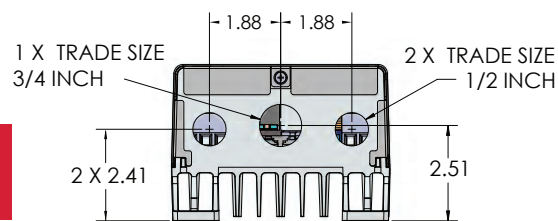
All unit dimensions are identical.

All units weigh 6.0 lbs. (2.8 KG).

All dimensions are in inches.



Power	Output Voltage	Output Current
1 = 180w	22 = 12/24V	1006 = 10A @ 12V; 6A @ 24V (180 only)
3 = 300w		1210 = 12A @ 12V; 10A @ 24V (300 only)
4 = 450w		1515 = 15A @ 12V; 15A @ 24V (450 only)



### Alarm & Communication Options

- A = base model; includes J-1939 & Modbus communications
- D = base model + LCD display + 5 ea. Form C alarm relays
- E = base model + LCD display + 2 ea. Form C alarm relays
- F = base model + LCD display + 5 ea. Form C alarm relays + keypad control

## The most rugged, advanced technology industrial charger available

Contact SENS or your local sales representative for additional specification and installation information, or visit our website for latest available data.

Specification subject to change without notice.

SENS, Stored Energy Systems, the battery/rectifier logo, Dynamic Boost, HELIX, and MicroGenius are trademarks of Stored Energy Systems LLC.

Patented US 9,270,140; 9,385,556; 9,413,186; 9,509,164. Other patents pending.



## Section 1—Catalog Numbering

### PowerPact™ with Micrologic™ Circuit Breakers

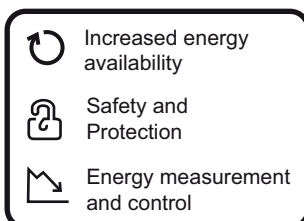
The PowerPact H-, J-, and L-frame circuit breakers are designed to protect electrical systems from damage caused by overloads and short circuits. H- and J-frame circuit breakers are available with either thermal-magnetic or Micrologic electronic trip units. L-frame circuit breakers are available with Micrologic electronic trip units only.



### Direct Access to Energy Management

The new generation PowerPact with Micrologic circuit breakers set the standard with direct access to energy management. Integrated metering enhances their protective functions. For the first time, Schneider Electric™ users can monitor energy from 15 to 3000 A, offering new performance in a remarkably compact device.

- Smart – A meter in every breaker
- Safe – Combines safety and performance in one compact device
- Simple – To select, install, and use



# PowerPact H-, J-, and L-Frame Circuit Breakers

## Catalog Numbering

### Catalog Numbering

**Table 1: Circuit Breaker Catalog Numbers**

Segment	Character	Description	—	J	L	L	3	6	250	W	T	—	—	—	—
Brand	—	<b>Square D</b>													
	N	Schneider Electric													
Frame	H	H-Frame													
	<b>J</b>	<b>J-Frame</b>													
	L	L-Frame													
Performance Level (kA)		See Table 2													
Terminations	<b>L</b>	<b>Lugs Line/Load Side</b>													
	M	Lugs Line Side													
	P	Lugs Load Side													
	F	Bus Bar													
	A	A-Line													
	S	Rear Connected													
	N	Plug-in													
	D	Drawout													
	K	Reverse I-Line													
Poles	2	Two Pole													
	<b>3</b>	<b>Three Pole</b>													
	4	Four Pole													
Voltage	<b>6</b>	<b>600 V</b>													
	4	480 V													
Amperage	060	60 A													
	100	100 A													
	150	150 A													
	<b>250</b>	<b>250 A</b>													
	400	400 A													
	600	600 A													
Mission Critical	000	Switch or Frame Only													
	W	(J- and L-frame with D, G, J and L-interrupting ratings)													
Trip Unit	See Table 3														
I-Line Phasing															
Accessory Suffix Code	See Table 4														

**Table 2: Interrupting Rating**

	UL® / CSA® / NOM®					IEC 647-2 Icu/Ics					
	240 Vac	480 Vac	<b>600 Vac</b>	250 Vdc <sup>1</sup>	500 Vdc <sup>2</sup>	220/240 Vac	380/440/415 Vac	500/525 Vac	690 Vac	250 Vdc <sup>1</sup>	500 Vdc <sup>3</sup>
<b>D</b>	25 kA	18 kA	<b>14 kA</b>	20 kA	—	25/25 kA	18/18 kA	14/14 kA	—	20 kA	20 kA
<b>G</b>	65 kA	35 kA	18 kA	20 kA	20 kA	65/65 kA	35/35 kA	18/18 kA	—	20 kA	20 kA
<b>J</b>	100 kA	65 kA	25 kA	20 kA	—	100/100 kA	65/65 kA	25/25 kA	—	20 kA	20 kA
<b>L</b>	125 kA	100 kA	50 kA	20 kA	50 kA	125/125 kA	100/100 kA	50/50 kA	—	20 kA	20 kA
<b>R</b>	200 kA	200 kA	100 kA	—	—	150 kA	125 kA	75 kA	20 kA	—	—

<sup>1</sup> 250 Vdc ratings only available with PowerPact H or J circuit breakers with thermal-magnetic trip units (not including MCP).

<sup>2</sup> UL 500 Vdc ratings only available with PowerPact H-, J-, and L-frame circuit breakers with thermal-magnetic trip units (not including MCP).

<sup>3</sup> IEC 500 Vdc rating only available on PowerPact J-frame circuit breakers.

## PowerPact H-, J-, and L-Frame Circuit Breakers

### General Information

### Table 11: Circuit Breakers

[illegible]

<sup>1</sup> H and J-frame breakers with Micrologic trip units available only with three poles. The HJ, HL and the J-Frame two pole circuit breakers are three pole modules.

<sup>2</sup> DC not available with PowerPact H, J or L-frame circuit breakers with Micrologic trip units.

<sup>3</sup> 500 Vdc specific catalog numbers, ungrounded UPS systems only.

<sup>4</sup>  $I_{CS}$  for 600 A L-frame circuit breaker at 525 V is 19 kA.

<sup>5</sup> OSN: Over Sized Neutral protection for neutrals carrying high currents (e.g. 3rd harmonics).

<sup>6</sup> ZSI using restraint wires.

<sup>7</sup> Rear connection is not available for 700–1200 A four pole L-frame circuit breakers.

## PowerPact H-, J-, and L-Frame Circuit Breakers

### Circuit Breakers

**Table 20: H-Frame 150 A and J-Frame 250 A Electronic Trip UL Rated Circuit Breakers (600 Vac, 50/60 Hz) With Factory Sealed Trip Unit Suitable for Reverse Connection**

Electronic Trip Unit			Sensor Rating	Interrupting Rating				
Type	Function	Trip Unit		D	G	J <sup>1</sup>	L <sup>2</sup>	R <sup>2</sup>
Standard (80%) Rated Circuit Breakers, Three-Pole								
Standard	LI	3.2 <sup>2</sup>	60 A <sup>3</sup>	HDL36060U31X	HGL36060U31X	HJL36060U31X	HLL36060U31X	HRL36060U31X
			100 A <sup>3</sup>	HDL36100U31X	HGL36100U31X	HJL36100U31X	HLL36100U31X	HRL36100U31X
			150 A <sup>3</sup>	HDL36150U31X	HGL36150U31X	HJL36150U31X	HLL36150U31X	HRL36150U31X
			250 A <sup>4</sup>	JDL36250U31X	JGL36250U31X	JJL36250U31X	JLL36250U31X	JRL36250U31X
Standard	LSI	3.2S <sup>2</sup>	60 A <sup>3</sup>	HDL36060U33X	HGL36060U33X	HJL36060U33X	HLL36060U33X	HRL36060U33X
			100 A <sup>3</sup>	HDL36100U33X	HGL36100U33X	HJL36100U33X	HLL36100U33X	HRL36100U33X
			150 A <sup>3</sup>	HDL36150U33X	HGL36150U33X	HJL36150U33X	HLL36150U33X	HRL36150U33X
			250 A <sup>4</sup>	JDL36250U33X	JGL36250U33X	JJL36250U33X	JLL36250U33X	JRL36250U33X
Ammeter	LSI	5.2A	60 A <sup>3</sup>	HDL36060U43X	HGL36060U43X	HJL36060U43X	HLL36060U43X	HRL36060U43X
			100 A <sup>3</sup>	HDL36100U43X	HGL36100U43X	HJL36100U43X	HLL36100U43X	HRL36100U43X
			150 A <sup>3</sup>	HDL36150U43X	HGL36150U43X	HJL36150U43X	HLL36150U43X	HRL36150U43X
			250 A <sup>4</sup>	JDL36250U43X	JGL36250U43X	JJL36250U43X	JLL36250U43X	JRL36250U43X
Energy	LSI	5.2E	60 A <sup>3</sup>	HDL36060U53X	HGL36060U53X	HJL36060U53X	HLL36060U53X	HRL36060U53X
			100 A <sup>3</sup>	HDL36100U53X	HGL36100U53X	HJL36100U53X	HLL36100U53X	HRL36100U53X
			150 A <sup>3</sup>	HDL36150U53X	HGL36150U53X	HJL36150U53X	HLL36150U53X	HRL36150U53X
			250 A <sup>4</sup>	JDL36250U53X	JGL36250U53X	JJL36250U53X	JLL36250U53X	JRL36250U53X
Ammeter	LSIG	6.2A	60 A <sup>3</sup>	HDL36060U44X	HGL36060U44X	HJL36060U44X	HLL36060U44X	HRL36060U44X
			100 A <sup>3</sup>	HDL36100U44X	HGL36100U44X	HJL36100U44X	HLL36100U44X	HRL36100U44X
			150 A <sup>3</sup>	HDL36150U44X	HGL36150U44X	HJL36150U44X	HLL36150U44X	HRL36150U44X
			250 A <sup>4</sup>	JDL36250U44X	JGL36250U44X	JJL36250U44X	JLL36250U44X	JRL36250U44X
Energy	LSIG	6.2E	60 A <sup>3</sup>	HDL36060U54X	HGL36060U54X	HJL36060U54X	HLL36060U54X	HRL36060U54X
			100 A <sup>3</sup>	HDL36100U54X	HGL36100U54X	HJL36100U54X	HLL36100U54X	HRL36100U54X
			150 A <sup>3</sup>	HDL36150U54X	HGL36150U54X	HJL36150U54X	HLL36150U54X	HRL36150U54X
			250 A <sup>4</sup>	JDL36250U54X	JGL36250U54X	JJL36250U54X	JLL36250U54X	JRL36250U54X
100% Rated Circuit Breakers, Three-Pole								
			60 A <sup>3</sup>	HDL36060CU31X	HGL36060CU31X	HJL36060CU31X	HLL36060CU31X	HRL36060CU31X
Standard	LI	3.2 <sup>2</sup>	100 A <sup>3</sup>	HDL36100CU31X	HGL36100CU31X	HJL36100CU31X	HLL36100CU31X	HRL36100CU31X
			150 A <sup>3</sup>	HDL36150CU31X	HGL36150CU31X	HJL36150CU31X	HLL36150CU31X	HRL36150CU31X
			250 A <sup>4</sup>	JDL36250CU31X	JGL36250CU31X	JJL36250CU31X	JLL36250CU31X	JRL36250CU31X
Standard	LSI	3.2S <sup>2</sup>	60 A <sup>3</sup>	HDL36060CU33X	HGL36060CU33X	HJL36060CU33X	HLL36060CU33X	HRL36060CU33X
			100 A <sup>3</sup>	HDL36100CU33X	HGL36100CU33X	HJL36100CU33X	HLL36100CU33X	HRL36100CU33X
			150 A <sup>3</sup>	HDL36150CU33X	HGL36150CU33X	HJL36150CU33X	HLL36150CU33X	HRL36150CU33X
			250 A <sup>4</sup>	JDL36250CU33X	JGL36250CU33X	JJL36250CU33X	JLL36250CU33X	JRL36250CU33X
Ammeter	LSI	5.2A	60 A <sup>3</sup>	HDL36060CU43X	HGL36060CU43X	HJL36060CU43X	HLL36060CU43X	HRL36060CU43X
			100 A <sup>3</sup>	HDL36100CU43X	HGL36100CU43X	HJL36100CU43X	HLL36100CU43X	HRL36100CU43X
			150 A <sup>3</sup>	HDL36150CU43X	HGL36150CU43X	HJL36150CU43X	HLL36150CU43X	HRL36150CU43X
			250 A <sup>4</sup>	JDL36250CU43X	JGL36250CU43X	JJL36250CU43X	JLL36250CU43X	JRL36250CU43X
Energy	LSI	5.2E	60 A <sup>3</sup>	HDL36060CU53X	HGL36060CU53X	HJL36060CU53X	HLL36060CU53X	HRL36060CU53X
			100 A <sup>3</sup>	HDL36100CU53X	HGL36100CU53X	HJL36100CU53X	HLL36100CU53X	HRL36100CU53X
			150 A <sup>3</sup>	HDL36150CU53X	HGL36150CU53X	HJL36150CU53X	HLL36150CU53X	HRL36150CU53X
			250 A <sup>4</sup>	JDL36250CU53X	JGL36250CU53X	JJL36250CU53X	JLL36250CU53X	JRL36250CU53X

<sup>1</sup> UL Listed/CSA Certified as current-limiting circuit breakers.

<sup>2</sup> Three-pole circuit breakers with this trip unit can be used for two-pole applications.

<sup>3</sup> Standard lug kit: AL150HD. Terminal wire range: 14–3/0 AWG Al or Cu.

<sup>4</sup> Standard lug kit: AL250JD. Terminal wire range: 3/0 AWG–350 kcmil Al or Cu.  
For smaller wire range (4–4/0 AWG Al or Cu), replace the lug's wire binding screws with the larger binding screws provided.

## PowerPact H-, J-, and L-frame Circuit Breaker Trip Units

**Table 12: Micrologic Trip Unit Features**

Features	Micrologic Trip Unit (X = Standard Feature, O = Available Option)					
	Standard		Ammeter		Energy	
	3.2/3.3	3.2S/3.3S	5.2A/5.3A	6.2A/6.3A	5.2E/5.3E	6.2E/6.3E
<b>LI</b>	X					
LSI <sup>1</sup>		X	X		X	
LSIG/Ground Fault Trip <sup>2</sup>				X		X
Ground-Fault Alarm Trip				X		X
Current Settings Directly in Amperes	X	X	X	X	X	X
True RMS Sensing	X	X	X	X	X	X
UL Listed	X	X	X	X	X	X
Thermal Imaging	X	X	X	X	X	X
LED for Long-Time Pickup	X	X	X	X	X	X
LED for Long-Time Alarm	X	X	X	X	X	X
LED Green "Ready" Indicator	X	X	X	X	X	X
Up to 12 Alarms Used Together			X	X	X	X
Digital Ammeter			X	X	X	X
Zone-Selective Interlocking <sup>3</sup>			X	X	X	X
Communications	O	O	O	O	O	O
LCD Display			X	X	X	X
Front Display Module FDM121			O	O	O	O
Advanced User Interface			X	X	X	X
Neutral Protection			X	X	X	X
Contact Wear Indication <sup>4</sup>			X	X	X	X
Incremental Fine Tuning of Settings			X	X	X	X
Load Profile <sup>4, 5</sup>			X	X	X	X
Power Measurement					X	X
Power Quality Measurements					X	X

<sup>1</sup> The LSI with 3.2S/3.3S trip units have fixed short time and long time delays.

<sup>2</sup> Requires neutral current transformer on three-phase four-wire loads.

<sup>3</sup> ZSI for H/J-frame devices is only OUT. ZSI for L-frame devices is IN and OUT.

<sup>4</sup> Indication available using the communication system only.

<sup>5</sup> % of hours in 4 current ranges: 0–49%, 50–79%, 80–89%, and >90%  $I_n$ .

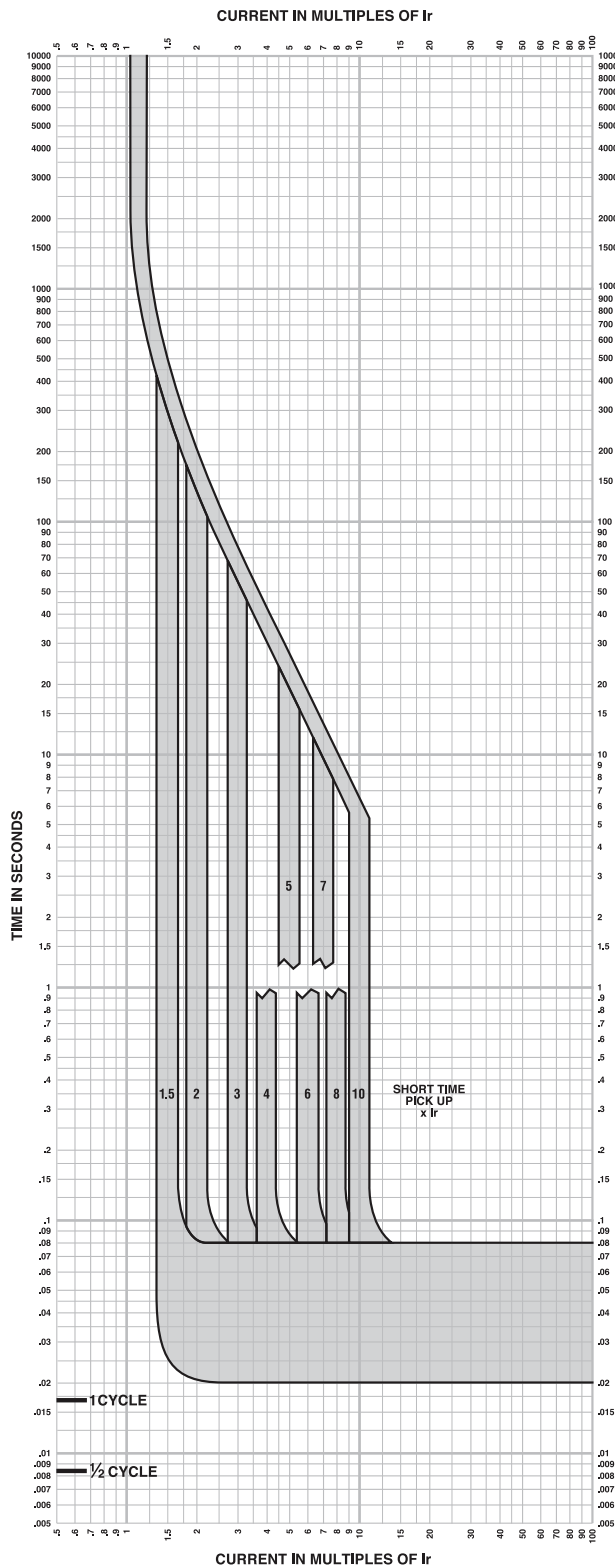
### Thermal-Magnetic or Electronic Trip Unit?

Thermal-magnetic trip units (available on H- and J-frame circuit breakers only) protect against overcurrents and short-circuits using tried and true techniques. For applications requiring installation optimization and energy efficiency, electronic trip units offering more advanced protection functions combined with measurements.

Trip units using digital electronics are faster as well as more accurate. Wide setting ranges make installation upgrades easier. Designed with processing capabilities, Micrologic trip units can provide measurement information and device operating assistance. With this information, users can avoid or deal more effectively with disturbances and can play a more active role in system operation. They can manage the installation, anticipate events and plan any necessary servicing.

PowerPact H-, J-, and L-Frame Circuit Breakers  
Trip Curves

Figure 117: Micrologic 3.3S and 3.3S-W Electronic Trip Unit Long Time/Short Time Trip Curve



**MICROLOGIC™ ELECTRONIC TRIP UNITS**  
**Micrologic™ 3.3S and 3.3S-W**  
**Long Time/Short Time Trip Curve**  
**250A, 400A L-Frame**

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

**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 20 minutes is required between overloads to completely reset thermal-imaging.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of the current.

Curves apply from -35°C to +70°C (-31°F to +158°F) ambient temperature.





## Manufacturer's Basic Limited Warranty

This Taylor Power Systems Standby Generator System has been manufactured and inspected with care by experienced craftsmen. If you are the original purchaser, Taylor Power Systems, Inc. warrants for **two years or 1500 hours**, whichever occurs first, that the system will be free from defects in material and workmanship if properly installed, maintained, and operated in accordance with Taylor Power Systems, Inc. instruction manuals. A Taylor Power distributor, dealer, or authorized representative must perform startup inspection/warranty registration, and warranty repairs.

During the warranty period, repair or replacement at Taylor Power's option will be furnished free of charge for parts and labor, provided an inspection to Taylor Power's satisfaction discloses a defect in material and workmanship, and provided that the part or parts are returned to Taylor Power or an authorized service station, if requested.\*

This warranty does not apply to malfunctions caused by damage, unreasonable use, unapproved modifications, misuse, abuse, or normal wear and tear while in your possession.

\*Some restrictions may apply. Contact your Taylor Power Systems distributor/dealer for full details.

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### **Warranty Periods**

#### **1. Emergency or Standby Duty**

Standby generators must be permanently installed, properly enclosed, ventilated, and used as back up to the normal power source.

The warranty period is **24 months** from date of startup by the first owner/user or 1500 hours of operation, limited to a maximum of 750 hours in the first year.

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#### **2. Continuous or Prime Duty**

Continuous or prime power service describes operation in a permanent or mobile application where no other source of power is generally available. Rental sets, and specific products for irrigation and refrigeration meet this criteria. Cogeneration and peak shaving installations are considered prime power.

The warranty period is 12 months from date of startup by the first owner/user or 3000 hours of operation, whichever is shorter.

#### LIMITED WARRANTY CONDITIONS

Before there is any protection under this Limited Warranty, the distributor/dealer must: complete the Taylor Power Systems Warranty, Startup Validation Inspection form and return it to Taylor Power Systems within 30 days of the startup date. In addition, this Limited Warranty is not valid or enforceable unless all supporting maintenance records are kept on file with the end user and made available upon request from factory, the generator set is routinely exercised in accordance with operating instructions, and the installation meets the general guidelines, standards, and recommendations as laid out in the Installation Guide provided with the product and all local standards and codes applicable in the location of installation.

#### Engine Manufactures Warranty:

The engine manufacture issues its own separate warranty covering the engine's performance and parts. In the event of an engine related failure, Taylor Power Systems, Inc. can refer you to an engine authorized service center.

To obtain warranty service, call 1-800-748-9980 for your nearest authorized Taylor Power Systems service representative, or write Taylor Power Systems, Warranty Department, 947 Industrial Park Drive, Clinton, MS 39056. Service provided by unauthorized persons will void this Limited Warranty. Failure to use genuine Taylor Power Systems replacement part(s) will void this Limited Warranty.

Travel shall be allowed up to a maximum of 300 miles round trip and a maximum of 7 hours travel time.

Taylor Power Systems, Inc. will provide replacement parts to claimant's location within the United States. If claimant is located outside the continental United States, all parts shipments are FOB point of debarkation. In the event warranty repairs are affected outside the boundaries of the United States of America, Taylor Power Systems, Inc. is not responsible for any duties, taxes, or associated charges as may be applicable in accordance with the regulations of the country where such warranty repair is performed.

TAYLOR POWER SYSTEMS SHALL NOT BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY KIND including, but not limited to, injury to individuals, personal property, or business losses due to down time, installation charges, telephone charges, or transportation charges in connection with the replacement or repair of defective parts or damages resulting from outside influences (e.g. lightning, power surge, or pest damage).

THIS IS OUR EXCLUSIVE WRITTEN WARRANTY. We make no other express or implied warranty nor is anyone authorized to make any on our behalf.

ANY IMPLIED OR STATUTORY WARRANTY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, is expressly limited to the duration of this warranty. Some states do not allow limitations on how long an implied warranty lasts, or the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

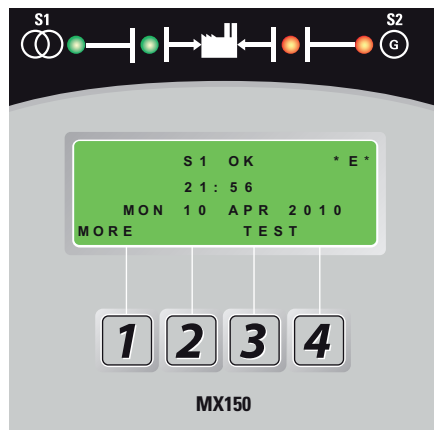
This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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**The following will not be covered by this warranty:**

1. Normal engine wear, routine tune-ups, tune-up parts, adjustments, installation charges, startup cost, improper startup inspection, and periodic service.
2. Damage caused by accidents, improper installation (unless installed by Taylor Power Systems, Inc.), shipping and handling, or improper storage.
3. Damage caused by operation with improper fuel or at speeds, loads, conditions, modifications, or installation contrary to published specifications or recommendations.
4. Damage caused by negligent maintenance such as:
  - a. Failure to provide the specified type and sufficient lubricating oil.
  - b. Failure to provide sufficient coolant, cooling air and to keep the air intake and cooling fin areas clean.
  - c. Failure to service the air cleaner.
  - d. Failure to perform scheduled maintenance as prescribed in supplied manuals.
  - e. Fuel Contamination (including water etc.).
  - f. Improper use of starting aids
5. Labor and travel expenses related to starting batteries.
6. Engine coolant heaters, heater controls, and circulating pumps after the first year.
7. Rental equipment including neither replacement generators nor any other equipment (etc. Cranes, trucks) needed during performance of warranty repairs.
8. Parts purchased from sources other than Taylor Power. Replacement of a failed Taylor Power part with a non-Taylor Power part voids warranty on that part.
9. Engine fluids such as fuel, oil, or coolant/antifreeze.
10. Shop supplies such as adhesives, cleaning solvents, and rags.
11. Expenses incurred investigating performance complaints unless the problem is caused by defective Taylor Power materials or workmanship.
12. Maintenance items such as fuses, filters, spark plugs, loose/leaking clamps, and adjustments.
13. Any overtime travel or labor to make repairs under warranty.
14. Any special access fees or additional cost required to gain access to Taylor Power Systems, Inc. equipment, including but not limited to any training or safety policy requirements to gain access.
15. Trailer lights, wiring, and brakes.

## MX150 Control Panel



Front View

400 amp 347/600 Volt 3 phase  
3 pole solid neutral Single Sided  
Bypass Automatic Transfer Switch  
for Life Safety

## Standard Features (MSTDG Option Pkg.)

<b>6/P</b>	Test Switch, Momentary
<b>A3</b>	Auxiliary Contact: Closed when the switch is in the Source 2 position (S2)
<b>A4</b>	Auxiliary Contact: Closed when the switch is in the Source 1 position (S1)
<b>CALIBRATE</b>	Capabilities are available for Frequency and AB, BC, CA Phase to Phase voltage for both Sources
<b>CDT</b>	Daily 7, 14, 28 timed exercise (CDT memory backup battery included), pushbutton/timer operation
<b>E</b>	Engine Start Contact
<b>EL/P</b>	Event Log of 16 Events that track date, time, reason and action taken
<b>J1E</b>	Adjustable under frequency sensor for S2
<b>K/P</b>	Voltage and Frequency Indication for S1 and S2
<b>L</b>	Indicating LED Pilot Lights: <ul style="list-style-type: none"> <li><b>L1</b> Indicates switch in S2 position</li> <li><b>L2</b> Indicates switch in S1 position</li> <li><b>L3</b> Indicates S1 source available</li> <li><b>L4</b> Indicates S2 source available</li> </ul>
<b>P1</b>	Time Delay to Engine Start
<b>Q2</b>	Peak Shave / Remote Load Test
<b>R50</b>	In-Phase Monitor, self-adjusting
<b>T</b>	Time Delay on Retransfer to Normal: To delay retransfer to S1 (immediate retransfer on S2 failure)
<b>R2E</b>	Under voltage sensing of S2
<b>S13</b>	Microprocessor activated commit / no commit on transferring to S2
<b>U</b>	Time Delay for Engine Cool Down: Allows engine to run unloaded after switch retransfer to S1
<b>W</b>	Time Delay on Transfer to Emergency: To delay transfer to S2 after availability
<b>YEN</b>	Pushbutton Bypass of T & W Timers

When specified for use with a ZTGD Series delayed transition switch, the control panel also includes the following:

<b>DT</b>	Time Delay from Neutral Switch Position to S1 on Retransfer
<b>DW</b>	Time Delay from Neutral Switch Position to S2
<b>LN/P</b>	Center-Off position/Off Delay Timing indicating lights

## Additional Standard Features (MEXEG Option Pkg.)

<b>CDP</b>	Clock Exerciser Load/No Load (Replaces CDT Exerciser Option)
<b>VI</b>	Voltage Imbalance Monitor (Three Phase)



GE's Zenith ZTG Series switches are built for standard applications requiring the dependability and ease of operation found in a power contactor switch.

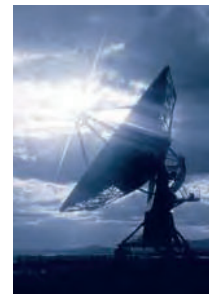
- Ratings 40 to 3000 amps (2, 3 or 4 poles)

- UL 1008 listed at 480 VAC
- CSA certified at 600 VAC (200-260 amps - 480V)

- NFPA 70, 99, 101 and 110
- IEEE 446 and 241
- NEC 517, 700, 701 and 702
- NEMA ICS2-447
- UL 508 and 50
- ANSI C33.76
- ICS 6
- NEMA 250
- Equipment (Controls and Power Section)  
**Seismic Test Qualified to:**
  - ✓ IBC-2006
  - ✓ IEEE-693-2005
- Double throw, mechanically interlocked contactor mechanism
- Electrically operated, mechanically held
- Designed for emergency and standby applications
- Available in standard (ZTG) or delayed transition (ZTGD) models

ZTG switches are equipped with GE's Zenith MX150 microprocessor panel, which controls the operation and displays the status of the transfer switch's position, timers and available sources. As an embedded digital controller, the MX150 offers high reliability and ease of unattended operation across a range of applications. The MX150 features include:

- Timer and voltage/frequency settings adjustable without disconnection from the power section
- Built-in diagnostics with an LCD display for immediate troubleshooting
- LED/LCD indicators for ease of viewing and long life
- Nonvolatile memory—clock battery backup not required for standard switch operation
- Processor and digital circuitry isolated from line voltage
- Inputs optoisolated for high electrical immunity to transients and noise
- Communications network interface



#### Fully Approved

- UL and CSA listed
- NFPA 70, 99 101 and 110
- IEEE 446 and 241
- NEC 517, 700, 701 and 702
- NEMA ICS2-447
- UL 508 and 50
- ANSI C33.76
- ICS 6
- NEMA 250
- IBC-2006
- IEEE-693-2005
- Ringing wave immunity per IEEE 472 (ANSI C37.90A)

- Conducted and Radiated Emissions per EN55022 Class B (CISPR 22) (Exceeds EN55011 & MILSTD 461 Class 3)
- ESD immunity test per EN61000-4-2 Class B (Level 4)
- Radiated RF, electromagnetic field immunity test per EN61000-4-3 (ENV50140) 10v/m
- Electrical fast transient/burst immunity test per EN61000-4-4
- Surge immunity test per EN61000-4-5 IEEE C62.41 (1.2 X 50µs, 0.5 & 4 kV)
- Conducted immunity test per EN61000-4-6 (ENV50141)
- Voltage dips and interruption immunity EN61000-4-11

#### Design and Construction Features

- Close differential 3 phase under-voltage sensing of Source 1 (normal)—factory standard setting 90% pickup, 80% dropout (adjustable); under-frequency sensing of Source 1 factory setting 95% pickup (adjustable)
- Voltage and frequency sensing of the Source 2 (emergency)—factory standard setting 90% pickup voltage, 95% pickup frequency (adjustable)
- Test switch (fast test/load/no load) to simulate Source 1 (normal) failure—automatically bypassed should the Source 2 (emergency) fail
- NEMA Type 1 enclosure is standard—also available in open style or NEMA Types 3R, 4, 4X or 12





REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
G	S-8604	REVISED DWG	04/05/07 YJS MES

**ZTG SERIES WITH MX150 MICROPROCESSOR-BASED CONTROL PANEL  
AUTOMATIC TRANSFER SWITCH (ATS) 40-3000 AMP**

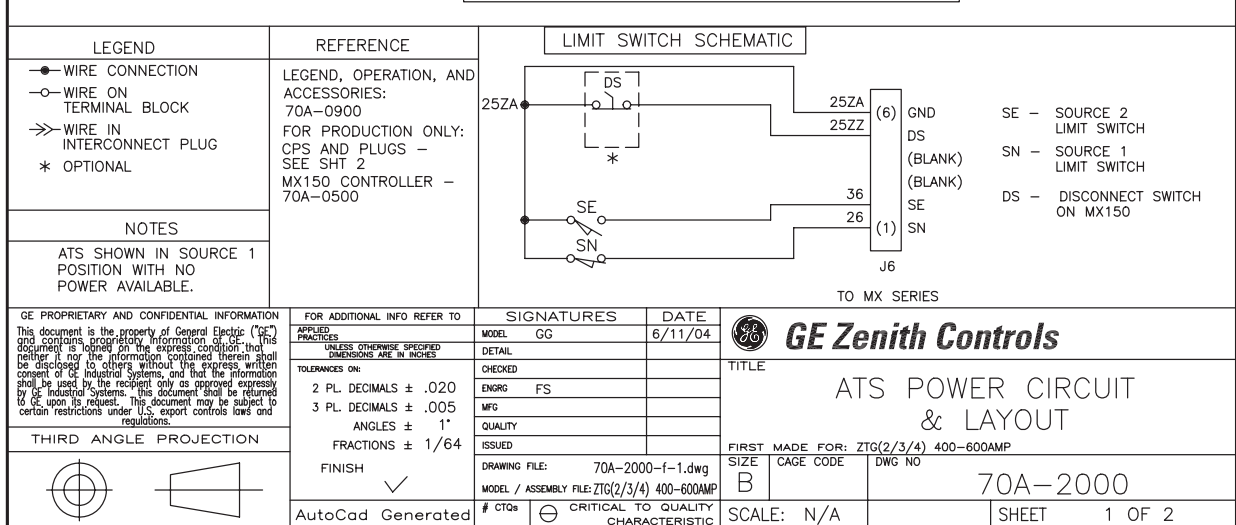
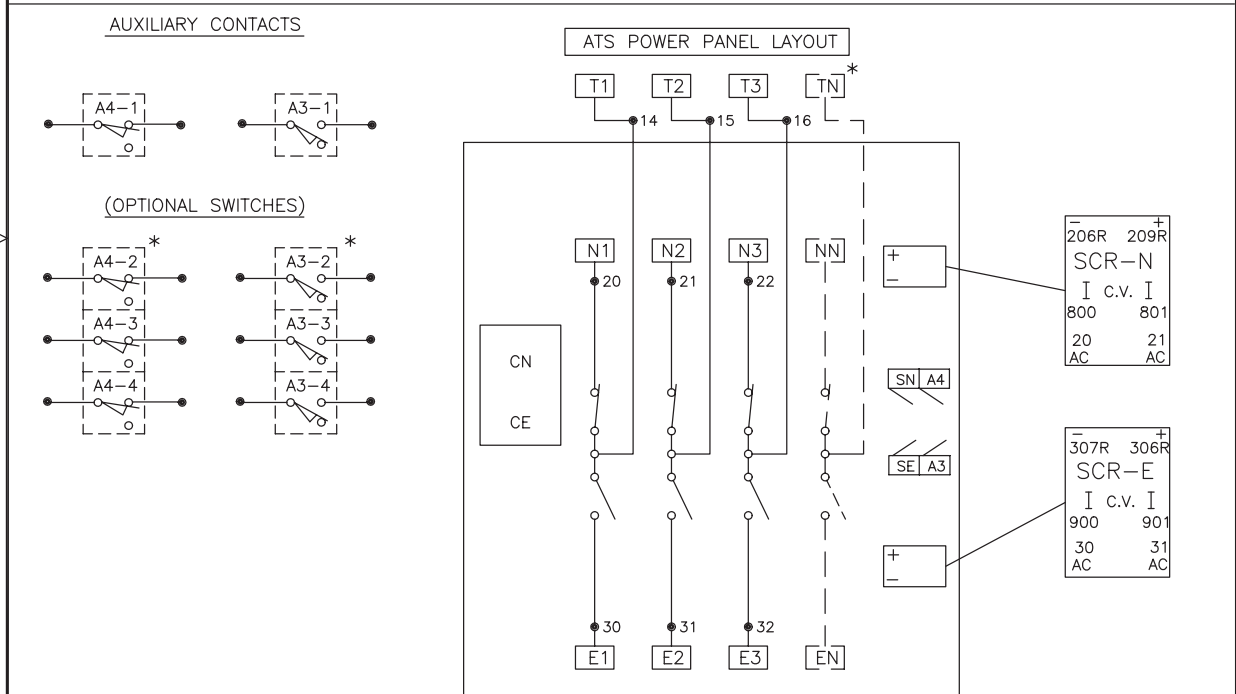
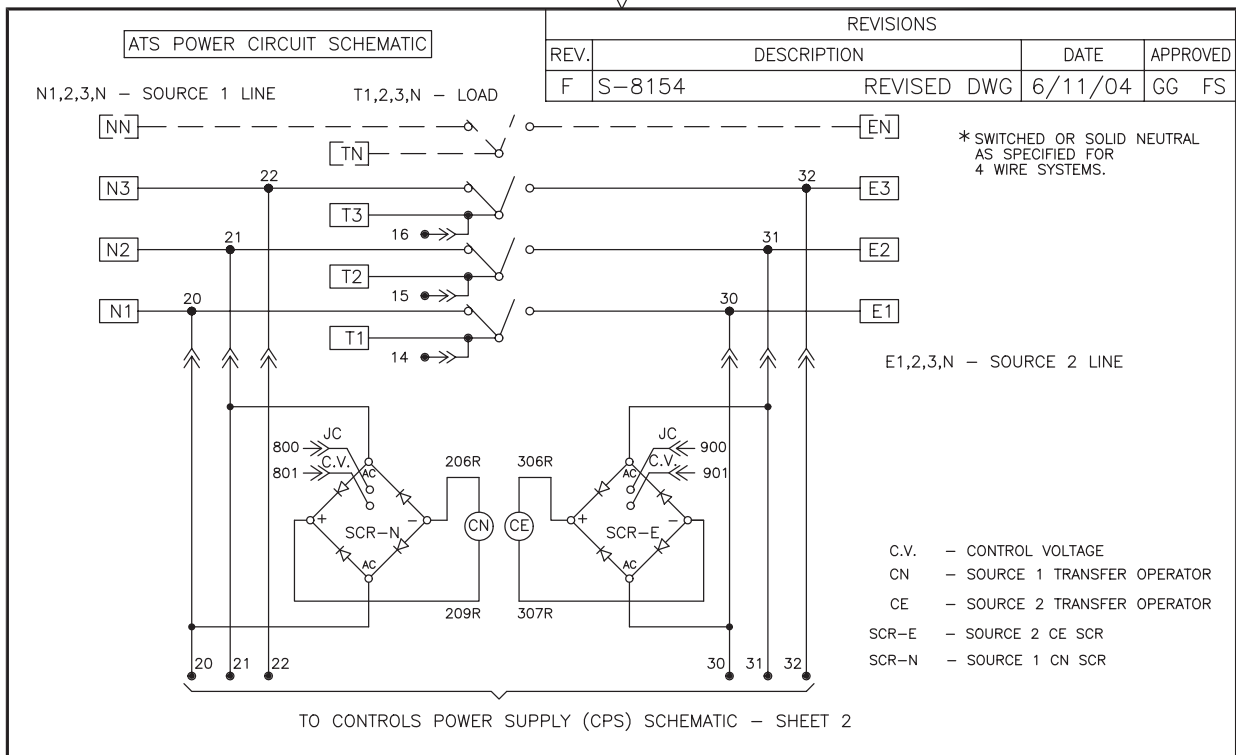
**FOR USE ON EMERGENCY OR STANDBY SYSTEMS - RATED FOR TOTAL SYSTEM & MOTOR LOAD**

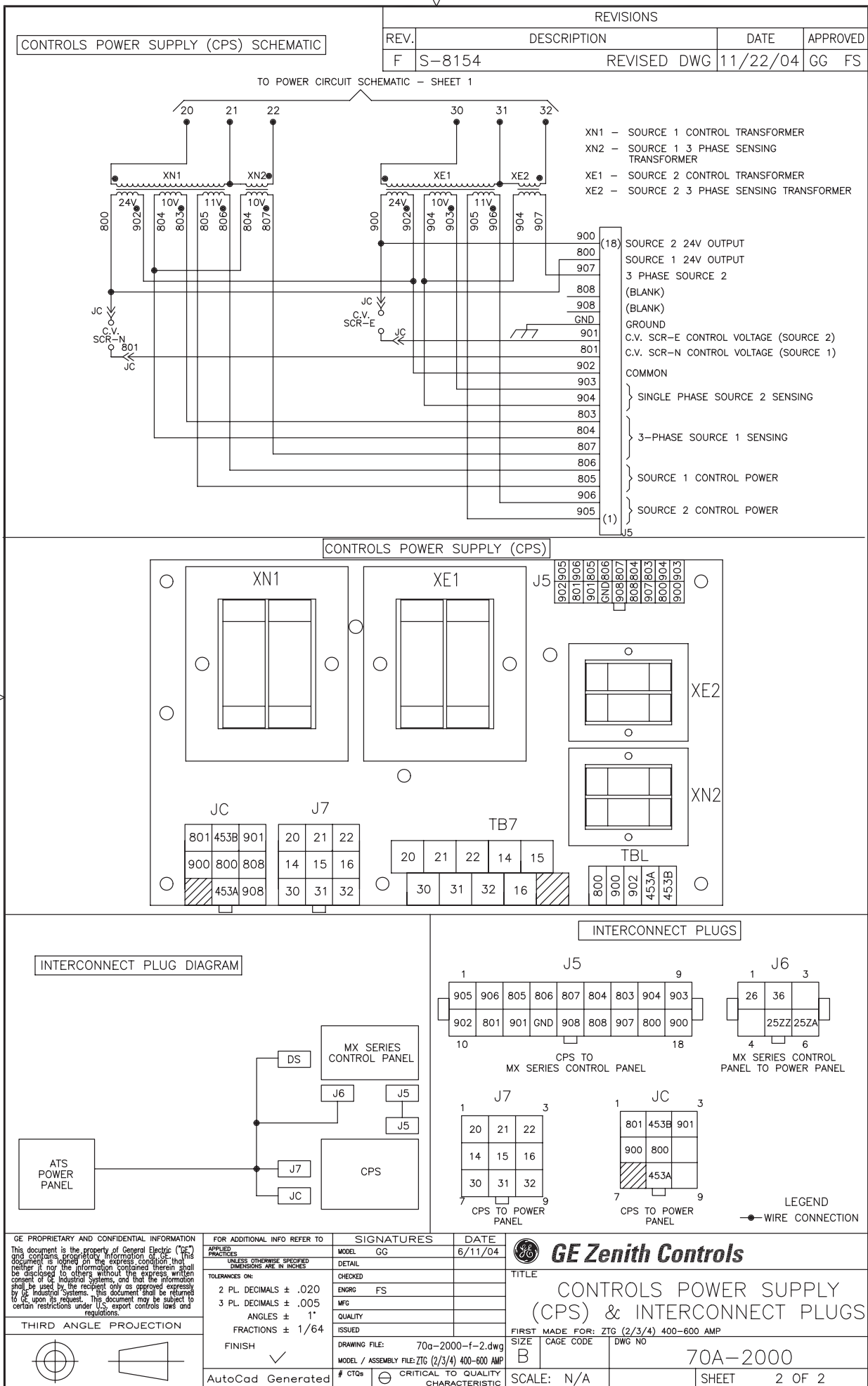
A. LEGEND	D. MEXEG OPTION PACKAGE.	E. OPTIONAL ACCESSORIES
<p><b>CONTROLS POWER SUPPLY (CPS)</b></p> <p>XE1,XE2..... Control Transformer, Source 2 XN1,XN2..... Control Transformer, Source 1</p> <p><b>Power Panel</b></p> <p>N1,2,3,(N).....Source 1 Line _____ E1,2,3,(N).....Source 2 Line _____ T1,2,3,(N).....Load Connections</p> <p>BR.....Bridge Rectifier CE.....Source 2 Transfer Operator CN.....Source 1 Transfer Operator CNE.....Main Transfer Operator (400 Amp) GND.....Ground NB.....Neutral Bar (if required) SCR-E.....SCR Source 2 SCR-N.....SCR Source 1 SCE,SCN.....CNE Limit Switches SE.....Source 2 Position Limit Switch SN.....Source 1 Position Limit Switch</p> <p><b>Interconnect Plugs</b> J1, J2, J4, J5, J6, J7, Jc</p> <p><b>B. OPERATION</b></p> <p>When Source 1 line drops below the preset "Fail" Values, Source 1 voltage sensing circuit initiates the engine start circuit.</p> <p>When Source 2 line voltage and frequency reach the preset "Restore" Values, the MX controller initiates a transfer signal through the SCR-E to operate the main transfer operator. The load is now transferred to the Source 2 line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Source 1.</p> <p>When Source 1 line voltage reaches the preset "Restore" Values, the MX controller initiates a transfer signal through the SCR-N to operate the main transfer operator. The load is now re-transferred back to the Source 1 line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Source 2.</p> <p><b>Test Switch</b></p> <p>The Test Switch simulates source 1 line failure when activated. To test, activate the Test Switch, thus allowing the transfer switch to transfer to the Source 2 position. Deactivate the Test Switch. The transfer switch will reset to the Source 1 position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.</p> <p><b>[X] C. MSTDG OPTION PACKAGE.</b></p> <p>6 Test Switch, Momentary. A3 Auxiliary Contact Closed when the switch is in Source 2 position. A4 Auxiliary Contact Closed when the switch is in Source 1 position.</p> <p><b>CALIBRATE</b></p> <p>Source 1 &amp; Source 2 Calibrate capabilities for voltage a frequency.</p> <p><b>CDT Timer Exerciser Load / No Load, one event:</b> allows the Generator to start and run unloaded or simulate a power failure, start Generator and run under load. Can be configured by end user for a 1, 7, 14, or 28 day cycle. Exercise duration can be set between 5 and 60 minutes in 1 minute increments. Factory default is 20 minutes. When exercise is impending, (*E*) appears in the upper right hand corner of LCD screen. configured via CFG menu and set via SET menu.</p>	<p><b>DS</b> Disconnect Switch. Inhibits transfer to either direction when in Inhibit. 40-600 Amp optional, located next to controller. 800-3000 Amp standard, located next to controller.</p> <p><b>E</b> Engine Start Contacts. EL/P Event Log: Sequentially Numbered Log of 16 events that track date, time, reason and action taken</p> <p><b>System Data:</b> Total Life Transfers (N2P) Days Powered Up Total Transfers to S2 Total S1 Failures Total S1 available in Hrs Total S2 available in Hrs. (NIP)</p> <p><b>KP</b> Frequency, Indication S1 &amp; S2</p> <p><b>L</b> Indicating LED lights. L1 Indicates Switch in Source 2 position. L2 Indicates Switch in Source 1 position. L3 Indicates Source 1 available. L4 Indicates Source 2 available. LN center-off position LCD-indicator.</p> <p><b>N1</b> Running Time indicator. <b>N2</b> Operation Counter indicator. <b>P1</b> Time Delay Source 2 Start. Adjustable 0-10 seconds. Standard setting in 3 seconds. Adjust via SET menu. <b>Q2</b> Peak Shave / Remote Load Test: Input for Peak Shave or Remote Load Test. Includes automatic return to Source 1 if Source 2 fails and Source 1 present. Energize Q2 to Peak shave/Load test. <b>R50</b> In-Phase Monitor. Prevents transfer until two sources are in-phase. <b>S13</b> Transfer Commit or no Commit to transfer upon Engine start. Time Delay (S1) source 1 Stable Timer. To delay transfer to Source 1. <b>U</b> Source 2 Stop Delay Timer. <b>W</b> Time Delay (S2) Source 2 Stable Timer. To delay transfer to Source 2. <b>YEN</b> Bypass Timers Key utilizing keypad. When applicable, the system prompts the user to press a button to bypass (T) or (W) Timers should the user so desires.</p> <p><b>[X] D. MEXEG OPTION PACKAGE.</b></p> <p>In addition to the Features Listed under the MSTDG package, this package includes the following Features.</p> <p><b>A3</b> Auxiliary Contact: closed when switch is in Source 2 position. <b>A4</b> Auxiliary Contact: closed when switch is in Source 1 position. <b>VI</b> Voltage Imbalance (Three Phase) User Configured On or Off. Range: 5% to 20% of Nominal voltage 10 to 30 seconds, user adjustable. Resolution: 1% increments Minimum Differential: 2% minimum between "Fail" and "Restore" settings. Factory default: 10% "Fail", 8% "Restore", 30 seconds.</p> <p><b>CDP</b> Clock Exerciser Load / No Load, one event: allows the Generator to start and run unloaded or simulate a power failure, start Generator and run under load. Can be configured by end user for a 1, 7, 14, 28, or 365 day cycle. A total of 7 independent exercise periods (up to 10 hours each) can be programmed for each of the daily, weekly, 14-day, and 28-day Exercisers. A total of 12 independent exercise periods (up to 10 hours each) can be programmed for the 365-day Exerciser. When exercise is impending, (*E*) appears in the upper right hand corner of LCD screen. configured via CFG menu and set via SET menu.</p>	<p><b>[ ] 6A</b> Test Switch, Maintained/Momentary. Door mount <b>[ ] 6AP</b> Test Switch Maintained/Momentary Utilizing Keypad. <b>[ ] A62</b> Sequential Universal Motor load Disconnect Circuit. Normally closed Auxiliary contacts for motor disconnect loads. Open 0-60 seconds prior to transfer, after transfer or both in either direction then reclose in timed sequence after transfer. <b>[ ] A1</b> Auxiliary Contact, Operates on Source 1 line failure. <b>[ ] A1E</b> Auxiliary Contact, Operates on Source 2 line failure. <b>[ ] A3</b> Auxiliary Contacts Closed when the transfer switch is in Source 2 position. <b>[ ] A4</b> Auxiliary Contacts Closed when the transfer switch is in Source 1 position. <b>[ ] B9</b> Battery charger. <b>[ ] CTAP</b> Alarm Panel on transfer to Source 2 with Silence button. <b>[ ] DS</b> Disconnect Switch: Permits transfer in "AUTO" position and inhibits transfer in "INHIBIT" position. <b>[ ] F</b> Fan contact, operates when generator is running. <b>[ ] HT</b> Heater, and Thermostat. <b>[ ] M90</b> Digital Power Meter with Display: Amps, Bolts and Frequency. <b>[ ] M91</b> Digital Meter w/Display of Amps, Watts, Volts, Frequency, KVA, KVAR, PF, etc. Plus THD capability w/ Ethernet. <b>[ ] Q3</b> Inhibit Transfer to Source 2: Input Circuit to inhibit transfer to Source 2. <b>[X] T3/W3</b> Elevator Pre-Signal Auxiliary Contacts: Open 0-60 sec.prior to transfer to either direction, re-closes after transfer. <b>[ ] UMD</b> Universal Motor Load Disconnect Circuit: Aux.Contact opens 0-60 sec. Adjustable, 1 sec. increments) prior to transfer in either direction, recloses after transfer. Can be configured by end user for Pre-transfer, Post-transfer or both. Factory default 5 sec. Timers are not bypassed when transferring from dead source. <b>[ ] ZNET</b> Network Communication Interface Card.</p> <p><b>NOTES:</b></p> <p>1. <b>CAUTION:</b> In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.</p> <p>2. <b>GROUNDING TERMINAL:</b> A grounding terminal (GND) is provided. When installing open type switches connect this terminal to the metal enclosure or an equivalent earth ground.</p> <p>3. <b>WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.</b></p> <p>4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.</p> <p>5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE IS NOT SUPPLIED. RIGHT-HAND POLE IS NOT SUPPLIED ON 400 AMP UNITS.</p>

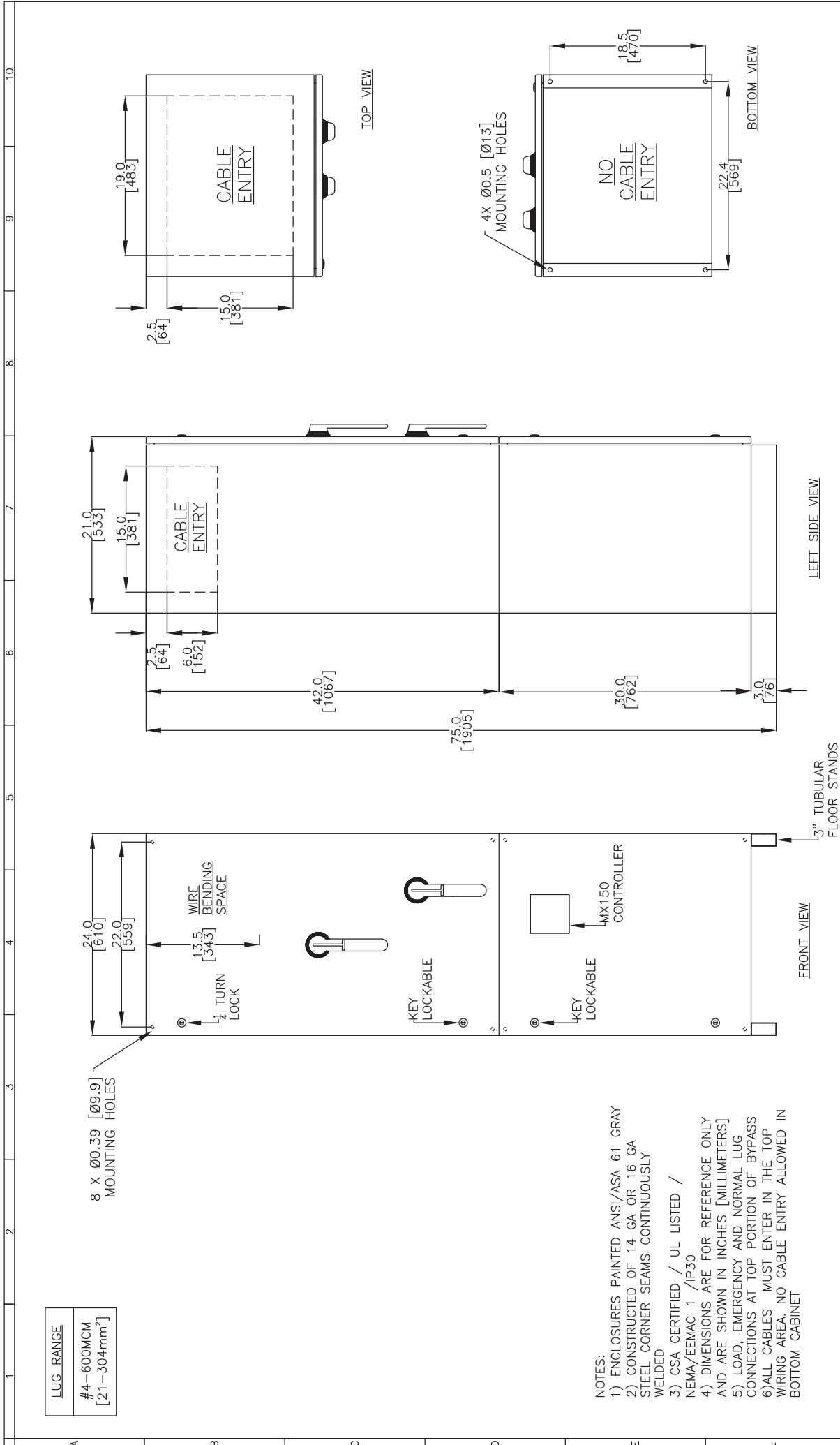
GE PROPRIETARY AND CONFIDENTIAL INFORMATION	FOR ADDITIONAL INFO REFER TO	SIGNATURES	DATE	GE Zenith Controls	
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.	APPLIED PRACTICES	MODEL GG	2/13/03	LEGEND, OPERATION, AND ACCESSORIES	
	TOLERANCES ON:	CHECKED			TITLE
	2 PL. DECIMALS ± .020	ENGRG FS			
	3 PL. DECIMALS ± .005	MFG			
THIRD ANGLE PROJECTION	ANGLES ± 1°	QUALITY			
	FRACTIONS ± 1/64	ISSUED			
	FINISH	DRAWING FILE: 70a-0900-g-1.dwg	FIRST MADE FOR:	SIZE	
AutoCad Generated	MODEL / ASSEMBLY FILE: ZTGAA-400 (40-4000 A)	CAGE CODE	DWG NO		
	# CTOs	CRITICAL TO QUALITY CHARACTERISTIC	SCALE: -	70A-0900	
				SHEET 1 OF 1	











LUG RANGE
#4-600MCM [21-304mm <sup>2</sup> ]

- NOTES:
- 1) ENCLOSURES PAINTED ANSI/ASA 61 GRAY
  - 2) CONSTRUCTED OF 14 GA OR 16 GA STEEL CORNER SEAMS CONTINUOUSLY WELDED
  - 3) CSA CERTIFIED / UL LISTED / NEMA/EEMAC 1 /IP30
  - 4) DIMENSIONS ARE FOR REFERENCE ONLY AND ARE SHOWN IN INCHES [MILLIMETERS]
  - 5) LOAD, EMERGENCY AND NORMAL LUG CONNECTIONS AT TOP PORTION OF BYPASS
  - 6) ALL CABLES MUST ENTER IN THE TOP WIRING AREA. NO CABLE ENTRY ALLOWED IN BOTTOM CABINET

REV	DESCRIPTION	DATE	APPR.	DRAWN S.L.	APPROVED	DATE 25/09/16	SCALE N.T.S.	GE	400 Amp 600 Volt 3 Phase, 3 Pole Solid Neutral Automatic Transfer Switch Single Sided Bypass for Life Safety	GE Zenith Controls	SHOP NUMBER: Forestside Towns	DWG NUMBER:	SHEET 1 OF 1



## REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
D	S-8079	REVISED DWG 01/24/04	AMG FS

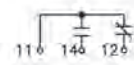
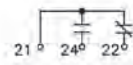
## Elevator Pre/Post Contacts

## RELAY OUTPUT MODULE

## SCHEMATIC



CLIP.....PS-3147...(1) or (2) as required

T3/W3  
OUTPUTT3/W3  
OUTPUT

CONTACT RATING: 10A @ 250 VAC or 30 VDC

## OPTIONAL ACCESSORIES

- T3/W3 -Transfer pre-signal time delay.
- Normally open Auxiliary contact for elevator pre-signal.
  - Closes 0-60 seconds prior to transfer in either direction and reopens after transfer.
  - Timers are adjustable, 0-60 seconds in 1 second increments, factory default is 20 seconds.
  - Timers are bypassed when transferring from dead source.

## NOTES/INSTRUCTIONS

1. MOUNT RELAY OUTPUT MODULE ON DIN RAIL ON MX150 CONTROL PANEL.
2. PLACE IDENTIFICATION LABEL ON RELAY OUTPUT MODULE AND FILL IN OPTION CODE AS REQUIRED. ENABLE T3/W3.
3. FOR MORE THEN FOUR T3/W3 CONTACTS, ADDITIONAL RELAY OUTPUT MODULES MUST BE USED.

## TO SET TIMERS:

FROM S1 OK SCREEN:

1. Press **MORE**.
2. Press **SET** to **SET USER SETUP** menu.
3. Press **MORE** to scroll to **SET LOAD PRE-SIGNAL TD** then press **SEL**.
4. Enter Access code located on in white label on the inside cover, then press **SEL**.
5. Cursor is indicated as a line under character to be changed. Change values with up and down keys. Press **SAVE** after each entry to move to the next value to be changed.
6. When complete, press **MORE** to scroll to **BACK**.
7. Press **ESC** to the S1 OK screen.
8. During operation, ATA (Alternate Timer Active), indicates that there is another timer that is active or about to be active during or after the present timing cycle.
9. To display the status of that timer, press **MORE**.

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THIRD ANGLE PROJECTION



FOR ADDITIONAL INFO REFER TO

TOLERANCES ON:  
2 PL. DECIMALS ± .020  
3 PL. DECIMALS ± .005  
ANGLES ± 1°  
FRACTIONS ± 1/64

FINISH

AutoCad Generated

SIGNATURES

MGR.	GG	DATE	11/02/02
CHECKED			
ENGRG	FS		
MFG			
QUALITY			
ISSUED			

DRAWING FILE: 70r-1003-d-1.dwg  
MFG ASSEMBLY FILE: M X 150

# CTOs

CRITICAL TO QUALITY CHARACTERISTIC



GE Zenith Controls

TITLE

T3/W3 OPTIONS  
MX150

FIRST MADE FOR:

SIZE CAGE CODE

DWG NO

SCALE: -

SHEET 1 OF 1



