



Weaver

CONSTRUCTION MANAGEMENT

3679 S Huron Street, Suite 404 Englewood, Colorado 80110

Phone: (303) 789-4111 FAX: (303) 789-4310

SUBMITTAL TRANSMITTAL

February 20, 2012

Submittal #: 16231-001

PROJECT: **Harold Thompson Regional WRF**
Birdsall Rd.
Fountain, CO 80817
Job No. 2908

ENGINEER: **GMS, Inc.**
611 No. Weber St., #300
Colorado Springs, CO 80903
719-475-2935 Roger Sams

OWNER: **Lower Fountain Metropolitan
Sewage Disposal District**
901 S. Santa Fe Ave.
Fountain, CO 80817
719-382-5303 James Heckman

CONTRACTOR: **McDade Woodcock, Inc.**
7222 Commerce Center Drive, #245
Colorado Springs, CO 80909
719-264-1236

SUBJECT: Electrical Submittal - 16231-001 600 kW & 1250 kW GenSets w/ 800 Amp & 2000 Amp ATS's (Hard copy and CD in mail)

SPEC SECTION: 16231

PREVIOUS SUBMISSION DATES: none

DEVIATIONS FROM SPEC: ___ YES x NO

CONTRACTOR'S STAMP: This submittal has been reviewed by Weaver Construction Management and, unless indicated otherwise, has been found to be in conformance with the intent of the contract documents.

Contractor's Stamp:

Engineer's Stamp:

Date:

Reviewed by: John Jacob

(X) Reviewed Without Comments

() Reviewed With Comments

ENGINEER'S

COMMENTS:



**Rocky
Mountain**

Power Generation Division
8211 East 96th Avenue
Henderson, CO 80640

**Project: Harold D Thompson Water Reclamation
Contractor: McDade Woodcock
Submittal: #1 Rev.0
Date:2/2/12**

**600 kW Generator Set
Zenith - 800 Amp ZBTS ATS**



Sales Representative: Brian Taylor
Phone: (303) 927-2248
Email: brian.d.taylor@cummins.com

Our energy working for you.™



**Power
Generation**

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Generator Package Weight

	Weight in Pounds	Weight in Kilograms
Generator Wet Weight (oil & coolant)	14,372.00	6,519.03
Enclosure & Exhaust Silencer	7,000.00	3,175.15
Fuel Tank	6,500.00	2,948.35
Accessories	543.40	246.48

	Weight in Pounds	Weight in Kilograms
Total Ship Weight without Fuel	28,415.40	12,889.01

	Weight in Pounds	Weight in Kilograms
Total Pad Weight with Fuel	40,335.40	18,295.83

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Bill of Materials
Harold D Thompson Water Reclamation
600 kW Generator Set
800 Amp Automatic Transfer Switch
McDade Woodcock
CRM Project #63439, Revision # 0

Line	Qty.	Description	Part Number
1			
2	1	Cummins Diesel Generator Set	600 DQCA
3		Full Rated Output To: 8,875 Ft. Elevation, 104° F Ambient	
4		Duty Rating-Standby Power	A331
5		600 kW, 750 kVA, 0.8 P.F., 60 Hz, 1800 RPM	B601
6		Listing-UL2200	L090
7		Cert-Seismic, IBC2000,2003,2006, Ss=3.41g.rooftop	L156
8		Emission Certification-EPA, Tier 2, NSPS CI	L170
9		Stationary Emergency	
10		Voltage- 277/480 VAC , 3-Phase, Wye	R002
11			
12		Equipped with:	
13		Set Control-PCC2100 Generator Control Panel	H643
14		Engine/Generator Safeties	
15		Auto Start/Stop Control	
16		Display-Control, Graphical	H605
17		Meters-AC Output Analog	H606
18		Display Language-English	H536
19		Alarm-Audible, Engine Shut Down	KA08
20		Control Mounting-Front Facing	H679
21		Fuel/Water Separator	C127
22		Radiator 50°c Ambient, With Pusher Fan	E074
23		Shutdown-Low Coolant Level	H389
24		Engine Air Cleaner	D041
25		Heater-Alternator	A293
26		240 VAC = 300 Watts / 1.25 Amps	
27		Single Water Jacket Heater, Single Phase	H557
28		Reconnectable To The Following VAC:	
29		240 VAC = 6,420 Watts, 26.75 Amps Total	
30		Product Revision - B	SPEC-B
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Line	Qty.	Description	Part Number
37			
38		PCC2100 Control Custom Fault Inputs	
39		Cust. Fault #1 - Battery Charger Fault	
40		Cust. Fault #2 - Ground Fault Indication	
41		Cust. Fault #3 - Low Fuel Level	
42		Cust. Fault #4 - Rupture Basin Alarm	
43			
44		Common Alarm Relay Option - PCC2100 Control	
45	1	Common Alarm Relays-Genset Status, User Configured	K631
46		Optional Configurable Output Relays: 10 Amp @ 30 VDC	
47		(2) Form-A & (2) Form-B Contacts Per Relay	
48		Cust. Relay #1 - Common Alarm, Warning Faults	
49		Cust. Relay #2 - Common Alarm, Shutdown Faults	
50		Cust. Relay #3 - Mode Control Switch-Not In Auto	
51		Standard Configurable Relay Outputs:	
52		2 Amp @ 30 VDC / 3 Amp @ 120 VAC	
53		Cust. Output #4 - Generator Running (Ready to Load)	
54		Installed In PCC2100 Genset Control	
55			
56		Network Communications Module Option - PCC2100 Control	
57	1	Interface-Communications Network Module, FTT-10	KP60
58		Installed In PCC2100 Genset Control	
59			
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71			
72		Digital Input/Output Module-Base Kit	
73	1	Digital Input/Output Module-Base (FT-10)	0541-0771
74		Eight (8) Form-C Relay Output Sets	
75		Relay Ratings:	
76		2 Amp @ 30 VDC / 2 Amp @ 250 VAC	
77		Four (4) Discrete Dry Contact Inputs	
78		Discrete Inputs Have The Following Configuration Options:	
79		Active High or Active Low	
80		Event - Warning or Shutdown	
81		Programmable Text - Displayed On Genset HMI	
82		Installation By Electrical Contractor	
83		Installation Recommendation: Install Close To The BAS	
84			
85		Digital Input/Output Module-Expansion Kit	
86	1	Digital Input/Output Module-Expansion	0541-0772
87		Eight (8) Form-C Relay Output Sets	
88		Relay Ratings:	
89		2 Amp @ 30 VDC / 1 Amp @ 125 VAC	
90		Four (4) Discrete Dry Contact Inputs	
91		Discrete Inputs Have The Following Configuration Options:	
92		Active High or Active Low	
93		Event - Warning or Shutdown	
94		Programmable Text - Displayed On Genset HMI	
95		Installation By Electrical Contractor	
96		Installation Recommendation: Install Close To The BAS	
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Line	Qty.	Description	Part Number
105			
106		Remote Network Annunciator-FT10	
107	1	Cummins Remote Network Annunciator Panel, 20 Light	0541-0814-02
108		Flush/Surface NEMA Type 1 Enclosure	
109		Cust. Fault #1 - Battery Charger Fault	
110		Cust. Fault #2 - Ground Fault Indication	
111		Cust. Fault #3 - Low Fuel Level	
112		Cust. Fault #4 - Rupture Basin Alarm	
113		Contractor Note: FT10 Network Cabling Requirements.	
114		Requires Twin Power Conductors, Stranded Twisted Pair,	
115		Unshielded Network Data Cable. (Belden 85102 or 8471)	
116		Installation By Electrical Contractor	
117			
118		KP91 - PJ 800 Amp (Main Line Circuit Breaker)	
119	1	Cummins/Square D Local Main Line Circuit Breaker	KP91
120		Ref. Square D Catalog #0612CT010R01/06	
121		Square D/PJ Circuit Breaker - 800 Amp	
122		PJ-800 Amp Current Sensor Set @ 800 Amp Trip	
123		UL/IEC Listed, Service Entrance, 100% Rated, 3-Pole	
124		Interrupting Rating 100 kA @ 240 VAC	
125		Interrupting Rating 65 kA @ 480 VAC	
126		MICROLOGIC 3.0 Trip Unit, Type F-Rating Plug	
127		Adjustable Solid State Trip Unit-672 to 800 Amp	
128	1	Circuit Breaker Accessory, 24 VDC Shunt Trip	KP99
129		Auxiliary & Trip Contacts, Left Side	
130	1	Indication-Ground Fault,3-Pole Xfr Sw, Rmt Mt CT	H666
131		NEMA Type 1 Enclosure	
132		Full Neutral Bus & Ground Bond	
133		Mechanical Lugs: (3) 3/0 AWG-500 KCMIL CU Per Phase	
134		(Mounted Left Side Of The Control Panel)	
135			
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Line	Qty.	Description	Part Number
139			
140		Cummins Engine Coolant & Lube Oil	
141	1-Lot	Initial Fill of Engine Coolant, Ethylene Glycol	50/50
142	1-Lot	Initial Fill of Lube Oil, Cummins Blue	15W/40
143			
144		Cummins Factory Testing	
145	1	Cummins Typical Generator Set Production Test	CPG TGSPT
146			
147		Cummins Generator Set Warranty	
148	1	Warranty: 5-Year Extended Coverage	L030
149		From Initial Date Of Start-Up	
150			
151		Engine Starting Batteries	
152	2	Diesel Engine Starting Batteries, 8D Lead/Acid Type	908D
153			
154		Engine Starting Batteries Warming Pads	
155	2	Kim Battery Warming Pads, 120 VAC, 75 Watt Each	KB7515
156	1	Thermostat, On at 40°F, Off at 60°F	DIT46
157			
158		SENS 10 Amp Battery Charging System	
159	1	SENS EnerGenius Battery Charger, NFPA-110 Alarms	NRG22-10-RC
160		10 Amp @ 12/24 VDC Output, 60HZ-120/208-240 VAC Input	
161			
162		632H / ACE Vibration Isolators	
163	8	ACE Seismic Control Spring Isolators, Zone 3	632H
164		3600 Lb. Each, 1" Deflection	
165			
166		Exhaust System	
167	1	Harmony Series Critical Grade Cool Series - Silencer	K-H1-5-4072001
168		Compressed Thermal/Acoustical Fiberglass Packed-	
169		Stainless Steel Corrugated Flex Connectors and Rain Cap	
170		Nut, Bolt and Gasket Hardware	
171			
172			

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Line	Qty.	Description	Part Number
173			
174		Weather Protective Enclosure	
175	1	Genset Enclosure - Weather Protective	4072001
176		No Duct, No Insulation	
177		UL2200 Listed & Labeled	
178		14 Gauge Steel Construction	
179		Four Point Lifting System For Enclosure Only	
180		Two Sets of Double 72" Doors Per Side	
181		One Single 36" Door Per Side	
182		All Door Latches Keyed Alike	
183		Motorized Inlet Louver Air Intake With Screen	
184		Gravity Radiator Discharge Louver With Screen	
185		Interior Mounted Exhaust Silencer	
186		Paint Color: Cummins Beige	
187			
188		Genset Enclosure Electrical	
189	1	15kVA Single Phase Mini Power-Zone	MPZ15S40F
190		High Voltage: 480 VAC, Low Voltage: 120/240 VAC	
191		NEMA 3R Enclosure	
192		Primary Main Circuit Breaker: 70 Amp	
193		Secondary Main Circuit Breaker: 80 Amp	
194		(24) 1-Pole Breakers, (12) 2-Pole Breakers	
195	5	SQD - Miniature Circuit Breaker-20 Amp	QOB120
196	2	SQD - Miniature Circuit Breaker-30 Amp	QOB230
197		Enclosure Electrical Components	
198	2	3 way Toggle Switch	HBL1203IVORY
199	1	4 Way Toggle Switch	HBL1224IVORY
200	6	NEMA 5-20R 20 Amp 120 VAC GFCI Receptacle	GFR5362IVORY
201	5	FLUORESCENT SCREW IN (JELLY JAR)	CF15EL/TWIST
202	2	Emergency Lighting with Two 6-VDC Lamp Heads	4PG94
203	1	Interior Space Heater	3UG73
204			
205			
206			

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Line	Qty.	Description	Part Number
207			
208		Genset Sub-Base Fuel Tank	
209	1	UL142, Double Wall Sub-Base Fuel Tank, 1490G Max Cap	2072001-XL
210		UL-142 Listed & Labeled	
211		Engine Supply & Return Connections	
212		Integral Welded Fuel Fill Spill Containment	
213		Stub-Up Zone	
214		Pads for ACE Mountings Vibration Isolators	
215	1	2" Normal Vent-Fuel Cell - C&B	401-01-2000
216	1	2" Normal Vent-Containment Basin - C&B	401-01-2000
217	2	6" Emergency Vent-Fuel Cell - OPW	201M-8081
218	2	6" Emergency Vent-Containment Basin - OPW	201M-8081
219	1	Mechanical Fuel Level Gauge - Krueger	FG-13
220	1	Low Level Float Switch - 50% Fuel Level - Madison	M4500-01BK70
221	1	High Level Float Switch - 90% Fuel Level - Madison	M4500-01BK70
222	1	Basin Leak Detection Float Switch - Madison	M4500-01BK70
223	1	High Fuel Level Alarm Kit - C&B	1400-13-1000
224		Set High Fuel Level Float Switch @ 90%	
225	1	61fSTOP-Overfill Prevention Valve-Set @ 95% - OPW	61fSTOP-2000
226		Equipped with Drop Tube For Submerged Filling	
227		*Extend Normal Vent 12' Above Grade	
228	1	2" Camlock Locking Cap - OPW	634B-1050
229	1	Exterior Color - Black Paint	Paint
230			
231		#2 Diesel Fuel	
232	1	Initial Fill - 1490 Gallons	#2 Diesel Fuel
233	1	Refill After Testing - 170 Gallons	#2 Diesel Fuel
234			
235		CRM On-Site Testing	
236	1	CRM Site Tests:	4-Hour Load Test
237		4-Hour Load Test With CRM Resistive Load Bank	
238		CRM Test Documentation Required	
239			
240			

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Line	Qty.	Description	Part Number
241			
242		O&M Manual's	
243	4	Operator's & Maintenance Manuals - DQCA	0998-0058-02
244	4	Operator's & Maintenance Manuals - ZBTS	
245			
246		Spare Parts	
247	2	Engine Oil Filter (Fleetguard)	LF670
248	1	Engine Air Filters (Fleetguard)	AF25593
249	2	Engine Fuel Filters (Fleetguard)	FS1006
250	1	Engine Water Filter (Fleetguard)	WF2076
251	1	Replacement Element - 10 Micron	2020TM-OR
252	2	ATM Mini 2-Amp Fuse-Gray	ATM-2
253	2	ATM Mini 5-Amp Fuse-Tan	ATM-5
254	2	ATM Mini 10-Amp Fuse-Red	ATM-10
255			
256		Maintenance Service Contract - 1 Year	
257	1	Maintenance Service Contract - 1 Year - To Include:	Service Contract
258		1-Minor & 1-Major Maintenance Service	
259		Minor Service Includes: Inspection of Unit and Fluid Levels.	
260		Test Transfer Switch Operation if Allowed By Owner	
261		Major Service Includes: Changing Engine Oil and Oil Filters.	
262		Changing Engine Fuel and Air Filters.	
263		Note: All Services Done During Normal Weekday Business Hours.	
264			
265	1	Zenith 800 ZBTS	ZBTS00B00080EZ-
266		Amps: 800	EC01ZVC70MEXE
267		Volts:277/480 - 3 Phase, 4 Wire	
268		Poles: 3	
269		Enclosure: NEMA 1	
270		Cable Entry: Top & Bottom	
271		Weight: 1355 lbs.	
272		Dimensions: 90"H x 40" W x 42.25" D	
273		Lugs: 4 #2 to 600 MCM-mech style lugs for all connections	
274		(No ground lugs or bus included)	

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PROTOTYPE TEST SUPPORT (PTS) 60 HZ TEST SUMMARY				
GENERATOR SET MODELS		REPRESENTATIVE PROTOTYPE		
600DQCA	750DQCB	Model:	800DQCC	
800DQCC		Alternator:	HC6H	
		Engine:	QSK23-G3 NR1	



The following summarizes prototype testing conducted on the designated representative prototype of the specified models. This testing is conducted to verify the complete generator set electrical and mechanical design integrity. Prototype testing is conducted only on generator sets not sold as new equipment.

Maximum Surge Power: 833 kW

The generator set was evaluated to determine the stated maximum surge power.

Torsional Analysis and Testing:

The generator set was tested to verify that the design is not subjected to harmful torsional stresses. A spectrum analysis of the transducer output was conducted over the speed range of 1350 to 1950 RPM.

**Cooling System: 50 °C Ambient
0.5 in. H2O restriction**

The cooling system was tested to determine ambient temperature and static restriction capabilities. The test was performed at full rated load in elevated ambient temperature under stated static restriction conditions.

Durability:

The generator set was subjected to a minimum 500 hour endurance test operating at variable load up to the standby rating based upon MIL-STD-705 to verify structural soundness and durability of the design.

Electrical and Mechanical Strength:

The generator set was tested to several single phase and three phase faults to verify that the generator can safely withstand the forces associated with short circuit conditions. The generator set was capable of producing full rated output at the conclusion of the testing.

Steady State Performance:

The generator set was tested to verify steady state operating performance was within the specified maximum limits.

Voltage Regulation:	±0.50%
Random Voltage Variation:	±0.50%
Frequency Regulation:	Isochronous
Random Frequency Variation:	±0.25%

Transient Performance:

The generator set was tested with the standard alternator to verify single step loading capability as required by NFPA 110. Voltage and frequency response on load addition or rejection were evaluated. The following results were recorded:

Full Load Acceptance:

Voltage Dip:	35.0	%
Recovery Time:	2.5	Second
Frequency Dip:	8.3	%
Recovery Time:	3.5	Second

Full Load Rejection:

Voltage Rise:	24.1	%
Recovery Time:	1.2	Second
Frequency Rise:	3.8	%
Recovery Time:	1.6	Second

Harmonic Analysis:

(per MIL-STD-705B, Method 601.4)

Harmonic	Line to Line		Line to Neutral	
	No Load	Full Load	No Load	Full Load
3	0.052	0.04	0.144	0.092
5	0.128	1.36	0.058	1.32
7	1	0.196	1	0.19
9	0.012	0.034	0.033	0.066
11	0.985	0.84	1.01	0.83
13	0.158	0.32	0.12	0.29
15	0	05	0.025	0.022

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THE VMC GROUP
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SEISMIC DESIGN
OF
NON-STRUCTURAL
COMPONENTS AND SYSTEMS



**Power
Generation**

CERTIFICATE OF COMPLIANCE

Cummins Power Generation has qualified the listed standard engine generator set packages as CERTIFIED¹ for seismic application.

The basis of qualification is by shake table testing and analysis, in accordance with the following International Building Code² (IBC) releases.

IBC 2000, IBC 2003, IBC 2006

The following model designations and bulleted options are included in this certification. A complete list of certified models, options, and installation methods are detailed in reports numbered VMA-44898-1, -2, and -3 as issued by The VMC Group.

Model Designation	Rating (kW)	Steel Enclosure Options				Aluminum Enclosure Options			Fuel Tank Options
		Basic Open Generator Set	Weather Protective	Sound Level 1	Sound Level 2	Weather Protective	Sound Level 1	Sound Level 2	Standard Sub-base
DQFAA, DQFAB, DQFAC, DQFAD	750/800/800/1000	•	•	•	•	•	•	•	•
DQCA, DQCB, DQCC	600/750/800	•	•	•	•	•	•	•	•
DQMAA	600	•	•	•	•	•	•	•	•

This certification includes the open generator set and the enclosed generator set when installed with or without the sub-base tank and with or without a package mounted radiator, as limited by the table above. The generator set and included options must be a catalogue design and factory supplied. The generator set and applicable options must be installed and attached to the building structure per the manufacturer supplied seismic installation instructions. This certification is exclusive only to factory supplied accessories. Non-factory accessories such as, but not limited to, mufflers, remote radiators, isolation/restraint devices, and electrical components are beyond the scope of this certification.

The above referenced equipment is APPROVED for seismic application when properly installed,³ used as intended, and located in the United States. Lookup the interpolated project specific Design Spectral Response Acceleration at Short Periods, S_{DS} , value in the table below as it pertains to the applicable building code and Importance Factor, I_p , and compare to the allowed value. As limited by the tabulated values, below grade, grade, and roof-level installations, as well as installations in essential facilities and for life safety applications, both requiring post event functionality, were $I_p=1.5$ are permitted and included in this certification.

The basis of this certification is through finite element analysis of the main force resisting members of the unit. Additional calculations were conducted to ensure components, accessories, and options remained intact and attached to the unit under seismic load conditions. All non-robust components, considered critical to the unit's continued function, were successfully shake tested, in three (3) orthogonal axes, under the witness of and analytical evaluation by an independent approval agency, The VMC Group. Seismic shake table testing was conducted in accordance with ICC-ES AC-156 to envelope the required response spectrum (RRS) of maximum flexible region acceleration (A_{FLEX}) of 3.09g and a zero period acceleration (A_{RIG}) of 2.32g.

For calculations and analysis, the Seismic Design Acceleration, F_p/W_p ,⁴ was calculated as 4.35g for Load Resistance Factored Design (LRFD) methods, equivalent to 3.04g for Allowable Stress Design (ASD) methods. All calculations were conducted using the ASD analysis method. This included but was not limited to the skid anchoring requirements tank anchoring requirements, tank to skid attachment, enclosure to skid attachment, tank structural comparison, enclosure structural comparison, internal isolation ratings, and various component stress analyses. The Seismic Design Acceleration, F_p/W_p , used for calculations and analysis, is defined per the building code (or respective design standard) for the section titled Seismic Design Requirements for Non-structural (architectural, mechanical, and electrical) Components. The seismic design level is based on the LRFD calculation shown below.

IBC 2006	$F_p/W_p = 0.4 \times (S_{DS}=1.93) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.25) \times (1+2(z/h=1.0))$	= 4.35g
	$F_p/W_p = 0.4 \times (S_{DS}=2.28) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.25) \times (1+2(z/h=0.77))$	= 4.35g
IBC 2003 / 2000	$F_p/W_p = 0.4 \times (S_{DS}=2.41) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.00) \times (1+2(z/h=1.0))$	= 4.35g
	$F_p/W_p = 0.4 \times (S_{DS}=2.46) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.00) \times (1+2(z/h=0.96))$	= 4.35g

This certification covers all applications that fall below the limitations in the chart below.

IBC 2006	IBC 2006	IBC 2003 / 2000	IBC 2003 / 2000
$S_{DS} \leq 1.93$	$1.93 < S_{DS} \leq 2.28$	$S_{DS} \leq 2.41$	$2.41 < S_{DS} \leq 2.46$
$I_p \leq 1.5$	$I_p \leq 1.5$	$I_p \leq 1.5$	$I_p \leq 1.5$
$a_p/R_p \leq 1.25$	$a_p/R_p \leq 1.25$	$a_p/R_p \leq 1.0$	$a_p/R_p \leq 1.0$
$z/h \leq 1.0$ (roof)	$z/h = 0.77$	$z/h \leq 1.0$ (roof)	$z/h = 0.96$

Soil Classes A, B, C, D, E, Seismic Use groups I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the S_{DS} value stated above.



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SEISMIC DESIGN
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**Power
Generation**

CERTIFICATE OF COMPLIANCE

Notes and Comments:

1. All equipment listed herein successfully passed the seismic acceptance criteria for shake testing non-structural components and systems as set forth in the ICC AC-156 (2007). The test response spectrum (TRS) enveloped the design response spectrum (DRS) for all units tested. The units cited in this certification were representative samples of a contingent of models and all remained captive and structurally sound after the seismic shake simulation. The units also remained functionally operational after the simulation testing as functional testing was completed by the equipment manufacturer before and after the seismic simulations. Although a seismic qualified unit inherently contains some wind resisting capacity, that capacity is undetermined and is excluded from this certification. Snow/Ice loads have been neglected and thus limit the unit to be installed both indoors (covered by an independent protective structure) and out of doors (exposed to accumulating snow/ice) for snow/ice loads no greater than 30 psf for all applications.
2. The following building codes are addressed under this certification:
 - IBC 2000 – referencing ASCE 7-98 and ICC AC-156
 - IBC 2003 – referencing ASCE 7-02 and ICC AC-156
 - IBC 2006 – referencing ASCE 7-05 and ICC AC-156
3. Refer to the manufacturer supplied installation drawings for anchor requirements and mounting considerations for seismic applications. Required anchor locations, size, style, and load capacities (tension and shear) are specified on the installation drawings. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection, wall design, and attachment to non-building structures must be outlined and approved by the Engineer of Record for the project or building. Structural walls, structural floors, and housekeeping pads must also be seismically designed and approved by the project or building Structural Engineer of Record to withstand the seismic anchor loads as defined on the installation drawings. The installing contractor is responsible for observing the installation requirements detailed in the seismic installation drawings and the proper installation of all anchors and mounting hardware.
4. When the site soil properties or final equipment installation location are not known, the soil site coefficient, F_A , defaults to the Soil Site Class D coefficient. Soil Classes A, B, C, D, E, Seismic Use groups I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the S_{ds} values on page 1, respective to the applicable building code, Importance factor, and z/h ratio. A seismic importance factor, $I_p=1.5$, applies to this certification to include essential facility requirements and life safety applications for post event functionality.

Certification Issued By: The VMC Group
Document Control Number: VMA-44898-CCS (Revision 2)

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Expiration Date: 12/31/2011



John P. Giuliano, PE
President, The VMC Group

Gary A. Lafine
Product Management Director
Consumer and Genset Business
Cummins Power Generation

Diesel generator set QSK23 series engine



> **Specification sheet**
545 kW - 800 kW 60 Hz



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Description

Cummins Power Generation commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary standby and prime power applications. Codes or standards compliance may not be available with all model configurations – consult factory for availability.



This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.



The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins Power Generation products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.



All low voltage models are CSA certified to product class 4215-01.



The generator set is available listed to UL 2200, Stationary Engine Generator Assemblies for all 60 Hz low voltage models. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage. Circuit breaker assemblies are UL 489 Listed for 100% continuous operation and also UL 869A Listed service Equipment.

U.S. EPA

Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 2 exhaust emission levels. U.S. applications must be applied per this EPA regulation.

Features

Cummins® heavy-duty engine - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

Alternator - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

Permanent magnet generator (PMG) - Offers enhanced motor starting and fault clearing short-circuit capability.

Control system - The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

Cooling system - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

Enclosures - Optional weather protective and sound attenuated enclosures are available.

NFPA - The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

Model	Standby rating		Prime rating		Continuous rating		Data sheets	
	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz	50 Hz
DQCA	600 (750)		545 (684)				D-3352	
DQCB	750 (938)		600 (750)				D-3353	
DQCC	800 (1000)		725 (906)				D-3354	

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Generator set specifications

Governor regulation class	ISO8528 Part 1 Class G3
Voltage regulation, no load to full load	± 0.5%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Radio frequency emissions compliance	IEC 801.2 through IEC 801.5; MIL STD 461C, Part 9

Engine specifications

Bore	169.9 mm (6.69 in)
Stroke	169.9 mm (6.69 in)
Displacement	23.15 litres (1413 in ³)
Configuration	Cast iron, in line 6 cylinder
Battery capacity	1400 amps minimum at ambient temperature of 0 °C to 10 °C (32 °F to 50 °F)
Battery charging alternator	35 amps
Starting voltage	24 volt, negative ground
Fuel system	Direct injection: number 2 diesel fuel, fuel filter, automatic electric fuel shutoff
Fuel filter	Spin-on fuel filters with water separator
Air cleaner type	Dry replaceable element with restriction indicator
Lube oil filter type(s)	Fleetguard dual venturi spin-on, combination full flow and bypass filters
Standard cooling system	High ambient radiator

Alternator specifications

Design	Brushless, 4 pole, drip proof revolving field
Stator	2/3 pitch
Rotor	Single bearing, flexible discs
Insulation system	Class H
Standard temperature rise	125 °C standby at 40 °C ambient
Exciter type	PMG (permanent magnet generator)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower fan
AC waveform total harmonic distortion	< 5% no load to full linear load, < 3% for any single harmonic
Telephone influence factor (TIF)	< 50 per NEMA MG1-22.43
Telephone harmonic factor (THF)	< 3

Available voltages

60 Hz line-neutral/line-line	50 Hz line-neutral/line-line
<ul style="list-style-type: none"> • 110/190 • 115/200 • 120/208 • 127/220 • 139/240 • 220/380 • 230/380 • 240/416 • 255/440 • 277/480 • 347/600 	

* Note: Consult factory for other voltages.

Generator set options and accessories

Engine

- 208/240/480 V coolant heater for ambient above 4.5 °C (40 °F)
- Fuel/water separator
- Heavy duty air cleaner

Control panel

- 120/240 V 100 W control anti-condensation heater
- Paralleling configuration
- Remote fault signal package
- Run relay package

Alternator

- 80 °C rise
- 105 °C rise
- 125 °C rise
- 120/240 V anti-condensation heater
- Temperature sensor - alternator bearing RTD

Cooling system

- 50 °C ambient

Exhaust system

- Industrial grade exhaust silencer
- Residential grade exhaust silencer
- Critical grade exhaust silencer

Generator set

- AC entrance box
- Battery
- Battery rack with hold-down - floor standing

- Circuit breaker - set mounted
- Disconnect switch - set mounted
- PowerCommand Network
- Remote annunciator panel
- Spring isolators
- 2 year warranty
- 5 year warranty
- 10 year major components warranty

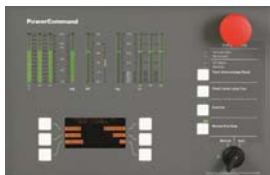
* Note: Some options may not be available on all models - consult factory for availability.

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S-1551g (6/11)

Control system PCC 3201



PowerCommand control is an integrated generator set control system providing governing, voltage regulation, engine protection and operator interface functions. Major features include:

- Integral AmpSentry™ Protective Relay providing a full range of alternator protection functions that are matched to the alternator provided.
- Battery monitoring and testing features and smart starting control system.
- Three phase sensing, full wave rectified voltage regulation system, with a PWM output for stable operation with all load types.
- Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics.
- Optional Echelon® LONWORKS® network interface.

Operator/display panel

- Off/manual/auto mode switch
- Manual run/stop switch
- Panel lamp test switch
- Emergency stop switch
- Exercise switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments
- LED lamps indicating not in auto, common warning, common shutdown, remote start
- Configurable for local language

Engine protection

- Overspeed shut down
- Low oil pressure warning and shut down
- High coolant temperature warning and shut down
- High oil temperature warning
- Low coolant level warning or shut down
- Low coolant temperature warning
- High and low battery voltage warning
- Weak battery warning
- Dead battery shut down
- Fail to start (overcrank) shut down
- Fail to crank shut down
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication

Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature
- Lube oil temperature
- Engine speed
- Engine ECM data

AmpSentry AC protection

- Over current and short-circuit shut down
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shut down
- Over and under frequency shut down
- Overload warning with alarm contact
- Reverse power and reverse Var shut down

Alternator data

- Line-to-line and line-to-neutral AC volts
- Three phase AC current
- Frequency
- Total and individual phase power factor, kW and kVA
- Bus voltage and frequency (with paralleling options)

Other data

- Genset model data
- Start attempts, starts, running hours
- kW hours (total and since reset)
- Fault history
- Load profile (accessible with InPower)

Governing

- Digital electronic isochronous governor
- Temperature dynamic governing
- Smart idle speed mode

Voltage regulation

- Digital PWM electronic voltage regulation
- Three phase line-to-neutral sensing
- Single and three phase fault regulation
- Configurable torque matching

Control functions

- Data logging on faults
- Fault simulation (requires InPower)
- Time delay start and cooldown
- Cycle cranking
- Configurable customer outputs (4)
- Configurable network inputs (8) and outputs (16) (with optional network)
- Remote emergency stop

~~Paralleling (Option)~~

- ~~- Active digital phase lock loop synchronizer~~
- ~~- Isochronous kW and kVar load sharing controls~~
- ~~- kW import/export and kVar/PP control for utility (mains) paralleling~~

Options

- Thermostatically controlled space heater
- Key-type mode switch
- Ground fault module
- Auxiliary relays (3)
- Echelon LONWORKS interface
- Modion Gateway to convert to Modbus (loose)
- PowerCommand iWatch web server for remote monitoring and alarm notification (loose)
- Digital input and output module(s) (loose)
- Remote annunciator (loose)
- Paralleling
- Power transfer control

For further detail see document S-1444.

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S-1551g (6/11)

Ratings definitions

Emergency standby power (ESP):

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Limited-time running power (LTP):

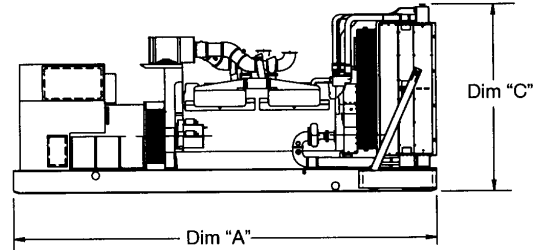
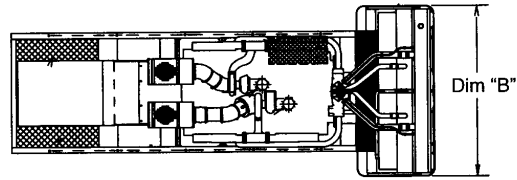
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

Prime power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Base load (continuous) power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

Do not use for installation design

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set Weight* dry kg (lbs)	Set Weight* wet kg (lbs)
DQCA	4394.5 (173)	1715 (68)	2060.1 (81.1)	6377 (14061)	6518 (14372)
DQCB	4394.5 (173)	1715 (68)	2060.1 (81.1)	6377 (14061)	6518 (14372)
DQCC	4394.5 (173)	1715 (68)	2060.1 (81.1)	6377 (14061)	6518 (14372)

* Note: Weights represent a set with standard features. See outline drawings for weights of other configurations.

Cummins Power Generation

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Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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S-1551g (6/11)



Model: DQCA
Frequency: 60
Fuel type: Diesel
KW rating: 600 standby
545 prime
Emissions level: EPA NSPS Stationary Emergency Tier 2

➤ **Generator set data sheet**



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Exhaust emission data sheet:	EDS-1086
Exhaust emission compliance sheet:	EPA-1120
Sound performance data sheet:	MSP-1064
Cooling performance data sheet:	MCP-173
Prototype test summary data sheet:	PTS-160
Standard set-mounted radiator cooling outline:	
Optional set-mounted radiator cooling outline:	
Optional heat exchanger cooling outline:	
Optional remote radiator cooling outline:	

Fuel consumption	Standby				Prime				Continuous
	kW (kVA)				kW (kVA)				kW (kVA)
Ratings	600 (750)				545 (681)				
Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full	Full
US gph	13.0	22.5	33.0	42.0	12.0	21.0	30.0	38.5	
L/hr	49.2	85.2	124.9	159.0	45.4	79.5	113.6	145.7	

Engine	Standby rating	Prime rating	Continuous rating
Engine manufacturer	Cummins Inc.		
Engine model	QSK23-G7 NR2		
Configuration	Cast Iron, in line 6 cylinder		
Aspiration	Turbocharged and air-to-air aftercooled		
Gross engine power output, kWm (bhp)	910 (1220)	680 (905)	
BMEP at set rated load, kPa (psi)	1944 (282)	1752 (254)	
Bore, mm (in)	170 (6.69)		
Stroke, mm (in)	170 (6.69)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	10.21 (2010)		
Compression ratio	16:1		
Lube oil capacity, L (qt)	102 (108)		
Overspeed limit, rpm	2100		
Regenerative power, kW	93		

Fuel flow		
Maximum fuel flow, L/hr (US gph)	685 (181)	
Maximum fuel inlet restriction, kPa (in Hg)	13.44 (4)	
Maximum fuel inlet temperature, °C (°F)	71 (160)	

Air	Standby rating	Prime rating	Continuous rating
Combustion air, m ³ /min (scfm)	59 (2081)	59 (2081)	
Maximum air cleaner restriction, kPa (in H ₂ O)	6.2 (25)		
Alternator cooling air, m ³ /min (cfm)	117 (4156)		

Exhaust

Exhaust flow at set rated load, m ³ /min (cfm)	137 (4830)	137 (4830)	
Exhaust temperature, °C (°F)	440 (824)	429 (804)	
Maximum back pressure, kPa (in H ₂ O)	10.1 (40.8)		

Standard set-mounted radiator cooling

Ambient design, °C (°F)	50 (122)		
Fan load, kW _m (HP)	27 (36)		
Coolant capacity (with radiator), L (US gal)	89 (23.5)		
Cooling system air flow, m ³ /min (scfm)	1252 (44183)		
Total heat rejection, MJ/min (Btu/min)	26.4 (25002)	26.4 (25002)	
Maximum cooling air flow static restriction, kPa (in H ₂ O)	0.12 (0.5)		
Maximum fuel return line restriction kPa (in Hg)	30.47 (9)		

Optional set-mounted radiator cooling

Ambient design, °C (°F)			
Fan load, kW _m (HP)			
Coolant capacity (with radiator), L (US gal)			
Cooling system air flow, m ³ /min (scfm)			
Total heat rejection, MJ/min (Btu/min)			
Maximum cooling air flow static restriction, kPa (in H ₂ O)			
Maximum fuel return line restriction, kPa (in Hg)			

Optional heat exchanger cooling

Set coolant capacity, L (US gal)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum raw water pressure, jacket water circuit, kPa (psi)			
Maximum raw water pressure, aftercooler circuit, kPa (psi)			
Maximum raw water pressure, fuel circuit, kPa (psi)			
Maximum raw water flow, jacket water circuit, L/min (US gal/min)			
Maximum raw water flow, aftercooler circuit, L/min (US gal/min)			
Maximum raw water flow, fuel circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US gal/min)			
Raw water delta P at min flow, jacket water circuit, kPa (psi)			
Raw water delta P at min flow, aftercooler circuit, kPa (psi)			
Raw water delta P at min flow, fuel circuit, kPa (psi)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum fuel return line restriction, kPa (in Hg)			

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Optional remote radiator cooling¹

	Standby rating	Prime rating	Continuous rating
Set coolant capacity, L (US gal)			
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)			
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum friction head, jacket water circuit, kPa (psi)			
Maximum friction head, aftercooler circuit, kPa (psi)			
Maximum static head, jacket water circuit, m (ft)			
Maximum static head, aftercooler circuit, m (ft)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum fuel flow, L/hr (US gph)			
Maximum fuel return line restriction, kPa (in Hg)			

Weights²

Unit dry weight kgs (lbs)	6379 (14061)
Unit wet weight kgs (lbs)	6521 (14372)

Notes:

¹ For non-standard remote installations contact your local Cummins Power Generation representative.

² Weights represent a set with standard features. See outline drawing for weights of other configurations.

Derating factors

Standby	Engine power available up to 2705 m (8875 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 4.4% per 305 m (1000 ft). Above 40 °C (104 °F) derate 10% per 10 °C (18 °F).
Prime	Engine power available up to 2641 m (8665 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 4.5% per 305 m (1000 ft). Above 40 °C (104 °F) derate 20.9% per 10 °C (18 °F).
Continuous	

Ratings definitions

Emergency standby power (ESP):	Limited-time running power (LTP):	Prime power (PRP):	Base load (continuous) power (COP):
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.	Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.

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Alternator data

Voltage	Connection ¹	Temp rise degrees C	Duty ²	Single phase factor ³	Max surge kVA ⁴	Winding No.	Alternator data sheet	Feature Code
380-480	Wye	125/105	S/P		2944	312	ADS-309	B282-2
600	Wye	125/105	S/P		2944	7	ADS-309	B300-2
600	Wye	105/80	S/P		2944	7	ADS-309	B301-2
220/380	Wye	105/80	S/P		3313	311	ADS-310	B599-2
480	Wye	105/80	S/P		2944	312	ADS-309	B600-2
480	Wye	80	S		2944	312	ADS-309	B601-2
600	Wye	80	S		2944	7	ADS-309	B604-2
380	Wye	80	S		3866	312	ADS-311	B660-2
190-480	Wye	125/105	S/P		2944	311	ADS-309	B731-2
208/416	Wye	105/80	S/P		2944	311	ADS-309	B733-2
208/416	Wye	80	S		3313	311	ADS-310	B734-2
440	Wye	125/105	S/P		2944	312	ADS-309	B741-2

Notes:

¹ Limited single phase capability is available from some three phase rated configurations. To obtain single phase rating, multiply the three phase kW rating by the Single Phase Factor³. All single phase ratings are at unity power factor.

² Standby (S), Prime (P) and Continuous ratings (C).

³ Factor for the *Single Phase Output from Three Phase Alternator* formula listed below.

⁴ Maximum rated starting kVA that results in a minimum of 90% of rated sustained voltage during starting.

Formulas for calculating full load currents:

Three phase output

$$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$$

~~Single phase output~~

~~$$\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$$~~

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Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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PowerCommand® 2100 digital generator set control



> Specification sheet

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Power Generation

Description

The PowerCommand® 2100 Control is a microprocessor-based generator set monitoring, metering and control system. The control provides an operator interface to the genset, digital voltage regulation, digital governing and generator set protective functions. The integration of all the functions into a single control system provides enhanced reliability and performance compared to conventional control systems.

The PowerCommand control is designed for mounting on the generator set and is suitable for use on a wide range of generator sets in non-parallel applications. The PowerCommand Control will directly read AC voltages up to 600 VAC and can be configured for any frequency, voltage and power connection configuration from 120 to 600 VAC.

The control offers a wide range of standard control and digital display features so custom control configurations are not needed to meet application specifications. System reliability is not compromised by use of untested special components.

Power for PowerCommand Control is usually derived from the generator set starting batteries. It functions without degradation in performance over a voltage range from 8 VDC to 35 VDC.

Features

Digital engine speed governing controls - Provide isochronous frequency regulation (optional on some genset models).

Digital voltage regulation - 3-phase sensing.

AmpSentry™ protective relay - UL Listed, true alternator over current protection.

Analog and digital AC output metering.

Battery monitoring system - Senses and warns against a weak battery condition.

Digital alarm and status message display.

Generator set monitoring - Displays status of all critical engine and alternator functions.

Smart starting control system - Temperature dynamic integrated fuel ramping to limit black smoke and frequency overshoot, in addition to optimized cold weather starting.

PCCNet Interface - A proprietary RS485 network interface to allow easy plug and play interface to remote annunciators, relay modules for extensible I/O and other devices.

Advanced serviceability - Interfaces to InPower™, a PC-based software service tool. A version of InPower is available for customer use.

PowerCommand LonWorks® network (optional) - Provides interfaces to external devices through a twisted pair wire and other media.

Certifications - Suitable for use on generator sets that are designed, manufactured, tested, and certified to relevant UL, NFPA, ISO, IEC, and CSA standards.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor service network.

Operator panel

The operator panel provides the user with a complete package of easy to view and use information. Connections to the operator panel are locking plug interfaces for reliable, vibration-resistant interconnection to the generator set wiring harness.

Control switches and functions

Off/manual/auto mode control switch - The *not in auto* lamp will flash when the control is in the *manual* or *off* mode. In the *auto* mode, the generator set can be started with a start signal from a remote device, such as an automatic transfer switch.

Manual run/stop control switch - When the mode control switch is in the *manual* position and the *manual/run/stop* switch is pressed, the generator set will start, bypassing time delay start. The control is configurable to include an idle period on manual start. If the generator set is running in the *manual* mode, pressing the *run/stop* switch will cause the generator set to shut down after a cool down at idle period.

Panel lamp/lamp test control switch - Depressing the *panel lamp* switch will cause the panel illumination to operate for approximately 10 minutes. Pressing and holding the switch will sequentially illuminate all LED lamps on the panel to confirm proper operation of these components.

Fault acknowledge/reset switch - The control includes a *fault acknowledge* function to allow the operator to reset the fault condition. If the fault condition is not corrected, the fault will reappear, but will not be logged as a separate event. Multiple faults can be logged and displayed at one time.

Emergency stop control switch - Pressing the *emergency stop* switch will cause the generator set to immediately shut down. The generator set is prevented from running or cranking with the switch pressed in.

Operator adjustments - The control includes provisions for many set up and adjustment functions via raise/lower switches on the operator panel. Functions that can be adjusted by the operator include:

- Time delay start (0-300 seconds)
- Time delay stop (0-600 seconds)
- Alternator voltage ($\pm 5\%$)
- Alternator frequency ($\pm 5\%$)

Indicating lamps



The operator panel includes a series of LED indicating lamps to allow the operator to view the general status of the generator set. Functions displayed include:

Green lamps to indicate generator set running (operating at rated voltage and frequency); remote start signal received.

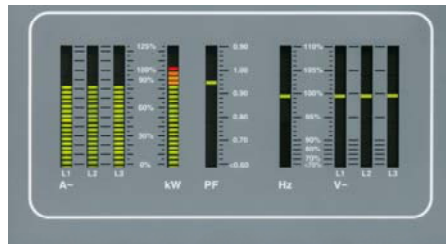
Red (flashing) lamp to indicate not-in-auto mode and a red lamp to indicate common shutdown.

Amber lamp for common warning.

Lamps (5) are configurable for color and function. These lamps are configured with InPower for any condition monitored by the control. Default configuration for these lamps include the following functions:

- Low oil pressure warning
- High engine temperature warning
- Low oil pressure shutdown
- Over speed shutdown
- Fail to start

Analog AC metering panel (optional)



The PowerCommand control can be equipped with an analog AC metering panel that simultaneously displays 3-phase line-to-line AC volts and current, kW, power factor, and frequency.

The meter panel is composed of a series of LEDs configured in bar graphs for each function. The LEDs are color coded, with green indicating normal range values, amber for warning levels and red for shutdown conditions. Scales for each function are in % of nominal rated values. Resolution is 1% for values close to nominal and increases at values far from nominal.

Alphanumeric display panel



The PowerCommand control is provided with an alphanumeric display capable of displaying 2 lines of data with approximately 20 characters per line. The display is accompanied by a set of six tactile-feel membrane switches that are used by the operator to navigate through

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control menus and to make control adjustments. (There are no rotary potentiometers in the control. All adjustments are made via the display panel or InPower). Display is configurable for multiple languages. It is configurable for units of measurement.

All data on the control can be viewed by scrolling through screens with the navigation keys.

The control displays all active fault conditions with the latest displayed first. Active and inactive faults are displayed.

The display panel includes a screen-saver timer that will turn off the display after 30 minutes of inactivity. Touching any key will turn the screen back on.

Generator set hardware data - Generator set rating in kVA, complete generator set model number and provisions for generator set serial number, engine model and serial number, and alternator model and serial number. The control stores the part number of the control and the software version present in the control. This information is read using InPower.

Data logs - Number of start attempts and number of start attempts since reset. Number of times generator set has run and duration of generator set running time. Generator set kWh produced. The control also stores number of start attempts, operating hours and kW hours since each has been reset. This data is read with InPower.

Adjustment history - Provides a record of adjustment and setting changes made on the control and identifies whether adjustment was made via the operator panel or with a service tool. If a service tool is used, the control provides a record of the serial number of the tool used. This information is read with InPower.

Fault history - Provides a record of the most recent fault conditions with time stamp, along with the number of times each fault has occurred. Up to 20 events are stored in the control non-volatile memory.



Load profile data - Control logs data indicating the operating hours at percent of rated kW load in 10% increments. The data is presented on the operator panel based on total operating hours on the generator set based on number of hours under 30% load and number of hours at more than 90% of rated. InPower can be used to read data in detail (10% increments).

Generator set output voltage - All phases, line-to-line and line-to-neutral, accuracy 1%. Data for all phases is displayed simultaneously to allow viewing of voltage balance.

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Generator set output current - All phases, accuracy 1%. Data for all phases is displayed simultaneously to allow viewing of load balance.

Generator set output frequency.

Generator set power output - PowerCommand displays generator set kW and kVA output (average and individual phase and direction of flow), and power factor with leading/lagging indication. Accuracy 5%.

Generator set kWh power output - Displays total kilowatt-hours produced by the generator set and total produced since last reset, with time stamp of time of last reset.

Generator set control temperature.

Engine starting battery voltage.

Engine lube oil pressure.

Engine coolant temperature.

Engine lube oil temperature (option on some genset models).

System data display - The generator set will exchange data with Cummins Power Generation transfer switches utilizing PowerCommand transfer controls and other generator sets using the PowerCommand 2100 control that are located on the same site and interconnected using a PowerCommand network. Information displayed from each transfer switch in the system includes: transfer switch name (assigned by customer at site), kW load (when fitted with load monitoring equipment), sources available, source connected and if any alarm conditions are present on the switch. Genset data includes genset name, kW load, status and name of any alarm conditions that are present.

Service adjustments - The operator panel includes provisions for adjustment and set up of all control functions in the generator set. The operator panel includes an access code that is used to protect the control from unauthorized service level adjustments.

Internal control functions

Engine control

Remote start mode - PowerCommand accepts a ground signal from remote devices or a network signal to automatically start the generator set and immediately accelerate to rated speed and voltage.

PowerCommand includes a smart starting system that is designed to quickly start the engine, minimize black smoke, minimize voltage and frequency overshoot, and oscillations on starting. The control system does this by careful control of the engine fuel system and alternator excitation system.

The control can incorporate a time delay start and a warm-up period at idle speed. See *Engine governing* for details.

Sleep mode - PowerCommand can be configured to include a sleep mode. When enabled, and when the mode select switch is in the off position, the control will revert to

a low power consumption mode until a control switch on the operator panel is operated (reset, panel lamp, manual run or emergency stop).

Data logging - The control maintains a record of manual control operations, warning and shutdown conditions, and other events. The control also stores critical engine and alternator data before and after a fault occurs, for use by InPower and the technician in evaluating the root causes for the fault condition.

Fault simulation mode - PowerCommand, in conjunction with InPower software, will accept commands to allow a technician to verify the proper operation of all protective functions of the control by simulating failure modes or by forcing the control to operate outside of its normal operating ranges.

Engine starting - The control system automatically controls the engine starter and provides proper engine fueling and alternator control to provide fast and efficient starting.

Cycle cranking - Configurable for number of starting cycles (1 to 7) and duration of crank and rest periods. Control includes starter protection algorithms to prevent the operator from specifying a starting sequence that might be damaging.

Time delay start and stop (cool down) - Configurable for time delay of 0-300 seconds prior to starting after receiving a remote start signal; and for time delay of 0-600 seconds prior to ramp-to-idle or shutdown after signal to stop in normal operation modes. Default for both time delay periods is 0 seconds.

Engine governing

The PowerCommand control includes integrated digital governing capability to directly drive an engine fuel control valve. Features of the governing system (when enabled) include:

Isochronous governing - Controls engine speed within $\pm 0.25\%$ for any steady state load from no load to full load. Frequency drift will not exceed $\pm 0.5\%$ for a 33 °C (60 °F) change in ambient temperature over an 8 hour period.

Temperature dynamics - Modifies the engine fuel system (governing) control parameters as a function of engine temperature. Allows engine to be more responsive when warm and more stable when operating at lower temperature levels.

Smart idle mode - Engine governing can be regulated at an idle speed for a programmed period on automatic stop of the engine or in manual mode. In an automatic mode, the control will bypass the idle period if the engine is at a low load level for sufficient duration for cool down. During idle mode engine protective functions are adjusted for the lower engine speed, and alternator function and protections are disabled.

Idle speed can be initiated by the operator when the generator set is running in the manual mode.

Glow plug control (optional) - Modifies the engine start cycle to include a programmed time period for operation of glow plugs. This feature is available on generator sets that require glow plug control only.

Alternator control

PowerCommand includes an integrated 3-phase line-to-neutral sensing voltage regulation system that is compatible with either shunt or PMG type excitation systems (some generator set models are always PMG). The voltage regulation system is full wave rectified and has a PWM output for good motor starting capability and stability when powering non-linear loads. Major system features include:

Digital output voltage regulation - PowerCommand will regulate output voltage to within 0.5% for any loads between no load and full load. Voltage drift will not exceed $\pm 0.5\%$ for a 33 °C (60 °F) change in temperature in an 8 hour period. On engine starting, or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level.

Torque-matched V/Hz overload control - The voltage roll-off set point and rate of decay (i.e., the slope of the V/Hz curve) is adjustable in the control.

Fault current regulation - PowerCommand will regulate the output current on any phase to a maximum of 3 times rated current under fault conditions for both single phase and three phase faults. The regulation system will drive a permanent magnet generator (PMG) to provide 3 times rated current on all phases for motor starting and short circuit coordination purposes.

Protective functions

On a warning condition the control will indicate a fault by lighting the warning LED on the control panel and displaying the fault name and code on the operator display panel. The nature of the fault and time of occurrence are logged in the control. The service manual and InPower service tool provide service keys and procedures based on the service codes provided.

On a shutdown condition, the control will light the shutdown LED on the control panel, display the fault name and code, initiate shutdown and lock out the generator set. The control maintains a data log of all fault conditions as they occur and time stamps them with the controller run time and engine operating hours data. Adjustments to most set points are made using the InPower service tool.

The control system includes a "fault bypass" mode that may be enabled by a service technician. The fault bypass mode forces the system to function regardless of the status of protective functions. (Each function must be individually bypassed.) In this mode the only protective functions that are operational are over speed, loss of speed sensor, moving the control switch to the off position or pressing the emergency stop switch. The control maintains a record of the time that the mode is enabled,

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and all warning or shutdown conditions that have occurred while in the “*fault bypass*” mode.

The control system automatically captures the generator set logged parameters on a fault condition.

Many protective functions within the control system are configurable for warning, shutdown or both (2 levels). Exceptions to this include functions such as over speed conditions and loss of speed sensing. In addition, some functions can incorporate control functions as a consequence of a fault.

System protective functions:

Ground fault warning (optional) - 600 VAC class generator sets with solid ground. Ground fault sensing is adjustable over a range of 100-1200 amps with time delays of 0-1 second. May be configured for shutdown rather than alarm.

Configurable alarm and status inputs - PowerCommand will accept up to four alarm or status inputs (configurable contact closed to ground or open) to indicate customer-specified conditions. The control is programmable for warning, shutdown or status indication, and for labeling the input. Eight additional faults can be input to the control via the network.

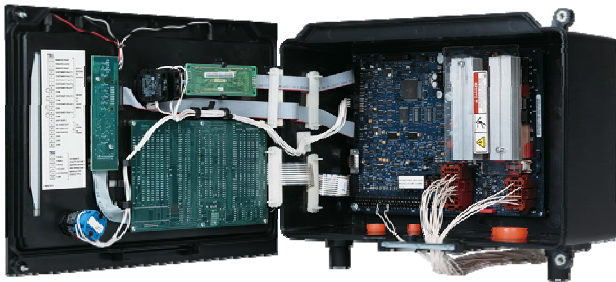
Emergency stop - Annunciated whenever the local or remote emergency stop signal is received. Alarm panel distinguishes between local or remote operation.

Engine protection

Over speed shutdown - Default setting is 115% of nominal.

Low lube oil pressure shutdown - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

Low lube oil pressure warning - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.



High coolant temperature shutdown - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

High coolant temperature warning - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

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High oil temperature warning (optional) - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

Low coolant level warning/shutdown - Optional on some genset models.

Low coolant temperature warning - Indicates that engine temperature may not be high enough for a 10-second start or proper load pickup.

Low and high battery voltage warning - Indicates battery charging system failure by continuously monitoring battery voltage.

Weak battery warning - The control system will test the battery bank each time the generator set is signaled to start, and indicate a warning if the generator set battery indicates impending failure.

Dead battery shutdown - Indicates that generator set failed to start due to failed starting battery.

Fail to start (overcrank) shutdown.

Fail to crank shutdown - Control has signaled starter to crank engine but engine does not rotate.

Redundant starter disconnect.

Cranking lockout - The control will not allow the starter to attempt to engage or to crank the engine when the engine is rotating.

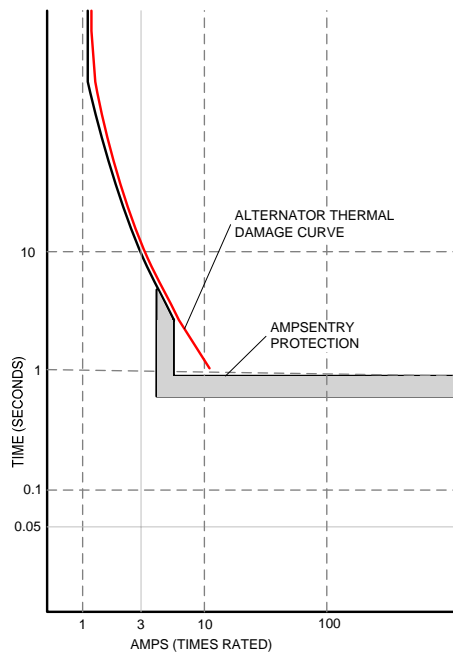
Sensor failure indication - All analog sensors are provided with sensor failure logic to indicate if the sensor or interconnecting wiring has failed. Separate indication is provided for fail high or low.

AmpSentry protective relay

AmpSentry protective relay is a UL Listed comprehensive monitoring and control system integral to the PowerCommand Control System that guards the electrical integrity of the alternator and power system by providing protection against a wide array of fault conditions in the generator set or in the load. It also provides single and three phase fault current regulation so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. See document R1053 below for a full size time over current curve.

Over current warning - Output current on any phase at more than 110% of rating for more than 60 seconds or more than 400% for more than 1 second.

Over current shutdown (51) - Output current on any phase is more than 110%, less than 175% of rating and approaching thermal damage point of alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time.



Reverse Var shutdown - Shutdown level is adjustable: threshold 0.15-0.50 per unit, delay 10-60 seconds. Defaults: 0.20, 10 seconds.

Excitation fault - Shutdown of generator set will occur on loss of voltage sensing inputs to control.



Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F), and for storage from 55 °C to +80 °C (-67 °F to +176 °F). Control will operate with humidity up to 95%, non-condensing. Control operation is not restricted by altitude.

The control system is housed in a NEMA 3R/IP53 enclosure. The operator control panel has a single membrane surface which is impervious to the effects of dust, moisture, oil and exhaust fumes. The panel uses sealed membrane or oil-tight switches to provide long reliable service life in harsh environments.

The control system is specifically designed and tested for resistance to RFI/EMI and to resist the effects of vibration to provide a long reliable life when mounted on a generator set. The control includes transient voltage surge suppression to provide compliance to referenced standards.

Control interface

Input signals to the PowerCommand control include:

Remote start signal - May be connected via either discrete signal or Lon™ Network, or both.

Remote emergency stop.

Remote alarm reset.

Configurable customer inputs - Control includes (4) input signals from customer discrete devices that are configurable for warning, shutdown or status indication, as well as message displayed.

Output signals from the control include four configurable relay drivers. Defaults for these are:

Generator set common warning signal - Operates when unit set is running under alarm conditions.

Generator set common shutdown signal.

Short circuit shutdown - Output current on any phase is more than 110%, more than 175% of rating, and approaching thermal damage point of alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time.

High AC voltage shutdown (59) - Output voltage on any phase exceeds preset values. Time to trip is inversely proportional to amount above threshold. Values adjustable from 105-125% of nominal voltage with time delay adjustable from 0.25-10 seconds. Default value is 110% for 10 seconds.

Low AC voltage shutdown (27) - Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of reference voltage, time delay 2-10 seconds. Default value is 85% for 10 seconds. Function tracks reference voltage.

Under frequency shutdown (81u) - Generator set output frequency cannot be maintained. Settings are adjustable from 0-10 Hz below nominal governor set point for a 0-20 second time delay. Default: 6 Hz, 10 seconds.

Over frequency shutdown/warning (81o) - Adjustable for operation in a range of 0-10 Hz above nominal frequency, with a time delay of 0-20 seconds. Defaults: Disabled.

Over load (kW) warning - Provides a warning indication when engine is operating at a load level over a set point or due to under frequency. Adjustment range: 50-140% of rated kW, 0-120 second delay. Defaults: 105%, 60 seconds.

Reverse power shutdown (32) - Adjustment range: 5-20% of standby kW rating, delay 1-15 seconds. Defaults: 10%, 3 seconds.

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Not in auto - Indicates that the mode control switch is not in the *auto* position or that the genset is shutdown under a fault condition.

Ready to load (generator set running) signal - Operates when the generator set has reached 90% of rated speed and voltage and latches until generator set is switched to *off* or *idle* mode.

Control power for auxiliary devices is available from the controller.

Network connections include:

PCCNet interface - A proprietary dedicated RS485 network for use in operating remote annunciator panels and remote I/O modules.

Serial interface - This communication port is to allow the control to communicate with a personal computer running InPower software.

Echelon® LonWorks® interface (optional).

Software

InPower - A PC-based software service tool that is designed to directly communicate to PowerCommand generator sets and transfer switches to facilitate service and monitoring of these products.

PowerCommand for Windows® - A software tool that is used primarily by operators to remotely monitor and control generator sets, transfer switches and other on-site power system devices.

Warranty

PowerCommand control systems are a part of complete power systems provided by Cummins Power Generation, and are covered by a one-year limited warranty as a standard feature.

Extended warranty options are available for coverage up to 10 years.

Certifications

PowerCommand meets or exceeds the requirements of the following codes and standards:

NFPA110: For Level 1 systems

UL508: Recognized or Listed and suitable for use on UL 2200 Listed generator sets

CSA C282-M1999: Compliance

CSA 22.2: No. 14 M91 Industrial Controls

ISO 8528-4: 1993 compliance, Controls and Switchgear

NFPA99: Standard for Health Care Facilities

CE Mark: Control system suitable for use on generator sets to be CE-marked

EN 50081-2: Industrial Emissions

EN 50082-2: Industrial Susceptibility

ISO 7637, pulses #2b, 4: DC Supply Surge Voltage Test

Mil Std 202C, Method 101: Salt Fog Test

ANSI C62.41: Surge Withstand

IEC 801.2, 3, 4, 5: For Susceptibility, Conducted and Radiated Electromagnetic Emissions.

ISO9001: PowerCommand control systems and generator sets are designed and manufactured in ISO9001 certified facilities.

Options and accessories

- Analog AC metering display - Provides a bar graph display of 3-phase AC volts and amps, kW, power factor and frequency.
- Key-type mode select switch - Replaces off/manual/auto switch with a key-type switch.
- Ground fault alarm module - Installs a separate ground fault indication relay and harness into a control customer input.
- Exhaust temperature monitoring.
- Digital remote annunciator.
- Digital output relay module - Provides (3) relays, each with 2 normally open and 2 normally closed contacts rated 10 A at 600 VAC, 5 A at 24 VDC. Functions of the relays are configurable.
- Engine oil temperature indication - Some genset models incorporate this feature as standard. On all models, the control may be configured to include an oil temperature warning or shutdown when oil temperature sensing is provided.
- CAN engine interface (optional on some models). Allows the genset control to directly monitor an engine control module.
- LON interface.
- Input/output expansion module - Provides up to 16 configurable Form-C relays, 12 configurable discrete inputs and 8 analog inputs.

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See your distributor for more information

Cummins Power Generation

Americas

1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
Phone: 763 574 5000
Fax: 763 574 5298

Europe, CIS, Middle East and Africa

Manston Park Columbus Ave.
Manston Ramsgate
Kent CT 12 5BF United Kingdom
Phone 44 1843 255000
Fax 44 1843 255902

Asia Pacific

10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building electrical except through an approved device or after building main breaker is open.



ALTERNATOR DATA SHEET

Frame Size: **HC6G**

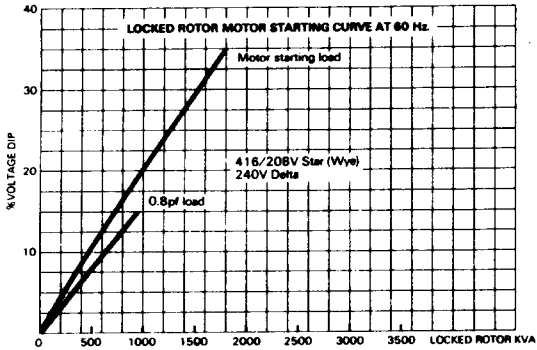
CHARACTERISTICS								
WEIGHTS:		Wound Stator Assembly	1998 lb	900 kg				
		Rotor Assembly	1689 lb	761 kg				
		Complete Alternator	4240 lb	1910 kg				
MAXIMUM SPEED:			2250 rpm					
EXCITATION CURRENT:		Full Load	2.5 Amps					
		No Load	0.5 Amps					
INSULATION SYSTEM:		Class H Throughout						
3 Ø RATINGS (0.8 power factor)		60 Hz				50 Hz		
(Based on specified temperature rise at 40°C ambient temperature)		110/190*	120/208*	139/240*		110/190*	120/208*	127/220*
		<u>220/380</u>	<u>240/416</u>	<u>277/480</u>	<u>347/600</u>	<u>220/380</u>	<u>240/415</u>	<u>254/440</u>
150°C Rise Ratings	kW	665	730	837	837	656	656	656
	kVA	831	913	1046	1046	820	820	820
125°C Rise Ratings	kW	640	700	800	800	640	640	640
	kVA	800	875	1000	1000	800	800	800
105°C Rise Ratings	kW	580	650	730	730	600	600	600
	kVA	725	813	913	913	750	750	750
80°C Rise Ratings	kW	520	588	632	632	520	520	520
	kVA	650	710	790	790	650	650	650
REACTANCES (per unit, ±10%)		110/190*	120/208*	139/240*		110/190*	120/208*	127/220*
(Based on full load at 125°C Rise Rating)		<u>220/380</u>	<u>240/416</u>	<u>277/480</u>	<u>347/600</u>	<u>220/380</u>	<u>240/415</u>	<u>254/440</u>
Synchronous		3.87	3.53	3.03	2.96	3.14	2.63	2.34
Transient		0.31	0.28	0.24	0.22	0.25	0.21	0.19
Subtransient		0.23	0.21	0.18	0.16	0.17	0.15	0.13
Negative Sequence		0.27	0.24	0.21	0.20	0.21	0.18	0.16
Zero Sequence		0.03	0.03	0.03	0.03	0.03	0.02	0.02
MOTOR STARTING		<u>Broad Range</u>			<u>600</u>	<u>Broad Range</u>		
Maximum kVA (90% Sustained Voltage)		2944			2944	2000		
TIME CONSTANTS (Sec)		<u>Broad Range</u>			<u>600</u>	<u>Broad Range</u>		
Transient		0.185			0.185	0.185		
Subtransient		0.025			0.025	0.025		
Open circuit		2.350			2.350	2.350		
DC		0.040			0.040	0.040		
WINDINGS (@ 20°C)		<u>Broad Range</u>			<u>600</u>	<u>Broad Range</u>		
Stator Resistance (Ohms per phase)		0.0074			0.0110	0.0074		
Rotor Resistance (Ohms)		1.3700			1.3700	1.3700		
Number of Leads		6 (12 Optional)			6	6 (12 optional)		

* 12 lead reconnectible option is required to obtain low (parallel wye) voltages.

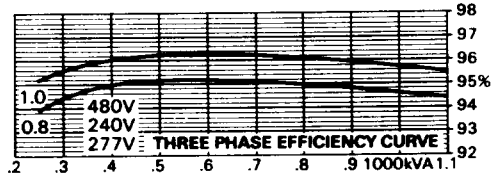
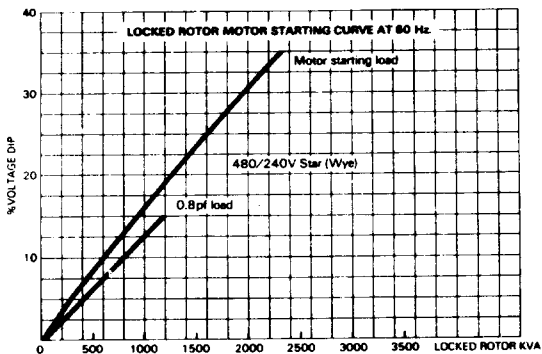
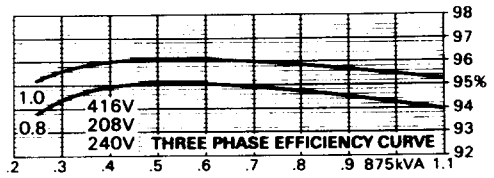
OPERATING CHARACTERISTICS

60 Hz

% Voltage Dip vs Locked Rotor kVA

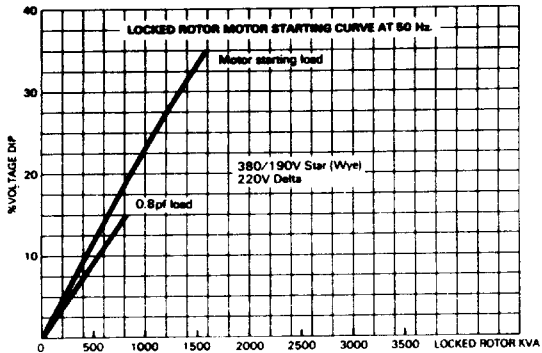


% Efficiency vs kVA

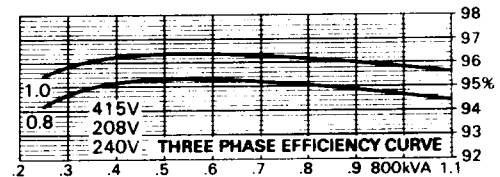
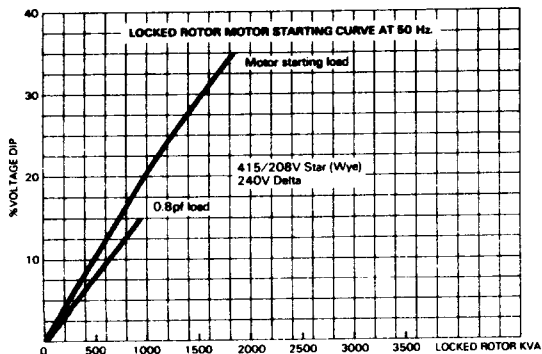
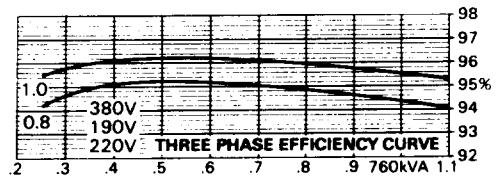


50 Hz

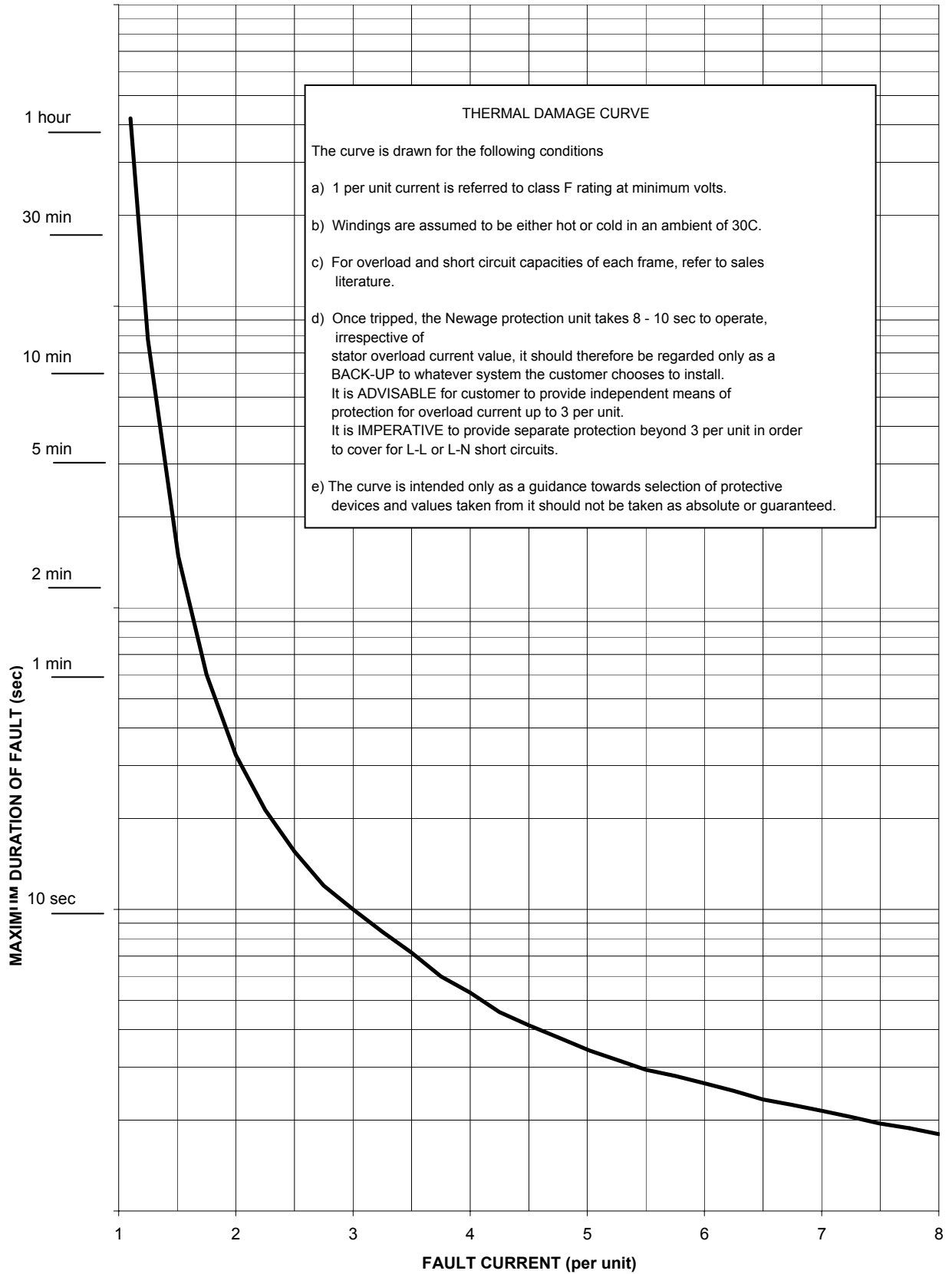
% Voltage Dip vs Locked Rotor kVA



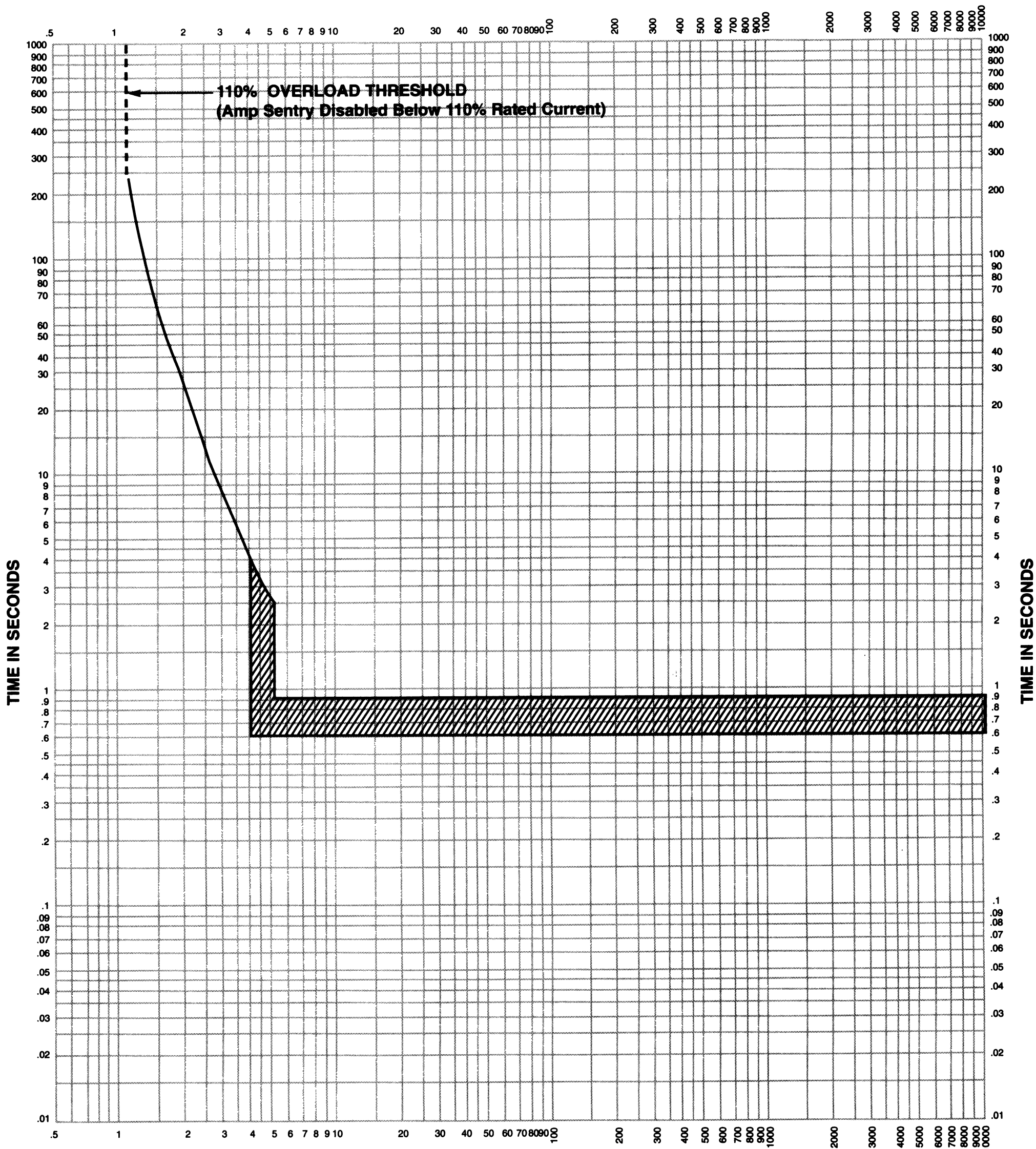
% Efficiency vs kVA



THERMAL DAMAGE CURVE



CURRENT IN MULTIPLES OF GENERATOR SET RATING



CURRENT IN MULTIPLES OF GENERATOR SET RATING



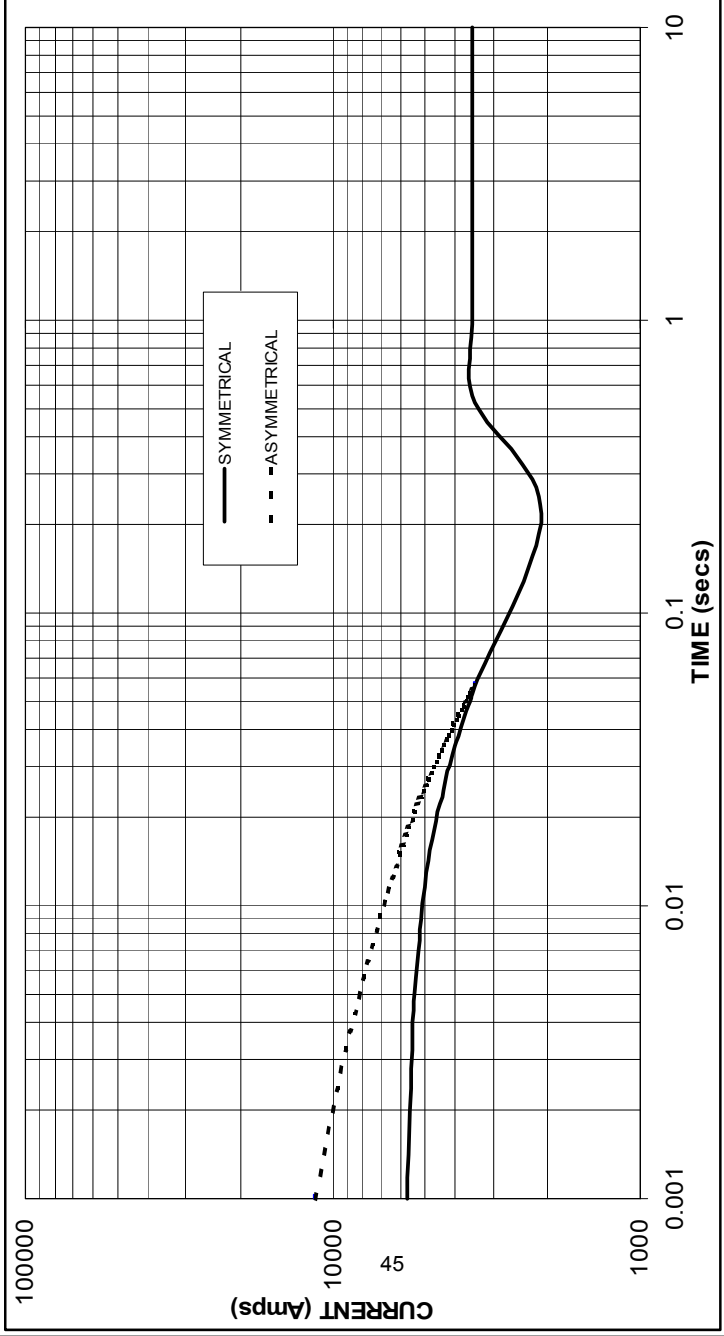
**PowerCommand™ Control Amp Sentry™
Time-Over-Current Characteristic Curve**

**Note: This curve is applicable to
all Onan PowerCommand™ Generator Sets.**

THREE PHASE PHASE SHORT CIRCUIT DECREMENT CURVE

A.V.R TYPE MX WINDING 311 / 312 4 POLE FREQ 60 HZ 1800 Rev/Min

SERIES STAR (WYE) CONNECTION NO LOAD EXCITATION AT RATED SPEED



SUSTAINED SHORT CIRCUIT = 3500 AMPS

NOTE 1

THE FOLLOWING MULTIPLICATION FACTORS SHOULD BE USED TO ADJUST THE VALUES FROM CURVES BETWEEN THE 0.001 SECONDS AND THE MINIMUM CURRENT POINT IN RESPECT OF NOMINAL OPERATING VOLTAGE

VOLTAGE	FACTOR	2 PHASE L-L 1 PHASE L-N
416 V	X 1.00	X 0.87
440 V	X 1.06	X 1.3
460 V	X 1.12	X 1.80
480 V	X 1.17	X 1.50
		X 2.50
		10 SEC 5 SEC 2 SEC

THE SUSTAINED CURRENT VALUE IS 3500 AMPS AT 480 VOLTAGE LEVEL

APPLICATION DATA SHEET NUMBER HC6G/311 / 312/60/MX/5 ISSUE A DATE 3/14/2001

NOTE 2

THE FOLLOWING MULTIPLICATION FACTORS SHOULD BE USED TO CONVERT THE VALUES CALCULATED IN ACCORDANCE WITH NOTE 1 TO THOSE APPLICABLE TO THE VARIOUS TYPES OF SHORT CIRCUIT

INSTANTANEOUS	3 PHASE	2 PHASE L-L 1 PHASE L-N
MINIMUM	X 1.0	X 0.87
SUSTAINED	X 1.0	X 1.3
MAX SUSTAINED DURATION	X 1.0	X 1.80
		X 1.50
		X 2.50
		10 SEC 5 SEC 2 SEC

ALL OTHER TIMES ARE UNCHANGED

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**Power
Generation**

Exhaust Emission Data Sheet

600DQCA

60 Hz Diesel Generator Set Nonroad

Engine Information:

Model:	Cummins Inc QSK23-G7 NR2	Bore:	6.69 in. (170 mm)
Type:	4 Cycle, In Line, 6 Cylinder Diesel	Stroke:	6.69 in. (170 mm)
Aspiration:	Turbocharged and CAC	Displacement:	1413 cu. in. (23.1 liters)
Compression Ratio:	16.0:1		
Emission Control Device:	Turbocharged with Charge Air Cooled		

	1/4	1/2	3/4	Full	Full
PERFORMANCE DATA	Standby	Standby	Standby	Standby	Prime
Engine HP @ Stated Load (1800 RPM)	226	453	679	905	815
Fuel Consumption (gal/hr)	13.7	23.1	32.7	42.0	38.4
Exhaust Gas Flow (CFM)	2005	3055	4045	4835	4520
Exhaust Temperature (°F)	595	710	775	825	805
EXHAUST EMISSION DATA					
HC (Total Unburned Hydrocarbons)	1.05	0.47	0.28	0.19	0.23
NOx (Oxides of Nitrogen as NO2)	2.80	3.00	3.60	4.40	4.10
CO (Carbon Monoxide)	1.50	0.56	0.24	0.16	0.19
PM (particular Matter)	0.32	0.16	0.06	0.04	0.05
SO2 (Sulfur Dioxide)	N/A	N/A	N/A	N/A	N/A
Smoke (Bosch)	1.10	0.90	0.50	0.40	0.50

All values are Grams per HP-Hour

TEST CONDITIONS

Data was recorded during steady-state rated engine speed (± 25 RPM) with full load ($\pm 2\%$). Pressures, temperatures, and emission rates were stabilized.

Fuel Specification: 46.5 Cetane Number, 0.035 Wt.% Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.
 Fuel Temperature: 99 ± 9 °F (at fuel pump inlet)
 Intake Air Temperature: 77 ± 9 °F
 Barometric Pressure: 29.6 ± 1 in. Hg
 Humidity: NOx measurement corrected to 75 grains H2O/lb dry air
 Reference Standard: ISO 8178

The NOx, HC, CO and PM emission data tabulated here were taken from a single engine under the test conditions shown above. Data for the other components are estimated. These data are subjected to instrumentation and engine-to-engine variability. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures and instrumentation. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

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**Power
Generation**

EPA Tier 2 Exhaust Emission Compliance Statement 600DQCA 60 Hz Diesel Generator Set

Compliance Information:

The engine used in this generator set complies with the Tier 2 emissions limits of U.S EPA New Source Performance Standards for Stationary Emergency engines under the provisions of 40 CFR 60 Subpart IIII when tested per ISO 8178 D2.

Engine Manufacturer:	Cummins Inc
EPA Certificate Number:	CEX-NRCI-11-24
Effective Date:	12/17/2010
Date Issued:	12/17/2010
EPA Diesel Engine Family:	BCEXL023.AAB
CARB Executive Order:	

Engine Information:

Model:	Cummins Inc QSK23-G7 NR2	Bore:	6.69 in. (170 mm)
Engine Nameplate HP:	1220		
Type:	4 Cycle, In Line, 6 Cylinder Diesel	Stroke:	6.69 in. (170 mm)
Aspiration:	Turbocharged and Charged After Cooled(Air-to-Air)	Displacement:	1413 cu. in. (23.15 liters)
Compression Ratio:	16.0:1		
Emission Control Device:	Turbocharged and Charged After Cooled(Air-to-Air)		

U.S. Environmental Protection Agency NSPS Stationary Emergency Tier 2 Limits

(All values are Grams per HP-Hour)

<u>COMPONENT</u>	
NOx + HC (Oxides of Nitrogen as NO2 + Non Methane Hydrocarbons)	4.77
CO (Carbon Monoxide)	2.61
PM (Particulate Matter)	0.15

Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

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High Ambient Air Temperature Radiator Cooling System

	Duty	Rating (kW)	Max Cooling @ Air Flow Static Restriction, Unhoused (inches water/mm water)				Housed in Free Air, No Air Discharge Restriction					
			0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1						
			Maximum Allowable Ambient Temperature, Degree C									
60 Hz	Standby	600	60	59	57	53						
	Prime	545	N/A	N/A	N/A	N/A						
	Continuous		N/A	N/A	N/A	N/A						
50 Hz	Standby		N/A	N/A	N/A	N/A						
	Prime		N/A	N/A	N/A	N/A						
	Continuous		N/A	N/A	N/A	N/A						

Notes:

1. Data shown are anticipated cooling performance for typical generator set.
2. Cooling data is based on 1000 ft (305 m) site test location.
3. Generator set power output may need to be reduced at high ambient conditions. Consult generator set data sheet for derate schedules.
4. Cooling performance may be reduced due to several factors including but not limited to: Incorrect installation, improper operation, fouling of the cooling system, and other site installation variables.

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Sound Pressure Level @ 7 meters, dB(A)

See Notes 1-8 listed below

Configuration		Measurement Location Number								Average
		1	2	3	4	5	6	7	8	
Standard - Unhoused	Infinite Exhaust	89	93	94	95	98	95	93	93	94
F200 -Weather	Mounted Muffler	84	80	78	89	90	90	77	80	86
F201 - Quiet Site II First Stage	Mounted Muffler	84	79	72	73	77	73	73	79	78
F202 - Quiet Site II Second Stage	Mounted Muffler	72	70	73	73	74	75	74	71	73

Sound Power Level, dB(A)

See Notes 2-6, 9, 10 listed below

Configuration		Octave Band Center Frequency (Hz)								Overall Sound Power Level
		63	125	250	500	1000	2000	4000	8000	
Standard - Unhoused	Infinite Exhaust	82	101	106	112	114	114	112	107	120
F200 -Weather	Mounted Muffler	92	101	106	108	107	106	103	98	114
F201 - Quiet Site II First Stage	Mounted Muffler	91	99	100	101	100	100	99	94	108
F202 - Quiet Site II Second Stage	Mounted Muffler	85	95	95	92	99	98	98	90	105

Exhaust Sound Pressure Level @ 1 meter, dB(A)

Open Exhaust (No Muffler Rated Load)	Octave Band Center Frequency (Hz)								Sound Pressure Level
	63	125	250	500	1000	2000	4000	8000	
	104	111	119	120	120	125	125	123	

Note:

- Position 1 faces the engine front. The positions proceed around the generator set in a counter-clockwise direction in 45° increments. All positions are at 7m (23 ft) from the surface of the generator set and 1.2m (48") from floor level.
- Sound levels are subject to instrumentation, measurement, installation and manufacturing variability.
- Sound data with remote-cooled generator sets are based on rated loads without cooling fan noise.
- Sound levels for aluminum enclosures are approximately 2 dB(A)s higher than listed sound levels for steel enclosures.
- Sound data for generator set with infinite exhaust do not include exhaust noise.
- Data is based on full rated load with standard radiator-cooling fan package
- Sound Pressure Levels are measured per ANSI S1.13 and ANSI S12.18, as applicable.
- Reference sound pressure is 20 µPa.
- Sound Power Levels per ISO 3744 and ISO 8528-10, as applicable.
- Reference power = 1 pw (10⁻¹²W)
- Exhaust Sound Pressure Levels are per ISO 6798, as applicable.

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**KP91 - PJ800 AMP MCCB
MICROLOGIC 3.0 LI TRIP UNIT
ADJ. RATING PLUG TYPE-F
672 TO 800 AMP TRIP
SET @ 800 AMP
(LT - Ir = 1)**



P-Frame 1200 A

**POWERPACT® P-Frame Molded Case
Circuit Breakers (Standard or 100% rated up to 1200 A)**

The most compact and innovative molded case circuit breakers

POWERPACT Molded Case Circuit Breakers lead the industry with proven, reliable protection and innovative design. Providing unparalleled performance and control, this generation of P-frame circuit breakers features exclusive MICROLOGIC® Trip Units, which allow for a range of sophisticated applications for metering and monitoring. In addition, units can be interchanged to allow for maximum flexibility and are field-installable for easy upgrades as needed.

The circuit breakers are available in 100% rated construction up to 1200 A to meet a broad range of commercial and industrial application needs.

Full-Featured Performance

- P-frame – 1200A available in both standard and 100% ratings with sensor sizes 250–1200A. Interrupting ratings (AIR)
J-65kAIR at 480 VAC
- MICROLOGIC 3.0 Trip Unit

POWERPACT® P-Frame Molded Case Circuit Breakers (Standard or 100% rated up to 1200 A)

Onboard Intelligence

For “smarter breakers,” a range of MICROLOGIC® Trip Units provides advanced functionality, such as a communications interface, and power metering and monitoring capabilities. With the appropriate MICROLOGIC Trip Unit, you can communicate with breakers, gather power information, monitor events and remotely control breakers based on predetermined conditions, leading to substantial savings in electrical system operating costs.

These interchangeable, microprocessor-controlled, plug-in devices provide the next generation of protection, measurement and control functions, delivering not only greater electrical system safety but also improved system integration and coordination.



MICROLOGIC® Trip Units

MICROLOGIC 3.0 and 5.0

- Basic circuit protection including long-time, instantaneous and optional short-time adjustments

MICROLOGIC 3.0A, 5.0A and 6.0A

- Long-time, instantaneous and optional short-time adjustments
- Integrated ammeter and phase loading bar graph
- LED trip indicator
- Zone selective interlocking with downstream and upstream breakers
- Optional ground-fault protection
- Optional MODBUS® communications interface

MICROLOGIC 5.0P and 6.0P

- Long-time, instantaneous and optional short-time adjustments
- Advanced relay protection (current imbalance, under/over voltage, etc.)
- Inverse Definite Minimum Time Lag (IdmtL) long-time delay curve shaping for improved coordination
- Basic power metering and monitoring functions
- Standard MODBUS communications interface compatibility with POWERLOGIC® installations
- Standard GF alarm on 5.0P. 6.0P has equipment ground-fault tripping protection

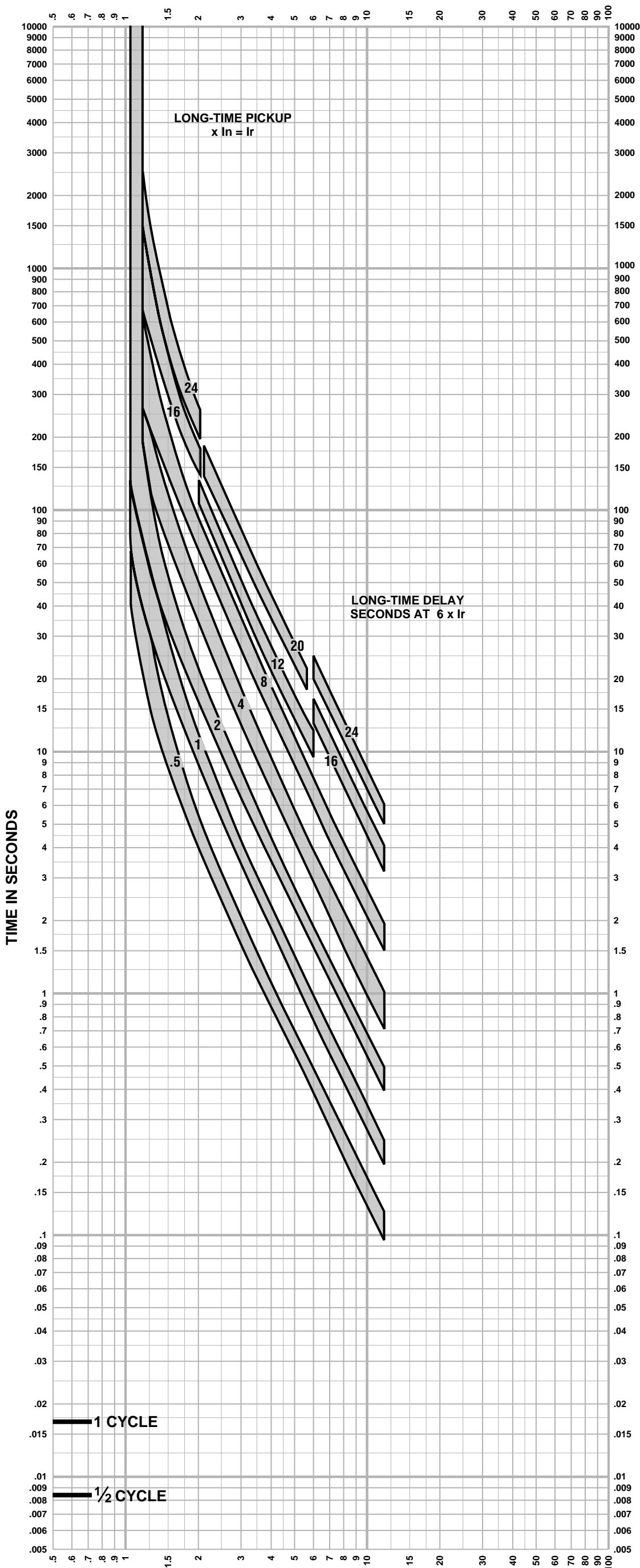
MICROLOGIC 5.0H and 6.0H

- All 5.0P and 6.0P functions
- Enhanced POWERLOGIC power metering and monitoring capabilities
- Basic power quality (harmonic) measurement
- Waveform capture

Contact your Square D sales representative for additional information. Or, visit www.SquareD.com.



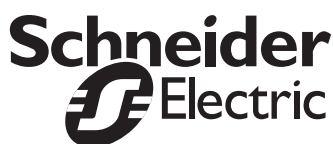
CURRENT IN MULTIPLES OF I_r ($I_r = \text{LONG-TIME SETTING} \times I_n$)



CURRENT IN MULTIPLES OF I_r
($I_r = \text{LONG-TIME SETTING} \times I_n$)

- Merlin Gerin
- Modicon
- Square D
- Telemecanique
- Federal Pioneer
- Federal Pacific

Schneider Electric Brands



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**MICROLOGIC® 3.0 A TRIP UNIT
CHARACTERISTIC TRIP CURVE NO. 613-6**

Long-time Pickup and Delay

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

Curves apply from -30°C to +60°C ambient temperature.

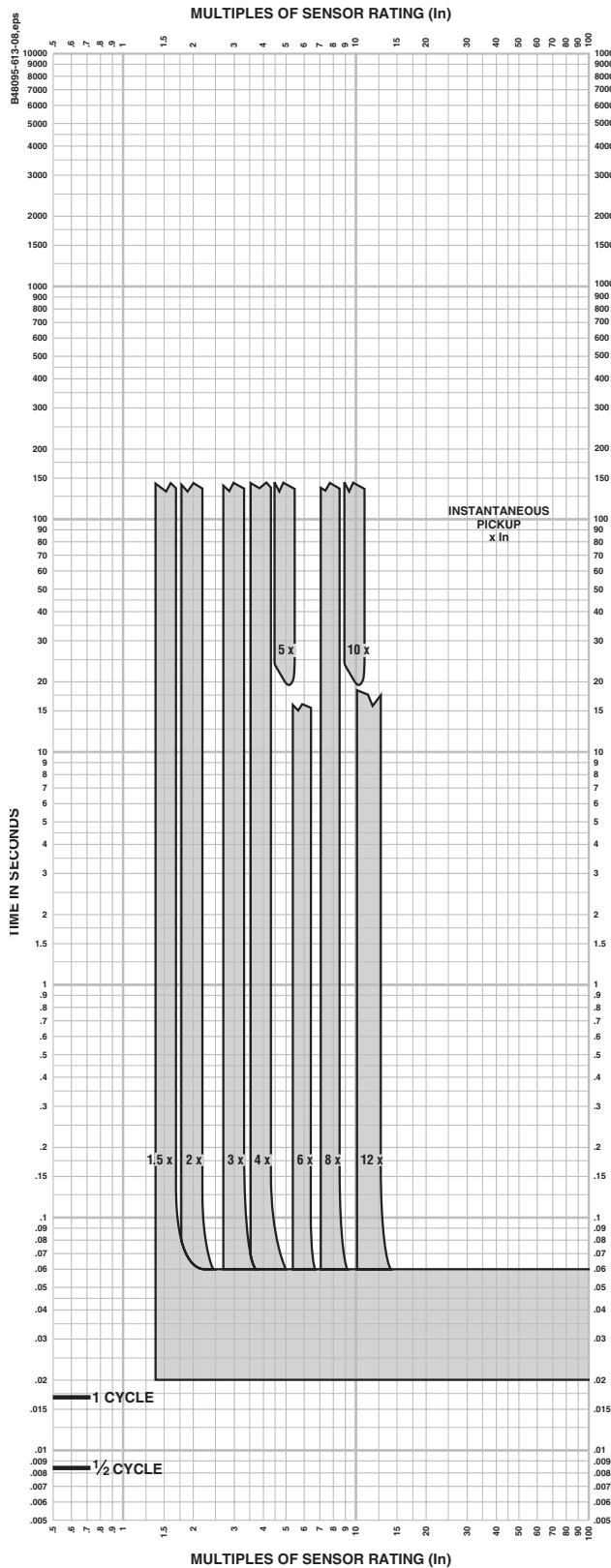
Notes:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately 20 minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the instantaneous setting.
3. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of the current.
4. See 613-8 for instantaneous pickup trip curve.

M-frame, P-frame, R-frame and NS630b–NS3200 Electronic Trip Circuit Breakers

Section 11—Trip Curves

Micrologic 3.0A Trip Unit Characteristic Trip Curve



Micrologic 3.0A Trip Unit

Instantaneous Pickup, 1.5X to 12X

Characteristic Trip Curve No. 613-8

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

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

Notes:

The end of the curve is determined by the interrupting rating of the circuit breaker.

Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.

The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.

See trip curve 613-6 on page 112 for long-time pickup and delay trip curves.

Curve No. 0613TC0008
Drawing No. B48095-613-08

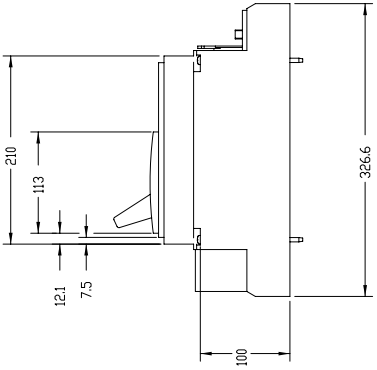
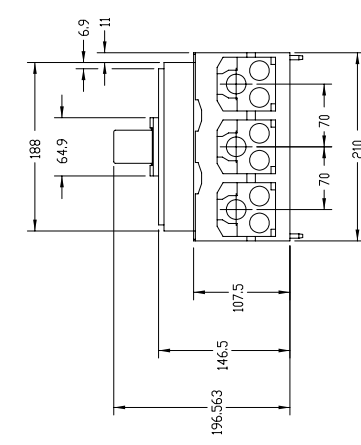
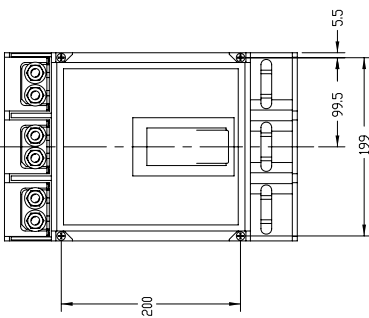
M-frame, P-frame, R-frame and NS630b–NS3200 Electronic Trip Circuit Breakers
Section 11—Trip Curves

Table 72: Instantaneous Override Values Characteristic Trip Curve

UL/IEC Circuit Breaker	Instantaneous Override ¹ (kA RMS)		
PJ 800	10 ± 10%		

¹ Note: Faults at or above instantaneous override value will be cleared at 25 msec or less.

REV. NO.	DATE	BY	CHKD	DESCRIPTION	DATE	BY	CHKD	DESCRIPTION
1				PRODUCTION RELEASE				
2				CHANGE TABLE				
3				P.J. WAS PG				
4				ADD & RELEASE JASH NO -01				
5				ADD CURRENT ER TABULATION				
6				ADD MATERIAL TO -01 CURRENT ER TAB				
7				REVISE INTERRUPT RATING TABLE				
8				NOTE 4, STUDS FOR BUSS BAR WAS STABS				



TYPE F	84%	86%	88%	90%	92%	94%	96%	98%	100%
0320_2182	672	688	704	720	736	752	768	784	800

- NOTES:
- THIS PART IS VENDOR SOURCE CONTROLLED.
 - ELECTRONIC TRIP CIRCUIT BREAKER, STANDARD MICROLOGIC 3.0 TRIP UNIT. (L1).
 - BREAKERS TO BE SUPPLIED WITH TYPE F PLUG.
 - BREAKERS TO BE SUPPLIED WITH STUDS FOR BUSS BAR ON LINE/TOP SIDE AND WITH LUGS ON LOAD/BOTTOM SIDE.
 - AGENCIES: 3 POLE UL LISTED IEC
 - INTERRUPTING RATING

CIRCUIT BREAKER	UL/CSA RATING (60 Hz)	IEC 60947-2 RATING (50/60 Hz)
PJ	100 kA	25 kA
	65 kA	25 kA
	25 kA	65 kA
	65 kA	35 kA
	35 kA	50 kA
	50 kA	25 kA
	25 kA	380/415 Vac
	Icu	Ics
	Icu	Ics
 - LEVEL OF OPERATION ABOVE 80% CONTINUOUS LOAD REQUIRES SPECIAL TESTING, INSTALLATION AND APPLICATION REQUIREMENTS PER VENDOR LITERATURE.

CURRENT_ER	PRODUCTION P/N	BREAKER	POLES	VOLTS UL/IEC	PLUG TYPE
FRD26895	0320_2182	PJ800	3	600 (690)	F

FORM 34

ITEM	PART NO	DESCRIPTION OR MATERIAL	DATE
1	D CRANE	03-21-03	
2	E CRANE	03-21-03	
3	F CRANE	03-21-03	

APPROVED: E. CZECHOWSKI

DATE: 03-21-03

SCALE: AS SHOWN

SCALE: 1:1

DWG NO: 0320_2182

PG: 1 OF 1

NRG

Intelligent Engine Start Battery Charger



The Smart Choice for Mission-Critical Engine Starting

- **Fast, accurate, mission-critical charging** – gives best starting reliability
- **Replace nearly any charger** – without planning ahead
- **Industry-first battery-fault alarm** - helps dispatch service early
- **1 million hour observed MTBF** – means longest charger life
- **Smart design** – stops load dump and other damaging transients



NRG Battery Charger Benefits and Features



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

SENS NRG battery charger maximizes starting system reliability while slashing genset servicing costs:

One NRG replaces almost any charger without extra site visits. Installers can select or change at any time 120, 208 or 240 volts AC input, 12 or 24-volt battery and output settings optimized for nearly any lead-acid or nickel cadmium battery.

Easy to understand user interface provides state-of-the-art system status – including digital metering, NFPA 110 alarms and a battery fault alarm that can send service personnel to the site before failure to start.

Batteries charged by NRG give higher performance and last longer. In uncontrolled environments precision charging by SENS increases battery life and watering intervals 400% or more.

NRG meets all relevant industry standards – including UL, NFPA 110 and CE. All units are either C-UL listed or C-UL recognized. 50/60 Hz units add CE marking to UL agency marks.

EnerGenius reliability technology built into every charger includes:

- All-electronic operation with generous component de-rating
- Disconnected/reversed/incorrect voltage battery alarm and protection
- Protection of connected equipment against load dump transients
- Widest temperature rating, and overtemperature protection
- Superior lightning and voltage transient protection
- Demonstrated field MTBF > 1 million hours
- Standard 3-year warranty and available reimbursement of customer field service costs

Earn the best return on your charger investment – choose SENS NRG

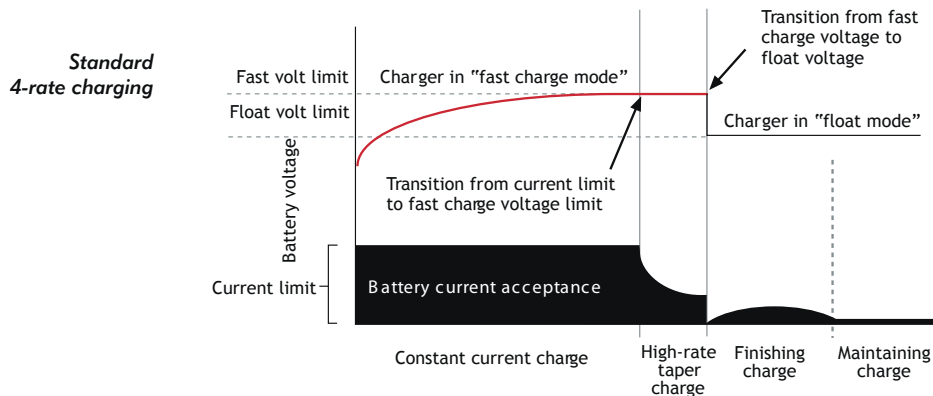
NRG Specifications

AC Input

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

Charger Output

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



User Interface, Indication and Alarms

Digital meter	Switch-selectable meter for output volts, amps
Accuracy	$\pm 2\%$ volts, $\pm 5\%$ amps
Alarms	LED and Form C contact(s) per table:



Front panel status display

Alarm System Functions

	Alarm code "1" ¹	Alarm code "C" (meets requirements of NFPA 110)
AC good	LED	LED
Float mode	LED	LED
Fast charge	LED	LED
Temp comp active	LED	LED
AC fail	LED ²	LED and Form C contact
Low battery volts		LED and Form C contact
High battery volts		LED and Form C contact
Charger fail	LED ²	LED and Form C contact
Battery fault ³	LED ²	LED and Form C contact

- Alarms "1" available only on 10A charger
- Form C contact provides summary alarm of these conditions. BBHH chargers include this alarm configuration. Contacts rated 2A @ 26 VDC resistive
- Battery fault alarm indicates these fault conditions:
 - Battery disconnected - Battery polarity reversed - Mismatched charger battery voltage - Open or high resistance charger to battery connection
 - Open battery cell or excessive internal resistance

Controls

AC input voltage select
Optional 12/24-volt output select
Battery program select
Fast charger enable/disable
Temp compensation enable
Remote temp comp enable

Field-selectable switch
Field-selectable two-position jumper
Field-selectable six-position jumper
Field-selectable two-position jumper
Standard. Can be disabled or re-enabled in the field
Connect optional remote sensor to temp comp port



Simple field adjustments

Environmental

Operating temperature
Over temperature protection
Humidity
Vibration (10A unit)
Transient immunity

-20C to +60C, meets full specification to +45C
Gradual current reduction to maintain safe power device temperature
5% to 95%, non-condensing
UL 991 Class B (2G sinusoidal)
ANSI/IEEE C62.41, Cat. B, EN50082-2 heavy industrial

Agency Standards

Safety

Agency marking

EMI
NFPA standards
Optional agency compliance

C-UL listed to UL 1236 (required for UL 2200 gensets), CSA standard 22.2 no. 107.2-M89
CE: 50/60 Hz units DOC to EN 60335
60 Hz: C-UL-US listed
50/60 Hz: C-UL-US listed plus CE marked
FCC Part 15 Class B; EN 50081-2
NFPA 70, NFPA 110. (NFPA 110 requires Alarms "C")
Units with Alarms "1" configuration available with additional compliance to UL category BBHH and NFPA 20

Construction

Housing/configuration

Packaging
Dimensions
Printed circuit card
Cooling
Protection degree
Damage prevention
Electrical connections

Material: Heavy clear anodized aluminum. Configuration options:
• Fully enclosed: C-UL listed enclosure
• Open frame: C-UL recognized
• Slimline: C-UL recognized open frame construction with remote isolation transformer
Open-frame and Slimline configurations only available in bulk OEM quantities and packaging
See Drawings and Dimensions page for details
Surface mount technology, conformal coated
Natural convection
Listed housing: NEMA-1 (IP20). Optional NEMA 3R enclosure
Fully recessed display and controls
Compression terminal blocks

Warranty

Standard warranty
Optional warranty

Three year parts and labor warranty from date of shipment
If specified at time of order, warranty coverage is increased to reimburse customer's documented field service costs up to the original charger price. Contact the factory for full details

Optional features

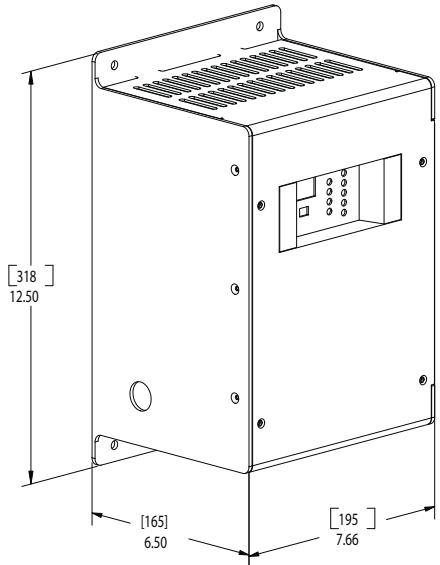
Input
Remote temp comp sensor
Drip shield
NEMA 3R housing
UL BBHH listing
Field service warranty

Input frequency, 50/60 Hz
Recommended where battery and charger are in different locations
Protects from dripping water
Enables outdoor installation (remote temp sensor recommended)
Available in 10A units with Alarms "1"
Reimbursement of customer field service expenses up to charger price

Drawings and Dimensions

10A Chargers

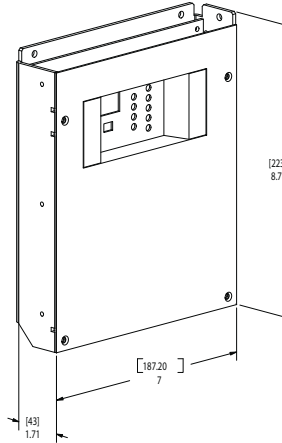
Enclosed and Open Frame Configurations



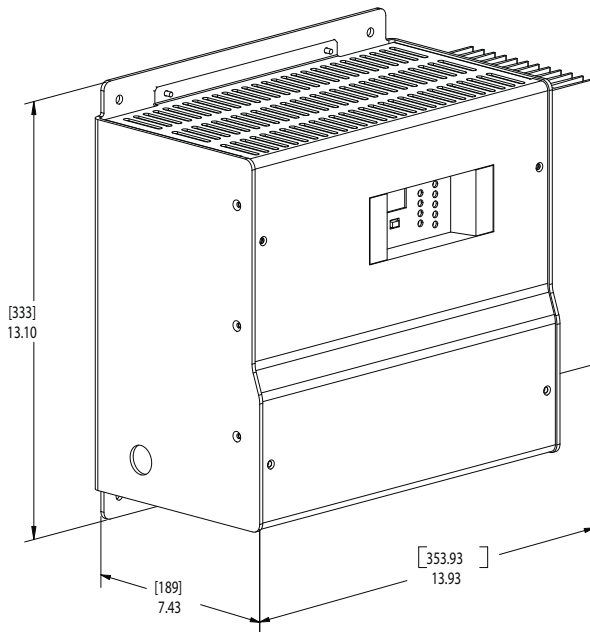
Open-frame configuration omits front cover

10A Chargers

Slimline Open Frame Configuration



Slimline can be mounted either flat or edgewise



Open-frame configuration omits front cover

20A Chargers

Enclosed and Open Frame Configurations

Housing Dimensions Table

Amps	Configuration	Width	Depth	Height
10	Enclosed	7.66" (195 mm)	6.50" (165 mm)	12.50" (318 mm)
10	Open-frame	7.66" (195 mm)	6.50" (165 mm)	12.50" (318 mm)
10	Slimline – flat mount	7.00" (187 mm)	1.71" (43 mm)	8.78" (223 mm)
10	Slimline – edge mount	1.71" (43 mm)	7.00" (187 mm)	8.78" (223 mm)
20	Enclosed	13.93" (354 mm)	7.43" (189 mm)	13.10" (333 mm)
20	Open-frame	13.93" (354 mm)	7.43" (189 mm)	13.10" (333 mm)

NRG Ordering Information					
Output volts	Output amps	Model	Available configurations	NFPA 110 Alarms	Lbs/Kg
12	10	NRG12-10-R1	Enclosed, Open-frame, Slimline	No	19 / 8.7
12	10	NRG12-10-RC	Enclosed, Slimline	Yes	19 / 8.7
24	10	NRG24-10-R1	Enclosed, Open-frame, Slimline	No	24 / 10.9
24	10	NRG24-10-RC	Enclosed, Slimline	Yes	24 / 10.9
12/24	10	NRG22-10-R1	Enclosed, Open-frame, Slimline	No	24 / 10.9
12/24	10	NRG22-10-RC	Enclosed, Slimline	Yes	24 / 10.9
12	20	NRG12-20-RC	Enclosed, Open-frame	Yes	39 / 17.7
24	20	NRG24-20-RC	Enclosed, Open-frame	Yes	42 / 19.1
12/24	20	NRG22-20-RC	Enclosed, Open-frame	Yes	42 / 19.1

All models offer field-selectable input 120/208-240 volts. 60 Hz input is standard with C-UL listing. Optional 50/60 Hz input includes C-UL listing and adds CE mark.

Model Number Breakout



- Model**
- Output voltage**
12: 12 volts
24: 24 volts
22: 12/24-volt field selectable
- Output current**
10: 10 amps
20: 20 amps
- AC input**
R: 120/208-240 VAC, 60 Hz
H: 120/208-240 VAC, 50/60 Hz
- Alarm system code**
1: LED and single Form C contact
C: LEDs and Form C contacts to meet NFPA 110
- Housing/Agency**
L: Enclosed: C-UL listed
R: Open-frame: C-UL recognized
S: Slimline open-frame: C-UL recognized (10A only)
- UL category code**
S: UL category BBGQ (standard)
H: UL category BBHH (Alarms "1" only)

The Smart Choice for Mission-Critical Engine Starting

Additional Information

Contact SENS or your local sales representative for additional specification, engineering and installation information



Contact Information

For information and service on any SENS product, please contact us at:
 Sales 1.866.736.7872 • 303.678.7500 • Fax 303.678.7504
 www.sens-usa.com • info@sens-usa.com
 1840 Industrial Circle, Longmont, CO 80501 USA



STOP!

Verify that all settings shown below are correct *before energizing charger*. **CAUTION:** Correct settings are essential to ensure proper battery performance and long battery life. *Before installation*, ensure adequate battery to charger wire gauge. Wire gauge that is too small may activate the open battery detector and the charger will shut down:

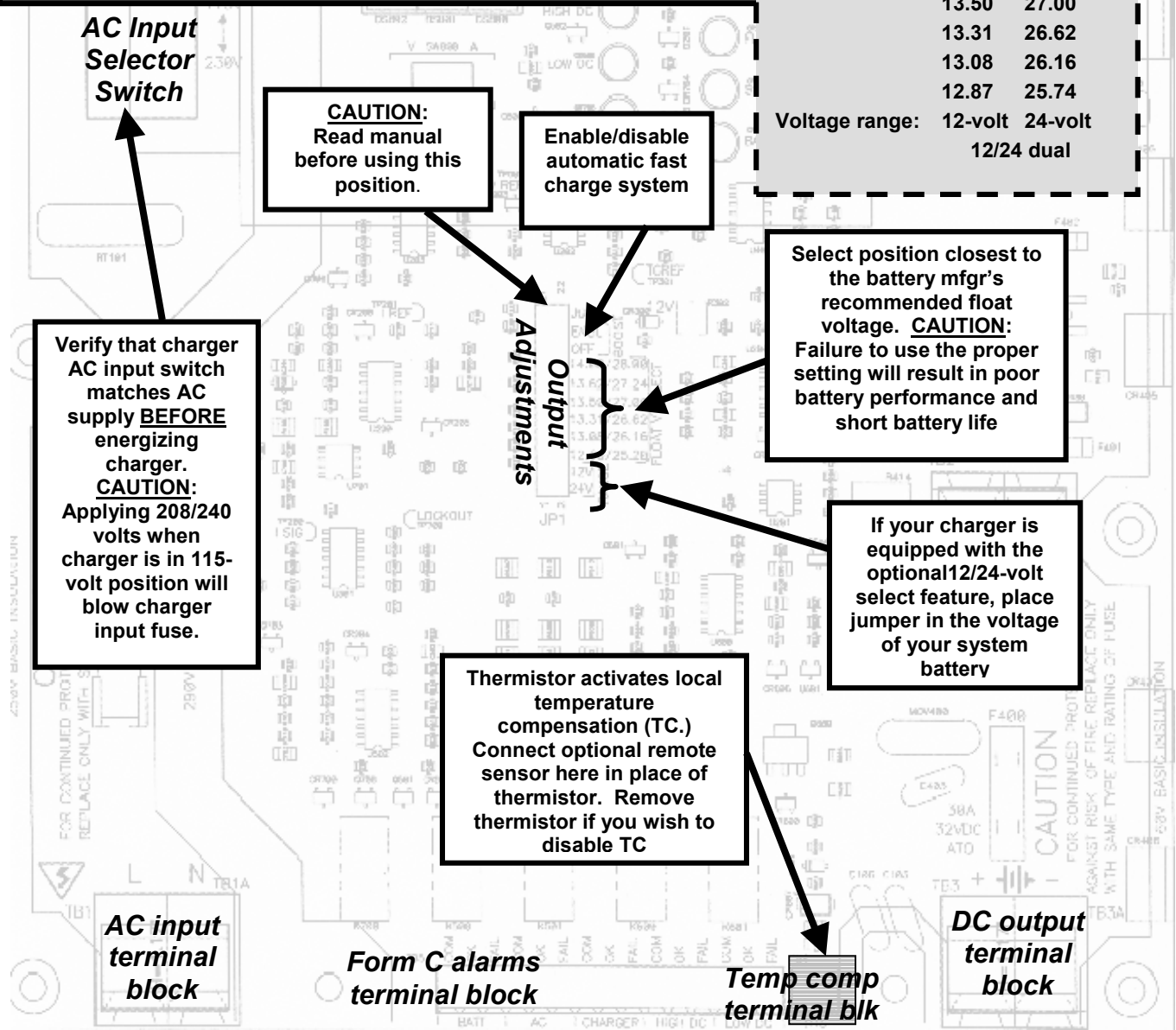
AWG	Recommended Charger to Battery Distance (Ft.)			
	12V/10A	24V/10A	12V/20A	24V/20A
10	10	19	N/A	N/A
8	15	30	7	15
6	24	48	12	24

For runs exceeding the above values, call SENS at 1-800-742-2326 or (303) 678-7500.

FACTORY SETTINGS

Charger is factory set for the following settings. Change the setting if needed for your battery or site conditions

Input	230 VAC	
Jump:	DISABLED	
Fast charge:	ENABLED / OFF	
Float voltage	14.30	28.60
	13.62	27.24
	13.50	27.00
	13.31	26.62
	13.08	26.16
Voltage range:	12-volt	24-volt
	12/24 dual	



Verify that charger AC input switch matches AC supply **BEFORE** energizing charger. **CAUTION:** Applying 208/240 volts when charger is in 115-volt position will blow charger input fuse.

CAUTION: Read manual before using this position.

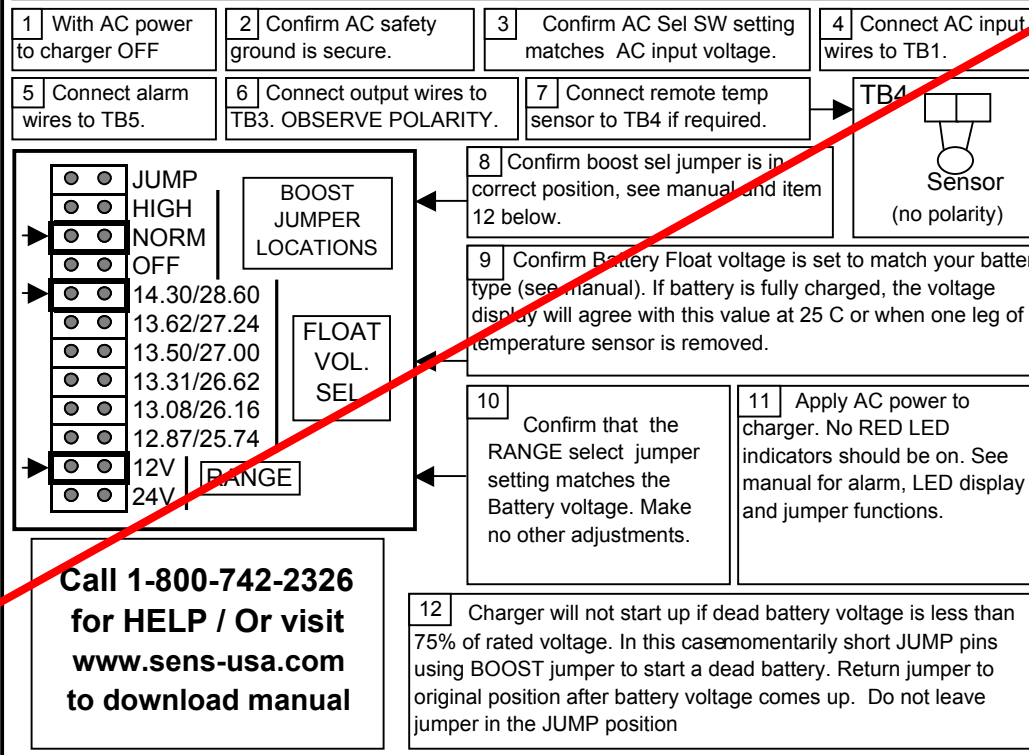
Enable/disable automatic fast charge system

Select position closest to the battery mfg's recommended float voltage. **CAUTION:** Failure to use the proper setting will result in poor battery performance and short battery life

If your charger is equipped with the optional 12/24-volt select feature, place jumper in the voltage of your system battery

Thermistor activates local temperature compensation (TC.) Connect optional remote sensor here in place of thermistor. Remove thermistor if you wish to disable TC

**ALL ADJUSTMENTS TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY
SEE INSTALLATION MANUAL FOR DETAILS**



**Call 1-800-742-2326
for HELP / Or visit
www.sens-usa.com
to download manual**

4.125

5.00 max

NOTES:

1. LETTERING TO BE BLACK INK ON SILVER FOIL LABEL, MATERIAL RATED PER R/C (PGDQ2). LABEL ADHESIVE PROVIDED MUST BE SUITABLE FOR USE ON ALUMINUM & RATED FOR 80 DEG C MINIMUM.
2. PSA MATERIAL IS TO BE PROVIDED WITH RELEASE LINER.
3. RADIUS CORNERS .125" MAXIMUM.
4. THIS DRAWING NOT TO SCALE.



DCN No.	105073		
Drawn By:	KL	Date:	1/13/2006
Approved By:		Date:	
DWG Name:	LABEL, INSIDE COVER, NRG10/20		
PN: 808526	DWG REV.	C	

PowerCommand® Digital Input/output Module

DIM - Base, DIM - Expansion



> **Specification sheet**

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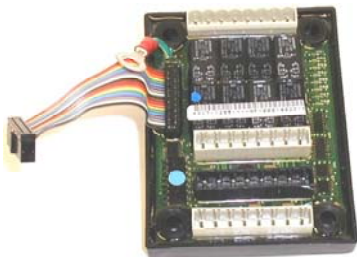
**Power
Generation**

Description

The PowerCommand® Digital Input/output Module (DIM) provides up to sixteen (16) output relays for local or remote monitoring and control of power system equipment such as motors, louvers, lamps, fans and pumps. The relays may be controlled as a group or individually by PowerCommand software or other system components. The DIM may be added at any point in the network using twisted-pair cabling.

DIM - Base contains eight (8) Form-C relay output sets and four (4) discrete dry contact inputs.

DIM - Expansion easily connects to DIM - Base to provide an additional eight (8) Form-C relay output sets for extended control and monitoring and (4) additional discrete dry contact inputs.



DIM - Expansion

Features

- Up to sixteen (16) Form-C latching relays provide easy control of system equipment such as lamps, louvers, motors and pumps.
- Four (4) discrete dry contact inputs for monitoring equipment status. Equipment status may be shared with other network modules.
- DIM - Base provides eight (8) Form-C contact output sets and four (4) discrete inputs.
- DIM - Expansion provides an additional eight (8) output relays and (4) additional discrete inputs.
- May be connected at any point in the PowerCommand Network.
- Pluggable connectors allow easy one-time wiring.
- Less wiring makes installation and system upgrades quick and easy.
- May be remotely monitored and controlled with PowerCommand Software for Windows® V 2.01.
- PowerCommand Controls are supported by a worldwide network of independent distributors who provide parts, service and warranty support.
- UL Listed and labeled; CSA certified; CE marked.

Specifications

Signal requirements

Network connections: Echelon® LonWorks®, twisted-pair 78 kbps, FT-10

Control power: 10-36 VDC

Current: 100 mA typical

Wiring materials for network signals are UL Listed NEMA Level 4 twisted pair wiring. Terminations for control power accept wire up to 16 ga.

Environment

The DIM - Base and Expansion is designed for proper operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and for storage from -40 °C to +80 °C (-40 °F to +176 °F). Control will operate with humidity up to 95%, non-condensing, and at altitudes up to 5000 m (13000 ft).

Relay ratings (DIM - Base)

Revision A: 1 A @ 125 VAC, 2 A @ 30 VDC
Revision 2 A: 2 A @ 250 VAC, 2 A @ 30 VDC

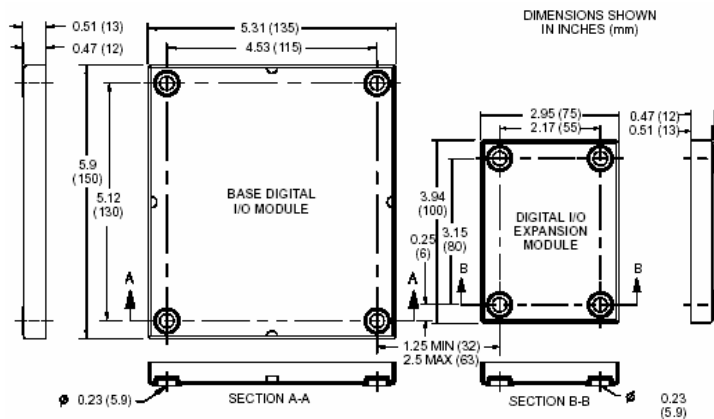
Relay ratings (DIM - Expansion)

1 A @ 125 VAC, 2 A @ 30 VDC

Network length: Maximum 1400 m (4600 ft)

Approved wiring: UTP NEMA Level 4, Cat 5 (stranded)

Dimensions



Ordering information

Part number	Description
0541-0771	Digital Input/output Module - Base (DIM - Base), FT-10
0541-0772	Digital Input/output Module - Expansion (DIM - Expansion), FT-10

See your distributor for more information.

Cummins Power Generation

Americas

1400 73rd Avenue N.E.
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Europe, CIS, Middle East and Africa

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Manston Ramsgate
Kent CT 12 5BF United Kingdom
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Singapore 608838
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Fax 65 6417 2399

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S-1431c (9/07)



PowerCommand® Remote Annunciator Panel (LonWorks System annunciator)



> Specification sheet

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Power Generation

Description

The PowerCommand® Network Annunciator is a network component that provides remote system status indication for emergency and other power systems in compliance to the requirements of NFPA 110. The network annunciator may also be used for remote indication of any condition that is monitored by a PowerCommand Network.

The Network Annunciator reduces installation costs and improves design flexibility by use of a PowerCommand Network to transmit all the genset and transfer switch system signals rather than using relay contacts for this purpose.

Control power for PowerCommand Network products is usually derived from the genset starting batteries. The control functions over a voltage range from 8 VDC to 35 VDC.

Features

- Visual indication of 20 network conditions and network status.
- Audible indication of any network condition - Annunciator also includes pushbutton switch to silence the audible alarm. Alarm horn sound level is approximately 90 dB(A) at 30 cm.
- Standard NFPA 110 label, field configurable for other alarm and status conditions.
- Configurable for compliance to NFPA 99 requirements.
- Sealed membrane panel design provides environmental protection for internal components and is easy to clean.
- Warranty - PowerCommand Controls are supported by a worldwide network of independent distributors who provide parts, service and warranty support.
- UL Listed and labeled; CSA certified; CE marked.
- Wall mount NEMA 1 enclosure or flush mount configurations available.

Specifications

Signal requirements

Network connections: Echelon® LonWorks®, twisted-pair 78 kbps, FT-10.

Control power: 8-30 VDC, 3.5 W (maximum) 0.8 W typical.

Wiring materials for network signals are UL Listed 4 twisted pair wiring. Terminations for control power accept wire up to 16 ga.

Environment

The annunciator is designed for proper operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and for storage from -40 °C to +80 °C (-40 °F to +176 °F). Control will operate with humidity up to 95%, non-condensing and at altitudes up to 5000 m (13,000 ft).

Alarm Horn

Sound Level: 90 dB(A) at 30 cm

Physical

Weight: 1.45 kg (3.2 lbs) (board plus enclosure)

Power

Maximum Consumption: 5 W

Standby Consumption: 0.4 W or less

Network Length: Maximum 1400 m (4600 ft), when using NEMA Level 4 cable

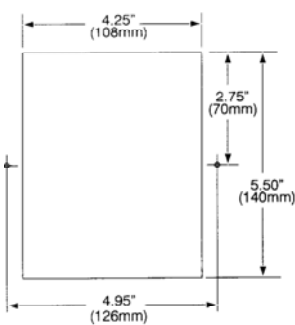
Self-binding configurations - Supports use of up to four annunciators with up to one genset and one transfer switch.

Maximum wire lengths - control power-self-binding system

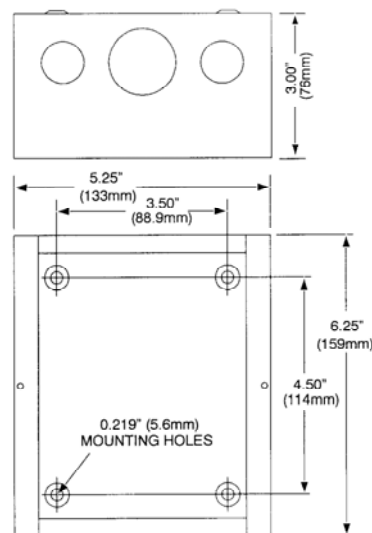
Wire size	12 VDC	24 VDC
22 ga	100 m (330 ft)	338 m (1100 ft)
20 ga	158 m (520 ft)	537 m (1760 ft)
18 ga	250 m (820 ft)	852 m (2790 ft)
16 ga	398 m (1300 ft)	1352 m (4430 ft)
14 ga	631 m (2070 ft)	1400 m (4600 ft)

Dimensions

Cut out detail (without enclosure)



Annunciator enclosure



Dimensions: in (mm)

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S-1343e (9/07)

Label configurations & standard bindings

NFPA 110 genset alarm and status annunciator

The following conditions are provided as standard on the annunciator:

- High battery voltage (A)
- Low battery voltage (A)
- Genset running (G)
- Genset supplying load (G)
- Pre-low oil pressure (A)
- Low oil pressure (R)
- Pre-high coolant temperature (A)
- High coolant temperature (R)
- Low engine temperature (A)
- Overspeed (R)
- Fail to start (overcrank) (R)
- Not in auto (R)
- Battery charger malfunction (A)
- Low fuel (A)
- Low coolant level (R)
- Spare (4) (G)
- Common alarm

(A) = Amber; (R) = Red; (G) = Green

Extended genset alarm and status annunciator

The following conditions are provided as standard on the annunciator:

- Check genset (R)
- Ground fault (A)
- High AC voltage (R)
- Low AC voltage (R)
- Under frequency (R)
- Overload (R)
- Over current (R)
- Short circuit (R)
- Reverse KW (R)
- Reverse kVAR (A)
- Fail to sync (A)
- Fail to close (R)
- Load demand (G)
- Genset CB tripped (R)
- Utility CB tripped (R)
- Emergency stop (R)
- Spare (4) (G)

(A) = Amber; (R) = Red; (G) = Green

8-Point (genset)

The following conditions are provided as standard on the annunciator:

- Check genset (A)
- Genset supplying load (A)
- Genset running (G)
- Not in auto (G)
- High/low engine temp (G)
- Low oil pressure (A)
- Low coolant level (R)
- Low fuel level (A)
- Spare (8) (G)

(A) = Amber; (R) = Red; (G) = Green

4-Point (genset)

The following conditions are provided as standard on the annunciator:

- Check genset (A)
- Genset supplying load (A)
- Genset running (G)
- Not in auto (G)
- Spare (16) (G)

(A) = Amber; (R) = Red; (G) = Green

ATS-extended

This annunciation set is often used with PLT-series equipment. The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 1 connected (G)
- Source 2 connected (G)
- Check ATS (R)
- ATS not in auto
- Test/exercise
- Transfer pending
- Load shed
- Transfer inhibit
- Fail to close
- Fail to disconnect
- Fail to synchronize
- Low battery-controller
- Low battery-network

(A) = Amber; (R) = Red; (G) = Green

ATS 8-point

The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 1 connected (G)
- Source 2 connected (G)
- Common alarm (A)
- Not in auto (R)
- Test/exercise mode (A)
- Low control battery (A)
- Spare (8) (G)

(A) = Amber; (R) = Red; (G) = Green

ATS 4-point

The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 2 connected (G)
- Source 1 connected (G)

(A) = Amber; (R) = Red; (G) = Green

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S-1343e (9/07)

Custom alarm configuration

#	Color (R/Y/G)	Label	Horn (Y/N)	#	Color (R/Y/G)	Label	Horn (Y/N)
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

Ordering information

Part number	Description
0541-0814-01	Network annunciator, open construction, for panel mounting
0541-0814-02	Network annunciator including control box for surface wall mounting

See your distributor for more information.

Cummins Power Generation

Americas

1400 73rd Avenue N.E.
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 Phone: 763 574 5000 USA
 Fax: 763 574 5298

Europe, CIS, Middle East and Africa

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 Manston Ramsgate
 Kent CT 12 5BF United Kingdom
 Phone 44 1843 255000
 Fax 44 1843 255902

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 TT International Tradepark
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 Fax 65 6417 2399

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 S-1343e (9/07)



POWERCOMMAND NETWORKS

NETWORK CABLING AND CONNECTIONS FOR FTT-10 NETWORKS

Network Topology

FTT-10 networks are designed to support free topology wiring, and will accommodate bus, star, ring, or any combination of these topologies. Excepting the double-terminated bus topology, only one point of termination is required for any free topology segment. Note that the actual termination circuit will vary by application (See “Cable Termination” below.)

Network Nodes

Each device with an FTT-10 transceiver is a network node. The maximum number of nodes on a network segment and on the total network is partly dependant on the network application. For example, a network that is connecting only a few discrete variables between devices and has no monitoring software attached could probably support 64 nodes (maximum allowable on a segment per Echelon specs.) At the other extreme, a network with a large amount of inter-device bindings and being monitored by PowerCommand PULSE with Reporting option would not be able to support more than 12 devices using a single FTT-10 channel. However, with the appropriate addition of other network management devices, the PULSE example could potentially support 64 devices or even more. If there is any question about how many devices your network can support, contact the Network Applications Engineer in the CPG System Sales department.

Network Cable Selection

The following cables are qualified for use with FTT-10 networks:

- NEMA Level IV cable (Onan P/N 334-1350 [PVC] or 334-1351 [Plenum])
- Belden 85102 or Belden 8471 (both are single twisted pair, 16 AWG)
- TIA Category 5 (CAT5)

Network wiring should be run in separate conduit and installed following local electrical codes. Any wire connected to Generator Sets must be stranded wire (NFPA110, Para. 7.12.4.1). Except when using ring topology, cabling is not polarity sensitive. The average temperature of the wire should not exceed +55°C (+131°F). Cable distance must comply with transmission specifications listed below. The *maximum total wire length* is the total length of wire within a segment. The *maximum node-to-node distance* is the maximum allowable distance between each individual node or the terminator.

Table 1 Free Topology

	Maximum node-to-node distance (Ft)	Maximum total Wire length (Ft)
Belden 8471	1300	1600
Belden 85102	1600	1600
NEMA Level IV	1300	1600
TIA Category 5	800	1400

POWERCOMMAND NETWORKS

NETWORK CABLING AND CONNECTIONS FOR FTT-10 NETWORKS

Table 2 Double-Terminated Bus Topology

	Maximum Bus length (Ft)
Belden 8471	8800
Belden 85102	8800
NEMA Level IV	4500
TIA Category 5	2900

A double-terminated bus may have stubs of up to 10 feet from the bus to each device.

Cable Termination

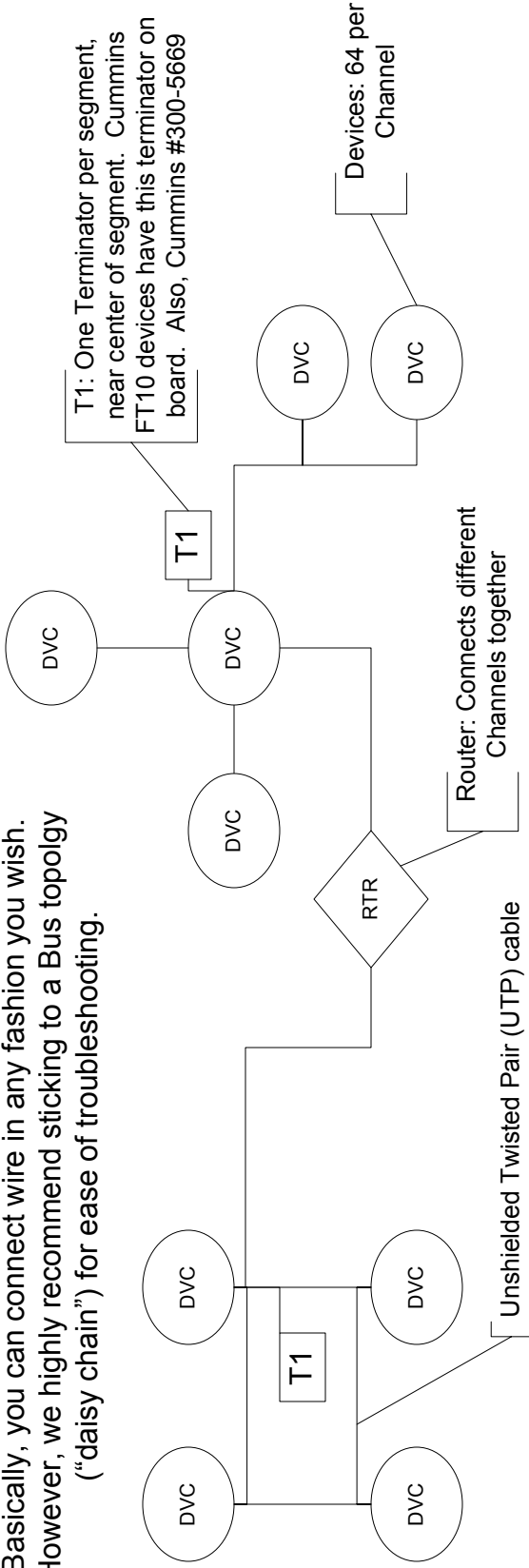
FTT-10 network segments require termination for proper data transmission performance. Free topology and Double-terminated Bus topology networks differ in their termination requirements.

Free topology segments only require one terminator per segment. This terminator can be placed anywhere in the segment, but is recommended to be placed near the middle of the segment. All PowerCommand network interface modules (i.e. GCM, NCM, GLC), Control Communications Modules (CCM), Digital I/O Modules (DIM) and Lonworks Annunciators have an on-board free topology terminator. It is recommended that this be used on a free topology segment. Optionally an external free topology terminator (Onan P/N 0300-5669) can be used.

Double-terminated Bus segments must be terminated at both ends of the segment. An FTT-10 Bus terminator (Onan P/N 0300-5729) must be used.

FT-10 Physical Wiring: Method 1, Free Topology

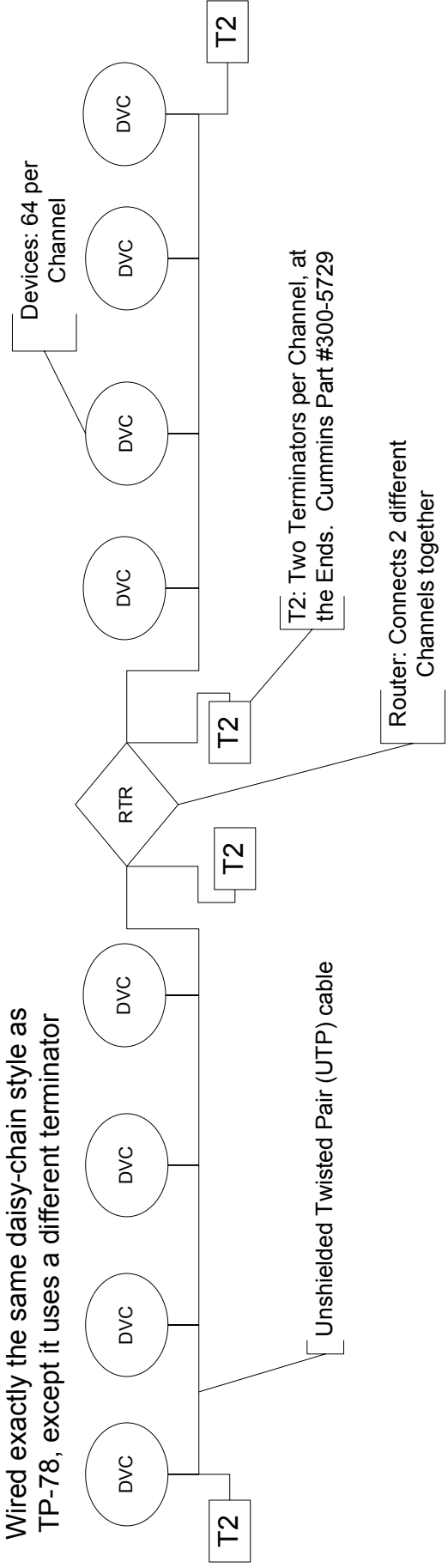
Basically, you can connect wire in any fashion you wish. However, we highly recommend sticking to a Bus topology ("daisy chain") for ease of troubleshooting.



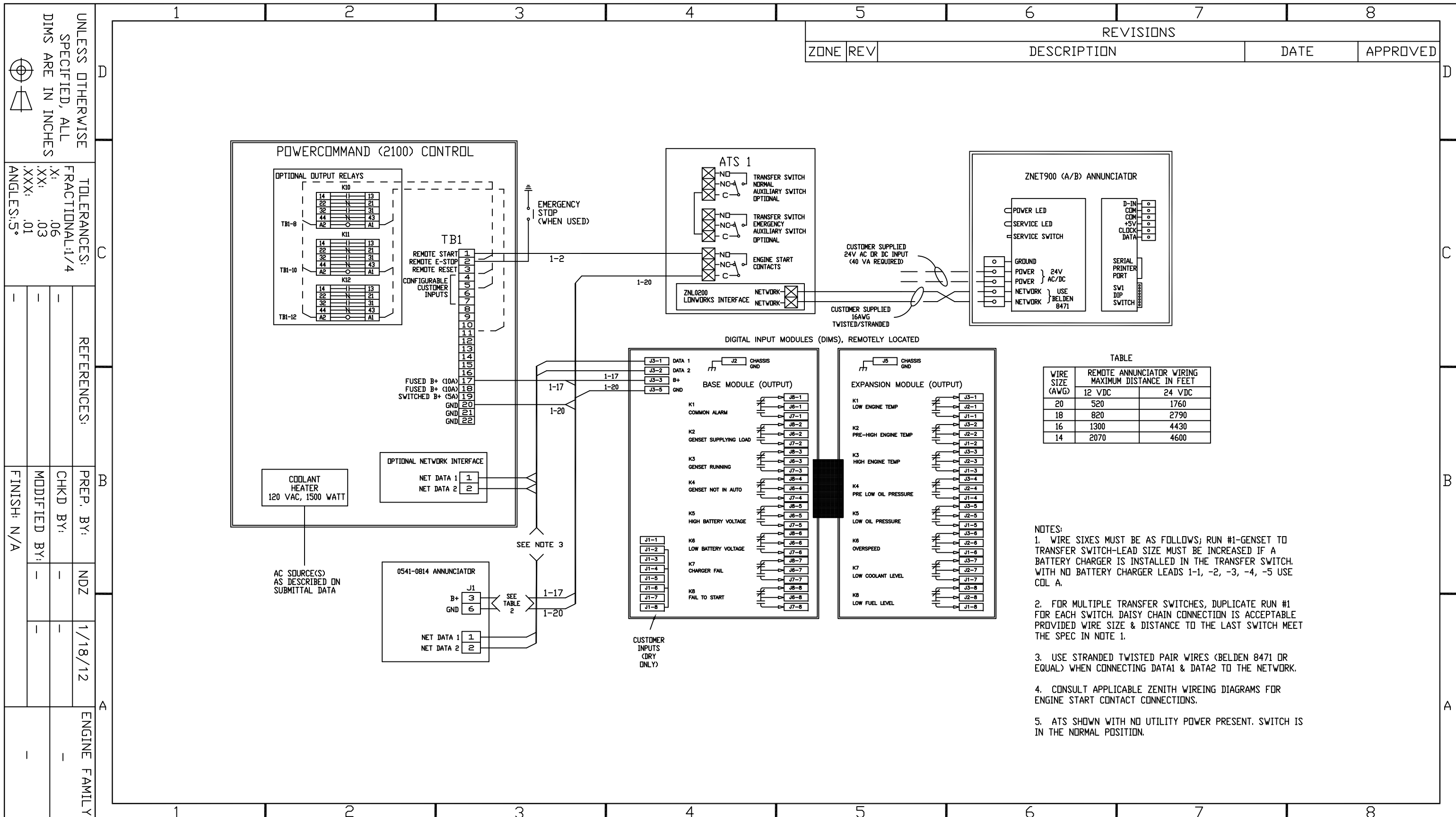
Note: Although LonMaker says that you can have 2 segments to a channel, we are not confident in this, so stick to a maximum of 64 devices, 1 segment per channel

FT-10 Physical Wiring: Method 2, Multi-Drop Bus

Wired exactly the same daisy-chain style as TP-78, except it uses a different terminator



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Cummins Rocky Mountain
 8211 E 96th AVE
 HENDERSON, COLORADO 80640
 PH: 303-287-0201
 FAX: 303-287-4837

SITE NAME: HAROLD D THOMPSON
 WATER RECLAMATION
 CONTRACTOR NAME:
 MCDADE WOODCOCK

CONTACT NAME:
 -
 CONTACT NO:
 -

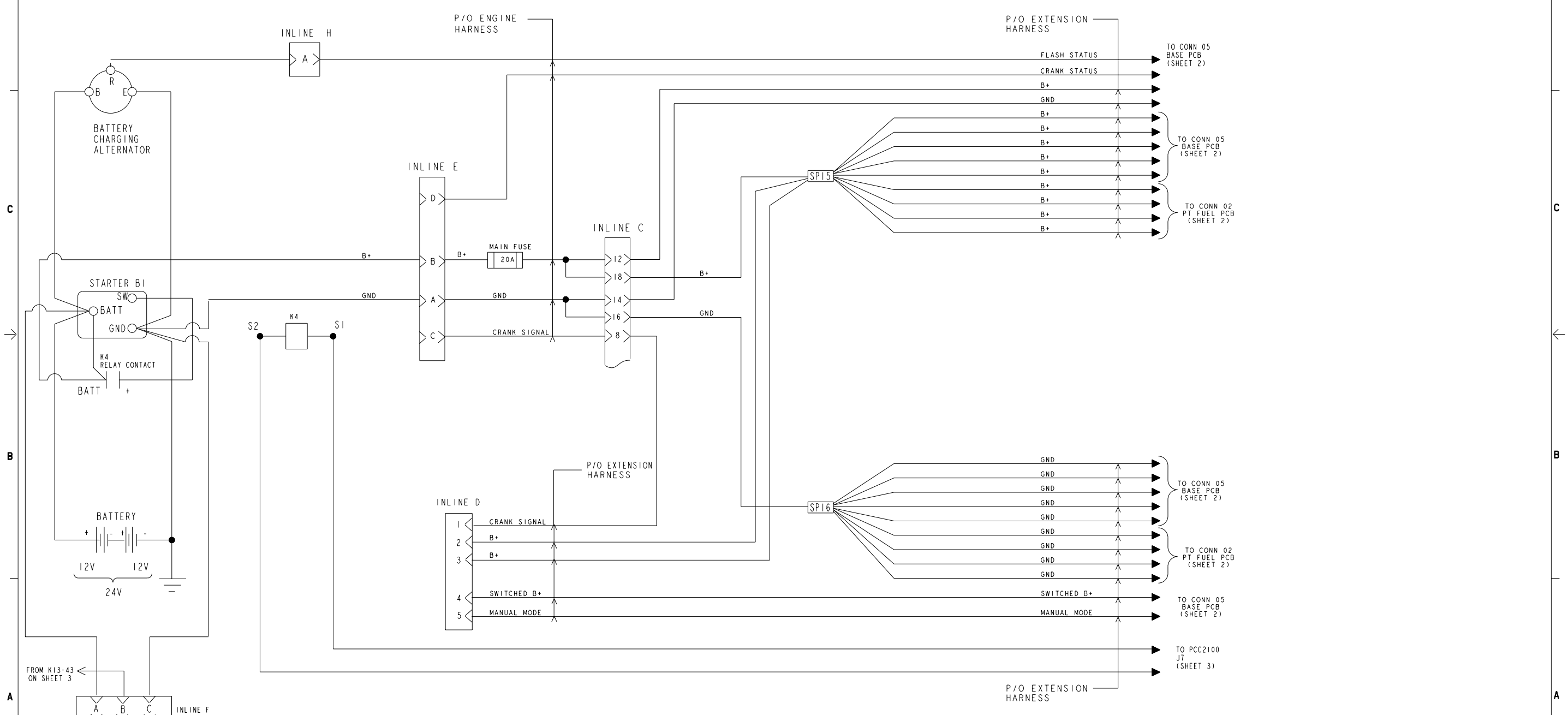
CUSTOMER PROJECT NO:
 -
 CRM PROJECT NO:
 63439

TITLE: INTERCONNECT PCC2100
 NETWORK&Z-NET ANNUNCIATOR
 SIZE DWG NO: 5000537
 SCALE: NONE DO NOT SCALE SHEET: 1 OF 1

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REL NO	LTR	NO	REVISION	ZONE	DR	CHKD	APPROVED	DATE
ECO-101507	G	1	SEE SHEET 3		GWH	VO	PUSHKAR	03SEP08

DC POWER AND STARTER WIRING



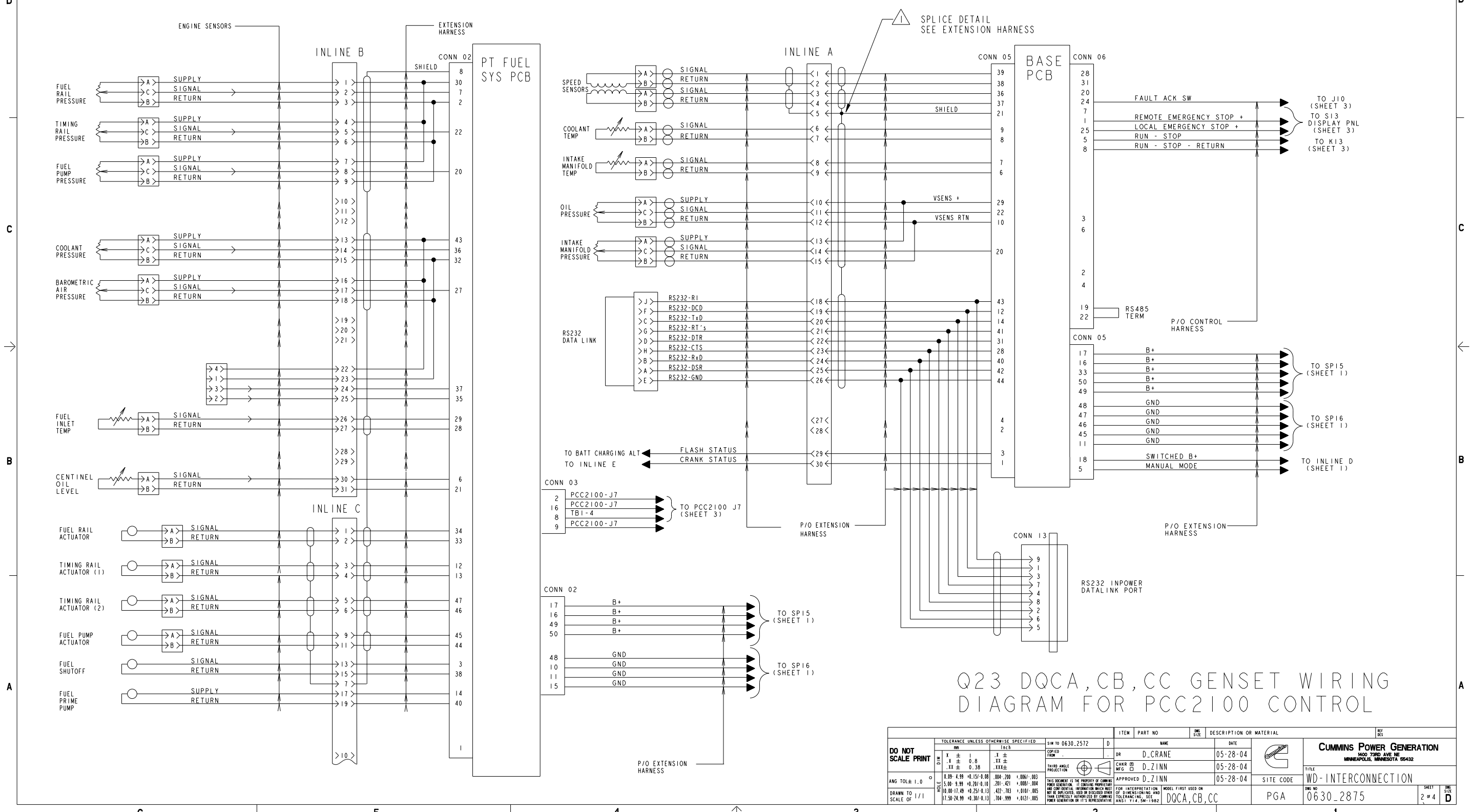
Q23 DQCA, CB, CC GENSET WIRING DIAGRAM FOR PCC2100 CONTROL

DO NOT SCALE PRINT		TOLERANCE UNLESS OTHERWISE SPECIFIED		DIM		ITEM PART NO		DESCRIPTION OR MATERIAL		REV DES	
mm		Inch		mm		NAME		DATE		FILE	
0.00	± 0.10	0.00	± 0.004	0.00	± 0.004	D	D. CRANE	05-28-04		CUMMINS POWER GENERATION 1400 73RD AVE NE MINNEAPOLIS, MINNESOTA 55432	
0.00	± 0.25	0.00	± 0.010	0.00	± 0.010		D. ZINN	05-28-04		WD-INTERCONNECTION	
0.00	± 0.50	0.00	± 0.020	0.00	± 0.020		APPROVED D. ZINN	05-28-04		SITE CODE	PGA
0.00	± 1.00	0.00	± 0.040	0.00	± 0.040					DWG NO	0630_2875
0.00	± 1.50	0.00	± 0.060	0.00	± 0.060					DRG FILE	1 of 4
0.00	± 2.00	0.00	± 0.080	0.00	± 0.080					SHEET	D

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REL NO	LTR	NO	REVISION	ZONE	DR	CHKD	APPROVED	DATE
ECO-101507	G	-			GWH	VO	PUSHKAR	03SEP08

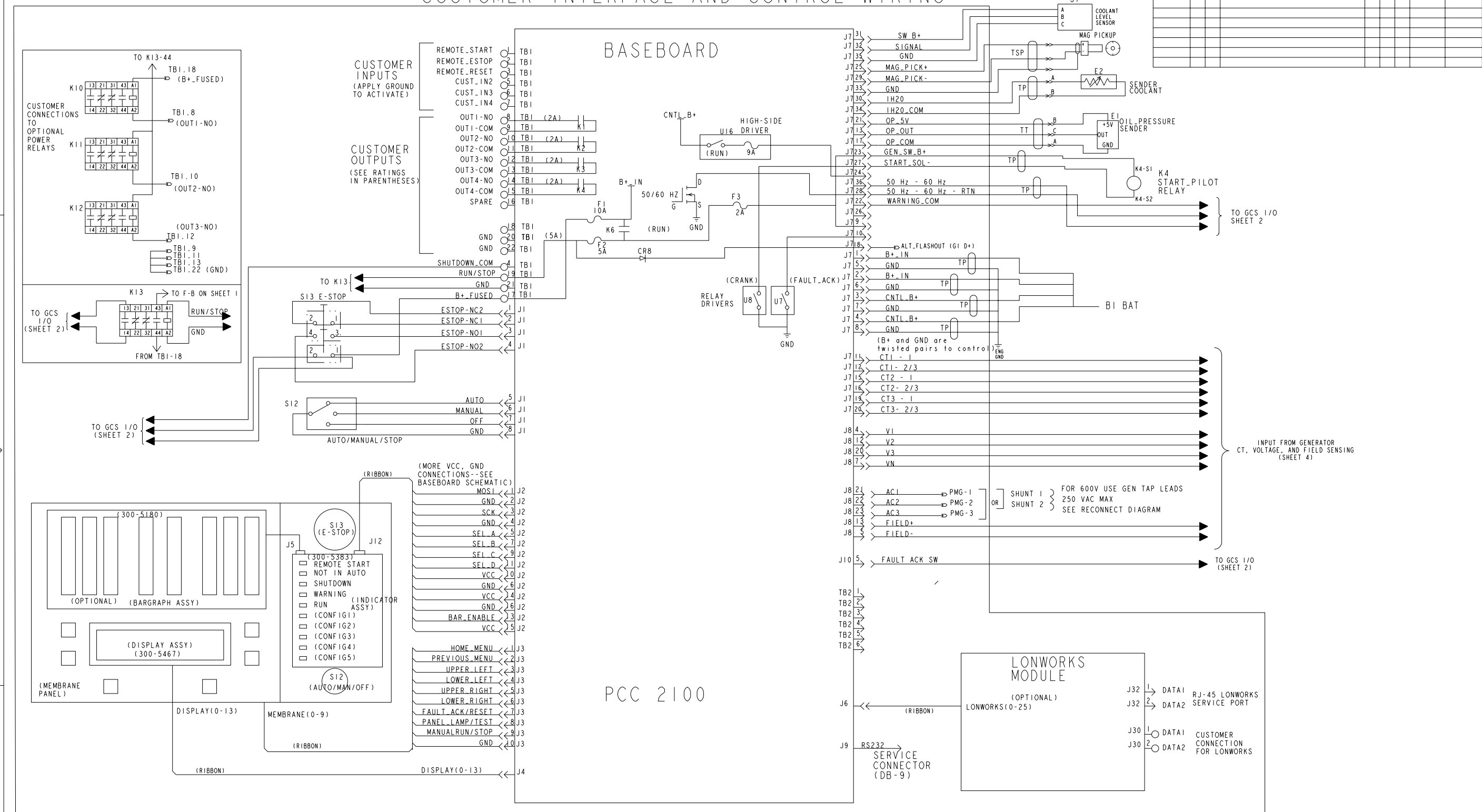
ENGINE SENSORS AND GCS I/O



Q23 DQCA, CB, CC GENSET WIRING DIAGRAM FOR PCC2100 CONTROL

DO NOT SCALE PRINT		TOLERANCE UNLESS OTHERWISE SPECIFIED		DIM TO 0630_2572		ITEM PART NO		DESCRIPTION OR MATERIAL		REV DES	
mm	Inch	mm	Inch	mm	Inch	DR	NAME	DATE			
0.25 ± 0.01	0.010 ± 0.004	0.25 ± 0.01	0.010 ± 0.004	0.25 ± 0.01	0.010 ± 0.004	D	D. CRANE	05-28-04			
0.50 ± 0.02	0.020 ± 0.008	0.50 ± 0.02	0.020 ± 0.008	0.50 ± 0.02	0.020 ± 0.008						
1.00 ± 0.04	0.040 ± 0.016	1.00 ± 0.04	0.040 ± 0.016	1.00 ± 0.04	0.040 ± 0.016						
1.50 ± 0.06	0.060 ± 0.024	1.50 ± 0.06	0.060 ± 0.024	1.50 ± 0.06	0.060 ± 0.024						
2.00 ± 0.08	0.080 ± 0.032	2.00 ± 0.08	0.080 ± 0.032	2.00 ± 0.08	0.080 ± 0.032						
3.00 ± 0.12	0.120 ± 0.048	3.00 ± 0.12	0.120 ± 0.048	3.00 ± 0.12	0.120 ± 0.048						
4.00 ± 0.16	0.160 ± 0.064	4.00 ± 0.16	0.160 ± 0.064	4.00 ± 0.16	0.160 ± 0.064						
5.00 ± 0.20	0.200 ± 0.080	5.00 ± 0.20	0.200 ± 0.080	5.00 ± 0.20	0.200 ± 0.080						
6.00 ± 0.24	0.240 ± 0.096	6.00 ± 0.24	0.240 ± 0.096	6.00 ± 0.24	0.240 ± 0.096						
8.00 ± 0.32	0.320 ± 0.128	8.00 ± 0.32	0.320 ± 0.128	8.00 ± 0.32	0.320 ± 0.128						
10.00 ± 0.40	0.400 ± 0.160	10.00 ± 0.40	0.400 ± 0.160	10.00 ± 0.40	0.400 ± 0.160						
12.00 ± 0.48	0.480 ± 0.192	12.00 ± 0.48	0.480 ± 0.192	12.00 ± 0.48	0.480 ± 0.192						
15.00 ± 0.60	0.600 ± 0.240	15.00 ± 0.60	0.600 ± 0.240	15.00 ± 0.60	0.600 ± 0.240						
20.00 ± 0.80	0.800 ± 0.320	20.00 ± 0.80	0.800 ± 0.320	20.00 ± 0.80	0.800 ± 0.320						
25.00 ± 1.00	1.000 ± 0.400	25.00 ± 1.00	1.000 ± 0.400	25.00 ± 1.00	1.000 ± 0.400						
30.00 ± 1.20	1.200 ± 0.480	30.00 ± 1.20	1.200 ± 0.480	30.00 ± 1.20	1.200 ± 0.480						
40.00 ± 1.60	1.600 ± 0.640	40.00 ± 1.60	1.600 ± 0.640	40.00 ± 1.60	1.600 ± 0.640						
50.00 ± 2.00	2.000 ± 0.800	50.00 ± 2.00	2.000 ± 0.800	50.00 ± 2.00	2.000 ± 0.800						
60.00 ± 2.40	2.400 ± 0.960	60.00 ± 2.40	2.400 ± 0.960	60.00 ± 2.40	2.400 ± 0.960						
80.00 ± 3.20	3.200 ± 1.280	80.00 ± 3.20	3.200 ± 1.280	80.00 ± 3.20	3.200 ± 1.280						
100.00 ± 4.00	4.000 ± 1.600	100.00 ± 4.00	4.000 ± 1.600	100.00 ± 4.00	4.000 ± 1.600						
120.00 ± 4.80	4.800 ± 1.920	120.00 ± 4.80	4.800 ± 1.920	120.00 ± 4.80	4.800 ± 1.920						
150.00 ± 6.00	6.000 ± 2.400	150.00 ± 6.00	6.000 ± 2.400	150.00 ± 6.00	6.000 ± 2.400						
200.00 ± 8.00	8.000 ± 3.200	200.00 ± 8.00	8.000 ± 3.200	200.00 ± 8.00	8.000 ± 3.200						
250.00 ± 10.00	10.000 ± 4.000	250.00 ± 10.00	10.000 ± 4.000	250.00 ± 10.00	10.000 ± 4.000						
300.00 ± 12.00	12.000 ± 4.800	300.00 ± 12.00	12.000 ± 4.800	300.00 ± 12.00	12.000 ± 4.800						
400.00 ± 16.00	16.000 ± 6.400	400.00 ± 16.00	16.000 ± 6.400	400.00 ± 16.00	16.000 ± 6.400						
500.00 ± 20.00	20.000 ± 8.000	500.00 ± 20.00	20.000 ± 8.000	500.00 ± 20.00	20.000 ± 8.000						
600.00 ± 24.00	24.000 ± 9.600	600.00 ± 24.00	24.000 ± 9.600	600.00 ± 24.00	24.000 ± 9.600						
800.00 ± 32.00	32.000 ± 12.800	800.00 ± 32.00	32.000 ± 12.800	800.00 ± 32.00	32.000 ± 12.800						
1000.00 ± 40.00	40.000 ± 16.000	1000.00 ± 40.00	40.000 ± 16.000	1000.00 ± 40.00	40.000 ± 16.000						

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(DQCA, CB, CC WITH HC6, GCS GOVERNED ENGINE)

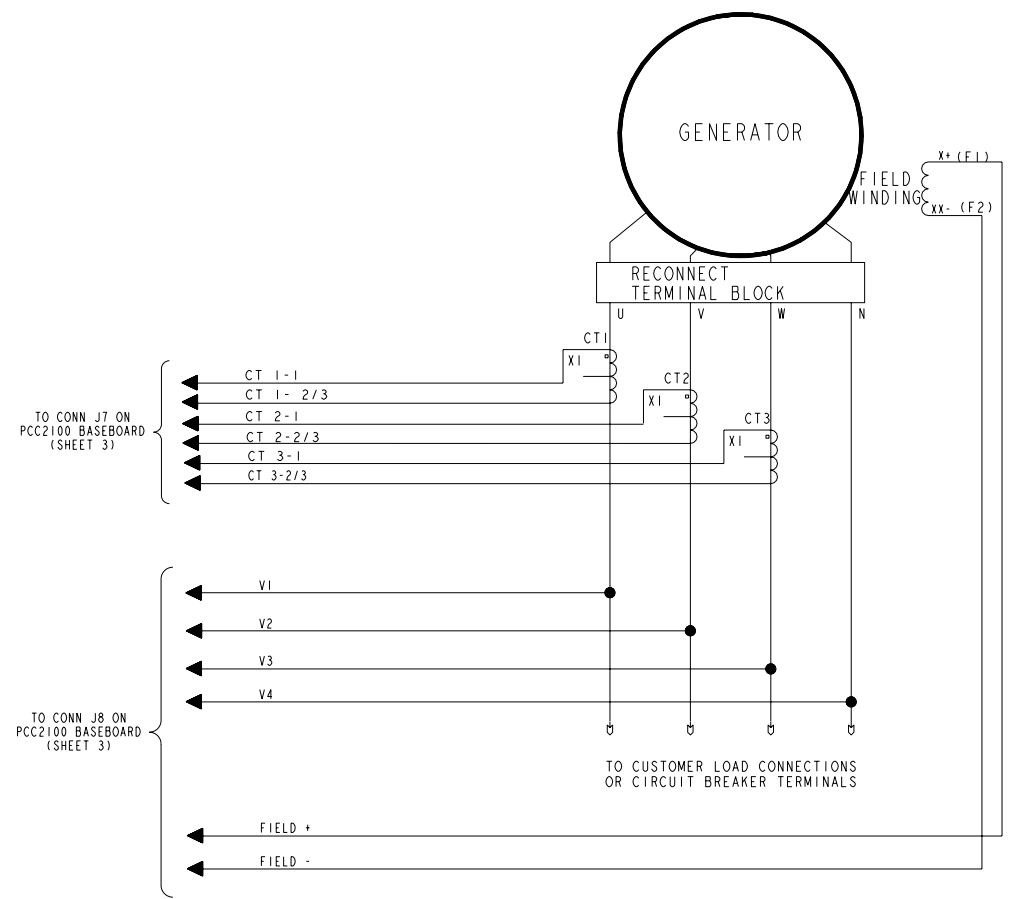
Q23 DQCA, CB, CC GENSET WIRING DIAGRAM FOR PCC2100 CONTROL

DO NOT SCALE PRINT		TOLERANCE UNLESS OTHERWISE SPECIFIED		DIM TO 0630_2572		ITEM PART NO		DESCRIPTION OR MATERIAL		REV DES	
		mm	Inch								
		X ± 1	.X ±								
		.X ± 0.8	.XX ±								
		.XX ± 0.38	.XXX ±								
		0.09 - 4.99 +0.15/-0.08	.004 - .200 +.001/-0.003								
		5.00 - 9.99 +0.20/-0.10	.201 - .421 +.002/-0.004								
		10.00 - 17.49 +0.25/-0.13	.422 - .103 +.002/-0.005								
		17.50 - 24.99 +0.30/-0.13	.704 - .999 +.002/-0.005								
		THIS DOCUMENT IS THE PROPERTY OF CUMMINS POWER GENERATION. IT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE REPRODUCED, COPIED, OR DISCLOSED WITHOUT EXPRESSLY AUTHORIZED BY CUMMINS POWER GENERATION OR ITS REPRESENTATIVE.									
		DRAWN TO SCALE OF 1/1		ANG TOL: 1.0 °		COPIED FROM		THIRD ANGLE PROJECTION		APPROVED	
						DR		DATE		SHEET	
						D. CRANE		05-28-04		3 of 4	
						D. ZINN		05-28-04		D	
						D. ZINN		05-28-04			
						DQCA, CB, CC		SITE CODE		D	
						PGA		0630_2875			
								CUMMINS POWER GENERATION			
								1400 73RD AVE NE			
								MINNEAPOLIS, MINNESOTA 55432			
								WD-INTERCONNECTION			

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REL NO	LTR	NO	REVISION	ZONE	DR	CHKD	APPROVED	DATE
ECO-101507	G	-	-	GWH	VO	PUSHKAR	03SEP08

GENERATOR/BUS CONNECTIONS



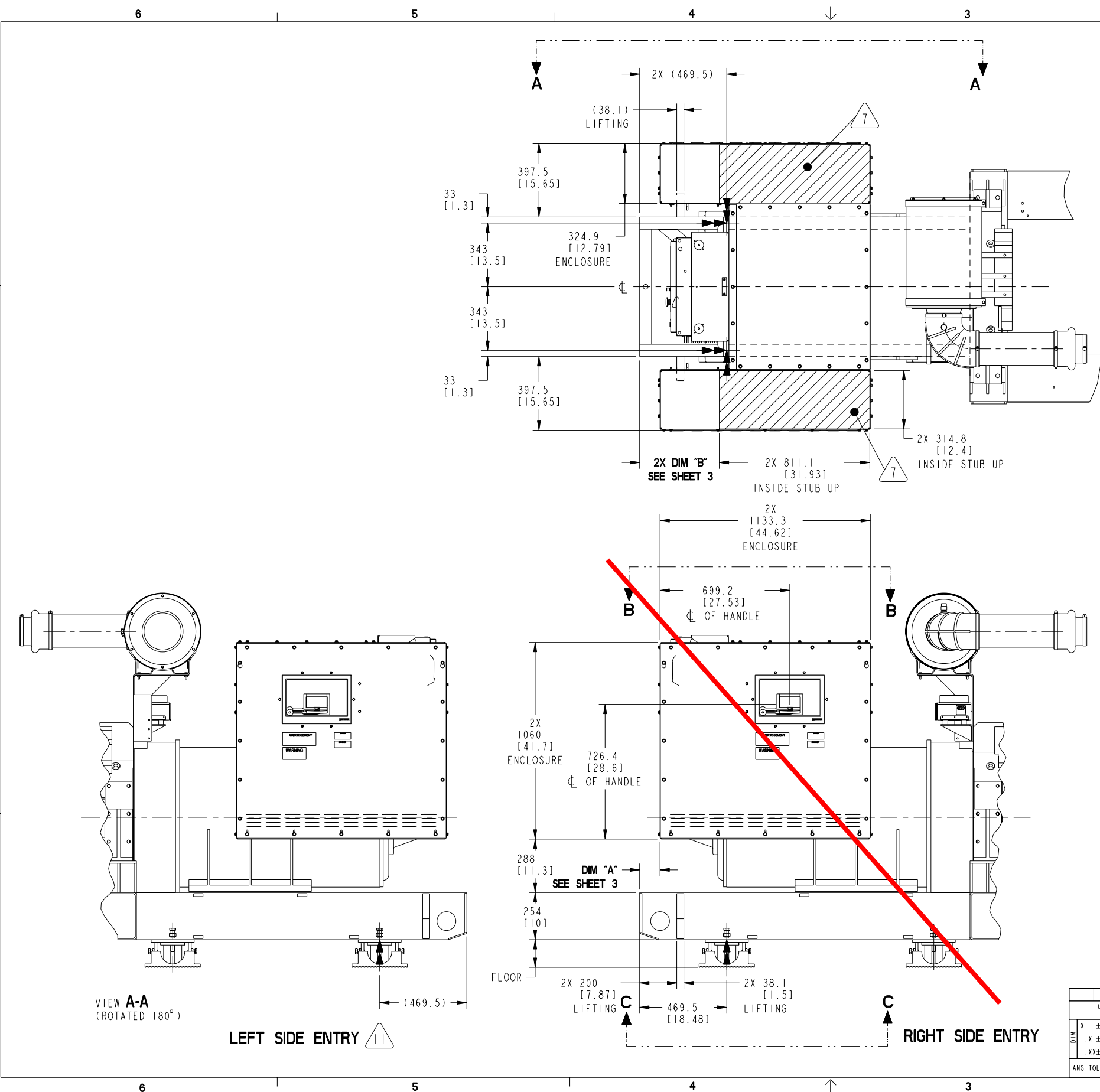
Q23 DQCA, CB, CC GENSET WIRING DIAGRAM FOR PCC2100 CONTROL

TOLERANCE UNLESS OTHERWISE SPECIFIED		DIM TO 0630_2572		ITEM	PART NO	QTY	DESCRIPTION OR MATERIAL	REV
		mm	Inch	NO	NAME	DATE		DES
DO NOT SCALE PRINT		X ± 1	.X ±	DR	D. CRANE	05-28-04		
		.X ± 0.8	.XX ±	CHKD	D. ZINN	05-28-04		
		.XX ± 0.38	.XXX ±	MFG				
ANG TOL: 1.0		0.09 - 4.99	+0.15/-0.00	APPROVED	D. ZINN	05-28-04	SITE CODE	WD-INTERCONNECTION
DRAWN TO SCALE OF 1/1		5.00 - 9.99	+0.20/-0.10				PGA	0630_2875
		10.00 - 17.49	+0.25/-0.13					4 of 4
		17.50 - 24.99	+0.30/-0.13					D
			.004 - .200	THIS DOCUMENT IS THE PROPERTY OF CUMMINS POWER GENERATION. IT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE REPRODUCED, COPIED, OR DISCLOSED WITHOUT EXPRESSLY AUTHORIZED BY CUMMINS POWER GENERATION OR ITS REPRESENTATIVE.		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE: MODEL FIRST USED ON DQCA, CB, CC		

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REL NO	LTR NO	REVISION	ZONE	DWN	CHK	APVD	DATE
ECO-100339	B	1 SEE ECO FOR DETAILS		SMM	MT	MT	06-11-08

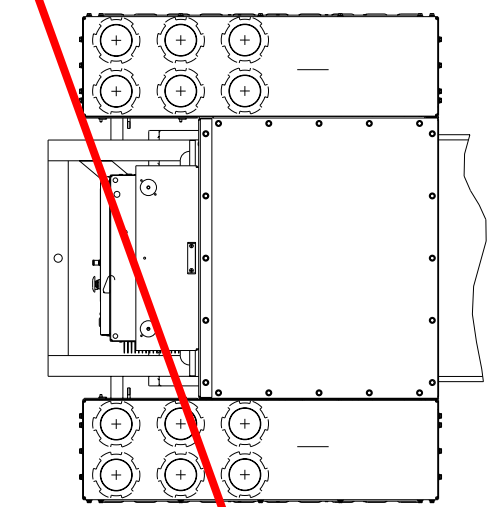
- NOTE:
- DIMENSIONS SHOWN IN [] ARE IN INCHES.
 - COMMON REFERENCE POINT ON GENSET SKID (→). POINTS TO ANCHORING HOLE ON SKID. SEE GENSET_OUTLINE (FOUNDATION) FOR DETAILS.
 - LISTED TORQUE VALUES ARE FOR MAXIMUM CONDUCTOR SIZES ACCOMMODATED. CONSULT UL 486 TABLE 7-4, 7-5 AND 7-6 FOR SMALLER CONDUCTOR SIZES.
 - ALL ITEMS SHOWN IN ILLUSTRATION ARE FOR REFERENCE ONLY.
 - ELECTRICAL CONDUITS MUST:
 - PROVIDE FLEXIBLE CONNECTION (USING FLEXIBLE CONDUIT AND CABLES). -LFMC
 - INSTALLED IN A WAY THAT IT WILL ABSORB OR REDUCE VIBRATION CONDITIONS, FOR EXAMPLE: ADD OFF-SET BENDS, BETWEEN THE MOUNTING SURFACE OF THE CIRCUIT BREAKER ENCLOSURE AND THE STUB AREA ORIGINATING IN CONCRETE OR THE TYPE OF BASE FLOORING.
 - FLEXIBLE CONDUITS MUST ALLOW FOR GENERATOR SET MOVEMENT AS MUCH AS ±50 [2] IN THE VERTICAL DIRECTION.
 - AREA SHOWN INDICATES APPROXIMATE OFFSET PLACEMENT OF THE ELECTRICAL FLEXIBLE CONDUIT STUB-UP AREA ORIGINATING IN CONCRETE OR OTHER TYPE OF BASE FLOORING RELATIVE TO CIRCUIT BREAKER LOCATION WITHIN ENCLOSURE TO PROVIDE VIBRATION PROTECTION.
 - WIRE-CONDUIT COMBINATIONS MEET NEC AND CEC. TO USE OTHER COMBINATIONS, REFER TO APPLICABLE CODES TO ENSURE THAT WIRE AMPACITY, BEND SPACE AND GUTTER SPACE MEET THE REQUIREMENTS.
 - SHUNT TRIP UNITS CAN BE OPERATED AT 75% OF NOMINAL VOLTAGE AND WILL ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE.
 - SHUNT TRIP UNITS CAN BE OPERATED AT 70% TO 100% OF NOMINAL VOLTAGE AND WILL ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE.
 - ALL DIMENSIONS SHOWN FOR RIGHT SIDE ENTRY ALSO APPLY TO LEFT SIDE ENTRY IN MIRROR ORIENTATION.
 - ALTERNATOR MODEL HC634G & R-FRAME CIRCUIT BREAKER ARE BEING SHOWN FOR DRAWING SIMPLICITY.
 - "NS" SHUNT TRIP HAS NO INTERNAL CONTACTS, IT MUST BE USED IN CONJUNCTION WITH AUXILIARY CONTACTS TO ACCEPT CONTINUOUS APPLIED VOLTAGE. IT CAN OPERATE AT 75% OF NOMINAL VOLTAGE.
 - 800 AMP BREAKER:
A LUG ACCEPTING (2) 3/0-600 kcmil CONDUCTORS IS AVAILABLE THRU ACCESSORIES. PGA PART NUMBER 0332-4278.
 - 1200 AMP BREAKER:
A LUG ACCEPTING (3) 3/0-600 kcmil CONDUCTORS IS AVAILABLE THRU ACCESSORIES. PGA PART NUMBER 0332-4279.



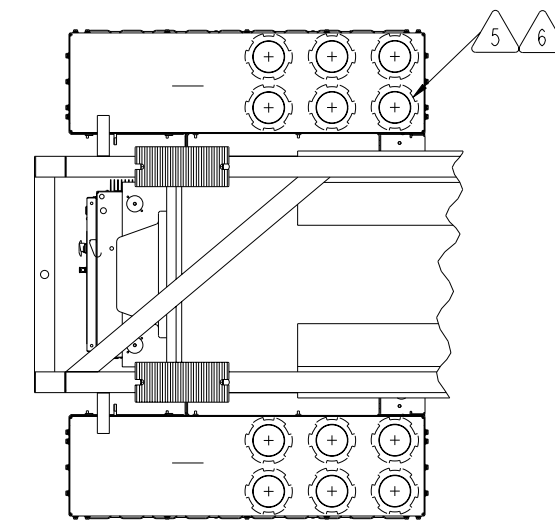
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		DIM TOL.		SCALE: 3/32		ANG TOL: ± 1.0°	
X ± 1	0.00- 4.99 +0.15/-0.08	DO NOT SCALE PRINT	DWN I.LANDRUS	CUMMINS POWER GENERATION		1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432	
.X ± 0.8	5.00- 9.99 +0.20/-0.10		CHK L.NAVARRETE	CIRCUIT BRKR OUTLINE		(23 LITER)	
.XX ± 0.38	10.00-17.99 +0.25/-0.13		APVD L.NAVARRETE	DATE 07-27-06		SITE CODE	
	17.50-24.99 +0.30/-0.13			PGF		0500_4540	
PROPERTY OF CUMMINS POWER GENERATION GROUP				FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994		SHEET 1 OF 3	

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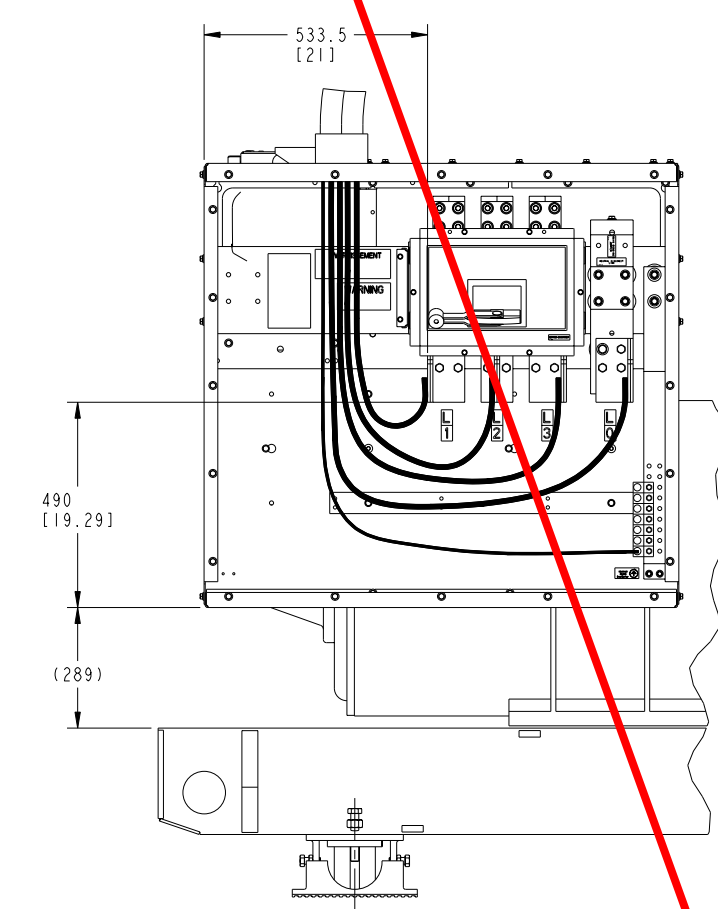
REL NO	LTR	NO	REVISION	ZONE	DM	CD	APVD	DATE
ECO-100339	B	1	SEE ECO FOR DETAILS	-	SMM	MT	MT	06-11-08



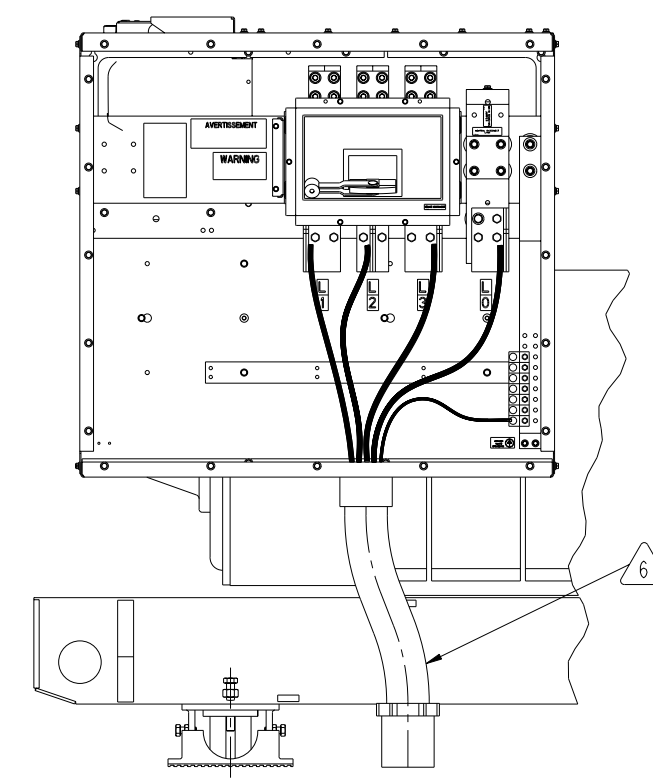
VIEW B-B
TOP ENTRANCE
SCALE 3/32



VIEW C-C
BOTTOM ENTRANCE
SCALE 3/32



RIGHT SIDE
TOP ENTRY ROUTING EXAMPLE
SCALE 1/8



RIGHT SIDE
BOTTOM ENTRY ROUTING EXAMPLE
SCALE 1/8

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		DT	ITEM	PART NO	DESCRIPTION OR MATERIAL
X ± 1	0.00- 4.99 +0.15/-0.08	DO NOT SCALE PRINT			
.X ± 0.8	5.00- 9.99 +0.20/-0.10	SIM TO: I.LANDRUS			
.XX ± 0.38	10.00-17.49 +0.25/-0.13	CD: L.NAVARRETE			
ANG TOL: ± 1.0°	17.50-24.99 +0.30/-0.13	APVD: L.NAVARRETE			
SCALE: 3/32		DATE: 07-27-06			
		SITE CODE: PGF			
		SHEET: 2 of 3			
		DATE: 06-11-08			

CUMMINS POWER GENERATION
1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432

CIRCUIT BRKR OUTLINE
(23 LITER)

PGF
0500_4540

Pro/ENGINEER

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REL NO	LTM NO	REVISION	ZONE	DWN	CRD	APVD	DATE
ECO-100339	B	1	SEE ECO FOR DETAILS	-	SMM	MT	06-11-08

UL/IEC LUGS					TABLE 1 ACCESSORY SPECIFICATIONS			
LUG	FRAME	MAX AMPS	WIRE RANGE COPPER	DIM D ±.25 [1.0]	ACCESSORY DESCRIPTION	CONTACT RATING	INRUSH	CONNECTION TYPE
	SQUARE D NSJ	400A 3 OR 4 POLE	#2-600 KCMIL	554 [21.8]	24 VDC SHUNT TRIP	-----	10A	COMPRESSION TERMINALS #20-16 AWG OR SMALLER TORQUE: 10 LB-IN
	SQUARE D NSJ W/STR23SP TRIP UNIT	600A 3-POLE	2/0-350 KCMIL	554 [21.8]	24 VDC SHUNT TRIP	-----	10A	COMPRESSION TERMINALS #20-16 AWG OR SMALLER TORQUE: 10 LB-IN
	SQUARE D P 800 W/MICROLOGIC 3.0 TRIP UNIT	800A 3-POLE	3/0-500 KCMIL	599 [23.5]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN
	SQUARE D P 800 W/MICROLOGIC 3.0 TRIP UNIT	800A 3-POLE	3/0-500 KCMIL	599 [23.5]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN
	SQUARE D P 1200 W/MICROLOGIC 3.0 TRIP UNIT	1200A 3-POLE	3/0-500 KCMIL	556 [21.8]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN
	SQUARE D P 1200 W/MICROLOGIC 3.0 TRIP UNIT	1200A 3-POLE	3/0-500 KCMIL	556 [21.8]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN
	SQUARE D R 2500/2000/1600 3-POLE 1600-2500 AMP BUS BARS STANDARD W/MICROLOGIC 3.0 TRIP UNIT		NEMA HOLE PATTERN	490 [19]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN
	SQUARE D R 2500/2000/1600 3-POLE 1600-2500 AMP BUS BARS STANDARD W/MICROLOGIC 3.0 TRIP UNIT		NEMA HOLE PATTERN	490 [19]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN
	R 2500/2000/1600 W/OPTIONAL LUG 1600-2500 AMP BREAKERS TORQUE 375 IN LBS [42 Nm]		#2-600 KCMIL	490 [19]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN
	R 2500/2000/1600 W/OPTIONAL LUG 1600-2500 AMP BREAKERS TORQUE 375 IN LBS [42 Nm]		#2-600 KCMIL	490 [19]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN

TABLE 2 TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2008, ARTICLE 310.15 AT 75C TEMPERATURE RATED CONDUCTOR AT 30C AMBIENT AND ANNEX C (LIQUID TIGHT FLEXIBLE METAL CONDUIT - LFMC)						
MAX BRKR AMPS	WIRE (COPPER)		CABLE AMPACITY	TOTAL NUMBER OF CONDUITS		
	QTY	SIZE		QTY	SIZE (IN INCHES)	
2500	6	600 KCMIL	420	6	4	
2000	5	600 KCMIL	420	5	4	
1600	5	600 KCMIL	420	5	4	
1200	3	500 KCMIL	385	3	3	
1000	3	400 KCMIL	335	3	3	
800	2	300 KCMIL	285	2	3	
630	2	350 KCMIL	310	2	3	
600	2	350 KCMIL	310	2	3	
400	1	600 KCMIL	420	1	4	
250	1	250 KCMIL	255	1	2 1/2	
100	1	2 KCMIL	115	1	2	

TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2008, ARTICLE 310.15
AND TABLE 310-16 AT 75C TEMPERATURE RATED CONDUCTOR AT 40C
AMBIENT AND ANNEX C (LIQUID TIGHT FLEXIBLE METAL CONDUIT - LFMC)

MAX BRKR AMPS	WIRE (COPPER)		CABLE AMPACITY	TOTAL NUMBER OF CONDUITS		
	QTY	SIZE		QTY	SIZE (IN INCHES)	
2500	6	750 KCMIL	418	6	4	
2000	5	700 KCMIL	405	5	4	
1600	4	700 KCMIL	405	4	4	
1000	3	500 KCMIL	334	3	3 1/2	
800	3	350 KCMIL	273	3	3	

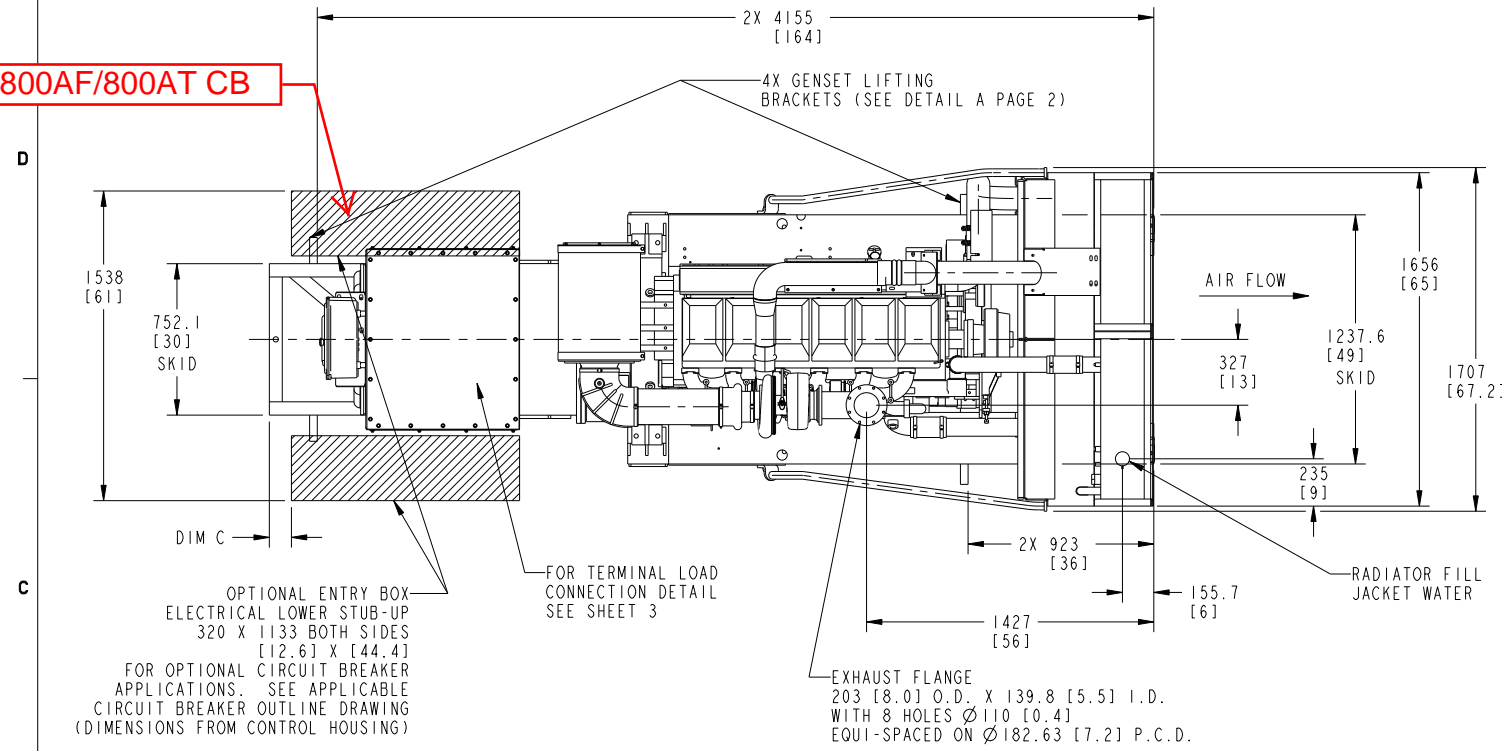
TABLE 3			
GENSET MODEL	ALTERNATOR MODEL	DIM "A"	DIM "B"
<input checked="" type="checkbox"/> DQCA	<input checked="" type="checkbox"/> HC634G	109.7 [4.32]	431.9 [17.0]
<input type="checkbox"/> DQCB	<input type="checkbox"/> HC634H	109.7 [4.32]	431.9 [17.0]
<input type="checkbox"/> DQCC	<input type="checkbox"/> HC634J	109.7 [4.32]	431.9 [17.0]
	<input type="checkbox"/> HC634K	8.7 [.34]	330.9 [13.03]

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		QTY		ITEM	PART NO	DESCRIPTION OR MATERIAL
DO NOT SCALE PRINT		DWG		I. LANDRUS		
DATE		CRD		L. NAVARRETE		
DATE		APVD		L. NAVARRETE		
DATE		DATE		07-27-06		
ANG TOL: ± 1.0°		SCALE:		3/32		
PROPERTY OF CUMMINS POWER GENERATION GROUP		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994		FIRST USED ON DQCA, CB, CC		
CUMMINS POWER GENERATION 1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432		CIRCUIT BRKR OUTLINE (23 LITER)		SITE CODE		
PGF		D		0500_4540		
SHEET 3 OF 3		DWB		B		

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REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-120204	B	1	ADD ADD AIR CLEANER OPTION TABULATION	JPR	KK	K KISHORE	11OCT11

800AF/800AT CB

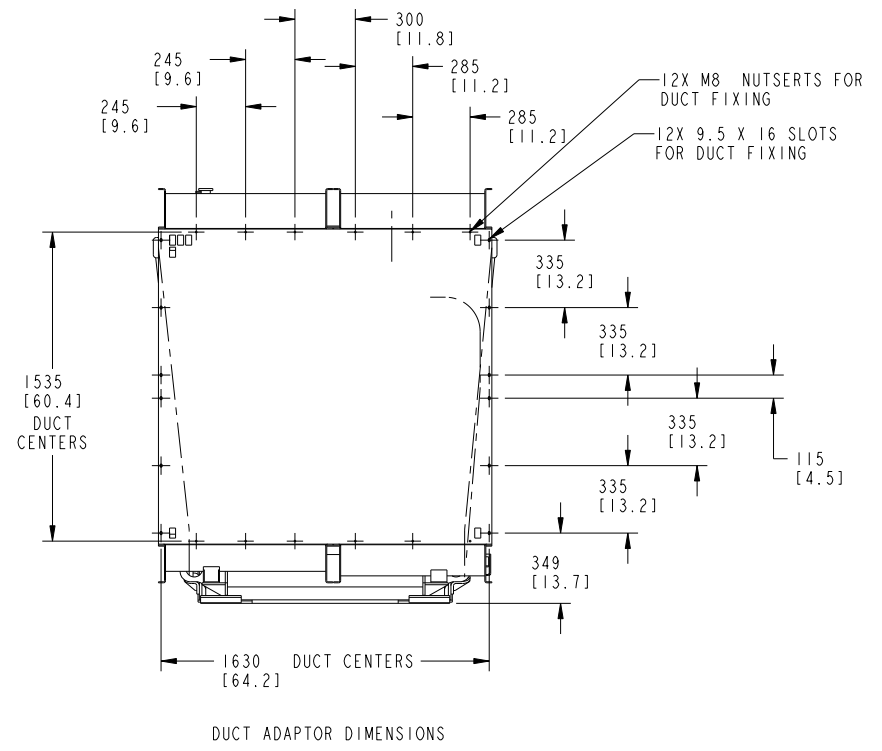
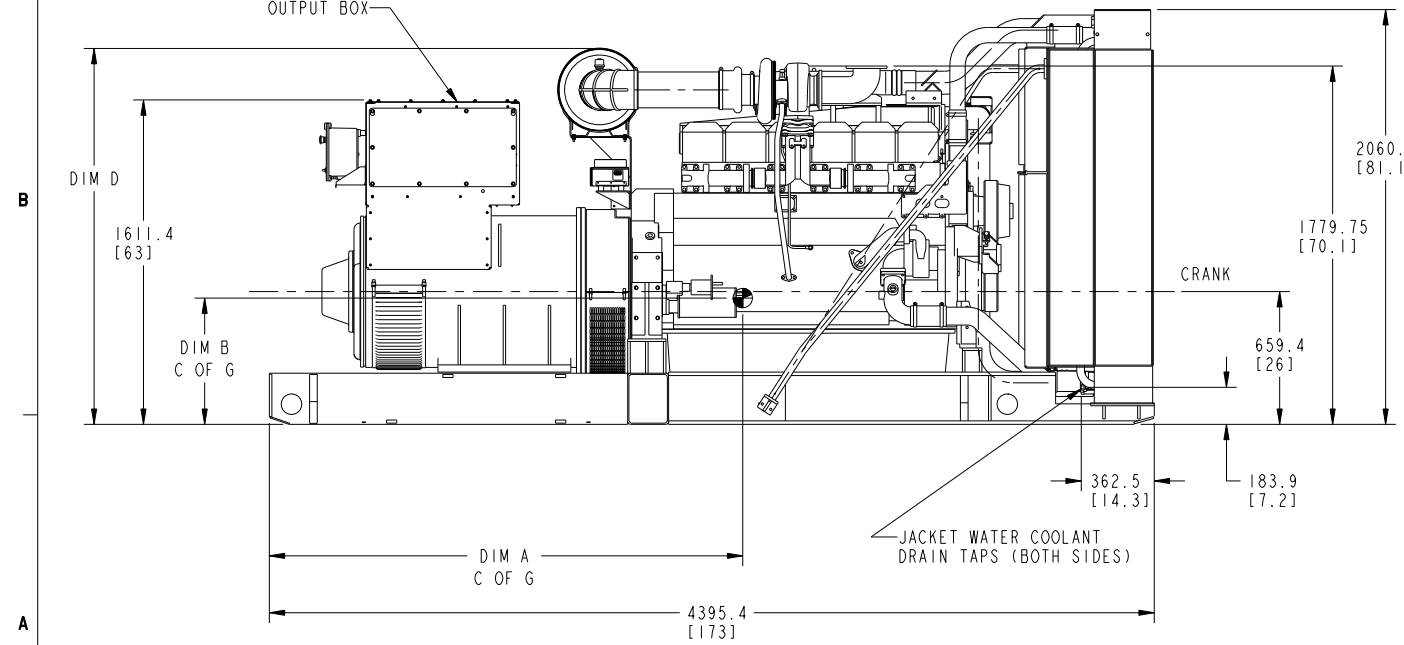


- NOTES:
1. DIMENSIONS SHOWN IN [] BRACKETS ARE INCHES.
2. GENSET SHIPPED FILLED WITH ENGINE OIL.

GEN FRAME SIZE	DIM A C OF G	DIM B C OF G	DIM C	GENSET WT W/O COOLANT		GENSET WT W/COOLANT	
				KGS	LBS	KGS	LBS
HC6G	2334 [91.9]	820 [32.3]	109	6377	14061	6518	14372
HC6H	2305 [90.7]	820 [32.3]	109	6327	14032	6600	14705
HC6J	2274 [89.5]	820 [32.3]	109	6682	14734	6823	15044
HC6K	2223 [87.5]	820 [32.3]	9	6955	15336	7096	15646

OPTIONAL ENTRY BOX ELECTRICAL LOWER STUB-UP 320 X 1133 BOTH SIDES [12.6] X [44.4] FOR OPTIONAL CIRCUIT BREAKER APPLICATIONS. SEE APPLICABLE CIRCUIT BREAKER OUTLINE DRAWING (DIMENSIONS FROM CONTROL HOUSING)
FOR TERMINAL LOAD CONNECTION DETAIL SEE SHEET 3
OUTPUT BOX
DIM C

AIR CLEANER OPTION	DIM D HEIGHT
STANDARD AIR CLEANER	1867 [74]
HEAVY DUTY AIR CLEANER	2479 [97.6]

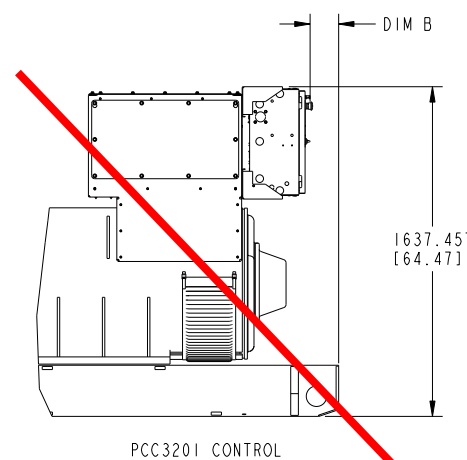
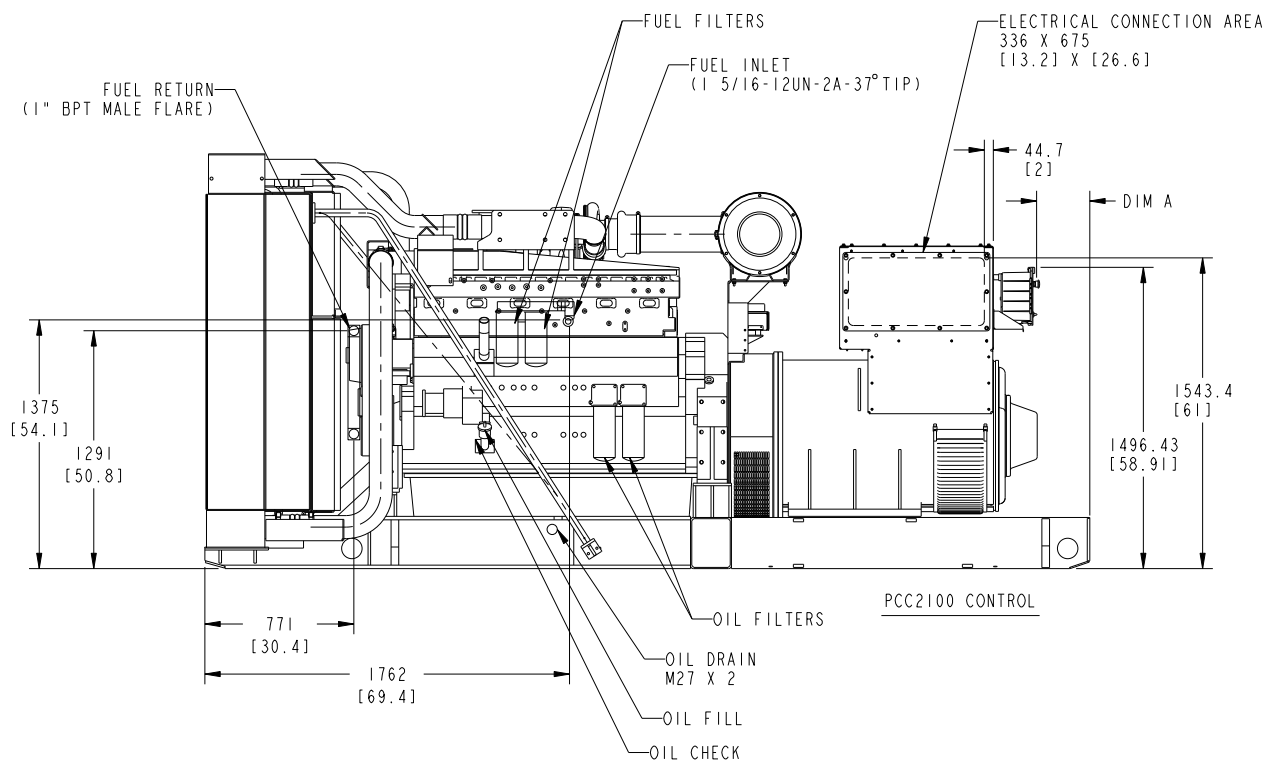


RADIATOR COOLED (50C)

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM 10 0500-4050	OWN J. GIANNINI		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT			CAD K. RABADI		GENSET_OUTLINE (23 LITER)	
X ± 1 .X ± 0.8 .XX ± 0.38 ANG TOL: ± 1.0°	0.00- 4.99 +0.15/-0.08 5.00- 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13	FIRST USED ON POWER GENERATION GROUP DATE 29MAR10 DQCA	APVD K. RABADI DATE 29MAR10 PGF	SITE CODE D	A030Y552	SHEET 1 OF 3 REV B

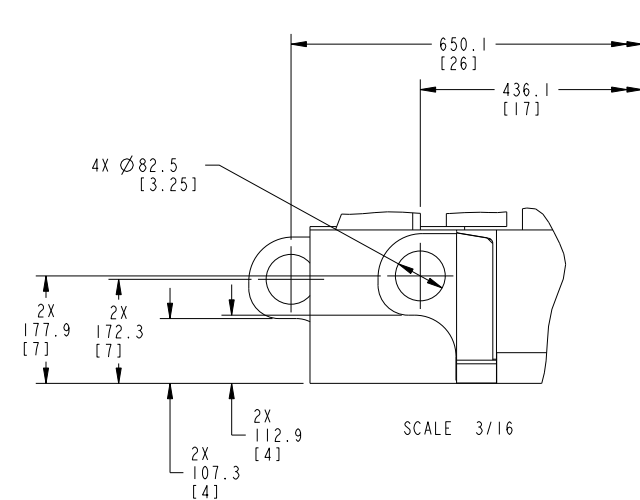
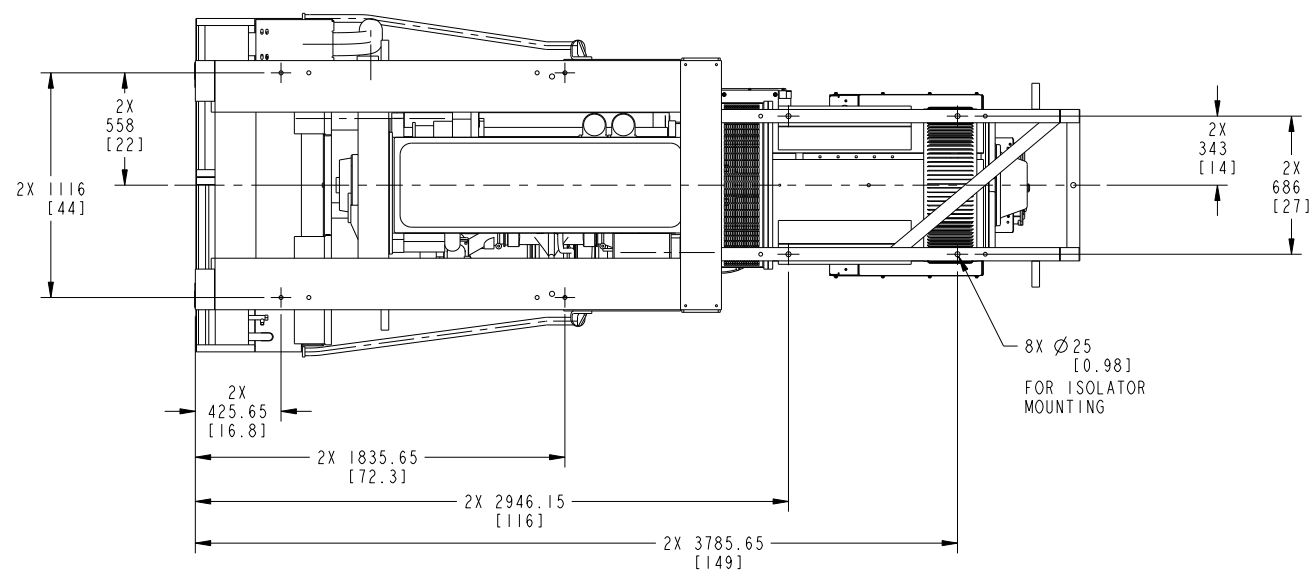
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REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-120204	B	--	---	JPR	KK	K KISHORE	11OCT11



- NOTE:
1. DIMENSIONS SHOWN IN [] BRACKETS ARE INCHES.
 2. FUEL INLET HOSE-1650 [65] LONG WITH 1"-11.5 NPT EXTERNAL FITTING.
FUEL RETURN HOSE-2000 [79] LONG WITH 1"-11.5 NPT EXTERNAL FITTING.

TABULATION		
GEN FRAME SIZE	DIM A	DIM B
HC6G,H,J	264 [10.4]	142 [5.6]
HC6K	403 [15.9]	41 [1.6]



UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM 10 0500-4050	OWN J.GIANNINI		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT		CND K.RABADI	APVD K.RABADI		GENSET_OUTLINE (23 LITER)	
DIM TOL X ± 1 .X ± 0.8 .XX ± 0.38 ANG TOL: ± 1.0°	HOLE 0.00- 4.99 +0.15/-0.08 5.00- 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13	DATE 29MAR10 SCALE: 1/16	DATE 29MAR10 SITE CODE PGF	FIRST USED ON OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994	DQCA	PGF A030Y552

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GENERAL NOTES:

- 1) TANK TO BE INSTALLED IN ACCORDANCE W/ AFFIXED LABELING, THE FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE, NFPA 30, AND ANY OTHER PREVAILING CODE.
- 2) THIS SUBBASE TANK IS DESIGNED TO SUPPORT A DIESEL ENGINE GENERATOR.
- 3) UL-2085 TANKS WILL TYP. HAVE A 3" FLANGE ON SIDES & UL-142 TANKS WILL TYP. HAVE A 3 1/2" FLANGE.

TANK CONSTRUCTION:

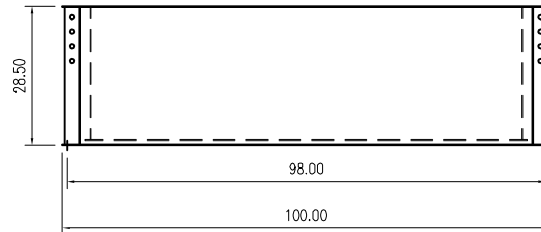
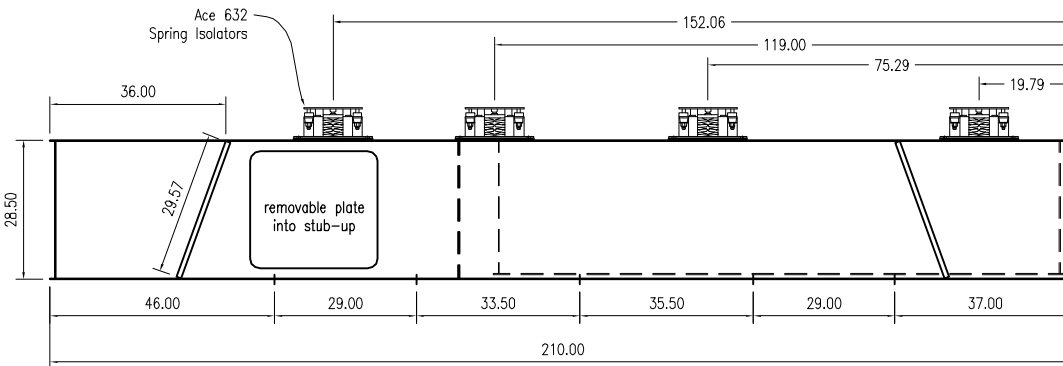
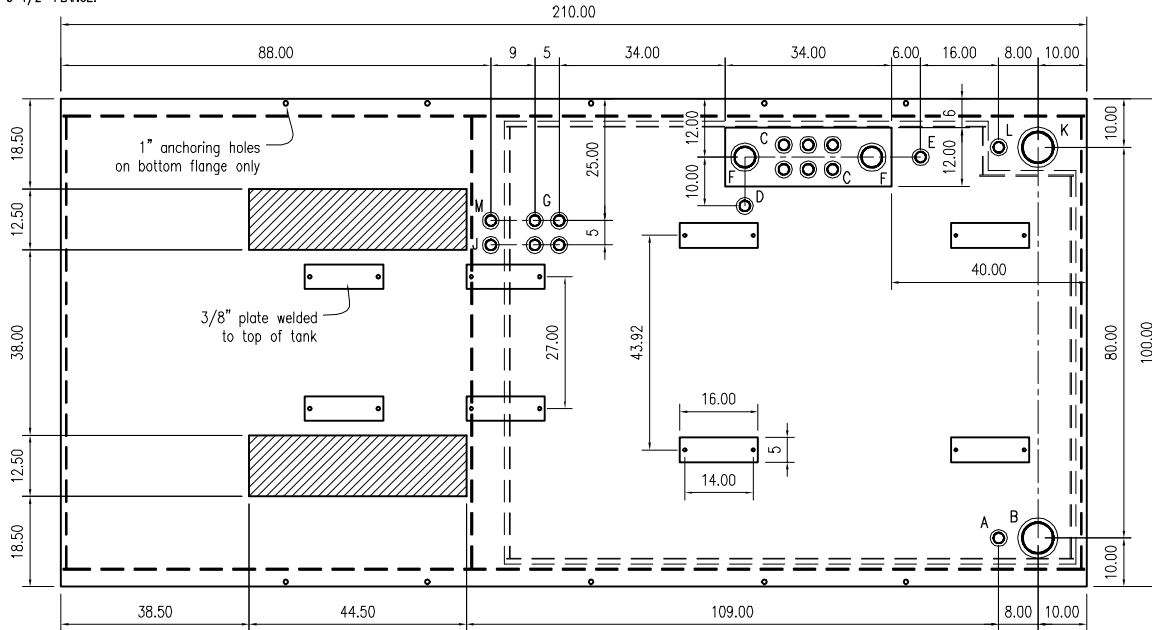
- 1) SIDE AND END CHANNELS ARE 3/16" STEEL FOR GENSETS LESS THAN 12,000 LBS, AND 1/4" THICK STEEL FOR GENSETS MORE THAN 12,000 LBS.
- 2) OUTER TANK TOP & BOTTOM IS 3/16" STEEL.
- 3) INNER TANK TOP IS 3/16" STEEL.
- 4) INTERNAL BAFFLE TO SEPARATE COOL SUPPLY FUEL FROM HOT RETURN FUEL.
- 5) INTERNAL BRACING AND BOTTOM FLOOR SUPPORTS NOT SHOWN.
- 6) INTERIOR COATED WITH RUST INHIBITOR.
- 7) EXTERIOR PRIMED W/2-PART EPOXY AND FINISH PAINTED W/URETHANE.

TANK SPECIFICATIONS:

- 1) ENGINE TYPE: Diesel
- 2) GENSET WEIGHT: lbs (wet)
- 3) DOUBLE WALL SPECIFICATION
 X CLOSED TOP DIKED
 X SECONDARY CONTAINMENT
 X PROTECTED SECONDARY CONTAINMENT
- 4) SUB-BASE TANK OPTIONS:
 X LOW FUEL LEVEL SWITCH
 X LIFTING RINGS
 X HIGH FUEL LEVEL SWITCH
 X FUEL IN BASIN SWITCH
 X NORMAL VENT CAP
 X EMERGENCY VENT CAP
 X REMOVABLE END CHANNEL
 X 2" NPT LOCKABLE FILL CAP W/RISER
 TANK COMES STANDARD WITH A DIRECT READING MECHANICAL FUEL LEVEL GAUGE.

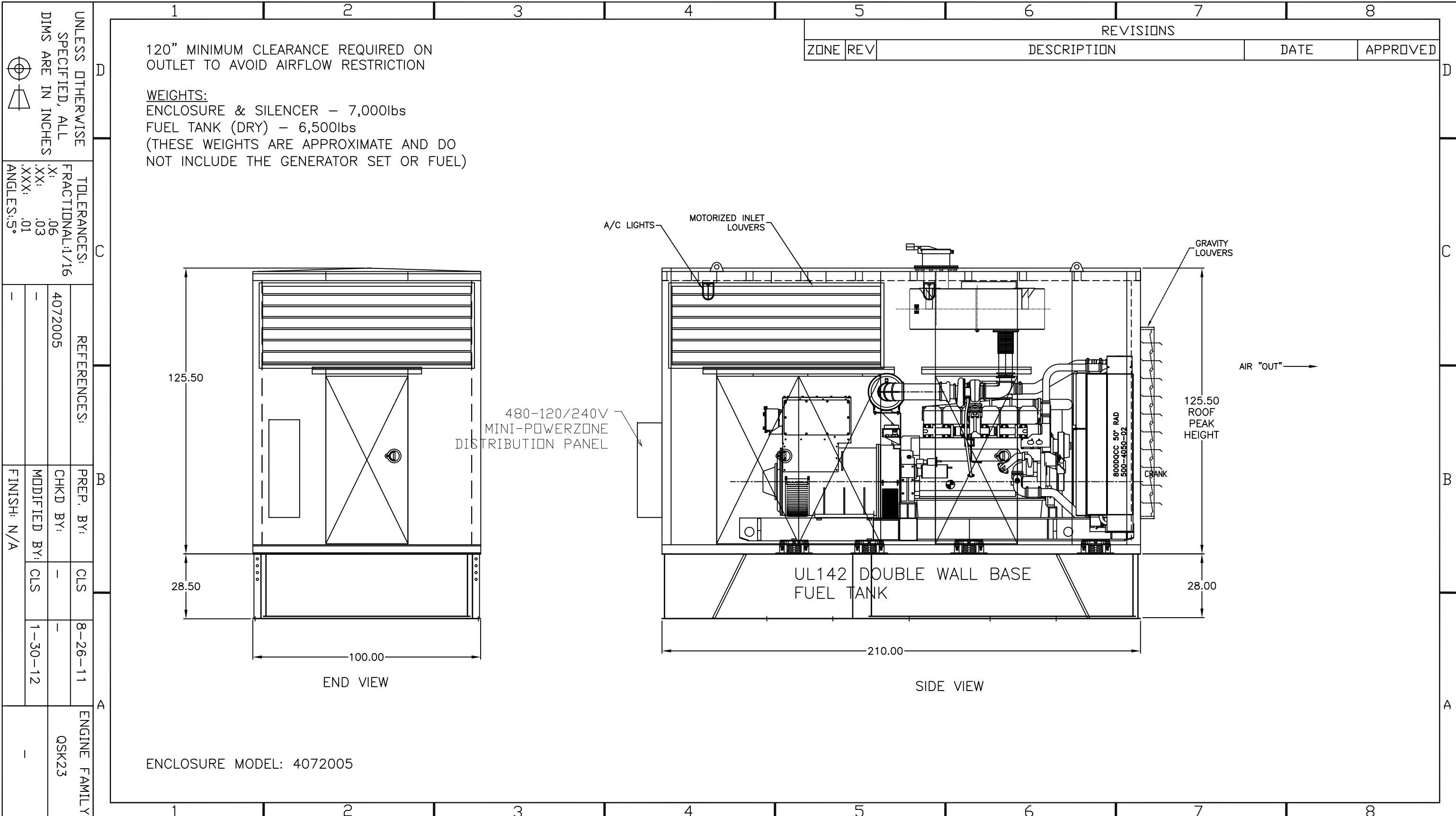
TANK FITTINGS:

- A) 2" NPT PRIMARY ATMOSPHERIC VENT
- B) 6" NPT PRIMARY EMERGENCY VENT FITTING PER NFPA 30
- C) 2" NPT FOR MISC. FITTINGS (x6)
- D) 2" NPT FOR REMOVABLE FUEL SUPPLY DIP TUBE
- E) 2" NPT FOR REMOVABLE FUEL RETURN DIP TUBE
- F) 4" NPT TANK FLANGE
- G) 2" NPT FOR LEAK LEVEL LOCATIONS
- J) 2" NPT FOR LEAK DETECTION SWITCH
- K) 6" NPT SECONDARY EMERGENCY VENT FITTING PER NFPA 30
- L) 2" NPT SECONDARY ATMOSPHERIC VENT
- M) 2" NPT FOR VISUAL PORT



	Superior Systems & Technologies 274 County Rd 287 Merrell, TX 79536 325-690-0248 Fax: -4111	1160 Gallon UL142 Listed Sub-Base	P.O.#: ----	GENSET: 600 DQCA	NAME: ----	DATE: ----
			WO #: ----	TANK WEIGHT: 6,500 LBS	<input type="checkbox"/> APPROVED AS IS: Manufacturing may proceed	
DRAWN BY: F. Quiñeros SCALE: NTS	CUSTOMER: CUMMINS ROCKY MOUNTAIN	QUOTE #: 02245	TANK COLOR: ----	<input type="checkbox"/> APPROVED WITH NOTED CHANGES: Resubmit drawing; manufacturing may proceed.		
DATE: 01-27-12 SHEET: 1 OF 1	JOB NAME: HAROLD D. THOMPSON	REVISION: A 99	DRAWING #: SCGBT-1160-02245	<input type="checkbox"/> NOT APPROVED: Correct drawing as noted and resubmit for approval before manufacturing begins.		

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REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

120" MINIMUM CLEARANCE REQUIRED ON OUTLET TO AVOID AIRFLOW RESTRICTION

WEIGHTS:
 ENCLOSURE & SILENCER - 7,000lbs
 FUEL TANK (DRY) - 6,500lbs
 (THESE WEIGHTS ARE APPROXIMATE AND DO NOT INCLUDE THE GENERATOR SET OR FUEL)

UNLESS OTHERWISE SPECIFIED, ALL DIMS ARE IN INCHES

TOLERANCES:
 FRACTIONAL: 1/16
 .X: .06
 .XX: .03
 .XXX: .01
 ANGLES: 5°

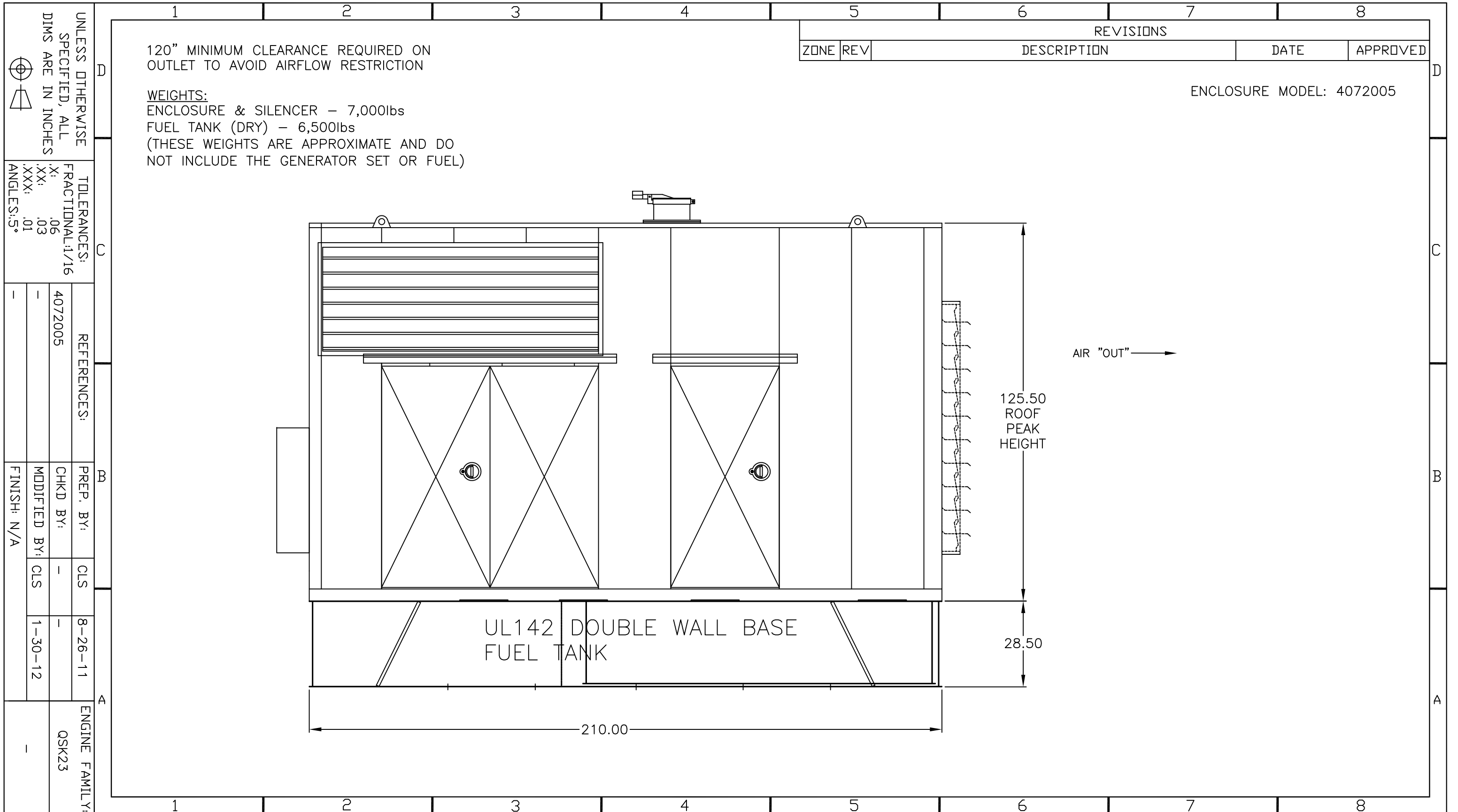
REFERENCES:	PREP. BY:	CLS	8-26-11
4072005	CHKD BY:	-	-
	MODIFIED BY:	CLS	1-30-12
	FINISH:	N/A	

ENCLOSURE MODEL: 4072005

ENGINE FAMILY:
 QSK23

<p>8211 E 96th AVE HENDERSON, COLORADO 80640 PH: 303-287-0201 FAX: 303-287-4837</p>	SITE NAME: HAROLD D THOMPSON WRF	CONTACT NAME: -	CUSTOMER PROJECT NO: -	TITLE: GENERAL ARRANGEMENT
	CONTRACTOR NAME: -	CONTACT NO: -	CRM PROJECT NO: -	SIZE DWG NO: P2011-0140A SCALE: 1:50 DO NOT SCALE SHEET: 1 OF 4

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Cummins Rocky Mountain
8211 E 96th AVE
HENDERSON, COLORADO 80640
PH: 303-287-0201
FAX: 303-287-4837

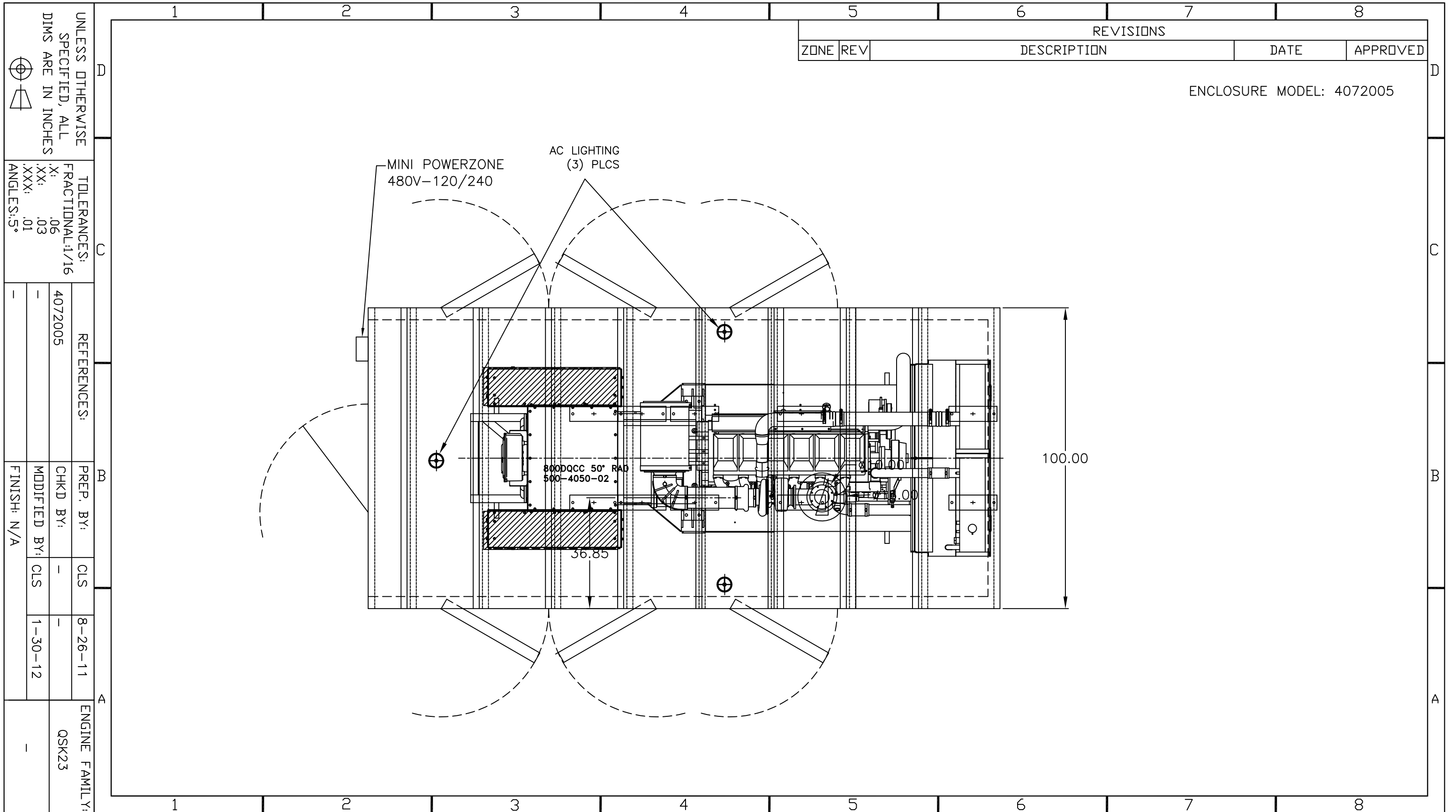
SITE NAME: HAROLD D THOMPSON
WRF
CONTRACTOR NAME: -


CONTACT NAME: -
CONTACT NO: -

CUSTOMER PROJECT NO: -
CRM PROJECT NO: -

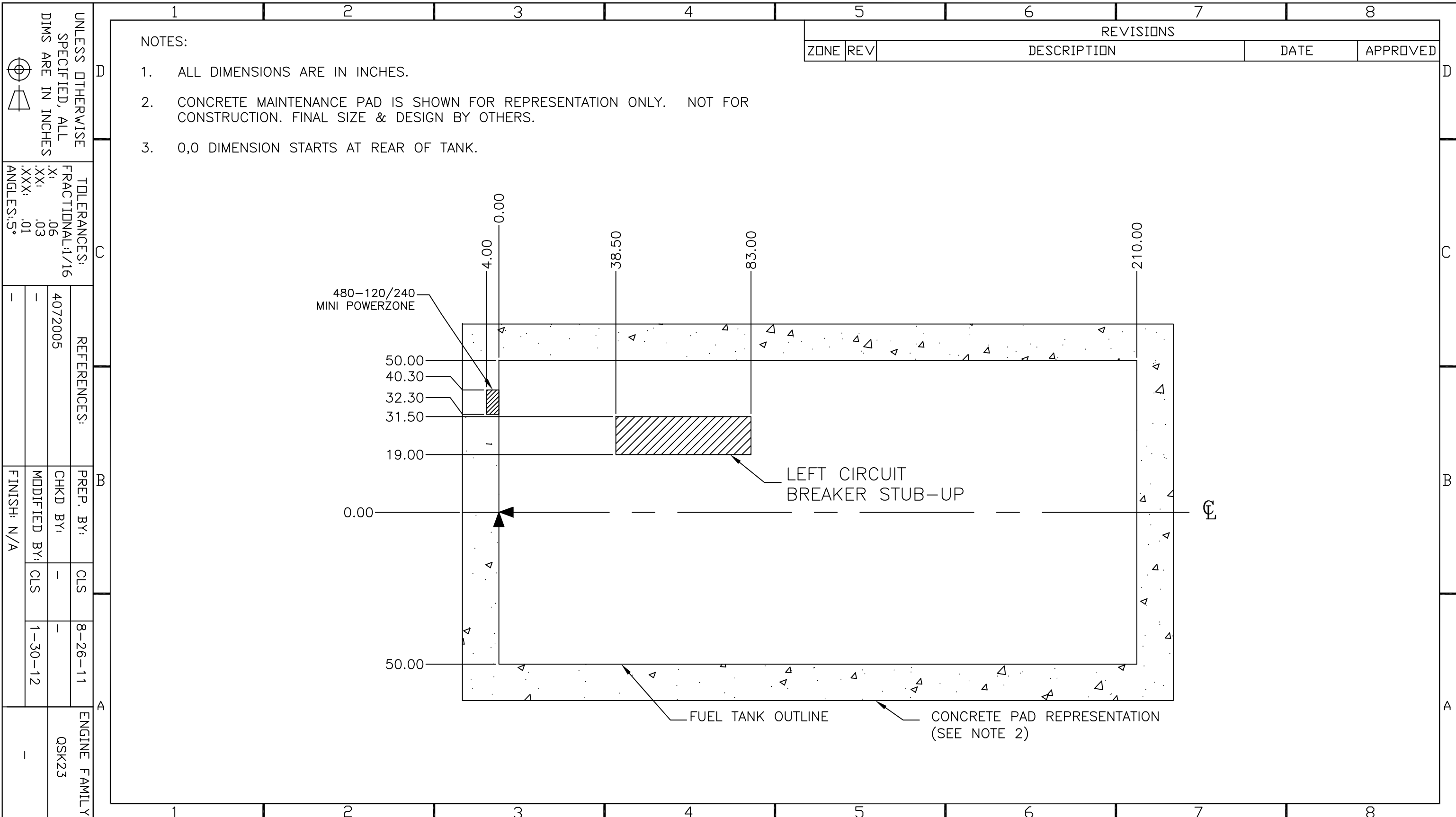
TITLE: GENERAL ARRANGEMENT
SIZE: B
DWG NO: P2011-0140A
SCALE: 1:30
DO NOT SCALE
REV: A
SHEET: 2 OF 4

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 <p>8211 E 96th AVE HENDERSON, COLORADO 80640 PH: 303-287-0201 FAX: 303-287-4837</p>	SITE NAME: HAROLD D THOMPSON WRF	CONTACT NAME: -	CUSTOMER PROJECT NO: -	TITLE: GENERAL ARRANGEMENT
	CONTRACTOR NAME: -	CONTACT NO: -	CRM PROJECT NO: -	SIZE DWG NO: P2011-0140A SCALE: 1:30 DO NOT SCALE

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Cummins Rocky Mountain
 8211 E 96th AVE
 HENDERSON, COLORADO 80640
 PH: 303-287-0201
 FAX: 303-287-4837

SITE NAME: HAROLD D THOMPSON WRF
 CONTRACTOR NAME: -

CONTACT NAME: -
 CONTACT NO: -

CUSTOMER PROJECT NO: -
 CRM PROJECT NO: -

TITLE: ELECTRICAL STUB-UP
 SIZE: B
 DWG NO: P2011-0140A
 SCALE: 1:30
 DO NOT SCALE
 SHEET: 3 OF 4
 REV: A

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Commercial Extended Warranty Statement

Our energy working for you.™



Commercial Extended Warranty Statements

**Feature Codes
L030**

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Limited Standby 5 Year or 1,500 hour Basic Extended Warranty – L030

Commercial Generating Set

When purchased, this limited extended warranty applies to Cummins Power Generation® branded commercial generating sets and associated accessories (hereinafter referred to as "Product").

This warranty covers any failures of the Product, under normal use and service, which result from a defect in material or factory workmanship.

Warranty Period:

The warranty start date is the date of initial start up, first rental, demonstration or 18 months after factory ship date, whichever is sooner. The coverage duration is 5 years from warranty start date or 1,500 hours or whichever occurs first.

Emergency Standby Power (ESP) is defined as the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage. The permissible average power output over 24 hours of operation shall not exceed 70% of the ESP.

Cummins Power Generation® Responsibilities:

In the event of a failure of the Product during the extended warranty period due to defects in material or workmanship, Cummins Power Generation® will only be responsible for the following costs:

- All parts required to repair the Product.

Owner Responsibilities:

The owner will be responsible for the following:

- Notifying Cummins Power Generation® distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins Power Generation®'s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.

In addition, the owner will be responsible for:

- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of generating sets used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- Labor and travel after the base warranty period expires.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

Limitations:

This limited extended warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Normal wear and tear.
- Improper and/or unauthorized installation.
- Owner's or operator's negligence, accidents or misuse.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins Power Generation® published guideline or policy.
- Use of improper or contaminated fuels, coolants or lubricants.
- Improper storage before and after commissioning.

- Owner's delay in making Product available after notification of potential Product problem.
- Use of steel enclosures within 60 miles of the coast of salt water when aluminum or an alternate non-corrosive material enclosure option is available.
- Replacement parts and accessories not authorized by Cummins Power Generation®.
- Use of Battle Short Mode.
- Owner or operator abuse or neglect such as: operation without adequate coolant or lubricants; overfueling; overspeeding; lack of maintenance to lubricating, cooling or air intake systems; late servicing and maintenance; improper storage, starting, warm-up, run-in or shutdown practices, or for progressive damage resulting from a defective shutdown or warning device.
- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the generating set.

This limited extended warranty does not cover costs resulting from:

- Difficulty in gaining access to the Product.
- Repair of cosmetic damage to enclosures.

Items not covered by this limited extended warranty:

- Batteries
- Enclosures
- Coolant heating elements
- Maintenance items

Aftertreatment component failures

www.cumminspower.com

CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:

Failed components claimed under warranty remain the property of Cummins Power Generation®. Cummins Power Generation® has the right to reclaim any failed component that has been replaced under warranty.

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS POWER GENERATION ® IN REGARD TO THE PRODUCT. CUMMINS POWER GENERATION® MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT IS CUMMINS POWER GENERATION® LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

This limited extended warranty shall be enforced to the maximum extent permitted by applicable law. This limited extended warranty gives the owner specific rights that may vary from state to state or from jurisdiction to jurisdiction.

Product Model Number: _____

Product Serial Number: _____

Date in Service: _____

Notes:





McCLURE-HILL INCORPORATED

Attention:

Date: **January 17, 2012**

Reference: **Harold D Thompson Water Submittal**

Quote Number: DB101011-5

McClure-HILL, INC (**MHI**) is pleased to quote the following **GE Zenith Controls, Inc** bypass/isolation, closed transition, automatic transfer switch

Item 2:

Model Number: **ZBTSCTB00080EZE01ZVC70MEXE**

Amps: **800**

Poles: **3**

Volts: **277/480 -3Ø, 4W**

Enclosure: **NEMA 1**

Designation: -----

Lugs: **4 #2 to 600 MCM per/Ø - mech. style
lugs for all connections**

Cable entry: **Top & bottom**

Weight: **1435 lbs**

(no ground lugs or ground bus included)

WCR: **85,000 AIC (w/specific MCCB)**

Dimensions: **90”H x 40”W x 42.25”D***

200,000 AIC (w/current limiting fuse)

***(please note this ATS requires front and one other side access and this ATS has ventilation requirements on all sides) – 1600-4000 A only**

This ATS is equipped with the following accessories (microprocessor based, MX 250 with MEXES option package):

A1-aux contact S.P.D.T. – normal (source 1) failure

A1E-aux contact S.P.D.T. – emergency (source 2) failure

2xA3- emergency (source 2) position aux contact

2xA4- normal (source 1) aux contact

BBA: Back Bay Adapter

Calibrate-microprocessor activated calibration feature

CD/P-programmable exerciser daily, 7-14-28-365 days user- selectable, with or without load

DT-time delay from neutral switch position to normal on retransfer (disables ability to have R50)

DW-time delay from neutral switch position to emergency on retransfer (disables ability to have R50)

E-engine start contact

EL/P-event log of last 16 events

J2E-adjustable over/under frequency sensor (source 2 or emergency)

J2N-adjustable over/under frequency sensor (source 1 or normal)

K/P-frequency indication (on the controller)

K2-voltmeter & frequency on MX 250 LCD three phase display for both sources

L1-LED source 2 (emergency) position indicator

L2-LED Source 1(normal) position indication

L3-LED source 1 (normal) source availability indication

L4-LED source 2 (emergency) source availability indication

LN/P-center-off position / LCD indication on microprocessor

LBE-red indicating LED, bypass to “emergency, stand by or alternate” position

LBN-green indicating LED, bypass to “normal” position

L1-amber indicating LED, ATS is “isolate” position

LT-amber indicating LED, ATS is “test” position

LDS-red indicating LED, “disconnect switch activated”

L12-red indicating LED, ATS is “inhibited” mode due to activation of bypass feature and/or DS switch activated

P1-engine start timer

Q2-peak shave/remote load test/area protection- relay (specify voltage)

R2E-Under voltage sensing (source 2 or emergency) (single phase)

R7-over voltage sensing (source 2 or emergency) single phase

R8-over voltage sensing (source 2 or emergency) 3 phase

R16-phase rotation sensing of source 1 and source 2

R17-under voltage sensing: source 2 (emergency) (3 phase)

6175 N. Ponderosa Way, Parker CO 80134 PH: 303-805-9956 FAX: 303-805-9953



M c C L U R E - H I L L I N C O R P O R A T E D

Attention:

Date: **January 17, 2012**

Reference: **Harold D Thompson Water Submittal**

Quote Number: DB101011-5

Page 2

Item 2 continued:

R50-in phase monitor between source 1 and source 2 to allow transfer (with enable/disable) (closed transition only)
S13/P-microprocessor activated commit/no commit on transferring to emergency source (with enable/disable)

SPO-Closed Transition

T-retransfer to normal adjustable time delay

T3/W3: Pre signal contact

TMS: Transition Mode Selector Switch

TS-test switch, "standard, quick and no load" options all embedded on MX 250 control panel and protected by security code.

U-engine stop/cool adjustable cool down timer CD/P-programmable exerciser

VI-voltage imbalance between phases (applies to 3 phase only)

W-adjustable time delay on transfer to emergency source

YEN/P-bypass transfer timer function (soft switch in controller)

6/P-microprocessor activated test switch : a momentary test switch

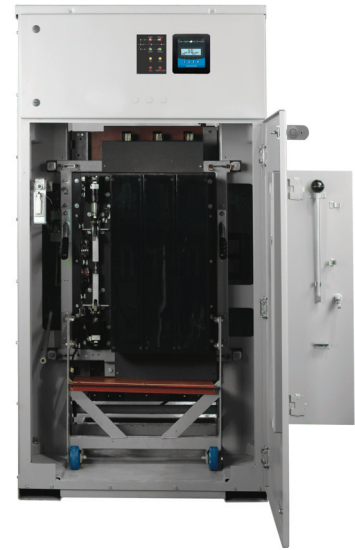
ZNETL: Lon works communication module

All ATS's are equipped with password protected alpha numeric keypads for all adjustments, settings and configurations. All ATS's are equipped with event logging, transfer counter, LED test function, frequency and volt meters (both normal and alternate sources) on MX 250 control panel

All prices quoted are firm for thirty (30) days from date listed on top of each quotation page. All prices quoted are in accordance with GE Zenith's standard terms and Conditions. See GE Zenith web page at www.zenithcontrols.com for a copy of these Terms and Conditions. All quoted prices are FOB factory unless specifically enumerated in the below listed price(s). All taxes, special permits, shipping and any additional fees are not included in the below listed prices.

Zenith ZBTS/ ZBTSD/ZBTSCT

Transfer/Bypass-Isolation Transfer Switches



Introduction

GE's Zenith ZBTS Series Bypass-Isolation Transfer Switch consists of two major modules – the automatic transfer and the bypass-isolation switches. The automatic transfer switch module is GE's proven Zenith ZTS Series, built in ZTS, ZTSD or ZTSCT configuration and constructed for rugged, reliable operation. The same components – heavy-duty silver alloy contacts, rugged drive mechanism and silver plated bus bar inter-connections are used throughout the ZBTS Series.

Features and Benefits

GE's design requires no additional load break contacts which cause load interruption during bypass-isolation functions. The bypass-isolation switch contacts are out of the system current path except during actual bypass operation. Therefore, they are not constantly exposed to the destructive effects of potential fault currents. The Source 1 (normal), Source 2 (emergency) and load are connected between the automatic transfer switch and the bypass-isolation switch through solidly braced isolating contacts that are open when the automatic transfer switch is isolated. All current carrying components provide high withstand current ratings in excess of those specified in UL 1008 standards.

Description and Operation

The bypass section is a ZTS switch provided with a quick make/quick break manual load transfer handle and GE's control/interlock system consisting of both mechanical and electrical interlocks. The bypass switch is equipped with normal failure sensing and a time delay to start the engine automatically if the ATS has been removed for service. The modules are mounted in a compact enclosure and completely interconnected requiring only Source 1 (normal), Source 2 (emergency) and load cable connections. Once installed, no cables need to be removed to isolate the transfer switch module for maintenance or inspection. The automatic transfer switch may be withdrawn for testing or maintenance without disturbing the load. The transfer switch module has three positions:

1. Automatic/Connected: The transfer switch is carrying the load, and the bypass switch is in the open position. This is the normal operating position.

2. Test: The bypass switch is closed and feeding the load. The transfer switch has control power and may be operated for test purposes via the test switch on the enclosure door. The load is not affected during testing
3. Isolate: The transfer switch is withdrawn from all power and ready for maintenance. The load is served by the bypass switch.

The Automatic Transfer Switch is installed on a draw-out mechanism, with electrical and mechanical interlocks for secure removal after load bypass. The ATS control/logic panel is mounted on the enclosure door and connected by a wire harness and multi-pin disconnect plugs. The transfer switch and/or the control panel may be tested, isolated and removed for maintenance without load interruption.

The bypass-isolation switch module is the same basic design as the automatic transfer switch module and thus has the same electrical ratings. Manually operated, it features high speed, quick make/quick break contact action. The bypass-isolation switch has three basic positions:

1. Automatic: Source 1 (Normal) bypass contacts open, Source 2 (emergency) bypass contacts open.
2. Bypass Normal: Source 1 (Normal) bypass contacts closed, Source 2 (emergency) bypass contacts open.
3. Bypass Emergency: Source 1 (Normal) bypass contacts open, Source 2 (emergency) bypass contacts closed.

Interlocks and Indicators

Every ZBTS Series Bypass-Isolation Transfer Switch is supplied with all necessary electrical and mechanical interlocks to prevent improper sequence of operation as well as the necessary interlocking circuit for engine starting integrity. Each ZBTS Series Switch is furnished with a detailed, step-by-step operating instruction plate, as well as the following function diagnostic lights:

- Source 1 (Normal) Available
- Source 2 (Emergency) Available
- Bypass Switch in Source 1 (Normal) Position
- Bypass Switch in Source 2 (Emergency) Position
- Automatic Transfer Switch in Test Position
- Automatic Transfer Switch Isolated
- Automatic Transfer Switch Inhibit
- Automatic Transfer Switch Operator Disconnect Switch "Off"
- Automatic Transfer Switch in Source 1 (Normal) Position
- Automatic Transfer Switch in Source 2 (Emergency) Position



ZBTS & ZBTSD Model, Dimensions and Weights

Ampere Rating	Poles	NEMA 1 Enclosed				Weight		Application Notes	
		Height (A)	Width (B)	Depth (C)	Reference Figure	Open Type	NEMA 1		
100, 150 225, 260 400	2, 3	83 (211)	30 (76)	31 (79)	A	310 (141)	770 (350)	1 - 9 1 - 7, 10 1 - 7, 10 - 12 1 - 7, 10 - 11	
	4	83 (211)	30 (76)	31 (79)		380 (173)	840 (322)		
600	3	90 (229)	36 (91)	28.25 (72)	B	660 (299)	1220 (533)		
	4	90 (229)	40 (102)	28.25 (72)		770 (349)	1365 (619)		
800, 1000 1200	3	90 (229)	40 (102)	28.25 (72)		C	765 (347)		1355 (615)
	4	90 (229)	46 (117)	28.25 (72)			910 (413)		1570 (712)
1600, 2000 2600	3	80 (2023)	40.6 (1031)	64.6 (1640)	C	1978 (897)	4044 (1835)		
	4	80 (2023)	46.1 (1171)	64.6 (1640)		2275 (1032)	4431 (2010)		
3000	3	80 (2023)	40.6 (1031)	64.6 (1640)	D	2572 (1166)	4456 (2021)		
	4	80 (2023)	46.1 (1171)	64.6 (1640)		3049 (1383)	4977 (2258)		
4000	3	90 (229)	47.5 (121)	81 (206)	D	4310 (1955)	4660 (2113)		
	4	90 (229)	54 (137)	81 (206)		5510 (2499)	5860 (2658)		

ZBTST Model, Dimensions and Weights

Ampere Rating	Poles	NEMA 1 Enclosed				Weight		Application Notes	
		Height (A)	Width (B)	Depth (C)	Reference Figure	Open Type	NEMA 1		
100, 150 225, 260 400, 600	3	90 (229)	36 (91)	28.25 (72)	B	730 (331)	1280 (581)	1 - 8	
	4	90 (229)	40 (102)	28.25 (72)		840 (381)	1385 (628)		
800, 1000 1200	3	90 (229)	40 (102)	28.25 (72)		C	835 (379)	1435 (651)	1 - 9
	4	90 (229)	46 (117)	28.25 (72)			980 (444)	1640 (744)	
1600, 2000 2600	3	80 (2023)	40.6 (1031)	64.6 (1640)	C	1978 (897)	4044 (1835)	1 - 7, 10	
	4	80 (2023)	46.1 (1171)	64.6 (1640)		2275 (1032)	4431 (2010)		
3000	3	80 (2023)	40.6 (1031)	64.6 (1640)	D	2572 (1166)	4456 (2021)	1 - 7 10 - 12	
	4	80 (2023)	46.1 (1171)	64.6 (1640)		3049 (1383)	4977 (2258)		
4000	3	90 (229)	47.5 (121)	81 (206)	D	4380 (1986)	4730 (2145)		
	4	90 (229)	54 (137)	81 (206)		5580 (2531)	5930 (2689)		

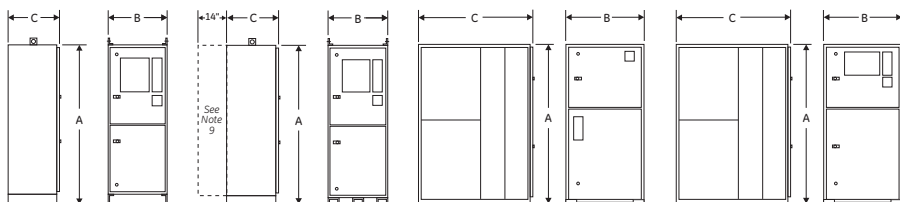


Figure A

Figure B

Figure C

Figure D

ZBTSD Model - Delayed Transition Transfer/Bypass-Isolation Switches

The ZTSD Delayed Transition Transfer Switch with a timed center-off position is available in a bypass configuration. The ZBTSD Model Bypass incorporates the features of both the ZBTS Bypass-Isolation Switch and the ZTSD unit for transfer of large motor loads, transformers, UPS systems or load shedding to a neutral "Off" position. Reference the ZTSD unit features and operation discussion for more details.

Electrical Ratings

- Ratings 100 to 4000 amperes
- 2, 3 or 4 Poles
- Open type, NEMA 1, 3R, 4, 4X and 12
- Available with Zenith ZTS, ZTSD and ZTSC Series Automatic Transfer Switch
- Bypass and transfer switch have identical ratings
- Suitable for emergency and standby applications on all classes of load, 100% tungsten rated through 400 amps
- UL 1008 listed at 480 VAC
- CSA C22.2 No. 178 certified at 600 VAC

Performance Features

- Load is not interrupted during bypass operation
- High close-in and withstand capability
- Temperature rise test per UL 1008 conducted after overload and endurance tests exceeds UL requirements
- Available in ZBTS (utility-generator), ZBTSU (utility-utility), ZBTSG (generator-generator) and ZBTSM (manual) configurations; models include standard, delayed and closed transition

Design and Construction Features

- Automatic transfer switch is located on a draw out mechanism to facilitate maintenance
- Emergency power systems can be electrically tested without disturbing the load
- Power cables do not have to be disconnected to remove the transfer switch
- Bypass to any available source with the automatic transfer switch removed

ZBTST Model - Closed Transition Transfer/Bypass-Isolation Switches

The ZBTST Closed Transition Transfer Switch may be applied with a bypass-isolation switch for the utmost in reliability and versatility. The ZBTST Model provides the ability to withdraw the transfer switch unit for maintenance or inspection. Reference the ZBTST unit features and operation discussion for more details.

Application Notes:

1. Metric dimensions (cm) and weights (Kg) shown in parenthesis adjacent to English measurements in inches and pounds.
2. Includes 1.25" door projection beyond base depth. Allow a minimum of 3" additional depth for projection of handle, light, switches, pushbuttons, etc.
3. All dimensions and weights are approximate and subject to change without notice.
4. Special enclosures (NEMA 3R, 4, 4X, 12, etc.) dimensions and layout may differ. Consult the GE factory for details.
5. Bypass Model product can not be ordered with inverted style.
6. Special lug arrangements may require different enclosure dimensions. For certified drawings, contact the GE factory.
7. Packing materials must be added to weights shown. Allow 15% additional weight for cartons, skids, crates, etc.
8. Add 4" in height for removable lifting lugs.
9. ZBTS(D) 600-1200A & ZBTST 100-1200A standard configuration is top entry. 14" rear adapter bay required for bottom entry. Consult the GE factory for details.
10. Bypass switch weights for 1600 - 4000 amp units vary up to 10% based on connections variations. Weights shown are for estimation only.
11. 3000 amp depth dimension is standard. Depending on your cable/conduit requirements you may desire a deeper enclosure. Consult the GE factory for further details.
12. Lug adapters for 3000-4000 amp limits may be staggered length for ease of entrance. Consult the GE factory for details.

AL-CU UL Listed Solderless Screw-Type Terminals for External Power Connections

Switch Size Amps	Normal, Emergency & Load Terminals	
	Cables/Pole	Wire Ranges
ZBTS & ZBTSD		
100-225	1	#6 to 250 MCM
260	1	#4 to 600 MCM
400	1	#4 to 600 MCM
600	2	#2 to 600 MCM
800 / 1000 / 1200	4	#2 to 600 MCM
1600 / 2000 / 2600 / 3000 / 4000	*	*
ZBTST		
100-400	1	#4 to 600 MCM
600	2	#2 to 600 MCM
800 / 1000 / 1200	4	#2 to 600 MCM
1600 / 2000 / 2600 / 3000 / 4000	*	*

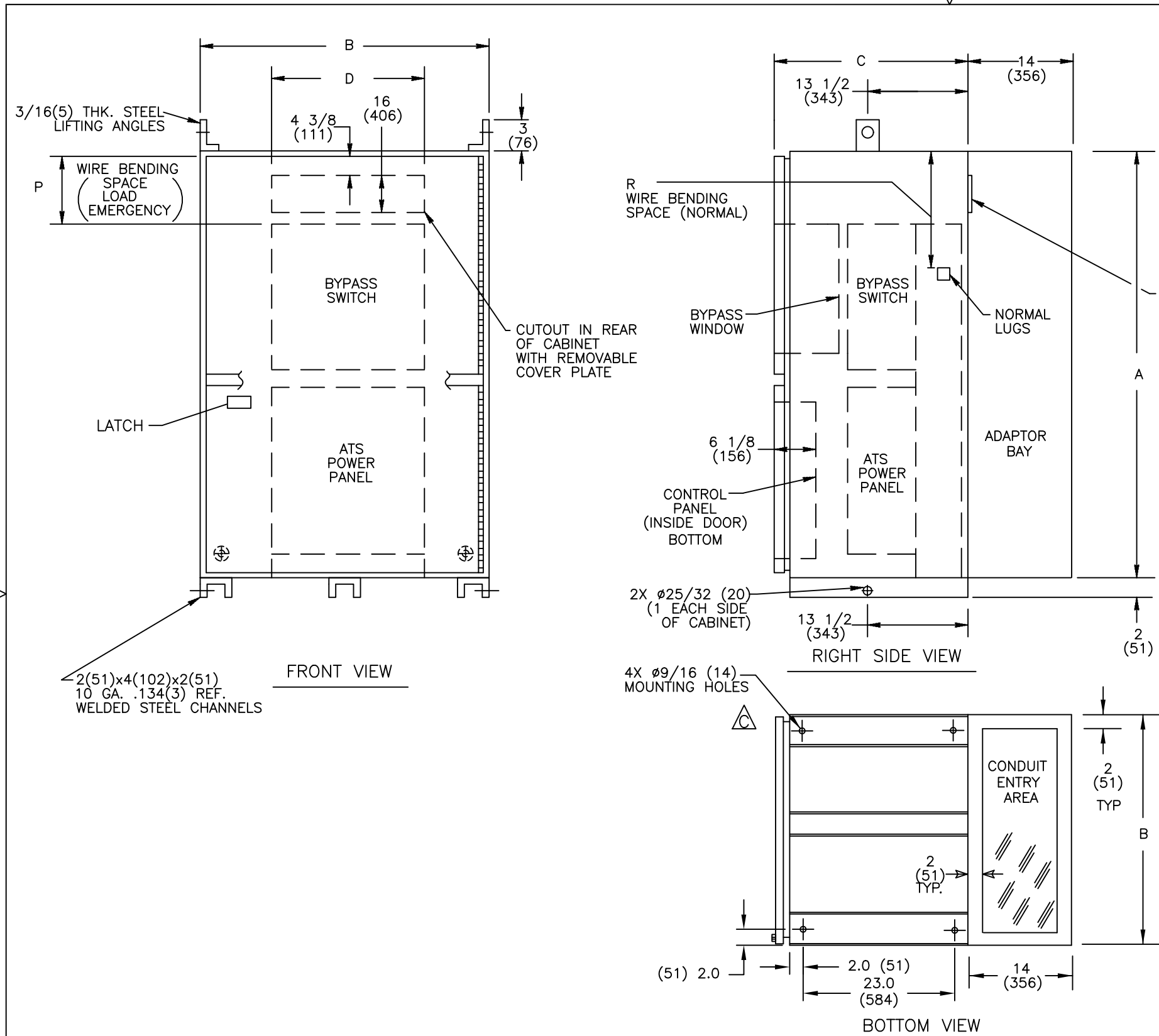
* Line and load terminals are located in rear and arranged for bus bar connection. Terminal lugs are available at additional cost. Contact the GE factory for more details.



imagination at work



GE Energy - Digital Energy
830 W 40th Street, Chicago, IL 60609 USA
800 637 1738 www.gepowerquality.com



REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
C	S-8766-1 REVISED DWG	05/13/08	GG CE

ZBTSCT SWITCHES	NO. POLES	NEMA(1) CABINET	LUG RANGE	WIRE BENDING SPACE	
				P(EMERG)	R(NORMAL)
100-400 AMP	2,3	F-1800MP	(QTY 1) #4-600 MCM (33-304mm ²)	18 1/4 (464)	31 3/8 (797)
	4	F-1801MP			27 1/8 (689)

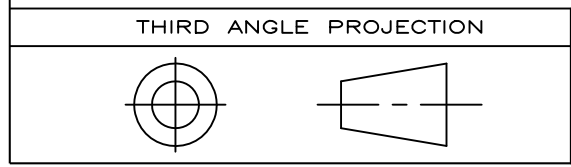
ZBTS/ZBTSD/CT SWITCHES	NO. POLES	NEMA(1) CABINET	LUG RANGE	WIRE BENDING SPACE	
				P(EMERG)	R(NORMAL)
600 AMP	2,3	F-1800MP	(QTY 2) #2-600 MCM (33-304mm ²)	18 1/4 (464)	31 3/8 (797)
	4	F-1801MP			27 1/8 (689)
800-1200 AMP	2,3	F-1802MP	(QTY 4) #2-600 MCM (33-304mm ²)	18 1/4 (464)	29 5/8 (752)
	4	F-1803MP			25 1/8 (638)

CABINET DIMENSIONS					
CABINET	ADAPTER BAY	A	B	C	D
F-1800MP	26H-1332	88 (2235)	36 (914)	28 1/4 (718)	24 (610)
F-1802MP	26H-1333	88 (2235)	40 (1016)	28 1/4 (718)	28 (711)
F-1803MP	26H-1334	88 (2235)	46 (1168)	28 1/4 (718)	34 (864)
F-1801MP	26H-1333	88 (2235)	40 (1016)	28 1/4 (718)	28 (711)

NOTES:

- MATERIAL: 10 GA. STEEL .134(3) REF. UNLESS OTHERWISE NOTED.
- FINISH: PER F-7000.
- LOAD AND EMERGENCY LUG CONNECTIONS AT TOP OF BYPASS SWITCH. NORMAL LUG CONNECTIONS ON RIGHT SIDE OF MOUNTING FRAME.
- CABLES MUST ENTER FROM TOP ONLY IN MAIN TRANSFER SWITCH CABINET. CABLES MAY ENTER FROM ANY DIRECTION IN REAR ADAPTOR BAY.
- ALL SIDE, TOP AND REAR PANELS ON ADAPTOR BAY ARE REMOVABLE.
- ALL DIMENSIONS ARE FOR REFERENCE ONLY AND SHOWN IN INCHES(MILLIMETERS).
- CONSTRUCTION PER UL 1008

SIGNATURES		DATE			GE Zenith Controls
MODEL GG		05/13/08			
DETAIL				TRANSFER SWITCHES NEMA 1 ENCL. W/ ADAPTER BAY	
CHECKED				FIRST MADE FOR: ZBTS(D) 600-1200 AMP & ZBTSCT 100-1200 AMP	
ENGRG CE				SIZE	CAGE CODE
MFG				B	
QUALITY				DWG NO	
ISSUED				50C-1003AB	
DRAWING FILE: 50c-1003ab-b-1.dwg				SCALE: N/A	
MODEL / ASSEMBLY FILE: ZBTS(D) 600-1200AMP & ZBTSCT 100-1200 AMP				SHEET 1 OF 2	
# CTQs		CRITICAL TO QUALITY CHARACTERISTIC			



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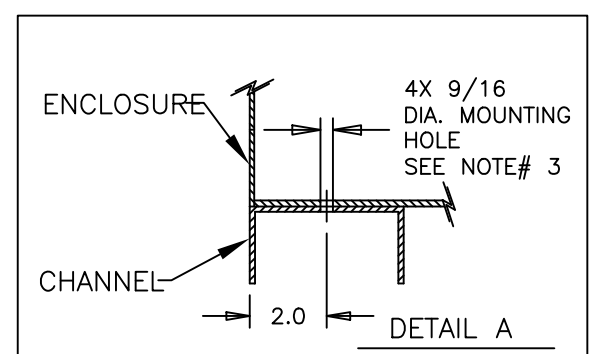
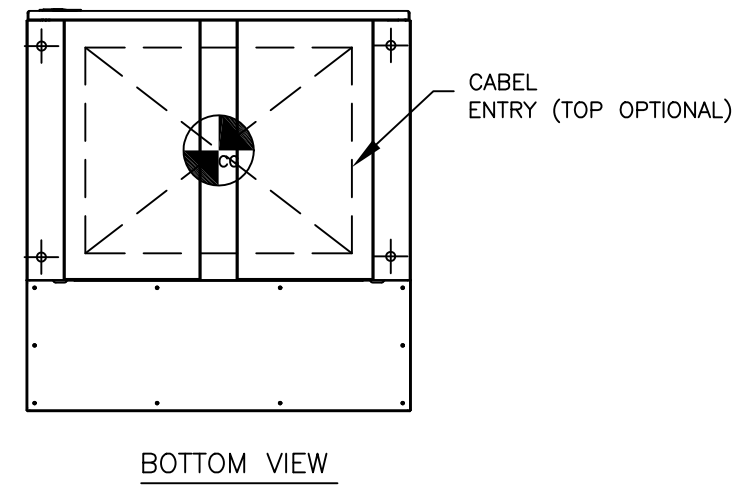
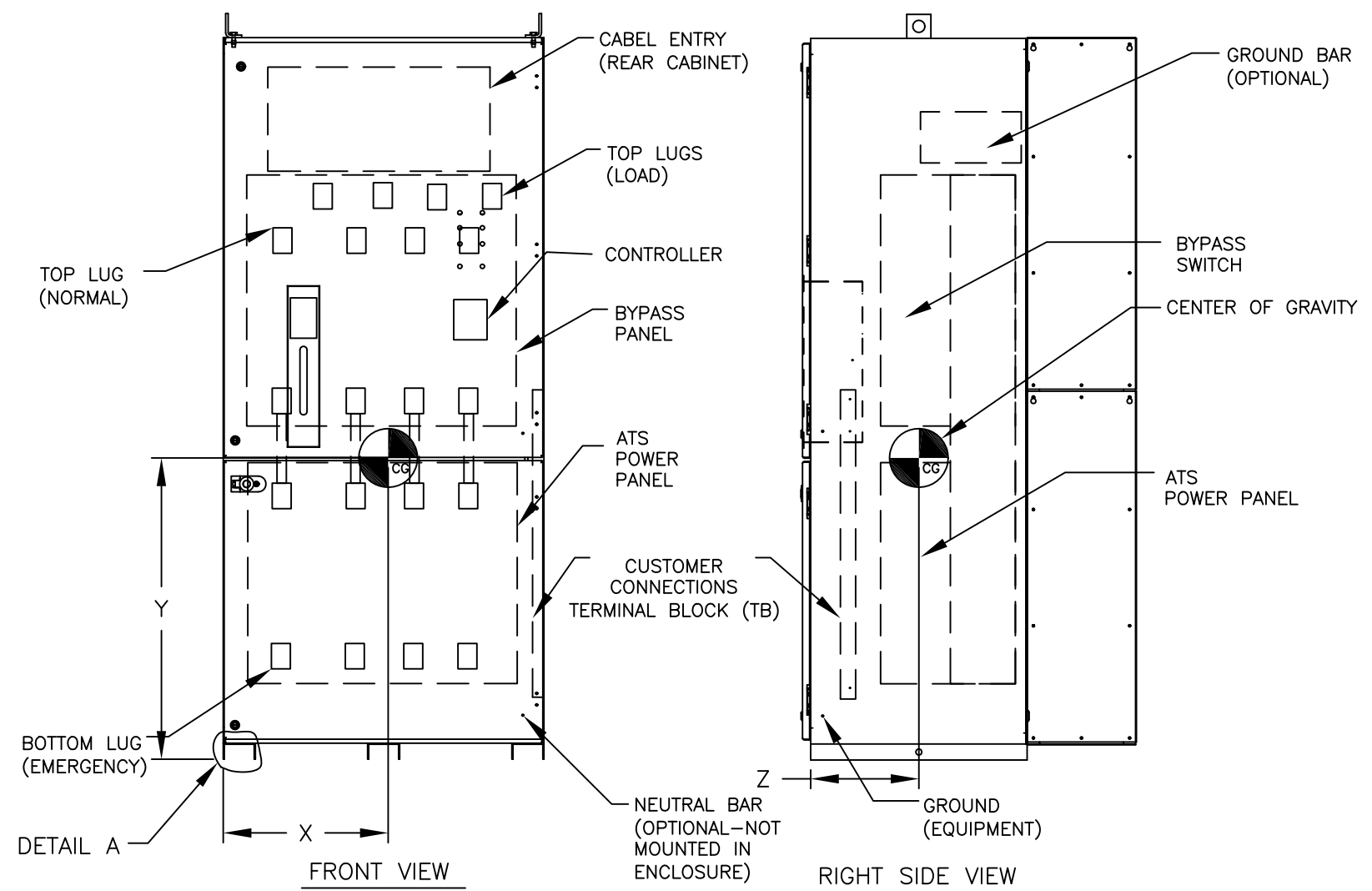
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REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
C	S-8766-1 ADD 2ND SHT	05/13/08	GG CE

TIGHTENING TORQUE FOR LUGS		
SOCKET SIZE ACROSS FLATS	TORQUE	
	Lb-Ft	N-m
1/8	4	5.4
5/32	8	10.9
3/16	10	13.6
7/32	12	16.3
1/4	17	23.1
5/16	23	31.2
3/8	31	42.1
1/2	42	57.0
9/16	50	67.9

ZBTS(D)CT AMP	POLE	WEIGHT LB(kg)	CENTER OF GRAVITY in(mm)		
			X	Y	Z
600	2,3	1635(742)	18.0 (457)	36.0 (914)	24.0 (610)
	4	1740(789)			
800-1200	2,3	1685(764)	21.0 (533)	36.0 (914)	24.0 (610)
	4	1790(812)			



NOTES:

- ALL DIMENSIONS ARE FOR REFERENCE ONLY AND SHOWN IN INCHES (MILLIMETERS).
- SEISMIC DATA OF MOST VULNERABLE ATS CONSTRUCTION WITHIN ITS PLATFORM:

<p>MAXIMUM DEFLECTION AT TOP OF GEAR: dss=1.41 INCHES (36 MM) dfb=0.67 INCHES (17 MM)</p> <p>QUALIFIED BY: TIME HISTORY SHAKE TABLE TEST IEEE-693-2005-HIGHx2.5 (64) IBC-2003-300%G</p> <p>RESONANCE FREQUENCIES: fss=7.0 Hz ffb=10.2 Hz fv=>33.0 Hz</p> <p>MAXIMUM REACTION TO ANY BOLT: Vss=788 LBS (358 KG) SHEAR (DEAD LOAD +/- SEISMIC) Vfb=788 LBS (358 KG) SHEAR Tv=3170 LBS (1441 KG) UP Pv=3787 LBS (1721 KG) DOWN</p>
--

- BOLT ENCLOSURE FROM THE C-CHANNEL BASE USING THE FOLLOWING SEISMIC CERTIFIED MOUNTING HARDWARE PER MOUNTING HOLE : (HARDWARE PROVIDED BY INSTALLER).
 - 1/2"-13 GRADE 5 BOLT TORQUE TO 70 FT. LBS. (95 NEUTON METERS).
 - US STANDARD HIGH STRENGTH ZINC PLATED FLAT WASHER 5/8 (16) I.D. AND AND 1/2 (13) O.D.
 - 1/2 (13) HELICAL SPRING LOCK WASHER.

SIGNATURES		DATE
MODEL	GG	05/13/08
DETAIL		
CHECKED		
ENGRG	CE	
MFG		
QUALITY		
ISSUED		
DRAWING FILE: 50c-1003ab-a-2.dwg		
MODEL / ASSEMBLY FILE: ZBTS(D) 600-1200 AMP & ZBTSCT 100-1200 AMP		
# CTQs		

GE Zenith Controls

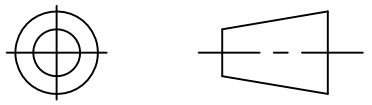
TITLE: ZBTS(D) & ZBTSCT INSTALLATION DWG. NEMA-1

FIRST MADE FOR: ZBTS(D) 600-1200 AMP & ZBTSCT 100-1200 AMP

SIZE: B CAGE CODE: DWG NO: 50C-1003AB

SCALE: N/A SHEET 2 OF 2

THIRD ANGLE PROJECTION



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ZBTST SERIES WITH MX250 MICROPROCESSOR-BASED CONTROL PANEL		REVISIONS	
BYPASS/ISOLATION TRANSFER SWITCH 100-1200 AMP		DESCRIPTION	DATE
J	S-8604	REVISED SHEET 2	04/12/07
FOR USE ON EMERGENCY OR STANDBY SYSTEMS - RATED FOR TOTAL SYSTEM & MOTOR LOAD		APPROVED YJS MES	

A. LEGEND

MX Series Microprocessor-Based Control Panel

Standard Features:

- DT.....Time Delay to SOURCE 1
- DW.....Time Delay to SOURCE 2
- L1.....SOURCE 2 Position Light
- L2.....SOURCE 1 Position Light
- L3.....SOURCE 1 Available Light
- L4.....SOURCE 2 Available Light

Controls Power Supply (CPS)

- XE1,XE2.....Control Transformer, SOURCE 2
- XN1,XN2.....Control Transformer, SOURCE 1

Power Panel

- N1,2,3,(N).....SOURCE 1 Line
- E1,2,3,(N).....SOURCE 2 Line

T1,2,3,(N).....Load Connections

- CE.....Transfer Operator, SOURCE 2
- CEO.....Transfer Operator, Open SOURCE 2.
- CN.....Transfer Operator, SOURCE 1
- CNO.....Transfer Operator, Open SOURCE 1
- DS.....Disconnect Switch
- GND.....Ground
- NB.....Neutral Bar (if required)
- SCR-E.....SCR, Source 2
- SCR-EO.....SCR, Source 2 Open
- SCR-N.....SCR, Source 1
- SCR-NO.....SCR, Source 1 Open
- SE.....SOURCE 2 Position Limit Switch
- SEO.....SOURCE 2 OPEN Position Limit Switch
- SN.....SOURCE 1 Position Limit Switch
- SNO.....SOURCE 1 OPEN Position Limit Switch

B. OPERATION (OPEN TRANSITION)

When SOURCE 1 line voltage drops below the preset "Fail" values, the SOURCE 1 voltage sensing circuit initiates the engine start circuit.

When SOURCE 2 line voltage and frequency reach the preset "restore" values, the MX controller initiates a transfer signal through the SCR-NO to operate the OPEN position. After a set time delay, the MX controller initiates a transfer signal through the SCR-E to operate the transfer operator. The load will be transferred to the SOURCE 2 position. The transfer switch is mechanically locked. The SN limit switch awaits the next operation to SOURCE 1.

When SOURCE 1 line voltage and frequency reach the preset "Restore" values, the MX controller initiates a transfer signal through the SCR-EO to operate the transfer operator. The load will be transferred to the OPEN position. After a set time delay, the MX controller initiates a transfer signal through the SCR-N to operate the transfer operator. Load will be re-transferred back to the SOURCE 1 position. The transfer switch is mechanically locked. The SE limit switch awaits the next operation to SOURCE 2.

The Test Switch simulates a SOURCE 1 line failure when activated. To test, activate the Test Switch, thus allowing the transfer switch to Transfer to the SOURCE 2 position. De-activate the Test Switch. The transfer switch will transfer to the SOURCE 1 position. Testing at least once a month is recommended. For hospital EMERGENCY systems, test once a week.

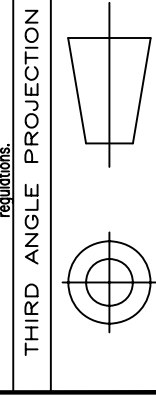
Disconnect Switch (DS)

When the Disconnect Switch is placed in the INHIBIT position, the circuits to the transfer operators are opened and transfer cannot take place.

C. PARALLELING REQUIREMENTS

1. The unit is Factory set to accomplish transfer within 5 electrical degrees.
2. Requires an Isochronous Governor with an operating frequency of 60 ± 0.2 Hz.
3. Requires a shunt trip breaker on the Generator set with a response time not exceeding 50ms.

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THIRD ANGLE PROJECTION	FINISH	2 PL. DECIMALS ± .020	
	✓	3 PL. DECIMALS ± .005	
		ANGLES ± 1°	
		FRACTIONS ± 1/64	



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CTOs

CRITICAL TO QUALITY CHARACTERISTIC

SCALE: NA

FIRST MADE FOR: ZBTST(100-1200 AMP)

SIZE CAGE CODE DWG NO

SHEET 1 OF 8



GE Zenith Controls

LEGEND, OPERATION & ACCESSORIES

76A-2000

D. OPERATION (CLOSED TRANSITION)

Zenith Closed Transition Transfer Switches are designed to Transfer load between two available sources, without interrupting power to the load (make-before-break). Paralleling of the two sources occurs within a predefined window of synchronization and lasts less than 100ms. The initial source is then disconnected.

To test the ATS, activate the test switch to drop out the Engine Start Relay (P1). The ATS closes into SOURCE 2 only after the SYNC Check ensures the proper phase relationship between both sources. After the ATS closes into SOURCE 2, the SE limit switch becomes activated. The controller initiates a transfer signal through the SCR-NO, which opens the ATS out of SOURCE 1. When the ATS has opened out of SOURCE 1, the SNO limit switch activates. The ATS has now closed into the SOURCE 2 position without interrupting the load.

Deactivating the Test switch initiates the retransfer. The ATS closes into SOURCE 1 only after the SYNC ensures proper phase relationship between both sources. After the ATS closes into SOURCE 1 the SN limit switch becomes activated. The controller initiates a transfer signal through the SCR-EO which opens the ATS out of SOURCE 2. When the ATS has opened out of SOURCE 2, the SEO limit switch activates. The ATS has now closed back into the SOURCE 1 position without interrupting the load.

The ATS defaults to an open transition transfer when SOURCE 1 source fails. This signals the generator to start. After the generator voltage and frequency reach the preset "Restore" values, the ATS transfers to SOURCE 2. Closed transition transfer is not possible with one source available. One can select an Open Transition transfer via the optional Transition Mode Selector (TMS) for testing.

If while in Closed Transition Mode, the ATS fails to open the source it is attempting to "transfer out of", the source that the ATS just closed into will be opened leaving the ATS in its initial source while disabling all other transfer operations until the problem is corrected and the "Fail to Open Lockout Reset" has been pressed. Also a dry contact (STE) to shunt trip the generator circuit breaker is available to remove the generator from the bus if neither operator opened.

ACCESSORY GROUP PACKAGES:

E. (STDS) GROUP PACKAGE

- 6. A3, A4, CALIBRATE, CDT DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, R50, S13, T, U, VI, W AND YEN.

F. (EXES) OPTION PACKAGE

- 6. A1, A1E, A3, A4, CALIBRATE, CDP DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, Q2, R16, R50, S13, T, U, VI, W & YEN.

G. (CONS) OPTION PACKAGE

- 6. A1, A1E, A3, A4, CALIBRATE, CDP, DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, Q2, Q3, Q7, R16, R50, S13, T, T3/W3, U, UMD, VI, W AND YEN.

H. (SENS) OPTION PACKAGE

- 6. A1, A1E, A3, A4, CALIBRATE, CDP, DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, Q2, Q7, R1-1/R1-3, R16, R50, S12, S13, T, U, VI, W AND YEN.

I. (SPES) OPTION PACKAGE

- 6. A1, A1E, A3, A4, CALIBRATE, CDP, DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, Q2, Q3, Q7, R1-1/R1-3, R16, R50, S5, S13, T, T3/W3, U, UMD, VI, W AND YEN.

J. (PSGS) OPTION PACKAGE

- 6. A1, A1E, A3, A4, CALIBRATE, CDP, DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, Q2, Q3, Q7, R1-1/R1-3, R15, R16, R50, S12, S13, T, T3/W3, U, UMD, VI, W AND YEN.

NOTES:

1. **CAUTION:** 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.
2. **GROUNDING TERMINAL:** A grounding terminal (GND) is provided. When installing open type switches connect this terminal to the metal enclosure or on equivalent earth ground.
3. **WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.**
4. **OPEN TRANSITION OPERATION CAN BE SELECTED WITH BOTH SOURCES AVAILABLE.**
5. **OPEN TRANSITION OCCURS BY DEFAULT WHEN THE LOAD-CONNECTED SOURCE FAILS.**
6. **ON SINGLE PHASE UNITS WHERE THE SOURCE 2 SOURCE IS A UTILITY LINE, CONNECT SOURCE 2 LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.**
7. **ON SINGLE PHASE (2 POLE) UNITS, THE CENTER POLE, 47N & 47E ARE NOT SUPPLIED.**

3Ø 27/59N & E ARE REPLACED BY 1Ø 27/59N & E.



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ZBTSCTL SERIES WITH MX250 MICROPROCESSOR-BASED CONTROL PANEL BYPASS/ISOLATION TRANSFER SWITCH 100-1200AMP		REV. J		DESCRIPTION		DATE		APPROVED	
FOR USE ON EMERGENCY OR STANDBY SYSTEMS-RATED FOR TOTAL SYSTEM & MOTOR LOAD		S-8604		REVISED DWG		04/12/07		YJS MES	

REVISIONS

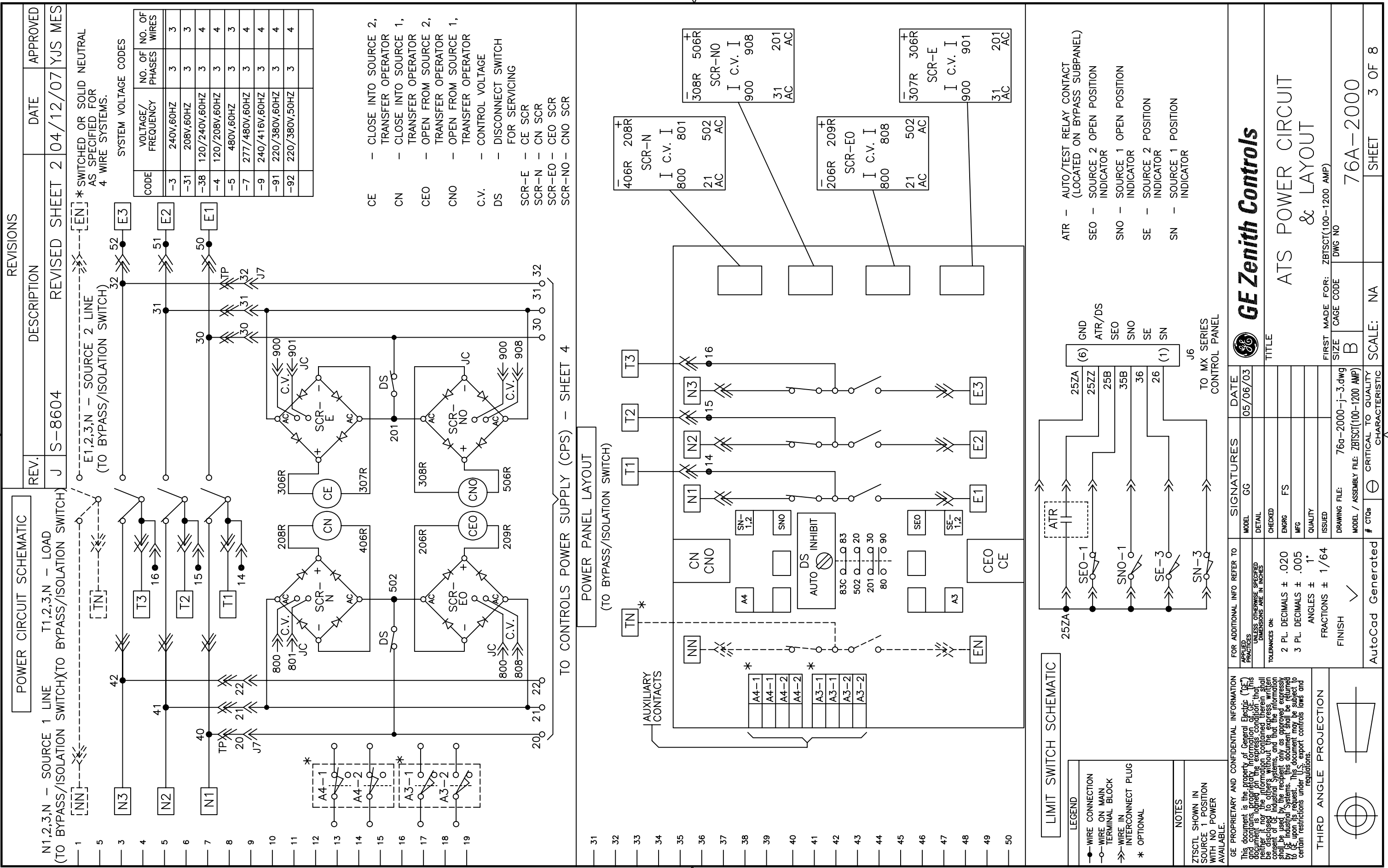
K. ACCESSORIES DEFINITION:

<input type="checkbox"/> M6 Test Switch, Momentary. <input type="checkbox"/> M6A Test Switch, Maintained/Momentary. Door mount. <input type="checkbox"/> M6AP Test Switch Maintained/Momentary Utilizing Keypad. <input type="checkbox"/> M6B Test Switch, Maintained-Auto/Momentary-test, Key Operated. <input type="checkbox"/> M6C Test Switch, Maintained-Auto/Maintained-test, Key Operated. <input type="checkbox"/> A1 Auxiliary Contact, Operates on Source 1 line failure. <input type="checkbox"/> A1E Auxiliary Contact, Operates on Source 2 line failure. <input type="checkbox"/> A3 Auxiliary Contact Closed when the switch is in Source 2 position. <input type="checkbox"/> A4 Auxiliary Contact Closed when the switch is in Source 1 position. <input type="checkbox"/> A62 Sequential Universal Motor load Disconnect Circuit. <input type="checkbox"/> B9 Battery charger. <input type="checkbox"/> CALIBRATE Source 1 & Source 2 Calibrate capabilities for voltage a frequency. <input type="checkbox"/> CDP 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. <input type="checkbox"/> CDT Timer 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, 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. <input type="checkbox"/> CTAP Alarm Panel on transfer to Source 2 w/Silence button. <input type="checkbox"/> DS Disconnect Switch, Auto /Inhibit. Inhibits transfer in either direction when in inhibit. Allows automatic operation when in Auto. <input type="checkbox"/> DT Time delay from Neutral switch position to Source 1 position. <input type="checkbox"/> DW Time delay from Neutral switch position to Source 2 position. <input type="checkbox"/> E Engine Start Contact. <input type="checkbox"/> EL/P Event Log: Sequentially Numbered Log of 16 events that track date, time, reason and action taken. <p>System Data: 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> <input type="checkbox"/> F Fan contact operates when generator is running. <input type="checkbox"/> HT Heater and Thermostat. <input type="checkbox"/> K Frequency Meter, Door mount. <input type="checkbox"/> KP Frequency, LCD-Indication S1 & S2 <input type="checkbox"/> L 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.	<input type="checkbox"/> M1 Single Phase Amp Meter <input type="checkbox"/> M2 Three Phase Amp Meter <input type="checkbox"/> M3 Single Phase Volt Meter <input type="checkbox"/> M4 Three Phase Volt Meter <input type="checkbox"/> M90 2000 Digital Power Monitor Δ <input type="checkbox"/> M91 EPM 6000 Digital Power Meter w/RS485 Δ <input type="checkbox"/> N1 Running Time meter, Door Mount. <input type="checkbox"/> N2 Operation Counter meter, Door Mount. <input type="checkbox"/> P1 Time Delay Source 2 Start. Adjustable 0 to 10 sec. <input type="checkbox"/> P2 Time Delay Source 2 Start. Adjustable 1/6 to 300 sec. <input type="checkbox"/> Q2 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. <input type="checkbox"/> Q3 Inhibit Transfer to Source 2 Circuit. <input type="checkbox"/> Q7 Inhibit Transfer to Source 1 Circuit. <input type="checkbox"/> R2E Under voltage sensing of Source 2 for single-phase. (R17 replaces R2E for Utility to Utility switches) <input type="checkbox"/> R1-1/R1-3 Source 1 Over Voltage sensing for single and three phase systems. <input type="checkbox"/> R16 Phase Rotation Sensing <input type="checkbox"/> R26 Interruptable Power Rate Provisions <input type="checkbox"/> R50 In-Phase Monitor. Prevents transfer until two sources are in-phase. <input type="checkbox"/> S5 Auto/Semi Manual selector, Utilizing keypad <input type="checkbox"/> S12 Auto/Manual selector, Utilizing keypad <input type="checkbox"/> S13 Transfer Commit or no Commit to transfer upon Engine start. <input type="checkbox"/> S14 Test/Auto/Source 1 Selector, Door mount <input type="checkbox"/> SW1 Auto/Off/Start Engine control selector Door mount <input type="checkbox"/> SW2 Auto/Off Engine control selector Door mount <input type="checkbox"/> SW3 Source Priority Selector Switch Door mount <input type="checkbox"/> T Time Delay to SOURCE 1 stable timer <input type="checkbox"/> T3/W3 Elevator Pre-Signal Auxiliary Contacts: Open 0-60 sec. prior to transfer to either direction, re-closes after transfer. <input type="checkbox"/> U Source 2 Stop Delay Timer. <input type="checkbox"/> UMD Universal Motor Load Disconnect Circuit. <input type="checkbox"/> V Voltage Imbalance Sensing (Three Phase) <input type="checkbox"/> W Time Delay (S2) Source 2 Stable Timer. To delay transfer to Source 2. <input type="checkbox"/> YEN Bypass T and W Timers utilizing keypad. <input type="checkbox"/> ZNET Network Communication Interface Card.
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GE Zenith Controls		TITLE LEGEND, OPERATION, AND ACCESSORIES	
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FOR ADDITIONAL INFO REFER TO APPLIED PROCEDURES UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL DECIMALS ± .020 3 PL DECIMALS ± .005 ANGLES ± 1° FRACTIONS ± 1/64 FINISH ✓		DATE 05/06/03 FIRST MADE FOR: ZBTSCT (100-1200Amps) SIZE CAGE CODE B DWG NO 76A-2000	
THIRD ANGLE PROJECTION 		SCALE: NA SHEET 2 OF 8	
AutoCad Generated		CHARACTERISTIC	



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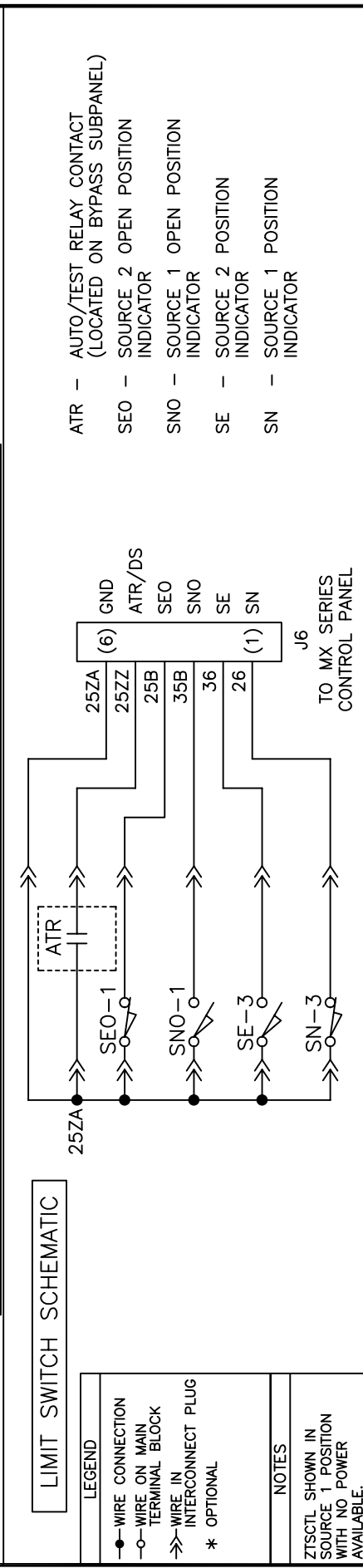
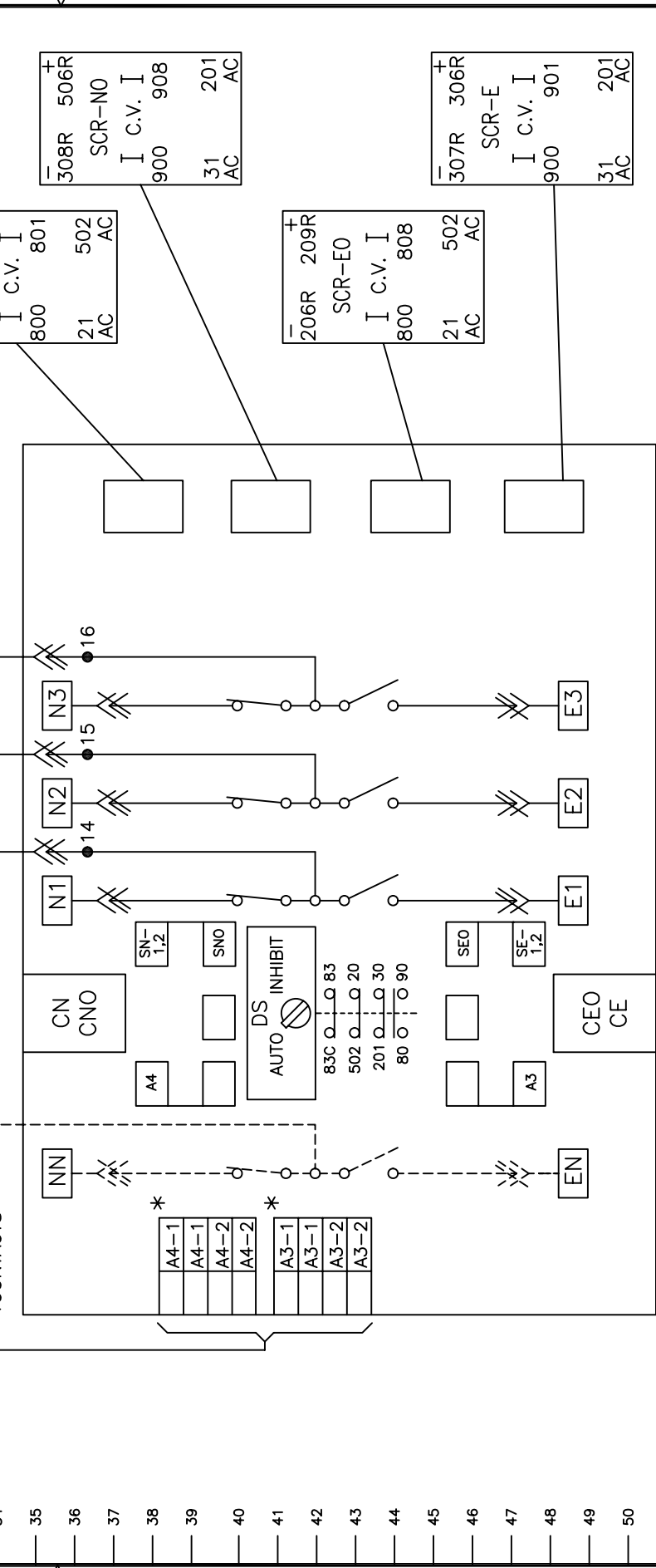


POWER CIRCUIT SCHEMATIC		REVISIONS	
REV.	DESCRIPTION	DATE	APPROVED
J	S-8604	04/12/07	YJS MES

SYSTEM VOLTAGE CODES	
CODE	VOLTAGE/FREQUENCY
-3	240V,60HZ
-31	208V,60HZ
-38	120/240V,60HZ
-4	120/208V,60HZ
-5	480V,60HZ
-7	277/480V,60HZ
-9	240/416V,60HZ
-91	220/380V,60HZ
-92	220/380V,50HZ

NO.	DESCRIPTION
1	N1,2,3,N - SOURCE 1 LINE (TO BYPASS/ISOLATION SWITCH)
2	T1,2,3,N - LOAD
3	E1,2,3,N - SOURCE 2 LINE (TO BYPASS/ISOLATION SWITCH)
4	* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

NO.	DESCRIPTION
5	CE - CLOSE INTO SOURCE 2, TRANSFER OPERATOR
6	CN - CLOSE INTO SOURCE 1, TRANSFER OPERATOR
7	CEO - OPEN FROM SOURCE 2, TRANSFER OPERATOR
8	CNO - OPEN FROM SOURCE 1, TRANSFER OPERATOR
9	C.V. - CONTROL VOLTAGE
10	DS - DISCONNECT SWITCH FOR SERVICING
11	SCR-E - CE SCR
12	SCR-N - CN SCR
13	SCR-EO - CEO SCR
14	SCR-NO - CNO SCR



LIMIT SWITCH SCHEMATIC																									
LEGEND	<ul style="list-style-type: none"> ● WIRE CONNECTION ○ WIRE ON MAIN TERMINAL BLOCK ⇨ WIRE IN INTERCONNECT PLUG * OPTIONAL 																								
NOTES	ZTSCTL SHOWN IN SOURCE 1 POSITION WITH NO POWER AVAILABLE.																								
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<p>THIRD ANGLE PROJECTION</p>																									
<p>FOR ADDITIONAL INFO REFER TO</p> <table border="1"> <tr><td>MODEL</td><td>GG</td><td>SIGNATURES</td><td>DATE</td></tr> <tr><td>DETAIL</td><td>CHECKED</td><td></td><td>05/06/03</td></tr> <tr><td>ENGRG</td><td>ENGRG</td><td></td><td></td></tr> <tr><td>MFG</td><td>MFG</td><td></td><td></td></tr> <tr><td>QUALITY</td><td>QUALITY</td><td></td><td></td></tr> <tr><td>ISSUED</td><td>ISSUED</td><td></td><td></td></tr> </table>		MODEL	GG	SIGNATURES	DATE	DETAIL	CHECKED		05/06/03	ENGRG	ENGRG			MFG	MFG			QUALITY	QUALITY			ISSUED	ISSUED		
MODEL	GG	SIGNATURES	DATE																						
DETAIL	CHECKED		05/06/03																						
ENGRG	ENGRG																								
MFG	MFG																								
QUALITY	QUALITY																								
ISSUED	ISSUED																								
<p>2 PL. DECIMALS ± .020</p> <p>3 PL. DECIMALS ± .005</p> <p>ANGLES ± 1°</p> <p>FRACTIONS ± 1/64</p> <p>FINISH ✓</p>																									
<p>AutoCad Generated</p>																									
<p>GE Zenith Controls</p> <p>ATS POWER CIRCUIT & LAYOUT</p> <p>FIRST MADE FOR: ZBTSC1(100-1200 AMP)</p> <p>SIZE CAGE CODE DWG NO</p> <p>B 76A-2000</p> <p>SCALE: NA</p> <p>SHEET 3 OF 8</p>																									

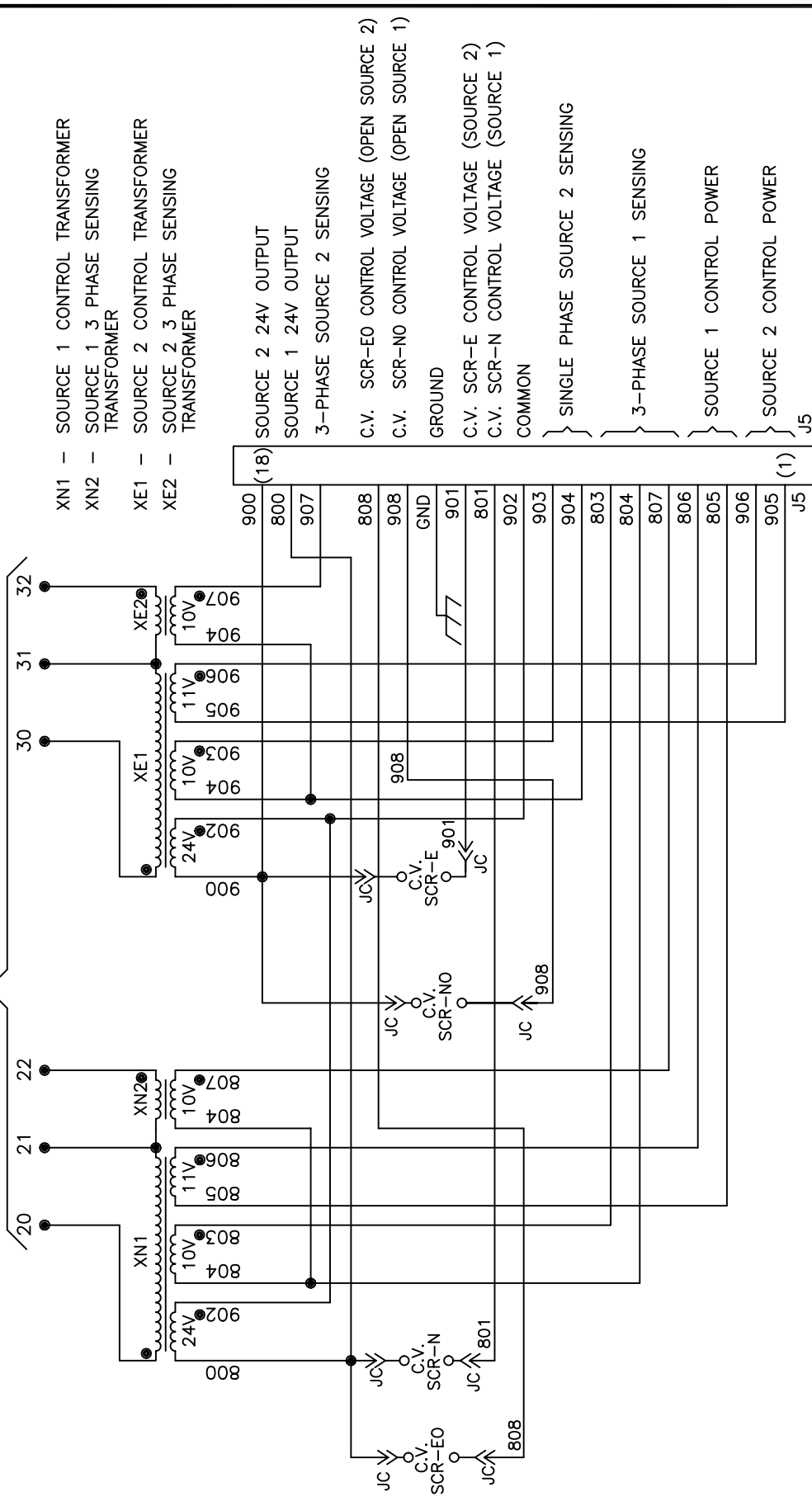
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CONTROLS POWER SUPPLY (CPS) SCHEMATIC

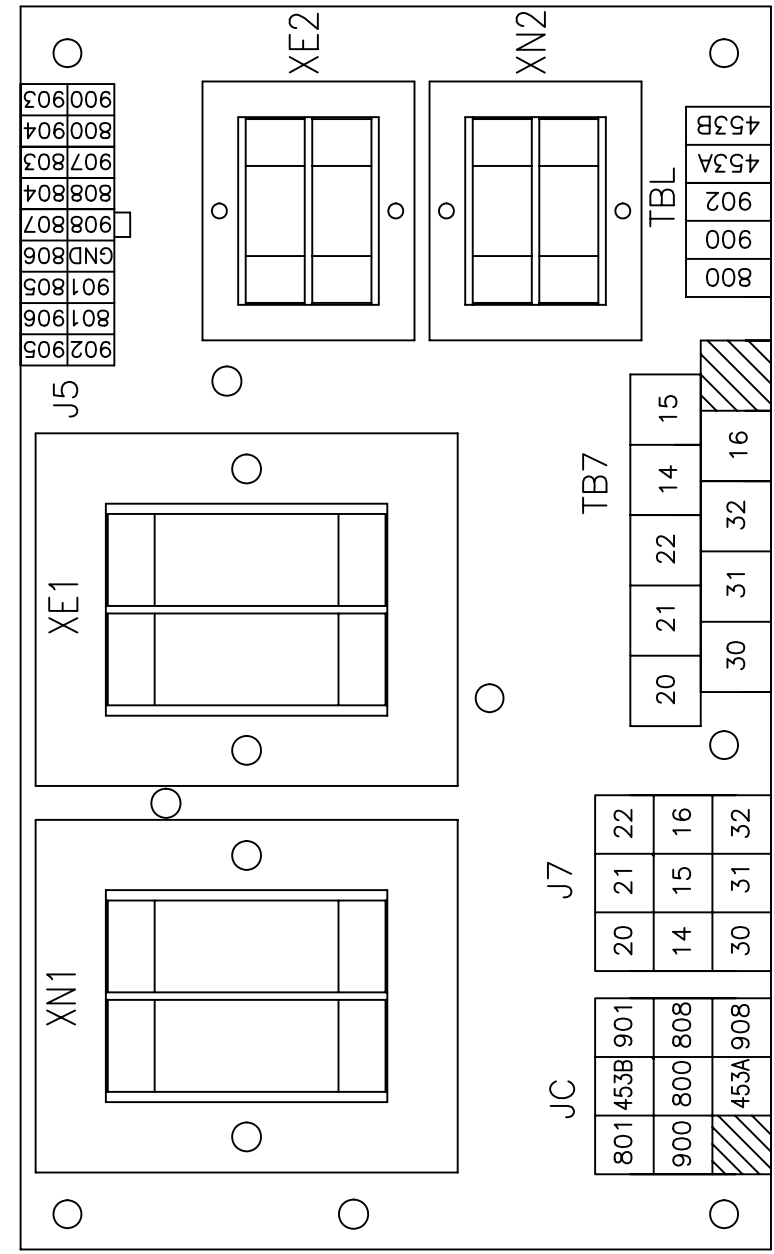
REV.	DESCRIPTION	DATE	APPROVED
J	S-8604	04/12/07	YJS MES

REVISIONS

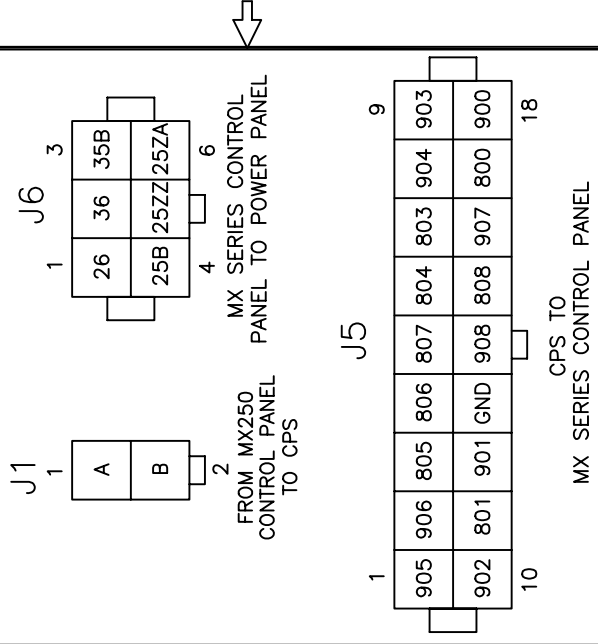
TO POWER CIRCUIT SCHEMATIC - SHEET 3



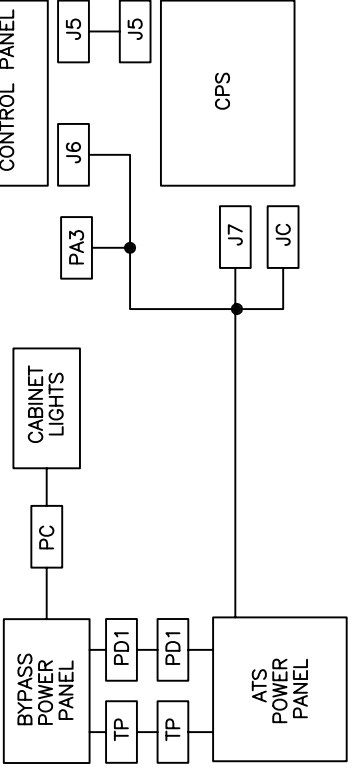
CONTROLS POWER SUPPLY (CPS)



INTERCONNECT PLUGS



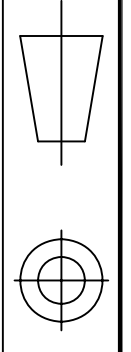
INTERCONNECT PLUG DIAGRAM



LEGEND

- WIRE CONNECTION
- * OPTIONAL

THIRD ANGLE PROJECTION



FOR ADDITIONAL INFO REFER TO	SIGNATURES	DATE
APPLIED DIMENSIONS ARE IN INCHES	GG	05/06/03
UNLESS OTHERWISE SPECIFIED	DETAIL	
TOLERANCES ON:	CHECKED	
2 PL. DECIMALS ± .020	ENGRG	FS
3 PL. DECIMALS ± .005	MFG	
ANGLES ± 1°	QUALITY	
FRACTIONS ± 1/64	ISSUED	
FINISH	DRAWING FILE:	76a-2000-j-4.dwg
✓	MODEL / ASSEMBLY FILE:	ZBTSC1(100-1200 AMP)
AutoCad Generated	# CTOs	0
	CRITICAL TO QUALITY CHARACTERISTIC	
	SCALE:	NA
	SHEET	4 OF 8



TITLE
CONTROLS POWER SUPPLY(CPS)
& INTERCONNECT PLUGS

FIRST MADE FOR: ZBTSC1(100-1200 AMP)
CAGE CODE
SIZE B
DWG NO 76A-2000

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OPERATION: BYPASS/ISOLATION SWITCH		REVISIONS	
REV.	DESCRIPTION	DATE	APPROVED
J	S-8604	04/12/07	YJS MES
REVISED SHEET 2		SHEET 2	

AUTOMATIC

- Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
- Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

- Open bottom cabinet door and turn DS to "INHIBIT".
- Turn Bypass Selector Switch (BSS) to same power source as ATS.
- Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

- Bypass per above instructions.
- Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
- Turn DS to "AUTO".
- Test Switch (TS) on microprocessor controller will allow electrical operation of ATS.

TO ISOLATE ATS

- Bypass per above instructions.
- Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

- Bypass and isolate per above instructions.
- Disconnect multipin plugs and external connections to ATS.
- Rotate four power panel latches to vertical position, slide ATS forward & lock slide mechanism in place.
- ATS can now be removed from cabinet.

TO RECONNECT ATS

- Roll cart back into cabinet.
- Slide four corner latches of ATS to outermost position.
- Turn DS Switch to "INHIBIT".
- Manually position ATS into same source as Bypass Switch.
- Reconnect multipin plugs and external connections to ATS.
- Rotate crank mechanism clockwise until ATS TEST light is illuminated.
- Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
- Turn DS to "INHIBIT".
- Rotate crank mechanism clockwise until ATS location pointer is aligned with "AUTO" mark on location indicator. (ATS must be in same source as Bypass).
- Turn DS to "AUTO" and open Bypass with MBH.
- ATS is now fully automatic (Figure 1).

- NOTES:
- DS in "INHIBIT" will prevent ATS electrical operation.
 - DO NOT use excessive force on mechanical handles.
 - Above Figures depict Bypass SOURCE 1. Sequence is same for Bypass SOURCE 2.
 - When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
 - To operate Bypass Switch when ATS is in TEST or ISOLATE:
 - Move MBH downward (to open Bypass Contacts BN/BE).
 - Turn BSS to opposite power source.
 - Move MBH upward to close into selected power source.

FIG. 1 BP IS OPEN WITH ATS IN SOURCE 1

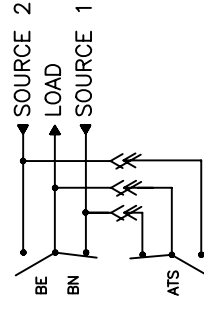


FIG. 2 BP IN SOURCE 1 WITH ATS IN SOURCE 1

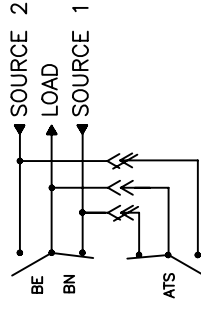


FIG. 3 BP IN SOURCE 1 WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

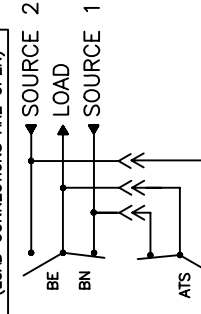


FIG. 4 BP IN SOURCE 1 WITH ATS ISOLATED

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS
 N1,2,3(N)..... SOURCE 1 Line connections
 E1,2,3(N)..... SOURCE 2 Line connections
 T1,2,3(N)..... Load Line connections
 BE..... Bypass SOURCE 2 contacts
 BN..... Bypass SOURCE 1 contacts
 BSS..... Bypass Selector Switch
 MBH..... Manual Bypass Handle

II. (BP) BYPASS/ISOLATION SWITCH: ELECTRICAL COMPONENTS
 AA-1,2,3..... Limit switch held actuated in Auto location of ATS, Non-actuated Test and Isolated locations.
 AB3-1,2,3,4,5..... Limit switch, actuated in Bypass SOURCE 2 position
 AB4-1,2,3..... Limit switch, actuated in Bypass SOURCE 1 position
 ACU/ACD..... Limit switch actuated when crankhandle is engaged
 AE-1,2..... Limit switch, switches Engine Start from ATS control to bypass control during ATS isolate
 AI-1,2,3..... Limit switch, actuated in Isolate location
 AT-1,2..... Limit switch, actuated in Test location
 ATR..... Auto/Test Relay. Energized in AUTO and TEST locations
 AUTO..... Auto location relay, Energized in Auto location
 BR-1,2,3..... Bridge Rectifier
 C..... Capacitor: RNH
 CBC..... Crank Solenoid
 CBE..... SOURCE 2 Bypass Permissive Solenoid
 CBN..... SOURCE 1 Bypass Permissive Solenoid
 D..... Diode
 R..... Resistor: RNH
 RNH..... Relay normally held, 24 VDC coil, 3PDT
 XBE..... SOURCE 2 line control transformer
 XBN..... SOURCE 1 line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA..... SOURCE 1 available
 LEA..... SOURCE 2 available
 LBN (NOTE 1)..... Bypass SOURCE 1 (BN closed)
 LBE (NOTE 1)..... Bypass SOURCE 2 (BE closed)
 LAT (NOTE 1)..... ATS in Test location
 LAI (NOTE 1)..... ATS in Isolate location
 LIT (NOTE 1)..... ATS Inhibit
 LDS (NOTE 1)..... ATS DS switch in INHIBIT position

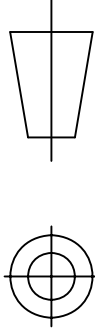
NOTES

OPERATION:
 1. BP-Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
 2. ATS-Automatic Transfer Switch.

LEGEND:
 1. Indicator off during automatic operation of ATS.
 2. Four pole includes neutral lugs.

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THIRD ANGLE PROJECTION



GE Zenith Controls

BYPASS/ISOLATION
 LEGEND & OPERATION

FOR ADDITIONAL INFO REFER TO APPLIED STANDARDS UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	SIGNATURES	DATE	TITLE
MODEL GG	GG	05/06/03	
DETAIL	CHECKED		
ENGRG FS			
MFG			
QUALITY			
ISSUED			
DRAWING FILE: 76a-2000-j-5.dwg	SIZE	FIRST MADE FOR: ZBTSC1(100-1200 AMP)	DWG NO
MODEL / ASSEMBLY FILE: ZBTSC1(100-1200 AMP)	B		76A-2000
# CTOs	⊖	CRITICAL TO QUALITY CHARACTERISTIC	SCALE: NA
AutoCad Generated			SHEET 5 OF 8



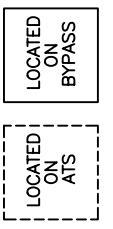
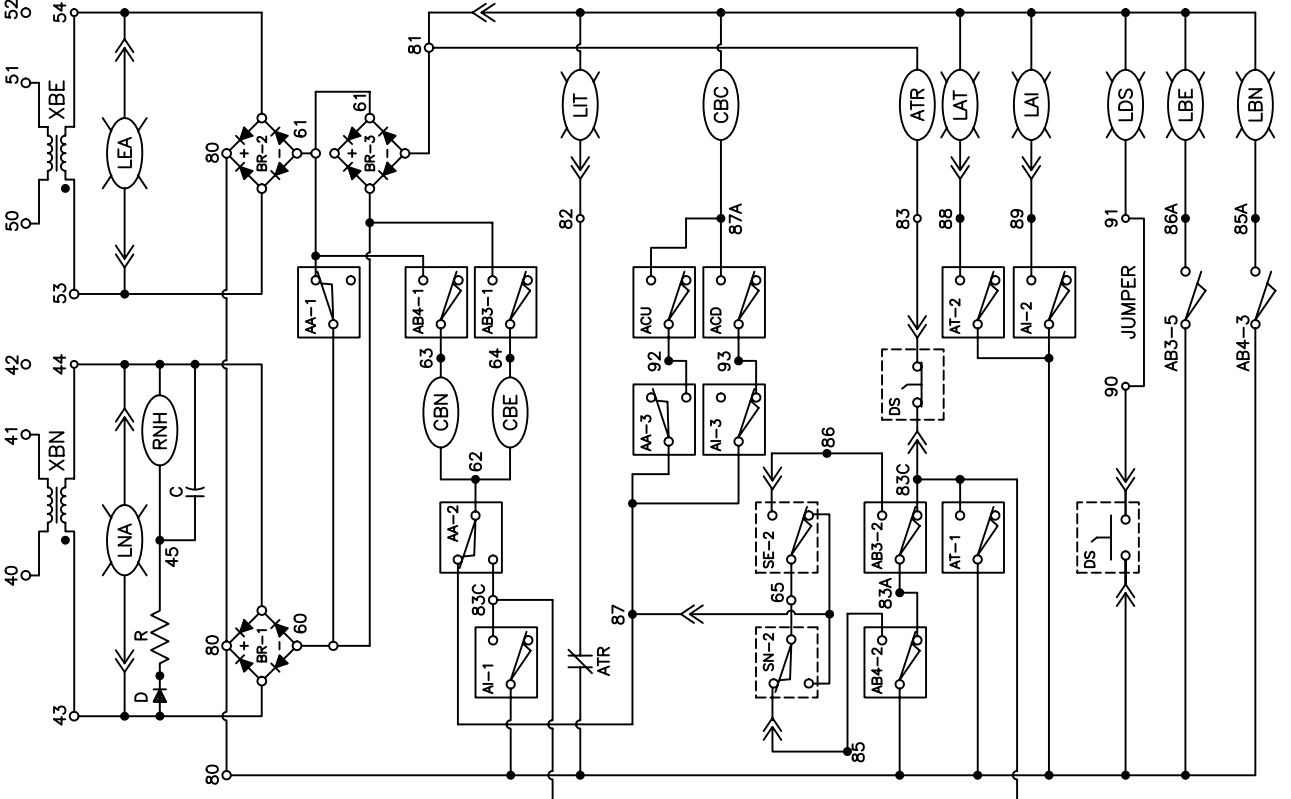
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REVISIONS

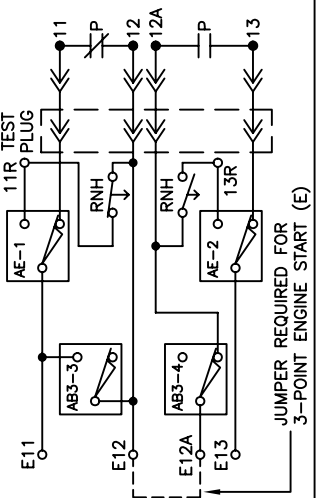
REV.	DESCRIPTION	DATE	APPROVED
J	S-8604	04/12/07	YJS MES
52			
54			

- BYPASS/ISOLATION SCHEMATIC
- BYPASS SOURCE 1 CONTROL TRANSFORMER
 - BYPASS SOURCE 2 CONTROL TRANSFORMER
 - SOURCE 1 AVAILABLE LIGHT
 - SOURCE 2 AVAILABLE LIGHT
 - SOURCE 1ALLY HELD RELAY
 - DIODE
 - RESISTOR, RNH
 - CAPACITOR, RNH
 - BRIDGE RECTIFIER
 - LIMIT SWITCH, ATS AUTO LOCATION
 - SOURCE 1 TRANSFER OPERATOR
 - SOURCE 2 TRANSFER OPERATOR
 - LIGHT, BYPASS SOURCE 2
 - LIGHT, BYPASS SOURCE 1
 - LIMIT SWITCH, BYPASS SOURCE 1
 - LIMIT SWITCH, BYPASS SOURCE 2
 - AUTO/TEST RELAY
 - LIGHT, ATS INHIBIT
 - DISCONNECT SWITCH FOR SERVICING
 - LIGHT, DISCONNECT SWITCH INHIBIT POSITION
 - LIMIT SWITCH
 - CRANK SOLENOID
 - LIMIT SWITCH, ATS TEST LOCATION
 - LIGHT, ATS TEST LOCATION
 - LIMIT SWITCH, ATS ISOLATE LOCATION
 - LIMIT SWITCH, CRANK HANDLE ENGAGED



ENGINE START SCHEMATIC

- ENGINE START CIRCUIT
- AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
- AB3-3,4 - LIMIT SWITCH, BYPASS SOURCE 2



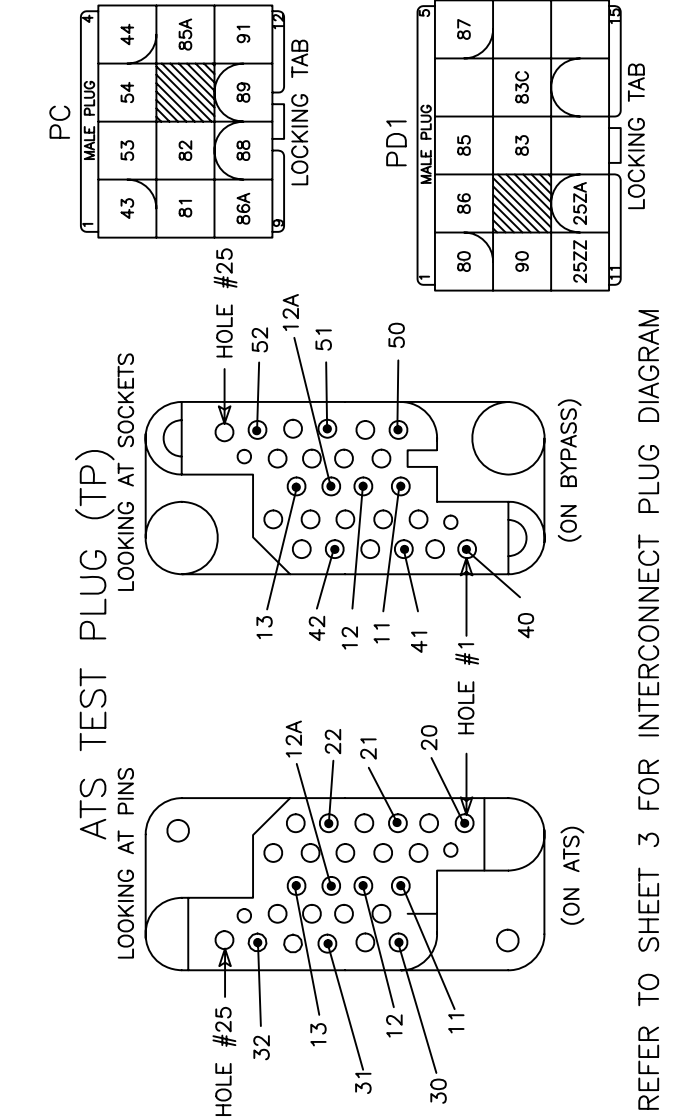
LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION		BYPASS MODE	
	TEST	REMOVE	SOURCE 1	SOURCE 2
AA	X			
AT		X		
AI		X		
AE		X		
SN			X	
SE				X
AB4				X
AB3				X



SOURCE 1/SOURCE 2 TRANSFER PERMIT CIRCUIT (ALH IN AUTO AND TEST LOCATION WITH DS IN AUTO POSITION)

BYPASS SUBPANEL



- LEGEND
- WIRE CONNECTION
 - WIRE ON MAIN TERMINAL BLOCK
 - WIRE IN INTERCONNECT PLUG
- NOTES
- ZBTSCTL SHOWN IN SOURCE 1 POSITION WITH NO POWER AVAILABLE.

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FOR ADDITIONAL INFO REFER TO APPLIED FRAGILES UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

- 2 PL. DECIMALS ± .020
- 3 PL. DECIMALS ± .005
- ANGLES ± 1°
- FRACTIONS ± 1/64

FINISH ✓

AutoCad Generated

THIRD ANGLE PROJECTION

SIGNATURES: MODEL GG, DATE 05/06/03

DETAIL CHECKED ENGRG FS, MFG QUALITY ISSUED

DRAWING FILE: 76a-2000-j-5.dwg, MODEL / ASSEMBLY FILE: ZBTSCT(100-1200 AMP)

CTOs

CRITICAL TO QUALITY CHARACTERISTIC

GE Zenith Controls

TITLE: BYPASS/ISOLATION SCHEMATIC & PLUGS

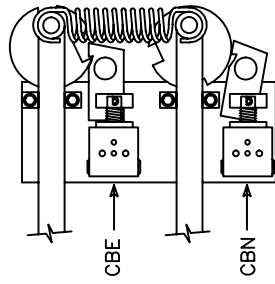
FIRST MADE FOR: ZBTSCT(100-1200 AMP), SIZE CAGE CODE B, DWG NO 76A-2000

SHEET 6 OF 8

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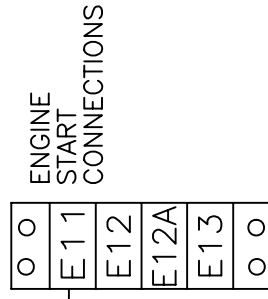


REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
J	S-8604 REVISED SHEET 2	04/12/07	YJS MES

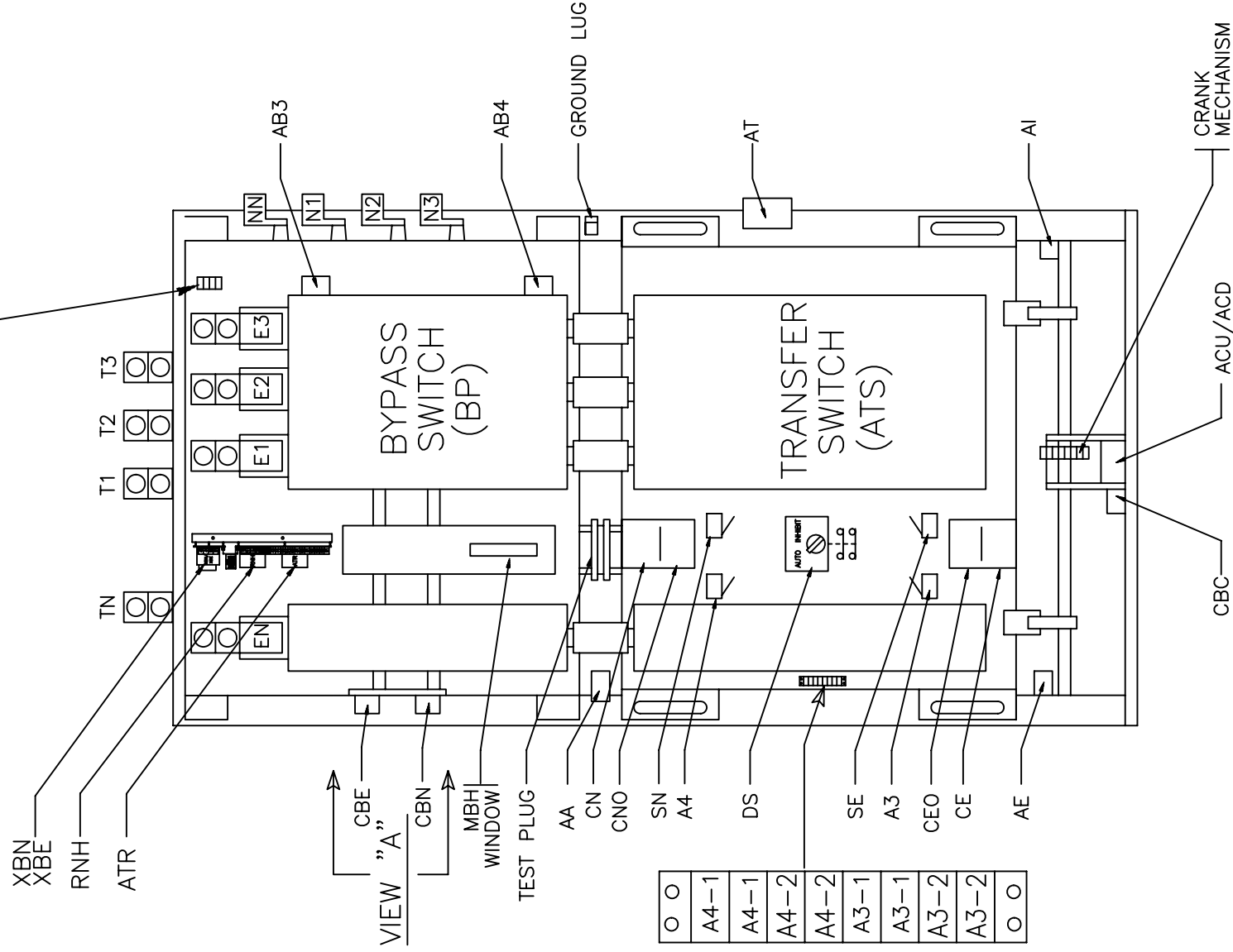


VIEW "A"

BYPASS/ISOLATION TRANSFER SWITCH



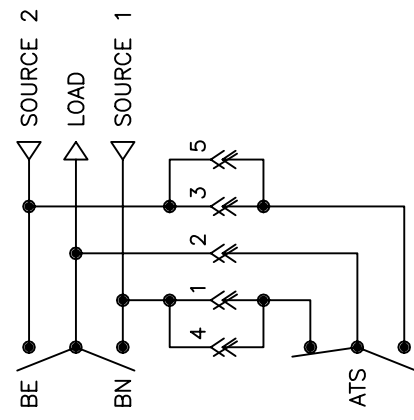
ENGINE START CONNECTIONS



WIRE NUMBERING CHART

LIMIT SWITCHES	C	NC	NO
AA-1	60		61
AA-2	62	83C	87
AA-3	87	92	80A
AB3-1	64		60
AB3-2	83A	83C	86
AB3-3	E12		E11
AB3-4	E12A	12A	
AB3-5	80	86A	
AB4-1	63		61
AB4-2	80	83A	85
AB4-3	80	86A	
ACD	93		87A
ACU	92		87A
AE-1	E11	11	11R
AE-2	E13	13	13R
AI-1	80		83C
AI-2	80		89
AI-3	87	93	
AT-1	80		83C
AT-2	80		88
SE-2	65	87	86
SN-2	65	87	85

BYPASS/ISOLATION DIAGRAM



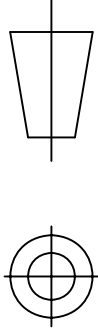
ATS LOCATION	LOAD CARRYING CONTACTS	ATS TEST PLUG (TP)
AUTO	1 2 3	4 5
TEST	X X X	X X X
ISOLATE	O O O	O O O

X = CLOSED
O = OPEN

NOTES
ATS SHOWN IN SOURCE 1 POSITION WITH NO POWER AVAILABLE.

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THIRD ANGLE PROJECTION



GE Zenith Controls

BYPASS/ISOLATION TRANSFER SWITCH

FOR ADDITIONAL INFO REFER TO	SIGNATURES	DATE
APPLIED FRAGMENTS	MODEL GG	05/06/03
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DETAIL CHECKED	
TOLERANCES ON:	ENGRG FS	
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3 PL. DECIMALS ± .005	QUALITY	
ANGLES ± 1°	ISSUED	
FRACTIONS ± 1/64	DRAWING FILE: 76a-2000-j-7.dwg	
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AutoCad Generated	# CTOs	CRITICAL TO QUALITY CHARACTERISTIC

FIRST MADE FOR: ZBTSC1(100-1200 AMP)

SIZE CAGE CODE DWG NO

B 76A-2000

SCALE: NA

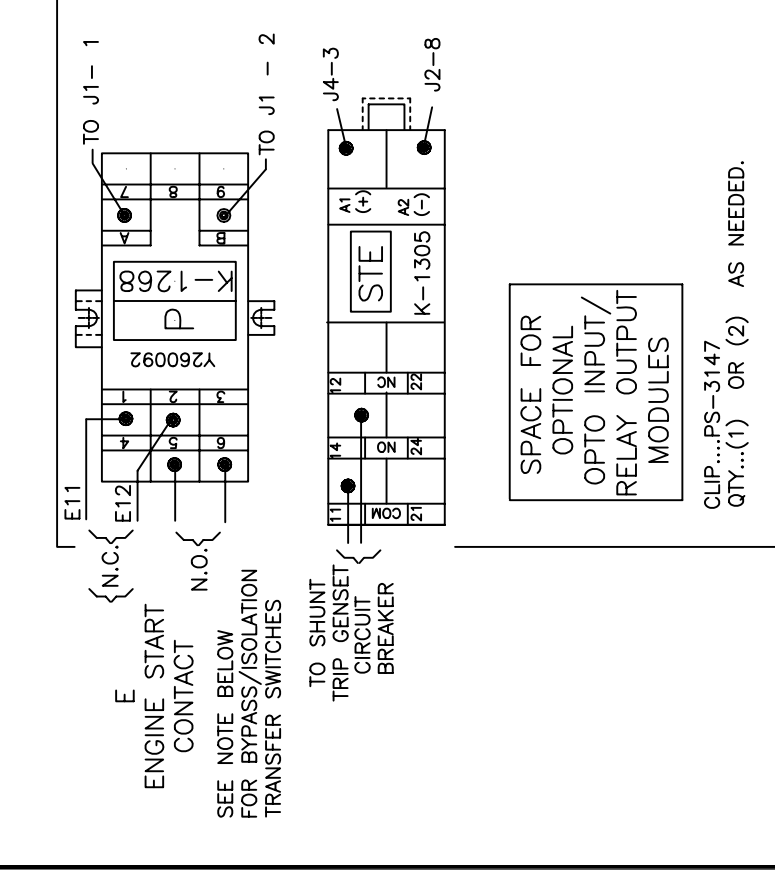
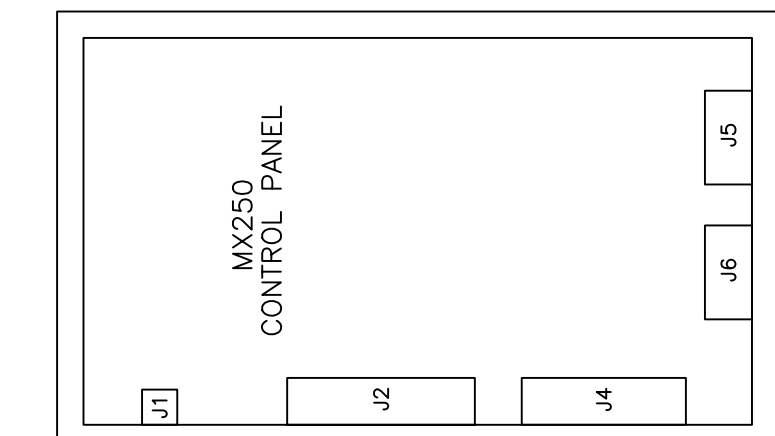
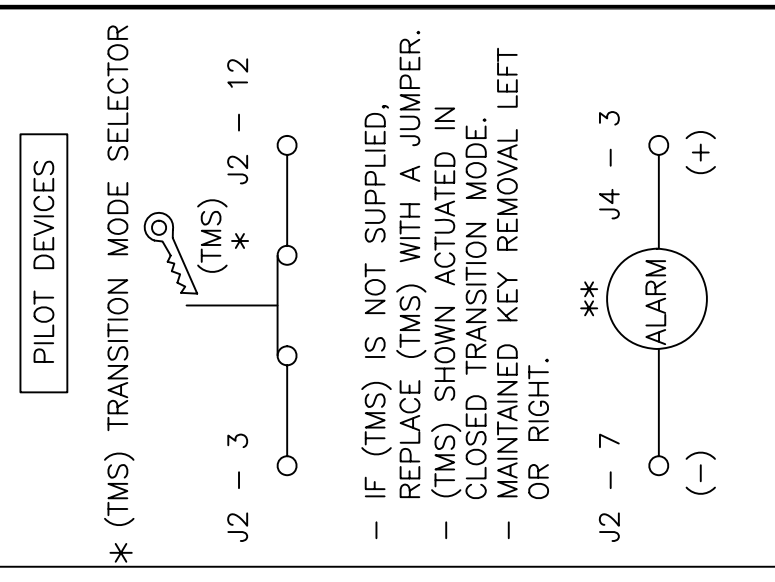
SHEET 7 OF 8

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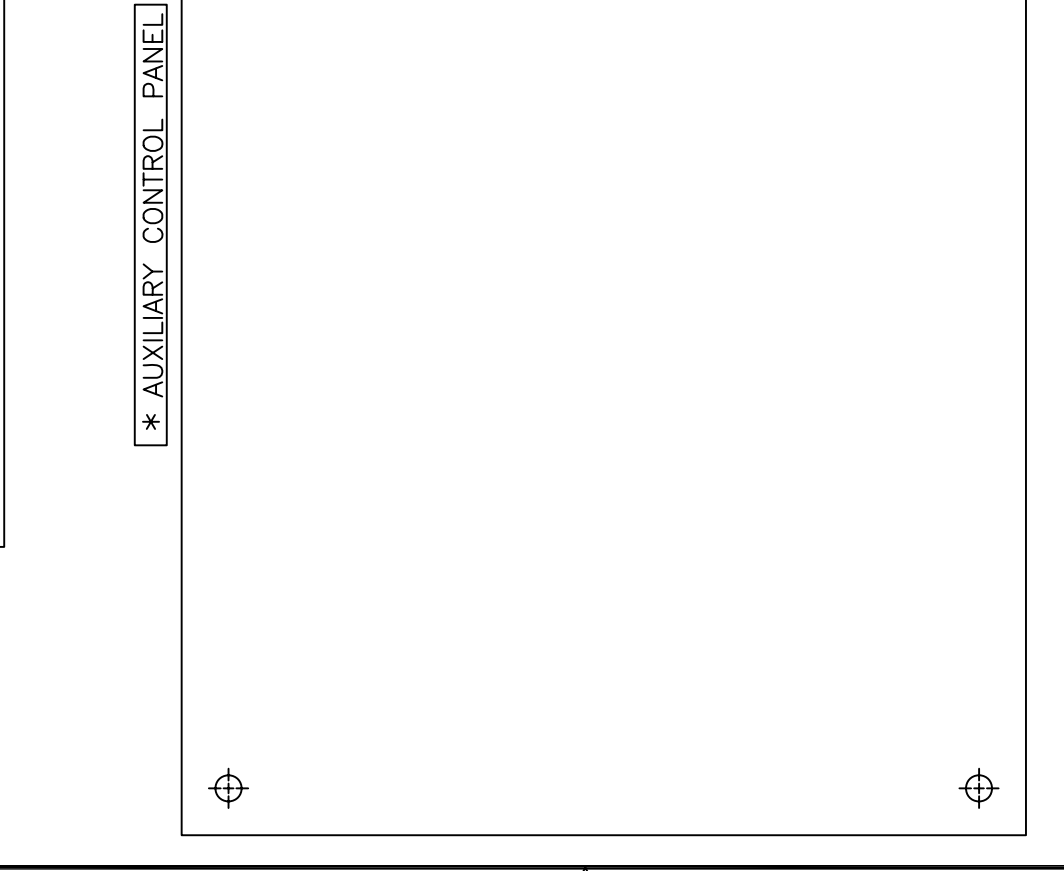
REVISED SHEET 2		REVISED SHEET 2		REVISED SHEET 2	
REV.	DESCRIPTION	DATE	DATE	DATE	APPROVED
J	S-8604	04/12/07	04/12/07	04/12/07	YJS MES

INSIDE VIEW OF CABINET DOOR	
-----------------------------	--



*** AUXILIARY CONTROL PANEL**

(12" X 18")
 (305mm X 457mm)



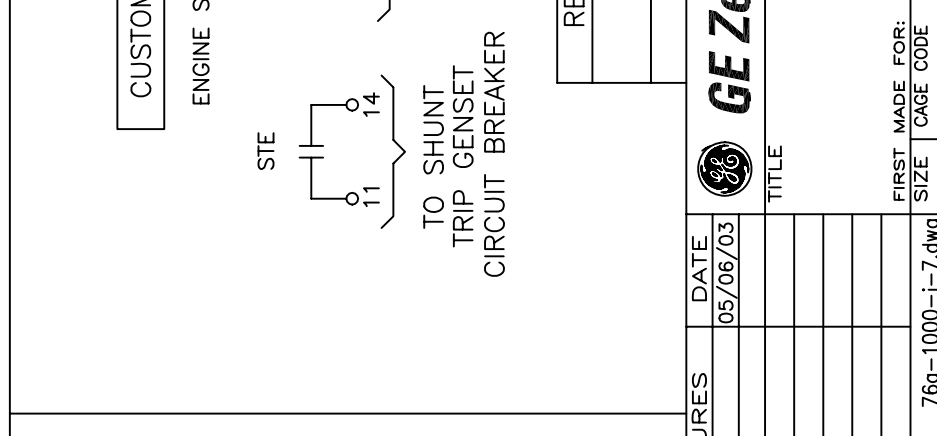
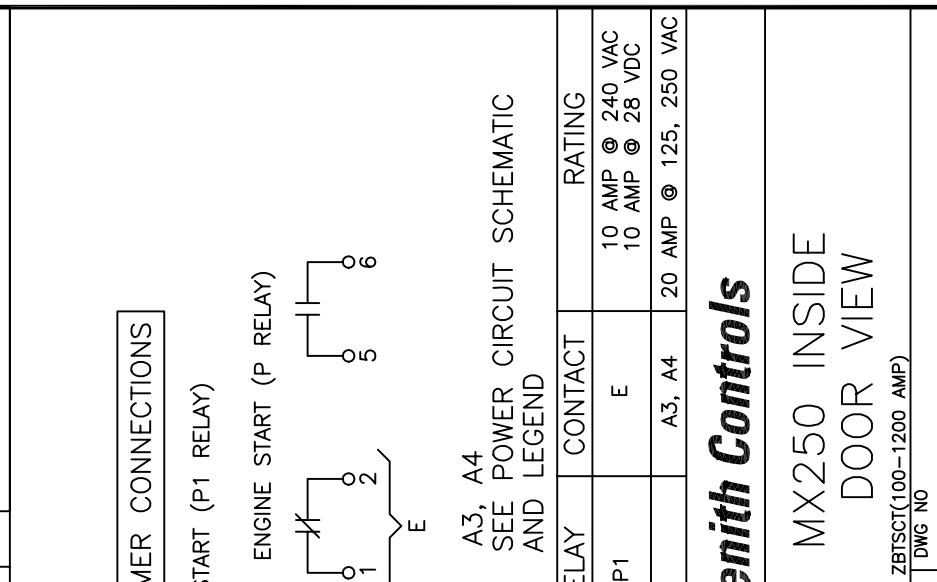
LEGEND

- WIRE CONNECTION
- WIRE ON TERMINAL BLOCK
- * OPTIONAL

NOTES

FOR BYPASS/ISOLATION TRANSFER SWITCHES CONSULT STANDARD DIAGRAM FOR INTERCONNECTION OF ENGINE START P RELAY WITH TEST PLUG.

** ALARM.....Y780029 FOR NEMA 3R, 4, 4X, 12 ADD: BAFFLE PLATE ASSEMBLY: PS-8892 GASKET.....PS-8891



RELAY	CONTACT	RATING
P1	E	10 AMP @ 240 VAC 10 AMP @ 28 VDC
	A3, A4	20 AMP @ 125, 250 VAC

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THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO	SIGNATURES	DATE
APPLIED MODEL GG	GG	05/06/03
DETAIL CHECKED		
ENGRG FS		
MFG		
QUALITY		
ISSUED		
DRAWING FILE: 76a-1000-j-7.dwg		
MODEL / ASSEMBLY FILE: ZBTSCI(100-1200 AMP)		
# CTOs	⊖	CRITICAL TO QUALITY CHARACTERISTIC

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GE Zenith Controls

MX250 INSIDE DOOR VIEW

FIRST MADE FOR: ZBTSCI(100-1200 AMP)
 SIZE CAGE CODE DWG NO
 B 76A-2000

SHEET 8 OF 8

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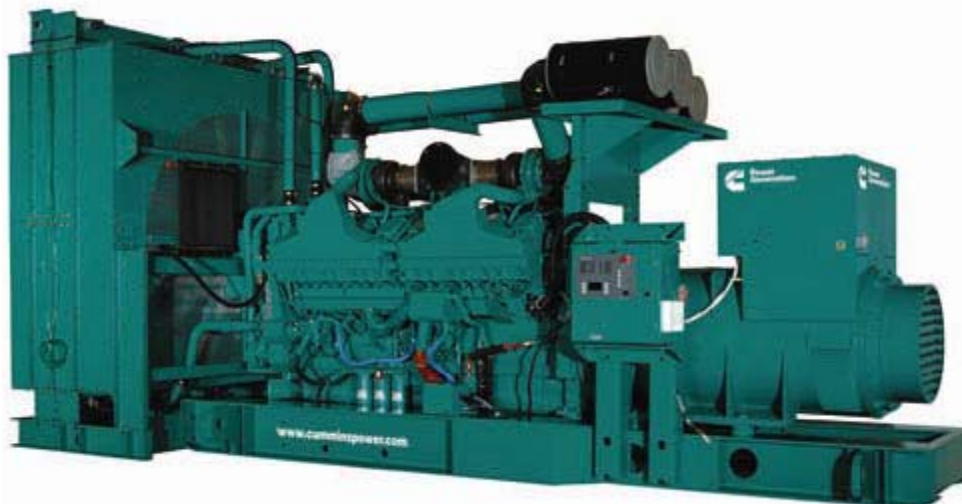


**Rocky
Mountain**

Power Generation Division
8211 East 96th Avenue
Henderson, CO 80640

**Project: Harold D Thompson Water Reclamation
Contractor: McDade Woodcock
Submittal: #1 Rev.0
Date: 8/8/12**

1250 kW Diesel Generator Set
Zenith - 2000 AMP ZBTS ATS



Sales Representative: Brian Taylor
Phone: (303) 927-2248
Email: brian.d.taylor@cummins.com

Our energy working for you.™



**Power
Generation**

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Generator Package Weight

	Weight in Pounds	Weight in Kilograms
Generator Wet Weight (oil & coolant)	24,893.00	11,291.27
Enclosure & Exhaust Silencer	10,500.00	4,762.72
Fuel Tank	9,500.00	4,309.13
Accessories	268.40	121.74

	Weight in Pounds	Weight in Kilograms
Total Ship Weight without Fuel	45,161.40	20,484.87

	Weight in Pounds	Weight in Kilograms
Total Pad Weight with Fuel	65,641.40	29,774.44

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Bill of Materials
Harold D Thompson Water Reclamation
1250 kW Generator Set
2000 Amp Automatic Transfer Switch
McDade Woodcock
CRM Project #63439, Revision # 0

Line	Qty.	Description	Part Number
1			
2	1	Cummins Diesel Generator Set	1250 DQGAA
3		Full Rated Output To: 6030 Ft. Elevation, 104° F Ambient	
4		Duty Rating-Standby Power	A331
5		1,250 kW, 1,563 kVA , 0.8 P.F., 60 Hz, 1800 RPM	B600
6		Listing-UL2200	L090
7		Cert-Seismic, IBC2000,2003,2006, Ss=3.41g.rooftop	L156
8		Emissions Certification-EPA, Tier 2, NSPS, CI	L170
9		Stationary Emergency	
10		Voltage- 277/480 VAC , 3-Phase, Wye	R002
11			
12		Equipped with:	
13		Set Control-PCC3201 Generator Control Panel	H611
14		Engine/Generator Safeties	
15		Auto Start/Stop Control	
16		Display Language-English	H536
17		Exciter/Voltage Regulator-PMG, 3-Phase Sensor	
18		Engine Governor-Electronic, Isochronous Only	
19		Display-Control, Graphical	H605
20		Meters-AC Output Analog	H606
21		Control Mounting-Front Facing	H679
22		Alarm-Audible, Engine Shut Down	KA08
23		Fuel/Water Separator	C127
24		24 VDC Starting System	A334
25		24 VDC Battery Charging Alternator	A333
26		Engine Cooling-Enhanced High Ambient Air Temp.	E126
27		Shutdown-Low Coolant Level	H389
28		Engine Air Cleaner	D041
29		Dual Water Jacket Heaters, Single Phase	H557
30		Reconnectable To The Following VAC:	
31		240 VAC = 12,840 Watts, 53.5 Amps Total	
32		Heater-Alternator	A293
33		240 VAC = 300 Watts / 1.25 Amps	
34		Filters-Engine Oil, Full Flow and Bypass	H607
35		Product Revision - A	SPEC-A
36			

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Bill of Materials
Harold D Thompson Water Reclamation
1250 kW Generator Set
2000 Amp Automatic Transfer Switch
McDade Woodcock
CRM Project #63439, Revision # 0

Line	Qty.	Description	Part Number
37			
38		PCC3201 Control Custom Fault Inputs	
39		Cust. Fault #1 - Battery Charger Fault	
40		Cust. Fault #2 - Ground Fault Indication	
41		Cust. Fault #3 - Low Fuel Level	
42		Cust. Fault #4 - Rupture Basin Alarm	
43			
44		Common Alarm Relay Option - PCC3201 Control	
45	1	Optional Shutdown Alarm Relay Output-3 PDT	K911
46		10 Amp @ 28 VDC	
47		Cust. Relay K16 - Activates On An Alarm Condition	
48		Installed In PCC3201 Genset Control	
49			
50		Run Relay Option - PCC3201 Control	
51	1	Optional Configurable Custom Run Relay Outputs-3 PDT	K974
52		10 Amp @ 28 VDC	
53		Cust. Relay K11 - Activates When Genset Is Running	
54		Cust. Relay K12 - Activates When Genset Is Running	
55		Cust. Relay K13 - Activates When Genset Is Running	
56		Installed In PCC3201 Genset Control	
57			
58		Network Communications Module Option - PCC3201 Control	
59	1	Interface-Communications Network Module, FTT-10	KP60
60		Installed In PCC3201 Genset Control	
61			
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Bill of Materials
Harold D Thompson Water Reclamation
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Line	Qty.	Description	Part Number
71			
72		Digital Input/Output Module-Base Kit	
73	1	Digital Input/Output Module-Base (FT-10)	0541-0771
74		Eight (8) Form-C Relay Output Sets	
75		Relay Ratings:	
76		2 Amp @ 30 VDC / 2 Amp @ 250 VAC	
77		Four (4) Discrete Dry Contact Inputs	
78		Discrete Inputs Have The Following Configuration Options:	
79		Active High or Active Low	
80		Event - Warning or Shutdown	
81		Programmable Text - Displayed On Genset HMI	
82		Installation By Electrical Contractor	
83		Installation Recommendation: Install Close To The BAS	
84			
85		Digital Input/Output Module-Expansion Kit	
86	1	Digital Input/Output Module-Expansion	0541-0772
87		Eight (8) Form-C Relay Output Sets	
88		Relay Ratings:	
89		2 Amp @ 30 VDC / 1 Amp @ 125 VAC	
90		Four (4) Discrete Dry Contact Inputs	
91		Discrete Inputs Have The Following Configuration Options:	
92		Active High or Active Low	
93		Event - Warning or Shutdown	
94		Programmable Text - Displayed On Genset HMI	
95		Installation By Electrical Contractor	
96		Installation Recommendation: Install Close To The BAS	
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Bill of Materials
Harold D Thompson Water Reclamation
1250 kW Generator Set
2000 Amp Automatic Transfer Switch
McDade Woodcock
CRM Project #63439, Revision # 0

Line	Qty.	Description	Part Number
105			
106		Remote Network Annunciator-FT10	
107	1	Cummins Remote Network Annunciator Panel, 20 Light	0541-0814-02
108		Flush/Surface NEMA Type 1 Enclosure	
109		Cust. Fault #1 -Charger Fault	
110		Cust. Fault #3 - Spare	
111		Cust. Fault #2 - Spare	
112		Cust. Fault #4 - Rupture Basin Alarm	
113		Contractor Note: FT10 Network Cabling Requirements.	
114		Requires Twin Power Conductors, Stranded Twisted Pair,	
115		Unshielded Network Data Cable. (Belden 85102 or 8471)	
116		Installation By Electrical Contractor	
117			
118		KP85 - RL 2000 Amp (Main Line Circuit Breaker)	
119	1	Cummins/Square D Local Main Line Circuit Breaker	KP85
120		Ref. Square D Catalog #0612CT010R01/06	
121		Square D/RL Circuit Breaker - 2000 Amp	
122		RL-2000 Amp Current Sensor Set @ 2000 Amp Trip	
123		UL/IEC Listed, Service Entrance, 100% Rated, 3-Pole	
124		Interrupting Rating 125 kA @ 240 VAC	
125		Interrupting Rating 100 kA @ 480 VAC	
126		MICROLOGIC 3.0 Trip Unit, Type F-Rating Plug	
127		Adjustable Solid State Trip Unit-1680 to 2000 Amp	
128	1	Circuit Breaker Accessory, 24 VDC Shunt Trip	KP99
129		Auxiliary & Trip Contacts, Left Side	
130	1	Indication-Ground Fault,3-Pole Xfr Sw, Rmt Mt CT	H666
131		NEMA Type 1 Enclosure	
132		Full Neutral Bus & Ground Bond	
133		Compression Lugs Std: NEMA Hole Pattern	
134	1	Mechanical Lugs: (6) #2 AWG-600 KCMIL CU Per Phase	KR01
135		(Mounted Left Side Of The Control Panel)	
136			
137			
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Bill of Materials
Harold D Thompson Water Reclamation
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CRM Project #63439, Revision # 0

Line	Qty.	Description	Part Number
139			
140		Cummins Engine Coolant & Lube Oil	
141	1-Lot	Initial Fill of Engine Coolant, Ethylene Glycol	50/50
142			
143	1-Lot	Initial Fill of Lube Oil, Cummins Blue	15W/40
144			
145		Cummins Factory Testing	
146	1	Cummins Typical Generator Set Production Test	CPG TGSPT
147			
148		Cummins Generator Set Warranty	
149	1	Warranty: 5-Year Extended Coverage	L030
150		From Initial Date Of Start-Up	
151			
152		Engine Starting Batteries	
153	4	Diesel Engine Starting Batteries, 8D Lead/Acid Type	908D
154			
155		Engine Starting Batteries Warming Pads	
156	4	Kim Battery Warming Pads, 120 VAC, 75 Watt Each	KB7515
157	1	Thermostat, On at 40°F, Off at 60°F	DIT46
158			
159		CPG Plastic Battery Box	
160	4	Battery Box 8D Battery-Black Plastic	0416-1263
161			
162		SENS 10 Amp Battery Charging System	
163	1	SENS EnerGenius Battery Charger, NFPA-110 Alarms	NRG22-10-RC
164		10 Amp @ 12/24 VDC Output, 60HZ-120/208-240 VAC Input	
165			
166		632-H / ACE Vibration Isolators	
167	12	ACE Seismic Control Spring Isolators	632-H
168		3600 Lb. Each, 1" Deflection, 0.2" Motion Limitation	
169			
170			
171			
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Bill of Materials
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CRM Project #63439, Revision # 0

Line	Qty.	Description	Part Number
173			
174		Weather Protective Enclosure	
175	1	Genset Enclosure - Weather Protective	4085021
176		No Duct, No Insulation	
177		UL2200 Listed & Labeled	
178		14 Gauge Steel Construction	
179		Four Point Lifting System For Enclosure Only	
180		Two Sets of Double 72" Doors Per Side	
181		One Rear 36" Door	
182		Motorized Inlet Louvers	Ruskin SAMPLE
183		Gravity Radiator Discharge Louver With Screen	Grainger
184		Interior Mounted Exhaust System	
185		Designed With Removable Front, Radiator Access	
186		Paint Color: Cummins Beige	
187			
188		Exhaust System	
189	1	Critical Grade - Cool Series - Exhaust Silencer 14"	K-H2-5-4085020
190		Compressed Thermal/Acoustical Fiberglass Packed-	
191		Corrugated Flex Connectors and Rain Cap	
192		Nut, Bolt and Gasket Hardware	
193			
194		Maintenance Service Contract - 1 Year	
195	1	Maintenance Service Contract - 1 Year - To Include:	Service Contract
196		1-Minor & 1-Major Maintenance Service	
197		Minor Service Includes: Inspection of Unit and Fluid Levels.	
198		Test Transfer Switch Operation if Allowed By Owner	
199		Major Service Includes: Changing Engine Oil and Oil Filters.	
200		Changing Engine Fuel and Air Filters.	
201		Note: All Services Done During Normal Weekday Business Hours.	
202			
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CRM Project #63439, Revision # 0

Line	Qty.	Description	Part Number
207			
208		Genset Enclosure Electrical	
209	1	25kVA Single Phase Mini Power-Zone	MPZ25S40F
210		High Voltage: 480 VAC, Low Voltage: 120/240 VAC	
211		NEMA 3R Enclosure	
212		Primary Main Circuit Breaker: 100 Amp	
213		Secondary Main Circuit Breaker: 125 Amp	
214		(28) 1-Pole Breakers, (14) 2-Pole Breakers	
215	5	SQD - Miniature Circuit Breaker-20 Amp	QOB120
216	2	SQD - Miniature Circuit Breaker-30 Amp	QOB230
217		Enclosure Electrical Components	
218	2	3 way Toggle Switch	HBL1203IVORY
219	1	4 Way Toggle Switch	HBL1224IVORY
220	6	NEMA 5-20R 20 Amp 120 VAC GFCI Receptacle	GFR5362IVORY
221	5	FLUORESCENT SCREW IN (JELLY JAR)	CF15EL/TWIST
222	2	Emergency Lighting with Two 6-VDC Lamp Heads	4PG94
223	1	Interior Space Heater	3UG73
224			
225		Spare Parts	
226	4	Engine Oil Filter (Fleetguard)	LF9050
227	2	Engine Air Filters (Fleetguard)	AF25593
228	3	Engine Fuel Filters (Fleetguard)	FF5644
229	1	Engine Water Filter (Fleetguard)	WF2076
230	1	Replacement Element - 10 Micron	2020TM-OR
231	2	Fuse, 5 Amp (Total Of 7-Used)	0340-0475-14
232	1	Control Panel Indicator Lamps	322-0017
233			
234		CRM On-Site Testing	
235	1	CRM Site Tests:	4-Hour Load Test
236		4-Hour Load Test With CRM Resistive Load Bank	
237		CRM Test Documentation Required	
238			
239			
240			

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Bill of Materials
Harold D Thompson Water Reclamation
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CRM Project #63439, Revision # 0

Line	Qty.	Description	Part Number
241			
242		Genset Sub-Base Fuel Tank	
243	1	Double Wall Sub-Base Fuel Tank	2085020
244		UL-142 Listed & Labeled	
245		24 Hour Fuel Cell Capacity	
246		Engine Supply & Return Connections	
247		Integral Welded Fuel Fill Spill Containment	
248		Stub-Up Zone	
249		Pads for ACE Mountings Vibration Isolators	
250	1	2" Normal Vent-Fuel Cell - C&B	401-01-2000
251	1	2" Normal Vent-Containment Basin - C&B	401-01-2000
252	1	6" Emergency Vent-Fuel Cell - OPW	201M-8081
253	1	6" Emergency Vent-Containment Basin - OPW	201M-8081
254	1	Mechanical Fuel Level Gauge - Krueger	FG-13
255	1	Low Level Float Switch - 50% Fuel Level - Madison	M4500-01BK70
256	1	High Level Float Switch - 90% Fuel Level - Madison	M4500-01BK70
257	1	Basin Leak Detection Float Switch - Madison	M4500-01BK70
258	1	High Fuel Level Alarm Kit - C&B	1400-13-1000
259		Set High Fuel Level Float Switch @ 90%	
260	1	61fSTOP-Overfill Prevention Valve-Set @ 95% - OPW	61fSTOP-2000
261		Equipped with Drop Tube For Submerged Filling	
262	1	2" Camlock Locking Cap - OPW	634B-1050
263	1	4" NPT Black Pipe Nipple X 5" Long-OPV Mounting	BN4X5
264		*Extend Normal Vent	
265	1	Exterior Color - Black Paint	Paint
266			
267		DQGAA O&M Manual	
268	1	Operator's & Maintenance Manuals - DQGAA	0998-0073
269	4	Operator's & Maintenance Manuals - ZBTS	
270			
271		#2 Diesel Fuel	
272	1	Initial Fill - 2225Gallons	#2 Diesel Fuel
273	1	Refill After Testing - 370 Gallons	#2 Diesel Fuel
274			

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Line	Qty.	Description	Part Number
275			
276	1	Zenith 2000 ZBTS	ZBTS00B00200EZ-
277		Amps: 2000	EC01ZVC70MEXE
278		Volts:277/480 - 3 Phase, 4 Wire	
279		Poles: 3	
280		Enclosure: NEMA 1	
281		Cable Entry: Top & Bottom	
282		Weight: 4044 lbs.	
283		Dimensions: 80"H x 40.6" W x 64.6" D	
284		Lugs: 8 to 750 MCM-mech style lugs for all connections	
285		(No ground lugs or bus included)	
286			
287	1	Z - Net 900	
288		Annunciator (Lonworks)	Z - Net 900
289		Up to 8 ATS Units	
290			
291			
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PROTOTYPE TEST SUPPORT (PTS) 60 HZ TEST SUMMARY

GENERATOR SET MODELS	REPRESENTATIVE PROTOTYPE
1250DQGAA	Model: 1500DQGAB
1500DQGAB	Alternator: P734C
	Engine: QSK50-G4 NR2



The following summarizes prototype testing conducted on the designated representative prototype of the specified models. This testing is conducted to verify the complete generator set electrical and mechanical design integrity. Prototype testing is conducted only on generator sets not sold as new equipment.

Maximum Surge Power: 1580 kW

The generator set was evaluated to determine the stated maximum surge power.

Torsional Analysis and Testing:

The generator set was tested to verify that the design is not subjected to harmful torsional stresses. A spectrum analysis of the transducer output was conducted over the speed range of 1200 to 2000 RPM.

Cooling System: 40 °C Ambient
0.5 in. H2O restriction

The cooling system was tested to determine ambient temperature and static restriction capabilities. The test was performed at full rated load in elevated ambient temperature under stated static restriction conditions.

Electrical and Mechanical Strength:

The generator set was tested to several single phase and three phase faults to verify that the generator can safely withstand the forces associated with short circuit conditions. The generator set was capable of producing full rated output at the conclusion of the testing.

Steady State Performance:

The generator set was tested to verify steady state operating performance was within the specified maximum limits.

Voltage Regulation:	±0.50%
Random Voltage Variation:	±0.50%
Frequency Regulation:	Isochronous
Random Frequency Variation:	±0.25%

Transient Performance:

The generator set was tested with the standard alternator to verify single step loading capability as required by NFPA 110. Voltage and frequency response on load addition or rejection were evaluated. The following results were recorded:

Full Load Acceptance:

Voltage Dip:	40.4	%
Recovery Time:	4.2	Second
Frequency Dip:	7.5	%
Recovery Time:	5.6	Second

Full Load Rejection:

Voltage Rise:	26.4	%
Recovery Time:	2.8	Second
Frequency Rise:	3.5	%
Recovery Time:	1.3	Second

Harmonic Analysis:

(per MIL-STD-705B, Method 601.4)

Harmonic	<u>Line to Line</u>		<u>Line to Neutral</u>	
	<u>No Load</u>	<u>Full Load</u>	<u>No Load</u>	<u>Full Load</u>
3	0.18	0.01	0.13	0.08
5	0.2	2.3	0.13	2.3
7	0.52	1.46	0.48	0.74
9	0.08	0.03	0.03	0.07
11	0.65	0.49	0.64	0.46
13	0.21	0.28	0.19	0.31
15	0.05	0.05	0.03	0.1

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THE VMC GROUP
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SEISMIC DESIGN
OF
NON-STRUCTURAL
COMPONENTS AND SYSTEMS



**Power
Generation**

CERTIFICATE OF COMPLIANCE

Cummins Power Generation has qualified the listed standard engine generator set packages as CERTIFIED¹ for seismic application.

The basis of qualification is by shake table testing and analysis, in accordance with the following International Building Code² (IBC) releases.

IBC 2000, IBC 2003, IBC 2006

The following model designations and bulleted options are included in this certification. A complete list of certified models, options, and installation methods are detailed in report number VMA-45188-RS as issued by The VMC Group.

Model Designation	Rating (kW)	EPA Rating	Basic Open Generator Set	Steel Enclosure Options			Aluminum Enclosure Options			Fuel Tank Options
				Weather Protective	Sound Level 1	Sound Level 2	Weather Protective	Sound Level 1	Sound Level 2	Standard Sub-base
DQLC, DQLD, DQLE	2500/2750/2500	Tier 1/Tier 1/Tier 2	•	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DQKH	2250	Tier 2	•	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DQKAA, DQKAB	1750/2000	Tier 2	•	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DQGAA, DQGAB	1250/1500	Tier 2	•	N/A	N/A	N/A	N/A	N/A	N/A	N/A

This certification includes the open generator set only and does not include the enclosure or any fuel tank. The generator set and included options must be a catalogue design and factory supplied. The generator set and applicable options must be installed and attached to the building structure per the manufacturer supplied seismic installation instructions. This certification is exclusive only to factory supplied accessories. Non-factory accessories such as, but not limited to, mufflers, remote radiators, isolation/restraint devices, and electrical components are beyond the scope of this certification.

The above referenced equipment is APPROVED for seismic application when properly installed,³ used as intended, and located in the United States. Lookup the interpolated project specific Design Spectral Response Acceleration at Short Periods, S_{DS} , value in the table below as it pertains to the applicable building code and Importance Factor, I_p , and compare to the allowed value. As limited by the tabulated values, below grade, grade, and roof-level installations, as well as installations in essential facilities and for life safety applications, both requiring post event functionality, were $I_p=1.5$ permitted and included in this certification.

The basis of this certification is through finite element analysis of the main force resisting members of the unit. Additional calculations were conducted to ensure components, accessories, and options remained intact and attached to the unit under seismic load conditions. All non-robust components, considered critical to the unit's continued function, were successfully shake tested, in three (3) orthogonal axes, under the witness of and analytical evaluation by an independent approval agency, The VMC Group. Seismic shake table testing was conducted in accordance with ICC-ES AC-156 to envelope the required response spectrum (RRS) of maximum flexible region acceleration (A_{FLEX}) of 3.09g and a zero period acceleration (A_{RIG}) of 2.32g. However, the certification is limited by the analysis seismic design level shown next.

For calculations and analysis, the Seismic Design Acceleration, F_p/W_p ,⁴ was calculated as 1.45g for Load Resistance Factored Design (LRFD) methods, equivalent to 1.02g for Allowable Stress Design (ASD) methods. All calculations were conducted using the ASD analysis method. This included but was not limited to the finite element analysis of the main force resisting members of the unit, skid anchoring requirements, component attachment hardware, and various component stress analyses. The Seismic Design Acceleration, F_p/W_p , used for calculations and analysis, is defined per the building code (or respective design standard) for the section titled Seismic Design Requirements for Non-structural (architectural, mechanical, and electrical) Components. The seismic design level is based on the LRFD calculation shown below.

IBC 2006	$F_p/W_p = 0.4 \times (S_{DS}=1.93) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.25) \times (1+2(z/h=0.0))$	= 1.45g (grade)
	$F_p/W_p = 0.4 \times (S_{DS}=0.64) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.25) \times (1+2(z/h=1.0))$	= 1.45g (roof)
IBC 2003 / 2000	$F_p/W_p = 0.4 \times (S_{DS}=2.41) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.00) \times (1+2(z/h=0.0))$	= 1.45g (grade)
	$F_p/W_p = 0.4 \times (S_{DS}=0.80) \times (F_A=1.0) \times (I_p=1.5) \times (a_p/R_p=1.00) \times (1+2(z/h=1.0))$	= 1.45g (roof)

This certification covers all applications that fall below the limitations in the chart below.

IBC 2006	IBC 2006	IBC 2003 / 2000	IBC 2003 / 2000
$S_{DS} \leq 0.64$	$S_{DS} \leq 1.93$	$S_{DS} \leq 0.80$	$S_{DS} \leq 2.41$
$I_p \leq 1.5$	$I_p \leq 1.5$	$I_p \leq 1.5$	$I_p \leq 1.5$
$a_p/R_p \leq 1.25$	$a_p/R_p \leq 1.25$	$a_p/R_p \leq 1.0$	$a_p/R_p \leq 1.0$
$z/h \leq 1.0$ (roof)	$z/h = 0$ (grade)	$z/h \leq 1.0$ (roof)	$z/h = 0$ (grade)

Soil Classes A, B, C, D, E, Seismic Use groups I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the S_{ds} value stated above.



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**Power
Generation**

CERTIFICATE OF COMPLIANCE

Notes and Comments:

1. All equipment listed herein successfully passed the seismic acceptance criteria for shake testing non-structural components and systems as set forth in the ICC AC-156 (2007). The test response spectrum (TRS) enveloped the design response spectrum (DRS) for all units tested. The units cited in this certification were representative samples of a contingent of models and all remained captive and structurally sound after the seismic shake simulation. The units also remained functionally operational after the simulation testing as functional testing was completed by the equipment manufacturer before and after the seismic simulations. Although a seismic qualified unit inherently contains some wind resisting capacity, that capacity is undetermined and is excluded from this certification. Snow/Ice loads have been neglected and thus limit the unit to be installed both indoors (covered by an independent protective structure) and out of doors (exposed to accumulating snow/ice) for snow/ice loads no greater than 30 psf for all applications.
2. The following building codes are addressed under this certification:
 - IBC 2000 – referencing ASCE 7-98 and ICC AC-156
 - IBC 2003 – referencing ASCE 7-02 and ICC AC-156
 - IBC 2006 – referencing ASCE 7-05 and ICC AC-156
3. Refer to the manufacturer supplied installation drawings for anchor requirements and mounting considerations for seismic applications. Required anchor locations, size, style, and load capacities (tension and shear) are specified on the installation drawings. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection, wall design, and attachment to non-building structures must be outlined and approved by the Engineer of Record for the project or building. Structural walls, structural floors, and housekeeping pads must also be seismically designed and approved by the project or building Structural Engineer of Record to withstand the seismic anchor loads as defined on the installation drawings. The installing contractor is responsible for observing the installation requirements detailed in the seismic installation drawings and the proper installation of all anchors and mounting hardware.
4. When the site soil properties or final equipment installation location are not known, the soil site coefficient, F_A , defaults to the Soil Site Class D coefficient. Soil Classes A, B, C, D, E, Seismic Use groups I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the S_{ds} values on page 1, respective to the applicable building code, Importance factor, and z/h ratio. A seismic importance factor, $I_p=1.5$, applies to this certification to include essential facility requirements and life safety applications for post event functionality.

Certification Issued By: The VMC Group
Document Control Number: VMA-45188-CCS Rev. 2

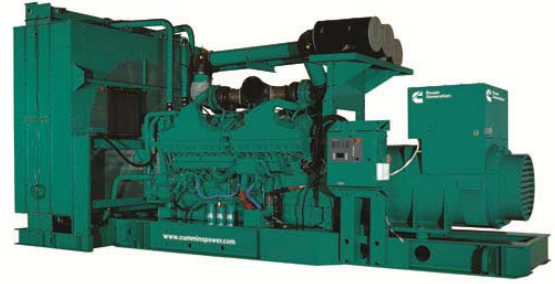
Issue Date: 11/11/2009
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Expiration Date: 12/31/2011



John P. Giuliano, PE
President, The VMC Group

Gary A. Lafine
Product Management Director
Consumer and Genset Business
Cummins Power Generation

Diesel generator set QSK50 series engine



> **Specification sheet**
1100 kW - 1500 kW 60 Hz



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Description

Cummins Power Generation commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary standby and prime power applications. Codes or standards compliance may not be available with all model configurations – consult factory for availability.



This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.



The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins Power Generation products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.



All low voltage models are CSA certified to product class 4215-01.



The generator set is available listed to UL 2200, Stationary Engine Generator Assemblies for all 60 Hz low voltage models. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage. Circuit breaker assemblies are UL 489 Listed for 100% continuous operation and also UL 869A Listed Service Equipment.

U.S. EPA

Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 2 exhaust emission levels. U.S. applications must be applied per this EPA regulation.

International Building Code

The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006 and IBC2009.

Features

Cummins® heavy-duty engine - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

Alternator - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

Permanent magnet generator (PMG) - Offers enhanced motor starting and fault clearing short-circuit capability.

Control system - The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

Cooling system - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

NFPA - The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

Model	Standby rating		Prime rating		Continuous rating		Data sheets	
	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz	50 Hz
DQGAA	1250 (1563)		1100 (1375)				D-3333	
DQGAB	1500 (1875)		1350 (1688)				D-3334	

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Generator set specifications

Governor regulation class	ISO8528 Part 1 Class G3
Voltage regulation, no load to full load	± 0.5%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Radio frequency emissions compliance	IEC 801.2 through IEC 801.5; MIL STD 461C, Part 9

Engine specifications

Bore	158.8 mm (6.25 in)
Stroke	158.8 mm (6.25 in)
Displacement	50.3 litres (3067 in ³)
Configuration	Cast iron, V 16 cylinder
Battery capacity	1800 amps minimum at ambient temperature of 0 °C (32 °F)
Battery charging alternator	35 amps
Starting voltage	24 volt, negative ground
Fuel system	Cummins' Modular Common Rail System
Fuel filter	Dual element 10 micron filtration spin-on fuel filter with 15 micron water separator
Air cleaner type	Dry replaceable element
Lube oil filter type(s)	Four spin-on, combination full flow filter and bypass filters
Standard cooling system	High ambient radiator

Alternator specifications

Design	Brushless, 4 pole, drip proof revolving field
Stator	2/3 pitch
Rotor	Single bearing, flexible disc
Insulation system	Class H
Standard temperature rise	150 °C standby at 40 °C ambient
Exciter type	PMG (permanent magnet generator)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower fan
AC waveform total harmonic distortion	< 5% no load to full linear load, < 3% for any single harmonic
Telephone influence factor (TIF)	< 50 per NEMA MG1-22.43
Telephone harmonic factor (THF)	< 3

Available voltages

60 Hz line-neutral/line-line	50 Hz line-neutral/line-line
<ul style="list-style-type: none"> • 220/380 • 277/480 • 2400/4160 • 255/440 • 347/600 	

* Note: Consult factory for other voltages.

Generator set options and accessories

Engine

- 208/240/480 V thermostatically controlled coolant heater for ambient above 4.5 °C (40 °F)
- 208/240/480 V thermostatically controlled coolant heater for ambient below 4.5 °C (40 °F)
- Dual 120 V 300 W lube oil heaters
- Dual 208/240 V 300 W lube oil heaters
- Dual 480 V 300 W lube oil heaters

Control panel

- 120/240 V 100 W control anti-condensation heater
- Paralleling configuration
- Remote fault signal package
- Run relay package
- Exhaust pyrometer
- Fuel pressure indication
- Ground fault indication

Alternator

- 80 °C rise
- 105 °C rise
- 125 °C rise
- 120/240 V 300 W anti-condensation heater

Exhaust system

- Industrial grade exhaust silencer
- Residential grade exhaust silencer
- Critical grade exhaust silencer
- Exhaust packages

Cooling system

- Remote radiator

Generator set

- AC entrance box
- Battery
- Battery charger
- Circuit breaker - set mounted
- Disconnect switch - set mounted
- PowerCommand Network
- Remote annunciator panel
- Spring isolators
- 2 year warranty
- 5 year warranty
- 10 year major components warranty

* Note: Some options may not be available on all models - consult factory for availability.

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Control system PCC 3201



PowerCommand control is an integrated generator set control system providing governing, voltage regulation, engine protection and operator interface functions. Major features include:

- Integral AmpSentry™ Protective Relay providing a full range of alternator protection functions that are matched to the alternator provided.
- Battery monitoring and testing features and smart starting control system.
- Three phase sensing, full wave rectified voltage regulation system, with a PWM output for stable operation with all load types.
- Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics.
- Optional Echelon® LONWORKS® network interface.

Operator/display panel

- Off/manual/auto mode switch
- Manual run/stop switch
- Panel lamp test switch
- Emergency stop switch
- Exercise switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments
- LED lamps indicating not in auto, common warning, common shutdown, remote start
- Configurable for local language

Engine protection

- Overspeed shut down
- Low oil pressure warning and shut down
- High coolant temperature warning and shut down
- High oil temperature warning
- Low coolant level warning or shut down
- Low coolant temperature warning
- High and low battery voltage warning
- Weak battery warning
- Dead battery shut down
- Fail to start (overcrank) shut down
- Fail to crank shut down
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication

Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature
- Lube oil temperature
- Engine speed
- Engine ECM data

AmpSentry AC protection

- Over current and short-circuit shut down
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shut down
- Over and under frequency shut down
- Overload warning with alarm contact
- Reverse power and reverse Var shut down

Alternator data

- Line-to-line and line-to-neutral AC volts
- Three phase AC current
- Frequency
- Total and individual phase power factor, kW and kVA
- Bus voltage and frequency (with paralleling options)

Other data

- Genset model data
- Start attempts, starts, running hours
- kW hours (total and since reset)
- Fault history
- Load profile (accessible with InPower)

Governing

- Digital electronic isochronous governor
- Temperature dynamic governing
- Smart idle speed mode

Voltage regulation

- Digital PWM electronic voltage regulation
- Three phase line-to-neutral sensing
- Single and three phase fault regulation
- Configurable torque matching

Control functions

- Data logging on faults
- Fault simulation (requires InPower)
- Time delay start and cooldown
- Cycle cranking
- Configurable customer outputs (4)
- Configurable network inputs (8) and outputs (16) (with optional network)
- Remote emergency stop

Paralleling (Option)

- Active digital phase lock loop synchronizer
- Isochronous kW and kVar load sharing controls
- kW import/export and kVar/PF control for utility (mains) paralleling

Options

- Thermostatically controlled space heater
- Key-type mode switch
- Ground fault module
- Auxiliary relays (3)
- Echelon LONWORKS interface
- Modion Gateway to convert to Modbus (loose)
- PowerCommand iWatch web server for remote monitoring and alarm notification (loose)
- Digital input and output module(s) (loose)
- Remote annunciator (loose)
- Paralleling
- Power transfer control

For further detail see document S-1444.

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S-1512g (6/11)

Ratings definitions

Emergency standby power (ESP):

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Limited-time running power (LTP):

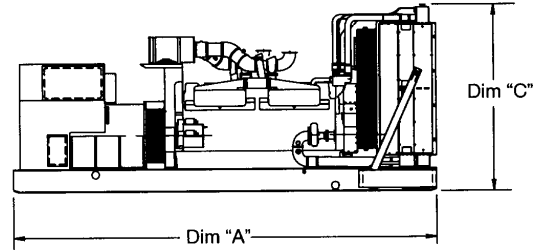
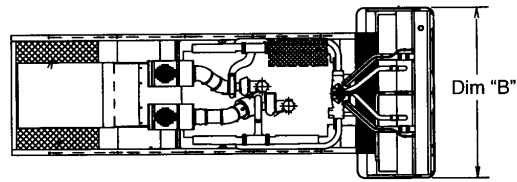
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

Prime power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Base load (continuous) power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

Do not use for installation design

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set Weight* dry kg (lbs)	Set Weight* wet kg (lbs)
DQGAA	5969 (235)	2007 (79)	2840 (112)	10989 (24220)	11493 (25330)
DQGAB	5969 (235)	2007 (79)	2840 (112)	10989 (24220)	11493 (25330)

* Note: Weights represent a set with standard features. See outline drawings for weights of other configurations.

Cummins Power Generation

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Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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S-1512g (6/11)

Model: DQGAA
 Frequency: 60
 Fuel type: Diesel
 KW rating: 1250 standby
 1100 prime
 Emissions: EPA NSPS Stationary Emergency Tier 2

† Generator set data sheet



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Exhaust emission data sheet:	EDS-1058
Exhaust emission compliance sheet:	EPA-1092
Sound performance data sheet:	MSP-1033
Cooling performance data sheet:	MCP-151
Prototype test summary data sheet:	PTS-265
Standard set-mounted radiator cooling outline:	0500-4357
Optional set-mounted radiator cooling outline:	
Optional heat exchanger cooling outline:	
Optional remote radiator cooling outline:	0500-4309

Fuel consumption	Standby				Prime				Continuous
	kW (kVA)				kW (kVA)				kW (kVA)
Ratings	1250 (1563)				1100 (1375)				
Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full	Full
US gph	27.9	51.3	72.9	92.7	25.8	45.6	65.3	82.2	
L/hr	105.6	194.2	276	350.9	97.7	172.6	247.2	311.8	

Engine	Standby rating	Prime rating	Continuous rating
Engine manufacturer	Cummins Inc.		
Engine model	QSK50-G4 NR2		
Configuration	Cast iron, V 16 cylinder		
Aspiration	Turbocharged and low temperature aftercooled		
Gross engine power output, kWm (bhp)	1656 (2220)	1478 (1974)	
BMEP at set rated load, kPa (psi)	1827 (265)	1606 (232)	
Bore, mm (in)	159 (6.25)		
Stroke, mm (in)	159 (6.25)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	9.5 (1875)		
Compression ratio	15:1		
Lube oil capacity, L (qt)	235 (248)		
Overspeed limit, rpm	2100 ±50		
Regenerative power, kW	168		

Fuel flow		
Maximum fuel flow, L/hr (US gph)	757 (200)	
Maximum fuel inlet restriction, kPa (in Hg)	30 (9.0)	
Maximum fuel inlet temperature, °C (°F)	70 (160)	

Air	Standby rating	Prime rating	Continuous rating
Combustion air, m ³ /min (scfm)	130 (4570)	124 (4375)	
Maximum air cleaner restriction, kPa (in H ₂ O)	6.2 (25)		
Alternator cooling air, m ³ /min (cfm)	207 (7300)		

Exhaust

Exhaust flow at set rated load, m ³ /min (cfm)	291 (10290)	261 (9225)	
Exhaust temperature, °C (°F)	417 (782)	372 (702)	
Maximum back pressure, kPa (in H ₂ O)	6.78 (27)		

Standard set-mounted radiator cooling

Ambient design, °C (°F)	50 (122)		
Fan load, kW _m (HP)	45 (60)		
Coolant capacity (with radiator), L (US gal)	541 (143)		
Cooling system air flow, m ³ /min (scfm)	1705 (60150)		
Total heat rejection, MJ/min (Btu/min)	59.88 (56796)	52.45 (49727)	
Maximum cooling air flow static restriction, kPa (in H ₂ O)	0.12 (0.5)		
Maximum fuel return line restriction kPa (in Hg)			

Optional set-mounted radiator cooling

Ambient design, °C (°F)			
Fan load, kW _m (HP)			
Coolant capacity (with radiator), L (US gal)			
Cooling system air flow, m ³ /min (scfm)			
Total heat rejection, MJ/min (Btu/min)			
Maximum cooling air flow static restriction, kPa (in H ₂ O)			
Maximum fuel return line restriction, kPa (in Hg)			

Optional heat exchanger cooling

Set coolant capacity, L (US gal)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum raw water pressure, jacket water circuit, kPa (psi)			
Maximum raw water pressure, aftercooler circuit, kPa (psi)			
Maximum raw water pressure, fuel circuit, kPa (psi)			
Maximum raw water flow, jacket water circuit, L/min (US gal/min)			
Maximum raw water flow, aftercooler circuit, L/min (US gal/min)			
Maximum raw water flow, fuel circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US gal/min)			
Raw water delta P at min flow, jacket water circuit, kPa (psi)			
Raw water delta P at min flow, aftercooler circuit, kPa (psi)			
Raw water delta P at min flow, fuel circuit, kPa (psi)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum fuel return line restriction, kPa (in Hg)			

Optional remote radiator cooling¹

	Standby rating	Prime rating	Continuous rating
Set coolant capacity, L (US gal)			
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)	1920 (550)		
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)	540 (142)		
Heat rejected, jacket water circuit, MJ/min (Btu/min)	29.89 (28352)	26.57 (25197)	
Heat rejected, aftercooler circuit, MJ/min (Btu/min)	21.98 (20845)	19 (18025)	
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)	8.0 (7600)	6.86 (6505)	
Maximum friction head, jacket water circuit, kPa (psi)	67 (10)		
Maximum friction head, aftercooler circuit, kPa (psi)	48 (7)		
Maximum static head, jacket water circuit, m (ft)	18.3 (60)		
Maximum static head, aftercooler circuit, m (ft)	18.3 (60)		
Maximum jacket water outlet temp, °C (°F)	104 (220)	100 (212)	
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)	49 (120)		
Maximum aftercooler inlet temp, °C (°F)	71 (160)	66 (150)	
Maximum fuel flow, L/hr (US gph)			
Maximum fuel return line restriction, kPa (in Hg)			

Weights²

Unit dry weight kgs (lbs)	10989 (24220)
Unit wet weight kgs (lbs)	11493 (25330)

Notes:

¹ For non-standard remote installations contact your local Cummins Power Generation representative.

² Weights represent a set with standard features. See outline drawing for weights of other configurations.

Derating factors

Standby	Engine power available up to 1845 m (6054 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 6.6% per 305 m (1000 ft) and 14.0% per 10 °C (18 °F).
Prime	Engine power available up to 1333 m (4374 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 6.6% per 305 m (1000 ft) and 14.0% per 10 °C (18 °F).
Continuous	

Ratings definitions

Emergency standby power (ESP):	Limited-time running power (LTP):	Prime power (PRP):	Base load (continuous) power (COP):
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.	Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.

Alternator data

Voltage	Connection ¹	Temp rise degrees C	Duty ²	Single phase factor ³	Max surge kVA ⁴	Winding No.	Alternator data sheet	Feature Code
380	Wye, 3-phase	150/105	S/P/C		6716		ADS-331	B595-2
380	Wye, 3-phase	125/105/80	S/P/C		5743		ADS-332	B598-2
380	Wye, 3-phase	105/80	P/C		5521		ADS-331	B659-2
380	Wye, 3-phase	80	P		6716		ADS-332	B687-2
380	Wye, 3-phase	80	S		7695		ADS-333	B660-2
440	Wye, 3-phase	80	P		5521		ADS-330	B689-2
440	Wye, 3-phase	125/105	S/P		5743		ADS-330	B663-2
440	Wye, 3-phase	80	S		6716		ADS-331	B688-2
480	Wye, 3-phase	125/105	S/P		5521		ADS-330	B376-2
480	Wye, 3-phase	105/80	S/P		5743		ADS-330	B600-2
480	Wye, 3-phase	80	S		6716		ADS-331	B601-2
600	Wye, 3-phase	125/105	S/P		5521		ADS-330	B602-2
600	Wye, 3-phase	105/80	S/P		5743		ADS-330	B603-2
600	Wye, 3-phase	80	S		6716		ADS-331	B604-2
4160	Wye, 3-phase	105	P		6204		ADS-322	B312-2
4160	Wye, 3-phase	105/80	S/P		6204		ADS-322	B313-2
4160	Wye, 3-phase	80			7005		ADS-323	B314-2

Notes:

¹ Limited single phase capability is available from some three phase rated configurations. To obtain single phase rating, multiply the three phase kW rating by the Single Phase Factor³. All single phase ratings are at unity power factor.

² Standby (S), Prime (P) and Continuous ratings (C).

³ Factor for the *Single Phase Output from Three Phase Alternator* formula listed below.

⁴ Maximum rated starting kVA that results in a minimum of 90% of rated sustained voltage during starting.

Formulas for calculating full load currents:

Three phase output

$$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$$

~~Single phase output~~

~~$$\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$$~~

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Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.



Exhaust Emission Data Sheet

1250DQGAA

60 Hz Diesel Generator Set

Engine Information:

Model:	Cummins Inc QSK50-G4 NR2	Bore:	6.25 in. (159 mm)
Type:	4 Cycle, 60°V, 16 Cylinder Diesel	Stroke:	6.25 in. (159 mm)
Aspiration:	Turbocharged and Low Temperature Aftercooled	Displacement:	3067 cu. In. (50.2 liters)
Compression Ratio:	15.0:1		
Emission Control Device:	Turbocharged and Low Temperature Aftercooled		

	<u>1/4</u>	<u>1/2</u>	<u>3/4</u>	<u>Full</u>	<u>Full</u>
PERFORMANCE DATA	Standby	Standby	Standby	Standby	Prime
BHP @ 1800 RPM (60 Hz)	462	924	1386	1848	1626
Fuel Consumption (gal/Hr)	27.9	51.3	72.9	92.7	82.2
Exhaust Gas Flow (CFM)	4310	7240	9330	10570	9980
Exhaust Gas Temperature (°F)	625	725	760	813	782
EXHAUST EMISSION DATA					
HC (Total Unburned Hydrocarbons)	0.34	0.25	0.14	0.10	0.12
NOx (Oxides of Nitrogen as NO2)	3.50	3.43	3.96	5.40	4.60
CO (carbon Monoxide)	1.16	0.66	0.41	0.44	0.40
PM (Particular Matter)	0.16	0.08	0.05	0.03	0.05
SO2 (Sulfur Dioxide)	0.14	0.13	0.12	0.11	0.11
Smoke (Bosch)	0.40	0.30	0.30	0.20	0.20
All values are Grams per HP-Hour, Smoke is Bosch#					

TEST CONDITIONS

Data is representative of steady-state engine speed (± 25 RPM) with full load ($\pm 2\%$). Pressures, temperatures, and emission rates were stabilized.

Fuel Specification: ASTM D975 No. 2-D diesel fuel with 0.03-0.05% sulfur content (by weight), and 40-48 cetane number.

Fuel Temperature: 99 ± 9 °F (at fuel pump inlet)

Intake Air Temperature: 77 ± 9 °F

Barometric Pressure: 29.6 ± 1 in. Hg

Humidity: NOx measurement corrected to 75 grains H2O/lb dry air

Reference Standard: ISO 8178

The NOx, HC, CO and PM emission data tabulated here are representative of test data taken from a single engine under the test conditions shown above. Data for the other components are estimated. These data are subjected to instrumentation and engine-to-engine variability. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures and instrumentation. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

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EPA Tier 2 Exhaust Emission Compliance Statement 1250DQGAA 60 Hz Diesel Generator Set

Compliance Information:

The engine used in this generator set complies with the Tier 2 emissions limits of U.S EPA New Source Performance Standards for Stationary Emergency engines under the provisions of 40 CFR 60 Subpart IIII when tested per ISO 8178 D2.

Engine Manufacturer: Cummins Inc
 EPA Certificate Number: CEX-STATCI-11-04
 Effective Date: 06/08/2010
 Date Issued: 06/08/2010
 EPA Diesel Engine Family: BCEXL050.AAD
 CARB Executive Order:

Engine Information:

Model:	Cummins Inc QSK50-G4 NR2	Bore:	6.25 in. (159 mm)
Engine Nameplate HP:	2220	Stroke:	6.25 in. (159 mm)
Type:	4 Cycle, 60°V, 16 Cylinder Diesel	Displacement:	3067 cu. in. (50.2 liters)
Aspiration:	Turbocharged and Low Temperature Aftercooled		
Compression Ratio:	15.0:1		
Emission Control Device:	Turbocharged and Low Temperature Aftercooled		

U.S. Environmental Protection Agency NSPS Stationary Emergency Tier 2 Limits

(All values are Grams per HP-Hour)

<u>COMPONENT</u>	
NOx + HC (Oxides of Nitrogen as NO2 + Non Methane Hydrocarbons)	4.77
CO (Carbon Monoxide)	2.61
PM (Particulate Matter)	0.15

Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

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ALTERNATOR DATA SHEET

Frame Size P734B

CHARACTERISTICS

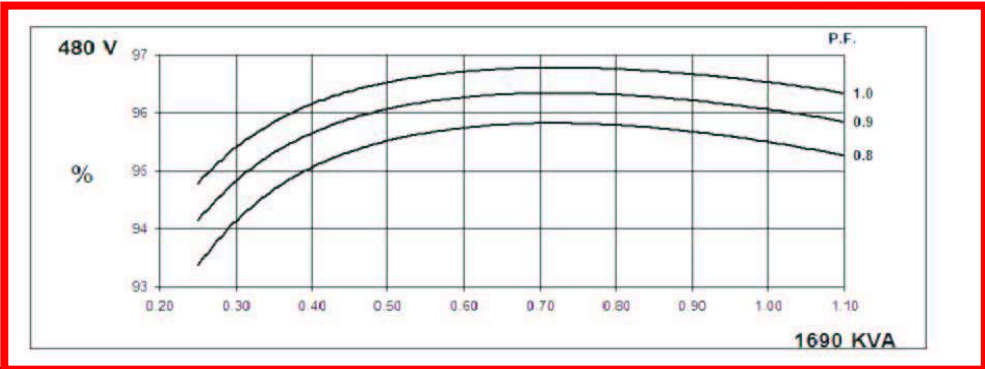
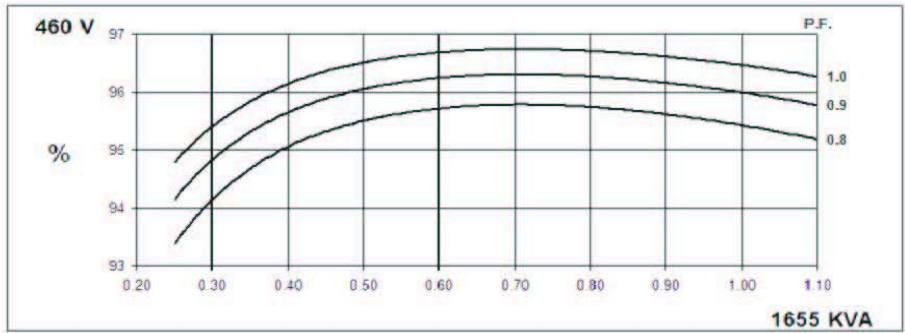
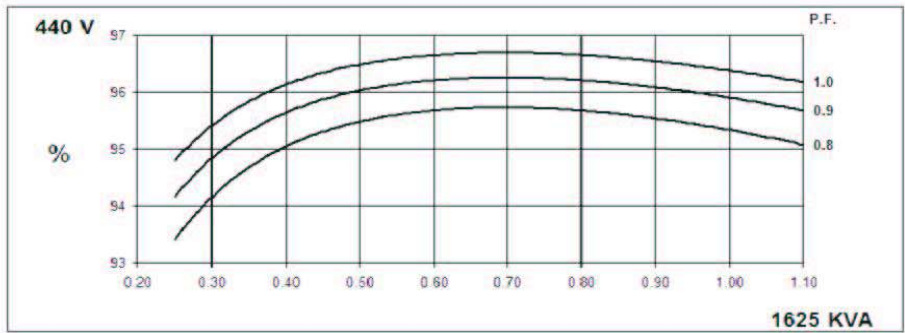
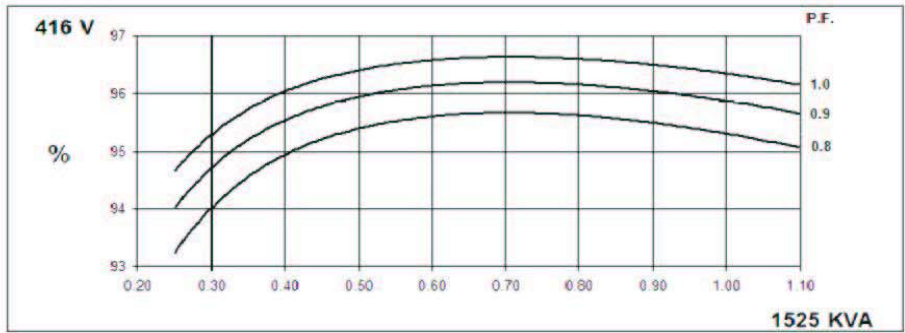
WEIGHTS:	Stator Assembly:	2879 lb	1306 kg
	Rotor Assembly:	2493 lb	1131 kg
	Complete Assembly:	6085 lb	2760 kg
MAXIMUM SPEED:		2250 rpm	
EXCITATION CURRENT:	Full Load	3.6 Amps	
	No Load	0.5 Amps	
INSULATION SYSTEM:	Class H Throughout		

3 Ø RATINGS (0.8 power factor) <small>(Based on specific temperature rise at 40°C ambient temperature)</small>	60 Hz Voltage (winding no)						
	<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
163°C Rise Ratings			1148	1304	1392	1448	1448
	kW						
	kVA		1435	1630	1740	1810	1810
150°C Rise Ratings			1116	1272	1352	1408	1408
	kW						
	kVA		1395	1590	1690	1760	1760
125°C Rise Ratings			1072	1220	1300	1352	1352
	kW						
	kVA		1340	1525	1625	1690	1690
105°C Rise Ratings			924	1102	1200	1260	1260
	kW						
	kVA		1155	1415	1510	1575	1575
80°C Rise Ratings			924	1048	1116	1164	1164
	kW						
	kVA		1155	1310	1395	1455	1455
REACTANCES (per unit ± 10%) <small>(Based on full load at 125°C Rise Rating)</small>	<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
Synchronous			4.47	4.25	4.04	3.53	3.08
Transient			0.28	0.26	0.25	0.22	0.19
Subtransient			0.20	0.19	0.18	0.16	0.14
Negative Sequence			0.29	0.27	0.26	0.23	0.20
Zero Sequence			0.04	0.04	0.03	0.03	0.02
MOTOR STARTING	<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
Maximum kVA (90% Sustained Voltage)			4602	4602	4602	4602	4602
TIME CONSTANTS (Sec)	<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
Transient			0.130	0.130	0.130	0.130	0.130
Subtransient			0.010	0.010	0.010	0.010	0.010
Open Circuit			2.140	2.140	2.140	2.140	2.140
DC			0.020	0.020	0.020	0.020	0.020
WINDINGS (@20°C)	<u>220/380</u> (13)	<u>240/416</u> (13)	<u>220/380</u> (312)	<u>240/416</u> (312)	<u>254/440</u> (312)	<u>277/480</u> (312)	<u>347/600</u> (07)
Stator Resistance (Line to Line, Ohms)			0.00126	0.00126	0.00126	0.00126	0.00520
Rotor Resistance (Ohms)			1.85	1.85	1.85	1.85	1.67
Number of Leads			6	6	6	6	6

**60
Hz**

Winding 312

THREE PHASE EFFICIENCY CURVES

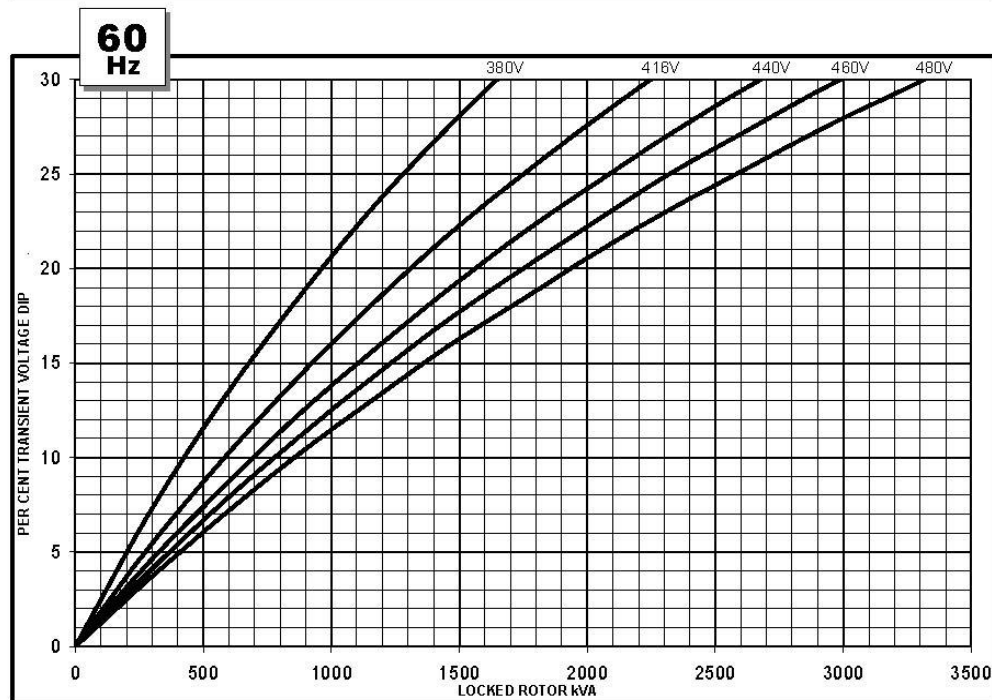
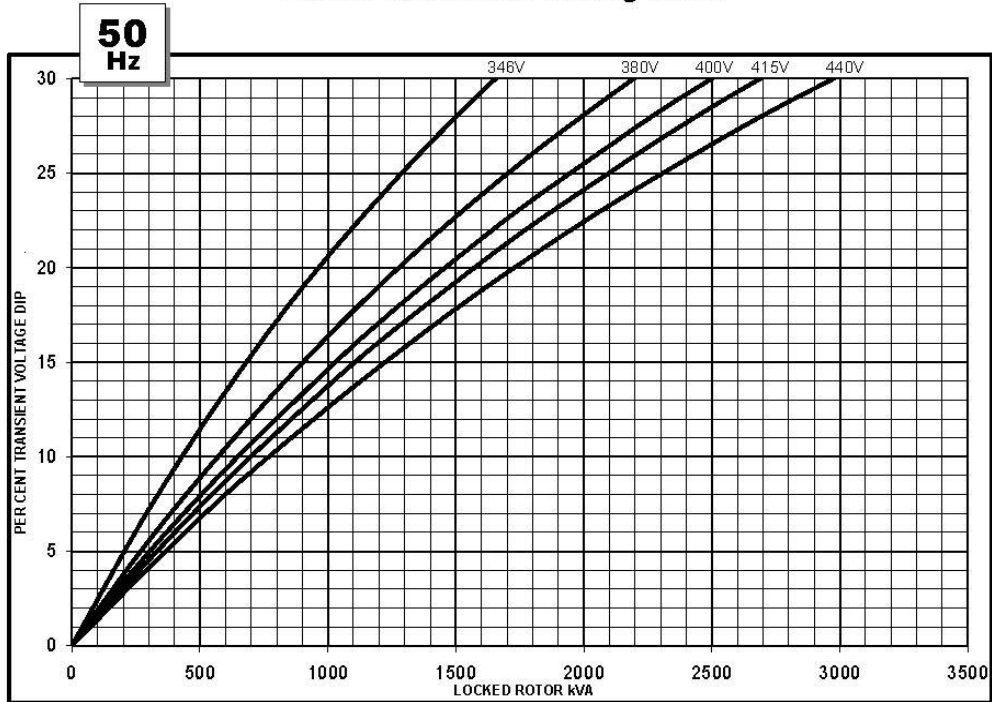




Alternator Data Sheet Frame Size: **P734B**

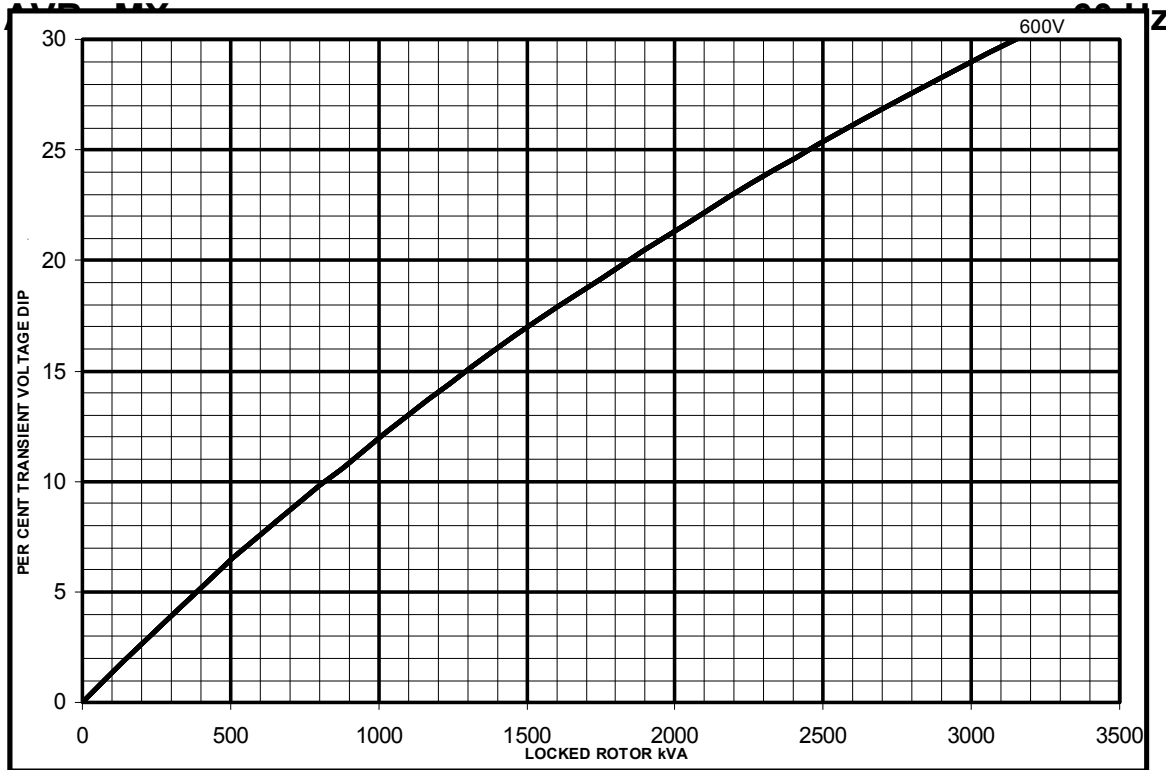
Winding 312

Locked Rotor Motor Starting Curve





**Winding 07
LOCKED ROTOR MOTOR STARTING CURVE**

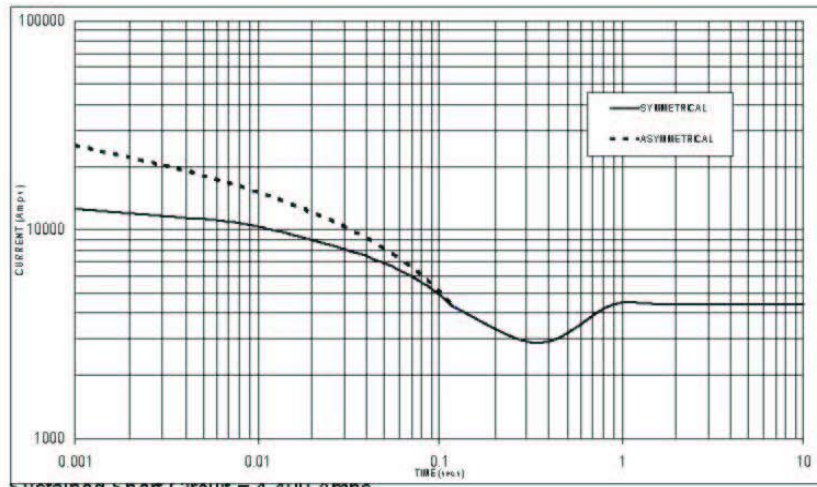




Alternator Data Sheet Frame Size: P734B

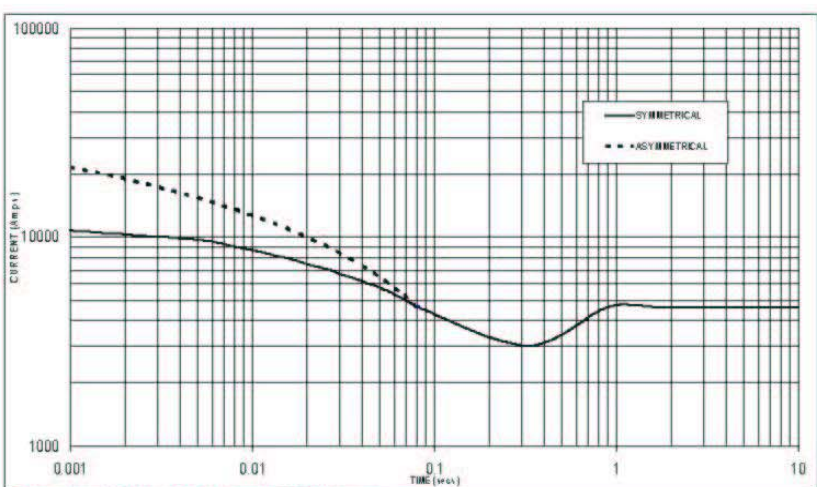
Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed Based on star (wye) connection.

50 Hz



Sustained Short Circuit = 4,400 Amps

60 Hz



Sustained Short Circuit = 4,650 Amps

Note 1

The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

50Hz		60Hz	
Voltage	Factor	Voltage	Factor
380v	x 1.00	416v	x 1.00
400v	x 1.05	440v	x 1.06
415v	x 1.09	460v	x 1.10
440v	x 1.16	480v	x 1.15

The sustained current value is constant irrespective of voltage level

Note 2

The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

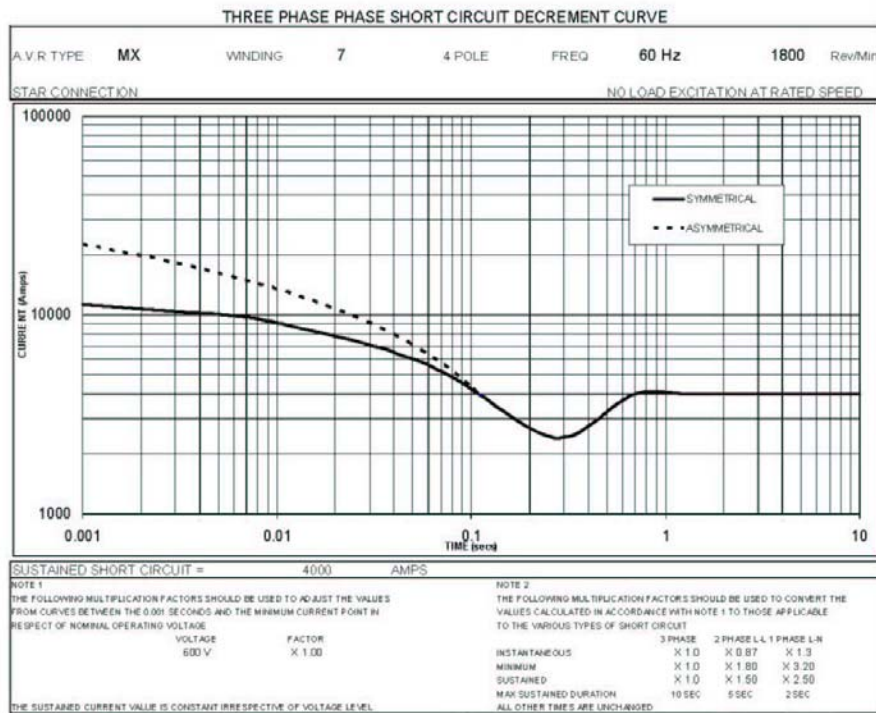
	3-phase	2-phase L-L	1-phase L-N
Instantaneous	x 1.00	x 0.87	x 1.30
Minimum	x 1.00	x 1.80	x 3.20
Sustained	x 1.00	x 1.50	x 2.50
Max. sustained duration	10 sec.	5 sec.	2 sec.

All other times are unchanged

Note 3

Curves are drawn for Star (Wye) connected machines.

Alternator Data Sheet Frame Size: P734B





High Ambient Air Temperature Radiator Cooling System

	Duty	Rating (kW)	Max Cooling @ Air Flow Static Restriction, Unhoused (inches water/mm water)					Housed in Free Air, No Air Discharge Restriction				
			0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	1.0/25.4					
			Maximum Allowable Ambient Temperature, Degree C									
60 Hz	Standby	1250	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Prime	1100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Continuous		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
50 Hz	Standby		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Prime		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Continuous		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Enhanced High Ambient Air Temperature Radiator Cooling System

	Duty	Rating (kW)	Max Cooling @ Air Flow Static Restriction, Unhoused (inches water/mm water)					Housed in Free Air, No Air Discharge Restriction				
			0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	1.0/25.4					
			Maximum Allowable Ambient Temperature, Degree C									
	Standby	1250	53.6	52.2	50.9	49.6	48.4	N/A	N/A	N/A	N/A	
60 Hz	Prime	1100	54.0	52.4	51.1	51.4	50.4	N/A	N/A	N/A	N/A	
	Continuous		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Standby		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
50 Hz	Prime		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Continuous		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Notes:

1. Data shown are anticipated cooling performance for typical generator set.
2. Cooling data is based on 1000 ft (305 m) site test location.
3. Generator set power output may need to be reduced at high ambient conditions. Consult generator set data sheet for derate schedules.
4. Cooling performance may be reduced due to several factors including but not limited to: Incorrect installation, improper operation, fouling of the cooling system, and other site installation variables.

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**KP85 - RL2000 AMP MCCB
MICROLOGIC 3.0 LI TRIP UNIT
ADJ. RATING PLUG TYPE-F
1680 TO 2000 AMP TRIP
SET @ 2000 AMP
(LT - Ir = 1)**



R-Frame

**POWERPACT® R-Frame Molded Case
Circuit Breakers (Standard or 100% rated up to 2500 A)**

The most compact and innovative molded case circuit breakers

POWERPACT Molded Case Circuit Breakers lead the industry with proven, reliable protection and innovative design. Providing unparalleled performance and control, this generation of R-frame circuit breakers features exclusive MICROLOGIC® Trip Units, which allow for a range of sophisticated applications for metering and monitoring. In addition, units can be interchanged to allow for maximum flexibility and are field-installable for easy upgrades as needed.

The circuit breakers are available in 100% rated construction up to 2500 A to meet a broad range of commercial and industrial application needs.

Full-Featured Performance

- R-frame – 2500A available in both standard and 100% ratings with sensor sizes 600–2500A. Interrupting ratings (AIR)
L-100kAIR at 480 VAC
- MICROLOGIC 3.0 Trip Unit

POWERPACT® R-Frame Molded Case Circuit Breakers (Standard or 100% rated up to 2500 A)

Onboard Intelligence

For “smarter breakers,” a range of MICROLOGIC® Trip Units provides advanced functionality, such as a communications interface, and power metering and monitoring capabilities. With the appropriate MICROLOGIC Trip Unit, you can communicate with breakers, gather power information, monitor events and remotely control breakers based on predetermined conditions, leading to substantial savings in electrical system operating costs.

These interchangeable, microprocessor-controlled, plug-in devices provide the next generation of protection, measurement and control functions, delivering not only greater electrical system safety but also improved system integration and coordination.



MICROLOGIC® Trip Units

MICROLOGIC 3.0 and 5.0

- Basic circuit protection including long-time, instantaneous and optional short-time adjustments

MICROLOGIC 3.0A, 5.0A and 6.0A

- Long-time, instantaneous and optional short-time adjustments
- Integrated ammeter and phase loading bar graph
- LED trip indicator
- Zone selective interlocking with downstream and upstream breakers
- Optional ground-fault protection
- Optional MODBUS® communications interface

MICROLOGIC 5.0P and 6.0P

- Long-time, instantaneous and optional short-time adjustments
- Advanced relay protection (current imbalance, under/over voltage, etc.)
- Inverse Definite Minimum Time Lag (IdmtL) long-time delay curve shaping for improved coordination
- Basic power metering and monitoring functions
- Standard MODBUS communications interface compatibility with POWERLOGIC® installations
- Standard GF alarm on 5.0P. 6.0P has equipment ground-fault tripping protection

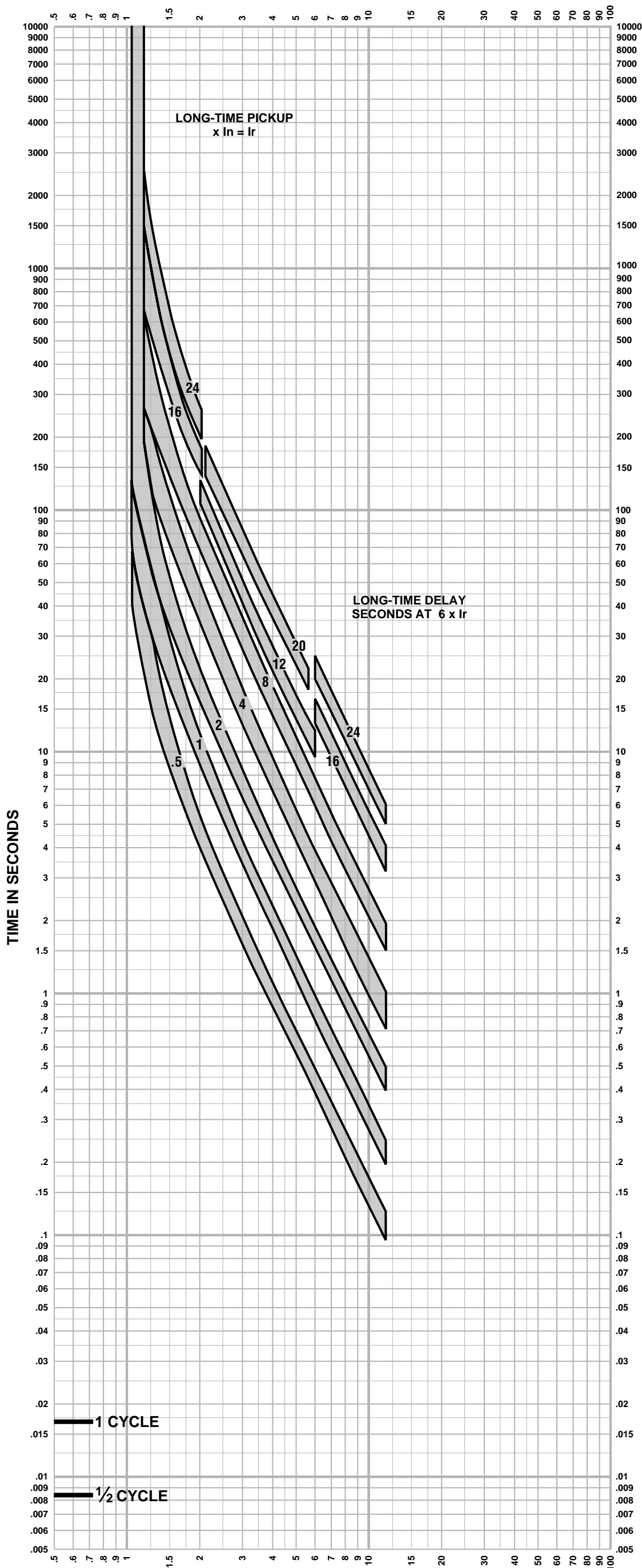
MICROLOGIC 5.0H and 6.0H

- All 5.0P and 6.0P functions
- Enhanced POWERLOGIC power metering and monitoring capabilities
- Basic power quality (harmonic) measurement
- Waveform capture

Contact your Square D sales representative for additional information. Or, visit www.SquareD.com.



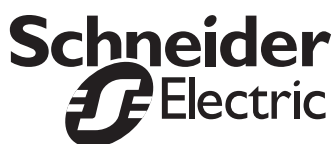
CURRENT IN MULTIPLES OF I_r ($I_r = \text{LONG-TIME SETTING} \times I_n$)



CURRENT IN MULTIPLES OF I_r
($I_r = \text{LONG-TIME SETTING} \times I_n$)

- Merlin Gerin
- Modicon
- Square D
- Telemecanique
- Federal Pioneer
- Federal Pacific

Schneider Electric Brands



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**MICROLOGIC® 3.0 A TRIP UNIT
CHARACTERISTIC TRIP CURVE NO. 613-6**

Long-time Pickup and Delay

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

Curves apply from -30°C to +60°C ambient temperature.

Notes:

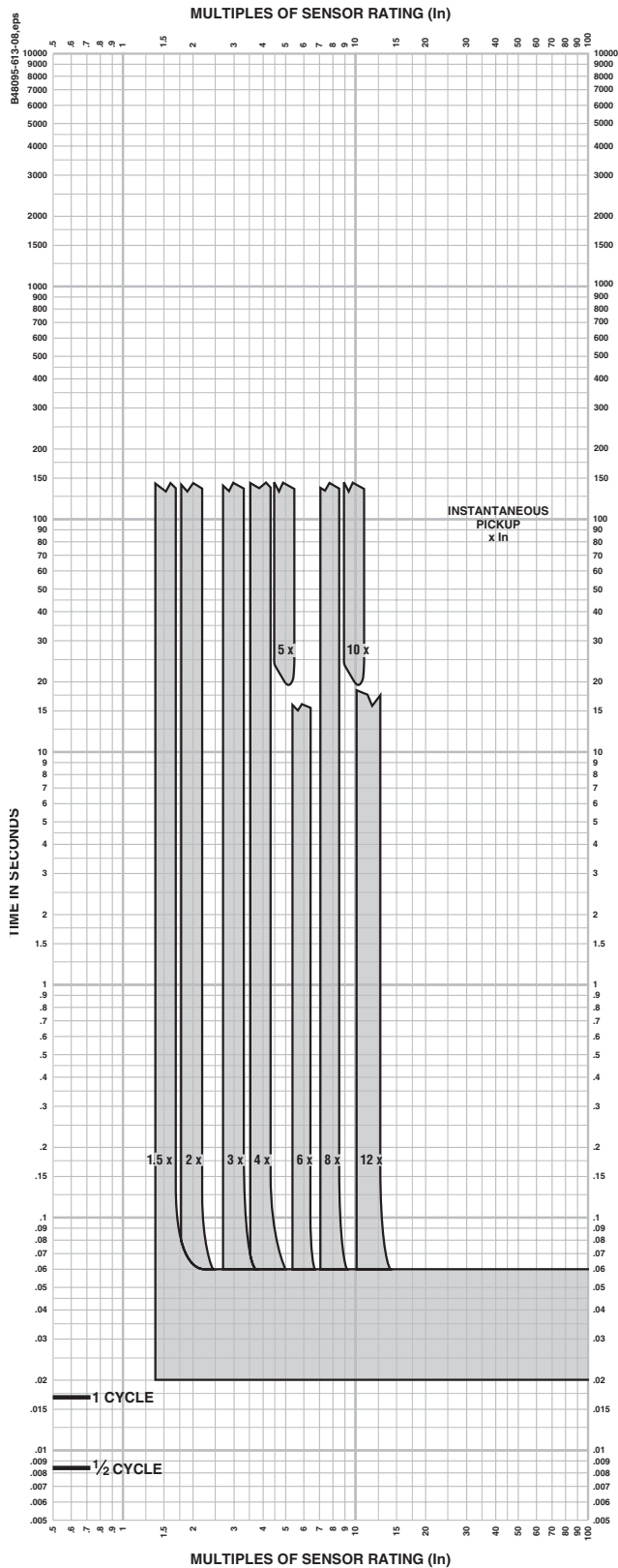
1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately 20 minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the instantaneous setting.
3. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of the current.
4. See 613-8 for instantaneous pickup trip curve.

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M-frame, P-frame, R-frame and NS630b–NS3200 Electronic Trip Circuit Breakers

Section 11—Trip Curves

Micrologic 3.0A Trip Unit Characteristic Trip Curve



Micrologic 3.0A Trip Unit

Instantaneous Pickup, 1.5X to 12X

Characteristic Trip Curve No. 613-8

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

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

Notes:

The end of the curve is determined by the interrupting rating of the circuit breaker.

Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.

The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.

See trip curve 613-6 on page 112 for long-time pickup and delay trip curves.

Curve No. 0613TC008
Drawing No. B48095-613-08

M-frame, P-frame, R-frame and NS630b–NS3200 Electronic Trip Circuit Breakers

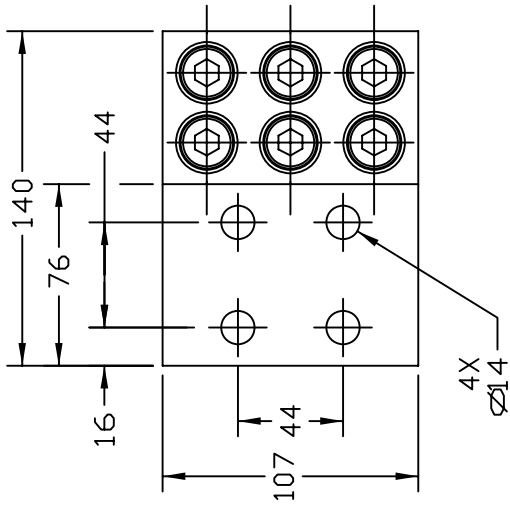
Section 11—Trip Curves

Table 72: Instantaneous Override Values Characteristic Trip Curve

UL/IEC Circuit Breaker	Instantaneous Override ¹ (kA RMS)		
RL 2000	48 ± 15%		

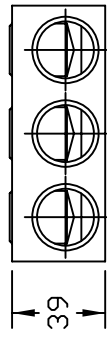
¹ Note: Faults at or above instantaneous override value will be cleared at 25 msec or less.

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD16141	A	1	PRODUCTION RELEASE	-	DC	EC	EC	03-24-03



NOTES:

1. THIS PART IS VENDOR SOURCE CONTROLLED. SEE APPROVED PRODUCT VENDOR LIST.
2. TYPE L3D4-600 ELECTRO TIN PLATED.
3. WIRE SIZE #2 TO 600 MCM.
4. MATERIAL 6061-T6 ALUMINUM.
5. CSA / UL 90°C RATING 486B LISTED.



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	E_CZECHOWSKI	E_CZECHOWSKI	03-24-03		
	E_CZECHOWSKI	E_CZECHOWSKI	03-24-03		

CUMMINS POWER GENERATION
 1400 75RD AVE NE
 MINNEAPOLIS, MINNESOTA 55432
 TITLE LUG-CABLE (SOLDERLESS)
 DWG NO 0332_3949
 SHEET 1 OF 1

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 MODEL FIRST USED ON HC6/HC7 CB
 APPROVED E_CZECHOWSKI
 FOR INTERPRETATION OF DIMENSIONS, SEE AND TOLERANCING, SEE ANSI Y14.5M-1988

NRG

Intelligent Engine Start Battery Charger



The Smart Choice for Mission-Critical Engine Starting

- **Fast, accurate, mission-critical charging** – gives best starting reliability
- **Replace nearly any charger** – without planning ahead
- **Industry-first battery-fault alarm** - helps dispatch service early
- **1 million hour observed MTBF** – means longest charger life
- **Smart design** – stops load dump and other damaging transients



NRG Battery Charger Benefits and Features



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

SENS NRG battery charger maximizes starting system reliability while slashing genset servicing costs:

One NRG replaces almost any charger without extra site visits. Installers can select or change at any time 120, 208 or 240 volts AC input, 12 or 24-volt battery and output settings optimized for nearly any lead-acid or nickel cadmium battery.

Easy to understand user interface provides state-of-the-art system status – including digital metering, NFPA 110 alarms and a battery fault alarm that can send service personnel to the site before failure to start.

Batteries charged by NRG give higher performance and last longer. In uncontrolled environments precision charging by SENS increases battery life and watering intervals 400% or more.

NRG meets all relevant industry standards – including UL, NFPA 110 and CE. All units are either C-UL listed or C-UL recognized. 50/60 Hz units add CE marking to UL agency marks.

EnerGenius reliability technology built into every charger includes:

- All-electronic operation with generous component de-rating
- Disconnected/reversed/incorrect voltage battery alarm and protection
- Protection of connected equipment against load dump transients
- Widest temperature rating, and overtemperature protection
- Superior lightning and voltage transient protection
- Demonstrated field MTBF > 1 million hours
- Standard 3-year warranty and available reimbursement of customer field service costs

Earn the best return on your charger investment – choose SENS NRG

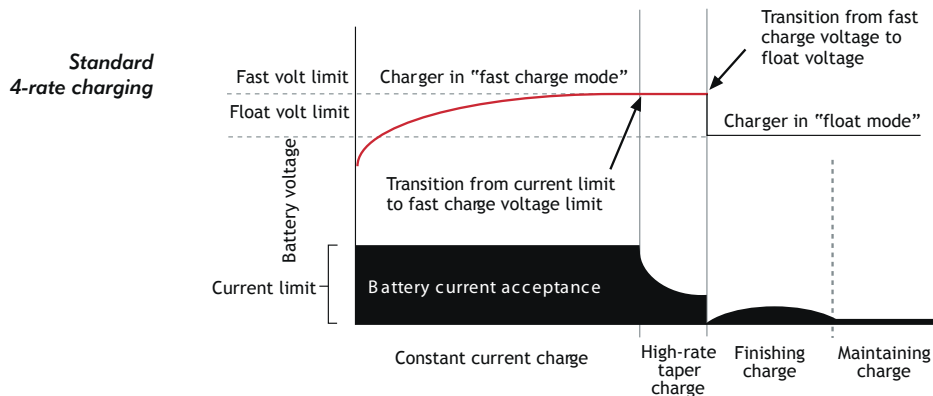
NRG Specifications

AC Input

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

Charger Output

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



User Interface, Indication and Alarms

Digital meter	Switch-selectable meter for output volts, amps
Accuracy	$\pm 2\%$ volts, $\pm 5\%$ amps
Alarms	LED and Form C contact(s) per table:



Front panel status display

Alarm System Functions

	Alarm code "1" ¹	Alarm code "C" (meets requirements of NFPA 110)
AC good	LED	LED
Float mode	LED	LED
Fast charge	LED	LED
Temp comp active	LED	LED
AC fail	LED ²	LED and Form C contact
Low battery volts		LED and Form C contact
High battery volts		LED and Form C contact
Charger fail	LED ²	LED and Form C contact
Battery fault ³	LED ²	LED and Form C contact

- Alarms "1" available only on 10A charger
- Form C contact provides summary alarm of these conditions. BBHH chargers include this alarm configuration. Contacts rated 2A @ 26 VDC resistive
- Battery fault alarm indicates these fault conditions:
 - Battery disconnected - Battery polarity reversed - Mismatched charger battery voltage - Open or high resistance charger to battery connection
 - Open battery cell or excessive internal resistance

Controls

AC input voltage select
Optional 12/24-volt output select
Battery program select
Fast charger enable/disable
Temp compensation enable
Remote temp comp enable

Field-selectable switch
Field-selectable two-position jumper
Field-selectable six-position jumper
Field-selectable two-position jumper
Standard. Can be disabled or re-enabled in the field
Connect optional remote sensor to temp comp port



Simple field adjustments

Environmental

Operating temperature
Over temperature protection
Humidity
Vibration (10A unit)
Transient immunity

-20C to +60C, meets full specification to +45C
Gradual current reduction to maintain safe power device temperature
5% to 95%, non-condensing
UL 991 Class B (2G sinusoidal)
ANSI/IEEE C62.41, Cat. B, EN50082-2 heavy industrial

Agency Standards

Safety

Agency marking

EMI
NFPA standards
Optional agency compliance

C-UL listed to UL 1236 (required for UL 2200 gensets), CSA standard 22.2 no. 107.2-M89
CE: 50/60 Hz units DOC to EN 60335
60 Hz: C-UL-US listed
50/60 Hz: C-UL-US listed plus CE marked
FCC Part 15 Class B; EN 50081-2
NFPA 70, NFPA 110. (NFPA 110 requires Alarms "C")
Units with Alarms "1" configuration available with additional compliance to UL category BBHH and NFPA 20

Construction

Housing/configuration

Packaging
Dimensions
Printed circuit card
Cooling
Protection degree
Damage prevention
Electrical connections

Material: Heavy clear anodized aluminum. Configuration options:
• Fully enclosed: C-UL listed enclosure
• Open frame: C-UL recognized
• Slimline: C-UL recognized open frame construction with remote isolation transformer
Open-frame and Slimline configurations only available in bulk OEM quantities and packaging
See Drawings and Dimensions page for details
Surface mount technology, conformal coated
Natural convection
Listed housing: NEMA-1 (IP20). Optional NEMA 3R enclosure
Fully recessed display and controls
Compression terminal blocks

Warranty

Standard warranty
Optional warranty

Three year parts and labor warranty from date of shipment
If specified at time of order, warranty coverage is increased to reimburse customer's documented field service costs up to the original charger price. Contact the factory for full details

Optional features

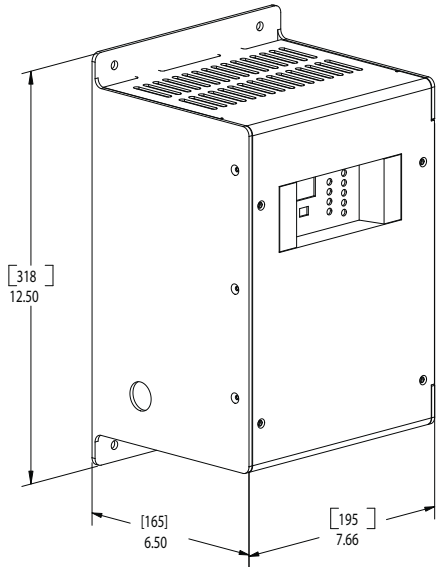
Input
Remote temp comp sensor
Drip shield
NEMA 3R housing
UL BBHH listing
Field service warranty

Input frequency, 50/60 Hz
Recommended where battery and charger are in different locations
Protects from dripping water
Enables outdoor installation (remote temp sensor recommended)
Available in 10A units with Alarms "1"
Reimbursement of customer field service expenses up to charger price

Drawings and Dimensions

10A Chargers

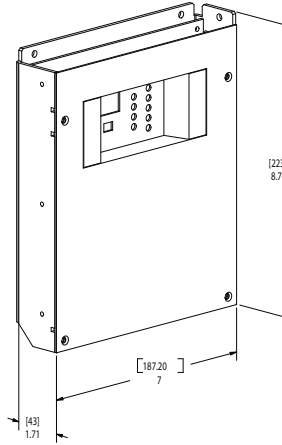
Enclosed and Open Frame Configurations



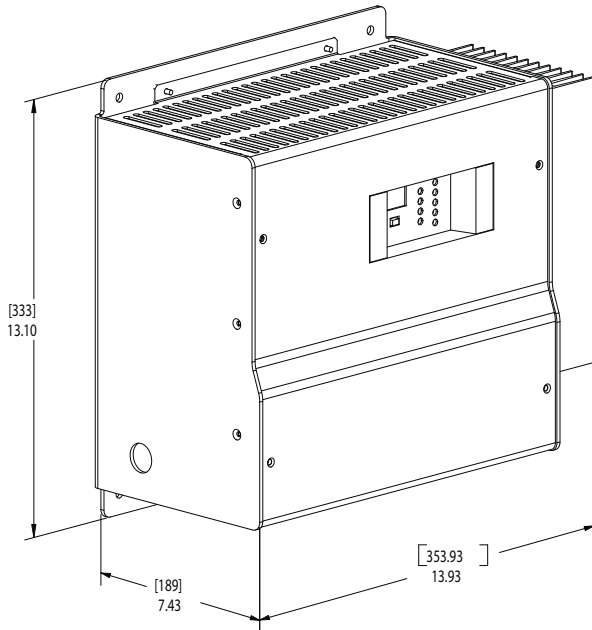
Open-frame configuration omits front cover

10A Chargers

Slimline Open Frame Configuration



Slimline can be mounted either flat or edgewise



Open-frame configuration omits front cover

20A Chargers

Enclosed and Open Frame Configurations

Housing Dimensions Table

Amps	Configuration	Width	Depth	Height
10	Enclosed	7.66" (195 mm)	6.50" (165 mm)	12.50" (318 mm)
10	Open-frame	7.66" (195 mm)	6.50" (165 mm)	12.50" (318 mm)
10	Slimline – flat mount	7.00" (187 mm)	1.71" (43 mm)	8.78" (223 mm)
10	Slimline – edge mount	1.71" (43 mm)	7.00" (187 mm)	8.78" (223 mm)
20	Enclosed	13.93" (354 mm)	7.43" (189 mm)	13.10" (333 mm)
20	Open-frame	13.93" (354 mm)	7.43" (189 mm)	13.10" (333 mm)

NRG Ordering Information					
Output volts	Output amps	Model	Available configurations	NFPA 110 Alarms	Lbs/Kg
12	10	NRG12-10-R1	Enclosed, Open-frame, Slimline	No	19 / 8.7
12	10	NRG12-10-RC	Enclosed, Slimline	Yes	19 / 8.7
24	10	NRG24-10-R1	Enclosed, Open-frame, Slimline	No	24 / 10.9
24	10	NRG24-10-RC	Enclosed, Slimline	Yes	24 / 10.9
12/24	10	NRG22-10-R1	Enclosed, Open-frame, Slimline	No	24 / 10.9
12/24	10	NRG22-10-RC	Enclosed, Slimline	Yes	24 / 10.9
12	20	NRG12-20-RC	Enclosed, Open-frame	Yes	39 / 17.7
24	20	NRG24-20-RC	Enclosed, Open-frame	Yes	42 / 19.1
12/24	20	NRG22-20-RC	Enclosed, Open-frame	Yes	42 / 19.1

All models offer field-selectable input 120/208-240 volts. 60 Hz input is standard with C-UL listing. Optional 50/60 Hz input includes C-UL listing and adds CE mark.

Model Number Breakout



- Model**
- Output voltage**
12: 12 volts
24: 24 volts
22: 12/24-volt field selectable
- Output current**
10: 10 amps
20: 20 amps
- AC input**
R: 120/208-240 VAC, 60 Hz
H: 120/208-240 VAC, 50/60 Hz
- Alarm system code**
1: LED and single Form C contact
C: LEDs and Form C contacts to meet NFPA 110
- Housing/Agency**
L: Enclosed: C-UL listed
R: Open-frame: C-UL recognized
S: Slimline open-frame: C-UL recognized (10A only)
- UL category code**
S: UL category BBGQ (standard)
H: UL category BBHH (Alarms "1" only)

The Smart Choice for Mission-Critical Engine Starting

Additional Information

Contact SENS or your local sales representative for additional specification, engineering and installation information



Contact Information

For information and service on any SENS product, please contact us at:
 Sales 1.866.736.7872 • 303.678.7500 • Fax 303.678.7504
 www.sens-usa.com • info@sens-usa.com
 1840 Industrial Circle, Longmont, CO 80501 USA



STOP!

Verify that all settings shown below are correct *before energizing charger*. **CAUTION:** Correct settings are essential to ensure proper battery performance and long battery life. *Before installation*, ensure adequate battery to charger wire gauge. Wire gauge that is too small may activate the open battery detector and the charger will shut down:

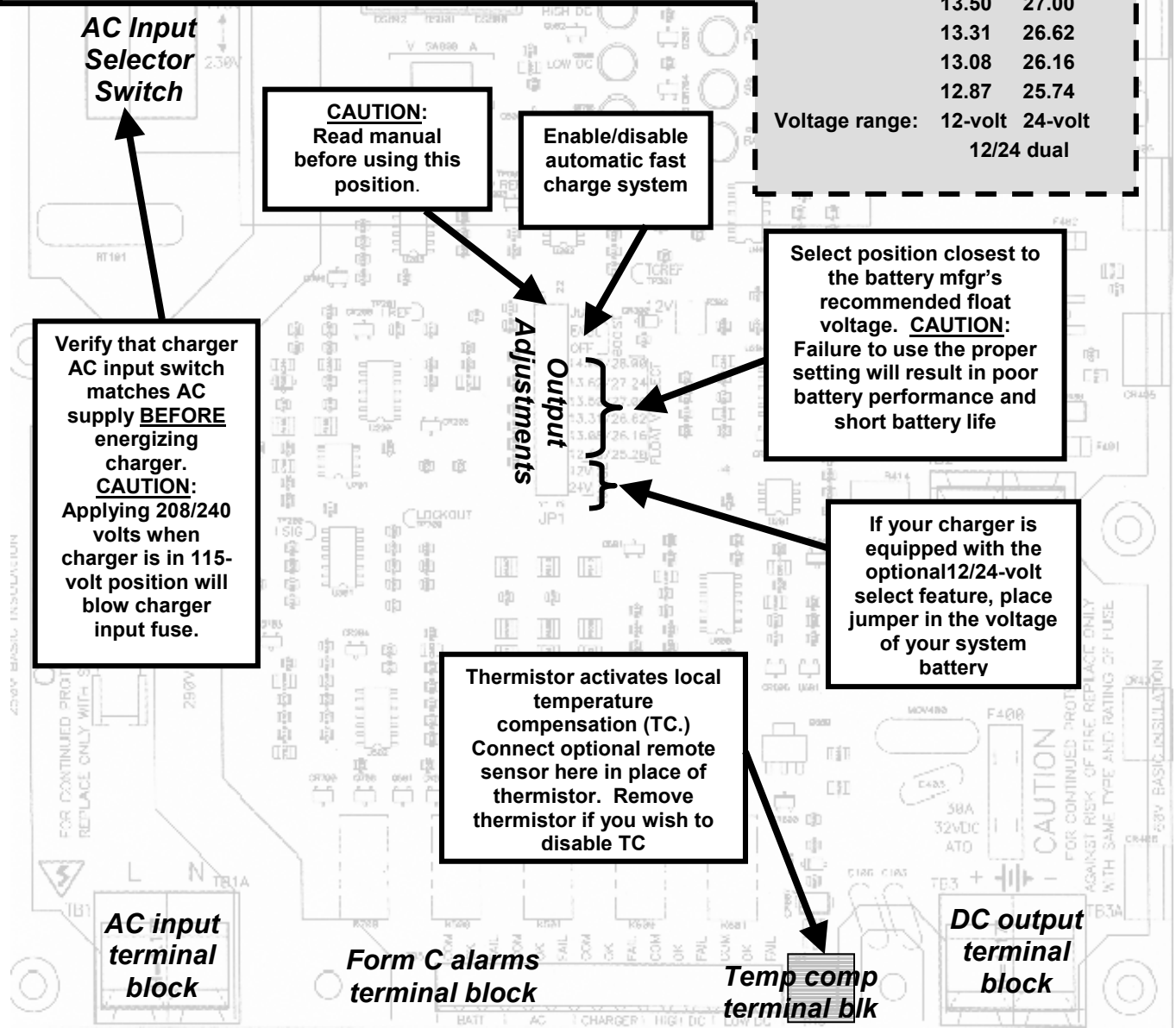
AWG	Recommended Charger to Battery Distance (Ft.)			
	12V/10A	24V/10A	12V/20A	24V/20A
10	10	19	N/A	N/A
8	15	30	7	15
6	24	48	12	24

For runs exceeding the above values, call SENS at 1-800-742-2326 or (303) 678-7500.

FACTORY SETTINGS

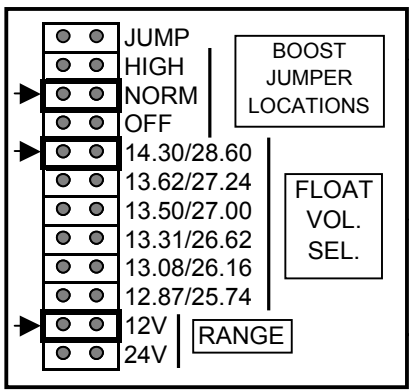
Charger is factory set for the following settings. Change the setting if needed for your battery or site conditions

Input	230 VAC
Jump:	DISABLED
Fast charge:	ENABLED / OFF
Float voltage	14.30 28.60 13.62 27.24 13.50 27.00 13.31 26.62 13.08 26.16 12.87 25.74
Voltage range:	12-volt 24-volt 12/24 dual



**ALL ADJUSTMENTS TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY
SEE INSTALLATION MANUAL FOR DETAILS**

- | | | | |
|--------------------------------|--|---|----------------------------------|
| 1 With AC power to charger OFF | 2 Confirm AC safety ground is secure. | 3 Confirm AC Sel SW setting matches AC input voltage. | 4 Connect AC input wires to TB1. |
| 5 Connect alarm wires to TB5. | 6 Connect output wires to TB3. OBSERVE POLARITY. | 7 Connect remote temp sensor to TB4 if required. | |



- | | |
|---|---|
| 8 Confirm boost sel jumper is in correct position, see manual and item 12 below. | 9 Confirm Battery Float voltage is set to match your battery type (see manual). If battery is fully charged, the voltage display will agree with this value at 25 C or when one leg of temperature sensor is removed. |
| 10 Confirm that the RANGE select jumper setting matches the Battery voltage. Make no other adjustments. | 11 Apply AC power to charger. No RED LED indicators should be on. See manual for alarm, LED display and jumper functions. |

**Call 1-800-742-2326
for HELP / Or visit
www.sens-usa.com
to download manual**

- | |
|--|
| 12 Charger will not start up if dead battery voltage is less than 75% of rated voltage. In this case momentarily short JUMP pins using BOOST jumper to start a dead battery. Return jumper to original position after battery voltage comes up. Do not leave jumper in the JUMP position |
|--|

4.125

5.00 max

NOTES:

1. LETTERING TO BE BLACK INK ON SILVER FOIL LABEL, MATERIAL RATED PER R/C (PGDQ2). LABEL ADHESIVE PROVIDED MUST BE SUITABLE FOR USE ON ALUMINUM & RATED FOR 80 DEG C MINIMUM.
2. PSA MATERIAL IS TO BE PROVIDED WITH RELEASE LINER.
3. RADIUS CORNERS .125" MAXIMUM.
4. THIS DRAWING NOT TO SCALE.



DCN No.	105073		
Drawn By:	KL	Date:	1/13/2006
Approved By:		Date:	
DWG Name:	LABEL, INSIDE COVER, NRG10/20		
PN: 808526	DWG REV.	C	

PowerCommand® Digital Input/output Module DIM - Base, DIM - Expansion



> **Specification sheet**



**Power
Generation**

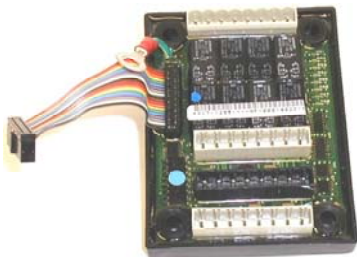
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Description

The PowerCommand® Digital Input/output Module (DIM) provides up to sixteen (16) output relays for local or remote monitoring and control of power system equipment such as motors, louvers, lamps, fans and pumps. The relays may be controlled as a group or individually by PowerCommand software or other system components. The DIM may be added at any point in the network using twisted-pair cabling.

DIM - Base contains eight (8) Form-C relay output sets and four (4) discrete dry contact inputs.

DIM - Expansion easily connects to DIM - Base to provide an additional eight (8) Form-C relay output sets for extended control and monitoring and (4) additional discrete dry contact inputs.



DIM - Expansion

Features

- Up to sixteen (16) Form-C latching relays provide easy control of system equipment such as lamps, louvers, motors and pumps.
- Four (4) discrete dry contact inputs for monitoring equipment status. Equipment status may be shared with other network modules.
- DIM - Base provides eight (8) Form-C contact output sets and four (4) discrete inputs.
- DIM - Expansion provides an additional eight (8) output relays and (4) additional discrete inputs.
- May be connected at any point in the PowerCommand Network.
- Pluggable connectors allow easy one-time wiring.
- Less wiring makes installation and system upgrades quick and easy.
- May be remotely monitored and controlled with PowerCommand Software for Windows® V 2.01.
- PowerCommand Controls are supported by a worldwide network of independent distributors who provide parts, service and warranty support.
- UL Listed and labeled; CSA certified; CE marked.

Specifications

Signal requirements

Network connections: Echelon® LonWorks®, twisted-pair 78 kbps, FT-10

Control power: 10-36 VDC

Current: 100 mA typical

Wiring materials for network signals are UL Listed NEMA Level 4 twisted pair wiring. Terminations for control power accept wire up to 16 ga.

Environment

The DIM - Base and Expansion is designed for proper operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and for storage from -40 °C to +80 °C (-40 °F to +176 °F). Control will operate with humidity up to 95%, non-condensing, and at altitudes up to 5000 m (13000 ft).

Relay ratings (DIM - Base)

Revision A: 1 A @ 125 VAC, 2 A @ 30 VDC
Revision 2 A: 2 A @ 250 VAC, 2 A @ 30 VDC

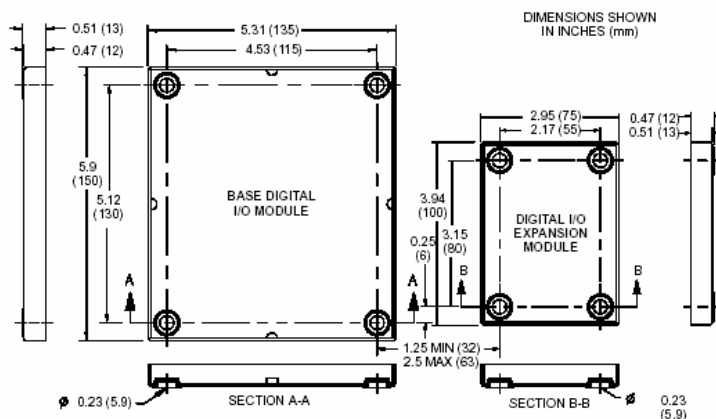
Relay ratings (DIM - Expansion)

1 A @ 125 VAC, 2 A @ 30 VDC

Network length: Maximum 1400 m (4600 ft)

Approved wiring: UTP NEMA Level 4, Cat 5 (stranded)

Dimensions



Ordering information

Part number	Description
0541-0771	Digital Input/output Module - Base (DIM - Base), FT-10
0541-0772	Digital Input/output Module - Expansion (DIM - Expansion), FT-10

See your distributor for more information.

Cummins Power Generation

Americas

1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
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Fax: 763 574 5298

Europe, CIS, Middle East and Africa

Manston Park Columbus Ave.
Manston Ramsgate
Kent CT 12 5BF United Kingdom
Phone 44 1843 255000
Fax 44 1843 255902

Asia Pacific

10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

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S-1431c (9/07)



PowerCommand[®] Remote Annunciator Panel (LonWorks System annunciator)



> Specification sheet

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Power
Generation

Description

The PowerCommand[®] Network Annunciator is a network component that provides remote system status indication for emergency and other power systems in compliance to the requirements of NFPA 110. The network annunciator may also be used for remote indication of any condition that is monitored by a PowerCommand Network.

The Network Annunciator reduces installation costs and improves design flexibility by use of a PowerCommand Network to transmit all the genset and transfer switch system signals rather than using relay contacts for this purpose.

Control power for PowerCommand Network products is usually derived from the genset starting batteries. The control functions over a voltage range from 8 VDC to 35 VDC.

Features

- Visual indication of 20 network conditions and network status.
- Audible indication of any network condition - Annunciator also includes pushbutton switch to silence the audible alarm. Alarm horn sound level is approximately 90 dB(A) at 30 cm.
- Standard NFPA 110 label, field configurable for other alarm and status conditions.
- Configurable for compliance to NFPA 99 requirements.
- Sealed membrane panel design provides environmental protection for internal components and is easy to clean.
- Warranty - PowerCommand Controls are supported by a worldwide network of independent distributors who provide parts, service and warranty support.
- UL Listed and labeled; CSA certified; CE marked.
- Wall mount NEMA 1 enclosure or flush mount configurations available.

Specifications

Signal requirements

Network connections: Echelon® LonWorks®, twisted-pair 78 kbps, FT-10.

Control power: 8-30 VDC, 3.5 W (maximum) 0.8 W typical.

Wiring materials for network signals are UL Listed 4 twisted pair wiring. Terminations for control power accept wire up to 16 ga.

Environment

The annunciator is designed for proper operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and for storage from -40 °C to +80 °C (-40 °F to +176 °F). Control will operate with humidity up to 95%, non-condensing and at altitudes up to 5000 m (13,000 ft).

Alarm Horn

Sound Level: 90 dB(A) at 30 cm

Physical

Weight: 1.45 kg (3.2 lbs) (board plus enclosure)

Power

Maximum Consumption: 5 W

Standby Consumption: 0.4 W or less

Network Length: Maximum 1400 m (4600 ft), when using NEMA Level 4 cable

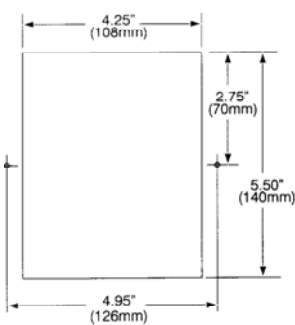
Self-binding configurations - Supports use of up to four annunciators with up to one genset and one transfer switch.

Maximum wire lengths - control power-self-binding system

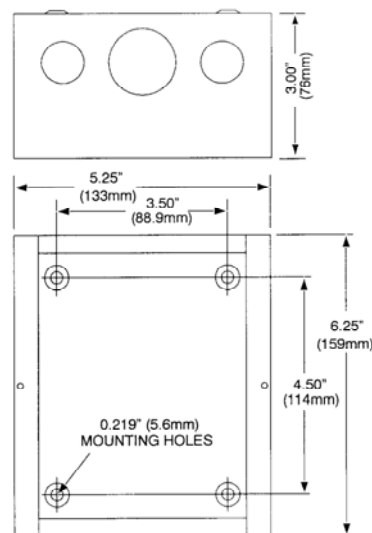
Wire size	12 VDC	24 VDC
22 ga	100 m (330 ft)	338 m (1100 ft)
20 ga	158 m (520 ft)	537 m (1760 ft)
18 ga	250 m (820 ft)	852 m (2790 ft)
16 ga	398 m (1300 ft)	1352 m (4430 ft)
14 ga	631 m (2070 ft)	1400 m (4600 ft)

Dimensions

Cut out detail (without enclosure)



Annunciator enclosure



Dimensions: in (mm)

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S-1343e (9/07)

Label configurations & standard bindings

NFPA 110 genset alarm and status annunciator

The following conditions are provided as standard on the annunciator:

- High battery voltage (A)
- Low battery voltage (A)
- Genset running (G)
- Genset supplying load (G)
- Pre-low oil pressure (A)
- Low oil pressure (R)
- Pre-high coolant temperature (A)
- High coolant temperature (R)
- Low engine temperature (A)
- Overspeed (R)
- Fail to start (overcrank) (R)
- Not in auto (R)
- Battery charger malfunction (A)
- Low fuel (A)
- Low coolant level (R)
- Spare (4) (G)
- Common alarm

(A) = Amber; (R) = Red; (G) = Green

Extended genset alarm and status annunciator

The following conditions are provided as standard on the annunciator:

- Check genset (R)
- Ground fault (A)
- High AC voltage (R)
- Low AC voltage (R)
- Under frequency (R)
- Overload (R)
- Over current (R)
- Short circuit (R)
- Reverse KW (R)
- Reverse kVAR (A)
- Fail to sync (A)
- Fail to close (R)
- Load demand (G)
- Genset CB tripped (R)
- Utility CB tripped (R)
- Emergency stop (R)
- Spare (4) (G)

(A) = Amber; (R) = Red; (G) = Green

8-Point (genset)

The following conditions are provided as standard on the annunciator:

- Check genset (A)
- Genset supplying load (A)
- Genset running (G)
- Not in auto (G)
- High/low engine temp (G)
- Low oil pressure (A)
- Low coolant level (R)
- Low fuel level (A)
- Spare (8) (G)

(A) = Amber; (R) = Red; (G) = Green

4-Point (genset)

The following conditions are provided as standard on the annunciator:

- Check genset (A)
- Genset supplying load (A)
- Genset running (G)
- Not in auto (G)
- Spare (16) (G)

(A) = Amber; (R) = Red; (G) = Green

ATS-extended

This annunciation set is often used with PLT-series equipment. The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 1 connected (G)
- Source 2 connected (G)
- Check ATS (R)
- ATS not in auto
- Test/exercise
- Transfer pending
- Load shed
- Transfer inhibit
- Fail to close
- Fail to disconnect
- Fail to synchronize
- Low battery-controller
- Low battery-network

(A) = Amber; (R) = Red; (G) = Green

ATS 8-point

The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 1 connected (G)
- Source 2 connected (G)
- Common alarm (A)
- Not in auto (R)
- Test/exercise mode (A)
- Low control battery (A)
- Spare (8) (G)

(A) = Amber; (R) = Red; (G) = Green

ATS 4-point

The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 2 connected (G)
- Source 1 connected (G)

(A) = Amber; (R) = Red; (G) = Green

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S-1343e (9/07)

Custom alarm configuration

#	Color (R/Y/G)	Label	Horn (Y/N)	#	Color (R/Y/G)	Label	Horn (Y/N)
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

Ordering information

Part number	Description
0541-0814-01	Network annunciator, open construction, for panel mounting
0541-0814-02	Network annunciator including control box for surface wall mounting

See your distributor for more information.

Cummins Power Generation

Americas

1400 73rd Avenue N.E.
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 Fax 65 6417 2399

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POWERCOMMAND NETWORKS

NETWORK CABLING AND CONNECTIONS FOR FTT-10 NETWORKS

Network Topology

FTT-10 networks are designed to support free topology wiring, and will accommodate bus, star, ring, or any combination of these topologies. Excepting the double-terminated bus topology, only one point of termination is required for any free topology segment. Note that the actual termination circuit will vary by application (See “Cable Termination” below.)

Network Nodes

Each device with an FTT-10 transceiver is a network node. The maximum number of nodes on a network segment and on the total network is partly dependant on the network application. For example, a network that is connecting only a few discrete variables between devices and has no monitoring software attached could probably support 64 nodes (maximum allowable on a segment per Echelon specs.) At the other extreme, a network with a large amount of inter-device bindings and being monitored by PowerCommand PULSE with Reporting option would not be able to support more than 12 devices using a single FTT-10 channel. However, with the appropriate addition of other network management devices, the PULSE example could potentially support 64 devices or even more. If there is any question about how many devices your network can support, contact the Network Applications Engineer in the CPG System Sales department.

Network Cable Selection

The following cables are qualified for use with FTT-10 networks:

- NEMA Level IV cable (Onan P/N 334-1350 [PVC] or 334-1351 [Plenum])
- Belden 85102 or Belden 8471 (both are single twisted pair, 16 AWG)
- TIA Category 5 (CAT5)

Network wiring should be run in separate conduit and installed following local electrical codes. Any wire connected to Generator Sets must be stranded wire (NFPA110, Para. 7.12.4.1). Except when using ring topology, cabling is not polarity sensitive. The average temperature of the wire should not exceed +55°C (+131°F). Cable distance must comply with transmission specifications listed below. The *maximum total wire length* is the total length of wire within a segment. The *maximum node-to-node distance* is the maximum allowable distance between each individual node or the terminator.

Table 1 Free Topology

	Maximum node-to-node distance (Ft)	Maximum total Wire length (Ft)
Belden 8471	1300	1600
Belden 85102	1600	1600
NEMA Level IV	1300	1600
TIA Category 5	800	1400

POWERCOMMAND NETWORKS

NETWORK CABLING AND CONNECTIONS FOR FTT-10 NETWORKS

Table 2 Double-Terminated Bus Topology

	Maximum Bus length (Ft)
Belden 8471	8800
Belden 85102	8800
NEMA Level IV	4500
TIA Category 5	2900

A double-terminated bus may have stubs of up to 10 feet from the bus to each device.

Cable Termination

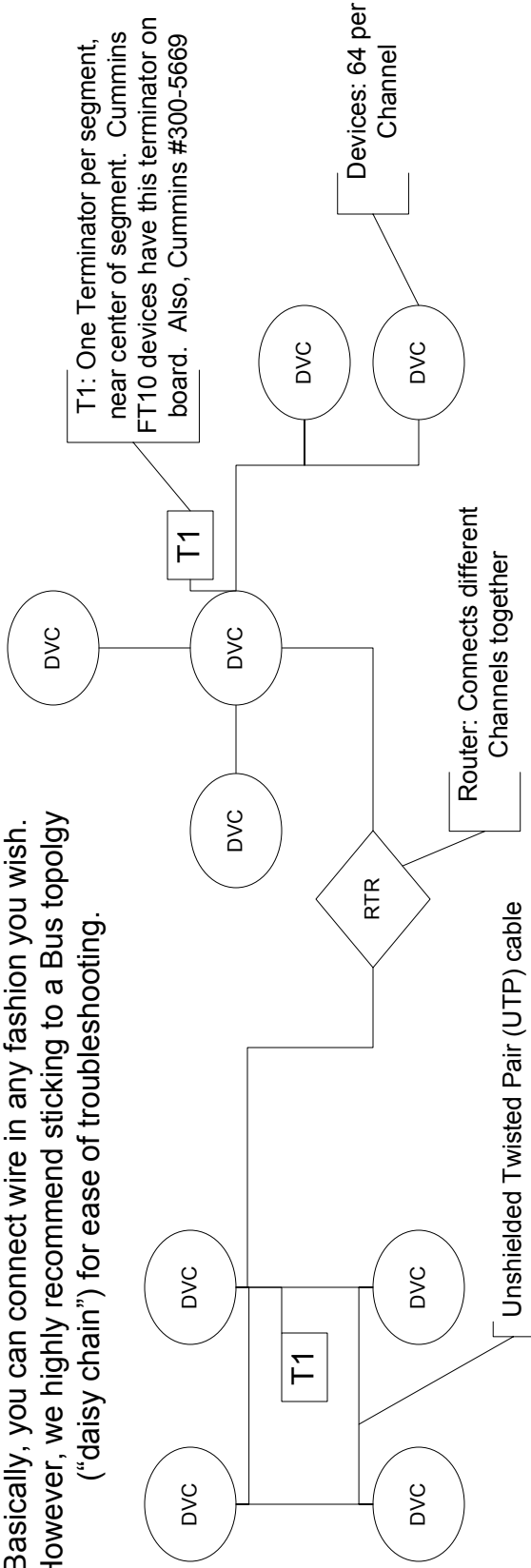
FTT-10 network segments require termination for proper data transmission performance. Free topology and Double-terminated Bus topology networks differ in their termination requirements.

Free topology segments only require one terminator per segment. This terminator can be placed anywhere in the segment, but is recommended to be placed near the middle of the segment. All PowerCommand network interface modules (i.e. GCM, NCM, GLC), Control Communications Modules (CCM), Digital I/O Modules (DIM) and Lonworks Annunciators have an on-board free topology terminator. It is recommended that this be used on a free topology segment. Optionally an external free topology terminator (Onan P/N 0300-5669) can be used.

Double-terminated Bus segments must be terminated at both ends of the segment. An FTT-10 Bus terminator (Onan P/N 0300-5729) must be used.

FT-10 Physical Wiring: Method 1, Free Topology

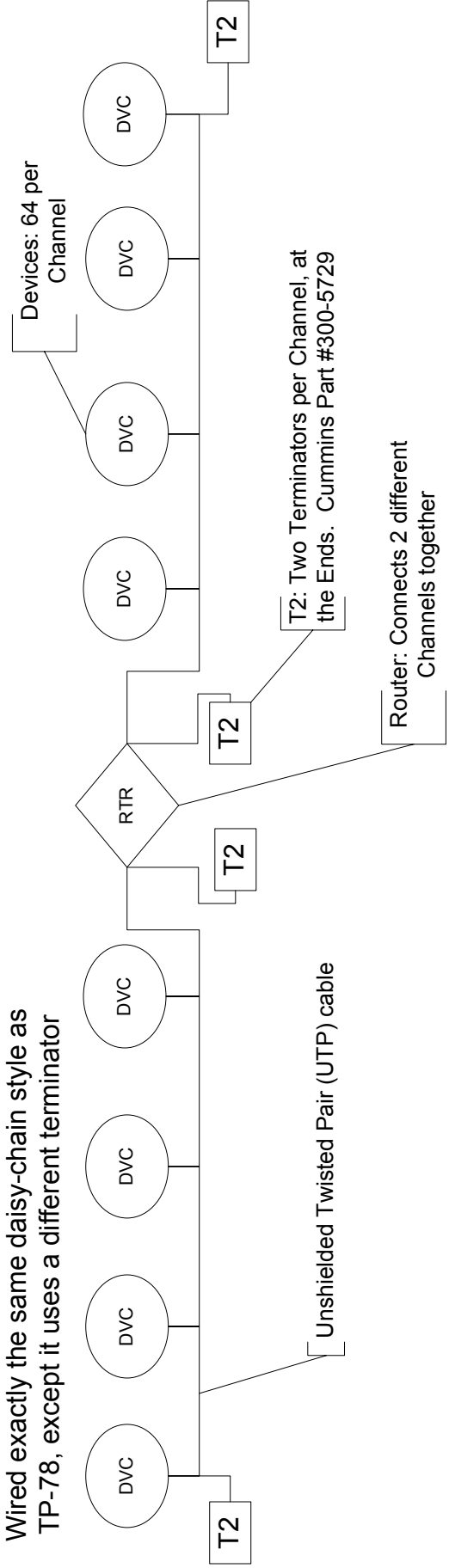
Basically, you can connect wire in any fashion you wish. However, we highly recommend sticking to a Bus topology ("daisy chain") for ease of troubleshooting.



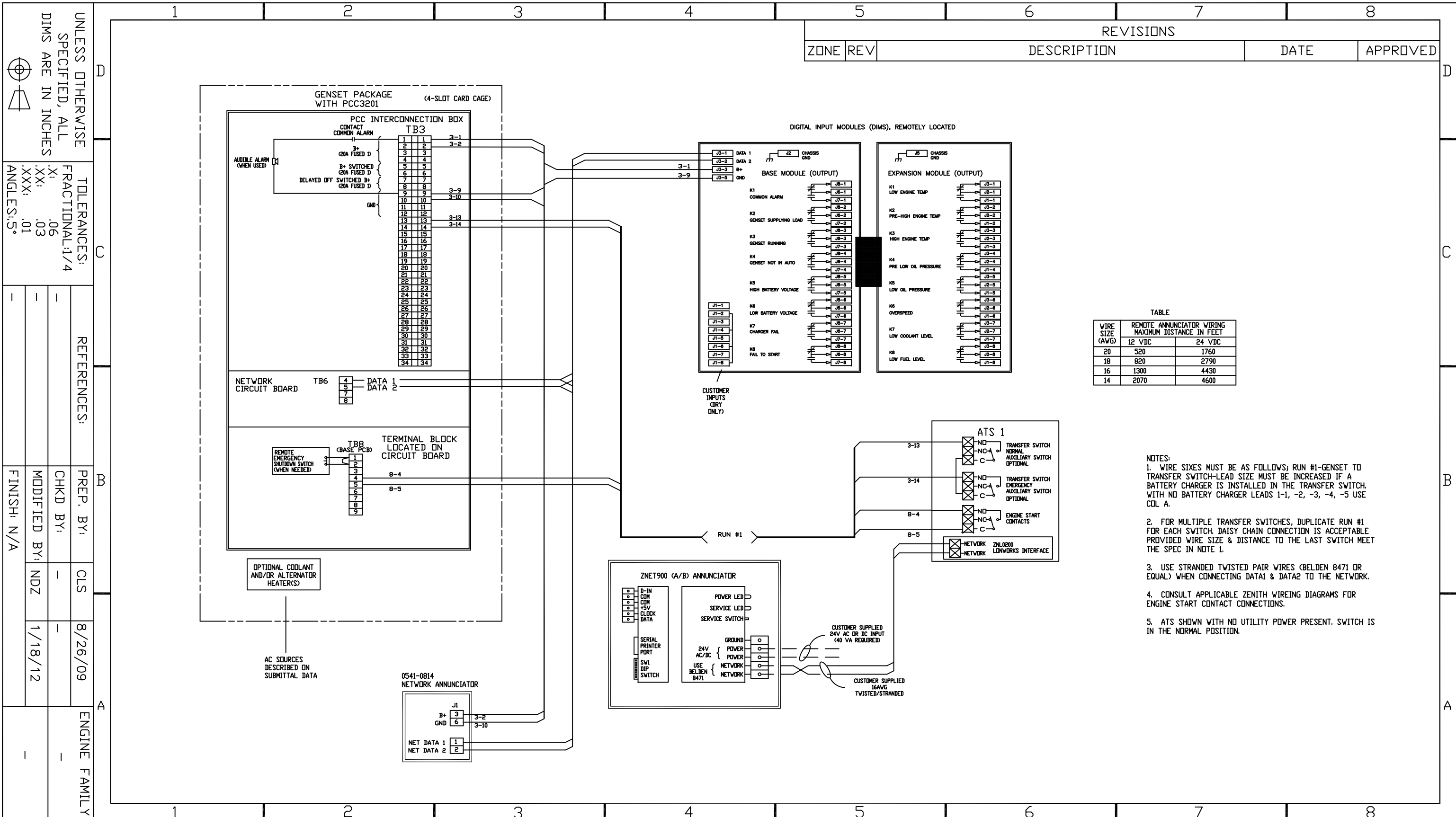
Note: Although LonMaker says that you can have 2 segments to a channel, we are not confident in this, so stick to a maximum of 64 devices, 1 segment per channel

FT-10 Physical Wiring: Method 2, Multi-Drop Bus

Wired exactly the same daisy-chain style as TP-78, except it uses a different terminator



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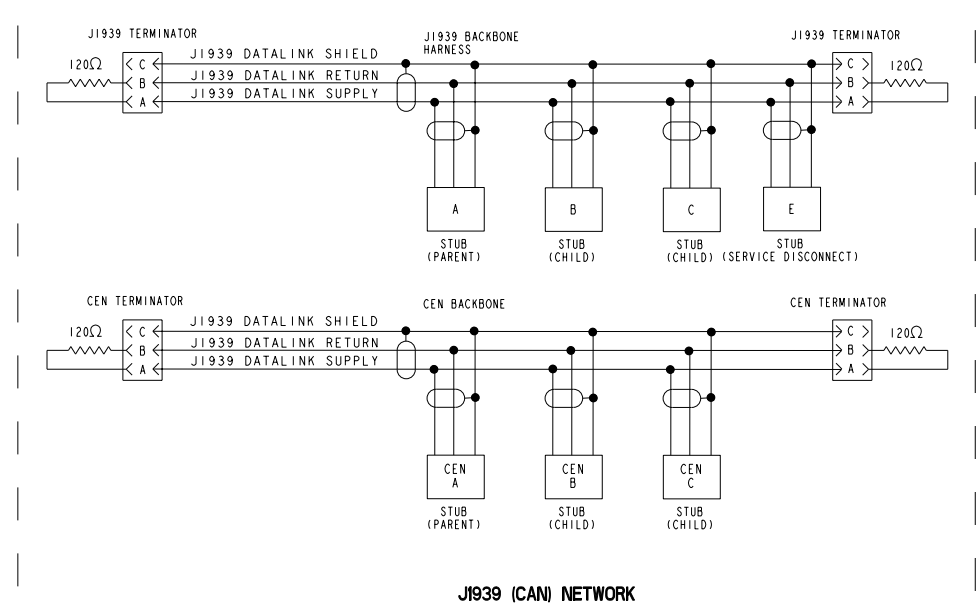
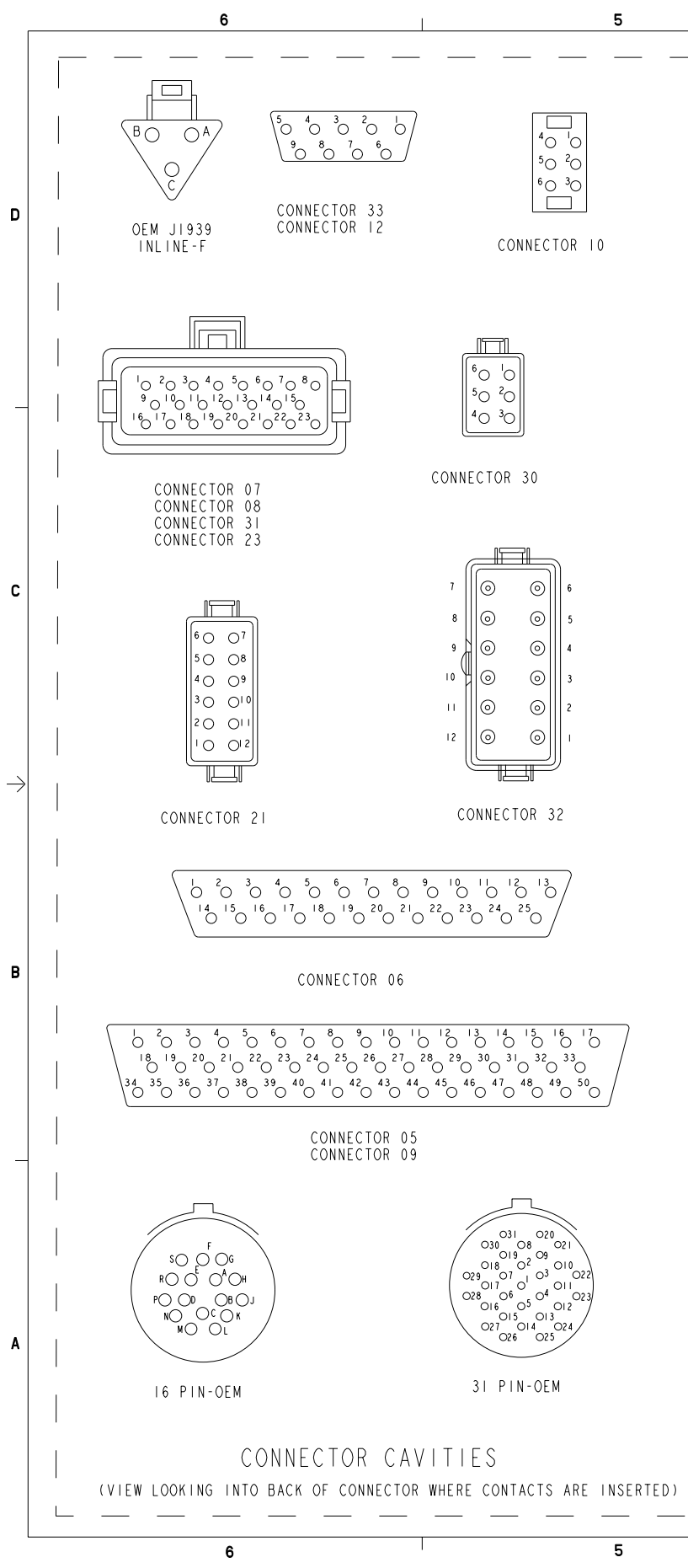
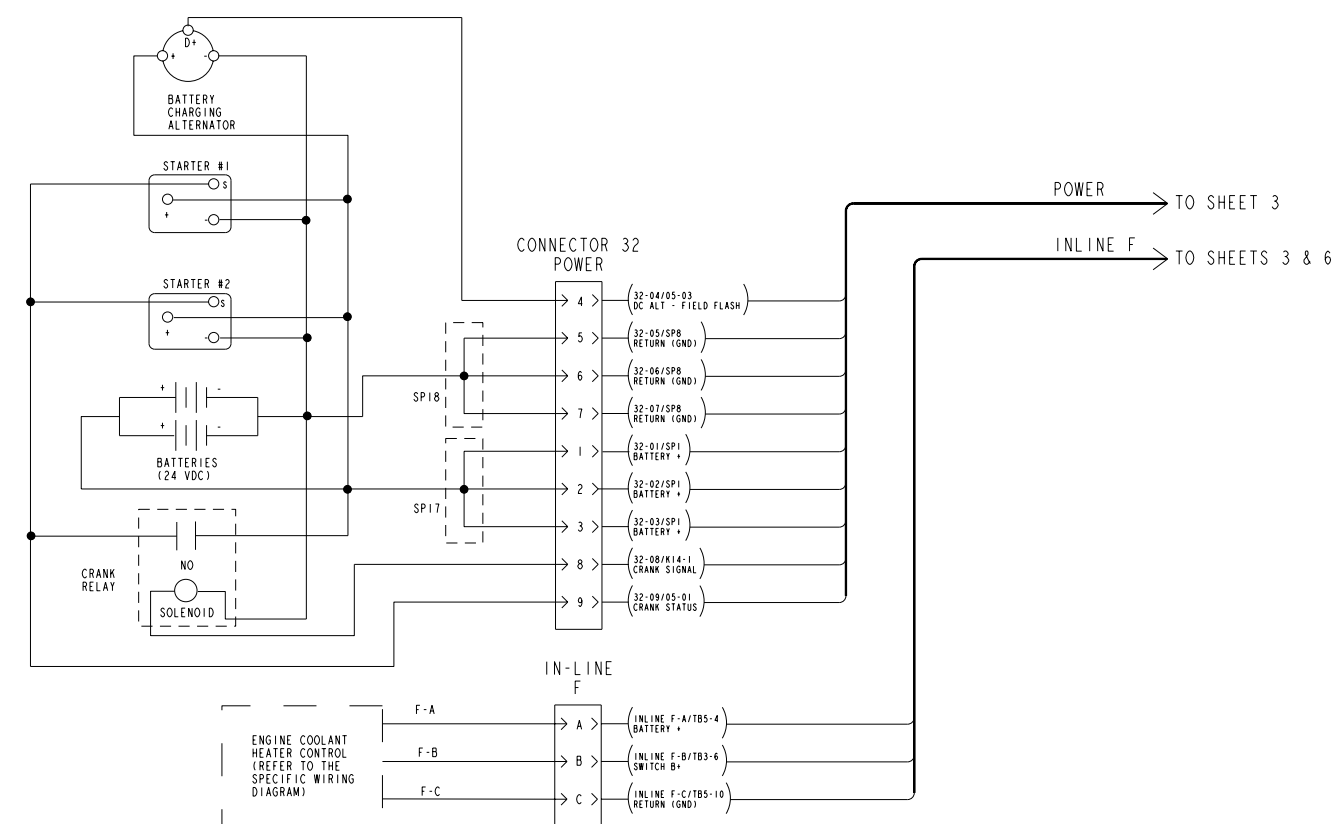


	8211 E 96th AVE HENDERSON, COLORADO 80640 PH: 303-287-0201 FAX: 303-287-4837	SITE NAME: HAROLD D THOMPSON WATER RECLAMATION	CONTACT NAME: -	CUSTOMER PROJECT NO: -	TITLE: INTERCONNECT PCC3201 NETWORK & Z-NET ANNUNCIATOR
	CONTRACTOR NAME: MCDADE WOODCOCK	CONTACT NO: -	CRM PROJECT NO: 63439	SIZE DWG NO: 5000536 SCALE: NONE DO NOT SCALE	REV: A SHEET: 1 OF 1

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REL NO	LIT	NO	REVISION	ZONE	DWN	CKD	APVD	DATE
ECO-101553	D	1	SEE PAGE 4		CF	MT	TULADHAR	04SEP08

ENGINE STARTER/POWER HARNESS

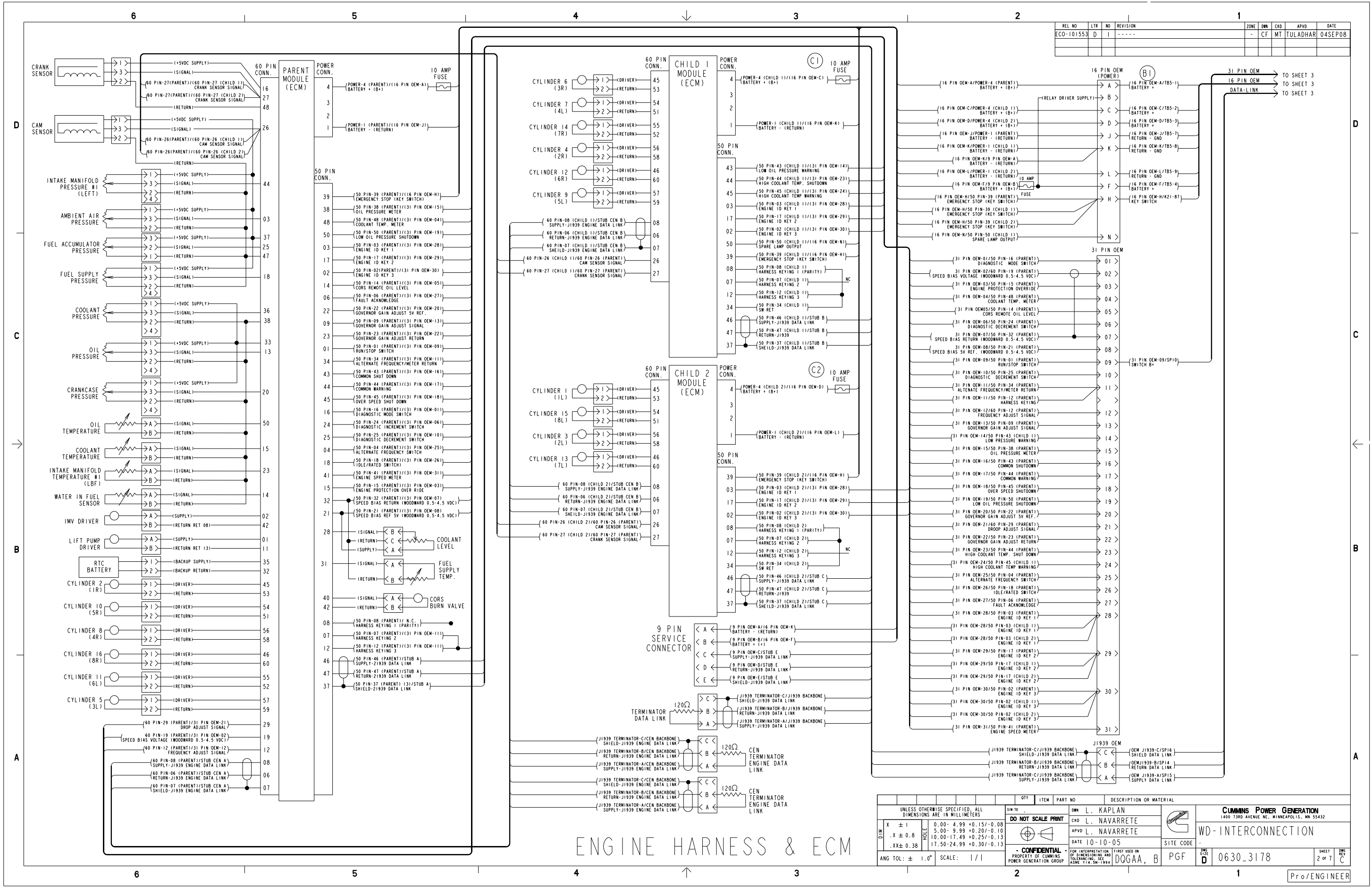


- NOTE:
1. WIRE DESIGNATIONS ARE IN FROM / TO FORMAT INCLUDING SIGNAL DESCRIPTION.
 2. THIN LINES REPRESENT SINGLE WIRES AND HEAVY LINES REPRESENT BUNDLED WIRES.

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		DWT		ITEM		PART NO		DESCRIPTION OR MATERIAL	
DO NOT SCALE PRINT		DWN		L. KAPLAN		CUMMINS POWER GENERATION		1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432	
X ± 1		TOLER		5.00- 9.99 +0.15/-0.08		APVD		L. NAVARRETE	
.X ± 0.8		TOLER		10.00-17.49 +0.25/-0.13		DATE		10-10-05	
.XX ± 0.38		TOLER		17.50-24.99 +0.30/-0.13		SITE CODE			
ANG TOL: ± 1.0°		SCALE: 1/1		PROPERTY OF CUMMINS POWER GENERATION GROUP		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994		FIRST USED ON	
				DOGAA, B		PGF		0630-3178	
								SHEET 1 OF 7	

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REL NO	LTN	NO	REVISION	ZONE	OWN	CHK	APVD	DATE
ECO-101553	D	1	----		CF	MT	TULADHAR	04SEP08



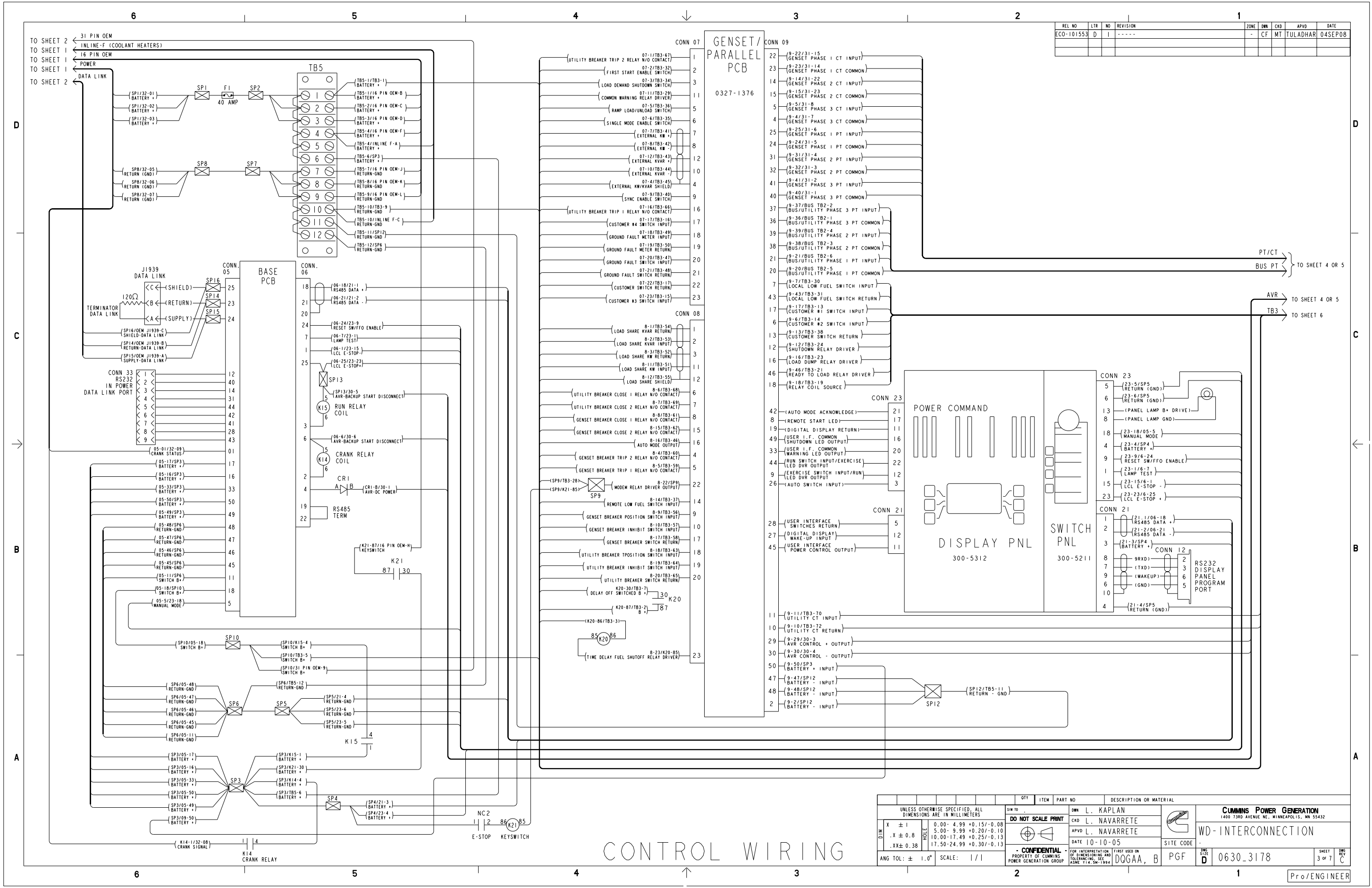
ENGINE HARNESS & ECM

QTY	ITEM	PART NO	DESCRIPTION OR MATERIAL
1	DO NOT SCALE PRINT		
1	11939 TERMINATOR-C/J1939 BACKBONE		
1	11939 TERMINATOR-B/J1939 BACKBONE		
1	11939 TERMINATOR-A/J1939 BACKBONE		
1	11939 TERMINATOR-C/J1939 BACKBONE		
1	11939 TERMINATOR-B/J1939 BACKBONE		
1	11939 TERMINATOR-A/J1939 BACKBONE		
1	11939 TERMINATOR-C/J1939 BACKBONE		
1	11939 TERMINATOR-B/J1939 BACKBONE		
1	11939 TERMINATOR-A/J1939 BACKBONE		

Prof. ENGINEER

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REL NO	LTN	NO	REVISION	ZONE	OWN	CHK	APVD	DATE
ECO-101553	D	1	-----		CF	MT	TULADHAR	04SEP08



CONTROL WIRING

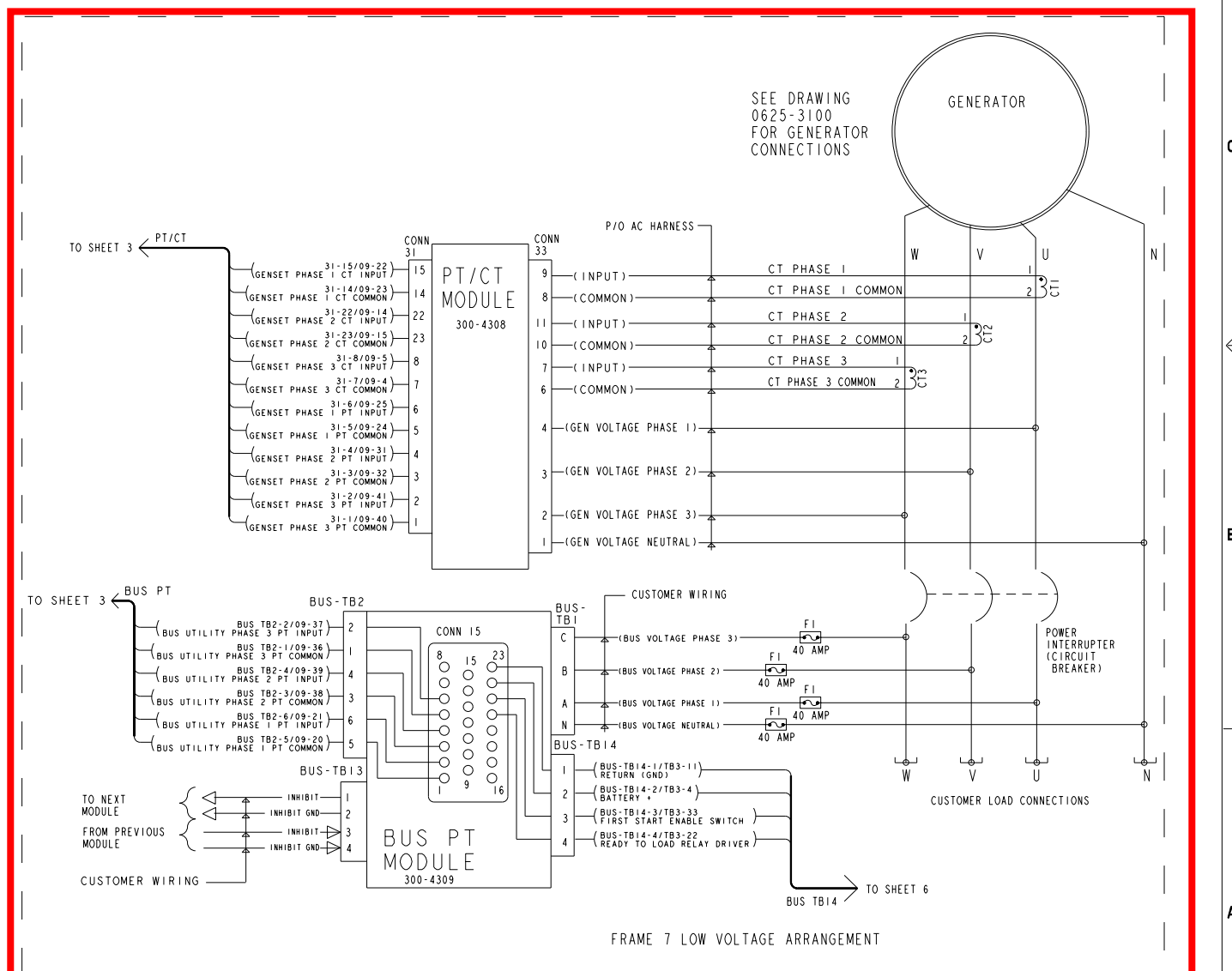
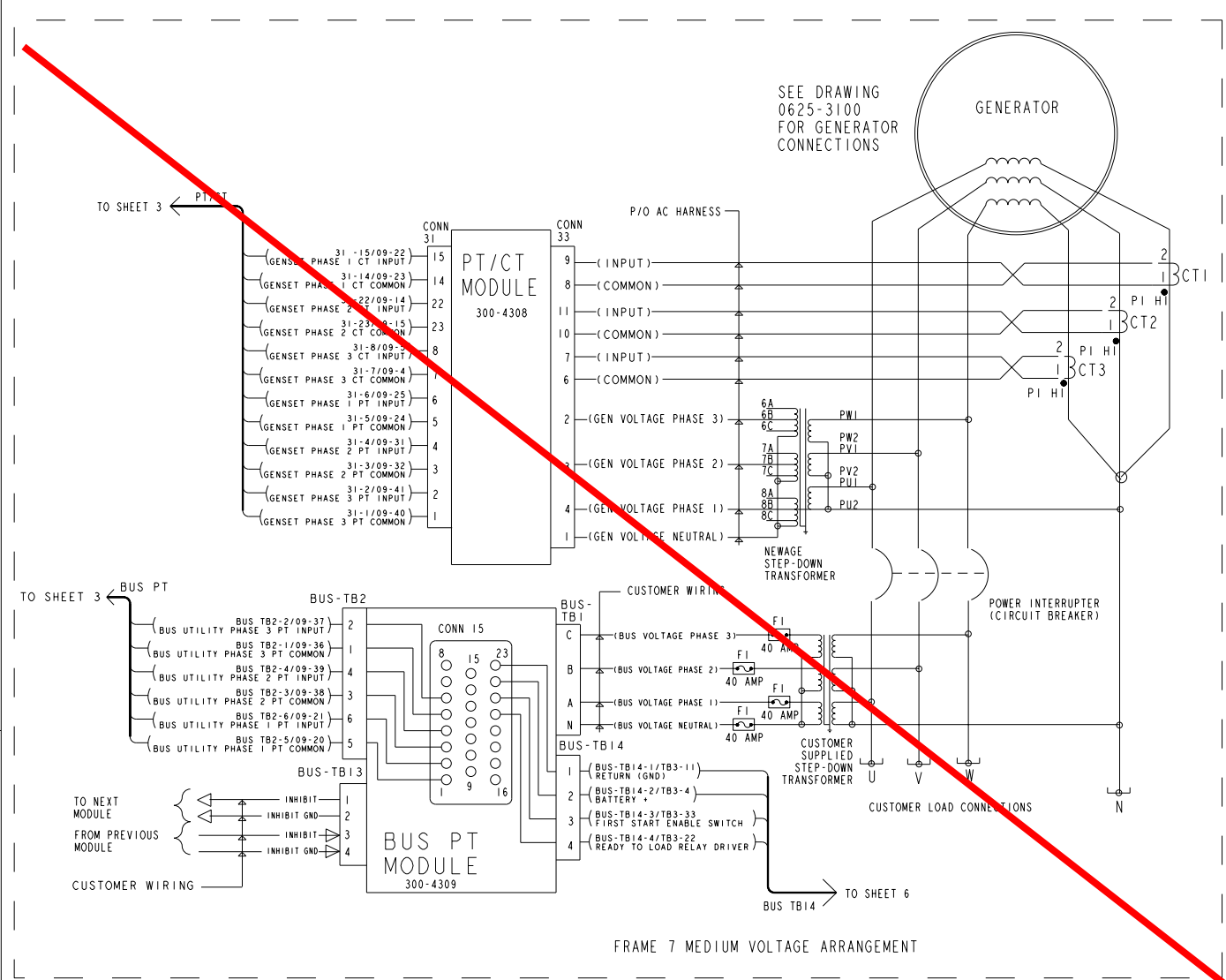
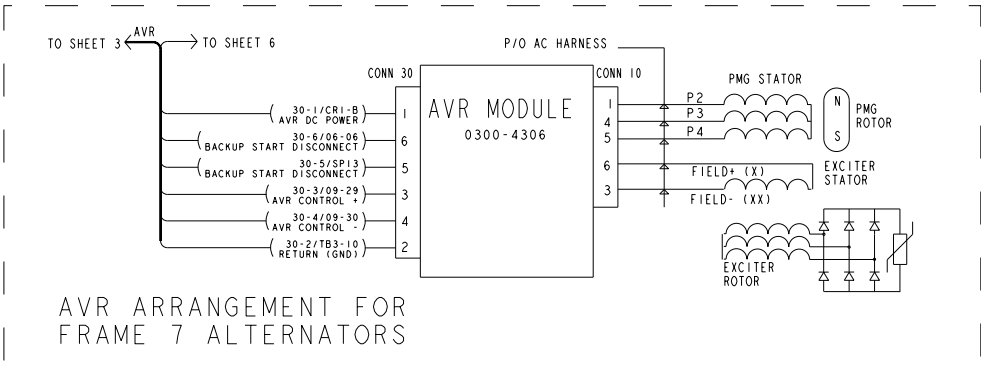
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		DTL		ITEM	PART NO	DESCRIPTION OR MATERIAL
X ± 1		DO NOT SCALE PRINT		OWN	L. KAPLAN	
.X ± 0.8		CONFIDENTIAL		CHK	L. NAVARRETE	
.XX ± 0.38		FOR INTERPRETATION AND TOLERANCING, SEE ASME Y14.5M-1994		APVD	L. NAVARRETE	
ANG TOL: ± 1.0°		SCALE: 1/1		DATE	10-10-05	
				SITE CODE		
				SIZE	D 0630-3178	
				SHEET	3 OF 7	
				DRG	C	

Prof/ENGINEER

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REL NO	LTR	NO	REVISION	ZONE	DWN	CHK	APVD	DATE
ECO-101553	D	1	ZONE B2 GEN VOLTAGE PHASE 3 & PHASE 1 SWITCH PLACES	-	CF	MT	TULADHAR	04SEP08

GENERATOR / BUS CONNECTIONS

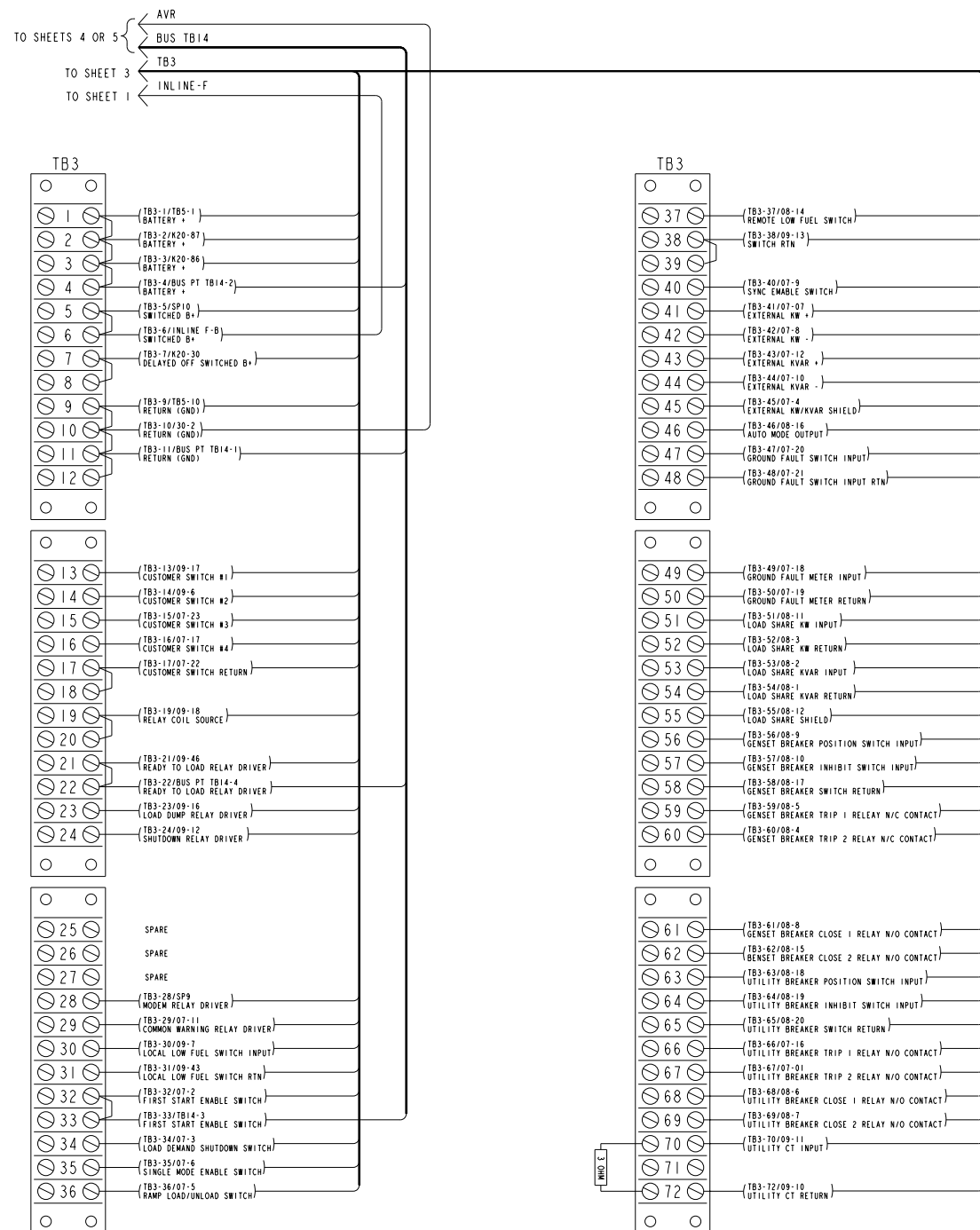


DIM		TOLERANCE		SCALE		DATE		SHEET	
X ± 1	0.00 - 4.99 +0.15/-0.08	DO NOT SCALE PRINT	DATE 10-10-05	4 of 7	PROF/ENGINEER	CUMMINS POWER GENERATION 1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432			
.X ± 0.8	5.00 - 9.99 +0.20/-0.10	CONFIDENTIAL	DATE 10-10-05	4 of 7	PROF/ENGINEER	WD-INTERCONNECTION			
.XX ± 0.38	10.00 - 17.49 +0.25/-0.13	PROPERTY OF CUMMINS POWER GENERATION GROUP	DATE 10-10-05	4 of 7	PROF/ENGINEER	0630-3178			
ANG TOL: ± 1.0°	17.50 - 24.99 +0.30/-0.13	FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	DATE 10-10-05	4 of 7	PROF/ENGINEER	0630-3178			

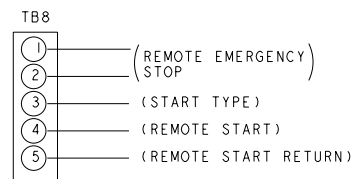
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CUSTOMER CONNECTIONS

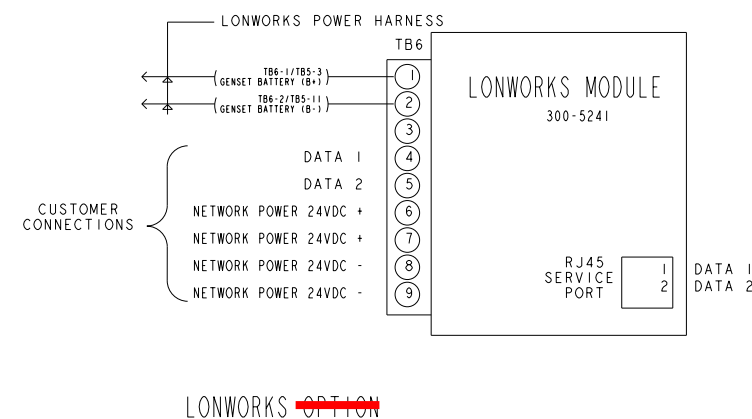
REL NO	LTR NO	REVISION	ZONE	DWN	CRD	APVD	DATE
ECO-101553	D	1	----	-	CF	MT	TULADHAR 04SEP08



CUSTOMER CONNECTIONS ON BASE PCB



TABULATION		
TB8-	FUNCTION	DESCRIPTION
1 2	REMOTE EMERGENCY STOP	OPEN THE CONNECTION BETWEEN THESE TERMINAL POSITIONS TO INITIATE AN EMERGENCY STOP. TERMINAL POSITIONS MUST BE SHORTED TOGETHER IF REMOTE EMERGENCY STOP IS NOT USED.
3	REMOTE START TYPE	DETERMINES START TYPE: OPEN = EMERGENCY START SEQUENCE. CLOSED = NORMAL START SEQUENCE. APPLY REMOTE START RETURN (TB8-5) TO CLOSE.
4	REMOTE START	APPLY REMOTE START RETURN (TB8-5) TO REMOTE START THE GENSET.
5	REMOTE START RETURN	RETURN LINE FOR REMOTE START TYPE AND REMOTE START.



UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		DTM	ITEM	PART NO	DESCRIPTION OR MATERIAL
X ± 1	0.00- 4.99 +0.15/-0.08	DO NOT SCALE PRINT		DWN	L. KAPLAN
.X ± 0.8	5.00- 9.99 +0.20/-0.10	PROPERTY OF CUMMINS POWER GENERATION GROUP		CRD	L. NAVARRETE
.XX ± 0.38	10.00-17.49 +0.25/-0.13	FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994		APVD	L. NAVARRETE
ANG TOL: ± 1.0°	17.50-24.99 +0.30/-0.13	DATE	10-10-05	DATE	10-10-05
SCALE: 1/1		SITE CODE		PGF	0630-3178

CUMMINS POWER GENERATION
1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432

WD-INTERCONNECTION

DATE 10-10-05
SITE CODE
PGF 0630-3178

Proj/ENGINEER

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REL NO	LTN	NO	REVISION	ZONE	DWN	CFD	APVD	DATE
ECO-101553	D	1	-----	-	CF	MT	TULADHAR	04SEP08

TB3-	FUNCTION	DESCRIPTION
1-4	B+	24VDC/10 AMPS BATTERY VOLTAGE SUPPLY
5-6	SWITCHED B+	24VDC/10 AMPS BATTERY VOLTAGE SUPPLY, AVAILABLE WHEN GENSET IS RUNNING
7-8	DELAYED OFF SWITCHED B+	24VDC/10 AMPS BATTERY VOLTAGE SUPPLY, AVAILABLE WHEN GENSET IS RUNNING. CONFIGURABLE DELAYED OFF IS TYPICALLY USED FOR FUEL SHUTOFF
9-12	GND	BATTERY NEGATIVE
13	CONFIGURABLE INPUT #1	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
14	CONFIGURABLE INPUT #2	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
15	CONFIGURABLE INPUT #3	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
16	CONFIGURABLE INPUT #4	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
17	CONFIGURABLE INPUT RETURN	RETURN PATH FOR CONFIGURABLE INPUTS. (TB3-13,14,15,16)
19	RELAY COIL SOURCE	SWITCHED 24VDC POWER SUPPLY. USE ON THE HIGH SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH A RELAY DRIVER. PROVIDES A MINIMUM 800ma OF CURRENT
21-22	READY TO LOAD RELAY DRIVER	ACTIVATES WHEN GENSET HAS REACHED 90% OF FREQUENCY. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH A RELAY COIL SOURCE (TB3-19/20)
23	LOAD DUMP RELAY DRIVER	ACTIVATES AT A CONFIGURABLE LOAD LEVEL OR UNDER FREQUENCY CONDITION. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH A RELAY COIL SOURCE (TB3-19/20)
24	COMMON SHUTDOWN RELAY DRIVER	ACTIVATES ON ANY GENSET SHUTDOWN CONDITION. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH A RELAY COIL SOURCE (TB3-19/20)
25	SPARE	
26	SPARE	
27	SPARE	
28	MODEM RELAY DRIVER	PROVIDES A CONFIGURABLE METHOD OF CONTROLLING AND CYCLING POWER TO AN EXTERNAL MODEM. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH RELAY COIL SOURCE (TB3-19/20)
29	COMMON WARNING RELAY DRIVER	ACTIVATES ON ANY WARNING CONDITION. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH A RELAY COIL SOURCE (TB3-19/20)
30	LOCAL LOW FUEL INPUT	PROVIDES A LOW FUEL INDICATION FOR GENSETS SUPPLIED WITH A DAY TANK OR AN INTEGRATED FUEL TANK. SWITCH RETURN WITH TB3-31
31	LOCAL LOW FUEL RETURN	SWITCH RETURN FOR LOCAL LOW FUEL INPUT (TB3-30)
32-33	FIRST START INPUT	FOR PARALLELING APPLICATIONS, CONNECTS TO REMOTE MASTER START SENSOR OR BUS PT IMODULE WITH FIRST START SENSOR
34	LOAD DEMAND INPUT	FOR MULTIPLE GENSET PARALLEL APPLICATIONS. INPUT ALLOWS GENSET TO RAMP TO NO LOAD, OPEN BREAKER AND SHUT DOWN. REMOVING INPUT CAUSES GENSET TO START, SYNCHRONIZE, CLOSE BREAKER, AND RAMP TO LOAD. APPLY WITH SWITCH RETURN (TB3-38/39)
35	SINGLE MODE ENABLE INPUT	FOR SINGLE GENSET PARALLEL POWER TRANSFER (PLT) APPLICATIONS ONLY. APPLY WITH SWITCH RETURN (TB3-38/39) TO ENABLE MODE
36	RAMP LOAD/UNLOAD SWITCH	USED WITH MULTIPLE GENSETS IN PARALLEL IN CONJUNCTION WITH A MASTER CONTROL OR OTHER PLC DEVICE. APPLY SWITCH RETURN (TB3-38/39) TO LOAD/UNLOAD GENSET AS LOAD PROFILE DICTATES
37	REMOTE LOW FUEL INPUT	PROVIDES A LOW FUEL INDICATION FOR GENSETS THAT ARE NOT FITTED WITH AN INTEGRATED FUEL TANK. APPLY SWITCH RETURN TB3-38/39 TO ACTIVATE
38-39	SWITCH RETURN	SWITCH RETURN FOR TB3-34, 35, 36, AND 37
40	SYNC ENABLE INPUT	FOR USE IN SINGLE MODE PLT APPLICATIONS ONLY. INPUT SIGNALS GENSET TO SYNCHRONIZE WITH UTILITY
41	LOAD GOVERN KW+ INPUT	ALLOWS A REMOTE DEVICE TO CONTROL KW LOAD ON GENSET WHILE UTILITY PARALLELED. ANALOG INPUT 0-5VDC
42	LOAD GOVERN KW-	RETURN LINE LOAD GOVERN KW
43	LOAD GOVERN KVAR+ INPUT	ALLOWS A REMOTE DEVICE TO CONTROL KVAR LOAD ON GENSET WHILE UTILITY PARALLELED. ANALOG INPUT 0-5VDC. THIS INPUT IS DEFAULTED TO "DISABLED" AND IS ENABLED WITH INPOWER
44	LOAD GOVERN KVAR-	RETURN LINE LOAD GOVERN KVAR

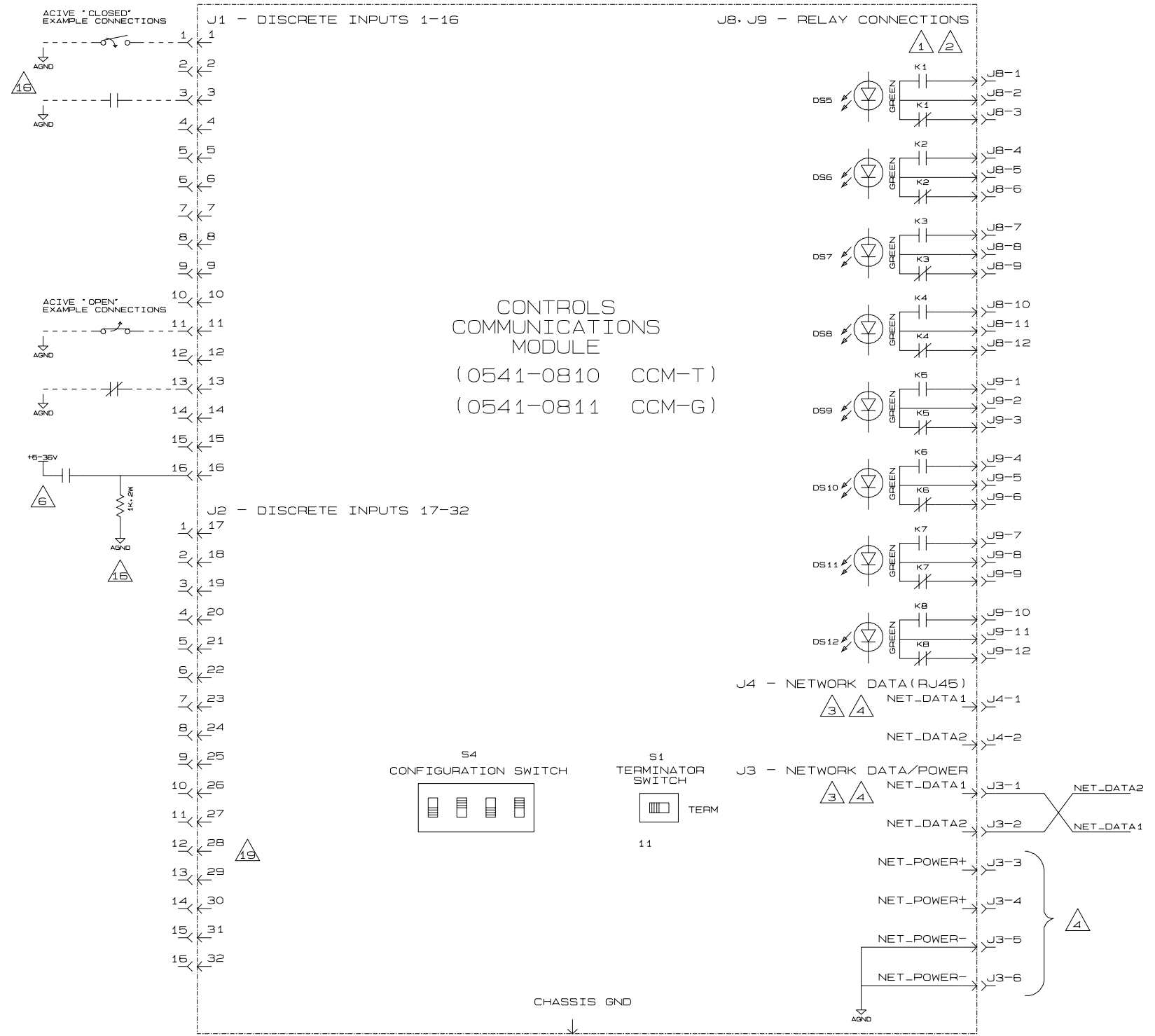
TB3-	FUNCTION	DESCRIPTION
45	EXTERNAL KW/KVAR SHIELD	SHIELD TERMINATION POINT FOR LOAD GOVERN INPUTS
46	AUTO MODE OUTPUT	SWITCH BATTERY 24VDC, FUSED AT 5A. AVAILABLE WHEN GENSET IS IN AUTO MODE
47	GROUND FAULT INPUT	ACTIVATES A GROUND FAULT WARNING WHEN SWITCHED TO THE GROUND FAULT RETURN (TB3-48). USE IN CONJUNCTION WITH AN EXTERNAL GROUND FAULT RELAY
48	GROUND FAULT RETURN	RETURN LINE FOR GROUND FAULT INPUT
49	GROUND FAULT ANALOG INPUT	FUTURE FEATURE
50	GROUND FAULT METER RETURN	RETURN LINE FOR GROUND FAULT ANALOG INPUT
51	LOAD SHARE KW+	FOR ISOLATED BUS PARALLELING ONLY. KW LOAD SHARING LINES FOR POWER COMMAND GENSETS
52	LOAD SHARE KW-	RETURN FOR LOAD SHARE KW
53	LOAD SHARE KVAR+	FOR ISOLATED BUS PARALLELING ONLY. KVAR LOAD SHARING LINES FOR POWER COMMAND GENSETS
54	LOAD SHARE KVAR+	RETURN FOR LOAD SHARE KVAR
55	LOAD SHARE SHIELD	SHIELD TERMINATION POINT FOR LOAD SHARE KW AND LOAD SHARE KVAR LINES
56	GENSET BREAKER POSITION SWITCH INPUT	FOR PARALLELING AND POWER TRANSFER CONTROL APPLICATIONS. WHEN CLOSED INDICATES TO CONTROL THAT GENSET BREAKER IS CLOSED. USE WITH GENSET BREAKER SWITCH RETURN (TB3-58)
57	GENSET BREAKER INHIBIT SWITCH INPUT	FOR PARALLELING APPLICATIONS. WHEN CLOSED TO GENSET BREAKER SWITCH RETURN (TB3-50), GENSET BREAKER WILL OPEN, OR BE PREVENTED FROM CLOSING
58	GENSET BREAKER SWITCH RETURN	RETURN LINE FOR TB3-56/57
59	GENSET BREAKER OPEN COMMAND	FOR USE IN PARALLELING AND POWER TRANSFER CONTROL APPLICATIONS. NORMALLY CLOSED CONTACT THAT OPENS TO OPEN GENSET BREAKER. USE WITH TB3-60
60	GENSET BREAKER OPEN COMMAND RETURN	USE WITH TB3-59
61	GENSET BREAKER CLOSE COMMAND	FOR USE IN PARALLELING AND POWER TRANSFER CONTROL APPLICATIONS. NORMALLY OPEN CONTACT THAT CLOSSES TO CLOSE GENSET BREAKER. USE WITH TB3-62
62	GENSET BREAKER CLOSE COMMAND RETURN	USE WITH TB3-61
63	UTILITY BREAKER POSITION INPUT	FOR POWER TRANSFER CONTROL APPLICATIONS. WHEN CLOSED INDICATES TO CONTROL THAT UTILITY BREAKER IS CLOSED. USE WITH UTILITY BREAKER RETURN (TB3-65)
64	UTILITY BREAKER INHIBIT INPUT	FOR POWER TRANSFER CONTROL APPLICATIONS. WHEN CLOSED TO UTILITY BREAKER RETURN (TB3-65), UTILITY BREAKER WILL OPEN, OR BE PREVENTED FROM CLOSING
65	UTILITY BREAKER RETURN	USE WITH TB3-63/64
66	UTILITY BREAKER OPEN COMMAND	FOR POWER TRANSFER CONTROL APPLICATIONS. NORMALLY CLOSED CONTACT THAT OPENS TO OPEN UTILITY BREAKER. USE WITH TB3-67
67	UTILITY BREAKER OPEN COMMAND RETURN	USE WITH TB3-66
68	UTILITY BREAKER CLOSE COMMAND	FOR POWER TRANSFER CONTROL APPLICATIONS. NORMALLY OPEN CONTACT THAT CLOSSES TO CLOSE UTILITY BREAKER. USE WITH TB3-69
69	UTILITY BREAKER CLOSE COMMAND RETURN	USE WITH TB3-68
70	SYSTEM LOAD INPUT	FOR POWER TRANSFER CONTROL APPLICATIONS. ACCEPTS CT INPUT FOR MONITORING B PHASE CURRENT ON THE UTILITY BUS. USE UTILITY CT RETURN (TB3-72). A 3 OHM BURDEN RESISTOR IS CONNECTED ACROSS TB3-70 AND TB3-72
71	SPARE	
72	SYSTEM LOAD RETURN	USE WITH TB3-70

CUSTOMER CONNECTIONS
(DESCRIPTIONS)

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		DTM	ITEM	PART NO	DESCRIPTION OR MATERIAL
X ± 1		DO NOT SCALE PRINT		DWN L. KAPLAN	CUMMINS POWER GENERATION 1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432
.X ± 0.8				CFD L. NAVARRETE	WD-INTERCONNECTION
.XX ± 0.38				APVD L. NAVARRETE	DATE 10-10-05
ANG TOL: ± 1.0°		SCALE: 1/1		DATE 10-10-05	SITE CODE
				DATE 10-10-05	SHEET 7 OF 7
				DATE 10-10-05	PROJ 0630_3178
				DATE 10-10-05	PROJ 0630_3178

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REV. NO.	DATE	BY	CHKD	APPROVED	DATE
FRO11647	A	1			03-22-02
FRO13621	B	1			02-04-02
FRO14880	C	1			02-03-03
FRO29208	D	1			08-26-06

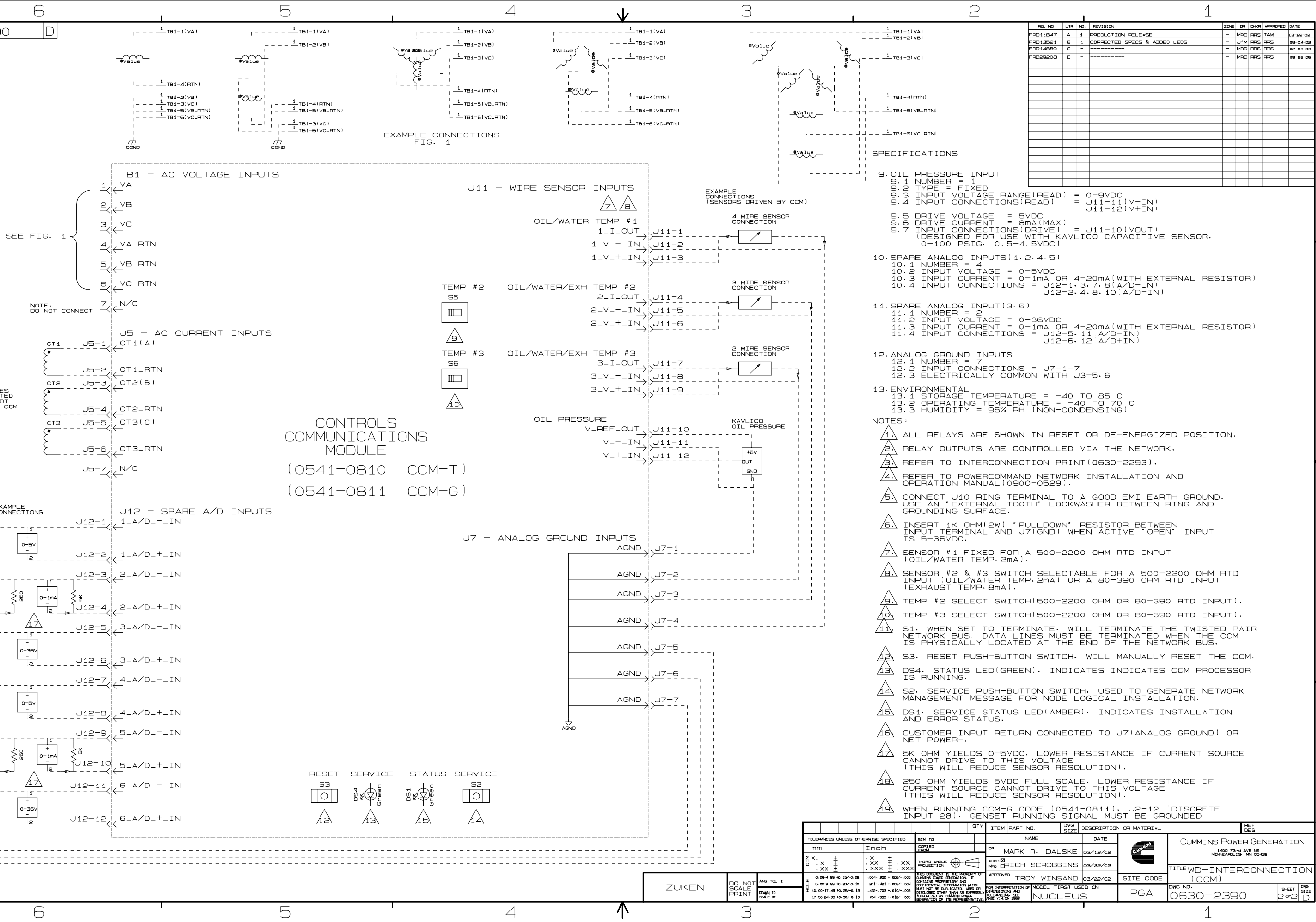


SPECIFICATIONS

- NET POWER**
 - INPUT VOLTAGE = 5-36VDC (OPERATING RANGE)
 - INPUT CURRENT = 150mA @ 36VDC
200mA @ 24VDC
400mA @ 12VDC
1.25A @ 5VDC
- NET DATA**
 - TYPE = ECHELON LONTALK FT10
 - INPUT CONNECTIONS = J3-1(NET DATA1)
J3-2(NET DATA2)
J4-1(RJ45-NET DATA1)
J4-2(RJ45-NET DATA2)
(J4(RJ45), SERVICE/INSTALLATION USE ONLY)
- DISCRETE INPUTS**
 - TYPE = DISCRETE
 - NUMBER = 32
CONNECT TO DRY CONTACTS ONLY
RETURN TO ANALOG GROUND(J7)
 - OUTPUT CURRENT = 0.5mA SOURCE (INPUTS 1-24, CLOSED)
0.05mA SOURCE (INPUTS 25-32, CLOSED)
 - VOLTAGE THRESHOLDS (TO ACTIVATE) = 1V (FOR ACTIVE "CLOSED")
4V (FOR ACTIVE "OPEN")
 - INPUT CONNECTIONS = J1(INPUT 1-16)
J2(INPUT 17-32)
J7(ANALOG GROUND)
- RELAY OUTPUTS**
 - TYPE = NON-LATCHING
 - NUMBER = 8 (K1, K2, K3, K4, K5, K6, K7, K8)
 - CONTACTS = 1 FORM C
2A @ 30VDC
2A @ 250VAC
 - OUTPUT CONNECTIONS = J8, 9-3, 6, 9, 12(N/C CONTACTS)
J8, 9-2, 5, 8, 11(COMMON)
J8, 9-1, 4, 7, 10(N/O CONTACTS)
- 3 PHASE VOLTAGE INPUTS**
 - INPUT VOLTAGE = 0-600VAC(LINE-TO-LINE) OR 0-347VAC(LINE-TO-NEUTRAL)
 - INPUT CONNECTIONS = TB1-1, 2, 3(VA, VB, VC)
TB1-4, 5, 6(VA RTN, VB RTN, VC RTN)
TB1-7(DO NOT CONNECT)
 - MAXIMUM VOLTAGE BETWEEN ANY LINE(TB1-1 TO 6)
AND CHASSIS GND(J10) = 0-600VAC
- 3 PHASE CURRENT INPUTS**
 - INPUT CURRENT = 0-5A AC
 - INPUT CONNECTIONS = J5-1, 3, 5(CT1, CT2, CT3)
J5-2, 4, 6(CT1 RTN, CT2 RTN, CT3 RTN)
J5-7(DO NOT CONNECT)
- RTD TEMPERATURE INPUTS**
 - NUMBER = 3
 - TYPE = 1 FIXED, 2 SWITCH SELECTABLE
 - INPUT VOLTAGE RANGE(READ) = 0-9VDC
 - DRIVE CURRENT = 2mA OR 8mA
 - INPUT CONNECTIONS(READ) = J11-2, 5, 8(V-IN)
J11-3, 6, 9(V+IN)
 - INPUT CONNECTIONS(DRIVE) = J11-1, 4, 7(I-OUT)

TOLERANCES UNLESS OTHERWISE SPECIFIED		SIM TO		QTY		ITEM PART NO.		DESCRIPTION OR MATERIAL		REF DES	
mm	Inch	COPIED	FORM	DR	MARK R. DALSKA	DATE	03/12/02	CUMMINS POWER GENERATION 1420 73rd AVE NE MINNEAPOLIS, MN 55432			
0.004	0.0015	THIRD ANGLE	PROJECTION	CHKD BY	TRICH SCROGGINS	DATE	03/22/02	TITLE WD-INTERCONNECTION (CCM)			
0.004-0.008	0.0015-0.003	APPROVED		TROY WINSAND	DATE	03/22/02	SITE CODE		DWG NO. 0630-2390		
0.008-0.012	0.0015-0.004	FOR INTERPRETATION OF DIMENSIONS AND TOLERANCES SEE		NUCLEUS	PGA		SHEET 1 of 2				
0.012-0.016	0.0015-0.005	DRAWN TO SCALE OF									
0.016-0.020	0.0015-0.006	SCALE OF									

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REL. NO.	LTR.	NO.	REVISION	DATE	APPROVED	DATE
FRD11847	A	1	PRODUCTION RELEASE			03-22-02
FRD13521	B	1	CORRECTED SPECS & ADDED LEADS			02-04-02
FRD14880	C	-	-			02-03-03
FRD29208	D	-	-			02-26-06

TOLERANCES UNLESS OTHERWISE SPECIFIED		QTY	ITEM	PART NO.	DWG. SIZE	DESCRIPTION OR MATERIAL	REF. DES.
mm	Inch						
0.01	.0005						
0.02	.0010						
0.05	.0020						
0.10	.0040						
0.15	.0060						
0.20	.0080						
0.30	.0120						
0.50	.0200						
1.00	.0400						
1.50	.0600						
2.00	.0800						

ZUKEN	DO NOT SCALE PRINT	ANG. TOL. 1	SCALE UP
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CUMMINS POWER GENERATION	
1420 72nd AVE NE	
MINNEAPOLIS, MN 55432	
TITLE WD-INTERCONNECTION (CCM)	
APPROVED	TROY WINSAND 03/22/02
DATE	03/12/02
DR	MARK R. DALSKE
CHKD BY	RICH SCROGGINS 03/22/02
APP'D BY	
DATE	
MODEL FIRST USED ON	
FOR INFORMATION OF DIMENSIONS AND TOLERANCES SEE	
ANG. TOL. 1	
SCALE UP	
SCALE OF	
ANG. TOL. 1	
SCALE OF	

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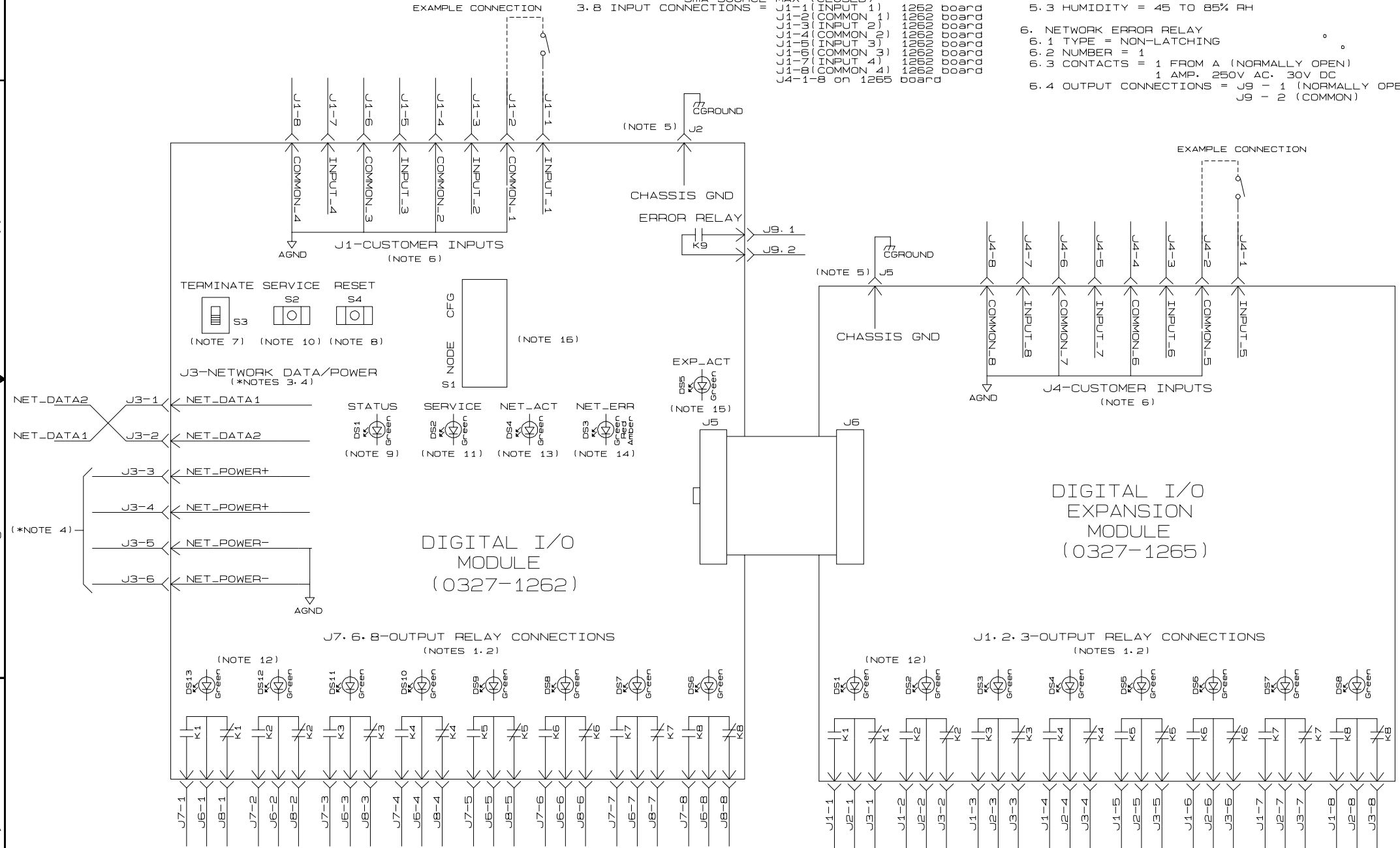
SPECIFICATIONS

1. NET POWER
 - 1.1 INPUT VOLTAGE = 8-40VDC (OPERATING RANGE)
 - 1.2 INPUT CONNECTIONS = J3-3 (NET POWER+), J3-5 (NET POWER-)
 - 1.3 OUTPUT CONNECTIONS = J3-4 (NET POWER+), J3-6 (NET POWER-)
2. NET DATA
 - 2.1 TYPE ECHOLON LONTALK™ 78kb TWISTED PAIR TRANSFORMER COUPLED
 - 2.2 INPUT CONNECTIONS = J3-1 (NET DATA1), J3-2 (NET DATA2)
3. CUSTOMER INPUTS
 - 3.1 TYPE = DISCRETE
 - 3.2 NUMBER = 4 : 8 WITH EXPANSION BOARD CONNECT TO DRY CONTACTS ONLY RETURN TO COMMON OF SAME NUMBERED INPUT
 - 3.3 OUTPUT = 5VDC (OPEN) 5mA SOURCE
 - 3.8 INPUT CONNECTIONS =

J1-1 (INPUT 1)	12662	board
J1-2 (COMMON 1)	12662	board
J1-3 (INPUT 2)	12662	board
J1-4 (COMMON 2)	12662	board
J1-5 (INPUT 3)	12662	board
J1-6 (COMMON 3)	12662	board
J1-7 (INPUT 4)	12662	board
J1-8 (COMMON 4)	12662	board
J4-1-8 on 1265	board	
4. OUTPUT RELAYS
 - 4.1 TYPE = NON-LATCHING
 - 4.2 NUMBER = 8 : 16 WITH EXPANSION BOARD
 - 4.3 CONTACTS = 1 FORM C
 - .5A @ 250VAC. 1262 BOARD
 - 1A @ 125VAC. 1265 BOARD
 - 2A @ 30VDC (RATING LIMITED BY UL TEST)
 - 4.4 OUTPUT CONNECTIONS =

J8 (N/C CONTACTS)	12662	board
J6 (COMMON)	12662	board
J7 (N/O CONTACTS)	12662	board
J3 (N/C CONTACTS)	12662	board
J2 (COMMON)	12662	board
J1 (N/O CONTACTS)	12662	board
5. ENVIRONMENTAL
 - 5.1 STORAGE TEMPERATURE = -40 TO 85 °C
 - 5.2 OPERATING TEMPERATURE = -40 TO 85 °C
 - 5.3 HUMIDITY = 45 TO 85% RH
6. NETWORK ERROR RELAY
 - 6.1 TYPE = NON-LATCHING
 - 6.2 NUMBER = 1
 - 6.3 CONTACTS = 1 FROM A (NORMALLY OPEN), 1 AMP, 250V AC, 30V DC
 - 6.4 OUTPUT CONNECTIONS = J9 - 1 (NORMALLY OPEN), J9 - 2 (COMMON)

REL. NO.	LTR.	NO.	REVISION	ZONE	DR.	CHKD.	APPROVED	DATE
FR011647	A	1	PRODUCTION RELEASE	-	TAM	MRQ	TAM	12-16-01
FR013521	B	1	SPECIFICATIONS CHANGED 4.3 ADDED 6	-	JFM	RPS	RPS	09-04-02
FR014680	C	1	REV 4.3 SPECS: ADD 1A, 125VAC, 1265	-	MRQ	RPS	RPS	02-03-03



- NOTES**
1. ALL RELAYS SHOWN IN RESET OR DE-ENERGIZED POSITION. DO NOT MAINTAIN THE LAST STATE WHEN POWER IS LOST.
 2. OUTPUT RELAYS ARE CONTROLLED VIA THE NETWORK.
 3. REFER TO INTERCONNECTION PRINT (0630-2293).
 4. REFER TO POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL (900-0529).
 5. CONNECT J2 RING TERMINAL TO A GOOD EARTH GROUND. USE AN "EXTERNAL TOOTH" LOCKWASHER BETWEEN RING AND GROUNDING SURFACE.
 6. DO NOT APPLY VOLTAGE TO CUSTOMER INPUTS 1-8.
 7. S3, WHEN SET TO TERMINATE, WILL TERMINATE THE TWISTED PAIR BUS. DATA LINES MUST BE TERMINATED WHEN THE DIM IS PHYSICALLY LOCATED AT THE END OF THE NETWORK BUS.
 8. S4, RESET PUSH-BUTTON SWITCH, WILL MANUALLY RESET THE DIM.
 9. DS1, STATUS LED (GREEN), INDICATES DIM PROCESSOR IS RUNNING.
 10. S2, SERVICE PUSH-BUTTON SWITCH, USED TO GENERATE NETWORK MANAGEMENT MESSAGE FOR NODE LOGICAL INSTALLATION.
 11. DS2, SERVICE LED (AMBER), INDICATES THE INSTALLATION AND ERROR STATUS.
 12. DS5-DS13 (GREEN) ON THE DIM BOARD INDICATE WHICH RELAYS ARE ENERGIZED. DS1-DS8 (GREEN) ON THE EXPANSION BOARD INDICATE WHICH RELAYS ARE ENERGIZED.
 13. DS3, NET-ERR LED (GREEN, RED, AMBER), INDICATES NETWORK ACTIVITY.
 14. DS3, NET-ERR LED (GREEN, RED, AMBER), INDICATES NETWORK CONNECTION. IF IT IS RED, THE DIM IS NOT CONNECTED TO THE NETWORK. IF IT IS AMBER, IT IS CONNECTED, BUT NOT BOUND. IF IT IS GREEN, THE DIM IS CONNECTED AND BOUND.
 15. DS5, EXP-ACT LED (GREEN), INDICATES COMMUNICATION BETWEEN MAIN AND EXPANSION BOARD.
 16. S1, CONFIGURATION SWITCH, USED TO CONFIGURE DEVICE FOR SELF-INSTALLATION. REFER TO POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL, 900-0529.

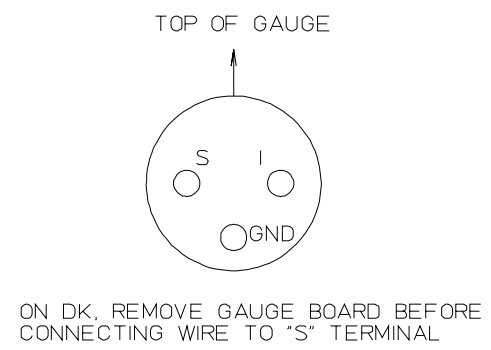
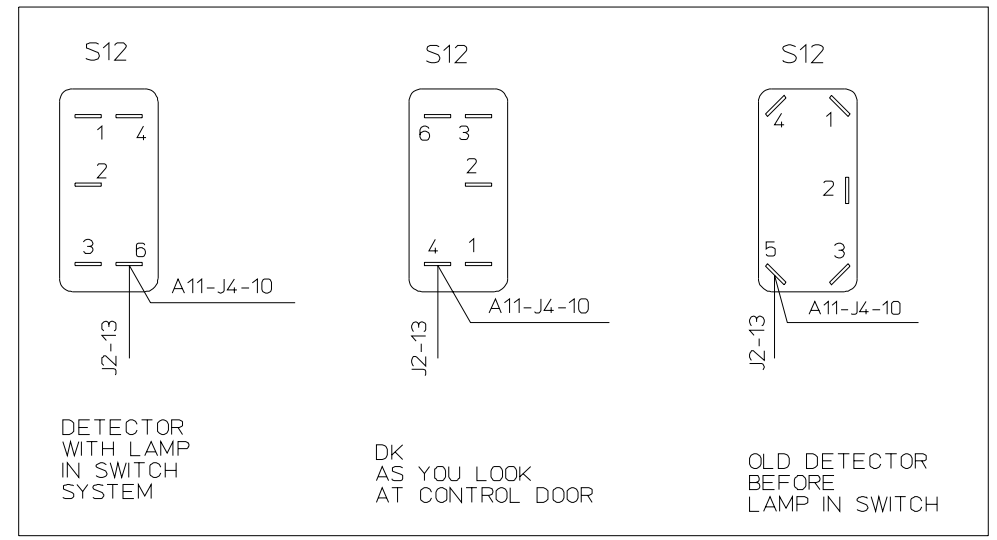
TOLERANCES UNLESS OTHERWISE SPECIFIED		SIM TO		QTY		ITEM PART NO.		DESCRIPTION OF MATERIAL		REF DES			
mm	Inch	COPIED	DATE	DR	NAME	DATE	CUMMINS POWER GENERATION						
0.004-0.008	.0015-.0031	THIRD ANGLE PROJECTION	10/18/01	DR	TROY WINSAND	10/18/01	1420 73rd AVE NE WILMINGTON, MA 01897					SHEET	DWG
0.008-0.015	.0031-.0063		02/12/02	CHKD	MARK R. DALSKE	02/12/02						TITLE	
0.015-0.030	.0063-.0125			APPROVED	TROY WINSAND	10/18/01	SITE CODE		PGA	DWG NO. 0630-2276			
0.030-0.060	.0125-.0250			FOR INFORMATION OF MODEL FIRST USED ON		NUCLEUS							

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0630-2384 D

REV NO.	LTRING	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD11847	A	1					03-22-02
FRD13521	B	1					09-04-02
FRD14880	C	1					02-03-03
		2					02-03-03

J2-13 CONNECTION



WIRE SIZE	DISTANCE IN FEET ONE WAY			C
	A 12/24V	B 12 VOLT	B 24 VOLT	
24	500	---	---	---
22	700	---	---	---
18	1500	20	175	---
16	3000	35	250	14
14	---	55	400	20
12	---	90	650	30

FOR CT'S USE COLUMN C FOR B+, GND USE COLUMN B FOR ALL ELSE USE COLUMN A

NOTES:

- 1 IF SET IS EQUIPPED WITH TIME DELAY START/STOP MODULE. THE START SIGNAL FROM CCM-J8-1 SHOULD BE CONNECTED TO A15-TB1-5. IF NOT EQUIPPED THE START SIGNAL WILL BE CONNECTED TO A11-TB1-6.
- 2 S12 IDENTIFICATION:
DK CONTROL...S12, AS YOU LOOK AT THE CONTROL DOOR OPEN, IS LOCATED ON YOUR LEFT. YOU NEED TO CONNECT THE RESET POWER LEAD TO TERMINAL NUMBER 4. TERMINAL 4 WILL BE LOCATED TO THE OUTSIDE EDGE OF THE CONTROL ON THE LEFT.

CHECK TO SEE THAT IT IS CONNECTED TO A11-J4-10. REMOVE THE FASTON, CONNECT THE PIGGY BACK AND REPLACE THE FASTON.

DETECTOR IDENTIFICATION...IF YOUR CONTROL HAS A RESET SWITCH WITH INDICATOR LAMP IN IT, S12 WILL BE TO YOUR RIGHT WITH THE DOOR OPEN. YOU NEED TO CONNECT THE RESET POWER LEAD TO TERMINAL NUMBER 6.

TERMINAL 6 WILL BE ON THE RIGHT HAND SIDE OF THE SWITCH AT THE BOTTOM. CHECK TO SEE THAT IT IS CONNECTED TO A11-J4-10. REMOVE THE FASTON, CONNECT THE PIGGY BACK AND REPLACE THE FASTON.

IF YOUR CONTROL DOES NOT HAVE AN INDICATOR LAMP IN THE RESET SWITCH, S12 WILL BE LOCATED TO YOUR RIGHT WITH THE DOOR OPEN. YOU NEED TO CONNECT THE RESET POWER LEAD TO TERMINAL NUMBER 5.

TERMINAL 5 WILL BE ON THE LEFT HAND SIDE OF THE SWITCH AT THE BOTTOM. CHECK TO SEE THAT IT IS CONNECTED A11-J4-10. REMOVE THE FASTON, CONNECT THE PIGGY BACK AND REPLACE THE FASTON.
- 3 THE GAUGE SIGNAL CIRCUIT SHOULD BE CONNECTED TO THE "S" TERMINAL OF THE GAUGE.
DK CONTROL...THE "S" TERMINAL IS LOCATED TO THE RIGHT SIDE OF THE GAUGE WITH THE DOOR OPEN.

REMOVE THE GAUGE BOARD ON THE WATER TEMP GAUGE AND CONNECT THE SIGNAL WIRE THEN REPLACE THE GAUGE BOARD. CHECK TO SEE THAT THE EXISTING WIRE IS MARKED M12-S OR M11-S.

DETECTOR CONTROL...THE "S" TERMINAL IS LOCATED TO THE LEFT SIDE OF THE GAUGE WITH THE DOOR OPEN. CHECK TO SEE THAT THE EXISTING WIRE IS MARKED M12-S OR M11-S. CONNECT THE SIGNAL WIRE AND TIGHTEN THE NUT.
- 4 USE COLUMN "C" FOR DETERMINING WIRE SIZES BASED ON DISTANCE FOR CT'S. USE COLUMN "B" FOR DETERMINING WIRE SIZES BASED ON DISTANCE FOR B+ AND GND CIRCUITS. COLUMN "A" CAN BE USED FOR ALL OTHER CIRCUITS.

NOTE THAT THE DISTANCE IS MEASURED IN FEET FROM THE SET TO THE CCM BOARD ONE WAY ONLY.

STRANDED WIRE IS PREFERRED FOR VIBRATION RESISTANCE.
- 5 REMOVE WIRE FROM TB21-28,29,30 AND REMOVE THE SPADE LUG. RELUG WITH SPLICE AND CONNECT WIRE TO CCM BOARD TERMINAL J5-1, J5-3, J5-5. CONNECT ADDITIONAL WIRE FROM TB21-28,29,30 AND CONNECT TO CCM BOARD TERMINAL J5-2, J5-4, J5-6.
- 6 CT CIRCUITS MUST BE FULLY CONNECTED BEFORE STARTING SET. ELECTRICAL HAZARD OR DAMAGE TO EQUIPMENT COULD RESULT.
- 7 WHEN CCM IS USED WITH A 7 LIGHT CONTROL THESE CONNECTIONS WILL NOT BE AVAILABLE.
- 8 FOR DELTA WIRED SETS, TIE ALL RETURNS TOGETHER. NO CONNECTION IS MADE TO TB21-26. LEAVE FLOATING.
- 9 IF SENDER READINGS ARE REQUIRED WHEN GENSET IS NOT RUNNING. THE FOLLOWING CONNECTIONS MAY BE NECESSARY:
(DETECTOR ONLY) REMOVE THE WIRE M12-1 (TEMP GAUGE) AND SAFELY TIE THE LEAD BACK INTO THE HARNESS. INSTALL A JUMPER FROM A11-TB1-7 (B+ FUSED) TO M12-1.
- 10 WHEN THE INPUT IS ACTIVE "OPEN" (5-36VDC), YOU MUST CONNECT A 1K,2W PULL-DOWN RESISTOR BETWEEN J2-13 AND J7-3 (AGND). FOR DK AND DETECTOR SETS, A11-J4-10 IS ACTIVE "OPEN" 12V - 24V.

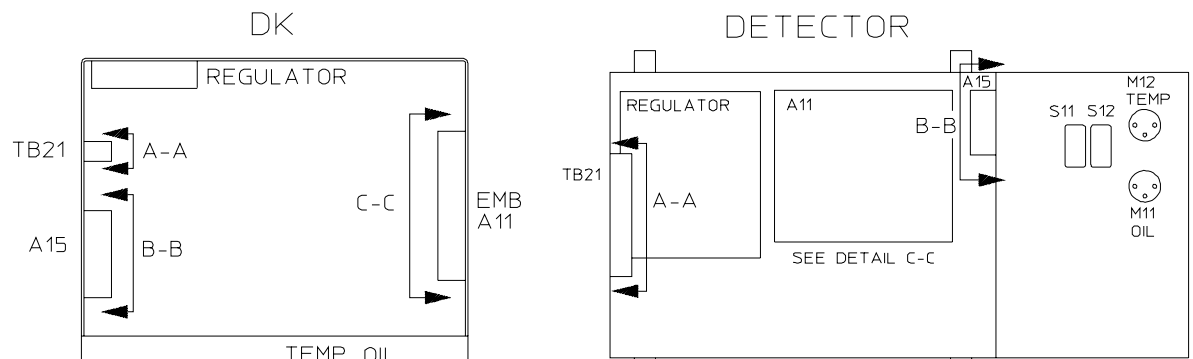
NOTES	FROM	TO	OPTIONAL CONNECTIONS	COLOR
DC CONNECTIONS				
1	J8-1	START	A11-TB1-6	A15-TB1-5
	J8-2	CCM B+	J9-3	
	J8-4	RESET	A11-TB2-5	
	J8-5	GND	J9-6	
	J8-7	SHUTDOWN	A11-TB2-16	
	J8-8	GND	J1-6	
3, 3, 9	J11-12	OP GAUGE	M11-S	
	J11-3	WT GAUGE	M12-S	
	J11-11	GND	J3-2	
	J11-2	GND	J6-2	
	J1-2	FAULT2	A11-TB2-2	
	J1-1	FAULT1	A11-TB2-4	
	J2-16	LO COOL LVL		
	J2-15	CHRG AC FAIL		
	J2-14	SW RUN		
2, 10	J2-13	SW OFF	S12-??	
	J2-12	RUN	A11-TB1-3	
	J2-11	PLOP	A11-TB2-11	
	J2-10	PHET	A11-TB2-10	
	J2-9	LOP	A11-TB2-9	
	J2-8	HET	A11-TB2-8	
	J2-7	OS	A11-TB2-7	
	J2-6	OC	A11-TB2-6	
	J2-5	LO BATTERY		
	J2-4	HI BATTERY		
	J2-3	LET	A11-TB2-13	
	J2-2	LOW FUEL	A11-TB2-15	
	J2-1	COM ALARM	A11-TB1-4	
	J2-1	1K,2W RSTR	J6-1	
	J12-5	SENSED GND	A11-TB1-5	
	J12-6	SENSED B+	A11-TB1-7	
	J3-4	CCM B+	A11-TB1-7	
	J3-5	CCM GND	A11-TB1-5	
AC CONNECTIONS				
	TB1-1	VA GEN8	TB21-22	
	TB1-2	VB GEN7	TB21-23	
	TB1-3	VC GEN6	TB21-25	
	TB1-4	NEUTRAL	TB21-26	
	TB1-5	NEUTRAL	TB1-4	
	TB1-6	NEUTRAL	TB1-5	
	J10		GND LUG IN BOX	
			CONTROL GND STUD	
4, 5	J5-1	CT21-(+)	CT21	
4, 5	J5-2	CT21-(-)	TB21-28	
4, 5	J5-3	CT22-(+)	CT22	
4, 5	J5-4	CT22-(-)	TB21-29	
4, 5	J5-5	CT23-(+)	CT23	
4, 5	J5-6	CT23-(-)	TB21-30	

TOLERANCES UNLESS OTHERWISE SPECIFIED		SM TO	DATE	CUMMINS POWER GENERATION	
mm	Inch	DATE	DATE	4400 73RD AVE NE MINNEAPOLIS, MN 55432	
X ±	X ±	DR MARK R. DALSKE	03-19-02	TITLE	
XX ±	XX ±	CHKR RICH SCROGGINS	03-22-02	WD-INTERCONNECTION(CCMG)	
XXX ±	XXX ±	APPROVED TROY WINSAND	03-22-02	DWD NO. 0630-2384	
THIS DOCUMENT IS THE PROPERTY OF CUMMINS POWER GENERATION. IT IS LOANED TO YOU FOR YOUR USE ONLY. IT IS TO BE RETURNED TO CUMMINS POWER GENERATION WITH ALL ORIGINAL MARKINGS AND DIMENSIONS. NO PARTS ARE TO BE REMOVED OR MODIFIED. ANY REVISIONS TO THIS DOCUMENT WILL BE INDICATED BY A REVISION SYMBOL AND A DATE. THE USER SHALL BE RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION CONTAINED HEREIN.			FOR INTERPRETATION OF MODEL FIRST USED ON DIMENSIONING AND TOLERANCING, SEE ANG YLSUM-997		
0.004-0.99	+0.15/-0.08	004-200	+0.001/-0.003	SHEET 1 OF 2	
5.00-9.99	+0.20/-0.10	201-421	+0.001/-0.004	Dwg	
10.00-17.49	+0.25/-0.13	422-703	+0.010/-0.005	1 of 2	
17.50-24.99	+0.30/-0.13	704-999	+0.021/-0.005	D	

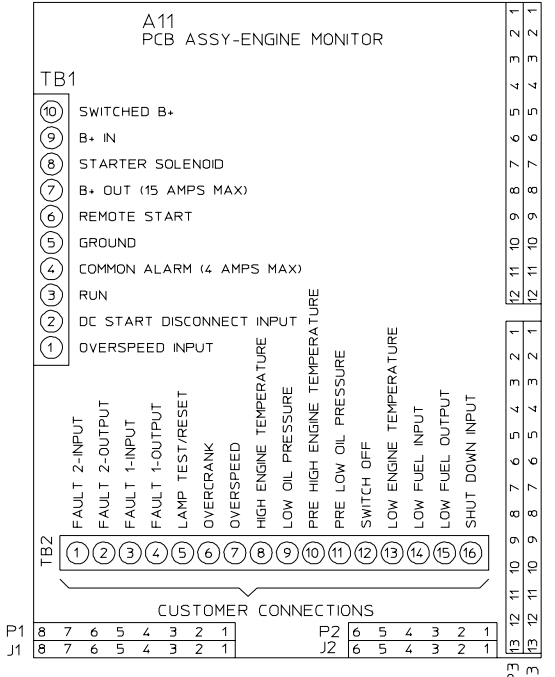
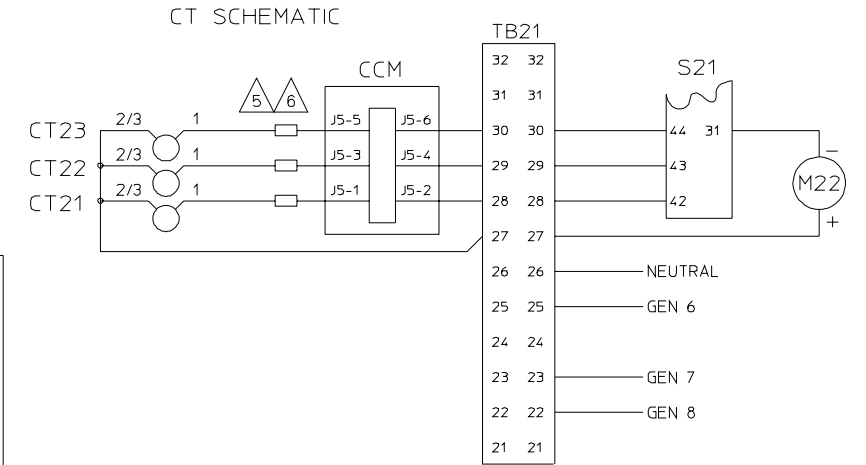
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0630-2384 D

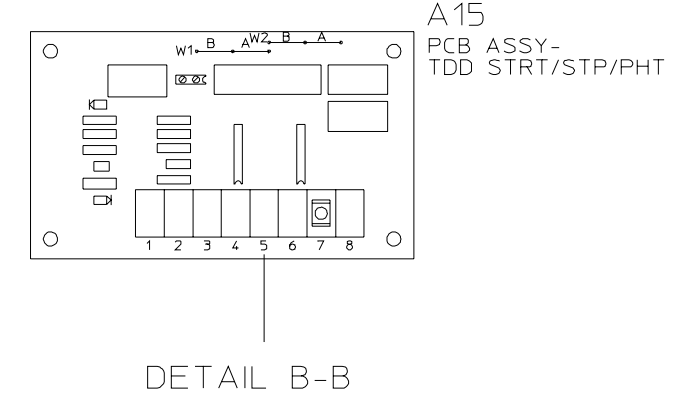
REV NO.	LTRING	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD11847	A	1	-	IMRD	RFS	TAW	03-22-02
FRD13521	B	1	J8-5 WAS J1-5 J8-2 WAS J1-2	5-C	JM	RFS	09-04-02
	2	J3-3 WAS J9-3 J3-6 WAS J9-6	6-C	JM	RFS	RFS	09-04-02
	3	J11-2 WAS J3-3	4-B	JM	RFS	RFS	09-04-02
	4	J7-2 WAS J6-2	4-A	JM	RFS	RFS	09-04-02
FRD14880	C	2	SWAP .5 CONNECTIONS PER ECO	-	IMRD	RFS	02-03-03



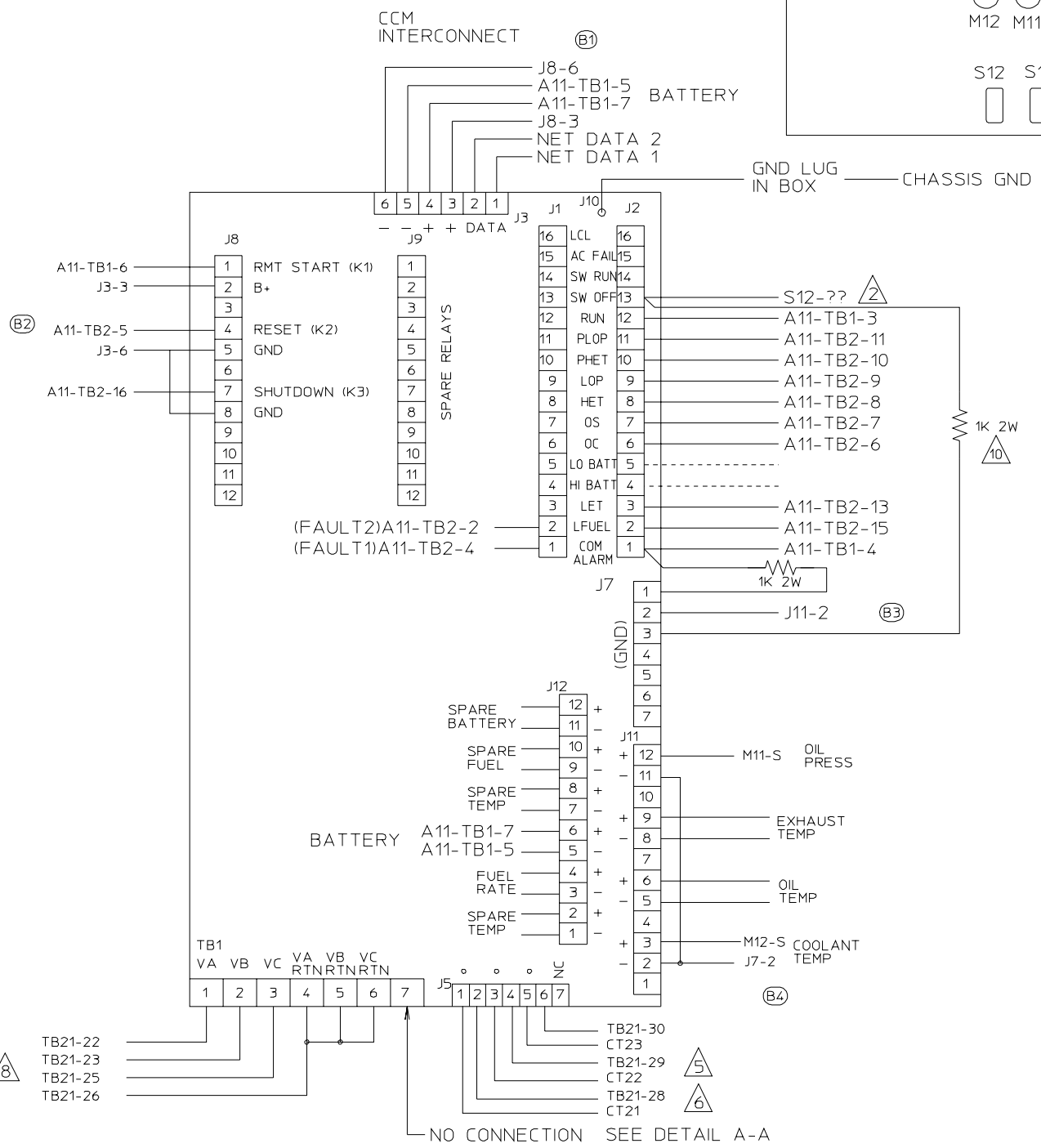
(INSIDE VIEW)
LEFT SIDE WALL-VERTICAL
BOTTOM OF TRAY-HORIZONTAL



DETAIL C-C



DETAIL B-B



TOLERANCES UNLESS OTHERWISE SPECIFIED		SM TO	DATE	DESCRIPTION OR MATERIAL	REF
mm	Inch	DATE	DATE		
0.00-1.99	+0.15/-0.08	004-200	+0.001-0.003		
5.00-9.99	+0.20/-0.10	201-421	+0.001-0.004		
10.00-17.49	+0.25/-0.13	422-793	+0.010-0.025		
17.50-24.99	+0.30/-0.13	704-999	+0.021-0.025		

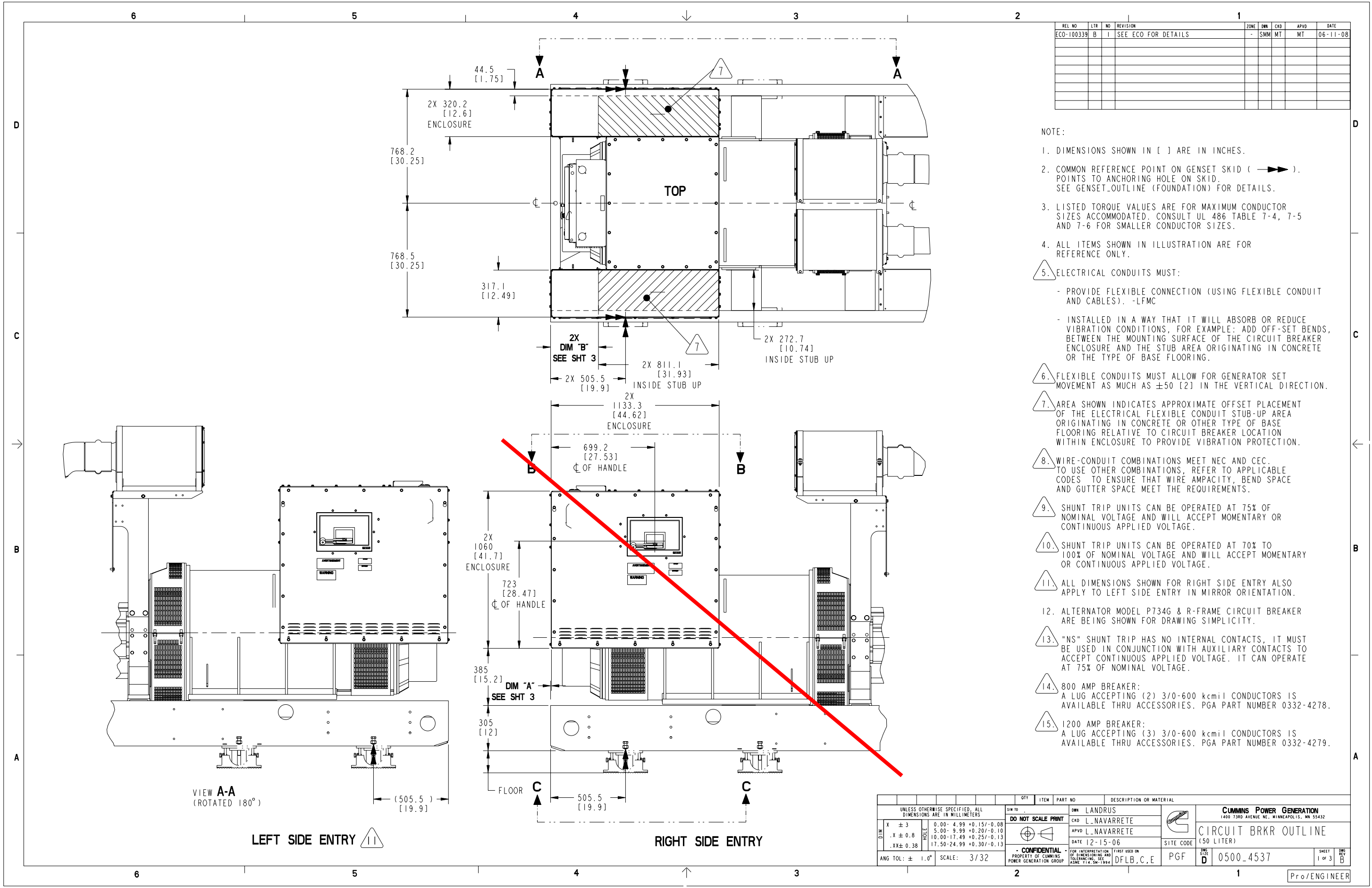
QTY	ITEM	PART NO.	DESCRIPTION OR MATERIAL	REF
	DR	MARK R. DALSKA	03-19-02	
	CHKR	RICH SCROGGINS	03-22-02	
	APPROVED	TROY WINSAND	03-22-02	
	FOR INTERPRETATION OF MODEL FIRST USED ON DIMENSIONING AND TOLERANCING, SEE ANG YLSUM-987			
	NUCLEUS			
	PGA			
	WD-INTERCONNECTION(CCMG)			

HP SYS DWG
DO NOT SCALE PRINT

ANGLE 1/2 ±
SCALE OF NONE

DWG NO. 0630-2384
SHEET 2 OF 2

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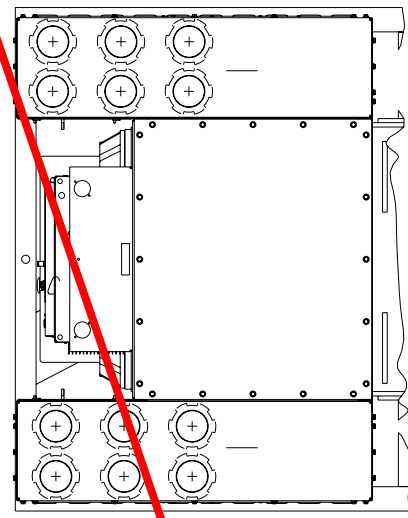
REL NO	LTM NO	REVISION	ZONE	OWN	CHK	APVD	DATE
ECO-100339	B	1	SEE ECO FOR DETAILS	SMM	MT	MT	06-11-08

- NOTE:
- DIMENSIONS SHOWN IN [] ARE IN INCHES.
 - COMMON REFERENCE POINT ON GENSET SKID (\rightarrow). POINTS TO ANCHORING HOLE ON SKID. SEE GENSET_OUTLINE (FOUNDATION) FOR DETAILS.
 - LISTED TORQUE VALUES ARE FOR MAXIMUM CONDUCTOR SIZES ACCOMMODATED. CONSULT UL 486 TABLE 7-4, 7-5 AND 7-6 FOR SMALLER CONDUCTOR SIZES.
 - ALL ITEMS SHOWN IN ILLUSTRATION ARE FOR REFERENCE ONLY.
 - ELECTRICAL CONDUITS MUST:
 - PROVIDE FLEXIBLE CONNECTION (USING FLEXIBLE CONDUIT AND CABLES). -LFMC
 - INSTALLED IN A WAY THAT IT WILL ABSORB OR REDUCE VIBRATION CONDITIONS, FOR EXAMPLE: ADD OFF-SET BENDS, BETWEEN THE MOUNTING SURFACE OF THE CIRCUIT BREAKER ENCLOSURE AND THE STUB AREA ORIGINATING IN CONCRETE OR THE TYPE OF BASE FLOORING.
 - FLEXIBLE CONDUITS MUST ALLOW FOR GENERATOR SET MOVEMENT AS MUCH AS ± 50 [2] IN THE VERTICAL DIRECTION.
 - AREA SHOWN INDICATES APPROXIMATE OFFSET PLACEMENT OF THE ELECTRICAL FLEXIBLE CONDUIT STUB-UP AREA ORIGINATING IN CONCRETE OR OTHER TYPE OF BASE FLOORING RELATIVE TO CIRCUIT BREAKER LOCATION WITHIN ENCLOSURE TO PROVIDE VIBRATION PROTECTION.
 - WIRE-CONDUIT COMBINATIONS MEET NEC AND CEC. TO USE OTHER COMBINATIONS, REFER TO APPLICABLE CODES TO ENSURE THAT WIRE AMPACITY, BEND SPACE AND GUTTER SPACE MEET THE REQUIREMENTS.
 - SHUNT TRIP UNITS CAN BE OPERATED AT 75% OF NOMINAL VOLTAGE AND WILL ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE.
 - SHUNT TRIP UNITS CAN BE OPERATED AT 70% TO 100% OF NOMINAL VOLTAGE AND WILL ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE.
 - ALL DIMENSIONS SHOWN FOR RIGHT SIDE ENTRY ALSO APPLY TO LEFT SIDE ENTRY IN MIRROR ORIENTATION.
 - ALTERNATOR MODEL P734G & R-FRAME CIRCUIT BREAKER ARE BEING SHOWN FOR DRAWING SIMPLICITY.
 - "NS" SHUNT TRIP HAS NO INTERNAL CONTACTS. IT MUST BE USED IN CONJUNCTION WITH AUXILIARY CONTACTS TO ACCEPT CONTINUOUS APPLIED VOLTAGE. IT CAN OPERATE AT 75% OF NOMINAL VOLTAGE.
 - 800 AMP BREAKER: A LUG ACCEPTING (2) 3/0-600 kcmil CONDUCTORS IS AVAILABLE THRU ACCESSORIES. PGA PART NUMBER 0332-4278.
 - 1200 AMP BREAKER: A LUG ACCEPTING (3) 3/0-600 kcmil CONDUCTORS IS AVAILABLE THRU ACCESSORIES. PGA PART NUMBER 0332-4279.

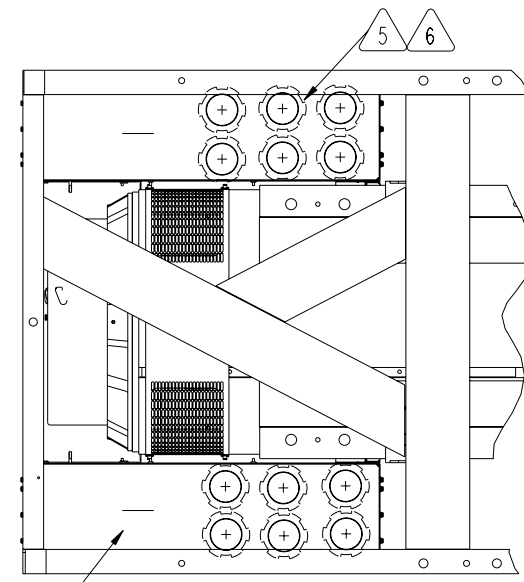
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	DTM	ITEM	PART NO	DESCRIPTION OR MATERIAL
X ± 3 .X ± 0.8 .XX ± 0.38	TOLER 0.00- 4.99 +0.15/-0.08 5.00- 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13	DO NOT SCALE PRINT	OWN LANDRUS	CUMMINS POWER GENERATION 1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432 CIRCUIT BRKR OUTLINE (50 LITER)
		PROPERTY OF CUMMINS POWER GENERATION GROUP FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	DATE 12-15-06 SITE CODE	
ANG TOL: $\pm 1.0^\circ$	SCALE: 3/32	CONFIDENTIAL	PGF	SHEET 1 OF 3 DATE 06-11-08

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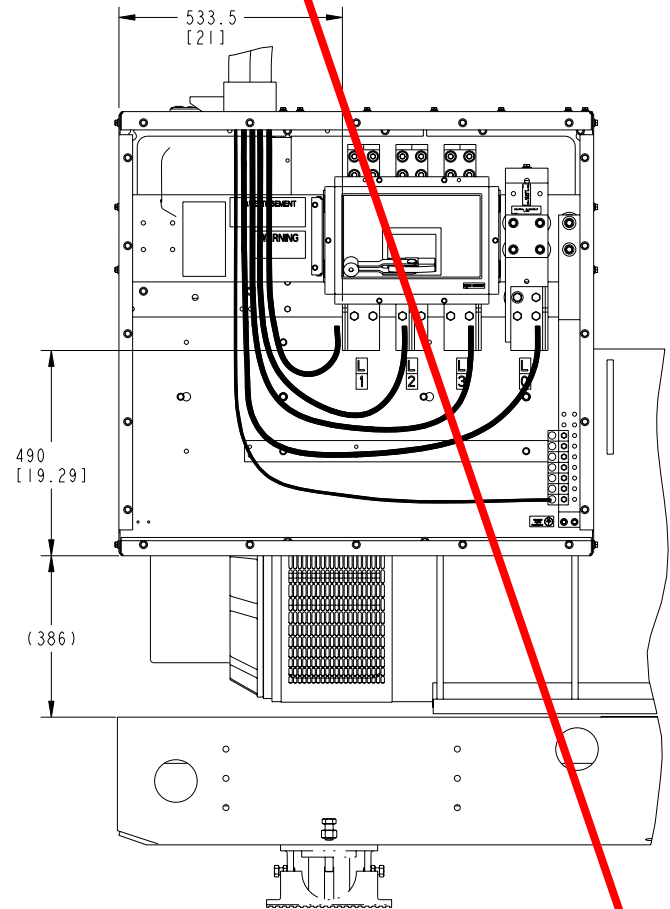
REL NO	LTR	NO	REVISION	ZONE	OWN	CKD	APVD	DATE
ECO-100339	B	1	SEE ECO FOR DETAILS	-	SMM	MT	MT	06-11-08



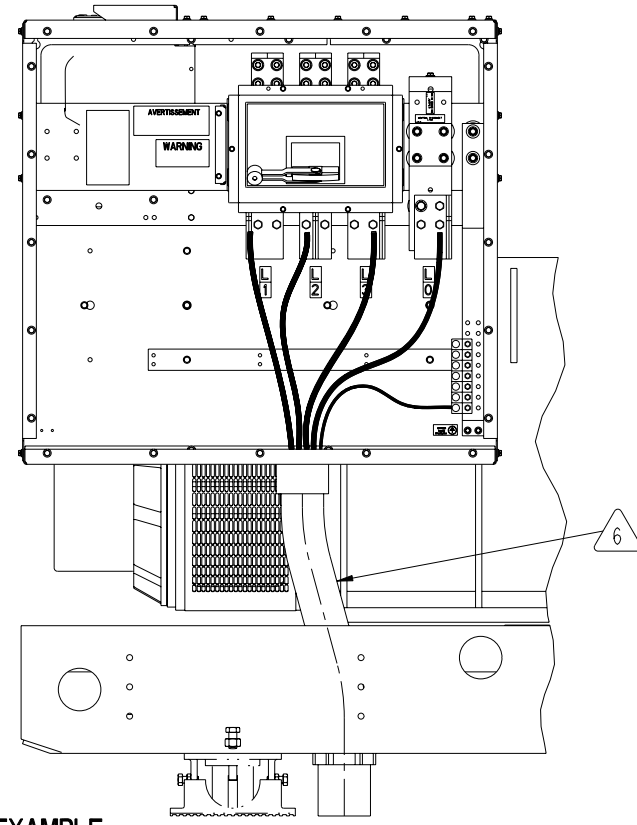
VIEW B-B
TOP ENTRANCE
SCALE 3/32



VIEW C-C
BOTTOM ENTRANCE
SCALE 3/32



RIGHT SIDE
TOP ENTRY ROUTING EXAMPLE
SCALE 1/8



RIGHT SIDE
BOTTOM ENTRY ROUTING EXAMPLE
SCALE 1/8

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		DTL	ITEM	PART NO	DESCRIPTION OR MATERIAL
X ± 3	0.00- 4.99 +0.15/-0.08	SIM TO: DO NOT SCALE PRINT			
.X ± 0.8	5.00- 9.99 +0.20/-0.10	OWN: LANDRUS			
.XX ± 0.38	10.00-17.49 +0.25/-0.13	CKD: L.NAVARRETE			
ANG TOL: ± 1.0°	17.50-24.99 +0.30/-0.13	APVD: L.NAVARRETE			
SCALE: 3/64		DATE: 12-15-06			
		SITE CODE: PGF			
		FIRST USED ON: DFLB, C, E			
		PROPERTY OF CUMMINS POWER GENERATION GROUP			
		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994			

CUMMINS POWER GENERATION
1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432

CIRCUIT BRKR OUTLINE
(50 LITER)

PGF 0500-4537

SHEET 2 OF 3
DWG REV B

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REL NO	LTN NO	REVISION	ZONE	DMN	CKD	APVD	DATE
ECO-100339	B	1	SEE ECO FOR DETAILS				06-11-08

UL/IEC LUGS					TABLE 1 ACCESSORY SPECIFICATIONS			
LUG	FRAME	MAX AMPS	WIRE RANGE COPPER	DIM D ±25 [1.0]	ACCESSORY DESCRIPTION	CONTACT RATING	INRUSH	CONNECTION TYPE
	SQUARE D NSJ	400A 3 OR 4 POLE	#2-600 KCMIL	554 [21.8]	24 VDC SHUNT TRIP	-----	10A	COMPRESSION TERMINALS #20-16 AWG OR SMALLER TORQUE: 10 LB-IN
	SQUARE D NSJ W/STR23SP TRIP UNIT	600A 3-POLE	2/0-350 KCMIL	554 [21.8]	24 VDC SHUNT TRIP	-----	10A	COMPRESSION TERMINALS #20-16 AWG OR SMALLER TORQUE: 10 LB-IN
	SQUARE D P 800 W/MICROLOGIC 3.0 TRIP UNIT	800A 3-POLE	3/0-500 KCMIL	599 [23.5]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN
	SQUARE D P 1200 W/MICROLOGIC 3.0 TRIP UNIT	1200A 3-POLE	3/0-500 KCMIL	556 [21.8]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN
	SQUARE D R 2500/2000/1600 3-POLE 1600-2500 AMP BUS BARS STANDARD W/MICROLOGIC 3.0 TRIP UNIT		NEMA HOLE PATTERN	490 [19]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN
	R 2500/2000/1600 W/OPTIONAL LUG 1600-2500 AMP BREAKERS TORQUE 375 IN LBS [42 Nm]		#2-600 KCMIL	490 [19]	24 VDC SHUNT TRIP	-----	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN
					1 EA. FORM C 4 AUX CONTACT + 1 TRIP ALARM	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125VDC, 0.3A AT 250 VDC	----	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN

TABLE 2 TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2008, ARTICLE 310.15 AT 75C TEMPERATURE RATED CONDUCTOR AT 30C AMBIENT AND ANNEX C (LIQUID TIGHT FLEXIBLE METAL CONDUIT - LFMC)					
MAX BRKR AMPS	WIRE (COPPER)		CABLE AMPACITY	TOTAL NUMBER OF CONDUITS	
	QTY	SIZE		QTY	SIZE (IN INCHES)
2500	6	600 KCMIL	420	6	4
2000	5	600 KCMIL	420	5	4
1600	5	600 KCMIL	420	5	4
1200	3	500 KCMIL	385	3	3
1000	3	400 KCMIL	335	3	3
800	2	300 KCMIL	285	2	3
630	2	350 KCMIL	310	2	3
600	2	350 KCMIL	310	2	3
400	1	600 KCMIL	420	1	4
250	1	250 KCMIL	255	1	2 1/2
100	1	2 KCMIL	115	1	2

TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2008, ARTICLE 310.15 AND TABLE 310-16 AT 75C TEMPERATURE RATED CONDUCTOR AT 40C AMBIENT AND ANNEX C (LIQUID TIGHT FLEXIBLE METAL CONDUIT - LFMC)					
MAX BRKR AMPS	WIRE (COPPER)		CABLE AMPACITY	TOTAL NUMBER OF CONDUITS	
	QTY	SIZE		QTY	SIZE (IN INCHES)
2500	6	750 KCMIL	418	6	4
2000	5	700 KCMIL	405	5	4
1600	4	700 KCMIL	405	4	4
1000	3	500 KCMIL	334	3	3 1/2
800	3	350 KCMIL	273	3	3

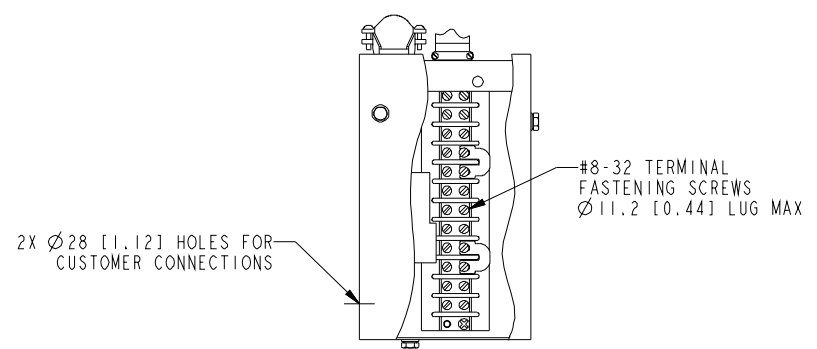
TABLE 3			
GENSET MODEL	ALTERNATOR MODEL	DIM "A"	DIM "B"
<input checked="" type="checkbox"/> DFLB	<input checked="" type="checkbox"/> P734B	247.6 [9.75]	569.8 [22.43]
<input type="checkbox"/> DFLC	<input type="checkbox"/> P734C	247.6 [9.75]	569.8 [22.43]
<input type="checkbox"/> DFLE	<input type="checkbox"/> P734D	98.6 [3.89]	420.8 [16.57]
<input checked="" type="checkbox"/> DOGAA	<input type="checkbox"/> P734E	98.6 [3.89]	420.8 [16.57]
<input type="checkbox"/> DOGAB	<input type="checkbox"/> P734F	3.6 [.14]	325.8 [12.83]
	<input type="checkbox"/> P734G	3.6 [.14]	325.8 [12.83]

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		QTY	ITEM	PART NO	DESCRIPTION OR MATERIAL
X ± 3	0.00- 4.99 +0.15/-0.08				
.X ± 0.8	5.00- 9.99 +0.20/-0.10				
.XX ± 0.38	10.00-17.49 +0.25/-0.13				
	17.50-24.99 +0.30/-0.13				
ANG TOL: ± 1.0°	SCALE: 3/64				

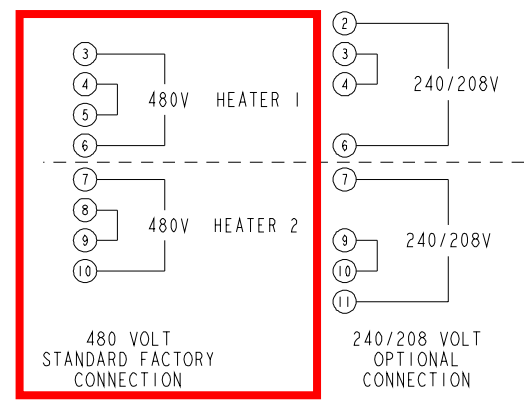
DMN LANDRUS	CKD L.NAVARRETE	APVD L.NAVARRETE	DATE 12-15-06
CUMMINS POWER GENERATION 1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432		CIRCUIT BRKR OUTLINE (50 LITER)	
SITE CODE		PGF	0500-4537
SHEET 3 OF 3		DATE 06-11-08	

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REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD16606	A	1	PRODUCTION RELEASE	-	WP	WP	EK	05-06-03
FRD33816	B	1	CHG HEATER AMPERAGE TABLE, SEE ECO	-	GJT	BG	NAVARRETE	09-24-07

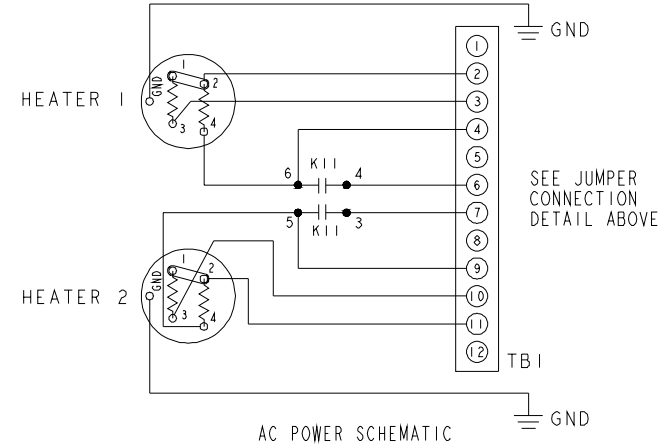
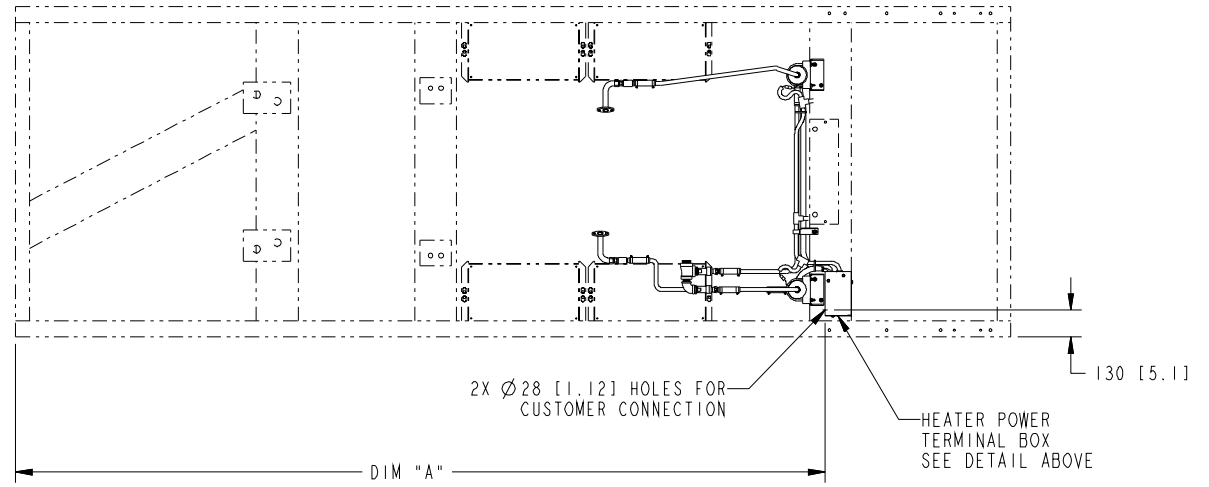


DETAIL OF HETER TERMINAL BOX



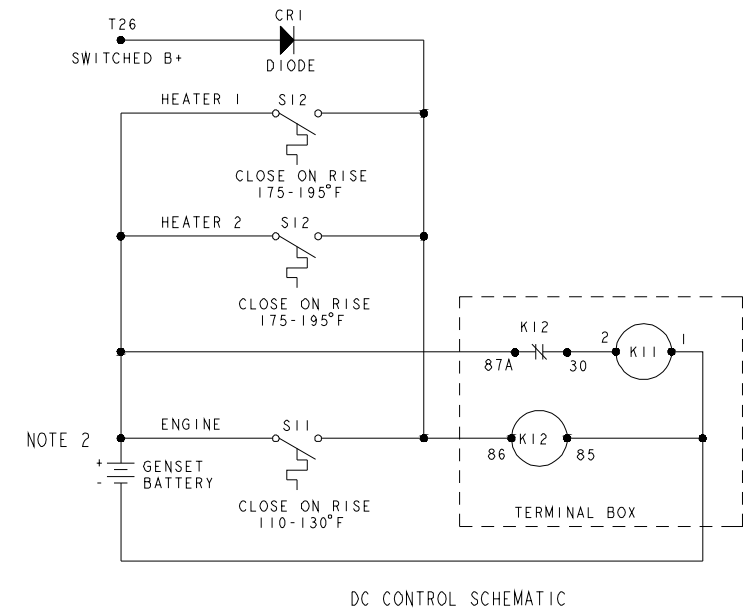
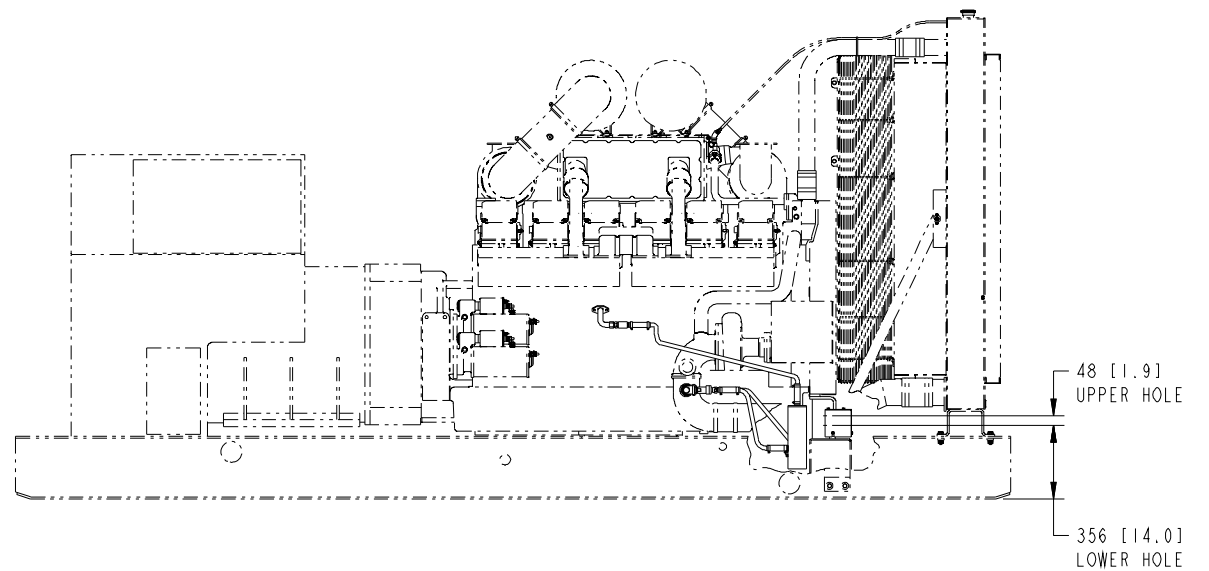
JUMPER CONNECTION DETAIL

- NOTES:
- DIMENSIONS IN [] ARE INCHES.
 - THE HEATER CONTROL RELAY DRAWS 83mA OF CURRENT WHEN THE HEATERS ARE UNPOWERED. HEATERS ARE NOT POWERED WHEN:
 - THE ENGINE HAS REACHED DESIGN TEMPERATURE OR
 - THE ENGINE IS RUNNING.
- ⚠ A BATTERY CHARGER IS REQUIRED TO PREVENT BATTERY DISCHARGE.



AC POWER SCHEMATIC

SINGLE PHASE HEATER VOLTAGE	FEATURE CODE H556 TWO HEATERS			FEATURE CODE H557 TWO HEATERS		
	HEATER AMPS	TOTAL AMPS	TOTAL WATTS	HEATER AMPS	TOTAL AMPS	TOTAL WATTS
208	18.0	36.0	7485	23.1	46.3	9630
240	20.8	41.6	9980	26.8	53.5	12840
480	10.4	20.8	9980	13.4	26.8	12840



DC CONTROL SCHEMATIC

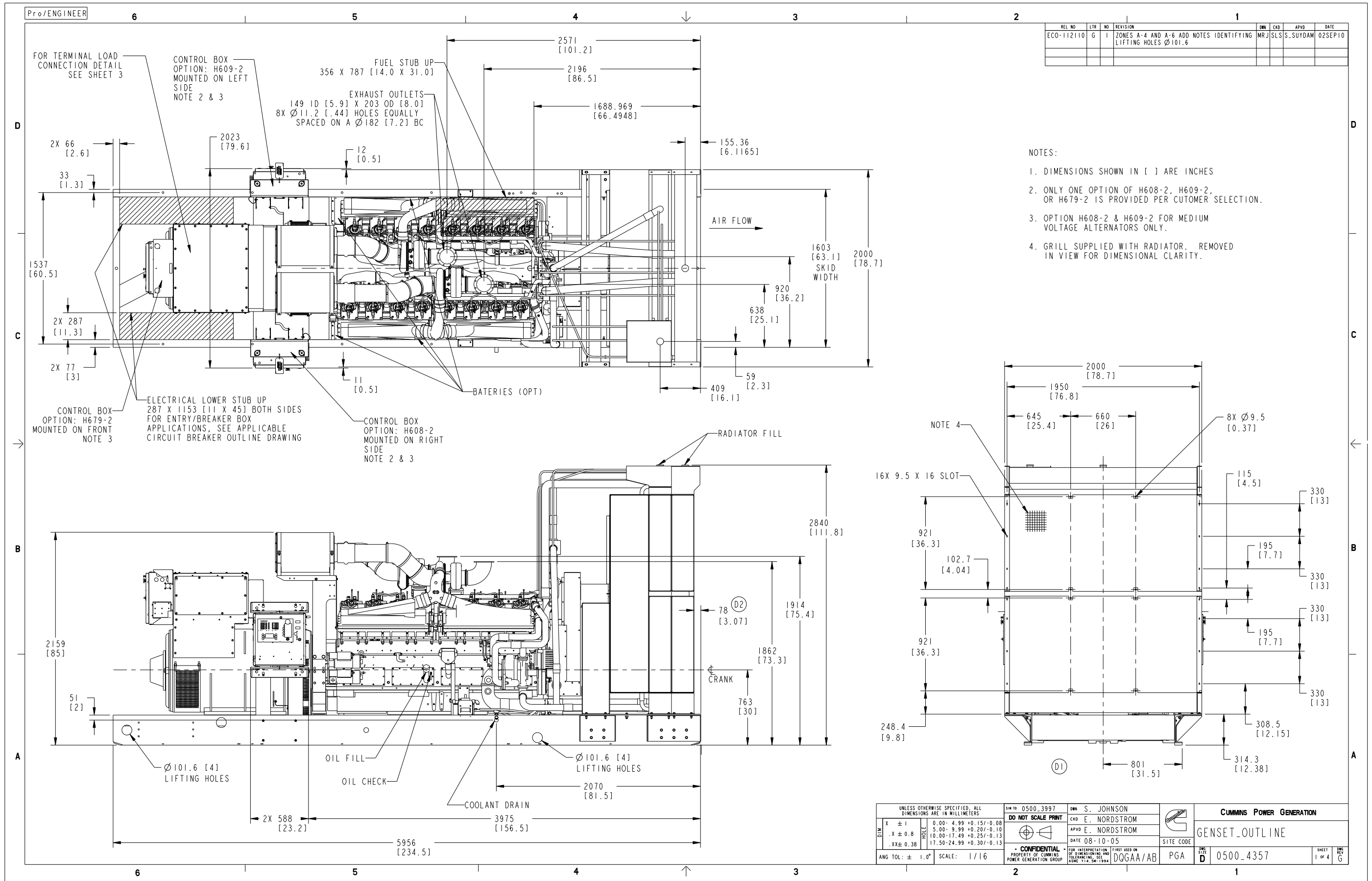
GENSET ENGINE/MODEL	DIM "A"
KTA 38 DFJA, JB, JC, JD	3927 [154.6]
KTA 50 DFLM, LC, LD, MB	4475 [176.2]

DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED	QTY	ITEM	PART NO	DESCRIPTION OR MATERIAL	DATE	REF DIS
FRD16606	0.005	1	DR	W. PELTIER	05-06-03		
FRD33816	0.005	1	CHKR	W. PELTIER	05-06-03		
			APPROVED	E. KROHNFELDT	05-06-03		
				DFJ, DFL			

CUMMINS POWER GENERATION
 4001 75th Ave NE
 Minneapolis, Minnesota 55432

TITLE: INTERFACE_OUTLINE (HEATER)
 SHEET: 1 of 1
 DATE: 0500_3821

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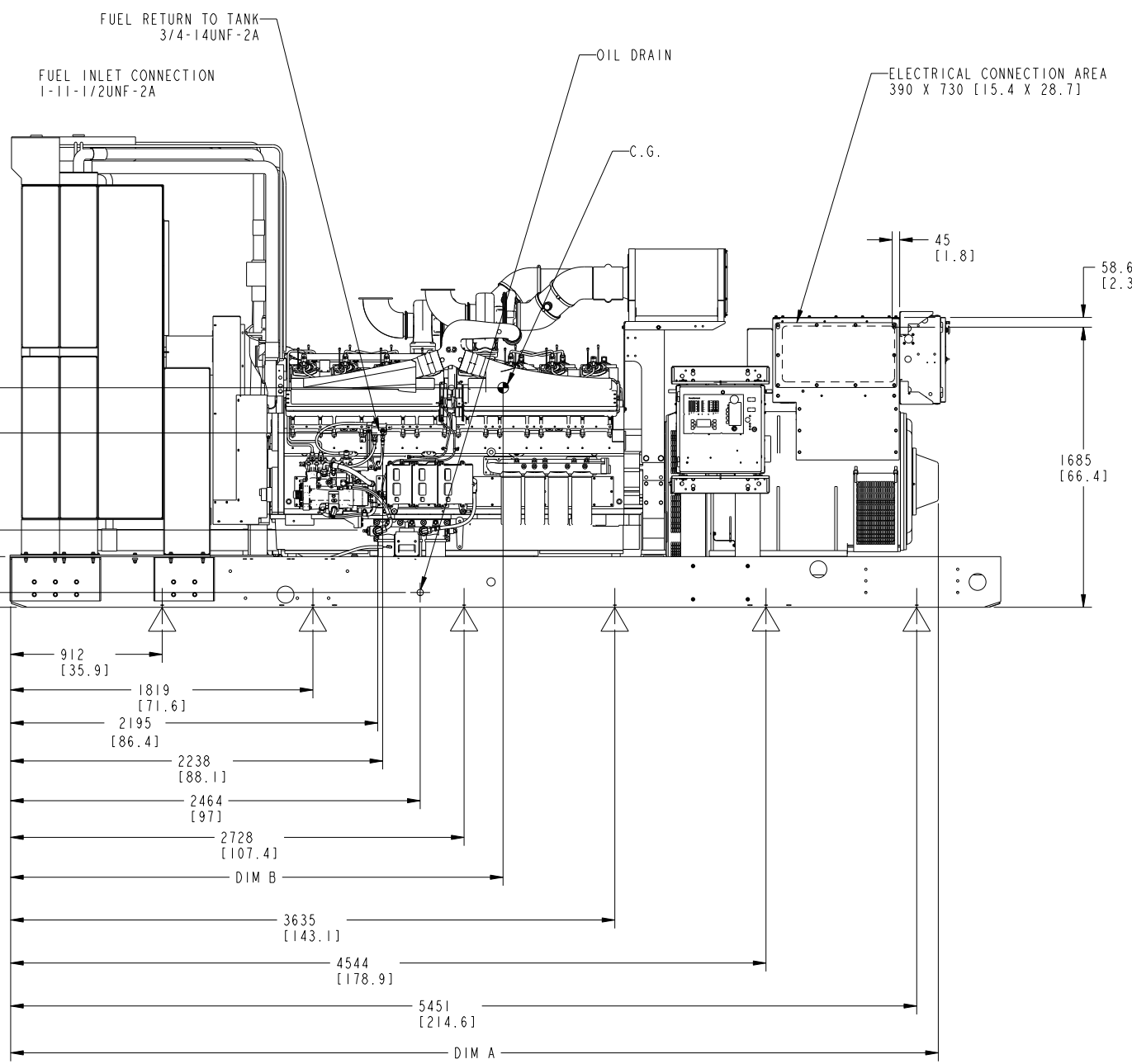


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REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-112110	G	--	---	MRJ	SLS	S.SUYDAM	02SEP10

NOTES:

- FOR NON-SEISMIC INSTALLATION: $\varnothing 19[.75]$ HOLES MARKED BY \triangle FOR 12 POINT ISOLATION MOUNTING.
FOR SEISMIC INSTALLATION: $\varnothing 21[.83]$ HOLES MARKED BY \triangle FOR 12 POINT ISOLATION MOUNTING
- FUEL IN HOSE $\varnothing 22 \times 1270 [50.0]$ LONG WITH 1-11 1/2 NPTF EXTERNAL THREAD FITTING. FUEL OUT HOSE $\varnothing 16 \times 1270 [50.0]$ LONG WITH 3/4-14 NPTF EXTERNAL THREAD FITTING.
- DIMENSIONS SHOWN IN [] ARE INCHES
- GENSET SHIPPED FILLED WITH ENGINE OIL.



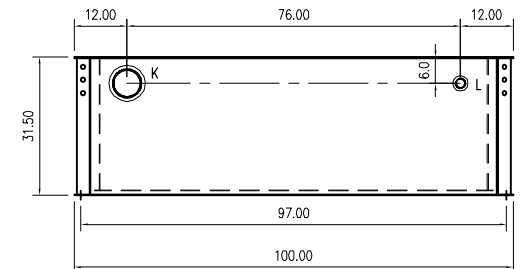
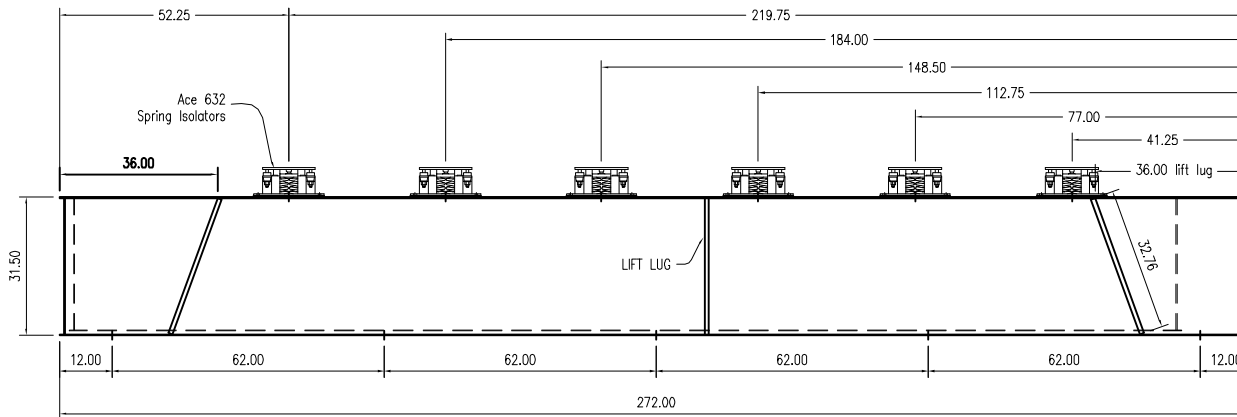
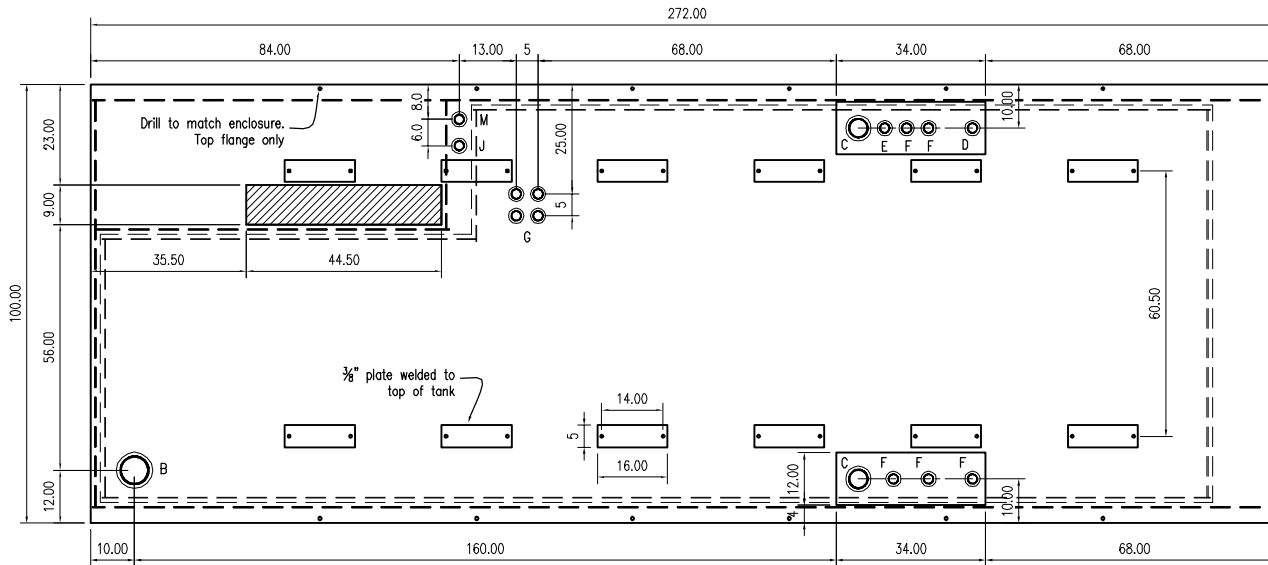
TABULATION OIL SUMP STANDBY (50 U.S. GALLONS)						
GEN. FRAME SIZE	DIM A	DIM B C.G. W/COOLANT	GENSET WT W/O COOLANT		GENSET WT W/COOLANT	
			KGS.	LBS.	KGS.	LBS.
P7B	5642 [222.1]	2888 [113.7]	10787	23783	11291	24893
P7C	5642 [222.1]	2936 [115.6]	11046	24333	11349	25403
P7D	5792 [228.0]	2987 [117.6]	11346	25014	11849	26124
P7E	5792 [228.0]	3025 [119.1]	11584	25539	12087	26649
P7F	5877 [231.4]	3071 [120.9]	11868	26165	12371	27275
P7G	5877 [231.4]	3104 [122.2]	12082	26637	12585	27747
MV7F	5765 [227.0]	2903 [114.3]	10893	24015	11396	25125
MV7G	5915 [232.9]	3010 [118.5]	11723	25305	11981	26415

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM NO 0500_3997	OWN S. JOHNSON		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT		CAD E. NORDSTROM	APVD E. NORDSTROM		GENSET_OUTLINE	
X ± 1 .X ± 0.8 .XX ± 0.38		0.00- 4.99 +0.15/-0.08 5.00- 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13	DATE 08-10-05	SITE CODE	FIRST USED ON DOGAA/AB PGD 0500_4357	
ANG TOL: ± 1.0°		SCALE: 1/16	- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP	FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	SHEET 2 OF 4	REV G

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GENERAL NOTES:

- 1) TANK TO BE INSTALLED IN ACCORDANCE W/ AFFIXED LABELING, THE FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE, NFPA 30, AND ANY OTHER PREVAILING CODE.
- 2) THIS SUBBASE TANK IS DESIGNED TO SUPPORT A DIESEL ENGINE GENERATOR.
- 3) UL-2085 TANKS WILL TYP. HAVE A 3" FLANGE ON SIDES & UL-142 TANKS WILL TYP. HAVE A 3 1/2" FLANGE.



TANK CONSTRUCTION:


- 1) SIDE AND END CHANNELS ARE 3/16" STEEL FOR GENSETS LESS THAN 12,000 LBS, AND 1/4" THICK STEEL FOR GENSETS MORE THAN 12,000 LBS.
- 2) OUTER TANK TOP & BOTTOM IS 3/16" STEEL.
- 3) INNER TANK TOP IS 3/16" STEEL.
- 4) INTERNAL BAFFLE TO SEPARATE COOL SUPPLY FUEL FROM HOT RETURN FUEL.
- 5) INTERNAL BRACING AND BOTTOM FLOOR SUPPORTS NOT SHOWN.
- 6) INTERIOR COATED WITH RUST INHIBITOR.
- 7) EXTERIOR PRIMED W/2-PART EPOXY AND FINISH PAINTED W/URETHANE.

TANK SPECIFICATIONS:

- 1) ENGINE TYPE: Diesel
 - 2) GENSET WEIGHT: lbs (wet)
 - 3) DOUBLE WALL SPECIFICATION
 - CLOSED TOP DIKED
 - SECONDARY CONTAINMENT
 - PROTECTED SECONDARY CONTAINMENT
 - 4) SUB-BASE TANK OPTIONS:
 - LOW FUEL LEVEL SWITCH
 - LIFTING RINGS
 - HIGH FUEL LEVEL SWITCH
 - FUEL IN BASIN SWITCH
 - NORMAL VENT CAP
 - EMERGENCY VENT CAP
 - REMOVABLE END CHANNEL
 - 2" NPT LOCKABLE FILL CAP W/RISER
- TANK COMES STANDARD WITH A DIRECT READING MECHANICAL FUEL LEVEL GAUGE.

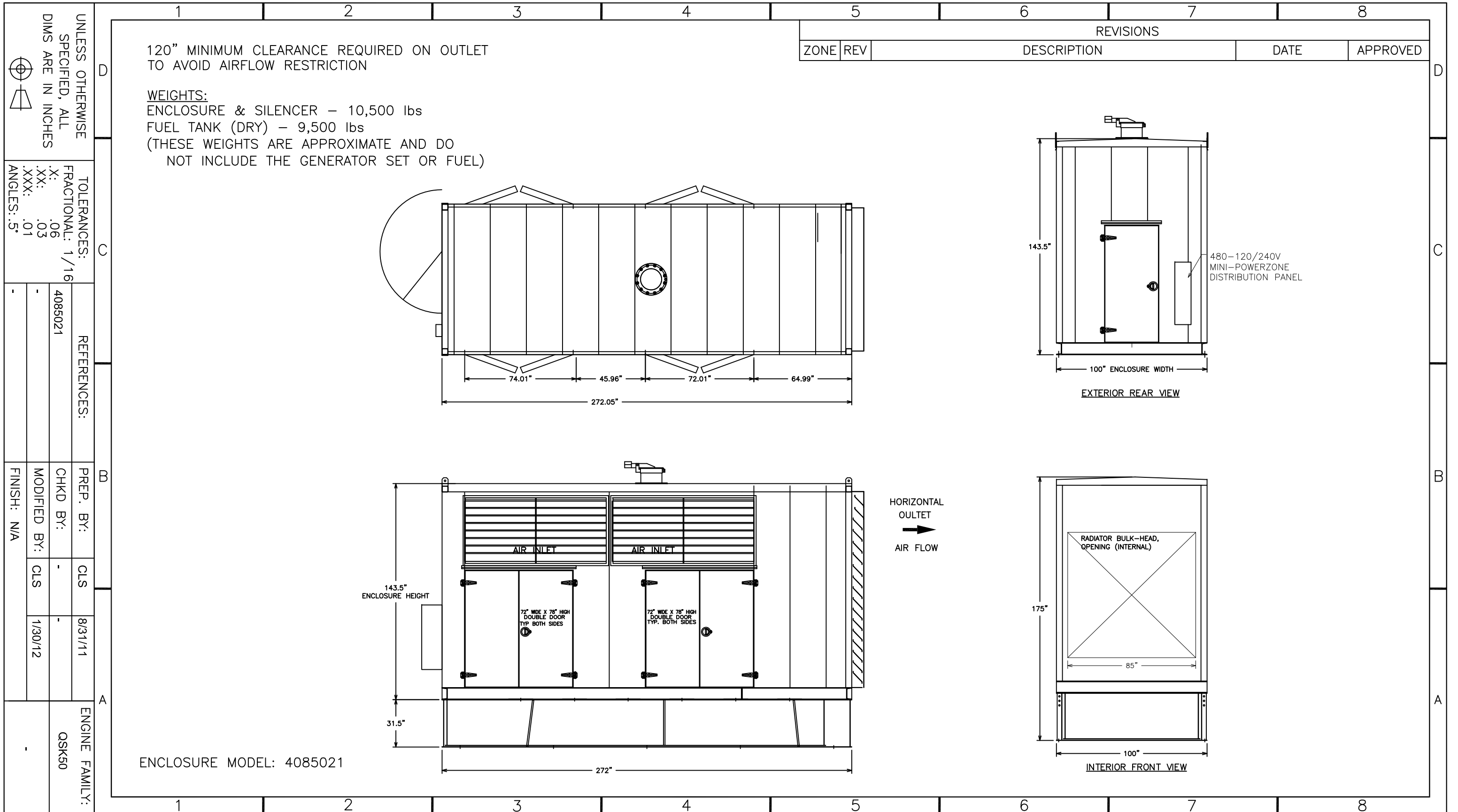
TANK FITTINGS:

- A) 2" NPT PRIMARY ATMOSPHERIC VENT
- B) 6" NPT PRIMARY EMERGENCY VENT FITTING PER NFPA 30
- C) 4" NPT FUEL FILL FITTINGS
- D) 2" NPT FOR REMOVABLE FUEL SUPPLY DIP TUBE
- E) 2" NPT FOR REMOVABLE FUEL RETURN DIP TUBE
- F) 2" NPT FOR FILL, SITE, SPARES
- G) 2" NPT FOR LEVEL SNDR ZONES
- J) 2" NPT FOR LEAK DETECTION SWITCH
- K) 6" NPT SECONDARY EMERGENCY VENT FITTING PER NFPA 30
- L) 2" NPT SECONDARY ATMOSPHERIC VENT
- M) 2" NPT FOR SPARE/VISUAL PORT

 Superior Systems & Technologies 274 County Rd 287 Meriden, TX 79536 254-690-0248 Fax: -4111	2560 Gallon UL142 Listed Sub-Base	P.O.#: ----	GENSET: 1250 DQGAA	NAME: ----	DATE: ----
		WO #: ----	TANK WEIGHT: 9,500 LBS	<input type="checkbox"/> APPROVED AS IS: Manufacturing may proceed <input type="checkbox"/> APPROVED WITH NOTED CHANGES: Resubmit drawing; manufacturing may proceed. <input type="checkbox"/> NOT APPROVED: Correct drawing as noted and resubmit for approval before manufacturing begins.	
DRAWN BY: F. Gutierrez DATE: 01-27-12	SCALE: NTS SHEET: 1 OF 1	CUSTOMER: CUMMINS ROCKY MOUNTAIN JOB NAME: HAROLD D. THOMPSON	QUOTE #: 02245 REVISION: A 109	TANK COLOR: ---- DRAWING #: SCGBT-2560-02245	

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UNLESS OTHERWISE SPECIFIED, ALL DIMS ARE IN INCHES

TOLERANCES:
FRACTIONAL: 1/16
.X: .06
.XX: .03
.XXX: .01
ANGLES: .5°

REFERENCES:
4085021

PREP. BY: CHKD BY: CLS
8/31/11
1/30/12

ENGINE FAMILY: QSK50

Cummins Rocky Mountain
8211 E 96th AVE
HENDERSON, COLORADO 80640
PH: 303-287-0201
FAX: 303-287-4837

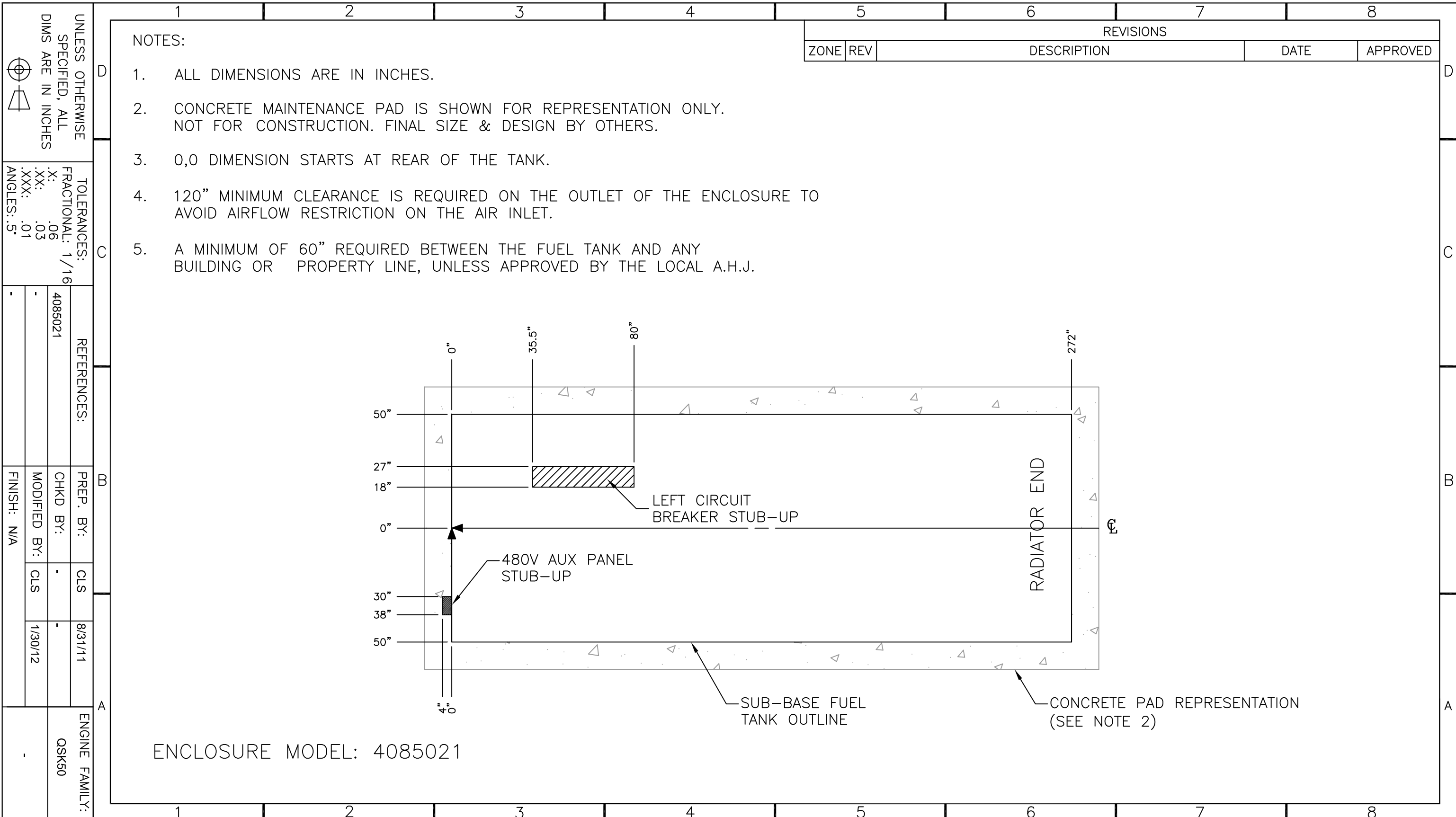
SITE NAME: HAROLD D THOMPSON WRF
CONTRACTOR NAME: -

CONTACT NAME: -
CONTACT NO: -

CUSTOMER PROJECT NO: -
CRM PROJECT NO: 63439

TITLE: GENERAL ARRANGEMENT
SIZE B DWG NO: P2011-0139A REV: A
SCALE: 1:60 DO NOT SCALE SHEET: 2 OF 3

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<p>8211 E 96th AVE HENDERSON, COLORADO 80640 PH: 303-287-0201 FAX: 303-287-4837</p>	SITE NAME: HAROLD D THOMPSON WRF	CONTACT NAME: -	CUSTOMER PROJECT NO: -	TITLE: ELECTRICAL STUB UP
	CONTRACTOR NAME: -	CONTACT NO: -	CRM PROJECT NO: 63439	SIZE B DWG NO: P2011-0139A SCALE: 1:40 DO NOT SCALE REV: A SHEET: 3 OF 3

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Commercial Extended Warranty Statement

Our energy working for you.™



**Power
Generation**

Commercial Extended Warranty Statements

**Feature Codes
L030**

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Limited Standby 5 Year or 1,500 hour Basic Extended Warranty – L030

Commercial Generating Set

When purchased, this limited extended warranty applies to Cummins Power Generation® branded commercial generating sets and associated accessories (hereinafter referred to as "Product").

This warranty covers any failures of the Product, under normal use and service, which result from a defect in material or factory workmanship.

Warranty Period:

The warranty start date is the date of initial start up, first rental, demonstration or 18 months after factory ship date, whichever is sooner. The coverage duration is 5 years from warranty start date or 1,500 hours or whichever occurs first.

Emergency Standby Power (ESP) is defined as the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage. The permissible average power output over 24 hours of operation shall not exceed 70% of the ESP.

Cummins Power Generation® Responsibilities:

In the event of a failure of the Product during the extended warranty period due to defects in material or workmanship, Cummins Power Generation® will only be responsible for the following costs:

- All parts required to repair the Product.

Owner Responsibilities:

The owner will be responsible for the following:

- Notifying Cummins Power Generation® distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins Power Generation®'s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.

In addition, the owner will be responsible for:

- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of generating sets used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- Labor and travel after the base warranty period expires.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

Limitations:

This limited extended warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Normal wear and tear.
- Improper and/or unauthorized installation.
- Owner's or operator's negligence, accidents or misuse.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins Power Generation® published guideline or policy.
- Use of improper or contaminated fuels, coolants or lubricants.
- Improper storage before and after commissioning.

- Owner's delay in making Product available after notification of potential Product problem.
- Use of steel enclosures within 60 miles of the coast of salt water when aluminum or an alternate non-corrosive material enclosure option is available.
- Replacement parts and accessories not authorized by Cummins Power Generation®.
- Use of Battle Short Mode.
- Owner or operator abuse or neglect such as: operation without adequate coolant or lubricants; overfueling; overspeeding; lack of maintenance to lubricating, cooling or air intake systems; late servicing and maintenance; improper storage, starting, warm-up, run-in or shutdown practices, or for progressive damage resulting from a defective shutdown or warning device.
- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the generating set.

This limited extended warranty does not cover costs resulting from:

- Difficulty in gaining access to the Product.
- Repair of cosmetic damage to enclosures.

Items not covered by this limited extended warranty:

- Batteries
- Enclosures
- Coolant heating elements
- Maintenance items

Aftertreatment component failures

www.cumminspower.com

CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:

Failed components claimed under warranty remain the property of Cummins Power Generation®. Cummins Power Generation® has the right to reclaim any failed component that has been replaced under warranty.

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS POWER GENERATION ® IN REGARD TO THE PRODUCT. CUMMINS POWER GENERATION® MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT IS CUMMINS POWER GENERATION® LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

This limited extended warranty shall be enforced to the maximum extent permitted by applicable law. This limited extended warranty gives the owner specific rights that may vary from state to state or from jurisdiction to jurisdiction.

Product Model Number: _____

Product Serial Number: _____

Date in Service: _____

Notes:





McCLURE-HILL INCORPORATED

Attention:

Date: **January 17, 2012**

Reference: **Harold D Thompson Water Submittal**

Quote Number: **DB101011-5**

McClure-HILL, INC (**MHI**) is pleased to quote the following **GE Zenith Controls, Inc** bypass/isolation, closed transition, automatic transfer switch

Item 1:

Model Number: **ZBTSCTB00200EZEC01ZVC70MEXE**

Poles: **3**

Enclosure: **NEMA 1**

Lugs: **8 to 750 MCM per/Ø - mech. style**

lugs for all connections

(no ground lugs or ground bus included)

Dimensions: **80”H x 40.6”W x 64.6”D***

Amps: **2000**

Volts: **277/480 -3Ø, 4W**

Designation: -----

Cable entry: **Top & bottom**

Weight: **4044 lbs**

WCR: **100,000 AIC (w/specific MCCB)**

200,000 AIC (w/current limiting fuse)

***(please note this ATS requires front and one other side access and this ATS has ventilation requirements on all sides) – 1600-4000 A only**

This ATS is equipped with the following accessories (microprocessor based, MX 250 with MEXES option package):

A1-aux contact S.P.D.T. – normal (source 1) failure

A1E-aux contact S.P.D.T. – emergency (source 2) failure

2xA3- emergency (source 2) position aux contact

2xA4- normal (source 1) aux contact

Calibrate-microprocessor activated calibration feature

CD/P-programmable exerciser daily, 7-14-28-365 days user- selectable, with or without load

DT-time delay from neutral switch position to normal on retransfer (disables ability to have R50)

DW-time delay from neutral switch position to emergency on retransfer (disables ability to have R50)

E-engine start contact

EL/P-event log of last 16 events

J2E-adjustable over/under frequency sensor (source 2 or emergency)

J2N-adjustable over/under frequency sensor (source 1 or normal)

K/P-frequency indication (on the controller)

K2-voltmeter & frequency on MX 250 LCD three phase display for both sources

L1-LED source 2 (emergency) position indicator

L2-LED Source 1(normal) position indication

L3-LED source 1 (normal) source availability indication

L4-LED source 2 (emergency) source availability indication

LN/P-center-off position / LCD indication on microprocessor

LBE-red indicating LED, bypass to “emergency, stand by or alternate” position

LBN-green indicating LED, bypass to “normal” position

L1-amber indicating LED, ATS is “isolate” position

LT-amber indicating LED, ATS is “test” position

LDS-red indicating LED, “disconnect switch activated”

L12-red indicating LED, ATS is “inhibited” mode due to activation of bypass feature and/or DS switch activated

Lugs: Max Mechanical Lugs

P1-engine start timer

Q2-peak shave/remote load test/area protection- relay (specify voltage)

R2E-Under voltage sensing (source 2 or emergency) (single phase)

R7-over voltage sensing (source 2 or emergency) single phase

R8-over voltage sensing (source 2 or emergency) 3 phase

R16-phase rotation sensing of source 1 and source 2

R17-under voltage sensing: source 2 (emergency) (3 phase)

6175 N. Ponderosa Way, Parker CO 80134 PH: 303-805-9956 FAX: 303-805-9953



M c C L U R E - H I L L I N C O R P O R A T E D

Attention:

Date: **January 17, 2012**

Reference: **Harold D Thompson Water Submittal**

Quote Number: DB101011-5

Page 2

Item 1 continued:

R50-in phase monitor between source 1 and source 2 to allow transfer (with enable/disable) (closed transition only)
S13/P-microprocessor activated commit/no commit on transferring to emergency source (with enable/disable)

SPO-Closed Transition

T-retransfer to normal adjustable time delay

T3/W3: Pre signal contact

TMS: Transition Mode Selector Switch

TS-test switch, "standard, quick and no load" options all embedded on MX 250 control panel and protected by security code.

U-engine stop/cool adjustable cool down timer CD/P-programmable exerciser

VI-voltage imbalance between phases (applies to 3 phase only)

W-adjustable time delay on transfer to emergency source

YEN/P-bypass transfer timer function (soft switch in controller)

6/P-microprocessor activated test switch : a momentary test switch

ZNETL: Lon works communication module

All ATS's are equipped with password protected alpha numeric keypads for all adjustments, settings and configurations. All ATS's are equipped with event logging, transfer counter, LED test function, frequency and volt meters (both normal and alternate sources) on MX 250 control panel

All prices quoted are firm for thirty (30) days from date listed on top of each quotation page. All prices quoted are in accordance with GE Zenith's standard terms and Conditions. See GE Zenith web page at www.zenithcontrols.com for a copy of these Terms and Conditions. All quoted prices are FOB factory unless specifically enumerated in the below listed price(s). All taxes, special permits, shipping and any additional fees are not included in the below listed prices.



McCLURE-HILL INCORPORATED

Attn:

Date: **November 17, 0212**

Reference: **Harold D Thompson Water**

Quote Number: **DB101011-5**

McClure-HILL, INC (**MHI**) is pleased to quote the following **GE Zenith Controls, Inc**

Item 3:

ZNET 900

Annunciator (lonworks) up to 8 ATS units.

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Zenith ZBTS/ ZBTSD/ZBTSCT

Transfer/Bypass-Isolation Transfer Switches



Introduction

GE's Zenith ZBTS Series Bypass-Isolation Transfer Switch consists of two major modules – the automatic transfer and the bypass-isolation switches. The automatic transfer switch module is GE's proven Zenith ZTS Series, built in ZTS, ZTSD or ZTSCT configuration and constructed for rugged, reliable operation. The same components – heavy-duty silver alloy contacts, rugged drive mechanism and silver plated bus bar inter-connections are used throughout the ZBTS Series.

Features and Benefits

GE's design requires no additional load break contacts which cause load interruption during bypass-isolation functions. The bypass-isolation switch contacts are out of the system current path except during actual bypass operation. Therefore, they are not constantly exposed to the destructive effects of potential fault currents. The Source 1 (normal), Source 2 (emergency) and load are connected between the automatic transfer switch and the bypass-isolation switch through solidly braced isolating contacts that are open when the automatic transfer switch is isolated. All current carrying components provide high withstand current ratings in excess of those specified in UL 1008 standards.

Description and Operation

The bypass section is a ZTS switch provided with a quick make/quick break manual load transfer handle and GE's control/interlock system consisting of both mechanical and electrical interlocks. The bypass switch is equipped with normal failure sensing and a time delay to start the engine automatically if the ATS has been removed for service. The modules are mounted in a compact enclosure and completely interconnected requiring only Source 1 (normal), Source 2 (emergency) and load cable connections. Once installed, no cables need to be removed to isolate the transfer switch module for maintenance or inspection. The automatic transfer switch may be withdrawn for testing or maintenance without disturbing the load. The transfer switch module has three positions:

1. Automatic/Connected: The transfer switch is carrying the load, and the bypass switch is in the open position. This is the normal operating position.

2. Test: The bypass switch is closed and feeding the load. The transfer switch has control power and may be operated for test purposes via the test switch on the enclosure door. The load is not affected during testing
3. Isolate: The transfer switch is withdrawn from all power and ready for maintenance. The load is served by the bypass switch.

The Automatic Transfer Switch is installed on a draw-out mechanism, with electrical and mechanical interlocks for secure removal after load bypass. The ATS control/logic panel is mounted on the enclosure door and connected by a wire harness and multi-pin disconnect plugs. The transfer switch and/or the control panel may be tested, isolated and removed for maintenance without load interruption.

The bypass-isolation switch module is the same basic design as the automatic transfer switch module and thus has the same electrical ratings. Manually operated, it features high speed, quick make/quick break contact action. The bypass-isolation switch has three basic positions:

1. Automatic: Source 1 (Normal) bypass contacts open, Source 2 (emergency) bypass contacts open.
2. Bypass Normal: Source 1 (Normal) bypass contacts closed, Source 2 (emergency) bypass contacts open.
3. Bypass Emergency: Source 1 (Normal) bypass contacts open, Source 2 (emergency) bypass contacts closed.

Interlocks and Indicators

Every ZBTS Series Bypass-Isolation Transfer Switch is supplied with all necessary electrical and mechanical interlocks to prevent improper sequence of operation as well as the necessary interlocking circuit for engine starting integrity. Each ZBTS Series Switch is furnished with a detailed, step-by-step operating instruction plate, as well as the following function diagnostic lights:

- Source 1 (Normal) Available
- Source 2 (Emergency) Available
- Bypass Switch in Source 1 (Normal) Position
- Bypass Switch in Source 2 (Emergency) Position
- Automatic Transfer Switch in Test Position
- Automatic Transfer Switch Isolated
- Automatic Transfer Switch Inhibit
- Automatic Transfer Switch Operator Disconnect Switch "Off"
- Automatic Transfer Switch in Source 1 (Normal) Position
- Automatic Transfer Switch in Source 2 (Emergency) Position



ZBTS & ZBTSD Model, Dimensions and Weights

Ampere Rating	Poles	NEMA 1 Enclosed				Weight		Application Notes	
		Height (A)	Width (B)	Depth (C)	Reference Figure	Open Type	NEMA 1		
100, 150 225, 260 400	2, 3	83 (211)	30 (76)	31 (79)	A	310 (141)	770 (350)	1 - 9	
	4	83 (211)	30 (76)	31 (79)		380 (173)	840 (322)		
600	3	90 (229)	36 (91)	28.25 (72)	B	660 (299)	1220 (533)		
	4	90 (229)	40 (102)	28.25 (72)		770 (349)	1365 (619)		
800, 1000 1200	3	90 (229)	40 (102)	28.25 (72)		C	765 (347)		1355 (615)
	4	90 (229)	46 (117)	28.25 (72)			910 (413)		1570 (712)
1600, 2000 2600	3	80 (2023)	40.6 (1031)	64.6 (1640)	C	1978 (897)	4044 (1835)		1 - 7, 10
	4	80 (2023)	46.1 (1171)	64.6 (1640)		2275 (1032)	4431 (2010)		
3000	3	80 (2023)	40.6 (1031)	64.6 (1640)	D	2572 (1166)	4456 (2021)		1 - 7, 10 - 12
	4	80 (2023)	46.1 (1171)	64.6 (1640)		3049 (1383)	4977 (2258)		
4000	3	90 (229)	47.5 (121)	81 (206)	D	4310 (1955)	4660 (2113)	1 - 7, 10 - 11	
	4	90 (229)	54 (137)	81 (206)		5510 (2499)	5860 (2658)		

ZBTST Model, Dimensions and Weights

Ampere Rating	Poles	NEMA 1 Enclosed				Weight		Application Notes	
		Height (A)	Width (B)	Depth (C)	Reference Figure	Open Type	NEMA 1		
100, 150 225, 260 400, 600	3	90 (229)	36 (91)	28.25 (72)	B	730 (331)	1280 (581)	1 - 8	
	4	90 (229)	40 (102)	28.25 (72)		840 (381)	1385 (628)		
800, 1000 1200	3	90 (229)	40 (102)	28.25 (72)		C	835 (379)	1435 (651)	1 - 9
	4	90 (229)	46 (117)	28.25 (72)			980 (444)	1640 (744)	
1600, 2000 2600	3	80 (2023)	40.6 (1031)	64.6 (1640)	C	1978 (897)	4044 (1835)	1 - 7, 10	
	4	80 (2023)	46.1 (1171)	64.6 (1640)		2275 (1032)	4431 (2010)		
3000	3	80 (2023)	40.6 (1031)	64.6 (1640)	D	2572 (1166)	4456 (2021)	1 - 7 10 - 12	
	4	80 (2023)	46.1 (1171)	64.6 (1640)		3049 (1383)	4977 (2258)		
4000	3	90 (229)	47.5 (121)	81 (206)	D	4380 (1986)	4730 (2145)	10 - 12	
	4	90 (229)	54 (137)	81 (206)		5580 (2531)	5930 (2689)		

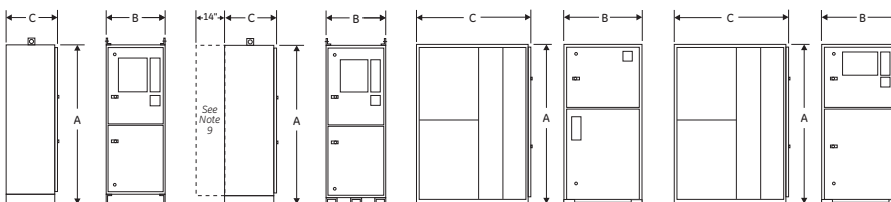


Figure A

Figure B

Figure C

Figure D

ZBTSD Model - Delayed Transition Transfer/Bypass-Isolation Switches

The ZTSD Delayed Transition Transfer Switch with a timed center-off position is available in a bypass configuration. The ZBTSD Model Bypass incorporates the features of both the ZBTS Bypass-Isolation Switch and the ZTSD unit for transfer of large motor loads, transformers, UPS systems or load shedding to a neutral "Off" position. Reference the ZTSD unit features and operation discussion for more details.

ZBTST Model - Closed Transition Transfer/Bypass-Isolation Switches

The ZTST Closed Transition Transfer Switch may be applied with a bypass-isolation switch for the utmost in reliability and versatility. The ZBTST Model provides the ability to withdraw the transfer switch unit for maintenance or inspection. Reference the ZTST unit features and operation discussion for more details.

Electrical Ratings

- Ratings 100 to 4000 amperes
- 2, 3 or 4 Poles
- Open type, NEMA 1, 3R, 4, 4X and 12
- Available with Zenith ZTS, ZTSD and ZTSC Series Automatic Transfer Switch
- Bypass and transfer switch have identical ratings
- Suitable for emergency and standby applications on all classes of load, 100% tungsten rated through 400 amps
- UL 1008 listed at 480 VAC
- CSA C22.2 No. 178 certified at 600 VAC

Performance Features

- Load is not interrupted during bypass operation
- High close-in and withstand capability
- Temperature rise test per UL 1008 conducted after overload and endurance tests exceeds UL requirements
- Available in ZBTS (utility-generator), ZBTSU (utility-utility), ZBTSG (generator-generator) and ZBTSM (manual) configurations; models include standard, delayed and closed transition

Design and Construction Features

- Automatic transfer switch is located on a draw out mechanism to facilitate maintenance
- Emergency power systems can be electrically tested without disturbing the load
- Power cables do not have to be disconnected to remove the transfer switch
- Bypass to any available source with the automatic transfer switch removed

Application Notes:

1. Metric dimensions (cm) and weights (Kg) shown in parenthesis adjacent to English measurements in inches and pounds.
2. Includes 1.25" door projection beyond base depth. Allow a minimum of 3" additional depth for projection of handle, light, switches, pushbuttons, etc.
3. All dimensions and weights are approximate and subject to change without notice.
4. Special enclosures (NEMA 3R, 4, 4X, 12, etc.) dimensions and layout may differ. Consult the GE factory for details.
5. Bypass Model product can not be ordered with inverted style.
6. Special lug arrangements may require different enclosure dimensions. For certified drawings, contact the GE factory.
7. Packing materials must be added to weights shown. Allow 15% additional weight for cartons, skids, crates, etc.
8. Add 4" in height for removable lifting lugs.
9. ZBTS(D) 600-1200A & ZBTST 100-1200A standard configuration is top entry. 14" rear adapter bay required for bottom entry. Consult the GE factory for details.
10. Bypass switch weights for 1600 - 4000 amp units vary up to 10% based on connections variations. Weights shown are for estimation only.
11. 3000 amp depth dimension shown is standard. Depending on your cable/conduit requirements you may desire a deeper enclosure. Consult the GE factory for further details.
12. Lug adapters for 3000-4000 amp limits may be staggered length for ease of entrance. Consult the GE factory for details.

AL-CU UL Listed Solderless Screw-Type Terminals for External Power Connections

Switch Size Amps	Normal, Emergency & Load Terminals	
	Cables/Pole	Wire Ranges
ZBTS & ZBTSD		
100-225	1	#6 to 250 MCM
260	1	#4 to 600 MCM
400	1	#4 to 600 MCM
600	2	#2 to 600 MCM
800 / 1000 / 1200	4	#2 to 600 MCM
1600 / 2000 / 2600 / 3000 / 4000	*	*
ZBTST		
100-400	1	#4 to 600 MCM
600	2	#2 to 600 MCM
800 / 1000 / 1200	4	#2 to 600 MCM
1600 / 2000 / 2600 / 3000 / 4000	*	*

* Line and load terminals are located in rear and arranged for bus bar connection. Terminal lugs are available at additional cost. Contact the GE factory for more details.



imagination at work



GE Energy - Digital Energy
830 W 40th Street, Chicago, IL 60609 USA
800 637 1738 www.gepowerquality.com

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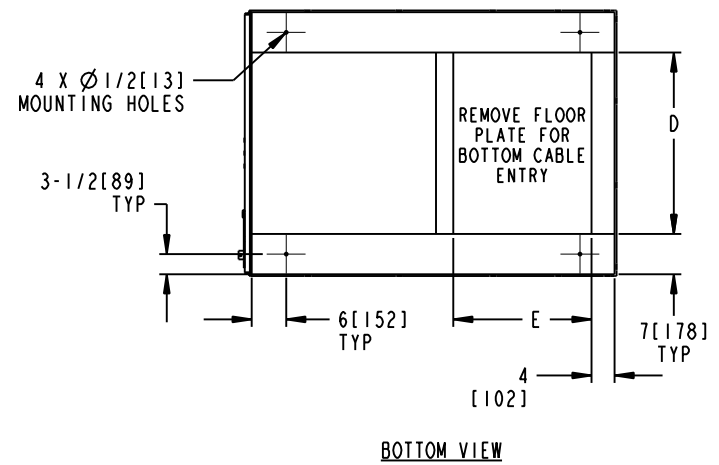
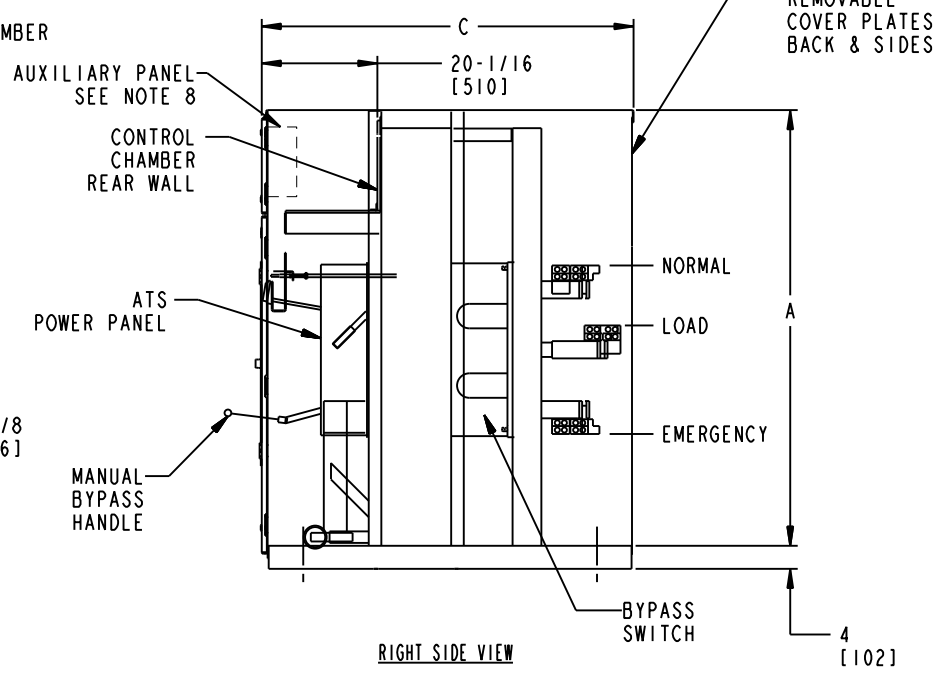
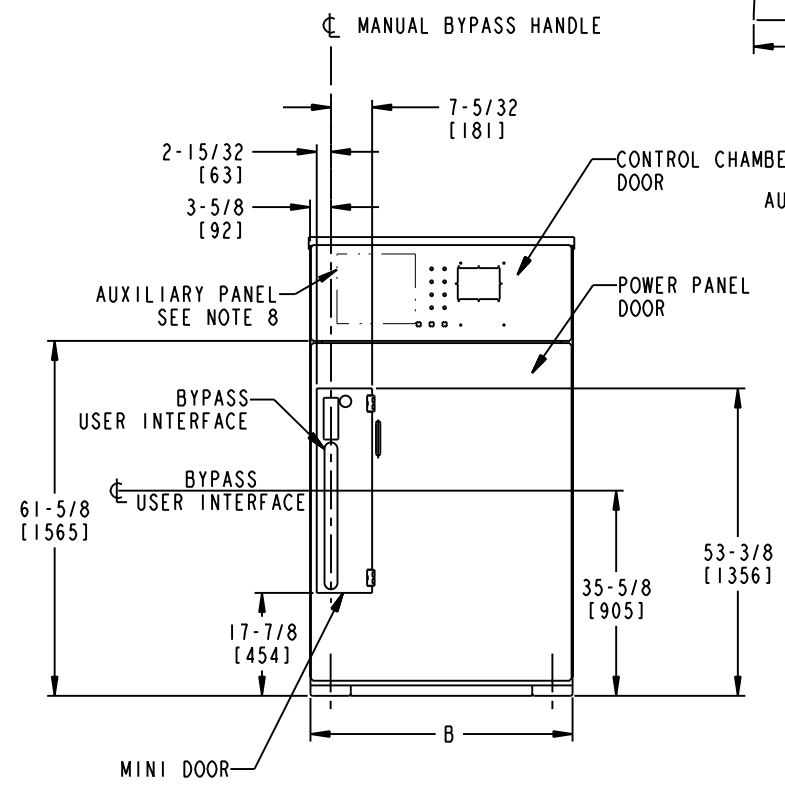
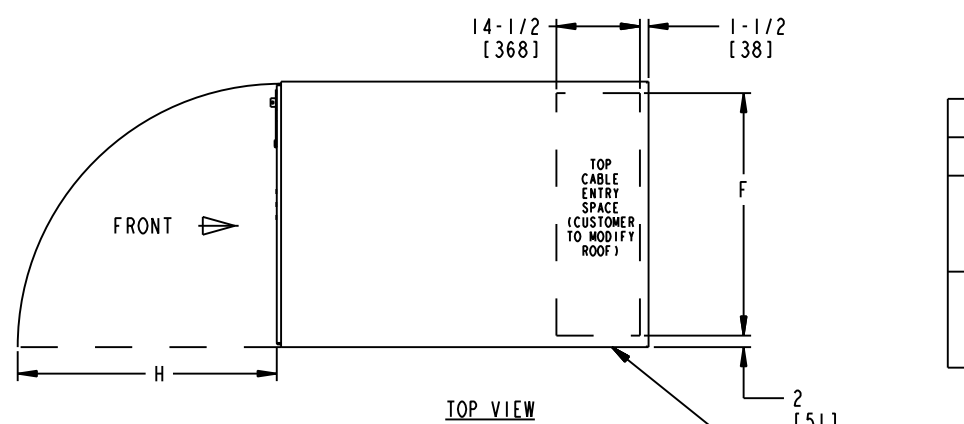
REVISIONS				
REV.	DESCRIPTION	DATE	APPROVED	
B	S-8796	REVISED	12/05/08	PK SA
C	S-8863	REVISED	05/22/09	SS SA
D	S-8929	REVISED	01/25/10	SS SA
E	S-8971	UPDATED DWG FOR 2600A	05/19/10	YP MAS

CABINET	CABINET DIMENSIONS						CABINET REFERENCE DRAWING
	A	B	C	D	E	F	ENCLOSURE KIT
3-POLE	75-5/8 [1921]	40-19/32 [1031]	64-9/16 [1640]	26 [660]	24 [610]	36-1/2 [927]	F-1966MP
4-POLE	75-5/8 [1921]	46-3/32 [1171]	64-9/16 [1640]	31-1/2 [800]	24 [610]	42 [1067]	F-1967MP

RECOMMENDED CLEARANCES	
CABINET	H(FRONT)
3-POLE	40-5/32 [1020]
4-POLE	45-21/32 [1160]

IMPORTANT NOTE:
 LUGS ARE SUPPLIED AS OPTIONAL ACCESSORY ONLY. TYPICAL CONFIGURATION SHOWN FOR REFERENCE ONLY

- NOTES:**
- MATERIAL: 10 GA. STEEL .134(3) REF. UNLESS OTHERWISE NOTED
 - FINISH: PER F-7000.
 - LUGS SHOWN FOR TOP CABLE ENTRY MAY BE RESERVED FOR BOTTOM CABLE ENTRY. LUGS ARE SUPPLIED AS OPTION ONLY.
 - ALL DIMENSIONS ARE FOR REFERENCE ONLY AND SHOWN IN INCHES(MILLIMETERS).
 - ALL HANDLING AND MOVEMENT OF CABINET MUST BE DONE IN THE UPRIGHT POSITION ONLY.
 - CONSTRUCTION PER UL-1008.
 - ACCESS TO SIDES AND REAR OF UNIT RECOMMENDED.
 - AUXILIARY PANEL SUPPLIED AS OPTIONAL ONLY.



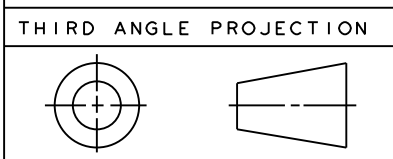
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APPLIED PRACTICES	SA	09/19/08
DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED IN DRAWING	SA	09/19/08
TOLERANCE ON:	CHECKED	-
1 PL DECIMALS ±0.0	ENGRG	-
2 PL DECIMALS ±0.02	MFG	-
3 PL DECIMALS ±0.005	QUALITY	-
ANGLES ±1.0	ISSUED	-
FRACTIONS ±	SOLID MODEL: 50C-2039	-
FINISH		
CRITICAL TO QUALITY CHARACTERISTIC		

GE Zenith Controls

TITLE **TRANSFER SWITCH - NEMA 1 ENCL**
1600-3000 A
ZBTS(D/CT)

SIZE DRAWING **50C-2039** REV **E**

SCALE: 0.030 REF. No: . SHEET 1 OF 4



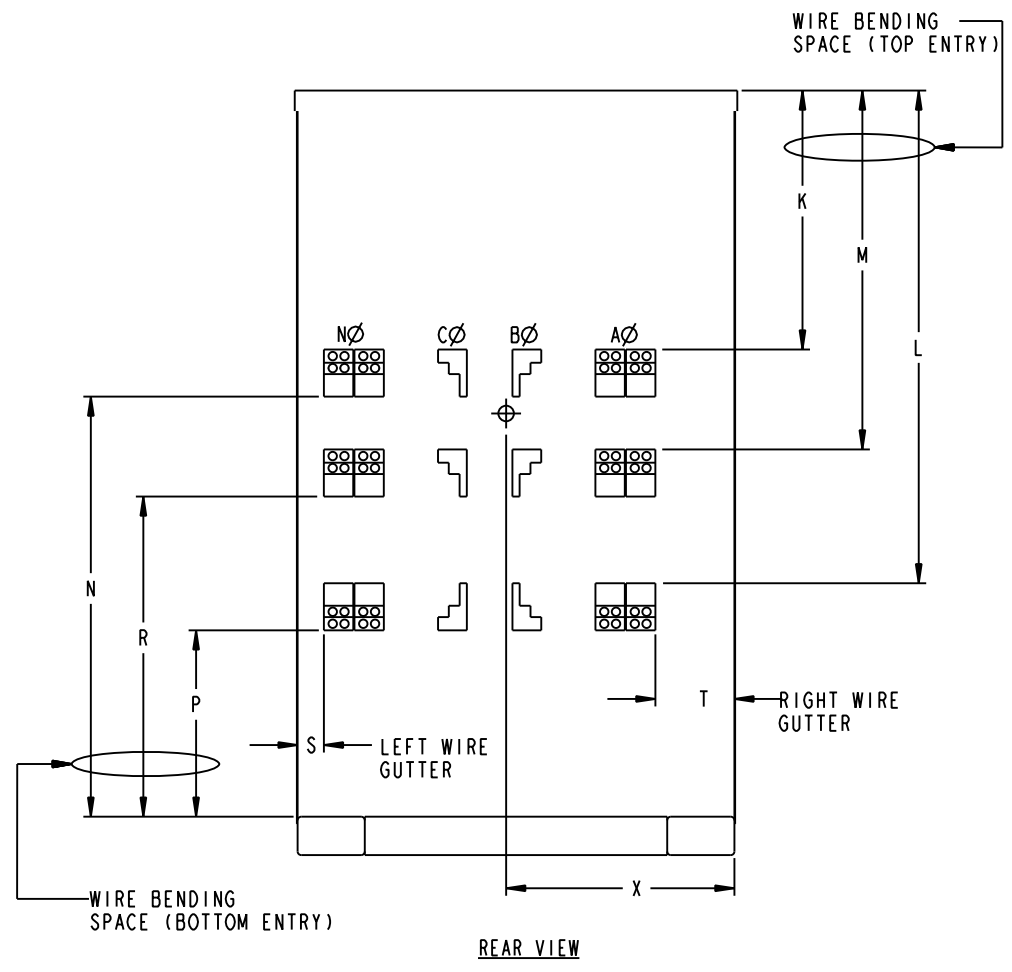
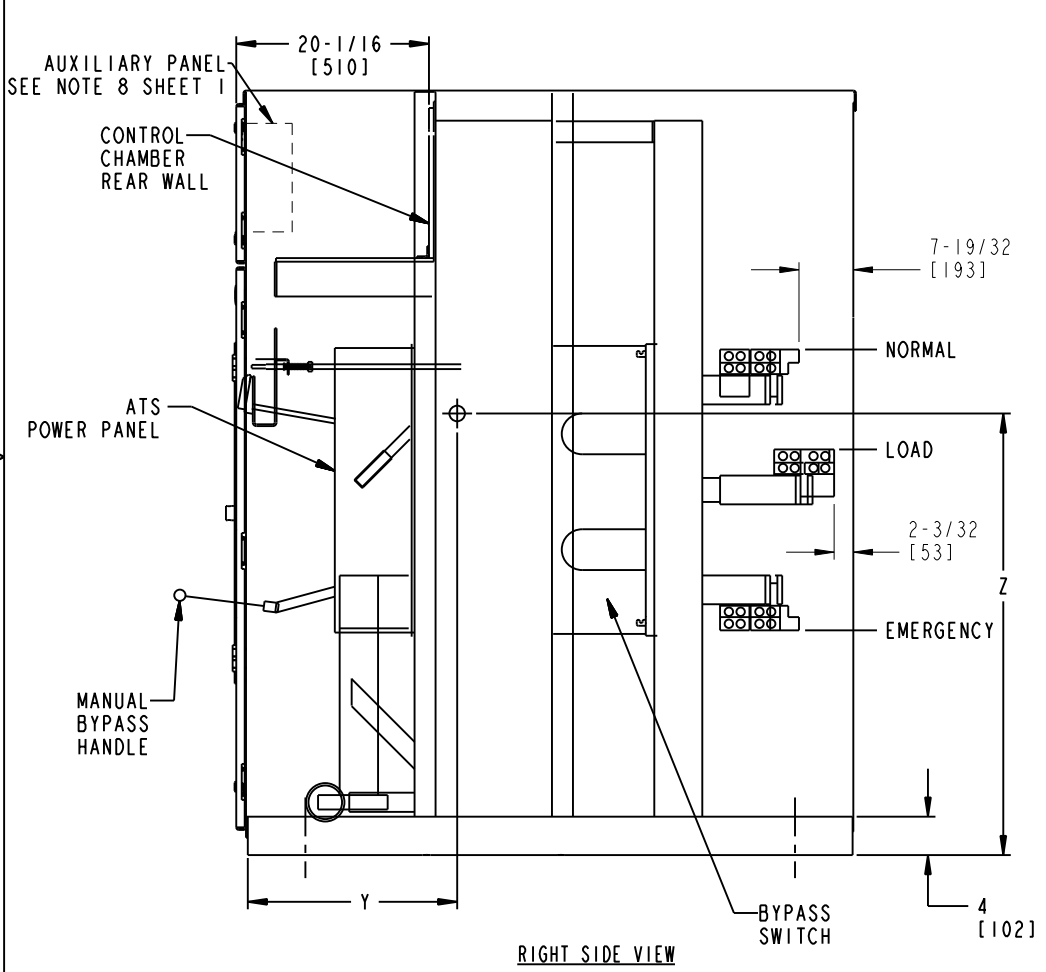
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D	S-8929	REVIS	01/25/10	SS	SA
E	S-8971	UPDATED DWG FOR 2600A	05/19/10	YP	MAS

Z(B)TS(D/CT) SWITCH	CONTROLLER TYPE	CABINET	LUG RANGE	WIRE BENDING SPACE						WIRE GUTTERS			
				TOP ENTRY			BOTTOM ENTRY			S(LEFT)	T(RIGHT)		
				K(NORM)	L(EMERG)	M(LOAD)	N(NORM)	P(EMERG)	R(LOAD)				
1600-2600 AMP	MX-250	3-POLE	(4 PORTS/LUG) #2-600 MCM (33-304mm ²)	26-31/32	51-5/16	37-3/8	43-3/4	19-13/32	33-11/32	2-3/4	8-7/32		
				[685]	[1303]	[949]	[1111]	[493]	[847]	[70]	[209]		
3000 AMP				3-POLE	(4 PORTS/LUG) #4-750 MCM	26-15/32	51-13/16	36-7/8	44-1/4	18-29/32	33-7/8	3-7/16	8-29/32
						[673]	[1316]	[937]	[1124]	[480]	[860]	[87]	[226]
1600-2600 AMP	MX-250	3-POLE	(4 PORTS/LUG) #4-750 MCM	26-31/32	48-3/16	37-3/8	43-3/4	22-13/32	33-11/32	2-3/4	8-7/32		
				[685]	[1224]	[949]	[1111]	[569]	[847]	[70]	[209]		
3000 AMP				3-POLE	(4 PORTS/LUG) #4-750 MCM	26-15/32	47-9/16	36-7/8	44-1/4	23-3/64	33-7/8	3-7/16	8-29/32
						[673]	[1208]	[937]	[1124]	[585]	[860]	[87]	[226]

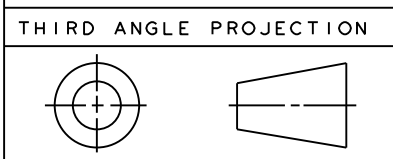


CENTER OF GRAVITY					
Z(B)TS(D/CT) SWITCH	CABINET	X	Y	Z	WEIGHT LB(KG)
1600-2600 AMP	3-POLE	20-1/8 [511]	29-3/16 [741]	38-1/8 [968]	4713 [2138]
	4-POLE	22-7/8 [581]	29-7/16 [748]	38 [965]	5125 [2325]
3000 AMP	3-POLE	20-7/16 [519]	30-3/16 [767]	37-17/32 [953]	5341 [2423]
	4-POLE	23-9/27 [591]	30-13/32 [772]	37-9/16 [954]	5747 [2606]

IMPORTANT NOTE:
 LUGS ARE SUPPLIED AS OPTIONAL ACCESSORY ONLY. TYPICAL CONFIGURATION SHOWN FOR REFERENCE ONLY

- NOTES:
1. ALL CABLE ENTRY IN REAR OF CABINET. NO CABLE ENTRY IN FRONT OF CABINET.
 2. WIRE BENDING AND GUTTER SPACES MEASURED AT POINT OF CONNECTION TO LUGS.
 3. LUGS SHOWN FOR TOP CABLE ENTRY MAY BE RESERVED FOR BOTTOM CABLE ENTRY. LUGS ARE SUPPLIED AS OPTION ONLY.
 4. ALL DIMENSIONS ARE FOR REFERENCE ONLY AND SHOWN IN INCHES(MILLIMETERS).

BYPASS SWITCH SHOWN WITH REAR MECHANICAL LUGS



FOR ADDITIONAL INFO REFER TO:	SIGNATURES	DATE
APPLIED PRACTICES	MODEL SA	09/19/08
DIMENSIONS ARE IN INCHES	DETAIL SA	09/19/08
UNLESS OTHERWISE SPECIFIED IN DRAWING	CHECKED	.
TOLERANCE ON:	ENGRG	.
1 PL DECIMALS ±0.0	MFG	.
2 PL DECIMALS ±0.02	QUALITY	.
3 PL DECIMALS ±0.005	ISSUED	.
ANGLES ±1.0	SOLID MODEL: 50C-2039	
FRACTIONS ±		
FINISH		
CRITICAL TO QUALITY CHARACTERISTIC		

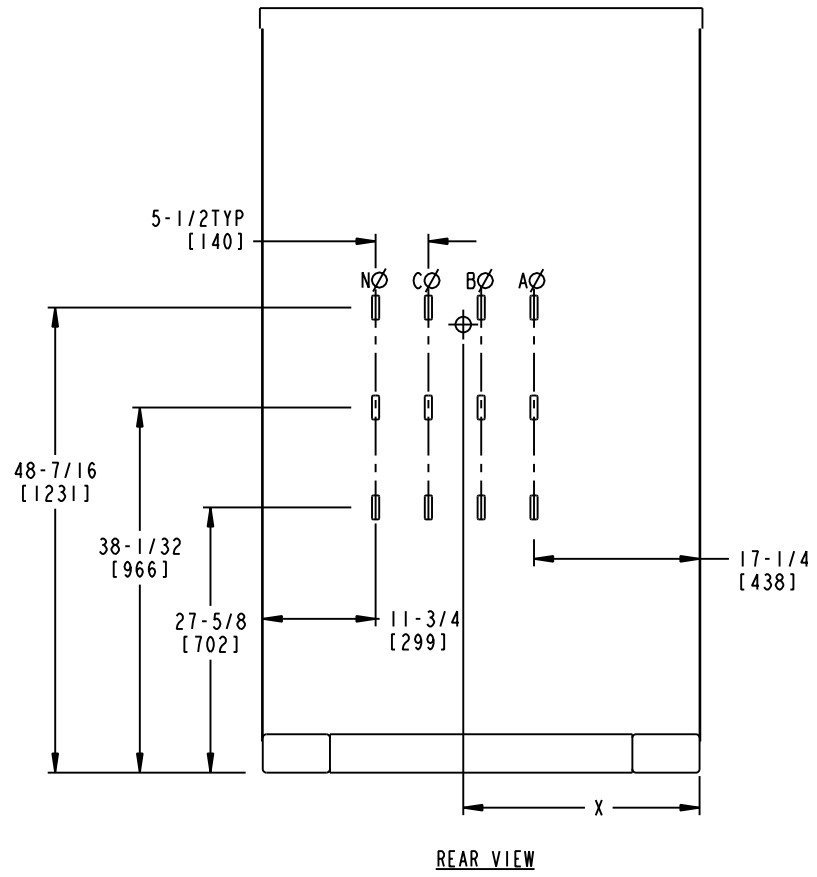
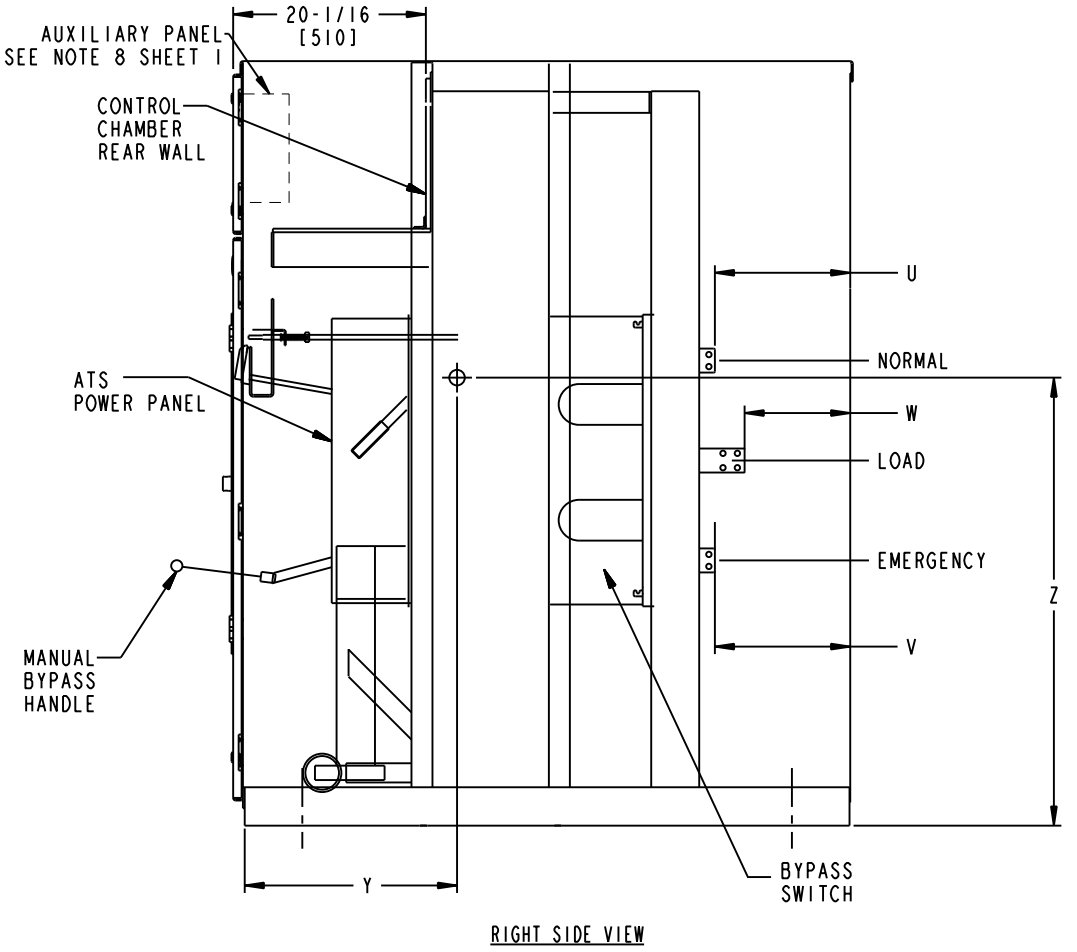
GE Zenith Controls
 TITLE **TRANSFER SWITCH - NEMA 1 ENCL**
1600-3000 A
ZBTS(D/CT)
 SIZE DRAWING **50C-2039** REV **E**
 SCALE: 0.050 REF. No: SHEET 2 OF 4



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D	S-8929	REVISD	01/25/10	SS	SA
E	S-8971	UPDATED DWG FOR 2600A	05/19/10	YP	MAS

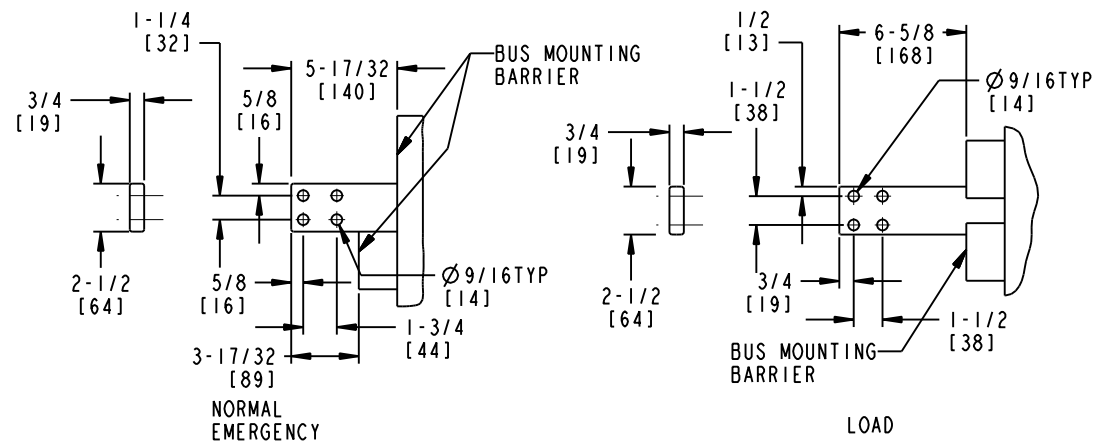


ZBTS(D/CT) SWITCH	CONTROLLER TYPE	CABINET	U(NORM)	V(EMERG)	W(LOAD)
1600-2600 AMP	MX-250	3-POLE	14-3/32 [358]	14-3/32 [358]	11 [279]
		4-POLE			
3000 AMP		3-POLE	15-5/8 [397]	15-5/8 [397]	9-5/32 [233]
		4-POLE			

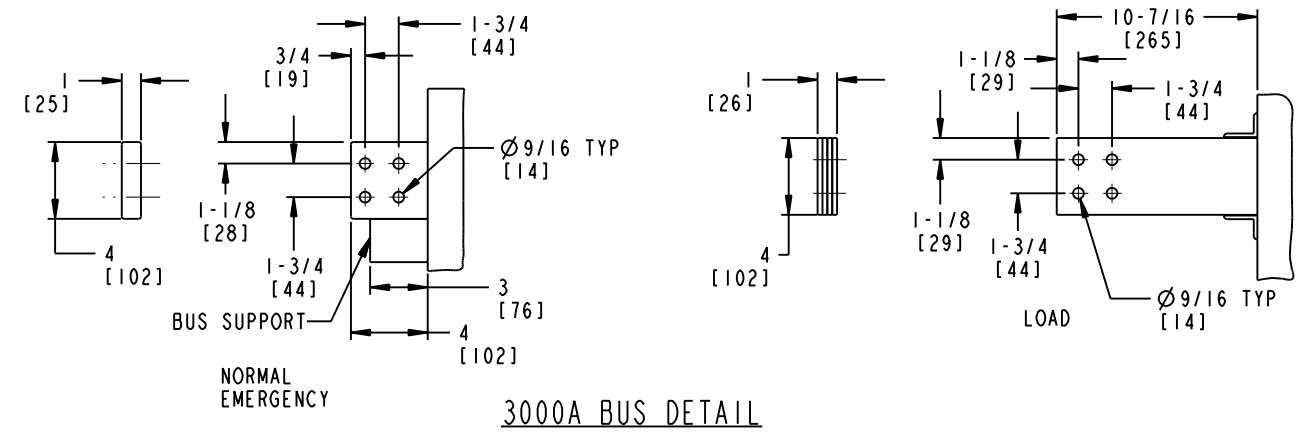
CENTER OF GRAVITY					
ZBTS(D/CT) SWITCH	CABINET	X	Y	Z	WEIGHT LB(KG)
1600-2600 AMP	3-POLE	19-31/32 [507]	27-17/32 [699]	38-1/8 [968]	4490 [2037]
	4-POLE	22-11/16 [576]	27-5/8 [702]	37-31/32 [964]	4842 [2196]
3000 AMP	3-POLE	20-5/16 [516]	28-11/32 [720]	37-15/32 [952]	4997 [2267]
	4-POLE	23-1/8 [587]	28-1/2 [724]	37-9/16 [954]	5305 [2406]

NOTES:
 1. ALL DIMENSIONS ARE FOR REFERENCE ONLY AND SHOWN IN INCHES(MILLIMETERS).

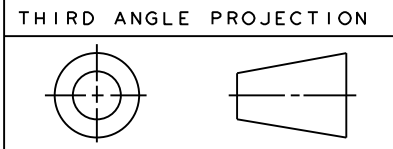
BYPASS SWITCH SHOWN WITH REAR BUS



1600-2600A BUS DETAIL



3000A BUS DETAIL



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APPLIED PRACTICES	SA	09/19/08
DIMENSIONS ARE IN INCHES	SA	09/19/08
UNLESS OTHERWISE SPECIFIED IN DRAWING		
TOLERANCE ON:		
1 PL DECIMALS ±0.0		
2 PL DECIMALS ±0.02		
3 PL DECIMALS ±0.005		
ANGLES ±1.0		
FRACTIONS ±		
FINISH		
CRITICAL TO QUALITY CHARACTERISTIC		

GE Zenith Controls

TITLE **TRANSFER SWITCH - NEMA 1 ENCL**
1600-3000 A
ZBTS(D/CT)

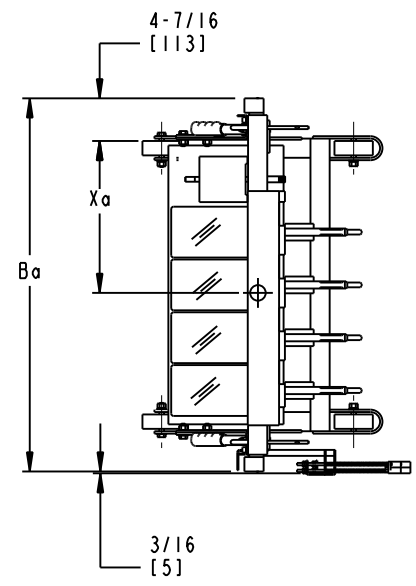
SIZE DRAWING **B** **50C-2039** REV **E**

SCALE: 0.050 REF. No: SHEET 3 OF 4

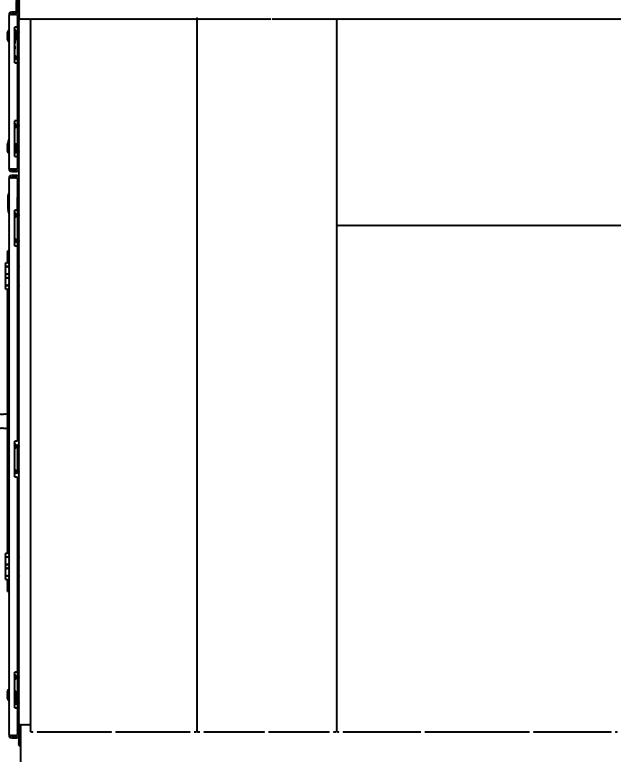
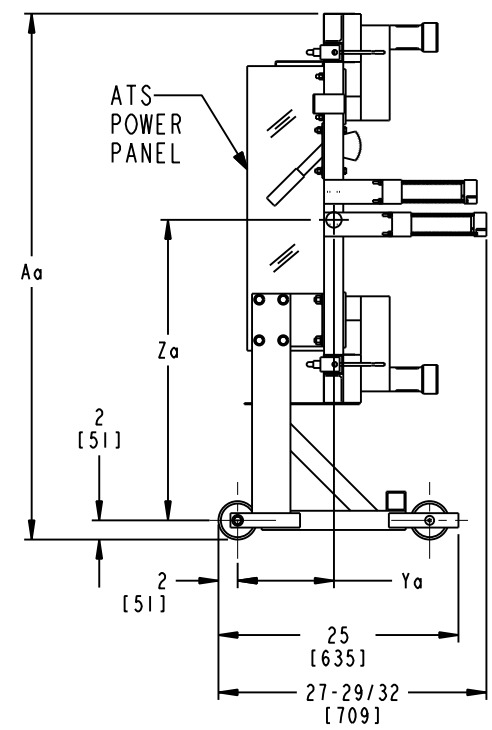
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D	S-8929	REVISED	01/25/10	SS SA
E	S-8971	UPDATED DWG FOR 2600A	05/19/10	YP MAS



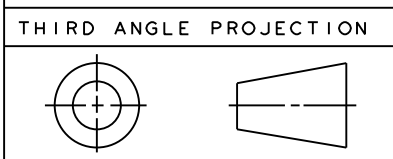
ATS POWER PANEL WITH CART DIMENSIONS			
ZBTS(D/CT) SWITCH	POLES	Aa	Ba
1600-2600 AMP	3-POLE	54-25/32 [1391]	33-3/8 [848]
	4-POLE	54-25/32 [1391]	38-7/8 [987]
3000 AMP	3-POLE	56-5/8 [1438]	33-3/8 [848]
	4-POLE	56-5/8 [1438]	38-7/8 [987]



CENTER OF GRAVITY OF ATS POWER PANEL WITH CART					
ZBTS(D/CT) SWITCH	POLES	Xa	Ya	Za	WEIGHT LB(KG)
1600-2600 AMP	3-POLE	13 [330]	10-1/8 [257]	29-17/32 [750]	559 [253]
	4-POLE	15-13/16 [402]	10-7/32 [260]	29-7/8 [759]	683 [310]
3000 AMP	3-POLE	13-15/32 [342]	11-5/8 [295]	30-7/32 [767]	725 [329]
	4-POLE	16-9/32 [414]	11-13/16 [300]	30-17/32 [775]	904 [410]

NOTES:
 1. ALL DIMENSIONS ARE FOR REFERENCE ONLY AND SHOWN IN INCHES(MILLIMETERS).

ATS POWER PANEL SHOWN OUT-SIDE THE ENCLOSURE



Part must conform to SI 900000 Sect. 4, Toxicity Procedure 135

FOR ADDITIONAL INFO REFER TO:	SIGNATURES	DATE
APPLIED PRACTICES		
DIMENSIONS ARE IN INCHES		
UNLESS OTHERWISE SPECIFIED IN DRAWING		
TOLERANCE ON:		
1 PL DECIMALS ±0.0		
2 PL DECIMALS ±0.02		
3 PL DECIMALS ±0.005		
ANGLES ±1.0		
FRACTIONS ±		
FINISH		
CRITICAL TO QUALITY CHARACTERISTIC		

GE Zenith Controls

TITLE **TRANSFER SWITCH - NEMA 1 ENCL**
1600-3000 A
ZBTS(D/CT)

SIZE DRAWING **50C-2039** REV **E**

SCALE: 0.050 REF. No: SHEET 4 OF 4

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ZBTST SERIES WITH MX250 MICROPROCESSOR-BASED CONTROL PANEL
 BYPASS/ISOLATION TRANSFER SWITCH
 1600-3000 AMP
 FOR USE ON EMERGENCY OR STANDBY SYSTEMS
 - RATED FOR TOTAL SYSTEM & MOTOR LOAD

REV.	DESCRIPTION	DATE	APPROVED
H	S-8604 REVISED SHEET 2	04/12/07	YJS MES

REVISIONS

A. LEGEND

MX Series Microprocessor-Based Control Panel
 Standard Features:

- DT..... Time Delay to SOURCE 1
- DW..... Time Delay to SOURCE 2
- L1..... SOURCE 2 Position Light
- L2..... SOURCE 1 Position Light
- L3..... SOURCE 1 Available Light
- L4..... SOURCE 2 Available Light

Controls Power Supply (CPS)

- XE1,XE2.....Control Transformer, SOURCE 2
- XN1,XN2.....Control Transformer, SOURCE 1

Power Panel

- N1,2,3,(N)..... SOURCE 1 Line
- E1,2,3,(N)..... SOURCE 2 Line

T1,2,3,(N)..... Load Connections

- CE.....Transfer Operator, SOURCE 2
- CEO.....Transfer Operator, Open SOURCE 2.
- CN.....Transfer Operator, SOURCE 1
- CNO.....Transfer Operator, Open SOURCE 1
- DS.....Disconnect Switch
- GND.....Ground
- NB.....Neutral Bar (if required)
- SCR-E.....SCR, Source 2
- SCR-EO.....SCR, Source 2 Open
- SCR-N.....SCR, Source 1
- SCR-NO.....SCR, Source 1 Open
- SE.....SOURCE 2 Position Limit Switch
- SEO.....SOURCE 2 OPEN Position Limit Switch
- SN.....SOURCE 1 Position Limit Switch
- SNO.....SOURCE 1 OPEN Position Limit Switch

B. OPERATION (OPEN TRANSITION)

When SOURCE 1 line voltage drops below the preset "Fail" values, the SOURCE 1 voltage sensing circuit initiates the engine start circuit.

When SOURCE 2 line voltage and frequency reach the preset "restore" values, the MX controller initiates a transfer signal through the SCR-NO to operate the OPEN position. After a set time delay, the MX controller initiates a transfer signal through the SCR-E to operate the transfer operator. The load will be transferred to the SOURCE 2 position. The transfer switch is mechanically locked. The SN limit switch awaits the next operation to SOURCE 1.

When SOURCE 1 line voltage and Frequency reach the preset "Restore" values, the MX controller initiates a transfer signal through the SCR-EO to operate the transfer operator. The load will be transferred to the OPEN position. After a set time delay, the MX controller initiates a transfer signal through the SCR-N to operate the transfer operator. Load will be re-transferred back to the SOURCE 1 position. The transfer switch is mechanically locked. The SE limit switch awaits the next operation to SOURCE 2.

The Test Switch simulates a SOURCE 1 line failure when activated. To test, activate the Test Switch, thus allowing the transfer switch to Transfer to the SOURCE 2 position. De-activate the Test Switch. The transfer switch will transfer to the SOURCE 1 position. Testing at least once a month is recommended. For hospital EMERGENCY systems, test once a week.

Disconnect Switch (DS)

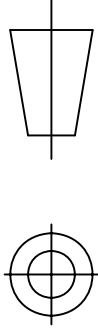
When the Disconnect Switch is placed in the INHIBIT position, the circuits to the transfer operators are opened and transfer cannot take place.

C. PARALLELING REQUIREMENTS

1. The unit is Factory set to accomplish transfer within 5 electrical degrees.
2. Requires an Isochronous Governor with an operating frequency of 60 ± 0.2 Hz.
3. Requires a shunt trip breaker on the Generator set with a response time not exceeding 50ms.

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THIRD ANGLE PROJECTION



AutoCad Generated

CTOs

CRITICAL TO QUALITY CHARACTERISTIC

SCALE: NA

FIRST MADE FOR: ZBTST(1600-3000 AMP)

SIZE CAGE CODE DWG NO

76A-3000

SHEET 1 OF 8

D. OPERATION (CLOSED TRANSITION)

Zenith Closed Transition Transfer Switches are designed to Transfer load between two available sources, without interrupting power to the load (make-before-break). Paralleling of the two sources occurs within a predefined window of synchronization and lasts less than 100ms. The initial source is then disconnected.

To test the ATS, activate the test switch to drop out the Engine Start Relay (P1). The ATS closes into SOURCE 2 only after the SYNC Check ensures the proper phase relationship between both sources. After the ATS closes into SOURCE 2, the SE limit switch becomes activated. The controller initiates a transfer signal through the SCR-NO, which opens the ATS out of SOURCE 1. When the ATS has opened out of SOURCE 1, the SNO limit switch activates. The ATS has now closed into the SOURCE 2 position without interrupting the load.

Deactivating the Test switch initiates the retransfer. The ATS closes into SOURCE 1 only after the SYNC ensures proper phase relationship between both sources. After the ATS closes into SOURCE 1 the SN limit switch becomes activated. The controller initiates a transfer signal through the SCR-EO which opens the ATS out of SOURCE 2. When the ATS has opened out of SOURCE 2, the SEO limit switch activates. The ATS has now closed back into the SOURCE 1 position without interrupting the load.

The ATS defaults to an open transition transfer when SOURCE 1 source fails. This signals the generator to start. After the generator voltage and frequency reach the preset "Restore" values, the ATS transfers to SOURCE 2. Closed transition transfer is not possible with one source available. One can select an Open Transition transfer via the optional Transition Mode Selector (TMS) for testing.

If while in Closed Transition Mode, the ATS fails to open the source it is attempting to "transfer out of", the source that the ATS just closed into will be opened leaving the ATS in its initial source while disabling all other transfer operations until the problem is corrected and the "Fail to Open Lockout Reset" has been pressed. Also a dry contact (STE) to shunt trip the generator circuit breaker is available to remove the generator from the bus if neither operator opened.

ACCESSORY GROUP PACKAGES:

E. (STDS) GROUP PACKAGE

- 6. A3, A4, CALIBRATE, CDT DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, R50, S13, T, U, VI, W AND YEN.

F. (EXES) OPTION PACKAGE

- 6. A1, A1E, A3, A4, CALIBRATE, CDP DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, Q2, R16, R50, S13, T, U, VI, W & YEN.

G. (CONS) OPTION PACKAGE

- 6. A1, A1E, A3, A4, CALIBRATE, CDP, DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, Q2, Q3, Q7, R16, R50, S13, T, T3/W3, U, UMD, VI, W AND YEN.

H. (SENS) OPTION PACKAGE

- 6. A1, A1E, A3, A4, CALIBRATE, CDP, DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, Q2, Q7, R1-1/R1-3, R16, R50, S12, S13, T, U, VI, W AND YEN.

I. (SPES) OPTION PACKAGE

- 6. A1, A1E, A3, A4, CALIBRATE, CDP, DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, Q2, Q3, Q7, R1-1/R1-3, R16, R50, S5, S13, T, T3/W3, U, UMD, VI, W AND YEN.

J. (PSGS) OPTION PACKAGE

- 6. A1, A1E, A3, A4, CALIBRATE, CDP, DS, DT, DW, E, EL/P, KP, L1, L2, L3, L4, LN, P1, Q2, Q3, Q7, R1-1/R1-3, R15, R16, R50, S12, S13, T, T3/W3, U, UMD, VI, W AND YEN.

NOTES:

1. **CAUTION:** 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.
2. **GROUNDING TERMINAL:** A grounding terminal (GND) is provided. When installing open type switches connect this terminal to the metal enclosure or on equivalent earth ground.
3. **WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.**
4. **OPEN TRANSITION OPERATION CAN BE SELECTED WITH BOTH SOURCES AVAILABLE.**
5. **OPEN TRANSITION OCCURS BY DEFAULT WHEN THE LOAD-CONNECTED SOURCE FAILS.**
6. **ON SINGLE PHASE UNITS WHERE THE SOURCE 2 SOURCE IS A UTILITY LINE, CONNECT SOURCE 2 LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.**
7. **ON SINGLE PHASE (2 POLE) UNITS, THE CENTER POLE, 47N & 47E ARE NOT SUPPLIED.**

3Ø 27/59N & E ARE REPLACED BY 1Ø 27/59N & E.



GE Zenith Controls

TITLE

LEGEND, OPERATION & ACCESSORIES

DWG NO

76A-3000

SHEET 1 OF 8

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ZBTSCT SERIES WITH MX250
MICROPROCESSOR-BASED CONTROL PANEL
BYPASS/ISOLATION TRANSFER SWITCH 1600-3000AMP

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
H	S-8604 REVISED DWG	04/12/07	YJS MES

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

K. ACCESSORIES DEFINITION:

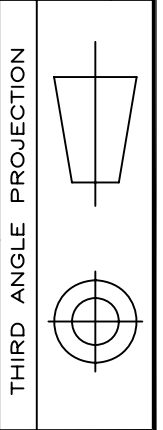
- M1 Single Phase Amp Meter
- M2 Three Phase Amp Meter
- M3 Single Phase Volt Meter
- M4 Three Phase Volt Meter
- M90 2000 Digital Power Monitor Δ
- M91 EPM 6000 Digital Power Meter w/RS485 Δ
- N1 Running Time meter, Door Mount.
- N2 Operation Counter meter, Door Mount.
- P1 Time Delay Source 2 Start. Adjustable 0 to 10 sec.
- P2 Time Delay Source 2 Start. Adjustable 1/6 to 300 sec.
- Q2 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.
- Q3 Inhibit Transfer to Source 2 Circuit.
- Q7 Inhibit Transfer to Source 1 Circuit.
- R2E Under voltage sensing of Source 2 for single-phase. (R17 replaces R2E for Utility to Utility switches)
- R1-1/R1-3 Source 1 Over Voltage sensing for single and three phase systems.
- R16 Phase Rotation Sensing
- R26 Interruptable Power Rate Provisions
- R50 In-Phase Monitor. Prevents transfer until two sources are in-phase.
- S5 Auto/Semi Manual selector, Utilizing keypad
- S12 Auto/Manual selector, Utilizing keypad
- S13 Transfer Commit or no Commit to transfer upon Engine start.
- S14 Test/Auto/Source 1 Selector, Door mount
- SW1 Auto/Off/Start Engine control selector Door mount
- SW2 Auto/Off Engine control selector Door mount
- SW3 Source Priority Selector Switch Door mount
- T Time Delay to SOURCE 1 stable timer
- T3/W3 Elevator Pre-Signal Auxiliary Contacts: Open 0-60 sec. prior to transfer to either direction, re-closes after transfer.
- U Source 2 Stop Delay Timer.
- UMD Universal Motor Load Disconnect Circuit.
- VI Voltage Imbalance Sensing (Three Phase)
- W Time Delay (S2) Source 2 Stable Timer. To delay transfer to Source 2.
- YEN Bypass T amd W Timers utilizing keypad.
- ZNET Network Communication Interface Card.

- 6 Test Switch, Momentary.
- 6A Test Switch, Maintained/Momentary. Door mount.
- 6AP Test Switch Maintained/Momentary Utilizing Keypad.
- 6B Test Switch, Maintained-Auto/Momentary-test, Key Operated.
- 6C Test Switch, Maintained-Auto/Maintained-test, Key Operated.
- A1 Auxiliary Contact, Operates on Source 1 line failure.
- A1E Auxiliary Contact, Operates on Source 2 line failure.
- A3 Auxiliary Contact Closed when the switch is in Source 2 position.
- A4 Auxiliary Contact Closed when the switch is in Source 1 position.
- A62 Sequential Universal Motor load Disconnect Circuit.
- B9 Battery charger.
- CALIBRATE Source 1 & Source 2 Calibrate capabilities for voltage a frequency.
- CDP 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.
- CDT Timer 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, 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.
- CTAP Alarm Panel on transfer to Source 2 w/Silence button.
- DS Disconnect Switch, Auto /Inhibit. Inhibits transfer in either direction when in inhibit. Allows automatic operation when in Auto.
- DT Time delay from Neutral switch position to Source 1 position.
- DW Time delay from Neutral switch position to Source 2 position.
- E Engine Start Contact.
- EL/P Event Log: Sequentially Numbered Log of 16 events that track date, time, reason and action taken.

- System Data: 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)
- F Fan contact operates when generator is running.
- HT Heater and Thermostat.
- K Frequency Meter, Door mount.
- KP Frequency, LCD-Indication S1 & S2
- L 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.

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FOR ADDITIONAL INFO REFER TO	SIGNATURES	DATE
APPLIED FRACILES UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	GG	05/06/03
TOLERANCES ON: 2 PL DECIMALS ± .020 3 PL DECIMALS ± .005 ANGLES ± 1° FRACTIONS ± 1/64 FINISH ✓	CHECKED ENGRG FS MFG QUALITY ISSUED	
DRAWING FILE: 76a-3000-h-2.dwg MODEL / ASSEMBLY FILE: ZBTSCT(1600-3000 AMP)	# CTOs	



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GE Zenith Controls

LEGEND, OPERATION,
AND ACCESSORIES

FIRST MADE FOR:	SIZE	CAGE CODE	DWG NO
ZBTSCT(1600-3000 AMP)	B		76A-3000

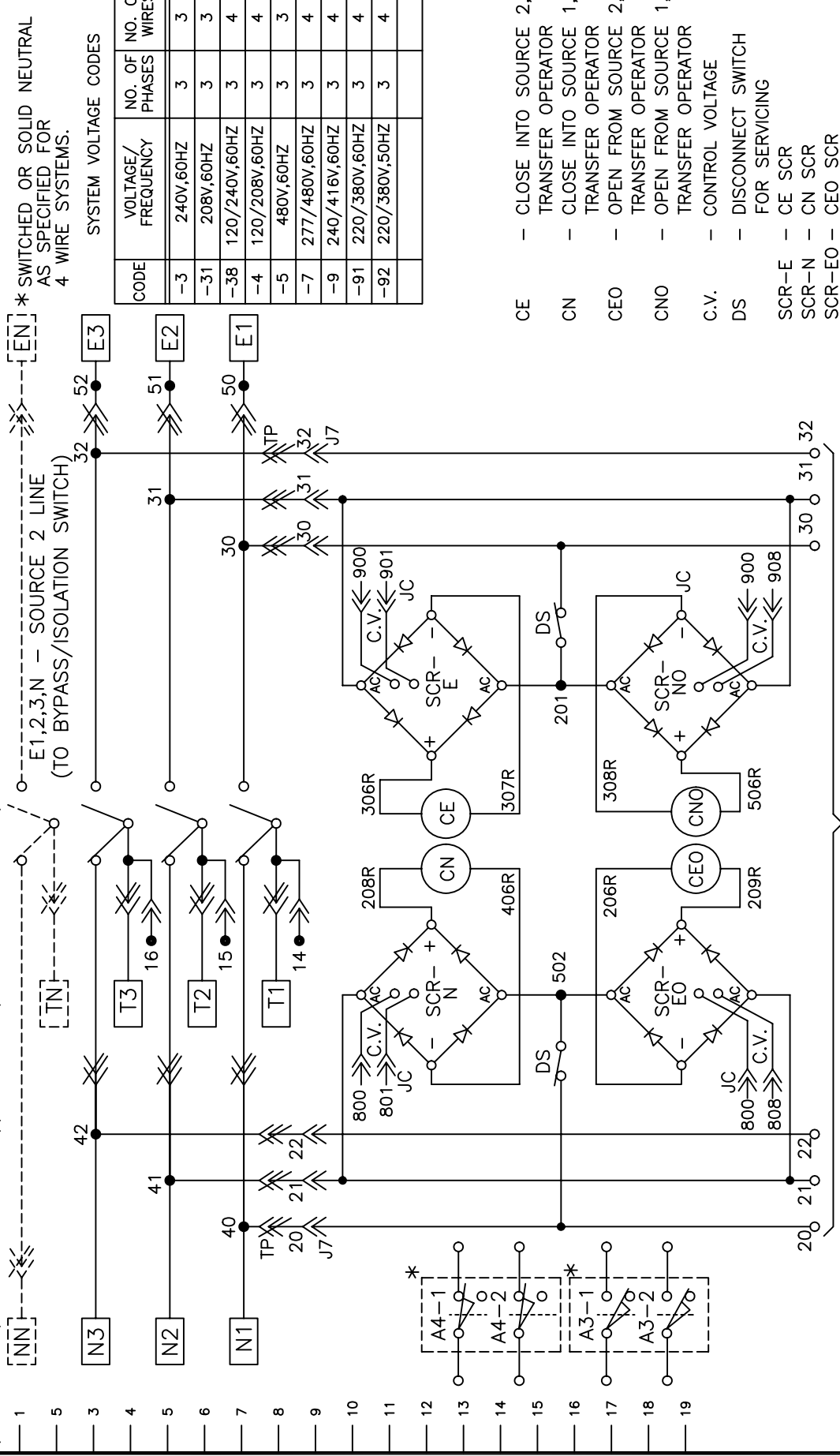
CRITICAL TO QUALITY CHARACTERISTIC	SCALE:	SHEET	2 OF 8
	NA		



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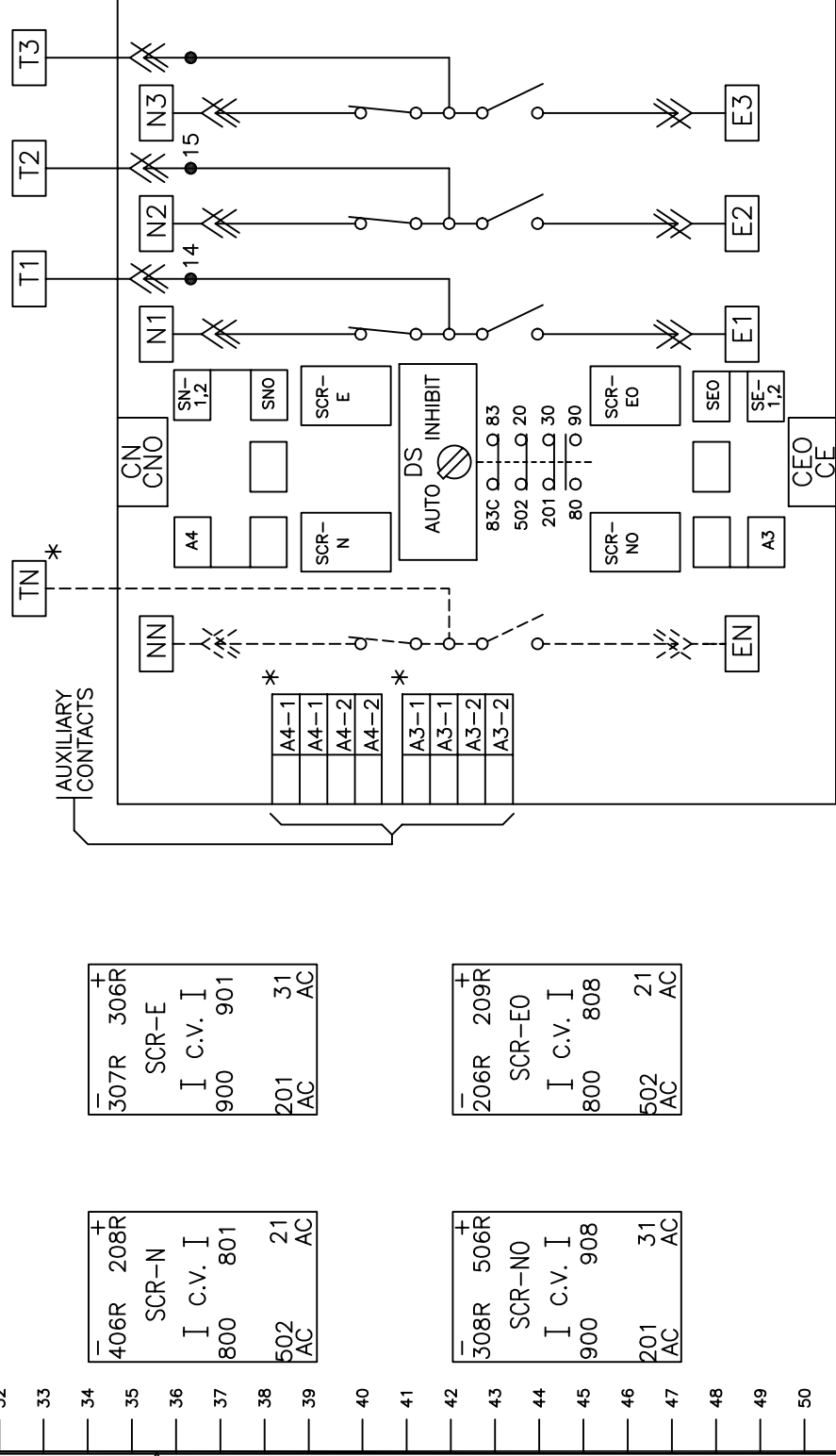
POWER CIRCUIT SCHEMATIC

N1,2,3,N - SOURCE 1 LINE T1,2,3,N - LOAD
(TO BYPASS/ISOLATION SWITCH)(TO BYPASS/ISOLATION SWITCH)

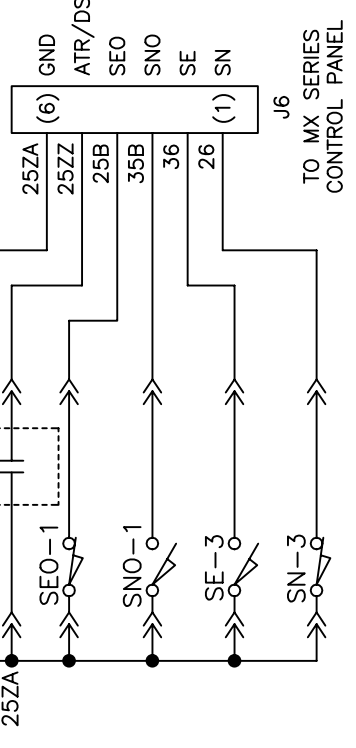


TO CONTROLS POWER SUPPLY (CPS) - SHEET 4

POWER PANEL LAYOUT
(TO BYPASS/ISOLATION SWITCH)



LIMIT SWITCH SCHEMATIC



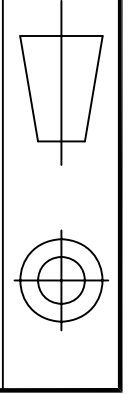
- ATR - AUTO/TEST RELAY CONTACT (LOCATED ON BYPASS SUBPANEL)
- SE0 - SOURCE 2 OPEN POSITION INDICATOR
- SNO - SOURCE 1 OPEN POSITION INDICATOR
- SE - SOURCE 2 POSITION INDICATOR
- SN - SOURCE 1 POSITION INDICATOR

- LEGEND**
- WIRE CONNECTION
 - WIRE ON MAIN TERMINAL BLOCK
 - ⇨ WIRE IN INTERCONNECT PLUG
 - * OPTIONAL
- NOTES**
- ZTSCT SHOWN IN SOURCE 1 POSITION WITH NO POWER AVAILABLE.

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THIRD ANGLE PROJECTION



REV.	DESCRIPTION	DATE	APPROVED
H	S-8604	04/12/07	YJS MES

REVISIONS

CODE	VOLTAGE/FREQUENCY	NO. OF PHASES	NO. OF WIRES
-3	240V,60HZ	3	3
-31	208V,60HZ	3	3
-38	120/240V,60HZ	3	4
-4	120/208V,60HZ	3	4
-5	480V,60HZ	3	3
-7	277/480V,60HZ	3	4
-9	240/416V,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

- CE - CLOSE INTO SOURCE 2, TRANSFER OPERATOR
- CN - CLOSE INTO SOURCE 1, TRANSFER OPERATOR
- CEO - OPEN FROM SOURCE 2, TRANSFER OPERATOR
- CNO - OPEN FROM SOURCE 1, TRANSFER OPERATOR
- C.V. - CONTROL VOLTAGE
- DS - DISCONNECT SWITCH FOR SERVICING
- SCR-E - CE SCR
- SCR-N - CN SCR
- SCR-EO - CEO SCR
- SCR-NO - CNO SCR

GE Zenith Controls

ATS POWER CIRCUIT & LAYOUT

FIRST MADE FOR: ZBTSCT(1600-3000 AMP)
DWMG NO 76A-3000

SIZE CAGE CODE B
DRAWING FILE: 76a-3000-h-3.dwg
MODEL / ASSEMBLY FILE: ZBTSCT(1600-3000 AMP)

SCALE: NA

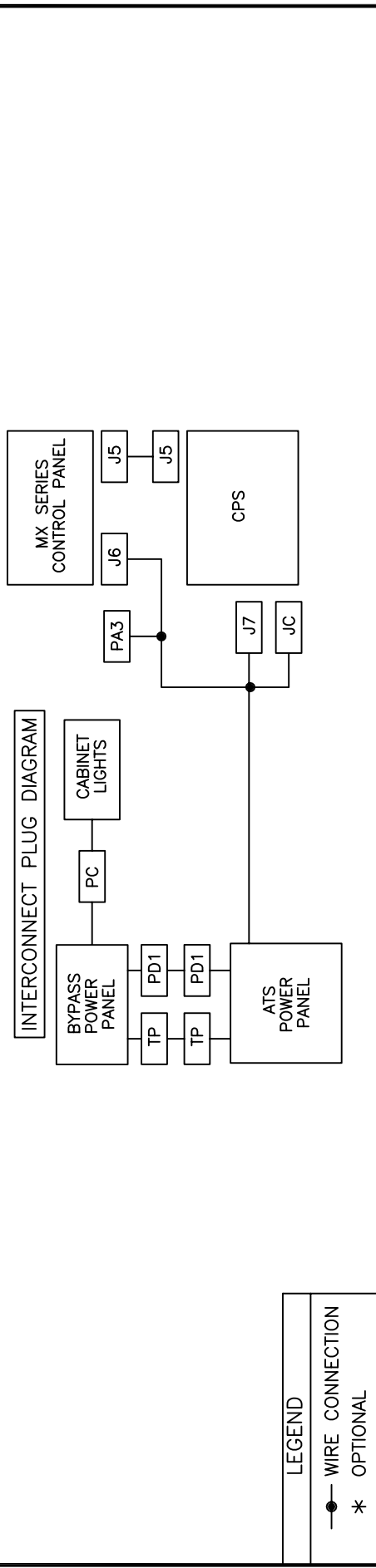
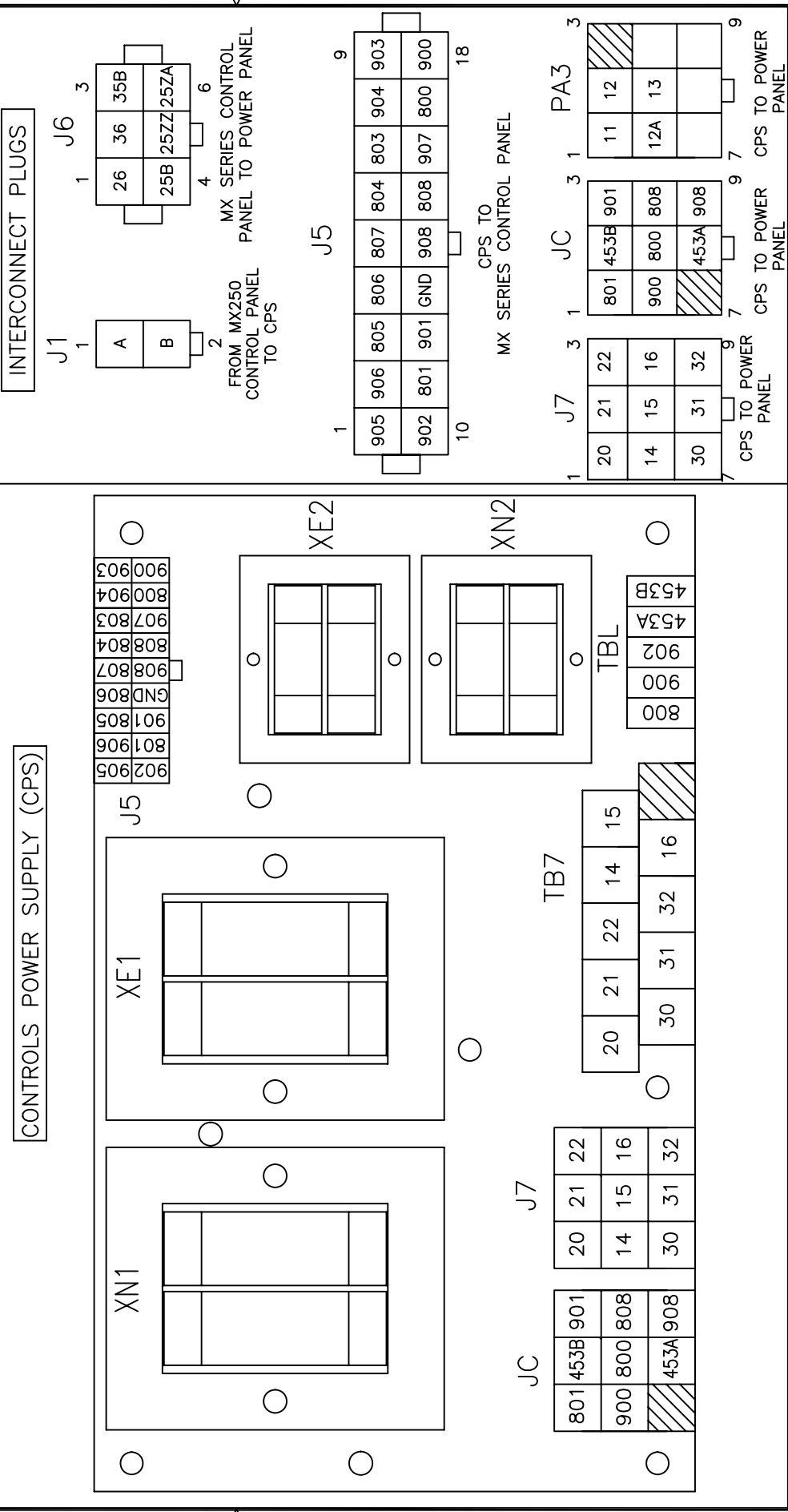
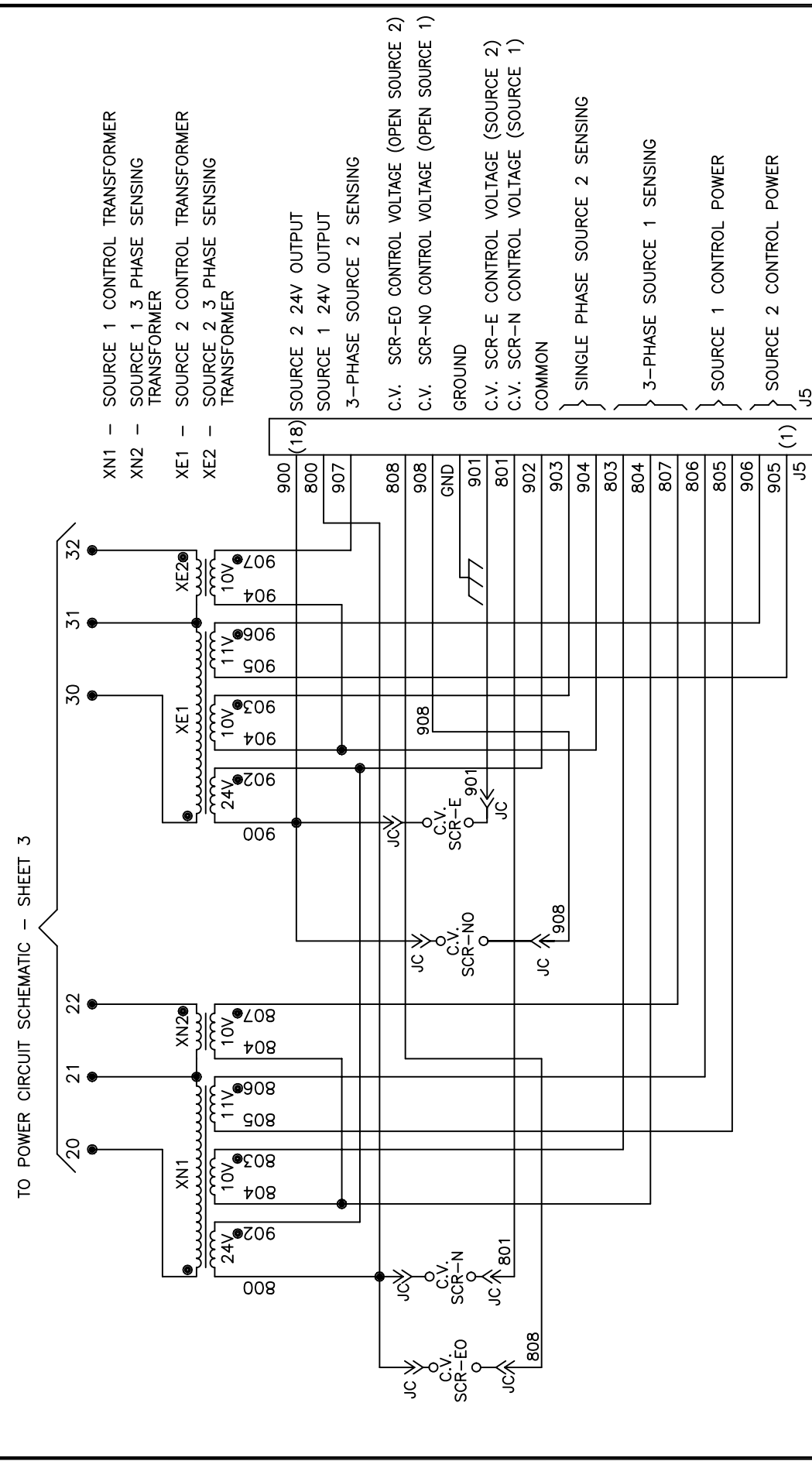
SHEET 3 OF 8

FOR ADDITIONAL INFO REFER TO	SIGNATURES	DATE
APPLIED FRAGMENTS	GG	05/06/03
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
TOLERANCES ON:		
2 PL. DECIMALS ± .020		
3 PL. DECIMALS ± .005		
ANGLES ± 1°		
FRACTIONS ± 1/64		
FINISH		
AutoCad Generated		

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CONTROLS POWER SUPPLY (CPS) SCHEMATIC

REV.	DESCRIPTION	DATE	APPROVED
H	S-8604	04/12/07	YJS MES



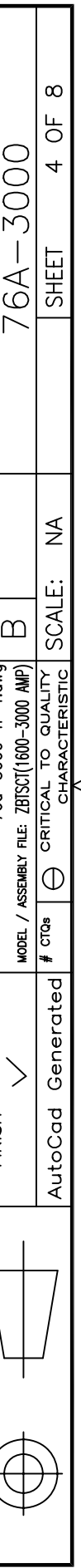
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APPLIED: MODEL GG
 UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 CHECKED: ENGRG FS
 MFG: MFG
 QUALITY: QUALITY
 ISSUED: ISSUED
 DRAWING FILE: 76a-3000-h-4.dwg
 MODEL / ASSEMBLY FILE: ZBITSC1(1600-3000 AMP)
 FINISH: ✓
 FRACTIONS ± 1/64
 ANGLES ± 1°
 2 PL. DECIMALS ± .020
 3 PL. DECIMALS ± .005

FOR ADDITIONAL INFO REFER TO: SIGNATURES: DATE: 05/06/03
 MODEL: GG
 DETAIL: DETAIL
 CHECKED: ENGRG FS
 MFG: MFG
 QUALITY: QUALITY
 ISSUED: ISSUED

TITLE: CONTROLS POWER SUPPLY(CPS) & INTERCONNECT PLUGS
 FIRST MADE FOR: ZBITSC1(1600-3000 AMP)
 SIZE: B
 CAGE CODE: 76A-3000
 DWG NO: 76A-3000
 SCALE: NA
 CHARACTERISTIC: NA
 SHEET: 4 OF 8



LEGEND
 ● WIRE CONNECTION
 * OPTIONAL

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REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
H	S-8604 REVISED SHEET 2	04/12/07	YJS MES

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door and turn DS to "INHIBIT".
2. Turn Bypass Selector Switch (BSS) to same power source as ATS.
3. Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
3. Turn DS to "AUTO".
4. Test Switch (TS) on microprocessor controller will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

1. Bypass and isolate per above instructions.
2. Disconnect multipin plugs and external connections to ATS.
3. Slide four corner latches of ATS to innermost position.
4. ATS can now be removed from cabinet.

TO RECONNECT ATS

1. Roll cart back into cabinet.
2. Slide four corner latches of ATS to outermost position.
3. Turn DS Switch to "INHIBIT".
4. Manually position ATS into same source as Bypass Switch.
5. Reconnect multipin plugs and external connections to ATS.
6. Rotate crank mechanism clockwise until ATS TEST light is illuminated.
7. Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Rotate crank mechanism clockwise until drawbar flange is aligned with "AUTO" mark on location indicator (ATS must be in same source as Bypass).
10. Turn DS to "AUTO" and open Bypass with MBH.
11. ATS is now fully automatic (Figure 1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Above Figures depict Bypass SOURCE 1. Sequence is same for Bypass SOURCE 2.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE:
 - a) Move MBH downward (to open Bypass Contacts BN/BE).
 - b) Turn BSS to opposite power source.
 - c) Move MBH upward to close into selected power source.

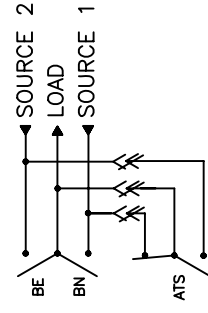


FIG. 1 BP IS OPEN WITH SOURCE 1

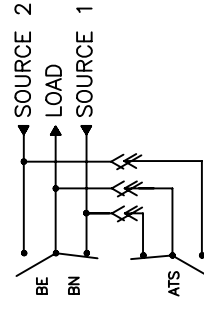


FIG. 2 BP IN SOURCE 1 WITH SOURCE 1

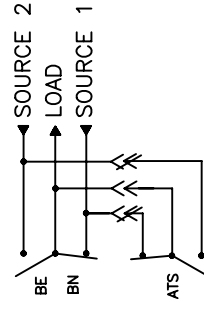


FIG. 3 BP IN SOURCE 1 WITH SOURCE 2 (LOAD CONNECTIONS ARE OPEN)

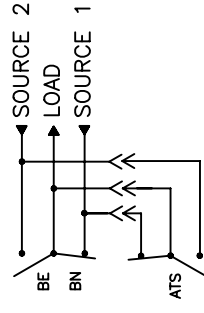


FIG. 4 BP IN SOURCE 1 WITH ATS ISOLATED

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS
 N1,2,3(N)..... SOURCE 1 Line connections
 E1,2,3(N)..... SOURCE 2 Line connections
 T1,2,3(N)..... Load Line connections
 BE..... Bypass SOURCE 2 contacts
 BN..... Bypass SOURCE 1 contacts
 BSS..... Bypass Selector Switch
 MBH..... Manual Bypass Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS
 AA-1,2,3..... Limit switch held actuated in Auto location of ATS, Non-actuated Test and Isolated locations.
 AB3-1,2,3,4,5..... Limit switch, actuated in Bypass SOURCE 2 position
 AB4-1,2,3..... Limit switch, actuated in Bypass SOURCE 1 position
 AE-1,2..... Limit switch, switches Engine Start from ATS control to bypass control during ATS isolate
 AI-1,2..... Limit switch, actuated in Isolate location
 AT-1,2..... Limit switch, actuated in Test location
 ATR..... Auto/Test Relay. Energized in AUTO and TEST locations
 AUTO..... Auto location relay, Energized in Auto location
 BR-1,2,3..... Bridge Rectifier
 C..... Capacitor: RNH
 CBC..... Crank Solenoid
 CBE..... SOURCE 2 Bypass Permissive Solenoid
 CBN..... SOURCE 1 Bypass Permissive Solenoid
 CH-1..... Limit switch actuated when crankhandle is engaged
 D..... Diode
 R..... Resistor: RNH
 RNH..... Relay SOURCE 1ly held, 24 VDC coil, 3PDT
 XBE..... SOURCE 2 line control transformer
 XBN..... SOURCE 1 line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS
 LNA..... SOURCE 1 available
 LEA..... SOURCE 2 available
 LBN (NOTE 1)..... Bypass SOURCE 1 (BN closed)
 LBE (NOTE 1)..... Bypass SOURCE 2 (BE closed)
 LAT (NOTE 1)..... ATS in Test location
 LAI (NOTE 1)..... ATS in Isolate location
 LIT (NOTE 1)..... ATS Inhibit
 LDS (NOTE 1)..... ATS DS switch in INHIBIT position

NOTES

- OPERATION:
 1. BP-Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
 2. ATS-Automatic Transfer Switch.
- LEGEND:
 1. Indicator off during automatic operation of ATS.
 2. Four pole includes neutral lugs.

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FOR ADDITIONAL INFO REFER TO
 APPLIED DIMENSIONS ARE IN INCHES
 UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES
 TOLERANCES ON:
 2 PL. DECIMALS ± .020
 3 PL. DECIMALS ± .005
 ANGLES ± 1°
 FRACTIONS ± 1/64
 FINISH ✓

SIGNATURES
 MODEL GG
 DETAIL CHECKED
 ENGRG FS
 MFG
 QUALITY
 ISSUED

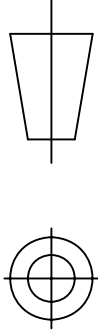
DATE
 05/06/03



GE Zenith Controls

BYPASS/ISOLATION SCHEMATICS & PLUGS

THIRD ANGLE PROJECTION



CTOs

AutoCad Generated

CRITICAL TO QUALITY CHARACTERISTIC

SCALE: NA

SHEET 5 OF 8

SIZE B

CAGE CODE

DWG NO

FIRST MADE FOR: ZBTSC1(1600-3000 AMP)

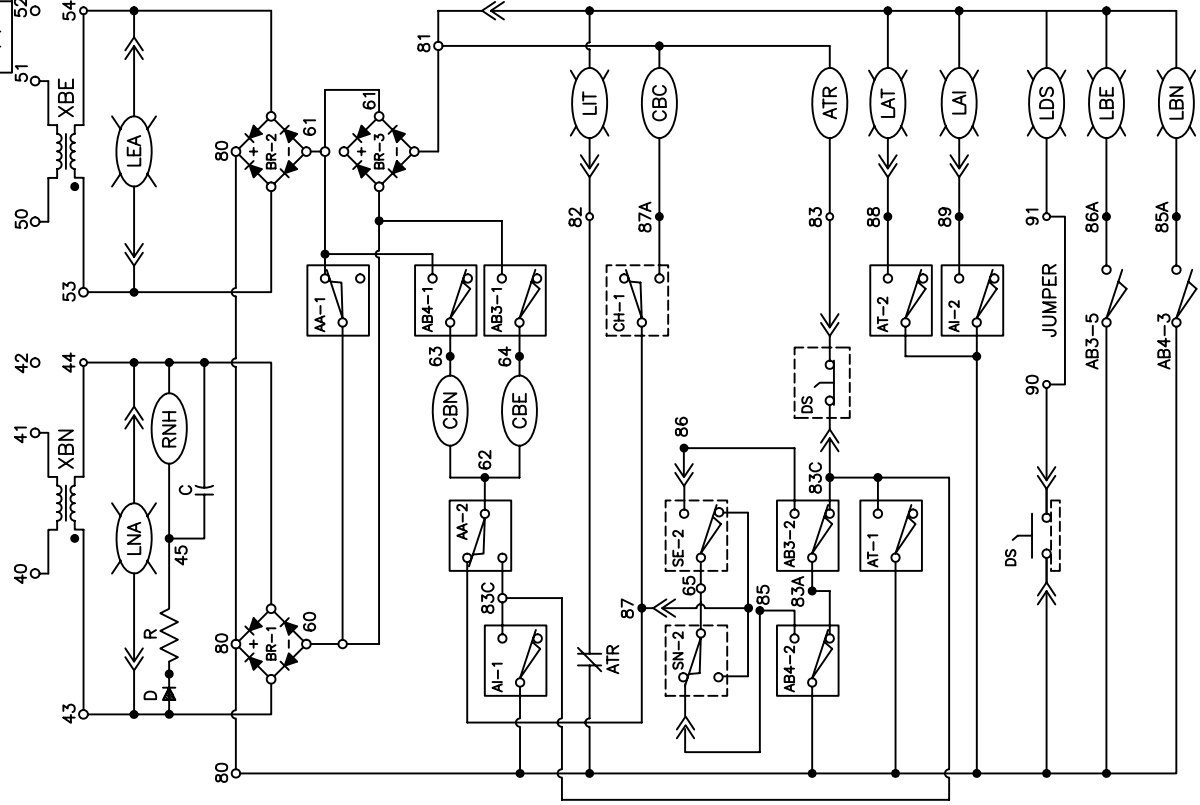
76A-3000

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REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
H	S-8604 REVISED SHEET 2	04/12/07	YJS MES

BYPASS/ISOLATION SCHEMATIC



- 181
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- 183
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- BYPASS SOURCE 1 CONTROL TRANSFORMER
- BYPASS SOURCE 2 CONTROL TRANSFORMER
- SOURCE 1 AVAILABLE LIGHT
- SOURCE 2 AVAILABLE LIGHT

- SOURCE 1ALLY HELD RELAY

- DIODE
- RESISTOR, RNH
- CAPACITOR, RNH
- BRIDGE RECTIFIER

- LIMIT SWITCH, ATS AUTO LOCATION

- SOURCE 1 TRANSFER OPERATOR
- SOURCE 2 TRANSFER OPERATOR

- LIGHT, BYPASS SOURCE 2
- LIGHT, BYPASS SOURCE 1

- LIMIT SWITCH, BYPASS SOURCE 1
- LIMIT SWITCH, BYPASS SOURCE 2
- AUTO/TEST RELAY
- LIGHT, ATS INHIBIT
- DISCONNECT SWITCH FOR SERVICING
- LIGHT, DISCONNECT SWITCH INHIBIT POSITION

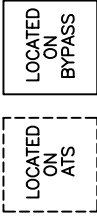
- LIMIT SWITCH

- CRANK SOLENOID

- LIMIT SWITCH, ATS TEST LOCATION

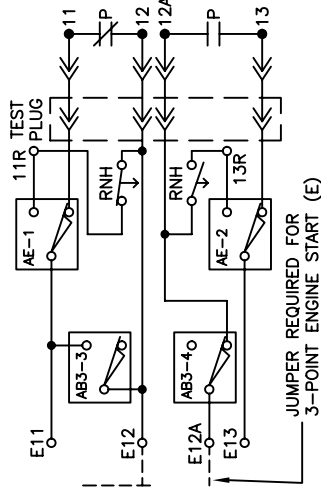
- LIGHT, ATS TEST LOCATION

- LIMIT SWITCH, ATS ISOLATE LOCATION



ENGINE START SCHEMATIC

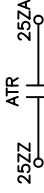
- ENGINE START CIRCUIT
- AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
- AB3-3,4 - LIMIT SWITCH, BYPASS SOURCE 2



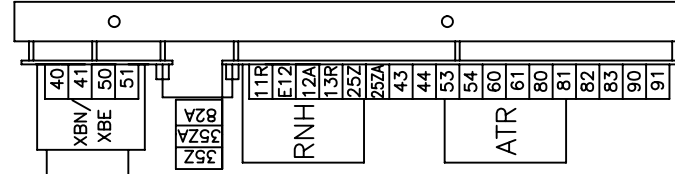
LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION		BYPASS MODE	
	REMOVE	TEST	SOURCE 1	SOURCE 2
AA	X			OPEN
AT		X		
AI			X	
AE			X	
SN				X
SE				X
AB4				X
AB3				X

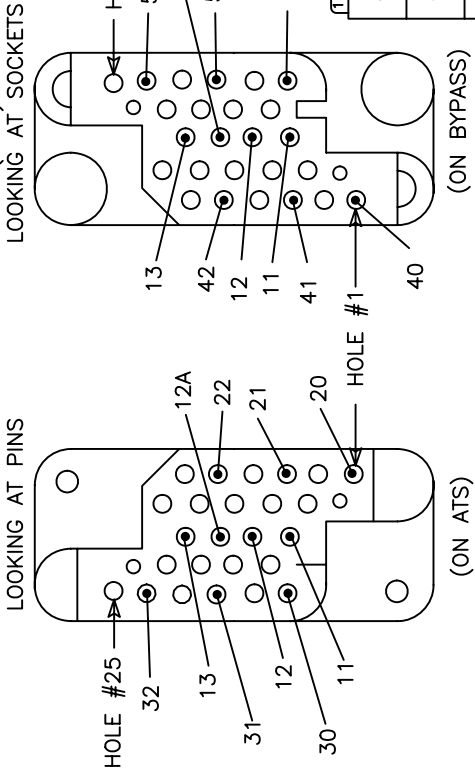
SOURCE 1/SOURCE 2 TRANSFER PERMIT CIRCUIT (ALH IN AUTO AND TEST LOCATION WITH DS IN AUTO POSITION)



BYPASS SUBPANEL



ATS TEST PLUG (TP)

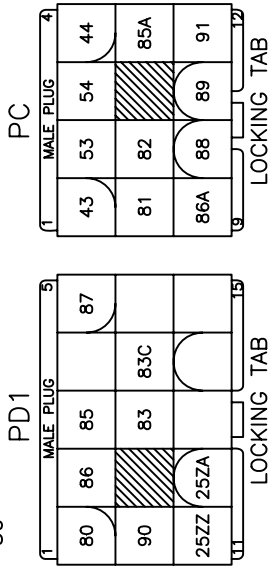


LEGEND

- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- ➔ WIRE IN INTERCONNECT PLUG

NOTES

ZBTSCTL SHOWN IN SOURCE 1 POSITION WITH NO POWER AVAILABLE.



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FOR ADDITIONAL INFO REFER TO	SIGNATURES	DATE
APPLIED FRAGMENTS UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	MODEL GG	05/06/03
TOLERANCES ON:	DETAIL CHECKED	
2 PL. DECIMALS ± .020	ENGRG FS	
3 PL. DECIMALS ± .005	MFG	
ANGLES ± 1°	QUALITY	
FRACTIONS ± 1/64	ISSUED	
FINISH ✓	DRAWING FILE: 76a-3000-h-6.dwg	
	MODEL / ASSEMBLY FILE: ZBTSCT(1600-3000 AMP)	

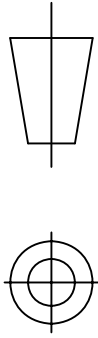
GE Zenith Controls

BYPASS/ISOLATION SCHEMATIC & PLUGS

FIRST MADE FOR: ZBTSCT(1600-3000 AMP)

SIZE CAGE CODE DWG NO: B 76A-3000

THIRD ANGLE PROJECTION



AutoCad Generated

CTos

CRITICAL TO QUALITY

SCALE: NA

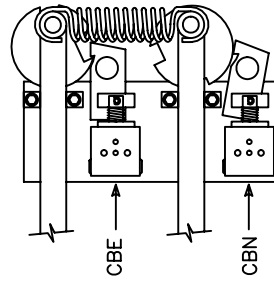
SHEET 6 OF 8

REFER TO SHEET 3 FOR INTERCONNECT PLUG DIAGRAM

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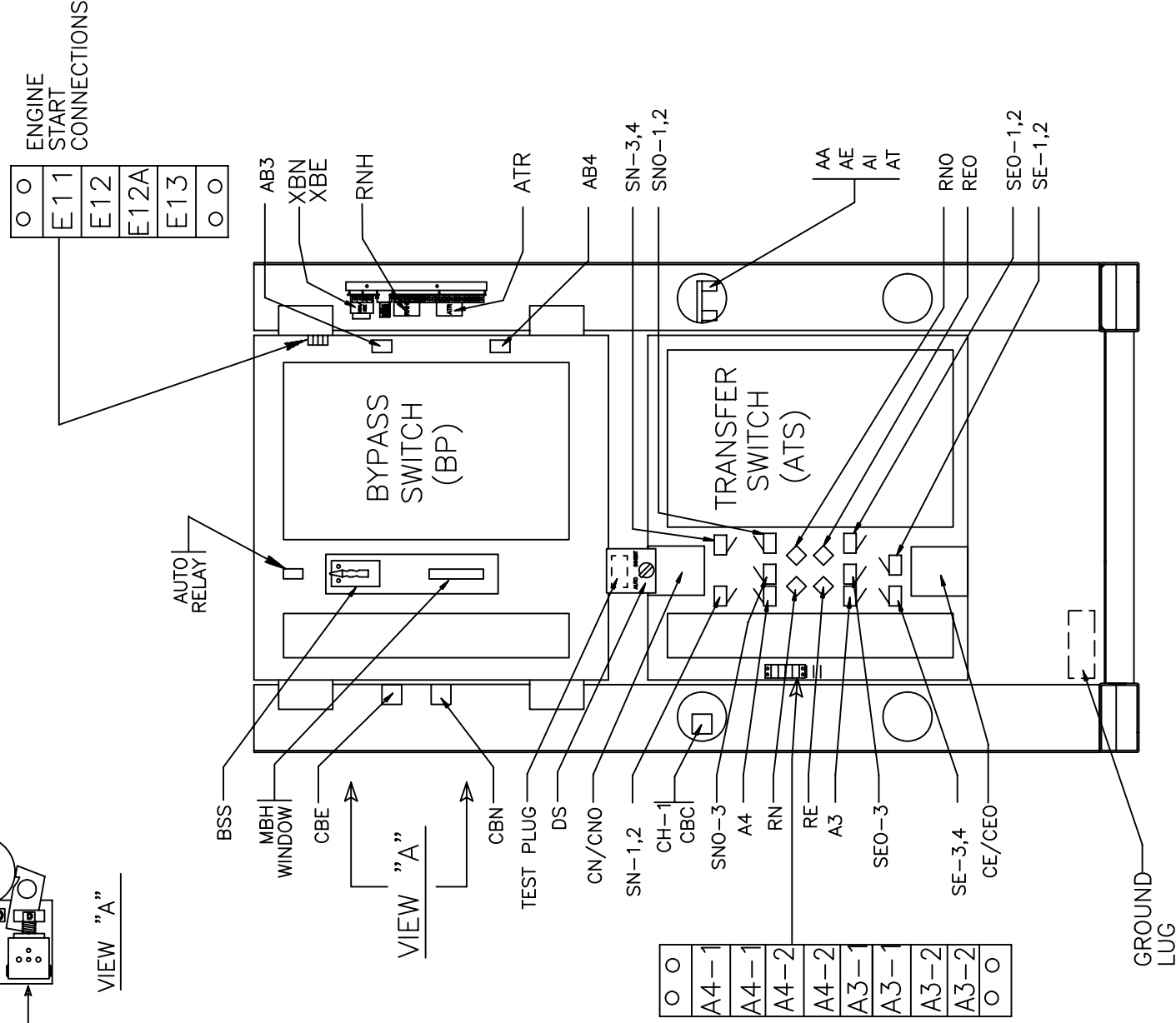


REVISIONS		DESCRIPTION	DATE	APPROVED
REV.	H	S-8604	04/12/07	YJS MES
		REVISED SHEET 2	04/12/07	YJS MES



VIEW "A"

BYPASS/ISOLATION TRANSFER SWITCH



ENGINE START CONNECTIONS

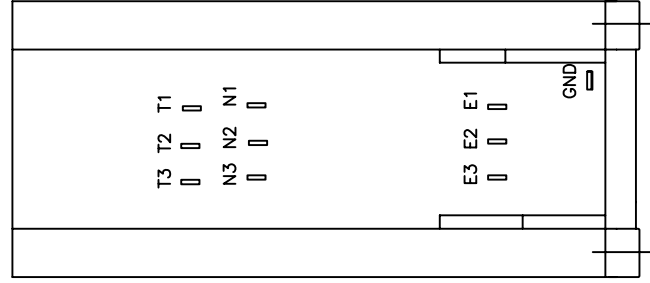
○ ○	E11
○ ○	E12
○ ○	E12A
○ ○	E13
○ ○	○ ○

VIEW "A"

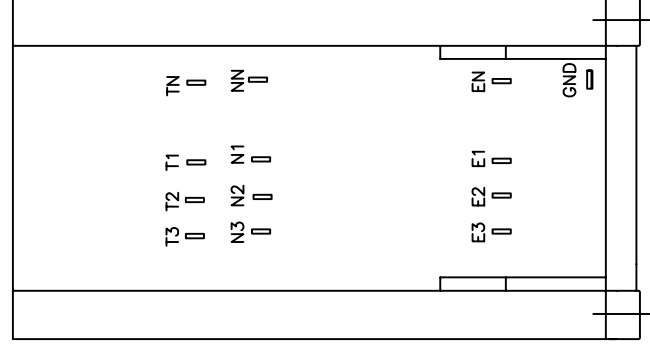
WIRE NUMBERING CHART

LIMIT SWITCHES	C	NC	NO
AA-1	60		61
AA-2	62	83C	87
AB3-1	64		60
AB3-2	83A	83C	86
AB3-3	E12		E11
AB3-4	E12A	12A	
AB3-5	80	86A	
AB4-1	63		61
AB4-2	80	83A	85
AB4-3	80	85A	
AE-1	E11	11	11R
AE-2	E13	13	13R
AI-1	80		83C
AI-2	80		89
AT-1	80		83C
AT-2	80		88
CH-1	87	87A	
SE-2	65	87	86
SN-2	65	87	85
AA-3	80		80A

STANDARD LUG CONFIGURATION
(CONSULT FACTORY FOR OPTIONAL CONFIGURATIONS)
REAR VIEW OF ENCLOSURE



2/3-POLE SWITCH

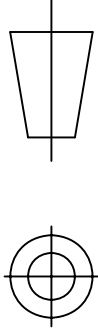


4-POLE SWITCH

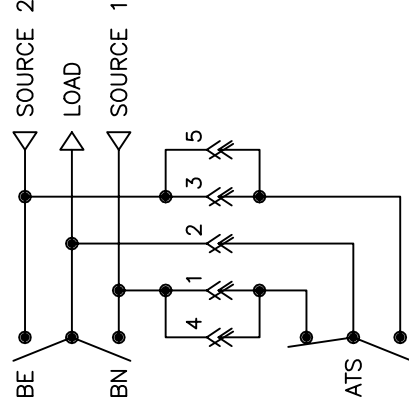
NOTES

ZBTSC1L SHOWN IN SOURCE 1 POSITION WITH NO POWER AVAILABLE.

THIRD ANGLE PROJECTION



BYPASS/ISOLATION DIAGRAM



ATS LOCATION	LOAD CARRYING CONTACTS	ATS TEST PLUG (TP)
AUTO	1 X 2 X 3 X	4 X 5 X
TEST	0 0 0 0	0 0 0 0
ISOLATE	0 0 0 0	0 0 0 0

X = CLOSED
O = OPEN

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FOR ADDITIONAL INFO REFER TO	SIGNATURES	DATE
APPLIED MODEL	GG	05/06/03
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DETAIL	
TOLERANCES ON:	CHECKED	
2 PL. DECIMALS ± .020	ENGRG FS	
3 PL. DECIMALS ± .005	MFG	
ANGLES ± 1°	QUALITY	
FRACTIONS ± 1/64	ISSUED	
FINISH	DRAWING FILE:	76a-3000-h-7.dwg
✓	MODEL / ASSEMBLY FILE:	ZBTSC1(1600-3000 AMP)



GE Zenith Controls

BYPASS/ISOLATION TRANSFER SWITCH

#	CTOs	CRITICAL TO QUALITY CHARACTERISTIC	SCALE:	NA
AutoCad	Generated			

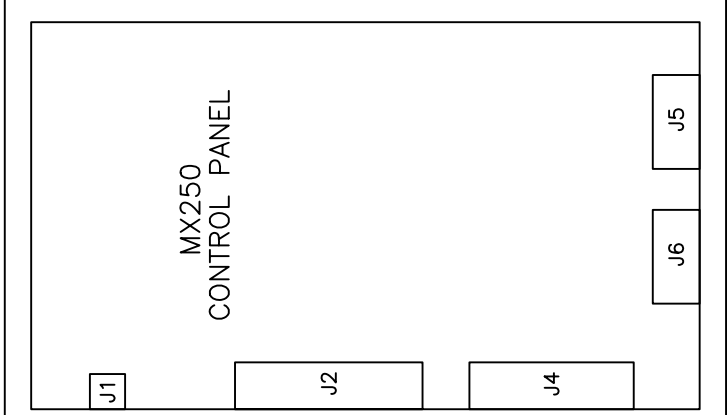
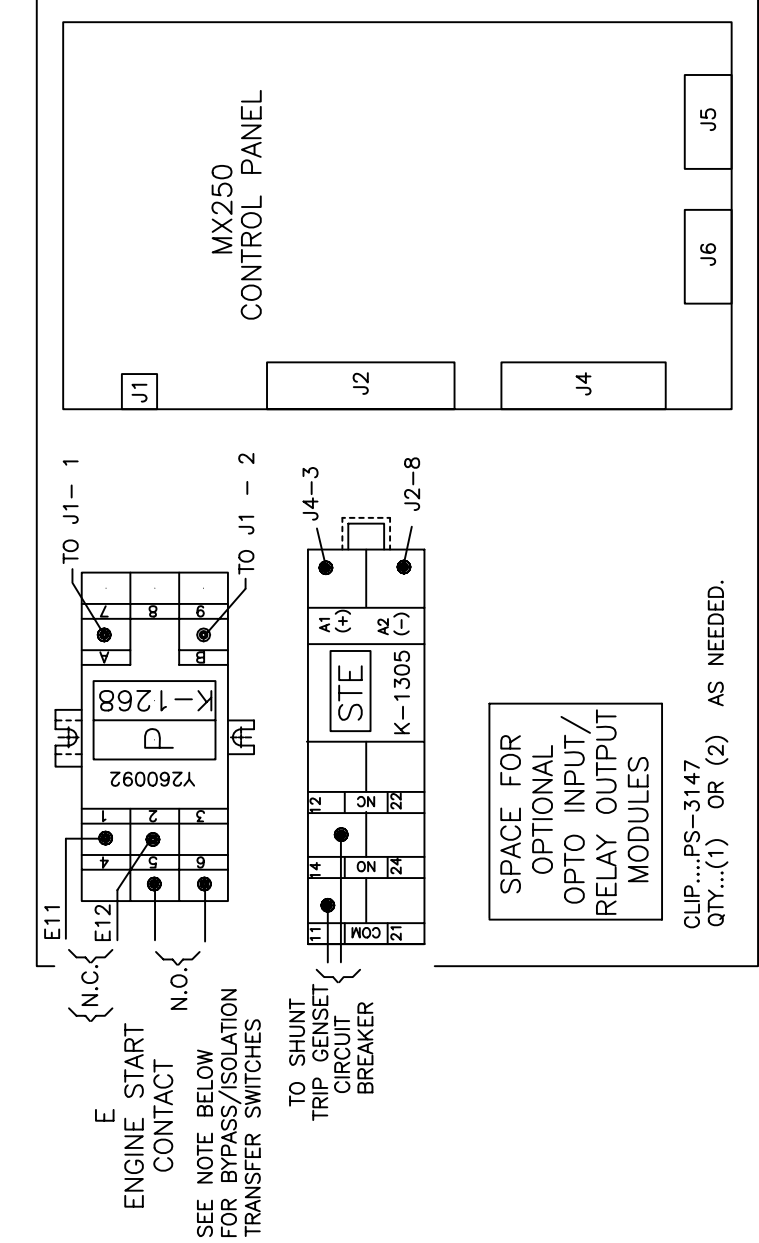
FIRST MADE FOR:	DWG NO	SHEET	7 OF 8
ZBTSC1(1600-3000 AMP)	76A-3000		

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REVISED SHEET 2		REVISED SHEET 2		REVISED SHEET 2	
REV.	DESCRIPTION	DATE	DATE	DATE	APPROVED
H	S-8604	04/12/07	04/12/07	04/12/07	YJS MES

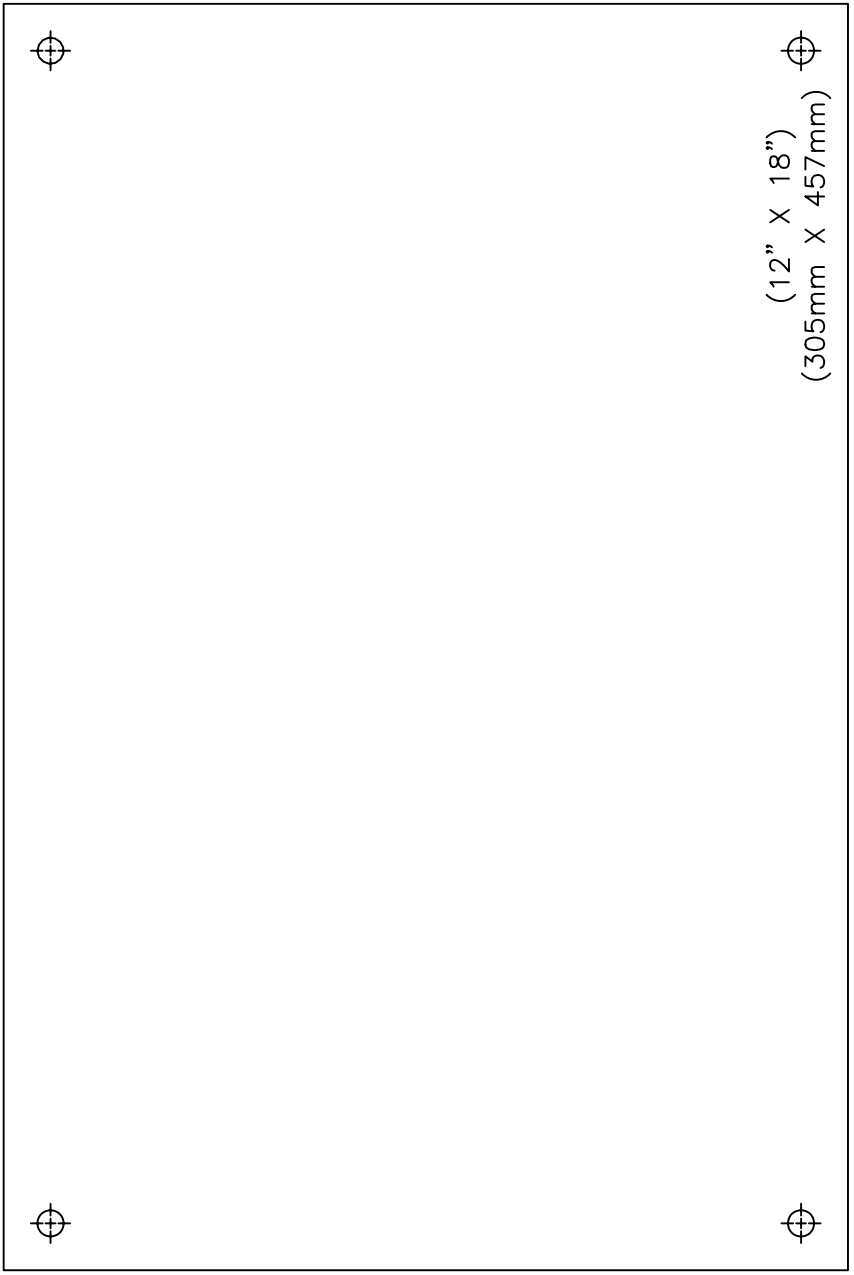
INSIDE VIEW OF CABINET DOOR	
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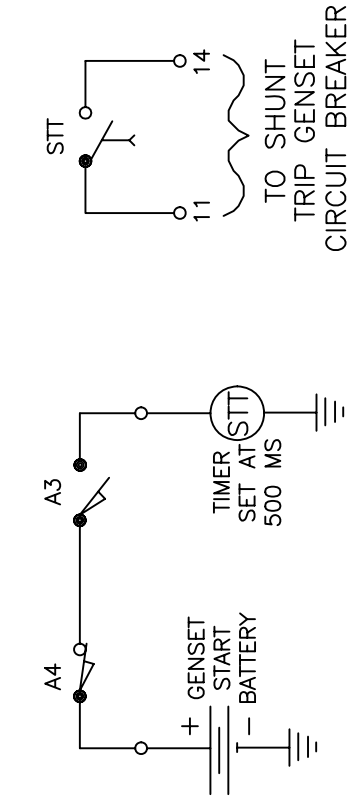
SPACE FOR
OPTIONAL
OPTO INPUT/
RELAY OUTPUT
MODULES

CLIP...PS-3147
QTY...(1) OR (2) AS NEEDED.

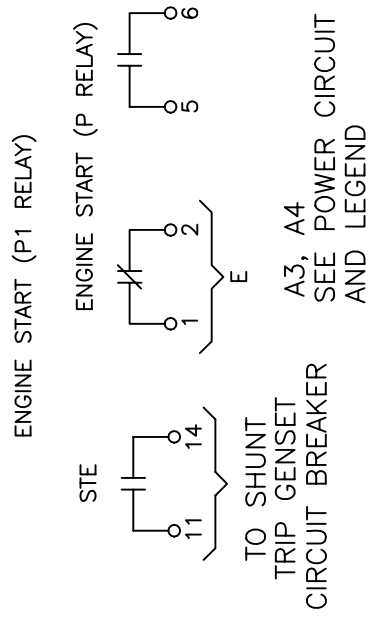
* AUXILIARY CONTROL PANEL



RECOMMENDED ADDITIONAL
EXTENDED PARALLEL PROTECTION



CUSTOMER CONNECTIONS



RELAY	CONTACT	RATING
P1	E	10 AMP @ 240 VAC 10 AMP @ 28 VDC



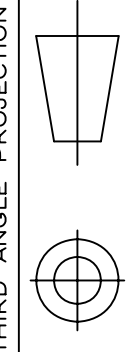
GE Zenith Controls

MX250 INSIDE
DOOR VIEW

76A-3000

FIRST MADE FOR: ZBITSC(1600-3000 AMP)
SIZE CAGE CODE DWG NO
B 76A-3000

AutoCad Generated



THIRD ANGLE PROJECTION

SHEET 8 OF 8

LEGEND

- WIRE CONNECTION
- WIRE ON TERMINAL BLOCK
- * OPTIONAL

NOTES

FOR BYPASS/ISOLATION TRANSFER SWITCHES CONSULT STANDARD DIAGRAM FOR INTERCONNECTION OF ENGINE START P RELAY WITH TEST PLUG.

** ALARM.....Y780029
FOR NEMA 3R, 4, 4X, 12 ADD:
BAFFLE PLATE ASSEMBLY: PS-8892
GASKET.....PS-8891

FOR ADDITIONAL INFO REFER TO	SIGNATURES	DATE
APPLIED MODEL GG	GG	05/06/03
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DETAIL	
TOLERANCES ON:	CHECKED	
2 PL. DECIMALS ± .020	ENGRG FS	
3 PL. DECIMALS ± .005	MFG	
ANGLES ± 1°	QUALITY	
FRACTIONS ± 1/64	ISSUED	
FINISH ✓	DRAWING FILE: 76a-1000-h-8.dwg	
	MODEL / ASSEMBLY FILE: ZBITSC(1600-3000 AMP)	
	# CTOs	
	CRITICAL TO QUALITY CHARACTERISTIC	
	SCALE: NA	

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ZNET™ Communication and Control Systems

Communication is the key to success in any project. With the increasing complexity of building operations and the need to consolidate information and control points, owners require a solution to their site needs. Emergency power systems and their associated distribution are vital links within any installation and therefore the remote monitoring and control of these systems is a necessity rather than an option.

In the past, application of such systems has been hampered by the number of interconnecting wires required for signal and control, the interface of multiple software packages that may not link to each other because of proprietary protocols, the separation of the HVAC system from power monitoring and the lack of available products in the emergency power industry.

GE Zenith Controls introduces the ZNET™ communication system to solve these concerns and to provide single source responsibility for your emergency power monitoring system. Consisting of multiple solutions, GE Zenith's ZNET™ product line allows the owner to customize his system and easily add to it at a later point, whether with additional GE Zenith products or to interface it with other systems within the facility. GE Zenith's ZNET™ provides system options for the owner:

- SIMPLICITY** Transfer Switch Interface and Remote Annunciator Panel
- VERSATILITY** ZNET™ Monitoring and Control Software
- ADAPTABILITY** Future upgrade or retrofit of existing equipment into the ZNET™ network

GE Zenith utilizes an *open protocol* system that is widely available and understood. The LonWorks based ZNET™ system can support multiple physical media (with routers between different types of media) and can support a large number of nodes which may be located in different areas.



These nodes can include microcontroller based systems, personal computers, PLCs, annunciators, etc. There is also the capability of peer to peer communication between nodes and the network is capable of handling high data transfer rates with secure transmission.

The ZNET™ transfer switch interface software package and custom SCADA/HMI systems are available for monitoring, control, data logging, debugging, etc.

GE Zenith has a long established track record which includes interfacing extremely complex systems including transfer switch and generator control systems as well as building management and facility control packages. GE Zenith's engineers design each system, whether a standard annunciation package or custom SCADA, with the critical nature of our product and your installation in mind.

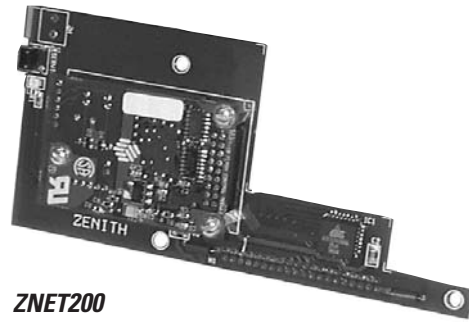
ZNET™ systems are available in standard configurations for transfer switch installations as well as custom communications packages for paralleling switchgear, distribution and transfer switch projects. GE Zenith can also interface into most PLC, SCADA, power monitoring and building management systems.

Transfer Switch Network Interface

The ZNET™ system is available for all GE Zenith transfer switch products whether purchased today or several years ago. In addition, GE Zenith offers retrofit services and controls to allow interface of competitive products into the ZNET™ system. In this way, and with our open protocol, GE Zenith provides excellent system flexibility and the ability to ensure that your needs will not outgrow your investment.

ZNET200

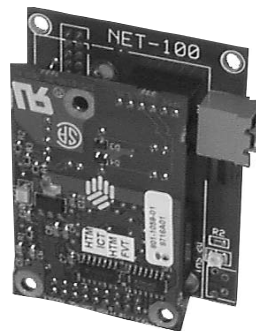
The ZNET200 system card connects directly to GE Zenith's MX200 control panel and communicates directly with the micro controller. This combination provides the owner with the highest level of options and remote monitoring/control. Utilizing the ZNET1000 software system or ZNET™ SCADA, the user may interface directly with the ATS controller and set parameters at a remote location. Consult the feature chart on Page 5 for more details (*specify ZNET200L for LonWorks or ZNET200M for Modbus*).



ZNET200

ZNET100

The ZNET100 system interface connects to the MX100 control panel and interfaces with the MX100 microprocessor and allows basic control, test and indication of the transfer switch functions. This unit may also be used with the ZNET1000 or SCADA software package (*LonWorks only*).



ZNET100

ZNET90

Designed for connection to GE Zenith's SSRCP control panel whether purchased today or in years past, the ZNET90 system provides a simple method to link combination relay logic/solid state controls to our network. This system is easy to retrofit to SSRCP units already installed in the field and may be used with ZNET1000 or SCADA software.



ZNET90

ZNET50

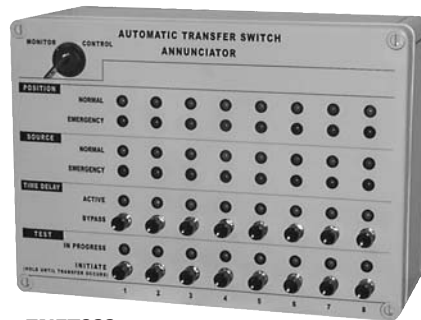
Many installations have older or competitive transfer switches within the facility. GE Zenith has designed a network interface with this application in mind. Available in standard and custom configurations as well as designed into ZNET1000 or SCADA software, GE Zenith can meet your needs for system integration.



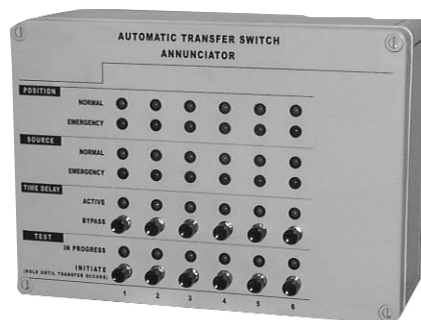
ZNET50

NOTE:

24 VAC or DC supply required to annunciate. If not available on-site, specify ZNET10PS accessory for 120/240 - 24 VAC power adapter to be supplied by GE Zenith.



ZNET900



ZNET901



ZNET902P



ZNET903P

An owner may have many transfer switches scattered throughout his facility and therefore have a need for remote indication and control of the units. In its simplest form, this control may take the form of an annunciator panel. GE Zenith meets this application with the ZNET900 series of annunciators. Available in many different standard and custom configurations and with a multitude of options, the ZNET900 series has been designed to interface into the same open protocol network as the transfer switches and ZNET1000 software system.

The ZNET900 annunciator is available in either a 4 or 8 ATS configuration. The base unit contains the network interface card allowing a slave unit for an additional 6 ATSs to be attached without the need to purchase another interface. Multiple units can be installed anywhere on the network and the system allows for expansion to meet the needs of a growing facility.

The slave annunciator provides for up to 6 additional ATSs for each master annunciator installed. The ZNET901 mounts next to the master unit and shares the network interface and power supply.

Each master annunciator is provided with a standard serial interface port for an external printer. The printers (optional) may be either a standard table top or wall mounted tape printer.

These printers capture events occurring on the network including:

- ATS test
- ATS position change
- Source availability change
- Transfer/retransfer timer bypass
- Operator actions
- ATS identification

Printers are available as accessories from GE Zenith Controls. Specify:

ZNET902P — Tabletop dot matrix printer

ZNET903P — Wall or panel-mounted tape printer

ZNET1000 Series Control Software

The ZNET1000 Series transfer switch control and monitoring system is a Windows 95/98 or Windows NT based package that allows the user to access, monitor and control multiple automatic transfer switches over a LonWorks based network.

The host PC software package provides software interfaces to the LonWorks network using OLE technology. It provides an object oriented, graphical interface as well as allowing the user interactive screens for system monitoring and control.

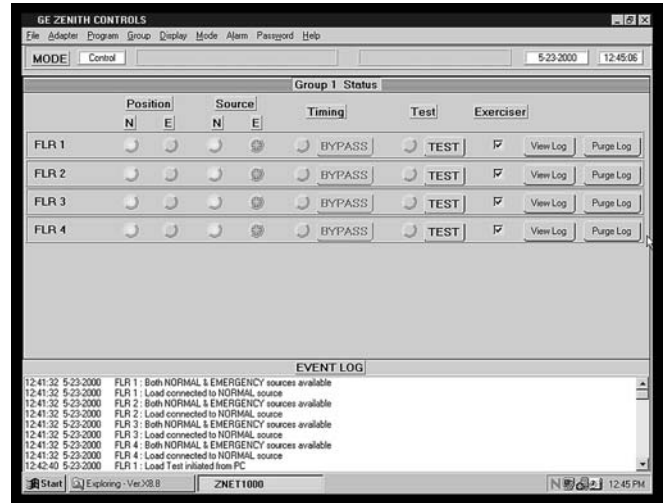
The ZNET™ software has alarm, historical data storage and trending capabilities which allow the operator to log data and view them later.

Simple pull-down menus allow the user to alternate between groups of switches, status screens, configuration and data information. The user is able to set a wide variety of parameters including test, exercise and timer/voltage values. Reference the chart on *Page 5* for the available features for each control interface.

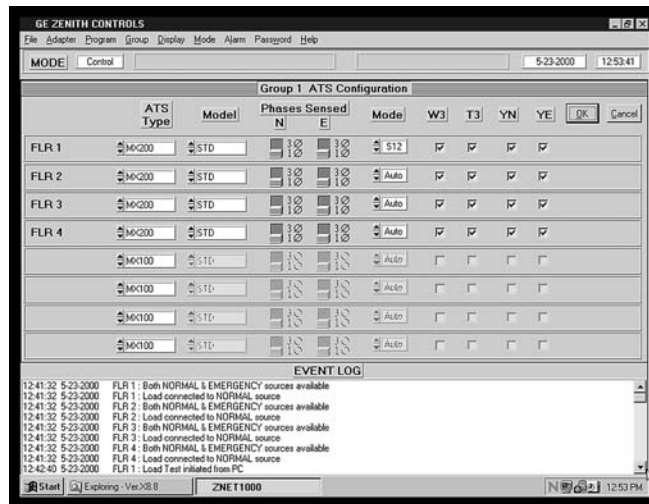
This open protocol system may be interfaced with a wide variety of options including:

- ZTS series transfer switches with the MX200 microprocessor
- ZTG series transfer switches with the MX100 microprocessor
- GE Zenith transfer switches with the SSRCP control panel
- Older GE Zenith and competitive products
- ZNET900 series annunciator panels
- Standard and cellular modems
- RF and IR communication devices
- Energy Commander paralleling switchgear systems, both PLC and non-PLC based
- ZNET™ SCADA systems
- Building management systems

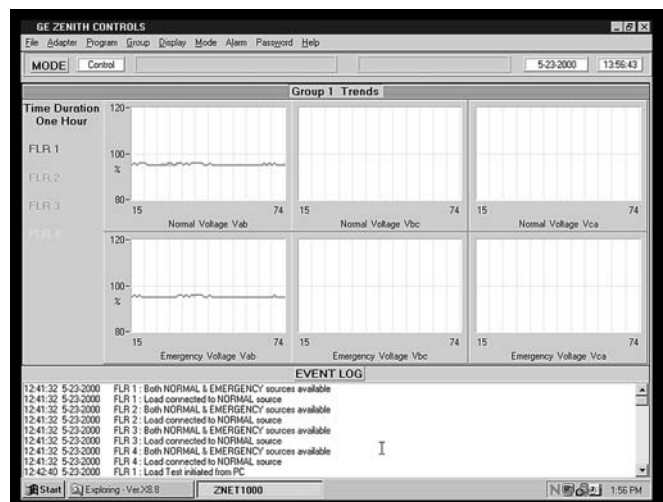
The ZNET™ hardware system is also compatible with gateways that allow use with Modbus, BACnet, Ethernet, and other networks. Consult the GE Zenith factory for further information on system interfaces and engineering requirements.



Status Screen



ATS Configuration Screen



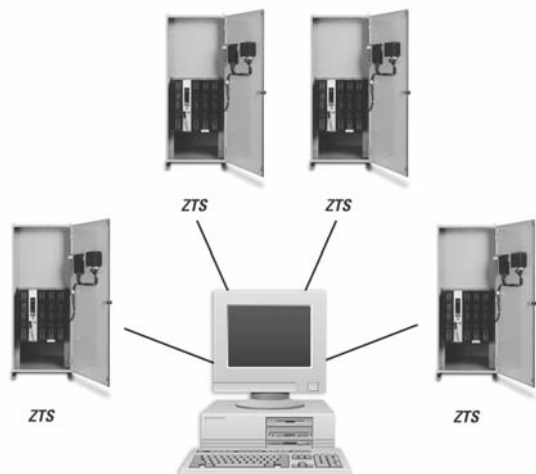
Trends Screen

The ZNET™ system is flexible enough to work with a wide variety of transfer switches and controls. The chart below indicates which features are standard (S) within the ZNET1000 and ZNET1050 software and which controls will offer options (O). Older ZTS series switches may be retrofit with either an MX100 or MX200 series microprocessor to increase the available functions.

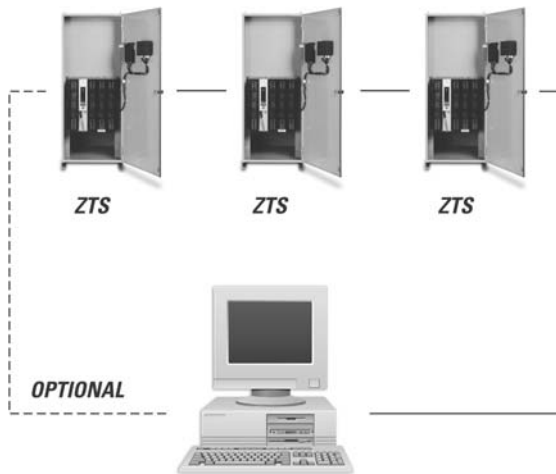
Parameter	ZNET1000 Monitor/ Control	ZNET1050 Monitor/ Control	ZNET200 MX200	ZNET100 MX100	ZNET90 SSRCP	ZNET50 Older GE Zenith and Competitive Products	ZNET900 Annunciator
Switch Position (Normal/Open/Emergency)	Monitor	Monitor	S	S	S	S	S
Normal Source Available	Monitor	Monitor	S	S	S	S	S
Emergency Source Available	Monitor	Monitor	S	S	S	S	S
Remote Test	Control	Control	S	S	S	S	S
Remote Test Mode (Load/No Load/Fast)	Control	Control	S				
Test Status	Monitor	Monitor	S	S	O	O	S
Exerciser Status	Monitor	Monitor	S		O	O	
Switch in Test or Exercise (Load/No Load)	Control	Control	S		O	O	
Time Delay Operating	Monitor	Monitor	S	S	S	O	S
Timer Bypass	Control	Control	S	S	S	O	S
Timer Setting Values (P, T, U, W, DT, DW, T3, W3, A6)	Control	—	S				
Timer In-progress Values (P, T, U, W, DT, DW, T3, W3, A6)	Monitor	Monitor	S				
Load Shed	Control	—	S		O	O	
Load Shed Status	Monitor	—	S		O	O	
Normal and Emergency Voltage Pickup and Dropout Values	Control	—	S				
Normal and Emergency Frequency Pickup Values	Control	—	S				
Controller Fault – Communication Link Fault	Monitor	Monitor	S		O	O	S
Switch not in Auto	Monitor	Monitor	S		O	O	
Aux 1, Aux 2	Control	—	S		O	O	
Switch Serial Number	Monitor	Monitor	S				
Network Address	Monitor	Monitor	S	S	S	S	
Normal and Emergency Voltages	Monitor	—	S				
Normal and Emergency Frequencies	Monitor	—	S				
Time in Emergency	Monitor	Monitor	S				
Number of Switch Transfers	Monitor	Monitor	S				
Inhibit Transfer to Normal/Emergency	Control	—	S		O	O	
Event Log (ZNET™ Software)	Monitor	Monitor	S	S	S	S	Print Only
Trending (ZNET™ Software)	Monitor	—	S				Print Only

ZNET™ Control Software

GE Zenith's ZNET™ system offers many options to make your installation meet your needs. ZNET™ is extremely versatile, offering an open protocol and well-proven architecture. Therefore, it may be configured to operate over different types of networks and with different methods of communication.



Star Bus



Ring or Network Bus

Optional Equipment

<div style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">ZNET 10PS</div>	<p>Power Supply 120/240 - 24 VAC Mounted in enclosure</p>	<div style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">ZNET31</div>	<p>Network system modem and adapter mounted in enclosure * Specify ZNET31M (Modbus) or ZNET31L (LonWorks)</p>
<div style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">ZNET A1MOD</div>	<p>RS232/485 Converter for Modbus card only</p>	<div style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">ZNET902P</div>	<p>Tabletop printer, dot matrix type for use with ZNET1000 (continuous feed paper suggested)</p>
<div style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">ZNET ASLTA-10</div>	<p>LonWorks Network Adapter Card</p>	<div style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">ZNET903P</div>	<p>Tape printer for use with ZNET900 annunciator mounted in enclosure (specify 903PF for flush; 903PT for table top; or 903PX for open type)</p>
<div style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">ZNET APCLTA-10</div>	<p>Desktop Network Adapter Card</p>	<div style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">ZNET200M - DEV</div>	<p>Modbus development kit with program software, flash programmer module, cable and manual</p>
<div style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">ZNET APCC-10</div>	<p>Laptop Network Adapter Card</p>	<div style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">ZNET200M - FLASH</div>	<p>Modbus flash upgrade kit to download and update Modbus card firmware</p>
<div style="border: 1px solid gray; padding: 5px; background-color: #f0f0f0;">ZNET30</div>	<p>ATS modem * (Consult factory for specifications)</p>		

* Dedicated phone line required for operation

GE Zenith's power monitoring and control system is a combination of its Energy Commander line of synchronizing switchgear, ZTS transfer switches and state-of-the-art supervisory control and data acquisition (SCADA) software. These products together provide for a powerful system which can provide many benefits to the user.

Primary Benefits

This user-friendly system allows the operator to remotely perform many power monitoring and control activities, thereby allowing the operator to:

- Automatically maintain operations and maximize power system reliability through emergency/standby schemes, load shedding schemes, breaker sequencing and power factor correction
- Become informed of critical situations via user-defined alarm set-points and quickly diagnose system data during an outage and return to service
- Reduce hardware and space needs (the proper equipment can replace conventional indicating meters and the necessary wiring)
- Enjoy complete system flexibility and make use of standard hardware products and industry standard communications
- Gain better control of power consumption

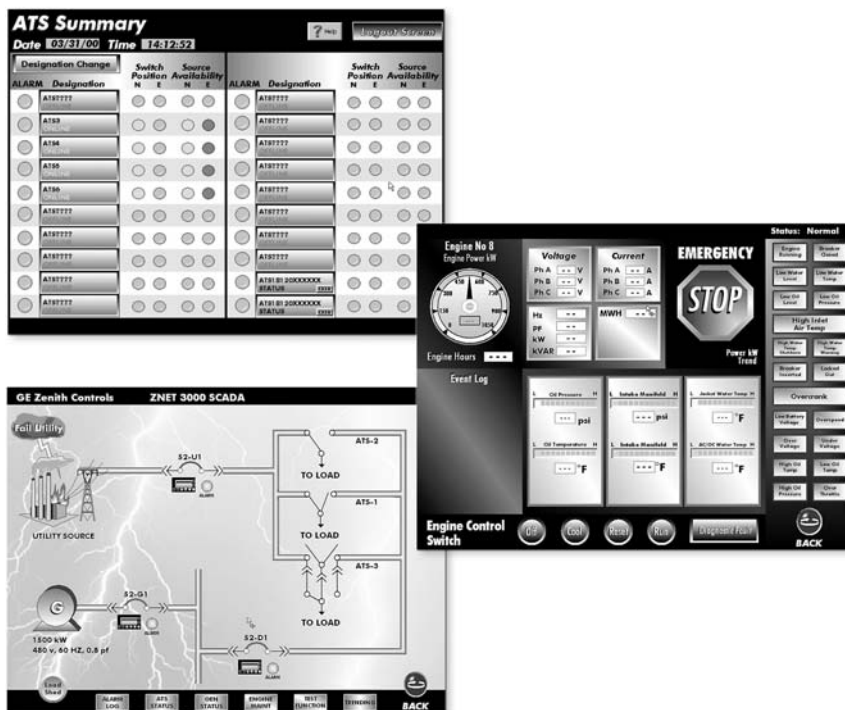
Additional Benefits

GE Zenith's power monitoring and control systems provide facility owners with these benefits:

- Help cut energy costs, reduce equipment downtime and improve equipment utilization (resulting in a greater return on investment)
- Identify and correct potential problems before equipment damage occurs, thereby prolonging equipment life as well as determining proper maintenance schedules

SCADA Features

- Operate with user-friendly Windows™ software
- Integrate with plant wide systems, such as building automation, energy management, distributed process control and security systems
- Integrate switchgear and transfer switch monitoring and control
- Manually control circuit breakers, check present settings and access breaker trip history
- View the switchgear elevation drawing and the one-line diagram, complete with status information and real-time metering values
- View traditional metering of true RMS currents, voltages, power factor, frequency, wathours, varhours, demand current, demand power and more
- Monitor, capture, store and analyze waveform data from all three phases of current and voltage for a given circuit
- Display the status of any discrete input monitored, such as breaker status, transformer fans on/off, liquid levels and more
- Record times and dates of peak demand periods and last meter resets, energy management alarm history plus minimum and maximum operating ranges for 20 meter values through the software's superior data communications networking ability
- Monitor temp levels of power transformers
- Program the system to accept and report analog and digital inputs such as pressure, gas, steam and critical battery voltage levels
- View operating and maintenance instructions on-line



Glossary of Common Terms

Analog: A continuous real-time function or parameter in which the information values are represented in a variable and continuous waveform.

Annunciator: Electrically controlled signal board or indicator typically used in a network configuration.

ANSI: American National Standards Institute. The principal standards development body in the USA.

ASCII: American Standard Code for Information Interchange. A universal standard for encoding alphanumeric characters into 7 or 8 binary bits. (Drawn up by ANSI to ensure compatibility between different computer systems).

Asynchronous Transmission: Communications in which characters can be transmitted arbitrarily, at any unsynchronized time, and where the time intervals between transmitted characters may be of varying lengths. Communication is controlled by start and stop bits at the beginning and end of each character.

Baud Rate: A unit of speed that refers to the number of discrete bytes per second, and which refers to the number of times the condition of the communication line changes.

BIT: The smallest unit of data processing information. A BIT (or Binary DigIT) assumes a value of either 1 or 0 in the binary number system, and is used in representation of digital variables.

Bps: Bits per second. This is the unit of data transmission rate used in our system.

BSC: Bisynchronous Transmission – A byte or character oriented communication protocol that has become the industry standard. It uses a set of control characters for synchronized transmission of binary coded data between stations in a data communications system.

Bus: A data path shared by many devices, with one or more conductors for transmitting signals, data or power.

Byte: A data unit of eight bits of information; sometimes called a “character”.

Client: Software requesting data from a device.

COM Port: A hardware port used for transmission of data between computers or between computers and peripheral devices one bit at a time over two single lines.

Digital Signal: Discrete, uniform signals as opposed to the continuously varying levels of an analog signal.

DDE: Dynamic Data Exchange – A Microsoft™ software protocol from which Windows-based applications share information.

Duplex: The ability to send and receive data over the same communications line.

Encoder: A circuit which changes a given signal into a coded combination for purposes of optimum transmission of the signal.

Firmware: A computer program or software stored permanently in PROM (Programmable Read-Only-Memory) or ROM (Read-Only-Memory), or semi-permanently in EPROM (Erasable Programmable Read-Only-Memory).

Full Duplex: Two-way simultaneous communication; also known as echo-plex since the local device expects the remote device to echo back the transmitted characters.

Gateway: A device used to connect two different networks which translates the different protocols so that they become compatible with each other.

GUI: Graphical User Interface – The front-end system interface which is graphically oriented for making it easier to use.

Half Duplex: Transmission in either direction, but not a simultaneous two-way transmission.

Host computer: The central computer at the other end of a dial-up connection in a network. This computer is remotely accessed and therefore relinquishes network control.

Interface: A shared boundary defined by common physical inter-connection characteristics, signal characteristics and measuring of interchanged signals.

LAN: Local Area Network – A data communications network or system that provides interconnection of a variety of data communications devices within a small, limited geographical area (typically a few hundred feet) with moderate to high transmission rates (from a minimum of 100 kbps to a maximum of 50 Mbps).

Multidrop: A single communication line or bus used to connect three or more points in a network.

Network: An interconnected group of nodes or stations.

Network Topology: The physical and logical relationship of nodes in a network; the schematic arrangement of the links and nodes of a network typically in the form of a star, ring, tree or bus topology.

Node: A point of interconnection to a network. Could also refer to any intelligent device connected to the network. This includes terminal servers, host computers, and any other devices (such as printers and terminals) that are directly connected to the network.

Packet: A series of bits containing data and control information, including source and destination node addresses, formatted for transmission from one node to another.

Parallel Transmission: A transmission model where multiple data bits are sent simultaneously over separate parallel lines. Accurate synchronization is achieved by using a timing (strobe) signal. This type of transmission is usually uni-directional.

PLC: Programmable Logic Controller – An intelligent digital device that can be programmed to control the logic or sequence of activities in certain elements to which it is connected in a circuit or network.

Port: A physical connector on a device which is typically used for input/output of digital and analog signals.

Protocol: A formal set of conventions governing the formatting, control procedures and relative timing of message exchange between two communicating systems.

RAM: Random-Access-Memory – Semiconductor read/write volatile data where loss of data can occur if power supply is turned off or even temporarily disrupted.

Repeater: A network device that repeats signals from one cable onto one or more other cables while restoring signal timing and waveforms.

Serial Transmission: Transfer of data characters one bit at a time sequentially, using a single electrical path.

Server: A computer or software application that provides data to a client computer or other application in a network.

Synchronous Transmission: Transmission in which data bits are sent at a fixed rate with the transmitter and receiver synchronized. This type of transmission also eliminates the need for start and stop bits (which is a requirement for asynchronous transmission).

Topology: Physical configuration of network nodes. (e.g. bus, ring, star, tree, etc).

Transceiver: A combination of transmitter and receiver packaged as one element or device.

Transducer: Any device that generates an electrical signal from real-world physical measurements; also a generic term for sensors and their supporting circuitry.

Twisted Pair: A data transmission medium, consisting of two pairs of insulated copper wires twisted together. Twisting improves its immunity to interference from nearby electrical sources that may corrupt the transmitted signal.

UTP: Unshielded Twisted Pair.

WAN: Wide-Area-Network – A network using common carrier transmission services for the transmission of data over a large geographical area.



GE Zenith Controls

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