1807743-043-AA01-0005

MUSTANG CAT

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FOR INFORMATION ONLY ☐

Tori Coker
Digitally signed by Tori Coker
DN: C=US, E=vcoker@audubooncompanies.com, CN=Tori Coker
Date: 2020.10.05 13:10:26-05'00'

GENERATOR & LOAD BANK DATA BOOK

XTO Husky

Caterpillar G3520 Natural Gas Generator Set 4160 Volts, 60 Hertz

For Approval

Salesman: Donny Corley

Project Manager: Eric Thackerson

Mustang CAT Sales Number: 105051

9-18-2020

PO 1807743-043 Databook

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CAT PROVIDED EQUIPMENT STORAGE GUIDES

CAT TEST REPORTS

P.O. Box 1373 • 12800 Northwest Freeway
Houston, Texas 77251-1373
Phone (713) 460-7211
Fax (713) 460-3852

Reference: Audubon – XTO Husky
Subject: Caterpillar Generator Set

CAT G3520H Natural GAS Generator Set (1) Unit

FOB – Tulsa, Oklahoma

- Estimated 2048ekW (Start-Up "Rich GAS")
- Estimated 2363ekW (Normal Op "Residue GAS")
- 4160V – 60Hz – 3 Phase
- Engine Driven Radiator
- EMCP Local Control Panel
- Local Annunciator
- Generator Space Heater
- Gen Temp Monitoring Pkg.
- Batteries and Rack
- Weather Resistant Enclosure
- Carlsbad Canyon Tan Paint Color
- 120/208 Load Center
- 120mph Wind Rating
- Base Skid
- 20A Battery Charger
- Spill Containment
- Exhaust Silencer
- Jacket Water Heater
- Electric Starting Motor
- NGR – Nema3R
- Factory Test Report .8 PF

Caterpillar Switchgear

FOB – Alpharetta, Georgia

4160V – 2MW - Load Bank

CATERPILLAR

GENERAL INFORMATION

G3520H Engine "H" Series Engine

Caterpillar Gas Engine Control Module (GECM)

(Based upon ADEM4 Module)

Features include:

Fuel/air ratio control

Start/stop logic:

Gas purge cycle

Staged shutdown

Engine Protection Systems:

Detonation Sensitive Timing

High exhaust temperature shutdown

(For a complete listing check sales technical or service literature.)

Governor (See Governor below.)

Transient Richening and Turbo Bypass Control

Ignition (See Ignition below.)

Humidity Management Strategy

Speed Increasing Gearbox, 1500 to 1800 RPM (60Hz)

Gearbox Protection Systems (60Hz)

Gearbox High/Low Oil Pressure Shutdown (60Hz)

Gearbox High Oil Temperature Shutdown (60Hz)

Gearbox Heating Coil (60Hz)

AIR INLET SYSTEM

Two-element single-stage air-cleaner with enclosure and service indicator mounted on package is standard on this Genset.

EXHAUST SYSTEM

Dry exhaust manifold, insulated and shielded

Cat-flanged face outlet on turbocharger

Individual exhaust port and turbocharger with Gas ECM providing alarms and shutdowns.

FUEL SYSTEM

Engine-installed electronic fuel control valve with 4-inch tube 8-bolt DN100 flange.

Throttle plate, electronically controlled 24V DC actuator; controlled by Gas Engine Control Module.

Fuel train is required to be installed at the time of installation and it is offered as standard based on the region selected.

Gas trains contain the following parts.

24V DC Energized-To-Run (ETR) Gas Shutoff Valve.

Fuel filter

Gas pressure regulator

This also contains the flexible connection to the Engine Fuel inlet
Fuel system is sized for 31.5 to 47.2 MJ/nM3 (800 to 1200 btu/cu ft)
dry pipeline natural gas with pressure of 13.8 to
34.5 kPa (1.5 psi to 5 psi) to the engine fuel control valve or
25.5 to 48.3 kPa (2.7 to 7 psi) to the shipped loose gas train (Remote mounted listed below).

Remote mounted gas train intended for use upstream of the engine fuel
inlet. Sized for minimum 31.5 MJ/Nm3 (800 btu/cu ft) dry pipeline
natural gas with inlet pressure range of 19.2 to 48.3 kPa (2.78 to 7
psi). Requires 24VDC with maximum power of 152VA. Gas train consists of:
DN100 (4 inch) flanged inlet and ANSI CLASS 150 (3 inch) outlet connections,
manual shutoff valve, 1 micron filter at 96% efficiency with
differential pressure gauges, pressure regulator, 24VDC ETR
(Energized-To-Run) double solenoid shutoff valve with visual position
indicators, low pressure, high pressure switch and 600 mm flexible
braided hose.

GENERATORS AND GENERATOR ATTACHMENTS
3-phase brushless, salient pole
6 lead
IEC Platinum Stator RTDs (.00385 Temp coefficient)
60 Hz - IVR is standard
Caterpillar-s Integrated Voltage Regulator (IVR).
IVR includes reactive droop capability, 3-phase voltage sensing,
KVAR/PF modes, RFI suppression, min/max exciter.
Limiter and exciter diode monitor.
Winding and Bearing temperature detectors
Anti-Condensation space heaters
3000 Frame Generators 60 Hz MV & HV
Form Wound
Permanent Magnet Excitation
NEMA Class H insulation, Class F temperature rise at 40C ambient
GOVERNING SYSTEM
ADEM A4 speed governor with 4 to 20 ma (0V to 5V) speed input.
Redundant Shutdown (Overspeed protection through a duplicate speed
sensing system).
IGNITION SYSTEM
Electronic Ignition System (controlled by ADEM A4)
Individual Cylinder Detonation Sensitive Timing (DST)
INSTRUMENTATION
Customer interface including EMCP4.3 controller
(package mounted on low and medium voltage, shipped loose
on high voltage) that includes:

24-volt DC operation

Environmental sealed front face
Text alarm/event descriptions
Kilowatt transducer output

Controls:
Speed/ Voltage adjust
Auto/start/stop control
Alarm acknowledge
Emergency stop pushbutton
Customer Warning/Shutdown Lamp test
True RMS AC metering, 3-phase, +/-2% accuracy
Remote monitoring and Control capability
Warning/shutdown with common LED indication of shutdowns
with indicating lights for:
Low oil pressure
High/Low coolant temperature
High engine oil temp
Low, High and weak battery voltage
Overspeed
Failure to start (Overcrank)
Emergency stop
Loss of sensing
Air filter restriction
Impending shutdown

Digital indication for:
RPM
DC volts
Operating hours
Oil pressure (psi, kPa or bar)
Volts (L-L & L-N), frequency (Hz)
Amps (per phase & average)
Two (2) dedicated digital inputs
Twelve (12) Programmable digital inputs
Two (2) dedicated digital outputs
Sixteen (16) programmable digital outputs

Environmental:
Control module operating temperature:-40C to 70C
Display operating temperature: - 20C to 70C
Humidity: 100% condensing 30C to 60C
Storage temperature: -40C to 85C
Vibration: Random profile, 24-1000Hz, 6.0G rms

Generator protection:
Generator phase sequence
Over/Under voltage
Over/ Under frequency
Reverse power(kW)
Reverse reactive power(kVar)
Over current
Current balance
Over/Loss of Excitation
Generator temperature detectors
The Control Panel Quick Starting Guide will be provided with the package documentation.

LITERATURE
English (CD Rom with product documentation)
More Language Literature available as optional
LUBE SYSTEM
Lubricating oil is available as an option
Gear type lube oil pump.
Oil filter, filler and dipstick.
Integral lube oil cooler.
Oil drain valve.
Positive crank ventilation. (Ingestive system to return crankcase
(This is not developed for landfill/ digester gas applications)
(Shipped loose)
MOUNTING SYSTEM
Rails - Engine/Generator/Gearbox mounting (60Hz)
Spring anti-vibration mounts Included
COOLING SYSTEM
JW and SCAC engine-driven pumps (Engine driven pumps are standard iron on selected feature codes)
JW and SCAC thermostats
JW (with pumps)/Connections - ANSI CLASS 150
JW (without pumps)/Connections - CAT flange
2nd stage SCAC - CAT flange
STARTING/CHARGING SYSTEM
24V starting motors.
Battery disconnect switch
Jacket water heater is included 220V Single Phase:
Included 60-amp, 24V charging alternator
Battery with rack and cables are available as an option

GENERAL
Paint--Caterpillar Yellow except rails Gloss Black
RH service

Damper guard
NOTE: "Stationary Use Only Label": Effective January 2004, the US EPA Nonroad Mobile SI rule restricts the use of SI gas engines in the United States. Caterpillar's Gas Engines are not certified for mobile applications within the US and are to be used in "stationary use only" applications. All gas engines will have this label attached regardless of the dealer placing the order.

Effective with sales to the first user on or after August 1, 2014

CATERPILLAR LIMITED WARRANTY

Industrial, Petroleum, Locomotive, and Agriculture Engine Products and Electric Power Generation Products

Worldwide

Caterpillar Inc. or any of its subsidiaries ("Caterpillar") warrants new and remanufactured engines and electric power generation products sold by it (including any products of other manufacturers packaged and sold by Caterpillar), to be free from defects in material and workmanship.

This warranty does not apply engines sold for use in on-highway vehicle or marine applications; engines in machines manufactured by or for Caterpillar; C175, 3500 and 3600 series engines used in locomotive applications; 3000 Family engines, C0.5 through C4.4 and ACERT™ (C6.6, C7, C7.1, C9, C9.3, C11, C13, C15, C18, C27, and C32) engines used in industrial, mobile agriculture and locomotive applications; or Cat® batteries. These products are covered by other Caterpillar warranties.

This warranty is subject to the following:

Warranty Period

- For industrial engines, engines in a petroleum applications or Petroleum Power Systems (excluding petroleum fire pump application), or engines in a Locomotive application, or Uninterruptible Power Supply (UPS) systems, the warranty period is 12 months after date of delivery to the first user.
- For engines used in petroleum fire pump and mobile agriculture applications the warranty period is 24 months after date of delivery to the first user.
- For controls only (EPIC), configurable and custom switchgear products, and automatic transfer switch products, the warranty period is 24 months after date of delivery to the first user.
- For new CG132, CG170 and CG260 series power generation products the warranty period is 24 months/16,000 hours, whichever comes first, after date of delivery to first user.
- For electric power generation products other than CG132, CG170 and CG260 series in prime or continuous applications the warranty period is 12 months. For standby applications the warranty period is 24 months/1000 hours. For emergency standby applications the warranty period is 24 months/400 hours. All terms begin after date of delivery to the first user.
- For all other applications the warranty period is 12 months after date of delivery to the first user.

Caterpillar Responsibilities

If a defect in material or workmanship is found during the warranty period, Caterpillar will, during normal working hours and at a place of business of a Cat dealer or other source approved by Caterpillar:

- Provide (at Caterpillar's choice) new, Remanufactured, or Caterpillar approved repaired parts or assembled components needed to correct the defect.

Note: New, remanufactured, or Caterpillar approved repaired parts or assembled components provided under the terms of this warranty are warranted for the remainder of the warranty period applicable to the product in which installed as if such parts were original components of that product. Items replaced under this warranty become the property of Caterpillar.

- Replace lubricating oil, filters, coolant, and other service items made unusable by the defect.
- Provide reasonable and customary labor needed to correct the defect, including labor to disconnect the product from and reconnect the product to its attached equipment, mounting, and support systems, if required.

For new 3114, 3116, and 3126 engines and electric power generation products (including any new products of other manufacturers packaged and sold by Caterpillar):

- Provide travel labor, up to four hours round trip, if in the opinion of Caterpillar, the product cannot reasonably be transported to a place of business of a Cat dealer or other source approved by Caterpillar (travel labor in excess of four hours round trip, and any meals, mileage, lodging, etc. is the user's responsibility).

For all other products:

- Provide reasonable travel expenses for authorized mechanics, including meals, mileage, and lodging, when Caterpillar chooses to make the repair on-site.

User Responsibilities

The user is responsible for:

- Providing proof of the delivery date to the first user.
- Labor costs, except as stated under "Caterpillar Responsibilities," including costs beyond those required to disconnect the product from and reconnect the product to its attached equipment, mounting, and support systems.
- Travel or transporting costs, except as stated under "Caterpillar Responsibilities."
- Premium or overtime labor costs.
- Parts shipping charges in excess of those that are usual and customary.
- Local taxes, if applicable.
- Costs to investigate complaints, unless the problem is caused by a defect in Caterpillar material or workmanship.
- Giving timely notice of a warrantable failure and promptly making the product available for repair.

(Continued on reverse side…)

- Performance of the required maintenance (including use of proper fuel, oil, lubricants, and coolant) and items replaced due to normal wear and tear.
- Allowing Caterpillar access to all electronically stored data.

Limitations

Caterpillar is not responsible for:

- Failures resulting from any use or installation that Caterpillar judges improper.
- Failures resulting from attachments, accessory items, and parts not sold or approved by Caterpillar.
- Failures resulting from abuse, neglect, and/or improper repair.
- Failures resulting from user's delay in making the product available after being notified of a potential product problem.
- Failures resulting from unauthorized repairs or adjustments, and unauthorized fuel setting changes.
- Damage to parts, fixtures, housings, attachments, and accessory items that are not part of the engine, Cat Selective Catalytic Reduction System or electric power generation product (including any products of other manufacturers packaged and sold by Caterpillar).
- Repair of components sold by Caterpillar that is warranted directly to the user by their respective manufacturer. Depending on type of application, certain exclusions may apply. Consult your Cat dealer for more information.

This warranty covers every major component of the products. Claims under this warranty should be submitted to a place of business of a Cat dealer or other source approved by Caterpillar. For further information concerning either the location to submit claims or Caterpillar as the issuer of this warranty, write Caterpillar Inc., 100 N. E. Adams St., Peoria, IL USA 61629.

Caterpillar's obligations under this Limited Warranty are subject to, and shall not apply in contravention of, the laws, rules, regulations, directives, ordinances, orders, or statutes of the United States, or of any other applicable jurisdiction, without recourse or liability with respect to Caterpillar.

For products operating outside of Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:

NEITHER THE FOREGOING EXPRESS WARRANTY NOR ANY OTHER WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED, IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS THAT IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, EXCEPT CATERPILLAR EMISSION-RELATED COMPONENTS WARRANTIES FOR NEW ENGINES, WHERE APPLICABLE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISION OF MATERIAL AND SERVICES, AS SPECIFIED HEREIN.

CATERPILLAR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.

IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS IS EXCLUDED IN ITS ENTIRETY.

For personal or family use engines or electric power generation products, operating in the USA, its territories and possessions, some states do not allow limitations on how long an implied warranty may last nor allow the exclusion or limitation of incidental or consequential damages. Therefore, the previously expressed exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights, which vary by jurisdiction. To find the location of the nearest Cat dealer or other authorized repair facility, call (800) 447-4986. If you have questions concerning this warranty or its applications, call or write:

In USA and Canada: Caterpillar Inc., Engine Division, P. O. Box 610, Mossville, IL 61552-0610, Attention: Customer Service Manager, Telephone (800) 447-4986. Outside the USA and Canada: Contact your Cat dealer.

For products operating in Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:

THIS WARRANTY IS IN ADDITION TO WARRANTIES AND CONDITIONS IMPLIED BY STATUTE AND OTHER STATUTORY RIGHTS AND OBLIGATIONS THAT BY ANY APPLICABLE LAW CANNOT BE EXCLUDED, RESTRICTED OR MODIFIED ("MANDATORY RIGHTS"). ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED (BY STATUTE OR OTHERWISE), ARE EXCLUDED.

NEITHER THIS WARRANTY NOR ANY OTHER CONDITION OR WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED (SUBJECT ONLY TO THE MANDATORY RIGHTS), IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS THAT IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

TO THE EXTENT PERMITTED UNDER THE MANDATORY RIGHTS, IF CATERPILLAR IS THE SUPPLIER TO THE USER, CATERPILLAR'S LIABILITY SHALL BE LIMITED AT ITS OPTION TO (a) IN THE CASE OF SERVICES, THE SUPPLY OF THE SERVICES AGAIN OR THE PAYMENT OF THE COST OF HAVING THE SERVICES SUPPLIED AGAIN, AND (b) IN THE CASE OF GOODS, THE REPAIR OR REPLACEMENT OF THE GOODS, THE SUPPLY OF EQUIVALENT GOODS, THE PAYMENT OF THE COST OF SUCH REPAIR OR REPLACEMENT OR THE ACQUISITION OF EQUIVALENT GOODS.

CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.

CATERPILLAR IS NOT LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES UNLESS IMPOSED UNDER MANDATORY RIGHTS.

IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS IS EXCLUDED IN ITS ENTIRETY.

Cat® G3512H/G3516H/G3520H

60Hz High-Efficiency Generator Sets

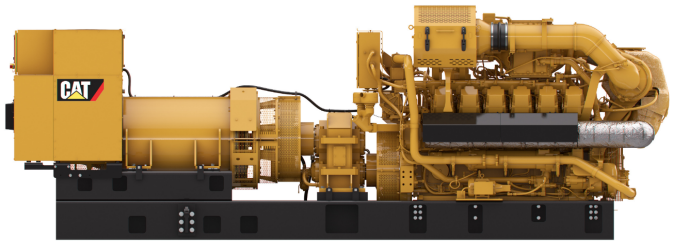


Image shown may not reflect actual configuration

CAT Energy Systems

With power output from 1500 to 2500 ekW and top tier electrical efficiency, these innovative gas generator sets are setting new industry standards.

Features

- Ideally suited to the electricity balancing market
- Various options for the highest overall levels of efficiency
- Individually adapted to your specific requirements

Equipment

Basic Installed Equipment

- High power density and efficiency engine
- EMCP 4.3 generator set control, protection, and monitoring
- SR5 high efficiency design generator

Technical Data Overview

	G3512H	G3516H	G3520H
Engine Speed – rpm	1500	1500	1500
Arrangement and number of cylinders	V12	V16	V20
Bore/stroke – mm (in)	170/215	170/215	170/215
Displacement – L (in^3)	58.5 (3570)	78 (4675)	97.5 (5956)

SR5 Generators

3000 Frame

Standby Power

50 Hz 3000-4000 kVA 1500 rpm
60 Hz 3000-4000 ekW 1800 rpm

Prime Power

50 Hz 2725-3600 kVA 1500 rpm
60 Hz 2725-3600 ekW 1800 rpm

Continuous Power

50 Hz 2500-3250 kVA 1500 rpm
60 Hz 2500-3250 ekW 1800 rpm

FEATURES

GENERAL

- Standards: meets the requirements of NEMA, IEC, ISO, IEEE, BS, AS
- Industry leading insulation technology
- Proven mechanical and electrical design
- Reliable and durable construction
- Improved excitation system for high power quality
- Improved motor starting capability
- Radio frequency noise suppression better than industry standards
- Superior construction and testing

STANDARD

- 3 phase brushless, salient pole
- NEMA Class H insulation
- Class F temperature rise at 40° C ambient
- 2/3 winding pitch
  - – Form wound
  - – Permanent magnet excitation
  - – Winding temperature detectors
  - – Space Heater Kit
- Standard voltages*:*
  50 Hz: 11 kV
  60 Hz: 12.47 kV
- Bus bar connections:
  50 Hz models: IEC standard hole pattern
  60 Hz models: NEMA standard hole pattern
- Cat® Digital Voltage Regulator (Cat DVR*)*

OPTIONAL

- Bearing temperature detectors
- Optional voltages:
- 50 Hz: 3.3 kV, 6.3 kV, 6.6 kV, 6.9 kV, 10 kV, 10.5 kV
- 60 Hz: 4.16 kV, 6.3 kV, 6.6 kV, 6.9 kV, 13.2 kV,13.8 kV
- Oversized generators for Class B temperature rise
- Top or bottom cable entry

SR5 Generators

SPECIFICATIONS

Type . . .. Brushless, revolving field
Solid-state automatic voltage regulator
Construction. . . . . Two bearings
three phase, series star connected
Enclosure . . . . Drip proof IP23, guarded
Overspeed capability
50 Hz . . . . 150% of synchronous speed
60 Hz . . . . 125% of synchronous speed
Waveform deviation, line to line, no load less than 3%
Paralleling capability . . . . Standard with adjustable
voltage droop
Voltage level adjustment . . . . +/- 5.0%
Voltage regulator. . .. . 3-phase sensing with
variable Volts-Per Hertz response
Voltage regulation, steady state. . . . .+/- 0.5%
Voltage regulation with 3% speed change . . ..+/- 0.5%
Voltage gain . . . . adjustable to compensate for
engine speed droop and line loss
Number of leads 6

PRODUCT SUPPORT

- Standard Caterpillar warranty
- Optional extended Caterpillar warranty
- Serviceable parts available through Cat Parts System
- Service intervals agree with recommended engine practices

SERVICEABILITY

- Stator leads exit top
- Replaceable bearing sleeve(s) for longer life and lower repair cost
- Easy access to serviceable parts
- Improved wire and terminal identification ensuring reliable connection

MAIN STATOR CONSTRUCTION

The 3000 frame generators use round lamination stator design.

Stator coil pitch, coil distribution designed to produce optimum waveform and minimum total harmonic distortion. Stator slots are insulated by slot liners and coil separators. Slot liners, coil separators, and top sticks provide a minimum of 25 mm (1 in) distance from the coil to ground. The thickness of liners, separators, and phase sheets provides superior protection between phases and ground.

ROTOR CONSTRUCTION

The main rotor is constructed using a precision “wet” layer winding process with epoxy painted on the bare rotor and on each layer. This ensures bonding of all the wire layers together, bonding of the coils to the rotor laminations, and a sealed insulation system. The rotor is put in the oven for curing the epoxy.

The exciter rotor is machine wound and receives a trickle coat of a fungus-resisting resin. Numerically controlled turning and grinding machines produce rotor shafts with close repeatable tolerances. Grade-8 bolts are used wherever joints are subject to induced stresses. A complete coating of red sealer is applied to protect the rotors and shaft from corrosion.

Every production rotor is dynamically balanced in two planes to within 0.0508 mm deflection peak-to-peak amplitude and run at rated speed before assembly assembly into the stator.

G3520H

GENSET - WITHOUT RADIATOR

GAS ENGINE SITE SPECIFIC TECHNICAL DATA
Audubon - XTO Husky

CATERPILLAR®

ENGINE SPEED (rpm):	1500	RATING STRATEGY:	HUMIDITY/FUEL TOLERANT
COMPRESSION RATIO:	11.1	RATING LEVEL:	CONTINUOUS
AFTERCOOLER TYPE:	SCAC	FUEL SYSTEM:	CAT LOW PRESSURE WITH AIR FUEL RATIO CONTROL
AFTERCOOLER - STAGE 2 INLET (°F):	130		
AFTERCOOLER - STAGE 1 INLET (°F):	192	**SITE CONDITIONS:**	
JACKET WATER OUTLET (°F):	210	FUEL:	Audubon Husky - Normal GAS
ASPIRATION:	TA	FUEL PRESSURE RANGE(psig): (See note 1)	2.0-5.0
COOLING SYSTEM:	JW+OC+1AC, 2AC+GB	FUEL METHANE NUMBER:	99.8
CONTROL SYSTEM:	ADEM4 W/ IM	FUEL LHV (Btu/scf):	883
EXHAUST MANIFOLD:	DRY	ALTITUDE(ft):	3150
COMBUSTION:	LOW EMISSION	INLET AIR TEMPERATURE(°F):	97
NOx EMISSION LEVEL (g/bhp-hr NOx):	1.0	STANDARD RATED POWER:	3448 bhp@1500rpm
SET POINT TIMING:	24	POWER FACTOR:	1.0
		VOLTAGE(V):	4160-13800

				MAXIMUM RATING	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE		
RATING		**NOTES**	**LOAD**	**100%**	**100%**	**75%**	**50%**
GENSET POWER	(WITH GEARBOX, WITHOUT FAN)	(2)(3)	ekW	2485	2418	1813	1219
GENSET POWER	(WITH GEARBOX, WITHOUT FAN)	(2)(3)	kVA	2485	2418	1813	1219
ENGINE POWER	(WITHOUT GEARBOX, WITHOUT FAN)	(3)	bhp	3447	3355	2528	1714
INLET AIR TEMPERATURE			°F	91	97	97	97
GENERATOR EFFICIENCY		(2)	%	97.5	97.4	97.0	96.1
GENSET EFFICIENCY	(ISO 3046/1)	(4)(5)	%	43.7	43.6	42.4	40.1
THERMAL EFFICIENCY		(4)(6)	%	42.3	42.4	43.9	46.9
TOTAL EFFICIENCY		(4)(7)	%	86.0	86.0	86.3	87.0
ENGINE DATA							
GENSET FUEL CONSUMPTION	(ISO 3046/1)	(8)	Btu/ekW-hr	7805	7826	8044	8501
GENSET FUEL CONSUMPTION	(NOMINAL)	(8)	Btu/ekW-hr	8074	8096	8322	8794
ENGINE FUEL CONSUMPTION	(NOMINAL)	(8)	Btu/bhp-hr	5821	5834	5969	6254
AIR FLOW (@inlet air temp, 14.7 psia)	(WET)	(9)	ft3/min	6522	6405	4764	3183
AIR FLOW	(WET)	(9)	lb/hr	28165	27379	20363	13606
FUEL FLOW (60ºF, 14.7 psia)			scfm	379	370	285	202
INLET MANIFOLD PRESSURE		(10)	in Hg(abs)	138.8	135.2	102.3	70.7
EXHAUST TEMPERATURE - ENGINE OUTLET		(11)	°F	753	759	818	918
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(12)	ft3/min	15445	15095	11794	8529
EXHAUST GAS MASS FLOW	(WET)	(12)	lb/hr	29147	28336	21101	14130
MAX INLET RESTRICTION		(13)	in H2O	14.53	14.06	9.90	7.23
MAX EXHAUST RESTRICTION		(13)	in H2O	20.15	19.20	10.91	5.22
EMISSIONS DATA - ENGINE OUT							
NOx (as NO2)		(14)(15)	g/bhp-hr	1.00	1.00	1.00	1.00
CO		(14)(15)	g/bhp-hr	1.50	1.49	1.41	1.44
THC (mol. wt. of 15.84)		(14)(15)	g/bhp-hr	1.93	1.94	2.02	1.90
NMHC (mol. wt. of 15.84)		(14)(15)	g/bhp-hr	0.27	0.27	0.28	0.27
NMNEHC (VOCs) (mol. wt. of 15.84)		(14)(15)(16)	g/bhp-hr	0.21	0.21	0.22	0.21
HCHO (Formaldehyde)		(14)(15)	g/bhp-hr	0.29	0.29	0.28	0.28
CO2		(14)(15)	g/bhp-hr	379	385	435	416
EXHAUST OXYGEN		(14)(17)	% DRY	9.6	9.5	9.2	8.7
HEAT REJECTION							
LHV INPUT		(18)	Btu/min	334451	326226	251487	178626
HEAT REJ. TO JACKET WATER (JW)		(19)	Btu/min	35290	34857	29742	25188
HEAT REJ. TO ATMOSPHERE	(INCLUDES GENERATOR)	(19)	Btu/min	8446	8348	7435	5861
HEAT REJ. TO LUBE OIL (OC)		(19)	Btu/min	12857	12726	11438	9874
HEAT REJECTION TO EXHAUST (LHV TO 248°F)		(19)	Btu/min	65238	64246	53649	42620
HEAT REJ. TO A/C - STAGE 1 (1AC)		(19)(21)	Btu/min	28583	27150	15867	6493
HEAT REJ. TO A/C - STAGE 2 (2AC)		(19)(21)	Btu/min	15412	14831	10046	5545
HEAT REJECTION FROM GEARBOX (GB)		(19)	Btu/min	1155	1124	847	574
PUMP POWER		(20)	Btu/min	859	859	859	859

COOLING SYSTEM SIZING CRITERIA				
TOTAL JACKET WATER CIRCUIT (JW+OC+1AC)	(22)	Btu/min	90358	90811
TOTAL STAGE 2 AFTERCOOLER CIRCUIT (2AC+GB)	(22)	Btu/min	19164	19447
HEAT REJECTION TO EXHAUST (LHV TO 248°F)	(22)	Btu/min	71761	70671
A cooling system safety factor of 0% has been added to the cooling system sizing criteria.				

MINIMUM HEAT RECOVERY				
TOTAL JACKET WATER CIRCUIT (JW+OC+1AC)	(23)	Btu/min	69200	67345
TOTAL STAGE 2 AFTERCOOLER CIRCUIT (2AC+GB)	(23)	Btu/min	15738	15157
HEAT REJECTION TO EXHAUST(LHV TO 248°F)	(23)	Btu/min	51674	49913

CONDITIONS AND DEFINITIONS

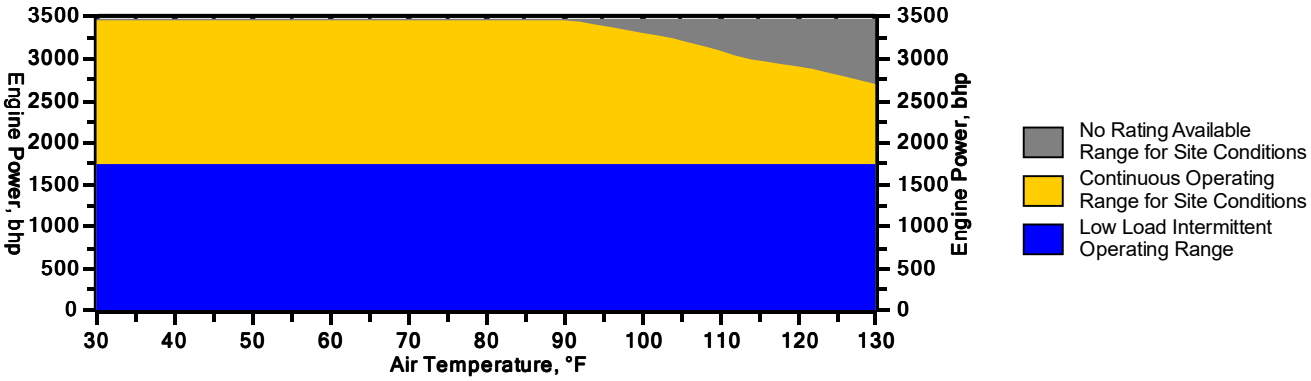
Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site inlet air temperature. 100% rating at maximum inlet air temperature is the maximum engine capability for the specified fuel at site altitude and maximum site inlet air temperature. Maximum rating is the maximum capability at the specified aftercooler inlet temperature for the specified fuel at site altitude and reduced inlet air temperature. Lowest load point is the lowest continuous duty operating load allowed. No overload permitted at rating shown.

For notes information consult page three.

PREPARED BY: Donny Corley, Mustang CAT
Data generated by Gas Engine Rating Pro Version 6.09.02
Ref. Data Set EM3735-00-001, Printed 25Feb2019

Engine Power vs. Inlet Air Temperature

Data represents temperature sweep at 3150 ft and 1500 rpm



NOTES

1. Fuel pressure range specified is to the engine fuel control valve. Additional fuel train components should be considered in pressure and flow calculations.

2. Generator efficiencies, power factor, and voltage are based on specified generator. [Genset Power (ekW) is calculated as: (Engine Power (bkW) - Gearbox Power (bkW)) x Generator Efficiency], [Genset Power (kVA) is calculated as: (Engine Power (bkW) - Gearbox Power (bkW)) x Generator Efficiency / Power Factor]

3. Rating is with two engine driven water pumps. Tolerance is (+)3, (-)0% of full load. All derates are applied without pumps , then pump power is subtracted to obtain final rating.

4. Efficiency represents a Closed Crankcase Ventilation (CCV) system installed on the engine.

5. Genset Effieciency published in accordance with ISO 3046/1.

6. Thermal Efficiency is calculated based on energy recovery from the jacket water, lube oil, 1st stage aftercooler, and exhaust to 248ºF with engine operation at ISO 3046/1 Genset Efficiency, and assumes unburned fuel is converted in an oxidation catalyst.

7. Total efficiency is calculated as: Genset Efficiency + Thermal Efficiency. Tolerance is ±10% of full load data.

8. ISO 3046/1 Genset fuel consumption tolerance is (+)5, (-)0% at the specified power factor. Nominal genset and engine fuel consumption tolerance is ± 1.5% of full load data at the specified power factor.

9. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.

10. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.

11. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.

12. Exhaust flow value is on a "wet" basis. Flow is a nominal value with a tolerance of ± 6 %.

13. Inlet and Exhaust Restrictions are maximum allowed values at the corresponding loads. Increasing restrictions beyond what is specified will result in a significant engine derate.

14. Emissions data is at engine exhaust flange prior to any after treatment.

15. NOx tolerance's are ± 18% of specified value. All other emission values listed are higher than nominal levels to allow for instrumentation, measurement, and engine-to-engine variations. They indicate the maximum values expected under steady state conditions. Fuel methane number cannot vary more than ± 3. THC, NMHC, and NMNEHC do not include aldehydes

16. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ

17. Exhaust Oxygen level is the result of adjusting the engine to operate at the specified NOx level. Tolerance is ± 0.5.

18. LHV rate tolerance is ± 1.5%.

19. Heat rejection values are representative of site conditions. Tolerances, based on treated water, are ± 10% for jacket water circuit, ± 50% for atmosphere, ± 20% for lube oil circuit, ± 10% for exhaust, ± 5% for aftercooler circuit, and ± 5% for Gearbox.

20. Pump power includes engine driven jacket water and aftercooler water pumps. Engine brake power includes effects of pump power.

21. Aftercooler heat rejection is nominal for site conditions and does not include an aftercooler heat rejection factor. Aftercooler heat rejection values at part load are for reference only.

22. Cooling system sizing criteria represent the expected maximum circuit heat rejection for the ratings at site, with applied plus tolerances. Total circuit heat rejection is calculated using formulas referenced in the notes on the standard tech data sheet with the following qualifications. Aftercooler heat rejection data (1AC & 2AC) is based on the standard rating. Jacket Water (JW), Oil Cooler (OC), and Gearbox (GB) heat rejection values are based on the respective site or maximum column. Aftercooler heat rejection factors (ACHRF) are specific for the site elevation and inlet air temperature specified in the site or maximum column, referenced from the table on the standard data sheet

23. Minimum heat recovery values represent the expected minimum heat recovery for the site, with applied minus tolerances. Do not use these values for cooling system sizing.

Constituent	Abbrev	Mole %	Norm
Water Vapor	H2O	0.0000	0.0000
Methane	CH4	96.7500	96.7500
Ethane	C2H6	0.0800	0.0800
Propane	C3H8	0.0000	0.0000
Isobutane	iso-C4H1O	0.0000	0.0000
Norbutane	nor-C4H1O	0.0000	0.0000
Isopentane	iso-C5H12	0.0000	0.0000
Norpentane	nor-C5H12	0.0000	0.0000
Hexane	C6H14	0.0000	0.0000
Heptane	C7H16	0.0000	0.0000
Nitrogen	N2	3.1700	3.1700
Carbon Dioxide	CO2	0.0000	0.0000
Hydrogen Sulfide	H2S	0.0000	0.0000
Carbon Monoxide	CO	0.0000	0.0000
Hydrogen	H2	0.0000	0.0000
Oxygen	O2	0.0000	0.0000
Helium	HE	0.0000	0.0000
Neopentane	neo-C5H12	0.0000	0.0000
Octane	C8H18	0.0000	0.0000
Nonane	C9H20	0.0000	0.0000
Ethylene	C2H4	0.0000	0.0000
Propylene	C3H6	0.0000	0.0000
TOTAL (Volume %)		100.0000	100.0000

Fuel Makeup:	Audubon Husky -
Unit of Measure:	English

Calculated Fuel Properties

Caterpillar Methane Number:	99.8
Lower Heating Value (Btu/scf):	883
Higher Heating Value (Btu/scf):	980
WOBBE Index (Btu/scf):	1172
THC: Free Inert Ratio:	30.55
Total % Inerts (% N2, CO2, He):	3.17%
RPC (%) (To 905 Btu/scf Fuel):	100%
Compressibility Factor:	0.998
Stoich A/F Ratio (Vol/Vol):	9.23
Stoich A/F Ratio (Mass/Mass):	16.27
Specific Gravity (Relative to Air):	0.567
Fuel Specific Heat Ratio (K):	1.318

CONDITIONS AND DEFINITIONS

Caterpillar Methane Number represents the knock resistance of a gaseous fuel. It should be used with the Caterpillar Fuel Usage Guide for the engine and rating to determine the rating for the fuel specified. A Fuel Usage Guide for each rating is included on page 2 of its standard technical data sheet.

RPC always applies to naturally aspirated (NA) engines, and turbocharged (TA or LE) engines only when they are derated for altitude and ambient site conditions.

Project specific technical data sheets generated by the Caterpillar Gas Engine Rating Pro program take the Caterpillar Methane Number and RPC into account when generating a site rating.

Fuel properties for Btu/scf calculations are at 60F and 14.696 psia.

Caterpillar shall have no liability in law or equity, for damages, consequently or otherwise, arising from use of program and related material or any part thereof.

FUEL LIQUIDS

Field gases, well head gases, and associated gases typically contain liquid water and heavy hydrocarbons entrained in the gas. To prevent detonation and severe damage to the engine, hydrocarbon liquids must not be allowed to enter the engine fuel system. To remove liquids, a liquid separator and coalescing filter are recommended, with an automatic drain and collection tank to prevent contamination of the ground in accordance with local codes and standards.

To avoid water condensation in the engine or fuel lines, limit the relative humidity of water in the fuel to 80% at the minimum fuel operating temperature.

G3520H

GENSET - WITHOUT RADIATOR

GAS ENGINE SITE SPECIFIC TECHNICAL DATA
Audubon - XTO Husky

CATERPILLAR®

ENGINE SPEED (rpm):	1500	RATING STRATEGY:	HUMIDITY/FUEL TOLERANT
COMPRESSION RATIO:	11.1	RATING LEVEL:	CONTINUOUS
AFTERCOOLER TYPE:	SCAC	FUEL SYSTEM:	CAT LOW PRESSURE WITH AIR FUEL RATIO CONTROL
AFTERCOOLER - STAGE 2 INLET (°F):	130		
AFTERCOOLER - STAGE 1 INLET (°F):	192	**SITE CONDITIONS:**	
JACKET WATER OUTLET (°F):	210	FUEL:	Audubon Huskt - Rich GAS
ASPIRATION:	TA	FUEL PRESSURE RANGE(psig): (See note 1)	2.0-5.0
COOLING SYSTEM:	JW+OC+1AC, 2AC+GB	FUEL METHANE NUMBER:	57.3
CONTROL SYSTEM:	ADEM4 W/ IM	FUEL LHV (Btu/scf):	1187
EXHAUST MANIFOLD:	DRY	ALTITUDE(ft):	3150
COMBUSTION:	LOW EMISSION	INLET AIR TEMPERATURE(°F):	97
NOx EMISSION LEVEL (g/bhp-hr NOx):	1.0	STANDARD RATED POWER:	3448 bhp@1500rpm
ANCILLARY LOAD (ekW):	60	POWER FACTOR:	1.0
SET POINT TIMING:	16	VOLTAGE(V):	4160-13800

				MAXIMUM RATING	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE		
RATING		**NOTES**	**LOAD**	**100%**	**100%**	**75%**	**57%**
GENSET POWER	(WITH ANCILLARY LOAD, WITH GEARBOX)	(2)(3)	ekW	2048	2048	1536	1159
GENSET POWER	(WITH ANCILLARY LOAD, WITH GEARBOX)	(2)(3)	kVA	2048	2048	1536	1159
ENGINE POWER	(WITHOUT GEARBOX, WITHOUT FAN)	(3)	bhp	2932	2932	2232	1714
INLET AIR TEMPERATURE			°F	97	97	97	97
GENERATOR EFFICIENCY		(2)	%	97.2	97.2	96.7	96.1
GENSET EFFICIENCY	(ISO 3046/1)	(4)(5)	%	41.6	41.6	40.1	38.1
THERMAL EFFICIENCY		(4)(6)	%	43.0	43.0	44.4	46.4
TOTAL EFFICIENCY		(4)(7)	%	84.6	84.6	84.5	84.5
ENGINE DATA							
GENSET FUEL CONSUMPTION	(ISO 3046/1)	(8)	Btu/ekW-hr	8209	8209	8511	8963
GENSET FUEL CONSUMPTION	(NOMINAL)	(8)	Btu/ekW-hr	8492	8492	8805	9272
ENGINE FUEL CONSUMPTION	(NOMINAL)	(8)	Btu/bhp-hr	5932	5932	6061	6269
AIR FLOW (@inlet air temp, 14.7 psia)	(WET)	(9)	ft3/min	5482	5482	4123	3138
AIR FLOW	(WET)	(9)	lb/hr	23435	23435	17623	13414
FUEL FLOW (60ºF, 14.7 psia)			scfm	244	244	190	151
INLET MANIFOLD PRESSURE		(10)	in Hg(abs)	114.9	114.9	87.8	68.3
EXHAUST TEMPERATURE - ENGINE OUTLET		(11)	°F	815	815	873	949
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(12)	ft3/min	13455	13455	10601	8550
EXHAUST GAS MASS FLOW	(WET)	(12)	lb/hr	24284	24284	18283	13939
MAX INLET RESTRICTION		(13)	in H2O	14.53	14.53	10.30	8.22
MAX EXHAUST RESTRICTION		(13)	in H2O	20.15	20.15	11.73	7.33
EMISSIONS DATA - ENGINE OUT							
NOx (as NO2)		(14)(15)	g/bhp-hr	1.00	1.00	1.00	1.00
CO		(14)(15)	g/bhp-hr	1.68	1.68	1.59	1.61
THC (mol. wt. of 15.84)		(14)(15)	g/bhp-hr	1.44	1.44	1.52	1.46
NMHC (mol. wt. of 15.84)		(14)(15)	g/bhp-hr	0.70	0.70	0.74	0.71
NMNEHC (VOCs) (mol. wt. of 15.84)		(14)(15)(16)	g/bhp-hr	0.37	0.37	0.39	0.38
HCHO (Formaldehyde)		(14)(15)	g/bhp-hr	0.25	0.25	0.24	0.24
CO2		(14)(15)	g/bhp-hr	413	413	472	462
EXHAUST OXYGEN		(14)(17)	% DRY	9.2	9.2	8.9	8.5
HEAT REJECTION							
LHV INPUT		(18)	Btu/min	289909	289909	225441	179057
HEAT REJ. TO JACKET WATER (JW)		(19)	Btu/min	31352	31352	26115	23490
HEAT REJ. TO ATMOSPHERE	(INCLUDES GENERATOR)	(19)	Btu/min	9164	9164	7586	6549
HEAT REJ. TO LUBE OIL (OC)		(19)	Btu/min	12096	12096	10912	9874
HEAT REJECTION TO EXHAUST (LHV TO 248°F)		(19)	Btu/min	61340	61340	51221	44098
HEAT REJ. TO A/C - STAGE 1 (1AC)		(19)(21)	Btu/min	21172	21172	12661	6480
HEAT REJ. TO A/C - STAGE 2 (2AC)		(19)(21)	Btu/min	12748	12748	9150	6105
HEAT REJECTION FROM GEARBOX (GB)		(19)	Btu/min	982	982	748	574
PUMP POWER		(20)	Btu/min	859	859	859	859

COOLING SYSTEM SIZING CRITERIA				
TOTAL JACKET WATER CIRCUIT (JW+OC+1AC)	(22)	Btu/min	77417	77417
TOTAL STAGE 2 AFTERCOOLER CIRCUIT (2AC+GB)	(22)	Btu/min	16210	16210
HEAT REJECTION TO EXHAUST (LHV TO 248°F)	(22)	Btu/min	67474	67474
A cooling system safety factor of 0% has been added to the cooling system sizing criteria.				

MINIMUM HEAT RECOVERY				
TOTAL JACKET WATER CIRCUIT (JW+OC+1AC)	(23)	Btu/min	58007	58007
TOTAL STAGE 2 AFTERCOOLER CIRCUIT (2AC+GB)	(23)	Btu/min	13044	13044
HEAT REJECTION TO EXHAUST(LHV TO 248°F)	(23)	Btu/min	48048	48048

CONDITIONS AND DEFINITIONS

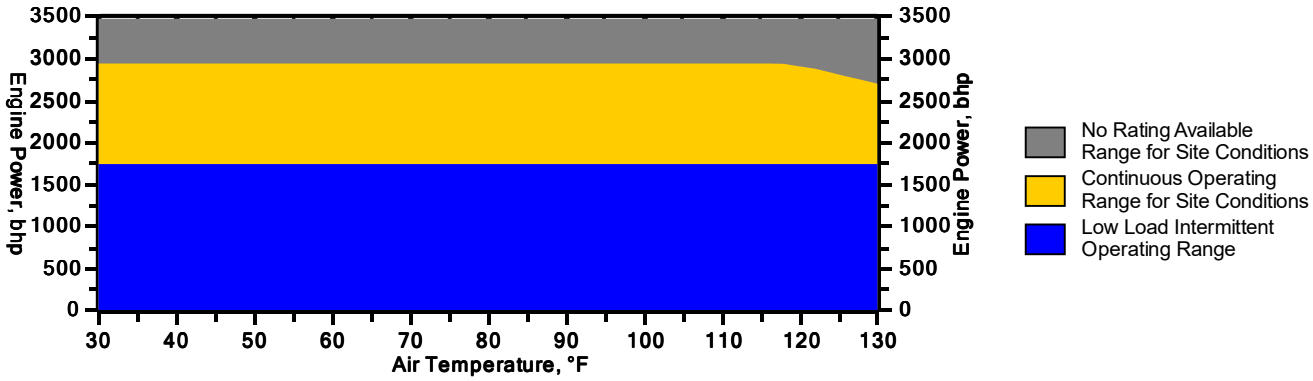
Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site inlet air temperature. 100% rating at maximum inlet air temperature is the maximum engine capability for the specified fuel at site altitude and maximum site inlet air temperature. Maximum rating is the maximum capability at the specified aftercooler inlet temperature for the specified fuel at site altitude and reduced inlet air temperature. Lowest load point is the lowest continuous duty operating load allowed. No overload permitted at rating shown.

For notes information consult page three.

PREPARED BY: Donny Corley, Mustang CAT
Data generated by Gas Engine Rating Pro Version 6.09.02
Ref. Data Set EM3735-00-001, Printed 25Feb2019

Engine Power vs. Inlet Air Temperature

Data represents temperature sweep at 3150 ft and 1500 rpm



NOTES

1. Fuel pressure range specified is to the engine fuel control valve. Additional fuel train components should be considered in pressure and flow calculations.

2. Generator efficiencies, power factor, and voltage are based on standard generator. [Genset Power (ekW) is calculated as: ((Engine Power (bkW) - Gearbox Power (bkW)) x Generator Efficiency) - Ancillary Load (ekW)], [Genset Power (kVA) is calculated as: (((Engine Power (bkW) - Gearbox Power (bkW)) x Generator Efficiency) - Ancillary Load (ekW)) / Power Factor]

3. Rating is with two engine driven water pumps. Tolerance is (+)3, (-)0% of full load. All derates are applied without pumps , then pump power is subtracted to obtain final rating.

4. Efficiency represents a Closed Crankcase Ventilation (CCV) system installed on the engine.

5. Genset Effieciency published in accordance with ISO 3046/1.

6. Thermal Efficiency is calculated based on energy recovery from the jacket water, lube oil, 1st stage aftercooler, and exhaust to 248ºF with engine operation at ISO 3046/1 Genset Efficiency, and assumes unburned fuel is converted in an oxidation catalyst.

7. Total efficiency is calculated as: Genset Efficiency + Thermal Efficiency. Tolerance is ±10% of full load data.

8. ISO 3046/1 Genset fuel consumption tolerance is (+)5, (-)0% at the specified power factor. Nominal genset and engine fuel consumption tolerance is ± 1.5% of full load data at the specified power factor.

9. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.

10. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.

11. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.

12. Exhaust flow value is on a "wet" basis. Flow is a nominal value with a tolerance of ± 6 %.

13. Inlet and Exhaust Restrictions are maximum allowed values at the corresponding loads. Increasing restrictions beyond what is specified will result in a significant engine derate.

14. Emissions data is at engine exhaust flange prior to any after treatment.

15. NOx tolerance's are ± 18% of specified value. All other emission values listed are higher than nominal levels to allow for instrumentation, measurement, and engine-to-engine variations. They indicate the maximum values expected under steady state conditions. Fuel methane number cannot vary more than ± 3. THC, NMHC, and NMNEHC do not include aldehydes

16. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ

17. Exhaust Oxygen level is the result of adjusting the engine to operate at the specified NOx level. Tolerance is ± 0.5.

18. LHV rate tolerance is ± 1.5%.

19. Heat rejection values are representative of site conditions. Tolerances, based on treated water, are ± 10% for jacket water circuit, ± 50% for atmosphere, ± 20% for lube oil circuit, ± 10% for exhaust, ± 5% for aftercooler circuit, and ± 5% for Gearbox.

20. Pump power includes engine driven jacket water and aftercooler water pumps. Engine brake power includes effects of pump power.

21. Aftercooler heat rejection is nominal for site conditions and does not include an aftercooler heat rejection factor. Aftercooler heat rejection values at part load are for reference only.

22. Cooling system sizing criteria represent the expected maximum circuit heat rejection for the ratings at site, with applied plus tolerances. Total circuit heat rejection is calculated using formulas referenced in the notes on the standard tech data sheet with the following qualifications. Aftercooler heat rejection data (1AC & 2AC) is based on the standard rating. Jacket Water (JW), Oil Cooler (OC), and Gearbox (GB) heat rejection values are based on the respective site or maximum column. Aftercooler heat rejection factors (ACHRF) are specific for the site elevation and inlet air temperature specified in the site or maximum column, referenced from the table on the standard data sheet

23. Minimum heat recovery values represent the expected minimum heat recovery for the site, with applied minus tolerances. Do not use these values for cooling system sizing.

Constituent	Abbrev	Mole %	Norm
Water Vapor	H2O	0.0000	0.0000
Methane	CH4	71.2300	71.2942
Ethane	C2H6	16.0000	16.0144
Propane	C3H8	8.0000	8.0072
Isobutane	iso-C4H1O	0.8000	0.8007
Norbutane	nor-C4H1O	1.6800	1.6815
Isopentane	iso-C5H12	0.2200	0.2202
Norpentane	nor-C5H12	0.1800	0.1802
Hexane	C6H14	0.0000	0.0000
Heptane	C7H16	0.0000	0.0000
Nitrogen	N2	1.6200	1.6215
Carbon Dioxide	CO2	0.1800	0.1802
Hydrogen Sulfide	H2S	0.0000	0.0000
Carbon Monoxide	CO	0.0000	0.0000
Hydrogen	H2	0.0000	0.0000
Oxygen	O2	0.0000	0.0000
Helium	HE	0.0000	0.0000
Neopentane	neo-C5H12	0.0000	0.0000
Octane	C8H18	0.0000	0.0000
Nonane	C9H20	0.0000	0.0000
Ethylene	C2H4	0.0000	0.0000
Propylene	C3H6	0.0000	0.0000
TOTAL (Volume %)		99.9100	100.0000

Fuel Makeup:	Audubon Huskt - Rich
Unit of Measure:	English

Calculated Fuel Properties

Caterpillar Methane Number:	57.3
Lower Heating Value (Btu/scf):	1187
Higher Heating Value (Btu/scf):	1307
WOBBE Index (Btu/scf):	1360
THC: Free Inert Ratio:	54.5
Total % Inerts (% N2, CO2, He):	1.8%
RPC (%) (To 905 Btu/scf Fuel):	100%
Compressibility Factor:	0.996
Stoich A/F Ratio (Vol/Vol):	12.29
Stoich A/F Ratio (Mass/Mass):	16.15
Specific Gravity (Relative to Air):	0.761
Fuel Specific Heat Ratio (K):	1.274

CONDITIONS AND DEFINITIONS

Caterpillar Methane Number represents the knock resistance of a gaseous fuel. It should be used with the Caterpillar Fuel Usage Guide for the engine and rating to determine the rating for the fuel specified. A Fuel Usage Guide for each rating is included on page 2 of its standard technical data sheet.

RPC always applies to naturally aspirated (NA) engines, and turbocharged (TA or LE) engines only when they are derated for altitude and ambient site conditions.

Project specific technical data sheets generated by the Caterpillar Gas Engine Rating Pro program take the Caterpillar Methane Number and RPC into account when generating a site rating.

Fuel properties for Btu/scf calculations are at 60F and 14.696 psia.

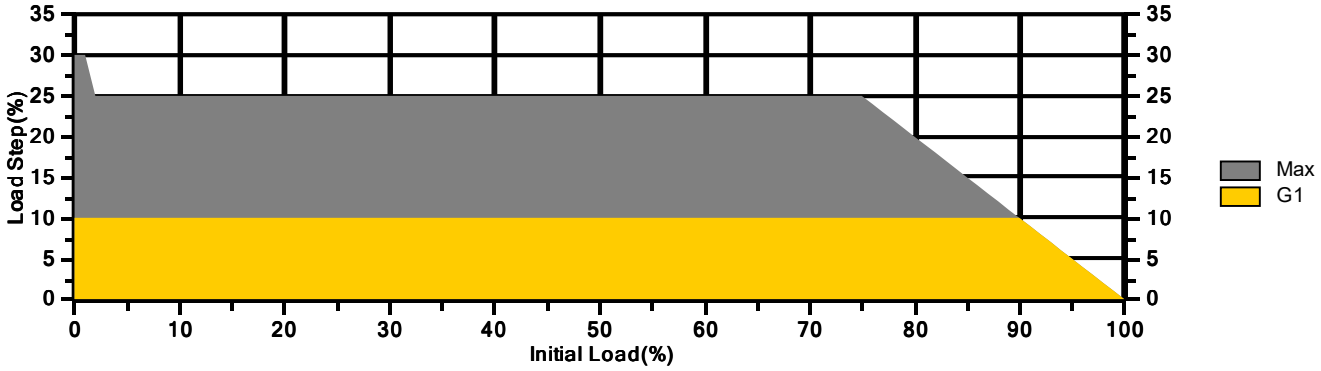
Caterpillar shall have no liability in law or equity, for damages, consequently or otherwise, arising from use of program and related material or any part thereof.

FUEL LIQUIDS

Field gases, well head gases, and associated gases typically contain liquid water and heavy hydrocarbons entrained in the gas. To prevent detonation and severe damage to the engine, hydrocarbon liquids must not be allowed to enter the engine fuel system. To remove liquids, a liquid separator and coalescing filter are recommended, with an automatic drain and collection tank to prevent contamination of the ground in accordance with local codes and standards.

To avoid water condensation in the engine or fuel lines, limit the relative humidity of water in the fuel to 80% at the minimum fuel operating temperature.

Load Acceptance



Transient Load Acceptance					
Load Step	Frequency Deviation +/- (%)	Voltage Deviation +/- (%)	Recovery Time (sec)	Classification as Defined by ISO 8528 - 5	Notes
30	+5/-25	+10/-35	40		
25	+5/-15	+10/-25	30		
20	+8/-13	+11/-19	22.5		
15	+10/-10	+12/-12	15		
10	+8/-8	+14/-14	10	G1	2
5	+6/-6	+6/-6	10	G1	2
-10	+8/-8	+14/-14	10		
-15	+10/-10	+12/-12	15		
-25	+18/-10	+10/-10	25		
Breaker Open	+24/-15	+18/-15	20		1
Recovery Specification	+1.75/-1.75	+5/-5			
Steady State Specification	+1.25/-1.25	+5/-5			

Transient Information

The transient load steps listed above are stated as a percentage of the engine's full rated load as indicated in the appropriate performance technical data sheet. Site ambient conditions, fuel quality, inlet/exhaust restriction and emissions settings will all affect engine response to load change. Engines that are not operating at the standard conditions stated in the Technical data sheet should be set up according to the guidelines included in the technical data; applying timing changes and/or engine derates as needed. Adherence to the engine settings guidelines will allow the engines to retain the transient performance stated in the tables above as a percentage of the site derated power (where appropriate).Fuel supply pressure and stability is critical to transient performance. Proper installation requires that all fuel train components (including filters, shut off valves, and regulators) be sized to ensure adequate fuel be delivered to the engine. The following are fuel pressure requirements to be measured at the engine mounted fuel control valve.

a. Steady State Fuel Pressure Stability +/- .15 psi/sec
b. Transient fuel Pressure Stability +/- .15 psi/sec

Inlet water temperature to the SCAC must be maintained at specified value for all engines. It is important that the external cooling system design is able to maintain the Inlet water temp to the SCAC to within +/- 1 °C during all engine-operating cycles. The SCAC inlet temperature stability criterion is to maintain stable inlet manifold air temperature. The Air Fuel Ratio control system requires up to 180 seconds to converge after a load step has been performed for NOx to return to nominal setting. If the stabilization time is not met between load steps the transient performance listed in the document may not be met. Differences in generator inertia may change the transient response of engine. Engine Governor gains and Voltage regulator settings may need to be tuned for site conditions. The time needed to start and stabilize at rated engine speed is a minimum of 60 seconds after a successful crank cycle. Engines must be maintained in accordance to guidelines specified in the Caterpillar Service Manuals applicable to each engine. Wear of components outside of the specified tolerances will affect the transient capability of the engine. Steady state voltage and frequency stability specified at +/-2 sigma or better. Transient performance data is representative of a "Hot" (previously loaded or fully heat soaked) genset.

NOTES

1. For unloading the engine to 0% load from a loaded condition no external input is needed. The engine control algorithm employs a load sensing strategy to determine a load drop. In the event that the local generator breaker opens the strategy provides control to the engine that resets all control inputs to the rated idle condition. This prevents engine over speeding and will allow the engine to remain running unloaded at the rated synchronous speed.
2. The engines specified above have been tested against the voltage deviation, frequency deviation, and recovery time requirements defined in ISO 8528 - 5. At this time the engines stated above will meet class G1 transient performance as defined by ISO 8528 - 5 with exceptions.

API HEAT TRANSFER
PERFORMANCE IS EVERYTHING

Technical Data Sheet

Customer:	Mustang CAT	**Attn:** Donny Corley		**Date:**	2/25/2019
API Assy No.	TBD	**Customer No:**	**TBD**	**Proposal:**	ZTS-2019-0092
Application	TBD			**Prepared:**	Zach Smith
Engine	G3520H 3447 HP @ 1500 RPM				

AC PERFORMANCE

AC Heat Rejection:	21080 ***BTU/Min***	**Flow Height:**		115.16 ***in.***	
(Safety Factor)	10 ***%***	**No-Flow Height:**		110.00 ***in.***	
Flow Rate:	180 ***GPM***	**Core Depth:**		1.93 ***in.***	
Fluid Type:	50/50 ***Glycol/H_2O***	**Core Type:**	LT3090		
Fluid Temperature In:	146 ***°F***		Copper, 9		***FPI***
Fluid Temperature Out:	130 ***°F***		Louvered		
Ambient Temperature:	97 ***°F***		Plate Fin		
Cooling Air Temperature In:	107 ***°F***	**No. of Passes:**	1		
Cooling Air Temperature Out:	118 ***°F***				
Internal Pressure Drop @ Design Point:	3.54 ***PSI***				
Cooling Air Flow Required:	111000 ***SCFM @***	.31 ***in- H_2O***			
Limiting Ambient Temperature:	97 ***°F***				

JW PERFORMANCE

JW Heat Rejection:	99394 ***BTU/Min***	**Flow Height:**		115.16 ***in.***	
(Safety Factor)	10 ***%***	**No-Flow Height:**		110.00 ***in.***	
Flow Rate:	490 ***GPM***	**Core Depth:**		6.22 ***in.***	
Fluid Type:	50/50 ***Glycol/H_2O***	**Core Type:**	K7090		
Fluid Temperature In:	210 ***°F***		Copper,9		***FPI***
Fluid Temperature Out:	183 ***°F***		Non-Louvered		
Ambient Temperature:	97 ***°F***		Plate Fin		
Cooling Air Temperature In:	118 ***°F***	**No. of Passes:**	1		
Cooling Air Temperature Out:	167 ***°F***				
Internal Pressure Drop @ Design Point:	1.05 ***PSI***				
Cooling Air Flow Required:	111000 ***SCFM @***	1.03 ***in- H_2O***			
Limiting Ambient Temperature:	97 ***°F***				

FAN DATA[2]

Fan Manufacturer:	Moore			**External Restriction**	.5 ***in- H_2O***
Fan Model:	10KHDVT-30			**Elevation**	31500 ***ft.***
Fan Diameter:	98 ***in.***			**Blade Angle**	25 **°**
Number of Blades:	8			**Fan Speed:**	600 ***RPM***
Draft Type:	Blower			**Fan Tip Speed:**	15394 ***FPM***
				Drive Type	Engine
Theoretical Air Flow:	111000 ***SCFM @***	1.83	***in- H_2O***	**Drive Ratio**	.4:1
Fan Derate:					
Noise[3]:	94.5 dBA @ 6ft			**Fan Power Draw**	73.26 **HP @ Std.**

[2] Multi-Wing America has provided their sizing program to API Heat Transfer for general use and assistance with our mutual customers. The performance enclosed is contingent upon Multi-Wing America verifying fan performance upon order placement.
[3] Fan only, free field; Radiator system typically adds 3 dBA to 10 dBA depending on installation site.

GENERATOR DATA

JULY 23, 2019

For Help Desk Phone Numbers Click here

Selected Model

Engine: 3520	**Generator Frame:** 3044	**Genset Rating (kW):** 2469.0	**Line Voltage:** 4160
Fuel: Natural Gas	**Generator Arrangement:** 5504568	**Genset Rating (kVA):** 3086.0	**Phase Voltage:** 2402
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 0.8	**Rated Current:** 428.3
Duty: CONTINUOUS	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 41205 /43202 /43647 /8357

Spec Information

Generator Specification

Frame: 3044 **Type:** SR5	**No. of Bearings:** 2
Winding Type: FORM WOUND	**Flywheel:** 21.0
Connection: SERIES STAR	**Housing:** 00
Phases: 3	**No. of Leads:** 6
Poles: 4	**Wires per Lead:** 1
Sync Speed: 1800	**Generator Pitch:** 0.6667

Generator Efficiency

Per Unit Load	kW	Efficiency %
0.25	617.3	91.9
0.5	1234.5	95.3
0.75	1851.8	96.3
1.0	2469.0	96.7
1.1	2715.9	96.8

Reactances	Per Unit	Ohms
SUBTRANSIENT - DIRECT AXIS X''_d	0.0896	0.5023
SUBTRANSIENT - QUADRATURE AXIS X''_q	0.1435	0.8045
TRANSIENT - SATURATED X'_d	0.1223	0.6860
SYNCHRONOUS - DIRECT AXIS X_d	1.5287	8.5718
SYNCHRONOUS - QUADRATURE AXIS X_q	0.9147	5.1292
NEGATIVE SEQUENCE X_2	0.1165	0.6534
ZERO SEQUENCE X_0	0.0146	0.0817

Time Constants	Seconds
OPEN CIRCUIT TRANSIENT - DIRECT AXIS T'_{d0}	5.0760
SHORT CIRCUIT TRANSIENT - DIRECT AXIS T'_d	0.6170
OPEN CIRCUIT SUBSTRANSIENT - DIRECT AXIS T''_{d0}	0.0510
SHORT CIRCUIT SUBSTRANSIENT - DIRECT AXIS T''_d	0.0370
OPEN CIRCUIT SUBSTRANSIENT - QUADRATURE AXIS T''_{q0}	0.0250
SHORT CIRCUIT SUBSTRANSIENT - QUADRATURE AXIS T''_q	0.0040
EXCITER TIME CONSTANT T_e	0.1761
ARMATURE SHORT CIRCUIT T_a	0.0570

Short Circuit Ratio: 0.98	Stator Resistance = 0.0409 Ohms	Field Resistance = 1.1257 Ohms

Voltage Regulation	
Voltage level adjustment: +/-	5.0%
Voltage regulation, steady state: +/-	0.5%
Voltage regulation with 3% speed change: +/-	0.5%
Waveform deviation line - line, no load: less than	3.0%
Telephone influence factor: less than	100

Generator Excitation

	No Load	Full Load, (rated) pf	
		Series	Parallel
Excitation voltage:	15.76 Volts	47.04 Volts	Volts
Excitation current	1.64 Amps	4.03 Amps	Amps

Selected Model

Engine: 3520	**Generator Frame:** 3044	**Genset Rating (kW):** 2469.0	**Line Voltage:** 4160
Fuel: Natural Gas	**Generator Arrangement:** 5504568	**Genset Rating (kVA):** 3086.0	**Phase Voltage:** 2402
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 0.8	**Rated Current:** 428.3
Duty: CONTINUOUS	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 41205 /43202 /43647 /8357

Generator Mechanical Information

Center of Gravity

Dimension X	-1233.0 mm	-48.5 IN.
Dimension Y	0.0 mm	0.0 IN.
Dimension Z	0.0 mm	0.0 IN.

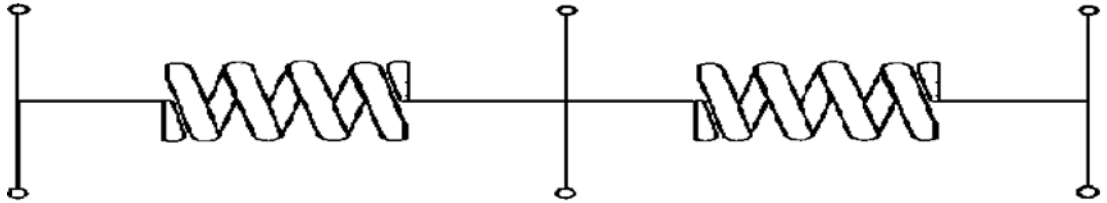
- "X" is measured from driven end of generator and parallel to rotor. Towards engine fan is positive. See General Information for details
- "Y" is measured vertically from rotor center line. Up is positive.
- "Z" is measured to left and right of rotor center line. To the right is positive.

Generator WT = 7390 kg	* Rotor WT = 2361 kg	* Stator WT = 5029 kg
16,292 LB	5,205 LB	11,087 LB

Rotor Balance = 0.0508 mm deflection PTP

Overspeed Capacity = 125% of synchronous speed

Generator Torsional Data



J1 = Coupling and Fan | **J2 = Rotor** | **J3 = Exciter End**

TOTAL J = J1 + J2 + J3

K1 = Shaft Stiffness between J1 + J2 (Diameter 1)

K2 = Shaft Stiffness between J2 + J3 (Diameter 2)

J1	K1	Min Shaft Dia 1	J2	K2	Min Shaft Dia 2	J3
115.5 LB IN. s^2	0.0 MLB IN./rad	0.0 IN.	998.5 LB IN. s^2	0.0 MLB IN./rad	0.0 IN.	18.6 LB IN. s^2
13.05 N m s^2	0.0 MN m/rad	0.0 mm	112.811 N m s^2	0.0 MN m/rad	0.0 mm	2.1 N m s^2
			Total J			
			1,132.6 LB IN. s^2			
			127.961 N m s^2			

Selected Model

Engine: 3520	**Generator Frame:** 3044	**Genset Rating (kW):** 2469.0	**Line Voltage:** 4160
Fuel: Natural Gas	**Generator Arrangement:** 5504568	**Genset Rating (kVA):** 3086.0	**Phase Voltage:** 2402
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 0.8	**Rated Current:** 428.3
Duty: CONTINUOUS	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 41205 /43202 /43647 /8357

Generator Cooling Requirements - Temperature - Insulation Data

Cooling Requirements:		Temperature Data: (Ambient 40 ^{0}C)	
Heat Dissipated:	84.3 kW	**Stator Rise:**	105.0 ^{0}C
Air Flow:	270.0 m^3/min	**Rotor Rise:**	105.0 ^{0}C

Insulation Class: H

Insulation Reg. as shipped: 100.0 MΩ minimum at 40 ^{0}C

Thermal Limits of Generator

Frequency:	60 Hz
Line to Line Voltage:	4160 Volts
B BR 80/40	2594.0 kVA
F BR -105/40	3125.0 kVA
H BR - 125/40	3438.0 kVA
F PR - 130/40	3438.0 kVA

Selected Model

Engine: 3520	**Generator Frame:** 3044	**Genset Rating (kW):** 2469.0	**Line Voltage:** 4160
Fuel: Natural Gas	**Generator Arrangement:** 5504568	**Genset Rating (kVA):** 3086.0	**Phase Voltage:** 2402
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 0.8	**Rated Current:** 428.3
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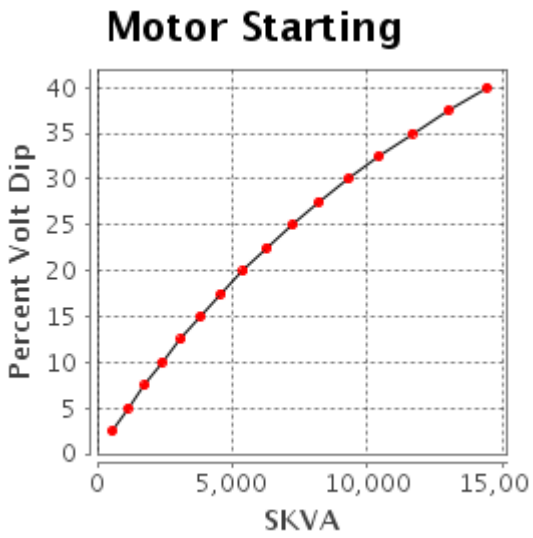
Version: 41205 /43202 /43647 /8357

Starting Capability & Current Decrement

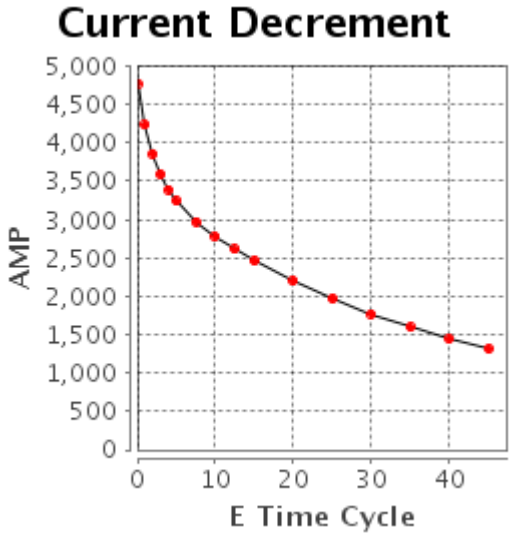
Motor Starting Capability (0.4 pf)

SKVA	Percent Volt Dip
556	2.5
1,140	5.0
1,757	7.5
2,407	10.0
3,095	12.5
3,823	15.0
4,596	17.5
5,416	20.0
6,290	22.5
7,222	25.0
8,218	27.5
9,285	30.0
10,431	32.5
11,666	35.0
12,999	37.5
14,444	40.0



Current Decrement Data

E Time Cycle	AMP
0.0	4,775
1.0	4,234
2.0	3,857
3.0	3,590
4.0	3,393
5.0	3,242
7.5	2,973
10.0	2,777
12.5	2,612
15.0	2,464
20.0	2,200
25.0	1,970
30.0	1,770
35.0	1,595
40.0	1,442
45.0	1,316



Instantaneous 3 Phase Fault Current: 4775 Amps **Instantaneous Line - Line Fault Current:** 3595 Amps

Instantaneous Line - Neutral Fault Current: 5815 Amps

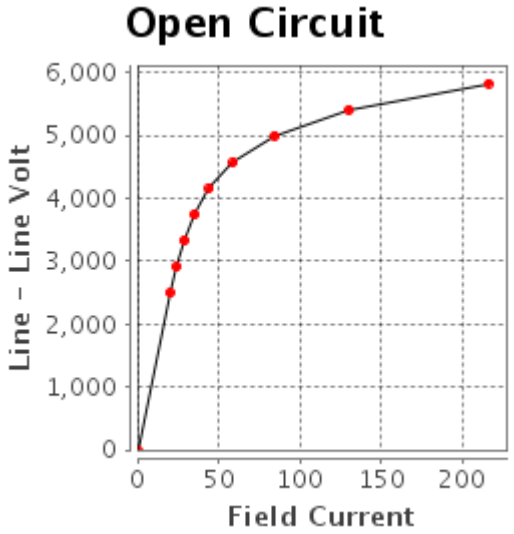
Selected Model

Engine: 3520	**Generator Frame:** 3044	**Genset Rating (kW):** 2469.0	**Line Voltage:** 4160
Fuel: Natural Gas	**Generator Arrangement:** 5504568	**Genset Rating (kVA):** 3086.0	**Phase Voltage:** 2402
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 0.8	**Rated Current:** 428.3
Duty: CONTINUOUS	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 41205 /43202 /43647 /8357

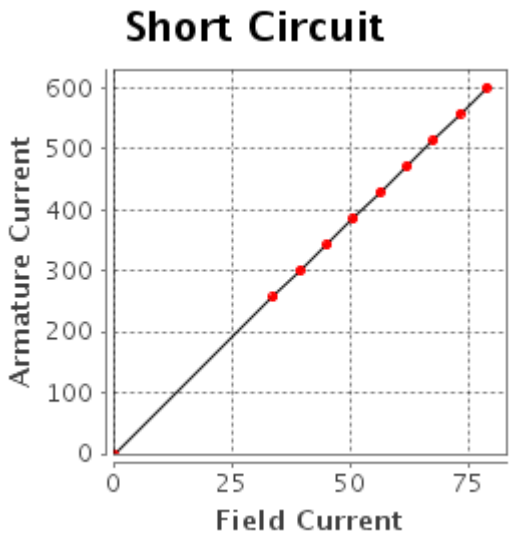
Generator Output Characteristic Curves
Open Circuit Curve

Field Current	Line - Line Volt
0.0	0
20.0	2,496
24.0	2,912
28.8	3,328
35.1	3,744
44.3	4,160
59.1	4,576
84.5	4,992
130.4	5,408
216.0	5,824



Short Circuit Curve

Field Current	Armature Current
0.0	0
33.8	257
39.4	300
45.1	343
50.7	385
56.3	428
62.0	471
67.6	514
73.2	557
78.9	600



Selected Model

Engine: 3520
Fuel: Natural Gas
Frequency: 60
Duty: CONTINUOUS

Generator Frame: 3044
Generator Arrangement: 5504568
Excitation Type: Permanent Magnet
Connection: SERIES STAR

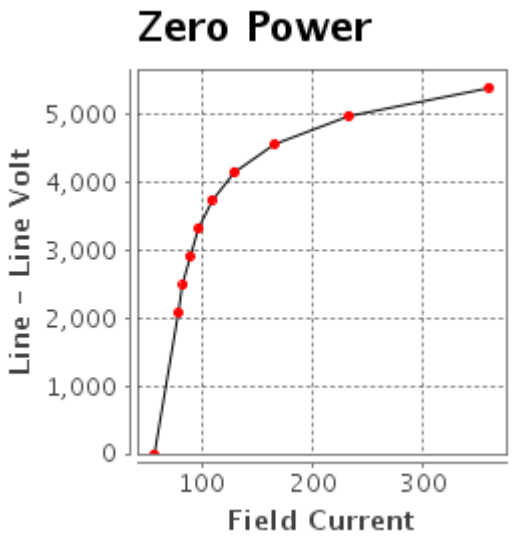
Genset Rating (kW): 2469.0
Genset Rating (kVA): 3086.0
Pwr. Factor: 0.8
Application: EPG

Line Voltage: 4160
Phase Voltage: 2402
Rated Current: 428.3
Status: Current
Version: 41205 /43202 /43647 /8357

Generator Output Characteristic Curves

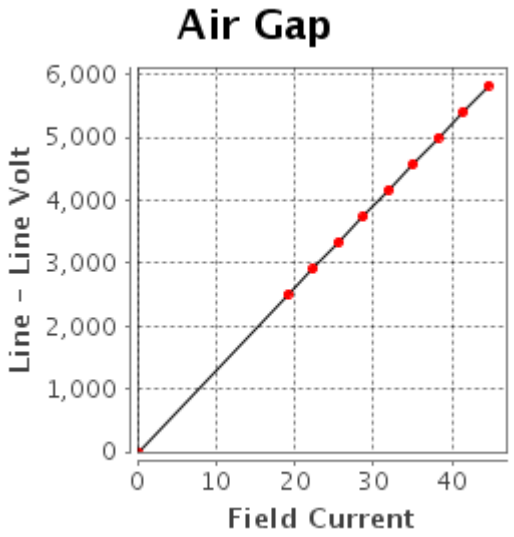
Zero Power Factor Curve

Field Current	Line - Line Volt
56.3	0
78.3	2,080
82.8	2,496
88.5	2,912
96.4	3,328
108.5	3,744
129.1	4,160
165.6	4,576
233.0	4,992
359.8	5,408



Air Gap Curve

Field Current	Line - Line Volt
0.0	0
19.1	2,496
22.3	2,912
25.5	3,328
28.7	3,744
31.9	4,160
35.0	4,576
38.2	4,992
41.4	5,408
44.6	5,824



Selected Model

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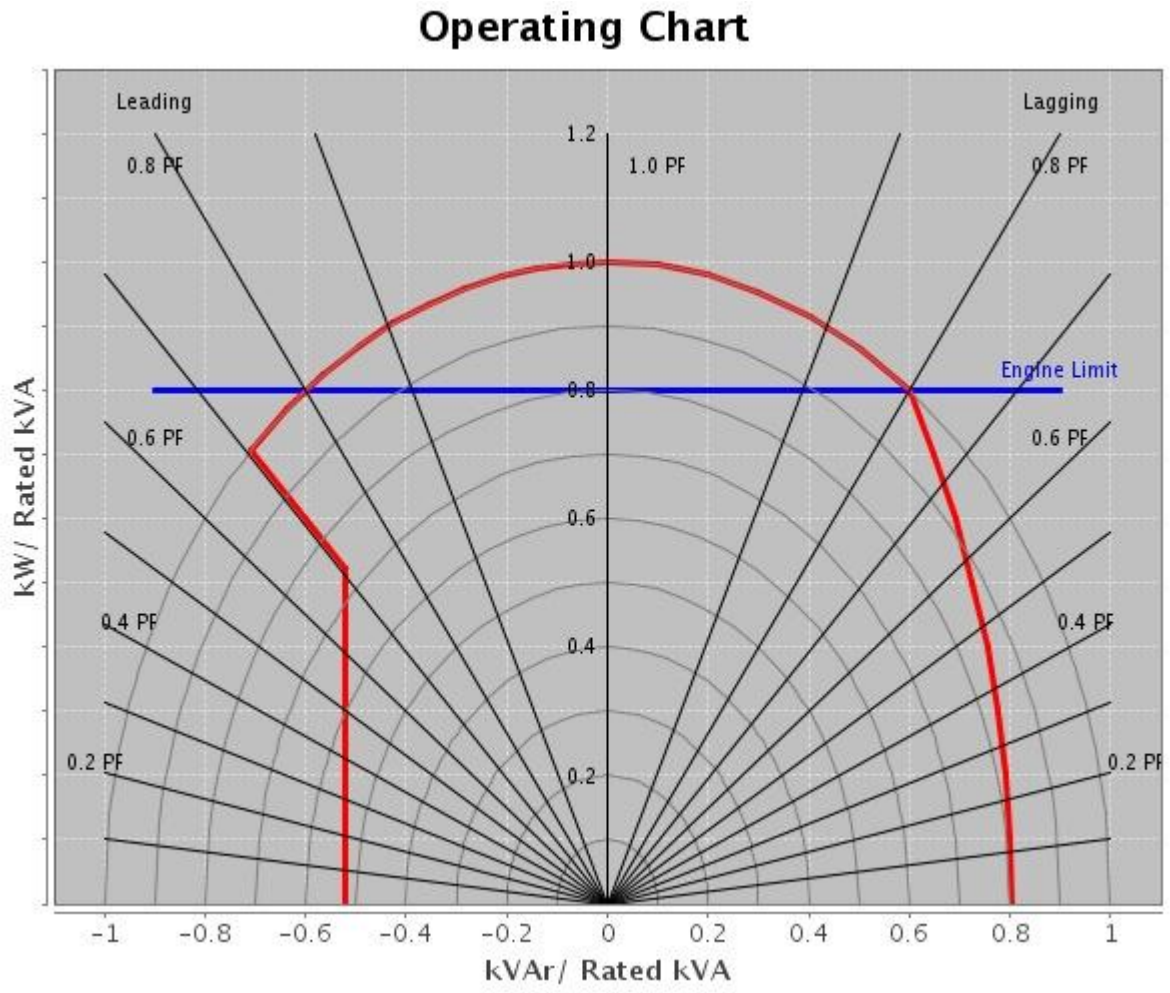
Fuel: Natural Gas	**Generator Arrangement:** 5504568	**Genset Rating (kVA):** 3086.0	**Phase Voltage:** 2402
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 0.8	**Rated Current:** 428.3
Duty: CONTINUOUS	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 41205 /43202 /43647 /8357

Reactive Capability Curve



Selected Model

Engine: 3520	**Generator Frame:** 3044	**Genset Rating (kW):** 2469.0	**Line Voltage:** 4160
Fuel: Natural Gas	**Generator Arrangement:** 5504568	**Genset Rating (kVA):** 3086.0	**Phase Voltage:** 2402
Frequency: 60	**Excitation Type:** Permanent Magnet	**Pwr. Factor:** 0.8	**Rated Current:** 428.3
Duty: CONTINUOUS	**Connection:** SERIES STAR	**Application:** EPG	**Status:** Current

Version: 41205 /43202 /43647 /8357

General Information

DM7827 Caterpillar SR5-HV Generators (50 Hz, 60 Hz)
Data for 3000 frame Caterpillar SR5-HV generators built by Leroy Somer USA.

Refer to DM7821 for explanation of all generator data in Technical Marketing Information (TMI) except generator efficiency for which the explanation is given below.

GENERATOR EFFICIENCY
Generator efficiency is the percentage of engine flywheel (or other prime mover) power that is converted into electrical output. The generator efficiency shown is calculated by the summation of all losses method, and is determined in accordance with the IEC Standard 60034. The efficiency considers only the generator. There is no consideration of engine or parasitic losses here.

Refer to DM7830 for high voltage protective setting values and limits.

EMCP 4

Image shown may not reflect actual package

EMCP 4.3 GENERATOR SET CONTROLLER

Caterpillar is leading the power generation market place with power solutions engineered to deliver unmatched performance, reliability, durability and cost-effectiveness.

FEATURES

GENERAL DESCRIPTION

The Cat® EMCP 4.3 offers fully featured power metering, protective relaying and engine and generator control and monitoring. Engine and generator controls, diagnostics, and operating information are accessible via the control panel keypads; diagnostics from the EMCP 4 optional modules can be viewed and reset through the EMCP 4.3.

FULL RANGE OF ATTACHMENTS

- Wide range of system expansion attachments, designed specifically to work with the EMCP 4.
- Flexible packaging options for easy and cost effective installation.

WORLD WIDE PRODUCT SUPPORT

- Cat dealers provide extensive pre and post sale support.
- Cat dealers have over 1,600 dealer branch stores operating in 200 countries.

FEATURES

- A 480 x 320 pixel, 5.5 inch, white backlit graphical display denotes text alarm/event descriptions, set points, engine and generator monitoring, and is visible in all lighting conditions.
- Textual display with support for 28 languages, including character languages such as Arabic, Chinese, and Japanese.
  Advanced engine monitoring is available on systems with an ADEM™ controller.
- Integration with the Cat Digital Voltage Regulator (CDVR) provides enhanced system performance.
- Fully featured power metering, protective relaying, engine and generator parameter viewing, and expanded AC metering are all integrated into this controller.
- Real-time clock allows for date and time stamping of diagnostics and events in the control's logs as well as service maintenance reminders based on engine operating hours or calendar days.
- Up to 40 diagnostic events are stored in the non-volatile memory.
- Ability to view and reset diagnostics on EMCP 4 optional modules via the control panel removes the need for a separate service tool for troubleshooting.
- Set points and software stored in non-volatile memory, preventing loss during a power outage.
- Reduced power mode offers a low power state to minimize battery power requirements.
- Three levels of security allow for configurable operator privileges.
- Selectable units
  - Temperature: °C or °F
  - Pressure: psi, kPa, bar
  - Fuel Consumption: Gal/hr or Liter/hr

STANDARDS

- UL Recognized
- CSA C22.2 No.100,14, 94
- Complies with all necessary standards for CE Certification
  98/37/EC Machinery Directive
  - BS EN 60204-1 Safety of Machinery
  89/336/EEC EMC Directive
  - BS EN 50081-1 Emissions Standard
  - BS EN 50082-2 Immunity Standard
  73/23/EEC Low Voltage Directive
  - EN 50178 LVD Standard
  IEC529, IEC60034-5, IEC61131-3
- MIL STND 461

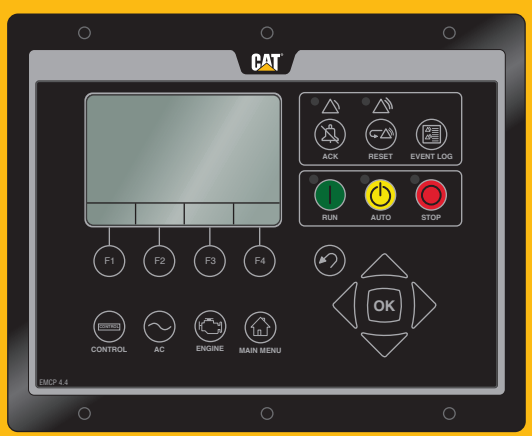
STANDARD FEATURES

Generator Monitoring	• Voltage (L-L, L-N) • Current (Phase) • Average Volt, Amp, Frequency • kW, kVAr, kVA (Average, Phase, %) • Power Factor (Average, Phase) • kW-hr, kVAr-hr (total) • Excitation voltage and current (with CDVR) • Generator stator and bearing temp (with optional module)
Generator Protection	• Generator phase sequence • Over/Under voltage (27/59) • Over/Under frequency (81 O/U) • Reverse Power (kW) (32) • Reverse Reactive Power (kVAr) (32RV) • Overcurrent (50/51) • Current Balance (46)
Engine Monitoring	• Coolant temperature • Oil pressure • Engine speed (RPM) • Battery voltage • Run hours • Crank attempt and successful start counter • Enhanced engine monitoring (with electronic engines)
Engine Protection	• Control switch not in auto (alarm) • High coolant temp (alarm and shutdown) • Low coolant temp (alarm) • Low coolant level (alarm) • High engine oil temp (alarm and shutdown) • Low, high, and weak battery voltage • Overspeed • Overcrank
Control	• Run / Auto / Stop control • Speed and voltage adjust • Local and remote emergency stop • Remote start/stop • Cycle crank
Inputs & Outputs	• Two dedicated digital inputs • Twelve programmable digital inputs • Sixteen programmable digital outputs
Communications	• Primary and accessory CAN data links • RS-485 annunciator data link • Modbus TCP (10BT Ethernet) • Modbus RTU (RS-485 Half duplex)
Language Support	Arabic, Bulgarian, Chinese, Czech, Danish, Dutch, English, Estonian, Finnish, French, German, Greek, Hungarian, Icelandic, Italian, Latvian, Lithuanian, Japanese, Norwegian, Polish, Portuguese, Romanian, Russian, Slovak, Slovene, Spanish, Swedish, Turkish
Environmental	• Control module operating temperature: -40°C to 70°C • Display operating temperature: -20°C to 70°C • Humidity: 100% condensing 30°C to 60°C • Storage temperature: -40°C to 85°C • Vibration: Random profile, 24-1000 Hz, 6.0G rms

EMCP 4.3/4.4

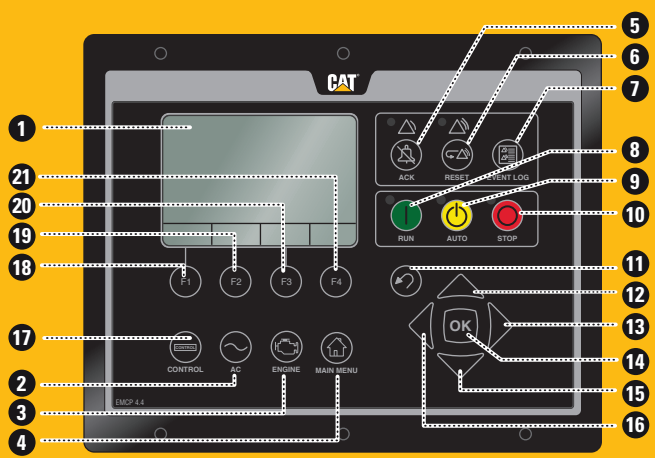
Quick Start Guide

5



Return to RUN / STOP / AUTO as required

OVERVIEW



1. Display Screen
2. AC Overview Key
3. Engine Overview Key
4. Main Menu/Home Key
5. Alarm Acknowledge/Silence Key with Yellow Warning Lamp
6. Event Reset Key with Red Shutdown Lamp
7. Event Log Key
8. Run Key
9. Auto Key
10. Stop Key
11. Escape Key
12. Scroll Up Key
13. Scroll Right Key
14. OK Key
15. Scroll Down Key
16. Scroll Left Key
17. Control Key
18. F1 Soft Key
19. F2 Soft Key
20. F3 Soft Key
21. F4 Soft Key

To START

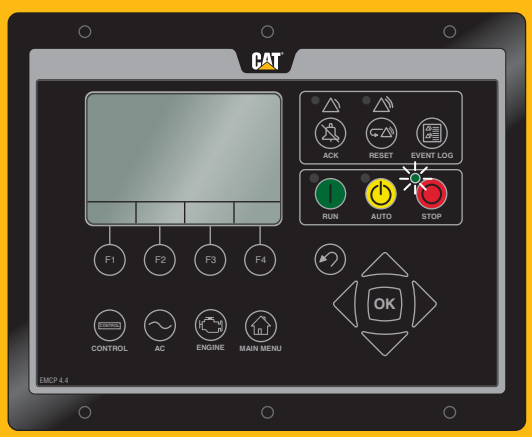
Press RUN Key

CATERPILLAR®
TODAY'S WORK. TOMORROW'S WORLD.™

LEXE0187-00

CATERPILLAR®

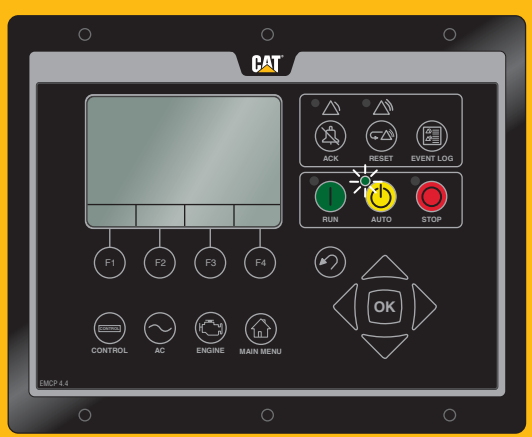
To STOP



Press STOP Key

STOP

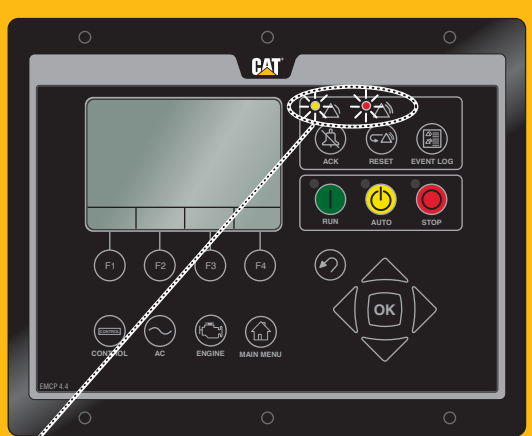
AUTO Mode



Press AUTO Key

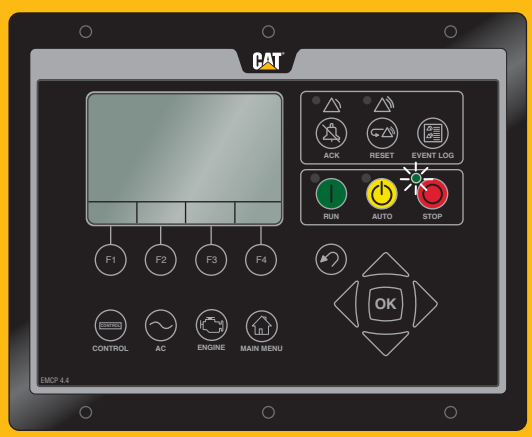
AUTO

1 Fault / Alarm Reset Process



If either of these indication lamps are flashing or solid there is a warning or shutdown

2 Fault / Alarm Reset



Press STOP Key

STOP

3 Fault / Alarm Reset

Press RESET key

RESET

4 Fault / Alarm Reset All. The display will show:

OK

Press OK Key to clear all Warnings and / or Shutdowns (or)

Press ESCAPE Key to cancel

EMCP 4 RS-485 ANNUNCIATOR

The EMCP 4 RS-485 annunciator serves to display generator set system alarm conditions and status indications. The annunciator has been designed for use on the EMCP 4 RS-485 annunciator data link for remote applications, providing customers with enhanced site flexibility.

The EMCP 4 annunciator is configurable to the standards of NFPA 99/110 for emergency standby generator systems.

One local annunciator will be provided on the generator set

FEATURES

- The EMCP 4 annunciator provides sixteen (16) individual points of annunciation, with two (2) LED's included for each point.
- An additional pair of LED's provides status indication of the RS-485 communication network.
- Includes alarm horn with lamp test and alarm acknowledge pushbuttons.
- Configurable to NFPA 99/110 requirements for local and remote annunciation on emergency standby generator systems.
- Provides custom label kit including software for customer's specific alarms and arrangement
- Designed and tested to meet stringent impulse shock and operating vibration requirements
- Uses high quality shielded twisted-triad cable for robust remote communications
- Graphic symbols are provided next to each pair to indicate various alarms and events
- The annunciator can be mounted remotely up to 1200 m (4,000 ft).
- Provides superior visibility of the LED's in direct sunlight

SPECIFICATIONS

Technical Data

Electrical

Battery Voltage Functional Range: 9 to 32 VDC

Power Consumption

Maximum: ≈ 12 watt at 24 VDC

Standby: ≈ 5 watt at 24 VDC

Control Power: 12-24 VDC

Communication: RS-485

Single, 8-pin Connector

Alarm

Sound Level 80 db

PHYSICAL

Weight	2.5 lb or ≈ 1.13 kg

ENVIRONMENTAL

Operating Temperature	–40° C to 70° C –40° F to 158° F
Storage Temperature	–50° C to 70° C –58° F to 158° F
Relative Humidity	90%

CERTIFICATIONS

UL Recognized

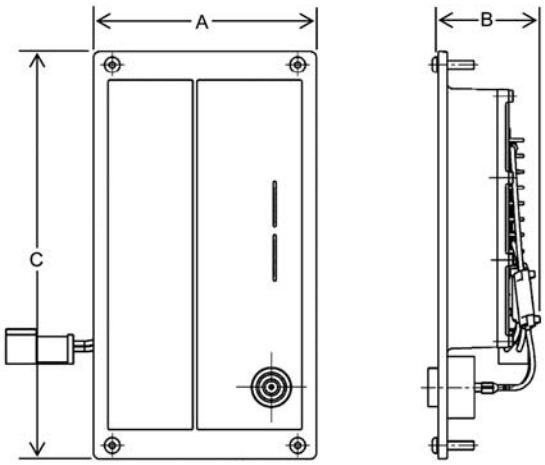
LED COLOR SCHEME

Each pair of LED's on the annunciator consists of two of three colors: green, yellow and red, which allows for custom configuration of status, warning and shutdown conditions.
The available colors and combinations are:

Row	LED 1	LED 2
1	Red	Yellow
2	Red	Yellow
3	Red	Yellow
4	Red	Yellow
5	Red	Yellow
6	Red	Green
7	Red	Yellow
8	Red	Yellow
9	Red	Yellow
10	Red	Yellow
11	Red	Yellow
12	Red	Yellow
13	Green	Yellow
14	Green	Yellow
15	Red	Green
16	Red	Yellow

STANDARD LED CONFIGURATION

- Emergency stop shutdown
- Overcrank shutdown
- Low coolant temperature warning
- High coolant temperature warning/shutdown
- Low oil pressure warning/shutdown
- Overspeed warning/shutdown
- Low coolant level warning/shutdown
- Low fuel level warning/shutdown
- EPS supplying load status
- Control switch not in auto warning
- High battery voltage warning/shutdown
- Low battery voltage warning/shutdown
- BATT charger AC failure warning/shutdown
- Low cranking voltage
- Engine running
- Tier 4 SCR



Annunciator Dimensions		
A	158 mm	6.22 in
B	60 mm	2.37 in
C	288 mm	11.34 in

RTD MODULE

GENERAL DESCRIPTION

The Cat® RTD module serves to provide expandable engine and generator temperature monitoring capability for your package generator set.

The Cat Service Tool ET is used to configure the RTD module, while all monitored temperatures and alarm conditions are viewable on the EMCP 4 control panel. Configuration capability includes the desired operating temperature setpoints for high and low temperature settings.

The RTD Module can be Package or Remote mounted (up to 800 feet) and features rugged packaging and watertight Deutsch IPD connectors.

These features all add to the sense of value and dependability that comes with your purchase of Caterpillar products.

OPERATOR INTERFACE

- All RTD monitored parameters are available for viewing with EMCP 4.2 or higher Controller.

FEATURES/BENEFITS

- Customer programmable protective functions, available as alarm and shutdown, protects against high and low temperature conditions.
- CAN communication network interface with EMCP 4.2 or higher eliminates the need for multiple switches, meters, transducers, relays, and sending units, which translates to less wiring and fewer opportunities for mechanical failures.
- Remote customer communications are supported by MODBUS protocol (via EMCP 4.2 or higher) which easily interfaces with existing plant systems and equipment.
- Set points are stored in nonvolatile memory, preventing loss during a power outage.

COMMUNICATION

- Single, standard 40-pin connector.
- Accessory Data Link.
- MODBUS (Customer Communication) – via EMCP 4.2 or higher controller.

GENERAL SPECIFICATIONS

TECHNICAL DATA

- Reads up to eight (8) Platinum RTD inputs having two, three, or four-wire inputs.
- Burden is limited to less than 200 mA. Inrush does not exceed 800 mA.
- Isolation voltage is 1500 VAC (RMS) or 2550V for 1 sec.
- System throughput has all 8 channels scanned in 2 seconds (250 mSec./channel).
- Optical Isolation is 500 VDC from input to ground. Three way isolation is provided for the CAN line, inputs and power supply.

GENERAL SPECIFICATIONS (CONT'D)

ENVIRONMENTAL

- Operating temperature range of –40° C to 85° C (–40° F to 185° F) – for ambient temperatures exceeding 85° C, the temperature scanner may deviate in accuracy an additional ±1° C.
- Storable temperature range is –50° C to +120° C (–238° F to +248° F).
- Protected against 95% humidity non-condensing, 30° C to 60° C (86° F to 140° F).
- Overall drift with temperature is 15mOhm/° C (maximum).

MOUNTING

- Encapsulated in a rugged aluminum housing with watertight connectors (IP65 rating).
- Suitable for moist, high shock and vibration environments.
- Designed to meet relevant European standards for EMI/RFI/Immunity without the use of external filtering.

NETWORK COMMUNICATIONS INTERFACE

- Retains current date and time relative to synchronization every 24 hours (or upon boot up) with equipment system time via an explicit command from the EMCP 4.2 or higher (or Cat ET) – synchronization time is accurate to within 1 sec.
- Monitored parameters and setpoints are customizable to customer specification.
- Module is fully functional during configuration and communications.
- Module operates normally with loss of communication link, retaining configured values and error codes in non-volatile memory.
- Parameter values and diagnostic error codes are retained when the modules are de-energized.

AVAILABLE TEMPERATURE INPUTS

The RTD Module is configured to accept inputs for the following temperatures, to be displayed at the EMCP 4.2 or higher controller in either Fahrenheit or Celsius:

- Air Inlet Temperature
- Generator Bearing Temperatures (1-2)
- Generator Winding Temperature (1-3)
- Ambient Air Temperature
- Auxiliary Temperature (1-2)
- Battery Temperature (1-2)
- Engine Auxiliary Coolant Temperature
- Engine Coolant Temperature
- Engine Intercooler Temperature
- Engine Oil Temperature (1-2)
- Exhaust Gas Port Temperature (1-20)
- Exhaust Gas Temperature
- Left Manifold Exhaust Gas Temperature
- Right Manifold Exhaust Gas Temperature
- Fuel Temperature
- Intake Manifold Temperature (1-6)
- Engine Bearing Temperature (1-11)
- Turbo Oil Temperature
- Turbocharger Compressor Inlet Temperature (1-4)
- Turbocharger Turbine Inlet Temperature (1-4)
- Turbocharger Turbine Outlet Temperature (1-4)

RTD MODULE DIAGNOSTICS

The RTD Module is configured to display the following diagnostics for each of the listed Inputs, to be displayed at the EMCP 4.2 or higher controller:

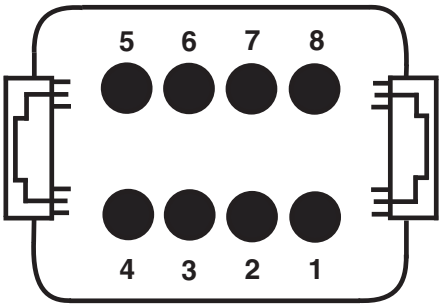
- RTD Input Sensor Open Circuit
- RTD Input Sensor Short Circuit
- RTD Input High Temperature Warning
- RTD Input High Temperature Shutdown
- RTD Input Low Temperature Warning

RTD MODULE LOG ENTRIES

The RTD Module is capable of storing up to twenty diagnostic log entries, viewable from the EMCP 4.2 or higher controller. Each log entry includes the following information:

- Time of Last Occurrence
- Date of Last Occurrence
- Time of First Occurrence
- Date of First Occurrence
- Engine Run Hours – First Occurrence
- Engine Run Hours – Last Occurrence
- Number of Occurrences

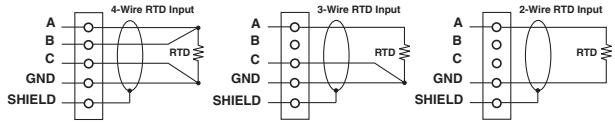
TYPICAL CONNECTIONS — POWER AND CAN BUS



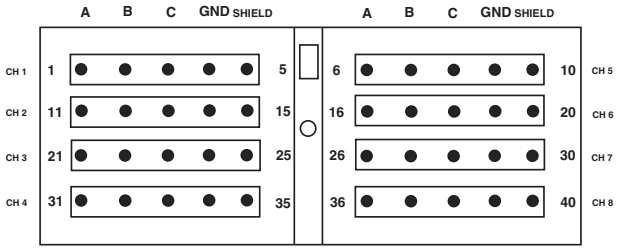
FRONT VIEW
MODULE MOUNTED CONNECTOR
DEUTSCH P/N: DT13-08PA

1 = PWR+
2 = CAN-H
3 = CAN-L
4 = PWR-
5 = SHIELD
6,7,8 = NOT USED

TYPICAL CONNECTIONS — RTD MODULE



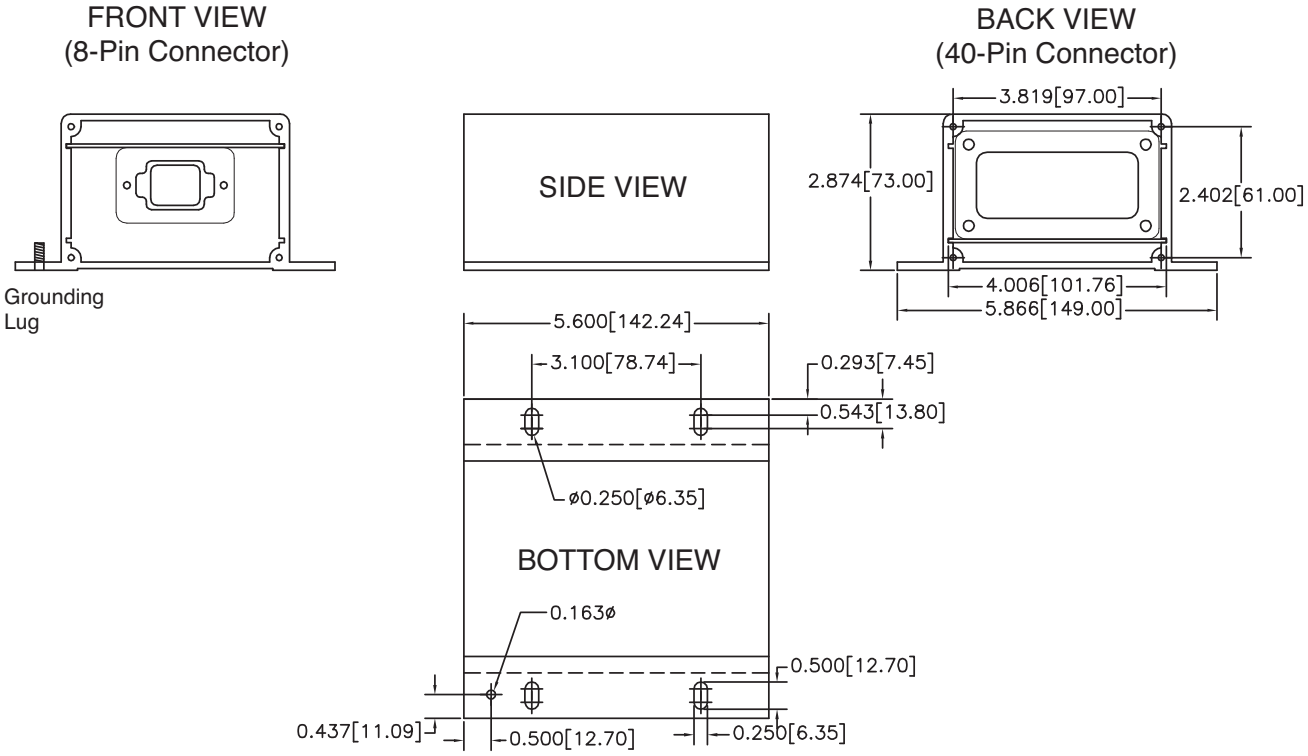
RTD MODULE - PIN OUT



FRONT VIEW OF
MODULE MOUNTED CONNECTOR

Nov. 3/03 AJW

DIMENSIONS



Connectors excluded from overall dimensions.

Dimensions: inches [mm]

CATERPILLAR®

DISCRETE INPUT/ OUTPUT (I/O) MODULE

GENERAL DESCRIPTION

The Caterpillar Discrete Input/Output (I/O) module serves to provide expandable Input and Output capability for your package generator set. The Discrete I/O Module is capable of reading 12 discrete inputs and setting eight (8) relay outputs.

The Caterpillar Service Tool ET is used to configure the Discrete I/O module, while all monitored Input and Output status conditions are viewable on the EMCP 3 control panel.

The Discrete I/O Module can be Package or Remote mounted (up to 800 feet) and features rugged packaging and watertight Deutsch IPD connectors.

These features all add to the sense of value and dependability that comes with your purchase of Caterpillar products.

OPERATOR INTERFACE

- All Discrete I/O status conditions are available for viewing with the EMCP 3.2 & 3.3 Controllers.

FEATURES/BENEFITS

- Capable of reading twelve (12) discrete inputs and setting eight (8) relay outputs
- J1939 communication network eliminates the need for multiple relays, which translates to less wiring and fewer opportunities for mechanical failures.
- Remote customer communications are supported by MODBUS protocol using RS-485 (via EMCP 3.2 & 3.3), which easily interfaces with existing plant systems and equipment.
- Set points are stored in nonvolatile memory, preventing loss during a power outage.

COMMUNICATION

- Single, standard 40-pin connector
- J1939 #2 (Accessory Data Link)
- MODBUS RS-485 (Customer Communication) via the EMCP 3.2 & 3.3 controllers

GENERAL SPECIFICATIONS

- Reads twelve (12) discrete inputs and sets eight (8) Form C relay outputs rated for rated resistive loads of:
  - 2A @ 30 VDC for Normally Closed (NC) relays
  - 2A @ 125 VAC for Normally Closed (NC) relays
  - 2A @ 277 VAC for Normally Closed (NC) relays
  - 2A @ 30 VDC for Normally Open (NO) relays
  - 2A @ 125 VAC for Normally Open (NO) relays
  - 2A @ 277 VAC for Normally Open (NO) relays.
- For inductive loads, the ratings are:
  - 0.5A @ 250 VAC cos ∅ = 0.4
  - 1A @ 250 VAC cos ∅ = 0.8
  - 0.8A @ 250 VAC cos ∅ = 0.9

GENERAL SPECIFICATIONS (CONT'D)

- Encapsulated in a rugged aluminum housing with watertight connectors (IP67 rating)
- Suitable for moist, high shock and vibration environments
- Modules are designed for package mounting on power generator sets or remotely, up to 800 ft.
- Configuration is accomplished with Caterpillar ET Service Tool.
- Multiple Discrete I/O modules can be used on a J1939 communications network.
- Protected against 95% humidity non-condensing, 30° C to 60° C.
- Operating temperature range of –40° C to 85° C (–40° F to 185° F) – for ambient temperatures exceeding 85° C, the temperature scanner may deviate in accuracy an additional ±1° C.
- Storable temperature range is –50° C to +120° C.
- Designed to meet relevant European standards for EMI/RFI/Immunity without the use of external filtering.
- Maximum level of current draw of 400 mA + 50 mA per energized relay @ 12 VDC
- Isolation voltage: 4000 VAC (RMS), 50/60 Hz for 1 min. between coil and contacts, 750 VAC, 50/60 Hz for 1 min. between contacts of the same polarity
- System throughput: All channels are scanned in 100 mSec.
- Input level characteristics:
  Low-Level input voltage: 0 to 0.8V
  High-Level input voltage: 3.75 to 24V
  Inputs have internal pull-up resistors.
- Inputs that generate a warning message auto-reset whenever the input returns to non-active state.
- Inputs that generate a shutdown message continue to broadcast that message until the input returns to non-active state and a reset message is received from the EMCP 3.2 or 3.3.
- Each output is configured to activate based upon the message that is received on the J1939 Data Link and can be configured to activate on Alarm, Shutdown or Diagnostic condition – or a combination of all three.
- Optical isolation is provided for the CAN line
- Retains current date and time relative to synchronization every 24 hours (or upon boot up) with equipment system time via an explicit command from the EMCP 3.2 & 3.3 – synchronization time is accurate to within 1 sec.
- Converts between physical I/O and CAN (SAE J1939) data link commands.
- Monitored parameters and diagnostics as well as setpoints are customizable to customer specification
- Module operates normally with loss of communication link, retaining configured values in non-volatile memory.
- Remains energized during engine cranking.
- For J1939 compliance, all modules comply with the applicable portions of the following:
  SAE J1939-21, July 1998, Data Link Layer
  SAE J1939-71, January 2002, Application Layer.

Discrete I/O Module Configuration Parameters:

The Discrete I/O Module is configurable to display the following parameters for each of the available Inputs:

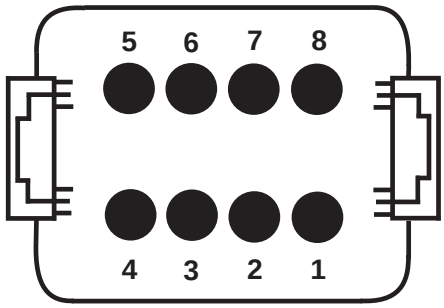
Active State (Active High or Active Low)
Input Time Delay (0-120 seconds).

Available Inputs/Outputs:

The Discrete I/O Module is configured to accept inputs for the following conditions, with the listed condition displayed at the EMCP 3 controller:

Description	Input	Output
Fuel Level Secondary Tank	X	X
Starting Air Pressure		X
Fuel Pressure		X
Fuel Filter Differential Pressure		X
Fuel Level (Primary Tank)	X	X
Engine Oil Level		X
Oil Filter Differential Pressure		X
Engine Oil Pressure		X
Crankcase Pressure		X
Air Filter Differential Pressure		X
Engine Coolant Temperature		X
Engine Coolant Level	X	X
Extinguisher System Pressure	X	X
Battery Voltage		X
Ambient Air Temperature		X
Inlet Air Temperature		X
Exhaust Temperature		X
Fuel Temperature		X
Engine Oil Temperature		X
Engine Overspeed		X
Emergency Stop Shutdown		X
Gen. Bearing Temperature #1		X
Gen. Winding Temperature (1-3)		X
Ruptured Fuel Basin-Primary Tank	X	X
Engine Failure to Start Shutdown		X
Generator Frequency		X
Generator Voltage		X
Generator Reactive Power (VAR)		X
Generator AC Current		X
Generator Reverse Power (kW)		X
Voltage Regulator Failure		X
Service Interval Warning		X
Air Shutoff Damper Close	X	X
Gen. Supplying Load	X	X
Battery Charger Failure	X	X
Gen. Breaker Closed	X	X
Utility Breaker Closed	X	X
Engine in Cooldown		X
Generator Control Not in Auto		X
Unexpected Engine Shutdown		X
User Defined Input (1-12)	X	

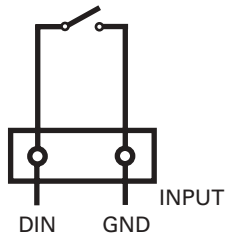
TYPICAL CONNECTIONS – POWER AND CAN BUS:

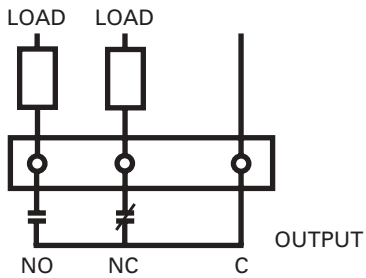


FRONT VIEW
MODULE MOUNTED CONNECTOR
DEUTSCH P/N: DT13-08PA

1 = PWR+
2 = CAN-H
3 = CAN-L
4 = PWR-
5 = SHIELD
6,7,8 = NOT USED

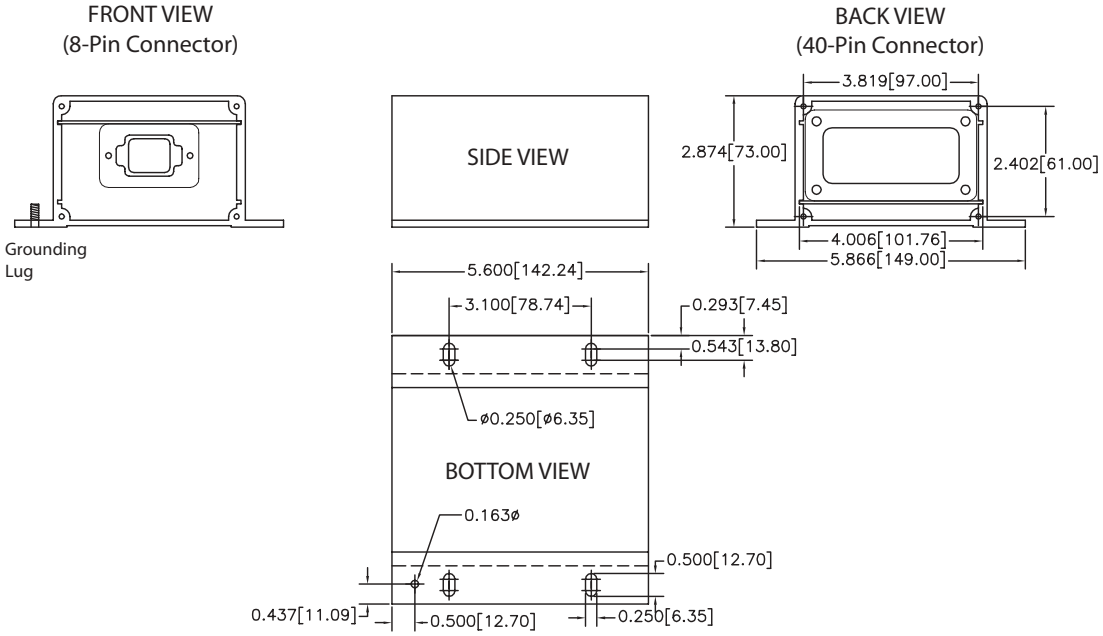
TYPICAL CONNECTIONS – DISCRETE I/O MODULE:





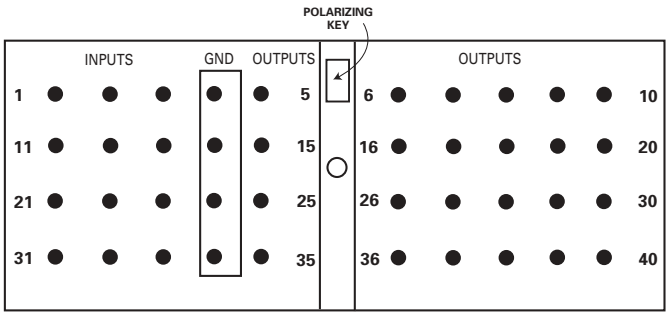
CATERPILLAR®

DIMENSIONS



Connectors excluded from overall dimensions. Dimensions: inches [mm]

**FRONT VIEW OF
MODULE MOUNTED CONNECTOR
DEUTSCH P/N: DRC13-40PB**



NO - Normally Open
NC - Normally Closed
C - Common

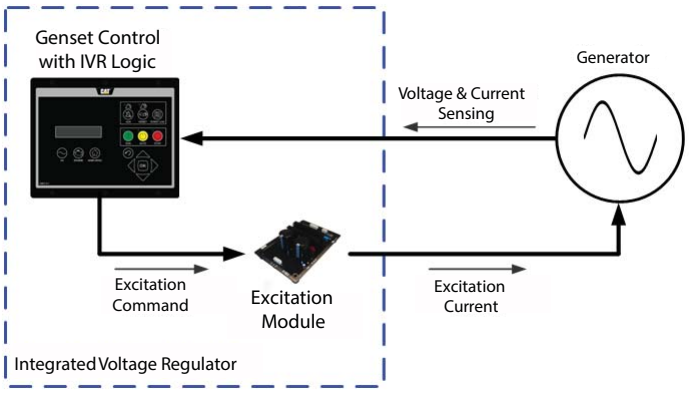
INPUTS	Pin
DIN1	1
DIN2	11
DIN3	21
DIN4	31
DIN5	2
DIN6	12
DIN7	22
DIN8	32
DIN9	3
DIN10	13
DIN11	23
DIN12	33
GND	4
GND	14
GND	24
GND	34

OUTPUTS	Pin
NC_1	5
C_1	6
NO_1	7
NC_2	15
C_2	16
NO_2	17
NC_3	25
C_3	26
NO_3	27
NC_4	35
C_4	36
NO_4	37
NC_5	8
C_5	9
NO_5	10
NC_6	18
C_6	19
NO_6	20
NC_7	28
C_7	29
NO_7	30
NC_8	38
C_8	39
NO_8	40

LEHE4754-01 (04-05)

Materials and specifications are subject to change without notice.
The International System of Units (SI) is used in this publication.

INTEGRATED VOLTAGE REGULATOR



INTEGRATED VOLTAGE REGULATOR

The Integrated Voltage Regulator (IVR) is designed to provide robust, precise closed-loop control of the generator voltage, optimized transient performance and industry leading feature specification.

Caterpillar is leading the power generation marketplace with power solutions engineered to deliver unmatched flexibility, expandability, reliability and cost-effectiveness.

FEATURES

When used with an Excitation Module, EMCP 4.3/4.4 and IVR-compatible EMCP 4.1/4.2 controllers offer:

- Automatic Voltage Regulation (AVR)
- Programmable stability settings
- Soft start control with an adjustable time setting in AVR control mode
- Dual Slope, Configurable Under Frequency (Volts/Hz) regulation
- Three-phase or single-phase generator voltage (RMS) sensing/regulation in AVR mode
- Setpoint adjustment from the EMCP display or Cat® ET Service Tool
- IVR Operating Status and Voltage Bias Overview screens to provide an enhanced level of user interface
- Integrated Voltage Regulator event monitoring

EMCP 4.3/4.4 and IVR-compatible EMCP 4.2 controllers also offer:

- Power Factor Regulation (PF)
- Reactive Droop compensation
- Line drop compensation

WORLDWIDE PRODUCT SUPPORT

- Worldwide parts availability through the Cat dealer network
- Over 1,800 dealer branch stores operating in 200 countries
- The best product support record in the industry
- Cat dealers provide extensive post sale support including maintenance and repair agreements

COMPLETE SYSTEM INTEGRATION

Fully designed and factory tested to work seamlessly with Cat generators using Self Excitation (SE), Internal Excitation (IE) or Permanent Magnet (PMG) excitation systems and EMCP controls.

INTEGRATED VOLTAGE REGULATOR

INTEGRATED VOLTAGE REGULATOR FEATURE SPECIFICATION

	~~EMCP 4.1~~	~~EMCP 4.2~~	EMCP 4.3	~~EMCP 4.4~~
				
SPECIFICATIONS				
No Load to Full Load Regulation	±0.5%	±0.25%	±0.25%	±0.25%
Configurable Volts / Hz Characteristic	•	•	•	•
Configurable Knee Frequency	•	•	•	•
Regulator ResponseTime	10 ms	10 ms	5 ms	5 ms
Single andThree Phase Sensing	•	•	•	•
Voltage Adjustment Range (Configurable up to)	± 30%	± 30%	± 30%	± 30%
CONTROL				
Dual Slope Configurable Volts / Hz Characteristic	•	•	•	•
Excitation Enable / Disable Selection	•	•	•	•
Line Loss (I^2R) Compensation	–	•	•	•
Reactive Droop Compensation	–	•	•	•
Power Factor Control Mode	–	•	•	•
PROTECTION / ALARMS				
Generator Overvoltage	•	•	•	•
Generator Undervoltage	•	•	•	•
Over Excitation	•	•	•	•
Loss of Sensing	•	•	•	•
Generator Reverse VARs	–	•	•	•
Event Log	•	•	•	•
METERING				
EMCP AC Metering	•	•	•	•
EMCP Power Metering	–	•	•	•
Excitation Command Percentage	•	•	•	•
Operating Mode Status Indication	•	•	•	•

INTEGRATED VOLTAGE REGULATOR

INTEGRATED VOLTAGE REGULATOR FEATURE SPECIFICATION (continued)

	~~EMCP 4.1~~	~~EMCP 4.2~~	EMCP 4.3	~~EMCP 4.4~~
				
VOLTAGE ADJUSTMENT				
EMCP 4 Display Voltage Bias	•	•	•	•
Digital Input (Raise / Lower) Voltage Bias[1]	•	•	•	•
Potentiometer Voltage Bias[1]	•	•	•	•
Analog Voltage Bias – Voltage Range[1]	0V to 5V	0V to 5V	-10V to +10V	-10V to +10V
Analog Voltage Bias – Current Range[1]	–	–	0mA to 20mA	0mA to 20mA
Analog Voltage Bias – PWM Range[1]	–	–	0% to 100%	0% to 100%
SCADA (Modbus) Voltage Bias	–	•	•	•

[1]Requires an available input on the EMCP 4.

INTEGRATED VOLTAGE REGULATOR

EXCITATION MODULE SPECIFICATION

The Integrated Voltage Regulator consists of an EMCP 4 interfacing with an Excitation Module. There are a range of Excitation Modules available to match Cat generator sets.

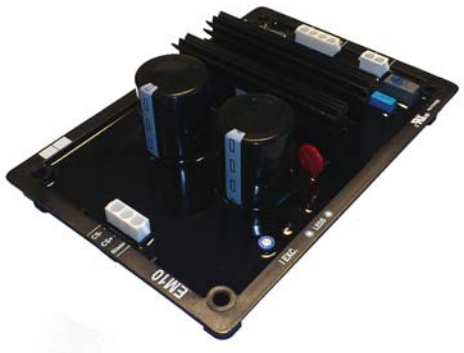


Figure 1:
EM10 Excitation Module

Figure 2:
EM15 Excitation Module

EXCITATION MODULE TECHNICAL SPECIFICATION

	EM10	~~EM15~~
Compatible Generator Excitation Types	~~Self Excitation (SE)~~ ~~Internal Excitation (IE)~~ Permanent Magnet (PMG)	
Nominal Field Current Output	6 Amps	7 Amps
Maximum (forcing) Field Current Output	10 Amps	15 Amps
Maximum AC Voltage Input	180 Vrms	240 Vrms

For more information on the Excitation Module refer to the component spec sheet.

INTEGRATED VOLTAGE REGULATOR

EMCP 4 DISPLAY

~~EXAMPLE SCREENS – EMCP 4.1/4.2~~

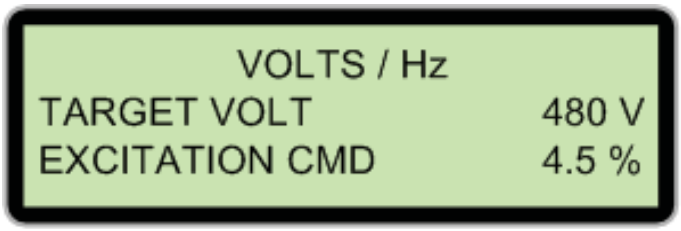


Figure 3: IVR Overview Screen

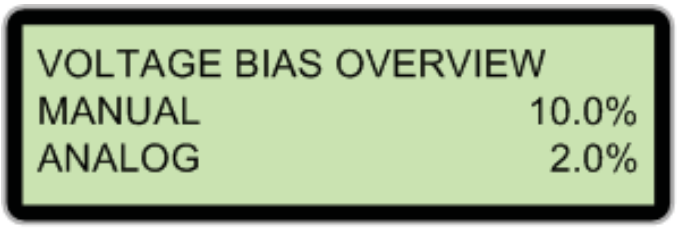


Figure 4: Voltage Bias Overview Screens

EXAMPLE SCREENS – EMCP 4.3/4.4

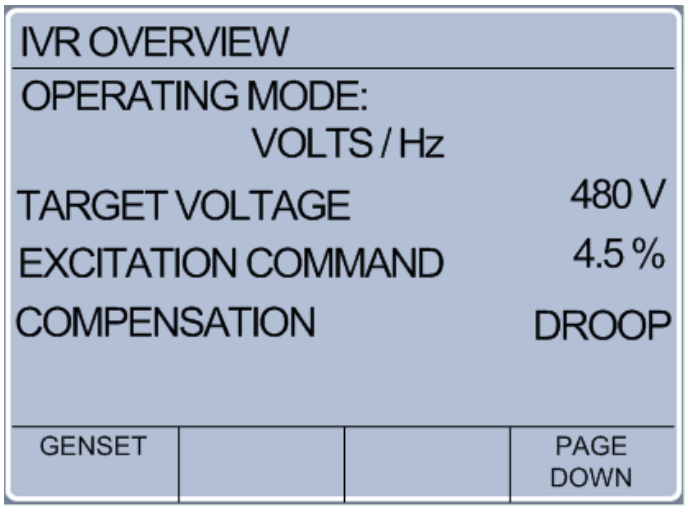


Figure 5: IVR Overview Screen

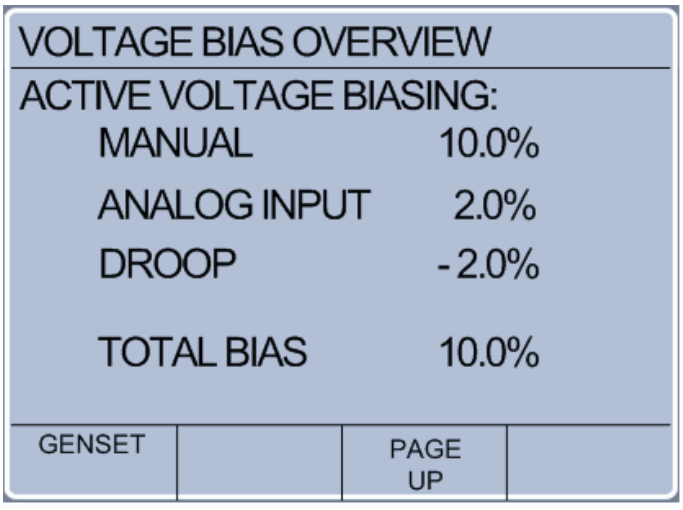


Figure 6: Voltage Bias Overview Screen

LEHE0448-00 (08/13)

ENGINE CONTROLLER

ADEM™ A4 Engine Controller

The ADEM™ A4 is the main Electronic Control Module (ECM) used on select diesel engines. The ADEM A4 provides a higher degree of control over a large number of combustion variables. The ADEM A4 is designed to control/interface Electronic Unit Injector (EUI) equipped engines. The ADEM A4 engine system is composed of the ADEM A4 ECM, control software, sensors, actuators, fuel injectors, and interface to the generator system. The prime benefit of an ADEM A4 engine system is to better control and maintain the particulate emissions, both steady state and transient, while improving engine performance

FEATURES

RELIABLE, DURABLE

All ADEM A4 controllers are designed to survive the harshest environments.

- Environmentally sealed, die-cast aluminum housing isolates and protects electronic components from moisture and dirt contamination.
- Rigorous vibration testing ensures product reliability and durability.
- Accuracy maintained from –40° C to 85° C
- Electrical noise immunity to 100 volts/meter
- Internal circuits are designed to withstand shorts to +battery and –battery.

SIMPLE SERVICING

Each ADEM A4 system works in combination with the Cat® ET service tool software to keep the engine operating at peak performance.

- Displays measured parameters
- Retrieves active and logged event code documenting abnormal system operation
- Performs calibrations and diagnostic tests
- Supports flash programming of new software into the ADEM A4 ECM

SELF DIAGNOSTICS

Each ADEM A4 ECM has a full compliment of diagnostics. The ECM can detect faults in the electrical system and report those faults to the service technician for quick repair.

- Self-diagnostic capability pinpoints operational problems in need of attention.

ADVANCED FEATURES

- Enhanced performance from fuel injection timing and limiting
- Adjustable monitoring of vital engine parameters
- Programmable speed acceleration ramp rate
- Data link interfaces

ENGINE CONTROLLER

DESCRIPTION

The ECM is housed in an environmentally sealed casting. All wiring connections to the ECM are made using two sealed connectors: a single seventy-pin connector and a single one hundred twenty-pin connector.

ENGINE SPEED GOVERNING

Desired engine speed is calculated by the ECM and held within ±0.2 Hz for isochronous and droop mode. The ECM accounts for droop that is requested. The proper amount of fuel is sent to the injectors due to these calculations. The ECM also employs cooldown/shutdown strategies, acceleration delays on startup, acceleration ramp times and speed reference.

FUEL LIMITING

Warm and cold fuel-air ratio control limits are controlled by the ECM. Electronic monitoring system derates, torque limit, and cranking limit, programmable torque scaling, and cold cylinder cutout mode are standard features.

FUEL INJECTION TIMING

Master timing for injection is controlled by the ECM control. Temperature dependencies are accounted for in the fuel injection calculations.

ELECTRONIC MONITORING

Electronic monitoring of vital engine parameters can be programmed. Warning, derate, and shutdown event conditions may be customized by the user.

INFORMATION MANAGEMENT

The ECM stores information to assist with electronic troubleshooting. Active and logged diagnostic codes, active events, logged events, fuel consumption, engine hours, and instantaneous totals aid service technicians when diagnosing electronic faults and scheduling preventive maintenance.

CALIBRATIONS

Engine performance is optimized through injection timing. Auto/manual sensor calibrations are standard features.

ON-BOARD SYSTEM TESTS

System tests are available to assist in electronic troubleshooting. These tests include: injector activation, injector cutout, and override of control outputs.

DATA LINK INTERFACES

The ADEM A4 communicates with the EMCP via a dedicated communication network.

ELECTRONIC SENSING

The following sensing is available on the ADEM A4: oil pressure, fuel pressure, fuel temperature, atmospheric pressure, air inlet temperature, turbo outlet pressure, engine coolant temperature, engine speed, throttle, position, exhaust temperature, oil filter pressure differential, fuel filter pressure differential, air filter pressure differential and crankcase pressure.

ENGINE CONTROLLER

SPECIFICATIONS

Impervious to:
salt spray, fuel, oil and oil additives, coolant, spray cleaners, chlorinated solvents, hydrogen sulfide and methane gas, and dust

Input and output protection
all inputs and outputs are protected against short circuits to +battery and –battery

Input voltage range (24 VDC nominal)
18 to 32 VDC

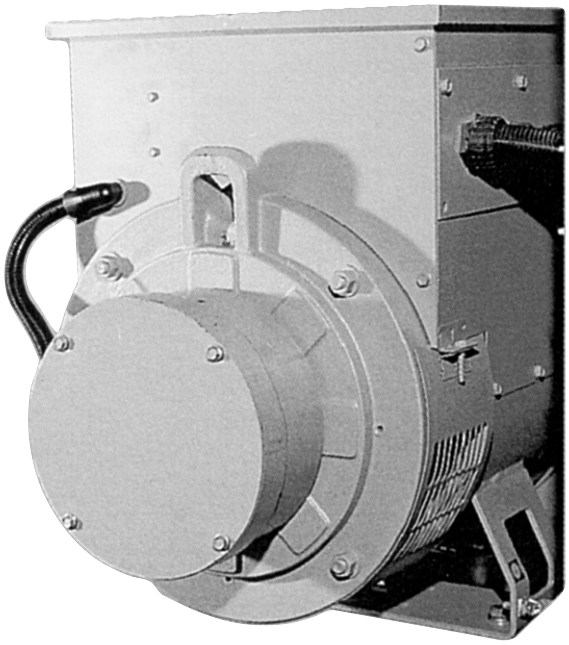
Mounting
engine mounted

Reverse polarity protected

Shock, withstands 20 g

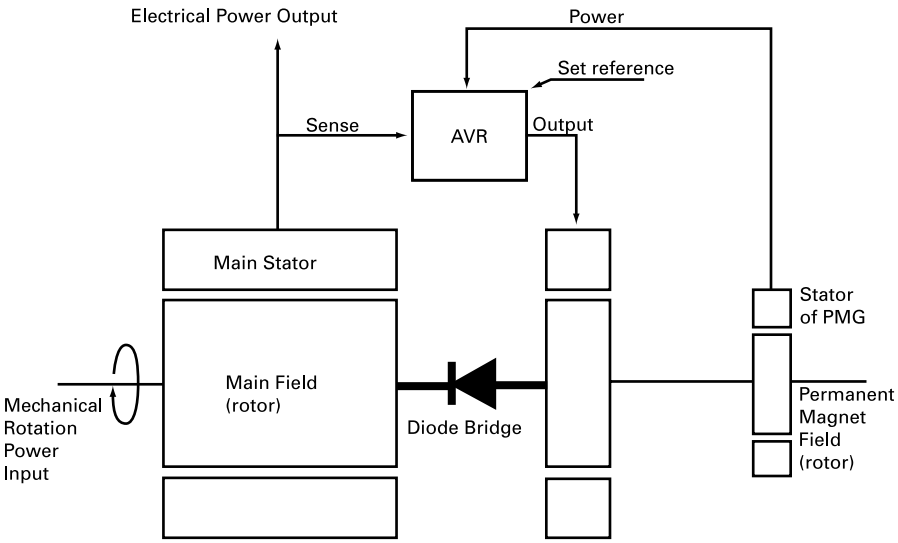
Temperature range
Operating: –40° C to 85° C (–40° F to 185° F)
Storage: –50° C to 120° C (–58° F to 248° F)

Vibration
withstands 8.0 g @ 24 to 2 kHz

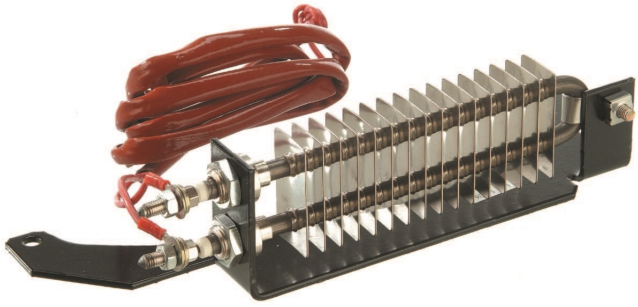


AVR12 – PERMANENT MAGNET GENERATOR

The permanent magnet generator (PMG) option upgrades the excitation system of the generator from the standard self-excited system to a separately-excited system. The PMG couples to the non-drive end of the generator and provides an independent source of excitation power that ensures initial voltage build-up. The PMG improves the voltage response of the generator during transient load application, such as motor starting, and provides a sustained short-circuit current for the operation of protective devices. Isolation of the excitation power ensures that regulation is not affected by non-linear distorting loads.



BLOCK DIAGRAM OF PMG



Picture shown may not reflect actual configuration

Generator Space Heater

for 1400 OD Frame

GENERAL DESCRIPTION

Humidity is a natural enemy of generators and all electrical equipment.

Space heaters are designed to protect generator windings from abnormally high humidity conditions when the generator is idle. The heater maintains the air around the windings at a suitable temperature to prevent winding corrosion due to condensation.

Generator space heaters use electrical resistance and are located within the generator stator housing.

Space heaters are particularly recommended for generator sets located in a low ambient and/or high humidity environment. As a further benefit, space heaters provide an excellent method of drying out a generator after long transit or storage.

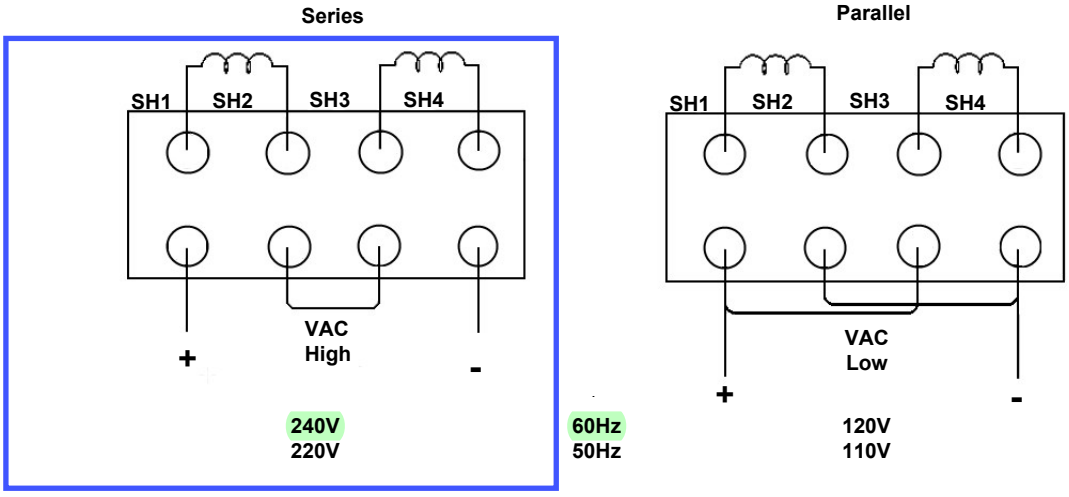
Because space heaters are required only during non-operative periods, they require availability of a power source separate from the generator set itself.

When the generator set is not running the heater automatically connects to the AC supply through a power relay mounted in the control panel. Upon receiving a start signal the AC supply is automatically disconnected by the power relay and automatically reconnected when the start signal is removed.

The 1400 frame space heater uses two heating elements.
Heater element electrical data: Voltage - 230V, Power - 500W.

All space heaters are designed for 110 - 240 volt operation (50 or 60 Hz) by making series or parallel connections at the terminal strip.

Space Heaters Connection Diagram



Cat® Batteries

Cat Batteries – Greater Starting Power – Lower Maintenance – Longer Life

Cat Premium High Output (PHO) batteries are used in all Caterpillar Machines and Engine Gen-Sets. They are designed to meet stringent Caterpillar design specifications, which provide industry leading cold cranking amp (CCA) capability and maximum vibration resistance.

Maintenance Free or low maintenance designs are available in wet and dry configurations.

General Service Line batteries are available in Maintenance Free or low maintenance designs and in wet or dry configurations. Wide selections of BCI group sizes are available for automotive, light truck, bus, industrial, agricultural, marine, recreational and valve regulated (VRLA-AGM & Gel) applications.

Caterpillar. The difference counts.™

Cat Dealers define world – class product support. We offer you the right parts and service solutions, when and where you need them.

The Cat Dealer network of highly trained experts keeps your entire fleet up and running to maximize your equipment investments.

CATERPILLAR®

World's Toughest Batteries

Premium High Output – Maximum Vibration Resistance

- Vibration Resistance...five times the Industry Standard
- Exclusive "flat top" BCI group 4D & 8D batteries are Maintenance Free and have the industries highest cold cranking amps (CCA)
- Popular BCI group 31 Maintenance Free batteries with industry leading cold cranking amps...up to 1000 (CCA), for electric power, machine or on-highway truck and bus applications. Deep cycle models available for truck, marine or recreational usage

Four 9X-9720 Dry 4D Size batteries will be provided with the generator set.

Specifications for Cat Premium High Output Batteries – Available Worldwide

BCI Group Size	Part No.	Cold Cranking Amps"	Reserve Capacity Minutes'	Volts	Amp Hr. Capacity @ 20 Hrs.	Construction	Add Water Maintenance Check Hours	BCI Overall Dimensions Length In (mm)	Width In (mm)	Height In (mm)	Nominal Weight Wet Lb (kg)	Dry Lb (kg)	Nominal Acid to Fill Qt (liter)
8D	153-5720	1500	465	12	210	C	MF	20.47 (520)	10.8 (275)	9.76 (248)	132 (60)	–	–
8D	101-4000	1400	400	12	190	LAC+	1000	20.7 (526.5)	10.96 (278)	9.76 (248)	132 (60)	86 (39)	18.0 (17.0)
4D	153-5710	1400	425	12	200	C	MF	20.47 (520)	8.58 (218)	9.76 (248)	119 (54)	–	–
4D	153-5700	1125	305	12	145	C	MF	20.47 (520)	8.58 (218)	9.76 (248)	101 (46)	–	–
4D	9X-9720	1000	275	12	140	LAC+	1000	20.75 (527)	8.58 (218)	9.76 (248)	101 (46)	59 (27)	15.9 (15.0)
31	175-4370	825	190	12	100	C/S**	MFA	12.9 (328.4)	6.74 (171.2)	9.29 (236)	60 (27)	–	–
31	175-4360	710	185	12	100	C/S***	MFA	12.9 (328.4)	6.74 (171.2)	9.29 (236)	60 (27)	–	–
31	**250-0480**	710	185	12	100	C/SDT***	MF	12.9 (328.4)	6.74 (171.2)	9.29 (236)	60 (27)	–	–
31	115-2422	1000	170	12	90	C SAE	MFA	12.9 (328.4)	6.74 (171.2)	9.46 (240.3)	60 (27)	–	–
31	115-2421	950	170	12	90	C SAE +	MFA	12.9 (328.4)	6.74 (171.2)	9.46 (240.3)	60 (27)	44 (20)	6.6 (6.2)
31	9X-3404	950	165	12	100	C SAE	MF	13 (330.2)	6.77 (172)	9.46 (240.3)	58 (26)	–	–
31	3T-5760	750	165	12	100	C SAE	MF	13 (330.2)	6.77 (172)	9.46 (240.3)	55 (25)	–	–
24	153-5656	650	110	12	52	SC	MF	10.98 (278.9)	6.85 (174)	9.0 (229.1)	39 (18)	–	–
65	230-6368	880	140	12	80	SC	MF	11.9 (303.4)	7.5 (190.8)	7.5 (191.4)	45.5 (21)	–	–
74	153-5660	650	110	12	52	SC*	MF	10.98 (278.9)	7.0 (178.2)	8.15 (206.9)	39 (18)	–	–
58	175-4280	500	70	12	35	SC	MF	9.96 (253.1)	7.2 (182.5)	6.9 (176)	31 (14)	–	–
2	153-5690	765	210	6	90	LAC+	1000	10.24 (260)	6.8 (173)	8.72 (221.6)	37 (17)	22 (10)	4.8 (4.5)

Construction Notes:
LAC = Low Maintenance, Hybrid Construction
C = Calcium Lead Alloy Grid Design
MF = Maintenance Free
MFA = Maintenance Free with Accessible Vent Caps
S = Stud Terminals
+ = Shipped Dry Only
* = Side Terminals
** = Starting and Deep Cycle Battery
*** = Deep Cycle and Starting Battery
" = For 30 seconds at 0° F (-18° C)
' = Minimum of 25 amp output at 80° F (27° C)
SAE = Uses SAE Posts
SDT = Dual, Top mounted Terminals, Stud and SAE Post, Marine Deep Cycle/Starting Battery
SC = Silver (Ag) Calcium Alloy Grids for resistance to high underhood temperatures

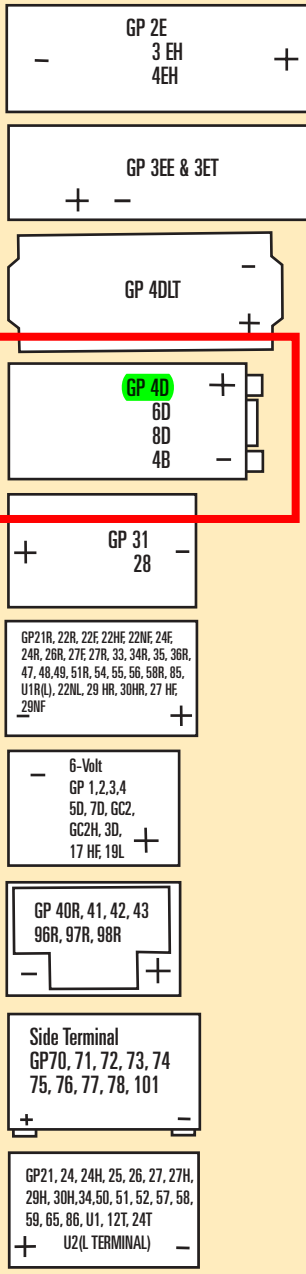
Rugged Design – Built Tough – Reliable Starting

- Positive and Negative plates are anchored to container bottom and locked at the top of cell element for maximum vibration resistance.
- Heavy-duty forged terminal post bushings provide maximum strength and resistance to acid seepage.
- Hefty full-frame grids, no sharp edges, optimum acid/paste combination provides better charge acceptance after deep discharge.
- Manifold vented cover with built-in Flame Arrestor…a safety feature that directs corrosive gases away from the battery and hold-downs.
- Thick, robust container resists rugged treatment typical of heavy-duty commercial use. Embossed part number & descriptors for easy serviceability.

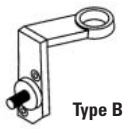
Four 9X-9720 Dry 4D Size batteries will be provided with the generator set.

Battery Information

BCI Terminal Locations



Transit Bus Terminal for 8D Part # 250-0473
One piece end terminal.
Right end of Battery.
1/2" - 13 Steel Positive Stud
3/8" - 16 Steel Negative Stud



Cat Premium High Output Batteries – Built Tough to Exceed Demanding Performance Test Requirements:

100 hour Vibration Testing – Five Times the Industry Standard

- Battery must be able to withstand vibration forces without suffering mechanical damage, loss of capacity, loss of electrolyte or without developing internal/external leaks
- Battery must pass a high rate discharge test after the vibration testing

Five 72-hour Deep Discharge/Recharge Test Cycles

- Battery must recover to 25 charging amps within 20 minutes and meet Industry Electrical Performance Standards

30 Day Complete Discharge Test

- Battery must recover to 25 charging amps within 60 minutes and meet Industry Electrical Performance Standards after recharging

SAE J2185 Life Cycle Test

- Battery subject to deeper discharge and charge cycles at extreme temperatures not normally encountered in starting a machine or vehicle

Cold Soak Test

- Battery cold soaked at sub-freezing temperatures and then tested by starting an equally cold engine

Battery Accessories

Group 31 – Charging Posts for Stud Terminals – Part # 4C-5637
Screw-in Charging Posts for Side Terminals – Part # 4C-5638
Wing Nut – Part # 2B-9498 for Part #'s 175-4390/175-4370/175-4360/8C-3628
Wing Nut – Part # 3B-0723 for Part #'s 8C-3638 and 8C-3639
Digital Battery Analyzer – Part # 177-2330
Battery Voltmeter – Part # 4C-6600
Battery Load Tester – Part # 4C-4911
Booster Cable 12' (3.66 m) – Part # 4C-4933
Booster Cable 20' (6.00 m) – Part # 4C-4937
Heavy Duty Commercial Fast Charger (110V) – Part # 4C-4921
Heavy Duty Commercial Fast Charger (220V) – Part # 4C-4910
Extra Vent Caps (6) for Dry Batteries – Part # 7N-0060

Note: Ratings and Part Numbers are subject to change without notice.

Recycle all scrap batteries.
We accept lead-acid batteries for recycling.

Cat Batteries

World Wide Application Flexibility

Marine Commercial Vessels
Maintenance Free 4D, 8D and Group 31 Batteries. General Service Line Line valve regulated (VRLA) Gel batteries. High Marine Cranking Amps (MCA) and Deep Cycling capabilities.

Automotive-Truck-Bus & RV
A wide selection of popular BCI group sizes. Maintenance Free, Severe Service and Deep Cycle models. Application Specific Group 31 Truck Batteries.

Commercial & Recreational
A wide selection of premium batteries in most BCI group sizes for light commercial, recreational, agricultural and industrial applications.

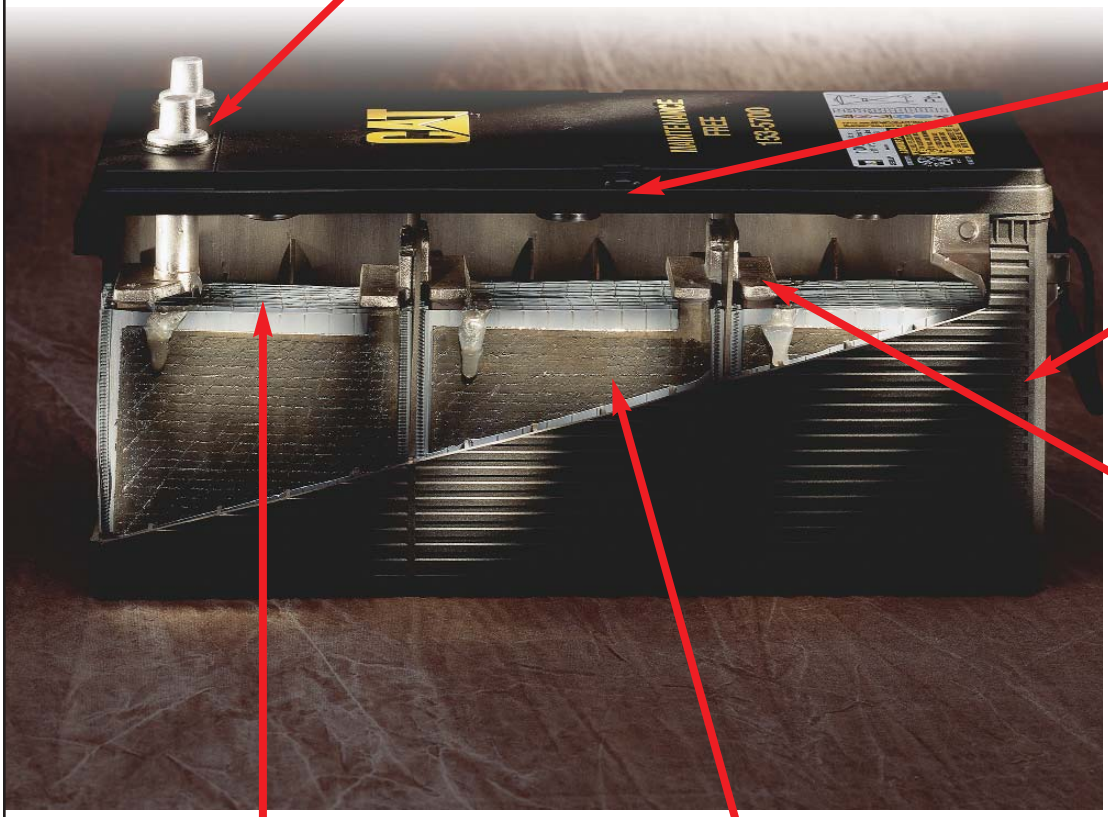
Marine Pleasure Craft
Premium High Output BCI Group 31, Dual Terminal Deep Cycle Batteries. General Service Line BCI group 24M, 27M and 8V sizes.

Electric Power Generation
Premium High Output Maintenance Free and Accessible batteries in BCI group 4D, 8D, & 31 sizes. High Cold Cranking Amp (CCA) Capability. General Service Line valve regulated (VRLA)
AGM batteries for UPS or stationary power applications.

Construction & Mining
Premium High Output Maintenance Free batteries. BCI group 4D, 8D and 31 Sizes. Industry leading cold cranking amps (CCA) and maximum vibration resistance.

Cat Batteries

Heavy-duty Forged Terminal Post Bushings



Built-in Flame Arrestor

Robust Reinforced Case

Vibration Resistant Plates & Elements

Heavy-duty Grids

Rugged Separators

Robust Components = Long Life + Reliable Starts

- Heavy-duty forged terminal post bushings provide maximum strength and resistance to acid seepage that causes corrosion and black posts. Thicker internal terminal posts provide lower electrical resistance and higher cold cranking amp output.
- Rugged microporous polyethylene envelope separators protect against “shorts” and vibration damage. Deep Cycle batteries utilize double insulated Glass mat separators for longer cycling life.
- Maintenance Free batteries utilize calcium lead alloy on both positive and negative plates that reduces gassing and water consumption. Automotive batteries have Silver (Ag) Calcium Alloy Grids for resistance to high underhood temperatures.
- Heavy-duty, full frame battery grids with no sharp edges. An optimum acid/paste combination provides better charge acceptance after a deep discharge.
- Positive and Negative plates are anchored to the container bottom and the cell element is locked at the top for maximum vibration resistance. Straps are thicker, heavier and cast (not welded) into the plates.
- Manifold vented cover with built-in Flame Arrestor…a safety feature that directs corrosive gases away from the battery and hold-downs.
- Robust reinforced case provides extra strength in all temperature extremes. Brickwork design on sides reduces chance of punctures and case flexing. Embossed part number and descriptors for easy serviceability.

For more information, see us today or visit our web site at www.cat.com

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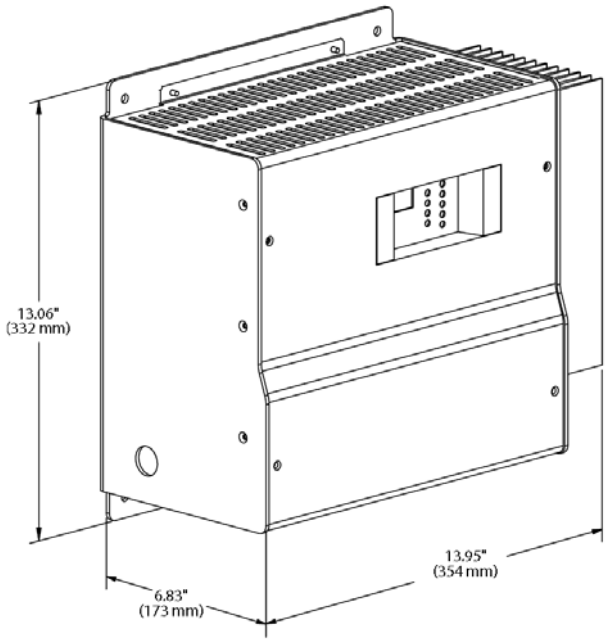


Image Shown may not Reflect Actual Package

UL 20 AMP BATTERY CHARGER

This battery charger offers accurate, automatic charging of lead-acid and nickel cadmium batteries. The output voltage automatically adjusts to changing input, load, battery and ambient conditions. This prevents battery over-charging and consequent loss of battery electrolyte.

Standard features include AC line compensation, precision voltage regulation, current limiting, automatic 2-rate charging, voltmeter and ammeter, temperature compensation and UL Listing.

The user interface is easy to understand with digital metering, NFPA 110 alarms and a battery fault alarm.

SPECIFICATION

Input Supply	110-120 V
	208-240 V
AC and DC Fuses	(2 input and 2 output)
Output voltage	24V
Frequency	50/60 Hz
Operating temperature	-20°C (-4°F)
	to +60°C (140°F)

Housing constructed of rustproof anodized aluminum.

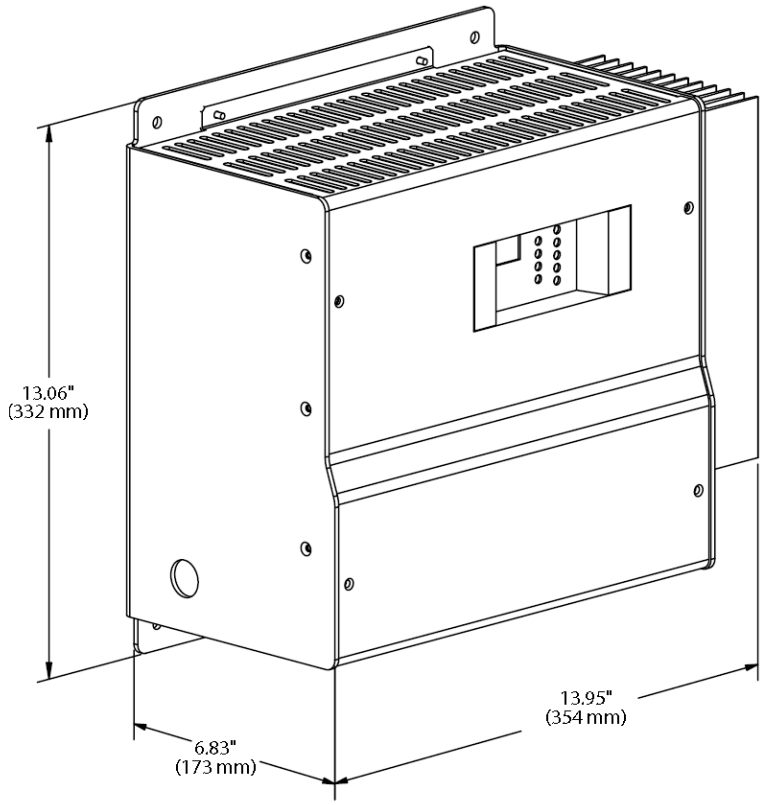
STANDARDS

- C-UL listed to UL 1236
- NFPA 70, NFPA 110
- CSA 22.2 No 107 certified
- UL 1564
- CE DOC to EN 60335
- IBC Seismic Certification

FEATURES

- Electronically current limited at 105% of rated output
- Alarm system
- Digital Display
- Lightning and voltage transient protection
- Protection of connected equipment against load dump
- Constant voltage, current limited, 4-rate automatic equalization
- IP 20 housing
- Temperature Compensation
  - On board temperature sensor with remote port
- AC isolated from DC
- Auto AC line compensation
- Output regulated by sensed battery voltage

BATTERY CHARGER



Output		Input	
Amps	Volts	Hz	Volts
20	24	50/60	110-120 208-240

Width	Depth	Height	Weight
354 mm (13.93")	173 mm (6.83")	332 mm (13.06")	19.1 kg (42 lb)

Feature code
BTC 20A2

NFPA 110 alarm package as follows:

- AC on — Green led (indication)
- AC fail — Red led and form C contact (2A)
- Float mode — LED
- Fast charge — LED
- Temp comp active — LED
- Low battery volts — Red led and Form C contact
- High Battery Volts — Red led and Form C contact
- Charger fail — Red led and Form C contact
- Battery fault — Red led and Form C contact
  - Battery disconnected
  - Battery polarity reversed
  - Mismatched charger battery voltage
  - Open or high resistance charger to battery connection
  - Open battery cell or excessive internal resistance

www.Cat-ElectricPower.com

NRG Specifications

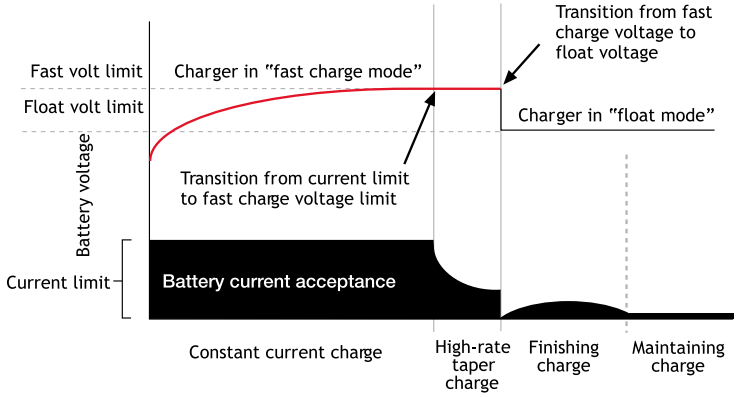
AC Input

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

Charger Output

Nominal voltage 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	±0.5% (1/2%) line and load regulation
Current	10 or 20 amps nominal
Electronic current limit	105% rated output typical – no crank disconnect required
Charge characteristic	Constant voltage, current limited, 4-rate automatic equalization
Temperature compensation	Enable or disable anytime, remote sensor optional
Output protection	Current limit, 1-pole fuse, transient suppression

Standard 4-rate charging



User Interface, Indication and Alarms

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

Front panel status display

Alarm System Functions

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

1. Three-position jumper allows user to select from three display settings: alternating volts / amps (normal), constant volts, or constant amps
2. Contacts rated 2A @ 30 VDC resistive
3. 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	Field-selectable switch
Optional 12/24-volt output select	Field-selectable two-position jumper
Battery program select	Field-selectable six-position jumper
Meter display select	Field-selectable three-position jumper
Fast charger enable/disable	Field-selectable two-position jumper
Temp compensation enable	Standard. Can be disabled or re-enabled in the field
Remote temp comp enable	Connect optional remote sensor to temp comp port

Simple field adjustments

Environmental

Operating temperature	-20C to +60C, meets full specification to +45C
Over temperature protection	Gradual current reduction to maintain safe power device temperature
Humidity	5% to 95%, non-condensing
Vibration (10A unit)	UL 991 Class B (2G sinusoidal)
Transient immunity	ANSI/IEEE C62.41, Cat. B, EN50082-2 heavy industrial, EN 61000-6-2
Seismic Certification	IBC 2000, 2003, 2006, 2009 Maximum S_{ds} of 2.28 g, Optional OSHPD pre-approval

Agency Standards

Safety	C-UL listed to UL 1236 (required for UL 2200 gensets), UL Category BBGQ, CSA standard 22.2 no. 107.2-M89 CE: 50/60 Hz units DOC to EN 60335
Agency marking	60 Hz: C-UL-US listed 50/60 Hz: C-UL-US listed plus CE marked
EMC	Emissions: FCC Part 15, Class B; EN 50081-2 Immunity: EN 61000-6-2
NFPA standards	NFPA 70, NFPA 110. (NFPA 110 requires Alarms "C")
Optional agency compliance	OSHPD pre-approval

Construction

Housing/configuration	Material: Non-corroding aluminum. C-UL listed enclosure.
Dimensions	See Drawings and Dimensions page for details
Printed circuit card	Surface mount technology, conformal coated
Cooling	Natural convection
Protection degree	Listed housing: NEMA-1 (IP20). Optional IP21 drip shield. Optional NEMA 3R enclosure
Damage prevention	Fully recessed display and controls
Electrical connections	Compression terminal blocks

~~Warranty~~

~~Standard warranty~~	~~Three year parts and labor warranty (10 years magnetics and power semiconductors) from date of shipment~~
~~Optional warranty~~	~~If specified at time of order, warranty coverage can be increased to reimburse customer's documented field service costs up to the original charger price or increased to 5 or 10 years with field service cost reimbursement. Contact the factory for full details~~

CAT Warranty

~~Optional features~~

~~Input~~	~~Input frequency, 50/60 Hz~~
~~Remote temp comp sensor~~	~~Recommended where battery and charger are in different locations~~
~~Drip shield meets s/b (IP21)~~	~~Protects from dripping water~~
~~NEMA 3R housing~~	~~Enables outdoor installation (remote temp sensor recommended)~~
~~Field service warranty~~	~~Reimbursement of customer field service expenses up to charger price for 3, 5, or 10 years~~

JACKET WATER HEATER

With Circulating Pump

Caterpillar offers a factory-installed jacket water heater for increased cold-starting capability. The system includes heater, isolation valves, circulation pump, hoses and generator space heater relay.

FEATURES

Factory Installed

- Complete with hoses, circulating pump, and isolation valves
- Base frame mounting minimizes engine induced vibration
- Automatically disconnected when engine is running via the generator space heater relay
- Supplied with UL recognized components
- Thermostat is factory pre-set to 49°C (120°F)

Improved Performance

- Greater than 30% reduction in power consumption
- Uniform heating over entire cooling system
- Reduced temperature at outlet extends hose and coolant life
- Longer heating element life

SPECIFICATIONS

Unit specifications

	Design Voltage	
	220	240
Rating	9 kW	9 kW
Frequency	50/60	50/60
Phase	1	1
Amps	41	37
Flow Rate	32LPM (10GPM)	32LPM (10GPM)
Circulation Pump Rating	96W	96W
Control Voltage	24VDC	24VDC
Adjustable Thermostat	18.3°- 60°C (65°-140°F)	65°-140°F (65°-140°F)
Shipping Weight	31.8kg (70lbs)	31.8 lbs (70lbs)
Optional Voltage (with 90% heating capacity and ±5% voltage fluctuation)	208	227

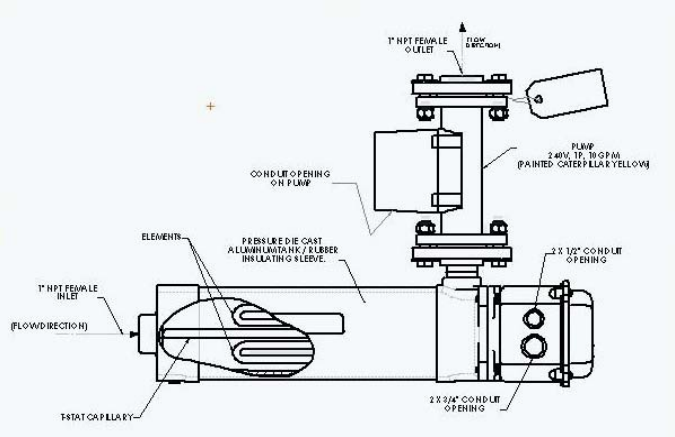
Heater Design Description

The jacket water heater package is designed to efficiently pre-heat the 3500 engine by heating and circulating the engine's coolant. The forced coolant circulation allows the design to operate at a higher wattage and efficiency than standard thermal siphon tank heaters (tank heaters). This design results in the following benefits:

- Reduction of the maximum coolant temperatures associated with tank heater design.
- Increase life of heater hoses, engine seals, and heating elements.
- Improve heat transfer efficiency from elements to engine coolant.
- More uniform engine temperature distribution.
- Application of a thermostat with a reduced thermal differential.
- Greater than a 50% reduction of the thermostat cycle rate.
- Lower customer utility costs and increased heater reliability.
- Heater thermostat's setpoint is preset from the factory for maximum operation efficiency.

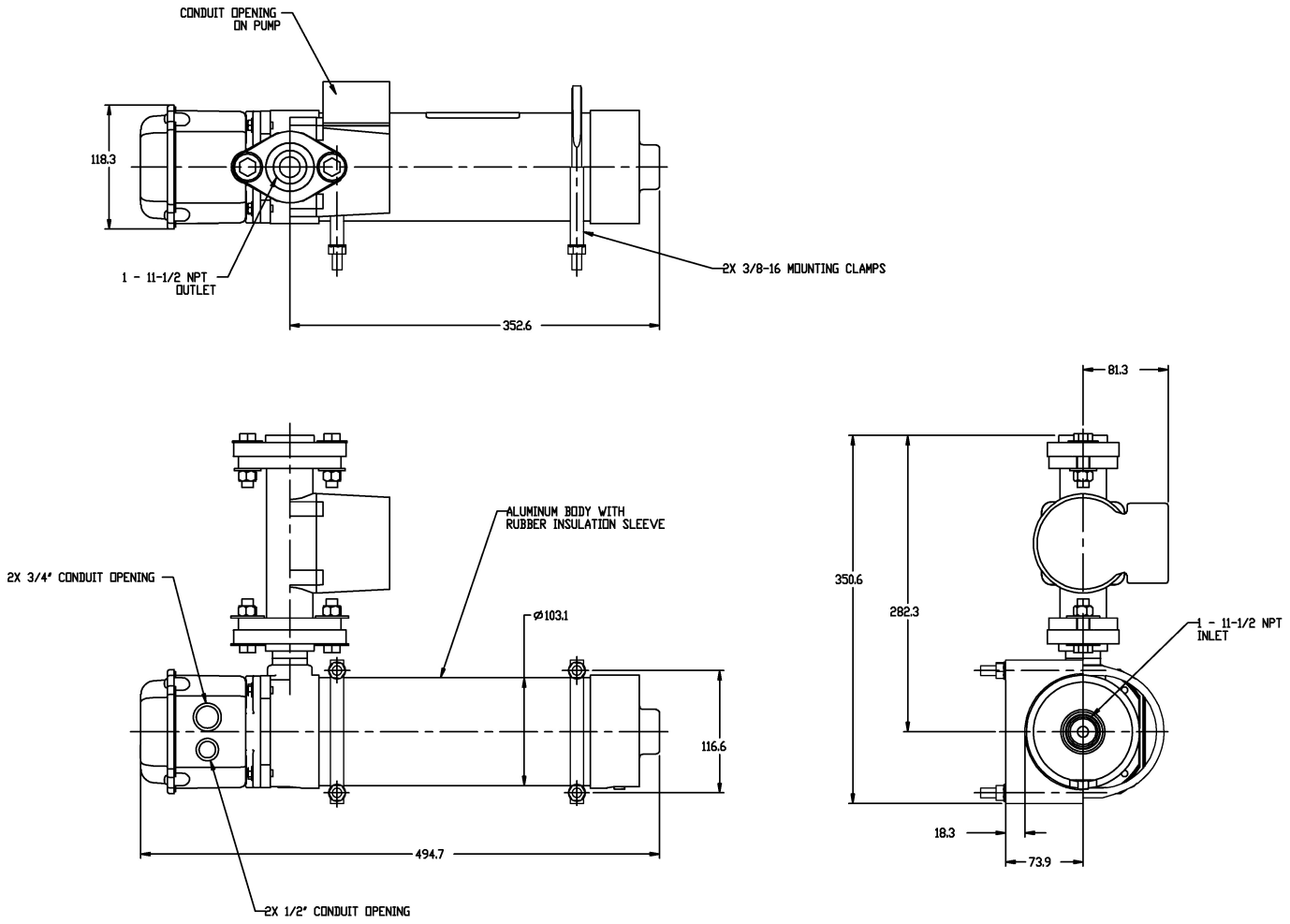
Heater Operation / Wiring

A 10-gallon per minute pump is located at the heater outlet to pull the coolant through the heater. An adjustable thermostat probe is located inside the heater tank near the inlet of the heater and responds to the temperature of the coolant entering the tank. The figure below shows the general heater design.



Overall Heater Layout

Jacket Water Heater Group General Dimension



Drawing Reference No.: 235-1224, 237-2236
Unless otherwise specified; all dimensions are for reference.
U.S. sourced

www.CAT-ElectricPower.com

Printed in U.S.A.

Materials and specifications are subject to change without notice.
The International System of Units (SI) is used in this publication.

The Inside Story

Cat® Fuel, Oil, and Transmission Filters

CATERPILLAR®

Visibly Better

Cat® Fuel, Oil, and Transmission Filters

The consistent quality of Cat® Filters is your best protection.

When you see inside a Cat Filter, the difference is clear. The advanced design features found in Cat Filters combine to deliver maximum filtration efficiency and the protection you need to get the most out of your machine.

All filters are not the same. Cat Filters have:

- Acrylic beads to prevent pleat bunching
- Spiral roving for greater pleat stability
- A nylon center tube to prevent metal contamination
- Molded end caps to prevent leaks

Cat Filters have a one-piece canister. During the manufacturing process the edge of the canister is folded down onto the base plate. This gives Cat Filters the ability to withstand greater pressures and virtually eliminates leaks.

The acrylic beads in Cat® Filters keep the pleated filter media evenly spaced.

Other brands of filters commonly experience pleat bunching, which leads to clogging and shorter change intervals. Bunching can also trigger bypass allowing contaminants to circulate through the system and cause additional wear.

With Cat Filters it is easy to see the difference. Acrylic beads rigidly maintain pleat spacing to prevent bunching and to maximize the surface area throughout the life of the filter. This helps Cat Filters capture and hold contaminates until the next change interval. This can mean fewer oil changes per year, decreased downtime, and lower owning and operating costs.

Cat Filters have acrylic beads to keep the pleated filter media rigid and evenly spaced.

Acrylic Beads

CAT® FUEL, OIL, AND TRANSMISSION FILTERS

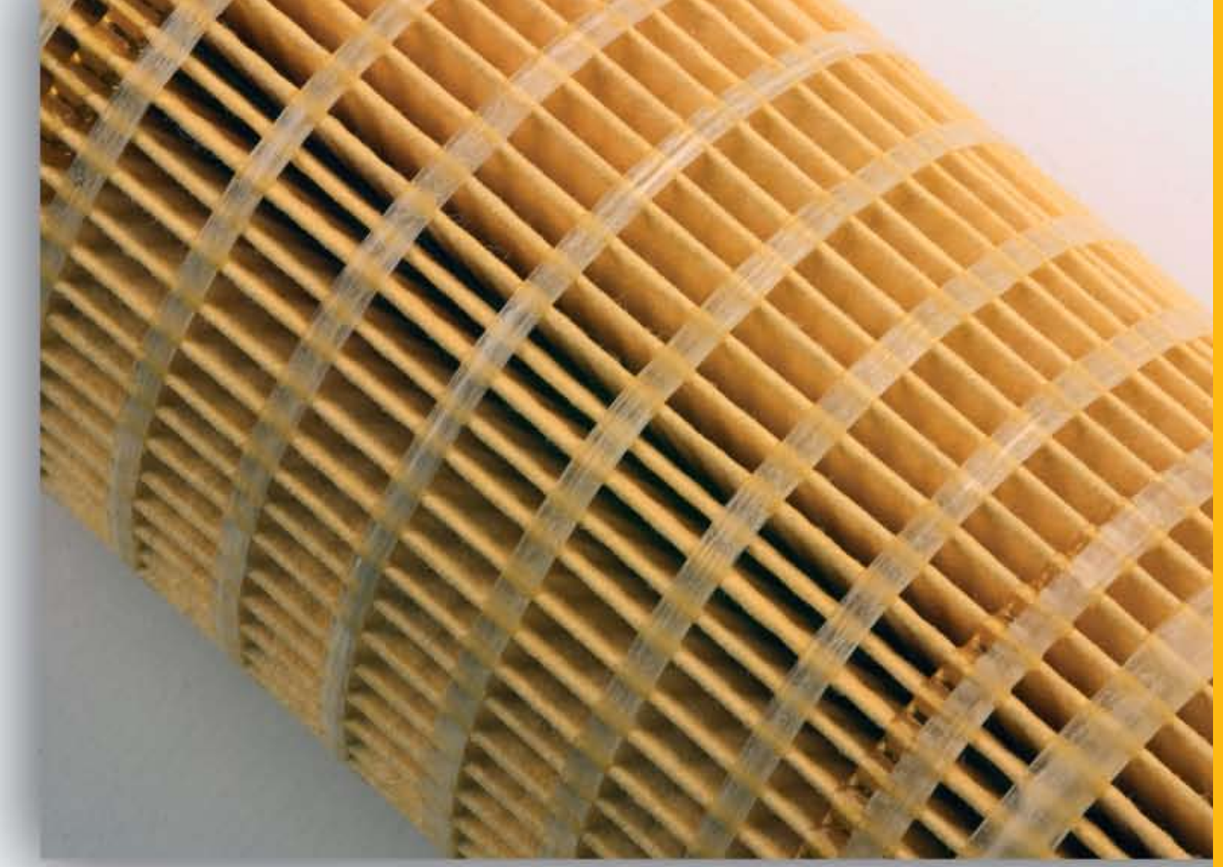
Spiral Roving

Cat® Fuel, Oil, and Transmission Filters

The fiberglass spiral roving in Cat® Filters keeps filter media pleats from flexing as fluid travels through the media.

With other brands of filters, pleats often flex releasing contaminants through the filter media into the "clean" side where they cause additional component wear.

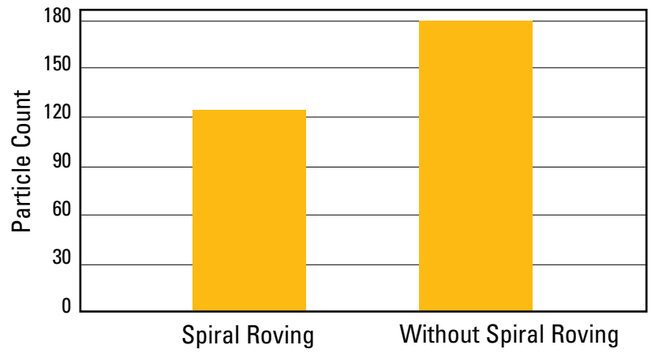
The spiral roving in Cat Filters eliminates pleat movement ensuring that contaminates are captured and held. This is particularly important during machine cold start and machine shutdown.



Cat® Filters have a fiberglass cord wrapped around the cylinder of filter media. This spiral roving keeps pleats in place, allowing for better filtration.

Filtration efficiency is directly impacted by pleat movement because the motion of pleats can allow contaminates to work their way through the media into the clean side of the filter.

During testing, particle counts of filters with spiral roving were 45% lower than similar filters without spiral roving.



Cat® Filters use non-metallic center tubes to add strength and to eliminate a source of contamination.

Non-metallic center tubes make Cat Filters stronger.

Other brands of filters use metal center tubes, which often carry metal contaminants leftover from the manufacturing process. These are picked up by the fluid from the clean side of the media and continue through the system to cause component wear.

The center tubes in Cat Filters are made out of fiberglass-reinforced nylon, eliminating a common source of metal contamination. Plus, Cat non-metallic center tubes are 30% stronger than typical metal tubes to help prevent collapse during pressure spikes and cold starts.

Center Tube

CAT® FUEL, OIL, AND TRANSMISSION FILTERS

Molded Endcaps

CAT® FUEL, OIL, AND TRANSMISSION FILTERS

Cat Filters eliminate the potential for gaps by inserting the filter media directly into the end caps as they are formed.

The molded end caps in Cat® Filters completely seal the clean side of the filter from the dirty side.

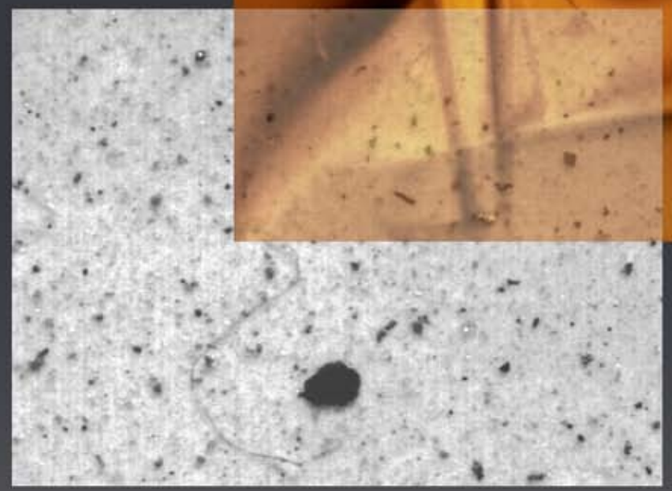
With competitive filters, metal end caps are glued on top of the filter pleats. This can leave gaps that allow contaminants to reenter the clean side of the filter.

The molded end caps in Cat Filters eliminate the possibility of gaps. During the manufacturing process, the filter media is inserted into the polyurethane before it hardens creating an impregnable bond that keeps contaminates confined to the dirty side of the filter.

An aluminum base plate is joined to the molded end cap and enclosed within the one-piece canister. This gives Cat Filters greater burst strength and eliminates a potential source of metal contamination.

Out of Sight

Is Not Out of Mind

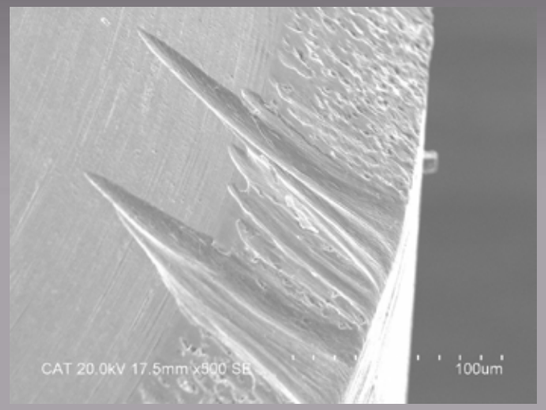


Contamination, even by particles too small to see, costs you money. As contaminates move through the system they cause component wear.

For example, are you replacing fuel injectors too often? This may be due to fuel system contamination.

Where Does Contamination Come From?
Fuel can become contaminated at many places: directly from the distributor, during operation, and/or through maintenance work. Contamination can even be found inside a brand new filter. This is why it is important to choose the consistent quality delivered only by Cat® Filters.

The advanced design features of Cat Filters combined with the automated manufacturing process maintain the integrity of the clean side of each and every Cat Filter: from when it leaves the factory, all the way until the next change interval.



Invisible Threat, Real Damage
Even the smallest contaminates are destructive because the drive to lower emissions has resulted in higher pressures and very tight clearances. For example, fuel injector openings can be as small as five microns in size (table salt ranges from 100 - 300 microns). When contaminates larger than four microns pass through the filter, micro-abrasion occurs (pictured left). Cat Advanced High Efficiency Filters are able to remove 98% of all particulates four microns in size, and larger, from the fuel system before damage occurs.

Consistent Quality

Cat® Fuel, Oil, and Transmission Filters

Cat® Filters achieve a standard of consistent quality that is unmatched by competitive filters. This is possible because Cat Filters are built in automated manufacturing facilities where quality is continuously verified through multiple layers of computerized monitoring, testing, and inspection.

Save Cents?

Not all filters are equal. While other filters may initially cost less, they will quickly end up costing you more through lower productivity, shorter filter/fluid change intervals, and faster component wear.

Make Sense.

Choosing the consistent quality of Cat® Filters makes sense. Only Cat Filters provide the protection needed to give you the lowest owning and operating costs.

Cat Filters are made better. While other filter brands may fit your machine, only Cat Filters deliver the best protection for your engine, hydraulic, and transmission systems.

Get the Inside Story.

LEDQ6225-05
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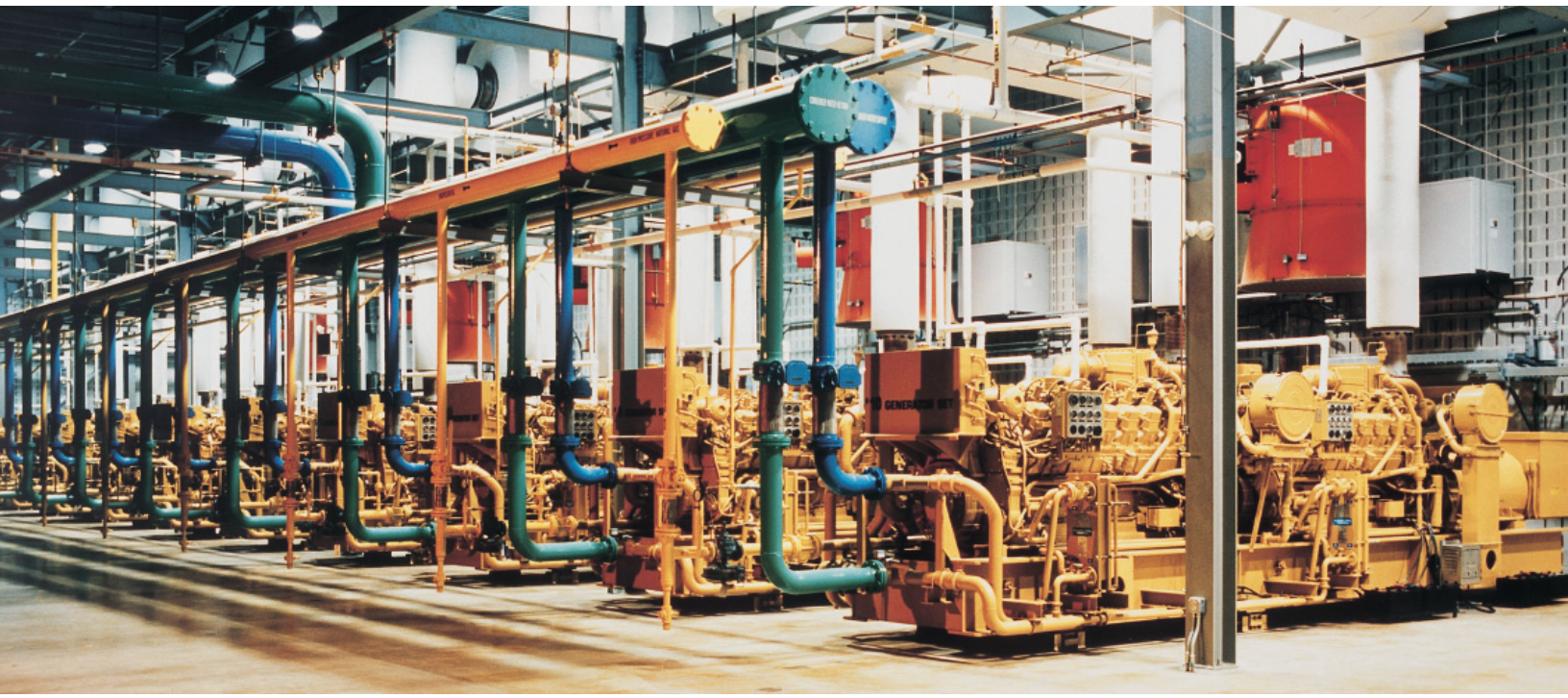
Cat® NGEO EL350™

Engine oil for natural gas applications and other engines requiring low-ash oil. **SAE 40**



Recommended Use

- Provides superior lubrication in high-horsepower gaseous-fueled engines
- Compatible with exhaust catalyst applications that require a low-phosphorus oil
- Compatible with “lean burn” engines requiring low-ash oil
- Provides optimum engine and oil life with low-sulfur gaseous fuels that contain less than 0.43 mg hydrogen per mega Joule (0.35 mg hydrogen sulfide per BTU)
- May be used in engines that use high-sulfur gas, provided that shorter drain intervals are employed

Discover the Difference

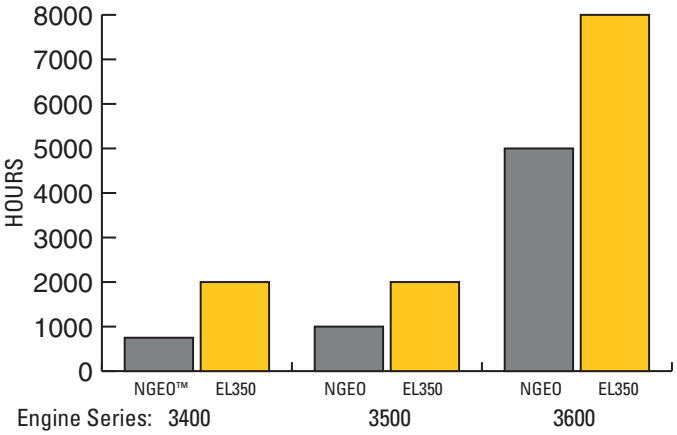
Cat NGEO EL350 is developed, tested and approved by Caterpillar to meet the same high standards as Genuine Cat Parts.

- Factory-Fill—Used as standard factory-fill for Cat natural gas engines.
- Reduced Piston and Cylinder Wear—Anti-oxidation and anti-nitration properties prevent deposit buildup to minimize scuffing, scoring and wear.
- Increased Spark Plug and Valve Life—Excellent detergent and dispersant additives protect against deposits and damage.
- Corrosion Protection—Acid neutralizers protect parts from rust and copper corrosion.
- Extended Drain Intervals—Provides extended oil drain capabilities when using our S•O•S℠ Services.

CATERPILLAR®

Cat NGEO EL350

Recommended Drain Intervals



Typical Characteristics*

SAE Viscosity Grade	40
Gravity @ 16° C	
API (ASTM D287)	29.3
Specific	0.882
Flash Point, °C (ASTM D92)	247
Pour Point, °C (ASTM D97)	–21
Viscosity	
cSt @ 40° C (ASTM D445)	125
cSt @ 100° C (ASTM D445)	13
Viscosity Index (ASTM D2270)	97
Sulfated Ash, % wt. (ASTM D874)	0.54
TBN, mg KoH/g (ASTM D2896)	6.2
Phosphorus, % wt. (Spectro or AA)	0.03
Calcium, % wt. (Spectro or AA)	0.13

*The values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice.

Extended Drain Intervals

When used in recommended engines, Cat NGEO EL350 can extend oil change intervals by 60 to 160% over NGEO. The graph to the left compares intervals for NGEO with those for NGEO EL350 where Cat Filters and S•O•S Services are used.

S•O•S Services for early problem detection

Protect your investment with Cat S•O•S oil analysis, the ultimate detection and diagnostic tool for your equipment. S•O•S helps you detect potential problems before they can lead to major failures and costly, unscheduled downtime.

Cat Filters: Complete protection for your engine

Combine Cat Fluids with Cat Filters for the highest level of contamination control and protection for your machine. We recommend Cat Filters for all Cat engine applications.

Health and Safety

Under normal conditions of intended use, this product does not pose a risk to health. Excessive exposure may result in eye, skin or respiratory irritation. Always observe good hygiene measures. Read and understand the Material Safety Data Sheet (MSDS) before using this product. For a copy of the MSDS, contact us or visit the web at www.catmsds.com.

CAT® DEALERS DEFINE WORLD-CLASS PRODUCT SUPPORT.

We offer you the right parts and service solutions, when and where you need them.

The Cat Dealer network of highly trained experts keeps your entire fleet up and running to maximize your equipment investment.

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Cat® NGEC™

Premix 50/50

Prevents Freezing While Providing Superior Component Protection

Cat® NGEC™ (Natural Gas Engine Coolant) is a heavy-duty cooling system fluid designed to prevent freezing and boiling while providing superior component protection. Approved for use in all Cat natural gas and diesel engines, as well as, in most diesel, gas, or natural gas engines made by other manufacturers (follow OEM recommendations).

Benefits

Performance

Cat NGEC protects the cooling system of your natural gas engine over a temperature range of -34°F (-37°C) to 265°F (129°C). Additional freeze protection can be gained when the coolant concentration is raised to 60%.

Component Protection

Cat NGEC contains inhibitors that provide superior protection for metal components, especially aluminum, against pitting and corrosion. The formulation of Cat NGEC minimizes the formation of foam.

Ready-To-Use

Cat NGEC is premixed with deionized water and embitterment. No Supplemental Coolant Additive is needed until testing indicates.

CATERPILLAR®

Cat NGEC Provides Top Component Protection

Aluminum can be a very difficult metal to protect from corrosion and cavitation (boiling) damage. Cat NGEC is formulated to provide excellent protection for all metals used in cooling systems. In testing (ASTM D2809) with aluminum water pumps, Cat NGEC demonstrated its superior ability to protect compared to competitive heavy duty coolants.

Cat® NGEC™ protected this water pump and earned a nine out of ten on the test.

Results using a competitive heavy duty coolant that claimed to meet industry standards. The test score for this coolant was less than 4.

Typical Characteristics[1]	
ASTM Specification	ASTM D6210
Color	Magenta
Boiling protection – 15 psi (1 bar) radiator cap	
50% Cat NGEC/50% water	129°C (265°F)
60% Cat NGEC/40% water[2]	132°C (270°F)
Freeze protection	
50% Cat NGEC/50% water	-37°C (-34°F)
60% Cat NGEC/40% water[2]	-52°C (-62°F)
pH (50% solution)	10.5
Nitrite (50% solution)	1,200 ppm
Molybdate (50% solution)	310 ppm
Silicon (in the form of silicates) (50% solution)	120 ppm
Phosphate	0 ppm

[1]The values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice.

[2]Higher levels of glycol reduces the heat transfer performance of the coolant. For optimum performance, Caterpillar recommends a 50/50 percent mix of Cat NGEC and water, unless additional freeze protection is required.

Formulated to meet or exceed the following ASTM standards: D3306, D4985, D6210, TMC RP302, TMC RP329

Drain Interval

When used in Cat natural gas engines and properly maintained with Cat SCA, Cat NGEC has a drain interval of three years. Refer to the Operation and Maintenance Manual of your specific machine/engine for drain intervals based on service hours.

S•O•S℠ Fluid Analysis Services for Early Problem Detection

Protect your investment with Cat S•O•S Coolant Analysis, the ultimate detection and diagnostic tool for your engines. Refer to the Caterpillar Operation and Maintenance Manual for the recommended intervals of S•O•S Level 1 Coolant Analysis (such as every 250 hours). Level 2 Coolant Analysis is recommended at least annually for all Cat engines and machines.

Testing Nitrite Levels

Field testing of coolant nitrite levels can be performed using the 4C-9301 test kit. Results are immediate and SCA additions can be made as needed.

Coolant Maintenance Resources

For in-depth information on coolant maintenance, refer to the Cooling System Specifications section of the latest version of SEBU6400 – Caterpillar Gas Engine Lubricant, Fuel, and Coolant Recommendations.

Health and Safety

For information on proper use for health, safety, and environment, please refer to the Material Safety Data Sheet (MSDS). Read and understand the MSDS before using this product. Always observe good hygiene measures. For a copy of the MSDS, contact us or visit the web at www.catmsds.com.

CAT® DEALERS DEFINE WORLD-CLASS PRODUCT SUPPORT.

We offer you the right parts and service solutions, when and where you need them.

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Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Cat ® NGEC Natural Gas Engine Coolant

Product Use: Antifreeze/Coolant
Product Number(s): 227813
Company Identification
Chevron Products Company
Global Lubricants
6001 Bollinger Canyon Rd.
San Ramon, CA 94583
United States of America
www.chevronlubricants.com

Transportation Emergency Response
CHEMTREC: (800) 424-9300 or (703) 527-3887
Health Emergency
Chevron Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623
email : lubemsds@chevron.com

SECTION 2 HAZARDS IDENTIFICATION

CLASSIFICATION: Target organ toxicant (repeated exposure): Category 2.

Signal Word: Warning

Target Organs: May cause damage to organs (Kidney) through prolonged or repeated exposure.

PRECAUTIONARY STATEMENTS:
Prevention: Do not breathe dust/fume/gas/mist/vapours/spray.
Response: Get medical advice/attention if you feel unwell.
Disposal: Dispose of contents/container in accordance with applicable local/regional/national/international regulations.

HAZARDS NOT OTHERWISE CLASSIFIED: Not Applicable

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Ethylene Glycol	107-21-1	30 - 60 %wt/wt
Sodium tetraborate, pentahydrate	12179-04-3	0.1 - 1 %wt/wt

SECTION 4 FIRST AID MEASURES

Description of first aid measures
Eye: No specific first aid measures are required. As a precaution, remove contact lenses, if worn, and flush eyes with water.
Skin: No specific first aid measures are required. As a precaution, remove clothing and shoes if contaminated. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: If swallowed, get immediate medical attention. Do not induce vomiting. Never give anything by mouth to an unconscious person.
Inhalation: No specific first aid measures are required. If exposed to excessive levels of material in the air, move the exposed person to fresh air. Get medical attention if coughing or respiratory discomfort occurs.

Most important symptoms and effects, both acute and delayed
IMMEDIATE HEALTH EFFECTS
Eye: Not expected to cause prolonged or significant eye irritation.
Skin: Contact with the skin is not expected to cause prolonged or significant irritation. Contact with the skin is not expected to cause an allergic skin response. Not expected to be harmful to internal organs if absorbed through the skin.
Ingestion: Toxic; may be harmful or fatal if swallowed.
Inhalation: Not expected to be harmful if inhaled. Breathing this material at concentrations above the recommended exposure limits may cause central nervous system effects. Central nervous system effects may include headache, dizziness, nausea, vomiting, weakness, loss of coordination, blurred vision, drowsiness, confusion, or disorientation. At extreme exposures, central nervous system effects may include respiratory depression, tremors or convulsions, loss of consciousness, coma or death.

DELAYED OR OTHER HEALTH EFFECTS:
Target Organs: Contains material that may cause damage to the following organ(s) following repeated inhalation at concentrations above the recommended exposure limit:Kidney Risk depends on duration and level of exposure. See Section 11 for additional information.

Indication of any immediate medical attention and special treatment needed Not Applicable

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames. Dry Chemical, CO2, AFFF Foam or alcohol resistant foam.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: This material will burn although it is not easily ignited. See Section 7 for proper handling and storage. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic

compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in vicinity of spilled material.
Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

General Handling Information: Do not taste or swallow antifreeze or solution. Keep out of the reach of children and animals.
Precautionary Measures: Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Wash thoroughly after handling. Keep out of the reach of children.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

General Storage Information: Do not store in open or unlabeled containers.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below the recommended exposure limits. Use in a well-ventilated area.

PERSONAL PROTECTIVE EQUIPMENT
Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.
Skin Protection: No special protective clothing is normally required. Where splashing is possible, select

protective clothing depending on operations conducted, physical requirements and other substances in the workplace. Suggested materials for protective gloves include: Natural rubber, Neoprene, Nitrile Rubber, Polyvinyl Chloride (PVC or Vinyl).
Respiratory Protection: Determine if airborne concentrations are below the recommended occupational exposure limits for jurisdiction of use. If airborne concentrations are above the acceptable limits, wear an approved respirator that provides adequate protection from this material, such as: Air-Purifying Respirator for Organic Vapors, Dusts and Mists.

Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Agency	TWA	STEL	Ceiling	Notation
Ethylene Glycol	ACGIH	--	--	100 mg/m3	--
Sodium tetraborate, pentahydrate	ACGIH	2 mg/m3	6 mg/m3	--	--

Consult local authorities for appropriate values.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Purple
Physical State: Liquid
Odor: Faint or Mild
Odor Threshold: No data available
pH: 10 - 11
Vapor Pressure: <0.1 mmHg @ 20 °C (68 °F)
Vapor Density (Air = 1): 2.1 (Typical)
Initial Boiling Point: 107.8°C (226°F)
Solubility: Miscible
Freezing Point: -36.7°C (-34.1°F)
Specific Gravity: 1.08 @ 15.6°C (60.1°F) / 15.6°C (60.1°F)
Viscosity: No data available
Decomposition temperature: No data available
Octanol/Water Partition Coefficient: No data available

FLAMMABLE PROPERTIES:
Flammability (solid, gas): No Data Available

Flashpoint: Not Applicable
Autoignition: No data available
Flammability (Explosive) Limits (% by volume in air): Lower: Not Applicable Upper: Not Applicable

SECTION 10 STABILITY AND REACTIVITY

Reactivity: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Incompatibility With Other Materials: Not applicable
Hazardous Decomposition Products: Aldehydes (Elevated temperatures), Ketones (Elevated

temperatures)
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects
Serious Eye Damage/Irritation: The eye irritation hazard is based on evaluation of data for product components.

Skin Corrosion/Irritation: The skin irritation hazard is based on evaluation of data for product components.

Skin Sensitization: The skin sensitization hazard is based on evaluation of data for product components.

Acute Dermal Toxicity: The acute dermal toxicity hazard is based on evaluation of data for product components.

Acute Oral Toxicity: The acute oral toxicity hazard is based on evaluation of data for product components.

Acute Inhalation Toxicity: The acute inhalation toxicity hazard is based on evaluation of data for product components.
Acute Toxicity Estimate: Not Determined

Germ Cell Mutagenicity: The hazard evaluation is based on data for components or a similar material.

Carcinogenicity: The hazard evaluation is based on data for components or a similar material.

Reproductive Toxicity: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Single Exposure: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Repeated Exposure: The hazard evaluation is based on data for components or a similar material.

ADDITIONAL TOXICOLOGY INFORMATION:
This product contains ethylene glycol (EG). The toxicity of EG via inhalation or skin contact is expected to be slight at room temperature. The estimated oral lethal dose is about 100 cc (3.3 oz.) for an adult human. Ethylene glycol is oxidized to oxalic acid which results in the deposition of calcium oxalate crystals mainly in the brain and kidneys. Early signs and symptoms of EG poisoning may resemble those of alcohol intoxication. Later, the victim may experience nausea, vomiting, weakness, abdominal and muscle pain, difficulty in breathing and decreased urine output. When EG was heated above the boiling point of water, vapors formed which reportedly caused unconsciousness, increased lymphocyte count, and a rapid, jerky movement of the eyes in persons chronically exposed. When EG was administered orally to pregnant rats and mice, there was an increase in fetal deaths and birth defects. Some of these effects occurred at doses that had no toxic effects on the mothers. We are not aware of any reports that EG causes reproductive toxicity in human beings.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY

This material is not expected to be harmful to aquatic organisms.
The product has not been tested. The statement has been derived from the properties of the individual components.

MOBILITY
No data available.

PERSISTENCE AND DEGRADABILITY
This material is expected to be readily biodegradable. The biodegradability of this material is based on an evaluation of data for the components or a similar material.
The product has not been tested. The statement has been derived from the properties of the individual components.

POTENTIAL TO BIOACCUMULATE
Bioconcentration Factor: No data available.
Octanol/Water Partition Coefficient: No data available

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by international, country, or local laws and regulations.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Description: PROPRIETARY ANTIFREEZE PREPARATION IN NON-BULK PACKAGING; NOT REGULATED FOR TRANSPORT UNDER 49 CFR
Additional Information: Bulk shipments containing a reportable quantity (RQ, 5000 pounds or more) of ethylene glycol in a single packaging are transported as hazardous material. The shipping description is: UN3082, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (ETHYLENE GLYCOL CONTAINS BITTERANT), 9, III, RQ (ETHYLENE GLYCOL)

IMO/IMDG Shipping Description: NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORTATION UNDER THE IMDG CODE

ICAO/IATA Shipping Description: Anti-freeze Preparations, Proprietary; NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER ICAO

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code:
Not applicable

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES:

1. Immediate (Acute) Health Effects: NO
2. Delayed (Chronic) Health Effects: YES
3. Fire Hazard: NO
4. Sudden Release of Pressure Hazard: NO
5. Reactivity Hazard: NO

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	03=EPCRA 313
01-2A=IARC Group 2A	04=CA Proposition 65
01-2B=IARC Group 2B	05=MA RTK
02=NTP Carcinogen	06=NJ RTK
	07=PA RTK

The following components of this material are found on the regulatory lists indicated.

Sodium tetraborate, pentahydrate	05, 06, 07
Ethylene Glycol	03, 05, 06, 07

CHEMICAL INVENTORIES:
All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada), EINECS (European Union), IECSC (China), KECI (Korea), PICCS (Philippines), TSCA (United States).

One or more components does not comply with the following chemical inventory requirements: ENCS (Japan).

NEW JERSEY RTK CLASSIFICATION:
Under the New Jersey Right-to-Know Act L. 1983 Chapter 315 N.J.S.A. 34:5A-1 et. seq., the product is to be identified as follows: Refer to components listed in Section 3.

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 2 Flammability: 1 Reactivity: 0

HMIS RATINGS: Health: 2* Flammability: 1 Reactivity: 0
(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

LABEL RECOMMENDATION:
Label Category : ANTIFREEZE/COOLANT 1 - AFC1

REVISION STATEMENT: This revision updates the following sections of this Safety Data Sheet: 1-16
Revision Date: MAY 04, 2015

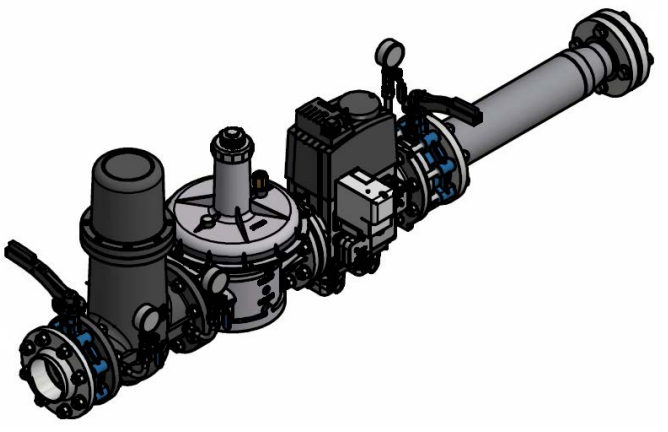
ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
GHS - Globally Harmonized System	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Governmental Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	SDS - Safety Data Sheet
HMIS - Hazardous Materials Information System	NFPA - National Fire Protection Association (USA)

DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration
NCEL - New Chemical Exposure Limit	EPA - Environmental Protection Agency
SCBA - Self-Contained Breathing Apparatus	

Prepared according to the 29 CFR 1910.1200 (2012) by Chevron Energy Technology Company, 6001 Bollinger Canyon Road San Ramon, CA 94583.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.



Picture shown may not reflect actual configuration

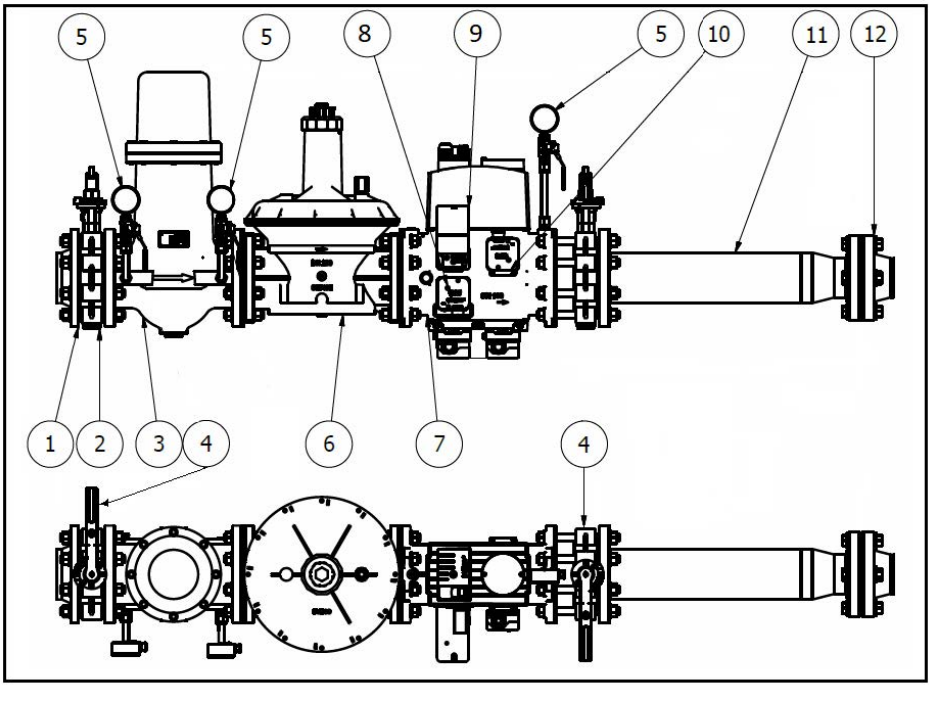
FUEL TRAIN
for use with gas engines

Caterpillar offers off engine gas trains that come shipped loose from the factory. The typical gas engine fuel system is comprised of several main components that serve a role in providing reliable fuel-air mixing in response to the engine's performance needs. Regional specifications are offered as standard in the fuel trains.

The customer is responsible for ensuring proper fuel train installation as it comes shipped loose from the factory. Please see Installation and Maintenance Guide for specifics of the Fuel System for Certain Gas Engines.

Example Consist:

1. Inlet flange
2. Valve
3. One micron filter
4. Ball valve
5. Pressure gauge
6. Pressure regulator
7. Spring
8. Low pressure switch
9. Valve proving system
10. High pressure switch
11. Flexible braided hose
12. Outlet flange



Picture shown may not reflect actual configuration

ATTACHMENT

Specifications

Engine Model	Feature Code	Part Number	Type	Weight (kg)	L x W x H (mm)	Inlet Pressure Range (PSIG)	Inlet Flange	Manual Isolation Valve(s)	Pressure Switches	Outlet Flange	Max Power (VA)
G3512	FPSTD01	473-4647	CSA B149 (CAN) NFPA 37 (US)	172	1670 x 391 x 568	2.6 - 7	DN80 (PN16)	(2) Inlet & Outlet	Low Pressure - Auto Reset High Pressure - Manual Reset	ANSI CLASS 150 (3")	125
G3512	LFP0001 (LP)	518-6142	CSA B149 (CAN) NFPA 37 (US)	351	2,128 x 561 x 884	0.65 - 5	DN125 (PN16)	(1) Inlet	Low Pressure - Auto Reset High Pressure - Manual Reset	ANSI CLASS 150 (3")	125
G3512E G3512H	GASTRN8	397-7661	EN 746-2 (EUR)	165	1485 x 408 x 541	2.78 - 7	DN80 (PN16)	(1) Inlet	Low Pressure - Auto Reset High Pressure - Auto Reset	ANSI CLASS 150 (3")	250
	GASTRN7	397-7666	CSA B149 (CAN) NFPA 37 (US)	176	1529 x 587 x 614	2.78 - 7	DN80 (PN16)	(2) Inlet & Outlet	Low Pressure - Auto Reset High Pressure - Manual Reset	ANSI CLASS 150 (3")	250
	GASTRN9	397-7662	AS3814 / AS5601 (AUST)	95	1850 x 388 x 540	2.78 - 7	DN80 (PN16)	(1) Inlet	Low Pressure - Auto Reset High Pressure - Auto Reset	ANSI CLASS 150 (3")	125
G3516H G3520E	GASTRN4	390-9001	EN 746-2 (EUR)	184	1784 x 383 x 651	2.78 - 7	DN100 (4")	(1) Inlet	Low Pressure - Auto Reset High Pressure - Auto Reset	ANSI CLASS 150 (3")	310
	GASTRN3	390-9000	CSA B149 (CAN) NFPA 37 (US)	196	1784 x 378 x 651	2.78 - 7	DN100 (4")	(2) Inlet & Outlet	Low Pressure - Auto Reset High Pressure - Manual Reset	ANSI CLASS 150 (3")	310
	GASTRN5	390-8999	AS3814 / AS5601 (AUST)	195	2105 x 423 x 648	2.78 - 7	DN100 (4")	(1) Inlet	Low Pressure - Auto Reset High Pressure - Auto Reset	ANSI CLASS 150 (3")	310
G3520H	GASTRN4	396-3131	EN 746-2 (EUR)	290	2110 x 385 x 853	3.7 - 7	DN125 (5")	(1) Inlet	Low Pressure - Auto Reset High Pressure - Auto Reset	DN100 (4")	152
	GASTRN3	396-3130	CSA B149 (CAN) NFPA 37 (US)	304	2112 x 367 x 863	3.7 - 7	DN125 (5")	(2) Inlet & Outlet	Low Pressure - Auto Reset High Pressure - Manual Reset	DN100 (4")	152
	GASTRN5	396-3129	AS3814 / AS5601 (AUST)	307	2431 x 441 x 863	3.7 - 7	DN125 (5")	(1) Inlet	Low Pressure - Auto Reset High Pressure - Auto Reset	DN100 (4")	152

WEDLAKE
QUALITY GENERATOR PRODUCTS

SUBMITTAL BILL OF MATERIAL

PROJECT OUTLINE

TERMS AND CONDITIONS:

- PLEASE REVIEW 2018 PRICE LETTER
- SUBMITTALS ON NEW PURCHASE ORDERS MUST BE RETURNED TO WEDLAKE APPROVED WITHIN 30 DAYS AFTER THE DRAWING ISSUE DATE. LATE SUBMITTALS MAY BE SUBJECT TO A MATERIAL SURCHAGE

☐ APPROVED

☐ APPROVED AS NOTED

☐ NOT APPROVED REQUIRING REVISION

DATE: BY:

WEDLAKE MAY REQUIRE APPROVAL OF UPDATED DRAWINGS IF "APPROVED AS NOTED" IS SELECTED

PROJECT INFORMATION

PROJECT NAME:	**AUDUBON HUSKEY**
CUSTOMER:	Mustang CAT
QUOTE NUMBER:	MM022019MDC
SUBMITTAL DRAWING NUMBER:	00148
SUBMITTAL REVISION:	B

WEDLAKE SUPPLIED EQUIPMENT

PART NUMBER	DESCRIPTION	QTY/UNIT
200	WEATHERGUARD MODEL ENCLOSURE	1
800	GENSET ASSEMBLY	1
802	ELECTRICAL PACKAGE	1
806	EXHAUST SYSTEM PACKAGE	1

CUSTOMER SUPPLIED EQUIPMENT

PART NUMBER	DESCRIPTION	QTY/UNIT	REVISION
5680548	CAT GAS-GENSET, G3520	1	-
4337089	SPRING VIBRATION ISOLATOR	18	-
BTC20A2	BATTERY CHARGER, 20A	1	-
5147D1	RADIATOR	1	-

WEDLAKE
QUALITY GENERATOR PRODUCTS

SUBMITTAL BILL OF MATERIAL

PROJECT OUTLINE

ENCLOSURE BILL OF MATERIAL

PART NUMBER	DESCRIPTION	QTY
FC20-0001	WEATHERGUARD MODEL	1
FC20-0018	GALVANNEAL STEEL CONSTRUCTION, 14 GA. THICKNESS	1
FC20-0024	PERIMETER DRIP RAIL SYSTEM	1
FC20-0028	LIFTING EYES, ENCLOSURE ONLY, 1.5" 34300 LBS	1
FC20-0031	SEISMIC DESIGN	1
FC20-0046	WIND RATED DESIGN, 120 MPH	1
FC20-0051	EXTERIOR SILENCER MOUNT	1
FC20-0052	TEXTURED PAINT FINISH	1
FC20-0054	SINGLE DOOR, FREEZER HANDLE LATCH	2
FC20-0055	DOUBLE DOOR, FREEZER HANDLE LATCH	2
FC20-0059	ZINC PLATED STEEL MOUNTING HARDWARE	1
FC20-0083	FIXED DISCHARGE LOUVER, 3", SCREENED	1
FC20-0090	FIXED INTAKE LOUVER, 10", SCREENED	1
FC80-0001	SKID TOP SPILL CONTAINMENT	1
807	LIFT SKID BASE	1
2010-01	T-HANDLE LATCH, KEY AND PADLOCKABLE, SINGLE POINT	2
2010-02	T-HANDLE LATCH, KEY AND PADLOCKABLE, TWO POINT	2
2012-01	DOOR HINGE KIT, LIFT-OFF WELD-ON STYLE, STEEL, GREASABLE	4
2013-01	DOOR HOLDER, ZINC COATED	4
2018-01	PERSONNEL ROOFTOP ANCHOR RING	6
2021-01	RADIATOR CAP ACCESS, BOLT-ON	1
2022-01	ENGINE DRAIN CONNECTION PLATE, 2X 1.5NPT, 2X 0.75NPT	1
2023-01	CLEANOUT ACCESS, BOLT-ON PANEL	1
C-0001	LOCK-COTE 29 PRIMER	1
C-0011	AMERCOAT 450H GLOSS ALIPHATIC POLYURETHANE TOPCOAT	1

WEDLAKE
QUALITY GENERATOR PRODUCTS

SUBMITTAL BILL OF MATERIAL

PROJECT OUTLINE

ELECTRICAL BILL OF MATERIAL

PART NUMBER	DESCRIPTION	QTY
7000-02	LOAD CENTER, SQUARE D QO SERIES, 120/208V 1 PH 3W, 100A, NEMA 1 ENCLOSURE	1
7007-01	INTERIOR LIGHTING KIT, 120 VAC, 4X 4FT LED LIGHT FIXTURE, WET LOCATION RATED, 2X THREE-WAY SWITCHES	1
7008-01	INTERIOR LIGHTING KIT, 24 VDC, 2X 2FT LED LIGHT FIXTURE, WET LOCATION RATED, 60 MIN TIMER SWITCH	1
7011-01	GFCI RECEPTACLE, NEMA5-20R 20A 125V	2
FC70-0001	CONDUIT, EMT	1
FC70-0004	STRAP, CONDUIT, STANDARD TYPE	1
FC70-0006	WIRING, THHN COPPER	1

ASSEMBLY BILL OF MATERIAL

PART NUMBER	DESCRIPTION	QTY
8042-02	GEN-SET INSTALLATION TO SKID FRAME	1
8043-02	ENCLOSURE INSTALLATION TO SKID FRAME	1
8044-01	EXHAUST SYSTEM INSTALLATION	1
8045-01	BATTERY CHARGER, RACK, BATTERIES INSTALLATION	1
8047-01	ENGINE DRAINS PLUMBED TO ENCLOSURE FITTING PLATE	1
8048-01	FUEL LINES PLUMBED FROM GENSET TO TANK W/ CUSTOMER SUPPLIED LINES	1
8075-01	INSTALL CUSTOMER SUPPLIED RADIATOR AND FILL WITH 50/50 ANTIFREEZE	1

EXHAUST SYSTEM BILL OF MATERIAL

PART NUMBER	DESCRIPTION	QTY
A202-5118-2	CRITICAL GRADE SILENCER, 18" CRITICAL GRADE STYLE, SPARK ARRESTING, CARBON STEEL	1
10-1F1-1218-CAT1812	FLEX PIPE, 12' CAT TO 12" ANSI, 18" OAL	1
RC18	RAIN CAP, 18" PIPE	1

SUBMITTAL BILL OF MATERIAL

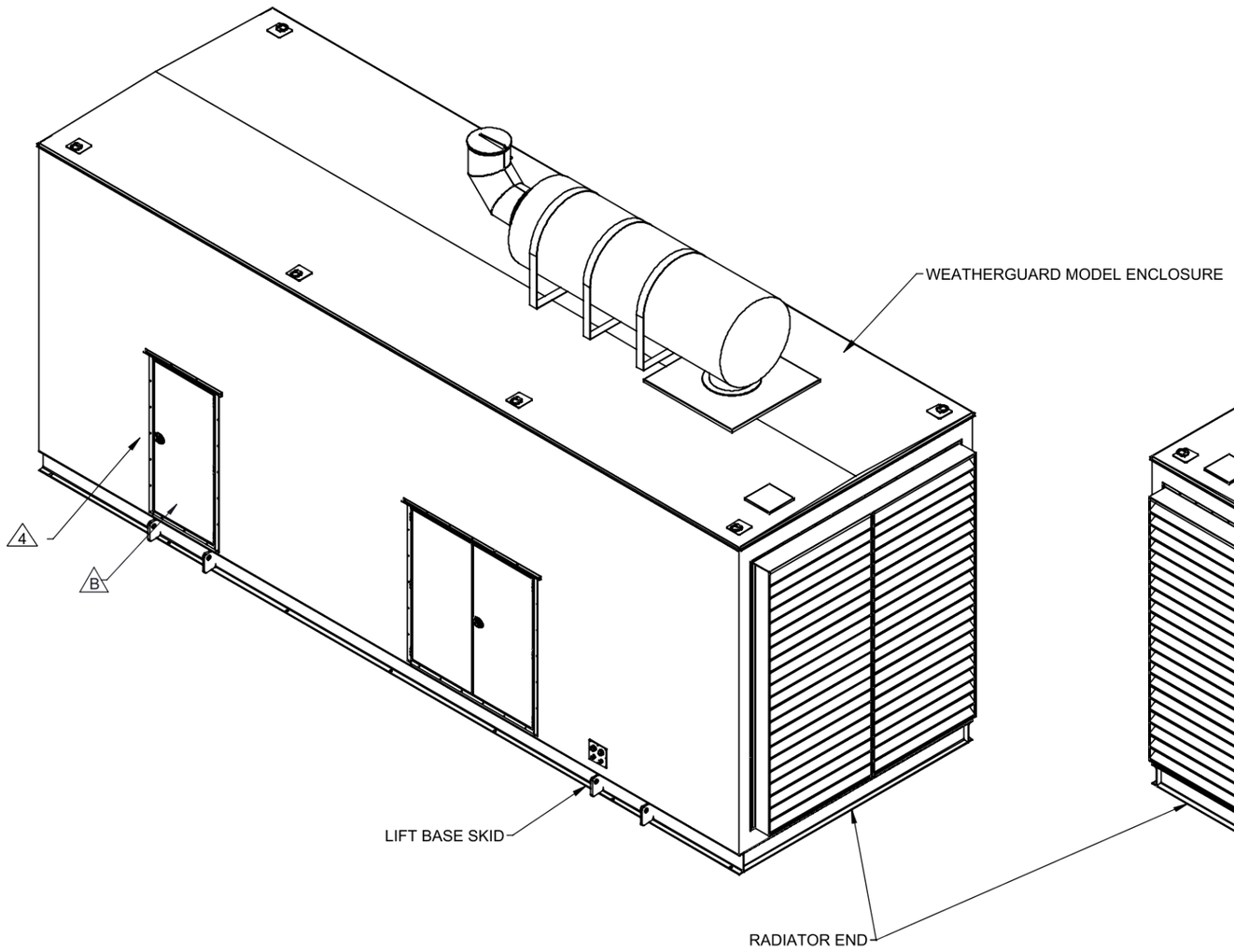
PROJECT OUTLINE

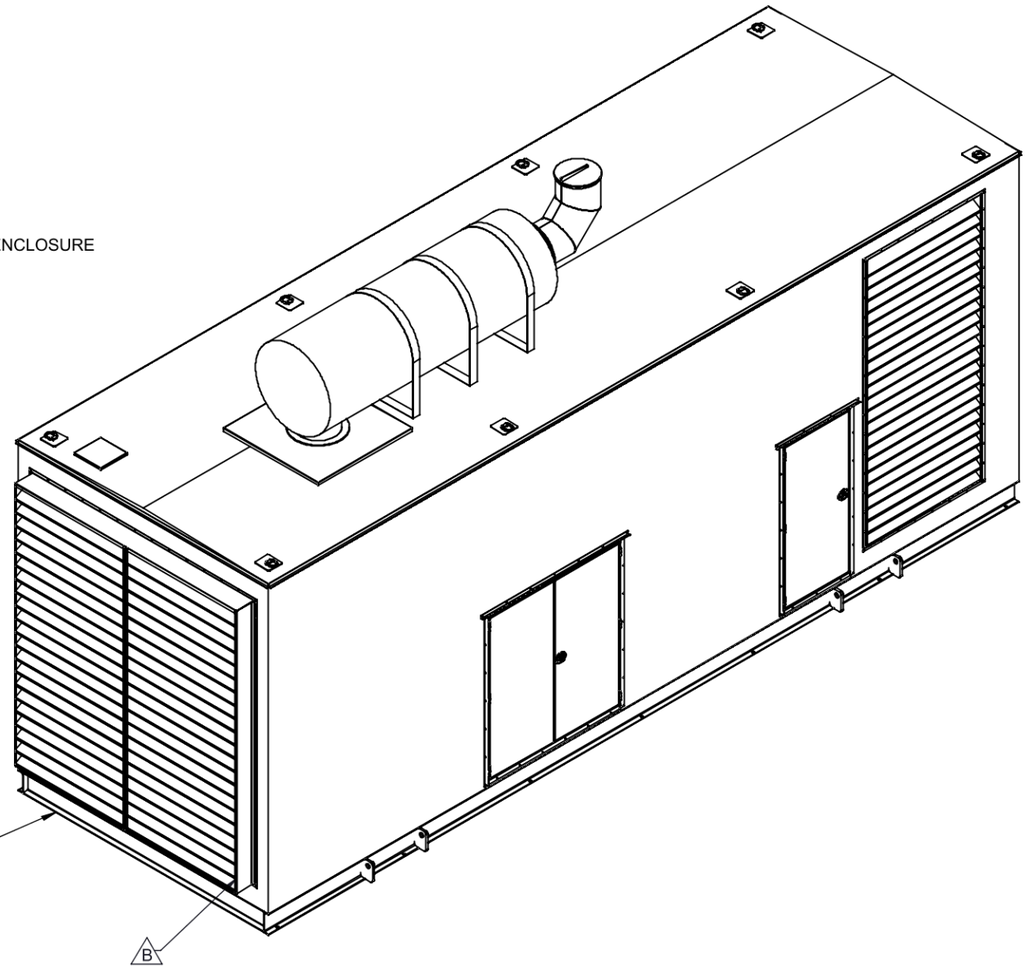
SIZING AND PERFORMANCE TABLES

SHIPPING DIMENSIONS (INCHES)			
ITEM	**LENGTH**	**WIDTH**	**HEIGHT**
ASSEMBLED ENCLOSURE SYSTEM	**435**	**147**	**180**

PACKAGE WEIGHT	
GEN-SET WET W/ RAD (LBS)	**48,319**
ENCLOSURE W/ SKID (LBS)	**23,400**
TOTAL SHIPPING DRY (LBS)	**71,719**

EQUIPMENT DATA	
MAKE	**CAT**
MODEL	**G3520**
LENGTH (INCHES)	**365.0**
WIDTH (INCHES)	**123.0**
HEIGHT (INCHES)	**144.0**
COMBUSTION & COOLING AIR (CFM)	**100,000**
FUEL CONSUMPTION (GPH) 100% LOAD	-





GENERAL NOTES

1. SEE SHIPPING DIMENSION TABLE
2. ASSEMBLED CENTER OF GRAVITY
3. FRONT OF GEN-SET FRAME
4. FORMED WALL PANEL SEAMS ARE NOT SHOWN
5. ENCLOSURE ELECTRICAL CONDUIT ROUTES NOT SHOWN. CONNECTION TO GEN MADE FROM CEILING DROP BY LIQUID TIGHT FLEXIBLE CONDUIT
6. WIRING TERMINATED IN GEN CABINET FOR GEN ACCESORY EQUIPMENT, CONNECTIONS MADE BY OTHER

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	BY
	A	RELEASE FOR APPROVAL	6/29/2019	JK
B4, D8	B	ADJUST RIGHT REAR DOOR POSITION TO ALIGN WITH GEN EXTENSION BOX, REPLACE INSET LOUVRE WITH HIGH FLOW REVERSE MOUNT LOUVRE	4/1/2020	JK

UNLESS OTHERWISE SPECIFIED
1) DIMENSIONS ARE IN INCHES
2) TOLERANCES ARE:
.XXX ± 0.031
.XX ± 0.063
.X ± 0.125
FRACTIONS ± 1/16
ANGULAR ±1°

BREAK ALL SHARP EDGES AND CORNERS

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

WEDLAKE FABRICATING, INC.
QUALITY GENERATOR PRODUCTS

DWG. NO. 00148

DESCRIPTION: CUSTOMER APPROVAL DRAWING

DRAWN BY: JK

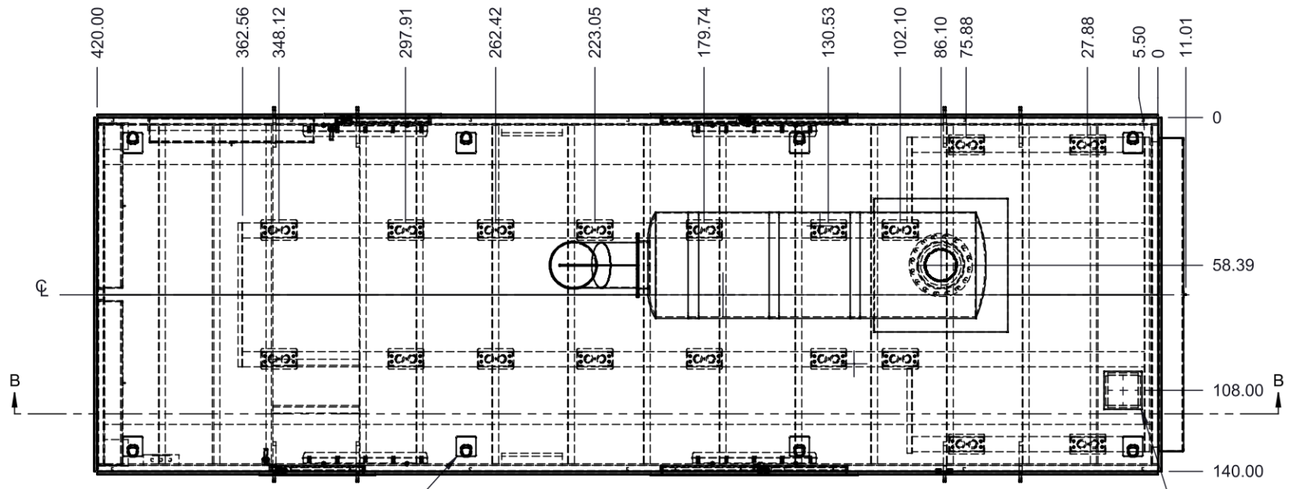
DATE: 6/29/2019

SIZE: B

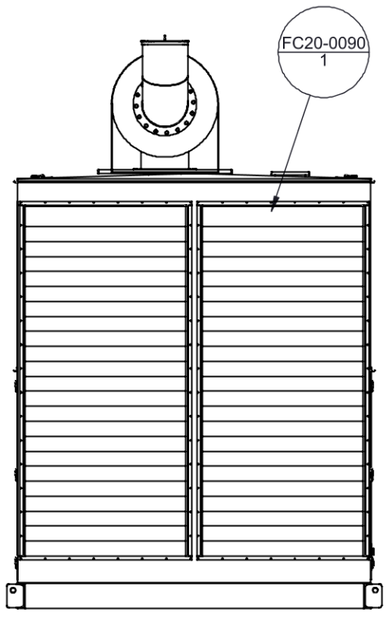
REV.: B

SCALE: 1:60

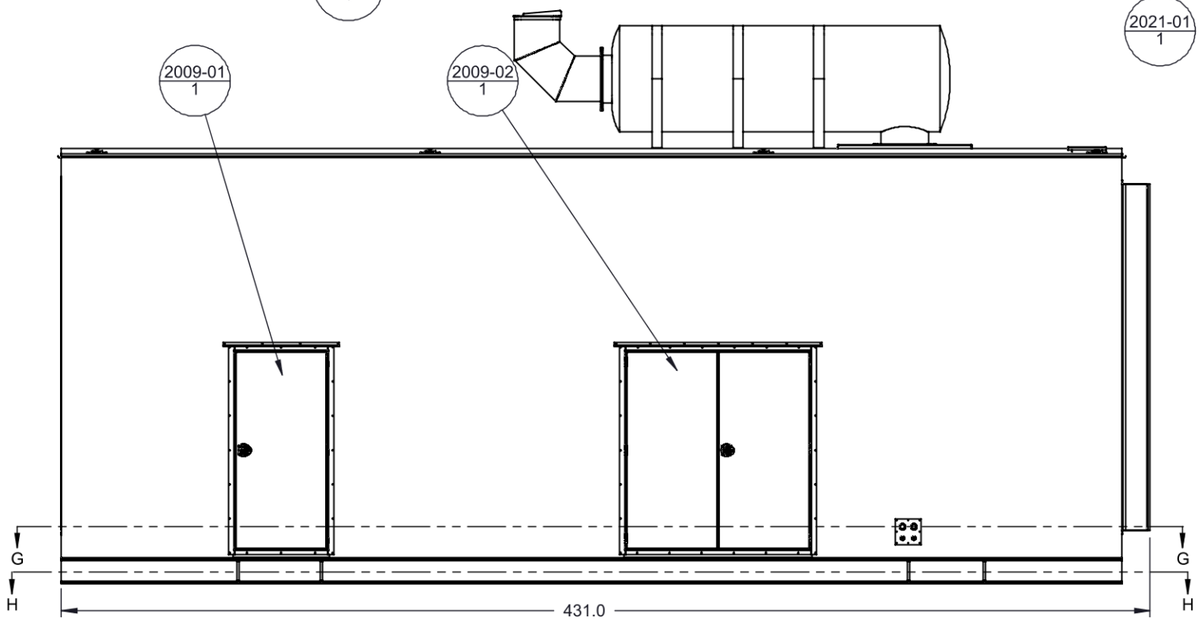
SHEET 1 OF 8



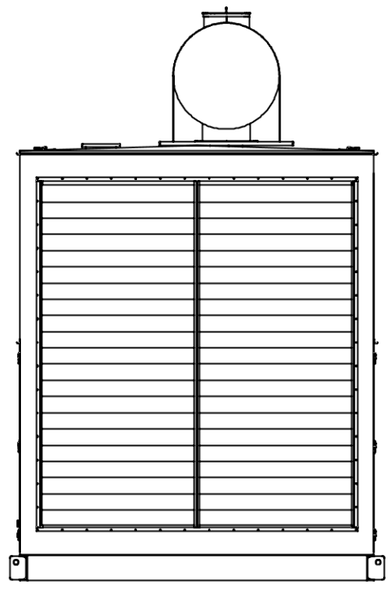
TO PVIEW



INTAKE END



SIDE VIEW



AIR DISCHAGE END

UNLESS OTHERWISE SPECIFIED
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2) TOLERANCES ARE:
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.XX ± 0.063
.X ± 0.125
FRACTIONS ± 1/16
ANGULAR ±1°

BREAK ALL SHARP EDGES AND CORNERS

DO NOT SCALE DRAWING

THIRD ANGLE PROJECTION

WEDLAKE FABRICATING, INC.
QUALITY GENERATOR PRODUCTS

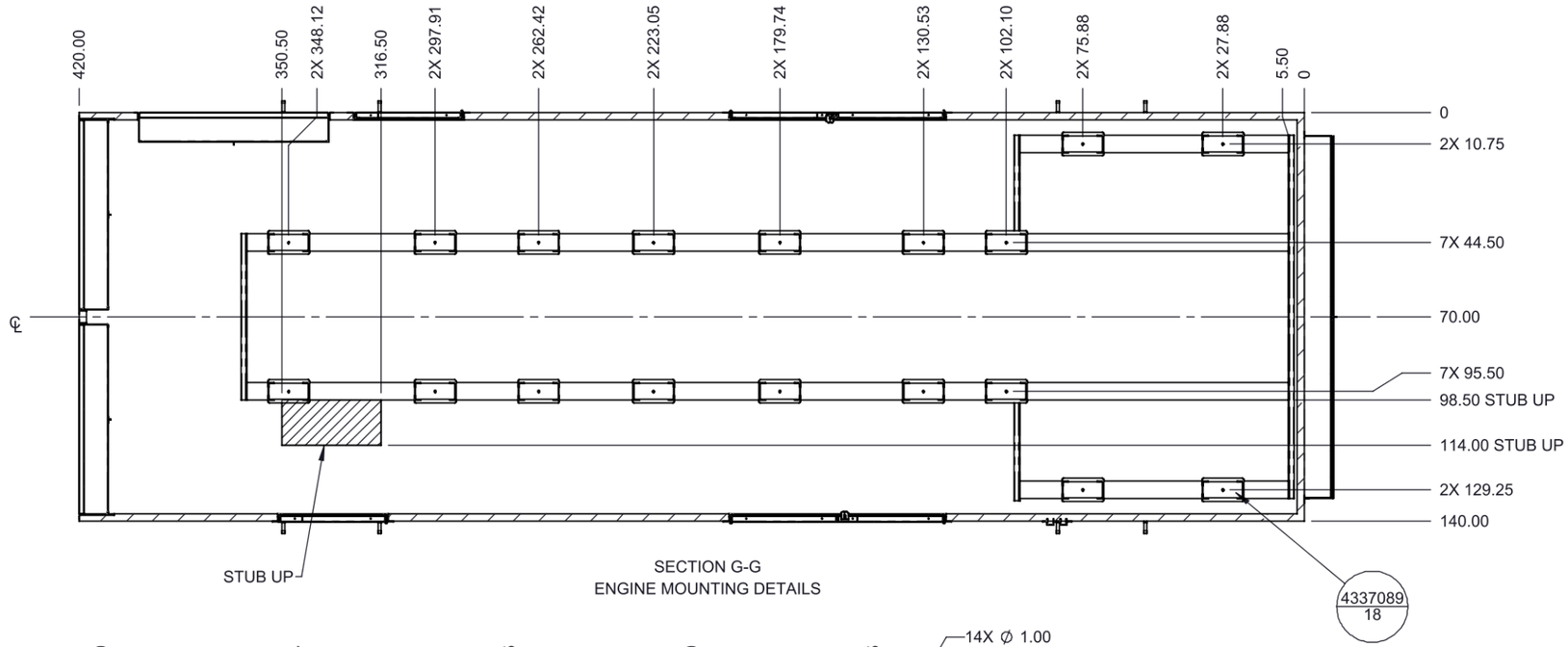
DWG. NO. 00148

DESCRIPTION: CUSTOMER APPROVAL DRAWING

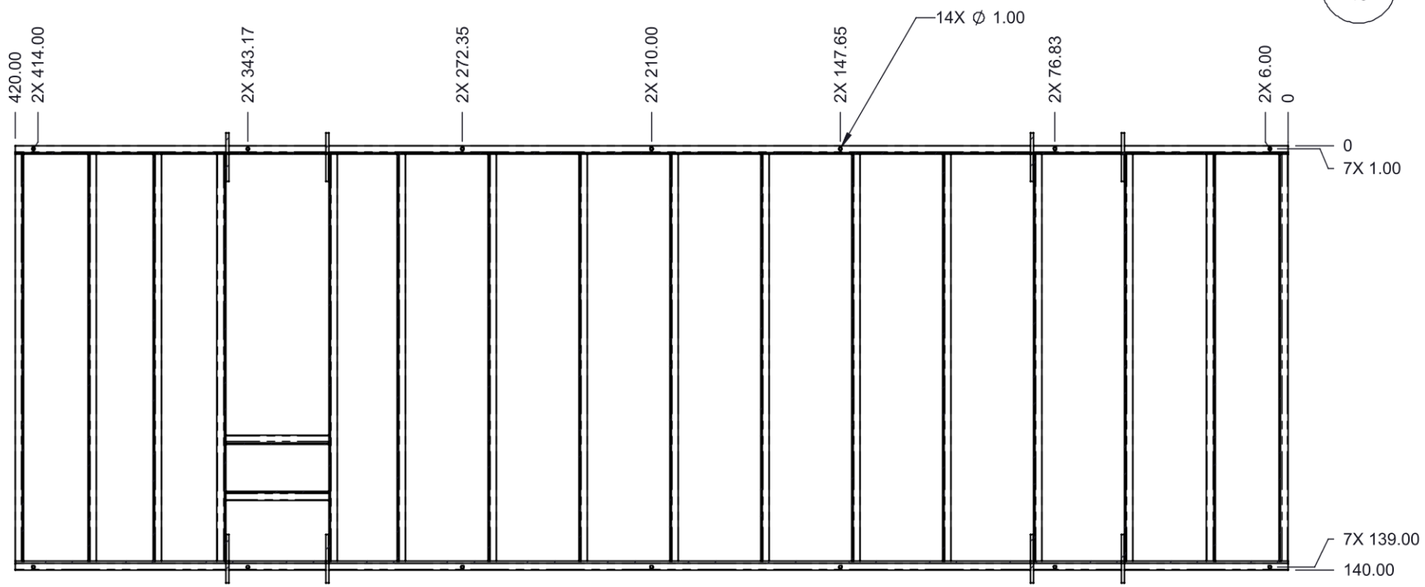
DRAWN BY	DATE	SIZE	REV.
JK	6/29/2019	B	B

SCALE: 1:60

SHEET 2 OF 8



SECTION G-G
ENGINE MOUNTING DETAILS



SECTION H-H
ANCHORING DETAILS

UNLESS OTHERWISE SPECIFIED
1) DIMENSIONS ARE IN INCHES
2) TOLERANCES ARE:
.XXX ± 0.031
.XX ± 0.063
.X ± 0.125
FRACTIONS ± 1/16
ANGULAR ±1°

BREAK ALL SHARP EDGES AND CORNERS

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

WEDLAKE FABRICATING, INC.
QUALITY GENERATOR PRODUCTS

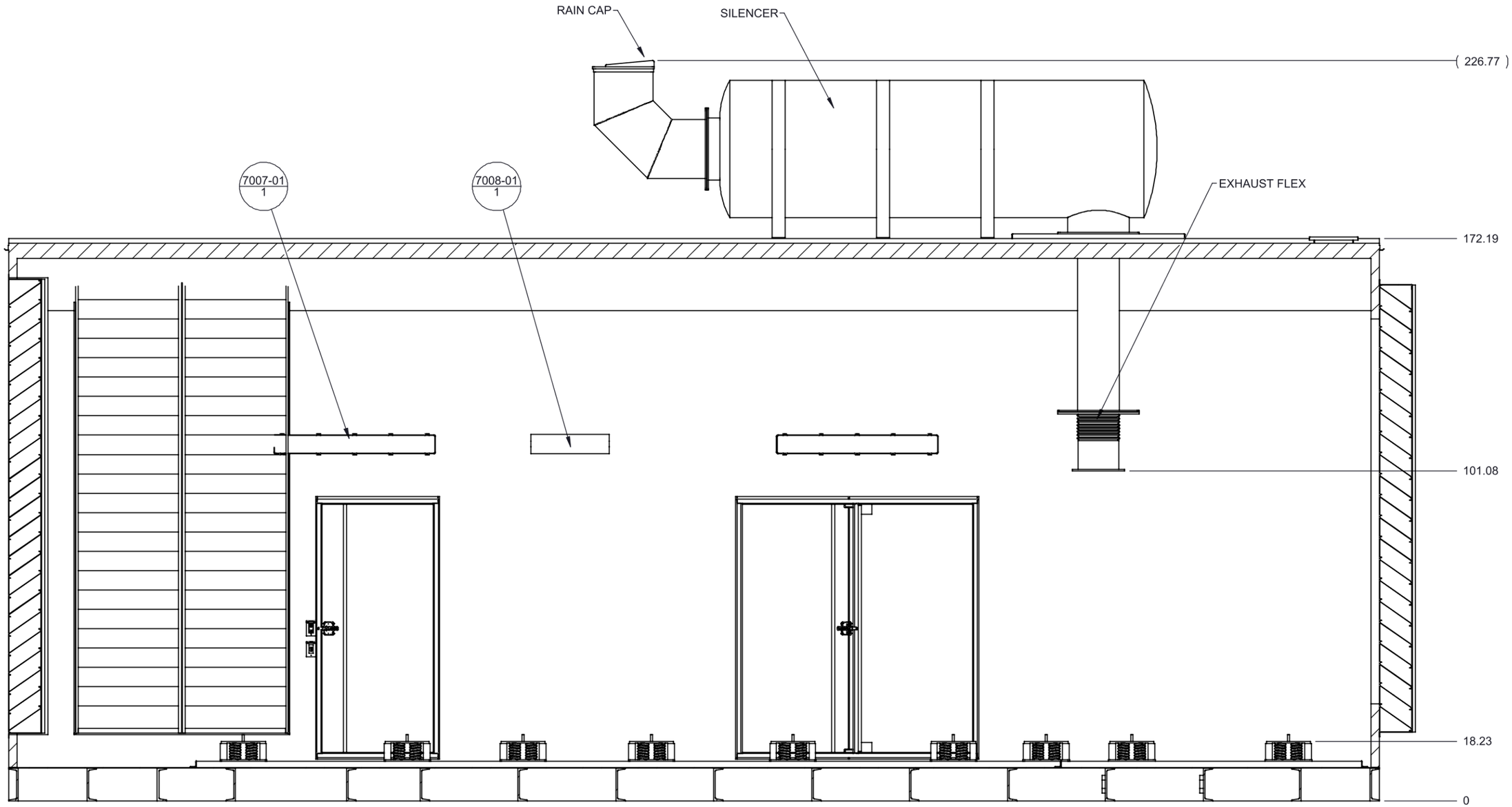
DWG. NO. 00148

DESCRIPTION: CUSTOMER APPROVAL DRAWING

DRAWN BY	DATE	SIZE	REV.
JK	6/29/2019	B	B

SCALE: 1:50

SHEET 3 OF 8



SECTION B-B

UNLESS OTHERWISE SPECIFIED
1) DIMENSIONS ARE IN INCHES
2) TOLERANCES ARE:
.XXX ± 0.031
.XX ± 0.063
.X ± 0.125
FRACTIONS ± 1/16
ANGULAR ±1°

BREAK ALL SHARP EDGES AND CORNERS

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

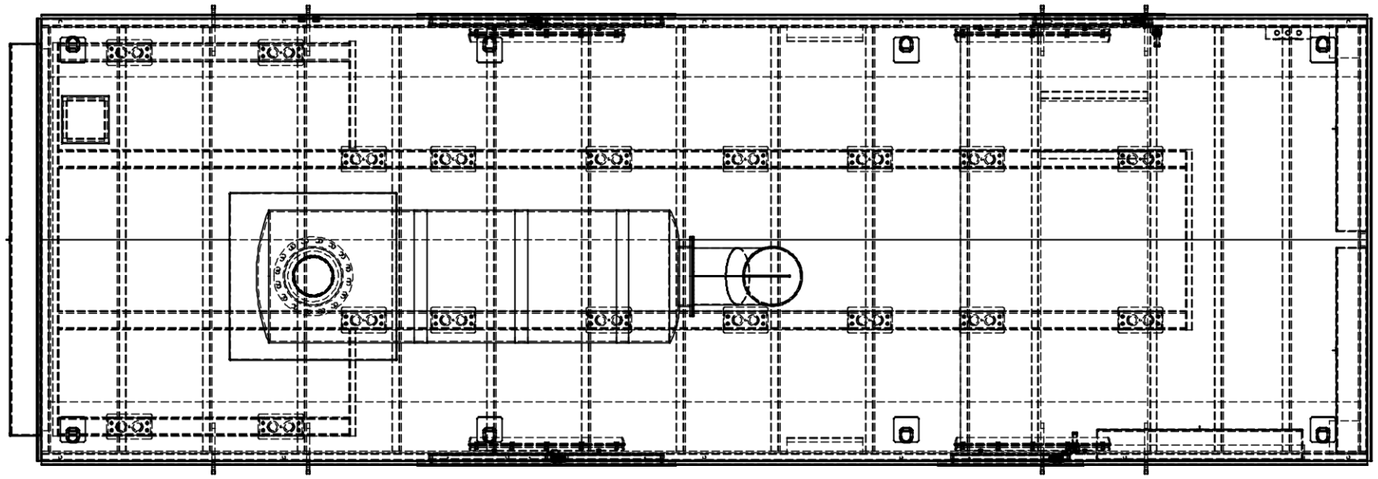
WEDLAKE FABRICATING, INC.
QUALITY GENERATOR PRODUCTS

DWG. NO.
00148

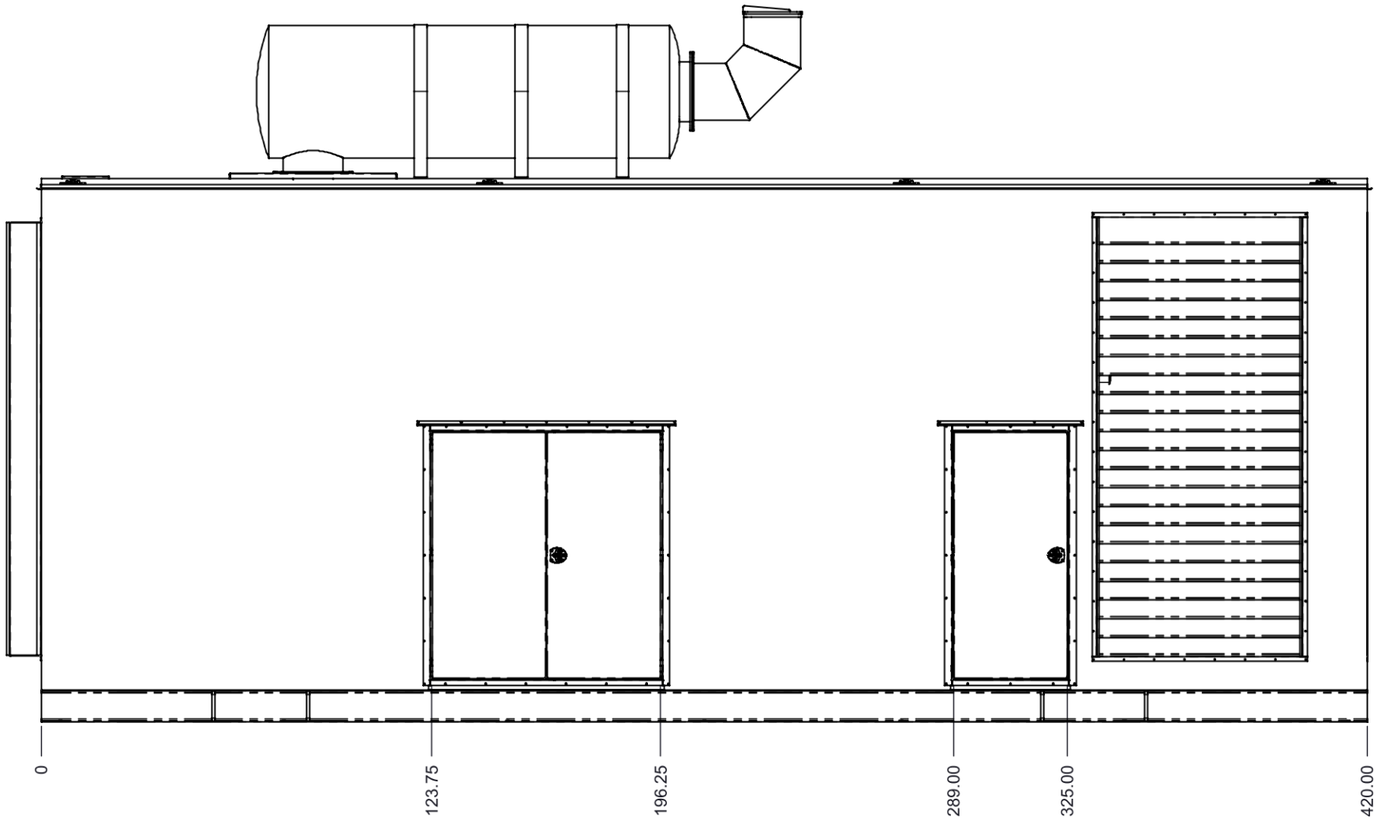
DESCRIPTION
CUSTOMER APPROVAL DRAWING

DRAWN BY	DATE	SIZE	REV.
JK	6/29/2019	B	B
	SCALE: 1:32	SHEET 4 OF 8	

RADIATOR END



TOP VIEW



UNLESS OTHERWISE SPECIFIED
1) DIMENSIONS ARE IN INCHES
2) TOLERANCES ARE:
.XXX ± 0.031
.XX ± 0.063
.X ± 0.125
FRACTIONS ± 1/16
ANGULAR ±1°

BREAK ALL SHARP EDGES AND CORNERS

THIRD ANGLE PROJECTION

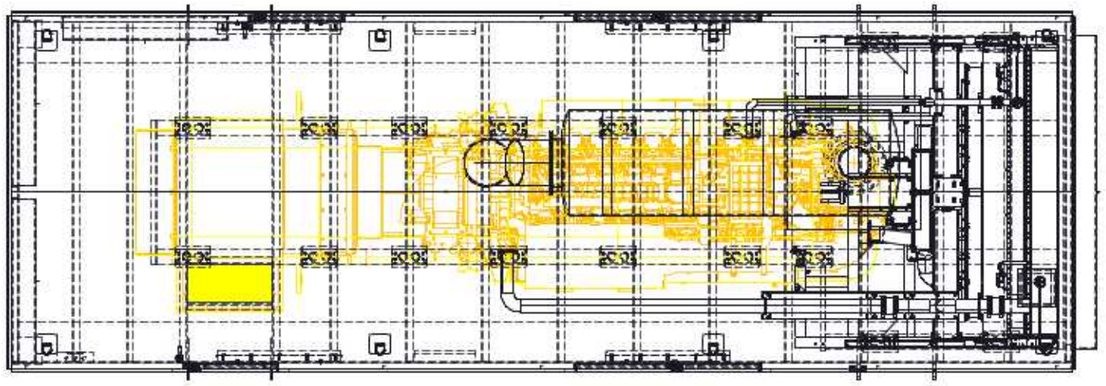
DO NOT SCALE DRAWING

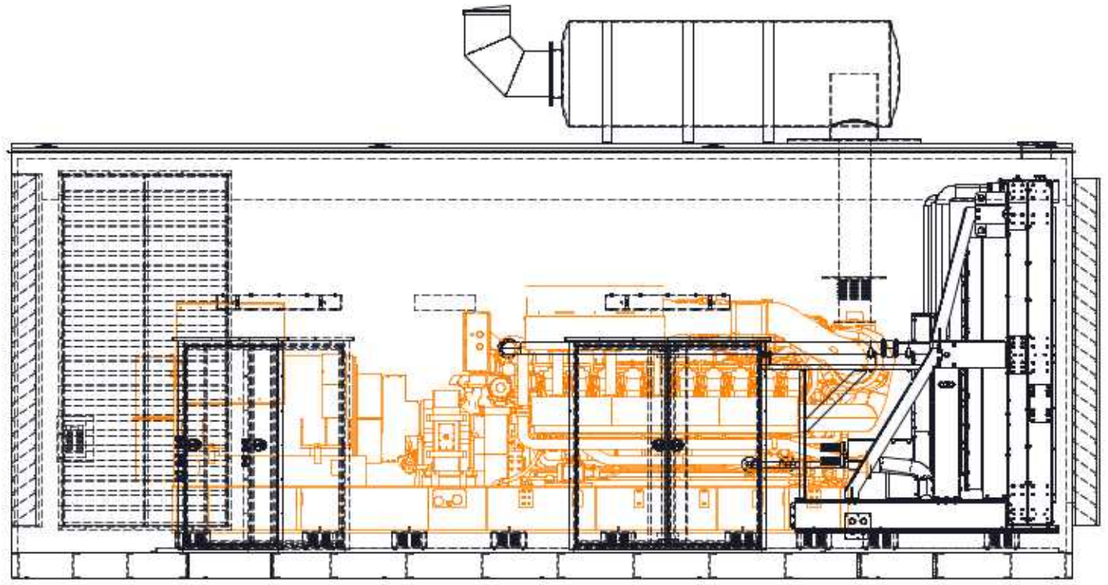
WEDLAKE FABRICATING, INC.
QUALITY GENERATOR PRODUCTS

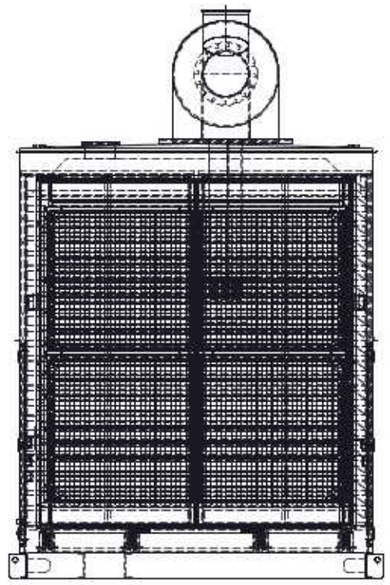
DWG. NO. 00148

DESCRIPTION: CUSTOMER APPROVAL DRAWING

DRAWN BY	DATE	SIZE	REV.
JK	6/29/2019	B	B
	SCALE: 1:48	SHEET 5 OF 8	







UNLESS OTHERWISE SPECIFIED
1) DIMENSIONS ARE IN INCHES
2) TOLERANCES ARE:
XXX ± 0.001
XX ± 0.063
X ± 0.125
FRACTIONS ± 1/16
ANGULAR ±1°

BREAK ALL SHARP EDGES AND CORNERS

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

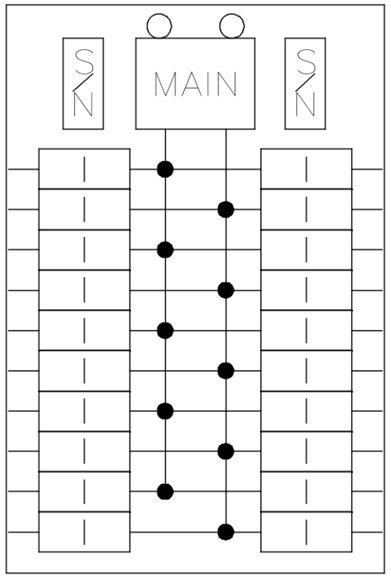
WEDLAKE FABRICATING, INC.
QUALITY GENERATOR PRODUCTS

DWG. NO.
00148

DESCRIPTION
CUSTOMER APPROVAL DRAWING

DRAWN BY	DATE	SIZE	REV.
JK	6/29/2019	B	B
	SCALE: 1:24	SHEET 6 OF 8	

DESCRIPTION	LOAD AMPS	CB AMPS	CKT NO
INTERIOR LIGHTING		20	1
GFCI RECEP 1		20	3
GFCI RECEP 2		20	5
BATTERY CHARGER		20	7
ANTI-CONDENSATE HEATER		20	9
COOLANT HEATER		50	11
			13
			15
			17
			19



CKT NO	CB AMPS	LOAD AMPS	DESCRIPTION
2			
4			
6			
8			
10			
12			
14			
16			
18			
20			

PANEL SCHEDULE

UNLESS OTHERWISE SPECIFIED
1) DIMENSIONS ARE IN INCHES
2) TOLERANCES ARE:
.XXX ± 0.031
.XX ± 0.063
.X ± 0.125
FRACTIONS ± 1/16
ANGULAR ±1°

BREAK ALL SHARP EDGES AND CORNERS

DO NOT SCALE DRAWING

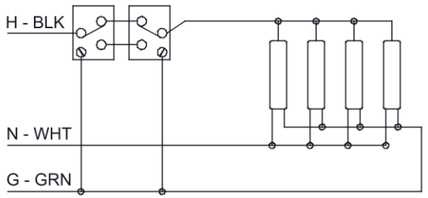
THIRD ANGLE PROJECTION

WEDLAKE FABRICATING, INC.
QUALITY GENERATOR PRODUCTS

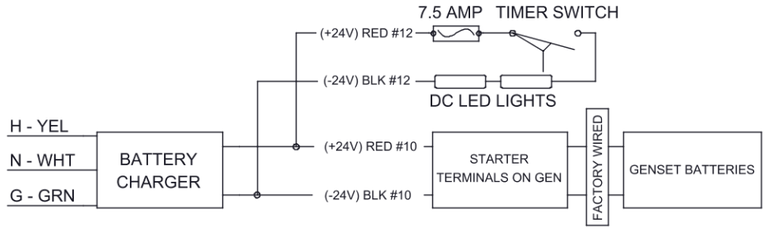
DWG. NO.
00148

DESCRIPTION
CUSTOMER APPROVAL DRAWING

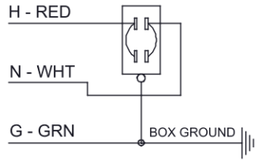
DRAWN BY	DATE	SIZE	REV.
JK	6/29/2019	B	B
	SCALE: 1:4	SHEET 7 OF 8	



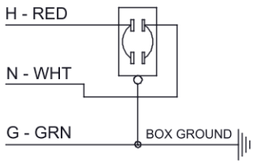
INTERIOR LIGHTING
#12 AWG WIRE



BATTERY CHARGER
#12 AWG WIRE



GFCI RECEP 1
#12 AWG WIRE



GFCI RECEP 2
#12 AWG WIRE

ALTERNATOR HEATER
#12 AWG WIRE SIZE

COOLANT HEATER
#8 AWG WIRE SIZE

UNLESS OTHERWISE SPECIFIED
1) DIMENSIONS ARE IN INCHES
2) TOLERANCES ARE:
.XXX ± 0.031
.XX ± 0.063
.X ± 0.125
FRACTIONS ± 1/16
ANGULAR ±1°

BREAK ALL SHARP EDGES AND CORNERS

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

WEDLAKE FABRICATING, INC.
QUALITY GENERATOR PRODUCTS

DWG. NO.
00148

DESCRIPTION
CUSTOMER APPROVAL DRAWING

DRAWN BY	DATE	SIZE	REV.
JK	6/29/2019	B	B

SCALE: 1:36

SHEET 8 OF 8

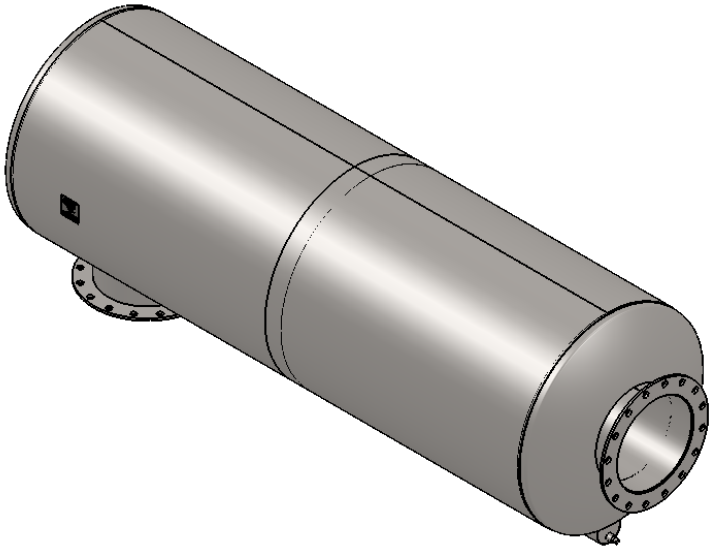
WEDLAKE

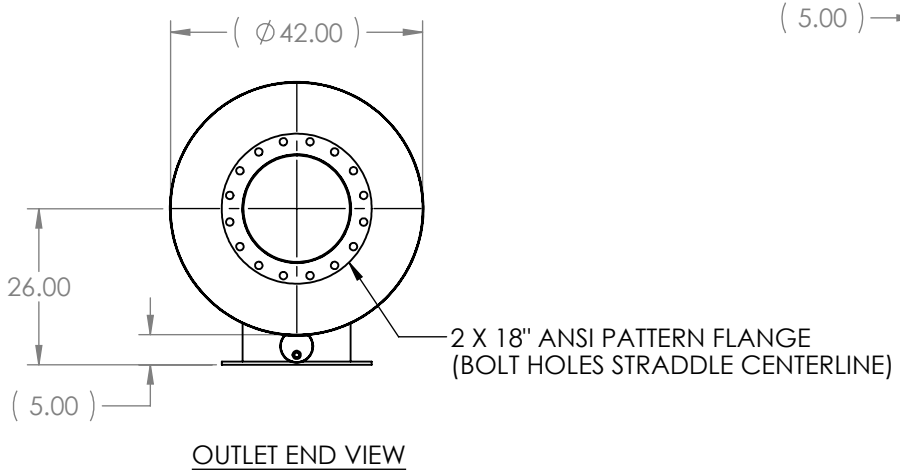
QUALITY GENERATOR PRODUCTS

PRODUCT DATA SPECIFICATION SHEETS

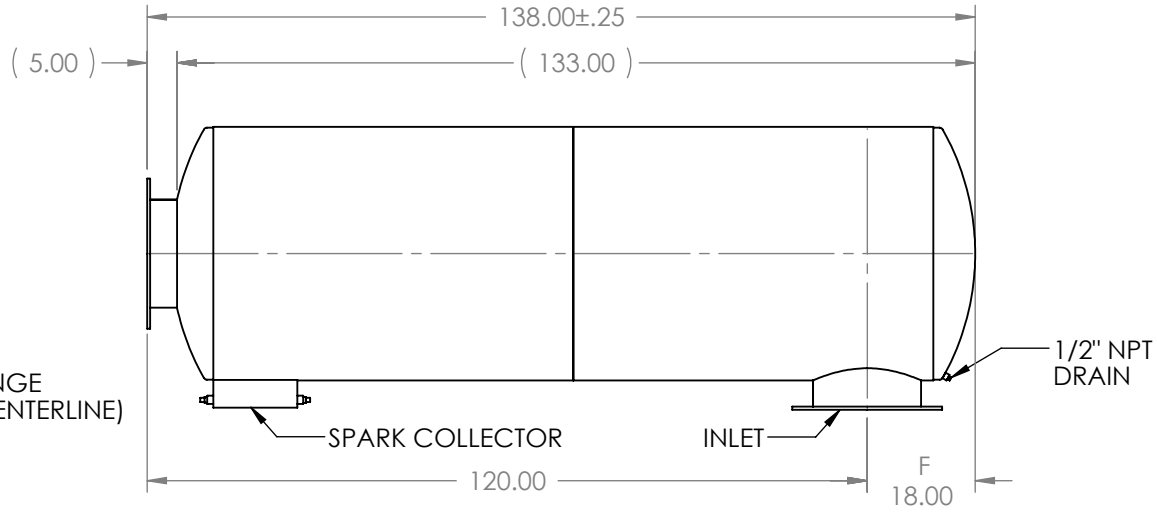
Submittal: 00148

Revision: A





OUTLET END VIEW



SIDE VIEW

NOTES:
1. F MIN = 18.00"
2. F MAX = 59.00"
3. PART #A202-5118-2-F20 WOULD HAVE AN F DIMENSION OF 20.00"

UNLESS OTHERWISE SPECIFIED:	DRAWN	ATS/KKA	03/09/11
DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ±1/8" ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ±.13 THREE PLACE DECIMAL ±.125	CHECKED		
	ENG APPR.		
INTERPRET GEOMETRIC TOLERANCING PER:			
MATERIAL SEE BOM			
FINISH HIGH HEAT BLACK			
DO NOT SCALE DRAWING			

GT EXHAUST™

PART # A202-5118-2

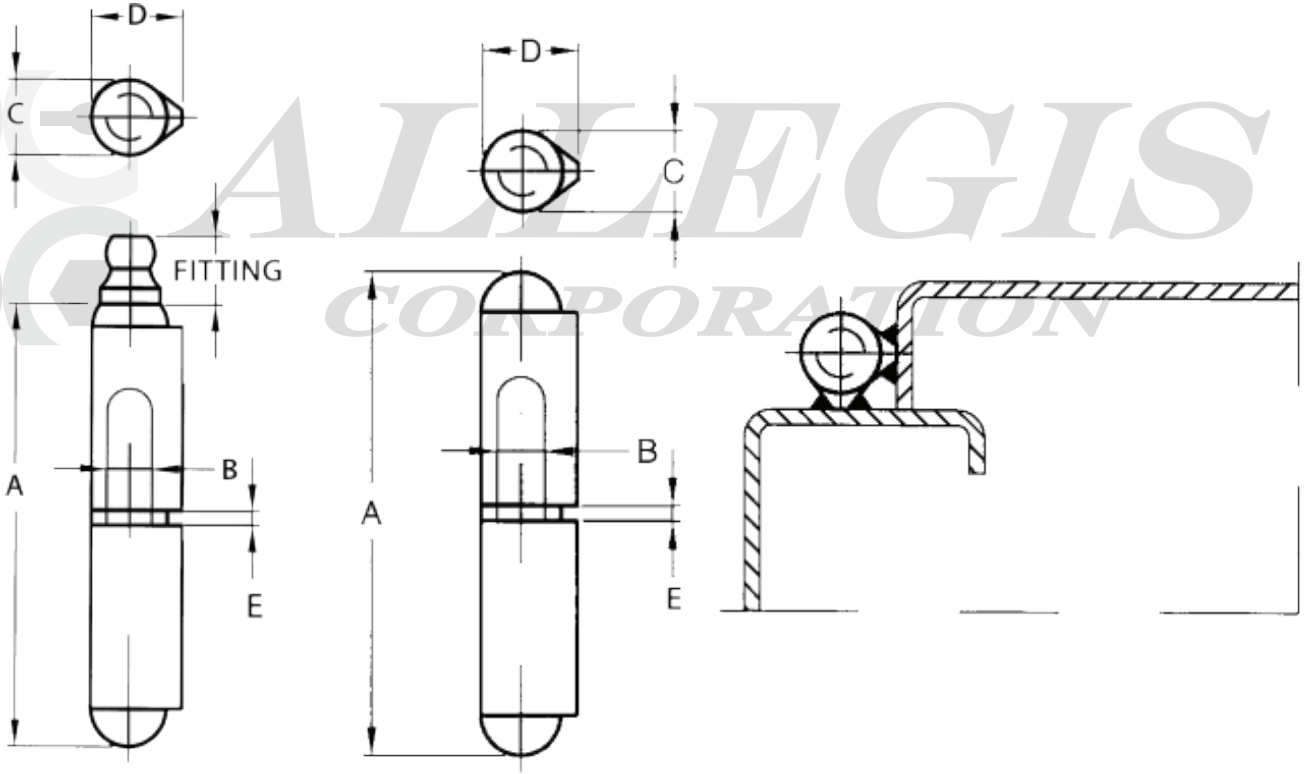
TITLE: A202-5118 18" CRITICAL GRADE S.A.
STYLE 2

SIZE	DWG. NO.	REV
A		A

SCALE: 1:32	WEIGHT: 1148	SHEET 1 OF 1

5 4 3 2 1

Brass Pin With Grease Fitting	mm	A	in.	mm	B	in.	mm	C	in.	mm	D	in.	mm	E	in.
H2360	60		2.362	6		.236	10		.393	11.9		.467	2		.078
H2370	70		2.755	6		.236	11.5		.452	13.2		.520	2		.078
H2380	80		3.149	8		.314	13		.511	15.5		.610	2		.078
H2310	100		3.937	10		.393	16		.629	19.6		.772	2		.078
H2312	120		4.724	10		.393	16		.629	19.6		.772	2		.078
H2315	150		5.905	13		.511	20		.787	25.4		1.00	2		.078
H2318	180		7.086	13		.511	20		.787	25.4		1.00	2		.078
H2320	200		7.874	16		.629	23		.905	28.5		1.122	3		.118

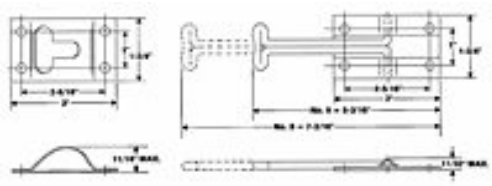


www.ALLEGISCORP.com ***1-866-378-7550***		MATERIAL / FINISH : Steel construction w/ brass pin	
REV. : 1 : 1	DATE : 2-20-2015	DESCRIPTION : Weld-on Hinge	DRAWING NO. : H2360 - H2320

Polar Hardware Mfg Co., Inc.
1813 W. Montrose Ave
Chicago, IL 60613
Phone:773.935.8600 • **Fax:**773.935.8749
Email: info@polarmfg.com • **Website:** www.polarmfg.com

Item # 9, 9 Polar Hold Tite Door Holders

Steel door holder with rigid steel wire hook. Holes for No.10 screw



Specifications

Hook Size	4 in
Material	Zinc Plated

LASTER/CASTOR CORPORATION
TULSA, OKLAHOMA

PRODUCT DATA SHEET

29 – 86 GRAY INHIBITIVE UNIVERSAL/TIE COAT PRIMER

DESCRIPTION: ***LockCote 29-86*** Gray Inhibitive Universal/Tie Coat Primer provides excellent corrosion protection of steel surfaces and can be top coated with alkyds, epoxies, or polyurethanes. ***LockCote 29-86*** Gray Inhibitive Universal/Tie Coat Primer is formulated with a corrosion inhibiting pigment that helps protect steel surfaces even in harsh marine environments. ***LockCote 29-86*** Gray Inhibitive Universal/Tie Coat Primer produces a very smooth surface which makes it suitable as an automotive primer.

TYPICAL USES INCLUDE

Storage Tanks and Piping	Marine Vessels	Automobiles
Structural Steel and Bridges	Machinery and Equipment	Buildings, Trucks, and Trailers

TYPICAL PHYSICAL PROPERTIES:

COLOR: Gray

COMPONENTS: One

GLOSS: Flat

MIXING RATIO (BY VOL.): N/A

WT./GALLON: 10.9 lbs

POT LIFE: N/A

VISCOSITY AT 77º F: 68 KU

SHELF LIFE: 2 Years

SOLIDS BY WEIGHT: 60%

TEMP. RESISTANCE: 200º F

SOLIDS BY VOLUME: 40%

CHEM. RESISTANCE: Moderate

THEORETICAL COVERAGE:
640 ft^2/gal @ 1 mil dft

FLASH POINT: 81º F, TCC

V.O.C.: 4.3 lbs/gal

RECOMMENDED D.F.T.: 1.5 – 2 mils

DRY TIME: @ 77º F, 55% R.H.

To Touch: 15 - 20 Minutes
To Handle: 2 Hours
To Recoat: 3 Hours

THINNING: Spray: T-42

APPLICATION METHODS:
Spray, Dip, Electrostatic Spray

FILM THICKNESS:

Wet: 3.5 – 5.0 mils
Dry: 1.5 – 2.0 mils

APPLICATION EQUIPMENT:

CONVENTIONAL: DeVilbiss 510 Gun
D Tip + Needle, 704 Air Cap

AIRLESS: Graco 30:1 Pump
613 Tip or equivalent

CLEANING OF EQUIPMENT:
T-42

PACKAGING:

1 Gallon Cans 5 Gallon Pails 55 Gallon Drums

APPLICATION CONDITIONS:

Surface should be dry, above 40º F and at least 5º F above the dew point.

SURFACE PREPARATION:

Remove all grease, oil, dirt, dust or other contaminants.
PREFERRED: SSPC–SP6 Commercial Blast Cleaning

CORROSIVE: SSPC–SP10 Near White Metal Blast Cleaning

MINIMUM: SSPC–SP2 and 3 Hand and Power Tool Cleaning

PREVIOUSLY PAINTED SURFACES:

Remove all grease, oil, dirt, dust or other contaminants by Hand or Power Tool Cleaning. Surface must be clean and dry, SSPC–SP2 or 3 or Brush-Off Blast Cleaning SSPC-SP7. Spot prime all bare areas.

RECOMMENDED TOP COAT:

Enamel
Epoxy
Polyurethane

SAFETY INFORMATION DOT CLASSIFICATION: PAINT UN 1263

DANGER: Causes eye burns and skin irritation. Vapor harmful. Dried film of this paint may be harmful if eaten or chewed. Contains organic solvent. Do not get in eyes, on skin or on clothing. Wear eye protective equipment when handling. Keep away from heat, sparks, and flame. Avoid breathing vapor or mist. Wash thoroughly after handling. Wear appropriate, properly fitted respirator (NIOSH/MSHA approved) during and after application unless air monitoring demonstrates vapor/mist levels are below applicable level. Follow respirator manufacturer's directions for use. Keep container closed. Keep out of reach of children.

FIRST AID: **IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. CALL A PHYSICIAN. FOR SKIN CONTACT, FLUSH WITH WATER AND WASH WITH SOAP AND WATER. REMOVE CONTAMINATED CLOTHING AND LAUNDER BEFORE REUSE. IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO-MOUTH, AND CALL A PHYSICIAN.**

NOTICE: Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling the contents may be harmful or **fatal.**

Laster/Castor Corporation
918-234-7777
www.LCCCoatings.com

AMERCOAT® 450 H

DESCRIPTION

Gloss aliphatic polyurethane topcoat (450 Series)

PRINCIPAL CHARACTERISTICS

- High gloss topcoat with unlimited recoatability
- Outstanding weather resistance with excellent color and gloss retention
- VOC compliant
- Tough, flexible and abrasion resistant
- Cures through a wide temperature range

COLOR AND GLOSS LEVEL

- Standard Color Offering, Safety Colors, Custom Colors
- Gloss

BASIC DATA AT 68°F (20°C)

Data for mixed product	
Number of components	Two
Mass density	1.1 - 1.5 g/cm^3, (8.8 - 12.1 lb/US gal), depending on color
Volume solids	67 ± 2%
VOC (Supplied)	EPA Method 24: 2.6 lb/US gal (311.5 g/l)
Temperature resistance (Continuous)	To 200°F (93°C)
Temperature resistance (Intermittent)	To 250°F (121°C)
Recommended dry film thickness	2.0 - 3.0 mils (50 - 75 µm) depending on system
Theoretical spreading rate	537 ft^2/US gal for 2.0 mils (13.4 m^2/l for 50 µm)
Shelf life	Base: at least 36 months when stored cool and dry Hardener: at least 24 months when stored cool and dry

Notes:

- See ADDITIONAL DATA – Overcoating intervals
- See ADDITIONAL DATA – Curing time
- Color will drift at elevated temperatures
- Intermittent temperature resistance should be less than 5% of the time, and maximum 24 hours
- Product is acceptable at higher film builds and may be applied up to 5 mils (127 µm) dry film thickness using multiple wet passes. A flash off time may be required in some circumstances

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Bringing innovation to the surface.™

AMERCOAT® 450 H

RECOMMENDED SUBSTRATE CONDITIONS AND TEMPERATURES

- Coating performance is proportional to the degree of surface preparation. Refer to the application instructions for specifc primers and intermediate coats for application and curing procedures. Ensure epoxies are free from amine blush prior to overcoating. All previous coats must dry and free of contaminants. Adhere to all minimum and maximum topcoat times for specific primers and intermediate coats. Aged epoxy coatings require abrading prior to applying the product. A test patch over unknown coatings is recommended.

Substrate temperature and application conditions

- Surface temperature during application should be between 20°F (-7°C) and 120°F (49°C)
- Surface temperature during application should be at least 5°F (3°C) above dew point
- Ambient temperature during application and curing should be between 20°F (-7°C) and 120°F (49°C)
- Relative humidity during application and curing should not exceed 85%

SYSTEM SPECIFICATION

- Primers: AMERCOAT 68HS, AMERCOAT 68MCZ, AMERCOAT 370, AMERCOAT 385, AMERCOAT 399, AMERLOCK 2/400, PITTGUARD Epoxies

Mixing ratio by volume: base to hardener 80:20 (4:1)

- Pre-mix base component with a pneumatic air mixer at moderate speeds to homogenize the container. Add hardener to base and agitate with a power mixer for 1–2 minutes until completely dispersed

Pot life

4 hours at 70°F (21°C)

Note: See ADDITIONAL DATA – Pot life

Application

- Area should be sheltered from airborne particulates and pollutants
- Ensure good ventilation during application and curing
- Provide shelter to prevent wind from affecting spray patterns

Material temperature

Material temperature during application should be between 40°F (4°C) and 90°F (32°C)

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AMERCOAT® 450 H

Air spray

- A moisture and oil trap in the main line is essential. Product is sensitive to moisture contamination
- Use standard conventional equipment

Recommended thinner

THINNER 21-06 (AMERCOAT 65) (xylene)), THINNER 21-25 (AMERCOAT 101) (recommended for > 90°F (32°C)), THINNER 50-48 (AMERCOAT 923)

Volume of thinner

0 - 20%

Nozzle orifice

Approx. 0.070 in (1.8 mm)

Airless spray

- 28:1 pump or larger
- Can be applied with plural component equipment

Recommended thinner

THINNER 50-48 (AMERCOAT 923), THINNER 21-06 (AMERCOAT 65) (xylene)), THINNER 21-25 (AMERCOAT 101) (recommended for > 90 °F (32°C)), THINNER 60-12 (AMERCOAT 911)

Nozzle orifice

0.013 – 0.015 in (approx. 0.33 – 0.38 mm)

Brush/roller

- Use a high quality natural bristle brush and/or solvent resistant, 1/4" or 3/8" nap roller. Ensure brush/roller is well loaded to avoid air entrainment. Multiple coats may be necessary to achieve adequate film-build
- AMERCOAT 851 flow control additive can be used to for enhanced flow and leveling with brush and roll application

Recommended thinner

AMERCOAT 65 (Xylene)| AMERCOAT 101 (recommended for >90°F (32°C)), AMERCOAT 923

Cleaning solvent

Amercoat 12 Cleaner (Thinner 90-58)

AMERCOAT® 450 H

ADDITIONAL DATA

Overcoating interval for DFT up to 2.0 mils (51 µm)					
Overcoating with...	**Interval**	**32°F (0°C)**	**50°F (10°C)**	**70°F (21°C)**	**90°F (32°C)**
itself	Minimum	24 hours	12 hours	4 hours	2 hours
	Maximum	Unlimited	Unlimited	Unlimited	Unlimited

Overcoating interval with PPG 866M (Amercoat 866M) accelerator at 2.0 mils (51 microns)						
Overcoating with...	**Interval**	**20°F (-7°C)**	**32°F (0°C)**	**50°F (10°C)**	**70°F (21°C)**	**90°F (32°C)**
itself	Minimum	32 hours	16 hours	4 hours	1.5 hours	1 hour
	Maximum	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited

Full cure times at 2 mils dft	
Substrate temperature	**Full cure**
40°F (4°C)	21 days
50°F (10°C)	14 days
70°F (21°C)	7 days
90°F (32°C)	4 days

Note: Full cure indicates substantial cure for most service conditions. Coating will continue to increase in mechanical and chemical resistance after these times.

Curing time for DFT up to 2.0 mils (51 µm)		
Substrate temperature	**Dry to touch**	**Dry to handle**
32°F (0°C)	4 hours	3 days
50°F (10°C)	90 minutes	24 hours
70°F (21°C)	45 minutes	8 hours
90°F (32°C)	20 minutes	4 hours

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Curing time with PPG 866M (Amercoat 866M) accelerator at 2.0 mils		
Substrate temperature	**Dry to touch**	**Dry to handle**
20°F (-7°C)	8 hours	3 days
32°F (0°C)	4 hours	36 hours
50°F (10°C)	75 minutes	8 hours
70°F (21°C)	25 minutes	2.5 hours
90°F (32°C)	10 minutes	105 minutes

Note: Note that pot life will be significantly reduced when using 866M accelerator

Pot life (at application viscosity)	
Mixed product temperature	**Pot life**
50°F (10°C)	6 hours
70°F (21°C)	4 hours
90°F (32°C)	2 hours

Note: The pot life will be reduced by approximately half when using 866M accelerator

Product Qualifications

- Compliant with USDA Incidental Food Contact Requirements
- SSPC Paint 36 Level 3 Performance

SAFETY PRECAUTIONS

- For paint and recommended thinners see INFORMATION SHEETS 1430, 1431 and relevant Material Safety Data Sheets
- This is a solvent-borne paint and care should be taken to avoid inhalation of spray mist or vapor, as well as contact between the wet paint and exposed skin or eyes

WORLDWIDE AVAILABILITY

It is always the aim of PPG Protective and Marine Coatings to supply the same product on a worldwide basis. However, slight modification of the product is sometimes necessary to comply with local or national rules/circumstances. Under these circumstances an alternative product data sheet is used.

PPG Protective & Marine Coatings
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AMERCOAT® 450 H

REFERENCES

• CONVERSION TABLES	INFORMATION SHEET	1410
• EXPLANATION TO PRODUCT DATA SHEETS	INFORMATION SHEET	1411
• SAFETY INDICATIONS	INFORMATION SHEET	1430
• SAFETY IN CONFINED SPACES AND HEALTH SAFETY, EXPLOSION HAZARD – TOXIC HAZARD	INFORMATION SHEET	1431

WARRANTY

PPG warrants (i) its title to the product, (ii) that the quality of the product conforms to PPG's specifications for such product in effect at the time of manufacture and (iii) that the product shall be delivered free of the rightful claim of any third person for infringement of any U.S. patent covering the product. THESE ARE THE ONLY WARRANTIES THAT PPG MAKES AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, UNDER STATUTE OR ARISING OTHERWISE IN LAW, FROM A COURSE OF DEALING OR USAGE OF TRADE, INCLUDING WITHOUT LIMITATION, ANY OTHER WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR USE, ARE DISCLAIMED BY PPG. Any claim under this warranty must be made by Buyer to PPG in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life of the product, or one year from the date of the delivery of the product to the Buyer, whichever is earlier. Buyer's failure to notify PPG of such non-conformance as required herein shall bar Buyer from recovery under this warranty.

LIMITATIONS OF LIABILITY

IN NO EVENT WILL PPG BE LIABLE UNDER ANY THEORY OF RECOVERY (WHETHER BASED ON NEGLIGENCE OF ANY KIND, STRICT LIABILITY OR TORT) FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IN ANY WAY RELATED TO, ARISING FROM, OR RESULTING FROM ANY USE MADE OF THE PRODUCT. The information in this sheet is intended for guidance only and is based upon laboratory tests that PPG believes to be reliable. PPG may modify the information contained herein at any time as a result of practical experience and continuous product development. All recommendations or suggestions relating to the use of the PPG product, whether in technical documentation, or in response to a specific inquiry, or otherwise, are based on data, which to the best of PPG's knowledge, is reliable. The product and related information is designed for users having the requisite knowledge and industrial skills in the industry and it is the end-user's responsibility to determine the suitability of the product for its own particular use and it shall be deemed that Buyer has done so, as its sole discretion and risk. PPG has no control over either the quality or condition of the substrate, or the many factors affecting the use and application of the product. Therefore, PPG does not accept any liability arising from any loss, injury or damage resulting from such use or the contents of this information (unless there are written agreements stating otherwise). Variations in the application environment, changes in procedures of use, or extrapolation of data may cause unsatisfactory results. This sheet supersedes all previous versions and it is the Buyer's responsibility to ensure that this information is current prior to using the product. Current sheets for all PPG Protective & Marine Coatings Products are maintained at www.ppgpmc.com. The English text of this sheet shall prevail over any translation thereof.

Packaging: Available in 1-gallon and 5-gallon kits

Product code	Description
AT45H23	Pearl Gray Base
AT45H3	White Base
AT45H9	Black Base
AT45HT1	Deep Tint Base *
AT45HT2	Light Tint Base *
AT45HT3	Neutral Tint Base *
AT45HT4	Red Tint Base *
AT45HT5	High Hiding Yellow Tint Base *
AT45H71	Safety Red Base
AT45H81	Safety Yellow Base
AT 45H-B	Hardener

Note: * Tintable using UCD V-Line colorants only

PPG Protective & Marine Coatings
Bringing innovation to the surface.™

Product data sheet
Characteristics

QO120M100
LOAD Centre QO MB 240V 100A 1PH 20SP

Product availability: Stock - Normally stocked in distribution facility

Main

Product or component typeproduct or component type	Load Centre
Range of productrange of product	QO
Load centre typeload centre type	Main breaker
Line Rated CurrentLine Rated Current	100 A
Number of spacesnumber of spaces	20
Short-circuit current rentsshort-circuit current	22 kA
Number of circuitsnumber of circuits	20
Number of tandem circuit breakersnumber of tandem circuit breakers	0
PhasePhase	1 phase
System VoltageSystem Voltage	120/240 V AC

Complementary

AWG gaugeAWG gauge	AWG 6...AWG 1 (aluminium/copper)
NEMA degree of protectionNEMA degree of protection	NEMA 1 indoor
Cover typecover type	Order separately
Device compositiondevice composition	Grounding bar (ordered separately)
Electrical connectionelectrical connection	Lugs
Wiring configurationwiring configuration	3-wire
Materialmaterial	Tin plated copper busbar
Box numberbox number	6
Product certificationsproduct certifications	UL listed

Ordering and shipping details

CategoryCategory	00001 - QO 1PH LC,12-42 CKT,NEMA1
Discount ScheduleDiscount Schedule	DE3A
GTINGTIN	00785901847878
Nbr. of units in pkg.Nbr. of units in pkg.	1
ReturnabilityReturnability	Y
Country of originCountry of origin	US

Offer Sustainability

Sustainable offer statusSustainable offer status	Not Green Premium product
RoHS (date code: YYWW)RoHS (date code: YY-WW)	Compliant - since 1411 - Schneider Electric declaration of conformity Schneider Electric declaration of conformity
REAChREACh	Reference not containing SVHC above the threshold
Product end of life instructionsProduct end of life instructions	Need no specific recycling operations

Contractual warranty

Warranty periodWarranty period	18 months

QO® and Homeline® Load Centers and Enclosures

Class 1100

Catalog
1100CT0501

2007

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Homeline® Circuit Breakers and Load Centers 40

a brand of Schneider Electric

SQUARE D

36559

PRODUCT DESCRIPTION

QO® Circuit Breaker Load Centers from Square D® are Underwriters Laboratories (UL) Listed panelboards. They are designed to meet residential, commercial, and industrial requirements to protect electrical systems, equipment, and people.

QO® Circuit Breaker Load Center

Features

- Single- or three-phase construction
- 30 400 A main lug or main circuit breaker ratings
- 2 4 2 circuit indoor or outdoor versions
- Flush or surface mounting
- Aluminum bus construction on fixed mains panels
- Service entrance equipment capable panels
- Straight-in wiring to minimize service cable installation
- Convertible mains to meet changing job site requirements
- Standard 22/10 k AIR series rating on main circuit breaker panels, increasing application capability
- 65 k AIR ratings for main lugs panels for industrial applications
- 65 k AIR rating with optional main circuit breaker on three-phase panels for industrial applications
- Shielded one-piece plated copper bus construction on convertible mains panels, an industry exclusive for protection and performance
- Single captive screw interior mounting on indoor panels to ease removal
- Split branch neutral for clutter-free wiring
- Top or bottom feed by rotating convertible mains panels 180 degrees
- Top or bottom feed for three-phase convertible panels by removing main circuit breaker and rotating panel 180 degrees
- Combination slot/square drive neutral, ground, and cover screws for positive drive and improved torque
- Three grounding bar mounting locations for ease of wiring
- Automatic flush adjustment cover to speed installation
- Tangential main service knockouts that eliminate offsets
- Equipment grounding bar included with main lug load centers
- Covers sold separately
- Provisions for door lock on convertible mains panel covers
- Two branch circuit breaker twistouts that are factory removed for easier installation of circuit breakers
- Side hinge doors on outdoor convertible main panels
- Outdoor panel covers lockable with padlock
- Manual and automatic transfer switch capability

QO® and Homeline® Load Centers and Enclosures
Catalog Number Description

CATALOG NUMBER DESCRIPTION

QO® Load Centers

Number Segment	Character	Description	QO®	1	3040	L	200	G	—	—
Load Center Family	QO®	UL and NOM Listed								
	CQO	CSA® Certified								
Phase	1	Blank or 1 = Single								
		3 = Three								
Spaces / Circuits	3040									
Mains Type	M	Main circuit breaker								
	MX	Main circuit breaker for Automatic Transfer Switch								
	L	Main lugs								
	U	Universal mains (studs only)								
Amperes										
Grounding Bar	Blank	Purchase separately								
	G	Included								
	N	Neutral installed								
	T	Factory-installed								
Cover	Blank	Purchase cover separately								
	C	Combination flush / surface indoor cover								
	DF	Flush cover with door								
	DS	Surface cover with door								
	F	Flush cover								
	R	Rainproof								
	RB	Rainproof for B hub								
	S	Surface cover								
Special Construction	CU	Copper bussing								
	FT	Feed-thru lugs								
	GP	Generator panel								
	NM	Non-metallic enclosure								
	R	Generator receptacle								
	WG	Wide gutter riser panel								

QO® Circuit Breakers

Number Segment	Character	Description	QO®	1	15	—
Brand	QO	Full Size				
	QOT	Tandem				
Number of Poles						
Amperes						
Device Name	Blank	10,000 AIR				
	EPD	30 mA equipment ground fault protection				
	GFI	Ground fault circuit interruption				
	HID	For use on high intensity discharge lighting systems				
	HM	High magnetic trip circuit breakers are recommended for applications where high initial inrush current may occur				
	K	Key operated				
	PL	Remote control switching capability				
	SWN	Switch neutral common trip				
	VH	22,000 AIR				
	AFI	Arc fault circuit interruption				
	CAFI	Combination arc fault circuit interruption				

36559

4-Ft. LED VAPOR TIGHT ALUMINUM HOUSING IP66 WET LOCATION

LVTSHB-4-60W-5K-CL-NC-.5HUB-24-in wire

General Description and Usage

The LVTSHB Series fixture is an IP66 wet location (wash down) LED strip fixture for use in both indoor and outdoor applications. The fixture provides a high performance optical system to deliver general ambient lighting for applications such as food service, agricultural, retail, warehouse and general commercial and industrial environments. The high-efficacy light engine delivers long life and excellent color, ensuring a superior quality lighting.

The LVTSHB Series fixtures are designed for horizontal (ceiling) or vertical (wall) surface mounting or hanging applications. Fixture housing is made of aluminum which provides strength and allows excellent heat dissipation. The diffuser is frosted enhanced polycarbonate material for high light transmittance. The LED engine is comprised of SMD 2835 LED chips which provide up to 110 lumens per watt. Recommended fixture operating temperatures are from -30 degrees C to 60 degrees C ambient. Color index is >82. Fixtures are connectable with optional connecting cord.

Electrical

Fixtures are standard for use in 120-277 volt environments. Long-life LEDs, coupled with high-efficiency drivers, provide superior level and quality of illumination for extended service life. Fixture life is greater than 50,000 hours. Maximum in-line connection cannot exceed 600 watts.

Listings

ETL certified to U.S. and Canadian standards. DesignLights Consortium® (DLC) qualified product.

Note:
Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

LED Benefits

- Environmental friendly - No mercury or lead
- Up to 60% energy saving compared to fluorescent luminaires
- Maintenance free operation, last up to 20 times longer than conventional lamps
- Direct replacement for traditional T8 fluorescent

CBI Special Part Number

LVTSHB-4-60W-5K-CL-NC-.5HUB-24-in wire

Description

> LVTSHB - LED Vapor Tight IP66

> 4 - 4 Ft. long

> 60W - 60-watt

> 5K -5000K

> CL - Clear lens

> NC - Not connectible to other fixtures

> .5HUB - 1/2-inch hub on the power end

> 24-in wire - three AC wires (black, white and green) extending outside of the hub by 24-nches.

Switches, Three Way
20A, 120-277V AC
Specification Grade Commercial Switch

HUBBELL

Features

- Thread cleaning captive mounting screw
- Abuse resistant nylon toggle
- Steel, zinc plated bridge is corrosion resistant

Ordering Information

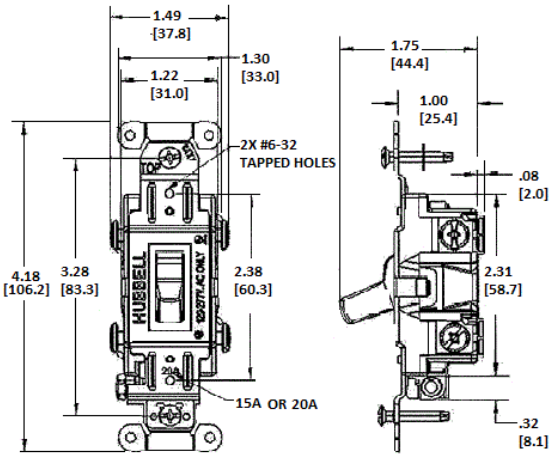
Description	Toggle Color	UPC	Catalog Number
Toggle, side wired only	White	783585902142	CS320W

Listings

UL Listed
CSA Certified
Fed. Spec. W-S-896

Specifications

Top Material	Thermoplastic, Gray
Base Material	Thermoplastic, Black
Toggle Material	Nylon
Contacts	Silver Alloy
Terminal Screws	Brass
Auto Grounding Mounting Bridge	Zinc Plated Steel
Ground Screw	Brass (Green)



Performance

Electrical

Dielectric Voltage	Withstands 1500V AC minimum for 1 minute
Max. Continuous Current	20A
Max. Working Voltage	277V AC
Overload	Minimum 4.8 times rated current for 100 cycles
Temperature Rise	30°C maximum at rated current

Mechanical

Terminal Accommodations	#14 AWG min. - #10 AWG max. solid and stranded copper wire only

Environmental

Flammability	UL 94V-2
Operating Temperature	Max. continuous: 75°C; Min. continuous: -40°C without impact

Online Resources

Customer Use Drawing
eCatalog

Dimensions in Inches (mm)

Universal Flip-Lid Weatherproof Covers

T&B Catalog Number: DCCU
UPC Number: 04226900428
Status: Active
Description:

Single Gang Universal Flip-Lid Weatherproof Receptacle Cover, Silver, Die Cast Zinc

Features

	Included adapter plates offer 12 installation options with 1-gang cover and 25 installation options with 2-gang cover.
	Keyhole openings on back enable easy installation on an existing outlet.
	Durable, die-cast zinc-alloy construction.
	Suitable for use in wet locations with cover closed.
	Lockable for security when not in use.
	Preconfigured for GFCI, the industry's most common outdoor application.
	Capable of mounting either vertically or horizontally.
	Easy access to outlet with 130 degree opening

Application

	Suitable for use in wet locations with cover closed

General

Color	Silver
Number of Gangs	One

Packaging

Package in Units	25
T&B Sold in UOM	Each
T&B Weight Per UOM	0.47 lbs. Each

Application Support

T&B Instruction Sheets	ta04044-tb2
Product Brochure-Universal Flip-Lid Cover	Available on Website
D-Pak Merchandising System	Available on Website
Industry Cross Reference	Available on Website

Certifications

File Nbr:
E 28688

For further technical assistance, please contact us...

Thomas & Betts - USA
8155 T&B Blvd.
Memphis, TN 38125
www.tnb.com

T&B Technical Support
MS 3B-50
8155 T&B Blvd.
Memphis, TN 38125

Hours: 7AM - 6PM CDT
Monday-Friday
Phone: (888) 862-3289
Fax: (901) 252-1321
Email:techsupport@tnb.com

24-VOLT DC
LED VAPOR TIGHT
1', 2', 3', 4', 8'
ALUMINUM HOUSING
IP66 WET LOCATION

24-VOLT DC
LVTSHB SERIES

Fixtures are not inter-connectible

General Description and Usage

The LVTSHB Series fixture is an IP66 wet location (wash down) LED strip fixture for use in both indoor and outdoor applications. The fixture provides a high performance optical system to deliver general ambient lighting for applications such as food service, agricultural, retail, warehouse and general commercial and industrial environments. The high-efficacy light engine delivers long life and excellent color, ensuring a superior quality lighting.

The LVTSHB Series fixtures are designed for horizontal (ceiling) or vertical (wall) surface mounting or hanging applications. Fixture housing is made of aluminum which provides strength and allows excellent heat dissipation. The diffuser is frosted enhanced polycarbonate material for high light transmittance. The LED engine is comprised of SMD 2835 LED chips which provide up to 110 lumens per watt. Recommended fixture operating temperatures are from degrees C to 60 degrees C ambient. Color index is >82. Fixtures are not connectible.

Electrical

Fixtures are for use in 24-volt DC environments. Long-life LEDs, coupled with high-efficiency drivers, provide superior level and quality of illumination for extended service life. Fixture life is 50,000 hours.

Listings

The LVTSHB is certified cETLus for installations in the U.S. or Canada. The fixture is certified to CSA C22.2 No.250.0 and conforms to UL 1598.
DesignLights Consortium® (DLC) qualified product.

Note:
Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

LED Benefits

- Environmental friendly - No mercury or lead
- Up to 60% energy saving compared to fluorescent luminaires
- Maintenance free operation, last up to 20 times longer than conventional lamps
- Direct replacement for traditional T8 fluorescent

Available Configurations

- LVTSHB-8-24DC--5K / 8-ft. / 13,200 lm
- LVTSHB-4-24DC-5K / 4-ft. / 6600 lm
- LVTSHB-3-24DC-5K / 3-ft. / 4400 lm
- LVTSHB-2-24DC-5K / 2-ft. / 3300 lm
- LVTSHB-1-24DC-5K / 1-ft. / 2200 lm

Dimensions

- 8-ft. fixture - 94"L x 3.50"W x 2.375"H
- 4-ft. fixture - 47"L x 3.50"W x 2.375"H
- 3-ft. fixture – 35"L x 3.50"W x 2.375"H
- 2-ft. fixture – 23"L x 3.50"W x 2.375"H
- 1-ft. fixture – 12"L x 3.50"W x 2.375"H

,

Fixtures provided with mounting hardware and electrical connector shown below:

Project:

Location:

Product Type:

Contact/Phone:

Model #:

FF Series
Commercial Series

The FF Series Commercial Auto-Off Timers are designed to replace any standard wall switch - single or multi-gang. This series of energy-efficient mechanical timers do not require electricity to operate. In addition, they automatically limit the ON times for fans, lighting, motors, heaters, and other energy consuming loads.

Features

- Hold feature enables the user to override the automatic shut-off function
- Rugged time dial plate easily withstands the abuse encountered in commercial environments
- Commercial “brushed metal” (plastic construction) look meets NEC requirements
- Time saving up front terminal connection with teeter-type terminals
- Press-on knob design ensures quick and easy installation
- CFL compatible

Not for use with sunlamps, saunas, or loads that could cause personal injury if timed incorrectly.

Ratings

Resistive:	20 Amp, 125 VAC, 50/60 Hz 10 Amp, 250 VAC, 50/60 Hz 10 Amp, 277 VAC, 50/60 Hz
Tungsten:	7 Amp, 125 VAC
Motor:	1 HP, 120 VAC, 50/60 Hz 2 HP, 240 VAC, 50/60 Hz
Dimensions:	2.79" H x 1.6" W x 1.19" D

FF15MC

FF60MC

FF30MH

FF Series

Model Number	Time Cycle	Switch	Hold	Color
FF5M	5 Minutes	SPST	No	Brushed Metal Finish
FF5MH	5 Minutes	SPST	Yes	Brushed Metal Finish
FF15MC	15 Minutes	SPST	No	Brushed Metal Finish
FF15MH	15 Minutes	SPST	Yes	Brushed Metal Finish
FF30MC	30 Minutes	SPST	No	Brushed Metal Finish
FF30MH	30 Minutes	SPST	Yes	Brushed Metal Finish
FF60MC	60 Minutes	SPST	No	Brushed Metal Finish
FF60MHC	60 Minutes	SPST	Yes	Brushed Metal Finish
FF2H	2 Hours	SPST	No	Brushed Metal Finish
FF4H	4 Hours	SPST	No	Brushed Metal Finish
FF6H	6 Hours	SPST	No	Brushed Metal Finish
FF6HH	6 Hours	SPST	Yes	Brushed Metal Finish
FF12HC	12 Hours	SPST	No	Brushed Metal Finish
FF12HHC	12 Hours	SPST	Yes	Brushed Metal Finish
FF315M	15 Minutes	SPDT	No	Brushed Metal Finish
FF330M	30 Minutes	SPDT	No	Brushed Metal Finish
FF360M	60 Minutes	SPDT	No	Brushed Metal Finish
FF32H	2 Hours	SPDT	No	Brushed Metal Finish
FF32HH	2 Hours	SPDT	Yes	Brushed Metal Finish
FF34H	4 Hours	SPDT	No	Brushed Metal Finish
FF34HH	4 Hours	SPDT	Yes	Brushed Metal Finish
FF36H	6 Hours	SPDT	No	Brushed Metal Finish
FF312H	12 Hours	SPDT	No	Brushed Metal Finish
FF312HH	12 Hours	SPDT	Yes	Brushed Metal Finish
FF415M	15 Minutes	DPST	No	Brushed Metal Finish
FF430M	30 Minutes	DPST	No	Brushed Metal Finish
FF460M	60 Minutes	DPST	No	Brushed Metal Finish
FF46H	6 Hours	DPST	No	Brushed Metal Finish
FF412H	12 Hours	DPST	No	Brushed Metal Finish

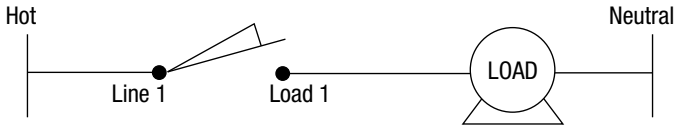
Specification

The timer shall be of the appropriate dimensions and design to provide for direct replacement of a standard wall switch in a single gang 2 ½" deep junction box. The timer shall include a spiral time scale to provide easy selection of a desired time setting. Molded white knob and brushed metal finish wall plate shall be a press-on type requiring no screw or other hardware to secure. The polymeric time dial shall replace a standard switch plate without modifications. The timer shall have a UL listed rating of:

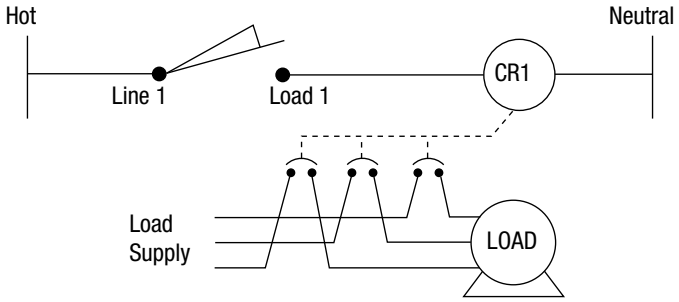
- 1 HP at 125 VAC, 50/60 Hz
- 2 HP at 250 VAC, 50/60 Hz
- 20 Amp, 120 VAC, 50/60 Hz
- 10 Amp, 250 VAC, 50/60 Hz
- 10 Amp, 277 VAC, 50/60 Hz
- 7 Amp, 125 VAC, Tungsten

The timer field wiring connections shall be secured by means of a teeter-type terminal screw to provide secure connections for appropriate wire sizes. The timer shall be _____ (SPST)(DPST)(SPDT). The timer _____ (Shall) (Shall Not) have a Hold feature and shall have a time cycle of _____(See Time Cycles Listed). The timer shall be Intermatic model _____(See Model Numbers Listed).

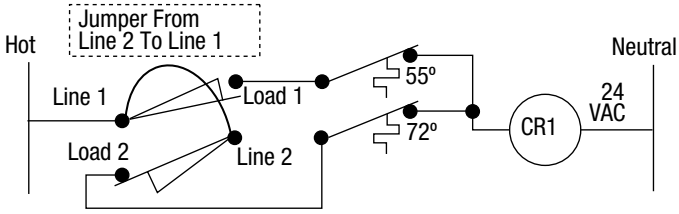
Diagrams



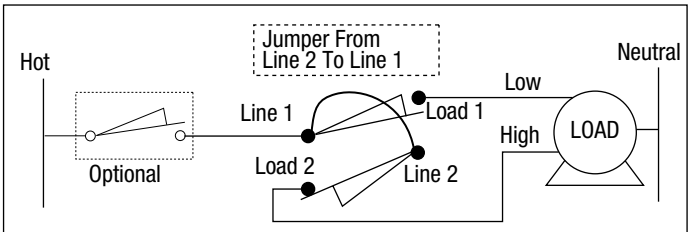
Example for SPST motor load control.



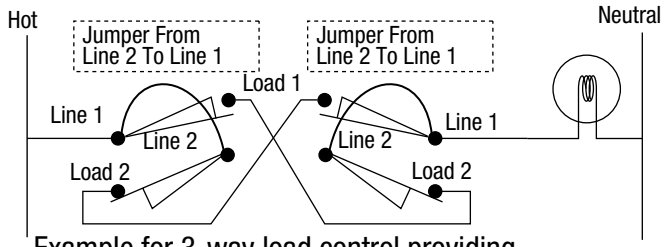
Example for SPST large motor load control using a 3-pole contactor or motor starter.



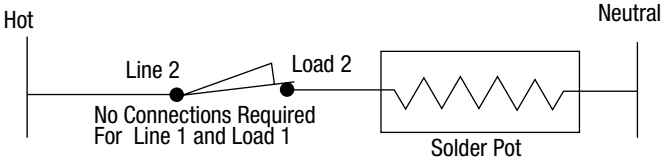
Example for control of low voltage set-back set-up thermostats using SPDT timer.



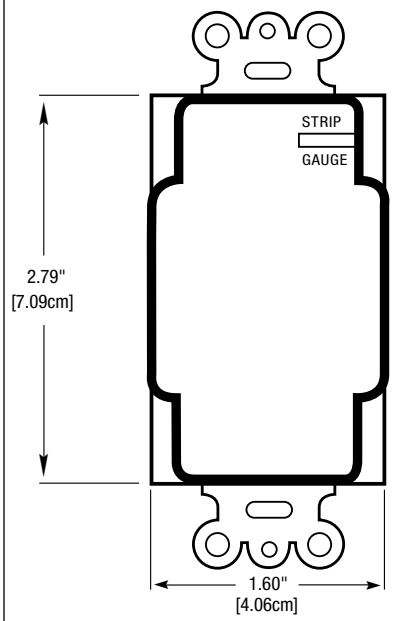
Example for timed selection of low or high speed motor with optional timer to limit operation time regardless of speed selected.

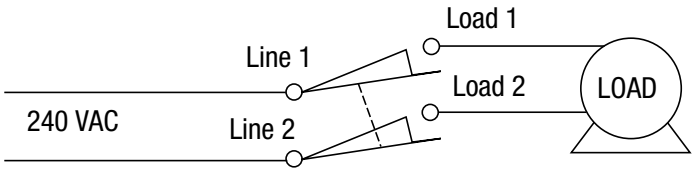


Example for 3-way load control providing timed override from more than one location.

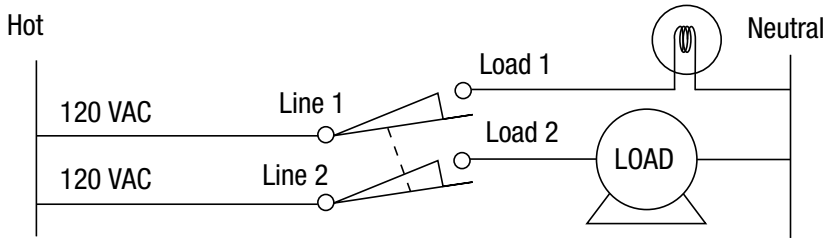


Example for reverse action control. The load is switched off when timer is operated for a limited time then switches back on.





Example for breaking both sides of a 240 volt load using DPST contacts.



Example for controlling two loads simultaneously by using DPST contacts.

Notes

Ground Fault Products
Commercial Standard GFCI Receptacles

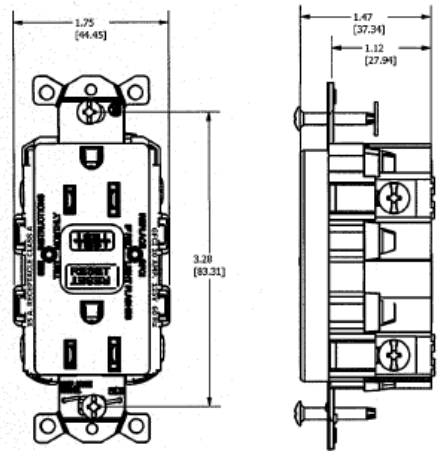
HUBBELL

Features

- Patented AUTOGUARD® self test technology
- Internal back wiring clamp and guide for quick and secure termination
- Triple wipe construction

Ordering Information

Description	Color	UPC	Catalog Number
20A, 125V, Style Line®, assembled in the USA, AUTOGUARD® self test GFCI receptacle, flush face, back and side wired, multiple drive screws	Ivory	883778124228	GFRST20IU



Listings

UL Listed - Canadian and U.S.
Meets ADA Standards
Meets all NEC® requirements
CSA Certified
NEMA® WD-6 Compliant

Specifications

Face	Nylon
Base	Nylon
Power Contacts	Brass
Ground Contacts	Brass
Mounting Strap	Zinc plated steel
Mounting Screws	Zinc plated steel

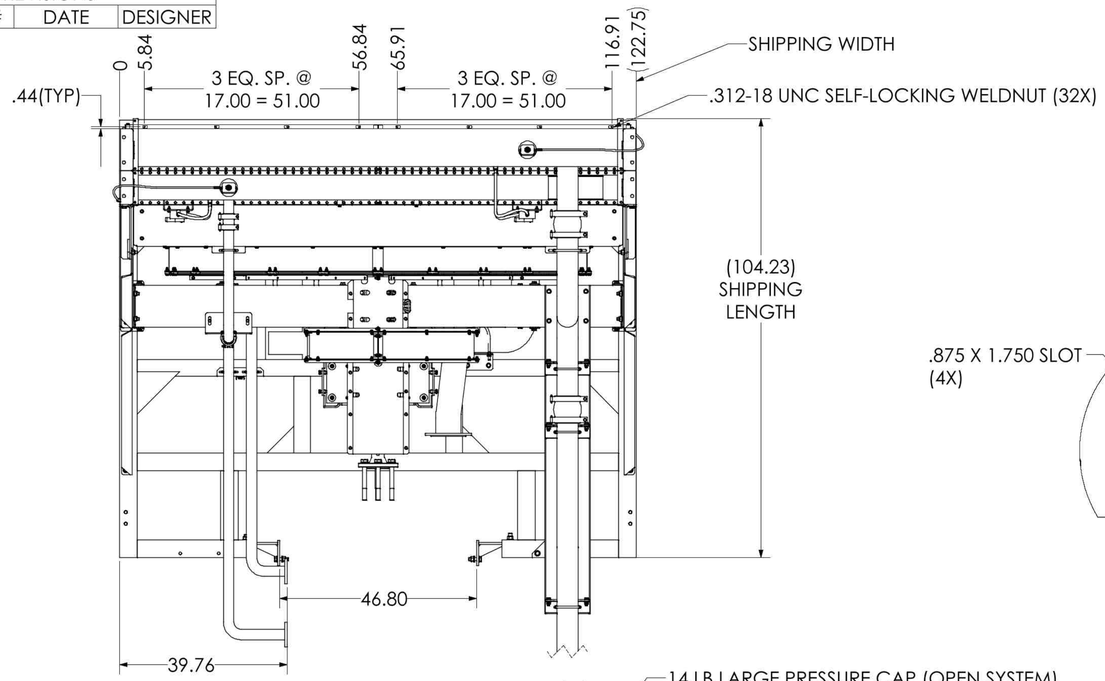
Online Resources

Customer Use Drawing
eCatalog
Installation Instructions

Dimensions in Inches (mm)

HUBBELL®
Wiring Device-Kellems

REVISIONS			
REV.	ECN #	DATE	DESIGNER



APPROVAL PRINT issued by API Heat Transfer

Check (☑) One

- ☐ Approved AS IS
- ☐ Approved AS NOTED
- ☐ Resubmit AS NOTED

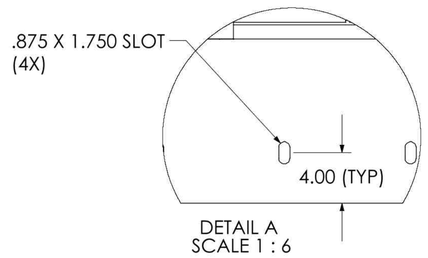
PRINT NAME

SIGNATURE

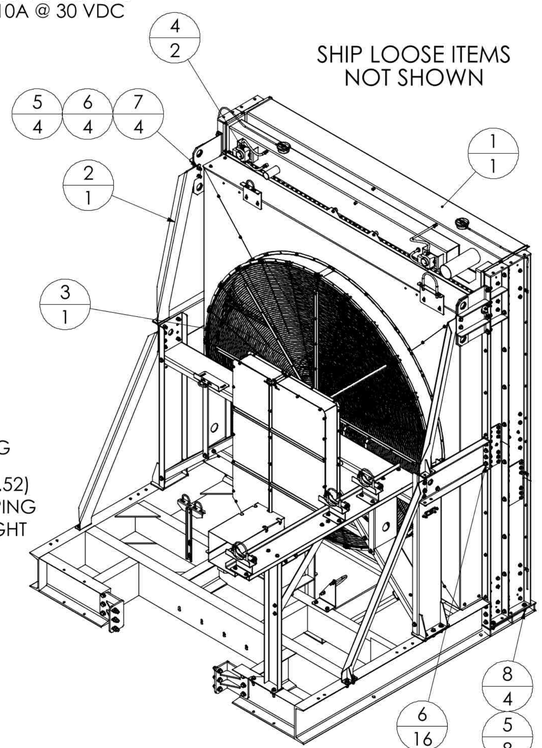
DATE

Please return Signed & Dated **APPROVAL PRINT** to API Heat Transfer

ITEM NO.	PART NO.	DESCRIPTION	QTY.
1	5147D1	BOLTED RADIATOR ASSY.(B)	1
2	5147D1-SKA	RADIATOR SKID FRAME ASSY	1
3	5147-FGG	FAN GUARD GROUP	1
4	2890B-LSG	LEVEL SWITCH GAGE	2
5	73431	.625 ZP STL SAE FLATWASHER	26
6	73004	.625-11 UNC BOLT x 2.00 LG. ZP GR8	18
7	70549	.625-11 UNC NYLON INSERT HEXNUT	22
8	70836	.625-11 UNC BOLT x 2.25 LG. ZP GR8	4
9	5147D-RET	RETRO-FIT KIT	1
10	-	*** SHIPPED LOOSE WITH UNIT ***	-
11	5147D1-DK1	DRIVE COUPLING KIT	1
12	5147D1-HWK	HARDWARE KIT	1
13	73344	PIPE KIT CAT G3520H	1



2890B/LSG NOTES:
FLOAT OPERATED LEVEL GAUGE W/ SPDT SWITCH
RATED: 10A @125 VAC
.05A @125 VDC
10A @ 30 VDC

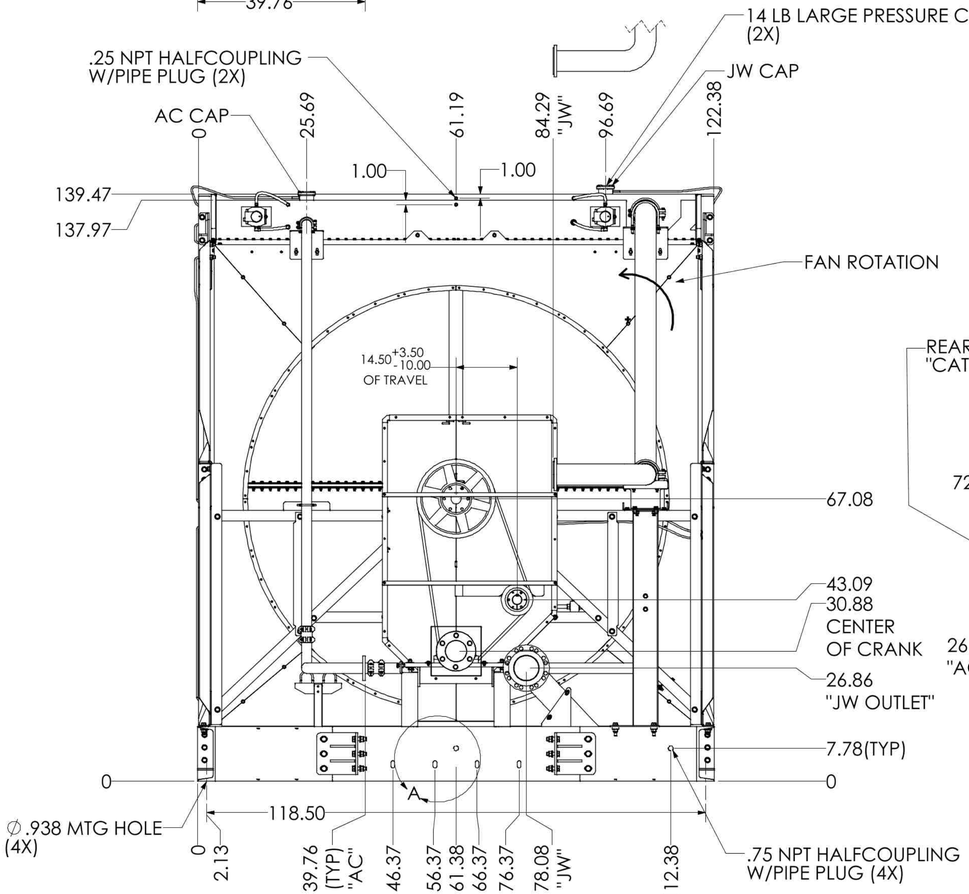


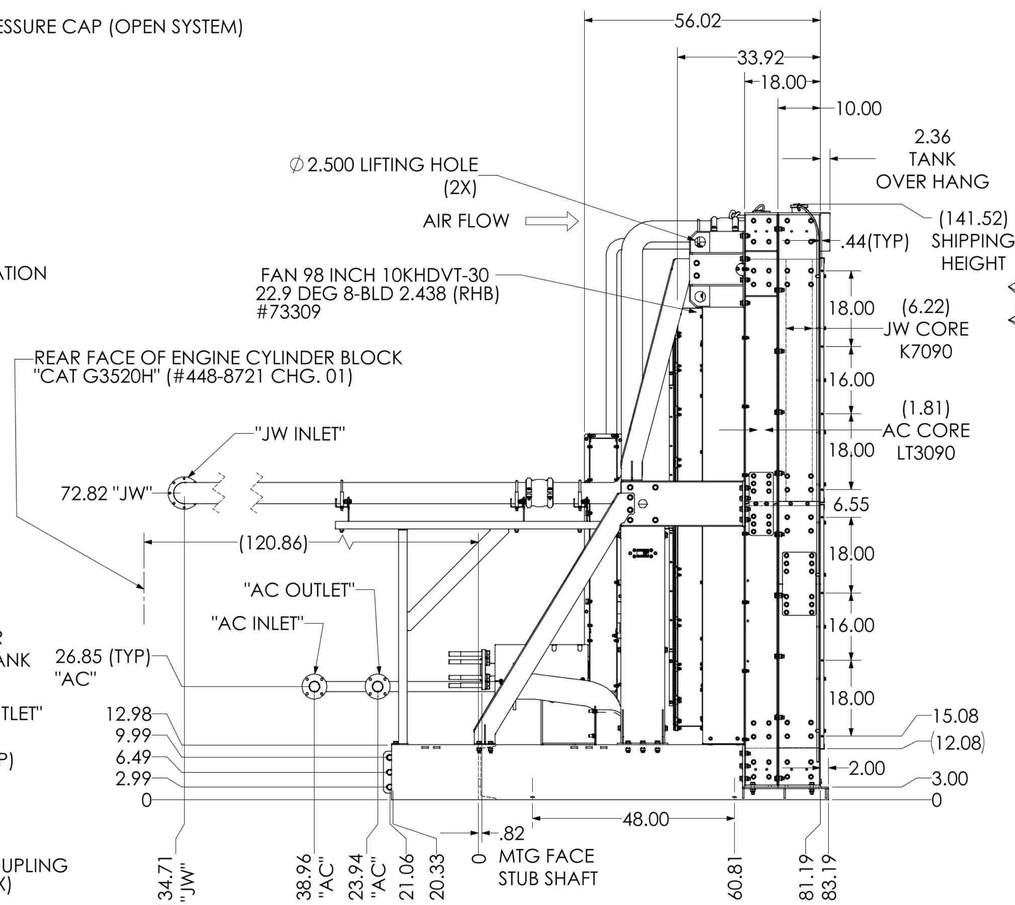
DRIVE KIT INFORMATION
ENGINE RPM: 1500
FAN RPM: 600
FAN POWER DRAW
73.3 HP @STD

ESTIMATED JW CAPACITY = 179.20 GALLONS
W/ 17.92 GALLONS OF EXPANSION

ESTIMATED AC CAPACITY =64.94 GALLONS
W/ 8.70 GALLONS OF EXPANSION

COATING: BLACK (B)
ESTIMATED UNIT DRY WEIGHT = 9588 LBS.





ALL TOLERANCES ARE NON-ACCUMULATIVE			
GENERAL TOLERANCE		STANDARD TOLERANCE	
SUPERCEDE STANDARD TOLERANCES AND ARE:		UNLESS OTHERWISE SPECIFIED ARE:	
MTG FEATURE SIZE	+/- .03	2 PLACE DIMENSIONS: +/- .19	
MTG LOCATION	+/- .06	3 PLACE DIMENSIONS: +/- .063	
MTG HOLE LOCATION CTR-CTR	+/- .06	ALL DIMENSIONS SHOWN ARE IN INCHES	
CONNECTION SIZE	+/- .03	ALL ANGLED DIMENSIONS ARE REFERENCE	
CONNECTION LOCATION	+/- .13	THIRD ANGLE PROJECTION	
CONNECTION LCTN CTR-CTR	+/- .13		

Covrad GT — An API Heat Transfer Company

CUSTOMER: MUSTANG CAT — CUSTOMER REV: -

CUSTOMER NUMBER: - — DRAWING NO: 5147D1-AS — ISSUE NO: P-03

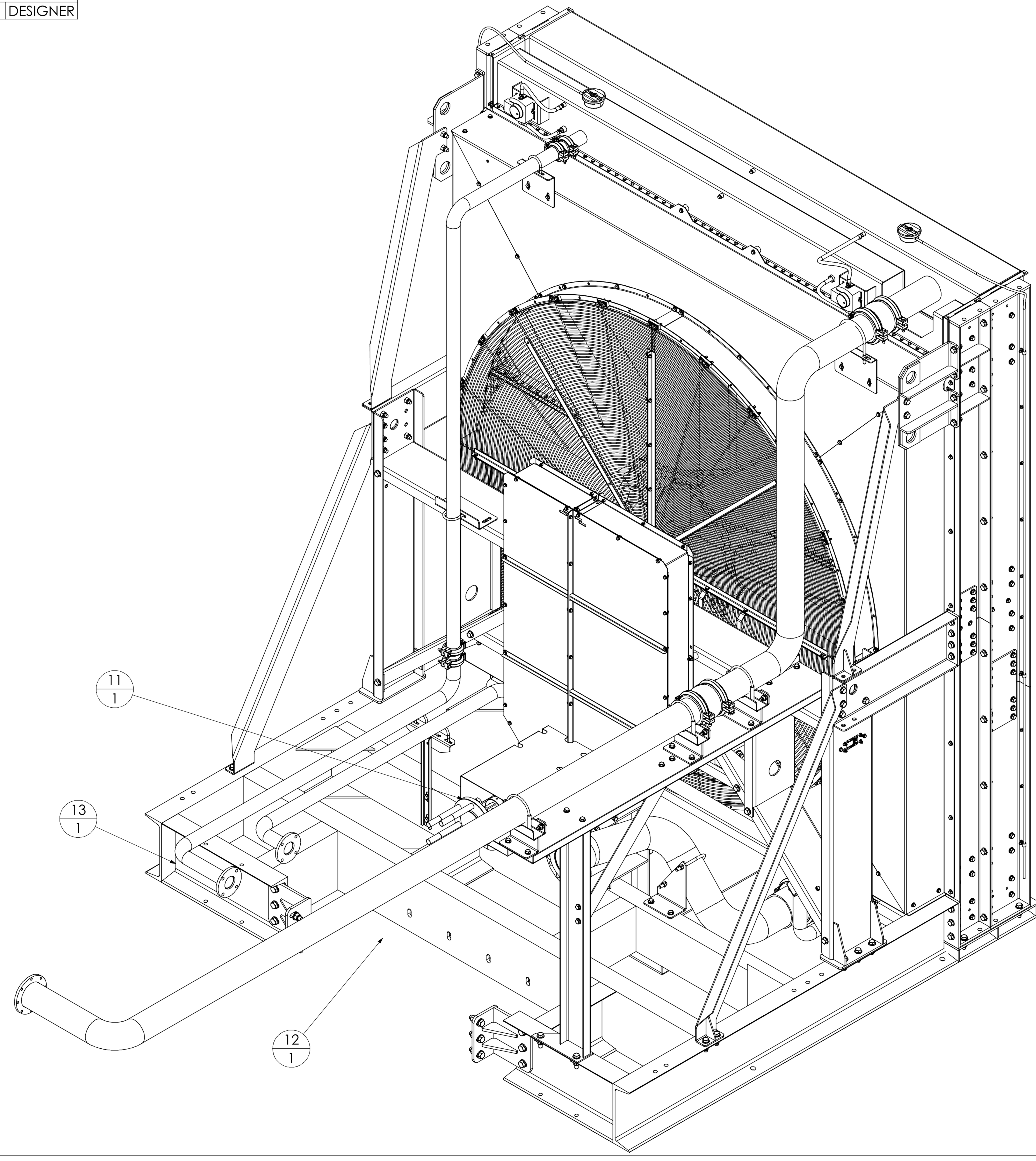
DESCRIPTION: BOLTED RADIATOR ASSY.

SCALE: 1:18 — DATE: 5/30/2019 — SHEET: 1 of 2 D

DESIGNED BY: BHB — DETAILED BY: BHB — CHK'D: -

PART NO.: 5147D1/AS

REVISIONS			
REV.	ECN #	DATE	DESIGNER



- SEE 5147D1/DK1 PRINT FOR DRIVE KIT DETAIL
- SEE 5147D/HWK PRINT FOR HARDWARE KIT DETAIL
- SEE 73343 PRINT FOR PIPE KIT DETAIL

COATING: BLACK (B)
ESTIMATED UNIT DRY WEIGHT = 9588 LBS.

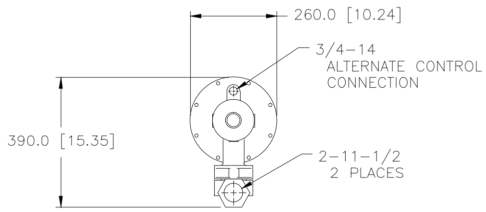
ALL TOLERANCES ARE NON-ACCUMULATIVE	
GENERAL TOLERANCE SUPERCEDE STANDARD TOLERANCES AND ARE:	STANDARD TOLERANCE UNLESS OTHERWISE SPECIFIED ARE: 2 PLACE DIMENSIONS: +/- .19 3 PLACE DIMENSIONS: +/- .063
MTG FEATURE SIZE +/- .03 MTG LOCATION +/- .06 MTG HOLE LOCATION CTR-CTR +/- .06 CONNECTION SIZE +/- .03 CONNECTION LOCATION +/- .13 CONNECTION LCTN CTR-CTR +/- .13	ALL DIMENSIONS SHOWN ARE IN INCHES ALL ANGLED DIMENSIONS ARE REFERENCE THIRD ANGLE PROJECTION

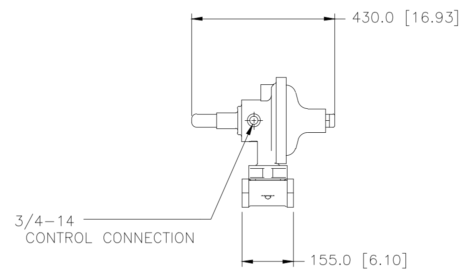
Covrad GT
An AHI Heat Transfer Company

CUSTOMER: MUSTANG CAT		CUSTOMER REV: -
CUSTOMER NUMBER: -	DRAWING NO: 5147D1-AS	ISSUE NO: P-03
DESCRIPTION: BOLTED RADIATOR ASSY.		
SCALE: 1:10	DATE 5/30/2019	SHEET: 2 of 2 D
DESIGNED BY: BHB	DETAILED BY: BHB	CHK'D: -

PART NO: 5147D1/AS

METRIC 440-8649





LA-3782 SHOWN

MODEL	TYPE	PRICING AR
G3520	1	LA-3782 CHG 04
G3516		
G3512		210-2007 CHG 04

SPEC NO.	NAME
1E2733	DRAWING-AUTOCAD
1E0011	INTPR & TOL

DRN C.A. THURMAN
CHK C.A. THURMAN
APPD M.A.MARTENS
CONCEPT | EXP | PRE PROD. | PROD. X

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN MM [INCH]
DIMENSIONS W/O TOL ARE BASIC

SCALE 1 = 5
SHEET 4 OF 4
THIRD ANGLE PROJECTION

CHG	DATE
00	01APR13

CATERPILLAR INC.

INSTALLATION-ATTACHMENT
FUEL REGULATOR

440-8649 | VER - | CONTROL DES ☒ SUB W575 | E

ASCO®

LOAD BANK
APPROVAL DRAWINGS

Audubon Husky

CUSTOMER: Mustang CAT

DATE: June 4, 2019

AVTRON

ASCO Power Technologies, 6255 Halle Drive Cleveland, OH, 44125. Telephone (216) 573-7600

ASCO Power Technologies®

www.ascopower.com

SUBMITTAL DATA

FOR

Audubon Husky

EQUIPMENT:	9820 Series Load Bank
CUSTOMER:	Mustang CAT
PURCHASE ORDER NO.:	105051 002
QUOTATION NO.:	DB19020006
VENDOR:	ASCO Power Technologies 6255 Halle Drive Cleveland, OH, 44125
ASCO SALES ORDER NO.:	2403192
ASCO SALES:	Daniel.Bichimer@ascopower.com 216-573-7600 x1552

AVTRON

ASCO Power Technologies
6255 Halle Drive
Cleveland, OH 44125

T (216) 573 7600
F (216) 573 5953

www.emersonnetworkpower.com/loadbank

SUBMITTAL BILL OF MATERIAL

Qty (1) 1319516
9820 2000KW,4160V,3PH,60Hz,
ENCLR,CPT,ALC

ASCO Series 9800 K875A-MV Listed Outdoor Medium Voltage Resistive Load Bank System:

Rated at 2000 KW at 4,160 Volts AC, 3 Phase, 60 Hertz, 277 Amps per Phase
The System will consist of an Avtron Model K875A Outdoor Resistive Load Bank and an Outdoor, Pad-Mount, Dry-type Step-Down Transformer. The Load Bank and Transformer will be factory mounted and interconnected on a common structural steel skid base. A complete description of the Load Bank and Step-Down Transformer are as described below:

Rating: 2000 KW at 480 Volts AC, 3 Phase, 60 Hertz, 2404 Amps per Phase

Tolerance: -0 to +5% overall Load Tolerance at rated Voltage.

Duty Cycle: Rated for continuous operation.

Load Step Resolution: 50 KW.

Cooling System: An integrally mounted Blower Motor with direct drive fan provides the necessary cooling air.

Control Power: An Integral Control Power Transformer is provided for control circuit operation.

Operator Controls: Remote Control Panel in a NEMA-4 type wall-mount enclosure.

Automatic Load Controller: Adjusts load bank to maintain minimum load.

Auto Load Dump Circuit: drops load bank from external contact control.

Load Elements: Avtron Helidyne™ Resistor Load Elements. No cool down period required!

Safety Features: Branch circuit fusing, a differential pressure switch provides cooling air loss protection, an over-temperature switch is provided to sense load bank exhaust temperature, blower motor circuit is protected by current limiting fuses, and thermal overload relays, operator warning and caution statements are located on appropriate access panels.

Construction: The load bank is constructed of heavy gauge aluminized steel with polyester powder coat paint finish. All exterior fasteners are stainless steel. Fork-lift channels are provided in the base for lifting. The load bank is designed for installation and operation outdoors on a roof, floor, or concrete pad. Cooling airflow is vertical. A thermostatically controlled heater strip is provided within the load bank relay compartment to minimize the effects of moisture and condensation.

Load Connections: Copper bus bars with NEMA 4-hole pattern are provided for customer load connections.

2000 KVA Step Down Transformer (Dry-Type), suitable for outdoor installation

Primary:	4,160 Volts
Secondary:	480 Volts
Phase:	3

AVTRON

ASCO Power Technologies
6255 Halle Drive
Cleveland, OH 44125

T (216) 573 7600
F (216) 573 5953

www.emersonnetworkpower.com/loadbank

Frequency:	60 Hz.
Enclosure:	Outdoor, Pad Mount Type (including air filters and anti-condensation heaters)
Windings:	Aluminum
Temperature Rise:	150 degree C
Insulation Class:	220 degree C
Protection:	Transformer Secondary Fusing provided. Transformer primary circuit breaker or disconnect device to be provided by others.

The Load Bank and Step-Down Transformer will be factory mounted and interconnected on a common structural steel skid base. Exhaust hoods to ship loose.

Load Bank Dimensions and weight: 241"L x 71"W x 150.5"H; 19,000 LBS (Approx.)

DRAWINGS FOR APPROVAL

Pub5537	**Avtron 9820 Series Outdoor, Resistive Load Bank**
Pub5604	**Avtron 9820 Series Outdoor, Resistive Load Bank, ALC**
SB4282	**Avtron 9820 Series Outdoor, Resistive Load Bank Outline**
SB2950	**Avtron 9820 Control Panel**
SB2196	**Avtron 9820 Remote Enclosure**
1319516	**Avtron 9820 Series Outdoor, Resistive Load Bank System**
1320370	**Avtron 9820 Series Outdoor, Resistive Load Bank Schematic**
1320372	**Avtron 9820 Series Outdoor, Interconnection Diagram**

ASCO® Avtron 9800 Load Bank

The ASCO Model 9800 (formerly Avtron K875A-MV) Medium Voltage Load Bank is an AC Resistive, skid mounted design for outdoor use when up to 3000 kW is required.

The ASCO Avtron 9800 load bank (part of the 9000 series permanent medium voltage product range) features the most comprehensive innovations in both design and technology.

Load Bank Ratings

Standard capacity ratings of:

- 500 kW
- 750 kW
- 1000 kW
- 1250 kW
- 1500 kW
- 2000 kW
- 2500 kW
- 3000 kW

Standard load step resolution of either 5 or 50 kW.

The 9800 comes standard with a step down power transformer which is factory mounted on an industrial skid. Typical input voltages are:

- 4160
- 12470
- 13200
- 13800

Please consult factory for non-standard ratings.

Blower Motor Control

The blower motor(s) are factory wired to the low voltage load bank input.

An optional 120V, 1 Phase, 60 Hz control power transformer is available for control circuit operation.

The control power transformer receives its power from the blower motor circuit.

Cooling System

Approximately 20,000 CFM cooling (per individual vertical frame) is provided by integral TEFC or TEAO motor which is direct coupled to the cooling fan blade.

The fan motor is fully protected with fuses, motor starter contractor, and overload relay.

Operator Controls

The standard load control for the 9800 is a remote manual toggle. Controls include: Power On/Off switch, Blower Start/Stop push buttons, Master Load On/Off switch, and Individual Load Step switches. Visual indicators include: Power On, Blower On, and Blower/Air Failure.

Digital Monitoring

Available as an option.

Construction

The load bank is constructed using heavy gauge aluminized steel per ASTM A463. It is designed for continuous outdoor weatherproof operation.

All exterior fasteners are stainless steel. The main input bus, load step relays, fuses, and blower/control relays are located in the main enclosure.

Finish

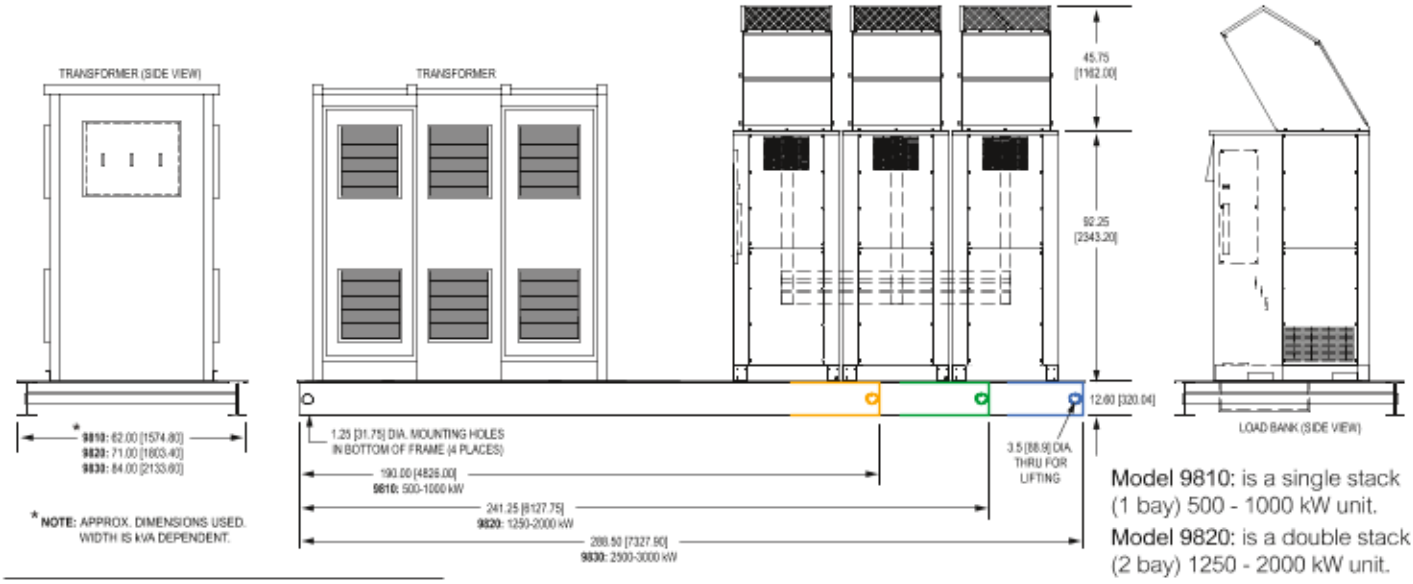
The 9800 has a high quality baked polyester powder coated finish with a film thickness of 2.8 +/- 0.4 mils per coat. The standard color is gray (ANSI 61).

Two Year Warranty Included

The equipment is covered by an industry exclusive 24-month parts and labor warranty.

ASCO®

For more information on the 9800 or any other 9000 series load bank please contact a member of our sales team at customercare@ascopower.com or 216-573-7600.



Model 9810: is a single stack (1 bay) 500 - 1000 kW unit.

Model 9820: is a double stack (2 bay) 1250 - 2000 kW unit.

Model 9830: is a triple stack (3 bay) 2500 - 3000 kW unit.

All dimensions are in inches [millimeters]. Specifications subject to change without notice.

Resistor Elements

ASCO load banks use helically wound chromium alloy Helidyne elements. Elements are fully supported across their entire length by segmented ceramic insulators on stainless steel rods. These elements are designed to operate at approximately 1/2 of their maximum continuous wire rating.

Elements are positioned within the cooling airstream for optimal performance. Changes in resistance due to temperature are minimized by maintaining conservative watt densities.

The overall load tolerance of the 9800 load bank is -0, +5%. This ensures that advertised kW is delivered at rated voltage.

The elements are continuously rated at the specific voltage. Tests at lower voltages, with a corresponding reduction in overall rating, may be carried out.

Safety Features

A differential pressure switch is interlocked with the load application controls to prevent load from being supplied if cooling air is not present.

An overtemperature switch is provide to sense the load bank exhaust. The switch is interlocked with the load application controls to disable load from being supplied if an overtemperature condition is present.

The fan motors are protected with fuses and overloads.

Major fault protection is provided by branch circuit fuse protection. Fuse protection is provided on all load steps.

The exterior of the load bank has appropriate warning and caution statements on access panels.

Internal access is restricted by bolt on exterior panels.

The air intake on the 9800 is designed to prevent objects greater than 0.50" diameter from being ingested into the unit.

Vertical air discharge is provided and exhaust air is directed upward away from personnel.

Ambient Temperature and Humidity

The 9800 load bank is designed for continuous duty cycle with no limitations. The ambient temperatures range is -20°F to 120°F (-28°C to 50°C).

Optional Accessories

- Control Power Transformer
- NEMA 4 Type Control Panel Enclosure
- Automatic Load Control
- Digital Metering with Data Logging
- SIGMA 2 Digital Controls
- Remote I/O Control
- Pilot Relay Control
- PLC Control
- Arctic Rating (low temperature)

Weight and Dimensions for Load Bank System

Capacity (kW)	Dimensions (approx. in/mm)			Weight (approx. lb/kg)
	Length	Width	Height	
500-1000	190/4826	62/1574	150.5/3822	10,000/4536
1250-2000	241.25/6127.75	71/1803	150.5/3822	19,000/8618
2500-3000	288.5/7327.9	84/2134	150.5/3822	20,500/9298

Transformer

Outdoor construction, dry type designed for 150°C rise (220°C insulation system) with secondary fusing. Primary protection, disconnect, or circuit breaker provided by others.

Documentation - Operating Manual

A comprehensive operator's manual is supplied electronically via a USB drive.

Sections include: Safety, Installation, Operation, Maintenance, and Troubleshooting.

Testing and Standards

ASCO load banks comply with NEMA, NEC, and ANSI standards. Quality control system is certified to ISO9001 standards.

ASCO Power Technologies | Avtron Load Bank Products
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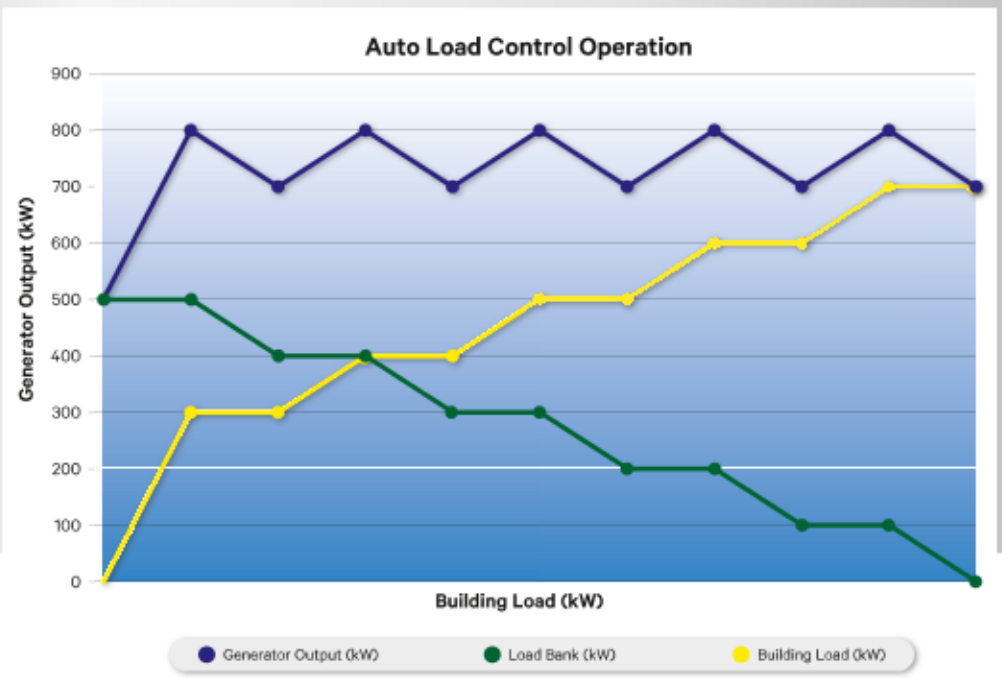
Publication 5537 • Rev. B

ASCO® Avtron Load Banks

Automatic Load Control

The ASCO Automatic Load Control is a standard accessory for 1000 SERIES (radiator mounted) or 4000 SERIES (outdoor free standing style load banks).



Typical Automatic Load Control response graph.

ASCO Automatic Load Control toggle switch shown on load bank control panel.

The Automatic Load Control (ALC) is a load bank accessory designed to add or remove load steps to maintain an approximate target load level on the generator to which the load bank is connected.

The controller is intended for use with standby or emergency backup power systems. The controller is employed during a utility service power outage when the standby generator is supplying power to the building load. When the controller is operating, the load bank will automatically provide supplemental load capacity to the power source.

The purpose of automatic load control is to maintain optimum loading of the generator and to prevent "wet stacking" on the generator which might occur when the building load alone is low in comparison to generator capacity.

Key Features

- Automatically keeps a Minimum Load on Generator Set
- Used with Radiator and Freestanding Load Banks
- Monitors Building Current
- Loose Current Transformer Provided
- Factory Set Operating Points
- Extended Time Versions also available

ASCO®

For more information on ASCO load bank products, please contact a member of our sales team at customercare@ascopower.com or 216-573-7600.

Specifications

Operation

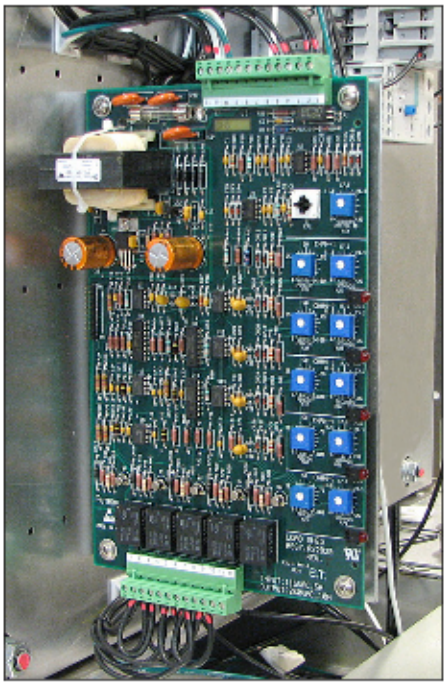
When the automatic load control is initiated, the controller will start the load bank by turning on the blower (free standing outdoor load banks only). After a time delay (typically two to five seconds), the controller begins adding load steps, with a time delay between the addition of each step. The load steps are added in sequence, usually from smallest to largest and removed in reverse sequence; first on/last off, last on/first off.

The building load is continually monitored by means of a current transformer placed between the load bank and the building load. **Correct placement of the current transformer is critical to proper operation of the automatic load control.** The current transformer does NOT monitor the load bank itself, and so does not monitor the total load on the generator. Only the building load is monitored, downstream from the generator and load bank.

With current transformer input from actual building load, the controller adds or removes load steps to supplement the building load and maintain optimum loading on the generator. The current transformer provides input to a series of current sensing relays. There is one adjustable current sensing relay for each load step. These settings are set at the factory and are based on generator kW capacity.

The current sensors enable a load step if the building load is less than the relay set point. The load step is disabled if the building load equals or exceeds the relay set point.

The automatic load control load steps are determined by the load steps available in the load bank. Load step resolution with the controller maybe different from the load step resolution on the load bank.



An Automatic Load Control circuit board.

The controller window is determined by the largest step in the controller. The window is the difference between the target maximum load at which load steps are removed, and the minimum load on the generator after the controller has dropped its largest step.

Components

The ASCO Automatic Load Control consists of a current transformer, an ASCO designed circuit board and a mode selector switch. The mode selector switch is added to the load bank control panel and is used to select load bank operation in either Manual or Automatic modes.

MANUAL MODE: In the manual mode, the automatic load control is disabled and the load bank can be used manually to test and exercise the generator.

AUTOMATIC MODE: In the automatic mode, the load bank will sit idle until an external, normally open contact closes and initiates automatic load control operations.

Generator Capacity:

The kW capacity of the generator is the single most important and essential piece of information needed when specifying Automatic Load Control. Generator capacity must be known to select the current transformer and determine load control steps. As noted above, the generator can be overloaded if the load control steps and current sensor settings are not appropriate for the generator.

Settings

The provided current transformer is sized to handle the generators maximum current at 0.8 power factor. Current sense relays are set individually for each load step. The first current sensor is set for the target maximum load (typically 80%) minus the first load control step, usually the smallest. The next current sensor and succeeding sensors are set for the previous level minus the next load control step.

Consideration must also be given for the load bank controls and fan motor(s) which may draw additional power from the generator. The potential exists that these additional current draws could overload the generator if not properly compensated for.

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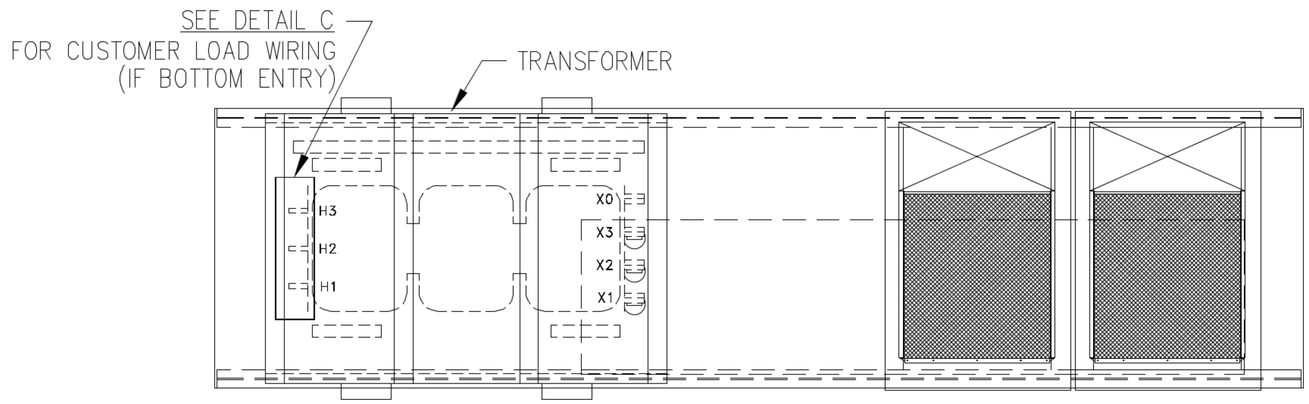
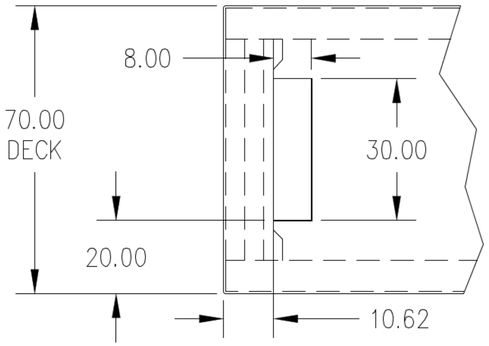
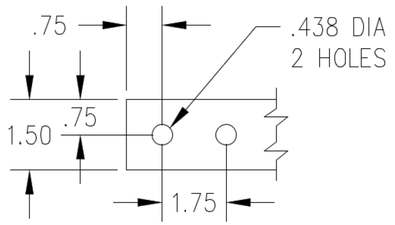
Publication 5604 • Rev. B





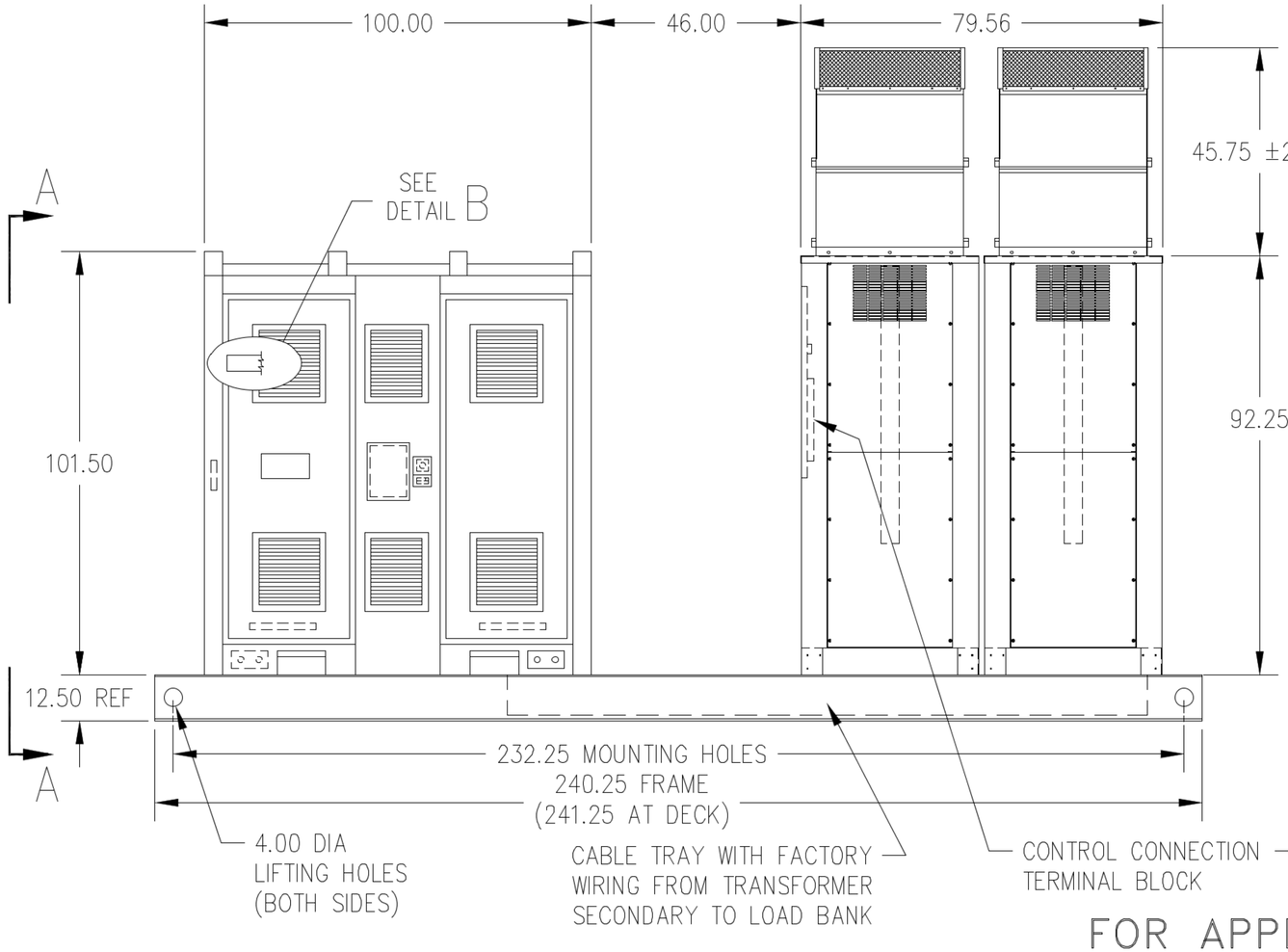
DETAIL C

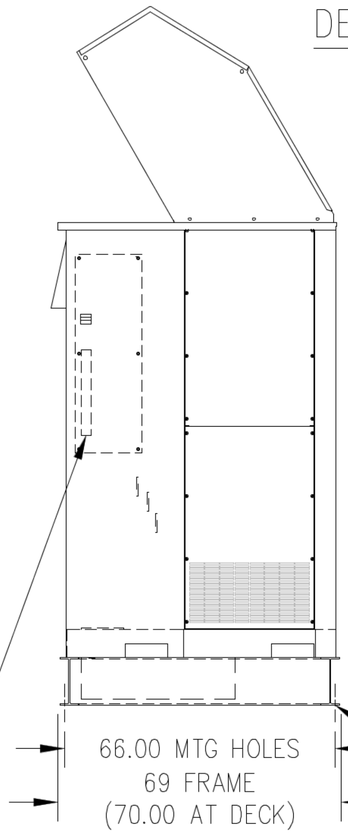


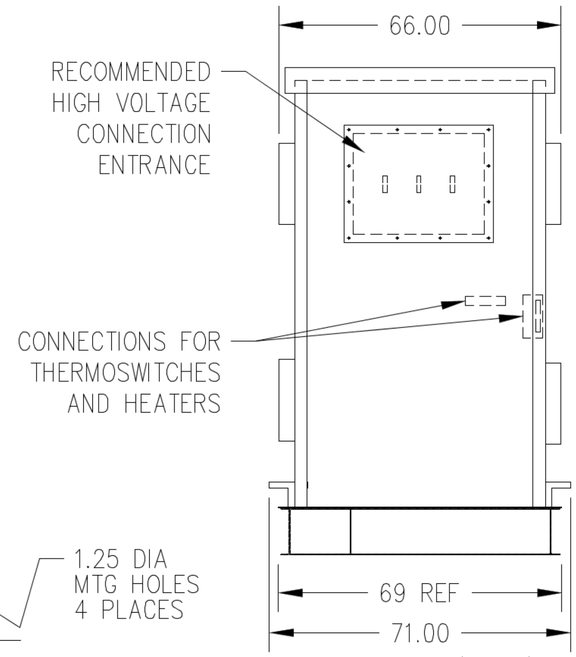
HV TERMINALS
.25 X 1.50 ALIMINUM

DETAIL B

LINE CONNECTIONS







SECTION A–A

FOR APPLICATION ENGINEERING USAGE ONLY

2. ALL DIMENSIONS ARE APPROX.
1. WEIGHT: 19,500 LBS. [8845 KG] APPROX.
UNLESS OTHERWISE SPECIFIED THE ABOVE NOTES APPLY

REV.				
D	LA3356	SJ	JPH	6/07/18
	UPDATE ACAD TEMPLATE			
C	LA1233	JAF	JWE	1/13/14
	REVISED WEIGHT			
B	LA1270	JAF	JWE	5/23/13
	REVISE PER ECN			
A	LA0680	RGR	PPP	5/27/11
	REVISE PER ECN			

REV. TO SHEET	ECN NO.	BY	APP.	DATE

PROJECT NAME:

LOAD BANK SYSTEM 2000 KVA

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	RGR	4/29/09
CHECKED	RGR	4/29/09
PROJECT APPROVAL	JWE	4/29/09
FINAL APPROVAL		

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-1-003. FOR PLASTIC PARTS SEE MP-1-055

ASSEM. REF. NO.

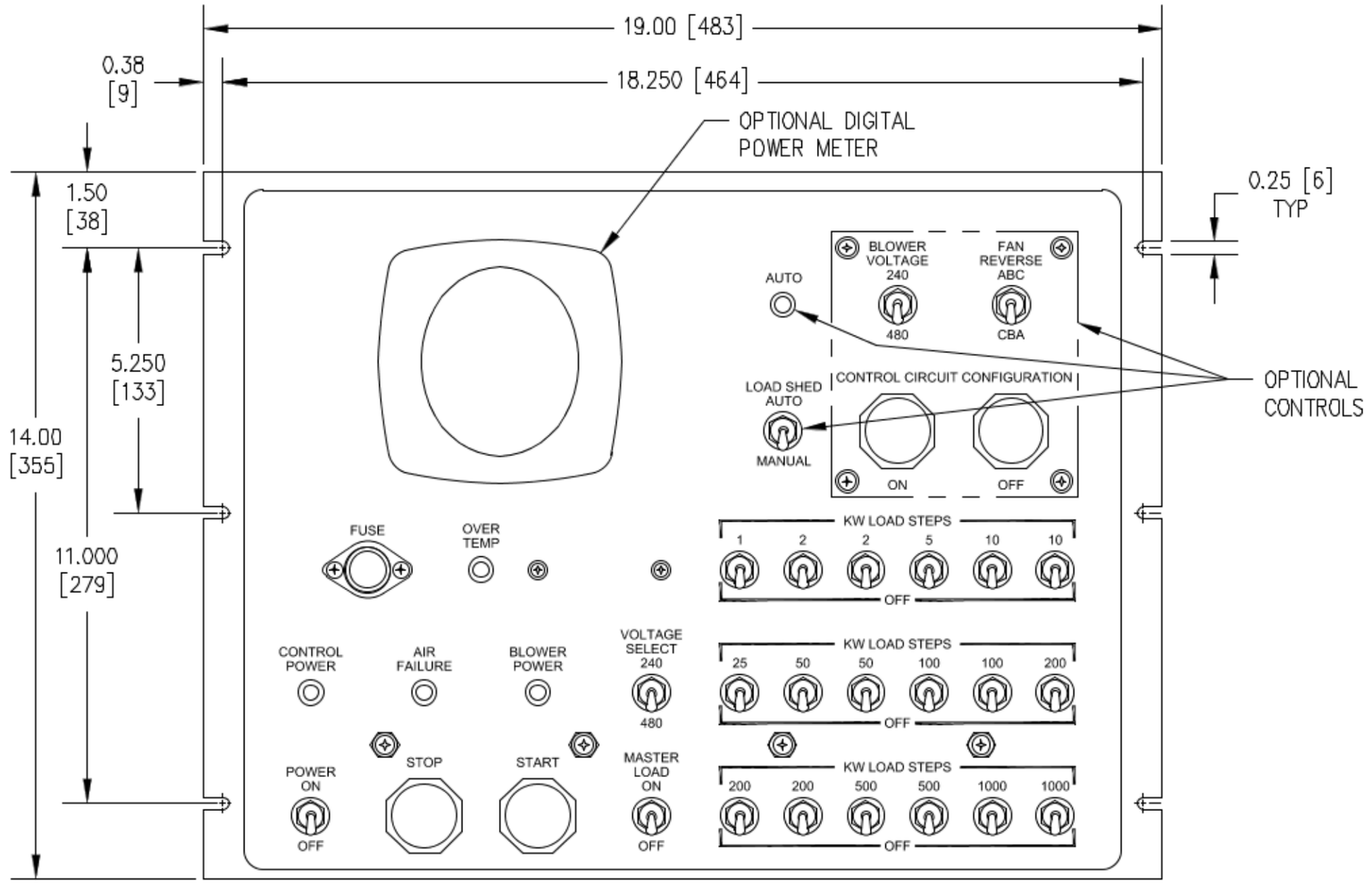
ASCO® ASCO Power Technologies, L.P. FLORHAM PARK, NEW JERSEY 07932 U.S.A.

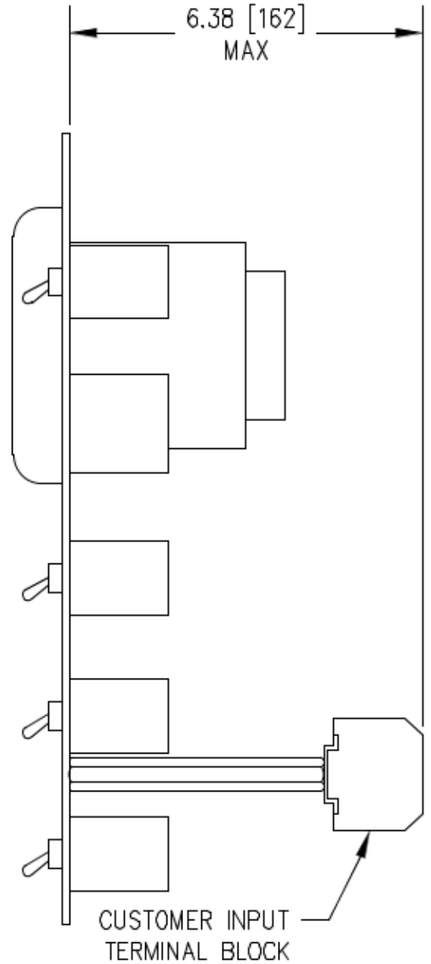
COMPUTER GENERATED DRAWING

SCALE 1/16" = 1" | SIZE DS

DWG. NO. SB4282

DRAWING REV. D | ECN NO. LA3356 | SHEET 1 OF 1





2. ALL DIMENSIONS ARE APPROX. IN STANDARD & [METRIC]
1. WEIGHT: 15 LBS [6.8 KGS]

FOR APPLICATION ENGINEERING USAGE ONLY

REV. TO SHEET	ECN NO.	BY	APP.	DATE
B	LA2191	JRF	JPH	9/16/15
	REVISED TITLEBLOCK			
A	CE414	JAF	PPP	4/13/06
	REVISED PER ECN			

PROJECT NAME:

CONTROL PANEL (OUTLINE)

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	JJF	6/23/99
CHECKED	JJF	6/24/99
PROJECT APPROVAL	DK	6/24/99
FINAL APPROVAL		

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-1-003. FOR PLASTIC PARTS SEE MP-1-055

ASSEM. REF. NO.

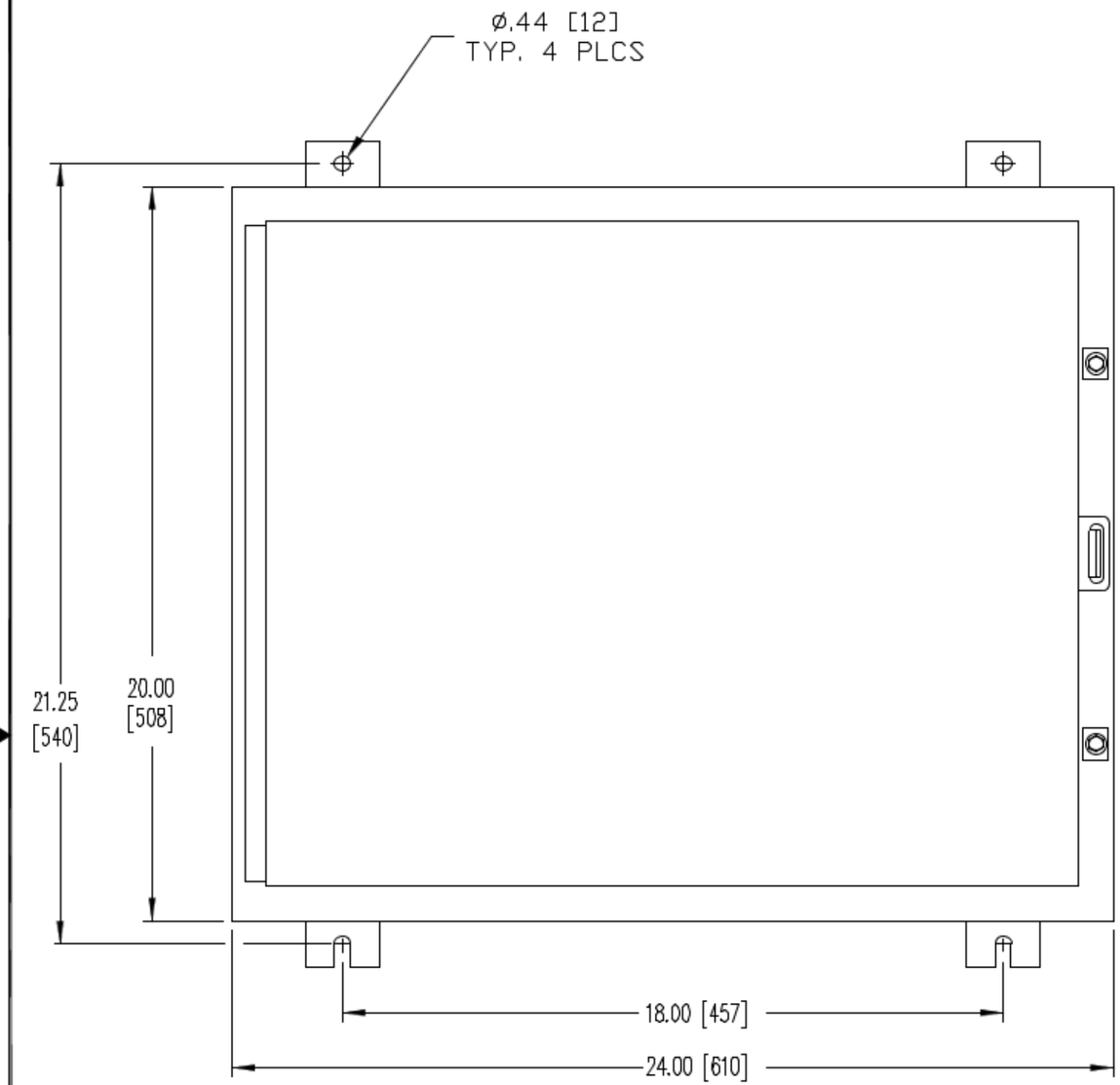
ASCO® ASCO POWER TECHNOLOGIES, L.P.
FLORHAM PARK, NEW JERSEY 07932 U.S.A.

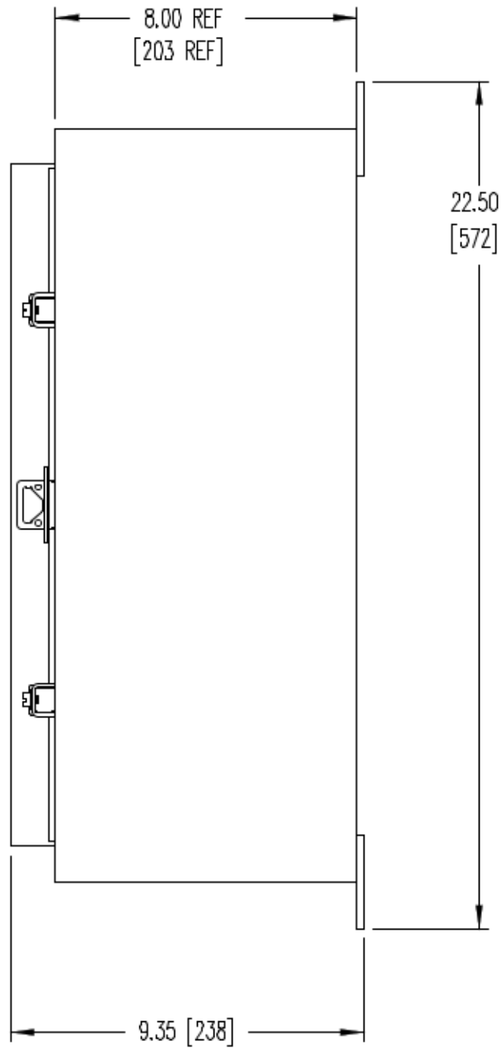
COMPUTER GENERATED DRAWING

SCALE 2.6666 | SIZE BS

DWG. NO. SB2950

DRAWING REV. B | ECN NO. LA2191 | SHEET 1 OF 1





FOR APPLICATION ENGINEERING USAGE ONLY

REV. TO SHEET	ECN NO.	BY	APP.	DATE
B	LA2849	AVC	JPH	6/2/17
	ADD METRIC DIMENSIONS			
A	CF709	RGR	DK	4/22/09
	ADD METRIC DIMENSIONS			

PROJECT NAME:

ENCLOSURE,
WALL MOUNT, TYPE NEMA 4

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	BH	4/27/92
CHECKED		
PROJECT APPROVAL	AM	4/27/92
FINAL APPROVAL		

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-I-003. FOR PLASTIC PARTS SEE MP-I-055

ASSEM. REF. NO.

ASCO® ASCO Power Technologies, L.P.
Florham Park, New Jersey 07932 U.S.A.

COMPUTER GENERATED DRAWING

SCALE 1:1 | SIZE BS

DWG. NO. SB2196

DRAWING REV. B | ECN NO. LA2849 | SHEET 1 OF 1

3. DIMENSION ARE IN INCHES [mm].
2. ALL DIMENSIONS ARE APPROX.
1. WEIGHT: 60 LBS [27.2 KG]

NOTES:

LOAD BANK SYSTEM: 2000 KVA @ 4,160 VOLT, 3 PHASE 60 HZ

ASSEMBLY INSTRUCTIONS:

1. MOUNT LOAD BANK (ITEM 2) AND TRANSFORMER (ITEM 1) TO SKID (ITEM 6) USING 3/4–10 SST HARDWARE. USE THREADLOCK AS REQUIRED.
2. ATTACH FUSES (ITEM 5) TO X1–X3 CONNECTIONS ON THE TRANSFORMER'S SECONDARY USING 1/2–13 HARDWARE.
3. MOUNT TWO WIRE SUPPORTS (ITEM 9) AS REQUIRED TO SUPPORT CABLE (ITEM 3) OFF SECONDARY FUSES ON TRANSFORMER ITEM #1.
4. USE TWELVE 4/0 CABLES IN PARALLEL FROM EACH OF THE TRANSFORMER'S SECONDARY BUS FUSES TO EACH OF THE LOAD BANK'S INPUT BUSS BARS. ALL CABLES USED SHOULD BE THE SAME LENGTH. WIRE PER SHEET 3.
5. USE THREE 4/0 CABLE TO CONNECT THE TRANSFORMER'S SECONDARY "X0" TO THE TRANSFORMER'S GROUND BUS AND TO THE LOAD BANK'S GROUND STUD. ATTACH TWO WRAPS OF GREEN ELECTRICAL TAPE TO EACH END OF THESE CABLES. WIRE PER SHEET 3.
6. CABLES RUN BETWEEN THE TRANSFORMER AND THE LOAD BANK SHOULD BE RUN IN THE CABLE TRAY. CABLES SHOULD BE EVENLY SPACED THROUGHOUT THE CABLE TRAY. USE 1/2–13 HARDWARE TO SECURE WIRING.

NOTES CONTINUED ON SHEET 2

ITEM NO.	NO. REQD	PART NO.	DESCRIPTION	REF DES/ MATERIAL
11	8	530080	WASHER, FLAT, 3/4, STAINLESS STEEL	
10	8	507237	BOLT, 3/4–10 x 2.25 LG, STAINLESS STEEL	
9	2	C28495	CHANNEL, WIRE SUPPORT	
8				
7	2	B33465	DESIGNATION PLATE	
6	1	D46246	SKID	
5	3	AVT–325031	FUSE, 3000 AMP, 600V	F1001–1003
4	1	A34202	PLATE, IDENT	
3	560ft	390309	CABLE, #4/0 , 105 Degree C.	
2	1	1320369	LOAD BANK	
1	1	B33015	2000 KVA TRANSFORMER	

LIST OF MATERIAL

PROJECT NAME:	REV. TO SHEET	ECN NO.	BY	APP.	DATE

LOAD BANK SYSTEM
(OUTLINE DRAWING SB4282)

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	SJ	5/23/19
CHECKED	DK	5/23/19
PROJECT APPROVAL	DK	5/23/19
FINAL APPROVAL	RJS	5/23/19

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP–I–003. FOR PLASTIC PARTS SEE MP–I–055

ASSEM. REF. NO.

ASCO® ASCO POWER TECHNOLOGIES, L.P.
FLORHAM PARK, NEW JERSEY 07932 U.S.A.

COMPUTER GENERATED DRAWING

SCALE 1:1 | SIZE AS

DWG. NO. 1319516

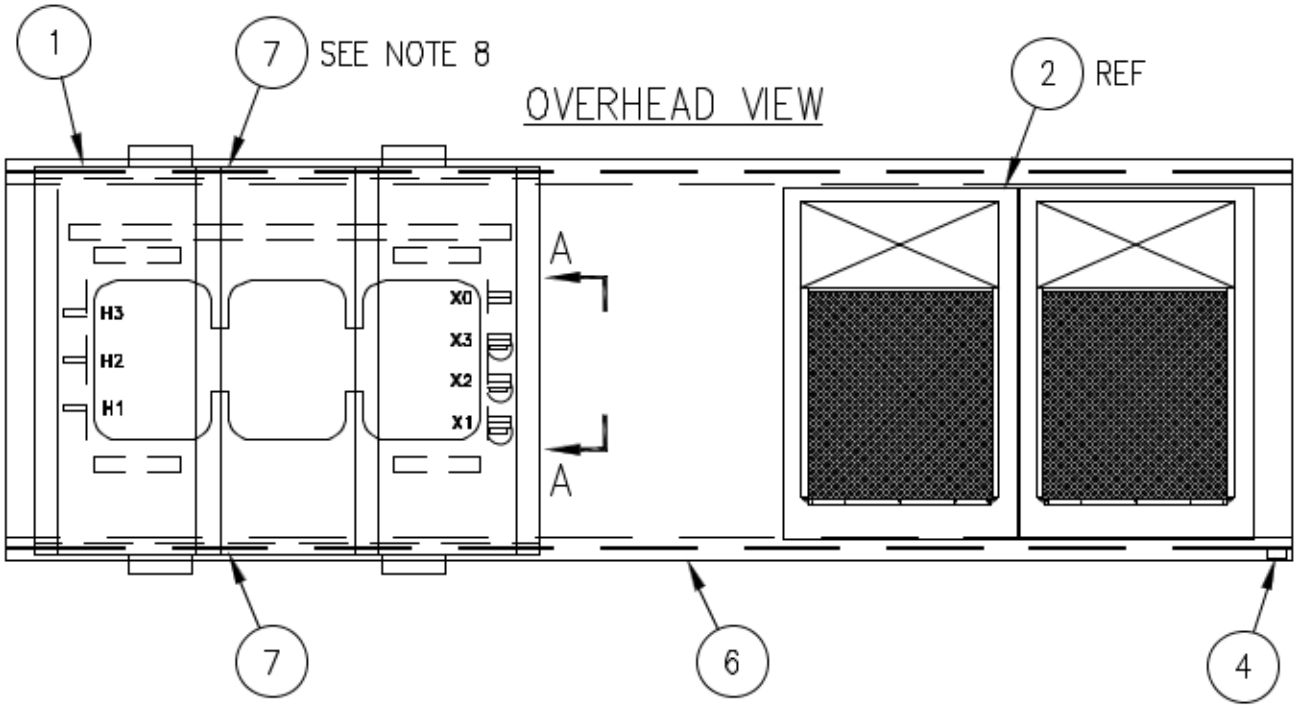
DRAWING REV. — | ECN NO. | SHEET 1 OF 4

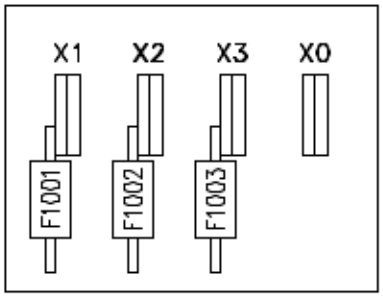
SIMILAR TO 1189263

7. LINE DRILL AND MOUNT IDENTIFICATION PLATE (ITEM 4) ON THE LOAD BANK SKID USING #4–40 SST HDW OR DRIVE SCREWS AS SHOWN ON THIS SHEET.
8. PLACE DESIGNATION PLATES (ITEM 7) ON THE FRONT AND BACK OF THE TRANSFORMER IN AN OPEN AREA, AND CLOSE TO EYE LEVEL.

TEST INSTRUCTIONS:

VERIFY PROPER INTERCONNECTIONS BETWEEN THE TRANSFORMER AND THE LOAD BANK. USE OF AN IMPEDANCE BRIDGE TO VERIFY WIRING MAY BE REQUIRED.





DETAIL A–A

PROJECT NAME:	REV. TO SHEET	ECN NO.	BY	APP.	DATE
LOAD BANK SYSTEM					

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	SJ	5/23/19
CHECKED	DK	5/23/19
PROJECT APPROVAL	DK	5/23/19
FINAL APPROVAL	RJS	5/23/19

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP–I–003. FOR PLASTIC PARTS SEE MP–I–055

ASSEM. REF. NO.

ASCO® ASCO POWER TECHNOLOGIES, L.P.
FLORHAM PARK, NEW JERSEY 07932 U.S.A.

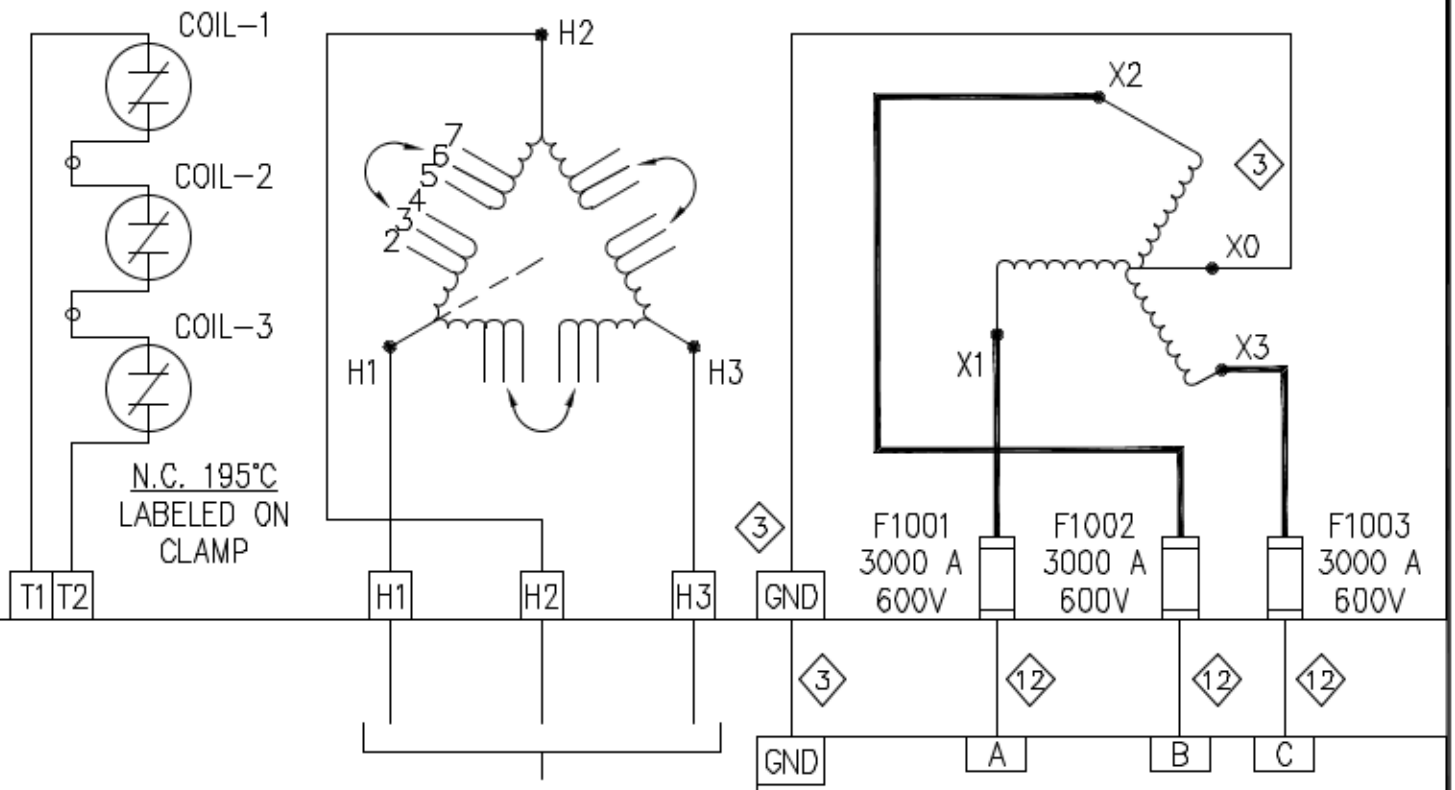
COMPUTER GENERATED DRAWING

SCALE 1:1 | SIZE AS

DWG. NO. 1319516

DRAWING REV. — | ECN NO. | SHEET 2 OF 4

TRANSFORMER B33015
(OUTLINE DRAWING SB4282)



4,160 VAC
3PH, 60 HZ
278 AMPS/PHASE

LOAD BANK
4820/1320369
(SCHEMATIC DIAGRAM 1320370
(OUTLINE DRAWING SB2827)

DASHED LINES INDICATE CUSTOMER WIRING

BOLD LINES INDICATE THAT FUSES ARE BOLTED DIRECTLY TO BUS BARS

WIRE CODE

◇12 BLACK #4/0 AWG (PN 390309), 12 WIRES IN PARALLEL

◇3 BLACK #4/0 AWG (PN 390309), 3 WIRES IN PARALLEL

PROJECT NAME:	REV. TO SHEET	ECN NO.	BY	APP.	DATE

LOAD BANK SYSTEM

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	SJ	5/23/19
CHECKED	DK	5/23/19
PROJECT APPROVAL	DK	5/23/19
FINAL APPROVAL	RJS	5/23/19

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-I-003. FOR PLASTIC PARTS SEE MP-I-055

ASSEM. REF. NO.

ASCO® ASCO POWER TECHNOLOGIES, L.P.
FLORHAM PARK, NEW JERSEY 07932 U.S.A.

COMPUTER GENERATED DRAWING

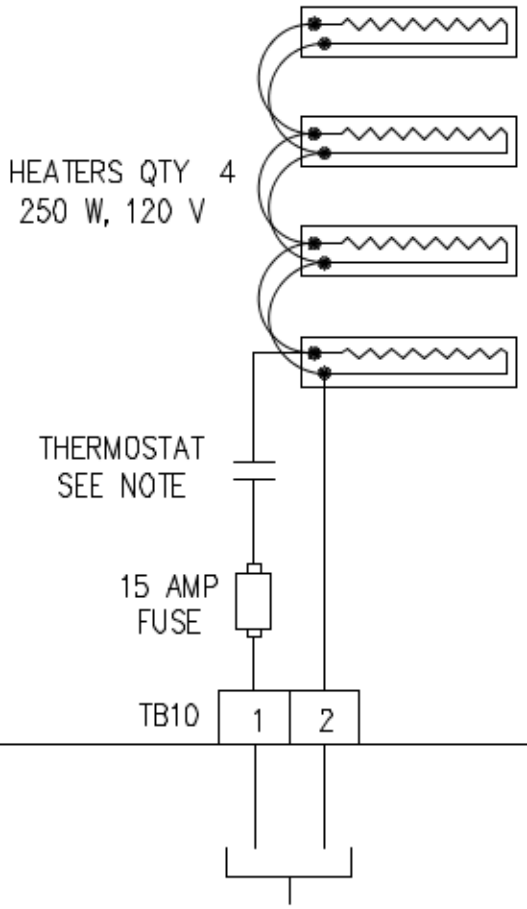
SCALE 1:1 | SIZE AS

DWG. NO. 1319516

DRAWING REV. — | ECN NO. | SHEET 3 OF 4

TRANSFORMER B33015

(OUTLINE DRAWING SB4282)



120 VAC,
1PH, 60 HZ

NOTE: THERMOSTAT WILL CLOSE WHEN TEMPERATURE FALLS BELOW SET VALUE.
THERMOSTAT IS ADJUSTABLE FROM 40–80°F.

PROJECT NAME:	REV. TO SHEET	ECN NO.	BY	APP.	DATE

LOAD BANK SYSTEM

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	SJ	5/23/19
CHECKED	DK	5/23/19
PROJECT APPROVAL	DK	5/23/19
FINAL APPROVAL	RJS	5/23/19

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-I-003. FOR PLASTIC PARTS SEE MP-I-055

ASSEM. REF. NO.

ASCO® ASCO POWER TECHNOLOGIES, L.P.
FLORHAM PARK, NEW JERSEY 07932 U.S.A.

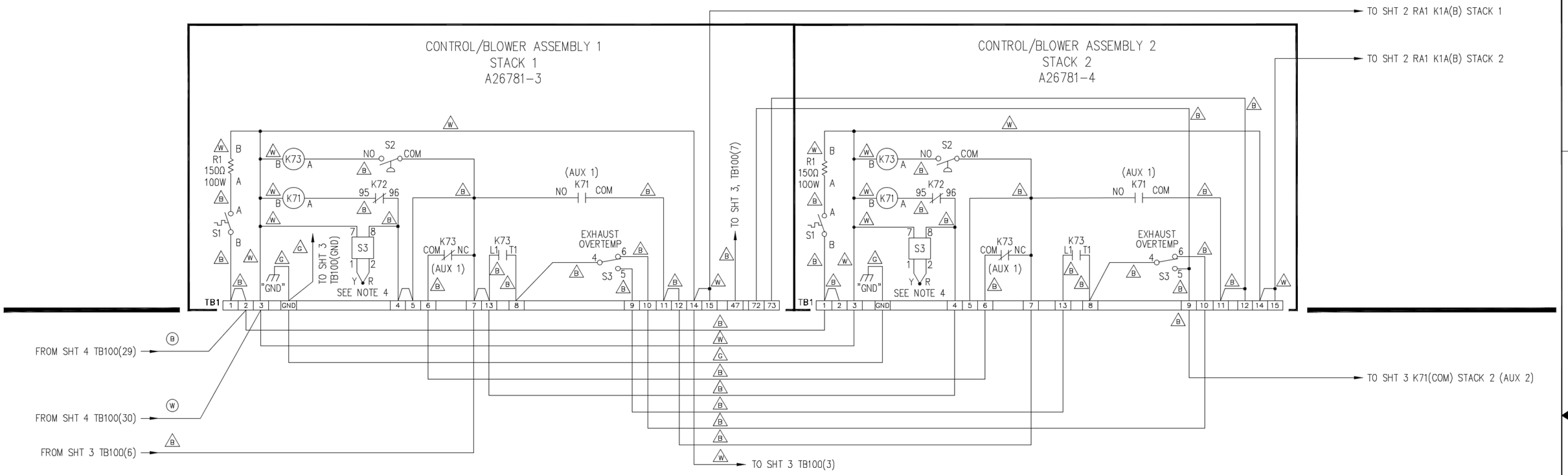
COMPUTER GENERATED DRAWING

SCALE 1:1 | SIZE AS

DWG. NO. 1319516

DRAWING REV. — | ECN NO. | SHEET 4 OF 4

LOAD BANK 4820/1320369



REFERENCE DRAWING 1320372 FOR INTERCONNECTION
WIRING DIAGRAM BETWEEN LOAD BANK AND CONTROL PANEL D36925-2

6.

5. DO NOT BUNDLE CONTROL WIRES WITH POWER WIRES.

4. THERMOCOUPLE A24741 IS WIRED AT TOP ASSEMBLY.
   SET S3 TO 375°.

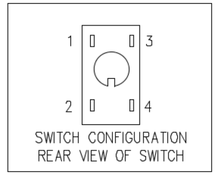
3.

2. IF EXTERNAL POWER IS REQUIRED, REMOVE WIRING
   FROM TB2(1-3) TO MAIN LOAD BUS AND CONNECT EXTERNAL
   SOURCE TO TB2(1-3).

1. WIRE CODE

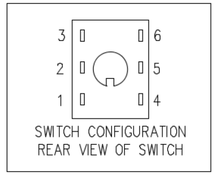
   INDICATOR LIGHTS (DS1-DS4 & DS30) ONLY CAN BE #16-#22 AWG.

- (B) INDICATES WIRE TO BE BLACK #16 AWG (PN 390008)
- (W) INDICATES WIRE TO BE WHITE #16 AWG (PN 390008)
- (G) INDICATES WIRE TO BE GREEN #16 AWG (PN 390008)
- (B) INDICATES WIRE TO BE BLACK #14 AWG (PN 390011)
- (W) INDICATES WIRE TO BE WHITE #14 AWG (PN 390011)
- (G) INDICATES WIRE TO BE GREEN #14 AWG (PN 390011)
- (B) INDICATES WIRE TO BE BLACK #12 AWG (PN 390014)
- (W) INDICATES WIRE TO BE WHITE #12 AWG (PN 390014)
- (G) INDICATES WIRE TO BE GREEN #12 AWG (PN 390014)
- [W] INDICATES WIRE TO BE WHITE #18 AWG (PN 390005)
- ◇3 INDICATES WIRE TO BE BLACK #6 AWG (PN 390020)
- ◇5 INDICATES WIRE TO BE BLACK #2 AWG (PN 390022)
- [B] INDICATES WIRE TO BE BLACK #22 AWG (PN 390001)
- [W] INDICATES WIRE TO BE WHITE #22 AWG (PN 390001)



SWITCH CONFIGURATION
REAR VIEW OF SWITCH

SWITCHES S8-S12,S14-S16,S19,S20



SWITCH CONFIGURATION
REAR VIEW OF SWITCH

SWITCH S30

PROJECT NAME:	REV. TO SHEET	ECN NO.	BY	APP.	DATE
SCHEMATIC DIAGRAM, LOAD BANK (2000KW, 480V)					

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	SJ	5/23/19
CHECKED	DK	5/23/19
PROJECT APPROVAL	DK	5/23/19
FINAL APPROVAL	RJS	5/23/19

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-1-003. FOR PLASTIC PARTS SEE MP-1-055

ASSEM. REF. NO.

ASCO® ASCO POWER TECHNOLOGIES, L.P.
FLORHAM PARK, NEW JERSEY 07932 U.S.A.

COMPUTER GENERATED DRAWING

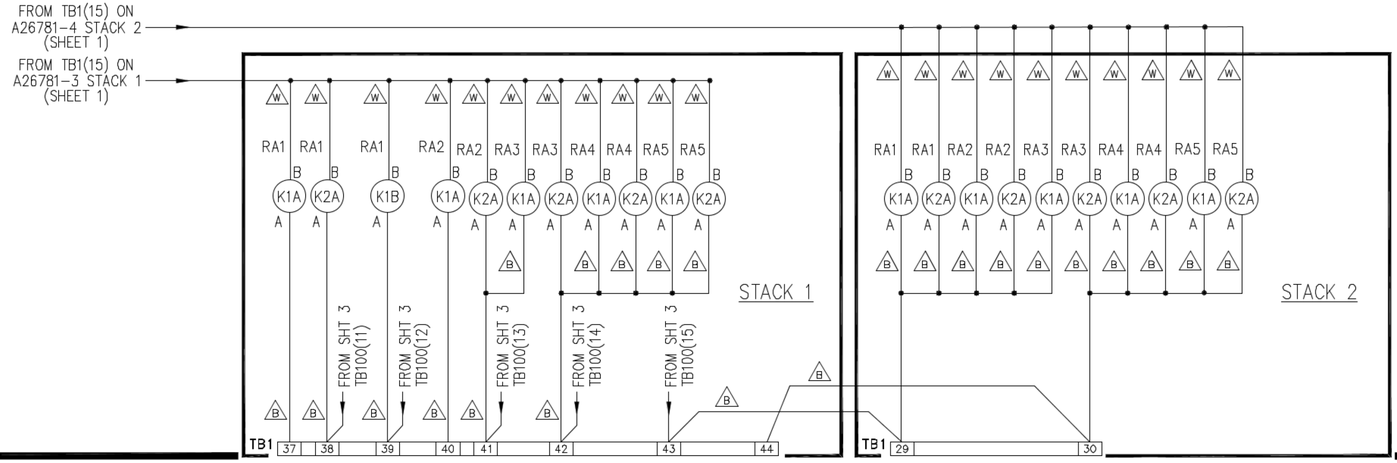
SCALE 1:1 | SIZE DS

DWG. NO. 1320370

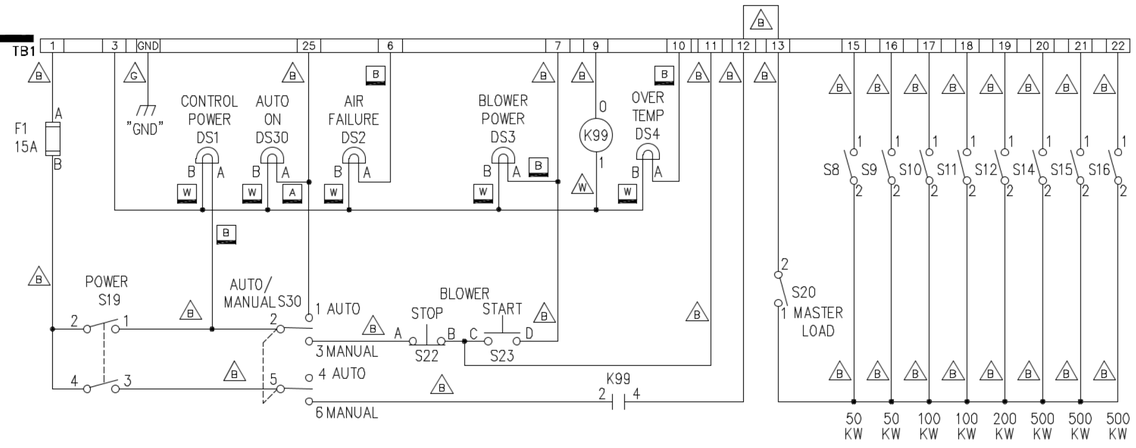
DRAWING REV. — | ECN NO. | SHEET 1 OF 6

SIMILAR TO 1200414

LOAD BANK 4820/1320369



REFERENCE DRAWING 1320372 FOR INTERCONNECTION
WIRING BETWEEN LOAD BANK AND CONTROL PANEL D36925-2



CONTROL PANEL D36925-2

SEE SHEET 1 FOR WIRE CODE

PROJECT NAME:	REV. TO SHEET	ECN NO.	BY	APP.	DATE
SCHEMATIC DIAGRAM, LOAD BANK					

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	SJ	5/23/19
CHECKED	DK	5/23/19
PROJECT APPROVAL	DK	5/23/19
FINAL APPROVAL	RJS	5/23/19

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-1-003. FOR PLASTIC PARTS SEE MP-1-055

ASSEM. REF. NO.

COMPUTER GENERATED DRAWING

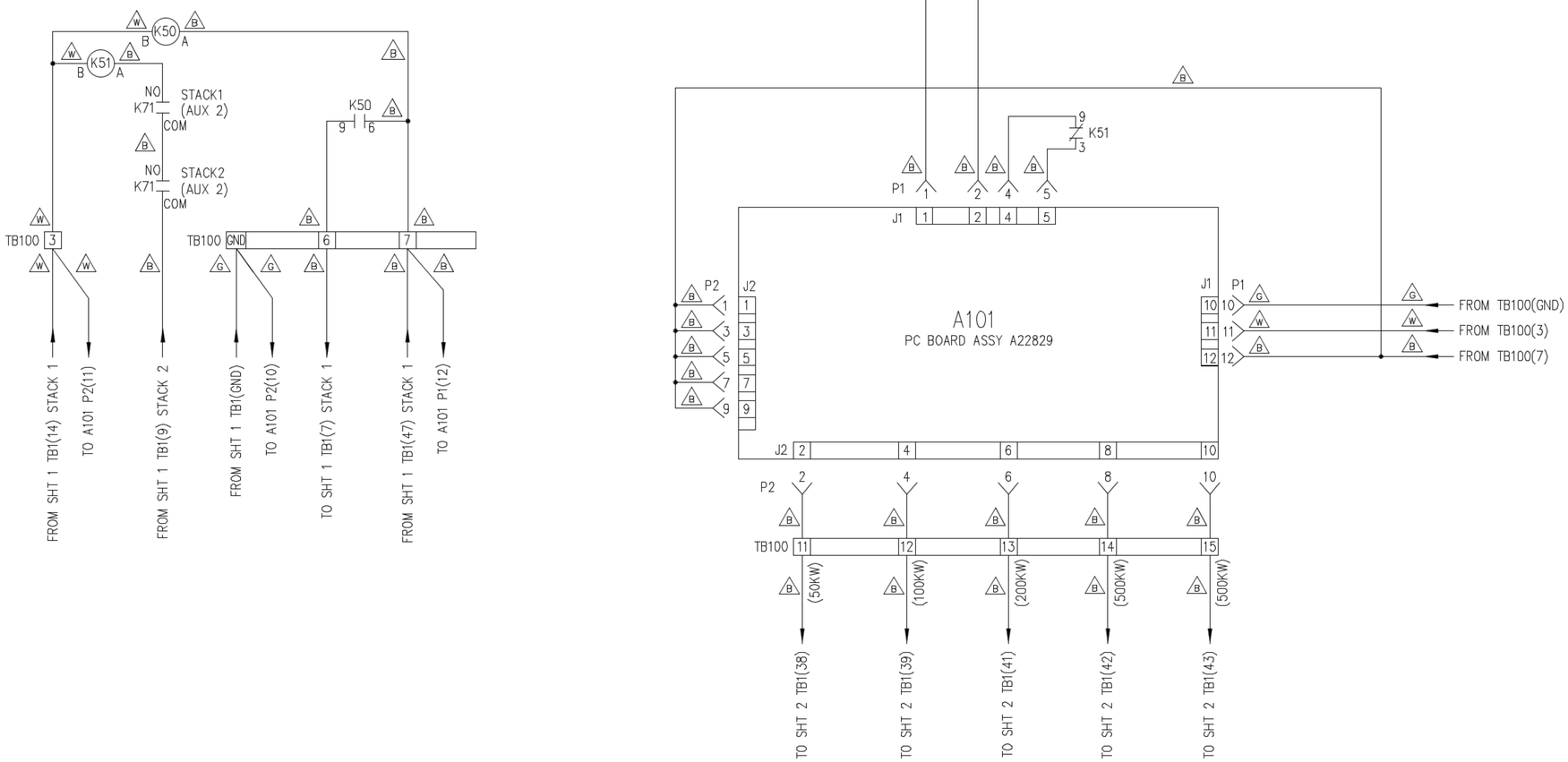
SCALE 1:1 SIZE DS

DWG. NO. 1320370

DRAWING REV. _ ECN NO. SHEET 2 OF 6

ASCO® ASCO POWER TECHNOLOGIES, L.P. FLORHAM PARK, NEW JERSEY 07932 U.S.A.

LOAD BANK 4820/1320369



VARIABLE RESISTOR	BLDG KW	BLDG AMPS	RELAY SETPOINT	% DIAL
R21	1840	255	2.13	42.5
R34	1740	241	2.01	40.2
R47	1540	214	1.78	35.6
R60	1040	144	1.20	24.1
R73	540	75	0.62	7.8

PC BOARD VARIABLE RESISTOR SETTINGS

ADJUST VARIABLE RESISTORS, ON PC BOARD A101 R26, R39, R52, R65 AND R78 TO 3 SECONDS. ADJUST R14 ON A101 TO 3 SECONDS.

4160 VAC, 3 PH, 60 HZ
WITH 600:5 C.T. RATIO

GENSET RATED 2363 KW @ 4160VAC, 3 PH, 60 Hz

SEE SHEET 1 FOR WIRE CODE

PROJECT NAME:

SCHEMATIC DIAGRAM, LOAD BANK

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	SJ	5/23/19
CHECKED	DK	5/23/19
PROJECT APPROVAL	DK	5/23/19
FINAL APPROVAL	RJS	5/23/19

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-1-003. FOR PLASTIC PARTS SEE MP-1-055

ASSEM. REF. NO.

ASCO® ASCO POWER TECHNOLOGIES, L.P. FLORHAM PARK, NEW JERSEY 07932 U.S.A.

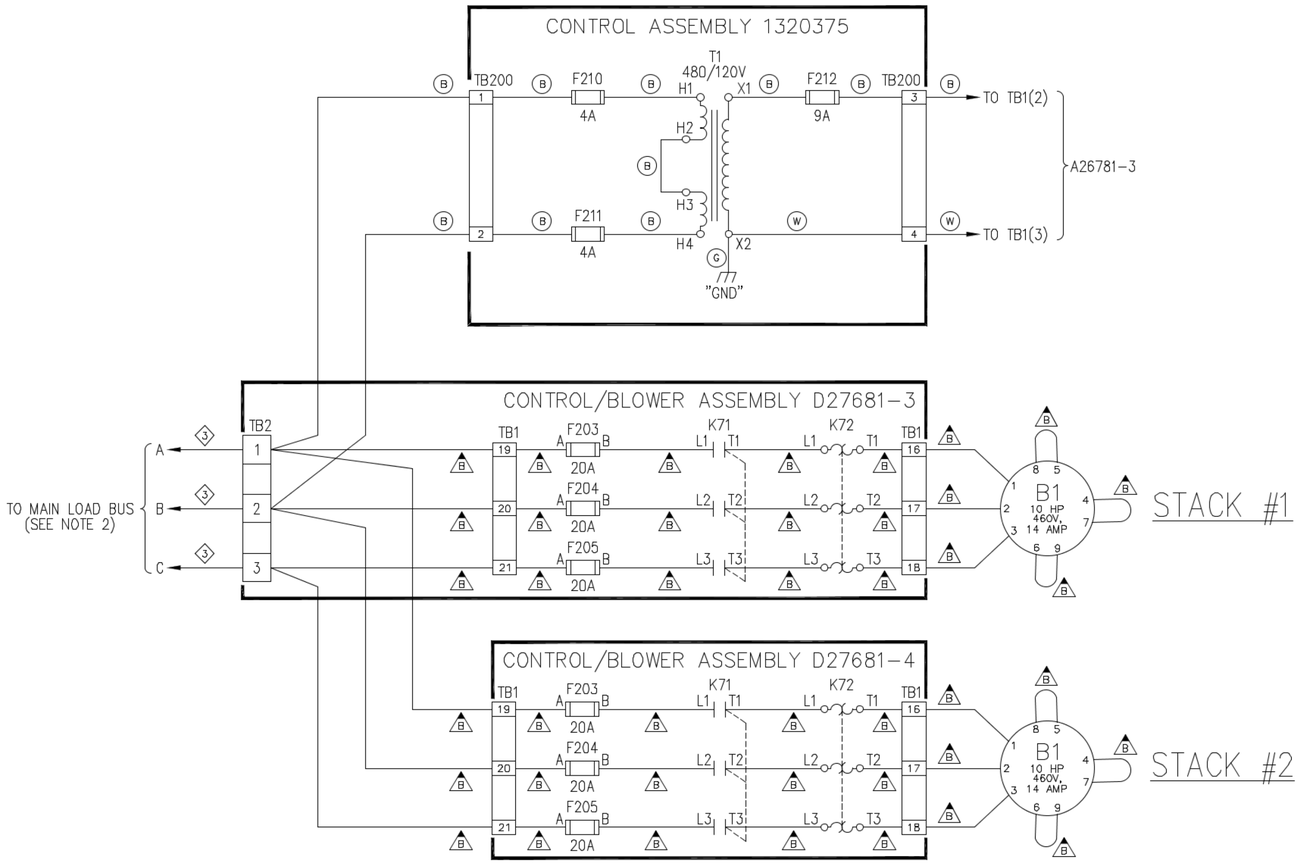
COMPUTER GENERATED DRAWING

SCALE 1:1 SIZE DS

DWG. NO. 1320370

DRAWING REV. — ECN NO.

LOAD BANK 4820/1320369



SEE SHEET 1 FOR WIRE CODE

PROJECT NAME:	REV. TO SHEET	ECN NO.	BY	APP.	DATE
SCHEMATIC DIAGRAM, LOAD BANK					

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	SJ	5/23/19
CHECKED	DK	5/23/19
PROJECT APPROVAL	DK	5/23/19
FINAL APPROVAL	RJS	5/23/19

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-1-003. FOR PLASTIC PARTS SEE MP-1-055

ASSEM. REF. NO.

ASCO® ASCO Power Technologies, L.P.
FLORHAM PARK, NEW JERSEY 07932 U.S.A.

COMPUTER GENERATED DRAWING

SCALE 1:1 SIZE DS

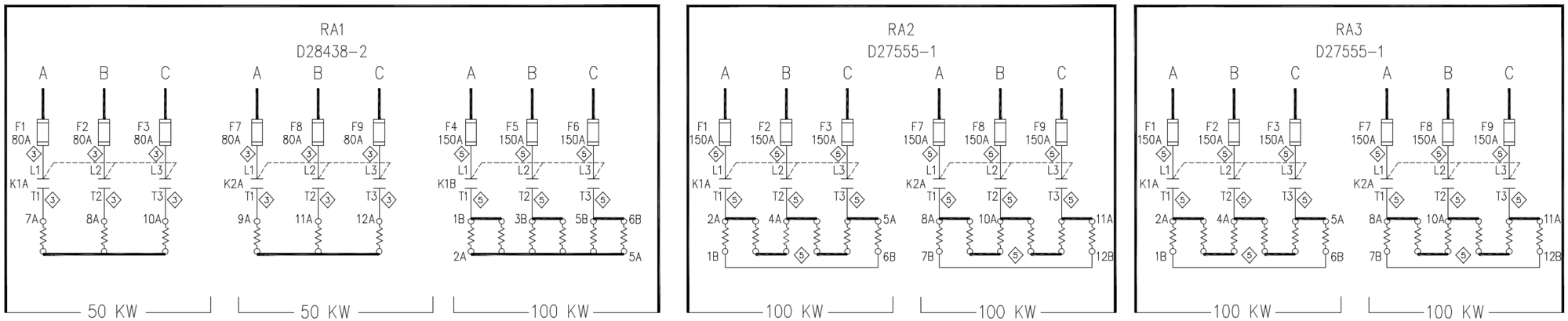
DWG. NO. 1320370

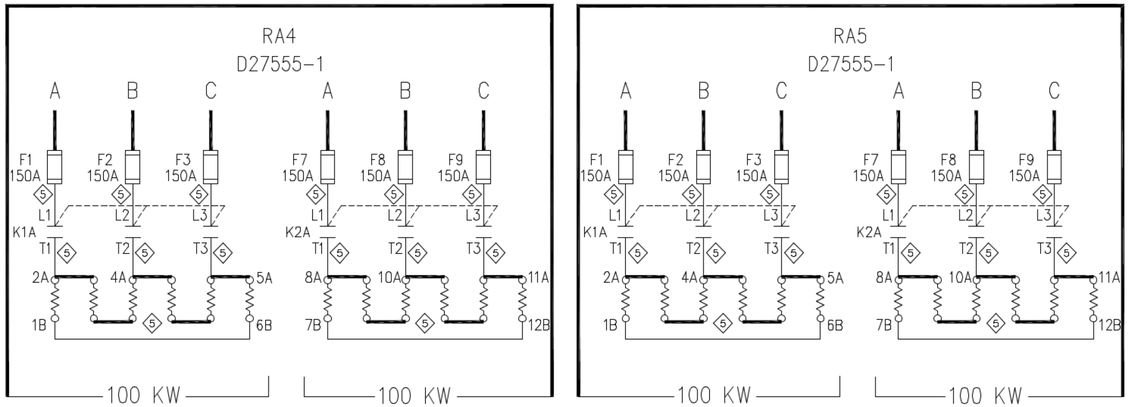
DRAWING REV. — ECN NO. SHEET 4 OF 6

LOAD BANK 4820/1320369

STACK #1

MAIN LOAD BUS INPUT
2000 KW, 480 V
3 PH, 60 HZ,
2404 AMP/PHASE
A
B
C





SEE SHEET 1 FOR WIRE CODE

PROJECT NAME:		REV. TO SHEET	ECN NO.	BY	APP.	DATE
SCHEMATIC DIAGRAM, LOAD BANK						THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	SJ	5/23/19
CHECKED	DK	5/23/19
PROJECT APPROVAL	DK	5/23/19
FINAL APPROVAL	RJS	5/23/19

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-1-003. FOR PLASTIC PARTS SEE MP-1-055

ASSEM. REF. NO.

COMPUTER GENERATED DRAWING

SCALE 1:1 SIZE DS

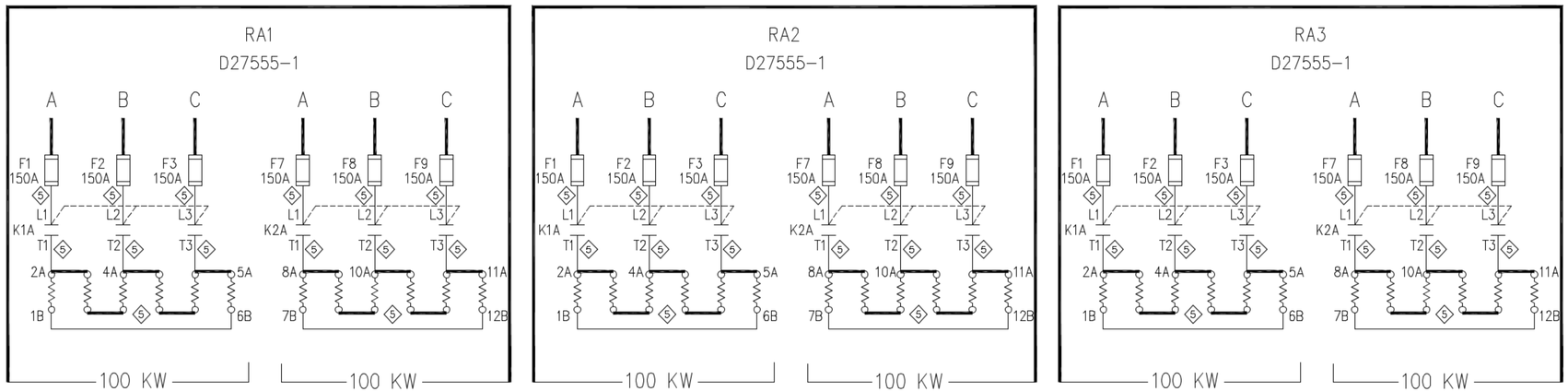
DWG. NO. 1320370

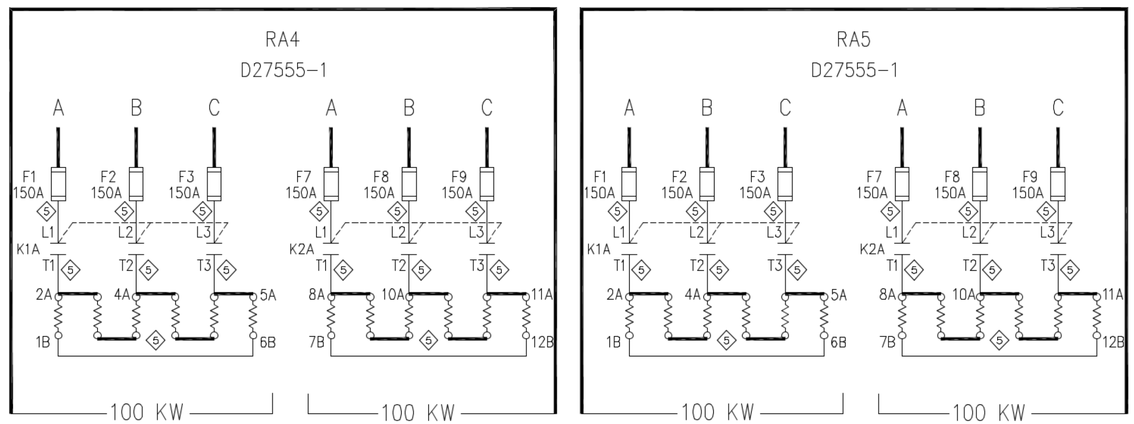
DRAWING REV. _ ECN NO. SHEET 5 OF 6

ASCO® ASCO Power Technologies, L.P.
FLORHAM PARK, NEW JERSEY 07932 U.S.A.

LOAD BANK 4820/1320369

STACK #2





SEE SHEET 1 FOR WIRE CODE

PROJECT NAME:	REV. TO SHEET	ECN NO.	BY	APP.	DATE
SCHEMATIC DIAGRAM, LOAD BANK					

THIRD ANGLE PROJECTION

	BY	DATE
DRAWN BY	SJ	5/23/19
CHECKED	DK	5/23/19
PROJECT APPROVAL	DK	5/23/19
FINAL APPROVAL	RJS	5/23/19

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-1-003. FOR PLASTIC PARTS SEE MP-1-055

ASSEM. REF. NO.

COMPUTER GENERATED DRAWING

SCALE 1:1 SIZE DS

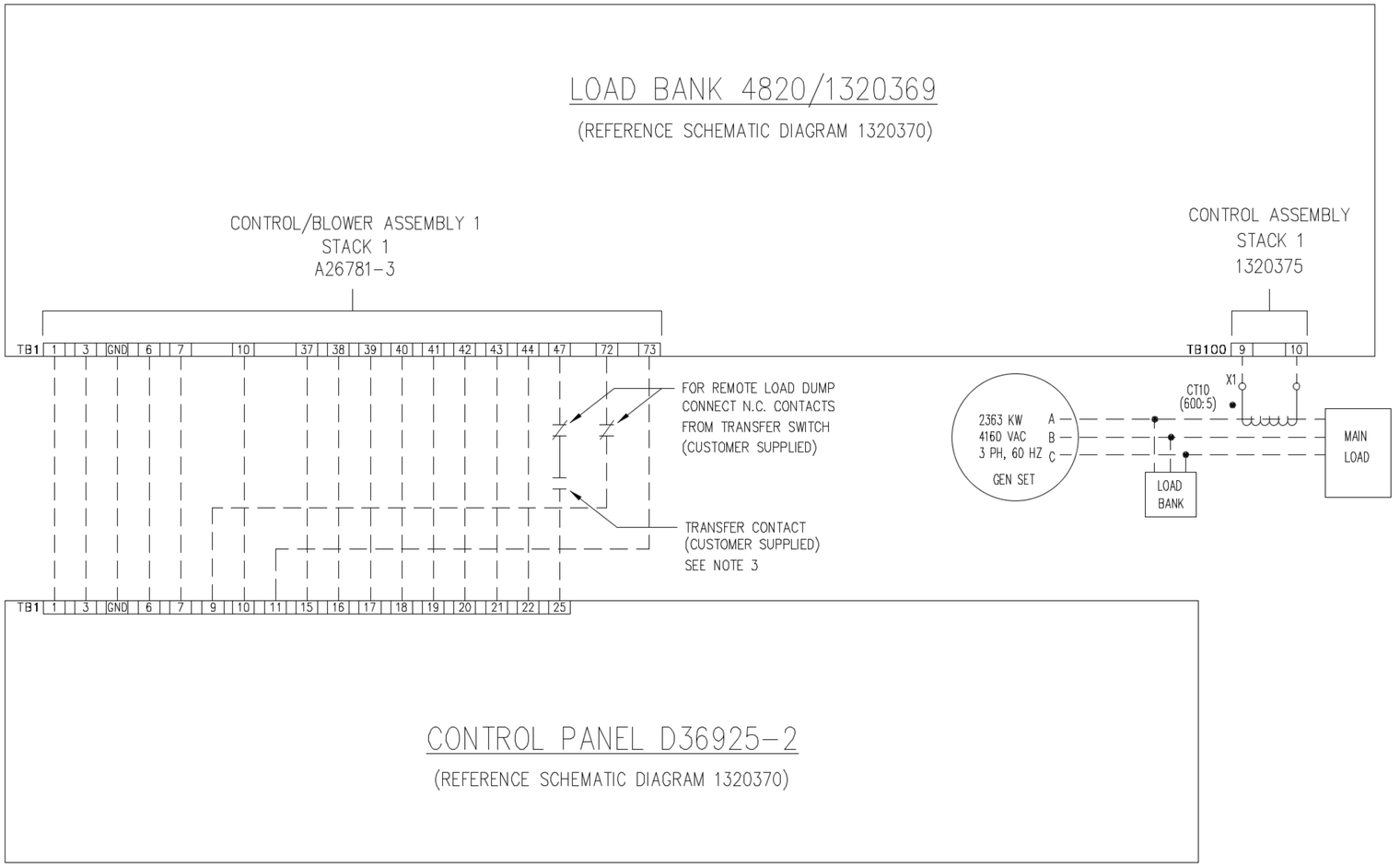
DWG. NO. 1320370

DRAWING REV. —

ECN NO.

SHEET 6 OF 6

ASCO® ASCO POWER TECHNOLOGIES, L.P. FLORHAM PARK, NEW JERSEY 07932 U.S.A.



4. DASHED LINES INDICATE CUSTOMER WIRING.
3. FOR REMOTE LOAD DUMP IN THE AUTO MODE, ADD N.C. CONTACT IN SERIES WITH THE TRANSFER N.O. CONTACT.
2. THIS DRAWING SHOWS ONLY THE CUSTOMER INTERCONNECTION WIRING BETWEEN THE LOAD BANK AND THE CONTROL PANEL. ADDITIONAL CUSTOMER INTERCONNECTION WIRING MAY BE REQUIRED IF METERING OR OTHER OPTIONAL EQUIPMENT IS PROVIDED.
1. 120 VAC CONTROL POWER IS REQUIRED IF THE CONTROL TRANSFORMER OPTION IS NOT USED.

PROJECT NAME:

INTERCONNECTION DIAGRAM, LOAD BANK, CONTROL PANEL

	BY	DATE
DRAWN BY	SJ	5/23/19
CHECKED	DK	5/23/19
PROJECT APPROVAL	DK	5/23/19
FINAL APPROVAL	RJS	5/23/19

MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-1-003. FOR PLASTIC PARTS SEE MP-1-055

ASSEM. REF. NO.

ASCO® ASCO Power Technologies, L.P. FLORHAM PARK, NEW JERSEY 07932 U.S.A.

REV. TO SHEET | ECN NO. | BY | APP. | DATE

THIRD ANGLE PROJECTION

COMPUTER GENERATED DRAWING

SCALE 1:1 | SIZE DS

DWG. NO. 1320372

DRAWING REV. — | ECN NO. | SHEET 1 OF 1

SIMILAR TO 1200417

ASCO Load Bank Storage

2-year storage is considered as long-term storage. It is recommended to review the old or latest product manual along with storage notes shown below. Also, advisable to contract with the long-term storage facility/company and follow their additional requirements.

These comments are general in nature and are not to be construed as acceptance criteria for long term storage.

For outdoor storage, the load bank must be on a clean, level, dry paved surface where standing water cannot pool. Exhaust hoods to be removed and stored indoors. Replaced hoods with sealed covers. Avtron can offer a quote on these. Shock or vibration must not exceed 2 mils maximum at 60HZ to prevent motor bearings from brinelling. Foundation surface cannot be dirt, mud or loose gravel/stone. No vegetation growth permitted around load bank. Load bank cannot be stored in a salt laden or polluted environment. Do not store in a dusty area or construction site. External utility power is to be provided to activate the factory heaters. Note factory heaters or supplemental heaters must be energized with a humidistat controller (not provided) to help protect the load bank. As supplied, the standard heaters will only activate when ambient falls below 50F.This is not adequate.

It is important to operate the fan motors. Do not let the Load Bank sit idle outdoors for more than 60 days. Each fan motor is to be run for 30 minutes minimum, every two months to prevent/limit condensation problems. Fans can be operated in pairs but not all at once. The fan should be operated on a day when no precipitation is in the air.
If load bank has a remote control, control must be stored indoors in a controlled environment.

General instructions given above applies to transformer too. For detailed storage instruction on transformer refer transformer product manual.

Once the unit is near actual start-up date, contract with Asco to have a Load Bank tech on site to do a complete inspection and start up service.

Cat® Engine Storage and Preservation

Preserve Your Investment….

If your engine is out of operation and use is not expected short term, precautions should be taken to protect your engine from damage and ensure proper operation when you return to full production.

If an engine is not in use, oil can run off the cylinder walls, piston rings, main bearings, connecting rod bearings, crankshaft, gears, and other parts that normally receive lubrication.

This lack of lubricant allows corrosion to begin to appear on the metal, especially in areas of high humidity.

Preserve your investment by following the engine storage and preservation procedures recommended by Caterpillar. Your Cat® dealer has all the supplies and reference material you will need to preserve your investment.

Parts Needed to Preserve Your Engine

Part	Part Numbers and Available Quantities
Volatile Corrosion Inhibitors (VCI) Oil	4C-6792 – 0.946 L (1.0 qt) 4C-6794 – 18.950 L (5.0 gal) 185-4770 – 18.9 L (5.0 gal) EAME* only
Cat® Extended Life Coolant (ELC)	Contact your local Cat dealer for part numbers and available container sizes.
Cat Antifreeze	8C-3684 – 3.78 L (1 gal) 8C-3686 – 208 L (55 gal)
Cooling System Conditioner	3P-2044 – 0.946 L (1 qt) 5P-2907 – 208 L (55 gal) 6V-3542 – 0.237 L (0.25 qt) 8T-1589 – 0.473 L (0.5 qt)

*EAME – Europe, Africa, Middle East

Part numbers and package quantities may vary by region. For a complete listing of parts needed, please contact your local Cat dealer.

Equipment Needed to Preserve Your Engine

Part	Part Numbers and Available Quantities
Sprayer	331-3626
Rust Preventive	Cat 450 Rust Preventive Oil
Oils & Lubricants	Refer to the Operations & Maintenance Manual for your engine
Multipurpose Grease	5P-0960 129-1952 EAME* only
Filters	Refer to the Parts Book for your engine
Coolant Conditioner Test Kit	4C-9301
Coolant and Battery Tester	245-5829
Volatile Corrosion Inhibitors (VCI) Oil	4C-6792 – 0.946 L (1.0 qt) 4C-6794 – 18.950 L (5.0 gal) 185-4770 – 18.9 L (5.0 gal) EAME* only
Calibration Fluid	6V-6067 – 208.1 L (54.9 gal) 6V-6068 – 18.9 L (5.0 gal) 185-4665 – 18.9 L (5.0 gal) EAME* only

*EAME – Europe, Africa, Middle East

CATERPILLAR®

Cat® Engine Storage and Preservation

Storage Procedures – Up to One Year for All Diesel and Natural Gas Engines

1. Clean the engine of any dirt, rust, grease, and oil. Inspect the exterior. Paint areas that contain paint damage with good quality paint.
2. Remove any dirt from the air cleaner(s). Check all seals, gaskets, and the filter element for damage.
3. Apply lubricant to all points shown in the Operation & Maintenance Manual, "Lubrication & Maintenance Table" for your equipment.
4. Drain and replace the crankcase oil and change the oil filter(s). For the proper procedure, refer to the Operation & Maintenance Manual for your equipment.
5. If equipped with an air starter, fill the reservoir with a mixture of 50 percent VCI oil and 50 percent engine oil.
6. Add VCI oil to the crankcase at the rate of three to four percent by volume.

   Note: If the engine crankcase is full, drain enough engine oil so the mixture can be added.
7. Remove the air filter element(s). Turn the engine at cranking speed with the throttle control in FUEL OFF position. Use a sprayer to add a mixture of 50 percent VCI oil and 50 percent engine oil into the air inlet or turbocharger inlet.

   Note: VCI oil mixture can also be added to the inlet by removing the plug for checking turbocharger boost pressure. The minimum application rate is 5.5 mL per L (3 oz per 1000 cu in) of engine displacement.
8. Use a sprayer to apply a 50 percent VCI oil and 50 percent engine oil mixture into the exhaust openings. The minimum application rate is 5.5 ml per L (3 oz per 1000 cu in) of engine displacement. Seal the exhaust pipe, including any drain holes in the muffler.
9. Remove the fuel from the secondary fuel filter housing or empty and reinstall the spin-on fuel filter element to remove any dirt and water. Drain the fuel injection pump (sleeve metering only).

   Clean the primary fuel filter. Fill with calibration fluid or kerosene. Install the primary fuel filter and operate the priming pump. This will send clean oil to the secondary filter and engine.

   Open the fuel tank drain valve and allow any water or dirt to drain from inside the fuel tank. Apply a spray of 30 ml per 30 L (1 oz per 7.50 gal) of fuel tank capacity to prevent rust in the fuel tank. Add 0.15 ml per L (.02 oz per 1 gal) of commercial biocide such as Biobor JF or an equivalent to the fuel.

   Apply a small amount of oil to the threads on the fuel tank filler neck and install the cap. Seal all openings to the tank to prevent evaporation of the fuel and preservative.
10. Remove the fuel nozzles or spark plugs and apply 30 ml (1 oz) of VCI oil mixture (50 percent VCI oil and 50 percent engine oil) in each cylinder.

    Use a bar or turning tool to turn the engine over slowly to put the oil on the cylinder walls. Install all fuel nozzles or spark plugs and tighten to the correct torque.
11. Spray a thin amount of VCI oil mixture (50 percent VCI oil and 50 percent engine oil) on the flywheel, ring gear teeth, and starter pinion. Install the covers to keep in the VCI vapors.
12. Apply a heavy amount of multipurpose grease (MPGM) to all outside parts that move, such as rod threads, ball joints, linkage, etc.

    Note: Install all covers and ensure that tape has been installed over all openings, air inlet, exhaust openings, flywheel housing, crankcase breather(s), dipstick tubes, etc.

    Ensure that all covers are air tight and weatherproof. Use a waterproof, weather resistant type tape such as Kendall No. 231 or an equivalent. Do not use duct tape. Duct tape will only seal for a short period of time.
13. Under most conditions it is best to remove the batteries and use them in another application. As an alternative, place them in storage where they can be periodically checked and electrically charged again when needed.

    If the batteries are not removed, wash the tops of the batteries until clean. Apply an electrical charge to the batteries to obtain a specific gravity of 1.225.

    Disconnect the battery terminals. Place a plastic cover over the batteries.
14. Loosen all belts (fan, alternator, etc.).
15. Place a waterproof cover over the engine. Ensure the engine cover is secure, but loose enough to allow air to circulate around the engine to prevent damage from condensation.
16. Attach a tag to the engine with a notation of the date that the unit was preserved.
17. Remove the waterproof cover every two or three months and check the engine for corrosion. If the engine has signs of corrosion at the check period, repeat the protection procedure.

For complete storage procedures, contact your local Cat dealer.

PEHJ0241
www.cat.com

CATERPILLAR®

Cutler-Hammer

Greenwood, S.C. 29648

Long Term Equipment Storage Instructions

Cutler-Hammer packages switchgear to assure protection during shipment. However, packaging for shipment is not necessarily suitable for long term storage. Moreover, part of the original packing may be discarded when the switchgear is removed from the carrier. Switchgear bus runs, because of their convolutions and open connection ends, are particularly vulnerable to moisture and dirt during storage.

It is the responsibility of the purchaser to assure protection during storage to maintain equipment warranty.

PRIMARY CONSIDERATIONS

Proper storage must protect switchgear and bus duct from moisture, environmental contamination, and physical damage. This protection must be accomplished with proper:

A. ventilation
B. heat
C. supporting foundation
D. shelter

VENTILATION

To prevent moisture condensation, air must be free to move through and around the switchgear and bus duct:

A. Switchgear vents must be open for free air circulation.
B. Protective covering such as tarpaulins, plastic or paper shrouds and shipment packaging must be provided with ventilation for free air to circulate from the bottom through the top of the switchgear. It may be advisable to place the switchgear on supports to elevate it to promote ventilation upward, through the equipment.
C. Enclosed storage areas such as buildings, warehouses, sheds, temporary shelters, and the like must be well ventilated because so-called indoor storage areas can be damaging without adequate ventilation.

HEAT

To prevent moisture condensation, heat may be required depending upon the shelter, rate of temperature change, extremes of temperature change, humidity, etc. in the locality. When in doubt, heat is recommended.

A. Enclosed storage areas with heat are generally satisfactory if the storage area temperature is maintained at least ten degrees above the outside temperature.
B. Enclosed storage areas without heat are generally satisfactory if the switchgear itself is provided with internal heat in each cubicle or section.
C. Open outdoor storage areas without heat should be avoided, but can be satisfactory if the switchgear itself is provided with internal heat in each cubicle or section.

NOTE: OUTDOOR SWITCHGEAR IS GENERALLY SUPPLIED WITH INTERNAL HEATERS WHICH MAY BE UTILIZED. INDOOR SWITCHGEAR MAY NOT BE PROVIDED WITH INTERNAL HEATERS SO THAT TEMPORARY HEATERS MAY BE REQUIRED. A 60 WATT LIGHT BULB IN THE BOTTOM COMPARTMENT IN BOTH FRONT AND REAR SECTIONS MAY BE ADEQUATE FOR TEMPORARY HEAT.

SUPPORTING FOUNDATION

To prevent distortion and stresses in the switchgear or bus duct assemblies, the foundation of the storage area must be reasonably true and flat.

To minimize the effects of ground temperature, ground moisture, and promote air circulation during storage, it may be advisable to place the switchgear on supports to elevate it above ground level. The foundation must be such that standing water must not allowed to collect under the assemblies.

SHELTER

To properly protect the switchgear during storage, the type of shelter required will depend upon local facilities available and local conditions such as rain, snow, wind, dust, dirt, drippings, moving vehicles, local construction, and the like. Furthermore, the shelter must incorporate the ventilation, heat, and supporting foundation features described earlier.

The ideal shelter would be a clean, heated, ventilated and well-constructed building.

The minimum shelter (which should be avoided) would be a protective covering such as a tarpaulin, plastic shroud, or paper shroud (which should be made of fireproof materials) in an outdoor area. Should this be necessary, the switchgear or bus duct protective covering must be provided with ventilation. Furthermore, the switchgear must be provided with internal heat in each cubicle or section.

STORAGE OF SPARE PARTS AND MISCELLANEOUS EQUIPMENT

All parts should be stored with the same care as the main switchgear.

GENERAL NOTES FOR LONG TERM EQUIPMENT STORAGE

1. CHECK THE VENTILATION OF THE SWITCHGEAR ITSELF.
2. CHECK THE VENTILATION OF THE PROECTIVE COVERINGS. SERIOUS DAMAGE CAN RESULT FROM AN NON-VENTILATED TARPAULIN.
3. CHECK THE VENTILATION OF ENCLOSED STORAGE AREAS OR BUILDINGS.
4. VENTILATION IS A MUST.
5. CHECK FOR ADEQUATE HEAT. WHEN IN DOUBT PROVIDE HEAT.
6. CHECK FOR DISTORATION.
7. CHECK FOR DRAINAGE AND STANDING WATER.
8. CHECK WEATHER PROTECTION INCLUDING OPEN DOORS, WINDOWS, DRAFTS, ETC.
9. AVOID OUTDOOR STORAGE.
10. USE FIREPROOF MATERIALS.

INSPECT PERIODICALLY

CATERPILLAR

ESO Number: SZNMT00
Engine Serial #: GFR01266

Generator Set Specifications

Engine

Engine Sales Model:	G3520SITASCAC	
Engine Size:	3520	
Fuel Type:	SI	
Engine Arr.:	5570153	
Dyno Test Spec:	4581979	
Rated Speed:	1500	RPM
Cooling System:	SCAC	
Aspiration Type:	TA	

Generator

Package Serial No.		
Generator Serial No.	G7Y00353	
Genset Arr:	5504568	
Genset Model:	AB041	
Frame Size:	3044	
Electrical Rating:	2469	KW
Rated Frequency:	60	Hz
Rated Voltage:	4160	Volts
Rated P.F.:	0.80	
Tested:	Without Fan	

System

Test Date.	24-Feb-2020 4:18
Run No.:	1
Test Type:	0P1793
Pass/Fail:	PASSED
Test Cell:	525
Facility:	LAFAYETTE
P.L. Setting:	LL1120
Test Spec:	3L0462-05
Procedure:	100

Load Steps

Static Test					Transient Test					Load Reject Test				
Step No	Load	Units	PF	Step Time (Min)	Step No	Initial	Final	Units	PF	Step No	Initial	Final	Units	PF
1	2469	KW	0.80	1.00						1	2469	0	KW	1.00

Test Tolerances

Static Steps			
	Line Voltage	(+- %)	4.0
	Avg Voltage	(+- %)	1.0
	Current	(+- %)	3.0
	Power Factor	(+-)	0.01
	Comment:		
Full Load Point			
	Power	(+ %)	3.0
	Power	(- %)	0.5
	Speed	(+- rpm)	100
	Frequency	(+- Hz)	1.050
	Comment:		
Transient Frequency			
	Overshoot	(%)	0.0
	Undershoot	(%)	0.0
	Recovery Band	(+- %)	0.00
	Recovery Time	(sec)	0.0
	Steady State Band	(+- %)	0.00
	Steady State Time	(sec)	0.0
	Comment:		
Transient Voltage			
	Overshoot	(%)	0.0
	Undershoot	(%)	0.0
	Recovery Band	(+- %)	0.00
	Recovery Time	(sec)	0.0
	Steady State Band	(+- %)	0.00
	Steady State Time	(sec)	0.0
	Comment:		
Load Reject			
	Frequency Band	(+- %)	35.00
	Voltage band	(+- %)	35.00
	Stability Interval	(sec)	15.0
	Evaluation interval	(sec)	30.0
	Comment:	FRQ:[1.25] [35.00]; VLT:[2.50] [35.00]; STB:[10.00] [15.00];	
High Idle Stability and No-Load Poin			
	Frequency band	(+- %)	1.00
	Evaluation interval	(sec)	30.0
	Min Speed	(rpm)	1,485
	Max Speed	(rpm)	1,515
	Comment:		
Max No-Load Speed			
	Min Speed	(rpm)	1,485
	Max Speed	(rpm)	1,515
	Comment:	SPD_MIN:[0.00] [1485.00]; SPD_MAX:[0.00] [1515.00];	

CATERPILLAR

ESO Number: SZNMT00
Engine Serial #: GFR01266

Test Report

Generator Serial #:	G7Y00353	Fuel Type:	SI	Test Date:	24-Feb-2020 4:18
Dyno Test Spec:	4581979	Cooling System:	SCAC	Pass/Fail:	PASSED
Engine Arr.:	5570153	Test Cell:	525	ECM Codes:	No
		Test Run No.:	1		
		Tested:	W/O Fan		

No Load	Amount from Nominal	Measured	Specification
High Idle Speed	0 RPM	1500 RPM	1500 RPM
Phase A Volts	0.1 %	4163 V	4160 V
Phase B Volts	0.1 %	4165 V	4160 V
Phase C Volts	0.0 %	4158 V	4160 V
Test Voltage	0.0 %	4162 V	4160 V

Load Reject — Voltage Stability — Frequency Stability

	Initial %	Final %	Sec	Sec

Full Load	Amount from Nominal	Measured	Specification
Rated Engine Speed	0 RPM	1500 RPM	1500 RPM
Power	0.4 %	2483.4 kW	2469 kW
Corrected Power	0.4 %	2479.2 kW	2469 kW
Correction Factor	1.0000	1.0000	none
Frequency	-0.1 %	59.9 Hz	60 Hz
Phase A Volts	-0.1 %	4156 V	4160 V
Phase B Volts	0.0 %	4159 V	4160 V
Phase C Volts	-0.2 %	4150 V	4160 V
Test Voltage	-0.1 %	4155 V	4160 V
Phase A Current	-0.1 %	429 Amp	428 Amp
Phase B Current	-0.5 %	428 Amp	428 Amp
Phase C Current	0.6 %	433 Amp	428 Amp
Test Current	0.4 %	430 Amp	none Amp
Power Factor	0.0 %	0.800	0.800
Comp Outlet	-	474.67 KPa	
Gas Supply	-	145.43 KPa	
Inlet Manifold	-	KPa	458.0 KPa
Throttle Delta	-	KPa	27.0 KPa
Exhaust O2	-	%	9.80 %
Exhaust NOX	-	ppm	1 ppm

Load Reject — Voltage Stability — Frequency Stability

	Initial %	Final %	Sec	Sec
1	100.00	0.00	0.10	0.10

CATERPILLAR

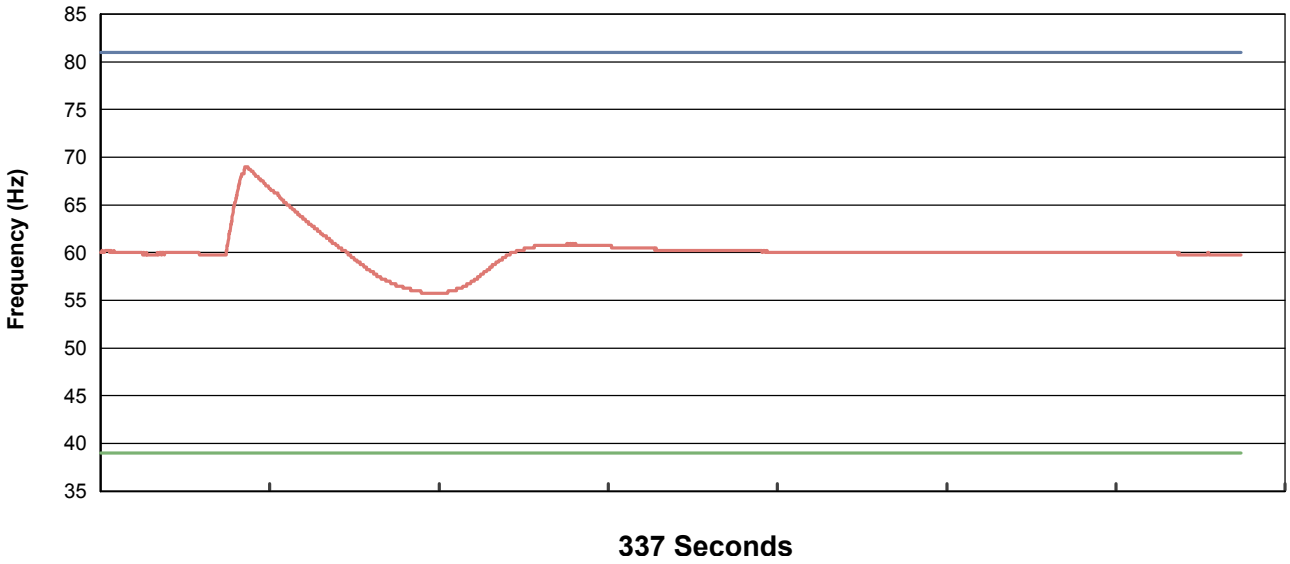
ESO Number: SZNMT00
Engine Serial #: GFR01266

Load Reject Report

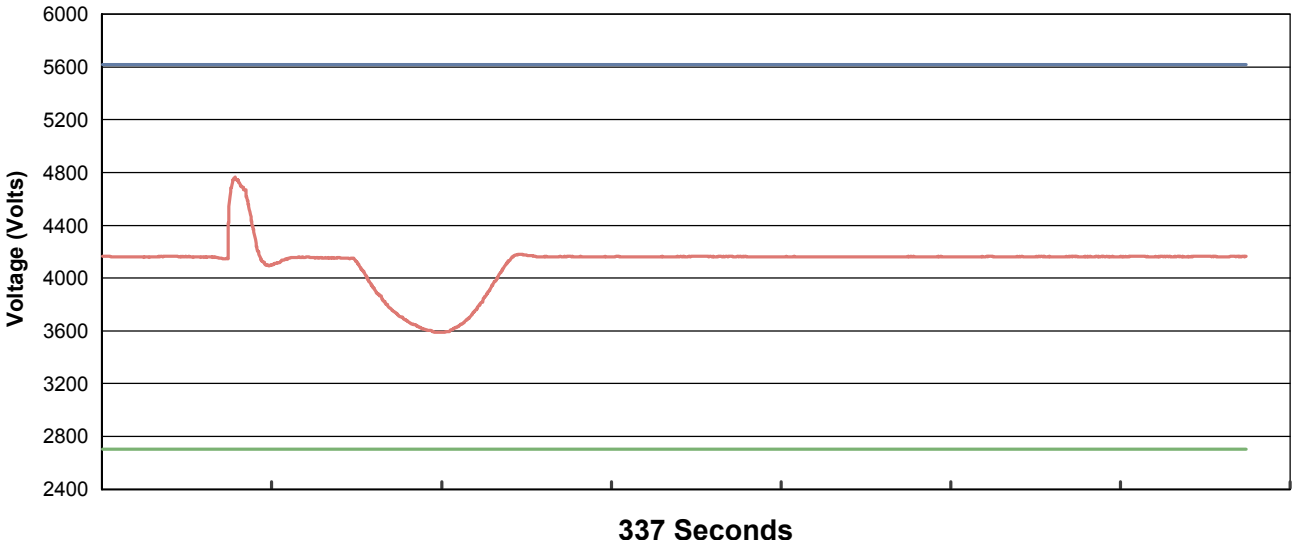
Generator Serial #:	G7Y00353	Fuel Type:	SI	Sample Time:	24-Feb-2020 5:08
Engine Serial #:	GFR01266	Cooling System:	SCAC	Load Setting:	0.0 KW
Dyno Test Spec:	4581979	Test Cell:	525	Test State:	Load Rjct Stp # 1 Rpet # 3
Engine Arr.:	5570153	Test Run No.:	1		

Frequency Stability:	0.10	Sec	Voltage Stability:	0.10	Sec
Initial Load Percentage	100.00	%	Transitional Load Pct:	0.00	%

Frequency Response



Voltage Response



CATERPILLAR

ESO Number: SZNMS00
Engine Serial #: GFR01267

Generator Set Specifications

Engine

Engine Sales Model:	G3520SITASCAC	
Engine Size:	3520	
Fuel Type:	SI	
Engine Arr.:	5570153	
Dyno Test Spec:	4581979	
Rated Speed:	1500	RPM
Cooling System:	SCAC	
Aspiration Type:	TA	

Generator

Package Serial No.		
Generator Serial No.	G7Y00352	
Genset Arr:	5504568	
Genset Model:	AB041	
Frame Size:	3044	
Electrical Rating:	2469	KW
Rated Frequency:	60	Hz
Rated Voltage:	4160	Volts
Rated P.F.:	0.80	
Tested:	Without Fan	

System

Test Date.	26-Feb-2020 6:19
Run No.:	1
Test Type:	0P1793
Pass/Fail:	PASSED
Test Cell:	525
Facility:	LAFAYETTE
P.L. Setting:	LL1120
Test Spec:	3L0462-05
Procedure:	100

Load Steps

Static Test					Transient Test					Load Reject Test				
Step No	Load	Units	PF	Step Time (Min)	Step No	Initial	Final	Units	PF	Step No	Initial	Final	Units	PF
1	2469	KW	0.80	1.00						1	2469	0	KW	1.00

Test Tolerances

Static Steps			
	Line Voltage	(+- %)	4.0
	Avg Voltage	(+- %)	1.0
	Current	(+- %)	3.0
	Power Factor	(+-)	0.01
	Comment:		
Full Load Point			
	Power	(+ %)	3.0
	Power	(- %)	0.5
	Speed	(+- rpm)	100
	Frequency	(+- Hz)	1.050
	Comment:		
Transient Frequency			
	Overshoot	(%)	0.0
	Undershoot	(%)	0.0
	Recovery Band	(+- %)	0.00
	Recovery Time	(sec)	0.0
	Steady State Band	(+- %)	0.00
	Steady State Time	(sec)	0.0
	Comment:		
Transient Voltage			
	Overshoot	(%)	0.0
	Undershoot	(%)	0.0
	Recovery Band	(+- %)	0.00
	Recovery Time	(sec)	0.0
	Steady State Band	(+- %)	0.00
	Steady State Time	(sec)	0.0
	Comment:		
Load Reject			
	Frequency Band	(+- %)	35.00
	Voltage band	(+- %)	35.00
	Stability Interval	(sec)	15.0
	Evaluation interval	(sec)	30.0
	Comment:		
High Idle Stability and No-Load Poin			
	Frequency band	(+- %)	1.00
	Evaluation interval	(sec)	30.0
	Min Speed	(rpm)	1,485
	Max Speed	(rpm)	1,515
	Comment:	FRQ:[0.00] [1.00]; EVAL:[0.00] [30.00];	
Max No-Load Speed			
	Min Speed	(rpm)	1,485
	Max Speed	(rpm)	1,515
	Comment:		

CATERPILLAR

ESO Number: SZNMS00
Engine Serial #: GFR01267

Test Report

Generator Serial #:	G7Y00352	Fuel Type:	SI	Test Date:	26-Feb-2020 6:19
Dyno Test Spec:	4581979	Cooling System:	SCAC	Pass/Fail:	PASSED
Engine Arr.:	5570153	Test Cell:	525	ECM Codes:	No
		Test Run No.:	1		
		Tested:	W/O Fan		

No Load	Amount from Nominal	Measured	Specification
High Idle Speed	0 RPM	1500 RPM	1500 RPM
Phase A Volts	0.1 %	4164 V	4160 V
Phase B Volts	0.2 %	4167 V	4160 V
Phase C Volts	0.0 %	4160 V	4160 V
Test Voltage	0.1 %	4164 V	4160 V

Load Reject — Voltage Stability — Frequency Stability

	Initial %	Final %	Sec	Sec

Full Load	Amount from Nominal	Measured	Specification
Rated Engine Speed	-1 RPM	1499 RPM	1500 RPM
Power	0.1 %	2471.5 kW	2469 kW
Corrected Power	0.1 %	2472.7 kW	2469 kW
Correction Factor	1.0000	1.0000	none
Frequency	0.0 %	60.0 Hz	60 Hz
Phase A Volts	0.1 %	4164 V	4160 V
Phase B Volts	0.1 %	4165 V	4160 V
Phase C Volts	0.0 %	4158 V	4160 V
Test Voltage	0.1 %	4163 V	4160 V
Phase A Current	0.0 %	428 Amp	428 Amp
Phase B Current	-0.5 %	426 Amp	428 Amp
Phase C Current	0.5 %	430 Amp	428 Amp
Test Current	-0.1 %	428 Amp	none Amp
Power Factor	0.0 %	0.801	0.800
Comp Outlet	-	466.75 KPa	
Gas Supply	-	145.64 KPa	
Inlet Manifold	-	KPa	458.0 KPa
Throttle Delta	-	KPa	27.0 KPa
Exhaust O2	-	%	9.80 %
Exhaust NOX	-	ppm	1 ppm

Load Reject — Voltage Stability — Frequency Stability

	Initial %	Final %	Sec	Sec
1	100.00	0.00	0.10	0.10

CATERPILLAR

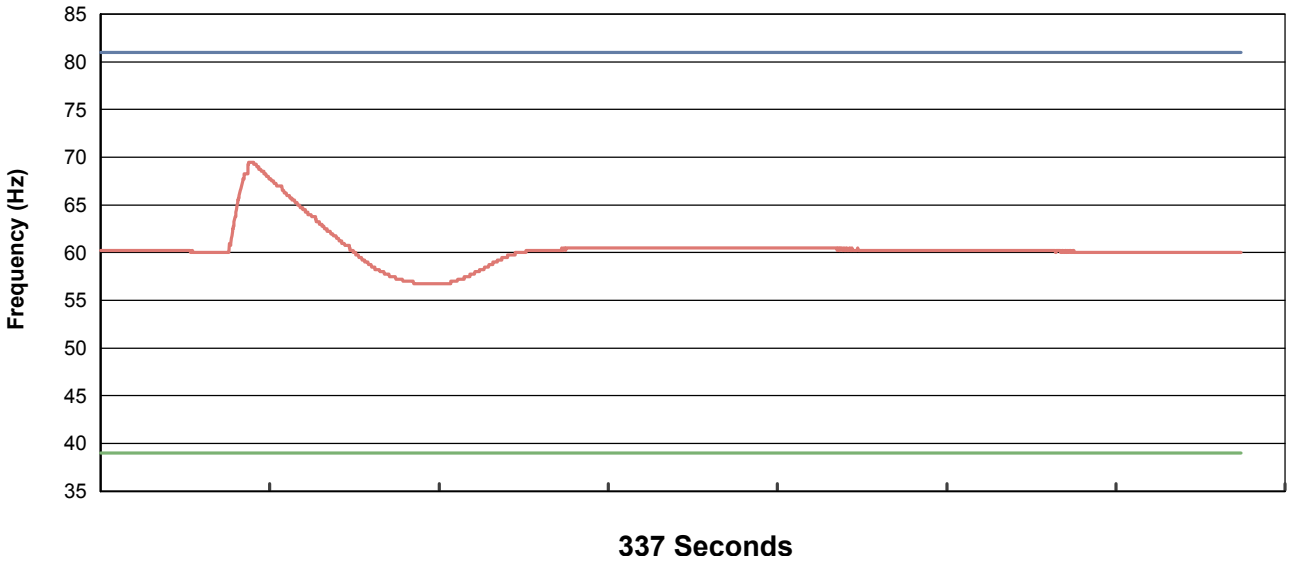
ESO Number: SZNMS00
Engine Serial #: GFR01267

Load Reject Report

Generator Serial #:	G7Y00352	Fuel Type:	SI	Sample Time:	26-Feb-2020 7:06
Engine Serial #:	GFR01267	Cooling System:	SCAC	Load Setting:	0.0 KW
Dyno Test Spec:	4581979	Test Cell:	525	Test State:	Load Rjct Stp # 1
Engine Arr.:	5570153	Test Run No.:	1		

Frequency Stability:	0.10	Sec	Voltage Stability:	0.10	Sec
Initial Load Percentage	100.00	%	Transitional Load Pct:	0.00	%

Frequency Response



Voltage Response