Sales and Service

Shenandoah WWT

SUBMITTAL
Project # 329042

SUBMITTED TO:

Lakeshore Engineering

February 23, 2023

For questions or comments regarding this submittal, please contact your Cummins Sales and Service Project Manager listed below.

Please return all submittal correspondence to your Project Manager.

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Cummins Sales and Service certifies that these drawings, materials lists, specification and data sheets have been checked prior to submittal and they accurately depict the proposed equipment. Cummins Sales and Service certifies that to the best of our knowledge, the data described in these drawings, materials lists and data sheets is true and correct.

Note: Please note that issuance of these submittals shall not be deemed or interpreted as performance nor acceptance of your Purchase Order Terms and Conditions.

Sales and Service

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Cummins Sales and Service

Section 1 – Project Information

February 9, 2023

Bill of Material

Feature Code	Description	Qty
DQFAD	**DQFAD, Commercial Diesel Generator Set, 1000kW Standby 60Hz**	2
Install-US-Stat	U.S. EPA, Stationary Emergency Application	
1000DQFAD	1000DQFAD, Diesel Genset, 60Hz, 1000kW	
A331-2	Duty Rating - Standby Power (ESP)	
L170-2	Emission Certification, EPA, Tier 2, NSPS CI Stationary Emergency	
L090-2	Listing - UL 2200	
R002-2	Voltage - 277/480, 3 Phase, Wye, 4 Wire	
B283-2	Alternator - 60Hz, 3 Phase, Wye, Extended Range, 105/80C	
A292-2	Alternator Heater, 120 Volt AC	
F202-2	Steel Sound Attenuated Level 2 Enclosure, with Exhaust System	
P175-2	Enclosure Color - Green, Steel	
F208-2	Cooling Air Outlet - Horizontal, Sound Attenuated	
C252-2	Fuel Tank - Sub Base, 2000 Gallon, UL142 Compliant	
L163-2	Listing, ULC - S601 - 07	
C215-2	Alarm - High Fuel Fill	
C127-2	Fuel Water Separator	
C256-2	Fuel Tank Connection - Dual Stub Up	
H609-2	Control Mounting - Left Facing	
KX21-2	Generator Set Control - PowerCommand 3.3, Paralleling with MLD	
H606-2	Analog Meters - AC Output	
H678-2	LCD Control Display	
K631-2	Relays - Genset Status, User Configured	
KA08-2	Alarm - Audible, Engine Shutdown	
KP74-2	Stop Switch - Emergency, Externally Mounted	
KU32-2	Relay - Alarm Shutdown	
KU67-2	Relays - Paralleling Circuit Breaker Control	
H536-2	Control Display Language - English	
KU93-2	Circuit Breaker or Entrance Box or Terminal Box - Left Only	
KP87-2	Circuit Breaker - 1600, Left, 3P, UL 600, IEC 415, UL Serv Ent 100%	
0231	Terminal Box-Low Voltage, Right-None	
KB73-2	Bottom Entry, Left	
3520	Load Connections-None	
KR01-2	Circuit Breaker Lugs - Mechanical, Left Side	
KU99-2	Ground Fault Indication Relay - None	
D041-2	Engine Air Cleaner - Normal Duty	
B786-2	External Battery Charger - 12 Amp, Regulated	
E126-2	Engine Cooling - Radiator, Enhanced High Ambient Air Temperature, Ship Fitted	
H389-2	Shutdown - Low Coolant Level	
E098-2	Sight Glass - Coolant Level	
H557-2	Coolant Heater - 208/240/480 Volts AC, Below 40F Ambient Temperature	
H734-2	Oil Sampling Valve	
L010-2	Test Record - Strip Chart	
L015-2	Test - Extended, Standby Load, 1 Hour	
L023-2	Test Record - Safety Shutdowns	
L024-2	Test Record - Exhaust Temperature	
L026-2	Cummins Certified Test Record	
L027-2	Test - Witness	
L028-2	Genset Warranty - 2 Years Base	
L050-2	Literature - English	
ST120SN3RSL, PILNCCB,	**E STOP BRK Glass NEMA 3 w/ contacts**	2

PILNOCB W/CONTACT		
NSBOP21	**Service - start up & testing**	2
NSBOP22	**Service - load bank testing**	2
NSBOP21	**Service -Training**	2
NSBOP34	**Eaton 400 100,000 KAIC Rated ATS**	1
NSBOP34	**Eaton 400**	1
PCIL PCIL200 Z555-7	**DMC 8000-Single PLC & Paralleling gear (Gen breakers are stacked in one section)** PCIL200, Control-Master, IsoBusPLC, Touch Screen Includes factory start up see attached	1

Sales and Service

Section 2 – Generator Spec Sheets

Specification sheet

Diesel generator set QST30 series engine

680 kW - 1000 kW 60 Hz

Description

Cummins® commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary Standby and Prime power applications.

Features

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

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

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

Circuit breakers - Option for manually-and/or electrically-operated circuit breakers.

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

Masterless Paralleling - An optional electrically operated circuit breaker can be added for a simple masterless paralleling solution.

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

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

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

	Standby rating	Prime rating	Continuous rating	Data sheets
Model	60 Hz kW (kVA)	60 Hz kW (kVA)	60 Hz kW (kVA)	60 Hz
DQFAA	750 (938)	680 (850)		D-3329
DQFAB	800 (1000)	725 (907)		D-3330
DQFAC	900 (1125)	818 (1023)		D-3331
DQFAD	1000 (1250)	900 (1125)		D-3332

Generator set specifications

Performance Class	Genset models have been tested in accordance with ISO 8528-5. Consult factory for transient performance information.
Voltage regulation, no load to full load	± 0.5%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Electromagnetic Compatibility Performance	Emissions to EN 61000-6-2:2005 Immunity to EN 61000-6-4:2007+A1:2011

Engine specifications

Bore	140 mm (5.51 in.)
Stroke	165.0 mm (6.5 in.)
Displacement	30.5 L (1860 in^3)
Cylinder block	Cast iron, V 12 cylinder
Battery capacity	1600 amps minimum at ambient temperature of -18 °C to 0 °C (0 °F to 32 °F)
Battery charging alternator	35 amps
Starting voltage	24 volt, negative ground
Fuel system	Direct injection: number 2 diesel fuel, fuel filter, automatic electric fuel shutoff
Fuel filter	Triple element, 10 micron filtration, spin-on fuel filters with water separator
Air cleaner type	Dry replaceable element
Lube oil filter type(s)	Four spin-on, combination full flow filter and bypass filters
Standard cooling system	High ambient radiator

Alternator specifications

Design	Brushless, 4 pole, drip-proof, revolving field
Stator	2/3 pitch
Rotor	Single bearing flexible discs
Insulation system	Class H on low and medium voltage, Class F on high voltage
Standard temperature rise	125 °C Standby at 40 °C ambient
Exciter type	PMG (Permanent Magnet Generator)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower fan
AC waveform Total Harmonic Distortion (THDV)	< 5% no load to full linear load, < 3% for any single harmonic

Available voltages

60 Hz Line – Neutral/Line - Line

• 120/208	• 220/380	• 240/416	• 347/600
• 139/240	• 230/400	• 277/480	

Note: Consult factory for other voltages.

Generator set options

Engine

- 208/240/480 V coolant heater for ambient above 4.5 °C (40 °F)
- 208/240/480 V coolant heater for ambient below 4.5 °C (40 °F)

Control panel

- PowerCommand 3.3 with Masterless Load Demand (MLD)
- Run relay package
- Ground fault indication
- Paralleling configuration
- Remote fault signal package
- Exhaust gas temperature sensor
- 120/240 V 100 W control anti-condensation heater

Alternator

- 80 °C rise
- 105 °C rise
- 125 °C rise
- 120/240 V 300 W anti-condensation heater
- Temperature sensor - RTDs, 2-phase
- Temperature sensor – alternator bearing RTD
- Differential current transformers

Exhaust system

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

Cooling system

- High ambient 50 °C radiator

Generator set

- AC entrance box
- Battery
- Battery rack with hold-down - floor standing
- Circuit breaker - set mounted
- Disconnect switch - set mounted
- PowerCommand network
- Remote annunciator panel
- Spring isolators
- 2 year warranty
- 5 year warranty
- 10 year major components warranty

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

PowerCommand 3.3 Control System

An integrated microprocessor based generator set control system providing voltage regulation, engine protection, alternator protection, operator interface and isochronous governing. Refer to document S-1570 for more detailed information on the control.

AmpSentry – Includes integral AmpSentry protection, which provides a full range of alternator protection functions that are matched to the alternator provided.

Power management – Control function provides battery monitoring and testing features and smart starting control system.

Advanced control methodology – Three phase sensing, full wave rectified voltage regulation, with a PWM output for stable operation with all load types.

Communications interface – Control comes standard with PCCNet and Modbus® interface.

Service - InPower™ PC-based service tool available for detailed diagnostics, setup, data logging and fault simulation.

Easily upgradeable – PowerCommand controls are designed with common control interfaces.

Reliable design – The control system is designed for reliable operation in harsh environment.

Multi-language support

Operator panel features

Operator/display functions

- Displays paralleling breaker status
- Provides direct control of the paralleling breaker
- 320 x 240 pixels graphic LED backlight LCD
- Auto, manual, start, stop, fault reset and lamp test/panel lamp switches
- Alpha-numeric display with pushbuttons
- LED lamps indicating generator set running, remote start, not in auto, common shutdown, common warning, manual run mode, auto mode and stop

Paralleling control functions

- First Start Sensor System selects first generator set to close to bus
- Phase Lock Loop Synchronizer with voltage matching
- Sync check relay
- Isochronous kW and kVar load sharing
- Load govern control for utility paralleling
- Extended Paralleling (Base Load/Peak Shave) Mode
- Digital power transfer control, for use with a breaker pair to provide open transition, closed transition, ramping closed transition, peaking and base load functions,
- Alternator data
- Line-to-Neutral and Line-to-Line AC volts
- 3-phase AC current
- Frequency
- kW, kVar, power factor kVA (three phase and total)
- Engine data
- DC voltage
- Engine speed
- Lube oil pressure and temperature
- Coolant temperature
- Comprehensive FAE data (where applicable)
- Other data
- Genset model data
- Start attempts, starts, running hours, kW hours
- Load profile (operating hours at % load in 5% increments)
- Fault history
- Data logging and fault simulation (requires InPower)

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S-1508 (07/22)

Standard control functions

Digital governing

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

Digital voltage regulation

- Integrated digital electronic voltage regulator
- 3-phase, 4-wire Line-to-Line sensing
- Configurable torque matching

AmpSentry AC protection

- AmpSentry protective relay
- Over current and short circuit shutdown
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shutdown
- Over and under frequency shutdown
- Overload warning with alarm contact
- Reverse power and reverse Var shutdown
- Field overload shutdown

Engine protection

- Battery voltage monitoring, protection and testing
- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown
- Full authority electronic engine protection

Control functions

- Time delay start and cool down
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop
- Data logging
- Cycle cranking
- Load shed
- Configurable inputs and outputs (4)
- Remote emergency stop

Options

- Auxiliary output relays (2)

Ratings definitions

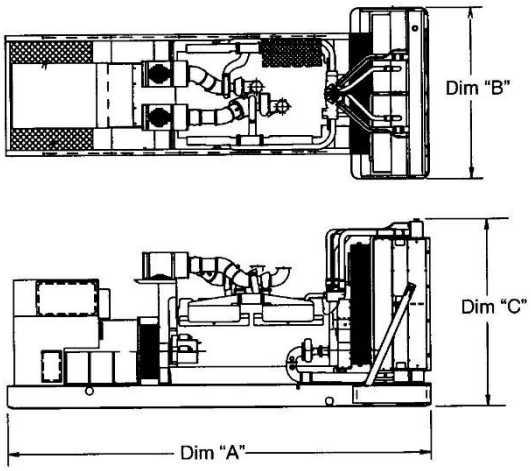
Emergency Standby Power (ESP):
Applicable for supplying power continuously to varying electrical loads for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528 and ISO 3046-1, obtained and corrected in accordance with ISO 15550).

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

Prime Power (PRP):
Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046-1. Data shown above represents gross engine performance and capabilities as per ISO 3046-1, obtained and corrected in accordance with ISO 15550.

Base Load (Continuous) Power (COP):
Applicable for supplying power continuously to a constant load up to the full output rating for unlimited hours. No sustained overload capability is available for this rating. Consult authorized distributor for rating. (Equivalent to Continuous Power in accordance with ISO 8528 and ISO 3046-1, obtained and corrected in accordance with ISO 15550).

This rating is not applicable to all generator set models.



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

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Model	Dim ‘A’ mm (in.)	Dim ‘B’ mm (in.)	Dim ‘C’ mm (in.)	Set Weight dry* (lb)	Set Weight wet* (lb)
DQFAA	4287 (168.8)	1990 (78.3)	2355 (92.7)	6671 (14707)	6969 (15363)
DQFAB	4287 (168.8)	1990 (78.3)	2355 (92.7)	6894 (15199)	7192 (15855)
DQFAC	4287 (168.8)	1990 (78.3)	2355 (92.7)	7373 (16254)	7670 (16910)
DQFAD	4287 (168.8)	1990 (78.3)	2355 (92.7)	7631 (16824)	7929 (17480)

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

Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

ISO 9001 **ISO 14001** **ISO 45001**	This product was manufactured in a facility whose quality management system is certified to ISO 9001 and its Health Safety Environmental Management Systems certified to ISO 14001 and ISO 45001.	UL LISTED	This product is listed to UL 2200, Stationary Engine Generator Assemblies.
PTS	The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.	**U.S. EPA**	Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 2 exhaust emission levels. U.S. applications must be applied per this EPA regulation.
CSA®	All genset models are available as CSA certified to CSA C22.2 No.100	**International Building Code**	The generator set package is available certified for seismic application in accordance with International Building Code.

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S-1508 (07/22)

Generator Set Data Sheet

Model: DQFAD
Frequency: 60 Hz
Fuel Type: Diesel
kW Rating: 1000 Standby
900 Prime
Emissions level: EPA NSPS Stationary Emergency Tier 2

Exhaust emission data sheet:	**EDS-1063**
Exhaust emission compliance sheet:	**EPA-1097**
Sound performance data sheet:	**MSP-1038**
Cooling performance data sheet:	**MCP-156**
Prototype test summary data sheet:	**PTS-266**
Standard set-mounted radiator cooling outline:	**A049K674**
Optional remote radiator cooling outline:	**A053G787**

Fuel Consumption

	Standby				Prime				Continuous
	kW (kVA)				kW (kVA)				kW (kVA)
Ratings	1000 (1250)				900 (1125)				
Load	**1/4**	**1/2**	**3/4**	**Full**	**1/4**	**1/2**	**3/4**	**Full**	**Full**
US gph	18.7	36.4	54.2	71.9	16.9	32.4	48.0	63.5	
L/hr	70.6	137.8	205.1	272.3	64.0	122.8	181.5	240.3	

Engine

	Standby rating	Prime rating	Continuous rating
Engine manufacturer	Cummins Inc.		
Engine model	QST30-G5 NR2		
Configuration	Cast iron, V 12 cylinder		
Aspiration	Turbocharged and low temperature after-cooled		
Gross engine power output, kWm (bhp)	1112 (1490)	1007 (1350)	
BMEP at set rated load, kPa (psi)	2417 (351)	2160 (313)	
Bore, mm (in.)	140 (5.51)		
Stroke, mm (in.)	165 (6.5)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	9.91 (1950)		
Compression ratio	14.7:1		
Lube oil capacity, L (qt)	154 (162.8)		
Overspeed limit, rpm	2100 ±50		
Regenerative power, kW	82		

Fuel Flow

Maximum fuel flow, L/hr (US gph)	570 (150)	
Maximum fuel inlet restriction, kPa (in Hg)	27 (8.0)	
Maximum fuel inlet temperature, °C (°F)	66 (150)	

Air	Standby rating	Prime rating	Continuous rating
Combustion air, m^3/min (scfm)	88 (3150)	81 (2880)	
Maximum air cleaner restriction, kPa (in H_2O)	6.2 (25)		
Alternator cooling air, m^3/min (cfm)	204 (7300)		

Exhaust

Exhaust flow at set rated load, m^3/min (cfm)	211 (7540)	195 (6950)	
Exhaust temperature, °C (°F)	477 (890)	467 (873)	
Maximum back pressure, kPa (in H_2O)	6.8 (27)		

Standard Set-Mounted Radiator Cooling

Ambient design, °C (°F)	50 (122)		
Fan load, kW_m (HP)	19.0 (25.5)		
Coolant capacity (with radiator), L (US gal)	167 (44)		
Cooling system air flow, m^3/min (scfm)	1115 (38800)		
Total heat rejection, MJ/min (Btu/min)	49.1 (46545)	44.07 (41775)	
Maximum cooling air flow static restriction, kPa (in H_2O)	0.12 (0.5)		
Maximum fuel return line restriction kPa (in Hg)	67.5 (20)		

Optional Heat Exchanger Cooling

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

Optional Remote Radiator Cooling[1]	Standby rating	Prime rating	Continuous rating
Set coolant capacity, L (US gal)			
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)	992 (262)		
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)	303 (80)		
Heat rejected, jacket water circuit, MJ/min (Btu/min)	22.67 (21500)	21.01 (19925)	
Heat rejected, aftercooler circuit, MJ/min (Btu/min)	18.35 (17400)	15.69 (14885)	
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)	6.1 (5753)	5.6 (5301)	
Maximum friction head, jacket water circuit, kPa (psi)	69 (10)		
Maximum friction head, aftercooler circuit, kPa (psi)	48 (7)		
Maximum static head, jacket water circuit, m (ft)	14 (46)		
Maximum static head, aftercooler circuit, m (ft)	14 (46)		
Maximum jacket water outlet temp, °C (°F)	104 (220)	100 (212)	
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)	41 (105)		
Maximum aftercooler inlet temp, °C (°F)	62 (143)	56 (133)	
Maximum fuel flow, L/hr (US gph)			
Maximum fuel return line restriction, kPa (in Hg)	67.5 (20)		

Weights[2]

Unit dry weight kgs (lbs)	7594 (16742)
Unit wet weight kgs (lbs)	7857 (17322)

Notes:

[1] For non-standard remote installations contact your local Cummins representative.

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

Derating Factors

Standby	Engine power available up to 701 m (2300 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 3.5% per 305 m (1000 ft) and 7% per 10 °C (18°F).
Prime	Engine power available up to 727 m (2385 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 3.5% per 305 m (1000 ft) and 7% per 10 °C (18 °F).
Continuous	

Ratings Definitions

Emergency Standby Power (ESP):	**Limited-Time Running Power (LTP):**	**Prime Power (PRP):**	**Base Load (Continuous) Power (COP):**
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528.	Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514. No sustained overload capability is available at this rating.

Alternator Data

Voltage	Connection[1]	Temp rise degrees C	Duty[2]	Single phase factor[3]	Max surge kVA[4]	Surge kW	Winding No.	Alternator data sheet	Feature code
208-240/416-480	Wye	125/105	S/P		4725	1034	311	ADS-633	BC34-2
380-480	Wye	125/105	S/P		4602	1018	312	ADS-330	B282-2
600	Wye	125/105	S/P		3866	1021	7	ADS-311	B300-2
380-480	Wye	105/80	S/P		4602	1018	312	ADS-330	B283-2
600	Wye	105/80	S/P		4234	1024	7	ADS-312	B301-2
380-480	Wye	80	S		5521	1024	312	ADS-331	B284-2
600	Wye	80	S		4602	1004	7	ADS-330	B604-2

Notes:

[1] Limited single phase capability is available from some three phase rated configurations. To obtain single phase rating, multiply the three phase kW rating by the Single Phase Factor[3]. All single phase ratings are at unity power factor.

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

[3] Factor for the *Single phase output from Three phase alternator* formula listed below.

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

Formulas for Calculating Full Load Currents:

Three phase output

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

Single phase output

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

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

For more information contact your local Cummins distributor or visit power.cummins.com

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D-3332_DQFAD (10/21)

Specification Sheet

PowerCommand® 3.3 Generator Set Digital Integrated Control System

Bargraph Optional

Introduction

The PowerCommand® 3.3 control system is a microprocessor-based generator set monitoring, metering, and control system, which is comprised of PowerCommand® Control 3300 and the Human Machine Interface 320. PCC3300 supports multiple operation modes including:

- Standalone,
- Synchronization only,
- Isolated bus paralleling,
- Utility single generator set paralleling,
- Utility multiple generator set paralleling,
- Utility single generator set paralleling with power transfer control (automatic mains failure),
- Isolated bus paralleling with Masterless Load Demand

PowerCommand® Control 3300 is designed to meet the exacting demands of the harsh and diverse environments of today's typical power generation applications for Full Authority Electronic or Hydromechanical engine power generator sets.

Offering enhanced reliability and performance over more conventional generator set controls via the integration of all generator control functions into a single system, PCC3300 is your Power of One generator set control solution.

Benefits and Features

- 320 x 240 pixels graphical LED backlit LCD
- Multiple languages supported
- AmpSentry™ protection provides industry-leading generator overcurrent protection
- Digital Power Transfer Control (Automatic Mains Failure) provides load transfer operation in open transition, closed transition, or soft (ramping) transfer modes
- Extended Paralleling (Peak Shave/Base Load) regulates the genset real and reactive power output while paralleled to the utility. Power can be regulated at either the genset or utility bus monitoring point
- Digital frequency synchronization and voltage matching
- Isochronous Load Sharing
- Droop kW and kVAr control
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop initiate a test with or without load, or a Base Load or Peak Shave session
- Digital automatic voltage regulation is provided using three phase sensing and full wave FET type regulator, which is compatible with either shunt or PMG excited systems with a standard AUX103 AVR or an option for a more powerful high-current field drive capability AUX106 AVR
- Digital engine speed governing is provided on applicable platforms
- Generator set monitoring (including metering) and protection with PCC3300 measuring voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Utility / AC Bus metering and protection with PCC3300 voltage, current, kW and kVAr offering a measurement accuracy of 1%
- 12 V (DC) and 24 V (DC) battery operation
- RS-485 Modbus® interface for interconnecting to customer equipment
- Warranty and service – Cummins Power Generation offers a comprehensive warranty and worldwide distributor service network
- Global regulatory certification and compliance: PCC3300 is suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., UKCA, and CE standards

PowerCommand® Generator Set Digital Control System PCC 3300

Introduction

PCC3300 is an industry-leading digital generator set control suitable for usage on a wide range of diesel and lean burn natural gas generator sets in both standalone as well as paralleling applications.

PowerCommand® is compatible with either shunt or PMG excitation, and is suitable for usage with reconnectable or non-reconnectable generators. Configuration for any frequency, voltage and power connection from 120 V (AC) to 600 V (AC) line-to-line or 601 V (AC) to 45k V (AC) with an external PT is supported. The PCC3300 derives its own power from the generator set starting batteries and functions over a voltage range of 8 V (DC) to 30 V (DC).

Features

- PCC3300 supports configurable control features via software download using InPower PC-compatible software
- 12 V (DC) and 24 V (DC) battery operation
- Digital automatic voltage regulation is provided using three phase sensing and full wave FET type regulator, which is compatible with either shunt or PMG excited systems with a standard AUX103 AVR or an option for a more powerful high-current field drive capability AUX106 AVR
- Digital engine speed governing on applicable platform is provided, which is capable of providing isochronous frequency regulation
- Full authority J1939 CANBus® prime mover communications and control is provided for platforms with an Engine Control Module (ECM)
- AmpSentry" protection provides industry-leading alternator overcurrent protection:
  - Time-based generator protection applicable to both line-to-line and line-to-neutral, that can detect an unbalanced fault condition and swiftly react appropriately. Balanced faults can also be detected by AmpSentry and appropriate acted upon.
  - Reduces the risk of Arc Flash due to thermal overload or electrical faults by inverse time protection
- Generator set monitoring offers status information for all critical prime mover and generator functions
- AC and DC digital generator set metering is provided. AC measurements are configurable for single or three phase sensing with PCC3300 measuring voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Battery monitoring system continually monitors the battery output and warns of the potential occurrence of a weak battery condition
- Relay drivers for prime mover starter, fuel shutoff (FSO), glow plug/spark ignition power and switched B+ applications are provided
- Integrated generator set protection is offered to protect the prime mover and generator
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop initiate a test with or without load, or a Base Load or Peak Shave session
- Digital Power Transfer Control (Automatic Mains Failure) provides load transfer operation in open transition, closed transition, or soft (ramping) transfer modes
- Extended Paralleling (Peak Shave/Base Load) regulates the genset real and reactive power output while paralleled to the utility. Power can be regulated at either the genset or utility bus monitoring point
- Digital frequency synchronization and voltage matching
- Isochronous Load Sharing
- Droop kW and kVAr Control
- The synchronization check function provides adjustments for phase angle window, voltage window, frequency window and time delay
- Utility / AC Bus metering and protection with PCC3300 voltage, current, kW and kVAr offering a measurement accuracy of 1%
- Advanced serviceability is offered via InPower™, a PC-based software service tool
- PCC3300 is designed for reliable operation in harsh environments with the unit itself being a fully encapsulated module
- RS-485 ModBus interface for interconnecting to customer equipment
- Native on PCC3300: Four discrete inputs, two dry contact relay outputs and two low-side driver outputs are provided and are all configurable.
  - Optional extra PCC3300 input and output capability available via AUX101
- Warranty and service – Cummins Power Generation offers a comprehensive warranty and worldwide distributor service network
- Global regulatory certification and compliance: PCC3300 is suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., UKCA and CE standards

Base Control Functions

HMI capability

Options: Local and remote HMI320 options are available

Operator adjustments: The HMI320 includes provisions for many set up and adjustment functions.

Genset hardware data: Access to the control and software part number, genset rating in kVA and genset model number is provided from the HMI320 or InPower.

Data logs: Information concerning all of the following parameters is periodically logged and available for viewing; engine run time, controller on time, number of start attempts, total kilowatt hours, and load profile. (Control logs data indicating the operating hours at percent of rated kW load, in 5% increments. The data is presented on the operation panel based on total operating hours on the generator.)

Fault history: Provides a record of the most recent fault conditions with control date and time stamp. Up to 32 events are stored in the control non-volatile memory.

Alternator data

- Voltage (single or three phase line-to-line and line-to-neutral)
- Current (single or three phase)
- kW, kVAr, Power Factor, kVA (three phase and total)
- Frequency

For Lean Burn Natural Gas Engine applications:

- Alternator heater status
- Alternator winding temperature (per phase) as well as alternator drive end and non-drive end bearing

Utility/AC bus data

- Voltage (three phase line-to-line and line-to-neutral)
- Current (three phase and total)
- kW, kVAR, Power Factor, kVA (three phase and total)
- Frequency

AmpSentry: 3x current regulation for downstream tripping/motor inrush management. Thermal damage curve (3-phase short) or fixed timer (2 sec for 1-Phase Short or 5 sec for 2-Phase short).

Engine data

- Starting battery voltage
- Engine speed
- Engine temperature
- Engine oil pressure
- Engine oil temperature
- Intake manifold temperature
- Coolant temperature
- Comprehensive Full Authority Engine (FAE) data (where applicable)

Lean Burn Natural Gas (LBNG) application parameters include:

- Safety shutoff valve status
- Valve proving status
- Downstream gas pressure
- Gas inlet pressure
- Gas mass flow rate
- Control valve position
- Gas outlet pressure
- Manifold pressure and temperature
- Throttle position
- Compressor outlet pressure
- Turbo speed
- Compressor bypass position
- Cylinder configuration (e.g., drive end and non-drive end configurations)
- Coolant pressure 1 and 2 as well as coolant temperature 1 and 2 for both HT/LT respectively
- Exhaust port temperature (up to 18 cylinders)
- Pre-filter oil pressure
- Exhaust back pressure
- Parent ECM internal temperature and isolated battery voltage
- Speed bias
- Child ECM internal temperature and isolated battery voltage
- Knock level, spark advance, and knock count (for up to 18 cylinders)
- Auxiliary supply disconnector status
- Engine heater status
- Coolant circulating pump status
- Lube oil priming pump status
- Lube oil status
- Oil heater status
- Derate authorization status
- Start system status
- Ventilator fan status
- Ventilation louvre status
- Radiator fan status
- DC PSU status
- Start inhibit/enable status and setup

Service adjustments – The HMI320 includes provisions for adjustment and calibration of genset control functions. Adjustments are protected by a password. Functions include:

- Engine speed governor adjustments
- Voltage regulation adjustments
- Cycle cranking
- Configurable fault set up
- Configurable input and output set up
- Meter calibration
- Paralleling setup
- Display language and units of measurement

Prime Mover Control

SAE-J1939 CAN interface to full authority ECMs (where applicable). Provides data transfer between genset and engine controller for control, metering and diagnostics.

12 V (DC) or 24 V (DC) nominal battery voltage is supported by PCC3300 for normal operation.

Temperature dependant prime mover governing dynamics: This function is supported enabling the engine to be responsive when warm and more stable when operating at lower temperature via providing control and modification over electronic governing parameters as a function of engine temperature.

Isochronous governing is provided in order to control prime mover speed within ±0.25% of nominal rated speed for any steady state load from no load to full load. During operation frequency drift should not exceed ±0.5% of nominal frequency given a 33ºC (or 60ºF) chance in ambient temperature within an eight-hour period.

Droop electronic speed is governing capability is natively offered by PCC3300 to permit droop from 0% to 10% between no load to full load.

Remote start capability is built into the PCC3300 as the unit accepts a ground signal from remote devices to automatically command the starting of the generator set as well as the reaching of rated speed, voltage and frequency or otherwise run at idle speed until prime mover temperature is adequate. The presence of a remote start signal shall cause the PCC3300 to leave sleep mode and return to normal power mode. PCC3300 supports an option for delayed start or stop.

Remote Start Integrity: In compliance with NEC2017 Start Signal Integrity standard – NFPA70 Article 700.10(D)(3), the remote start circuit from ATS to PCC3300 is continuously monitored for signal disturbance due to broken, disconnected or shorted wires via a configurable input. Loss of signal integrity results in activation of a remote start signal.

Remote and local emergency stopping capability: PCC3300 accepts ground signal from a locally or remoted mounted emergency stop switch to cause the generator set to immediately shutdown. The generator set is prevented from either running or cranking with the emergency stop switch engaged. If PCC3300 is in sleep mode, then the activation of any emergency stop switch shall return PCC3300 is normal powered state along with the activation of the corresponding shutdown and run-prevention states.

Sleep mode: PowerCommand 3.3 supports a configurable low current draw state, which is design with consideration to the needs of prime applications or others application without a battery charger (in order to minimize battery current drain).

Automatic prime mover starting: Any generator set controlled by PCC3300 is capable of automatic starting achieved via either magnetic pickup or main alternator output frequency. PCC3300 additionally supports configurable glow plug control where applicable.

Prime mover cycle cranking: PCC3300 supports configurable starting cycles and rest periods. Built in starter protection are incorporated to prevent the operator from specifying a starting sequence that may be damaging.

Configurable time delay functionality: PCC3300 supports time delayed generator set starting and stopping (for cooldown). Permissible time delays are as follows (noting a default setting is 0 seconds):

1. Start delay: 0 seconds to 300 seconds prior to starting after receiving a remote start signal.
2. Stop delay: 0 seconds to 600 seconds prior to shut down after receiving a signal to stop in normal operation modes.

Lean Burn Natural Gas application specific parameters

PCC3300 supports prime mover inhibiting in order to permit application-specific processes (i.e. Auxiliaries) to be started first.

Generator Control

PCC3300 performs both Genset voltage sensing and Genset voltage regulation as follows:

- Voltage sensing is integrated into PCC3300 via three phase line-to-line sensing that is compatible with shunt or PMG excitation systems
- Automatic voltage regulation is accomplished by using a three phase fully rectified input and has a FET output for good motor starting capability.

Major features of generator control include:

Digital output voltage regulation - Capable of regulating output voltage to within +/-1.0% for any loads between no load and full load. Voltage drift will not exceed +/-1.5% for a 40 ºC (104 ºF) change in temperature in an eight-hour period. On engine starting or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level.

The automatic voltage regulator feature can be disabled to allow the use of an external voltage regulator.

Droop voltage regulation - Control can be adjusted to droop from 0-10% from no load to full load.

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

Fault current regulation - PowerCommand® will regulate the output current on any phase to a maximum of three times rated current under fault conditions for both single phase and three phase faults. In conjunction with a permanent magnet generator, it will provide three times rated current on all phases for motor starting and short circuit coordination purpose.

Cylinder Cut-off System (CCS): PCC 3300 supports Cylinder Cut-off System which is used to operate the engines on half bank at no load and light load conditions. CCS has below benefits on engine

performance- improved emission standards, improved fuel efficiency, reduced hydrocarbons, reduced white smoke, reduced wet stacking and higher exhaust temperature at light loads to improve turbocharger operations and catalyst performance.

Step Timing Control (STC): PCC 3300 supports STC functionality which is used to advance the engine timing of a hydro-mechanical engine during start up and light load conditions. During ADVANCED injection timing, it:

- Improves cold weather idling characteristics
- Reduces cold weather white smoke
- Improves light load fuel economy
- Reduces injector carboning

Paralleling Functions

First Start Sensor™ system – PowerCommand® provides a unique control function that positively prevents multiple gensets from simultaneously closing to an isolated bus under black start conditions. The First Start Sensor system is a communication system between the gensets that allows the gensets to work together to determine which genset is a system should be the first to close to the bus. The system includes an independent backup function, so that if the primary system is disabled the required functions are still performed.

Synchronizing – Control incorporates a digital synchronizing function to force the genset to match the frequency, phase and voltage of another source such as a utility grid. The synchronizer includes provisions to provide proper operation even with highly distorted bus voltage waveforms. The synchronizer can match other sources over a range of 60-110% of nominal voltage and -24 to +6 hertz. The synchronizer function is configurable for slip frequency synchronizing for applications requiring a known direction of power flow at instant of breaker closure or for applications where phase synchronization performance is otherwise inadequate.

Load sharing control – The genset control includes an integrated load sharing control system for both real (kW) and reactive (kVar) loads when the genset(s) are operating on an isolated bus. The control system determines kW load on the engine and kVar load on the alternator as a percent of genset capacity, and then regulates fuel and excitation systems to maintain system and genset at the same percent of load without impacting voltage or frequency regulation. The control can also be configured for operation in droop mode for kW or Kvar load sharing.

Load govern control– When PowerCommand® receives a signal indicating that the genset is paralleled with an infinite source such as a utility (mains) service, the genset will operate in load govern mode. In this mode the genset will synchronize and close to the bus, ramp to a pre-programmed kW and kVar load level, and then operate at that point. Control is adjustable for kW values from 0-100% of standby rating, and 0.7-1.0 power factor (lagging). Default setting is 80% of standby and 1.0 power factor. The control includes inputs to allow independent control of kW and kVar load level by a remote device while in the load govern mode. The rate of load increase and decrease is also adjustable in the control. In addition, the control can be configured for operation in kW or kVAR load govern droop.

Load demand control – The control system includes the ability to respond to an external signal to initiate load demand operation. On command, the genset will ramp to no load, open its paralleling breaker, cool down, and shut down. On removal of the command, the genset will immediately start, synchronize, connect, and ramp to its share of the total load on the system.

Sync check – The sync check function decides when permissive conditions have been met to allow breaker closure. Adjustable criteria are: phase difference from 0.1-20 deg, frequency difference from 0.001-1.0 Hz, voltage difference from 0.5-10%, and a dwell time from 0.5-5.0 sec. Internally the sync check is used to perform closed transition operations. An external sync check output is also available.

Genset and utility/AC bus source AC metering – The control provides comprehensive three phase AC metering functions for both monitored sources, including: 3-phase voltage (L-L and L-N) and current, frequency, phase rotation, individual phase and totalized values of kW, kVAR, kVA and Power Factor; totalized positive and negative kW-hours, kVAR-hours, and kVA-hours. Three wire or four wire voltage connection with direct sensing of voltages to 600V, and up to 45kV with external transformers. Current sensing is accomplished with either 5 amp or 1 CT secondaries and with up to 10,000 amp primary. Maximum power readings are 32,000kW/kVAR/kVA.

Power transfer control – provides integrated automatic power transfer functions including source availability sensing, genset start/stop and transfer pair monitoring and control. The transfer/retransfer is configurable for open transition, fast closed transition (less than 100msec interconnect time), or soft closed transition (load ramping) sequences of operation. Utility source failure will automatically start genset and transfer load, retransferring when utility source returns. Test will start gensets and transfer load if test with load is enabled. Sensors and timers include:

Under voltage sensor: 3-phase L-N or L-L under voltage sensing adjustable for pickup from 85-100% of nominal. Dropout adjustable from 75-98% of pickup. Dropout delay adjustable from 0.1-30 sec.

Over voltage sensor: 3-phase L-N or L-L over voltage sensing adjustable for pickup from 95-99% of dropout. Dropout adjustable from 105-135% of nominal. Dropout delay adjustable from 0.5-120 sec. Standard configuration is disabled and is configurable to enabled in the field using the HMI or InPower service tools.

Over/Under frequency sensor: Center frequency adjustable from 45-65 Hz. Dropout bandwidth adjustable from 0.3-5% of center frequency beyond pickup bandwidth. Pickup bandwidth adjustable from 0.3-20% of center frequency. Field configurable to enable.

Loss of phase sensor: Detects out of range voltage phase angle relationship. Field configurable to enable.

Phase rotation sensor: Checks for valid phase rotation of source. Field configurable to enable.

Breaker tripped: If the breaker tripped input is active, the associated source will be considered as unavailable.

Timers: Control provides adjustable start delay from 0 - 300sec, stop delay from 0 - 800sec, transfer delay from 0-120sec, retransfer delay from 0-1800sec, programmed transition delay from 0-60sec, and maximum parallel time from 0-1800sec.

Negative Sequence Current Protection: PCC3300 supports this protection natively in order to determine if the generator is at any point was running subject to negative phase sequencing.

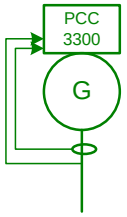
Breaker control – Utility and Genset breaker interfaces include separate relays for opening and closing breaker, as well as inputs for both 'a' and 'b' breaker position contacts and tripped status. Breaker diagnostics include Contact Failure, Fail to Close, Fail to Open, Fail to Disconnect, and Tripped. Upon breaker failure, appropriate control action is taken to maintain system integrity.

Exerciser clock –The exerciser clock (when enabled) allows the system to be operated at preset times in either test without load, test with load, or extended parallel mode. A Real Time Clock is built in. Up to 12 different programs can be set for day of week, time of day, duration, repeat interval, and mode. For example, a test with load for 1 hour every Tuesday at 2AM can be programmed. Up to 6 different exceptions can also be set up to block a program from running during a specific date and time period.

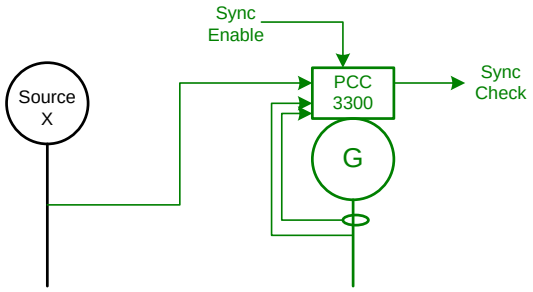
Extended paralleling – In extended paralleling mode (when enabled) the controller will start the genset and parallel to a utility source and then govern the real and reactive power output of the genset based on the desired control point. The control point for the real power (kW) can be configured for either the genset metering point ("Base Load") or the utility metering point ("Peak Shave"). The control point for the reactive power (kVAR or Power Factor) can also be independently configured for either the genset metering point or the utility metering point. This flexibility would allow base kW load from the genset while maintaining the utility power factor at a reasonable value to avoid penalties due to low power factor. The System always operates within genset ratings. The control point can be changed while the system is in operation. Set points can be adjusted via hardwired analog input or adjusted through an operator panel display or service tool.

Application types – Controller is configured to operating in one of six possible application types. These topologies are often used in combinations in larger systems, with coordination of the controllers in the system either by external device or by interlocks provided in the control. Topologies that may be selected in the control include:

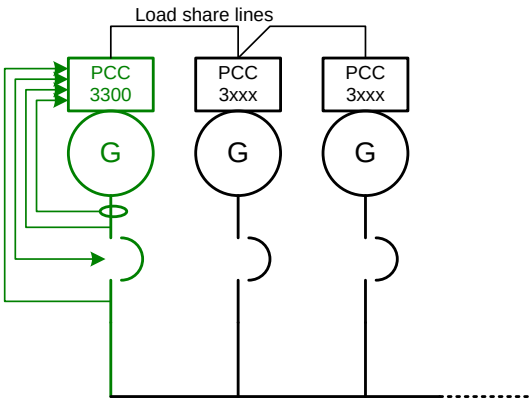
Standalone: Control provides monitoring, protection and control in a non-paralleling application.



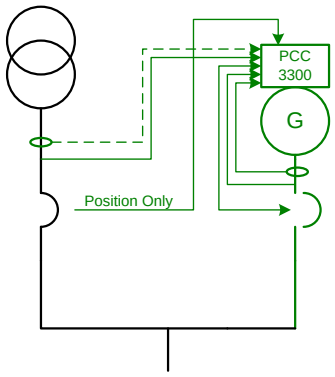
Synchronizer only: control will synchronize the genset to other source when commanded to either via a hardwired or Modbus driven input.



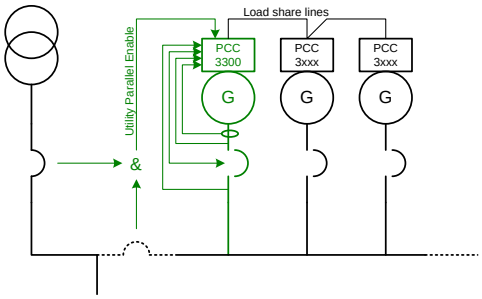
Isolated Bus: allows the genset to perform a dead bus closure or synchronize to the bus and isochronously share kW and kVAR loads with other gensets.



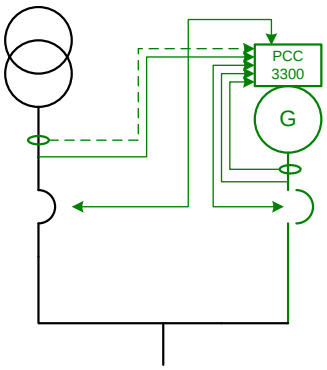
Utility Single: Control monitors one genset and utility. The control will automatically start and provide power to a load if the utility fails. The control will also resynchronize the genset back to the utility and provides extended paralleling capabilities.



Utility Multiple: Supports all functionality of Isolated Bus and provides extended paralleling to the utility. Extended paralleling load set points follow a constant setting; dynamically follow an analog input, Modbus register or HMI.

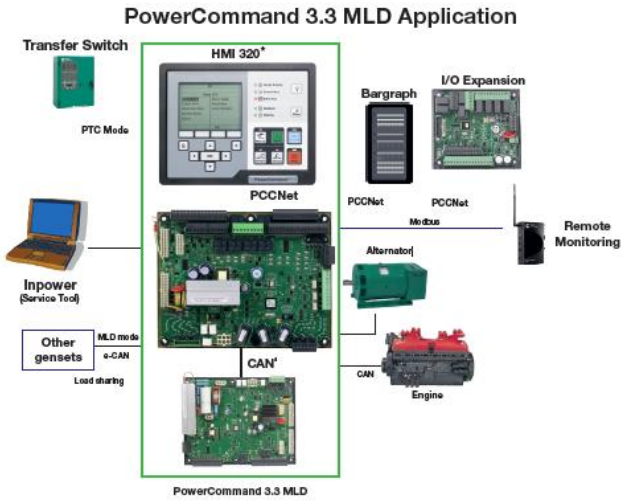


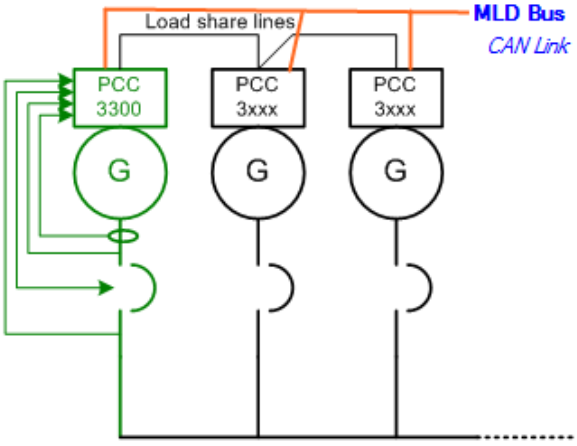
Power Transfer Control: Control operates a single genset/single utility transfer pair in open transition, fast closed transition, or soft closed transition. Extended paralleling functionality also provides base load and peak shave options.



Masterless Load Demand (Optional Feature):

PowerCommand® 3.3 with Masterless Load Demand (MLD) technology enables generator sets to start/stop automatically based on load demand. Masterless Load Demand-capable generators are equipped with an additional s-CAN network connection that allows sharing of information amongst paralleled generator sets. MLD has been designed for hassle-free installation, commissioning and operation. MLD functionality. Integrated on-board system logic provides the MLD topology control without the need for any additional system.





PCC3300 External Voltage and Frequency Biasing Inputs

PCC3300 supports externally driven voltage and frequency biasing capability in order to permit external paralleling (if intending to use this feature please contact your local distributor for further information).

Protective Functions

On operation of a protective function the control will indicate a fault by illuminating the appropriate status LED on the HMI, as well as display the fault code and fault description on the LCD. The nature of the fault and time of occurrence are logged in the control. The service manual and InPower service tool provide service keys and procedures based on the service codes provided. Protective functions include:

Battle short mode

When enabled and the *battle short* switch is active, the control will allow some shutdown faults to be bypassed. If a bypassed shutdown fault occurs, the fault code and description will still be annunciated, but the genset will not shutdown. This will be followed by a *fail to shutdown* fault. Emergency stop shutdowns and others that are critical for proper operation (or are handled by the engine ECM) are not bypassed. Please refer to the Control Application Guide or Manual for list of these faults.

Derate

The Derate function reduces output power of the genset in response to a fault condition. If a Derate command occurs while operating on an isolated bus, the control will issue commands to reduce the load on the genset via contact closures or Modbus. If a Derate command occurs while in utility parallel mode, the control will actively reduce power by lowering the base load kW to the derated target kW.

Configurable alarm and status inputs

The control accepts up to four alarm or status inputs (configurable contact closed to ground or open) to indicate a configurable (customer-specified) condition.

The control is programmable for warning, derate, shutdown, shutdown with cooldown or status indication and for labeling the input.

Emergency stop

Annunciated whenever either emergency stop signal is received from external switch.

General prime mover protection

Low and high battery voltage warning - Indicates status of battery charging system (failure) by continuously monitoring battery voltage.

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

Low coolant level warning – Can be set up to be a warning or shutdown.

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

Fail to start (overcrank) shutdown - The control system will indicate a fault if the genset fails to start by the completion of the engine crack sequence.

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

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

Fault simulation –The control in conjunction with InPower software, will accept commands to allow a technician to verify the proper operation of the control and its interface by simulating failure modes or by forcing the control to operate outside of its normal operating ranges. InPower also provides a complete list of faults and settings for the protective functions provided by the controller.

For Lean Burn Natural Gas Engine applications:

Off load running (protection) – This feature protects the engine in the event the genset is being called to go off load for too long.

Hydro Mechanical fuel system engine protection:

Overspeed shutdown – Default setting is 115% of nominal

Low lube oil pressure warning/shutdown – Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

High lube oil temperature warning/shutdown – Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

High engine temperature warning/shutdown – Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

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

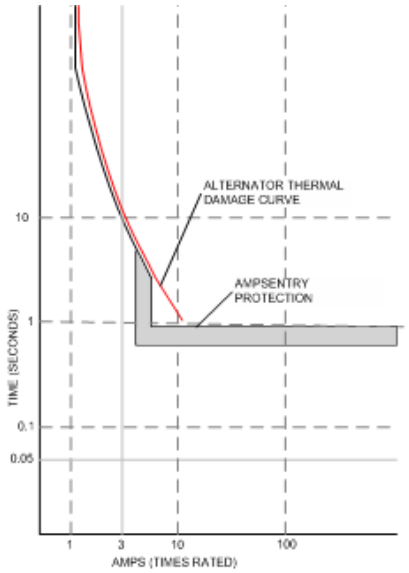
High intake manifold temperature shutdown – Level is preset (configurable with InPower or HMI) to match the capabilities of the engine used. Control includes time delays to prevent nuisance alarms.

Full authority electronic engine protection:

Engine fault detection is handled inside the engine ECM. Fault information is communicated via the SAE-J1939 data link for annunciation in the HMI.

Alternator Protection

AmpSentry protective relay - A comprehensive monitoring and control system integral to the PowerCommand® Control System that guards the electrical integrity of the alternator and power system by providing protection against a wide array of fault conditions in the genset or in the load. It also provides single and three phase fault current regulation (3x Current) so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. Thermal damage curve (3 phase short) or fixed timer (2sec for 1P short, 5sec for 2P short). See document R1053 for a full-size time over current curve. The control does not included protection required for interconnection to a utility (mains) service.



AmpSentry Maintenance Mode (AMM) - Instantaneous tripping, if AmpSentry Maintenance mode is active (50mS response to turn off AVR excitation/shutdown genset) for arc flash reduction when personnel are near genset.

High AC voltage shutdown (59) - Output voltage on any phase exceeds preset values. Time to trip is inversely proportional to amount above threshold. Values adjustable from 105-125% of nominal voltage, with time delay adjustable from 0.1-10 seconds. Default value is 110% for 10 seconds.

Low AC voltage shutdown (27) - Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of reference voltage, time delay 2-20 seconds. Default value is 85% for 10 seconds. Function tracks reference voltage. Control does not nuisance trip when voltage varies due to the control directing voltage to drop, such as during a V/Hz roll-off or synchronizing.

Under frequency shutdown (81 u) - Genset output frequency cannot be maintained. Settings are adjustable from 2-10 Hz below reference governor set point, for a 5-20 second time delay. Default: 6 Hz, 10 seconds. Under frequency protection is disabled when excitation is switched off, such as when engine is operating in idle speed mode.

Over frequency shutdown/warning (81o) - Genset is operating at a potentially damaging frequency level. Settings are adjustable from 2-10 Hz above nominal governor set point for a 1-20 second time delay. Default: 6 Hz, 20 seconds, disabled.

Overcurrent warning/shutdown (51) - Implementation of the thermal damage curve with instantaneous trip level calculated based on current transformer ratio and application power rating.

Loss of sensing voltage shutdown - Shutdown of genset will occur on loss of voltage sensing inputs to the control.

Field overload shutdown - Monitors field voltage to shutdown genset when a field overload condition occurs.

Over load (kW) warning - Provides a warning indication when engine is operating at a load level over a set point. Adjustment range: 80-140% of application rated kW, 0-120 second delay. Defaults: 105%, 60 seconds.

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

Reverse Var shutdown (40) - Shutdown level is adjustable: 15-50% of rated Var output, delay 10-60 seconds. Default: 20%, 10 seconds.

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

Negative sequence overcurrent warning (46) – Control protects the generator from damage due to excessive imbalances in the three phase load currents and/or power factors.

Custom overcurrent warning/shutdown (51) – Control provides the ability to have a custom time overcurrent protection curve in addition to the AmpSentry protective relay function.

Ground fault overcurrent (51G) – Control detects a ground fault either by an external ground fault relay via a contact input or the control can measure the ground current from an external current transformer. Associated time delays and thresholds are adjustable via InPower or HMI.

Paralleling Protection

Breaker fail to close Warning: When the control signals a circuit breaker to close, it will monitor the breaker auxiliary contacts and verify that the breaker has closed. If the control does not sense a breaker closure within an adjustable time period after the close signal, the fail to close warning will be initiated.

Breaker fail to open warning: The control system monitors the operation of breakers that have been signaled to open. If the breaker does not open within and adjustable time delay, a Breaker Fail to Open warning is initiated.

Breaker position contact warning: The controller will monitor both 'a' and 'b' position contacts from the breaker. If the contacts disagree as to the breaker position, the breaker position contact warning will be initiated.

Breaker tripped warning: The control accepts inputs to monitor breaker trip / bell alarm contact and will initiate a breaker tripped warning if it should activate.

Fail to disconnect warning: In the controller is unable to open either breaker, a fail to disconnect warning is initiated. Typically, this would be mapped to a configurable output, allowing an external device to trip a breaker.

Fail to synchronize warning: Indicates that the genset could not be brought to synchronization with the bus. Configurable for adjustable time delay of 10 -900 seconds, 120 default.

Phase sequence sensing warning: Verifies that the genset phase sequence matches the bus prior to allowing the paralleling breaker to close.

Maximum parallel time warning (power transfer control mode only): During closed transition load transfers, control independently monitors paralleled time. If time is exceeded, warning is initiated and genset is disconnected.

Bus or genset PT input calibration warning: The control system monitors the sensed voltage from the bus and genset output voltage potential transformers. When the paralleling breaker is closed, it will indicate a warning condition if the read values are different.

Field Control Interface

Input signals to the PowerCommand® control include:

- Coolant level (where applicable)
- Fuel level (where applicable)
- Remote emergency stop
- Remote fault reset
- Remote start
- Rupture basin
- Start type signal
- Battle short
- Load demand stop
- Synchronize enable
- Genset circuit breaker inhibit
- Utility circuit breaker inhibit
- Single mode verify
- Transfer inhibit – prevent transfer to utility (in power transfer control mode)
- Retransfer inhibit – prevent retransfer to genset (in power transfer control mode)
- kW and kVAR load setpoints

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

Input signals for Lean Burn Natural Gas Engine applications:

- Gearbox oil pressure/temperature protection
- Fire fault
- Earth fault support as a discrete input via an appropriate secondary detection device
- Differential fault
- DC power supply fault
- Genset Interface Box (GIB) isolator open fault
- Start inhibit/enable (x3)
- Radiator fan trip
- Ventilator fan trip
- Ventilation louvers closed
- Start system trip
- Alternator heater trip
- Alternator heater status
- Alternator winding temperature (PT100 RTDx3)
- Alternator drive end bearing temperature (PT100 RTD)
- Alternator non-drive end bearing temperature (PT100 RTD)

Output signals from the PowerCommand® control include:

- Load dump signal: Operates when the genset is in an overload condition.
- Delayed off signal: Time delay-based output which will continue to remain active after the control has removed the run command. Adjustment range: 0 - 120 seconds. Default: 0 seconds.

- Configurable relay outputs: Control includes (4) relay output contacts (3 A, 30VDC). These outputs can be configured to activate on any control warning or shutdown fault as well as ready to load, not in auto, common alarm, common warning and common shutdown.
- Ready to load (genset running) signal: Operates when the genset has reached 90% of rated speed and voltage and latches until genset is switched to off or idle mode.
- Paralleling circuit breaker relays outputs: Control includes (4) relay output contacts (3.5A, 30 VDC) for opening and closing of the genset and utility breakers.

Output Signals for Lean Burn Natural Gas Engine applications:

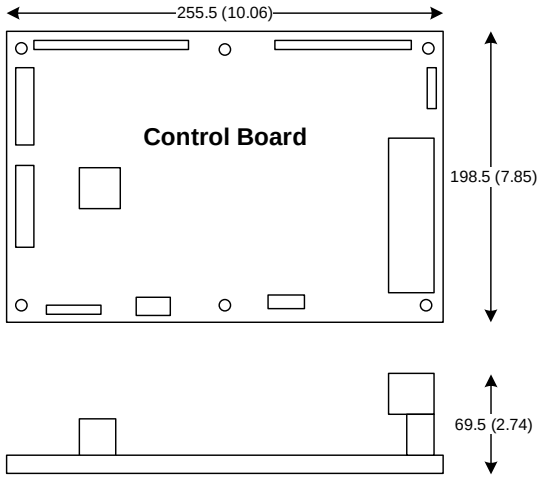
- Start inhibit/enable event
- Emergency stop event
- Ventilator fan run control
- Louvre control
- Radiator fan control
- Alternator heater control
- Engine at idle speed event

Communications connections include:

- PC tool interface: This RS-485 communication port allows the control to communicate with a personal computer running InPower software.
- Modbus RS-485 port: Allows the control to communicate with external devices such as PLCs using Modbus protocol.

  Note - An RS-232 or USB to RS-485 converter is required for communication between PC and control.
- Networking: This RS-485 communication port allows connection from the control to the other Cummins Power Generation products.

Mechanical Drawing



PowerCommand® Human Machine Interface HMI320

Description

This control system includes an intuitive operator interface panel that allows for complete genset control as well as system metering, fault annunciation, configuration and diagnostics. The interface includes five genset status LED lamps with both internationally accepted symbols and English text to comply with customer's needs. The interface also includes an LED backlit LCD display with tactile feel soft-switches for easy operation and screen navigation. It is configurable for units of measurement and has adjustable screen contrast and brightness.

The *run/off/auto* switch function is integrated into the interface panel.

All data on the control can be viewed by scrolling through screens with the navigation keys. The control displays the current active fault and a time-ordered history of the five previous faults.

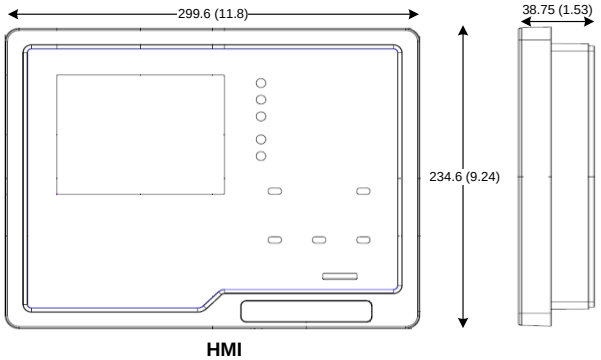
Features:

- LED indicating lamps
  - genset running
  - remote start
  - not in auto
  - shutdown
  - warning
  - auto
  - manual and stop
  - Circuit breaker open (if equipped)
  - Circuit breaker closed (if equipped)
- 320 x 240 pixels graphic LED backlight LCD.
- Four tactile feel membrane switches for LCD defined operation. The functions of these switches are defined dynamically on the LCD.
- Seven tactile feel membrane switches dedicated screen navigation buttons for up, down, left, right, ok, home and cancel.
- Six tactile feel membrane switches dedicated to control for auto, stop, manual, manual start, fault reset and lamp test/panel lamps.
- Two tactile feel membrane switches dedicated to control of circuit breaker (where applicable).
- Allows for complete genset control setup.
- Certifications: Suitable for use on gensets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., UKCA and CE standards.
- Languages supported: English, Spanish, French, German, Italian, Greek, Portuguese, Finnish, Norwegian, Danish, Russian (Cyrillic), Chinese, Hungarian, Japanese, Polish, Korean, Romanian, Brazilian Portuguese, Turkish, Dutch, and Czech

Communications connections include:

- PC tool interface - This RS-485 communication port allows the HMI to communicate with a personal computer running InPower.
- This RS-485 communication port allows the HMI to communicate with the main control board.

Mechanical Drawing



HMI

Dimensions: mm (inches)

Software

InPower (beyond 6.5 version) is a PC-based software service tool that is designed to directly communicate to PowerCommand® gensets and transfer switches, to facilitate service and monitoring of these products.

Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 ºC (-40 ºF) to +70º C (158 ºF), and for storage from -55 ºC (-67 ºF) to +80 ºC (176 ºF). Control will operate with humidity up to 95%, non-condensing.

The HMI is designed for proper operation in ambient temperatures from -20 ºC (-4 ºF) to +70 ºC (158 ºF), and for storage from -30 ºC (-22 ºF) to +80 ºC (176 ºF).

The control board is fully encapsulated to provide superior resistance to dust and moisture. Display panel has a single membrane surface, which is impervious to effects of dust, moisture, oil and exhaust fumes. This panel uses a sealed membrane to provide long reliable service life in harsh environments.

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

Certifications

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

- NFPA 110 for level 1 and 2 systems.
- ISO 8528-4:2005 compliance, controls and switchgear (second edition)
- CE marking: The CE marking is only valid when equipment is used in a fixed installation application. Material compliance declaration is available upon request.
- UKCA marking- The UKCA marking is only valid when equipment is used in a fixed installation application. Material compliance declaration is available upon request.
- EN 50081-1,2 residential/light industrial emissions or industrial emissions.
- EN 50082-1,2 residential/light industrial or industrial susceptibility.
- ISO 7637-2, level 2; DC supply surge voltage test.
- Mil Std 202C, Method 101 and ASTM B117: Salt fog test.
- UL 6200 recognized, suitable for use on UL 2200 Listed generator sets.
- CSA C282-M1999 compliance
- CSA 22.2 No. 14 M91 industrial controls.
- PowerCommand® control systems and generator sets are designed and manufactured in ISO 9001 certified facilities.
- ROHS (Restriction of Hazardous substance) complaint both for HMI 320 & PCC3300v2.

Reference Documents

Please refer to the following reference documents available in the PowerSuite library:

- PowerCommand™ 3.3. Application Guide
- T-037: PowerCommand Control Application Manual (ANSI Protective Functions)
- T-040: PowerCommand 3.3 Paralleling Application Guide

Please refer to the following reference documents available on Cummins Quickserve:

- Service Manuals for PC3.3 (non-MLD) and PC3.3 (MLD)
- Modbus Register Mapping

Warranty

All components and subsystems are covered by an express limited one-year warranty. Other optional and extended factory warranties and local distributor maintenance agreements are available.

PCCNet COMPATIBLE

2023 EPA Tier 2 Exhaust Emission Compliance Statement 1000DQFAD Stationary Emergency,

60 Hz Diesel Generator Set

Compliance Information:

The engine used in this generator set complies with Tier 2 emissions limit of U.S. EPA New Source Performance Standards for stationary emergency engines under the provisions of 40 CFR 60 Subpart IIII.

Engine Manufacturer:	Cummins Inc.
EPA Certificate Number:	PCEXL030.AAD-032
Effective Date:	06/15/2022
Date Issued:	06/15/2022
EPA Engine Family (Cummins Emissions Family):	PCEXL030.AAD

Engine Information:

Model:	QSK30/QST30-G/QST30-G5 NR2	Bore:	5.51 in. (140 mm)
Engine Nameplate HP:	1490	Stroke:	6.50 in. (165 mm)
Type:	4 Cycle, 50°V, 12 Cylinder Diesel	Displacement:	1860 cu. in. (30.5 liters)
Aspiration:	Turbocharged & Low Temperature After-Cooled	Compression Ratio:	14.7:1
Emission Control Device:	Electronic Control		

Diesel Fuel Emissions Limits

D2 cycle exhaust emissions	Grams per BHP-hr			Grams per kW_m-hr		
	NO_X + NMHC	CO	PM	NO_X + NMHC	CO	PM
EPA Emissions Limit	4.8	2.6	0.15	6.4	3.5	0.20

Test methods: EPA emissions recorded per 40 CFR Part 60, 89, 1039, 1065 and weighted at load points prescribed in the regulations for constant speed engines.

Diesel fuel specifications: Cetane number: 40-50. Reference: ASTM D975 No. 2-D, 300-500 ppm Sulfur.

Reference conditions: Air inlet temperature: 25°C (77°F), Fuel inlet temperature: 40°C (104°F). Barometric pressure: 100 kPa (29.53 in Hg), Humidity: 10.7 g/kg (75 grains H_2O/lb) of dry air; required for NOx correction, Restrictions: Intake restriction set to a maximum allowable limit for clean filter; Exhaust back pressure set to a maximum allowable limit.

Tests conducted using alternate test methods, instrumentation, fuel or reference conditions can yield different results.
Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

Cooling system data
DQFAD

Enhanced High Ambient Air Temperature Radiator Cooling System												
				Max cooling @ air flow static restriction, unhoused (inches water/mm water)						Housed in free air, no air discharge restriction		
				0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	1.0/25.4	1.5/38.1	Weather	Sound level 1	Sound level 2
	Fuel Type	Duty	Rating (kW)	Maximum allowable ambient temperature, degree C								
60 Hz	Diesel	Standby	1000	61.5	58.6	55.4	52.1	49.9	40.7	53.4	52.4	52.3
		Prime	900	60.0	57.1	54.1	51.4	48.0	39.6	53.0	52.1	52.0
				Airflow (m^3/s) – Actual @ Fan								
				20.3	19.4	18.6	17.6	16.5	14.9	18.3	18.0	17.9

Notes:

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

A-weighted Sound Pressure Level @ 7 meters, dB(A)

See notes 2, 5 and 7-11 listed below

Configuration	Exhaust	Applied Load	Position (Note 2)								8 Position Average
			1	2	3	4	5	6	7	8	
Standard – Unhoused	Infinite Exhaust	0% Prime	84.4	87.4	87.3	89.4	86.4	88.7	89.8	87.5	87.9
		75% Prime	87.8	91.1	90.7	91.7	88.7	91.2	92.0	90.9	90.7
		100% Prime	88.9	92.7	92.4	93.3	89.6	92.7	93.4	92.3	92.2
		100% Standby	90.1	93.1	93.3	93.8	90.1	93.3	94.0	93.0	92.8
Standard – Unhoused (Remote Cooling)	Infinite Exhaust	0% Prime	82.6	87.0	86.2	86.9	85.9	88.5	88.4	87.3	86.9
		75% Prime	87.5	90.8	91.2	91.5	89.6	90.8	91.7	91.1	90.7
		100% Prime	88.7	92.3	92.7	92.7	91.3	92.7	93.1	92.2	92.2
		100% Standby	90.2	93.2	93.9	93.8	92.1	93.8	94.1	93.3	93.2
F200 – Weather	Genset Mounted Muffler	0% Prime	87.2	86.7	77.9	85.4	83.4	85.3	76.9	85.9	84.8
		75% Prime	90.6	88.9	80.7	87.9	85.7	88.2	79.5	88.4	87.5
		100% Prime	91.7	90.6	82.3	89.2	87.2	89.5	81.1	89.7	88.8
		100% Standby	92.2	91.4	83.5	90.0	88.1	90.3	82.0	90.6	89.6
F201 – Quiet Site II First Stage	Genset Mounted Muffler	0% Prime	79.5	73.6	69.5	69.2	71.1	68.6	68.4	73.7	73.5
		75% Prime	83.0	76.8	73.9	73.6	75.6	74.1	72.1	76.1	77.1
		100% Prime	84.5	78.4	76.0	76.2	78.5	76.8	74.6	78.2	79.1
		100% Standby	85.3	79.4	77.3	77.6	79.6	78.1	75.9	79.2	80.1
F202 – Quiet Site II Second Stage	Genset Mounted Muffler	0% Prime	71.7	69.8	68.6	72.5	70.7	74.2	68.4	68.3	71.0
		75% Prime	72.6	72.2	73.5	76.0	73.2	74.5	71.2	72.3	73.4
		100% Prime	73.5	73.4	74.9	77.2	75.1	75.3	72.3	73.3	74.6
		100% Standby	74.2	73.8	75.5	78.0	75.5	76.2	72.9	73.8	75.3

Average A-weighted Sound Pressure Level @ 1 meter, dB(A)

See notes 1, 5 and 7-14 listed below

Configuration	Exhaust	Applied Load	Octave Band Center Frequency (Hz)											Overall Sound Pressure Level
			16	31.5	63	125	250	500	1000	2000	4000	8000	16000	
Standard – Unhoused	Infinite Exhaust	0% Prime	N/A	42.1	62.4	80.7	85.4	89.7	93.1	91.0	85.8	79.3	70.9	97.1
		75% Prime	N/A	44.8	63.6	81.1	86.3	91.3	94.8	94.5	91.6	86.9	77.6	99.9
		100% Prime	N/A	46.5	65.9	81.8	87.1	92.2	95.7	95.9	92.9	92.7	79.6	101.4
		100% Standby	N/A	47.1	66.6	82.4	87.3	92.4	96.0	96.5	93.4	94.6	81.7	102.1
Standard – Unhoused (Remote Cooling)	Infinite Exhaust	0% Prime	N/A	41.3	58.2	72.3	80.7	88.2	92.4	89.6	84.5	78.0	69.9	95.8
		75% Prime	N/A	44.0	60.9	76.9	83.2	90.6	94.8	94.9	91.0	86.9	77.4	99.7
		100% Prime	N/A	46.8	64.4	80.1	84.0	91.6	96.0	96.4	92.6	90.4	79.1	101.2
		100% Standby	N/A	47.1	64.1	80.1	84.4	91.8	96.3	97.4	93.5	95.1	80.5	102.4
F200 – Weather	Genset Mounted Muffler	0% Prime	N/A	45.5	67.0	76.2	81.2	84.9	87.2	83.7	78.4	69.9	57.5	91.3
		75% Prime	N/A	52.6	70.8	79.8	84.1	86.9	89.4	86.7	82.7	79.0	65.6	93.9
		100% Prime	N/A	54.2	72.0	81.1	85.5	88.5	90.9	87.9	83.9	82.4	67.1	95.4
		100% Standby	N/A	54.4	72.8	81.7	86.1	89.7	91.7	88.9	84.6	84.3	68.7	96.4
F201 – Quiet Site II First Stage	Genset Mounted Muffler	0% Prime	N/A	44.1	65.4	72.5	71.1	73.1	74.9	73.3	69.2	61.1	49.8	80.7
		75% Prime	N/A	52.1	70.2	76.4	77.1	78.7	78.7	79.1	75.6	74.4	58.1	86.0
		100% Prime	N/A	53.3	71.4	78.1	79.8	82.0	81.9	80.8	76.9	77.9	60.1	88.5
		100% Standby	N/A	53.5	71.7	78.8	80.7	83.6	83.5	81.5	78.1	79.8	62.0	89.8
F202 – Quiet Site II Second Stage	Genset Mounted Muffler	0% Prime	N/A	39.4	59.9	72.3	76.3	68.0	68.5	67.4	62.0	54.0	43.9	79.1
		75% Prime	N/A	40.7	64.4	74.6	72.3	68.7	75.5	78.2	77.5	70.4	54.8	83.5
		100% Prime	N/A	42.5	65.0	75.1	72.2	70.7	76.6	79.7	79.3	74.9	58.5	85.0
		100% Standby	N/A	42.0	65.4	75.2	72.3	71.5	77.2	80.5	80.0	77.1	60.2	85.9

A-weighted Sound Pressure Level @ Operator Location, dB(A)

See notes 1, 3, 5 and 7-14 listed below

Configuration	Exhaust	Applied Load	Octave Band Center Frequency (Hz)											Overall Sound Pressure Level
			16	31.5	63	125	250	500	1000	2000	4000	8000	16000	
Standard – Unhoused	Infinite Exhaust	100% Prime	N/A	53.2	67.7	79.0	83.7	86.7	89.6	91.0	85.6	88.1	70.4	96.0
		100% Standby	N/A	54.0	69.3	79.5	83.5	86.7	90.2	91.7	86.0	93.8	75.3	97.9
Standard – Unhoused (Remote Cooling)	Infinite Exhaust	100% Prime	N/A	50.2	61.3	74.5	83.7	88.1	90.3	92.6	86.0	85.4	70.1	96.6
		100% Standby	N/A	50.7	61.6	74.7	83.9	88.0	91.0	92.9	86.9	90.9	71.5	97.7
F200 – Weather	Genset Mounted Muffler	100% Prime	N/A	44.5	66.3	73.2	77.3	80.8	83.3	79.4	74.0	74.9	59.2	87.5
		100% Standby	N/A	45.4	67.0	73.4	77.8	81.8	84.7	80.2	74.7	76.7	60.5	88.6
F201 – Quiet Site II First Stage	Genset Mounted Muffler	100% Prime	N/A	48.2	61.8	68.6	71.6	73.4	74.2	74.5	69.1	65.4	48.6	80.5
		100% Standby	N/A	48.7	62.5	69.5	72.2	74.3	74.9	75.3	69.7	65.7	50.2	81.2
F202 – Quiet Site II Second Stage	Genset Mounted Muffler	100% Prime	N/A	39.9	56.0	71.6	70.3	67.4	72.4	76.3	70.7	68.1	51.3	80.4
		100% Standby	N/A	39.0	56.5	71.4	70.3	68.4	72.6	77.0	71.2	68.3	52.8	80.8

Sound Data
DQFAD
QST30 60Hz Diesel

A-weighted Sound Power Level, dB(A)

See notes 1, 3 and 6-14 listed below

Configuration	Exhaust	Applied Load	Octave Band Center Frequency (Hz)											Overall Sound Power Level
			16	31.5	63	125	250	500	1000	2000	4000	8000	16000	
Standard – Unhoused	Infinite Exhaust	0% Prime	N/A	61.7	82.1	100.3	105.0	109.3	112.7	110.6	105.4	98.9	90.6	116.8
		75% Prime	N/A	64.4	83.2	100.7	106.0	111.0	114.4	114.2	111.2	106.6	97.2	119.5
		100% Prime	N/A	66.2	85.5	101.4	106.7	111.9	115.3	115.5	112.5	112.3	99.2	121.0
		100% Standby	N/A	66.7	86.2	102.1	106.9	112.0	115.6	116.1	113.1	114.3	101.3	121.7
Standard – Unhoused (Remote Cooling)	Infinite Exhaust	0% Prime	N/A	61.0	77.8	91.9	100.3	107.9	112.0	109.2	104.2	97.7	89.5	115.4
		75% Prime	N/A	63.7	80.5	96.5	102.9	110.3	114.5	114.6	110.7	106.5	97.0	119.4
		100% Prime	N/A	66.5	84.1	99.7	103.7	111.2	115.7	116.0	112.2	110.1	98.8	120.8
		100% Standby	N/A	66.7	83.7	99.7	104.0	111.5	116.0	117.0	113.1	114.7	100.1	122.0
F200 – Weather	Genset Mounted Muffler	0% Prime	N/A	67.0	88.6	97.8	102.8	106.5	108.8	105.3	100.0	91.5	79.1	112.8
		75% Prime	N/A	74.1	92.4	101.4	105.7	108.4	110.9	108.3	104.3	100.5	87.2	115.5
		100% Prime	N/A	75.7	93.5	102.7	107.1	110.1	112.4	109.4	105.5	104.0	88.7	117.0
		100% Standby	N/A	76.0	94.3	103.3	107.6	111.3	113.3	110.4	106.2	105.9	90.3	117.9
F201 – Quiet Site II First Stage	Genset Mounted Muffler	0% Prime	N/A	66.0	87.4	94.4	93.1	95.1	96.9	95.2	91.2	83.1	71.8	102.6
		75% Prime	N/A	74.1	92.1	98.4	99.1	100.6	100.7	101.1	97.6	96.4	80.0	108.0
		100% Prime	N/A	75.2	93.3	100.1	101.7	103.9	103.8	102.8	98.9	99.8	82.1	110.5
		100% Standby	N/A	75.5	93.7	100.7	102.7	105.6	105.5	103.5	100.0	101.8	83.9	111.8
F202 – Quiet Site II Second Stage	Genset Mounted Muffler	0% Prime	N/A	61.5	82.0	94.3	98.4	90.1	90.5	89.5	84.1	76.0	65.9	101.2
		75% Prime	N/A	62.8	86.5	96.7	94.4	90.8	97.6	100.3	99.5	92.5	76.9	105.6
		100% Prime	N/A	64.6	87.1	97.1	94.3	92.8	98.7	101.8	101.4	97.0	80.6	107.1
		100% Standby	N/A	64.0	87.5	97.3	94.4	93.6	99.3	102.6	102.1	99.2	82.2	107.9

Exhaust Sound Power Level, dB(A)

See notes 4 and 6-14 listed below

Configuration	Applied Load	Octave Band Center Frequency (Hz)											Overall Sound Power Level
		16	31.5	63	125	250	500	1000	2000	4000	8000	16000	
Open Exhaust (No Muffler)	0% Prime	N/A	61.1	92.9	103.8	110.8	109.4	106.6	105.2	103.5	96.1	86.0	115.3
	75% Prime	N/A	66.9	102.0	111.9	115.4	120.6	117.6	119.4	118.8	112.7	103.1	126.1
	100% Prime	N/A	66.4	102.4	112.3	116.6	120.3	117.9	121.3	120.7	114.9	104.8	127.1
	100% Standby	N/A	69.4	103.7	114.0	117.6	121.3	119.4	122.4	121.5	116.1	105.0	128.2

Global Notes:

1. Sound pressure levels at 1 meter are measured per the requirements of ISO 3744, ISO 8528-10, and European Communities Directive 2000/14/EC as applicable. The microphone measurement locations are 1 meter from a reference parallelepiped just enclosing the generator set (enclosed or unenclosed).
2. Seven-meter measurement location 1 is 7 meters (23 feet) from the generator (alternator) end of the generator set, and the locations proceed counterclockwise around the generator set at 45° angles at a height of 1.2 meters (48 inches) above the ground surface.
3. Sound Power Levels are calculated according to ISO 3744, ISO 8528-10, and/or CE (European Union) requirements.
4. Exhaust Sound Levels are measured and calculated per ISO 6798, Annex A.
5. Reference Sound Pressure Level is 20 µPa
6. Reference Sound Power Level is 1 pW (10^{-12} Watt)
7. Sound data for remote-cooled generator sets are based on rated load without cooling fan noise.
8. Sound data for the generator set with infinite exhaust do not include the exhaust noise contribution
9. Published sound levels are measured at CE certified test site and are subject to instrumentation measurement, installation, and manufacturing variability.
10. Unhoused/Open configuration generator sets refers to generator sets with no sound enclosures of any kind.
11. Housed/Enclosed/Closed/Canopy configuration generator sets refer to generator sets that have noise reduction sound enclosure installed over the generator set and usually integrally attached to the skid base/base frame/fuel container base of the generator set.

12. Published sound levels meet the requirements India's Central Pollution Control Board (Ministry of Environment & Forests), vide GSR 371 (E), which states the A-weighted sound level at 1 meter from any diesel generator set up to a power output rating of 1000kVA shall not exceed 75 dB(A).
13. For updated noise pollution information for India see website: http://www.envfor.nic.in/legis/legis.html
14. Sound levels must meet India's Ambient Air Noise Quality Standards detailed for Daytime/Night-time operation in Noise Pollution (Regulation and Control) Rules, 2000

Specification Sheet

Enclosures and Tanks

250-1000 kW Gensets

Enclosure Standard Features

- 14-gauge steel construction (panels)
- Stainless steel hardware
- Zinc phosphate pretreatment, e-coat primer and super durable powder topcoat paint minimize corrosion and color fade
- Package listed to UL 2200
- Designed to satisfy national electrical code installation requirements
- Fuel and electrical stub-up area within enclosure perimeter
- Fixed louvers
- Cambered roof prevents water accumulation
- Recessed, lockable doors in two sides
- Retainers hold doors open for easy access
- Enclosed exhaust silencer ensures safety and protects against rust
- Rain cap
- Exterior oil and coolant drains with interior valves for ease of service
- Rodent barriers on inlet
- Non-hydroscopic sound attenuating material
- Side mounted controls and circuit breakers
- Easy access lifting points for spreader bars
- Dual vibration isolation system (250-500 kW)
- Spring vibration isolation system (600-1000 kW)
- Enclosure mounts to lifting base or fuel tank (250-500 kW)
- Enclosure mounts to lifting base (600-1000 kW)
- Factory pre-assembled package
- Designed for outdoor use only
- Externally mounted emergency stop button for operator safety (optional on 250-500 kW)
- Horizontal air discharge to prevent leaf and snow accumulation (600-1000 kW)

Options

- Three levels of sound attenuation
- Motorized louvers to protect from ice and snow accumulation (available on air inlet for all models and on air outlet on level II, 250-500 kW enclosures only)
- Horizontal air discharge, sound level 2 only (250-500 kW)
- Aluminium construction with roll-coated polymer paint
- Wind rated to 150 mph
- Neutral sandstone paint color
- Factory mounted battery charger
- External 120 VAC service outlet
- Rain hoods for air inlet (250-500 kW)
- Lifting base in lieu of a sub-base tank (250-500 kW)
  - Pre-wired AC distribution package
  - 100 amp (250-500 kW) or 150 amp (600-1000 kW) main circuit breaker; connected to 120 VAC Line-Neutral and 208 or 240 VAC Line-Line, spare breaker positions and capacity for future upgrades (600-1000 kW)
  - GFCI protected internal 120 VAC service receptacle
  - GFCI protected weather proof external 120 volt service receptacle
  - All factory installed AC powered features pre-wired into load center
- Interior lights – 120 volt (600-1000 kW)
- Rain hoods for air inlet (250-500 kW)
- Seismic isolators available (600-1000 kW)

Fuel Tanks

Standard sub-base tank features

- UL 142 Listed
- ULC-S601-07 Listed
- NFPA37 compliant
- Dual walled, steel construction
- Emergency tank and rupture basin vents
- Tank mounted mechanical fuel gauge
- Fuel supply and return tubes
- Top mounted leak detection float switch
- Low and high level fuel switches
- Mounting brackets for optional pump and control (250-500 kW)
- Integral lifting points

Sub-base tank options

- Pre-wired fuel pump and control
- Fuel overfill alarm – internal or external
- Overflow and tank fill plugs
- Five gallon spill fill box – internal or external
- Fill pipe extender
- Local code approvals available

200-500 kW Dual Wall Sub-base Fuel Tanks – usable operating hours

Genset model (60 Hz)	Gallons /hour at full load	270 gallon tank	300 gallon tank	400 gallon tank	500 gallon tank	600 gallon tank	660 gallon tank	720 gallon tank	850 gallon tank	1420 gallon tank	1470 gallon tank	1700 gallon tank	2050 gallon tank	2525 gallon tank
250 DQDAA	20	14	15	20	25	30	33	36		72	74		104	
275 DQDAB	21	13	14	19	24	29	31	34		66	70		96	
300 DQDAC	23	12	13	17	22	26	29	31		61	64		88	
300 DQHAB	23	12	13	17	22	26	29		37			74		
450 DFEJ	30	9	10	13	17	20	22		28			57		84
500 DFEK	34	8	9	11	15	18	19		25			50		74

Operating hours are measured at 60 Hz, standby rating.

600-1000 kW Dual Wall Sub-base Fuel Tanks – usable operating hours

Genset model	Gallons /hour at full load	200 gallon tank	660 gallon tank	1000 gallon tank	1500 gallon tank	2000 gallon tank	2400 gallon tank
600 DQCA	42	5	16	24	36	48	57
600 DQPAA	45	4	15	22	33	44	53
650 DQPAB	50	4	13	20	30	40	48
750 DQCB	51	4	13	20	29	39	47
750 DQFAA	53	4	12	19	28	38	45
800 DQCC	53	4	12	19	28	38	45
800 DQFAB	56	4	12	18	27	36	43
900 DQFAC	64	3	10	16	23	31	38
1000 DQFAD	72	3	9	14	21	28	33

*3000 gallon tank offered as an accessory kit – refer to NAAC-5853 spec sheet.

- Operating hours are measured at 60 Hz, standby rating.
- Up to 90% fill alarm to comply with NFPA30, operating capacity is reduced by 10%.

Enclosure Package Sound Pressure Levels @ 7 meters dB(A)

Genset model	Weather protective enclosure (F200, F203)	QuietSite level 1 sound attenuated enclosure (F201, F204)	QuietSite level 2 sound attenuated enclosure (F202, F205)
250 DQDAA	90	88	72
275 DQDAB	90	88	73
300 DQDAC	90	88	73
300 DQHAB	89	88	76
450 DFEJ	88	85	74
500 DFEK	89	87	73
600 DQCA	90.6/86*	79.3/78*	74.1/73*
600 DQPAA	89.10	80.70	74.70
650 DQPAB	89.70	81.40	75
750 DQCB	91.1/87*	79.9/79*	75.3/74*
750 DQFAA	87.8	77.8	73.8
800 DQCC	91.3/87*	80.2/79*	75.7/74*
800 DQFAB	88.1	78.3	74
900 DQFAC	88.8	79.1	74.6
1000 DQFAD	89.6	80.1	75.3

- All data is 60 Hz, full load standby rating, steel enclosures only.
- Data is a measured average of 8 positions.
- Sound levels for aluminium enclosures are approximately 2 dB(A) higher than listed sound levels for steel enclosures.

* Sound data with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD)

Package Dimensions of Enclosure, Exhaust System, and UL Tank

250-500 kW

Tank size (gal)	Weather protective package length (in)	QuietSite level I package length (in)	QuietSite level 2 package length (in)	Width (in)	Height (in)	Weather protective package weight (lbs)	QuietSite level 1 package weight (lbs)	QuietSite level 2 package weight (lbs)
270	188	188	222	82	106	4991	5471	6711
300	188	188	222	82	104	5648	6073	6991
400	188	188	222	82	106	5833	6258	7176
500	188	188	222	82	108	5956	6381	7299
600	188	188	222	82	111	6116	6541	7459
660	188	188	222	82	113	6235	6660	7578
720	188	188	222	82	114	6174	6599	7517
850	188	188	222	82	118	6529	6954	7872
1420	200	200	222	82	128	6863	7343	8583
1470	192	192	222	82	128	7253	7733	8973
1700	234	234	234	82	128	7982	8407	9325
2050	284	284	284	82	128	8383	8863	10103
2525	346	346	346	82	128	9391	9871	11111
Lifting base	188	188	222	82	100	4335	4760	5678

600-1000 kW

Tank size (gal)	Weather protective package length (in)	QuietSite level I package length (in)	QuietSite level 2 package length (in)	Width (in)	Height (in)	Weather protective package weight (lbs)	QuietSite level 1 package weight (lbs)	QuietSite level 2 package weight (lbs)
200	260	303	315	98	137	10194	13074	14954
660	260	303	315	98	137	9586	12466	14346
1000	260	303	315	98	141	10117	12997	14877
1500	260	303	315	98	146	10677	13557	15437
2000	292	327	327	98	143	11959	14839	16719
2400	338	338	338	98	143	12961	15841	17721

- This weight does not include the generator set. Consult your local Cummins distributor or the appropriate generator specification sheet.
- Width is 86” lifting eye to lifting eye (250-500 kW), 102” lifting eye to lifting eye (600-1000 kW).
- Height - Florida, Michigan, and Suffolk add 6.4” (250-500 kW) or 2” (600-1000 kW) for bottom space.
- Maximum length emergency vent removed.

	CSA - The generator set is CSA certified to product class 4215-01.
	UL - The generator set is available listed to UL 2200, stationary engine generator assemblies. The PowerCommand® control is listed to UL 508 - Category NITW7 for U.S. and Canadian usage.

For more information contact your local Cummins distributor or visit power.cummins.com

Our energy working for you.™

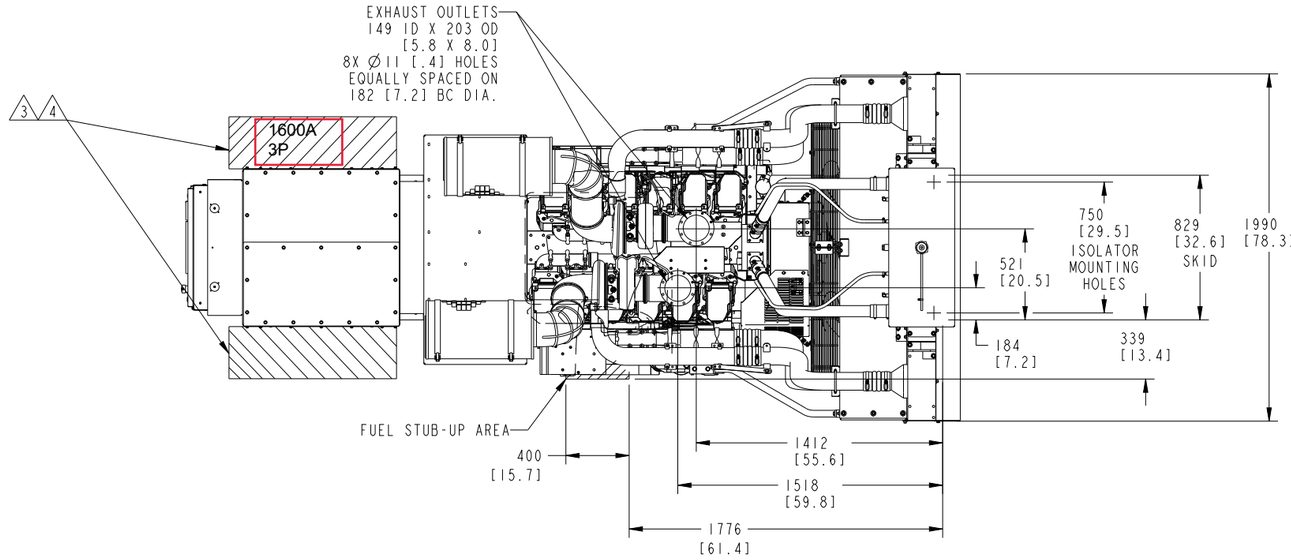
S-1443 (11/18)

Sales and Service

Section 3 – Generator Drawings

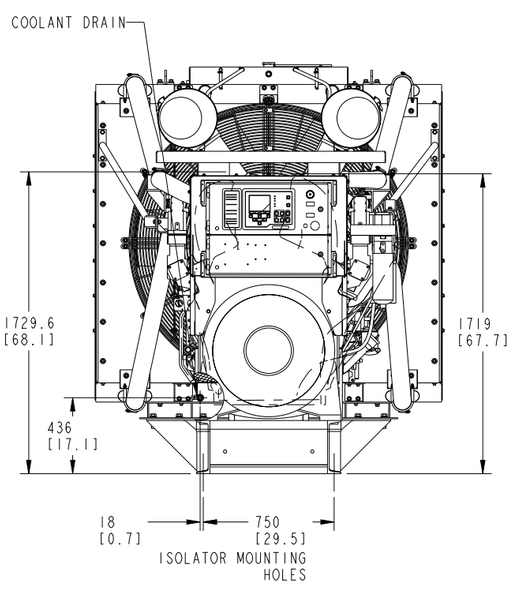
PTC® Creo® Parametric

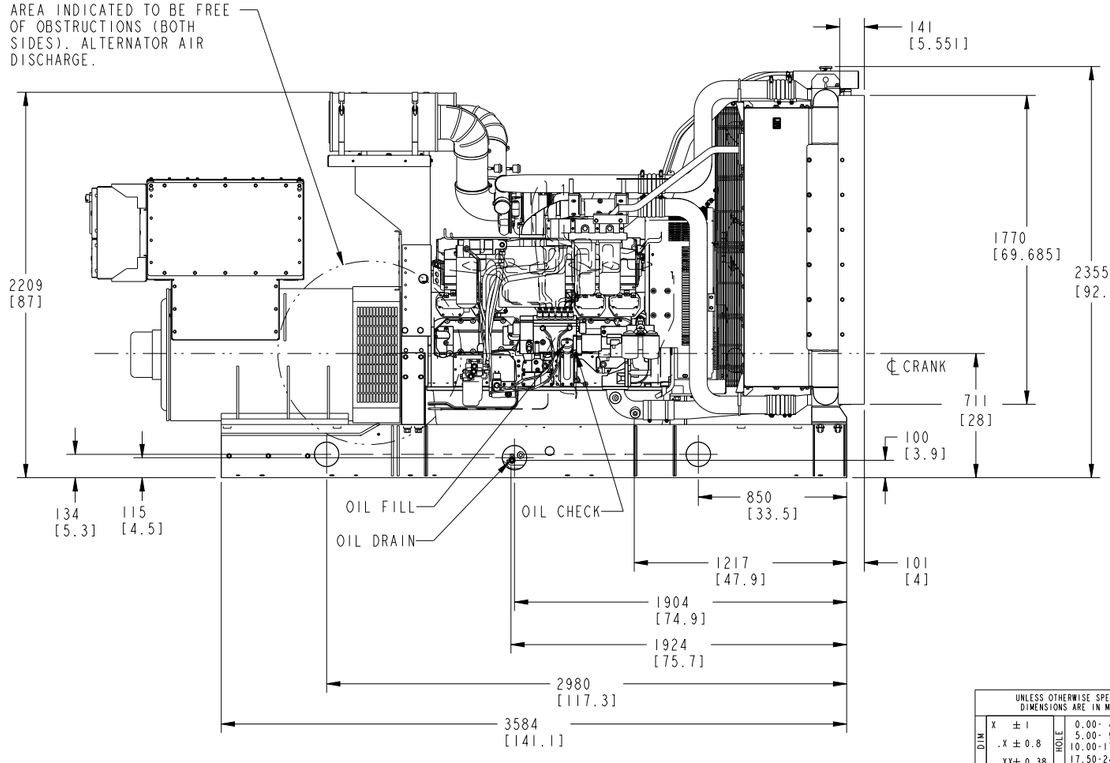
REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-179470	D	1	DRAWING HAS BEEN PICTORIALLY UPDATED TO SHOW CORRECT ENGINE	CJF	LC	L CASSENS	13SEP18



NOTES:

1. ALL DIMENSIONS ARE REFERENCE, UNLESS SPECIFICALLY TOLERANCED.
2. DIMENSIONS SHOWN IN [ ] ARE INCHES.
3. REFER TO CIRCUIT BREAKER OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA FOR SPECIFIC BREAKERS.
4. FOR ENTRANCE BOX APPLICATIONS, SEE APPLICABLE ENTRANCE BOX OUTLINE DRAWING.
5. 25 [1] DIA HOLES MARKED BY △ FOR 10 POINT ISOLATION MOUNTING.
6. FUEL IN HOSE [Ø.75] X 2009 [79.1] LONG WITH 3/4-14 NPTF EXTERNAL THREAD FITTING. FUEL OUT HOSE [Ø.50] X 1270 [50.0] LONG WITH 3/4-14 NPTF EXTERNAL THREAD FITTING.
7. TERMINALS WILL ACCOMMODATE STANDARD NEMA AND IEC 2-HOLE LUGS.
8. TERMINALS WILL ACCOMMODATE UP TO 10-750 MCM LUGS.
9. TERMINALS WILL ACCOMMODATE UP TO 6-350 CMC LUGS OR 4-500 MCM LUGS.
10. (NOTE REMOVED)



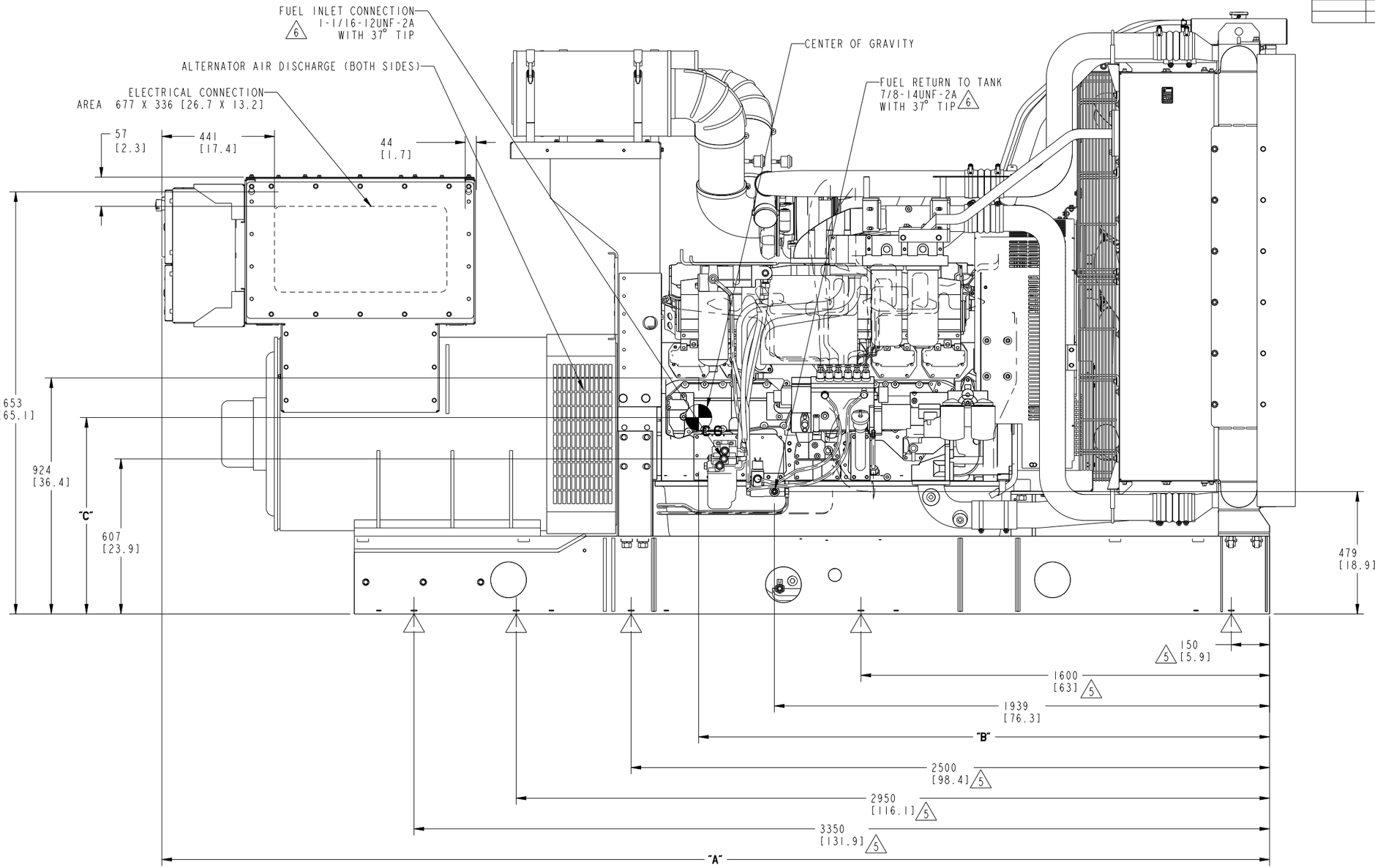


UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS									
DIM	X ± 1	HOLE	0.00- 4.99 +0.15/-0.08	SIM TO A034N275	DWN A_MARBHAL		CUMMINS POWER GENERATION		
	.X ± 0.8		5.00- 9.99 +0.20/-0.10	DO NOT SCALE PRINT	CKD S_VENKATESAN				
	.XX± 0.38		10.00-17.49 +0.25/-0.13		APVD S_VENKATESAN				
			17.50-24.99 +0.30/-0.13		DATE 06AUG15		OUTLINE, GENSET		
ANG TOL: ± 1.0°			SCALE: 1/16	- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP	FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994	FIRST USED ON DQFAA/B/C/D	SITE CODE PGF	DWG SIZE D	A049K674 SHEET 1 of 4 DWG REV D

Drawing Name: A049K675 Revision: D
Part Name: A049K674 Revision: D
ECO-179470 Sheet 1 of 5

PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-179470	D	--	-----	CJF	LC	L CASSENS	13SEP18



TABULATION

GEN. FRAME SIZE	DIM "A"	DIM."B" C.G.	DIM."C" C.G.	GEN SET DRY WT KGS	GEN SET DRY WT LBS	GEN SET WET WT KGS	GEN SET WET WT LBS
HC6G	4326 [170.3]	2022 [79.6]	830 [32.7]	6377	14060	6641	14640
HC6H	4326 [170.3]	2060 [81.1]	828 [32.6]	6615	14585	6879	15165
HC6J	4326 [170.3]	2096 [82.5]	824 [32.4]	6838	15076	7102	15656
HC6K	4427 [174.3]	2108 [83.0]	823 [32.4]	6913	15242	7177	15822
P7B	4418 [174]	2192 [86.3]	817 [32.2]	7317	16132	7581	16712
P7C	4418 [174]	2210 [87.0]	813 [32.0]	7575	16701	7839	17281

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

DIM: X ±1; .X ±0.8; .XX± 0.38

HOLE: 0.00- 4.99 +0.15/-0.08; 5.00- 9.99 +0.20/-0.10; 10.00-17.49 +0.25/-0.13; 17.50-24.99 +0.30/-0.13

ANG TOL: ± 1.0° SCALE: 1/8

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APVD S_VENKATESAN
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FIRST USED ON DQFAA/B/C/D

SITE CODE PGF

CUMMINS POWER GENERATION

OUTLINE, GENSET

DWG SIZE D | A049K674 | SHEET 2 OF 4 | DWG REV D

Drawing Name: A049K675 Revision: D
Part Name: A049K674 Revision: D
ECO-179470 Sheet 2 of 5

PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
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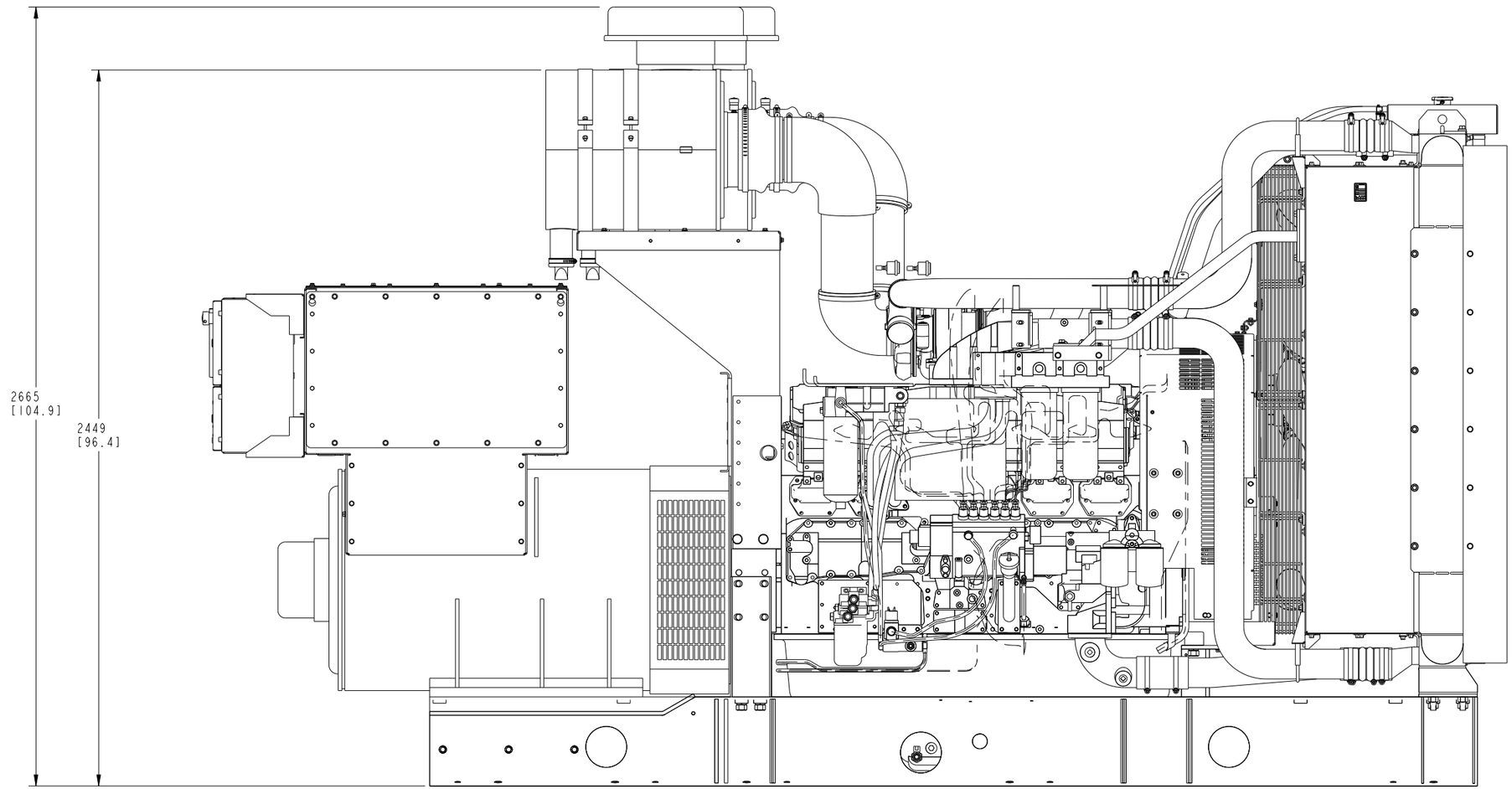

HEAVY DUTY AIR CLEANERS

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

DIM		HOLE	
	X ± 1		0.00- 4.99 +0.15/-0.08
	.X ± 0.8		5.00- 9.99 +0.20/-0.10
	.XX± 0.38		10.00-17.49 +0.25/-0.13
			17.50-24.99 +0.30/-0.13

ANG TOL: ± 1.0° SCALE: 1/8

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DWN A_MARBHAL
CKD S_VENKATESAN
APVD S_VENKATESAN
DATE 06AUG15

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994 — FIRST USED ON DQFAA/B/C/D

SITE CODE PGF

CUMMINS POWER GENERATION

OUTLINE, GENSET

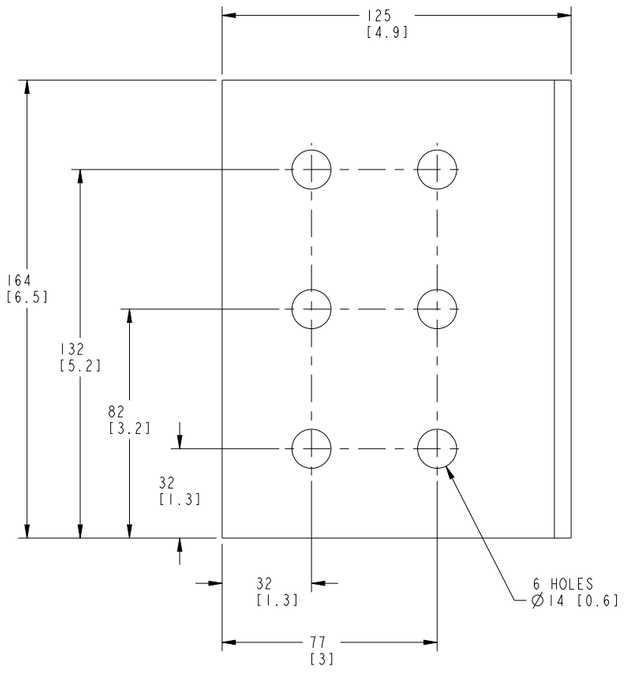
DWG SIZE D | A049K674 | SHEET 3 of 4 | DWG REV D

Drawing Name: A049K675 Revision: D
Part Name: A049K674 Revision: D
ECO-179470 Sheet 3 of 5

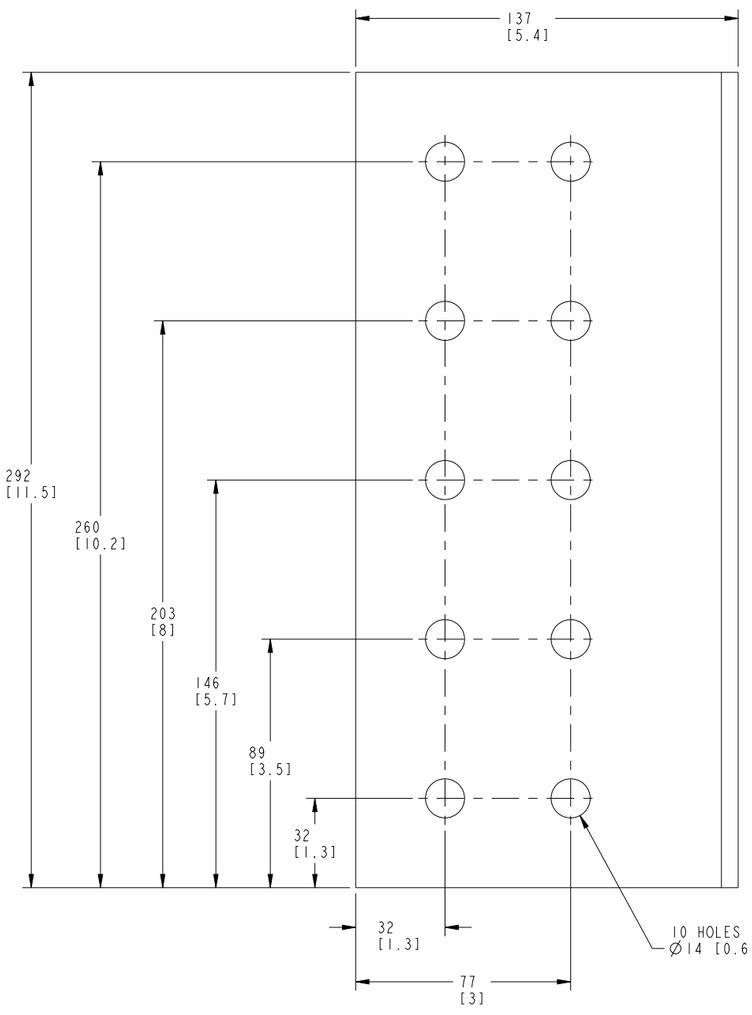
PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-179470	D	--	-----	CJF	LC	L CASSENS	13SEP18

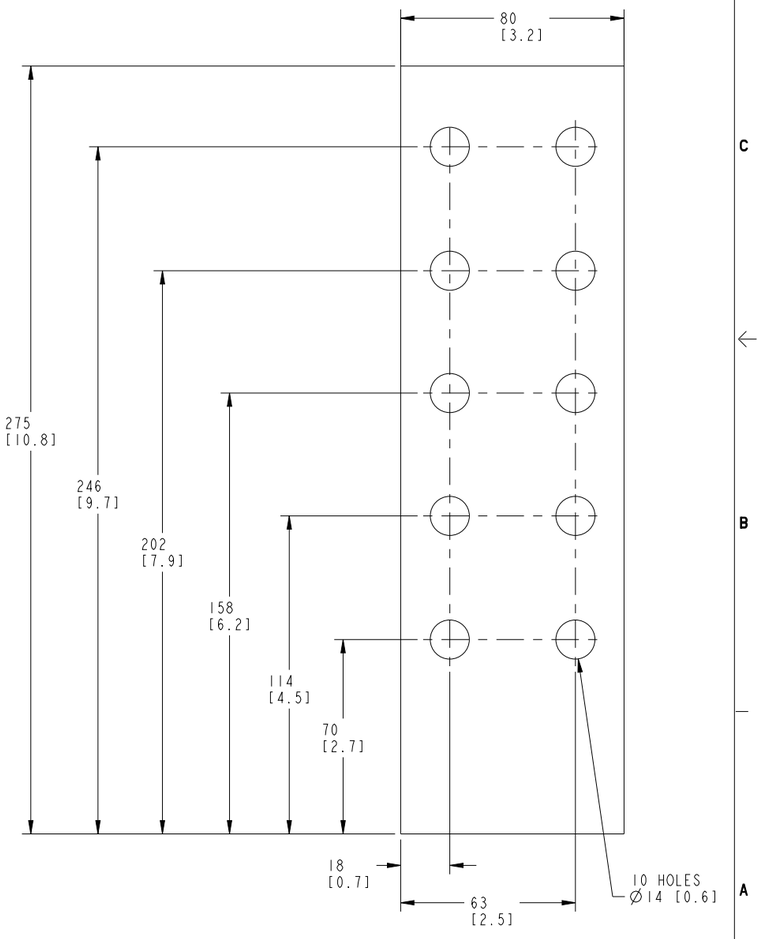
GENERATOR OUTPUT TERMINALS
(FOR NON-RECONNECTABLE HC6 ALTERNATORS)
△7 △9



GENERATOR OUTPUT TERMINALS
(FOR RECONNECTABLE HC6)
△7 △8



GENERATOR OUTPUT TERMINALS
(FOR NON-RECONNECTABLE P7)
△7 △8



UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

DIM		HOLE	
	X ± 1		0.00- 4.99 +0.15/-0.08
	.X ± 0.8		5.00- 9.99 +0.20/-0.10
	.XX± 0.38		10.00-17.49 +0.25/-0.13
			17.50-24.99 +0.30/-0.13

ANG TOL: ± 1.0° SCALE: 1/16

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994. FIRST USED ON DQFAA/B/C/D

SITE CODE PGF

CUMMINS POWER GENERATION

OUTLINE, GENSET

DWG SIZE D | A049K674 | SHEET 4 of 4 | DWG REV D

Drawing Name: A049K675 Revision: D
Part Name: A049K674 Revision: D
ECO-179470 Sheet 4 of 5

FEATURE CODE F202,F205 OPTIONAL FEATURE CODE K074,K102

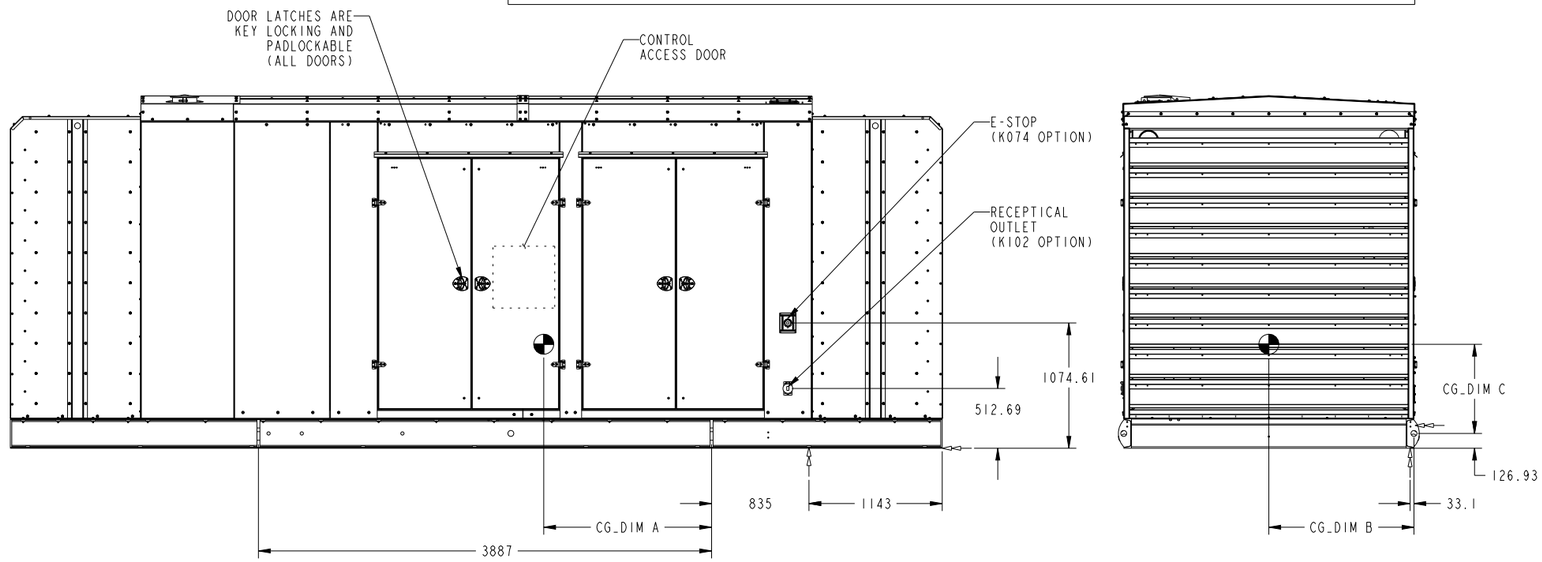
NOTES:

1. DIMENSIONS SHOWN IN [ ] ARE INCHES.
2. FOUNDATION REFERENCE POINT (⊶). SEE FOUNDATION DRAWING FOR DETAILS.

TABULATION

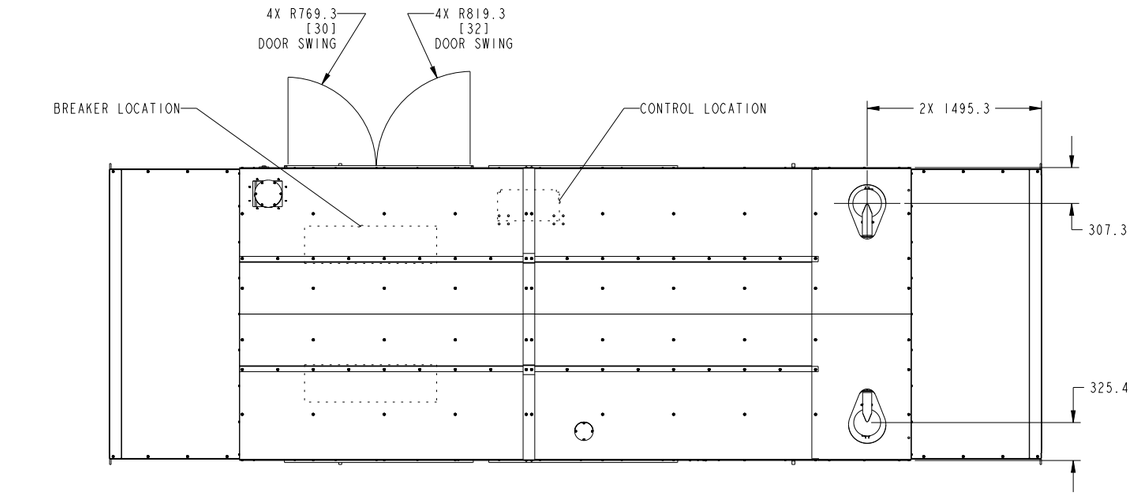
MODEL	GENERATOR	STEEL ENCLOSURE WEIGHT KG (LBS) ±5%	ALUMINUM ENCLOSURE WEIGHT KG (LBS) ±5%	CG_DIM "A"	CG_DIM "B"	CG_DIM "C"	DIM_D ± 75 [3]
DQCA,DQCB DQCC	HC6G	12339 [27202]	10884 [23994]	2038 [80.2]	1244.7 [49]	846 [33.3]	1529 [60]
	HC6H	12489 [27533]	11034 [24325]	2021 [79.6]		845 [33.3]	
	HC6J	12644 [27875]	11189 [24667]	2019 [79.5]		844 [33.2]	
	HC6K	12917 [28477]	11462 [25269]	2031 [80]		842 [33.1]	
	S6D	12339 [27202]	10884 [23994]	2038 [80.2]		846 [33.3]	
	S6E	12489 [27533]	11034 [24325]	2021 [79.6]		845 [33.3]	
DFGB,DFGE	HC5E	11373 [25074]	9918 [21866]	2199 [86.6]		1093 [43]	1490 [59]
	HC5F	11555 [25474]	10097 [22260]	2126 [83.7]		1057 [41.6]	
	HC6G	12008 [26474]	10553 [23266]	2080 [81.9]		1054 [41.5]	1599 [63]
	HC6H	12076 [26624]	10621 [23416]	2052 [80.8]		1054 [41.5]	
	HC6J	12371 [27274]	10916 [24066]	2020 [79.5]		1053 [41.5]	
DFHA,DFHB DFHC,DFHD DQFAA,DQFAB DQFAC,DQFAD	HC6G	12634 [27853]	11179 [24645]	2065 [81.3]		794 [31.3]	1570 [62]
	HC6H	12872 [28377]	11417 [25169]	2041 [80.4]		791 [31.1]	
	HC6J	13095 [28869]	11640 [25661]	2017 [79.4]		788 [31]	
	HC6K	13170 [29034]	11715 [25826]	2009 [79.1]		787 [31]	
	P7B	13256 [29224]	11801 [26016]	1960 [77.2]		786 [30.9]	1698 [67]
	P7C	13514 [29794]	12059 [26586]	1945 [76.6]		784 [30.9]	
	S6D	12634 [27853]	11179 [24645]	2065 [81.3]		794 [31.3]	1570 [62]
	S6E	12872 [28377]	11417 [25169]	2041 [80.4]		791 [31.1]	
	S6F	13095 [28869]	11640 [25661]	2017 [79.4]		788 [31]	
DQPAA,DQPAB	HC5F	11537 [25434]	10082 [22226]	2043 [80.4]		827 [32.6]	1438 [56.6]
	HC6G	11608 [25592]	10154 [22385]	2059 [81.1]		826 [32.5]	
	HC6H	11846 [26117]	10391 [22909]	2081 [81.9]		823 [32.4]	

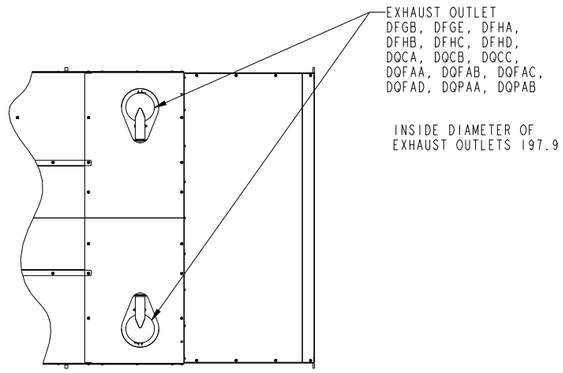
*** WEIGHT & CG'S ARE SHOWN WITH F202 STEEL ENCLOSURE, AND STANDARD WET GENSET. ADDITION OF OTHER FEATURES MAY CHANGE THE WEIGHT.

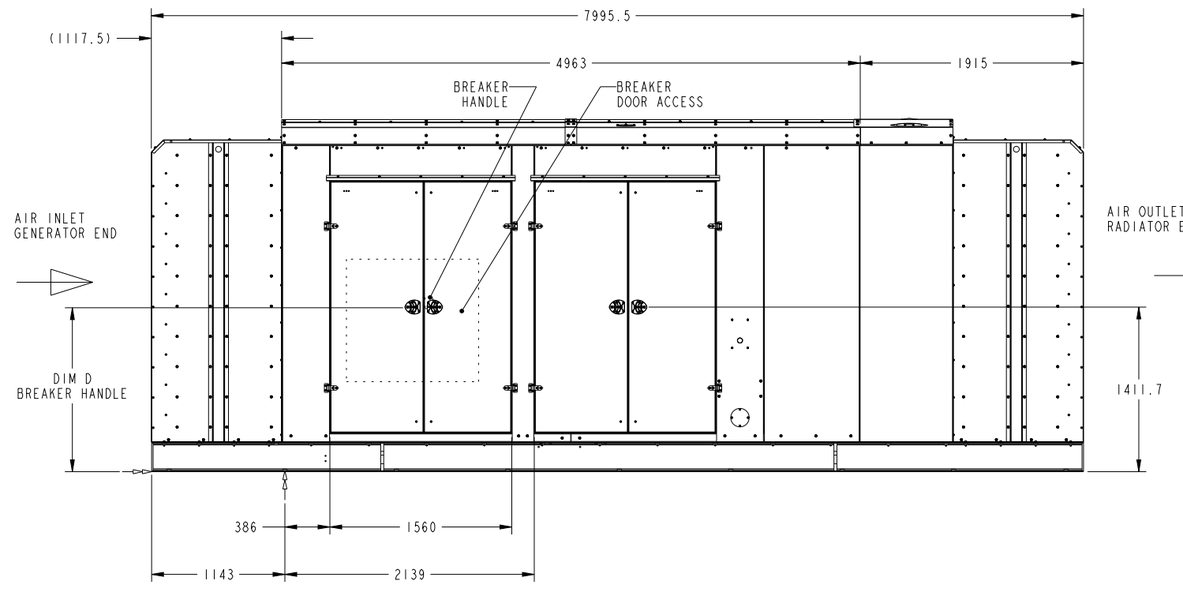


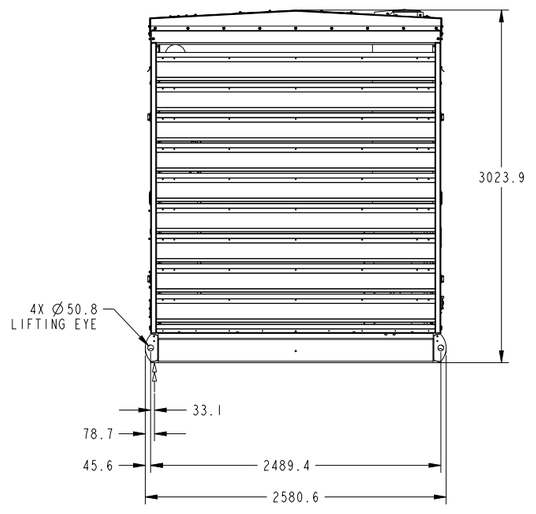
LAST DATUM LETTER USED: .		LAST REFERENCE LETTER USED: .	
MODEL/PLATFORM:		THIS PART IS SIMILAR TO: 0500-4147	
UNLESS OTHERWISE SPECIFIED THE FOLLOWING SHALL APPLY			ANG. TOL.: ± 1°
SURFACE FINISH PER: ISO 1302		SURFACE FINISH: Ramax -	
WALL THICKNESS:-	DRAFT ANGLES:-	EDGE RADII:-	FILLET RADII:-
DIMENSIONAL TOLERANCES:	X ± 3	.X ± 0.8	.XX ± 0.38
HOLE SIZE 0.00-4.99 TOL. +0.15/-0.08	HOLE SIZE 5.00-9.99 TOL. +0.20/-0.10	HOLE SIZE 10.00-17.49 TOL. +0.25/-0.13	HOLE SIZE 17.50-24.99 TOL. +0.30/-0.13
Cummins Inc.			
DIMENSIONS ARE IN: MILLIMETERS [ ] ARE IN: -	SIZE: A1	SCALE:0.047	
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	THIRD ANGLE PROJECTION		CAD SYSTEM PTC® Creo® Parametric

Part Number: **A034L228** Part Revision: **F**
Part Name: **OUTLINE,ENCLOSURE**
Drawing Category: **Detail** State: **Released** Sheet **1** of **3**









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DIMENSIONS ARE IN: MILLIMETERS [ ] ARE IN: -	SIZE: A1	SCALE:0.047
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	THIRD ANGLE PROJECTION	CAD SYSTEM PTC® Creo® Parametric

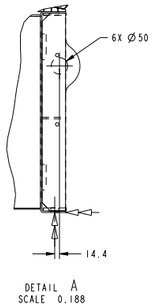
Document Generated: **30MAY2019 21:13 GMT**

Part Number: **A034L228** Part Revision: **F**

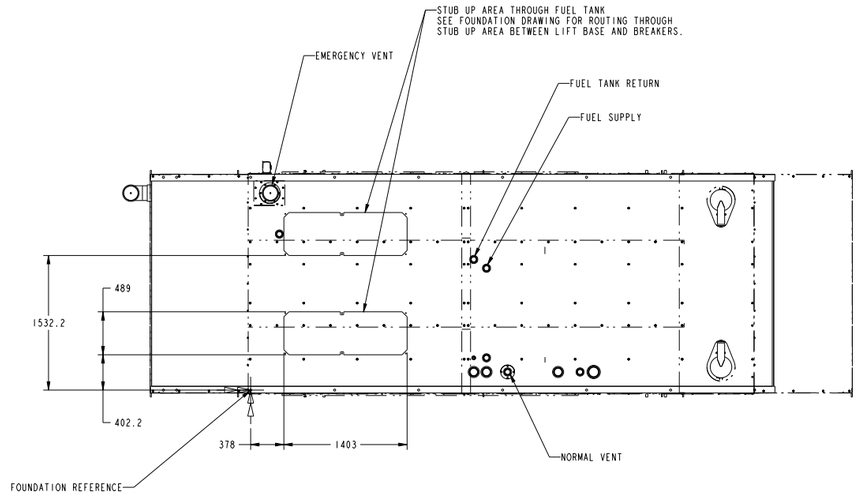
Part Name: **OUTLINE,ENCLOSURE**

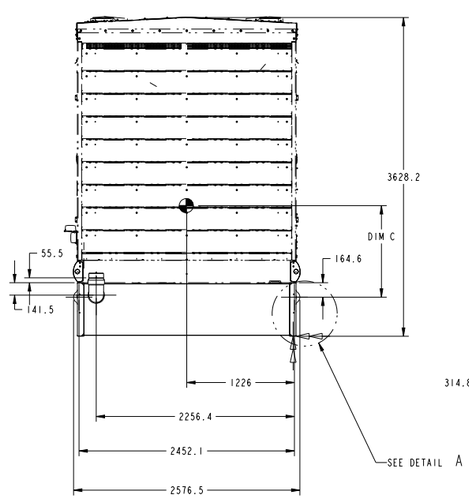
Drawing Category: **Detail** State: **Released** Sheet **2** of **3**

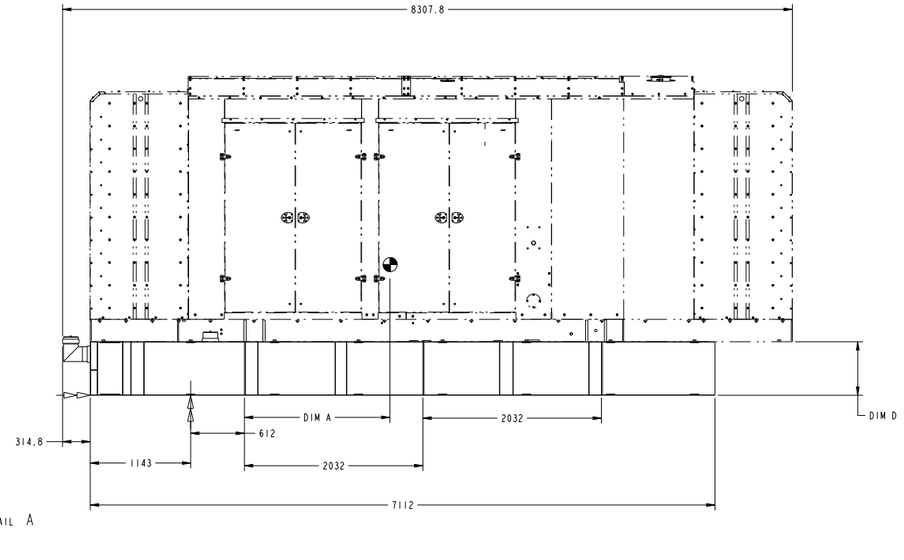
FEATURE CODE C252 WITH F202 OR F205



DETAIL A
SCALE 0.188







NOTES:

1. DIMENSION SHOWN IN [ ] ARE IN INCHES.
2. SEE FOUNDATION DRAWING FOR REFERENCE POINT LOCATION (⊢⊂⊃⊂⊃) (SHEET 4).
3. TANK CHANNEL SUPPORT BRACKETS (0319-5654) ARE OPTIONAL. IF CUSTOMER REQUIRES THE BRACKETS THEY ARE SHIPPED SEPERATELY. NOT SHOWN ON DRAWING.

TABULATION

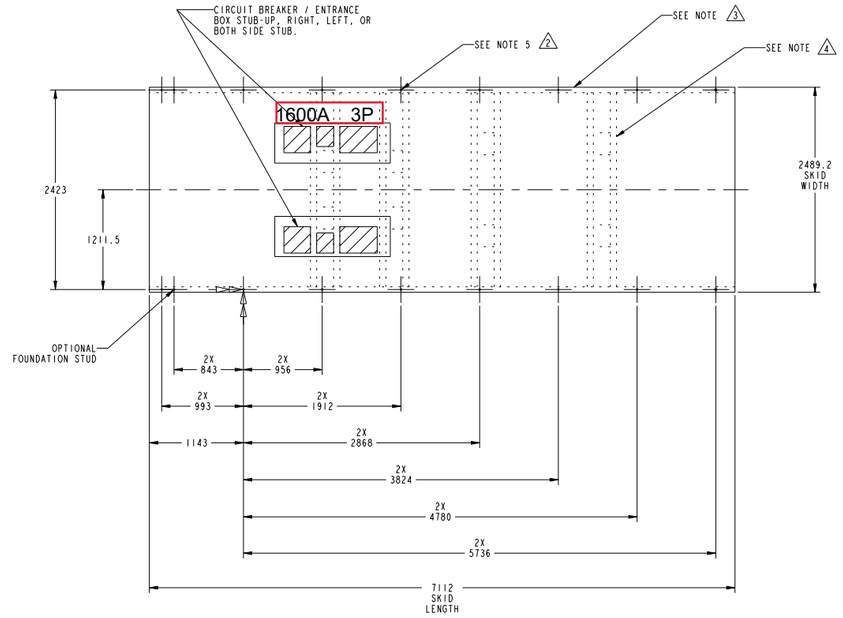
FUEL TANK WITH LEVEL 2 ENCLOSURE FEATURE CODE F202 OR F205

FUEL TANK FEATURE CODE	FUEL TANK SIZE/WEIGHT DIM D	MODEL	GENERATOR	WEIGHT KG [LBS]	CG_DIM "A"	CG_DIM "C"
C252	2000 GALLON 2768 [6100] 609.6 [24]	DQCA,DQCB DQCC	HC6G	4977 [33019]	2166 [85]	968 [38]
			HC6H	5127 [33350]	2151 [85]	970 [38]
			HC6J	5282 [33691]	2136 [84]	972 [38]
			HC6K	5555 [34293]	2110 [83]	975 [38]
			S6D	4977 [33019]	2166 [85]	968 [38]
			S6E	5127 [33350]	2151 [85]	970 [38]
		DQFAA,DQFAB DQFAC,DQFAD	HC6G	5507 [34186]	2183 [86]	1008 [40]
			HC6H	5744 [34710]	2163 [85]	1011 [40]
			HC6J	5967 [35202]	2145 [84]	1015 [40]
			HC6K	6042 [35367]	2138 [84]	1016 [40]
			P7B	6128 [35557]	2121 [84]	1017 [40]
			P7C	6523 [36427]	2100 [83]	1022 [40]
			S6D	5507 [34186]	2183 [86]	1008 [40]
			S6E	5744 [34710]	2163 [85]	1011 [40]
			S6F	5967 [35202]	2145 [84]	1015 [40]
		DQMAA	HC5D	2968 [28590]	2100 [82.7]	632 [24.9]
			HC5E	3118 [28921]	2083 [82.0]	632 [24.9]
			HC5F	3259 [29230]	2019 [79.5]	632 [24.9]
			HC6G	3318 [29362]	2050 [80.7]	640 [25.2]
			HC6H	3557 [29887]	2024 [79.7]	640 [25.2]
		DQPAA DQPAB	HC5F	3869 [30574]	1995 [78.5]	863 [34.0]
			HC6G	3941 [30732]	2008 [79.1]	863 [34.0]
			HC6H	4179 [31257]	2026 [79.8]	865 [34.1]

*** WEIGHT & CG'S ARE SHOWN WITH F202 STEEL ENCLOSURE, AND STANDARD WET GENSET. ADDITION OF OTHER FEATURES MAY CHANGE THE WEIGHT. FOR F205 ENCLOSURE (ALUMINUM) REDUCE WEIGHT BY 924 (2036)

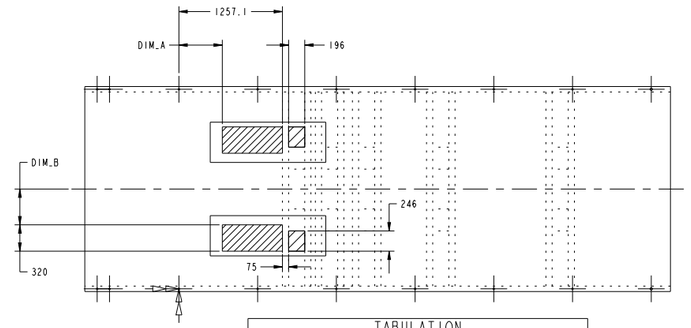
Cummins Inc.		
DIMENSIONS ARE IN: MILLIMETERS [ ] ARE IN: "	SIZE: A0	SCALE:1
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	THIRD ANGLE PROJECTION	CAD SYSTEM PTC® Creo® Parametric

Part Number: **A035H278** Part Revision: **G**
Part Name: **OUTLINE,FUEL SYSTEM**
Drawing Category: **Detail** State: **Released**

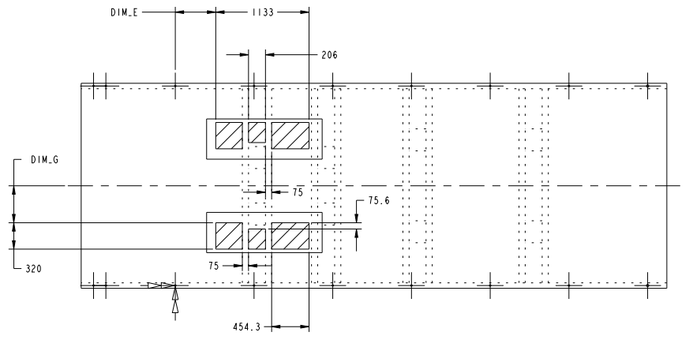


NOTES:

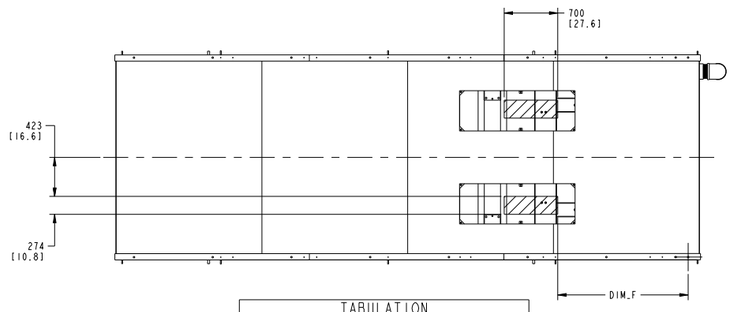
1. DIMENSIONS IN [ ] ARE IN INCHES.
2. FUEL TANK HAS A FLANGE THICKNESS OF 6.4mm [.25 INCHES] ALLOW EXTRA LENGTH ON HARDWARE FOR UNEVENESS OF MOUNTING SURFACE. (MOUNTING DIMENSIONS PERTAIN TO ALL FUEL TANKS)
3. LIFTING BASE OR FUEL TANK PERIMETER IS SHOWN. FOUNDATION SHOULD BE EXTENDED BEYOND THIS PERIMETER. SEE (T030) APPLICATION MANUAL.
4. HIDDEN LINES REPRESENT LIFT BASE CROSSMEMBERS.
5. FOR IBC/OSHPD INSTALLATIONS REFER SEISMIC REQUIREMENT INSTRUCTIONS A045K403. FOR NON SEISMIC INSTALLATION SIZE AN APPROPRIATE FOUNDATION BOLT FOR 24mm TANK MOUNTING HOLE.



TABULATION			
GENSET	GENERATOR	DIM_A	DIM_B
DQFAA, DQFAB DQFAC, DQFAD	HC6G/H/J	527 [20.7]	434.5 [17.1]
	HC6K	425 [16.7]	
	P7B/C	444 [17.5]	448.7 [17.7]
	S6D	653 [25.7]	474.4 [18.7]
	S6E/F	533 [21]	



TABULATION			
GENSET	GENERATOR	DIM_E	DIM_G
DQCA, DQCB DQCC	HC6G/H/J	491.3 [19.3]	449 [17.7]
	HC6K	391.3 [15.4]	
	S6D	617.3 [24.3]	474.4 [18.7]
	S6E	497.3 [19.6]	



TABULATION		
GENSET	GENERATOR	DIM_F
DQMAA	HC5D, E & ALL HC6	1062 [41.8]
	HC5F	987 [38.8]

Cummins Inc.		
DIMENSIONS ARE IN: MILLIMETERS [ ] ARE IN:	SIZE: A0	SCALE:1
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	THIRD ANGLE PROJECTION	CAD SYSTEM PTC® Creo® Parametric

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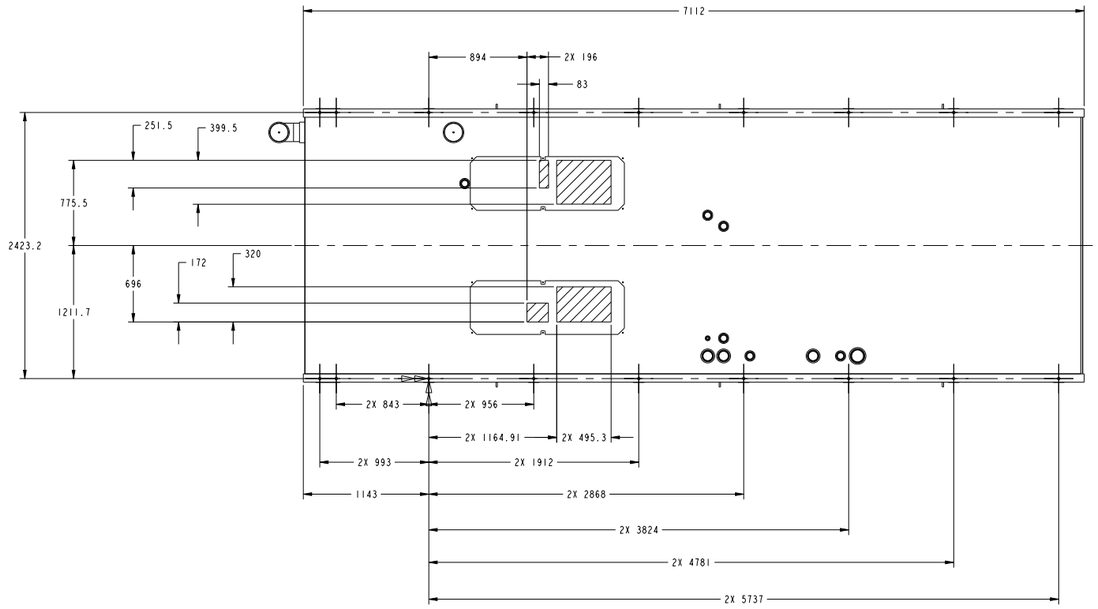
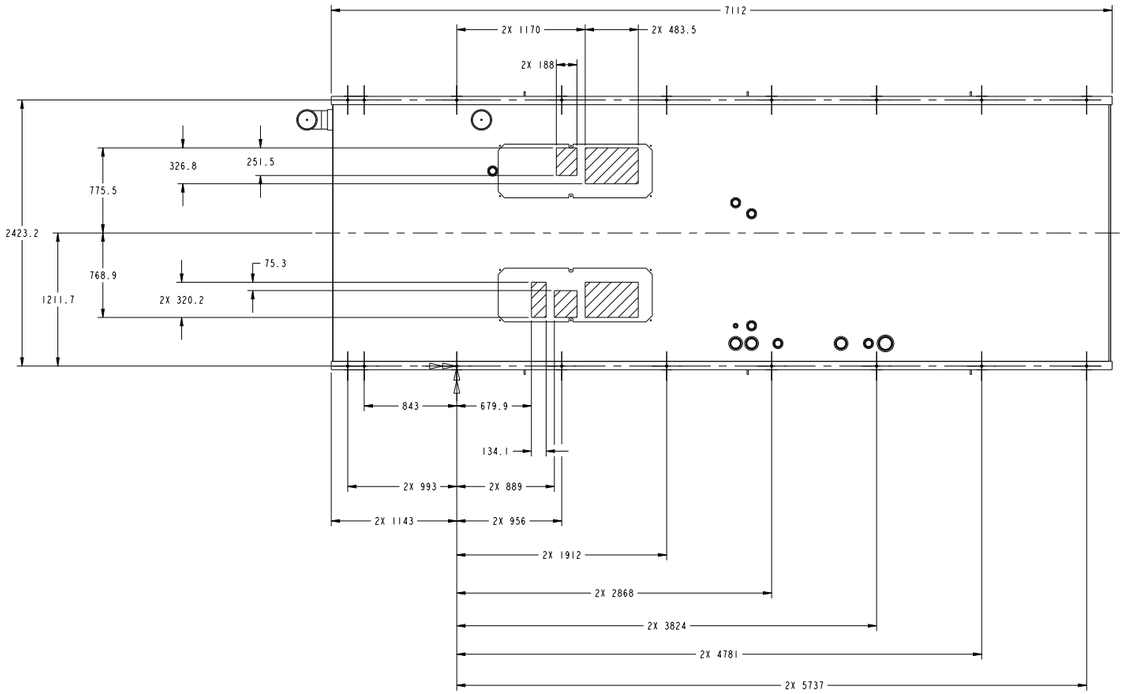
Part Number: **A035H278** Part Revision: **G**
Part Name: **OUTLINE,FUEL SYSTEM**
Drawing Category: **Detail** State: **Released** Sheet **4** of **6**



TABULATION	
GENSET	GENERATOR
DQPAA DQPAB	HC5F



TABULATION	
GENSET	GENERATOR
DQPAA DQPAB	HC6G HC6H

Cummins Inc.		
DIMENSIONS ARE IN: MILLIMETERS [ ] ARE IN: -	SIZE: A0	SCALE:1
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	THIRD ANGLE PROJECTION	CAD SYSTEM PTC® Creo® Parametric

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Part Number: **A035H278** Part Revision: **G**
Part Name: **OUTLINE,FUEL SYSTEM**
Drawing Category: **Detail** State: **Released** Sheet **5** of **6**

Cummins Sales and Service

Section 4 – Generator Accessories

Our energy working for you.™

Power Generation

Battery Charger

15Amp(12Volt), 12Amp(24Volt)

0300–5878–01, 0300–5878–02, 0300–5878–03,
0300–5878–04, 0300–5878–05, 0300–5878–06,
0300–5878–07, 0300–5878–08, 0300–5878–09,
0300–5878–10, 0300–5878–11, 0300–5878–12,
0300–5878–13, 0300–5878–14, 0300–5878–15,
0300–5878–16, 0300–5878–17, 0300–5878–18,
A029Y213, A029Y217, A029Y218, A029Y219,
A029Y220, A029Y221, A030K698

English – Original Instructions 11–2012 901–0107 (Issue 7)

Specifications

BATTERY CHARGER FEATURES	
Compatible Battery Types	12 or 24-Volt Lead-Acid, Gel, AGM, Ni–Cad
Maximum Charge Rate	15 Amps @ 12 VDC or 12 Amps @ 24 VDC
Operating Input Voltage	120, 208, 240, 277, 380, 416, 480, 600 VAC
Operating Input Frequency	50 or 60 Hz
Charge Control	4-Stage Automatic Charger with Equalize Charging Capabilities
Available Battery Type Settings	Lead-Acid / Gel / AGM / Ni-Cad
Configurations	Stand-Alone and Transfer Switch Assembly
Temperature Sensing:	
Charger Temperature	Internal Charger Temperature Sensor
Temperature Compensation Charging	Optional Battery Temperature Sensor
Network Interface (Not currently available)	RS-485 Connector
Alarm Contacts	2 Amps, 30 VDC
ENVIRONMENT	
Temperature Range When Operating Within UL BBHH Specifications	–22 to +122 Degrees F (–30 to +50 Degrees C)
Operating Temperature Range	–22 to +140 Degrees F (–30 to +60 Degrees C)
Non-Operating Temperature Range	–22 to +158 Degrees F (–30 to +70 Degrees C)
Relative Humidity	95% (Drip-Proof)
WEIGHT AND DIMENSIONS	
Weight	11.6 lbs (5.22 kg)
Dimensions: Length x Depth x Height	9.75 x 5.56 x 6.14 Inches (247.6 x 141.2 x 156 MM)

ELECTRICAL RATINGS

INPUT		12V BATTERY CHARGER			24V BATTERY CHARGER		
VOLTAGE (NOMINAL)	CURRENT (AMPS)	OUTPUT VOLTAGE	FLOAT VOLTAGE	OUTPUT CURRENT (AMPS)	OUTPUT VOLTAGE	FLOAT VOLTAGE	OUTPUT CURRENT (AMPS)
120, 208, 240	4.7, 2.75, 2.4	15.0	13.5	15.0	30.0	27.0	12.0
277	2.1	15.0	13.5	15.0	30.0	27.0	12.0
380	1.5	15.0	13.5	15.0	30.0	27.0	12.0
416	1.4	15.0	13.5	15.0	30.0	27.0	12.0
480	1.2	15.0	13.5	15.0	30.0	27.0	12.0
600	1.0	15.0	13.5	15.0	30.0	27.0	12.0

UL LISTING

The battery charger is UL listed for BBHH and BBGQ type applications (battery chargers for emergency standby generators). In BBHH and BBGQ applications,

- The battery charger can only be used with lead-acid batteries. Other battery types can be used in non-BBHH/BBGQ applications.
- The battery charger is rated at 50°C ambient.
- The maximum amp-hour capacity rating for this charger is 200 amp-hours for BBHH and BBGQ applications. This is based on the maximum size battery bank the charger can completely charge from a 0% state of charge in a 24 hour time frame. For Non–BBHH or BBGQ applications the amp–hour capacity rating should be kept under 400 amp–hours.

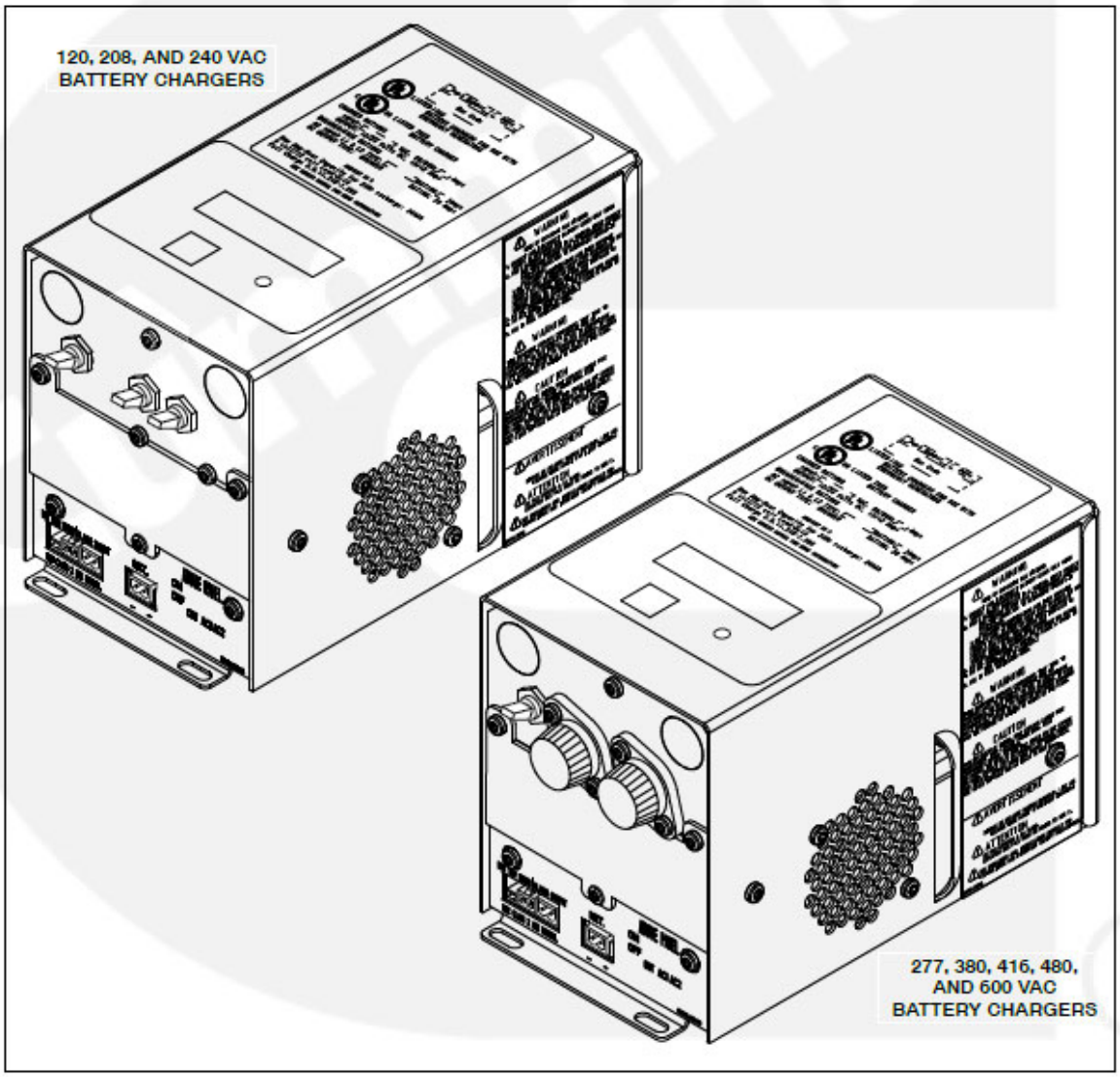


FIGURE A. BATTERY CHARGERS WITH UL MARKINGS

Specification sheet

PowerCommand® annunciator discrete input or PCCNet

Description

The Universal Annunciator Module provides visual and audible indication of up to 20 separate alarm or status conditions, based on discrete (relay) inputs or network inputs. Each LED can be controlled by either a discrete wire input or by a signal on the PCCNet network sent from an external device, such as a PCC1301 or PCC2100 (version 2.4 or later) control.

In addition to the LEDs, the annunciator can control four custom relays based on signals received over the PCCNet. When one of the annunciator's discrete inputs is activated, the annunciator will broadcast that information over the network. By taking advantage of the network, discrete inputs and custom relays, the annunciator can be used as expanded I/O for a genset controller.

Easily installed in a location to give immediate notification of an alarm or warning status. Designed to give operating/monitoring personnel quick-glance status information. The module directly senses battery voltage to provide green/yellow/red alarm and status information for that parameter.

Genset controller complies with NFPA level two requirements when used with the display but without the annunciator panel. When used with the annunciator it meets NFPA level one requirements (Emergency and Standby power systems). The annunciator module can also be used for monitoring of transfer switch or other equipment status.

Features

- Visual and audible warnings of up to 20 separate alarm or status conditions.
- LEDs can be controlled either via PCCNet or discrete input.
- Status of discrete inputs is broadcast on network.
- Four custom relays can be controlled over the PCCNet network.
- Configurable LED color (red, yellow or green) and selectable horn operation allows maximum flexibility.
- Standard NFPA 110 label, field configurable for other alarm status and conditions.
- Each audible alarm is annunciated, regardless of the number of existing alarm conditions displayed.
- Sealed membrane panel design provides environmental protection for internal components and is easy to clean.
- Configurable for negative (ground) input or positive input.
- Integral DC voltage sensing.
- Flush or surface mount provisions.
- UL Listed and labeled; CSA certified; CE marked.

Specifications

Signal requirements

Positive - Input impedance is 1.82 kOhms to ground; maximum input voltage = 31 VDC.

Negative - Input impedance is 1.82 kOhms to Bat+: inputs are at Bat+ level when open.

Sink/source current threshold for detection - 150 Ua minimum, 3 mA maximum.

Typical conductor size: 16 ga for 304.8 m (1000 ft)

Max conductor size for terminal: 12 ga

Relay outputs

0.2 A at 125 VAC and 1 A at 30 VDC

Network connections

Use Belden 9729 two pair, stranded, shielded 24 AWG twisted pair cable for all PCCNet connections. Total network length cannot exceed 1219 m (4000 ft). Up to 20 nodes can be connected to the network.

Note: Any communications wire connected to the generator set should be stranded cable.

Power

Maximum consumption: 15 watts

Battery voltage

Functional range - Audible and visual conditions operational from 6.5 to 31 VDC.

Low voltage setting - 12.0 VDC for 12 Volt nominal systems; 24.0 for 24 Volt nominal systems.

High voltage setting - 16.0 Volt for 12 Volt nominal systems; 32.0 Volt for 24 Volt nominal systems.

Alarm horn

Sound level: 90 dB at 30 cm

Physical

Weight (with enclosure): 1.4 kg (3.0 lbs)

Temperature

-20 °C to +70 °C (-4 °F to +158 °F)

Humidity

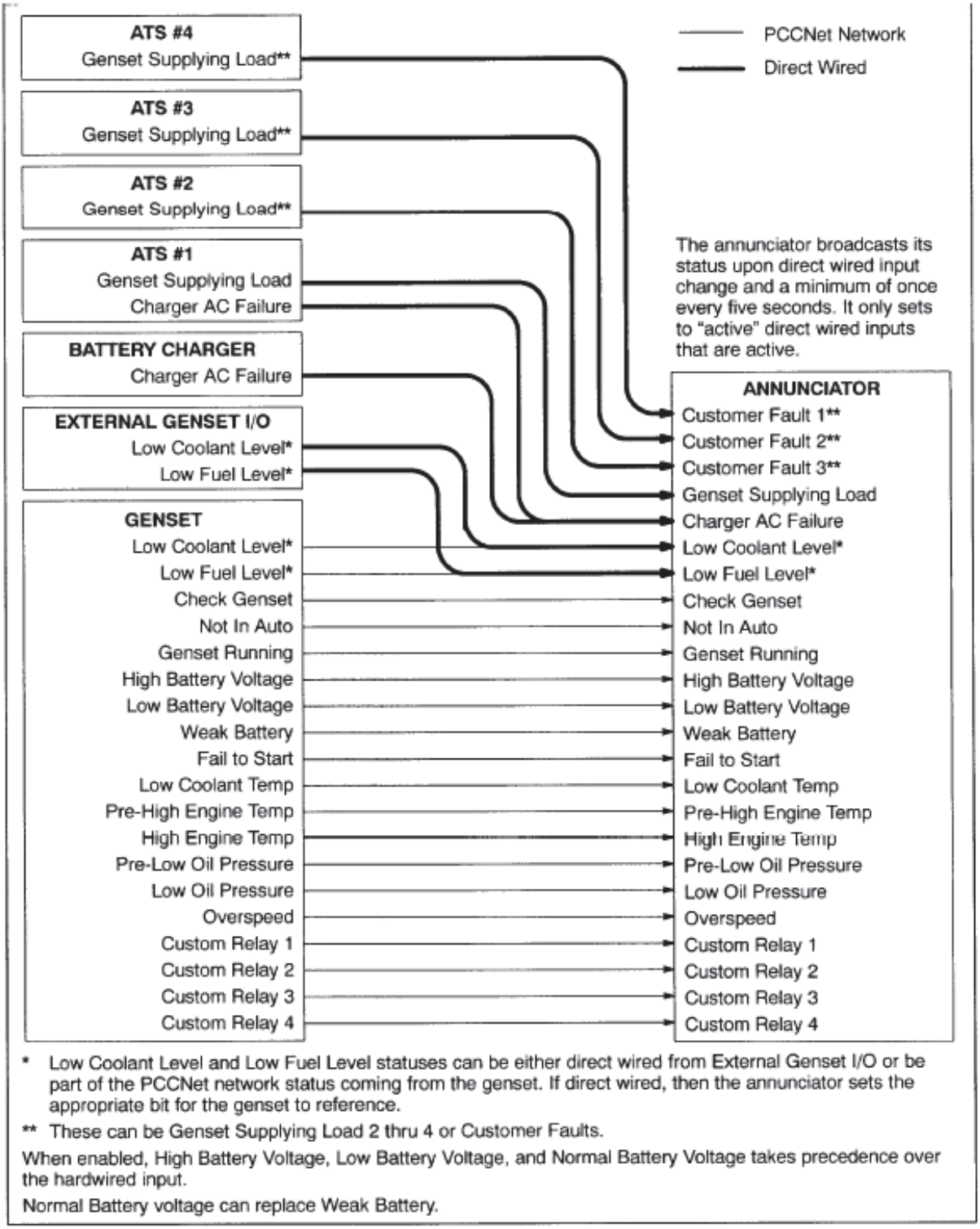
10% to 95% RH (non-condensing)

Default lamp configurations

Can be configured for current NFPA 110 standard or as a replacement for Legacy (pre-2001) NFPA 110 annunciator (300-4510 or 300 4511)

		NFPA 110		
Lamp	**Description**	**Color**	**Horn**	**Flash**
DS1	Customer fault 1	Green	No	No
DS2	Customer fault 2	Amber	No	No
DS3	Customer fault 3	Red	No	No
DS4	Genset supplying load	Amber	No	No
DS5	Charger AC failure	Amber	Yes	No
DS6	Low coolant level	Amber	Yes	No
DS7	Low fuel level	Red	Yes	No
DS8	Check generator set	Amber	No	No
DS9	Not in auto	Red	Yes	Yes
DS10	Generator set running	Amber	No	No
DS11	High battery voltage	Amber	Yes	No
DS12	Low battery voltage	Red	Yes	No
DS13	Weak battery	Red	Yes	No
DS14	Fail to start	Red	Yes	No
DS15	Low coolant temp	Red	Yes	No
DS16	Pre-high engine temp	Amber	Yes	No
DS17	High engine temp	Red	Yes	No
DS18	Pre-low oil pressure	Red	Yes	No
DS19	Low oil pressure	Red	Yes	No
DS20	Overspeed	Red	Yes	No

Typical installation



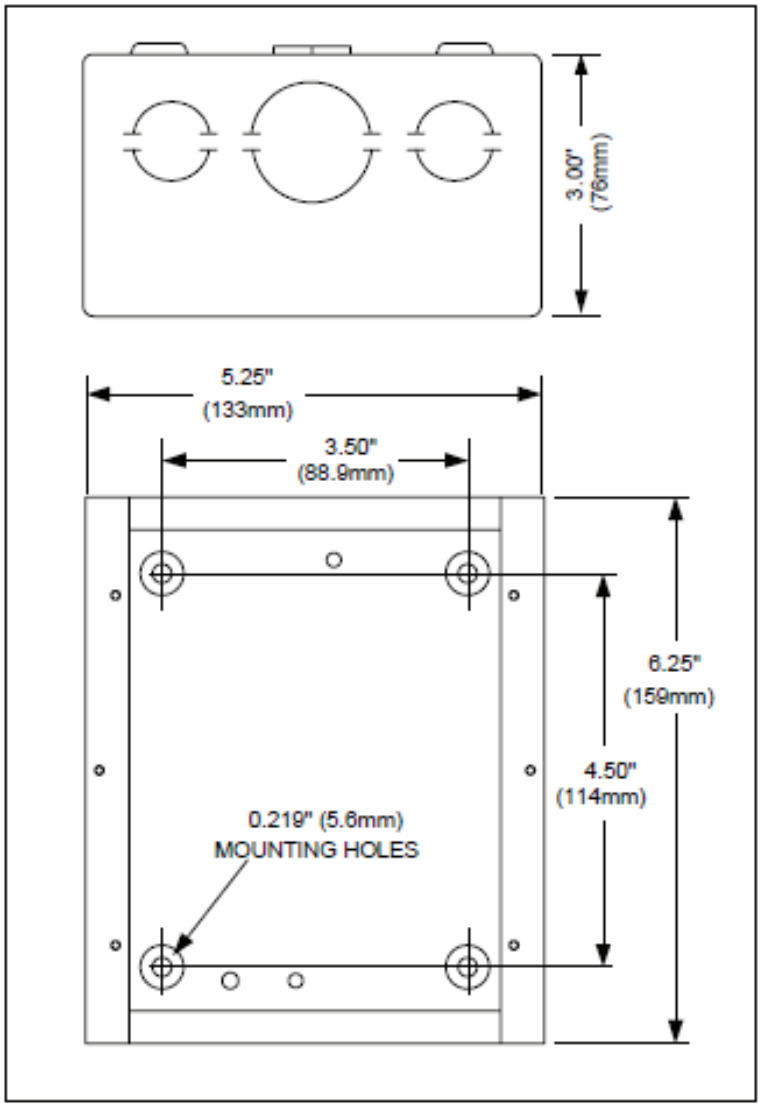
* Low Coolant Level and Low Fuel Level statuses can be either direct wired from External Genset I/O or be part of the PCCNet network status coming from the genset. If direct wired, then the annunciator sets the appropriate bit for the genset to reference.

** These can be Genset Supplying Load 2 thru 4 or Customer Faults.

When enabled, High Battery Voltage, Low Battery Voltage, and Normal Battery Voltage takes precedence over the hardwired input.

Normal Battery voltage can replace Weak Battery.

Dimensions



Dimensions: in (mm)

Ordering information

Part number	Description
0300-5929-01	Panel mount
0300-5929-02	Panel with enclosure

For more information contact your local Cummins distributor or visit power.cummins.com

Our energy working for you.™

S-1472 (11/17)

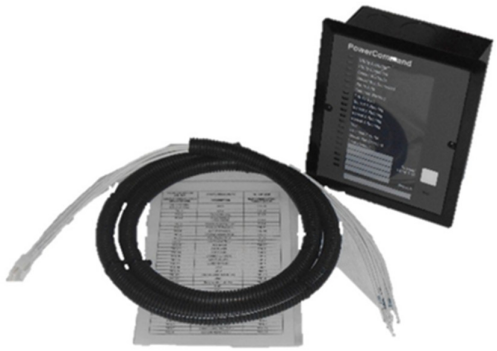
Annunciators

RS485 Annunciator

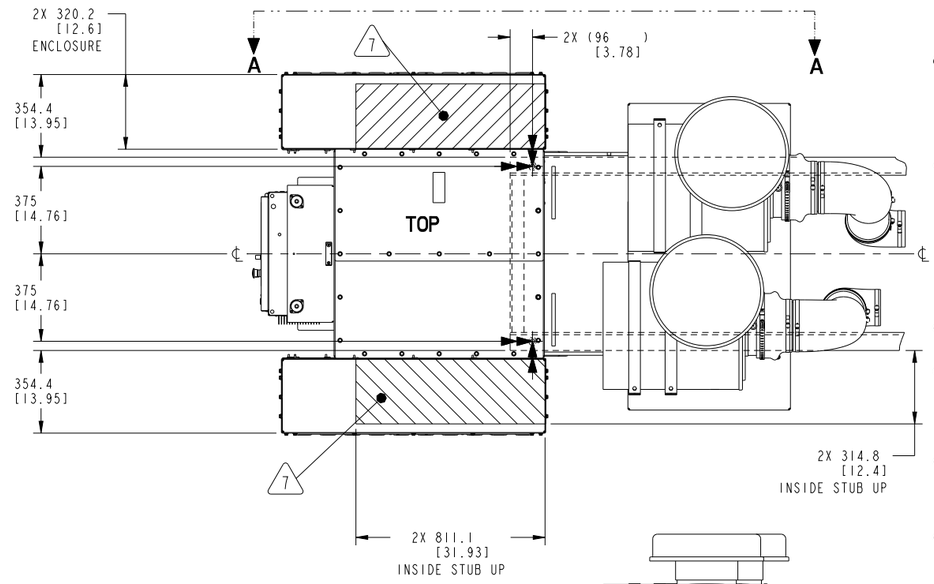
The Universal Annunciator Module provides visual and audible indication of up to 20 separate alarm or status conditions, based on discrete (relay) inputs or network inputs. Each LED can be controlled by either a discrete wire input or by a signal on the PCCnet network sent from an external device, such as a PCC1302, 2300, 3300 controls. Remote annunciator panels comply with NFPA 110 (Emergency and Standby Power Systems). The annunciator module can also be used for monitoring of transfer switch or other equipment status.

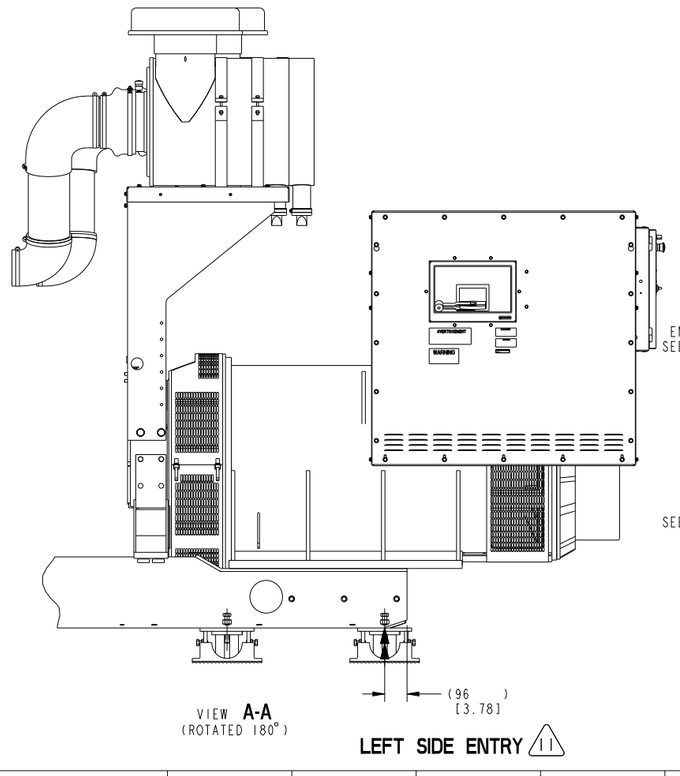
In addition to the LEDs, the annunciator can control four custom relays based on signals received over the PCCnet. When one of the annunciator's discrete inputs is activated, the annunciator will broadcast that information over the network. By taking advantage of the network, discrete inputs and custom relays, the annunciator can be used as expanded I/O for a PCC1302, 2300, 3300 controls.

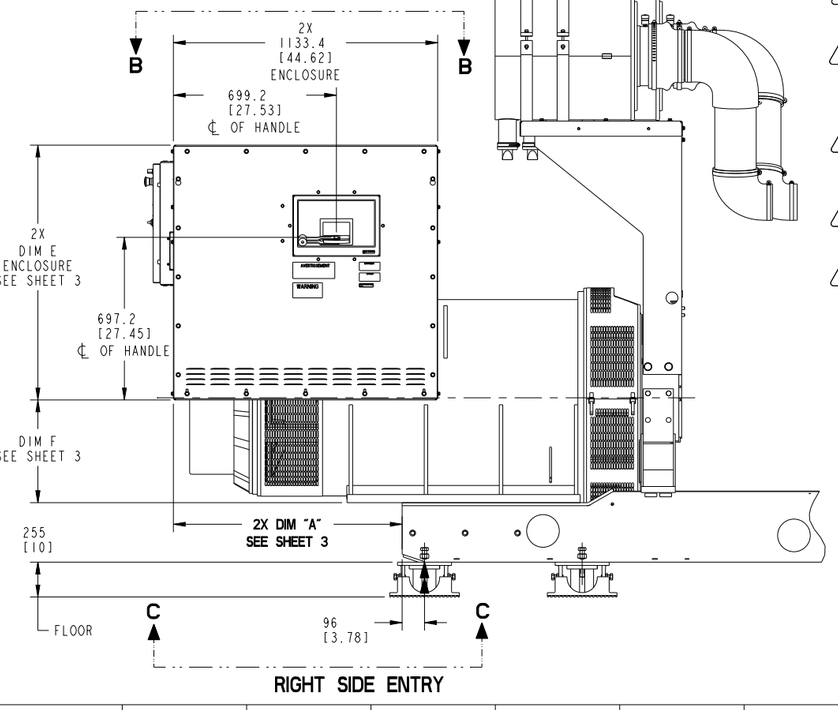
Part Number	Compatibility	Kit Includes
A045J199	RS22, RS25, RS30, RS36, RS40 RX30, RX36, RX40, RX45, RX50, RX60 RS50, RS60, RS80, RS100 RS125, RS150	Panel Mount version: Annunciator, wiring harness, cable tie, and window splice
A045J201		Enclosure version: Annunciator, wiring harness, cable tie, and window splice



HC6/P7







NOTES:

1. STANDARD FEATURE ON SCHNEIDER ELECTRIC NW BREAKER.
2. COMMON REFERENCE POINT ON GENSET SKID (➡). POINTS TO ANCHORING HOLE ON SKID. SEE GENSET_OUTLINE (FOUNDATION) FOR DETAILS.
3. LISTED TORQUE VALUES ARE FOR MAXIMUM CONDUCTOR SIZES ACCOMMODATED. CONSULT UL 486 TABLE 7-4, 7-5 AND 7-6 FOR SMALLER CONDUCTOR SIZES.
4. ALL ITEMS SHOWN IN ILLUSTRATION ARE FOR REFERENCE ONLY.
5. ELECTRICAL CONDUITS MUST:
   - PROVIDE FLEXIBLE CONNECTION (USING FLEXIBLE CONDUIT AND CABLES).
   - INSTALLED IN A WAY THAT IT WILL ABSORB OR REDUCE VIBRATION CONDITIONS, FOR EXAMPLE: ADD OFF-SET BENDS, BETWEEN THE MOUNTING SURFACE OF THE CIRCUIT BREAKER ENCLOSURE AND THE STUB AREA ORIGINATING IN CONCRETE OR THE TYPE OF BASE FLOORING.
6. CONDUIT AND CABLE INSTALLATION SHOULD PROVIDE VIBRATION BETWEEN GENSET AND GROUND.
7. AREA SHOWN INDICATES APPROXIMATE OFFSET PLACEMENT OF THE ELECTRICAL FLEXIBLE CONDUIT STUB-UP AREA ORIGINATING IN CONCRETE OR OTHER TYPE OF BASE FLOORING RELATIVE TO CIRCUIT BREAKER LOCATION WITHIN ENCLOSURE TO PROVIDE VIBRATION PROTECTION.
8. WIRE-CONDUIT COMBINATIONS MEET NEC AND CEC. TO USE OTHER COMBINATIONS, REFER TO APPLICABLE CODES TO ENSURE THAT WIRE AMPACITY, BEND SPACE AND GUTTER SPACE MEET THE REQUIREMENTS.
9. SHUNT TRIP UNITS CAN BE OPERATED AT 75% OF NOMINAL VOLTAGE AND WILL ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE.
10. SHUNT TRIP UNITS CAN BE OPERATED AT 70% TO 100% OF NOMINAL VOLTAGE AND WILL ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE.
11. ALL DIMENSIONS SHOWN FOR RIGHT SIDE ENTRY ALSO APPLY TO LEFT SIDE ENTRY IN MIRROR ORIENTATION.
12. ALTERNATOR MODEL P734C & R-FRAME CIRCUIT BREAKER ARE SHOWN ON SHEET 1, 2 FOR DRAWING SIMPLICITY.
13. "NS" SHUNT TRIP HAS NO INTERNAL CONTACTS, IT MUST BE USED IN CONJUNCTION WITH AUXILIARY CONTACTS TO ACCEPT CONTINUOUS APPLIED VOLTAGE. IT CAN OPERATE AT 75% OF NOMINAL VOLTAGE.
14. 800 AMP BREAKER:
    A LUG ACCEPTING (2) 3/0-600 kcmil CONDUCTORS IS AVAILABLE THRU ACCESSORIES. PGA PART NUMBER 0332-4278.
15. 1200 AMP BREAKER:
    A LUG ACCEPTING (3) 3/0-600 kcmil CONDUCTORS IS AVAILABLE THRU ACCESSORIES. PGA PART NUMBER 0332-4279.
16. ALTERNATOR MODEL S6E & R-FRAME CIRCUIT BREAKER ARE SHOWN ON SHEET 4, 5 FOR DRAWING SIMPLICITY

LAST DATUM LETTER USED: .		LAST REFERENCE LETTER USED: .	
MODEL/PLATFORM:		THIS PART IS SIMILAR TO: -	
UNLESS OTHERWISE SPECIFIED THE FOLLOWING SHALL APPLY			ANG. TOL.: ± 1°
SURFACE FINISH PER: ISO 1302		SURFACE FINISH: Ramax -	
WALL THICKNESS:-	DRAFT ANGLES:-	EDGE RADII:-	FILLET RADII:-
DIMENSIONAL TOLERANCES:	X ± 3	.X ± 0.8	.XX ± 0.38
HOLE SIZE 0.00-4.99 TOL. +0.15/-0.08	HOLE SIZE 5.00-9.99 TOL. +0.20/-0.10	HOLE SIZE 10.00-17.49 TOL. +0.25/-0.13	HOLE SIZE 17.50-24.99 TOL. +0.30/-0.13
Cummins Inc.			
DIMENSIONS ARE IN: MILLIMETERS [ ] ARE IN: INCHES	SIZE: A1	SCALE:3/32	
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	THIRD ANGLE PROJECTION	CAD SYSTEM PTC® Creo® Parametric	

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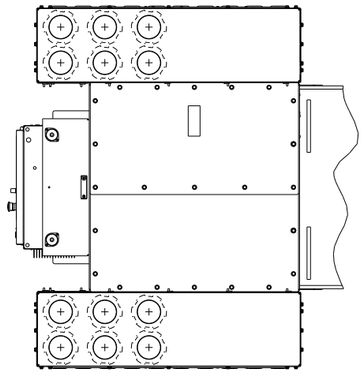
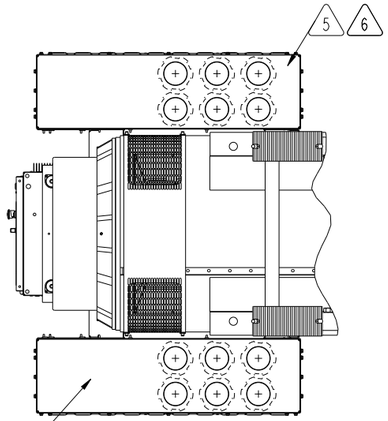
Part Number: **A040V836** Part Revision: **F**
Part Name: **OUTLINE,CIRCUIT BREAKER**
Drawing Category: **Detail** State: **Released**

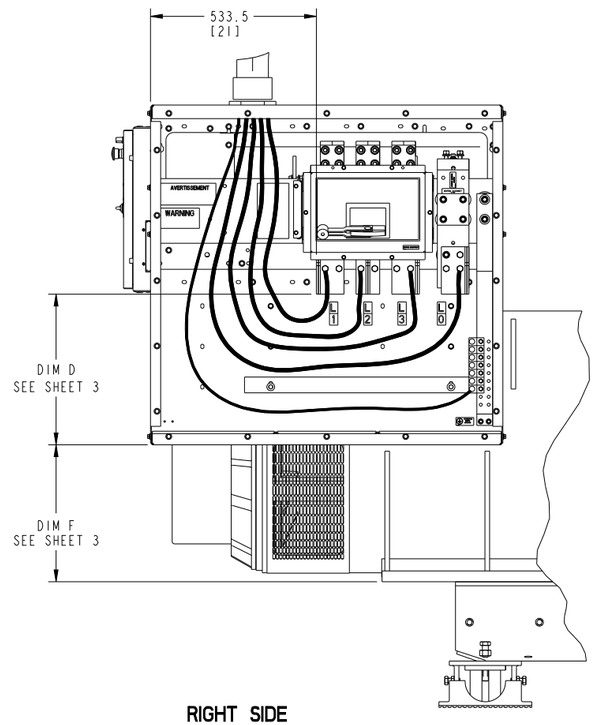
HC6/P7



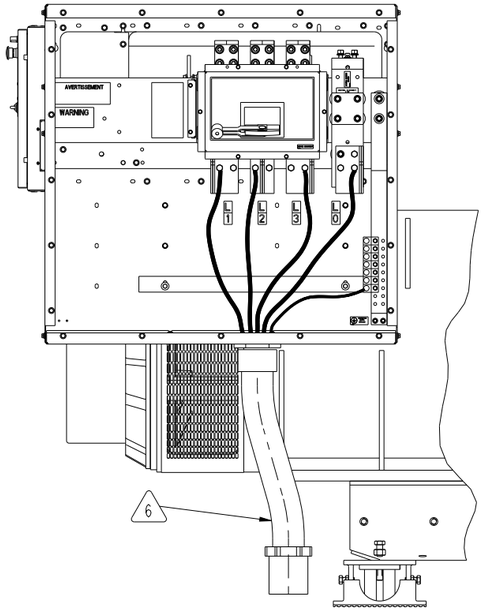
VIEW **B-B**
TOP ENTRANCE
SCALE 3/32



VIEW **C-C**
BOTTOM ENTRANCE
SCALE 3/32



RIGHT SIDE
TOP ENTRY ROUTING EXAMPLE
SCALE 1/8



RIGHT SIDE
BOTTOM ENTRY ROUTING EXAMPLE
SCALE 1/8

Cummins Inc.		
DIMENSIONS ARE IN: MILLIMETERS [ ] ARE IN: INCHES	SIZE: A1 SCALE:3/64	
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	THIRD ANGLE PROJECTION	CAD SYSTEM PTC® Creo® Parametric

Document Generated: **01JUL2019 15:04 GMT**

Part Number: **A040V836** Part Revision: **F**
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Drawing Category: **Detail** State: **Released**

TABLE 1

UL/IEC LUGS							ACCESSORY SPECIFICATIONS			
LUG	FRAME	MAX AMPS	WIRE RANGE COPPER	DIM D ±25 [1.0]	DIM E ±25 [1.0]	DIM F ±25 [1.0]	ACCESSORY DESCRIPTION	CONTACT RATING	INRUSH	CONNECTION TYPE
	SQUARE D NSJ	400A 3 OR 4 POLE	#2-600 KCMIL	554 [21.8]	1092 [43.02]	440.5 [17.34]	24 VDC SHUNT TRIP	----------	10A 10	COMPRESSION TERMINALS #20-16 AWG OR SMALLER TORQUE: 10 LB-IN
	SQUARE D NLGL W/ MICROLOGIC 5.0 TRIP UNIT	600A 3-POLE	2/0-350 KCMIL	554 [21.8]	1092 [43.02]	440.5 [17.34]	24 VDC SHUNT TRIP 9 13	----------	10A 10	COMPRESSION TERMINALS #20-16 AWG OR SMALLER TORQUE: 10 LB-IN
							1 EA. FORM C 1 AUX CONTACT + 1 TRIP ALARM 9 13	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125VDC, 0.3A AT 250 VDC	----	
14	SQUARE D P 800 W/MICROLOGIC 5.0 TRIP UNIT	800A 3-POLE	3/0-500 KCMIL	599 [23.5]	1092 [43.02]	440.5 [17.34]	24 VDC SHUNT TRIP 9 13	----------	200VA 10	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN
							1 EA. FORM C 1 AUX CONTACT + 1 TRIP ALARM 9 13	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125VDC, 0.3A AT 250 VDC	----	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN
15	SQUARE D P 1200 W/MICROLOGIC 5.0 TRIP UNIT	1200A 3-POLE	3/0-500 KCMIL	556 [21.8]	1092 [43.02]	440.5 [17.34]	24 VDC SHUNT TRIP 9 13	----------	200VA 10	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN
							1 EA. FORM C 1 AUX CONTACT + 1 TRIP ALARM 9 13	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125VDC, 0.3A AT 250 VDC	----	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN
	SCHNEIDER ELECTRIC NW 2000/1600 (ELECTRICALLY OPERATED) 1600-3000 AMP BREAKERS BUS BARS STANDARD W/MICROLOGIC 5.0 TRIP UNIT		NEMA HOLE PATTERN	490 [19]	1242.6 [48.92]	290.5 [11.44]	24 VDC SHUNT TRIP 9 13 1	----------	200VA 10	PUSH-IN TERMINAL FOR 1 OR 2 #18-14 AWG.
							1 EA. FORM C 4 AUX CONTACT + 1 TRIP ALARM 9 13 1	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125VDC, 0.3A AT 250 VDC	----	PUSH-IN TERMINAL FOR 1 OR 2 #18-16 AWG.
	SQUARE D R 2500/2000/1600 3-POLE 1600-2500 AMP BUS BARS STANDARD W/MICROLOGIC 5.0 TRIP UNIT		NEMA HOLE PATTERN	490 [19]	1092 [43.02]	440.5 [17.34]	24 VDC SHUNT TRIP 9 13	----------	200VA 10	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 10 LB-IN
							1 EA. FORM C 4 AUX CONTACT + 1 TRIP ALARM 9 13	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125VDC, 0.3A AT 250 VDC	----	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN
	SCHNEIDER ELECTRIC NW 2000/1600 (ELECTRICALLY OPERATED) W/OPTIONAL LUG 1600-3000AMP BREAKERS TORQUE 375 IN LBS [42 Nm] 3		#2-600 KCMIL	490 [19]	1242.6 [48.92]	290.5 [11.44]	24 VDC SHUNT TRIP 9 13 1	----------	200VA 10	PUSH-IN TERMINAL FOR 1 OR 2 #18-16 AWG.
							1 EA. FORM C 4 AUX CONTACT + 1 TRIP ALARM 9 13 1	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125VDC, 0.3A AT 250 VDC	----	PUSH-IN TERMINAL FOR 1 OR 2 #18-16 AWG.
	R 2500/2000/1600 W/OPTIONAL LUG 1600-2500 AMP BREAKERS TORQUE 375 IN LBS [42 Nm] 3		#2-600 KCMIL	490 [19]	1092 [43.02]	440.5 [17.34]	24 VDC SHUNT TRIP 9 13	----------	200VA 10	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN
							1 EA. FORM C 4 AUX CONTACT + 1 TRIP ALARM 9 13	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125VDC, 0.3A AT 250 VDC	----	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN

TABLE 2

TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2008, ARTICLE 310.15 AT 75C TEMPERATURE RATED CONDUCTOR AT 30C AMBIENT AND ANNEX C 8

MAX BRKR AMPS	WIRE (COPPER)		CABLE AMPACITY	TOTAL NUMBER OF CONDUITS	
	QTY	SIZE		QTY	SIZE (IN INCHES)
2500	6	600 KCMIL	420	6	4
2000	5	600 KCMIL	420	5	4
1600	5	600 KCMIL	420	5	4
1200	3	500 KCMIL	385	3	3
1000	3	400 KCMIL	335	3	3
800	2	300 KCMIL	285	2	3
630	2	350 KCMIL	310	2	3
600	2	350 KCMIL	310	2	3
400	1	600 KCMIL	420	1	4
250	1	250 KCMIL	255	1	2 1/2
100	1	2 KCMIL	115	1	2

TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2008, ARTICLE 310.15 AND TABLE 310-16 AT 75C TEMPERATURE RATED CONDUCTOR AT 40C AMBIENT AND ANNEX C 8

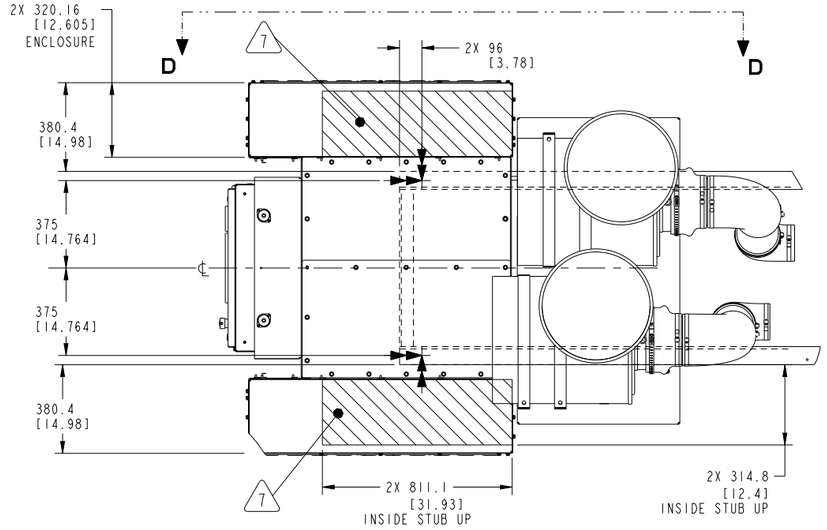
MAX BRKR AMPS	WIRE (COPPER)		CABLE AMPACITY	TOTAL NUMBER OF CONDUITS	
	QTY	SIZE		QTY	SIZE (IN INCHES)
2500	6	750 KCMIL	418	6	4
2000	5	700 KCMIL	405	5	4
1600	4	700 KCMIL	405	4	4
1000	3	500 KCMIL	334	3	3 1/2
800	3	350 KCMIL	273	3	3

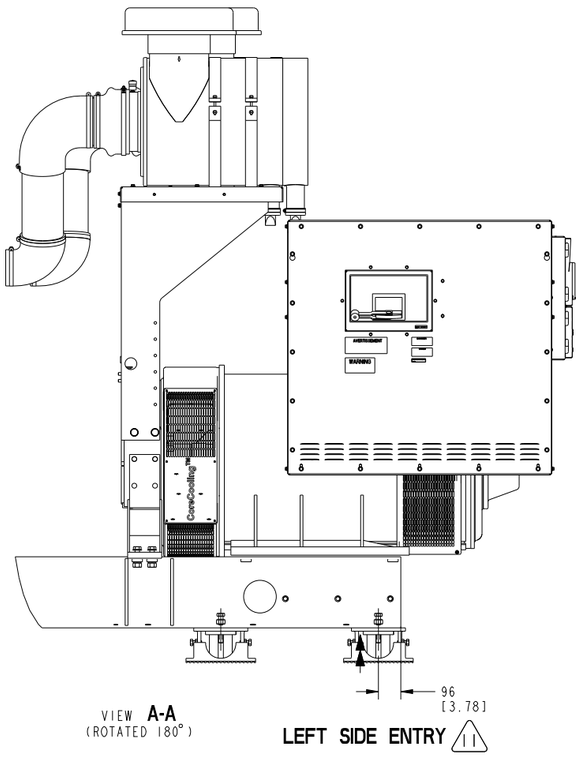
TABLE 3

GENSET MODEL	ALTERNATOR MODEL	DIM "A"
☐ DQFAA ☐ DQFAB ☐ DQFAC ☐ DQFAD	☐ HC634G	654 [25.74]
	☐ HC634H	654 [25.74]
	☐ HC634J	654 [25.74]
	☐ HC634K	755 [29.72]
	☐ P734B	746 [29.37]
	☐ P734C	746 [29.37]
	☐ S6D	528 [20.77]
	☐ S6E	648 [24.49]
	☐ S6F	

Cummins Inc.		
DIMENSIONS ARE IN: MILLIMETERS [ ] ARE IN: INCHES	SIZE: A1	SCALE:3/64
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	THIRD ANGLE PROJECTION	CAD SYSTEM PTC® Creo® Parametric

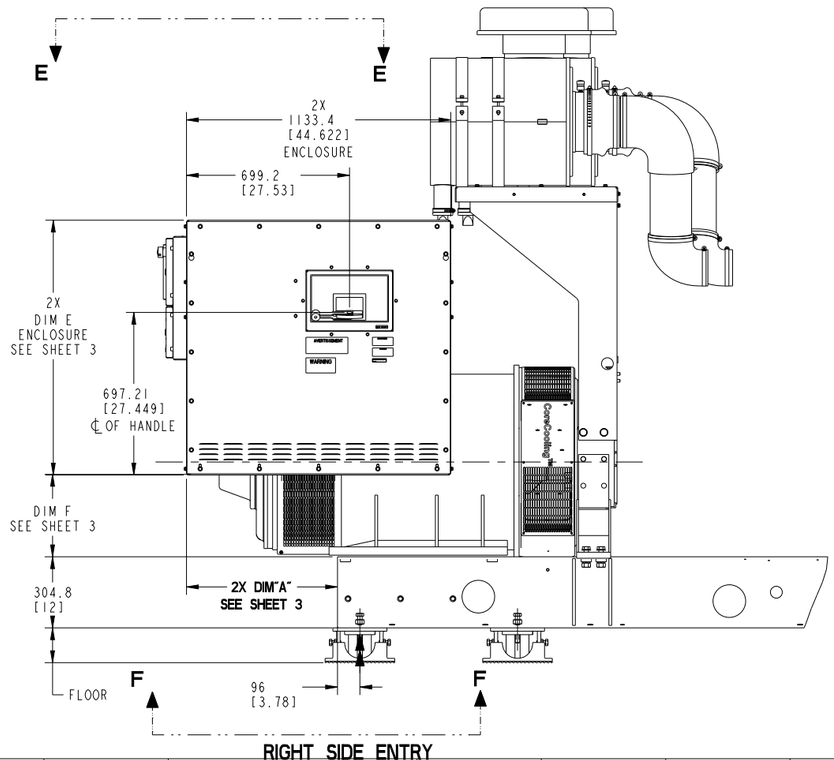
S6





VIEW A-A
(ROTATED 180°)

LEFT SIDE ENTRY (11)



RIGHT SIDE ENTRY

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DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	THIRD ANGLE PROJECTION	CAD SYSTEM PTC® Creo® Parametric

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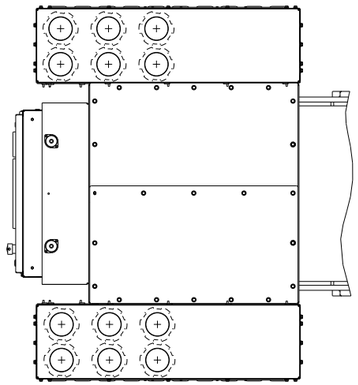
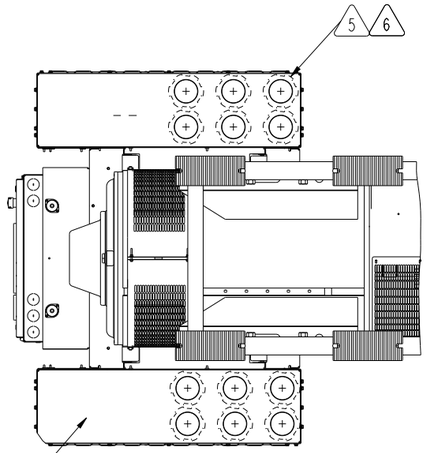
Part Number: **A040V836** Part Revision: **F**
Part Name: **OUTLINE,CIRCUIT BREAKER**
Drawing Category: **Detail** State: **Released**

S6

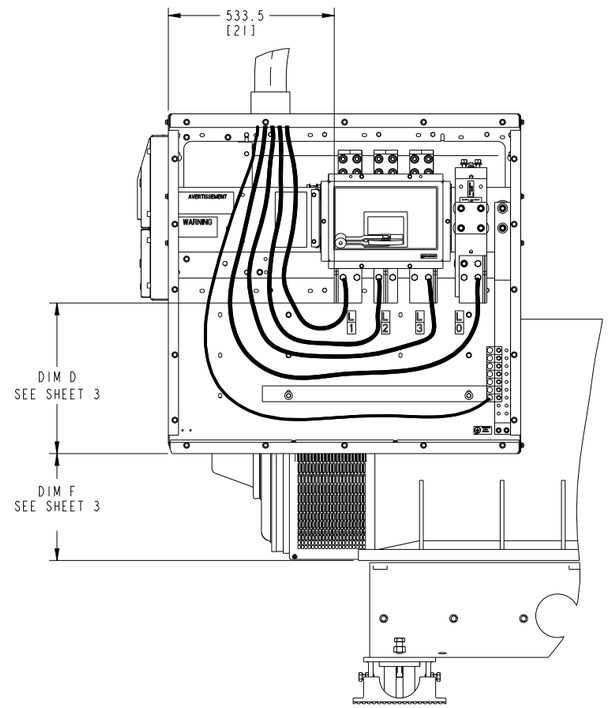


VIEW **E-E**
TOP ENTRANCE
SCALE 3/32

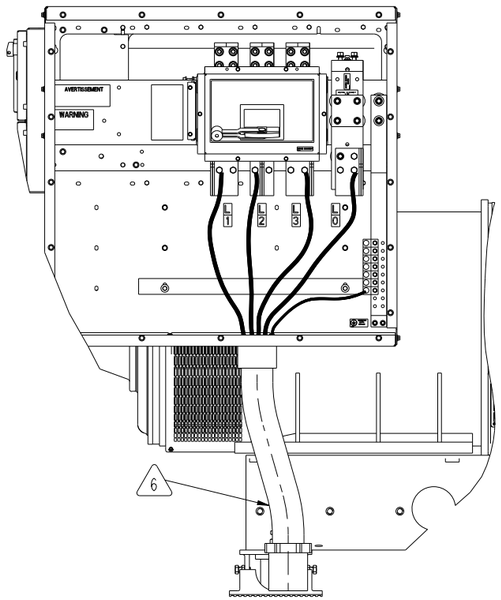


BOTTOM OF CIRCUIT BREAKER BOX

VIEW **E-E**
BOTTOM ENTRANCE
SCALE 3/32



RIGHT SIDE
TOP ENTRY ROUTING EXAMPLE
SCALE 1/8



RIGHT SIDE
BOTTOM ENTRY ROUTING EXAMPLE
SCALE 1/8

Cummins Inc.		
DIMENSIONS ARE IN: MILLIMETERS [ ] ARE IN: INCHES	SIZE: A1	SCALE:3/32
DIMENSIONING AND TOLERANCING PER: ASME Y14.5-2009	THIRD ANGLE PROJECTION	CAD SYSTEM PTC® Creo® Parametric

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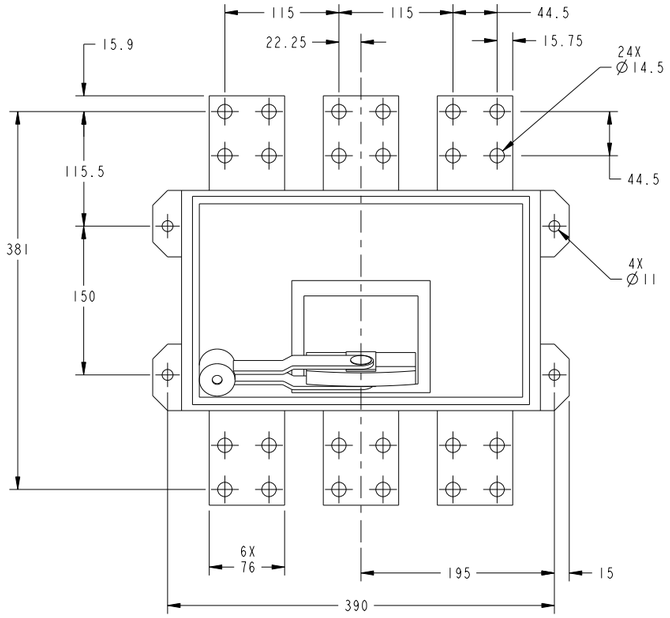
Drawing Category: **Detail** State: **Released**

0320_2164	D	Pro/ENGINEER	METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
ECO-103185	H	1	ADD P/N A029B150 & A029B151	-	DA	DA	PL	07JAN09
		2	UPDATED NOTES	-	DA	DA	PL	07JAN09



TABULATION	
PART NO.	CURRENT_ER
0320_2164_01	FRD26895
0320_2164_02	FRD26895
0320_2164_03	FRD26895
0320_2164_04	FRD26895
0320_2164_05	FRD26895
0320_2164_06	FRD26895
0320_2164_07	FRD27516
A029B150	ECO-103185
A029B151	ECO-103185

BREAKER SIZE	TERMINAL THICKNESS "A"	
	mm	[IN]
1600 A	12.8	[0.50]
2000 A	16.0	[0.63]
2500 A	20.0	[0.79]
3000 A	20.0	[0.79]

NOTES:

1. THIS PART IS MANUFACTURING SOURCE CONTROLLED.
2. ELECTRONIC TRIP CIRCUIT BREAKER. STANDARD MICROLOGIC 3.0 TRIP UNIT. (LI)
   FOR 0320_2164_07, ELECTRONIC MICROLOGIC TRIP UNIT IS 6.0A (LSIG).
3. BREAKERS TO BE SUPPLIED WITH TYPE F PLUG.

TYPE F PLUG AMPERAGE SETTINGS									
TYPE F	84%	86%	88%	90%	92%	94%	96%	98%	100%
-01	2100	2150	2200	2250	2300	2350	2400	2450	2500
-02	1680	1720	1760	1800	1840	1880	1920	1960	2000
-03	1344	1376	1408	1440	1472	1504	1536	1568	1600

BREAKERS TO BE SUPPLIED WITH TYPE A PLUG.

TYPE A PLUG AMPERAGE SETTINGS									
TYPE A	40%	45%	50%	60%	63%	70%	80%	90%	100%
-07	640	720	800	960	1008	1120	1280	1440	1600
A029B150	1200	1350	1500	1800	1890	2100	2400	2700	3000

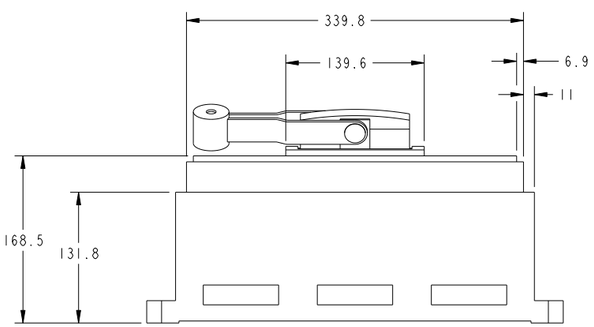
4. BREAKERS TO BE SUPPLIED WITH NO LUGS (AS SHOWN).
5. AGENCIES: 3 POLE UL LISTED
   IEC
6. INTERRUPTING RATING

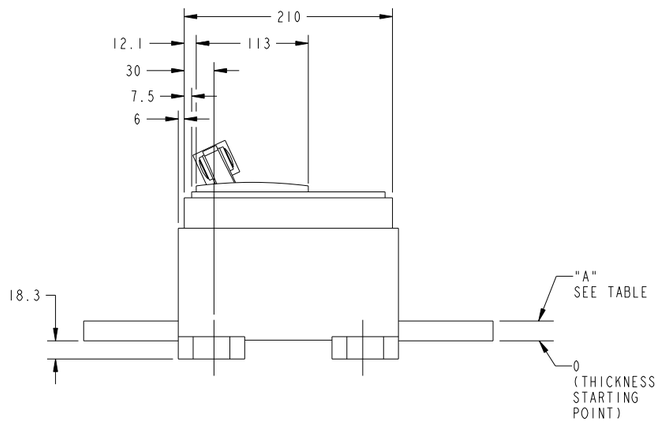
CIRCUIT BREAKER	UL/CSA RATING (60 Hz)			IEC 60947-2 RATING (50/60 Hz)			
				240 Vac		380/415 Vac	
	240 Vac	480 Vac	600 Vac	Icu	Ics	Icu	Ics
RL	125 kA	100 kA	50 kA	125 kA	65 kA	85 kA	45 kA

7. LEVEL OF OPERATION ABOVE 80% CONTINUOUS LOAD REQUIRES SPECIAL TESTING, INSTALLATION AND APPLICATION REQUIREMENTS PER VENDOR LITERATURE.

PRODUCTION P/N	BREAKER	POLES	RATINGS	PLUG TYPE
0320_2164_01	RL2500	3	SEE NOTE 6	F
0320_2164_02	RL2000	3	SEE NOTE 6	F
0320_2164_03	RL1600	3	SEE NOTE 6	F
0320_2164_07	RL1600	3	SEE NOTE 6	A
A029B150	RL3000	3	SEE NOTE 6	A

ACCESSORIES P/N	BREAKER	POLES	MATERIAL
0320_2164_04	RL2500	3	0320_2164_01
0320_2164_05	RL2000	3	0320_2164_02
0320_2164_06	RL1600	3	0320_2164_03
A029B151	RL3000	3	A029B150





-THIS IS A CONTROLLED PRODUCT-
PER ONAN PROCEDURE FRE-1002

TO MAINTAIN COMPLIANCE WITH REQUIREMENTS OF THE CODES, STANDARDS, OR AGENCIES LISTED BELOW

☒ CSA ☒ UL ☐ EC ☐ RVIA ☐ ABYC
☐ OTHER _____ ☐ OTHER _____

AND/OR ASSIGN INTERNAL ONAN DESIGN CONTROL FACILITIES ☐

CHANGES, DEVIATIONS, OR SUBSTITUTIONS OF MATERIAL, PROCESS, OR PERFORMANCE FOR THIS PRODUCT MUST BE APPROVED BY THE FOLLOWING DESIGN CONTROL FACILITIES

DESIGN CONTROL FACILITY _____
DESIGN CONTROL FACILITY _____

DO NOT SCALE PRINT

ANG TOL± 1.0 °

DRAWN TO SCALE OF 3/8

TOLERANCE UNLESS OTHERWISE SPECIFIED			
	mm	Inch	
DIM	X ± 1 .X ± 0.8 .XX ± 0.38	.X ± .XX ± .XXX±	
HOLE	0.99 - 4.99 +0.15/-0.00 5.00 - 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13	.004-.200 +.006/-.003 .201-.421 +.008/-.004 .422-.703 +.010/-.005 .704-.999 +.012/-.005	

SIM TO _____
COPIED FROM _____
THIRD ANGLE PROJECTION

ITEM	PART NO	DRG SIZE	DESCRIPTION OR MATERIAL	REF DES

	NAME	DATE
DR	D CRANE	03-21-03
CHKR ☒ MFG ☐	E_CZECHOWSKI	03-21-03
APPROVED	E_CZECHOWSKI	03-21-03

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: HC6/HC7

SITE CODE: PGA

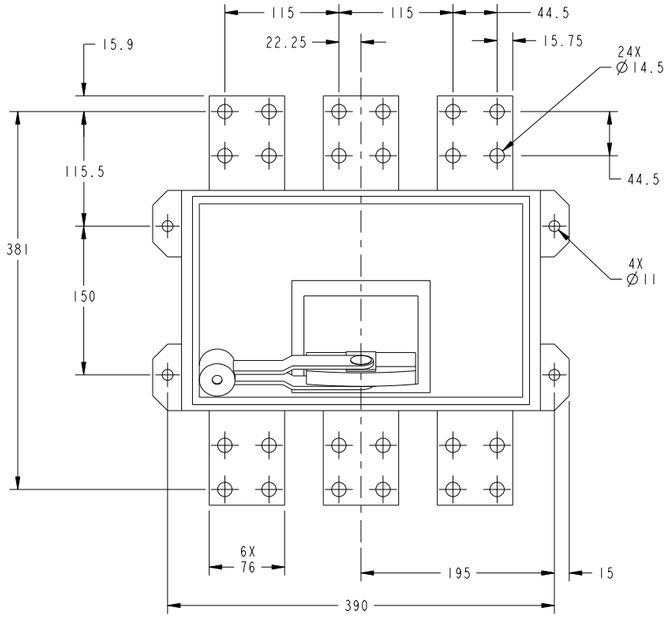
CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: CIRCUIT_BREAKER .

DWG NO: 0320_2164 | SHEET 1 of 1 | DRG SIZE D

0320_2164	D	Pro/ENGINEER	METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
ECO-103185	H	1	ADD P/N A029B150 & A029B151	-	DA	DA	PL	07JAN09
		2	UPDATED NOTES	-	DA	DA	PL	07JAN09



TABULATION	
PART NO.	CURRENT_ER
0320_2164_01	FRD26895
0320_2164_02	FRD26895
0320_2164_03	FRD26895
0320_2164_04	FRD26895
0320_2164_05	FRD26895
0320_2164_06	FRD26895
0320_2164_07	FRD27516
A029B150	ECO-103185
A029B151	ECO-103185

BREAKER SIZE	TERMINAL THICKNESS "A"	
	mm	[IN]
1600 A	12.8	[0.50]
2000 A	16.0	[0.63]
2500 A	20.0	[0.79]
3000 A	20.0	[0.79]

NOTES:

1. THIS PART IS MANUFACTURING SOURCE CONTROLLED.
2. ELECTRONIC TRIP CIRCUIT BREAKER. STANDARD MICROLOGIC 3.0 TRIP UNIT. (LI)
   FOR 0320_2164_07, ELECTRONIC MICROLOGIC TRIP UNIT IS 6.0A (LSIG).
3. BREAKERS TO BE SUPPLIED WITH TYPE F PLUG.

TYPE F PLUG AMPERAGE SETTINGS									
TYPE F	84%	86%	88%	90%	92%	94%	96%	98%	100%
-01	2100	2150	2200	2250	2300	2350	2400	2450	2500
-02	1680	1720	1760	1800	1840	1880	1920	1960	2000
-03	1344	1376	1408	1440	1472	1504	1536	1568	1600

BREAKERS TO BE SUPPLIED WITH TYPE A PLUG.

TYPE A PLUG AMPERAGE SETTINGS									
TYPE A	40%	45%	50%	60%	63%	70%	80%	90%	100%
-07	640	720	800	960	1008	1120	1280	1440	1600
A029B150	1200	1350	1500	1800	1890	2100	2400	2700	3000

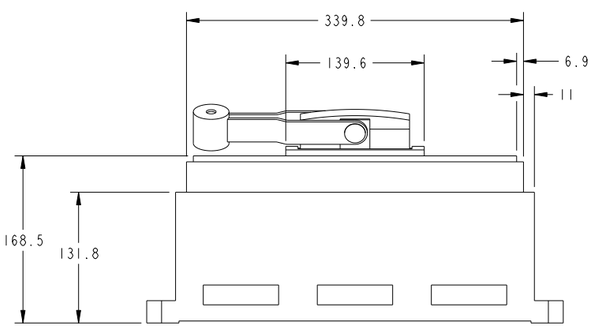
4. BREAKERS TO BE SUPPLIED WITH NO LUGS (AS SHOWN).
5. AGENCIES: 3 POLE UL LISTED
   IEC
6. INTERRUPTING RATING

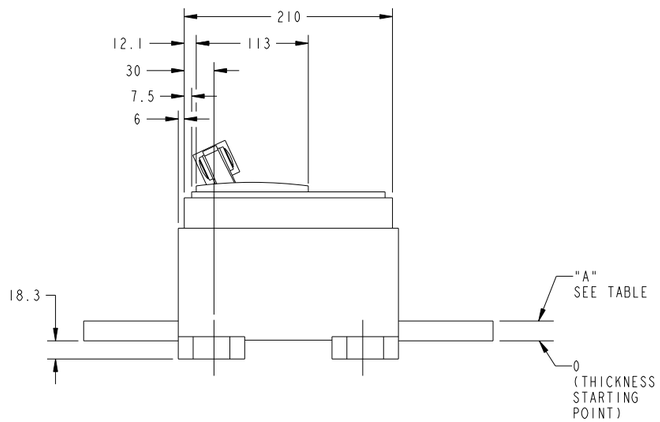
CIRCUIT BREAKER	UL/CSA RATING (60 Hz)			IEC 60947-2 RATING (50/60 Hz)			
				240 Vac		380/415 Vac	
	240 Vac	480 Vac	600 Vac	Icu	Ics	Icu	Ics
RL	125 kA	100 kA	50 kA	125 kA	65 kA	85 kA	45 kA

7. LEVEL OF OPERATION ABOVE 80% CONTINUOUS LOAD REQUIRES SPECIAL TESTING, INSTALLATION AND APPLICATION REQUIREMENTS PER VENDOR LITERATURE.

PRODUCTION P/N	BREAKER	POLES	RATINGS	PLUG TYPE
0320_2164_01	RL2500	3	SEE NOTE 6	F
0320_2164_02	RL2000	3	SEE NOTE 6	F
0320_2164_03	RL1600	3	SEE NOTE 6	F
0320_2164_07	RL1600	3	SEE NOTE 6	A
A029B150	RL3000	3	SEE NOTE 6	A

ACCESSORIES P/N	BREAKER	POLES	MATERIAL
0320_2164_04	RL2500	3	0320_2164_01
0320_2164_05	RL2000	3	0320_2164_02
0320_2164_06	RL1600	3	0320_2164_03
A029B151	RL3000	3	A029B150





-THIS IS A CONTROLLED PRODUCT-
PER ONAN PROCEDURE FRE-1002

TO MAINTAIN COMPLIANCE WITH REQUIREMENTS OF THE CODES, STANDARDS, OR AGENCIES LISTED BELOW

☒ CSA ☒ UL ☐ EC ☐ RVIA ☐ ABYC
☐ OTHER _____ ☐ OTHER _____

AND/OR ASSIGN INTERNAL ONAN DESIGN CONTROL FACILITIES ☐

CHANGES, DEVIATIONS, OR SUBSTITUTIONS OF MATERIAL, PROCESS, OR PERFORMANCE FOR THIS PRODUCT MUST BE APPROVED BY THE FOLLOWING DESIGN CONTROL FACILITIES

DESIGN CONTROL FACILITY _____
DESIGN CONTROL FACILITY _____

DO NOT SCALE PRINT

ANG TOL± 1.0 °

DRAWN TO SCALE OF 3/8

TOLERANCE UNLESS OTHERWISE SPECIFIED			
	mm	Inch	
DIM	X ± 1 .X ± 0.8 .XX ± 0.38	.X ± .XX ± .XXX±	
HOLE	0.99 - 4.99 +0.15/-0.00 5.00 - 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13	.004-.200 +.006/-.003 .201-.421 +.008/-.004 .422-.703 +.010/-.005 .704-.999 +.012/-.005	

SIM TO _____
COPIED FROM _____
THIRD ANGLE PROJECTION

ITEM	PART NO	DRG SIZE	DESCRIPTION OR MATERIAL	REF DES

	NAME	DATE
DR	D CRANE	03-21-03
CHKR ☒ MFG ☐	E_CZECHOWSKI	03-21-03
APPROVED	E_CZECHOWSKI	03-21-03

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: HC6/HC7

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: CIRCUIT_BREAKER .

DWG NO: 0320_2164 | SHEET 1 of 1 | DRG SIZE D

Catalog Numbers

Table 47: UL/IEC Rated, Unit-Mount, Manually-Operated, Standard-Rated Electronic Trip Circuit Breakers with Basic Electronic Trip and Micrologic™ Electronic Trip Units—600A to 1200A

Trip Unit Type	Circuit Breaker Catalog Number			
	Current Rating (Sensor Rating)			
	600 A	800 A	1000 A	1200 A
Basic Electronic Trip Unit Not interchangeable				
ET1.0I 2P[1], 3P Fixed Long-time	RGF36060	RGF36080	RGF36100	RGF36120
	RJF36060	RJF36080	RJF36100	RJF36120
	RKF36060	RKF36080	RKF36100	RKF36120
	RLF36060	RLF36080	RLF36100	RLF36120
Micrologic Interchangeable Standard Trip Unit				
3.0 (LI) 3P, 4P[2]	RGF36060U31A	RGF36080U31A	RGF36100U31A	RGF36120U31A
	RJF36060U31A	RJF36080U31A	RJF36100U31A	RJF36120U31A
	RKF36060U31A	RKF36080U31A	RKF36100U31A	RKF36120U31A
	RLF36060U31A	RLF36080U31A	RLF36100U31A	RLF36120U31A
5.0 (LSI) 3P, 4P[2]	RGF36060U33A	RGF36080U33A	RGF36100U33A	RGF36120U33A
	RJF36060U33A	RJF36080U33A	RJF36100U33A	RJF36120U33A
	RKF36060U33A	RKF36080U33A	RKF36100U33A	RKF36120U33A
	RLF36060U33A	RLF36080U33A	RLF36100U33A	RLF36120U33A
Micrologic Interchangeable Ammeter Trip Unit[3]				
3.0A (LI) 3P, 4P[2]	RGF36060U41A	RGF36080U41A	RGF36100U41A	RGF36120U41A
	RJF36060U41A	RJF36080U41A	RJF36100U41A	RJF36120U41A
	RKF36060U41A	RKF36080U41A	RKF36100U41A	RKF36120U41A
	RLF36060U41A	RLF36080U41A	RLF36100U41A	RLF36120U41A
5.0A (LSI) 3P, 4P[2]	RGF36060U43A	RGF36080U43A	RGF36100U43A	RGF36120U43A
	RJF36060U43A	RJF36080U43A	RJF36100U43A	RJF36120U43A
	RKF36060U43A	RKF36080U43A	RKF36100U43A	RKF36120U43A
	RLF36060U43A	RLF36080U43A	RLF36100U43A	RLF36120U43A
6.0A (LSIG) 3P, 4P[2]	RGF36060U44A	RGF36080U44A	RGF36100U44A	RGF36120U44A
	RJF36060U44A	RJF36080U44A	RJF36100U44A	RJF36120U44A
	RKF36060U44A	RKF36080U44A	RKF36100U44A	RKF36120U44A
	RLF36060U44A	RLF36080U44A	RLF36100U44A	RLF36120U44A
Micrologic Interchangeable Power Trip Unit with Modbus® Communications				
5.0P (LSI) 3P, 4P[2]	RGF36060U63AE1	RGF36080U63AE1	RGF36100U63AE1	RGF36120U63AE1
	RJF36060U63AE1	RJF36080U63AE1	RJF36100U63AE1	RJF36120U63AE1
	RKF36060U63AE1	RKF36080U63AE1	RKF36100U63AE1	RKF36120U63AE1
	RLF36060U63AE1	RLF36080U63AE1	RLF36100U63AE1	RLF36120U63AE1
6.0P (LSIG) 3P, 4P[2]	RGF36060U64AE1	RGF36080U64AE1	RGF36100U64AE1	RGF36120U64AE1
	RJF36060U64AE1	RJF36080U64AE1	RJF36100U64AE1	RJF36120U64AE1
	RKF36060U64AE1	RKF36080U64AE1	RKF36100U64AE1	RKF36120U64AE1
	RLF36060U64AE1	RLF36080U64AE1	RLF36100U64AE1	RLF36120U64AE1
Micrologic Interchangeable Harmonic Trip Unit with Modbus Communications				
5.0H (LSI) 3P, 4P[2]	RGF36060U73AE1	RGF36080U73AE1	RGF36100U73AE1	RGF36120U73AE1
	RJF36060U73AE1	RJF36080U73AE1	RJF36100U73AE1	RJF36120U73AE1
	RKF36060U73AE1	RKF36080U73AE1	RKF36100U73AE1	RKF36120U73AE1
	RLF36060U73AE1	RLF36080U73AE1	RLF36100U73AE1	RLF36120U73AE1
6.0H (LSIG) 3P, 4P[2]	RGF36060U74AE1	RGF36080U74AE1	RGF36100U74AE1	RGF36120U74AE1
	RJF36060U74AE1	RJF36080U74AE1	RJF36100U74AE1	RJF36120U74AE1
	RKF36060U74AE1	RKF36080U74AE1	RKF36100U74AE1	RKF36120U74AE1
	RLF36060U74AE1	RLF36080U74AE1	RLF36100U74AE1	RLF36120U74AE1

1 For 2P, replace the leading 3 in the catalog number following the prefix with a 2 (RGF36060 becomes RGF26060.)

2 For 4P, replace the leading 3 in the catalog number following the prefix with a 4 (RPF36060U31A becomes RGF46060U31A).

3 Add E1 suffix for Modbus communications.

Table 48: UL/IEC Rated, Unit-Mount, Manually-Operated, Standard-Rated Electronic Trip Circuit Breakers with Basic Electronic Trip and Micrologic™ Electronic Trip Units—1600A to 3000A

Trip Unit Type	Circuit Breaker Catalog Number			
	Current Rating (Sensor Rating)			
	1600 A	2000 A	2500 A	3000 A
Basic Electronic Trip Unit Not interchangeable				
ET1.0I 2P[1], 3P Fixed Long-time	RGF36160	RGF36200	RGF36250	—
	RJF36160	RJF36200	RJF36250	—
	RKF36160	RKF36200	RKF36250	—
	RLF36160	RLF36200	RLF36250	—
Micrologic Interchangeable Standard Trip Unit				
3.0 (LI) 3P, 4P[2]	RGF36160U31A	RGF36200U31A	RGF36250U31A	RGF36300U31A
	RJF36160U31A	RJF36200U31A	RJF36250U31A	RJF36300U31A
	RKF36160U31A	RKF36200U31A	RKF36250U31A	RKF36300U31A
	RLF36160U31A	RLF36200U31A	RLF36250U31A	RLF36300U31A
5.0 (LSI) 3P, 4P[2]	RGF36160U33A	RGF36200U33A	RGF36250U33A	RGF36300U33A
	RJF36160U33A	RJF36200U33A	RJF36250U33A	RJF36300U33A
	RKF36160U33A	RKF36200U33A	RKF36250U33A	RKF36300U33A
	RLF36160U33A	RLF36200U33A	RLF36250U33A	RLF36300U33A
Micrologic Interchangeable Ammeter Trip Unit[3]				
3.0A (LI) 3P, 4P[2]	RGF36160U41A	RGF36200U41A	RGF36250U41A	RGF36300U41A
	RJF36160U41A	RJF36200U41A	RJF36250U41A	RJF36300U41A
	RKF36160U41A	RKF36200U41A	RKF36250U41A	RKF36300U41A
	RLF36160U41A	RLF36200U41A	RLF36250U41A	RLF36300U41A
5.0A (LSI) 3P, 4P[2]	RGF36160U43A	RGF36200U43A	RGF36250U43A	RGF36300U43A
	RJF36160U43A	RJF36200U43A	RJF36250U43A	RJF36300U43A
	RKF36160U43A	RKF36200U43A	RKF36250U43A	RKF36300U43A
	RLF36160U43A	RLF36200U43A	RLF36250U43A	RLF36300U43A
6.0A (LSIG) 3P, 4P[2]	RGF36160U44A	RGF36200U44A	RGF36250U44A	RGF36300U44A
	RJF36160U44A	RJF36200U44A	RJF36250U44A	RJF36300U44A
	RKF36160U44A	RKF36200U44A	RKF36250U44A	RKF36300U44A
	RLF36160U44A	RLF36200U44A	RLF36250U44A	RLF36300U44A
Micrologic Interchangeable Power Trip Unit with Modbus® Communications				
5.0P (LSI) 3P, 4P[2]	RGF36160U63AE1	RGF36200U63AE1	RGF36250U63AE1	RGF36300U63AE1
	RJF36160U63AE1	RJF36200U63AE1	RJF36250U63AE1	RJF36300U63AE1
	RKF36160U63AE1	RKF36200U63AE1	RKF36250U63AE1	RKF36300U63AE1
	RLF36160U63AE1	RLF36200U63AE1	RLF36250U63AE1	RLF36300U63AE1
6.0P (LSIG) 3P, 4P[2]	RGF36160U64AE1	RGF36200U64AE1	RGF36250U64AE1	RGF36300U64AE1
	RJF36160U64AE1	RJF36200U64AE1	RJF36250U64AE1	RJF36300U64AE1
	RKF36160U64AE1	RKF36200U64AE1	RKF36250U64AE1	RKF36300U64AE1
	RLF36160U64AE1	RLF36200U64AE1	RLF36250U64AE1	RLF36200U64AE1
Micrologic Interchangeable Harmonic Trip Unit with Modbus Communications				
5.0H (LSI) 3P, 4P[2]	RGF36160U73AE1	RGF36200U73AE1	RGF36250U73AE1	RGF36300U73AE1
	RJF36160U73AE1	RJF363200U73AE1	RJF36250U73AE1	RJF36300U73AE1
	RKF36160U73AE1	RKF363200U73AE1	RKF36250U73AE1	RKF36300U73AE1
	RLF36160U73AE1	RLF36200U73AE1	RLF36250U73AE1	RLF36300U73AE1
6.0H (LSIG) 3P, 4P[2]	RGF36160U74AE1	RGF36200U74AE1	RGF36250U74AE1	RGF36300U74AE1
	RJF36160U74AE1	RJF36200U74AE1	RJF36250U74AE1	RJF36300U74AE1
	RKF36160U74AE1	RKF36200U74AE1	RKF36250U74AE1	RKF36300U74AE1
	RLF36160U74AE1	RLF36200U74AE1	RLF36250U74AE1	RLF36300U74AE1

1 For 2P, replace the leading 3 in the catalog number following the prefix with a 2 (RGF36060 becomes RGF26060.)

2 For 4P, replace the leading 3 in the catalog number following the prefix with a 4 (RPF36060U31A becomes RGF46060U31A).

3 Add E1 suffix for Modbus communications.

Specifications

Electronic trip molded case circuit breakers have a molded case made of a glass-reinforced insulating material (thermal set composite resin) that provides high dielectric strength. These circuit breakers:

- Are available in either dual-rated Underwriters Laboratory® (UL®) / International Electrotechnical Commission® (IEC®) or IEC-only constructions
- Are also Canadian Standard Association® (CSA®) and Association of the Electrical Sector® (ANCE®) certified (dual-rated UL/IEC circuit breakers only)
- Are manufactured in unit-mount, I-Line™ and drawout (P-frame and NS630b–NS1600) constructions
- Are available with either type ET or Micrologic electronic tripping systems
- Provide optional power monitoring, communications, protective relaying, integral ground-fault protection for equipment and zone-selective interlocking functions
- Share common tripping of all poles
- Can be mounted and operated in any position
- Are equipped with an externally-accessible test port for use with hand-held and full-function test sets
- Are available in motor circuit protector and automatic molded case switch constructions
- Can be reverse connected, without restrictive LINE and LOAD markings
- Meet the requirements of National Electrical Code® (NEC®) Sections 240.6 by providing a means to seal the rating plug and trip unit adjustments

Codes and Standards

M-, P- and R-frame, and NS630b–NS3200 electronic trip circuit breakers and switches are manufactured and tested in accordance with the following standards:

Table 1: Standards

M-Frame, P-Frame and R-Frame Circuit Breakers	P- and R-Frame Switches	NS630b–NS3200 Circuit Breakers	NS630b–NS3200 Switches
UL 489[1] IEC Standard 60947-2 CSA C22.2 No 5 Federal Specification W-C-375B/GEN NEMA AB1 NMX J-266 UTE, VDE, BS, CEI, UNE, CCC	UL 489[2] IEC Standard 60947-3 CSA C22.2 No 5 Federal Specification W-C-375B/GEN NEMA AB1 NMX J-266 UTE, VDE, BS, CEI, UNE	IEC Standard 60947-2 Federal Specification W-C-375B/GEN NEMA AB1 UTE, VDE, BS, CEI, UNE	IEC Standard 60947-3 Federal Specification W-C-375B/GEN NEMA AB1 UTE, VDE, BS, CEI, UNE

1 PowerPact M-frame circuit breaker is in UL File E10027.
PowerPact P-frame circuit breaker is in UL File E63335.
PowerPact R-frame circuit breaker is in UL FIle E10027.

2 PowerPact P-frame switch is in UL File E103740.
PowerPact R-frame switch is in UL FIle E33117.

Circuit breakers should be applied according to guidelines detailed in the NEC and other local wiring codes.

Circuit Breaker Ratings

Interrupting Rating

The interrupting rating is the highest current at rated voltage the circuit breaker is designed to safely interrupt under standard test conditions. Circuit breakers must be selected with interrupting ratings equal to or greater than the available short-circuit current at the point where the circuit breaker is applied to the system (unless it is a branch device in a series rated combination). Interrupting ratings are shown on the front of the circuit breaker. For grounded B phase interrupting ratings, see Data Bulletin 2700DB0202.

Table 2: UL/IEC Circuit Breaker Interrupting Ratings

Circuit Breaker[1]	UL/CSA Rating (60 Hz)				IEC 60947-2 Rating (50/60 Hz)			
	3 Phase			Grounded B Phase (1Ø-3Ø)	240 Vac		380/415 Vac	
	240 Vac	480 Vac	600 Vac	240 Vac 2P	Icu	Ics	Icu	Ics
MG	65 kA	35 kA	18 kA	65 kA	50 kA	25 kA	35 kA	20 kA
MJ	100 kA	65 kA	25 kA	65 kA	65 kA	35 kA	50 kA	25 kA
PG	65 kA	35 kA	18 kA	65 kA	50 kA	25 kA	35 kA	20 kA
PJ	100 kA	65 kA	25 kA	65 kA	65 kA	35 kA	50 kA	25 kA
PK	65 kA	50 kA	50 kA	65 kA	50 kA	25 kA	50 kA	25 kA
PL	125 kA	100 kA	25 kA	65 kA	125 kA	65 kA	85 kA	45 kA
RG	65 kA	35 kA	18 kA	35 kA	50 kA	25 kA	35 kA	20 kA
RJ	100 kA	65 kA	25 kA	100 kA	65 kA	35 kA	50 kA	25 kA
RK	65 kA	65 kA	65 kA	65 kA	85 kA	65 kA	70 kA	55 kA
RL	125 kA	100 kA	50 kA	125 kA	125 kA	65 kA	85 kA	45 kA

[1] The K interrupting rating is recommended for applications having high inrush and/or non-linear loads such as large motors, transformers, motors with soft starts, etc.

Table 3: IEC Only Circuit Breaker Interrupting Ratings (50/60 Hz)

Circuit Breaker	Interrupting Rating	220/240 Vac		380/415 Vac		440 Vac		500/525 Vac		660/690 Vac	
		Icu	Ics	Icu	Ics	Icu	Ics	Icu	Ics	Icu	Ics
Electrically Operated											
NS630b–NS1600	N Interrupting Rating	50 kA	37 kA	50 kA	37 kA	50 kA	37 kA	40 kA	30 kA	30 kA	22 kA
NS630b–NS1600	H Interrupting Rating	70 kA	35 kA	70 kA	35 kA	65 kA	32 kA	50 kA	25 kA	42 kA	21 kA
NS630b–NS1000	L Interrupting Rating	150 kA	150 kA	150 kA	150 kA	130 kA	130 kA	100 kA	100 kA	—	—
Manually Operated											
NS630b–NS1600	N Interrupting Rating	85 kA	50 kA	50 kA	50 kA	50 kA	50 kA	40 kA	40 kA	30 kA	30 kA
NS630b–NS1600	H Interrupting Rating	85 kA	52 kA	70 kA	52 kA	65 kA	48 kA	50 kA	37 kA	42 kA	31 kA
NS630b–NS1000	L Interrupting Rating	150 kA	150 kA	150 kA	150 kA	130 kA	130 kA	100 kA	100 kA	—	—
NS630b–NS800	R Interrupting Rating	200 kA	200 kA	200 kA	200 kA	200 kA	200 kA	100 kA	100 kA	75 kA	75 kA
NS1600b–NS3200	N Interrupting Rating	85 kA	65 kA	70 kA	52 kA	65 kA	65 kA	65 kA	65 kA	65 kA	65 kA
NS1600b–NS3200	H Interrupting Rating	125 kA	94 kA	85 kA	64 kA	85 kA	64 kA	—	—	—	—

exceeded, will trip the circuit breaker with no intentional delay. Instantaneous trip dial settings are 2–16 x I_n for 600 A circuit breakers and 1.5–12 x I_n for 800–1200 A circuit breakers.

Micrologic™ Electronic Trip Systems

The P-frame, R-frame and NS630b–NS3200 electronic trip circuit breakers can be equipped with the optional Micrologic trip systems listed below:

Table 15: Micrologic Trip Systems

Model	(LS0) Long-time + Short-time + Zero delay (IEC Rated Only)	(LI) Long-time + Instantaneous Protection (UL Listed, IEC Rated)	(LSI) Long-time + Short-time + Instantaneous Protection (UL LIsted, IEC Rated)	(LSIG) Long-time + Short-time + Instantaneous Protection + Equipment Ground-fault Protection (UL LIsted, IEC Rated)
Micrologic Basic Trip Unit	2.0	3.0	5.0	—
Micrologic A Trip Unit	2.0A	3.0A	5.0A	6.0A
Micrologic P Trip Unit	—	—	5.0P	6.0P
Micrologic H Trip Unit	—	—	5.0H	6.0H

Trip units are designed to protect power circuits and loads. Micrologic trip systems use a set of current transformers (called CTs or sensors) to sense current, a trip unit to evaluate the current, and a tripping solenoid to trip the circuit breaker. Adjustable rotary switches on the trip unit allow the user to set the proper overcurrent or equipment ground-fault current protection required in the electrical system. If current exceeds a set value for longer than its set time delay, the trip system opens the circuit breaker. Alarms may be programmed for remote indications. Measurements of current, voltage, frequency, power, and power quality optimize continuity of service and energy management.

Integration of protection functions in the Application Specific Integrated Circuit (ASIC) electronic component used in all Micrologic trip units guarantees a high degree of reliability and immunity to conducted or radiated disturbances. On Micrologic P and H trip units, advanced functions are managed by an independent microprocessor.

Circuit breakers are shipped with the trip unit long-time pickup switch set at 1.0 and all other trip unit adjustments set at their lowest settings. Actual settings required for a specific application must be determined by a qualified consultant or plant engineer. A coordination study is recommended to provide coordination between all circuit breakers in the distribution system.

Table 16: Micrologic™ Trip Unit Features

Feature	Micrologic Trip Unit (X = Standard Feature O = Available Option)										
	Standard			Ammeter				Power		Harmonics	
	2.0	3.0	5.0	2.0A	3.0A	5.0A	6.0A	5.0P	6.0P	5.0H	6.0H
Field-Installable	X	X	X	X	X	X	X	X	X	X	X
LI		X			X						
LS0	X			X							
LSI			X			X		X		X	
LSIG/Ground-Fault Trip[1]							X		X		X
Ground-Fault Alarm/No Trip[1, 2]								X		X	
Ground-Fault Alarm and Trip[1, 2]									X		X
Adjustable Rating Plugs	X	X	X	X	X	X	X	X	X	X	X
True RMS Sensing	X	X	X	X	X	X	X	X	X	X	X
UL Listed		X	X		X	X	X	X	X	X	X
Thermal Imaging	X	X	X	X	X	X	X	X	X	X	X
Phase-Loading Bar Graph				X	X	X	X	X	X	X	X

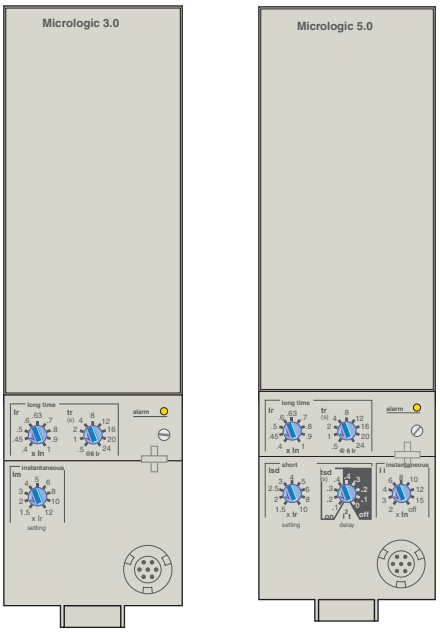
Table 16: Micrologic™ Trip Unit Features *(continued)*

Feature	Micrologic Trip Unit (X = Standard Feature O = Available Option)										
	Standard			Ammeter				Power		Harmonics	
	2.0	3.0	5.0	2.0A	3.0A	5.0A	6.0A	5.0P	6.0P	5.0H	6.0H
LED for Long-Time Pick-Up	X	X	X	X	X	X	X	X	X	X	X
LED for Trip Indication				X	X	X	X	X	X	X	X
Digital Ammeter				X	X	X	X	X	X	X	X
Zone-Selective Interlocking[3]				X		X	X	X	X	X	X
Communications				O	O	O	O	X	X	X	X
LCD Dot Matrix Display								X	X	X	X
Advanced User Interface								X	X	X	X
Protective Relay Functions								X	X	X	X
Neutral Protection[1]								X	X	X	X
Contact Wear Indication								X	X	X	X
Incremental Fine Tuning of Settings								X	X	X	X
Selectable Long-Time Delay Bands								X	X	X	X
Power Measurement								X	X	X	X
Power Quality Measurements										X	X
Waveform Capture										X	X

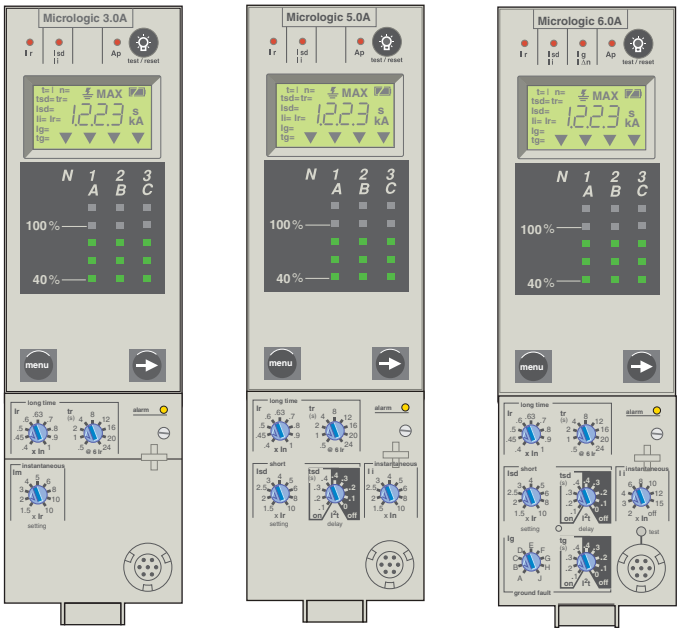
1 3Ø, 4W circuits require either a neutral current transformer or a 4-pole breaker.

2 Requires M6C Programmable Contact Module.

3 Not available for 2.0A trip units as upstream devices.

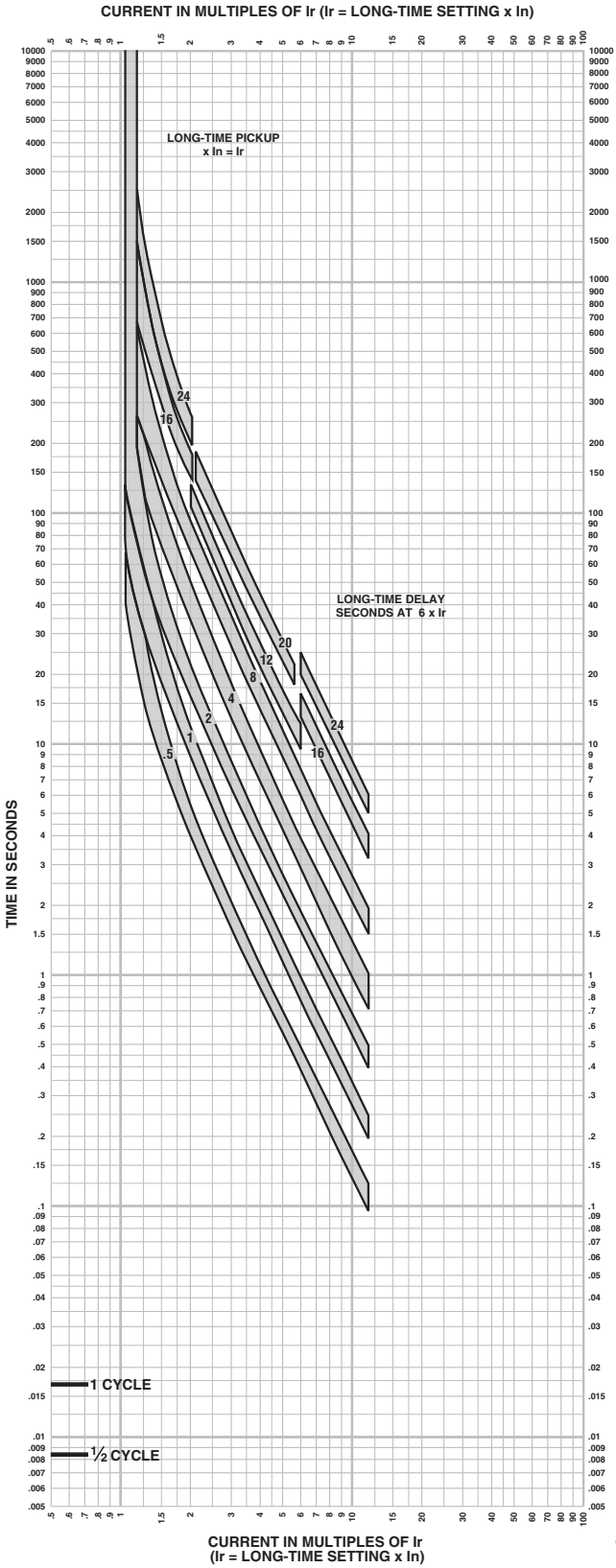


Micrologic 3.0 and 5.0 Basic Trip Units



Micrologic 3.0A, 5.0A and 6.0A Trip Units

Micrologic 3.0A P-Frame and R-Frame Trip Unit Characteristic Trip Curve



Micrologic 3.0A Trip Unit

Long-Time Pickup and Delay

Characteristic Trip Curve No. 613-6

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

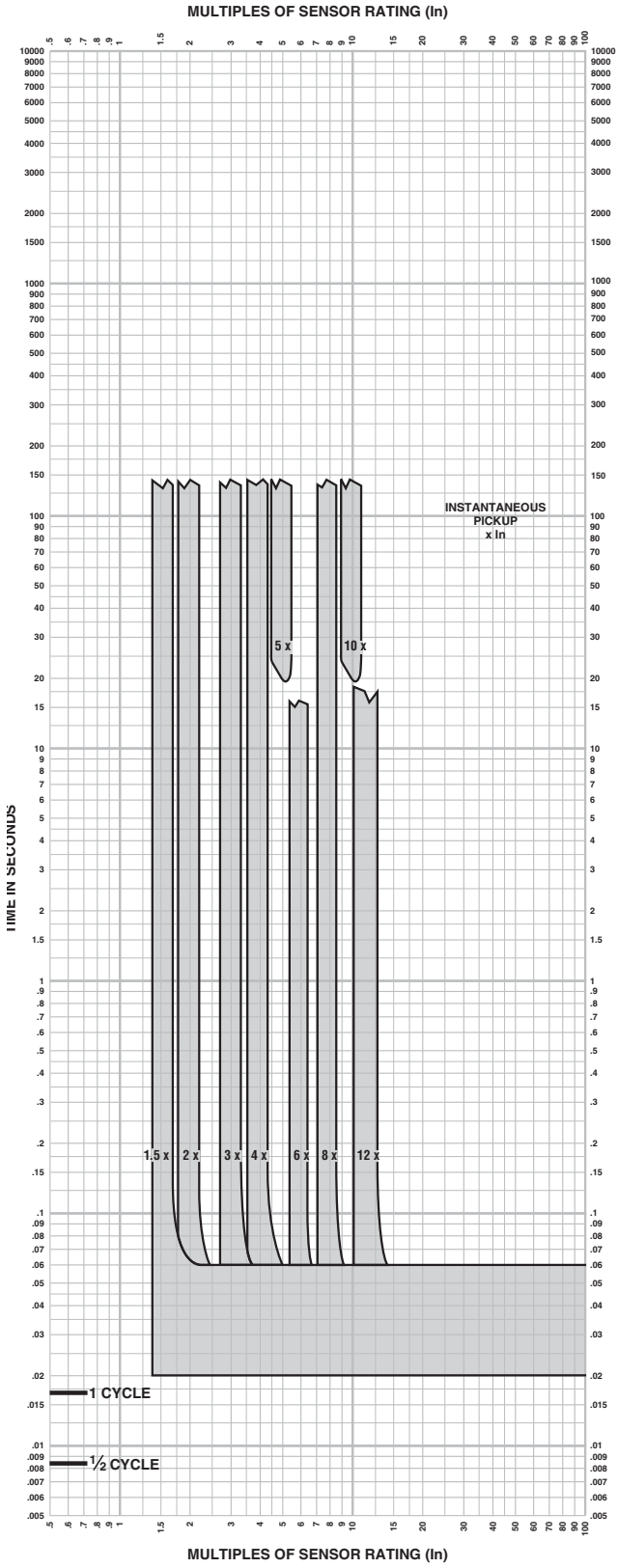
Curves apply from -30°C to +60°C (-22°F to +140°F) ambient temperature.

Notes:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the instantaneous setting of the circuit breaker.
3. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
4. See trip curve 613-8 on page 139 for instantaneous pickup trip curve.

Curve No. 0613TC0006
Drawing No. B48095-613-06

Micrologic 3.0A P-Frame and R-Frame Trip Unit Characteristic Trip Curve



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

Micrologic 3.0A Trip Unit

Instantaneous Pickup, 1.5X to 12X

Characteristic Trip Curve No. 613-8

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

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

Notes:

1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
3. The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.
4. See trip curve 613-6 on page 138 for long-time pickup and delay trip curves.

EMERGENCY DISCONNECT

OPERATOR STATION

BREAK GLASS TO RELEASE BUTTON

PILLA MODEL SERIES ST120

ST120SN3RSL-Emergency Generator Stop

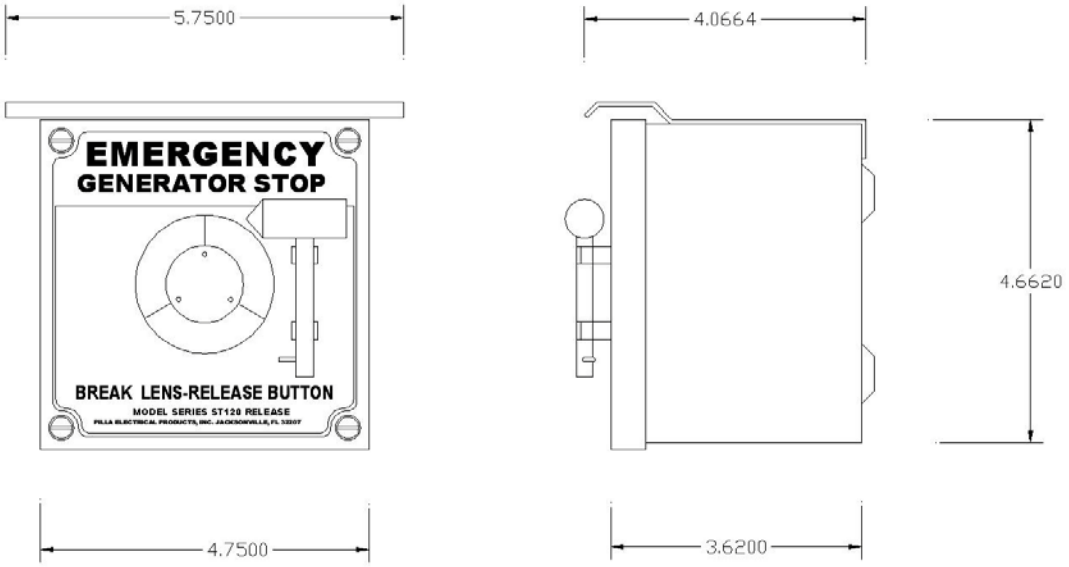
A complete, finish-quality break glass station with a full range of factory installed options. Standard models include several NEMA ratings.

Description				
SURFACE MOUNT	NEMA 3R	RAINPROOF, ALL-METAL	1/2-3/4" KNOCKOUT ON BOTTOM AND BACK	1-6 CONTACI BLOCK CAPACITY

FEATURES

- Operator automatically releases when glass is broken (standard-Suffix BP1 / BP2 models require button to be manually depressed)
- Optional suffix TG / P3 / P3 / K1/K4 models are labeled: "Break Glass-Operate Switch"
- Contact blocks rated 10 AMP continuous up to 600 Volts*
- Accepts up to four contact blocks in 3.5 inch depth backbox
- Compact 4.5 x 4.5 inch metal backbox has red enamel finish with 1/2-3/4" inch knockout provided bothom and back
- Standard models: Type PILNCCB / PILNOCB contacts remain open/closed with glass intact--close/open when glass is broken
- Suffix BP1/BP2/TG/P1/P3/K1/K4 models: Type PILNCCB / PILNOCB contacts remain closed/open with glass intact--open/close when glass is broken and device manually actuted
- One extra replacement lens included with each ST120

MODEL SERIES ST120SN3RSL-EMERGENCY GENERATOR STOP



SURFACE MOUNT, NEMA 3R, RAINPROOF, ALL-METAL, 1/2"-3/4" KNOCKOUT BOTTOM AND BACK, 1-6 CONTACT BLOCK CAPATITY

Sales and Service

Section 5 – ATS Spec Sheets & Drawings - EATON

Shenandoah Wasterwater

Submittal for Approval

Negotiation Number

ATP20120X3K1

Volume 1 of 1

Equipment:

Date: 2/10/2023

Main Table of Contents

Project Name: Shenandoah Wasterwater
General Order No:
Negotiation No: ATP20120X3K1
Alternate No: 0000

Item No.	Qty	Product	Description
	1	Transfer Switches	Power Frame Breaker/Switch, ATC-900, 480/277 Vac, 60hz, 3 Phase, 4 Wire, 3 Poles

Catalog No ATV9MGA30400XSU
Designation ATS-ABLWR

Qty	List of Materials
1	ATV9MG Fixed 3 Poles 400 Amps -
1	Enclosure - Type-1
1	Bus material - Plated Copper
1	1b. Time Delay Normal to Emergency Adj. 0-9999 sec
1	1c. Time Delay Normal Disconnect Adjustable 0-10 Sec
1	1d. Time Delay Normal Reconnect Adjustable 0-60 Sec
1	2a. Time Delay Engine Start Adj. 0-120 sec
1	3b. Time Delay Emergency to Normal Adj. 0-9999 sec
1	3c. Time Delay Emergency Disconnect Adjustable 0-10 Sec
1	3d. Time Delay Emergency Reconnect Adjustable 0-10 Sec
1	4b. Time Delay Engine Cool-off Adj. 0-9999 sec
1	5h. Emergency (S2) Sensing Phase Reversal
1	5j. Emergency (S2) Sensing Under Voltage/Under Freq
1	5k. Emergency (S2) Sensing Over Voltage/Over Freq
1	5l. Emergency (S2) Sensing Voltage Unbalance
1	5m. Emergency (S2) Sensing Phase Loss
1	6b. Test Pushbutton
1	7a. Time Delay Engine Fail Adj. 0-6 sec
1	8e. Bypass All Timers
1	9b. Maintenance Selector Switch Isolates Elec. Op.
1	10a. Preferred Source Selector
1	10b. Source Selector - Utility to Utility or Utility to Gen
1	10d. Source Selector - Generator to Generator
1	12c. LED Indicator Normal Position
1	12d. LED Indicator Emergency Position
1	12g. LED Indicator Normal Source Available
1	12h. LED Indicator Emergency Source Available
1	14e/f. Source Available (1 Form C)
1	15e/f. Source Position Indication (1 Form C Micro Switch Outputs)
1	21a. Special Terminals
1	22. Ground bus with lug provision (20 hole) for #6-350MCM
1	23m. Auto Plant Exerciser Selectable-Disabled/Daily/Calendar Dates, 0-600 min, Load/No Load w/Fail Safe
1	26h. Normal (S1) Sensing Phase Reversal
1	26j. Normal (S1) Sensing Under-voltage/Under-frequency
1	26k. Normal (S1) Sensing Over-voltage/Over-frequency
1	26l. Normal (S1) Sensing Voltage Unbalance
1	26m. Normal (S1) Sensing Phase Loss
1	29g. Selector Switch for Auto or Non-Auto Operation
1	32a. Time Delayed (adjustable - min:sec)
1	35a. Pre-transfer Signal Contacts (1 Form C)
1	35d. Post-transfer Signal Contacts (1 Form C)
1	42. IBC/CBC Seismic Qualified
1	48d1. Ethernet Communication (Gateway PXG900 internally mounted & wired)
1	48f. MODBUS Communication
1	48u. USB Port for Memory Stick

Project Name: Shenandoah Wasterwater **Negotiation No:** ATP20120X3K1
General Order No: **Alternate No:** 0000

Qty	List of Materials
1	49c. Multi-Tap Transformer
1	59a. Silver Plated Copper
1	61e. 24VDC Input for ATC-900 (includes DCT module)
1	80b. Input Terminal Blocks
1	80c. Output Terminal Blocks

Item No.	Qty	Product	Description
	1	Transfer Switches	Molded Case Breaker/Switch, ATC-900, 480/277 Vac, 60hz, 3 Phase, 4 Wire, 3 Poles

Catalog No ATV9LDA30400XSU
Designation ATS-UV

Qty	List of Materials
1	ATV9LD 3 Poles 400 Amps -
1	Enclosure - Type-1
1	1b. Time Delay Normal to Emergency Adj. 0-9999 sec
1	1c. Time Delay Normal Disconnect Adjustable 0-10 Sec
1	1d. Time Delay Normal Reconnect Adjustable 0-60 Sec
1	2a. Time Delay Engine Start Adj. 0-120 sec
1	3b. Time Delay Emergency to Normal Adj. 0-9999 sec
1	3c. Time Delay Emergency Disconnect Adjustable 0-10 Sec
1	3d. Time Delay Emergency Reconnect Adjustable 0-10 Sec
1	4b. Time Delay Engine Cool-off Adj. 0-9999 sec
1	5h. Emergency (S2) Sensing Phase Reversal
1	5j. Emergency (S2) Sensing Under Voltage/Under Freq
1	5k. Emergency (S2) Sensing Over Voltage/Over Freq
1	5l. Emergency (S2) Sensing Voltage Unbalance
1	5m. Emergency (S2) Sensing Phase Loss
1	6b. Test Pushbutton
1	7a. Time Delay Engine Fail Adj. 0-6 sec
1	8e. Bypass All Timers
1	9b. Maintenance Selector Switch Isolates Elec. Op.
1	10a. Preferred Source Selector
1	10b. Source Selector - Utility to Utility or Utility to Gen
1	10d. Source Selector - Generator to Generator
1	12c. LED Indicator Normal Position
1	12d. LED Indicator Emergency Position
1	12g. LED Indicator Normal Source Available
1	12h. LED Indicator Emergency Source Available
1	15e/f. Source Position Indication (1 Form C Micro Switch Outputs)
1	22. Ground Bar
1	23m. Auto Plant Exerciser Selectable-Disabled/Daily/Calendar Dates, 0-600 min, Load/No Load w/Fail Safe
1	26h. Normal (S1) Sensing Phase Reversal
1	26j. Normal (S1) Sensing Under-voltage/Under-frequency
1	26k. Normal (S1) Sensing Over-voltage/Over-frequency
1	26l. Normal (S1) Sensing Voltage Unbalance
1	26m. Normal (S1) Sensing Phase Loss
1	29g. Selector Switch for Auto or Non-Auto Operation
1	32a. Time Delayed (adjustable - min:sec)
1	35a. Pre-transfer Signal Contacts (1 Form C)
1	35d. Post-transfer Signal Contacts (1 Form C)
1	42. IBC/CBC Seismic Qualified
1	48d1. Ethernet Communication (Gateway PXG900 internally mounted & wired)

Project Name: Shenandoah Wasterwater
General Order No:
Negotiation No: ATP20120X3K1
Alternate No: 0000

Qty	List of Materials
1	48f. MODBUS Communication
1	48u. USB Port for Memory Stick
1	49c. Multi-Tap Transformer
1	61e. 24VDC Input for ATC-900 (includes DCT module)

Eaton Selling Policy 25-000 applies.

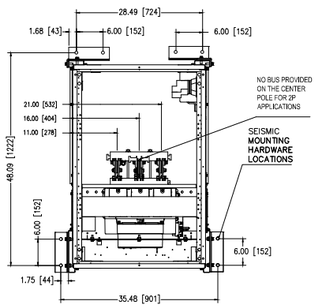
All orders must be released for manufacture within 90 days of date of order entry. If approval drawings are required, drawings must be returned approved for release within 60 days of mailing. If drawings are not returned accordingly, and/or if shipment is delayed for any reason, the price of the order will increase by 1.0% per month or fraction thereof for the time the shipment is delayed.

Seller shall not be responsible for any failure to perform, or delay in performance of, its obligations resulting from the COVID-19 pandemic or any future epidemic, and Buyer shall not be entitled to any damages resulting thereof.

General Information: Transfer Switches

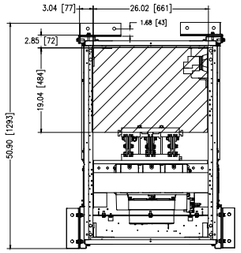
Transfer Switch Information	
Catalog Number:	ATV9MGA30400XSU
System Information	480/277 Vac, 60hz 3 Phase, 4 Wire, 3 poles
Transition Mode:	Open
NEMA Enclosure:	Type-1
Controller Type:	ATC-900
Continuous Current (Amperes):	400
Withstand and Close-On Rating:	100kA (0.05 sec) and 85kA (0.5 sec)
Features Included	
Standard Features:	1b, 1c, 1d, 2a, 3b, 3c, 3d, 4b, 5h, 5j, 5k, 5l, 5m, 6b, 7a, 8e, 10b, 10d, 12c, 12d, 12g, 12h, 14e, 14f, 15e, 15f, 22, 23m, 26h, 26j, 26k, 26l, 26m, 32a, 42, 48f, 48u, 49c, 59a, 80b, 80c,
Optional Features:	9b, 10a, 21a, 29g, 35a, 35d, 48d1, 61e,
Terminal Connections	
Source 1 Terminals:	(6) 1/0-750 CU/AL
Source 2 Terminals:	(6) 1/0-750 CU/AL
Load Side Terminals:	(6) 1/0-750 CU/AL
Neutral Terminals:	(18) 500-750 CU/AL
Shipping State:	GA

NOTE: MINIMUM 3" SPACING BETWEEN ENCLOSURE AND WALL REQUIRED.



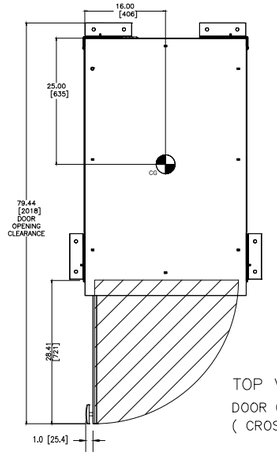
PLAN VIEW

SEISMIC MOUNTING DIMENSIONS
FOR 0.5–13 BOLTS (8 REQUIRED)



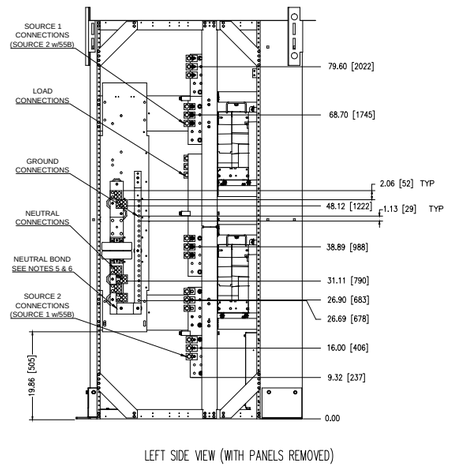
TOP VIEW

CABLE ENTRY AREA
(CROSSHATCHED)

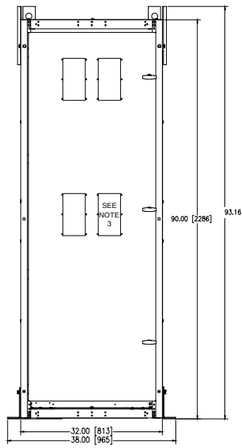


TOP VIEW

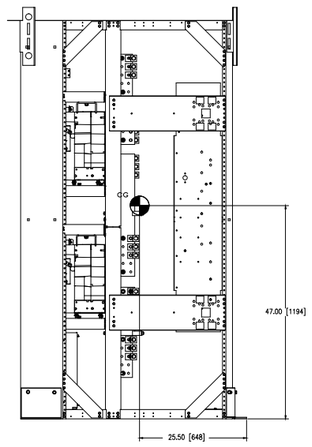
DOOR OPENING AREA
(CROSSHATCHED)



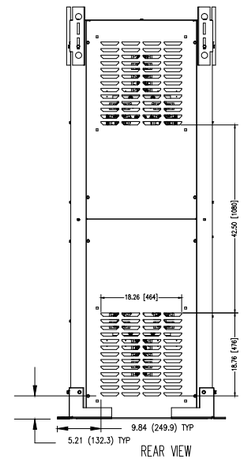
LEFT SIDE VIEW (WITH PANELS REMOVED)



FRONT VIEW



RIGHT SIDE VIEW



REAR VIEW

REQUIRED FOR SEISMIC, RECOMMENDED FOR ALL APPLICATIONS:
USE 8, .5–13 UNC GRADE 5 OR BETTER HEX HEAD BOLTS AND WASHERS: THESE BOLTS ARE TO BE TORQUED TO 50 FT. LBS. (68 NM).

MINIMUM 3" SPACING BETWEEN ENCLOSURE AND WALL REQUIRED.

NOTES:
1 APPROXIMATE SHIPPING WEIGHT = 1050 LBS [477 KG]
2 DIMENSIONS SHOWN IN INCHES [MILLIMETERS] NOT TO SCALE
3 CONTROLS PROVIDED BASED ON CUSTOMER ORDER INFORMATION.
5 FOR SWITCHED NEUTRAL APPLICATIONS, CONNECT TO TERMINALS MARKED 'NN', 'EN', AND 'TN'. NEUTRAL ASSEMBLY IS NOT PROVIDED. FOR 3 PHASE 3 WIRE SYSTEMS NEUTRAL ASSEMBLY IS NOT PROVIDED.
6 NEUTRAL TO GROUND BOND REQUIRED FOR SERVICE ENTRANCE APPLICATIONS HARDWARE SHIPS LOOSE.

CG CENTER OF GRAVITY

REVISION			
1	ECN066866		
2	ECN068835 REMOVED SE FROM TITLE ADDED NOTE 6 HAYES 12/14/2012 WILLIAMS 12/14/2012		
3	UPDATED DOOR OPENING VIEW HAYES 12/3/2014 BALLARD 12/3/2014		
4	TWO DOOR OPENING VIEWS WERE OVERLAPPING BALLARD 4/29/2015		
5	REVISED TITLE BLOCK AND NOTES. JILL BALLARD 9/6/2016		

	DFTR HAYES	DATE 9/25/2012
	APPD MYERS	DATE 9/25/2012
FEDERAL ID NO. 88725	S.O.	
PRODUCT CODE AT	REVISION 5	DESIGNATION

TITLE FLOOR MOUNT MAGNUM BREAKER | NEMA 1 BEHIND
3P 200–2000A | FIXED

TYPE AUTO & NON–AUTO TRANSFER — OUTLINE

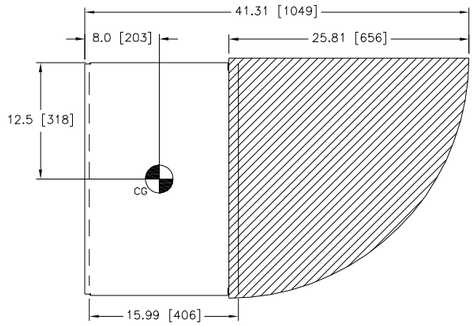
G.O. — DWG 66A8472 — SHEET 1 OF 1

CDETTBL REV 02

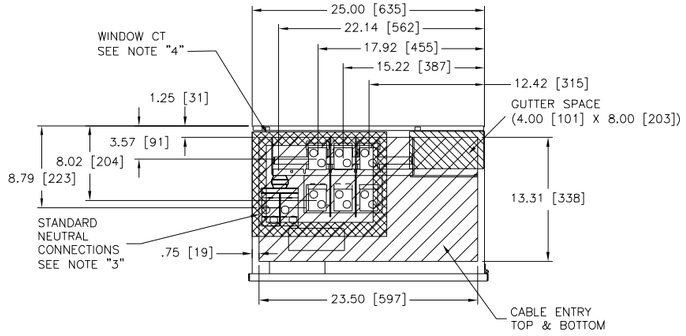
GO/NEG-Alt-Date:	ATP20120X3K1-0000-2/10/2023	**Job Name:**	Shenandoah Wasterwater
Item Number:	**Catalog Number:** ATV9MGA30400XSU	**Designation:**	ATS-ABLWR

General Information: Transfer Switches

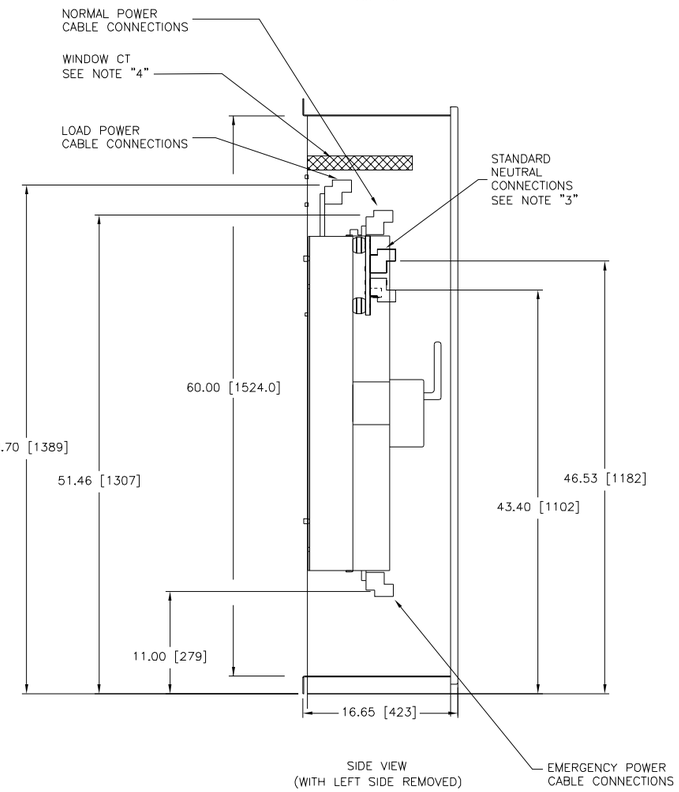
Transfer Switch Information	
Catalog Number:	ATV9LDA30400XSU
System Information	480/277 Vac, 60hz 3 Phase, 4 Wire, 3 poles
Transition Mode:	Open
NEMA Enclosure:	Type-1
Controller Type:	ATC-900
Continuous Current (Amperes):	400
Withstand and Close-On Rating:	65kA
Features Included	
Standard Features:	1b, 1c, 1d, 2a, 3b, 3c, 3d, 4b, 5h, 5j, 5k, 5l, 5m, 6b, 7a, 8e, 10b, 10d, 12c, 12d, 12g, 12h, 14c, 14d, 15e, 15f, 22, 23m, 26h, 26j, 26k, 26l, 26m, 32a, 42, 48f, 48u, 49c,
Optional Features:	10a, 29g, 35a, 35d, 48d1, 61e,
Terminal Connections	
Source 1 Terminals:	(1) 4/0-600 CU/AL
Source 2 Terminals:	(1) 4/0-600 CU/AL
Load Side Terminals:	(2) #1-500 CU/AL
Neutral Terminals:	(6) 250-350 CU/AL
Shipping Calculation	
Shipping State:	GA
Estimated Freight Charge	$174 each, from El Paso, TX



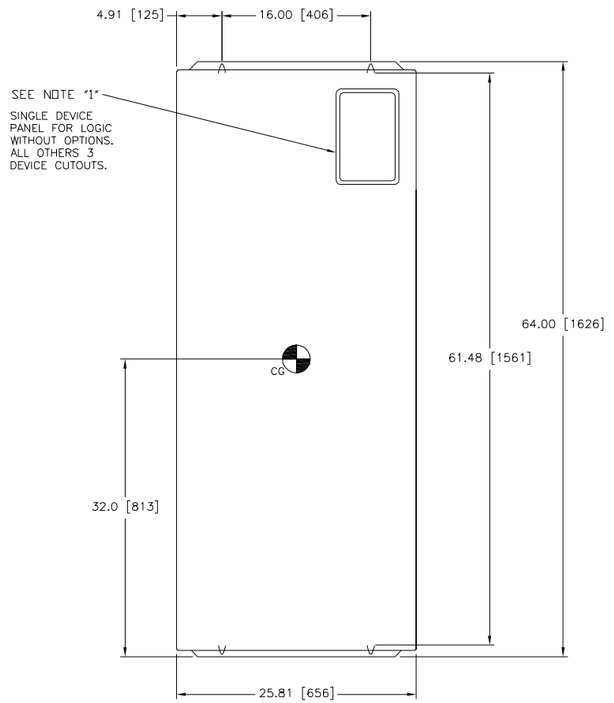
TOP VIEW



PLAN VIEW



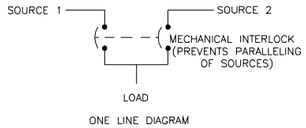
SIDE VIEW
(WITH LEFT SIDE REMOVED)



FRONT VIEW

Seismic Mechanical Mounting Requirements

A For wall mount seismic application use (4) 1/2-13UNC grade 5 or better hex head bolts and washers. These bolts are to be torqued to 75 ft.lbs. (102 Nm).



ONE LINE DIAGRAM

NOTES:

1 Automatic, Non-automatic, Manual, and Service Entrance controls provided based on customer order information.

2 Dimensions: inches [millimeters].

3 For switched neutral applications, connect to terminals marked "NN", "EN", and "LN". Neutral assembly will not be provided.

4 If a Ground Fault Sensing System was ordered, a window CT and a GFR relay are provided. Installer to route all load phase and neutral conductors through window CT with "H1" and "X1" markings facing the bus terminals.

5 CG = Center of gravity.

6 Nema 3R and 12 have three latches equally spaced on handle side of enclosure.

7 This drawing pertains to the switch types listed in the following table:

APPROX. SHIPPING WT. Lbs. (Kg)	CATALOG NUMBER	STYLE NUMBER
390 (177)	ATV2	N/A
425 (193)	ATV4	N/A
390 (177)	ATVA	68C8440G14
425 (193)	ATVI	N/A
425 (193)	NTVE	N/A
425 (193)	MTVX	N/A
425 (193)	ATV3	N/A

GS-0577 01	REVISION				
	2	BN # GS-1021 ADD ATV AND ATVG AND REVISE ALL ATVA TO ATVE. MOVE DEVICE PANEL CUTOUT. KOZAR 1/01/2001 LATHROP PRINCE			
	3	BN # GS-1238 ADD ATVA TO TABLE. KOZAR 03/18/2002 LATHROP PRINCE			
	4	BN # GS-1873 ADD NOTE 10 DRAWING. UPDTE DRAWING FORMAT. KOZAR 06/23/2003 LATHROP PRINCE			
	5	BN # GS-2014 ADDED MTVX TO DRAWING CHANGED TO 68C8440 KOZAR 01/26/2004 MARTIN PRINCE			
	6	BN # GS-2106 ADD ATV3 HEG 04/02/2004 LATHROP PRINCE			
	7	BN # GS-2247 REVISE NOTES FROM TABLE KOZAR 10/13/2004 LATHROP PRINCE			
	8	BN # GS-2332 ERASE DOOR HANDLES HEG 03/04/2005 LATHROP PRINCE			
	9	ECN#31492 REVISE TITLE ON TITLE BLOCK JILL BALLARD 2/19/2009			

THE INFORMATION ON THIS DOCUMENT WAS CREATED BY CUTLER-HAMMER. IT WAS DISCLOSED IN CONFIDENCE AND IS ONLY TO BE USED FOR THE PURPOSE IN WHICH IT WAS SUPPLIED.

DFTR	DATE
KOZAR	08/23/2001
APPD	DATE
LATHROP	08/23/2001
S.O.	

FEDERAL ID NO.	PRODUCT CODE	REVISION
88725	ATS	09

EATON | Cutler-Hammer

TITLE AUTOMATIC TRANSFER SWITCH
400A 3P NEMA 1, 3R, 12; WITHOUT OPTION 21

TYPE LD WALL MOUNT TRANSFER SWITCH | OUTLINE

G.O. | DWG 67B8326 | SHEET 01 OF 01

CDEFTBL REV 02

GO/NEG-Alt-Date:	ATP20120X3K1-0000-2/10/2023	**Job Name:**	Shenandoah Wasterwater
Item Number:	**Catalog Number:** ATV9LDA30400XSU	**Designation:**	ATS-UV

EATON | Cutler-Hammer

Transfer Switches

Technical Data TD01602016E

New Information

Automatic Transfer Switch Family

Contents

Transfer Switch Equipment

Transfer Switch Equipment

Automatic Transfer Switches

Automatic Transfer Switch Family

Product Description

Eaton's Cutler-Hammer® Automatic Transfer Switches are reliable, rugged, versatile and compact assemblies for transferring essential loads and electrical distribution systems from one power source to another.

Transfer switches can be supplied in separate enclosures for stand-alone applications or can be supplied as an integral component in the following equipment:

- Magnum™ DS Switchgear.
- Pow-R-Line Switchboards.
- Motor Control Centers.
- Panelboards.

For detailed information on the aforementioned equipment, please see Eaton's 14th edition of the *Consulting Application Guide*.

Note:
For information on "Transfer Switch Panels," refer to **Section 4** of the *Distribution Products and Services* catalog "Advanced Residential Products."

Application Description

A transfer switch is a critical component of any emergency or standby power system. When the normal (preferred) source of power is lost, a transfer switch quickly and safely shifts the load circuit from the normal source of power to the emergency (alternate) source of power. This permits critical loads to continue running with minimal or no outage. After the normal source of power has been restored, the re-transfer process returns the load circuit to the normal power source.

Transfer switches are available with different operational modes including:

- Manual.
- Non-automatic.
- Automatic.
- Bypass isolation.
- Soft load.
- Maintenance bypass.

The power switching operation of transfer switches may be separated into the three (3) key categories of:

- Open Transition — Break-before-Make operation.
- Closed Transition — Make-before-Break operation.
- Closed Transition Soft Load — Both sources are paralleled and can remain so indefinitely.

The three (3) basic components of a transfer switch are:

- Power switching device to shift the load circuits to and from the power source.
- Transfer Logic Controller to monitor the condition of the power sources and provide the control signals to the power switching device.
- Control power source to supply operational power to the controller and switching device.

Typical Applications

All Eaton transfer switches are designed to meet the requirements set forth by UL® 1008, however, all transfer switches are not created equal. You can be assured of safe and reliable operation from all types of transfer switches that Eaton offers.

TABLE 1. UL 1008 ENDURANCE TESTING

ATS RATING (AMPERES)	RATE OF OPERATION PER MINUTE	WITH CURRENT	WITHOUT CURRENT	TOTAL
0 – 300	1	6000	—	6000
301 – 400	1	4000	—	4000
401 – 80	1	2000	1000	3000
801 – 1600	0.5	1500	1500	3000
1601 – 4000	0.25	1000	2000	3000

TABLE 2. UL 1008 LIFE EXPECTANCY

		LIFE EXPECTANCY IN YEARS	
ATS RATING (AMPERES)	MINIMUM OPERATIONS PER YEAR	WITH CURRENT APPLIED	WITHOUT CURRENT APPLIED
0 – 300	52	115	115
301 – 400	52	76	76
401 – 800	52	38	57
801 – 1600	52	28	57
1601 – 5000	52	19	57

UL 1008 Endurance Testing

The importance of specifying a UL 1008 transfer switch can be seen in **Table 1**. When specifying any UL 1008 transfer switch, you can be assured the switch has met and passed the following endurance testing.

UL 1008 Life Expectancy

Transfer switch applications typically require a plant exerciser once a week or once a month. **Table 2** demonstrates the life expectancy operating the UL 1008 switch once a week for the life of the switch.

Utility — Generator

Transfer switches are traditionally applied between a utility and a generator set for emergency and standby power systems.

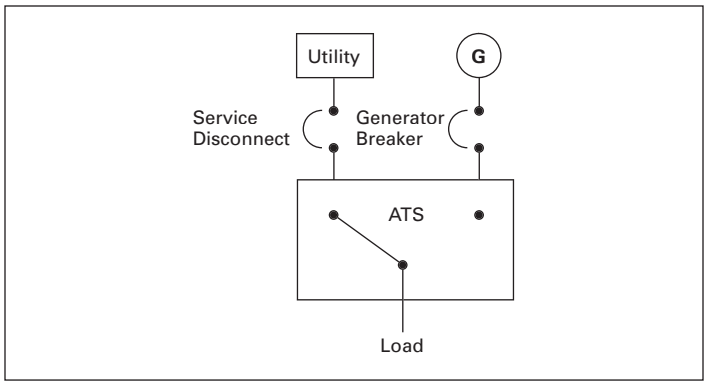


FIGURE 1. STANDARD APPLICATION UTILITY — GENERATOR

Generator — Generator

Transfer switches are sometimes applied between two generator sets for prime power use, often in remote installations. In such applications, source power is periodically alternated between the generator sets to equally share run-time.

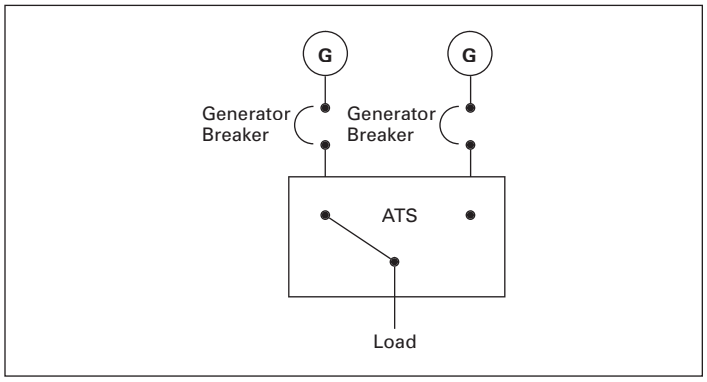


FIGURE 2. STANDARD APPLICATION GENERATOR — GENERATOR

Service Entrance Rated Transfer Switches

Modifying the molded case switch in the transfer switch by adding trip units and optional ground fault, along with adding the service entrance option eliminates the need for separate upstream disconnect devices and their respective power interconnections. This means the Automatic Transfer Switch (ATS) is installed directly at the point of service entrance, saving valuable space and cost.

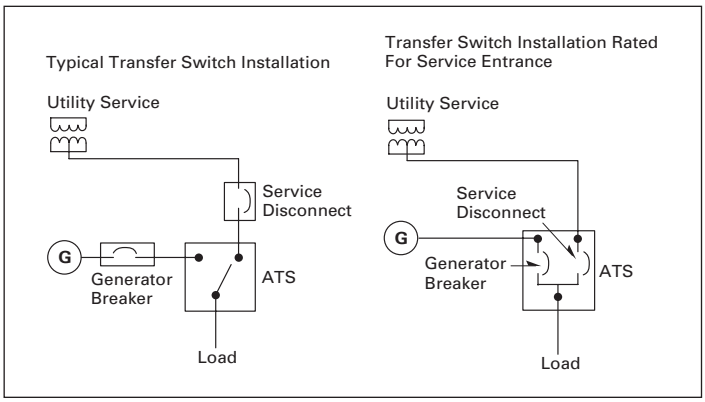


FIGURE 3. SERVICE ENTRANCE RATED TRANSFER SWITCHES

Built-in Protection

All Eaton Molded Case Switches are "self protected," such that under extreme fault conditions, the switch will open before destroying itself. This feature allows Eaton to offer "Maintenance Free Contacts" on the molded case transfer switch. The molded case switches have instantaneous magnetic trip units installed in each switch. These trips are not accessible once installed by the factory to eliminate field tapering. The trips are set to a minimum of 12 to 15 times the rated current of the molded case device, well above any coordination set points. This means they will not interfere with the normal operation of the distribution system and will only trip if something is very wrong.

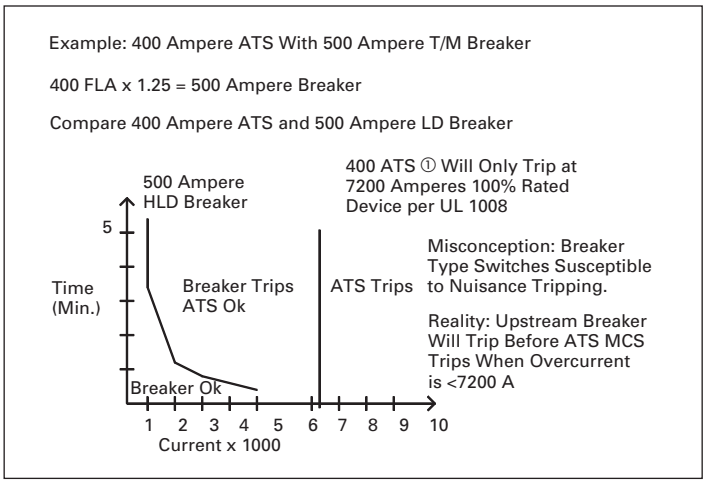


FIGURE 4. BUILT-IN PROTECTION

① Magnetic Trip 12 x frame rating.

TABLE 3. TRANSFER SWITCH PRODUCT FAMILY

	TRANSFER SWITCH EQUIPMENT CATALOG NUMBERING SYSTEM									
DESCRIPTION	**TYPE**	**ORIENTATION**	**LOGIC**	**FRAME**	**SWITCH**	**POLES**	**AMPERES**	**VOLTAGE**	**ENCLOSURE**	**LISTING**
 Manual (600 Vac) (30 – 1000 A)	MT = Manual Refer to **Page 6**	H = Horizontal V = Vertical	X = No Logic	Molded Case Device FD = 30 – 150 A KD = 150 – 300 A LD = 400 – 600 A MD = 600 – 800 A NB = 800 – 1000 A	Fixed Mount A = FM, N(MCS) E(MCS) B = FM, N(MCB) E(MCB) C = FM, N(MCB) E(MCS) D = FM, N(MCS) E(MCB)	2 = 2-Poles 3 = 3-Poles 4 = 4-Poles	0030 = 30 A 0070 = 70 A 0100 = 100 A 0150 = 150 A 0225 = 225 A 0300 = 300 A 0400 = 400 A 0600 = 600 A 0800 = 800 A 1000 = 1000 A	E = 600 V 60 Hz	K = Open S = NEMA 1 J = NEMA 12 R = NEMA 3R L = NEMA 4 D = NEMA 4X	U = UL Listed R = UL Recognized X = No Listing
 Non-Automatic (600 Vac) (30 – 4000 A)	NT = Non-Automatic Refer to **Page 9**	H = Horizontal V = Vertical	E = Electro-mechanical	Molded Case Device FD = 30 – 150 A KD = 150 – 300 A LD = 400 – 600 A MD = 600 – 800 A NB = 800 – 1000 A Insulated Case Device (Magnum) MG = 600 – 4000 A	Fixed Mount A = FM, N(M/MPS) E(M/MPS) B = FM, N(M/MPB) E(M/MPB) C = FM, N(M/MPB) E(M/MPS) D = FM, N(M/MPS) E(M/MPB) Drawout Mount E = DO, N(MPS) E(MPS) F = DO, N(MPB) E(MPB) G = DO, N(MPB) E(MPS) H = DO, N(MPS) E(MPB)	2 = 2-Poles 3 = 3-Poles 4 = 4-Poles (4-Poles – 3000 A Maximum)	0030 = 30 A 0070 = 70 A 0100 = 100 A 0150 = 150 A 0225 = 225 A 0300 = 300 A 0400 = 400 A 0600 = 600 A 0800 = 800 A 1000 = 1000 A 1200 = 1200 A 1600 = 1600 A 2000 = 2000 A 2500 = 2500 A 3000 = 3000 A 4000 = 4000 A 5000 = 5000 A	A = 120 V 60 Hz B = 208 V 60 Hz E = 600 V 60 Hz G = 220 V 50/60 Hz H = 380 V 50 Hz K = 600 V 50 Hz M = 230 V 50 Hz N = 401 V 50 Hz O = 415 V 50 Hz W = 240 V 60 Hz X = 480 V 60 Hz Z = 365 V 50 Hz	K = Open S = NEMA 1 R = NEMA 3R J = NEMA 12 L = NEMA 4 D = NEMA 4X (J, L and D 65 kAIC, 1200 A and Below Only)	U = UL Listed R = UL Recognized X = No Listing
 Maintenance Bypass (600 Vac) (100 – 1000 A)	MB = Maintenance Bypass Refer to **Page 12**	H = Horizontal	E = Electro-mechanical	Molded Case Device FD = 100 – 150 A KD = 150 – 300 A LD = 400 – 600 A MD = 600 – 800 A NB = 800 –1000 A	Fixed Mount A = FM, N(MCS) E(MCS)	2 = 2 Poles 3 = 3 Poles 4 = 4 Poles	0100 = 100 A 0150 = 150 A 0225 = 225 A 0300 = 300 A 0400 = 400 A 0600 = 600 A 0800 = 800 A 1000 = 1000 A	A = 120 V 60 Hz B = 208 V 60 Hz E = 600 V 60 Hz G = 220 V 50/60 Hz H = 380 V 50 Hz K = 600 V 50 Hz M = 230 V 50 Hz N = 401 V 50 Hz O = 415 V 50 Hz W = 240 V 60 Hz X = 480 V 60 Hz Z = 365 V 50 Hz	K = Open S = NEMA 1 J = NEMA 12 R = NEMA 3R L = NEMA 4 D = NEMA 4X	U = UL Listed R = UL Recognized X = No Listing
 Automatic (Wall-Mount) (600 Vac) (30 – 1000 A)	AT = Automatic Refer to **Page 13**	H = Horizontal V = Vertical	3 = ATC-300 I = ATC-600	Molded Case Device FD = 30 – 200 A KD = 150 – 300 A LD = 400 – 600 A MD = 600 – 800 A NB = 800 – 1000 A (FD = 200 A Available on ATH3 Only)	Fixed Mount A = FM, N(MCS) E(MCS) B = FM, N(MCB) E(MCB) C = FM, N(MCB) E(MCS) D = FM, N(MCS) E(MCB)	2 = 2-Poles 3 = 3-Poles 4 = 4-Poles	0030 = 30 A 0070 = 70 A 0100 = 100 A 0150 = 150 A 0200 = 200 A 0225 = 225 A 0300 = 300 A 0400 = 400 A 0600 = 600 A 0800 = 800 A 1000 = 1000 A	A = 120 V 60 Hz B = 208 V 60 Hz E = 600 V 60 Hz G = 220 V 50/60 Hz H = 380 V 50 Hz K = 600 V 50 Hz M = 230 V 50 Hz N = 401 V 50 Hz O = 415 V 50 Hz W = 240 V 60 Hz X = 480 V 60 Hz Z = 365 V 50 Hz	K = Open S = NEMA 1 J = NEMA 12 R = NEMA 3R L = NEMA 4 D = NEMA 4X	U = UL Listed R = UL Recognized X = No Listing
 Automatic (Free Standing) (600 Vac) (600 – 5000 A)	AT = Automatic Refer to **Page 19**	V = Vertical	I = ATC-600 IQ Transfer	Insulated Case Device (Magnum) MG = 600 – 5000 A	Fixed Mount A = FM, N(MPS) E(MPS) B = FM, N(MPB) E(MPB) C = FM, N(MPB) E(MPS) D = FM, N(MPS) E(MPB) Drawout Mount E = DO, N(MPS) E(MPS) F = DO, N(MPB) E(MPB) G = DO, N(MPB) E(MPS) H = DO, N(MPS) E(MPB)	2 = 2 Poles 3 = 3 Poles 4 = 4 Poles (4 Poles – 3000 A Maximum)	0600 = 600 A 0800 = 800 A 1000 = 1000 A 1200 = 1200 A 1600 = 1600 A 2000 = 2000 A 2500 = 2500 A 3000 = 3000 A 4000 = 4000 A 5000 = 5000 A (600 A FM only)	A = 120 V 60 Hz B = 208 V 60 Hz E = 600 V 60 Hz G = 220 V 50/60 Hz H = 380 V 50 Hz K = 600 V 50 Hz M = 230 V 50 Hz N = 401 V 50 Hz O = 415 V 50 Hz W = 240 V 60 Hz X = 480 V 60 Hz Z = 365 V 50 Hz	S = NEMA 1 R = NEMA 3R	U = UL Listed R = UL Recognized X = No Listing

Key: DO = Drawout
FM = Fixed Mounted
MPB = Magnum Power Breaker
MPS = Magnum Power Switch
MCB = Molded Case Breaker
MCS = Molded Case Switch

TABLE 3. TRANSFER SWITCH PRODUCT FAMILY (CONTINUED)

TRANSFER SWITCH EQUIPMENT CATALOG NUMBERING SYSTEM

DESCRIPTION	TYPE	ORIENTATION	LOGIC	FRAME	SWITCH	POLES	AMPERES	VOLTAGE	ENCLOSURE	LISTING
 Automatic Closed Transition (<100 ms) (600 Vac) (600 – 5000 A)	CT = Closed Transition	V = Vertical	I = ATC-800 Closed Transition IQ Transfer	Device (Magnum) MG = 600 – 5000 A	Fixed Mount A = FM, N(MPS) E(MPS) B = FM, N(MPB) E(MPB) C = FM, N(MPB) E(MPS) D = FM, N(MPS) E(MPB) Drawout Mount E = DO, N(MPS) E(MPS) F = DO, N(MPB) E(MPB) G = DO, N(MPB) E(MPS) H = DO, N(MPS) E(MPB)	2 = 2-Poles 3 = 3-Poles 4 = 4-Poles (4 Poles – 3000 A Maximum)	0600 = 600 A 0800 = 800 A 1000 = 1000 A 1200 = 1200 A 1600 = 1600 A 2000 = 2000 A 2500 = 2500 A 3000 = 3000 A 4000 = 4000 A 5000 = 5000 A (600 A FM Only)	A = 120 V 60 Hz B = 208 V 60 Hz E = 600 V 60 Hz G = 220 V 50/60 Hz H = 380 V 50 Hz K = 600 V 50 Hz M = 230 V 50 Hz N = 401 V 50 Hz O = 415 V 50 Hz W = 240 V 60 Hz X = 480 V 60 Hz Z = 365 V 50 Hz	S = NEMA 1 R = NEMA 3R	U = UL 1008 Listed R = UL Recognized Z = UL 891 Listed X = No Listing
 Bypass Isolation (600 Vac) (800 – 5000 A)	BI = Bypass Isolation Refer to **Page 24**	V = Vertical	I = ATC-600	Device (Magnum) MG = 200 – 5000 A	Drawout Mount E = DO, N(MPS) E(MPS) F = DO, N(MPB) E(MPB) G = DO, N(MPB) E(MPS) H = DO, N(MPS) E(MPB)	2 = 2-Poles 3 = 3-Poles 4 = 4-Poles (4 Poles – 3000 A Maximum)	0200 = 200 A 1000 = 1000 A 1200 = 1200 A 1600 = 1600 A 2000 = 2000 A 2500 = 2500 A 3000 = 3000 A 4000 = 4000 A 5000 = 5000 A	A = 120 V 60 Hz B = 208 V 60 Hz E = 600 V 60 Hz G = 220 V 50/60 Hz H = 380 V 50 Hz K = 600 V 50 Hz M = 230 V 50 Hz N = 401 V 50 Hz O = 415 V 50 Hz W = 240 V 60 Hz X = 480 V 60 Hz Z = 365 V 50 Hz	S = NEMA 1 R = NEMA 3R	U = UL 1008 Listed R = UL Recognized Z = UL 891 Listed X = No Listing
 Closed Transition Bypass Isolation (<100 ms) (600 Vac) (800 – 5000 A)	CB = Closed Transition Bypass Isolation	V = Vertical	I = ATC-800 Closed Transition IQ Transfer	Device (Magnum) MG = 600 – 5000 A	Drawout Mount E = DO, N(MPS) E(MPS) F = DO, N(MPB) E(MPB) G = DO, N(MPB) E(MPS) H = DO, N(MPS) E(MPB)	2 = 2-Poles 3 = 3-Poles 4 = 4-Poles (4 Poles – 3000 A Maximum)	0800 = 800 A 1000 = 1000 A 1200 = 1200 A 1600 = 1600 A 2000 = 2000 A 2500 = 2500 A 3000 = 3000 A 4000 = 4000 A 5000 = 5000 A	A = 120 V 60 Hz B = 208 V 60 Hz E = 600 V 60 Hz G = 220 V 50/60 Hz H = 380 V 50 Hz K = 600 V 50 Hz M = 230 V 50 Hz N = 401 V 50 Hz O = 415 V 50 Hz W = 240 V 60 Hz X = 480 V 60 Hz Z = 365 V 50 Hz	S = NEMA 1 R = NEMA 3R	U = UL 1008 Listed R = UL Recognized Z = UL 891 Listed X = No Listing
 Closed Transition Soft Load (600 Vac) (800 – 5000 A)	CT= Closed Transition Soft Load Refer to **Page 59**	V = Vertical	C = Soft Load P = Soft Load Parallel Source	Device (Magnum) MG = 600 – 5000 A	Fixed Mount A = FM, N(MPS) E(MPS) B = FM, N(MPB) E(MPB) C = FM, N(MPB) E(MPS) D = FM, N(MPS) E(MPB) Drawout Mount E = DO, N(MPS) E(MPS) F = DO, N(MPB) E(MPB) G = DO, N(MPB) E(MPS) H = DO, N(MPS) E(MPB)	2 = 2-Poles 3 = 3-Poles 4 = 4-Poles (4 Poles – 3000 A Maximum)	0800 = 800 A 1000 = 1000 A 1200 = 1200 A 1600 = 1600 A 2000 = 2000 A 2500 = 2500 A 3000 = 3000 A 4000 = 4000 A 5000 = 5000 A	A = 120 V 60 Hz B = 208 V 60 Hz E = 600 V 60 Hz G = 220 V 50/60 Hz H = 380 V 50 Hz K = 600 V 50 Hz M = 230 V 50 Hz N = 401 V 50 Hz O = 415 V 50 Hz W = 240 V 60 Hz X = 480 V 60 Hz Z = 365 V 50 Hz	S = NEMA 1 R = NEMA 3R (NEMA 3R Walk-In or Non-Walk-In)	U = UL 1008 Listed R = UL Recognized Z = UL 891 Listed X = No Listing

Key: DO = Drawout
FM = Fixed Mounted
MPB = Magnum Power Breaker
MPS = Magnum Power Switch
MCB = Molded Case Breaker
MCS = Molded Case Switch

Molded Case Switches — Manual Wall-Mount

Manual Wall-Mount Transfer Switch

Product Description

Eaton's Cutler-Hammer Wall-Mount manually operated transfer switches are designed for a variety of standby power applications for critical loads. In the event of a primary power source interruption, the user can manually transfer the load circuits to the standby power source. Once primary power has been restored, the user can manually transfer the load circuits back to the primary power source.

Application Description

Manual transfer switches cover applications ranging from 30 to 1000 amperes through 600 Vac, for standard manual configurations, and open transition.

Features, Benefits and Functions

Features

- Molded case switch power contact assemblies.
- Positive mechanical interlocking.
- Permanently affixed manual operating handle.

Benefits

- High withstand, totally enclosed for maximum arc suppression and isolation during power transfer.
- Optional trip units offer system overcurrent protection.
- Prevents the paralleling of two sources of power.
- Permits safe and convenient manual transfer of power.

Standards and Certifications

- Complies with UL 1008 and UL 489 standards.
- IBC seismic qualified.
- Meets American Bureau of Shipping (ABS) approval.

Technical Data and Specifications

TABLE 4. WALL-MOUNT TRANSFER SWITCH STANDARD TERMINAL DATA FOR POWER CABLE CONNECTIONS

SWITCH AMPERE RATING	BREAKER FRAME	LINE SIDE (NORMAL AND STANDBY SOURCE)	LOAD CONNECTION	NEUTRAL CONNECTION
30 – 100	HFD	(1) #14 – 1/0	(1) #14 – 1/0	(3) #14 – 1/0
150 – 225	HFD	(1) #6 – 300	(1) #6 – 300	(3) #4 – 300
225 – 300	HKD	(1) #3 – 350	(1) #6 – 350	(3) #4 – 350
400	HLD	(1) 4/0 – 600	(2) #1 – 500	(6) 250 – 350
600	HLD	(1) 3/0 – 350	(2) #1 – 500	(6) 250 – 350
600	HMDL	(2) #1 – 500	(2) #1 – 500	(12) 4/0 – 500
600 (4-Pole)	NB	(3) 3/0 – 400	(3) 3/0 – 400	(3) 3/0 – 400
800	HMDL	(3) 3/0 – 400	(3) 3/0 – 400	(12) 4/0 – 500
800	HNB	(4) 4/0 – 500	(4) 4/0 – 500	(12) 4/0 – 500
1000	HNB	(4) 4/0 – 500	(4) 4/0 – 500	(12) 4/0 – 500

Note:
All terminals suitable for copper or aluminum conductors.

Note:
For alternate terminal sizes, contact Eaton.

TABLE 5. TRANSFER SWITCH RATINGS — SYSTEMS COORDINATION INFORMATION — WITHSTAND, CLOSING AND INTERRUPTING RATINGS ①

STANDARD UL 1008 3-CYCLE — HORIZONTAL AND VERTICAL INDUSTRIAL

ATS AMPERE RATING	ANY BREAKER RATING			RATINGS WHEN USED WITH UPSTREAM FUSE (KA)		
	240 VOLTS	480 VOLTS	600 VOLTS	MAXIMUM FUSE RATING	FUSE TYPE ②	600 VOLTS
30	100	65	25	200	J, T	200
70	100	65	25	200	J, T	200
100	100	65	25	200	J, T	200
150	100	65	25	400	J, T	200
200	100	65	25	400	J, T	200
225	100	65	25	400	J, T	200
300	100	65	25	400	J, T	200
400	100	65	25	600	J, T	200
600	100	65 ③	25	800/1200	J, T	100/200
800	65	50 ③	25	1200/1600	L	100/200
1000	65	50 ③	25	1600	L	200

① For maximum breaker ratings in circuits when the transfer switch is evaluated as a "Motor Branch Circuit Conductor," refer to NEC Section 430-25 for sizing.
② Class RK5 fuse with 100 kA rating.
③ 4-pole units rated 35 kA.

TABLE 6. 30 – 1000 AMPERE TYPE MTVX DIMENSIONS IN INCHES (MM) AND APPROXIMATE SHIPPING WEIGHTS

SWITCH TYPE	ENCLOSURE A HEIGHT	ENCLOSURE B WIDTH	ENCLOSURE C DEPTH	GUTTER SPACE D WIDTH	GUTTER SPACE E DEPTH	GUTTER SPACE F BENDING	BOLT PATTERN G HORIZONTAL	BOLT PATTERN H VERTICAL	STANDARD TERMINALS ① LINE	STANDARD TERMINALS ① LOAD	STANDARD TERMINALS ① NEUTRAL	WEIGHT LBS. (KG)
HKD (150 – 225 A)	48.00 (1219.2)	20.81 (528.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	10.59 (269.0)	11.00 (279.4)	45.50 (1155.7)	(1) #3 – 350	(1) #6 – 350	(3) #4 – 350	305 (138)
HLD (300 A)	56.00 (1422.4)	20.81 (528.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	13.59 (345.2)	11.00 (279.4)	53.50 (1358.9)	(1) #3 – 350	(1) #6 – 350	(3) #4 – 350	395 (179)
HLD (400 A)	64.00 (1625.6)	25.81 (655.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	10.54 (267.7)	16.00 (406.4)	61.48 (1561.6)	(1) 4/0 – 600	(2) #1 – 500	(6) 250 – 350	395 (179)
HLD (400 A) ②	53.00 (1346.2)	25.81 (655.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	11.85 (301.0)	16.00 (406.4)	50.48 (1282.2)	(2) 3/0 – 350	(2) #1 – 500	(6) 250 – 350	395 (179)
HLD (600 A)	64.00 (1625.6)	25.81 (655.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	10.54 (267.7)	16.00 (406.4)	61.48 (1561.6)	(2) 3/0 – 350	(2) #1 – 500	(12) 4/0 – 500	395 (179)
HLD (600 A) ②	64.00 (1625.6)	25.81 (655.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	10.54 (267.7)	16.00 (406.4)	61.48 (1561.6)	(2) 400 – 500	(2) #1 – 500	(12) 4/0 – 500	395 (179)
HMDL (600 A)	76.74 (1949.2)	25.81 (655.6)	19.50 (495.3)	8.00 (203.2)	4.00 (101.6)	17.73 (450.3)	16.00 (406.4)	75.15 (1908.8)	(2) #1 – 500	(2) #1 – 500	(12) 4/0 – 500	510 (232)
HMDL (800 A)	76.74 (1949.2)	25.81 (655.6)	19.50 (495.3)	8.00 (203.2)	4.00 (101.6)	17.73 (450.3)	16.00 (406.4)	75.15 (1908.8)	(3) 3/0 – 400	(3) 3/0 – 400	(12) 4/0 – 500	510 (232)
NB (800 – 1000 A)	76.74 (1949.2)	25.81 (655.6)	19.50 (495.3)	8.00 (203.2)	4.00 (101.6)	17.58 (446.5)	16.00 (406.4)	75.15 (1908.8)	(4) 4/0 – 500	(4) 4/0 – 500	(12) 4/0 – 500	540 (245)

① Suitable for Cu or Al wire. Consult the factory for other available terminal sizes.
② Alternate line terminals.

TABLE 7. 30 – 150 AMPERES TYPE MTHXFD MANUAL DIMENSIONS IN INCHES (MM) AND WEIGHTS LBS. (KG)

30 – 150 AMPERES DIMENSIONS A	B	C	D	E	F	G	H	WEIGHT LBS. (KG)
22.88 (581.2)	13.13 (333.5)	22.74 (577.6)	22.62 (574.5)	24.50 (622.3)	9.78 (248.4)	10.28 (261.1)	32.31 (820.7)	143 (65)

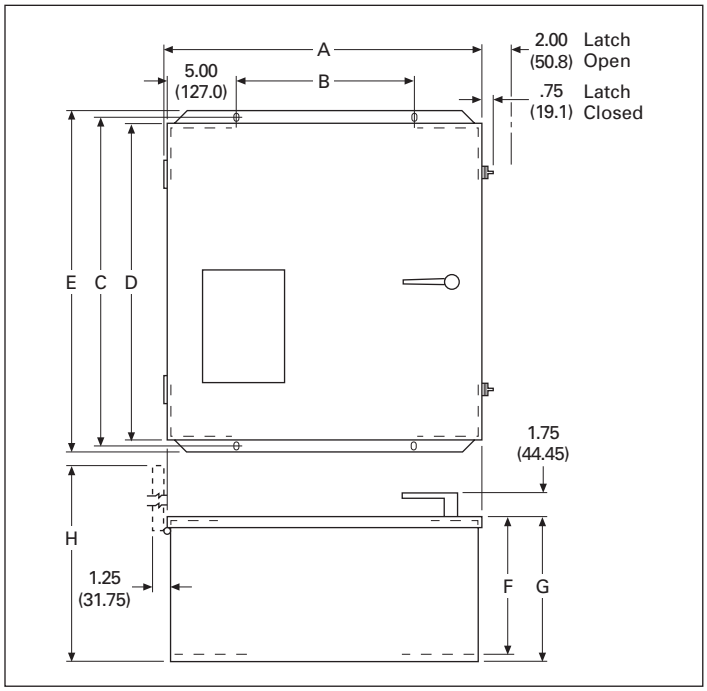


FIGURE 5. DIMENSIONS

TABLE 8. POWER PANEL AND TRANSFORMER PANEL DIMENSIONS IN INCHES (MM)

POWER PANEL TYPE	DIMENSIONS HEIGHT	WIDTH	DEPTH
Power Panel			
HFD	11.00 (279.4)	17.00 (431.8)	6.81 (173.0)
HKD	24.50 (622.3)	11.88 (301.8)	17.50 (444.5)
HLD	26.00 (660.4)	16.88 (428.8)	17.50 (444.5)
HMDL	36.25 (920.8)	16.88 (428.8)	17.50 (444.5)
NB	36.25 (920.8)	16.88 (428.8)	19.00 (482.6)
Transformer Panel			
HFD	22.00 (558.8)	16.50 (419.1)	6.50 (165.1)
HKD, HLD, HMDL and NB	28.63 (727.2)	8.25 (209.6)	5.50 (139.7)

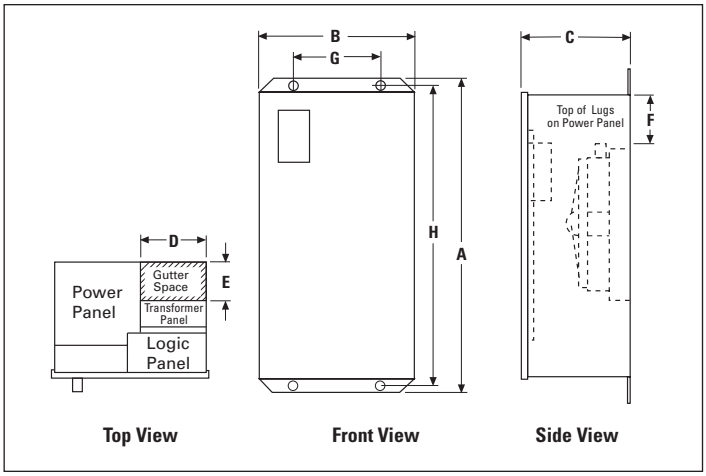
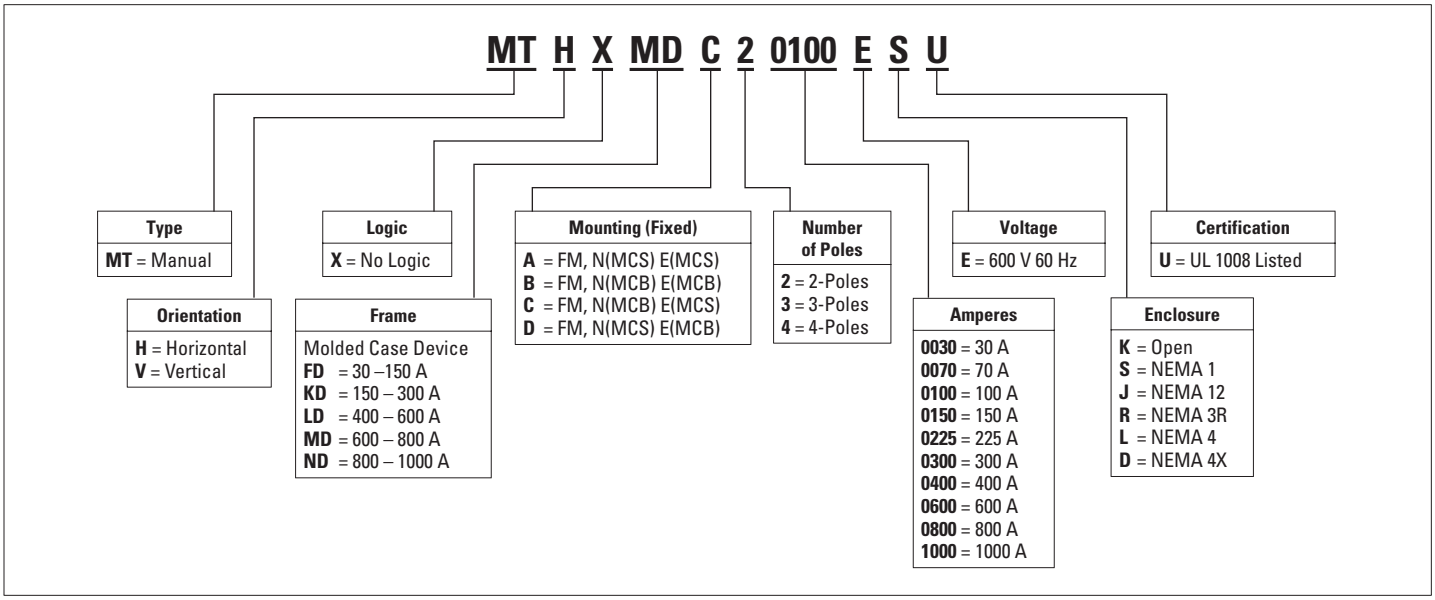


FIGURE 6. DIMENSIONS

Dimensions are approximate in inches (mm).
Should not be used for construction purposes.

TABLE 9. MANUAL WALL-MOUNT TRANSFER SWITCH CATALOG NUMBERING SYSTEM



Molded Case Switches — Non-Automatic Wall-Mount

Non-Automatic Wall-Mount

Product Description

Eaton's Cutler-Hammer Wall-Mount Non-Automatic Transfer Switches are designed for a variety of standby power applications for critical loads.

In the event of a primary power source interruption, the user can manually transfer the load circuits to the standby power source through the use of an external pushbutton. Once primary power has been restored, the user can manually transfer the load circuits back to the primary power source through the use of an external pushbutton.

Application Description

Non-Automatic transfer switches cover applications ranging from 30 to 1000 amperes through 600 Vac, for manual configurations, open transition, standard or service entrance.

Features, Benefits and Functions

Features

- Molded case switch power contact assemblies.
- Positive mechanical and electrical interlocking.
- Permanently affixed manual operating handle.
- Pushbutton operation.

Benefits

- High withstand, totally enclosed for maximum arc suppression and isolation during power transfer.
- Optional trip units offer system overcurrent protection.
- Prevents the paralleling of two sources of power.
- Permits safe and convenient manual transfer of power under load via external pushbutton initiated operation.

Standards and Certifications

- Complies with UL 1008 and UL 489 standards.
- IBC seismic qualified.
- Meets American Bureau of Shipping (ABS) approval.

TABLE 10. WALL-MOUNT TRANSFER SWITCH STANDARD TERMINAL DATA FOR POWER CABLE CONNECTIONS

SWITCH AMPERE RATING	BREAKER FRAME	LINE SIDE (NORMAL AND STANDBY SOURCE)	LOAD CONNECTION	NEUTRAL CONNECTION
30 – 100	HFD	(1) #14 – 1/0	(1) #14 – 1/0	(3) #14 – 1/0
150 – 225	HFD	(1) #6 – 300	(1) #6 – 300	(3) #4 – 300
225 – 300	HKD	(1) #3 – 350	(1) #6 – 350	(3) #4 – 350
400	HLD	(1) 4/0 – 600	(2) #1 – 500	(6) 250 – 350
600	HLD	(1) 3/0 – 350	(2) #1 – 500	(6) 250 – 350
600	HMDL	(2) #1 – 500	(2) #1 – 500	(12) 4/0 – 500
600 (4-Pole)	NB	(3) 3/0 – 400	(3) 3/0 – 400	(3) 3/0 – 400
800	HMDL	(3) 3/0 – 400	(3) 3/0 – 400	(12) 4/0 – 500
800	HNB	(4) 4/0 – 500	(4) 4/0 – 500	(12) 4/0 – 500
1000	HNB	(4) 4/0 – 500	(4) 4/0 – 500	(12) 4/0 – 500

Note:
All terminals suitable for copper or aluminum conductors.

Note:
For alternate terminal sizes, contact Eaton.

TABLE 11. TRANSFER SWITCH RATINGS — SYSTEMS COORDINATION INFORMATION — WITHSTAND, CLOSING AND INTERRUPTING RATINGS ①

STANDARD UL 1008 3-CYCLE — HORIZONTAL AND VERTICAL INDUSTRIAL

ATS AMPERE RATING	ANY BREAKER RATING			RATINGS WHEN USED WITH UPSTREAM FUSE (KA)		
	240 VOLTS	480 VOLTS	600 VOLTS	MAXIMUM FUSE RATING	FUSE TYPE ②	600 VOLTS
30	100	65	25	200	J, T	200
70	100	65	25	200	J, T	200
100	100	65	25	200	J, T	200
150	100	65	25	400	J, T	200
200	100	65	25	400	J, T	200
225	100	65	25	400	J, T	200
300	100	65	25	400	J, T	200
400	100	65	25	600	J, T	200
600	100	65 ③	25	800/1200	J, T	100/200
800	65	50 ③	25	1200/1600	L	100/200
1000	65	50 ③	25	1600	L	200

① For maximum breaker ratings in circuits when the transfer switch is evaluated as a "Motor Branch Circuit Conductor," refer to NEC Section 430-25 for sizing.
② Class RK5 fuse with 100 kA rating.
③ 4-pole units rated 35 kA.

TABLE 12. 30 – 1000 AMPERE TYPES NTHE, NTVE DIMENSIONS IN INCHES (MM) AND APPROXIMATE SHIPPING WEIGHTS

SWITCH TYPE	ENCLOSURE A HEIGHT	ENCLOSURE B WIDTH	ENCLOSURE C DEPTH	GUTTER SPACE D WIDTH	GUTTER SPACE E DEPTH	GUTTER SPACE F BENDING	BOLT PATTERN G HORIZONTAL	BOLT PATTERN H VERTICAL	STANDARD TERMINALS ① LINE	STANDARD TERMINALS ① LOAD	STANDARD TERMINALS ① NEUTRAL	WEIGHT LBS. (KG)
HFD (30 – 100 A) ②	47.74 (1213.0)	20.81 (528.6)	17.22 (437.0)	8.00 (203.2)	4.00 (101.6)	6.22 (157.9)	10.75 (273.0)	45.24 (1049.1)	(1) #14 – 1/0	(1) #14 – 1/0	(3) #14 – 1/0	227 (103)
HFD (150 A) ②	47.74 (1213.0)	20.81 (528.6)	17.22 (437.0)	8.00 (203.2)	4.00 (101.6)	6.22 (157.9)	10.75 (273.0)	45.24 (1049.1)	(1) #6 – 300	(1) #6 – 300	(3) #4 – 300	227 (103)
HKD (150 – 225 A)	48.00 (1219.2)	20.81 (528.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	10.59 (269.0)	11.00 (279.4)	45.50 (1155.7)	(1) #3 – 350	(1) #6 – 350	(3) #4 – 350	305 (138)
HKD (300 A)	56.00 (1422.4)	20.81 (528.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	13.59 (345.2)	11.00 (279.4)	53.50 (1358.9)	(1) #3 – 350	(1) #6 – 350	(3) #4 – 350	395 (179)
HLD (400 A)	64.00 (1625.6)	25.81 (655.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	10.54 (267.7)	16.00 (406.4)	61.48 (1561.6)	(1) 4/0 – 600	(2) #1 – 500	(6) 250 – 350	395 (179)
HLD (400 A) ③	53.00 (1346.2)	25.81 (655.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	11.85 (301.0)	16.00 (406.4)	50.48 (1282.2)	(2) 3/0 – 350	(2) #1 – 500	(6) 250 – 350	395 (179)
HLD (600 A)	64.00 (1625.6)	25.81 (655.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	10.54 (267.7)	16.00 (406.4)	61.48 (1561.6)	(2) 3/0 – 350	(2) #1 – 500	(12) 4/0 – 500	395 (179)
HLD (600 A) ③	64.00 (1625.6)	25.81 (655.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	10.54 (267.7)	16.00 (406.4)	61.48 (1561.6)	(2) 400 – 500	(2) #1 – 500	(12) 4/0 – 500	395 (179)
HMDL (600 A)	76.74 (1949.2)	25.81 (655.6)	19.50 (495.3)	8.00 (203.2)	4.00 (101.6)	17.73 (450.3)	16.00 (406.4)	75.15 (1908.8)	(2) #1 – 500	(2) #1 – 500	(12) 4/0 – 500	510 (232)
HMDL (800 A)	76.74 (1949.2)	25.81 (655.6)	19.50 (495.3)	8.00 (203.2)	4.00 (101.6)	17.73 (450.3)	16.00 (406.4)	75.15 (1908.8)	(3) 3/0 – 400	(3) 3/0 – 400	(12) 4/0 – 500	510 (232)
NB (800 – 1000 A)	76.74 (1949.2)	25.81 (655.6)	19.50 (495.3)	8.00 (203.2)	4.00 (101.6)	17.58 (446.5)	16.00 (406.4)	75.15 (1908.8)	(4) 4/0 – 500	(4) 4/0 – 500	(12) 4/0 – 500	540 (245)

① Suitable for Cu or Al wire. Consult the factory for other available terminal sizes.
② NTHE with multi-tap voltage selection panel.
③ Alternate line terminals.

TABLE 13. POWER PANEL AND TRANSFORMER PANEL DIMENSIONS IN INCHES (MM)

POWER PANEL TYPE	DIMENSIONS HEIGHT	WIDTH	DEPTH
Power Panel			
HFD	11.00 (279.4)	17.00 (431.8)	6.81 (173.0)
HKD	24.50 (622.3)	11.88 (301.8)	17.50 (444.5)
HLD	26.00 (660.4)	16.88 (428.8)	17.50 (444.5)
HMDL	36.25 (920.8)	16.88 (428.8)	17.50 (444.5)
NB	36.25 (920.8)	16.88 (428.8)	19.00 (482.6)
Transformer Panel			
HFD	22.00 (558.8)	16.50 (419.1)	6.50 (165.1)
HKD, HLD, HMDL and NB	28.63 (727.2)	8.25 (209.6)	5.50 (139.7)

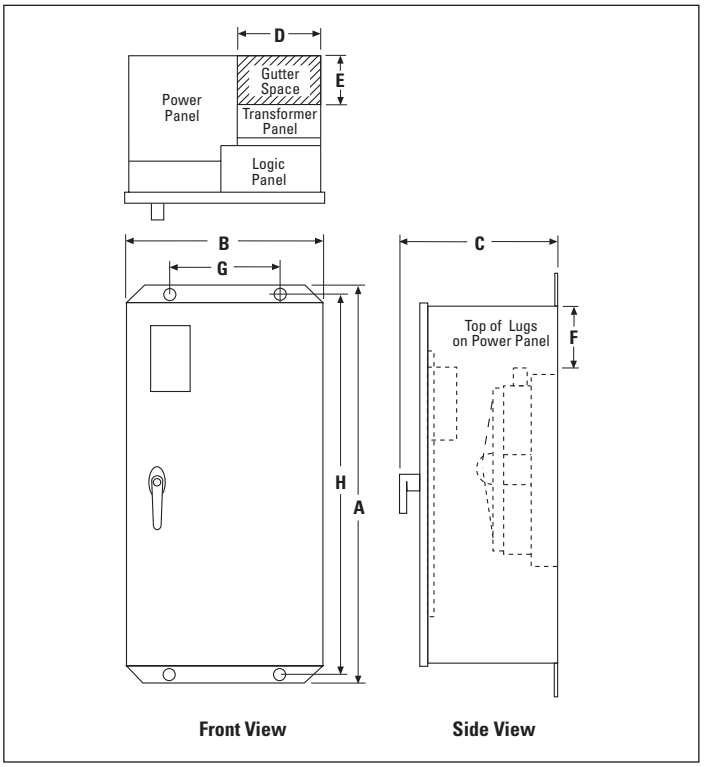
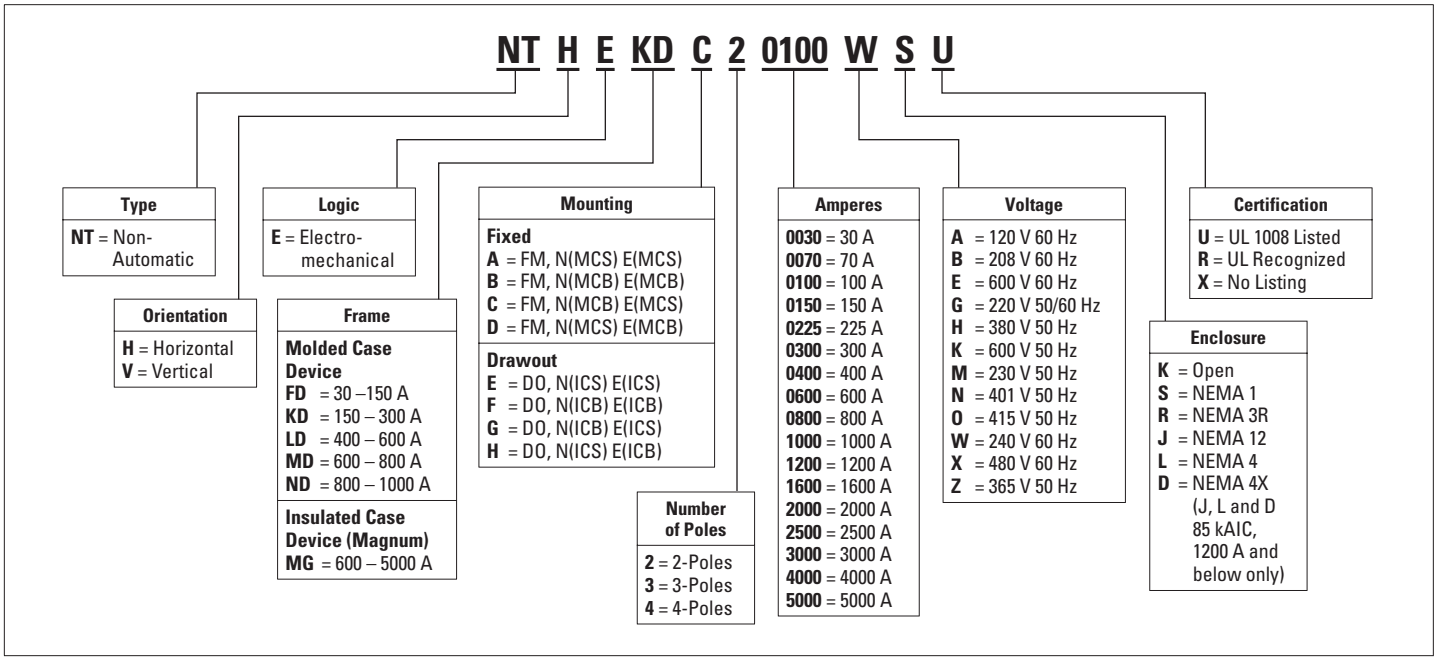


FIGURE 7. DIMENSIONS

Dimensions are approximate in inches (mm).
Should not be used for construction purposes.

TABLE 14. NON-AUTOMATIC WALL-MOUNT TRANSFER SWITCH CATALOG NUMBERING SYSTEM



Maintenance Bypass Switches Type MBHE 100 – 1000 Amperes

Type MBHE Maintenance Bypass Switch

General Description

Eaton's Cutler-Hammer Maintenance Bypass Switch is a UL 1008 listed device that provides a simple and effective means for bypassing un-interruptible power supplies while maintaining continuity of power to the critical computer loads. A maintenance bypass switch is a requirement on every UPS installation in order to accommodate the maintenance and testing of the UPS system.

Features

- UL 1008 listing — File E61639.
- Make-before-break electrical operation.
- Lockout circuit to be wired into the UPS bypass authorization.
- Pilot devices to show UPS position "Normal" and "Bypassed."
- Pilot device to show "Lockout" enabled.
- Reliable manually initiated electrical operation.
- High interrupting ratings are standard.
- Molded case switch designs are available.
- Solid neutral connections are standard.

Benefits

- Safe and reliable operation is ensured due to the simple and durable switching design.
- Unauthorized bypass is prevented by the need of UPS system to send the bypass authorized signal.
- 100% current ratings makes selection to the UPS kVA ratings easy to accomplish.
- Use of interrupting rating switches makes the maintenance bypass switches adaptable to systems with high levels of available fault current.

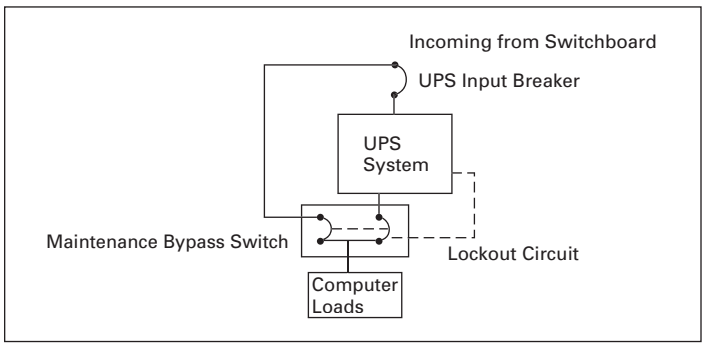


FIGURE 8. SINGLE LINE DIAGRAM OF MAINTENANCE BYPASS SWITCH

Dimensions are approximate in inches (mm).
Should not be used for construction purposes

Layout Dimensions

Manual Transfer and Maintenance Bypass Switches

100 – 150 Amperes Type MTHXFD Manual /100 – 1000 Amperes Type MBHE Maintenance Bypass

TABLE 15. MANUAL AND MAINTENANCE BYPASS ENCLOSURES — DIMENSIONS IN INCHES (MM)

	DIMENSIONS							
AMPERES	A	B	C	D	E	F	G	H
100 – 150	22.88 (581.2)	13.13 (333.5)	22.74 (577.6)	22.62 (574.5)	24.50 (622.3)	9.78 (248.4)	10.28 (261.1)	32.31 (820.7)
225 – 300	38.88 (987.6)	29.13 (739.9)	35.74 (907.8)	35.62 (904.7)	37.50 (952.5)	17.28 (438.9)	17.78 (438.9)	55.81 (1417.6)
400	38.88 (987.6)	29.13 (739.9)	35.74 (907.8)	35.62 (904.7)	37.50 (952.5)	17.28 (438.9)	17.78 (438.9)	55.81 (1417.6)
600	38.88 (987.6)	29.13 (739.9)	49.74 (1263.4)	49.62 (1260.3)	51.50 (1308.1)	17.28 (438.9)	17.78 (438.9)	55.81 (1417.6)
800	38.88 (987.6)	29.13 (739.9)	49.74 (1263.4)	49.62 (1260.3)	51.50 (1308.1)	17.28 (438.9)	17.78 (438.9)	55.81 (1417.6)
1000	38.88 (987.6)	29.13 (739.9)	59.74 (1517.4)	59.62 (1514.3)	61.50 (1562.1)	17.28 (438.9)	17.78 (438.9)	55.81 (1417.6)

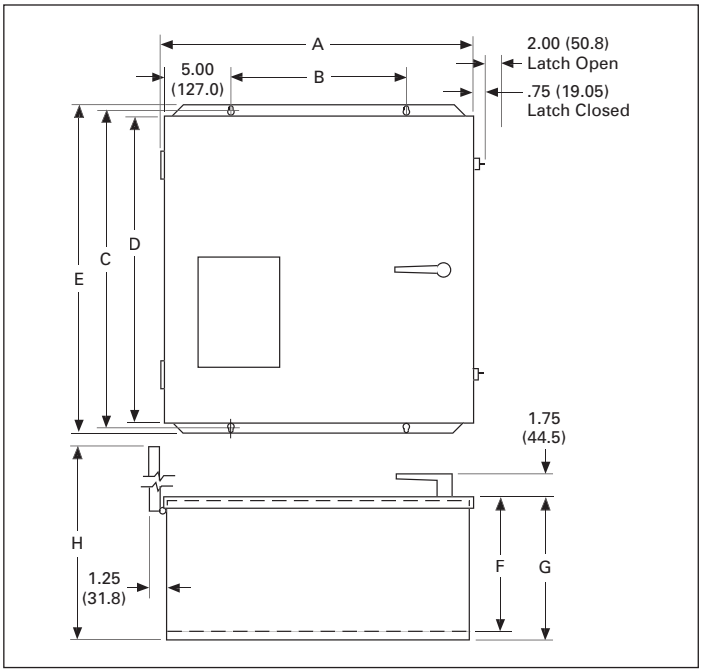


FIGURE 9. MANUAL AND MAINTENANCE BYPASS SWITCHES — DIMENSIONS IN INCHES (MM)

Wall-Mount Transfer Switches Contactor, Molded Case and Circuit Breaker Design

Wall-Mount Transfer Switch

Product Description

Eaton's Cutler-Hammer Wall-Mount Transfer Switches are designed for a variety of standby power applications for critical loads. They provide flexibility, reliability and value in a compact package. In the event of a primary power source interruption, a transfer switch provides an effective means to transfer the load circuits to an alternate power source while reducing the possibility of injury or property damage.

Wall-Mount Transfer Switches meet or exceed all industry standards for endurance, reliability and performance. They are listed under Underwriters Laboratories UL 1008 Standard for Transfer Switch Equipment and optionally available as suitable for emergency and standby systems as defined in NFPA 99 for health care facilities.

ATC-300 Automatic Transfer Switch shown above.

Combination Automatic Transfer Switches and Bypass Isolation are designed for applications where preventive maintenance, inspection and testing must be accomplished while maintaining continuity of power to the load. This is typically required in critical life support systems and standby power situations that require safe maintenance of the system with no disruption of the power.

Electrical Ratings

- Molded case and circuit breaker 30 – 1000 amperes.
- 2-Position Contactors 100, 200, 320, 400 and 600 amperes.
- 3-Position Contactors 100, 200, 300, 400, 600, 800, 1000 and 1200 amperes.

Note:
For 3-position contactors, contact factory.

- 2-, 3- or 4-poles.
- Up to 600 Vac, 50/60 Hz.
- NEMA 1, 3R, 12, open.
- Suitable for emergency and standby systems (all loads).
- UL 1008 listed.
- CSA® C22.2 No. 178 certified.

Industrial Design Highlights

- Double-throw, mechanically interlocked transfer mechanism.
- High withstand and closing ratings.
- Seismic Zone 4 qualified (BOCA®, CBC, IBC, UBC®).

Standard Features

- Auxiliary relay contacts:
  - Source 1 present 2NO and 2NC
  - Source 2 present 2NO and 2NC
- Switch position indication contacts:
  - Source 1 position 1NO and 1NC
  - Source 2 position 1NO and 1NC
- Source 1 and Source 2 sensing:
  - Undervoltage/underfrequency
  - Overvoltage/overfrequency
  - 3-phase rotation protection
  - 3-phase voltage unbalance/loss
- Pre-transfer signal contacts 1NO/1NC.
- Go to Emergency (Source 2).
- Seven field-programmable time delays.
- LCD-based display for programming, system diagnostic and Help message display.
- Mimic diagram with source available and connected LED indication.
- Time-stamped history log.
- System test pushbutton.
- Programmable plant exerciser — OFF, daily, 7, 14, 28-day interval selectable run time 0 – 600 minutes no load/load with fail-safe.
- Safe manual operation under full load with permanently affixed operating handle.

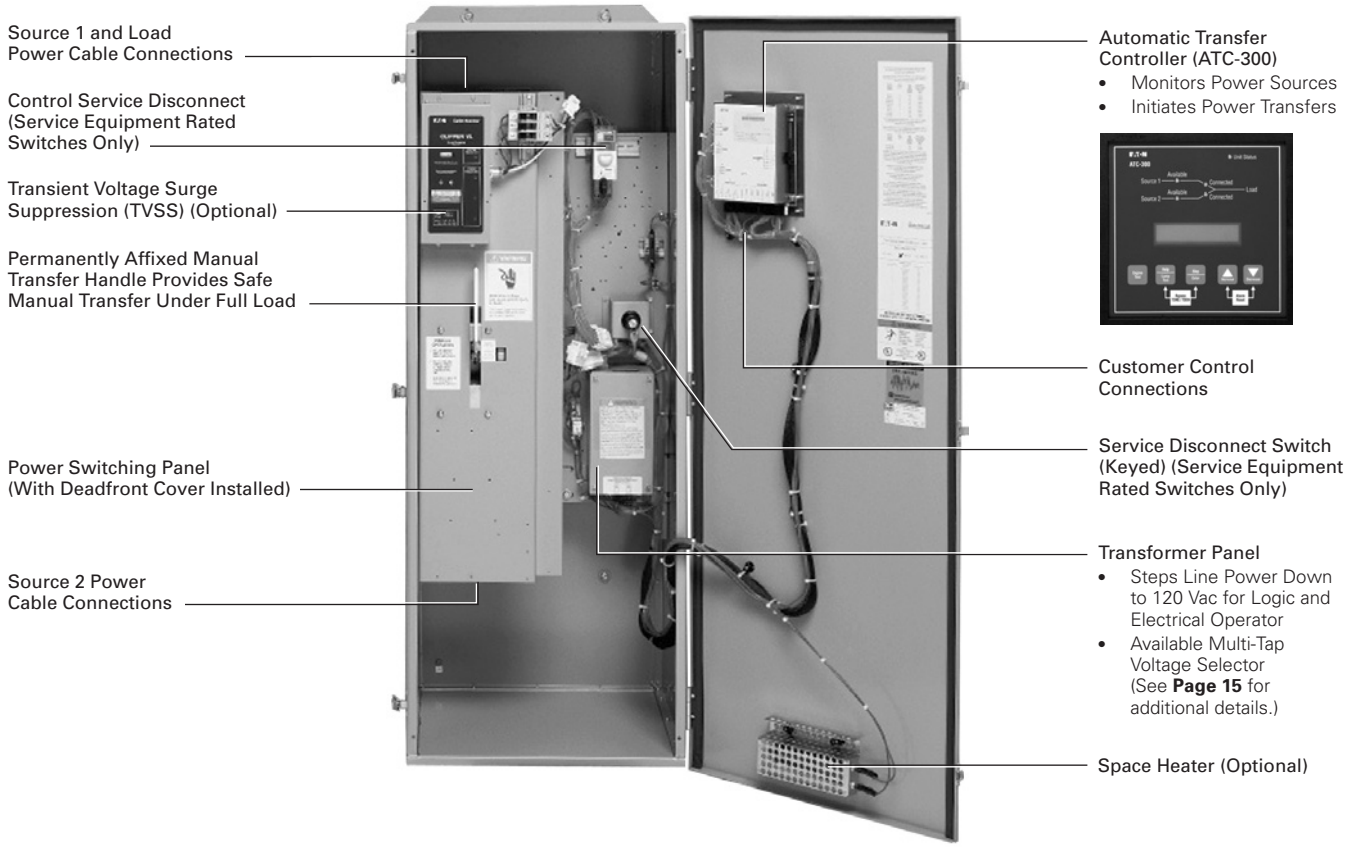
Note:
Not available on Contactor Transfer Switch.

Optional Features

- Suitable for use as service equipment in the standard enclosure size. ①
- Available TVSS for power/controller, engine start circuit, phone and cable connections.
- Integrated distribution panels. ①
- Field-selectable multi-tap transformer panel permits operation on a wide range of system voltages.
- Integral overcurrent protection. ①
- Space heater with thermostat.
- Ammeter — load side.
- Stainless steel cover for controller.

① Not available on Contactor Transfer Switch.

Basic Components of the Wall-Mount ATS



Basic Components of Automatic Transfer Switches

Features, Benefits and Functions

Cutler-Hammer Superior Design Transfer Switch Characteristics

Unmatched Performance and Versatility

The Cutler-Hammer family of wall-mount transfer switches offers unmatched performance, versatility and value for power switching applications. At the heart of these designs is the Cutler-Hammer Molded Case Switch, designed specifically to meet UL 1008.

Superior Main Contact Structure

All Cutler-Hammer Wall-Mount Transfer Switches meet or exceed the standards set forth in UL 1008 and UL 489. No other transfer switch manufacturer has met the rigid testing requirements of this combination of standards. Completely enclosed contacts add a measure of safety and reliability. It also ensures the integrity of the contact assemblies and minimizes the need for periodic maintenance of the contacts, reducing downtime.

Fast, Powerful and Safe Power Switching Mechanism

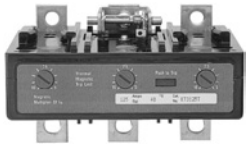
The power panel utilizes a unidirectional gear motor mechanism. The power panel can be operated manually under a FULL LOAD.

Molded Case Switch Features

Molded Case Switch

- True 4-pole switched neutral availability.
- Totally enclosed contact assembly.

Optional Integral Overcurrent Protection Capability



Optional Thermal-Magnetic or Electronic Trip Units

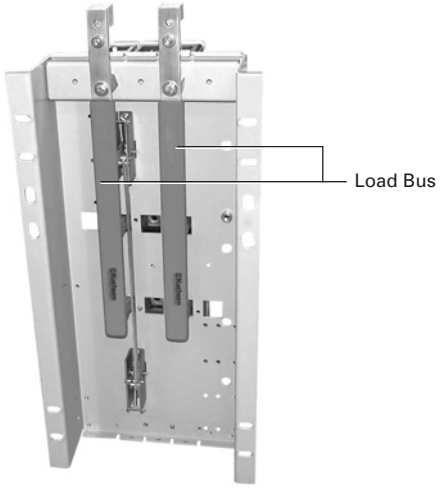
For service entrance and other applications, trip units can be integrated into the power switching section. This eliminates the need for separate upstream protective devices, saving cost and space.

Mechanical Interlock

Triple Interlocks

Wall-mount transfer switches feature a rear-mounted, patented fail-safe mechanical interlock to prevent paralleling of sources. This is, in addition to, software interlocking and the interlocking inherently provided by the transfer mechanism.

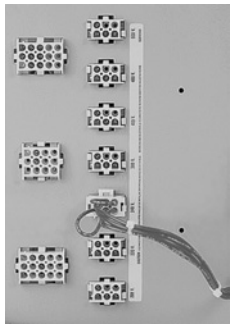
Load Bus Assembly



Load Bus

The load bus can be oriented for either top or bottom access.

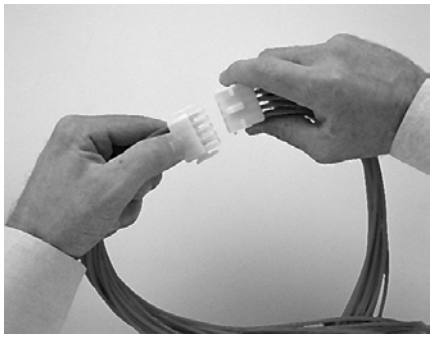
Multi-Tap Voltage Selector



Multi-Tap Voltage Selector

The industry-exclusive Cutler-Hammer Multi-Tap System Voltage Selector allows our transfer switch to be applied on most system voltages just by proper insertion of the selector plug. Available in two configurations: Worldwide Multi-Tap with 600, 480, 415, 380, 240, 220 and 208 Vac, single- and 3-phase, 50 and 60 Hz taps. North American Multi-Tap with 600, 480, 240, 208 and 120 Vac, single- and 3-phase, 60 Hz taps.

Ease of Maintenance



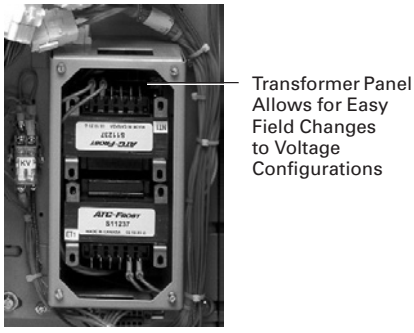
Logic Disconnect Plugs

Keyed quick-disconnect plugs are provided for easy and complete isolation of the control circuitry.

Maintenance can be performed on the logic independent from the power sections and still allow the user to manually transfer power under full load conditions.

North American Voltage Selector

Transformer Panel Location



Transformer Panel Opened

North American Multi-Tap transformer comes with 600, 480, 240, 208 and 120 Vac, single- and 3-phase, and 60 Hz taps which are all field selectable. Simply remove the steel cover and move the appropriate blue flag terminal to the desired voltage. All switches are shipped with the blue flag in the 600 volt position.

Contactor-Based Transfer Switch ①

TABLE 16. UL 1008 WITHSTAND AND CLOSE-ON RATINGS (KA)

CONTACTOR STYLE	UL 1008 AMPERE RATING	SPECIFIC BREAKER RATING: MAXIMUM CIRCUIT BREAKER SIZE AMPERES	SPECIFIC BREAKER RATING: MAXIMUM AMPERES AT 480 VAC (UL)
61WNU-3FD	100	125	30,000
64WNU-3FD	200	250	50,000
64WNU-3FD	320	600	50,000
64WNU-3FD	400	600	50,000
66WNU-3FD	600	800	65,000

① Consult factory for withstand ratings on the 3-position contactor switches 100 – 1200 amperes.

TABLE 17. TERMINAL DATA OPTIONS FOR POWER CABLE CONNECTIONS

SWITCH RATING AMPERES	LINE SIDE (NORMAL AND STANDBY SOURCE)	LOAD CONNECTION	NEUTRAL CONNECTION
100	(1) #14 – 2/0	(1) #14 – 2/0	(3) #14 – 2/0
200	(1) #6 – 250	(1) #6 – 250	(3) 1/0 – 250
320	(1) #4/0 – 600	(1) #4/0 – 600	(6) 250 – 500
	(2) 1/0 – 250	(2) 1/0 – 250	(12) 4/0 – 500
			(9) 500 – 750
400	(1) #4/0 – 600	(1) #4/0 – 600	(6) 250 – 500
	(2) 1/0 – 250	(2) 1/0 – 250	(12) 4/0 – 500
			(9) 500 – 750
600	(2) #2 – 600	(2) #2 – 600	(12) 4/0 – 500
			(9) 500 – 750

Molded Case Transfer Switch and Circuit Breaker

TABLE 18. UL 1008 WITHSTAND AND CLOSE-ON RATINGS (KA)

SWITCH AMPERE RATING	UL 1008 3-CYCLE ANY BREAKER RATING: 240 VAC	480 VAC	600 VAC	RATINGS WHEN USED WITH UPSTREAM FUSE: MAXIMUM FUSE RATING	FUSE TYPE	600 VAC
30 – 100	100	65	25	200	J, T	200
150	100	65	25	400	J, T	200
225	100	65	25	400	J, T	200
300	100	65	25	400	J, T	200
400	100	65	25	600	J, T	200
600 ②	100	65	25	1200	J, T	200
800 ②	65	50	25	1600	L	200
1000 ②	65	50	25	1600	L	200

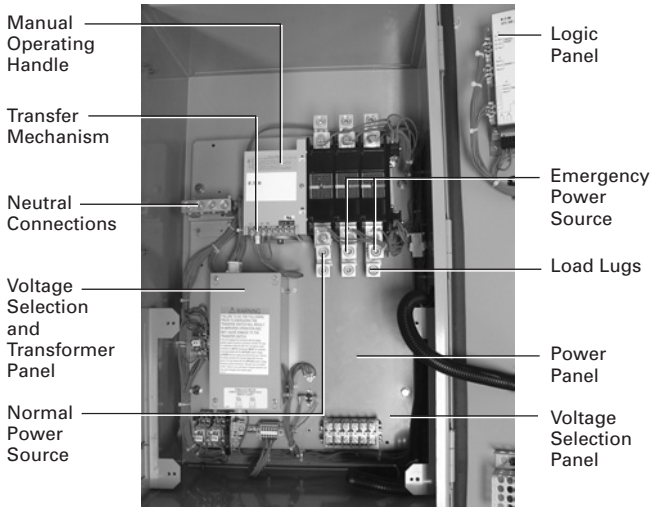
② For 600, 800 and 1000 ampere ratings, 1- through 4-pole units are rated 35 kA.

TABLE 19. WALL-MOUNT TRANSFER SWITCH STANDARD TERMINAL DATA FOR POWER CABLE CONNECTIONS

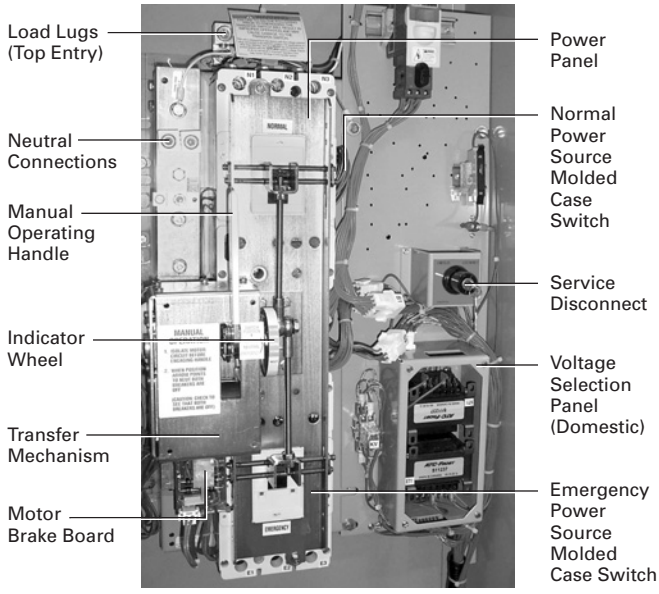
SWITCH AMPERE RATING	BREAKER FRAME	LINE SIDE (NORMAL AND STANDBY SOURCE)	LOAD CONNECTION	NEUTRAL CONNECTION
30 – 100	HFD	(1) #14 – 1/0	(1) #14 – 1/0	(3) #14 – 1/0
150 – 225	HFD	(1) #6 – 300	(1) #6 – 300	(3) #4 – 300
150 – 225	HKD	(1) #3 – 350	(1) #6 – 350	(3) #4 – 350
225 – 300	HKD	(1) #3 – 350	(1) #6 – 350	(3) #4 – 350
400	HLD	(1) 4/0 – 600	(2) #1 – 500	(6) 250 – 350
600	HLD	(1) 3/0 – 350	(2) #1 – 500	(6) 250 – 350
600	HMDL	(2) #1 – 500	(2) #1 – 500	(12) 4/0 – 500
600 (4-Pole)	NB	(3) 3/0 – 400	(3) 3/0 – 400	(3) 3/0 – 400
800	HMDL	(3) 3/0 – 400	(3) 3/0 – 400	(12) 4/0 – 500
800	HNB	(4) 4/0 – 500	(4) 4/0 – 500	(12) 4/0 – 500
1000	HNB	(4) 4/0 – 500	(4) 4/0 – 500	(12) 4/0 – 500

Note:
All terminals suitable for copper or aluminum conductors.

Note:
For alternate terminal sizes, contact Eaton.



Typical Contactor-Based ATS 100 – 600 Amperes



Typical (225 – 1000 Amperes) Vertical Design Transfer Switch Equipment

TABLE 20. INDUSTRIAL MOLDED CASE TRANSFER SWITCH CATALOG NUMBERING SYSTEM

AT V 3 KD A 3 0400 X S U

Type	Logic	Switch	Amperes ②	Voltage	Certification
AT = Automatic **BI** = Bypass Isolation	**1** = ATC 100 **3** = ATC 300 **I** = ATC 600	**A** = S1 (MCS) S2 (MCS) **B** = S1 (MCB) S2 (MCB) **C** = S1 (MCB) S2 (MCS) **D** = S1 (MCS) S2 (MCB) **X** = Fix Mounted Contactor	**0030** = 30 A **0070** = 70 A **0100** = 100 A **0150** = 150 A **0200** = 200 A **0225** = 225 A **0300** = 300 A **0320** = 320 A **0400** = 400 A **0600** = 600 A ⑤ **0800** = 800 A **1000** = 1000 A **1200** = 1200 A	**A** = 120 V 60 Hz **B** = 208 V 60 Hz **E** = 600 V 60 Hz **G** = 220 V 50/60 Hz **H** = 380 V 50 Hz **K** = 600 V 50 Hz **M** = 230 V 50 Hz **N** = 401 V 50 Hz **O** = 415 V 50 Hz **W** = 240 V 60 Hz **X** = 480 V 60 Hz **Z** = 365 V 50 Hz	**U** = UL Listed **R** = UL Recognized **X** = No Listing

Orientation	Frame Size (Amperes)	Number of Poles	Enclosure
H = Horizontal **V** = Vertical **C** = Contactor	Molded Case Device ① **C2** = 2-Position Contactor **C3** = 3-Position Contactor ③④ **FD** = 30 – 150 **KD** = 225 – 300 **LD** = 400 **MD** = 600 (3-pole only) **NB** = 800 – 1000 ⑤	**2** = 2-Poles **3** = 3-Poles **4** = 4-Poles ⑤	**K** = Open **S** = NEMA 1 **J** = NEMA 12 **R** = NEMA 3R

① HFD = 200 and 225 amperes, HLD = 600 amperes, HMD = 800 amperes for 240/120 Vac single-phase, 3-wire and 208Y/120 Vac 3-phase, 4-wire systems only.
② The Contactor-Based Transfer Switch is currently available in 100, 200, 320, 400 and 600 amperes only. Contact the factory for availability on the 800, 1000 and 1200 ampere switch.
③ For closed transition contactor, CTC8C3, consult factory.
④ For Bypass Isolation contactor, BICIC3, consult factory.
⑤ 4-pole 600 ampere will use an NB breaker.

Note:
MCB = Molded Case Breaker, MCS = Molded Case Switch.

Layout Dimensions

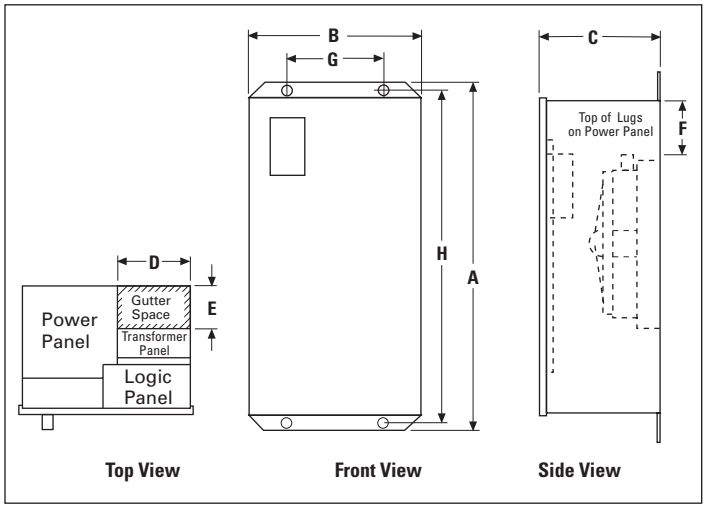


FIGURE 10. DIMENSION VIEWS

See **Table 21** on **Page 18**.

Dimensions are approximate in inches (mm).
Should not be used for construction purposes.

TABLE 21. CONTACTOR-BASED AND MOLDED CASE TRANSFER SWITCHES — DIMENSIONS IN INCHES (MM) AND APPROXIMATE SHIPPING WEIGHTS IN LBS. (KG)

		ENCLOSURE			GUTTER SPACE		BOLT PATTERN		STANDARD TERMINALS ①			
SWITCH RATING AMPERES	SWITCH TYPE	A HEIGHT	B WIDTH	C DEPTH	D WIDTH	E DEPTH	G HORIZONTAL	H VERTICAL	LINE SIDE (NORMAL LOAD & STANDBY SOURCE) CONNECTION		NEUTRAL CONNECTION	WEIGHT LBS. (KG)
Contactor-Based — 2-Position ②												
100	—	35.61 (904.5)	20.06 (509.5)	11.34 (288.0)	2.00 (51.0)	5.00 (127.0)	10.25 (260.4)	34.73 (882.1)	(1) #14 – 1/0	(1) #14 – 1/0	(3) #14 – 1/0	156 (71)
200	—	35.61 (904.5)	20.06 (509.5)	11.34 (288.0)	2.00 (51.0)	5.00 (127.0)	10.25 (260.4)	34.73 (882.1)	(1) #6 – 250 ①	(1) #6 – 250 ①	(3) 1/10 – 250	160 (73)
300	—	53.00 (1346.2)	25.81 (655.6)	16.72 (425.0)	4.00 (101.0)	12.00 (304.0)	16.00 (406.4)	50.48 (1282.2)	(1) #4/0 – 600 (2) 1/0 – 250	(1) #4/0 – 600 (2) 1/0 – 250	(3) 250 – 500 (12) 4/0 – 500 (9) 500 – 750	244 (110)
400	—	53.00 (1346.2)	25.81 (655.6)	16.72 (425.0)	4.00 (101.0)	12.00 (304.0)	16.00 (406.4)	50.48 (1282.2)	(1) #4/0 – 600 ① (2) 1/0 – 250	(1) #4/0 – 600 ① (2) 1/0 – 250	(3) 250 – 500 (12) 4/0 – 500 (9) 500 – 750	244 (110)
600	—	64.00 (1625.6)	25.81 (655.6)	16.72 (425.0)	3.00 (76.0)	9.00 (228.0)	16.00 (406.4)	61.48 (1561.6)	(2) #2 – 600 ①	(2) #2 – 600 ①	(12) 4/0 – 500 (9) 500 – 750	395 (180)
Molded Case												
30 – 100	HFD ③	47.74 (1213.0)	20.81 (528.6)	17.22 (437.0)	8.00 (203.2)	4.00 (101.6)	10.75 (273.0)	46.44 (1180.0)	—	—	—	232 (105)
150 – 225	HFD ③	47.74 (1213.0)	20.81 (528.6)	17.22 (437.0)	8.00 (203.2)	4.00 (101.6)	10.75 (273.0)	46.44 (1180.0)	—	—	—	232 (105)
30 – 100	HFD ④	47.74 (1213.0)	20.81 (528.6)	17.22 (437.0)	8.00 (203.2)	4.00 (101.6)	10.75 (273.0)	46.44 (1180.0)	—	—	—	240 (190)
150	HFD ④	47.74 (1213.0)	20.81 (528.6)	17.22 (437.0)	8.00 (203.2)	4.00 (101.6)	10.75 (273.0)	46.44 (1180.0)	—	—	—	240 (190)
150 – 225	HFD ③	35.61 (904.0)	20.06 (509.5)	13.34 (339.0)	8.00 (203.2)	4.00 (101.6)	10.75 (273.0)	34.31 (904.0)	—	—	—	150 (68)
150 – 225	HKD	56.00 (1422.4)	20.81 (528.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	11.00 (279.4)	45.50 (1155.7)	—	—	—	305 (134)
300	HKD	53.00 (1346.2)	25.81 (655.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	11.00 (279.4)	53.50 (1358.9)	—	—	—	295 (134)
400	HLD	53.00 (1346.0)	25.81 (655.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	16.00 (406.4)	51.50 (1308.0)	—	—	—	425 (193)
600	HLD ③	64.00 (1625.6)	25.81 (655.6)	18.40 (467.4)	8.00 (203.2)	4.00 (101.6)	16.00 (406.4)	62.50 (1588.0)	—	—	—	475 (214)
600	HMDL	76.74 (1949.2)	25.81 (655.6)	19.50 (495.3)	8.00 (203.2)	4.00 (101.6)	16.00 (406.4)	75.15 (1908.8)	—	—	—	480 (218)
800	HMDL ③	76.74 (1949.2)	25.81 (655.6)	19.50 (495.3)	8.00 (203.2)	4.00 (101.6)	16.00 (406.4)	75.15 (1908.8)	—	—	—	510 (232)
800 – 1000	HNB	76.74 (1949.2)	25.81 (655.6)	19.50 (495.3)	8.00 (203.2)	4.00 (101.6)	16.00 (406.4)	75.15 (1908.8)	—	—	—	540 (245)

① Suitable with copper only.
② For contactor-based 3-position dimensions, contact factory.
③ 240/120 volt, single-phase, 3-wire or 208 volt, 3-phase, 4-wire systems only.
④ With multi-tap voltage selection panel.

Floor-Standing Magnum Transfer Switches

Floor-Standing Magnum Transfer Switch

Product Description

Eaton's Magnum Transfer Switches are designed for a variety of standby power applications for critical and non-critical loads. They monitor both Source 1 (Normal) and Source 2 (Emergency) power sources. In the event of a Source 1 power interruption, these switches will automatically transfer the load circuits to the Source 2 power source. Once Source 1 power source has been restored, the process is automatically reversed.

The Magnum family of transfer switches covers applications ranging from 200 to 5000 amperes (A) through 600 Vac. Some of the applications are; automatic or non-automatic configurations, open or closed transition, and standard or rated suitable for use as service entrance. They are designed for applications where total system coordination must be accomplished while achieving a high level of Withstand, Interrupting, and Closing performance.

Drawout construction is available for applications, such as critical life support systems, where preventive maintenance, inspection, and testing must be accomplished while maintaining continuity of power to the load.

Eaton Magnum Transfer Switches meet or exceed all industry standards for endurance, reliability, and performance. They are listed under Underwriters Laboratories UL 1008 Standard for Transfer Switch Equipment. With certain options, they also comply with Source 2 and standby system requirements as defined in NFPA® 99 for health care facilities.

Features, Benefits and Functions

- UL 1008 listed.
- Freestanding.
- Magnum insulated case devices.
- Fastest switching times available (<3 cycles).
- High withstand ratings.
- Full 60-cycle short time withstand capability.
- Safe manual transfer under load.
- Multi-tap voltage selection plug.
- Integral service entrance capability.
- Integral overcurrent protection capability.
- Drawout capability.
- Programmable microprocessor controller with keypad entry and display.
- Communications capable.
- Durable powder-coated steel enclosures.
- Seismic Zone 4 Qualified (BOCA, CBC, IBC, UBC).
- American Bureau of Shipping Qualified.
- ISO 9000.
- ISO 14000 Environmental.
- Ambient temperature range: -40˚C to 40˚C (-40˚F to 104˚F).
- Operating temperature range: -20˚C to 70˚C (-4˚F to 158˚F).
- Operating humidity: up to 90%.
- Relative humidity (non-condensing).

Standards and Certifications

Magnum Transfer Switch Family

- Magnum fixed mount 200 – 5000 A.
- Magnum drawout 200 – 5000 A.

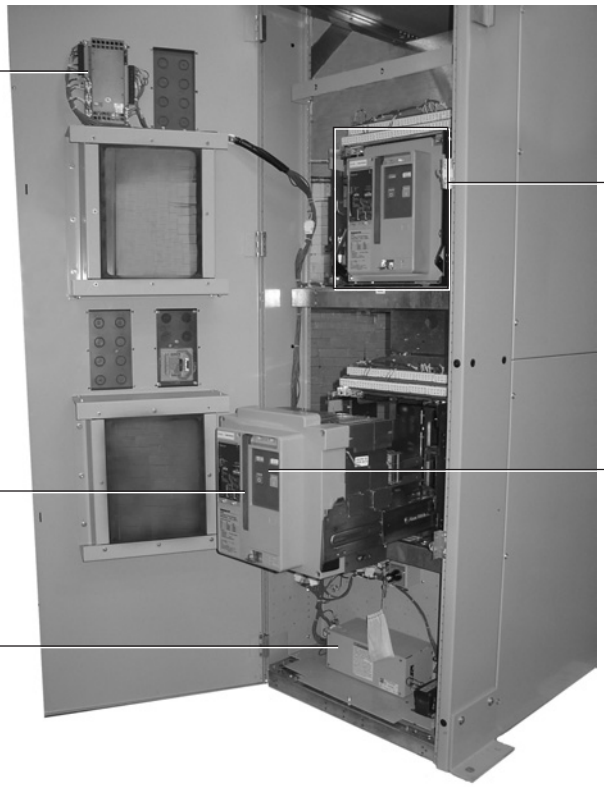
Eaton Magnum Transfer Switches offer the utmost in flexibility, reliability and value. These switches must exceed many national and international standards. They are designed and built in accordance with the following:

UL 891	Standard for Switchboards carrying up to 200,000 A
UL 1008	Standard for Safety for Automatic Transfer Switches 4000 and 5000 amperes available as UL 891 only.
UL 489	Standard for Circuit Breakers and Molded Case Switches
CSA 22.2-178 .	Canadian Transfer Switch Standard
NEC Articles . .	Code Sections
517, 700, 701, 702	Applicable Switch Equipment
NFPA 110	Source 2 and Standby Power Systems
NFPA 99	Health Care Facilities
EGSA 100S . . .	Standard for Transfer Switches
NEMA ICS10	Standard for Transfer Switch Equipment
UBC.	Uniform Building Code for Seismic Zone 4
ISO® 9000. . . .	International Organization for Standardization
CBC.	California Building Code
IBC	International Building Code
BOCA	Building Officials Code Administrators.

Basic Switch Components

Indicating Lights

ATC-600 Logic Shown
- Monitors Source Condition
- Initiates Power Transfers



Power Panel
- Performs power transfer between Source 1 and Source 2 utilizing Magnum Power Switch or Magnum Power Breaker

Manual Charging Handle

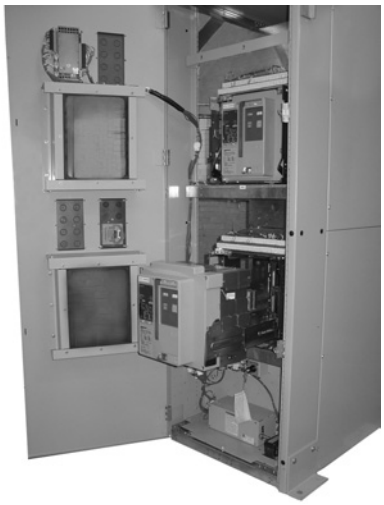
Electrical Operator Pushbutton

Transformer Panel
- Steps line power down to 120 Vac for logic and electrical operator control power
- Multi-Tap Voltage Selector for application on a variety of system voltages
- Engine Start Contacts

Basic Switch Components of Magnum Automatic Transfer Switches

Magnum Drawout Transfer Switch

Magnum Drawout



2000 Amperes, 3-Pole NEMA 1 Enclosed Drawout

- 200 – 5000 amperes.
- 2-, 3-, 4-pole (except 4000 amperes: 2- and 3-pole only).
- 120 – 600 Vac.
- 100,000 amperes withstand/closing/interrupting at 480 Vac.
- Short Time Withstand – 85,000 for 30 cycles.
- Drawout construction with switch position indicator.
- Completely interchangeable power switching devices.
- Available in NEMA Type 1 and 3R enclosures.
- Rear, side and top cable access.

The Eaton Drawout Magnum Switch should be considered for any systems requiring either greater redundancy, easier maintainability, or where true selective coordination is desired.

The Eaton Drawout Magnum Switch provides the capability to isolate either of the two power sources (Source 1 or Source 2) and its associated logic, while maintaining power to the load.

Each switching section is independent and can be replaced either with a spare switch, or for less critical replacement needs, a replacement unit is available from the factory.

Magnum Fixed Mount Transfer Switch

Magnum Fixed Mount

2000 Amperes, 4-Pole, NEMA 1 Enclosed

- 200 – 5000 A.
- 2-, 3-, 4-pole (except 3200 amperes: 2- and 3-pole only).
- 120 – 600 Vac.
- 100,000 amperes withstand/closing/interrupting at 480 Vac.
- Short Time Withstand – 85,000 for 30 cycles.
- Fixed mount construction.
- Available in NEMA Type 1 and 3R enclosures.
- Rear, side and top cable access.

Transfer Switch Withstand Ratings

TABLE 22. SYSTEMS COORDINATION INFORMATION — WITHSTAND, CLOSING AND INTERRUPTING RATINGS

RATING WHEN USED WITH UPSTREAM CIRCUIT BREAKER		RATING WHEN USED WITH UPSTREAM FUSE
TRANSFER SWITCH AMPERE RATING	**3 CYCLE 600 V (KA)**	**30 CYCLE 600 V (KA)**
800	100	85
1000	100	85
1200	100	85
1600	100	85
2000	100	85
2500	100	85
3200	100	85
4000	100	85
5000	100	85

Tested in accordance with UL 1008. Eaton Drawout Magnum Transfer Switch will coordinate with a power switching device short time rating. Contact factory for details.

Front Access Option 54A is Available on All Magnum Designs

Power and Transformer Panels

Unmatched Performance and Versatility

The Eaton family of Magnum transfer switches offers unmatched performance, versatility, and value for standby power applications. At the heart of these designs is the Magnum switch with the following features:

Superior Main Contact Structure

All Eaton Magnum Transfer Switches meet or exceed the standards set forth in UL 1008 and UL 489 with high withstand, totally enclosed Magnum switches. No other transfer switch manufacturer has met the rigid testing requirements of this combination of standards. Completely enclosed contacts add a measure of safety and reliability. It also ensures the integrity of the contact assemblies and minimizes the need for periodic maintenance of the contacts, reducing downtime and maintenance time.

Fast, Powerful and Safe Switching Mechanism

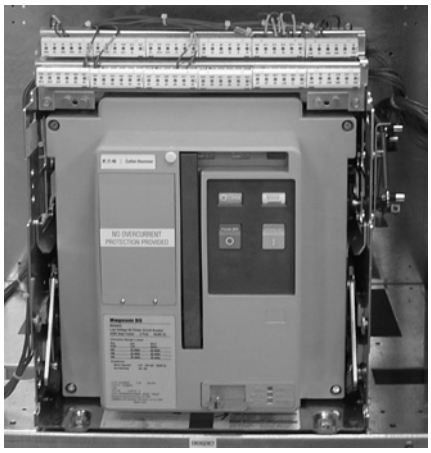
The mechanism utilizes a high speed ≤ than 3-cycle stored energy switching mechanism. This mechanism can be operated manually under a FULL LOAD.

Ease of Coordination and Application — Short Time Withstand

The use of electronic trips has allowed performance curve shaping to facilitate proper system coordination. The most significant is the "short time" rated trip unit.

These trip settings may be set for what are considered extremely high currents for much longer durations than the 3-cycle withstand test required under UL 1008. To facilitate improved coordination, Eaton Magnum transfer switches have been tested and are provided with 30-cycle, extended withstand ratings.

Magnum Switch Features



Magnum Insulated Case Switch

- UL 489 and UL 1008 listed. 4000 and 5000 amperes available as UL 891 only.
- 65 – 100 kA standard withstand ratings.
- 30-cycle, extended withstand ratings.
- ≤ than 3-cycle closing speed.
- Electrically operated.
- True 4-pole switched neutral availability.
- Totally enclosed contact assembly.
- 3A/3B auxiliary contacts for customer connection (each Magnum switch).

Optional Integral Overcurrent Protection Capability

Optional Digitrip™ Magnum Trip Unit

Service Entrance

For service entrance and other applications, Digitrip solid-state trip units can be integrated into the power switching section. This eliminates the need for separate upstream protective devices, saving cost and space. Available with various combinations of Long, Short Time, Instantaneous, Ground Fault Protection, and Communications.

Interlocking for Open Transition Applications

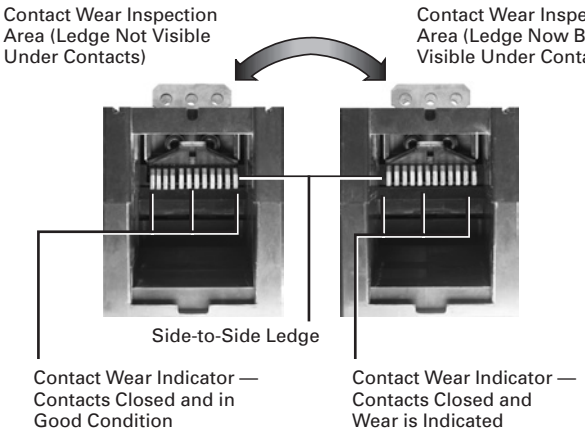
Mechanical Cable Interlock

The open transition type Magnum Transfer Switches feature both mechanical (cable) and electrical interlocking to prevent paralleling of sources.

Multi-Tap Voltage Selector

Voltage Selection Terminals

Allows the transfer switch to be readily applied on most system voltages worldwide by connecting to the proper terminals. Available system voltages include 120, 208, 220, 230, 240, 380, 401, 415, 480 or 600 Vac, 50 or 60 Hz.



Contact Wear Indicators

Logic

Application Versatility

Whether the application calls for open or closed transition, Eaton has the right logic controller for the task. IQ Transfer controllers have set a new standard for transfer switch technology featuring:

- Microprocessor-based logic.
- Digital display.
- Field set point programmability.
- Transfer history.
- PowerNet™ Communications capability.
- Voltmeter and frequency meter.
- True rms voltage sensing.
- Mimic BUS/LED display.
- Load voltage decay delayed transition capability.
- In-phase monitor capability.
- Field upgrade capability.

Automatic Transfer Open Transition

ATC-600 IQ Transfer

Open transition type Magnum transfer switches utilize the Eaton programmable ATC-600 microprocessor-based logic controller.

Refer to technical data TD.15A.05.T.E Open Transition IQ Transfer (ATC-600) for Automatic Transfer Switches for additional information.

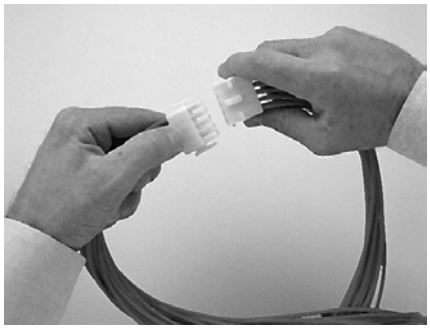
Automatic Transfer Closed Transition

ATC-800 Closed Transition IQ Transfer

Closed transition applications feature the ATC-800 Closed Transition IQ Transfer logic controller.

Refer to technical data TD.15A.09.T.E Closed Transition IQ Transfer (ATC-800) for Automatic Transfer Switches for additional information.

Ease of Maintenance



Logic Disconnect Plugs

Keyed quick-disconnect plugs are provided for easy and complete isolation of the control circuitry.

Maintenance can be performed on the logic independent from the power sections and still allow the user to manually transfer power under full load conditions.

Bypass Isolation Transfer Switch

Bypass Isolation Transfer Switch

Product Description

A bypass isolation switch utilizes loadbreak isolation and bypass transfer power contacts. Thus, should voltage be lost on the line to which the ATS is connected, and should a manual bypass be required to the other line, this can be accomplished safely and quickly as described below. With contactor designs utilizing non-loadbreak isolation and bypass switches, manual bypass to the other line is hindered by mechanical or electrical safety interlocking.

Application Description

The bypass isolation switch is designed for applications where maintenance, inspection and testing must be performed while maintaining continuous power to the load. This is typically required in critical life support systems and standby power situations calling for safe system maintenance with no power disruptions. Such a design allows for the quick removal of the different switching devices for inspection, maintenance or replacement.

Features, Benefits and Functions

The Eaton transfer switch is a rugged, compact design utilizing Magnum power switches or Magnum power circuit breakers to transfer essential loads from one power source to another. Open transition switching devices are interlocked to prevent both switching devices from being closed at the same time. The versatile design, in addition to standard transfer functions, offers an optional integral thermal and short circuit protection in either or both switching devices.

The switching devices are in a compact vertical arrangement. The logic can be easily disconnected from the switching device without disturbing critical connections. The enclosure is free standing, and, by using the specially supplied cleats, the switch is seismic approved (Option 42). The terminals are mounted in the rear of the switch, permitting rear, top, bottom or side cable or bus bar entrance.

The switching devices have a high withstand rating. The high-speed, stored-energy switching mechanism guarantees a transfer time of less than 3 cycles.

Features

- Reliable microprocessor logic.
- Designed to safely withstand fault currents.
- Eliminates need for complex interlocks.
- Most versatile bypass isolation transfer switch available.
- Cutler-Hammer drawout cassette design.
- Overcurrent protection available.
- No loadbreak when bypassing to the same source.
- Drawout capabilities on both ATS and Bypass portions.
- Compact design.
- Ability to test power switching elements during drawout process.
- Power switching devices completely interchangeable between ATS and Bypass portions.

Standards and Certifications

Eaton transfer switch equipment is listed for application by UL and CSA. In addition, Eaton ATSs are listed in File E38116 by Underwriters Laboratories under Standard UL 1008. This standard covers requirements for ATSs intended for use in ordinary locations to provide for lighting and power as follows:

A. In emergency systems, in accordance with Articles 517 and 700 in the National Electrical Code (NEC), American National Standards Institute/National Fire Protection Association (ANSI/NFPA) 70 and the NFPA No. 76A and/or

B. In standby systems, in accordance with Article 702 of the NEC and/or

C. In legally required standby systems in accordance with Article 701 of the NEC. Eaton ATSs are available to meet NFPA 110 for emergency and standby power systems, and NFPA 99 for health care facilities when ordered with the appropriate options. Since Eaton ATSs utilize specially designed switches and/or switching devices as the main power switching contacts, these devices must also be listed under the additional UL Standard 1066. UL utilizes two basic types of listing programs:

   a. Label Service and b) Re-examination. UL 1066 employs a label service listing program which requires an extensive follow-up testing program for listed devices. Standard UL 1008 for ATSs lists devices under the re-examination program which only requires a continual physical re-examination of the components used in the product to ensure consistency with the originally submitted device. Follow-up testing IS NOT required by UL 1008. Representative production samples of switches and switching devices used in Eaton ATSs are subjected to a complete test program identical to the originally submitted devices on an ongoing periodic basis per UL 1066. The frequency of such a re-submittal can be as often as every quarter for a low ampere device.

Note:
IBC seismic qualified.

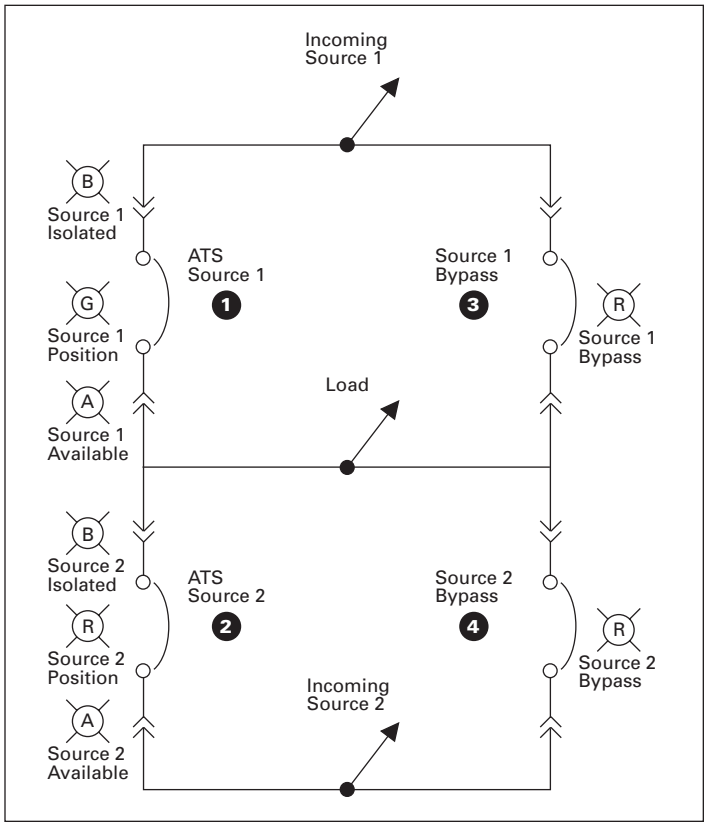


FIGURE 11. TYPICAL BYPASS ISOLATION SWITCH SCHEMATIC

Magnum Bypass Isolation Front View

TABLE 23. WITHSTAND RATINGS

RATING WHEN USED WITH UPSTREAM CIRCUIT BREAKER		RATING WHEN USED WITH UPSTREAM FUSE
TRANSFER SWITCH AMPERE RATING	**3-CYCLE 600 VOLT (KA)**	**30-CYCLE 600 VOLT (KA)**
200	100	85
1000	100	85
1200	100	85
1600	100	85
2000	100	85
2500	100	85
3200	100	85
4000	100	85
5000	100	85

- Tested in accordance with UL 1008.
- Eaton Drawout Magnum Transfer Switch will coordinate with a power switching device short time rating.
- Contact factory for details.

Product Selection

Eaton Transfer Switch Equipment offers flexibility and versatility to the system designer and user. All switches include the basic features necessary for normal operation as standard. Eaton also offers an extensive array of optional features/accessories that allows the user to customize a new transfer switch to match the application. Select the appropriate catalog number for the application from **Table 24** below. Then choose from **Table 44** any optional features/accessories needed to complete the project requirements.

Catalog Number: ATVIMGB33200XRU with Optional Features 16B, 37B and 42.

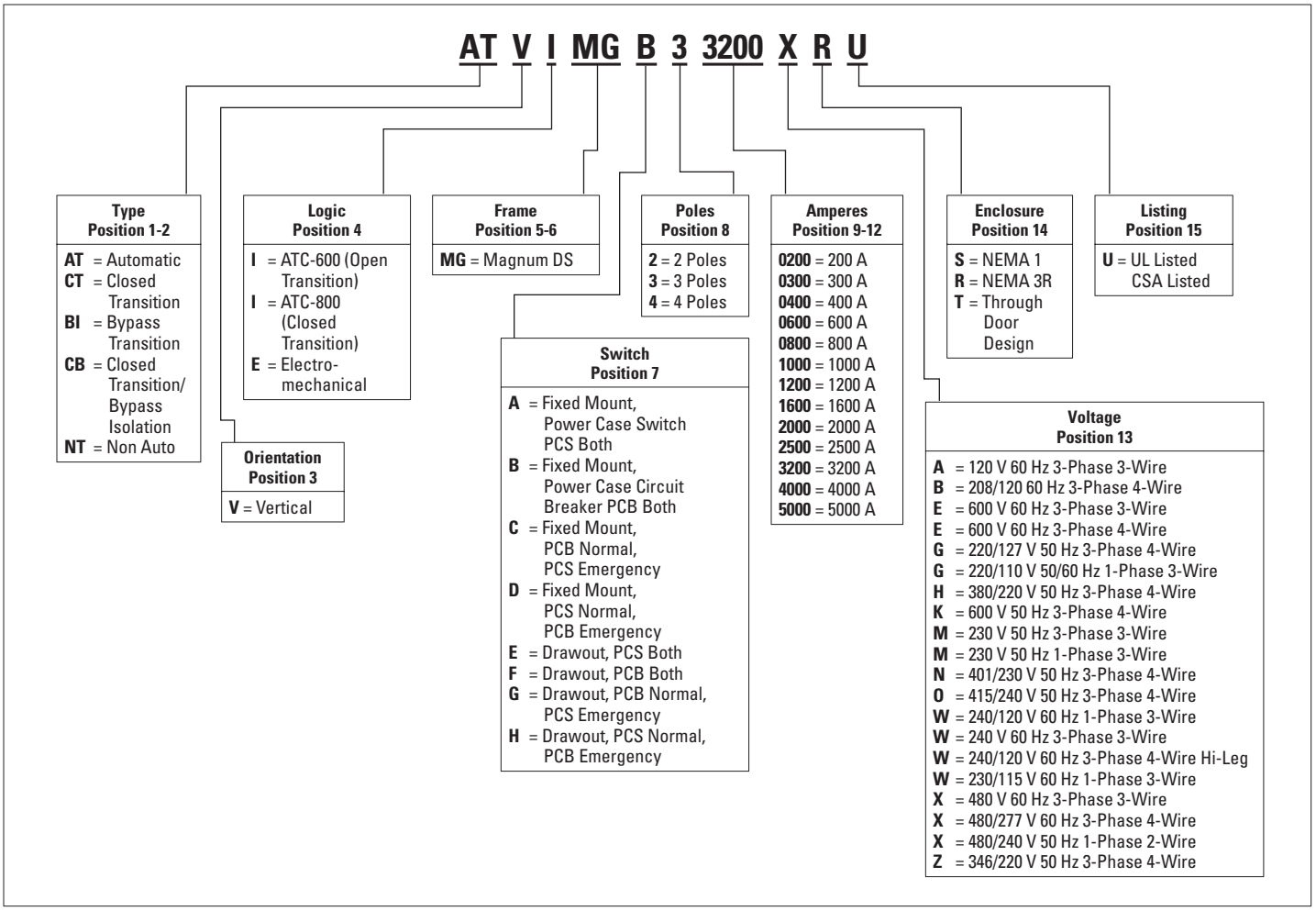
The example above would specify the following:

- Automatic transfer switch.
- Vertical configuration.
- IQ transfer logic.
- Magnum DS frame.
- Fixed mount.
- 3-pole.
- 3200 amperes.
- 480 volts.
- NEMA 1 enclosure.
- UL listed.
- ATC-600 Transfer Logic.
- Integral overcurrent protection both sources.
- Service entrance rated with ground fault protection.
- Seismic Zone 4 qualified.

Catalog Numbering System

TABLE 24. CATALOG NUMBERING SYSTEM — MAGNUM BYPASS, AUTOMATIC AND NON-AUTOMATIC TRANSFER SWITCHES 200 – 5000 AMPERES

Using the Catalog Numbering System provides an overview of the ten basic style/feature categories which generate the 15 digit catalog number.



PCS = Power Case Switch
PCB = Power Circuit Breaker

Dimensions and Weights — Magnum Fixed Mount and Drawout Transfer Switches

Automatic, Non-Automatic and Manual Transfer Switches

Enclosures meet all current applicable NEMA and UL standards for conduit entry, cable bending, gutter space, and shielding of live components.

NEMA 1 and NEMA 3R Enclosures

Magnum Transfer Switches are supplied with a front door only. They can be mounted in a corner or against a wall. Access to cable space can be via either side, bottom, top, or the rear.

Note:
Add 3 inches to the height, 6 inches to the width, and 3 inches to the depth to all enclosure dimensions to account for the seismic Zone 4 mounting brackets.

TABLE 25. MAGNUM FIXED MOUNTED TRANSFER SWITCHES — DIMENSIONS ① IN INCHES (MM)

AMPERE RATING	NUMBER OF POLES	A HEIGHT	B WIDTH	C DEPTH	SHIPPING WEIGHT LBS. (KG)
NEMA 1 Enclosed Fixed Mount Transfer Switch					
200 – 2000	2	90.00 (2286)	32.00 (813)	48.00 (1219)	1050 (477)
200 – 2000	3	90.00 (2286)	32.00 (813)	48.00 (1219)	1050 (477)
200 – 2000	4	90.00 (2286)	32.00 (813)	48.00 (1219)	1250 (568)
2500 – 3200	2	90.00 (2286)	44.00 (1118)	48.00 (1219)	1900 (863)
2500 – 3200	3	90.00 (2286)	44.00 (1118)	48.00 (1219)	1900 (863)
2500 – 3200	4	90.00 (2286)	44.00 (1118)	48.00 (1219)	2000 (910)
4000	2 or 3	91.50 (2324)	48.00 (1219)	48.00 (1219)	1150 (521)
4000	4	91.50 (2324)	54.00 (1372)	48.00 (1219)	1300 (589)
5000	2 or 3	91.50 (2324)	48.00 (1219)	48.00 (1219)	1300 (589)
5000	4	91.50 (2324)	54.00 (1372)	48.00 (1219)	1450 (657)
NEMA 3R Enclosed Fixed Mounted Transfer Switch					
200 – 2000	2	90.00 (2286)	32.00 (711)	63.00 (1600)	1600 (726)
200 – 2000	3	90.00 (2286)	32.00 (711)	63.00 (1600)	1600 (726)
200 – 2000	4	90.00 (2286)	32.00 (711)	63.00 (1600)	1800 (817)
2500 – 3200	2	90.00 (2286)	44.00 (1118)	63.00 (1600)	2400 (1090)
2500 – 3200	3	90.00 (2286)	44.00 (1118)	63.00 (1600)	2400 (1090)
2500 – 3200	4	90.00 (2286)	44.00 (1118)	63.00 (1600)	2500 (1135)
4000	2 or 3	—	—	—	—
4000	4	—	—	—	—
5000	2 or 3	—	—	—	—
5000	4	—	—	—	—

① A wireway is required, See **Table 27**.

Dimensions are approximate in inches (mm).
Should not be used for construction purposes.

TABLE 26. WIREWAY DIMENSIONS — DIMENSIONS IN INCHES (MM)

AMPERE RATING	NUMBER OF POLES	A HEIGHT	B WIDTH	C DEPTH	SHIPPING WEIGHT LBS. (KG)
3200 & Below	All	91.00 (2311)	32.00 (813)	48.00 (1219)	850 (386)
4000	3	91.50 (2324)	38.00 (965)	48.00 (1219)	900 (408)
4000	4	91.50 (2324)	38.00 (965)	48.00 (1219)	1050 (476)
5000	3	91.50 (2324)	38.00 (965)	60.00 (1524)	1100 (498)
5000	4	91.50 (2324)	38.00 (965)	60.00 (1524)	1250 (566)

Note:
All weights are approximate.

TABLE 27. CONNECTION TYPE

CONNECTION TYPE			
LINE	EMERGENCY	LOAD	WIREWAY
Cable	Cable	Cable	Yes
Bus	Cable	Cable	Yes
Cable	Bus	Cable	Yes
Cable	Cable	Bus	Yes
Bus	Bus	Cable	No
Bus	Cable	Bus	No
Cable	Bus	Bus	No
Bus	Bus	Bus	No

Note:
A wireway is required in accordance with **Table 27**.

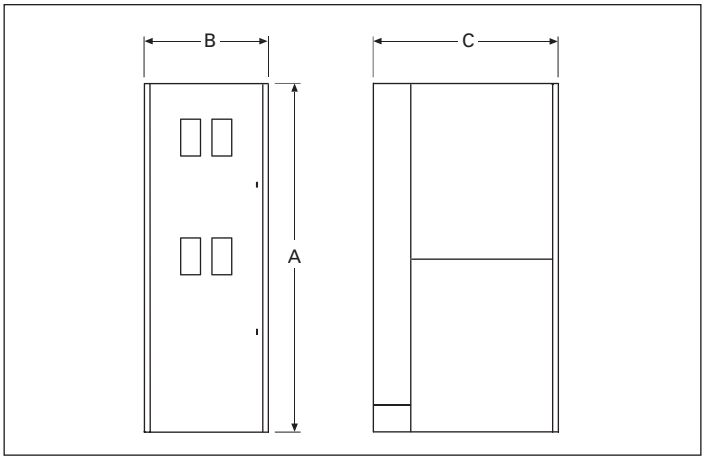


Figure 12. 200 – 2000 Ampere Fixed Mount NEMA 1

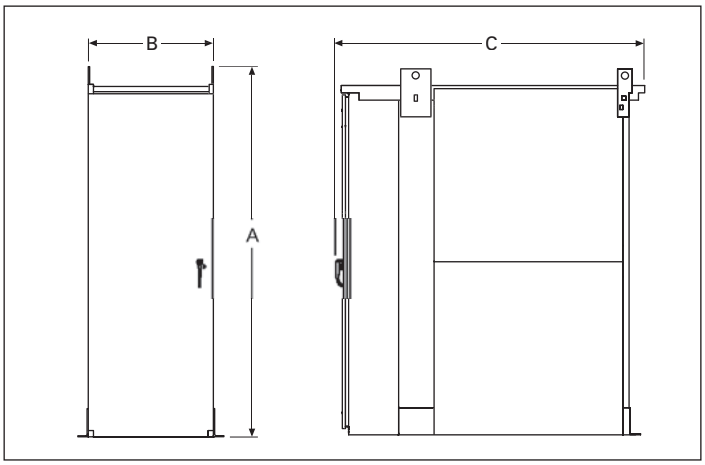


FIGURE 13. 200 – 2000 Ampere Fixed Mount NEMA 3R

TABLE 28. MAGNUM DRAWOUT TRANSFER SWITCHES — DIMENSIONS ① IN INCHES (MM)

AMPERE RATING	NUMBER OF POLES	A HEIGHT	B WIDTH	C DEPTH	SHIPPING WEIGHT LBS. (KG)
NEMA 1 Enclosed Drawout Transfer Switch					
200 – 2000	2	90.00 (2286)	32.00 (813)	60.00 (1524)	1600 (727)
200 – 2000	3	90.00 (2286)	32.00 (813)	60.00 (1524)	1600 (727)
200 – 2000	4	90.00 (2286)	32.00 (813)	60.00 (1524)	1900 (864)
2500 – 3200	2	90.00 (2286)	44.00 (1118)	60.00 (1524)	2500 (1136)
2500 – 3200	3	90.00 (2286)	44.00 (1118)	60.00 (1524)	2500 (1136)
2500 – 3200	4	90.00 (2286)	44.00 (1118)	60.00 (1524)	2800 (1273)
4000	2 or 3	91.50 (2324)	48.00 (1219)	60.00 (1524)	1250 (566)
4000	4	91.50 (2324)	54.00 (1372)	60.00 (1524)	1400 (635)
5000	2 or 3	91.50 (2324)	48.00 (1219)	60.00 (1524)	1400 (635)
5000	4	91.50 (2324)	54.00 (1372)	60.00 (1524)	1550 (703)
NEMA 3R Enclosed Drawout Transfer Switch					
200 – 2000	2	90.00 (2286)	32.00 (813)	75.00 (1905)	2100 (953)
200 – 2000	3	90.00 (2286)	32.00 (813)	75.00 (1905)	2100 (953)
200 – 2000	4	90.00 (2286)	32.00 (813)	75.00 (1905)	2400 (1090)
2500 – 3200	2	90.00 (2286)	44.00 (1118)	75.00 (1905)	3000 (1362)
2500 – 3200	3	90.00 (2286)	44.00 (1118)	75.00 (1905)	3000 (1362)
2500 – 3200	4	90.00 (2286)	44.00 (1118)	75.00 (1905)	3300 (1498)
4000	2 or 3	—	—	—	—
4000	4	—	—	—	—
5000	2 or 3	—	—	—	—
5000	4	—	—	—	—

① A wireway is required, See **Table 30**.

TABLE 29. WIREWAY DIMENSIONS — DIMENSIONS IN INCHES (MM)

AMPERE RATING	NUMBER OF POLES	A HEIGHT	B WIDTH	C DEPTH	SHIPPING WEIGHT LBS. (KG)
3200 & Below	All	91.00 (2311)	32.00 (813)	48.00 (1219)	850 (386)
4000	3	91.50 (2324)	38.00 (965)	48.00 (1219)	900 (408)
4000	4	91.50 (2324)	38.00 (965)	48.00 (1219)	1050 (476)
5000	3	91.50 (2324)	38.00 (965)	60.00 (1524)	1100 (498)
5000	4	91.50 (2324)	38.00 (965)	60.00 (1524)	1250 (566)

Note:
All weights are approximate.

TABLE 30. CONNECTION TYPE

CONNECTION TYPE			
LINE	**EMERGENCY**	**LOAD**	**WIREWAY**
Cable	Cable	Cable	Yes
Bus	Cable	Cable	Yes
Cable	Bus	Cable	Yes
Cable	Cable	Bus	Yes
Bus	Bus	Cable	No
Bus	Cable	Bus	No
Cable	Bus	Bus	No
Bus	Bus	Bus	No

Note:
A wireway is required in accordance with **Table 30**.

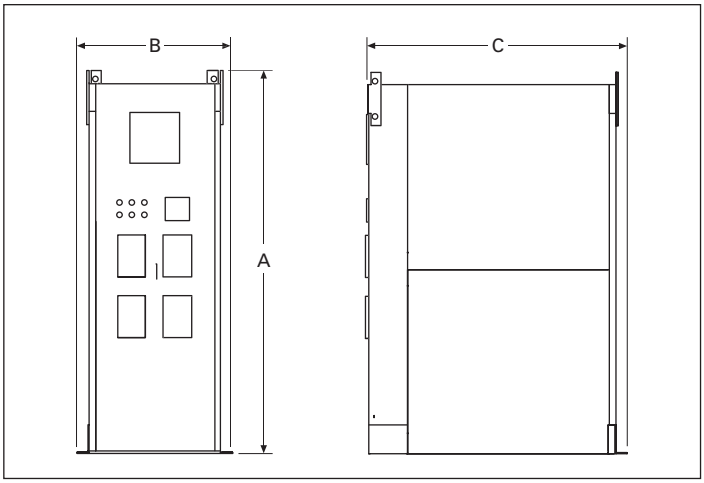


FIGURE 14. 200 – 2000 AMPERE DRAWOUT NEMA 1

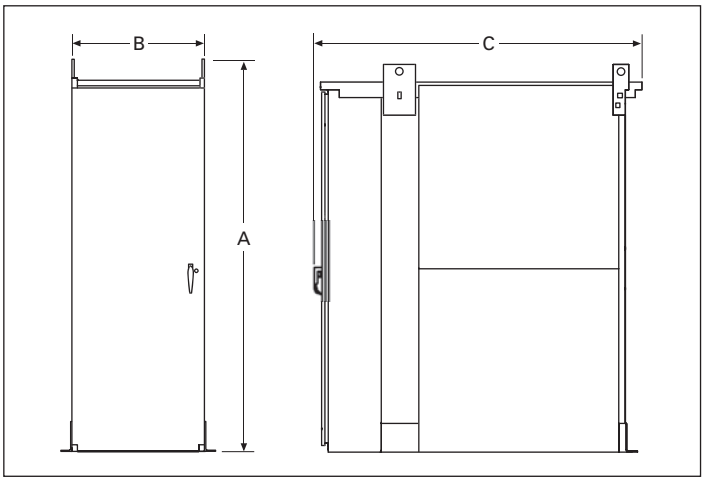


FIGURE 15. 200 – 2000 AMPERE DRAWOUT NEMA 3R

Dimensions are approximate in inches (mm).
Should not be used for construction purposes.

TABLE 31. MAGNUM BYPASS ISOLATION DRAWOUT TRANSFER SWITCHES — DIMENSIONS ① IN INCHES (MM)

AMPERE RATING	NUMBER OF POLES	A HEIGHT	B WIDTH	C DEPTH	SHIPPING WEIGHT LBS. (KG)
NEMA 1 Enclosed Drawout Transfer Switch					
200 – 2000	2	90.00 (2286)	64.00 (1626)	60.00 (1524)	3100 (1409)
200 – 2000	3	90.00 (2286)	64.00 (1626)	60.00 (1524)	3100 (1409)
200 – 2000	4	90.00 (2286)	64.00 (1626)	60.00 (1524)	3700 (1682)
2500 – 3200	2	90.00 (2286)	64.00 (1626)	60.00 (1524)	4700 (2136)
2500 – 3200	3	90.00 (2286)	64.00 (1626)	60.00 (1524)	4700 (2136)
2500 – 3200	4	90.00 (2286)	64.00 (1626)	60.00 (1524)	5500 (2500)
4000	2 or 3	91.50 (2324)	48.00 (1219)	60.00 (1524)	1250 (568)
4000	4	91.50 (2324)	54.00 (1372)	60.00 (1524)	1400 (635)
5000	2 or 3	91.50 (2324)	48.00 (1219)	60.00 (1524)	1400 (635)
5000	4	91.50 (2324)	54.00 (1372)	60.00 (1524)	1550 (703)
NEMA 3R Enclosed Drawout Transfer Switch					
200 – 2000	2	90.00 (2286)	64.00 (1626)	75.00 (1905)	3700 (1682)
200 – 2000	3	90.00 (2286)	64.00 (1626)	75.00 (1905)	3700 (1682)
200 – 2000	4	90.00 (2286)	64.00 (1626)	75.00 (1905)	4300 (1955)
2500 – 3200	2	90.00 (2286)	64.00 (1626)	75.00 (1905)	5300 (2410)
2500 – 3200	3	90.00 (2286)	64.00 (1626)	75.00 (1905)	5300 (2410)
2500 – 3200	4	90.00 (2286)	64.00 (1626)	75.00 (1905)	6000 (2730)
4000	2 or 3	—	—	—	—
4000	4	—	—	—	—
5000	2 or 3	—	—	—	—
5000	4	—	—	—	—

① A wireway is required, See **Table 33**.

TABLE 32. WIREWAY DIMENSIONS — DIMENSIONS IN INCHES (MM)

AMPERE RATING	NUMBER OF POLES	A HEIGHT	B WIDTH	C DEPTH	SHIPPING WEIGHT LBS. (KG)
3200 & Below	All	91.00 (2311)	32.00 (813)	48.00 (1219)	850 (386)
4000	3	91.50 (2324)	38.00 (965)	48.00 (1219)	900 (408)
4000	4	91.50 (2324)	38.00 (965)	48.00 (1219)	1050 (476)
5000	3	91.50 (2324)	38.00 (965)	60.00 (1524)	1100 (498)
5000	4	91.50 (2324)	38.00 (965)	60.00 (1524)	1250 (566)

Note:
All weights are approximate.

TABLE 33. CONNECTION TYPE

CONNECTION TYPE			
LINE	**EMERGENCY**	**LOAD**	**WIREWAY**
Cable	Cable	Cable	Yes
Bus	Cable	Cable	Yes
Cable	Bus	Cable	Yes
Cable	Cable	Bus	Yes
Bus	Bus	Cable	No
Bus	Cable	Bus	No
Cable	Bus	Bus	No
Bus	Bus	Bus	No

Note:
A wireway is required in accordance with **Table 33**.

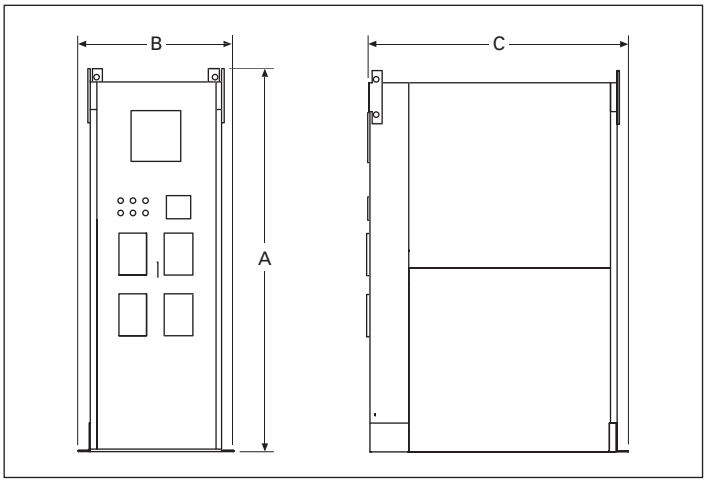


FIGURE 16. 200 – 2000 AMPERE DRAWOUT MOUNT NEMA 1

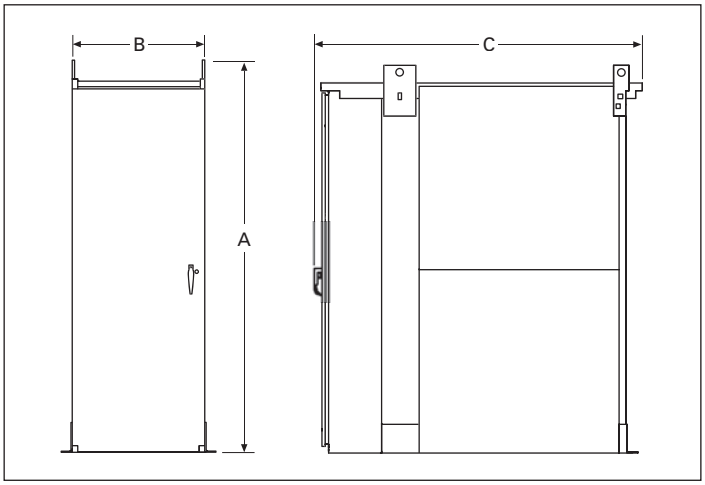
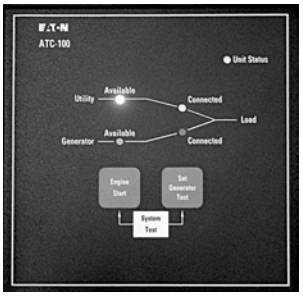


FIGURE 17. 200 – 2000 AMPERE DRAW-OUT MOUNT NEMA 3R

Dimensions are approximate in inches (mm).
Should not be used for construction purposes.

ATC-100 Controller



ATC-100 Controller

Product Description

The ATC-100 Controller is a comprehensive, multi-function, microprocessor- based ATS controller. It is a compact, self-contained, panel mounted device designed to replace traditional relay and solid-state logic panels.

Application Description

The ATC-100 Controller provides an unmatched degree of programmed flexibility to address the needs of any system. It operates from all system voltages between 120 and 480 Vac, single-phase and 3-phase, at 50 or 60 Hz. In addition, a period of no control power operation is provided. The ATC-100 Controller monitors the condition of the 3-phase line-to-line voltage and frequency of both the Utility and Generator power sources. It can also be set up for single-phase operation. The ATC-100 Controller provides the necessary intelligence to ensure that the transfer switch operates properly through a series of programmed sensing and timing functions.

Features, Benefits and Functions

Standard Features

- Auxiliary relay contacts:
  - Source 1 Present 2NO & 2NC
  - Source 2 Present 2NO & 2NC
- Switch position indication contacts:
  - Source 1 Position 1NO & 1NC
  - Source 2 Position 1NO & 1NC
- Source 1 & Source 2 sensing:
  - Undervoltage/underfrequency
  - Overvoltage/overfrequency
  - 3-phase rotation protection
  - 3-phase voltage unbalance/loss
- Pre-transfer signal contacts 1NO/1NC.
- Go to Emergency (Source 2).
- Seven field programmable time delays.
- LCD-based display for programming, system diagnostic and Help message display.
- Mimic diagram with source available and connected LED indication.
- Time-stamped history log.
- System test pushbutton.
- Programmable plant exerciser — OFF, daily, 7, 14, 28-day interval selectable run time 0 – 600 minutes no load/load with fail-safe.
- Safe manual operation under full load with permanently affixed operating handle.
- Monitor Utility and Generator power source voltages and Generator power source frequency.
- Provide undervoltage protection of the Utility and Generator power sources.
- Provide underfrequency and overfrequency protection of the and Generator power source.
- Permit easy customer set-up.
- Permit system testing.
- Provide faceplate source status indications.

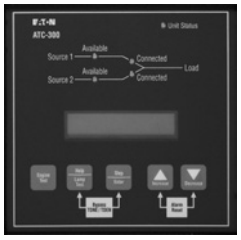
TABLE 34. CONTROLLER SETTINGS

DESCRIPTION	RANGE	FACTORY DEFAULT	FIXED/ JUMPER
Time Delay Engine Start	3 Seconds	3 Seconds	Fixed Setting
Time Delay Normal to Emergency	2 or 15 Seconds	15 Seconds	Jumper-Selectable
Time Delay Emergency to Normal	5 Minutes	5 Minutes	Fixed Setting
Time Delay Engine Cool-off	5 Minutes	5 Minutes	Fixed Setting
Time Delay Emergency Fail Timer	6 Seconds	6 Seconds	Fixed Setting
Nominal Frequency	50 or 60 Hz	As Ordered	Jumper-Selectable
Nominal Voltage	120, 208, 220, 230, 240, 380, 415 or 480 Volts	As Ordered	Jumper-Selectable
Three-Phase or Single-Phase	1 or 3	As Ordered	Jumper-Selectable
Utility Undervoltage Dropout	80% of Nominal Voltage	80% of Nominal Voltage	Fixed Setting
Generator Undervoltage Dropout	80% of Nominal Voltage	80% of Nominal Voltage	Fixed Setting
Utility Undervoltage Pickup	90% of Nominal Voltage	90% of Nominal Voltage	Fixed Setting
Generator Undervoltage Pickup	90% of Nominal Voltage	90% of Nominal Voltage	Fixed Setting
Generator Underfrequency Dropout	90% of Nominal Frequency	90% of Nominal Frequency	Fixed Setting
Generator Underfrequency Pickup	95% of Nominal Frequency	95% of Nominal Frequency	Fixed Setting
Generator Overfrequency Dropout	Off or 115% of Nominal Frequency	Off	Jumper-Selectable
Generator Overfrequency Pickup	Off or 110% of Nominal Frequency	Off	Jumper-Selectable
Generator Test On/Off	Off, No Load Transfer, Load Transfer	Off	Jumper-Selectable
Generator Test Interval	7-Day, 14-day, or 28-day	7-Day	Jumper-Selectable
Engine Run Test Time	15 Minutes	15 Minutes	Fixed Setting

TABLE 35. ATC-100 CONTROLLER SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Input Control Voltage	95 to 145 Vac 50/60 Hz
Voltage Measurements of	Utility V_{AB} Generator V_{AB} Utility V_{BC} Generator V_{BC} Utility V_{CA} Generator V_{CA}
Voltage Measurement Range	0 to 575 Vac rms (50/60 Hz)
Voltage Measurement Accuracy	±1% of Full Scale
Frequency Measurements of	Generator
Frequency Measurement Range	40 Hz to 70 Hz
Frequency Measurement Accuracy	±0.3 Hz Over the Measurement Range
Undervoltage Dropout	80% of the Nominal System Voltage
Undervoltage Pickup	90% of the Nominal System Voltage
Underfrequency Dropout Range	90% of the Nominal System Frequency
Underfrequency Pickup Range	95% of the Nominal System Frequency
Overfrequency Dropout Range	115% of the Nominal System Frequency
Overfrequency Pickup Range	110% of the Nominal System Frequency
Operating Temperature Range	-20 to +70°C (-4 to +158°F)
Storage Temperature Range	-30 to +85°C (-22 to +185°F)
Operating Humidity	0 to 95% Relative Humidity (Non-condensing)
Operating Environment	Resistant to Ammonia, Methane, Nitrogen, Hydrogen and Hydrocarbons
Generator Start Relay	5 A, 1/6 hp @ 250 Vac 5 A @ 30 Vdc with a 150 W Maximum Load
K1, K2 Relays	10 A, 1 – 3 hp @ 250 Vac 10 A @ 30 Vdc
Applicable Testing	UL Recognized Component UL 1008, UL 991 Environmental IEC 61000-4-2, 61000-4-3, 61000-4-4, 61000-4-5, 61000-4-6, 61000-4-11 CISPR 11, Class B FCC Part 15, Class B
Enclosure Compatibility	NEMA 1, NEMA 3R and NEMA 12 UV Resistant ATC-100 Faceplate

ATC-300 Controller



ATC-300 Controller

Product Description

AT3 switches are equipped with the high-performance ATC-300 digital transfer controller for rock-solid monitoring, status reporting and transfer control operation. Superior design and robust construction make the AT3 the industry benchmark for critical and distributed power systems.

Application Description

The Cutler-Hammer AT3 Automatic Transfer Switch from Eaton's electrical business is designed to provide unmatched performance, reliability and versatility for critical standby power applications.

Features, Benefits and Functions

Standard Features

- Auxiliary relay contacts:
  - Source 1 Present 2NO & 2NC
  - Source 2 Present 2NO & 2NC
- Switch position indication contacts:
  - Source 1 Position 1NO & 1NC
  - Source 2 Position 1NO & 1NC
- Source 1 & Source 2 sensing:
  - Undervoltage/underfrequency
  - Overvoltage/overfrequency
  - 3-phase rotation protection
  - 3-phase voltage unbalance/loss
- Pre-transfer signal contacts 1NO/1NC.
- Go to Emergency (Source 2).
- Seven field programmable time delays.
- LCD-based display for programming, system diagnostic and Help message display.
- Mimic diagram with source available and connected LED indication.
- Time-stamped history log.
- System test pushbutton.
- Programmable plant exerciser — OFF, daily, 7, 14, 28-day interval selectable run time 0 – 600 minutes no load/load with fail-safe.
- Safe manual operation under full load with permanently affixed operating handle.

Optional Features

- Suitable for Use as Service Equipment in the standard enclosure size.
- Available TVSS surge suppression for power/controller, engine start circuit, phone and cable connections.
- Integrated distribution panels.
- Field-selectable multi-tap transformer panel permits operation on a wide range of system voltages.
- Integral overcurrent protection.
- Space heater with thermostat.
- Ammeter — load side.
- Stainless steel cover for controller.

TABLE 36. PROGRAMMING SELECTIONS

PARAMETERS	SET POINTS
TDNE	0 to 1800 Seconds
TDEN	0 to 1800 Seconds
TDEC	0 to 1800 Seconds
TDES	0 to 120 Seconds
TDN	0 to 120 Seconds
TDEF	0 to 6 Seconds
In Phase	Enabled or Disabled
In Phase Frequency Difference	0.0 to 3.0 Hz
Sync Time	1 to 60 Minutes
Pre-Transfer Signal Service	0 to 120 Seconds
Plant Exerciser	Disabled, 7, 14 or 28 Day Interval, 0 – 600 Minutes, Load or No Load
Sensing	3-phase or 1-phase
System Selection	Utility — Utility or Utility — Generator
PT Ratio	2:1 to 500:1
Commit to Transfer in TDNE	0 or 1
Re-Transfer Mode	Automatic or Manual
Engine Test Mode	Disabled, Load or No Load

Product Specifications

TABLE 37. ATC-300 CONTROLLER SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Input Control Voltage	65 to 145 Vac 50/60 Hz
Voltage Measurements of	Source 1 V_{AB} Source 2 V_{AB} Source 1 V_{BC} Source 2 V_{BC} Source 1 V_{CA} Source 2 V_{CA}
Voltage Measurement Range	0 to 790 Vac rms (50/60 Hz)
Voltage Measurement Accuracy	±2% of Nominal Input Voltage
Frequency Measurement for	Source 1 and Source 2
Frequency Measurement Range	40 Hz to 70 Hz
Frequency Measurement Accuracy	±0.1 Hz
Undervoltage Dropout Range	50% to 90% of Nominal Voltage
Undervoltage Pickup Range	(Dropout +2%) to 99% of the Nominal System Voltage
Overvoltage Dropout Range	105% to 120% of Nominal Voltage
Overfrequency Pickup Range	101% to (Dropout -1 Hz) of the Nominal System Frequency
Underfrequency Dropout Range	90 to 97% of the Nominal System Frequency
Underfrequency Pickup Range	(Dropout +1 Hz) to 99% of the Nominal System Frequency
Overfrequency Dropout Range	103 to 110% of the Nominal System Frequency
Overfrequency Pickup Range	101% to (Dropout -1 Hz) of the Nominal System Frequency
Operating Temperature Range	-20 to +70°C (-4 to +158°F)
Storage Temperature Range	-30 to +85°C (-22 to +185°F)
Operating Humidity	0 to 95% Relative Humidity (Non-condensing)
Operating Environment	Resistant to Ammonia, Methane, Nitrogen, Hydrogen and Hydrocarbons
Generator Start Relay	5 A, 1/6 hp @ 250 Vac / 5 A @ 30 Vdc with a 150 W Maximum Load
K1, K2, Pretransfer, Alarm Relays	10 A, 1 – 3 hp @ 250 Vac / 10 A @ 30 Vdc
Applicable Testing	UL Recognized Component Meets Intent of UL 991, 1008 Meets IEC 1000-4-2, 1000-4-3, 1000-4-4, 1000-4-5, 1000-4-6, 1000-4-11 Meets CISPR 11, Class A Complies with FCC Part 15, Class A
Enclosure Compatibility	NEMA 1, NEMA 3R, and NEMA 12 UV Resistant ATC-300 Faceplate

ATC-600 Controller

IQ Transfer Controller

ATC-600

Product Description

Eaton's Cutler-Hammer ATC-600 is a microprocessor-based logic controller to be used with Cutler-Hammer transfer switches. This device is door-mounted and provides the operator with an at-a-glance overview of switch status and parameters, as well as key diagnostic data. Real-time values for volts and frequency can be viewed via the front panel LED display, along with an indication of the power source currently in use.

The ATC-600 continuously monitors either single-phase or 3-phase voltages for Source 1, Source 2, and the load. When the Source 1 voltage or frequency is detected to be below the customer programmed set points, transfer to Source 2 is initiated. When the Source 2 voltage and frequency are detected to be within the programmed parameters, the transfer occurs. While the load is connected to Source 2, the ATC-600 continues to monitor Source 1. As soon as the Source 1 voltage and frequency return to within the programmed limits, and after a programmed time delay, a re-transfer back to Source 1 is initiated.

The ATC-600 uses microprocessor technology to provide the operator with a vast array of selections. Depending on the application, the user can "customize" the ATC-600 to meet the particular application. A summary of several key selections is listed in **Table 38.**

Application Description

The ATC-600 is equipped to display history information either via the front panel or over PowerNet. Source 1 and Source 2 Run Time, Available Time, and Connect Time are available, as well as Load Energized Time, Number of Transfers, and the Date, Time and Reason for the Last 16 Transfers.

For communications capability, the ATC-600 can be equipped with a PONI card which will allow the user to communicate with the unit via Series III software. All settings for purchased options can be set from the faceplate of the unit or downloaded over PowerNet. Series III software allows for charting of key historical data, as well as providing the capability to monitor and control the transfer switch from a remote location.

For further information on PowerNet products and software, see **Section 25** of Eaton's 14th edition of the *Consulting Application Guide*.

TABLE 38. PROGRAMMING SELECTIONS

PARAMETERS	SET POINTS
TDNE	0 to 1800 Seconds
TDEN	0 to 1800 Seconds
TDEC	0 to 1800 Seconds
TDES	0 to 120 Seconds
TDN ①	0 to 120 Seconds or
	Based on Load Voltage Decay (2 – 30% of Nominal Voltage)

① Optional features.

TABLE 38. PROGRAMMING SELECTIONS (CONTINUED)

PARAMETERS	SET POINTS
TDEF	0 to 6 Seconds
In Phase	Enabled or Disabled
IPFD ②	0.0 to 3.0 Hz
SYNC ③	1 to 60 Minutes
Load Sequencing ①	Up to 10 Devices (Via Subnetwork)
Pre-Transfer Signal Device ①	0 to 120 Seconds Up to 10 Devices (Via Subnetwork)
Plant Exerciser ①	Load or No Load Transfer (Selectable)
Preferred Source Selector ①	Source 1 or Source 2 or None
Sensing	3-Phase or 1-Phase
System Selection	Utility/Generator or Dual Utility or Dual Generator

② In Phase Frequency Difference.
③ Sync Time Allowance.

Product Specifications

TABLE 39. SPECIFICATIONS

DESCRIPTION		SPECIFICATION
Input Control Power Range		65 Vac rms to 160 Vac rms (50/60 Hz)
Voltage Measurements of		Source 1 V_{AB} Source 2 V_{AB} Load V_{AB} Source 1 V_{BC} Source 2 V_{BC} Load V_{BC} Source 1 V_{CA} Source 2 V_{CA} Load V_{CA}
Voltage Measurement Range		0 to 790 Vac rms (50/60 Hz)
Voltage Measurement Accuracy		±2% of Nominal Input Voltage
Frequency Measurement for		Source 1 and Source 2
Frequency Measurement Range		40 Hz to 80 Hz
Frequency Measurement Accuracy		±0.1 Hz
Undervoltage Sensing		Source 1 and Source 2
Undervoltage Dropout Range		50% to 90% of Nominal Voltage
Overvoltage Dropout Range ④		105% to 120% of Nominal Voltage
Underfrequency Dropout Range ④		90% to 100% of Nominal Frequency
Overfrequency Dropout Range ④		100% to 120% of Nominal Frequency
Contact Outputs:	Two Form A Contacts for Generator start	5 A 250 Vac; 5 A 30 Vdc
	Four Form A Contacts for Control Functions	10 A 250 Vac; 10 A 30 Vdc
	Three Form C Contacts for Control Functions	10 A 250 Vac; 10 A 30 Vdc
Communications Output Over PowerNet (Optional)		PONI (Product Operated Network Interface)
Front Panel Indications:	Automatic Mode	Blinking LED Indicates Automatic Operation
	Test Mode	LED Illuminated Indicating the Unit is in the TEST Mode
	Program Mode	LED Illuminated Indicating the Unit is in the Program Mode Blinking LED Indicates User is Viewing Set Points in Program Mode
LED Lights to Indicate		Source 1 Available (Amber), Source 2 Available (Amber), Source 1 Connected (Green), Source 2 Connected (Red), Source 1 Preferred (Red), Source 2 Preferred (Red), Load Energized (Red)
LED Display to Indicate		History Information, Set Points, Real-Time Clock
Environmental Temperature Range		Operation: -20°C to +70°C Storage: -30°C to +85°C
Applicable Standards		UL 1008, UBC and BOCA for Seismic Zone 4

④ Optional features.

ATC-800 Controller

Closed Transition IQ Transfer Controller

ATC-800

Product Description

The Closed Transition IQ Transfer [CTIQ Transfer (ATC-800)] is a programmable, microprocessor-based monitoring device designed for use in Eaton Closed Transition Transfer Switches (CTVI/CBVI). By using the Eaton CTIQ Transfer (ATC-800), the user may avoid intentional interruption of power when both sources of power are available. This make-before-break mode of operation is useful during testing of the engine generator under load and where a predetermined transfer to the generator is desired. Source paralleling duration is limited to less than 100 msec.

Passive Closed Transition

The Closed Transition mode of operation requires that both power sources be synchronized in voltage, frequency and phase angle within prescribed limits. Eaton's CTIQ Transfer (ATC-800) utilizes a technique that involves waiting for synchronization of the two sources without actively controlling the generator's voltage or frequency. The mode of operation is anticipatory in that the switch close command is initiated before the sources are exactly in-phase. Utilizing the phase angle and frequency difference between the two sources, a calculation is made to predict when both sources would be in-phase. The response time of the switch is then factored in to determine when the switch close signal should be given to assure optimal closure of the two sources in-phase.

The Eaton Closed Transition IQ Transfer (ATC-800) must be selected with one of two feature sets: 47C or 47D. The difference between these two feature sets is the action taken by the CTIQ Transfer (ATC-800) if it is determined that the two sources will not achieve synchronization. If Feature set 47C is selected, failure to synchronize results in the switch reverting to an Open Transition mode of operation. However, if Feature set 47D is selected, failure to synchronize will result in the CTIQ Transfer (ATC-800) refusing to Transfer to Source 2 and an alarm signal being activated. In neither case will there be a paralleling of sources if synchronization is not achieved.

Application Description

- The generator used with a closed transition transfer switch must be equipped with an isochronous governor.
- When paralleling sources, fault current contributions from both sources should be considered in the system design.
- Closed Transition (make-before-break) technology causes paralleling with the Source 1. It is the user's responsibility to comply with any requirements regarding protective relaying. Protective relaying is not supplied with the standard transfer switch, but is available.

Switch Application Section

Eaton Closed Transition IQ Transfer (ATC-800) Features

The CTIQ Transfer (ATC-800) is a door-mounted, totally enclosed device that is customer accessible from the transfer switch front panel.

Data access and programming operations are performed using the CTIQ (ATC-800) Transfer's touch-sensitive function buttons in conjunction with an easy-to-read, illuminated, alphanumeric LED display. Both the function buttons and the display window are part of the device's front panel. A built-in Help button provides user assistance in the form of message displays.

The CTIQ Transfer (ATC-800) is communications ready and compatible with all Eaton IQ devices as well as the Eaton PowerNet system-wide supervisory and control software. This permits monitoring and control of several transfer switches, locally or remotely, from a single point.

Features, Benefits and Functions

Additional Features

- Source paralleling duration is limited to 100 misc. or less.
- Applicable for use on any low or medium voltage application through 38 kV.
- True rms three-phase voltage sensing on Normal, Source 2 and Load.
- Frequency sensing on Normal and Source 2.
- Programmable set points stored in non-volatile memory.
- PowerNet Communication to personal computer either on-site or remote.
- Historical data on most recent transfers (up to 16 events) viewable at switch. Unlimited history storage (remote) available when used with PowerNet software.
- Wide range of user-selectable option combinations.
- Load sequencing.
- Engine start contacts.
- Engine Test Switch with user-selectable Test Mode and Fail-Safe.
- Alarm contact (multiple alarm functions available).
- Pre-transfer signal.
- Heartbeat Monitor (flashing green Automatic light signifies that the CTIQ Transfer (ATC-800) is operating properly).
- Instrumentation:
  - Voltmeter (Accuracy ±1%)
  - Reads line-to-line on Sources 1 and 2 and Load
  - Frequency Meter (40 – 80 Hz, accuracy ±.1 Hz)
  - Source Available Time (both sources)
  - Source Connected Time (both sources)
  - Source Run Time

ATC-800 Programming

Button Functions

Three buttons provide easy access to all commonly used CTIQ Transfer (ATC-800) functions.

When the preferred source is connected and the ATS is operating normally, the Automatic indicator light will be flashing and the display window will be blank.

Using the Display Select button, the operator can step through each of the six display families:

- Source 1.
- Source 2.
- Load.
- History.
- Time/Date.
- Set Points.

Note:
Stepping through the various display modes does not alter preset values or otherwise affect operation of the ATS.

ATC-800 Closed Transition IQ Transfer Controller

Once the desired display family is selected, the user may press the Step button to cycle through specific parameters or metered values shown in the display window.

Initial Programming

Factory programming will load all customer specified functions and presets. At the customer's request, Eaton will add, delete or adjust optional features.

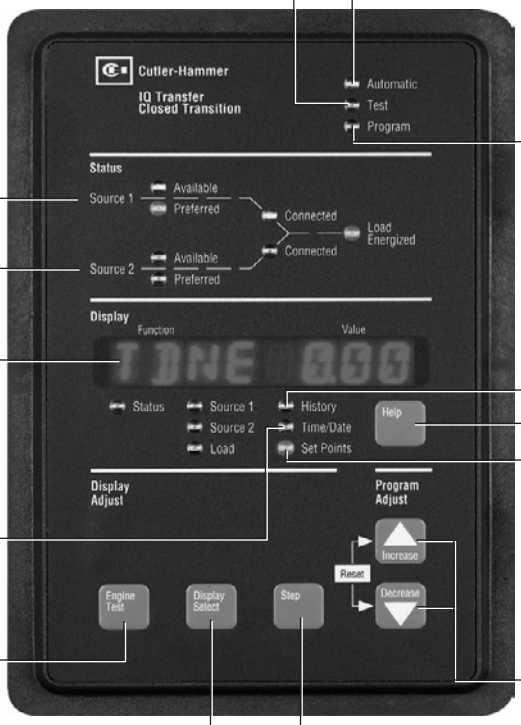
Customer Programming

Customers may reprogram set points and other parameters to match their application, using the Program switch located on the rear of the unit. Once the programming mode has been activated and the Program light is flashing, the user may access Set Point settings by pressing the Display Select button until the Set Points LED is illuminated. Values for individual set points may then be altered by pressing the Increase or Decrease buttons. Once a parameter has been reset, the user advances to the next set point by pressing the Step button.

While the CTIQ Transfer (ATC-800) is in the Program mode, the device continues to operate in accordance with the previously programmed set points and parameters. The unit is never off-line, and preset values do not change until programming has been completed.

Once reprogramming is complete, the user may return the Program switch to the Run position. At this point, all new values are stored in the CTIQ's (ATC-800) non-volatile memory, and the unit returns to Automatic mode.

Closed Transition IQ Transfer (ATC-800) Front Panel Display and Button Functions



Test
Indicator light is on when unit is in Test mode.

Automatic
LED indicates that the ATS is operating normally and is in the Automatic mode.

Program
LED indicates until is in Programming mode. (**Note:** This mode is activated using the Program switch located on the rear of the unit.

Source 1, Source 2, and Load
Colored LED lights show status of both Sources and Load.

History
By pressing the Display Select button to light the History LED and the Step button to rotate through available data, historical or cumulative values for Available Time (Both Sources), Connected Time (Both Sources), Number of Transfers and Date/Time Reason for last 16 transfers are displayed.

LED Display
Unit will provide LED readout showing actual metered values for Voltage, Frequency and Condition (including Normal, Undervoltage, Overvoltage, etc.

Help
Pressing the Help button in any function mode will bring up display messages, explanations and prompts to assist the operator.

Time/Date
Displays real-time clock. Clock can be easily set in this mode using the Increase and Decrease buttons.

Set Points
Selecting this LED permits the user to display existing programmed values.

Engine Test Buttons
Pressing this button twice Initiates an engine test.

Increase/Decrease
A detailed explanation of these buttons can be found in the Operation section.

Display Select
- Source 1
- Source 2
- Load
- History
- Time/Date
- Set Points

Button is discussed in Operation section.

Step Button
Shows multiple variables under each display select function.

Definitions

Closed Transition: Closed transition is a feature that will temporarily parallel two live sources in a make-before-break scheme when performing a transfer. The CTIQ (ATC-800) Transfer will close the switching devices for both sources, paralleling both sources, for a maximum time of 100 milliseconds after the sources are synchronized.

Open Transition/In-Phase Monitor: In-Phase monitor is a feature that will allow a transfer between two sources only when the phase difference between the two sources is near zero. This is an open transition transfer that prevents inrush currents from exceeding normal starting currents in the case where motor loads are being transferred.

Open Transition/Delayed with Load Voltage Decay: Load voltage decay transfer is a feature that, after opening the switch for the original source, holds in the neutral position until the voltage on the load is less than 30% of rated voltage. This is an open transition that prevents inrush currents from exceeding normal starting currents in the case where motor loads are being transferred.

Operation

The Eaton CTIQ (ATC-800) Transfer operates in the following modes to meet most load management applications:

- Loss of Normal Power
  - Open Transition to Alternate Source
- Normal Power Restored
  - Closed Transition back to Normal Source
- Peak Shave (Remote or Local)
  - Closed Transition to and from Alternate Source
- Test (User Selectable)
  - Load Transfer — Closed Transition to and from Alternate Source
  - No-Load Transfer — Starts Alternate Power Source and Allows to Run Unloaded; No Transfer Takes Place

Closed Transition Operation Modes

Feature Set 47C Closed/In-Phase/Load Voltage Decay

CTIQ (ATC-800) Transfer controllers equipped with Feature Set 47C execute the following sequence of operations upon receipt of a request for transfer: the controller waits (for a pre-selected time frame) for synchronization of voltage and frequency. If achieved, a closed transition transfer occurs. Failure to synchronize results in the controller defaulting to an in-phase monitor, open transition, mode of operation. If the two sources fail to achieve frequency synchronization within the user selectable range, the controller defaults to an open transition using a Load Voltage Decay delayed transition.

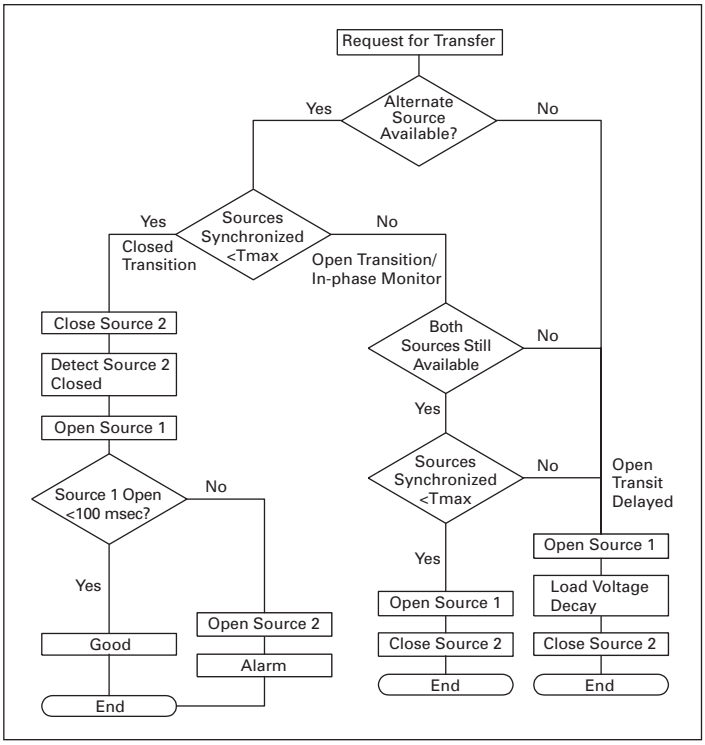


FIGURE 18. FEATURE SET 47C SCHEMATIC

TABLE 40. CLOSED TRANSITION/IN-PHASE STANDARD FEATURES

STANDARD FEATURES	CUSTOMER ADJUSTMENTS
Closed Transition Frequency Difference (Hz)	0.0 to 0.3 Hz
Closed Transition Voltage Difference (Volts)	1 to 5%
In-phase Transition Frequency Difference (Hz)	0.0 to 0.3 Hz
Closed Transition Synchronization Timer	1 to 60 Minutes
In-phase Transition Synchronization Timer	1 to 60 Minutes

In-Phase Transfer

Feature Set 47D Closed Only

CTIQ (ATC-800) Transfer controllers equipped with Feature Set 47D only transfer to an alternate source when both sources are synchronized. For synchronization to occur, both voltage and frequency differentials must fall within the user selectable ranges. If synchronization does not occur (within a pre-selected amount of time) the controller will maintain load connection to the current power source and initiate an alarm.

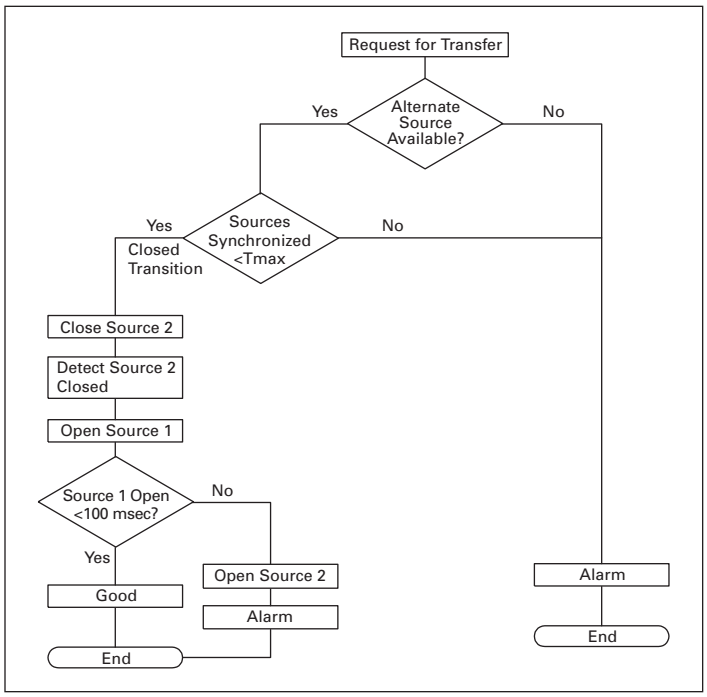


FIGURE 19. FEATURE SET 47D SCHEMATIC

TABLE 41. CLOSED TRANSITION STANDARD FEATURES

STANDARD FEATURES	CUSTOMER ADJUSTMENTS
Closed Transition Frequency Difference (Hz)	0.0 to 0.3 Hz
Closed Transition Voltage Difference	1 to 5%
Closed Transition Synchronization Timer	1 to 60 Minutes

TABLE 42. ATC CONTROLLER FEATURE SELECTION CHART

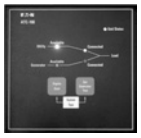
FEATURE DESCRIPTION	 ATC-100	 ATC-300	 ATC-600	 ATC-800
Transition				
Open Transition	Standard	Standard	Standard	Standard
Closed Transition	Not Available	Not Available	Not Available	Standard
Timers				
Time Delay Normal to Emergency (TDNE)	Standard	Standard	Standard	Standard
Time Delay Engine Start (TDES)	Standard	Standard	Standard	Standard
Time Delay Emergency to Normal (TDEN)	Standard	Standard	Standard	Standard
Time Delay Engine Cooldown (TDEC)	Standard	Standard	Standard	Standard
Time Delay Emergency Fail (TDEF)	Standard	Standard	Standard	Standard
Engine/Generator exerciser				
Plant Exerciser (PE) with Fail-Safe	Selectable — OFF, 7, 14, 28 Day Interval Selectable Run Time 0 – 600 Minutes No Load/Load with Fail-safe	Programmable — OFF, Daily, 7, 14, 28 Day Interval Selectable Run Time 0 – 600 Minutes No Load/Load with Fail-safe	Programmable — OFF, Daily, 7, 14, 28 Day Interval Selectable Run Time 0 – 600 Minutes No Load/Load with Fail-safe	Programmable — OFF, Daily, 7, 14, 28 Day Interval Selectable Run Time 0 – 600 Minutes No Load/Load with Fail-safe
Source 1 Sensing				
All-Phase Undervoltage and Underfrequency Protection	Standard	Standard	Standard	Standard
All-Phase Overvoltage and Overfrequency Protection	Standard	Standard	Standard	Standard
Three-Phase Rotation Sensing	Not Available	Standard	Standard	Standard
Three-Phase Voltage Unbalance/Loss	Not Available	—	—	—
Source 2 Sensing				
All-Phase Undervoltage and Underfrequency Protection	Standard	Standard	Standard	Standard
All-Phase Overvoltage and Overfrequency Protection	Standard	Standard	Standard	Standard
Three-Phase Rotation Sensing	Not Available	Standard	Standard	Standard
Three-Phase Voltage Unbalance/Loss	Not Available	—	—	—
Manual Controls				
Test Operators	Standard	Standard	Standard	Standard
4-Position Test Selector Switch (FPSS)	Not Available	Optional	Optional	Optional
Time Delay Bypass Pushbutton	Standard	Standard	Standard	Standard
Maintenance Selector Switch (MSS)	Not Available	Not Available	Not Available	Not Available
Automatic/Manual Operation Selector Switch	Not Available	Optional	Optional	Optional
Automatic Transfer or Automatic Transfer with Non-Automatic Re-Transfer Operation	Not Available	Optional	Optional	Optional
Indications/and Status Display				
Source 1 Connected/Source 2 Connected	Standard	Standard	Standard	Standard
Source 1 Present/Source 2 Present	Standard	Standard	Standard	Standard
Source 1 Tripped/Source 2 Tripped	Standard	Standard	Standard	Standard
Customer Outputs				
Source 1/Source 2 Present Contacts	Not Available	Optional 2NO & 2NC	Optional 2NO & 2NC	Optional 2NO & 2NC
Source 1/Source 2 Present Contacts	Not Available	Optional 2NO & 2NC	Optional 2NO & 2NC	Optional 2NO & 2NC
Source 1 Available/Source 2 Available Contacts	Not Available	Optional 2NO & 2NC	Optional 2NO & 2NC	Optional 2NO & 2NC
Switch Position Indication Contact				
Source 1 Position Indication Contact	Not Available	2NO & 2NC	2NO & 2NC	2NO & 2NC
Source 1 Position Indication Contact	Not Available	2NO & 2NC	2NO & 2NC	2NO & 2NC
Pre-Transfer Signal Contacts	—	Standard 1NO & 1NC	Standard 1NO & 1NC	Standard 1NO & 1NC
Customer Inputs				
Go to Emergency (Source 2)	—	—	—	—
Load Shed	Not Available	Not Available	Optional	Optional

TABLE 42. ATC CONTROLLER FEATURE SELECTION CHART (CONTINUED)

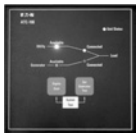
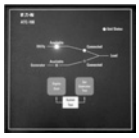
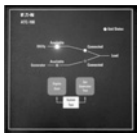
FEATURE DESCRIPTION	 ATC-100	 ATC-300	 ATC-600	 ATC-800
Switch Position Indication Contact				
Source 1 Position Indication Contact	Not Available	2NO & 2NC	2NO & 2NC	2NO & 2NC
Source 1 Position Indication Contact	Not Available	2NO & 2NC	2NO & 2NC	2NO & 2NC
Pre-Transfer Signal Contacts	—	Standard 1NO & 1NC	Standard 1NO & 1NC	Standard 1NO & 1NC
Customer Inputs				
Go to Emergency (Source 2)	—	—	—	—
Load Shed	Not Available	Not Available	Optional	Optional
Integral Overcurrent Protection				
Source 1, Source 2 or Both	—	Optional	Optional	Optional
Metering				
DP400 Monitoring Voltage, Amps, Frequency, Power Factor, Harmonic Distortion on Source 1 and Source 2	Not Available	Optional	Optional	Optional
IQ Analyzer Monitoring Voltage, Amps, Frequency, Power Factor, Harmonic Distortion on Source 1 and Source 2 with Waveform Capture	Not Available	Optional	Optional	Optional
Ammeter — Load Side (Digital, All-Phases Metered)	Not Available	Optional	Optional	Optional
Rear Bus Connections	Not Available	Optional	Optional	Optional
Optional Terminals	Not Available	Optional	Optional	Optional
Transfer Mode Open Transition				
Time Delay Neutral	Not Available	Optional	Optional	Optional
In-Phase Monitoring	Standard	Optional	Optional	Optional
Load Voltage Decay	Not Available	Optional	Optional	Optional
Transfer Mode Closed Transition				
Time Delay Neutral	Not Available	Not Available	Not Available	Optional
In-Phase Monitoring	Not Available	Not Available	Not Available	Optional
Load Voltage Decay	Not Available	Not Available	Not Available	Optional
Service Entrance Rating				
Source 1, Source 2 or Both & With and Without Ground Fault Protection	Optional	Optional	Optional	Optional
Stainless Steel Cover				
SS Lockable Cover for Controller	Not Available	Optional	Optional	Optional
Integral Distribution Panel	—	Optional	Not Available	Not Available
Space Heater with Thermostat				
100 Watts	Not Available	Optional	Optional	Optional
400 Watts	Not Available	Optional	Optional	Optional
Building Codes				
Seismic Zone 4 Certified (BOCA, CBC, IBC, UBC)	Standard	Standard	Standard	Standard
Communications	Not Available	Not Available	Optional	Optional
Transient Voltage Surge Protection				
Single-Phase	Optional	Optional	Optional	Optional
Three-Phase	Optional	Optional	Optional	Optional
Password Protection	—	Standard	Standard	Standard

TABLE 43. ATC CONTROLLER SPECIFICATION SELECTION CHART

SPECIFICATION DESCRIPTION	 ATC-100	FACTORY DEFAULT SETTINGS	 ATC-300	FACTORY DEFAULT SETTINGS	 ATC-600	FACTORY DEFAULT SETTINGS	 ATC-800	FACTORY DEFAULT SETTINGS
Programming Selections								
Time Delay Normal to Emergency	3 Seconds (Fixed)	—	0 – 1800 Seconds	0:00	0 – 1800 Seconds	0:00	0 – 1800 Seconds	0:00
Time Delay Emergency to Normal	7 Minutes (Fixed)	—	0 – 1800 Seconds	5:00	0 – 1800 Seconds	5:00	0 – 1800 Seconds	5:00
Time Delay Engine Cooldown	5 Minutes (Fixed)	—	0 – 1800 Seconds	5:00	0 – 1800 Seconds	5:00	0 – 1800 Seconds	5:00
Time Delay Engine Start	10 Seconds (Fixed)	—	0 – 120 Seconds	0:03	0 – 120 Seconds	0:03	0 – 120 Seconds	0:03
Time Delay Neutral	N/A	—	0 – 120 Seconds	0:00	0 – 120 Seconds or Based on Load Voltage Decay of 2% – 30% of Nominal	0:00	0 – 120 Seconds or Based on Load Voltage Decay of 2% – 30% of Nominal	0:00
Time Delay Source 2 Fail	N/A	—	0 – 6 Seconds	0:06	0 – 6 Seconds	0:06	0 – 6 Seconds	0:06
Time Delay Voltage Unbalance	N/A	—	10 – 30 Seconds	20	N/A	20	N/A	20
Voltage Unbalance Three-Phase	N/A	—	0 or 1 (1 = Enabled)	1	—	1	—	1
% of Unbalanced Voltage Dropout	N/A	—	5% to 20% (DO) Dropout -2% to 3% (PU)	20%	N/A	20%	N/A	20%
Phase Reversal Three-Phase	N/A	—	OFF, ABC, CBA	Off	N/A	Off	N/A	Off
In-Phase	N/A	—	0 or 1 (1 = Enabled)	0	Enabled or Disabled	0	Enabled or Disabled	0
Load Sequencing	N/A	—	N/A	—	Up to 10 Devices (via Sub-Network)	—	Up to 10 Devices (via Sub-Network)	—
Pre-Transfer Signal	N/A	—	1 – 120 Seconds (Form "C" Contact)	0:00	0 – 120 Seconds (Up to 10 Devices via Sub-Network)	0:00	0 – 120 Seconds (Up to 10 Devices via Sub-Network)	0:00
Plant Exerciser	Selectable Day, Off, 7, 14, 28-Day Interval, 15 Minutes Run Time, No Load	Off	Selectable — Off, Daily or 7, 14, 28 Day Intervals, 0 – 600 Minutes, Load or No Load	Off	Selectable — Disabled or 7-Day Interval, 0 – 600 Minutes, Load or No Load	Off	Selectable — Disabled or 7-Day Interval, 0 – 600 Minutes, Load or No Load	Off
Preferred Source Selection	N/A	—	N/A	—	Source 1 or 2 or None	—	Source 1 or 2 or None	—
Commitment to Transfer in TDNE	N/A	—	N/A	—	Enabled or Disabled	—	Enabled or Disabled	—
Re-Transfer Mode	N/A	—	N/A	—	Automatic or Manual	—	Automatic or Manual	—
Auto Daylight Savings Time Adjustment	N/A	—	0 or 1 (1 = Enabled)	1	—	1	—	1
System Selection	Utility/Generator or Dual Utility	—	Utility/Generator or Dual Utility	—	Utility/Generator or Dual Utility or Dual Generator	—	Utility/Generator or Dual Utility or Dual Generator	—
Additional Information	PA01600002E	—	TD01602006E	—	TD.15A.05.T.E.	—	TD.15A.05.T.E.	—

Note:
Features are order specific. Not all features are supplied as standard.

TABLE 43. ATC CONTROLLER SPECIFICATION SELECTION CHART (CONTINUED)

SPECIFICATION DESCRIPTION	 ATC-100	FACTORY DEFAULT SETTINGS	 ATC-300	FACTORY DEFAULT SETTINGS	 ATC-600	FACTORY DEFAULT SETTINGS	 ATC-800	FACTORY DEFAULT SETTINGS
System Application Voltage	120/240 V, 208 V ①	—	Up to 600 Vac	600 Vac	Up to 600 Vac	600 Vac	Up to 600 Vac	600 Vac
Voltage Specifications								
Voltage Measurements of:	Source 1 and 2	—	Source 1 and 2 — V_{AB}, V_{BC} and V_{CA}	—	Source 1, 2 and Load — V_{AB}, V_{BC} and V_{CA}	—	Source 1, 2 and Load — V_{AB}, V_{BC} and V_{CA}	—
Voltage Measurement Range	120 – 240 Vac	—	0 – 790 Vac rms	—	0 – 790 Vac rms	—	0 – 790 Vac rms	—
Operating Power	95 – 145 Vac	—	65 – 145 Vac	—	65 – 145 Vac	—	65 – 145 Vac	—
Frequency Specifications								
Frequency Measurements of:	Source 2	—	Source 1 and 2	—	Source 1 and 2	—	Source 1 and 2	—
Frequency Measurement Range	50 – 60 Hz	—	40 – 70 Hz	—	40 – 70 Hz	—	40 – 70 Hz	—
Environmental Specifications								
Operating Temperature Range	-20° to +70°C	—	-20° to +70°C	—	-20° to +70°C	—	-20° to +70°C	—
Storage Temperature Range	-30° to +85°C	—	-30° to +85°C	—	-30° to +85°C	—	-30° to +85°C	—
Operating Humidity	0 to 95% Relative Humidity (Non-condensing)	—	0 to 95% Relative Humidity (Non-condensing)	—	0 to 95% Relative Humidity (Non-condensing)	—	0 to 95% Relative Humidity (Non-condensing)	—
Operating Environment	Resistant to Ammonia, Methane, Nitrogen, Hydrogen and Hydrocarbons	—	Resistant to Ammonia, Methane, Nitrogen, Hydrogen and Hydrocarbons	—	Resistant to Ammonia, Methane, Nitrogen, Hydrogen and Hydrocarbons	—	Resistant to Ammonia, Methane, Nitrogen, Hydrogen and Hydrocarbons	—
Front Panel Indication								
Mimic Diagram With LED Indication	Unit Status. Source 1 and 2 Available and Connected (5 Total)	—	Unit Status. Source 1 and 2 Available and Connected (5 Total)	—	Automatic, Test and Program Mode. Source 1 and 2 Available, Connected and Preferred. Load Energized (10 Total)	—	Automatic, Test and Program Mode. Source 1 and 2 Available, Connected an Preferred. Load Energized (10 Total)	—
Main Display	N/A	—	LCD-based Display	—	LED Display	—	LED Display	—
Display Language	N/A	—	English, French	English	English	English	English	English
Communications Capable	N/A	—	N/A	②	PONI/INCOM™	②	PONI/INCOM	②
Enclosure Compatibility	NEMA 1 and 3R	—	NEMA 1, 12 and 3R, UV Resistant Faceplate	③	NEMA 1, 12, 3R and 4X UV Resistant Faceplate	③	NEMA 1, 12, 3R and 4X UV Resistant Faceplate	③
Operating Environmental Range	Operation -20°C to +70°C, Storage -30°C to +85°C, Humidity 0% to 95% Relative (Noncondensing)	—	Operation -20°C to +70°C, Storage -30°C to +85°C, Humidity 0% to 95% Relative (Noncondensing)	—	Operation -20°C to +70°C, Storage -30°C to +85°C, Humidity 0% to 95% Relative (Noncondensing)	—	Operation -20°C to +70°C, Storage -30°C to +85°C, Humidity 0% 95% Relative (Noncondensing)	—

① Single-phase.
② Transfer on customer input.
③ As ordered.

Note:
Features are order specific. Not all features are supplied as standard.

TABLE 44. AUTOMATIC TRANSFER SWITCH FEATURES

		WALL-MOUNT PRODUCT							FLOOR STANDING		CLOSED TRANS-ITION	SOFT LOAD
		RLC1	ATV1 ATH1 ATC1	ATV3 ATH3	ATC3 ①	ATVI ATHI	NTHE NTVE	MTHX MTVX	ATVIMG	BIVIMG	CTVIMG	CTVCMG
FEATURE NUMBER	DESCRIPTION	RESIDENTIAL CONTACTOR SWITCH ATC-100 CONTROLLER	LIGHT COMMERCIAL MOLDED CASE DEVICE AND CONTACTOR DESIGN ATC-100 CONTROLLER	MOLDED CASE SWITCH ATC-300 CONTROLLER	CONTACTOR SWITCH ATC-300 CONTROLLER	MOLDED CASE DEVICE ATC-600 IQ TRANSFER	NON-AUTOMATIC TRANSFER SWITCH	MANUAL TRANSFER SWITCH	MAGNUM FIXED AND DRAWOUT MOUNT ATC-600 IQ TRANSFER	MAGNUM BYPASS ISOLATION ATC-600 IQ TRANSFER	MAGNUM FIXED AND DRAWOUT MOUNT ATC-800 CLOSED TRANSITION	MAGNUM LOAD FIXED AND DRAWOUT MOUNT ATC-5000 SOFT LOAD
	Timers											
1	Time Delay Normal to Emergency (TDNE) Fixed 2 Seconds or 15 Seconds	S	S									
	Adjustable 0 – 1800 Seconds			S	S	S			S	S	S	S
2	Time Delay Engine Start (TDES) Fixed 3 Seconds	S	S									
	Adjustable 0 – 120 Seconds			S	S	S			S	S	S	S
3	Time Delay Emergency to Normal (TDEN) Fixed 1 Minute	S	S									
	Adjustable 0 – 1800 Seconds			S	S	S			S	S	S	S
4	Time Delay Engine Cooldown (TDEC) Fixed 5 Minutes	S	S									
	Adjustable 0 – 1800 Seconds			S	S	S			S	S	S	S
5	**Emergency (S2) Source Sensing**											
5H	Phase Reversal			S	S	O			O	O	O	O
5J	All Phase Undervoltage/Underfrequency	S	S	S	S	S			S	S	S	S
5K	All Phase Overvoltage/Overfrequency			S	S	S			S	S	S	S
5L	All Phase Voltage Unbalance and Phase Loss											
5N	All Phase Overfrequency	S	S									O
6	**System or Engine Test**											
6B	System Test Pushbutton	S	S	S	S	S			S	S	S	S
6D	Maintained 2-Position Test Switch					O			O	O	O	O
6H	Maintained 4-Position Test Switch					O			O	S	O	O
7	Time Delay Emergency Fail (TDEF) Fixed 6 Seconds	S	S									
	Time Delay Emergency Fail (TDEF) Adjustable 0 – 6 Seconds			S	S	S			S	S	S	S
8	**Pushbutton Bypass**											
8C	Bypass TDEN			S	S	S			S	S	S	S
8D	Bypass TDNE			S	S	S			S	S	S	S
9	**Maintenance Selector Switch**											
9B	Electrical Operator Isolator Switch			O	O	O			O	O	O	O
10	**Preferred Source Selector Switch**											
10B	Utility to Utility or Utility to Generator					O			S	S	S	S
10D	Generator to Generator					O			S	S	S	S

① Consult factory for contactor rating availability.

S = Standard, O = Optional

TABLE 44. AUTOMATIC TRANSFER SWITCH FEATURES (CONTINUED)

		WALL-MOUNT PRODUCT							FLOOR STANDING		CLOSED TRANS-ITION	SOFT LOAD
		RLC1	ATV1 ATH1 ATC1	ATV3 ATH3	ATC3 ①	ATVI ATHI	NTHE NTVE	MTHX MTVX	ATVIMG	BIVIMG	CTVIMG	CTVCMG
FEATURE NUMBER	DESCRIPTION	RESIDENTIAL CONTACTOR SWITCH ATC-100 CONTROLLER	LIGHT COMMERCIAL MOLDED CASE DEVICE AND CONTACTOR DESIGN ATC-100 CONTROLLER	MOLDED CASE SWITCH ATC-300 CONTROLLER	CONTACTOR SWITCH ATC-300 CONTROLLER	MOLDED CASE DEVICE ATC-600 IQ TRANSFER	NON-AUTOMATIC TRANSFER SWITCH	MANUAL TRANSFER SWITCH	MAGNUM FIXED AND DRAWOUT MOUNT ATC-600 IQ TRANSFER	MAGNUM BYPASS ISOLATION ATC-600 IQ TRANSFER	MAGNUM FIXED AND DRAWOUT MOUNT ATC-800 CLOSED TRANSITION	MAGNUM LOAD FIXED AND DRAWOUT MOUNT ATC-5000 SOFT LOAD
12	**Pilot Lights**											
12C	Normal (S1) Source Connected	S	S	S	S	S	S		S	S	S	S
12D	Emergency (S2) Source Connected	S	S	S	S	S	S		S	S	S	S
12G	Normal (S1) Source Available	S	S	S	S	S	S		S	S	S	S
12H	Emergency (S2) Source Available	S	S	S	S	S	S		S	S	S	S
12L	Normal (S1) Source Tripped (Requires Feature 16)			O		O	O		O	O	O	O
12M	Emergency (S2) Source Tripped (Requires Feature 16)			O		O	O		O	O	O	O
14	**Auxiliary Relay Contacts**											
14C	Normal (S1) Source Available 4 Form C					O						
14D	Emergency (S2) Source Available 4 Form C					O						
14E	Normal (S1) Source Available 1 Form C					S			S	S	S	S
14F	Emergency (S2) Source Available 1 Form C					S			S	S	S	S
14G	Normal (S1) Source Available 2 Form C		S	S	S							
14H	Emergency (S2) Source Available 2 Form C		S	S	S							
15	**Position Contacts**											
15E	Normal (S1) Source Position 1 Form C		O	S	O	O			S	S	S	
15F	Emergency (S2) Source Position 1 Form C		O	S	O	O			S	S	S	
15M	Source 2 Load Shed Contacts 4 Form C	O										
16	**Integral Overcurrent Protection**											
16N	Normal (S1) Switch Only			O		O	O	O	O	O	O	O
16E	Emergency (S2) Switch Only			O		O	O	O	O	O	O	O
16B	Normal (S1) and Emergency (S2) Switches			O		O	O	O	O	O	O	O
16S	Service Equipment/Overcurrent Protection (S1)	O										
18	**Metering**											
18O	IQ Analyzer Normal (S1)					O	O		O	O	O	O
18P	IQ Analyzer Emergency (S2)					O	O		O	O	O	O
18Q	IQ Analyzer Switch Selectable (S1) and (S2)					O	O		O	O	O	O
18V	IQ Analyzer Load Side					O	O		O	O	O	
18R	IQ DP-4000 Normal (S1)					O	O		O	O	O	
18S	IQ DP-4000 Emergency (S2)					O	O		O	O	O	
18T	IQ DP-4000 Switch Selectable (S1) and (S2)					O	O		O	O	O	
18U	IQ DP-4000 Load Side					O	O		O	O	O	O
18W	Load Side Ammeter			O	O							

① Consult factory for contactor rating availability.

S = Standard, O = Optional

TABLE 44. AUTOMATIC TRANSFER SWITCH FEATURES (CONTINUED)

		WALL-MOUNT PRODUCT							FLOOR STANDING		CLOSED TRANS-ITION	SOFT LOAD
		RLC1	ATV1 ATH1 ATC1	ATV3 ATH3	ATC3 ①	ATVI ATHI	NTHE NTVE	MTHX MTVX	ATVIMG	BIVIMG	CTVIMG	CTVCMG
FEATURE NUMBER	DESCRIPTION	RESIDENTIAL CONTACTOR SWITCH ATC-100 CONTROLLER	LIGHT COMMERCIAL MOLDED CASE DEVICE AND CONTACTOR DESIGN ATC-100 CONTROLLER	MOLDED CASE SWITCH ATC-300 CONTROLLER	CONTACTOR SWITCH ATC-300 CONTROLLER	MOLDED CASE DEVICE ATC-600 IQ TRANSFER	NON-AUTOMATIC TRANSFER SWITCH	MANUAL TRANSFER SWITCH	MAGNUM FIXED AND DRAWOUT MOUNT ATC-600 IQ TRANSFER	MAGNUM BYPASS ISOLATION ATC-600 IQ TRANSFER	MAGNUM FIXED AND DRAWOUT MOUNT ATC-800 CLOSED TRANSITION	MAGNUM LOAD FIXED AND DRAWOUT MOUNT ATC-5000 SOFT LOAD
20A	Rear Bus Connections			O		O	O	O	O	O	O	O
21A	Non-Standard Terminals		O	O	O	O	O	O	O	O	O	O
23	**Plant Exerciser**											
23A	Selectable — Disabled/7, 14, 28 Day Interval, Fixed 15 Minutes, Load/No Load, with Fail-Safe	S	S									
23J	Selectable — Disabled/7 Day Interval, 0 – 600 Minutes, Load/No Load, with Fail-safe					S			S	S	S	S
23K	Selectable — Disabled/7, 14, 28 Day Interval, 0 – 600 Minutes, Load/No Load, with Fail-Safe			S	S							
26	**Normal (S1) Source Sensing**											
26D	Go to Emergency (S2) Input			S	S	S			S	S	S	S
26H	Phase Reversal Protection			S	S	O			O	O	O	O
26J	All Phase Undervoltage/Underfrequency			S	S	S			S	S	S	S
26K	All Phase Overvoltage/Overfrequency			S	S	S			S	S	S	S
26L	Three-Phase Voltage Unbalance/ Phase Loss			S		O						
26M	Generator Utility Sensing	O	O									
26P	All Phase Undervoltage	S	S									O
29	**Alternative Transfer Modes of Operation**											
29G	Selector Switch for Automatic or Non-Automatic Operation (Switch must be Labeled as Non-Automatic)			O		O			O	O	O	
29J	Automatic Transfer Operation with Selectable (Via Programming) Automatic or Non-Automatic Retransfer Operation with Fail-Safe					O			O	O	O	
32	**Delayed Transfer Operation Modes**											
32A	Time Delay Neutral Adjustable 0 – 120 Seconds			S		S			S	S	S	S
32B	Load Voltage Decay Adjustable 2 – 30% Nominal Voltage					O			O	O	O	O
32C	In-Phase Monitor Defaults to Load Voltage Decay								O	O	O	O
32D	In-Phase Monitor Defaults to Time Delay Neutral								O	O	O	O
32E	Delay Transition Timer Adjustable 3 – 60 Seconds						S					
32F	In-Phase Monitor				S							
34	**Logic Extender Cable**											
34A	48 Inches (1219 mm)					O	O					
34C	96 Inches (2438 mm)					O	O					
34E	144 Inches (3658 mm)					O	O					

① Consult factory for contactor rating availability.

S = Standard, O = Optional

TABLE 44. AUTOMATIC TRANSFER SWITCH FEATURES (CONTINUED)

		WALL-MOUNT PRODUCT							FLOOR STANDING		CLOSED TRANS-ITION	SOFT LOAD
		RLC1	ATV1 ATH1 ATC1	ATV3 ATH3	ATC3 ①	ATVI ATHI	NTHE NTVE	MTHX MTVX	ATVIMG	BIVIMG	CTVIMG	CTVCMG
FEATURE NUMBER	DESCRIPTION	RESIDENTIAL CONTACTOR SWITCH ATC-100 CONTROLLER	LIGHT COMMERCIAL MOLDED CASE DEVICE AND CONTACTOR DESIGN ATC-100 CONTROLLER	MOLDED CASE SWITCH ATC-300 CONTROLLER	CONTACTOR SWITCH ATC-300 CONTROLLER	MOLDED CASE DEVICE ATC-600 IQ TRANSFER	NON-AUTOMATIC TRANSFER SWITCH	MANUAL TRANSFER SWITCH	MAGNUM FIXED AND DRAWOUT MOUNT ATC-600 IQ TRANSFER	MAGNUM BYPASS ISOLATION ATC-600 IQ TRANSFER	MAGNUM FIXED AND DRAWOUT MOUNT ATC-800 CLOSED TRANSITION	MAGNUM LOAD FIXED AND DRAWOUT MOUNT ATC-5000 SOFT LOAD
35A	**Pretransfer Signal Contacts 1 Form C**			S	S	0			0	0	0	0
36	**Load Shed from Emergency**					0			0	0	0	0
37	**Rated as Suitable for Use as Service Equipment ②③ (Requires 16B or 16N or 16S)**											
37A	Without Ground Fault Protection	0		0		0	0		0	0	0	0
37B	With Ground Fault Protection			0		0	0		0	0	0	0
38	**Stainless Steel Device Covers**											
38A	SS Cover for Device Plate or Service Equipment Disconnect	0	0	0	0	0	0		0	0	0	0
38B	SS Cover for Controller	0	0	0	0	0	0		0	0	0	0
39	**Distribution Panel (For 240/120 V, AT_3 Switches Only)**											
39A	225 A with (2) 200 A Feeders			0								
39B	300 A with (3) 200 A Feeders			0								
39C	400 A with (4) 200 A Feeders			0								
41	**Space Heater with Thermostat**											
41A	100 Watts		0	0	0	0	0	0				
41C	400 Watts					0	0	0	0	0	0	0
42	**Seismic Zone 4 Certified, CBC, IBC, UBC, BOCA**			S	S	S	S	S	S	S	S	S
45	**Load Sequencing Contacts**											
45A	Load Sequencing Contacts (1)					0			0	0	0	0
45B	Load Sequencing Contacts (2)					0			0	0	0	0
45C	Load Sequencing Contacts (3)					0			0	0	0	0
45D	Load Sequencing Contacts (4)					0			0	0	0	0
45E	Load Sequencing Contacts (5)					0			0	0	0	0
45F	Load Sequencing Contacts (6)					0			0	0	0	0
45G	Load Sequencing Contacts (7)					0			0	0	0	0
45H	Load Sequencing Contacts (8)					0			0	0	0	0
45I	Load Sequencing Contacts (9)					0			0	0	0	0
45J	Load Sequencing Contacts (10)					0			0	0	0	0
47	**Closed Transition Operational Modes (User Must Specify Mode)**											
47C	Closed Transition In-Phase with Default to Load Voltage Decay										0	0
47D	Closed Transition										0	0
47E	Closed Transition In-Phase with Defaults to Time Delay Neutral										0	0
48	**Communications**											
48A	IPONI Module					0			0	0	0	0
48D	EPONI Module (10Base-T Only)											
48E	EPONI Module (10Base-T and 10Base-FL)											
48F	MPONI Module (Modbus®)					0			0	0	0	0

① Consult factory for contactor rating availability.

② Ground Fault protection is required for Service Disconnects rated 1000 amperes or more if the electrical service is a solidly grounded wye system of more than 150 volts to ground but not exceeding 600 volts phase to phase.

③ Select 16S for Service Entrance rating on RLC1.

S = Standard, O = Optional

TABLE 44. AUTOMATIC TRANSFER SWITCH FEATURES (CONTINUED)

		WALL-MOUNT PRODUCT							FLOOR STANDING		CLOSED TRANS-ITION	SOFT LOAD
		RLC1	ATV1 ATH1 ATC1	ATV3 ATH3	ATC3 ①	ATVI ATHI	NTHE NTVE	MTHX MTVX	ATVIMG	BIVIMG	CTVIMG	CTVCMG
FEATURE NUMBER	DESCRIPTION	RESIDENTIAL CONTACTOR SWITCH ATC-100 CONTROLLER	LIGHT COMMERCIAL MOLDED CASE DEVICE AND CONTACTOR DESIGN ATC-100 CONTROLLER	MOLDED CASE SWITCH ATC-300 CONTROLLER	CONTACTOR SWITCH ATC-300 CONTROLLER	MOLDED CASE DEVICE ATC-600 IQ TRANSFER	NON-AUTOMATIC TRANSFER SWITCH	MANUAL TRANSFER SWITCH	MAGNUM FIXED AND DRAWOUT MOUNT ATC-600 IQ TRANSFER	MAGNUM BYPASS ISOLATION ATC-600 IQ TRANSFER	MAGNUM FIXED AND DRAWOUT MOUNT ATC-800 CLOSED TRANSITION	MAGNUM LOAD FIXED AND DRAWOUT MOUNT ATC-5000 SOFT LOAD
51	**Transient Voltage Surge Protection (Listed Rating is per Phase)**											
51D1	50 kA — Clipper Device Connected to Source 1			0	0	0	0	0				
51E1	80 kA — Clipper Device Connected to Source 1			0	0	0	0	0				
51F1	100 kA — Clipper Device Connected to Source 1			0	0	0	0	0				
51G1	50 kA — CHSP Device Connected to Source 1 (240/120 Vac Single-Phase Only)			0	0		0	0				
51H1	75 kA — CHSP Device Connected to Source 1 (240/120 Vac Single-Phase Only)			0	0		0	0				
51J4	Telephone/Modem/DSL (4 Lines Total)			0	0	0	0	0	0	0	0	
51K4	Cable TV/Satellite Cable/Cable Modem (2 Lines Total)			0	0	0	0	0	0	0	0	
51M4A	12 Vdc Generator Start Circuit Protection			0	0	0	0	0	0	0	0	
51M4B	24 Vdc Generator Start Circuit Protection			0	0	0	0	0	0	0	0	0
51NA1	100 kA — Surge Device with AdVisor Source1								0	0	0	0
51NS1	100 kA — Surge Device with SuperVisor Source 1								0	0	0	0
51NN1	100 kA — Surge Device with NetVisor Source 1								0	0	0	0
51QA1	160 kA — Surge Device with AdVisor Source 1								0	0	0	0
51QS1	160 kA — Surge Device with SuperVisor Source 1								0	0	0	0
51QN1	160 kA — Surge Device with NetVisor Source 1								0	0	0	0
51SA1	200 kA — Surge Device with AdVisor Source 1								0	0	0	0
51SS1	200 kA — Surge Device w/SuperVisor Source 1								0	0	0	0
51SN1	200 kA — Surge Device w/NetVisor Source 1								0	0	0	0
54A	**Front Access Cabinet**								0	0	0	0

① Consult factory for contactor rating availability.

S = Standard, O = Optional

Transfer Switch — Standard and Optional Features for Cutler-Hammer Transfer Switches

Timers

1. Time Delay Normal to Emergency (TDNE)

Provides a time delay to allow for the generator to warm up before transferring the load from the Normal Source to the Emergency Source. Timing begins only after the Emergency Source becomes available and deemed good based on the programmable voltage and frequency set points in the controller.

2. Time Delay Engine Start (TDES)

Provides a time delay before initiating the generator start cycle. This is to account for momentary power outages or voltage fluctuations of the Normal Source. Provides a Form "C" contact to the generator starter circuit.

3. Time Delay Emergency to Normal (TDEN)

Provides a time delay of the re-transfer operation to permit stabilization of the Normal Source. Timing begins only after the Normal Source becomes available and deemed good based on the programmable voltage and frequency set points in the controller. This function is fail-safe protected.

4. Time Delay Engine Cooldown (TDEC)

Provides a time delay before initiating the generator stop cycle after the re-transfer operation. This allows the generator to cool down by running unloaded. Timing begins on completion of the re-transfer cycle.

7. Time Delay Emergency Fail (TDEF)

Provides a time delay that prevents a connected emergency source from being declared "Unavailable" based on the customer's set points. This is to account for momentary generator fluctuations. If the Source 2 remains in a failed state, then 0.5 second after the TDEF timer expires the transfer switch will proceed with the programmed sequence for re-transfer if Source 1 is available. This time delay is only implemented when Source 2 is a generator.

Note:
This feature is also enabled when large loads cause generator output to drop below customer set points.

Plant Exerciser

23A. Plant Exerciser With Fail-safe

Provides a means for automatic testing of the engine generator set or standby power system. All programmed time delays in the controller will be performed during plant exerciser operations.

Programmable set points for test intervals are start time, either disabled, daily, 7, 14 or 28 days.

15-minute fixed engine test time.

Test may be performed with or without load transfer. Test may be manually cancelled during the operation. This function is "fail-safe" protected.

23J. Plant Exerciser (PE) With Fail-safe

Provides a means for automatic testing of the engine generator set or standby power system. All programmed time delays in the controller will be performed during the plant exerciser operation.

Programmable set points for test interval are Start Time, either disabled or 7 days, and engine test time.

Test may be performed with or without a load transfer. Test may be manually cancelled during the operation. This is a "fail-safe" operation.

23K. Plant Exerciser With Fail-safe

Provides a means for automatic testing of the engine generator set or standby power system. All programmed time delays in the controller will be performed during plant exerciser operations.

Programmable set points for test intervals are start time, either disabled, daily, 7, 14 or 28 days, engine test time.

Test may be performed with or without load transfer. Test may be manually cancelled during the operation. This function is "fail-safe" protected.

Source 1 Sensing

26. Source 1 — Monitoring and Protection

Provides Source 1 monitoring and protection functions. If Source 1 fails, then the Automatic Transfer Controller will begin the sequence of operations necessary to transfer the load to Source 2. All **Feature 26** monitoring and protection functions are fail-safe operations.

26H. Three-Phase Rotation Protection

Provides three-phase reversal sensing in order to protect against transferring to an out-of-phase source. The controller will treat the opposite source as unavailable if the sources are out of phase, based on programmable set points in the controller.

26J. All-Phase Undervoltage/Underfrequency Protection

Provides all-phase undervoltage/ underfrequency monitoring and protection based on programmable set points in the controller.

26K. All-Phase Overvoltage/Overfrequency Protection

Provides all-phase overvoltage/overfrequency monitoring and protection based on programmable set points in the controller.

26L. Three-Phase Voltage Unbalance/ Phase Loss

Provides phase loss detection from blown fuses on the Source 1.

26M. Generator Utility Sensing

Allows for the switch to operate with generators that have internal utility sensing. This option comes as a kit that needs to be field installed.

Source 2 Sensing

5. Source 2 — Monitoring and Protection

Provides monitoring and protection based on the Source 2 voltage and/or frequency set points. All **Feature 5** monitoring and protection functions are fail-safe operations.

5J. All-Phase Undervoltage/Underfrequency Protection

Provides Undervoltage/Underfrequency monitoring and protection based on programmable set points in the controller.

5K. All-Phase Overvoltage/Overfrequency Protection

Provides Over/Voltage/Overfrequency monitoring and protection based on programmable set points in the controller.

5H. Three-Phase Rotation Protection

Provides three-phase reversal sensing in order to protect against transferring to an out-of-phase source. The controller will treat the opposite source as unavailable if the sources are out of phase, based on programmable set points in the controller.

5L. Three-Phase Voltage Unbalance/Phase Loss

Provides phase loss detection from blown fuses on the Source 2 supply circuit.

Manual Controls

6B. Test Operators

Automatic Transfer Switches are provided with a Test Pushbutton that simulates a loss of the Source 1 as standard. All programmed time delays (TDNE, TDEN, etc.) will be performed as part of the Test. Engine run time of the Test is equal to the Plant Exerciser programmed set point. All Tests are fail-safe protected.

6H. 4-Position Test Selector Switch (FPSS)

Provides a 4-position, maintained contact selector switch marked "Auto," "Test," "Engine Start," and "Off." The FPSS is fail-safe protected, except for the "Off Position." Transfer Switch operation is determined by the switch position. Transfer Switch operations are as follows:

"Auto" — Automatic operation mode.

"Test" — A Load test is performed until the switch is moved to another position.

"Engine Start" — A No-Load test is performed until the switch is moved to another position.

"Off" — The Automatic Transfer Controller and engine start contact are disabled. A white pilot light is provided to indicate that the FPSS is in the "Off" position.

Note:
This option will force the switch to be marked as non-automatic based on UL 1008.

8. Time Delay Bypass Pushbutton

Provides a momentary contact pushbutton to bypass the TDNE (**Feature 1**) and/or TDEN (**Feature 2**) time delays. The Time Delay Bypass Pushbutton contact, when closed, will reduce any or all of the programmed time delay to zero. Must be executed when TDNE or TDEN timer is displayed on the controller.

8C. Bypass Time Delay Emergency to Normal (TDEN)

8D. Bypass Time Delay Normal to Emergency (TDNE)

9B. Maintenance Selector Switch (MSS)

Provides a 2-position, maintained contact selector switch marked "Operate" and "Disable." When the MSS is placed in the "Disable" position, the controller logic will be disconnected from the transfer motor circuit. The MSS is placed in the "Operate" position for normal automatic operation.

29. Transfer Operation Modes

Provides standard or optional transfer modes, mode selection devices and operational methods for Transfer Switches.

29G. Automatic/Manual Operation With Selector Switch

Provides 2-position selector switch (labeled Auto/Manual) that permits selection of the Automatic or Manual transfer. When in the "Auto" position, the transfer switch operates with fully automatic transfer, re-transfer and generator startup and shutdown operations. When in the "Manual" position, manual operation is required to initiate the generator startup or re-transfer with generator shutdown operations.

Note:
Transfer switches with **Feature 29G** must be labeled as Non-Automatic Transfer Switch equipment.

29J. Automatic Transfer or Automatic Transfer With Non-Automatic Re-transfer Operation

Provides a field-selectable programmable set point that permits the transfer switch to operate in one of the following 2 transfer modes (A or B).

A. Fully automatic operation.

B. Automatic engine/generator startup and automatic transfer operation from Source 1 to Source 2. Manual pushbutton operation is required to initiate the re-transfer operation and engine/generator shutdown. The pushbutton for manual re-transfer operation is included. This is fail-safe protected.

10. Preferred Source Selector

Provides a means to designate either Source 1 or Source 2 as the "Preferred" source. The "Preferred" source is the source that the transfer switch will connect the load to if it is available.

Note:
This is a programmable software feature not an actual switch.

10B. Preferred Source Selector

Provides a programmable source selector for use on systems comprised of dual utility or utility and engine/ generator power sources.

10D. Preferred Source Selector

Provides a programmable source selector for use on systems comprised of dual engine/generator power sources. (Dual engine starting circuits are provided.)

Indications/and Status Display

12C. Source 1 — Load Connected

Provides a green indication that indicates the load is connected to Source 1 when lit.

12D. Source 2 — Load Connected

Provides a red indication that indicates the load is connected to Source 2 when lit.

12G. Source 1 — Present

Provides a white or amber indication "Depending on the Controller" that Source 1 has power, however this does not indicate whether Source 1 is acceptable.

12H. Source 2 — Present

Provides an amber indication that Source 2 has power, however this does not indicate whether Source 2 is acceptable.

Overcurrent Trip Indication

Available only with Integral Overcurrent Protection (**Feature 16**). (Shown on Automatic Transfer Controller Display.)

12L. Source 1 Trip Indication

The Automatic Transfer Controller display will read "Lockout" if the Source 1 circuit breaker is in the "tripped" position.

12M. Source 2 Trip Indication

The Automatic Transfer Controller display will read "Lockout" if the Source 2 circuit breaker is in the "tripped" position.

Customer Outputs

14. Relay Auxiliary Contacts

14C. Source 1 Present

Provides 4 Form "C" relay auxiliary contacts. The relay is energized when Source 1 is Present.

14D. Source 2 Present

Provides 4 Form "C" relay auxiliary contacts. The relay is energized when Source 2 is Present.

14E. Source 1 Available

Provides 1 Form "C" relay auxiliary contact. The relay is energized when Source 1 is available and within the controller's programmable set points.

14F. Source 2 Available

Provides 1 Form "C" relay auxiliary contact. The relay is energized when Source 2 is available and within the controller's programmable set points.

14G. Source 1 Present

Provides 2 Form "C" relay auxiliary contacts. The relay is energized when Source 1 is available and within the controller's programmable set points.

14H. Source 2 Present

Provides 2 Form "C" relay auxiliary contacts. The relay is energized when Source 2 is available and within the controller's programmable set points.

15. Switch Position Indication Contact

Provides a contact that indicates if the power switching device is in the "open" or "closed" position.

15E. Source 1 Position Indication Contact

Provides 1 Form "C" contact that indicates the position of the Source 1 power switching device.

15F. Source 2 Position Indication Contact

Provides 1 Form "C" contact that indicates the position of the Source 2 power-switching device.

15M. Source 2 Load Shed Contacts

Provides 4 Form "C" contacts to initiate a load circuit disconnect while on Source 2. This gives the user the capability of selectively choosing not to run certain loads while on Source 2.

35A. Pre-Transfer Signal With 1 Form "C" Contact

Provides a signal prior to the transferring of the load. Will not transfer until the programmable delay set point in the controller is reached. If both sources are not available, this option will ignore the time delay set in the controller.

Customer Inputs

26D. Go to Emergency (Source 2)

Provides the capability for an external contact closure to initiate a transfer to the Source 2 power source. This includes starting the generator, performing the programmed time delays and the transfer operation. Re-transfer will occur when the external contact is opened. This is a fail-safe function.

36. Load Shed From Emergency

Provides the capability for an external NC contact to initiate a load circuit disconnection from the Source 2 power source. If the load circuit is connected to Source 2 and the contact is opened, then a re-transfer to Source 1 is completed if Source 1 is available. If Source 1 is not available, then the transfer switch will transfer to neutral. If the load circuit is connected to Source 1 and the contact is open, then a transfer Source 2 is prohibited.

16. Integral Overcurrent Protection

Provides thermal-magnetic overcurrent protection integral to the power switching device(s). All **Feature 16** options include a "Lock-out" function. If the power switching breaker trips on an overcurrent condition, then "Lockout" is displayed on the Automatic Transfer Controller display and automatic operation is prevented until the appropriate source is manually reset. On non-automatic switches, a blue light is supplied to indicate the "lockout."

16B. Integral Overcurrent Protection on Both Power Source Switching Devices

Provides integral overcurrent protection on both Source 1 and Source 2 power switching devices.

16E. Integral Overcurrent Protection on the Source 2 Power Switching Device

Provides integral overcurrent protection on the Source 2 power switching device.

16N. Integral Overcurrent Protection on the Source 1 Power Switching Device

Provides integral overcurrent protection on the Source 1 power switching device.

16S. External Overcurrent Protection on the Source 1 Power Switching Device

Provides overcurrent protection on the Source 1 power switching device.

18. Metering

The microprocessor-based multi-function monitoring and display features the latest technological advances in metering and communications capabilities.

Available with an optional communications interface. (See **Feature 48** — Communications for available communication modules.)

Feature 18 metering options include all required external devices (CTs etc.) for a fully functioning metering system.

IQ Analyzer

The IQ Analyzer is an rms sensing, multi-function microprocessor-based monitoring and display device with waveform capture that provides simultaneous monitoring of current, voltage, frequency, power (real, reactive and apparent), energy (real, reactive and apparent), demand (forward, reverse and net), harmonics (magnitude and phase angle), power factor and percent THD (current and voltage).

18O. IQ Analyzer — Source 1 Line Side Metering

Provides an IQ Analyzer for monitoring the Source 1 line side circuit.

18P. IQ Analyzer — Source 2 Line Side Metering

Provides an IQ Analyzer for monitoring the Source 2 line side circuit.

18Q. IQ Analyzer With Selector Switch for Source 1 or Source 2 Line Side Metering

Provides an IQ Analyzer with a Source selector switch for monitoring the Source 1 or Source 2 line side circuit.

IQ DP-4000

The IQ DP-4000 is an rms sensing, multi-function microprocessor-based monitoring and display device that provides simultaneous monitoring of current, voltage, frequency, power (real, reactive and apparent), energy (real, reactive and apparent), power factor and percent THD (current and voltage).

18R. IQ DP-4000 — Source 1 Line Side Metering

Provides an IQ DP-4000 for monitoring the Source 1 line side circuit.

18S. IQ DP-4000 — Source 2 Line Side Metering

Provides an IQ DP-4000 for monitoring the Source 2 line side circuit.

18T. IQ DP-4000 With Selector Switch for Source 1 or Source 2 Line Side Metering

Provides an IQ DP-4000 with a Source selector switch for monitoring the Source 1 or Source 2 line side circuit.

18U. IQ DP-4000 — Load Side Metering

Provides an IQ DP-4000 for monitoring the load side circuit.

18V. IQ Analyzer — Load Side Metering

Provides an IQ Analyzer for monitoring the load side circuit.

18W. Ammeter Side Metering

Provides an ammeter for monitoring the load side circuit.

20A. Rear Bus Provisions

Provides Source 1, Source 2 and Load Circuit rear accessible bus stabs with provision for busbar connection. Cutler-Hammer Transfer Switches are provided with either front or rear (dependant on switch type) connected solderless screw-type terminals for power cable connection as standard.

21A. Optional Power Cable Connection Terminals

Cutler-Hammer Transfer Switches are provided as standard with Source 1, Source 2 and Load Circuit solderless screw-type terminals for power cable connection. Alternate terminal wire sizes, and compression lug provisions may be available dependant on transfer switch type and ampere rating.

32. Delayed Transition Transfer Modes for Open Transition Transfer Switches

Provides delayed transition transfer modes for an open transition transfer switch. Often used in systems with inductive loads, a delayed transition transfer switch may prevent or reduce inrush currents due to out of phase switching of inductive loads.

32A. Time Delay Neutral

Provides a time delay in the neutral position during the transfer and re-transfer operations during which both Source 1 and Source 2 are disconnected from the load circuit. This allows inductive loads time to reach a safe voltage and eliminate back EMF. The time delay is programmable and is the same for both transfer and re-transfer operations. This is a passive feature which requires the consulting Eng./installer to determine the settings based on how the user will operate the facility. Adjustable 0 – 120 seconds.

32B. Load Voltage Decay

Provides load voltage measurement to sense back EMF that is generated when the transfer switch is the neutral position. It provides a delay in transfer in either direction if an unacceptable level is sensed as established by a programmed set point. This is an active feature that adapts to how the facility is operating in order to minimize neutral position wait time, but ensure safety. Adjustable 2 – 30% of nominal voltage.

32C. In-Phase Transition With Default to Load Voltage Decay

Provides In-Phase transition, which is a feature that will permit a transfer or re-transfer between 2 available sources that have a phase angle difference near zero. The In-Phase transition feature includes permissible frequency difference and synchronization time set points. In the event Source 1 and Source 2 fail to synchronize within the permitted frequency difference and time, then the controller defaults to the Load Voltage Decay operation as described in **Feature 32B**. Adjustable Frequency Difference 0.0 – 3.0 Hz. Adjustable Synchronization Time Allowance 1 – 60 minutes.

32D. In-Phase Transition With Default to Time Delay Neutral

Provides In-Phase transition, which is a feature that will permit a transfer or re-transfer only between 2 available sources that have a phase angle difference near zero. The In-Phase transition feature includes permissible frequency difference and synchronization time set points. In the event Source 1 and Source 2 fail to synchronize within the permitted frequency difference and time then the controller defaults to the Time Delay Neutral operation as described in **Feature 32A**. Adjustable Frequency Difference 0.0 – 3.0 Hz. Adjustable Synchronization Time Allowance 1 – 60 minutes.

32F. In-Phase Transition

Provides In-Phase transition, this feature will permit a transfer or re-transfer between 2 available sources that have a phase angle difference of 8 degrees or less. The In-Phase transition feature includes permissible frequency difference and synchronization time set points. In the event Source 1 and Source 2 fail to synchronize within the permitted frequency difference and time, the Alarm relay will energize and "Failed to Sync" will be displayed on Line 1 of the controller. After resetting the alarm, another in-phase transition may be attempted or a non-synchronized transfer may be initiated by failing the connected source. The adjustable frequency difference is 0.0 to 3.0 Hz. If the synchronization does not occur within a specified amount of time, the Alarm relay will energize and the failure will be logged into the Transfer History as either "Sync Fail - Freq" or "Sync Fail - Phase" depending on whether the frequency difference or the phase difference was excessive.

47. Transfer Modes for Closed Transition Transfer Switches

Provides available transition transfer modes for a closed transition transfer switch. Closed Transition is a "make before break" transfer and re-transfer scheme that will parallel (a maximum of 100 ms) Source 1 and Source 2 providing a seamless transfer when both sources are available. The closed transition feature includes permissible voltage difference frequency difference and synchronization time allowance set points. The phase angle difference between the 2 sources must be near zero for a permitted transfer. These are all programmable set points in the controller.

47C. Closed Transition With Default to In-Phase Transition With Default to Load Voltage Decay

Provides a closed transition transfer as the primary transfer mode. In the event Source 1 and Source 2 fail to synchronize within the permitted voltage difference, frequency difference, phase angle difference and time, then the controller defaults to the In-Phase Transition With Default to Load Voltage Decay operations as described in **Features 32C** and **32B**. Adjustable Frequency Difference 0.0 – 0.3 Hz. Adjustable Voltage Difference 1 – 5 percent V. Adjustable synchronization Time Allowance 1 – 60 minutes.

47D. Closed Transition

Provides a closed transition transfer as the primary transfer mode. Only under a fail-safe condition (i.e., loss of the connected source) will the controller transfer to the alternate source using the Load Voltage Decay operation as described in **Feature 32B**. Adjustable Frequency Difference 0.0 – 0.3 Hz. Adjustable Voltage Difference 1 – 5% V.

47E. Closed Transition With Default to In-Phase Transition With Default to Time Delay Neutral

Provides a closed transition transfer as the primary transfer mode. In the event Source 1 and Source 2 fail to synchronize within the permitted voltage difference, frequency difference, phase angle difference and time, then the controller defaults to the In-Phase Transition With Default to Time Delay Neutral operation as described in **Features 32D** and **32A**. Adjustable Frequency Difference 0.0 – 0.3 Hz. Adjustable Voltage Difference 1 – 5 percent V. Adjustable synchronization Time Allowance 1 – 60 minutes.

Logic Extender Cable

34A. 48 Inches (1219 mm)

Provides logic extension cable with connectors.

34C. 96 Inches (2438 mm)

Provides logic extension cable with connectors.

34E. 144 Inches (3658 mm)

Provides logic extension cable with connectors.

37. Service Equipment Rated Transfer Switch

Provides the label "Suitable for use as Service Equipment" and the features necessary to meet the requirements for the label. Includes service disconnect with visible indication and neutral assembly with removable link. **Feature 16B** or **16N** must be selected separately.

37A. Service Equipment Rated Transfer Switch Without Ground Fault Protection

Provides Service Equipment rating for an application that does not require ground fault protection.

37B. Service Equipment Rated Transfer Switch With Ground Fault Protection

Provides Service Equipment rating for an application that requires ground fault protection.

38. Stainless Steel Cover

Provides protection for the controller.

39. Distribution Panel

The Distribution Panel feature utilizes a Panelboard design with bolt-on circuit breakers. Bolt-on breakers are designed to hold up to the changes in temperature and humidity that an industrial application calls for. (240/120 Vac single-phase systems only.)

39A. 225 A With (2) 200 A Feeders

39B. 300 A With (3) 200 A Feeders

39C. 400 A With (4) 200 A Feeders

41. Space Heater With Thermostat

Provides a space heater and adjustable thermostat. External control power is not required. Availability is dependent on transfer switch type.

41A. Space Heater With Thermostat — 100 Watt

Provides 100-watt space heater with an adjustable thermostat.

41C. Space Heater With Thermostat — 400 Watt

Provides 400-watt space heater with an adjustable thermostat.

42. Seismic Certification

Provides a Seismic certified Transfer Switch with certificate for application is Seismic Zone 4 under the California Building Code (CBC), the Uniform Building Code (UBC) and BOCA, and International Building Code (IBC).

45. Load Sequencing Capability

Provides the capability for sequential closure of up to 10 addressable relays after a transfer. Each Addressable Relay provides (1) Form "C" contact. A single adjustable time delay between each of the relay closures is provided. Operates via a sub-network. Adjustable 1 – 120 seconds.

45A. Load Sequencing Contact

Provides (1) addressable relay.

45B. Load Sequencing Contact

Provides (2) addressable relays.

45C. Load Sequencing Contact

Provides (3) addressable relays.

45D. Load Sequencing Contact

Provides (4) addressable relays.

45E. Load Sequencing Contact

Provides (5) addressable relays.

45F. Load Sequencing Contact

Provides (6) addressable relays.

45G. Load Sequencing Contact

Provides (7) addressable relays.

45H. Load Sequencing Contact

Provides (8) addressable relays.

45I. Load Sequencing Contact

Provides (9) addressable relays.

45J. Load Sequencing Contact

Provides (10) addressable relays.

48. Communication Modules

Provides communications modules for the ATC-600 and ATC-800 (Closed Transition) transfer switch controllers. A separately mounted communications module will enable the automatic transfer controller to be remotely monitored controlled and programmed via a network.

48A. Communications Module — IPONI

Provides INCOMM protocol communications modules.

48D. Communications Module — EPONI

Provides INCOMM protocol via Ethernet communications module. (10Base-T only.)

48E. Communications Module — EPONI

Provides INCOMM protocol via Ethernet communications module. (10Base-T and 10Base-FL.)

48F. Communications Module — MPONI

Provides Modbus RTU protocol via communications module.

Transient Voltage Surge Protection

There are 3 surge options to choose from. They are CHSP, CVL, CPS. In addition there are 2 generator start circuits protectors. The listed rating is per Phase and availability is dependent on transfer switch type.

Generator Start Circuit Protection

51M4A. 12 Vdc Engine control Start Circuit Protection.

51M4B. 24 Vdc Engine control Start Circuit Protection.

CHSP Surge Suppression is designed for single-phase loads with a maximum capacity of 70 k per phase. Also available for telephone and cable applications.

51G1. 50 kA — Connected to Source 1. (240/120 Vac single-phase systems only.)

51H1. 75 kA — Connected to Source 1. (240/120 Vac single-phase systems only.)

51J4. Telephone/Modem/DSL (4 Lines Total.)

51K1. Cable TV/Satellite Cable/Cable Modem.

CVL is a Clipper commercial grade protection and EMI/RFI filter. Comes standard with phase indicator lights to monitor component status, Form "C" alarm contacts and an audible alarm. Surge range 50 to 100 k per phase.

51D1. 50 kA Connected to Source 1.

51E1. 80 kA Connected to Source 1.

51F1. 100 kA Connected to Source 1 (2 Lines Total.)

CPS is a Clipper commercial grade protection and EMI/RFI filter. Available range is 100 to 200 k phase-to-phase Industrial grade surge protection.

CPS AdVisor has phase status indicator lights to indicate protection availability and a Form "C" alarm contact and audible alarm.

Field Kits Available

Replacement controllers as, well as field upgrade kits, are available and identified by style numbers.

Controller Field Kits — **8160A00G X X**
Consult factory for correct selection for group number.

Option Field Kits — **8160A X X G X X**
Consult factory for correct selection of style number.

CPS SuperVisor has a voltage meter and transient counter, with event capture phase status indicator lights to indicate protection availability, and a Form "C" alarm contact and audible alarm.

CPS NetVisor has voltage meter and transient counter, with event capture, life remaining and %THD communication over Modbus and Ethernet. Phase status indicator lights to indicate protection availability. Form "C" alarm contact and audible alarm.

51NA1. 100 kA — Surge Device with AdVisor.

51NS1. 100 kA — Surge Device with SuperVisor Source 1.

51NN1. 100 kA — Surge Device with NetVisor Source 1.

51QA1. 160 kA — Surge Device with AdVisor Source 1.

51QS1. 160 kA — Surge Device with SuperVisor Source 1.

51QN1. 160 kA — Surge Device with NetVisor Source 1.

51SA1. 200 kA — Surge Device with AdVisor Source 1.

51SS1. 200 kA — Surge Device with SuperVisor Source 1.

51SN1. 200 kA — Surge Device with NetVisor Source 1.

54. Front Access

54A. Front Access Cabinet available for all Magnum products. This option will add an additional pull section mounted on the side of the switch.

Glossary

With respect to their use in this document and as they relate to switch operation, the following terminology is defined:

Available — A source is defined as "available" when it is within its undervoltage/overvoltage/underfrequency/overfrequency (if applicable) set point ranges for the nominal voltage and frequency setting.

Fail-safe — A feature that prevents disconnection from the only available source and will also force a transfer or re-transfer operation to the only available source.

Re-Transfer — "Re-Transfer" is defined as a change of the load connection from the secondary to primary source.

Source 1 — is the primary source or Normal Source or Normal Power Source or Normal. (Except when Source 2 has been designated the "Preferred Source.")

Source 2 — is the secondary source or Emergency Source or Emergency Power Source or Emergency or Standby or Backup source. (Except when Source 2 has been designated the "Preferred Source.")

Source 1 — Failed or Fails — Source 1 is defined as "failed" when it is outside of its undervoltage or overvoltage or underfrequency or overfrequency (if applicable) set point ranges for the nominal voltage and frequency setting.

Source 2 — Failed or Fails — Source 2 is defined as "failed" when it is outside of its undervoltage or overvoltage or underfrequency or overfrequency (if applicable) set point ranges for the nominal voltage and frequency setting for a time exceeding 0.5 seconds after the Time Delay Emergency Fail (TDEF) time delay expires.

Transfer — "Transfer" is defined as a change of the load connection from the primary to secondary source except when specifically used as "Transfer to Neutral."

Transfer to Neutral — "Transfer to Neutral" is defined as when the load circuits are disconnected from both Source 1 and Source 2.

Transfer Switch Optional Components

Metering

IQ Analyzer

Highly accurate source or load metering can be provided for advanced energy management and power quality analysis. Meeting the stringent ANSI C12.16 Class 10 accuracy requirement, Eaton's IQ Analyzer meter can measure parameters including voltage, current, power (watts, vars and VA), energy, frequency, demand, power factor, %THD (voltage and current), K factor, CBEMA derating factor and crest factor. IQ Analyzer can also communicate with Eaton's industry accepted IMPACC and PowerNet™ Power Management Systems. (See Eaton TD 17530, available on line, for more information.)

Protective Relaying

Protective Relay

For paralleling (including soft loading/ unloading) applications, utility grade protective relaying is optional, and offered when utility interconnection standard requires additional protection on top of that provided by ATC-5000 controller. The following protective relays can be included in Eaton Soft Load ATS:

- Beckwith M-3410A — See **Appendix B** for details.
- Beckwith M-3520.
- Schweitzer SEL-351.
- Schweitzer SEL-547.
- Basler BE1-951.
- Basler BE1-IPS100.

All above protective relays provide protection necessary to satisfy IEEE P1547 standard "IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems." See **Table 45**.

TABLE 45. PROTECTIVE RELAYS

				UTILITY INTERTIE PROTECTION					
ANSI/IEEE NUMBER	**FUNCTION**	**ATC-5000**	**EATON DIGITRIP (OPTIONAL)**	**BECKWITH M-3410A (OPTIONAL)**	**BECKWITH M-3520 (OPTIONAL)**	**SCHWEITZER SEL-547 (OPTIONAL)**	**SCHWEITZER SEL-351 (OPTIONAL)**	**BASLER BE1-951 (OPTIONAL)**	**BASLER BE1-IPS100 (OPTIONAL)**
21	Phase Distance				O				
24	Overexcitation V/Hz							S	S
25	Synchronizer	S							
	Synch Check			S	S	S	S	S	S
27	Undervoltage	S ①②		S	S	S	S	S	S
27G	Ground Undervoltage			S	O				
32	Reverse/Forward Power	S ①		S	S	S	S	S	S
40	Loss-of-Field			S					
46	Negative Sequence Overcurrent	S ①		S	S				
47	Negative Sequence Overvoltage			S	S	S		S	S
50	Instantaneous Phase Overcurrent	S ①	S ①②		S		S	S	S
50N	Instantaneous Ground Overcurrent		O ①②		S		S	S	S
51	ac Time Overcurrent	S ①②	S ①②				S	S	S
51N	ac Time Ground Overcurrent		O ①②	S	S		S	S	S
51V	Voltage Restrained Overcurrent			S	S				S
59	Overvoltage	S ①②		S	S	S	S	S	S
59G	Ground Overvoltage			S	O				S
59I	Peak Overvoltage			S	O				
60FL	VT Fuse-Loss Detection			S	S			S	S
62	General Purpose Timers							S	
67	Phase Directional Overcurrent				S		S		S
67N	Residual Directional Overcurrent				O		S		
72	Phase/Vector Shift	S ②							
79	Reconnect Enable Time Delay			S	S		S		S
81 O/U	Over/Underfrequency	S ①②		S	S	S	S	S	S
81R	Rate of Change of Frequency				O				S

① Generator Protective Feature S = Standard Function; O = Optional Function.
② Utility Protective Feature.

Transient Voltage Surge Suppression

Eaton's Clipper Power System —Visor™ series transient voltage surge suppression (TVSS) components can be integrated into any closed transition soft load switch. Surge current ratings 100 kA, 160 kA and 200 kA per phase provide a range of cost effective facility-wide protection solutions. Status indication on each phase is standard with any TVSS option. Metering and communication capabilities are also available. See Appendix C for details.

Communications

Optional communication capability via Communication Gateway is available allowing remote data access, control, programming, system interface and dispatch.

System Interface

A system control panel provides user-friendly interface to the closed transition soft load controller, allowing operators to easily monitor the switching devices position and manually test generator and the system operations.

Switching Devices Status Lights

- Source 1 Open (Green).
- Source 1 Closed (Red).
- Source 1 Trip (Amber).
- Source 2 Open (Green).
- Source 2 Closed (Red).
- Source 2 Trip (Amber).

Front Panel Control Switches and Lights

The combination of the following pilot devices can be implemented on the unit:

- AUTO/TEST Switch.
- SYSTEM TEST Switch.
- TEST MODE Switch.
- ALARM SILENCE Switch.
- READY FOR OPERATION Lamp (White) — Verifies the ATC-5000 status.

Optional Intergral Overcurrent Protection Capability

For service entrance applications, Digitrip microprocessor-based trip units can be integrated into the power switching devices. This eliminates the need for the separate upstream protective device, saving installation cost and space. Available with various combinations of Long, Short, Instantaneous and Ground Fault Protection, Digitrips can communicate with Eaton's IMPACC and PowerNet™ Power Management Systems.

Optional On-board 24 Vdc Power Supply

On-board 24 Vdc power supply circuit, consisting of two (2) 12 Vdc gel-cell UPS type batteries and battery charger, is available on the unit to provide dc control power to soft load transfer switch components. Engine battery can be connected in the "best battery" circuit as well, further improving the system's reliability.

Transfer Switch — Optional Components

TABLE 46. OPTIONS

DESCRIPTION	
Service Entrance Rating	
16N	Overcurrent Protection — Normal
16E	Overcurrent Protection — Emergency
16B	Overcurrent Protection — Both
37A	Service Entrance
37B	Service Entrance with Ground Fault
Metering	
18O	IQ Analyzer — Normal
18P	IQ Analyzer — Emergency
18Q	IQ Analyzer — N/E Selectable
18U	IQ Analyzer — Load
Plant Exerciser	
23J	Automatic 24 Hours/7 Days Selectable Load/No Load
Expanded Controller I/O	
25A	Additional Discrete and Analog I/O for Genset Control and Monitoring
Space Heater and Thermostat	
41C	400 W Heater with Thermostat
Surge Protection	
51M4B	Engine Control (24 Vdc) Surge Device
51NA1	100 kA Surge Device with AdVisor Source 1
51NS1	100 kA Surge Device with SuperVisor Source 1
51NN1	100 kA Surge Device with NetVisor Source 1
51QA1	160 kA Surge Device with AdVisor Source 1
51QS1	160 kA Surge Device with SuperVisor Source 1
51QN1	160 kA Surge Device with NetVisor Source 1
51SA1	200 kA Surge Device with AdVisor Source 1
51SS1	200 kA Surge Device with SuperVisor Source 1
51SN1	200 kA Surge Device with NetVisor Source 1
On-Board 24 Vdc Power Supply	
24C	Battery Charger and Gell-Cell Batteries
Protective Devices	
53A	Beckwith M-3410A
53B	Schweitzer SEL-547
53C	Basler BE1-951
53D	Beckwith M-3520
53E	Schweitzer SEL-351
53F	Basler BE1-IPS100
Communication	
54B	External Communication Gateway
54C	Serial Modbus Over Ethernet
Field Start-up	
56A	2-Day Start-up (Includes 1 Day for Travel)

Appendix A

TABLE 47. KW TO AMPERE CONVERSION CHART

THREE-PHASE AMPERE TABLE AT COMMON LINE-TO-LINE VOLTAGE

KW ①	200 V	208 V	220 V	230 V	240 V	380 V	400 V	415 V	460 V	480 V	600 V
5.0	18	17	16	16	15	9	9	9	8	8	6
7.5	27	26	25	24	23	14	13	13	12	11	9
10.0	36	34	33	31	30	19	18	17	16	15	12
15.0	54	52	49	47	45	28	27	26	24	23	18
20.0	72	69	66	63	60	38	36	35	31	30	24
25.0	90	87	82	78	75	47	45	43	39	38	30
30.0	108	104	98	94	90	57	54	52	47	45	36
40.0	144	139	131	126	120	76	72	70	63	60	48
50.0	180	173	164	157	150	95	90	87	78	75	60
60.0	217	208	197	188	180	114	108	104	94	90	72
75.0	271	260	246	235	226	142	135	130	118	113	90
80.0	289	278	262	251	241	152	144	139	126	120	90
100.0	361	347	328	314	301	190	180	174	157	150	120
125.0	451	434	410	392	376	237	226	217	196	188	150
150.0	541	520	492	471	451	285	271	261	235	226	180
175.0	631	607	574	549	526	332	316	304	275	263	210
200.0	722	694	656	628	601	380	361	348	314	301	241
250.0	902	867	820	784	752	475	451	435	392	376	301
300.0	1083	1041	984	941	902	570	541	522	471	451	361
350.0	1263	1214	1148	1098	1052	665	631	609	549	526	421
400.0	1443	1388	1312	1255	1203	760	722	696	628	601	481
500.0	1804	1735	1640	1569	1504	950	902	870	784	752	601
600.0	2165	2082	1968	1883	1804	1140	1083	1043	941	902	722
700.0	2526	2429	2296	2197	2105	1329	1263	1217	1098	1052	842
800.0	2887	2776	2624	2510	2406	1519	1443	1391	1255	1203	962
900.0	3248	3123	2952	2824	2706	1709	1624	1565	1412	1353	1083
1000.0	3609	3470	3280	3138	3007	1899	1804	1739	1569	1503	1203

① At 0.8 Power Factor.

Appendix B
M-3410A Inter-Tie Protective Relay

Refer to the appropriate table to make protective relaying changes.

TABLE 48. M-3410A INTER-TIE PROTECTIVE RELAY SET POINTS

DEVICE NUMBER	FUNCTION	SET POINT RANGES	INCREMENT	ACCURACY
Sync Check				
25	Phase Angle Window	0° to 90°	1°	±1°
	Upper Voltage Limit	100.0 to 120.0% ①	0.1%	±0.5 V or ±0.5%
	Lower Voltage Limit	70.0 to 100.0% ①	0.1%	±0.5 V or ±0.5%
	Delta Voltage Limit	1.0 to 50.0% ①	0.1%	±0.5 V
	Delta Frequency Limit	0.001 to 0.500 Hz	0.001 Hz	±0.001 Hz or 5%
	Sync Check Time Delay	1 to 8160 Cycles	1 Cycle	—
	Dead Voltage Limit	0.0 to 50.0% ①	0.1%	±0.5 V or ±0.5%
	Dead Time Delay	1 to 8160 Cycles	1 Cycle	±2 Cycles
	Sync Check may be operated as a stand-alone function or supervised by 79 (reconnect). Various combinations of input supervised hot/dead closing schemes may be selected. This function can only be enabled in line-to-line VT configuration and when function 27G and 59G are not enabled.			
Phase Undervoltage				
27	Pickup #1, #2	4 to 100% ①	0.1%	±0.5 V or ±0.5%
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	±2 Cycles ②
Ground Undervoltage				
27G	Pickup	4 to 100% ③	1.0%	±0.5 V or ±0.5%
	Time Delay	1 to 8160 Cycles	1 Cycle	±2 Cycles
	This function can only be enabled when the relay is configured in line-to-line VT and the 25 function is not enabled.			
Directional Power				
32	Pickup #1, #2	-3.00 to +3.00 PU	0.01 PU	±0.02 PU or 2% ④
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	±2 Cycles
	The per-unit pickup is based on nominal VT secondary voltage and nominal CT secondary current settings for currents less that 14 A (2.8 A). This function can be selected as overpower or underpower in the forward direction (positive setting). This function can also be selected for single-phase detection for line-to-ground VT. Minimum sensitivity of 100 mA for 5 A CT (real component of current).			
Loss-of-Field (Dual-Zone Offset-MHO Characteristic)				
40	Circle Diameter #1, #2	0.01 to 3.00	0.01 PU	±0.01 PU or ±5% ④
	Offset #1, #2	-2.0 to 2.0	0.01 PU	±0.01 PU or ±5% ④
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	±2 Cycles
27	Voltage Control (Positive Sequence)	4 to 100% ①	0.1%	±0.5 V or ±0.5%
	Directional Element	Fixed at -13°	—	—
Negative Sequence Overcurrent				
46	**Definite Time**			
	Pickup	3% to 300% ⑤	1%	±0.1 A or ±5% ⑥ (±0.02 A or ±5%)
	Time Delay	1 to 8160 Cycles	1 Cycle	±2 Cycles
	Inverse Time			
	Pickup	3% to 100% ⑤	0.1%	±0.1 A or ±3% ⑥ (±0.02 A or ±3%)
	Characteristic Curves	Definite Time/Inverse Time/Very Inverse/Extremely Inverse/IEC/I^2t = K		
	Time Dial Setting	0.5 to 11.0	0.1	±3 Cycles or ±10% ⑥
		0.05 to 1.10 (IEC)	0.01	—
		1 to 95 (I^2t = K)	1	—
	For I^2t = K Curve Only			
	Definite Maximum Time to Trip	600 to 65,500 Cycles	1 Cycle	±3 Cycles or ±10%
	Reset Time (Linear)	4 Minutes (From Threshold of Trip)	—	—
Negative Sequence Overvoltage				
47	Pickup #1, #2	4 to 100% ①	0.1%	±0.5 V or ±0.5%
	Time Delay #1, #2	1 to 8160 Cycles	1 Cycle	±2 Cycles

① Of nominal voltage.
② When DFT is selected, the time delay accuracy is ±2 cycles. When rms is selected, an additional time delay from 0 to +20 cycles may occur.
③ Of nominal voltage, maximum of 600 V. This function can only be enabled when the relay is configured in line-to-line VT and the 25 function is not enabled.
④ Accuracy applies for a nominal current range of 2.5 A to 6 A (5 A CT) or 0.5 A to 1.5 A (1 A CT).
⑤ Of nominal current for currents less than 14 A (2.8 A).
⑥ Accuracy applies for a nominal current range of 2.5 A to 6 A (5 A CT) or 0.5 A to 1.5 A (1 A CT), and for a pickup of >5%.

TABLE 48. M-3410A INTER-TIE PROTECTIVE RELAY SET POINTS (CONTINUED)

DEVICE NUMBER	FUNCTION	SET POINT RANGES	INCREMENT	ACCURACY
Inverse Time Residual Overcurrent				
51N	Pickup	0.50 to 6.00 A (0.10 to 1.20 A)	0.1 A	±0.1 A or ±3% (±0.02 A or ±3%)
	Characteristic Curves	Definite Time/Inverse Time/Very Inverse/Extremely Inverse/IEC		
	Time Dial			
	Standard Curves #1 – #4	0.5 to 11.0	0.1	±3 Cycles or ±10%
	IEC Curves #1 – #4	0.05 to 1.10	0.01	—
Inverse Time Overcurrent, with Voltage Control or Voltage Restraint				
51V	Pickup	0.50 to 12.00 A (0.10 to 2.40 A)	0.01 A	±0.1 A or ±3% (±0.02 A or ±3%)
	Characteristic Curves	Definite Time/Inverse/Very Inverse/Extremely Inverse/IEC Curves		
	Time Dial	0.5 to 11.0	0.1	±3 Cycles or ±10%
		0.05 to 1.10 (IEC Curves)	0.01	—
	Voltage Control (VC) or	4 to 150.0% ①	0.1%	±0.5 V or ±5%
	Voltage Restraint (VR)	Linear Restraint	—	—
Phase Overvoltage				
59	Pickup #1, #2	100 to 150% ①	0.1%	±0.5 V or ±0.5% (±0.02 A or ±3%)
	Time Delay	1 to 8160 Cycles	1 Cycle	±2 Cycles ②
Ground Overvoltage				
59G	Pickup	4 to 150% ①	1.0%	±0.5 V or ±0.5% (±0.02 A or ±3%)
	Time Delay	1 to 8160 Cycles	1 Cycle	±2 Cycles
	This function can only be enabled when the relay is configured in line-to-line VT and the 25 function is not enabled.			
Peak Overvoltage				
59I	Pickup	100 to 150% ③	0.1%	±3% ④
	Time Delay	1 to 8160 Cycles	1 Cycle	±3 Cycles
VT Fuse-Loss Detection				
60FL	A VT fuse-loss condition is detected by using the positive and negative sequence components of the voltages and currents. VT fuse-loss output can be initiated from internally generated logic or from input contacts.			
	Time Delay	1 to 8160 Cycles	1 Cycle	±2 Cycles
Reconnect Enable Time Delay				
79	Time Delay	2 to 65,500 Cycles	1 Cycle	±2 Cycles
	Reconnect timer starts when all outputs designated as trip outputs reset.			
Over/Underfrequency				
81	Pickup #1, #2, #3, #4	50.00 to 67.00 Hz (40.00 to 57.00 Hz ⑤)	0.01 Hz	±0.03 Hz
	Time Delay #1, #2, #3, #4	2 to 65,500 Cycles	1 Cycle	±2 Cycles or ±0.01%
	The pickup accuracy applies to 60 Hz models at a range of 57 to 63 Hz, and to 50 Hz models as a range of 47 to 53 Hz. The accuracy is ±0.15 Hz for a range of 52 to 57 Hz, and 63 to 67 Hz (for 60 Hz nominal) and 42 to 47 Hz and 53 to 57 Hz (for 50 Hz nominal).			
Nominal Settings				
	Nominal Voltage	50 to 500 V ⑥	1 V	—
	Nominal Current	0,50 to 6.00 A	0.01 A	—
	VT Configuration	Line-Line/Line-Ground/Line-Ground-to-Line-Line ⑦		
	Seal-in Delay	2 to 8160 Cycles	1 Cycle	±1 Cycle or ±1.0%

① Of nominal voltage.
② When DFT is selected, the time delay accuracy is ±2 cycles. When rms is selected, an additional time delay from 0 to +20 cycles may occur.
③ Instantaneous voltage magnitude response; intended for ferroresonance protection.
④ For fundamental (60 Hz/50 Hz) signal only. For distorted input signals, the accuracy degrades as the order of harmonic signal increases.
⑤ This range applies to 50 Hz nominal frequency models.
⑥ Maximum measured range for (25), (59), (59G) and (59I) function settings is ≤600 V.
⑦ When line-ground-to-line-line is selected, the relay internally calculates the line-line voltage from the line-ground voltages for all voltage-sensitive functions. When the line-ground-to-line-line selection is applied, the nominal voltage selection should be the line-line nominal voltage (not line-ground nominal voltage).

Appendix C
Transient Voltage Surge Suppression Device

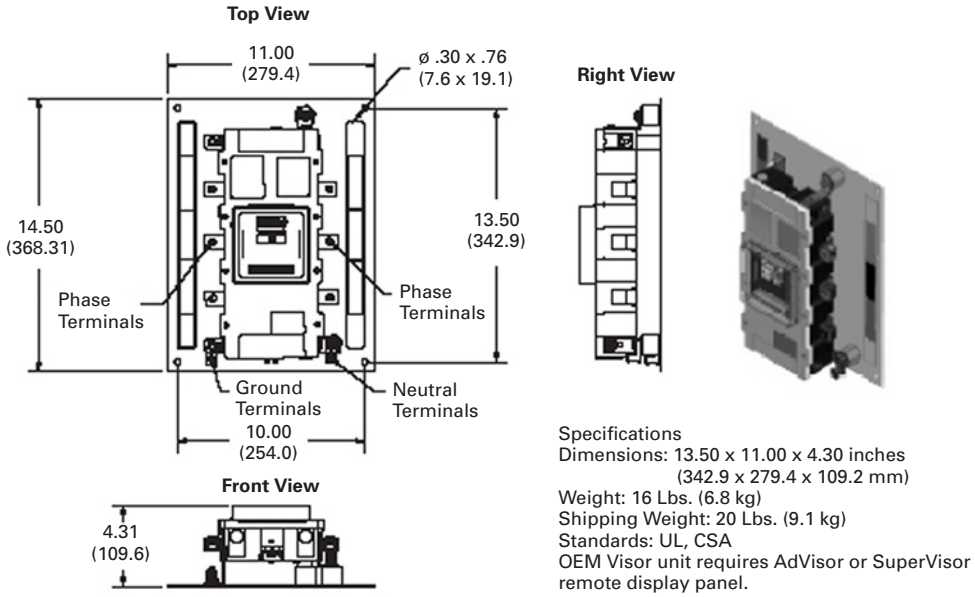


FIGURE 20. VISOR OEM 100, 100 AND 200 KA TECHNICAL DATA

Technical Data

TABLE 49. VISOR SERIES — GENERAL PARAMETERS

DESCRIPTION	OEM VISOR
kA/Mode	50 – 250
kA/Phase	100 – 500
Split-Phase System	240
	L, L, N, G
Wye System Voltages	120/208
	277/480
	347/600
	L, L, L, N, G
Delta System Voltages	240
	480
	600
	L, L, L, G
International System Voltages	127/220Y
	230/400
	L, L, L, N, G
	Mexico, other
Monitoring	AdVisor
	SuperVisor
	NetVisor
Mounting	Panelboards (PRL1A, 2A, 3A, 4)
	Remote Monitor Device Panel (Switchboard, Switchgear, Busway) MCC Version
Remote Display Cables ①	
Ribbon Cable	3 and 6 feet (0.9 and 1.8 m)
DB15 600 V Class Cable	8 and 16 feet (2.4 and 4.9 m)
Temperature	
Storage	-40ºC to +60ºC
Operation	-20ºC to +60ºC
Humidity (Relative)	5 – 95%
Warranty	10 years
Certifications/Listing	UL 1449 2nd Edition, CSA 22.2, UL 1283.

① Remote display cables only for use on configuration B and Z models.

Standards and Certifications

- All Visor Series units have been tested by UL and meet the requirements under UL 1449 2nd Edition for surge suppression devices.
- All Visor Series units have been tested as per NEMA LS-1 and ANSI/IEEE C62.45.
- Category A3 Ringwave (6 kV open circuit, 200 A short circuit current at 100 kHz).
- Category B3 Ringwave (6 kV open circuit, 500 A short circuit current at 100 kHz).
- Category C1 Combination Wave (6 kV 1.2/50us open circuits, 3 kA 8/20us short circuit current).
- Category C3 Combination Wave (20 kV 1.2/50us open circuits, 10 kA 8/20us short circuit current).
- UL 1020 (standard for safety for thermal cutoffs for use in electrical appliances and components).
- UL 1283 listed for EMI/RFI noise attenuation filtering (50 db at 100 kHz).
- CSA C22.2.

Dimensions are approximate in inches (mm).
Should not be used for construction purposes.

Magnum Closed Transition Soft Load Transfer Switches with ATC 5000 Controller

Magnum Closed Transition Soft Load Transfer Switch with ATC 5000 Controller

Product Description

General Information

Electrical power generation located at or near the point of its consumption, commonly referred to as **Distributed Generation,** has seen tremendous growth recently due to factors such as limited utility grid generation and transmission capacity combined with the onset of utility deregulation. Strong economic incentives now exist for many users to consider on-site self generation for both improved power reliability and energy cost reduction. Additionally, these opportunities have spurred the development of new and unique types of generating and switching technologies.

Eaton Closed Transition Soft Load Automatic Transfer Switches are just such a technology. Closed transition soft load transfer switches are an ideal solution for power availability, energy management, and generator-set exercising applications. Unlike traditional open transition switches that provide a break-before-make operation, the closed transition soft load switch allows two power sources, usually the utility and a generator set, to be paralleled indefinitely. This permits the load, inductive or resistive, to be gradually and seamlessly transferred from one source to another. All of this is accomplished through the make-before-break operation of the switch with no power interruption to the load.

Eaton Closes Transition Soft Load Switch utilizes an integrated microprocessor based power controller to make active paralleling of two power sources possible. It manages the speed governor and voltage regulator of the generator set to bring the two sources into synchronization. This approach allows the transfer switch to be applied in soft load transfer applications. In addition, it can also be used as a peak shaving switch helping customers to reduce their peak demand charges by paralleling the generator set with the utility source during times of high electrical demand.

Standard fixed drawout or drawout bypass isolation configurations are available with or without an integral service entrance rating. If a switch with a service entrance rating is used as service entrance equipment, the need for separate service disconnects and overcurrent protective devices is eliminated.

Eaton Closed Transition Soft Load Automatic Transfer Switches are available for 800 through 3200 ampere, up to 600 Vac, 50 or 60 Hz applications worldwide. They are offered in both indoor (NEMA 1) and outdoor (NEMA 3R) free standing enclosures utilizing drawout or fixed insulated case Magnum DS switching devices. The Magnum DS switching device is a 100% rated device with a 100 kA interrupting capability at 600 Vac.

Application Description

Power reliability and power costs are two issues of strategic importance in almost all industry segments. Businesses have critical processes that cannot tolerate a shut down, while an extended failure in many cases could cause unrecoverable losses. In addition, significant changes in the utility industry have created on-site generation opportunities for customers to address their power reliability and energy cost concerns. This type of on-site power generation at or near the point of consumption is known as distributed generation. Market studies estimate that over 40% of generation capacity added in the United States alone over the next 10 years will be distributed. A key enabler of these on-site generation systems and reliable power in general is often a closed transition soft load transfer switch.

Typical applications for Eaton Closed Transition Soft Load Automatic Transfer Switches include industrial processes, data centers and critical care facilities. Actually, any location with critical loads where the absence of power could result in lost revenue, production time, or personal injury should make this equipment a prime consideration.

Consider several specific applications:

- A facility with emergency or critical power systems wanting to test their generator sets without a power interruption.
- Any industrial, institutional, or commercial business seeking ways to lower energy costs by reducing demand charges, which can represent over 50% of an electrical bill.
- Energy Service Companies interested in offering performance based solutions to their customer base.
- Electrical power providers interested in offering power reliability solutions to their customer base in return for long term electrical contracts.

The Eaton Closed Transition Soft Load Automatic Transfer Switch can be applied in new installations or as a retrofit to replace an existing open transition transfer switch. A number of application issues should be reviewed. First, since most generator sets run on diesel fuel, there are exhaust emission concerns to consider. In some markets, the Environmental Protection Agency (EPA) limits the number of hours annually that a generator set can be operated. Methods to deal with such restrictions, should they present a problem, are the use of natural gas or dual fuel (natural gas/diesel mixture) types of generator sets. A second issue relates to electrical utility interconnection standards. Many utility companies require multiple levels of protective relaying when a user wishes to parallel to the utility grid. The cost of meeting some of these specifications can be high. These issues should be discussed when peak shaving is being considered.

Features, Benefits and Functions

Sequence of Operations

Automatic Mode Operation — Transfer Switch Loss of Normal Power

The system will continuously monitor the condition of the normal power supply. When the voltage or frequency of the normal source is sensed outside the user adjustable set points, and after an adjustable time delay to override momentary dips and/or outages, a contact shall close to initiate a starting of the emergency or stand-by source. Transfer to the alternate source shall take place upon attainment of adjustable pick-up voltage and frequency of the alternate source.

Return of Normal Power — Breaker Open Transition Logic Selected

When normal source has been restored and is within the pre-selected ranges for voltage and frequency and after a time delay to ensure the integrity of the normal power source, the load shall be transferred back to normal source in a break-before-make transfer scheme. The generator set will continue to run for a user adjustable time to allow the generator set to run unloaded for cool down, after which the engine will be shut down. Upon completion the system will then be ready for automatic operation.

Return of Normal Power — Breaker Closed Transition Logic Selected

When the normal source has been restored and is within the pre-selected ranges for voltage and frequency, and after an adjustable time-delay to ensure the integrity of the normal source, the load shall be transferred back to the normal source in a make-before-brake transfer scheme.

On completion of the time delay, the generator set bus will automatically synchronize with the utility service across the Source 1 (normal) breaker. When the two systems are synchronized, the Source 1 (nor-

mal) breaker will close and the Source 2 (emergency) breaker will open. The generator set will continue to run for a user adjustable time to allow the generator set to run unloaded for cool down, after which the engine will be shut down. Upon completion the system will then be ready for automatic operation.

Return of Normal — Breaker Interchange (Soft Load) Logic Selected

When the normal source has been restored and is within the preselected ranges for voltage and frequency, and after an adjustable time-delay to ensure the integrity of the normal source, the load shall be transferred back to the normal source in a make-before-brake transfer scheme. On completion of the time delay, the generator set bus will automatically synchronize with the utility service across the Source 1 (normal) breaker. When the two systems are synchronized, the Source 1 (normal) breaker will close and the generator set will gradually transfer all loads to the utility.

On completion of the load transfer sequence the Source 2 (emergency) breaker will open. The generator set will continue to run for a user adjustable time to allow the generator set to run unloaded for cool down, after which the engine will be shut down. Upon completion the system will then be ready for automatic operation.

Peak Shaving

The closed transition soft load transfer switch can be factory configured to automatically parallel to the utility. In this operation mode, the switch will be paralleled with the utility when the user adjustable load power level is exceeded for the predetermined amount of time.

Test Mode Operation

Engine Run Test Mode

To perform an engine run test, first place the System Test switch in the "Run" position. Next place the Auto/Test switch in the "Test" position. The engine start contact will close, the engine will start and the generator will produce nominal voltage and frequency. **Neither** Source 1 nor Source 2 breaker will be operated.

Returning either the System Test to "Off" position or Auto/Test switch to "Auto" position will remove the "Engine Start" command. The engine will shut down.

Transfer Test Mode (Open Transfer)

This operation is carried out when the controller's Breaker Logic is programmed for Open Transition via ATC-5000 Input 64.

To perform an open transition test, first place the Test Mode selector switch in the "Mode 1" position, followed by placing the System Test switch in "Test" position followed by placing Auto/Test selector switch in the "Test" position. After an adjustable time delay, the generator will start. After the nominal voltage and frequency are reached, the Source 1 (normal) breaker will open and the Source 2 (emergency) breaker will close on the dead bus.

Returning either the Auto/Test selector switch to "Auto" position or the Test Mode selector switch to "Off" position will cause the system to return to normal power as described in "Return Of Normal Power — Breaker Open Transition Logic Selected."

Transfer Test Mode (Closed Transition)

This operation is carried out when the controller's Breaker Logic is changed to Closed Transfer via ATC-5000 Input 64.

To perform a closed transition test, first place the Test Mode selector switch in the "Mode 2" position, followed by placing the System Test switch in "Test" position followed by placing the Auto/Test selector switch in the "Test" position. After an adjustable time delay, the generator will start. After the nominal voltage and frequency are reached, the generator bus will be synchronized to the utility across the Source 2 (emergency) breaker. When the two sources are synchronized the Source 2 (emergency) breaker closes and then Source 1 (normal) breaker opens.

Returning either the Auto/Test selector switch to "Auto" position or the System Test selector switch to "Off" position will cause the system to return to normal power as described in "Return Of Normal Power — Breaker Closed Transition Logic Selected."

Transfer Test Mode (Interchange — Soft Load Transition)

This operation is carried out when the controller's Breaker Logic is programmed for Interchange (Soft Load Transition).

To perform an interchange (soft load transition) test, first place the Test Mode selector switch in the "Mode 1" position, followed by placing the System Test switch in "Test" position followed by placing the Auto/Test selector switch in the "Test" position. After an adjustable time delay, the generator will start. After the nominal voltage and frequency are reached, the generator bus will be synchronized to the utility across the Source 2 (emergency) breaker. When the two sources are synchronized the Source 2 (emergency) breaker is closed and the generator gradually assumes all load. On completion of the load transfer sequence the Source 1 (normal) breaker will open.

Returning either the Auto/Test selector switch to "Auto" position or the System Test selector switch to "Off" position will cause the system to return to normal power as described in "Return of Normal Power (Switch in Closed Transition Mode)."

Paralleling Test mode (Baseload)

This operation is carried out when the controller's Breaker Logic is changed to Parallel via ATC-5000 Input 64 and the Baseload operation is selected.

To perform a paralleling test in a base load mode, first place the Test Mode selector switch in the "Mode 2" position, followed by placing the System Test switch in "Test" position followed by placing the Auto/Test selector switch in the "Test" position. After an adjustable time delay, the generator will start. After the nominal voltage and frequency are reached, the generator bus will be synchronized to the utility across the Source 2 (emergency) breaker. When the two sources are synchronized the Source 2 (emergency) breaker is closed and the generator gradually assumes load up to the user programmable power level and then continuously maintains its power output.

Returning either the Auto/Test selector switch to "Auto" position or the System Test selector switch to "Off" position will cause the generator to gradually unload and then the Source 2 (emergency) breaker will open. The generator set will continue to run for a user adjustable time allowing the generator set to run unloaded for cool down, after which the engine will be shut down. Upon completion the system will then be ready for automatic operation.

Paralleling Test Mode (Import/Export)

This operation is carried out when the controller's Breaker Logic is changed to Parallel (via ATC-5000 Input 64 and the Import/Export operation is selected.

To perform a paralleling test in Import/Export mode, first place the Test Mode selector switch in the "Mode 2" position, followed by placing the System Test switch in "Test" position followed by placing the Auto/Test selector switch in the "Test" position. After an adjustable time delay, the generator will start. After the nominal voltage and frequency are reached, the generator bus will be synchronized to the utility across the Source 2 (emergency) breaker. When the two sources are synchronized the Source 2 (emergency) breaker is closed and the generator gradually assumes load up to the user programmable import (adjustable power setting for power supplied from the utility) or export (adjustable power setting for power supplied to the utility) power level and then continuously varies its power output to maintain the selected power flow.

Returning either the Auto/Test selector switch to "Auto" position or the System Test selector switch to "Off" position will cause the generator to gradually unload and then the Source 2 (emergency) breaker will open. The generator set will continue to run for a user adjustable time allowing the generator set to run unloaded for cool down, after which the engine will be shut down. Upon completion the system will then be ready for automatic operation.

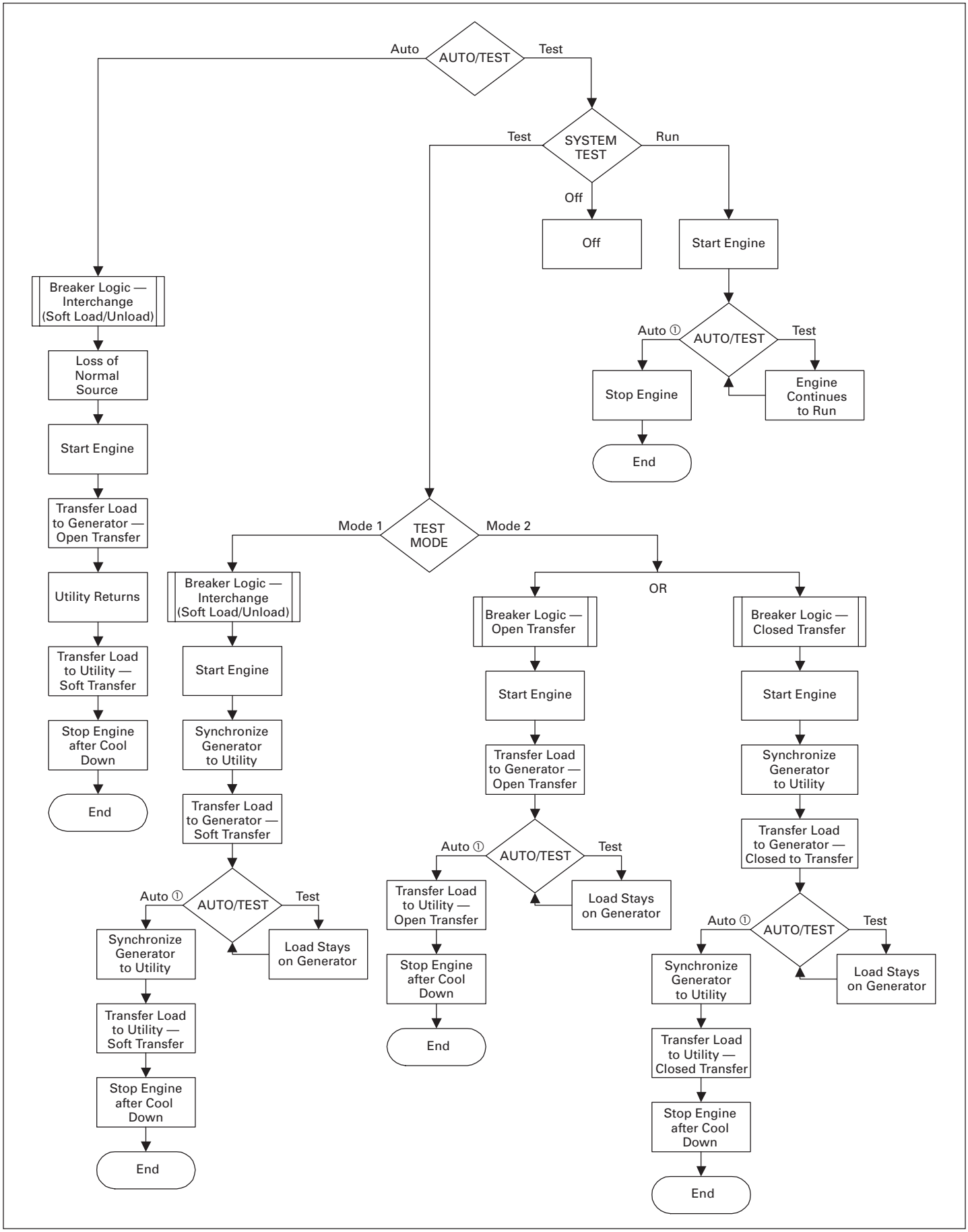


FIGURE 21. SEQUENCE FLOW CHART — SOFT LOAD ATS

① Or switch SYSTEM TEST selector switch to OFF.

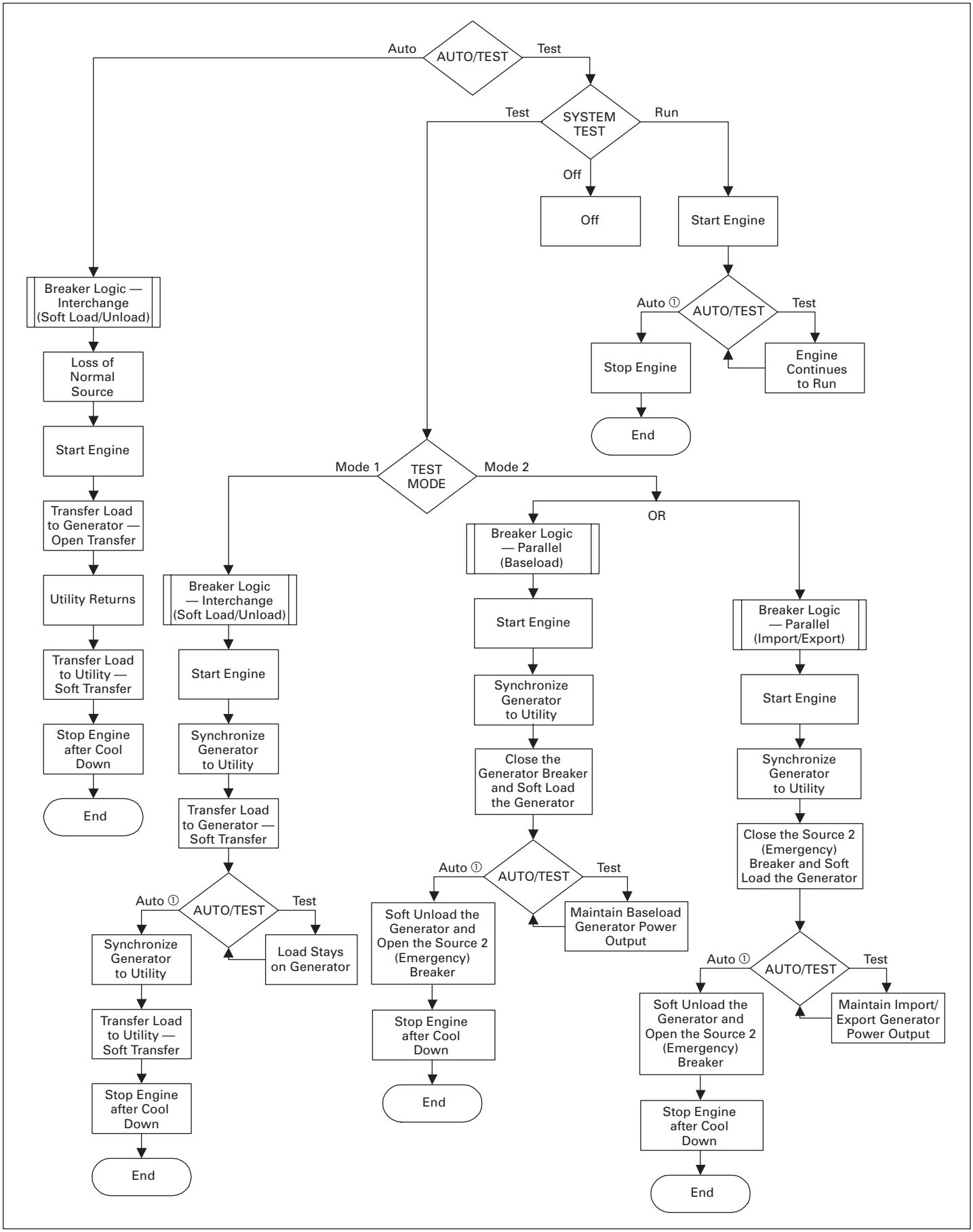


FIGURE 22. SEQUENCE FLOW CHART — SOFT LOAD ATS WITH EXTENDED PARALLELING CAPABILITIES

① Or switch SYSTEM TEST selector switch to OFF.

Technical Data and Specifications

System

Standards

Eaton Soft Load ATSs are listed in File E38116 by Underwriters Laboratories, under Standard UL 1008. This standard covers requirements for ATSs intended for use in ordinary locations to provide for lighting and power as follows:

A. In emergency systems, in accordance with articles 517 and 700 in the National Electrical Code (NEC), American National Standards Institute/National Fire Protection Association (ANSI/NFPA) 70 and the NFPA No. 76A and/or

B. In stand-by systems, in accordance with Article 702 of the NEC and/or

C. In legally required stand-by systems in accordance with article 701 of the NEC.

Eaton ATSs are available to meet NFPA 110 for emergency and stand-by power systems, and NFPA 99 for health care facilities when ordered with the appropriate options.

Since Eaton ATSs utilize specially designed switches and/or switching devices as the main power switching contacts, these devices must also be listed under the additional UL Standard 1066. UL utilizes two basic types of listing programs: a) Label Service and b) Re-examination. UL 1066 employs a label service listing program which requires an extensive follow-up testing program for listed devices. Standard UL 1008 for ATSs lists devices under the re-examination program which only requires a continual physical re-examination of the components used in the product to insure consistency with the originally submitted device. Follow-up testing IS NOT required by UL 1008.

Representative production samples of switches and switching devices used in Eaton ATSs are subjected to a complete test program identical to the originally submitted devices on an ongoing periodic basis per UL 1066.

The frequency of such a re-submittal can be as often as every quarter for a low ampere device.

Environmental

Seismic

With proper installation and by including Option 42 which includes specially designed cleats, the Magnum transfer switch is a Seismic Certified Transfer Switch with certificate for application that is Seismic Zone 4 under the California Building Code, the Uniform Building Code, and BOCA.

Operational Conditions

Normal operation in an electrical equipment room for indoor applications. Outdoor applications can subject units to falling rain, freezing temperatures, and 95% humidity (non condensing).

Ambient temperature for operation is between -20 and +65°C (-4 and 149°F).

TABLE 50. SYSTEM RATINGS

STANDARD UL 1008 3-CYCLE		30-CYCLE EXTENDED RATING
ATS AMPERE RATING	RATINGS WHEN USED WITH UPSTREAM BREAKER (KA) 120 – 600 VAC	RATINGS USED FOR COORDINATION WITH UPSTREAM BREAKERS WITH SHORT TIME RATING 120 – 600 VAC
Magnum DS Fixed and Drawout		
800	100	85
1000	100	85
1200	100	85
1600	100	85
2000	100	85
2500	100	85
3200	100	85

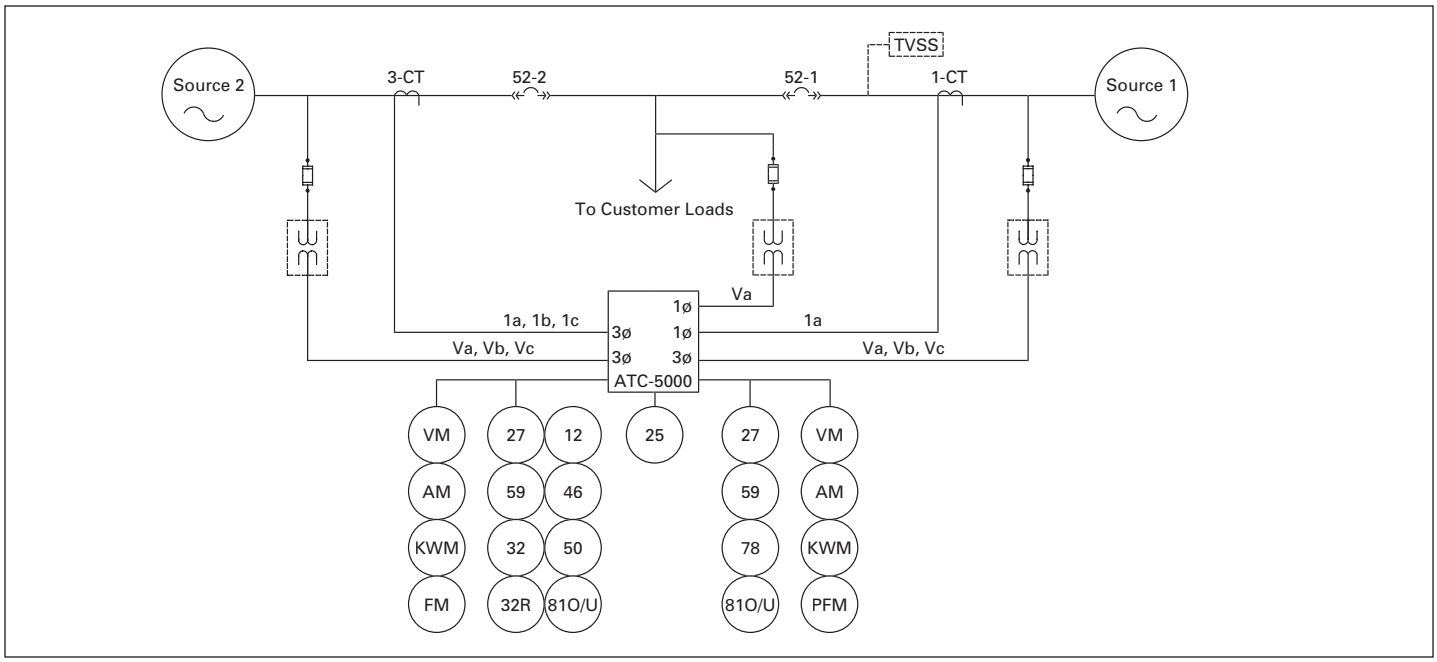


FIGURE 23. Typical System Diagram — Standard One Line

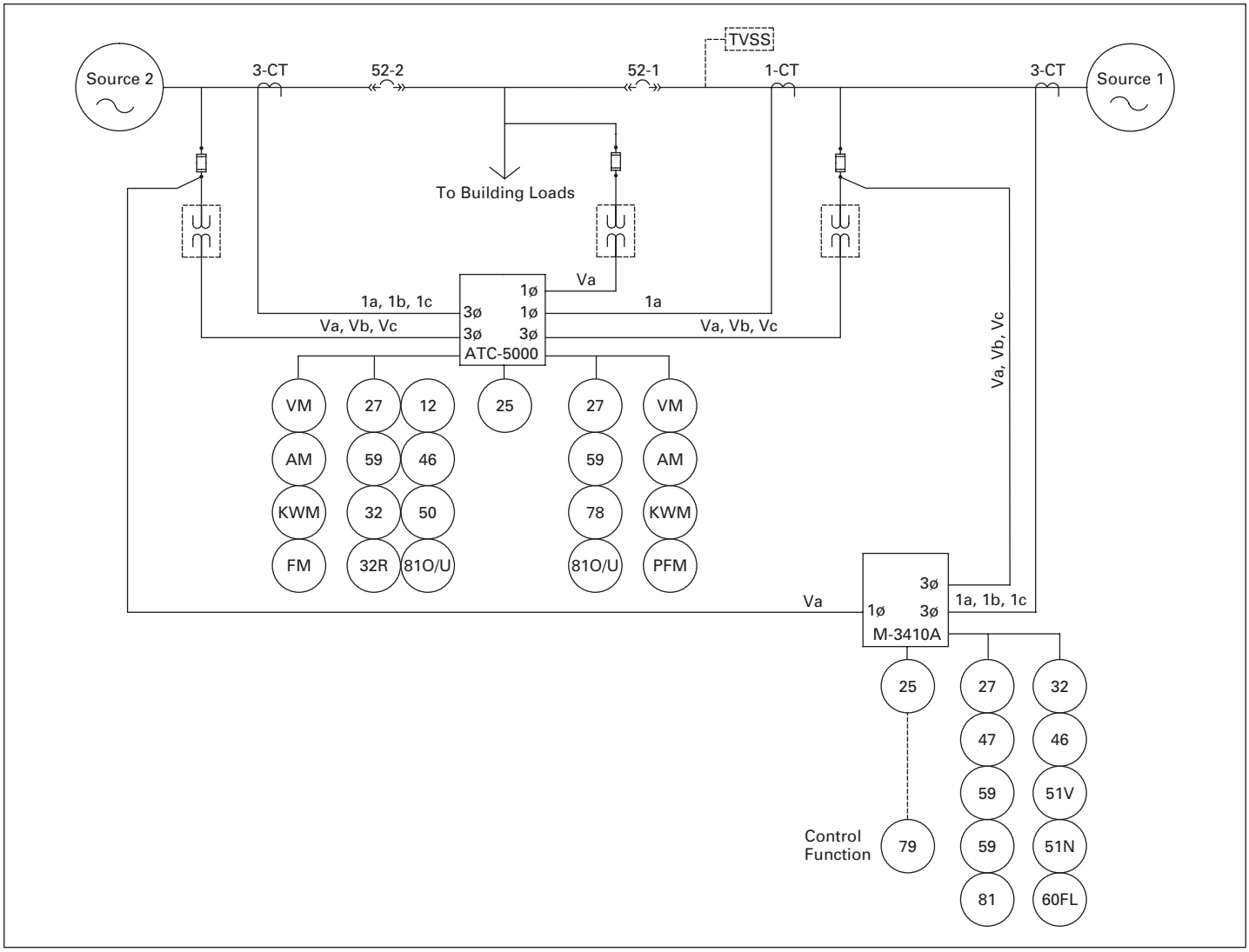
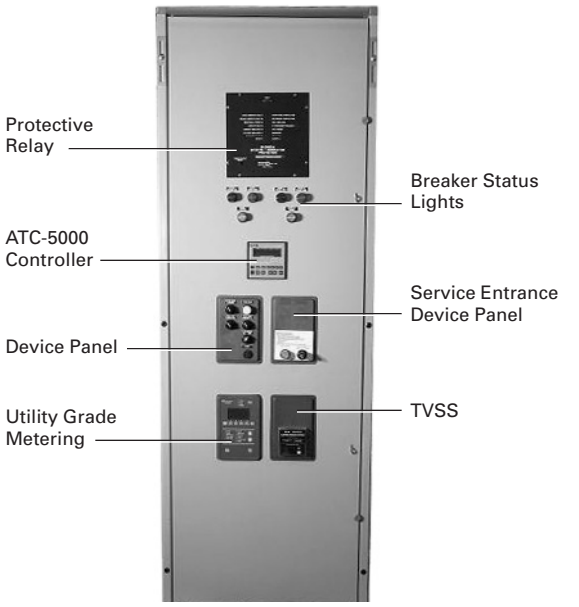
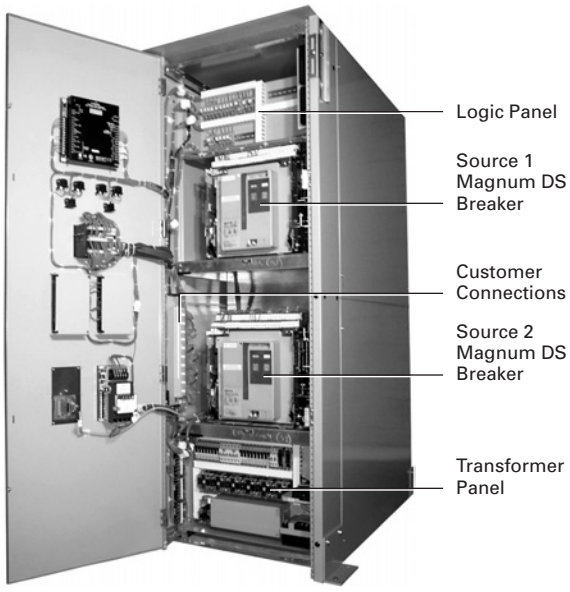


FIGURE 24. TYPICAL SYSTEM DIAGRAM — STANDARD ONE LINE WITH UTILITY GRADE MULTI-FUNCTION RELAYING

Base Components





Magnum Soft Load ATS Base Components

Enclosure

The rugged steel switch enclosure is supplied with four door hinges, regardless of enclosure size, to ensure proper support of the door and door mounted devices. The hinges have removable hinge pins to facilitate door removal. The doors are supplied as standard with thumbscrew and padlock latches. Cable entry holes are the customer's responsibility.

The door is used to mount a variety of lights, switches, and push buttons, depending upon the options required for a particular switch. All switch doors are supplied with a heavy duty plastic accessory panel in place, whether or not external devices are required. When lights, pushbuttons, or switches are required, they are normally mounted in the plastic door mounted panel.

Transfer switch enclosures and some internal steel mounting plates, such as the transformer panel mounting plate, go through a pre-treatment cleaning system prior to painting to insure a durable finish. Should the enclosure become scratched and in need of touch up paint, use ANSI 61. All remaining steel is galvanized.

The standard switch enclosure is NEMA Type 1 for general indoor use **Table 51**.

TABLE 51. TRANSFER SWITCH EQUIPMENT ENCLOSURES

NEMA TYPE	DESIGN	PROTECTION
1	Indoor	Enclosed Equipment
3R	Outdoor	Rain, Ice Formation

Power Cables

Power cables are to be connected to solderless screw type lugs located on

the transfer switch switching devices. Refer to the separate Customer Wiring Diagrams supplied with the transfer switch equipment for power termination. Verify that the lugs supplied will accommodate the power cables being used. Also verify that the cables comply with local electrical codes. Standard transfer switch equipment, as supplied from the factory, will accommodate the wire sizes shown in **Table 52**.

TABLE 52. WIRE SIZE FOR AVAILABLE POWER CABLE CONNECTIONS

DEVICE	SWITCH AMPERE RATING	CABLES PER PHASE	RANGE WIRING SIZE
Switch	800 – 2000	6	3/0 – 750 kcmil
	2500 – 3200	9	3/0 – 750 kcmil
Neutral	800 – 2000	24	4/0 – 500 kcmil
	2500 – 3200	36	4/0 – 500 kcmil

TABLE 53. DIMENSIONS CHART

			DIMENSIONS IN INCHES (MM)					
			NEMA 1			NEMA 3R		
DESIGN	AMPERES	POLES	HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH	DEPTH
Fixed	800 – 2000	3 & 4	90.00 (2286.0)	32.00 (812.8)	48.00 (1219.2)	90.00 (2286.0)	32.00 (812.8)	54.00 (1371.6)
	2500 – 3200	3 & 4	90.00 (2286.0)	44.00 (1117.6)	48.00 (1219.2)	90.00 (2286.0)	44.00 (1117.6)	54.00 (1371.6)
Drawout	800 – 2000	3 & 4	90.00 (2286.0)	32.00 (812.8)	60.00 (1524.0)	90.00 (2286.0)	32.00 (812.8)	66.00 (1676.4)
	2500 – 3200	3 & 4	90.00 (2286.0)	44.00 (1117.6)	60.00 (1524.0)	90.00 (2286.0)	44.00 (1117.6)	66.00 (1676.4)
Fixed With Bypass Isolation	800 – 2000	3 & 4	90.00 (2286.0)	64.00 (1625.6)	48.00 (1219.2)	90.00 (2286.0)	64.00 (1625.6)	54.00 (1371.6)
	2500 – 3200	3 & 4	90.00 (2286.0)	88.00 (2235.2)	48.00 (1219.2)	90.00 (2286.0)	88.00 (2235.2)	54.00 (1371.6)
Drawout With Bypass Isolation	800 – 2000	3 & 4	90.00 (2286.0)	64.00 (1625.6)	60.00 (1524.0)	90.00 (2286.0)	64.00 (1625.6)	66.00 (1676.4)
	2500 – 3200	3 & 4	90.00 (2286.0)	88.00 (2235.2)	60.00 (1524.0)	90.00 (2286.0)	88.00 (2235.2)	66.00 (1676.4)

Product Selection

Transfer Switch Catalog Number Identification

Transfer switch equipment catalog numbers provide a significant amount of relevant information that pertains to a particular piece of equipment. The catalog number identification table (**Table 54**) provides the required interpretation information. An example for an open transition switch is offered to initially simplify the process.

Example: Catalog Number (circled numbers correspond to position headings in **Table 54**).

①to②	③	④	⑤to⑥	⑦	⑧	⑨to⑫	⑬	⑭	⑮
CT	V	C	MG	E	3	2000	X	R	U

The catalog number CTVCMGE32000XRU describes a Soft Load ATS with the drawout switching devices mounted vertically in the enclosure. The intelligence, represented by the ATC-5000, is a microprocessor-based logic package.

The Magnum Breaker is used as the switching device and is a 3-pole molded case breaker for each source. The continuous current rating of this equipment is 2000 A and is applicable at 480/277 Vac, 60 Hz. The transfer switch equipment is enclosed in a NEMA 3R enclosure and is listed for Underwriters Laboratories (UL).

Catalog Numbering System

TABLE 54. TRANSFER SWITCH CATALOG NUMBER SYSTEM — MAGNUM SOFT LOAD TRANSFER SWITCHES 800 – 3200 AMPERES

Using the Catalog Numbering System provides an overview of the ten basic style/feature categories which generate the 15 digit catalog number.

CT V C MG E 3 2000 X R U

Type
Position 1-2
CT = Closed Transition

Logic
Position 4
C = ATC 5000

Frame
Position 5-6
MG = Molded Cases Magnum DS

Poles
Position 8
3 = 3 Poles
4 = 4 Poles

Amperes
Position 9-12
0800 = 800 A
1000 = 1000 A
1200 = 1200 A
1600 = 1600 A
2000 = 2000 A
2500 = 2500 A
3200 = 3200 A

Enclosure
Position 14
S = NEMA 1
R = NEMA 3R

Listing
Position 15
U = UL Listed

Orientation
Position 3
V = Vertical

Switch
Position 7
A = Fixed Mount, Power Case Switch PCS Both
B = Fixed Mount, Power Case Circuit Breaker PCB Both
C = Fixed Mount, PCB Normal, PCS Emergency
D = Fixed Mount, PCS Normal, PCB Emergency
E = Drawout, PCS Both
F = Drawout, PCB Both
G = Drawout, PCB Normal, PCS Emergency
H = Drawout, PCS Normal, PCB Emergency

Voltage
Position 13
A = 120 V 60 Hz 3-Phase 3-Wire
B = 208/120 60 Hz 3-Phase 4-Wire
E = 600 V 60 Hz 3-Phase 3-Wire
E = 600 V 60 Hz 3-Phase 4-Wire
G = 220/127 V 50 Hz 3-Phase 4-Wire
G = 220/110 V 50/60 Hz 1-Phase 3-Wire
H = 380/220 V 50 Hz 3-Phase 4-Wire
K = 600 V 50 Hz 3-Phase 4-Wire
M = 230 V 50 Hz 3-Phase 3-Wire
M = 230 V 50 Hz 1-Phase 3-Wire
N = 401/230 V 50 Hz 3-Phase 4-Wire
O = 415/240 V 50 Hz 3-Phase 4-Wire
W = 240/120 V 60 Hz 1-Phase 3-Wire
W = 240 V 60 Hz 3-Phase 3-Wire
W = 240/120 V 60 Hz 3-Phase 4-Wire Hi-Leg
W = 230/115 V 60 Hz 1-Phase 3-Wire
X = 480 V 60 Hz 3-Phase 3-Wire
X = 480/277 V 60 Hz 3-Phase 4-Wire
X = 480/240 V 50 Hz 1-Phase 2-Wire
Z = 346/220 V 50 Hz 3-Phase 4-Wire

PCS = Power Case Switch
PCB = Power Circuit Breaker

ATC-5000 Specifications

ATC-5000 Integrated Microprocessor Controller

The integrated logic controller is a microprocessor-based generator set control and management package. ATC-5000 provides a user-friendly interface allowing operators to easily view system status, view and reset alarms, display metered values and modify device set points.

The unit provides fully integrated communication to engine Electronic Control Units (ECUs) including:

- [via CAN bus] standard SAE J1939, Deutz EMR, Scania S6, mtu MDEC;
- [via RS-232] Caterpillar CCM to EMCP-II, and ECM.

Features include:

- Integrated LED display.
- Automatic Transfer Switch Logic.
- True rms sensing.
- Frequency and Voltage Bias Outputs for the generator sets.
- Protective Relays.
  - Device 25A Synchronizer
  - Device 59/27 O/U Voltage for generator set and utility tie
  - Device 81 O/U Frequency for generator set and utility tie
  - Device 78 Phase/Vector shift for the utility tie
  - Device 32/32R Overload/Reverse Power for the generator set
  - Device 46 Load Imbalance for the generator set
  - Device 50/51 Overcurrent for the generator set
- Load Management.
  - Automatic base load/peak shaving
  - Import/Export power control
- Automatic Start/Stop sequencing for gas and diesel engines.
- Load dependent start/stop.
- Real Power/PF control.
- Counters for kWh, engine starts, operating hours and maintenance call.
- Freely configurable discrete and analog alarm inputs.
- Freely configurable relay and analog outputs.
- Language Manager.
- Event Logging.
- PC and front panel configurable.
- Multi level password protection.
- Battery voltage monitoring.
- CAN bus communication.

Specifications

Accuracy . . . . . Class 1
Power supply . . . . . 12/24 Vdc (9.5 to 32 Vdc)
Intrinsic consumption . . . . . Maximum 20 W
Ambient temperature . . . . . -20 to 70˚C
Ambient humidity . . . . . 95%, Non-condensing
Voltage Rated (Vrated): . . . . . [1] 69/120 Vac or [4] 231/400 Vac
UL: . . . . . [1] Maximum 86/150 Vac or
[4] Maximum 173/300 Vac
Setting range(sec.)star: . . . . . [1] 50 to 125 Vac or
[4] 50 to 480 Vac
Setting range(sec.)delta: . . . . . [1] 50 to 114 Vac or
[4] 50 to 380 Vac
Setting range (prim.): . . . . . 0.050 to 65,000 kVac
Measuring frequency . . . . . 50/60 Hz (40 to 70 Hz)
Linear measuring range up to . . . . . 1.3 ¥ Vrated
Input resistance . . . . . [1] 0.21 MW, [4] 0.7 MW
Maximum power consumption per path . . . . . <0.15 W
Current (rated values; Irated) . . . . . [../1]../1A or [../5]../5A
Current-carrying capacity . . . . . I_{gen} = 3.0 ¥ Irated
I_{mains} = 1.5 ¥ Irated
Load . . . . . <0.15 VA
Related short-time current (1s) . . . . . [../1] 50 ¥ Irated,
[../5] 10 ¥ Irated

Discrete inputs . . . . . Isolated
Input range . . . . . 12/24 Vdc (6 to 32 Vdc)
Input resistance . . . . . Approx. 6.8 kW
Analog inputs . . . . . Freely scaleable
Type . . . . . 0/4 to 20 mA, Pt100, VDO
Resolution . . . . . 10 Bit
Relay outputs . . . . . Potential free
Contact material . . . . . AgCdO
Load (GP) . . . . . 2.00 Aac @ 250 Vac
2.00 Adc @ 24 Vdc/0.36 Adc @ 125 Vdc/
0.18 Adc @ 250 Vdc
Pilot duty (PD) B300
1.00 Adc @ 24 Vdc/0.22 Adc @ 125 Vdc/
0.10 Adc @ 250 Vdc

Analog outputs . . . . . Isolated
Type . . . . . 0/4 to 20 mA, freely scaleable
Resolution . . . . . 8/12 Bit (depending on model)
Maximum load 0/4 – 20 mA . . . . . 500 W
Insulating voltage . . . . . 1,500 Vdc
Housing . . . . . Type APRANORM DIN 43 700
Dimensions . . . . . 144 ¥ 144 ¥ 118 mm
Front cutout . . . . . 138[+1.0] ¥ 138[+1.0] mm
Connection . . . . . Screw/plug terminals depending
on connector 1.5 mm^2 or 2.5 mm^2
Front . . . . . Insulating surface
Protection system . . . . . With proper installation
Front IP42
(sealed IP45; gasket kit = P/N 8923-1039)
Back IP21
Weight . . . . . Depending on version, approx. 1,000g
Disturbance test (CE) . . . . . Tested according to applicable
EN guidelines
Listings . . . . . UL/cUL® listed (voltages up to 300 Vac

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Moon Township, PA 15108-4312
United States
tel: 1-800-525-2000
www.EatonElectrical.com

Cutler-Hammer

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All Magnum Breaker Types—Features, Benefits and Functions

- **Interruption ratings up to 200 kA** with current limiting performance and low current let-through to reduce damaging energy to down-stream equipment at high fault levels or with high short-time ratings for increased selectivity
- **Short-time ratings up to 100 kA** to maximize system coordination and selectivity
- **Four physical frame sizes** (narrow, standard, double narrow and double) to promote breaker application in compact modular enclosures
- **Continuous current ratings from 800–6000A** with 100% rating at 40°C and no derating on most ratings up to 50°C in a properly sized and ventilated enclosure
- **Fixed breaker mounting configurations** with horizontal and optional vertical and front connected terminal connections
- **Drawout breaker mounting configurations** with cassette and optional safety shutters
- **Three- and four-pole breaker configurations**
- **Through-the-door design** for human interface with the breaker compartment door closed
- **Two-step stored energy mechanism** for manually and electrically operated breakers
- **Digitrip™ RMS Trip Unit family protection** with four models each providing increasing levels of protection and feature options for coordination, information and diagnostics:
  - ❑ Microprocessor-based rms sensing
  - ❑ Basic to programmable over-current protection and alarms
  - ❑ Local display for information, status and diagnostics
  - ❑ Ampere, voltage and power metering
  - ❑ Power quality, harmonics and waveform capture
  - ❑ Communications with translators to common protocols
  - ❑ Zone selective interlocking for improved coordination
  - ❑ Integral Arcflash Reduction Maintenance System™
  - ❑ Breaker health monitoring
- **Field-installable accessories** (UL listed) common across the breaker frames and designed to be easily installed in the field to service or modify the breaker at the point of use
- **Secondary terminal contacts** mounted at the top front of the breaker and away from the primary voltage areas for improved safety and access. Finger-safe terminal blocks accommodate ring-tongue or spade type terminals as standard

Through-the-Door Design for Human Interface with the Breaker Compartment Door Closed

High Technology Microprocessor-Based Digitrip RMS 1150+ Trip Units are Available with Advanced Features Like Programmable Overcurrent Settings, Power Metering, Power Quality and Communications

Breaker Features on Front Cover

The controls and indicators are functionally grouped on the breaker faceplate to optimize the human interface, visibility and ease of use. For maximum safety, a modern, through-the-door design permits access to the breaker levering system, trip unit, controls and indicators with the door closed.

① Mechanical trip flag pop-out indicator (optional)—red
Interlocked indicator requiring manual reset is also available

② Accessory viewing windows for:

- ❑ Shunt Trip Attachment (STA)
- ❑ Spring Release device (SR)
- ❑ Undervoltage Release (UVR) device or second STA

③ Digitrip RMS trip unit (Model 520M shown) protected by clear cover

④ Contact status indicators:

- ❑ OPEN—green
- ❑ CLOSED—red

⑤ Spring status indicators:

- ❑ Charged—yellow
- ❑ Discharged—white

⑥ Push OFF (open) pushbutton—red

⑦ Push ON (close) pushbutton—green

⑧ Manual spring charging handle for manually charging the stored energy springs

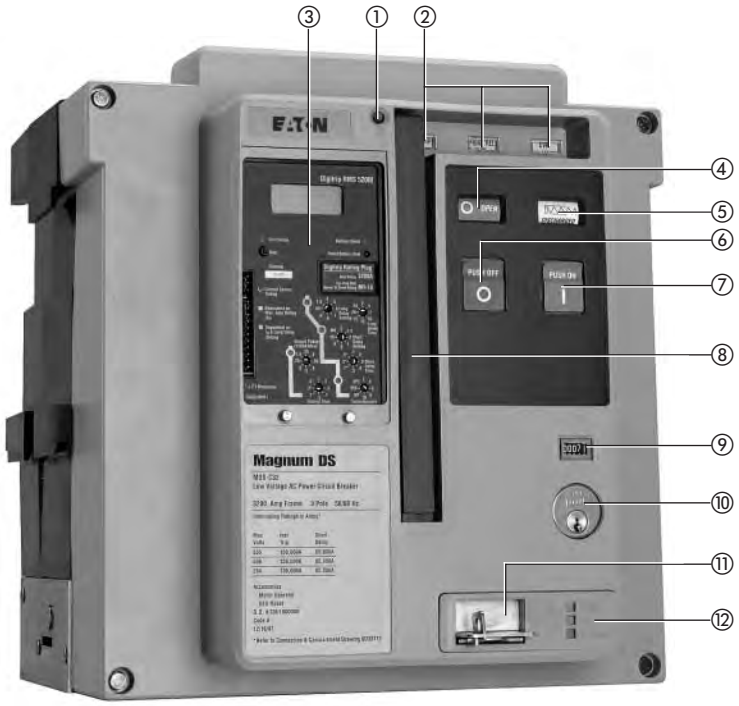
⑨ Mechanical operations counter (optional)

⑩ Key off lock (optional)

⑪ Padlockable levering device shutter for drawout breakers

⑫ Color-coded position indicator for drawout breakers:

- ❑ CONNECT—red
- ❑ TEST—yellow
- ❑ DISCONNECT—green



Magnum DS Drawout Breaker

Accessory Viewing Windows Visibly Confirm the Breaker Shunt Trip, Spring Release, UVR Installation and Their Control Voltage Rating

Drawout Breaker Levering Can be Accomplished with the Compartment Door Closed without the Need for a Special Levering Tool

Through-the-Door Design for Human Interface with the Breaker Compartment Door Closed, for Example, Manually Charging the Stored Energy Springs

Breaker Internal Features

Magnum circuit breakers are designed for ease of access for inspection, modification and maintenance at the point of use. The breaker front cover is easily removed with four captive bolts, revealing the modular internal breaker features.

① Secondary terminal points for internal standardized breaker wiring connections

② Breaker accessory mounting deck with three positions for mounting:

- ❑ Shunt Trip Attachment (STA)
- ❑ Spring Release device (SR)
- ❑ Undervoltage Release (UVR) device or second STA

③ Digitrip RMS Trip Unit (Model 1150+ shown)

④ Spring charging motor (optional) for electrically charging the stored energy springs

⑤ Manual spring charging handle for manually charging the stored energy springs

⑥ Padlockable levering device shutter for drawout breakers

⑦ Color-coded position indicator for drawout breakers:

- ❑ CONNECT—red
- ❑ TEST—yellow
- ❑ DISCONNECT—green

⑧ Secondary contact blocks for connection to external cell control wiring

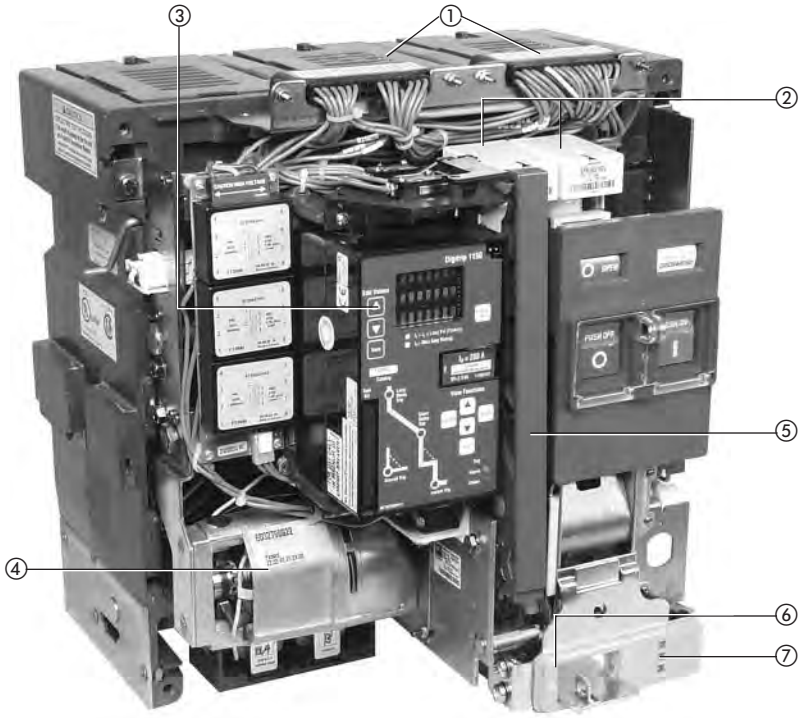
⑨ Removable arc chute covers for easy access to breaker main contacts

⑩ Primary finger cluster disconnecting contacts for drawout breaker are mounted on the breaker element for ease of access for inspection and maintenance

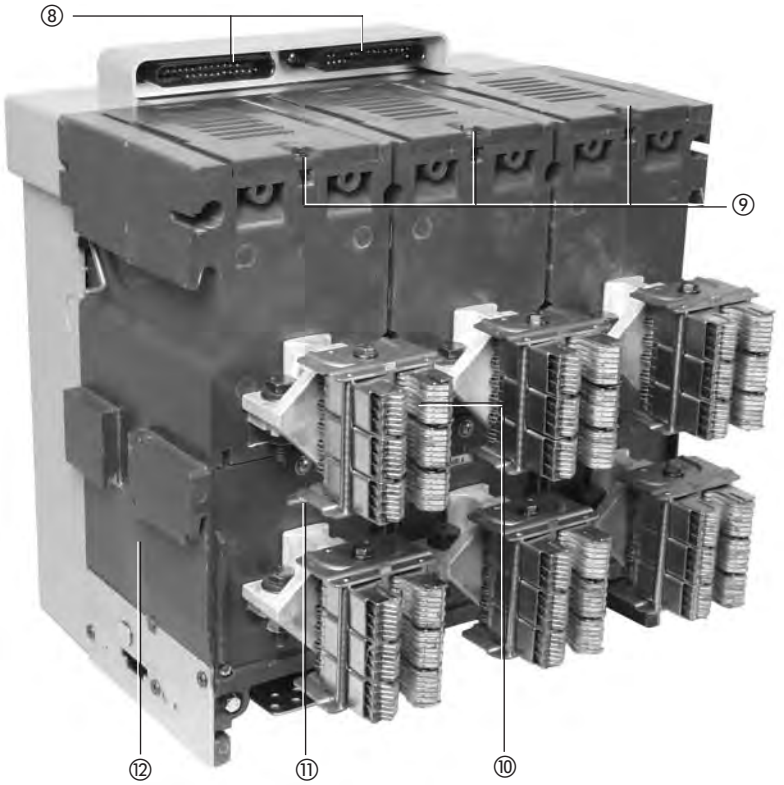
Note: Some competitors mount the primary finger clusters inside the cell, requiring shutdown of the switchgear for inspection and maintenance.

⑪ Current sensor viewing windows to view and confirm breaker sensor rating

⑫ Rigid frame housing (thermoset composite resin) providing increased strength and durability



Magnum Drawout Breaker Front View with Front Cover Removed Showing Easy Access to the Breaker Internal Devices



Magnum Drawout Breaker Rear View Showing Primary Disconnecting Finger Clusters Mounted on the Breaker for Ease of Inspection

Magnum DS Low Voltage Power Circuit Breakers

Magnum DS is a true UL 1066 listed low voltage power circuit breaker family, designed for the highest performance requirements of switchgear and specialty enclosure applications.

- Magnum DS low voltage power circuit breakers have short-time withstand and interruption ratings up to 100 kA at 635 Vac with continuous current ratings up to 6000A to maximize system coordination and selectivity
- Magnum MDDX non-current limiting PCBs have 200 kA interrupting ratings and up to 100 kA short-time rating at 508 Vac with continuous current ratings up to 6000A
- Magnum MDSX current limiting power circuit breakers (fuseless) have 200 kA interrupting ratings and 30–50 kA short-time ratings at 480 Vac with continuous current ratings up to 5000A
- Magnum MDSL current limiting power circuit breakers with integral current limiters (fuses) have 200 kA interrupting ratings at 600 Vac with continuous current ratings up to 2000A

UL and ANSI Test Certifications

Magnum DS meets or exceeds the applicable ANSI, NEMA, UL and CSA® standards, including:

- ANSI C37.13 (low voltage AC power circuit breakers used in enclosures)
- ANSI C37.16 (preferred ratings, related requirements, and application recommendations for low voltage power circuit breakers and AC power circuit breakers)
- ANSI C37.17 (trip devices for AC and general purpose DC low voltage power circuit breakers)
- ANSI C37.50 (test procedures for low voltage AC power circuit breakers used in enclosures)
- UL 1066 (standard for low voltage AC and DC power circuit breakers used in enclosures)
- NEMA SG3 (this standard adopts ANSI C37.16 in its entirety)

Comprehensive Enclosure Solutions

Magnum DS has proven performance in Eaton manufactured switchgear and switchboards with the following test certifications:

- UL 1558 (Magnum DS low voltage metal-enclosed switchgear)
- UL 891 (Pow-R-Line® C low voltage switchboards)
- UL 1008 standard for transfer switch equipment
- UL, CSA 22.2.31 low voltage assemblies

Approvals

- UL listed: Magnum DS breaker UL File No. E52096 and cassette UL File No. E204565
- ABS (American Bureau of Shipping) Type Listed Certificate Number 04-HS422844A-DUB

Magnum DS, MDSX and MDSL Circuit Breakers

Magnum DS low voltage power circuit breakers have high withstand ratings from 42 to 100 kA to provide for maximum system coordination and selectivity.

Magnum MDSX current limiting power circuit breakers have fast opening contacts to provide interrupting ratings up to 200 kA at 508 Vac without fuses.

Magnum MDSL current limiting power circuit breakers have integral current limiters to provide interrupting ratings of 200 kA at 600 Vac.

26

Selecting the Optimal Magnum Solution for System Coordination, Interruption Performance and Arc Flash Reduction

Table 26.1-1. System Application Considerations

Magnum Breaker Type	Short-Time Current (See Table 26.1-2)	System Coordination	Interruption	Arc Flash Energy	Operating System Convenience and Life Time Cost
 **MDS and MDDX** High short-time current—LS trip functions with trip unit instantaneous off	Up to 65 kA (narrow frame) Up to 85 kA (standard frame) Up to 100 kA (double narrow and double frame)	Up to 100 kA	Up to 100 kA at 635 Vac—MDS/MDN Up to 200 kA at 508 Vac MDDX	Highest energy	Inspect, reset and close after interruption
 **MDSX** Current limiting—fast opening reverse loop contacts with trip unit instantaneous off	30 kA (standard frame) 50 kA (double frame)	Up to the rated short-time current Based on trip unit settings	200 kA at 508 Vac	Lower energy at fault levels in current limiting range above short-time current rating	Inspect, reset and close after interruption
 **MDSL** Current limiting — integral current limiters with trip unit instantaneous off	Based on current limiter selected	Based on current limiter selected and trip unit settings	Up to 200 kA at 600 Vac	Lower energy at fault levels in the current limiting range of current limiter	Blown limiters require replacement and inventory Operating watts loss is higher than fuse-less breakers
All Magnum breakers with trip unit instantaneous on	Per Magnum breaker type applied	Trip unit instantaneous settings affect system coordination and continuity	Per Magnum breaker type applied	May be reduced by employing trip unit: Ground fault settings, zone selective interlocking, Arcflash Reduction Maintenance System	Per Magnum breaker type applied

Magnum MDS, MDN and MDDX High Short-Time Current Rating Breakers for Maximum Coordination

Magnum MDS and MDDX breakers are designed to hold in and carry their rated short-time current up to 0.5 seconds, the maximum trip unit short-time delay setting. System coordination is maximized when the instantaneous trip unit settings are either turned off or set high enough to facilitate coordination with other load side protective devices in the circuit.

Energy let-through and arc flash energy to the downstream circuit can be significantly reduced by employing instantaneous trip unit settings, as well as ground fault and zone interlocking. However, the desire to reduce arc flash may have to be balanced with the necessity to maintain system coordination and continuity. This is especially true at the low fault levels characteristic of arcing faults, because the trip unit instantaneous trip setting may have to be set as low as the minimum setting, which could cause lack of coordination.

The integral Arcflash Reduction Maintenance System trip unit option can be employed to optimize arc flash reduction during system startup and maintenance operations.

Magnum MDSX Fuseless Interruption Up to 200 kA Current Limiting Performance

Magnum MDSX breakers provide new fuseless technology with interruption ratings up to 200 kA at 508 Vac. The interruption performance is current limiting when the fault currents exceeds the short-time current rating. The self-protecting fast-opening reverse-loop contacts quickly open, clearing the fault in approximately 1/4 cycle, reducing energy let-through and arc flash energy.

Below their short-time current rating, MDSX breakers coordinate like standard MDS breakers. Arc flash levels to the downstream circuit can be reduced by employing the trip unit instantaneous settings as well as ground fault, zone interlocking and Arcflash Reduction Maintenance System features.

MDSX breakers have the same compact footprint as standard MDS breakers.

MDSX improves overall operating system continuity, convenience and life cycle costs by eliminating fuse trucks, blown limiter change outs, replacement limiter inventories and the higher operating watts loss associated with fuses.

Magnum MDSL Interruption Up to 200 kA with Integral Current Limiters

Magnum MDSL breakers with integral current limiters provide interruption ratings up to 200 kA at 600 Vac. MDSL is especially effective in reducing energy let-through and arc flash at the highest fault currents and those that fall within the current limiting range of the current limiter. Interruption is clean and efficient with most of the arc display contained within the current limiter. A wide array of current limiter ratings are available for selection and application with the breaker current sensor ratings and trip unit settings to provide for system coordination.

When fault currents fall below the current limiting range of the limiter, energy let-through and arc flash energy will increase. In this range, a lower rated current limiter may be applied, but considerations must be given to nuisance blowing of the limiter and system coordination.

MDSL breakers can also employ trip unit instantaneous settings as well as ground fault, zone interlocking and Arcflash Reduction Maintenance System features to reduce arc flash levels. Physically, they are 6.00 inches (152.4 mm) deeper than standard construction Magnum breakers.

Magnum DS Switchgear Class UL 1066

Magnum DS Low Voltage Power Circuit Breaker Family ANSI Rated for Switchgear Applications

Table 26.1-2. Magnum DS Switchgear Class UL 1066 Low Voltage Power Circuit Breakers

Frame Amperes	Breaker Type Catalog Number	Frame Type	rms Symmetrical Current Ratings kA 50/60 Hz ①					Available Current Sensor and Rating Plugs for Digitrip RMS Trip Unit (Establishes Breaker I_n Rating)
			Interrupting at 254 Vac	Interrupting at 508 Vac	Interrupting at 635 Vac	Short-Time Withstand Rating	Fixed Internal Instantaneous Trip	
800	MDN-408	Narrow	42	42	42	42	—	200, 250, 300, 400, 600, 800
	MDN-508	Narrow	50	50	50	50	—	
	MDN-608	Narrow	65	65	65	65	—	
	MDN-C08	Narrow	100	100	65	20	18 x I_n	
	MDS-408	Standard	42	42	42	42	—	
	MDS-608	Standard	65	65	65	65	—	
	MDS-808	Standard	85	85	85	85	—	
	MDS-C08	Standard	100	100	100	85	85	
	MDS-L08 ②	Standard	200	200	200	—	—	
1200	MDN-412	Narrow	42	42	42	42	—	200, 250, 300, 400, 600, 800, 1000, 1200
	MDN-512	Narrow	50	50	50	50	—	
	MDN-612	Narrow	65	65	65	65	—	
	MDS-412	Standard	42	42	42	42	—	
	MDS-512	Standard	50	50	50	50	—	
	MDS-612	Standard	65	65	65	65	—	
	MDS-812	Standard	85	85	85	85	—	
	MDS-C12	Standard	100	100	100	85	—	
	MDS-X12 ③	Standard	200	200	65	30	—	
1600	MDN-416	Narrow	42	42	42	42	—	200, 250, 300, 400, 600, 800, 1000, 1200, 1600
	MDN-516	Narrow	50	50	50	50	—	
	MDN-616	Narrow	65	65	65	65	—	
	MDN-C16	Narrow	100	100	65	30	18 x I_n	
	MDS-616	Standard	65	65	65	65	—	
	MDS-816	Standard	85	85	85	85	—	
	MDS-C16	Standard	100	100	100	85	85	
	MDS-L16 ②	Standard	200	200	200	—	—	
	MDS-X16 ③	Standard	200	200	④	30	30	
2000	MDN-620	Narrow	65	65	65	65	—	200, 250, 300, 400, 600, 800, 1000, 1200, 1600, 2000
	MDN-C20	Narrow	100	100	65	35	18 x I_n	
	MDS-620	Standard	65	65	65	65	—	
	MDS-820	Standard	85	85	85	85	—	
	MDS-C20	Standard	100	100	100	85	85	
	MDS-L20 ②	Standard	200	200	200	—	—	
	MDS-X20 ③	Standard	200	200	④	30	30	

① Interrupting ratings shown based on breaker equipped with integral Digitrip RMS trip unit. Interruption ratings for non-automatic breakers are equal to the published short-time withstand rating. These interruption ratings are based on the standard duty cycle consisting of an open operation, a 15-second interval and a close-open operation, in succession, with delayed tripping in case of short-delay devices. The standard duty cycle for short-time ratings consists of maintaining the rated current for two periods of 1/2 seconds each, with a 15-second interval of zero current between the two periods.

② Magnum MDSL current limiting power circuit breaker with integral current limiters. Current limiter selected determines short-time and fixed instantaneous trip rating. Maximum voltage rating is 600 Vac.

③ Magnum MDSX fuseless current limiting power circuit breakers with fast opening contacts. See **Table 26.1-1** on **Page 26.1-6** for peak let-through chart.

④ Product to be tested. Contact Eaton for product rating.

Table 26.1-2. Magnum DS Switchgear Class UL 1066 Low Voltage Power Circuit Breakers (Continued)

Frame Amperes	Breaker Type Catalog Number	Frame Type	rms Symmetrical Current Ratings kA 50/60 Hz ①					Available Current Sensor and Rating Plugs for Digitrip RMS Trip Unit (Establishes Breaker I_n Rating)
			Interrupting at 254 Vac	Interrupting at 508 Vac	Interrupting at 635 Vac	Short-Time Withstand Rating	Fixed Internal Instantaneous Trip	
3200	MDS-632	Standard	65	65	65	65	—	200, 250, 300, 400, 600, 800, 1000, 1200, 1600, 2000, 2500, 3000, 3200
	MDS-832	Standard	85	85	85	85	—	
	MDS-C32	Standard	100	100	100	85	85	
	MDS-X32 ②	Double	200	200	③	50	50	
4000	MDN-640	Double narrow	65	65	65	65	—	2000, 2500, 3200, 4000
	MDN-840	Double narrow	85	85	65	85	—	
	MDN-C40	Double narrow	100	100	65	100	—	
	MDS-840	Double	85	85	85	85	—	
	MDS-C40	Double	100	100	100	100	—	
	MDS-X40 ④	Double	200	200	③	50	50	
	MDD-X40	Double	200	200	100	100	—	
5000	MDS-850	Double	85	85	85	85	—	2500, 3200, 4000, 5000
	MDS-C50	Double	100	100	100	100	—	
	MDS-X50 ④⑤	Double	200	200	③	50	50	
	MDD-X50	Double	200	200	100	100	—	
6000	MDS-C60 ⑤	Double	100	100	100	100	—	3200, 4000, 5000, 6000
	MDD-X60 ⑤	Double	200	200	100	100	—	2500, 3200, 4000, 5000

① Interrupting ratings shown based on breaker equipped with integral Digitrip RMS trip unit. Interruption ratings for non-automatic breakers are equal to the published short-time withstand rating. These interruption ratings are based on the standard duty cycle consisting of an open operation, a 15-second interval and a close-open operation, in succession, with delayed tripping in case of short-delay devices. The standard duty cycle for short-time ratings consists of maintaining the rated current for two periods of 1/2 seconds each, with a 15-second interval of zero current between the two periods.

② Magnum MDSL current limiting power circuit breaker with integral current limiters. Current limiter selected determines short-time and fixed instantaneous trip rating. Maximum voltage rating is 600 Vac.

③ Product to be tested. Contact Eaton for product rating.

④ Magnum MDSX fuseless current limiting power circuit breakers with fast opening contacts. See **Table 26.1-1** on **Page 26.1-6** for peak let-through chart.

⑤ Breaker applied in a tested fan-cooled enclosure.

Magnum MDSX Fuseless Current Limiting Power Circuit Breakers

Magnum MDSX

Magnum MDSX Current Limiting Power Circuit Breakers have fast opening contacts to provide interrupting ratings up to 200 kA at 508 Vac without fuses. The interruption performance is current limiting when the fault currents exceed the short-time current rating. The self-protecting fast opening reverse loop contacts quickly open, clearing the fault in approximately 1/4 cycle, reducing energy let-through and arc flash energy. Below their short-time current rating, MDSX breakers coordinate like standard MDS breakers.

Arc flash levels to the downstream circuit can be reduced by employing the trip unit instantaneous settings as well as ground fault, zone interlocking, and Arcflash Reduction Maintenance System™ features. MDSX breakers have the same compact footprint as standard MDS breakers. MDSX improves overall operating system continuity, convenience and life cycle costs by eliminating fuse trucks, blown limiter change outs, replacement limiter inventories and the higher operating watts loss associated with fuses.

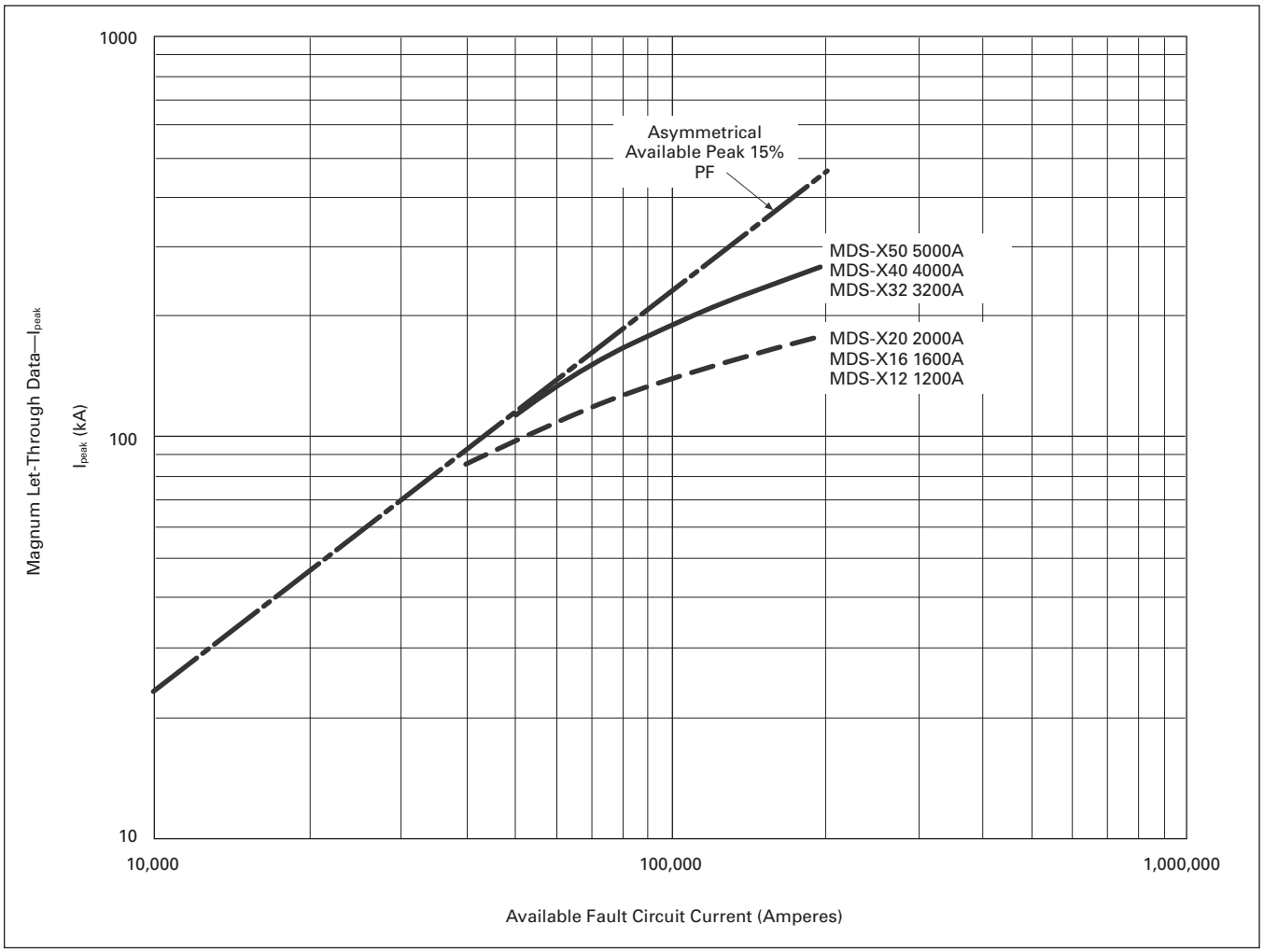


Figure 26.1-1. Magnum Let-Through Data

Magnum MDSL Fused Current Limiting Power Circuit Breakers

The following curves illustrate the ratings, melting time-current characteristics and current limiting, or let-through characteristics, of limiters for Magnum low voltage power circuit breakers.

The let-through current for a given limiter application is readily determined by extending a vertical line from the applicable maximum available symmetrical fault amperes at the bottom margin to the characteristic line for the particular limiter, and from this intersection extending a horizontal line to the left margin and reading the peak current. The withstand rating of any circuit elements protected by the limiters should be at least equal to this peak current.

It will be noted that the let-through current increases with the limiter size or ampere rating; in other words, the maximum current limiting effect is obtained with the smallest size. This effect is to be expected, because the resistance decreases as the rating increases. If the vertical line from the bottom margin as described in the previous paragraph does not intersect the limiter characteristic line, the available system fault current is below the "threshold" current of that limiter, and it will offer no current limiting effect.

The current limiting principle is illustrated below:

I_a = The Available Peak Fault Current

t_m = The Melting Time

I_p = The Peak Let-Through Current

t_a = The Arcing Time

t_c = The Total Interrupting (Clearing) Time

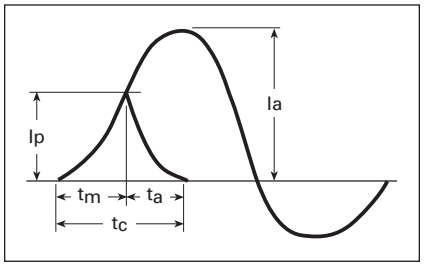


Figure 26.1-2. Current Limiting

Limiter Selection

The selection of a suitable limiter rating for a given application is generally governed by a choice of the following types of protection:

A. Maximum protection of "downstream" components. Type MDSL breakers are often used for this purpose even when the maximum available fault currents are within the interrupting rating of the corresponding unfused Magnum breakers.

B. Protection of the circuit breaker only.

Case A would tend to use the smallest available limiter; Case B the largest. When downstream protection is required, the selection is usually a compromise, because certain small limiters cannot be coordinated with the breaker to avoid nuisance blowing on overloads or small and moderate short circuits.

Minimum, recommended and maximum limiter sizes for Magnum MDSL breakers are given in the table below.

Table 26.1-3. Magnum MDSL Ratings

Frame	Available Sensor/ Rating Plug (Amperes)	Catalog Number
800	200, 250, 300, 400, 600, 800	**MDSL08**
1600	200, 250, 300, 400, 600, 800, 1000, 1200, 1600	**MDSL16**
2000	1600, 2000	**MDSL20**

Table 26.1-4. Magnum MDSL Sensor/Rating Plug vs.Current Limiter Selection ①

Sensor and Rating Plug I_n	MDSL Current Limiter Selection Chart ②									
200	MA250	MA300	MA400	MA600 ③	MA800	MB1200	MB1600	MB2000	MD2500	MD3000
250			MA400	MA600	MA800 ③	MB1200	MB1600	MB2000	MD2500	MD3000
300			MA400	MA600	MA800 ③	MB1200	MB1600	MB2000	MD2500	MD3000
400				MA600	MA800	MB1200 ③	MB1600	MB2000	MD2500	MD3000
600					MA800	MB1200	MB1600	MB2000 ③	MD2500	MD3000
800						MB1200	MB1600	MB2000	MD2500 ③	MD3000
1000							MB1600	MB2000	MD2500 ③	MD3000
1200								MB2000	MD2500 ③	MD3000
1600										MD3000 ③
2000										MD3000 ③

① Select the current limiter based on the Magnum breaker frame and current sensor and rating plug as shown.

② Refer to MDSL current limiter curves for let-through and time characteristics.

③ The recommended ratings shown as shaded provide for reduced current let-through and breaker coordination within the trip unit settings. Selection of current limiters below the recommended ratings shown provides lower current let-through; however, trip unit settings must be considered to avoid nuisance operation.

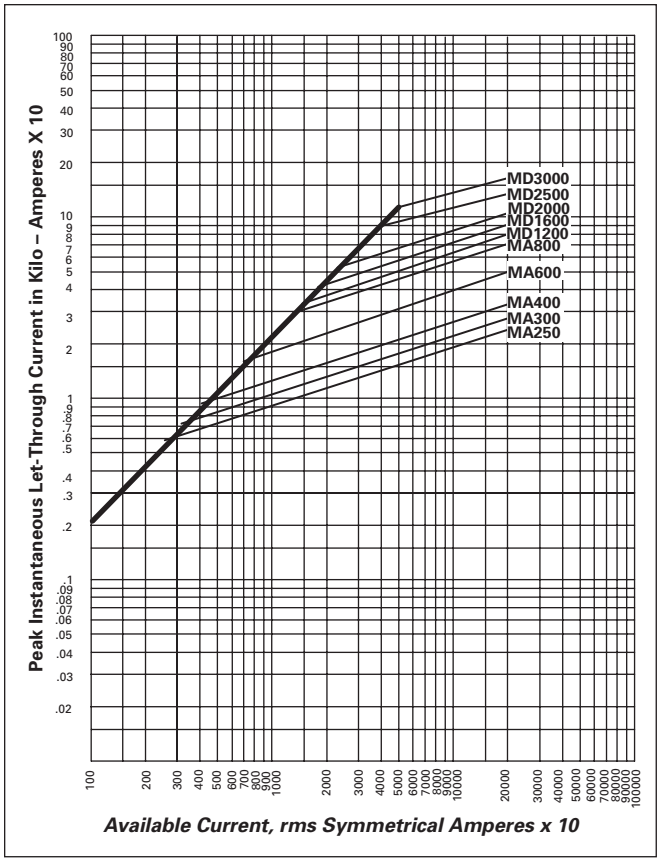


Figure 26.1-3. Type Magnum DSL Limiters, Peak Let-Through Current Characteristics

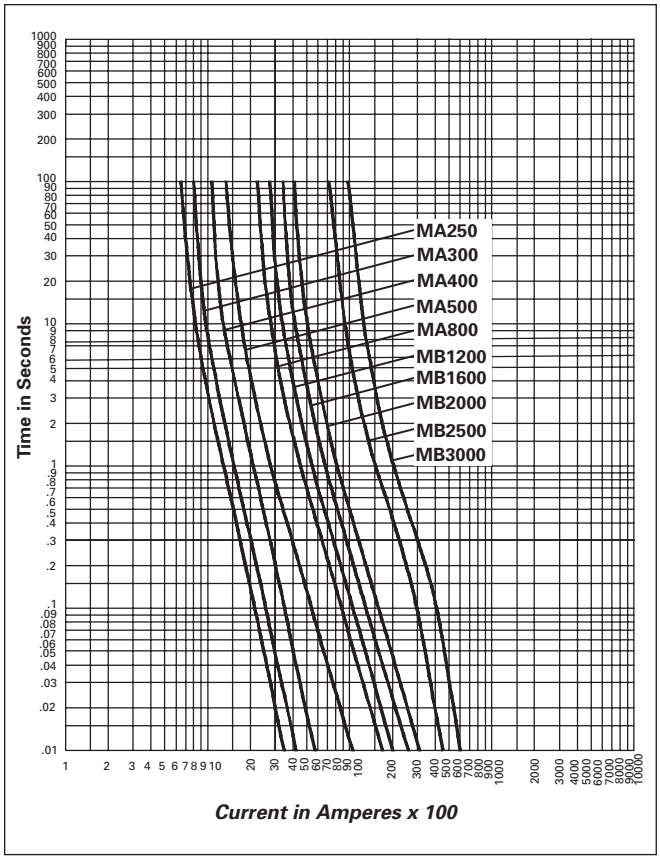


Figure 26.1-4. Type Magnum DSL Limiters Average Melting Time-Current Characteristics

Breaker-Mounted Options

Magnum breakers are available with a comprehensive array of factory-installed breaker options to enable configured-to-order solutions for specified customer requirements. Field option kits are available to provide easy service, modification and customization of the breaker at the point of use.

- **Shunt trip device** (**ST**). Provides for remote electrically controlled breaker opening when energized by a rated voltage input
- **Spring charge motor (MOT)**. Charges the breaker closing springs automatically, facilitating remote or local closing. The motor assembly includes its own cut-off switch that changes state at the end of the charging cycle. This contact can be wired out for external indication
- **Spring release device** (**SR**). Provides for remote electrically controlled breaker closing when its coils are energized by a rated voltage input
- **Undervoltage release** (**UVR**). Trips the breaker when an existing voltage signal is lost or falls below an established threshold
- **Auxiliary switch**. Up to 6a/6b auxiliary individual dedicated contacts are available for customer use to indicate if the breaker is in the OPEN or CLOSE position
- **Mechanical trip indicator flag** ①. The red trip indicator flag pops out to provide local visual indication when the Digitrip RMS trip unit acts to trip the breaker on an overcurrent condition. Available in two options: an interlocked version that mechanically locks out the breaker until the indicator is manually reset and a non-interlocked version for indication only
- **Bell alarm/overcurrent trip switch** ① **(OTS)**. Provides two Form C contacts that change state when the Digitrip RMS trip unit acts to trip the breaker. The contacts are available for external indication or customer use and are manually reset by the mechanical trip indicator
- **Padlockable pushbutton cover**. Permits padlocking hinged cover plates to block access to the PUSH ON and PUSH OFF buttons on the breaker faceplate
- **Mechanical operations counter**. Records mechanical operations of the breaker over its installed life
- **Key off lock provisions**. Enables mounting of a single cylinder Kirk®, Castell or Ronis Key Lock to lock the breaker in the OPEN position
- **Latch check switch**. Provides one Form C contact that changes state when the breaker is ready to close. Can be wired to the spring release device for fast transfer applications or wired for external ready-to-close indication

Shunt Trip, Spring Release and Undervoltage Release Device Installed on Accessory Deck

Auxiliary Switches Come in Modular 2a/2b Contact Stages Providing up to 6a/6b Dedicated Contacts

Mechanical Trip Indicator with Bell Alarm (OTS) Switches Mounted ①

① For the Digitrip RMS 1150+ trip unit, other protective functions, if programmed, will cause the OTS and mechanical trip indicator flag to operate.

Magnum 1150+ Trip Unit with Arcflash Reduction Maintenance System, 24-Digit LED Display, Programmable Protection, Alarms and Relaying, Power Metering, Power Quality and Alarms, Waveform Capture, Communications and Breaker Health Monitoring

Arcflash Reduction Maintenance System

The Arcflash Reduction Maintenance System Maintenance Mode function of the Digitrip 520MC and 1150+ can reduce arc flash incident energy that is generated on a fault condition. This is accomplished by an analog trip circuit that, when armed, provides a fast-acting response to the fault. This is separate from the normal system protection setting of instantaneous.

Eaton's Arcflash Reduction Maintenance System employs a separate, dedicated analog trip circuit that eliminates microprocessor latencies, resulting in clearing times that are **faster than standard instantaneous tripping**. This provides superior arc flash reduction to competitors' systems that simply lower the standard instantaneous pickup set point.

There are three ways to arm the Maintenance Mode Arcflash Reduction Maintenance System setting. One method is locally at the trip unit front panel. For the 520MC, the two-position switch in the Maintenance Mode section of the trip unit is used. Turning the switch to the ON position will arm the setting. For the 1150+, the local front keypad is used to enable the Maintenance Mode setting. The setting is located in the SYSTEM submenu of programmable settings (PGM SET).

For the second method of arming the Maintenance Mode function, a remote switch wired through the breaker secondary contacts can remotely arm the Maintenace Mode setting. A high-quality gold-plated or palladium contact is required in this application.

A third method to arm the Maintenance Mode setting is via a communication device. There is a confirmation screen that verifies the arming. A BIM (Breaker Interface Module) or Power Xpert® system are communication methods to arm the setting.

The Arcflash Reduction Maintenance System setting has five unique settings (2.5, 4.0, 6.0, 8.0, 10.0 x I_n). To adjust this setting, a rotary switch on the trip unit face is provided for the 520MC while the 1150+ trip unit uses its local keypad.

For all three arming methods, the 520MC provides a blue LED to confirm the Maintenance Mode function is on. In addition, there is also a normally open breaker contact that allows the user to wire in an external stacklight or annunciator for remote indication. For the 1150+, the message "Maintenance Mode Enabled" will be shown on its LED display. The 1150+ also has an alarm relay that can be programmed to track the Maintenance Mode state.

The maintenance mode function will provide fast tripping even when the regular Instantaneous is set to OFF. The instantaneous LED position is also used to indicate a trip initiated by the Maintenance Mode setting. The 520MC LCD display, if powered, will indicate with four dashes while the 1150+ will display the message "Maintenance Mode Trip."

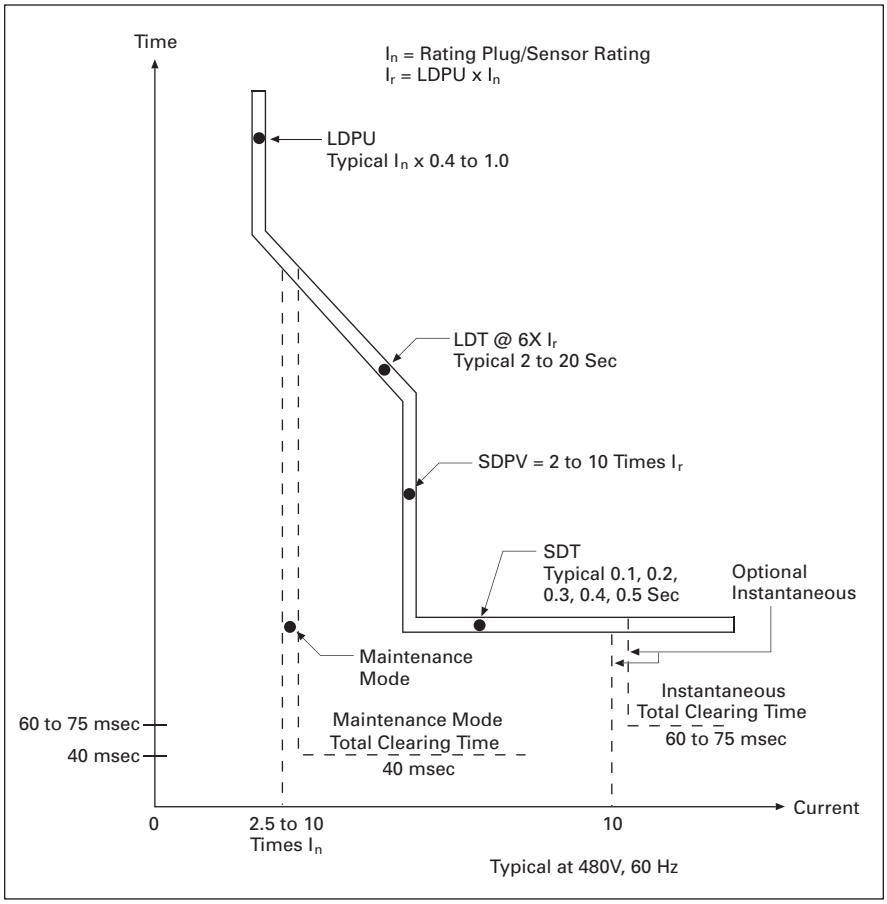
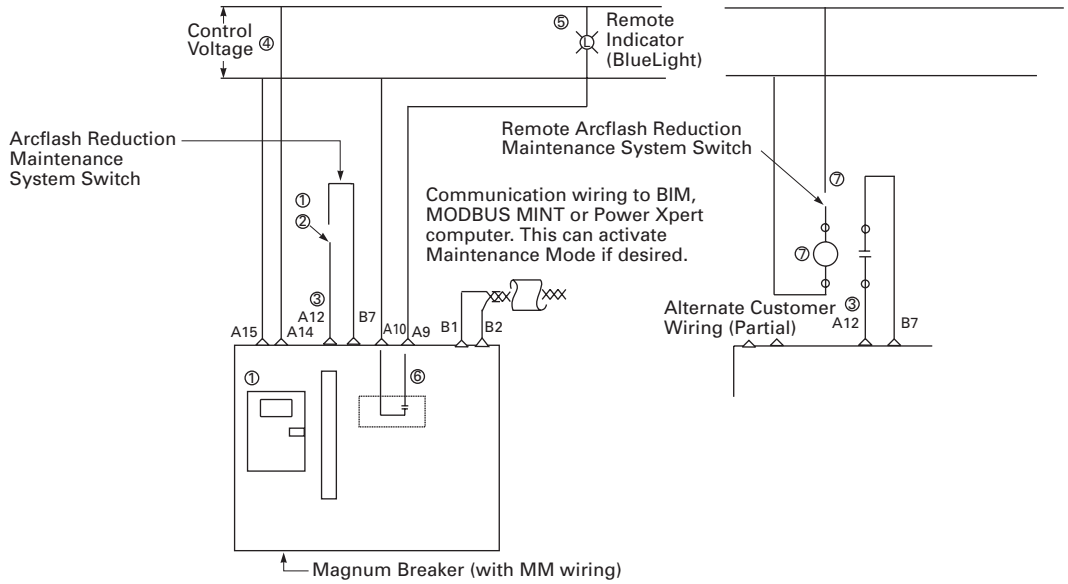


Figure 26.1-5. Arcflash Reduction Maintenance System—Typical Time Current Curve with Maintenance Mode



① The Digitrip 520MC (Cat 5ARMxxx) can locally be placed in Maintenance Mode via a two-position switch located on the trip unit. The function can also be armed via a remote switch as shown. In addition, the function can be activated via communications. A blue LED on the Digitrip verifies the Digitrip is in Maintenance Mode.

② The recommended selector switch for this low voltage application is Eaton part number 10250T1333-2E, which includes a contact block rated for logic level and corrosive use.

③ The maximum length of this wiring to remote Arcflash Reduction Maintenance System switch (or alternate relay contact) is 9.78 ft (3m). Use #20 AWG wire or larger.

④ Control voltage is 120 Vac or 230 Vac or 24–48 Vdc or 125 Vdc. Check Magnum circuit breaker front cover for trip unit power requirements.

⑤ A remote stack light, annunciator panel or other remote indication device can be connected to verify that the Digitrip is in Maintenance Mode.

⑥ Relay in (GF alarm/PS module) makes when in Maintenance Mode. Contact is rated 1A at 120 Vac or 0.5A at 230 Vac or 1A at 24–48 Vdc and 0.35A at 125 Vdc.

⑦ The Digitrip 520MC can also be placed remotely in its Maintenance Mode via a general purpose relay–ice cube type with logic level contacts–activated by remote control switch. A recommended type is IDEC Relay RY22. Choose voltage as desired.

Figure 26.1-6. Maintenance Mode Wiring Digitrip 520MC

Digitrip 520 Trip Unit

Digitrip 520 Trip Unit with Basic Overcurrent Protection

The Digitrip 520 is a simple basic trip unit with three available types of protection (LI, LSI and LSIG). Up to nine rotary-type current and time settings provide for maximum flexibility in curve-shaping and multi-unit coordination.

- The Instantaneous function (I) includes an off position setting when Short Time (S) protection is provided to increase application flexibility in the field
- I^2t time delay settings for better curve shaping when Short Time (S) and Ground Fault (G) protective functions are selected
- Zone Selective Interlocking (ZSI) provided when Short Time (S) and/or Ground Fault (G) protective functions are selected. ZSI provides hard-wired positive system coordination, allowing the breaker closest to the fault to trip first, thus avoiding unnecessary and costly system downtime. ZSI is a useful method to reduce arc flash

Digitrip 520M Trip Unit

Digitrip 520M Trip Unit with Four-Digit LCD Display and Ampere-based Metering, Alarms and System Diagnostics

The Digitrip 520M is available with three types of protection (LSI, LSIG and LSIA) and includes the following added features:

- Four-digit LCD display with a step pushbutton to scroll through the display data, including ampere-based metering of phase, neutral and ground currents, plus operational and cause-of-trip diagnostic information
- When specified, the Power Relay Module (PRM) is supplied to perform the following features:
  - Power up the trip unit display from an external customer supplied source through the breaker secondary contacts to retain the cause-of-trip and magnitude of trip information
  - Provide relay contact for remote indication of overload (LSI) or ground trip (LSIG) or ground alarm (LSIA)
- Type LSIA units alarm only when ground fault settings are exceeded, which is quite useful in critical power applications
- Plug receptacle for auxiliary power module to power up the trip unit display during bench testing remote from the switchgear

Digitrip 520MC Trip Unit

Digitrip 520MC Trip Unit With Arcflash Reduction Maintenance System, Four-Digit LCD Display and Ampere-based Communications

The Digitrip 520MC is available in three types of protection (LSI, LSIG and LSIA) and includes the following enhancements:

- Communications of ampere-based data, breaker status and cause-of-trip information using the INCOM™ communications system. Each trip unit has a unique hexadecimal address (001 to 999) set by rotary switches. A red transmit LED is provided to confirm communications activity. Peripheral translator devices are available to convert INCOM to other protocols like Modbus, Ethernet and so on
- Arcflash Reduction Maintenance System allows the operator to enable a special trip unit maintenance mode with a preset accelerated instantaneous override trip that can reduce arc flash energy up to 30%. This accelerated tripping results in total clearing times that are faster than standard instantaneous tripping. The arc flash reduction level is preset at the trip unit using a five-position switch that facilitates the maximum arc flash reduction setting possible while avoiding nuisance tripping. The Arcflash Reduction Maintenance System can be turned on locally at the trip unit, remotely using peripheral devices, or via communications. A blue LED provides local indication the trip unit is in the Maintenance Mode. Remote indication can be accomplished by a dedicated trip unit contact for use with a stack light or annunciator panel, or via communications

Digitrip 1150+ Trip Unit

Digitrip 1150+ Trip Unit

The Digitrip 1150+ trip unit is a highly advanced programmable protective device available in three types of protection (LSI, LSIG and LSIA). The following is a first level summary of the special features and options:

- 24-character LED digital display easily visible from 50 feet and ideal for dark equipment environments
- Membrane type dust-resistant keypad pushbuttons to facilitate local unit programming, including view functions (Up, Down, ESCape, SELect and Reset), edit values (Up, Down and Save) and battery test
- Programmable trip unit settings and curves including I^2t and I^4t curves, as well as IEEE moderately inverse, very inverse and extremely inverse curves
- Voltage and power metering
- Power quality monitoring and alarm with THD and waveform capture
- Health menu—The health menu on the Digitrip 1150+ front panel will provide information on the Magnum circuit breaker's health, as well as a history of the circuit breaker and circuit it is protecting. This data is useful for planning maintenance and inspection schedules. The type of data includes the total number of all instantaneous and short delay trips seen by the circuit breaker. A second counter shows the number of overloads (LDT) and ground faults (GFT) encountered while in service. The OP count provides data on the number of close operations experienced by the circuit breaker. The last time the circuit breaker was operated (open or closed or tripped) is viewable with time and date displayed. Also included is the maximum temperature in degrees Centigrade as seen by the Digitrip microprocessor CHip. The capture of the data requires external trip unit power. This data, once captured, is stored in non-volatile memory. These features are available for remote communications
- Programmable alarm contacts or trip contacts
- Programmable relay functions including undervoltage, overvoltage, underfrequency, overfrequency, reverse power, voltage unbalance and phase rotation
- Communications of comprehensive access to trip unit capabilities including programmable settings, breaker control, metering, alarm, status, relaying and diagnostic information. Peripheral translator devices are available to convert INCOM to other protocols like Modbus, Ethernet and so on
- Accessory bus for use with peripheral digital relay modules that can be programmed through the trip unit keypad for additional auxiliary and various alarm contacts
- Arcflash Reduction Maintenance System allows the operator to enable a special trip unit Maintenance Mode with a preset accelerated instantaneous override trip that can reduce arc flash energy up to 30%. This accelerated tripping results in total clearing times that are faster than standard instantaneous tripping. The arc flash reduction level is preset at the trip unit for the maximum arc flash reduction setting possible, while avoiding nuisance tripping. The Arcflash Reduction Maintenance System can be turned on locally at the trip unit, remotely using peripheral devices, or via communications. The display provides local indication the trip unit is in the Maintenance Mode. Remote indication can be accomplished by a dedicated trip unit contact for use with a stack light or annunciator panel, or via communications

Table 26.1-6. Digitrip Trip Units for Magnum DS and SB ANSI/UL Rated Power Circuit Breakers

					
Trip Unit Type		**Digitrip 520**	**Digitrip 520M**	**Digitrip 520MC**	**Digitrip 1150+** ①
Ampere range Interrupting rating at 480V rms sensing		200–6000A 42–200 kA Yes	200–6000A 42–200 kA Yes	200–6000A 42–200 kA Yes	200–6000A 42–200 kA Yes
Protection and Coordination					
Protection	Ordering options Fixed rating plug (I_n) Overtemperature trip	LI, LSI, LSIG Yes Yes	LSI, LSIG, LSIA Yes Yes	LSI, LSIG, LSIA Yes Yes	LSI, LSIG, LSIA Yes Yes
Long delay protection (L)	Long delay pickup Long delay time I^2t at 6 x I_r Long delay time I^4t IEEE curves	0.4–1.0 x (I_n) 2–24 seconds No No	0.4–1.0 x (I_n) 2–24 seconds No No	0.4–1.0 x (I_n) 2–24 seconds No No	0.4–1.0 x (I_n) 2–24 seconds 1–5 seconds Yes
	Long delay thermal memory High load alarm	Yes No	Yes No	Yes No	Yes 0.5–1.0 x (I_r)
Short delay protection (S)	Short delay pickup Short delay time I^2t at 8 x I_r Short delay time flat Short delay time ZSI	200–1000% x (I_r) and M1 100–500 ms 100–500 ms Yes	200–1000% x (I_r) and M1 100–500 ms 100–500 ms Yes	200–1000% x (I_r) and M1 100–500 ms 100–500 ms Yes	200–1000% x (I_r) and M1 100–500 ms 100–500 ms Yes
Instantaneous protection (I)	Instantaneous pickup Making current release Off position	200–1000% x (I_n) and M1 Yes LSI and LSIG	200–1000% x (I_n) and M1 Yes Yes	200–1000% x (I_n) and M1 Yes Yes	200–1000% x (I_n) and M1 Yes Yes
Ground fault protection (G) ②	Ground fault alarm Ground fault pickup Ground fault delay I^2t at 0.625 x I_n	No 25–100% x (I_n) 100–500 ms	Yes 25–100% x (I_n) 100–500 ms	Yes 25–100% x (I_n) 100–500 ms	Yes 24–100% x (I_n) 100–500 ms
	Ground fault delay flat Ground fault ZSI Ground fault thermal memory	100–500 ms Yes Yes	100–500 ms Yes Yes	100–500 ms Yes Yes	100–500 ms Yes Yes
Disable ground fault protection		No	No	No	No
Neutral protection (N)		Model LSI	Model LSI	Model LSI	Model LSI
System Diagnostics					
Cause-of-trip LEDs Magnitude of trip information		Yes No	Yes Yes	Yes Yes	Yes Yes
Remote signal contacts Programmable contacts		No No	Yes No	Yes No	Yes Yes
System Monitoring					
Digital display Current (%) full scale sensor		No No	4-character LCD Yes ±2%	4-character LCD Yes ±2%	24-character LED Yes ±1%
Voltage (%) L to L Power and energy (%) Apparent power kVA and demand		No No No	No No No	No No No	Yes ±1% Yes ± 2% Yes
Reactive power kVAR Power factor Crest factor		No No No	No No No	No No No	Yes Yes Yes
Power quality—harmonics % THD, waveform capture		No No	No No	No No	Yes Yes
System Communications					
Type Power supply in breaker		No N/A	No Optional	INCOM Standard	INCOM/TripLink Standard
Additional Features					
Trip log (three events) Electronic operations counter		No No	No No	No No	Yes Yes
Testing method ③ Waveform capture		Test set No	Test set No	Test set No	Integral and test set Yes
Arcflash Reduction Maintenance System Breaker health monitor Protective relay functions		No No No	No No No	Yes No No	Yes Yes Yes ①

① Over and undervoltage alarm or trip, over and underfrequency alarm or trip, voltage unbalance alarm or trip, reverse power trip, and phase rotation alarm are included.

② 1200A maximum ground fault setting per UL/NEC®.

③ Test set for secondary injection.

Legend: I_n = Rating Plug and Sensor Rating.
I_r = Long Delay Pickup setting.

Zone Selective Interlocking

Zone selective interlocking provides positive system coordination by allowing the breaker closest to the fault to trip without any preset time delays. This is achieved by setting up the distribution system as shown in **Figure 26.1-8**. The hardwired connection between the trip units sends a restraining signal upstream, allowing the breaker closest to the fault to act instantaneously. Zone selective interlocking also reduces stress on the distribution system by isolating faults without time delays.

By definition, a selectively coordinated system is one where by adjusting trip unit pickup and time delay settings, the circuit breaker closest to the fault trips first. The upstream breaker serves two functions: (1) backup protection to the downstream breaker and (2) protection of the conductors between the upstream and downstream breakers. These elements are provided for on Digitrip trip units.

For faults that occur on the conductors between the upstream and downstream breakers, it is ideally desirable for the upstream breaker to trip with no time delay. This is the feature provided by zone selective interlocking. Digitrip trip units include this option.

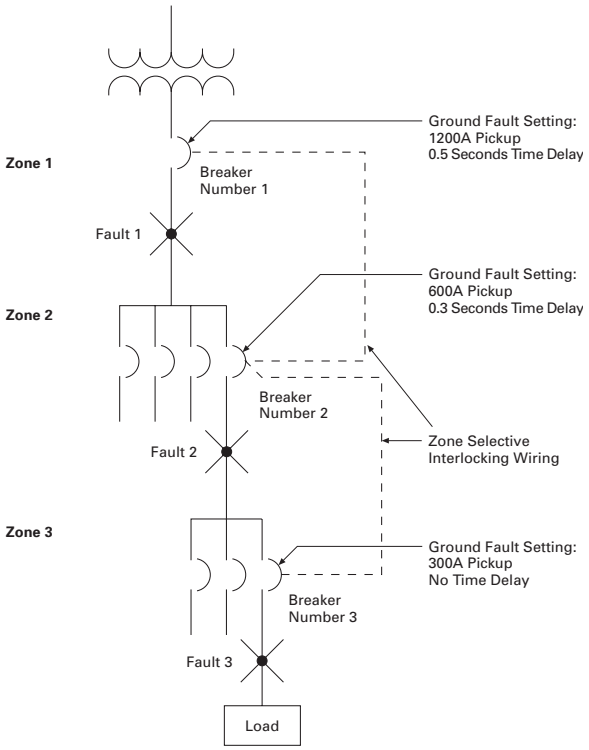
Zone selective interlocking is a communication signal between trip units applied on upstream and downstream breakers. Each trip unit must be applied as if zone selective interlocking were not employed, and set for selective coordination.

During fault conditions, each trip unit that senses the fault sends a restraining signal to all upstream trip units. This restraining signal results in causing the upstream trip to continue timing as it is set. In the absence of a restraining signal, the trip unit trips the associated breaker with no intentional time delay, minimizing damage to the fault point. This restraining signal is a very low level. To minimize the potential for induced noise, and provide a low impedance interface between trip units, twisted pair conductors are used for interconnection.

Ground fault and short delay pickup on Digitrip trip units have zone selective interlocking.

Zone selective interlocking may be applied as a type of bus differential protection. It must be recognized; however, that one must accept the minimum pickup of the trip unit for sensitivity.

It must also be recognized that not all systems may be equipped with zone selective interlocking. Systems containing multiple sources, or where the direction of power flow varies, require special considerations, or may not be suitable for this feature. Digitrip zone interlocking has been tested with up to three levels with up to 20 trip units per level.



Fault 1

There are no interlocking signals. The main breaker trip unit will initiate the trip instantaneously.

Fault 2

The feeder breaker trip unit will initiate the trip instantaneously to clear the fault; and Zone 2 will send an interlocking signal to the Zone 1 trip unit. The Zone 1 trip unit will begin to time out, and in the event that the feeder breaker in Zone 2 would not clear the fault, the main breaker in Zone 1 will clear the fault in 0.5 seconds.

Fault 3

The branch breaker trip unit will initiate the trip instantaneously to clear the fault; and Zone 3 will send an interlocking signal to the Zone 2 trip unit; and Zone 2 will send an interlocking signal to Zone 1.

Zone 1 and Zone 2 trip units will begin to time out, and in the event that the branch breaker in Zone 3 would not clear the fault, the feeder breaker in Zone 2 will clear the fault in 0.3 seconds. Similarly, in the event that the feeder breaker in Zone 2 would not clear the fault, the main breaker in Zone 1 will clear the fault in 0.5 seconds.

Figure 26.1-8. Zone Selective Interlocking

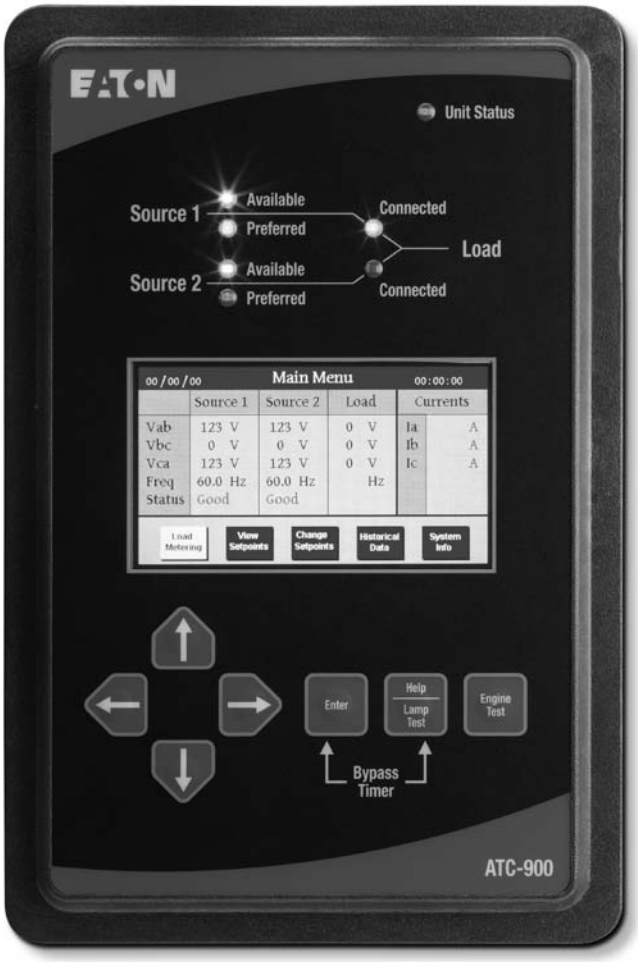
Table 26.1-7. Magnum DS and SB Breaker Control Device Application Guide—Vdc

Breaker Control Device Nominal Voltage		24 Vdc	32 Vdc	48 Vdc	125 Vdc	250 Vdc
Shunt Trip (ST)	Trip circuit		—			
Operational voltage range	70–110%	17–26 Vdc		34–53 Vdc	77–138 Vdc	154–275 Vdc
Power consumption (inrush)	(required for 35 ms)	250 watts		250 watts	450 watts	450 watts
Opening time	Seconds	35 ms		35 ms	35 ms	35 ms
Spring Release (SR)	Close circuit		—			
Operational voltage range	70–110%	17–26 Vdc		34–53 Vdc	77–138 Vdc	154–275 Vdc
Power consumption (inrush)	(required for 200 ms)	250 watts		250 watts	450 watts	450 watts
Closing time	Seconds	40 ms		40 ms	40 ms	40 ms
Spring Charge Motor (MOT)			—			
Operational voltage range	85–110% voltage	20–26 Vdc		41–53 Vdc	94–138 Vdc	187–225 Vdc
Amps (running)	Running	12.0A		5.0A	2.0A	1.0A
Amps (inrush)	% of running	300%		500%	600%	600%
Power consumption		300 watts		250 watts	250 watts	250 watts
Charging time	Seconds	5 sec		5 sec	5 sec	5 sec
Undervoltage Release (UVR)						
Operational voltage range	85–110% voltage	20–26 Vdc	27–35 Vdc	41–53 Vdc	94–138 Vdc	187–275 Vdc
Drop-out voltage range	30–60% voltage	7–14 Vdc	10–19 Vdc	14–29 Vdc	33–75 Vdc	66–150 Vdc
Power consumption (inrush)	Required for 200 ms	250 watts	275 watts	275 watts	450 watts	450 watts
Power consumption (continuous)	Required for 400 ms	18 watts	15 watts	18 watts	10 watts	10 watts
Opening time	Seconds	70 ms	70 ms	70 ms	70 ms	70 ms
Auxiliary Switches			—			
Minimum load						
Contact rating	Inductive load	0.5A		0.5A	0.5A	0.25A

Table 26.1-8. Magnum DS and SB Breaker Control Device Application Guide—Vac

Breaker Control Device Nominal Voltage		120 Vac	240 Vac	415 Vac	480 Vac	600 Vac
Shunt Trip (ST)	Trip circuit			—	—	—
Operational voltage range	70–110%	77–140 Vac	146–264 Vac			
Power consumption (inrush)	(Required for 35 ms)	450 VA	450 VA			
Opening time	Seconds	35 ms	35 ms			
Spring Release (SR)	Close circuit			—	—	—
Operational voltage range	70–110%	77–140 Vac	146–264 Vac			
Power consumption (inrush)	(Required for 200 ms)	450 VA	450 VA			
Closing time	Seconds	40 ms	40 ms			
Spring Charge Motor (MOT)				—	—	—
Operational voltage range	85–110% voltage	93–140 Vac	177–264 Vac			
Amps (running)	Running	2.0A	1.0A			
Amps (inrush)	% of running	600%	600%			
Power consumption		250 VA	250 VA			
Charging time	Seconds	5 sec	5 sec			
Undervoltage Release (UVR)						
Operational voltage range	85–110% voltage	94–140 Vac	177–264 Vac	323–457 Vac	408–528 Vac	510–660 Vac
Drop-out voltage range	30–60% voltage	33–76 Vac	62–144 Vac	114–249 Vac	144–288 Vac	180–360 Vac
Power consumption (inrush)	Required for 200 ms	450 VA	400 VA	480 VA	400 VA	400 VA
Power consumption (continuous)	Required for 400 ms	10 VA	10 VA	10 VA	10 VA	10 VA
Opening time	Seconds	70 ms	70 ms	70 ms	70 ms	70 ms
Auxiliary Switches				—	—	—
Minimum load						
Contact rating	Inductive load	10A	10A			

ATC-900 Automatic Transfer Switch Controller



Introduction

Description

Eaton's ATC-900 brings intelligence, adaptability, and enhanced supervisory and programming capabilities to Eaton's complete transfer switch product offering including contactor, breaker and Magnum® based transfer switches.

High reliability makes the ATC-900 ideal for mission critical installations in the healthcare, water, industrial, and data center industries. An intelligent control architecture allows the ATC-900 to address virtually any system requirements. Typical applications include utility-to-utility, utility-to-generator, and generator-to-generator transfer pairs and advanced programing features provide for control of three-source systems. Design flexibility allows for operations with open, in-phase, delayed or closed transition platforms.

Ease-of-use is a major benefit of the ATC-900 controller. The simple yet powerful user interface, includes many intuitive operating features. The color display and LED indications provide enhanced operator visibility of transfer switch status and system detail. Clear operational focus was achieved through design simplicity. Front arrow keys allow for quick screen navigation, removal of codes and abbreviations avoid potential confusion, and refined data screens provide for ease of viewing and edits.

The one standard model concept offers a variety of monitoring and control features, selective load shedding, remote load testing, along with event logging/recording and Modbus® communications. With configurable monitoring and control features and add-on accessory modules, the ATC-900 provides the flexibility to meet current and future system needs.

Primary functions

The ATC-900 Automatic Transfer Switch Controller offers these standard features:

- Monitor normal and emergency-source voltages and frequencies
- Provide transfer and re-transfer control signals
- Provide engine/generator start and shutdown signals
- Permit user programming of operational set points
- Display real-time and historical information
- Permit system testing
- Store customer and factory-established parameters in nonvolatile memory
- Provide faceplate source status indication
- Provide an LCD for programming and status readouts

Features and benefits

- LCD screen for system status, programming, system diagnostics, help, and troubleshooting
- Event logging and recording, 450 time stamped events
- 0–600V field programmable system voltage flexible configuration with assignable inputs and outputs
- Three-source ATS control—master and slave controller functionality
- Selective, automatic load shedding
- Industry standard communication protocols—Modbus RTU and/or Modbus TCP/IP communications interface
- USB drive for uploading and downloading of event data
- USB drive for uploading and downloading programmed set points

Powering Business Worldwide

Table 1. ATC-900 features

Features	ATC-900
Hardware	
4.3-inch color TFT LCD display	✓
UV-resistant faceplate	✓
Mimic diagram and LED status indicators	✓
Suitable for application over a wide range of environmental conditions	✓
Positive feedback membrane pushbuttons for application in harsh environments	✓
Help function for detailed description of displayed message	✓
Password protected system test pushbutton	✓
Bypass time delay pushbutton	✓
Form-C engine start contact for Source 1 and Source 2	✓
S1 and S2 available Form-C contacts	✓
Self-diagnostic and system diagnostic functions with LED indication	✓
DC power input	Optional
Metering	
True rms voltage sensing of Source 1, Source 2, and Load	✓
Frequency sensing of Source 1, Source 2, and Load	✓
Voltage unbalance and phase rotation sensing	✓
Load current sensing	Optional
Sampling at 64 samples per cycle	Optional
Source 1 voltages (3Φ)	✓
Source 2 voltages (3Φ)	✓
Load voltages (3Φ)	✓
Source 1 frequency	✓
Source 2 frequency	✓
Load frequency	✓
Load currents (3Φ)	Optional
Load kW	Optional
Load kVAR	Optional
Load kVA	Optional
PF	Optional
Programming	
Programmable set points stored in nonvolatile memory	✓
System monitoring with historical data storage and display	✓
Digital set points for accurate and consistent performance	✓
Password-protected access to control functions and set point programming	✓
4 programmable control inputs	✓
4 programmable control outputs	✓
Expandable I/O modules (up to 20 I/O total)	Optional
Automatic plant exerciser—two plant exerciser schedules, Off, daily, 7-day, 14-day, 28-day, calendar, separate TDNE, TDEN, TDEC timers from normal operation, control input provided for remotely initiating an engine test	✓
Communications	
Modbus RTU	✓
Modbus TCP/IP	Optional
USB port for set point configuration and event-recording downloads	✓
Event history	
320 time-stamped events	✓
2 seconds of metered data stored before and after a transfer event	Optional

Table 2. Technical specifications

Parameter	Specification
Control power	120 Vac (50/60 Hz) (operating range 65–160 Vac) or 24 Vdc (±10%) with DCT module
Power consumption	18 VA
Environmental conditions	
Operating temperature	-4.0–158ºF (-20–70ºC)
Operating humidity	Up to 90% relative humidity (non-condensing)
Enclosure compatibility	NEMA® 12 (standard mounting) NEMA 4/4X (mounted with gasket between panel and device faceplate) NEMA 3R (outdoor) UV resistant ATC-900 faceplate
System voltage application	120–600 Vac (50/60 Hz) (single or three phase)
Voltage measurements	Source 1, Source 2 and Load (VAB, VBC, VCA for three-phase system)
Voltage measurement range	0–700 Vac
Voltage measurement accuracy	±1% of reading
Frequency measurements	Source 1 and Source 2
Frequency measurement range	40–80 Hz
Frequency measurement accuracy	±0.1 Hz
Applicable testing	UL® recognized component 2009 IBC, 2010 CBC and OSHPD certified in ATS assemblies Complies with UL 991 environmental tests Complies with IEC 61000-4-2, 61000-4-3, 61000-4-4, 61000-4-5, and 61000-4-6 Complies with CISPR 11, Class A Complies with FCC Part 15, Subpart B, Class A
CSA® conformance	C22.2 No. 178-1978 (reaffirmed 1992)
CE mark	European standards conformance

Reference documents and resources

- Instruction bulletin: IB01602088E
- Web-based demo: www.eaton.com/ats

Simple, powerful user interface

LED mimic diagram
Source 1 and *Source 2* color-coded LEDs provide *Available* and *Connected* status indication.

Status screen
The ATC-900 *Main Menu* screen provides transfer switch status at a glance. *Source 1*, *Source 2*, and load-metering data are displayed as well as any active alarms.

Display
The ATC-900 eliminates the use of codes and abbreviations for transfer switch functions. Data screens are grouped for ease of viewing and edits.

Arrow key navigation
Right and *Left Arrow Keys* are used to navigate menu options and *Up* and *Down Arrow Keys* are used to select and change set point values.

Unit status light
This LED blinks green indicating that the ATC-900 is operating and providing the transfer switch control function in keeping with programmed set points. If the LED is not lit or is on continuously, a problem may be indicated.

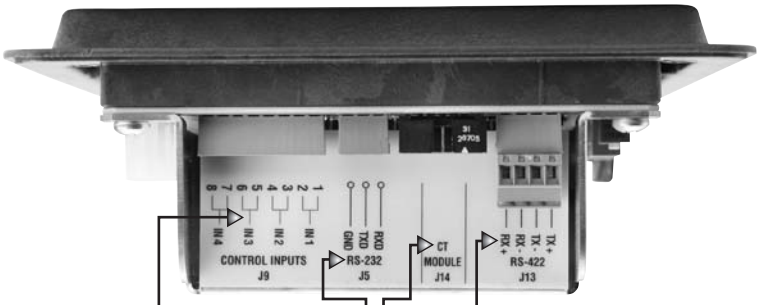
Help
Displays controller firmware version and user tips.

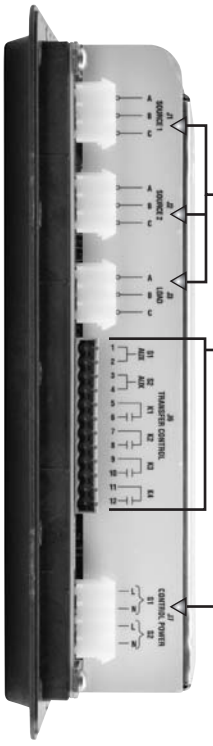
Lamp test
Pressing the *Lamp Test* pushbutton lights all LEDs and then displays ATC-900 controller information.

Engine test
Performs an engine test using the programmed engine run and cool down times. This is a password-protected feature.

Bypass time delays
Pressing the *Enter* and *Help* pushbuttons simultaneously reduces the active programmed time delay to zero to simplify test procedures.

Figure 1. ATC-900 user interface





Configurable inputs
System inputs are "wetted" contacts. System inputs can be configured to perform a preset list of functions. (Note: A factory configured input cannot be reconfigured in the field if the factory provides associated hardware.)

Factory use only
The sensing inputs are the connection points for monitoring Source 1, Source 2, and the Load. Three-phase systems are connected to Phase A, B and C. Single-phase systems are connected to points Phase A and Phase B.

Factory use only

- **Source 1 and Source 2 auxiliary:** These inputs are connected to the power switching devices position indication contacts.
- **K1, K2, K3 and K4:** These Form-A output contacts are utilized to control the power switching mechanism. They operate in conjunction with the Source 1 and 2 auxiliary inputs.

Control power inputs (Source 1 and Source 2)
The control power input range is 65–145 Vac, 50/60 Hz, 9–36 Vdc.

RS-422

DCT module

RS-232 (ATC-900 ECAM)

Modbus 485

Accessory I/O port

USB port

Earth ground
Provides a connection point for the common system ground.

Generator start
Form-C contact. This is a latching relay utilized to initiate startup and shutdown cycles of the engine/generator set. The *GENERATOR START* contact is rated 5 amperes at 250 Vac/30 Vdc.

Configurable outputs
Four Form-C dry relay contacts that can be configured to perform a preset list of functions. Contacts are rated 10 amperes at 250 Vac/30 Vdc. (Note: A factory-configured output cannot be reconfigured in the field if the factory provides associated hardware.)

Source 1 and Source 2 available
Form-C dry relay contacts that indicate Source 1 and Source 2 availability based on the programmed voltage and frequency set points. Contacts are rated 10 amperes at 250 Vac/30 Vdc.

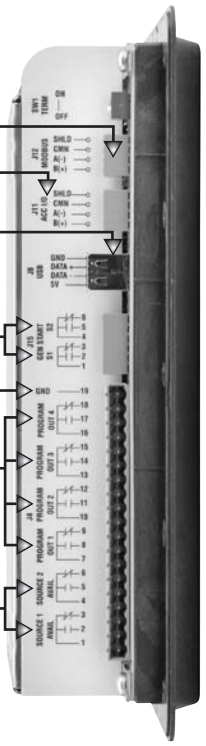


Figure 2. ATC-900 connections

ATC-900 programmable set points

Table 3 lists only controller features; switch features are not listed, as they are defined by switch construction. Transition settings are specific to the transfer switch construction.

Table 3. Features and set points

Option number	Description	Range	Factory default
General settings			
—	Set new password	0000–9999	0900
—	Selected language	English, French or Spanish	English
—	Nominal frequency	50 or 60 Hz	As ordered
—	Nominal voltage	110–600V	As ordered
—	Number of phases	1 or 3	As ordered
—	Number of generators	0, 1 or 2	1
—	Preferred source	Source 1 or Source 2	Source 1
—	PT ratio	2:1–500:1	As ordered
—	CT ratio	200–5000	—
—	Daylight Saving Time	On or Off	1
—	Operating mode	Stand-alone/Master or Slave	Master
—	Phase sequence check	ABC, CBA or Off	Off
—	Commitment to transfer in TDNE	Yes or No	No
—	Manual retransfer	Auto, Manual or External	As ordered
—	Modbus address	1–247	1
—	Modbus baud rate	0 = 9600, 1, Even	9600
		1 = 9600, 1, Odd	—
		2 = 9600, 2, None	—
		3 = 9600, 1, None	—
		4 = 19,200, 1, Even	—
		5 = 19,200, 1, Odd	—
		6 = 19,200, 2, None	—
		7 = 19,200, 1, None	—
Transition settings			
47	Closed transition		
	Closed transition On or Off	On or Off	As ordered
	Closed voltage difference	1–5%	2%
	Closed frequency difference	0.0–0.3 Hz	0.3
32f/32d	Open—in-phase transition		
	In-phase On or Off	Disable, in-phase default to alarm, in-phase default to open transition	As ordered
	In-phase frequency difference	0.0–3.0 Hz	1.0
—	Synchronization timer	1–60 minutes	5
32a/32d	Open—delayed transition		
	Time delay neutral	0–120 seconds	0
	Load voltage decay	2–30% of nominal voltage	6%
Time delays			
1a	Time delay normal to emergency	0–9999 seconds	0:00
3a	Time delay emergency to normal	0–9999 seconds	5:00
35A	Time delay pre-transfer	0–120 seconds	0:01
35C	Time delay post-transfer	0–120 seconds	0:10
2A	Time delay engine 1 start	0–120 seconds	0:03
—	Time delay engine 2 start	0–120 seconds	0:03
4A	Time delay engine cool-off	0–9999 seconds	5:00
7A	Time delay engine fail timer	0–6 seconds	0:06
—	Voltage unbalance time delay	10–30 seconds	0:30
Source settings			
26P	Source 1 undervoltage dropout	70–97% of nominal	80%
	Source 1 undervoltage pickup	(dropout + 2%) to 99% of nominal	90%
5P	Source 2 undervoltage dropout	70–97% of nominal	80%
	Source 2 undervoltage pickup	(dropout + 2%) to 99% of nominal	90%
26K	Source 1 overvoltage dropout	105–120% of nominal (0 = disabled)	115%
	Source 1 overvoltage pickup	103% of nominal to (dropout - 2%) (0 = disabled)	105%
5K	Source 2 overvoltage dropout	105–120% of nominal (0 = disabled)	115%
	Source 2 overvoltage pickup	103% of nominal to (dropout - 2%) (0 = disabled)	105%
26J	Source 1 underfrequency dropout	90–97% of nominal (0 = disabled)	94%
	Source 1 underfrequency pickup	(dropout + 1 Hz) to 99% of nominal (0 = disabled)	96%
5J	Source 2 underfrequency dropout	90–97% of nominal (0 = disabled)	94%
	Source 2 underfrequency pickup	(dropout + 1 Hz) to 99% of nominal (0 = disabled)	96%
26N	Source 1 overfrequency dropout	103–110% (0 = disabled)	106%
	Source 1 overfrequency pickup	101% to (dropout - 1 Hz) (0 = disabled)	104%
5N	Source 2 overfrequency dropout	103–110% (0 = disabled)	106%
	Source 2 overfrequency pickup	101% to (dropout - 1 Hz) (0 = disabled)	104%
26L	Source 1 percent for unbalanced voltage dropout	5–20% of phase-to-phase voltage unbalance (0 = disabled)	12%
	Source 1 percent for unbalanced voltage pickup	3% to (dropout - 2%) (0 = disabled)	10%
5L	Source 2 percent for unbalanced voltage dropout	5–20% of phase-to-phase voltage unbalance (0 = disabled)	12%
	Source 2 percent for unbalanced voltage pickup	3% to (dropout - 2%) (0 = disabled)	10%
Engine test/plant exerciser (PE1 and PE2 are independently programmable)			
6B	Engine test pushbutton on panel		
	Test mode	No load, load transfer, disabled	Load transfer
	Engine run test time	0–600 minutes	
23M	PE time delay normal to emergency	0–9999 seconds	1 minute
	PE time delay emergency to normal	0–9999 seconds	1 minute
	PE time delay engine cooldown	0–9999 seconds	5 minutes
	PE1/PE2 test mode	No load, load transfer, disabled	Disabled
	PE1/PE2 run time	0–600 minutes	30 minutes
	PE1/PE2 schedule	Off, daily, 7-day, 14-day, 28-day or calendar date (up to 12 user-specified dates)	
	PE1/PE2 calendar date	Month: 1–12; Day: 1–31	
	PE1/PE2 day of week	1 Sunday, 2 Monday, 3 Tuesday, 4 Wednesday, 5 Thursday, 6 Friday or 7 Saturday	
	PE1/PE2 plant start time	HH:MM AM/PM	
Accessory I/O			
—	Accessory I/O modules	0–4	—

Table 3 is continued in column 2 of this page.

Flexible configuration

Designed for scalability, the ATC-900 can be configured for a wide variety of applications. A mix-and-match approach to features allows the user to build a transfer switch controller that meets the precise application needs.

The ATC-900 controller includes 4 user configurable inputs and outputs. The inputs and outputs can be assigned functions from a predefined list of options either at the factory or in the field.

- Inputs
  - Monitor mode
  - Bypass timers
  - Lockout
  - Manual retransfer On or Off
  - Manual retransfer
  - Slave in
  - Remote engine test
  - Preferred source selection
  - Go to emergency
  - Emergency inhibit
  - ATS on bypass
  - Go to neutral
- Outputs (control)
  - Load sequence
  - Selective load shed
  - Load bank control
  - Pre/post transfer
  - Pre transfer
  - Post transfer
  - User remote control
- Outputs (status/alarms)
  - Source 1 available (standard)
  - Source 2 available (standard)
  - Source 1 connected
  - Source 2 connected
  - ATS not in automatic
  - General alarm
  - ATS in test
  - Engine test aborted
  - Cooldown in process
  - Engine start contact status
  - Generator 1 start status
  - Generator 2 start status
  - Emergency inhibit on
  - ATS on bypass

Additional I/O can be added at any time by adding an external I/O module. Each I/O module contains 4 inputs and outputs and up to 4 modules can be daisy chained to the ATC-900 controller.

I/O module: The ATC-900 optional I/O module provides users with four additional assignable inputs and outputs. Up to four I/O modules can be added to an ATC-900 controller providing a total of 20 inputs and outputs.

Metering

Optional metering requires the addition of a DCT module. The DCT module mounts directly on the back of the controller.

The DCT module incorporates a current transformer interface to the ATC-900 allowing current to be metered along with voltage and frequency. Combined with the ATC-900, the DCT module serves as a multifunction power meter and provides measurement of the listed electrical parameters. Readings are displayed on the ATC-900 controller display or can be monitored through Modbus 485.

Figure 3. DCT module attached

Voltage inputs (measurement category)

- **Range:** universal, auto-ranging up to 416 Vac L-N, 721 Vac L-L
- **Supported hookups:** 3-Element Wye or Delta
- **Input impedance:** 2m ohm/phase
- **Burden:** 0.0022 VA/phase at 120V
- **Fault withstand:** meets IEEE® C37.90.1

Current inputs

- 5A nominal, 10A maximum
- **Burden:** 0.005 VA per phase maximum at 11A
- **Pickup current:** 0.1% of nominal
- **Connections:** Screw terminals
- **Max input wire gauge:** AWG #12/2.5 mm 2
- **Fault withstand:** 100A/10 seconds, 300A/3 seconds, 500A/1 second

Isolation

- All inputs are isolated to 2600 Vac

Measurement methods

- **Voltage, current:** true RMS
- **Power:** sampling at 64 samples per cycle on all channels measured readings simultaneously
- **A/D conversion:** 16 simultaneous 12 bit analog to digital converters

Table 4. Current voltage frequency metering data

Current metering	Units	Accuracy	Notes
IA, IB, IC	Amperes	±1% of reading	—
Voltage metering	**Units**	**Accuracy**	**Notes**
VAB, VBC, VCA	Volts	±1% of reading	Line-to-line voltage
Frequency metering	**Units**	**Accuracy**	**Notes**
Frequency	Hz	±0.2 Hz of reading	Range is 20–255 Hz

Table 5. Power and energy metering data

Power metering	Units	Accuracy	Notes
Power	kW	±2% of reading	Approximately 1-second update
kVA	kVA	±2% of reading	Approximately 1-second update
kVAR	kVAR	±2% of reading	Approximately 1-second update
PF (power factor)	—	0 to ±1.00	—

Diagnostics and troubleshooting

In a mission-critical application, a failure to transfer to the backup power system requires quick and decisive action. Eaton's ATC-900 controller provides users with the data required to quickly identify the root cause of a backup power system failure and minimize system downtime. This data allows the user to identify a specific event and obtain the detailed event information including a step by step breakdown of the transfer sequence.

Historical data

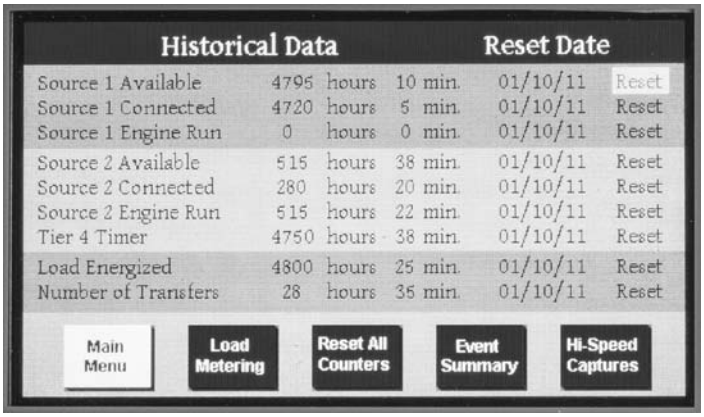


Figure 4. Historical data display

The historical data display indicates historical and cumulative counter values as follows:

- Source 1 available
- Source 1 connected
- Source 1 engine run
- Source 2 available
- Source 2 connected
- Source 2 engine run
- Tier IV timer
- Load energized
- Number of transfers

Historical counter resets are date and time stamped events that are captured in the event log.

Event summary

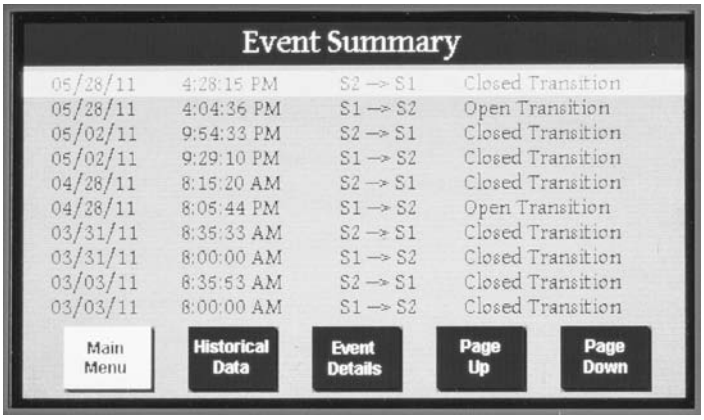


Figure 5. Event summary display

The ATC-900 controller stores 100 transfer summaries, 350 transfer details, 100 alarms, and 20 time adjustments.

Events include:

- Actions of the transfer sequence
- Alarms
- Changes to the set points
- Changes to the time/date
- Resetting a historical counter
- Engine run test

Time-stamping resolution of 1 second.

Event details

Figure 6. Event details display

Each transfer event can be exploded to view a step by step, time stamped, sequence of operation for a transfer event. All metered values are also logged for each event and can be viewed on the event data screen.

Time stamping resolution of 0.1 seconds.

Hi-speed capture

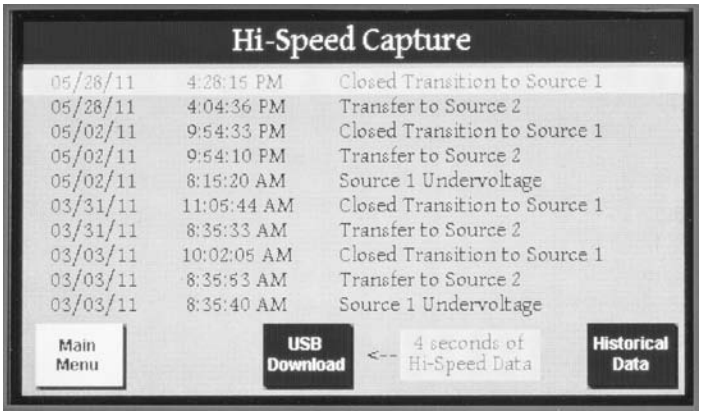


Figure 7. High speed capture display, pre and post event

The ATC-900 stores metered data updated on a continuous 20 millisecond basis for specific events. The data is captured 2 seconds before and 2 seconds after the event (except for a power failure, which is 4 seconds before). Oscillographic data for 10 events is stored in the controller and may be downloaded over USB or displayed graphically.

Events Include:

1. Source unavailability actions that initiate a transfer sequence (undervoltage, overvoltage, etc.)
2. Successful transfers (at the point of breaker/contactor closure)
3. Unsuccessful transfers (at the point of breaker/contactor failure to close or open)

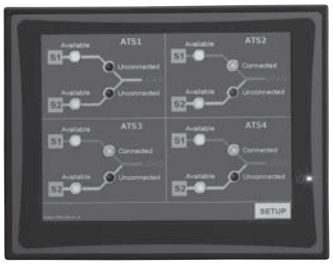
Industry standard communication protocol

Every ATC-900 controller includes a standard Modbus RTU communications interface with an option to upgrade to Modbus TCP/IP.

The ATC-900 is also compatible with Eaton's Power Xpert® Gateway for web-based monitoring, Modbus TCP/IP, SNMP, or BACnet®/IP. The Power Xpert Gateway can be used to consolidate data from up to 64 devices, including communications ready transfer switch controllers, trip units, and meters, as well as other Eaton devices. Versions of the Power Xpert Gateway include email event notification and data-logging functionality.

HM*i* Remote Annunciator and Controller

The HMi Remote Annunciator and Controller monitors and controls up to eight transfer switches on a 7" LCD touchscreen. It is compatible with either Modbus RTU or Modbus TCP/IP protocols. A basic mimic bus for each transfer switch displays source availability, source connected and preferred source. Users can drill down to metered source values and event history for each transfer switch. All control features are password-protected and include engine test, transfer to emergency (peak shaving), manual re-transfer, and bypass time delays.



USB programming port

Every ATC-900 transfer switch includes a front panel, NEMA 4X rated USB port for use in configuring set points or downloading event data to a USB flash drive. To reduce the time spent on site for commissioning, set points can be configured at a PC using the ATC-900 configuration software and saved to a USB flash drive to be uploaded to one or multiple controllers. Set points are also easily copied from one controller to another.

Downloading event capture data provides the user the ability to more thoroughly analyze high speed capture data using a PC, or data can be emailed to Eaton's Technical Support Team when offsite troubleshooting support is required.

Power Xpert Architecture

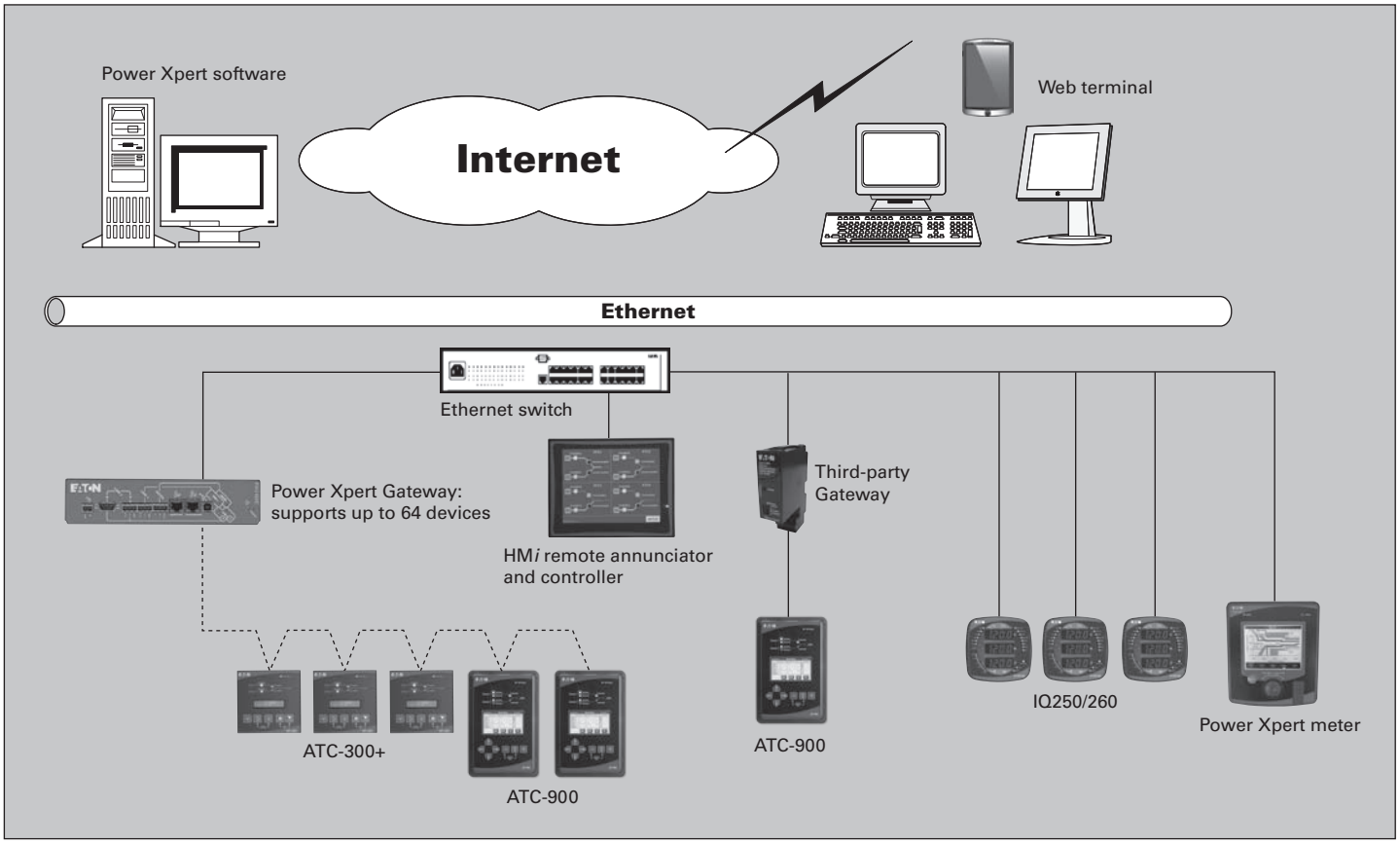


Figure 8. Power Xpert Architecture with ATC-900

Special applications

Three-source ATS control

The ATC-900 Master/Slave controller functionality provides the user with the ability to use two independent transfer switches in three-source systems consisting of a utility and two generator sources. In a three-source system, the Master ATS controls the engine starting and stopping of the Slave ATS.

In the event of a Source 1 power failure, the Master ATS engine start relay closes signaling the Slave ATS to start both generators. (Note: The Slave ATS requires continuous power using either the DCT Module for a DC power input or a UPS input.) The Master ATS handles all transfer time delays between the utility to generator transfer. If the preferred generator does not start within the programmed time delay, the Slave ATC-900 will initiate a transfer to the non-preferred generator. If "None Preferred" is selected, then both generators will start and the Slave ATS will transfer to the first generator source available. The ATC-900 will sense the load is connected to a good source and shut down the second generator.

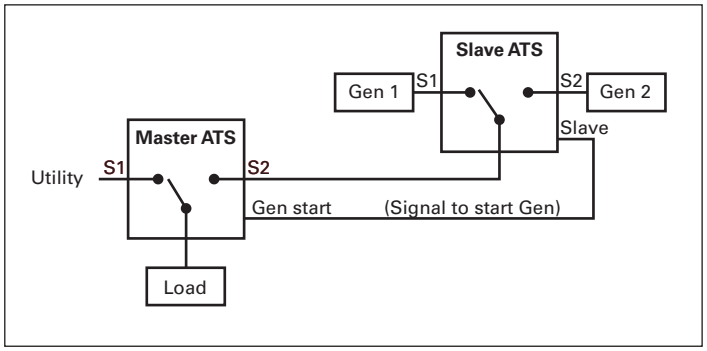


Figure 9. Three-source transfer switch arrangement

Load management

The ATC-900 includes several features to enhance the user's ability to manage load while on the alternate source.

- Integrated load metering: Provides metering data that allows the user to monitor energy utilization and manage system loading.
- Selective load shedding: Selectively drop non-essential loads when a user-defined kW level is reached. The transfer switch remains on generator.
- Load shed to neutral (where ATS construction allows): Provides the ability to load shed to a neutral position from a generator source.
- Pre/post transfer signals: Provides the ability to stop select loads during the transfer process.
- Load bank disable output: Disengages a load bank if utility power is lost during an engine test.

Dimensions in inches (mm)

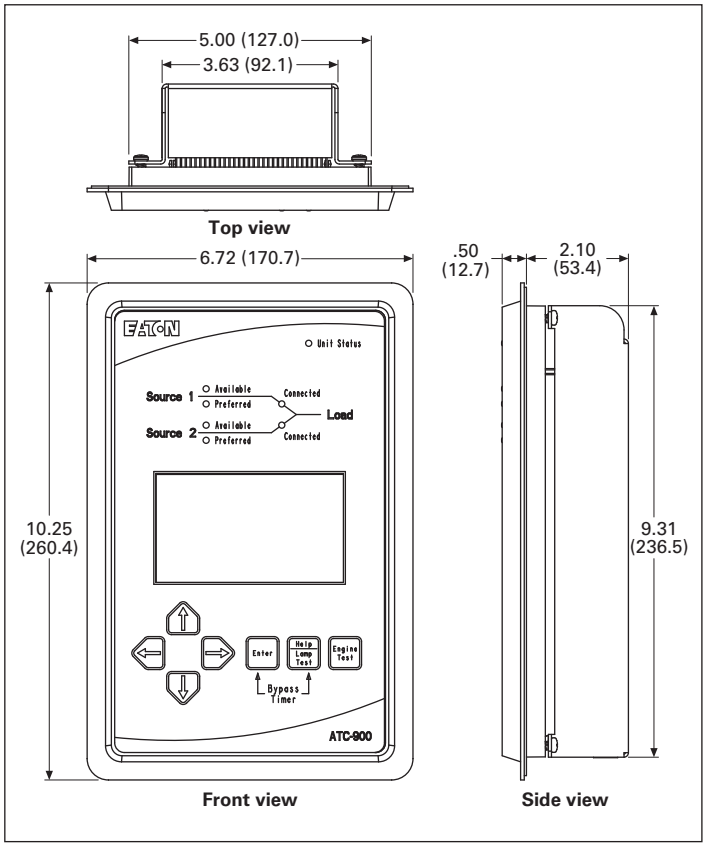


Figure 10. ATC-900

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

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Powering Business Worldwide

Sales and Service

Section 6 – Startup & Warranty

Cummins Sales and Service

Customer / Contractor Pre Commissioning Inspection Form

The intent of this form is for the contractor to prepare for equipment to be commissioned by a certified Cummins Field Service Power Generation Technician. Filling out this form is required and will minimize delays due to equipment failing to meet requirements. Completing this checklist in its entirety should minimize the need for additional billing beyond the previously provided commissioning quote.

The items listed are the responsibility of the contractor and not Cummins Sales and Service.

Project Name/End User: _____

Contractor: _____

Address: _____ **Contact:** _____

Business Phone: _____ **Cell Phone:**_____

Email: _____

ON SITE INFORMATION

On-Site Contact Information: _____

Address: _____

Time Requested Onsite: _____

Sub location of Generator (ie. Roof, basement, floor): _____

Does the facility have the following: Loading Dock ☐ Elevator ☐

Access (from truck and load bank parking to generator in feet): _____

Parking: Is parking available on-site for service truck: Yes ☐ No ☐

Permits: Have all necessary air quality and local permits been secured: Yes ☐ No ☐ N/A ☐

Fuel Tank Testing: Is fuel tank testing required: Yes ☐ No ☐

If yes when is the inspector scheduled for: _____

Sales and Service

ON SITE INFORMATION CONTINUED

YES	NA	NO
☐	☐	☐
☐	☐	☐
☐	☐	☐

Is the facility occupied and is customer aware there will be power outages after generator is started?

Will there be any site safety training needed for technician prior to beginning? On site contact for training: _____

Will customer representative be on site for operator training?

On site contact for operator training: _____

MECHANICAL LOCATION AND PLACEMENT OF THE GENERATOR SET

YES	NA	NO
☐	☐	☐
☐	☐	☐
☐	☐	☐
☐	☐	☐

Generator is properly secured to pad or vibration isolators

Generator Enclosure and/or Room is free of all debris

No airflow obstructions to the engine or generator are present for cooling combustion (See Cummins T-030 or Installation manual of generator set)

Room is designed for adequate inlet and outlet airflow

GASEOUS FUEL Natural Gas/LP Vapor/LP Liquid

YES	NA	NO
☐	☐	☐
☐	☐	☐
☐	☐	☐
☐	☐	☐

Natural gas and/or LPG fuel supply is connected.

Fuel piping is the appropriate size based on full-load CFH/BTU requirement. Pipe size after service regulator: _____

Service regulator(s), (if supplied), fuel strainer(s), flexible fuel line(s) and manual shut off are installed

Fuel pressure after service regulator is:_____inches of H2O

I have read and fully understand the fuel requirements for this equipment, I am verifying that the piping and fuel supply meets or exceeds those requirements. I also understand failure to meet the requirements will result in additional charges.

_____ _____

Contractor "requestor" Signature ***Date***

Sales and Service

DIESEL FUELED GENERATORS

YES	NA	NO	
☐	☐	☐	Flexible fuel connections, (supply and return) are connected to generator and piping.
☐	☐	☐	Day tank installed, wired and plumbed (lines free of obstruction) to genset and main fuel tank if applicable. Only black iron pipe for fuel lines, never use copper or galvanized pipe.
☐	☐	☐	All tanks filled with enough fuel to perform startup and testing.
☐	☐	☐	A return line from engine to day tank and day tank to main tank should be in place

EXHAUST SYSTEM

YES	NA	NO	
☐	☐	☐	Exhaust wrapped or isolated to prevent accidental activation of fire protection devices and sprinklers.
☐	☐	☐	Exhaust flex-pipe is installed at engine exhaust outlet (The silencer and flex-pipe are supplied with the generator set).
☐	☐	☐	Silencer is installed with appropriate supports (no weight should be placed on the exhaust outlet of the genset).
☐	☐	☐	Exhaust system has proper expansion joints and wall thimbles (Thimbles are required for wall or roof penetration).

GENERATOR ELECTRICAL CONNECTIONS

YES	NA	NO	
☐	☐	☐	Load conductors connected to breakers
☐	☐	☐	Flexible connections used on all conduit connections to the generator set output box
☐	☐	☐	Remote start interconnection **stranded** wiring is installed between the generator set and the automatic transfer switch(s) and annunciator.
☐	☐	☐	AC Power conductors in dedicated conduit separate from any DC control or network wiring
☐	☐	☐	Ground fault connected/functioning on generator, if supplied
☐	☐	☐	AC power wired to the coolant heaters (Do NOT energize)
☐	☐	☐	Check for AC oil pan heater, control heater or generator winding heater (Needing AC wiring)
☐	☐	☐	Generator is grounded in compliance with local codes
☐	☐	☐	If applicable, louver motors are operational and connected to generator controls

GENERATOR ELECTRICAL CONNECTIONS CONTINUED

YES	NA	NO
☐	☐	☐
☐	☐	☐
☐	☐	☐

Annunciator mounted in a location where someone can observe a fault of the remote generator system
Where is annunciator located? _____

Are there additional ancillary devices/equipment that need to be integrated into the system? If yes, please define_____

Battery charger mounted (free of vibration, weather, accessible for an operator to observe easily) and connected to the appropriate AC and DC wiring to operate the charger.

TRANSFER SWITCH ELECTRICAL CONNECTIONS

YES	NA	NO
☐	☐	☐
☐	☐	☐
☐	☐	☐

Conductors connected for Utility, Load and Emergency

Remote start interconnection **stranded** wiring is installed between the generator set and the automatic transfer switch(s).

Four Pole Transfer Switch: Is generator neutral grounded? ☐

DAY OF STARTUP

YES	NA	NO
☐	☐	☐
☐	☐	☐
☐	☐	☐

Training of facility personnel will be done on the same day as start up. Additional trips for operational training will be an additional charge.

Can transfer switch be tested at time of generator startup? (There will be a power interruption) ***Note: After hours testing could result in additional charges.***

If the associated switchgear and/or ATS(s) are not provided by Cummins, will the manufacturer's representative be on site?

Exercise with or without load? ☐

If known, Transfer Time delay set recommendations Generator Set to exercise Day:_____ Time:_____

_____ _____

Contractor "requestor" Signature ***Printed Name***

Date: _____

Please complete this form and return to schedule start up, if not returned within 5 business days prior to scheduled startup it may be delayed. I understand that the start-up date may have to be rescheduled at my expense if the above items have not been completed properly.

INSTRUCTION OF OPERATIONS AND MAINTENANCE PERSONNEL
Generator

PROJECT:

Training will be conducted by a factory-trained maintenance specialist in engine / generator maintenance and service. Training duration will be approximately 1 hour with a question and answer session to last as long as needed to satisfy owner.

LESSON PLAN

I. Safety
   a. General safety precautions
   b. Equipment safety code
   c. Electrical shock and arc flash
II. Equipment Operation
   a. Engine/generator operation process
   b. Fundamental operating principals of the engine/generator
   c. Identify all components of equipment – mechanical, electrical, and electronic
      i. Standard operating procedures – start-up, monitoring, and shut-down
III. Component Description
   a. Identify each component's function – Engine/generator and Automatic Transfer Switch and their relationship to one another (if applicable)
IV. Preventive Maintenance
   a. Inspection Procedures
      i. Inspection with equipment in operation
      ii. Potential trouble symptoms
      iii. Planned maintenance requirements and intervals
   b. Procedures for testing equipment after maintenance has been performed
V. Service Events
   a. Alarms / Display Messages
   b. Procedures
      i. E-stop reset
   c. Symptom list
   d. Equipment Troubleshooting
   e. Probable Cause & Recommended Correction

"HANDS-ON" DEMONSTRATION

The instructor will demonstrate the engine/generator functionality in auto and manual modes.

Disclaimer
Training is for informational purposes only. If you have any specific safety or operational questions refer to the Operators Manual and/or Sequence of Operations documentation.

Warranty Statement

Global Commercial Warranty Statement

Generator Set

English
Original Instructions

7-2017

A028U870 (Issue 5)

Our energy working for you.™

Power Generation

Limited Warranty

Commercial Generating Set

This limited warranty applies to all Cummins Power Generation® branded commercial generating sets and associated accessories (hereinafter referred to as "Product").

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

Warranty Period:

The warranty start date† is the date of initial start up, first rental, demonstration or 18 months after factory ship date, whichever is sooner. See table for details.

Continuous Power (COP) is defined as being the maximum power which the generating set is capable of delivering continuously whilst supplying a constant electrical load when operated for an unlimited number of hours per year. No overload capability is available for this rating.

Prime Power (PRP) is defined as being the maximum power which a generating set is capable of delivering continuously whilst supplying a variable electrical load when operated for an unlimited number of hours per year. The permissible average power output over 24 hours of operation shall not exceed 70% of the PRP. For applications requiring permissible average output higher than stated, a COP rating should be used.

Limited-Time Running Power (LTP) is defined as the maximum power available, under the agreed operating conditions, for which the generating set is capable of delivering for up to 500 hours of operation per year.

Emergency Standby Power (ESP) is defined as the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 500 hours of operation per year. The permissible average power output over 24 hours of operation shall not exceed 70% of the ESP.

Environmental Protection Agency – Stationary Emergency (EPA-SE) is defined as being the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generator set is capable of delivering in the event of a utility power outage or under test conditions and used in strict accordance with the EPA NSPS for stationary engines, 40 CFR part 60, subparts IIII and JJJJ, where a reliable utility must be present. The permissible average power output over 24 hours of operation shall not exceed 70% of the EPA-SE.

Data Center Continuous (DCC) is defined as the maximum power which the generator is capable of delivering continuously to a constant or varying electrical load for unlimited hours in a data center application.

Base Warranty Coverage Duration
(Whichever occurs first)

Rating	Months	Max. Hours
COP	12	Unlimited
PRP	12	Unlimited
LTP	12	500 hrs
ESP	24	1000 hrs
EPA-SE	24	Unlimited
DCC	24	Unlimited

† Warranty start date for designated rental and oil and gas model Products is determined to be date of receipt of Product by the end customer.

Cummins Power Generation® Responsibilities:

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

- All parts and labor required to repair the Product.
- Reasonable travel expenses to and from the Product site location.
- Maintenance items that are contaminated or damaged by a warrantable failure.

Owner Responsibilities:

The owner will be responsible for the following:

- Notifying Cummins Power Generation® distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins Power Generation®'s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.
- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of generating sets used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

Limitations:

This limited warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Inappropriate use of an EPA-SE application generator set relative to EPA's standards.
- Normal wear and tear.
- Improper and/or unauthorized installation.
- Negligence, accidents or misuse.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins Power Generation® published guideline or policy.
- Use of improper or contaminated fuels, coolants or lubricants.
- Improper storage before and after commissioning.
- Owner's delay in making Product available after notification of potential Product problem.
- Replacement parts and accessories not authorized by Cummins Power Generation®.
- Use of Battle Short Mode.
- Owner or operator abuse or neglect such as: operation without adequate coolant or lubricants; overfueling; overspeeding; lack of maintenance to lubricating, cooling or air intake systems; late servicing and maintenance; improper storage, starting, warm-up, run-in or shutdown practices, or for progressive damage resulting from a defective shutdown or warning device.
- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the generating set.

This limited warranty does not cover costs resulting from:

- Difficulty in gaining access to the Product.
- Damage to customer property.

A "Data center" is defined as a dedicated facility that house computers and associated equipment for data storage and data handling.

Reliable utility is defined as utility power without routine or regularly scheduled black-outs.

Please contact your local Cummins Power Generation® Distributor for clarification concerning these limitations.

CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:

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

Extended Warranty:

Cummins Power Generation® offers several levels of Extended Warranty Coverage. Please contact your local Cummins Power Generation ® Distributor for details.
www.power.cummins.com

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

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

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

Product Model Number:_____
Product Serial Number:_____
Date in Service:_____