

# Volume 15: Solar Inverters and Electrical Balance of System



*Powering Business Worldwide*



# Electrical Balance of System for Residential Installations

Our roots in the electrical business run deep. Eaton is a global technology leader in electrical components and systems for power quality, distribution and control. Our industry leading products and services are designed to deliver:

- Reliability
- Efficiency
- Safety



Powering Business Worldwide

## Eaton Solar

### *One-stop BOS shopping*

We can assemble a package of Balance of System (BOS) equipment that is ready to be installed. You will have one vendor, one purchase order, one delivery schedule and a single point of accountability.

- We can customize our solutions to the physical dimensions of your home
- Our BOS solutions will work with many photovoltaic (PV) panel manufacturers
- We offer a wide range of solar power solutions

## Eaton product solutions combine:

- DC switching (UL98 and UL98B)
- Robust inverter technology – same reliable technology that is used in our UPS systems (UL1741)
- AC switching and protection

### EATON'S ELECTRICAL BALANCE OF SYSTEM

- A** DC combiners and switches (600 Vdc)
- B** Solar inverters (600 Vdc)
- C** AC meter breakers, loadcenters and switches
- D** Electric vehicle charging
- E** Eaton Certified Contractor Network



# Electrical Balance of System for Residential Installations

## A DC combiners and switches (600 Vdc)

Eaton's solutions for protecting and switching DC current are designed and tested to meet UL1741, UL98 and UL98B requirements for solar electrical balance of system equipment.

## B Solar inverters (600 Vdc)

Eaton's solar inverters use the same robust, reliable technology we put in our uninterruptible power systems (UPS). Solar inverters are designed and tested to meet UL1741 standards.

## C AC meter breakers, load centers and switches

Eaton's AC switching and protection solutions are designed to meet 2008 NEC® Article 690.64(B)(2) sizing requirements for solar photovoltaic systems.

## D Electric vehicle charging

Eaton is uniquely positioned to create a safe and reliable infrastructure that supports the use of electric vehicles. Our family of charging solutions is the most robust, flexible offering on the market.

### DC combiner boxes



- Combines input photovoltaic strings forming a single output
- Options include string monitoring and surge protection

### Solar inverters: 3.8 kW - 7 kW



- CEC rated for 97% efficiency
- Integral AC/DC switching with four-string combiner

### Solar-ready meter breaker



- Complete family of circuit breakers for all applications

### EV charging station



### DC disconnect switches



- Isolates photovoltaic source
- Provides rooftop disconnect required by fire departments

### Solar-ready loadcenter



### AC disconnect switches



- Isolates utility feed

## Eaton Certified Contractor Network



# Electrical Balance of System for Commercial Installations

As your single-source supplier for a solar balance of system package, Eaton can help you build a solar system tailored to the needs of a retail, commercial or institutional site with a focus on:

- Reliability
- Efficiency
- Safety



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We know space is always at a premium. That's why we offer totally integrated power control and management solutions like inverters and solar switchboards. These space-savings lineups house the system's DC switching equipment, solar inverter and AC switching equipment. The equipment is pre-configured for easy installation, saving space, time and cost.

We can also help you customize your electrical system package to the requirements of your facility, including the physical dimensions of your building or installation. In addition, our regional satellites and service centers are knowledgeable about local electrical codes and regulations in your area, which allows us to customize your solutions accordingly.

## Eaton product solutions combine:

- DC switching (UL98 and UL98B)
- DC combiners (UL1741)
- Robust inverter technology
- AC switching and protection
- Integrated metering
- Customized packaging and pre-configuration

## EATON'S ELECTRICAL BALANCE OF SYSTEM

- A** DC combiners, switches and switched combiners (600 Vdc)
- B** Solar inverters (600 Vdc) and solar transformers
- C** AC switchgear
- D** Monitoring and metering
- E** Electric vehicle charging
- F** Electrical solar services

# Electrical Balance of System for Commercial Installations

## A DC combiners, switches and switched combiners (600 Vdc)

DC disconnect switches



DC circuit breakers



DC switched combiners



DC switchboards



## B Solar inverters (600 Vdc) and solar transformers

Commercial-scale solar inverters – 250kW through 500kW



Medium voltage step-up transformer



© 2010 Photo courtesy of Cooper Power Systems

## C AC switchgear

AC switchboards



AC disconnect switches



## C AC switchgear

AC circuit breakers



Medium voltage AC switchgear



## D Monitoring and metering

Meters and software



## E Electric vehicle charging

Electric vehicle charging and integrated power stations for solar canopies



Custom Solar Switchboards



Low voltage and medium voltage transformers and substations



## F Electrical solar services





# Electrical Balance of System for Utility Installations

Our roots in the electrical industry run deep. As a bankable partner with 100 years of innovation, we are your single source supplier of electrical balance of system solutions to help improve:

- Reliability
- Efficiency
- Safety



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Eaton provides complete electrical balance of system solutions from the combiners, to the inverter, to the medium voltage interconnection to the grid.

Our NEMA 3R enclosures and outdoor electrical houses help protect equipment from the elements and keep it operating.

Eaton can also help support solar farms once they are operating. We offer an extensive selection of operations training for electrical power systems equipment, and we are a leader in electrical safety training. We can even help monitor and manage solar system performance with our remote performance monitoring services.

## Eaton product solutions combine:

- DC switching (UL98 and UL98B)
- DC combiners (UL1741)
- Robust inverter technology – same reliable technology that is used in our battery storage inverters
- AC switchgear
- Integrated metering
- Customized packaging and pre-configuration

## EATON'S ELECTRICAL BALANCE OF SYSTEM

- A** DC combiners, switches and switched combiners (1000 Vdc)
- B** Solar inverters (1000 Vdc) and solar transformers
- C** AC switchgear
- D** Monitoring and metering
- E** Electrical solar services

# Electrical Balance of System for Utility Installations

## A DC combiners, switches and switched combiners (1000 Vdc)

DC disconnect switches



Switched combiners



DC circuit breakers



DC switchboards



## B Solar inverters (1000 Vdc) and solar transformers

Utility-scale solar inverters – 250kW through 500kW



Medium voltage step-up transformer



© 2010 Photo courtesy of Cooper Power Systems

## C AC switchgear

AC switchboards



AC disconnect switches



## C AC switchgear

AC circuit breakers



Medium voltage AC switchgear



## D Monitoring and metering

Meters and software



## E Electrical solar services



Custom Solar Switchboards



Low voltage and medium voltage transformers and substations







# Commercial and Utility Electrical Solar Services

Eaton's Electrical Services and Systems engineers can help manage the power of the sun. We offer the convenience of turnkey project teams who can design, build and support your solar power system.



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## Design

### Pre-installation services

Eaton's Electrical Services and Systems (EESS) team can help you choose a solar system that makes technical and financial sense. Our comprehensive solar site assessment service evaluates topics like optimal panel placement, estimated revenues and projected maintenance costs. And our experienced power system engineers can design a solar system that will always operate at peak performance.

## Build

### Installation services

Our field service engineers can install, start up and commission any manufacturer's solar power equipment quickly using our efficient, standardized processes. Your solar system will be up and running safely and reliably.

## Support

### Post-installation services

Eaton's remote performance monitoring services track solar power outputs and identify trends over time. That makes it easier to spot performance trends.

### Additional services

Eaton offers many additional services that help keep workers safe and clean, reliable power flowing.

- Arc flash hazard analysis and solutions
- Power reliability studies
- LEED certification audits





## Design

- Solar site assessments including technical and financial analysis
- Solar system design including shading and annual kWh output analysis
- Photovoltaic panel design
- Electrical balance of system design
- Monitoring system design (meters and software)
- Building connection and substation design
- Turnkey construction project management, including design and procurement services



## Build

- Turnkey construction projects
- Photovoltaic panel installation
- Electrical balance of system installation
- Monitoring system installation (meters and software)
- Building infrastructure connection
- Substation construction
- Utility grid interconnection, synchronizing and controls
- Solar system commissioning and performance verification



## Support

- Remote performance monitoring (metering and data collection)
- Ongoing energy production monitoring and rebate certifications
- Building energy audits
- Site power quality, load shedding and future expansion analysis
- Maintenance
- Operations training for site personnel
- Safety training

Eaton Grid-Tied Solar Inverter  
(3.8–7 kW)



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Power Xpert™ Solar 250 kW Inverter



Power Xpert Solar 1500 kW Inverter





## Dimensions, Weights and Ratings

Dimensions, weights and ratings given in this catalog **are approximate and should not be used for construction purposes**. Drawings containing exact dimensions are available upon request. All listed product specifications and ratings are subject to change without notice. Photographs are representative of production units.

## Terms and Conditions

All prices and discounts are subject to change without notice. When price changes occur, they are published in Eaton's *Price and Availability Digest* (PAD). All orders accepted by Eaton's Electrical Sector are subject to the general terms and conditions as set forth in Appendix 1—Eaton Terms & Conditions.

## Technical and Descriptive Publications

This catalog contains brief technical data for proper selection of products. Further information is available in the form of technical information publications and illustrated brochures. If additional product information is required, contact your local Eaton Products Distributor, call **1-800-525-2000** or visit our website at **[www.eaton.com](http://www.eaton.com)**.

## Compliance with Nuclear Regulation 10 CFR 21

Eaton products are sold as commercial grade products not intended for application in facilities or activities licensed by the United States Nuclear Regulatory Commission for atomic purposes, under 10 CFR 21. Further certification will be required for use of these products in a safety-related application in any nuclear facility licensed by the U.S. Nuclear Regulatory Commission.

## WARNING

The installation and use of Eaton products should be in accordance with the provisions of the U.S. National Electrical Code® and/or other local codes or industry standards that are pertinent to the particular end use. Installation or use not in accordance with these codes and standards could be hazardous to personnel and/or equipment.

These catalog pages do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Eaton Products Distributor or Sales Office. The contents of this catalog shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Eaton's Electrical Sector. The warranty contained in the contract between the parties is the sole warranty of Eaton. Any statements contained herein do not create new warranties or modify the existing warranty.



Powering Business Worldwide

**Eaton is a global leader in power distribution, power quality, control and automation, and monitoring products.**

At Eaton, we believe a reliable, efficient and safe power system is the foundation of every successful enterprise. Through innovative technologies, cutting-edge products and our highly skilled services team, we empower businesses around the world to achieve a powerful advantage.

In addition, Eaton is committed to creating and maintaining powerful customer relationships built on a foundation of excellence. From the products we manufacture to our dedicated customer service and support, we know what's important to you.

## Solutions

Eaton takes the complexity out of power systems management with a holistic and strategic approach, leveraging our industry-leading technology, solutions and services. We focus on the following three areas in all we do:

- Reliability—maintain the appropriate level of power continuity without disruption or unexpected downtime
- Efficiency—minimize energy usage, operating costs, equipment footprint and environmental impact
- Safety—identify and mitigate electrical hazards to protect what you value most

## Using the Eaton Catalog Library

As we grow, it becomes increasingly difficult to include all products in one or two comprehensive catalogs. Knowing that each user has their specific needs, we have created a library of catalogs for our products that when complete, will contain 15 volumes. Since the volumes will continuously be a work in progress and updated, each volume will stand alone. Refer to our volume directory, MZ08100001E, for a quick glance of where to look for the products you need. The 15 volumes include:

- Volume 1—Residential and Light Commercial (CA08100002E)
- Volume 2—Commercial Distribution (CA08100003E)
- Volume 3—Power Distribution and Control Assemblies (CA08100004E)
- Volume 4—Circuit Protection (CA08100005E)
- Volume 5—Motor Control and Protection (CA08100006E)
- Volume 6—Solid-State Motor Control (CA08100007E)
- Volume 7—Logic Control, Operator Interface and Connectivity Solutions (CA08100008E)
- Volume 8—Sensing Solutions (CA08100010E)
- Volume 9—Original Equipment Manufacturer (CA08100011E)
- Volume 10—Enclosed Control (CA08100012E)
- Volume 11—Vehicle and Commercial Controls (CA08100013E)
- Volume 12—Aftermarket, Renewal Parts and Life Extension Solutions (CA08100014E)
- Volume 13—Counters, Timers and Tachometers (CA08100015E)—Available in electronic format only
- Volume 14—Fuses (CA08100016E)—Available in electronic format only
- Volume 15—Solar Inverters and Electrical Balance of System (CA08100018E)

These volumes are not all-inclusive of every product, but they are meant to be an overview of our product lines. For our full range of product solutions and additional product information, consult [Eaton.com/electrical](http://Eaton.com/electrical) and other catalogs and product guides in our literature library. These references include:

- The Consulting Application Guide (CA08104001E)
- The Eaton Power Quality Product Guide (COR01FYA)

If you don't have the volume that contains the product or information that you are looking for, not to worry. You can access every volume of the catalog library at [Eaton.com/electrical](http://Eaton.com/electrical) in the Literature Library.

By installing our Automatic Tab Updater (ATU), you can be sure you always have the most recent version of each volume and tab.



## Icons



### Green Leaf

Eaton Green Solutions are products, systems or solutions that represent Eaton benchmarks for environmental performance. The green leaf symbol is our promise that the solution has been reviewed and documented as offering exceptional, industry-leading environmental benefits to customers, consumers and our communities. Though all of Eaton's products and solutions are designed to meet or exceed applicable government standards related to protecting the environment, our products with the Green Leaf designation further provide "exceptional environmental benefit."



### Learn Online

When you see the Learn Online icon, go to [Eaton.com/electrical](http://Eaton.com/electrical) and search for the product or training page. There you will find 100-level training courses, podcasts, webcasts or games and puzzles to learn more.



### Drawings Online

When you see the Drawings Online icon, go to [Eaton.com/electrical](http://Eaton.com/electrical) and find the products page. There you will find a tab that includes helpful product drawings and illustrations.

## Contact Us

If you need additional help, you can find contact information under the Customer Care heading of [Eaton.com/electrical](http://Eaton.com/electrical).

**Eaton Grid-Tied Solar Inverter  
(3.8–7 kW)**



**Solar Power Center Loadcenters and  
Meter Breakers**



**Residential Electric Vehicle Charging**



## 1.1 Eaton Grid-Tied Solar Inverter (3.8–7 kW)

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## Product Overview

The Eaton Grid-Tied Solar Inverter's breakthrough technology and features deliver maximum return on investment for consumers. Eaton solar inverter units offer the highest efficiency and voltage operating ranges available in order to maximize energy yield.

Installation time and costs are greatly reduced through packaging the combiner box, AC/DC disconnects and wire raceway with the inverter. The design also simplifies service on the unit through a two-piece modular configuration, which allows the wiring box to remain connected and mounted if the need ever arises to replace the power module.

## Features and Benefits

### Ratings

- 3800W, 4000W, 5000W, 6000W, 7000W

### Maximum Energy Harvest

- 97% CEC efficiency
- Broad voltage operating range (105–500 Vdc) for superior performance in low light and high temperature environments
- Transformerless design

### Saves Installation Time and Cost

- Integrated PV system AC/DC disconnect switch
- Four branch circuit-rated negative and positive fused inputs
- Integrated NEC®-compliant wire raceway

## Contents

### Description

Eaton Grid-Tied Solar Inverter (3.8–7 kW)

Product Selection/Technical Data

and Specifications . . . . .

### Page

**V15-T1-3**

### Versatility in Installation

- Field-selectable voltage output: 208/240/277 Vac
- LCD display with side pushbutton for nighttime monitoring
- NEMA® 3R enclosure
- Two-piece modular design

### Eaton Value

- A global leader in inverter technology
- Complete balance of system provider
- Eaton reputation for quality, support, and service
- Installation certification via Eaton Certified Contractor Network (ECCN)

## Application Description

Available in four individual sizes: 4 kW, 5 kW, 6 kW and 7 kW respectively. The 4 kW unit has the ability to be field-converted to output 3.8 kW to accommodate lower rated AC loadcenters. This inverter family is to be used in grid-tied applications only, thus having the ability to feed power to the utility grid. The design focus of these residential/light commercial inverters was on maximizing energy harvest and minimizing installation time and cost. The inverters boast an extremely high efficiency and a wide DC voltage operating range, while fully integrating the complete balance of system into the unit, including a four-string DC combiner, a DC disconnect switch, an AC disconnect switch and a wire raceway.

## Standards and Certifications

- ETL Listed (in compliance with UL® Std 1741)
- CSA® Listed (Std C22.2 No. 107.1)
- CEC Listed



## Product Selection/Technical Data and Specifications

## Eaton Grid-Tied Solar Inverter (3.8–7 kW)

Description	PV240	PV250	PV260	PV270
<b>Input (DC)</b>				
Nominal DC voltage	360V	360V	360V	360V
Maximum DC voltage	600V	600V	600V	600V
System startup voltage	150V	150V	150V	150V
Shutdown voltage	Typical 80V	Typical 80V	Typical 80V	Typical 80V
MPPT voltage range	105–500V	105–500V	105–500V	105–500V
Full rating voltage range	225–500V	200–500V	200–500V	200–500V
Maximum DC current	19A	26A	32A	37A
Number of DC input terminals	4	4	4	4
<b>Output (AC)</b>				
Nominal AC power at 240 Vac and 277 Vac	3800W	4000W	5000W	6000W
Nominal AC power at 208 Vac	3800W	3800W	4600W	7000W
Maximum AC power at 240 Vac and 277 Vac	3800W	4000W	5000W	7000W
Maximum AC power at 208 Vac	3800W	3800W	4600W	7000W
Nominal AC voltage	208V/240V/277V	208V/240V/277V	208V/240V/277V	208V/240V/277V
Nominal frequency	60 Hz	60 Hz	60 Hz	60 Hz
Disconnection time of excess operational frequency range	<0.16 sec	<0.16 sec	<0.16 sec	<0.16 sec
Nominal AC current at 208 Vac	18.3A	18.3A	22.1A	28.9A
Nominal AC current at 240 Vac	15.8A	16.7A	20.8A	25.0A
Nominal AC current at 277 Vac	13.7A	14.4A	18.1A	25.3A
Maximum AC current at 208 Vac	18.3A	18.5A	22.5A	30.0A
Maximum AC current at 240 Vac	15.8A	18.5A	22.5A	33.2A
Maximum AC current at 277 Vac	13.7A	16.4A	20.5A	28.7A
Power factor	> 0.99	> 0.99	> 0.99	> 0.99
<b>Efficiency</b>				
Peak efficiency	97.50%	97.50%	97.50%	97.50%
CEC efficiency	97%	97%	97%	97%
<b>General Data</b>				
Topology	Transformerless	Transformerless	Transformerless	Transformerless
Dimensions (W/H/D) inches	17.1/33.3/8.3	17.1/33.3/8.3	17.1/33.3/8.3	17.1/33.3/8.3
Weight (lbs)	86	90	101	101
Power consumption: standby/night	< 7W/< 0.2W	< 7W/< 0.2W	< 7W/< 0.2W	< 7W/< 0.2W
DC insulation resistance	> 4M ohms	> 4M ohms	> 4M ohms	> 4M ohms
Enclosure	NEMA 3R	NEMA 3R	NEMA 3R	NEMA 3R
Heat dissipation	Force air cooling, variable fan speed according to temperature on heat sink			
Operating temperature range	–25 to +50°C	–25 to +50°C	–25 to +50°C	–25 to +50°C
Humidity	0 to 95%, noncondensing	0 to 95%, noncondensing	0 to 95%, noncondensing	0 to 95%, noncondensing
Communication	RS-232/Super-485	RS-232/Super-485	RS-232/Super-485	RS-232/Super-485
Ground fault protection	Internal GFCI and Isolation detection function, in accordance with UL 1741			
Disconnect	Integrated AC and DC switch	Integrated AC and DC switch	Integrated AC and DC switch	Integrated AC and DC switch
Certifications	ETL (in compliance with UL 1741), CSA, CEC			
DC surge protection	4 kV	4 kV	4 kV	4 kV
AC surge protection	6 kV	6 kV	6 kV	6 kV



## Solar Power Center Loadcenters and Meter Breakers

### Product Description

Eaton's Solar Power Centers combine both utility power and solar photovoltaic (PV) power into one enclosure. Solar Power Centers can be applied as a component of a complete PV electrical system. Eaton offers the most complete line of Balance of System (BOS) products in the industry, along with a wide variety of configurations including loadcenters and meter breakers.

The Solar Power Centers feature industry-exclusive factory-installed permanent markings, which help to ensure National Electrical Code® (NEC) compliance. Required by the NEC, these markings enable quick and easy identification of product ratings and location of the parallel energy source disconnect. Prior to installation, contact your local utility to confirm approval.

### Product Types

Loadcenters are enclosures specifically designed to house the branch circuit breakers and wiring required to distribute power to individual circuits. They contain either a main breaker when used at the service entrance point or a main lug when used as a sub-panel to add circuits to existing service. The main breaker protects the entire panel and can be used as a service disconnect. The branch breakers protect the wires leading to individual electrical loads such as fixtures and outlets.

## Contents

### Description

Solar Power Center Loadcenters and Meter Breakers

Description	Page
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Meter breakers are service entrance equipment that consist of a single meter socket and loadcenter (circuit breaker distribution section) or meter socket and main breaker combined in one enclosure. Sometimes called Combos, All-in-Ones, Meter Centers or Meter Mains, these units are increasing in popularity as the socket and loadcenter or main breaker are located in one location, thus providing the contractor with a labor and material savings when installing.

Meter breakers are most often sold in the western, southwestern and southeastern United States. The popularity of meter breakers is continuing to increase as more utilities deregulate and pass the responsibility of supplying watt-hour meter sockets on to the electrical contractor.



## Application Description

### How to Size a Solar-Ready Loadcenter or a Meter Breaker for your Solar Application

The National Electrical Code (2008) Section 690.64(B)(2)/(2011) Section 705.12(D)(2) states: "The sum of the ampere ratings of overcurrent devices in circuits supplying power to a busbar or conductor shall not exceed 120 percent of the rating of the busbar or conductor."

For example: A 200A main breaker loadcenter + a backfed 70A PV breaker = 270A = 120% of the 225A busbar rating. In 2014, 120% was extended to 125% of the conductor rating.

**Note:** Check with local utility for exact requirements.

Panel Main Breaker Ampere Rating	Standard Bus Ampere Rating	Maximum Total Ampere Rating of all PV Backfed Mains	Maximum Ampere Rating of Panel Mains + PV Mains
100	100	20	120
100	125	50	150
125	125	25	150
200	200	40	240
200	225	70	270
225	225	45	270
400	400	80	480

## Features and Benefits

### Solar Power Center

- Up to 225A rated copper bussing maximizes solar source up to 70A for standard units
- 100A, 125A and 200A main breakers available factory installed, which provides additional flexibility in PV sizing
- Main breaker and PV backfed main are located at opposite ends of the distribution panel
- Single-phase, three-wire 120/240 Vac
- Overhead and underground feed applications
- Padlocking provisions
- Surface and flush designs available
- Top or bottom exit of load wiring
- Limited lifetime warranty for Type CH and 10-year warranty for Type BR

### Loadcenters

- Type CH features plug-on neutral loadcenters and breakers that enable the contractor to connect the breaker directly to the neutral bar, eliminating the need for wiring a pigtail
- Type CH features unique stab design, which provides a tight connection to the bus
- Top or bottom feed
  - Straight-in wiring saves labor and material
  - Only one panel for either application—no modifications necessary
- Extra 1.50-inch (38.1 mm) knockout for bundling enables easier installation
- Drywall marking on enclosure indicates proper mounting depth for flush applications
- Unique sandalwood finish is aesthetically appealing with scratch-resistant powder coating
- Silver flash plated copper bus provides superior conductivity

### Meter Breakers

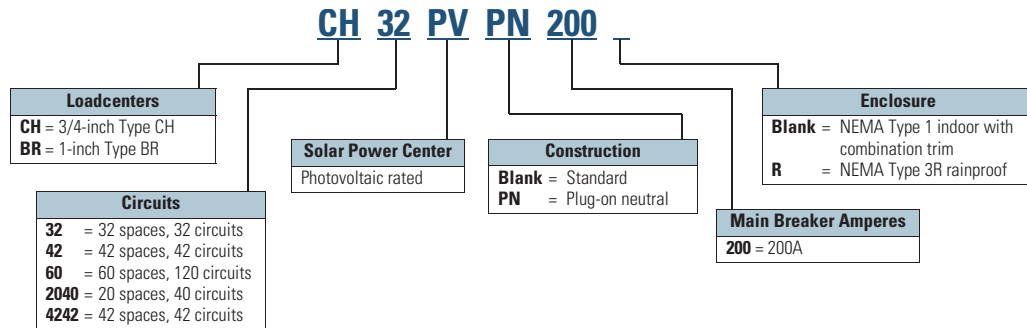
- Meter socket and distribution section are located in one enclosure, which provides labor and material savings
- EUSERC / West Coast and Non-EUSERC designs
- Ring, ringless and lever bypass designs
- 7-inch-deep designs available, which is ideal for stucco homes
- Endwall knockouts are easily accessible for future wiring without damaging stucco

## Standards and Certifications

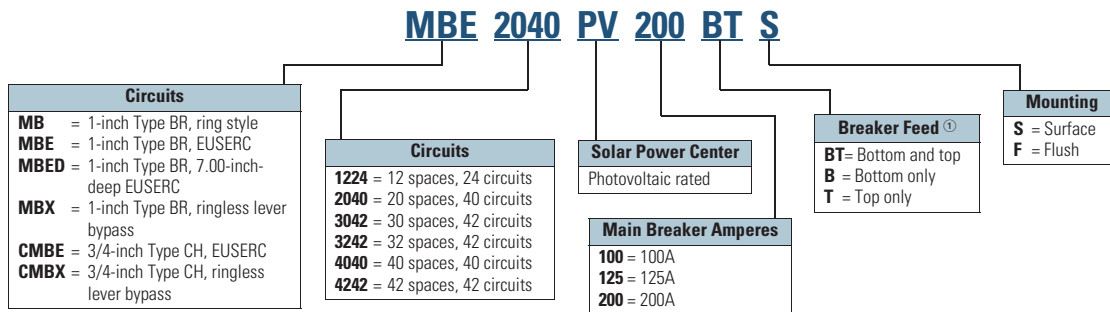
- Complies with NEC (2008) Section 690.64(B) / (2011) Section 705.12(D), which identifies the acceptable installation and marking requirements for utility interactive solar inverters
- UL Listed
- Non-EUSERC
- EUSERC/West Coast

## Catalog Number Selection

## Solar Power Center Loadcenters



## Solar Power Center Meter Breakers

**Note**

① See product selection table on next page for valid catalog strings. Contact the Eaton Flex Center with questions or if you can not find the right catalog string.

## Product Selection

## Solar Power Center Meter Breakers

## Type CH Meter Breakers

Max. Number of 3/4-Inch Spaces	Max. Number of Circuits	Main Breaker (A)	Bus Rating (A)	Max. PV Input (A)	Mounting	Service Design	Bus	kAIC	Enclosure <sup>①</sup>	Catalog Number
<b>Combination Service Entrance Devices—EUSERC (Side-by-Side Construction)</b>										
32	42	200	225	70	Flush	UG	Cu	22	7	CMBE3242PV200BF
32	42	200	225	70	Surface	UG	Cu	22	7	CMBE3242PV200BS
42	42	200	225	70	Flush	UG/OH	Cu	22	12	CMBE4242PV200BF
42	42	200	225	70	Surface	UG/OH	Cu	22	12	CMBE4242PV200BS
42	42	200	225	70	Surface	OH	Cu	22	12	CMBE4242PV200TS
<b>Combination Service Entrance Devices—Non-EUSERC—Lever Bypass (Over/Under Construction)</b>										
32	42	200	225	70	Surface	UG/OH	Cu	22	14	CMBX3242PV200TS

## Type BR Meter Breakers

Max. Number of 1-Inch Spaces	Max. Number of Circuits	Main Breaker (A)	Bus Rating (A)	Max. PV Input (A)	Mounting	Service Design	Bus	kAIC	Enclosure <sup>①</sup>	Catalog Number
<b>Combination Service Entrance Devices—EUSERC (Side-by-Side Construction)</b>										
12	24	100 <sup>②</sup>	125	50	Flush	UG/OH	Al	10	2	MBE1224PV100BTF
12	24	100 <sup>②</sup>	125	50	Surface	UG/OH	Al	10	2	MBE1224PV100BTS
12	24	125 <sup>②</sup>	125	25	Flush	UG/OH	Al	10	2	MBE1224PV125BTF
12	24	125 <sup>②</sup>	125	25	Surface	UG/OH	Al	10	2	MBE1224PV125BTS
20	40	200	225	70	Flush	UG/OH	Cu	22	18	MBE2040PV200BTF
20	40	200	225	70	Surface	UG/OH	Cu	22	18	MBE2040PV200BTS
30	42	200	225	70	Flush	UG	Cu	22	7	MBE3042PV200BF
30	42	200	225	70	Surface	UG	Cu	22	7	MBE3042PV200BS
40	40	200	225	70	Flush	UG/OH	Cu	22	12	MBE4040PV200BTF
40	40	200	225	70	Surface	UG/OH	Cu	22	12	MBE4040PV200BTS
<b>Combination Service Entrance Devices—EUSERC—7-Inch-Deep Design</b>										
30	42	200	225	70	Semi-flush	UG	Cu	22	—	MBED3042PV200BF
<b>Combination Service Entrance Devices—Non-EUSERC (Over/Under Construction)</b>										
20	40	200	225	70	Surface	UG/OH	Cu	22	—	MB2040PV200BTS
<b>Combination Service Entrance Devices—Non-EUSERC—Lever Bypass (Over/Under Construction)</b>										
20	40	200	225	70	Surface	UG/OH	Cu	22	—	MBX2040PV200BTS

## Solar Power Center Loadcenters

## Type CH Plug-On Neutral Loadcenters

Max. Number of 3/4-Inch Spaces	Max. Number of Circuits	Main Breaker (A) <sup>③</sup>	Bus Rating (A)	Max. PV Input (A)	Mounting	Enclosure	Bus	kAIC	Box Size <sup>④</sup>	Cover Included	Catalog Number
32	32	200	225	70	Combination	NEMA 1	Cu	25	J	Yes	CH32PVPN200
42	42	200	225	70	Combination	NEMA 1	Cu	25	K	Yes	CH42PVPN200
60	120 <sup>⑤</sup>	200	225	70	Combination	NEMA 1	Cu	25	N	Yes	CH60PVPN200

## Type BR Loadcenters

Max. Number of 1-Inch Spaces	Max. Number of Circuits	Main Breaker (A) <sup>③</sup>	Bus Rating (A)	Max. PV Input (A)	Mounting	Enclosure	Bus	kAIC	Box Size <sup>④</sup>	Cover Included	Catalog Number
20	40	200	225	70	Combination	NEMA 1	Cu	25	D1	Yes	BR2040PV200
20	40	200	225	70	Surface	NEMA 3R	Cu	25	D1R	Yes	BR2040PV200R <sup>④</sup>
42	42	200	225	70	Combination	NEMA 1	Cu	25	L2	Yes	BR4242PV200
42	42	200	225	70	Surface	NEMA 3R	Cu	25	L2R	Yes	BR4242PV200R <sup>④</sup>

## Notes

<sup>①</sup> For box size information, refer to Electrical Sector Solutions—Volume 1: Residential and Light Commercial, Tab 1, CA08100002E.

<sup>②</sup> Type BR main breaker factory installed. All other units Type CSR.

<sup>③</sup> Type CSR main breaker factory installed.

<sup>④</sup> Rainproof panels are furnished with hub closure plates. For rainproof hubs or box size information, refer to Electrical Sector Solutions—Volume 1: Residential and Light Commercial, Tab 1, CA08100002E.

<sup>⑤</sup> Requires the use of Type CHNT breakers.



Contact the Eaton Flex Center (1-800-330-6479 or [flexcenterlincoln@eaton.com](mailto:flexcenterlincoln@eaton.com)) for additional solar features including different device availability, main breaker, bus and solar input ratings.

### Additional Information

Loadcenter and accessories—reference **Volume 1—Residential and Light Commercial**, CA08100002E, Tab 1.

Meter breaker and accessories—reference **Volume 1—Residential and Light Commercial**, CA08100002E, Tab 1.

Replacement parts for Solar Power Centers.

- Meter breaker:
  - Deadfront
  - Swing door
  - Utility pull section cover
- Loadcenter:
  - Combination cover
  - NEMA 3R covers
  - NEMA 3R deadfronts

### Replacement Parts

#### Meter Breaker

Meter Breaker	Deadfront	Swing Door	Utility Pull Section Cover	Breaker Cover Deep
CMBE3242PV200BF	MBICVR6PV	MBFCVR7PVCH	MBUCVR2PV	—
CMBE3242PV200BS				
CMBE4242PV200BF	MBICVR23PV	MBFCVR5PVCHB	MBUCVR4PV	—
CMBE4242PV200BS				
CMBE4242PV200TS	MBICVR23PV	MBFCVR5PVCHT	MBUCVR4PV	—
CMBX3242PV200TS	CMBXDICVR1PV	CMBXDFCVR1PV	—	—
MBE1224PV100BTF	MBICVR25PV	MBFCVR13PV	MBUCVR3PV	—
MBE1224PV100BTS				
MBE1224PV125BTF				
MBE1224PV125BTS				
MBE2040PV200BTF	MBICVR30PV	MBFCVR14PV	MBDCVR4PV	—
MBE2040PV200BTS				
MBE3042PV200BF	MBICVR31PV	MBFCVR7PVBR	MBUCVR2PV	—
MBE3042PV200BS				
MBE4040PV200BTF	MBICVR24PV	MBFCVR5PVBR	MBUCVR4PV	—
MBE4040PV200BTS				
MBED3042PV200BF	N/A	MBEDFCVR2PV	MBEDUCVR1PV	MBEDDCVR2PV
MB2040PV200BTS	MBICVR1PV	MBFCVR2PV	—	—
MBX2040PV200BTS	ARP03070CHPV	ARP03071CHPV	—	—

#### Loadcenter

NEMA 1	Combination Cover	NEMA 3R Cover	NEMA 3R Deadfront
CH32PVPN200	CH8JFPV	—	—
CH42PVPN200	CH8KFPV	—	—
CH60PVPN200	CH8NFPV	—	—
BR2040PV200	BRCOVC35PV	—	—
BR4242PV200	BRCOVC53PV	—	—
<b>Raintight</b>			
BR2040PV200R	—	BR3RD00R9PV	BR3RDF11PV
BR4242PV200P	—	BR3RD00R13PV	BR3RDF15PV

Charging Stations



Charging Stations

Product Description

Eaton’s established excellence in both the automotive and electrical distribution/control industries have created a perfect platform for all electrical vehicle charging needs. Whether it’s a residential system, a commercial endeavor or a system to support fleet electric vehicles, Eaton has the products and the depth of experience to support, install and service electric vehicle chargers.

Features

- Eaton has been managing power systems (electrical, fluid, and air) for over 100 years
- Eaton is a Tier 1 Automotive Supplier. This connectivity with the major automotives enables Eaton to be on the forefront of emerging vehicle technologies
- Turnkey installation solutions through Eaton Engineering Services (EES) and Eaton Certified Contractor Network (ECCN) throughout the United States and Canada
- Eaton is the only provider of a full family of electric vehicle charging products
- Eaton provides a one stop solution for all your electrical distribution needs
- Restricted accessibility options such as credit card and radio frequency identification (RFID)

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# 1.3

## Residential Electric Vehicle Charging

### Charging Stations

#### 1

#### Product Overview

#### Vehicle Chargers



Description	Level 1 Universal Receptacle	Level 1 Charging Station	Level 2 Charging Station	Electric Vehicle Simulator
Input voltage	110/120 Vac	110/120 Vac	208/240 Vac	—
Input amperage	20A, 40A or 80A (1–4 vehicles)	16A	16A or 30A	—
Max power	Up to 1.9W at 16A per connection	1.9 kW (L116 style)	3.8 kW (L216 style) 7.2 kW (L230 style)	—
Mount	Pedestal/bollard	Wallmount or pedestal	Wallmount or pedestal	—
Safety specifications	UL 2594 for EV use cUL 2594 for EV use	ETL Listed to UL 2594/2231/1998 cETL Listed	ETL Listed to UL 2594/2231/1998 cETL Listed	—
Enclosure	NEMA 3R stainless steel	NEMA 3R stainless steel	NEMA 3R stainless steel	—
Quick and easy installation	Yes	Yes	Yes	—
Ground fault protection	Yes	Yes	Yes	—
Overcurrent protection	Yes	Yes	Yes	—
Features	1-4 multi-vehicle support Integrated high-efficiency LED lighting Build-to-order customization available	SAE J1772™ compliant Permanent or cord-and-plug wallmount Quick and easy installation Build-to-order customization available	SAE J1772 compliant Permanent or cord-and-plug wallmount Quick and easy installation Build-to-order customization available	—
Options	Utility grade, sub-metering, access control	High-efficiency, LED site-lighting, sub-metering	High-efficiency, LED site-lighting, sub-metering	—
Applications/markets	Single and multi-family homes, parking garages, university campuses, truck stops, restaurants, airports, municipalities, shopping centers, corporate offices, hotels	Single and multi-family homes, real estate developers, builders, military bases, government city centers, schools, small offices	Single and multi-family homes, real estate developers, builders, government city centers, schools, small offices	—
Charge time				—



Level 1 Universal Receptacle



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Level 1 Universal Receptacle

Product Description

Eaton's 120 Vac Level 1 Universal Receptacle Charging Station provides a safe, reliable means for charging up to four vehicles at a time. It is the perfect solution for buildings that require multiple-vehicle charging, such as apartments and offices.

This innovative charging station provides a universal receptacle for up to four EVs. It's perfect for charging electric cars, e-bikes, NEVs, electric service vehicles and golf carts, simultaneously. For applications that require more than four vehicles to be charged, Eaton's Level 1 Universal Receptacle Charging Stations can be connected in a series with optional utility-grade sub-metering.

Features

- Perfect for charging electric vehicles (with their respective cordsets), e-bikes, NEVs, electric service vehicles, and golf carts
- 110/120 Vac
- 20, 40, and 80A units available
- Charge up to four vehicles
- Pedestal and bollard styles available
- Locking provision to prevent cordset theft
- Support hook to prevent unintentional unplugging with heavier EV cordsets

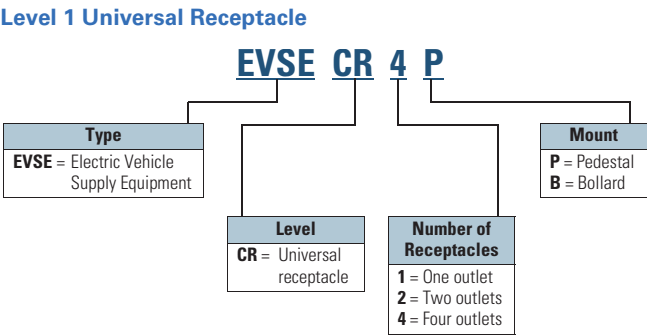
Standards and Certifications

- NEC 625 compliant
- UL Listed to UL 2594 for EV use



- Charging stations can be connected in series
- NEMA 5-20 T-slot receptacles
- Rugged stainless steel construction
- Indoor/outdoor rated
- Optional LED lighting available
- Optional utility grade sub-metering
- Customization available

Catalog Number Selection



# 1.3

## Residential Electric Vehicle Charging

### Level 1 Universal Receptacle

#### 1

#### Product Selection

##### Level 1 Universal Receptacle



##### Level 1 Universal Receptacle

###### Description

Input voltage	110/120 Vac
Input amperage	20A, 40A or 80A (1–4 vehicles)
Max power	Up to 1.9W at 16A per connection
Mount	Pedestal/bollard
Safety specifications	UL 2594 for EV use cUL 2594 for EV use
Enclosure	NEMA 3R stainless steel
Quick and easy installation	Yes
Ground fault protection	Yes
Overcurrent protection	Yes
Features	1–4 multi-vehicle support Integrated high-efficiency LED lighting Build-to-order customization available
Options	Utility grade, sub-metering, access control
Applications/markets	Single and multi-family homes, parking garages, university campuses, truck stops, restaurants, airports, municipalities, shopping centers, corporate offices, hotels
Charge time	

#### Technical Data and Specifications

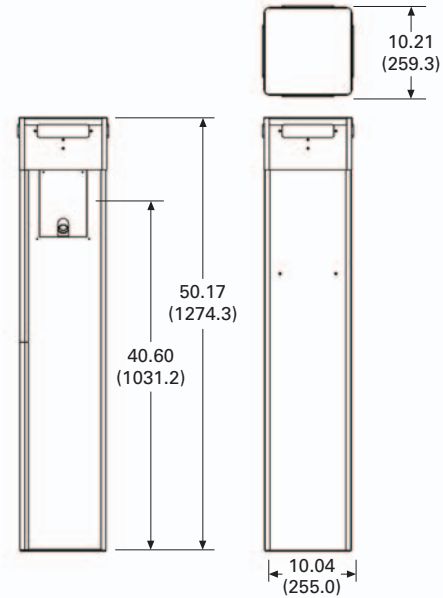
##### Level 1 Universal Receptacle

Description	Specification
<b>Electrical Input</b>	
Voltage	110/120 Vac
Amperage	20A, 40A, 80A (pedestal for 1–4 vehicles)
<b>Electrical Output</b>	
Power	Up to 1.9 kW at 16A per connection
Connection	1-4 NEMA 5-20T receptacles (pedestal mount)
<b>Physical/Environmental</b>	
Weight	50 lbs
Operating temperature	–30° to 50°C
Enclosure rating	NEMA Type 3R
<b>Safety</b>	
Listed to UL 2594 for EV use	✓
Listed to cUL for EV use	✓
Ground fault protection	✓
Overcurrent protection	✓

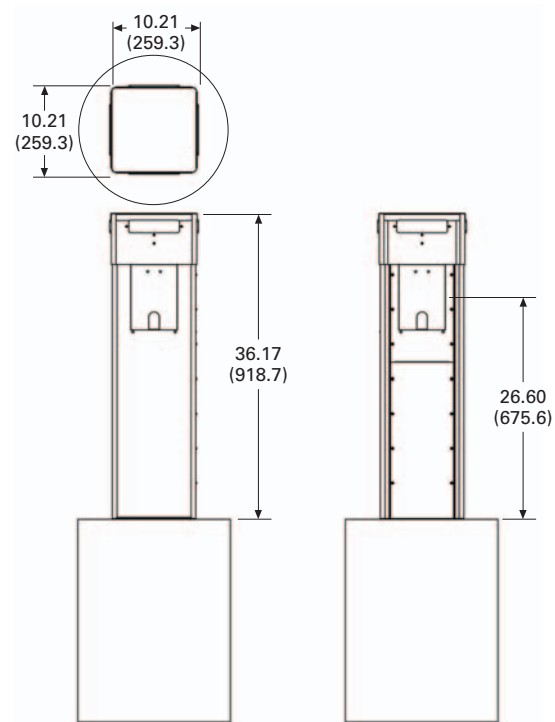
#### Dimensions

Approximate Dimensions in Inches (mm)

##### Pedestal



##### Bollard



## Level 1 Charging Station



## Level 1 Charging Station

## Product Description

Eaton offers a full family of reliable, responsible electric vehicle (EV) chargers for residential applications. Our established excellence in the automotive and electrical distribution and control industries allows us to provide a wide range of innovative EV charging solutions to suit your individual needs. In addition, the Eaton Certified Contractor Network (ECCN) can provide turnkey services, from design to installation.

This 120 Vac charging station provides an economical and versatile EV charging solution.

## Features

- Provides an economical and versatile solution for charging electric vehicles
- 110/120 Vac
- 16A units available
- Wallmount and pedestal styles
- Quick and easy installation
- Rugged stainless steel construction
- Indoor/outdoor rated
- Auto-reset feature
- Hardwire connected
- Optional advanced cord management to protect SAE J1772 connector
- Standard 24 foot cord
- Optional LED lighting available
- Optional utility grade sub-metering
- Customization available

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## Intuitive User Interface



## Optional LED Lighting



## Standards and Certifications

- SAE J1772 compliant connector
- ETL listed to UL 2594/2231/1998





# 1.3

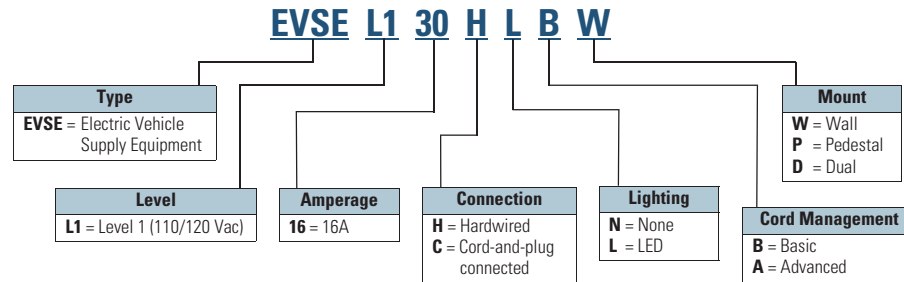
## Residential Electric Vehicle Charging

### Level 1 Charging Station

#### 1

#### Catalog Number Selection

#### Level 1 Charging Station




#### Product Selection

##### Level 1 Charging Station



#### Level 1 Charging Station

Description	
Input voltage	110/120 Vac
Input amperage	16A
Max power	1.9 kW (L116 style)
Mount	Wallmount or pedestal
Safety specifications	UL 2594 for EV Use cUL 2594 for EV Use
Enclosure	NEMA 3R stainless steel
Quick and easy installation	Yes
Ground fault protection	Yes
Overcurrent protection	Yes
Features	SAE J1772 compliant Permanent or cord-and-plug wallmount Quick and easy installation Build-to-order customization available
Options	High-efficiency, LED site-lighting, sub-metering
Applications/markets	Single and multi-family homes, real estate developers, builders, military bases, government city centers, schools, small offices
Charge time	

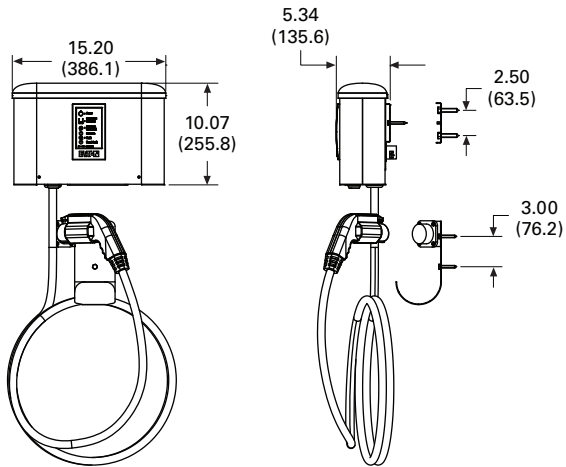
#### Technical Data and Specifications

#### Level 1 Charging Station

Description	Specification
<b>Electrical Input</b>	
Voltage	110/120 Vac
Amperage	16A (L116 Style)
Connection	Hardwired connected
<b>Electrical Output</b>	
Power	1.9 kW (L116 Style)
Connector	SAE J1772
Cable length	24 feet
<b>Physical/Environmental</b>	
Weight	23 lbs
Operating temperature	-30° to 50°C
Status indicators	5 LEDs: "Power/Ready", "Connected/Charging", "Remotely Controlled", "Fault" and "Service"
Push buttons	Two buttons: "Override" and "Reset Fault"
Enclosure rating	NEMA Type 3R—stainless steel
<b>Safety</b>	
ETL Listed to UL 2594/2231/1998	✓
cETL Listed	✓
Interlocked power protection	✓
Ground fault protection	✓
Overcurrent protection	✓

**Dimensions**

Approximate Dimensions in Inches (mm)  
(Advanced cord management)

**Level 1 Charging Station**

## Level 2 Charging Station



## Level 2 Charging Station

## Product Description

Using an industry standard J1772 30A or 70A connector, the Level 2 charging station will easily fill a depleted all-electric vehicle battery in three to four hours while the owner is working, shopping or sleeping. The Level 2 charging station is ideal for residential or commercial EV charging applications.

## Features

- Charge electric vehicles up to 5 times faster than with a vehicle's cordset
- 208/240 Vac
- 16 and 30A units available
- Wallmount and pedestal styles
- Quick and easy installation
- Rugged stainless steel construction
- Indoor/outdoor rated
- Auto-reset feature
- Hardwire connected
- Optional advanced cord management to protect SAE J1772 connector
- Standard 24 foot cord
- Optional LED lighting available
- Optional utility grade sub-metering
- Customization available

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## Intuitive User Interface



## Optional LED Lighting



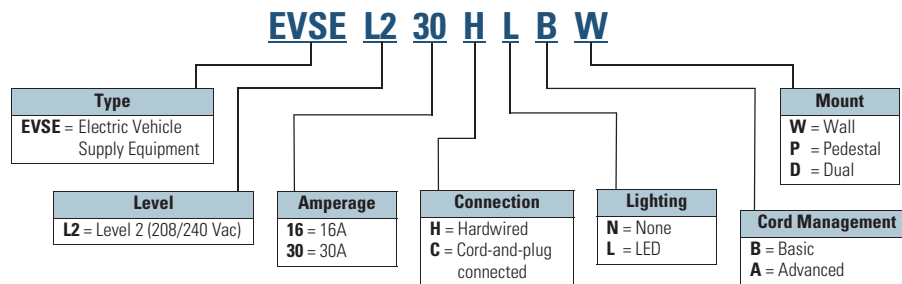
## Standards and Certifications

- SAE J1772 compliant connector
- ETL listed to UL 2594/2231/1998



## Catalog Number Selection

## Level 2 Charging Station



## Product Selection

## Level 2 Charging Station



## Level 2 Charging Station

Description	
Input voltage	208/240 Vac
Input amperage	16A or 30A
Max power	3.8 kW (L216 style) 7.2 kW (L230 style)
Mount	Wallmount or pedestal
Safety specifications	ETL Listed to UL 2594/2231/1998 cETL Listed
Enclosure	NEMA 3R stainless steel
Quick and easy installation	Yes
Ground fault protection	Yes
Overcurrent protection	Yes
Features	SAE J1772 compliant Permanent or cord-and-plug wallmount Quick and easy installation Build-to-order customization available
Options	High-efficiency, LED site-lighting, sub-metering
Applications/markets	Single and multi-family homes, real estate developers, builders, government city centers, schools, small offices
Charge time	

## Technical Data and Specifications

## Level 2 Charging Station

Description	Specification
<b>Electrical Input</b>	
Voltage	208/240 Vac
Amperage	16A (L116 Style) 30A (L230 Style)
Connection	Hardwired connected
<b>Electrical Output</b>	
Power	3.8 kW (L216 Style) 7.2 kW (L230 Style)
Connector	SAE J1772
Cable length	24 feet
<b>Physical/Environmental</b>	
Weight	23 lbs
Operating temperature	-30° to 50°C
Status indicators	5 LEDs: "Power/Ready", "Connected/Charging", "Remotely Controlled", "Fault" and "Service"
Push buttons	Two buttons: "Override" and "Reset Fault"
Enclosure rating	NEMA Type 3R—stainless steel
<b>Safety</b>	
ETL Listed to UL 2594/2231/1998	✓
cETL Listed	✓
Interlocked power protection	✓
Ground fault protection	✓
Overcurrent protection	✓



# 1.3

## Residential Electric Vehicle Charging

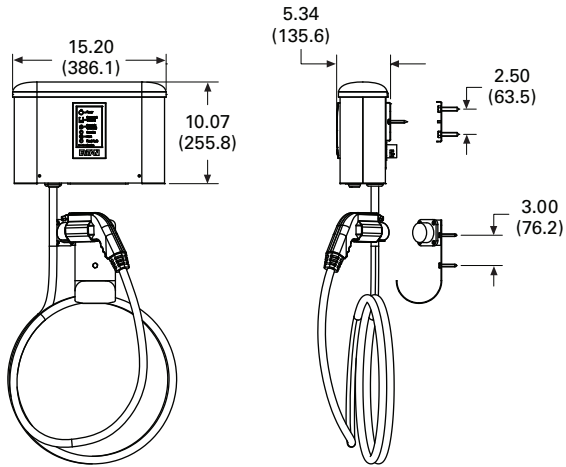
### Level 2 Charging Station

#### 1

#### Dimensions

Approximate Dimensions in Inches (mm)  
(Advanced cord management)

#### Level 2 Charging Station



Electric Vehicle Simulator



Electric Vehicle Simulator

Product Description

To ensure correct installation of Electric Vehicle Chargers, Eaton introduces the EVSE Electric Vehicle Simulator. Eaton’s EV Simulator allows installers to immediately test the functionality of the EVSE on-site during installation.

Features

- Confirm proper operation of any J1772 compliant EVSE without the need of an actual electric vehicle
- Rugged case is perfect for service personnel
- Easy-to-follow testing instructions printed on unit
- Ready to charge
- Ground fault simulation
- Charging indicator
- Pilot signal test points for oscilloscopes

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Easy to Follow Test Instructions



# 1.3

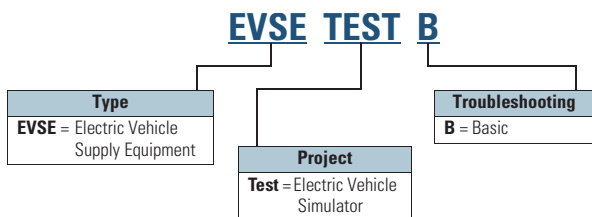
## Residential Electric Vehicle Charging

### Electric Vehicle Simulator

1

#### Catalog Number Selection

##### Electric Vehicle Simulator



#### Technical Data and Specifications

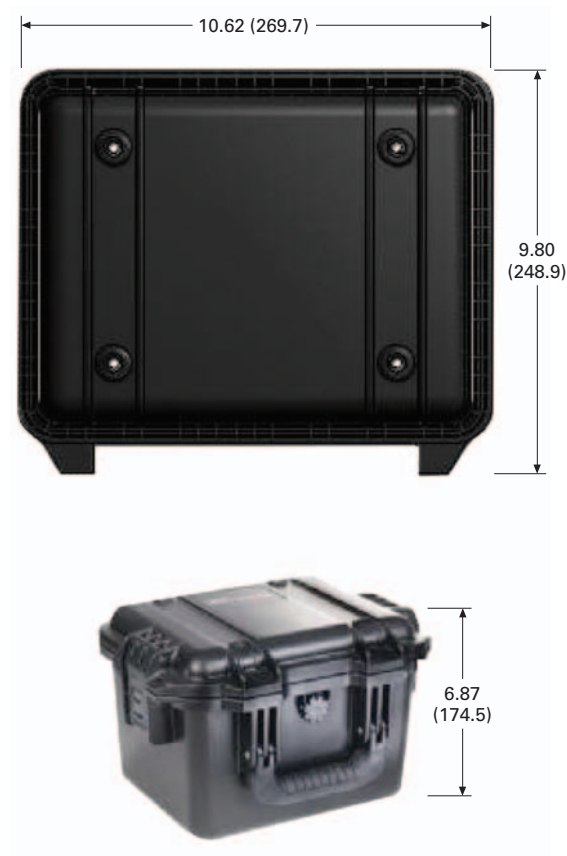
##### Electric Vehicle Simulator

Description	Specification
<b>Electrical Input</b>	
Voltage	120/208/240 Vac
Connection	J1772 inlet
<b>Physical/Environmental</b>	
Operating temperature	–30° to 50°C
Status indicator	One light: "Charging"
Push buttons	One button: "Ground Fault"
Switch	One switch: "Ready/Not Ready"
Test points (banana jack receptacles)	Pilot (1 kHz PWM signal) ground
<b>Tests EVSE Safety and Functionality</b>	
EVSE ability to charge vehicle	✓
Confirm interlocked power	✓
Confirm ground fault detection	✓
J1772 "handshake" compatibility	✓

#### Dimensions

Approximate Dimensions in Inches (mm)

##### Electric Vehicle Simulator



Electric Vehicle Charging Station Pedestal



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Electric Vehicle Charging Station Pedestal

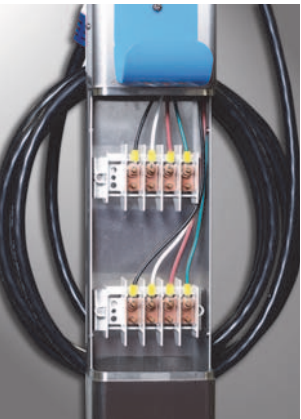
Product Description

Plug-in electric vehicles are becoming popular due to rising fuel costs and environmental concerns. Eaton’s EV Charging Station provides a safe and reliable means to quickly power up electric vehicles.

Features

- EV Charging Pedestals ship with EV Chargers mounted and pre-wired
- Single or dual EVSE pedestal options
- Available with Eaton Level 1 and Level 2 charging stations
- Quick and easy installation
- Rugged stainless steel construction
- Indoor/outdoor rated
- Standard 24 foot cord
- Optional utility-grade sub-metering
- Greater flexibility for external installations
- Dual EVSE pedestal option allows for multiple vehicle charging
- Customization available

Pedestal Wiring



Standards and Certifications

- UL 1773/50/50E





# 1.3

## Residential Electric Vehicle Charging

### Electric Vehicle Charging Station Pedestal

#### 1

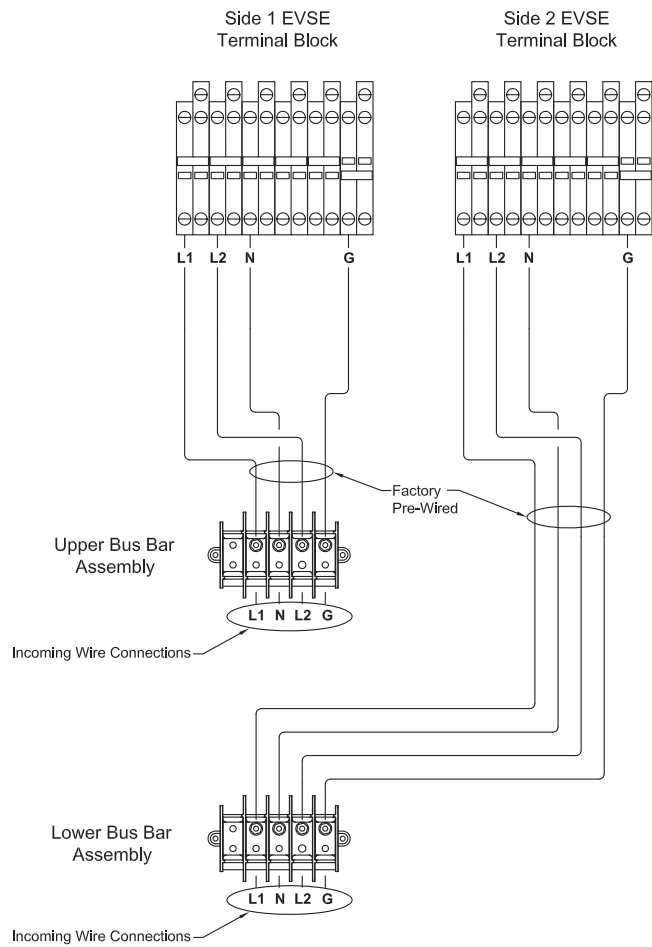
#### Technical Data and Specifications

##### Electric Vehicle Charging Station Pedestal

Description	Specification
<b>Weight (lbs)</b>	
Single EVSE—mount pedestal	42 lbs
Dual EVSE—mount pedestal	65 lbs
<b>Enclosure</b>	
Rating/material	NEMA 3R—stainless steel

#### Wiring Diagram

##### Electric Vehicle Charging Station Pedestal

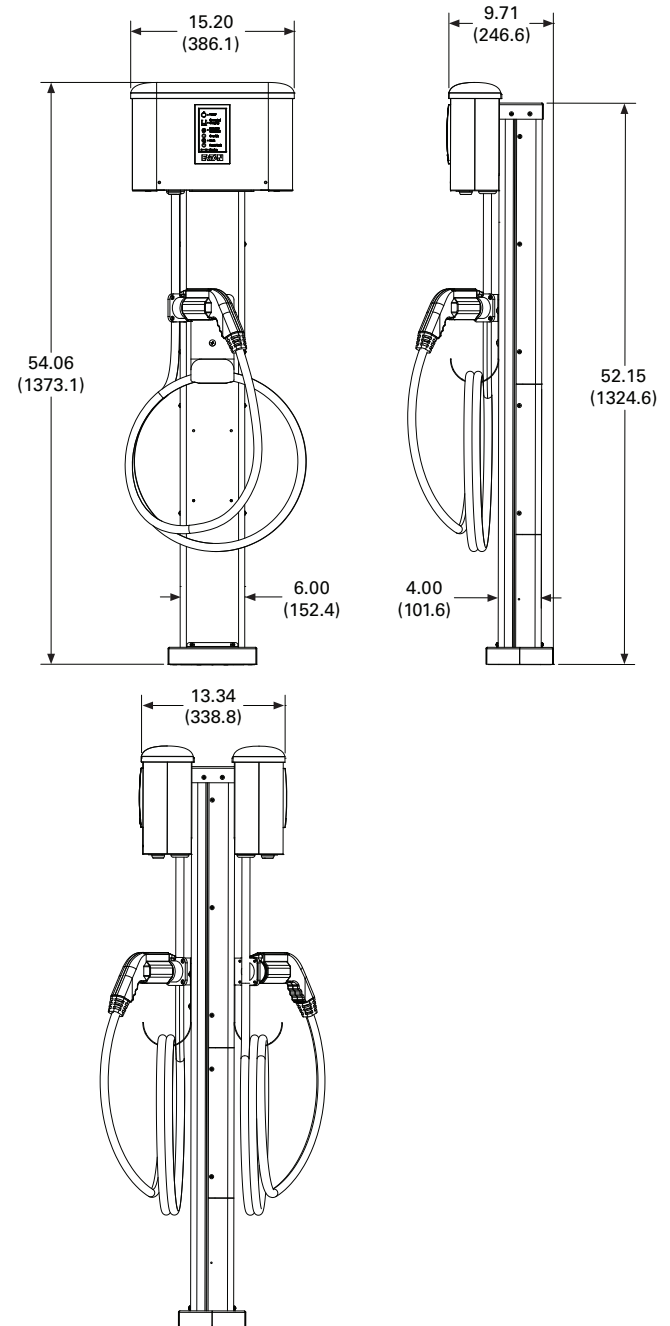


#### Dimensions

Approximate Dimensions in Inches (mm)

##### Electric Vehicle Charging Station Pedestal

Description	
Single EVSE pedestal—H x W x D	54.06 (1373.1) x 15.20 (386.1) x 9.70 (246.4)
Dual EVSE pedestal—H x W x D	54.06 (1373.1) x 15.20 (386.1) x 13.30 (337.8)



Power Xpert Solar 250 kW Inverter



Power Xpert Solar 1500/1650 kW Inverter



600 Vdc Per Pole and 1000 Vdc Disconnect



Pow-R-Line C Group-Mounted Distribution Switchboard



<b>2.1</b>	<b>Power Xpert Solar 250 kW Inverter</b>	
	Product Description . . . . .	V15-T2-2
<b>2.2</b>	<b>Power Xpert Solar 1500/1650 kW Inverter</b>	
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<b>2.3</b>	<b>DC Disconnects</b>	
	Product Description . . . . .	V15-T2-13
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	Pow-R-Line C Distribution Switchboards	
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<b>2.5</b>	<b>Panelboards—Solar Applications</b>	
	Introduction	
	Product Selection Guide . . . . .	V15-T2-25
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	Solar Monitoring . . . . .	V15-T2-77

Power Xpert Solar 250 kW Inverter



## Power Xpert Solar 250 kW Inverter

### Product Description

The Eaton Power Xpert Solar 250 kW Inverter incorporates Eaton's programmable logic controllers (PLCs), advanced variable frequency drives and protective relays. Every critical component inside the Power Xpert Solar 250 kW Inverter is proven to be reliable based on the known life cycles of high volume industrial and electrical control equipment.

Engineered for ease-of-installation, operation, and maintenance, the Power Xpert Solar 250 kW Inverter contains the intelligence to automate the commissioning, operation, and shut down procedures with minimal physical action. These robust utility-interactive three-phase inverters are based on Eaton's mature motor-drive assembly featuring Eaton's Active Front End® (AFE) control technology.

The Power Xpert Solar 250 kW inverter is designed specifically for 480 Vac three-phase utility (grid) applications and 600 Vdc (open circuit) PV systems. It is an excellent choice for either indoor or outdoor installations from a company known for its state-of-the-art electrical products and industry support.

- CEC 96% efficiency
- >99% MPPT efficiency—3rd Party verified
- Earliest startup—latest shutdown with DC excitation and zero load grid sync
- Minimized offline nuisance events with superior fault tolerance of a utility grade electric protection relay

### Contents

#### Description

Description	Page
Power Xpert Solar 250 kW Inverter	
Standards and Certifications . . . . .	<b>V15-T2-3</b>
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Product Selection . . . . .	<b>V15-T2-5</b>
Technical Data and Specifications . . . . .	<b>V15-T2-6</b>
Dimensions . . . . .	<b>V15-T2-7</b>

### Features and Benefits

**Dual-Stage 250 kW inverter with hysteresis, 2 x 125 kW design**, provides optimum efficiency in lower irradiance conditions. Offers less stressful power-stage operation for improved inverter longevity. Seamless dual-inverter operation.

**Grid Sensor based vector control** ensures precise synchronism and fast response to grid dynamics, ensuring a stable operation and an improved solar energy harvesting.

**Advanced Proportional Integral Derivative (PID) control** enables precise synchronization to the grid, finer current and power limits. Improved temperature limits, better reactive power or power factor control.

**DC excitation algorithm and system control Smart PV** energy utilization over wasteful utility-based methods of energizing the transformer. Faster morning "wake-up" and power export. Faster mid-day re-connect improves energy harvesting during utility anomalies and outages, minimal-stress "zero-crossing" grid connection process, less part-count for improved solar-system reliability.

**Large DC bus capacitors** smart, extremely low ripple-current on the PV array makes for a better, trouble-free solar-module operation. Reduced stress on solar modules and wiring control algorithm ensures lower stress on isolation transformer over adverse environmental conditions.

#### Inverter re-combiner box with DC circuit breaker option available:

- Optional inverter re-combiner box with DC breakers to meet NEC® 2011 requirements for safe DC disconnect, eliminating the need for external DC disconnects
- DC breaker option eliminates the need to replace DC fuses, allowing cost and time savings (lowering O&M costs)
- Current sensing of each DC input is available for array zone monitoring; DC input current is reported to inverter controller, which makes it available via Modbus®

- DC breakers can be individually turned off, allowing isolation of a defective sub-array while allowing other sub-arrays to operate. This feature enhances de-bugging procedures and maximizes fault-tolerance
- DC breakers are available on different configurations and ampacity (90A DC, 100A DC, 125A DC, 150A DC, 175A DC, 200A DC and 225A DC)

#### **Inverter grounding bus**

on DC and AC sides allows installation as per NEC 690.47 (C) (1), (2), or (3), should the facility POCC have a bonded equipment-ground to the facility's grounding electrode system.

#### **Maximum power point:**

Fast (mSec based) response time with variable step-size control reacts to sudden changes, improved current response for low-irradiance periods, sudden-onset shading and grid outages, superior solar-energy harvesting

**Isolation-transformer-based solar inverter** which operates with all photovoltaic modules (technologies), negative and positive grounded PV systems.

#### **Eaton Logic Controller (ELC) watch-dog system**

that ensures greater system integration and information response for display and stored performance data. It Isolates controls from external interference (anti-hacking)

#### **Rich standard features and options list**

- Full-load DC switch disconnect and AC breaker, lockout/tagout compatible
- Lockable display and controls door with window sealed against the elements
- Configurable utility connection
  - Three-wire delta (A/B/C), no neutral required
  - Four-wire wye (A/B/C/N), N-sensing only
- 100 kA surge protection
- 200 kAIC AC breaker
- Large DC and AC conductor gland plates on bottom and immediate sides
- Color, menu-driven display
- Indicator lights (LEDs) and selection switch
- Remote, field-duplicable up-fits
  - Remote indicators (LEDs)
  - Remote OFF (shutdown)
- AC view-window for visible blade disconnect
- Infrared inspection ports for DC and AC cabinets
- CEC approved 2% PBI power meter
- Internal heater for humidity and cold temperature control
- Multiple DC input (combiner) with fuse and breaker options
- SunSpec Alliance compatible monitoring (gateway)

#### **Two-cabinet design Inverter and isolation transformer**

that enables integration into electrical rooms, provides better package for roof-top installations, is easier to receive, lift, transport and secure, design category(s) seismic complaint, terminated transformer cables included.

#### **Easy maintenance by Eaton's Electrical Services & Systems (EESS)**

- No ladder required to service cooling-system air filters; ground-level access
- Three-door design ensures wide opening for limited-access locations
- Country and worldwide local services

#### **Commissioning support**

through country and worldwide local services.

#### **Remote monitoring interface**

support via Modbus/TCP with an RJ 45 plug, and a terminal block supplying additional I/O and a 120 Vac power supply for compatibility with third party monitoring applications.

**Advanced anti-islanding function**, which prevents the operation of the inverter in the event of a utility outage.

#### **AC overcurrent protection and safety**

inverter is equipped with a 200 kAIC AC breaker that is operable from the outside of the unit via lockout/tagout-capable handle.

No need for AC fuse replacements, minimizing O&M costs.

Inverter doors are fitted with mechanical interlocks that will safely shut down the inverter if doors are opened.

#### **Human Machine Interface (HMI):**

A color touch screen LCD display that represents the status screens during normal operation and additional screens with password protection for access to configuration, troubleshooting, and service.

#### **Standards and Certifications**

- UL® 1741 2nd Edition January 2010
- IEEE® 1547
- NFPA 70, National Electrical Code® (NEC)
- CEC Listed (California Energy Commission)
- Seismic qualified to IBC/CBC



# 2.1

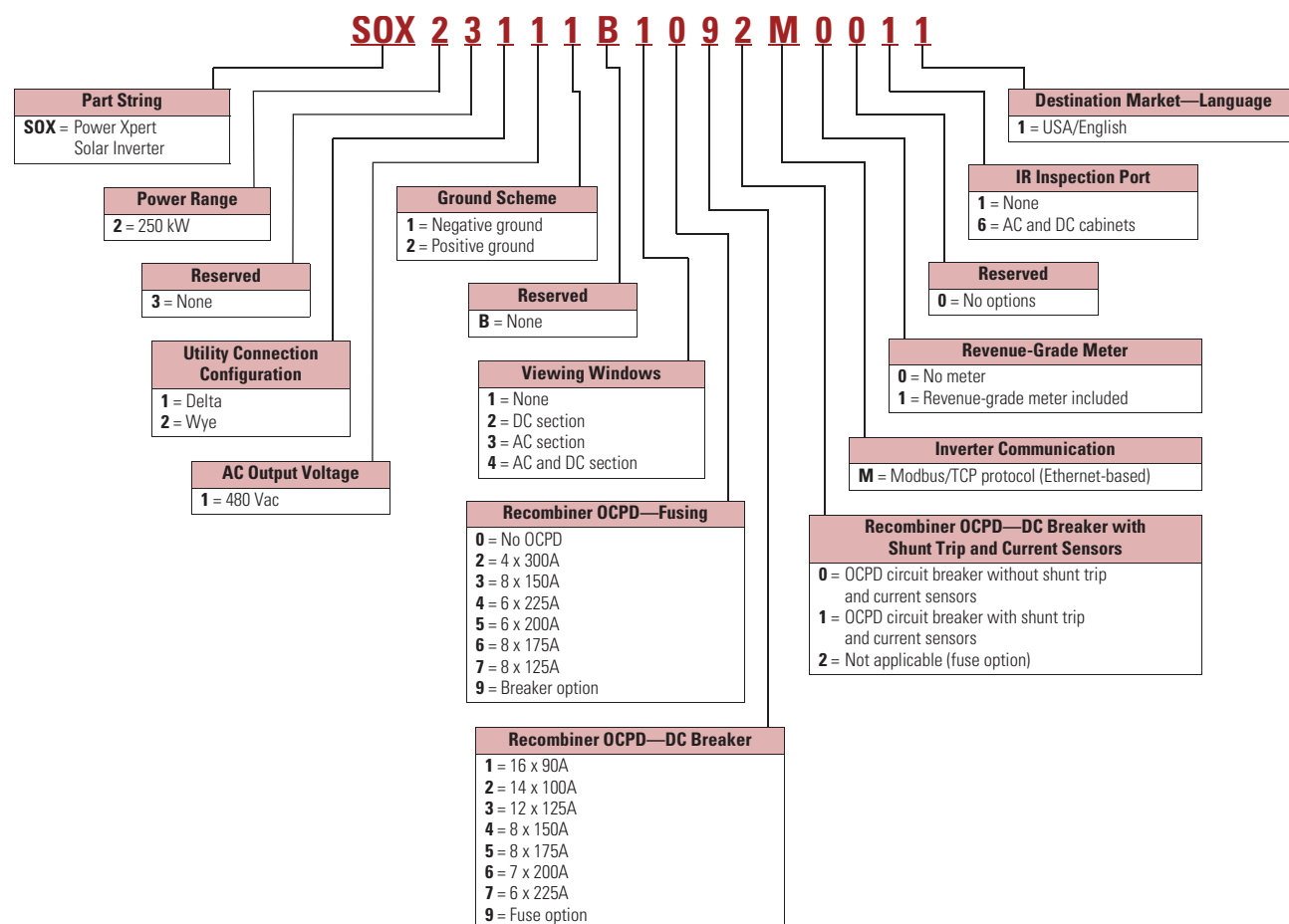
## Power Xpert Solar 250 kW Inverter

2

### Catalog Number Selection

The catalog number is what determines the exact product feature set. The base configuration and subsequent catalog number of the Power Xpert Solar 250 kW Inverter is **SOX23111B1092M0011**.

### Power Xpert Solar 250 kW inverter



## Product Selection

2

## Overcurrent Protection Device—Fusing Option

Recombiner OCPD— Fusing	Utility Connection Configuration	Ground Scheme	Viewing Windows	Revenue Grade Meter	Catalog Number <sup>①</sup>
No OCPD	Delta	Negative ground	None	Not included	SOX23111B1092M0011
4 x 300A fuse	Delta	Positive ground	None	Not included	SOX23112B1292M0011
6 x 225A fuse	Delta	Negative ground	DC section	Not included	SOX23111B2492M0011
6 x 200A fuse	Wye	Positive ground	DC section	Not included	SOX23212B2592M0011
8 x 175A fuse	Wye	Negative ground	AC section	Not included	SOX23211B3692M0011
8 x 150A fuse	Wye	Positive ground	AC section	Not included	SOX23212B3392M0011
8 x 125A fuse	Wye	Negative ground	AC and DC section	Not included	SOX23211B4792M0011

## Overcurrent Protection Device—DC Breaker Option, without Shunt Trip and Current

Recombiner OCPD— DC Breaker	Utility Connection Configuration	Ground Scheme	Viewing Windows	Revenue Grade Meter	Catalog Number <sup>①</sup>
16 x 90A	Delta	Negative ground	AC and DC section	Not included	SOX23111B4910M0011
14 x 100A	Delta	Positive ground	None	Not included	SOX23112B1920M0011
12 x 125A	Delta	Negative ground	None	Not included	SOX23111B1930M0011
8 x 150A	Wye	Positive ground	DC section	Not included	SOX23212B2940M0011
8 x 175A	Wye	Negative ground	DC section	Not included	SOX23211B2950M0011
7 x 200A	Wye	Positive ground	AC section	Not included	SOX23212B3960M0011
6 x 225A	Wye	Negative ground	AC section	Not included	SOX23211B3970M0011

## Overcurrent Protection Device—DC Breaker Option, with Shunt Trip and Current

Recombiner OCPD— DC Breaker	Utility Connection Configuration	Ground Scheme	Viewing Windows	Revenue Grade Meter	Catalog Number <sup>①</sup>
16 x 90A	Delta	Positive ground	AC and DC Section	Not included	SOX23112B4911M0011
14 x 100A	Delta	Negative ground	AC and DC Section	Not included	SOX23111B4921M0011
12 x 125A	Delta	Positive ground	None	Not included	SOX23112B1931M0011
8 x 150A	Wye	Negative ground	None	Not included	SOX23211B1941M0011
8 x 175A	Wye	Positive ground	DC Section	Not included	SOX23212B2951M0011
7 x 200A	Wye	Negative ground	DC Section	Not included	SOX23211B2961M0011
6 x 225A	Wye	Positive ground	AC Section	Not included	SOX23212B3971M0011

**Note**

<sup>①</sup> Catalog numbers are not limited to the examples shown. More combinations may be obtained from catalog numbering system, see **Page V15-T2-4**.

## Technical Data and Specifications

## 2

## AC Output Specifications—Factory Default

Description	Specification
Maximum continuous output power	250 kW
Weighted efficiency (CEC)	96%
Maximum continuous output current	312A
Maximum fault current output	365A for 8ms
Maximum branch overcurrent protection	400A <sup>①</sup>
Nominal operating voltage	Three-phase 480 Vac
Operating voltage range	423–528 Vac
Nominal operating frequency	60 Hz
Operating frequency range	57.0–60.5 Hz
Tare loss	70W
Total harmonic distortion	< 3% THD
Power factor	> 0.99
Utility connection	Delta three-wire (A,B,C); wye four-wire (A,B,C,N) <sup>②</sup>

## DC Input Specifications

Description	Specification
DC maximum input voltage	600 Vdc
DC maximum power point tracking range (MPPT)	300–500 Vdc
DC operating range	300–600 Vdc
DC input start	400 Vdc <sup>③</sup>
DC operating current nominal	860A
Maximum DC ISC input	1340A
Factory configured PV array grounding	Positive/negative

## Mechanical Specifications

Description	Specification
Operating temperature range without power fold back	–20° to 50°C
Storage temperature range	–30° to 70°C
Enclosure rating	UL Type 3R
Enclosure(s) construction	Polyester powder coated cold rolled steel
Relative humidity	0 to 95% noncondensing
Inverter weight	4000 lbs (1814 kg)
Transformer weight	2850 lbs (1293 kg)
Inverter envelope dimensions in inches (mm) H x W x D	94.00 x 93.00 x 46.00 (2387.6 x 2362.2 x 1168.4)
Transformer dimensions in inches (mm) H x W x D	64.00 x 50.00 x 40.00 (1625.6 x 1270.0 x 1016.0)
Inverter and transformer mounting	Pad mount—not free standing
Isolation transformer—external	Delta/wye
Cooling	Air convection
Max altitude (before potential derating)	3300 ft (1000m)
Air flow/inverter	1700 cfm <sup>③</sup>
Seismic rating successfully evaluated	Seismic qualified to IBC/CBC

## Certifications

Description
UL 1741 2nd Ed Jan 2010, IEEE 1547

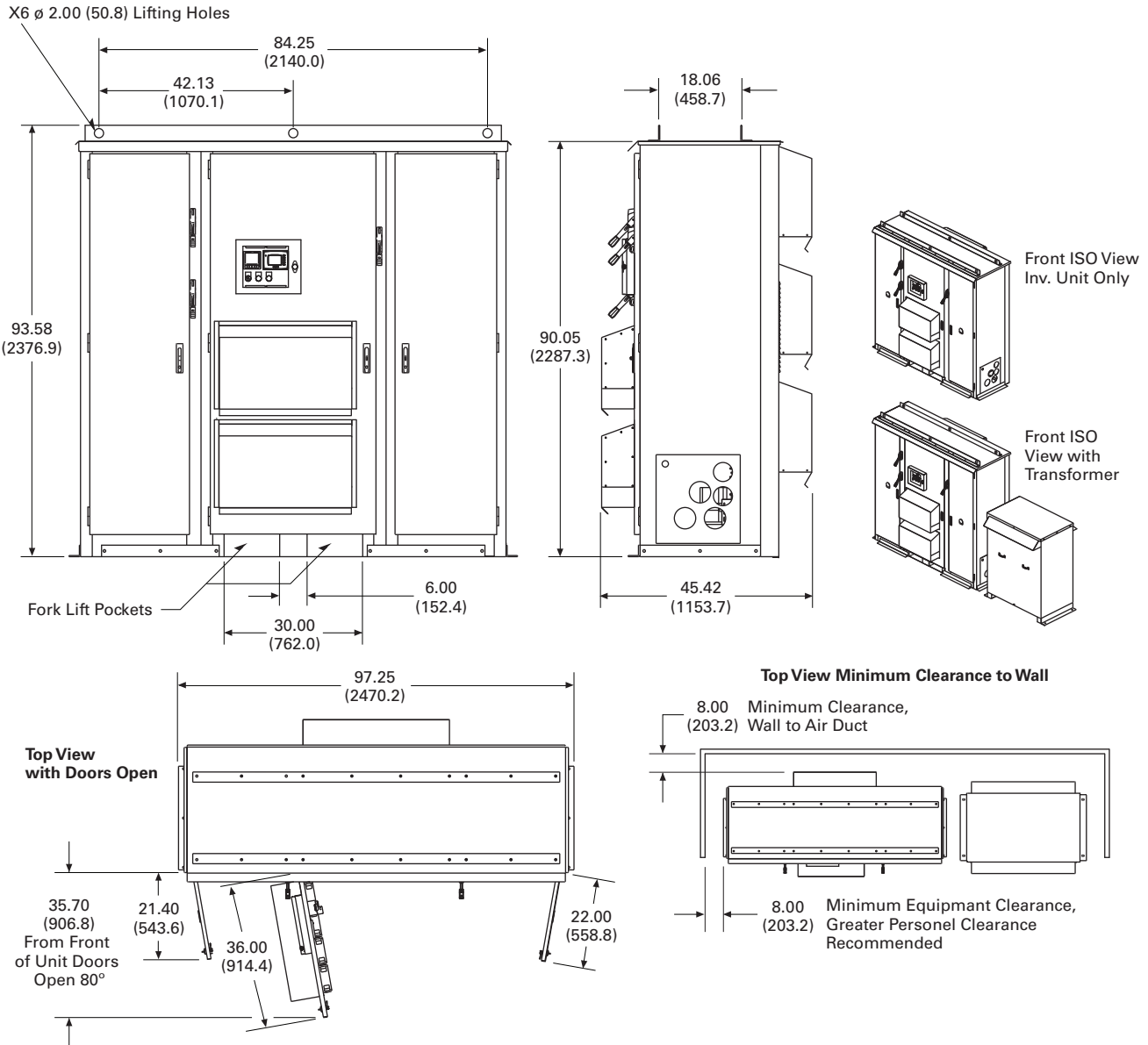
## Notes

- <sup>①</sup> 400A AC breaker.
- <sup>②</sup> Factory default is delta three-wire.
- <sup>③</sup> Factory default is 400 Vdc.

**Dimensions**

Approximate Dimensions in inches (mm)

2

**Power Xpert Solar 250 kW Inverter Dimensions and Connection Diagrams**



Power Xpert Solar 1500/1670 kW Inverter



## Contents

### Description

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Standards and Certifications . . . . .	<b>V15-T2-9</b>
Catalog Number Selection . . . . .	<b>V15-T2-10</b>
Technical Data and Specifications . . . . .	<b>V15-T2-11</b>
Dimensions . . . . .	<b>V15-T2-12</b>

## Power Xpert Solar 1500/1670 kW Inverter

### Product Description

The Power Xpert® Solar MW scale inverter is a rugged, robust and reliable solar inverter designed with Eaton engineering's 100-year tradition of safety and reliability. Designed for utility applications the Power Xpert Solar 1500/1670 is the world's largest PV inverter and sets the new standard in reliability and performance.

The inverter is outdoor-rated, and no extra shelter (canopy) or environmental protection is needed in order for the equipment to sustain operation in harsh environments (rain, dust, snow and sun). This makes the Power Xpert Solar inverter not only an economical and cost-effective solution but capable of rapid deployment and installation.

Availability is optimized by a complete fault tolerant design. This inverter is composed by three blocks of 500 kW (555 kW), which can be individually isolated in the unlikely event of a fault, allowing the inverter to operate at partial power until field service arrives on site. This provides for higher reliability and availability than using multiple smaller inverters.

The Power Xpert Solar inverter provides the most cost-effective solution in the market for the following reasons:

- Fully outdoor rated enclosure—no extra shelter or environmental protection needed

- Inverter includes:
  - Recombiner box with fuses
  - Load brake rated DC disconnect switches
  - AC circuit breaker for AC disconnection
  - AC and DC surge suppression
  - True MW design—one inverter is needed for 1.5 MW/1.67 MW station providing the lowest cost of installation and operation:
    - Fewer cement pads, less excavation and less cement
    - Reduced field labor for cabling and wiring due to fewer units needed
    - Direct-coupling, throat connection with step-up transformer
- Fault tolerance design—inverter is able to run at partial power (1/3, 2/3 of full power)
- High reliability due to conservatively rated components, film capacitors and liquid cooling
- No active power de-rating for up to  $\pm 0.91$  power factor support
- SCADA communication via Modbus® TCP

### Features and Benefits

- True MW scale inverter allows for maximum cost savings on installation of inverter and transformer. It also enables a skidless solution as there is only one inverter and a simple pad-mount transformer to be installed
- Inverter can be configured as a 1.5 MW or 1.67 MW for maximum output power optimization. Depending on the MPPT range for the array, the inverter output power can be set to 1.5 MW or 1.67 MW
- Power factor support at rated power. The inverter will supply full rate power (1.5 MW or 1.67 MW), and still provide support for up to a  $\pm 0.91$  power factor range. This provides cost optimization especially on projects with a power factor support requirement
- Maximum flexibility on grid support. Power Xpert Solar grid and frequency ride through settings are flexible and can be changed to meet local utility or special grid requirements
- Maximum DC/AC ratio (array  $I_{sc}$ ): Maximum array short-circuit current ( $I_{sc}$ ) cannot be higher than 4480 ADC. As long as this limit is maintained, the inverter warranty will not be voided
- The inverter voltage and frequency disturbance characteristics are set and controlled by a widely accepted protection relay SEL-751A. This device is well known by utilities and enables one extra protection layer for safe inverter shutdown under abnormal grid conditions
- Direct-coupling throat connection between the inverter and transformer enables cost savings on cables, conduits and pad installation. The throat connection has been implemented using Eaton's vast experience on low voltage switchgear with connection to a step-up transformer
- DC grounding configuration is available as positive and negative schemes
- A recombiner box with maximum flexibility is available. The standard configurations for number of DC inputs, DC fuse current and cable size are shown in the Catalog Number Selection graphic on **Page V15-T2-10**. The DC fuse ratings available are 160 A, 200 A, 250 A, 315 A, 350 A, 355 A and 400 A
- Array Zone monitoring is possible with the option of current sensing on each DC input. This option allows current monitoring of the ungrounded DC polarity inputs. Each DC input current measurement is stored on the internal inverter controller and available to a plant monitoring device via Modbus TCP
- Fiber optics communication connection is available for large plants, where inverter stations are placed at a far distance from the plant central controller or monitoring device
- Optional auxiliary I/O ports provide an effective way of cost-savings when external devices need to be monitored, such as step-up transformer measurements (liquid temperature, pressure and level). The standard offering is 6 digital inputs and 1 analog input. Other options are available, please consult factory
- A revenue grade meter in the low voltage side of the step-up transformer is also present as an option. Please consult an Eaton representative for further information

### Standards and Certifications

- The 1500 kW and 1670 kW inverters are certified by Intertek per UL® 1741



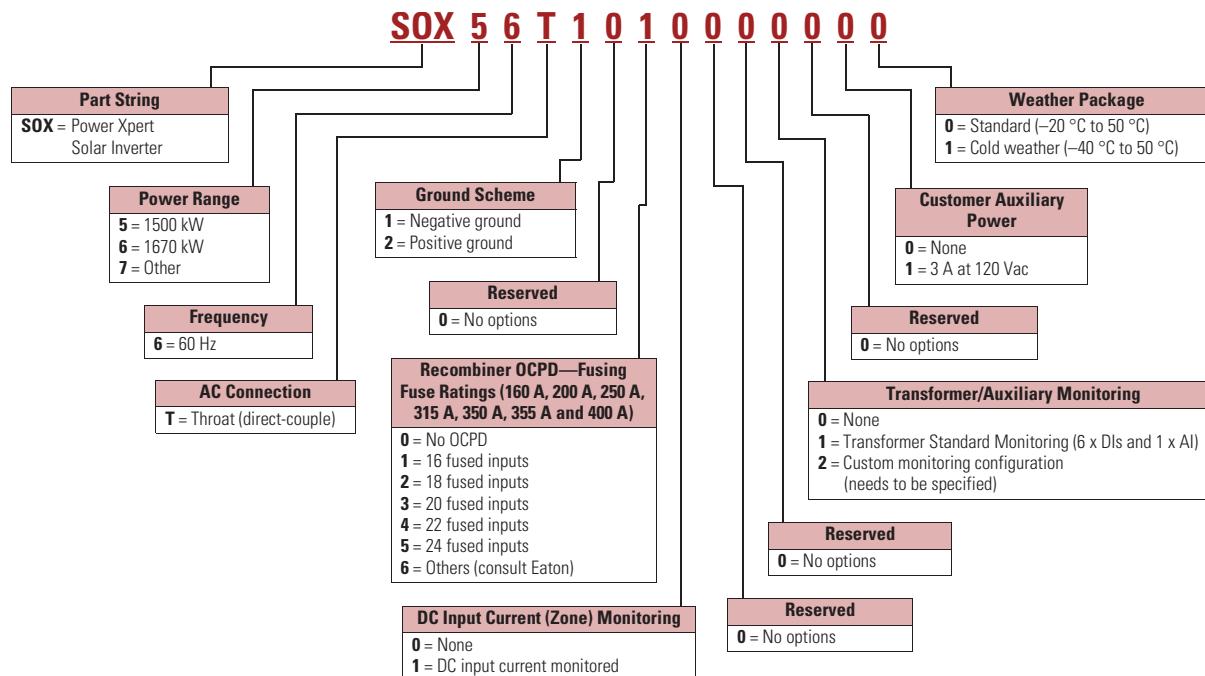
# 2.2

## Power Xpert Solar 1500/1670 kW Inverter

### Catalog Number Selection

The catalog number system is what determines the product configuration. The base configuration and subsequent catalog number of the Power Xpert Solar 1500/1670 kW Inverter is **SOX66T101000000**.

### Power Xpert Solar 1500/1670 kW Inverter



## Technical Data and Specifications

## Power Xpert Solar

2

Description	1500 kW	1670 kW
<b>AC Output</b>		
Nominal apparent power AC at 50 °C	1650 kVA	1831 kVA
Rated output power AC at 50 °C	1500 kW	1666 kW
Nominal output current	2707 A	2707 A
Maximum continuous output current at 50 °C	3000 A	3000 A
Nominal operating voltage	320 Vac	357 Vac
Operating voltage range (withstand)	+/-10%	+/-10%
Nominal operating frequency	60 Hz	60 Hz
Operating frequency range	57–63 Hz	57–63 Hz
Total harmonic distortion at rated power	Per IEEE 1547	Per IEEE 1547
Power factor at rated power	± 0.91 adjustable power factor (zero to unity)	± 0.91 adjustable power factor (zero to unity)
AC configuration	Delta three-wire or wye ungrounded	Delta three-wire or wye ungrounded
<b>DC Input</b>		
Number of DC inputs	Customer specified fuse arrangement (16–24 input pairs)	Customer specified fuse arrangement (16–24 input pairs)
Maximum input voltage open circuit, $V_{OC}$	1000 Vdc	1000 Vdc
MPPT DC voltage range for full power production	500–1000 Vdc	550–1000 Vdc
MPPT DC voltage range for CEC weighted efficiency	500–800 Vdc	550–800 Vdc
Nominal DC operating current DC	3100 ADC	3100 ADC
PV array grounding	Negative and positive (optional)	Negative and positive (optional)
DC monitoring	Optional current sensors on each DC input	Optional current sensors on each DC input
Maximum array Isc connected to inverter	4480 ADC	4480 ADC
<b>Efficiency and Losses</b>		
CEC weighted efficiency	98%	98.5%
Maximum inverter efficiency	98.6%	98.7%
Nighttime power consumption	333 W	335 W
<b>Protection</b>		
AC disconnect	AC circuit breaker with LOTO	AC circuit breaker with LOTO
AC surge suppression	Yes, monitored by inverter SCADA	Yes, monitored by inverter SCADA
DC disconnect	Load brake switch disconnect	Load brake switch disconnect
DC surge suppression	Yes, monitored by inverter SCADA	Yes, monitored by inverter SCADA
Ground fault monitoring	Yes, monitored by inverter SCADA	Yes, monitored by inverter SCADA
Insulation monitoring	Optional	Optional
<b>Communications and Controls</b>		
Communications with plant central controller	Modbus (TCP) copper and fiber connection available	Modbus (TCP) copper and fiber connection available
Power metering	Optional power metering device in LV side of step-up transformer	Optional power metering device in LV side of step-up transformer
HMI	Yes	Yes

# 2.2

## Power Xpert Solar 1500/1670 kW Inverter

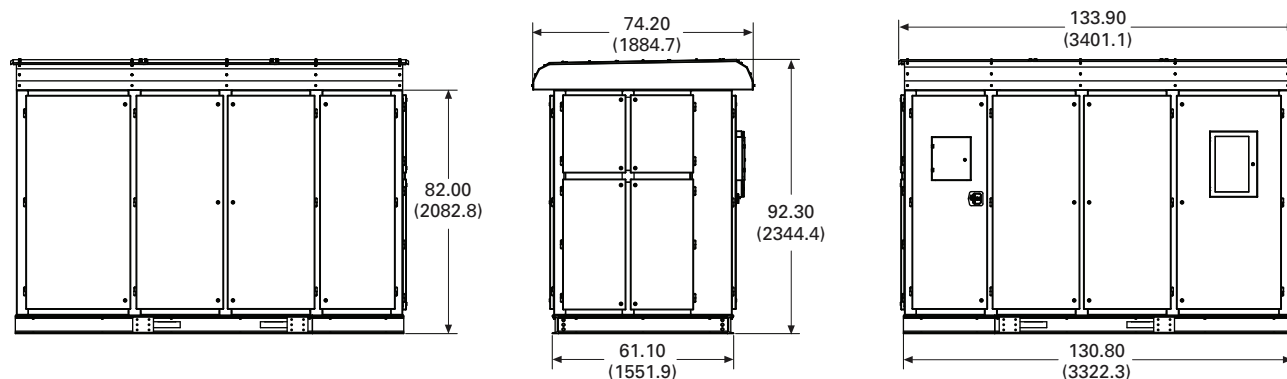
2

### Power Xpert Solar, continued

Description	1500 kW	1670 kW
<b>Mechanical</b>		
Operating temperature range full power	–20 °C to 50 °C	–20 °C to 50 °C
Optional extended temperature range (cold weather package)	–40 °C to 50 °C	–40 °C to 50 °C
Storage temperature range	–30 °C to 70 °C	–30 °C to 70 °C
Enclosure protection	Outdoor rated NEMA® 4 for controls equipment NEMA 3R for magnetics and switchgear	Outdoor rated NEMA 4 for controls equipment NEMA 3R for magnetics and switchgear
Enclosure painting	Powder-coated cold-rolled steel with corrosion-resistant hardware and fittings	Powder-coated cold-rolled steel with corrosion-resistant hardware and fittings
Relative humidity	0 to 100% condensing	0 to 100% condensing
Inverter mounting	Pad or skid mount	Pad or skid mount
Cooling	Independent, self-contained, closed-loop liquid cooling and air forced convection	Independent, self-contained, closed-loop liquid cooling and air forced convection
Maximum operating altitude	3300 ft (higher altitudes possible with derating)	3300 ft (higher altitudes possible with derating)
Inverter dimensions in inches (H x W x D) ①	96 x 131 x 62	96 x 131 x 62
<b>Design Features</b>		
Grid management features (optional)	LVRT	LVRT
	HVRT	HVRT
	ZVRT	ZVRT
	FRT	FRT
	Ramp control	Ramp control
	Frequency droop	Frequency droop
	Grid management features adjustable to meet FERC, WECC and ERCOT requirements	Grid management features adjustable to meet FERC, WECC and ERCOT requirements

### Dimensions

Approximate Dimensions in Inches (mm)



#### Note

① Preliminary.



600 Vdc Single-Pole Disconnect



### Contents

#### Description

600 Vdc Single-Pole Disconnects

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## 600 Vdc Single-Pole Disconnects

### Product Description

Eaton's offering of PV switches have multiple poles factory-wired, and they are approved for NEC Article 690 applications right from the box. Other manufacturers require the contractor to add jumpers to a two- or three-pole switch, add a neutral, and add labels to meet this requirement. For fusible switches, the Eaton PV single-pole switch requires only one fuse per switch—saving the customer at least one fuse on each switch.

### Application Description

When photovoltaic panels convert the sun's energy into electricity, the power generated is direct current (DC). Typically, the systems are designed with DC system voltages in the 400–600V range. This is much higher voltage than typically found in building systems. The higher voltage, when combined with the lack of a current sine wave with zero crossings, creates a number of challenges in wiring, particularly when switching circuits on and off.

DC circuits consist of two wires—a positive and a negative. In most PV systems, one of these wires is grounded (like a neutral in an AC system). Which of the two wires is grounded is specified by the solar panel manufacturer. The more common application is a negative ground, and the location of this bond is usually found at the inverter. Per the National Electrical Code (NEC) Section 690.5(A), only the current-carrying ungrounded conductor should be switched. Thus, in a negative-grounded system, only the positive wire is switched.

Unlike AC systems that possess a current sine wave with zero crossings, the interruption of higher voltage DC circuits requires an increased air gap to safely and quickly interrupt and break the arc. Within this family of switches, the increased gap is accomplished by wiring multiple poles of a single switch in series for safe arc interruption. The UL 98 listing of these products does not permit multiple circuits to be switched by one switch.

# 2.3

## DC Disconnects

### 600 Vdc Single-Pole Disconnects

#### Features

##### Standard Features

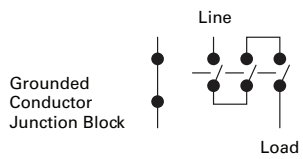
- All switches are single-pole and suitable for switching one circuit
- Clear polycarbonate deadfront to guard against accidental contact with live parts
- NEC 690.17—compliant labeling warning that the switch terminals may be energized in the open position
- NEC 690.14.(C) 2 required “PV System Disconnect” label included
- Isolated ground terminals (neutral) for grounded conductors
- Ground lug for equipment grounding conductor
- NEMA 3R, 12 and 4X stainless enclosures
- Fusible and non-fusible configurations—Class R fuse clips standard
- Fuse clips are located on the center pole to ensure that both fuse clips are de-energized—meets NEC Article 690.16, which requires isolation of the fuse from all potential supply sources
- Available for Flex Center modifications (windows, pilot lights, 316 grade stainless, and so on)

#### Standards and Certifications

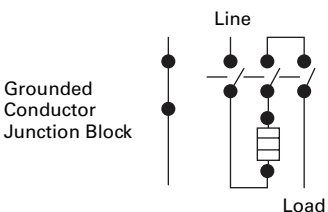
- UL 98 listed
- Marked as suitable for NEC 690 PV applications up to 600 Vdc
- OSHPD Special Seismic Certification Preapproval (OSP)

#### Wiring Diagrams

##### Non-Fusible 600 Vdc

Wiring Diagram	Ampere Rating	NEMA 3R	NEMA 12	NEMA 4X	Lug Capacity Main and Neutral (Isolated Ground) ①	Ground Lug
	30	DH161URKN	DH161UDKN	DH161UWKN	#2–#14 Cu/Al	#4–#14 Cu/Al
	60	DH162URKN	DH162UDKN	DH162UWKN	#2–#14 Cu/Al	#4–#14 Cu/Al
	100	DH163URKN	DH163UDKN	DH163UWKN	1/0–#14 Cu/Al	#4–#14 Cu/Al
	200	DH164URKN	DH164UDKN	DH164UWKN	300 kcmil—#6 Cu/Al ②	#2–#14 Cu/Al
	400	DH165URKN	DH165UDKN	DH165UWKN	(1) 750 kcmil—1/0 or (2) 300 kcmil—1/0 Cu/Al	250 kcmil—#6 Cu/Al
	600	DH166URKN	DH166UDKN	DH166UWKN	(1) 750 kcmil—1/0 and (1) 600 kcmil—#2 Cu/Al	250 kcmil—#6 Cu/Al

##### Fusible 600 Vdc (Class R Fuse Clips—One Fuse Required Per Switch)

Wiring Diagram	Ampere Rating	NEMA 3R	NEMA 12	NEMA 4X	Lug Capacity Main and Neutral (Isolated Ground) ①	Ground Lug
	30	DH161NRK	DH161NDK	DH161NWK	#2–#14 Cu/Al	#4–#14 Cu/Al
	60	DH162NRK	DH162NDK	DH162NWK	#2–#14 Cu/Al	#4–#14 Cu/Al
	100	DH163NRK	DH163NDK	DH163NWK	1/0–#14 Cu/Al	#4–#14 Cu/Al
	200	DH164NRK	DH164NDK	DH164NWK	300 kcmil—#6 Cu/Al ②	#2–#14 Cu/Al
	400	DH165NRK	DH165NDK	DH165NWK	(1) 750 kcmil—1/0 or (2) 300 kcmil—1/0 Cu/Al	250 kcmil—#6 Cu/Al
	600	DH166NRK	DH166NDK	DH166NWK	(1) 750 kcmil—1/0 and (1) 600 kcmil—#2 Cu/Al	250 kcmil—#6 Cu/Al

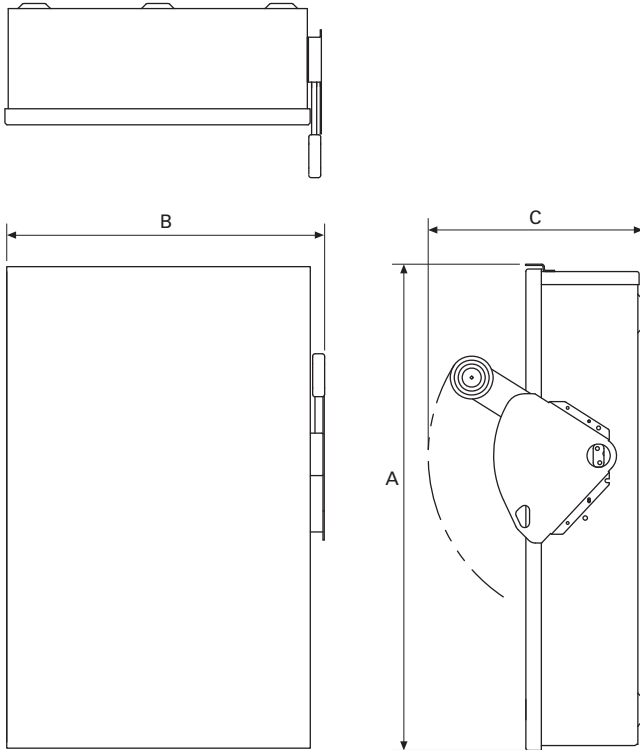
#### Notes

- ① UL 98 limits the conductor current sizing to 75°C. 90°C wire may be terminated per Article 110.14(C); however, the maximum current capacity is limited to NEC Table 310.16, 75°C column.
- ② N3R has 250 kcmil—#6 Cu/Al max lug capacity. NEMA12 and 4X have 300 kcmil—#6 Cu/Al.

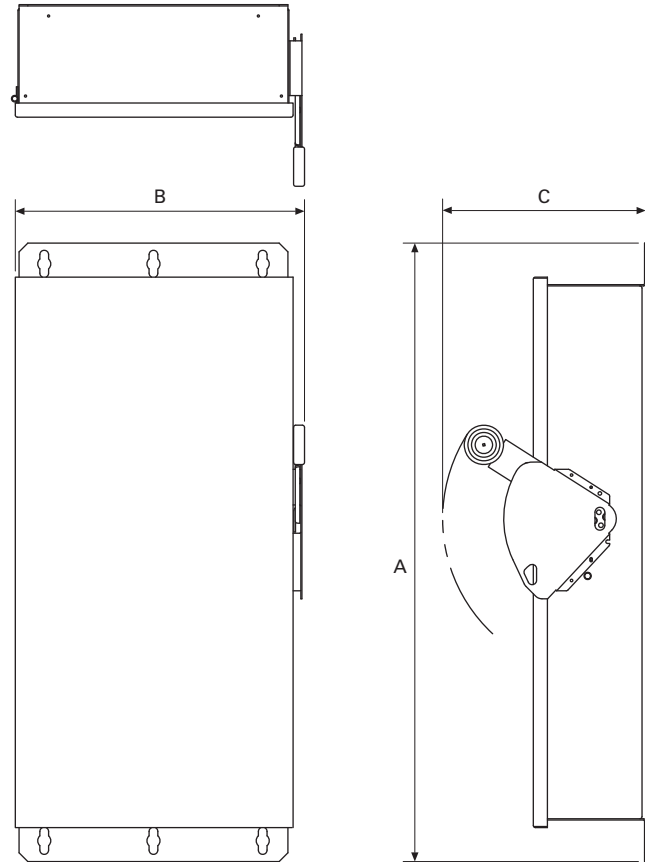
## Dimensions

Approximate Dimensions in Inches (mm)

### Type 3R Solar Switch



### Type 12-3R and 4X Solar Switch



### Type 3R Solar Switch

Ampere Rating	A	B	C	Main Lug Capacity <sup>①</sup>	Ground Lug Capacity
30	16.35 (415.3)	8.87 (225.3)	9.89 (251.2)	#2 AWG—#14 AWG Cu/Al	#4 AWG—#14 AWG Cu/Al
60	16.35 (415.3)	8.87 (225.3)	9.89 (251.2)	#2 AWG—#14 AWG Cu/Al	#4 AWG—#14 AWG Cu/Al
100	22.15 (562.6)	11.84 (300.7)	9.89 (251.2)	1/0 AWG—#14 AWG Cu/Al	#4 AWG—#14 AWG Cu/Al
200	28.27 (718.1)	16.66 (423.2)	11.26 (286.0)	250 kcmil—#6 AWG Cu/Al	#2 AWG—#14 AWG Cu/Al
400	45.00 (1143.0)	24.12 (612.6)	12.39 (314.7)	(1) 750 kcmil—1/0 or (2) 300 kcmil—1/0 Cu/Al	250 kcmil—#6 AWG Cu/Al
600	52.50 (1333.5)	25.12 (638.0)	14.07 (357.4)	(1) 750 kcmil—1/0 and (1) 600 kcmil—#2 AWG Cu/Al	250 kcmil—#6 AWG Cu/Al

### Type 12-3R and 4X Solar Switch

Ampere Rating	A	B	C	Main Lug Capacity <sup>①</sup>	Ground Lug Capacity
30 Non-fusible	14.14 (359.2)	8.76 (222.5)	10.22 (259.6)	#2 AWG—#14 AWG Cu/Al	#4 AWG—#14 AWG Cu/Al
30 Fusible	19.08 (484.6)	8.76 (222.5)	10.22 (259.6)	#2 AWG—#14 AWG Cu/Al	#4 AWG—#14 AWG Cu/Al
60 Non-fusible	14.14 (359.2)	8.76 (222.5)	10.22 (259.6)	#2 AWG—#14 AWG Cu/Al	#4 AWG—#14 AWG Cu/Al
60 Fusible	19.08 (484.6)	8.76 (222.5)	10.22 (259.6)	#2 AWG—#14 AWG Cu/Al	#4 AWG—#14 AWG Cu/Al
100	24.95 (633.7)	11.79 (299.5)	10.22 (259.6)	1/0 AWG—#14 AWG Cu/Al	#4 AWG—#14 AWG Cu/Al
200	35.38 (898.7)	16.95 (430.5)	11.63 (295.4)	300 kcmil—#6 AWG Cu/Al	#2 AWG—#14 AWG Cu/Al
400	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	(1) 750 kcmil—1/0 or (2) 300 kcmil—1/0 Cu/Al	250 kcmil—#6 AWG Cu/Al
600	63.00 (1600.2)	26.34 (669.0)	14.25 (362.0)	(1) 750 kcmil—1/0 and (1) 600 kcmil—#2 AWG Cu/Al	250 kcmil—#6 AWG Cu/Al

#### Note

<sup>①</sup> UL 98 limits the conductor current sizing to 75°C. 90°C wire may be terminated per Article 110.14(C); however, the maximum current capacity is limited to NEC Table 310.16, 75°C column.

600 Vdc Per Pole and 1000 Vdc Disconnect



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## 600 Vdc Per Pole and 1000 Vdc Disconnects

### Product Description

The latest addition to Eaton's solar disconnect family of products is the UL Listed 600 Vdc per pole, bi-directional disconnect. Listed to the UL 98B standard, this design has the capacity to switch multiple circuits of up to 600 Vdc each. Also included in the line are 1000 Vdc disconnects, designed for use in large scale projects where the higher voltage helps drive improved efficiencies.

The use of renewable energy sources is on the rise. Photovoltaic (PV) systems are among the fastest growing of the new green technologies, and they are being installed on a variety of building types and landscapes throughout North America. This results in a growing need for products to meet the requirements of these systems. Eaton's lineup of 600 Vdc per pole and 1000 Vdc switches are tested and listed to the rigorous UL 98B standard, in line with NEC 690 Code requirements for PV installations.

### Application Description

Switching devices primarily designed for DC service require design features to increase the total arcing voltage. This can be achieved by designing larger single air gaps and multiple gaps in series, or by using magnetic fields to force arc movement. In this safety switch design, Eaton uses magnetic fields, created with the use of permanent magnets, to stretch the arc. These products are not polarity sensitive, so they can be used on either negative or positive grounded systems, and they provide protection regardless of whether the current flow is in the "normal" direction or is reversed (possible due to miswiring or under a fault condition).

**Note:** Photos shown above—  
Left: 60A, 3 circuit, 600 Vdc per pole, NEMA 3R.  
Right: 200A, 4 circuit, 600 Vdc per pole, NEMA 4, w/ isolated grounded return terminals.

### Grounded PV systems

A large number of PV systems in North America to date are grounded systems. These systems will be either positive grounded or negative grounded. In a positive grounded system, the disconnect will switch (break) the negative (–) conductor only. Conversely, in a negative grounded system, the disconnect will switch (break) the positive (+) conductor only. It is important that the disconnect applied within a grounded PV system be properly rated for that specific system. Eaton's lineup of switches (600 Vdc and 1000 Vdc) are designed and UL Listed for use in both positive and negative grounded applications—one switch can be used on either system.

### Ungrounded PV systems

Somewhat less common today are ungrounded (floating) PV systems. These use transformerless inverters and, relative to the disconnects within the system, both the positive (+) and the negative (–) conductors are switched. Eaton is proud to also offer a series of disconnects (600 Vdc and 1000 Vdc) for ungrounded systems.

### Safety

The incorporation of the modified heavy duty safety switch mechanism provides a visible means of disconnect when the switch handle is in the OFF position. Blade disengagement from the stationary contact can be seen when viewing the switch base.

## Features

### Standard Features

- UL Listed to the UL 98B standard
- Marked as suitable for NEC 690 PV applications per UL 1741 requirements
- Suitable for use on positive and negative grounded systems, not polarity sensitive
- Bi-directional functionality; will break high-energy DC arc regardless of direction of current flow
- Ampacity range—30, 60, 100, 200 and 400A
- Clear polycarbonate deadfront shield
- Equipment ground
- NEMA 3R, 4 and 4X stainless steel enclosures
- Flex Center modification available, such as viewing windows, pilot lights and more

### 600 Vdc Specific Features

- First UL Listed 600 Vdc per pole, bi-directional solution in the market
- 2-, 3-, 4- and 6-circuit configurations for grounded systems
- 1-, 2- and 3-circuit configurations for ungrounded systems
- Fusible and non-fusible
- Grounded configurations include isolated return terminals. Exceptions include 6-circuit 30, 60, 100A, and 4-circuit 400A
- Suitable for use on a circuit capable of delivering up to 10,000A, 600 Vdc

### 1000 Vdc Specific Features

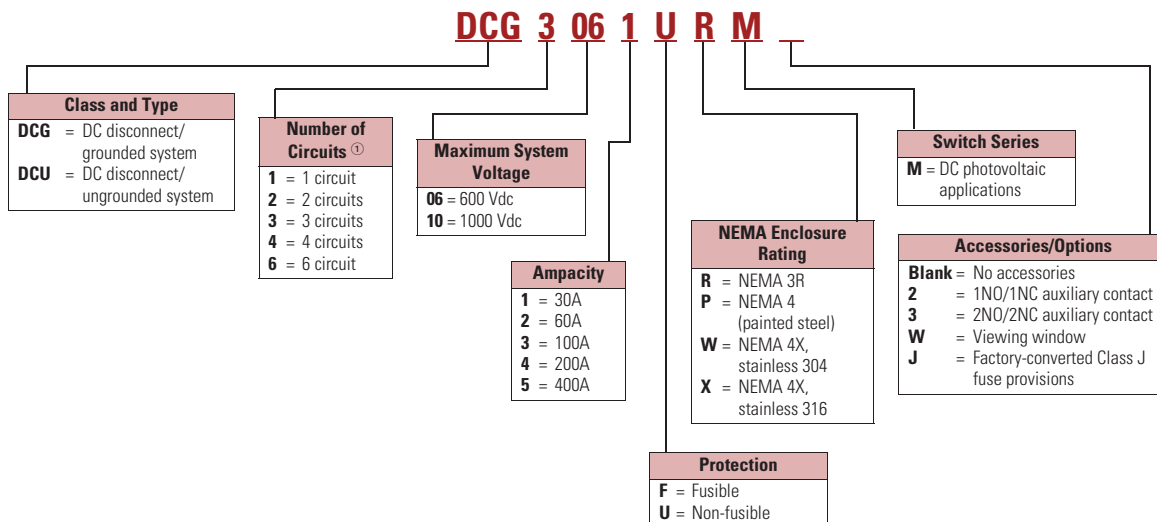
- 1-, 2- and 3-circuit configurations for both grounded and ungrounded systems
- Fusible and non-fusible
- Factory-installed jumpers
- Grounded configurations include isolated return terminals. Exceptions include 2-circuit 400A
- Suitable for use on a circuit capable of delivering up to 10,000A, 1000 Vdc

## Standards and Certifications

Listed to the UL 98B standard in-line with NEC 690 Code requirements for PV installations.

## Catalog Number Selection

### DC Disconnects



### Note

<sup>①</sup> Not all configurations for ampere rating and number of circuits are available. All circuit configurations can be found in the product dimension tables.



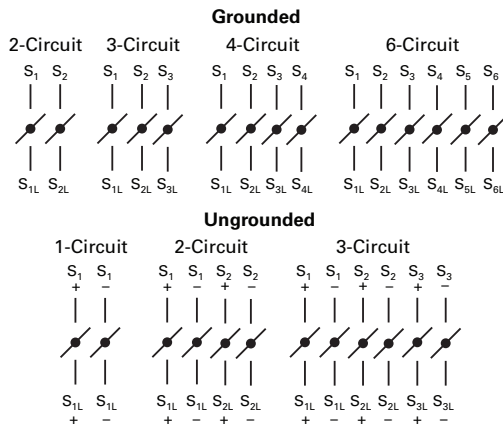
# 2.3

## DC Disconnects

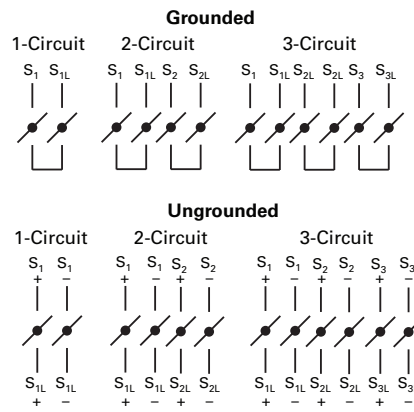
600 Vdc Per Pole and 1000 Vdc Disconnects

### Wiring Diagrams

#### 600 Vdc/Pole Wiring Diagrams (30–400A)



#### 1000 Vdc/Pole Wiring Diagrams (30–400A)



**Note:** Majority of grounded configurations have isolated return terminals. Due to enclosure size limitations, 600 Vdc exceptions include 6-circuit 30, 60, 100A; 4-circuit 400A; 1000 Vdc exceptions include 2-circuit 400A.

### DC Disconnect Lug Capacity

Maximum Vdc System Voltage	Ampere Rating	Lug Capacity <sup>①②③</sup>		Solid Return (for Grounded Conductor)		Equipment Ground	
		Main Input	Output	Input	Output	Input	Output
600	30	#2–#14 AWG	#2–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	#4–#14 AWG	#4–#14 AWG
	60	#2–#14 AWG	#2–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	#4–#14 AWG	#4–#14 AWG
	100	1/0–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	#4–#14 AWG	#4–#14 AWG
	200	300 kcmil–#6	300 kcmil–#6	300 kcmil–#6	300 kcmil–#6	#4–#14 AWG	1/0–#14
	400	(1) 750 kcmil–1/0 and (1) 600 kcmil–#2	(1) 750 kcmil–1/0 and (1) 600 kcmil–#2	(2) 750 kcmil–1/0	(2) 750 kcmil–1/0	#4–#14 AWG	250 kcmil–#6
1000	30	#2–#14 AWG	#2–#14 AWG	#2–#14 AWG	#2–#14 AWG	#4–#14 AWG	#4–#14 AWG
	60	#2–#14 AWG	#2–#14 AWG	#2–#14 AWG	#2–#14 AWG	#4–#14 AWG	#4–#14 AWG
	100	1/0–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	1/0–#14 AWG	#4–#14 AWG	#4–#14 AWG
	200	300 kcmil–#6	300 kcmil–#6	300 kcmil–#6	300 kcmil–#6	#4–#14 AWG	1/0–#14
	400	(1) 750 kcmil–1/0 and (1) 600 kcmil–#2	(1) 750 kcmil–1/0 and (1) 600 kcmil–#2	(2) 750 kcmil–1/0	(2) 750 kcmil–1/0	#4–#14 AWG	250 kcmil–#6

#### 600 Vdc Non-Fusible and Fusible

Amperes	Grounded Systems Number of Circuits					Ungrounded Systems Number of Circuits		
	1	2	3	4	6	1	2	3
30	●		●		◆	◆		◆
60	●		●		◆	◆		◆
100	●		●		◆	◆		◆
200	●	●	●	●	●	◆	◆	◆
400	●	●	●	■		◆	◆	
600	●							

#### 1000 Vdc Non-Fusible and Fusible

Amperes	Grounded Systems Number of Circuits			Ungrounded Systems Number of Circuits		
	1	2	3	1	2	3
30	●	◆		◆	◆	
60	●	◆		◆	◆	
100	●	◆		◆	◆	
200	●	●	●	◆	◆	◆
400	●	■		◆	◆	

#### Legend

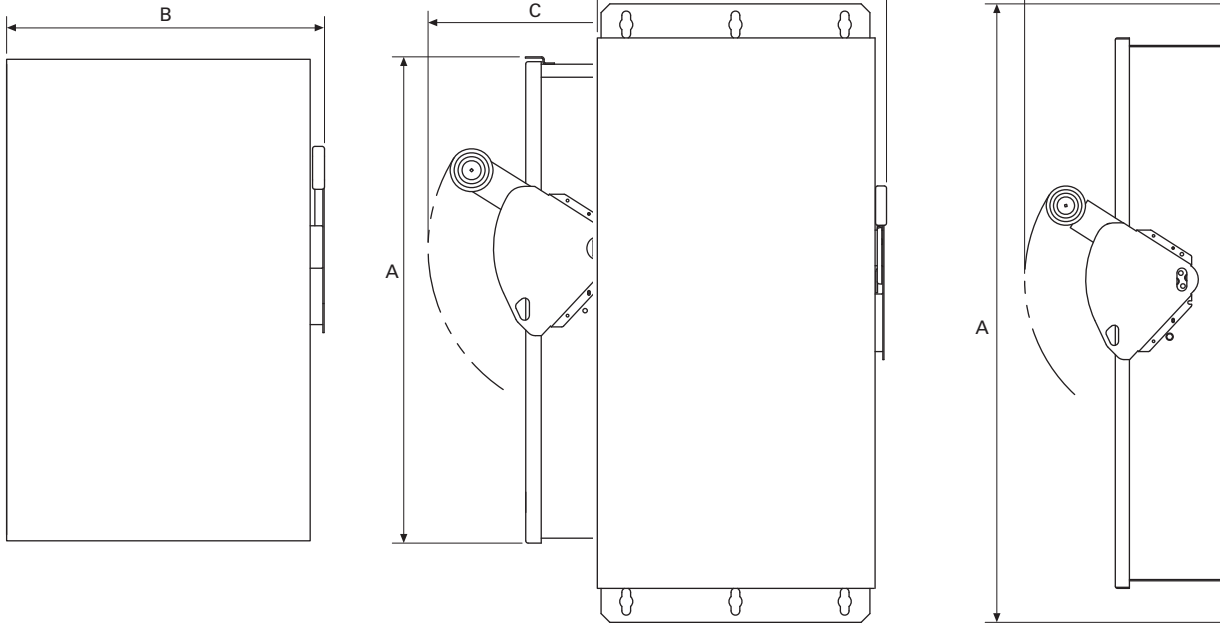
- Indicates grounded conductor terminal included with isolated lugs for each circuit.
- ◆ Indicates no grounded conductor terminal included.
- Indicates only non-fusible version includes grounded conductor terminal with isolated lug for each circuit.

#### Notes

- ① All lug capacities shown are for standard lugs. For options, including compression type, consult factory.
- ② All lugs are Cu/Al rated.
- ③ UL 98/98B limits the conductor current sizing to 75°C. 90°C wire may be terminated per Article 110.14(C); however, the maximum current capacity is limited to NEC Table 310.16, 75°C column.

**Dimensions**

Approximate Dimensions in Inches (mm)

**NEMA Type 3R****NEMA Type 4, 4X Stainless****2****600 Vdc Non-Fusible and Fusible**

Ampere Rating	Number of Circuits	NEMA Type 3R <sup>①</sup>				NEMA Types 4, 4X Stainless <sup>①</sup>			
		A	B	C	D	A	B	C	D
Grounded									
30, 60	3	16.27 (413.3)	8.87 (225.3)	9.89 (251.2)	5.25 (133.4)	19.08 (484.6)	8.76 (222.5)	10.22 (259.6)	5.50 (139.7)
30, 60	6	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)
100	3	21.99 (558.5)	11.84 (300.7)	9.89 (251.2)	5.25 (133.4)	24.95 (633.7)	11.79 (299.5)	10.22 (259.6)	5.50 (139.7)
100	6	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)
200	2	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	3	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	4	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)
200	6	39.18 (995.2)	30.18 (766.6)	11.63 (295.4)	6.44 (163.6)	39.18 (995.2)	30.18 (766.6)	11.63 (295.4)	6.44 (163.6)
400 <sup>②</sup>	2	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
400 <sup>②</sup>	3	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
400 <sup>②</sup>	4	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
Ungrounded									
30, 60	1	16.27 (413.3)	8.87 (225.3)	9.89 (251.2)	5.25 (133.4)	19.08 (484.6)	8.76 (222.5)	10.22 (259.6)	5.50 (139.7)
30, 60	3	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)
100	1	21.99 (558.5)	11.84 (300.7)	9.89 (251.2)	5.25 (133.4)	24.95 (633.7)	11.79 (299.5)	10.22 (259.6)	5.50 (139.7)
100	3	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)
200	1	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	2	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	3	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)
400 <sup>②</sup>	1	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
400 <sup>②</sup>	2	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)

**Notes**

① NEMA Type 4 and 4X stainless steel enclosures are suitable for mounting in either vertical or horizontal positions. NEMA Type 3R enclosures must be mounted vertically.

② For smaller NEMA 3R enclosure, consult factory.

# 2.3

## DC Disconnects

### 600 Vdc Per Pole and 1000 Vdc Disconnects

Approximate Dimensions in Inches (mm)

2

#### 1000 Vdc Non-Fusible (Fusible Available at 200A and 400A)

Ampere Rating	Number of Circuits	NEMA Type 3R ①				NEMA Types 4, 4X Stainless ①			
		A	B	C	D	A	B	C	D
Grounded									
30, 60	1	16.27 (413.3)	8.87 (225.3)	9.89 (251.2)	5.25 (133.4)	14.14 (359.2)	8.76 (222.5)	10.22 (259.6)	5.50 (139.7)
30, 60	2	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)
100	1	21.99 (558.5)	11.84 (300.7)	9.89 (251.2)	5.25 (133.4)	24.95 (633.7)	11.79 (299.5)	10.22 (259.6)	5.50 (139.7)
100	2	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)
200	1	35.38 (898.7)	16.95 (430.5)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.95 (430.5)	11.63 (295.4)	6.44 (163.6)
200	2	35.38 (898.7)	24.57 (624.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	24.57 (624.1)	11.63 (295.4)	6.44 (163.6)
200	3	35.38 (898.7)	24.57 (624.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	24.57 (624.1)	11.63 (295.4)	6.44 (163.6)
400 ②	1	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
400 ②	2	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
Ungrounded									
30, 60	1	16.27 (413.3)	8.87 (225.3)	9.89 (251.2)	5.25 (133.4)	14.14 (359.2)	8.76 (222.5)	10.22 (259.6)	5.50 (139.7)
30, 60	2	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)	19.08 (484.6)	12.88 (327.2)	10.22 (259.6)	5.50 (139.7)
100	1	21.99 (558.5)	11.84 (300.7)	9.89 (251.2)	5.25 (133.4)	24.95 (633.7)	11.79 (299.5)	10.22 (259.6)	5.50 (139.7)
100	2	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)	24.95 (633.7)	16.13 (409.7)	10.22 (259.6)	5.50 (139.7)
200	1	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	2	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	16.54 (420.1)	11.63 (295.4)	6.44 (163.6)
200	3	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)	35.38 (898.7)	24.46 (621.3)	11.63 (295.4)	6.44 (163.6)
400 ②	1	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)
400 ②	2	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)	57.47 (1459.7)	24.12 (612.6)	12.43 (315.7)	7.19 (182.6)

#### Notes

<sup>①</sup> NEMA Type 4 and 4X stainless steel enclosures are suitable for mounting in either vertical or horizontal positions. NEMA Type 3R enclosures must be mounted vertically.

<sup>②</sup> For smaller NEMA 3R enclosure, consult factory.

Pow-R-Line C Group-Mounted Distribution Switchboard



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Pow-R-Line C Distribution Switchboards

Product Description

Eaton’s Pow-R-Line C distribution switchboards combine a space-saving design with modular construction and increased system ratings to provide economical and dependable electrical system distribution and protection.

Application Description

Whether providing access for solar systems to main distribution systems or combining outputs of multiple inverters, Eaton’s Pow-R-Line C switchboards are available for customization for many applications, including backfeed scenarios.

Refer to Eaton’s *Consulting Application Guide*.

Features, Benefits and Functions

Pow-R-Line C designates a family of distribution switchboards, incorporating design concepts that fit the ever-increasing need for applications on high short-circuit systems, while retaining maximum safety and convenience throughout the line.

- 6000A maximum main bus rating
- 600 Vac and below
- 600 Vdc and below
- Front or rear accessible
- Type 1 or Type 3R enclosures
- ANSI-61 gray powder coat paint finish
- Microprocessor-based metering and monitoring devices
- Utility metering provisions
- Surge protective devices (SPD)
- Ground fault protection on mains and distribution devices
- Busway and transformer connections
- Complete protective device accessory capability
- 65 kAIC bus bracing standard; optional 100 or 200 kAIC
- Standard tin-plated aluminum bus; optional copper- or silver-plated copper bus
  - Standard bus ampacities based on UL heat test ratings. Optional density rated bus systems are also available

Main and Individually Mounted Devices

- Magnum® SB insulated case circuit breakers, 800–5000A, fixed or drawout
- Magnum DS power circuit breakers, 800–5000A, fixed or drawout
- Molded case circuit breakers, 400–2500A, fixed mounted
- Bolted pressure switches, 800–5000A
- FDPW fusible switches, 400–1200A

Group-Mounted Distribution Devices

- Molded case circuit breakers, 15–1200A
- FDPW fusible switches, 30–1200A

Front Accessible

Front-accessible switchboards align at the rear, enabling them to be placed against a wall (Pow-R-Line C front accessible). If the main section is deeper than others, due to physical size of the main device, the necessary off-set in line-up will occur in front, and the main section will be accessible from the side as well as from the front. Standard front accessible switchboards will align at the front and rear.

Rear Accessible

Rear-accessible switchboards align at the front and the rear. Bus maintenance and cable entry and exit require rear access.

**Standard Switchboard Height**

Standard Pow-R-Line C switchboard height is 90 inches (2286.0 mm).

**Group Mounting**

Group-mounted circuit protective devices are an assembly of units mounted on a panelboard type base (panelboard construction). Units may be molded case breakers, or FDPW fusible switches. Circuit protective devices are accessible from the front.

A main molded case breaker or main FDPW fusible switch, within the sizes listed for panelboard design, can be included in the panel-mounted assembly in lieu of a separate, individually mounted unit.

**Space Only for Future Devices Group-Mounted Construction**

Where space only for future circuit protective devices is required, the proper space and a blank filler plate will be supplied. Connections and mounting hardware are not included.

**Provision for Future Devices**

Where provisions for future circuit protective devices are required, space for the device, corresponding vertical bus, device connectors and the necessary mounting hardware will be supplied.

**Busbar System**

Standard bus in the switchboards is tin-plated aluminum. Silver-plated copper and tin-plated copper are also available.

Main bus and sub-main buses meet UL and NEMA standards for temperature rise on all Pow-R-Line C switchboards. Special bus densities are available.

**Overcurrent Devices**

To properly select and size overcurrent devices for use in a switchboard, the allowable temperature rise must be taken into account as to its effect on the tripping characteristics of the devices in question.

Accordingly, Article 220 of the NEC requires overcurrent devices to be rated not less than 125% of the continuous load they are protecting. To comply with this, an 80% derating factor must be used with all overcurrent devices such as molded case breakers and FDPW fusible switches unless they are tested and marked as 100% rated devices.

**Short-Circuit Rating**

Standard bus and connectors on all switchboards are rated for use on systems capable of producing up to 65,000A rms symmetrical short-circuit current at the incoming terminals.

Increased bus short-circuit ratings equal to that of connected switchboard devices, up to 200,000A rms symmetrical, are available in most Pow-R-Line C switchboards when approved main devices are installed. Contact Eaton for more information. UL labeled switchboard sections are marked with their applicable short-circuit rating.

**Provision for Busway Entrance and Exit**

Busway connections to switchboard sections include cutout and drilling in the top of the switchboard with riser connections from the switchboard device or bus, up to the point where the bus duct enters the switchboard. No connections are furnished external to the switchboard.

**Note:** In all transactions involving busway attached to switchboards, it is essential that information regarding orientation of the busway with respect to the front of the switchboard be supplied to the coordinating assembly plant.

On Pow-R-Line C switchboards, solid busbar is used to connect the bus duct to the individually mounted main device, main or sub-main switchboard bus, or vertical main bus of panel mounted circuit protective device panels. Busway fed by group-mounted branch devices are cable connected.

Aluminum riser connections are standard. Copper- or silver-plated copper is available as a modification.

**Transitions**

Transition structures are required for connecting switchboards to the secondary of power center transformer (dry or liquid filled), motor control centers, and for other special switchboard configurations such as “L” or “U” shaped lineups. In some applications, an extra structure complete with connections is required; in others, where switchboard depth and space permit, only the connection conductors are required. Refer to factory for these applications.

**Standards and Certifications**

- Meets NEMA Standard PB-2 and UL 891
- Seismically qualified

**Product Selection**

For complete application and pricing information, contact your local Eaton sales office.

**Technical Data and Specifications****Service**

- 120/240V, single-phase, three-wire
- 240/120V, 208Y/120V, 415Y/240V, 480Y/277V or 600Y/347V three-phase, four-wire
- 600 Vdc

**Main Bus Rating**

- 400–5000A

**Service Section**

- Main circuit breaker, 400–5000A
- Main fusible switch, 400–5000A
- Main lugs only, 400–6000A

**Metering Sections**

- Tenant main disconnects and meter sockets (200A maximum self-contained metered circuits)
- Hot sequence metering circuits
- Cold sequence metering circuits (WCMS only)
- Optional rear barriered wireways or load side pull sections for cable exit requirements
- Sections for metered circuits larger than 200A available with 400A continuous rated self-contained sockets or with CT compartment and transformer rated socket in combination with disconnect

Integrated Facility Switchboard



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Integrated Facility Switchboard

Product Description

Eaton’s Integrated Facility Switchboards use the modular Pow-R-Line C group-mounted switchboard design to integrate traditionally separate electrical distribution and control equipment into a single space-saving factory assembled and connected package.

The service entrance equipment can be integrated with multiple lighting and appliance branch panelboards into a compact front-accessible group-mounted switchboard. Where multiple panelboards are used in the same electrical room as a conventional distribution switchboard or power panelboards, the integrated design will significantly reduce equipment space requirements, as well as reduce installation time and cost.

Other associated equipment can also be integrated into the assembly, including dry-type distribution transformers, time clock space, lighting control, electronic controls, surge protective devices, metering and energy monitoring devices. Depending upon the application, other user-defined equipment such as a subsystem control package may also be incorporated.

Application Description

Eaton’s Integrated Facility Switchboards are designed to meet specific needs for:

- Solar/alternative energy integration projects
- Retail chain stores
- Commercial offices
- High rise buildings
- Correctional facilities
- Agricultural facilities
- Industrial facilities
- Hospitals/health care facilities
- Educational facilities

Whether the application is a multi-site prototype or single application, integrated switchboards offer time and space-saving features.

For complete application description, refer to Eaton’s *Consulting Application Guide*.



**Features, Benefits and Functions****Front Accessible**

Integrated Facility Switchboards are front accessible and align at the rear, enabling them to be placed against a wall. Most switchboards align at the front and the rear. If the main section is deeper than others, due to physical size of the main device, the necessary off-set in line-up will occur in front, and the main section will be accessible from the side as well as from the front.

**Standard Switchboard Height**

Switchboard height is 90 inches (2286.0 mm).

A limited offering of 78-inch (1981.2 mm) high equipment is available. Consult the factory for specific applications.

**Switchboard Shipping Splits**

The sections can be shipped as specified by the customer to meet specific requirements.

For retrofit applications, single-piece switchboard structures can be shipped to facilitate movement through limited access doorways, etc.

**Factory Interconnections**

Most sub-panels are fed from the main distribution panel feeder circuit breakers using copper cable sized per the NEC and UL.

**Space Savings**

The space-saving switchboard installation provides additional usable floor space. For example:

- Retail stores—floor space for sales
- Offices—additional storage, cubicle
- Health care—additional work area
- Retrofits—ability to fit existing rooms

**Site Construction Savings**

Timely installation of the electrical system typically is a key element on the critical path for any project.

Along with the time to install the equipment, other expenses include the time to handle all of the loose pieces of equipment arriving on a job site and ensuring it reaches the proper trades person. With Eaton's Integrated Facility Switchboards, one piece of equipment is typically shipped to a job site virtually eliminating these issues.

The equipment may also be used for temporary power on job sites, further reducing construction expenses and times.

**Standards and Certifications**

- Meets NEMA Standard PB-2 and UL 891
- Panelboards mounted inside the sections meet NEMA PB-1 and UL 67
- Other equipment is UL listed as applicable and appropriate

**Product Selection**

For complete application and pricing information, contact your local Eaton sales office.

**Additional Information**

For information on reverse feed breaker applications, please see **Consulting Application Guide—Molded-Case Circuit Breakers & Enclosures**, CA08104001E, Tab 27.

## Solar Panelboards



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## Product Selection Guide

## Product Types



Type PRL1a

**Bolt-On or Plug-On Circuit Breakers**  
**240 Vac Maximum**Main lugs only  
400A maximumMain circuit breaker  
400A maximumBranch circuit breakers  
100A maximum,  
Single-, two- and three-pole

Type PRL2a

**Bolt-On Circuit Breakers**  
**240 or 480Y/277 Vac; 125/250 Vdc Maximum**Main lugs only  
400A maximumMain circuit breaker  
400A maximumBranch circuit breakers  
100A maximum,  
Single-, two- and three-pole

Type PRL3a

**Bolt-On Circuit Breakers**  
**240, 480 or 600 Vac; 250 Vdc Maximum**Main lugs only  
800A maximumMain circuit breaker  
600A maximumBranch circuit breakers  
225A maximum,  
Single-, two- and three-pole

Type PRL4

**Circuit Breakers or Fusible Switches**  
**240, 480 or 600 Vac; 600 Vdc Maximum**Main lugs only  
1200A maximumMain circuit breaker  
1200A maximumMain fusible switch  
1200A maximum  
  
Branch circuit breakers  
1200A maximum,  
Single-, two- and three-poleBranch fusible switches  
1200A maximum,  
two- and three-pole

## Type PRL1a Panelboard



## Product Description

Eaton's EZ Box™ and EZ Trim™ represents the first significant change in panelboard box and trim designs in more than a half-century. The EZ Box and EZ Trim have been designed for faster, more secure and safer installations. The new EZ Box and EZ Trim are provided standard for Eaton's Pow-R-Line 1a and Pow-R-Line 2a lighting panelboards, as well as the Pow-R-Line 3a and Pow-R-Line 3E mid-range panelboard.



Flange Detail

## Features

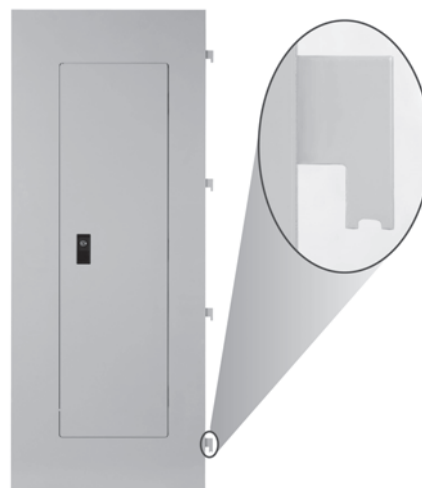
- Virtually eliminates sharp edges
- Trim installs in seconds rather than minutes
- Door-in-door is standard
- Ability to adjust flush box to wall irregularities
- Trim installs without the need for tools
- No exposed hardware (because there is none)

The EZ Box flanges are bent and painted, which virtually eliminates the sharp edges associated with traditional boxes. Additionally, all steel panelboard chassis parts are painted. This significantly reduces potential injury for material handlers and installers. Each flange is adjustable outward up to 3/4-inch (19.1 mm). This feature allows the installer to adjust flush box applications to be level and flat with the finished wall after the wall material is installed to help correct wall irregularities. The new box flange also provides the means for attaching the EZ Trim.

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Standalone Trim and Bottom Flange Hanger with Notch



Corner Flange Detail

**Fast Installation**

The EZ Trim incorporates a groundbreaking design that installs in seconds, rather than minutes. The standard trim features include door-in-door construction; no exposed hardware and no tools are required for installation.

Each EZ Trim includes hangers attached on the right side. The bottom trim hanger has a notch in its base. To install, the bottom hanger is inserted into the bottom right side box flange opening, resting the notch on the flange.



*Trim Hanger Inserted Into Box Flange*

The balance of the hangers are aligned with the other flange openings and pushed in. When all hangers are in the box flange, the trim is lifted up slightly to clear the notch on the bottom hanger, and the trim is self-supported on the EZ Box.

The installation is completed by swinging the trim to the closed position, then lifting and pushing slightly to the right. The trim will drop into place totally secured. The multi-point catches on the left side of the trim will lock into the left side box flange openings.

To prevent the trim from being removed by non-authorized persons, a unique sliding means automatically latches in place when the trim door is closed. Along with a new lock, the EZ Trim offers a high degree of door security.

**Standards and Certifications**

When used with Eaton's panelboard chassis, EZ Boxes and EZ Trims meet the following applicable industry standards:

- UL 50 listed
- NEMA Standard PB1
- Federal specifications
- National Electrical Code



*Trim Hanging on Surface Mounted Box*

## Product Selection

## Boxes and Trims Only—Type 1

2

## Types PRL1a, PRL2a and PRL3a (400A Maximum)

Box Dimensions—Inches (mm)	Height	YS Box Catalog Number	LT Trim Catalog Number	EZ Box ① Catalog Number	EZ Trim ① Catalog Number
20.00 W x 5.75 D (508.0 W x 146.1 D)	36.00 (914.4)	YS2036	LT2036S or F	EZB2036R	EZT2036S or F
	42.00 (1066.8)	YS2042	LT2042S or F	EZB2042R	EZT2042S or F
	48.00 (1219.2)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
	60.00 (1524.0)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
	72.00 (1828.8)	YS2072	LT2072S or F	EZB2072R	EZT2072S or F
	90.00 (2286.0)	YS2090	LT2090S or F	EZB2090R	EZT2090S or F

## Type PRL3a (600A)

Box Dimensions—Inches (mm)	Height	YS Box Catalog Number	LT Trim Catalog Number	EZ Box ① Catalog Number	EZ Trim ① Catalog Number
20.00 W x 5.75 D (508.0 W x 146.1 D)	36.00 (914.4)	YS2036	LTV2036S or F	EZB2036R	EZTV2036S or F
	48.00 (1219.2)	YS2048	LTV2048S or F	EZB2048R	EZTV2048S or F
	60.00 (1524.0)	YS2060	LTV2060S or F	EZB2060R	EZTV2060S or F
	72.00 (1828.8)	YS2072	LTV2072S or F	EZB2072R	EZTV2072S or F
	90.00 (2286.0)	YS2090	LTV2090S or F	EZB2090R	EZTV2090S or F

## Type PRL3a (800A)

Box Dimensions—Inches (mm)	Height	YS Box Catalog Number	LT Trim Catalog Number
28.00 W x 5.75 D	36.00 (914.4)	YS2836	LTV2836S or F
	48.00 (1219.2)	YS2848	LTV2848S or F
	60.00 (1524.0)	YS2860	LTV2860S or F
	72.00 (1828.8)	YS2872	LTV2872S or F
	90.00 (2286.0)	YS2890	LTV2890S or F

**Note**

① EZ Box must be used with EZ Trim.

### Pow-R-Line C Panelboards



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## Product Description

### Distribution Panelboards

Eaton's assembled panelboards are designed for sequence phase connection of branch circuit devices. This allows complete flexibility of circuit arrangement (single-, two- or three-pole) to allow balance of the electrical load on each phase.

Sturdy, rigid chassis assembly ensures accurate alignment of interior with panel front; prevents flexing and minimizes possibility of loosening or damage to current carrying parts during and after installation.

Four-point in-and-out adjustment of panel interior is provided to meet critical depth dimensions on flush installations. This compensates for possible misalignment of box at installation.

Main lugs are mechanical solderless type and approved for copper or aluminum conductors.

### Enclosures

Boxes are code-gauge galvanized steel, which include a painted box finished in ANSI-61 light gray to match the trim.

Standard panelboard cabinets are designed for indoor use. Alternate types are available for indoor and special purpose applications.

All enclosures are furnished in accordance with Underwriters Laboratories standards and include wiring gutters with proper wire bending space. Special cabinets can be provided at an additional charge.

The box dimensions shown are inside dimensions. For outside dimensions, add 1/4-inch (6.4 mm).

Standard panelboard boxes are supplied without knockouts (blank endwalls).

### Fronts

Fronts (trims) for all panelboards are made of code-gauge steel and have a high durability ANSI-61 light gray finish applied by a baked-on polyester powder coating paint system.

The fronts for lighting and appliance branch circuit panelboards and small power distribution panelboards include a door with rounded corners and concealed hinges. A flush-type latch and lock assembly is included. All locks are keyed alike. These trims are available in both surface- and flush-mounted designs.

**EZ Trim Features Standard Door-in-Door with No Exposed Hardware or Sharp Edges (no Tools are Required for Installation)**



**The Three-Piece Trim for Larger Power Distribution Panelboards Provides for Easy Handling and Installation**



Fronts for power distribution panelboards utilize a unique breaker front cover design in which each device has a dedicated bolt-on steel cover. The individual covers form a single deadfront for the panelboard that is used in conjunction with two wiring gutter covers to complete the trim. A door is not finished as part of the standard offering on these panelboards but can be provided, for an additional charge, using a deeper than standard box.



## Application Description

Whether providing access for solar systems to inverter inputs or combining outputs from multiple inverters, Eaton's Pow-R-Line C panelboards are available for customization for any application, including backfeed scenarios.

### Panelboard Selection Factors

In selecting a panelboard, the following factors must be considered:

- Service (voltage and frequency)
- Interrupting capacity (fully or series rated)
- Ampere rating of main
- Ampere ratings of branches
- Environment

### Panelboard Short-Circuit Rating

The short-circuit rating of Eaton's assembled panelboards are test verified by, and listed with, Underwriters Laboratories (UL). Generally, these ratings are that of the lowest interrupting rated device in the panel.

### Service Entrance Equipment

The National Electrical Code (NEC) requires that:

- A panel used as service entrance equipment must be located near the point where the supply conductors enter the building
- A panelboard having main lugs only shall have a maximum of six service disconnects to de-energize the entire panelboard from the supply conductors. Where more than six disconnects are required, a main service disconnect must be provided
- A disconnectable electrical bond must be provided between the neutral and ground
- A service entrance type UL label must be factory installed
- Ground fault protection of equipment shall be provided for each service disconnect rated 1000A or more if the electrical service is a solidly grounded wye system of more than 150V to ground, but not exceeding 600V phase-to-phase

**Note:** Service entrance panels must be identified as such on the order.

### Panelboard Standards

In 2008, both the National Electrical Code (Article 408) and UL 67 were updated to remove the mandated 42-circuit limitation. Eaton offers panelboards with more than 42 circuits for those jurisdictions that have adopted the 2008 NEC or later.

For jurisdictions that have not adopted the 2008 or later version of the National Electrical Code, the 42-circuit limitation for Lighting and Appliance Branch Panelboards remains in place. Check with your local code officials to determine specific jurisdiction status.

### Panelboard Installation

NEC requires that the operating handle of the topmost mounted device be no more than 6 feet 7 inches (2006.6 mm) above the finished floor and should be installed per NEC and manufacturer's instructions.

Additional boxes and fronts are required when the components required for one panelboard exceed the standard box dimensions.

### Multi-Section Panelboards

When two or more separate enclosures are required, separate fronts for each box are standard. A common front can be furnished at additional charge.

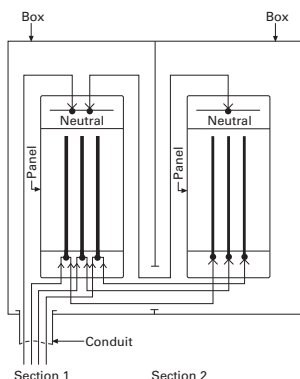
### Interconnecting Multi-Section Panelboards

When a panelboard, for connection to one feeder, must be furnished in more than one section (Box), each section must be furnished with main bus and terminals of the same rating, unless a main overcurrent device is provided in each section.

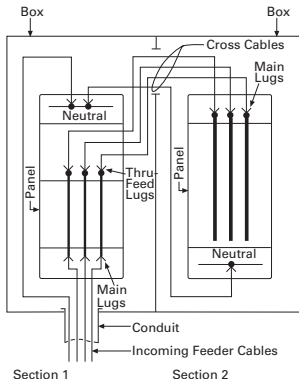
Sub-feed or through-feed provisions must also be included (and priced) to provide connection capability to the second section.

**Note:** Sub-feed or through-feed lugs cannot be used on any panelboard that is not protected by a single main overcurrent device either in the panelboard or immediately upstream, i.e., service entrance panelboards with main lugs only using the six disconnect rule.

## Sub-Feed Lugs



## Through-Feed Lugs



**Top Section View**

Conduit Nipple for Cross Wiring by Contractor

Wall

Trim

3/4 (19.1)

3/4 (19.1)

1 1/2 (38.1)

3/4 (19.1)

Trim

Wall

Contractor to Mount Boxes 1-1/2-inch (38.1 mm) Apart to Allow for 3/4-inch (19.1 mm) Extension on Both Flush Trims

Trim

Outside Edge of Box

3/4 (19.1)

3/4 (19.1)

3/4 (19.1)

3/4 (19.1)

3/4 (19.1)

Two Section Panelboard (Flush Mounting)

Flush Trim Extends 3/4-inch (19.1 mm) Beyond Outside of Box on All Four Sides

Each lighting and appliance branch circuit panelboard shall be individually protected on the supply side by not more than two main circuit breakers or two sets of fuses having a combined rating not greater than that on the panelboard.

**Ambient Temperatures**

The primary function of an overcurrent device is to protect the conductor and its insulation against overheating. In selecting the size of the devices and conductors, consideration should be given to the ambient temperature surrounding the conductors within and external to the panelboard. Cumulative heating within the panelboard may cause premature operation of the overcurrent protective devices.

Underwriters Laboratories test procedures are based, in part, on 80% loading of panelboard branch circuit devices. The NEC limits the loading of overcurrent devices in panelboards to 80% of rating where in normal operation the load will continue for three hours or more. Further derating may be required, depending on such factors as ambient temperature, duty cycle, frequency or altitude.

**Exception:** There is one exception to this rule in both UL and NEC. It applies to assemblies and overcurrent devices that have been listed for continuous duty at 100% of its rating.

**Special Conditions**

Standard panelboards, assembled with standard components, are adequate for most applications. However, special consideration should be given to those required for application under special conditions such as:

- Excessive vibration or shock
- Frequencies above 60 cycles
- Altitudes above 6600 feet (2011.7m)
- Damp environment (possible fungus growth)
- Compliance with federal, state and municipal electrical codes and standards

**Seismic Considerations**

The Uniform Building Code® and the International Building Code, as well as local and state building codes, place an emphasis on seismic building design requirements. Electrical distribution systems are treated as attachments to the building and therefore, fall into this category.

All Eaton panelboards are seismic qualified at the highest possible level, and have been tested in accordance with ANSI C37.81. This standard quantifies actual earthquake conditions, as well as equipment seismic capability.

**Harmonic Currents**

Standard panelboard neutrals are rated for 100% of the panelboard current. However, since harmonic currents can cause overheated neutrals, an option is provided for neutrals to be rated at 200% (1200A maximum neutral for 600A main bus) of the panelboard phase current.

Panelboards with the 200% rated neutral are UL listed as suitable for use with non-linear loads.

Prior to specifying the 200% rated neutral, Eaton recommends a harmonic survey be conducted of the distribution system, be it new or existing.

**Surge Protective Devices**

The quality of power feeding sensitive electronic loads is critical to the reliable operation of any facility. In modern offices, hospitals, and manufacturing facilities, the most frequent causes of microprocessor-based equipment downtime and damage are voltage transients and electrical noise.

Electrical loads and microprocessor-based equipment are highly susceptible to both high and low energy transients. High energy transients include lightning induced surges and power company switching. These high energy transients can destroy components instantly.

More frequently the electrical system experiences low energy transients and high frequency noise.

The effects of continual low energy transients and high frequency noise can cause erratic equipment performance or sudden failure of electronic circuit board components.

Eaton can provide protective and diagnostic systems integral to panelboards. The surge protective device (SPD) is integrated into the panelboards using a “zero lead length” direct busbar connection.

**Pow-R-Line 4**

The SPD protects sensitive electronic equipment from the damaging effects of high and low energy transients, as well as high frequency noise.

**Standards and Certifications**

Eaton's panelboards are designed to meet the following applicable industry standards, except where noted:

- Underwriters Laboratories:
  - Panelboards: UL 67
  - Cabinets and Boxes: UL 50

**Note:** Only panelboards containing UL listed devices can be UL labeled.

- National Electrical Code
- NEMA Standards: PB 1
- Federal Specification W-P-115c:
  - Circuit Breakers—Type I Class I
  - Fusible Switch—Type II Class I



## Technical Data and Specifications

### Panelboard Selection Guide

Panelboard Type	Device Type	Maximum Voltage Rating		Maximum Main Rating (Amperes)		Branch Circuits Ampere Range	Sub-Feed Breaker Maximum Amperes	AC Interrupting Capacity rms Symmetrical Amperes (kA)	
		AC	DC	MLO	Main Device			Fully Rated	Series Rated
PRL1a	Breaker	240	—	400	400	15–100	400	10–22	22–100
PRL2a	Breaker	240	250	400	400	15–100	400	65	65–200
	Breaker	480Y/277	250	400	400	15–100	400	14	22–150
PRL2R	Breaker	240	—	225	225	15–100	—	10–22	22–200
	Breaker	480Y/277	—	225	225	15–100	—	14	22–100
PRL3a	Breaker	240	250	800	600	15–225	600	10–200	22–200
	Breaker	480	250	800	600	15–225	600	14–100	22–150
	Breaker	600	250	800	600	15–225	600	14–35	—
PRL4B	Breaker	240	600	1200	1200	15–1200	—	10–200	22–200
	Breaker	480	600	1200	1200	15–1200	—	14–200	22–150
	Breaker	600	600	1200	1200	15–1200	—	14–200	—
PRL4F	Fusible	240	250	1200	1200	30–1200	—	100–200	—
	Fusible	600	250	1200	1200	30–1200	—	100–200	—

#### Terminal Wire Ranges, Pressure-Type Al/Cu Terminals Except as Noted

**Note:** All terminal sizes are based on wire ampacities corresponding to those shown in NEC Table 310.16 under the 75°C insulation columns (75°C wire). The use of smaller size, (in circular mills), regardless of insulation temperature rating, is not permitted.

Where copper-aluminum terminals are supplied on designated panelboard types, best results are obtained if a suitable joint compound is applied when aluminum conductors are used.

Check Eaton's standard terminal sizes versus customer requirements. In particular, 400 and 800A breakers often require nonstandard lugs.

Optional 750 kcmil mechanical screw-type terminals are available upon request. Panelboard dimensions may be affected, refer to Eaton.

### Standard Main Lug Terminals

Panel Type	Wire Size Ranges for Ampere Capacity						
	100A	225A	250A	400A	600A	800A	1200A
PRL1a	#12–1/0	#6–300 kcmil	—	(2) #4–500 kcmil	—	—	—
PRL2a	#12–1/0	#6–300 kcmil	—	(2) #4–500 kcmil	—	—	—
PRL3a	#12–1/0	—	#6–350 kcmil	(2) #4–500 kcmil	(2) #4–500 kcmil	(3) #4–500 kcmil	—
PRL4	—	—	#4–500 kcmil	(2) #4–500 kcmil	(2) #4–500 kcmil	(3) #4–500 kcmil	(4) #4–500 kcmil

## Standard Circuit Breaker Terminals

Breaker Type	Ampere Rating	Wire Range
BAB, QBHW, BABRSP, HQP, QPHW	15–70	#14–#4
	90–100	#8–1/0
EDB, EDS, ED, EDH, EDC	100–225	#4–4/0 or #6–300 kcmil
EGB, EGE, EGS, EGH	15–50	#14–3/0 AL/CU
	60–125	#6–3/0 AL/CU
EHD, FDB, FD, HFD, FDC, HFDDC ①	15–100	#14–1/0
	125–225	#4–4/0
FCL	15–100	#14–1/0
GHB, HGHB, GHQ, GHQRSP	15–20	#14–#10
	25–100	#10–1/0
EGB, EGS, EGH	15–50	#14–1/0
	60–125	#6–2/0
JD, HJD, JDC, HJDDC ①	70–250	#4–350 kcmil
DK	250–350	250–500 kcmil
	400	(2) 3/0–250 kcmil or (1) 3/0–500 kcmil
KD, HKD, KDC, HKDDC, ① CKD, CHKD	225	(1) #3–350 kcmil
	350	(2) 3/0–250 kcmil or
	400	(2) 3/0–250 kcmil or (1) 3/0–500 kcmil
LHH	150–400	#2–500 kcmil
	150–400	(2) #2–500 kcmil
	150–400	(1) 500–750 kcmil
LGE, LGH, LGC, LGU, LHH ②	250–400	(1) #2–500 kcmil
	500–600	(2) #2–500 kcmil
LD, HLD, LDC, HLDLC ① CLD, CHLD	300–500	(2) 250–350 kcmil
	600	(2) 400–500 kcmil
MDL, HMDL, HMDLDC ① CMDL, CHMDL	400–600	(2) #1–500 kcmil
	700–800	(3) 3/0–400 kcmil
ND, HND, CND, CHND, NDC, CNDC	800–1000	(3) 3/0–400 kcmil
	1200	(4) 4/0–500 kcmil
LCL	125–225	(1) #6–350 kcmil
	250–400	(1) #4–250 kcmil and (1) 3/0–600 kcmil
FB-P	15–100	#14–1/0
LA-P	70–225	#6–350 kcmil
	250–400	(1) #4–250 kcmil and (1) 3/0–600 kcmil
NB-P, NBDC ①	300–700	(2) #1–500 kcmil
	800	(3) 3/0–400 kcmil

## FDPW Switch Terminals

Ampere Rating	Wire Range
30	#14–1/0
60	#14–1/0
100	#14–1/0
200	#4–300 kcmil
400	250–750 kcmil or (2) 3/0–250 kcmil
600	(2) #4–600 kcmil or (4) 3/0–250 kcmil
800	(3) 250–750 kcmil or (6) 3/0–250 kcmil
1200	(4) 250–750 kcmil or (8) 3/0–250 kcmil

## Notes

① Suitable for DC applications only.

② LHH is 400A maximum.

## Selection Guide

## Molded Case Circuit Breaker Ratings

**Note:** Circuit breakers equal or exceed Federal Specification W-C-375b requirements for the particular class associated with each circuit breaker type.

2

Breaker Type	Continuous Ampere Rating	Number of Poles	Maximum Voltage AC	UL Listed Interrupting Ratings—kA Symmetrical Amperes					DC Rating Volts <sup>①</sup>	
				AC Rating Volts		277	480	600	125	250
BAB <sup>②③</sup> , HQP <sup>②③</sup>	15–70	1	120	10	—	—	—	—	—	—
	15–100	2	120/240	10	—	—	—	—	—	—
	15–100	2, 3	240	—	10	—	—	—	—	—
BABRP, BABRSP <sup>②</sup>	15–30	1	120	10	—	—	—	—	—	—
	15–30	2	120/240	10	—	—	—	—	—	—
QBGf, QBGFEP, QPGf, QPGFEP, QBAf, QBAG	15–40	1	120	10	—	—	—	—	—	—
	15–50	2	120/240	10	—	—	—	—	—	—
	15–20	1	120	10	—	—	—	—	—	—
	15–20	2	120/240	10	—	—	—	—	—	—
QBHW <sup>②③</sup> , QPHW <sup>②③</sup>	15–70	1	120	22	—	—	—	—	—	—
	15–100	2	120/240	22	—	—	—	—	—	—
	15–100	2, 3	240	—	22	—	—	—	—	—
QBHGf, QBHGFEP, QPHGf, QPHGFEP	15–30	1	120	22	—	—	—	—	—	—
	15–30	2	120/240	22	—	—	—	—	—	—
GQ, GHQ <sup>②</sup> , GHQRSP, GHB <sup>②③</sup>	15–20	1	277	65	—	14	—	—	—	—
	15–100 <sup>④</sup>	1	277	65	—	14	—	—	14	—
	15–100 <sup>④</sup>	2, 3	480Y/277	—	65	—	14	—	—	14
HGHB <sup>②</sup> , GHBGfEP	15–30	1	277	65	—	25	—	—	—	—
	15–60	1	277	—	—	14	—	—	—	—
GHBS	15–30	1	277	65	—	14	—	—	—	—
	15–30	2	480Y/277	—	65	—	14	—	—	—
EHD <sup>②③</sup>	15–100	1	277	—	—	14	—	—	10	—
	15–100	2, 3	480	—	18	—	14	—	—	10
EGB	15–125	1	277	35	35	18	—	—	10	—
	15–125	2, 3	480	—	35	—	18	—	—	10
EGS	15–125	1	277	100	—	35	—	—	35	—
	15–125	2, 3	480	—	100	—	35	—	—	35
EGH	15–125	1	277	200	—	65	—	—	42	—
	15–125	2, 3	480	—	200	—	65	—	—	42
FDB <sup>⑥</sup> , FD <sup>②③</sup>	15–150	2, 3	600	—	18	—	14	14	—	10
	15–150	1	277	—	—	35	—	—	10	—
	15–225	2, 3	600	—	65	—	35	18	—	10
HFD <sup>②③</sup>	15–150	1	277	—	—	65	—	—	10	—
	15–225	2, 3	600	—	100	—	65	25	—	22

## Notes

<sup>①</sup> DC ratings apply to substantially non-inductive circuits.

<sup>②</sup> 15 and 20A single-pole switching duty rated for fluorescent applications.

<sup>③</sup> Single-, two- and three-pole HACR rated.

<sup>④</sup> DC rated single-pole, 15–70A only.

<sup>⑤</sup> Two- and three-pole HACR rated.



## Selection Guide, continued

## 2

## Molded Case Circuit Breaker Ratings, continued

**Note:** Circuit breakers equal or exceed Federal Specification W-C-375b requirements for the particular class associated with each circuit breaker type.

Breaker Type	Continuous Ampere Rating	Number of Poles	Volts AC	UL Listed Interrupting Ratings—kA Symmetrical Amperes					DC Rating Volts <sup>①</sup>	
				AC Rating Volts		277	480	600	125	250
				120/240	240					
FDC <sup>②</sup>	15–225	2, 3	600	—	200	—	100	35	—	22
FCL	15–100	2, 3	480	—	200	—	150	—	—	—
EDB <sup>②</sup>	100–225	2, 3	240	—	22	—	—	—	10	—
EDS <sup>②</sup>	100–225	2, 3	240	—	42	—	—	—	10	—
ED <sup>②</sup>	100–225	2, 3	240	—	65	—	—	—	10	—
EDH <sup>②</sup>	100–225	2, 3	240	—	100	—	—	—	10	—
EDC <sup>②</sup>	100–225	2, 3	240	—	200	—	—	—	10	—
EGB <sup>②</sup>	15–125	1, 2, 3	240	—	25	—	18	—	—	—
EGE <sup>②</sup>	15–125	1, 2, 3	240	—	—	—	—	18	—	—
EGS <sup>②</sup>	15–125	1, 2, 3	240	—	85	—	35	22	—	—
EGH <sup>②</sup>	15–125	1, 2, 3	240	—	100	—	65	25	—	—
JD <sup>②</sup>	70–250	2, 3	600	—	65	—	35	18	—	10
HJD <sup>②</sup>	70–250	2, 3	600	—	100	—	65	25	—	22
JDC <sup>②</sup>	70–250	2, 3	600	—	200	—	100	35	—	22
DK	250–400	2, 3	240	—	65	—	—	—	—	10
KD, CKD <sup>③</sup>	100–400	2, 3	600	—	65	—	35	25	—	10 <sup>④</sup>
HKD, CHKD <sup>③</sup>	100–400	2, 3	600	—	100	—	65	35	—	22 <sup>④</sup>
LHH <sup>⑤</sup>	150–400	2, 3	480	—	100	—	65	35	—	42
KDC	100–400	2, 3	600	—	200	—	100	65	—	22 <sup>④</sup>
LCL <sup>⑤</sup>	125–400	2, 3	600	—	200	—	200	100	—	—
LGE	250–600	3	600	—	65	—	35	18	—	22
LGC <sup>⑤</sup>	250–600	2, 3	600	—	200	—	100	50	—	42
LGU <sup>⑤</sup>	250–600	2, 3	600	—	200	—	150	65	—	50
LD <sup>⑤</sup> , CLD <sup>③⑤</sup>	300–600	2, 3	600	—	65	—	35	25	—	22 <sup>④</sup>
LGH	250–600	3	600	—	100	—	65	35	—	22
HLD <sup>⑤</sup> , CHLD <sup>③⑤</sup>	300–600	2, 3	600	—	100	—	65	35	—	25 <sup>④</sup>
LDC <sup>⑤</sup> , CLDC <sup>③⑤</sup>	300–600	2, 3	600	—	200	—	100	50	—	25 <sup>④</sup>
MDL <sup>⑤</sup> , CMDL <sup>③⑤</sup>	400–800	2, 3	600	—	65	—	50	25	—	22 <sup>④</sup>
HMDL <sup>⑤</sup> , CHMDL <sup>③⑤</sup>	400–800	2, 3	600	—	100	—	65	35	—	25 <sup>④</sup>
ND <sup>⑤</sup> , CND <sup>③⑤</sup>	600–1200	2, 3	600	—	65	—	50	25	—	—
HND <sup>⑤</sup> , CHND <sup>③⑤</sup>	600–1200	2, 3	600	—	100	—	65	35	—	—
NDC <sup>⑤</sup> , CNDC <sup>③⑤</sup>	600–1200	2, 3	600	—	200	—	100	65	—	—
<b>Integrally Fused, Current Limiting Circuit Breakers</b>										
FB-P	15–100	2, 3	600	—	200	—	200	200	—	⑥
LA-P	70–400	2, 3	600	—	200	—	200	200	—	⑥
NB-P	300–800	2, 3	600	—	200	—	200	200	—	⑥

**Notes**

- ① DC ratings apply to substantially non-inductive circuits.
- ② Two- and three-pole HACR rated.
- ③ 100% rated circuit breaker.
- ④ DC rating not available with electronic trip.
- ⑤ Available with integral ground fault protection.
- ⑥ 100k based on NEMA test procedure.

Type PRL1a



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Type PRL1a

Product Description

- 240 Vac maximum
- Three-phase four-wire, three-phase three-wire, single-phase three-wire, single-phase two-wire
- 400A maximum mains
- 100A maximum branch breakers
- Bolt-on or plug-on branch breakers
- Each branch connector is capable of up to a total of 140A maximum by breaker ampere rating
- Factory assembled
- Refer to **Page V15-T2-29** for additional information

Application Description

- Lighting branch panelboard
- Fully rated or series rated
- Interrupting ratings up to 200 kA symmetrical
- Suitable for use as Service Entrance Equipment, when specified on the order
- See **Pages V15-T2-29** through **V15-T2-36** for additional information

Standards and Certifications

- UL 67, UL 50
- Federal Specification W-P-115c
- Refer to **Page V15-T2-29** for additional information



## Product Selection

2

Type PRL1a



## PRL1a

Ampere Rating	Interrupting Rating (kA Sym.) 240 Vac	Breaker Type
<b>Main Lug Only</b>		
100	—	—
225	—	—
400	—	—
<b>Main Breaker</b>		
100	10	BAB
100	18	EHD
100	22	QBHW
100	22	EDB
100	42	EDS
100	65	ED
100	65	FD, FDE
100	100	EDH
100	100	HFD, HFDE
225	22	EDB
225	42	EDS
225	65	ED
225	100	EDH
250	65	JD
250	100	HJD
250	200	JDC
400	65	DK
400	65	KD
400	100	HKD
400	100	LHH
400	200	KDC

## PRL1a Branch Circuit Breakers

**Bolt-on** = BAB, QBHW, QBGF, QBHGF, QBGFEP, QBHGFEP, QBAF, QBAG, QBHAF, QBHAG  
**Plug-on** = HQP, QPHW, QPGF, QPHGF, QPGFEP, QPHGFEP

Ampere Rating	Interrupting Rating (kA Sym.) 240 Vac <sup>①</sup>	Breaker Type
15–60	10	BAB, HQP
70	10	BAB, HQP
80–100	10	BAB, HQP
15–50 <sup>②</sup>	10	QBGF, QPGF <sup>③</sup>
15–50 <sup>②</sup>	10	QBGFEP, QPGFEP <sup>④</sup>
15–20	10	QB CAF <sup>⑤</sup>
15–60	10	BAB-D, HQP-D <sup>⑥</sup>
15–30	10	BAB-C, HQP-B <sup>⑦</sup>
15–30	10	BABRP <sup>⑧</sup>
15–30	10	BABRSP <sup>⑧</sup>
15–60	22	QBHW, QPHW
70	22	QBHW, QPHW
80–100	22	QBHW, QPHW
15–30	22	QBHGF, QPHGF <sup>③</sup>
15–30	22	QBHGFEP, QPHGFEP <sup>④</sup>
15–20	22	QBHCAF <sup>⑤</sup>
Provision	—	—

**Notes**

<sup>①</sup> Single-pole breakers are rated 120 Vac maximum.

<sup>②</sup> 50A devices are available as two-pole only.

<sup>③</sup> GFCI for 5 mA personnel protection.

<sup>④</sup> GFP for 30 mA equipment protection.

<sup>⑤</sup> Arc fault circuit breaker.

<sup>⑥</sup> HID (High Intensity Discharge) rated breaker.

<sup>⑦</sup> Switching Neutral Breaker. single-pole device requires two-pole space, two-pole device requires three-pole space.

<sup>⑧</sup> Solenoid operated breaker.

**Box Sizing and Selection**

Approximate Dimensions in Inches (mm)

**Assembled Circuit Breaker Panelboards and Lighting Controls**

Box size and box and trim catalog numbers for all standard panelboard types are found on **Page V15-T2-40**.

**Instructions**

- Using description of the required panelboard, select the rating and type of main required.
- Count the total number of branch circuit poles, including provisions, required in the panelboard. Do not count main breaker poles. Convert two- or three-pole branch breaker to single-poles, i.e., three-pole breaker, count as three poles.
- Determine sub-feed breaker or through-feed lug requirements.
- Select the main ampere rating section from table on **Page V15-T2-40**.
- Select panelboard type from first column, main breaker frame, if applicable, from second column, and sub-feed breaker frame, if applicable, from the third column.
- From Step #2, determine the number of branch circuits in Column 4.
- Read box size, box and trim catalog numbers across columns to the right. Specify surface or flush mounting on the order.

**Cabinets**

Fronts are code-gauge steel, ANSI-61 light gray painted finish.

Boxes are code-gauge galvanized steel without knockouts. Standard depth is 5-3/4 inches (146.1 mm). Standard width is 20 inches (508.0 mm). An optional 28-inch (711.2 mm) wide box is available.

**Top and Bottom Gutters**

5-1/2 inches (139.7 mm) minimum.

# 2.5

## Panelboards—Solar Applications

### Pow-R-Line C Panelboards

Approximate Dimensions in Inches (mm)

## 2

### PRL1a Panelboard Sizing

Panelboard Types	Main Breaker Types and Mounting Position (H) = Horizontal (V) = Vertical	Sub-Feed Breaker Types and Mounting Position (H) = Horizontal (V) = Vertical	Maximum No. of Branch Circuits Including Provisions	Box Dimensions ①			YS Box Catalog Number	LT Trim Catalog Number	EZ Box Catalog Number	EZ Trim Catalog Number
				Height	Width	Depth				
100A										
Main breaker	BAB, QBHW (H)	—	15	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	YS2036	LT2036S or F	EZB2036R	EZT2036S or F
		—	27	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		—	39	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		—	42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
Main lugs or main breaker	EHD, FD, HFD (V)	—	18	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	YS2036	LT2036S or F	EZB2036R	EZT2036S or F
		—	30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		—	42	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
Main lugs or main breaker with 100A through-feed lugs or sub-feed breaker	EHD, FD, HFD (V)	EHD, FD, HFD (V)	18	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		EHD, FD, HFD (V)	30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		EHD, FD, HFD (V)	42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
225A										
Main lugs or main breaker	EDB, EDS, ED, EDH, FD, HFD (V)	—	18	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	YS2036	LT2036S or F	EZB2036R	EZT2036S or F
		—	30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		—	42	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
Main lugs or main breaker with 225A throughfeed lugs or sub-feed breaker	FD, HFD, EDS, ED, EDH (V)	FD, HFD, EDS, ED, EDH (V)	18	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		FD, HFD, EDS, ED, EDH (V)	30	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
		FD, HFD, EDS, ED, EDH (V)	42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
400A										
Main breaker	DK, KD, HKD, KDC, LHH (V)	—	18	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		—	30	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
		—	42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
Main lugs or main breaker with 225A through-feed lugs or sub-feed breaker	DK, KD, HKD, KDC, LHH (V)	FD, HFD, EDS, ED, EDH (V)	18	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
		FD, HFD, EDS, ED, EDH (V)	30	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
		FD, HFD, EDS, ED, EDH (V)	42	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	YS2072	LT2072S or F	EZB2072R	EZT2072S or F
Main breaker with 400A through-feed lugs or sub-feed breaker	DK, KD, HKD, KDC, LHH (V)	DK, KD, HKD, KDC (V)	18	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	YS2072	LT2072S or F	EZB2072R	EZT2072S or F
		DK, KD, HKD, KDC (V)	30	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	YS2072	LT2072S or F	EZB2072R	EZT2072S or F
		DK, KD, HKD, KDC (V)	42	90.00 (2286.0)	20.00 (508.0)	5.75 (146.1)	YS2090	LT2090S or F	EZB2090R	EZT2090S or F

#### Note

① Smaller panelboard box sizes are available if required. Contact Eaton for application information.

Type PRL2a



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Type PRL2a

Product Description

- 480Y/277 Vac maximum (125 Vdc)
- Three-phase four-wire, three-phase three-wire, single-phase three-wire, single-phase two-wire
- 400A maximum mains
- 100A maximum branch breakers
- Bolt-on branch breakers
- Each branch connector is capable of up to a total of 140A maximum by breaker ampere rating
- Factory assembled
- Refer to **Page V15-T2-20** for additional information

Application Description

- Lighting branch panelboard
- Fully rated or series rated
- Interrupting ratings up to 200 kA symmetrical
- Suitable for use as Service Entrance Equipment, when specified on the order
- See **Pages V15-T2-20** through **V15-T2-36** for additional information

Standards and Certifications

- UL 67, UL 50
- Federal Specification W-P-115c
- Refer to **Page V15-T2-20** for additional information





## Product Selection

2

Type PRL2a



## PRL2a

Ampere Rating	Interrupting Rating (kA Symmetrical)			Breaker Type
	240 Vac	480Y/277 Vac	125/250 Vdc	
Main Lug Only				
100	—	—	—	—
225	—	—	—	—
400	—	—	—	—
Main Breaker				
100	65	14	14	GHB
100	18	14	10	EHD
100	65	35	10	FD, FDE
100	100	65	22	HFD, HFDE
100	200	100	22	FDC
225	65	—	—	ED
225	65	35	10	FD, FDE
225	100	65	22	HFD, HFDE
225	200	100	22	FDC
250	65	35	10	JD
250	100	65	22	HJD
250	200	100	22	JDC
400	65	35	10	KD
400	100	65	22	HKD
400	100	65	—	LHH
400	200	100	22	KDC

## PRL2a Branch Circuit Breakers

Ampere Rating	Interrupting Rating (kA Symmetrical)			Breaker Type
	240 Vac <sup>①</sup>	480Y/277 Vac	125/250 Vdc	
15–20	65	14	—	GHQ <sup>②</sup>
15–20	65	14	14	GHB <sup>②</sup>
25–60	65	14	14	GHB <sup>②</sup>
70–100	65	14	14	GHB <sup>②</sup>
15–30	65	25	—	HGHB <sup>②</sup>
15–20	65	14	—	GHQRSP <sup>③</sup>
15–30	65	14	—	GHBS <sup>②③</sup>
15–60	—	14	—	GHBGFEP <sup>②④</sup>
15–20	—	14	—	GHBHID <sup>②⑤</sup>
Provision	—	—	—	—

**Notes**

- <sup>①</sup> Interrupting ratings in this column are applicable to 120 Vac for single-pole breakers.  
<sup>②</sup> Must be used on 480Y/277V grounded wye systems only.  
<sup>③</sup> Remote controllable breaker.  
<sup>④</sup> GFP for 30 mA equipment protection. Requires two-pole spaces. 277 Vac only.  
<sup>⑤</sup> HID (High Intensity Discharge) rated breaker.

**Box Sizing and Selection**

Approximate Dimensions in Inches (mm)

**Assembled Circuit Breaker Panelboards and Lighting Controls**

Box size and box and trim catalog numbers for all standard panelboard types are found on **Page V15-T2-44**.

**Instructions**

- Using description of the required panelboard, select the rating and type of main required.
- Count the total number of branch circuit poles, including provisions, required in the panelboard. Do not count main breaker poles. Convert two- or three-pole branch breaker to single-poles, i.e., three-pole breaker, count as three poles.
- Determine sub-feed breaker or through-feed lug requirements.
- Select the main ampere rating section from table on **Page V15-T2-44**.
- Select panelboard type from first column, main breaker frame, if applicable, from second column, and sub-feed breaker frame, if applicable, from the third column.
- From Step #2, determine the number of branch circuits in Column 4.
- Read box size, box and trim catalog numbers across columns to the right. Specify surface or flush mounting on the order.

**Cabinets**

Fronts are code-gauge steel, ANSI-61 light gray painted finish.

Boxes are code-gauge galvanized steel without knockouts. Standard depth is 5-3/4 inches (146.1 mm). Standard width is 20 inches (508.0 mm). An optional 28-inch (711.2 mm) wide box is available.

**Top and Bottom Gutters**

5-1/2 inches (139.7 mm) minimum.

# 2.5

## Panelboards—Solar Applications

### Pow-R-Line C Panelboards

Approximate Dimensions in Inches (mm)

2

#### PRL2a Panelboard Sizing

Panelboard Types	Main Breaker Types and Mounting Position (H) = Horizontal (V) = Vertical	Sub-Feed Breaker Types and Mounting Position (H) = Horizontal (V) = Vertical	Maximum No. of Branch Circuits Including Provisions	Box Dimensions ①			YS Box Catalog Number	LT Trim Catalog Number	EZ Box Catalog Number	EZ Trim Catalog Number
				Height	Width	Depth				
100A										
Main breaker	BAB, QBHW (H)	—	15	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	YS2036	LT2036S or F	EZB2036R	EZT2036S or F
		—	27	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		—	39	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		—	42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
Main lugs or main breaker	EHD, FD, HFD, FDE, HFDE (V)	—	18	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	YS2036	LT2036S or F	EZB2036R	EZT2036S or F
		—	30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		—	42	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
Main lugs or main breaker with 100A through-feed lugs or sub-feed breaker	EHD, FD, FDE, HFD, HFDE (V)	EHD, FD, HFD (V)	18	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
			30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
			42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
225A										
Main lugs or main breaker	EDB, EDS, ED, EDH, FD, HFD, FDE, HFDE (V)	—	18	36.00 (914.4)	20.00 (508.0)	5.75 (146.1)	YS2036	LT2036S or F	EZB2036R	EZT2036S or F
		—	30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
		—	42	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
	JD, HJD, JDC (V)	—	18	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
		—	30	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
		—	42	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	YS2072	LT2072S or F	EZB2072R	EZT2072S or F
Main lugs or main breaker with 225A through-feed lugs or sub-feed breaker	EHD, FD, HFD, EDB, EDS, ED, EDH, FDE, HFDE (V)	EHD, FD, HFD, EDB, EDS, ED, EDH (V)	18	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
			30	48.00 (1219.2)	20.00 (508.0)	5.75 (146.1)	YS2048	LT2048S or F	EZB2048R	EZT2048S or F
			42	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
	JD, HJD, JDC (V)	EHD, FD, HFD, EDB, EDS, ED, EDH (V)	18	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
			30	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	YS2072	LT2072S or F	EZB2072R	EZT2072S or F
			42	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	YS2072	LT2072S or F	EZB2072R	EZT2072S or F
400A										
Main lugs or main breaker	DK, KD, HKD, KDC, LHH (V)	—	18	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
		—	30	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
		—	42	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	YS2072	LT2072S or F	EZB2072R	EZT2072S or F
Main lugs or main breaker with 225A through-feed lugs or sub-feed breaker	DK, KD, HKD, KDC, LHH (V)	EHD, FD, HFD, EDB, EDS, ED, EDH (V)	18	60.00 (1524.0)	20.00 (508.0)	5.75 (146.1)	YS2060	LT2060S or F	EZB2060R	EZT2060S or F
			30	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	YS2072	LT2072S or F	EZB2072R	EZT2072S or F
			42	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	YS2072	LT2072S or F	EZB2072R	EZT2072S or F
Main lugs or main breaker with 400A through-feed lugs or sub-feed breaker	DK, KD, HKD, KDC, LHH (V)	JD, HJD, JDC, DK, KD, HKD, KDC (V)	18	72.00 (1828.8)	20.00 (508.0)	5.75 (146.1)	YS2072	LT2072S or F	EZB2072R	EZT2072S or F
			30	90.00 (2286.0)	20.00 (508.0)	5.75 (146.1)	YS2090	LT2090S or F	EZB2090R	EZT2090S or F
			42	90.00 (2286.0)	20.00 (508.0)	5.75 (146.1)	YS2090	LT2090S or F	EZB2090R	EZT2090S or F

#### Note

① Smaller panelboard box sizes are available if required. Contact Eaton for application information.

Type PRL3a



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Type PRL3a

Product Description

- 600 Vac maximum (250 Vdc)
- Three-phase four-wire, three-phase three-wire, single-phase three-wire, single-phase two-wire
- 800A maximum main lugs
- 600A maximum main breaker
- 225A maximum branch breakers
- Bolt-on branch breakers
- Factory assembled
- Refer to **Page V15-T2-29** for additional information

Application Description

- Lighting panelboard or power distribution panelboard
- Fully rated or series rated
- Interrupting ratings up to 200 kA symmetrical
- Suitable for use as Service Entrance Equipment, when specified on the order
- See **Pages V15-T2-29** through **V15-T2-36** for additional information

Standards and Certifications

- UL 67, UL 50
- Federal Specification W-P-115c
- Refer to **Page V15-T2-29** for additional information



## Product Selection

2

Type PRL3a



## PRL3a

Ampere Rating	Interrupting Rating (kA Symmetrical)				Breaker Type
	240 Vac	480 Vac	600 Vac	250 Vdc	
Main Lug Only					
100	—	—	—	—	—
250	—	—	—	—	—
400	—	—	—	—	—
600	—	—	—	—	—
800 ①	—	—	—	—	—
Main Breaker					
100	18	14	—	10	EHD
100	18	14	14	10	FDB
100	22	—	—	—	EDB
100	42	—	—	—	EDS
100	65	—	—	—	ED
100	100	—	—	—	EDH
100	65	35	18	10	FD, FDE
100	100	65	25	22	HFD, HFDE
100	200	100	35	22	FDC
100	200	150	—	—	FCL
100	200	200	200	100 ②	FB-P ③
225	22	—	—	—	EDB
225	42	—	—	—	EDS
225	65	—	—	—	ED
225	100	—	—	—	EDH
225	200	—	—	—	EDC
225	65	35	18	10	FD, FDE
225	100	65	25	22	HFD, HFDE
225	200	100	35	22	FDC
250	65	35	18	10	JD
250	100	65	25	22	HJD
250	200	100	35	22	JDC
400	65	—	—	10	DK
400	65	35	25	10	KD
400	100	65	35	22	HKD
400	100	65	—	—	LHH
400	200	100	65	22	KDC
400	65	—	—	—	LCL ④
400	200	200	200	100 ②	LA-P ③④
600	65	35	18	22	LGE
600	100	65	35	22	LGH
600	200	100	50	42	LGC
600	65	35	25	22	LD
600	100	65	35	25	HLD
600	200	100	50	25	LDC
600	65	35	25	22	CLD ⑤
600	100	65	35	25	CHLD ⑤
600	200	100	50	25	CLDC ⑤

**Notes**

① 800A MLO requires 28-inch (711.2 mm) wide box.

② 100,000 based on NEMA test procedure.

③ Top feed only.

④ Requires 6.50-inch (165.1 mm) deep box. Not available in Type 3R, 12, 4 and 4X enclosures.

⑤ 100% rated circuit breaker. Requires copper bus. Not available in Type 12, 4 and 4X enclosures.

## PRL3a Branch Circuit Breakers

Ampere Rating	Interrupting Rating (kA Symmetrical)				Breaker Type
	240 Vac	480 Vac	600 Vac	250 Vdc	
15–60	10 <sup>(2)(3)</sup>	—	—	—	BAB
15–60	10	—	—	—	BAB-H
70	10 <sup>(2)(3)</sup>	—	—	—	BAB
70	10	—	—	—	BAB-H
80–100	10 <sup>(2)(3)</sup>	—	—	—	BAB
80–100	10	—	—	—	BAB-H
15–50 <sup>(1)</sup>	10 <sup>(2)(3)</sup>	—	—	—	QBGF
15–50 <sup>(1)</sup>	10	—	—	—	QBGFEP
15–20	10 <sup>(2)(3)</sup>	—	—	—	QB CAF <sup>(4)</sup>
15–60	10 <sup>(2)(3)</sup>	—	—	—	BAB-D <sup>(5)</sup>
15–30	10 <sup>(2)(3)</sup>	—	—	—	BAB-C <sup>(6)</sup>
15–30	10 <sup>(2)</sup>	—	—	—	BABRP <sup>(7)</sup>
15–30	10 <sup>(2)</sup>	—	—	—	BABRSP <sup>(7)</sup>
15–60	22 <sup>(2)(3)</sup>	—	—	—	QBHW
15–60	22	—	—	—	QBHW-H
70	22 <sup>(2)(3)</sup>	—	—	—	QBHW
70	22	—	—	—	QBHW-H
80–100	22 <sup>(2)(3)</sup>	—	—	—	QBHW
80–100	22	—	—	—	QBHW-H
15–30	22	—	—	—	QBHGF
15–30	22	—	—	—	QBHGFEP
15–20	22 <sup>(2)(3)</sup>	—	—	—	QBH CAF <sup>(4)</sup>
15–20	65	14 <sup>(8)(9)</sup>	—	—	GHQ
15–20	65	14 <sup>(8)(9)</sup>	—	14	GHB

## PRL3a Branch Circuit Breakers, continued

Ampere Rating	Interrupting Rating (kA Symmetrical)				Breaker Type
	240 Vac	480 Vac	600 Vac	250 Vdc	
25–60	65	14 <sup>(8)(9)</sup>	—	14	GHB
70–100	65	14 <sup>(8)(9)</sup>	—	14	GHB
15–30	65	25 <sup>(8)(9)</sup>	—	—	HGHB
15–20	65	14 <sup>(8)(9)</sup>	—	14	GHQRSP <sup>(7)</sup>
15–30	65	14 <sup>(8)(9)</sup>	—	14	GHBS <sup>(7)</sup>
15–60	—	14 <sup>(8)(9)</sup>	—	—	GBHGFEP
15–20	—	14 <sup>(8)(9)</sup>	—	—	GBHID <sup>(8)</sup>
15–60	18 <sup>(10)</sup>	14 <sup>(8)</sup>	—	10	EHD
70–100	18 <sup>(10)</sup>	14 <sup>(8)</sup>	—	10	EHD
15–60	18	V14	14	10	FDB
70–100	18	14	14	10	FDB
110–150	18	14	14	10	FDB
15–60	65 <sup>(10)</sup>	35 <sup>(8)</sup>	18	10	FD, FDE
70–100	65 <sup>(10)</sup>	35 <sup>(8)</sup>	18	10	FD, FDE
110–225	65 <sup>(10)</sup>	35	18	10	FD <sup>(10)</sup> , FDE
15–60	100 <sup>(10)</sup>	65 <sup>(8)</sup>	25	22	HFD, HFDE
70–100	100 <sup>(10)</sup>	65 <sup>(8)</sup>	25	22	HFD, HFDE
110–225	100 <sup>(10)</sup>	65	25	22	HFD <sup>(10)</sup> , HFDE
15–60	200	100	35	22	FDC
70–100	200	100	35	22	FDC
110–225	200	100	35	22	FDC <sup>(10)</sup>
100–225	22	—	—	—	EDB <sup>(10)</sup>
100–225	42	—	—	—	EDS <sup>(10)</sup>
100–225	65	—	—	—	ED <sup>(10)</sup>
100–225	100	—	—	—	EDH <sup>(10)</sup>
100–225	200	—	—	—	EDC <sup>(10)</sup>

**Notes**

- <sup>(1)</sup> 50A devices are available as two-pole only.
- <sup>(2)</sup> Single-pole breaker rated 120 Vac.
- <sup>(3)</sup> Two-pole breaker rated 120/240 Vac.
- <sup>(4)</sup> Arc fault circuit breaker.
- <sup>(5)</sup> HID (High Intensity Discharge) rated breaker.
- <sup>(6)</sup> Switching Neutral Breaker. single-pole device requires two-pole space, two-pole device requires three-pole space.
- <sup>(7)</sup> Solenoid operated breaker.
- <sup>(8)</sup> Single-pole breaker rated 277 Vac.
- <sup>(9)</sup> For use on 480Y/277V systems only.
- <sup>(10)</sup> AIC rating for two- and three-pole breakers only.
- <sup>(11)</sup> Maximum of six breakers per panel, 175–225A.



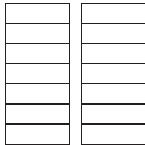
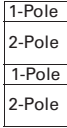
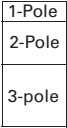
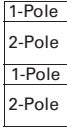
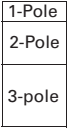
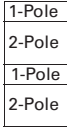
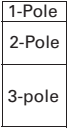
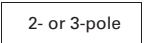
**Box Sizing and Selection**

Approximate Dimensions in Inches (mm)

**Panel Layout Instructions**

- Select:
  - Required mains (lugs or breaker).
  - Neutral where required.
  - Branch circuits as required.
- Layout panel as shown below, using appropriate “X” dimensions.
- Using total X units (panel height) find box height in inches (mm) and box catalog number from table below. (When total X units come out to an uneven number, use next highest number; i.e., if total X comes out 25X, use 31X.)

**Layout—PRL3a**

		Poles	
		6 - 3X	BAB, QBHW, QBCAF,
		12 - 5X	BABRP, BABRSP, QBHCAF
		18 - 8X	GHQ, GHB, HGHB
		24 - 10X	①
		30 - 13X	
		36 - 15X	
		42 - 18X	
		1X	EDB, EDS, ED, EDH, EDC,
		2X	EHD, FDB, FD, FDE, HFD, FDC, HFDE
		3X	150A max. per branch breaker (300A max. per connector)
		2X 2-Pole	EDB, EDS, ED, EDH, EDC
		3X three-pole	FD, HFD, FDC, ② FDE, HFDE
Neutral Section		5X	100–250A
		8X	400–800A
		11X	800A with through-feed lug
Main Lug Section		2X	100A
		5X	250A
		8X	400–600A
		14X	800A
Main Breaker Section	Horizontal Mounting	2X	EHD, FDB, FD,
		2-Pole	HFD, FDC, FDE, HFDE
		3X three-pole	EDB, EDS, ED, EDH, EDC ③
	Vertical Mounting	7X	EHD, FDB, FD, FDE, HFD, FDC, HFDE, EDB, EDS, ED, EDH, EDC ④
		9X	FCL, FB-P ⑤
		14X	JD, HJD, JDC
		15X	DK, KD, HKD, KDC, LHH
		17X	LD, HLD, LDC, CLD, CHLD, CLDC
		18X	LGE, LGH, LGC
		21X	LCL, LA-P ⑥⑥

**Notes**

- GHB, HGHB and GHQ breakers cannot be mixed on same connector as BAB, QBHW, BABRP and BABRSP.
- Maximum of six breakers per panel.
- Horizontal mounted 15–150A main breakers EHD, FDB, FD, FDE, HFD, HFDE and FDC, will be furnished as branch breaker construction. Branch breakers single-, two- or three-pole as required, may be located opposite these main breakers.
- If optional terminal kit 3TA225FDK is required, use 10X.
- FB-P and LA-P top mounting only.
- LCL or LA-P main breaker requires 6-1/2-inch (165.1 mm) deep box.

**Layout Example**

- Description of Panel  
Type PRL3a three-phase, four-wire, 120/208 Vac flush mounting. Panel to have short-circuit rating of 22,000 symmetrical amperes. Main breaker 400A, three-pole, bottom mounting. Branch circuits bolt-on as follows:  
12–200A single-pole QBHW  
1–200A three-pole ED  
1–225A three-pole ED
- Layout Information from **Layout—PRL3a** table (left):
  - 400A Neutral. . . . . = 8X
  - 12-poles of QBHW . . . . . = 5X
  - Two three-pole ED breakers . . = 6X
  - Main breaker, 400A,  
Three-pole DK. . . . . = 15X  
Total Height. . . . . = 34X
- From **Box Tabulation—PRL3a** table (below):
  - 34X Height (use 40X box)
  - Box Height 72 inches (1828.8 mm)
  - Box Catalog Number. . . . . **YS2072** or **EZB2072R**

**Box Tabulation—PRL3a**

“X” Units	Box Height	YS Box Catalog Number	LT Trim Catalog Number	EZ Box Catalog Number	EZ Trim Catalog Number
<b>100–400A</b>					
14X	36.00 (914.4)	<b>YS2036</b>	<b>LT2036S</b> or F	<b>EZB2036R</b>	<b>EZT2036S</b> or F
23X	48.00 (1219.2)	<b>YS2048</b>	<b>LT2048S</b> or F	<b>EZB2048R</b>	<b>EZT2048S</b> or F
31X	60.00 (1524.0)	<b>YS2060</b>	<b>LT2060S</b> or F	<b>EZB2060R</b>	<b>EZT2060S</b> or F
40X	72.00 (1828.8)	<b>YS2072</b>	<b>LT2072S</b> or F	<b>EZB2072R</b>	<b>EZT2072S</b> or F
53X	90.00 (2286.0)	<b>YS2090</b>	<b>LT2090S</b> or F	<b>EZB2090R</b>	<b>EZT2090S</b> or F
<b>600A</b>					
23X	48.00 (1219.2)	<b>YS2048</b>	<b>LTV2048S</b> or F	<b>EZB2048R</b>	<b>EZTV2048S</b> or F
31X	60.00 (1524.0)	<b>YS2060</b>	<b>LTV2060S</b> or F	<b>EZB2060R</b>	<b>EZTV2060S</b> or F
40X	72.00 (1828.8)	<b>YS2072</b>	<b>LTV2072S</b> or F	<b>EZB2072R</b>	<b>EZTV2072S</b> or F
53X	90.00 (2286.0)	<b>YS2090</b>	<b>LTV2090S</b> or F	<b>EZB2090R</b>	<b>EZTV2090S</b> or F
<b>800A</b>					
23X	48.00 (1219.2)	<b>YS2848</b>	<b>LTV2848S</b> or F	—	—
31X	60.00 (1524.0)	<b>YS2860</b>	<b>LTV2860S</b> or F	—	—
40X	72.00 (1828.8)	<b>YS2872</b>	<b>LTV2872S</b> or F	—	—
53X	90.00 (2286.0)	<b>YS2890</b>	<b>LTV2890S</b> or F	—	—

**Cabinets**

Fronts are code-gauge steel, ANSI-61 light gray painted finish.

Boxes are code-gauge galvanized steel without knockouts. Standard depth is 5-3/4 inches (146.1 mm).

Standard widths are:  
20-inch (508.0 mm)  
100–600A.  
28-inch (711.2 mm)  
800A.

**Standard Depth**

5-3/4 inches (146.1 mm).

**Top and Bottom Gutters**

5-1/2 inches (139.7 mm) minimum.

**Side Gutters**

4 inches (101.6 mm) minimum.

## Type PRL4



Type PRL4B Circuit Breaker and Type PRL4F Fusible Panelboards

## Contents

## Description

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Product Selection Guide . . . . .	V15-T2-25
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Type PRL1a . . . . .	V15-T2-37
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## Type PRL4

## Product Description

- 600 Vac maximum (600 Vdc)
- Three-phase, four-wire, three-phase three-wire, single-phase three-wire, single-phase two-wire
- PRL4B circuit breaker panelboard
- PRL4F fusible switch panelboard
- 1200A maximum mains
- 1200A maximum branch devices
- Bolt-on branch devices
- Factory assembled
- Refer to **Page V15-T2-29** for additional information

## Application Description

- Power distribution panelboard
- Fully rated or series rated
- Interrupting ratings up to 200 kA symmetrical
- Suitable for use as Service Entrance Equipment, when specified on the order
- See **Pages V15-T2-29** through **V15-T2-36** for additional information

## Standards and Certifications

- UL 67, UL 50
- Federal Specification
- W-P-115c
- Refer to **Page V15-T2-29** for additional information



## Product Selection

## 2

## Type PRL4



## PRL4 Main Lugs and Main Breakers

Ampere Rating	Interrupting Rating (kA Symmetrical)					Breaker Type
	240 Vac	480 Vac	600 Vac	250 Vdc	600 Vdc	
Main Lug Only						
250	—	—	—	—	—	—
400	—	—	—	—	—	—
600	—	—	—	—	—	—
800	—	—	—	—	—	—
1200	—	—	—	—	—	—
Main Breaker <sup>①</sup>						
250	65	35	18	10	—	JD
250	100	65	25	22	—	HJD
250	—	—	—	42	35	HJDDC <sup>②</sup>
250	200	100	35	22	—	JDC
250	200	200	—	—	—	LCL
400	65	—	—	10	—	DK
400	65	35	25	10	—	KD
400	65	35	25	—	—	CKD <sup>③④</sup>
400	100	65	35	22	—	HKD
400	—	—	—	42	35	HKDDC <sup>②</sup>
400	100	65	35	42	—	LHH
400	100	65	35	—	—	CHKD <sup>③④</sup>
400	200	100	65	22	—	KDC
400	200	200	—	—	—	LCL
400	200	200	200	—	—	LA-P
600	65	35	18	22	—	LGE <sup>①</sup>
600	100	65	35	22	—	LGH <sup>①</sup>
600	200	100	50	42	—	LGC
600	200	150	65	50	—	LGU
600	65	35	25	22	—	LD
600	65	35	25	—	—	CLD <sup>③</sup>
600	100	65	35	25	—	HLD
600	—	—	—	42	35	HLDDC <sup>②</sup>
600	100	65	35	—	—	CHLD <sup>③</sup>
600	200	100	50	25	—	LDC
600	200	100	50	—	—	CLDC <sup>③</sup>
800	65	50	25	22	—	MDL
800	100	65	35	25	—	HMDL
800	—	—	—	42	35	HMDLDC <sup>②</sup>
800	65	50	25	—	—	CMDL <sup>③</sup>
800	100	65	35	—	—	CHMDL <sup>③</sup>
800	200	200	200	—	—	NB-P
800	65	50	25	—	—	ND
800	100	65	35	—	—	HND
800	200	100	65	—	—	NDC
800	65	50	25	—	—	CND <sup>③⑤</sup>
800	100	65	35	—	—	CHND <sup>③⑤</sup>
800	200	100	65	—	—	CNDC <sup>③⑤</sup>
1200	65	50	25	—	—	ND
1200	100	65	35	—	—	HND
1200	200	100	65	—	—	NDC
1200	65	50	25	—	—	CND <sup>③⑤</sup>
1200	100	65	35	—	—	CHND <sup>③⑤</sup>
1200	200	100	65	—	—	CNDC <sup>③⑤</sup>
1200	—	—	—	42	50	NBDC <sup>②</sup>

## PRL4 Main Fusible Switches

Ampere Rating	Interrupting Rating (kA Symmetrical)		Device Type
	240 Vac	480 Vac	
Main Fusible Switch 240 Vac, 250 Vdc ⑥⑦⑧			
200	See Page V15-T2-39		FDPB
400			FDPW
600 ⑨			FDPW
800 ⑨			FDPW
1200 ⑨			FDPW
Main Fusible Switch 600 Vac ⑥⑦			
200	See Page V15-T2-39		FDPB
400			FDPW
600 ⑨			FDPW
800 ⑨			FDPW
1200 ⑨			FDPW

## Notes

- ① For ground fault protection on main devices, see **Modification 14** on Page V15-T2-63 or **Modification 15** on Page V15-T2-63
- ② For use on DC systems only.
- ③ 100% rated breaker. Requires copper bus. Not available in Type 12, 4 and 4X enclosures.
- ④ Breaker only available in three-pole frame.
- ⑤ Requires 44-inch (1117.6 mm) wide box.
- ⑥ For ground fault protection on main devices, see **Modification 15** on Page V15-T2-63.
- ⑦ Fuses not included. **Specify required fuse clips on all switches.**
- ⑧ Class J Fuse provisions are applicable only to 600V units. When required, use dimensions of 600V units for all voltages 600 and below.
- ⑨ No DC rating on 600, 800 and 1200A switches

## PRL4 Branch Devices

Ampere Rating	Interrupting Rating (kA Symmetrical)					Breaker Type
	240 Vac	480 Vac	600 Vac	250 Vdc	600 Vdc	
15–60	10 <sup>(2)(3)</sup>	—	—	—	—	BAB
15–60	10	—	—	—	—	BAB-H
70–100	10 <sup>(2)(3)</sup>	—	—	—	—	BAB
70–100	10	—	—	—	—	BAB-H
15–50 <sup>(1)</sup>	10 <sup>(2)(3)</sup>	—	—	—	—	QBGF
15–20	10 <sup>(2)(3)</sup>	—	—	—	—	QB CAF <sup>(4)</sup>
15–60	22 <sup>(2)(3)</sup>	—	—	—	—	QBHW
15–60	22	—	—	—	—	QBHW-H
70–100	22 <sup>(2)(3)</sup>	—	—	—	—	QBHW
70–100	22	—	—	—	—	QBHW-H
15–30	22 <sup>(2)(3)</sup>	—	—	—	—	QBHGF
15–20	22 <sup>(2)(3)</sup>	—	—	—	—	QBH CAF <sup>(4)</sup>
15–20	65 <sup>(2)</sup>	14 <sup>(5)</sup>	—	—	—	GHQ <sup>(7)</sup>
15–60	65 <sup>(2)</sup>	14 <sup>(5)</sup>	—	14	—	GHB <sup>(7)</sup>
70–100	65 <sup>(2)</sup>	14 <sup>(5)</sup>	—	14	—	GHB <sup>(7)</sup>
15–30	65 <sup>(2)</sup>	25 <sup>(5)</sup>	—	—	—	HGHB <sup>(7)</sup>
15–60	18 <sup>(8)</sup>	14 <sup>(5)</sup>	—	10	—	EHD
70–100	18 <sup>(8)</sup>	14 <sup>(5)</sup>	—	10	—	EHD
15–60	18	14	14	10	—	FDB
70–100	18	14	14	10	—	FDB
110–150	18	14	14	10	—	FDB
15–60	65 <sup>(8)</sup>	35 <sup>(5)</sup>	18	10	—	FD, FDE
70–100	65 <sup>(8)</sup>	35 <sup>(5)</sup>	18	10	—	FD, FDE
110–225	65 <sup>(8)</sup>	35	18	10	—	FD, FDE
15–60	100 <sup>(8)</sup>	65 <sup>(5)</sup>	25	22	—	HFD, HFDE
70–100	100 <sup>(8)</sup>	65 <sup>(5)</sup>	25	22	—	HFD, HFDE
110–225	100 <sup>(8)</sup>	65	25	22	—	HFD, HFDE
15–60	200	100	35	22	—	FDC
70–100	200	100	35	22	—	FDC
110–225	200	100	35	22	—	FDC
15–100	200	150	—	—	—	FCL
15–150	—	—	—	42	35	HFDDC <sup>(6)</sup>
100–225	22	—	—	—	—	EDB
100–225	42	—	—	—	—	EDS
100–225	65	—	—	—	—	ED
100–225	100	—	—	—	—	EDH
100–225	200	—	—	—	—	EDC
70–225	65	35	18	10	—	JD
250	65	35	18	10	—	JD
70–225	100	65	25	22	—	HJD

## PRL4 Branch Devices, continued

Ampere Rating	Interrupting Rating (kA Symmetrical)					Breaker Type
	240 Vac	480 Vac	600 Vac	250 Vdc	600 Vdc	
250	100	65	25	22	—	HJD
70–250	—	—	—	42	35	HJDDC <sup>(6)</sup>
70–225	200	100	35	22	—	JDC
250	200	100	35	22	—	JDC
125–250	200	200	—	—	—	LCL
250–400	65	—	—	10	—	DK
100–400	65	35	25	10	—	KD
100–400	65	35	25	—	—	CKD <sup>(9)(10)</sup>
100–400	100	65	35	22	—	HKD
100–400	—	—	—	42	35	HKDDC <sup>(6)</sup>
100–400	100	65	35	—	—	CHKD <sup>(9)(10)</sup>
125–400	100	65	35	42	—	LHH
100–400	200	100	65	22	—	KDC
200–400	200	200	—	—	—	LCL
250–600	65	35	18	22	—	LGE
300–600	65	35	25	22	—	LD
300–600	65	35	25	—	—	CLD <sup>(8)</sup>
250–600	100	65	35	22	—	LGH
300–600	100	65	35	25	—	HLD
300–600	—	—	—	42	35	HLDDC <sup>(6)</sup>
300–600	100	65	35	—	—	CHLD <sup>(1)</sup>
250–600	200	100	35	42	—	LGC
300–600	200	100	50	25	—	LDC
300–600	200	100	50	25	—	CLDC <sup>(1)</sup>
250–600	200	150	65	50	—	LGU
400–800	65	50	25	22	—	MDL
400–800	100	65	35	25	—	HMDL
300–800	—	—	—	42	35	HMDLDC <sup>(6)</sup>
400–800	65	50	25	—	—	CMDL <sup>(1)</sup>
400–800	100	65	35	—	—	CHMDL <sup>(1)</sup>
400–800	65	50	25	—	—	ND
400–800	100	65	35	—	—	HND
400–800	200	100	65	—	—	NDC
400–800	65	50	25	—	—	CND <sup>(1)(2)</sup>
400–800	100	65	35	—	—	CHND <sup>(1)(2)</sup>
400–800	200	100	65	—	—	CNDC <sup>(1)(2)</sup>
600–1200	65	50	25	—	—	ND
600–1200	100	65	35	—	—	HND
600–1200	200	100	65	—	—	NDC
600–1200	65	50	25	—	—	CND <sup>(1)(2)</sup>
600–1200	100	65	35	—	—	CHND <sup>(1)(2)</sup>
600–1200	200	100	65	—	—	CNDC <sup>(1)(2)</sup>
700–1200	—	—	—	42	50	NBDC <sup>(6)</sup>

## Notes

- <sup>(1)</sup> 50A devices are available as two-pole only.
- <sup>(2)</sup> Single-pole breakers rated 120 Vac.
- <sup>(3)</sup> Two-pole breakers rated 120/240 Vac.
- <sup>(4)</sup> Arc fault circuit breaker.
- <sup>(5)</sup> Single-pole breakers rated 277 Vac.
- <sup>(6)</sup> For use on DC systems only.
- <sup>(7)</sup> At 480V, must be used on 480Y/277V grounded wye systems only.
- <sup>(8)</sup> AIC rating for two- and three-pole breakers only.
- <sup>(9)</sup> 100% rated breaker. Requires copper bus. Not available in Type 12, 4 and 4X enclosures.
- <sup>(10)</sup> Breaker only available in three-pole frame.
- <sup>(11)</sup> Available in single branch mounting only.

## PRL4 Branch Devices, continued

Ampere Rating	Interrupting Rating (kA Symmetrical)				Breaker Type
	240 Vac	480 Vac	600 Vac	250 Vdc	
Integrally Fused, Current Limiting Circuit Breaker					
15–100	200	200	200	①	FB-P
125–225	200	200	200	①	LA-P
250–400	200	200	200	①	LA-P
400–600	200	200	200	①	NB-P
700–800	200	200	200	①	NB-P
Fusible Switches 240 Vac, 250 Vdc ②					
30/30 ③	See table at the right				FDPW-Twin
60/60 ③					FDPW-Twin
100/100 ③					FDPW-Twin
200/200					FDPB-Twin
100					FDPW-Single
200					FDPB-Single
400	See table at the right				FDPW-Single
600 ④					FDPW-Single
800 ④					FDPW-Single
1200 ④					FDPW-Single
Fusible Switches 600 Vac ②					
30/30 ③	See table at the right				FDPW-Twin
60/60 ③					FDPW-Twin
100/100 ③					FDPW-Twin
200/200 ⑤					FDPB-Twin
100					FDPW-Single
200					FDPB-Single
400	See table at the right				FDPW-Single
600 ④					FDPW-Single
800 ④					FDPW-Single
1200 ④					FDPW-Single

## FDPW and FDPB Switch Ratings, 240 or 600 Vac

Ampere Rating	Fuse Class Used	Short-Circuit Ratings (kA Symmetrical)
30–100	R, J ⑤	200
200 Single	R, J ⑤	200
200 Twin	R ⑥, J ⑤, T	200
400, 600 ⑦	R ⑦, J ⑤, T	200
800, 1200 ⑦	L	200

**Notes**

- ① 100 kAIC based on NEMA test procedure.
- ② Fuses not included. **Specify required fuse clips on all switches. (T fuse clips not available for 200/200 twin switches.)**
- ③ When branches of a twin unit are of different ampere ratings, as a 30–60 twin unit, price and layout as a 60–60 twin unit; when a 60–100 twin unit, price and layout as a 100–100 twin unit.
- ④ No DC rating on 600, 800 and 1200A switches.
- ⑤ Class J fuse provisions are applicable to 600V units. When required, use price and dimensions of 600V units for all voltages 600V and below.
- ⑥ Twin 200A switches are not available with Class R fuse clips at 600V.
- ⑦ When shunt trip is required, 400–600A switches used with Class R fuses are rated 100 kAIC.

### Box Sizing and Selection—PRL4B

Approximate Dimensions in Inches (mm)

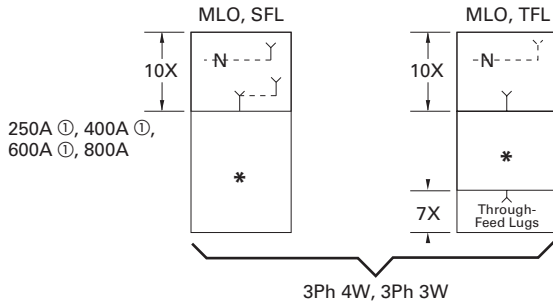
Main Lug Only (MLO), Main Breaker, Neutral, Through-Feed Lug (TFL) and Sub-Feed Lug (SFL) “X” Space Requirements. (For other configurations not shown, refer to Eaton.)

\* = Space available for branch devices. For device sizing, see **Page V15-T2-55**.

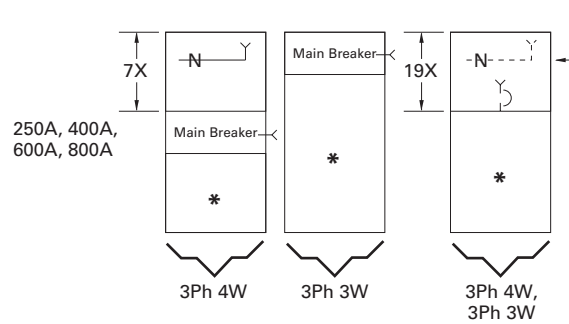
● = Blank means no bus under cover, to meet NEC cable bending space.

### PRL4B Layout

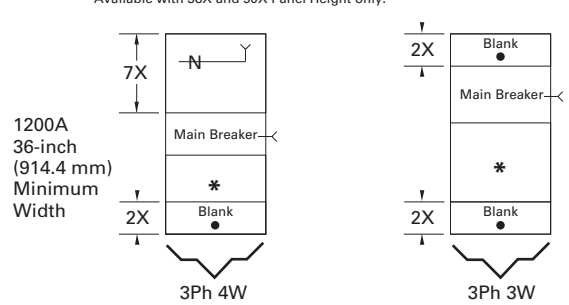
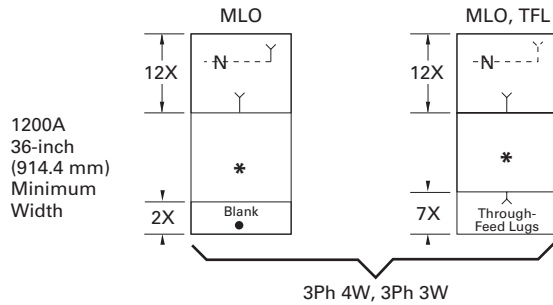
#### Standard Main Lug, Through-Feed and Sub-Feed Lugs ① (500 kcmil Maximum)



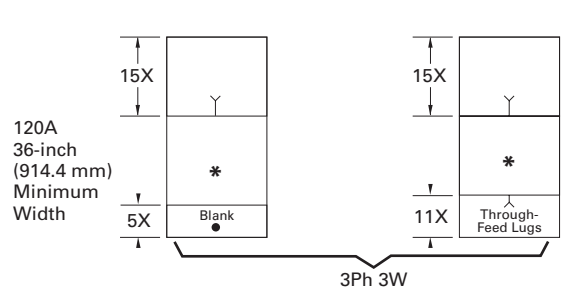
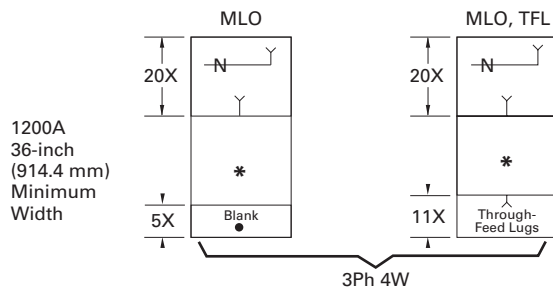
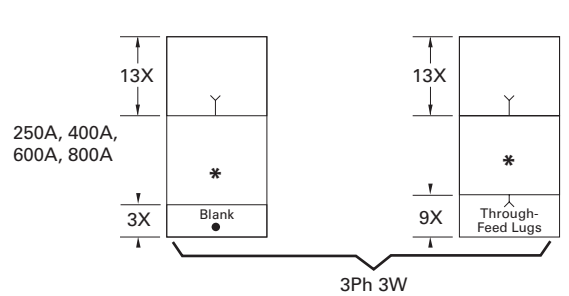
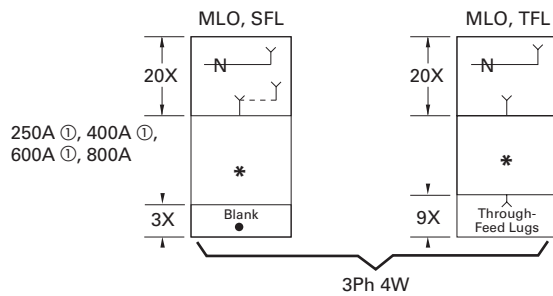
#### Main Breaker with Neutral (when required) (500 kcmil Maximum)



800A Vertically Mtd. MDL Main Breaker only in 24-inch (609.6 mm) wide box. Available with 38X and 50X Panel Height only.



#### Optional Main Lugs, Through-Feed and Sub-Feed Lugs ① (750 kcmil Maximum)



### Note

① Sub-feed lugs are available 250–600A. For 600A, use 1200A “A” space.



Approximate Dimensions in Inches (mm)

### Panel Layout and Dimensions

To determine the dimensions of a given panelboard enclosure, make a layout sketch by fitting together the main, branch and lug modules according to the appropriate tables in the layout guide. Assign “X” units to each module as shown and obtain a total “X” number.

The height of the enclosure is related to the total “X” units in the layout as shown in table on right. Three standard box heights are available to accommodate any and all layout arrangements. “X” unit totals that do not exactly match those in table on right must be rounded off to the next highest standard (26X, 38X, 50X).

If a calculated “X” total for a panel exceeds 50X, the panel must be split into two or more separate sections with “X” space for through-feed lugs figured in for all but one section. If a neutral is required, a separate neutral bar and appropriate “X” space must be included in each section.

### Layout Example

- 1–PRL4B panelboard, 480Y/277 volt, three-phase four-wire 65 kA, 800A, main lug, consisting of:
  - 12–20A/single-pole HFD
  - 2–250A/three-pole HJD
  - 1–400A/three-pole HKD

### Reference PRL4B Layout Example

- From layout guide, total “X” height of panel = 26X, (which is a design standard and no rounding off is necessary).
- From table on right, enclosure height for 26X panel = 57 inches (1447.8 mm).
- Width = 24 inches (609.6 mm)—directly from layout guide.
- Enclosure depth = 11.31 inches (287.0 mm)—standard for all PRL4 panelboards.

### PRL4B Layout Example

20A/1P	20A/1P	1X
20A/1P	20A/1P	1X
20A/1P	20A/1P	1X
20A/1P	20A/1P	1X
20A/1P	20A/1P	1X
20A/1P	20A/1P	1X
250A/3P		3X
250A/3P		3X
400A/3P		4X
Main Lugs	800A	10X
Neutral		

Total = 26X

### Box Dimensions—PRL4B

“X” Units	Catalog Number	Height	Width	Depth <sup>①</sup>
26X	<b>BX2457</b>	57.00 (1447.8)	24.00 (609.6)	11.31 (287.0)
38X	<b>BX2473</b>	73.50 (1866.9)	24.00 (609.6)	11.31 (287.0)
50X	<b>BX2490</b>	90.00 (2286.0)	24.00 (609.6)	11.31 (287.0)
38X	<b>BX3673</b>	73.50 (1866.9)	36.00 (914.4)	11.31 (287.0)
50X	<b>BX3690</b>	90.00 (2286.0)	36.00 (914.4)	11.31 (287.0)
38X	<b>BX4473</b>	73.50 (1866.9)	44.00 (1117.6)	11.31 (287.0)
50X	<b>BX4490</b>	90.00 (2286.0)	44.00 (1117.6)	11.31 (287.0)

### Top and Bottom Gutters

10.63-inch (269.9 mm) minimum.

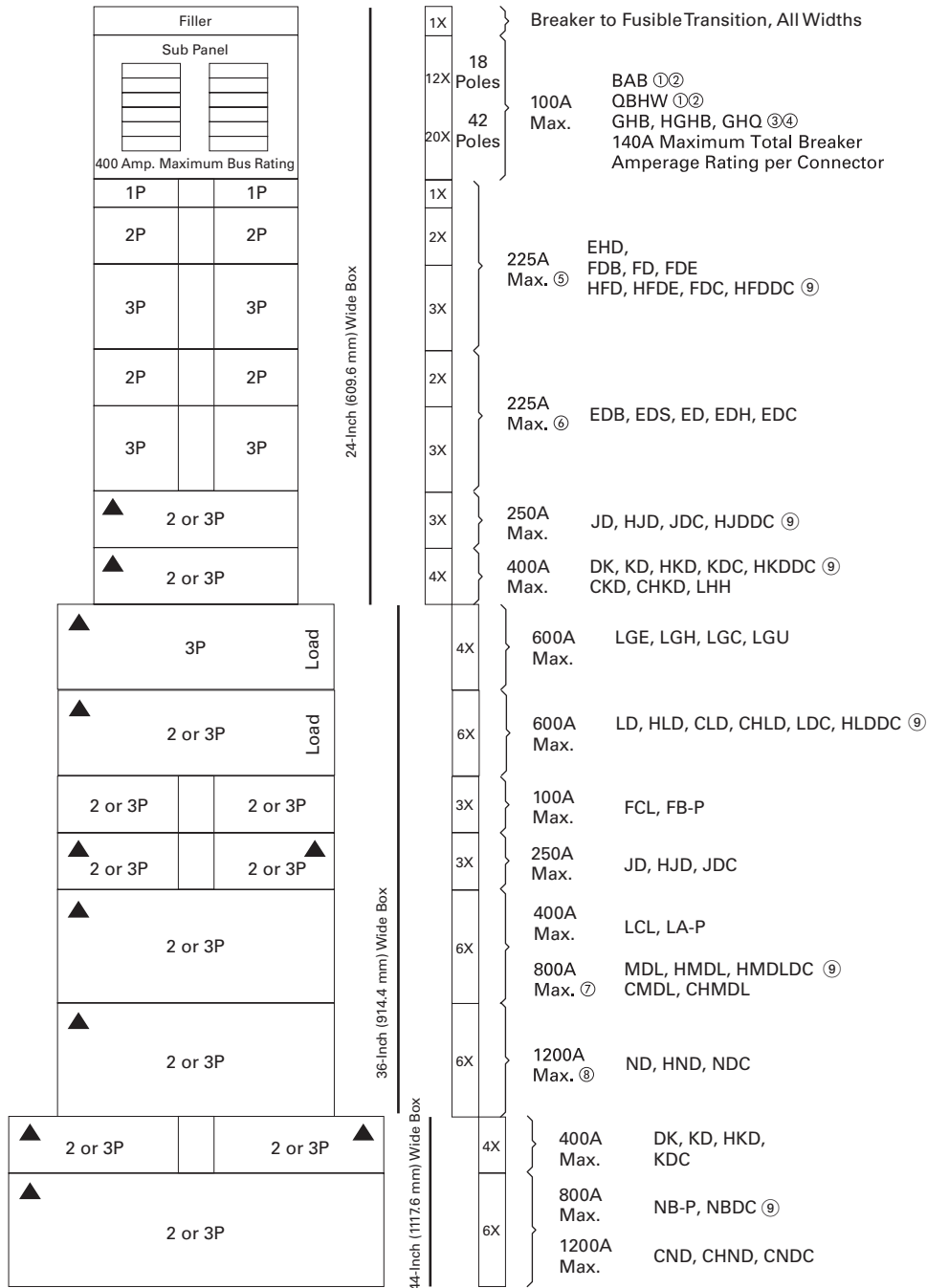
### Side Gutters—Minimum

24.00-inch (609.6 mm) wide box—5.00-inch (127.0 mm).  
 36.00-inch (914.4 mm) wide box—6.00-inch (152.4 mm).  
 44.00-inch (1117.6 mm) wide box—8.00-inch (203.2 mm).

### Notes

- <sup>①</sup> Box depth is 10.40 inches (264.2 mm), cover adds 0.90 inches (22.9 mm) to depth.  
 800A maximum bus size in 24.00-inch (609.6 mm) wide box. Flush trims not available on PRL4B panels.

### Layout for Branch and Horizontally Mounted Main Devices Layout—PRL4B



#### Notes

- ① BAB and QBHW breakers with shunt trips require one additional pole space, i.e., single-pole is two-pole size, two-pole is three-pole size, and three-pole is four-pole size.
- ② If panel contains only BAB or QBHW branch breakers, use a PRL1a panelboard.
- ③ GHB, HGHB or GHQ breakers cannot be mixed on same subchassis as BAB, QBHW.
- ④ If panel contains only GHB, HGHB or GHQ branch breakers, use a PRL2a panelboard.
- ⑤ When only one single-pole breaker of the group is required on either side of chassis, the single-pole breaker space required changes from 1X to 2X.
- ⑥ Minimum 36-inch (914.4 mm) wide box is required if optional #6–300 kcmil lug is required.
- ⑦ MDL main breaker in 24-inch (609.6 mm) wide box, refer to **Page V15-T2-53**.
- ⑧ Optional 750 kcmil terminal requires 44-inch (1117.6 mm) wide box.
- ⑨ For use on DC systems only.

See **Page V15-T2-53** for MLO or Neutral and Vertically Mounted Mains space requirements.

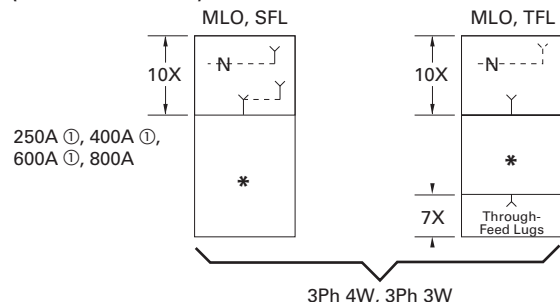
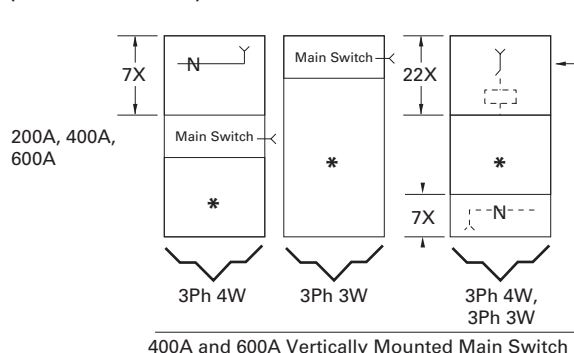
**Box Sizing and Selection—PRL4F**

Approximate Dimensions in Inches (mm)

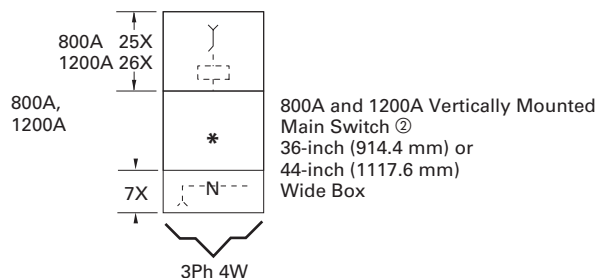
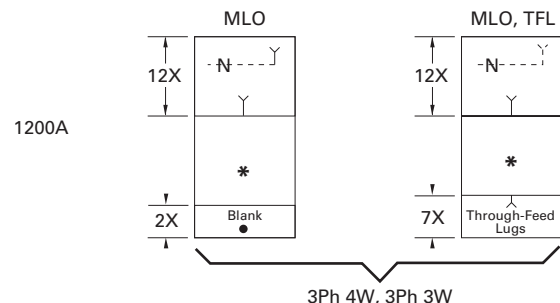
Main Lug (MLO), Main Switch, Neutral, Through-Feed (TFL) and Sub-Feed Lug (SFL) “X” Space Requirements. (For other configurations not shown, refer to Eaton.)

\* = Space available for branch devices. For device sizing, see **Page V15-T2-58**.

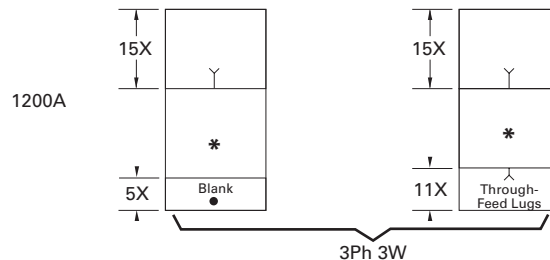
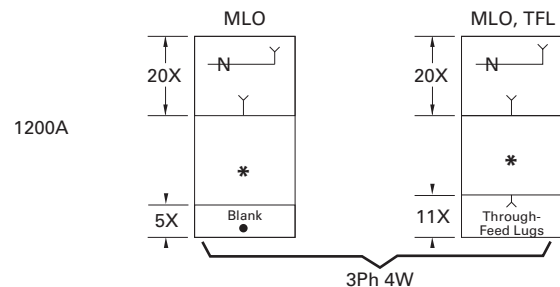
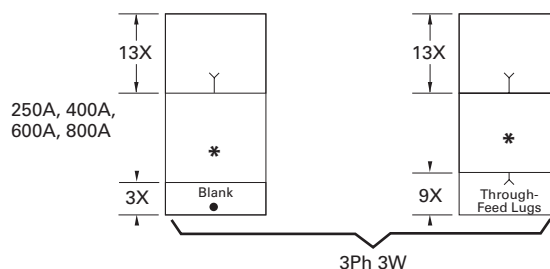
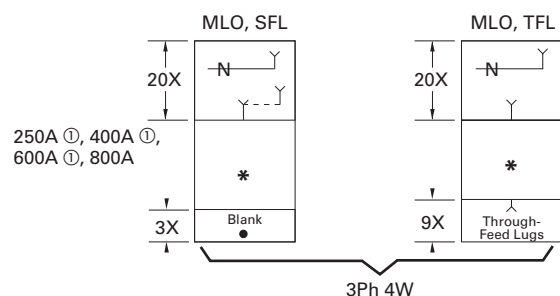
● = Blank means no bus under cover, to meet NEC cable bending space.

**PRL4F Layout****Standard Main Lug, Through-Feed and Sub-Feed Lugs ① (500 kcmil Maximum)****Main Switch with Neutral (when required) (500 kcmil Maximum)**

400A and 600A Vertically Mounted Main Switch



800A and 1200A Vertically Mounted Main Switch ②  
36-inch (914.4 mm) or  
44-inch (1117.6 mm)  
Wide Box

**Optional Main Lugs, Through-Feed and Sub-Feed Lugs ① (750 kcmil Maximum)****Notes**

① Sub-feed lugs are available 250–600A. For 600A, use 1200A “A” space.

② 800A and 1200A mains available only in vertical mounting.

Approximate Dimensions in Inches (mm)

### Panel Layout and Dimensions

To determine the dimensions of a given panelboard enclosure, make a layout sketch by fitting together the main, branch and lug modules according to the appropriate tables in the layout guide. Assign “X” units to each module as shown and obtain a total “X” number.

The height of the enclosure is related to the total “X” units in the layout as shown in table on right. Three standard box heights are available to accommodate any and all layout arrangements. “X” unit totals that do not exactly match those in table on right must be rounded off to the next higher standard (38X, 50X).

If a calculated “X” total for a panel exceeds 50X, the panel must be split into two or more separate sections with “X” space for through-feed lugs figured in for all but one section. If a neutral is required, a separate neutral bar and appropriate “X” space must be included in each section.

### Layout Example

- PRL4F, three-phase four-wire, 208Y/120 volt complete with 400A main switch and the following branches:
  - One 200A/three-pole
  - Two 100A/three-pole
  - Two 30A/three-pole

Panel to have short-circuit rating of 100 kA symmetrical.

### Reference PRL4F Layout Example

- From layout guide, total “X” height of panel = 43X.
- Rounded off to next higher standard = 50X.
- From table on right, enclosure height for 50X panel = 90 inches (2286.0 mm).
- Width = 36 inches (914.4 mm).
- Enclosure depth is standard for all PRL4 panelboards = 11.31 inches (287.0 mm).

### Type PRL4F Layout Example

400A Neutral		7X
30A/3P	30A/3P	4X
100A/3P	100A/3P	4X
200A/3P		6X
400A three-pole Main Switch (Vertical Mounted)		22X

Total = 43X

### Box Dimensions—PRL4F

“X” Units	Catalog Number	Height	Width	Depth <sup>①</sup>
38X	<b>BX3673</b>	73.50 (1866.9)	36.00 (914.4)	11.31 (287.0)
50X	<b>BX3690</b>	90.00 (2286.0)	36.00 (914.4)	11.31 (287.0)
38X	<b>BX4473</b>	73.50 (1866.9)	44.00 (1117.6)	11.31 (287.0)
50X	<b>BX4490</b>	90.00 (2286.0)	44.00 (1117.6)	11.31 (287.0)

### Top and Bottom Gutters

10.63 inches (269.9 mm) minimum.

### Side Gutters—Minimum

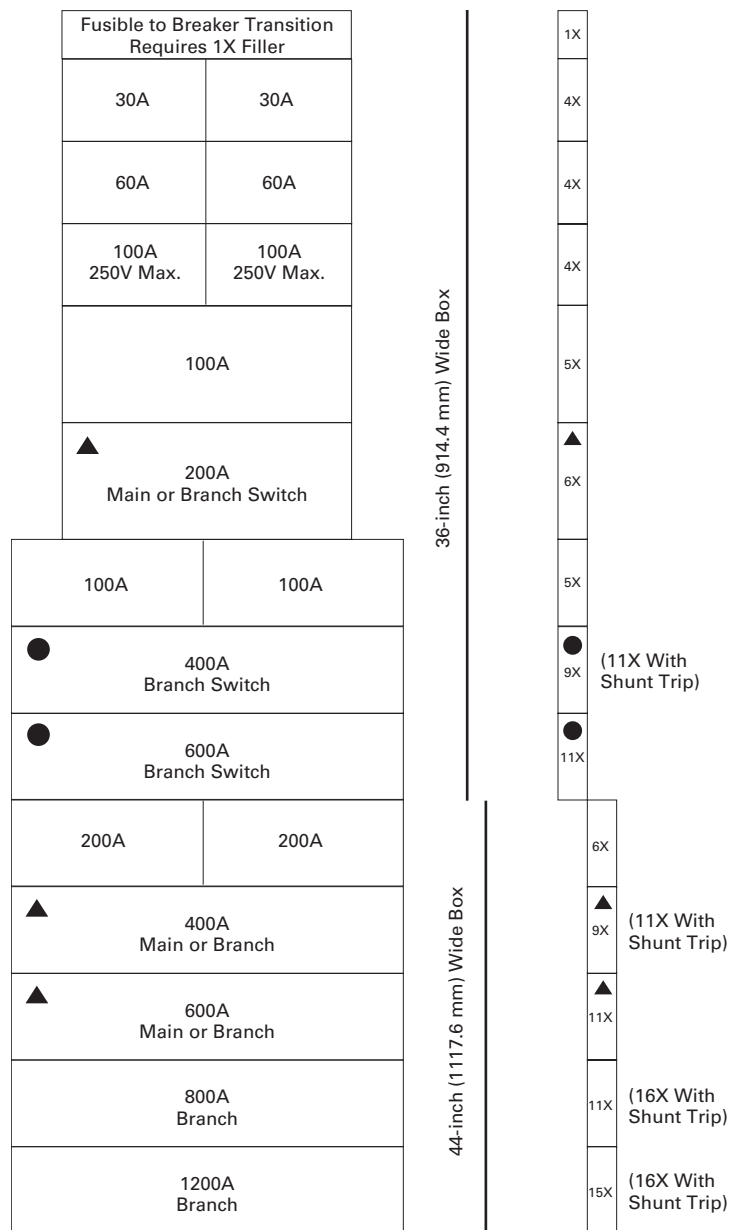
- 36-inch (914.4 mm) wide box:
  - 8-inch (203.2 mm)—200A maximum
  - 6-inch (152.4 mm)—400–1200A maximum
- 44-inch (1117.6 mm) wide box:
  - 10-inch (254.0 mm)—200A maximum
  - 8-inch (203.2 mm)—400–1200A

### Notes

<sup>①</sup> Box depth is 10.40-inch (264.2 mm), cover adds 0.90-inch (22.8 mm) to depth. Flush trims not available on PRL4F panels.

## Layout for Branch and Horizontally Mounted Main Device—PRL4F

2



▲ Fusible switch may be used as horizontally main.

● 400 and 600A horizontally mounted feeder switches in 36-inch (914.4 mm) or 44-inch (1117.6 mm) wide box. 400 and 600A horizontally mounted main switches only in 44-inch (1117.6 mm) wide box. For vertically mounted main, see **Page V15-T2-56** for sizing.

**Note:** See **Page V15-T2-56** for MLO or Neutral and Vertically Mounted Main space requirements.

### Panelboards and Lighting Controls



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Type PRL4 . . . . .	<b>V15-T2-49</b>
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### Types PRL1a, 2a, 3a, 4 Modifications Selection Guide

#### Modifications—Alphabetical Index

Modification	Item	Available on Panelboard Types				
		PRL1a	PRL2a	PRL3a	PRL4B	PRL4F
Ambient compensating breakers	1	No	No	Yes	Yes	—
Bus density	2	Yes	Yes	Yes	Yes	Yes
Cabinets—special: Types 2, 3R, 4, 4X, 12	3	Yes	Yes	Yes	Yes	Yes
Complete assembly	4	Yes	Yes	Yes	Yes	Yes
Compression type lugs, mains only	5	Yes	Yes	Yes	Yes	Yes
Concealed trim clamps (LT trim)	6	Yes	Yes	Yes	No	No
Conduit covers	7	Yes	Yes	Yes	Yes	Yes
Copper lugs	8	Yes	Yes	Yes	Yes	Yes
Copper main bus	9, 9a, 9b	Yes	Yes	Yes	Yes	Yes
Directory frame—metal	10	Yes	Yes	Yes	Yes	Yes
Doors, special	11	Yes	Yes	Yes	Yes	Yes
Fungus-proof	12	Yes	Yes	Yes	Yes	Yes
Ground bar	13	Yes	Yes	Yes	Yes	Yes
Electronic trip units	14	No	No	No	Yes	—
Ground fault protection (zero sequence)	15	No	No	No	Yes	Yes
Handle lockoff device	16	Yes	Yes	Yes	Yes	Std.
Hinges, special (LT trim)	17	Yes	Yes	Yes	Yes	Yes
Increased dimensions	18	Yes	Yes	Yes	No	No
Increased panel bus rating	19	Yes	Yes	Yes	No	No
Interiors to fit existing boxes	20	Yes	Yes	Yes	Yes	Yes
Locks, special (LT trim)	21	Yes	Yes	Yes	Yes	Yes
Molded case switches	22	Yes	Yes	Yes	Yes	No
Nameplates engraved	23	Yes	Yes	Yes	Yes	Yes

## Modifications—Alphabetical Index, continued

2

Modification	Item	Available on Panelboard Types				
		PRL1a	PRL2a	PRL3a	PRL4B	PRL4F
Neutral rated 200%	24	Yes	Yes	Yes	Yes	Yes
Painting and special coating	25	Yes	Yes	Yes	Yes	Yes
Permanent circuit numbers	26	Yes	Yes	Yes	Yes	Yes
Remote control switches (ASCO 920)	27	No	No	Yes	No	No
Service entrance	28	Yes	Yes	Yes	Yes	Yes
Shunt trips	29	Yes	Yes	Yes	Yes	Yes
Split bus or meter loop	30	No	No	Yes	No	No
Metering devices	31	No	No	No	Yes	Yes
Sub-metering, IQ Energy Sentinel	32	No	No	No	Yes	No
Sub-feed breakers	33	Yes	Yes	Yes	No	No
Sub-feed lugs	34	Yes	Yes	Yes	Yes	Yes
Tamperproof screws (LT trim)	35	Yes	Yes	Yes	Yes	Yes
Through-feed lugs	36	Yes	Yes	Yes	Yes	Yes
Time clock space only	37	Yes	Yes	Yes	—	—
Touchup paint	38	Yes	Yes	Yes	Yes	Yes
Surge protective device (SPD)	39	Yes	Yes	Yes	Ye	Yes
Terminals, copper only for breakers	40	Yes	Yes	Yes	Yes	—



**1. Ambient Compensating Breakers**

For ambient compensating breakers (where available) in lieu of standard breakers, add 10 percent to panelboard branch breaker and to main breaker list prices, if required. (Not UL listed.)

**2. Bus Density**

Main bus ampere rating is determined by UL listed temperature test. For 750A per square inch aluminum or 1000A per square inch copper, make price addition as follows:

**Modification 2**

Panel Type	Maximum Amperes
<b>Aluminum—750A per Square Inch</b>	
PRL1a, 2a	100
	225
	400
PRL3a	250
	400
PRL4	400
	800
<b>Copper—1000A per Square Inch</b>	
PRL1a, 2a	100
	225
	400
PRL3a	250
	600
PRL4	400
	1200

**3. Special Cabinet (Box) Construction****Modification 3**

Modification
<b>Type 1 Enclosure</b>
28-inch (711.2 mm) wide in place of standard 20-inch (508.0 mm) wide PRL1a, PRL2a, PRL3a
<b>Type 2 Enclosure</b>
(Drip-proof with gasketed trim) PRL1a, PRL2a, PRL3a 20-inch (508.0 mm) wide
<b>Type 3R Enclosure</b>
PRL1a, PRL2a 20-inch (508.0 mm) wide
PRL1a, PRL2a 28-inch (711.2 mm) wide
PRL3a ① 20-inch (508 mm) wide (600A maximum)
PRL3a ① 28-inch (711.2 mm) wide (600A maximum)
PRL4 24-inch (609.6 mm) or 36-inch (914.4) wide only
<b>Type 12 Enclosure</b>
PRL1a, PRL2a 20-inch (508.0 mm) wide
PRL1a, PRL2a 28-inch (711.2 mm) wide
PRL3a ① 20-inch (508 mm) wide (600A maximum)
PRL3a ① 28-inch (711.2 mm) wide (600A maximum)
PRL4 24-inch (609.6 mm) or 36-inch (914.4) wide only
Must also add bus density price from Modification 2 for PRL4
<b>Type 4 Enclosure or Type 4X Stainless Steel Enclosure</b>
Refer to Eaton

**4. Complete Assembly**

Complete assembly of panelboard box, interior and trim prior to shipment when required.

**5. Compression Main Lugs—Al/Cu Burndy Range Taking**

For other terminal types and box sizes, refer to Eaton.

**Modification 5—Compression Lug Data**

Main Amperes	Wire Range by Panel Type		
	PRL1a and PRL2a	PRL3a	PRL4
100	(1) #1–1/0 or (1) 2/0–300 kcmil	—	—
125	—	(1) #4–2/0 or (1) 2/0–300 kcmil	—
225	(1) 2/0–300 kcmil or (1) 4/0–500 kcmil	—	—
250	—	(1) 2/0–350 kcmil or (1) 4/0–500 kcmil	(2) 500–750 kcmil
400	(2) 4/0–300 kcmil or (2) 500–750 kcmil	(2) 4/0–300 kcmil or (2) 500–750 kcmil	(2) 500–750 kcmil
600	—	(2) 2/0–500 kcmil or (2) 500–750 kcmil	(2) 500–750 kcmil
800	—	—	(3) 500–750 kcmil
1200	—	—	(4) #2–600 kcmil or (4) 500–750 kcmil

**Modification 5—Box Height Additions**

Main Amperes	PRL1a, PRL2a	PRL3a without Neutral	PRL3a with Neutral
100	0	0X	0X
225	0	—	—
250	—	2X	5X
400	0	0X	0X
600	—	0X	0X

Maximum size for PRL1a and PRL2a panels:  
1–750 kcmil per phase, or 2–500 kcmil per phase.  
For PRL4 panels, see layout pages.

**6. Concealed Trim Clamps—LT Trim****Modification 6****Description**

Add per panel PRL1a, PRL2a, PRL3a

**7. Conduit Covers**

Fabricated sheet metal to cover open conduits above and/or below standard Type 1 box.

**Modification 7****Cover Type**

Conduit Enclosing Shield (open back)  
PRL1a, PRL2a, PRL3a, PRL4—Refer to Eaton

Conduit Enclosure (solid back)  
PRL1a, PRL2a, PRL3a, PRL4—Refer to Eaton

**Note**

① At 600A, PRL3a requires the addition of density rated copper bus for Type 3R or 12 enclosure.

**8. Copper Lugs**

Optional copper mechanical main lugs only. (Includes main incoming neutral lug.)

**Modification 8**

Main Amperes	Wire Range and Number of Lugs Per Phase
100	(1) #14–1/0
225	(1) #6–250 kcmil
250	(1) #6–250 kcmil
400	(2) #1/0–600 kcmil
600	(2) #1/0–600 kcmil
800	(2) #1/0–600 kcmil
1200	(3) #1/0–600 kcmil

**Modification 8—Box Height Additions**

Main Amperes	PRL1a, PRL2a	PRL3a without Neutral	PRL3a with Neutral	PRL4
100	0	0X	0X	—
225	0	—	—	—
250	—	0X	0X	0X
400	0	0X	0X	0X
600	—	1X	1X	0X
800	—	—	—	0X
1200	—	—	—	0X

**9. Copper Main Bus****Modification 9**

Available in PRL1a, PRL2a, PRL3a and PRL4

**9a. Silver-Plated Copper Main Bus****Modification 9a**

Available in PRL1a, PRL2a, PRL3a and PRL4

**9b. Tin-Plated Copper Main Bus (PRL1a, 2a, 3a, Only)****Modification 9b****Panel Type**

PRL1a, PRL2a, PRL3a

**10. Directory Frame—Metal****Modification 10****Frame Type**

Metal frame, plastic cover

**11. Trim and Door Modifications—Special Fronts and Doors****Modification 11****Description**

Door-in-door, one door over interior and one which exposes gutter. (LT Trim) (PRL1a, PRL2a, PRL3a only)

Common trim for two section panels with boxes bolted together. (LT Trim) (PRL1a, PRL2a, PRL3a only)

Standard flush lock with quarter turn fasteners at top and bottom of trim door (LT Trim) (standard on doors 48-inch (1219.2 mm) high and over). (PRL1a, PRL2a, PRL3a only)

To provide a trim with a lockable door for PRL4 panels (door-in-door is standard with this adder). Includes National lock with standard keying. <sup>①</sup>

**Add per panel**

**12. Fungus Proofing**

For fungus proofing external portions of circuit breakers and all non-metallic parts, add 10 percent of total panelboard list price. For fungus proofing fusible switches and all non-metallic parts, add 20 percent of total panelboard list price.

**13. Ground Bar****Modification 13**

Description		Bar Type
Panel Type		
PRL1a	Aluminum terminal bar for aluminum or copper cable	Standard, insulated/isolated ②
PRL2a		
PRL3a	Copper terminal bar for copper cable only	Standard, insulated/isolated ②
PRL4		
Column Type		
In Pull Box	Aluminum terminal bar for aluminum or copper cable	Standard, insulated/isolated ②
In Gutter		
	Copper terminal bar for copper cable only	Standard, insulated/isolated ②

**Notes**

<sup>①</sup> Extra depth box is required. Box will be 12.82-inch (325.6 mm) deep.

<sup>②</sup> For PRL1a, 2a, 3a and Column Type panelboards. The insulated/isolated ground bar includes a standard ground bar.

**14. Electronic Trip Units****Modification 14—Applies to Digitrip 310 and 310+ Trip Units****Description**

K-, L- and M-Frame Circuit Breaker (three-pole only)

Digitrip RMS310 LS

Digitrip RMS310 LSI

Digitrip RMS310 LSG ①

Digitrip RMS310 LSIG ①

N-Frame circuit breaker

Digitrip RMS310 LS

Digitrip RMS310 LSI

Digitrip RMS310 LSG ①

Digitrip RMS310 LSIG ①

Digiview Ammeter for 310+ Trip Unit

**15. Zero Sequence Ground Fault Protection**

For main devices only (circuit breakers or FDPW switch) in PRL4 assembled panels. Available in 250–1200A panels.

Price includes current monitors, ground bar, static sensor, shunt trip, necessary space, mounting and connecting in panelboards. Price does not include circuit breaker or FDPW switch.

Zero sequence ground fault is available with the following family of main devices:

**Modification 15****Main Device**

JD, KD, LD, MDL, ND, LCL, LA-P, NB-P  
FDPW switches  
(400–1200A)

**16. Circuit Breaker Handle Lockoff Devices****Modification 16****Breaker Types****Non-Padlockable**

BAB, QBHW, GHB, EHD, FDB, FD, ED, EDH, EDC, HQP, QPHW

JD, KD, MDL, ND

**Padlockable**

EHD, FDB, FD, HFD, FDC, ED, EDH, EDC, GHB, BAB, QBHW, HQP, QPHW, EGB, EGS, EGH

JD, KD, LD, MDL, ND, FDE, HFDE

**17. Special Hinges—LT Trim**

Piano hinges in lieu of standard hinges.

**18. Increased Dimensions (PRL1a, PRL2a and PRL3a Only)  
Type 1 Enclosure Only****Modification 18****Description****Increased End Gutters**

4 inch (101.6 mm) Top or Bottom

7 inch (177.8 mm) Top or Bottom

12 inch (304.8 mm) Top or Bottom

**Increased Side Gutters**

4 inch (101.6 mm) Left or Right

7 inch (177.8 mm) Left or Right

12 inch (304.8 mm) Left or Right

**19. Increased Panel Main Bus Rating (Three-Phase Four-Wire,  
Single-Phase Three-Wire)****Modification 19****Main Bus****Ampere Rating****Panel Type**

100–225/250 PRL1a, PRL2a, PRL3a

225–400

600 (PRL3a)

250–400 PRL4

400–600

600–800

800–1200

**20. Interior and Fronts to Fit Existing Boxes**

Refer to Eaton.

**21. Special Locks****Modification 21****Description****LT Type Trim**

Yale 511S with rosette

Yale 4651S (LL803 Key)

Master keying—above locks or standard lock—per panelboard

Corbin 15767 (Cat. #60 Key)

PRL1a, PRL2a, PRL3a

Tee handle and 3-point catch

PRL1a, PRL2a, PRL3a

COMPX metal lock with standard keying

PRL1a, PRL2a, PRL3a

COMPX metal lock with GE75 keyway

PRL1a, PRL2a, PRL3a, PRL4

**EZ Type Trim**

Standard Lock, Keyed GE75

Standard Lock, Keyed to Corbin TEU-1

Standard Lock, Keyed to Corbin Cat 60

Standard Lock, Keyed to Corbin WEM1

**Notes**

① Main breaker only.

PRL4 with door includes National lock with standard keying. See **Modification 11**.

**22. Molded Case Switches (Three-Pole, Two-Pole)****Modification 22****Not UL Listed**

Breaker Frame	Maximum Volts	Maximum Amperes
EHD	480	100
FD	600	225
JD	600	250
DK	240	400
KD	600	400
LD	600	600
MDL	600	800
ND	600	1200

**23. Nameplates, Engraved****Modification 23****Type**

Mastic back and installed by purchaser, per nameplate

Fixed to panel trim with two screws or rivets, per nameplate  
PRL1a, PRL2a, PRL3a only**24. Neutral Rated 200%****Modification 24**

Main Bus Rating	Neutral Rating
100	225
225	450
250	500
400	800
600	1200

**Modification 24—Box Height Additions**

Main Bus Rating	Neutral Rating	PRL1a, PRL2a	PRL3a	PRL4
100	225	0	0X	—
225	450	0	—	—
250	500	—	3X	0X
400	800	0	3X	0X
600	1200	—	3X	0X

**Note:** Dimensions based on mechanical lugs. For compression or copper lugs, refer to Eaton.

For 800 and 1200A PRL4 with 200% neutral, refer to Eaton.

**25. Painting and Special Coatings**

Standard boxes are code-gauge galvanized sheet steel. Standard trims are code-gauge sheet steel with a rust inhibiting phosphatized coating and finished with ANSI-61.

**Modification 25****Description**

Painted boxes (ANSI-61)

Painted trims or boxes (other than ANSI-61)

**26. Permanent Circuit Numbers****Modification 26****Description**

To provide permanently attached Micarta Xcircuit numbers.

**27. Remote Control Switches—ASCO 920 (Three-Pole, Two-Pole)**

Electrically operated, mechanically held remote control switch directly mounted to panelboard bus for total or split bus switching applications.

(For split bus applications, make price addition from **Modification 30.**)

480 Vac maximum short-circuit rating of panelboard is 22 kAIC maximum.

Includes complete installation in the panelboard with a screw cover over the switch compartment.

Pushbuttons or other control devices are not included. For control circuit modifications, refer to Eaton.

**Modification 27—Remote Control Switches (PRL3a Only)****Switch Rating Amperes**

30, 60, 75, 100, 150, 200, 225

**Modification 27—Remote Control Switch Modifications****Description**

Two-wire control relay

Three-wire control relay

Control power transformer

To provide hinged cover in place of standard screw cover

**28. Service Entrance**To provide a Service Entrance Label as detailed under the “Service Entrance Equipment” in application considerations. Only panelboards meeting these requirements can be labeled as such. The requirement for a Service Entrance Label must be noted on order entry. Includes neutral disconnect link and Service Entrance Equipment Label. (Ground bar not included—see **Modification 13.**)**Modification 28****Panel Type**

PRL1a, PRL2a, PRL3a, PRL4

**29. Shunt Trip for Main or Branch Circuit Breaker and FDPW Switches**

For tripping device from a remote point. Voltage and frequency must be specified. Wiring to terminal blocks is not included. Standard leads extend 18-inches (457.2 mm) out of device.

Factory-installed 120, 240 or 480 Vac shunt trips are available with UL listing as shown in table below. Underwriters Laboratories listing is not available for shunt trip mounted on molded case switches.

**Modification 29****Device**

BAB, QBHW

Requires one additional pole space, i.e., single-pole is two-pole size, two-pole is three-pole size and three-pole is four-pole size.

GHB (three-pole only)

All other circuit breakers

FDPW switch (400–1200A)

**30. Split Bus or Meter Loop (250A Max., 3Ph 4W, 3Ph 3W, 1Ph 3W, 1Ph 2W)**

Panel type PRL3a only. For enclosure size, refer to Eaton.

**Modification 30****Main Bus Amperes**

100–250

**31. Metering Devices (PRL4 Only)**

IQ digital metering for incoming service. Devices are installed in chassis mounted compartment with hinged door. Standard CTs (1200A maximum) are included with devices. Requires copper bus at 1200A.

**Modification 31**

Device	Box Height Addition
IQ 130 with CTs and display	13X
IQ 130 with CTs, no display	13X
IQ 140 with CTs and display	13X
IQ 140 with CTs, no display	13X
IQ 150 with CTs and display	13X
IQ 150 with CTs, no display	13X
IQ 210 with CTs	13X
IQ 220 with CTs	13X
IQ 230 with CTs	13X
IQ 230M with CTs	13X
IQ 250 with CTs and display	13X
IQ 250 with CTs, no display	13X
IQ 260 with CTs and display	13X
IQ 260 with CTs, no display	13X
PXM 2250 with CTs and display	13X
PXM 2250 with CTs, no display	13X
PXM 2260 with CTs and display	13X
PXM 2260 with CTs, no display	13X
PXM 2270 with CTs and display	13X
PXM 2270 with CTs, no display	13X

**32. Sub-Metering IQ Multi-Point Submeter II (PRL4 Only)**

Microprocessor-based breaker-mounted device to monitor power and energy (kW, kWh, kW demand). Device mounts on the load side of three-pole F-, J- and K-Frame feeder breakers. Units are shipped with the interior for field installation. Minimum box width of 36 inches (914.4 mm) is required.

**Modification 32****IQ Energy Sentinel**

F-Frame three-pole (150A maximum)

J-Frame three-pole

K-Frame three-pole

**33. Sub-Feed Breakers****Modification 33—Panel Types PRL1a, PRL2a, PRL3a One Breaker Per Panel**

Maximum Amperes	Number of Poles	Breaker Type	Interrupting Rating (kA Symmetrical)		Box Height Addition PRL3a
			240V	480V	
100	2	EHD	18	14	NA
150	2	FDB	18	14	NA
225	2	FD	65	35	NA
225	2	HFD	100	65	NA
225	2	FDC	200	100	NA
225	2	EDB	22	—	NA
225	2	EDS	42	—	NA
225	2	ED	65	—	NA
225	2	EDH	100	—	NA
225	2	JD	65	35	14X
225	2	HJD	100	65	14X
225	2	JDC	200	100	14X
250	2	JD	65	35	14X
250	2	HJD	100	65	14X
250	2	JDC	200	100	14X
400	2	DK	65	—	15X
400	2	KD	65	35	15X
400	2	HKD	100	65	15X
400	2	KDC	200	100	15X
100	3	EHD	18	14	NA
150	3	FDB	18	14	NA
225	3	FD	65	35	NA
225	3	HFD	100	65	NA
225	3	FDC	200	100	NA
225	3	EDB	22	—	NA
225	3	EDS	42	—	NA
225	3	ED	65	—	NA
225	3	EDH	100	—	NA
225	3	JD	65	35	14X
225	3	HJD	100	65	14X
225	3	JDC	200	100	14X
250	3	JD	65	35	14X
250	3	HJD	100	65	14X
250	3	JDC	200	100	14X
400	3	DK	65	—	15X
400	3	KD	65	35	15X
400	3	HKD	100	65	15X
400	3	KDC	200	100	15X

**Note:** 225A maximum on Column Type panels. Sub-feed breaker not available on PRL3a panel with subchassis.

**Modification 33—Panel Type PRL3a Only. Two Breakers Per Panel—Twin Mounted**

Maximum Amperes	Number of Poles	Breaker Type	Interrupting Rating (kA Symmetrical)		Box Height Addition PRL3a
			240 Volts	480 Volts	
225	2	JD	65	35	20X
225	2	HJD	100	65	20X
225	2	JDC	200	100	20X
250	2	JD	65	35	20X
250	2	HJD	100	65	20X
250	2	JDC	200	100	20X
225	3	JD	65	35	20X
225	3	HJD	100	65	20X
225	3	JDC	200	100	20X
250	3	JD	65	35	20X
250	3	HJD	100	65	20X
250	3	JDC	200	100	20X

**34. Sub-Feed Lugs (3Ph 4W, 3Ph 3W, 1Ph 3W, 1Ph 2W)**

**Note:** Not available on service entrance panels with main lugs only (six disconnect rule).

Mechanical Al/Cu lugs. Compression or copper lugs requires additional price adder from **Modification 5—Compression Lug Data** or **Modification 8** as appropriate.

Available on main lug panels only.

**Modification 34**

Main Amperes	Box Height Addition
<b>Panel Types PRL1a, PRL2a</b>	
100–225	0X
<b>Panel Type PRL3a</b>	
100–250	1X
<b>Panel Type PRL4</b> <sup>①</sup>	
250–400	0X
600	4X

**35. Tamperproof Screws—LT Trim****Modification 35****Description**

Tamperproof screws for trims, in lieu of standard screws.

**36. Through-Feed Lugs (3Ph 4W, 3Ph 3W, 1Ph 3W, 1Ph 2W)**

**Note:** 225 amperes maximum on Column Type panels. Not available on service entrance panels with main lugs only (six disconnect rule).

Mechanical Al/Cu lugs. Compression or copper lugs requires additional price adder from **Modification 5—Compression Lug Data** or **Modification 8** as appropriate.

Not available on panels with sub-feed breaker.

**Modification 36**

Main Amperes	Box Height Addition
<b>Panel Types PRL1a, PRL2a</b>	
100	②
225	②
400	②
<b>Panel Type PRL3a</b>	
100	2X
250	5X
400	8X
600	8X
800	14X
<b>Panel Type PRL4</b> <sup>②</sup>	
250	7X
400	7X
600	7X
800	7X
1200	5X

**37. Time Clock Space Only**

Includes box, trim, door and mounting pan.

**Modification 37****Enclosure Type****Type 1**

PRL1a, PRL2a, PRL3a (24-inch (609.6 mm) space)

PRL1a, PRL2a, PRL3a (36-inch (914.4mm) space)

**Type 3R**

PRL1a, PRL2a, PRL3a (24-inch (609.6 mm) space)

**38. Touchup Paint****Modification 38****Description**

12 oz. spray can. ANSI-61 light gray indoor

Case Lot of 12—12 oz. spray cans. ANSI-61 light gray indoor single style

**Notes**

① Refer to PRL4 layout.

② Refer to panelboard sizing charts.

**39. Surge Protective Device (SPD)****Type PRL1a, PRL2a and PRL 3a and Panelboards**

Package includes SPD unit connected to the panelboard bus.

Available for all enclosure types.

Sizing:

PRL1a, PRL2a: Add 7 inches (177.8 mm) to the standard box height.

PRL3a: Add 4X for 100–200 kA SPD units.

**Type PRL4 and Elevator Control Panelboards**

Package includes SPD unit and integral circuit breaker disconnect (30A) connected to the panel bus.

Available for all enclosure types.

The SPD unit and integral circuit breaker disconnect will require 7X of chassis space. (Only available in 36-inches (914.4 mm) or 44-inches (1117.6 mm) wide enclosure.)

**Modification 39**

Description	kA/Phase									
Surge Current Rating	50	80	100	120	160	200	250	300	400	
SPD Package Options										
Basic										
LEDs monitor L-N, L-G, L-L and N-G										
PRL1a, PRL2a, PRL3a	■	■	■	■	■	■	—	—	—	
PRL4, Elevator Control Panelboard	■	■	■	■	■	■	■	■	■	
Standard Feature Package										
LEDs monitor L-N, L-G, L-L and N-G										
EMI/RFI filtering										
Audible alarm with disable switch										
Form C relay contact										
PRL1a, PRL2a, PRL3a	■	■	■	■	■	■	—	—	—	
PRL4, Elevator Control Panelboard	■	■	■	■	■	■	■	■	■	
Standard Package										
LEDs monitor L-N, L-G, L-L and N-G										
EMI/RFI filtering										
Audible alarm with disable switch										
Form C relay contact										
Six digit LCD display										
Counts surges in all modes										
Non-volatile memory (no battery backup)										
Reset button designed to prevent accidental resets										
PRL1a, PRL2a, PRL3a	■	■	■	■	■	■	—	—	—	
PRL4, Elevator Control Panelboard	■	■	■	■	■	■	■	■	■	

**40. Copper Wire Only Terminals for Molded Case Circuit Breakers**

(To replace standard Al/Cu terminals.)

**Modification 40**

Breaker Frame	Maximum Breaker Ampere Rating	Terminal Material	Wire Range
F	225	Copper	#4–4/0
J	250	Stainless Steel	#4–350
K	225	Copper	(1) #3–350
	350	Copper	(1) 250–500
	400	Copper	(2) 3/0–250
L	600	Copper	(2) 250–500
M	600	Copper	(2) #2/0–500
	800	Copper	(3) #3/0–300
N	700	Copper	(2) #2/0–500
	1000	Copper	(3) #3/0–500
	1200	Copper	(4) #3/0–400

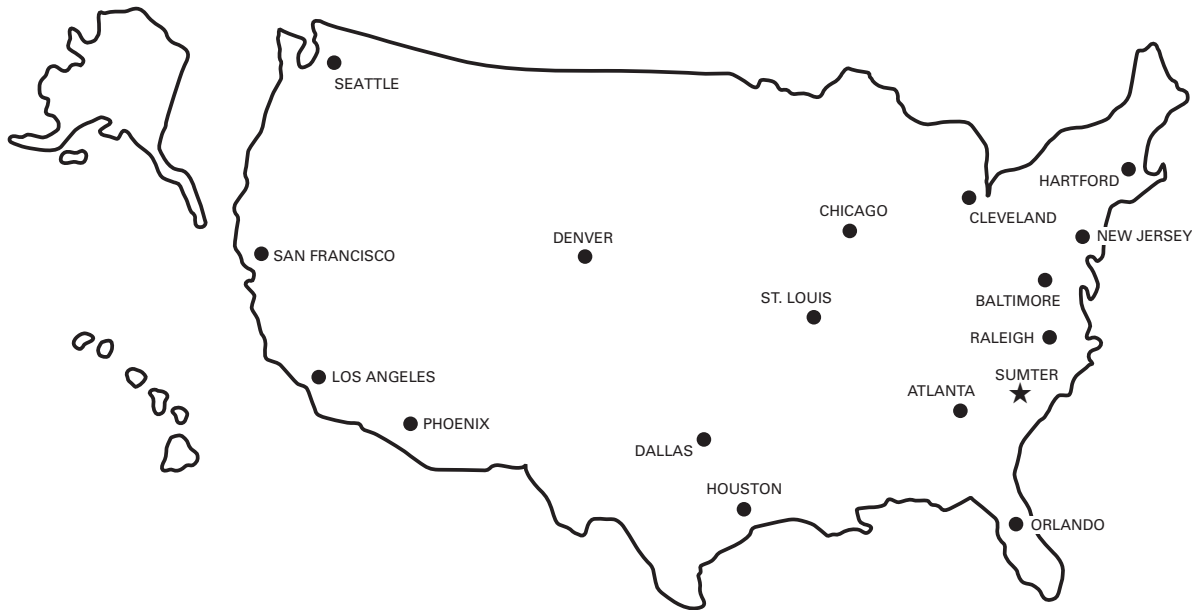
**Note**

- ① Requires 15A branch breaker for cable connection—three-pole (three-phase) or two-pole (single-phase). (Add breaker separately, not included in price.)



## Manufacturing Plant Locations

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**Main Plant****Sumter**

845 Corporate Circle  
P.O. Box 2258  
Sumter, SC 29150  
Phone (803) 481-3131

**Satellite Plants****Atlanta**

7000 Highlands Parkway SE  
Suite 102  
Smyrna, GA 30082  
Fax (770) 433-1863  
Phone (678) 309-4260

**Baltimore**

7451 Coca Cola Drive  
Suite C  
Hanover, MD 21076  
Fax (410) 796-7755  
Phone (410) 796-7777

**Chicago**

220 Windy Point Drive  
Glendale Heights, IL 60139  
Fax (630) 260-6303  
Phone (630) 860-3569

**Cleveland**

12875 Corporate Drive  
Suite E  
Parma, OH 44130  
Fax (216) 433-0545  
Phone (216) 433-0616

**Dallas**

631 Westport Parkway  
Suite 100  
Grapevine, TX 76051  
Fax (817) 251-6249  
Phone (817) 251-6797

**Denver**

2450 Airport Road  
Suite C  
Aurora, CO 80011  
Fax (303) 366-9993  
Phone (303) 366-2080

**Hartford**

40A International Drive  
Windsor, CT 06095  
Fax (860) 298-1305  
Phone (860) 298-1306

**Houston**

10810 West Little York  
Suite 100  
Houston, TX 77041  
Fax (713) 688-3764  
Phone (713) 688-8430

**Los Angeles**

Electrical Sector—Satellite  
11120 Philadelphia Street  
Mira Loma, CA 91752  
Fax (951) 685-3775  
Phone (951) 685-5788

**New Jersey**

96 Stemmers Lane  
Westampton, NJ 08060  
Fax (609) 835-4777  
Phone (609) 835-4230

**Orlando**

9436 Southridge Park Court  
Suite 100  
Orlando, FL 32819  
Fax (407) 841-9135  
Phone (407) 264-9301

**Phoenix**

921 South Park Lane  
Tempe, AZ 85281  
Fax (480) 449-4223  
Phone (480) 449-4222

**Raleigh**

2933 S. Miami Boulevard  
Suite 111  
Durham, NC 27703  
Fax (919) 572-9751  
Phone (919) 544-7074

**St. Louis**

56 Soccer Park Road  
Fenton, MO 63026  
Fax (636) 717-3590  
Phone (636) 717-3500

**San Francisco**

20923 Cabot Boulevard  
Hayward, CA 94545  
Fax (510) 784-8980  
Phone (510) 784-8981

**Seattle**

1604 15th Street SW  
Suite 114  
Auburn, WA 98001  
Fax (253) 833-5058  
Phone (253) 833-5021

**Satellites**

**A unique concept of facilities close to customer locations, assuring fast delivery of standard- and custom-assembled equipment *when it's needed.***

Located at strategic locations throughout the United States, these facilities manufacture and deliver standard or custom-assembled panelboards, switchboards and enclosed circuit breakers...when and where you need them. And, when you have an emergency, they can have your equipment ready in hours.

Highly trained and experienced personnel will manage your order and ensure that you receive on-time delivery of high quality equipment that meets your specifications.

**Special Configurations**

The unique capabilities of these plants and people can provide solutions for special products to meet special needs.

Typical examples include special dimensions, retrofit equipment and panelboard interiors to fit existing boxes.

**Speedy Delivery**

- Panelboards: from one to five days.
- Switchboards: between five and 10 days.
- Assembled Enclosed Circuit Breakers: from one to 10 days.

**Save Time and Money**

No matter your location, you will save time and money when ordering from a satellite. For more information, contact your Eaton representative or authorized distributor.

**Additional Information**

For information on reverse feed breaker applications, please see **Consulting Application Guide—Molded-Case Circuit Breakers & Enclosures**, CA08104001E, Tab 27.



Product Group Overview

Eaton has created several key support groups, for the direct purpose of providing the highest quality service available today in the renewable energy market segment. These valued-added support capabilities allow us to provide a level of service above all other manufacturers and regional independent organizations. Below is a description of the groups involved in completing any successful solar photovoltaic turnkey project from design through construction. Equipment startup and system commissioning and even long-term maintenance requirements are part of Eaton’s strengths.

Features

- Feasibility studies
- AC interconnection analysis
- DC and photovoltaic system engineering
- Turnkey construction
- Utility interconnection substations
- Equipment manufacturer
- Equipment and system commissioning
- Monitoring services
- Long term maintenance

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## Solar Renewable Analysis and Consultation

### Product Overview

Eaton's team can provide a cost-effective review with recommendations that maximizes solar renewable energy production. Eaton's approach investigates all or some of the following:

- Analysis of solar production potential by applying various methods of fixed, tilt and tracking systems
- Analysis of electrical interconnect feasibility and power usage
- Analysis of term-term maintenance and monitoring options and associated costs
- Development of Life-Cycle-Cost-Analysis (LCCA) for potential solar sites
- Initial analysis via use of Google-Earth photographs if feasible
- If required, specific site visits to further investigate the above
- If required, site visual audit of electrical equipment operating conditions
- Establishing a "Solar Production Index" when evaluating multiple sites
- Identify any potential issues with equipment life expectancy and warranty fulfillment obligations

Our analysis starts with the following premises that have been communicated to us by developers:

- Need to maximize solar energy production with expected 20-year solar variations
- Estimated construction costs identified and technical opinion of project completion from a technical and construction standpoint
- Preliminary review of any potential civil or structural issues involving potential solar sites
- Best practice recommendations for long-term monitoring to ensure maximum uptime and energy production to match the financial model
- Need for experienced analysis of hardware supplied, life expectancy and potential issues with warranty fulfillment obligations
- Recommendations for ongoing maintenance, operations and failure response

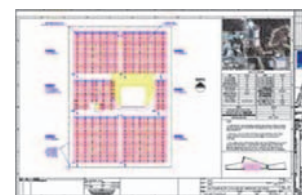
### Product Description

Eaton's Electrical Services & Systems Group has extensive experience in electrical power distribution systems design, installation, start-up, commissioning, maintenance, trouble-shooting, life-extension and ongoing monitoring of operating parameters as well as failure indicators. We have added expertise and direct experience in the area of solar renewable energy projects, therefore providing developers and investors a non-biased technical review of potential solar sites.

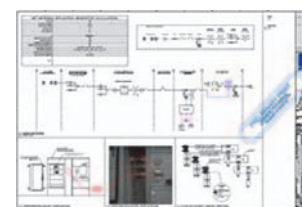
### Terms and Conditions

Eaton can provide the above services in accordance with Eaton Standard Terms and Conditions or other mutually acceptable terms at either a fixed price or a time-and-material basis. If you have any questions or requests, please contact your local Eaton Engineering Services & Systems office today.

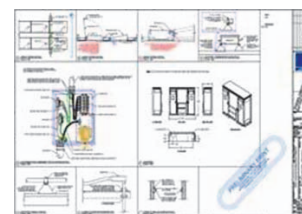
### Roof and Wind Analysis



### Electrical Design



### Construction Details





## Solar Design

### Product Overview

#### Interconnection Analysis Services

Power system analysis services offer a focused and systematic approach to enhance performance and design, validate equipment selection, and simulate response to abnormal conditions. Typical analysis services performed during design of new renewable generation sites include:

- **Short-Circuit Analysis**—Calculation of the available short-circuit currents at equipment locations throughout the power system. Evaluation of equipment ratings ensures equipment can withstand, and, where applicable, interrupt an electrical fault. Results are critical for proper system design, including specification and selection of equipment
- **Protective Device Coordination**—Determination of necessary characteristics, ratings, and settings for electrical protective devices
- **Arc Flash Analysis**—Calculation of arc flash hazards associated with energized work at locations throughout the power system in accordance with NFPA 70E, IEEE1584, National Electric Safety Code, and Z462 requirements
- **Load Flow Analysis**—Analysis of the system's capacity to supply electrical energy from the renewable energy source to the utility or customer under steady-state conditions, determination of appropriate continuous ratings for electrical equipment, and optimal placement and characteristics of reactive power compensation equipment
- **Harmonic Analysis**—Evaluation of harmonic currents on the electrical system introduced by the renewable energy source and application of harmonic mitigation equipment and design techniques
- **Transient Stability Analysis**—Evaluation of dynamic behavior of the renewable source and system voltages during transient conditions such as system faults or start-up
- **Switching Transient Analysis**—Analysis of system behavior during switching conditions to identify possible damaging voltage transients. Results are used to design and specify mitigation equipment such as snubbers

Typical design services include:

- **Distribution System Design**—Design and specification of the electrical distribution system from the point of interconnection to generation equipment
- **Substation Design**—Complete substation design service is available, including ground grid analysis and design, substation layout, equipment specification, protection, and control
- **Protection and Control**—Design of advanced electrical protection and control including transmission line protection, system automation, advanced metering and smart grid capabilities

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**DC Engineering Services**

One-line diagram of the power system is critical to support the system evaluation and analysis. The one-line diagram shows the identification and ratings of electrical equipment such as: transformers, cables, circuit breakers, protective relays, fuses, switches, current transformers, surge arresters, and so on. ANSI device numbers identify protective relay types. The one-line diagram is typically provided with each type of power system study. Electrical one-line diagram, showing DC and AC portions of the system, to include the following:

- Solar module manufacturer, type and catalog number; number of module strings, number of modules per string (DC)
- Make, model, DC kW rating of solar panels
- Make, model, AC kW rating of inverter(s)
- Make, model, voltage, and current interrupt rating of all AC and DC disconnect switches
- Make and model of all lightning arrestors and surge suppression equipment
- Make and model of combiner boxes and fuses
- Make, model and rating of all circuit breakers and electrical panels
- Make and model of the utility meter
- Size, insulation rating, and temperature rating of system wiring and nominal voltage present on each line

- Complete electrical circuit back to customer's utility connection. All customer electrical panels related to the PV system shall be shown. Such panels shall be labeled with the make, model, bus rating and customer designation. The main circuit breaker shall also be labeled with the make and rating (if applicable)
- Proper compliance with all authorities having jurisdiction
- Step up transformer, MV switchgear, and point of utility connection

Typical DC connection drawing, showing the following:

- Typical termination for a solar module string
- Typical panel to panel termination
- Typical combiner box termination
- Develop cable routing and interconnection details
- Step up transformer, MV switchgear, point of utility connection equipment
- Grounding plan

Equipment layout drawing(s), showing locations for the following:

- Solar modules
- Combiner boxes
- Disconnect switches
- Inverters
- Conduit routing
- Existing panel, switchboard, or switchgear connection
- Step up transformer, MV switchgear, point of utility connection arrangement

Cable and conduit schedule, to show:

- Cable/conduit ID
- From/To destinations
- Voltages, AC or DC
- Cable and conduit sizing
- Number of conductors/sets per phase
- Insulation type

Power Systems Engineering is an integral part of Eaton's electrical service capabilities. The combined Eaton Electrical Services & Systems team can provide a full scope of design and construction management services to support your project needs:

- Engineering and design
- Multi-vendor equipment supply
- Turnkey projects and construction management
- Installation services
- Power quality and load measurements
- Power quality investigation
- Energy management studies
- Renewable energy applications

**Electrical Design Submittals**

Eaton can prepare an equipment specification by using an approved single line diagram(s); knowledge of physical environment restrictions; the application of the electrical equipment; the equipment manufacturer's standards and options; the latest manufacturing industry standards; and a thorough knowledge of the latest local and national codes and regulations for installation of the equipment.

Eaton can develop equipment layout or arrangement plans that will identify the location of the equipment based upon the customer's physical restrictions. Once the equipment location has been determined, foundation designs, equipment grounding, and raceway routing designs will be developed and issued for approval.

Eaton can provide the following minimum design elements for the design deliverables:

- Title sheet
- Existing site plan
- PV array layout
- Electrical one-line diagram sheet
- Equipment location plan
- Equipment specifications
- 100% design drawings and other information as needed to enable accurate procurement and installation required to construct the project

**Product Description**

Eaton's Power System Engineering team is your ally to provide analysis and design for connecting renewable and alternative energy generation to the utility grid. Our experience and North American coverage make Eaton the choice to analyze and design the electrical distribution system and substation for wind and solar farm projects.

Our power system engineers bring extensive skills and expertise to power system analysis and design. Active participation in technical societies such as IEEE and collaboration with a variety of utilities and industries ensures that our engineers are knowledgeable about today's cutting edge engineering techniques.





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## Turnkey Services

### Product Overview

#### Services for Solar Photovoltaic Power

##### Pre-installation services

- Solar site assessments including technical and financial analysis
- Solar system design including shading and annual kWh output analysis
- Photovoltaic panel selection
- Electrical balance of system design
- Monitoring system design (meters and software)
- Building connection and substation design

##### Installation services

- Solar photovoltaic panel installation
- Electrical balance of system installation
- Building infrastructure connection
- Utility grid interconnection up to 345 kV substations, synchronizing and controls
- Solar system commissioning and performance verification

#### PV System Commissioning

- Eaton can provide start up and commissioning services for the solar array, DC equipment, inverters and all AC equipment up to the point of connection
- Eaton can supply all test equipment and labor to properly test the PV system
- Eaton can complete the required field verification of the solar system components from the PV panels to the electrical AC grid connection. Acceptance will involve several steps starting at factory testing through final site system performance evaluations, with ongoing reporting and evaluation
- Eaton can supply complete close out documentation including final test reports, O&M manuals, training and as built drawings

#### Post-installation services

- Remote performance monitoring (metering and data collection)
- Ongoing energy production monitoring and rebate certifications

- Site power quality, load shedding and future expansion analysis
- Maintenance
- Operations training for site personnel
- Safety training
- Access to around-the-clock customer support

#### Other services

- Arc flash hazard analysis and solutions
- Power reliability studies
- LEED certification audits
- Building energy audits

#### Equipment Solutions for Solar Photovoltaic Power

##### DC switching and protection

- DC solar disconnect switches
- DC solar integrated disconnect combiner switch
- DC string level and array level monitoring

##### Inverters

- Solar inverters
- String Inverters, commercial inverters, utility class inverters

#### AC switching and protection

- AC solar switchboards and panelboards
- AC solar load centers
- AC disconnect switches
- AC circuit breakers
- Low voltage and medium voltage AC switchgear
- Low voltage and medium voltage transformers

#### Packaging

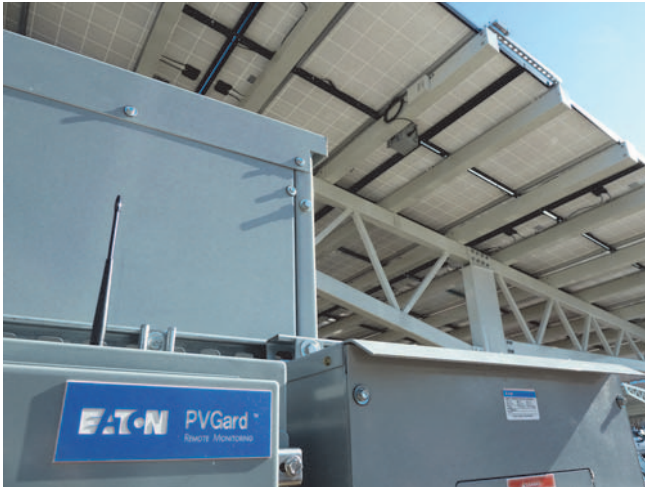
- Integrated Solar System (ISS)
- Integrated Power Assembly (IPA)

#### Monitoring and metering

- Metering solutions compatible with Eaton and other manufacturers' equipment
- Customized metering solutions
- Web-enabled data collection and monitoring
- Cellular and satellite communications

**Product Description**

Eaton's turnkey project capabilities can help you build your solar business without adding staff or assets. With decades of experience in managing electrical power, we know what it takes to design and install a power system that generates clean, reliable power.



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## Solar Monitoring

### Product Overview

PVGard® is a web-based solar monitoring system that can transmit via hard wire land lines or wireless communications from field acquired measurement parameters. Data parameters monitored and displayed can include but not be limited to the following measurements and displays:

Photovoltaic power output performance measurement transducers

- AC current and voltage
- DC current and voltage
- Kilowatt-hour meter

Meteorological data measurements

- Ambient air temperature
- Relative humidity
- Barometric pressure
- Wind speed
- Wind direction
- Rainfall
- Global horizontal irradiance
- Solar cell temperature

Real time data at minimal of 15 minute intervals

- AC current, voltage and kilowatt hours
- Solar plane of array irradiance
- Ambient temperature and wind speed

Calculated parameters

- AC power output
- Sunlight conversion efficiency to AC and DC power
- Inverter DC to AC power conversion efficiency
- Avoided pollutant emissions of CO<sub>2</sub>, SO<sub>x</sub>, and NO<sub>x</sub> gases

Inverter monitored data

- Watt-hour
- AC and DC voltage and current
- AC frequency
- Cumulated watt-hours
- Inverter error codes
- Inverter conversion efficiency
- DC string level and re-combiner current monitoring

Inverter System Sensors—(Enhanced monitoring parameters)

- Internal equipment enclosure temperatures and humidity
- Internal dust/smoke alarm levels within enclosures
- Water intrusion detector (floor water)
- Breaker trip or operation
- Fan and heater circuit operation
- Load current of main circuit breakers
- Transformer monitoring and alarms
- Relay status/health and Inverter error codes alarming
- Safe-solar detection and protection
- Quarterly performance reports to be e-mailed to site personnel
- Alarm conditions will be e-mailed and text-message to site personnel/Eaton
- Alarm and operating conditions will be summarized in quarterly report
- Inverter health index

The monitoring and display software permits customization to incorporate descriptive text, schematic diagrams, and user-specific data.

PVGard also provides the capability to generate the following type of graphs:

- Average plots of irradiance
- Average plots of ambient temperature and module temperature
- Daily value or totals of energy production
- Peak daily power
- Peak daily module temperature
- Peak daily irradiance plot over a specific month
- Monthly values of energy production
- Incident solar irradiance
- Cumulated yearly voided emissions of CO<sub>2</sub>, SO<sub>x</sub>, and NO<sub>x</sub> gases

The displayed data can also incorporate a looping background of pictures from the site, graphic overlays of the solar power generation in watts and watt-hours for each inverter. Other display capabilities:

- Project location on globe coordinates with zoom-in and out capability
- Current weather conditions
- Power generation from the total system and/or the individual solar power arrays
- Historic power generation
- Solar power system environmental impact
- Educational power point presentation (optional)
- Installed solar power electrical system overview and single line diagram

The display system can be capable of being programmed periodically to show additional information related to scheduled maintenance.

### Product Description

Eaton's PVGuard Engineered Monitoring system is a web-based system that monitors and proactively manages PV array equipment, inverters, AC equipment and weather parameters. Eaton builds in custom algorithms to track multiple inputs in order to improve and maintain system performance. For example PVGuard alerts users to underperforming panels and can schedule maintenance on inverters when expected production values are shown to be lower than optimal performance.

**Direct Current Circuit Breakers****PVGard Solar Photovoltaic Circuit Breakers****Dry-Type Transformer Family****3.1 Direct Current Circuit Breakers**

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## Direct Current Circuit Breakers



## Direct Current Circuit Breakers

## Product Description

DC (direct current) systems and applications are becoming commonplace as alternative energy sources have expanded and the number of DC devices and data centers using DC power has swelled.

Eaton offers molded case circuit breakers and switches to meet circuit protection and switching requirements for a host of different DC end use requirements. Applications include UPS battery supply circuits, solar systems and electric vehicle charging, as well as commercial and industrial distribution.

Current ratings are available from 15 to 2500A, with a full scale of voltage and interrupting ratings to address needs ranging from standard to the highest performance. Optional internal accessories provide remote tripping and indication of breaker status.

The DC breaker family is UL® 489 listed and exceeds the requirements in UL 489 Supplement SC for UPS applications. Eaton breakers may be applied in both ungrounded and select grounded applications, with poles connected in series to operate at the maximum voltages shown on **Page V15-T3-3**. To use DC circuit breakers on 600V grounded systems, three poles in series must be connected on the ungrounded leg.

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The HFDDC through HMDLDC DC breakers use the same internal and external accessories as their Series C or Series G AC frame equivalents. NBDC and PBDC use the same internal and external accessories as standard NB and PB breakers.

Many of the Eaton AC molded case circuit breakers carry 250 Vdc ratings for ungrounded systems. Refer to **Volume 4—Circuit Protection**, CA08100005E, Tab 2 for these interrupting tables.

**Quick Reference Direct Current Circuit Breakers****UL 489 Interrupting Capacity Ratings**

Circuit Breaker Type	Maximum Amperes	Interrupting Capacity (kA)								
		Volts DC <sup>①</sup>								
		125	Poles in Series	250 <sup>②</sup>	Poles in Series	500	600	Poles in Series	750 <sup>②</sup>	Poles in Series
EGEDC	100	10	1	35	2	35	—	3	—	—
EGSDC	100	35	1	42	2	50	—	3	—	—
EGHDC	100	42	1	50	2	65	—	3	—	—
HFDDC	225	42	1	50	2	—	42	3	42	4
JGEDC	250	35	1	35	2	—	35	3	—	—
JGSDC	250	42	1	42	2	—	50	3	—	—
JGHDC	250	50	1	50	2	—	65	3	—	—
HJDDC	250	42	1	50	2	—	42	3	—	—
HKDDC	400	42	1	50	2	—	42	3	—	—
LGEDC	600	22	1	22	2	—	35	3	—	—
LGSDC	600	22	1	22	2	—	50	3	—	—
LGHDC	600	50	1	50	2	—	65	3	—	—
HLDDC	600	42	1	50	2	—	35	3	—	—
HLDDC <sup>③</sup>	1200	42	1	50	2	—	—	—	—	—
HMDLDC	800	42	1	50	2	—	35	3	—	—
NBDC	1200	42	1	50	2	—	50	3	—	—
PBDC	2500	42	1	65	2	—	65	3	—	—

**IEC 60947-2 Interrupting Capacity Ratings**

Circuit Breaker Type	Maximum Amperes	125 Volts DC		Poles in Series	250 Volts DC		Poles in Series	600 Volts DC		Poles in Series
		Icu	Ics		Icu	Ics		Icu	Ics	
EGEDC	100	10	10	1	10	10	2	—	—	—
EGSDC	100	35	35	1	35	35	2	—	—	—
EGHDC	100	42	42	1	42	42	2	—	—	—
JGEDC	250	22	22	1	22	22	2	—	—	—
JGSDC	250	22	22	1	22	22	2	—	—	—
JGHDC	250	42	42	1	42	42	2	—	—	—
HJDDC	250	—	—	—	—	—	—	20	10	3
LGEDC	600	22	22	1	22	22	2	—	—	—
LGSDC	600	22	22	1	22	22	2	—	—	—
LGHDC	600	42	42	1	42	42	2	—	—	—
HLDDC	600	—	—	—	—	—	—	20	10	3
HMDLDC	800	—	—	—	—	—	—	20	10	3

**Notes**

<sup>①</sup> DC ratings apply to substantially non-inductive circuits. Time constants per UL 489.

<sup>②</sup> EGEDC through HMDLDC have been tested up to 300 Vdc to allow for battery charging voltages. 750 Vdc is common in transportation applications. HFDDC, four-pole 750 Vdc is available up to 150A maximum. 300 Vdc and 750 Vdc are not UL 489 listed voltage ratings.

<sup>③</sup> Four-pole frame with two-poles connected in parallel.

See **Page V15-T3-14** for series connection diagrams. Use NEC<sup>®</sup> rated cable to connect/short poles in series as shown.



# 3.1

## Direct Current Circuit Breakers

### Specialty Breakers

#### Catalog Number Selection

#### DC Circuit Breaker

3

### HFDDC 3 150 W

Frame	Number of Poles	Trip Unit Ampere Rating	Suffix
<b>EGEDC</b> = Series G—E (100A max.) <b>EGSDC</b> = Series G—E (100A max.) <b>EGHDC</b> = Series G—E (100A max.) <b>HFDDC</b> = Series C—F (225A max.) <b>JGEDC</b> = Series G—J (250A max.) <b>JGSDC</b> = Series G—J (250A max.) <b>JGHDC</b> = Series G—J (250A max.) <b>HJDDC</b> = Series C—J (250A max.) <b>HKDDC</b> = Series C—K (400A max.) <b>LGEDC</b> = Series G—L (600A max.) <b>LGSDC</b> = Series G—L (600A max.) <b>LGHDC</b> = Series G—L (600A max.) <b>HLDDC</b> = Series C—L (1200A max.) <b>HMDLDC</b> = Series C—M (800A max.) <b>NBDC</b> = NB (1200A max.) <b>PBDC</b> = PB (2500A max.)	<b>1</b> = Single-pole <b>2</b> = Two-pole <b>3</b> = Three-pole <b>4</b> = Four-pole	<b>015</b> = 15A <b>020</b> = 20A <b>025</b> = 25A <b>030</b> = 30A <b>035</b> = 35A <b>040</b> = 40A <b>045</b> = 45A <b>050</b> = 50A <b>060</b> = 60A <b>070</b> = 70A <b>080</b> = 80A <b>090</b> = 90A <b>100</b> = 100A <b>110</b> = 110A <b>125</b> = 125A <b>150</b> = 150A <b>175</b> = 175A <b>200</b> = 200A <b>225</b> = 225A <b>250</b> = 250A <b>300</b> = 300A <b>350</b> = 350A <b>400</b> = 400A <b>450</b> = 450A <b>500</b> = 500A <b>600</b> = 600A <b>700</b> = 700A <b>800</b> = 800A <b>900</b> = 900A <b>1000</b> = 1000A <b>1200</b> = 1200A <b>1600</b> = 1600A <b>2000</b> = 2000A <b>2500</b> = 2500A	<b>Series C, NB and PB Frames</b> <b>K</b> = Molded case switch <b>L</b> = Line and load terminals, F-Frame <b>MW</b> = 135% magnetic trip unit, without terminals <b>W</b> = Without terminals <b>Series G Frames</b> <b>FFG</b> = Fixed thermal, fixed magnetic trip unit, with terminals <b>FFW</b> = Fixed thermal, fixed magnetic trip unit, without terminals <b>FAG</b> = Fixed thermal, adjustable magnetic trip unit, with terminals <b>FAW</b> = Fixed thermal, adjustable magnetic trip unit, without terminals <b>KSG</b> = Molded case switch, with terminals <b>KSW</b> = Molded case switch, without terminals

## Product Selection

Type EGEDC DC Circuit Breakers—  
Three-Pole High Interrupting Capacity 35 kAIC at 500 Vdc

Maximum Continuous Ampere Rating at 40°C	Complete Circuit Breaker with Terminals Catalog Number	Complete Circuit Breaker without Terminals Catalog Number
25	EGEDC3025FFG	EGEDC3025FFW
30	EGEDC3030FFG	EGEDC3030FFW
35	EGEDC3035FFG	EGEDC3035FFW
40	EGEDC3040FFG	EGEDC3040FFW
45	EGEDC3045FFG	EGEDC3045FFW
50	EGEDC3050FFG	EGEDC3050FFW
60	EGEDC3060FFG	EGEDC3060FFW
70	EGEDC3070FFG	EGEDC3070FFW
80	EGEDC3080FFG	EGEDC3080FFW
90	EGEDC3090FFG	EGEDC3090FFW
100	EGEDC3100FFG	EGEDC3100FFW

Type EGSDC DC Circuit Breakers—  
Three-Pole High Interrupting Capacity 50 kAIC at 500 Vdc

Maximum Continuous Ampere Rating at 40°C	Complete Circuit Breaker with Terminals Catalog Number	Complete Circuit Breaker without Terminals Catalog Number
25	EGSDC3025FFG	EGSDC3025FFW
30	EGSDC3030FFG	EGSDC3030FFW
35	EGSDC3035FFG	EGSDC3035FFW
40	EGSDC3040FFG	EGSDC3040FFW
45	EGSDC3045FFG	EGSDC3045FFW
50	EGSDC3050FFG	EGSDC3050FFW
60	EGSDC3060FFG	EGSDC3060FFW
70	EGSDC3070FFG	EGSDC3070FFW
80	EGSDC3080FFG	EGSDC3080FFW
90	EGSDC3090FFG	EGSDC3090FFW
100	EGSDC3100FFG	EGSDC3100FFW

Type EGHDC DC Circuit Breakers—  
Three-Pole High Interrupting Capacity 65 kAIC at 500 Vdc

Maximum Continuous Ampere Rating at 40°C	Complete Circuit Breaker with Terminals Catalog Number	Complete Circuit Breaker without Terminals Catalog Number
25	EGHDC3025FFG	EGHDC3025FFW
30	EGHDC3030FFG	EGHDC3030FFW
35	EGHDC3035FFG	EGHDC3035FFW
40	EGHDC3040FFG	EGHDC3040FFW
45	EGHDC3045FFG	EGHDC3045FFW
50	EGHDC3050FFG	EGHDC3050FFW
60	EGHDC3060FFG	EGHDC3060FFW
70	EGHDC3070FFG	EGHDC3070FFW
80	EGHDC3080FFG	EGHDC3080FFW
90	EGHDC3090FFG	EGHDC3090FFW
100	EGHDC3100FFG	EGHDC3100FFW

## HFDDC


**Type HFDDC DC Circuit Breakers—  
Three-Pole High Interrupting Capacity 42 kAIC at 600 Vdc**

Maximum Continuous Ampere Rating at 40°C	Complete Circuit Breaker with Line and Load Terminals <sup>①</sup>			
	Single-Pole Catalog Number	Two-Pole Catalog Number	Three-Pole Catalog Number	Four-Pole Catalog Number
15	HFDDC1015L	HFDDC2015L	HFDDC3015L	HFDDC4015L
20	HFDDC1020L	HFDDC2020L	HFDDC3020L	HFDDC4020L
25	HFDDC1025L	HFDDC2025L	HFDDC3025L	HFDDC4025L
30	HFDDC1030L	HFDDC2030L	HFDDC3030L	HFDDC4030L
35	HFDDC1035L	HFDDC2035L	HFDDC3035L	HFDDC4035L
40	HFDDC1040L	HFDDC2040L	HFDDC3040L	HFDDC4040L
45	HFDDC1045L	HFDDC2045L	HFDDC3045L	HFDDC4045L
50	HFDDC1050L	HFDDC2050L	HFDDC3050L	HFDDC4050L
60	HFDDC1060L	HFDDC2060L	HFDDC3060L	HFDDC4060L
70	HFDDC1070L	HFDDC2070L	HFDDC3070L	HFDDC4070L
80	HFDDC1080L	HFDDC2080L	HFDDC3080L	HFDDC4080L
90	HFDDC1090L	HFDDC2090L	HFDDC3090L	HFDDC4090L
100	HFDDC1100L	HFDDC2100L	HFDDC3100L	HFDDC4100L
110	HFDDC1110L	HFDDC2110L	HFDDC3110L	HFDDC4110L
125	HFDDC1125L	HFDDC2125L	HFDDC3125L	HFDDC4125L
150	HFDDC1150L	HFDDC2150L	HFDDC3150L	HFDDC4150L
175	—	HFDDC2175L	HFDDC3175L	—
200	—	HFDDC2200L	HFDDC3200L	—
225	—	HFDDC2225L	HFDDC3225L	—

**Type JGEDC DC Circuit Breakers—  
Three-Pole High Interrupting Capacity 35 kAIC at 600 Vdc**

Maximum Continuous Ampere Rating at 40°C	Complete Breaker Catalog Number	Circuit Breaker Frame Only <sup>②</sup> Catalog Number	Thermal-Magnetic Trip Unit	Standard Terminals
			Catalog Number	Catalog Number
70	JGEDC3070FAG	JGEDC3250NN	JT3070FA	T250FJ
90	JGEDC3090FAG	JGEDC3250NN	JT3090FA	T250FJ
100	JGEDC3100FAG	JGEDC3250NN	JT3100FA	T250FJ
125	JGEDC3125FAG	JGEDC3250NN	JT3125FA	T250FJ
150	JGEDC3150FAG	JGEDC3250NN	JT3150FA	T250FJ
175	JGEDC3175FAG	JGEDC3250NN	JT3175FA	T250FJ
200	JGEDC3200FAG	JGEDC3250NN	JT3200FA	T250FJ
225	JGEDC3225FAG	JGEDC3250NN	JT3225FA	T250FJ
250	JGEDC3250FAG	JGEDC3250NN	JT3250FA	T250FJ

**Notes**

① For breaker without terminals, replace "L" with "W" at end of catalog number.

② For complete breaker, order individual frame, trip unit and terminals for field installation.

**Type JGSDC DC Circuit Breakers—  
Three-Pole High Interrupting Capacity 50 kAIC at 600 Vdc**

Maximum Continuous Ampere Rating at 40°C	Complete Breaker Catalog Number	Circuit Breaker Frame Only <sup>①</sup> Catalog Number	Thermal-Magnetic Trip Unit Catalog Number	Standard Terminals Catalog Number
70	JGSDC3070FAG	JGSDC3250NN	JT3070FA	T250FJ
90	JGSDC3090FAG	JGSDC3250NN	JT3090FA	T250FJ
100	JGSDC3100FAG	JGSDC3250NN	JT3100FA	T250FJ
125	JGSDC3125FAG	JGSDC3250NN	JT3125FA	T250FJ
150	JGSDC3150FAG	JGSDC3250NN	JT3150FA	T250FJ
175	JGSDC3175FAG	JGSDC3250NN	JT3175FA	T250FJ
200	JGSDC3200FAG	JGSDC3250NN	JT3200FA	T250FJ
225	JGSDC3225FAG	JGSDC3250NN	JT3225FA	T250FJ
250	JGSDC3250FAG	JGSDC3250NN	JT3250FA	T250FJ

JGHDC3250NN



**Type JGHDC DC Circuit Breakers—  
Three-Pole High Interrupting Capacity 65 kAIC at 600 Vdc**

Maximum Continuous Ampere Rating at 40°C	Complete Breaker Catalog Number	Circuit Breaker Frame Only <sup>①</sup> Catalog Number	Thermal-Magnetic Trip Unit Catalog Number	Standard Terminals Catalog Number
70	JGHDC3070FAG	JGHDC3250NN	JT3070FA	T250FJ
90	JGHDC3090FAG	JGHDC3250NN	JT3090FA	T250FJ
100	JGHDC3100FAG	JGHDC3250NN	JT3100FA	T250FJ
125	JGHDC3125FAG	JGHDC3250NN	JT3125FA	T250FJ
150	JGHDC3150FAG	JGHDC3250NN	JT3150FA	T250FJ
175	JGHDC3175FAG	JGHDC3250NN	JT3175FA	T250FJ
200	JGHDC3200FAG	JGHDC3250NN	JT3200FA	T250FJ
225	JGHDC3225FAG	JGHDC3250NN	JT3225FA	T250FJ
250	JGHDC3250FAG	JGHDC3250NN	JT3250FA	T250FJ

HJDDC3250



**Type HJDDC DC Circuit Breakers—  
Three-Pole High Interrupting Capacity 42 kAIC at 600 Vdc**

Maximum Continuous Ampere Rating at 40°C	Circuit Breaker Frame Only <sup>①</sup> Catalog Number	Thermal-Magnetic Trip Unit Catalog Number	Standard Terminals Catalog Number
70	HJDDC3250F	JT3070T	TA250KB
90	HJDDC3250F	JT3090T	TA250KB
100	HJDDC3250F	JT3100T	TA250KB
125	HJDDC3250F	JT3125T	TA250KB
150	HJDDC3250F	JT3150T	TA250KB
175	HJDDC3250F	JT3175T	TA250KB
200	HJDDC3250F	JT3200T	TA250KB
225	HJDDC3250F	JT3225T	TA250KB
250	HJDDC3250F	JT3250T	TA250KB

**Note**

<sup>①</sup> For complete breaker, order individual frame, trip unit and terminals for field installation.

# 3.1

## Direct Current Circuit Breakers

### Specialty Breakers

3

HKDDC3400



#### Type HKDDC DC Circuit Breakers— Three-Pole High Interrupting Capacity 42 kAIC at 600 Vdc

Maximum Continuous Ampere Rating at 40°C	Circuit Breaker Frame Only <sup>①</sup> Catalog Number	Thermal-Magnetic Trip Unit Catalog Number	Standard Terminals Catalog Number
100	HKDDC3400F	KT3100T	TA300K
125	HKDDC3400F	KT3125T	TA300K
150	HKDDC3400F	KT3150T	TA300K
175	HKDDC3400F	KT3175T	TA300K
200	HKDDC3400F	KT3200T	TA300K
225	HKDDC3400F	KT3225T	TA300K
250	HKDDC3400F	KT3250T	TA350K
300	HKDDC3400F	KT3300T	TA350K
350	HKDDC3400F	KT3350T	TA350K
400	HKDDC3400F	KT3400T	3TA400K <sup>②</sup>

LGEDC3630NN



#### Type LGEDC DC Circuit Breakers— Three-Pole High Interrupting Capacity 35 kAIC at 600 Vdc

Maximum Continuous Ampere Rating at 40°C	Complete Breaker Catalog Number	Circuit Breaker Frame Only <sup>①</sup> Catalog Number	Thermal-Magnetic Trip Unit Catalog Number	Standard Terminals Catalog Number
250	LGEDC3250FAG	LGEDC3630NN	LT3250FA	TA350LK
300	LGEDC3300FAG	LGEDC3630NN	LT3300FA	TA350LK
350	LGEDC3350FAG	LGEDC3630NN	LT3350FA	TA350LK
400	LGEDC3400FAG	LGEDC3630NN	LT3400FA	TA350LK
500	LGEDC3500FAG	LGEDC3630NN	LT4500FA	3TA632LK <sup>②</sup>
600	LGEDC3600FAG	LGEDC3630NN	LT3600FA	3TA632LK <sup>②</sup>

#### Type LGSDC DC Circuit Breakers— Three-Pole High Interrupting Capacity 50 kAIC at 600 Vdc

Maximum Continuous Ampere Rating at 40°C	Complete Breaker Catalog Number	Circuit Breaker Frame Only <sup>①</sup> Catalog Number	Thermal-Magnetic Trip Unit Catalog Number	Standard Terminals Catalog Number
250	LGSDC3250FAG	LGSDC3630NN	LT3250FA	TA350LK
300	LGSDC3300FAG	LGSDC3630NN	LT3300FA	TA350LK
350	LGSDC3350FAG	LGSDC3630NN	LT3350FA	TA350LK
400	LGSDC3400FAG	LGSDC3630NN	LT3400FA	TA350LK
500	LGSDC3500FAG	LGSDC3630NN	LT4500FA	3TA632LK <sup>②</sup>
600	LGSDC3600FAG	LGSDC3630NN	LT3600FA	3TA632LK <sup>②</sup>

#### Notes

<sup>①</sup> For complete breaker, order individual frame, trip unit and terminals for field installation.

<sup>②</sup> Three-pole kit.

**Type LGHDC DC Circuit Breakers—  
Three-Pole High Interrupting Capacity 65 kAIC at 600 Vdc**

Maximum Continuous Ampere Rating at 40°C	Complete Breaker Catalog Number	Circuit Breaker Frame Only <sup>①</sup> Catalog Number	Thermal-Magnetic Trip Unit Catalog Number	Standard Terminals Catalog Number
250	LGHDC3250FAG	LGHDC3630NN	LT3250FA	TA350LK
300	LGHDC3300FAG	LGHDC3630NN	LT3300FA	TA350LK
350	LGHDC3350FAG	LGHDC3630NN	LT3350FA	TA350LK
400	LGHDC3400FAG	LGHDC3630NN	LT3400FA	TA350LK
500	LGHDC3500FAG	LGHDC3630NN	LT4500FA	3TA632LK <sup>②</sup>
600	LGHDC3600FAG	LGHDC3630NN	LT3600FA	3TA632LK <sup>②</sup>

**HLDDC**



**Type HLDDC DC Circuit Breakers—  
Three-Pole High Interrupting Capacity 35 kAIC at 600 Vdc**

Maximum Continuous Ampere Rating at 40°C	Circuit Breaker Frame Only <sup>①</sup> Catalog Number	Thermal-Magnetic Trip Unit Catalog Number	Standard Terminals Catalog Number
300	HLDDC3600F	LT3300T	TA602LD
350	HLDDC3600F	LT3350T	TA602LD
400	HLDDC3600F	LT3400T	TA602LD
450	HLDDC3600F	LT3450T	TA602LD
500	HLDDC3600F	LT3500T	TA602LD
600	HLDDC3600F	LT3600T	3TA603LDK <sup>②</sup>

**Type HLDDC DC Circuit Breakers—  
Two-Pole High Interrupting Capacity 50 kAIC at 250 Vdc <sup>③④</sup>**

Maximum Continuous Ampere Rating at 40°C	Complete Breaker Catalog Number
600	HLDDC20600
700	HLDDC20700
800	HLDDC20800
900	HLDDC20900
1000	HLDDC21000
1200	HLDDC21200

**Notes**

- <sup>①</sup> For complete breaker, order individual frame, trip unit and terminals for field installation.
- <sup>②</sup> Three-pole kit.
- <sup>③</sup> Includes breaker frame, trip unit and terminals.
- <sup>④</sup> Four-pole breaker with two poles wired in parallel.

# 3.1

## Direct Current Circuit Breakers

### Specialty Breakers

3

HMDLDC3800F



#### Type HMDLDC DC Circuit Breakers— Three-Pole High Interrupting Capacity 35 kAIC at 600 Vdc

Maximum Continuous Ampere Rating at 40°C	Circuit Breaker Frame Only <sup>①</sup> Catalog Number	Thermal-Magnetic Trip Unit Catalog Number	Standard Terminals Catalog Number
300	HMDLDC3800F	MT3300T	TA700MA1
350	HMDLDC3800F	MT3350T	TA700MA1
400	HMDLDC3800F	MT3400T	TA700MA1
450	HMDLDC3800F	MT3450T	TA700MA1
500	HMDLDC3800F	MT3500T	TA700MA1
600	HMDLDC3800F	MT3600T	TA700MA1
700	HMDLDC3800F	MT3700T	TA700MA1
800	HMDLDC3800F	MT3800T	TA800MA2

#### Type NBDC DC Circuit Breakers— Three-Pole High Interrupting Capacity 50 kAIC at 600 Vdc

Maximum Continuous Ampere Rating at 40°C	Complete Circuit Breaker Factory Assembled without Terminals <sup>②</sup> Catalog Number	Includes Magnetic Trip Unit Calibrated at 135%	Standard Terminals Catalog Number
700	NBDC3700MW	Included	TA1000NB1
800	NBDC3800MW	Included	TA1000NB1
900	NBDC3900MW	Included	TA1000NB1
1000	NBDC31000MW	Included	TA1000NB1
1200	NBDC31200MW	Included	TA1200NB1

#### Type PBDC DC Circuit Breakers— Three-Pole High Interrupting Capacity 65 kAIC at 600 Vdc

Maximum Continuous Ampere Rating at 40°C	Complete Circuit Breaker Factory Assembled without Terminals <sup>②</sup> Catalog Number	Includes Magnetic Trip Unit Calibrated at 135%	Standard Rear Connectors Catalog Number
1600	PBDC31600W	Included	BA2000PB
2000	PBDC32000W	Included	BA2000PB
2500	PBDC32500W	Included	BA2500PB

#### Notes

- <sup>①</sup> Includes frame and trip unit. Order terminals or connectors separately.
- <sup>②</sup> For complete breaker, order individual frame, trip unit and terminals for field installation.



## DC Breaker Terminal Wire Ranges

Breaker Frame	Maximum Breaker Ampacity	Terminal Body Material	Wire Type	AWG Wire Range/ Number of Conductors	Metric Wire Range mm <sup>2</sup>	Number of Terminals Included	Standard Terminal Catalog Number
EGEDC, EGSDC, EGHDC	100	Aluminum	Cu/Al	14–1/0	2.5–50	3	3TA125EF
HFDDC	20	Steel	Cu/Al	14–10 (1)	2.5–4 (1)	3	3T20FB
	100	Steel	Cu/Al	14–1/0 (1)	2.5–50 (1)	3	3T100FB
	225	Aluminum	Cu/Al	4–4/0 (1)	25–95 (1)	3	3TA225FD
JGEDC, JGSDC, JGHDC	250	Stainless steel	Cu	4–350 (1)	25–185 (1)	1	T250FJ
HJDDC	250	Aluminum	Cu/Al	4–350 kcmil (1)	25–185 (1)	1	TA250KB
HKDDC	225	Aluminum	Cu/Al	3–350 kcmil (1)	35–185 (1)	1	TA300K
	350	Aluminum	Cu/Al	250–500 kcmil (1)	120–240 (1)	1	TA350K
	400	Aluminum	Cu/Al	3/0–250 kcmil (2)	95–120 (1)	3	3TA400K
LGEDC, LGSDC, LGHDC	400	Aluminum	Cu/Al	2–500 (1)	35–240 (1)	1	TA350LK
	630	Aluminum	Cu/Al	2–500 kcmil (2)	35–240 (2)	1	TA632L
	630	Aluminum	Cu/Al	2–500 kcmil (2)	35–240 (2)	3	3TA632LK
HLDDC	500	Aluminum	Cu/Al	3/0–350 kcmil (2)	95–150 (2)	1	TA602LD
	600	Aluminum	Cu/Al	400–500 kcmil (2)	185–240 (2)	3	3TA603LDK
HMDLDC	600	Aluminum	Cu/Al	1–500 kcmil (2)	—	1	TA700MA1
	800	Aluminum	Cu/Al	3/0–400 kcmil (3)	—	1	TA800MA2
NBDC	700	Aluminum	Cu/Al	3/0–400 kcmil (3)	95–185 (3)	1	TA1000NB1
	800	Aluminum	Cu/Al	3/0–400 kcmil (3)	95–185 (3)	1	TA1000NB1
	900	Aluminum	Cu/Al	3/0–400 kcmil (3)	95–185 (3)	1	TA1000NB1
	1000	Aluminum	Cu/Al	3/0–400 kcmil (3)	95–185 (3)	1	TA1000NB1
	1200	Aluminum	Cu/Al	4/0–500 kcmil (4)	120–240 (4)	1	TA1200NB1

## Molded Case Switches

Eaton's DC molded case switches are used in applications requiring a compact, high-capacity disconnect. They are UL 489 listed and have automatic high instantaneous current protection. These devices do not provide overload protection.

## Molded Case Switches

Maximum Continuous Ampere Rating at 40°C	Interrupting Capacity (Volts DC)	Poles in Series	With Line and Load Terminals	Without Line and Load Terminals
			Catalog Number	Catalog Number
600 Vdc Maximum				
100	42	3	HFDDC3100KL	HFDDC3100KW
150	42	3	HFDDC3150KL	HFDDC3150KW
225	42	3	HFDDC3225KL	HFDDC3225KW
250	65	3	JGKDC3250KSG	JGKDC3250KSW
250	42	3	HJDDC3250K	HJDDC3250KW
400	35	3	HKDDC3400K	HKDDC3400KW
	65	3	LGKDC3400KSG	LGKDC3400KSW
600	65	3	LGKDC3630KSG	LGKDC3630KSW
	35	3	HLDDC3600K	HLDDC3600WK
800	35	3	HMDLDC3800K	HMDLDC3800WK
500 Vdc Maximum				
100	65	3	EGK3100KSG	EGK3100KSW
250 Vdc Maximum				
100	50	2	HFDDC2100KL	HFDDC2100KW
150	50	2	HFDDC2150KL	HFDDC2150KW
225	50	2	HFDDC2225KL	HFDDC2225KW
1200	50	①	HLDDC21200K ①	HLDDC21200WK ①

## Note

① Four-pole frame with two-pole connected in parallel.

# 3.1

## Direct Current Circuit Breakers

### Specialty Breakers

#### Accessories

##### Internal Accessories

##### Field Installation Kits

Description	Factory Installation (HFDDC)	HFDDC ①	EGEDC, EGSDC, EGHDC	JGEDC, JGSDC, JGHDC	HJDDC	HKDDC	HLDDC	HMDLDC	NBDC	PBDC	
				LGEDC, LGSDC, LGHDC							
Right-Pole Mounting											
Auxiliary switch											
1A-1B	A06	A1X1PK	AUX1A1BPK	AUX1A1BPK	A1X2PK	A1X13PK	A1X4PK	A1X4PK	4980D16G05	2602D32G14	
2A-2B	A13	A2X1RPK	AUX2A2BPK	AUX2A2BPK	A2X2PK	A2X3PK	A2X4PK	A2X4PK	4980D16G06	2602D32G15	
Alarm switch											
1 make/1 break	B06	A1L1RPK	ALM1M1BEPK	ALM1M1BJPK	A1L2RPK	A1L3RPK	A1L4RPK	A1L4RPK	—	—	
Auxiliary and alarm combo											
1A-1B, 1 make/1 break	C05	AAL1RPK	AUXALRMEPK	AUXALRMJPK	AAL2RPK	AAL3RPK	AA114RPK	AA114RPK	—	—	
Left-Pole Mounting											
Shunt trip											
12 Vdc	S02	SNT1LP03K	SNT012CPK	SNT012CPK	SNT2P04K	SNT3P04K	SNT4LP03K	SNT4LP03K	2606D58G14	2606D59G28	
24 Vdc	S02	SNT1LP03K	SNT060CPK	SNT060CPK	SNT2P04K	SNT3P04K	SNT4LP03K	SNT4LP03K	2606D58G13	2606D59G27	
48 Vdc	S06	SNT1LP08K	SNT060CPK	SNT060CPK	SNT2P06K	SNT3P06K	SNT4LP23K	SNT4LP23K	2606D58G12	2606D59G26	
60 Vdc	S06	SNT1LP08K	SNT060CPK	SNT060CPK	SNT2P06K	SNT3P06K	SNT4LP23K	SNT4LP23K	2606D58G11	2606D59G25	
125 Vdc	S10	SNT1LP12K	SNT120CPK	SNT120CPK	SNT2P11K	SNT3P11K	SNT4LP26K	SNT4LP26K	2606D58G10	2606D59G24	
250 Vdc	S14	SNT1LP18K	—	—	SNT2P14K	SNT3P14K	SNT4LP14K	SNT4LP14K	2606D58G09	2606D59G23	
120 Vac	S06	SNT1LP12K	SNT120CPK	SNT120CPK	SNT2P11K	SNT3P11K	SNT4LP11K	SNT4LP11K	2060D58G05	2060D59G19	
Undervoltage release											
12 Vdc	U30	UVH1LP20K	UVR012DPK	UVR012DPK	UVH2LP20K	UVH3LP20K	UVH4LP20K	UVH4LP20K	372D032G06	4976D85G11	
24 Vdc	U34	UVH1LP21K	UVR024DPK	UVR024DPK	UVH2LP21K	UVH3LP21K	UVH4LP21K	UVH4LP21K	372D032G07	4976D85G12	
48 Vdc	U38	UVH1LP22K	UVR048DPK	UVR048DPK	UVH2LP22K	UVH3LP22K	UVH4LP22K	UVH4LP22K	372D032G08	4976D85G13	
125 Vdc	U42	UVH1LP26K	UVR125DPK	UVR125DPK	UVH2LP26K	UVH3LP26K	UVH4LP26K	UVH4LP26K	372D032G09	4976D85G17	
250 Vdc	U46	UVH1LP28K	UVR250DPK	UVR250DPK	UVH2LP28K	UVH3LP28K	UVH4LP28K	UVH4LP28K	372D032G10	4976D85G18	
120 Vac	U14	UVH1LP08K	UVR120APK	UVR120APK	UVH2LP08K	UVH3LP08K	UVH4LP08K	UVH4LP08K	373D632G05	5674D29G01	

#### Note

① F-Frame circuit breakers are factory sealed. Underwriters Laboratories requires that internal accessories be installed at the factory. Internal accessories are UL listed for factory installation under E7819. Where local codes and standards permit and UL listing is not required, internal accessories can be field installed. Accessory installation should be done before the circuit breaker is mounted and connected.

One accessory can be mounted per pole, per breaker. Factory installation of accessories is available. Contact Eaton for assistance with part number configuration.

**Jumpers**

Jumpers must be ordered separately. Priced individually.

**HFDDC Frame**

Description	Maximum Amperes	Catalog Number
Single copper jumper	60	DC1F060 <sup>①</sup>
	100	DC1F100 <sup>①</sup>
	125	DC1F125 <sup>①</sup>
	225	DC1F225 <sup>①</sup>
Package of 2 aluminum jumpers	100	DC2FD100A
Package of 3 aluminum jumpers	100	DC3FD100A

**JGEDC, JGSDC, JGHDC Frames**

Description	Maximum Amperes	Catalog Number
Single aluminum jumper	250	DC1JG250A <sup>①</sup>
Package of 2 aluminum jumpers	250	DC2JG250A <sup>①</sup>
Package of 20 aluminum jumpers	250	DC20JG250A <sup>①</sup>

**HKDDC Frame**

Description	Maximum Amperes	Catalog Number
Single copper jumper	400	DC1K400 <sup>①</sup>
Package of 2 aluminum jumpers	400	DC2KD400A <sup>①</sup>
Package of 3 aluminum jumpers	400	DC3KD400A <sup>①</sup>

**LGEDC, LGSDC, LGHDC Frames**

Description	Maximum Amperes	Catalog Number
Package of 2 aluminum jumpers	400	DC2LG400A
Package of 3 aluminum jumpers	400	DC3LG400A
Package of 30 aluminum jumpers	400	DC30LG400A

**Note**

<sup>①</sup> Not UL Listed; Non UL listed jumpers used in a UL application may need to be qualified by the OEM in their assembly. This may take place with UL or another certified testing agency.

# 3.1

## Direct Current Circuit Breakers

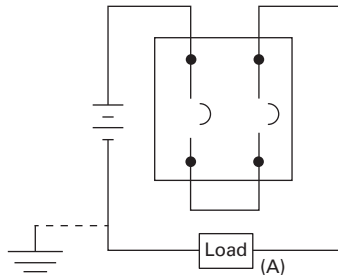
### Specialty Breakers

#### Wiring Diagrams

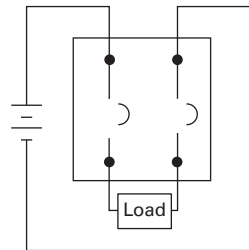
##### Series Connection Diagrams for DC Application <sup>①②</sup>

3

##### 250 Vdc Maximum—Two Poles in Series

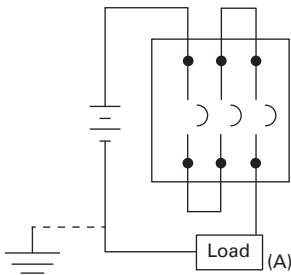


Suitable for use on ungrounded systems, or grounded systems that have one end of load (A) connected to grounded terminal, opposite poles in series connection.

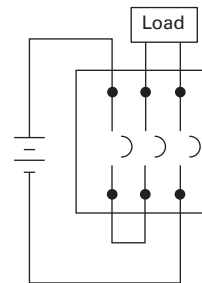


Suitable for use on ungrounded systems only.

##### 500 Vdc or 600 Vdc Maximum—Three Poles in Series

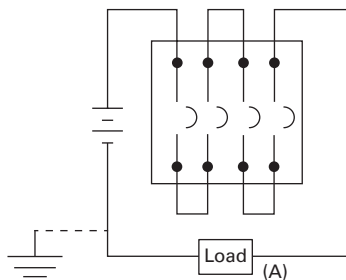


Suitable for use on ungrounded systems, or grounded systems that have one end of load (A) connected to grounded terminal, opposite poles in series connection.

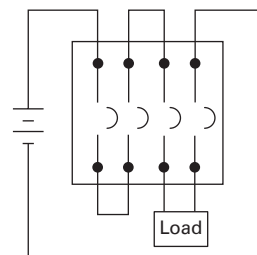


Suitable for use on ungrounded systems only.

##### 750 Vdc Maximum—Four Poles in Series



Suitable for use on ungrounded systems, or grounded systems that have one end of load (A) connected to grounded terminal, opposite poles in series connection.



Suitable for use on ungrounded systems only.

#### Notes

- ① Poles in series connection is customer supplied. Use rated cable per NEC.
- ② For grounded systems, all poles in series must be connected on non-grounded terminal, with load connected to grounded terminal.

**Dimensions**

Approximate Dimensions in Inches (mm)

**DC Breaker Dimensions**

Frame	Number of Poles	Width	Height	Depth
EGEDC, EGSDC, EGHDC	3	3.00 (76.2)	5.50 (139.7)	2.99 (75.9)
HFDDC	1	1.38 (35.1)	6.00 (152.4)	3.38 (86.0)
	2	2.75 (70.0)	6.00 (152.4)	3.38 (86.0)
	3	4.13 (105.0)	6.00 (152.4)	3.38 (86.0)
	4	5.50 (139.7)	6.00 (152.4)	3.38 (86.0)
JGEDC, JGSDC, JGHDC	3	4.13 (104.9)	7.00 (177.8)	3.57 (90.7)
HJDDC	2, 3	4.13 (105.0)	10.00 (254.0)	4.06 (103.1)
HKDDC	2, 3	5.50 (139.7)	10.13 (257.3)	4.10 (104.1)
LGEDC, LGSDC, LGHDC	3	5.48 (139.2)	10.13 (257.3)	4.09 (103.9)
600A Max. HLDDC	2, 3	8.25 (209.6)	10.75 (273.1)	4.06 (103.1)
1200A Max. HLDDC	4	11.00 (279.4)	10.75 (273.1)	4.06 (103.1)
HMDLDC	2, 3	8.25 (209.6)	16.00 (406.4)	4.06 (103.1)
NBDC	3	8.25 (209.6)	16.00 (406.4)	5.50 (139.7)
PBDC	3	12.06 (306.3)	22.06 (560.3)	9.06 (230.1)

## PVGuard Solar Photovoltaic Circuit Breakers



600 Vdc Per-Pole

1000 Vdc Poles-in-Series

## Contents

## Description

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## PVGuard Solar Circuit Breakers—600 Vdc Per-Pole and 1000 Vdc Poles-in-Series

## Product Overview

- Two PVGuard lineups
  - 600 Vdc per-pole breaker and switch. Each pole rated 600 Vdc
  - 1000 Vdc poles-in-series breaker and switch. Requires poles in series connection
- Both options UL 489B listed for solar photovoltaic circuit protection
- 50°C calibration
- Offers both 100% and 80% rated breakers
- Handle bi-directional current flow

## Product Description

Photovoltaic (PV) systems convert the energy of the sun into electrical power that is fed directly into the electric grid. Within the balance of system (BOS), direct current (DC) circuit breakers protect the wiring connected from the PV modules to the combiner or the inverter, while also behaving as a disconnect.

Eaton is a global leader in circuit protection and brings this expertise to bear in the photovoltaic market. PVGuard solar circuit breakers are part of a product family that combines a disconnect with circuit protection in a single, compact, resettable device to protect and isolate DC circuits as needed in photovoltaic systems. PVGuard breakers can replace fuses, fuse holders and disconnects in combiner box and inverter applications—saving space, streamlining design, purchasing and receiving, and reducing spare parts requirements.

There are two PVGuard lineups to choose from: the industry-exclusive, 600 Vdc per-pole breakers and switches designed for residential and light commercial applications and 1000 Vdc poles-in-series breakers and switches for commercial and utility scale applications.

**PVGuard 600 Vdc Per-Pole Lineup**

Only Eaton can offer this breakthrough breaker that will save significant space, time and cost. As a single-circuit-per-pole device, it allows space savings of up to 66% when compared to traditional poles-in-series disconnects, switches and breakers. In addition, it eliminates the need for jumpers for poles-in-series connection—saving on installation time, labor and even inventory.

**PVGuard 1000 Vdc Poles-in-Series Lineup**

This 1000 Vdc poles-in-series lineup provides reliable and safe disconnect means and overcurrent protection in a single, compact device for commercial and utility scale PV systems. This solution does not require jumpers with the breaker/switch to be a UL 489B listed device, providing reliability and flexibility in design without limitation on implementation of the breaker/switch. If needed, cost-effective Eaton jumpers can be included.

### Application Description

Photovoltaic (PV) systems convert the energy of the sun into electrical power that is fed directly into the electric grid. PVGard circuit breakers are used to protect the wiring from the modules to the combiner box or inverter from overcurrents, and to provide an isolation mechanism.

Eaton offers a complete line of UL 489 Listed multi-purpose 600 Vdc poles-in-series breakers and switches, as well as protection for the AC side of the inverter.

### Features

PVGard breakers are uniquely designed with these features:

- Meets the higher voltage and lower fault current levels of solar systems
- Tested to extreme ambient conditions from  $-40^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$
- Full complement of accessories for status, signalling, and on/off operation remotely
- Can handle bi-directional flow of current
- Can be applied in grounded, ungrounded or bi-polar systems
- Meets and exceeds the standards of UL 489B for photovoltaic molded case circuit breakers and molded case switches
- Available both standard (80%-rated) and 100%-rated breakers
- $50^{\circ}\text{C}$  calibration
- Ability to open on signal from DC arc or ground fault detector
- Wide range of current ratings increases options for matching incoming strings
- Eliminates fuse stocking costs and matching issues

Designed specifically for high- and low-temperature demands of PV installations, PVGard circuit breakers undergo extreme ambient cycling tests, and carry a robust operating temperature range. Trip units calibrate at 100% and 80% of nameplate current in a  $50^{\circ}\text{C}$  ambient, ensuring continuous operation in higher temperature environments typical to solar.

Rigorous third-party testing includes limited and standard fault current tests, electrical and mechanical endurance, di-electric voltage withstand and temperature tests. Eaton's PVGard products are stand-alone devices without requiring jumpers to be UL 489B listed devices.

PVGard breakers are available with a full complement of accessories to provide string status, enable remote trip, on/off operation, and can be customized to site requirements.

### Standards and Certifications

- Designed to meet UL 489B for solar photovoltaic circuit protection
- UL File E350638, Category Control Number DIUR





# 3.2

## PVGard Solar Circuit Breakers

### Specialty Breakers

#### Product Selection

Catalog number includes breaker frame and trip unit. Order terminals separately. See **Page V15-T3-22**. For complete internal and external accessories, see accessory section of each frame.

3

#### JG PVS Frame



#### JG PVS Frame, 250A Maximum, 600 Vdc Per Pole, 1.2 kA ①

Current Rating Amperes	Number Poles/ 600 Vdc Circuits	Trip Unit	80% Rated Catalog Number	100% Rated Catalog Number
90	3	Fixed thermal, fixed magnetic	JGPVS3090W	CJGPVS3090W
100	3	Fixed thermal, fixed magnetic	JGPVS3100W	CJGPVS3100W
125	3	Fixed thermal, fixed magnetic	JGPVS3125W	CJGPVS3125W
150	3	Fixed thermal, fixed magnetic	JGPVS3150W	CJGPVS3150W
175	3	Fixed thermal, fixed magnetic	JGPVS3175W	CJGPVS3175W
200	3	Fixed thermal, fixed magnetic	JGPVS3200W	CJGPVS3200W
225	3	Fixed thermal, fixed magnetic	JGPVS3225W	CJGPVS3225W
250	3	Fixed thermal, fixed magnetic	JGPVS3250W	CJGPVS3250W

#### KD PVS Frame



#### KD PVS Frame, 400A Maximum, 600 Vdc Per Pole, 3 kA ①

Current Rating Amperes	Number Poles/ 600 Vdc Circuits	Trip Unit	80% Rated Catalog Number	100% Rated Catalog Number
100	3	Fixed thermal, fixed magnetic	KDPVS3100W	CKDPVS3100W
125	3	Fixed thermal, fixed magnetic	KDPVS3125W	CKDPVS3125W
150	3	Fixed thermal, fixed magnetic	KDPVS3150W	CKDPVS3150W
175	3	Fixed thermal, fixed magnetic	KDPVS3175W	CKDPVS3175W
200	3	Fixed thermal, fixed magnetic	KDPVS3200W	CKDPVS3200W
225	3	Fixed thermal, fixed magnetic	KDPVS3225W	CKDPVS3225W
250	3	Fixed thermal, fixed magnetic	KDPVS3250W	CKDPVS3250W
300	3	Fixed thermal, fixed magnetic	KDPVS3300W	CKDPVS3300W
350	3	Fixed thermal, fixed magnetic	KDPVS3350W	CKDPVS3350W
400	3	Fixed thermal, fixed magnetic	KDPVS3400W	CKDPVS3400W

#### Note

① Terminals not included with frames.

Catalog number includes breaker frame and trip unit. Order terminals separately. See **Page V15-T3-22**.

### FD PV Frame

### FD PV Frame, 100A Maximum, 1000 Vdc, 3 kA ①



Current Rating Amperes	Poles in Series	Trip Unit	80% Rated Catalog Number	100% Rated Catalog Number
30	4	Fixed thermal, fixed magnetic	FDPV4030W	CFDPV4030W
40	4	Fixed thermal, fixed magnetic	FDPV4040W	CFDPV4040W
50	4	Fixed thermal, fixed magnetic	FDPV4050W	CFDPV4050W
60	4	Fixed thermal, fixed magnetic	FDPV4060W	CFDPV4060W
70	4	Fixed thermal, fixed magnetic	FDPV4070W	CFDPV4070W
80	4	Fixed thermal, fixed magnetic	FDPV4080W	CFDPV4080W
90	4	Fixed thermal, fixed magnetic	FDPV4090W	CFDPV4090W
100	4	Fixed thermal, fixed magnetic	FDPV4100W	CFDPV4100W

### KD PV Frame

### KD PV Frame, 250A Maximum, 1000 Vdc, 5 kA ①



Current Rating Amperes	Poles in Series	Trip Unit	80% Rated Catalog Number	100% Rated Catalog Number
125	4	Fixed thermal, fixed magnetic	KDPV4125W	CKDPV4125W
150	4	Fixed thermal, fixed magnetic	KDPV4150W	CKDPV4150W
175	4	Fixed thermal, fixed magnetic	KDPV4175W	CKDPV4175W
200	4	Fixed thermal, fixed magnetic	KDPV4200W	CKDPV4200W
225	4	Fixed thermal, fixed magnetic	KDPV4225W	CKDPV4225W
250	4	Fixed thermal, fixed magnetic	KDPV4250W	CKDPV4250W
300	4	Fixed thermal, fixed magnetic	KDPV4300W	CKDPV4300W
350	4	Fixed thermal, fixed magnetic	KDPV4350W	CKDPV4350W

### LG PV Frame

### LG PV Frame, 400A Maximum, 1000 Vdc, 5 kA ①



Current Rating Amperes	Poles in Series	Trip Unit	80% Rated Catalog Number	100% Rated Catalog Number
250	4	Fixed thermal, fixed magnetic	LGPV4250FFW	CLGPV4250FFW
300	4	Fixed thermal, fixed magnetic	LGPV4300FFW	CLGPV4300FFW
350	4	Fixed thermal, fixed magnetic	LGPV4350FFW	CLGPV4350FFW
400	4	Fixed thermal, fixed magnetic	LGPV4400FFW	CLGPV4400FFW

### MDL PV Frame

### MDL PV Frame, 600A Maximum, 1000 Vdc, 7.5 kA ①



Current Rating Amperes	Poles in Series	Trip Unit	80% Rated Catalog Number	100% Rated Catalog Number
300	3	Fixed thermal, fixed magnetic	MDLPV3300W	CMDLPV3300W
350	3	Fixed thermal, fixed magnetic	MDLPV3350W	CMDLPV3350W
400	3	Fixed thermal, fixed magnetic	MDLPV3400W	CMDLPV3400W
450	3	Fixed thermal, fixed magnetic	MDLPV3450W	CMDLPV3450W
500	3	Fixed thermal, fixed magnetic	MDLPV3500W	CMDLPV3500W
600	3	Fixed thermal, fixed magnetic	MDLPV3600W	CMDLPV3600W

#### Note

① Terminals not included with frames.

## Accessories

## Available Accessories

- Auxiliary switch
- Shunt trip
- Electrical operator
- Alarm lockout
- Undervoltage release
- Terminals
- Lock-off devices
- End cap kits
- Rotary handle mechanisms
- Flexible shaft handle mechanisms

## Optional modifications

- Freeze testing

For complete internal and external accessories, see the accessory section of each frame.

## External Accessories

Description	Frame	Catalog Number
<b>Imperial Base Mounting Hardware</b>		
0.164-32 x 1.5-inch pan-head steel screws and lockwashers	FD PV	<b>BMH1</b>
0.250-20 x 1.5 inch pan-head steel screws and lockwashers	KD PV KD PVS	<b>BMH3</b>
—	JG PVS	N/A
—	LG PV	N/A
0.3125-18 x 1.25 inch filister-head steel screws and lockwashers and flat washers	MDL PV	<b>BMH5</b>
<b>Metric Base Mounting Hardware</b>		
M4–0.7 x 38 mm pan-head steel screws and lockwashers	FD PV	<b>BMH1M</b>
M6–0.7 x 38 mm pan-head steel screws and lockwashers	KD PV KD PVS	<b>BMH3M</b>
—	JG PVS	Included <sup>①</sup>
—	LG PV	Included <sup>①</sup>
M8-1.25 x 35 mm pan-head steel screws and lockwashers	MDL PV	<b>BMH5M</b>
<b>Interphase Barriers</b>		
	FD PV	<b>IPB1</b>
	KD PV KD PVS	<b>IPB3</b>
	JG PVS	<b>FJIPBK</b> <sup>②</sup>
	LG PV	<b>IPB3</b>
	MDL PV	<b>IPB4</b>
<b>Non-Padlockable Handle Block</b>		
	FD PV	<b>LKD1</b>
	KD PV KD PVS	<b>LKD3</b>
	JG PVS	N/A
	LG PV	N/A
	MDL PV	<b>LKD4</b>
<b>Padlockable Handle Lock Hasp</b> <sup>③</sup>		
	FD PV	<b>PLK1</b>
	KD PV KD PVS	<b>PLK3</b>
	JG PVS	<b>FJPHL</b>
	LG PV	<b>LPHL</b>
	MDL PV	<b>HLK4</b>

Factory Modifications—Freeze Testing to –40°C <sup>④</sup>

Frame	Modification Code
FD PV	F01
JG PVS	F01
KD PV and KD PVS	F01
LG PV	F01
MDL PV	F01
Special calibration—contact Eaton for availability	

## Molded Case Switches

Eaton's DC molded case switches (MCS) are used in applications requiring a compact, high capacity disconnect. PVGuard 1000 Vdc

MCS are UL 489B listed and have automatic instantaneous current protection. These devices do not provide overload protection.

## Molded Case Switches

Maximum Continuous Ampere Rating at 50°C	Interrupting Capacity Vdc	Poles in Series	Catalog Number
<b>1000 Vdc Maximum</b>			
100	3000	4	<b>FDPV4100KW</b>
200	5000	4	<b>KDPV4200KW</b>
250	5000	4	<b>KDPV4250KW</b>
350	5000	4	<b>KDPV4350KW</b>
400	5000	4	<b>LGPV4400KSW</b>
600	7500	3	<b>MDLPV3600KSW</b>

## Notes

- ① Base mounting hardware is included with a circuit breaker or a molded case switch (included with breaker). If required separately, order 66A2546G02.
- ② Individually priced.
- ③ Locks in ON and OFF position.
- ④ Add 20% to list price.

### Internal Accessories—Right Pole Mounting

	FD PV ①		JG PVS		KD PV KD PVS		LG PV		MDL PV	
	Factory Modification Code	Field Kit Catalog Number	Factory Modification Code	Field Kit Catalog Number	Factory Modification Code	Field Kit Catalog Number	Factory Modification Code	Field Kit Catalog Number	Factory Modification Code	Field Kit Catalog Number
<b>Auxiliary Switch</b>										
1A-1B	A06	A1X1PK	A1	AUX1A1BPK	A06	A1X3PK	A1	AUX1A1BPK	A06	A1X4PK
2A-2B	A13	A2X1RPK	A2	AUX2A2BPK	A13	A2X3PK	A2	AUX2A2BPK	A13	A2X4PK
<b>Alarm Switch</b>										
1 make/1 break	B06	A1L1RPK	B1	ALM1M1BJPKL	B06	A1L3RPK	B1	ALM1M1BJPK	B06	A1L4RPK
<b>Auxiliary and Alarm Combo</b>										
1A-1B, 1 make/1 break	C05	AAL1RPK	B2w	AUXALRMJPK	C05	AAL3RPK	B2	AUXALRMJPK	C05	AA114RPK

### Internal Accessories—Left Pole Mounting

	FD PV ①		JG PVS		KD PV KD PVS		LG PV		MDL PV	
	Factory Modification Code	Field Kit Catalog Number	Factory Modification Code	Field Kit Catalog Number	Factory Modification Code	Field Kit Catalog Number	Factory Modification Code	Field Kit Catalog Number	Factory Modification Code	Field Kit Catalog Number
<b>Shunt Trip</b>										
12 Vdc	S02	SNT1LP03K	S4	SNT012CPK	S42	SNT3P04K	S4	SNT012CPK	S02	SNT4LP03K
24 Vdc	S02	SNT1LP03K	S1	SNT060CPK	S42	SNT3P04K	S1	SNT060CPK	S02	SNT4LP03K
48 Vdc	S06	SNT1LP08K	S1	SNT060CPK	S50	SNT3P06K	S1	SNT060CPK	S86	SNT4LP23K
60 Vdc	S06	SNT1LP08K	S1	SNT060CPK	S50	SNT3P06K	S1	SNT060CPK	S86	SNT4LP23K
125 Vdc	S10	SNT1LP12K	S5	SNT125DPK	S10	SNT3P11K	S2	SNT120CPK	S42	SNT4LP26K
250 Vdc	S14	SNT1LP18K	—	—	S14	SNT3P14K	—	—	S14	SNT4LP14K
120 Vac	S10	SNT1LP12K	S2	SNT120CPK	S10	SNT3P11K	S2	SNT120CPK	S10	SNT4LP11K
<b>Undervoltage Release</b>										
12 Vdc	U30	UVH1LP20K	—	—	T02	UVH3LP20K	U1	UVR012DPK	T02	UVH4LP20K
24 Vdc	U34	UVH1LP21K	U2	UVR024CPK	T02	UVH3LP21K	U2	UVR024DPK	T06	UVH4LP21K
48 Vdc	U38	UVH1LP22K	U4	UVR048DPK	T10	UVH3LP22K	U4	UVR048DPK	T10	UVH4LP22K
60 Vdc	—	—	U4	UVR048DPK	—	—	—	—	—	—
125 Vdc	U42	UVH1LP26K	U6	UVR125DPK	T14	UVH3LP26K	U6	UVR125DPK	T14	UVH4LP26K
250 Vdc	U46	UVH1LP28K	U8	UVR250DPK	T18	UVH3LP28K	U8	UVR250DPK	T18	UVH4LP28K
120 Vac	U14	UVH1LP08K	U5	UVR120APK	U18	UVH3LP08K	U5	UVR120APK	U18	UVH4LP08K

#### Notes

① Underwriters Laboratories requires that internal accessories for the FD PV be installed at the factory. Internal accessories are UL listed for factory installation under E7819. Where local codes and standards permit and UL listing is not required, internal accessories can be field installed. Accessory installation should be done before the circuit breaker is mounted and connected.

One accessory can be mounted per pole, per breaker.

# 3.2

## PVGard Solar Circuit Breakers

### Specialty Breakers

#### PVGard Solar Circuit Breaker Terminal Offering

Breaker Frame	Maximum Breaker Ampacity	Terminal Body Material	Wire Type	AWG Wire Range/ Number of Conductors	Metric Wire Range mm <sup>2</sup>	Number of Terminals Included	Standard Terminal Catalog Number	Comments
FD PV	50	Steel	Cu/Al	14–4 (1)	2.5–25 (1)	3	<b>3TA50FB</b>	
	100	Aluminum	Cu/Al	6–300 kcmil (1)	16–150 (1)	3	<b>3TA225FDK</b>	Includes 3P terminal cover
	100	Copper	Cu	4–4/0 (1)	25–95 (1)	3	<b>3T225FD</b>	
JG PVS	250	Aluminum	Cu/Al	#8–350 kcmil (1)	—	—	<b>TA250FJ</b>	
	250	Aluminum	Cu/Al	(2) 2/0–(2) 4/0	—	①	<b>3TA251FJK1</b>	
	250	Aluminum	Cu/Al	(2) 2/0–(2) 4/0	—	②	<b>3TA251FJK2</b>	
	250	Copper	Cu	#4–350 kcmil (1)	—	—	<b>T250FJ</b>	
KD PV KD PVS	225	Aluminum	Cu/Al	3–350 kcmil (1)	35–185 (1)	1	<b>TA300K</b>	
	250	Aluminum	Cu/Al	250–500 kcmil (1)	120–240 (1)	1	<b>TA350K</b>	
	250	Aluminum	Cu/Al	3/0–250 kcmil (2)	95–120 (1)	4	<b>4TA400K</b>	Contains interphase barriers
	250	Aluminum	Cu/Al	2/0–250 kcmil (2) or 2/0–500 kcmil (1)	70–240 (2)	4	<b>4TA401K</b>	
	300	Aluminum	Cu/Al	3/0–250 kcmil (2)	95–120 (2)	4	<b>4TA401K</b>	Contains interphase barriers
	350	Aluminum	Cu/Al	3/0–250 kcmil (2)	95–120 (2)	4	<b>4TA401K</b>	Contains interphase barriers
	225	Copper	Cu	3–350 kcmil (1)	35–185 (1)	1	<b>T300K</b>	
	250	Copper	Cu	250–500 kcmil (1)	120–240 (1)	1	<b>T350K</b>	
	250	Copper	Cu	3/0–250 kcmil (2)	95–120 (1)	4	<b>4T400K</b>	Contains interphase barriers
	300	Copper	Cu	3/0–250 kcmil (2)	95–120 (2)	4	<b>4TA401K</b>	Contains interphase barriers
	350	Copper	Cu	3/0–250 kcmil (2)	95–120 (2)	4	<b>4TA401K</b>	Contains interphase barriers
	400	Aluminum	Cu/Al	2–500 kcmil (2)	35–240 (2)	4	<b>4TA632LK</b>	Includes 4P terminal cover
	250	Copper	Cu	2–500 kcmil (1)	35–240 (1)	1	<b>T350LK</b>	
LG PV	400	Copper	Cu	2–500 kcmil (2)	35–240 (2)	4	<b>4T632LK</b>	Includes 4P terminal cover
	400	Copper	Cu	2–500 kcmil (2)	35–240 (2)	4	<b>4T632LK</b>	Includes 4P terminal cover
MDL PV	300	Aluminum	Cu/Al	1–500 kcmil (2)	—	1	<b>TA700MA1</b>	
	600	Aluminum	Cu/Al	3/0–400 kcmil (3)	—	1	<b>TA800MA2</b>	

#### Endcap Kits

Breaker Frame	Number of Poles	Thread Type	Thread Size	Catalog Number
FD PV	4	Imperial	10–32	<b>KPEK14</b>
	4	Metric	M–5	<b>KPEKM14</b>
JG PVS	3	Imperial	—	<b>FJ3RTDK</b>
	3	Metric	—	<b>FJ3RTWK</b>
KD PV	4	Imperial	0.312–18	<b>KPEK34</b>
	4	Metric	M–8	<b>KPEKM34</b>
KD PVS	3	Imperial	—	<b>KPEK3</b>
	3	Metric	—	<b>KPEKM3</b>
LG PV	4	Imperial	—	<b>N/A</b>
	4	Metric	M-10	<b>L4RTWK</b>
MDL PV	3	Imperial	—	—
	3	Metric	—	—

#### Notes

- ① Three terminals with terminal shield as a kit.  
 ② Three terminals with two interphase barriers as a kit.

### Jumpers

Jumpers must be ordered separately. Priced individually.

#### FD PV Frame

Description	Maximum Amperes	Catalog Number
Single copper jumper	60	DC1F060 <sup>①</sup>
	100	DC1F100 <sup>①</sup>
	125	DC1F125 <sup>①</sup>
	225	DC1F225 <sup>①</sup>
Package of 2 aluminum jumpers	100	DC2FD100A
Package of 3 aluminum jumpers	100	DC3FD100A

#### JG PVM, JG PVMD Frames

Description	Maximum Amperes	Catalog Number
Single aluminum jumper	250	DC1JG250A <sup>①</sup>
Package of 2 aluminum jumpers	250	DC2JG250A <sup>①</sup>
Package of 20 aluminum jumpers	250	DC20JG250A <sup>①</sup>

#### KD PV, KD PVM, KD PVMD Frames

Description	Maximum Amperes	Catalog Number
Single copper jumper	400	DC1K400 <sup>①</sup>
Package of 2 aluminum jumpers	400	DC2KD400A <sup>①</sup>
Package of 3 aluminum jumpers	400	DC3KD400A <sup>①</sup>

#### LG PV Frame

Description	Maximum Amperes	Catalog Number
Package of 2 aluminum jumpers	400	DC2LG400A
Package of 3 aluminum jumpers	400	DC3LG400A
Package of 30 aluminum jumpers	400	DC30LG400A

#### Note

<sup>①</sup> Not UL Listed; Non UL listed jumpers used in a UL application may need to be qualified by the OEM in their assembly. This may take place with UL or another certified testing agency.

**Technical Data and Specifications**

- Thermal-magnetic circuit breakers
- Designed to meet UL 489B for solar photovoltaic circuit protection
- 100% rated of the continuous current rating
- 50°C calibrated
- Can be applied in grounded, ungrounded or bi-polar systems
- Ability to open on signal from DC arc or ground fault detector
- Two PVGard lineups
  - UL File EE350638, Category Control Number DIUR
  - 600 Vdc per-pole breaker and switch
    - Each pole rated 600 Vdc
  - 1000 Vdc poles-in-series breaker and switch
    - Requires poles in series connection

**Quick Reference PVGard Solar Circuit Breakers  
600 Vdc Per-Pole****PVGard 600 Vdc Current Ratings by Frame  
UL 489B Interrupting Capacity (kA) 600 Vdc Per-Pole**

Circuit Breaker Type	Minimum Amperes	Maximum Amperes	kA Rating
JG PVS	90	250	1.2
KD PVS	100	400	3

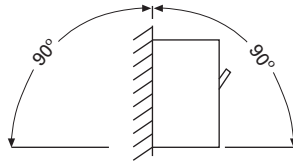
**Quick Reference PVGard Solar Circuit Breakers  
1000 Vdc Poles-in-Series****PVGard 1000 Vdc Current Ratings by Frame  
UL 489B Interrupting Capacity (kA) 1000 Vdc**

Circuit Breaker Type	Minimum Amperes	Maximum Amperes	kA Rating	Poles in Series
FD PV	30	100	3	4
KD PV	125	350	5	4
LG PV	250	400	5	4
MDL PV	300	600	7.5	3



### PVGard 600 Vdc Per-Pole Solar PV Circuit Breakers (100% and 80% Rated Frames)

	JG PVS	KD PVS
Number of 600 Vdc circuits	3	3
Maximum voltage rating	600 Vdc	600 Vdc
Ampere range	90–250A	100–400A
Interrupting capacity at 600 Vdc	1.2 kA	3 kA
Time constant	1 ms	1 ms
Trip unit type	Thermal-magnetic	Thermal-magnetic
Rated impulse withstand voltage		
Main conducting paths	8 kV	8 kV
Auxiliary circuits	4 kV	4 kV
Endurance		
Mechanical operations	10,000	6000
Electrical operations	400	400
Maximum switching frequency	240 per hour	240 per hour
Third-party certification	UL 489B	UL 489B
Environment		
Design ambient temperature	50°C	50°C
Maximum current at 60°C, as % of rated current	93%	93%
Maximum current at 70°C, as % of rated current	85%	85%
Operating temperature range	–20°C to +50°C	–20°C to +50°C
Storage temperature range	–20°C to +70°C	–20°C to +70°C
Suitable for freeze temperatures to –40°C	Option	Option
Relative humidity	0 to 95% noncondensing	0 to 95% noncondensing
Suitable for reverse-feed applications	Yes	Yes
Mounting—permissible mounting position		



#### Connection diagrams

##### Terminations

Al/Cu wire	TA250FJ: (1) #8–350 kcmil	TA300K: (1) #3–350 kcmil
	3TA251FJK1: (2) 2/0–(2) 4/0 ②	TA350K: (1) 250–500 kcmil
	3TA251FJK2: (2) 2/0–(2) 4/0 ③	TA403K: (2) 1/0–400 kcmil
Cu wire		3TA402K: (1) 500–750 kcmil ④
	T250FJ: (1) #4–350 kcmil	T300K: (1) #3–350 kcmil
Dimensions in inches (mm)		
Height	7.00 (177.8)	10.13 (257.3)
Width	4.13 (104.9)	5.50 (139.7)
Depth	3.57 (90.7)	4.10 (104.1)
Weight in lbs	6.6	11.42

#### Notes

- ① Line/top side connection only PVGard FD PVS breakers.
- ② Three terminals with terminal shield as a kit.
- ③ Three terminals with two interphase barriers as a kit.
- ④ Not UL 489B recognized size for maximum of 400A breaker.

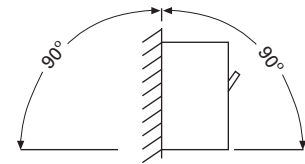
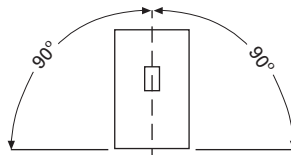
# 3.2

## PVGard Solar Circuit Breakers

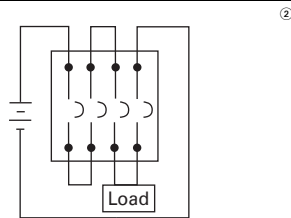
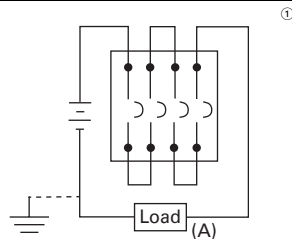
### Specialty Breakers

#### PVGard 1000 Vdc Solar PV Circuit Breakers (100% and 80% Rated Frames)

	FD PV	KD PV	LG PV	MDL PV
Number of poles	4	4	4	3
Maximum voltage rating	1000 Vdc	1000 Vdc	1000 Vdc	1000 Vdc
Maximum current rating	100A	350A	400A	600A
Interrupting capacity at 1000 Vdc	3 kA	5 kA	5 kA	7.5 kA
Time constant	1 ms	1 ms	1 ms	1 ms
Ampere range	15–100A	125–350A	250–400A	300–600A
Trip unit type	Thermal-magnetic	Thermal-magnetic	Thermal-magnetic	Thermal-magnetic
Rated impulse withstand voltage				
Main conducting paths	8 kV	8 kV	8 kV	8 kV
Auxiliary circuits	4 kV	4 kV	4 kV	4 kV
Endurance				
Mechanical operations	10,000	10,000	8000	8000
Electrical operations	1000	400	400	400
Maximum switching frequency	300 per hour	240 per hour	240 per hour	240 per hour
Third-party certification	UL 489B	UL 489B	UL 489B	UL 489B
Environment				
Design ambient temperature	50°C	50°C	50°C	50°C
Maximum current at 60°C, as % of rated current	91%	91%	93%	93%
Maximum current at 70°C, as % of rated current	88%	88%	88%	88%
Operating temperature range	–20°C to +50°C	–20°C to +50°C	–20°C to +50°C	–20°C to +50°C
Storage temperature range	–20°C to +70°C	–20°C to +70°C	–20°C to +70°C	–20°C to +70°C
Suitable for freeze temperatures to –40°C	Option	Option	Option	Option
Relative humidity	0 to 95% noncondensing	0 to 95% noncondensing	0 to 95% noncondensing	0 to 95% noncondensing
Suitable for reverse-feed applications	Yes	Yes	Yes	Yes
Mounting—permissible mounting position				



#### Connection diagrams



#### Terminations

Al/Cu wire	#6–300 kcmil	(2) 3/0–250 kcmil	(2) #2–500 kcmil	(3) 3/0–400 kcmil
Cu wire	#4–4/0	(2) 3/0–250 kcmil	(2) #2–500 kcmil	(3) 3/0–300 kcmil

#### Dimensions in inches (mm)

Height	6.00 (152.4)	10.13 (257.3)	10.13 (257.3)	16.00 (406.4)
Width	5.50 (139.7)	7.22 (183.4)	7.22 (183.4)	8.25 (209.5)
Depth	3.38 (85.9)	4.09 (103.9)	4.09 (103.9)	4.06 (103.1)
Weight in lbs	6	20	20	29

#### Notes

- ① Suitable for use on ungrounded systems, or grounded systems that have one end of load (A) connected to grounded terminal, opposite poles in series connection.
- ② Suitable for use on ungrounded systems only.

## Dimensions

Approximate Dimensions in Inches (mm)

### PVGard Solar Circuit Breakers—600 Vdc Per-Pole

Frame	Number of Circuits in a Frame	Width	Height	Depth
JG PVS	3	4.13 (104.9)	7.00 (177.8)	3.44 (87.4)
KD PVS	3	5.49 (139.4)	10.13 (257.2)	4.31 (109.6)

### PVGard Solar Circuit Breakers—1000 Vdc Poles-in-Series

Frame	Number of Poles	Width	Height	Depth
FD PV	4	5.50 (139.7)	6.00 (152.4)	3.38 (86.0)
KD PV	4	7.22 (183.4)	10.13 (257.3)	4.09 (103.9)
LG PV	4	7.22 (183.4)	10.13 (257.3)	4.09 (103.9)
MDL PV	3	8.25 (209.6)	16.00 (406.4)	4.06 (103.1)

# 3.2

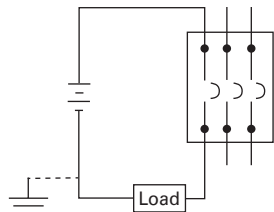
## PVGard Solar Circuit Breakers

### Specialty Breakers

#### Wiring Diagrams

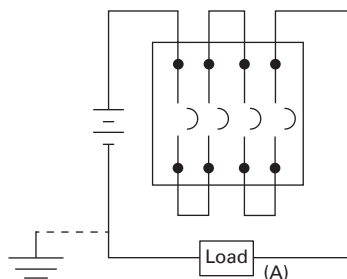
##### Series Connection Diagrams for DC Application <sup>①②</sup>

##### JF PVS, KD PVS—600 Vdc Per-Pole

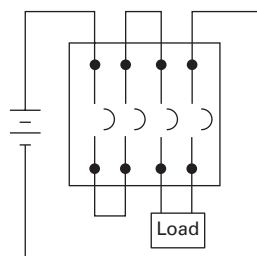


Suitable for grounded or ungrounded systems.  
Suitable for quantity (3) 600 Vdc circuits.

##### FD PV, KD PV, LG PV—1000 Vdc Maximum—Four Poles-in-Series

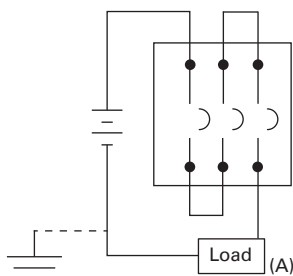


Suitable for use on ungrounded systems, or grounded systems that have one end of load (A) connected to grounded terminal, opposite poles in series connection.

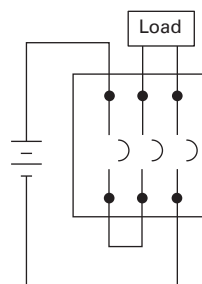


Suitable for use on ungrounded systems only.

##### MDL PV—1000 Vdc Maximum—Three Poles in Series



Suitable for use on ungrounded systems, or grounded systems that have one end of load (A) connected to grounded terminal, opposite poles in series connection.



Suitable for use on ungrounded systems only.

#### Notes

- ① Poles in series connection is customer supplied. Use rated cable per NEC.
- ② For grounded systems, all poles in series must be connected on non-grounded terminal, with load connected to grounded terminal.

## DC Switch Disconnectors



## Contents

## Description

DC Switch Disconnectors	
Product Selection . . . . .	V15-T3-30
Technical Data and Specifications . . . . .	V15-T3-34
Dimensions . . . . .	V15-T3-37

## DC Switch Disconnectors

## Product Description

Switch disconnectors N...DC in the special version for up to 1500 Vdc can be used on single- or two-poles. They comply with the isolation properties for earthed IT networks. Accessories, such as bridge kits, connection terminals and door coupling rotary handles, enable individual installation in the most varied types of distribution systems. Auxiliary switches, voltage releases and remote operators facilitate signalling and automation.

## Application Description

- Switch disconnectors for nominal system voltage up to 1500 Vdc
- Suitable for cabinets with ambient temperatures up to 70°C
- Main switch before DC/AC converter fulfills NEC requirements
- Safely switching in combiner boxes enables effective operation in case of maintenance with breaking capacity under load up to 4x nominal current
- Bi-directional functionality of switch contacts for array protection suitable for grounded or ungrounded systems

## Features

- Switch disconnectors N can be combined with voltage releases NZM...-XU, NZM...-XA and auxiliary contacts, as well as with remote operator NZM...-XR
- For DC switching, series connection of all four current paths is needed
- Standard equipment: screw-type connection, frame terminal available as an option
- For non-earthed networks (e.g., IT), the installation must be configured such that the likelihood of a double earth fault is negligibly small
- Switches can not be combined with withdrawable units and/or connection on rear
- N4-4-...S15-DC supply from the bottom only



## Standards and Certifications

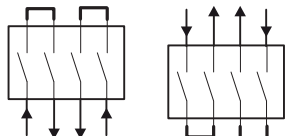
- IEC/EN 60947-3
- Main switch characteristics including positive drive to IEC/EN 60204 and VDE 0113
- Isolating characteristics to IEC/EN 60947 and VDE 0660
- Busbar tag shroud to VDE 0160 Part 100

## Product Selection

3

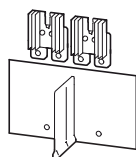
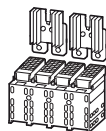
## Switch Disconnectors for 1000/1500 Vdc, Single- and Two-Pole

	Rated Operational Current Rated = Uninterrupted Current $I_n = I_u$	Short-Circuit Protective Device Fuse gR-Characteristic	Screw Connection	Units per Package	1000 Vdc Fixed Mounted Catalog Number	1500 Vdc Fixed Mounted Catalog Number
<b>N2-4</b> 	160A	200A	S	1	<b>N2-4-160-S1-DC</b>	<b>N2-4-160-S15-DC</b>
	200A	200A	S	1	<b>N2-4-200-S1-DC</b>	<b>N2-4-200-S15-DC</b>
	250A	200A	S	1	<b>N2-4-250-S1-DC</b>	<b>N2-4-250-S15-DC</b>
<b>N3-4</b> 	320A	500A	S	1	<b>N3-4-320-S1-DC</b>	<b>N3-4-320-S15-DC</b>
	400A	500A	S	1	<b>N3-4-400-S1-DC</b>	<b>N3-4-400-S15-DC</b>
	500A	500A	S	1	<b>N3-4-500-S1-DC</b>	<b>N3-4-500-S15-DC</b>
	550A	500A	S	1	<b>N3-4-550-S1-DC</b>	<b>N3-4-550-S15-DC</b>
<b>N4-4</b> 	800A	—	S	1	<b>N4-4-800-S1-DC</b>	<b>N4-4-800-S15-DC</b>
	1000A	—	S	1	<b>N4-4-1000-S1-DC</b>	<b>N4-4-1000-S15-DC</b>
	1250A	—	S	1	<b>N4-4-1250-S1-DC</b>	<b>N4-4-1250-S15-DC</b>
	1400A	—	S	1	<b>N4-4-1400-S1-DC</b>	<b>N4-4-1400-S15-DC</b>
	1600A	—	S	1	<b>N4-4-1600-S1-DC</b>	<b>N4-4-1600-S15-DC</b>

**Bridge Kits****Two-Pole (+ and –) on One Side**

- Model contains parts for upper or lower row of switchgear side for four-pole switches N...-S1(S15)-DC that are used as two-pole switches for DC
- Each link connects two contacts in series
- Incoming unit and outgoing at bottom according to the switching diagrams
- N4-4-... ≥1250A at 65°C alternate connection at bottom through module plates NZM4-4-XKM2S-1600
- N4-4-...S15-DC supply from the bottom only

3

**Bridge Kits NZM...-XKV...2P...****Bridge Kits**

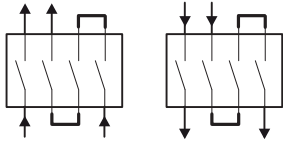
Rated Operational Current $I_n$	Protection Class	For Use With	Units Per Package	Catalog Number
<b>Including Cover</b>				
225A at 40°C 170A at 65°C	IP2X	N2-4-...S1-(S15)-DC	1	<b>NZM2-4-XKV2P</b>
250A at 40°C 190A at 65°C	IP2X	N2-4-...S1-(S15)-DC	1 ①	<b>NZM2-4-XKV2P-K</b>
517A at 40°C 435A at 65°C	IP2X	N3-4-...S1-(S15)-DC	1	<b>NZM3-4-XKV2P</b>
550A at 40°C 468A at 65°C	IP2X	N3-4-...S1-(S15)-DC	1 ①	<b>NZM3-4-XKV2P-K</b>
1400A at 40°C 1260A at 65°C	IP2X	N4-4-...S1-(S15)-DC	1	<b>NZM4-4-XKV2P</b>
<b>Including Insulation Plates and Phase Separator</b>				
238A at 40°C 180A at 65°C	IP00	N2-4-...S1-(S15)-DC	1	<b>NZM2-4-XKVI2P</b>
250A at 40°C 213A at 65°C	IP00	N2-4-...S1-(S15)-DC	1 ①	<b>NZM2-4-XKVI2P-K</b>
534A at 40°C 451A at 65°C	IP00	N3-4-...S1-(S15)-DC	1	<b>NZM3-4-XKVI2P</b>
550A at 40°C 501A at 65°C	IP00	N3-4-...S1-(S15)-DC	1 ①	<b>NZM3-4-XKVI2P-K</b>
1600A at 40°C 1500A at 65°C	IP00	N4-4-...S1-(S15)-DC	1 ①	<b>NZM4-4-XKVI2P-K</b>

**Note**

① Includes cooling unit.

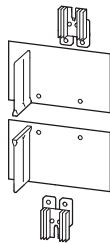
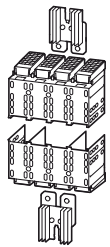
Detailed assignment taking into account ambient temperature, degree of protection and fitting position as listed in tables on **Pages V15-T3-34 and V15-T3-35**.



**Two-Pole (+ and –)  
Double Sided**

- Each link connects three contacts in series
- Incoming unit and outgoing at bottom or top, according to the switching diagrams

- Model contains parts for upper and lower row of switchgear side for four-pole switches N...-S1(S15)-DC that are used as two-pole switches for DC

**Bridge Kits****Bridge Kits NZM...-XKV...2POU...**

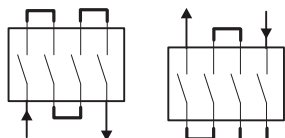
Rated Operational Current $I_n$	Protection Class	For Use With	Units Per Package	Catalog Number
<b>Including Cover</b>				
200A at 40°C 160A at 65°C	IP2X	N2-4-...S1-(S15)-DC	1	<b>NZM2-4-XKV2POU</b>
225A at 40°C 170A at 65°C	IP2X	N2-4-...S1-(S15)-DC	1 ①	<b>NZM2-4-XKV2POU-K</b>
400A at 40°C 388A at 65°C	IP2X	N3-4-...S1-(S15)-DC	1	<b>NZM3-4-XKV2POU</b>
517A at 40°C 435A at 65°C	IP2X	N3-4-...S1-(S15)-DC	1 ①	<b>NZM3-4-XKV2POU-K</b>
<b>Including Insulation Plates and Phase Separator</b>				
213A at 40°C 160A at 65°C	IP00	N2-4-...S1-(S15)-DC	1	<b>NZM2-4-XKVI2POU</b>
238A at 40°C 180A at 65°C	IP00	N2-4-...S1-(S15)-DC	1 ①	<b>NZM2-4-XKVI2POU-K</b>
501A at 40°C 418A at 65°C	IP00	N3-4-...S1-(S15)-DC	1	<b>NZM3-4-XKVI2POU</b>
534A at 40°C 451A at 65°C	IP00	N3-4-...S1-(S15)-DC	1 ①	<b>NZM3-4-XKVI2POU-K</b>

**Note**

① Includes cooling unit.

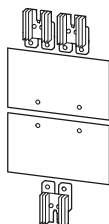
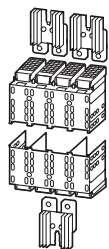
Detailed assignment taking into account ambient temperature, degree of protection and fitting position as listed in tables on **Pages V15-T3-34 and V15-T3-35**.

### Single-Pole (+ and -) Double Sided



- Each link connects four contacts in series (plus or minus)
- Incoming unit and outgoing at bottom or top, according to the switching diagrams
- Model contains parts for upper and lower row of switchgear side for four-pole switches N...-S1(S15)-DC that are used as single-pole switches for DC

### Bridge Kits



### Bridge Kits NZM...-XKV...1P...

Rated Operational Current I <sub>n</sub>	Protection Class	For Use With	Units Per Package	Catalog Number
<b>Including Cover</b>				
200A at 40°C 160A at 65°C	IP2X	N2-4-160(200)-S1-(S15)-DC	1	<b>NZM2-4-XKV1P</b>
225A at 40°C 170A at 65°C	IP2X	N2-4-...S1-(S15)-DC	1 ①	<b>NZM2-4-XKV1P-K</b>
400A at 40°C 388A at 65°C	IP2X	N3-4-320-S1-(S15)-DC	1	<b>NZM3-4-XKV1P</b>
517A at 40°C 435A at 65°C	IP2X	N3-4-400(500)-S1-(S15)-DC	1 ①	<b>NZM3-4-XKV1P-K</b>
<b>Including Insulation Plates</b>				
213A at 40°C 160A at 65°C	IP00	N2-4-...S1-(S15)-DC	1	<b>NZM2-4-XKV11P</b>
238A at 40°C 180A at 65°C	IP00	N2-4-200(250)-S1-(S15)-DC	1 ①	<b>NZM2-4-XKV11P-K</b>
501A at 40°C 418A at 65°C	IP00	N3-4-...S1-(S15)-DC	1	<b>NZM3-4-XKV11P</b>
534A at 40°C 451A at 65°C	IP00	N3-4-500(550)-S1-(S15)-DC	1 ①	<b>NZM3-4-XKV11P-K</b>

#### Note

① Includes cooling unit.

Detailed assignment taking into account ambient temperature, degree of protection and fitting position as listed in tables on **Pages V15-T3-34 and V15-T3-35**.

**Technical Data and Specifications**

Reduction of the rated operating current (derating) at different ambient temperatures, fitting positions, degrees of protection and jumper kits.

3

**Temperature Impact, Derating**

Load Disconnect Switch	Touch Protection	Jumper Kit	Fitting Position Load Disconnect Switch	Rated Operating Current Amperes									
				20°C	30°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C	70°C
N2-4-160-S1(15)-DC	IP2X	NZM2-4-XKV2P NZM2-3-XKV2POU-K NZM2-3-XKV1P-K	Vertical	160	160	160	160	160	160	160	160	160	160
	IP00	NZM2-4-XKV2P NZM2-3-XKV2POU-K NZM2-3-XKV1P-K	Horizontal	160	160	160	160	160	160	160	160	160	160
	IP2X	NZM2-3-XKV1P-K NZM2-4-XKV2P	Vertical	160	160	160	160	160	160	160	160	160	152
			Vertical	160	160	160	160	160	160	160	160	152	144
N2-4-200-S1(15)DC	IP00	NZM2-4-XKV2P-K	Vertical	200	200	200	200	200	200	200	200	200	200
			Horizontal	200	200	200	200	200	200	200	200	200	190
	IP2X	NZM2-4-XKV2P-K	Vertical	200	200	200	200	200	200	200	200	190	180
	IP00	NZM2-4-XKV2P NZM2-4-XKV2POU-K NZM2-4-XKV1P-K	Horizontal	200	200	200	200	200	200	200	190	180	170
	IP2X	NZM2-4-XKV2P NZM2-4-XKV2POU-K NZM2-4-XKV1P-K	Vertical	200	200	200	200	200	200	190	180	170	160
			Horizontal	200	200	200	200	200	190	180	170	160	—
	IP2X	NZM2-4-XKV2POU NZM2-4-XKV1P	Vertical	200	200	200	200	190	180	170	160	—	—
			Horizontal	200	200	200	190	180	170	160	—	—	—
N2-4-250-S1(15)-DC	IP00	NZM2-4-XKV2P-K	Vertical	250	250	250	250	250	250	238	225	213	200
			Horizontal	250	250	250	250	250	238	225	213	200	—
	IP2X	NZM2-4-XKV2P-K	Horizontal	250	250	250	250	238	225	213	200	—	—
	IP00	NZM2-4-XKV2P NZM2-4-XKV2POU-K NZM2-4-XKV1P-K	Horizontal	250	250	250	238	225	213	200	—	—	—
	IP2X	NZM2-4-XKV2P NZM2-4-XKV2POU-K NZM2-4-XKV1P-K	Vertical	250	250	238	225	213	200	—	—	—	—
			Horizontal	250	238	225	213	200	—	—	—	—	—
	IP00	NZM2-4-XKV2POU NZM2-4-XKV1P	Horizontal	250	238	225	213	200	—	—	—	—	—

## Temperature Impact, Derating, continued

Load Disconnect Switch	Touch Protection	Jumper Kit	Fitting Position Load Disconnect Switch	Rated Operating Current Amperes									
				20°C	30°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C	70°C
<b>N3-4-320-S1(15)-DC</b>	IP2X	NZM3-4-XKV2P NZM3-4-XKV2POU NZM3-4-XKV1P	Vertical	320	320	320	320	320	320	320	320	320	320
	IP00	NZM3-4-XKV12P NZM3-4-XKV12POU NZM3-4-XKV11P	Horizontal	320	320	320	320	320	320	320	320	320	320
<b>N3-4-400-S1(15)-DC</b>	IP2X	NZM3-4-XKV2P NZM3-4-XKV2POU-K NZM3-4-XKV1P-K	Vertical	400	400	400	400	400	400	400	400	400	400
	IP00	NZM3-4-XKV12P NZM3-4-XKV12POU NZM3-4-XKV11P	Horizontal	400	400	400	400	400	400	400	400	400	388
	IPX2	NZM3-4-XKV2POU	Vertical	400	400	400	400	400	400	400	400	388	—
		NZM3-4-XKV1P	Horizontal	400	400	400	400	400	400	400	388	376	—
<b>N3-4-500-S1(15)-DC</b>	IP00	NZM3-4-XKV12P-K	Vertical	500	500	500	500	500	500	485	470	455	440
			Horizontal	500	500	500	500	500	485	470	455	440	425
	IP2X	NZM3-4-XKV2P-K	Vertical	500	500	500	500	485	470	455	440	425	410
	IP00	NZM3-4-XKV12P NZM3-4-XKV12POU-K NZM3-4-XKV11P-K	Horizontal	500	500	500	485	470	455	440	425	410	400
	IP2X	NZM3-4-XKV2P NZM3-4-XKV2POU-K NZM3-4-XKV1P-K	Vertical	500	500	485	470	455	440	425	410	400	—
	IP00	NZM3-4-XKV12POU NZM3-4-XKV11P	Horizontal	500	485	470	455	440	425	410	400	—	—
<b>N3-4-550-S1(15)-DC</b>	IP00	NZM3-4-XKV12P-K	Vertical	550	550	550	550	550	550	534	517	501	484
			Horizontal	550	550	550	550	550	534	517	501	484	468
	IP2X	NZM3-4-XKV2P-K	Vertical	550	550	550	550	534	517	501	484	468	451
	IP00	NZM3-4-XKV12P NZM3-4-XKV12POU-K NZM3-4-XKV11P-K	Horizontal	550	550	550	534	517	501	484	468	451	435
	IP2X	NZM3-4-XKV2P NZM3-4-XKV2POU-K NZM3-4-XKV1P-K	Vertical	550	550	534	517	501	484	468	451	435	418
	IP00	NZM3-4-XKV12POU NZM3-4-XKV11P	Horizontal	550	534	517	501	484	468	451	435	418	402
<b>N4-4-800-S1(15)-DC</b>	IP2X	NZM4-4-XKV2P	Vertical	800	800	800	800	800	800	800	800	800	800
			Horizontal	800	800	800	800	800	800	800	800	800	800
<b>N4-4-1000-S1(15)-DC</b>	IP2X	NZM4-4-XKV2P	Vertical	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
			Horizontal	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
<b>N4-4-1250-S1(15)-DC</b>	IP2X	NZM4-4-XKV2P	Vertical	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250
			Horizontal	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250
<b>N4-4-1400-S1(15)-DC</b>	IP00	NZM4-4-XKV2P-K	Vertical	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
			Horizontal	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
	IP2X	NZM4-4-XKV2P	Vertical	1400	1400	1400	1400	1358	1330	1302	1274	1260	—
			Horizontal	1400	1400	1400	1358	1330	1302	1274	1260	—	—
<b>N4-4-1600-S1(15)-DC</b>	IP00	NZM4-4-XKV2P-K	Vertical	1600	1600	1600	1600	1576	1552	1528	1512	1500	1472
			Horizontal	1600	1600	1600	1576	1552	1528	1512	1500	1472	1448

# 3.3

## DC Switch Disconnectors

### Switch Disconnectors 1000 Vdc

Description			N2-4-...-S1-DC Max. 250A			N3-4-...-S1-DC Max. 550A				N4-4-...-S1-DC Max. 1600A			
Rated operational voltage	$U_e$	Vdc	1000			1000				1000			
Rated insulation voltage	$U_i$	Vdc	1000			1000				1000			
Rated impulse withstand voltage	$U_{imp}$												
Main contacts		V	8000			8000				8000			
Auxiliary contacts		V	6000			6000				6000			
Category of utilization			DC-22A			DC-22A				DC-22A			
Rated uninterrupted current with terminal jumpers at 40°C at 65°C	$I_u$	A	250			550				1600			
	$I_u$	A	250			500				1500			
Rated operating current	$I_e$	A	250			550				1600			
Rated switch-on and switch-off capacity		A	1200			2200				6400			
Rated short-time withstand current t = 1s	$I_{cw}$	kA	3, 6			6, 6				25 (0, 1s)			
Rated conditional short-circuit current With backup fuse up to 1000V	$I_q$	kA	15			15				—			
		A gR/gPV	200			2 x 250				—			
Maximum operating frequency		S/h	120			60				60			
Lifespan													
Mechanical		Operations	20,000			15,000				10,000			
Electrical (of which max. 50% trip by N/U release)		Operations	1000			1000				500			
Overvoltage category			III			III				III			
Degree of pollution			3			3				3			
Power loss at rated current	$I_u$	A	160	200	250	320	400	500	550	800	1000	1250	1600
Load disconnector switch	P	W	27	42	66	62	96	150	182	81	127	177	290
Jumper kit for each jumper fitted	P	W	1	1, 5	2	4	6	9, 5	11	0, 6	1	1, 6	2, 6

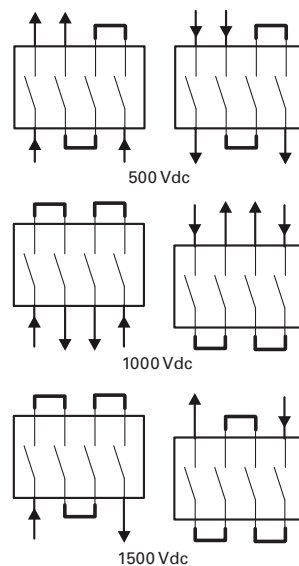
### Switch Disconnectors 1500 Vdc

Description			N2-4-...-S15-DC Max. 250A			N3-4-...-S15-DC Max. 550A				N4-4-...-S15-DC Max. 1600A			
Rated operational voltage	$U_e$	Vdc	1500			1500				1500			
Rated insulation voltage	$U_i$	Vdc	1500			1500				1500			
Rated impulse withstand voltage	$U_{imp}$												
Main contacts		V	10,000			10,000				10,000			
Auxiliary contacts		V	6000			6000				6000			
Category of utilization			DC-22A			DC-22A				DC-22A			
Rated uninterrupted current with terminal jumpers at 40°C at 65°C	$I_u$	A	250			550				1600			
	$I_u$	A	250			500				1500			
Rated operating current	$I_e$	A	250			550				1600			
Rated switch-on and switch-off capacity		A	1200			2200				6400			
Rated short-time withstand current t = 1s	$I_{cw}$	kA	3, 6			6, 6				25 (0, 1s)			
Maximum operating frequency		S/h	120			60				60			
Lifespan													
Mechanical		Operations	20,000			15,000				10,000			
Electrical (of which max. 50% trip by N/U release)		Operations	1000			1000				500			
Overvoltage category			III			III				III			
Degree of pollution			2			2				3			
Power loss at rated current	$I_u$	A	160	200	250	320	400	500	550	800	1000	1250	1600
Load disconnector switch	P	W	27	42	66	62	96	150	182	81	127	177	290
Jumper kit for each jumper fitted	P	W	1	1, 5	2	4	6	9, 5	11	0, 6	1	1, 6	2, 6

**Note:** N...S1-DC and N...S15-DC cannot be combined with plug-in or withdrawable units and/or in case of rear connection.

The diagram shows a two-wire circuit. On the left, a vertical branch contains a triangle symbol pointing upwards. The top horizontal wire contains a rectangular component followed by a switch. The bottom horizontal wire contains a rectangular component followed by a switch. On the right, a vertical branch contains a rectangular component. A lightning bolt symbol labeled ② points to the top wire between the first and second rectangular components. A lightning bolt symbol labeled ① points to the bottom wire between the second rectangular component and the rightmost rectangular component. Both symbols point to ground, represented by three horizontal lines of decreasing width.

**Rated Operating Voltage**  
**U<sub>e</sub> Maximum IT Network**



The technical drawing consists of three views of the M8 x 22 bracket:

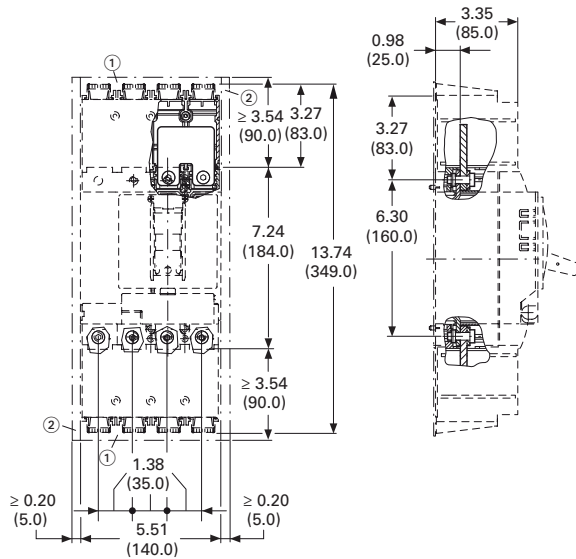
- Front View (Left):** Shows the bracket's profile with dimensions: total width ≥ 3.54 (90.0), mounting hole center-to-center distance 2.76 (70.0), top flange thickness 0.77 (19.5), main body height 7.24 (184.0), bottom flange thickness 0.77 (19.5), mounting hole diameter N 3.94 (100.0), internal slot width 5.31 (135.0), base plate thickness 1.38 (35.0), and SW5 screw holes.
- Side View (Right):** Shows the bracket's depth with dimensions: total depth 5.86 (149.0), mounting hole offset 0.98 (25.0), mounting hole diameter M8 x 22, top flange thickness 4.06 (103.0), main body depth 0.20 (5.0), bottom flange thickness 0.96 (24.5), and base plate thickness 0.12 (3.0).
- Detail View (Bottom Right):** Shows the corner joint with dimensions: vertical offset 3.15 (80.0), horizontal offset 2.85 (72.5), radius R124, angle ≤ 90°, and mounting hole diameter M4 x 85/20.

-

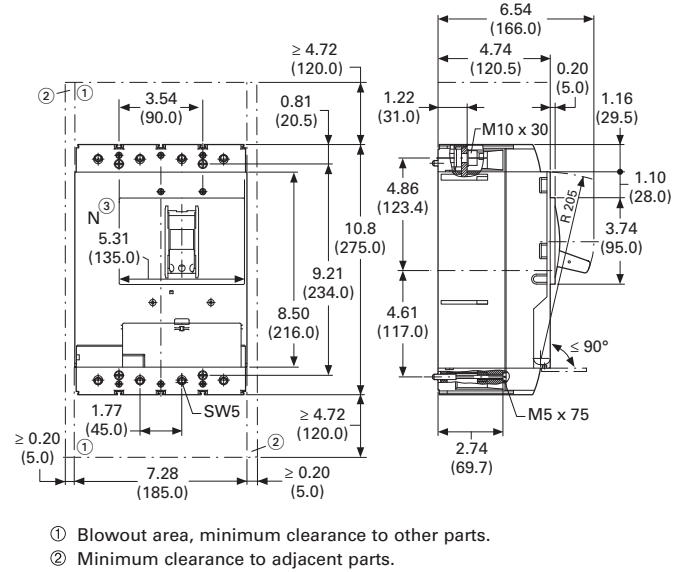
# 3.3 DC Switch Disconnectors

Approximate Dimensions in Inches (mm)

Jumper Kit, NZM2-4-XKV...

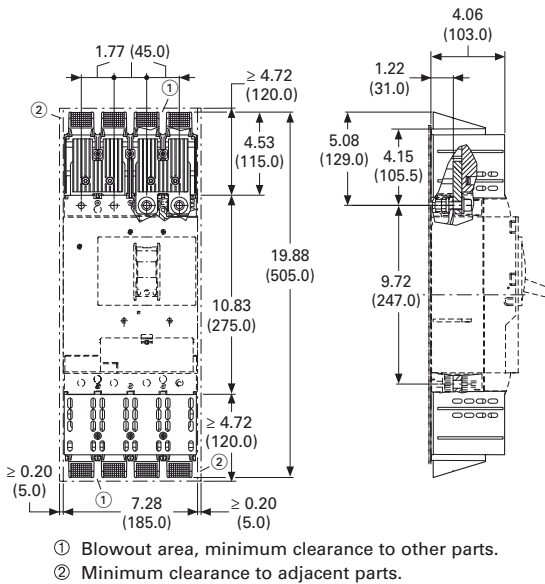


Switch Disconnectors, Four-Pole, N3-4...DC



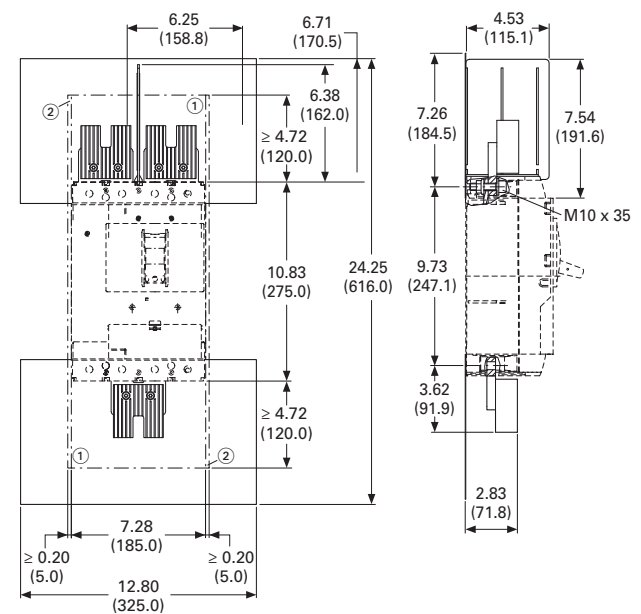
- ① Blowout area, minimum clearance to other parts.
- ② Minimum clearance to adjacent parts.

Jumper Kit, NZM3-4-XKV...



- ① Blowout area, minimum clearance to other parts.
- ② Minimum clearance to adjacent parts.

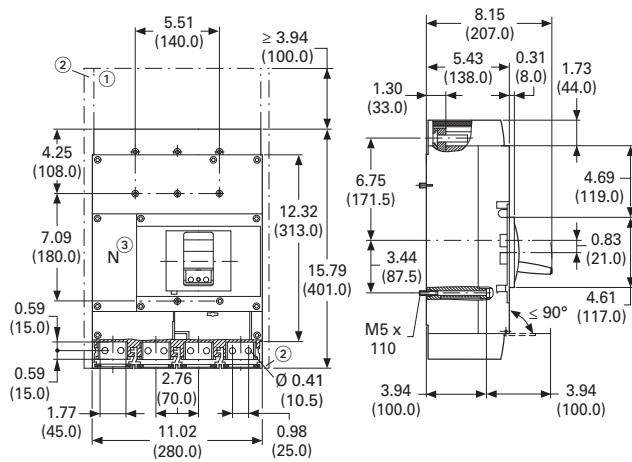
Jumper Kit, NZM3-4-XKVI...



- ① Blowout area, minimum clearance to other parts.
- ② Minimum clearance to adjacent parts.

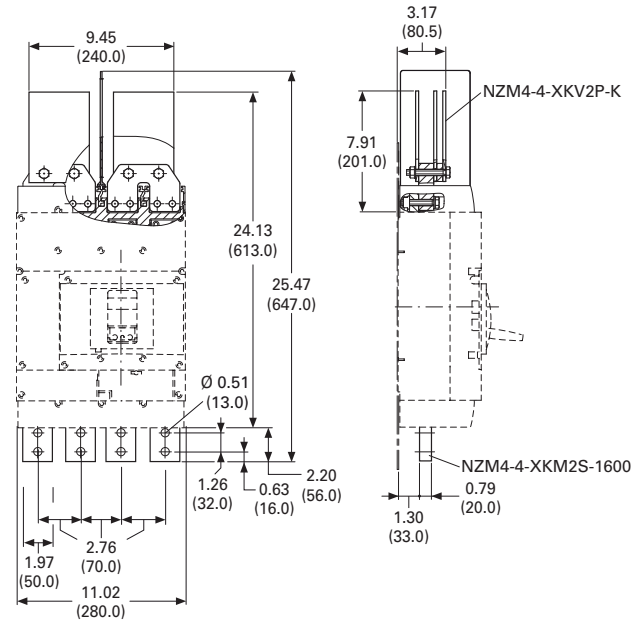
Approximate Dimensions in Inches (mm)

### Switch Disconnectors, Four-Pole, N4-4...DC

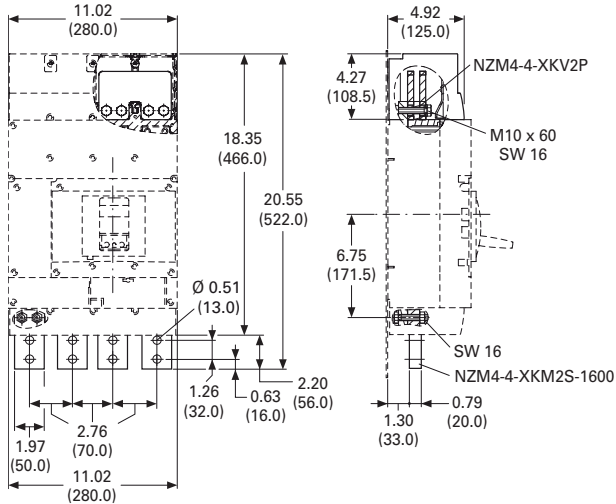


- ① Blowout area, minimum clearance to other parts.  
 ≤ 690V: 3.94 (100.0)  
 ≤ 1500V: 7.87 (200.0)
- ② Minimum clearance to adjacent parts.  
 ≤ 1000V: 0.59 (15.0)  
 ≤ 1500V: 2.76 (70.0)

### Jumper Kit, NZM4-4-XKV2P-K



### Jumper Kit, NZM4-4-XKV2P





## 600 Vdc and 1000 Vdc Disconnects

**Contents****Description**

DC Switches

**DC Switches****Product Description**

Eaton's new offering of PV switches have multiple poles factory-wired, and they are approved for NEC Article 690 applications right from the box. Other manufacturers require the contractor to add jumpers to a two- or three-pole switch, add a neutral, and add labels to meet this requirement. For fusible switches, the new Eaton PV switch requires only one fuse per switch—saving the customer at least one fuse on each switch.

For more information on Eaton's DC Switches, please see **Tab 2.4** of this catalog.

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**DC Switched Combiners****Contents****Description**

DC Switched Combiners

**3****DC Switched Combiners****Product Description**

The Eaton switched combiner (ESC) unites Eaton's 600 Vdc solar disconnect and source-combiner box in one convenient enclosure (1000 Vdc Switched Combiners available late 2012).

For more information on Eaton's DC Switched Combiners, please see **Tab 2.5** of this catalog.

# 3.6

## Dry-Type Distribution Transformers

### Encapsulated Transformers

#### Dry-Type Transformer Family

3



#### Contents

##### Description

##### Page

Encapsulated Transformers

Ventilated Transformers/

Open Core-Coil Assemblies . . . . .

**V15-T3-43**

### Encapsulated Transformers

#### Product Description

Eaton's family of encapsulated transformers is ideally suited for harsh outdoor environments. Their standard enclosure is NEMA® 3R rated, and are also available in NEMA 3R stainless steel, or NEMA 4X enclosures. The core and coil assembly is completely embedded in a sand and resin compound that seals out moisture and other contaminants.

Please refer to **Volume 2—Commercial Distribution**, CA08100003E, Tab 2 for more information.

### Dry-Type Transformer Family



### Contents

#### Description

Encapsulated Transformers . . . . .	V15-T3-42
Ventilated Transformers/ Open Core-Coil Assemblies	

#### Page

V15-T3-42

## Ventilated Transformers/Open Core-Coil Assemblies

### Product Description

Eaton offers a complete line of ventilated and totally enclosed non-ventilated transformers, in a variety of K-factor ratings and efficiency levels. Please refer to **Volume 2—Commercial Distribution**, CA08100003E, Tab 2 for additional information on Eaton's standard product offering.

In addition to these standard products, Eaton also offers custom design capabilities to meet the specific requirements of the solar industry. We offer special dimensions and layouts to meet a specific customer's needs. We can also design transformers to meet CEC weighted-efficiency levels, or other efficiency levels if necessary. Please contact your local Eaton representative for additional information on Eaton's custom design capabilities.

**Magnum DS Switchgear**



**Indoor Type VCP-W Metal-Clad Switchgear Assembly (5/15 kV shown)**



**Metering Products Family**



Eaton offers a full range of AC power distribution products to help you complete your electrical system. This table of contents provides references to other catalogs in our library where you can access selection and technical data for these products.

## Low Voltage Switchboards

Refer to **Volume 2—Commercial Distribution**,  
CA08100003E, Tab 4—Switchboards

## Low Voltage Switchgear

Refer to **Volume 3—Power Distribution and Control Assemblies**,  
CA08100004E, Tab 4—Low Voltage Switchgear

## Medium Voltage Switchgear

Refer to **Volume 3—Power Distribution and Control Assemblies**,  
CA08100004E, Tab 7—Medium Voltage Switchgear

## Transformers

Refer to **Consulting Application Guide**,  
CA08104001E, Tab 16—Substation Transformers

## AC Metering

Refer to **Volume 3—Power Distribution and Control Assemblies**,  
CA08100004E, Tab 9—Metering Devices, Protective Relays,  
Software and Connectivity

## AC Monitoring

Refer to **Volume 5—Motor Control and Protection**,  
CA08100006E, Tab 5—Motor Protection and Monitoring

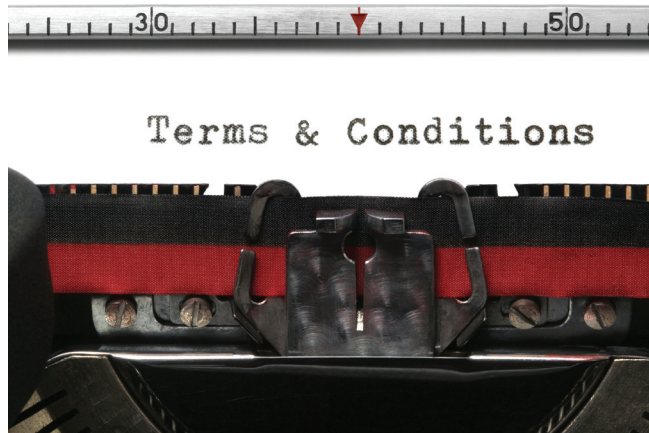
## Power Xpert Software

Refer to **Volume 3—Power Distribution and Control Assemblies**,  
CA08100004E, Tab 9—Metering Devices, Protective Relays,  
Software and Connectivity

## Other Services

Refer to **Consulting Application Guide**,  
CA08104001E, Tab 41—Power System Studies,  
Field Services (E-ESS)

## Eaton Terms & Conditions



## Contents

<i>Description</i>	<i>Page</i>
Terms and Conditions of Sale.....	<b>V15-A1-1</b>
Terms of Payment .....	<b>V15-A1-2</b>
Freight .....	<b>V15-A1-3</b>
Warranty.....	<b>V15-A1-3</b>

## Selling Policy (Supersedes Selling Policy 25-000, dated November 1, 2008)

### Terms and Conditions of Sale

The Terms and Conditions of Sale set forth herein, and any supplements which may be attached hereto, constitute the full and final expression of the contract for the sale of products or services (hereinafter referred to as Product(s) or Services by Eaton Corporation (hereinafter referred to as Seller) to the Buyer, and supersedes all prior quotations, purchase orders, correspondence or communications whether written or oral between the Seller and the Buyer. Notwithstanding any contrary language in the Buyer's purchase order, correspondence or other form of acknowledgment, Buyer shall be bound by these Terms and Conditions of Sale when it sends a purchase order or otherwise indicates acceptance of this contract, or when it accepts delivery from Seller of the Products or Services.

THE CONTRACT FOR SALE OF THE PRODUCTS OR SERVICES IS EXPRESSLY LIMITED TO THE TERMS AND CONDITIONS OF SALE STATED HEREIN. ANY ADDITIONAL OR DIFFERENT TERMS PROPOSED BY BUYER ARE REJECTED UNLESS EXPRESSLY AGREED TO IN WRITING BY SELLER. No contract shall exist except as herein provided.

#### **Complete Agreement**

No amendment or modification hereto nor any statement, representation or warranty not contained herein shall be binding on the Seller unless made in writing by an authorized representative of the Seller. Prior dealings, usage of the trade or a course of performance shall not be relevant to determine the meaning of this contract even though the accepting or acquiescing party had knowledge of the nature of the performance and opportunity for objection.

### **Quotations**

Written quotations are valid for 30 days from its date unless otherwise stated in the quotation or terminated sooner by notice.

Verbal quotations, unless accepted, expire the same day they are made.

A complete signed order must be received by Seller within 20 calendar days of notification of award, otherwise the price and shipment will be subject to re-negotiation.

### **Termination and Cancellation**

#### **Products**

Any order may be terminated by the Buyer only by written notice and upon payment of reasonable termination charges, including all progress billings and all incurred direct manufacturing costs.

#### **Services**

Any order may be terminated by the Buyer only by written notice and upon payment of reasonable termination charges including all costs plus profit.

Seller shall have the right to cancel any order at any time by written notice if Buyer breaches any of the terms hereof, becomes the subject of any proceeding under state or federal law for the relief of debtors, or otherwise becomes insolvent or bankrupt, generally does not pay its debts as they become due or makes an assignment for the benefit of creditors.

# Appendix 1—General Terms and Conditions of Sale

Effective Date: November 1, 2017

## **Prices**

All prices are subject to change without notice. In the event of a price change, the effective date of the change will be the date of the new price or discount sheet, letter or telegram. All quotations made or orders accepted after the effective date will be on the new basis. For existing orders, the price of the unshipped portion of an order will be the price in effect at time of shipment.

## **Price Policy—Products and Services**

When prices are quoted as firm for quoted shipment, they are firm provided the following conditions are met:

1. The order is released with complete engineering details.
2. Shipment of Products are made, and Services purchased are provided within the quoted lead time.
3. When drawings for approval are required for any Products, the drawings applicable to those Products must be returned within 30\* calendar days from the date of the original mailing of the drawings by Seller. The return drawings must be released for manufacture and shipment and must be marked "APPROVED" or "APPROVED AS NOTED." Drawing re-submittals which are required for any other reason than to correct Seller errors will not extend the 30-day period.

\* 60 days for orders through contractors to allow time for their review and approval before and after transmitting them to their customers.

If the Buyer initiates or in any way causes delays in shipment, provision of Services or return of approval drawings beyond the periods stated above, the price of the Products or Services will be increased 1% per month or fraction thereof up to a maximum of 18 months from the date of the Buyer's order. For delays resulting in shipment or provision of Services beyond 18 months from the date of the Buyer's order, the price must be renegotiated.

## **Price Policy—BLS**

Refer to Price Policy 25-050.

## **Minimum Billing**

Orders less than \$1,000 will be assessed a shipping and handling charge of 5% of the price of the order, with a minimum charge of \$25.00 unless noted differently on Product discount sheets.

## **Taxes**

The price does not include any taxes. Buyer shall be responsible for the payment of all taxes applicable to, or arising from the transaction, the Products, its sale, value, or use, or any Services performed in connection therewith regardless of the person or entity actually taxed.

## **Terms of Payment**

### **Products**

Acceptance of all orders is subject to the Buyer meeting Seller's credit requirements. Terms of payment are subject to change for failure to meet such requirements. Seller reserves the right at any time to demand full or partial payment before proceeding with a contract of sale as a result of changes in the financial condition of the Buyer. Terms of Payment are either Net 30 days from the date of invoice of each shipment or carry a cash discount based on Product type. Specific payment terms for Products are outlined in the applicable Product discount schedules.

### **Services**

Terms of payment are net within 30 days from date of invoice for orders amounting to less than \$50,000.00.

Terms of payment for orders exceeding \$50,000.00 shall be made according to the following:

1. Twenty percent (20%) of order value with the purchase order payable 30 days from date of invoice.
2. Eighty percent (80%) of order value in equal monthly payments over the performance period payable 30 days from date of invoice.

Except for work performed (i) under a firm fixed price basis or (ii) pursuant to terms of a previously priced existing contract between Seller and Buyer, invoices for work performed by Seller shall have added and noted on each invoice a charge of 3% (over and above the price of the work) which is related to Seller compliance with present and proposed environmental, health, and safety regulations associated with prescribed requirements covering hazardous materials management and employee training, communications, personal protective equipment, documentation and record keeping associated therewith.

## **Adequate Assurances**

If, in the judgment of Seller, the financial condition of the Buyer, at any time during the period of the contract, does not justify the terms of payment specified, Seller may require full or partial payment in advance.

## **Delayed Payment**

If payments are not made in accordance with these terms, a service charge will, without prejudice to the right of Seller to immediate payment, be added in an amount equal to the lower of 1.5% per month or fraction thereof or the highest legal rate on the unpaid balance.



## Freight

Freight policy will be listed on the Product discount sheets, or at option of Seller one of the following freight terms will be quoted.

### ***F.O.B.—P/S—Frt./Ppd. and Invoiced***

Products are sold F.O.B. point of shipment freight prepaid and invoiced to the Buyer.

### ***F.O.B.—P/S—Frt./Ppd. and Allowed***

Products sold are delivered F.O.B. point of shipment, freight prepaid and included in the price.

### ***F.O.B. Destination—Frt./Ppd. and Allowed***

At Buyer's option, Seller will deliver the Products F.O.B. destination freight prepaid and 2% will be added to the net price.

The term "freight prepaid" means that freight charges will be prepaid to the accessible common carrier delivery point nearest the destination for shipments within the United States and Puerto Rico unless noted differently on the Product discount sheets. For any other destination, contact Seller's representative.

### ***Shipment and Routing***

Seller shall select the point of origin of shipment, the method of transportation, the type of carrier equipment and the routing of the shipment.

If the Buyer specifies a special method of transportation, type of carrier equipment, routing, or delivery requirement, Buyer shall pay all special freight and handling charges.

When freight is included in the price, no allowance will be made in lieu of transportation if the Buyer accepts shipment at factory, warehouse, or freight station or otherwise supplies its own transportation.

## Risk of Loss

Risk of loss or damage to the Products shall pass to Buyer at the F.O.B. point.

### ***Concealed Damage***

Except in the event of F.O.B. destination shipments, Seller will not participate in any settlement of claims for concealed damage.

When shipment has been made on an F.O.B. destination basis, the Buyer must unpack immediately and, if damage is discovered, must:

1. Not move the Products from the point of examination.
2. Retain shipping container and packing material.
3. Notify the carrier in writing of any apparent damage.
4. Notify Seller representative within 72 hours of delivery.
5. Send Seller a copy of the carrier's inspection report.

### ***Witness Tests/Customer Inspection***

Standard factory tests may be witnessed by the Buyer at Seller's factory for an additional charge calculated at the rate of \$2,500 per day (not to exceed eight (8) hours) per Product type. Buyer may final inspect Products at the Seller's factory for \$500 per day per Product type.

Witness tests will add one (1) week to the scheduled shipping date. Seller will notify Buyer fourteen (14) calendar days prior to scheduled witness testing or inspection. In the event Buyer is unable to attend, the Parties shall mutually agree on a rescheduled date. However, Seller reserves the right to deem the witness tests waived with the right to ship and invoice Products.

## Held Orders

For any order held, delayed or rescheduled at the request of the Buyer, Seller may, at its sole option (1) require payment to be based on any reasonable basis, including but not limited to the contract price, and any additional expenses, or cost resulting from such a delay; (2) store Products at the sole cost and risk of loss of the Buyer; and/or (3) charge to the Buyer those prices under the applicable price policy. Payment for such price, expenses and costs, in any such event, shall be due by Buyer within thirty (30) days from date of Seller's invoice. Any order so held delayed or rescheduled beyond six (6) months will be treated as a Buyer termination.

### ***Drawing Approval***

Seller will design the Products in line with, in Seller's judgment, good commercial practice. If at drawing approval Buyer makes changes outside of the design as covered in their specifications, Seller will then be paid reasonable charges and allowed a commensurate delay in shipping date based on the changes made.

### ***Drawing Re-Submittal***

When Seller agrees to do so in its quotation, Seller shall provide Buyer with the first set of factory customer approval drawing(s) at Seller's expense. The customer approval drawing(s) will be delivered at the quoted delivery date. If Buyer requests drawing changes or additions after the initial factory customer approval drawing(s) have been submitted by Seller, the Seller, at its option, may assess Buyer drawing charges. Factory customer approval drawing changes required due to misinterpretation by Seller will be at Seller's expense. Approval drawings generated by Bid Manager are excluded from this provision.

## Warranty

### ***Warranty for Products***

Seller warrants that the Products manufactured by it will conform to Seller's applicable specifications and be free from failure due to defects in workmanship and material for one (1) year from the date of installation of the Product or eighteen (18) months from the date of shipment of the Product, whichever occurs first.

In the event any Product fails to comply with the foregoing warranty, Seller will, at its option, either (a) repair or replace the defective Product, or defective part or component thereof, F.O.B. Seller's facility freight prepaid, or (b) credit Buyer for the purchase price of the Product. All warranty claims shall be made in writing.

Seller requires all non-conforming Products be returned at Seller's expense for evaluation unless specifically stated otherwise in writing by Seller.

This warranty does not cover failure or damage due to storage, installation, operation or maintenance not in conformance with Seller's recommendations and industry standard practice or due to accident, misuse, abuse or negligence. This warranty does not cover reimbursement for labor, gaining access, removal, installation, temporary power or any other expenses, which may be incurred in connection with repair or replacement.

This warranty does not apply to equipment not manufactured by Seller. Seller limits itself to extending the same warranty it receives from the supplier.



# Appendix 1—General Terms and Conditions of Sale

Effective Date: November 1, 2017

## **Extended Warranty for Products**

If requested by the Buyer and specifically accepted in writing by Seller, the foregoing standard warranty for Products will be extended from the date of shipment for the period and price indicated below:

- 24 months—2% of Contract Price
- 30 months—3% of Contract Price
- 36 months—4% of Contract Price

## **Special Warranty (In and Out) for Products**

If requested by the Buyer and specifically accepted in writing by Seller, Seller will, during the warranty period for Products, at an additional cost of 2% of the contract price, be responsible for the direct cost of:

1. Removing the Product from the installed location.
2. Transportation to the repair facility and return to the site.
3. Reinstallation on site.

The total liability of Seller for this Special Warranty for Products is limited to 50% of the contract price of the particular Product being repaired and excludes expenses for removing adjacent apparatus, walls, piping, structures, temporary service, etc.

## **Warranty for Services**

Seller warrants that the Services performed by it hereunder will be performed in accordance with generally accepted professional standards.

The Services, which do not so conform, shall be corrected by Seller upon notification in writing by the Buyer within one (1) year after completion of the Services.

Unless otherwise agreed to in writing by Seller, Seller assumes no responsibility with respect to the suitability of the Buyer's, or its customer's, equipment or with respect to any latent defects in equipment not supplied by Seller. This warranty does not cover damage to Buyer's, or its customer's, equipment, components or parts resulting in whole or in part from improper maintenance or operation or from their deteriorated condition. Buyer will, at its cost, provide Seller with unobstructed access to the defective Services, as well as adequate free working space in the immediate vicinity of the defective Services and such facilities and systems, including, without limitation, docks, cranes and utility disconnects and connects, as may be necessary in order that Seller may perform its warranty obligations. The conducting of any tests shall be mutually agreed upon and Seller shall be notified of, and may be present at, all tests that may be made.

## **Warranty for Power Systems Studies**

Seller warrants that any power systems studies performed by it will conform to generally accepted professional standards. Any portion of the study, which does not so conform, shall be corrected by Seller upon notification in writing by the Buyer within six (6) months after completion of the study. All warranty work shall be performed in a single shift straight time basis Monday through Friday. In the event that the study requires correction of warranty items on an overtime schedule, the premium portion of such overtime shall be for the Buyer's account.

## **Limitation on Warranties for Products, Services and Power Systems Studies**

THE FOREGOING WARRANTIES ARE EXCLUSIVE EXCEPT FOR WARRANTY OF TITLE. SELLER DISCLAIMS ALL OTHER WARRANTIES INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

CORRECTION OF NON-CONFORMITIES IN THE MANNER AND FOR THE PERIOD OF TIME PROVIDED ABOVE SHALL CONSTITUTE SELLER'S SOLE LIABILITY AND BUYER'S EXCLUSIVE REMEDY FOR FAILURE OF SELLER TO MEET ITS WARRANTY OBLIGATIONS, WHETHER CLAIMS OF THE BUYER ARE BASED IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY), OR OTHERWISE.

## **Asbestos**

Federal Law requires that building or facility owners identify the presence, location and quantity of asbestos containing material (hereinafter "ACM") at work sites. Seller is not licensed to abate ACM. Accordingly, for any contract which includes the provision of Services, prior to (i) commencement of work at any site under a specific Purchase Order, (ii) a change in the work scope of any Purchase Order, the Buyer will certify that the work area associated with the Seller's scope of work includes the handling of Class II ACM, including but not limited to generator wedges and high temperature gaskets which include asbestos materials. The Buyer shall, at its expense, conduct abatement should the removal, handling, modification or reinstallation, or some or all of them, of said Class II ACM be likely to generate airborne asbestos fibers; and should such abatement affect the cost of or time of performance of the work, then Seller shall be entitled to an equitable adjustment in the schedule, price and other pertinent affected provisions of the contract.

## **Compliance with Nuclear Regulation**

Seller's Products are sold as commercial grade Products not intended for application in facilities or activities licensed by the United States Nuclear Regulatory Commission for atomic purposes. Further certification will be required for use of the Products in any safety-related application in any nuclear facility licensed by the U.S. Nuclear Regulatory Commission.

## **Returning Products**

Authorization and shipping instructions for the return of any Products must be obtained from Seller before returning the Products.

When return is occasioned due to Seller error, full credit including all transportation charges will be allowed.

## **Product Notices**

Buyer shall provide the user (including its employees) of the Products with all Seller supplied Product notices, warnings, instructions, recommendations, and similar materials.

## **Force Majeure**

Seller shall not be liable for failure to perform or delay in performance due to fire, flood, strike or other labor difficulty, act of God, act of any governmental authority or of the Buyer, riot, embargo, fuel or energy shortage, car shortage, wrecks or delays in transportation, or due to any other cause beyond Seller's reasonable control. In the event of delay in performance due to any such cause, the date of delivery or time for completion will be extended by a period of time reasonably necessary to overcome the effect of such delay.

## **Liquidated Damages**

Contracts which include liquidated damage clauses for failure to meet shipping or job completion promises are not acceptable or binding on Seller, unless such clauses are specifically accepted in writing by an authorized representative of the Seller at its headquarters office.

## **Patent Infringement**

Seller will defend or, at its option, settle any suit or proceeding brought against Buyer, or Buyer's customers, to the extent it is based upon a claim that any Product or part thereof, manufactured by Seller or its subsidiaries and furnished hereunder, infringes any United States patent, other than a claim of infringement based upon use of a Product or part thereof in a process, provided Seller is notified in reasonable time and given authority, information and assistance (at Seller's expense) for the defense of same. Seller shall pay all legal and court costs and expenses and court-assessed damages awarded therein against Buyer resulting from or incident to such suit or proceeding. In addition to the foregoing, if at any time Seller determines there is a substantial question of infringement of any United States patent, and the use of such Product is or may be enjoined, Seller may, at its option and expense: either (a) procure for Buyer the right to continue using and selling the Product; (b) replace the Product with non-infringing apparatus; (c) modify the Product so it becomes non-infringing; or (d) as a last resort, remove the Product and refund the purchase price, equitably adjusted for use and obsolescence. In no case does Seller agree to pay any recovery based upon its Buyer's savings or profit through use of Seller's Products whether the use be special or ordinary. The foregoing states the entire liability of Seller for patent infringement.

The preceding paragraph does not apply to any claim of infringement based upon: (a) any modification made to a Product other than by Seller; (b) any design and/or specifications of Buyer to which a Product was manufactured; or (c) the use or combination of Product with other products where the Product does not itself infringe. As to the above-identified claim situations where the preceding paragraph does not apply, Buyer shall defend and hold Seller harmless in the same manner and to the extent as Seller's obligations described in the preceding paragraph. Buyer shall be responsible for obtaining (at Buyer's expense) all license rights required for Seller to be able to use software products in the possession of Buyer where such use is required in order to perform any Service for Buyer.

With respect to a Product or part thereof not manufactured by Seller or its subsidiaries, Seller will attempt to obtain for Buyer, from the supplier(s), the patent indemnification protection normally provided by the supplier(s) to customers.

## **Compliance with OSHA**

Seller offers no warranty and makes no representation that its Products comply with the provisions or standards of the Occupational Safety and Health Act of 1970, or any regulation issued thereunder. In no event shall Seller be liable for any loss, damage, fines, penalty or expenses arising under said Act.

## **Limitation of Liability**

THE REMEDIES OF THE BUYER SET FORTH IN THIS CONTRACT ARE EXCLUSIVE AND ARE ITS SOLE REMEDIES FOR ANY FAILURE OF SELLER TO COMPLY WITH ITS OBLIGATIONS HEREUNDER.

NOTWITHSTANDING ANY PROVISION IN THIS CONTRACT TO THE CONTRARY, IN NO EVENT SHALL SELLER BE LIABLE IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE FOR DAMAGE TO PROPERTY OR EQUIPMENT OTHER THAN PRODUCTS SOLD HEREUNDER, LOSS OF PROFITS OR REVENUE, LOSS OF USE OF PRODUCTS, COST OF CAPITAL, CLAIMS OF CUSTOMERS OF THE BUYER OR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES WHATSOEVER, REGARDLESS OF WHETHER SUCH POTENTIAL DAMAGES ARE FORESEEABLE OR IF SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

THE TOTAL CUMULATIVE LIABILITY OF SELLER ARISING FROM OR RELATED TO THIS CONTRACT WHETHER THE CLAIMS ARE BASED IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE, SHALL NOT EXCEED THE PRICE OF THE PRODUCT OR SERVICES ON WHICH SUCH LIABILITY IS BASED.

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