



Quick-connect double-throw
safety switch

The safe way
to transfer power

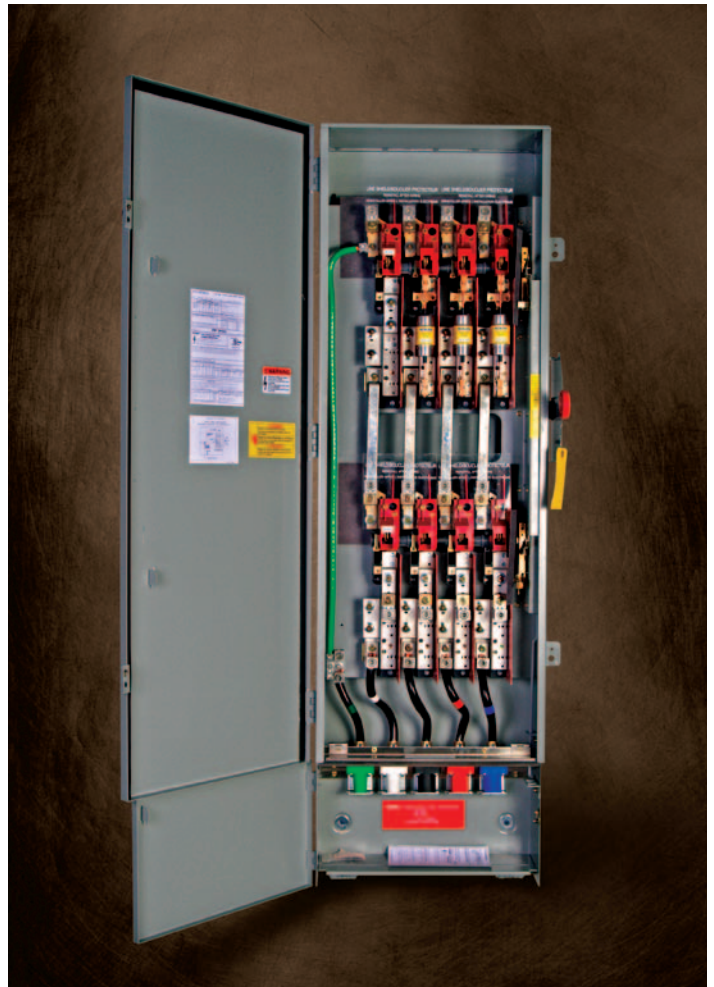
EATON

Powering Business Worldwide

Quick-connect double-throw

Innovation from the industry leader

Over the past decade, Eaton has led the industry in safety switch innovations by saying “Yes!” to customers who want custom solutions to switching problems. The Flex Center in the Cleveland, TN, plant has offered these solutions to customers through direct one-on-one contact —gaining understanding of the issues and developing solutions to fit those needs. During the past few years, the Flex Center has seen a growing customer need to be able to connect and disconnect portable generators to facilities’ electrical systems. Flex Center engineers developed the quick-connect double-throw (QCDT) switch to provide a safe and quick means of connecting portable generators to facilities, and transferring the building to backup power. Now, after a full engineering development program, Eaton proudly offers the QCDT as a complete UL® Listed product offering. This product focus provides an in-depth look at the product offering, its applications and National Electrical Code® considerations.



Eaton Quick-Connect Double-Throw

The QCDT product family solves many problems faced by customers trying to connect portable generators to their facilities.

Safety first

Connecting portable generators can pose serious risks if not done properly

Eaton's QCDT helps to minimize those risks. There are many potential hazards created when temporarily connecting high-ampacity portable equipment such as large generators. These hazards pose serious risks to life and property, and open businesses and individuals to liability for losses caused by improper or unsafe installation. The QCDT incorporates many design elements that ensure operator and public safety. The safety elements of the QCDT include:

- UL Listed device
- Meets NEC® requirements
- Receptacle compartment safety interlocks
- Utility isolation without key interlocks
- Proper material selection
- Exclusive trap-door system



Product overview



Double-throw switch

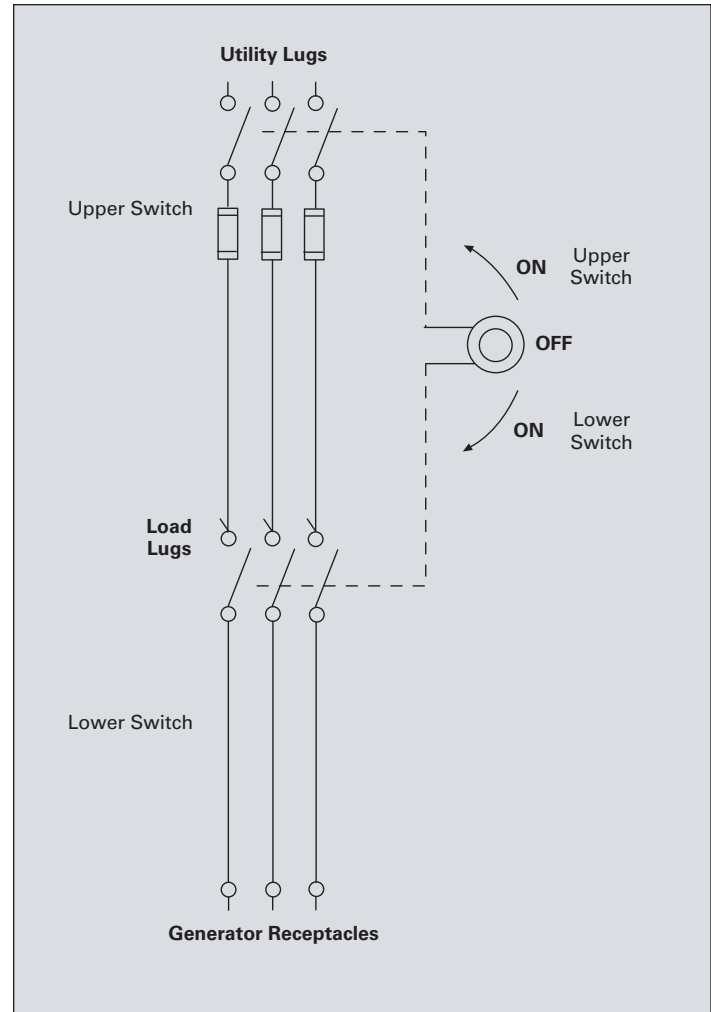
As a double-throw switch, the QCDT contains two vertically oriented switches in one enclosure that are operated by a single handle. In between the two switches is a common bus and lugs for outgoing cables. The handle has a three-position operation. In the upper position, the upper switch is closed; in the middle position, both switches are open; and in the lower position, the lower switch is closed. Thus, the two switches are mutually exclusive—that is, they cannot both be closed at the same time. The outgoing lugs are fed either from the top switch or the bottom switch, but never by both. This operation provides two important safety functions:

1. To keep from feeding generated power out to the utility wires, which could injure utility line workers and would also cause the generator to become overloaded
2. To prevent paralleling utility and generator sources when utility power is restored, which could cause damage to electrical equipment and would violate electrical codes and local laws

In the QCDT design, the upper switch serves as the utility main disconnect, and the lower switch is the generator disconnect. The difference between a standard double-throw switch and the QCDT is that the latter is supplied with the generator disconnect factory-wired to individual receptacles for each phase neutral and ground conductor. These receptacles are inlets for temporarily connecting a generator to the switch without knocking holes in the enclosure to terminate the wires at the mechanical lugs.

The QCDT may be configured with fused switches in either position. The most common application is shown in the figure at the right. In this arrangement, the switch is used as a service entrance switch, with the utility switch fused, and the generator switch non-fused.

In this manner, the main disconnect switch has the overcurrent protection required by NEC Article 230.90. Fuses are generally not required on the generator switch because generators are supplied with load side overcurrent protection.



Double-Throw Switches Have Two Interlocked Switches with a Common Load Side Connection

Both switches cannot be closed at the same time, ensuring that the building is isolated from the utility grid while on generator power.



1. 100A and 200A QCDT Receptacle Compartment with Generator Plugs Connected

The interlocked receptacle compartment has a hinged trap door for the generator inlet cables to exit. The generator switch cannot be closed while the cable compartment door is open.

2. 100A and 200A QCDT with Generator Cables Connected and Receptacle Compartment Door Closed

With the cable compartment door closed, and the generator switch closed, the interlock prevents the door from being opened.

3. 400–800A QCDT (400A Shown)

The 400A QCDT has a single row of receptacles, while the 600A and 800A have parallel receptacles.

4. 400–800A QCDT Cable Compartment

Like the 200A enclosure, the 400–800A enclosure has an interlocked door over the cable compartment, and a trap door to allow the generator cables to exit.

Features and options

Designed for all customers

The QCDT design includes elements for the user and the contractor alike.

For the user:

- Color-coordinated receptacles
- Trap-door design
- Receptacle compartment interlock
- Simple operation

For the contractor:

- Improved conduit entry options
- Lifting eyes
- Mounting assist bracket
- 100% copper conductors
- Copper foil wrapped electrical connections

The revolutionary (QCDT) takes Eaton's leadership in double-throw switch design to a new level of customer usability. Available from 100A to 800A, the QCDT's primary function is to serve as a service entrance main disconnect with the added functionality of factory-installed receptacles that allow customers to quickly connect a portable generator, to isolate the building from the utility grid and to transfer the building over to the portable generator. However, that description only tells what the QCDT does, and does not touch on all of the unique safety features of the design.



Generator connection compartment

The generator connection receptacles are located in a separate, isolated compartment of the switch. This receptacle compartment has a hinged trap door on the bottom to allow the connection cables to exit and a front door to access the receptacles. A key safety feature of the QCDT is that the receptacle compartment front door

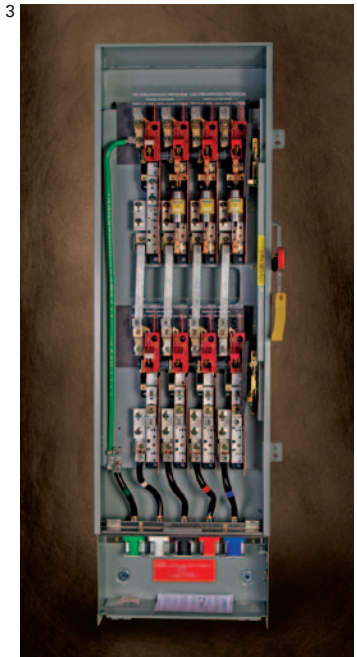
is interlocked with the lower (generator) switch. This interlock prevents the switch from being closed if the door is open, and also prevents the door from being opened if the switch is closed. Therefore, for operation of the switch, the door must be closed and secured—with the cables exiting through the trap door.

1. QCDT Interlock

The receptacle compartment is interlocked with the generator switch to prevent access to the receptacles when the generator switch is closed.

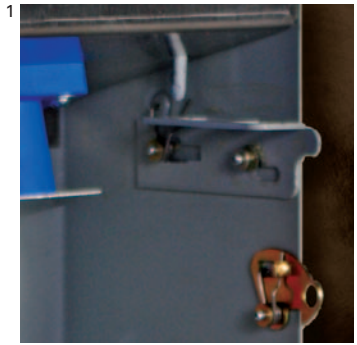
2. 400–800A QCDT

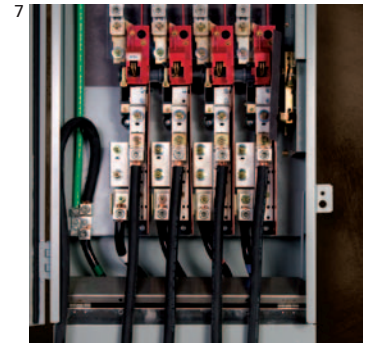
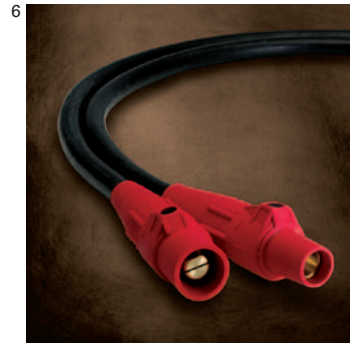
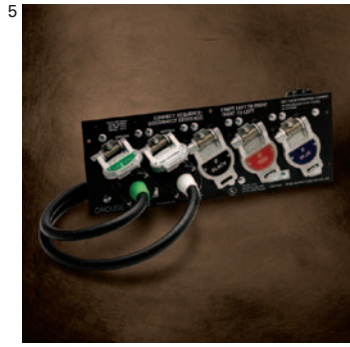
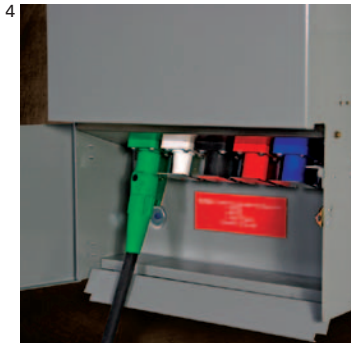
The higher ampacity QCDT switch design has the receptacle compartment on the right side to allow the bottom of the main compartment to be used for conduit entry.



3. 100A and 200A QCDT

The lower ampacity switches have the receptacles mounted on the bottom of the switch for a compact design.





Receptacle options

There are two receptacle options available in the QCDT—Cam-Lok® or Posi-Lok® styles. While both provide individual receptacles for each conductor, the Posi-Lok panel provides an added measure of safety by interlocking the receptacle covers with one another. This feature requires the user to connect the cables in the order ground–neutral–phase–phase–phase, and to disconnect in reverse order. The benefit is personnel safety because a low-impedance ground is the first wire to be connected and the last wire to be disconnected.

The standard receptacles supplied on the QCDT and the required connection plugs when the receptacles are used as inlet are shown on Page 11.

The plugs for these receptacles are not interchangeable so it is important that the receptacles on the switch match the cables that will be supplied with the generator. The E1016 Cam-Lok plugs are the most common in the industry. However, customers should consider who will be connecting the generators when they arrive on-site and what level of safety to employ.

4. Posi-Lok Receptacles

These receptacles have an added safety feature that requires the cables to be connected and disconnected in the proper sequence.

Connection cords

An important consideration for the customer is to understand who will provide the cord set to connect the generator. If the customer is planning on renting the generator, there needs to be a discussion with the rental company to ascertain if the rental company will be providing the cord sets. If so, the customer needs to ask what type of connectors are on the cords.

Another option available to customers is to purchase the cord sets from Eaton and keep the cords on-site. This guarantees that the proper plugs are on-site when they are needed.

UL listing

The QCDT product line is UL Listed (UL File 5239, Vol. 6, Section 19) and meets the requirements of the National Electrical Code, including the requirements of 110.3(B) that the product is listed and found suitable for a specified purpose (in this case, for use with portable electrical generators). Products that are field-modified to add receptacles, but have not been evaluated by UL, would be installed as a clear violation of 110.3(B).

5. Cam-Lok Receptacles

Cam-Loks are the better option when the connection of the portable generator will always be made by a licensed electrician.

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There are many companies and individuals that are producing products with similar quick-connect receptacles to the QCDT. Many of these are not UL Listed, and do not have the safety interlocks required by UL. Moreover, if the switch was originally a UL Listed product that has been modified, the switch may still bear the UL label even though the assembly is not listed. It is imperative that users know and understand the origin of the products being installed. Failure to do so could result in injury, property damage and death.

7. Posi-Lok Plugs

In addition to requiring connection in the proper sequence, the Posi-Lok plugs are also keyed to prevent the insertion of a plug into the wrong receptacle.

8. Foolproof Design

If for some reason cord sets are not available, the QCDT is equipped with auxiliary terminals for temporarily hardwiring, without damaging the enclosure or sacrificing safety.



Switch configurations

The QCDT is the first double-throw switch available from Eaton that allows for both fusible and non-fusible switches in the same enclosure. This allows customers to configure the switches in the QCDT to suit the individual application.

For service entrance applications, one would choose to have a fusible utility switch to provide the overcurrent protection required by NEC Article 230.90. Because generators commonly have overcurrent protection, the generator switch could be a simple non-fused disconnect. The fusible switch has a fault current rating of 100 kAIC at 600V.

The non-fusible switch is rated at 10 kAIC, which is more than sufficient to handle the output fault current from the generator.

If the QCDT is not a service entrance device and is fed on the normal side by a breaker or a fuse, then neither switch requires overcurrent protection, and both switches can be non-fused.

Switching neutral

Another switch option that requires consideration is whether or not to switch the neutral. The determining factor in this decision is whether the generator has a bonded neutral and thus meets the NEC definition of a separately derived system in Section 250.20(D). If the generator neutral is grounded, then the service disconnect neutral bond must be broken because there may be only one bonding point in the system. In addition to breaking the service bond, the separately derived system (generator) shall be grounded in accordance with Article 250.30.

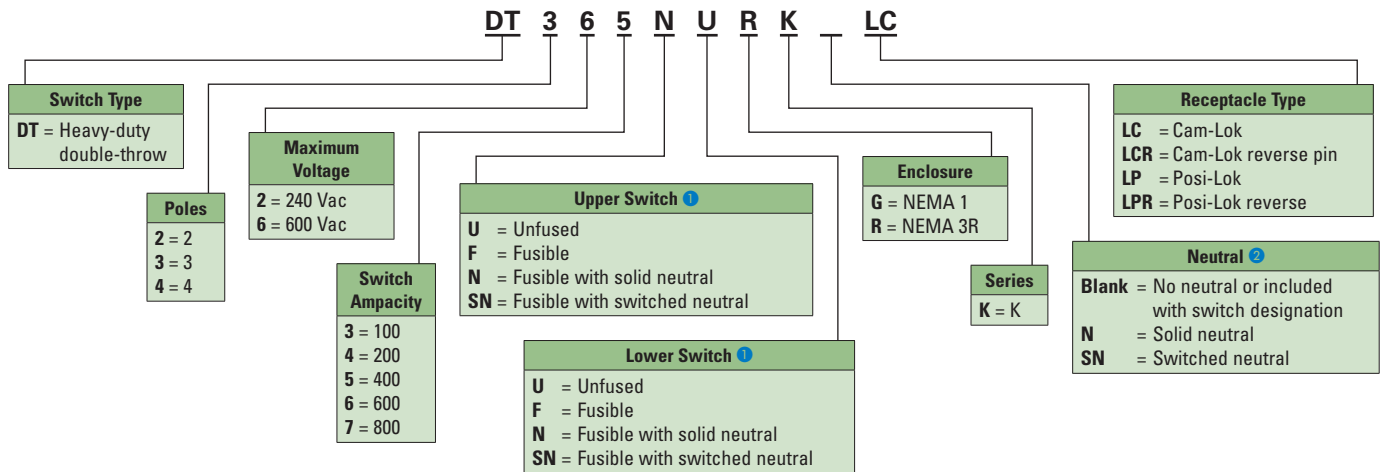
Breaking the service bond is done by selecting the switched neutral option. When this option is chosen, the neutral is factory bonded on the line side of the switch. However, this option should only be chosen if the generator neutral is bonded. In most applications, the generator neutral is not bonded, and a separately derived system is not created. In these cases, a solid neutral should be supplied. If a generator arrives with a bonded neutral, it is easier to disconnect the generator bond than to meet the requirements of Article 250.30.



Selecting the right QCDT



QCDT ordering guidelines

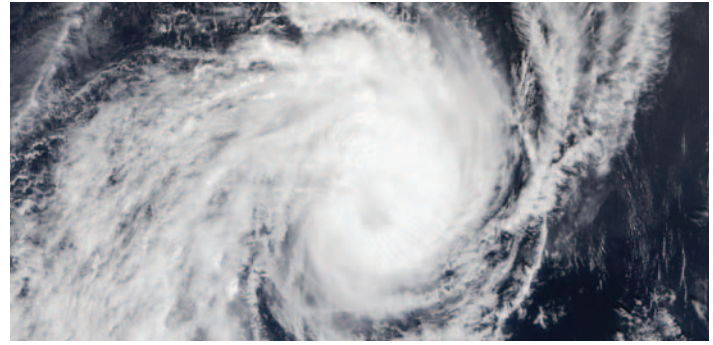


- ① When upper and lower switches are the same, the switch configuration is consolidated in one letter (e.g., "U" not "UU"). Also, a switch with a neutral will have either a solid neutral or a switched neutral, not both. Lastly, a switched neutral pole is never fused.
- ② This field is used only when a switch is completely non-fused.

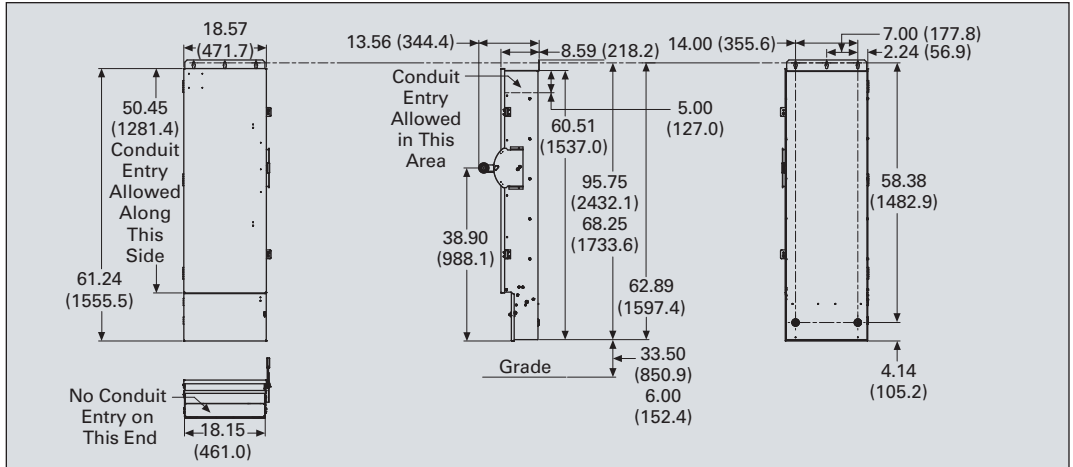
Selecting a QCDT is similar to selecting a safety switch—with a few more specifications to consider.

- Maximum voltage rating:
 - 240V
 - 600V
- Pole configuration:
 - Two-pole, three-wire, with a solid neutral
 - Three-pole, three-wire, with a switched neutral pole (two-phase and one neutral pole)
 - Three-pole, three-wire (no neutral)
 - Three-pole, four-wire, with a solid neutral
 - Four-pole, four-wire, with a switched neutral pole (three-phase and one neutral pole)
- Ampacity:
 - 100A
 - 200A
 - 400A
 - 600A
 - 800A
- Upper switch:
 - Fused
 - Non-fused
- Lower switch:
 - Fused
 - Non-fused
- Enclosure type:
 - NEMA 1 Indoor
 - NEMA 3R Outdoor
- Receptacle type:
 - Cam-Lok
 - Posi-Lok

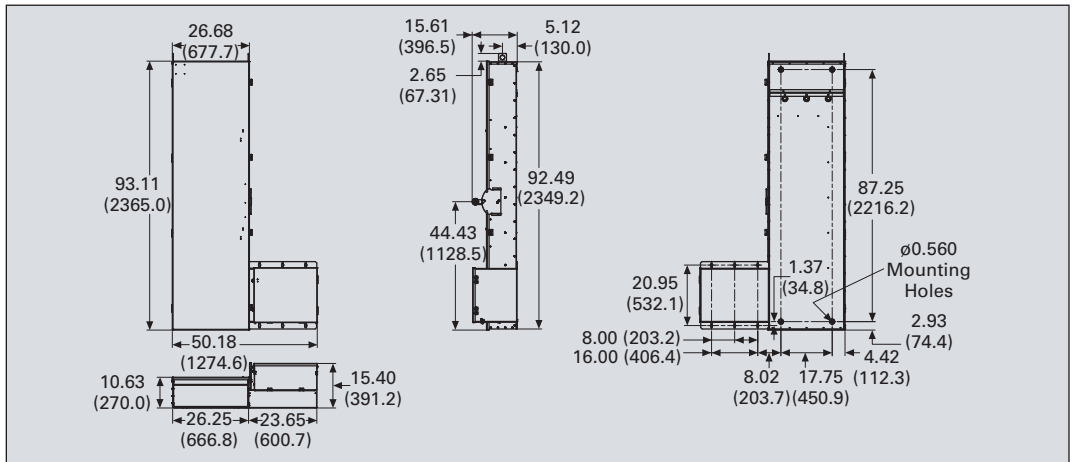
Dimensions



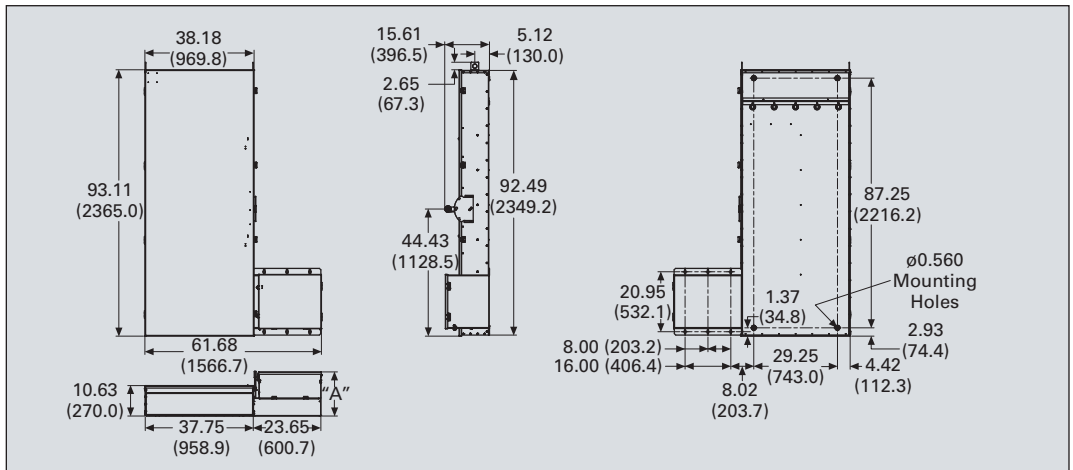
100/200A QCDT



400A QCDT



600-800A QCDT



Lugs and receptacles



Available lug capacities of the double-throw switch assembly with Cam-Lok or Posi-Lok receptacles

Double-Throw Switch Size – Cam-Lok or Posi-Lok Receptacles	Service Terminal Openings	Load Terminal Openings	Switched Neutral Pole Load Terminal Openings	Solid Neutral Terminal Openings	Ground Terminal Openings	Receptacle Bypass Terminal
100	(1) 1/0–14 AWG Cu/Al	(1) 1/0–14 AWG Cu/Al	(1) 1/0–14 AWG Cu/Al	(2) 1/0–14 AWG, (1) 2–14 AWG Cu/Al	(3) 2–14 AWG Cu/Al	(1) 10–32 screw mounting
200	(1) 300 kcmil–6 AWG Cu/Al	(1) 250 kcmil–6 AWG Cu/Al	(1) 250 kcmil–6 AWG Cu/Al	(2) 250 kcmil–6 AWG, (1) 1/0–14 AWG, (1) 2–14 AWG Cu/Al	(3) 2–14 AWG Cu/Al	(2) 1/4 studs, 1.75-inch spacing
400	(1) 750 kcmil–1/0 or (2) 300 kcmil–1/0 Cu/Al	(1) 750 kcmil–1/0 or (2) 300 kcmil–1/0 Cu/Al	(1) 750 kcmil–1/0 or (2) 300 kcmil–1/0 Cu/Al	(6) 500–250 kcmil, (6) 250 kcmil–6 AWG Cu/Al	(4) 250 kcmil–6 AWG Cu/Al	(2) 1/2–13 UNC studs, 1.75-inch spacing
600	(4) 750 kcmil–3/0 Cu/Al	(4) 500–250 kcmil Cu/Al	(4) 500–250 kcmil Cu/Al	(6) 500–250 kcmil, (4) 250 kcmil–6 AWG Cu/Al	(4) 250 kcmil–6 AWG Cu/Al	(2) 1/2–13 UNC studs, 1.75-inch spacing
800	(4) 750 kcmil–3/0 Cu/Al	(4) 500–250 kcmil Cu/Al	(4) 500–250 kcmil Cu/Al	(6) 500–250 kcmil, (4) 250 kcmil–6 AWG	(4) 250 kcmil–6 AWG Cu/Al	(2) 1/2–13 UNC studs, 1.75-inch spacing

Quick-connect double-throw standard receptacles and corresponding connection plugs

(Part numbers are Cooper Crouse-Hinds part numbers)

Switch Ampacity	Connector Color	Cam-Lok Connectors		Posi-Lok Connectors	
		Receptacle ①	Plug ②	Receptacle Panel	Plug ③
100	Ground (green)	E1016-1635S	E-Z1016-8366	Two-pole, three-wire with Solid Neutral or three-pole, three-wire with Switched Neutral Pole (two-phase and one Neutral Pole): E0200-1696/ three-pole, three-wire (no Neutral): E0200-1686-NN/ three-pole, four-wire with Solid Neutral or four-pole, four-wire with Solid Neutral or four-pole, four-wire with Switched Neutral Pole (three-phase and one Neutral Pole): E0200-1687	E0200-281 E0200-282 E0200-283 E0200-284 E0200-285
	Neutral (white)	E1016-1636S	E-Z1016-8367		
	A Phase (black)	E1016-1600S	E-Z1016-8387		
	B Phase (red)	E1016-1602S	E-Z1016-8389		
	C Phase (blue)	E1016-1612S	E-Z1016-8393		
200	Ground (green)	E1016-1635S	E-Z1016-8366	Two-pole, three-wire with Solid Neutral or three-pole, three-wire with Switched Neutral Pole (two-phase and one Neutral Pole): E0200-1696/ three-pole, three-wire (no Neutral): E0200-1686-NN/ three-pole, four-wire with Solid Neutral or four-pole, four-wire with Solid Neutral or four-pole, four-wire with Switched Neutral Pole (three-phase and one Neutral Pole): E0200-1687	E0200-281 E0200-282 E0200-283 E0200-284 E0200-285
	Neutral (white)	E1016-1636S	E-Z1016-8367		
	A Phase (black)	E1016-1600S	E-Z1016-8387		
	B Phase (red)	E1016-1602S	E-Z1016-8389		
	C Phase (blue)	E1016-1612S	E-Z1016-8393		
400	Ground (green)	E1016-1635S	E-Z1016-8366	Two-pole, three-wire with Solid Neutral or three-pole, three-wire with Switched Neutral Pole (two-phase and one Neutral Pole): E0400-1696/ three-pole, three-wire (no Neutral): E0400-1686-NN/ three-pole, four-wire with Solid Neutral or four-pole, four-wire with Solid Neutral or four-pole, four-wire with Switched Neutral Pole (three-phase and one Neutral Pole): E0400-1687	E0400-281 E0400-282 E0400-283 E0400-284 E0400-285
	Neutral (white)	E1016-1636S	E-Z1016-8367		
	A Phase (black)	E1016-1600S	E-Z1016-8387		
	B Phase (red)	E1016-1602S	E-Z1016-8389		
	C Phase (blue)	E1016-1612S	E-Z1016-8393		
600	Ground (green)	(2) E1016-1635S	(2) E-Z1016-8366	Two-pole, three-wire with Solid Neutral or three-pole, three-wire with Switched Neutral Pole (two-phase and one Neutral Pole): (2) E0400-1696/ three-pole, three-wire (no Neutral): (2) E0400-1686-NN/ three-pole, four-wire with Solid Neutral or four-pole, four-wire with Solid Neutral or four-pole, four-wire with Switched Neutral Pole (three-phase and one Neutral Pole): (2) E0400-1687	(2) E0400-281 (2) E0400-282 (2) E0400-283 (2) E0400-284 (2) E0400-285
	Neutral (white)	(2) E1016-1636S	(2) E-Z1016-8367		
	A Phase (black)	(2) E1016-1600S	(2) E-Z1016-8387		
	B Phase (red)	(2) E1016-1602S	(2) E-Z1016-8389		
	C Phase (blue)	(2) E1016-1612S	(2) E-Z1016-8393		
800	Ground (green)	(2) E1016-1635S	(2) E-Z1016-8366	Two-pole, three-wire with Solid Neutral or three-pole, three-wire with Switched Neutral Pole (two-phase and one Neutral Pole): (2) E0400-1696/ three-pole, three-wire (no Neutral): (2) E0400-1686-NN/ three-pole, four-wire with Solid Neutral or four-pole, four-wire with Solid Neutral or four-pole, four-wire with Switched Neutral Pole (three-phase and one Neutral Pole): (2) E0400-1687	(2) E0400-281 (2) E0400-282 (2) E0400-283 (2) E0400-284 (2) E0400-285
	Neutral (white)	(2) E1016-1636S	(2) E-Z1016-8367		
	A Phase (black)	(2) E1016-1600S	(2) E-Z1016-8387		
	B Phase (red)	(2) E1016-1602S	(2) E-Z1016-8389		
	C Phase (blue)	(2) E1016-1612S	(2) E-Z1016-8393		

① For non-standard receptacle options, please contact the Flex Center at 888-329-9272.

② E/E-Z 1016 type plugs listed in above table accept 2/0–4/0 size cable.

③ E0200 type plugs listed in above table accept #2–2/0 size cable. E0400 type listed accept 3/0–4/0 size cable.

Note: Switches are not supplied with the mating plugs. Eaton will supply the plug if cord sets are ordered.

Eaton is dedicated to ensuring that reliable, efficient and safe power is available when it's needed most. With unparalleled knowledge of electrical power management across industries, experts at Eaton deliver customized, integrated solutions to solve our customers' most critical challenges.

Our focus is on delivering the right solution for the application. But, decision makers demand more than just innovative products. They turn to Eaton for an unwavering commitment to personal support that makes customer success a top priority. For more information, **visit www.eaton.com/electrical**.

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