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Generator quick connect switchboard

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Application Considerations and Definitions

Eaton's Pow-R-Line® family of distribution switchboards incorporates new design concepts that fit the ever-increasing need for applications on high short-circuit systems, while retaining maximum flexibility, safety and convenience throughout the line.

Front-Access

Front-access switchboards align at the rear, enabling them to be placed against a wall (Type Pow-R-Line Xpert™ front accessible). If the main section is deeper than others, due to physical size of the main device, the necessary offset in lineup will occur in front, and the main section will be accessible from the side as well as from the front. Eaton also offers front accessible switchboards that align at the front and rear.

Front- and Rear-Access

Rear-access switchboards align at the front and the rear. Bus maintenance and cable entry and exit require rear access. There are two types of front- and rear-accessible switchboards. Both types use the same incoming utility and/or main structures. The first type uses group-mounted feeder devices with panel construction (Type Pow-R-Line Xpert front-and rear-accessible). The second type uses individually compartmentalized feeder devices with load side insulated bus bar extensions (Type Pow-R-Line *i*X).

Individually Mounted

Larger overcurrent protective devices (OCPD) may be individually mounted. In most cases, this means that the OCPD is mounted vertically in the switchboard and is connected via bus bar. All insulated case circuit breakers, power air circuit breakers and bolted pressure contact switches are individually mounted. Molded case circuit breakers 600 A and above may be individually mounted when used as a main or as a feeder device feeding other OCPD within a section or adjacent sections.

Compartmentalized Feeder and Branch Devices

Compartmentalized molded case circuit breakers and fusible switches provide additional isolation. Individually mounted molded case circuit breakers and fusible switches through 1200 A are available in a compartmentalized, rear-access, rear-connected switchboard. See Pow-R-Line *i*X switchboards in this section for details.

Standard Switchboard Height

Standard Pow-R-Line switchboard height is 90.00 inches (2286.0 mm). Contact Eaton for special heights.

Group Mounting

Group-mounted circuit protective devices are an assembly of units mounted on a panelboard type chassis. Units may be molded-case breakers, fusible switches, customer metering and surge protective devices.

A main molded case breaker or main 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.

Bus Bar System

Standard bus in the switchboards is tin-plated aluminum. Copper, silver-plated copper or 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 switchboards. Special density rated bus is 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 per UL 891.

Accordingly, 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 listed for application at 100% of the rating. All Magnum type breakers and bolted pressure switches are 100% rated.

Short-Circuit Rating

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

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

When air power circuit breakers are used as feeder devices in a switchboard, these devices may experience up to a 30-cycle (1/2 second) delay if the instantaneous setting is turned off. Eaton has qualified our low voltage switchboards when air power circuit breakers are used as feeders (and mains) to 30 cycles. This rating is not recognized under the UL 891 standard. However, Eaton has witness tested the structure bussing with a qualified National RecognizedTesting Laboratory (NRTL) at 30 cycles (1/2 second) up to 100 kAIC symmetrical.

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.

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 Xpert switchboards, a solid bus bar 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 an option.

Transitions

Transition structures are required for connecting switchboards to the secondary of power center transformer (fluid 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 Eaton for these applications.

Auxiliary Structures

These are normally mounted adjacent to service structures or distribution structures, and used where incoming service or feeder conductors require additional space or facilities not included in the standard switchboard, such as:

1. Mounted adjacent to a top connected service structure and used as a cable pull structure where service conductors are brought in underground. Auxiliary structures are the same depth and height as the service structure, and are wide enough to accommodate the incoming cables.
2. Mounted adjacent to a service structure and used as a bus transition compartment for running riser bus from the load-side of the service structure up to top outgoing bus duct connection when distribution structures are not required. Auxiliary structures are the same depth and height as service structures.

In addition to the above applications, auxiliary structures may be mounted adjacent to a distribution structure and used as a structure for lighting panel or other device that may be cable-connected to a branch circuit device in the distribution structure. Dimensions are compatible with the arrangements required.

Switchboards Used as Service Equipment

Service equipment is the electrical equipment that constitutes the main control and means of power cutoff the electric service (normally Power Company supply) brought into the building.

Where switchboards are to be used as service equipment, certain NEC and UL requirements apply that necessitate modifications not normally supplied in switchboards.

The following is a summary of the requirements that are pertinent to the application of a switchboard for service equipment:

A. A switchboard with main lugs only (no main disconnect) must be designed so that all circuits in the switchboard can be disconnected from the supply source by the operation of no more than six operating handles (breaker or switch).

   Switchboard equipped with main disconnect devices are not subject to the above six disconnect limitation, as the entire board can be de-energized with the main disconnect device.

   Ground fault protection of equipment must be provided for solidly grounded wye electrical services of more than 150 V to ground, but not exceeding 600 V phase-to-phase for each service disconnecting means rated 1000 A or more.

B. For testing purposes, means are also required to disconnect the switchboard neutral bus from the grounded service neutral conductor (single-phase, three-wire; and three-phase, four-wire systems). To comply with this requirement, a removable link (solid bar) is provided in the switchboard neutral bus. This link is generally located near the point where the main feeders enter the switchboard or in the area of the main disconnect device where one is provided.

To further comply with NEC and UL requirements, a separate bonding strap is connected from the neutral bus to the switchboard frame. This bonding connection is located on the line side of the removable neutral link, maintaining a service ground to the switchboard frame when the test link is removed. See **Figure 21.7-1**. UL labeling will clearly indicate service equipment listed switchboards.

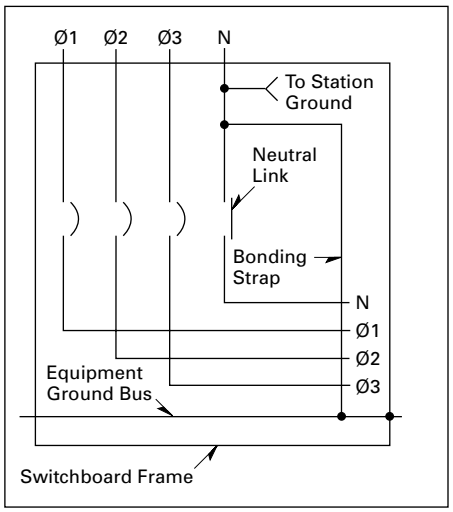


Figure 21.7-1. Neutral Link

Underwriters Laboratories Requirements and Labeling

The basic requirement for obtaining a UL label on a switchboard, is that all the component devices (breakers, switches, and so on) in the switchboard assembly are UL listed. In addition, the switchboard must comply with all applicable provisions of UL 891.

Today's modern electrical systems require that switchboards offer a wide selection of electrical devices, many of which do not fall within the scope of UL listed devices. Therefore, the conditions under which a switchboard may be labeled are limited.

Listed below are several important guidelines for consideration when a UL label is specified:

1. UL nameplates, where applicable, are supplied for each vertical structure rather than one common nameplate for the complete switchboard lineup. Where all of the component devices in the switchboard are UL listed and all applicable provisions of UL 891 are met, each of the switchboard sections may be labeled.
2. Individual vertical structures of a switchboard may be labeled where they comply with UL requirements, although other vertical structures in the same switchboard lineup may not meet the UL standards, and will not be labeled.
3. All Pow-R-Line Xpert switchboards are UL labeled when all mounted devices are UL listed.

Alternate Power Source Capabilities

Multiple solutions are available to accommodate alternate power sources available. Due to the large number of customer and system requirements, details are not provided in this guide. Eaton offers solutions that include main-main configuration and main-tie-main configurations. Automatic transfer equipment, including UL 1008 listed transfer switches and other automatic transfer schemes, are available.

Automatic Transfer Equipment

For continuity of service, automatic transfer equipment between two incoming sources may be required. This equipment transfers the load upon failure of the normal (or preferred) source to the standby (or alternate) source. Upon restoration of the normal source, the load is automatically transferred back to it. To accomplish this, electrically operated main protective devices (and bus tie devices, if required) must be employed. Additional relays also are required to detect source voltage failure and to transfer control power, when required. A manual selector switch is usually provided to select the mode of operation—automatic or manual transfer.

Seismic Qualification

Refer to Power Distribution Systems Design Guides for information on seismic qualification for this and other Eaton products.

Product Overview

Generator Quick Connect Switchboard Section

General Description

Eaton's Generator Quick Connect switchboard is an engineered switchboard assembly designed to allow easy and quick connection of a standby generator to your facility's service entrance switchboard.

Through inclusion of cam-type receptacles, standard mechanical lugs, a dedicated generator service disconnect and a key interlock transfer scheme, a facility can quickly be switched to generator power. By including the Generator Quick Connect switchboard, a facility can be on backup power without waiting on the utility to disconnect service.

Product Benefits

- **Decrease utility dependency:** In power outages, especially those that are widespread, the utility company may take hours before they are available to disconnect service from a facility. By use of the Generator Quick Connect switchboard, a facility is equipped with a means that allows switching between utility feed and a generator feed, without waiting for the utility to disconnect service
- **Decrease chance of spoilage:** For those facilities that house perishable goods that require controlled environmental conditions such as refrigeration, prolonged power outages can cost hundreds of thousands of dollars in spoilage. By use of the Generator Quick Connect switchboard, a facility ensures that they can be back on sustained power before spoilage occurs, and without the necessity of calling in expensive specialty equipment. In addition to direct loss of product, the result of spoilage can have a negative affect on a facility's insurance, which can result in additional long-term costs
- **Decrease chance of lost revenue:** Without a constant supply of electricity, a facility's revenue generation capability grinds to a halt. By use of the Generator Quick Connect switchboard, a facility's operations can be sustained and downtime can be reduced
- **Decrease chance of liability:** Among the risks to a facility during a power outage is the injury of patrons due to loss of lighting. By use of the Generator Quick Connect switchboard, a facility's lighting can be sustained, allowing for the safety of patrons
- **Decrease chance of loss and damage:** During a sustained power outage, a facility may become susceptible to loss due to theft, damage and other malicious acts. By use of the Generator Quick Connect Switchboard, a facility can better protect itself from these losses and damages
- **Quick and readily available connection:** In facilities that are not equipped for a backup generator, connection can demand field modification of existing switchboard structures, and/or even modification of the facility's physical structure. By use of the Generator Quick Connect Switchboard, the time required for these connections can be greatly reduced

Construction Specifications

Eaton's Generator Quick Connect switchboard is built to UL 891 listed Pow-R-Line Xpert switchboard standards. As such, the sizing rules of standard switchboards apply, and all modifications for Pow-R-Line Xpert switchboards are available.

For sizing information and available modifications, consult Eaton.

Circuit Breakers and Fusible Switches

Table 21.7-1. Molded Case Circuit Breakers

Circuit Breaker Type	Continuous Ampere Rating at 40 °C	Number of Poles	Voltage		Trip Type ①	UL Listed Interrupting Ratings rms Symmetrical Amperes									
						AC Ratings Volts						DC Ratings Volts ②			
			AC	DC		120	120/240	240	277	480	600	125	250	125/250	600
PDD2xF	100–225	2, 3	240	125	N.I.T.	—	—	22	—	—	—	10	—	—	—
PDD2xG	100–225	2, 3	240	125	N.I.T.	—	—	65	—	—	—	10	—	—	—
PDD2xM	100–225	2, 3	240	125	N.I.T.	—	—	100	—	—	—	10	—	—	—
PDD2xP	100–225	2, 3	240	125	N.I.T.	—	—	200	—	—	—	10	—	—	—
PDG2xF	15–100	1	277	125	N.I.T.	—	—	—	14	—	—	10	—	—	—
PDG2xF	15–100	2, 3	480	250	N.I.T.	—	—	18	—	14	—	—	10	—	—
HFDDC ③	15–150	2, 3	—	600	N.I.T.	—	—	—	—	—	—	42	42	—	35
PDG2xG	15–225	1	277	125	N.I.T.	—	—	—	35	—	—	10	—	—	—
PDG2xG	15–225	2, 3	600	250	N.I.T.	—	—	65	—	35	18	—	10	—	—
PDG2xG	15–225	4	600	250	N.I.T.	—	—	65	—	35	18	—	10	—	—
PDG2xM	15–225	1	277	125	N.I.T.	—	—	—	65	—	—	10	—	—	—
PDG2xM	15–225	2, 3	600	250	N.I.T.	—	—	100	—	65	25	—	22	—	—
PDG2xM	15–225	4	600	250	N.I.T.	—	—	100	—	65	25	—	22	—	—
PDG2xP	15–225	2, 3	600	250	N.I.T.	—	—	200	—	100	35	—	22	—	—
PDG2xP	15–225	4	600	250	N.I.T.	—	—	200	—	100	35	—	22	—	—
HJDDC ③	70–250	2, 3	—	600	I.T.	—	—	—	—	—	—	42	42	—	35
PDG3xGy	250–400	2, 3	240	250	N.I.T.	—	—	65	—	—	—	—	10	—	—
PDG3xG*	70–400	2, 3	600	250	I.T.	—	—	65	—	35	25	—	10	—	—
PDF3xG* ④	70–400	3	600	250	I.T.	—	—	65	—	35	25	—	10	—	—
PDG3xM*	70–400	2, 3	600	250	I.T.	—	—	100	—	65	35	—	22	—	—
PDF3xM ④	70–400	3	600	250	I.T.	—	—	100	—	65	35	—	22	—	—
PDD3xP*	70–400	2, 3	600	250	I.T.	—	—	200	—	100	50	—	22	—	—
HKDDC ③	100–400	2, 3	—	600	I.T.	—	—	—	—	—	—	42	42	—	35
LHH ⑤	125–400	2, 3	600	250	I.T.	—	—	100	—	65	35	—	42	—	—
NHH	150–350	3	600	—	—	—	—	100	—	65	35	—	—	—	—
PDG3xG* ⑥	300–600	2, 3	600	250	I.T.	—	—	65	—	35	25	10	22	—	—
PDG3xM* ⑥	300–600	2, 3	600	250	I.T.	—	—	100	—	65	35	10	22	—	—
PDG3xP* ⑤⑥	250–600	2, 3	600	250	I.T.	—	—	200	—	100	50	—	42	—	—
PDG4xG ⑥	400–800	2, 3	600	250	N.I.T.	—	—	65	—	50	25	—	22	—	—
PDF4xG ④⑥	400–800	3	600	—	N.I.T.	—	—	65	—	50	25	—	22	—	—
PDG4xM ⑤	400–800	2, 3	600	—	N.I.T.	—	—	100	—	65	35	—	25	—	—
PDF4xM ④⑥	400–800	3	600	—	N.I.T.	—	—	100	—	65	35	—	25	—	—
HMDLDC ③	300–800	2, 3	—	600	I.T.	—	—	—	—	—	—	42	42	—	—
PDG5xM	600–1200	2, 3	600	—	N.I.T.	—	—	100	—	65	35	—	—	—	—
PDG5xP	600–1200	2, 3	600	—	N.I.T.	—	—	200	—	100	50	—	—	—	—
NBDC ③	700–1200	2, 3	—	600	I.T.	—	—	—	—	—	—	42	42	—	50
PDG6xP* 1600	700–1600	3	600	—	N.I.T.	—	—	200	—	100	65	—	—	—	—
PDG6xP* 2000	1000–2000	3	600	—	N.I.T.	—	—	200	—	100	65	—	—	—	—
PDG6xP* 2500	1000–2500	3	600	—	N.I.T.	—	—	200	—	100	65	—	—	—	—
PDG6xP* ③⑦	1600–2000	2, 3	—	600	I.T.	—	—	—	—	—	—	42	65	—	65

① N.I.T. is non-interchangeable trip unit. I.T. is interchangeable trip unit.
② Two-pole circuit breaker, or two poles of three-pole circuit breaker at 250 Vdc.
③ For use on DC systems only.
④ 100% rated.
⑤ Not available in Pow-R-Line *i*X switchboards.
⑥ Available in bolt-on fixed mount or drawout feeder device.
⑦ Individually, vertically mounted.

Table 21.7-2. Magnum SB Insulated Case Circuit Breaker Interrupting Ratings ①

Circuit Breaker Type	Frame Amperes	Trip Unit Current Sensor and Rating Plug Ranges	Ratings rms Symmetrical Amperes (kAIC)		
			Interrupting Ratings		
			208/240 Vac	480 Vac	600 Vac
SBS-608	800	200–800	65	65	65
SBS-C08	800	200–800	100	100	85
SBS-612	1200	200–1200	65	65	65
SBS-C12	1200	200–1200	100	100	85
SBS-616	1600	200–1600	65	65	65
SBS-C16	1600	200–1600	100	100	85
SBS-620	2000	200–2000	65	65	65
SBS-C20	2000	200–2000	100	100	85
SBS-625	2500	200–2500	65	65	65
SBS-C25	2500	200–2500	100	100	85
SBS-630	3000	200–3000	65	65	65
SBS-C30	3000	200–3000	100	100	85
SBS-840	4000	2000–4000	65	65	65
SBS-C40	4000	2000–4000	100	100	85
SBS-850	5000	2500–5000	65	65	65
SBS-C50	5000	2500–5000	100	100	85

① Fixed internal instantaneous trip set at approximately 18 x I_n symmetrical.

Table 21.7-3. Series NRX RF Insulated Case Circuit Breaker Interrupting Ratings

Circuit Breaker Type	Frame Amperes	Trip Unit Current Sensor Ranges	Ratings rms Symmetrical Amperes (kAIC)	
			Interrupting Ratings	
			208/240 Vac	480 Vac
NRX-RF PXR 20/25	800	800	100	65
NRX-RF PXR 20/25	1200	800–1200	100	65
NRX-RF PXR 20/25	1600	800–1600	100	65
NRX-RF PXR 20/25	2000	800–2000	100	65
NRX-RF PXR 20/25	2500	800–2500	100	65
NRX-RF PXR 20/25	3000	800–3000	100	65
NRX-NF PXR 20/25	800	200–800	85	65
NRX-NF PXR 20/25	1200	200–1200	85	65

Table 21.7-4. Magnum DS Power Breaker Interrupting Ratings

Circuit Breaker Type	Frame Amperes	Ratings rms Symmetrical Amperes (kAIC)					
		Interrupting Ratings			Short-Time Rating ②		
		208/240 V	480 V	600 V	208/240 V	480 V	600 V
MDS-408	800	42	42	42	42	42	42
MDS-608	800	65	65	65	65	65	65
MDS-808	800	85	85	85	85	85	85
MDS-C08	800	100	100	100	85	85	85
MDS-616	1600	65	65	65	65	65	65
MDS-816	1600	85	85	85	85	85	85
MDS-C16	1600	100	100	100	85	85	85
MDS-620	2000	65	65	65	65	65	65
MDS-820	2000	85	85	85	85	85	85
MDS-C20	2000	100	100	100	85	85	85
MDS-632	3000	65	65	65	65	65	65
MDS-832	3000	85	85	85	85	85	85
MDS-C32	3000	100	100	100	85	85	85
MDS-840	4000	130	85	85	85	85	85
MDS-C40	4000	130	100	100	100	100	100
MDS-850	4000	130	85	85	85	85	85
MDS-C50	5000	130	100	100	100	100	100

② Also ratings without instantaneous trip.

Table 21.7-5. Current Limit-R Current Limiting Circuit Breakers—Non-Fused Type

Circuit Breaker Type	Cont. Ampere Rating at 40 °C	No. of Poles	Voltage		Trip Type ①	Federal Spec. W-C-375b	UL Listed Interrupting Ratings rms Symmetrical Amperes								
			AC	DC			AC Ratings Volts						DC ②		
							120	120/240	240	277	480	600	125	250	125/250
FCL	15–100	2, 3	480	—	N.I.T.	③	—	—	200,000	—	150,000	—	—	—	—
LCL	125–400	2, 3	600	—	N.I.T.	③	—	—	200,000	—	200,000	100,000	—	—	—

① N.I.T. is non-interchangeable trip unit and I.T. is interchangeable trip unit.
② Two-pole circuit breaker, or two poles of three-pole circuit breaker at 250 Vdc.
③ Not defined in W-C-375b.

Table 21.7-6. TRI-PAC Current Limiting Circuit Breakers—Fused Type

Circuit Breaker Type	Cont. Ampere Rating at 40 °C	No. of Poles	Voltage		Trip Type ④	Federal Spec. W-C-375b	UL Listed Interrupting Ratings rms Symmetrical Amperes								
			AC	DC			AC Ratings Volts						DC ⑤		
							120	120/240	240	277	480	600	125	250	125/250
FB	15–100	2, 3	600	250	N.I.T.	16a, 16b, 17a, 26a	—	—	200,000	—	200,000	200,000	—	—	100,000
LA	70–400	2, 3	600	250	I.T.	16a, 16b, 17a, 26a	—	—	200,000	—	200,000	200,000	—	—	100,000
NB	300–800	2, 3	600	250	I.T.	16b, 17a, 26a	—	—	200,000	—	200,000	200,000	—	—	100,000
PB	600–1600	2, 3	600	250	I.T.	17a, 26a	—	—	200,000	—	200,000	200,000	—	—	100,000

④ N.I.T. is non-interchangeable trip unit and I.T. is interchangeable trip unit.
⑤ Two-pole circuit breaker, or two poles of three-pole circuit breaker at 250 Vdc.

Table 21.7-7. Electrical Characteristics of Fusible Switches

Device Type	System Voltage	Ampere Rating	Interrupting Capacities kA Symmetrical Amperes
Fusible switch	240 or 600	30–600 300–1200 30–600 800, 1200	200 kAIC with Class R Fuses 200 kAIC with ClassT Fuses 200 kAIC with Class R and J Fuses 200 kAIC with Class L Fuses
Bolted pressure switch	240 or 480	800, 1200, 1600 2000, 2500, 3000, 4000, 5000 ⑥	200 kAIC with Class L Fuses 200 kAIC with Class L Fuses 200 kAIC with Class L Fuses

⑥ 5000 A bolted pressure contact switch is not UL listed.

Table 21.7-8. Standard Switchboard Terminals Standard Main Breaker, Branch Breaker, Main Switch or Branch Switch Terminals

Breaker Type	Ampere Rating	Wire Size Ranges
PDD2xF, PDD2xG, PDD2xM, PDD2xP	100–225	# 4–#4/0 or # 6–300 kcmil
PDG2xF, PDG2xG, PDG2xM PDG2xP	15–100 125–225	#14–#1/0 # 4–#4/0 or #6–300 kcmil
FCL	15–100	#14–#1/0
PDD3xGy	250–350 400	(1) 25–500 kcmil (2) 3/0–250 kcmil or (1) 3/0–500 kcmil
PDG3xG*, PDG3xM*, PDG3xP*, PDF3xG* ⑦, PDF3xM* ⑦	100–225 250–350 400	(1) #3–350 kcmil (1) 250–500 kcmil (2) 3/0–250 kcmil (1) 3/0–500 kcmil
PDG3xG*, PDG3xM*, LD ⑦, LHH, PDG3xP*, NHH	300–500 600 150–350	(2) 250–350 kcmil (2) 400–500 kcmil (1) #2–600 kcmil
PDG4xG, PDF4xG ⑦, PDG4xM, PDF4xM	400–600 700–800	(2) #1–500 kcmil (3) 3/0–400 kcmil (2) 500–750 kcmil
PDG5xM, PDG5xP, PDG6xM ⑦, PDG5xP ⑦	600–1000 1200	(3) 3/0–400 kcmil (4) 4/0–500 kcmil
LCL	125–225 250–400	(1) #6–350 kcmil (1) #4–250 kcmil and (1) 3/0–600 kcmil
FB-P	15–100	#14–1/0
LA-P	70–225 250–400	(1) #6–350 kcmil (1) #4–250 kcmil and (1) 3/0–600 kcmil
NB-P	350–700 800	(2) #1–500 kcmil (3) 3/0–400 kcmil

⑦ 100% rated breaker.

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 without voiding UL labels on devices and equipment.

Note: For other terminals available on some ratings of molded case circuit breakers and fusible switches, refer to Molded Case Circuit Breakers & Enclosures Design Guides.

Cable Ranges for Standard Secondary Device Terminals

Wire and cable terminals supplied on switchboard mounted devices for making up incoming or outgoing cable connections are of the mechanical screw clamp pressure type. All standard terminals are suitable for use with either aluminum or copper cable except as noted in the table. Panel mounted devices use the standard terminal provided with that device.

Table 21.7-9. Fusible Switches

Ampere Rating	Wire Size Ranges
30, 60, 100 200	#14–1/0 #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

Table 21.7-10. Standard Mechanical Incoming Terminal Ranges for Main Lugs Only and Main Devices Including Circuit Breakers and Fusible Devices

Ampere Rating	Cable Range
400 600 800	(2) #2–500 kcmil (2) #2–500 kcmil (3) #2–500 kcmil
1000 1200 1600	(4) #2–500 kcmil (4) #2–500 kcmil (5) #2–500 kcmil
2000 2500 3000	(6) #2–500 kcmil (7) #2–500 kcmil (10) #2–500 kcmil

Table 21.7-11. Range Taking Compression Main Terminals

Main Ampere Rating	Number of Conductors and Wire Range Per Phase	
	Aluminum Conductors	Copper Conductors
1200 1600 2000 2500	(4) 500–750 kcmil (5) 500–750 kcmil (6) 500–750 kcmil (7) 500–750 kcmil	(3) 500–750 kcmil (4) 500–750 kcmil (4) 500–750 kcmil (6) 500–750 kcmil
3000 4000 5000	(8) 500–750 kcmil (11) 500–750 kcmil (13) 500–750 kcmil	(7) 500–750 kcmil (9) 500–750 kcmil (11) 500–750 kcmil

① Compression terminations will take a range of conductors and include 500, 600, 700 and 750 kcmil.

Power Xpert Release Trip Unit for Insulated Case Circuit Breakers

Power Xpert Release Trip Unit

Description

Eaton's Power Xpert Release (PXR) trip units are programmable communicating microprocessor-based low-voltage electronic trip unit systems for Eaton insulated case circuit breakers. PXR trip units are available in two models: PXR 20 and PXR 25.

The PXR electronic trip units provide an enhanced and easy-to-use interface that enables end users and maintenance engineers to more easily change set points, test and configure circuit breakers, and review energy and power information. Also, the Power Xpert Protection Manager software provides the capability of secondary injection tests and reports on-demand without the need of expensive test kits.

Standards and Certifications

The PXR trip units are listed by Underwriters Laboratories (UL) and Canadian Standards Association (CSA®) for use in Series NRX™ NF and Series NRX RF circuit breakers. All PXR units have also passed the IEC 60947-2 test program that includes EMC testing. All trip units meet the low-voltage and EMC directives and carry the CE mark.

Features

Table 21.7-12. Power Xpert Features

Trip Unit	PXR 20	PXR 25
Diagnostics and Indication Features		
Trip log	10 trip events 200 summary Additional storage available via CAM module	
Alarm log	10 alarm events—through COM	
Waveform capture	One waveform event captured in ETU	
Display	LCD dot matrix	
LEDs	ETU status Long trip Short trip	Instantaneous trip Ground trip ARMS status
Power for cause of trip LEDs	Control power or battery	
Battery Indication	Display (no PTT)	
Maintenance/wellness health and diagnostics	ETU temp. and max. Trip count Ops count / last date	Operating (run) time Health bar (algorithm)
PXR Metering, Communications and Other Features		
Metering—current	Yes Phase, Neutral, Ground, min., max., demand, peak	
Metering—voltage	No	Yes L-L, L-N, avg. min., max., Frequency, min., max.
Metering—power	No	Yes kW, kVA, kvar Demand-kW, kVA, kvar Peak Demands
Metering—energy	No	Yes kWh-fwd, rev, net, tot kvarh-lead, lag, net, tot
Metering—PF apparent	No	Yes min., max.
Communications	Modbus RTU optional CAM modules optional	Modbus RTU native CAM modules optional
Testing method	PC via USB port Internal Secondary injection test circuit	
Relay outputs—alarms or trips	3	
QR code—support information	Yes	
Password—setting menu and test	Yes	
RoHS	Yes	
Protection Features		
Ordering options	LSI, LSIG/A	
Number of sensors	1 sensor—NF 1 sensor—RF	
Sensor (rating) plug (I_n)	No plug Programmable I_n (21)	
Slopes	It, I^2t, I^2t IEEE—MI, VI, EI	
System frequency	50 / 60 Hz	
Long delay pickup (I_r)	0.4 –1.0 x (I_n)(10)	
Long delay time I^2t at 6x (I_r)	0.5–24 s (10)	
Long delay thermal memory	Yes—Program disable	
Short delay pickup	1.5–10 x (I_n)(10)	
Short delay time I^2t at 8x (I_r)	0.1, 0.3, 0.4, 0.5 s	
Short delay time flat	0.0, 0.1, 0.2, 0.3, 0.4, 0.5 s	
Instantaneous pickup	2–15 x (I_n)(10)	
Ground (earth) fault pickup	Trip: 0.2–1.0 x (I_n)(5) Alarm: 0.2–1.0 x (I_n)(4) Off	
Ground (earth) fault time I^2t at 0.625 x (I_n)	0.1, 0.2, 0.3, 0.4, 0.5 s	
Ground (earth) fault time flat	0.1, 0.2, 0.3, 0.4, 0.5 s	
ZSI, short delay and ground	Programmable Display indication	
Neutral protection	Yes Off, 60, 100%	
ARMS—arc flash—mode/settings	Optional—on or off/remote 5 settings (x I_n)	

Power Xpert Release Trip Unit for Molded Case Circuit Breakers

Description

Eaton's Power Xpert Release (PXR) trip units are programmable communicating microprocessor-based low-voltage electronic trip unit systems for Eaton molded case circuit breakers. PXR trip units are available in four models: PXR 10, PXR 20, PXR 20D and PXR 25.

Standards and Certifications

The PXR trip units are listed by Underwriters Laboratories (UL) and Canadian Standards Association (CSA) for use in Frame PD-2, PD-3, PD-4, PD-5 and PD-6 molded case circuit breakers. All PXR units have also passed the IEC 60947-2 test program that includes EMC testing. All trip units meet the low-voltage and EMC directives and carry the CE mark.

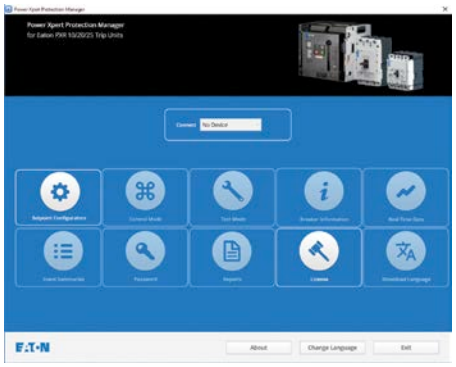
Features

The PXR electronic trip units provide an enhanced and easy-to-use interface that enables end users and maintenance engineers to more easily change set points, test and configure circuit breakers, and review energy and power information. Also, the Power Xpert Protection Manager software provides the capability of secondary injection tests and reports on-demand without the need of expensive test kits.

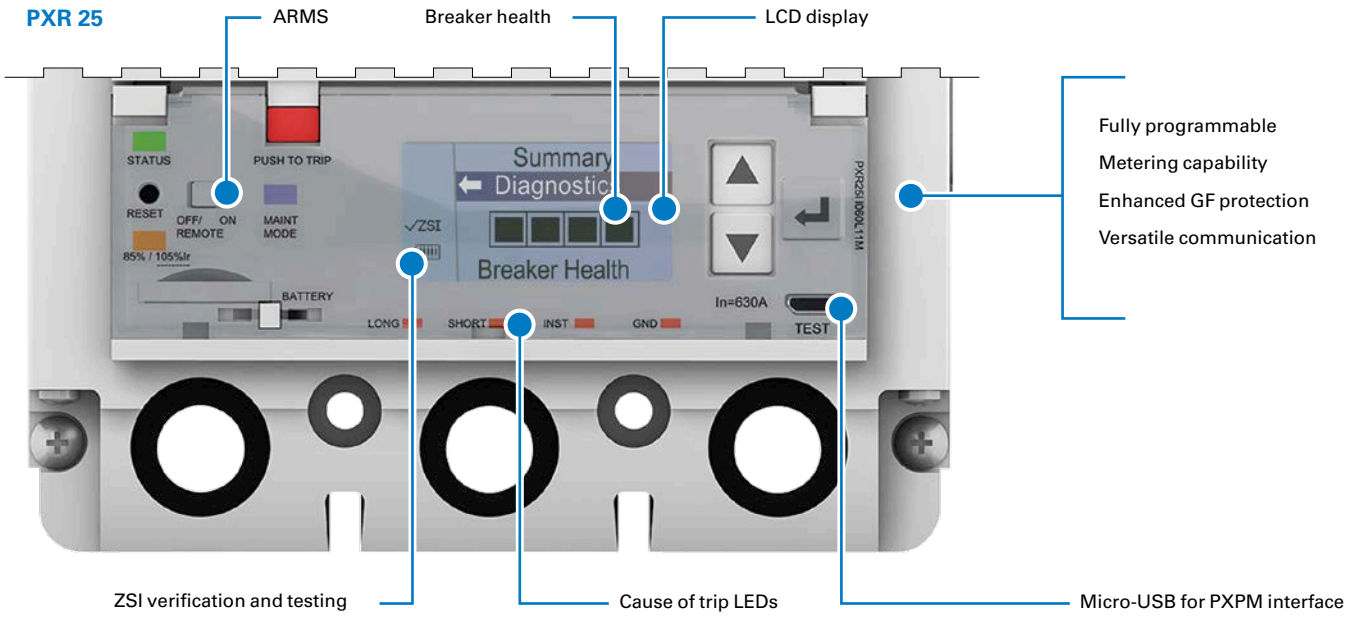
Advanced features include:

- Industry-first breaker health algorithms that provide real-time monitoring and communication of breaker condition
- Cause of trip LED indication and trip event data storage
- Zone selective interlocking (ZSI) verification and testing indication
- Adjustable Arcflash Reduction Maintenance System™ (ARMS) settings
- LCD display with programmable settings

Arcflash Reduction Maintenance System (ARMS)



Power Xpert Protection Manager (PXPM) Software



PXR 25 Trip Unit Features

Table 21.7-13. Power Xpert Release (PXR) Features

Features	PXR 10	PXR 20	PXR 20D	PXR 25
Protection types	LSI	LSI/LSIG	LSI/LSIG	LSI/LSIG
Status indication	Standard	Standard	Standard	Standard
USB secondary injection testing	Standard	Standard	Standard	Standard
Programmable by USB port (PXPM)	Standard	Standard	Standard	Standard
Independent instantaneous adjustment		Standard	Standard	Standard
Adjustable L, S, I, G pickup and time	Available through USB port (PXPM)	Standard	Standard	Standard
Cause of trip indication		Standard	Standard	Standard
Load alarm indication with 2 levels		Standard	Standard	Standard
Programmable load alarm levels			Standard	Standard
Ground fault protection and alarm		Optional	Optional	Optional
Arcflash Reduction Maintenance System (ARMS) Available PD3, PD4, PD5, PD6		Optional	Optional	Optional
Zone selective interlocking (ZSI) with indication		Optional	Optional	Optional
Programmable relays		Optional	Standard	Optional
Modbus RTU communication		Optional	Standard	Optional
CAM module communication		Optional	Optional	Optional
Rotatable LCD display			Standard	Standard
Breaker health and diagnostic monitoring		Available through USB port (PXPM)	Standard	Standard
Voltage metering accurate to 0.5%				Standard
Power and energy metering accurate to 1%				Standard

Application Description

As the Generator Quick Connect switchboard is based on the brand Pow-R-Line Xpert switchboard, it can be applied in both new and retrofit applications.

Significant Components and Assemblies

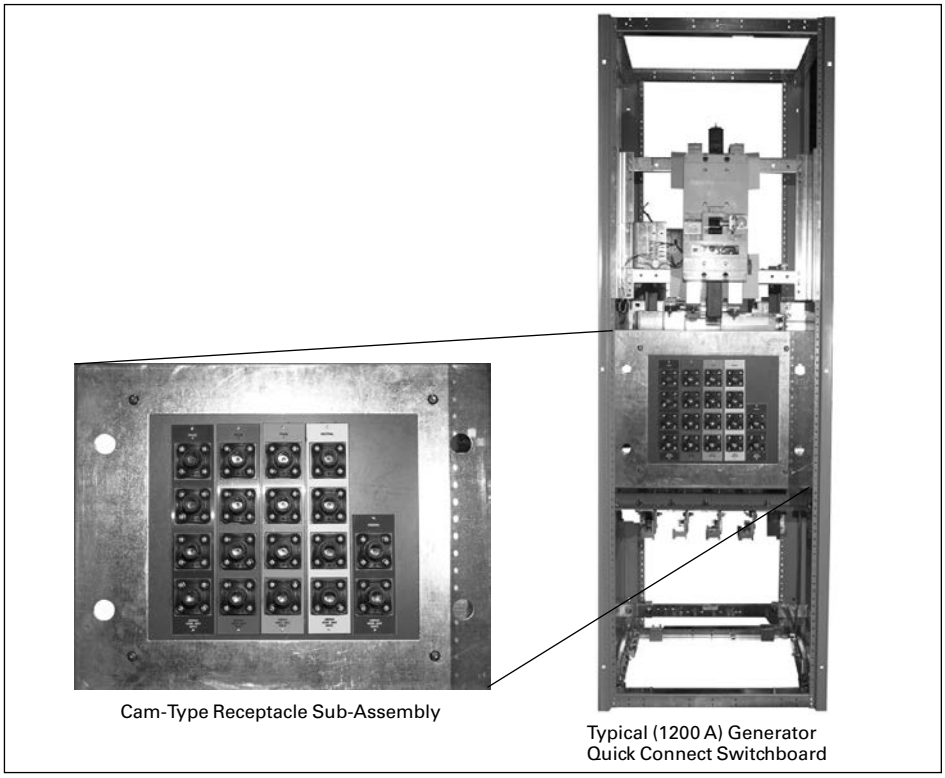
The Generator Quick Connect switchboard is based on the Pow-R-Line Xpert switchboard construction. However, as part of the larger assembly, there are several sub-assemblies that provide greater function and benefit to facilities. These components are described in the following and are illustrated in the photos to the right.

- **Generator disconnect:** The generator service disconnect is a UL listed circuit breaker with a key interlock in combination with one mounted on the main service disconnect. It can include ground fault protection, shunt trips, alarms, single-phase protection and auxiliary contacts
- **Cam-type receptacle sub-assembly:** This sub-assembly is designed to work with the quick connects that are commonly found on portable generator cables. This sub-assembly additionally includes color coding to industry standards for proper and easy phase identification, assuming proper installation
- **Permanent operation instructions:** Affixed to each Generator Quick Connect switchboard is a set of simple instructions for operation. With these instructions, any generator technicians can operate the mechanisms included in the assembly
- **Standard mechanical lugs: I**n addition to the cam-type receptacles, a set of standard mechanical lugs is provided with the Generator Quick Connect switchboard to allow an alternate method of connecting generator cables
- **Bus connection sub-assembly:** All connection methods described previously are connected together using only factory stamped and bent bus. Bus connection, as opposed to cable, provides a more robust and smaller construction

Table 21.7-14. Generator Quick Connect Dimensions and kW Ratings (Rated up to 480 V) ①

Ampere Rating ②	Number of Structures	Dimensions in Inches (mm)			kW (Max.) Rating ④			
					80% Rated Generator Disconnect Breaker		100% Rated Generator Disconnect Breaker	
		Depth ③	Structure Width	Total Width	480 V	208 V	480 V	208 V
400	1	30.00 (762.0)	30.00 (762.0)	30.00 (762.0)	213	92	266	115
600	1	30.00 (762.0)	30.00 (762.0)	30.00 (762.0)	319	138	399	173
800	1	30.00 (762.0)	30.00 (762.0)	30.00 (762.0)	425	184	531	230
1200	1	30.00 (762.0)	30.00 (762.0)	30.00 (762.0)	638	276	797	345
1600	1	30.00 (762.0)	30.00 (762.0)	30.00 (762.0)	850	368	1063	461
2000	1	30.00 (762.0)	30.00 (762.0)	30.00 (762.0)	1063	461	1329	576
2500	2	30.00 (762.0)	30.00 & 30.00 (762.0 & 762.0)	60.00 (1524.0)	1329	576	1661	720
3000	2	30.00 (762.0)	30.00 & 30.00 (914.4 & 914.4)	72.00 (1828.8)	N/A	N/A	1993	864

① 65 kAIC standard bus bracing.
② Type 3R enclosures shall be equipped with a 13.00-inch (330.2 mm) front structure extension.
③ Calculated using the following: kW (max.) = [(V*A*1.73*PF)/1000]*(Breaker Rating) with PF (power factor) equalling 0.8.
④ For applications above 3000 A, contact Eaton.



Significant Components an Assemblies (Typical)

Outdoor Enclosures

Non-Walk-in with Flat Roof

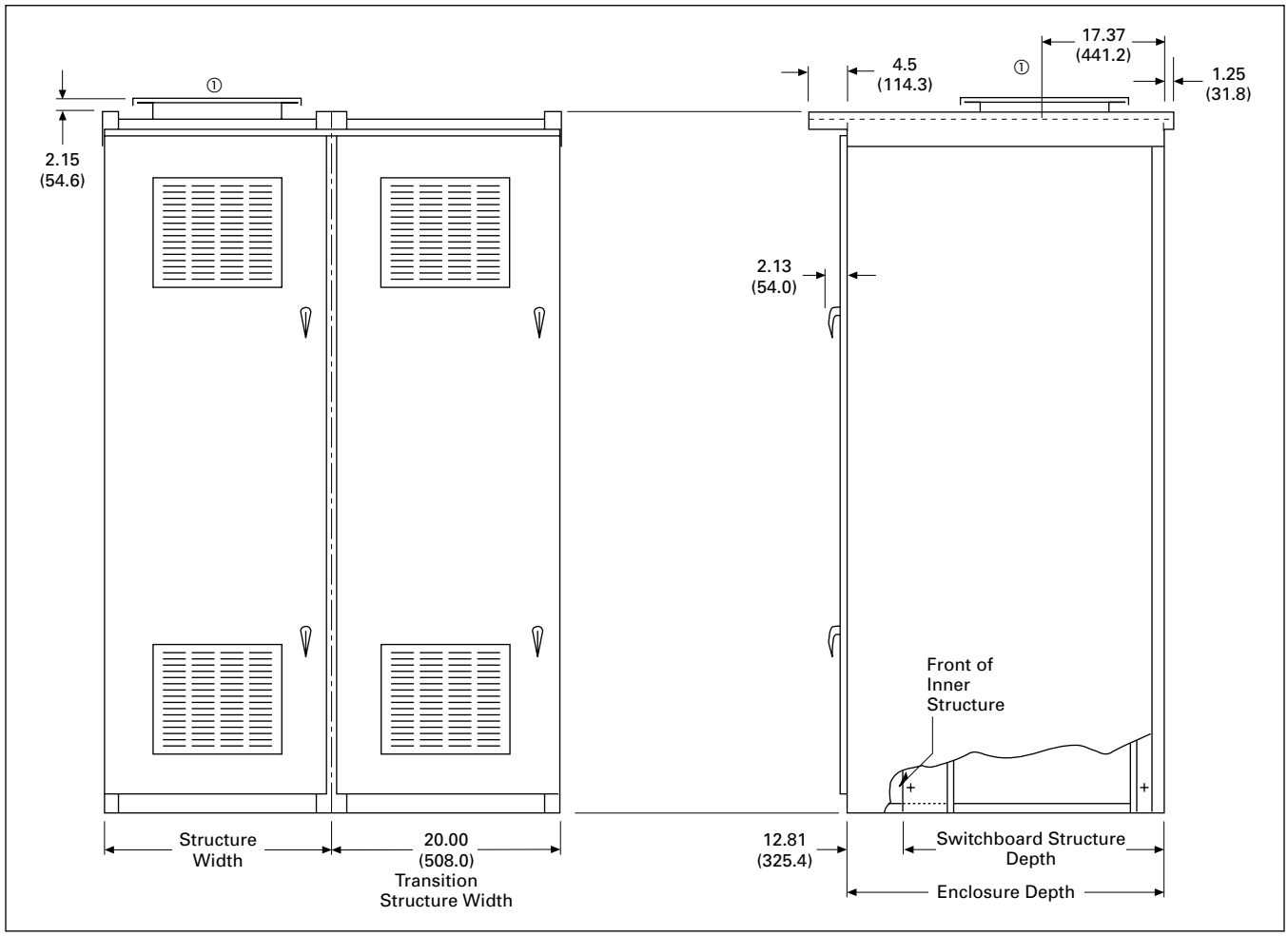


Figure 21.7-2. Front-Access—Non-Walk-In with Flat Roof—Dimensions in Inches (mm)
① Standard busway entry/exit location, 36.00-inch (914.4 mm) deep minimum.

Table 21.7-15. Switchboard Depths—Dimensions in Inches (mm)

Switchboard Indoor Structure Depth	Non-Walk-in Enclosure Depth
30 (762.0) 36 (914.4) 48 (1219.2)	43 (1092.2) 49 (1244.6) 61 (1549.4)

Non-Walk-in with Sloped Roof

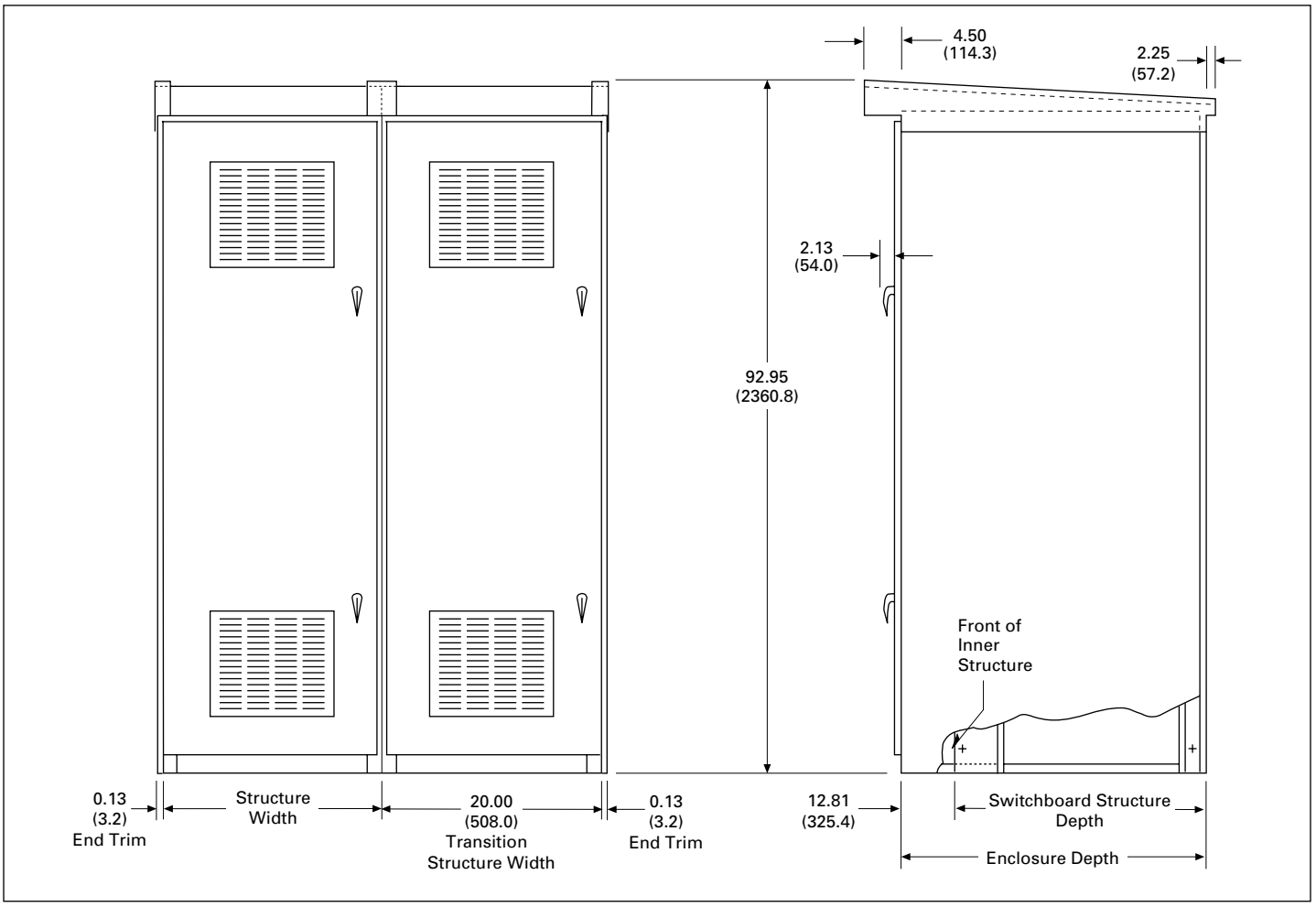


Figure 21.7-3. Front-Access—Non-Walk-In with Sloped Roof—Dimensions in Inches (mm)

Table 21.7-16. Switchboard Depths—Dimensions in Inches (mm)

Switchboard Indoor Structure Depth	Non-Walk-in Enclosure Depth
30 (762.0) 36 (914.4) 48 (1219.2)	43 (1092.2) 49 (1244.6) 61 (1549.4)

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