Power-Style™ QED-6 Rear-Connected Switchboard with MasterPacT™ and PowerPacT™ Circuit Breakers

Catalog

2746CT0101
07/2020

www.schneider-electric.com

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Power-Style QED-6 rear-connected switchboards are designed to provide superior electrical distribution, protection, and power quality management for the entire facility. The prime components are MasterPacT NW, MasterPacT NT, PowerPacT D, PowerPacT H, and PowerPacT J circuit breakers. QED-6 switchboards are designed to maximize the functionality of these circuit breakers, which, in turn, delivers maximum uptime, system selectivity, and circuit protection—all of this in a fully withdrawable construction.

Features and Benefits

- Power-Style QED-6 switchboards are listed to Underwriters Laboratories® (UL®) 891.
- MasterPacT drawout circuit breakers and PowerPacT D, H and J plug-in circuit breakers are listed to UL 489.
- Short circuit current rating up to 200 kA @ 240 V, 150 kA @ 480 V applications.
- Compartmentalized design segregates each circuit breaker.
- Family of field-installable upgrades including communications.
- Highest density of circuit breakers available in rear-connected switchboard construction.
- Front access to all controls and communications wire connections.
- Silver-plated bolted copper bus provided as standard (up to 6000 A maximum).
- Large rear cable compartment pull area allows maximum room for power cables.
- Bus provisions for future equipment expansion.

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Compartmentalization

Structures are compartmentalized and are built with barriers isolating each circuit breaker. The structure has large conduit space within the main and branch circuit breaker sections.

UL Listing

QED-6 switchboards are listed to UL 891. MasterPacT and PowerPacT circuit breakers are listed to UL 489. A UL label can be affixed where UL coverage exists for all component material, parts, and devices in the section.

Maximum Uptime

Drawout construction allows quick and simple replacement of circuit breaker elements. If an emergency occurs, circuit breakers may be removed from low-priority circuits and re-installed to serve high-priority circuits. MasterPacT and PowerPacT circuit breakers are easily changed while the remainder of the switchboard is energized.

Ease of Maintenance

MasterPacT and PowerPacT circuit breakers provide disconnecting and overload protection for the circuit it controls. Each is contained in an individual compartment and can be isolated easily from the energized circuit and withdrawn from the compartment for quick inspection, maintenance, or replacement. The entire switchboard or any other feeder circuits need not be shut down during this operation, thus minimizing production downtime.

Auxiliary Instrument Compartments

Optional control power transformers, meters, and other control devices can be mounted in the auxiliary instrument compartments. These compartments are furnished with hinged doors for easy access.

Secondary Horizontal and Vertical Wireways

The secondary wiring design allows for front access to circuit breaker control and communications wiring without removing the circuit breaker from its compartment. The vertical wireway is located on the right side of the section for easy access and wiring installation. The horizontal wireway is located directly above the circuit breaker, providing direct access to control and communication terminations.

Through-the-Door Construction

MasterPacT and PowerPacT circuit breakers provide clear access to all circuit breaker controls, indicators, and trip unit functionality without opening the compartment door. MasterPacT circuit breaker racking is also achieved with the compartment door closed.

MicroLogic™ Enhanced Functionality

The family of MicroLogic electronic and programmable trip units provide you with a choice of expanded information, power quality readings, and communication capabilities on MasterPacT circuit breakers. MicroLogic trip units can be integrated into the optional PowerLogic system.

PowerLogic™ Monitoring System

QED-6 switchboards are available with the PowerLogic metering, data acquisition, and control system. The optional system is used in addition to, or in lieu of, the Type A, Type P, and Type H MicroLogic trip units for the MasterPacT circuit breaker. PowerLogic functions are included in MicroLogic high-end trip units. Several highly accurate circuit monitors are available to work in conjunction with the PowerLogic System Manager Software to manage and control your electrical distribution system.

Equipment Standards

All QED-6 switchboards are assembled and tested in an ISO 9001 facility to applicable standards including:

Table 1 -

Standard	Description
UL 891	Dead-front distribution switchboards
NEMA PB-2	Dead-front distribution switchboards
UBC and IBC	Seismic applications

All circuit breakers are assembled and tested in an ISO 9001 facility. MasterPacT and PowerPacT circuit breakers are listed to the following:

Table 2 -

Standard	Description
UL 489	Molded case circuit breakers

Equipment Ratings

Application Voltage Systems	Ampacities	Interrupting Rating
120 Vac–600 Vac maximum	800–5000 A (main circuit breaker or main lugs only) 6000 A (thru bus)	Up to 200 kAIR @ 240 V Up to 150 kAIR @ 480 V Up to 100 kAIR @ 600 V
1Ø3W, 3Ø3W, 3Ø4W		
50/60 Hz		

General and Application Information

Power-Style QED-6 switchboards with MasterPacT and PowerPacT circuit breakers provide the necessary switchboards solution in commercial and industrial environments where uptime is essential. The switchboards are designed for ease of use, system selectivity, system uptime, and flexibility. The switchboard is easy to operate because of the technological advances in communications, power quality monitoring, and measuring capabilities.

QED-6 switchboards provide overload, short circuit, and equipment ground fault protection for circuits up to 600 volts. All circuit breakers are operational from the front without opening the circuit breaker compartment door. MicroLogic trip units are positioned and operational from the front of all MasterPacT circuit breakers.

All MasterPacT circuit breakers can be equipped with MicroLogic electronic and programmable trip units to provide you with a choice of expanded information, power quality measurement, protection, and communication capabilities. Additionally, the high-end MicroLogic trip units are compatible with the optional PowerLogic system.

The PowerPacT D, H and J circuit breakers are both thermal magnetic and electronic trip unit technology. These circuit breakers are primarily used for standard overcurrent protection; however, they can be adapted to communicate with PowerLogic circuit monitors through external current transformers.

QED-6 rear-connected switchboards are commonly found as the electrical service in the following applications:

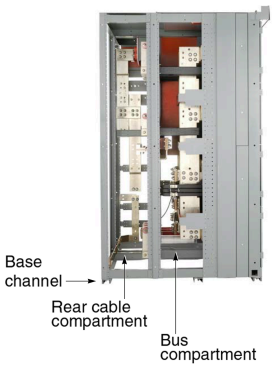
- Assembly plants
- Large warehouses
- Semi-conductor manufacturing
- Data centers
- Large office buildings
- Hospitals
- Universities
- Airports
- Network support facilities
- Telecommunications facilities
- Data collocation facilities
- Stadiums

Structure

The switchboard assembly is composed of vertical sections arranged according to customer requirements. Each section is divided into compartments for circuit breakers. Dependant on the size and type of circuit breaker, there can be from 2–12 compartments per vertical section. One or more of these compartments can be used as an auxiliary instrument compartment containing potential transformers, meters, relays, control power transformers, and other control devices.

A horizontal secondary wiring trough compartment for control wire routing is directly above each circuit breaker. A spacious wiring trough compartment is on the right side of each section. The combination of these wiring trough compartments allow for control and communications inter-wiring throughout the switchboard.

Figure 7 - Power-Style™ QED-6 Rear-Connected Switchboard (Side View)



QED-6 switchboards offer compartmentalized construction. Each vertical section consists of three compartments: a front compartment (including secondary wiring trough compartment), a bus compartment, and a rear cable compartment. The barrier between the bus and cable compartment is optional.

The front compartment is divided into smaller compartments that can contain individually mounted MasterPacT or PowerPacT circuit breakers, as well as auxiliary equipment. If desired, all compartments may be used for auxiliary equipment, circuit breakers, or a combination.

The circuit breaker is positioned to allow ample room for control and communications wiring.

Hinged doors on the auxiliary instrument compartment are available for mounting meters, relays, or other control equipment when it does not contain a circuit breaker. A circuit monitor display may be mounted on the hinged door of a compartment containing a main circuit breaker.

The examples below depict a typical QED-6 switchboard assembly.

Figure 8 - Switchgear (Front View)

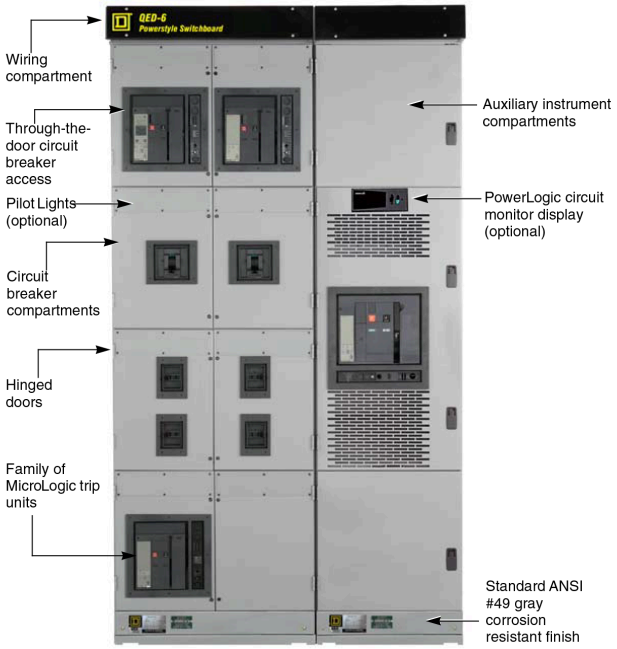
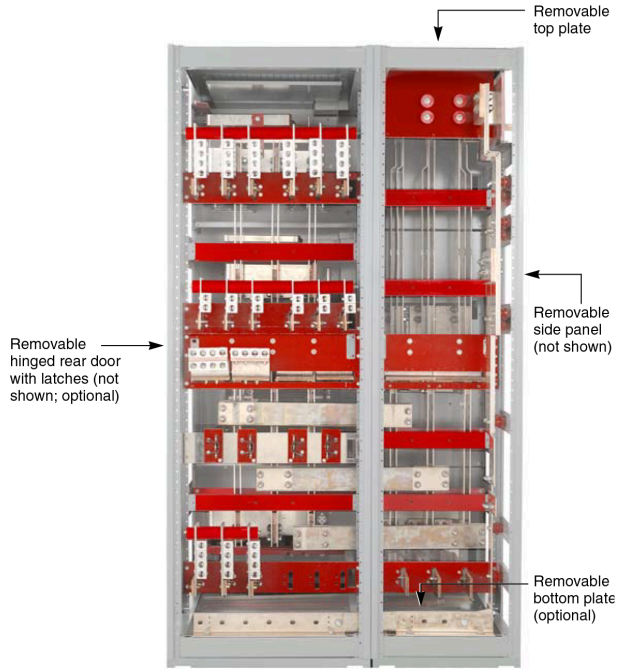


Figure 9 - Switchgear (Rear View)



Enclosures

NEMA Type 1 Indoor Enclosures

Figure 10 - QED-6 Switchboard, NEMA Type 1, Indoor Enclosure

The standard QED-6 switchboard enclosure is NEMA Type 1, general purpose. NEMA Type 1 enclosures are dead-front, metal-enclosed structures. All sheet steel parts of the enclosure, inside and out, are painted using an electro-deposition process.

Standard Features:

- Secondary wiring areas
- Removable, steel top plates over conduit entrance
- Hinged front doors with latches
- Circuit breaker or instrument compartment
- Bus compartment
- Cable compartment
- Capability for future expansion
- Two piece removable side and back plates
- 1 1/2-inch high base channels
- Electro-deposition paint process on structural parts
- ANSI #49 paint color
- Customer nameplates for each compartment Available Options:
- Vertical bus barriers
- Strip heaters in circuit breaker, bus, and cable compartments
- Overhead circuit breaker lifting device or floor crane
- Gasketing around doors and between sections
- Filtering of doors and vents
- Lockable hinged rear doors
- Lockable front hinged doors
- 18-inch high pull box
- Bottom plates
- Rodent barriers

NEMA Type 3R Enclosures

Figure 11 - Power-Zone Center, NEMA Type 3R, Walk-In Outdoor Enclosure

QED-6 switchboards are also available in a NEMA Type 3R walk-in enclosure for outdoor installation.

- Front aisle with steel entrance door equipped with panic hardware
- Lockable, hinged rear doors
- Interior fluorescent lighting
- Three-way light switch and convenience outlets near the entrance door
- Strip heaters in circuit breaker and bus compartments
- Overhead circuit breaker lifting device (traveling lifter assembly)
- Removable gasketed steel cover plates over conduit entrance
- One-piece construction for ease of installation

  NOTE: Assembly may be required if shipped split.

Available Options:

- Exhaust fan ventilation/inside temperature control
- Exterior lighting
- Undercoating
- Inside emergency lighting
- Top entry/exit for incoming and outgoing cables

Control and Communications Wiring

Control and communications wiring is installed and connected from the front of the switchboard. The secondary wiring design allows for circuit breaker compartment wiring without removing the circuit breaker from its compartment.

Control Conduit Entrances

The control wiring conduit entrance is in both the top and bottom of each section for maximum flexibility.

A removable top plate (4-inch by 5-inch) can be punched easily; up to four individual 3/4-inch control conduits per section.

Two bottom conduit entrances in each circuit breaker compartment permit cables to exit through the bottom of the compartment.

Horizontal Wireway

The secondary horizontal wireway (see Standard Features, page 13) is directly above each circuit breaker compartment, allowing easy access to secondary terminals.

Vertical Wireway

The vertical wireway is on the right side of the section for quick and easy wiring installation.

Figure 12 - Top Control Conduit Entrance

Figure 13 - Bottom Control Conduit Entrances

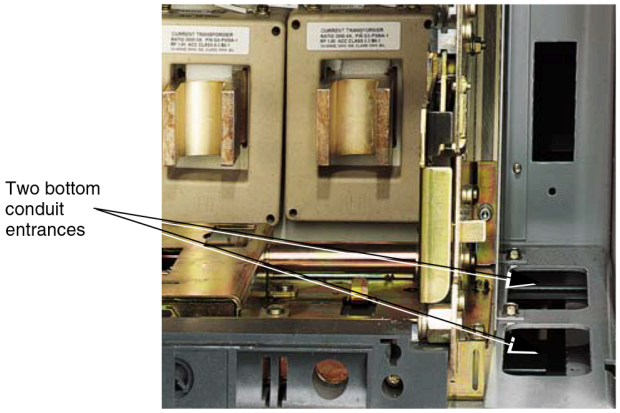
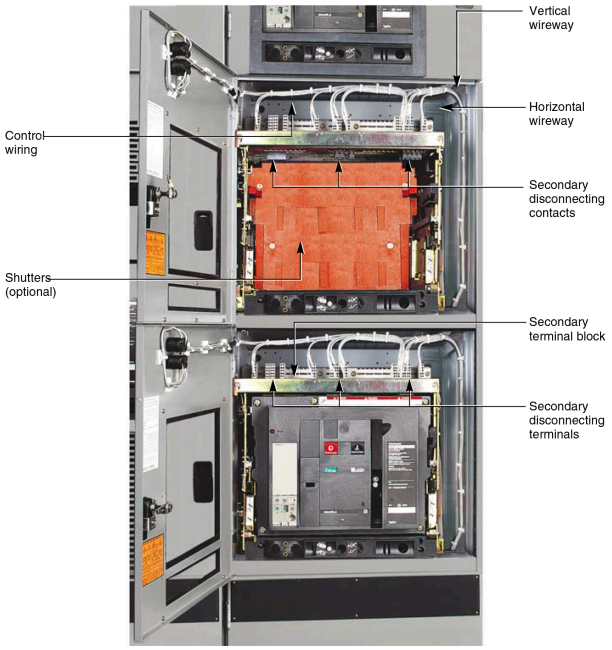


Figure 14 - Secondary Wiring System

MasterPacT NW Circuit Breaker Compartments



MasterPacT NT and PowerPacT D, H and J Circuit Breaker Compartments

Standard Features:

- Control wires in wiring trough above the circuit breaker compartment
- Originates directly from the circuit breaker without the use of an intermediate terminal block for factory and customer wiring
- Snap-in wire tie provisions
- Cage clamp terminal blocks locked directly on the circuit breaker cradle
- Control wiring AWG #14 SISMetering CT wiring AWG #10 SIS
  - — Locking pull apart terminal blocks at shipping splits
  - — Sleeve type “destination” wire markings
  - — Grommeted holes between circuit breaker compartments

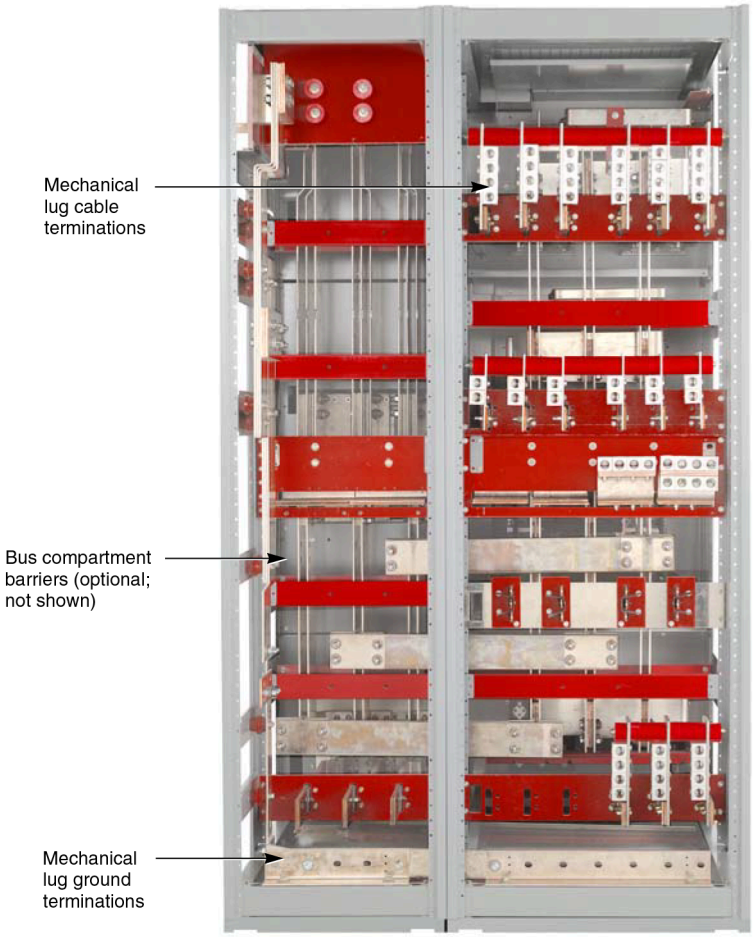
Available Options:

- Ring tongue control wiring
- Communications wiring AWG #22 shielded

Rear Cable Compartment

The rear cable compartment is behind the bus compartment. It provides room for rear access cable installation. Silver-plated copper load bars extend from the load side of the circuit breaker into the cable compartment. Cable terminations on the load bars permit cables to exit through either the top or bottom of the vertical sections.

Figure 15 - Rear Cable Compartment



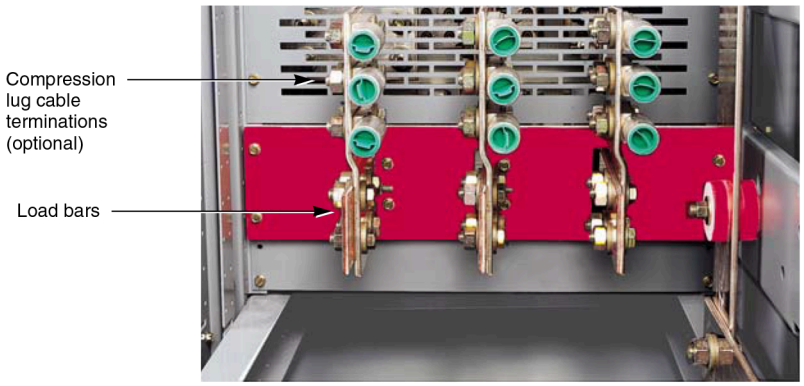
Standard Features:

- Mechanical lugs provided for customer connections
- Largest conduit area in this product class
- Two-piece removable rear covers (not shown)

Available Options:

- Compression lugs
- Cable supports
- Hinged full height rear door with padlock provisions
- 18-inch pull box

Figure 16 - Compression Lugs



Mechanical cable lugs are standard for customer cable connections. Optional compression lugs are available with MasterPacT circuit breakers. Optional cable supports (not shown) provide additional assistance in customer wiring.

Bus Compartment

The bus compartment contains the horizontal and vertical bus, and is between the circuit breaker compartment and the cable compartment. The bus compartment is separated from the circuit breaker compartment with grounded steel barriers. The optional side and rear barriers isolate the bus compartment from the rear cable compartment. In addition, service entrance barriers provide isolation around the incoming lines to meet UL and NEC requirements.

On four-wire systems, a neutral bus extends the length of the lineup and includes taps for the neutral cables in each vertical section. Feeder circuit breaker neutral sensors (current transformers) are provided on these taps when equipment ground fault protection is supplied. A removable link to the ground bus is furnished, but not connected in the main vertical section for grounded, four-wire systems. The ground bus is a silver-plated copper bus bar and is bolted to the rear bottom of the cable compartment and extends the entire length of the switchgear.

All bus joints use a minimum of two Grade-5 bolts and are secured with conical-type spring washers for maximum joint integrity. Standard bus is silver-plated copper and is fully rated. All vertical and cross bus ratings in QED-6 switchboards are based on a standard temperature rise of 149°F (65°C) above a maximum ambient air temperature of 104°F (40°C).

Figure 17 - Bus Compartment (Side View)

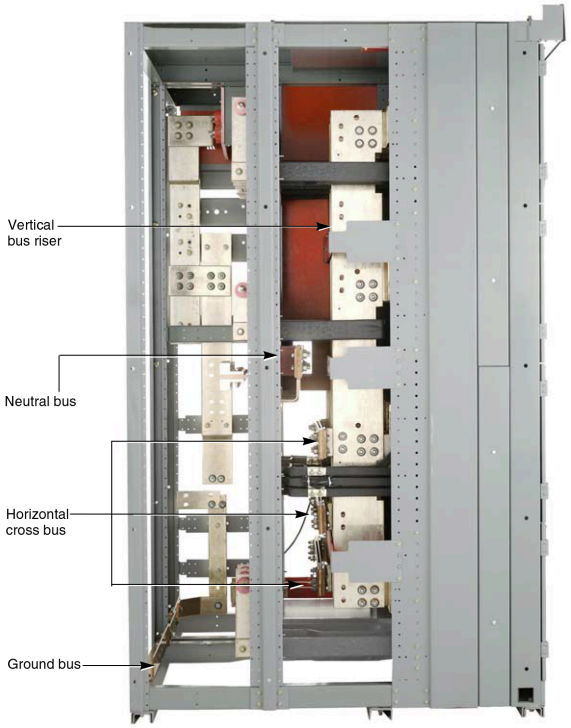
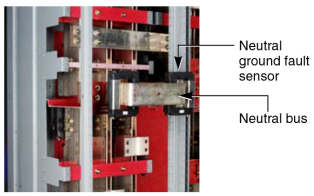


Figure 18 - Bus Compartment (Side View)



Standard Features:

- Silver-plated copper bus bars
- Up to 6000 A continuous
- All bus bars are sized for full system capacity
- Minimum of two Grade-5 bolt conical washer joints
- Sleeve type insulated runbacks

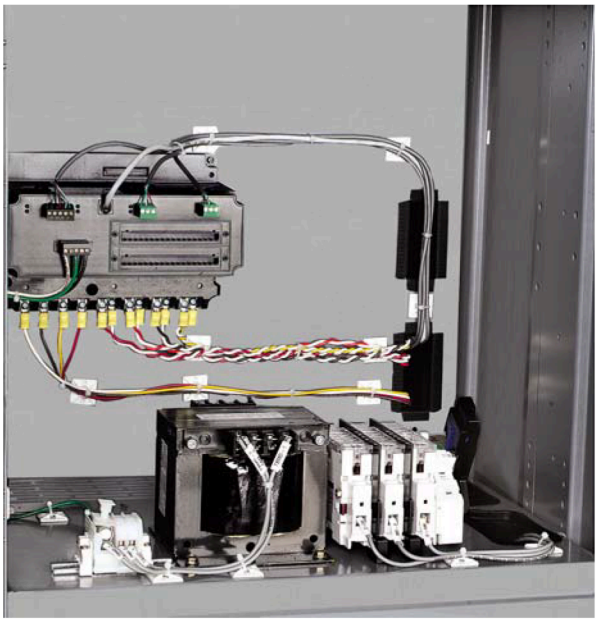
Available Options:

- Bus compartment barriers
- Side barriers in cable compartment
- Neutral bus center for easy terminations
- Tin-plated copper bus
- Bus sized to 1000 amps/in^2

Auxiliary Instrument Compartments

Auxiliary instrument compartments are the same size as circuit breaker compartments. Typical auxiliary instrument compartments contain control power transformers, control components, meters, relays, and other optional devices. Circuit monitor and power meter displays and other metering devices can be mounted on the door. Mounting pan in instrument compartments are painted white as standard.

Figure 19 - Typical Auxiliary Instrument Compartment



Auxiliary Sections

Optional, full-height, auxiliary sections with hinged front doors are available that can be bolted to feeder and main switchgear sections. In addition, auxiliary sections can be provided with through bus as needed.

Key Locks and Padlocks

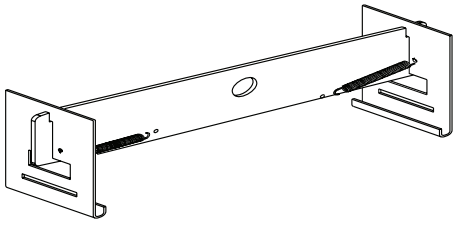
Optional key locks and padlocks can be provided for the circuit breaker compartments, auxiliary instrument compartments, auxiliary sections, and the rear doors on switchgear sections.

Moving and Handling Options

Optional key locks and padlocks can be provided for the circuit breaker compartments, auxiliary instrument compartments, auxiliary sections, and the rear doors on switchgear sections.

Lifter Bars

Figure 20 - MasterPacT NW Lifter Bar

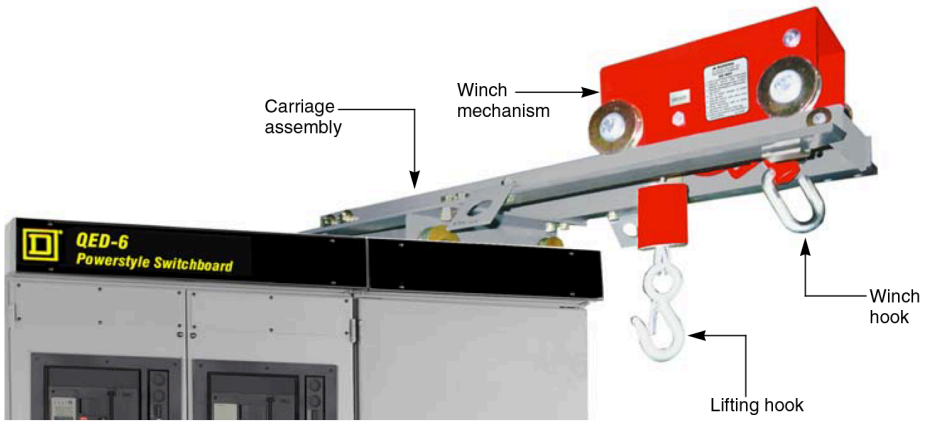


A circuit breaker lifter bar is used to lift MasterPacT NW or MasterPacT NT circuit breakers. The size of the circuit breaker determines which lifting bar should be used.

Traveling Lifter Assembly

A rail-mounted traveling type circuit breaker lifting device is optionally available with indoor type switchgear. The lifting device is available on enclosures with drip hoods and is capable of lifting MasterPacT NW circuit breakers into and out of any compartment. The circuit breaker is raised or lowered by manually cranking the hoisting mechanism. The traveling lifter assembly is supplied with outdoor walk-in enclosures.

Figure 21 - Rail-mounted Circuit Breaker Lifting Device



Floor Crane (not pictured)

In addition, a floor crane can be used with the lifter bar to move a MasterPacT circuit breakers into a dedicated work area.

MasterPacT™ Circuit Breakers

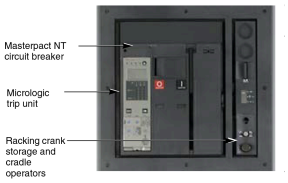
The primary components of the QED switchboard are the MasterPacT and PowerPacT circuit breakers. The MasterPacT drawout circuit breaker design allows easy access to circuit breaker controls, indicators, and the trip unit without opening the circuit breaker compartment door.

MasterPacT circuit breaker features and benefits:

- Through-the-door construction with front-accessible key interlocks, buttons, and indicators
- Individually-mounted, drawout circuit breaker
- Up to 200 kA @ 240 Vac or 150 kA @ 480 Vac interrupting rating without fuses
- 100% rated, two-step stored energy mechanism
- 800–5000 A frame MasterPacT NW
- 800–1200 A frame MasterPacTt NT
- Field-installable MicroLogic trip units with optional PowerLogic communications and monitoring features

Through-the-Door Construction

Figure 22 - Through-the-Door Access MasterPacT NT Circuit Breaker Shown



The closing and opening push buttons, the racking handle, and racking mechanism are accessible through the front door cutout, allowing circuit breaker operation and disconnection without opening the door. Optional shutters (see Secondary Wiring System, page 13) can be provided, covering live parts when the circuit breaker is removed.

Circuit Breaker Compartment

Figure 23 - MasterPacT NW Circuit Breaker Compartment

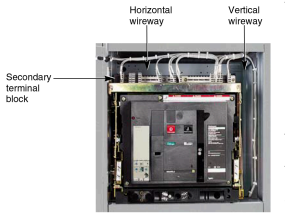
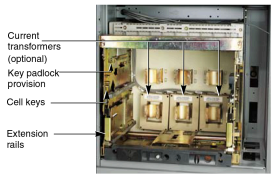


Figure 24 - MasterPacT NW Circuit Breaker Compartment with Current Transformers



The circuit breaker compartment consists of the circuit breaker cradle, a horizontal secondary terminal block on top of the cradle, and a vertical wireway on the right side of the compartment allowing for top and bottom customer wiring. The cradle structure is a bolted-in assembly that supports the circuit breaker. Integrated into the cradle are the circuit breaker interference interlocks or cell keys.

Cell keys are steel pins on the left side of the cradle. As the circuit breaker is pushed into the compartment, the bracket on the circuit breaker moves past a corresponding bracket on the cradle. If the circuit breaker is not matched correctly for the compartment, the brackets will interfere and the circuit breaker will not go into the compartment. Cell keying is a standard QED-6 switchboard feature.

The racking crank storage hole, racking crank hole, and “Push Stop Release” button are on the bottom of the cradle for MasterPacT NW and on the side of the cradle for MasterPacT NT. Circuit breaker racking is achieved with the circuit breaker compartment door closed.

When required for metering, optional current transformers are positioned around the stationary main contacts.

Interruption and Short-Time (Withstand) Ratings

QED-6 switchboards have high interrupting ratings to meet the demands of your application. Additionally, the small footprint keeps your electrical room dimensions to a minimum.

Figure 25 - NW08, NW12, NW16, NW20, NW30 (800–3000 A) N, H
NW08, NW12, NW16 (800–1600 A) L, LF
NW20 (2000 A) L-Branch, LF branch
NW20, NW25, NW30 (2000–3000 A) L

Figure 26 - NW40, NW50 (4000–5000 A) H, L

Family of MasterPacT NW Circuit Breakers (800–5000 A)

Figure 27 - NT08, NT12 (800–1200 A) N, H, L1, L, LF

MasterPacT NT Circuit Breaker (800–1200 A)

Table 3 - Ratings for UL 489 Listed MasterPacT NW Circuit Breakers

Frame rating		**800/1200/1600/2000 A**				**2500/3000 A**		**4000/5000 A**	
Interrupting rating code		**N**	**H**	**L**	**LF**	**H**	**L**	**H**	**L**
Interrupting current (kAIR RMS)	240 Vac, 50/60 Hz	65	100	200	200	100	200	100	200
	480 Vac, 50/60 Hz	65	100	150	150	100	150	100	150
	600 Vac, 50/60 Hz	50	85	100	100	85	100	85	100
Short-time withstand current (kA RMS)	ac 50/60 Hz, 1 s	42(1)	65(1)	30(2)	22	65	65	85	100

(1) 24 kA RMS for 800 A circuit breaker frame with 100 or 250 A sensor.
(2) 65 kA RMS for 2000 A.

Table 4 - Ratings for UL 489 Listed MasterPacT NT Circuit Breakers

Frame rating		800 A					1200 A			
Interrupting rating code		**N**	**H**	**L1**	**L**	**LF**	**N**	**H**	**L1**	**L**
Interrupting current (kAIR RMS)	240 Vac, 60 Hz	50	65	100	200	200	50	65	100	200
	480 Vac, 60 Hz	50	50	65	100	100	50	50	65	100
	600 Vac, 60 Hz	35	50	N/A	N/A	N/A	35	50	N/A	N/A
Short-time withstand current (kA RMS)	ac 60 Hz, 1 s	35	35	10	10	10	35	35	10	10

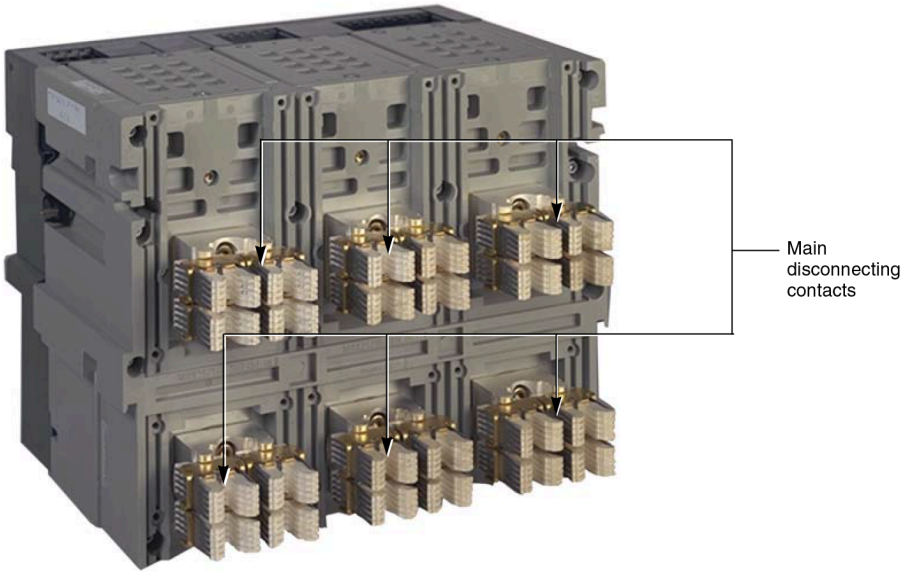
Circuit Breaker Parts

The MasterPacT NW circuit breaker has fewer parts than conventional circuit beakers while performing the same functions.

Figure 28 - MasterPacT NW Circuit Breaker (Front and Side View)

The main disconnecting contacts on the rear of the circuit breaker are spring-loaded and self-aligning. These contacts are designed so the pressure at the point of contact on the stationary connectors becomes greater under short circuit conditions.

Figure 29 - MasterPacT NW Circuit Breaker (Rear and Side View)



Two-Step Stored Energy Mechanism

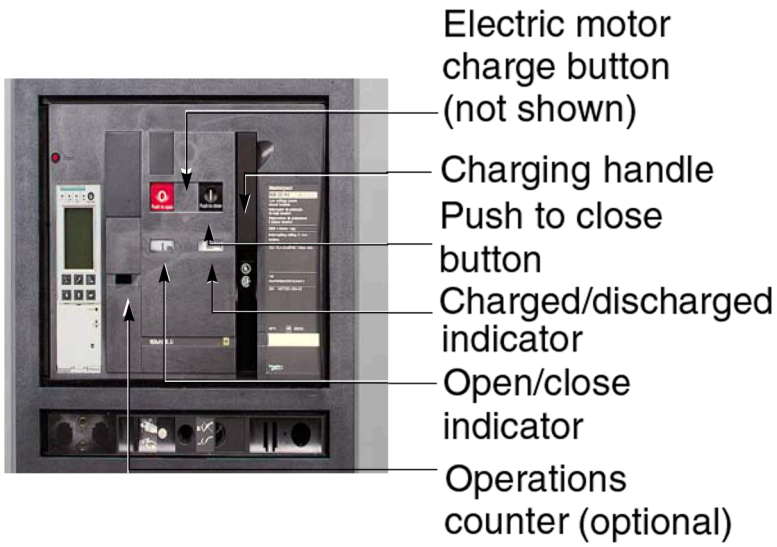
MasterPacT circuit breakers are stored energy devices with a two-step operating mechanism.

Electrically operated circuit breakers have a motor to charge the stored energy mechanism, electric close feature, and electric open feature.

On manually operated circuit breakers, the closing springs are charged by hand. For electrically operated circuit breakers, the springs are charged by an internal electric motor, but can also be manually charged if no control power is available.

Status indicators on the front of the circuit breaker indicate when the closing springs are charged or discharged.

Figure 30 - Two-Step Stored Energy Mechanism



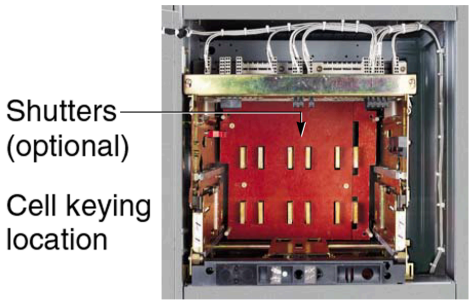
Circuit Breaker and Equipment Accessories

A number of MasterPacT circuit breaker accessories are available with QED-6 switchboards. A few of the most common accessories are listed below.

Shutters:

Optional shutters in the cradle automatically block access to the main disconnects when the circuit breaker is in the disconnect, test, or remove position. An optional padlock attachment to lock shutters closed is also available.

Figure 31 - Shutters



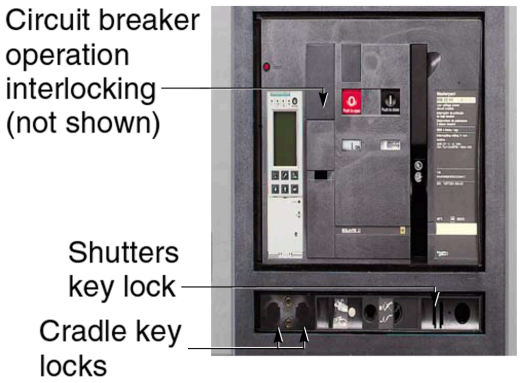
Field-installable and Upgradeable Options:

A family of field-installable coils, buttons, motors, connectors, and trip units that include, but are not limited to:

Trip units with or without PowerLogic monitoring capabilities (see MicroLogic™ Trip Units, page 25)

- Opening and closing coils (MX, XF)
- Shunt trip unit (MX)
- Undervoltage release (MN)
- Spring charging motor (MCH)
- Sensor plug
- Auxiliary contacts

Figure 32 - Operation Interlocking



Additional Accessories Available:

Table 5 - MasterPacT Accessories

Key interlocks	2
Padlock attachments	1
Bell alarm	Yes
Current transformers	Yes
Operator cover	Yes
Drawout assist handles	No

NOTE: Refer to the MasterPacT circuit breaker catalog for additional information.

PowerPacT™ Circuit Breakers

Circuit Breaker Compartment

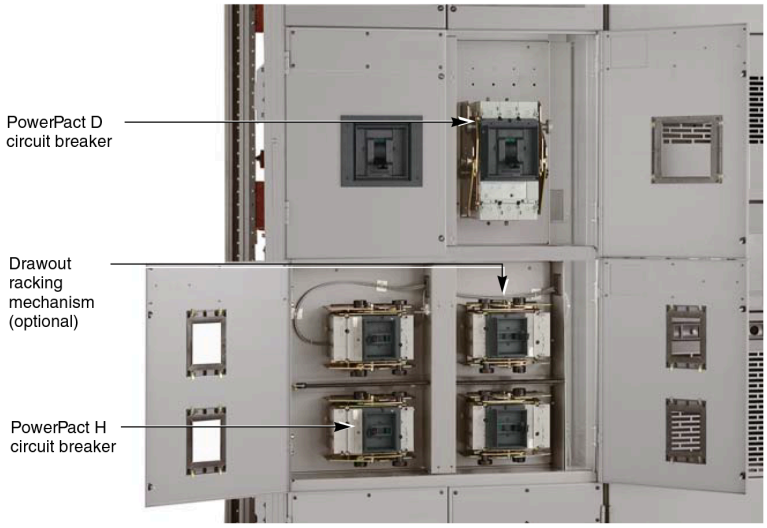
For smaller loads, the PowerPacT circuit breaker is also individually mounted for added isolation. The unique plug-in or drawout designs allow for quick and easy circuit breaker changes without the requirement of disturbing other branch circuit breakers.

Additional Accessories Available:

Table 6 - PowerPacT Accessories

Key interlocks	1
Padlock attachments	1
Bell alarm	Yes
Current transformers	Yes
Operator cover	No
Drawout assist handles	Yes

Figure 33 - PowerPacT Circuit Breaker Compartments



NOTE: Refer to the PowerPacT circuit breaker catalog for additional information.

Interruption and Short-Time (Withstand) Ratings

Table 7 - Ratings for UL 489 Listed PowerPacT D , H and J Circuit Breakers

Frame rating		**PowerPacT H and J 150/250 A**			**PowerPacT D 400/600 A**		
Interrupting rating code		**G**	**J**	**L**	**N**	**H**	**L**
Interrupting current (kAIR RMS)	240 Vac, 60 Hz	65	100	125	65	100	150
	480 Vac, 60 Hz	35	65	100	35	65	100
Short-time withstand current (kA RMS)	600 Vac, 60 Hz	18	25	50	18	25	25
	ac 60 Hz, 1 s	N/A	N/A	N/A	6	6	6

MicroLogic™ Trip Units

A family of field-installable trip units is available with MasterPacT circuit breakers. The circuit breaker overcurrent protection consists of a solid-state, microprocessor-based tripping device that requires no external power source. The complete tripping system has three main components: the molded sensors, the trip device (with rating plug), and the trip actuator. The microprocessor-based trip unit uses true RMS current level sensing. For additional information, refer to Functionality, page 28.

When the MasterPacT circuit breaker is closed, no external power is required for the protection system. For circuit protection the trip unit is powered by current signal levels and current sensors integrally mounted in the MasterPacT circuit breaker.

All trip units are UL Listed for use in MasterPacT circuit breakers.

Basic Trip Unit

Figure 34 - MicroLogic Basic Trip Unit

Standard Trip Features:

- True RMS sensing
- LI trip configuration
- Field-interchangeable long-time rating plugs
- LED long-time pickup indication
- Thermal imaging

Available Options:

- LSI trip configuration
- Test kits

Type A (Ammeter) Trip Unit

Figure 35 - MicroLogic Type A Trip Unit

Standard Trip Features:

- True RMS sensing
- LI trip configuration
- Field-interchangeable long-time rating plugs
- LED long-time pickup indication LSIG trip configurations
- Digital ammeter–phase and neutral
- Phase loading bar graph
- LED trip indication
- Zone-selective interlocking (ZSI) with short-time and equipment ground fault
- Thermal imaging

Available Options:

- LSI trip configuration
- LSIG (equipment ground fault trip)
- Test kits
- Modbus communication Available PowerLogic Features:
- Amps metering
- Circuit breaker open/close trip status
- Protection settings

Type P (Power Metering) Trip Unit

Figure 36 - MicroLogic Type P Trip Unit

Standard Trip Features:

- All standard features of MicroLogic Type A trip unit
- LSI trip configuration
- Incremental “fine tuning” of L, S, I, and, when selected, G pickup and delay settings
- LCD dot matrix display and LED trip indication
- Advanced user interface
- Advanced user indication (includes, but is not limited to):
  - over/under voltage
  - over/under frequency
- IDMTL: selectable long-time delay bands
- Thermal imaging
- Power measurement
- Contact wear indication
- Temperature indication
- Zone-selective interlocking (ZSI) with short-time and equipment ground fault

Available Options:

- LSIG (equipment ground fault trip with programmable equipment ground fault alarm)
- LSIA (programmable equipment ground fault alarm (no trip)
- Test kits
- Modbus communication Available PowerLogic Features:
- Amps metering
- Volts metering
- Energy accumulation
- Remote operation
- Circuit breaker open/close trip status
- Date/time stamping

Type H (Harmonics) Trip Unit

Figure 37 - MicroLogic Type H Trip Unit

Standard Trip Features:

- All standard features of MicroLogic Type P trip unit
- Advanced power measurements functions
- Fault waveform capture Available Options:
- LSIG (equipment ground fault trip) with programmable equipment ground fault alarm
- LSIA (programmable equipment ground fault alarm (no trip)
- Zone-selective interlocking equipment ground fault
- Test kits
- Modbus communication

Available PowerLogic Features:

- Amps metering
- Volts metering
- Energy accumulation
- Remote operation
- Waveform capture
- Data logging
- Circuit breaker open/close trip status
- Power quality measurements
- Harmonics measurements through 51st harmonic
- Date/time stamping

NOTE: Refer to the MasterPacT circuit breaker catalog for detailed information about the family of MicroLogic trip units.

Functionality

The table below lists the standard and optional trip unit features for MicroLogic Type A (Ammeter), Type P (Power Metering), and Type H (Harmonics) trip units for use in QED-6 switchboards.

Table 8 - MicroLogic Trip Unit Functionality

Functions	Basic	Type A	Type P	Type H
True RMS sensing	X	X	X	X
LI trip configuration	X	X	–	–
LSI	O	O	X	X
LSIG/equipment ground fault trip	–	O	O	O
Equipment ground fault alarm (no trip)	–	–	X	X
Equipment ground fault trip and programming alarm	–	–	O	O
Adjustable rating plugs	X	X	X	X
LED – long–time pickup	X	X	X	X
LED – trip indication	–	X	X	X
Digital ammeter	–	X	X	X
Phase loading bar graph	–	X	X	X
Zone selective interlocking	–	X	X	X
Communications	–	O	O	O
LCD dot matrix display	–	–	X	X
Advanced user interface	–	–	X	X
Protective relay functions	–	–	X	X
Thermal imaging	X	X	X	X
Contact wear indication	–	–	X	X
Temperature indication	–	–	X	X
Incremental fine tuning of settings	–	–	X	X
Selective long-time delay bands	–	–	X	X
Power measurement	–	–	X	X
Waveform capture	–	–	–	X
Data logging	–	–	X	X

– Not Applicable
X Standard Feature
O Optional Feature

Curves

For additional information on trip curves, please contact your local Schneider Electric™sales office.

PowerLogic™ System

QED-6 switchboards are available with PowerLogic metering, data acquisition, and control system features. The PowerLogic system is used in conjunction with MicroLogic Type A, Type P, and Type H trip units for the MasterPacT circuit breaker. The complete system is comprised of several devices including circuit monitors, power meters, trip units, programmable logic controllers, digital relays, transformer temperature controllers, I/O, lighting control, and more. System Manager Software is available to work in conjunction with these devices to manage and control your electrical distribution system.

Modbus™ industry standard data communications allow the PowerLogic system to replace discrete meters, multiple transducers, analog wires, and analog-to-digital conversion equipment. Extensive information can be transmitted over a single communications cable to a PowerLogic system display, a personal computer, programmable logic controller, or other host system.

The following MicroLogic trip units are compatible:

- Type A
- Type P
- Type H

Basic circuit information, such as amperes, can be monitored using MicroLogic Type A trip unit. Circuit breaker remote operation is available using the MicroLogic Type P, and Type H trip units with PowerLogic functionality. For additional information, refer to Functionality, page 28. PowerLogic circuit monitors also may be used for more sophisticated metering, power quality monitoring, data acquisition and control.

MicroLogic Trip Unit System Summary

In addition to its metering capabilities, the MicroLogic trip unit system is available with optional status inputs and relay outputs for monitoring discrete contacts and remote control of devices by way of the optional data communications channel.

MicroLogic trip unit metering functions include:

- Amperes and volts
- Frequency
- Power
- Power demand
- Energy
- Energy demand
- Power factor
- Power quality measurements
- Communications
- Fault waveform capture
- Waveform capture
- Data logging
- Programmable contacts

MicroLogic trip unit relaying functions include:

- Current unbalance
- Over/under voltage
- Over/under frequency
- Voltage unbalance
- Phase loss
- Phase sequence

- Reverse power

MasterPacT circuit breaker maintenance information:

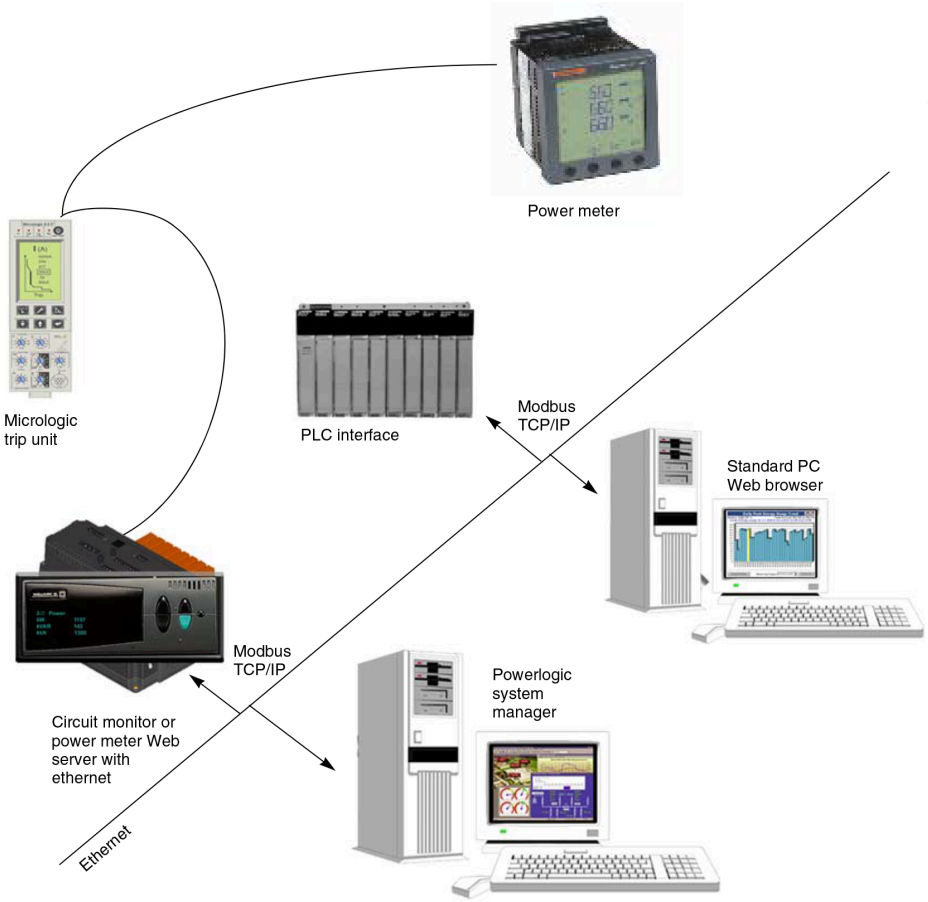
- Thermal imaging
- Contact wear indicator
- Temperature indication

System Communications

The PowerLogic, monitoring system, as well as Transparent Ready™Web Enabled (TRE) equipment, is available, as an option, with QED-6 Switchboards.

The PowerLogic power monitoring and control systems, and (TRE) systems use a high-performance ethernet backbone with Modbus communications. Information about the switchgear and its components is passed to and from a local or remote computer system using PowerLogic Modbus data communications.

Figure 38 - PowerLogic Data Communications System / TRE



System Components

PowerLogic system components and additional features are listed below.

PowerLogic System Components:

- System Manager Software
- PowerLogic ethernet gateway
- NOE ethernet card
- TCP/IP Modbus
- Modicon PLCs
- Circuit monitor
- Power meters
- Automatic control
- Digital relay
- Motor protection
- Transformer module
- MicroLogic trip units

Available PowerLogic Features:

- Custom software applications
- Communication interfaces

Circuit Monitors

PowerLogic circuit monitors and, power meters provide highly accurate meter readings along with disturbance monitoring, analog and digital I/O, onboard logging, and more. Circuit monitors and power meters can be mounted on QED-6 switchboards, auxiliary instrument compartments, and auxiliary sections.

Figure 39 - PowerLogic Circuit Monitor Display

NOTE: Detailed information about the PowerLogic system and components can be found in the PowerLogic monitoring and control system catalogs.

Arc Flash Protection with MasterPacT Circuit Breakers

What is an Arc Flash?

An arc flash occurs when insulation or isolation between electrified conductors is breached or can no longer withstand the applied voltage. As employees work on or near energized conductors or circuits, movement near or contact with the equipment (or a failure of the equipment) may cause a phase-to- ground and/or a phase-to-phase fault. Temperatures of more than 5,000 degrees Fahrenheit and a powerful explosion can be produced in an arc flash incident. The Occupational Safety and Hazard Administration® (OSHA)® has begun to enforce the NFPA 70E safety guidelines for arc flash safety.

The guidelines:

- provide analysis detailing arc flash incident energy, boundary distances, and the Personal Protective Equipment (PPE);
- state that PPE must be provided;
- mandate proper worker training;
- provide procedures for safe work practices;
- state that tools for a safe work environment must be provided; and
- state that equipment be installed in accordance with the safety requirements of the *National Electrical Code® (NEC®)*

MasterPacT Circuit Breaker Technology

Breakthrough technology was used to design the new MasterPacT circuit breakers to interrupt large amounts of fault current without being protected by fuses. The same technology and design that allows the MasterPacT NW and NT circuit breakers to interrupt large fault currents without fuses also provides very good arc flash limitation. The decision to design the MasterPacT to eliminate the need for fuse protection is based on the following:

- Requirements for smaller footprints and space-saving installations;
- Avoidance of fuse installation, maintaining supplies, and the need to enter the equipment in order to check and change fuses;
- The need to be adjustable to provide coordination with downstream products and better arc flash protection.

Advantages of using MasterPacT breakers and QED-6 switchboards when there are Arc Flash concerns:

- Arc Flash limiting feeder breakers up to 2000 A reduce arc incident energy on downstream equipment such as motor control centers (MCC's) and power distribution panels (PDP's).
- Through-the-door breaker operation allows unit to be operated/racked while door is closed.
- Optional rear hinged doors allow easy access to cables.
- MasterPacT arc flash breaker equations are easily inserted into software packages such as SKM Analysis.

  NOTE: For further information on applying MasterPacT breakers for arc flash protection, refer to data bulletins Arc Flash Protection with MasterPacT Circuit Breakers 0613DB0202 and Arc Flash Protection with MasterPacT Circuit Breakers 0100DB0402.

Technical Overview

This section contains basic technical information pertaining to Power-Style QED-6 switchboards, MasterPacT circuit breakers, PowerPacT circuit breakers, and MicroLogic trip units.

QED-6 Switchboard Ratings

Table 9 - Switchboard Ratings

Application Voltage Systems	Ampacities	Interrupting Rating
120 Vac–600 Vac maximum 1Ø3W, 3Ø3W, 3Ø4W 50/60 Hz	800–5000 A (main circuit breaker or main lugs only) 6000 A thru bus	Up to 200 kAIR @ 240 Vac Up to 150 kAIR @ 480 Vac Up to 100 kAIR @ 600 Vac
Equipment short-time rating	800–6000 A	Up to 100 k with MasterPacT NW Up to 65 k with MasterPacT NT Up to 6 k with PowerPacT D

Circuit Breaker Ratings

Circuit breakers are available in various levels of interrupting ratings *(AIR)* as listed below.

Table 10 - Interrupting Ratings of Circuit Breakers (RMS Symmetrical Amperes)

Circuit Breaker Model	Circuit Breaker Frame Size	Trip Current Range	Circuit Breaker Model No.	Interrupting Rating			Short-time Rating
				240 V	480 V	600 V	@ 480 V
PowerPacT H	150	15–150	H-G	65 k	35 k	18 k	N/A
	150	15–150	H-J	100 k	65 k	25 k	
	150	15–150	H-L	125 k	100 k	50 k	
PowerPacT J	250	175–250	J-G	65 k	35 k	18 k	N/A
	250	175–250	J-J	100 k	65 k	25 k	
	250	175–250	J-L	125 k	100 k	50 k	
PowerPacT D	150	60–150	D-N	65 k	35 k	18 k	6 k
	150	60–150	D-H	100 k	65 k	25 k	6 k
	250	100–250	D-N	65 k	35 k	18 k	6 k
	250	100–250	D-H	100 k	65 k	25 k	6 k
	400	160–400	D-N	65 k	35 k	18 k	6 k
	400	160–400	D-H	100 k	65 k	25 k	6 k
	400	160–400	D-L	150 k	100 k	25 k	6 k
	600	240–600	D-N	65 k	35 k	18 k	6 k
	600	240–600	D-H	100 k	65 k	25 k	6 k
	600	240–600	D-L	150 k	100 k	25 k	6 k
MasterPacT N	800	40–800	NT08N	50 k	50 k	35 k	35 k
	800	40–800	NT08H	65 k	50 k	50 k	35 k
	800	40–800	NT08L1	100 k	65 k	N/A	10 k
	800	40–800	NT08L	200 k	100 k	N/A	10 k
	800	40–800	NT08LF	200 k	100 k	N/A	10 k

Table 10 - Interrupting Ratings of Circuit Breakers (RMS Symmetrical Amperes) (Continued)

Circuit Breaker Model	Circuit Breaker Frame Size	Trip Current Range	Circuit Breaker Model No.	Interrupting Rating			Short-time Rating
				240 V	480 V	600 V	@ 480 V
	1200	240–1200	NT12N	50 k	50 k	35 k	35 k
	1200	240–1200	NT12H	65 k	50 k	50 k	35 k
	1200	240–1200	NT12L1	100 k	65 k	N/A	10 k
	1200	240–1200	NT12L	200 k	100 k	N/A	10 k
	1200	240–1200	NT12LF	200 k	100 k	N/A	10 k
MaterPacT NW	800	40–800	NW08N	65 k	65 k	50 k	42 k(3)
	800	40–800	NW08H	100 k	100 k	85 k	65 k(3)
	800	40–800	NW08L	200 k	150 k	100 k	30 k(3)
	800	40–800	NW08LF	200 k	150 k	100 k	22 k
	1200	240–1200	NW12N	65 k	65 k	50 k	42 k
	1200	240–1200	NW12H	100 k	100 k	85 k	65 k
	1200	240–1200	NW12L	200 k	150 k	100 k	30 k
	1200	240–1200	NW12LF	200 k	150 k	100 k	22 k
	1600	320–1600	NW16N	65 k	65 k	50 k	42 k
	1600	320–1500	NW16H	100 k	100 k	85 k	65 k
	1600	320–1600	NW16L	200 k	150 k	100 k	30 k
	1600	320–1600	NW16LF	200 k	150 k	100 k	22 k
	2000	400–2000	NW20N	65 k	65 k	50 k	42 k
	2000	400–2000	NW20H	100 k	100 k	85 k	65 k
	2000	400–2000	NW20L	200 k	150 k	100 k	65 k
	2000	400–2000	NW20LF	200 k	150 k	100 k	22 k
	2500	500–2500	NW25H	100 k	100 k	85 k	65 k
	2500	500–2500	NW25L	200 k	150 k	100 k	65 k
	3000	600–3000	NW30H	100 k	100 k	85 k	65 k
	3000	600–3000	NW30L	200 k	150 k	100 k	65 k
MasterPacT NW (31 inches wide)	4000	800–4000	NW40H	100 k	100 k	85 k	85 k
	4000	800–4000	NW40L	200 k	150 k	100 k	100 k
	5000	1000–5000	NW50H	100 k	100 k	85 k	85 k
	5000	1000–5000	NW50L	200 k	150 k	100 k	100 k

For additional short-time ratings, refer to the appropriate circuit breaker catalog sections.

Distribution Systems

This section contains a brief overview of Wye and Delta distribution systems.

Wye Solidly Grounded Systems

A Wye system is the most common type of three-phase distribution system for low voltage switchboards. Wye systems are either three- or four-wire distribution

(3) 24 k for NW08 with 100 amp or 250 amp secondary.

systems that are normally grounded, either in the equipment (see Four-Wire Wye System Fault Detection By Way of Current Relay, page 35) or at the transformer source (see Three-Wire Wye Distribution—Solidly Grounded System, page 35).

Figure 40 - Four-Wire Wye System Fault Detection By Way of Current Relay

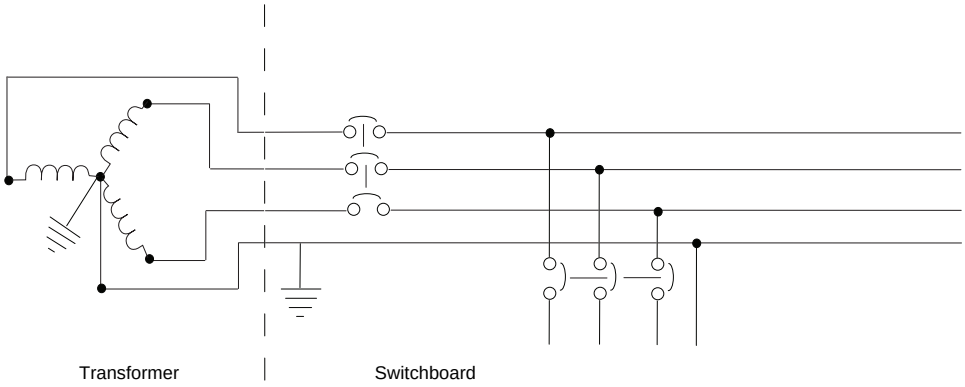
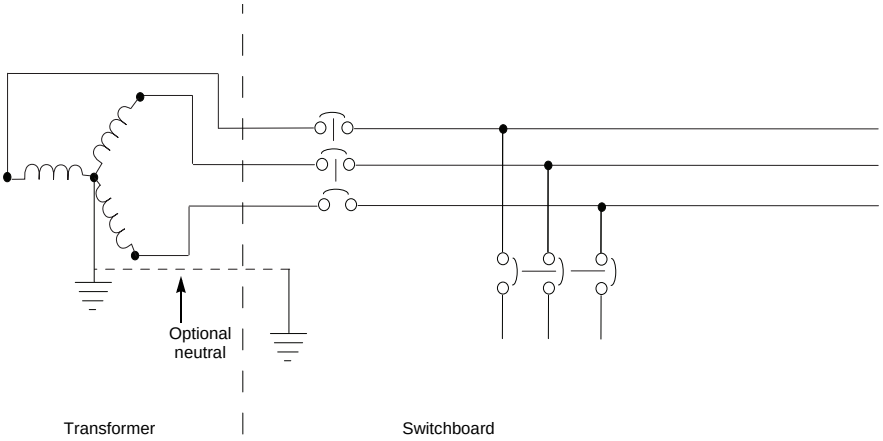


Figure 41 - Three-Wire Wye Distribution—Solidly Grounded System



When the system is grounded in the equipment and the neutral phase is carried through the equipment, the system is described as a four-wire solidly grounded system with neutral connections available to supply single phase-to-neutral loads, such as lighting loads.

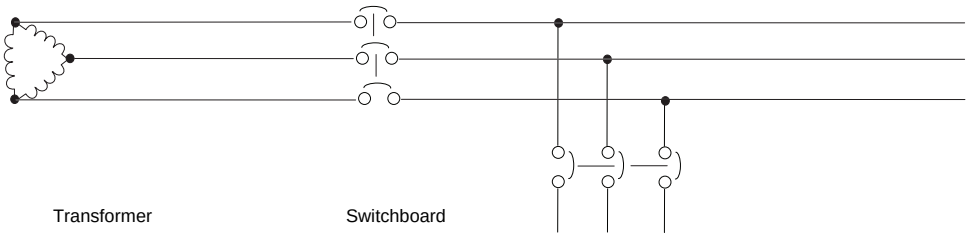
When the system is grounded at the transformer source and no neutral phase is carried through the equipment, the system is described as a three-wire solidly grounded system. No neutral connections are available; all loads must be three-phase (or single “phase-to-phase”) loads.

In some cases, the neutral is delivered to the service entrance where it is bonded to ground similar to the four-wire solidly grounded system.

Delta Grounded and Ungrounded Systems

Formerly common, Delta three-wire systems are rarely used in low voltage distribution systems. Delta three-wire distribution systems can be grounded or ungrounded services. Generally, Delta systems are ungrounded. In some cases, they are grounded on the “corner” of the Delta or some other point. Ungrounded Delta systems do not have a reference point or ground. Corner or Grounded B Phase Delta distribution systems do provide a reference point, but require one phase to be connected to the ground.

Figure 42 - Three-Wire Delta Distribution—Ungrounded



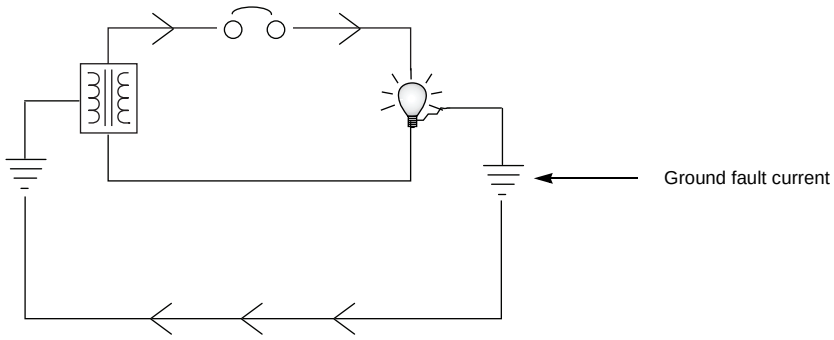
Although ungrounded systems have been used for many years, they are not recommended in newly designed low voltage distribution systems. Ungrounded power systems may be unstable. High resistance grounded systems as shown on Wye Systems Configured, page 40 and Delta Systems Configured, page 40 are recommended for use in newly designed low voltage distribution systems.

Equipment Ground Fault Protection for Wye Systems

The need for equipment ground fault protection in three-phase solidly grounded Wye systems is due to the possibility of low magnitude equipment ground fault currents. Phase-to-phase faults are of such a large magnitude that overcurrent protection devices (trip units) can operate rapidly and positively to signal the circuit breaker to open. Equipment ground faults can be of a much lower magnitude and require specialized elements in the trip unit for detection.

QED-6 switchboards with MasterPacT circuit breakers equipped with MicroLogic trip units have the capability of providing equipment ground fault sensing (alarm with no tripping) and equipment ground fault protection (tripping) on three-phase, three-wire and three-phase, four-wire solidly-grounded systems. MasterPacT circuit breakers can be used for overcurrent protection on ungrounded or resistance grounded systems, but are not suitable for equipment ground fault protection on these systems. Equipment ground faults are an inadvertent flow of current between the normal current-carrying conductors and ground. These ground faults usually start at a low level and, if left undetected, escalate causing significant heat and mechanical damage to the electrical system. Equipment ground faults can escalate to a phase-to-phase fault causing major system damage. The equipment ground fault system in the MasterPacT circuit breakers monitor the flow of current in the system and detects equipment ground fault currents. The circuit breaker will trip to protect the circuit, or send an alarm through the appropriate interface equipment, depending on the option installed.

Figure 43 - MasterPacT Circuit Breaker Ground Fault System Sensing Capabilities



The National Electric Code *(NEC)* requires equipment ground fault protection on solidly grounded Wye electrical services of more than 150 V to phase-to-ground, but not exceeding 600 V phase-to-phase for each service disconnect rated 1000 A or more. This includes service entrance, feeders and building disconnects. The *NEC* also requires equipment ground fault alarm (no tripping) on emergency systems and allows equipment ground fault alarm on continuous processes, fire pumps, and other circuits that would be more hazardous if stopped without an orderly shutdown.

Equipment Ground Fault Protection with Tripping

Equipment ground fault protection is available as an option on MasterPacT circuit breakers with MicroLogic 6.0A and higher trip units. MasterPacT circuit breakers offer three different equipment ground fault sensing options: residual, ground-source return, and modified differential. The sensing options make it possible to match the number and location of current sensors to the application. The pickup and delay settings for equipment ground fault are adjustable locally with the dial settings or through the key pad. The pickup and delay settings for equipment ground fault are also adjustable remotely over a computer network on MicroLogic 6.0 and higher trip units. A neutral current sensor *(NCT)* must be installed in the neutral if equipment ground fault alarm is used on a three-phase, four-wire system.

Equipment Ground Fault Protection without Tripping

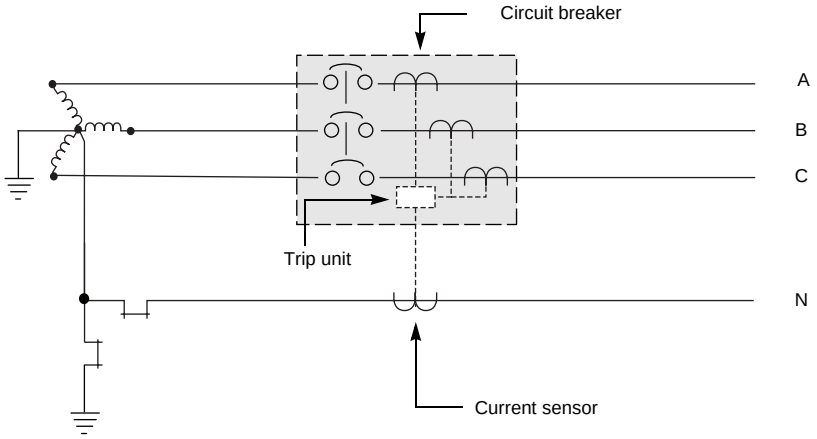
All MasterPacTt circuit breakers with MicroLogic 5.0P and higher trip units come standard with the ability to sense and report a equipment ground fault alarm through the optional programmable contact module or communication network. A neutral current sensor must be installed in the neutral if equipment ground fault alarm is used on a three-phase, four-wire system.

The pickup and delay settings for the equipment ground fault alarm are adjustable locally through the key pad on the trip unit or remotely over a computer network.

Residual Ground Fault Sensing

Residual ground fault sensing systems use one current sensor for each current-carrying conductor. The trip unit vectorially sums the secondary outputs from each sensor to determine if there is a ground fault and the magnitude of the ground fault. The following diagram shows the current sensors for a three-phase, four-wire system. There is a current sensor on each phase and the neutral.

Figure 44 - Typical Residual Ground Fault Sensing System with Phase Conductors

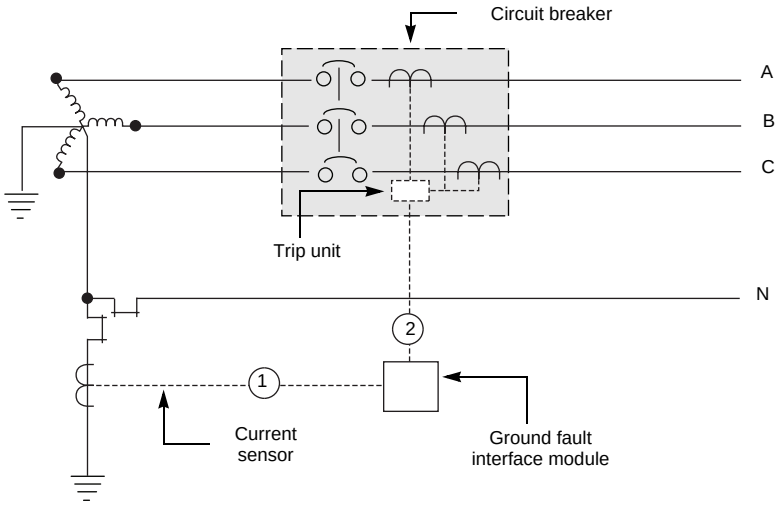


The sensors for the phase conductors A, B and C are inside the circuit breaker. The neutral current transformer is installed in the neutral circuit. If the circuit breaker were used on a three-phase, three- wire system, the neutral current transformer would not be necessary.

Ground Source Return

Ground source return ground fault sensing systems use one current sensor on the ground conductor. The current sensor measures the ground current flow. The following diagram shows the current sensor for a three-phase, four-wire system. Ground source return can also be used on three-phase, three-wire systems.

Figure 45 - Typical Ground Source Return Sensing System with Ground Fault Interface Module and Current Sensor



1	Minimum #14 AWG wire. Wiring must be shielded cable or twisted pair. Maximum of 500 ft (152 m) between ground fault interface module and current sensors.
2	Minimum #14 AWG wire. Wiring must be shielded cable or twisted pair. Maximum of 32 ft (10 m) between ground fault interface module and trip unit.

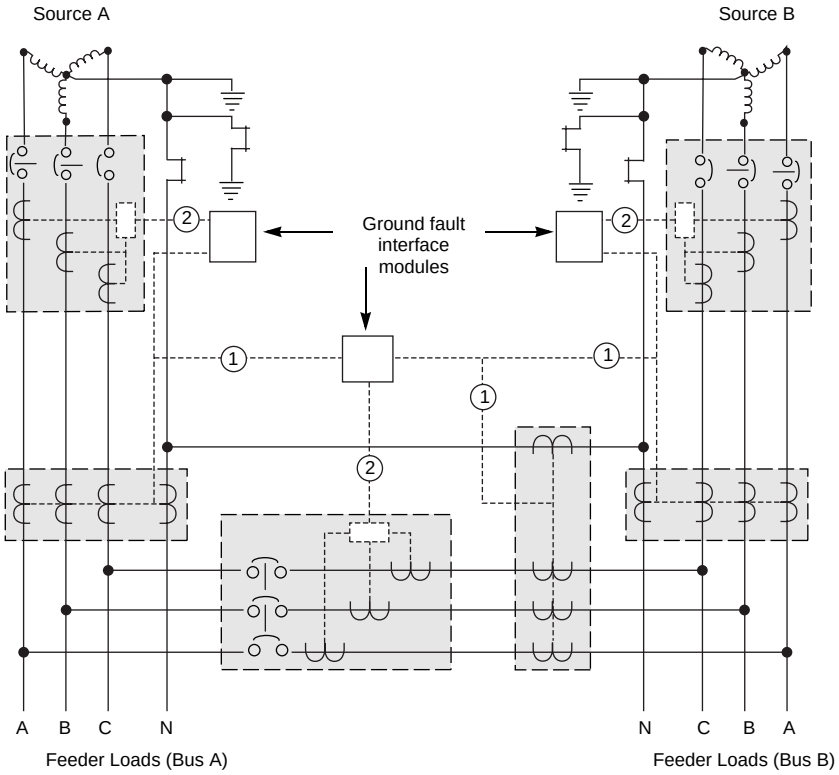
Ground-source return sensing systems require the use of the optional ground fault interface module and a sensor installed in the ground circuit.

The current sensor and ground fault interface module must be wired per the installation and wiring instructions included with the ground fault interface module.

Modified Differential Ground Fault System

A modified differential ground fault system *(MDGF)* is used for multiple sourced systems. Normal residual and ground-source return systems will not correctly sum all of the circulating currents caused by the multiple neutral paths and multiple grounds. The following diagram shows a typical main-tie- main system. Each source transformer is grounded, and the service entrance neutral is bonded to ground. Multiple neutral paths allow the neutral current to circulate and return to the supplying transformer by several different paths. The ground fault system must be capable of correctly summing these circulating currents.

Figure 46 - Typical Modified Differential Ground Fault System with Ground Fault Interface Modules



1	Minimum #14 AWG wire. Wiring must be shielded cable or twisted pair. Maximum of 500 ft (152 m) between ground fault interface module and current sensors.
2	Minimum #14 AWG wire. Wiring must be shielded cable or twisted pair. Maximum of 32 ft (10 m) between ground fault interface module and trip unit.

The modified differential ground fault sensing system requires the use of ground fault interface modules and current sensors installed in all normal current-carrying conductors.

The current sensors and ground fault interface modules must be wired in parallel and the polarity of the current sensors must be maintained per the installation and wiring instructions included with the ground fault interface module.

High Resistance Grounded Systems

Where continuance of service for your distribution system is a high priority, high-resistance grounding adds the features of a grounded system on an ungrounded system while minimizing the risk of service interruptions resulting from ground faults.

High resistance grounding simultaneously provides a system reference point (or ground) to overcome the negative effects of low level ground faults and limits the magnitude of current that can flow during a ground fault. A resistance value is selected to limit the overvoltage during arcing faults. Industry practice has established that the resistance value should be selected relative to the system capacitive charging current.

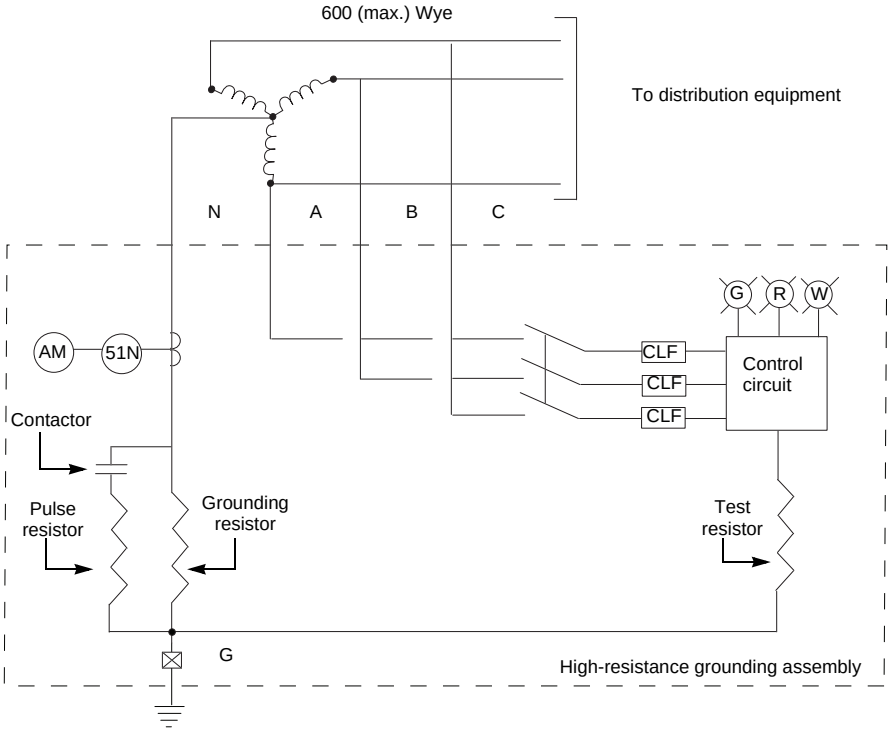
An ammeter, in the circuit of a grounding resistor/grounding transformer assembly, reads the total amount of the ground current flowing through the system. When a current-sensing relay is added, any levels in excess of the capacitive charging

current can be monitored. Alternatively, a voltmeter relay (not shown) can be connected across ground resistors to monitor the capacitive charging current in a resistor/grounding transformer assembly. The ground current ammeter provides a linear reading of the existent ac ground current present in the system for both the current and voltage detection methods described above.

Wye Systems Configured

High resistance grounding for Wye-connected systems is established by placing resistors in series with the neutral-to-ground connection of the power source. Grounding resistors are chosen to limit the ground current to a maximum value of five amperes. Line-to-neutral loads cannot be connected to a system where the neutral is resistance-grounded. For additional information, refer to 1999 NEC 250-36.

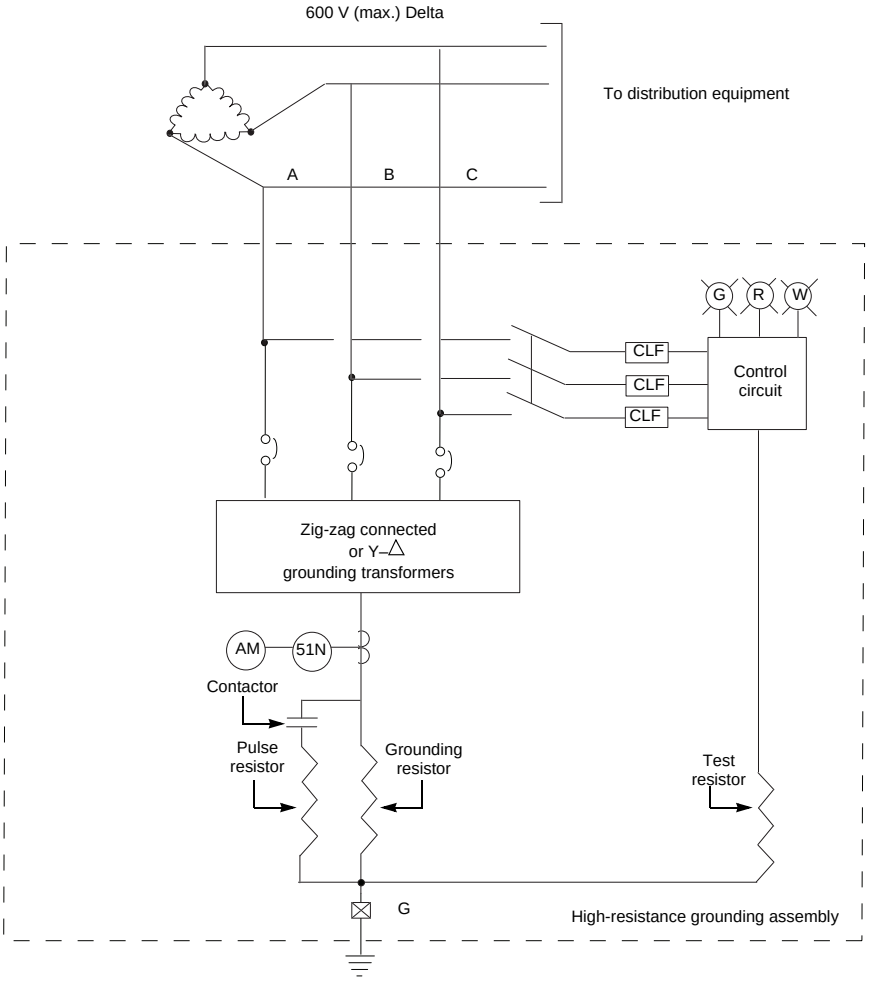
Figure 47 - Four-Wire Wye System Fault Detection By Way of Current Relay



Delta Systems Configured

A neutral point must be established in an ungrounded Delta-connected system using three single-phase transformers. Typically, grounding resistors and transformers are chosen to limit the ground current to a maximum value of five amperes. This technique can be applied on Wye-connected sources when the neutral point is not accessible from the service entrance conduit. The neutral point cannot be used to service phase-to-neutral loads.

Figure 48 - 3 Wire Delta System with Zig Zag Grounding Transformers



Automatic Transfer Systems

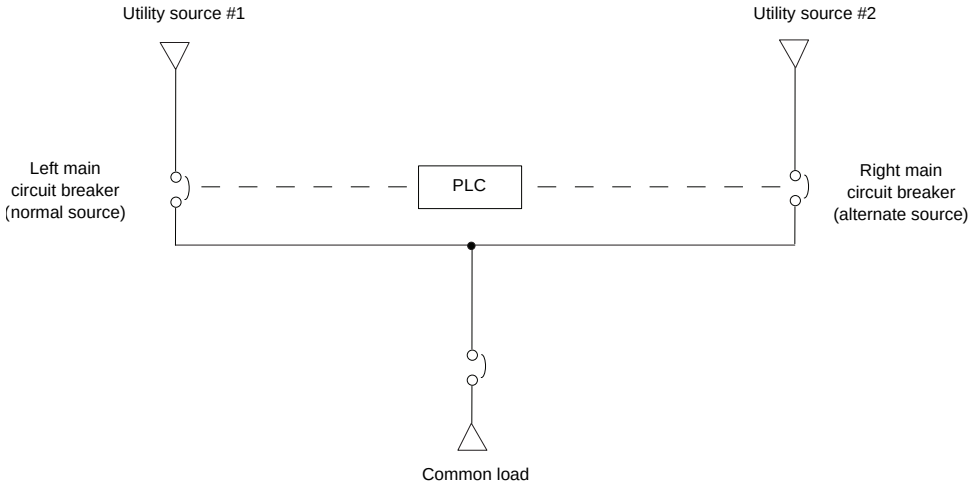
Automatic transfer systems minimize power interruption by transferring the load from the normal source to an alternate source when the normal source is temporarily unavailable. The system uses multiple connections to power sources, usually utility sources, and a programmable logic controller *(PLC)* to achieve this transfer. These systems also feature redundant supplies of control power.

See examples of automatic transfer systems with Main-Main Circuit Breakers, page 41 and Main-Tie-Main Circuit Breakers, page 42.

Main-Main Circuit Breakers

Each main circuit breaker connects to a utility source. When the normal source becomes unavailable, the system transfers to the alternate. If the system comes equipped with a preferred source selector option, the system reverts to the preferred source automatically once it is available. Without the selector, automatic retransfer does not occur.

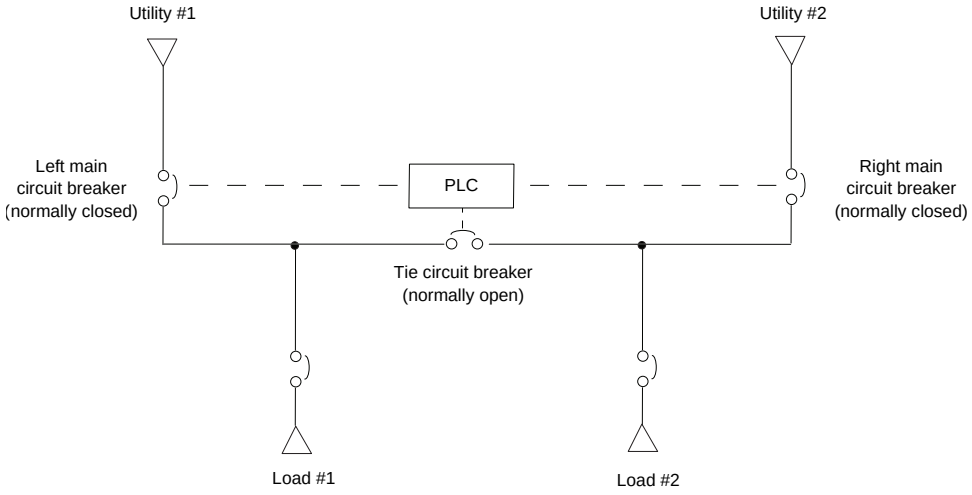
Figure 49 - Main-Main Circuit Breaker Configuration



Main-Tie-Main Circuit Breakers

Both main circuit breakers, connected to a utility source, are connected together by means of a normally open tie circuit breaker. Each main circuit breaker feeds independent load buses. Various settings of the preferred source selector switch and the retransfer on/off options determine which circuit breakers are closed during various operating conditions.

Figure 50 - Main-Tie-Main Circuit Breaker Configuration



Special Applications

This section contains information regarding low voltage systems in seismic and high altitude applications.

Seismic Applications

QED-6 switchboards have been tested for applications according to Uniform Building Code *(UBC)* Zone 4 requirements. Equipment must be anchored properly to fully comply with Zone 4 installations.

High Altitude Applications

When QED-6 switchboards are installed at a location greater than 6,600 feet above sea level, the ratings must be de-rated.

Table 11 - Altitude De-rating Factors

Altitude	Voltage(4)	Amps
6,600 ft (2,000 m) and below	100%	100%
8,500 ft (2,600 m)	95%	99%
13,000 ft (3,900 m)	80%	96%

NOTE: Ref. ANSI C37.20.1, QED-6 Switchboard Ratings, page 33.

(4) Dielectric withstand voltage (100% = 2200 v).

Dimensions

Layouts

Top and Bottom Conduit Entrance Dimensions–Not for Construction (consult factory drawings)

Figure 51 - Top Conduit Entrance–Auxiliary Section (22-inch wide)

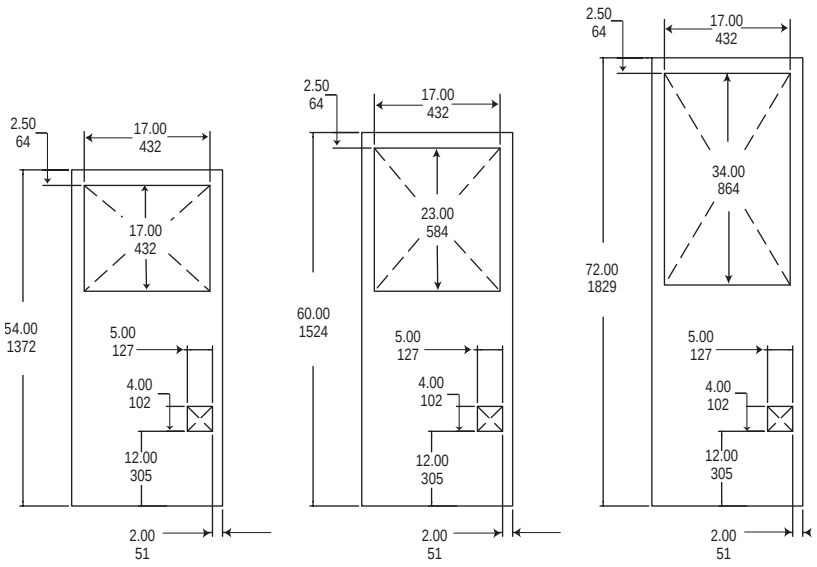
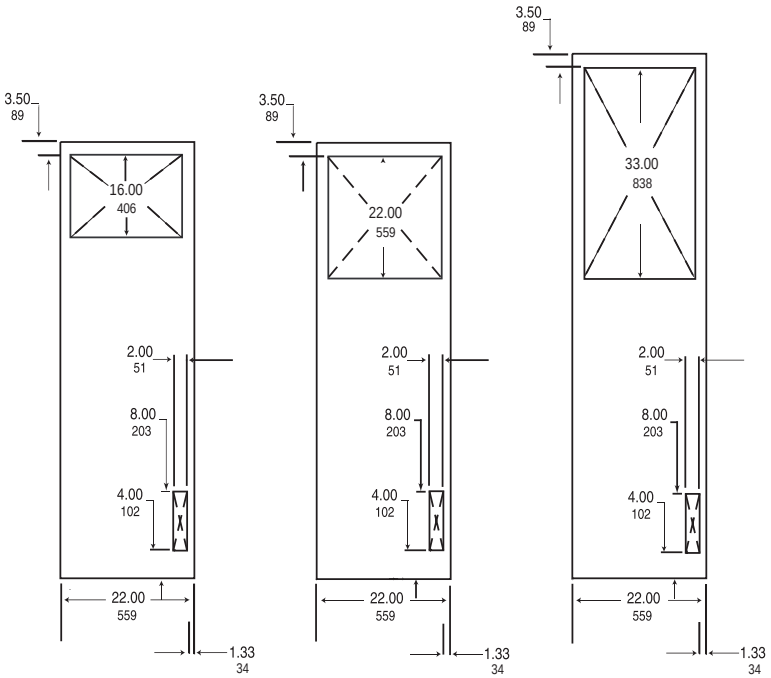


Figure 52 - Bottom Conduit Entrance–Auxiliary Section (22-inch wide)



Dimensions: in. mm

Figure 53 - Top Conduit Entrance–Auxiliary Section (30-inch wide)

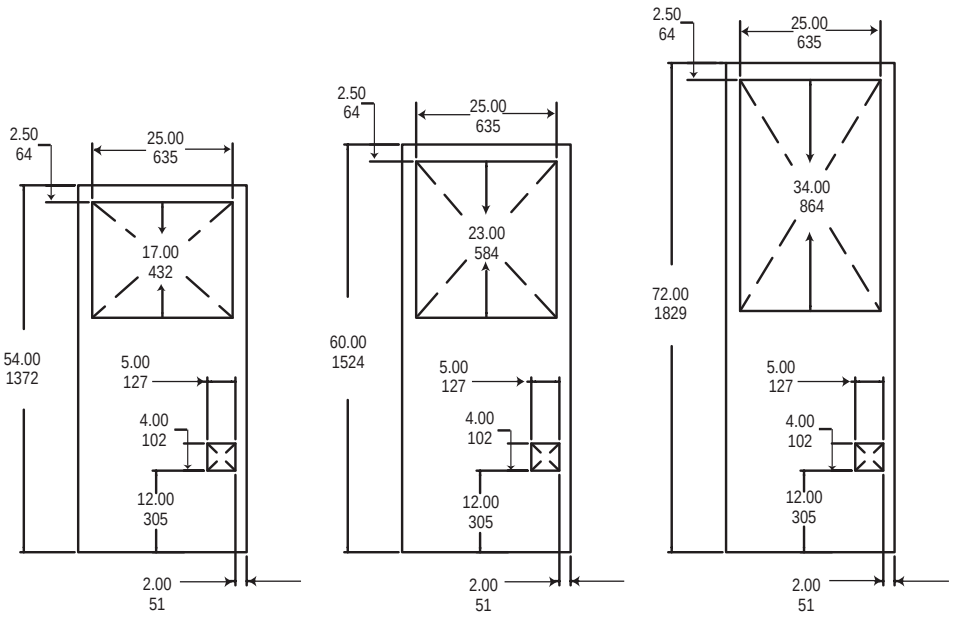
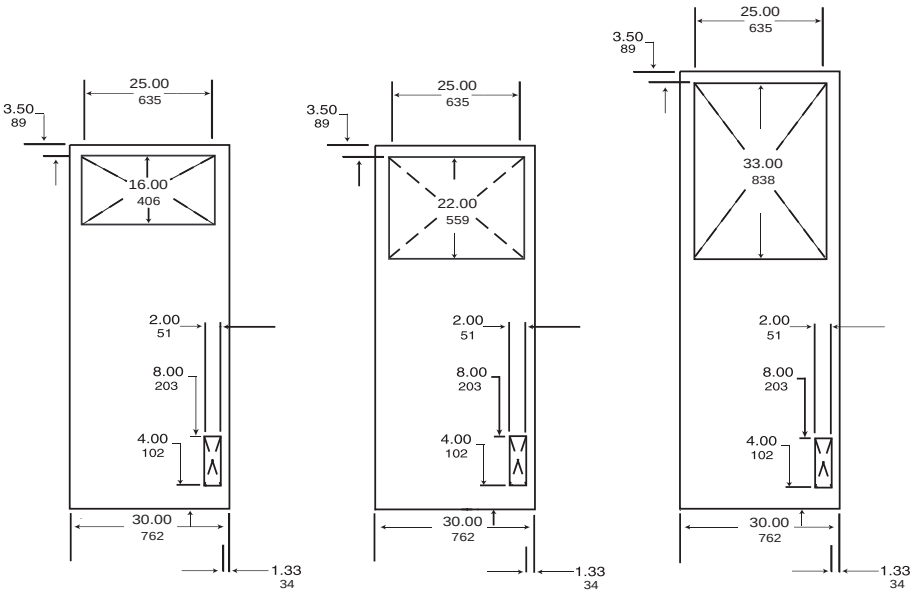


Figure 54 - Bottom Conduit Entrance–Auxiliary Section (30-inch wide)



Dimensions: in. mm

Figure 55 - Top Conduit Entrance–Auxiliary Section (36-inch wide)

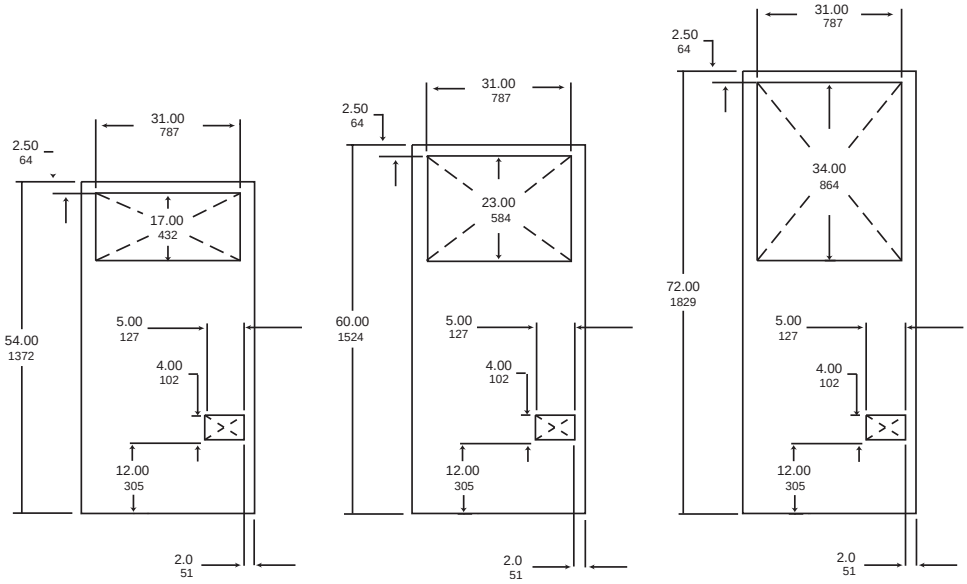
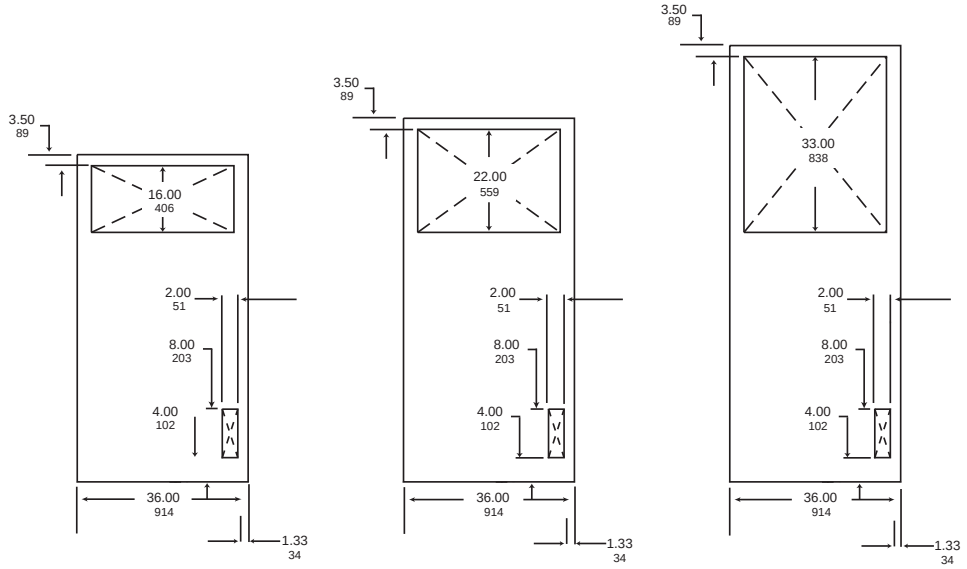
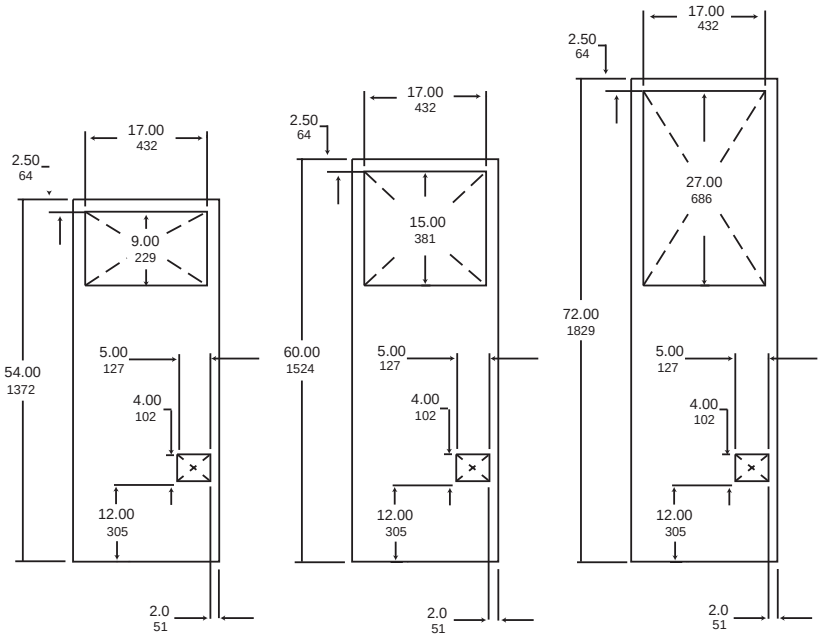


Figure 56 - Bottom Conduit Entrance–Auxiliary Section (36-inch wide)



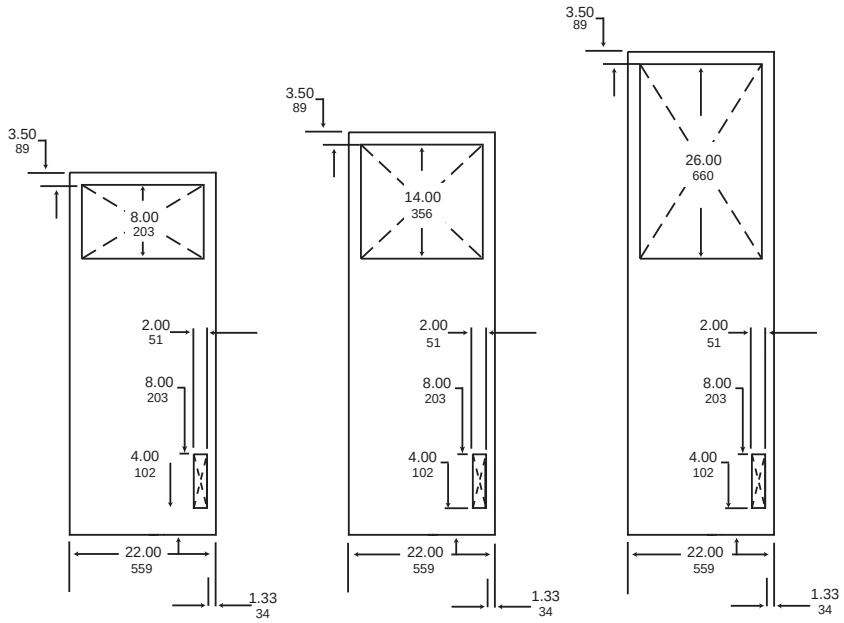
Dimensions: in. mm

Figure 57 - Top Conduit Entrance–Main, Tie, and Feeder Sections (22-inch wide)



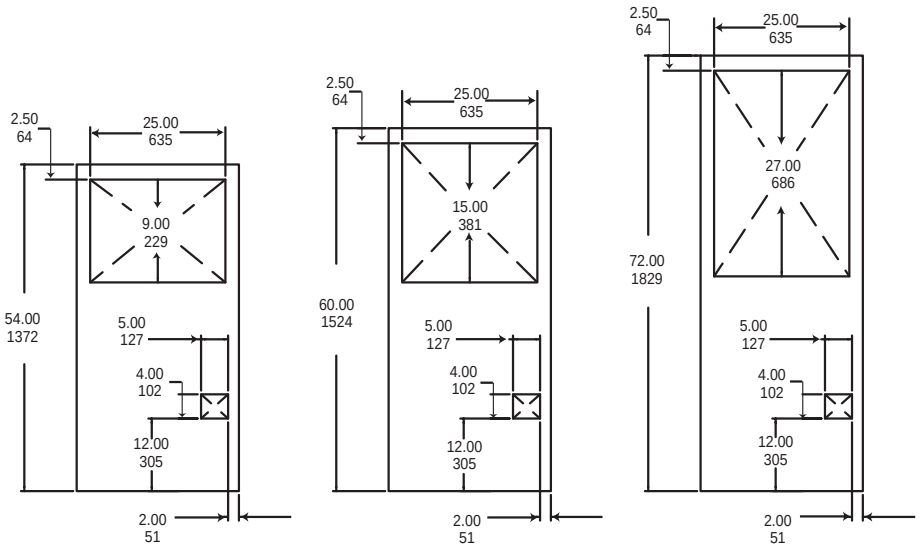
NOTE: Top conduit entrance area is reduced when close-coupled with a transformer.

Figure 58 - Bottom Conduit Entrance–Main, Tie, and Feeder Sections (22-inch wide)



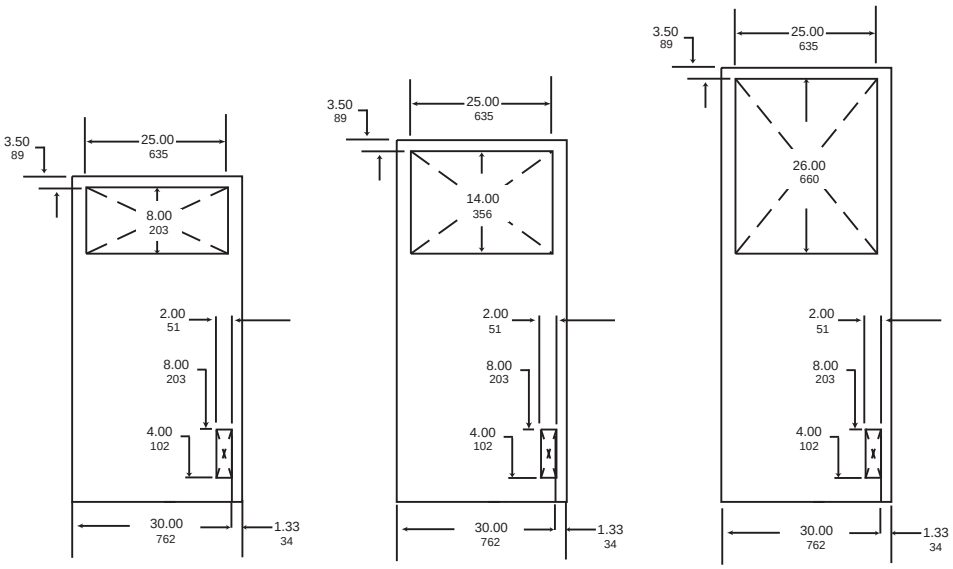
Dimensions: in. mm

Figure 59 - Top Conduit Entrance–Main, Tie, and Feeder Sections (30-inch wide)



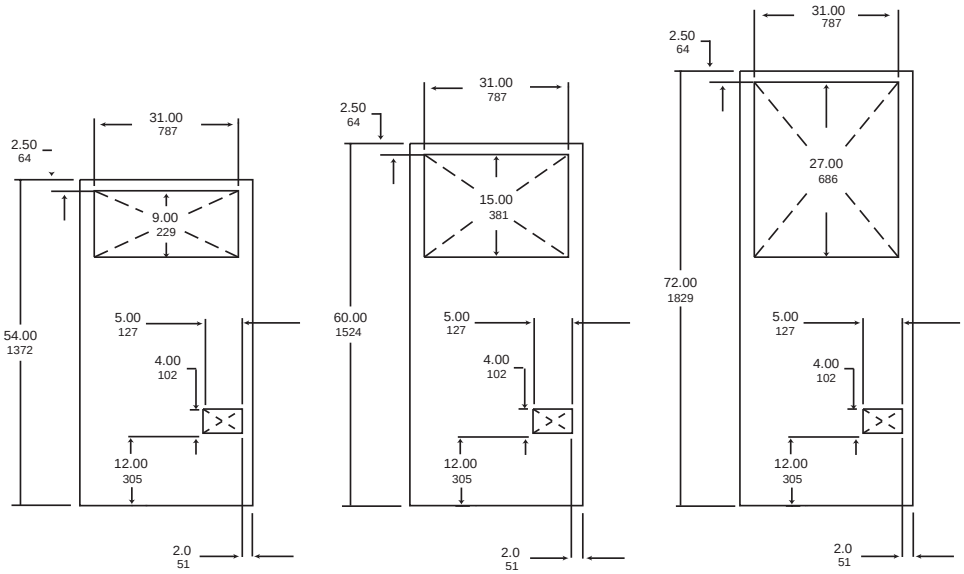
NOTE: Top conduit entrance area is reduced when close-coupled with a transformer.

Figure 60 - Bottom Conduit Entrance–Main, Tie, and Feeder Sections (30-inch wide)



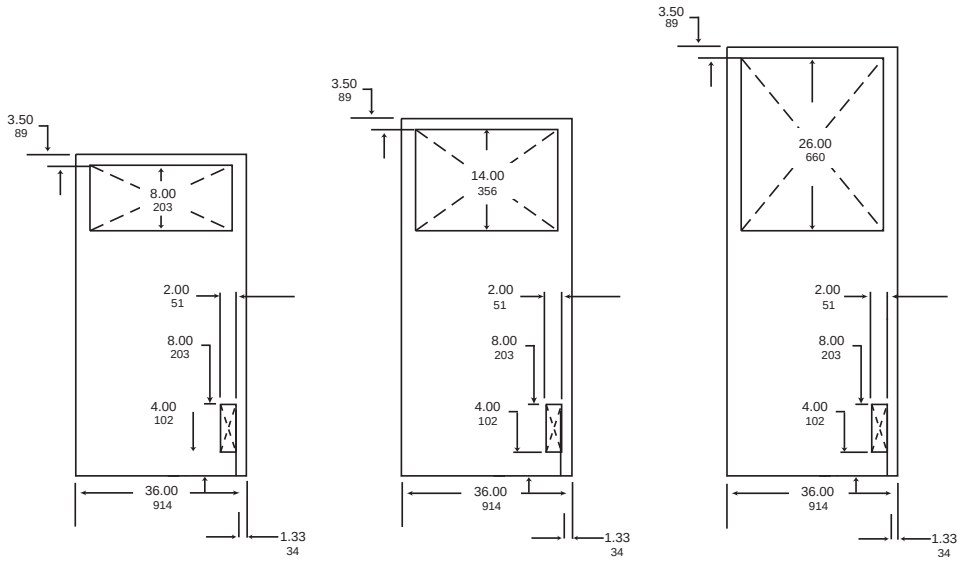
Dimensions: in. mm

Figure 61 - Top Conduit Entrance–Main, Tie, and Feeder Sections (36-inch wide)



NOTE: Top conduit entrance area is reduced when close-coupled with a transformer.

Figure 62 - Bottom Conduit Entrance–Main, Tie, and Feeder Sections (36-inch wide)



Front Elevation Dimensions–Not for Construction (consult factory drawings)

Dimensions: in. mm

Figure 63 - Typical Auxiliary Section (22-inch wide)

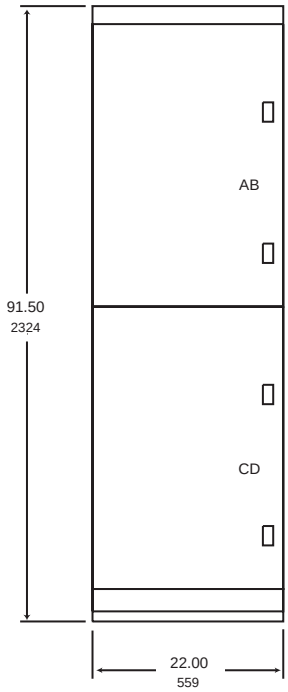


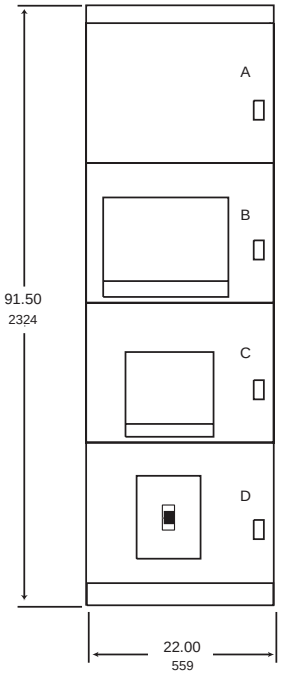
Table 12 - Typical Auxiliary Section (22, 30, and 36–inch wide)

Location	Description
AB	Blank or instrument
CD	Blank or instrument

Table 13 - Typical Mains Circuit Breakers (22–inch wide)

Location	Description	Frame Size	Frame SCCR
A	Blank or instrument	—	—
B	Main	800–2000 A	NW-N, H, L, LF
C, D	Feeder	800–1200 A	NT-N, H, L1, L, LF
C, D	Feeder	600 A	D-N, H, L
C, D	Feeder	800–2000 A	NW-N, H, L, LF

Figure 64 - Typical Mains Circuit Breakers (22-inch wide)



Dimensions: in. mm

Figure 65 - Typical Mains Circuit Breakers (22-inch wide)

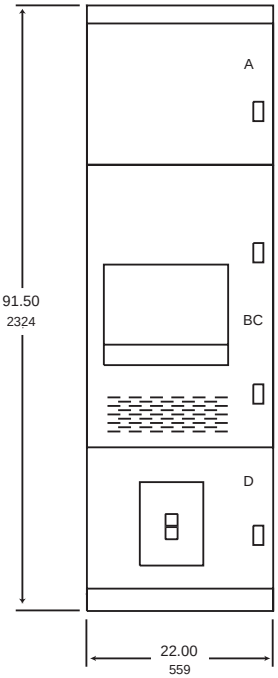


Table 14 - Typical Mains Circuit Breakers (22–inch wide)

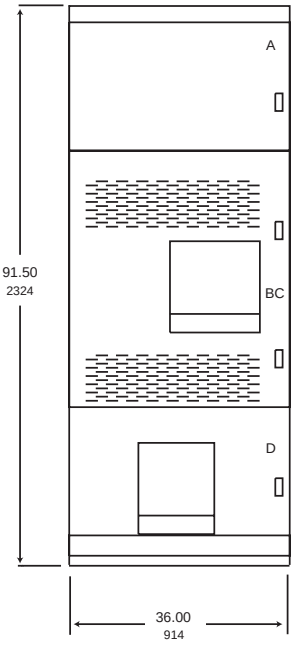
Location	Description	Frame Size	Frame SCCR
A	Blank or instrument	—	—
BC	Main	2500–3000 A	H, L
D	Feeder	800–2000 A	NW-N, H, L, LF
		800–1200 A	NT-N, H, L1, L, LF
		600 A	D-N, H, L

NOTE: Any main, tie, or feeder compartment positions may be used as a blank, or instrument compartment. Not convertible for future circuit breaker use. Height including secondary wiring trough compartment is 93.7 inches (2380 mm).

Table 15 - Typical Mains Circuit Breakers (36-inch wide)

Location	Description	Frame Size	Frame SCCR
A	Blank or instrument	—	—
BC	Mains	4000–5000 A	H, L
D	Feeder	800–2000 A	NW- N, H, L, LF
		(2) 800–1200 A	NT- N, H, L1, L, LF

Figure 66 - Typical Mains Circuit Breakers (36–inch wide)



Dimensions: **in.**
mm

Figure 67 - Typical Feeder Circuit Breakers (22-inch wide)

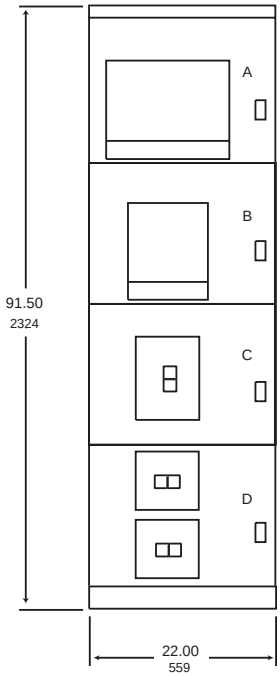
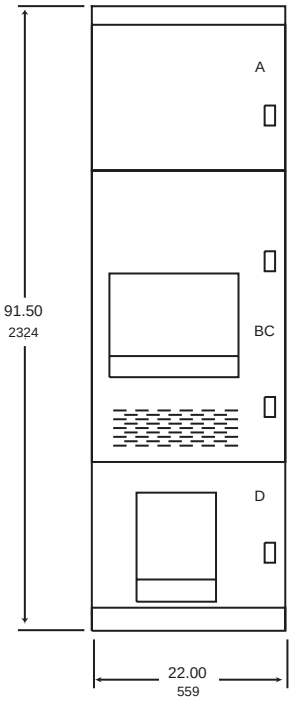


Figure 68 - Typical Feeder Circuit Breakers (22-inch wide)



Dimensions: **in.** **mm**

Table 16 - Typical Feeder Circuit Breakers (22-inch wide)

Location	Description	Frame Size	Frame SCCR
A, B, C, D	Feeder	800–2000 A	NW- N, H, L, LF
A, B, C, D	Feeder	800–1200 A	NT- N, H, L1, L, LF
A, B, C, D	Feeder	400–600 A	D- N, H, L
B, C, D	Feeder	(2) 150–250 A	H or J-G, J, L

NOTE: Any main, tie, or feeder compartment positions may be used as a blank, or instrument compartment. Not convertible for future circuit breaker use. Height including secondary wiring trough compartment is 93.7 inches (2380 mm).

Table 17 - Typical Feeder Circuit Breakers (22-inch wide)

Location	Description	Frame Size	Frame SCCR
AB	Feeder	2500 A	NW- H, L
BC	Feeder		
CD	Feeder		
BC	Feeder	3000 A	NW- H, L
CD	Feeder		
D	Feeder	800–2000 A	NW- N, H, L, LF
		800–1200 A	NT- N, H, L1, L, LF
		400–600 A	D- N, H, L
		(2) 150–250 A	H or J-G, J, L

Figure 69 - Typical Feeder Circuit Breakers (30–inch wide)

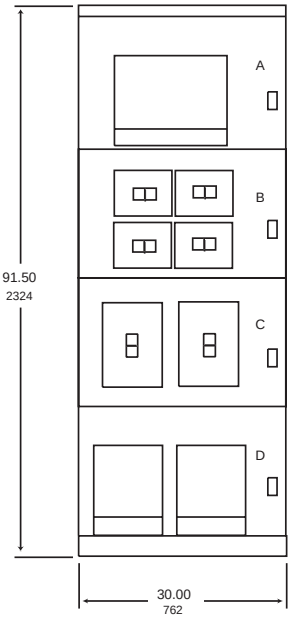
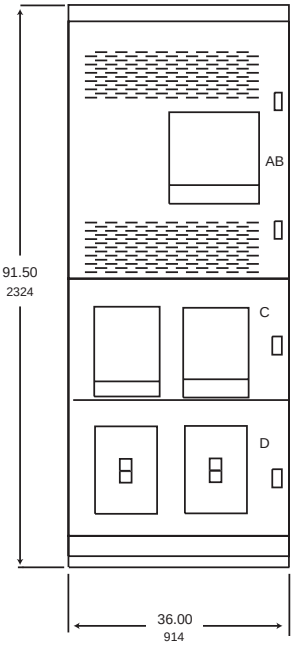


Figure 70 - Typical Feeder Circuit Breakers (36-inch wide)



Dimensions: in. mm

Table 18 - Typical Feeder Circuit Breakers (30-inch wide)

Location	Description	Frame Size	Frame SCCR
A, B, C, D	Feeder	800–2000 A	NW- N, H, L, LF
B, C, D	Feeder	(4) 150–250 A	H or J-G, J, L
A, B, C, D	Feeder	(2) 400–600 A	D- N, H, L
A, B, C, D	Feeder	800–1200 A	NT- N, H, L1, L, LF

NOTE: Any main, tie, or feeder compartment positions may be used as a blank, or instrument compartment. Not convertible for future circuit breaker use. Height including secondary wiring trough compartment is 93.7 inches (2380 mm).

Table 19 - Typical Feeder Circuit Breakers (36-inch wide)

Location	Description	Frame Size	Frame SCCR
AB, BC, CD	Feeder	2500–4000 A	NW- H, L
A, B, C, D	Feeder	(2) 800–1200 A	NT- N, H, L1, L, LF
A, B, C, D	Feeder	(2) 400–600 A	D- N, H, L

NOTE: Any main, tie, or feeder compartment positions may be used as a blank, or instrument compartment. Not convertible for future circuit breaker use. Height including secondary wiring trough compartment is 93.7 inches (2380 mm).

Figure 71 - NEMA 3R Walk-in Low Voltage Switchboard/Switchgear Top Conduit Entrance Dimensions–Not for Construction (consult factory drawings)

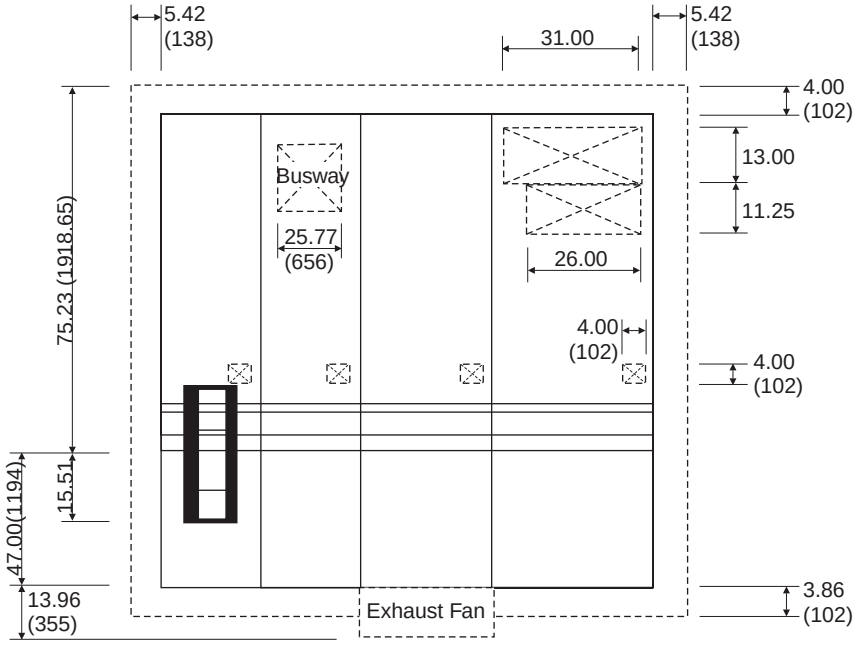
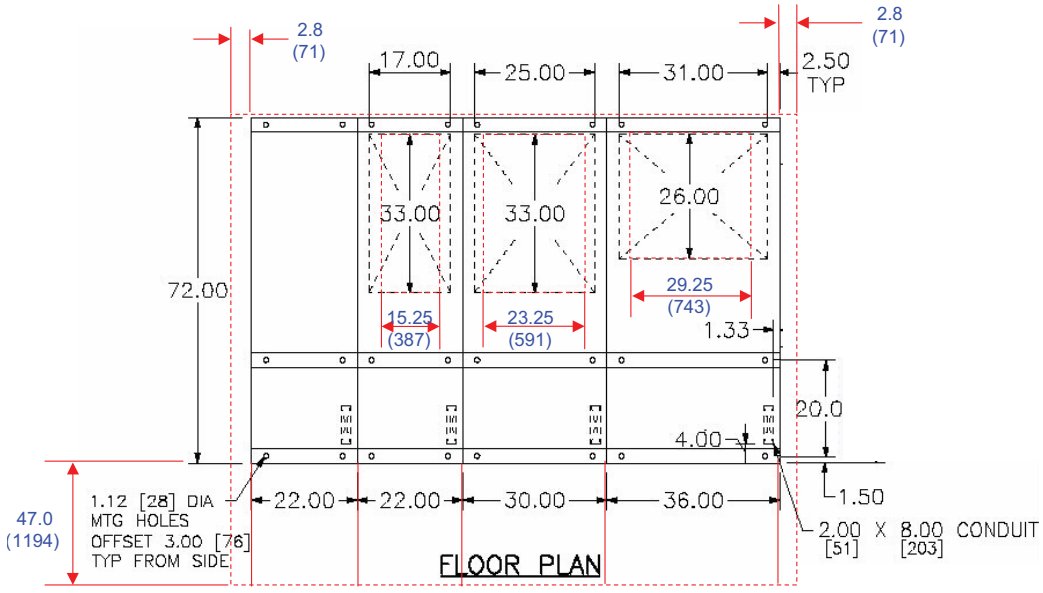


Figure 72 - NEMA 3R Walk-in Low Voltage Switchboard/Switchgear Bottom Conduit Entrance Dimensions–Not for Construction (consult factory drawings)



NOTE: Dimensions–Not for Construction (consult factory drawings).

Dimensions: in. mm

Figure 73 - Front View, NEMA 3R Walk-in Low Voltage Switchboard/Switchgear

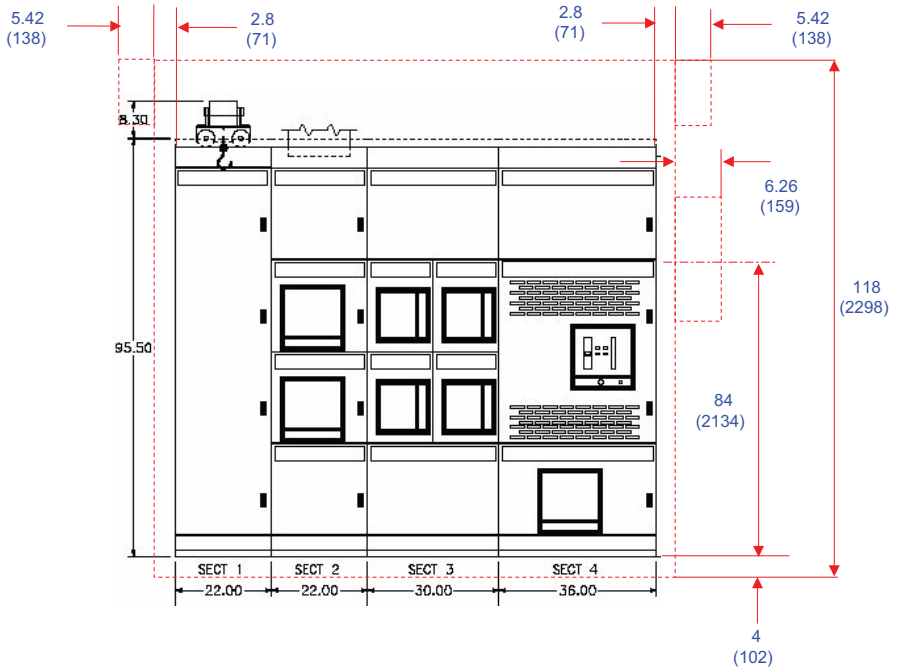
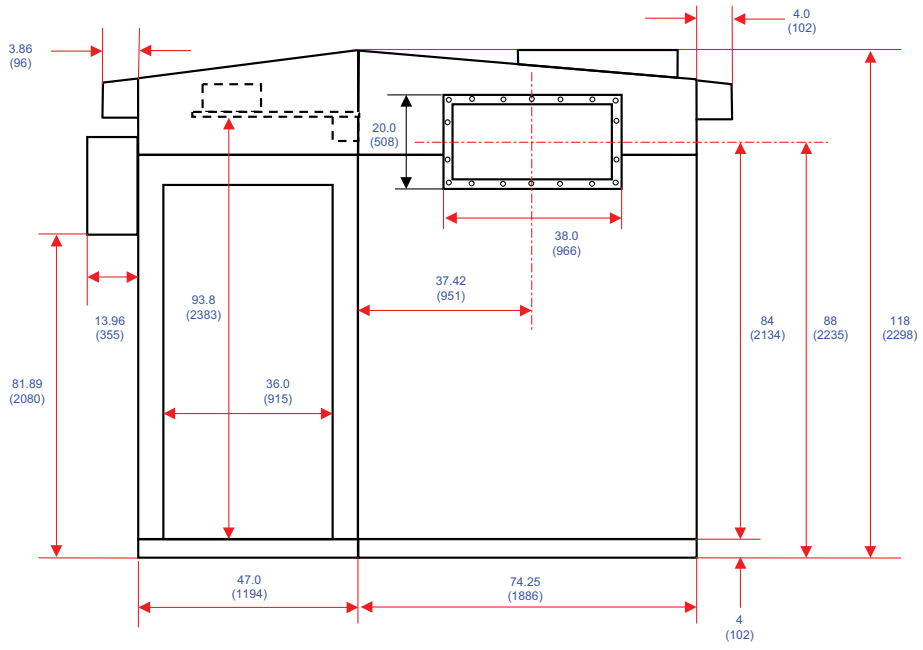


Figure 74 - Right Side View, NEMA 3R Walk-in Low Voltage Switchboard/ Switchgear



Dimensions: in. mm

Weights

Refer to the shipping documents for the actual weights and dimensions. The weights given here are approximate values.

Table 20 - Switchboard 4 High without Circuit Breakers

Bus Rating	22 Wide		30 Wide		36 Wide	
	lbs	Kg	lbs	Kg	lbs	Kg
1600–2000 A	1200	545	1250	568	1300	591
3000 A	1400	636	1350	659	1500	682
4000–5000 A	1700	773	‘750	796	1800	818

Table 21 - MasterPacT NW Circuit Breaker Weights

Amperes	Lbs.	Kg.
800	110	50
1600	110	50
2000	110	50
3000	110	50
2000	110	50
3000	110	50
4000(5)	230	105
5000(5)	230	105

Table 22 - MasterPacT NT Circuit Breaker Weights

Amperes	Lbs.	Kg.
800	40	18
1200	40	18

(5) 3-Pole (double-wide).

Suggested Specifications

General

This specification and associated drawings describe Power-Style QED-6 rear-connected switchboard assemblies listed to UL 891.

Standards

QED-6 switchboards equipment shall be designed, tested, and manufactured according to the following standards.

Standard	Description
UL 891	Dead-front switchboards
NEMA PB-2	Dead-front distribution switchboards

Main and feeder circuit breakers used in QED-6 switchboards shall be designed, tested, and manufactured to the following standards.

Ratings

The ampacity of the low voltage switchboards shall be determined by the loading of the feeder circuits. Select the ampacity rating from the following table.

Table 23 - System Ampacity

1200 A	3000 A
1600 A	4000 A
2000 A	5000 A
2500 A	—

The short-circuit current rating of the lineup shall be as specified on the drawings. All circuit interruption shall be accomplished by the circuit breaker and without the aid of limiter fuses. The circuit breaker short-time rating shall be as specified on the drawings.

Select the maximum ratings from the following table.

Table 24 - PowerPacT D, H and J Circuit Breakers

Service Voltage			Frame Size
240 V	480 V	600 V	
65 kAIR	35 kAIR	18 kAIR	150–600 A
100 kAIR	65 kAIR	25 kAIR	150–600 A
125 kAIR	100 kAIR	50 kAIR	150–250 A (H, J)
150 kAIR	100 kAIR	25 kAIR	400–600 A (D only)

600/347 Wye rating.

Table 25 - MasterPacT NW Circuit Breakers

Service Voltage			Frame Size
240 V	480 V	600 V	
65 kAIR	65 kAIR	50 kAIR	800–2000 A
65 kAIR	65 kAIR	50 kAIR	2500–5000 A
100 kAIR	100 kAIR	85 kAIR	800–3000 A
100 kAIR	100 kAIR	85 kAIR	4000–5000 A
200 kAIR	150 kAIR	100 kAIR	800–1600 A
200 kAIR	150 kAIR	100 kAIR	2000–3000 A
200 kAIR	150 kAIR	100 kAIR	4000–5000 A

Table 26 - MasterPacT NT Circuit Breakers

Service Voltage			Frame Size
240 V	480 V	600 V	
50 kAIR	50 kAIR	35 kAIR	800–1200 A
65 kAIR	50 kAIR	50 kAIR	800–1200 A
100 kAIR	65 kAIR	N/A	800–1200 A
200 kAIR	100 kAIR	N/A	800–1200 A

The assembly is designed for use on 50 Hz or 60 Hz electrical systems up to 600 Vac. Any items not specifically mentioned, but necessary for proper operation are implied in this specification.

Products

Manufacturers

Low voltage rear-connected switchboards shall be Power-Style QED-6 switchboards using MasterPacT NW, MasterPacT NT, PowerPacT D, H, and J circuit breakers by Square D.

Structure

General

1. Each steel section shall contain a circuit breaker compartment with one or more individual drawout circuit breaker(s), (and/or instrumentation compartments), plus a separate bus compartment and a rear compartment for incoming/outgoing cable connections.
2. A rigid, removable steel base channel shall be bolted to the frame to support the entire shipping section for moving on rollers and floor mounting.
3. The finish shall be medium ANSI 49 gray.

Dimensions

1. Section widths shall be 22-inches, 30-inches, or 36-inches wide, depending on the size of the circuit breakers being installed.
2. The lineup shall provide adequate wire bending space for mains and feeder circuit breakers using up to 750 kcmil wires.
3. Section depth shall be 60-inches minimum when using 800 A feeders. If additional wire bending and/or conduit space is required, specify 72-inch or 80-inch deep sections.

4. Adequate conduit space shall be provided to allow all conductors to exit the structure at the same end.

Moving and Handling

1. The lineup shall be divided into shipping splits not to exceed 88-inches wide and shall be capable of being lifted overhead or by using a forklift.
2. Each shipping split shall be provided with removable lifting straps.
3. Removable base channels shall be provided with prying slots to facilitate final positioning of the lineup at the job site.
4. An overhead lifter or a floor-mounted lifter shall be provided to assist with the installation or removal of circuit breakers.

Circuit Breaker Compartment

Circuit Breakers

1. Each circuit breaker shall be mounted in its own barriered compartment.
2. Feeder circuit breakers rated 2000 A or less shall be capable of being mounted in the uppermost compartment without de-rating.
3. The front of the circuit breaker shall protrude through the door of the switchboard allowing access to the operational buttons, and/or the toggle mechanism.
4. All mains shall be two-step stored energy circuit breakers and shall allow for closed-door racking.
5. All circuit breakers shall be drawout or plug-in style construction.
6. Circuit breakers of like frame sizes shall be interchangeable as standard.
7. All prepared spaces shall be fully equipped for future devices, including the racking, drawout, or plug-in mechanism, bussing, and secondary contacts.

Secondary Connections

1. All customer secondary control and communications connections shall be front accessible.
2. A dedicated wiring trough compartment shall be accessible from the front to permit easy access to all control or communications terminations.
3. Control connections shall be either cage clamp or optional ring tongue terminals. All control wire shall be #14 gauge SIS.
4. Dedicated conduit entry for control wires shall be provided at the top and bottom of each section, capable of landing up to three 1 1/2- inch conduits and shall be front accessible.

Instrumentation

1. Where additional space is required for instrumentation, such as CPTs and metering, a barriered instrumentation compartment shall be provided.
2. The instrumentation compartment shall not inhibit the routing of control or communication wires.

Bus Compartment

1. All vertical and horizontal distribution bus shall be rated for the full ampacity of the lineup, up to a maximum of 5000 A. Tapered bus is not acceptable.
2. All bus joints shall consist of Grade 5 hardware and conical washers to withstand mechanical forces exerted during short circuits.
3. Plating shall be applied continuously to all bus work.
4. All bus bars shall be silver-plated copper.
5. All runbacks from the circuit breaker compartment to the cable compartment shall be insulated.

Cable Compartment

1. All incoming or outgoing power conductors shall be routed through this area.
2. Branch circuit breakers shall have adequate wire bending space, regardless of the circuit breaker interrupting rating.
3. The conduit area for each section shall be a minimum of 17-inches wide and provide adequate depth for all section conduits.

Barriers

1. Barriers shall be provided between the circuit breaker compartment and distribution bus compartment.
2. Barriers shall be provided between the circuit breaker compartment and the adjacent section.
3. Each circuit breaker shall be mounted individually in a barriered compartment. Full steel barriers shall be located at the top, bottom, and sides of the circuit breaker compartment.

Circuit Breakers and Trip Units

Circuit Breakers

1. Circuit breakers shall be MasterPacT NW, MasterPacT NT, PowerPacT D, H and J circuit breakers by Square D listed to UL 489.
2. Circuit breakers shall be suitable for the specified short-circuit current rating without the use of external current-limiting fuses.
3. All circuit breakers or like frame size shall have field interchangeable electrical accessories, including shunt trip, auxiliary contacts, electrical operating mechanism, shunt close, and trip unit.
4. All secondary connections shall be terminated at the front of the circuit breaker cradle.
5. Each circuit breaker shall have built-in contact wear indicators.

Trip Units

1. All trip units shall be removable to allow for field upgrades.
2. Trip units shall incorporate “True RMS Sensing,” and have LED long-time pickup indications.
3. All trip units shall have the option to turn instantaneous to the OFF position.

The following table lists the standard and optional trip unit features. Select the appropriate trip unit(s) for the system performance desired.

Table 27 - MicroLogic Trip Unit Functionality

Functions	Basic	Type A	Type P	Type H
True RMS sensing	X	X	X	X
LI trip configuration	X	X	–	–
LSI	O	O	X	X
LSIG/equipment ground fault trip	–	O	O	O
Equipment ground fault alarm (no trip)	–	–	X	X
Equipment ground fault trip and programming alarm	–	–	O	O
Adjustable rating plugs	X	X	X	X
LED – long–time pickup	X	X	X	X
LED – trip indication	–	X	X	X
Digital ammeter	–	X	X	X
Phase loading bar graph	–	X	X	X
Zone selective interlocking	–	X	X	X
Communications	–	O	O	O
LCD dot matrix display	–	–	X	X
Advanced user interface	–	–	X	X
Protective relay functions	–	–	X	X
Thermal imaging	X	X	X	X
Contact wear indication	–	–	X	X
Temperature indication	–	–	X	X
Incremental fine tuning of settings	–	–	X	X
Selective long-time delay bands	–	–	X	X
Power measurement	–	–	X	X
Waveform capture	–	–	–	X
Data logging	–	–	X	X

– Not Applicable
X Standard Feature
O Optional Feature

Metering and Instrumentation

Main Metering

1. An optional PowerLogic PM 800, CM 3000 or CM 4000 Power Monitoring System by Square D shall be provided on the main circuit breaker when specified on the drawing.
2. CTs shall be sized appropriately for use on the main.
3. An optional low voltage Human Machine Interface and display shall be mounted on the same door as the main circuit breaker when specified on the drawing.
4. Optional input/output (I/O) and Ethernet communications card shall be provided when specified on the drawing.

Communications

1. Internal communications within the switchboard shall be Modbus.
2. Where specified, Transparent Ready equipment with an Ethernet gateway shall be located in the switchboard and accept inputs from the MicroLogic trip unit(s), PowerLogic PM 8, CM-3 or CM-4 circuit monitor(s), and Modicon PLCs.

Schneider Electric
800 Federal Street
Andover, MA 01810
USA

888–778–2733

www.schneider-electric.com

As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

2746CT0101