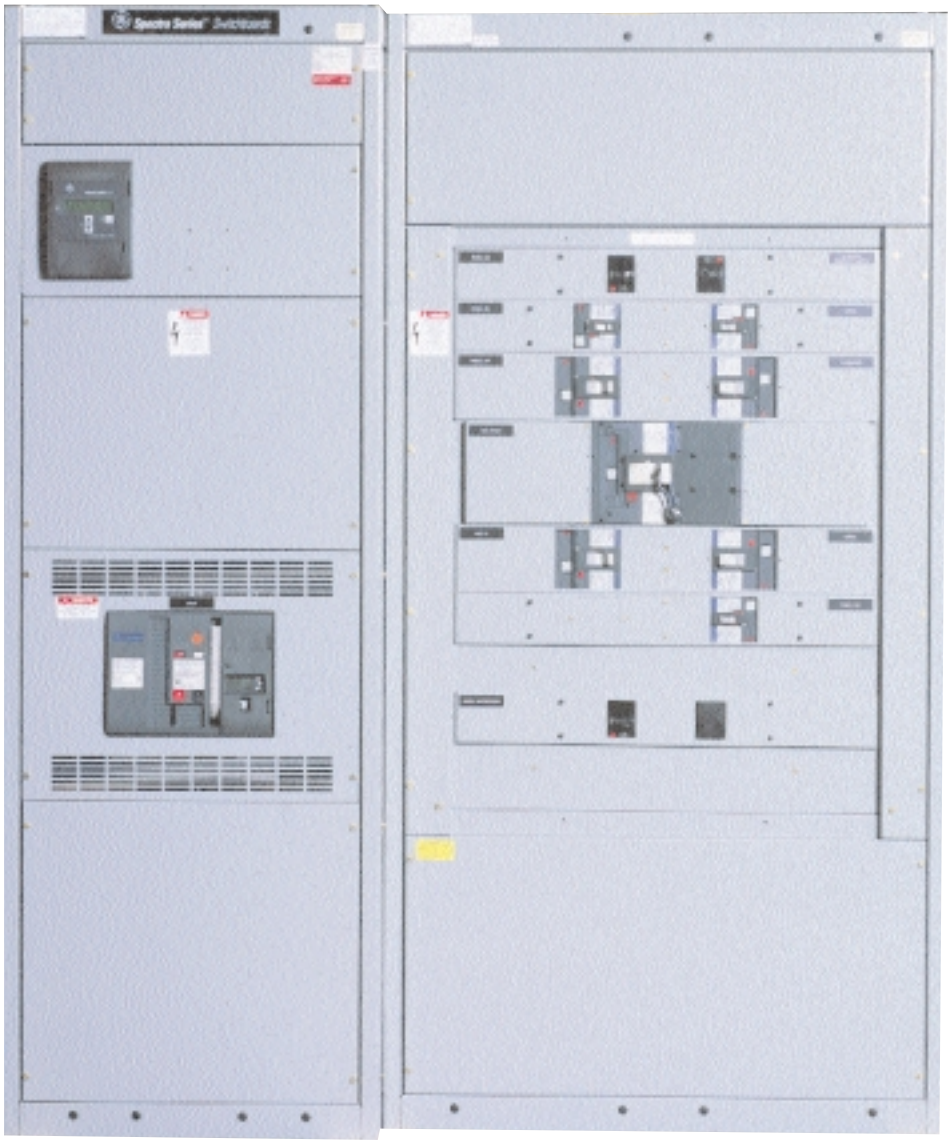
GE Industrial Systems



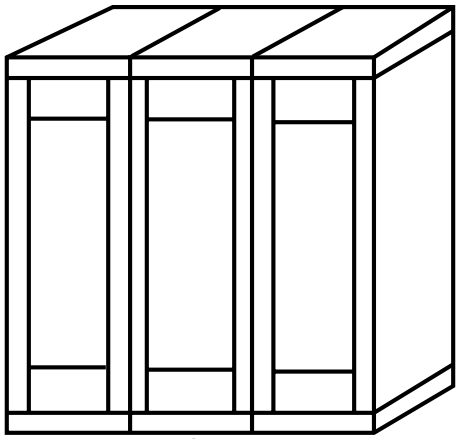
SPECTRA SERIES SWITCHBOARDS

Introduction

Spectra Series™ Switchboards offer a state-of the-art design that provides the high quality, safety and reliability long associated with GE group-mounted switchboards. Spectra Series Switchboards are designed and manufactured to meet the stringent GE internal standards along with NEMA, NEC, UL and CSA requirements. In addition, Spectra RMS™ Circuit Breakers meet all NEMA, NEC, UL and CSA requirements, plus those for JIS and IEC.

Contents

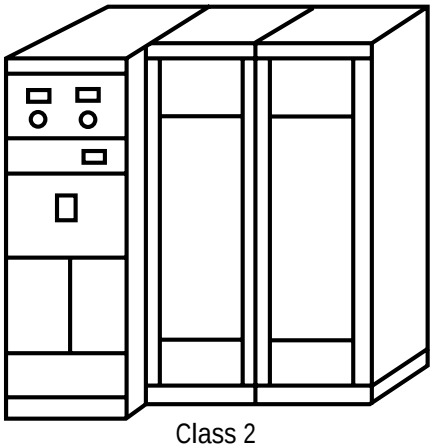
Spectra Series™ Switchboards



Class 1

- **Group-Mounted Main and Feeders Front-Accessible**
  1200A Mains maximum
  1200A Feeders maximum
  Rear alignment standard
  Minimum depth 25"
  Main lugs to 2000A
  May be mounted against wall

- **Main and Feeder Devices Group-Mounted**
  Molded case circuit breakers
  Fusible switches type ADS (Spectra plug-in only)
  Spectra RMS™① Molded case circuit breakers
  Spectra RMS① Molded case circuit breakers with MicroVersaTrip Plus™ or MicroVersaTrip PM™ trip units
  Current-limiting circuit breakers
  Integral ground fault with MicroVersaTrip Plus and PM, and Power+™
  Integral protective relay functions with MicroVersaTrip PM
  Integral POWER LEADER™ network communications with MicroVersaTrip PM



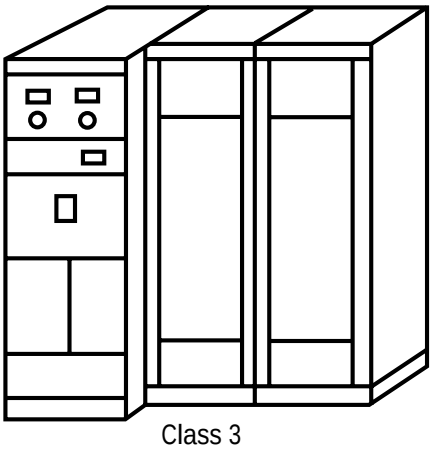
Class 2

- **Individually-Mounted Main, Group-Mounted Feeders Front Accessible or Front/Rear**
  4000A Mains maximum
  1200A feeders maximum
  Rear alignment standard
  Utility CT Compartments
  Main lugs to 6000A
  Depths: Mains 25" - 60" Feeders 25" minimum
  Plug-In™ or Bolt-On™ Construction for feeders

- **Mains Individually-Mounted**
  Power Break I® & Power Break II® Insulated case circuit breakers 800-4000A with Power+, MicroVersaTrip Plus or MicroVersaTrip PM trip units
  High pressure contact switches 800-4000A
  Integral ground fault with High Pressure Contact Switch, Spectra Series and Power Break Series
  Integral protective relay functions with MicroVersaTrip PM
  Integral POWER LEADER network communications with MicroVersaTrip PM
  Bolted Pressure Switches 800 - 4000A

- **Feeder Devices, Group-Mounted**
  Molded case circuit breakers
  Fusible switches type ADS (Plug-In only)
  Spectra RMS™① Molded case circuit breakers
  Spectra RMS① Molded case circuit breakers with MicroVersaTrip Plus or MicroVersaTrip PM trip units
  Current-limiting circuit breakers
  Integral ground fault with MicroVersaTrip Plus or MicroVersaTrip PM
  Integral protective relay functions with MicroVersaTrip PM
  Integral POWER LEADER network communications with MicroVersaTrip PM

AV3 Access Switchboards



Class 3

Class 3 Access Switchboards

• Features and Options

Rear accessible
Front and rear alignment
Depths 50-60 inches
Molded case / insulated case / low voltage power circuit breaker mains
Molded case distribution sections
Copper bus
Feeder operating handles “thru the door”

• Main and Tie Devices - Individually Mounted

Spectra molded case breaker up to 1200A
PowerBreak II insulated case breaker up to 4000A
WavePro / AKR low voltage power circuit breaker up to 5000A

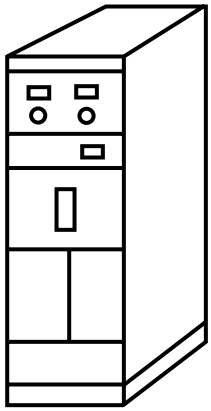
• Feeder Devices, Individually Mounted

Spectra molded case circuit breaker - E (150A), F (250A), G (600A), K (1200A) frame breakers, 80 & 100% rated
Current limiting breakers
Fuseless THLC 225 & 400A
Fused Tri-Break 400 / 600 / 800A

• General Construction Features

Tin plated copper main bus - standard, silver plating optional
2000A silver plated copper vertical (riser) bus - standard in MCCB sections
Shutters available on ICCB and LVPCB main and tie breakers
6000A main bus rating - maximum
Plug-in MCCB mounting with racking bolts - standard
Standard 30 cycle bus short circuit withstand rating up to 85ka allows LVPCB main w / o instantaneous trips
200ka bus bracing available with fused main device
Bare bus standard
Optional insulated horizontal main bus with phase isolated vertical bus available in all sections
Bus sizing based on 1000A IN^2 current density
15 / 30 / 45 inch wide MCCB sections

Spectra Series™ Switchboards



Class 5

- **Individually-Mounted Mains and Feeders**

8000A - 4000A
HPC Switch
PowerBreak
400A - 1200A
QMR Switch
Spectra Breaker
5000A Boltco Pressure Switch
AKR Breaker (Mains & Tie Devices only)
800A - 5000A AKR Breaker

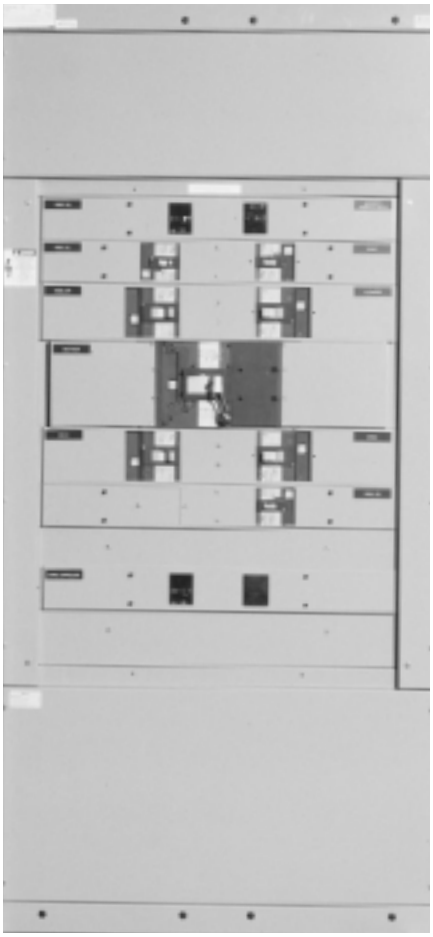
Note: For applications requiring insulated/isolated bus, generator control and extensive relaying refer to AV-3 or PowerBreak (EPC section 4).

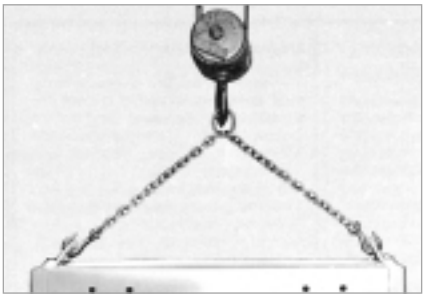
Flexibility, Reliability, Simplicity & Safety

GE has designed a bus bar interior for use in Spectra Series™ (group-mounted) Switchboards and Spectra Series Power Panelboards.

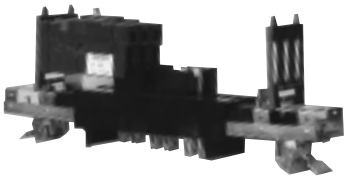
The distribution section interior is the basic building block, designed for use with either fusible switches (plug-in only) or molded case circuit breakers, or both.

The modularity of Spectra Plug-in is possible because the interior is designed to accept device modules with spring-reinforced jaws and pressure-locked connections. The jaws and connections are an integral part of the branch modules.





Standard lifting plates, shown, are normally furnished. Alternate lifting beams may be furnished depending on switchboard size and device loading.



Spectra Series Plug-In™ circuit breaker modules accept standard off-the-shelf GE breakers and are available far single- or double-branch mounting (through 600A) without any modifications, assuring proper phase arrangement.

Spectra Series Plug-In branch fusible modules can be single- or double- (through 200A) mounted, two- or three-pole.

Snap-on filler plates provide a durable attachment with no loose hardware.

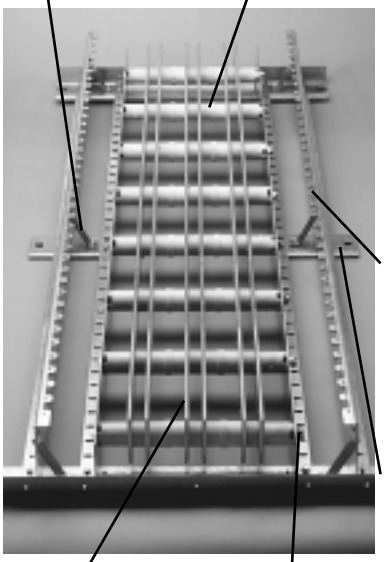
Spectra Switchboard - Group - Mounted Interior Design

The vertical design of the bus maximizes convective heat transfer. The bus bar insulator system provides short circuit bracing to 200 kA, Plug-In and 100kA Bolt-on 600-volt spacing (without having to add baffles) and eliminates the need for any additional insulation.

Spectra Plug-In™

Mounting support brackets between bus support rails and mounting rails.

Double-insulated system consisting of bus support assemblies of molded, glass-filled polyester insulation and insulating tubes over high-strength steel bolts spaced on 7" centers that prevent bus bars from distorting during short-circuit conditions.



Mounting rails (2) with means for positioning, engaging and grounding pressure-locked connections. (plug-in only)

Interior cross-member supports for mounting rails and bus support rails.

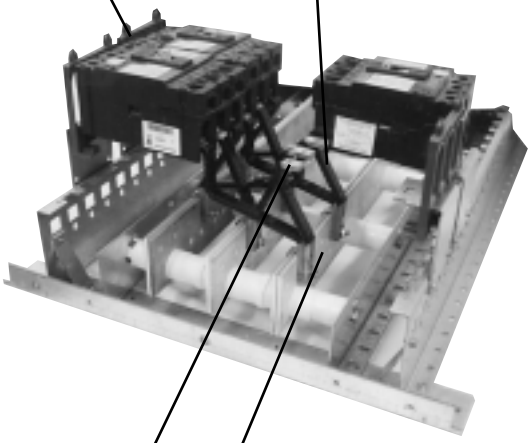
Isolated bus support rails (2).

Standard bus is aluminum, heat rated per UL. Optional ratings include 750A psi or 600A psi aluminum and heat rated per UL, 1000A psi or 800A psi copper. All vertical bus bars are silver plated.

Spectra Bolt-On™

Bolted connection between switchboard vertical bus and breaker primary connection.

Vertical bus oriented edgewise for ease of bolted breaker strap connections.



Vertical bus is pre-drilled for location of breakers in any standard position.

Anti-turn device utilized at the bolted connection between the breaker strap and vertical bus.

Field Changes Are Quick and Easy

Spectra Plug-In™ Switchboard Construction

The universal interior has made possible a family of modular components that provide the flexibility unique to the Spectra Series™ product line. By utilizing modular assembly and pressure-locked connections to the interior, maintenance and tests are easier and faster.

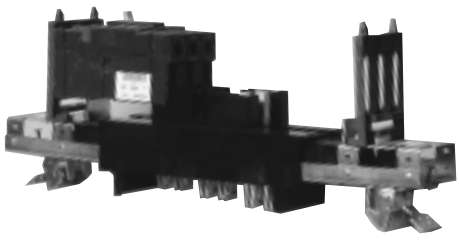
This innovative design approach also facilitates field reconfiguration. Branch fusible units can be removed and circuit breaker units substituted.

Fusible switch and circuit breaker modules each consist of two assemblies: the protective device (fusible switch unit or molded case circuit breaker) and a connecting mechanism. The connecting mechanisms are the intermediate electrical/mechanical connections between the protective device and the bus structure in the interior. The fusible connecting mechanism is in the same housing as the fusible switch unit. The molded case circuit breaker connecting mechanism is separate from the breakers and is designed to accept standard GE circuit breakers.

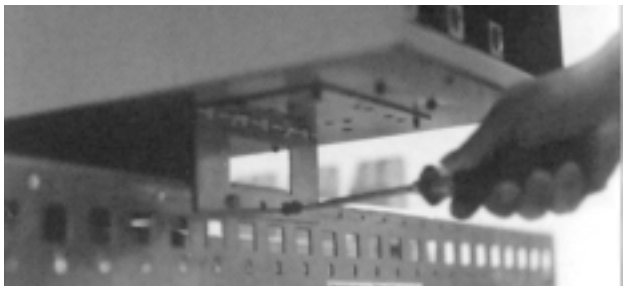
The electrical connection is made utilizing spring-reinforced jaws that engage the bus bars. This type of proven design, long utilized in switchgear and busway, provides a reliable and superior electrical connection.

Mechanical connection is made with a positive, self-aligning, spring-loaded locking device bolted to each side of the mounting module. When the device module is inserted in the interior, this mechanism springs into place and positive engaging latches secure the module to the interior mounting rails.

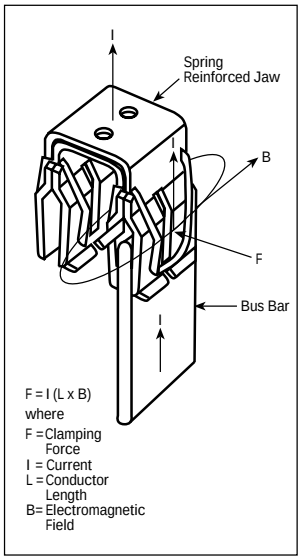
To prevent personnel from accidentally releasing the locked pressure connections, circuit breaker modules handles are bolted to each side of the module. Fusible modules are bolted directly to the interior mounting rails.



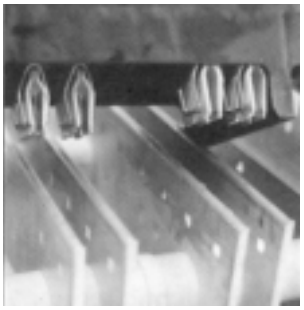
The circuit breaker mounting module has provisions for bolting various breaker ratings in place and barriers to divert ionized gases away from line terminals of opposite devices on the same module. Both types of connector-mounting modules are UL listed and CSA certified.



The fusible switch module has a self-aligning bracket screwed to the interior mounting rails.



The spring-reinforced jaw clamps onto the interior bus and maintains the electrical connection. At short circuit, a strong electro-magnetic field develops around the jaw. The resulting force increases the jaw pressure on the bus and maintains a secure connection. The design creates current paths and generates clamping forces as shown in the illustration.

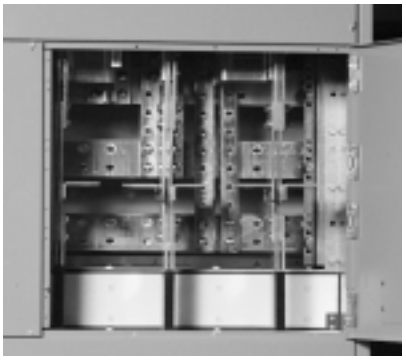


Features

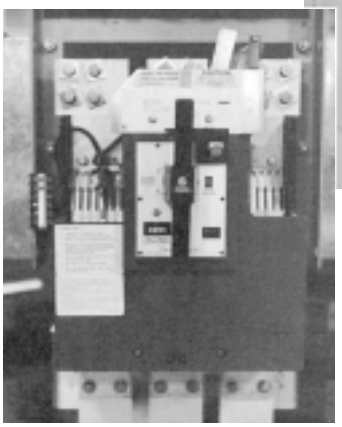
The main and utility CT compartments are designed to offer maximum flexibility. Individually-mounted main is available with Power Break II® insulated case circuit breakers, 800A-4000A; high pressure contact switches, 800A-4000A; fusible switches, 400A-1200A; AKR low voltage power circuit breakers, 800A-5000A; molded case circuit breakers, including MicroVersaTrip®, 400A-1200A; and bolted pressure switches. (800 - 5000A)

PCU units are available, allowing for motor starter applications up to 15hp. (plug-in only)

Standard utility current transformer compartments have barriers rear, top and bottom. Door has concealed hinges, three-point catch, with lockable and sealable handle. Optional side barriers are available. Current transformer compartments to meet other utility requirements are available.



A hinged door is standard on instrument and metering compartments.



Type HPC high pressure contact switches are available with integral ground fault protection.

Power Breaker II circuit breakers with MicroVersaTrip Plus™, MicroVersaTrip PM™ and Power+™ trip units are available as mains, submains, and ties in switchboards.

Spectra Bolt-On™ Specifications

Front & Front/Rear Accessible Group-Mounted Switchboards

- The contractor shall furnish and install complete all switchboards as shown on the drawings and as described in these specifications.
- The switchboards shall be designed, built and tested in accordance with NEMA PB-2 and Underwriters Laboratories No. UL 891 and the latest requirements of the National Electrical Code. All sections and devices shall be UL listed and labeled.
- Class 1 Switchboard shall be GE Spectra with all devices -- mains and branches -- group-mounted in panelboard construction. Switchboard shall be front and capable of being installed against a wall. Maximum main device rating is 1200A.
- Class 2 Switchboard shall be GE Spectra with an individually-mounted main device section feeding a group-mounted distribution section(s). Switchboard shall be front or front/rear accessible. Maximum device rating is 4000A.
- Switchboard shall be a completely self supporting structure with 90" high vertical sections bolted together to form the required arrangement. All sections shall be rear aligned and may be rolled, moved or lifted into the installation position and bolted directly to the floor without the addition of floor sills. The structure frame shall be die formed 12 gauge steel with reinforcing corner gussets. Bolt-on enclosure covers shall be code gauge steel. All steel surfaces shall be chemically cleaned prior to painting; exterior paint color shall be ANSI 61 Light Gray.
- Bus bars shall be tin plated aluminum (standard) having a cross-section that meets UL heat rise requirements.① They shall be mounted on supports of high impact non-tracking insulating material, and shall be braced to withstand the mechanical forces exerted during short circuit conditions; 65,000 amperes RMS Symmetrical short circuit bracing is standard, and optional bracing up to 100,000 amperes RMS Symmetrical is available. A full length horizontal ground bus is secured to each vertical section.
- Panel vertical bus bars shall be tin plated aluminum or silver plated copper.
- A-B-C type bus arrangement (left-to-right, top-to-bottom, front-to-rear) shall be used throughout to assure convenient safe testing and maintenance. Where special circuitry precludes this arrangement, bus bars shall be labeled.
- All lugs shall be UL listed for use with copper or aluminum cable whose ampacity is based on 75°C conductor temperature ratings.
- Switchboard current ratings including devices shall be based on operation in a 25°C room ambient, per UL 891. For higher ambient, refer to section 6-1, for derating.
- Group-mounted branch devices must be capable of being installed or removed without loosening or removing bus bars. The switchboard symmetrical interior shall be designed and assembled so that the main and branch circuit breakers are connected to the interior bus bars with copper mounting straps. Anti-turn clips shall be used to prevent the straps from twisting during installation. If anti-turn clips are not used, at least two bolts shall be used to prevent twisting or turning of the straps during installation. The interior shall have insulation barriers installed over unused spaces for extra safety when field service is required.
- When switchboards are series rated to meet short circuit requirements, appropriate labels shall be included in the equipment. The tested UL listed combination ratings shall also be included in the UL recognized Component Directory DKSY2 (UL Yellow Book).
- Bellville washers on aluminum bus.
- Alstan plating process on aluminum bus.
- Copper & aluminum electrical joints shall be plated as required for compatibility.
- Ground bus is sized per UL 891 optional ground bus available, rated at 25% of incoming ampacity.
- 200% rated neutral bus available.
- Standard horizontal bus is tapered per UL 891. Full size horizontal bus with provisions for future connections is available.
- Internal control wiring is per UL 891.
- Switchboard shall be constructed for 120/208 3Ø, 4W WYE, 120/240 3Ø, 4W delta 277/480 3Ø, 4W WYE, and 480V 3Ø, 4W delta.
- NEMA 3R construction available.

① Optional bus bars shall be tin-plated aluminum, having a cross-section with a current density not exceeding 750 amperes per square inch or 600 amperes per square inch or silver plated copper heat rated, 1000 amperes per square inch, or 800 amperes per square inch.

Spectra Plug-In™ Specifications

Front & Front/Rear Accessible Group-Mounted Switchboards

- The contractor shall furnish and install complete all switchboards as shown on the drawings and as described in these specifications.
- The switchboards shall be designed, built and tested in accordance with NEMA PB-2 and Underwriters Laboratories No. UL 891 and the latest requirements of the National Electrical Code. All sections and devices shall be UL listed and labeled.
- Class 1 Switchboard shall be GE Spectra with all devices -- mains and branches -- group-mounted in panelboard construction. Switchboard shall be front accessible and capable of being installed against a wall. Maximum main device rating is 1200A.
- Class 2 Switchboard shall be GE Spectra with an individually-mounted main device section feeding a group-mounted distribution section(s). Switchboard shall be front or front/rear accessible. Maximum device rating is 4000A.
- Switchboard shall be a completely self supporting structure with 90" high vertical sections bolted together to form the required arrangement. All sections shall be rear aligned and may be rolled, moved or lifted into the installation position and bolted directly to the floor without the addition of floor sills. The structure frame shall be die formed 12 gauge steel with reinforcing corner gussets. Bolt-on enclosure covers shall be code gauge steel. All steel surfaces shall be chemically cleaned prior to painting; exterior paint color shall be ANSI 61 Light Gray.
- Bus bars shall be tin plated aluminum (standard) having a cross-section that meets UL heat rise requirements.① They shall be mounted on supports of high impact non-tracking insulating material, and shall be braced to withstand the mechanical forces exerted during short circuit conditions; 65,000 amperes RMS Symmetrical short circuit bracing is standard, and optional bracing up to 200,000 amperes RMS Symmetrical is available. A full length horizontal ground bus is secured to each vertical section.
- Panel vertical bus bars shall be silver plated. (aluminum or copper).
- A-B-C type bus arrangement (left-to-right, top-to-bottom, front-to-rear) shall be used throughout to assure convenient safe testing and maintenance. Where special circuitry precludes this arrangement, bus bars shall be labeled.
- All lugs shall be UL listed for use with copper or aluminum cable whose ampacity is based on 75°C conductor temperature ratings.
- Switchboard current ratings including devices shall be based on operation in a 25°C room ambient, per UL 891. For higher ambient, refer to section 6-1, for derating.
- Group-mounted branch devices must be capable of being installed or removed without loosening or removing bus bars. The devices shall utilize spring reinforced jaws for engaging the bus bars, except 800 and 1,200 amp fusible modules. The mechanical connection to the bus structure shall be separate from the electrical connection. Circuit breaker modules shall utilize positive, self-aligning, spring loaded locking devices with handles that can be bolted to each side of the device to prevent accidentally releasing the locked pressure connections. Fusible modules shall utilize positive, self-aligning mounting brackets that are bolted to each side of the device. The group-mounted switchboard interior must be UL listed to accept both circuit breaker and fusible switches which may be intermixed.
- When switchboards are series rated to meet short circuit requirements, appropriate labels shall be included in the equipment. The tested UL listed combination ratings shall also be included in the UL recognized Component Directory DKSY2 (UL Yellow Book).
- Bellville washers on aluminum bus.
- Alstan plating process on aluminum bus.
- Copper & aluminum electrical joints shall be plated as required for compatibility.
- Ground bus is sized per UL 891 optional ground bus available, rated at 25% of incoming ampacity.
- 200% rated neutral bus available.
- Standard horizontal bus is tapered per UL 891. Full size horizontal bus with provisions for future connections is available.
- Internal control wiring is per UL 891.
- Switchboard shall be constructed for 120/208 3ø, 4W WYE, 120/240 3ø, 4W delta 277/480 3ø, 4W WYE, and 480V 3ø, 4W delta.
- NEMA 3R construction available.

① Optional bus bars shall be tin-plated aluminum, having a cross-section with a current density not exceeding 750 amperes per square inch or 600 amperes per square inch or silver plated copper heat rated, 1000 amperes per square inch, or 800 amperes per square inch.

Spectra Series™ Terminology

Accessible means not permanently closed in by the switchboard section structure, and capable of being inspected and maintained through access plates or doors without disturbing the switchboard section structure.

Ambient Temperature is the temperature of the surrounding medium that comes in contact with a fuse, breaker or conducting bus within a switchboard defined by UL 891 as 25°C for switchboard.

Ampacity is the amount of current in amps a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

AMP rating is the amount of current a fuse will carry continuously without deterioration, or a circuit breaker without tripping and without exceeding temperature rise limits specified for a particular fuse or circuit breaker by NEC requirements and UL standards.

Amp Setting, Adjustable varies the continuous current-carrying ability of a breaker through a predetermined range.

Arcing Fault is a high-impedance connection, such as an arc through air or across insulation, between two conductors.

Arcing Time, in a fuse, is the amount of time that elapses between the melting of the current-responsive element, such as a link, to the final circuit interruption. Arcing time is dependent upon such factors as circuit voltage and impedance.

Available Short-Circuit Current is the maximum rms (root-mean-square) symmetrical current at a given point in a power system, operating with maximum generating capacity and connected load, can deliver to any zero impedance short circuit applied at that given point.

Blank Space Only is specified when corresponding vertical bus device mounting and connecting straps are not furnished.

Branch Circuit is the circuit conductor between the final overcurrent device protection and the outlets or point of use.

Bus Bar is a solid aluminum or copper alloy bar that carries current to the branch or feeder devices in a power panelboard or switchboard. There is at least one bus bar for each phase of the incoming electrical service.

Bus Stub is a prefabrication provision manufactured in the switchboard for connection of incoming service or load bus.

Class I--Group mounted main and feeders.

Class II-Individually mounted main and group mounted feeders.

Class III-Individually mounted main and feeders with compartmentalization (not available in Spectra Switchboard.)

Class V-Individually mounted mains and feeders without compartmentalization.

Compartment is an area within a section that is so constructed as to isolate devices in that compartment from the surrounding area except for openings used for interconnections, control or ventilation.

Compression Lug, also called a crimp lug, is a lug that is crimped to hold cable.

Continuous Load is when the maximum current is expected to continue for three hours or more.

Current Density is rated current divided by the cross-section area of the conducting member (cable, bus bar, etc.) expressed in amps per square inch.

Current Sensors monitor and measure load current. A ground fault current is an imbalance that causes a relay to signal the breaker to trip at a preset time and current level if ground fault function is present.

Dead Front construction is where energized parts are not exposed to a person on the operating side of the equipment.

Distribution Switchboard is any switchboard which is not UL listed for service entrance or classified as a main switchboard.

Double-Branch is mounting that has two fusible switch units or circuit breakers installed side by side.

Draw-Out Mounted device can be removed from the stationary portion of a switchboard without unbolting connections or mounting supports. Draw-out mounting is available in Power Break II and AKR devices only.

Spectra Series™ Terminology

Electrically Operated refers to an electrically operated mechanism to remotely open and close a circuit breaker. Typically used in automatic throwover schemes and automatic control schemes.

Electrical Service or System is the conductors and equipment which delivers energy from the electrical supply system to the wiring system of the premises served. The service or system consists of the number of phases, number of wires, voltages and amps. Type of service determines the number of poles on the main device, the number of poles valid for feeder or branch devices and the minimum voltages for 1-, 2-, or 3-pole breakers and fusible switches.

Enclosure is a constructed case to protect personnel against contact with the enclosed equipment and to protect the enclosed equipment against environmental conditions.

Equipment Grounding is the interconnection and grounding of electrical conduction material that either encloses or is adjacent to power conducting components.

Expansion Kit is an assembled kit that can be installed in an empty side of a double-branch fusible switch unit to create a new fusible switch unit It includes the handle, base plate, cover plate, load base and switch.

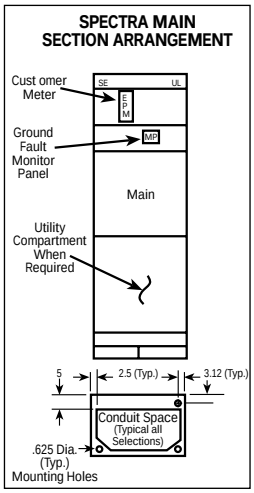
Feeder Circuit is all circuit conductors between the service equipment or the source of a separately derived system and the final branch-circuit overcurrent device.

Filler Mounts on side of fusible switch module, circuit breaker module, or between side trims to cover the front of the enclosure. The fillers plus trim comprise the enclosure front around the installed devices.

Fire Pump Disconnect serves only the code required fire pump. It must be connected ahead of any main device and sized to carry the locked rotor current of the fire pump per NFPA-20.

Frame Size is the physical size of the breaker with a specific range of amp ratings. For example, an Frame breaker is available in ratings of 70 amps to 225 amps in a 225 amp frame.

Front Accessible Single section arrangements with main device and utility cabinet furnished through 2000A ratings when the utility does not require potential transformers. If customer metering and/or ground fault relay is required, service cables must enter from above. Otherwise, two sections are provided. All other arrangements may require side or rear access, or additional section(s).



Front Only Accessible is a UL classification requiring that all line & load connections can be made from the front of the switchboard.

Front/Rear Access is configured where rear access is required for some or all of the line and load connections.

Front and Rear Line-Up occurs when all sections in a switchboard lineup are the same depth and front and rear surfaces are aligned.

Full Height Bus refers to the maximum vertical bus length available for the application.

Fully Rated Bus refers to having the same ampacity for the horizontal bus across the whole line-up.

Fuse Pullers are installed in fusible switch units to facilitate removal of the fuse.

Fuseholder or Fuse Block is an assembly of fuse clips and insulation for mounting and connecting a fuse into the circuit.

Fusible Switch is a device that can switch off current flow and to which a fuse(s) is added to protect conductors.

Spectra Series™ Terminology

Ground Bus is horizontal bus which is electrically continuous with the switchboard housing for termination of circuit ground conductor.

Ground Fault A fault condition created when an energized conductor comes in contact with earth ground or metallic structure, or causes an arc current to flow to ground.

Group (Panel)-Mounted device is one of a closely grouped assembly of devices which is mounted on a common base or mounting surface utilizing panelboard type construction. The total assembly is then mounted in a switchboard combination or distribution section.

Handle Lock Device is a mechanism to insert a lock to prevent operation of a circuit protective device. Most commonly used to lock device in the open or off position for safety while performing maintenance.

Heat Rise is the maximum temperature a component in a switchboard can increase in temperature over a defined amount 65°C per UL 891.

I^2t is the measure of heat energy developed within a circuit, in which I2 stands for effective let-through current squared and t is time in seconds.

Individually Mounted means device which is not panel-mounted and which may or may not be enclosed in its own compartment. Separated from other devices to minimize undesired influence from them. (i.e. GE Class 3 and PowerBreak Switchboard). Power Break, HPC, AKR and BPS devices are individually mounted.

Interior refers to the side rails, bus bars and insulation system that mounts in the enclosure. It is energized through the main device (lugs, fusible switch or circuit breaker) and, in turn, energizes the installed circuit-protective devices (fusible switch or circuit breaker).

Interrupting Rating is the highest rms-rated current a fuse or breaker is intended to interrupt under specified conditions.

Jaw refers to the metal parts that grip the interior bus bar and conduct electricity to the module bus bars. The jaws are spring-reinforced to provide a highly reliable electrical connection.

Key Interlock, commonly called Kirk-keys, provides a mechanical method to interlock two or more devices utilizing a removable key which can only be inserted in one location at one time.

Line refers to the incoming (live) side of equipment or device.

Load is the outgoing (switched) side of equipment or device.

Lug is a device to terminate cables.

Magnetic Trip is synonymous with instantaneous trip and describes a tripping action with no intentional time delay. Current exceeding the magnetic trip level will actuate the trip mechanism and open the breaker contacts immediately.

Main Device is a single device that disconnects all ungrounded switchboard conductors, other than control power conductors when used, from the supply bus.

Main Lug is the connecting means between the incoming service cable and the bus bar.

Mechanical Lug is a terminal with one or more wire binding screws that are tightened to hold the conductor or cable.

Mimic Bus functionally displays internal buswork by applying tape or plastic strip on equipment exterior.

NEMA Type 1 Enclosure - General Purpose Indoor is intended primarily to prevent accidental contact of personnel with the enclosed equipment. In addition, it provides protection against falling dirt and is gasketed with insect screens. The enclosure is intended for use indoors where it isn't exposed to unusual service conditions, dripping or splashing water, steam or conductive dusts (NEMA PB2-5.02).

NEMA 3R Outdoor Enclosures are intended for use in wet locations or outdoors to protect the enclosed equipment against rain. They are sleet (ice) resistant but are not dust, snow or sleet (ice) proof. If conduit connections are provided, these enclosures shall have a conduit hub or equivalent provision for watertight connections at the conduit entrance when the conduit enters at a level higher than the lowest live part. They have provisions for drainage.

Spectra Series™ Terminology

Overcurrent is any current in excess of the rated current of equipment or the ampacity of a conductor that can result from an overload, a short circuit or a ground fault.

Phase Failure Relay senses a loss of voltage in any of the three phases of a power system. It is used to alarm or trip an overcurrent device.

Plug-In Mounted device for line and load is one that can be plugged in to make electrical connections to a line and load bus bar. The device need not be self-supporting when withdrawn. It may be removed when switchboard is energized.

Pole The number of output terminals on a fusible switch or breaker that must be insulated and separated from each other.

Power Panelboard is any panelboard that is not a lighting or appliance panelboard as specified by UL and NEC and is not limited as to the number and rating of branch circuits, except for available spacing and physical size. The dead-front panelboard is accessible from the front only.

Quick-make, Quick-break refers to the action of mechanism, where the speed of the contacts in opening and closing a breaker or fusible switch is not controlled by the operator.

Rear-Only Accessible switchboards have all incoming and outgoing cable or bus connections accessible from the rear. Other connections may be front accessible.

Rear Line-Up Sections in a switchboard line-up are different depths and rear surfaces are aligned.

Rejection Fuse and Clip is a combination of Class R fuses and clips that will not accept fuses with a lower short-circuit rating. This type of fuse and clip has a mechanism that rejects standard NEMA Class H fuses.

Reverse Feed The following devices have been tested and are listed for reverse feeding: Fixed trip molded case circuit breakers, MVT+, MVT PM and Spectra Circuit Breakers. Reverse feed devices may have incoming (line) bottom and load top. They simplify bottom feed connections and minimize switchboard depth. High pressure contact switches (HPC) can be specified as bottom-fed devices. Power Break circuit breakers with MVT+, MVT PM and Power+ programmers can be reverse-fed without special ordering.

Rotor is a mechanism in a fusible switch unit that mechanically ensures all switch blades open/close simultaneously.

Selective Tripping is the application of circuit breakers or fuses in series, so that, of the breakers or fuses carrying fault current, only the one nearest the fault opens and isolates the faulted circuit from the system.

Series-Connected Rated Panel means the UL Listed short-circuit rating of the panel is equal to the IC rating of the main protective device when properly applied with branch circuit protective device. See section 6.2 for further details.

Service Disconnect is a device or group of devices that disconnects all ungrounded load conductors from the service (supply) conductors. The number of service disconnects is limited to 6 per the NEC.

Service Entrance Equipment usually consists of circuit breakers or switches and fuses and their accessories. It is located near the point of entrance of supply conductors to a building and is intended to constitute the main control and means of cutoff for the supply to the building. Service entrance equipment have a removable link between the neutral bus and ground bus. The main device must also be barriered from feeder devices.

Shunt Trip opens a circuit protection device by remote control.

Single-Branch A mounting module is a single device mounted in a designated vertical space. Refers to breakers or fused units.

Space and Busing for future when space and busing is only required for future inclusion of any specified devices, appropriate device supports, proper bus connections and corresponding vertical bus are furnished.

Standard (80%) and 100% Ratings Circuit breakers or fusible switches are to be applied at 80% of their ratings unless the overcurrent devices and the assemblies in which they are mounted are listed for operation at 100% of their ratings (NEC Articles 210-22(c), 220-3(a), 220-10(b), 384-16(c). Refer to listings for available 100% rated devices.

Spectra Series™ Terminology

Stationary-Mounted device can be removed only by unbolting electrical connections and mounting supports. Should only be removed when switchboard is deenergized.

Tapered Bus on UL 89 is the downsizing of the Busway ampacity based diversity standards.

Thermal Trip protects against sustained overloads. A bimetallic element reacts time-wise in inverse proportion to the current. If a circuit is overloaded, heat from excessive current flow causes the bimetal to bend, actuating the trip mechanism to open the breaker.

Time Delay is a term used by NEMA, ANSI and UL to denote a minimum opening time of 10 seconds on an overload current five times the amp rating of a circuit breaker or Class H, K, J and R fuses. Time delay is useful to let through momentary current inrushes, such as in motor startups, without interrupting the circuit.

Trip Function is that portion of the breaker that senses fault conditions, controls the associated logic functions and initiates and powers the breaker trip device.

Trip Mechanisms are independent of manual control handles. The breaker will trip when a fault occurs, even if the handle is held in the "ON" position.

Under voltage release instantaneously trips the breaker when voltage (control or line) drops to 30%-70% of nominal rating.

Voltage is electrical pressure that moves electrons through a conductor and is measured in volts.

Voltage Rating is the rms alternating current voltage at which a fuse or circuit breaker is designed to operate.

X Value is an arbitrary vertical measurement of the usable mounting space on a panelboard for a fusible switch or breaker. X is equal to 1 3/8 inches (1.375"). Height of the interior is the sum of the horizontally mounted, panel-mounted components.

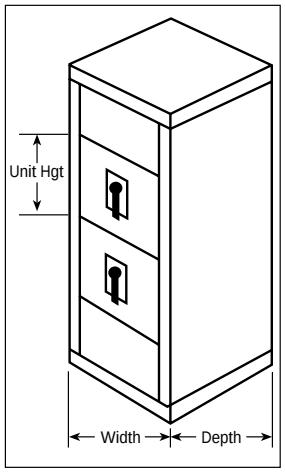
5.1 General

Switchboard Sizing Considerations
Listed below are rules and arrangements that must be considered when sizing and dimensioning Spectra Series switchboards.

Switchboard depth is the most variable of section dimensions as depth varies depending upon type and size of feed required; type, size, feed and combination of devices required; and the circuitry involved.

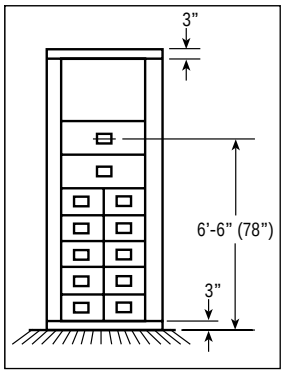
The dimensions shown in this publication are based on the following considerations.

- Typical circuit and device arrangements.
- Lug or busway feed not exceeding the ampacity of the largest rated devices. For oversize lugs, a lug section may be required. See Section 6.17.



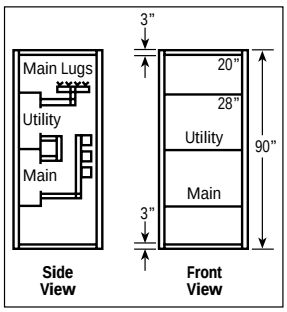
- When two or more devices are involved in the same section, the section width and depth is to be determined by the largest of the devices.
- Where bottom feed is involved, use reverse mounted or reverse fed main devices, if possible.(does not affect feeders) If not, a pull section may be required to prevent looping of bus bars and to facilitate barrier placement.
- Where main lugs are involved, spaces must be allowed for bending cable. Allow space at top (or bottom) of section per Section 6.17.
- In combining lug space and devices, there will be cases where it will not be possible to fit more than one device per section. When such space becomes critical, refer to factory for alternate arrangements.
- For connection to substation transformers, see Section 5-9 for further sizing requirements.
- Use of busway may dictate section dimensions. For busway locations and dimensions, see Section 5.9.
- Dimensions for front accessible sections may be reduced if rear accessibility is available.

6'-7" Handle Rule



The National Electrical Code (Article 380-8) requires that switches or circuit breakers shall be installed so that the center of the grip of the operating handle of the switch or circuit breaker when in its highest position is not more than 6'-7" above the floor or working platform. Housekeeping pads that elevate the switchboard above the standing surface may violate this rule. If' housekeeping pads are specified, they may have to be extended for the full working space.

Wiring Bending Space



The National Electrical Code latest issue (Tables 373-6 (a and b)) specify minimum wire bending space. A 20" unit height allowance as shown in Section 6.17 will meet NEC requirements and provide wire bending space for front and rear accessibility. The 20" allowance for wire bending space may be utilized for metering, but not for devices. If there is rear accessibility, then it may be possible to reduce or eliminate the 20" allowance. Refer to factory.

Wiring Terminals (Lugs)
Pressure type mechanical lugs suitable for 250-600 KCMIL aluminum or copper wire are provided for short circuit ratings to l00,000A. Above 100,000A, compression type lugs may be required.

When oversize lugs are required, a lug section with minimum width shown in Section 6.17 may be furnished.

Bused Pull Sections
Section has cross bus that connects to adjacent main section bus.

5.1 General

Pull Sections ③

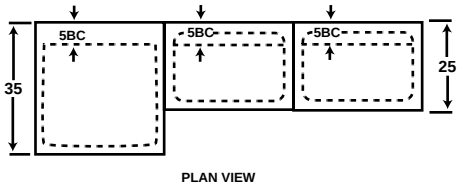
Pull sections are available in widths and depths from 15" to 60" in 5" increments. 20" width is standard. Depth is the same as the main section. The pull section provides space for pulling and installing cables. It is also used in bottom feed applications when reverse feed devices cannot be used. A barrier is provided for service entrance to meet NEC requirements. Busing and lugs are not provided.

Bused Pull Section Dimensions

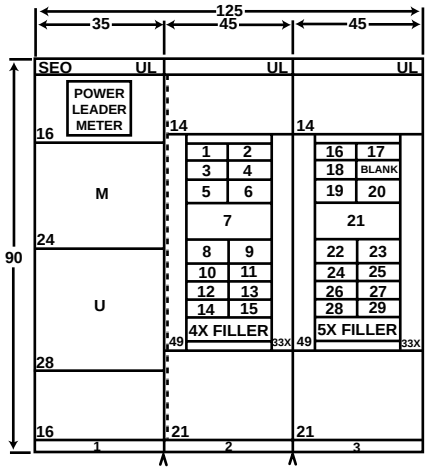
Amperes	Number of Lugs per Ø and N①	Section Width Minimum (inches)	Section Depth Minimum (inches)
800	3	30	25
1000	4	30	25
1200	4	30	25
1600	5	--	--
2000	6	30	25
2500	8	35②	--
3000	9	35②	30
4000	12	40	35
5000	15	45	40

① 50% neutral will have one-half the lugs shown, 250-600 MCM, Al or Cu wire.
② Section width minimum is 40" for 200KA.
③ Refer to Section 6.17 for cable bending space table.

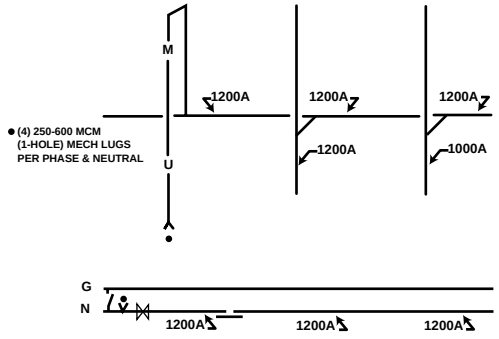
5.2 Typical Drawing



PLAN VIEW



FRONT VIEW



BUSSING DIAGRAM

Spectra Series™ Switchboard

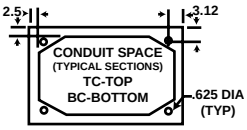
ORDER
MEB9410832X
CONT. ON SH.FL. SH.NO. 1

ACCESS TO: Front	PHASE: 3P4W
CLASS: 2	AMPERE: 1200A
LABEL: U/L SEO	BUS MATL: Copper
VOLTAGE: 480/277V	PLATE: Silver Plate
BUS BRACING (RMS SYM) 65000A	
SWITCHBOARD SC RATING (RMS SYM) 22000A	

POWER CO. STANDARD UTILITY CODE ZZ
C/T SPACE & MTG ONLY
C/T TYPE WINDOW
P/T TYPE
PER CE DWG 75C143813 PV101, 101A, 101B
PER PWR CO SPEC 75C323045A SH 1

CKT. NO.	DEVI CE DESCRIPTION	TRIP OR FUSE CLIP AMPS	POLES	CIRCUIT IDENTIFICATION ◘ LABELS ◘ NAMEPLATES
M	TK4V	1200	3	MAIN
1	SEHA	150	3	
2	SEHA	150	3	(SPACE AND BUS)
3	SFHA	200	3	
4	SFHA	200	3	
5	SGHA4	400	3	
6	SGHA4	400	3	
7	SKHA8	800	3	
8	SGHA6	600	3	
9	SGHA6	600	3	
10	SFHA	250	3	
11	SFHA	250	3	
12	SEHA	150	3	
13	SEHA	150	3	
14	SEHA	50	3	
15	SEHA	50	3	
16	SEHA	150	3	(SPACE AND BUS)
17	SEHA	50	3	
18	SFHA	200	3	
19	SFHA	250	3	
20	SFHA	250	3	
21	SKHA8	800	3	
22	SGHA4	400	3	
23	SGHA4	400	3	
24	SFHA	250	3	(SPACE AND BUS)
25	SFHA	250	3	(SPACE AND BUS)
26	SEHA	150	3	
27	SEHA	150	3	
28	SEHA	50	3	
29	SEHA	50	3	

NOTES:
1. Shipping splits between each section, ship each section separately.
2. Main furnished with integral ground fault protection.



NO.	DATE	REVISIONS	INITIALS
1	03/29/93	RELEASE FOR PRODUCTION	JY

MAT'L	MARK: MDS		PLANT: MEBANE
COST	JOB NAME: GET DRAFT		CUSTOMER: SPECTRA SWITCHBOARD
PANEL	ARCHITECTS:		CUST. ORDER NO. 3678-3456
SWBD	ENGINEER:		REQN NO: 37357 4935-1
	CONTRACTOR:		ED&C ORDER NO: MEB9410932XITEM 1
INSP.	MADE BY: ROGERW	ISSUED 3/29/93	MEB9410832X
CUST.	REL BY:	ROGERW	CONT. ON SH.FL. SH.NO. 1

5.3 Class 1 Switchboard - Group Mounted

Main Lug Section

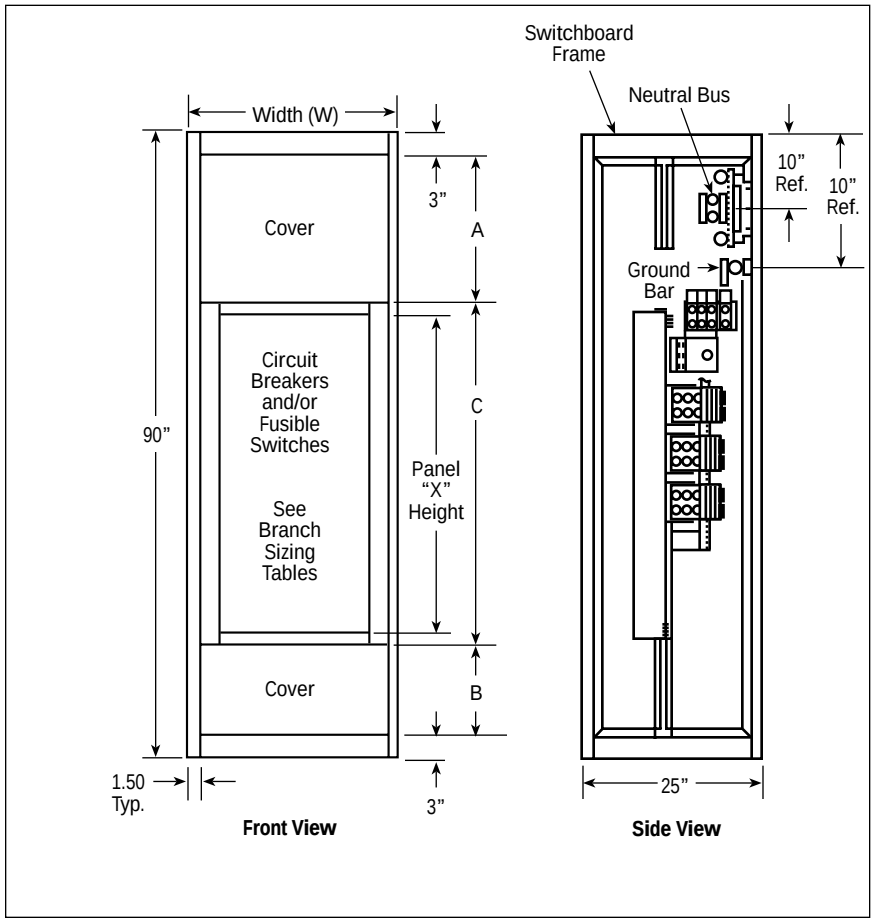
Standard Main Lug Terminations

Ampere Rating	Quantity and Size per Ø and N	Minimum Width (W)
400 & 600	(2) 1/0-600MCM	35
800 & 1000	(3) 1/0-600MCM	35
1200	(4) 1/0-600MCM	35
1600	(5) 1/0-600MCM	35
2000	(6) 1/0-600MCM	35
Over 2000	①	

① Rear access required.

Panel Rating	Panel X Height (X=1.375")	A	B	C
400-2000A	23X	21	28	35
	33X	21	14	49
	38X	21	7	56
	43X	21	0	63

Note: For bottom feed, reverse A & B dimensions.

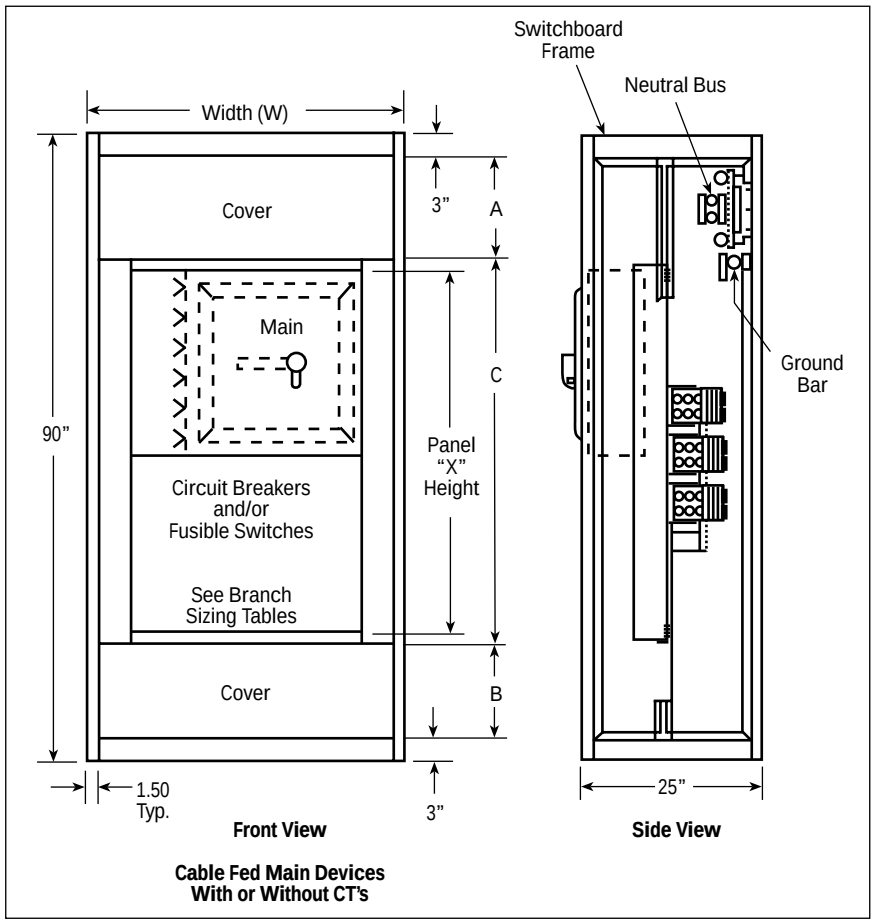


5.3 Class 1 Switchboard - Group Mounted

Main Device – Section

Type	Device	Amp Range	Main "X" Height	Min. Width (W)	Panel "X" Height	Top Main A	Top Main B	Bottom Main C	Bottom Main A	Bottom Main B	Bottom Main C
Circuit Breakers	SGDA, SGHA SGLA, SGPA SKHA, SKLA SKPA	400-600	4	35	33X	14	21	49	14	21	49
		800-1200	6	45	38X	14	14	56	23	21	56
Fusible Switch	ADS	4/600-H,K,R	10	45	43X	14	7	63	0①	21	63
		4/600-J,T	10	40	43X	14	7	63	0①	21	63
		800-1200	19	45	43X	14	7	63	0①	21	63

① Rear access is required.



Cable Fed Main Devices With or Without CT's

5.3 Class 1 Switchboard - Group Mounted

Distribution Section

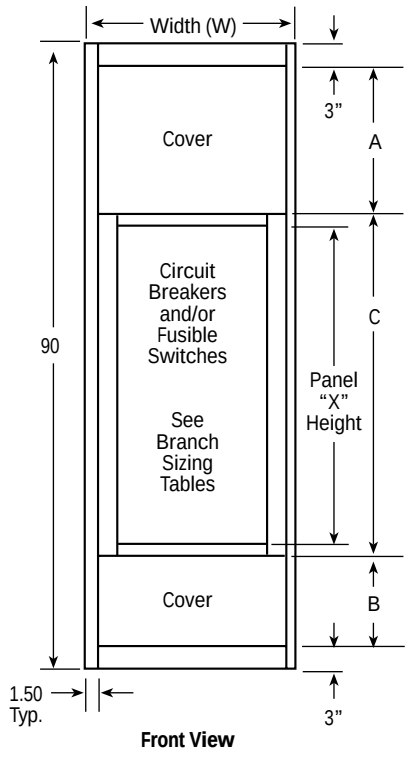


Figure 20.1

Panel "X" Height	A	B	C
23X	21	28	35
33X	14	21	49
38X	14	14	56
43X	7	14	63
53X	7	0①	77

① Rear access is required.

Distribution section side view same as main lug section side view except omit lugs.

5.3 Class 1 Switchboard - Group Mounted

Section Layout Notes

- These switchboard arrangements assume line cables enter top. When line cables enter from below, neutral and ground bus are mounted at bottom, and A and B cover dimensions are reversed.
- All dimensions are in inches and X values (1X = 1 3/8 inches).
- Front access to load cables requires a 7" high cover minimum.
- Front access to neutral and/or ground bus requires a 14" high cover minimum.
- Any circuit breakers with externally wired accessories (such as shunt trip, undervoltage release, auxiliary switches) will require a 1X filler between adjacent devices.
- For double branch units, only same circuit breaker type devices can be mounted across from each other.

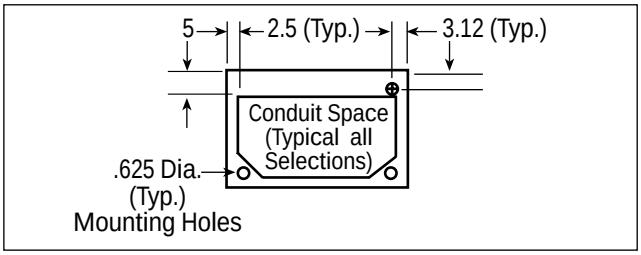


Figure 21.1

- All single branch circuit breakers, in service entrance equipment, are mounted with load lugs staggered to allow for equal cabling in both wire gutters. Main device line lugs are located on the left side.
- After determining all applicable conditions, lay out switchboard and calculate branch circuit "x" heights, including future space. Add spaces sufficient to fill panel to standard X increment.

ADS Fusible Switch Branch Device Sizing (Spectra Plug-In Only)

Switch Rating	Branch	Volts	Poles	Fuse Class	Blank Option	Minimum Width	X Height	Minimum Depth
30A	Double Branch	240V 600V	2, 3P	H, K, R	Yes	40W	4X	
60A	Double Branch	240V 600V	2, 3P	H, K, R	Yes	40W	4X 5X	
100A	Double Branch	240V 600V	2, 3P	H, J, K, R T	Yes	40W	5X 7X	
200A	Single Branch	240V 600V	2, 3P	H, K, R	No	40W	7X	25
	Double Branch			J, T	Yes			
	Double Branch			H, K, R	Yes	45W		
400A	Single Branch	240V 600V	2, 3P	J, T H, K, R	No	40W 45W		
600A	Single Branch	240V 600V	2, 3P	J, T H, K, R	No	40W 45W	10X	
800A 1200A	Single Branch	240V 600V	2, 3P	L	No	45W	19X	

5.3 Class 1 Switchboard - Group Mounted

Molded Case Circuit Breaker Branch Device Sizing - Plug-In

Mounting	Max. Breaker Amps	Breaker Frames	3-Pole Module② X-height	2-Pole Module② X-height	Minimum Width (Inches)	Minimum Depth (Inches)
Double	100	THQB, THHQB, TEY	3	--	35	25
		SE, SF	3	3	35	25
		SG	4	4	40	25
	150	TEB, TED, TQD, THQD	3	2	35	25
		THED, SF	3	3	35	25
		SG	4	4	40	25
	225	TQD, THQD	3	2	35	25
		SF	3	3	35	25
		SG	4	4	40	25
		TJD	6	6	45	25
	250	SF	3	3	35	25
		SG	4	4	40	25
		TJD	6	6	45	25
	400	SG	4	4	40	25
		SG	4	4	40	25
	600①	MicroVersaTrip Plus SGHB, SGLB, SGPB	4	–	40	25
Double Adjacent to Fusible Switch	150	SEDA, SEHA, SELA, SEPA	4	4	40	25
	250	SFHA, SFLA, SFPA	4	4	40	25
Single	250	SF	3	3	35	25
		SG	4	4	35	25
	400	TJD	6	6	35	25
		SG	4	4	35	25
		SG	4	4	35	25
	600	MicroVersaTrip Plus SGHB, SGLB, SGPB	4	–	35	25
		SK	6	6	40	25
	1200	MicroVersaTrip Plus SKHB, SKLB	6	–	40	25
Single Adjacent to Fusible Switch	250	SF	4	4	40	25
		SKP	6	6	45	25

① Double mounting not available in 2500A or higher main bus rating.
② Add 1x to height for accessories on breakers.

5.3 Class 1 Switchboard - Group Mounted

Molded Case Circuit Breaker Branch Device Sizing - Bolt-On

Mounting	Max. Breaker Amps	Breaker Frames	3-Pole Module② X-height	2-Pole Module② X-height	Minimum Width (Inches)	Minimum Depth (Inches)
Double	100	TED	3	2	35	25
		TEY	3	–	35	25
		SE, SF, THED	3	3	35	25
		SG	4	4	40	25
		THLC1	3	–	40	25
	150	TED	3	2	35	25
		SE, SF	3	3	35	25
		SG	4	4	40	25
		THLC1	3	–	40	25
		THLC2	5	–	40	25
	225	SF	3	3	35	25
		SG	4	4	40	25
		THLC2	5	–	40	25
	250	SF	3	3	35	25
		SG	4	4	40	25
		THLC4	5	–	45	25
	400	SG	4	4	40	25
		THLC4	5	–	45	25
	600①	SG	4	4	40	25
		MicroVersaTrip Plus SGHB, SGLB, SGPB	4	–	40	25
Single	250	SF	3	3	35	25
		SG	4	4	35	25
		THLC4	5	–	40	25
	400	SG	4	4	35	25
		SK	6	6	40	25
		THLC4	5	–	40	25
	600	SG	4	4	35	25
		MicroVersaTrip Plus SGHB, SGLB, SGPB	4	–	35	25
		SKH, SKL	6	6	40	25
	1200	SKH, SKL	6	6	40	25
		MicroVersaTrip Plus SKHB, SKLB	6	–	40	25
		SKP	6	6	45	25

① Double mounting not available in 2500A or higher main bus rating.
② Add 2x to height for accessories on breakers.

5.3 Class 1 Switchboard - Group Mounted

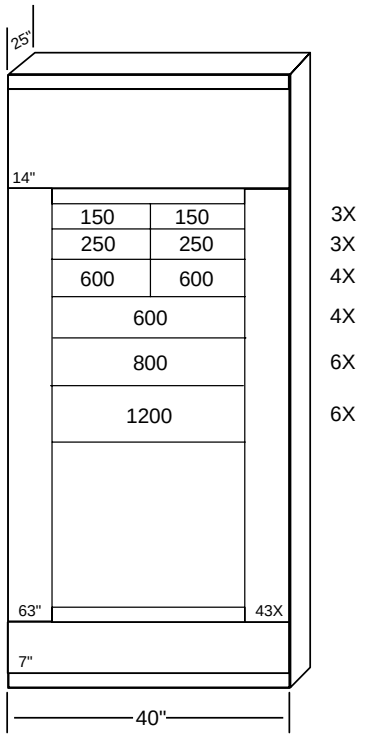
Branch Devices, Group Mounted, Breakers 100% Equipment Rated

Mounting	Max. Breaker Amps	Breaker Frames	3-Pole Module X-height①	2-Pole Module X-height①	Minimum Width (inches)	Minimum Depth (inches)
Twin	400	Spectra RMS Breaker SGHHA, SGLLA, SGPPA	4	4	40	25
Single	1000	Spectra RMS Breaker SKHHA, SKLLA, SKPPA	8	6	40	25
Twin	400	Spectra RMS Breaker with MicroVersaTrip Plus Trip Unit SGHHB, SGLLB, SGPPB	4	-	40	25
Single	1000	Spectra RMS Breaker MicroVersaTrip Plus Trip Unit SKHHB, SKLLB, SKPPB	8	-	40	25
Twin	400	Spectra RMS Breaker with MicroVersaTrip PM Trip Unit② SGHHB, SGLLB, SGPPB	6 or 5③	-	40	25
Single	1000	Spectra RMS Breaker MicroVersaTrip PM Trip Unit② SKHHB, SKLLB, SKPPB	8	-	40	25

① Add 1X per double or single branch for internal accessories side control wiring space (Shunt trip, auxiliary switch, bell alarm, undervoltage release).
② Breakers with MicroVersaTrip PM trip units must use a Voltage Module.
③ Breakers with MicroVersaTrip PM trip units must have installed auxiliary switch; 1X breaker side control wiring space is included.

Sample Feeder Mounting

Spectra Breakers



Notes:

600A frame breakers can only twin mount on main bus under 2500A.

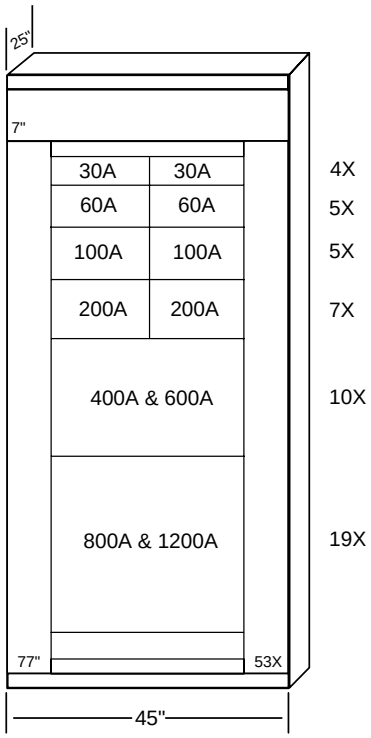
800A & 1200A breakers can mount in 40" wide section for 65kA and under. For 100kA ratings, 45" section is required.

X=1.375"

Front/Rear Access 53X interior available.

Font Only Access 43X interior available.

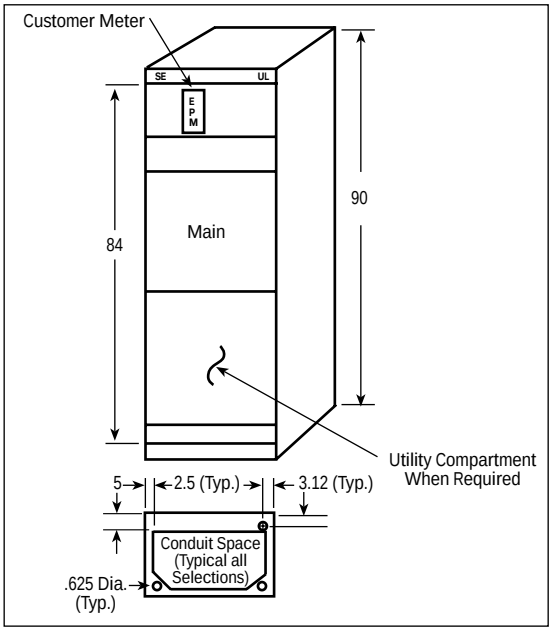
Ads Fused Switches



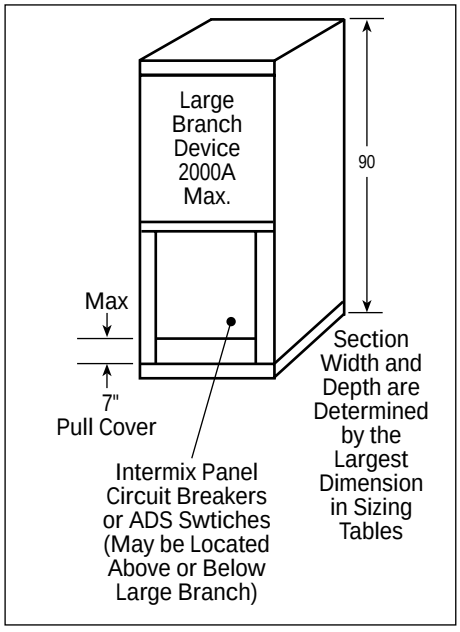
5.4 Class 2 Individually Mounted Main Group Mounted Feeders/ Class 5 Individually Mounted Switchboard

Single section arrangements with main device and utility cabinet are furnished through 2000A ratings when the utility does not require potential transformers. If customer metering and/or ground fault relay is required, service cables must enter from above. Otherwise, two sections are provided.

Spectra Main Section Arrangement



Intermix Design - side or rear access is required. Cable exit must be same as end panel.



Power Break Dimensions (Inches)
Includes Meter CTs

		Stationary③						Draw Out②					
Amp		Manual			Electrical			Manual			Electrical		
Rating		Unit	Section		Unit	Section		Unit	Section		Unit	Section	
Frame	Sensor	Height	Width	Depth	Height	Width	Depth	Height	Width	Depth	Height	Width	Depth
800②	200-800	20"	25"③	25"	20"	25"	30"	20"③	30"	35"	20"③	30"	40"
1600	800-1600	32	30	25	32	30	30	28	30	35	28	30	40
2000②	1000-2000	32	30	25	32	30	30	28	30	35	28	30	40
2500	400-2000	40	40	30	40	40	35	32	30	35	32	30	40
2500	2500	40	40	30	40	40	35	32	30	35	32	30	40
3000	3000	40	40	35	40	40	40	32	40	35	32	40	40
4000	4000	40	40	35	40	40	40	48	40	45	48	40	45

① MagneTrip is not available in 800A or small frame 2000A sizes.
② Max. of 24 secondary contacts for 800A frame drawout devices. All other frame sizes 48 secondary contact can be provided.
③ Two devices per section. Three or four devices require 30" section width.

5.4 Class 2 Individually Mounted Main Group Mounted Feeders/ Class 5 Individually Mounted Switchboard

The dimensions shown are minimum widths and depths of switchboard sections containing CT compartments only. If there are other devices located in the section, actual width will be based on the largest device required. Also, the entire switchboard lineup depth will be based on the largest device depth required.

The following utilities have approved the type of metering compartment shown. Compartments are available with the following features:

- CT bus bars mounted on high impact glass fiber polyester insulation and arranged in an edgewise plane.
- Door with concealed hinges, 3-point catch and lock, handle seal over CT compartment barriers rear and bottom (top). Note: The bottom barrier is furnished at top if main device is over CT compartment.
- 9" or 11" centerline is standard. For other centerlines, refer to factory.
- CT bus bars drilled for transformers with NEMA terminations.
- #10-32 and 1/4-20 screws for potential taps.
- Removable links provided if part of utility requirements.
- Cold sequence metering has CT compartment on load side of main device. Hot sequence CT compartment is on line side.

CT Compartment Dimensions

CT Centerline	Ampere Ratings	Minimum Section Width (inches) ①	Minimum Section Depth (inches) ①
9" or 11"	600	35	35
	800		
	1000		
	1200		
	1600		
	2000		
	2500		
	3000		
	4000	40	40

① Add 5" to depth when busway entrance is required.

Power Break II Dimensions (Inches)
Includes Incoming Lugs and Customer Meter CTs

		Stationary①						Draw Out① ② ③					
Amp Rating		Manual			Electrical			Manual			Electrical		
		Unit	Section		Unit	Section		Unit	Section		Unit	Section	
Frame	Sensor	Height	Width	Depth	Height	Width	Depth	Height	Width	Depth	Height	Width	Depth
800②	200, 400, 800	20"	25"①	30"	20"	25"	30"	20"①	30"	45"	20"①	30"	45"
1600	800, 1000, 1600	20	30	35	20	30	35	20	30	45	20	30	45
2000②	2000	20	30	35	20	30	35	20	30	45	20	30	45
2500	1000, 2000, 2500	40	40	40	40	40	40	32	30	45	32	30	45
3000	3000	40	40	40	40	40	40	32	40	45	32	40	45
4000	4000	40	40	40	40	40	40	44	40	45	44	40	45

① Width and depth will vary depending on lug arrangement and number of devices included in the section.
② Max. of 72 secondary contacts.
③ Rear access may be required for 2500A through 4000A drawout.

5.4 Class 2 Individually Mounted Main Group Mounted Feeders/ Class 5 Individually Mounted Switchboard

Main Devices (Inches)

Type	Device Designation	Ampere Rating	Stationary Min. Unit Height	Stationary Min. Section Width	Stationary Min. Section Depth②⑥	Draw out Min. Unit Height	Draw out Min. Section Width	Draw out Min. Section Depth②⑥
High Pressure Contact Switches	THPR⑦	800	28"①	30"	25"	--	--	--
		1200	32①	30	25	--	--	--
	THPC	1600	32	30	25	--	--	--
		2000	40	30	25	--	--	--
		2500	44	35	30	--	--	--
		3000	44	40	35	--	--	--
		4000③	52	40	40	--	--	--
Bolted Pressure Switches	QA or CBC	800	28	25	30	--	--	--
		1200	32	30	30	--	--	--
		1600	32	30	30	--	--	--
		2000	32	30	30	--	--	--
		2500	36	35	35	--	--	--
		3000	48	45	35	--	--	--
		4000	48	45	35	--	--	--
MCCB Standard & Hi-Break	SG	600	20	25⑤	25	--	--	--
	SK	1200	24	25⑤	25	--	--	--
Fuseless	THLC4	400	20	25⑤	25	--	--	--
Fusible Switch	QMR	400	28	25	25	--	--	--
		600	28	25	25	--	--	--
		800	28	35	25	--	--	--
		1200	28	35	25	--	--	--
AKR⑧	30	800	24	30	35	28	30	40④
	50	1600	24	30	35	28	30	40④
	T50H	2000	24	30	35	28	30	40④
	75	3200	32	35	40(	32	35	50
	100	4000	32	40	40	32	40	50④
	125	5000	(refer to factory GE-Houston)					
Metering		--	--	25	25	--	--	--
Ground Fault-Ground Break		--	8	25	25	--	--	--
Automatic Throwover	800	--	28H x 35W x 35D			--	--	--
	4000	--	28H x 35W x 35D			--	--	--

① CT compartment on line side requires 4" filler.
② If metering CTs are required, add 5" to depth. For devices at extreme top or bottom, depth shown may not provide sufficient conduit entrance space. See Section 5.10 for conduit space available.
③ When integral ground fault is present, a 4" filler is required on the load side.
④ Additional depth for metering CTs not required for any stationary units or for electrical drawout units.
⑤ 30" width is recommended for 1200A devices or when more than three devices are stacked in one section.
⑥ If vertical neutral bar is required, add 5" to depth.
⑦ Not available in electrical unit.
⑧ Refer to factory for integrally fused AKR breakers dimensions.

5.5 Utility Metering Compartments

Utility Company Information Request Matrix

		Known Sequence		Check marks indicate utility details required on each order		
Electric Utility Company	ED&C Utility Code	Hot	Cold	Sequence① (Hot or Cold)	CT Info②	PT Info 480V & Above②
Anderson Municipal, IN	AM	-	-	✔	✔	-
Anoka Electric Company, MN	AN	-	-	✔	✔	-
Appalachian Power Company, VA	AP	X	-	-	✔	✔
Atlantic Electric, NJ	AE	X	-	-	-	✔
Austin Electric Dept., TX	AU	-	-	✔	✔	-
Baltimore Gas & Electric, MD	BG	X	-	-	-	-
Bangor Hydro-Electric Co., ME	BH	-	X	-	✔	-
Belmont Municipal, MA	BM	-	X	-	✔	-
Blackstone Valley Electric Co., RI	BV	X	-	-	-	-
Boston Edison Co., MA	BE	-	X	-	-	-
Braintree Electric Light Co., MA	BL	-	X	-	✔	-
Burlington Electric Lighting Dept., VT	BD	-	-	✔	✔	-
Cambridge Electric Co., MA	CA	-	X	-	-	✔
Central Colorado Power/Centel Corp., CO	CX	X	-	-	✔	-
Central Hudson Gas & Electric, NY	CH	-	-	✔	✔	-
Central Illinois Light Co., IL	CT	-	-	✔	✔	-
Central Illinois Public Service, IL	CV	X	-	-	✔	-
Central Maine Power Co., ME	CM	-	-	✔	-	✔
Central Vermont Public Service Corp., VT	CR	X	-	-	✔	-
Chicopee Light & Power, MA	CL	-	X	-	✔	-
Cincinnati Gas & Electric, OH	CG	X	-	-	✔	✔
City of Dover, DE	CD	-	-	✔	✔	-
City of Vineland, NJ	CI	-	X	-	✔	-
Cleveland Electric Illuminating Co., OH	CC	-	X	-	✔	-
Colorado Springs Dept. of Utilities, CO	ZS	X	-	-	✔	-
Columbus Division of Electric, OH	CY	-	X	-	✔	-
Columbus Southern Power, OH	CU	-	-	✔	✔	-
Commonwealth Edison Co., IL	CE	X	-	-	-	-
Commonwealth Electric, MA	CW	-	X	-	-	✔
Concord Electric Co., NH	CO	-	X	-	✔	-
Connecticut Light & Power Co., CT	CN	-	X	-	✔	✔
Consolidated Edison Co., NY	CS	X	-	-	-	-
Consumers Power of Michigan, MI	CF	-	X	-	-	✔
Cornbelt Electric Co-Op., Il	CB	-	-	✔	✔	-
Danvers Electric Div., MA	DC	-	X	-	✔	-
Dayton Power & Light Co., OH	DP	X	-	-	✔	-
Delaware Power & Light Co., DE	DL	-	-	✔	✔	-
Delmarva Power & Light, DE	DM	-	-	✔	✔	✔
Detroit Edison Co., MI	DE	X	-	-	✔	-
Duquesne Light Co., PA	DU	X	-	-	✔	✔
East Central Electric, MN	EC	-	-	✔	✔	-
Eastern Edison Co., MA	EE	X	-	-	-	✔
Exeter & Hampton Electric Co., NH	EH	-	X	-	✔	✔
Freeport Electric Dept., NY	FE	X	-	-	-	-
Georgia Power Co., GA	GP	-	-	✔	✔	✔
Granite State, NH	GS	-	X	-	✔	-
Green Mountain Power Co.,VT	GM	X	-	-	✔	-
Greenport Electric Dept., NY	GL	X	-	-	-	-

5.5 Utility Metering Compartments

Utility Company Information Request Matrix (cont.)

		Known Sequence		Check marks indicate utility details required on each order		
Electric Utility Company	ED&C Utility Code	Hot	Cold	Sequence① (Hot or Cold)	CT Info②	PT Info 480V & Above②
Entergy Co., TX	GE	X	-	-	✔	-
Hancock Co. Rural Electric Corp., IA	HC	-	-	✔	✔	-
Illinois Power Co., IL	IC	X	-	-	✔	-
Indiana & Michigan Electric Co., IN	IM	X	-	-	✔	-
Indianapolis Power & Light, IN	IP	-	-	✔	✔	✔
Interstate Power Co., IA	IN	-	-	✔	✔	-
Iowa Electric Light & Power Co., IA	IE	-	-	✔	✔	-
Iowa Illinois Gas & Electric, IA	II	-	X	-	✔	-
Iowa Power & Light Co., IA	IO	-	-	✔	✔	-
Iowa Public Service, IA	IS	-	X	-	✔	-
Iowa Southern Utilities Co., IA	IU	-	-	✔	✔	-
Jacksonville Electric Authority, FL	JE	-	-	✔	✔	-
Jersey Central Power & Light, NJ	JC	-	-	✔	-	✔
Kansas City Power & Light Co., MO	KC	X	-	-	-	-
Kansas Gas & Electric Co., KS	KG	-	-	✔	✔	-
Kansas Power & Light, KS	KL	-	-	✔	✔	-
Kentucky Power, KY	KP	X	-	-	✔	-
Kentucky Utilities, KY	KU	X	-	-	✔	-
Lake Superior District Power Co., MN	LS	X	-	-	✔	-
Laverne Municipal Electric Plant, OK	LM	X	-	-	✔	-
Lincoln Electric System, NE	LO	-	-	✔	✔	-
Long Island Lighting Co., NY	LI	X	-	-	-	-
Louisville Gas & Electric Co., KY	LG	X	-	-	✔	-
Lubec Water & Electric District, ME	LL	-	X	-	✔	-
Madison Gas & Electric Co., WI	MG	-	X	-	-	-
Maine Public Service Corp., ME	MP	-	X	-	✔	-
Massachusetts Electric Co., MA	MC	X	-	-	-	✔
Metropolitan Edison Co., PA	ME	X	-	-	✔	✔
Minnesota Power & Light Co., MN	ML	-	-	✔	✔	-
Mississippi Power & Light Co., MS	MS	X	-	-	✔	-
Monongahela Power Co., WV	MO	-	-	✔	✔	✔
Montana Dakota Utilities, MT/ND/SD	MD	X	-	-	-	-
Muscatine Power & Water, IA	MW	-	-	✔	✔	-
Narragansett Electric Co., RI	NE	X	-	-	-	✔
New Orleans Public Service, LA	NO	X	-	-	✔	-
New York State Electric & Gas Corp., NY	NY	-	X	-	✔	✔
Newport Electric Corp., RI	NC	-	X	-	✔	-
Niagara Mohawk Corp., NY	NM	-	X	-	-	-
Northern Indiana Public Service, IN	NI	X	-	-	✔	-
Northern States Power Co., MN/WI/ND/SD	NS	X	-	-	✔	-
Northwestern Public Service, SD	NP	-	-	✔	-	-
Norwich Dept. of Public Utilities, CT	ND	-	X	-	✔	-
Norwood Municipal Light Co., MA	NL	-	X	-	✔	-
Ohio Edison Co., OH	OE	X	-	-	✔	-
Ohio Power Co., OH	OP	X	-	-	✔	✔
Omaha Public Power District, NE	OP	X	-	-	-	✔
Orange & Rockland Utilities	OR	X	-	-	-	-
Otter Tail Power Co., MN	OT	X	-	-	-	-

5.5 Utility Metering Compartments

Utility Company Information Request Matrix (cont.)

		Known Sequence		Check marks indicate utility details required on each order		
Electric Utility Company	ED&C Utility Code	Hot	Cold	Sequence① (Hot or Cold)	CT Info②	PT Info 480V & Above②
Parker Municipal Light Dept., SD	PM	-	-	✔	✔	-
Pennsylvania Electric Co., PA	PF	X	-	-	-	✔
Pennsylvania Power & Light Co., PA	PL	X	-	-	-	✔
Pennsylvania Power Co., PA	PY	-	-	✔	✔	-
Philadelphia Electric Co.,	PH	X	-	-	-	✔
Potomac Edison Co., MD	PT	X	-	-	✔	-
Potomac Electric Power Co., DC	PP	X	-	-	-	-
Public Service Electric & Gas Co., NJ	PS	-	-	✔	-	-
Public Service of Colorado, CO	PC	X	-	-	-	-
Public Service of Indiana, IN	PI	X	-	-	✔	-
Public Service of New Hampshire, NH	PU	-	-	✔	✔	-
Rochester Gas & Electric Co., NY	RG	X	-	-	✔	-
Rockville Centre Electric Dept., NY	RE	X	-	-	-	-
South Central Electric Association, MN	SC	-	-	✔	✔	-
South Hadley Electric Light Dept., MA	SH	-	-	✔	✔	-
South Norwalk Electric, CT	SN	-	X	-	✔	-
Southern Indiana Gas & Electric, IN	SI	-	X	-	✔	-
Southern Maryland Co-Op, MD	SM	X	-	-	✔	-
St. Louis Municipal Electric, MI	SL	-	-	✔	✔	-
Superior Water, Light & Power, MN	SW	X	-	-	✔	-
Toledo Edison, OH	TE	-	X	-	✔	-
Unified Illuminating Co., CT	UI	-	X	-	-	-
Union Electric of St. Louis, MO	UE	X	-	-	-	-
Union Light Heat & Power Co., KY	UL	X	-	-	✔	✔
Vermont Public Service, VT	VP	-	-	✔	✔	-
Village of Hamiliton, NY	VH	-	-	✔	✔	-
Virginia Electric Power Co., VA	VE	X	-	-	-	-
Wakefield Municipal, MA	WM	-	X	-	✔	-
Watertown Municipal Utilities, SD	WU	X	-	-	-	-
Watertown Municipal, NY	WA	-	X	-	✔	-
Wellesley Dept. of Public Works, MA	WY	-	X	-	✔	-
West Penn Power Co., PA	WP	X	-	-	✔	✔
Western Massachusetts Electric Co., MA	WT	-	X	-	✔	-
Westerville Electric Co., OH	WR	-	-	✔	-	-
Wheatland Electric Co-Op, KS	WC	-	-	✔	✔	-
Wisconsin Electric Power Co., WI	WE	X	-	-	-	-
Wisconsin Power & Light Co., WI	WL	X	-	-	-	✔
Wisconsin Public Service, WI	WS	X	-	-	-	-

① When CT and PT information is required, provide manufacturer's name, catalog number and rating.
② When sequence information is required, advise whether hot or cold sequence is to be provided.

Consult factory for other utilities.

West Coast Utilities - EUSERC

Spectra Switchboards constructed to EUSERC utility requirements are available. EUSERC covers utility termination and metering provisions. When ordering switchboards for EUSERC areas, please specify the utility. For more details, contact the factory.

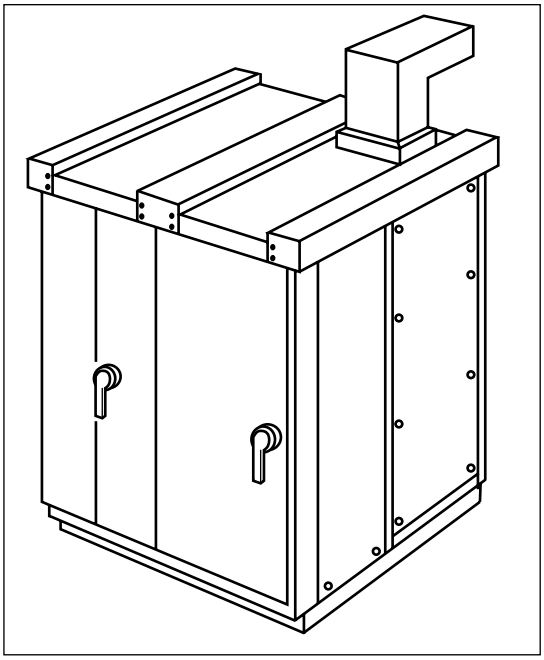
5.6 Outdoor Enclosures

NEMA 3R outdoor enclosures consist of standard indoor cubicles and components enclosed with a front frame and roof assembly to provide a weather resistant structure. Any number of sections may be bolted together. However, all sections must be of the same depth. Standard outdoor construction consists of:

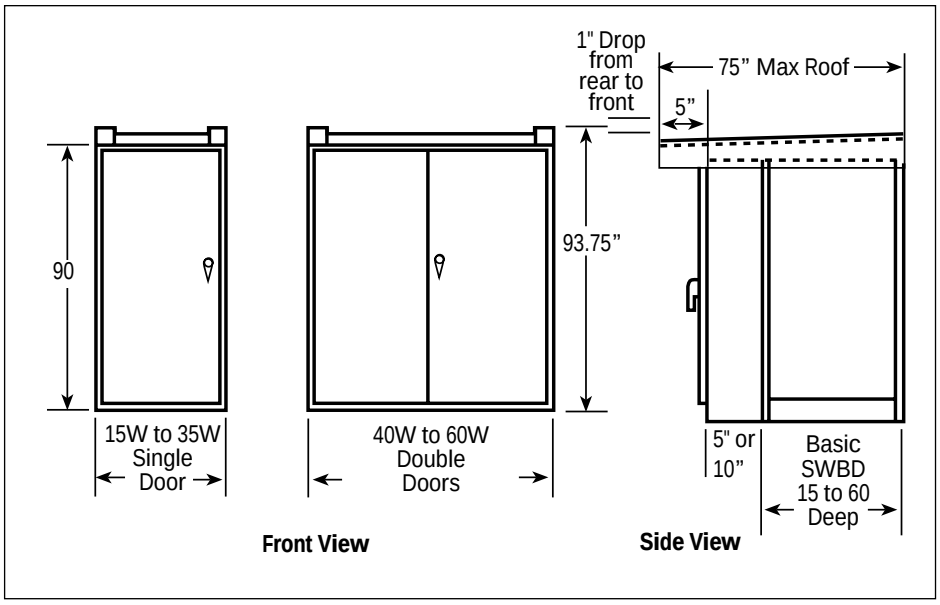
- 90" high sections.
- 1" sloped roof.
- Filtered front roof vents.
- Flat, front area floor.
- Single doors 15"-35" width; double doors 40"-60" width.
- Wind stop on each door.
- 3-point catch with provision for padlock.
- Front to rear full depth lifting beams.

Options available are:

- Gasketing.
- Fluorescent light, 120-volt, 15-amp and grounded convenience outlet.
- 1(" high floor sills with rodent guards.
- Rear doors same as front with wind stops.
- Inside, movable, 4-way hoist and trolley (walk-in only).
- Busway entrance.



Walk-in and Non-walk-in

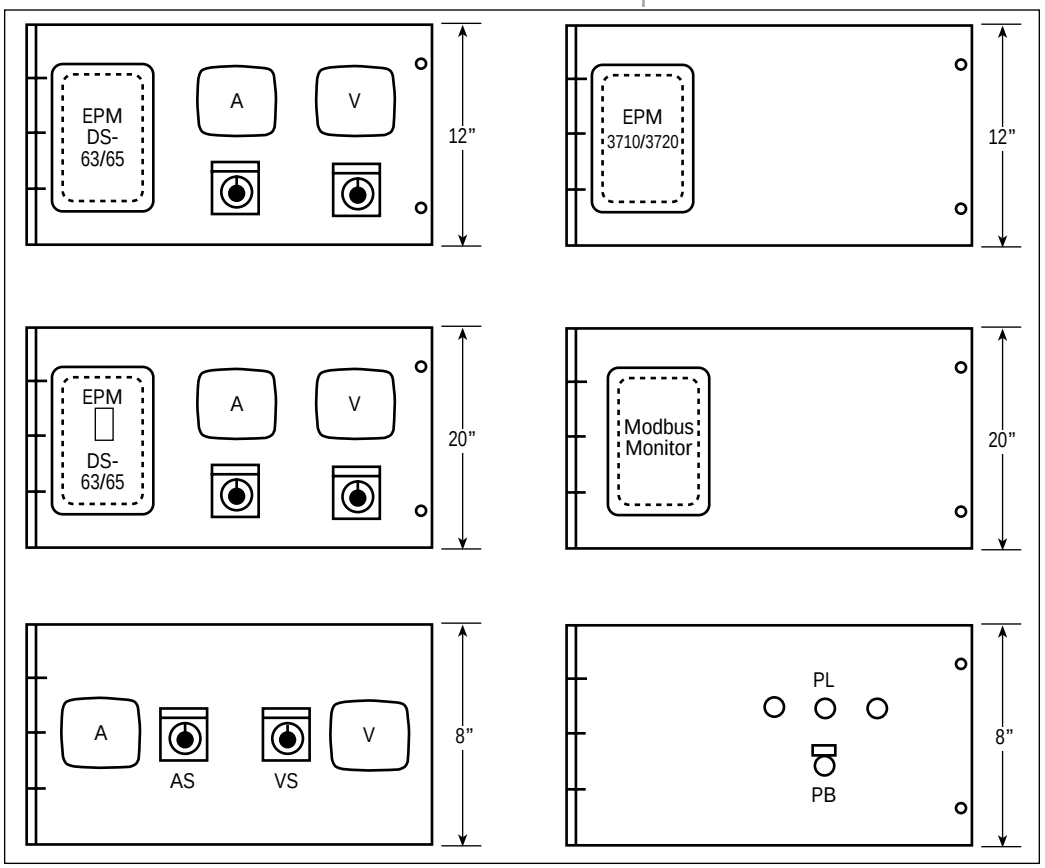


Note: For busway top exit application flat roof is used.

5.7 Instrument and Metering Arrangements

Instruments and metering for mains and feeders can be provided in top compartment of switchboard. Minimum height and width for different types of switchboards are shown. The minimum height should be increased in indicated increments as necessary to accommodate required instruments and/or meters. Some preferred arrangements are shown. Hinges door is standard on all meter doors.

Abbreviation	Description
A	Ammeter type AB40-250
V	Voltmeter type AB40, 250
EPM	EPM 3710/3720, 7300/7700
PQM	PQM, EPM
AS	Ammeter Switch
VS	Voltmeter Switch
PL	Pilot Light
PB	Push Button
GBR	Ground Break Relay



5.8 Busway Entrance

Busway Entrance

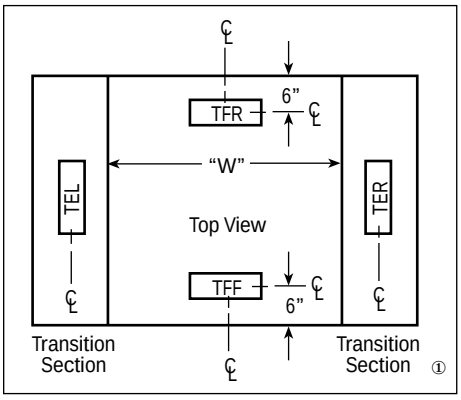
The Spectra Series Busway switchboard stub may connect to the switchboard top main bus or the line or load terminals of a device in the switchboard section into which it enters. All dimensions shown are to centerline of busway. The above is based on individually-mounted devices in switchboards. For main lug connection to group mounted switchboards, refer to factory. When two busway runs enter a switchboard section, refer to factory. For busway entrance locations other than Spectra Series™, refer to factory.

Switchboard Stubs

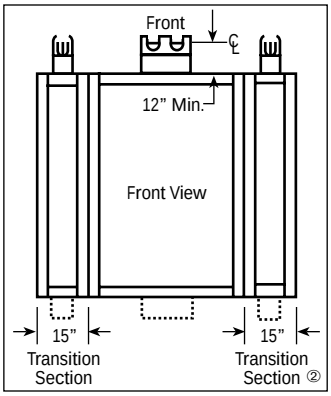
Both top and bottom entrance is available, however, TFR is the recommended standard entrance position. Dimensions for bottom entrance are the same as top entrance. Note that TEL and TER entrance positions require a separate 15-inch wide switchboard transition section adjacent to the switchboard main device for entrance.

TFR/TFF	W-Minimum Width Requirement	Minimum Depth Adder For TFR Only
800 - 1600A	25 W	10"
2000 - 2500A	30 W	10"
3000 - 4000A	40 W	10"

TEL - TER	Minimum Depth	Width Adder
800 - 2000A	30 D	15 W
2500 - 4000A	40 D	15 W



① TFR requires rear access or must be preassembled into switchboard before it is set into place.



② 15" dimensions become 20" on outdoor switchboards.

5.9 Low Voltage Transition Sections and Dual Voltage Switchboards

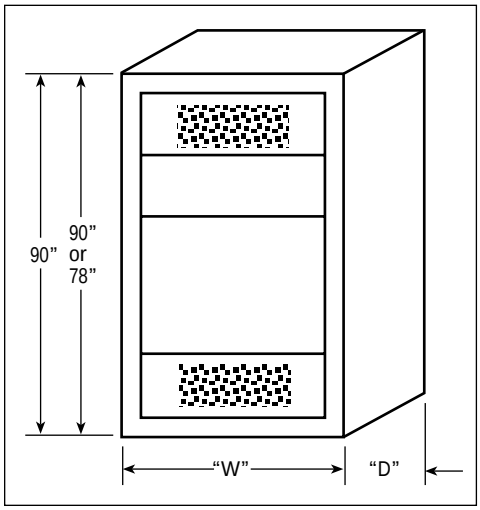
Spectra Series Low Voltage Transition Sections
Transition sections are required for connection of low voltage Spectra Series switchboards to all liquid-filled transformers 750 to 2500 kVA. They are also required for connection of switchboards to motor control centers. Transformer and transition sections are always aligned on center of depth of both sections.

Transition section depth is determined by device and circuitry of service entrance section. Transformer depth can be deeper, the same or shallower than the transition section depth.

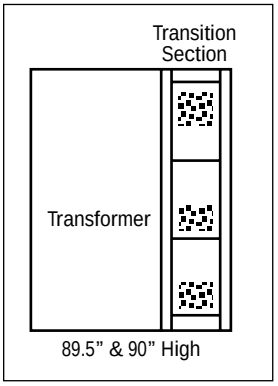
Note that the minimum allowable switchboard depth is 35" for connection to a transformer.

For the 1500 and 2000 kVA, 95 BiL transformers, a 100" high transition section is required. The switchboard remains 90" high.

Transition sections are 15" wide. Consult factory for non-standard applications.



Spectra Series Dual Voltage Switchboards
750 and 1000 kVA transformers are provided in NEMA 1 transformer enclosures. Primary and secondary flanges to switchboard sections do not require transition sections.

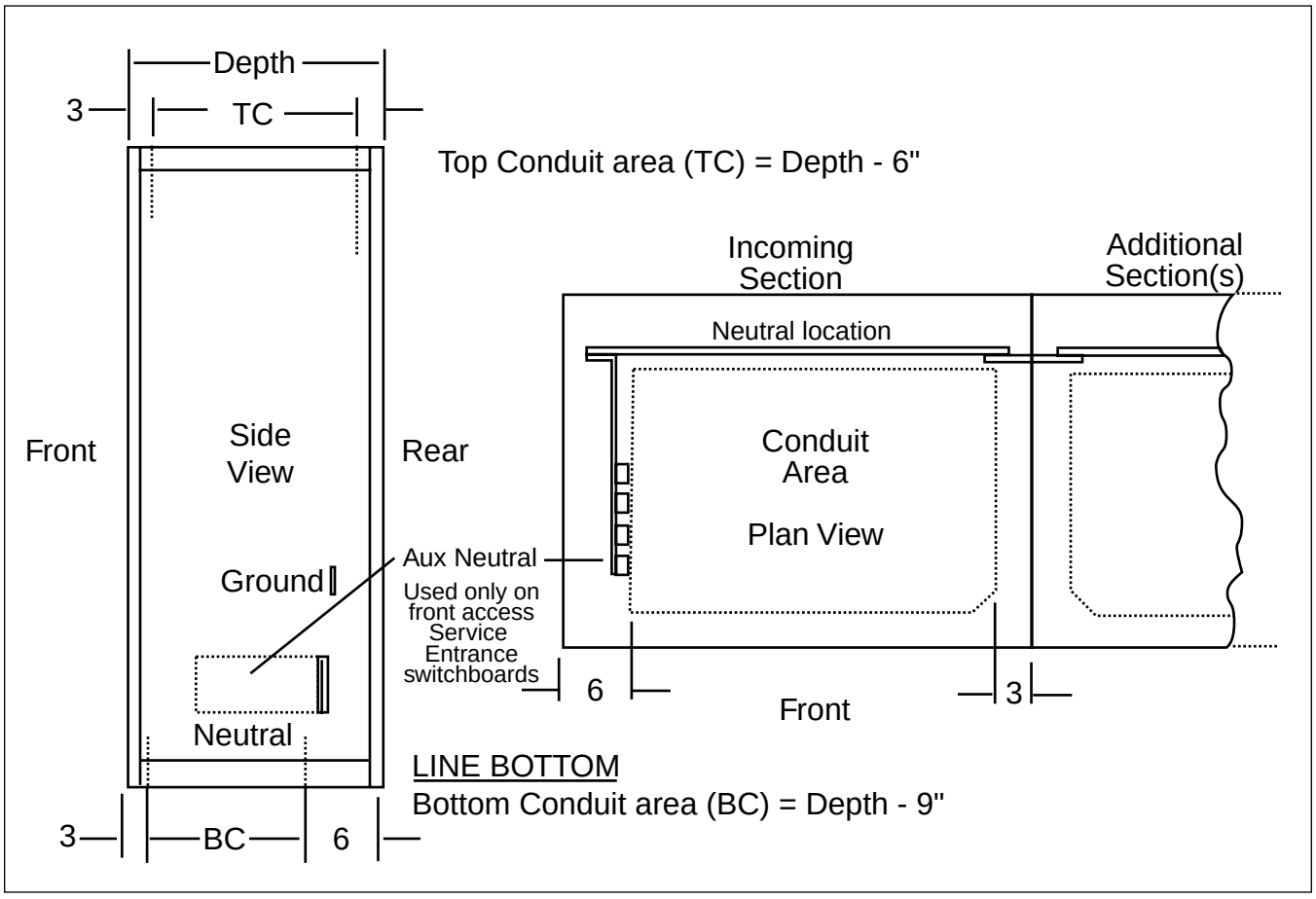


Core & coil type QLC transformers provided in switchboard enclosures cable connected to primary and secondary by equipment plant.

KVA	Self-Cooled	
	Width	Depth
30	30"	35"
45	30"	35"
75	35"	35"
112.5	40"	35"
150	45"	40"
225	45"	40"
300	55"	45"
500	55"	45"
750	50"	60"
1000	50"	60"

5.10 Conduit Entrance Space

Incoming Line Sections



Drawing is for basic guideline purposes, refer to factory for exact dimensions.

5.11 Switchboard Weights

Due to the great variety of sections, devices and circuitry, it is not feasible to give total weights for specific combinations. However, an estimate may be made by selecting device weights to average section weights (by bus material and ampacity). The resulting total weights are in a ±20% range and should be used for estimating purposes only.

Device Modification Weight (lbs.)

Type	Weight (lbs.)
Motor operator	15
MDP SR 735/737	
Ammeter-voltmeter	15
Metering C/T	10
Potential C/T	10
EPM	5
EPM 3710/3720	5
PQM	5
Meter switch	5
Test block	5

① Based on average section size and bus circuitry.

Utility Compartment Weight (lbs.)

Ampere Rating	Weight (lbs) Cu	Al
1000	80	70
2000	100	80
3000	120	90
4000	150	100

Section Weight (lbs.)

Type of Section	Approx. Weight Steel Only	Combined Weight Steel & Busing ① 1000A Cu	1000A Al	2000A Cu	2000A Al	3000A Cu	3000A Al	4000A Cu	4000A Al
Individually-Mounted Devices	600	750	650	900	750	1050	850	1200	950
Group-Mounted Devices	400	600	500	660	530	700	580	800	620