

Metal-Enclosed Load Interrupter Switchgear

With HVL/cc™ Switches

Voltage Ratings 2.4 kV to 17.5 kV

60 kV BIL to 110 kV BIL

Class 6045



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SQUARE D
Schneider Electric

Introduction

The HVL/cc™ Metal-Enclosed Load Interrupter Switchgear from Square D provides switching, metering, and interrupting capabilities for medium-voltage electrical power distribution systems.

It is designed to provide better performance and reliability, lower electrical costs, allow ease of system expansion and reduce equipment expense for systems ranging from 2.4 kV to 17.5 kV, 60 kV BIL—110 kV BIL. This switchgear is noted for its versatility, durability, and convenience. It has proven reliable both as service entrance equipment and in controlling substation transformers and is designed and manufactured in accordance with ANSI/IEEE, NEMA, CAN/CSA, UL and CUL standards C37.20.3, C37.20.4, C37.57, C37.58, CSA 22.2 no. 31, CSA 22.2 no. 193, and NEMA SG5 where applicable.

Made up of modular units, the HVL/cc is easy to expand. Two main bus positions allow future extensions and connections to existing equipment.

HVL/cc switchgear is available in either single or multiple bay units. To simplify handling and installation, each section is assembled before shipping. The design is compact, with front accessibility.

The HVL/cc switch can be equipped with either an over-toggle mechanism (OTM), which is standard, or an optional stored energy mechanism (SEM). An option with both mechanisms is the FUSELOGIC™ system. The FUSELOGIC system offers fuse tripping (with SEM) to provide protection against single phasing loads when a fuse has blown. It also has a mechanical interlock to prevent inadvertent switching until fuses have been installed or blown fuses have been replaced. (Additional details on page 5). An optional blown fuse flag is available with either OTM or SEM. The FUSELOGIC system on OTM offers 1 N.O.-1 N.C. auxiliary contact in addition to the blown fuse flag. The mechanical lockout feature is also included on OTM.

Mechanical interlocks are standard. This feature protects the operator by preventing the removal of the load-side panel while the load interrupter switch is closed and/or the optional ground switch is open.

HVL/cc switchgear is available for both indoor and outdoor enclosures. Each has features to ensure convenience, reliability, and durability.

Indoor switchgear includes lifting angles at the top corners of each shipping section for ease in handling, provisions for expansion, an 11 gauge steel enclosure, full-length ground bus in multiple bay enclosures, and padlocking for the load-side panel. Optional features include key interlocking and clear windows for inspection of optional load discharge assembly.

The outdoor switchgear is solidly constructed with a rear-sloping roof, a steel welded base and 11 gauge steel enclosure, gasketed front doors and strip heaters in each switch bay. Operating handles are enclosed by outer bulkhead type door.

The HVL/cc enclosure is designed for front access only and with minimum clearance can be positioned against walls, in small rooms or in prefabricated buildings. The small footprint can result in considerable cost savings from the reduction of building or room sizes.

Meter bays are available in both hot and cold sequence designs for Utilities and/or customer requirements (Consult factory for Dimensions and Availability).

Special utility metering bays can be provided as with our conventional HVL Metal-Enclosed switchgear.



General

Improved system performance and reliability, lower electrical power cost, easier system expansion, and reduced equipment expense are issues commanding serious attention in 2400 V to 17,500 V electrical power distribution system planning.

Square D Metal-Enclosed Load Interrupter Switchgear functions as a prime component of these systems providing necessary switching and overcurrent protection for the medium-voltage feeders. It is often used in conjunction with Square D unit substations. The switchgear is most frequently applied as service entrance equipment, although it performs equally well in controlling substation transformers and in sectionalizing medium-voltage feeder systems.

Standard Features

- Tested per ANSI standards C37.20.3, C37.20.4, C37.57, C37.58, CSA 22.2 no. 31, CSA 22.2 no. 193, and NEMA SG5 where applicable.
- Over Toggle Mechanism Type OTM
- Fuse/cable access panel automatically interlocked with the load interrupter switch and the optional Grounding Switch.
- Removable operating handles
- With the optional Grounding Switch, the cable/fuse compartment is not accessible unless the grounding switch is closed into the grounded position.
- Visible isolation viewing ports to view open, closed and grounded positions.
- Standard live line indicators that are powered by capacitor dividers internal to the insulators
 - On incoming circuits:
 - Provide "Incoming Live Line" Indication.
 - Provide "Incoming Line De-energized" Indication.
 - On feeder circuits:
 - Provide "Circuit Energized" Indication.
 - Provide "Circuit De-energized" Indication.
 - Provide "Blown Fuse" Indication.
 - Provide "Back-fed Circuit" Indication.
- Animated Mimic Bus
 - On ungrounded switches indicates "Closed" and "Open" Positions.
 - Units with grounding switches indicate "Closed", "Open" and "Grounded" Positions.
- Cable lugs. (1 set per phase)
 - Up to 2- 500 kcmil cables per phase in switch cells
 - Up to 3- 500 kcmil cables per phase in incoming line terminal chambers
- 600 Ampere tin plated copper main bus
- Belleville washers for all power connections
- Bi-Phenol epoxy switch enclosure and insulators
- UL/cUL Label.
- Suitable for Service Entrance Label.
- Meets NEC requirements for Service Entrance. (1999 Requirements)
- Tested to IEC 420 for switch-fuse combinations.
- 11 gauge steel enclosure.
- 1/4 by 2" copper ground bus meeting ANSI requirements for short circuit grounding.
- Duplex Switches. Single access panel automatically interlocked to prevent access unless both switches are opened (key interlocks are not required).
- Provision for padlocks and/or key locks.



Medium Voltage Fuse Style
Required with HVL/cc™
Switchgear
5.5 kV to 600E
15.5 kV to 360E
17.5 kV to 270E



General and Application Information

Options and Accessories

- Square D "DIN STYLE" current limiting fuses (with ANSI E-rated curves). These fuses are manufactured by Bussmann and are stocked by Square D Company in Smyrna as well as by Bussmann in St Louis.
- The FUSELOGIC™ system for Blown/Missing Fuse Indication (Local or Remote) and mechanical lockout feature to prevent reclosing the switch until 3 new fuses have been installed.
 - Anti-Single phasing protection due to blown fuses with the FUSELOGIC system
 - Blown fuse indicating contact for remote indication (one common contact)
- Fault making Grounding Switch.
 - On incoming switches grounds the incoming line
 - On feeder switches grounds the outgoing load
- Load discharge assembly for fused units only (used to discharge capacitive voltage in cables under blown fuse conditions)
- Switch position auxiliary switch
- Main Bus 1200 Ampere tin plated copper
- Live Line indicators on main bus
- Infrared viewing windows for main bus and fuse/cable compartments.
- Dual spring stored energy mechanism type SEM
- Motor operator for OTM and SEM mechanisms
- Opening and closing coils (SEM Mechanism only).
- Fast / Auto transfer configuration (Main-Main and Main-Tie Main)
 - Electrically interlocked.
 - Mechanically interlocked.
 - Operated from live line indicators.
 - Protective relaying - ANSI 51, 46, 27, 59, 47
- Duplex Configuration
 - Keyless interlock to lockout simultaneous closure of both duplex switches
- Surge Arresters (GE Type Tranquell® XE Polymer Only)
 - Distribution, Intermediate and Station Class ≤ 12 kV.
Standard 14.75" (375 mm) switch section.
Optional 20" (508 mm) and 29.50" (749 mm) section.
 - Distribution, Intermediate and Station Class > 12 kV.
Standard 20" (508 mm) switch section.
Optional 29.50" (749 mm) section.
- Modified cubicle widths for customers wanting additional working space for cable termination and fuse removal:
 - 20" (508 mm)
 - 29.50" (749 mm)
- Low Voltage Compartment with hinged door.
 - Space for PowerLogic Metering or relaying.
 - Space for control components.
- Heaters with thermostat
- 12 Circuit Panelboard in CPT unit adjacent to the operating mechanism.
- Capacitor trip unit
- Transitions to other Square D Company medium voltage equipment and power transformers. (Consult Factory)
- Stainless steel enclosures for corrosive environments. (Consult Factory for Availability)



The FUSELOGIC™ System

The new Square D medium voltage current limiting fuse sets the standard for features and protection. The new extended travel blown fuse indicator provides extended travel and increased energy to positively operate this optional feature.

The new FUSELOGIC system also prevents closing the HVL/cc™ switch if a fuse is blown or has not been installed. This reduces the potential of equipment damage due to single phasing because of a blown fuse. The FUSELOGIC system can be used to operate auxiliary contacts for optional local and/or remote indication or for fuse tripping.

NOTE: The FUSELOGIC system can only be operated by Square D fuses.

The fuse trip system requires the stored energy mechanism (SEM) with separate close and open springs. The motor operator is optional on both OTM and SEM.

For information about the FUSELOGIC system refer to Document number 6040DP9601 the FUSELOGIC system Application Guide or call Square D.

Type of Equipment Available—Indoor and Outdoor Weatherproof

Single Bay Switchgear contains a single fused or unfused switch in a free-standing enclosure. It is ideally suited for locating close to a load to control a single medium-voltage circuit.

Special emphasis is placed on conduit area, cable entrance, and terminations. Normally, no main bus is furnished in a single bay. A ground pad bonded to the steel frame is furnished with a cable lug termination. This equipment is designed for front accessibility only and bottom cable entry is preferred.

Multiple Bay Switchgear consists of a lineup of individual feeder switch bays connected to a common main bus. A main switch, fused or not fused, can be included in the lineup with a utility or user metering cubicle, depending upon job requirements. A continuous ground bus is bonded to the frame of each bay for the complete length of the lineup. The end cubicles are furnished with provisions for the addition of future feeder switch bays.



General and Application Information



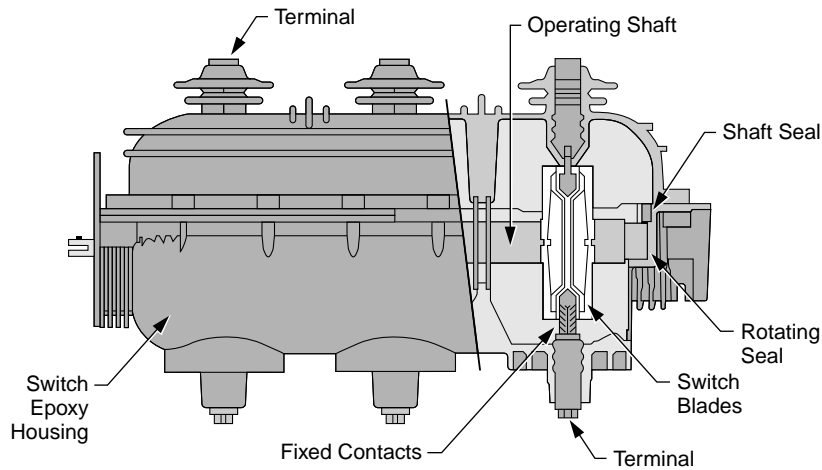
Outdoor Single Bay
HVL/cc Load Interrupter
Switchgear

Outdoor Single Switch or Multiple Bay Switchgear consists of medium-voltage components in a NEMA Type 3R enclosure. Access is through a gasketed front bulkhead-type door. The enclosure is designed so that the sheared edges of the steel are not exposed. The equipment is furnished with a welded, formed steel channel base and weatherproof paint finish.

- Roof sloped to rear for precipitation runoff
- Removable operating handles are enclosed
- Formed steel welded base
- Full-height gasketed outer front doors
- 11 GA steel enclosure per ANSI C37.20.3
- Removable split rear panels
- Strip heaters in each switch bay
- Door stay rods to hold outer-hinged doors in open position

HVL/cc™ Load Interrupter Switch Construction

- Sealed for life epoxy enclosure
- Rotary double break interrupting principle
- Interruption inside sealed enclosure
- Low SF₆ pressure (5.8 PSI). The switch is capable of interrupting load current at 0 PSIG
- Maintenance free contacts
- Two viewing ports to view the main switch contacts and optional ground switch contacts from the front panel



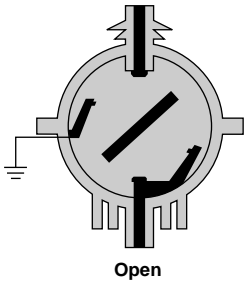
BIL for Available Voltages

- 4.76 kV–60 kV BIL
- 17.5 kV–95 kV BIL
- 17.5 kV–110 kV BIL

4.76 kV, 15 kV, and 17.5 kV

- 600 A Continuous Current
- 40,000 A (ASYM) Momentary Current
- 25,000 A (SYM) Short Time Current
- 1200 A (Non-Loadbreak only) Continuous Current





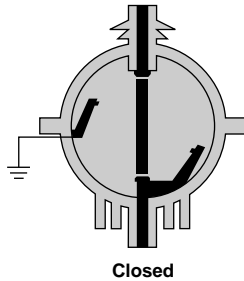
Operating Positions

Contacts in open position

- Moving contacts isolated from fixed contacts by SF₆ gas
- Gap designed to withstand the recovery voltage

Contacts in closed position

- Closing is high speed and independent of the user
- Switch meets all ANSI requirements

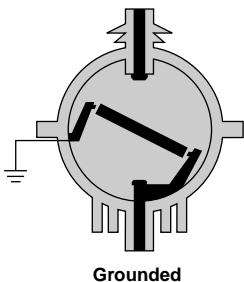


Contacts in grounded position

- Closing is high speed and independent of the user
- Grounding switch has full fault making capability

The HVL/cc™ switch with internal ground switch (optional) uses sulphur hexafluoride gas (SF₆) for insulation and interrupting. The live parts are contained in a sealed for life insulated enclosure. This switch offers remarkable characteristics including:

- Maximum operating reliability
- Low gas pressure – 5.8 PSI
- Long service life
- Maintenance-free contacts
- Rotary double break interrupting principal
- High electrical endurance
- Very low overvoltage level



Sequence of Operation—Opening the Switch

In the closed position, the main switch blades are engaged on the stationary contacts. The circuit current flows through the main blades. Live line indicators on the front mechanism cover will indicate that there is voltage present on the circuit.

Insert the removable switch operating handle into the lower operating slot on the front mechanism cover and rotate the handle counterclockwise towards the open symbol on the cover. After the springs become fully charged they will toggle over the dead center position and discharge their stored energy to the switch operating mechanism. The speed of the operating mechanism is independent of the speed of the user.

The action of the switch operating mechanism forces the main blades off the stationary main contacts in a double break configuration, thus causing circuit interruption. The mimic bus on the end of the switch shaft (visible on the mechanism cover) will indicate that the contacts are in the ungrounded open position. The live line indicators will go out.

The exceptional qualities of SF₆ gas are used to extinguish the electrical arc. The arc appears when the fixed and moving contacts separate. The combination of the current and the magnetic field created by the current cause arc rotation around the stationary contact. This rotation produces arc extension and cooling until the arc is extinguished at current zero. After this, the distance between the fixed and moving contacts is sufficient to withstand the recovery voltage. This system is both simple and sure and also provides extended electrical endurance due to very low wear on the contacts.

General and Application Information

Sequence of Operation—Grounding the Switch Main Contacts with Optional Ground Switch

After the switch is in the ungrounded open position, the operating handle can be removed from the lower operating slot and inserted into the top grounding slot. These slots are mechanically interlocked to prevent incorrect operation sequence. Rotate the handle counterclockwise until the springs become fully charged and toggle over the dead center position. The mechanism forces the main blades into the grounded position. The speed of the operating mechanism is also independent from the speed of the user, identical to the spring opening sequence. The mimic bus on the end of the switch shaft (visible on mechanism cover) will indicate that the contacts are in the grounded position. The front lower access panel can only be removed when the switch is in the grounded position.

Sequence of Operation—Closing the Switch with Optional Ground Switch

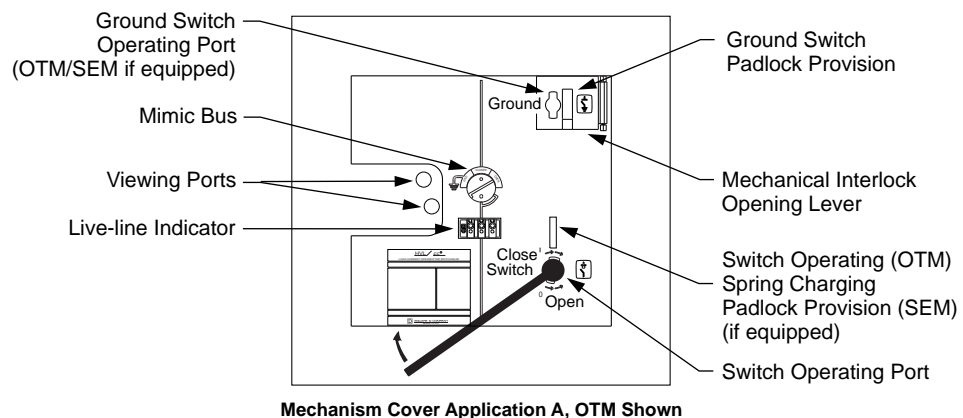
The front lower access panel must be installed and the switch blades removed from the grounded position (if supplied) before the switch main blades can be closed. Replace lower front access panel and insert the operating handle into the top grounding slot. Rotate the handle clockwise until the springs become fully charged and toggle over the dead center position. The mechanism forces the main blades into the ungrounded open position. The speed of the operating mechanism is also independent of the speed of the user. The mimic bus on the end of the switch shaft (visible on the mechanism cover) will indicate that the contacts are in the ungrounded open position. Because the ground switch is immersed in SF₆ gas, it has a short circuit making capability should a fault be on the circuit when the switch is operated.

After the switch is in the ungrounded open position, the handle may be removed from the top grounding slot and inserted into the lower operating slot. These slots are mechanically interlocked to lockout incorrect operation sequence. Rotate the handle clockwise until the springs become fully charged and they toggle over the dead center position. The mechanism forces the main blades into the closed position. The speed of the operating mechanism is also independent from the speed of the user. The mimic bus on the end of the switch shaft will indicate that the contacts are in the closed position. The live line indicators will indicate that voltage is present on the circuit.

When the movable main blades approach the stationary main blades, a high voltage arc is established across the diminishing SF₆ gap attempting to complete the circuit. The arc occurs between the tip of the stationary main contacts and the edge of the movable main blades. The arc is short and brief, since the fast closing blades minimize the arcing time. Spring pressure and the momentum of the fast moving main blades completely close the contacts. The force is great enough to cause the contacts to close even against the repelling short circuit magnetic forces if a fault exists on the circuit.

The switch nameplate prominently lists performance ratings, fuse supplied and equipment identification.

Motor operated HVL/cc™ switches are available for applications requiring remote operation. Used with MODICON Programmable Controllers, or electromechanical relays, motor operated switches may be used in automatic load transfer applications. Low voltage controls will be located in the top mounted low voltage compartment.



Mechanism Cover Application A, OTM Shown

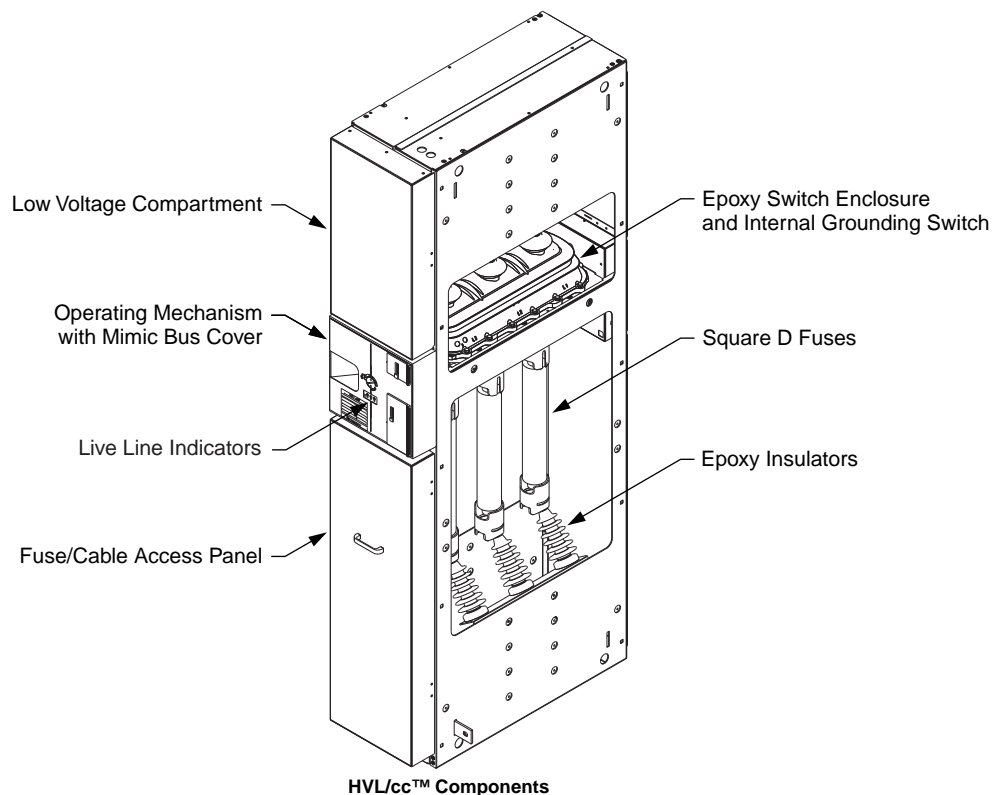


Construction Features of Indoor Equipment

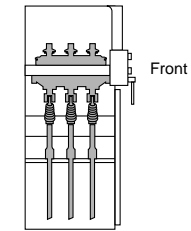
- Strong 11-gauge steel enclosure is completely grounded.
- ANSI 61 Paint finish is a TGIC polyester powder applied electrostatically to yield a rugged, durable surface coating.
- Epoxy insulators.
- Shatter resistant safety glass viewing ports for visual assurance of switch blade position
- Interlocked removable front panels for fuse or cable access.
- Sectionalized shipment when required.
- Sealed switch enclosure separate from the busbar compartment and the fuse/cable compartment by the enclosure surrounding the switch.
- Electrically and/or mechanically interlocked fuse/cable access panel permitting entry to fuses or cables only when switch is open and grounded (optional). Mechanical interlock also functions for unfused applications.
- Provisions for future expansion.
- Full-length ground bus in multiple bay enclosures.
- Access panel interlock (electrical and/or mechanical) which blocks removing the load-side panel while the switch or circuit interrupter is closed and/or ground switch is open.
- Switch interlock (electrical and/or mechanical) which blocks operating the switches main contacts while the load-side panel is removed.
- Provisions for padlocking the load-side panel.
- Key interlocking is available when required.

The three tin-plated copper busbars are parallel mounted A, B, C front to rear. 600 and 1200 A main bus is available. Connection is made to the fuses using field shapers.

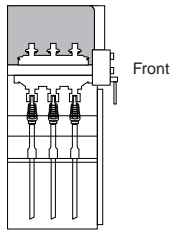
- Bare copper ground bus is bonded to equipment frame.



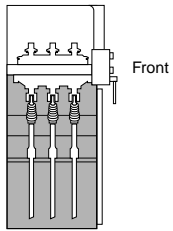
Technical Overview



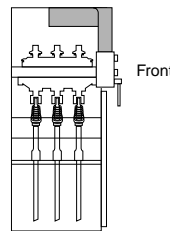
**Switch
Compartment**



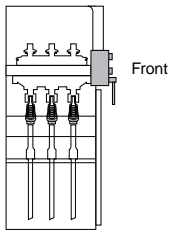
Bus Compartment



**Fuse/Cable
Compartment**



**Low Voltage/
Control
Compartment**



**Mechanism
Compartment**

HVL/cc™ COMPARTMENTS – SHOWN AS SHADED AREAS

Switch Compartment

- Sealed for life in SF₆ gas
- Interruption in sealed enclosure
 - No external arcing
- Unaffected by the environment

Bus Compartment

- Separate compartment isolated by switch insulation or sheet metal.
- Houses 3 parallel-mounted bus bars.
- Rating for main bus:
 - 600 A (standard)
 - 1200 A (optional)

Fuse/Cable Compartment

- Located below switch. (Application A)
- Frame to frame steel barriers.
- Accessed only after Grounding Switch is closed. (With ground switch option).
- Optional grounding of both sides of fuse available. (With internal ground switch and load discharge assembly.)

Low Voltage/Control Compartment

- Separate LV and control compartment.
- Space for metering and control components.

Mechanism Compartment

- Contains operators for switch and optional Grounding Switch.
 - Optional motor with padlockable control power disconnect switch.
 - Optional close and open coils.
- Standard live line indicators.
 - Externally mounted neon indicating lights (one per phase).
- Externally accessible.

Additional Components

Metering bays for user or power company equipment are available. They may be supplied fully equipped with necessary current transformers, potential transformers, meters, and associated devices or with provisions only for installing power company components at the job site.

Standardized utility metering bays match the adjacent switchgear and incorporate all the special requirements of the power company.

Standard HVL/cc customer meter bays are 29.50" (749 mm) wide.



Cable Terminations

The load cables are connected directly to the terminals of the switch. Transformer cables are connected to the lower fuse holder/field shaper.

Cables may have either:

- simplified terminations for dry-type one or three-core cables
- heat-shrink ends for dry-type or paper-insulated cables.

With basic equipment, the maximum cable sizes are:

- 3–500 kcmil for 1200 A incoming or outgoing terminal chambers.
- 2–500 kcmil for 600 A incoming or outgoing switch cubicles.
- 2–1/0 AWG for switches incorporating fuses and direct coupled to transformers.

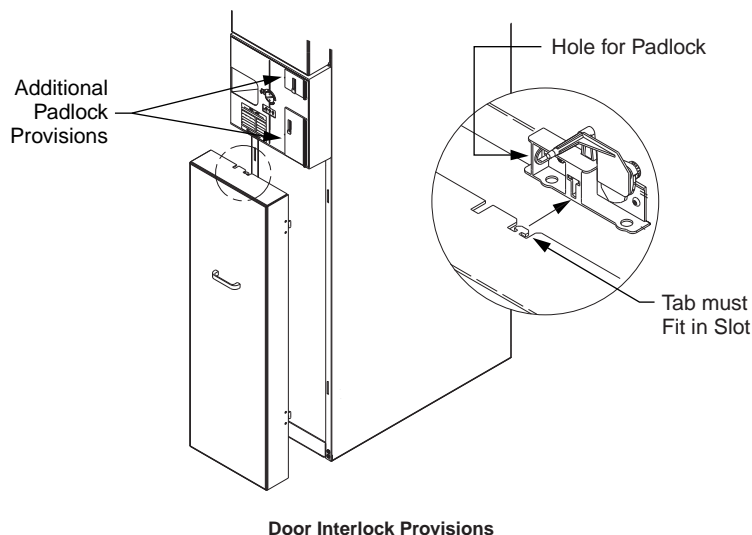
The optional Grounding Switch must be in the grounded position before the fuse/cable compartment may be accessed. The reduced depth of the cubicle allows for easy connection of all phases. An anti-rotation stud is incorporated in the field shaper. Square D supplied lugs must be used with this switchgear.

Distribution, intermediate and station class surge arresters ≤ 12 kV will fit in a standard 14.75" (375 mm) wide switch section.

NOTE: Arresters > 12 kV require a standard 20" (508 mm) switch section or optional 29.50" (749 mm) switch section.

Padlocking provisions are available for the motor cut-off switch, both or either the ground switch and/or the load switch by use of the Lexan® hinge covers supplied as options on the mechanism cover.

Key interlocks are optional equipment. They are often supplied in conjunction with metal-enclosed switchgear to direct proper operation and coordination of the equipment. The key interlock schemes are usually described on the switchgear assembly drawings supplied with the equipment.



Integrated Equipment Ratings

Medium-voltage metal-enclosed load interrupter switchgear is an integrated assembly of many components, properly selected and coordinated to provide reliable operation of the over-all equipment. Each component has its own ratings defined by its own industry standards (usually ANSI). In the past, these individual component ratings have been emphasized, since they often appear to be quite impressive but may be irrelevant to the component's application. The result has been confusion and a shifting of the burden for analysis, selection and coordination of specific components from the equipment manufacturer to the purchaser, who would rather evaluate over-all equipment performance.

Integrated ratings of the complete equipment are the natural solution, and Square D switchgear is rated in this manner. Integral equipment ratings are readily comparable with the anticipated voltage, short circuit and continuous current values obtained when designing a distribution system.

Table A below covers the HVL/cc™ load interrupter switches when applied without fuses.

Integrated Short-Circuit Current Ratings with Square D current limiting fuses are shown in Table B on page 14. Integrated equipment short-circuit current rating at a given voltage defines the maximum short circuit current to which the entire equipment may be subjected without damage to the equipment or endangering the operating personnel.

Current ANSI standards for metal-enclosed switchgear and the components are rated individually in rms symmetrical amperes. The integrated rating may also be expressed this way (the asymmetrical rating is obtained by multiplying the symmetrical value by 1.6). For convenience when comparing to older equipment, the integrated rating is also expressed in "MVA". The MVA ratings are calculated at the nominal system voltage and with the rms symmetrical amperes, e.g.: $MVA = \text{Nominal System Voltage, kV} \times \text{Amperes rms sym kA} \times \sqrt{3}$.

The integrated equipment rating combines the following ratings:

1. Switchgear—momentary and short time (bus bracing)
2. Load Interrupter Switch—momentary, fault closing and short time.
3. Fuses—interrupting and energy let-through characteristics (current limiting fuses limit the energy during a short circuit thereby allowing higher integrated ratings than the switches and switchgear would have if unfused).
4. Other components that may have limited capabilities.

Table A: Equipment Ratings without Fusing

Switch (kV) — Maximum Design	4.76	17.5	17.5
B.I.L. (kV)	60	95	110
Frequency (Hertz)	50/60	50/60	50/60
Withstand (kV)	19	36	36
Continuous Current (A)	600	600	600
Interrupting Current (A)	600	600	600
Fault Close (kA ASYM)	40	40	40
Momentary Current (kA ASYM)	40	40	40
Short Time Current (kA SYM)	25	25	25
Electrical Endurance (No. of Operations at 80% P.F.)	100	100	100
Mechanical Endurance (No. of Operations)	1000	1000	1000

NOTE: All switches have a 4 time fault close duty cycle.

Explanation of Ratings

Voltage Ratings: The voltage for a given system is normally expressed in nominal volts and is operated in a range that fluctuates based on a number of operating factors. ANSI standards generally recognize a tolerance of plus or minus 5%. For switchgear, the maximum design voltage should not be exceeded. When operated below this maximum, the equipment will withstand the 50 or 60 Hz voltage continuously, the low frequency withstand for one minute, and impulse voltages applied in accordance with ANSI design test procedures.



Continuous Current Rating: The over-all continuous current is determined by the component with the smallest capacity—bussing, load interrupter switch, fuses, fuse mountings, connections, etc. Unfused equipment is normally rated by the main bus which is available in ratings of 600 or 1200 Amperes continuous. The continuous current rating of fused equipment is generally determined by the fuses since the other components have greater current carrying capacities than the fuses.

HVL/cc™ Switch Interrupting Current Rating: The HVL/cc switch is designed and tested in accordance with ANSI standards as a “load interrupter” switch, capable of interrupting load currents up to its continuous current rating. However, per ANSI, this switch is not intended to be the main switching device. Load interrupter switches are not designed or tested for interrupting currents above their continuous currents.

Full Load Current Switching Endurance: In accordance with ANSI C37.20.4, the number of full load current interruptions at maximum design voltage which the switch can make is established through tests on “a circuit having a 0.8 power factor lagging,” and “requiring no maintenance for the number of operations stated.”

Short-Circuit Current Ratings: An integrated short-circuit current rating is normally established based on the Momentary, 2-second short time, and fault close capabilities of the equipment as explained in the section above on “Integrated Equipment Ratings”. The most important number is the Integrated Short-Circuit Current Rating which establishes overall rating for the equipment. This number is normally based on unfused switches. Current-limiting fuses can be used to increase the integrated rating. Use Table B on page 14 to select the proper fuse and associated integrated short-circuit current rating.

Mechanical Endurance: These numbers represent actual test values that the given switch rating has been subjected to. ANSI Standard C37.20.3 and proposed standard C37.20.4 do not require a “rating,” only testing to a specified minimum number of operations without repair, component replacement, or maintenance. In all cases the switch rating shown has been tested to many more than the minimum number of operations shown here.

Medium Voltage Fuse Selection

Fuses are usually used with the medium-voltage switch to provide overcurrent protection. They are normally mounted vertically below the switch (Application A). When an Application B (inverted) arrangement is used, the fuses are mounted above the switch.

Unless user job requirements demand otherwise, fuses are always connected to the load-side of the switch and are de-energized when the switch is open. When mounted in the switchgear, the fuses are readily accessible through an interlocked panel for easy removal.

Square D current limiting fuses must be provided in Square D HVL/cc™ Metal-Enclosed Switchgear. These provide short-circuit current interrupting protection equal to or greater than the short-circuit current rating of the equipment in accordance with their nominal current ratings and characteristic curves.

Current limiting type fuses offer the maximum short-circuit current rating and are most economical in the majority of “E” ratings in which they are available.

Fuses supplied with the equipment provide the following conditions when properly selected:

1. Fuse interrupting capacity will be in accordance with the integrated equipment short-circuit current rating.
2. Fuse continuous current “E” rating will be as required up to the maximum continuous current rating of the fuse.
3. Most applications seem to favor fast acting current limiting fuses. These fuses limit the let-through current and minimize the short circuit damage to a system. The fuses, completely factory assembled and sealed, keep out dust or foreign material, and operate without any noise, pressure or expulsion of gas, flame and extinguishing material, even at maximum capacity. Boric acid fuses are not available with HVL/cc switchgear.



Table B: Integrated Ratings for 600 A HVL/cc™ Switches with Square D Current Limiting Fuses

Current limiting fuses increase the integrated short-circuit current rating because of their energy-limiting capabilities. To increase the short-circuit current rating of the entire lineup of switchgear, current limiting fuses must be used in the entrance bays.

Current ratings are shown in rms symmetrical amperes.

- Symmetrical amperes = asymmetrical amperes ÷ 1.6.
- Nominal 3Ø symmetrical MVA rating = system nominal voltage, kV x sym. amperes, kA x $\sqrt{3}$.
- Ratings are based on an X/R ratio of 1.6.

Nominal System Voltage (kV)	Maximum Design Voltage (kV)	Integrated Short-Circuit Current Rating in rms Symmetrical Amperes	Maximum Integrated MVA Rating	Maximum Continuous Fuse Current
2.40	5.50	63,000 A	261 MVA	600
4.16	5.50	63,000 A	453 MVA	600
4.80	5.50	63,000 A	523 MVA	600
7.20	17.50	63,000 A	785 MVA	360
12.00	17.50	63,000 A	1309 MVA	360
12.47	17.50	63,000 A	1360 MVA	360
13.20	17.50	63,000 A	1440 MVA	360
13.80	17.50	63,000 A	1505 MVA	360
16.50	17.50	63,000 A	1800 MVA	270

Fuse Ratings

“E” rated Square D current limiting fuses function as follows:

- 100E or less – must melt in 300 seconds (5 minutes) on 200–240% of E (ampere) rating.
- Over 100E – must melt in 600 seconds (10 minutes) on 220–264% of E (ampere) rating.

Current Limiting Fuses

- Positive extended travel blown fuse indicator pin on Square D fuses only (used for the FUSELOGIC™ system applications)
- UL Listed
- Fast acting to limit available fault current stresses on the system and minimize damage to system components
- Silent non-venting interruption
- Completely factory assembled and sealed for consistent characteristics
- High-interrupting capacity
- No refills to replace or parts to clean
- Requires minimal electrical clearance; no exhaust clearance required
- Controlled arc voltages
- Standard travel blown fuse indicator pin on fuses other than Square D (cannot be used with Square D FUSELOGIC system Mechanism)
- Single and double barrel fuse designs
- Standard ANSI characteristic curves
- Used for blown fuse indication and blown fuse tripping (the FUSELOGIC system)
- 2 diameters (current rating dependent)
- 2 lengths (voltage rating dependent)
- Double barrel fuses increase ratings



Ratings and Selection

Table C: Fuse Ranges and Sizes

Square D Company general purpose E-Rated current limiting fuses only. Includes blown fuse actuator/indicator.

Description	Length		Diameter	
	IN	mm	IN	mm
5.5 kV, 10E–125E	17.40	442	2.00	51
5.5 kV, 150E–400E	17.40	442	3.00	76
17.5 kV, 10E–30E	17.40	442	2.00	51
17.5 kV, 40E–100E	17.40	442	3.00	76
17.5 kV, 125E–150E	17.40	442	3.50	88
15.5 kV, 175E–200E	21.10	537	3.50	88

Table D: Fuse Rating Table with Fuses in Parallel

Voltage	Fuse Rating	Number of Fuses	Fuse Size	Derating Factor	Integrated Rating	Cubicle Width (In)
5.5 kV	10 to 400	1	Actual	1.0	63 kA	14.75
	450	2	250	0.9	63 kA	20.00
	540	2	300	0.9	63 kA	20.00
	600	2	350	0.9	63 kA	20.00
15.5 kV	10 to 200	1	Actual	1.0	63 kA	14.75
	225	2	125	0.9	63 kA	20.00
	270	2	150	0.9	63 kA	20.00
	315	2	175	0.9	63 kA	20.00
	360	2	200	0.9	63 kA	20.00
17.5 kV	10 to 150	1	Actual	1.0	63 kA	14.75
	180	2	100	0.9	63 kA	20.00
	225	2	125	0.9	63 kA	20.00
	270	2	150	0.9	63 kA	20.00

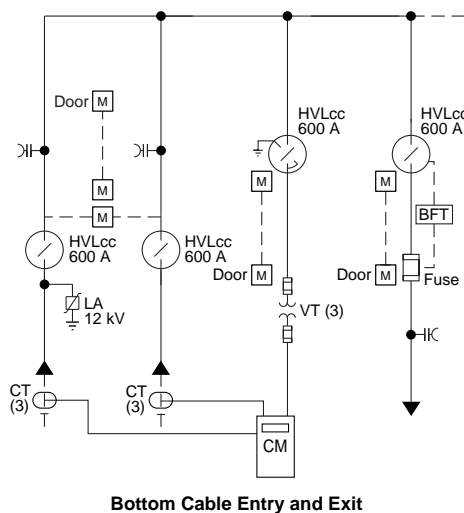
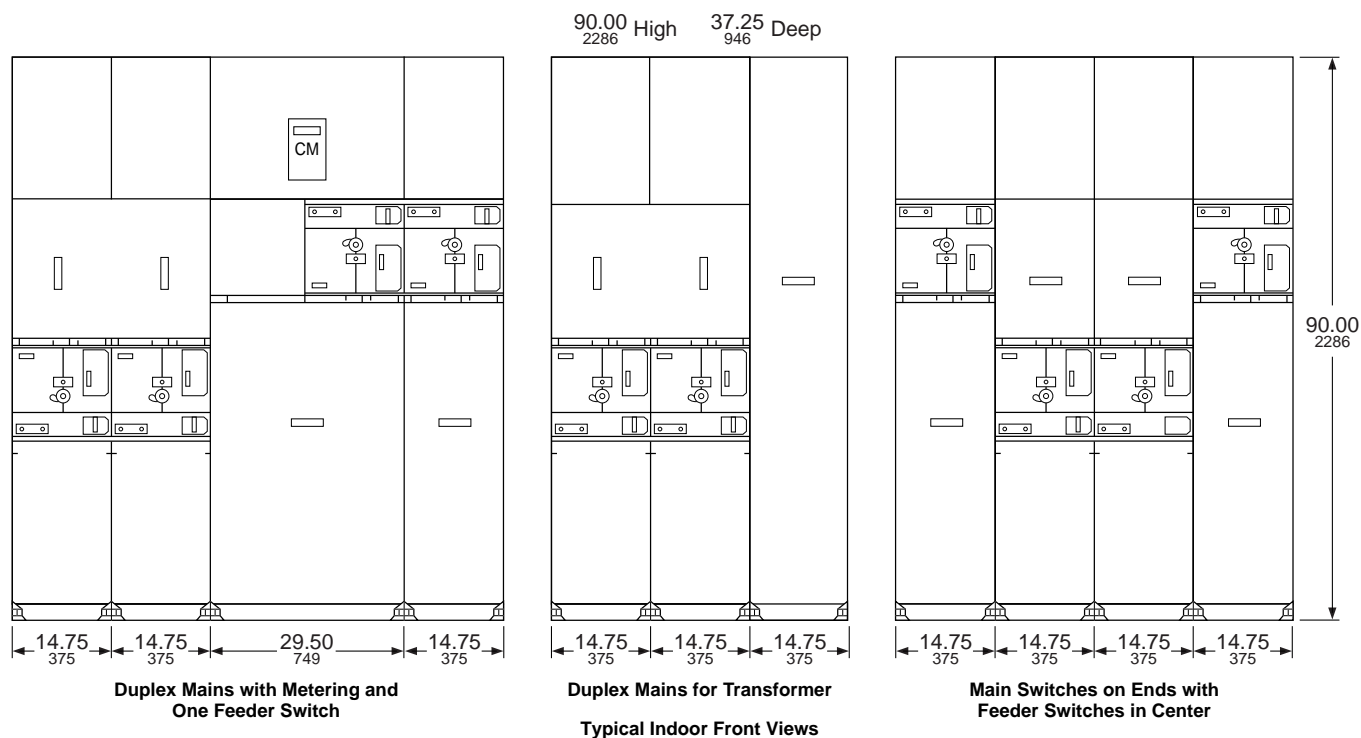
Table E: Altitude Correction Factors (ANSI C37.40-2.3)

The following table contains correction factors for applying metal-enclosed switchgear above 3300 feet or 1000 meters.

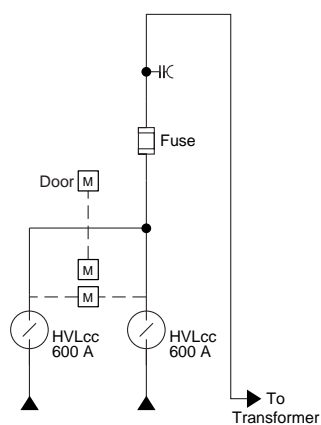
Altitude Above Sea Level		Multiply BIL and 1-minute Withstand Voltages by:	Multiply Continuous Current by:
Feet	Meters		
3300	1000	1.00	1.00
4000	1200	0.98	0.99
5000	1500	0.95	0.99
6000	1800	0.92	0.98
7000	2100	0.89	0.98
8000	2400	0.86	0.97
9000	2700	0.83	0.96
10000	3000	0.80	0.96
12000	3600	0.75	0.95
14000	4300	0.70	0.93
16000	4900	0.65	0.92
18000	5500	0.61	0.91
20000	6100	0.56	0.90



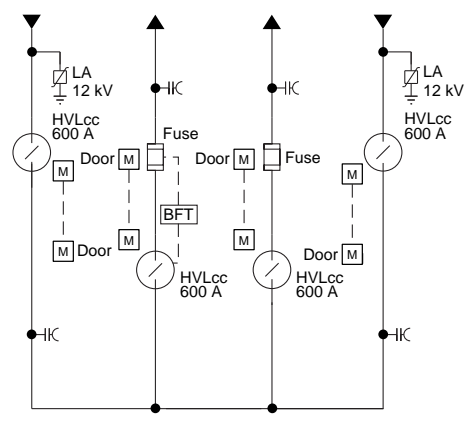
Arrangements



Bottom Cable Entry and Exit



Bottom Cable Entry with Connection to Transformer



Top Cable Entry and Exit

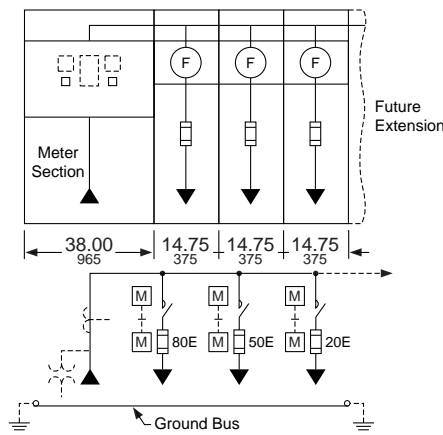
Typical Single Line Diagrams



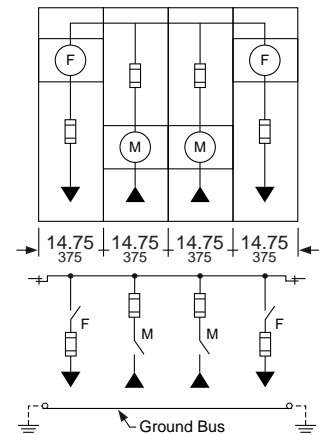
Typical Multiple Bay Switchgear Arrangements

Typical Multiple Bay Switchgear Arrangements with Front Access Only

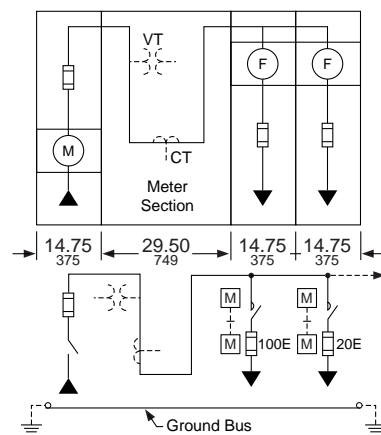
NOTE: When laying out HVL/cc™ lineups, group all top entry switches together and all bottom entry switches together to avoid transition sections.



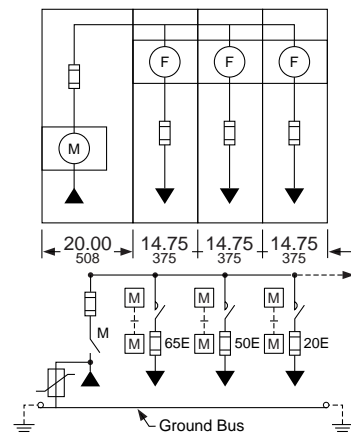
Incoming Line Hot Sequence Meter Bay with Bottom Cable Entry and Exit (Feeder Line-up Application A)



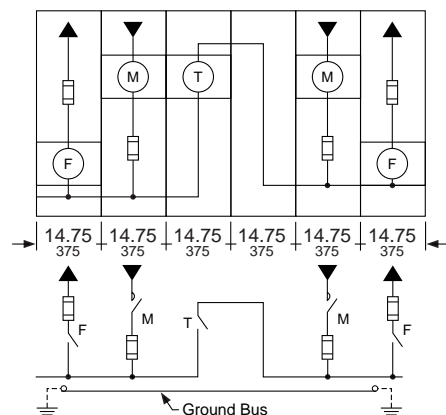
Main-Main Center Application B Located with Feeders (Application A) on Each Side (with Bottom Cable Entry and Exit)



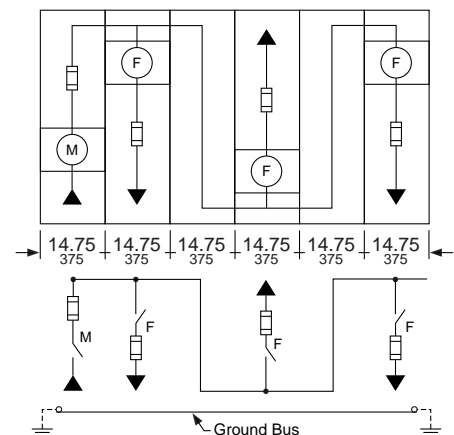
Application B Main Switch with Cold Sequence Meter Bay and Two Feeder Switches Application A (with Bottom Cable Entry and Exit)



Application B Main Switch with Surge Arresters and Feeders (Bottom Cable Entry and Exit)



**Main-Tie-Main Lineup with Feeders on Outside Ends (Top Cable Entry and Exit)
Mains and Tie are Application A and Feeders are Application B**

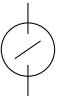
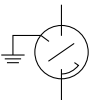




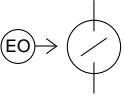
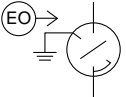

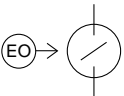
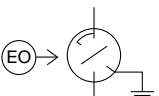

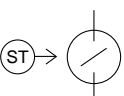
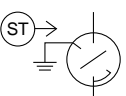

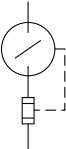


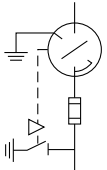

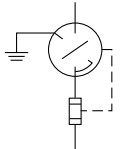



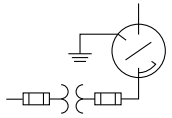

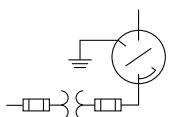






Application B Main Switch with Top and Bottom Exit Feeders (Requires Extra Transition Sections/ Not Recommended)



Standard Symbols

Standard Symbols

	Application A HVL/cc Switch (Hot Line at Top) (Manually Operated) No Ground Position		Application A HVL/cc Switch (Hot Line at Top) (Manually Operated) With Ground Position		Bar Type Current Transformer
	Application B HVL/cc Switch (Hot Line at Bottom) (Manually Operated) No Ground Position		Application B HVL/cc Switch (Hot Line at Bottom) (Manually Operated) With Ground Position		Window (Donut) Type Current Transformer or Ground Sensor CT
	Application A HVL/cc Switch (Hot Line at Top) (Electrically Operated) No Ground Position		Application A HVL/cc Switch (Hot Line at Top) (Electrically Operated) With Ground Position		Key Interlock
	Application B HVL/cc Switch (Hot Line at Bottom) (Electrically Operated) No Ground Position		Application B HVL/cc Switch (Hot Line at Bottom) (Electrically Operated) With Ground Position		Mechanical Interlock
	Application A HVL/cc Switch (Hot Line at Top) (Shunt Trip Operated) No Ground Position		Application A HVL/cc Switch (Hot Line at Top) (Shunt Trip Operated) With Ground Position		(1) Cable Lug per Phase
	Application A HVL/cc Switch (Hot Line at Top) with Blown Fuse Trip or Blown Fuse Indication No Ground Position		Live Line Indicator		Provisions Only for (1) Cable Lug per Phase
			Application A HVL/cc Switch (Hot Line at Top) with Ground Position and Load Discharge Assembly		Bus Shipping Split
			Application A HVL/cc Switch (Hot Line at Top) with Ground Position, Blown Fuse Trip or Blown Fuse Indication		Surge (Lightning) Arrester
			Capacitor Trip Unit		POWERLOGIC® Circuit Monitor
			Fixed Mounted Potential Transformer with Primary Fuse and HVL/cc Disconnect Switch (Ground Position Standard)		POWERLOGIC® Power Meter
			Control Power Transformer with Primary Fuses and HVL/cc Disconnect Switch (Ground Position Standard)		Undervoltage Relay
					Undervoltage Phase Sequence Relay
					Phase Loss/Balance Current Relay
					Time Overcurrent Relay



Cubicle Data and Weight (Indoor)

Description	H		W		D▲		Weight	
	IN	mm	IN	mm	IN	mm	lbs	kg
Interrupter Section	90.00	2286	14.75	375	37.25	946	445	202
Interrupter Section (with surge arresters ≤12 kV)*	90.00	2286	14.75	375	37.25	946	503	228
CPT Section	90.00	2286	29.50	749	37.25	946	834	378
Meter Section (hot or cold sequence)	90.00	2286	Consult Factory					
Power Dry Transformer Connection (Model 36)	90.00	2286						
Power Dry Transformer Connection Primary	90.00	2286						
Power Dry Transformer Connection Secondary	90.00	2286						
Liquid Transformer Primary Connection	90.00	2286						
Liquid Transformer Secondary Connection	90.00	2286						
Transition Section to HVL	90.00	2286						
Transition Section to MetalClad	90.00	2286						
Transition Section to 8198 MCC	100.00	2540						
Bus Transition Section	90.00	2286	14.75	375	37.25	946	445	202

▲ With front panels [footprint 33.25" (845 mm) with panels removed]

* Above 12 kV surge arresters (all classes) can be installed in 20.00" (508 mm) wide section.

Cubicle Data and Weight (Outdoor)

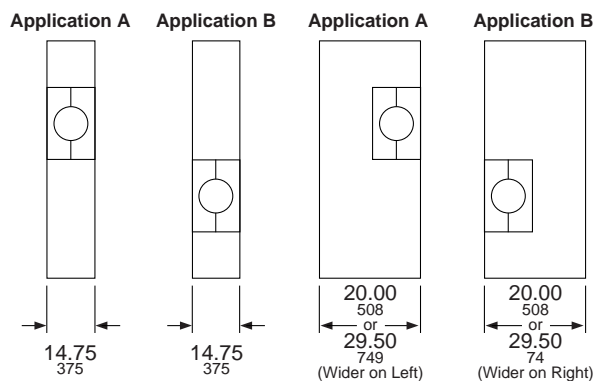
Description	H		W		D●		Weight	
	IN	mm	IN	mm	IN	mm	lbs	kg
Interrupter Section	99.75	2534	14.75	375	47.25	1200	765	347
Interrupter Section (with surge arresters ≤12 kV)*	99.75	2534	14.75	375	47.25	1200	807	366
CPT Section	99.75	2534	29.50	749	47.25	1200	864	392
Meter Section (hot or cold sequence)	99.75	2534	Consult Factory					
Power Dry Transformer Connection Primary	99.75	2534						
Power Dry Transformer Connection Secondary	99.75	2534						
Liquid Transformer Primary Connection	99.75	2534						
Liquid Transformer Secondary Connection	99.75	2534						
Transition Section to HVL	99.75	2534						
Transition Section to MetalClad	99.75	2534						
Transition Section to 8198 MCC	102.40	2601						
Bus Transition Section	99.75	2534	14.75	375	47.25	1200	525	238

● Dimensions listed are floor plan dimensions. Roof overhangs front and rear by 5.00" (127 mm).

▲ Contact Smyrna Product Management for all transformer connections.

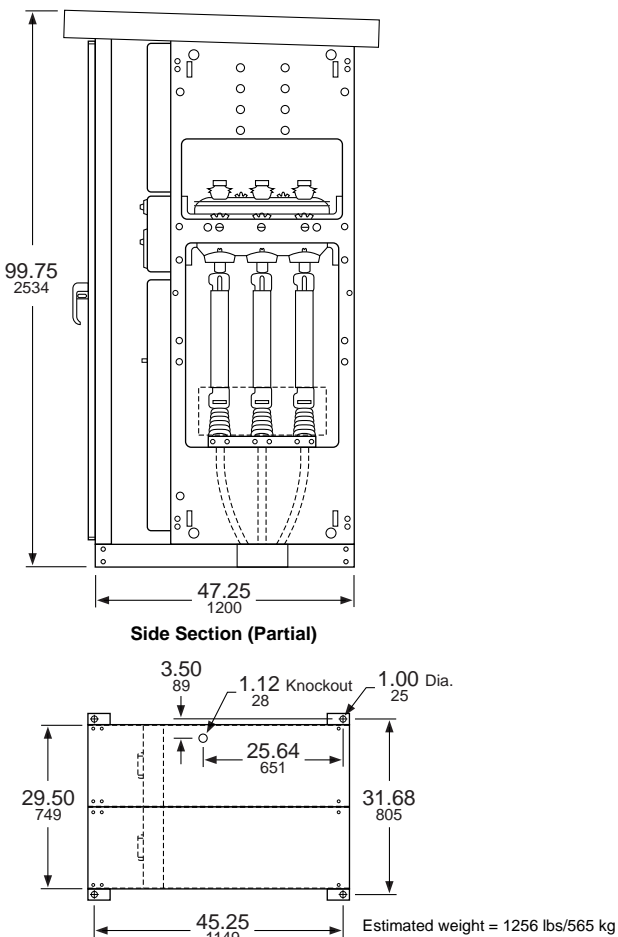
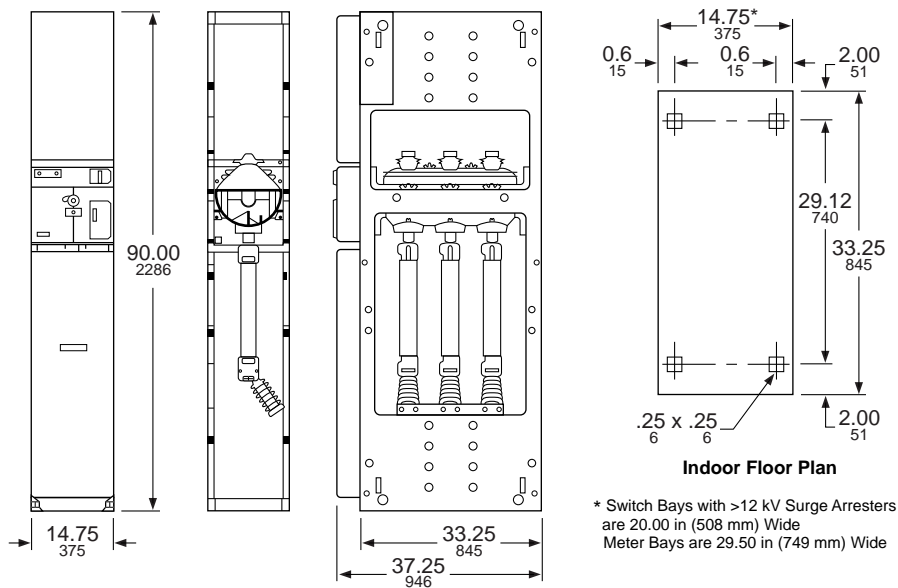
* Above 12 kV arresters can be installed in 20.00" (508 mm) wide section.

NOTE: Dimensions are **not** to be used for construction purposes.



Dimensions

Standard Dimensions (Approximate Dimensions — Not for Construction) 4.76 or 15 kV



Outdoor (N3R) Enclosure

Dual Dimensions: INCHES
Millimeters



INTRODUCTION

Grounding Switch

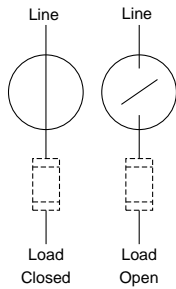
The HVL/cc switch may be equipped with an internally interlocked Grounding Switch that is formed as an integral part of the main power switch. The Grounding Switch feature is optional and must be specified at the time of the order. The Grounding Switch is only effective on one side of the switch. The options are: (1) **not** have a Grounding Switch (Figure 1), (2) having the Grounding Switch located on the load side of the switch (Figure 2), or (3) located on the line side of the switch (Figure 3).

NOTE: Fuses are not available on the arrangement with the line side having the grounded switch. Upstream protection must be provided.

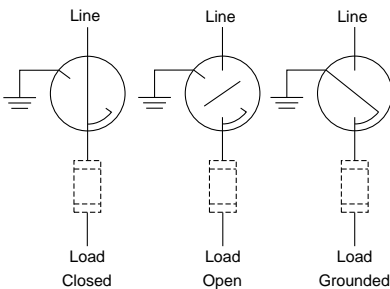
The Grounding Switch is capable of fault interrupting duty at the Short-Circuit Current Rating of the switch, however; this duty is not recommended.

Load Discharge Assembly (LDA)

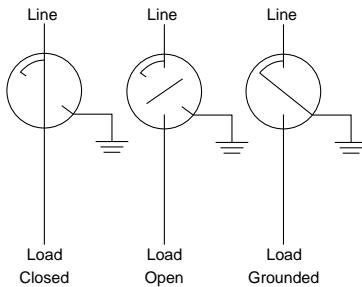
Also available as an additional accessory, is a “Load Discharge Assembly” which is located on the load side of power fuses (Figure 4). The purpose of this device is to drain capacitive charges from disconnected circuits. The “Load Discharge Assembly” is connected by a mechanical linkage with the Grounding Switch and operates simultaneously with the Grounding Switch as the Grounding Switch is operated by its mechanism. When the “Load Discharge Assembly” is operated, a grounded assembly comes into contact with the load end of the fuse assembly. The “Load Discharge Assembly” is available as an option when the HVL/cc Grounding Switch is specified and a fuse assembly is furnished. The “Load Discharge Assembly” is not rated for fault current duty and is not to be considered a Grounding Switch. The “Load Discharge Assembly” should not be used when active loads or generation exist down-stream from the fuses. The following illustrations depict the Grounding Switch and Load Discharge Assembly options available with the basic HVL/cc Switching unit.



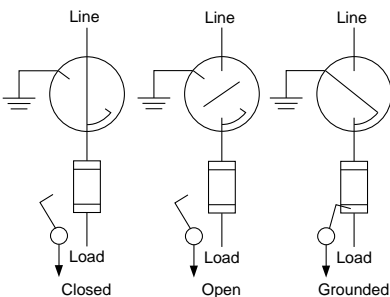
**HVLcc without
Grounding Switch
Figure 1**



**HVLcc with Grounding Switch
Ground on Load Side
Figure 2**



**HVLcc with Grounding Switch
Ground on Line Side
Figure 3**



**HVLcc with Grounding Switch
on Load Side and Load Discharge Assembly
Figure 4**

⚠ DANGER

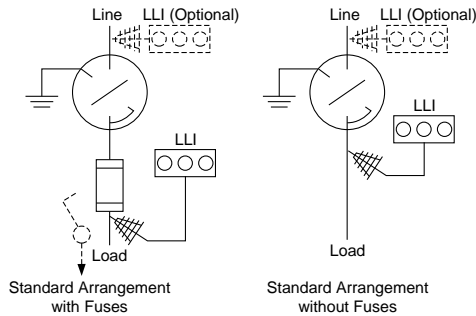
HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION

Use the load-side discharge assembly (LDA) only where there is no possibility of power back-feed from alternate power sources such as commercial power, down stream generator, and/or charged capacitor bank.

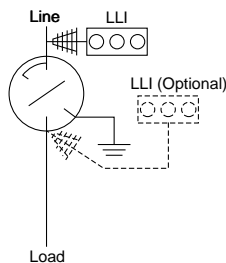
Failure to observe this instruction will result in death or serious injury.

HVL/cc™ Grounding Switch Application

Typical Installations



**HVLcc with Grounding Switch
on Load Side and Live Line Indicators
Figure 5**



**HVLcc with Grounding Switch
on Line Side and Live Line Indicators
Figure 6**

Live Line Indicators (LLI unit)

When a HVL/cc Switch is provided with a Grounding Switch, a Live Line Indicator (LLI) is always provided on the grounding side of the HVL/cc Switch to indicate the presence and/or absence of power (Figure 5). It is the operator's responsibility to observe the illumination of the LLI unit prior to closing the Grounding Switch. The LLI unit also has a provision for the use of a voltmeter or phase testing devices. The LLI unit is powered by three single-phase capacitive voltage dividers built into support insulators. The Voltage Dividers must be placed appropriately to provide the operator with correct information. Typical installations are shown at left.

General Application Rules for Live Line Indicator Units

With Grounding Switch on Load Side, With Power Fuses:

When a HVL/cc Switch is specified to have the Grounding Switch on the load side with power fuses, a LLI is provided as standard equipment with the voltage dividers located at the load end of the power fuses. A Line Side LLI unit and voltage divider may also be used as an additional cost option (Figure 5).

With Grounding Switch on Load Side, Unfused Switch:

A LLI unit and voltage divider is placed on the load side of the HVL/cc Switch as standard. A Line Side LLI unit and voltage divider may also be used as an additional cost option (Figure 5).

With Grounding Switch on Line Side, Unfused Switch:

A LLI unit and voltage divider is placed on the line side of the HVL/cc Switch as standard. A Load Side LLI unit and voltage divider may also be used as an additional cost option (Figure 6).

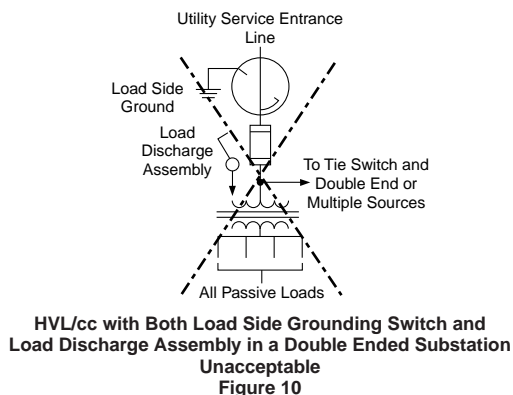
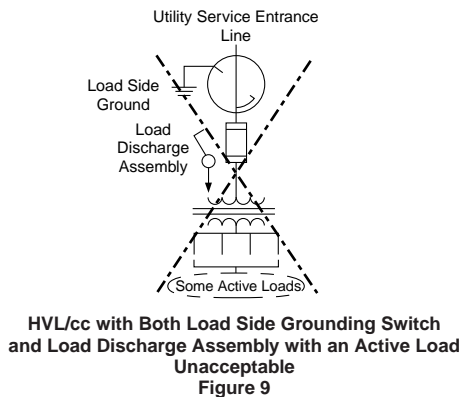
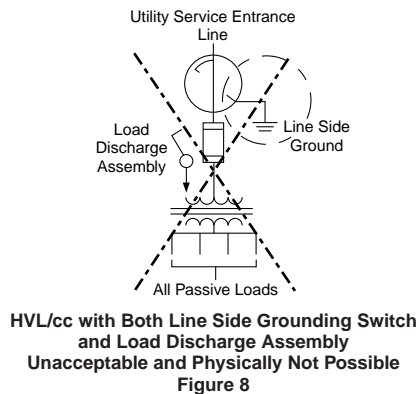
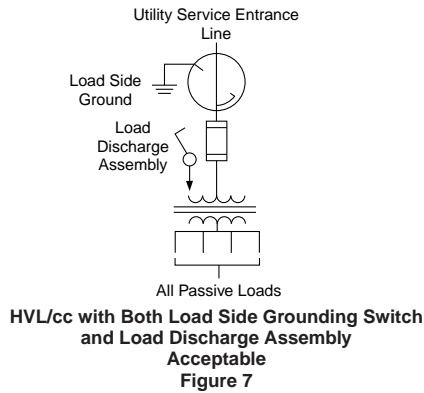
Testing

Before the operation of a Grounding Switch, proper operation of the LLI units shall be verified. If power is known to be present and all lights are illuminated prior to the operation of the switch, the LLI units are considered to be functioning as intended. If the LLI units are not illuminated and the existence of power is questionable, the existence of power shall be determined by the use of a properly rated voltage testing device. Voltage should be observed from line to line and line to ground through the ports near the LLI lights.

General Application Rules for Grounding Switch Application

A Grounding Switch should never be used in a circuit for which the operator does not have full control of the circuit and is capable of locking out and tagging out the circuit on both ends. As example, a Grounding Switch shall not be used on the line side of a HVL/cc that is considered a service disconnect (in accordance with NEC) connecting to a commercial utility source (Figure 7, page 23). A utility customer does not have control over the source of power thus a Grounding Switch for this service is prohibited. Within a utility power system or within a premise where the owner has control of both ends of the circuit, a Grounding Switch shall not be used unless the operator has exclusive control of all sources of power to the Grounding Switch.





A Load Discharge Assembly shall not be used if there is any possible source of power on the load or down stream side of the Load Discharge Assembly. As example, Load Discharge Assemblies shall not be used on the load side of switches involved in a double ended or multiple feed applications (Figures 8, 9 and 10). They shall not be used for power transformer applications where there is a possibility of back-feeding from a low voltage generator. An exception is made of this general rule where the source of down stream power is a generator and in this case, the removal of generator power is secured by the use of key interlocks.

A Grounding Switch may be used with a great deal of caution when used on the load side of Fused Main Switches of double-ended substations. Improper use of the Grounding Switch may cause inadvertent operation of the power fuses. The use of a Grounding Switch on the load side of non-fused main switches involved in a double ended or multiple feed system is unacceptable.

A Grounding Switch should be used with a great deal of caution on the load side of fused feeder switches to transformers that have sources of low voltage power beyond the secondary of the transformer such as generators or low voltage double ended substations. Although Grounding Switches are rated to be able to withstand a fault closing, such an operation will place a power system under stress. Transformer standards require agreement between user and transformer manufacturer for such an operation. Fuses are expensive and would need to be replaced. Key Interlocking may be applied to assist in the proper direction of switching activity to prevent inadvertent operation of the Grounding Switch under unfavorable conditions.

Specific Case Applications

Because of the nature of the electrical industry, there are common types of power systems. Each type of power system has specific characteristics that must be considered when applying various features of HVL/cc Grounding Switch. Pages 24-26 illustrate various power systems with recommended practice. These recommendations do not include the possible use of key interlocking which may also be provided to direct intended operation.

Recommended practice is shown in solid lines. Acceptable optional features are shown in dotted lines.

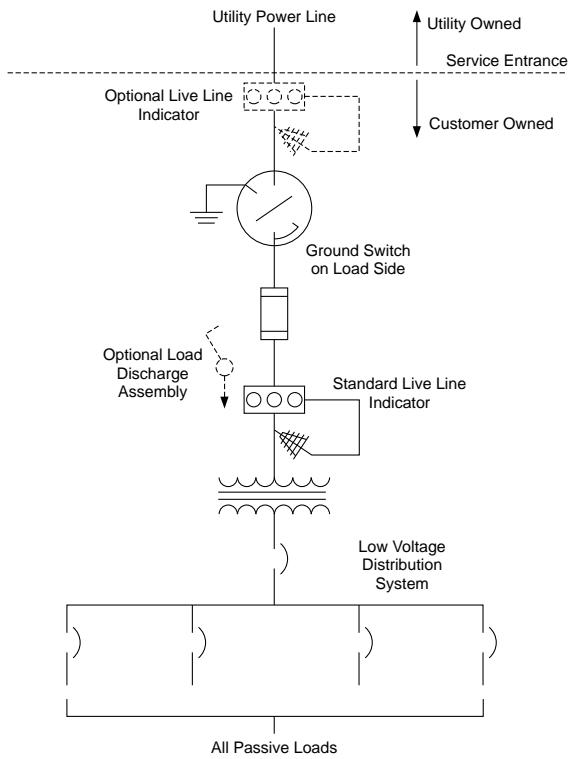
Most illustrations shown here assume power flow is from top to bottom. In many actual installations, switches are inverted with power flow from bottom to top. Such systems are not illustrated here, however the same principles demonstrated for a top to bottom power flow would be applicable for a bottom to top power flow.

All HVL/cc Switches are shown in the open position.

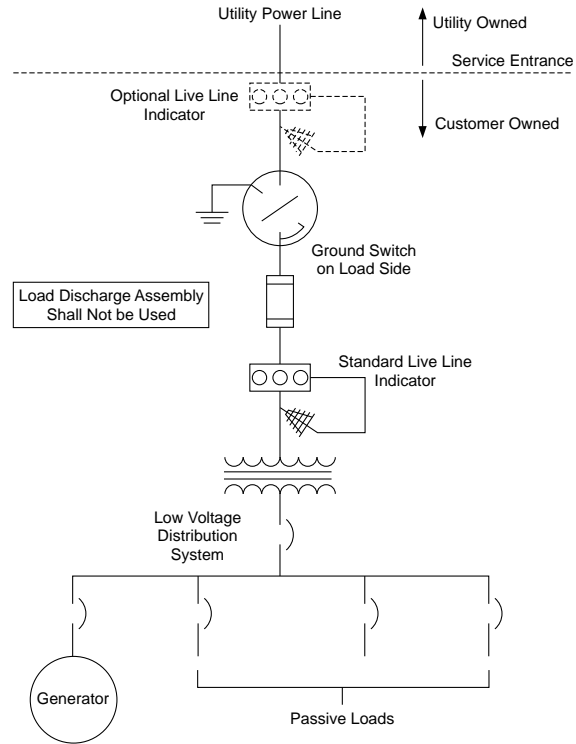
Again, as a cautionary note, Grounding Switches may only be used when the operator is in control of and has authority over the entire circuit being grounded. As example, an operator may have complete control over a load circuit and thus a Grounding Switch on the load side of a HVL/cc switch is acceptable. A Grounding Switch on the service or line side of a utility customer's service entrance disconnect (NEC) is not an acceptable application of a Grounding Switch. Such an application might disrupt service to other utility customers

HVL/cc™ Grounding Switch Application

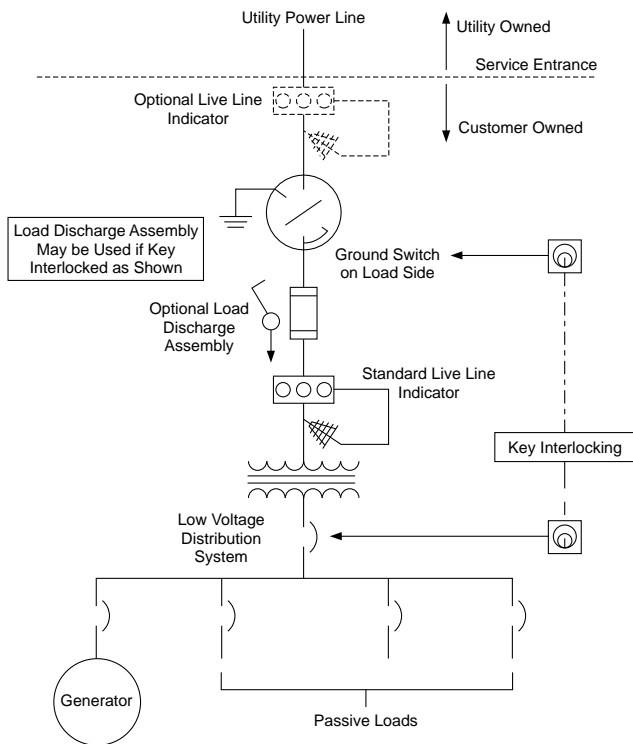
Application



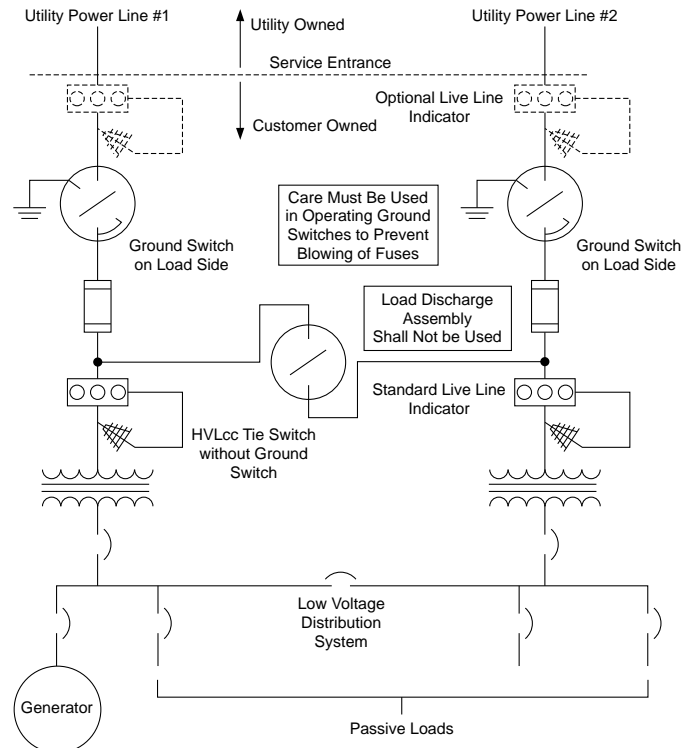
NEC Service Entrance to Single Transformer – All Passive Loads



NEC Service Entrance to Single Transformer with Down Stream Generators



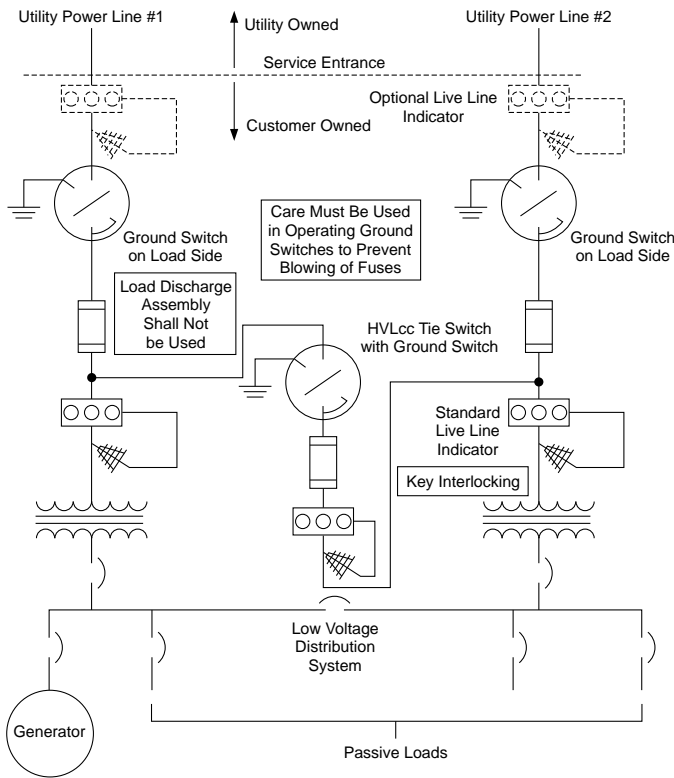
NEC Service Entrance to Single Transformer with Down Stream Generators



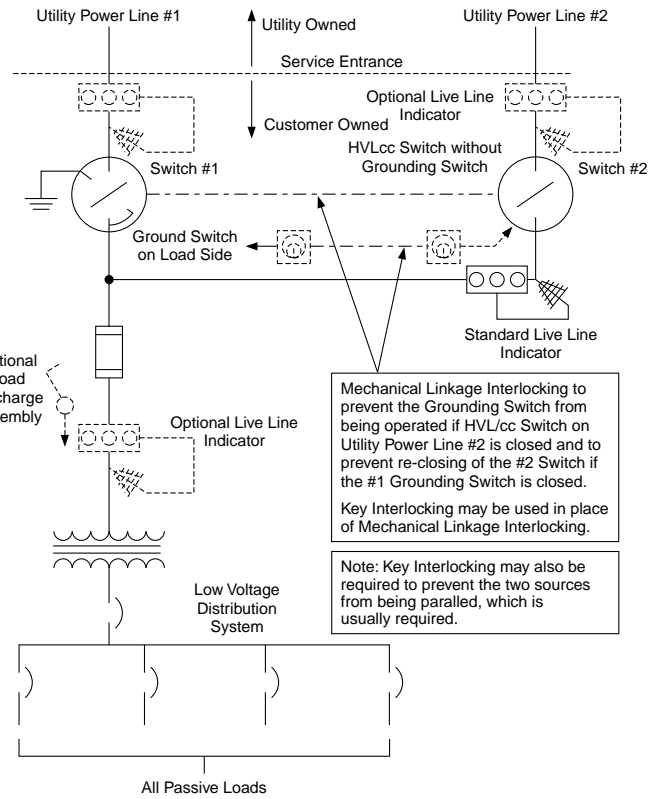
NEC Service Entrance to Double Ended Substation with or without Down Stream Generators



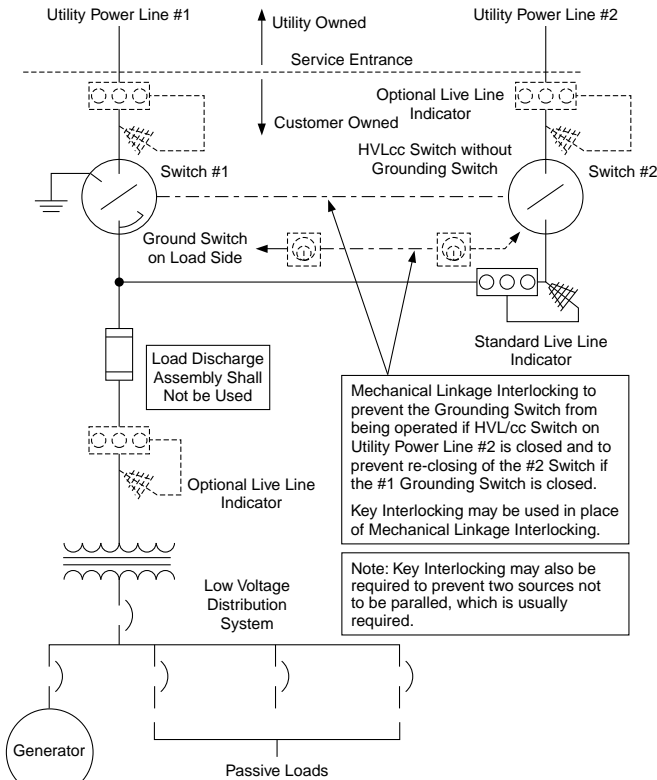
HVL/cc™ Grounding Switch Application



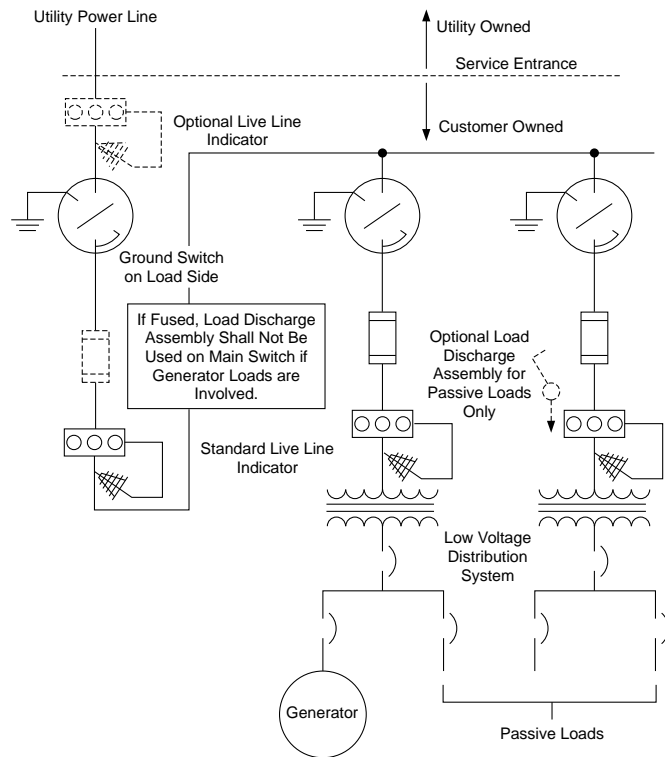
NEC Service Entrance to Double Ended Substation with or without Down Stream Generators with Fused Tie Switch



NEC Service Entrance to Duplex Switch with All Passive Loads



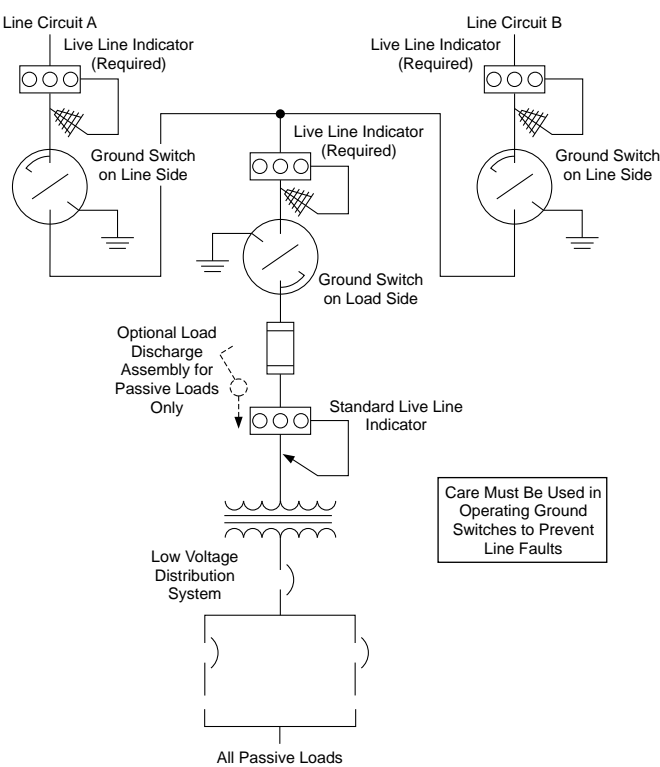
NEC Service Entrance to Duplex with Generator Loads



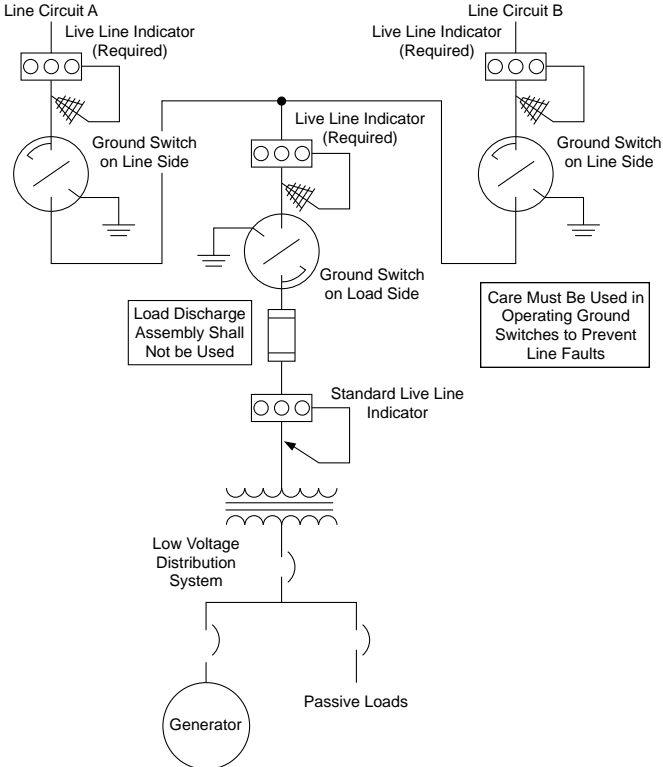
NEC Service Entrance to a Line - Up Feeders with Passive and Generator Loads



HVL/cc™ Grounding Switch Application



Utility or Heavy Industry Ring Bus Arrangement with Passive Loads



Utility or Heavy Industry Ring Bus Arrangement with Generator Loads



Duplex Switch Interlocking (see page 16)

Because of the popularity of the Duplex Switch (two services for a common load), mechanical interlocking is provided between the two Switches. This mechanical interlocking directs the proper operation of the Grounding Switch for the Duplex style switch. The interlocking is arranged such that the Grounding Switch on the #1 Switch cannot be operated if the #2 Switch is closed. Also the interlocking will prevent the re-closing of the #2 Switch if the #1 Switch is in the Grounded position. This interlocking may be employed for other power systems other than Duplex Switches if required. This mechanical interlocking may be provided by either Key Interlocking or by direct mechanical linkage.

Key Interlocking

Key Interlocking is not shown in this application manual as an extensive requirement. It is only shown as an alternative to mechanical interlocking for the Duplex Switch and to enable the use of the LDA for systems having a generator supply source down stream. Key Interlocking may be used as an additional precaution and to assist the user in performing the proper operating sequence before switching operations. It is not the scope of this application section to cover all possible combinations of suitable key interlocking schemes. Each power system must be evaluated and appropriate key interlocking specified to meet particular risks a system may have. This process is typically performed by the Professional Engineer of Record for the facility. Key Interlocking may be applied considering the following general philosophy:

General Philosophy

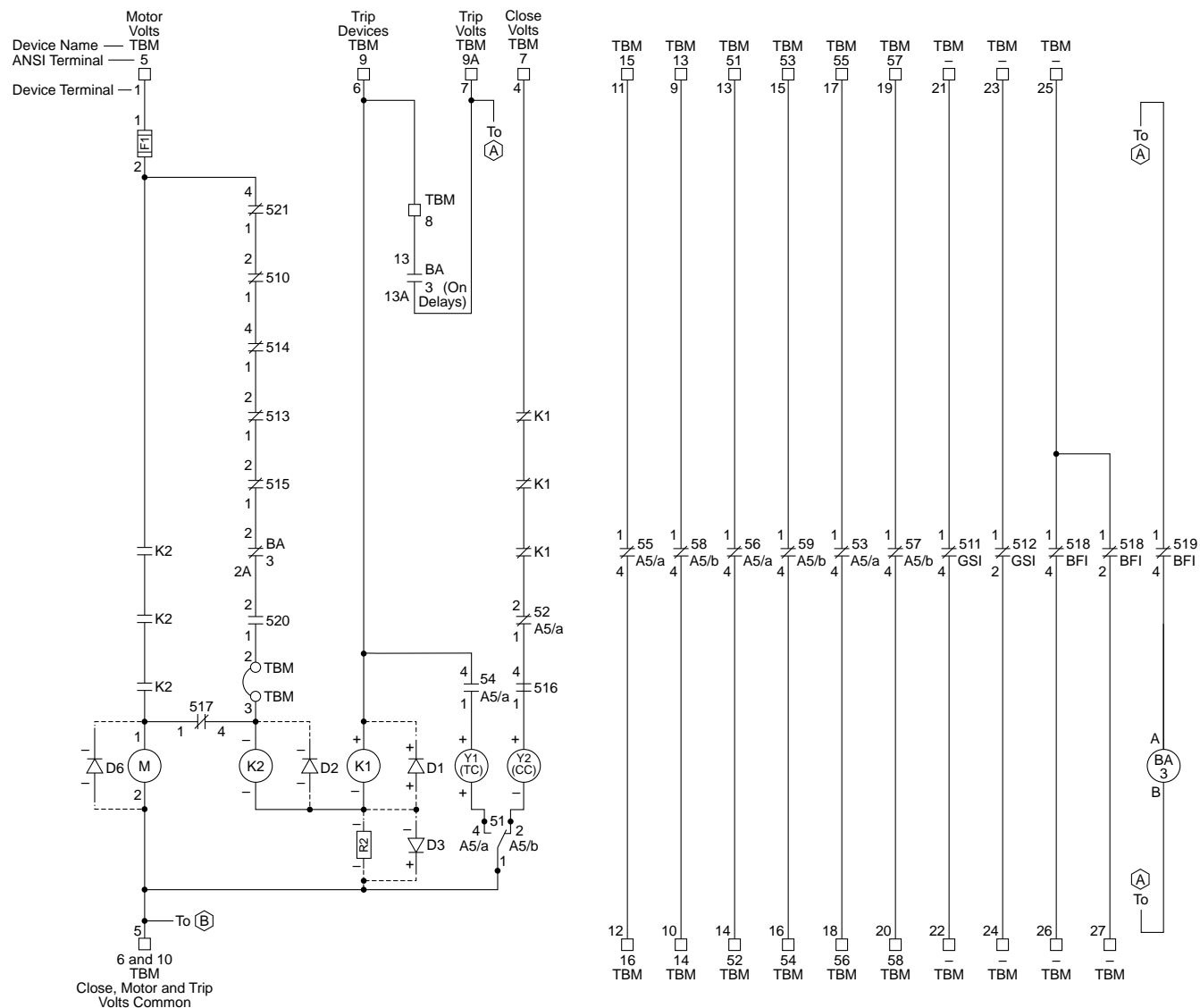
HVL/cc grounding switches are rated to withstand a full rated fault closure. It is considered an unreasonable risk to operate a power system in a manner that would stress the Grounding Switch to its rated capacity and subject the balance of the system including possible power transformers to needless fault currents. Whenever it is possible for a Grounding Switch to be operated in this mode, some mechanical means such as a mechanical interlock or key interlock will be provided by Square D to prevent the operator from inadvertently closing the Grounding Switch.

In a case where a Grounding Switch may be operated such that the fault current is limited by its own current limiting fuses, a mechanical or key interlock is not required because the fault current is significantly limited by the fuse. This exception is not applicable for non current limiting fuses or non fused HVL/cc devices. Since the LLI units are required, the operator must observe for the possibility of back-feeding and avoid the loss of the fuses. Ignoring the lighted LLI indicators can cause the loss of the current limiting fuses. However, the power system is not expected to be over-stressed even if proper procedures are not observed.

The Load Discharge Assemblies are to ensure that charges are drained from de-energized cables and down stream loads. If closed on any continuous source of power, significant damage will occur to the LDA and the HVL/cc. The use of the LDA is discouraged whenever there is any possibility of down stream power back-feeding (as discussed on page 23). They may be used in conjunction with on site generation if key interlocking is provided. Even key interlocking is sometimes compromised which in this case might cause significant damage to the LDA and risk to the operator. Key interlocking is considered acceptable for on site generators because under fault conditions a generator will produce limited, long term short circuit current, limiting the damage to the LDA. They should never be used where back-feeding may come from commercial sources.



Typical Control Circuit



Operation of Switch

1. The switch will close if the closing springs have been charged electrically or manually.
2. The closing circuit has continuity when the closing springs are charged, the switch is open and no continuous trip signal is applied. Applying a close signal energizes the close coil, Y2. It discharges the closing springs, closing the switch. When the switch closes, A5/a and A5/b change state.
3. A5/a closing allows continuity in the trip circuit. A5/b opens, opening the close circuit.
4. Applying a trip signal energizes the trip coil, Y1. It discharges the opening springs, opening the switch. When the switch opens, A5/a and A5/b change state.
5. Spare A5/a and A5/b contacts indicate the breaker state. A5/a closes when the switch closes. A5/b closes when the switch opens.

Legend

F1	Cartridge Fuse, KLM3
K1	Anti-Pump Relay
K2	Control Relay
M	Charging Motor
51, 53-56	Switch Position Auxiliary Switch Contacts (A5/a)
52, 57-59	Switch Position Auxiliary Switch Contacts (A5/b)
510, 11, 12	Grounding Switch Position Auxiliary Switch Contacts
513	Load Break Switch Operating Lever Actuated Contact
514	Grounding Switch Operating Lever Actuated Contact
515, 16	Charging Limit Switch Contacts
517	End of Charge Motor Contact
518, 19	Blown/Missing Fuse Indiction/Interlock
520	Control Depress Contact
521	Lock Auxiliary Switch
TBM	Terminal Block
Y1	Trip Coil
Y2	Close Coil
3	Auxiliary Blown/Missing Fuse Relay (Instantaneous and TDE)

NOTES:

1. Switch shown in the open state with closing springs discharged.
2. Grounding switch shown in the open state.
3. Some terminal points not shown for simplicity.
4. Switch wiring diagram is 44044-177.
5. Destination wire markers without wire numbers are used in mechanism.
6. Diodes are on DC control power module only.



Optional Mechanism Features and Ratings

Motor Option and Open/Close Coil Ratings (OTM/SEM Mechanisms)

		DC			AC	
Nominal Voltage		24	48	125	120	240
Motor Option OTM/SEM						
	Watts (DC)/VA (AC)	206/227	163/202	225/225	264/216	288/240
	Amps	8.6/9.45	3.4/4.2	1.8/1.8	2.2/1.8	1.2/1.0
	Seconds	<6	<7	<5	<5	<5
Opening Coil (SEM Mechanism Only)						
Shunt Trip	Watts (DC)/VA (AC)	224	238	331	402	840
	Amps	9.35	4.95	2.65	3.35	3.50
Closing Coil (SEM Mechanism Only)						
	Watts (DC)/VA (AC)	222	230	325	456	864
	Amps	9.25	4.80	2.60	3.80	3.60

MECHANISM FEATURES

OTM Over Toggle Mechanism

Switch Function

- Manually operated closing and opening independent of the speed of the user

Grounding Switch

- Manually operated closing independent of the speed of the user
- Operating energy is provided by a compressed spring
- Individual operator dependent opening

Auxiliary Contacts

- Switch Position 2 N.O. and 2 N.C.
- Switch Position 2 N.O. and 3 N.C. and Grounding Switch 1 N.O. and 1 N.C.
- Switch Position 1 N.C. and Grounding Switch 1 N.O. and 1 N.C. if with motor option

Mechanical Indication

- Blown fuse indicator if switch equipped with fuses

Motor Operator

SEM Stored Energy Mechanism

Switch Function

- Springs pre-charged without closing the switch in two steps providing stored energy within the mechanism.
- Switch opened and closed by the stored energy independent of the user speed of the pushbuttons.

Grounding Switch

- Manually operated closing independent of user speed
- Operating energy is provided by a compressed spring
- Individual operator dependent opening

Auxiliary Contacts

- Switch Position 2 N.O. and 2 N.C.
- Switch Position 2 N.O. and 3 N.C. and Grounding Switch 1 N.O. and 1 N.C.
- Switch Position 1 N.C. and Grounding Switch 1 N.O. and 1 N.C. if with motor option

Mechanical Indication

- Blown fuse indicator if switch equipped with fuses


Motor Operator

Close Coil

Trip Coil



Square D Company
330 Weakley Road
Smyrna, TN 37167
(615) 459-5026
www.squared.com

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