



## Master Break 5 & 15 kV ANSI, Metal Enclosed LIS TECHNICAL APPLICATION GUIDE

The Master Break Load Interrupter Switchgear by Spike Electric Controls is an ANSI-certified switch ideal for medium voltage circuits between 2.4 kV and 15 kV. It's mainly used to connect or disconnect transformers and can handle up to 600 amperes. Its flexible design fits various distribution needs, including single-circuit transformer control, duplex switching, and selector switch applications. It's popular across industries like oil and gas, pulp and paper, automotive, industrial processes, wastewater, petrochemical, and utilities.



**Valued Partner Acknowledgment Statement:** Spike Electric Controls has partnered with ABB as a Value Add Partner, blending ABB's cutting-edge technology with our expertise in electrical solutions to elevate industry standards. This partnership aims to globally enhance system efficiency, reliability, and sustainability, delivering sophisticated electrification solutions to our customers. Additionally, this alliance includes dual branding of our Switchgear products and extends ABB's warranties through Spike's comprehensive Switchgear solutions, ensuring quality and reliability.



## Certifications:

The Master Break LIS Switchgear is available with either a UL label or as a CUL certified lineup. The manufacturing facility for LIS Switchgear holds an ISO 9001 certification. The cUL mark signifies that the product has been tested and meets Canadian Standards established by the UL organization.

UL certification is an optional feature that must be requested separately.

## Applicable Standards:

The LIS Switchgear is designed, built, and tested in accordance with the IEEE C37.20.3 standard for metal-enclosed switchgear. It meets or exceeds all relevant ANSI, NEMA, and IEEE standards. It is important to note that while the National Electric Code (NEC) covers the installation of electric conductors and equipment, it is not intended as a design specification. Local code authorities evaluate the acceptance of an installed load interrupter switch based on factors independent of the factory-shipped equipment.

## Product Design and Features:

The LIS Switchgear LIS incorporate advanced interrupting technology found in ABB devices such as the VersaRupter switch. The mechanical design of the LIS Switchgear is optimized for flexibility, personnel and equipment protection, ease of maintenance, and installation convenience. It also offers several features for enhanced reliability, safety, and convenience, including:

- Full-height interphase barriers
- A split door design
- Horizontal barriers between the switch mechanism and fuse compartment
- An oversized viewing window
- Separate enclosed low-voltage panel

## Introduction:

The Master Break Load Interrupter Switch Switchgear, is an ANSI-certified load interrupter switch manufactured by Spike Electric Controls. This switch provides reliable and cost-effective load switching and protection for medium voltage circuit applications ranging from 2.4 kV to 15 kV, with a load interrupting rating of 600 amperes.

LIS Switchgear is mainly used as a primary or secondary disconnect switch for transformers. However, its versatile configurations make it suitable for various distribution requirements. It can be employed in single-circuit applications for on/off control of transformers, duplex switching, and selector switch applications.

Typical industries where LIS Switchgear finds application include oil and gas, pulp and paper, automotive, industrial processes, wastewater, petrochemical, and utility sectors.

**Table 1:** Switch ratings (per applicable standards)

Max kV	Impulse Withstand kV (Bil)	Amperes Continuous & Interrupting	Momentary Switch Closed Asym	Fault Close Asym
5.0	60	600	40,000	40,000
15.0	95	600	40,000	40,000

01  
BreakMaster  
showing switch  
assembly



01

02  
BreakMaster  
showing fuse  
assembly



02

03  
VersaRupter  
switch overview  
Modular design

### Construction:

The redesigned LIS Switchgear now features an advanced welded frame combined with welded panels, significantly enhancing both safety and durability. This innovative construction, made from 11-gauge sheet steel for all major components including doors and panels, ensures a more robust and sturdy structure. The upgrade emphasizes a rigorous safety protocol by treating all non-galvanized steel parts and painting them in ANSI 61 gray. Furthermore, the addition of a foot-operated doorstop significantly increases safety, marking a significant improvement over previous designs by prioritizing user security through enhanced structural integrity.

Each switch compartment and the fuse compartment are equipped with individual or "split" doors. The standard indoor depth for the enclosure is 80 inches for 27kV and 38kV, and 48 inches for 5kV, 15kV, and 17kV. The 38kV option is 60 inches wide, the 27kV option is 54 inches wide, and the 5kV, 15kV, and 17kV options are all 42 inches wide. The split rear and side covers allow easy access, and the top access covers are removable for convenient maintenance.

### Enclosure Features:

These steel-enclosed switch sections can be interconnected to centralize, protect, and switch loads of complex systems in medium voltage circuit applications. They are equally suitable for simpler applications such as primary or secondary disconnect switches for transformers. Additional sections can be added to an existing lineup in the field, often without the need for a transition section.

All un-plated steel parts undergo a powder coating paint process that provides lasting protection and passes the 1000-hour ASTM B117 salt spray test for exterior parts.

### Unit Features:

The LIS Switchgear offers optional multi-function meters that measure volts, amps, frequency, power factor, watts, and VARs. These meters can communicate using IEC-61850 RS-232, RS-485, and Modbus protocols. For safety, the metering components are completely isolated within an enclosed low-voltage panel.

To ensure safety during fuse access, the split door design prevents access to the live side of the switch when the lower door is open. The oversized viewing window and switch position markers allow for visual verification of the switch position. Full-height interphase barriers are standard on all switches, and both current limiting and expulsion fuses are available. The standard depths provide ample space for incoming or outgoing cables, and horizontal barriers between the switch mechanism and fuse compartment enhance safety.

\*Note: Optional wiring may not be available in all colors.

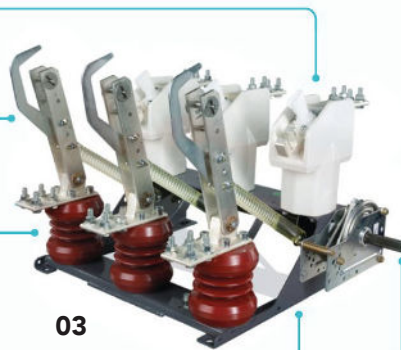
Puffer type arc  
extinguishing system

Current carrying  
components

Stand-off insulators

Heavy duty steel frame

Operating mechanism



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## Standard Features:

- Silver-plated copper bus
- Full-length ground bus
- Oversized viewing window
- Generous cable termination area
- Louvered ventilation (top and bottom)
- Full-height GP03 interphase barriers
- Split rear and side covers
- 11-gauge doors, barriers, and covers
- Tungsten-tipped arc interrupting blade
- Polyester coat paint
- Gray (ANSI 61) paint color
- Individual doors for switches and fuses
- Concealed door hinges
- Mechanical switch and door interlocking
- Non-corrosive permanent nameplate
- Key interlock provisions
- Switch padlock provisions
- Safety horizontal barrier

## Outdoor Enclosures:

For outdoor applications, the LIS Switchgear can be provided in outdoor non-walk-in or Power Distribution Center (PDC) enclosures. Standard outdoor features include:

- Removable filters for louver
- Long life space heaters
- 4-inch channel base
- Sloped roof
- Bottom closure plates
- Rodent barriers

## Interlocks:

The LIS Switchgear is equipped with a mechanical switch and door interlock as standard features. These interlocks prevent the opening of doors when the switch is in the "ON" position and also prevent the switch from closing when the door is open.

**Table 3:** VersaRupter Switch Configuration

Operating Mechanism	Handle Operator (Right Site)			Aux Switch		Shunt Trip	NM Motor (left side)
	A-Mech	Chain Drive	HM Direct Drive	6 Contact	125 VCD	110 VCD	110 VCD/DC
*		*					
*			*				
*			*	*			
*	*		*	*	*		
*	*		*	*		*	
*	*		*	*	*		*
*	*		*	*		*	*
*	*		*	*			*

Additionally, provisions are available for up to six optional key interlocks, which mechanically interlock two or more devices using a removable key that can only be inserted in one location at a time.

## Switch Mechanism:

The LIS Switchgear switch comprises a two-position (open, closed), three-pole, gang-operated, air interrupter switch. It utilizes two different mechanisms for closing and opening functions. The K-mechanism is a single spring snap action device that opens or closes by charging the spring past dead center using a manual operating handle. The A-mechanism, on the other hand, is a dual spring stored energy device suitable for remote tripping applications. The A-mechanism must be used when shunt tripping or mechanical fuse tripping is specified. In the closed operation, the opening spring is charged and latched by an operating handle or a motor operator.

## Fuses:

The LIS Switchgear is compatible with a variety of fuses to meet specific application requirements. A phase loss detection relay and potential transformers (PTs) are installed on the load side of the fuses, connected to terminal blocks to enable blown fuse indication. To facilitate a blown fuse trip option, a shunt trip is additionally installed and connected to terminal blocks for linking to an external power source, enhancing system responsiveness. For those opting for capacitive trip devices, manual selection is available; however, it requires factory quoting to ensure compatibility and cost-effectiveness. This setup ensures both flexibility and safety in electrical system management.

**Table 2:** Fuse Ratings

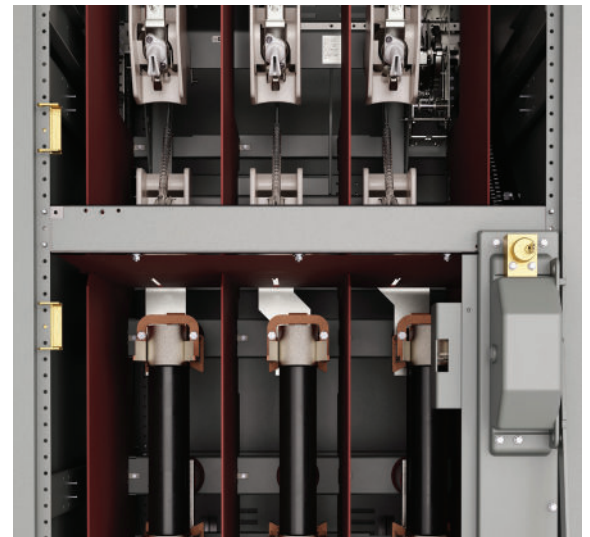
Fuse	Fuse Type	Voltage Class	Ampere Range
Current Limiting Fuses		5 kV	25 A - 900 A
	EJO 1	15 kV	20 A - 300 A
Expulsion Fuses	RBA200	5 kV - 15 kV	40 E - 200 E
	RBA400	5 kV - 15 kV	20 E - 300 E
	RBA800	5 kV - 15 kV	450 E - 720 E

**Table 4:** Other Reference Documents

Document	Document Number
BreakMaster Descriptive Bulletin.....	1VAL107101-DB
BreakMaster Flyer.....	1VAL107101-FL
Installation, Operation and Maintenance Manual for BreakMaster.....	1VAL108001-MB
VersaRupter MV Indoor Switch Descriptive Bulletin.....	1VAL206001-DB
Installation, Operation and Maintenance Manual for VersaRupter.....	IB2.1.2.7-4A
Switchgear Components and Accessories Technical Guide.....	1VAL104601-TG
REF615 Feeder Protection Relay Product Guide.....	1MAC105361-PG
RET615 Transformer Protection Relay Product Guide .....	1MAC204375-PG

### Optional Accessories and Features:

- The LIS Switchgear offers various optional accessories and features, including
- UL/cUL listed
- Copper tin-plated bus
- Insulated bus with joints protected by bus boots
- 80 kA momentary bus rating
- NEMA 2 drip-proof enclosure
- Weather and dust resistant
- Rear doors (full height or double)
- Vertical barriers for added safety
- Rodent barriers to prevent entry
- Bottom closure plates for complete enclosure
- Tamper-resistant hardware for enhanced security
- Auxiliary switches (3NO-3NC)
- Thermostat for temperature control
- Space heater (standard for outdoor, optional for indoor)
- Porcelain insulators for electrical insulation
- Customer metering for accurate measurement
- Surge arresters to protect against electrical surges
- Mimic bus for visual representation
- Space heater switch for easy control
- Ground studs for grounding purposes
- Convenience light for visibility
- Duplex receptacle for additional power outlets
- Run back bus for efficient power distribution
- Top hat for easy installation



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Generally, equipment bearing the UL listing mark can be installed to comply with the NEC.

### Testing:

The LIS Switchgear is designed and tested in accordance with the IEEE C37.20.3 metal-enclosed switchgear standard. During production, it undergoes high potential insulation tests on control wiring and power cabling, control circuit verification, functional operation tests on all devices, mechanical checks for kirk locks and switch and door interlocks, relay checks for proper performance characteristics, ratio and interconnection checks for potential transformers, and polarity verification for current transformers. Factory witness testing is also available upon request.

\*Please note that the National Electric Code (NEC) is not intended as a design specification, and the acceptance of an installed load interrupter switch by a local code authority relies on factors independent of the equipment as shipped from the factory. It is recommended to consult the NEC and follow local code requirements for proper installation.

## Nameplates:

The Master Break LIS & 15kV ANSI Metal Enclosed Load Interrupter Switch is equipped with unit service designation nameplates. These nameplates can be provided as blanks suitable for field engraving or pre-engraved at the factory. The standard nameplate is made of 2-ply thermoplastic material with a black face and white core. The size of the nameplate depends on the unit configuration and is either 2 5/32 inches x 3 1/2 inches or 1 inch x 3 inches. The nameplate is fastened using non-corrosive nylon clips, and stainless steel screws are available as an option.

By default, the nameplates are engraved with white letters on a black background, unless specified otherwise.

## Wire And Cable:

The standard control wire size for the Master Break LIS & 15kV ANSI Metal Enclosed Load Interrupter Switch is 12 AWG. Both control and power wire feature flame-retardant, moisture-heat-and oil-resistant thermoplastic insulation with a VW-1 rating and are rated for 600V. The conductors are made of stranded copper and are of the MTW type. The wire is rated for 90°C, and the terminals are rated for 75°C. Connections to space heater terminals utilize 12 AWG, 600V, 250°C Teflon wire.

As per NEC 79 - 13.2.4.3, the standard colors<sup>1</sup> for AC voltages are:

For AC (120/208/240 Volts):

- Black: Phase 1
- Red: Phase 2
- Blue: Phase 3
- White: Neutral
- Green: Ground

For AC (277/480 Volts):

- Brown: Phase 1
- Orange: Phase 2
- Yellow: Phase 3
- Gray: Neutral
- Green: Ground

Optional wiring available includes SIS heat-resistant synthetic rubber-covered switchboard wire and XHHW flame-retardant cross-linked synthetic polymer, both rated 600 V with stranded copper conductors, and a VW-1 flame rating (no PVC). Wire is rated 90°C and terminals are rated 75 °C.

\*Please note that not all colors are available with optional wiring.

## Environmental Conditions:

The Master Break LIS Switchgear is designed for operation in a clean, indoor environment with a maximum ambient temperature of 40°C. The recommended nominal minimum temperature for storage is -40°C, and for operation, it is -20°C. To ensure optimal performance in temperatures below 0°C, it is advisable to use space heaters. In situations where extremely cold temperatures are expected for extended periods, it is recommended to install the load interrupter switch in heated rooms or enclosures. The relative humidity, averaged over a 24-hour period, should not exceed 95% without condensation.

For outdoor installations, NEMA 3R non-walk-in weatherproof enclosures are required. It is recommended to consider thermostatically controlled space heaters for such applications.

The standard load interrupter switch design has an altitude limit of 6600 feet. If the application exceeds this altitude, please contact the factory for specific recommendations. Some components may have a lower altitude rating, which could further reduce the altitude limit of the load interrupter switch.

The equipment is inherently fungus-proofed, but to prevent fungus growth, it is essential to keep the equipment dry and above the dew point. The use of space heaters is recommended for this purpose. If the load interrupter switch is stored for an extended period, heaters should be energized. In cases involving export crating, provisions must be made on the outside of the crate to allow access to space heaters.

\*Please note that following these environmental guidelines ensures the optimal performance and longevity of the Master Break LIS Switchgear.





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## STRUCTURE:

### Enclosure Types:

The Master Break Switchgear is composed of standardized vertical sections that house vertical and horizontal busbars, wiring channels, and compartmented control units. These sections can be bolted together to create a single panel assembly, with line connection at a single point. The typical shipping configuration consists of a maximum of three sections.

#### NEMA Type 1:

##### Gasketed – semi dust-tight

This type features a gasketed enclosure that is semi dust-tight and designed for indoor use. It includes cushioned doors to reduce vibration. The standard finish is light-gray ANSI 61 with a phosphate rust inhibitor. Unpainted parts are zinc-plated or galvanized. The enclosures come with bolt-on rear covers, and hinged rear doors are available as an option. Pan-type doors utilize quarter-turn fasteners.

Optional features include gasketed doors, cover plates, and operating handles. The enclosure includes two heavy-duty 3 inches by 1-1/2 inches, 12-gauge floor sills and 1/4-inch structural lifting lugs. The standard configuration has an open bottom.

#### NEMA Type 2:

##### Drip-proof, indoor

Designed for indoor use, this drip-proof enclosure protects the enclosed equipment from falling noncorrosive liquids and dirt. It features drip shields on top of the load interrupter switches and neoprene closed-cell gasketing to guard against falling and splashing liquids. However, it is not water-tight.

The construction is similar to NEMA 12 gasketed construction but includes a catch pan-type drip shield on top and an open bottom. The drip shield extends four inches beyond the front of the load interrupter switch.

The standard finish is light gray ANSI 61, and the enclosure is furnished with removable conduit cover plates, unless otherwise specified.

#### NEMA Type 3R:

##### Rain-proof, outdoor

Designed for outdoor use, this rain-proof enclosure protects the enclosed equipment from rain. However, it is not dust-proof, snow-proof, or sleet-proof (ice-proof).

Optional lights and receptacles are available.

The non-walk-in enclosure consists of a specially constructed, fully gasketed section with a mating framework supporting a labyrinth-type sloped roof and an extended front (available as an option at an additional cost).

The enclosure is designed for bottom cable entry and exit, but top entry and exit are also possible. Mesh filters are included on the ventilation louvers, and the enclosure is equipped with a 90-degree door with a wind stop.

Standard features include thermostatically controlled space heaters and 3.5" floor channels.

### AC Power Bus System:

The AC power bus system is available in ratings of 600, 1200, and 2000 amperes and can be tin-plated copper, silver-plated copper,

or bare copper. The horizontal bus has a rated basic impulse level of 95kV. It has a mechanical strength of 25 kA RMS symmetrical for a 40 kA switch under short-circuit currents.

### Ground Bus System:

The ground bus is typically located near the AC power bus on the inside rear of the enclosure. It serves as a common termination point for all ground connections within each switch section, including the enclosing case, and provides a convenient terminal for incoming ground cables. It is important for the customer to establish a suitable ground connection to the bus for it to be effective. Alternatively, when a ground bus is not provided, the ground connection can be made to the provided ground stud.

### Control Bus System:

The control bus system facilitates the distribution of control power throughout a lineup of joined switches. It allows conductors from a single control power source to be terminated in one unit of the lineup, with the control bus used to distribute power to each unit. The control bus can also distribute power from a single control transformer located within the lineup. Typically, the control bus consists of properly sized insulated wire conductors running between terminal boards. The standard voltage for the control bus is 120 or 240 volts AC, and the maximum current rating is determined by the application, taking into account the total present and anticipated future load.

### Enclosure Options:

#### Space Heaters:

Space heaters are essential for preventing moisture condensation inside the load interrupter switchgear. Each vertical section is equipped with a bottom-mounted heater (62.5 watts at 120 V AC). To comply with UL regulations, the heaters are controlled by a thermostat. A terminal board for connecting an external 120 Vac power source is provided in the top horizontal wireway, next to the thermostat(s). This setup allows the heaters to remain operational even when the load interrupter switchgear is de-energized.

If required for export crating, the space heater circuit can be wired to an external plug to power the heaters during shipment and storage. Alternatively, the load interrupter switchgear can provide power for the space heaters if specified.

#### Bottom Plates:

Bolt-on plates are available for the bottom of each load interrupter switchgear section. These plates can be easily removed to facilitate conduit installation.

Extended Height Pull Box (Top Hat): A pull box can be added on top of a vertical section as an optional feature. The standard height is 12 inches, but other heights such as 6, 18, and 24 inches are also available. The top, front, and end covers of the pull box are removable for convenient access.

#### Rodent Barriers:

For additional protection against rodents, metal plates can be bolted to the bottom of each end section. These plates close the opening between the front and rear floor sills. If the floor sills are to be removed or embedded in concrete, rodent barriers are not required.

## CONFIGURATIONS



The Master Break LIS switches are versatile and can meet various distribution system requirements. They are available in different configurations, including single switches, duplex switches, line-ups, and options for motor operators, customer metering, and outdoor construction.

### Weights and Dimensions:

The weight of the LIS Switchgear load interrupter switches varies depending on the configuration type and construction. Please refer to Table 6 for approximate weights for estimation purposes.

### Cable Terminals:

Terminal lugs for both line and load cables are not included unless specified. Options for mechanical compression lugs or NEMA 2-hole compression-type lugs are available. It is essential for the customer to specify the number and size of cables when requesting lugs to be supplied by ABB.

**Table 6:** Typical Weights

Configuration	Weight (lbs)	
	NEMA 1	NEMA 3R
Single	1200	1550
Duplex	2500	3200
Mains/Ties	1800	2400
Branch	1200	1550
20" wide incoming cable	600	850
35" wide incoming cable	1050	1400

**Table 5:** Standard Configurations

Standard Configuration Features	Single	Duplex	Line-up
48" width	*		
84" width		*	
90" width	*	*	*
48" depth standard (includes arrester if required) 60" depth available.	*	*	*
Available section widths:			
55" mains / tie			*
35" branches			*
20" / 35" incoming terminal compartments			*
20" / 35" / 40" auxiliary sections			*
Extension required for oil-filled transformers only (18" wide)	*	*	*
Dry type & cast coil transformers require 3" in throat for outdoor enclosure	*	*	*
Key interlocking standard between switches and fuse compartment		*	



## Incoming Cable Section 30" & 42" W:

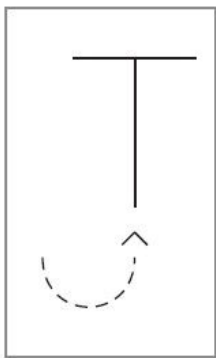
The Incoming Cable Section offers two width options: 30"W and 42"W.

For the 30"W option, it allows for both top and bottom cable entry. Arrester installation is only available for the Top Entry configuration. This option supports front access only or front and rear access. It can be configured with a depth of either 48"D or 60"D and can be set up to feed to the left or right side.

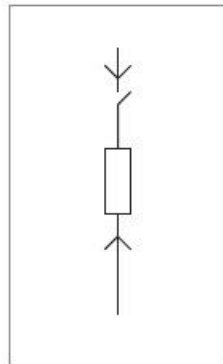
The 42"W option can be configured as a center tap, providing bus provisions that extend to both sides. It offers the choice of top or bottom cable entry, and arresters can be installed for both options. It allows for the installation of CTs, PTs, and CPTs (PT and CPT cannot be installed simultaneously). A depth of 48"D is available, but a depth of 60"D is required for PT or CPT installation. Additionally, an LV box with a meter or relay can be provided. This option provides more space for lugs in cable entry due to the inclusion of a larger lug strap.

Alternatively, the 42"W option can be set up to feed to one specific side (left or right). It supports both top and bottom cable entry options, and arresters are available for both. It allows for the installation of CTs, PTs, and CPTs (PT and CPT can be installed simultaneously). A depth of 48"D is available, but a depth of 60"D is required for PT or CPT installation. An LV box with a meter or relay can also be provided.

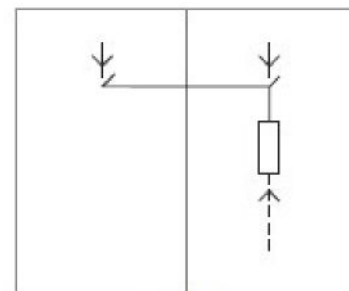
These options offer flexibility in cable entry and installation configurations for the incoming cable section.



Incoming



Single



Duplex

## Transition Section:

The LIS Switchgear can be close-coupled to transformers and switchgear using a transition compartment, creating a continuous lineup. The width of the transition compartment is typically 20 inches, but it can vary.

## Single Switch:

The single switch configuration consists of one load break switch section used for on/off switching. It can be fused or unfused and is connected to a common load.

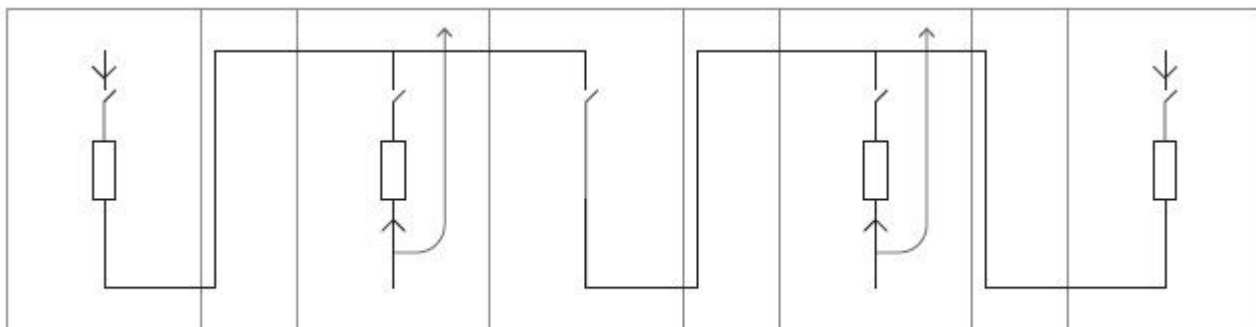
## Duplex Switch:

The duplex switch configuration provides on/off switching using two load break switch sections, one fused and one unfused, connected to a common load. Mechanical interlocks (key interlocks) prevent both switches from being closed simultaneously.

The duplex switch can function as a switch between two power sources, such as a primary and auxiliary power source. Its features include:

- Two 42-inch wide sections connected together
- One set of power fuses
- Four key interlocks as standard
- Optional utility metering compartments

All sections are aligned at the front and back and the main sections are 42" wide and require a 20" transition to branch switches.. The duplex switch offers a cost-effective alternative to other types of switchgear.

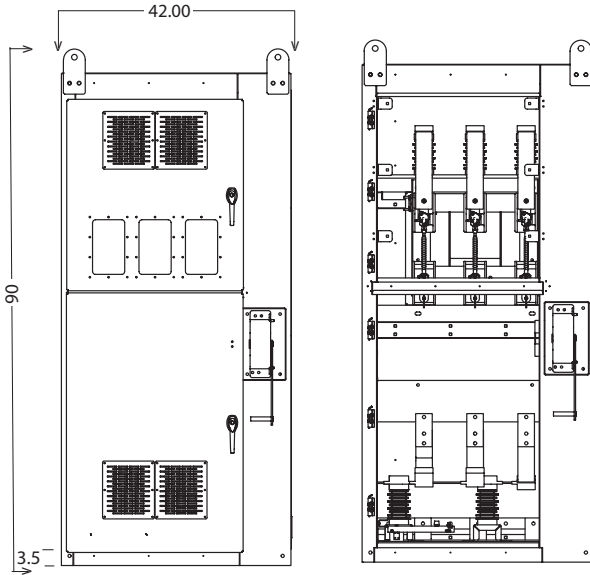


Line-up (main-tie-main)

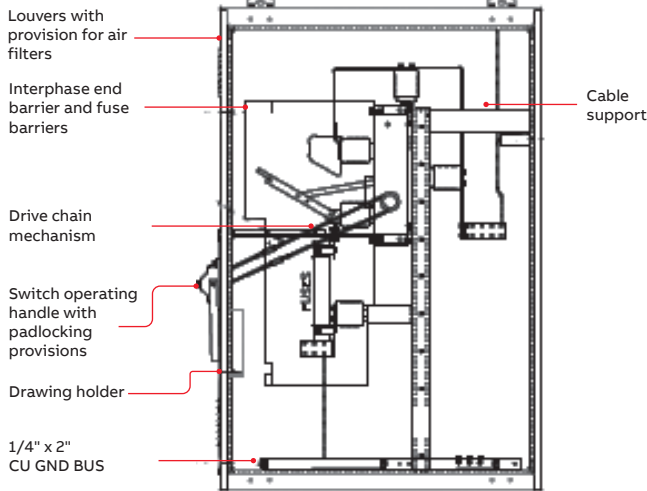
## Enclosure outline dimensions

### Single switch NEMA 1

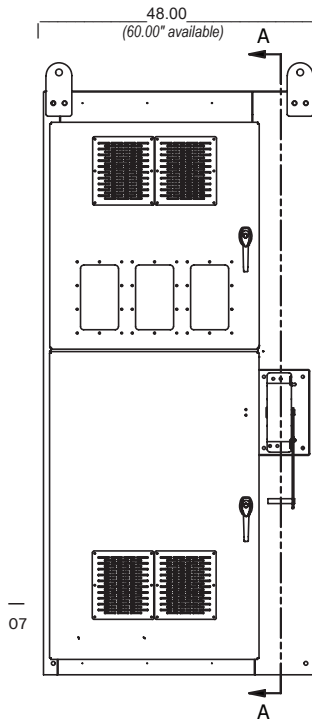
- 05 Front view with and without covers
- 06 Side view without covers
- 07 Right side view



05



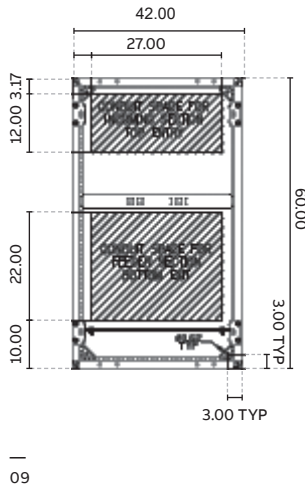
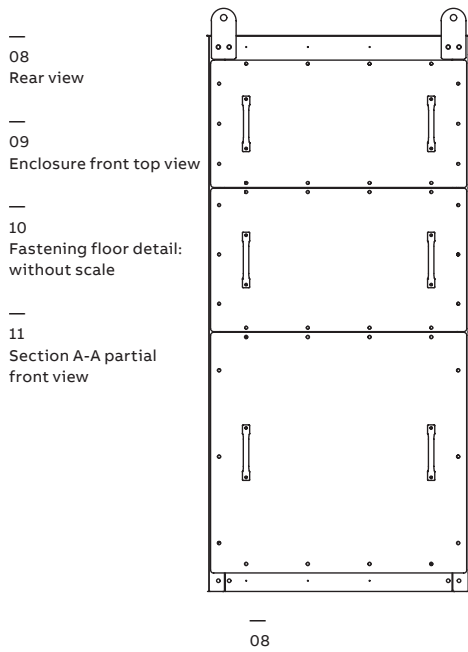
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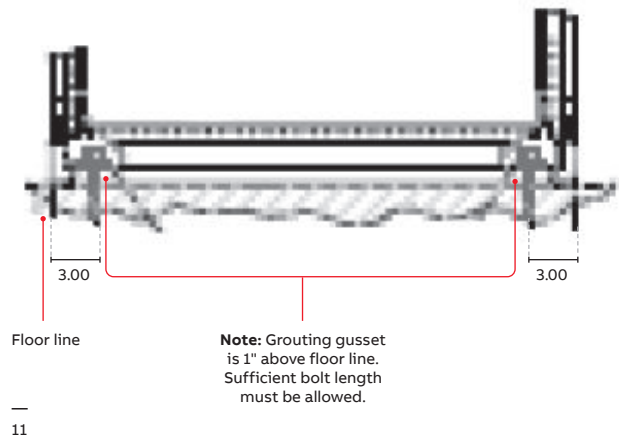
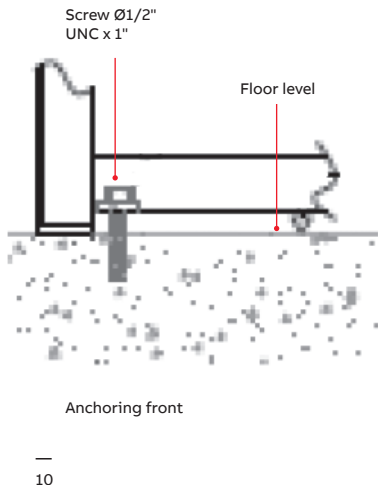


Note:

When embedding anchor bolts in the foundation, their location must follow the drawing provided by ABB for the specific equipment. In non-seismic locations, anchor bolts should be 1/2 inch in diameter, made of Grade 2 steel (minimum). The bolts must extend a minimum of 2 11/32 inches above grade to 3/4 inch above the floor channel.

Note:

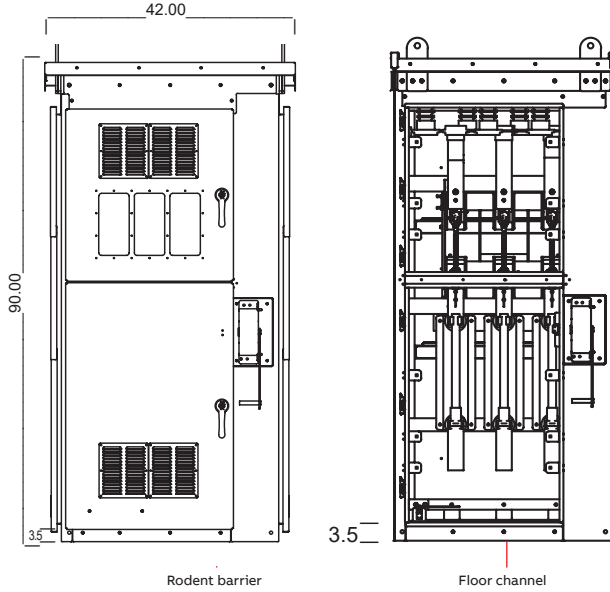
For seismic applications, use 1/2-inch x 13 TPI, grade 5 bolts torqued to 50 foot-pounds. Locate these bolts in each of the four corners in each section.



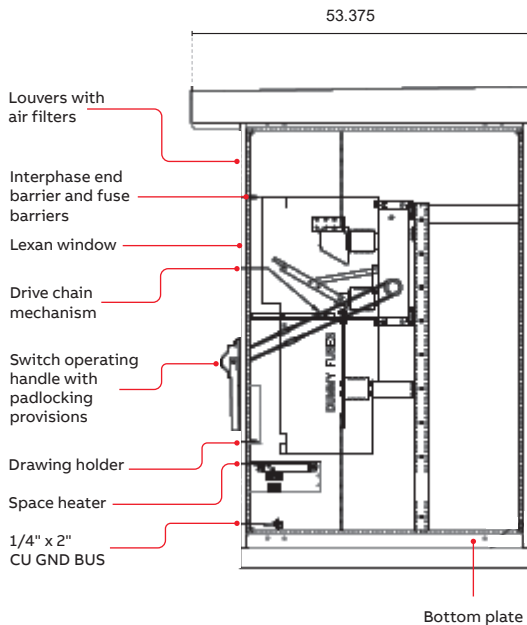
## Enclosure outline dimensions

### Single switch NEMA 3R

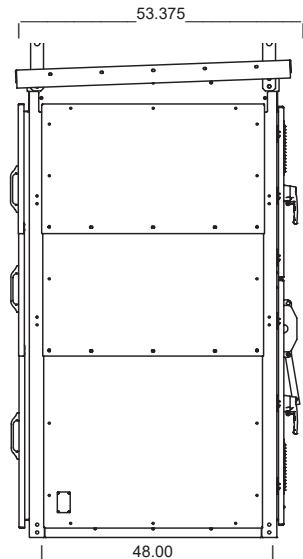
- 12  
Front view with and  
without covers
- 13  
Side view with covers
- 14  
Side view



—  
12



—  
13



—  
14

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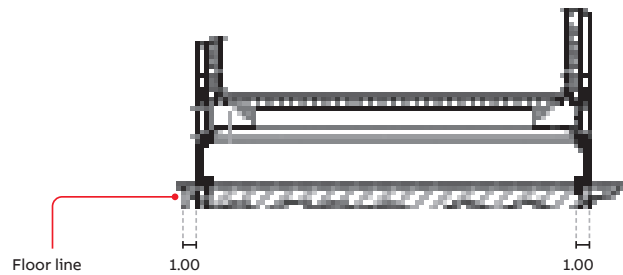
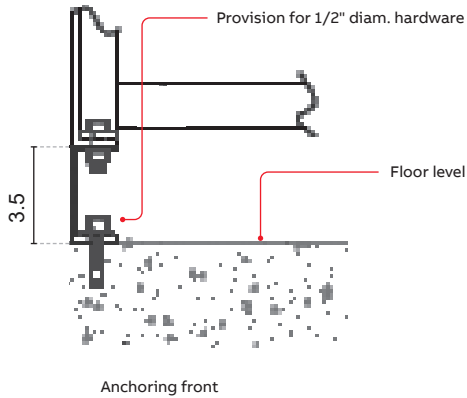
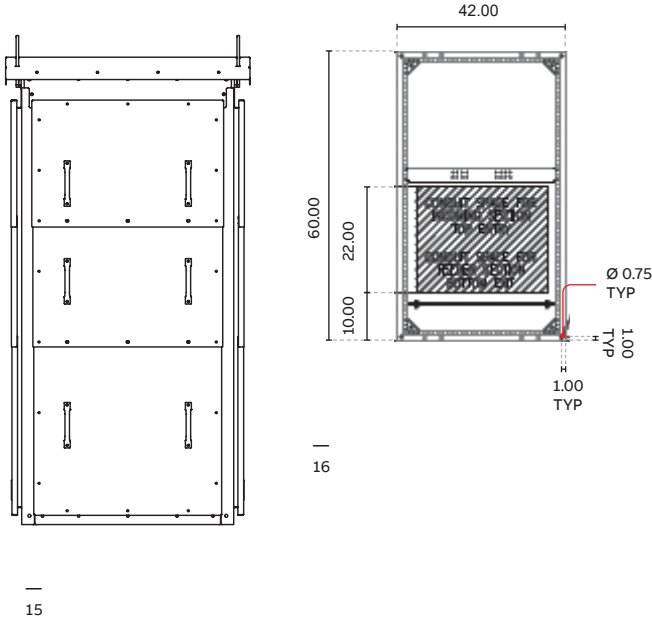


15  
Rear view

16  
Enclosure front top view

17  
Fastening floor detail:  
without scale

18  
Section A-A partial  
front view



17

18



## Enclosure outline dimensions

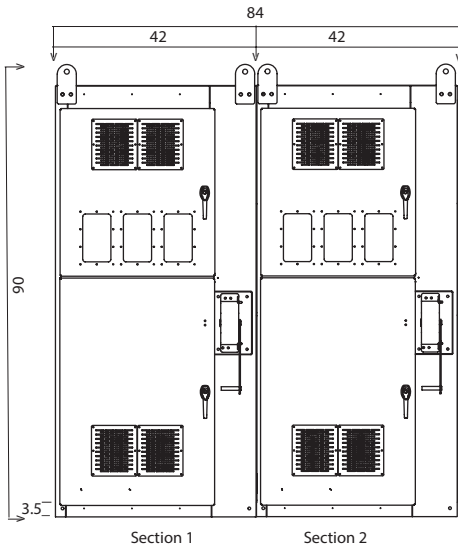
### Duplex switch NEMA 1

—  
19  
Front view

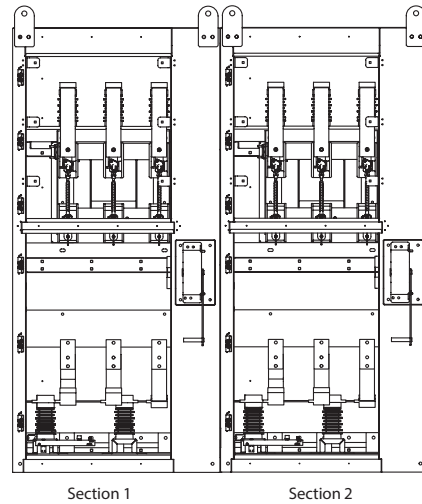
—  
20  
Front view without covers

—  
21  
Side view without covers  
covers SEC 1

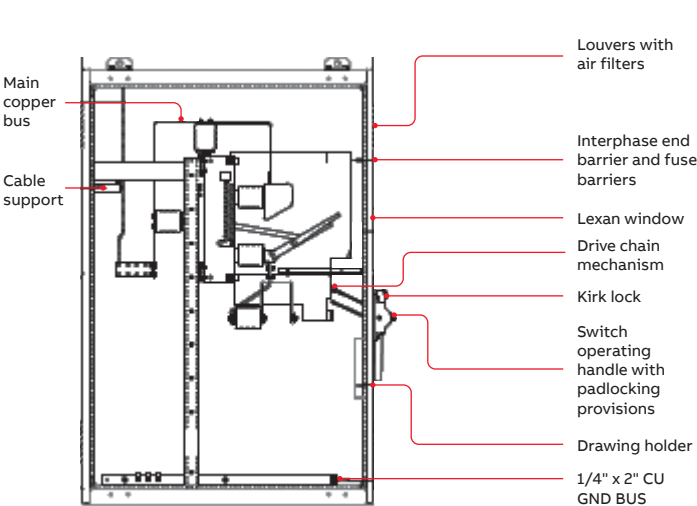
—  
22  
Side view without covers  
covers SEC 2



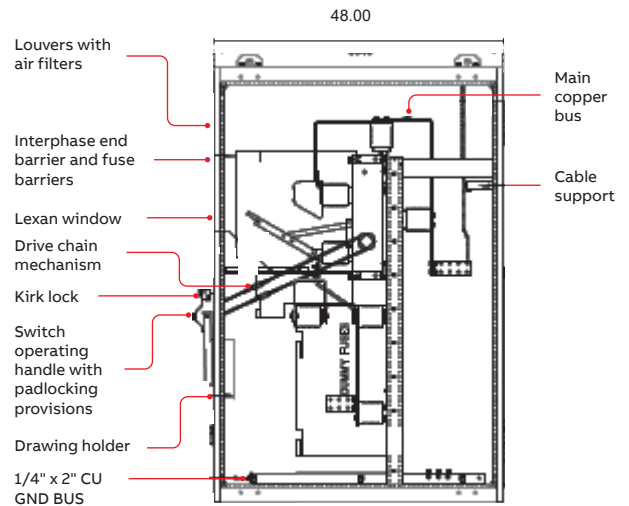
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19



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20



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21



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22

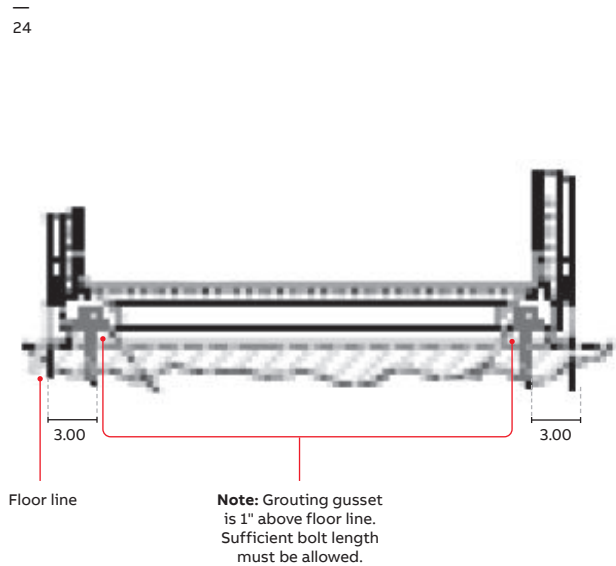
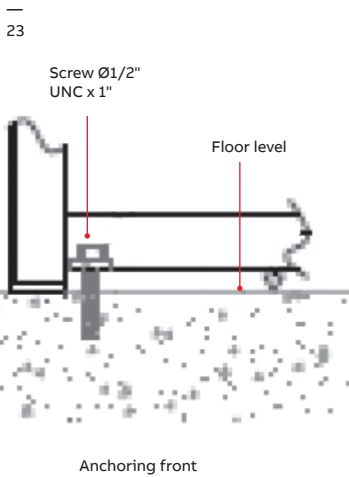
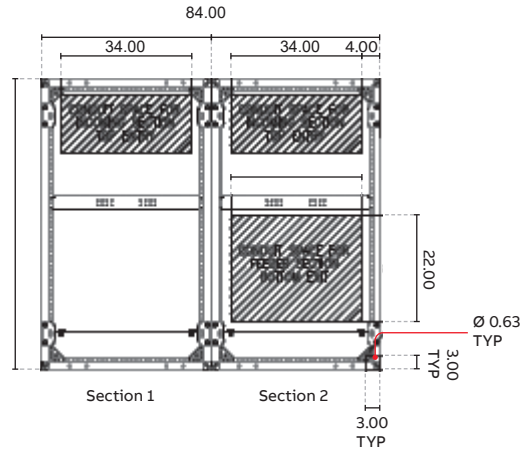
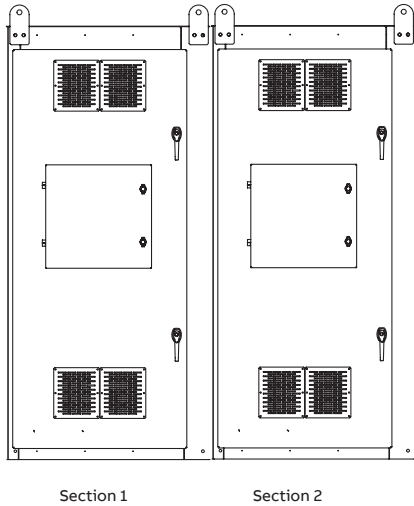


# Master Break

5 & 15 kV ANSI, Metal Enclosed LIS  
TECHNICAL APPLICATION GUIDE



- 23  
Rear view
- 24  
Enclosure front top view
- 25  
Fastening floor detail:  
without scale
- 26  
Section A-A partial  
front view



## Enclosure outline dimensions

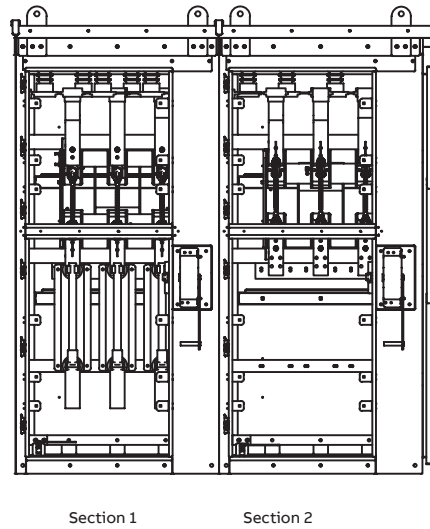
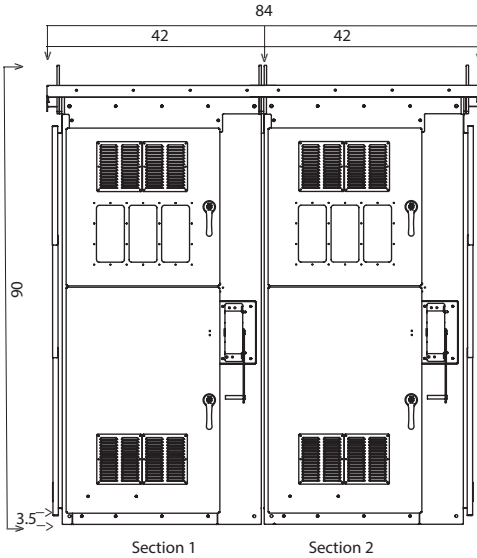
### Duplex switch NEMA 3R

—  
27  
Front view

—  
28  
Front view without covers

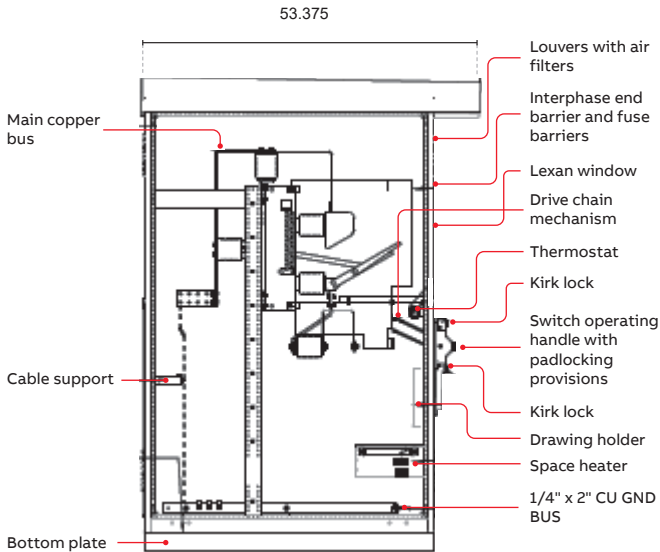
—  
29  
Side view without covers SEC 1

—  
30  
Side view without covers SEC 2

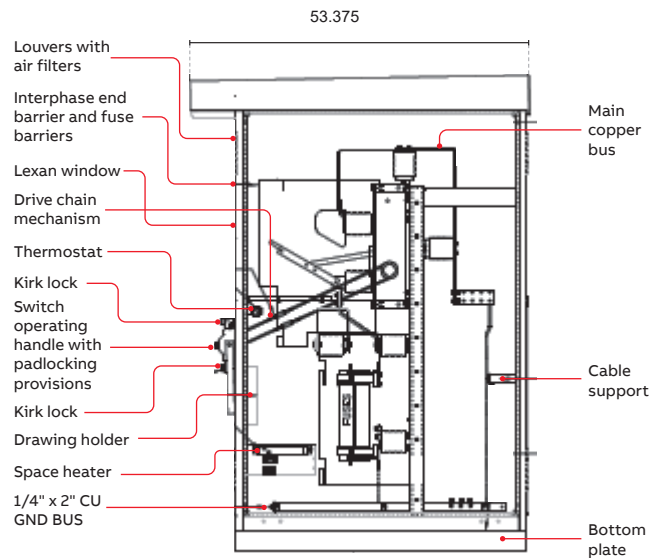


27

28



—  
29



—  
30

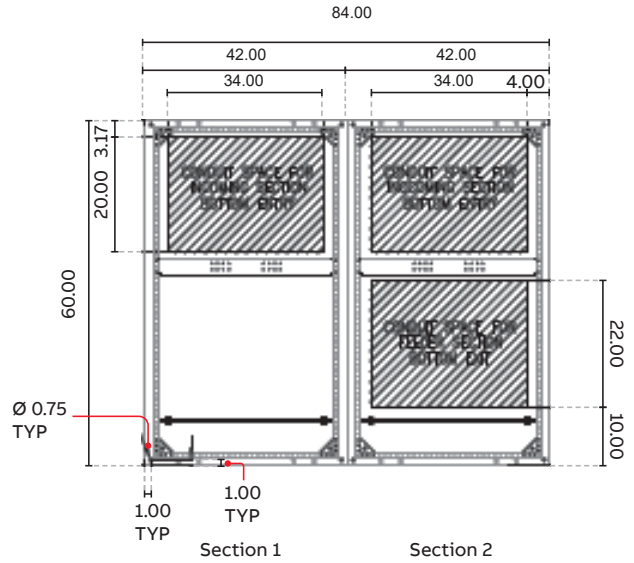
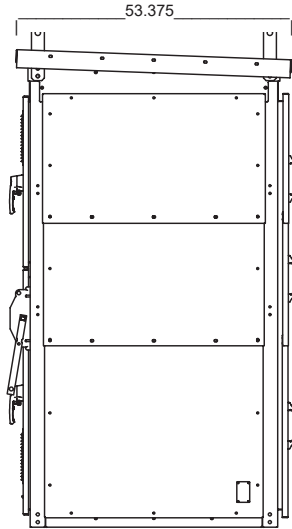


# Master Break

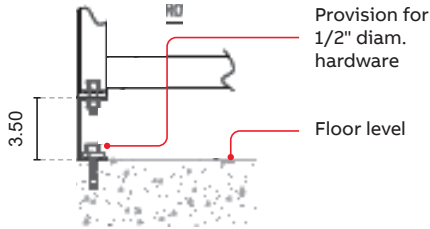
5 & 15 kV ANSI, Metal Enclosed LIS  
TECHNICAL APPLICATION GUIDE



- 31  
Right side view
- 32  
Enclosure front top view
- 33  
Fastening floor detail:  
without scale
- 34  
Section A-A partial  
front view

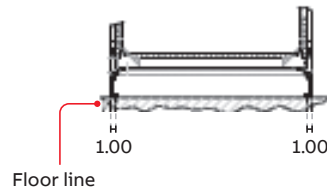


—  
31



Anchoring front

—  
32



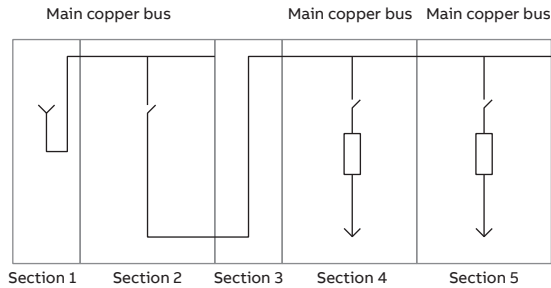
—  
34

—  
33

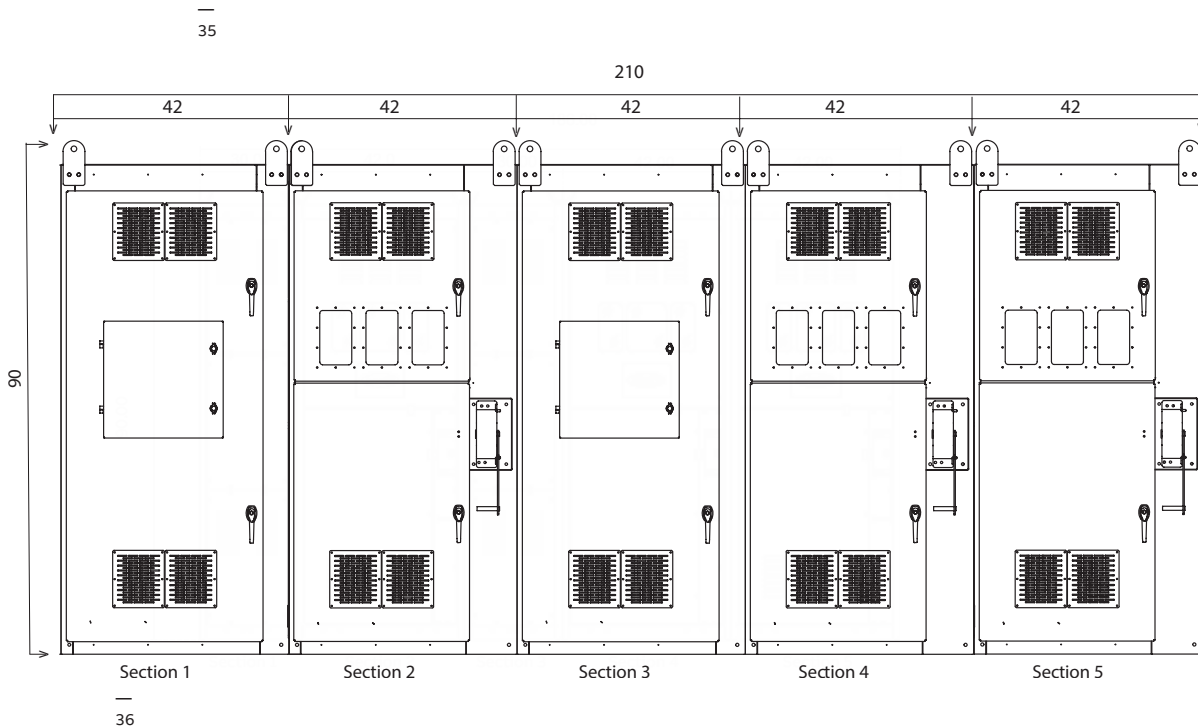
## Enclosure outline dimensions

### Typical lineup NEMA 1

—  
35  
Single line diagram



—  
36  
Front view

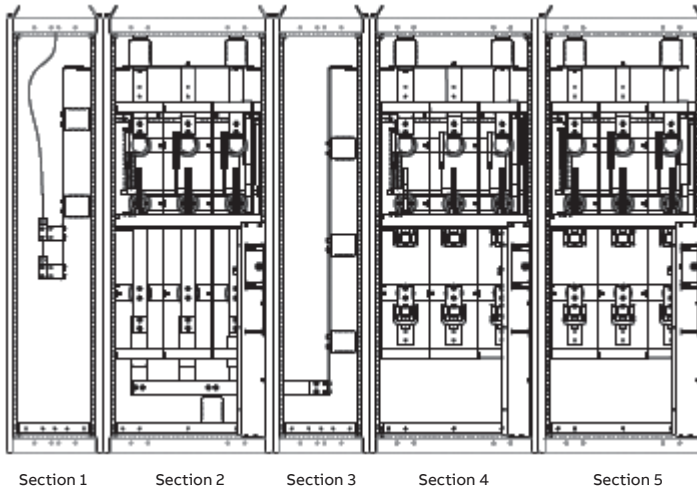


# Master Break

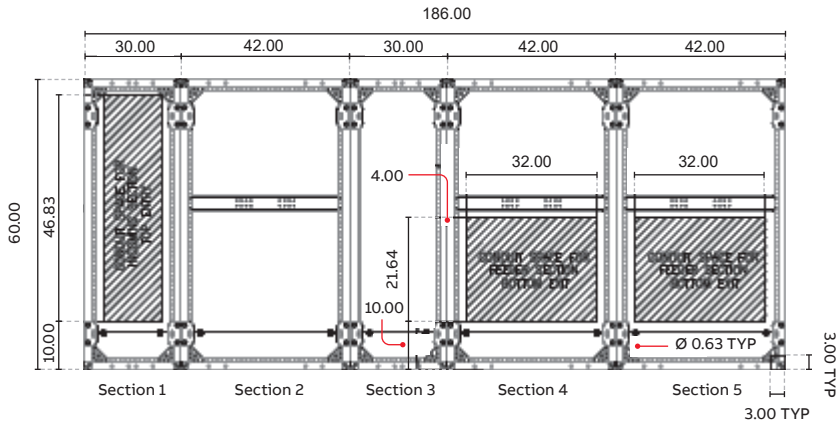
5 & 15 kV ANSI, Metal Enclosed LIS  
TECHNICAL APPLICATION GUIDE



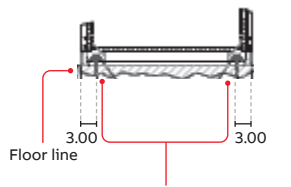
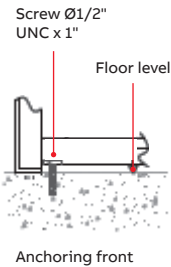
—  
37  
Front view without covers



—  
38  
Enclosure front top view



—  
39  
Fastening floor detail:  
without scale



**Note:** Grouting gusset is 1" above floor line. Sufficient bolt length must be allowed.

—  
40  
Section A-A partial  
front view

—  
37

—  
38

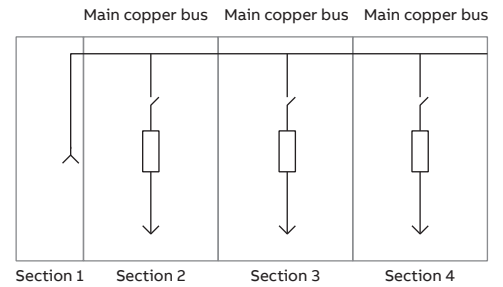
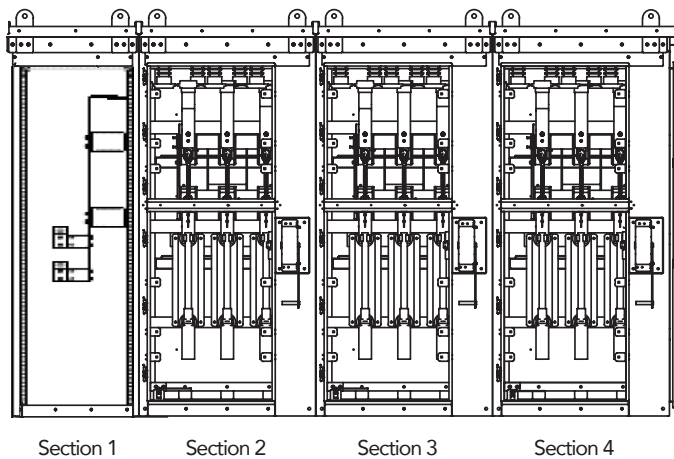
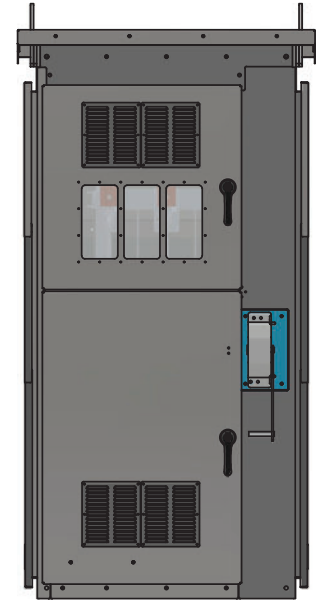
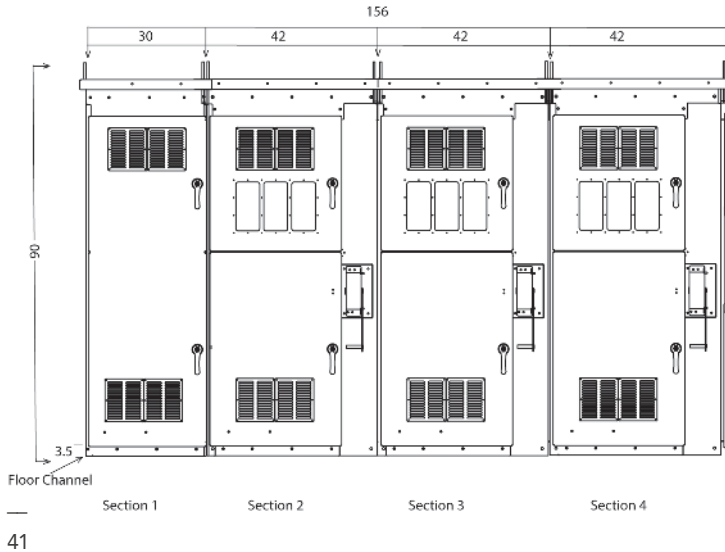
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39

—  
40

## Enclosure outline dimensions

### Typical lineup NEMA 3R

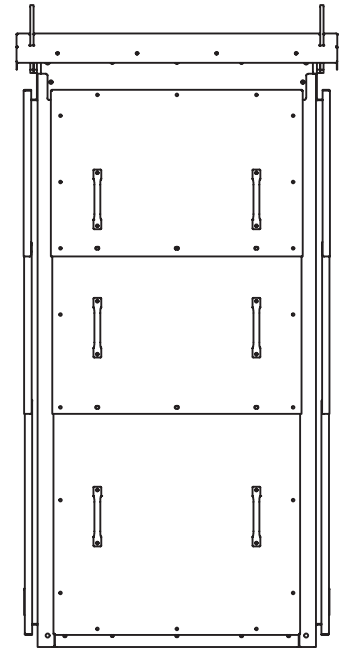
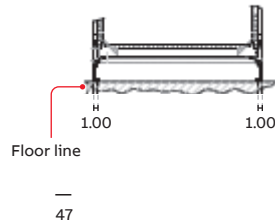
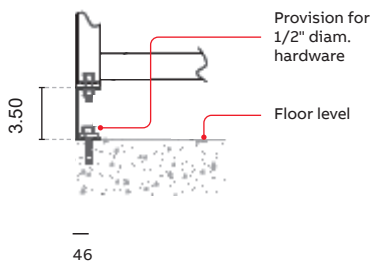
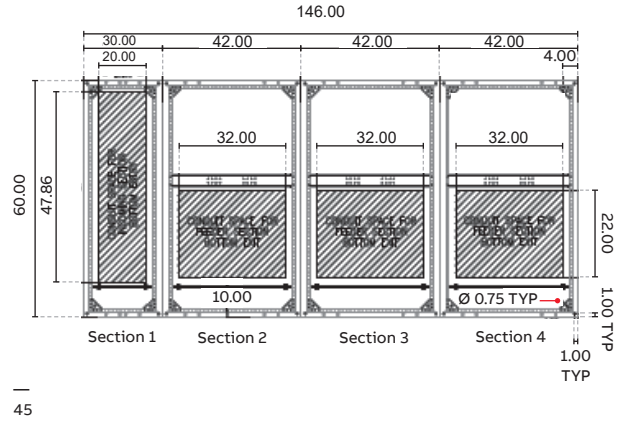
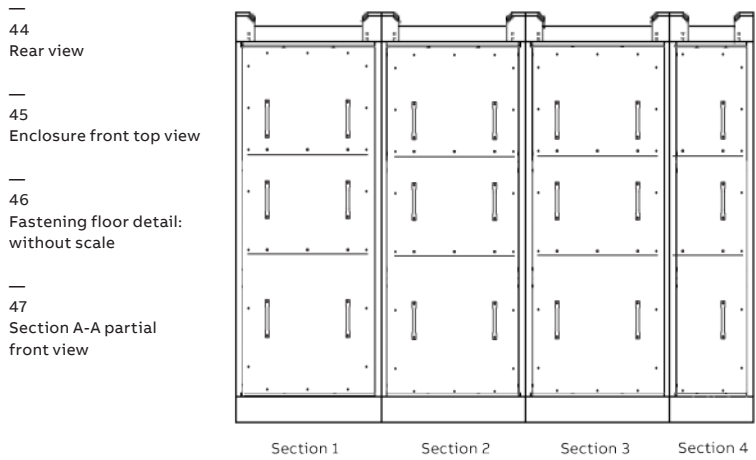
- 41 Front view
- 42 Single line diagram
- 43 Front view without covers





# Master Break

5 & 15 kV ANSI, Metal Enclosed LIS  
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**Green Energy Efficient:** The Master Break Load Interrupter Switchgear by Spike Electric Controls is a green energy-efficient solution for medium voltage circuits, due to its incorporation of advanced interrupting technology with ABB's VersaRupter switch. This technology ensures precise and efficient circuit interruptions, reducing energy loss. Its optimized design for safety, maintenance ease, and flexible application across various industries minimizes downtime and energy wastage. Additionally, features like full-height interphase barriers and an oversized viewing window enhance operational reliability and efficiency, contributing to its energy-saving capabilities.

## COMPONENTS

### VersaRupter® Switch:

48

VersaRupter® Switch

The VersaRupter® switch is a compact and reliable three-pole loadbreak switch that incorporates advanced interrupting technology for switchgear assemblies. It offers numerous benefits, including dependable performance and a space-saving design.

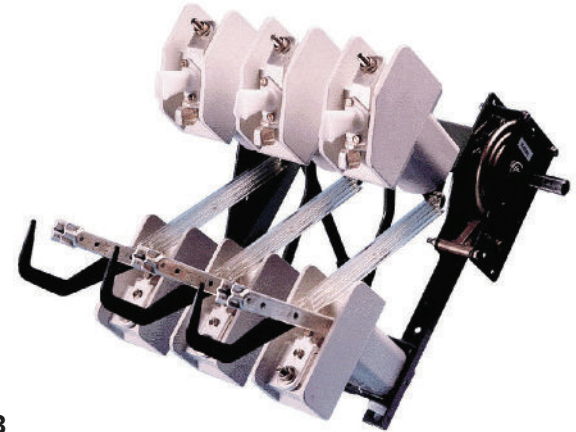
Some of the features of the VersaRupter® switch include:

- **Puffer Arc Extinguishing System:** The VersaRupter® switch features a puffer arc extinguishing system that allows for a high number of operations without excessive wear. It utilizes ablative arc chutes and a balanced combination of air and gas to reliably extinguish the arc.
- **Flexible Mounting:** The switch's latches are not gravity-dependent, enabling flexible mounting arrangements to suit various installation requirements.
- **Tight Phase Spacing:** For most ratings, the VersaRupter® switch offers tight phase spacing without the need for inter-phase barriers, optimizing space utilization.
- **Compact Operating Mechanisms:** The switch is available with compact operating mechanisms in stored energy or snap action varieties, providing efficient and reliable operation.
- **Compact Motor Operator:** The VersaRupter® switch can be equipped with a compact motor operator, allowing for convenient local or remote control.

The standard VersaRupter® switch consists of a heavy-duty steel frame with stand-off insulators, a unique puffer arc extinguishing system, an operating mechanism, and current-carrying components such as blade-type interrupters with cast hinges and jaw connectors.

Optional accessories and features include:

- A variety of operating handles
- A motor operator
- Auxiliary switches
- A shunt trip device
- Mechanical door interlocking
- Key interlocking



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**Table 7: VersaRupter at a glance**

Applications	Metal-enclosed switchgear for utility distribution, industrial, mining and commercial installations		
	Voltage	Loadbreak current	Momentary
Ratings	4.76-15 kV	600 A	40 kA momentary / 40 kA fault close
Actuators	Manual operation with choice of direct side drive, front chain or front shaft drive. Optional motor operation, optional shunt trip with A-mech only		
Options	Auxiliary switches, key interlocks		
Standards	IEEE C37.20.4-2013 & 2001IEC 60129, 60254, 60265, 60694, 420, 62271-105UL and CSA listings available for specific ratings		
Quality	ISO-9001 Complete design type test certificates available upon request. Switches are tested to a minimum of 1000 mechanical operations, 100 open/close operations up to 600 A		

Table 8: VersaRupter switch - technical details

Rated voltage (kV)	Rated maximum voltage (kV)	Rated current (A)	BIL withstand 1 (kV)	60 Hz withstand 1 minute (kV)	Pole spacing (in/mm)	Momentary asymmetrical (kA)	Fault-making asymmetrical (kA)	Peak withstand (peak kA)	Fault-making symmetrical (peak kA)	Short time current (kA/sec)
13.8	15	600	95	36	9.25/235	40	40	65	65	25/2

### Snap Action K-Mechanism:

The K-mechanism is a snap action device powered by a single spring. It allows the switch to open or close by charging the spring beyond its center point using any of the manual operating handles. The K-mechanism is compatible with various handle options and can also be used with type NM motor operators. However, the K-mechanism is not suitable for shunt trip or fuse trip applications.



### Arc Extinguishing Puffer System:

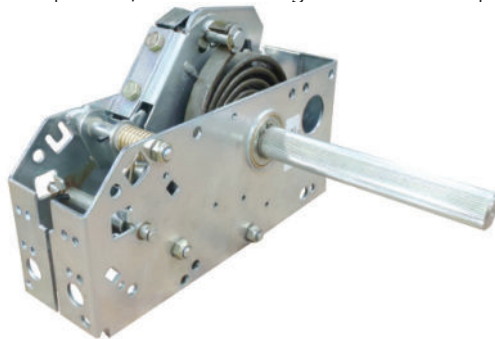
The Arc Extinguishing Puffer System is a highly efficient solution that ensures reliable and extended operations while minimizing wear. It incorporates the following features:

- Ablative arc chutes quench the arc effectively
- Balanced air and gas combination ensures reliable arc extinction
- Extended operations at full rated current
- Up to 100 operations at full rated current compared to 10-20 with ablative chutes alone
- Reduced maintenance due to minimized wear on arc chutes
- Eliminates interphase barriers in most ratings



### Stored Energy A-Mechanism:

The A-mechanism is a dual spring stored energy device designed for remote tripping applications. It is used when shunt tripping or mechanical fuse tripping is specified. In closed operation, the opening spring is charged and latched by an operating handle or a motor operator. The VersaRupter® switch can then be opened through various methods, including movement of the operating handle, motor operator, or electrical signal to a shunt trip device.



### Front Chain Drive Handle:

- Compatible with Kirk Key system
- Provisions for padlock attachment
- Optional door interlock feature
- Designed for K-mech mechanism only



—  
53  
HM front  
direct drive  
(motor) handle  
—  
54  
Auxiliary  
switch  
—  
55  
Shunt trip

### HM Front Direct Drive (Motor) Handle:

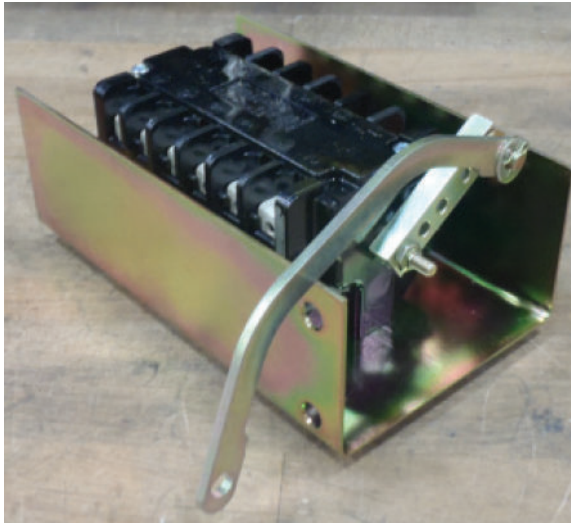
- Padlock provisions for enhanced security
- Optional Kirk Key and door interlocking for additional safety
- Compatible with both K-mechanism and A-mechanism



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### Auxiliary Switch:

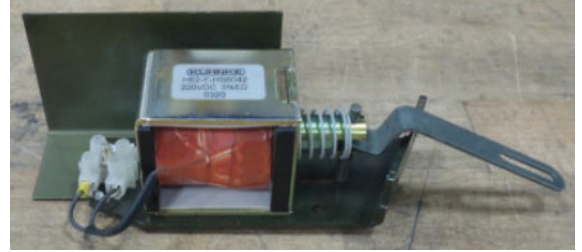
The auxiliary switch is connected to the jack shaft of the VersaRupter® switch and changes state along with the switch. It can be installed on all VersaRupter® ratings and is shipped with an equal number of normally open (NO) and normally closed (NC) contacts, which can be reconfigured in the field. For shunt trip applications, the auxiliary switch must be ordered and wired in series. It is available with six contacts (three NO and three NC).



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### Shunt Trip:

The shunt trip is responsible for actuating the trip latch on the A-mechanism. It can only be used with the A-mechanism and can be activated locally via a push button or remotely. It operates with an intermittent duty coil. To remove power after the VersaRupter® changes state, an auxiliary switch must be ordered and installed in series. The shunt trip can be used on all VersaRupter® ratings with the A-mechanism, with only 110V AC or 125V DC available on the BreakMaster product.



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Table 9: Technical data shunt trip device

Nominal coil voltage	Voltage range	Average current (Amps)		Power (VA)	Resistance
		IN	Istart		
110 VAC	-15% to +10%	2.7	5.0	300	79 +/- 15%
125 VDC	-15% to +10%	1.4	1.4	155	79 +/- 15%

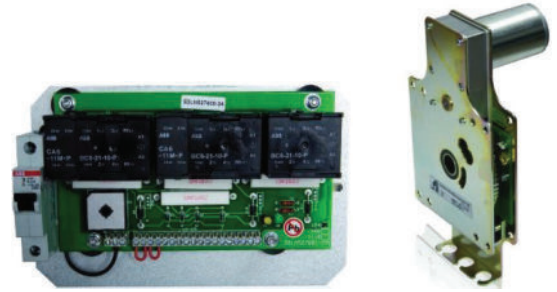


—  
56  
NM motor  
operator  
—  
57  
Spacer  
mounting  
bracket

### NM Motor Operator:

The remote or local electrical opening of the VersaRupter is facilitated by the VersaRupter control switch. This switch is installed directly on the operating shaft of the VersaRupter and is mounted on the left side of the switch, accompanied by a shaft extension. It is compatible with both A-mech and K-mech mechanisms. If manual operation is desired, the HM handle must be used. After each operation, the motor mechanically disconnects, allowing for manual operation of the VersaRupter if needed.

\*Please note that the spacer mounting bracket needs to be ordered separately, depending on the switch rating and desired mounting location. It's important to mention that only 110V AC/DC power is available on the BreakMaster product.



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57

Table 10: Technical data NH motor operator

Voltage AC/DC	110V
Current (A)	0.8
Power consumption (W)	85
Operating time (sec)	~4
Operating temperature (°F)	-40 to 134
Signaling time (sec)	0.5 - 2.0
Weight (lbs) (kg)	13.5 (6)
Operating voltage AC (V)	77 - 137
Operating voltage DC (V)	99 - 150



## PROTECTION AND CONTROL:

### Surge Protection:

Overvoltage damages can reduce insulation life, and protective measures are necessary to mitigate the effects of accidental overvoltage.

The primary factors contributing to overvoltage include:

- Lightning
- Switching surges
- Physical contact with higher voltage system
- Repetitive restrike (intermittent grounds)
- Resonance effects in series inductive capacitance circuits

Switching transients are a common occurrence in electrical systems. For installations with system voltages of 2300 volts and above, it is recommended to consider additional surge protection. This can be achieved through the use of surge capacitors and lightning arresters. Lightning arresters help reduce the amplitude of voltage impulse waves, while surge capacitors not only reduce the amplitude but also mitigate the steepness of the wave front. It's important to note that the installation of arresters may necessitate an auxiliary enclosure with a width of 20 inches.

— 58

Shark 100  
power meter

## SHARK 100 POWER METER High Accuracy Power and Energy Measurement

### Overview:

The SHARK 100 power meter is a highly accurate revenue-grade panel meter known for its exceptional performance in the industry. It offers superior functionality at a fraction of the cost compared to other devices. This meter is ideal for various applications, whether as a new metering solution or a replacement for existing analog meters.

### Application:

Suitable for continuous metering of electrical loads in generator panels, feeders, switchgear, and similar applications. It provides remote status monitoring when used with the EnerVista suite of software. It is designed for both low and medium voltage applications, offering a space-saving and cost-effective alternative to multiple analog meters.

### Key Benefits:

- High precision multifunction power meter with exceptional accuracy
- Outstanding performance at a competitive price point
- Compact design for easy installation, programming, and user-friendliness
- 0.2% class revenue-certified energy and demand metering for reliable measurements
- Accurate measurement of total harmonic distortion (%THD) for enhanced analysis
- Compatible with both ANSI and DIN cutout standards for versatile applications
- Large 3-line .56-inch bright LED display, ensuring improved visibility and extended lifespan
- User-programmable to accommodate various system voltages and current measurements
- Standard Modbus and DNP communications for seamless data integration

Optional Ethernet port available for simplified integration into new or existing LAN infrastructures and multi-point connectivity

### Monitoring and Metering Features:

- True RMS multifunction measurements including voltage, current, power, freq., energy, etc.
- Meets ANSI C12.20 (0.2%) and IEC 687 (0.2%) accuracy classes
- Future field upgradeable for added functionality, without removing installed meter
- Load percentage graphical bar for instant load visualization

### Communications:

- RS485 Modbus and DNP 3.0 Protocol up to 57.6K Baud (Serial Option)
- Modbus TCP Protocol through 10/100BaseTX via RJ45 (Ethernet Option)
- 3 Line .56 inches Bright Red LED Display
- Front IrDA Port laptop communication
- Pulse output for accuracy testing and energy

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# Master Break

5 & 15 kV ANSI, Metal Enclosed LIS  
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## SHARK 200 POWER METER Power Quality and Energy Cost Measurement

### Overview:

The Shark 200 meter provides revenue class (0.2%) three phase power metering with optional Ethernet, relay, status, and analog output communication modules. This flexible meter can be used for a wide range of high accuracy applications including disturbance recording and power quality studies.

Shark 200 can easily be mounted in a panel for generator monitoring, substation automation, power quality studies, data recording and more. The meter can also provide data to RTUs, PLCs and other control devices.

The Shark 200 is a highly accurate meter providing 0.1% accuracy for Voltage and Current. The unit's real-time clock provides time stamping of all logs as they are created. Up to 4 MB of data can be logged for analysis of historical trends, limit alarms, I/O changes power quality recording and sequence of events.

### Applications:

- Four quadrant energy and power monitoring of distribution feeders, transformers, reactors and generators
- Power monitoring of LV and MV industrial power control centers and motor control centers
- Energy monitoring of commercial and distribution utilities

### Key Benefits:

- Four Quadrant Energy and Power Measurement, complying with ANSI C12.20 (0.2% Accuracy)
- Analyze power quality over long periods of time to improve network reliability through high resolution event and disturbance recording
- Ideal for monitoring industrial power centers, data centers and hospitals due to high accuracy disturbance recording (up to 512 samples/cycle)
- Retrieve archived data, capture past events and analyze disturbances through high resolution data recording (up to 4MB of data logging)

Flexible communication options provide easy to access meter values, simplified configuration and seamless integration into new or existing automation systems



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### FEATURES:

#### Metering:

- Meets ANSI C 12.20 and IEC 687 (0.2%) accuracy
- Ia Ib Ic In
- Va Vb Vc Vab Vbc Vca
- Hz W VAR VA
- Wh VARh VAh
- Demand: W VAR VA
- Power factor
- Voltage and current angles
- Load bar

#### Power Quality:

- Harmonics to the 40th order
- Total harmonic distortion
- Disturbance recording and waveform capture
- Sag and swell

#### Data Logging:

- Up to 4 MB memory
- Disturbance recording power quality studies
- Load studies

#### Communications:

- Standard RS485 Modbus (DNP 3.0 and Modbus RTU or ASCII)
- Optional Ethernet 100BaseT
- IrDA Port
- Intuitive faceplate programming

#### Software:

- Embedded web server
- Communicator
- Enervista integrator
- Enervista launchpad

## PQM II POWER QUALITY METER Power Quality And Energy Cost Management

### Overview:

The PQM II, by Multilin, represents a new benchmark in metering technology. This advanced meter adheres to the latest industry specifications and offers precise and dependable three-phase power metering. It comes in a compact and contemporary package with the option for Ethernet and fiber communications module. The PQM II is suitable for various applications, including the metering of distribution feeders, transformers, generators, and motors.

### Applications:

- Metering distribution feeders, transformers, generators, capacitor banks, and motors.
- Ideal for medium and low voltage systems.
- Well-suited for commercial, industrial, and utility environments.
- Provides flexible control for demand load shedding, power factor management, and more.

### Key Benefits:

- Power quality metering with waveform capture and data logging
- User-friendly interface with keypad and large illuminated display
- Multiple communication ports for seamless integration with DCS and SCADA systems
- Supports DNP 3.0 and Modbus protocols
- Digital and analog I/Os for control and alarms
- Voltage disturbance recording for electrical sag and swell events

### Features:

#### Monitoring and Metering:

- Current measurements:  $I_a$ ,  $I_b$ ,  $I_c$ ,  $I_n$ .
- Voltage measurements:  $V_a$ ,  $V_b$ ,  $V_c$ ,  $V_{ab}$ ,  $V_{bc}$ ,  $V_{ca}$ .
- Voltage and current unbalance monitoring.
- True power factor crest and K factor measurements.
- Frequency (Hz), active power (W), reactive power (var), apparent power (VA).
- Energy measurements: Wh, varh, VAh, energy cost.
- Demand measurements: Current (A), active power (W), reactive power (var), apparent power (VA).
- Harmonic analysis up to the 63rd order, including THD and TIF.
- Event recorder with a capacity of 150 events.
- Waveform capture functionality.
- Data logger with a capacity of 98,000 events.
- Voltage disturbance monitoring.

#### Communications:

- Front RS232 serial port (1,200 to 19,200 bps)
- Two rear RS485 serial ports with ModBus and DNP 3.0 protocol

- Ethernet connectivity provided by MultiNet
- EnerVista software is provided for setup and monitoring functions
- External dial-in modem capabilities

#### Protection and Control:

- Measurements: Current (A), voltage (V), active power (W), reactive power (var), apparent power (VA), energy (varh, Wh), power factor (PF), frequency (Hz), unbalance.
- Demand measurement capabilities.
- Load shedding functionality.
- Power factor control.
- Pulse input totalizing.

For more information on PQM II, please visit: <https://www.gedigitalenergy.com/multilin/catalog/pqmil.htm>



## THREE-PHASE VOLTAGE MONITORS Model SPVRB

### General:

The SPVRB Voltage Sensing Relay, a UL Listed device with file No. E103039, offers reliable protection against single phase, phase loss, phase unbalance, and phase reversal in power systems. Its output contacts remain unaffected under normal conditions, changing state only when a prolonged abnormality occurs beyond the preset trip delay. Even during total power loss or de-energization, the SPVRB relay maintains the position of its output contacts. This versatile relay is highly recommended for use with manual reset switches and breakers, making it suitable for various applications. It is particularly effective in handling phase loss situations involving motor loads.



# Master Break

5 & 15 kV ANSI, Metal Enclosed LIS  
TECHNICAL APPLICATION GUIDE



## Features:

- Phase unbalance detection: 8% threshold.
- Adjustable trip delay: Trip delay can be set between 1 and 10 seconds after a fault occurs, preventing nuisance operations.
- Output relay: The relay features normally de-energized, form C contacts for easy circuit configuration.
- Electro-mechanical fault indicator: The indicator retains the memory of faults until manually reset.
- Door or panel mounting options available.
- Status indicator: Equipped with a bi-colored LED.
  - Green: Output relay is de-energized (normal condition).
  - Red: Output relay is energized (fault condition).
  - Dark: Output relay is de-energized (input power off).
- Provides protection against single-phase faults, phase loss, phase unbalance, and phase reversal.
- Automatic or manual mode:
  - Automatic mode: The relay automatically resets to normal once fault conditions are removed.
  - Manual mode: The relay resets to normal after the local or remote reset button is pressed, following the removal of fault conditions.

SPVRB - XXX --|  
                  |  
Input voltage:..|

120/208/240/480 or 575 Vac, (60 Hz)

380 or 415 Vac, (50 Hz)

<sup>1</sup> Bi-Colored LED Indicator

- Power system condition Normal (Green), Trip (Red)

<sup>2</sup> Electromechanical Diagnostic Indicator

- Phase loss

<sup>3</sup> Adjustable System Delay

- Phase loss
- Phase unbalance
- Single phase
- Phase reversal
- Under and over voltage

## SWITCHGEARMD™

### Asset Health Monitoring:

SwitchgearMD™ is a comprehensive monitoring and diagnostic solution designed for switchgear systems up to 27 kV. It provides continuous 24x7 monitoring of temperature, humidity, and partial discharge, enabling maintenance personnel to detect and address issues before equipment failures occur. Users can monitor their equipment on-site using the SWICOM HMI or remotely via a SCADA system. This proactive approach reduces downtime and enhances overall reliability.

SwitchgearMD™ supports both conventional and digital switchgear and offers two types of sensor solutions. The first is a wireless solution utilizing SAW sensors for temperature, humidity, and partial discharge monitoring. These sensors employ UHF measurements and provide real-time data. The second option is a wired solution using IR sensors for temperature and humidity monitoring. Both sensor types can be integrated with new switchgear installations or retrofitted to existing setups.

The temperature monitoring sensors include infrared (IR) sensors and surface acoustic wave (SAW) sensors. IR sensors require a line of sight and measure temperature rise ( $\Delta T$ ) relative to ambient conditions. This eliminates variations in measurements across panels or sites. The readings are transmitted as mV output signals to the SWICOM HMI or a control system.

IR sensors are made of non-conductive plastic bodies that are hermetically sealed and fully potted. They are mechanically and metallurgically stable throughout their service life and do not contain active electronic components or require an external power source. These sensors have a lifetime calibration and are UL recognized and CE certified.

The other sensor type, SENSEOR SAW sensors, is used for temperature and partial discharge monitoring. These wireless, surface-mount sensors are passive components with no active electronic elements or power requirements. The embedded piezoelectric SAW transducer converts electrical current into vibrations and then back to an electrical signature correlated with temperature. The sensors have internal antennas reflecting wireless RF signals to external antennas, which receive signals from an active Reader powered by a 24V DC supply. The Radio Frequency Transceiver enables remote interrogation of multiple wireless SAW sensors.

For cable connection monitoring, ABB's standard approach involves using IR sensors to monitor all outgoing/incoming points. If partial discharge monitoring is required in addition to temperature and humidity, the wireless SAW sensors must be utilized. However, if only partial discharge monitoring is needed, SENSEOR antennas alone are provided. Bus temperature monitoring is not necessary for conducting partial discharge monitoring

### Cable Temperature Ratings:

When using insulated primary cables for incoming or outgoing feeder connections to the switchgear bus, it is recommended to use cables with a temperature rating of 90°C. The full load current rating of the cable should be based on the 90°C ratings. The connection joints for incoming or outgoing cables are limited to a 45°C rise over a 40°C ambient temperature, resulting in a total temperature limit of 85°C. If the bus the cable is connected to is rated for 1200 A, the cable size and temperature ratings should not exceed 1200 A at the 90°C temperature rating of the cable.

It is important to avoid using cables with lower temperature ratings, such as 75°C, as they can overheat if the bus connection operates at full rated current. Similarly, using cables with higher temperature ratings, such as 105°C, can lead to overheating of the bus bar connection under full rated current. When using cables with higher temperature ratings, ensure they are sized based on the 90°C ratings for full load current.

## Packaging and Storage:

### Domestic Packaging:

Typically, a LIS Switchgear Lineup is packaged and shipped in separate vertical sections to facilitate handling. Upon customer request, the shipment can be split into a maximum of 2 or 3 sections. Each section or shipping split is mounted on a hardwood skid, making it easy to move using rollers or a fork-lift truck. Lifting eyes are also provided for crane transportation. To safeguard handles and devices, shipping blocks are placed on the front of the sections. Furthermore, the sections are wrapped in transparent stretch polyfilm to protect them from dust and dirt commonly encountered during transportation. Bus splice bars necessary for connecting the sections together are included.

### Export Crating:

For export shipments, the sections are securely fastened to a skid with a solid floor. A plywood crate, reinforced with 2 x 4 supports at the top and corners, is used to enclose the equipment, with a thickness of 3/8". To provide additional reinforcement, three horizontal steel bands measuring 1 1/4" are placed around the crate. It is important to protect the equipment from moisture and extreme temperatures during both shipment and storage (refer to the Environmental Considerations in the Overview section). In cases of prolonged shipping with export crating, it is recommended to wire the equipment's space heaters (if specified) to an external power source while in transit to minimize condensation.

### Storage:

If the equipment needs to be stored for an extended period, the following precautions should be taken:

1. Remove the equipment from the crate.
2. Store it in a clean, dry area at a moderate temperature. Cover it with a suitable canvas or heavy-duty plastic cover to prevent the entry of foreign materials.
3. In cool or damp storage areas, not only should the equipment be fully covered, but heat should also be provided to prevent moisture condensation inside the equipment. Activate the space heaters (if included in the equipment) or place a standard 120-volt, 75-watt lamp at the bottom of each vertical section.

## Paint Finish:

### Indoor equipment

Indoor Equipment: The standard paint system for indoor equipment involves two phases:

#### Phase I – Cleaning

- Steel parts are cleaned in a 7-stage spray washer using controlled cleaning solutions.
- After cleaning, the steel parts go through a drying oven at 300-350°F to ensure proper drying.
- This process produces an Iron Phosphate coating of at least 150 milligrams per square foot to meet MIL Spec. TT-C-490.

Table 11

Stage	Temperature	Chemical solution(s)
1-Cleaning	115-120°	Ferro clean
2-Rinse	105-118°	None
3-Iron phosphate	90-105°	Secure low foam
4-Rinse	Ambient	None
5-Non chrome sealer	Ambient	Non chrome final seal
6-Rinse	Ambient	None
7-Deionized rinse	Ambient	None

#### Phase II – Painting by electro-static powder process

- Primed metal parts undergo electrostatic coating with a powder paint.
- The powder paint used is 670-011 ANSI-61 Polyester Paint (Light Gray).
- After coating, the metal parts enter a drying oven at 360°F for 10 minutes.
- The standard color is ANSI-61 light gray with a gloss level of 6-12 and a thickness of 2-4 mils.
- This paint system withstands a minimum of 1000 hours of humidity test and 1000 hours of salt spray tests per ASTM117B.

