

DESCRIPTIVE BULLETIN

SafeGear® MCC

7.2 kV, 50 kA arc-resistant
Motor Control Center



**Medium voltage SafeGear®
Motor Control Center: controlling
energy for a safe world**

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Medium voltage SafeGear® MCC

Motor Control Center overview

Ideally suited for heavy duty applications of medium voltage motors, SafeGear® MCC is the perfect control and protection for your motors and transformers.

Designed with the highest degree of safety and reliability to meet industrial requirements, SafeGear® MCC is suitable for most market needs.

It is equipped with mechanical interlocks, between the removable contactor truck and the front door, to increase operation and maintenance safety.

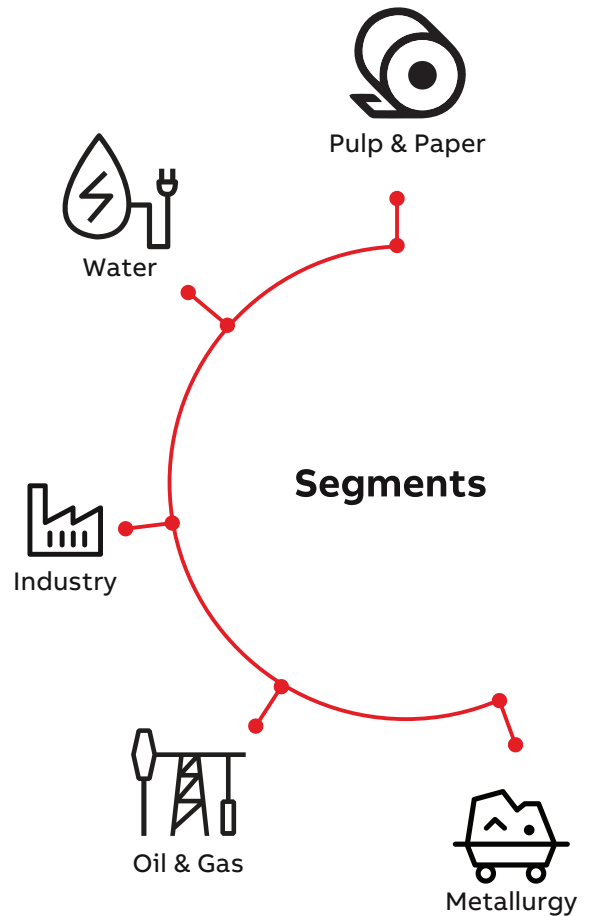
The withdrawable contactor design eliminates the need for an isolation switch. Due to the reduced number of parts and simple design, handling, maintenance and safety are improved.

A segregated LV instrument compartment with Type 2B arc resistant construction provides a high level of operator safety.

For optimal flexibility, SafeGear® MCC is designed to be used in combination with SafeGear® switchgear.

Featuring galvanized steel construction, hem bending manufacturing techniques, and Delrin® arc-quenching contacts (PT module), SafeGear® MCC is designed with safety, reliability and durability in mind.

SafeGear® MCC is in compliance and labeled according to the international standard UL-346.



Values and benefits

— 01 Arc-resistant design.

SafeGear® arc-resistant Motor Control Center is available in Accessibility Types 2B, in accordance with IEEE C37.20.7. This differentiates ABB from competitors who typically test to Type 2 arc-resistant construction.

SafeGear® MCC does not require an additional transition section to be coupled to SafeGear, reducing initial investment and required space in the electrical room.

— 02 Up to two contactors per frame.

SafeGear®MCC construction allows installation of up to two contactors per frame, up to 720 A, optimizing the quantity of frames and maximizing cost savings by more than 15% without considering the additional benefit of footprint reduction.

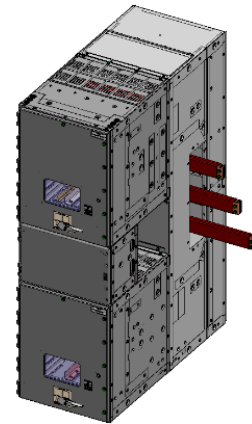
SafeGear® MCC is in compliance with the international standard IEEE C37.20.2 (metal-clad construction) improving safety for the users.

— 03 No transition section required.

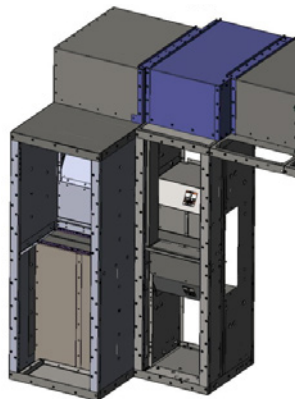
— 04 Metal-clad construction.



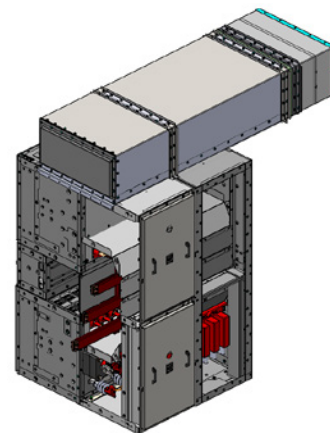
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Arc-resistant construction

SafeGear® meets today's challenge controlling energy for a safe world

—
01 Non-arc-resistant
Motor Control Center
50 kA interruption
at LAPEM test lab.

—
02 Arc-resistant
Motor Control Center
50 kA interruption
at LAPEM test lab.

No electrical system is foolproof. There is always a chance that insulation system deterioration, equipment malfunction or human error will result in an arc fault, with potentially catastrophic consequences.

When an arc fault occurs in conventional switchgear, the heat of the arc (30,000° C), can melt and even vaporize, compartment materials and components. Flames and hot gases escape and ignite nearby materials. As air temperature increases in the enclosed space, so does the pressure. The rapid pressure build-up is explosive, hurling objects such as doors, panels, and components.

Disastrous arc faults cost managers of large-power installations hundreds of thousands of dollars in lost equipment and downtime, as well as needless deaths and injuries. The images below illustrate the consequences of an arc fault in conventional gear and the advantages of using SafeGear arc-resistant Motor Control Center.

SafeGear® not only meets conventional standards for metal-clad switchgear, it goes beyond ANSI standards to provide the protection of arc-resistant construction.

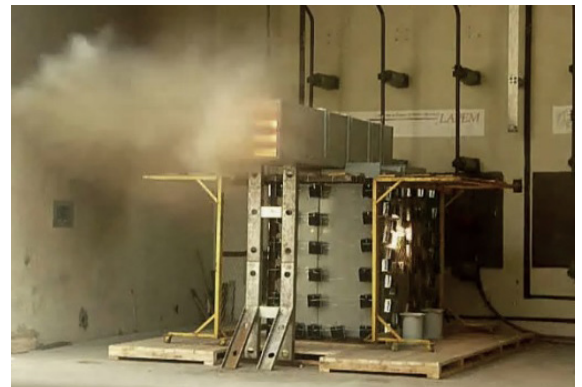
During an arc fault, expanding hot gases are carefully routed through a system of vents and flaps, generally through the roof and away from personnel at the front, rear or sides of the switchgear. Doors and panels are reinforced and sealed to withstand the temporary pressure surge until relief vents and flaps operate. Using techniques such as double sidewall and Type 2B construction, damage is contained into the gear inclusive when the low voltage compartment door is open.

SafeGear arc-resistant construction is design tested under actual arc-fault conditions and in conformance to ANSI/IEEE C37.20.7-2007 standards to verify:

- Cotton fabric test panels near the front, rear and sides do not ignite
- Doors and panels remain secure, except for minor distortion
- Components and molten materials are not ejected from the switchgear
- The arc does not burn through to the LV compartment (Type 2B)
- Ground connections remain intact



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SafeGear® MCC features

| Characteristic | |
|--|--------------------------|
| Type of construction | Metal-clad |
| Arc-resistant accessibility type | 2B |
| Short-time withstand current (main bus) | 50 kA (2sec) |
| Rated voltage | Up to 7.2 kV |
| Rated contactor current* | 4000 A |
| Insulation level/power frequency/lighting impulse BIL* | 7.2/20/60 kV |
| Rated frequency | 60 Hz |
| Rated main bus current* | 1200 A, 2000 A or 3000 A |

* Ratings given are for service conditions within temperature and altitude limitations as defined by UL 347-2009/IEEE C37.20.2-2015 metal-clad standard.

Product highlights

- Fully compliant to CSA and UL 347 6th edition for Motor Control Centers
- One and two-high construction (available for both 400 and 720 Amps)
- Dead front that avoids access to live parts
- Automatic secondary disconnects
- Closed door PT racking
- SmartRack® remote racking system for contactors as well as PTs
- Optional ground studs for safety during maintenance
- Optional infrared windows available for temperature monitoring
- Optional surge arresters for lightning protection

Standard Service conditions

The listed SafeGear® MCC ratings are applicable under the following conditions:

- Minimum ambient temperature: -5°C
- Maximum ambient temperature: $+40^{\circ}\text{C}$
- Maximum 24-hour ambient relative humidity: 85% non-condensing
- The normal operational altitude is up to 1000 m above sea level. For higher altitude applications, please consult your ABB sales representative
- Non-corrosive and non-contaminated atmosphere



Features construction

—
01 Contactor truck assembly.

—
02 Single-phase protection.

—
03 Shutters and exhaust plenum.

—
04 Exhaust plenum.

—
05 Main Bus and supports.

The vacuum contactor and power fuses are mounted on a fully withdrawable rackable truck. This truck assembly eliminates the need for an isolation switch, reducing the number of moving parts and simplifying the handling, maintenance and safety.

A blown fuse trip system can actuate a limit switch that will trip the contactor and energize an indicating lamp located on the instrument compartment cell door.

A metallic shutter blocks access to primary contacts when the contactor is in the Disconnected/Test position or removed from the SafeGear® MCC. The motion of the removable contactor opens and closes the shutter automatically.

In the event of an internal arc, the exhaust plenum will safely vent the gases outside the building. ABB's Relion® family of protection and control relays for distribution applications provides the performance, safety, and ease-of-use that MCC specifiers and users demand. The Relion 615 and 620 series offer complete protection and control for motors and transformers in MCC applications and are characterized by their flexibility and performance in today's and future distribution schemes.

Bus supports and insulation materials are flame-retardant, track-resistant and non-hygroscopic.

Bus bars are made of copper and have fully rounded edges. The standard bus insulation is made of a solid epoxy coating standard (heat-shrinkable tubing is available as an option).

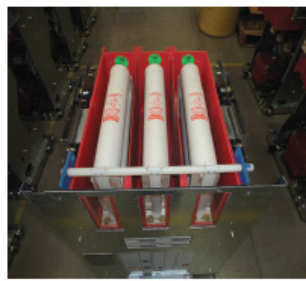
Connection joints, as well as bus bars, are silver-plated (tin plating is an option).

Current limiting power fuses are installed with the withdrawable contactor and are suitable for use with motor, capacitor or transformer applications. Power fuses for motor protection (Type R) will be equipped with bolted type connection. Optional power fuses for transformer protection (Type E) equipped with bolted type connection are also available.

SafeGear® MCC uses Delrin arc-quenching contacts for PT contacts. A sleeve with a round conductor probe is inserted into a receptacle with recessed contacts. Due to its unique properties, Delrin performs as self-lubricating contacts, arcs created during load break conditions are extinguished by a gas emitted by the Delrin material as it heats. The PT contact design also includes a shutter assembly as standard.



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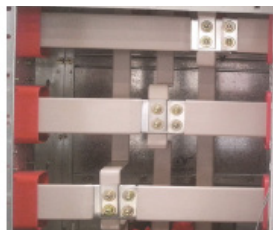
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06 Lift truck.

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07 Racking crank.

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08 Test cabinet.

PT arc-quenching contacts

SafeGear® MCC uses Delrin arc-quenching contacts for PT contacts. A sleeve with a round conductor probe is inserted into a receptacle with recessed contacts. Due to its unique properties, Delrin performs as self-lubricating contacts, arcs created during load break conditions are extinguished by a gas emitted by the Delrin material as it heats. The PT contact design also includes a shutter assembly as standard.

Galvanized steel construction

SafeGear® MCC is built using galvanized steel construction to enhance protection from rust, scratches and corrosion. Galvanized steel is used inside low voltage compartments for enhanced illumination properties to provide better compartment viewing.

Hem bending

Hem bends, the process of folding a single sheet of steel over upon itself, are used throughout SafeGear® MCC to increase rigidity and reduce arc propagation. This construction technique also protects maintenance personnel and any low voltage wiring inside the MCC as it eliminates sharp edges and burrs in the metal work.

Accessories

- Racking crank
- Test cabinet
- Lift truck
- SmartRack racking device
- Extension ramp



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MCC load capability

Maximum load controller ratings

The maximum load ratings for motors and transformers are shown in the following tables. This is only a guide. Larger motors and transformers can be supported depending on their performance ratings.

Maximum load ratings for motors

| Voltage rating (kV) | 2.4 | | 4.16 | | 4.8 | | 6.6 | | 6.9 | |
|-----------------------|------|------|------|------|------|------|------|------|------|------|
| Contactor rating (A) | 400 | 720 | 400 | 720 | 400 | 720 | 400 | 720 | 400 | 720 |
| Induction motors (HP) | 1500 | 2700 | 2600 | 4700 | 3000 | 5400 | 4200 | 7500 | 4400 | 7800 |
| Induction motors (kW) | 1100 | 2000 | 1900 | 3500 | 2200 | 4000 | 3100 | 5800 | 3200 | 5800 |
| Fuse type | 24R | 48X | 24R | 48X | 24R | 48X | 24R | 48X | 24R | 48X |

Considerations: Efficiency 95%, PF=0.9, Start time: 10 sec, Service Factor=1.25 (According to NEC), Fusing Factor Protection=1.33. The fuses shown were selected with the values above mentioned and they should only be taken as reference.

The final selection of power fuses is the responsibility of the customer based on system and load parameters and should be confirmed during engineering stage of the project.

Maximum load rating in kV for transformers

| Voltage rating (kV) | 2.4 | 4.16 | 4.8 | 6.9 |
|----------------------|------|------|------|------|
| Contactor rating (A) | 400 | 400 | 400 | 400 |
| Transformers (kVA) | 1000 | 2000 | 2500 | 1600 |
| Fuse type | 400E | 400E | 400E | 200E |

Fuses will conduct transformer magnetizing inrush current of 25 times transformer primary rated current for 0.1 seconds and 12 times for 0.01 second.

Fuse technology

There are two kinds of power fuses: standard general purpose and current limiting fuses.

Ratings of standard fuses depend on the normal continuous current and the time it takes for the fuses to respond to the different magnitudes of overcurrent. Fusible links, the principle elements of every fuse, can have different lengths and thicknesses and can be made of different metals or alloys.

The interrupting medium of a fuse also influences its operating characteristics. This characteristic of the standard fuse is an inversely proportional time-overcurrent curve, as shown schematically in the figure 1.

Proper selection of a fuse for an induction motor is very important. An improperly selected fuse can permanently damage the motor and other equipment in the system. Both starting inrush and normal load currents have to be considered.

Time-current characteristic curve of a power fuse

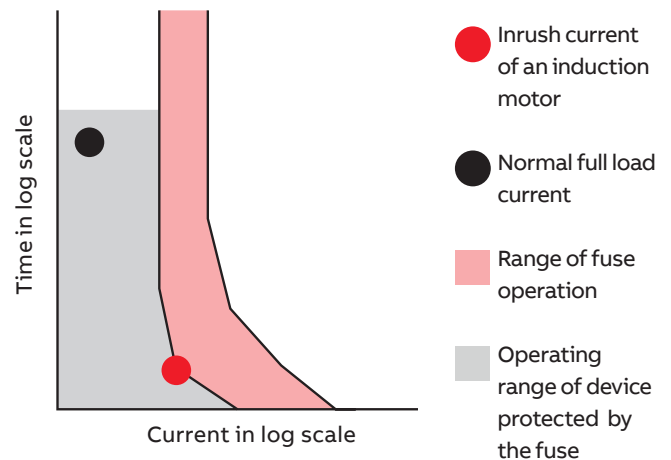


Figure 1

MCC Controller

Medium voltage HCV contactors are suitable for alternating current operation. The basic contactors consist of:

- Molded polyester resin monoblock containing the vacuum interrupters
- Bistable electromagnetic drive
- Multi-voltage feeder
- Auxiliary contacts
- Mechanical status indicator (open/closed)

Reduced maintenance: Vacuum bottle contacts have a long life with virtually no maintenance required.

Environment resistant: Ideal for use in high dust areas. Switching arc is contained within the vacuum bottle, shielding the main contacts.

Electronic control drive unit: All contactors include electronic control of the operating coil which offers a wide control voltage of 115/120 or 230/240 V ac 50/60 Hz (120/125 or 240/250 V dc), anti-chopping feature and reduced power consumption.

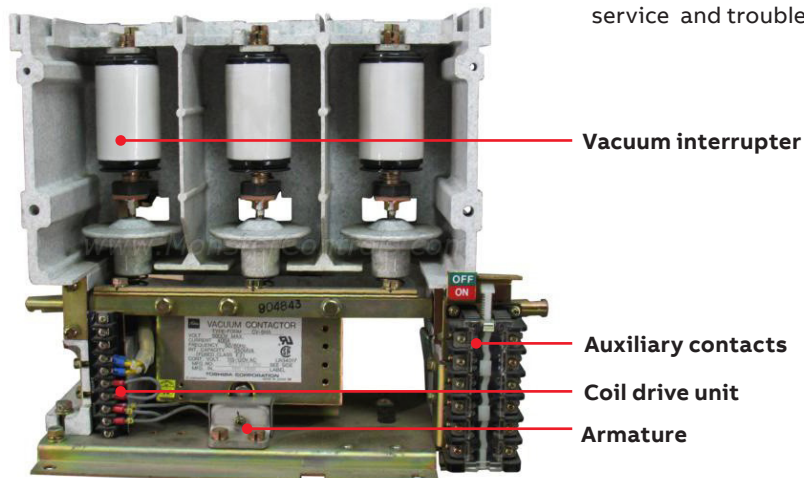
Designed for safety: High voltage and low voltage parts are separated by an insulated barrier (non-flammable molded frame).



Vacuum contactors are rated to perform a high number of switching operations before the unit requires maintenance, typically 2.5 million for the 400 A version and up to a million for the 720 A version.

Since vacuum contactors are not designed for interrupting currents higher than a few kiloamperes, a fuse in series is required to protect the distribution system against faults. The contactor requires a holding current in the solenoid coil to keep it in the closed position. Although the holding current is often quite small, customers are sometimes concerned that the contactor will open during a brief control power outage. Some designs incorporate mechanical latches to keep the contactors in a closed position, however, these latches do not perform all the functions of conventional circuit breakers.

A latched vacuum contactor is not a circuit breaker in terms of functionality or in terms of its rating. However, properly utilized, it can provide long service and trouble-free operation.



Distribution, protection and control

—
01 Relion 615 series.

—
02 Relion 620 Series.

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03 COM600 Distribution automation controller.

ABB's Relion® family of protection and control relays for distribution applications provides the performance, safety, and ease-of-use that MCC specifiers and users demand. The Relion 615 and 620 series offer complete protection and control for motors and transformers in MCC applications and are characterized by their flexibility and performance in today's and future distribution schemes.

The IEC 61850 implementation in Relion includes fast peer-to-peer communication over the substation bus. GOOSE (Generic Object Oriented Substation Events) communication is used between Relion devices in MCC to form a stable, reliable, and high-speed busbar protection system. Separate hard-wiring is not needed for the horizontal communication between the switchgear cubicles.

Relion relays for feeder protection offer an optional cable fault detection function that can detect extremely short duration underground faults. These faults are typically undetectable by conventional protection where there is no operation of the protection equipment. This feature helps users to learn of these events faster, resulting in reduced down time.

Relion 615 and 620 series relays include:

- Comprehensive set of protection and metering functions for feeders, transformers, and motors
- Draw-out design
- Integrated Open/Close push buttons and Local/Remote selector with indicating lights
- Protection and control for one and two breakers as well as breaker-and-a-half schemes
- Enhanced safety with optional arc fault protection in all 615 and 620 series relays
- Web browser based user interface accessible through an RJ45 front port
- Trip coil monitoring
- Monitoring of breaker health parameters such as travel time, number of operations, wear and tear, and spring charging time
- DNP3 and Modbus protocols included standard in all relays
- Relion relays are fully IEC 61850 compliant for communication and interoperability of substation automation devices
- Fully ANSI and RoHS compliant as well as UL listed

ABB's COM600 Grid Automation Controller can be used as a local HMI to display switchgear single line diagrams and the status of devices such as breakers, contactors and protection relays. COM600 also provides gateway functionality to enable switchgear integration into SCADA systems. It can be easily installed as part of the switchgear control devices.



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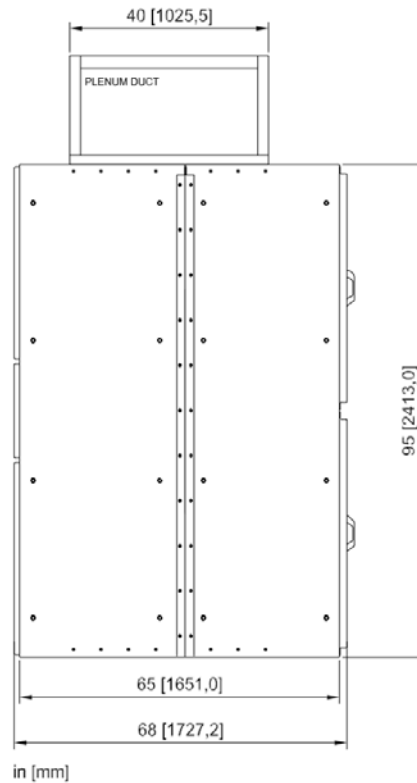
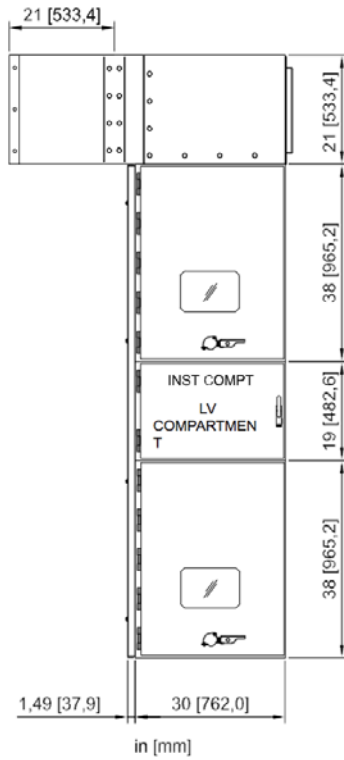
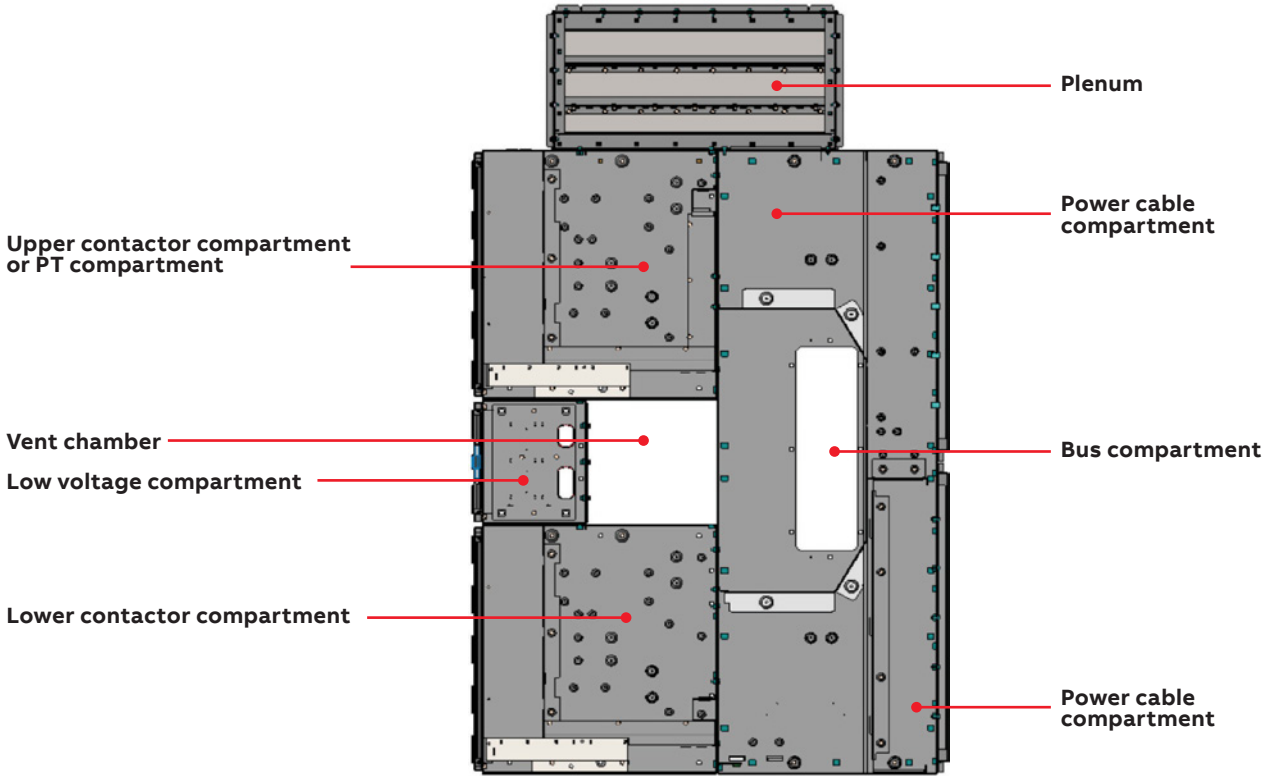
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General dimensions

SafeGear® MCC side view





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Your sales contact:

www.abb.com/contacts

abb.com/mediumvoltage

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