# SafeGear™ MCC

## Arc resistant metal-clad construction Motor Control Center

## TECHNICAL GUIDE

Power and productivity
for a better world™

# Contents

# 1. General

Designed for the highest degree of safety and reliability, the SafeGear™ MCC provides for maximum ease of use.

Operational and maintenance procedures are made from the front and rear of the SafeGear™ MCC, which is equipped with mechanical safety interlocks between the vacuum contactor and the contactor compartment door.

For optimal flexibility, the SafeGear™ MCC is designed to be used in combination with SafeGear™ Metal-Clad SwitchGear, so a transition cubicle is not needed.

Safe handling is by closed-door racking, automatic primary and secondary disconnects, and safe interlocking inside the cubicle. Significant components are mounted on the withdrawable truck simplifying maintenance and handling.

Design used in the contactor compartment grants easy access to all parts inside the cubicle. Unit is 30in wide, 95in high (including low voltage compartment) and 65in deep. Contactor rating is 400A. The main bus rates are 1200A, 2000 and 3000A of continuous current. All components are UL listed and conform to the appropriate NEMA standards.

# 2. Product description

The SafeGear™ MCC is available in arc-resistant metal-clad construction which employs a draw-out vacuum contactor compartment. A vertical section houses one or two vacuum contactor (one-high or two-high). All compartments are separated entities, in that they are segregated from the other compartments (Metal-Clad construction). The control compartment is located above the lower contactor compartment.

## 2.1 Standards

SafeGear™ MCC and main apparatus contained in it comply with the following standards:

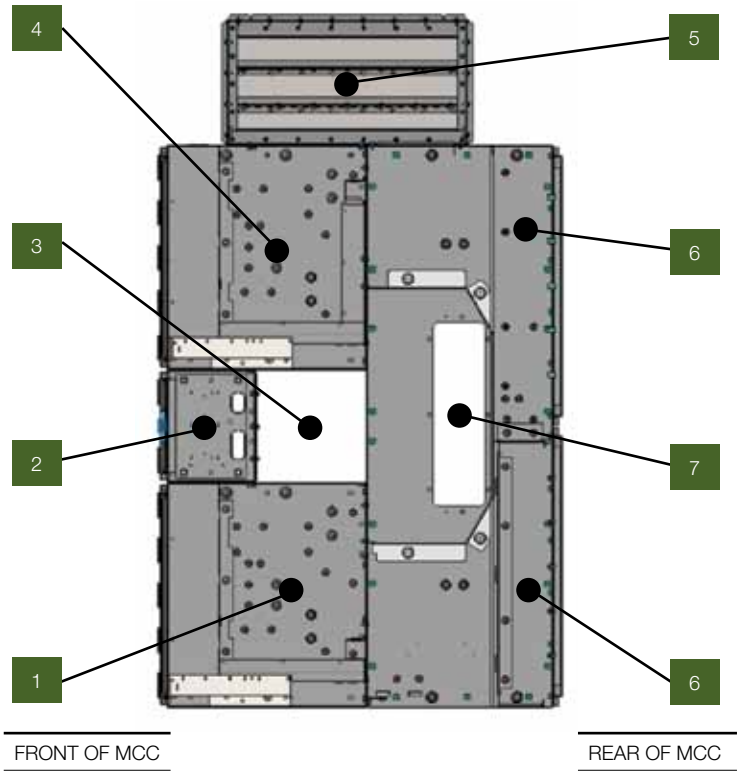
| | |
|---|---|
| UL 347 | Medium-Voltage AC contactors, controller and control centers |
| UL 50/50E | Enclosure for Electrical Equipment |
| ANSI/IEEE C37.20. 2 | Standard for Metal-clad switchgear |
| IEEE Guide C37.20.7 | Guide for test metal-enclosed switchgear for internal arcing faults |
| CSA C22.2 No. 253-09 | Medium-voltage ac contactors, controllers, and control centers |
| CSA 22.2 No. 14 | Industrial Control Equipment |
| NMX-J-564/106-ANCE | Asociación de Normalización y Certificación, A.C |
| NRF-146 | Tableros de Distribución en Media Tensión |
| NRF-048 | Diseño de instalaciones eléctricas |

## 2.2 Enclosure configuration

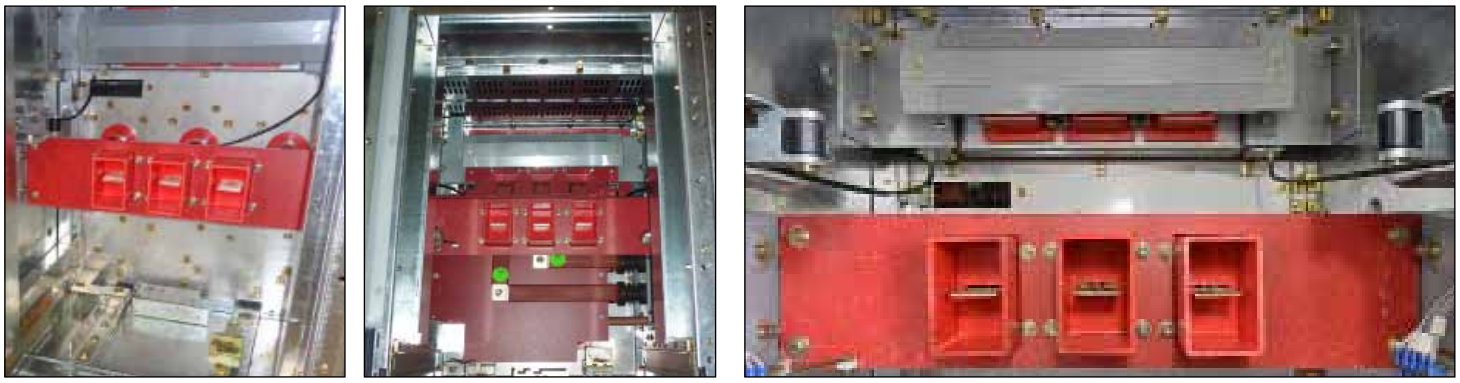
The SafeGear™ MMC is arc resistant and Metal-Clad construction with a ventilation plenum and “blow out” flaps.

Barriers, baffles, interlocks, etc., are used to ensure separation of the medium voltage circuits from the low voltage control circuitry.

The rear portion of the vertical section houses the main bus. Medium voltage power is supplied to the contactors by mean of vertical bus. Suitable reinforcements have been provided to withstand fault currents up to 50 kA.




| | |
|---|---|
| 1. | Contactor lower compartment |
| 2. | Low voltage compartment |
| 3. | Vent chamber |
| 4. | Contactor upper compartment or TP's compartment |
| 5. | Plenum |
| 6. | Power cables compartment |
| 7. | Bus compartment |



**Contactor Compartment**

## 2.3 Arc Resistant construction

This equipment was evaluated in accordance with the IEEE C37.20.7, entitled "Guide for Testing Metal - Enclosed Switchgear for Internal Arcing Faults. The SafeGear MCC is arc resistance accessibility type 2B. This type applies to constructions with arc resistant features at the freely accessible exterior (front, back, and sides) including the low voltage control compartment of the equipment.

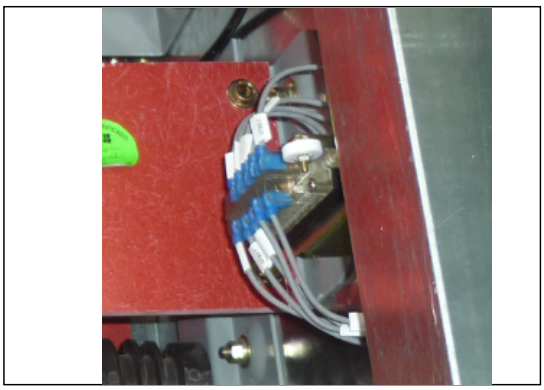
## 2.4 Contactor compartment

Typical contactor compartment interior with the line side shutter closed is shown below. The interlock linkage operates the line side terminal guard piece (shutter). 1-high and 2-high design use a draw-out 400A contactor. Contactor racking system allows two positions, Disconnected-Test (DISCONN.) and Connected (CONN.).

Contactor compartment includes interlocks to ensure proper sequencing and safe operation. Interlocks system avoid racking while the contactor compartment door is open. The contactor can only be racked into the connected position with the door closed, maintaining the integrity of arc resistance. The door only opens when the contactor is in the disconnected position (DISCONN.). Door padlock is provided as standard to secure the contactor in place.

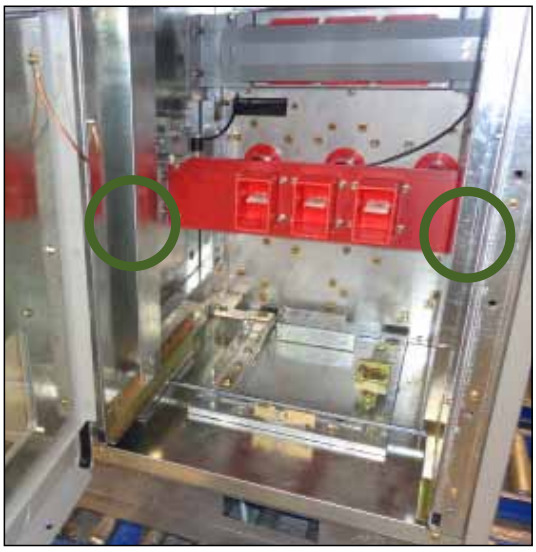
The contactor compartment includes stationary support bushings and primary contacts for coupling with the Contactor.

Automatic Secondary Connect System



Truck Operated Contact (TOC)

Contactor Grounding



Control Wiring Wireway

Shutters

### 2.4.1 Automatic secondary connect system

The contactor compartment includes a fully automatic secondary connect system, self-aligned, so manual connection is not required.

Secondary connector allows up to 25 pins contacts for control circuit. Connection is continuous during the contactor racking operation.

### 2.4.2 Truck operated contact (TOC)

Auxiliary switch contacts are actuated by the contactor position, Disconnected-Test (DISCONN.), and Connected position (CONN.). UL listed auxiliary switch is used, minimum 10 amperes, 600 volts AC.

### 2.4.3 contactorh grounding

A stationary ground contact placed in the contactor compartment, interacts with the contactor ground contact. Ground connection is continuous during the Contactor racking operation. Ground bars are made of tin plated copper and have round edges.

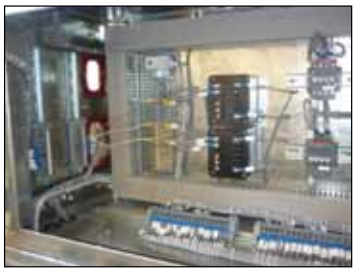
### 2.4.4 Shutters

Metalic shutter, covered by polycarbonate barrier, blocks access to primary contacts when the contactor is in the Disconnected-Test position or withdrawn from the cell. The motion of the withdrawable contactor opens and closes the shutter automatically with the contactor position and does not depend on gravity. Shutter is driven simultaneously from both sides for smooth, balanced operation. Interlocks prevent accidental opening of the shutters and access to energized contact stabs. Shutter is available with padlock provision.

### 2.4.5 Control wiring wireway

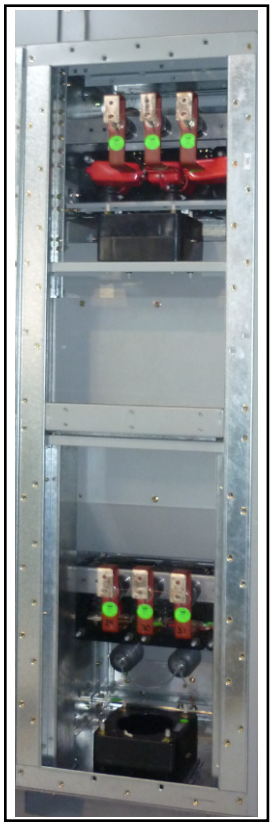
Control wiring wireway runs along both sides of the contactor compartment and into the control compartment.  Covered by galvanized steel ducts creates an enclosed wireway.  An enclosed channel runs through the lower left side of the contactor compartment to the CTs terminals.

Heater assembly

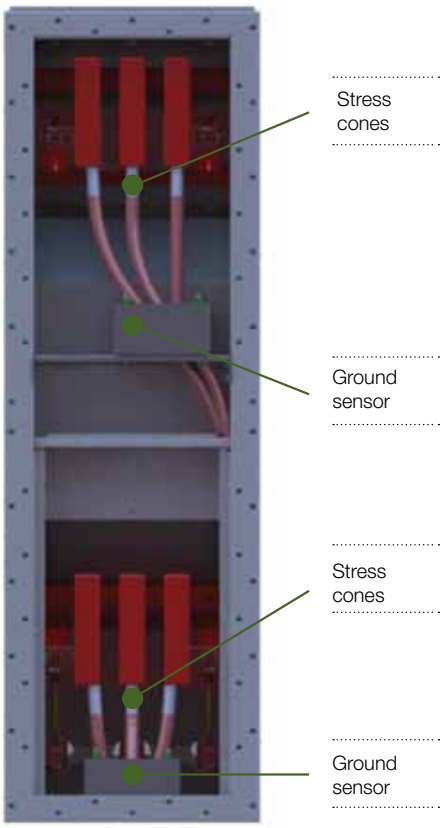


Low voltage compartment

Cables compartment with covers



Cables compartment without covers




Power cable incoming

### 2.4.6 Heater assembly

Recognized strip heaters are provided on bottom of contactor compartment to reduce condensation and dampness in humid environments. Strip type heaters are used in various combinations. Power provided by control power transformers.

| Heater selection guide | | |
|---|---|---|
| Rating power | Rating voltage | Part number |
| [W] | [V] | |
| 250 | 240 | OT1202PCN129728 |
| 500 | 240 | OT1205PCN129760 |

### 2.5 Low voltage compartment

All protection and control devices are mounted in a specific low voltage compartment. Each low voltage control compartment is completely isolated and segregated from medium voltage compartment according to Type 2B accessibility. This ensures safety for operations and maintenance personnel while they work on control and auxiliary circuits.

Devices and control switches are mounted on the door for easy readability and convenient access. Devices that do not require immediate access are mounted inside the compartment. The overall dimensions are 30in wide, 19 & 57in high and 15.12in deep.

### 2.6 Power cables compartment

Power cables compartment is fully segregated from the other compartments. Located at the rear of the MCC, cables compartment is segregated from the lower and upper compartment.

### 2.6.1 Power cable incoming

For lower or upper compartment, cables entry is rear and bottom. Easily accessible 2-NEMA cable lugs simplify power cable installation. Cables compartment have enough space for stress cones. Multiple cables that do not exceed this dimension may also be used.

| Cables configuration | | | | | |
|---|---|---|---|---|---|
| | Cables per phase | Compression lugs [MCM] | Overall insulated cable diameter [mm] | Conduit diameter [in] | Stress cone Length [in] |
| Bottom cable entry | Up to 2 | Up to 500 | Up to 39 | 6 | 10 |

Main Bus

PTs Compartment

Plenum

MCC Labeling

### 2.7 Main bus

The available main bus ratings are 1200A, 2000A and 3000A. The main bus compartment can be accessed from the back by unbolting the rear covers. Bus supports and insulation materials are flame-retardant, track resistant and non-hygroscopic. Bus bars are made of copper and have fully round edges. Bus bars and connections are silver-plated (tin-plated is available as an option) and heat-shrinkable tubing insulation is standard.

### 2.8 PTs compartment

PTs compartment is the same construction and overall dimensions as the contactor compartment. For PT contacts, ABB uses Delrin® arc-quenching contacts. A sleeve with a round conductor probe is inserted into a receptacle with recessed contacts. Due to the properties of Delrin®, which include self-lubrication, arcs created during load break conditions are extinguished by a gas emitted by the Delrin material as it heats. The recessed contact design also eliminates the need for safety shutters as access to live bus is very difficult.

### 2.9 plenum

Plenum is provided to exhaust any gases during an arc fault condition which is intended to be ventilated to the exterior of the building. The plenum is provided above the upper contactor compartment and bus and cable compartments. The plenum construction with external flanges makes it easy to do field installation.

### 2.10 MCC labeling

Each MCC lineup contains a master nameplate, typically located on the horizontal wireway door of the left most section. Each MCC lineup contains operation and danger labels.

# 3. HCV 5HA contactor

### 3.1 Contactor ratings

Contactor

| | |
|---|---|
| Rated Voltage | 7200 Volts |
| Rated Current | 400 Amps |
| Interrupting Capacity | 7000A RMS Symmetrical @5000V Max. |
| | 4500A RMS Symmetrical @7200V Max. |
| Permissible Switching Frequency | 1200/Hour |
| Mechanical Life | 2,500,000 Operations |
| Electrical Life | 250,000 Operations |
| Closing Time | 75-100 ms |
| Opening Time * | 20-30 ms |
| Arcing Time | 10 ms or less |
| Pick-Up Voltage AC or DC | 85% Rated (Hot) - 70% Rated (Cold) |
| Drop-Out Voltage AC or DC | 50% Rated (Hot) - 40% Rated (cold) |
| Rated Control Voltage AC | 115/120 or 230/240 V 50/60 Hz |
| Rated Control Voltage DC | 120/125 or 240/250 V |
| Coil Circuit Inrush | 670 VA AC (700 W DC) |
| Coil Circuit Holding | 85 VA AC (85 W DC) |
| Auxiliary Contact Arrangement | 3 N.O. - 3 N.C. |
| Auxiliary Contact Rating | 10 A, 600 V (NEMA Class A600) |

* - DC switching, opening terminals 3 & 4.

| HCV-5HAL (Latched type only) | |
|---|---|
| Permissible Switching Frequency | 300/Hour |
| Mechanical Life | 250,000 Operations |
| Tripping Voltage | 40-60% Rating DC |
| Tripping Current | 4.8 A DC Max |

### 3.2 Power fuses

Recognized Component R and E-Rated Fuses under UL can be used (please refer to the Engineering department in order to select other Power Fuses than shown). The following fuses are used with the contactor, depending upon the load requirements of the installation:

| Up to 4.8kV | | | Up to 7.2kV | | |
|---|---|---|---|---|---|
| Ferraz fuse catalog number | Size | Continuous ampere rating | Ferraz fuse catalog number | Size | Continuous ampere rating |
| A480R2R-1 | 2R | 70 | A072B1DARO-2R | 2R | 70 |
| A480R3R-2 | 3R | 100 | A072B1DARO-3R | 3R | 100 |
| A480R4R-1 | 4R | 130 | A072B1DARO-4R | 4R | 130 |
| A480R5R-1 | 5R | 150 | A072B1DARO-5R | 5R | 150 |
| A480R6R-1 | 6R | 170 | A072B1DARO-6R | 6R | 170 |
| A480R9R-1 | 9R | 740 | A072B1DARO-9R | 9R | 200 |
| A480R12R-2 | 12R | 230 | A072B2DARO-12R | 12R | 230 |
| A480R18R-2 | 18R | 300 | A072B2DARO-18R | 18R | 390 |

# 4. Optional components

**Current Transformers**

### 4.1 Current transformers (CTs)

CT models SAB or SCG by ABB (1-5A output) can be used. Up to 3 SAB-1/SAB-2 CTs may be installed per phase; 1 set of SAB-1D/SAB-2D; or 2 sets of SCG-3/ SCG-4/ SCG-5 may be installed per phase. CTs are mounted on the load side bus, provided with insulating tube made of glass polyester GPO-3. Both arrangements are supported by galvanized steel reinforcements.

| Selection Guide | | | | | |
|---|---|---|---|---|---|
| CTs per Phase | | | | | |
| SAB | SAB-D | SAB + SAB-D | SCG-3 | SCG-4 | SCG-5 |
| Up to 3 | 1 | 1/1 | Up to 2 | Up to 2 | Up to 2 |

| CTs Part Number | | | | | |
|---|---|---|---|---|---|
| CTs per Phase | | | | | |
| Primary Amps | SAB-1 | SAB-1D | SCG-3 | SCG-4 | SCG-5 |
| 50 | 923A329G01 | 923A331G01 | 7525A28G01 | 7525A29G01 | 7525A30G01 |
| 75 | 923A329G02 | 923A331G02 | 7525A28G02 | 7525A29G02 | 7525A30G02 |
| 100 | 923A329G03 | 923A331G03 | 7525A28G03 | 7525A29G03 | 7525A30G03 |
| 150 | 923A329G04 | 923A331G04 | 7525A28G04 | 7525A29G04 | 7525A30G04 |
| 200 | 923A329G05 | 923A331G05 | 7525A28G05 | 7525A29G05 | 7525A30G05 |
| 250 | 923A329G06 | 923A331G06 | 7525A28G06 | 7525A29G06 | 7525A30G06 |
| 300 | 923A329G07 | 923A331G07 | 7525A28G07 | 7525A29G07 | 7525A30G07 |
| 400 | 923A329G08 | 923A331G08 | 7525A28G08 | 7525A29G08 | 7525A30G08 |

Ground sensor for lower compartment

Ground sensor for upper compartment

Load side terminals

Surge arresters

### 4.2 Zero sequence CT (ground sensor CT)

Zero sequence CT for MCC is type BYZ-S by ABB, located on the floor directly under the load terminals for the lower compartment and located at the rear-middle of the frame for the upper compartment.

| Zero sequence CT selection guide | | |
|---|---|---|
| Primary Ampere Rating | IEEE Relaying Accuracy | Style Number |
| 50 | C10 | 6353C97H01 |
| 100 | C20 | 6353C97H02 |

### 4.3 Load side terminals

Bus bar terminals are provided with two holes (2-NEMA) preparation to connect the appropriate lugs, the lug kits can be supplied with each unit as an option.

### 4.4 surge arresters

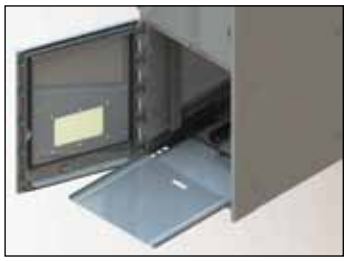
Protection of medium voltage AC networks against both, multiple atmospheric and switching overvoltages as well as Very Fast Transients (VFT). Suitable for instance for the protection of transformers, cables, motors and other medium voltage equipments. For indoor installation only, surge arresters can be Polim-D, MWD or Ohio-Brass type. Surge arresters are connected with NATVAR.

# 5. Accessories

Lift truck

### 5.1 Lift truck

Lift truck is required to rise or down the contactor into the upper contactor compartment to the appropriate height and safely rolled into the compartment. Lift truck has wheels for easy maneuvering in restricted space. Contactor have self-contained wheels for easy floor rolling and interlocks to fix it on the lift truck during maneuvering.



Extension Ramp

### 5.2 Extension ramp

Lower contactor compartment has provisions to put a ramp in front of it to withdraw the contactor, instead of a crane or lift truck. This ramp carries the contactor outside of the contactor compartment for maintenance or service.

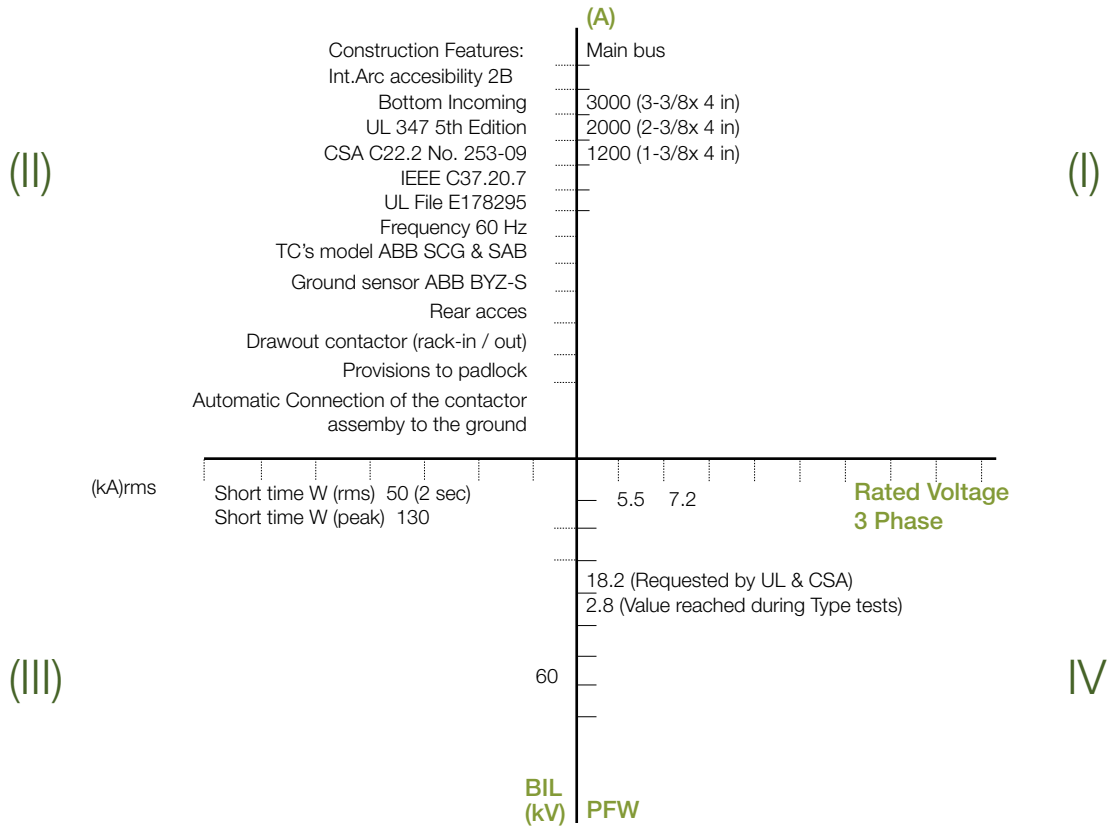
# 6. MCC Electrical features and normal service conditions

| MCC electrical features | | |
|---|---|---|
| Type of construction | | TYPE 1 Gasketed* |
| Arc-Resistant accessibility type | | 2B |
| Short-time withstand current (main bus) | | 50kA (2 sec.) |
| Rated voltage | (kV) | Up to 7.2 |
| Rated contactor current | (A) | 400 |
| Insulation level / Power Frequency / Lighting impulse BIL | (kV) | 7.2 / 20/ 60 |
| Rated frequency | (Hz) | 60 |
| Rated main bus current | (A) | 1200, 2000 or 3000 |
| Rated contactor current | (A) | 400 |

* Also known as NEMA 1A

| MCC normal operation conditions | |
|---|---|
| Minimum ambient temperature | -5°C |
| Maximum ambient temperature | 40°C |
| Maximum 24 hour ambient relative humidity | 95% non-condensing |
| Normal operational altitude above sea level | 1000m |
| Normal non-corrosive and non-contaminated atmosphere | |
| Seismic zone | D |

## SafeGear MCC
## Panel technical features



# 7. Applications of arc resistant metal-clad MCC

The MCC offers different options and configurations that allow a wide range of industry applications. Some of them are listed below

### Utilities and power plants

- Substations
- Power generation stations
- Transformer stations
- Switching stations
- Main and auxiliary switchgear

### Industry

- Pulp and paper
- Cement
- Textiles
- Chemicals
- Food
- Automotive
- Oil and gas facilities
- Metallurgy
- Rolling mills
- Mines

### Marine applications

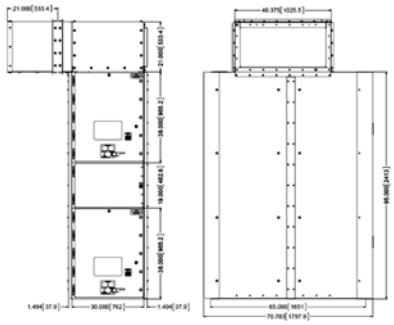
- Off-shore rigs
- Tankers
- Ships

# 8. MCC configurations

| Description | Standard configurations | | |
|---|---|---|---|
| Main bus | 1200 /2000/3000A | | |
| Power cable entry | Bottom | | |
| Bus bars finish | Silver-Plated | | |
| Aplication | 1-High | 2-High | 1-High & TPs Compartment |
| Bus Bars Insulation | Heat-Shrinkable Tubing | | |
| Ground bus | With rear extension | | Without rear extension |
| Contactor Compartment Door | Without mechanical trip | | With mechanical trip |

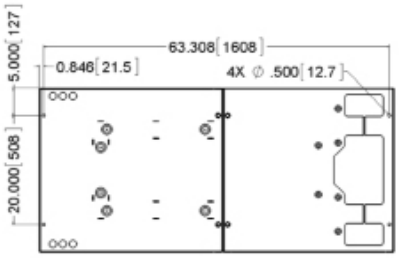
| Description | Options | | |
|---|---|---|---|
| CTs | Up to 3 sets of SAB or 1 of SAB-D | | Up to 2 sets of SCG-3, SCG-4 or SCG-5 |
| Surge Arresters | POLIM-D | OHIO BRASS | MWD |
| Ground Stud | Up to 40kA | | Up to 50kA |
| Ground Sensor | BYZ-S | | |
| Stress Cones | Up to 10” large | | |
| Infrared Windows | Crystal Window (Fluke) | | Polycarbonate Window (IRIS) |

# 9. General dimensions & weight of MCC



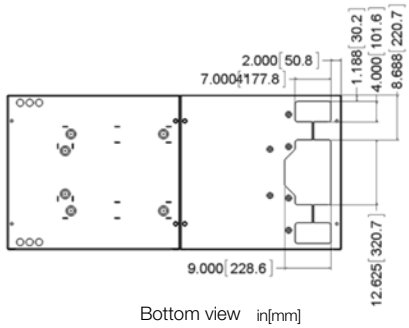
in[mm]

### 9.1 Anchor entry



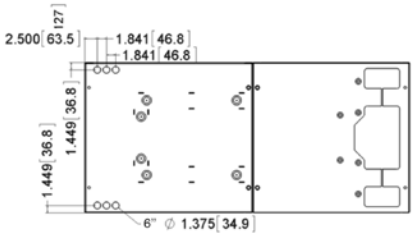

Bottom view in[mm]

### 9.2 Power cables entry




Bottom view in[mm]

### 9.3 Control wiring entry




Bottom view in[mm]

### 9.4 MCC weights

| Description | Weight kg (approx.) |
|---|---|
| 1-high | 700 |
| 2-high | 900 |
| Plenum per section | 50 |
| Plenum exhaust box (only one per lineup) | 70 |
| Contactor with fuses | 80 |

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