

ELECTRIFICATION PRODUCTS

SafeGear® Motor Control Center Controller

Arc-resistant metal-clad construction

Installation, operation and maintenance manual



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

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SafeGear® Motor Control Center Controller

This manual provides information for the Medium Voltage (2.4 kV to 6.9 kV) SafeGear® MCC Controller as described below.

All information in this booklet was current at the time of printing. All references in this booklet are determined from viewing the controller from the front.

Drawout (Removable)

A drawout controller is a controller that may be removed from a cell without the unbolting of any connections or mounting supports. It utilizes specific interlock devices that function according to ANSI standards, which allow for the safe removal of the device with minimal risk to personnel. It is intended for use in SafeGear®, Advance®, or abbreviated versions of ABB and OEM switchgear. It also contains plug-in primary and secondary disconnects with two physical ANSI operating positions within the cell: Connected and Test /Disconnected. In the connected position, both primary and secondary contacts shall be engaged. In the Test/Disconnected position, primary contacts are separated from the bus contacts while the secondary contacts remain engaged to the controller to be tested. The connection of secondary circuits shall be completely automatic, it shall not depend on operator interaction.

Fixed-Mount

A fixed-mount controller is intended to be mounted as a stationary device. It does not contain any racking related interlocks and/or primary leads. Primary connections are hard bussed to the associated gear in which the controller is installed by the consumer. Secondary wiring is terminated on a 5-foot length of wire from the compartment to secondary plugs that are the same as the draw-out versions. Plugs and associated pins can be purchased for plug in connection or the wires may be cut to provide direct connections. The fixed-mount version must be provided with the plugs in this manner to meet UL listing and to insure proper testing of the controller. The customer is responsible for any damage to the controller that is due to incorrect wiring of the controller.

Introduction and safe practices

The purpose of this manual is to provide instructions for unpacking, storage, installation, operation, and maintenance for the SafeGear® MCC Controller. This manual should be carefully read and used as a guide during installation, initial operation, and maintenance.

The specific ratings of each model controller are listed on the individual nameplates. The SafeGear® MCC Controller is a protective device. As such, they are maximum rated devices. Therefore under no circumstances should they be applied outside of their nameplate MCC ratings. Refer to ANSI and IEEE guidelines referring to the use of controller applications.



WARNING

The controllers described in this manual are designed and tested to operate within their nameplated rating. Operation outside of these ratings may cause the equipment to fail, resulting in property damage, bodily injury and/or death. All ANSI and NEC safety codes, safety standards and/or regulations as they may be applied to this type of equipment must be adhered to strictly.

Safe Practices

The design includes several interlocks and safety features which help ensure safe and proper operating sequences.

To ensure safety of personnel associated with installation, operation, removal, and maintenance of these controllers, the following recommendations must be followed.

Only qualified persons, as defined in the safety standards applied in the country where are going to be installed the controllers, who are familiar with the installation and maintenance of medium voltage circuits and equipment should be permitted to work on these controllers.

Read these instructions carefully before attempting any installation, operation, or maintenance of these power controllers.

- **DO NOT work on an energized controller.**
- **DO NOT work on a controller unless all components are disconnected by means of a visible controller and securely grounded.**
- **DO NOT work on a controller with power supplied to the secondary control circuit.**
- **DO NOT defeat safety interlocks. This may result in bodily injury, death and/or equipment damage.**
- **DO NOT work on a closed controller.**
- **DO NOT work on a controller with charged energy.**
- **DO NOT use a controller by itself as the sole means of isolating a medium or high voltage circuit.**
- **DO NOT leave a controller in an intermediate position in a cell. Always place the controller in the Disconnect/Test or Connect position without hesitation between positions.**

NOTICE

Failure to observe the requirements of US OSHA STANDARD 1910.269 can cause death or severe burns and disfigurement. This standard specifically prohibits the wearing of polyester, acetate, nylon, or rayon clothing by employees working with exposure to electric arcs or flames.

Receiving, handling and storage

SafeGear® MCC Controllers are subject to complete factory production tests and inspection prior to packaging and shipment. The shipping package is designed to provide reasonable protection during shipment and convenient handling. Accessories, such as racking handles, are shipped separately from the controller.

Receiving

Immediately upon receipt of the controller(s), examine the shipping container to determine if any damage or loss was sustained during transit. If damage or indication of rough handling is evident, take photos and file a damage claim at once with the carrier and promptly notify your ABB representative. ABB is not responsible for damage of goods after delivery to the carrier. However, ABB will lend assistance if notified of claims. Use care in unpacking to avoid damaging any controller parts.

Unpack controllers immediately upon receipt. If unpacking is delayed, difficulty may be experienced in making a claim for damages not evident upon receipt. Check the contents of each carton against the packing list before discarding any packing material. If any discrepancy is discovered, promptly notify the nearest district office. Information specifying the purchase order number, controller serial number, and part numbers of damaged or missing parts should accompany the claim.

Handling

SafeGear® MCC Controller shipping crates are designed to be handled by fork lift. See the Accessories section for information regarding the lifting accessories available for use with the SafeGear® MCC Controller. Once removed from the shipping container, the controller wheels are designed to move the controller across a clean smooth, paved even surface. Care must be taken not to damage the secondary locking tab (Figure 2) when transporting, rolling, or handling the SafeGear® MCC Controller.

DO NOT pull the controller by the front handles with the controller in any position other than full Disconnect.
DO NOT move the controller by pushing on the embedded pole assemblies or primary leads of the embedded poles. Damage and misalignment of the pole assemblies will occur if force is applied to them.

Storage

Controllers should be installed in their permanent location as soon as possible. If the controllers are not placed in service for some time, it is advisable to store in a covered, well-ventilated, dry, dust-free, non-corrosive ambient, away from any flammable materials and at a temperature between 23°F and 104°F. In any case, avoid any accidental impacts or positioning which stresses the structure of the apparatus.

This may be done by keeping the controller in its original shipping container and storing it in a warm, dry, and uncontaminated atmosphere. The controllers should be stored to minimize condensation. Moisture can cause deterioration of metal parts and high voltage insulation.

Prior to storage of the controller, verification should be made that it is free from shipping damage and is in satisfactory operating condition.

CAUTION

Do not stack controllers.
Shipping boxes can and will collapse causing damage to the controllers and or personnel and equipment.

MCC Controller

General overview

The SafeGear® MCC Controller is a magnetically actuated and latched controller capable of a very high number of operations due to its robust design. Controller's ratings are 400 A and 720 A and NEMA Class E2. It conforms to latest international standards such as UL 347, ICS3 part 2.



Controller features

- Fuse status indicator
- Position indicator
- Operation counter
- Controller status
- Local trip on the front side
- Blown fuse mechanism
- Extraction truck

Normal service conditions

Normal operation conditions	
Minimum ambient temperature	-5°C
Maximum ambient temperature	40°C
Maximum 24 hours ambient relative humidity	85% Non-condensing
Normal operational altitude above sea level	1000m
Normal non-corrosive and non-contaminated atmosphere	

Table 2
If the contactor is to be used in conditions other than those specified above, please consult the factory.

Controller weight approximate

Controller	400 A	720 A
Maximum weight approximate - lbs (kg)	375 (170)	750 (240)

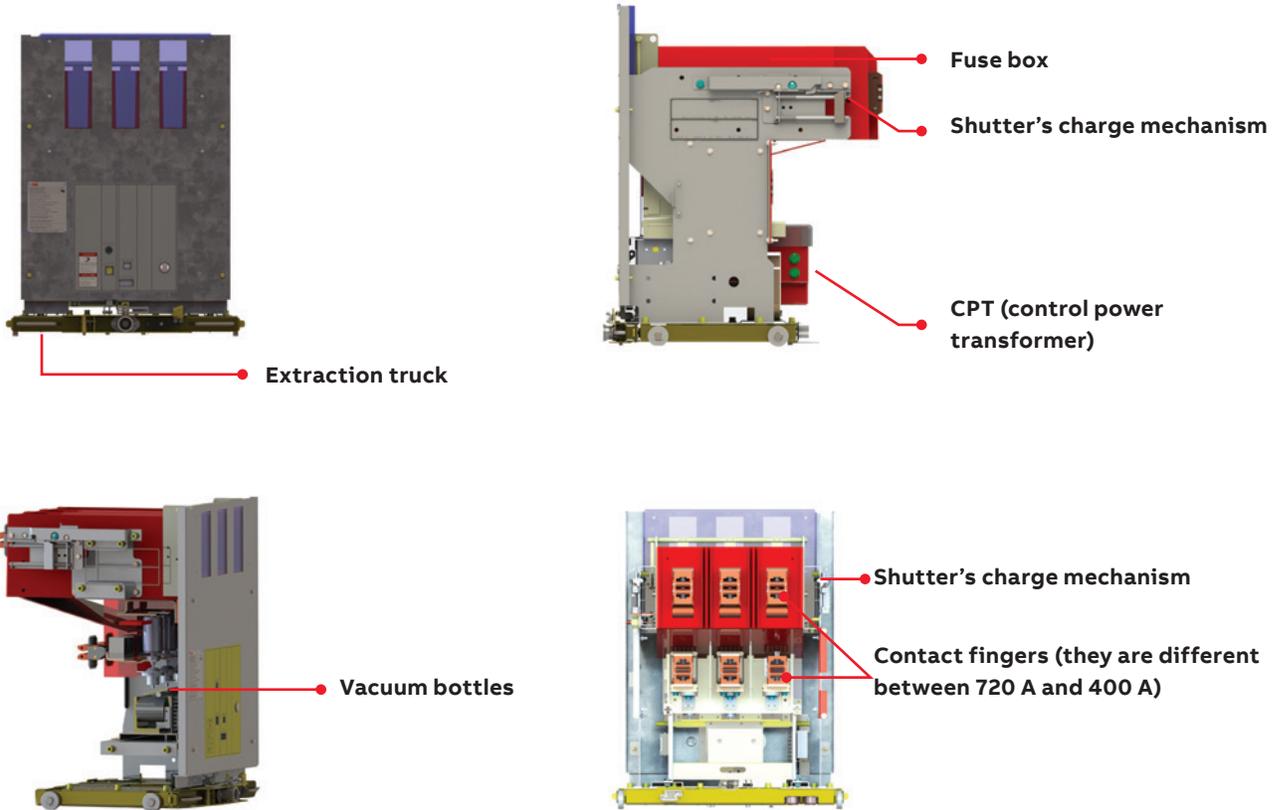
Table 3
The table shows approximated values for controller weight with 500VA CPT

Storage

Place the equipment on the shipping base. Store all equipment indoors in a well-ventilated area. The location where the contactor is to be installed should be free from dust, corrosive gas and moisture. When it is to be used in a chemical plant or in outdoor applications, take necessary precautions against corrosion, water seepage and condensation.

The storage building should have a well-drained paved floor. The temperature should be between 23°F (-5°C) and 104°F (40°C). The air should be dry (50% maximum humidity).

Construction



Extraction truck assembly

ABB's extraction truck assembly for MCC is integral to the controller itself, in lieu of being inside the MCC controller cell.

Vacuum controller, power fuses, control power transformer (CPT) and all auxiliary contacts are mounted on a truck assembly and completely removable from the cell to allow maintenance outside the cell and away from energized primary and secondary circuits.



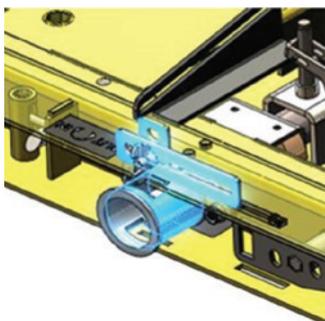
Racking system and disconnect

A racking system is integral to the controller. Racking is only possible with the door closed. The racking system has two positions (Connected and Test /Disconnected). In the connected position, both primary and secondary contacts shall be engaged. In the test/disconnected position, primary contacts are separated from the bus contacts while the secondary contacts remain engaged to the controller to be tested.

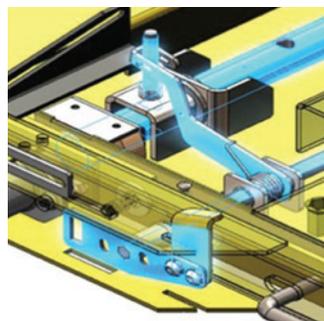
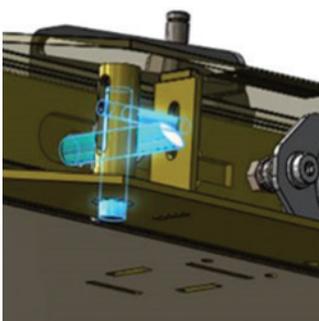
Interlocks

The truck has three different mechanical interlocks in the controller construction:

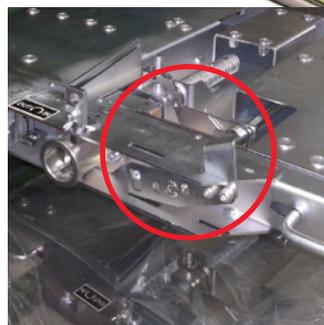
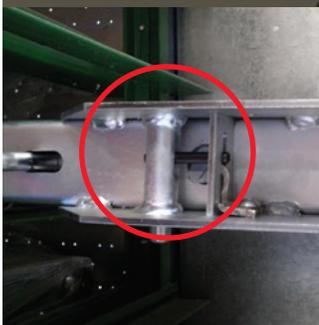
— 01 The first makes it impossible to rack the controller in with the door open. (Highlighted in red).



— 02 The second interlock does not allow opening of the door with the controller in connected position. (Highlighted in red).



— 03 The third and last interlock mechanism, is a padlock upon the principal screw (worm gear) to prevent racking. When the controller is in connected or disconnected position. (Highlighted in red).



01

02

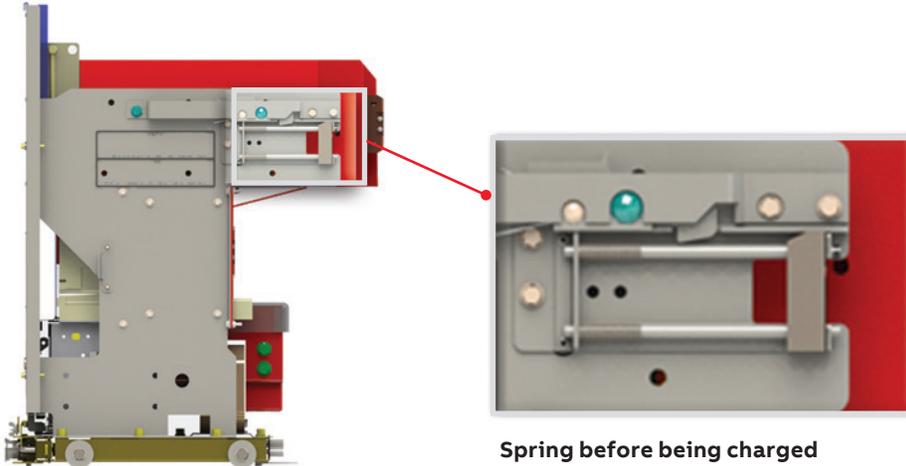
03

Shutter's charger mechanism

When the controller is removed, the shutter's position cover the primary contacts in the controller compartment. When charged, the springs and the controller is inserted, the shutter's charge mechanism provides the energy required to activate the opening of the shutter's charge mechanism and to permit the connection with the primary contacts.

Procedure

Before placing the contactor inside the module, it is necessary to manually charge the springs shown.



Steps for charging the springs manually

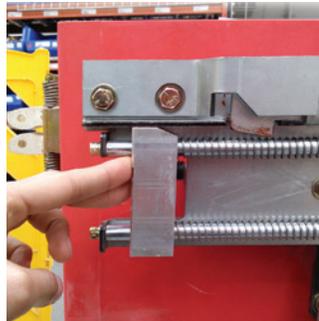
01 The spring is in its normal position.

02 Charge the spring manually (as shown in the picture).

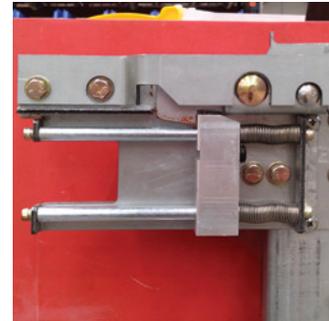
03 In this position, the spring is charged. (Note: When the spring is charged, it maintains its position as shown in the picture).



01



02



03

Insertion and removal

This section describes the necessary steps for inserting and removing a controller to and from the “Disconnect” position. Racking the controller to and from Disconnect/Test and Connected (Control circuit checkout) positions is covered in the next section. The following rules should always be observed when inserting a controller into the MCC compartment.

- ABB has specific accessories to be used with ABB controllers
- ALWAYS compare the controller ratings nameplate with the MCC ratings nameplate. Verify controller secondary control voltage ratings are in agreement with the MCC control voltage ratings
- DO NOT attempt to insert the controller prior to a complete inspection of both controller and MCC compartment controller and compartment must be free of tools, obstructions or foreign objects
- DO NOT attempt to insert or rack a closed controller
- DO NOT force a controller into or out of the cell

WARNING



Do not attempt to remove the controller from the controller compartment without the required ramp, dolly or lift truck. Refer to the specific MCC comp Installation, Operation and Maintenance manual for details. Before placing the controller inside the compartment, it is necessary to charge the springs of the shutter's charge mechanism.

CAUTION



Use of any other racking device not approved by ABB will void the warranty. Approved device shown below.

Insertion

(Refer to Figure 4 for compartment detail and Appendix A for controller detail)

1. Open MCC controller compartment door to its fully opened position
2. Align lift truck
3. Raise platform for easy insertion of platform guides, then lower lift truck until platform guides are fully engaged and hooked into MCC compartment cell
4. Pull back on lift truck to insure platform is fully engaged and level
5. Grasp lower truck handles on both sides of controller and pull handles inward to unlatch the controller from the lift truck platform
6. Push controller into controller compartment, pulling handles inward, before front of controller truck reaches front of MCC frame or damage to cell interlock tabs will occur. Interlocks may prevent or restrict insertion
7. Align cell interlock tabs with controller compartment and push handles out to fully engage tabs into slots (controller truck will be flush with MCC frame)

CAUTION

Always keep in mind the recommended safety procedures when working in medium voltage equipment. For the safety of personnel extracting the controller of the MCC, all components should be electrically disconnected by means of a visible break, securely grounded, locked out and tagged in accordance with personnel precautions.

Removal

(Refer to Figure 4 for compartment detail and Appendix A for controller detail).

1. Confirm (through window) that controller has been opened and racked to the disconnect position.
2. Open MCC controller compartment door to its fully opened position. The interlocking system prohibits racking while the door is open.
3. Align lift truck left and right platform guides with MCC latch openings.
4. Raise platform for easy insertion of platform guides, then lower lift truck until platform guides are fully engaged and hooked into MCC compartment cell.
5. Pull back on lift truck to insure platform is fully engaged and level.
6. Grasp lower truck handles on both sides of controller and pull handles outward to unlatch the controller from the MCC frame.
7. Pull controller from compartment onto lift platform insuring cell interlock tabs are engaged into the platform slots.

Racking

The racking system is unique and features two-positions:

- Test/Disconnect” position, primary contacts are separated from the bus contacts while the secondary contacts remain engaged to the controller to be tested. Shutters shall be interlocked in the closed position
- “Connected” position, both primary and secondary contacts shall be engaged

Control circuit checkout

The preferred method to check the control circuit is to furnish a separate temporary control power source of the required control voltage rating. The temporary source must have a properly coordinated backup protective device in the circuit.

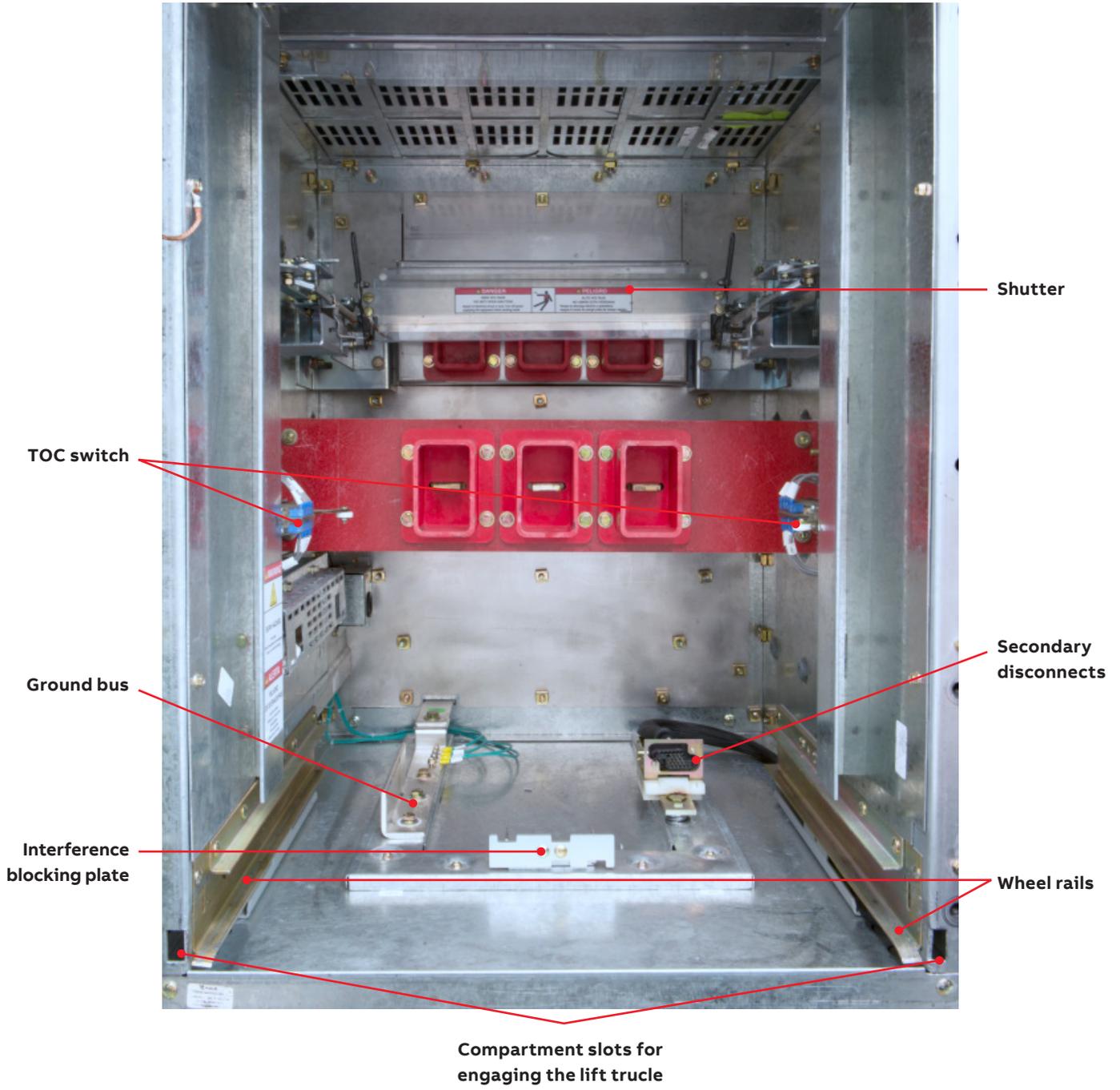
Set the device to clear any faults that might occur. Initially all controllers should be racked out (“DISCONNECTED” position) and the main circuit deenergized and grounded. When AC control power is from control power transformers in the MCC, remove all fuses in the transformer circuits.

1. Make sure all controller are open (OPEN).
2. Rack the controllers out to the open position (DISCONN).
3. Open all control power source contacts, if supplied.
4. Check each control switch or push-button. Make sure that they are open position (OPEN).
5. Connect a temporary control power source to the circuit load terminals in the MCC. Energize the control circuit from the temporary control power source.
6. Rack the controller to the connected position (CONN.). Open and close the controller to verify the correct connection in the secondary plug. Repeat the same operation for every controller assembly, one at a time.
7. Test the controllers for closing and tripping, operated on manual and electrically through the control circuit, while they are in the “DISCONN” position.
8. De-energize the control circuit. If AC control power is from transformers in the MCC, remove the separated temporary control power source. Reinstall all fuses in the transformer circuit.
9. Set all relays, regulators and other devices for proper operation of loads. The factory does not set the relays.

NOTE: Verify the proper phasing of all main circuits according to diagram

Compartment detail

Basic cell



Maintenance

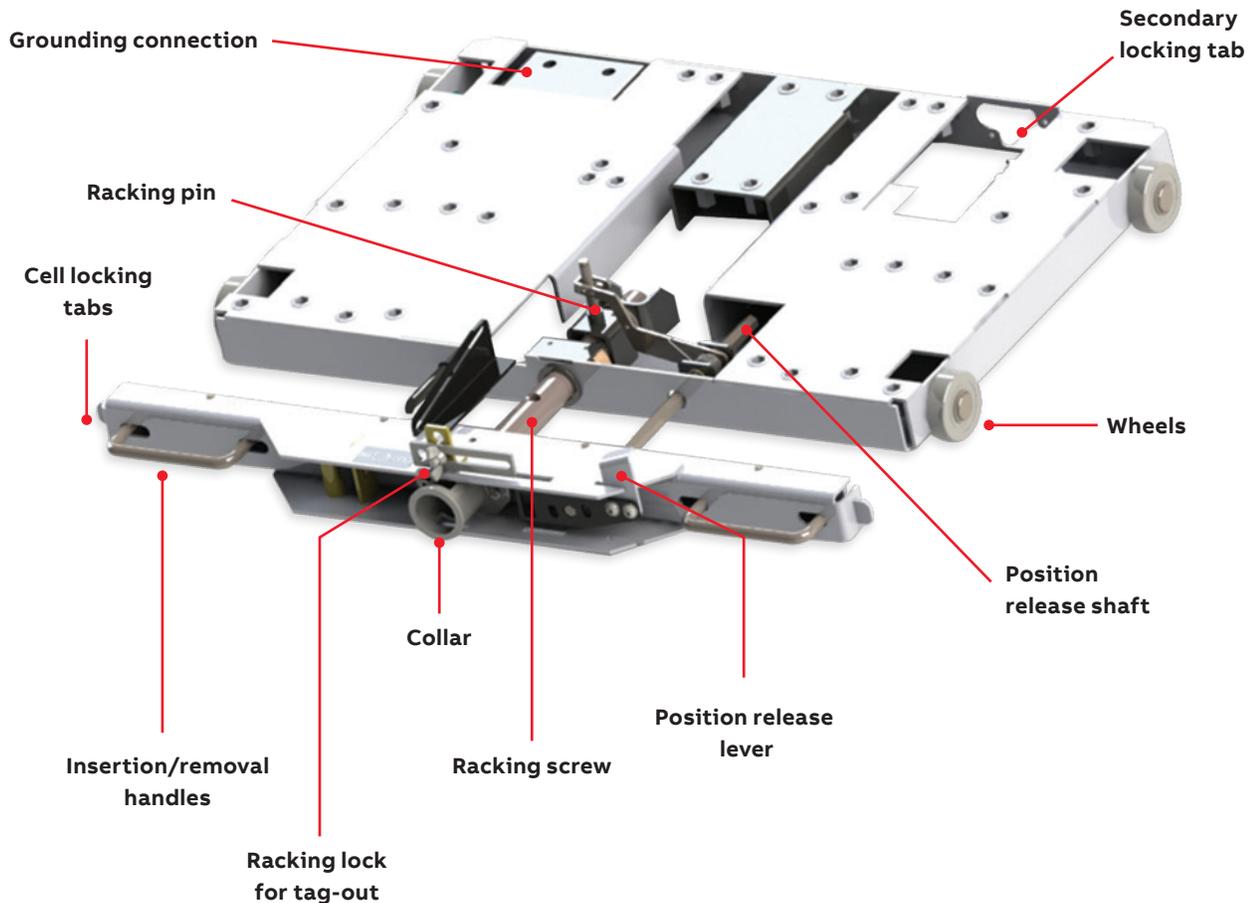
Extraction truck assembly

The extraction truck assembly requires visual inspection of hardware, lubrication and operations during routine maintenance.

With the controller outside the cell, verify all visible hardware tightness, including handles (8) and wheels (6). Wheels should rotate freely by hand movement. Replace or tighten any missing or loose hardware.

With the controller outside the cell, rotate the racking screw as though racking the controller to the connect position. This process will expose surfaces inside the truck that need to be inspected and lubricated. Apply grease "Moykote 33" to entire racking screw, pin and bushing surfaces. Inspect the position Release Shaft (3), cell locking tabs (7) and secondary Locking Tab (1) for any damage. Return truck to disconnect position. As a precaution, do not operate the controller outside the cell unless the truck is in the full disconnect position.

Truck shown with controller removed



Accessories



Lift Truck

A lift truck is required for all primary devices. The lift truck docks with the MCC, allowing a primary device to be raised or lowered to the appropriate height and safely rolled into the controller compartment. The lift truck has wheels for easy maneuvering in restricted aisle space common to MV MCC installations. A motor lift is available as an option. All primary devices have self-contained wheels for easy floor rolling.

⚠ CAUTION



- Always follow safe work practices when lifting the controllers to protect the safety of personnel and equipment
- Always inspect lift truck for signs of wear or damage before use
- Do not use a lift truck that is damaged or worn
- The lift truck IS NOT to be used for insertion of drawout controllers into MCC compartments
- The lift truck IS NOT to be used as the sole means of support when servicing the controller

Racking handle

The racking handle is designed to easily adjust the device into and out of a MCC compartment. It is also used to change the position of the device from the Disconnect and Connect positions. Press down on the release lever and rotate racking handle clockwise to rack in (toward Connect) and counter clockwise to rack out (from Connect).



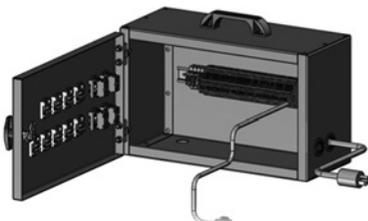
⚠ CAUTION

- Use of any other racking device not approved by ABB will void the warranty
- ABB will not be responsible for damage caused by the use of racking tools other than ABB's



Test jumper

A test jumper is an extension cord. It allows connection of secondary contacts on a vacuum controller to the MCC while outside a controller compartment. This enables the controller to be electrically operated using controls in the MCC, or electrically charged after manual operation of the controller in a MCC aisle.



Test cabinet

A test cabinet is a wall-mounted control cabinet connected to a separate power source and containing switches to open and close a controller. The test cabinet has a female connector and an umbilical cord (stored inside the cabinet) for connection to the controller, and serves as an aid to controller inspection and maintenance in MCC aisles or work areas.

Product end of life

ABB products are manufactured to meet or exceed the standards of compliance for quality and environmental management systems in accordance with ISO 9001 and ISO 14001. All of these items can be supplied with a certificate of quality. ABB is committed to complying with all legal and other relevant requirements for environmental protection in accordance with the ISO 14001 standards. The responsibility of the company is to facilitate subsequent recycling or disposal at the end of the product's life. During disposal of the product, it is always necessary to act in accordance with all local and national legal requirements that are in effect at the time of disposal.

Methods of disposal

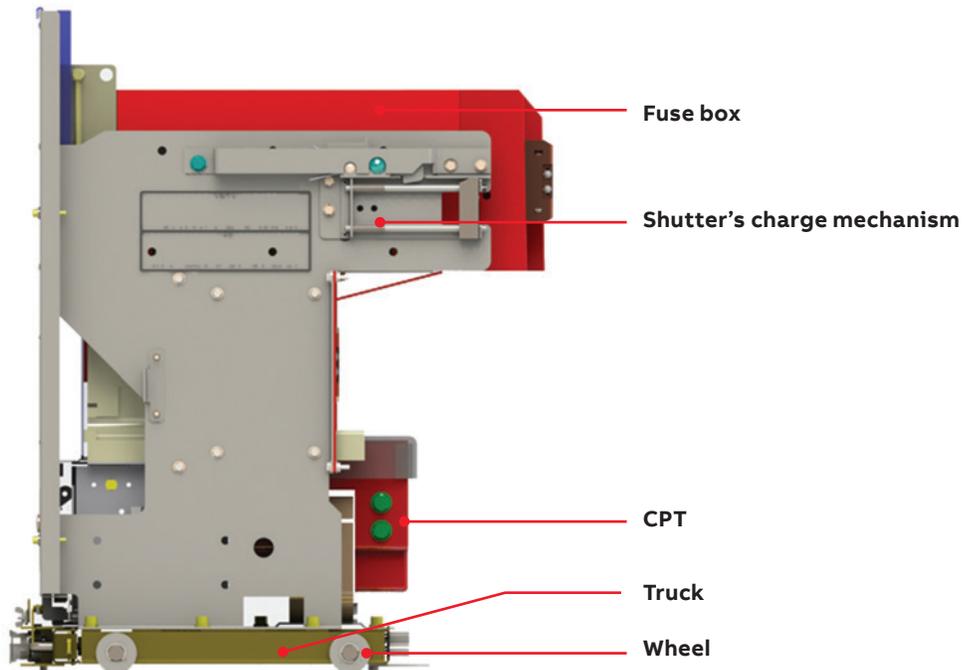
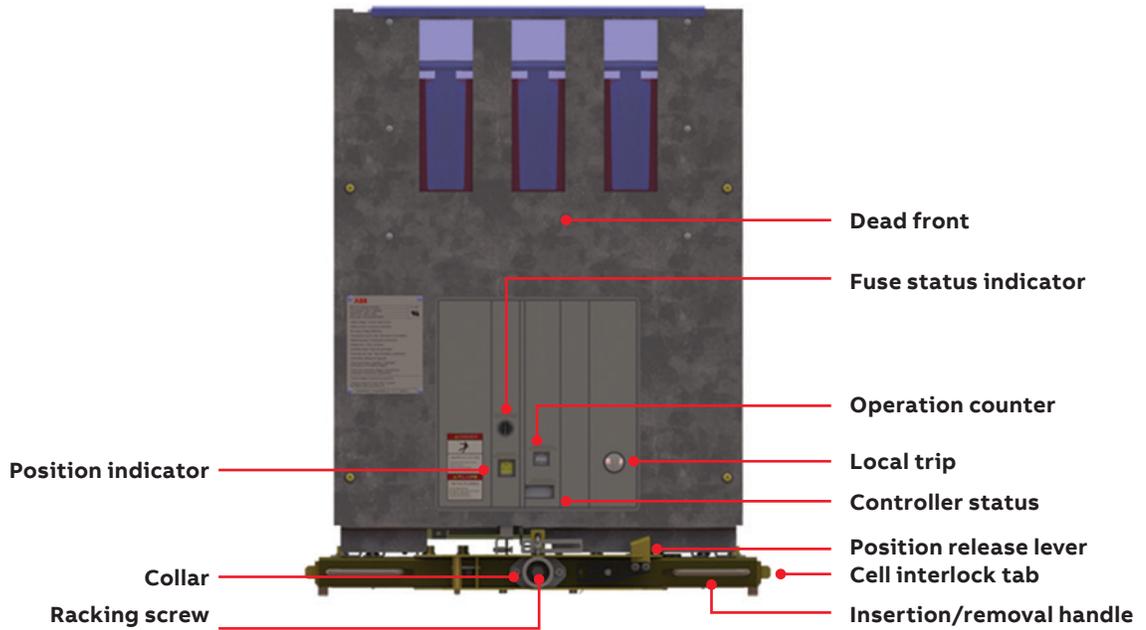
Disposal can be carried out in a manner of ways depending upon material of product. Below is the recommended method of disposal for various raw materials.

ABB is committed to complying with the relevant legal and other requirements for environmental protection according to the ISO 14001 standard. The duty of the company is to facilitate subsequent recycling or disposal at the end of product life. During disposal of the product, it is always necessary to act in accordance with local legal requirements in force.

Raw material	Recommended method of disposal
Metal material (Fe, Cu, Al, Ag, Zn, W, etc.)	Separation and recycling
Thermoplastics	Recycling or disposal
Epoxy Resin	Separation of metal and disposal of remains
Rubber	Disposal
Oil (transformer oil)	Draining and recycling or proper disposal
SF6 gas	Discharging from equipment
Packing material	Recycling or disposal

Appendix A

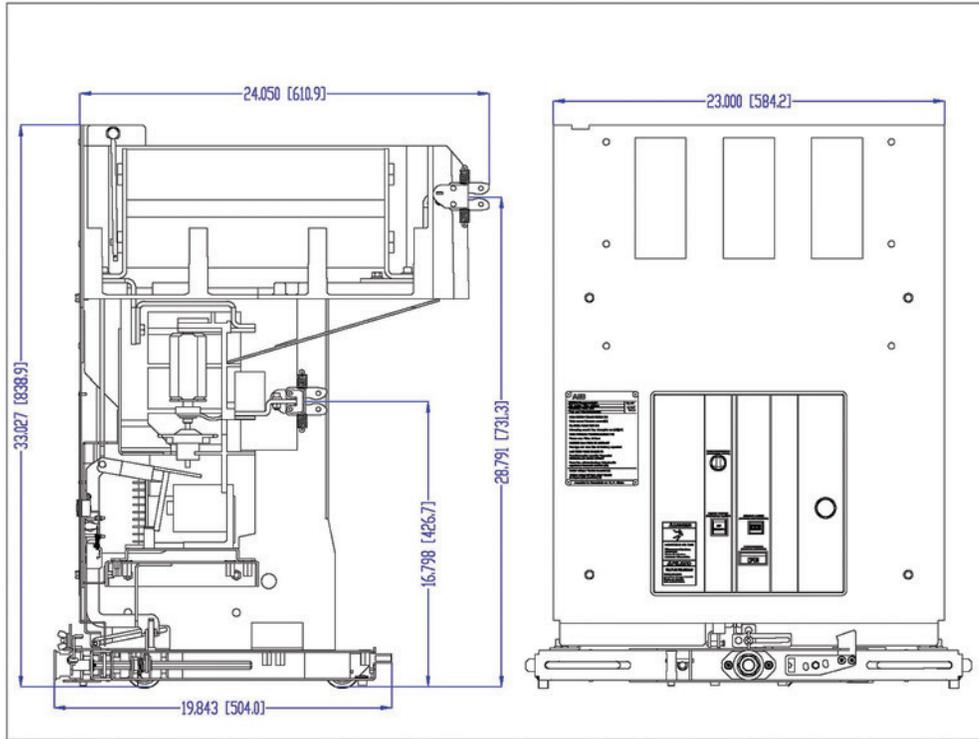
Basic controller layout



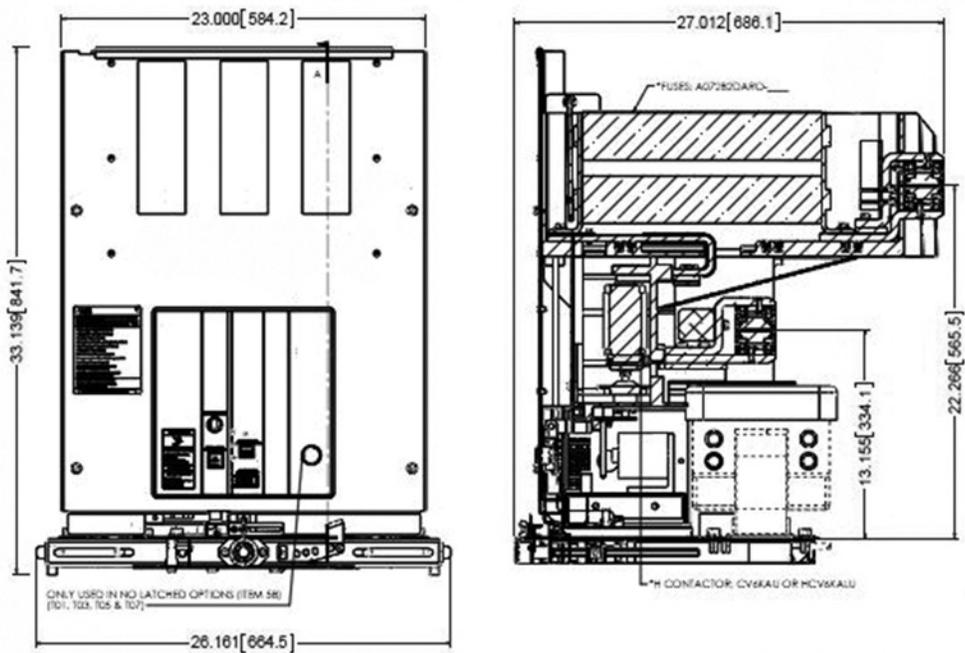
Appendix B

Basic controller dimensions

Drawout 400 A Controller



Drawout 720 A Controller



Appendix C
Antisingle phasing

What is a Phase Loss?

When one phase of a three-phases system is lost, a phase loss occurs. This is also called ‘single phasing’. Typically, a phase loss is caused by a blown fuse, thermal overload, broken wire, worn contact or mechanical failure. A phase loss that goes undetected can rapidly result in unsafe conditions, equipment failures, and costly downtime.

Voltages and currents in a three-phase system do not typically just drop to zero when a phase is lost. Often measurements yield confusing values that require a great deal of complex analysis to correctly interpret. Meanwhile, damage and downtime of the equipment continues to rise.

What happens with a phase loss?

When a three-phases motor runs with one phase missing, the remaining two -phases will take more load from the missing phase making them work harder, overheat and burn out.

To avoid the above condition the SafeGear® MCC controller has a blown fuse mechanism that ensure that all three phases are disconnected if only a single or two fuses blown.

Blown fuse mechanism

- 01 The fuse is working in the right position.
- 02 The sensor is not transmitting a signal.
- 03 When a fuse is blown, the mechanism is activated.
- 04 The sensor is transmit a signal to the relay and the three-phases are disconnected.



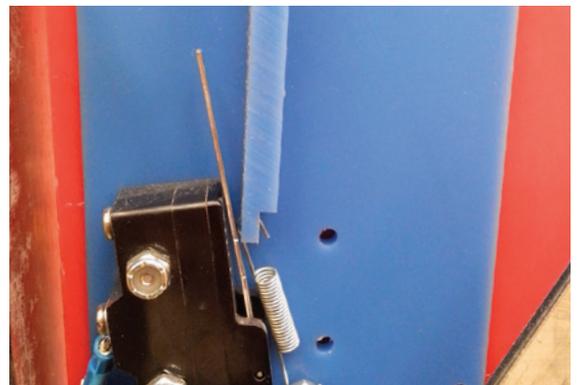
01



02



03



04

NOTE: This configuration is available and depends of relay's programming by others.

Appendix D

Instructions for replacement of fuses

The instructions provided below for the replacement of the motor controller fuses cover the minimum required information and considerations for proper replacement of the fuses. Always keep in mind the recommended safety procedures when working in medium voltage equipment. The fuse replacement must only be carried out once the controller has been electrically opened, racked out and removed from the MCC compartment.

For the safety of personnel extracting the controller of the MCC, all components should be electrically disconnected by means of a visible break, securely grounded, locked out and tagged in accordance with personnel precautions spelled out in ANSI/ASSE Z244.1 Control of Hazardous Energy – Lockout/Tagout and Alternative Methods.

Once the controller is outside the MCC compartment, follow the instructions below for the replacement of the fuses:

—
01 Remove the 4 bolts that secure the galvanized metal sheet cover (the dead front).

—
02 Verify the right position of the pins of the blown fuse mechanism that is shown in the picture below on the right.

—
03 The picture shows the improper position of the pins of the blown fuse mechanism for 400 A controller.



—
01

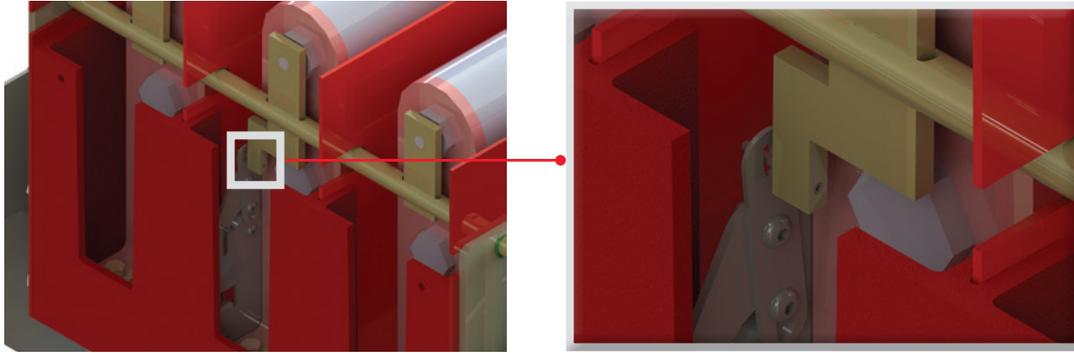


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02

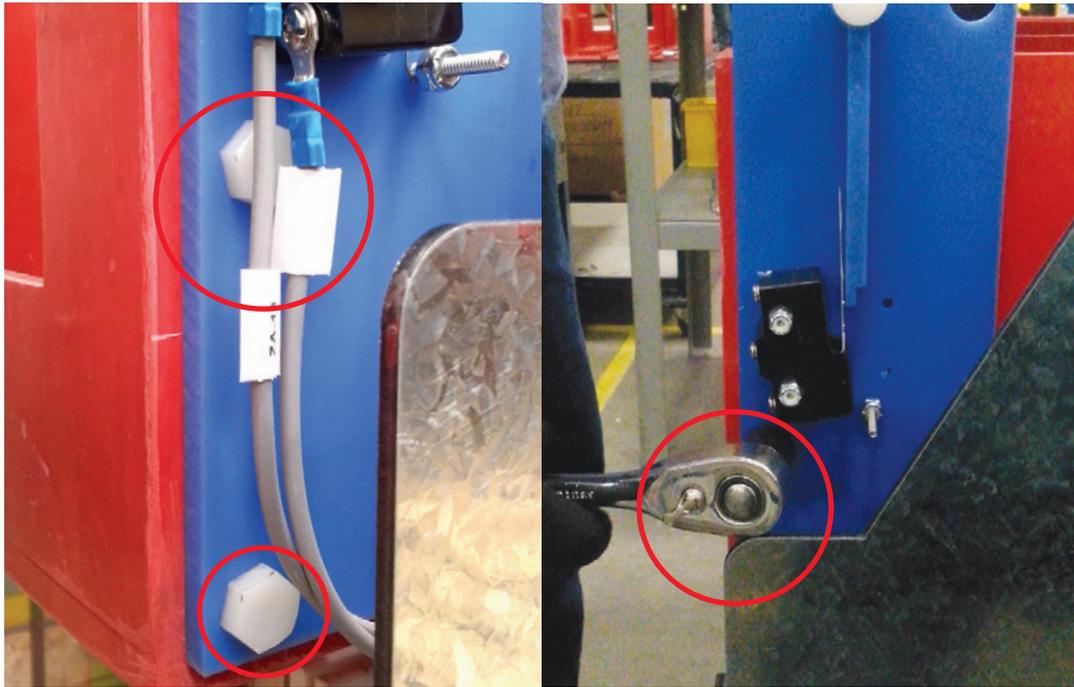


—
03

- 04 The picture shows the right position of the pin of the blow fuse mechanism for a 720 A controller.
- 05 Remove the plastic bolts on the cover that supports the blown fuse switch.
- 06 Remove the blown fuse mechanism.
- 07 Remove the 4 bolts that fix the fuse.



— 04



— 05



— 06



— 07

—
08 Extract the
insulation barrier
between the fuses.

—
09 The failed power
fuse can be removed.

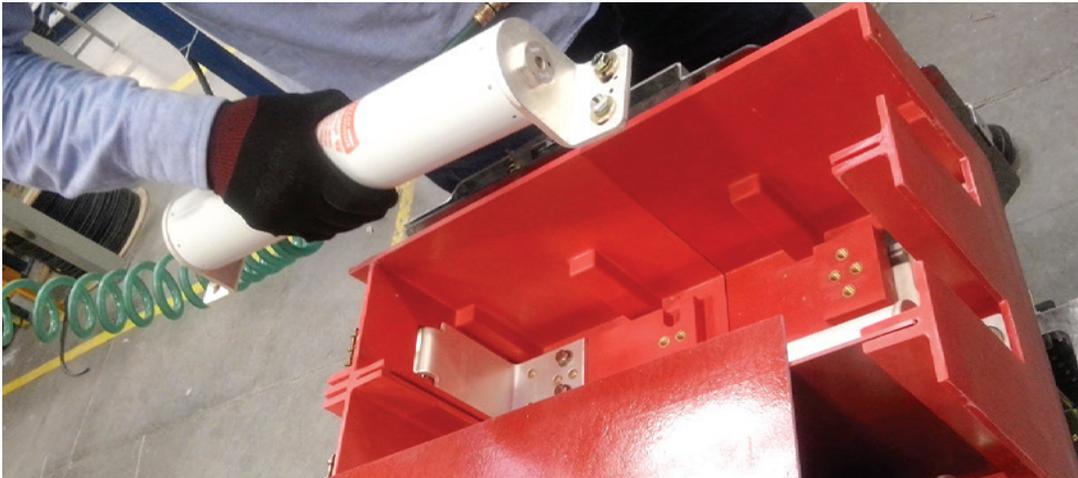
—
10 Replace it with a
new fuse which must
be the same size.



—
08



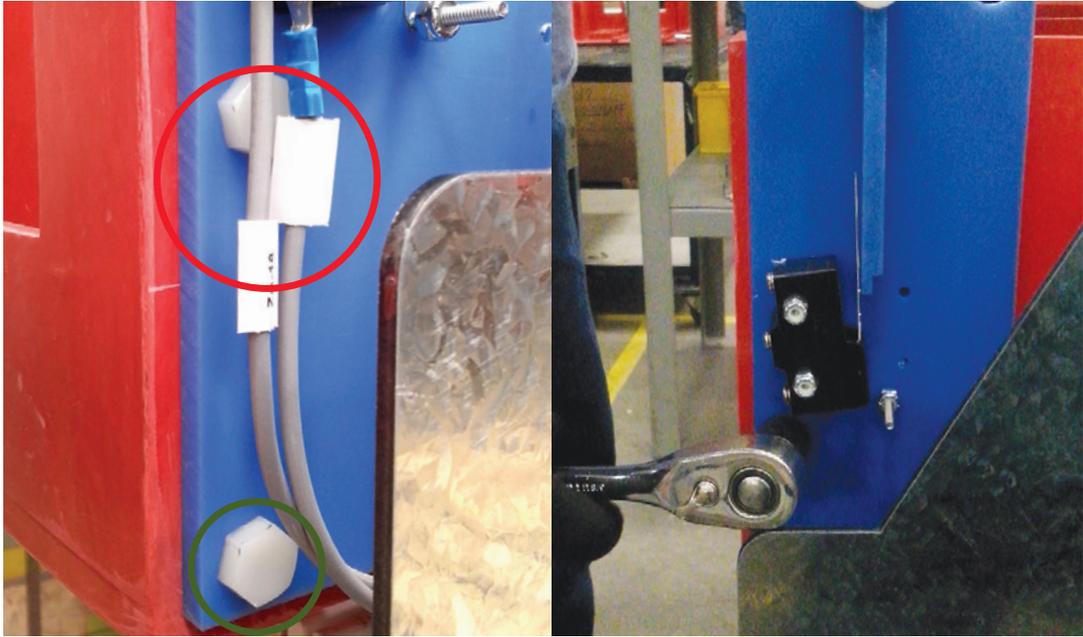
—
09



—
13 Tighten the plastic bolts on the cover that supports the blown fuse switch.

—
14 The fuse replacement is complete.

—
15 Place the dead front (galvanized metal sheet cover) and tighten the 4 bolts.



—
13



—
14



—
15

Appendix E

Opening time and ride through

The standard opening time is 280-320 ms for 400 A non-latched contactors.

In the contactor unit, the ride-through capability is achieved by operating the contactor coil at an excess current of that required to keep the contacts closed during normal operation.

The coils have the ability to store energy, the contactor has the ability to ride through a voltage sag or complete voltage dropout.

Hcv-5ha (no latch) opening time

The HCV-5HA opening time, with terminals 3 and 4 jumpered, and switching power on and off to terminals 1 and 2, is between 280-320 ms.

The HCV-5HA opening time, with terminals 1 and 2 continuously powered, and switching (opening) contacts connected to terminals 3 and 4, is between 20-30 ms.

When required decrease of the opening time to 20-30 ms, it must be verified according with the protections coordination (considering the fuses operation time) for a safe operation. For example: particularly for 24R fuse, is mandatory increase 100 ms the trip time in the protection relay in order to ensure that contactor opening time is not less than fuse operation time.

If more information is required, please consult the factory.

Appendix F

Local trip on the front

The SafeGear® MCC Controller can be provided with latched or unlatched controllers.

The latch controller has the mechanical interlock feature, where its contacts remain closed in spite of loss energy.

A button in front of the controller is used for manual trip manually when deenergized.

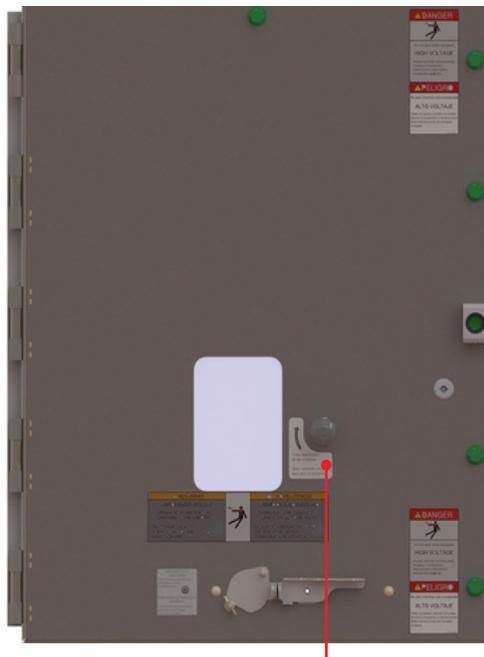
The trip mechanism is located on the controller compartment door. This is an optional feature that can be requested when the MCC is ordered.

Controller front



Manual trip

Controller compartment door



Trip mechanism

Appendix G

Maintenance procedure for vacuum interrupter

Always keep in mind the recommended safety procedures when working in medium voltage equipment. For the safety of personnel extracting the controller of the MCC, all components should be electrically disconnected by means of a visible break, securely grounded, locked out and tagged in accordance with personnel precautions spelled out in ANSI/ASSE Z244.1 Control of Hazardous Energy – Lockout/Tagout and Alternative Methods.

Procedure

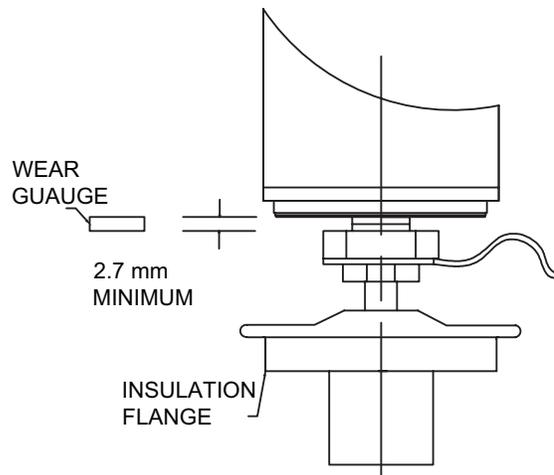
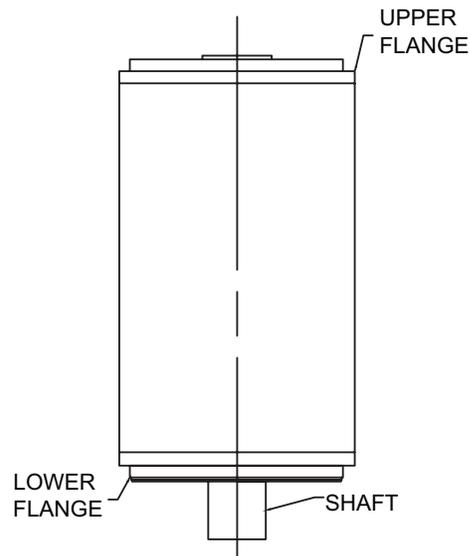
- Check the upper and lower flanges and interrupter shaft to see if they are contaminated or corroded
If contaminated use a clean cloth and rubbing alcohol
If corroded replace with a new interrupter

NOTE: Avoid touching the ceramic surface. Skin oils may harm the silicon vanish

- Check the main contact wear in the vacuum interrupter
If the wear gauge can be inserted, then there is sufficient contact material available for continued use
If the gauge cannot be inserted, replace the interrupter

NOTE: This check is made with the controller closed.

- Check vacuum in the vacuum interrupter
Apply 10kVAC between the upper and lower terminals for one minute
If there is no voltage breakdown, the vacuum interrupter is acceptable for continued use
If there is voltage breakdown, replace with a new vacuum interrupter before continued use



NOTE: If there is a vacuum failure, it can be confirmed by pushing down on the insulating flange below the vacuum interrupter. If the interrupter shaft can easily be moved, then the interrupter has lost vacuum.



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