



SafeGear™ Motor Control Center

Arc resistant metal-clad construction
Motor Control Center
Installation, operation and maintenance
manual

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Section 1

Safegear™ MCC Motor Control Center

General instructions

Read these instructions carefully before installation and use them as a guide during installation and initial operation.



File these instructions with other instruction books, drawings and descriptive data of the MCC. Keep this book available for the installation, operation, and maintenance of equipment. Using of these instructions will facilitate proper maintenance of the equipment and will prolongs its useful life.

Scope of instructions

The instructions are general in nature. They cover requirements for installation, setup, checkout and maintenance as applied to ABB medium voltage Motor Control Centers (MCC). These instructions do not attempt to cover all variations and combinations of equipment and installations. Information on particular installations appears in the following:

- Bills of materials that list electrical devices and equipment.
- Front view in the general arrangement.
- Single line drawings showing power connections.
- Floor plan, representing available space for power and control conduits.
- Special construction details.
- Elementary and schematic diagrams.
- Connection diagrams.

Section 2

Safety notes and warnings

Equipment operation depends on proper handling, installation and maintenance. Neglecting fundamental requirements may lead to personal injury, failure of the equipment and property damage.

Safety as described in this instruction book involves two conditions:

- Personal injury
- Product or property damage

Note: See "Disclaimer of warranties and limitation of liability", in this document.

Safety notations

Safety notations alert personnel to possible death, injury or property damage situations. The safety notations appear before the step in which the condition applies. The four hazard levels are:

	<div>DANGER</div> <div>DANGER, indicates a hazardous situation which, if not avoided, will result in death or serious injury.</div>
--	--



WARNING

WARNING, indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE, is used to address practices not related to personal injury.

Personnel installing, operating or maintaining this equipment must be qualified on all applicable local, regional, industry, governmental and OSHA safety procedures as well as commonly accepted safe working practices. Personnel working in or around this equipment must also exhibit common sense and good judgment regarding the potential hazards for themselves and other personnel in the area. These instructions are intended for use by fully qualified personnel and are not a substitute for adequate training, experience and supervision.



Should clarification or additional information be required, refer the matter to your ABB sales office. When communicating with ABB regarding the product covered by this Instruction book, always reference the ABB assigned Purchase Order (P.O.) number and/or equipment serial number.

Note: The Occupational Safety Hazards Administration, OSHA, is an organization of the government of U.S.A. dedicated to safety.

Section 3

Receiving, handling & storage

Receiving

Before shipment, the equipment is inspected and marked with its number and position. The factory ships the contactors separately.

Upon receipt, examine the shipment for damage or loss. Check the contents against the packing list before discarding any packing material. Notify the carrier and ABB at once of any discrepancies.

If there is damage from improper handling, file a claim for damages at once with the carrier and notify ABB.

Note: ABB standard shipments are "FOB Factory." ABB is not responsible for damage after delivery of the equipment to the carrier unless otherwise specified on the PO

Handling

NOTICE

For structural integrity, all doors and panels must be in place and securely fastened before moving the equipment.

NOTICE

Do not move or transport the frames with contactors or other drawout equipment installed in the compartments.

NOTICE

Before energizing the space heaters, remove all the packing materials. Open the breaker or cutout device that controls the heaters when is using a separated power source.

Storage

Place the equipment on the shipping base. Store all equipment indoors in a well-ventilated area.

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).

The sections ship wrapped in plastic for protection during shipment only. Remove the plastic wrap just before placing into storage. Cover with heavy wrapping paper or other moisture barrier. Use materials that will not trap moisture inside the unit. Do not cover louvered openings.

For long term storage, or in high-humidity, use space heaters to keep the interior dry. Bring power for the space heaters to the load terminals of the device that controls the heater circuits.

Note: The heater can be energized with an external source of power.

- Store contactors upright in their original shipping base.
- Do not stack.
- Do not store contactors in the compartments.

Section 4

Location site preparation

Overview

Before installing, consult all drawings supplied for the particular order. Drawings show top and front views of the lineup, primary and secondary connection diagrams and Bills of Materials. Study these drawings and the following recommendations before preparing the site plan drawings.

Location

Locate the lineup in accordance with local regulations. Clearances at the front should allow installation and removal of the draw-out equipment and lift devices. Allow enough clearance to service draw-out equipment in back to back installations (when it is applicable).

Recommended ceiling height for SafeGear™ MCC*		
RATING		FEET
25 kA		12
36 kA		14
50 kA		16

Table 4a * Maintain approximately 4 feet or more clearance from the top of the equipment to any obstruction.

Foundation


The factory supplies floor plan drawings for each installation. The floor must be straight and level within 0.25 inch over the full length and depth of the lineup. The finished floor under and in front of the line-up should be smooth.

Install power and secondary (control) conduits before moving the unit to the site. Available space for the conduits appears on the floor plans supplied with the units. Conduits should not extend more than one inch above the station floor level. Cover the conduit openings in the floor.

Section 5

Testing and final inspection

Testing



DANGER
Disconnect the primary power source during testing. Do not exceed the listed voltage class of the equipment during testing. Disconnect shunt connected coils such as potential transformer. Do not test sensors in solid state and relay with high voltage. Disconnect them before applying voltage.

With the equipment raised, assembled and connected, perform the following process:


- 1. Remove packing and shipping materials.
- 2. Make sure that all internal parts are clean and dry. If moisture is present, blow dry with warm air.
- 3. Remove any shipping blocks from relays.
- 4. Check for damaged insulation by applying potential tests to the primary bus. Apply potential tests phase-to-phase and phase to ground in accordance with “Field Test” values.

TEST VOLTAGES FOR DIELECTRIC VOLTAGE-WITHSTAND TEST	
Rated Control Voltages	Factory Test
0 V to 600V	2 x nominal voltage +1000V plus
601 V to 7200V	2.25 x nominal voltage +2000V plus

Table 6a

- 5. When the main circuit is de-energized and grounded, check the continuity of all circuits after installing the contactors. After this, energize the control source and operate the equipment. The indicating instruments verify the continuity of current transformer circuits and the energizing of the main circuit.

Control circuit checkout



DANGER
The contactor or cutout device of the local control power circuit must be opened when used a separated control power source.

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 contactors should be racked out (“DISCONN.” 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 contactor assemblies are open (OPEN).
2. Rack the contactors 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 contactor to the connected position (CONN.). Open and close the contactor to verify the correct connection in the secondary plug. Repeat the same operation for every contactor assembly, one at a time
7. Test the contactors 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.
10. Remove shorting screws from the terminal blocks in the current transformers circuits. Store screw in the tapped holes in the corners of the blocks (see Figure 6.1).

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

To open the short circuit device:

1. Make sure that the transformers circuits are completed. Do not put one of energized slitch in a secondry opened circait
2. To open the short circuit device:

2.1) Single Ratio – Remove and store the shorting screw “a”. Do not remove the ground screw “b”. 2.2)

Multi Ratio – Remove the shorting screw “a” and insert it according to the connection diagram below.

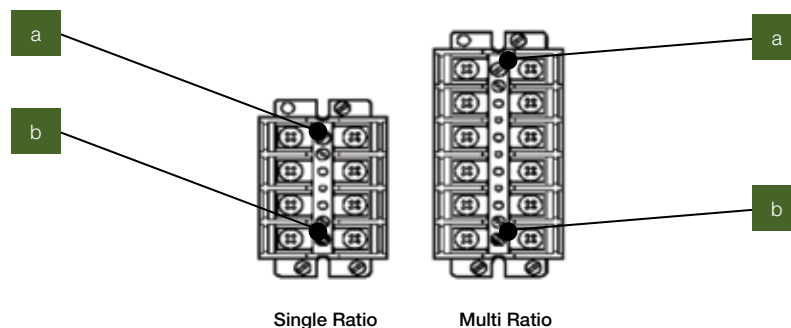



Figure 6.1 Short circuit device.

	DANGER
	There are hazards of electrical shocks and/or burns whenever working in or around of electrical equipment.
	Turn off power ahead of the MCC before performing any inspection or maintenance operations.
	Check incoming line terminals to verify that the equipment is de-energized and grounded.

Check out-going terminals to ensure that no back-feed condition exists.

Once installed and all connections made, perform a final check and test on the equipment and its controls. Check for correct equip-ment installation and that all connections are complete. Take extreme care to prevent the controlled equipment (load) from being connected to the system while performing preliminary tests.

Disconnect the line wirings if the line contactors are not in the system according to the connection diagram supplied with the equipment.

Typical circuit diagram HCV-5HA

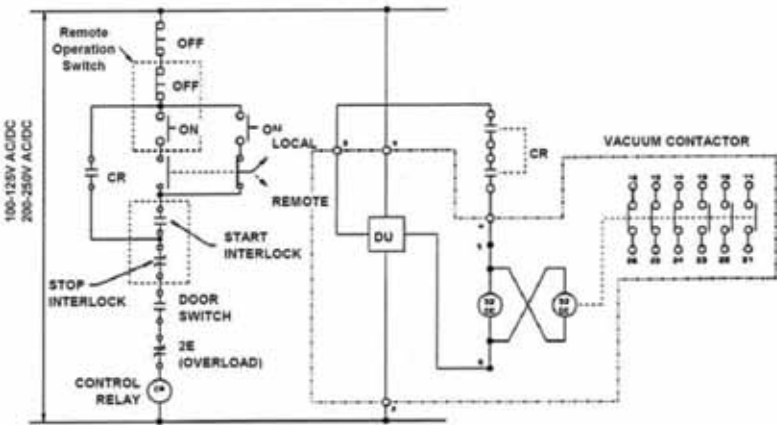



Figure 6.2 Standard operation circuit diagram of normally energized type.

Section 6
Putting into service

Safety precautions

	DANGER
	There are hazards of electrical shocks and/or burns whenever working in or around electrical equipment.
	Turn off power of the MCC before performing any inspection or maintenance operations.
	Check incoming line terminals to verify that the equipment is de-energized and grounded.

Check outgoing terminals to ensure that no back feed condition exists.

All contactors must be in “DISCONN.” position, when service or maintenance personnel are working on MCC, unplug the main bus feed and ground the whole system.

Before energizing the MCC, do a complete review of the mechanical operation of all devices. Remove clips of the relays, contactors, meters, etc.

Manually operate all contactors and relays. Moving parts should not bend. Verify that there are no foreign objects in the equipment. Use compressed, clean, dry air to clean all inside and outside surfaces.

Note: Current transformers secondary circuits should be short circuited.

Clean contact surfaces with a clean cloth and an OSHA approved solvent. Bolt the bus together. Conductivity of a bolted joint depends with the proper torquing of the bolts.

All contact surfaces of the bus will be bolted and plated.

Clean all surfaces with a clean cloth and use only OSHA approved solvent. Join bus bars with the correct screws a good conductivity depends of the appropriate torque applied.

Energizing main bus

After completing the control circuit checkout, energize the main bus as follows:

1. Verify that all doors and panels are in place and secured. All contactors must be racked out (“DISCONN.”).
2. Energize the incoming bus to the equipment's main circuit breakers or any other device located in the incoming of the lineup. Verify if operation of instruments and relays are correct.
3. Activate the independent control power source.
4. Energize the main bus closing the main circuit breaker; verify that the relays and other instruments are functioning correctly.
5. Place the contactors from the out position (“DISCONN.”) to the inserted position (“CONN.”).
6. Close the desired contactors.

Chapter 7

Standard construction

Contactor compartment

The principle of manufacturing is modular, for 400A contactor compartment the dimensions are 30” wide, 33.625” deep & 38” high. For control low voltage compartment (LVC) the dimensions are 30” wide, 15.12” deep, and 19” & 57” high. For main bus and cable compartment 1200A, 2000A & 3000A dimensions are 30” wide, 31.38” deep & 95” high. The general dimensions of the SafeGear™ MCC are 30” wide, 68” deep & 95” high without plenum.

The compartments are manufactured of galvanized steel material. The main parts of each compartment are designed with a double-bend in the end sides in order to get higher mechanical strength. The contactor truck has a galvanized steel base with wheels, in which are set the contactor and the fuses box. Three phases are connected by finger contacts.

The new design of the contactor truck allows manual insertion only when the contactor compartment door is closed, using a tool (racking lever). The secondary automatic system is auto adjustable so it does not require manual connection.

The standard paint color is ANSI 61. This powder paint has an electrostatic finish applied in a ferrous phosphate covering. This process reaches uniform and soft texture. Pieces that are not painted are fabricated with C.R.S. (Cold Rolled Steel) galvanized. Painted pieces are of black sheet C.R.S. or could have another finish to meet the IEEE C37.20.2.



Figure 7.1 Contactor compartment.



Figures 7.2.3 Power cables compartment.



Figure 7.4 Bus supports and bus bars.



Figure 7.5 Controller ground contact.



Figure 7.6 Automatic secondary.



Figure 7.7 Finger contacts.

Power cables compartment

The power cables compartment has provisions for several devices, for instance: current transformers (up to 3 per phase), surge arresters and ground sensor.

The power cables compartment has enough space to lodge up to 2 power cables per phase of 500 MCM (100% insulation level) with stress cone each.

Bus bars and supports

Bus bars are electrolytic copper sheathed in heat shrinkable tubing (epoxy Hysol coating as an option). They run horizontally and vertically along the bus & cable compartments. The cross section allows meeting the current specified by the design. The bus supports are polyester GPO-3, this design supports the electrodynamic forces caused by short circuit effects.

Contactor ground contact.

The ground contact is located at the front of the contactor compartment. The contactor is grounded in each position.

Secondary connection

Each contactor compartment includes an automatic device that connects the contactor low voltage control circuit, as well as to connect the circuit of opening and closing of the contactor.

Primary connection

Consists of a set of three copper contact fingers compressed by springs, these can be inspected by removing the contactor from the compartment. Line side finger contacts apply the correct pressure over the terminals, achieving self-alignment of the devices. All copper parts are silver-plated (tin plated are an option) for better conduction.

HCV-5HA RATINGS

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

Fuse replacement

Fuses must be de-energized and grounded before replacing them. The fuses replacement and installation is carried out with the contactor. Fuse are fixed by hexagonal screws. The fuses can be one barrel or double barrel; both have the same setup to fix, so additional attachment is not required.



Figure 7.8 Contactor.

HCV-5HAL (Latched Type Only)

Hardware	Qty. per fuse
Hexagonal 3/8"-16 X 1" UNC head screw Grade 5	4
Spring washer	4
Flat washer	4

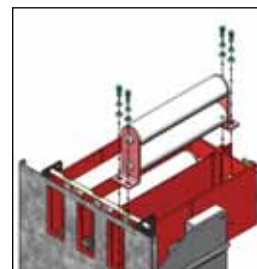


Figure 7.9 Fuse replacement.

Section 8

Contactor compartment operation



Figure 8.1 TOC.



Figure 8.2 Line side shutter.



Figure 8.3 Padlock provision.

Truck operated contact

The TOC interacts with the position of the contactor, either “CONN.”, “DISCONN.” or intermediate positions.

Note: TOC are factory calibrated, no further adjustment is necessary.

Line side shutter

The contactor compartment features a mechanical shutter lock to prevent access to the line side bus when the contactor is not in the compartment.

	DANGER Do not attempt to deactivate the shutter system. It only operates when the contactor is in the compartment
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Additional features include provision for padlock, when maintenance is required.

Contactor mounting in compartment

The contactor is located outside the compartment ready to be inserted.

NOTICE
Before putting the contactor into the contactor compartment, place the automatic secondary at its initial position (at the front of the compartment).

1. Use a Lift Truck to move the contactor to the height of the compartment.
2. Insert the tray guides of the Lift Truck in position in the compartment slots.
3. Release the contactor of the tray with the front hand grips and slide them firmly to the compartment until reach the slots located on the rails of the compartment.
4. Release Lift Truck.

At this point the Contactor is not connected to the load side bus. The position indicator is “DISCONN.” (extracted) and the status indicator is “OPEN”. The automatic secondary pins are connected to the contactor control board, which can close the contactor for testing in the status “CLOSED”.

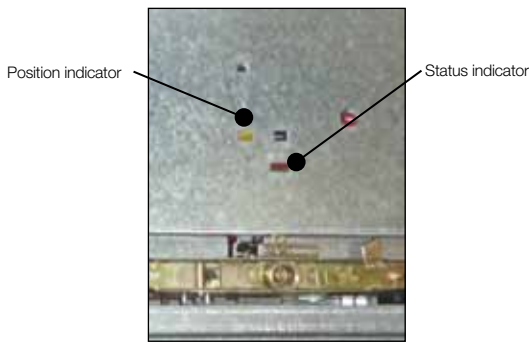


Figure 8.4 "DISCONN" position.



Figure 8.5 Insertion of the contactor.

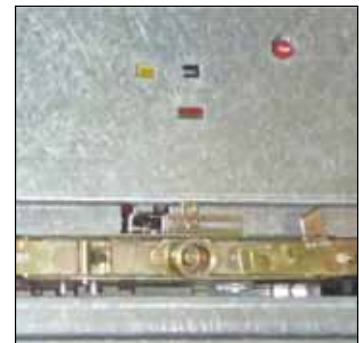


Figure 8.7 "DISCONN" position, door opened.

Racking-in the contactor

The contactor has a mechanical lock that interacts with the door to start the racking.

	CAUTION
<p>Do not attempt to rack the contactor with the door open, this may create a risk of electrical arcing and damage the equipment.</p>	

1. Close the door bolting all the screws.
2. Ensure that the contactor is open "OPEN".
3. Turn the door shutter to insert the lever.
4. Insert the handle and turn clockwise 10 complete cycles. Continues until the mechanical stop position is activated.

The contactor is now in the inserted position "CONN.", connected to the main bus through the line side bus. The load side bus is energized when the contactor is closed "CLOSED".

Racking-out the contactor

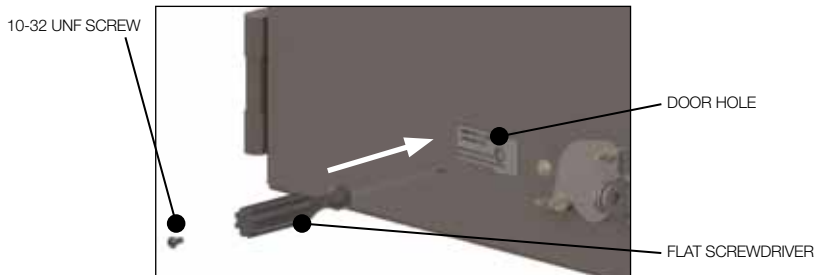
1. Open the contactor "OPEN".
2. Turn the door shutter to insert the lever.
3. Insert the handle and turn counter-clockwise 10 complete cycles. Continues until the mechanical stop position is activated.

The contactor position is "DISCONN." again.

Emergency door unlocking

To open the door using the emergency door lock, follow the steps below:

1. Remove the 10-32 UNF round head screw that is at the bottom of the contactor compartment door.
2. Using a slim screwdriver tool, introduce it through the door hole until it reaches the pin that is locking the door.
3. Move up the tool to release the locking pin that is locking the door.



NOTICE

Put the 10-32 UNF screw in place after unlocking the door

Figura 8.8 Door locking mechanism.

Section 9 Maintenance

Overview

Inspect all MCC installations at frequent intervals. Visually inspect the front and back to note any warped piece, loose bolts or screw undue vibration. Take corrective actions if any of these conditions is found.

Keep the MCC covered to prevent any dripping liquids falls on it, but do not cover the air vents

	<p>DANGER</p> <p>There are risks of electrocution and/or burns every time you work on or around electrical equipment. Disconnect power from the board before performing any maintenance. Check the terminals of the input line to verify that the equipment is disconnected. Check the output terminals to verify that there is no feedback.</p>
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	<p>WARNING</p> <p>Limit the using of solvents to remove grease and contaminants to the primary conductors, insulators and metal surfaces without paint. Do not use alcohol or freon. Use OSHA approved solvents according to local regulations. Use a nonflammable solvent equal to 300 PPM. Use solvents in well ventilated areas.</p>
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Removing the contactor with ramp (lower compartment only)



Figura 9.1 Contactor ramp for lower contactor compartment.

Safegear™ MCC has provisions to put a ramp in front of the contactor compartment to withdraw the contactor, instead of a crane or lift truck. This ramp carries the contactor outside the contactor compartment for maintenance or servicing.

Semi annual inspection

Perform a thorough inspection of the MCC at least semiannually. Emphasize the following points:

1. Perform an overall visual inspection.
2. Check all indicators, meters and instruments for proper operation.
3. Make sure all bolted connections are secure.
4. Verify operation of heaters and thermostats, if used.
5. Check for undue noise and or vibration that might cause loosen bolted connections.
6. Look for evidence of moisture in the MCC.
7. Note any unusual amount of ozone odor (distinctively pungent smell).

Annual inspection

In addition to the semi-annual inspection, perform the following recommended inspection and maintenance once a year, or sooner, if required by local conditions or regulations.

1. Bolted connections should be properly tight, discoloration, excessive corrosion, isolation fissure or discolored insulation may indicate an overheated connection. If found, follow the procedure described under section "Suspect Joint Maintenance". Verify the existence of safety connections and spacing adapted in the wiring.
2. Check the control wiring for signals of damage or wear. Change the wires that present doubtful conditions.
3. Check the resistors and other devices prone to over-heating.
4. Open all hinged doors and remove bolted panels.
5. Clean insulation thoroughly.
6. Withdraw and clean all removable components.
7. Clean the stationary portion of the MCC by wiping with a clean cloth. Use dry, compressed air for inaccessible areas.
8. Remove the covers of all panel devices where possible. Check wiring for secure connections. Clean contacts on relays and switches wherever necessary. Replace covers.
9. Remove air filters when used. Flush with clean water if necessary.
10. Follow the recommendations of any individual device instructions furnished for maintenance of the device.
11. Perform maintenance of contactors as recommended in contactor instruction manual, furnished with the MCC.

24 months inspection

In addition to the annual inspection, perform the following recommended inspection and maintenance at 24 month intervals, or sooner, if required by local conditions or regulations.

1. Perform maintenance of contactors as recommended in instructions furnished with the MCC
2. Check wiring for signs of discoloration of the secondary disconnect the plug due to heating or wear. Check if the insulation is cracked or fissured. Replace the wire with doubtful condition
3. Inspect the insulation system for the accumulation of contaminants. Wipe with a dry cloth or blow with compressed air and if necessary, wipe with a solvent approved by OSHA.
4. Check calibration of protective relays every two years.

10 year maximum inspection

In addition to the annual inspections and maintenance, perform the following recommended inspections and maintenance every ten years, or sooner, if required by local conditions or regulations.

1. Disassemble, inspect, clean, lubricate, adjust and calibrate contactor mechanisms.
2. Torque all primary conductor connection bolts to recommended values. See Table 9a.
3. Tighten all secondary control wire connections. Check for loose lug crimps and broken wire strands.

Suspect joint maintenance

1. Open the equipment and inspect the mounting surfaces.
2. Clean surfaces with a solvent approved by OSHA, restore contact surfaces from corrosion rubbing lightly with a cloth to polish as “3M Scotch Brite”. Take care to remove as little as possible the silver contact finish.
3. Replace parts that show signs of excessive corrosion, bowing, or casting.
4. Change contact jaws after being exposed to overheating in the failure of the contactor.
5. Protect the mating surfaces before assembly, with “ NO-OX-ID A-Special Electrical Grade” a product of Sanchem Chemical Co., or equivalent.
6. Use proper torque to tighten the bolts

TORQUE	
Screw (In)	Torque (Lb-In)
3/8	15min - 35max
1/2	30min - 80max

Table 9a Torque values

Care of finish

The finished MCC is strong and durable. Always keep the MCC clean. Cleaning with a dry cloth is usually sufficient. To remove oil and grease stains, use soap and warm water, drying with a soft clean cloth.

Because the color and finish can vary, see the Materials List before touching up with paint. Standard color is ANSI 61, light gray. A 12-ounce aerosol ANSI 61 ABB touch-up paint is available under part number 3A31540G03.

Spare parts

Previous experience and the number of vertical sections in service are the best guidelines for determining the stocking of replacement parts. Order factory original replacement parts from ABB only. Specify quantity, part numbers, description, and nameplate data of the device requiring the replacement parts. For replacement parts, call your nearest ABB office or representative.

End of life of product

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 either 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

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Contact us

Your sales contact:

www.abb.com/contacts

More product information:

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