# ADVAC™
# Medium Voltage Vacuum Circuit Breaker
# Installation and Operation Manual


Power and productivity
for a better world™

ABB

# ADVAC

| | Voltage Class (kV) | Ir (Amps) | Isc (kA) | Style Code first 5 digits | Max. Wave voltage (kV, rms) | Max. Sym. Interrupt & STC (kA, rms) | Close & Latch (kA, rms) | Lightning Impulse Withstand (BiL) (kV, Crest) | Low Frequency Withstand (Hi-Pot) (kV, rms) | Cap Switch | Interrupt Time (cycles) | Closing time | Contact Resistance <= (µΩ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drawout, Fixed, Roll on the floor | 5 | 1200 | 25 | AA4A1 | 4.76 | 25 | 65 | 60 | 19 | 630A C2 rated 15kA Peak 2.480 KHz | 3 | 30-60 | 46.1 |
| | | | 31.5 | AA4B1 | 4.76 | 31.5 | 82 | 60 | 19 | Rated cable charging current 26A, C1 | 3 | 30-60 | 46.1 |
| | | | 40 | AA4C1 | 4.76 | 40 | 104 | 60 | 19 | Rated cable charging current 26A, C1 | 5 | 50-80 | 35.85 |
| | | | 50 | AA4D1 | 4.76 | 50 | 130 | 60 | 19 | 1200A C2 rated 18kA Peak 2.4KHz | 5 | 50-80 | 35.85 |
| | | 2000 | 25 | AA4A2 | 4.76 | 25 | 65 | 60 | 19 | Rated cable charging current 26A, C1 | 3 | 30-60 | 16.9 |
| | | | 31.5 | AA4B2 | 4.76 | 31.5 | 82 | 60 | 19 | Rated cable charging current 26A, C1 | 3 | 30-60 | 16.9 |
| | | | 40 | AA4C2 | 4.76 | 40 | 104 | 60 | 19 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 16.9 |
| | | | 50 | AA4D2 | 4.76 | 50 | 130 | 60 | 19 | 1200A C2 rated 18kA Peak 2.4KHz | 5 | 50-80 | 12.93 |
| | | 3000 | 25 | AA4A3 | 4.76 | 25 | 65 | 60 | 19 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 13.28 |
| | | | 31.5 | AA4B3 | 4.76 | 31.5 | 82 | 60 | 19 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 13.28 |
| | | | 40 | AA4C3 | 4.76 | 40 | 104 | 60 | 19 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 13.28 |
| | | | 50 | AA4D3 | 4.76 | 50 | 130 | 60 | 19 | 1200A C2 rated 18kA Peak 2.4 Khz | 5 | 50-80 | 13.28 |
| | 8.25 | 1200 | 40 | AA4E1 | 8.25 | 40 | 104 | 95 | 36 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 35.85 |
| | | 2000 | | AA4E2 | 8.25 | 40 | 104 | 95 | 36 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 16.9 |
| | | 3000 | | AA4E3 | 8.25 | 40 | 104 | 95 | 36 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 13.28 |
| | 15 | 1200 | 25 | AA4G1 | 15 | 25 | 65 | 95 | 36 | 630A C2 rated 15kA Peak 2.480 KHz | 3 | 30-60 | 46.1 |
| | | | 31.5 | AA4H1 | 15 | 31.5 | 82 | 95 | 36 | Rated cable charging current 26A, C1 | 3 | 30-60 | 46.1 |
| | | | 40 | AA4J1 | 15 | 40 | 104 | 95 | 36 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 35.85 |
| | | | 50 | AA4K1 | 15 | 50 | 130 | 95 | 36 | 670A C1 rated 19kA Peak, 2.8kHz | 3 | 50-80 | 12.93 |
| | | 2000 | 25 | AA4G2 | 15 | 25 | 65 | 95 | 36 | Rated cable charging current 26A, C1 | 3 | 30-60 | 16.9 |
| | | | 31.5 | AA4H2 | 15 | 31.5 | 82 | 95 | 36 | Rated cable charging current 26A, C1 | 3 | 30-60 | 16.9 |
| | | | 40 | AA4J2 | 15 | 40 | 104 | 95 | 36 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 16.9 |
| | | | 50 | AA4K2 | 15 | 50 | 130 | 95 | 36 | 670A C1 rated 19kA Peak, 2.8kHz | 3 | 50-80 | 12.93 |
| | | 3000 | 25 | AA4G3 | 15 | 25 | 65 | 95 | 36 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 13.28 |
| | | | 31.5 | AA4H3 | 15 | 31.5 | 82 | 95 | 36 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 13.28 |
| | | | 40 | AA4J3 | 15 | 40 | 104 | 95 | 36 | 1200A C2 rated 18kA Peak 2.4 KHz | 3 | 50-80 | 13.28 |
| | | | 50 | AA4K3 | 15 | 50 | 130 | 95 | 36 | 1000A C2 rated 6kA Peak 500Hz | 3 | 50-80 | 12.51 |

## SafeGear HD™ ADVAC Breakers

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drawout | 15KV | 1200 | 50 | AA4L1 | 15 | 50 | 130 | 95 | 36 | 670A C1 rated 19kA Peak, 2.8kHz | 3 | 50-80 | 12.93 |
| | | 2000 | 50 | AA4L2 | 15 | 50 | 130 | 95 | 36 | 670A C1 rated 19kA Peak, 2.8kHz | 3 | 50-80 | 12.93 |
| | | 3000 | 50 | AA4L3 | 15 | 50 | 130 | 95 | 36 | 670A C1 rated 19kA Peak, 2.8kHz | 3 | 50-80 | 12.51 |
| | 15KV | 1200 | 63 | AA3M1 | 15 | 63 | 170 | 95 | 36 | 1770A C1 rated 15kA, 2Khz | 3 | 50-80 | |
| | | 2000 | 63 | AA3M2 | 15 | 63 | 170 | 95 | 36 | 1770A C1 rated 15kA, 2Khz | 3 | 50-80 | |
| | | 3000 | 63 | AA3M3 | 15 | 63 | 170 | 95 | 36 | 1770A C1 rated 15kA, 2Khz | 3 | 50-80 | |

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# FORWARD

This booklet provides information for the Medium Voltage (5kV to 27kV) AMVAC™ indoor circuit breakers as described below. Note: not all sections of this bulletin appllies to all the types of AMVAC™ circuit breakers. For example, the racking and interlock sections only apply to the draw-out (removable) versions and do not apply to the fixed-mount breaker styles. Also sections on the ED2 board contains all options available on the board but may not be utilized depending upon options ordered. All information in this booklet was current at the time of printing. All references in this booklet are determined from viewing the circuit breaker from the front.

## DRAWOUT (REMOVEABLE):

A drawout circuit breaker is a breaker 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 three physical ANSI operating positions within the cell: Disconnect, Test, and Connected. In the disconnected position there are no electrical connections. In the test position only, the secondary control wiring is connected via a patented disconnect mechanism which allows for remote testing of the breaker operations. The connected position, both primary and secondary circuits are connected and the breaker is ready for normal operation.

## FIXED-MOUNT:

A Fixed-mount circuit breaker 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 breaker is installed by the consumer. Secondary wiring is terminated on a 5 foot length of wire from the module 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 breaker. The customer is responsible for any damage to the breaker that is due to mis-wiring of the breaker.

## INTRODUCTION:

The purpose of this manual is to provide instructions for unpacking, storage, installation, operation and maintenance for the ADVAC™ vacuum circuit breakers. This manual should be carefully read and used as a guide during installation, initial operation, and maintenance.

The specific ratings of each model circuit breaker are listed on the individual nameplates. The ADVAC™ breakers are protective devices. As such, they are maximum rated devices. Therefore, they should not under any circumstances be applied outside of their nameplate ratings.

**WARNING**

**THE CIRCUIT BREAKERS DESCRIBED IN THIS BOOK ARE DESIGNED AND TESTED TO OPERATE WITHIN THEIR NAMEPLATE RATINGS. OPERATION OUTSIDE OF THESE RATINGS MAY CAUSE EQUIPMENT TO FAIL, RESULTING IN PROPERTY DAMAGE, BODILY INJURY AND/OR DEATH.**

**ALL SAFETY CODES, SAFETY STANDARDS AND/OR REGULATIONS AS THEY MAY BE APPLIED TO THIS TYPE OF EQUIPMENT MUST BE ADHERED TO STRICTLY.**

## SAFE PRACTICES:

ADVAC™ circuit breakers are equipped with high energy/high speed mechanisms. 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 and maintenance of these breakers, the following recommendations must be followed:

Only qualified persons, as defined in the National Electric Safety Code, who are familiar with the installation and maintenance of medium voltage circuits and equipment should be permitted to work on these breakers.

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

**DO NOT** work on an energized breaker.

**DO NOT** work on a breaker unless all components are disconnected by means of a visible break and securely grounded.

**DO NOT** work on a breaker 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 breaker.

**DO NOT** work on a breaker with a charged closing spring.

**DO NOT** use a circuit breaker by itself as the sole means of isolating a high voltage circuit.

**DO NOT** leave a breaker in an intermediate position in a cell. Always place the breaker in the disconnect, test or connected position.

**NOTICE**

**FAILURE TO OBSERVE THE REQUIREMENTS OF 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

ADVAC™ circuit breakers 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 to provide convenient handling. Accessories such as charging handles and racking handles are shipped separately from the circuit breaker.

## RECEIVING:

Immediately upon receipt of the circuit breakers, examine the cartons to determine if any damage or loss was sustained during transit. If damage or indication of rough handling is evident, file a damage claim at once with the carrier and promptly notify the nearest District Office. 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 circuit breaker parts.

Unpack circuit breakers as soon as possible after 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, carton number and part numbers of damaged or missing parts should accompany the claim.

## HANDLING:

ADVAC™ circuit breaker shipping containers are designed to be handled by a fork lift.

Once removed from the shipping container, the circuit breaker wheels are designed to move the breaker across a smooth, paved surface.

Care must be taken not to damage the secondary locking tab (item 6, page Fig.5) when transporting, rolling, or handling the ADVAC™ breakers.

DO NOT pull the circuit breaker truck by the front handles with the breaker in any position other than full disconnect. Handles lock in place when breaker is racked in.

## STORAGE:

Circuit breakers should be installed in their permanent location as soon as possible. If the breakers are not placed in service for some time, it is advisable to provide adequate means of environmental protection. This may be done by keeping the breaker in its original shipping container and storing in a warm, dry and uncontaminated atmosphere. The breakers should be stored to minimize condensation. Moisture can cause deterioration of metal parts and high voltage insulation.

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

**CAUTION**

**Do not stack crated breakers more than 3 high .**

**Containers will collapse causing damage to breakers!**

## LIFTING HOOK:

The lifting hook is specifically designed for general lifting and lowering of the Vacuum circuit breaker, from shipping pallets or for lifting onto and off of work tables. The lifting hook is not designed to be used for insertion or removal of the circuit breaker from the switchgear compartment, instead, the use of an appropriate lift truck is required or serious damage to the breaker may occur.

**CAUTION**

- **Always follow safe work practices when lifting the circuit breakers to protect the safety of personnel and equipment.**
- **Always inspect lifting hook for signs of wear or damage before use.**
- **Do not use a lifting hook that is damaged or worn.**
- **The lifting device (i.e. hoist, wench) should be suitably rated for lifting the circuit breaker load.**


**Figure 6: Lifting Hook Detail**

**Chain hook:**

Attach one lifting hook to each side of the circuit breaker on lifting hook angle.

**NOTE:** Lifting angles **must** be removed before breaker is inserted into switchgear compartment.

**RACKING HANDLE:**

The racking handle is designed to easily adjust the breaker into and out of a switchgear enclosure. It is also used to change the position of the device from the Disconnect, Test, and Connect positions. Press down on the release lever (2) and rotate racking handle (2) clockwise to rack in (toward Connect) and counter clockwise to rack out (from Connect).

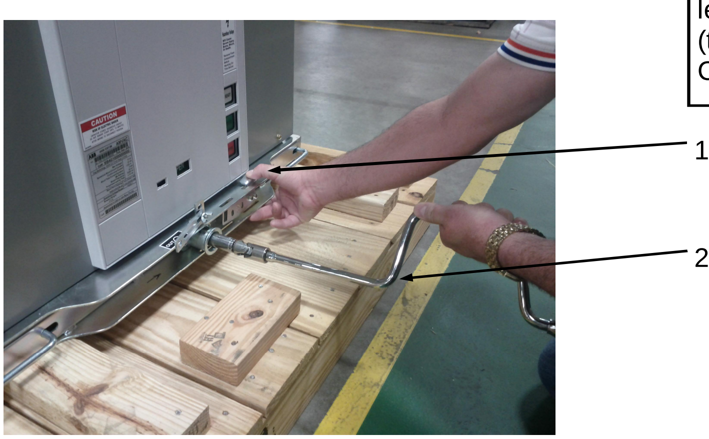


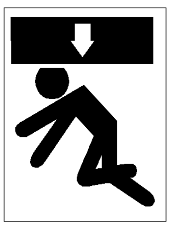

**Figure 7: Racking Handle**

## INSERTION AND REMOVAL

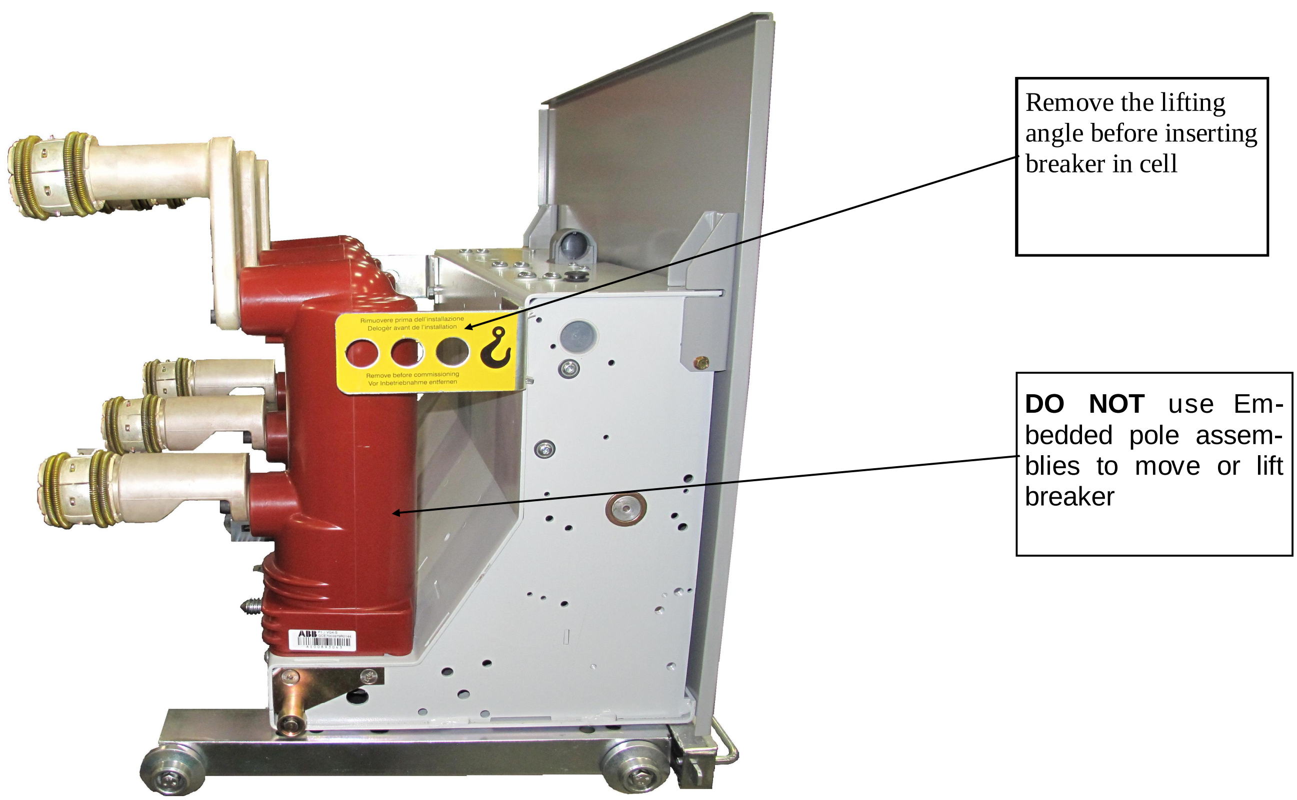
This section describes the necessary steps for inserting and removing a circuit breaker to and from the switchgear's "Disconnect" position. Racking the circuit breaker to and from Disconnect, Test and Connected positions is covered in the next section. The following rules should always be observed when inserting a circuit breaker into the switchgear compartment.

- **NOTE** ABB has specific accessories to be used with ABB breakers.
- **ALWAYS** compare the breaker ratings nameplate with the switchgear ratings nameplate. Verify breaker secondary control voltage ratings are in agreement with the switchgear control voltage ratings.
- **ALWAYS** make sure lifting angles (see photo below) are removed prior to inserting breaker into cell.
- **DO NOT** attempt to insert the circuit breaker prior to a complete inspection of both breaker and switchgear compartment. Breaker and compartment must be free of tools, obstructions or foreign objects.
- **DO NOT** attempt to insert or rack a closed circuit breaker.
- **DO NOT** force a breaker into or out of the cell.
- **DO NOT** remove or rotate interference blocking plate in switchgear compartment. Interference plate prevents improper rating circuit breaker from being inserted into switchgear compartment.

**WARNING**



**Do not attempt to remove the breaker from the circuit breaker compartment without the required ramp, dolly or lift truck. Refer to the specific switchgear Installation and Maintenance manual for details.**



# INSERTION AND REMOVAL

**CAUTION**

**Use of any other racking device not approved by ABB will void the warranty!!**

**Approved device shown**

**INSERTION:** *(Refer to [Figure 1] for compartment detail, [Appendix A] for breaker detail)*

1. Open switchgear breaker compartment door [H] to its fully opened position.
2. Align lift truck left & right platform guides with switchgear latch openings.
3. Raise platform for easy insertion of platform guides, then lower lift truck until platform guides are fully engaged and hooked into switchgear compartment cell.
4. Pull back on lift truck to insure platform is fully engaged & level.
5. Grasp lower truck handles [10] on both sides of breaker and pull handles inward to unlatch the breaker from the lift truck platform.
6. Push breaker into breaker compartment, pulling handles inward before front of breaker truck reaches front of switchgear frame or damage to cell interlock tabs [11] will occur. Interlocks may prevent or restrict insertion (Refer to Page 11 [Interlocks]).
7. Align cell interlock tabs with breaker compartment slots and push handles out to fully engage tabs into slots (breaker truck will be flush with switchgear frame).

**REMOVAL:** *(Refer to [Figure 1] for compartment detail, [Appendix A] for breaker detail)*

1. Confirm (through window) that breaker has been opened and racked to the disconnect position.
2. Open switchgear breaker compartment door to its fully opened position.
3. Insure breaker is discharged by pressing the close then open button sequentially.
4. Align lift truck left & right platform guides with switchgear latch openings.
5. Raise platform for easy insertion of platform guides, then lower lift truck until platform guides are fully engaged and hooked into switchgear compartment cell.
6. Pull back on lift truck to insure platform is fully engaged & level.
7. Grasp lower truck handles [10] on both sides of breaker and pull handles inward to unlatch the breaker from the switchgear frame.
8. Pull breaker from compartment onto lift platform insuring cell interlock tabs [11] are engaged into the platform slots and breaker truck handles are fully extended.

## RACKING:

ADVAC™ circuit breakers are designed with three positive racking positions. The Disconnect position allows only manual operation of the breaker without control power and with the shutters closed. The Test Position allows manual and electrical operation of the breaker with control power supplied through the secondary contacts with the shutters closed. As the breaker approaches the Connected position, an increase in racking force is required to lift the shutters and to engage the primary contacts. In the Connected position, the primary disconnects are fully engaged with the shutters open, electrical operation of the breaker through the secondary contacts remains enabled.

1. Engage Racking Handle onto Racking Screw (7)
2. Actuate Position Release Lever (9) to begin racking breaker.

## DISCONNECT THROUGH TEST:(Refer to Appendix A and Fig. 1)

1. Perform visual inspection of the Circuit Breaker:
    a. Verify Close/Open Indicator shows OPEN
    b. Verify Charged/Discharged Indicator shows DISCHARGED
    c. Breaker is prevented from closing by a mechanical interlock in the truck .
    d. Verify switchgear door is CLOSED.
2. Actuate (push down) Position Release Lever (9) to begin racking from Disconnect position
    a. Begin racking in the CLOCKWISE direction
    b. Release Position Release Lever once racking has begun (after Approx. 1/2 turn)
    c. Approximately four (4) revolutions (40mm) will move the breaker from the Disconnect to the Test position
        - The Test Position is indicated by a positive lock, preventing further racking shaft rotation.
        - Closing of the breaker is prevented between Disconnect and Test positions
        - Control power is available in the Test Position; shutters remain closed.

## TEST THROUGH CONNECT: (Refer to Appendix A and Fig. 1)

1. Perform visual inspection of the Circuit Breaker:
    a. Verify Close/Open Indicator shows OPEN
    b. Verify Charged/Discharged Indicator shows CHARGED
    c. Verify switchgear door is CLOSED.
2. Actuate (push down) Position Release Lever (9) to begin racking from Test position:
    a. Begin racking in the CLOCKWISE direction
    b. Release Position Release Lever once racking has begun (after approx. 1/2 turn)
    c. Approximately 21 revolutions (210mm) will move the breaker between the Test and Connect positions
        - The Connect Position is indicated by a positive lock, preventing further racking shaft rotation.
        - Closing of the breaker is prevented between Test and Connect positions
3. Once the Breaker is Fully in the connect position, and the positive lock position has been established, It is recommended that the racking screw be turned in the counterclockwise direction to release the pressure on the locking

## CONNECT THROUGH TEST: (Refer to Appendix A and Fig. 1)

1. Perform visual inspection Circuit Breaker:
    a. Verify Close/Open Indicator shows OPEN
    b. Verify switchgear door is CLOSED.
2. Actuate (push down) Position Release Lever (9) to begin racking from Connect position:
    a. Begin racking in the COUNTER-CLOCKWISE direction
    b. Release Position Release Lever once racking has begun (after 1/2 turn)
    c. Approximately 21 revolutions (210mm) will move the breaker between the Connect and Test positions
        - The Test Position is indicated by a positive lock, further racking shaft rotation is prevented.
        - Closing of the breaker is prevented between Connect and Test positions

## TEST → DISCONNECT:

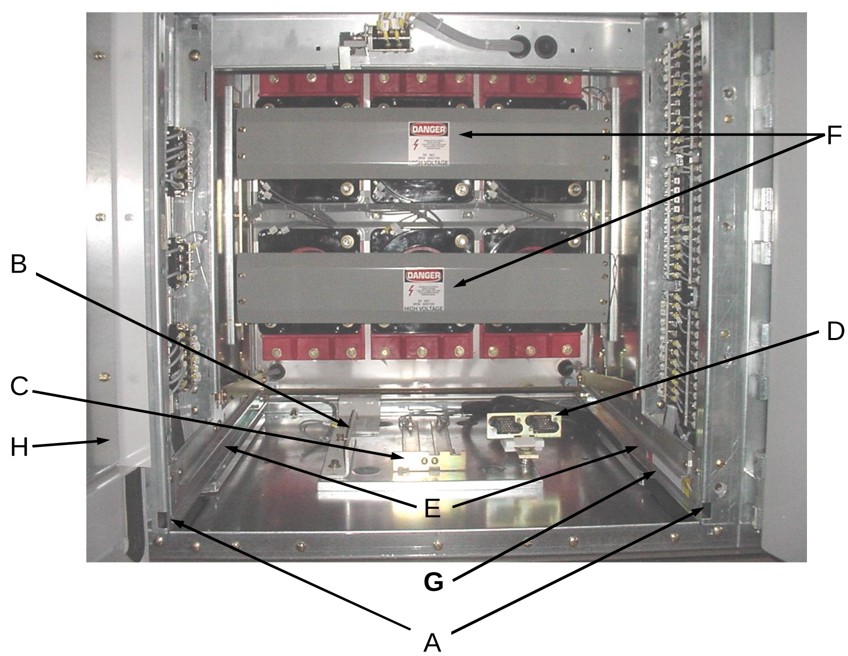
1. Perform visual inspection of the circuit breaker.
   a. Verify breaker is OPEN (push open button or initiate external electric trip if CLOSED).
   b. Verify switchgear breaker door is closed and secured.

2. Begin racking procedure using approved racking crank.
   a. Insert racking crank socket into breaker door access port and rotate until socket slides into position.
   b. Hold racking crank with left hand and depress position lever with right hand.
   c. Turn racking crank counter-clockwise for a ¼ turn before releasing position lever.
   d. Continue racking counter-clockwise (approx. 4 turns) until "Disconnect" position is reached.
   e. A positive stop will be felt and the position release lever will snap into the up position.
   f. Relieve tension on the racking pin and mechanical/electrical interlocks by reversing the racking crank slightly.

| | DISCONNECT | TEST | CONNECT |
|---|---|---|---|
| **Approximate Distance from Disconnect** | | 40 MM<br>4 REVOLUTIONS<br>1.57 INCHES | 250 MM<br>25 REVOLUTIONS<br>9.84 INCHES |
| **Manual Operation** | YES | YES | NOT RECOMMENDED |
| **Electrical Operation** | NO | YES | YES |
| **Control Power Available** | NO | YES | YES |
| **Shutter** | CLOSED | CLOSED | OPEN |
| **Primary Contacts Engaged** | NO | NO | YES |
| **Position Indication** | POSITIVE LOCK & CELL DECAL | POSITIVE LOCK & CELL DECAL | POSITIVE LOCK & CELL DECAL |
| **Interlocks** | INTERFERENCE BLOCKING PREVENTS INSERTION<br>RELEASE LEVER | RELEASE LEVER<br>CLOSING PREVENTED BETWEEN POSITIONS | CLOSING PREVENTED BETWEEN POSITIONS<br>RELEASE LEVER |
| **Requirements To Rack breaker from Position** | BREAKER OPEN<br>POSITION RELEASE LEVER ACTUATED | BREAKER OPEN<br>POSITION RELEASE LEVER ACTUATED | BREAKER OPEN<br>POSITION RELEASE LEVER ACTUATED |

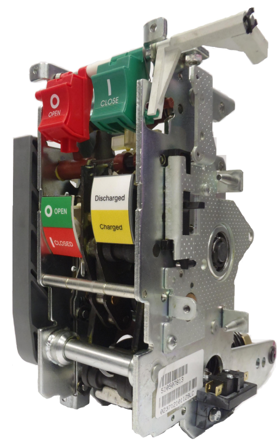
**Notes**:
A. Closed door racking is recommended between ALL positions.
B. The circuit breaker position is also indicated by a decal– see Fig 1. Item G

**Table 1: Summary Racking Data**




| # | Description |
|---|---|
| A | COMPARTMENT SLOTS |
| B | GROUND BAR |
| C | INTERFERENCE BLOCKING PLATE |
| D | SECONDARY DISCONNECTS |
| E | WHEEL RAILS |
| F | SHUTTERS |
| G | BREAKER POSITION LABEL DISCONNECT / TEST / CONNECT |
| H | COMPARTMENT DOOR |

**Figure 1: Basic Cell**



The EL operating mechanism of the Advac circuit breakers (in all versions) is fitted with a mechanical anti-pumping device which prevents re-closing due to either electrical or mechanical commands.

Should both the closing command and any one of the opening commands (local or remote) be active at the same time, there would be a continuous succession of opening and closing operations.

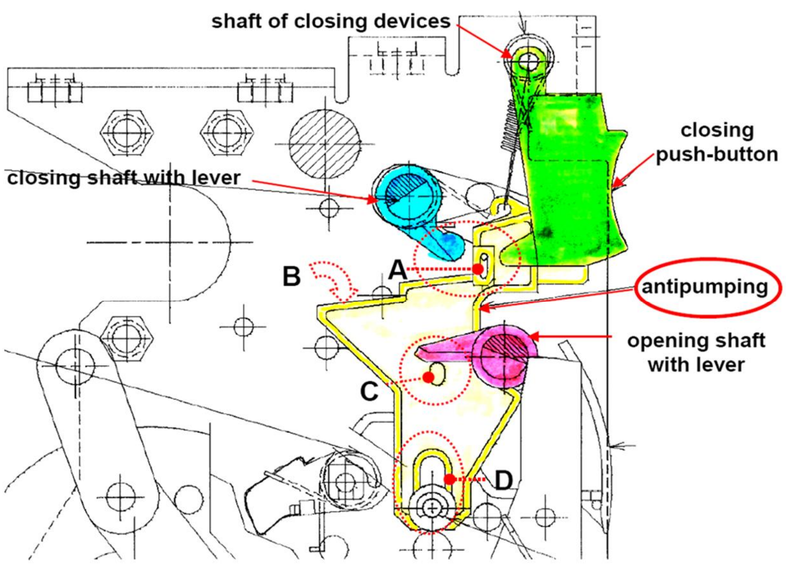
The anti-pumping device avoids this situation, ensuring that each closing operation is only followed by a single opening operation and that there is no closing operation after this. To obtain a further closing operation, the closing command must be released and then re-launched.

Furthermore, the anti-pumping device only allows circuit-breaker closure if the following conditions are present at the same time:

1. Closing spring fully charged
2. Opening mechanical pushbutton and/or opening release coils (-MO1/-MO2) are not active.
3. The circuit breaker is in the Open position.

Below is a side internal view of the EL mechanism and the associated anti-pumping component. When the opening pushbutton or coils are activated the **opening shaft lever** pushes down on point **C** of the anti-pump device. This causes the device to side down slot **D** in direction of arrow **B**. Then the trigger portion **A** moves out from between the **closing push-button** and the **closing shaft lever**. So if the closing button or signal is held active and the opening button or signal is then activated. The trigger **A** will pull out from between **closing shaft lever** and the **closing push button**. Once the open signal is released the trigger **A** will come to rest under the **closing push-button** and will not return between the **closing shaft lever** and **closing push-button** until the button or closing command is released.

The **closing push button** is operated by the closing coil (MC) directly by the **shaft closing device**. This allows the **anti-pumping** device to prohibit closing by manual or electrical means.



cross-section of the actuator; the view is from left to right side

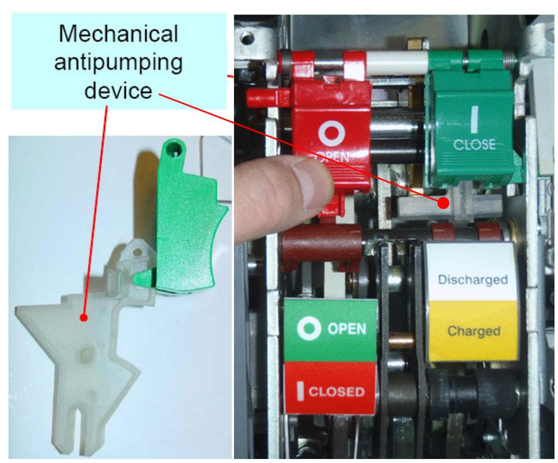
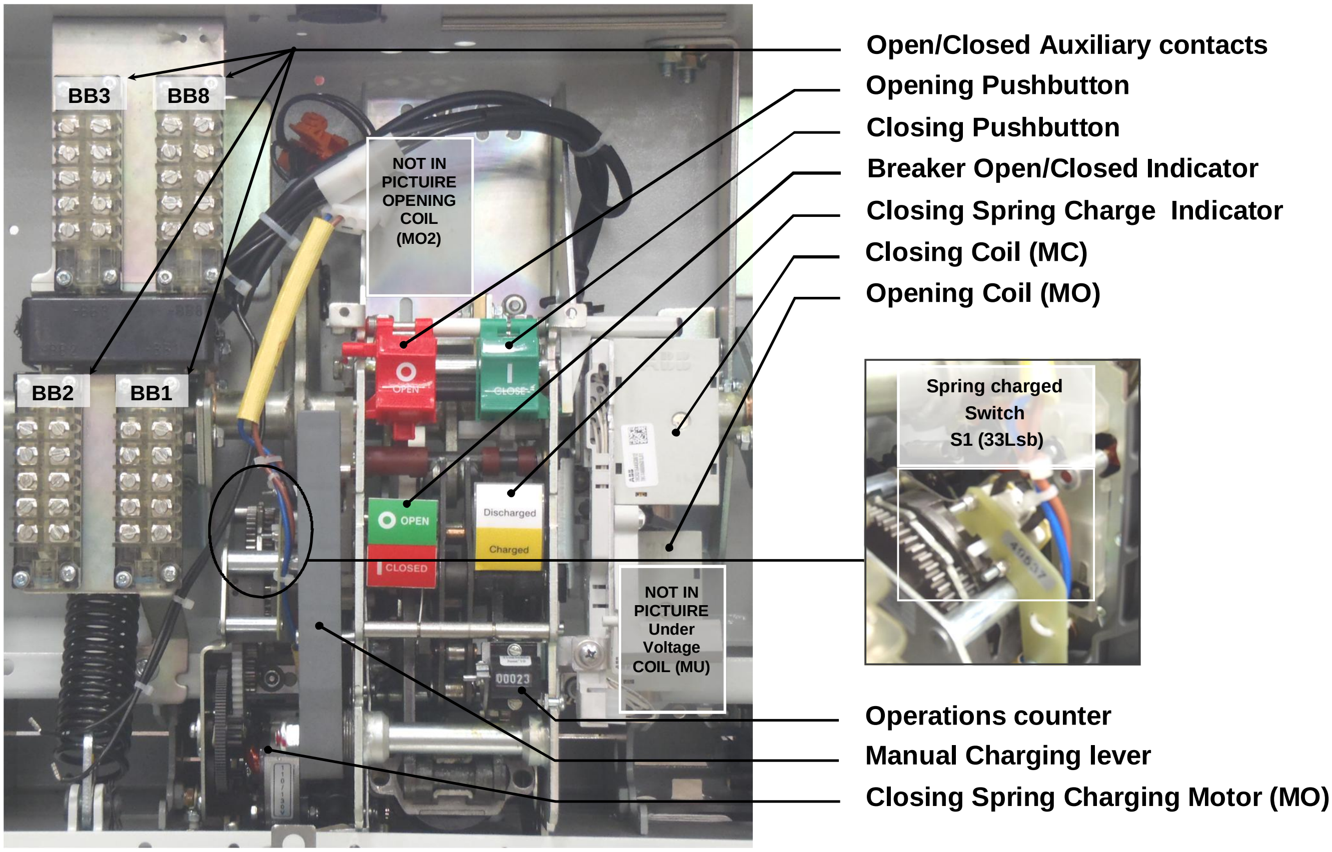
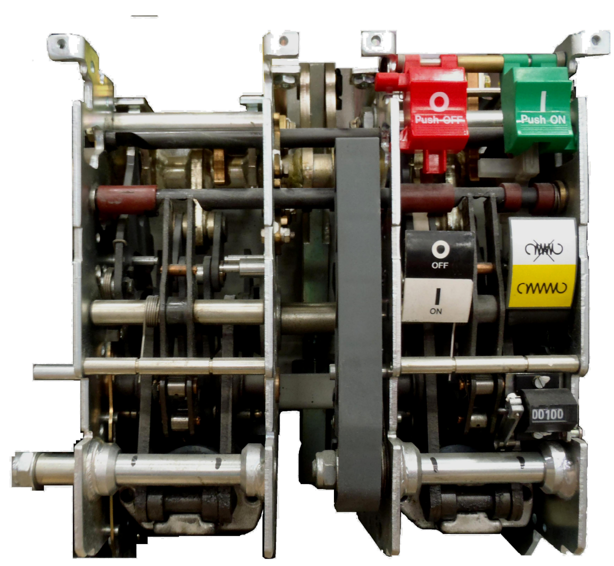


**Figure 2 Mechanism and Controls**

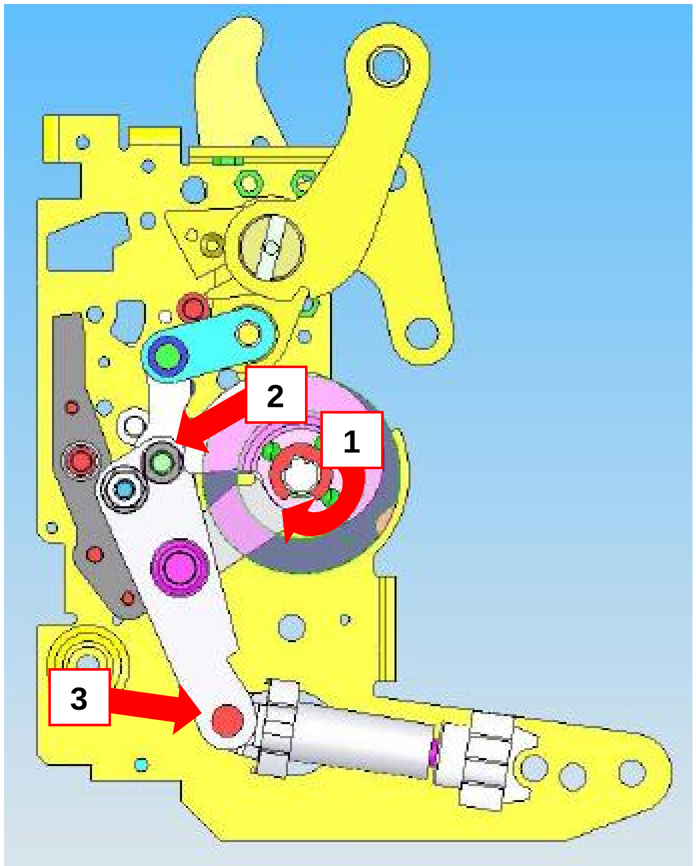



**SINGLE EL**

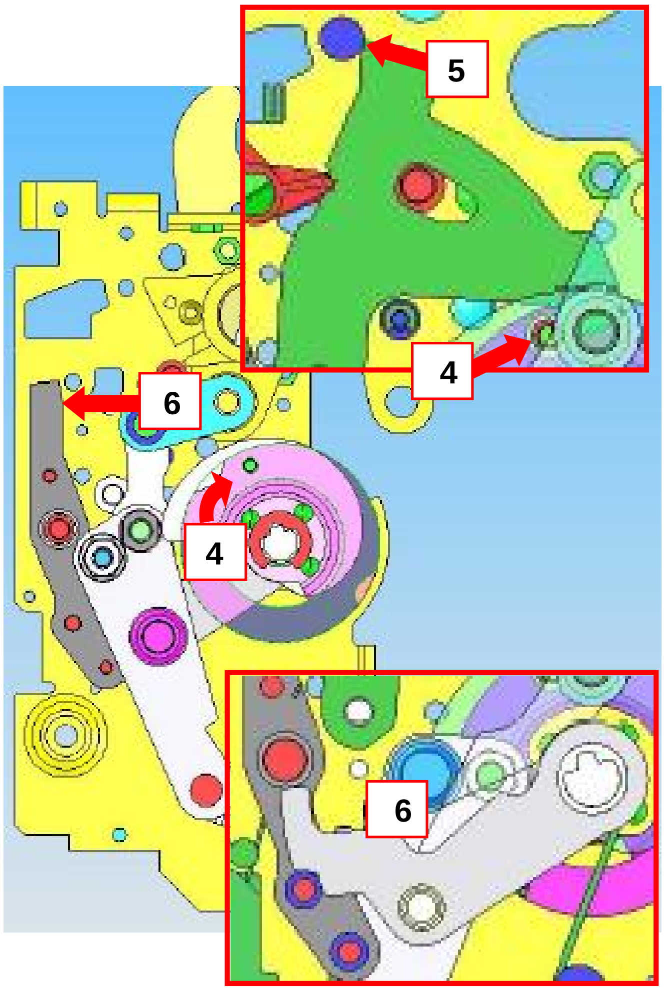
**TWIN EL**



# Description of EL Operation



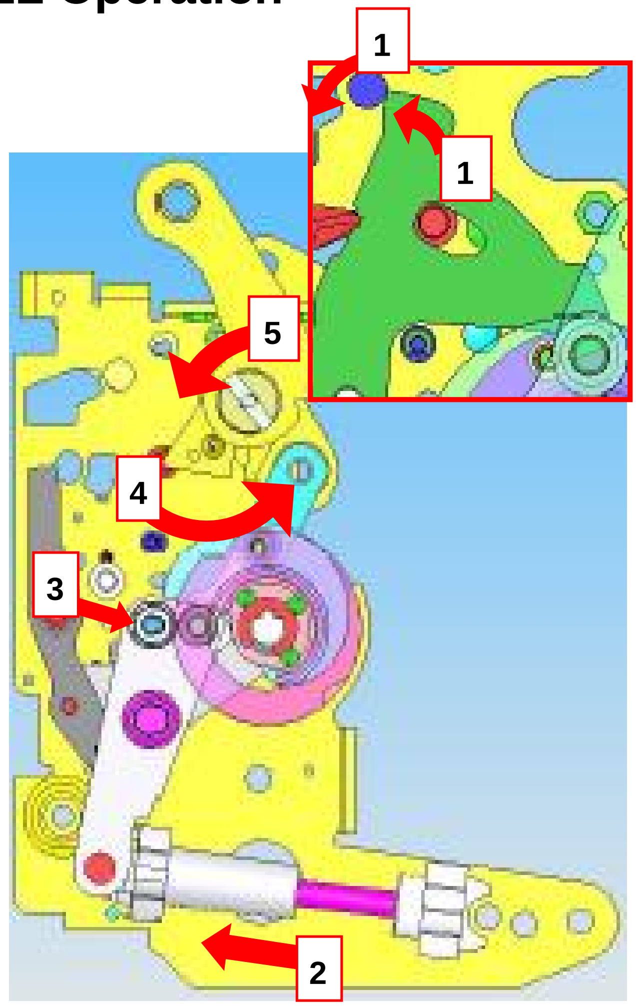

The EL mechanism can be charged manually using the spring charging lever or electrically by the spring charging gear motor. While activating one of the above mentioned methods, the cams (2) on the rotating operating shaft (1) move the closing lever assembly (3) to charge the closing spring.



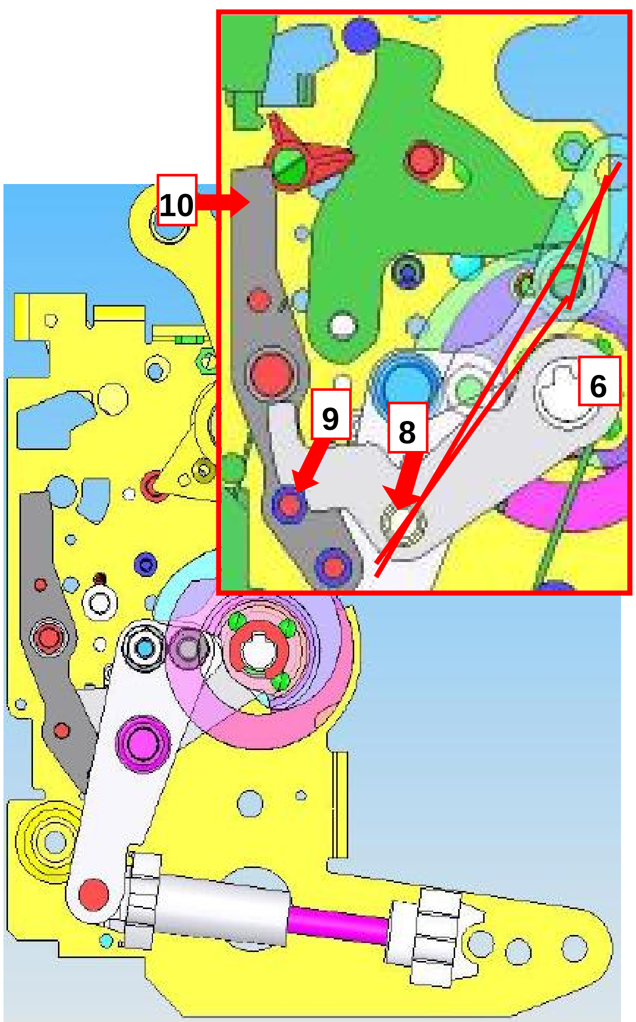

A part of the closing spring's force works on the closing hook through the closing lever assembly and the pin of the cam/toggle assembly (4). The closing hook remains locked by the closing shaft (5) and the opening hook reaches its position where it receives the central hook of the cam/ toggle assembly (6). The breaker signals that it is charged.

## Description of EL Operation

Activating the closing push button rotates the closing shaft and releases the closing hook (1). The stored energy of the closing spring is transferred to the closing lever assembly (2) which pushes the long levers of the cam/ toggle assembly connected by a pin (3). The long levers move the main shaft counter-clockwise (4) which transfers the motion to the push rods connected to the contacts in the vacuum interrupters. The breaker signals that it is closed

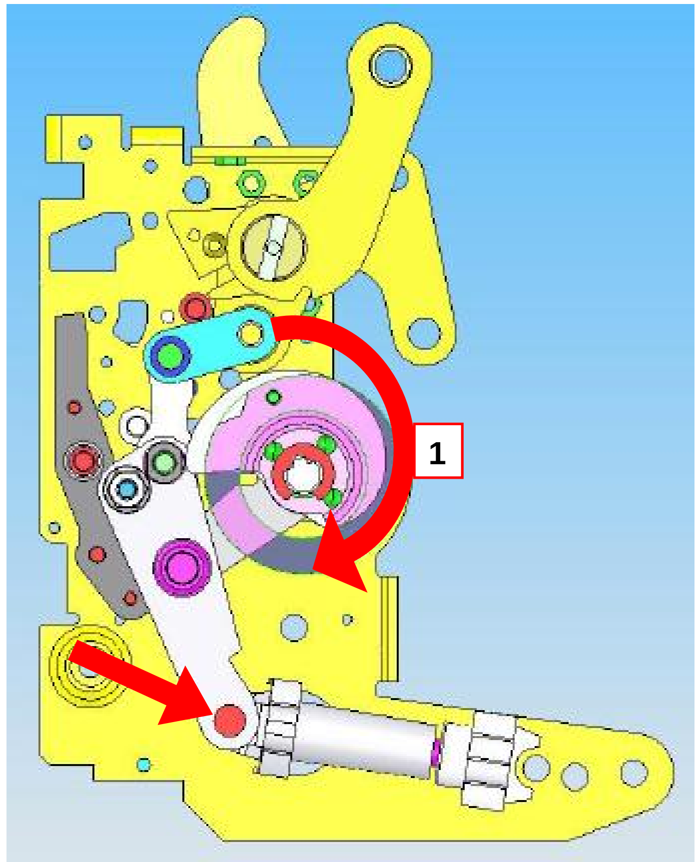


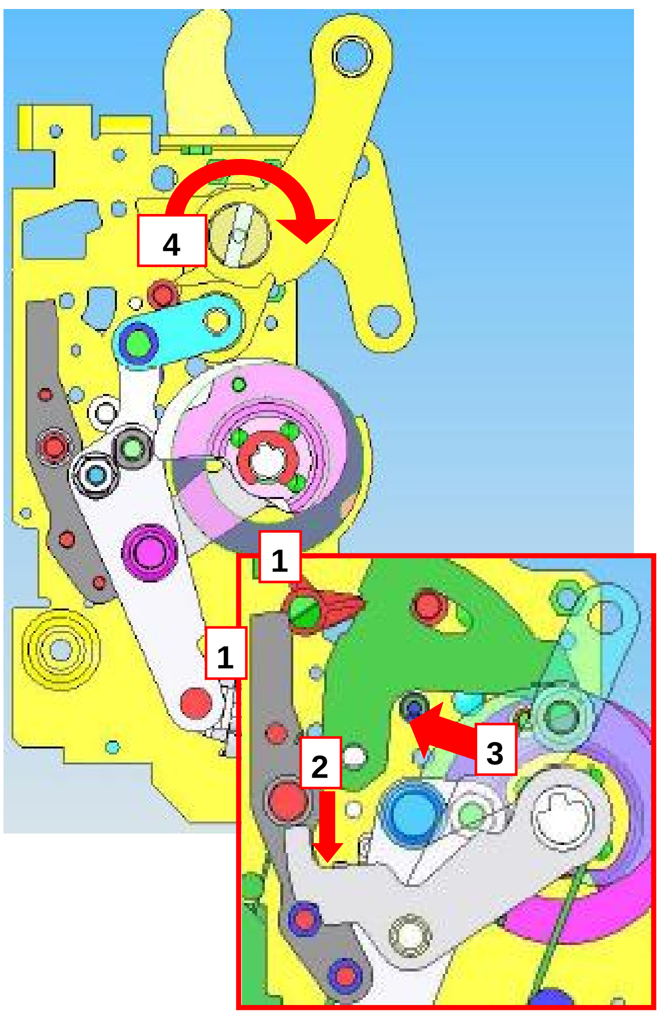

The long levers reach their settled position (6) once the breaker is closed and are held by the central hook of the cam/toggle assembly (8). The contact springs inside the poles and the opening spring inside the frame are charged. The contact springs maintain contact pressure while the breaker is in the closed position. The central hook applies force to the opening hook (9) which is locked by the opening shaft (10).



## Description of EL Operation

The charging motor (if present) automatically rotates the operating mechanism. The closing spring is now charged again and ready for the next closing operation.




Activating the opening push button rotates the opening shaft and releases the opening hook (1). This action releases the central hook of the cam/toggle assembly (2) allowing the contact and opening springs to transfer their energy to the long levers (3). The main shaft rotates clockwise (4) and the breaker signals that it is open.

## INTERLOCKS:

The ADVAC™ breaker contains a number of interlocks. A description of each interlock follows as encountered during racking of the breaker into the breaker compartment.

**DANGER**

**MODIFICATION TO INTERLOCKS CAN RESULT IN HAZARDOUS CONDITIONS TO PERSONNEL AND EQUIPMENT. DO NOT OVERRIDE, BY-PASS OR ADJUST INTERLOCKS. DO NOT REMOVE OR ROTATE INTERFERENCE BLOCKING PLATE.**

**INTERFERENCE BLOCKING:** A code plate in the breaker compartment prevents underrated breakers from being inserted into higher rated compartments. The code plate rating includes continuous current, interrupting current, close and latch capability and maximum voltage. Breakers with the same or higher code plate rating can be inserted into a compartment of equal or lower value.

**POSITIVE POSITION FOR RACKING:** The racking mechanism is blocked unless the interlock tabs are fully extended into the compartment slots.

**POSITIVE POSITION FOR REMOVAL:** The handle release pin prevents withdrawing the breaker from the compartment by blocking withdrawal of the locking tabs. The handle release pin blocks the handles unless the breaker is in the Disconnect position.

**CAUTION**

**THE CLOSING SPRING MAY BE MANUALLY RECHARGED IN THE DISCONNECT AND WITHDRAWN POSITIONS. VERIFY THAT THE BREAKER IS OPEN AND THE CLOSING SPRING IS DISCHARGED BEFORE REMOVING THE FRONT COVER.**

**POSITION INTERLOCKS:** The Position Release Lever must be depressed in order to begin racking the breaker in any direction from any positive position (Disconnect, Test, or Connect). The release lever is blocked from actuation when the breaker is CLOSED. The ability to close the breaker is blocked unless the breaker is in one of the three positive positions.

**CAUTION**

**THE CLOSING SPRING MUST BE MANUALLY DISCHARGED BEFORE THE BREAKER CAN BE REMOVED FROM THE CELL. THIS CAN BE ACCOMPLISHED BY CLOSING AND OPENING THE BREAKER WHILE IT IS IN THE DISCONNECT POSITION.**

## MANUAL OPERATION:

The breaker can be operated manually or electrically.

Refer to Basic Breaker Layout *[Appendix A]* for locations of indicators.

Inspect initial state of the breaker to determine the operations available from Table 2.

a. Closing Spring Charged/Discharged Indicator (6)

b. Close/Open Indicator (4)

| Closing Spring Indicator (6) | CLOSE/OPEN (4) | Operations Available | Proceed to Step |
|---|---|---|---|
| Discharged | Open | None Available | 2 |
| Discharged | Closed | Open | 6 |
| Charged | Open | Close-Open | 5 |
| Charged | Closed | Open-Close-Open | 7 |

Table 2: Operations

2. Pull out the manual Charge Handle (5) from the Front plate (1)
3. Charge the breaker closing spring by up and down motions of the Charge Handle (approximately 5 times)
   a. The Closing Spring is completely charged when
      - Charge handle has free movement
      - Closing Spring Charged/Discharged Indicator changes to CHARGE
4. Replace Charging Handle into Front Plate
   a. The Breaker is ready to perform a Close operation
5. Manually Close the breaker via Close Push Button (2)
   a. Breaker Closes
      - Close/Open Indicator changes to CLOSED
      - Closing Spring Charged/Discharged Indicator changes to DISCHARGED
   b. Breaker ready to perform an Open (O) operation (if O-C-O is desired, see Step 7)
6. Manually open the breaker via Open Push Button (3)
   a. Breaker opens
      - Close/Open Indicator changes to OPEN
      - Closing Spring Charged/Discharged Indicator remains DISCHARGED
   b. No additional operations available, return to Step 3 if additional operation is desired
7. If an Open-Close-Open (O-C-O) operation is desired:
   a. Recharge the breaker after step 5 ( Repeat Steps 3,4)
   b. Breaker now ready to perform (O-C-O) (Steps 6,5,6)
      - Closing Spring Charged/Discharged Indicator will remain CHARGED after first Open.

## ELECTRICAL OPERATION:

To operate the breaker electrically, control power must be available. The section entitled *Racking* describes the application of control power through the secondary disconnect when the breaker is in the Test and Connect positions. Optional test jumpers and test cabinets to connect control power to a withdrawn circuit breaker are available (contact the local ABB sales office for details).

1. Inspect initial state of the breaker to determine the operations available from Table 2 on previous page.
   a. Close/Open Indicator
   b. Closing Spring Charged/Discharged Indicator
   c. Circuit breaker position Test or Connect (or control power applied externally, if withdrawn)

2. Energize Control Power source
   a. Charging motor energizes
      - Charge time approximately 8-10 seconds (at nominal voltage)
      - Closing Spring Charged/Discharged Indicator shows CHARGED

   b. Breaker ready to perform C-O operation

3. Close breaker using manual close push-button or by electrical signal to the rclose coil (after close operation the motor charges unless control power is removed)
   a. Close coil operates
      - Close/Open Indicator changes to CLOSED
      - Closing Spring Charged/Discharged Indicator changes to DISCHARGED
      - Charging motor energizes
      - Charge time approximately 8-10 seconds (at nominal voltage)
      - Closing Spring Charged/Discharged Indicator shows CHARGED

   b. Breaker ready to perform O-C-O operation

4. Open breaker using manual open push-button or by electrical signal to the open coil
   a. Open coil operates and opens breaker
      - Close/Open Indicator changes to OPEN
      - Closing Spring Charged/Discharged Indicator remains CHARGED

   b. Breaker ready to perform C-O operation

5. Breaker ready to continue operations returning to step 3 above until the source of the control power is deactivated. Once control power is removed from the charging motor, the Closing Spring will not recharge after a close operation.

## CONTROL SCHEME:

ADVAC™ circuit breakers are available with two control packages. The standard package (see Appendix D) includes charge (MS), close (MC), and open (MO) functions, and 4a and 4b auxiliary contacts for customer use. The optional package (see Appendix D) adds to the standard package 5a and 4b auxiliary contacts for customer use as well as an optional second open/trip coil (MO2) and/or under voltage (MU) open/trip device if required. Refer to wiring diagrams in Appendix D and Figure 3 on the next page.

1. Initial State
    a. Closing Spring Discharged (33LSb Closed)
    b. Breaker Open (52a Open/52b Closed)
2. Upon available control power
    a. Secondary engaged
    b. Motor charges through 33LSb
3. Closing spring charged
    a. 33LSb opens (removing control power to motor)
    b. Breaker ready to close
4. Electrical control pulse sent to close Breaker *
    a. Current energizes Close Coil (MC) thru the closed blocking switch
        - Coil energizes releasing closing spring and closes breaker
            - –52a closes – 52b opens –33LSb closes
            - Motor charges through 33LSb, 33LSb Opens once closing spring is charged
        - Coil de-energizes with release of signal
5. Electrical control pulse sent to open circuit (note:
    - Current energizes 1st Trip/Open (MO1) or 2nd Trip/Open (MO2) or under voltage (MU)
    - Coil energizes releasing opening spring and opens breaker
        - –52a opens – 52b closes
    - Coil de-energizes with release of signal
    - Breaker ready to perform O-C-O operation

*Note: All open control signals must be zero and Drawout Breakers' must be in the test or connected positions to engage the Close Blocking switch located on the truck in order for the Breaker to close.

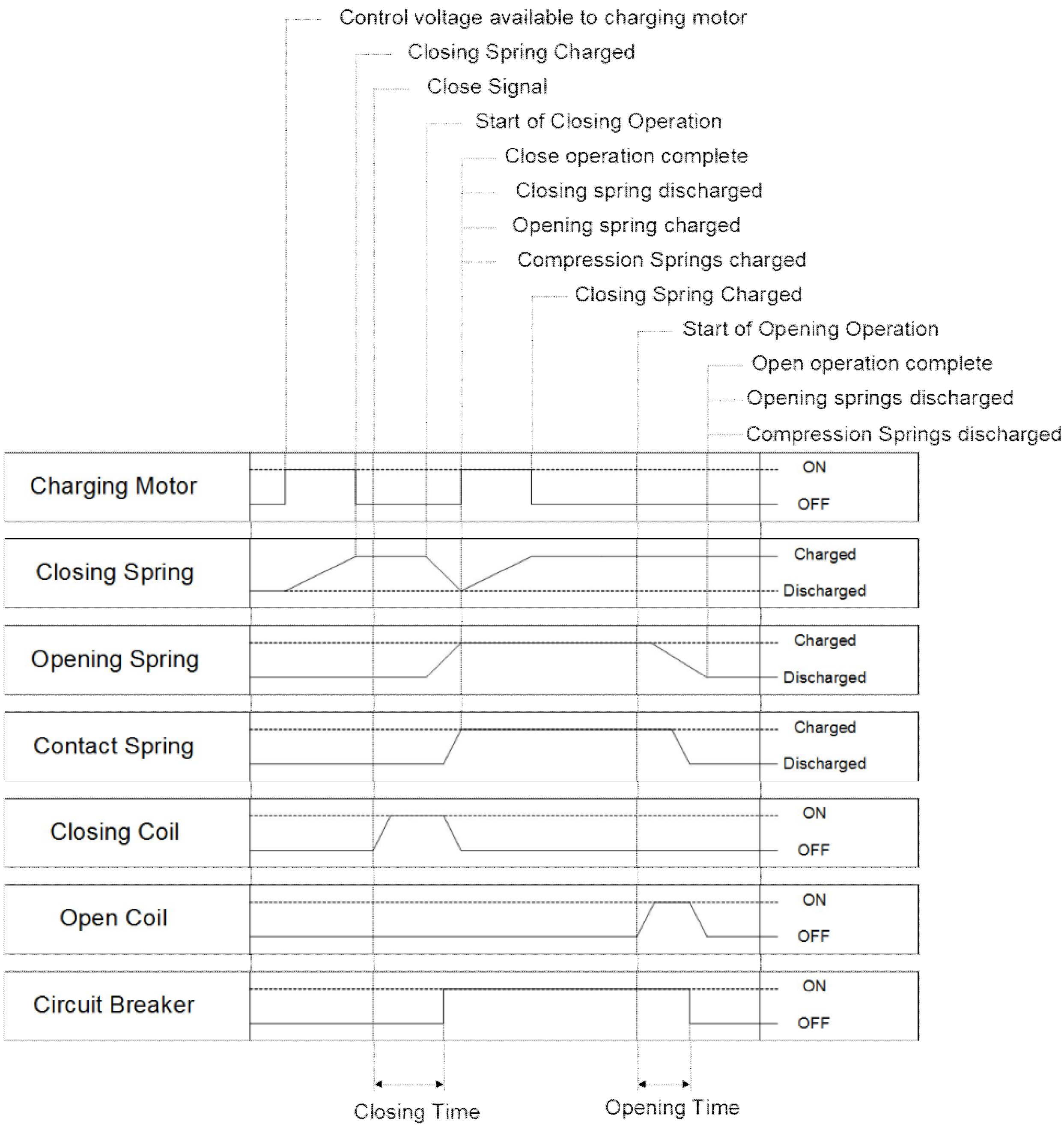



Figure 3: Sequence of Circuit Breaker Operation
(not to scale)

## MAINTENANCE

ADVAC™ circuit breakers are designed for a minimum amount of maintenance. Circuit breakers in a clean, non-corrosive environment require only annual inspection. Dusty or corrosive environments require inspection more often at the discretion of the user. Inspection is required following each interrupted fault.

**DO NOT** work on an energized breaker.

**DO NOT** work on a breaker unless all components are disconnected by means of a visible break and securely grounded.

**DO NOT** work on a breaker 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 breaker.

**DO NOT** work on a breaker with a charged closing spring.

**DO NOT** use a circuit breaker by itself as the sole means of isolating a high voltage circuit.

**DO NOT** leave a breaker in an intermediate position in a cell. Always have the breaker in the disconnect, test or connected position.

## MECHANISM: (Refer to Fig. 4a & 4b)

The mechanism requires visual inspection of hardware, lubrication and operation during routine inspection.

Before beginning any maintenance, open breaker external control power fuses (or breakers), discharge the Closing Springs by pressing the Manual Close Button. Open the breaker by pushing the Manual Open Button. Press the Close and Open buttons again to ensure the breaker is fully discharged. Verify springs are discharged by inspection of the Spring Charge Indicator. Remove the front cover with a Phillips screwdriver. Correct any loose or missing hardware.

Always lubricate the working surface of the Cams (B) and the entire Motor Linkage Assembly (P). Verify lubrication on latching surfaces located above the Charging Motor (D) in the mechanism (See Fig 4b). Remove any grease on the breaker frame Verify that the operation of the Manual Close and Open Push Buttons is free and smooth. Replace the front cover before operation. Manually operate the mechanism a minimum of 2-5 operations to exercise the mechanism.

**DANGER**

**High Speed Mechanical Parts. Serious injury may occur.**

**Keep hands and tools clear of the mechanism during opening and closing operations and anytime the closing or opening springs are charged. Before maintenance verify Closing Spring indicator reads "Discharged". Opening springs are always charged when the circuit breaker is closed.**

### General

The vacuum circuit-breakers are characterized by simple, sturdy construction and a long life. The operating mechanism requires maintenance and functional inspections to reach the expected operating life. The vacuum interrupters are maintenance free for their whole operating life. Vacuum interruption does not produce any harmful effects even when there are frequent interruptions at the rated and short circuit current. The interventions during service and their aim are determined by the ambient conditions, by the sequence of operations and by the short-circuit interruptions. The maintenance operations must only be carried out by trained personnel and who follow all the safety regulations. Furthermore, it is advisable to call on ABB personnel, at least in cases for checking the performances in service and for repairs. Cut the power supply off and put the apparatus under safe conditions during the maintenance operations. Before carrying out any operations, check that the circuit breaker is open, with the spring discharged and that it is not supplied power.

### Operating life expectancy

The operating life expectancy for the ADVAC circuit-breakers is as follows:

Vacuum interrupters: up to 30,000 operations, according to their type .

Switching device, actuator and transmission system: up to 30,000 operations, under normal operating conditions, according to the type of circuit breaker and with regular maintenance.

With operations correctly executed it is possible to carry out up to1000 racking-out/in operations (as prescribed in the ANSI C37.06 Standards)

.The data regarding the operating life are basically applicable to all the components which cannot be directly affected by operator activity. The manually operated components (moving parts of isolatable parts, etc.) can vary their due to their behavior.

### Inspections and functionality tests

Check the conditions of the interruption devices with regular inspections.

Inspection at fixed intervals can be avoided when the apparatus is permanently under the control of qualified personnel.

The checks must, first of all, include visual inspection to check for any contamination, traces of corrosion or electrical discharge phenomena.

Carry out more frequent inspections when there are unusual operating conditions (including severe climatic conditions) and in the case of environmental pollution (e.g. / high level of contamination or an atmosphere with aggressive agents).

Visual inspection of the isolating contacts. It is recommended to turn the contact system alternately in order to keep the internal surface of the contact areas clean. The contact areas must be cleaned when there are signs of overheating (discolored surface) .

In the case of abnormal conditions, take suitable overhauling measures .

**Stored energy operating mechanism**

Carry out the functional test of the operating mechanism after 5,000operations (2,000 operations for 3000 A circuit-breakers) or during ordinary maintenance operations Before doing the test, open the circuit-breaker and carry out the following operations

In the case of with-drawable circuit-breakers, take the circuit breaker to the isolated area for test

In the case of fixed circuit-breakers: cut off the power supply to the medium voltage circuit and follow proper lock-out tag out procedures as specified by the facility.

**Functional test**

With the circuit-breaker not connected to the load, carry out a few opening and closing operations.

Remove the breaker from the cell or rack breaker out to the disconnected position to cut the power supply to the spring charging motor.

Discharge the spring by closing and opening the circuit-breaker by means of the closing and opening pushbuttons

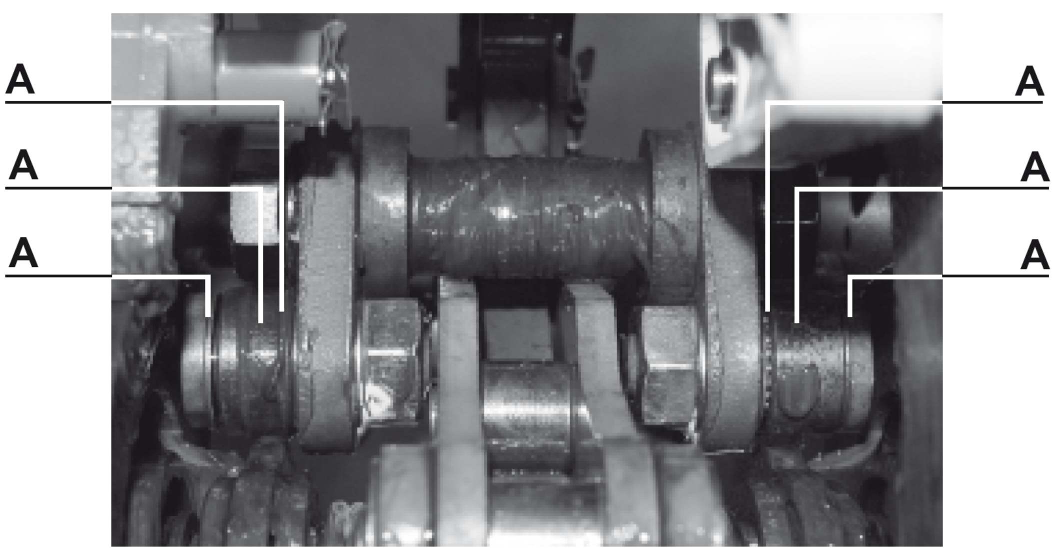
Visually inspect the lubrication conditions of the tulip isolating contacts, of the sliding surfaces, etc.

Check correct electrical and mechanical operation of the various devices, with particular attention to the interlocks.

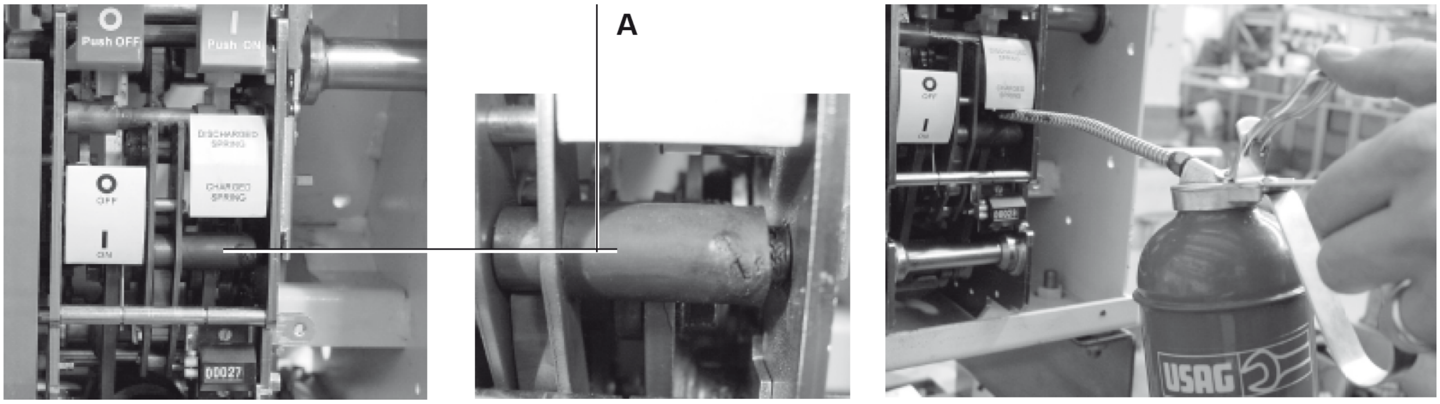
The screws and nuts are tightened in the factory and correct tightening is marked with a collared sign. No further tightening operations are foreseen during the operating life of the circuit breaker.

However, following any maintenance interventions, should it be necessary to retighten the screws follow torque valus on following page

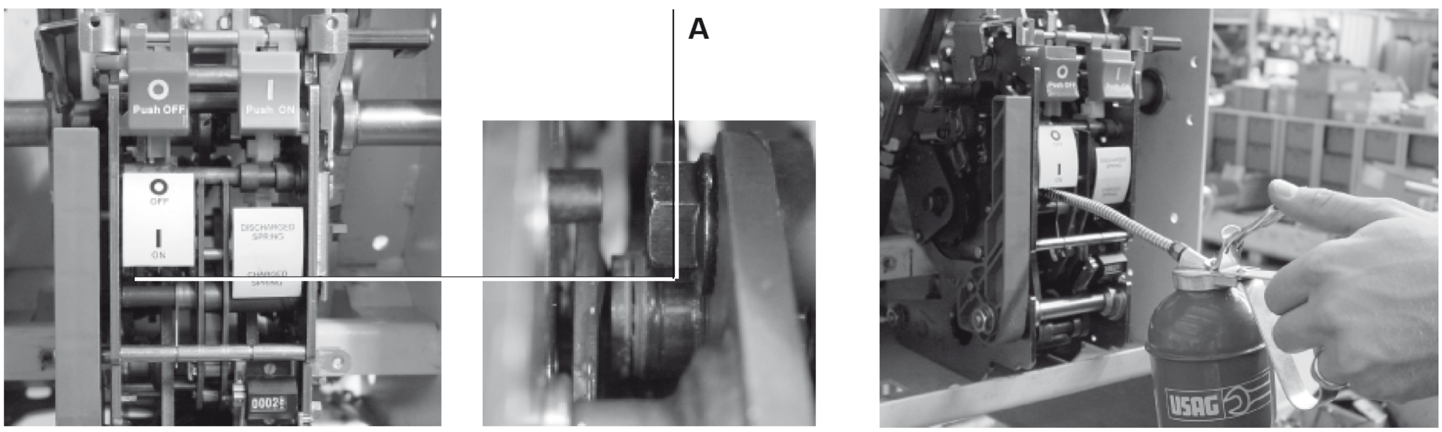
Check the main actuator lever roller bearing lubrication detail **A** below, it is advisable to lubricate with a few drops of SAE 80W/90 type oil, using a special oiler.



Charge the operating mechanism spring and lubricate the right-hand bearing (circuit-breaker seen from the front)



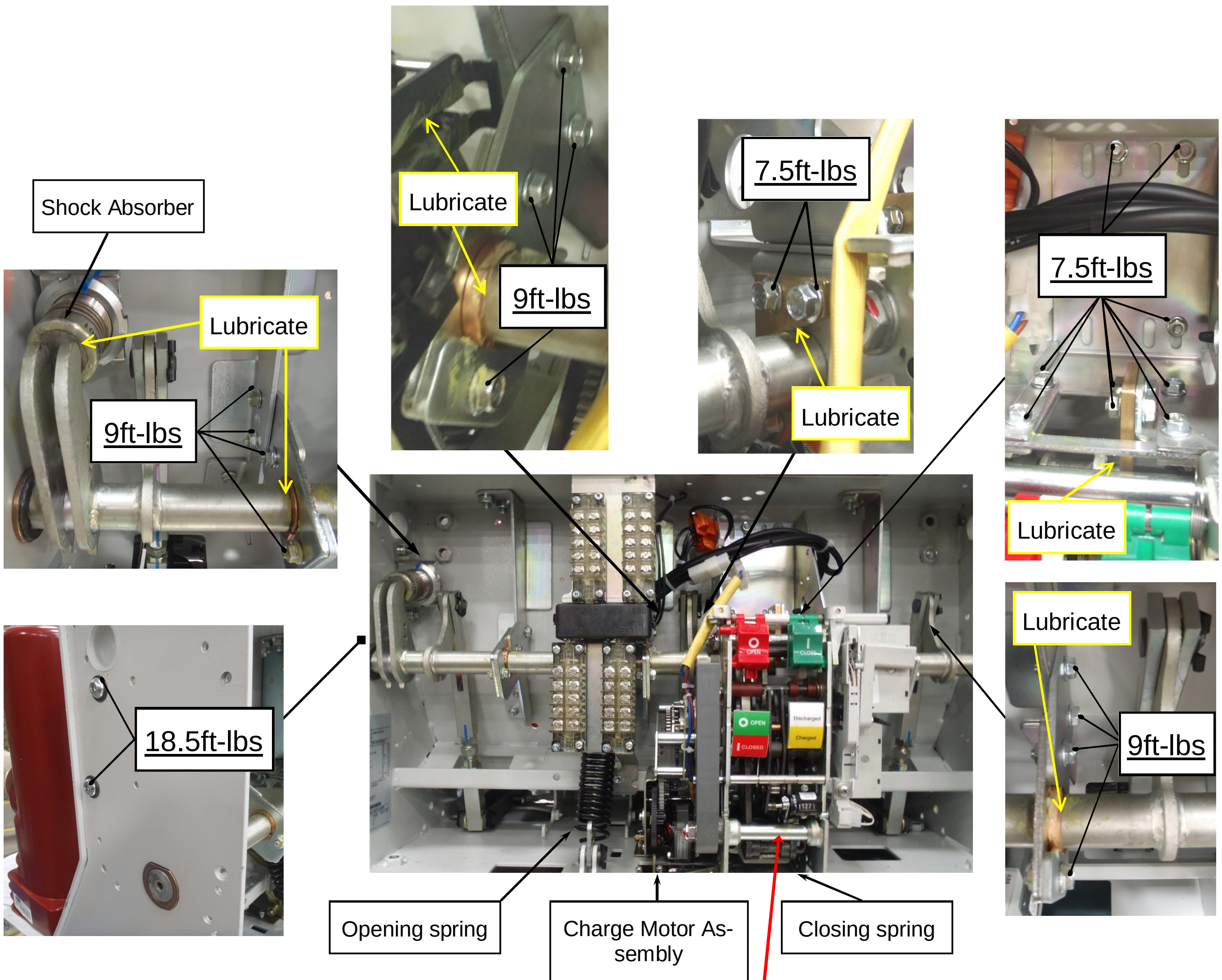

Close the circuit-breaker and lubricate the left-hand bearing  detail **A** below




Should maintenance be carried out by the customer’s personnel, responsibility for the interventions remains with the customer. The replacement of parts not included in the “List of spare parts” must only be carried out by ABB personnel.  In particular:

– complete pole with bushings/connections
– EL Actuator and  Spring Charging assembly
– Closing Spring set
– Opening Spring
– Shock-Absorber.

## Lubrication Points and Torque value




**Note:**

Replacement of the **EL Actuator** (trip box) can only be carried out by ABB personnel or by specially skilled trained personnel, particularly for the necessary adjustments.

## TRUCK:

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

With the breaker outside the cell, verify all visible hardware tightness, including handles (9) and wheels (7). Wheels should rotate freely by hand movement. Replace or tighten any missing or loose hardware.

With the breaker outside the cell, rotate the racking screw as though racking the breaker to the connect position. This process will expose surfaces inside the truck that need to be inspected and lubricated. Lubricate the exposed parts; specifically the entire Racking Screw (2) and Position Release Shaft (3) assemblies during the operation. Inspect breaker locking tabs (8) and Secondary Locking Tab (1) for any damage. Return truck to disconnect position. As a precaution, do not operate the breaker outside the cell unless the truck is in the full disconnect position.

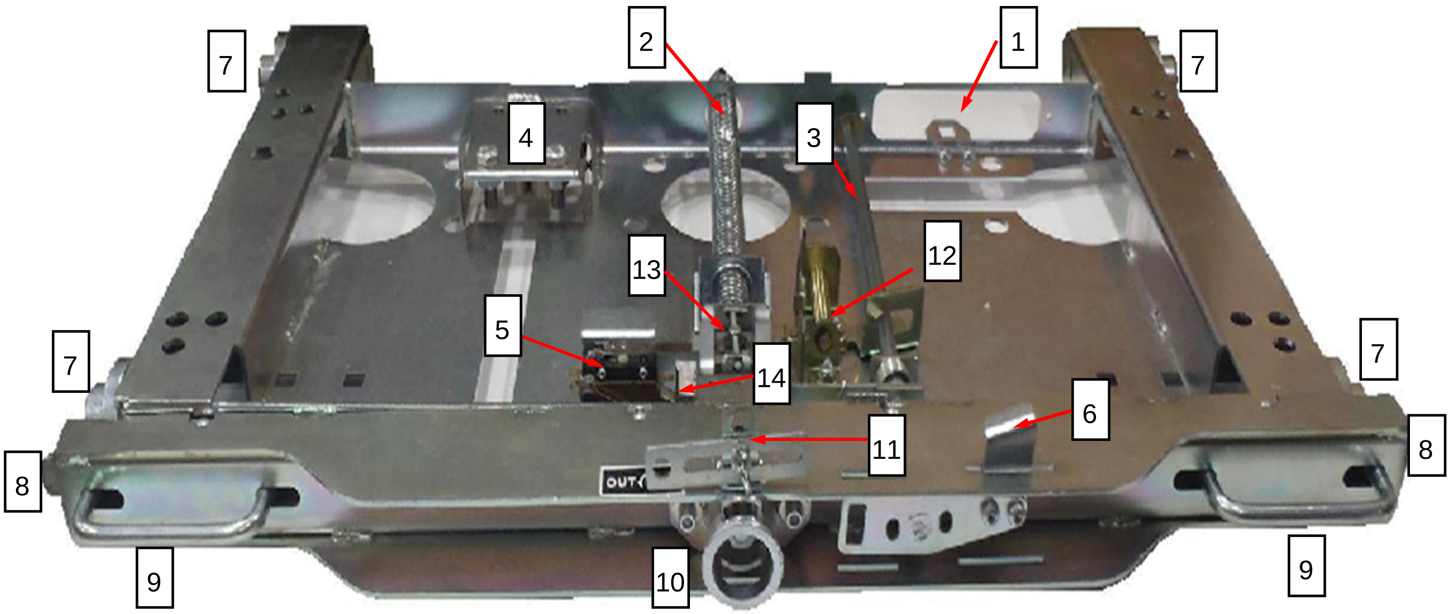



Figure 3: (Truck shown with breaker removed)

| | |
|---|---|
| 1 | Secondary Locking Tab |
| 2 | Racking Screw |
| 3 | Position Release Shaft |
| 4 | Grounding connection |
| 5 | Racking Pin Monitor / Close blocking switch |
| 6 | Position Release Lever |
| 7 | Wheels |

| | |
|---|---|
| 8 | Cell Locking Tabs |
| 9 | Insertion/Removal Handles |
| 10 | Racking Screw Collar |
| 11 | Racking Lock for tagout |
| 12 | Spring Charged Interlock |
| 13 | Racking pin |
| 14 | Breaker open Interlocks |

## CONTROL WIRING:

The control wiring requires visual inspection of hardware, low-frequency withstand voltage testing and 2-5 manual operations during routine maintenance. Disconnect control power before verifying secondary hardware and before low-frequency withstand voltage testing.

Remove the front cover with a screwdriver. Correct any loose or missing mounting hardware. Verify the ground wire connection to the frame and all connectors' alignment and snugness on the electrical components. Visually inspect the secondary plug and correct any pins that may have become displaced.

To verify the integrity of the secondary insulation, perform the following low-frequency withstand voltage test:

1. Connect all pins from the secondary to a test wire
2. Connect test wire to the high potential lead of the test machine
3. Ground the breaker frame
4. Start machine with output potential at 0 (zero) VAC RMS.
5. Increase the potential to the required insulation test voltage (1125VAC RMS)
6. Hold for one minute
7. Reduce potential to 0 (zero) VAC and turn off machine

A successful withstand indicates satisfactory insulation strength of the secondary circuit. Failing insulation will not sustain the voltage across the secondary. Replace the breaker control wiring if the insulation fails during low-frequency withstand voltage testing.

Replace the front cover before operation. Verify the operation with 2-5 electrical operations in the Test position or with a remote power supply.

**DANGER**

**The internal shield of a vacuum interrupter can acquire an electric charge which CAN BE retained even after the voltage is removed. Discharge the mid-band ring with a grounding stick before working on any part of the circuit breaker.**

## PRIMARY CIRCUIT ASSEMBLY: *(Pole)*

The primary circuit requires visual inspection of hardware, low-frequency withstand voltage testing and lubrication during routine maintenance.

All insulation material should be clean and free of structural cracks. Some minor cracks are inherent in the insulation material. Inspect for structural cracks and replace damaged parts.

Dirt or dust may create a dielectric path to ground on the insulation. Remove dust and dirt with a clean, lint-free cloth. Apply distilled water to the cloth to remove any difficult dirt. DO NOT return the breaker into service until the insulation surfaces are completely dry.

Lubrication on the primary contacts should be inspected during routine maintenance. Use NO-OX-ID special grade-A grease for the lubrication of primary contacts (ABB No. 713222A, 1 Pt. can).

**CAUTION**

**Applying abnormally high voltage across a pair of open contacts in vacuum may produce X-radiation. The radiation may increase with the increase in voltage and/or decrease in contact spacing. It is recommended that all operating personnel stand at least one meter away and in front of the circuit breaker during testing.**

To verify the integrity of the primary insulation, perform the following low-frequency withstand voltage test:

1. Close the breaker (no control power supplied to breaker)
   a. Connect the high potential lead to one pole
   b. Ground the remaining poles and breaker frame
2. Start machine with output potential at 0 (zero) VAC.
3. Increase the potential to the required voltage (see Table 2)
4. Hold for one minute
5. Decrease potential to 0 (zero) VAC and turn off machine
6. Repeat for the remaining poles

A successful withstand indicates satisfactory insulation strength of the primary circuit.

| Rated Max Voltage | Dielectric Test Value, 1 Minute Dry AC rms |
|---|---|
| 4.76kV | 15kV |
| 8.25kV | 27kV |
| 15kV | 27kV |

Table 3: Primary Low-Frequency Withstand Test Voltages

To verify the integrity of the vacuum interrupters perform the following low-frequency withstand voltage test:

1. Open the breaker (no control power supplied to breaker)
   a. Connect the high potential lead to one terminal
   b. Ground the remaining 5 terminals and breaker frame
2. Start machine with output potential at 0 (zero) VAC
3. Increase the potential to the required voltage (see Table 3 above)
4. Hold for one minute
5. Decrease potential to 0 (zero) and turn off machine
6. Repeat for the remaining 5 terminals

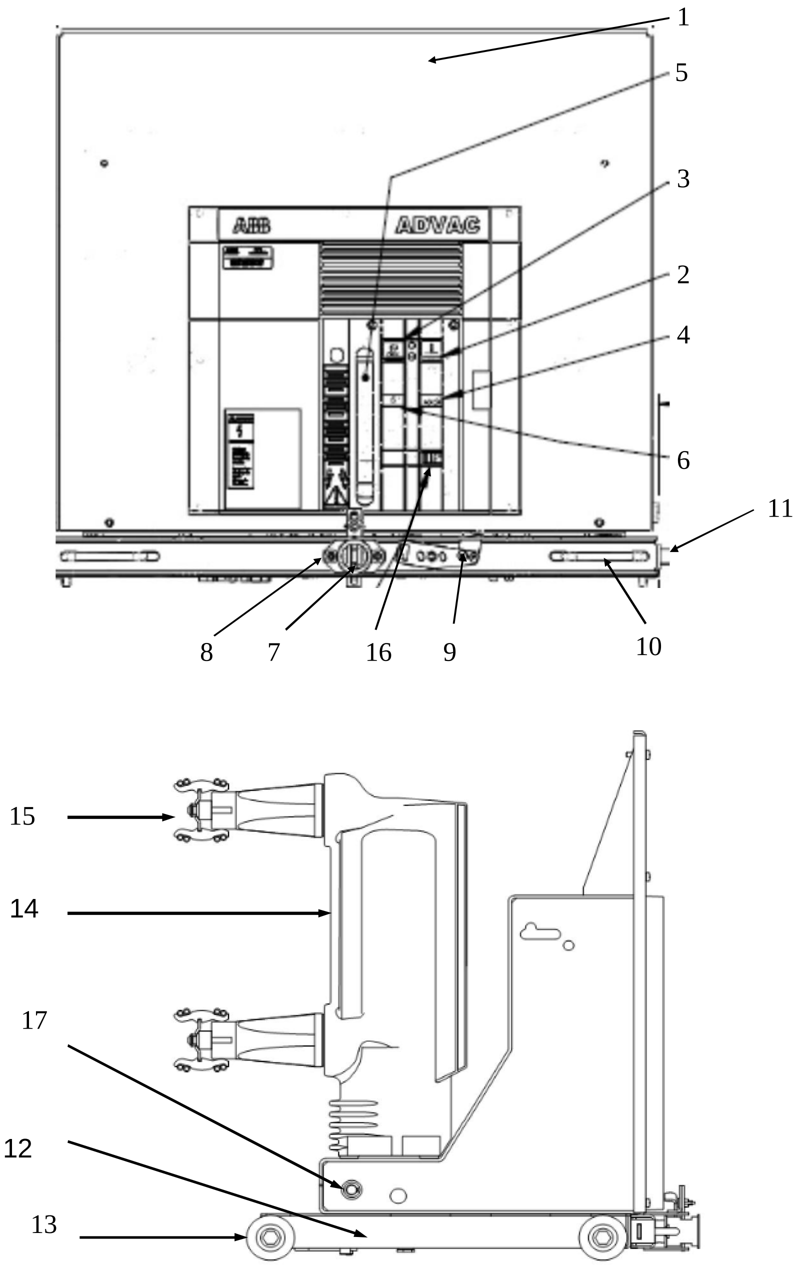
A successful withstand indicates satisfactory vacuum integrity.

Replace pole assemblies that fail to withstand the voltage across the open contacts, ( if flashover occurs).

Testing should be done with an AC source only. DC testing is not considered a valid test for vacuum integrity. If DC is the only available option, the peak DC voltage should not exceed the corresponding AC RMS test voltage. Additionally, a failure during DC testing should only be considered preliminary. Additional AC testing should be completed before replacement of the pole is considered to be warranted. Testing with meggers or other similar devices is not considered valid under any circumstances.

## APPENDIX A
## BASIC BREAKER LAYOUT

All ADVAC breakers have the same basic layout regardless of rating or pole configuration.



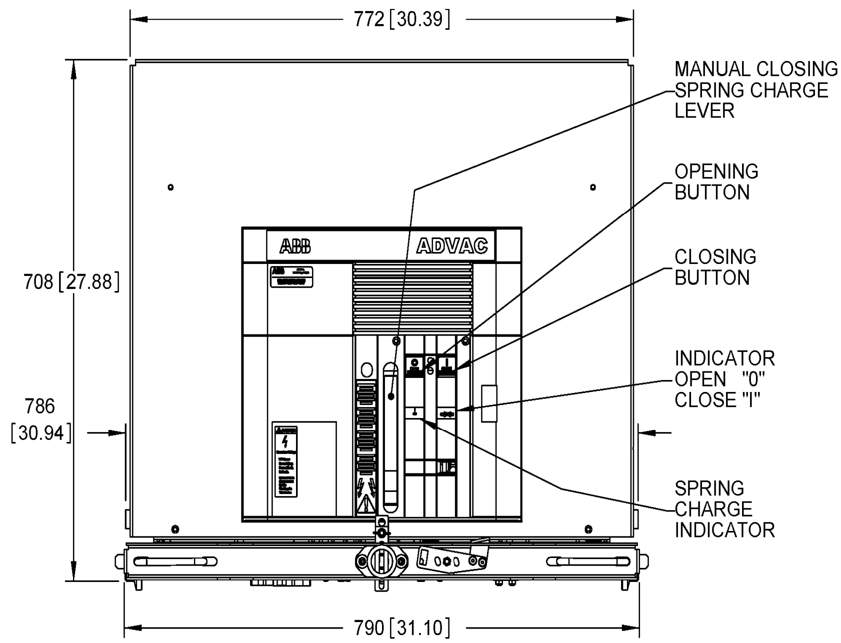

| # | Description |
|---|---|
| 1 | FRONT PLATE ASSEMBLY |
| 2 | CLOSE PUSH BUTTON |
| 3 | OPEN PUSH BUTTON |
| 4 | CLOSE/OPEN INDICATOR |
| 5 | CHARGING HANDLE |
| 6 | CHARGED/DISCHARGED INDICATOR |
| 7 | RACKING SCREW |
| 8 | COLLAR |
| 9 | POSITION RELEASE LEVER |
| 10 | HANDLE |
| 11 | CELL INTERLOCK TAB |
| 12 | TRUCK |
| 13 | WHEEL |
| 14 | POLE ASSEMBLY |
| 15 | PRIMARY CONTACT |
| 16 | OPERATION COUNTER |
| 17 | SHUTTER ACTUATOR (ROLLER) |

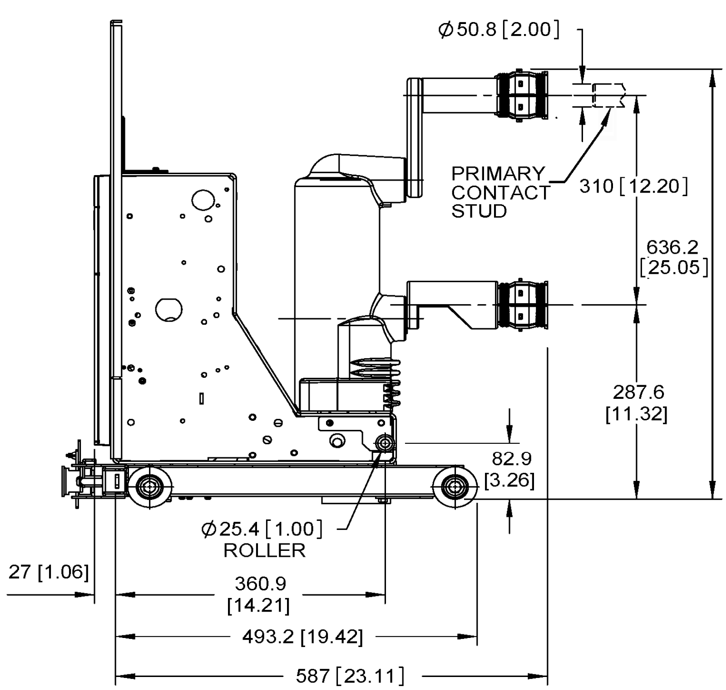
**Basic Breaker Layout**

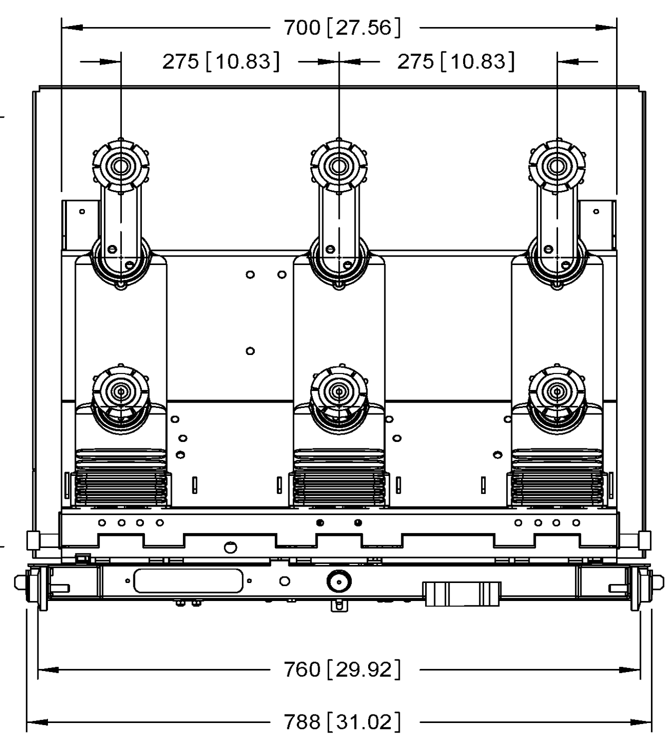
## APPENDIX B
## BASIC BREAKER DIMENSIONS AND WEIGHTS

All ADVAC breakers of this style have the same basic dimensions (i.e. pole spacing, mounting locations) regardless of pole configuration. Hole patterns do change dependent upon the amperage capacity of the breaker.

| TYPE | U | Ir | Isc | OP MECHANISM | CUBICLE |
|---|---|---|---|---|---|
| ADVAC | 4.76 kV | 1200 A | 25 - 31 kA | EL | SAFEGEAR |
| ADVAC | 15 kV | 1200 A | 20 - 25 - 31 kA | EL | SAFEGEAR |



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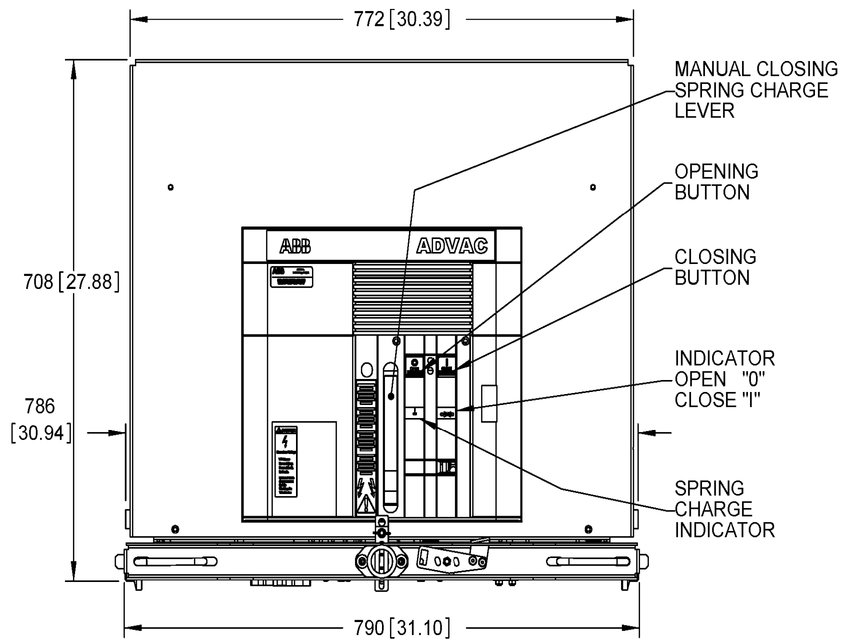
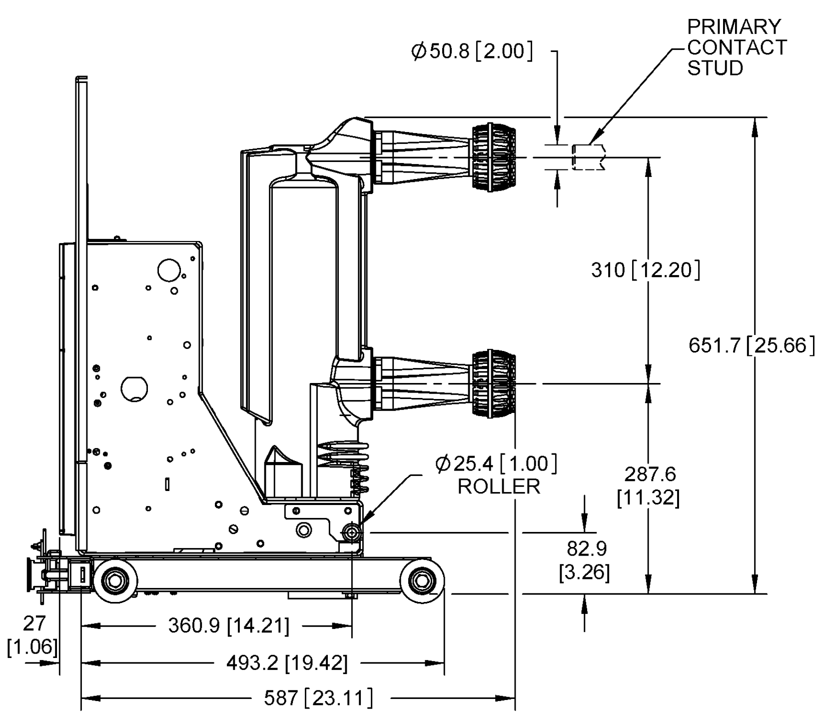
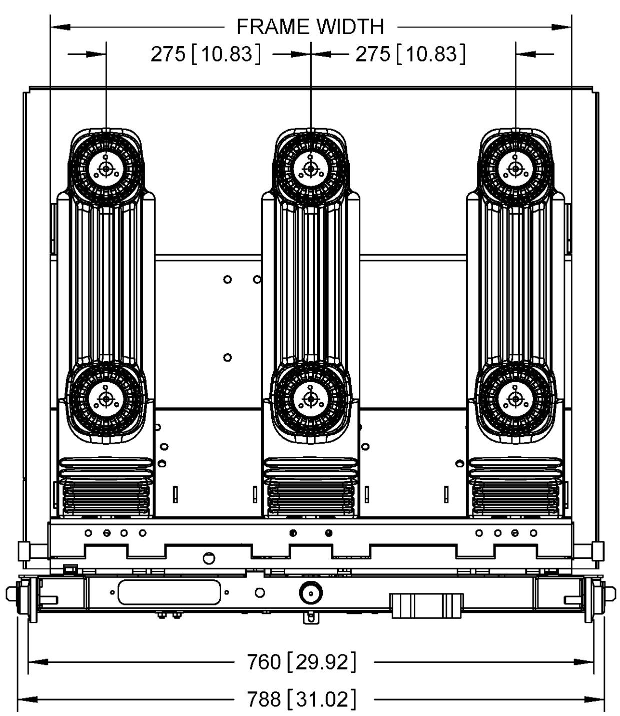
All ADVAC breakers of this style have the same basic dimensions (i.e. pole spacing, mounting locations) regardless of pole configuration. Hole patterns do change dependent upon the amperage capacity of the breaker.

| TYPE | U | Ir | Isc | OP MECHANISM | CUBICLE | FRAME WIDTH |
|---|---|---|---|---|---|---|
| ADVAC | 4.76 kV | 2000 A | 25 - 31 - 40 kA | EL | SAFEGEAR | 700 mm |
| ADVAC | 8.25 | 2000 A | 40 kA | EL | SAFEGEAR | 700 mm |
| ADVAC | 15 kV | 2000 A | 20 - 25 - 31 - 40 kA | EL | SAFEGEAR | 700 mm |
| ADVAC | 15 kV | 2000 A | 50 kA | T. EL | SAFEGEAR | 750 mm |

Weight **65561.48 g**



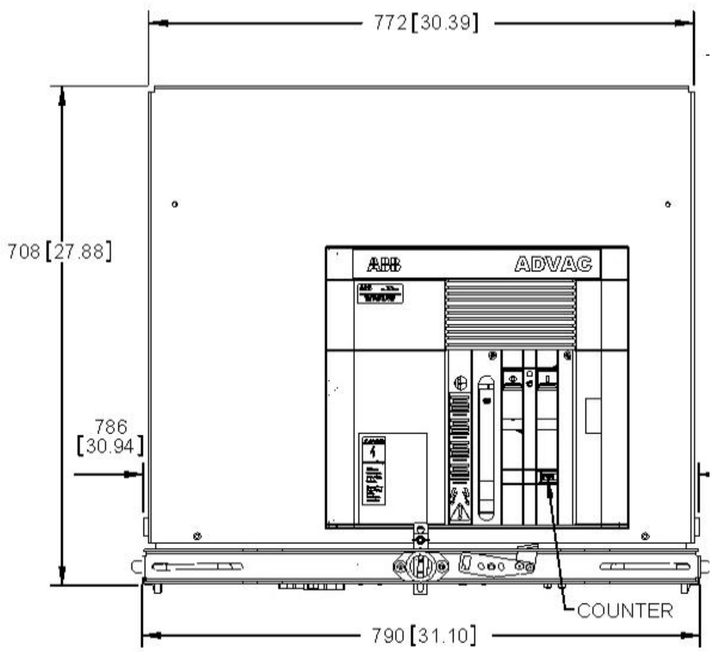



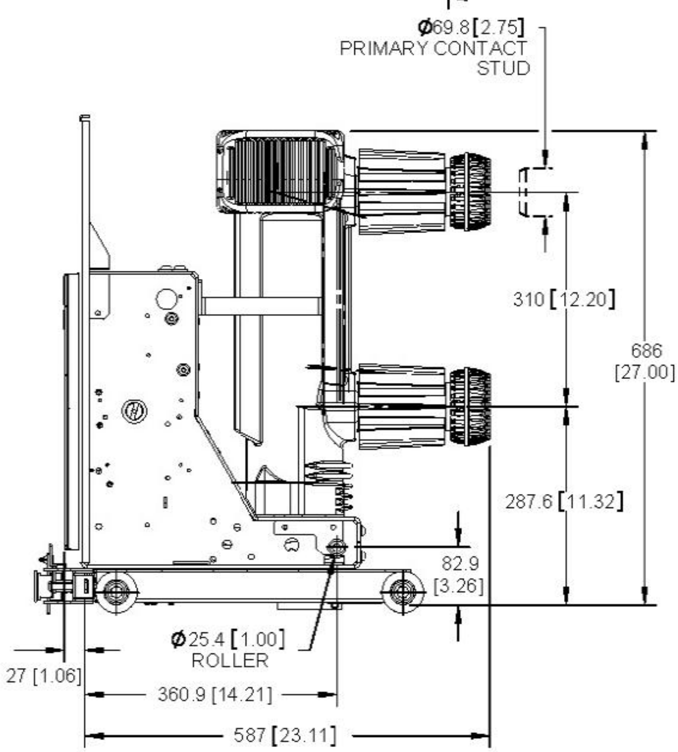



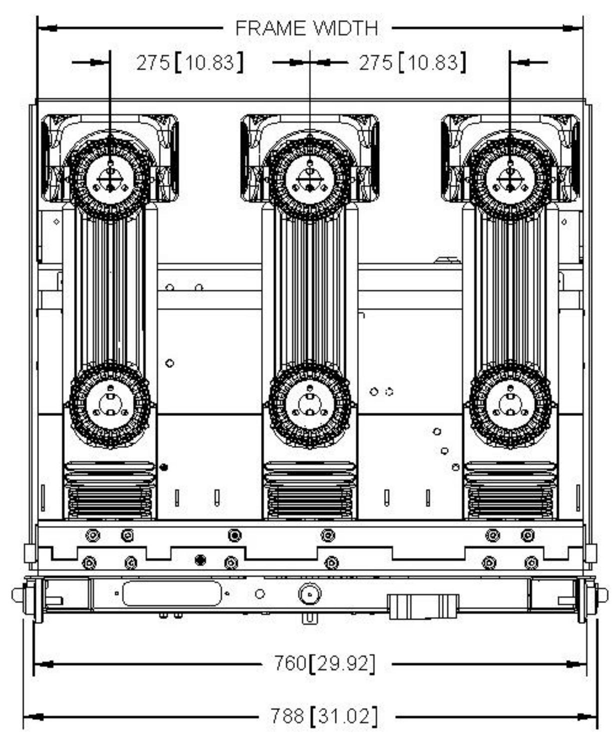
# APPENDIX B
# BASIC BREAKER DIMENSIONS AND WEIGHTS

All ADVAC breakers of this style have the same basic dimensions (i.e. pole spacing, mounting locations) regardless of pole configuration.   Hole patterns do change dependent upon the amperage capacity of the breaker.

| TYPE | U | $I_r$ | $I_{sc}$ | OP MECHANISM | CUBICLE | FRAME WIDTH |
|---|---|---|---|---|---|---|
| ADVAC | 4.76 kV | 3000 A | 25 - 31 - 40 kA | EL | SAFEGEAR | 700 mm |
| ADVAC | 4.76 kV | 3000 A | 50 kA | T. EL | SAFEGEAR | 750 mm |
| ADVAC | 8.25 kV | 3000 A | 40 kA | EL | SAFEGEAR | 700 mm |
| ADVAC | 15 kV | 3000 A | 20 - 25 - 31 - 40 kA | EL | SAFEGEAR | 700 mm |
| ADVAC | 15 kV | 3000 A | 50 kA | T. EL | SAFEGEAR | 750 mm |



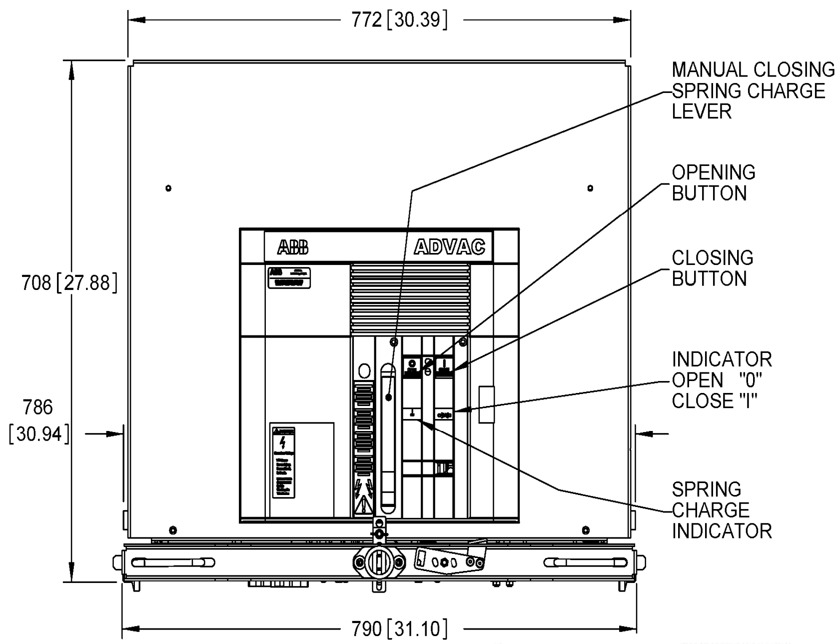



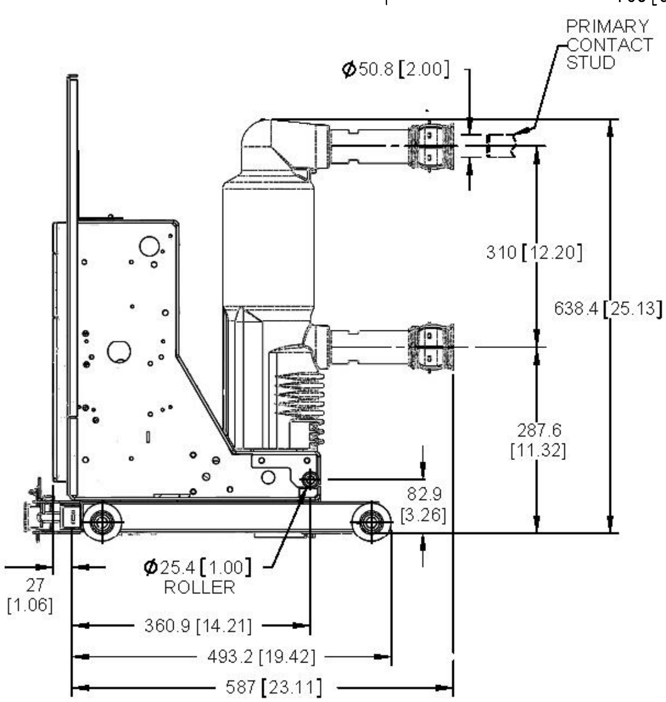



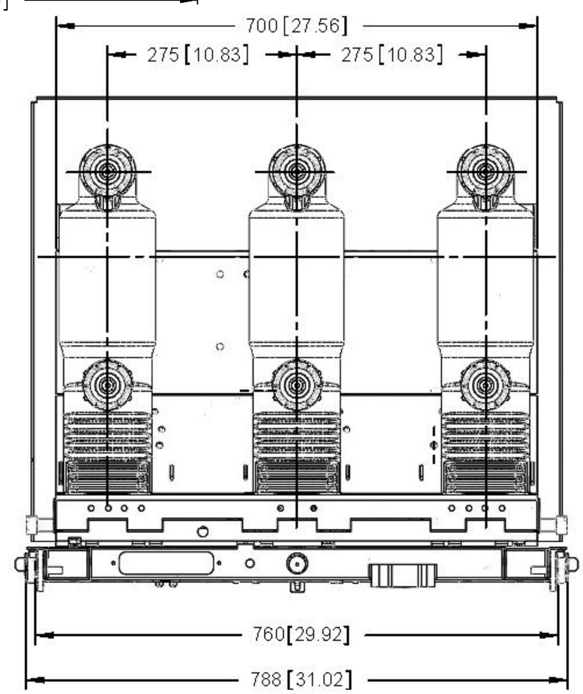
## APPENDIX B
## BASIC BREAKER DIMENSIONS AND WEIGHTS

All ADVAC breakers of this style have the same basic dimensions (i.e. pole spacing, mounting locations) regardless of pole configuration. Hole patterns do change dependent upon the amperage capacity of the breaker.

| TYPE | U | Ir | Isc | OP MECHANISM | CUBICLE |
|---|---|---|---|---|---|
| ADVAC | 4.76 kV | 1200 A | 40 kA | EL | SAFEGEAR |
| ADVAC | 8.25 kV | 1200 A | 40 kA | EL | SAFEGEAR |
| ADVAC | 15 kV | 1200 A | 40 kA | EL | SAFEGEAR |



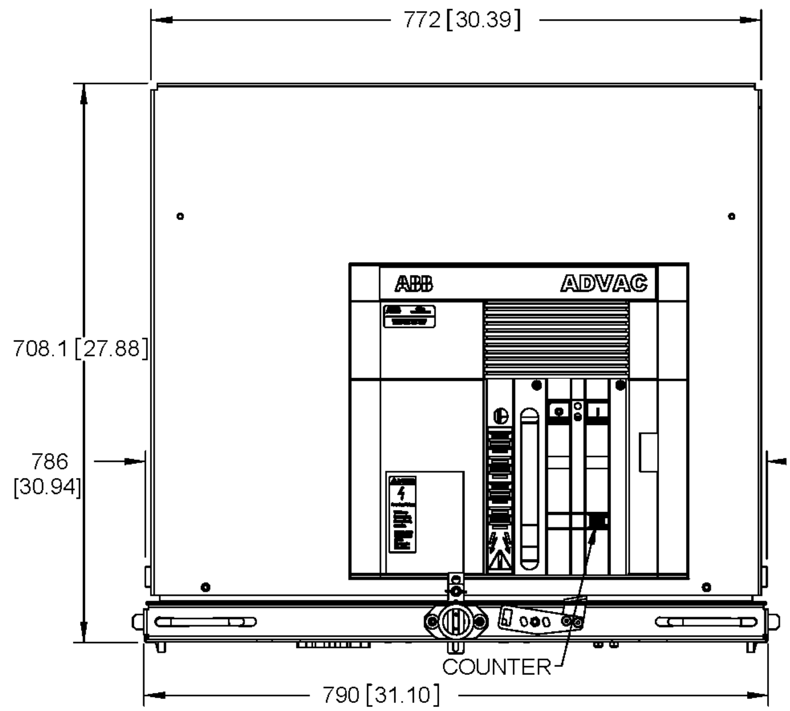



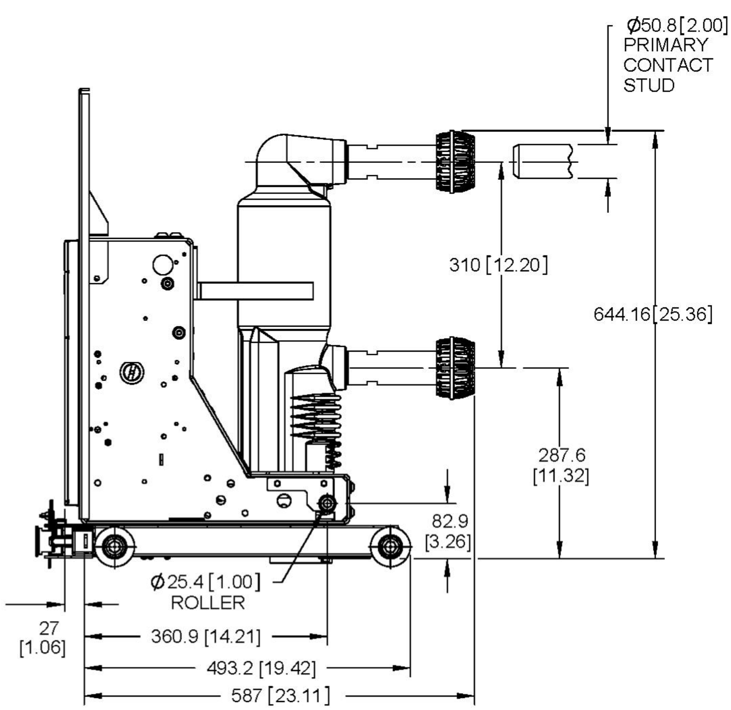



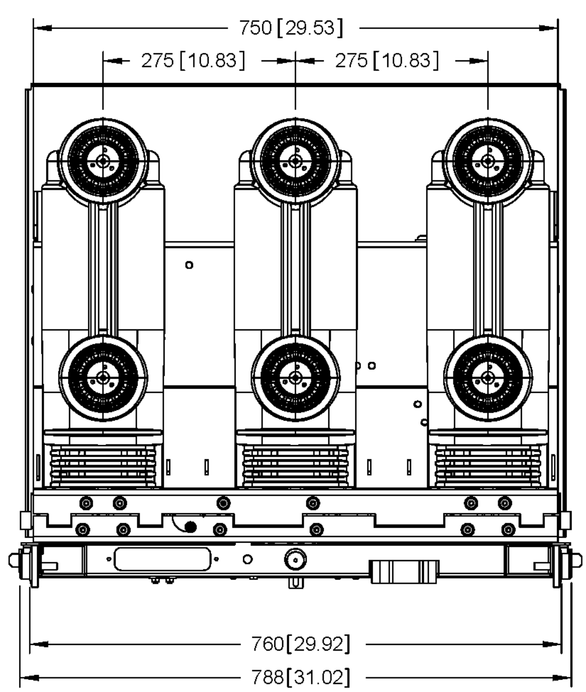
## APPENDIX B
## BASIC BREAKER DIMENSIONS AND WEIGHTS

All ADVAC breakers of this style have the same basic dimensions (i.e. pole spacing, mounting locations) regardless of pole configuration. Hole patterns do change dependent upon the amperage capacity of the breaker.

| TYPE | U | Ir | Isc | OP MECHANISM | CUBICLE |
|---|---|---|---|---|---|
| ADVAC | 4.76 kV | 1200 A | 50 kA | EL | SAFEGEAR |



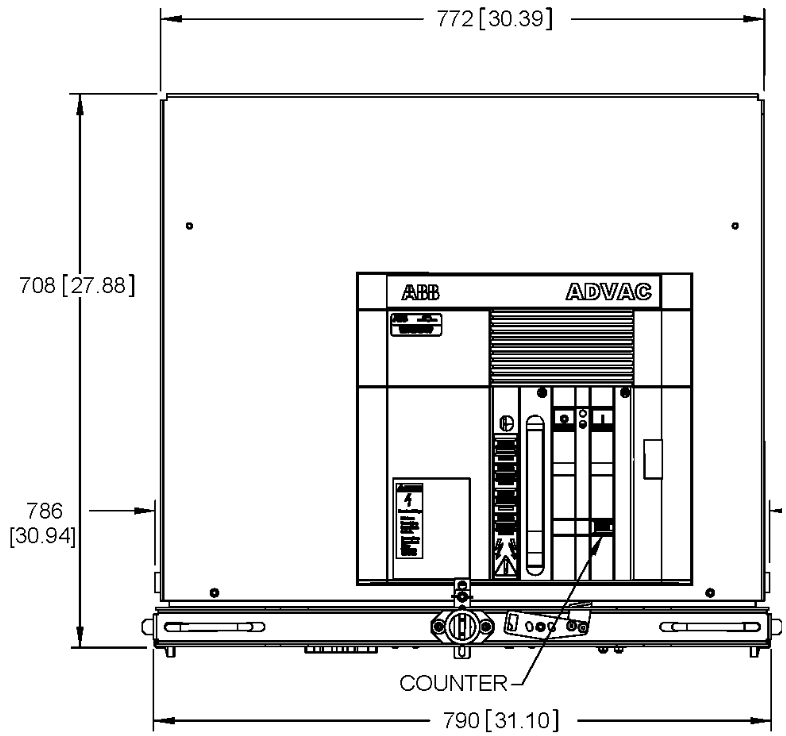



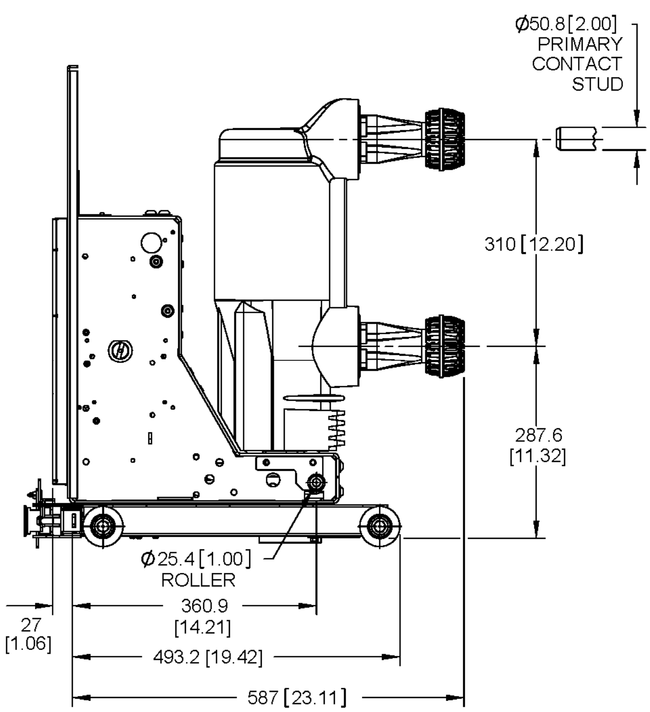



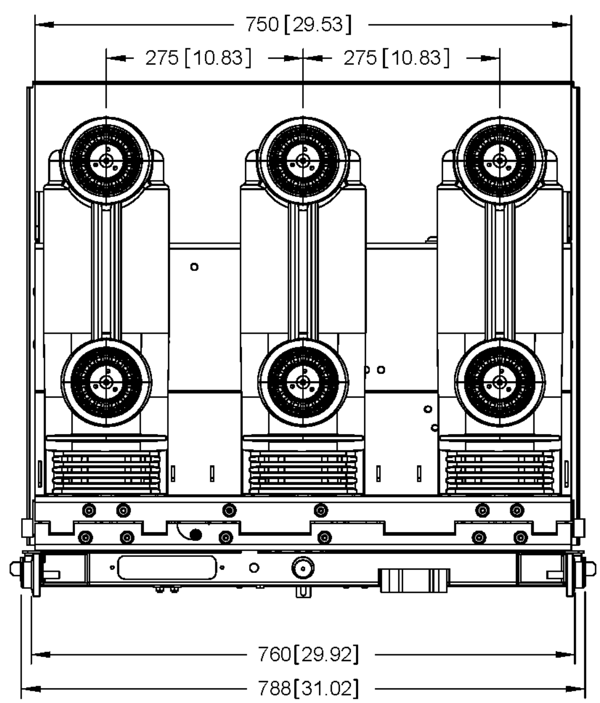
## APPENDIX B
## BASIC BREAKER DIMENSIONS AND WEIGHTS

All ADVAC breakers of this style have the same basic dimensions (i.e. pole spacing, mounting locations) regardless of pole configuration.   Hole patterns do change dependent upon the amperage capacity of the breaker.

| TYPE | U | Ir | Isc | OP MECHANISM | CUBICLE |
|---|---|---|---|---|---|
| ADVAC | 15 kV | 1200-2000 A | 50 kA | T. EL | SAFEGEAR |



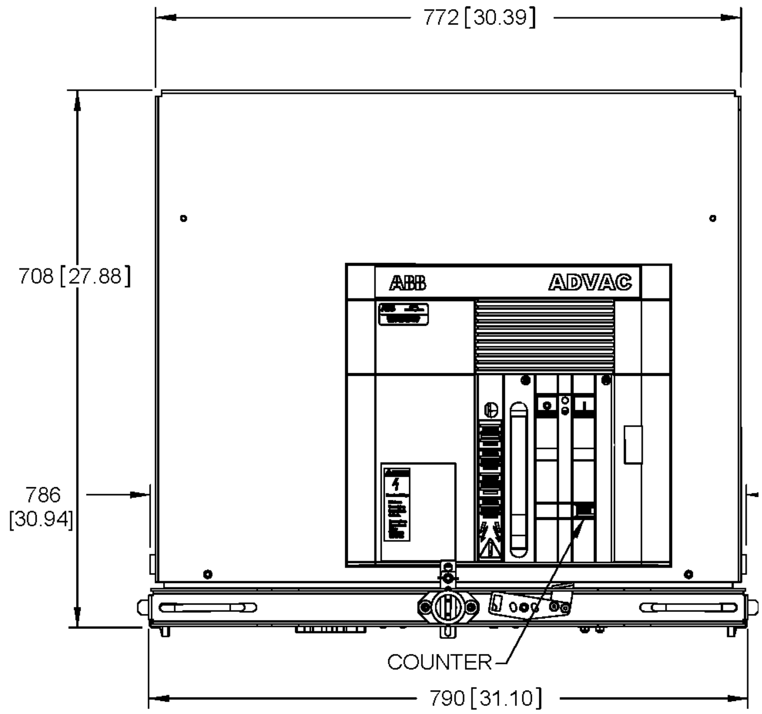



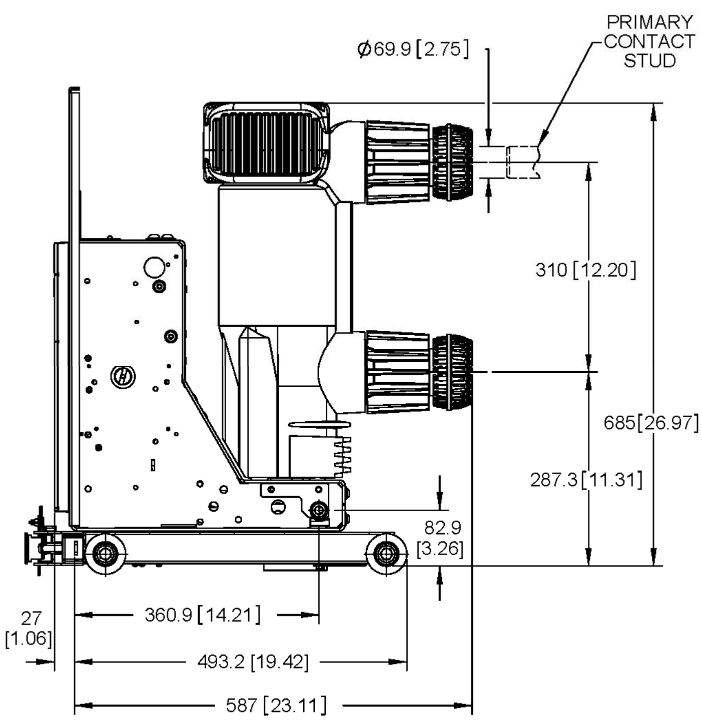



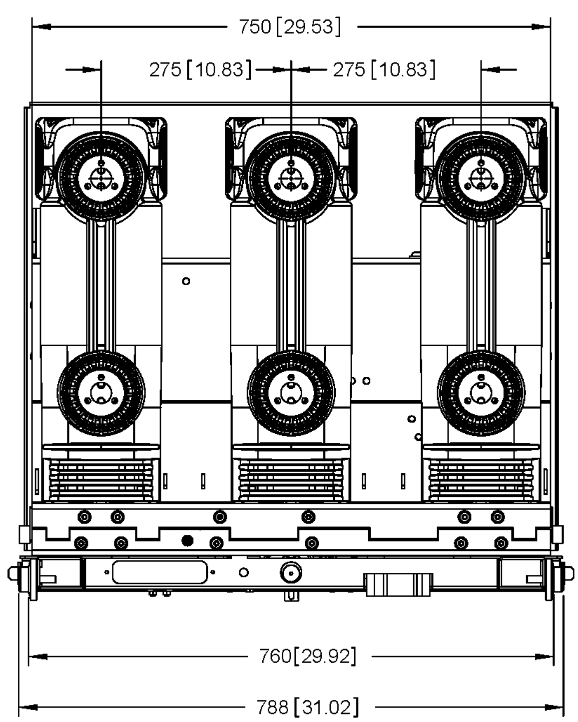
## APPENDIX B
## BASIC BREAKER DIMENSIONS AND WEIGHTS

All ADVAC breakers of this style have the same basic dimensions (i.e. pole spacing, mounting locations) regardless of pole configuration.   Hole patterns do change dependent upon the amperage capacity of the breaker.

| TYPE | U | Ir | Isc | OP MECHANISM | CUBICLE |
|---|---|---|---|---|---|
| ADVAC | 15 kV | 3000 A | 50 kA | T. EL | SAFEGEAR |



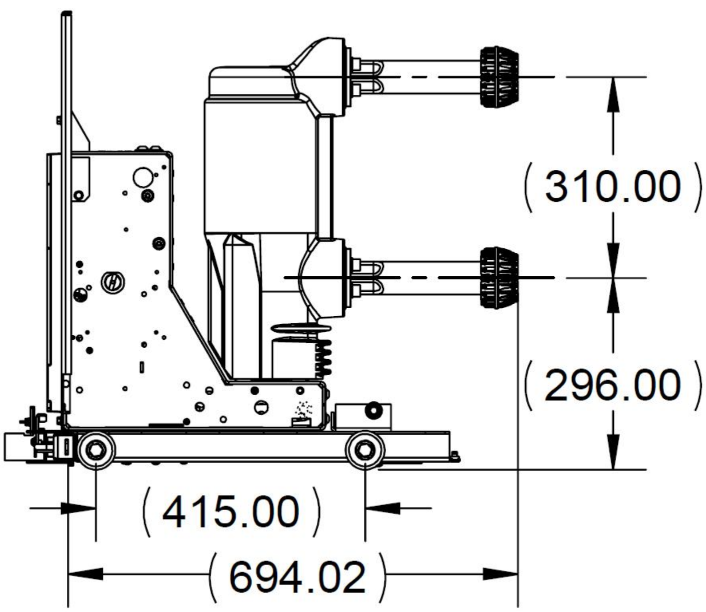



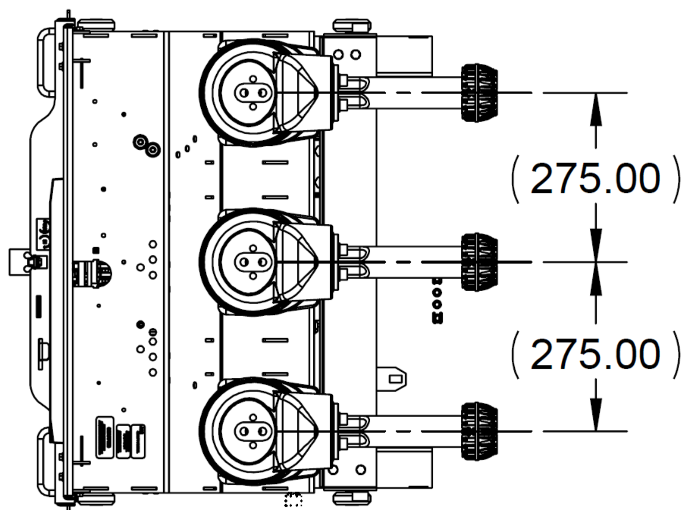
## APPENDIX B
## BASIC BREAKER DIMENSIONS AND WEIGHTS

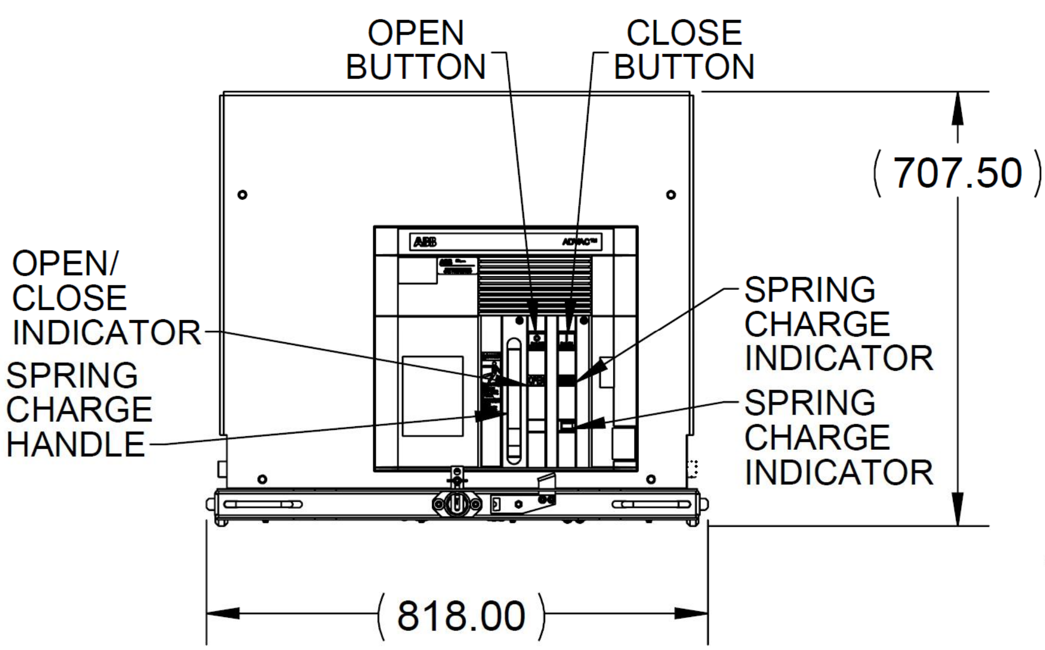
All ADVAC breakers of this style have the same basic dimensions (i.e. pole spacing, mounting locations) regardless of pole configuration.   Hole patterns do change dependent upon the amperage capacity of the breaker.

| TYPE | U | $I_r$ | $I_{SC}$ | MECHANISM | CUBILE |
|---|---|---|---|---|---|
| ADVAC | 15kV | 1200-2000A | 50kA | T. EL | SAFEGEAR HD$^{TM}$ |

Weight 410lbs, 186Kg



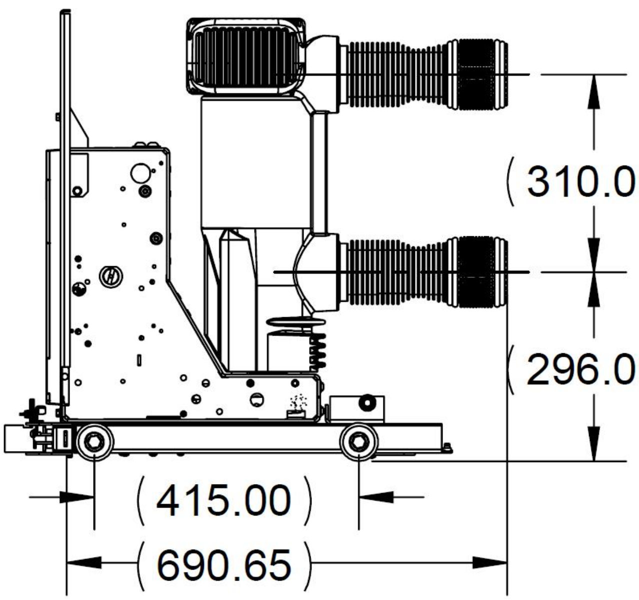



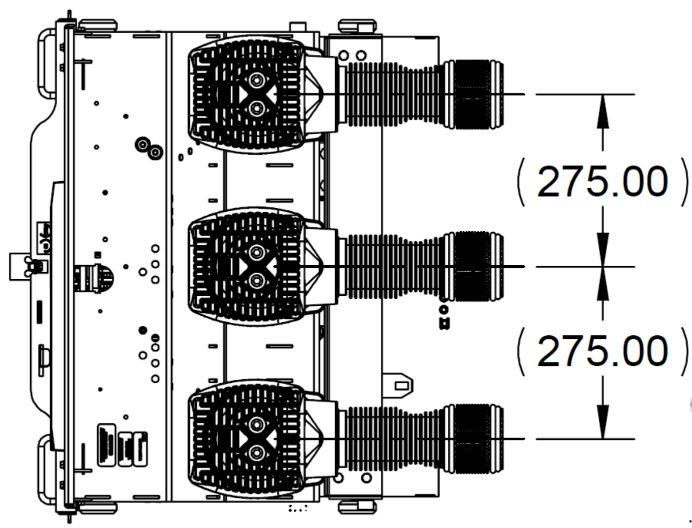
## APPENDIX B
## BASIC BREAKER DIMENSIONS AND WEIGHTS

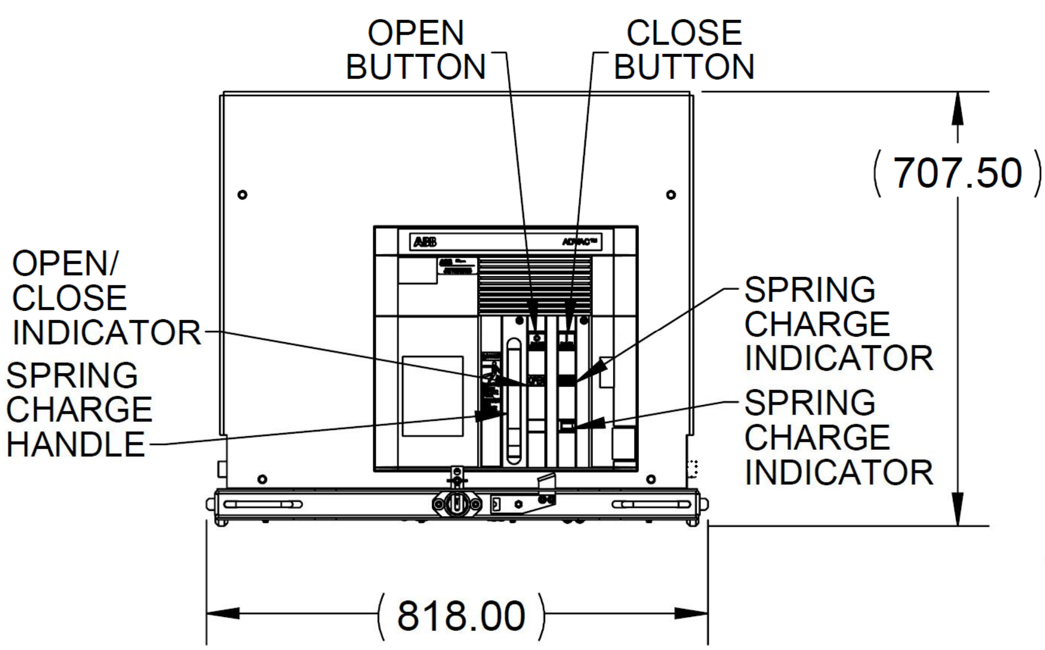
All ADVAC breakers of this style have the same basic dimensions (i.e. pole spacing, mounting locations) regardless of pole configuration.   Hole patterns do change dependent upon the amperage capacity of the breaker.

| TYPE | U | $I_r$ | $I_{SC}$ | MECHANISM | CUBILE |
|---|---|---|---|---|---|
| ADVAC | 15kV | 3000A | 50kA | T. EL | SAFEGEAR HD™ |

Weight 420lbs, 190Kg



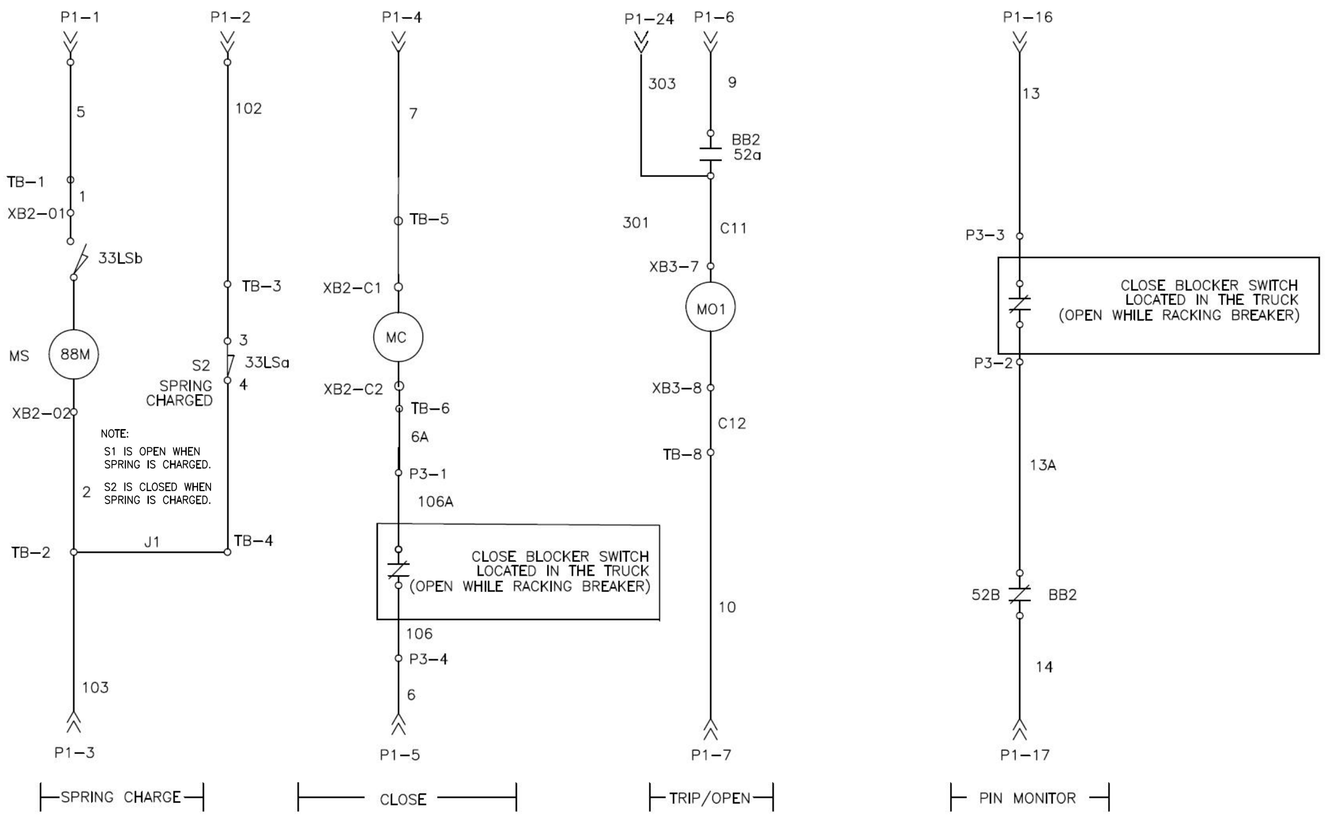



# APPENDIX D
# TYPICAL SCHEMATIC & WIRING DIAGRAMS

## STANDARD WIRING:

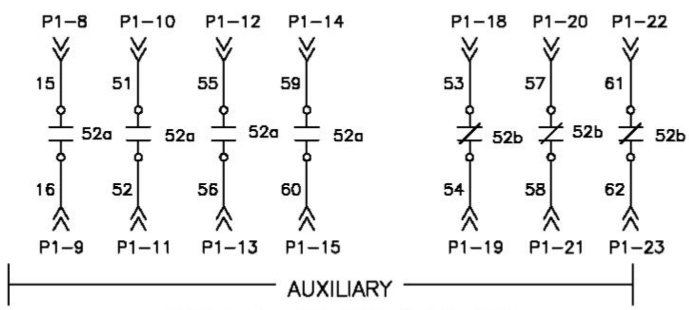
The schematic shows the basic wiring scheme for a breaker with single secondary wiring. This wiring includes four "a" and three "b" auxiliary contacts. The point-to-point diagram shows the physical connections and wire numbers used in the wiring harness.



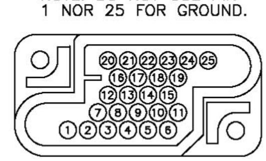

1 PLUG AUX G01

| PIN # | WIRE LOCATION | FUNCTION |
|---|---|---|
| 1 | 5 | + CTRL. PWR. |
| 2 | OPEN | |
| 3 | 103 | − CTRL. PWR. |
| 4 | 7 | CLOSE |
| 5 | 6 | CLOSE |
| 6 | 9 | + TRIP |
| 7 | 10 | − TRIP |
| 8 | 15 | + a1 |
| 9 | 16 | − a1 |
| 10 | 51 | + a2 |
| 11 | 52 | − a2 |
| 12 | 55 | + a3 |
| 13 | 56 | − a3 |
| 14 | 59 | + a4 |
| 15 | 60 | − a4 |
| 16 | 13 | Pin Monitor +b1 |
| 17 | 14 | Pin Monitor −b1 |
| 18 | 53 | + b2 |
| 19 | 54 | − b2 |
| 20 | 57 | + b3 |
| 21 | 58 | − b3 |
| 22 | 61 | + b4 |
| 23 | 62 | − b4 |
| 24 | 303 | trip coil mon. |
| 25 | OPEN | |

Plug 1 − P1




NOTE: DO NOT USE PIN 1 NOR 25 FOR GROUND.

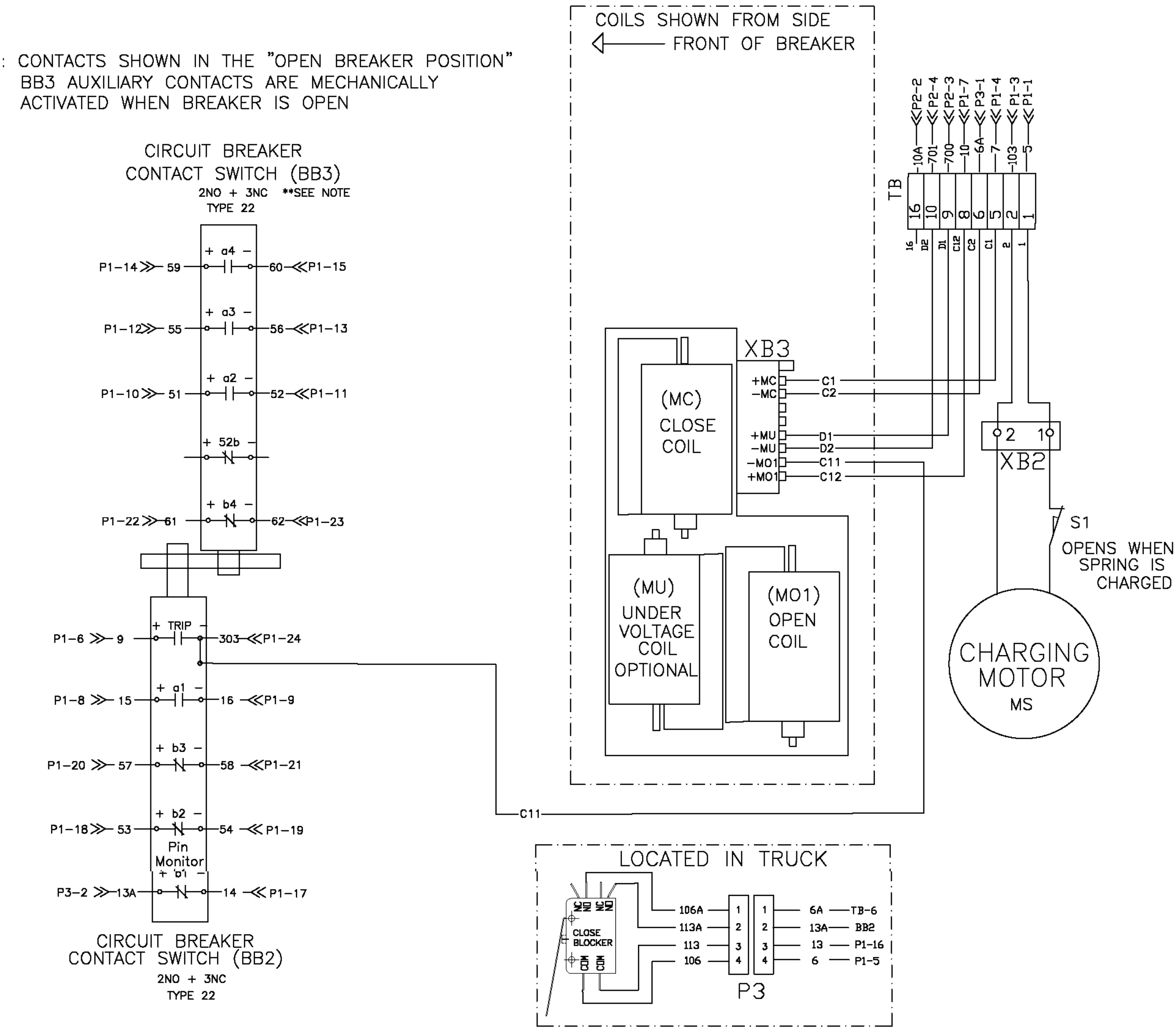



REAR VIEW OF BREAKER SECONDARY RECEPTICLE

# APPENDIX D
# TYPICAL SCHEMATIC & WIRING DIAGRAMS

## STANDARD WIRING:

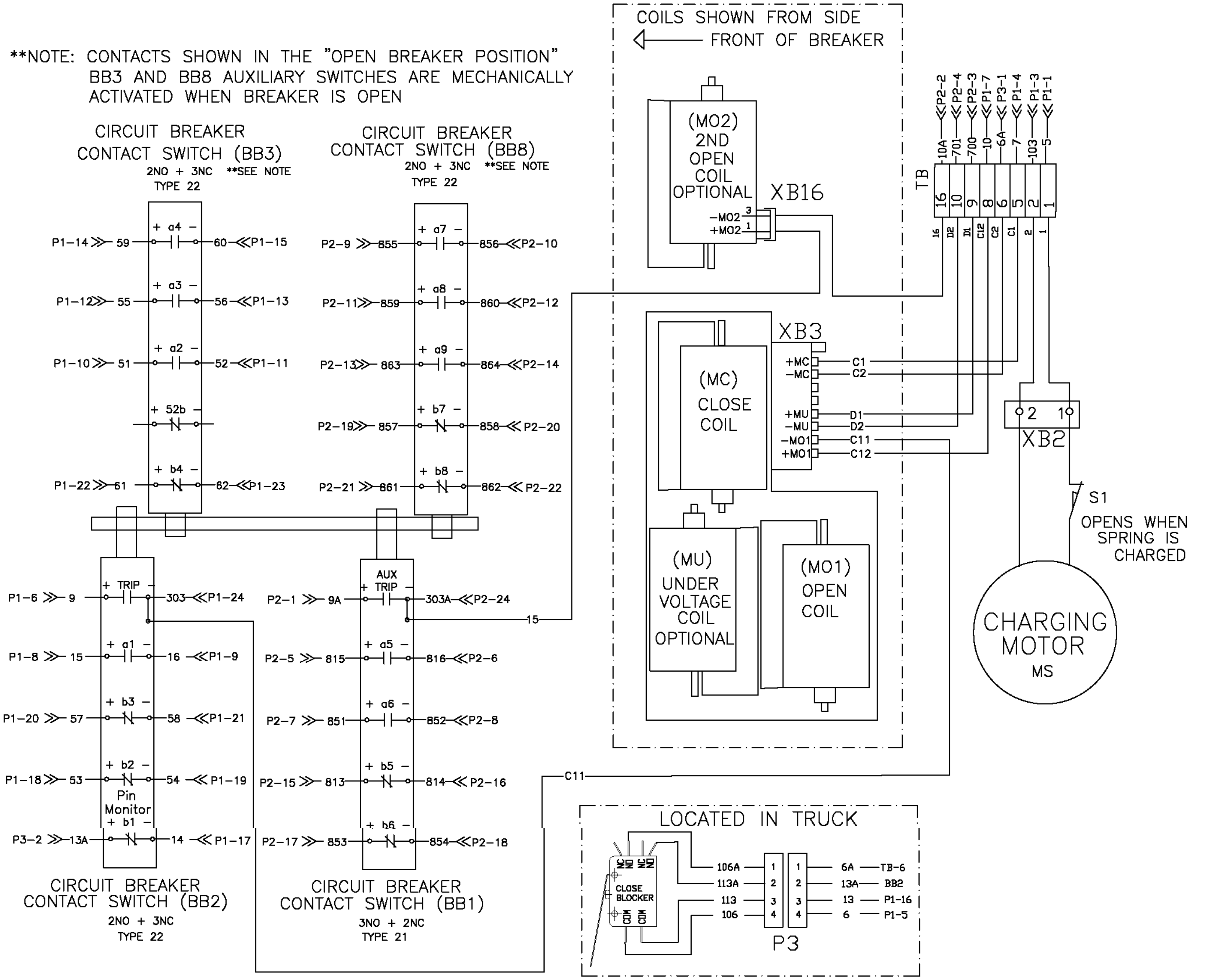
The schematic shows the basic wiring scheme for a breaker with single secondary wiring. This wiring includes four “a” and three “b” auxiliary contacts. The point-to-point diagram shows the physical connections and wire numbers used in the wiring harness.



# APPENDIX D
# TYPICAL SCHEMATIC & WIRING DIAGRAMS

## DUAL SECONDARY WIRING:

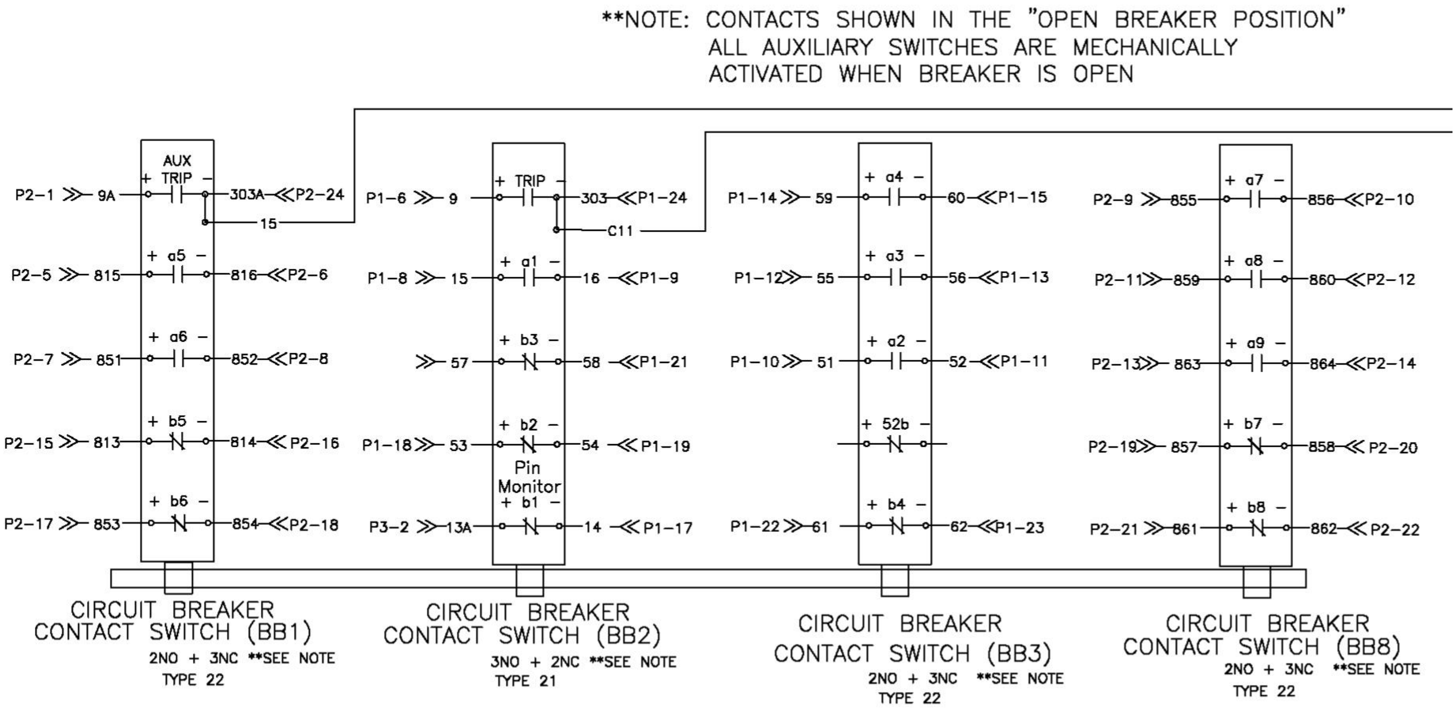
The schematic shows the basic wiring scheme for a breaker with optional wiring. This wiring includes nine “a” and seven“b” auxiliary contacts. The point-to-point diagram shows the physical connections and wire numbers used in the wiring harness.



# APPENDIX D
# TYPICAL SCHEMATIC & WIRING DIAGRAMS

## TWIN EL MECH

The schematic shows the basic wiring scheme for the twin EL breaker with optional wiring. This wiring includes nine “a” and seven “b” auxiliary contacts. The point-to-point diagram shows the physical connections and wire numbers used in the wiring harness.



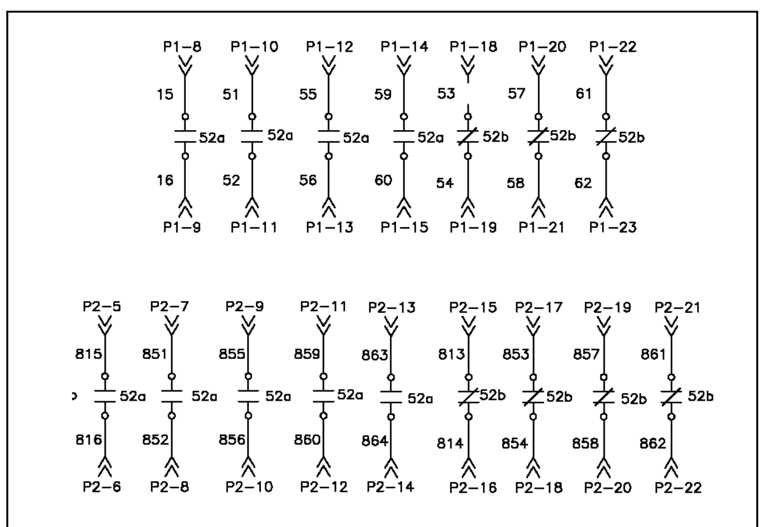

2 PLUG AUX G02

| PIN # | WIRE LOCATION | FUNCTION |
|---|---|---|
| 1 | 5 | + CTRL. PWR. |
| 2 | OPEN | |
| 3 | 103 | − CTRL. PWR. |
| 4 | 7 | CLOSE |
| 5 | 6 | CLOSE |
| 6 | 9 | + TRIP |
| 7 | 10 | − TRIP |
| 8 | 15 | + a1 |
| 9 | 16 | − a1 |
| 10 | 51 | + a2 |
| 11 | 52 | − a2 |
| 12 | 55 | + a3 |
| 13 | 56 | − a3 |
| 14 | 59 | + a4 |
| 15 | 60 | − a4 |
| 16 | 13 | Pin Monitor +b1 |
| 17 | 14 | Pin Monitor −b1 |
| 18 | 53 | + b2 |
| 19 | 54 | − b2 |
| 20 | 57 | + b3 |
| 21 | 58 | − b3 |
| 22 | 61 | + b4 |
| 23 | 62 | − b4 |
| 24 | 303 | trip coil mon. |
| 25 | OPEN | |

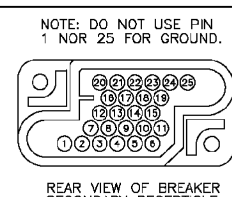
Plug 1 – P1

| PIN # | WIRE LOCATION | FUNCTION |
|---|---|---|
| 1 | 9A | + AUX TRIP |
| 2 | 10A | − AUX TRIP |
| 3 | 700 | + UVD |
| 4 | 701 | − UVD |
| 5 | 815 | +a5 |
| 6 | 816 | −a5 |
| 7 | 851 | +a6 |
| 8 | 852 | −a6 |
| 9 | 855 | +a7 |
| 10 | 856 | −a7 |
| 11 | 859 | +a8 |
| 12 | 860 | −a8 |
| 13 | 863 | +a9 |
| 14 | 864 | −a9 |
| 15 | 813 | +b5 |
| 16 | 814 | −b5 |
| 17 | 853 | +b6 |
| 18 | 854 | −b6 |
| 19 | 857 | +b7 |
| 20 | 858 | −b7 |
| 21 | 861 | +b8 |
| 22 | 862 | −b8 |
| 23 | OPEN | |
| 24 | 303A | trip coil mon. |
| 25 | OPEN | |

Plug 2 – P2



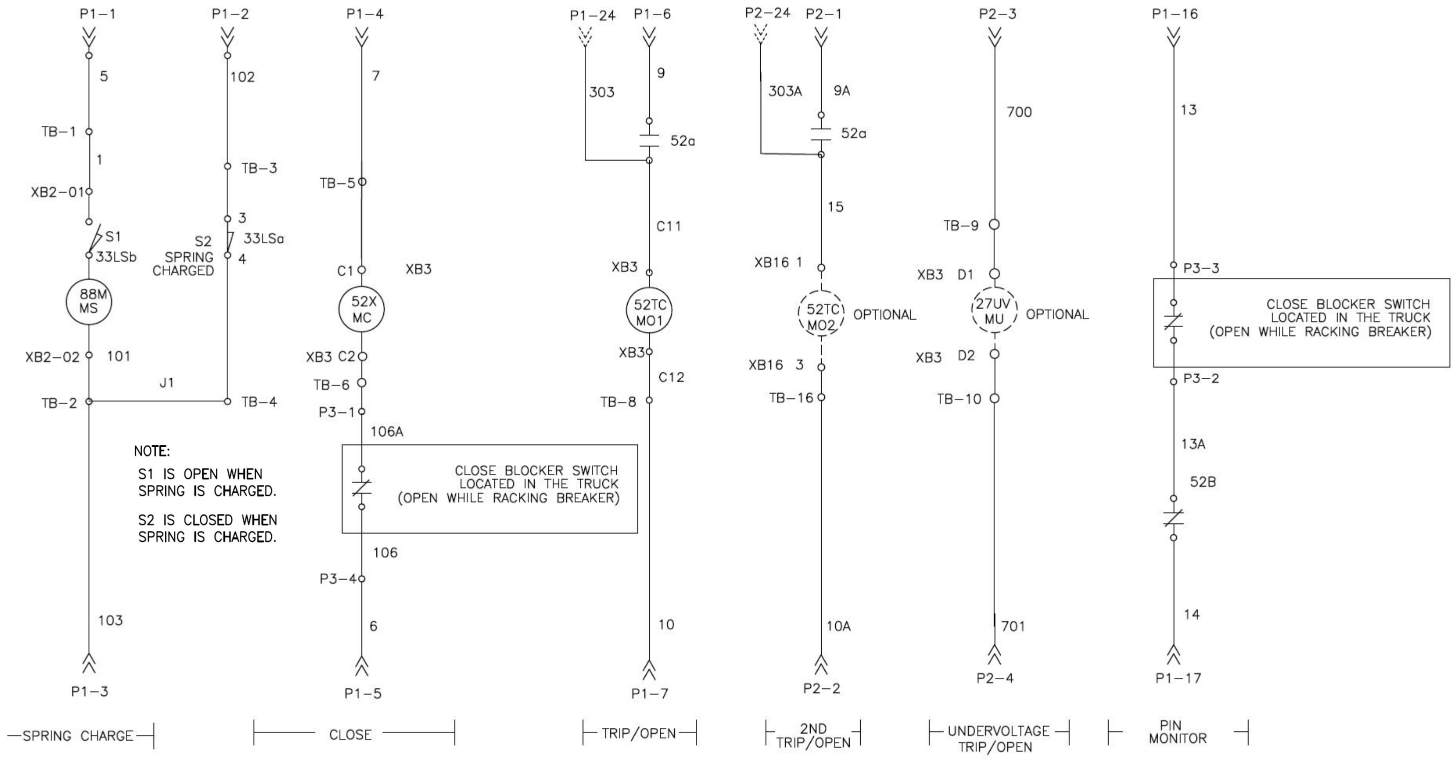

Auxiliary for customer use



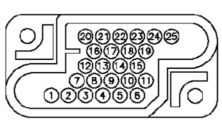
# APPENDIX D
# TYPICAL SCHEMATIC & WIRING DIAGRAMS

## DUAL SECONDARY WIRING:

The schematic shows the basic wiring scheme for a breaker with optional wiring. This wiring includes nine "a" and seven "b" auxiliary contacts. The point-to-point diagram shows the physical connections and wire numbers used in the wiring harness.




NOTE: DO NOT USE PIN 1 NOR 25 FOR GROUND.



REAR VIEW OF BREAKER SECONDARY RECEPTICLE

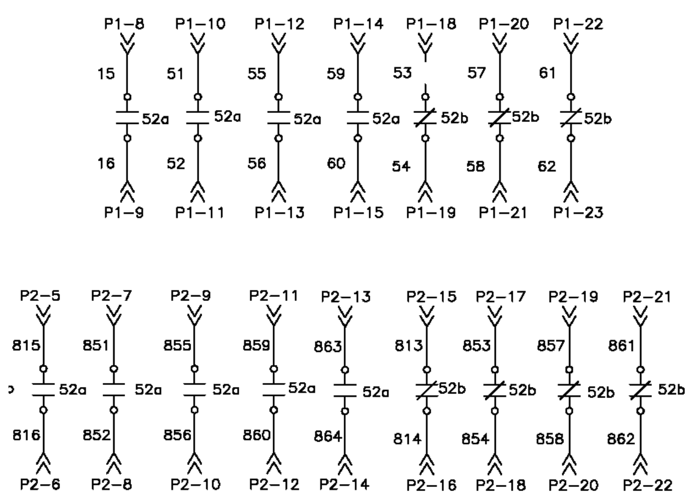
2 PLUG AUX G02

| PIN # | WIRE LOCATION | FUNCTION |
|---|---|---|
| 1 | 5 | + CTRL. PWR. |
| 2 | OPEN | |
| 3 | 103 | − CTRL. PWR. |
| 4 | 7 | CLOSE |
| 5 | 6 | CLOSE |
| 6 | 9 | + TRIP |
| 7 | 10 | − TRIP |
| 8 | 15 | + a1 |
| 9 | 16 | − a1 |
| 10 | 51 | + a2 |
| 11 | 52 | − a2 |
| 12 | 55 | + a3 |
| 13 | 56 | − a3 |
| 14 | 59 | + a4 |
| 15 | 60 | − a4 |
| 16 | 13 | Pin Monitor +b1 |
| 17 | 14 | Pin Monitor −b1 |
| 18 | 53 | + b2 |
| 19 | 54 | − b2 |
| 20 | 57 | + b3 |
| 21 | 58 | − b3 |
| 22 | 61 | + b4 |
| 23 | 62 | − b4 |
| 24 | 303 | trip coil mon. |
| 25 | OPEN | |

Plug 1 – P1

| PIN # | WIRE LOCATION | FUNCTION |
|---|---|---|
| 1 | 9A | + AUX TRIP |
| 2 | 10A | − AUX TRIP |
| 3 | 700 | + UVD |
| 4 | 701 | − UVD |
| 5 | 815 | +a5 |
| 6 | 816 | −a5 |
| 7 | 851 | +a6 |
| 8 | 852 | −a6 |
| 9 | 855 | +a7 |
| 10 | 856 | −a7 |
| 11 | 859 | +a8 |
| 12 | 860 | −a8 |
| 13 | 863 | +a9 |
| 14 | 864 | −a9 |
| 15 | 813 | +b5 |
| 16 | 814 | −b5 |
| 17 | 853 | +b6 |
| 18 | 854 | −b6 |
| 19 | 857 | +b7 |
| 20 | 858 | −b7 |
| 21 | 861 | +b8 |
| 22 | 862 | −b8 |
| 23 | OPEN | |
| 24 | 303A | trip coil mon. |
| 25 | OPEN | |

Plug 2 – P2



Auxiliary for customer use

# APPENDIX E
# Charging motor and Coil data

## Motor operator (-MS)

| Characteristics | | |
|---|---|---|
| Un | 24…30 - 48…60 - 110…130 - 220…250 V– | |
| Un | 100…130 - 220…250 V ~ 50/60 Hz | |
| Operating limits | 85 … 110% Un | |
| | ≤ 40 kA | 50 kA |
| Inrush power (Ps) | DC=600 W;<br>AC=600 VA | DC=900 W;<br>AC=900 VA |
| Rated power (Pn) | DC=200 W;<br>AC=200 VA | DC=350 W;<br>AC=350 VA |
| Inrush time | 0.2 s | 0.2 s |
| Charging time | 6-7 s | 6-7 s |
| Insulation voltage | 2000 V 50 Hz (for 1 min) | 2000 V 50 Hz (for 1 min) |

## APPENDIX E
## Charging motor and Coil data

- Shunt opening release (-MO1)
- Additional shunt opening release (-MO2)
- Shunt closing release (-MC)
- Locking magnet on the actuator (-RL1)

| | |
|---|---|
| Un | 24 - 30 - 48 - 60 - 110 - 125 - 220 - 250 V– |
| Un | 48 - 60 - 110 - 120 - 127 - 220 ... 240 V~ 50 Hz |
| Un | 110 - 120 - 127 - 220 - 240 V~ 60 Hz |
| Operating limits | 70 ... 110% Un |
| Inrush power (Ps) | DC 200 W; AC = 200 VA |
| Inrush time | approx. 100 ms |
| Continuous power (Pc) | DC = 5 W; AC = 5 VA |
| Opening time | 35 ... 60 ms |
| Closing time | 30 ... 80 ms |
| Insulation voltage | 2000 V 50 Hz (for 1 min) |

### Undervoltage release (-MU)

| | |
|---|---|
| Un | 24 - 30 - 48 - 60 - 110 - 125 - 220 - 250 V– |
| Un | 48 - 60 - 110 - 120 - 127 - 220 ... 240 V~ 50 Hz |
| Un | 110 - 120 ... 127 - 220 ... 240 V~ 60 Hz |
| Operating limits | |
| – circuit-breaker opening | 35-70% Un |
| – circuit-breaker closing | 85-110% Un |
| Inrush power (Ps) | DC 200 W; AC = 200 VA |
| Inrush time | approx. 100 ms |
| Continuous power | DC = 5 W; AC = 5 VA |
| Opening time | 60 ... 80 ms |
| Insulation voltage | 2000 V 50 Hz (for 1 min) |

# APPENDIX E
# Auxiliary contact data

## Auxiliary contacts of the circuit-breaker

| | |
|---|---|
| Rated insulation voltage according to VDE 0110, Group C | 660 V AC<br>800 V DC |
| Rated voltage | 24 V... 660 V |
| Insulation-test test voltage | 2.5 kV |
| Maximum rated current | 10 A |
| Number of contacts | 5 |
| Stroke | 6 mm ... 7 mm |
| Contact force | 26 N |
| On resistance | 3 mΩ |
| Storing temperature range | - 20° C ... + 120 °C |
| Operating temperature range | - 20° C ... + 70 °C |
| Contact over temperature | 20 K |
| Operating cycles | 30.000 |

Unlimited short circuit stability by using fuses of max. 10 A time-lag

| | Cosφ | Rated current | Breaking capacity |
|---|---|---|---|
| 220 V AC | 0.7 | 2.5 A | 25 A |
| 380 V AC | 0.7 | 1.5 A | 15 A |
| 500 V AC | 0.7 | 1.5 A | 15 A |
| 660 V AC | 0.7 | 1.2 A | 12 A |
| | **Time constant** | | |
| 24 V DC | 1 ms | 10 A | 12 A |
| | 15 ms | 10 A | 12 A |
| | 50 ms | 8 A | 10 A |
| | 200 ms | 4 A | 7.7 A |
| 60 V DC | 1 ms | 8 A | 10 A |
| | 15 ms | 6 A | 8 A |
| | 50 ms | 5 A | 6 A |
| | 200 ms | 4 A | 5.4 A |
| 110 V DC | 1 ms | 6 A | 8 A |
| | 15 ms | 4 A | 5 A |
| | 50 ms | 2 A | 4.6 A |
| | 200 ms | 1 A | 2.2 A |
| 220 V DC | 1 ms | 1.5 A | 2 A |
| | 15 ms | 1 A | 1.4 A |
| | 50 ms | 0.75 A | 1.2 A |
| | 200 ms | 0.5 A | 1 A |

## Ambient temperature

| | |
|---|---|
| Maximum | + 40 °C |
| Average maximum over 24 hours | + 35 °C |
| Minimum (according to class – 5), apparatus for indoor installation | - 30 °C |

## Humidity

The average value of the relative humidity, measured for a period longer than 24 hours, must not exceed 95%

The average value of the pressure of the water vapour without condensation, measured for a period longer than 24 hours, must not exceed 2.2 kPa.

The average value of the relative humidity, measured for a period longer than 1 month, must not exceed 90%.

The average value of the pressure of the water vapour, measured for a period longer than 1 month, must not exceed 1.8 kPa.

## Altitude

≤ 1000 (3300 ft.) m above sea level.
For application above 1000m (3300 ft.) C37.20.2 is applicable

## Climate

To avoid the risk of corrosion or other damage in areas:

- with a high level of humidity, and/or
- with rapid and large temperature variations, take appropriate steps (for example, by using suitable electric heaters) to prevent condensation phenomena.

For special installation requirements or other operating conditions, please contact ABB.

# Product Quality and Environmental Protection

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 14 001. All of these items can be supplied with a certificate of quality upon request.

## End of the product's life

ABB is committed to complying with all legal and other relevant requirements for environmental protection in accordance with the ISO 14 001 standards.

It is the responsibility of the product's owner to facilitate the subsequent recycling and/or disposal of the product 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 of the product can be carried out in a manner of different ways depending upon the materials contained within the product. Below is the recommended method of disposal for the various different materials which may be encountered during disposal of ABB products.

| RAW MATERIAL | RECCOMMENDED METHOD OF DISPOSAL |
|---|---|
| Metal material (Fe, Cu, Al, Ag, Zn, W, ect.) | Separation and recycling |
| Thermoplasts | 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 |

# Contact Us

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All sales are subject to ABB Inc.

General Terms and Conditions of Sale.

While every effort has been made to assure accuracy, the information in this document is subject to change without notice.



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for a better world™