



DISTRIBUTION SOLUTIONS

1YEPTSR0019S001 REV A

R-MEC Spring dead tank outdoor vacuum circuit breaker

Instruction, operation and maintenance manual
15.5kV 1250A



Contents

1	Safety Notices	4
2	Introduction	5
3	Receiving, handling and storage	5
3.1	Receiving Inspection	5
3.2	Handling	6
3.3	Storage	6
4	General product description	7
4.1	High Voltage Assembly	7
4.2	Housing	7
4.3	Phase assembly	7
4.4	Spring based mechanism	7
4.5	Trip and Close coils	7
4.6	2nd Tripping Coil (backup trip coil)	8
4.7	Trip Coil Monitor	8
4.8	Undervoltage Trip Coil (UV)	8
4.9	Vacuum interrupters life expectancy chart	9
4.10	Auxiliary switches – current specifications	9
4.11	Current transformer connections	10
4.12	Typical R-MEC ratings nameplate	10
4.13	HV components, typical schematic and general dimensions	11
5	Electrical specifications	14
6	Standard production tests	15
7	Operation	16
7.1	Manual spring charging operation	16
7.2	Electrical Spring Charging Operation	16
7.3	Circuit breaker closing	17
7.4	Circuit breaker opening	17
7.5	External manual trip push button	17
8	Operational check prior installation	19
8.1	Functional tests	19
8.2	Vacuum integrity test	19

9	Installation	21
9.1	Mounting	21
9.2	Grounding	21
9.3	Arrester Protection	21
9.4	Control Power	21
9.5	Final Inspection	22
10	Inspection, maintenance and adjustment	23
10.1	Maintenance periodicity	24
10.2	Control wiring and main components inspection	24
10.3	Torque verification in HV compartment components and mechanism	25
10.3.1	HV compartment components torque verification:	25
10.3.2	Mechanism torque verification:	25
10.4	Measurement and readjustment of contacts travel & overtravel gap (wipe)	27
10.5	Insulation evaluation (Hi-Pot) and contact resistance measurement	30
10.5.1	Insulation evaluation High Pot Test	30
10.5.2	Contact resistance measurement	30
10.6	Mechanism and HV components cleaning and relubrication	31
10.6.1	Shafts and hooks cleaning	31
10.6.2	Rollers cleaning	32
10.6.3	Check Cleaning effectiveness	32
10.7	Mechanism re-greasing	34
10.7.1	Shafts greasing	34
10.7.2	Closing hook pin greasing	35
10.7.3	Hooks greasing	35
10.7.4	Anti-reclosing lever greasing	36
10.7.5	Rollers greasing	36
10.8	Other parts to be lubricated	37
10.9	Final functional tests	37
11	R-MEC troubleshooting	38
12	End of life recycle/disposal	39

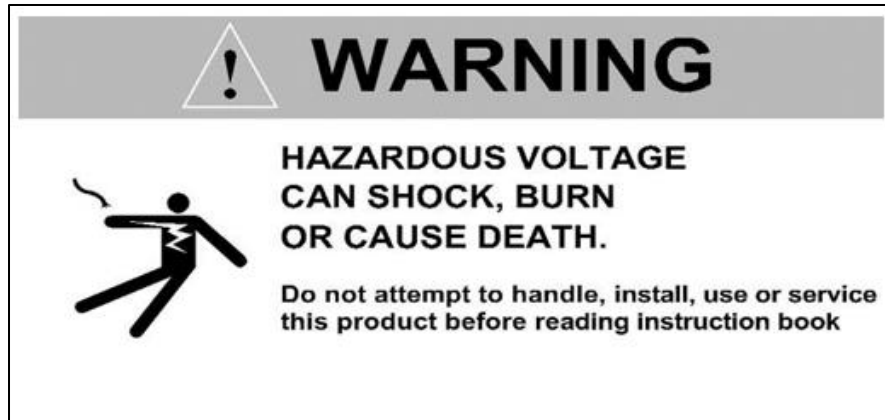


Figure 1 - Hazardous voltage warning

1 Safety Notices

Install the R-MEC circuit breaker within the design limitations as described on its nameplate and in these instructions.

Follow your company's safety procedures.

This breaker should not be used by itself as the sole means of isolating a high voltage circuit. For the safety of personnel performing maintenance operations on the breaker or connecting equipment, all components should be electrically disconnected by means of a visible break and should be securely grounded.

This product is intended to be operated and maintained by qualified persons, thoroughly trained and knowledgeable of the hazards involved. This publication is written only for such qualified persons and is not intended to be a substitute for adequate training and experience in the safety procedures for this device.

WARNING

Detailed descriptions of standard repair procedures, safety principles and service operations are not included. It is important to note this document contains some warnings and cautions against some specific service methods that could cause personal injury to service personnel, damage equipment, or render it unsafe. These warnings do not cover all conceivable ways in which service, whether or not recommended by ABB, might be performed or the possible hazardous consequences of each conceivable way, nor could ABB investigate all such ways. Anyone using service procedures or tools, whether or not recommended by ABB, must satisfy himself thoroughly that neither personal safety nor equipment safety will be jeopardized by the service method or tools selected.

All information contained in this manual is based on the latest product information available at the time of printing. The right is reserved to make changes at any time without notice.

2 Introduction

These instructions do not attempt to provide the user of this equipment with every possible difficulty that may occur in the application, operation and maintenance of the product. Also, as improvement in parts and assemblies are made, some parts may differ in appearance as depicted in the illustrations; however, functionality will be equivalent.

The Type R-MEC vacuum circuit breaker is a high-voltage, three-phase device incorporating three vacuum interrupters, gang operated by a spring charged mechanism. Together with the optional relaying and current transformers, the breaker will sense an overload and automatically open.

Satisfactory performance of the breaker is contingent upon the correct installation, and adequate maintenance and service of the product. Careful study of these instructions will permit the user to obtain maximum benefit from this device.

3 Receiving, handling and storage

Each breaker is assembled and tested at the factory prior to shipment following strict procedures.

This equipment was packed and shipped in factory new condition. If damage is noted, call the carrier at once for inspection and request an inspection report. File a formal claim with the carrier, supported with paid freight bill, inspection report and invoice. The local ABB Sales Office must be notified. This must be done within 10 days of receipt or receiver assumes all responsibility for damage.

3.1 Receiving Inspection

Upon receipt, it is important to inspect promptly to be certain that the correct material has been received. In case of shortage, immediately notify the local ABB Sales Office.

Check all parts against the shipping list as they are unpacked. Instructions and literature packed with the breaker should be kept with the unit. The cabinet provides a convenient place to keep this instruction book, a copy of the schematic diagram and the card with the service record of the unit. Additional copies may be obtained upon request from the local ABB Sales Office.

If the breaker is not to be placed in service immediately, it is essential that proper care be exercised in the handling and storage to ensure good operating conditions in the future. (See 3.3 storage).

3.2 Handling

The R-MEC circuit breaker comes with two brackets that attach to the sides of the cabinet and provide provisions for lifting the breaker. A two-point lift is recommended using the loops in these brackets. (See Figure 2 - Lifting detail)

CAUTION

Exercise care during lifting to avoid damage to the bushings. Breaker has high center of gravity.

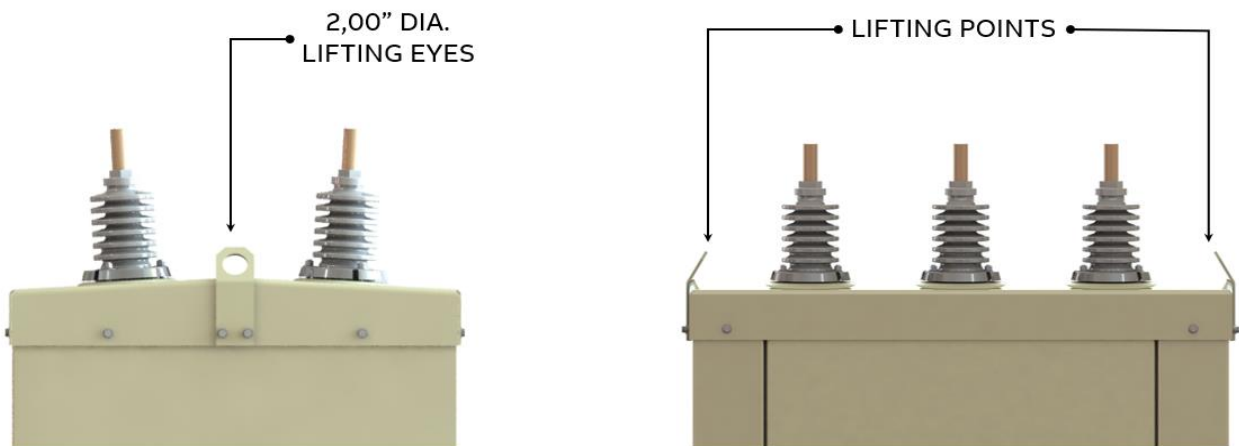


Figure 2 - Lifting detail

3.3 Storage

For prolonged storage, indoor storage is recommended. If stored outdoors, the cabinet heaters must be energized to maintain the warranty. The mechanism and control compartment is equipped with heaters to reduce condensation. This recommendation is also shown in following nameplate located low voltage compartment door.

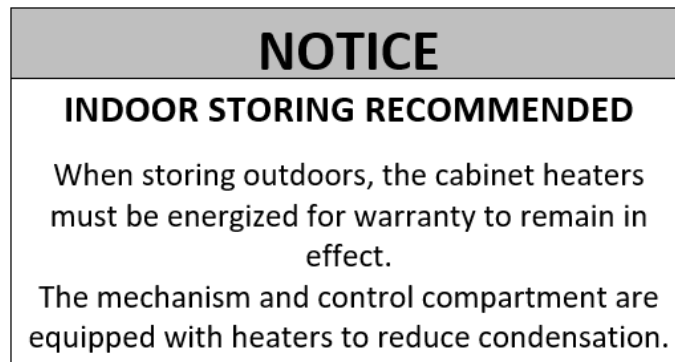


Figure 3 - Indoor storing recommended notice nameplate

4 General product description

4.1 High Voltage Assembly

The high-voltage section of the R-MEC consists of three individual phase assemblies mounted on insulating standoffs. Each phase of the R-MEC consists of a single vacuum interrupter, flexible shunt and operating rod.

4.2 Housing

The doors of the breaker housing are removable and retained by hinge pins. The position indicator is visible through the front door. The breaker nameplate showing rating information, serial number and customer order number is mounted on the right-hand side of the housing.

4.3 Phase assembly

Figure 16 shows the details of the phase assembly. The back bus work is attached directly to the fixed contact stud on the back end of the vacuum interrupter. The current transfer assembly housing is fastened to the opposite end of the vacuum interrupter. In the current transfer assembly, a contact block/flexible shunt transfers current from the moving contact of the vacuum interrupter directly through the bus to the bushing.

4.4 Spring based mechanism

The EL-mechanism is the core of the R-MEC mechanism, it's well proven modular design which allows the user to provide easy and quick maintenance. This mechanism was derived from other ABB medium voltage circuit breakers, installed in thousands of substations worldwide, therefore its reliability and robustness is ensured.

By utilizing a modular design, the R-MEC breaker has a quick-change trip/close coil and charging motor design that makes repair of these commonly repaired parts easy. Additionally, the R-MEC mechanism features a mechanical anti-pump device to eliminate reliance on electrical anti-pump devices. For breaker rebuilds or repairs, the entire EL-mechanism can be removed and replaced in under an hour. Replacement of coils and motor can be done within minutes by removing a single screw.

4.5 Trip and Close coils

R-MEC breaker features a set of smart coils for remote trip and close operations, with on-board microprocessors that monitor for coil continuity, over-current and over temperature scenarios and provide a more efficient response than standard coils. These coils are installed in right side of mechanism.

4.6 2nd Tripping Coil (backup trip coil)

A second tripping coil can be added as per customer requirements to provide a backup tripping coil in case the primary one is failed or simply because the control scheme requires it. This 2nd tripping coil will mechanically trip the mechanism with exactly the same functionality of the main standard tripping coil.

4.7 Trip Coil Monitor

Smart Coils can be monitored by means of a device known as STU (Shunt Trip Unit) that is wired in parallel with the trip coil to continuously monitor the health of the coil. This device will be shown an alarm through the simplicity of a NO/NC contact where a protection relay input can be connected.

It might be the case that when an ABB Relion relay is used as the main protection relay of the R-MEC circuit breaker, the STU device is replaced by the internal trip coil monitor available in one of the ABB Relion inputs. Consult schematics to confirm.

4.8 Undervoltage Trip Coil (UV)

Under voltage coil can be found in the coil support (right side of the EL mechanism) next to trip coil 1 and close coil. Function of Undervoltage trip coil is to automatically trip the R-MEC circuit breaker as soon as the control power is removed. Therefore, special care is needed when commissioning or during maintenance before control power is provided, as this UV coil will keep the R-MEC breaker in open position. Only after power is applied the UV coil will allow the breaker to close.

Whenever control voltage decays below rated value for UV coil (70 % of nominal control voltage) **BREAKER WILL AUTOMATICALLY TRIP WITHOUT ANY DELAY. Keep this above consideration in mind for safety during maintenance or testing procedure of R-MEC breaker.**

This coil is added into R-MEC mechanism as per customer request, therefore not all R-MEC in field will be featured with this undervoltage trip coil, consult Bill of Materials and schematics for reference.

4.9 Vacuum interrupters life expectancy chart

Following picture represents the relation between the current interrupted by the vacuum interrupters and the maximum number of operations at given current.

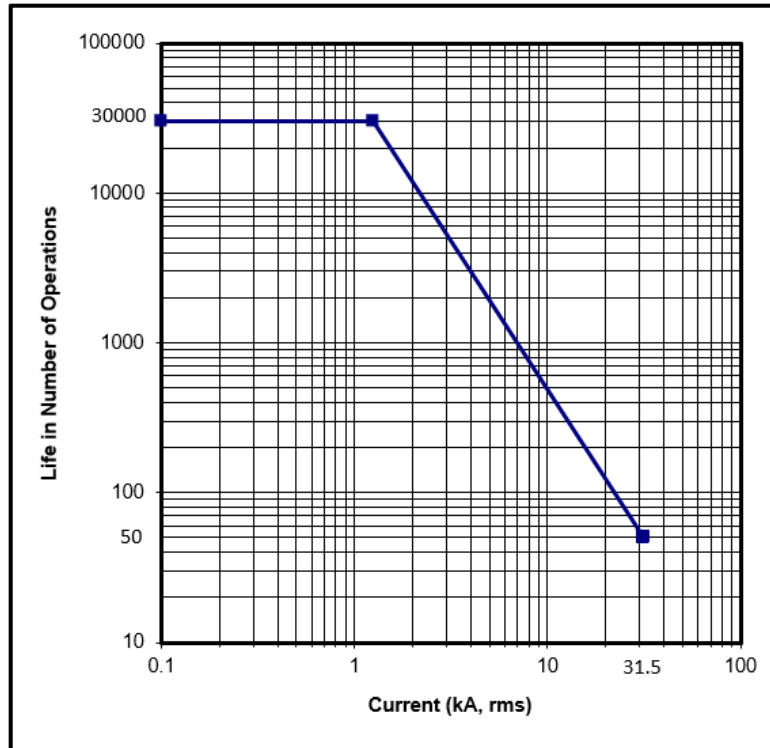


Figure 4 - R-MEC vacuum interrupter model VG4S-U

4.10 Auxiliary switches – current specifications

Following specifications define the main auxiliary switches capabilities. The quantity of available contacts will depend on the specific control, refer to schematics to confirm.

- Max operational voltage: 220 VDC/CVA
- Nominal switching current: 2.0 A
- Switching capability: Inductive loads with L/R ratio (time constant) of 20ms
- Max dielectric strength: 2.0kV for 1 minute
- Insulation resistance: $\geq 500 \text{ Mohm}$
- Max mechanical durability: $\geq 1,00,000$ operations
- Max electrical durability: $\geq 50,000$ operations

4.11 Current transformer connections

R-MEC circuit breaker can be featured with a maximum of 2 window type current transformers per bushing. These current transformers are usually manufactured by ABB following either IEEE or IEC standards, therefore secondary connections will follow standards regulations. Following table shows the secondary connections for most popular current transformers despite its application (relaying or metering). Refer to schematics to confirm ratio and secondary taps.

600:5 Multi-ratio		1200:5 Multi-ratio	
Terminal	Ratio	Terminal	Ratio
X2-X3	50-5	X2-X3	100-5
X1-X2	100-5	X1-X1	200-5
X1-X3	150-5	X1-X3	300-5
X4-X5	200-5	X4-X5	400-5
X3-X4	250-5	X3-X4	500-5
X2-X4	300-5	X2-X4	600-5
X1-X4	400-5	X1-X4	800-5
X3-X5	450-5	X3-X5	900-5
X2-X5	500-5	X2-X5	1000-5
X1-X5	600-5	X1-X5	1200-5

4.12 Typical R-MEC ratings nameplate

Following picture shows the standard R-MEC ratings nameplate, final ratings and details may vary from order to order depending on specific requirements of each job.

ABB			
Serial No:		Date MFR:	
TYPE			
Rated Max Voltage	kV	Rated Frequency	Hz.
Rated Continuous Current	A	KV Range Factor K	
Rated Lightning Impulse Withstand Voltage		kV	
Rated Symmetrical Interrupting Current		kA	
Rated Symmetrical Interrupting Time		Cycles	
Closing Control Voltage	Tripping Control Voltage		
Weight		Kg	
Style No.	IB No.		
Diagram No.	Control Input =		
Additional Information:			
<div style="display: flex; justify-content: space-between;"> ○ ○ </div>			
<small>MADE IN Mexico</small> <small>FOR PARTS OR SERVICE CALL 1-800-325-7947 OR YOUR LOCAL ABB REPRESENTATIVE</small>			

Figure 5 - Breaker nameplate

4.13 HV components, typical schematic and general dimensions

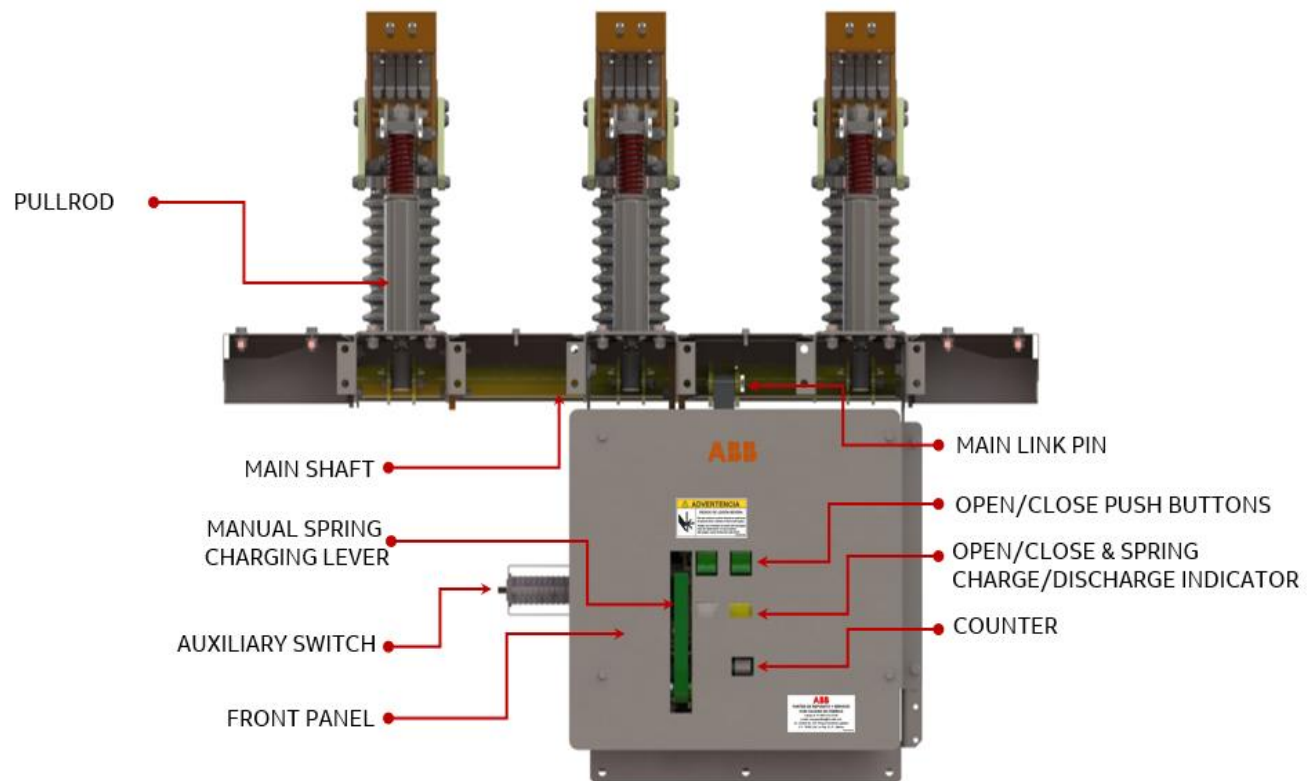


Figure 6 - High voltage compartment layout



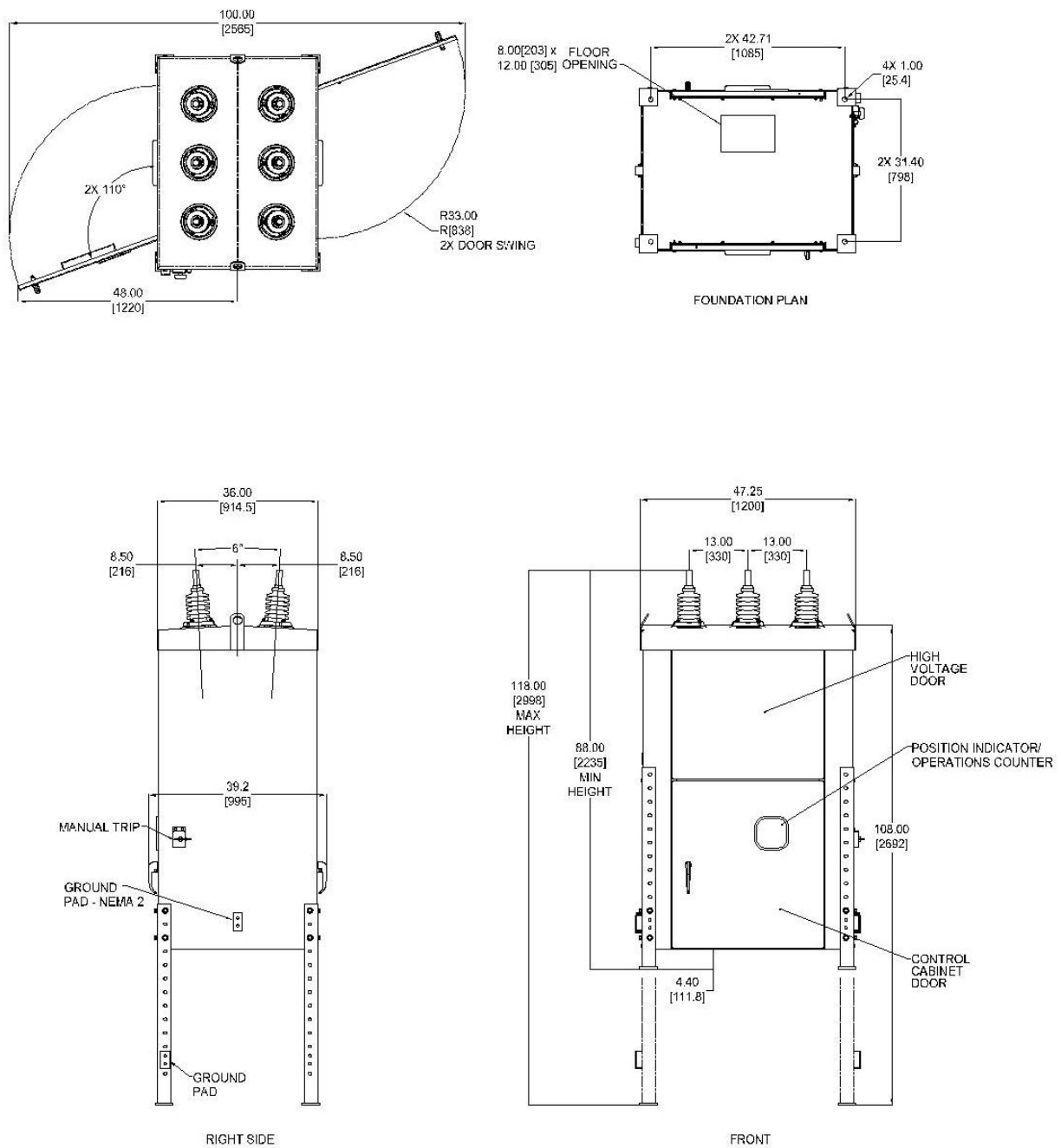


Figure 8 - R-MEC general dimensions 15.5kV, 1250A

5 Electrical specifications

Rated maximum voltage (rms):	15.5 kV
Rated lightning impulse withstand voltage (BIL)	110 kV
Rated power-frequency withstand voltage-Dry	50 kV (1 min)
Rated power-frequency withstand voltage-Wet	40 kV (10sec)
Rated frequency	50/60 Hz
Number of poles	3 – simultaneously operated
Rated continuous current (rms) @ 50/60Hz	1250 A
Rated symmetrical interrupting rms current	31.5 kA (E2)
Rated peak withstand	82 kA
Rated short time current	31.5 kA
Rated short time current duration	3 Sec
D.C. time constant	45ms
Minimum opening time	35ms
D.C. component	38%
TRV first pole to clear factor	29.2 kV
Operating duty sequence	O-0.3sec-CO-15sec-CO
Rated operating endurance	10,000 Operations (M2)
Short line fault surge impedance	450 Ω
Out of phase making and breaking current	7.875 kA
Out of phase voltage factor	2.5
Line charging current	100 A (C1)
Cable charging current	25 A (C1)
Back to back capacitor bank inrush making current	20 kA-peak
Back to back capacitor bank switching current	630 A (C1)
Capacitor bank frequency of inrush current	4250 Hz
Operating temperature	-30°C to +40°C (-22°F to 104°F)

6 Standard production tests

Standard production tests are carried out before each R-MEC breaker is shipped out according to IEEE C37.09 requirements, including the following tests:

- Verification of all wiring per connection diagrams
- Electrical operation: close and trip, overcurrent response and automatic closing, with relaying control option
- Check functioning of all manual controls: close/trip, local/remote, non-reclosing, ground fault bypass, etc.
- Three readings are made on each phase of the breaker using a Biddle “Ducter.” Typical values do not exceed 100 micro ohms.
- Voltage Withstand: the complete breaker is tested between live parts and tank, across open contacts and between phases. In compliance with IEEE C37.09 and IEC 62271-100, an AC dielectric withstand test at 50 kV is performed. Test duration is one minute.
- Wiring Insulation: The terminal block connections are given an over-potential test of 1800 volts AC to ground (for 1 sec).
- Verification of CTs functionality: each current transformer is verified to confirm ratio and polarity as per order specifications
- Manual trip validation: manual tripping functionality is verified; ANSI 69 function is tested (mechanical close blocking)
- Vacuum interrupters travel and operation synchronization: after settling of vacuum interrupters, travel displacement, penetration, bounce and timing is confirmed

7 Operation

Circuit breaker operation can be either manual or electrical (Figure 9 - **Circuit breaker operation**)

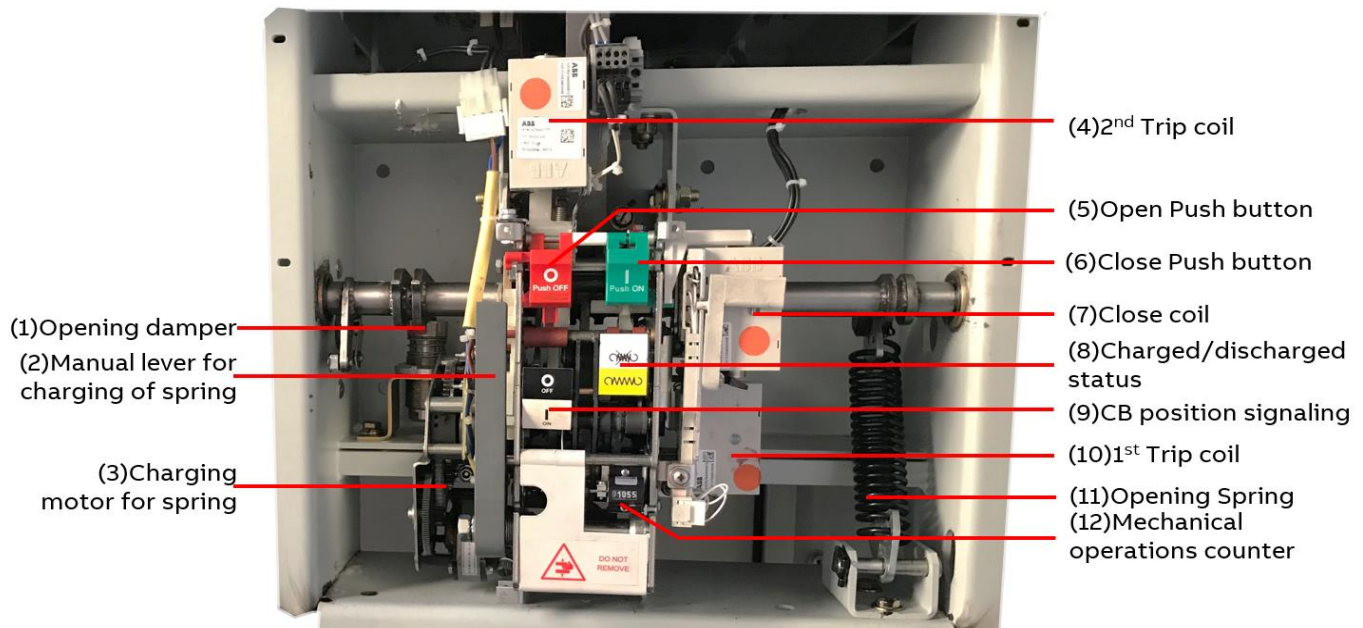


Figure 9 - Circuit breaker operation

7.1 Manual spring charging operation

To manually charge the closing spring, it is necessary to repeatedly activate the charging lever (2) (maximum rotation of the lever: about 90°) until the yellow signaling device (8) appears; indicating completion of charging. The maximum force which can normally be applied to the lever is <250N.

7.2 Electrical Spring Charging Operation

The R-MEC is equipped with an electric charging motor (3). When the control power is supplied to the charging motor circuit (see electrical diagram Figure 7), the charging motor will charge the closing spring until the yellow signal device appears. The circuit is designed such that the charging motor will turn on whenever the closing spring is discharged.

If the power circuit is cut off during charging, the geared motor stops and will automatically start recharging spring when the power returns. In any case, it is always possible to complete the recharging operation manually.

For remote signaling, spring charge status indicator is available as a “C Contact” in the BS2 module (see electrical diagram in Figure 7).

7.3 Circuit breaker closing

- In the open position, this operation can only be carried out with the closing spring completely charged
- The circuit breaker must be in open position and with the manual trip push button (located in the right-side panel from the exterior of the breaker) released.
- For manual closing, press the pushbutton (6).
- The operation can also be carried out remotely by means of control circuit delivering power to the close coil.
- The closing operation is signaled by the OPEN/CLOSE indicator (9).

7.4 Circuit breaker opening

- This operation can be carried out with the closing spring charged or discharged.
- For manual opening, press the pushbutton (5).
- The operation can also be carried out remotely by means of control circuit delivering power to trip coil (10) or optional second trip coil (4).
- The opening operation is signaled by the OPEN/CLOSE indicator (9).

7.5 External manual trip push button

The breaker has additionally a mechanical way available from the exterior for opening the breaker which is a red push button located in the right-side wall of the breaker. To use it following procedure must be followed:

1. If breaker is in closed position, release the lock pin from the side of the pushbutton and press the red button until it locks again with the lockpin.
2. After above step, breaker will automatically trip and remain locked in the trip position until push button is released again from the lock pin and returned to its original position (push button completely out of its bracket).
3. Push button has additionally a hole to keep manual trip mechanism in both conditions (tripped or free) with a LOTO device.

See Figure 10 for more detail.

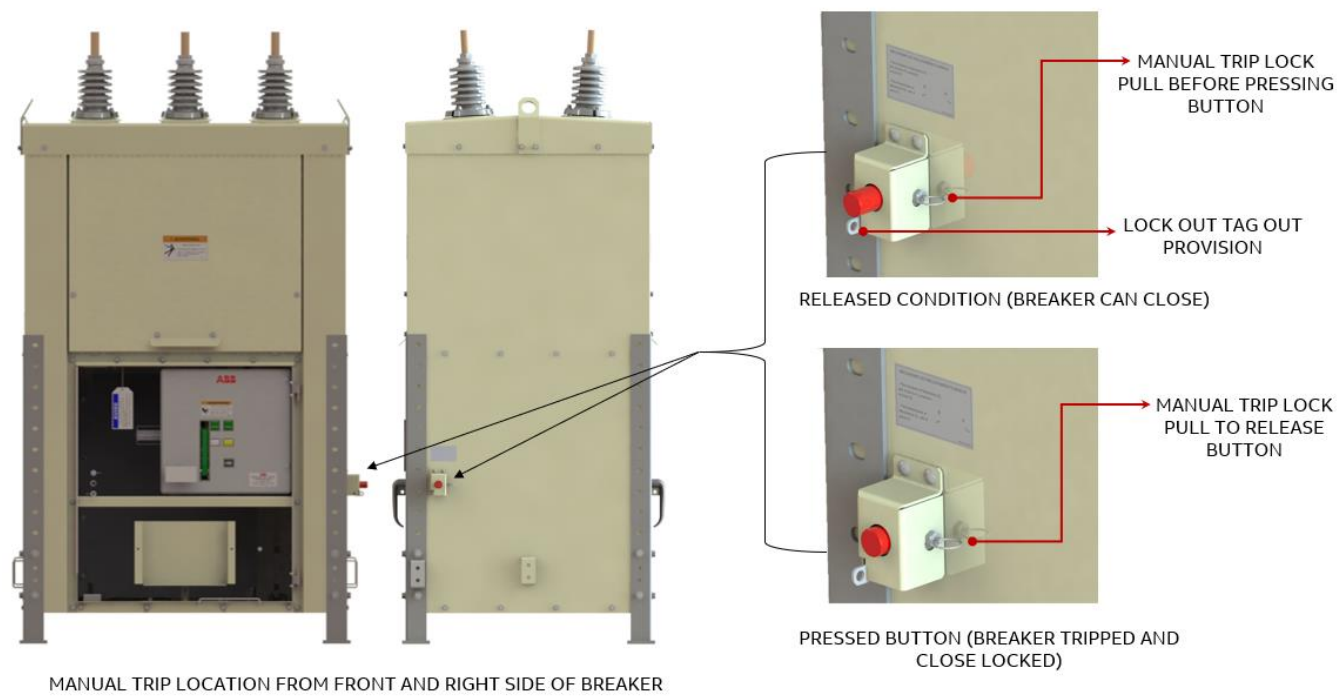


Figure 10 - External push button manual trip

8 Operational check prior installation

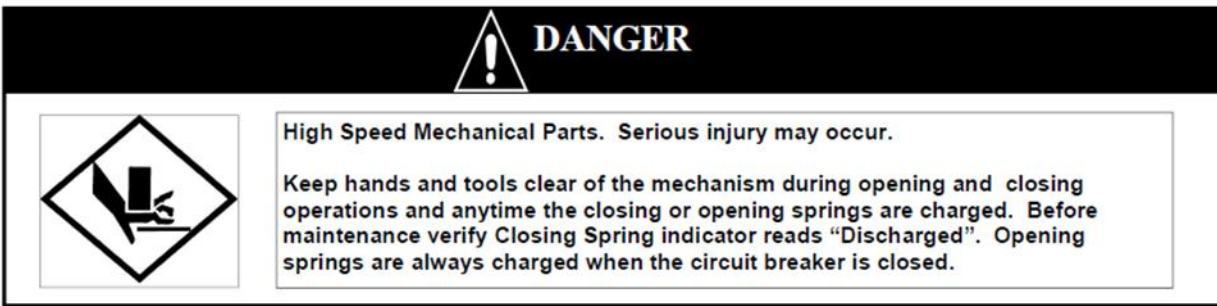


Figure 11 - Mechanical parts warning

The R-MEC breaker should be tested for mechanical and electrical operation before delivery to the installation site. Make the necessary control power connections (coils and motor). Open the door of the low voltage compartment to observe the mechanical operations.

8.1 Functional tests

1. Verify correct function of coils, motor, pushbuttons, signaling (breaker position “Green for open and red for close”), spring charging condition (white for discharged, yellow for charged spring) and operation counter.
2. Also verify manual trip operation as described and verify that auxiliary switches (52a/52b) change of position depending on the operation (close/open).
3. Perform a few operations with manual spring charging and the front pushbuttons and a few operations with the motor for spring charging and coils.
4. If the spring is not charged or if the external manual trip is pressed, the breaker should not close. Also verify antipumping function by holding open button and trying to close the breaker, breaker should not close.

8.2 Vacuum integrity test

Perform an over-voltage test on each phase assembly to verify that there has been no loss of vacuum in transportation or handling. Experience has shown that a vacuum interrupter with the vacuum seal intact will withstand 37.5 kVAC across the open contacts for one minute, and the same vacuum interrupter open to normal atmosphere will flashover at the gap at a much lower voltage.

**RADIATION WARNING**

High voltage applied across an open gap in a vacuum can produce X- radiation. No radiation is emitted when the interrupter is closed, since no gap exists. Also, when the breaker is open to the specified contact spacing in service or tested within the voltages specified.

X- radiation at one meter is below the level of concern. A danger could exist at voltages above or contact spacing below that specified on the nameplate.

Vacuum integrity test procedure:

1. With the breaker in the open position, jumper both sets of three top terminals together. Ground one set of terminals and the housing. Connect the high voltage to the other set of terminals.
2. Stand clear more than one meter before energizing the high voltage source.
3. Apply a test voltage of 37.5 kVAC for one minute. Do not exceed 37.5 kVAC.

If internal flashover occurs, isolate the phases and test each one independently to identify the defective interrupter. Any defective interrupter must be replaced prior to the breaker being placed in service.

9 Installation

The breaker must be vertical, level and securely fastened. Follow your company guidelines and codes for setting the height of the breaker, securing the frame to the foundation, and making power connections.

9.1 Mounting

The breaker is normally shipped suitable for substation mounting. The following is the recommended installation procedure:

1. With the lifting brackets mounted in each side of breaker's roof, lift the breaker off the pallet and move into position
2. Bolt the legs to the pad and raise the cabinet upper portion to the desired height
3. Bolt the legs to the sides of the breaker
4. Make sure all hardware is tight

9.2 Grounding

The breaker cabinet has two ground parts, one on each side wall. It is important that both of these be connected to the ground grid with #6AWG or larger wire. If the ground pad is provided on the roof, it should be connected to the ground pad on the side sheet.

9.3 Arrester protection

ABB recommends that surge arresters be properly applied in the substation.

9.4 Control power

Supply the control power as indicated on the schematic diagram. Verify the heaters connections before applying power. Check all terminal block connections for proper tightness. For details of the overall control circuit, refer to the specific schematic diagrams supplied with the breaker.

9.5 Final Inspection

When the breaker has been installed and all mechanical and electrical connections completed, EXCEPT ENERGIZING THE POWER LINE, the following points of inspection are recommended:

1. Ensure the breaker is properly leveled and securely anchored.
2. Make a final check of tightness of all hardware.
3. Check that the heaters work properly
4. Securely tighten terminal and ground connections.
5. Check control cable entrance fittings for tightness.
6. Operate the breaker from the pushbuttons to verify normal operation.
7. Secure all doors and ensure proper gasketing for weather.
8. Ensure that all tools are removed.

10 Inspection, maintenance and adjustment

The R-MEC circuit breaker is an extremely simple device and requires minimal inspections and maintenance, depending on the frequency of operation and local environmental conditions.



The safety and successful functioning of any apparatus or system connected with the breaker largely depends on the proper and reliable operation of the unit.

To provide long reliable service, the breaker must have systematic inspections at regular intervals. Operating experience based on environmental conditions, the number of operations, magnitude of interrupted current and any unusual operation, will establish a maintenance schedule that gives assurance of proper breaker reliability.

The maintenance activities are intended to only be carried out by qualified persons, thoroughly trained and knowledgeable of the hazards involved. Furthermore, it is advisable to call on ABB personnel, for checking the performance in service and for repairs.

Cut off the power supply to the medium voltage circuit and follow proper lock-out tag-out procedures as specified by the facility and applicable safety regulations. Ensure that, the apparatus is under safe conditions during the maintenance operations. Before carrying out any operations, check that the circuit breaker is open, with the spring discharged.

- DO NOT work on an energized circuit breaker
- DO NOT work on a closed 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 breaker with a charged closing spring
- DO NOT use a circuit breaker by itself as the sole means of isolating a high voltage circuit

 DANGER	
	<p>High Speed Mechanical Parts. Serious injury may occur.</p> <p>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.</p>

10.1 Maintenance periodicity

Given the R-MEC expectancy life of 10,000 operations, the maintenance plan is given in terms of these operations. A summary is provided in table below showing the different activities needed for each scenario.

Activity	Every 2000 operations ¹	Every 4000 operations ²
Control wiring and main components inspection <i>Chapter 10.2</i>	✓	
Torque verification in HV compartment components and mechanism <i>Chapter 10.3</i>	✓	
Measurement and readjustment of contacts travel & overtravel gap (wipe) <i>Chapter 10.4</i>	✓	
Insulation evaluation (Hi-Pot) and contact resistance measurement <i>Chapter 10.5</i>	✓	
Mechanism and HV components cleaning and relubrication <i>Chapter 10.6</i>		✓

¹ Activities to be performed after reaching operation number: 2000, 4000, 6000 and 8000

² Activities to be performed after reaching operation number 4000 and 8000

NOTE

Maintenance periodicity is based on a “normally polluted” environment. If the breaker is installed in environments with a higher pollution level (mining or similar), consider periodicity of maintenance to be reduced to half or as required to ensure proper working of the circuit breaker.

10.2 Control wiring and main components inspection

With the circuit-breaker completely disconnected from power system, perform the following maintenance activities:

1. Cut the power supply to the spring charging motor, refer to schematics to identify power control disconnect switch. Verify that the breaker operates correctly using the electrical controls.
1. Discharge the spring by closing and opening the circuit-breaker by means of the closing and opening pushbuttons in front of the mechanism (See Figure 9)
2. Confirm space heaters are working properly, and thermostat is functioning well
3. Verify standoff insulators and pull-rods from external damages (Figure 16)

4. Clean silicon surface of vacuum interrupter from dust/dirt with cleaning agents & dry cotton-cloth. Ensure that no cotton-threads are left on the surface (Figure 16)
5. Check for any abnormal contamination, traces of corrosion in housing and any trace of partial discharge phenomena on insulators
6. Check for all the retainers are in place and not missing or broken/cracked

10.3 Torque verification in HV compartment components and mechanism

Correct operation of components in HV compartment and mechanism are dependent on proper torque application in joint and fixing points, follow next steps to verify torque.

10.3.1 HV compartment components torque verification:

1. Torque on current carrying parts must be within following tolerances:
 - a) .250-20 flex connectors 7-10 ft-lbs (Figure 16)
 - b) .375-16 bus connections 27-35 ft-lbs (Figure 16 - M)
 - c) .500-13 contact block* 65-80 ft-lbs (Figure 17 - C)
2. Verify torque in vacuum interrupter rear fixing point
3. Verify torque in standoff insulators and front support (Figure 16)
4. Verify torque in support bars (front and rear) (Figure 16)
5. Verify torque in main shaft side bearing supports (Figure 6)
6. Verify torque between tray-system and main structure (Figure 6)

10.3.2 Mechanism torque verification:

Remove mechanism cover by unscrewing the four corner bolts, see Figure 6 for reference, continue with following activities once mechanism is exposed as in Figure 9:

1. Verify screws and links of auxiliary switch system (Figure 9)
2. Remove coil-bracket by unscrewing the coils-bracket-assembly screw (Figure 12), verify the screws used to fix the different coils are tight, re-assemble the coil-bracket-assembly on mechanism.
3. Spring-charging motor to be inspected for any abnormal noise. Absence of lubrication can cause noise. Re-tight spring charging motor as shown in picture Figure 13.
4. Check the counter increment after one CO cycle, and if it does not then replace the counter. Ensure the new counter reading is set to the previous counter reading. In order to remove counter, coil mounting-bracket needs to be removed as well.
5. Damper to be checked for the proper functioning and check that the oil/lubrication on top has not come out. If no lubrication is present, lubricate. Damper nut to be checked for tightness.

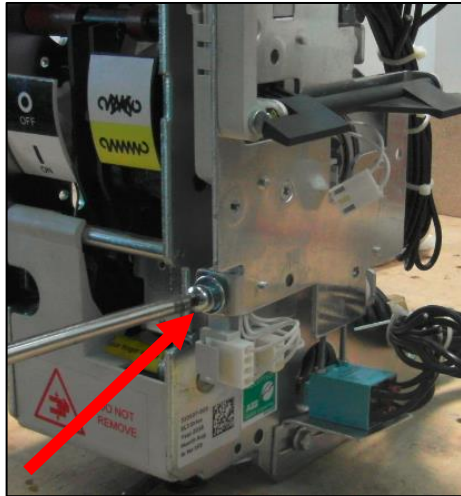


Figure 12 - Coils-bracket-assembly removal

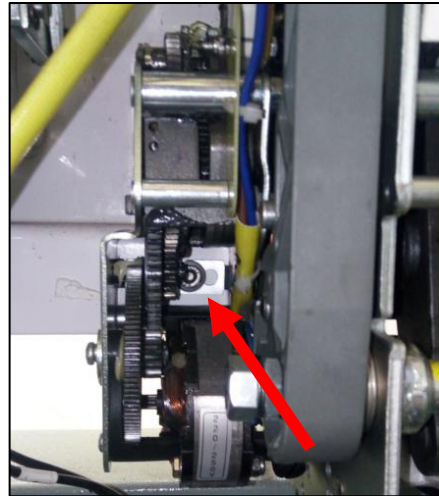


Figure 13 - Spring-charging motor screw

6. Check the plastic tube (passing thru pushbuttons) is not deformed (see Figure 14)
7. Apply grease Molykote 111 or similar on the pull-rod pin-surface as shown in Figure 15

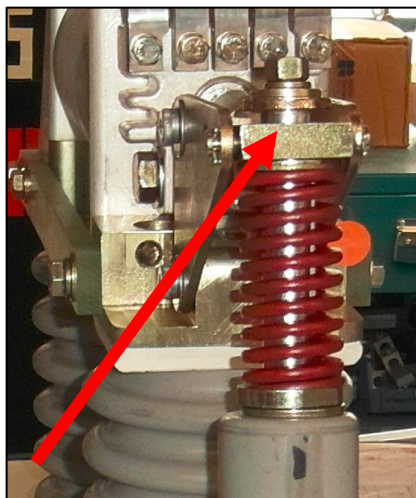


Figure 14 - Lubrication on pull-rod pin

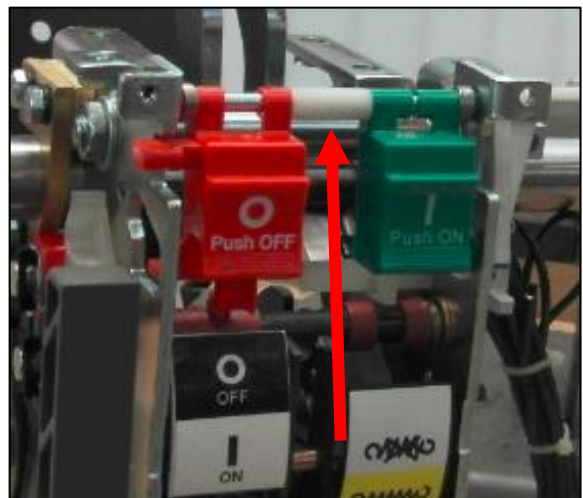


Figure 15 - Plastic tube

8. Verify torque in all mechanism frame hardware and mechanism fixing hardware, see Figure 18 and Figure 19 for reference. Torque on hardware to be applied as per below:

Bolt dimension	Tightening torque value Property class 8.8	Remarks
M5	7 Nm	Check calibration date of the torque tool before the application
M6	10 Nm	
M8	25 Nm	
M10	48 Nm	
M12	68 Nm	

10.4 Measurement and readjustment of contacts travel & overtravel gap (wipe)

1. For each phase assembly, measure contacts travel by measuring (K) in both conditions (open/close) with a Vernier caliper, measure the difference in measurements between contact block in open and closed position, ensure the travel limits are within 0.433" to 0.492" (11mm - 12.5mm).
If travel needs to be increased/decreased, this can be done by doing small adjustments in over-travel gap (wipe), follow next steps.
2. Measure over-travel gap (L) with the breaker in the close position. Confirm this measurement is within these limits: 0.177" to 0.204" (.196" std) [4.5 – 5.2mm (5mm std)]
Breakers in field can be found with lower values, it is mandatory to adjust back to described limits.
3. If needed, minor adjustments can be made to over-travel gap (L) by loosening the nut (D) and rotating the pullrod (A).
 - a. To increase overtravel, rotate pullrod counterclockwise
 - b. To decrease overtravel, rotate pullrod clockwise
 - c. One turn of pullrod, changes overtravel aprox 0.076" (1.95 mm)

Caution:

- Over-travel gap to be measured only in CLOSE position; for that purpose, springs need to be charged with help of manual-lever
 - Over-travel gap adjustment, by means of rotating pullrod, needs to be done when breaker is in OPEN position in small steps.
4. Travel can also be adjusted with the breaker in closed position by losing damper nut (Figure 6) and rotating damper clockwise (increase travel) and counterclockwise (reduce travel). DO NOT ADJUST MORE THAN 2 TURNS OF THE DAMPER (Figure 6) AS CLOSING/OPENING SPEEDS CAN BE MODIFIED AFTER RECOMMENDED NUMBER OF TURNS.
 5. After any adjustment in damper or contacts travel, recheck over-travel gap (L). Adjust (L) again if required. If over-travel gap (L) is confirmed tighten again the nut (D).
 6. Excess overtravel can cause faulty operation; if it happens, reduce overtravel to normal values and check that mechanism latches in closed condition.

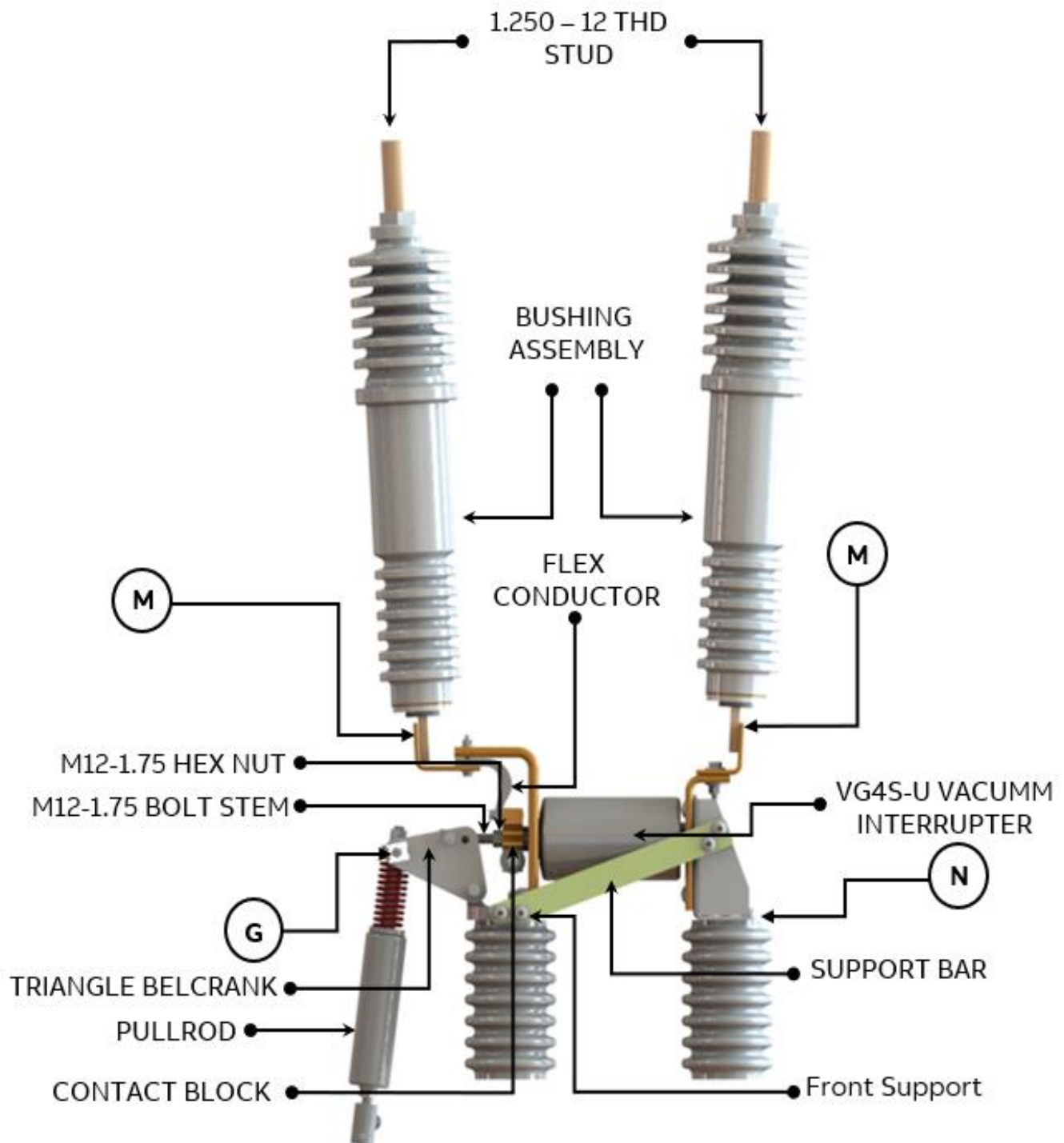


Figure 16 - R-MEC interrupter assembly 15.5kV, 1250A

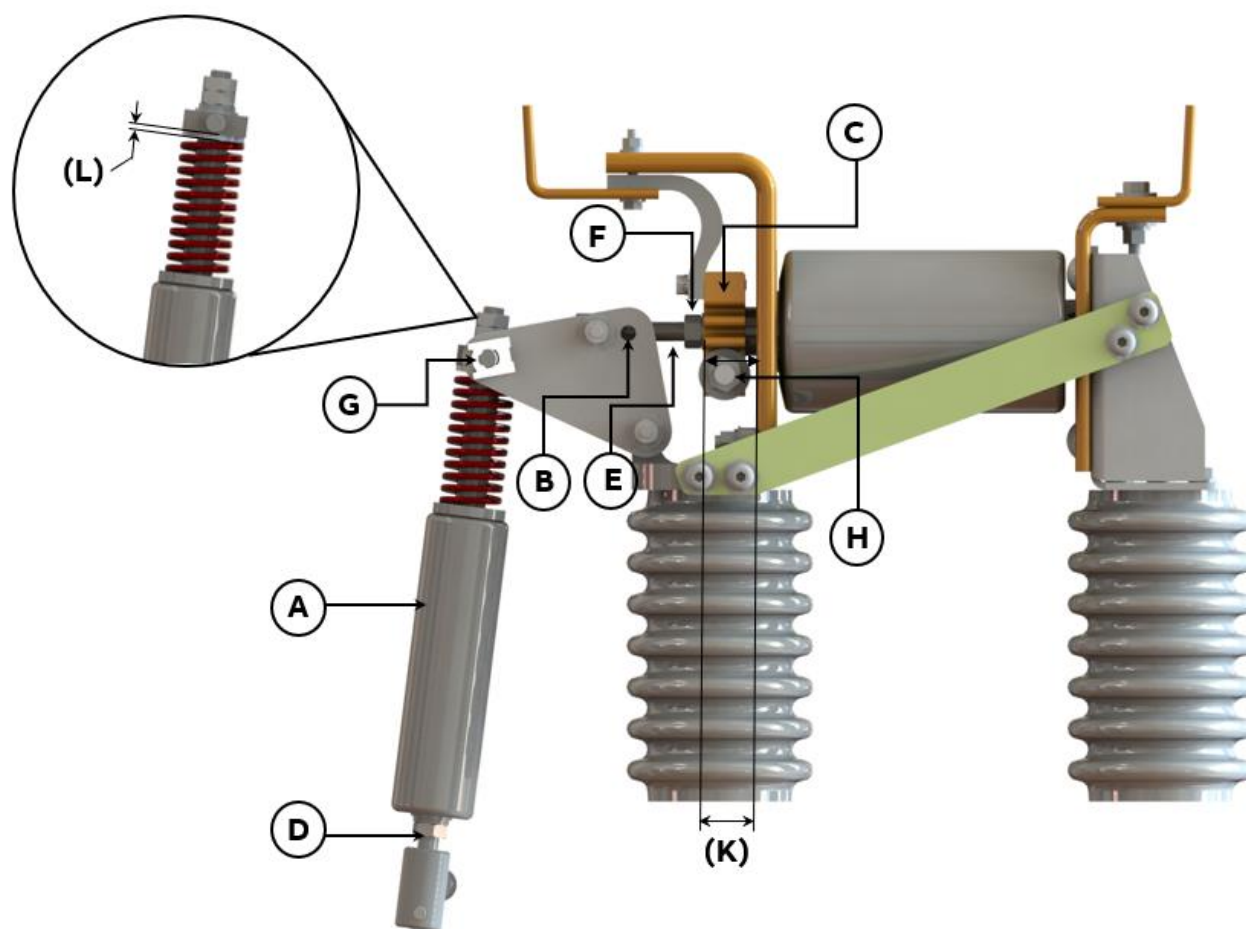


Figure 17 - Contact travel and over-travel adjustment 15.5kV 1250A

10.5 Insulation evaluation (Hi-Pot) and contact resistance measurement

10.5.1 Insulation evaluation High Pot Test



RADIATION WARNING

High voltage applied across an open gap in a vacuum can produce X- radiation. No radiation is emitted when the interrupter is closed, since no gap exists. Also, when the breaker is open to the specified contact spacing in service or tested within the voltages specified.

X- radiation at one meter is below the level of concern. A danger could exist at voltages above or contact spacing below that specified on the nameplate.

Vacuum integrity test procedure:

1. With the breaker in the open position, jumper both sets of three top terminals together. Ground one set of terminals and the housing. Connect the high voltage to the other set of terminals.
2. Stand clear more than one meter before energizing the high voltage source.
3. Apply a test voltage of 37.5 kVAC for one minute. Do not exceed 37.5 kVAC.

If internal flashover occurs, isolate the phases and test each one independently to identify the defective interrupter. Any defective interrupter must be replaced prior to the breaker being placed in service.

10.5.2 Contact resistance measurement

Measure contact resistance with suitable equipment rated not less than 100 A. The value should not exceed 100 micro ohms. If measured resistance is above this value, check again torque in main components as per 10.3.

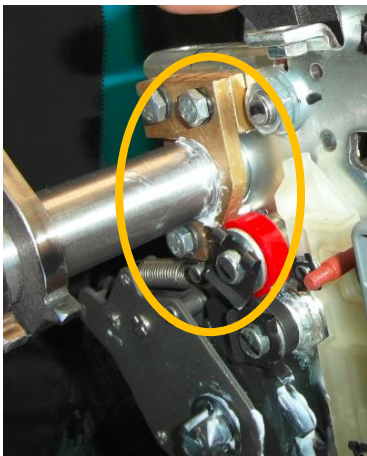


Figure 18 - Mechanism hardware 1

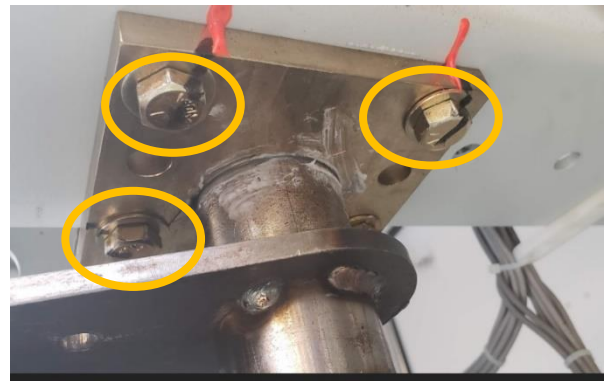


Figure 19 - Mechanism hardware 2

10.6 Mechanism and HV components cleaning and relubrication

10.6.1 Shafts and hooks cleaning

For cleaning purposes use diluent such as Rivolta B.W.R 210 or Tecno Europa C18 FAST. Clean the seats of the two shafts shown in the picture. Use a brush to help to remove old grease and dirt. Identify these components in followings in Figure 20, Figure 21 and Figure 22.

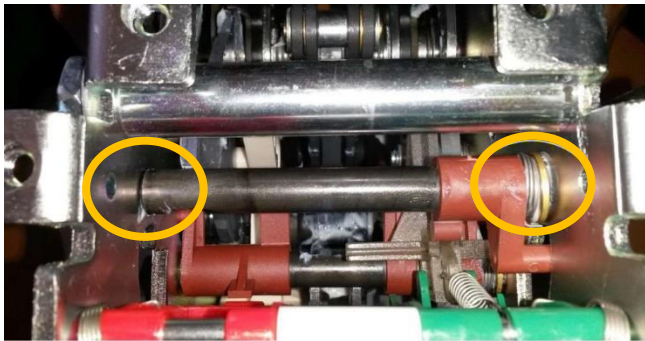


Figure 20 - Closing shaft and opening hook



Figure 21 - Closing shaft and opening hook 2



Figure 22 - Antireclosing lever and closing hook

10.6.2 Rollers cleaning

For cleaning purposes use diluent such as Rivolta B.W.R 210 or Tecno Europa C18 FAST. Clean the two rollers shown in Figure 23. Use a brush to help to remove old grease and dirt. Verify that both rollers can rotate free.



Figure 23 - Rollers cleaning

10.6.3 Check Cleaning effectiveness

a) Closing function

With closing spring discharged and the R-MEC breaker in open position, turn the closing shaft and then push the hook as in the picture.

Release the shaft and then release the hook. The cleaning is effective if the hook returns behind the shaft instantaneously without slow moving of either the shaft or the hook.

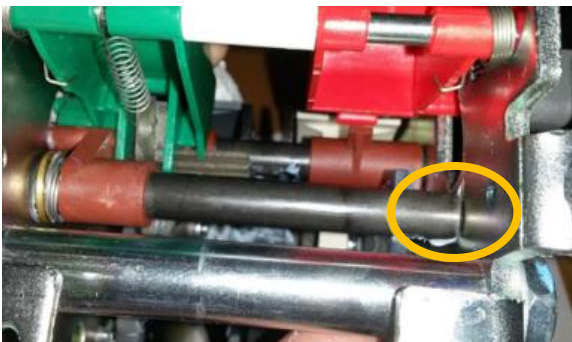


Figure 24 - Closing function verification

b) Anti-reclosing function

With closing spring discharged and the R-MEC breaker in open position push down the anti-reclosing lever and check that it restores its position.



Figure 25 - Anti-reclosing function verification

c) Opening function

With the closing spring charged and the R-MEC breaker in open position, turn the shaft and then push the hook as in the picture.

Release the Shaft and then release the hook.

The cleaning is effective if the hook returns behind the shaft instantaneously without slow moving of either the shaft or the hook.



Figure 26 - Opening function verification

10.7 Mechanism re-greasing

10.7.1 Shafts greasing

Before greasing remove the cleaner by means of pressurized air. Lubricate the seats of the three shafts shown in the Figure 28 on the inside of the sidewalls with Kluber Isoflex Topas NB 52 grease or similar (see Figure 27), preferable spray version.

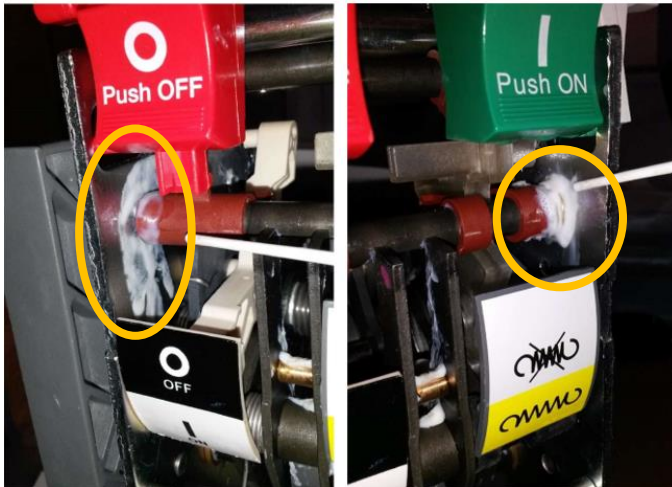


Figure 27 - Isoflex topas NB52

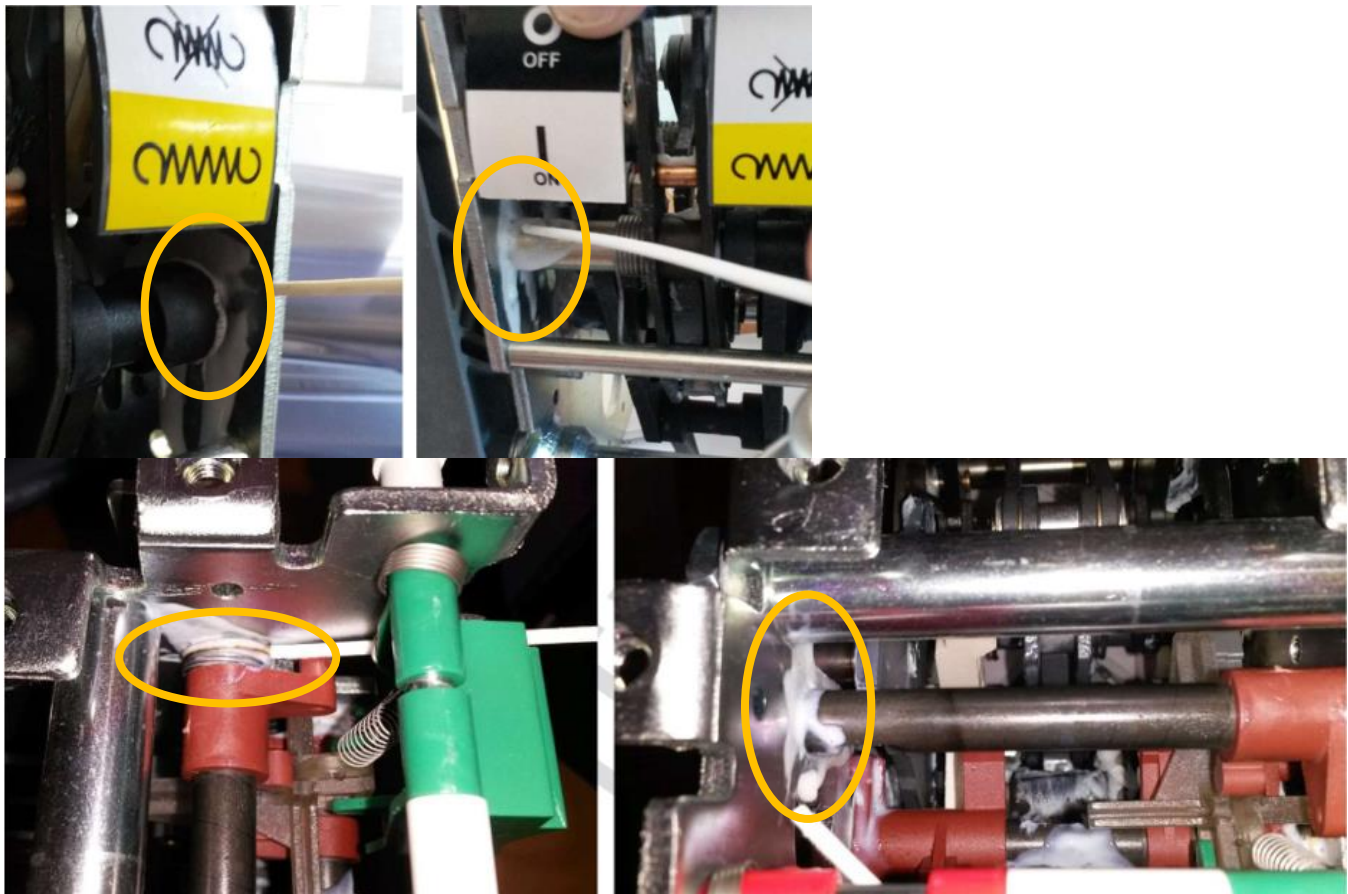


Figure 28 - Greasing of shafts

10.7.2 Closing hook pin greasing

Lubricate the pin shown in Figure 29 with Kluber Isoflex Topas NB 52 or similar grease lube, preferable spray version.

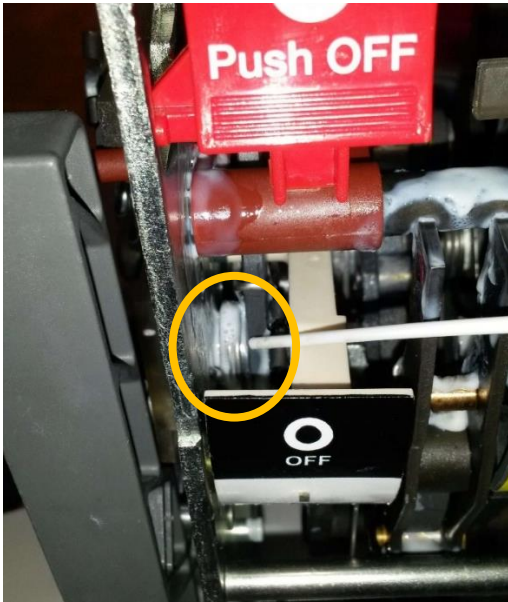


Figure 29 - Closing hook pin greasing

10.7.3 Hooks greasing

Grease the hooks as shown below in Figure 30 with Kluber Isoflex Topas NB 52 grease or similar, preferable spray version.



Figure 30 - Hooks greasing

10.7.4 Anti-reclosing lever greasing

Grease the anti-reclosing lever as shown below in Figure 31 with Kluber Isoflex Topas NB52 grease or similar, preferable spray version.



Figure 31 - Anti-reclosing lever greasing

10.7.5 Rollers greasing

Grease the two rollers with Isoflex Topas NB 52 grease or similar, preferable spray version, keeping hook under the shaft. See Figure 32.



Figure 32 - Rollers greasing

10.8 Other parts to be lubricated

Grease other parts of the mechanism in the shown areas using Kluber Isoflex Topas NB 52 grease or similar, preferable spray version. Some parts are accessible by de-installing the motor.

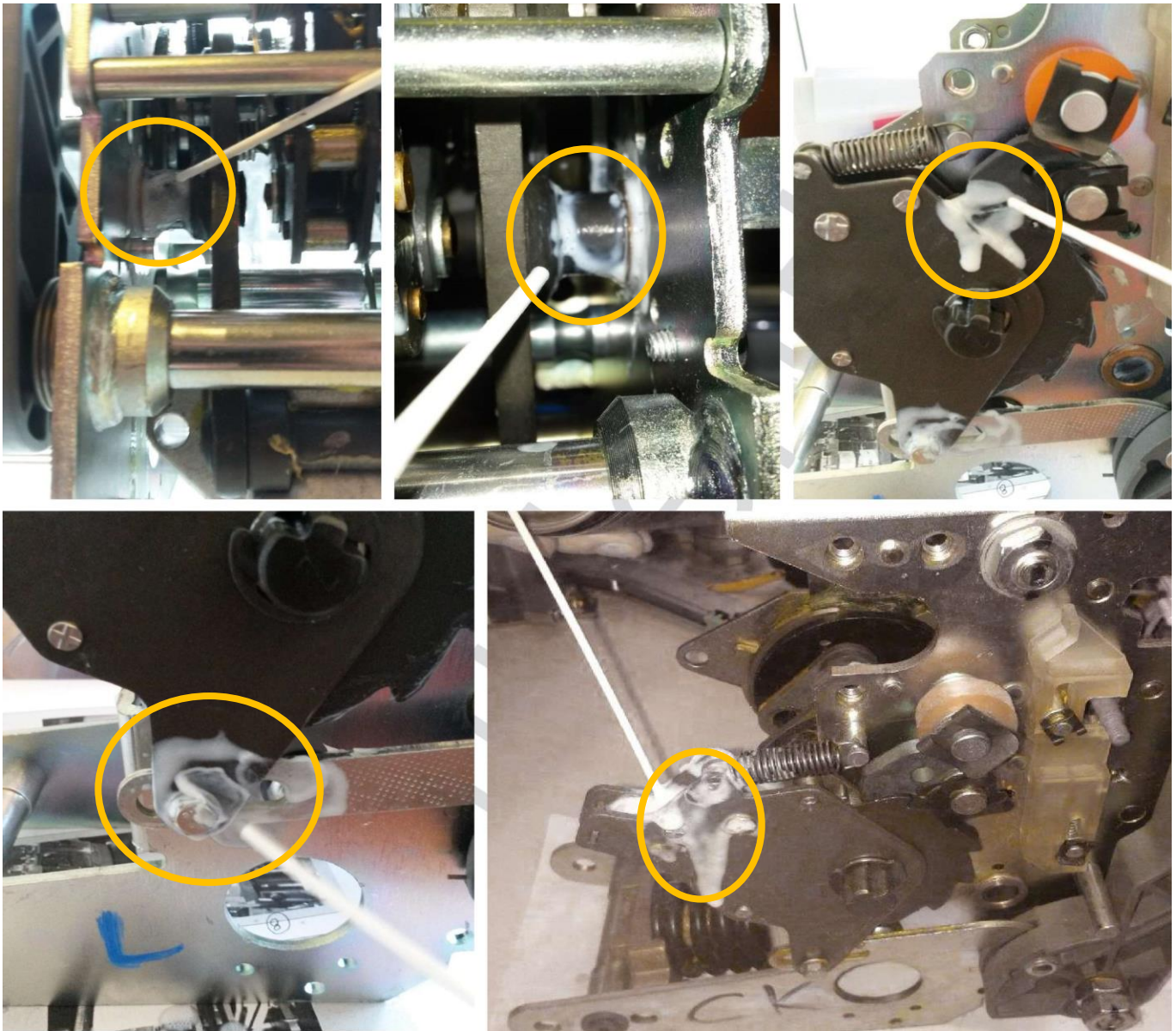


Figure 33 - Greasing other mechanism parts

10.9 Final functional tests

After re-greasing, repeat 10 times the checks listed in sub-clause 7 (closing function, anti-reclosing function, opening function)..

Finally, perform 30 complete operations: charge - close - recharge - open - close - open, 15 operations shall be carried out manually (closing/opening by pushbuttons, spring charging by lever) and 15 electrically (closing/opening by coils, spring charging by motor), checking the correct functionality of the breaker.

11 R-MEC troubleshooting

Fault	Cause	Remedy
Spring does not get charged	<ul style="list-style-type: none"> • Motor has wrong or no operating voltage • Motor gear damaged, motor burnt, gear-train damaged • Disconnection in motor wires 	<ul style="list-style-type: none"> • Check voltage at the motor leads and related terminal blocks • Replace burnt motor by removing frontal screw • Check if there is any loose connection
Closing of breaker does not take place although there is an indication that the spring is charged	<ul style="list-style-type: none"> • Close coil does not operate after powering • Wrong wiring of the auxiliary circuit 	<ul style="list-style-type: none"> • Tighten the frontal coil fixing screw if found loose • Check the wiring as per schematic drawing • Check voltage at the close coil connection and control circuitry • Replace coil by removing frontal fixing screw
Breaker fails to open	<ul style="list-style-type: none"> • Opening coil does not operate after powering • Wrong wiring of the auxiliary circuit 	<ul style="list-style-type: none"> • Tighten the frontal coil fixing screw if found loose • Check the wiring as per schematic drawing • Check voltage at the close coil connection and control circuitry • Replace coil by removing frontal fixing screw
Operations counter not operating	<ul style="list-style-type: none"> • Foreign body blocking operation • Failure in counter arm 	<ul style="list-style-type: none"> • Replace operations counter, ensure the new operations counter reflects the same number as the previous one
Improper damping or damper fluid leaking	<ul style="list-style-type: none"> • Foreign body blocking operation • Failure in damper 	<ul style="list-style-type: none"> • Replacement of damper • Measure the total height of original damper before removal and set the new one at same height
Breaker not correctly showing the position	<ul style="list-style-type: none"> • Blocked auxiliary switch • Auxiliary switch links disconnected or broken 	<ul style="list-style-type: none"> • Replace links • Replace of complete auxiliary switches block

Caution: Replacement should be done under supervision of qualified personnel.

In case of major replacements (i.e. complete mechanism) contact ABB service team.

12 End of life recycle/disposal

ABB is committed for complying with relevant legal and other statutory requirements for environment protection according to the ISO 140001 standard. The duty of the end user is to facilitate end of life recycling & disposal according to the applicable regulations.

During disposal of product, it is necessary to act in accordance with local legal requirements in force. Disposal can either be carried out thermally in an incineration plant or by storing on a waste site.

Following are the methods of recycle/disposal:

Raw Material	Recycle	Environment effects and reuse processes
Iron	Yes	Separate, utilize in favor of new source (ore)
Stainless steel	Yes	Separate, utilize in favor of new source (ore)
Copper	Yes	Separate, utilize in favor of new source (ore)
Brass	Yes	Separate, utilize in favor of new source (ore)
Aluminum	Yes	Separate, utilize in favor of new source (ore)
Zinc	Yes	Separate, utilize in favor of new source (ore)
Thermoplastic	Yes	Make granulate, re-use, or apply as energy superior
Epoxy incl. 60% quartz	Yes	Additive in refuse incineration
Rubber	Yes	Cut into pieces and use as high grade energy
Porcelain	Yes	Additive in cement mill
Packing foil	Yes	Cut into pieces and used for landfills
Wooden pallet	Yes	High grade energy additive in refuse incineration

For more information please contact:

ABB México SA de CV

Av. Central 310
San Luis Potosí, SLP, 78395
Phone: + 52 444-870-8000
01 800-5222-365
contact.center@mx.abb.com

ABB Inc.

Lake Mary, FL 32746
Phone: +1 407-732-2000 ext. 2510
+1 800-929-7947 ext. 5
customer.service.group@us.abb.com

<http://www.abb.com/mediumvoltage>

1YEPTSR0019S001 Rev. A – January 2020

All sales are subject to ABB 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

© Copyright 2020 ABB. All rights reserved

