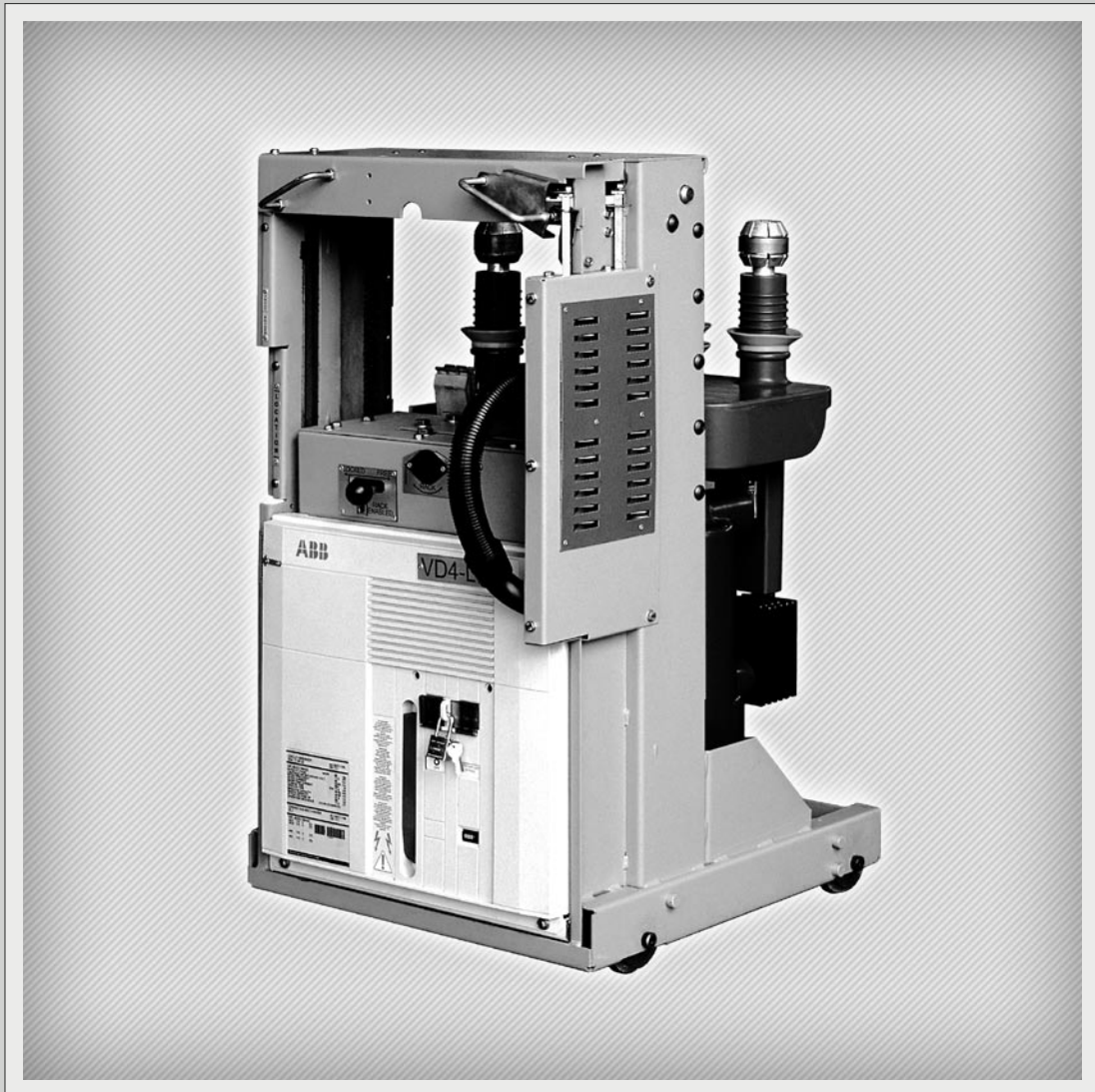


VD4-LMT

MV Vacuum Circuit Breaker Installation and Service Instructions

17.5 kV – 630 / 1,250 A – 31.5 kA



ABB

For your safety !

- Make sure that the installation room (i.e. spaces, divisions and the atmosphere) are suitable for the electrical apparatus.
- Check that the installation, putting into service and maintenance of this apparatus is carried out by qualified personnel with an in-depth knowledge of the apparatus and all the procedures as laid out in this installation and service instruction manual.
- Make sure that the standard and legal prescriptions are adhered to during installation, putting into service and maintenance, so that all procedures are carried out in strict compliance to the rules of good working practice and safety in the work place.
- Strictly follow the information given in this instruction manual.
- Check that the rated performance of the apparatus is not exceeded during service.
- Pay special attention to the danger notes as indicated in this manual by the following symbol :



- Check and ensure that the personnel operating the apparatus have this instruction manual on hand, as well as the necessary information for correct intervention.

**Please remember that responsible behaviour
will safeguard your life and that of others!**

**Should you be in any doubt whatsoever, please
contact ABB's 24hr Service Support Line on :**

0861 488 488

Introduction

This publication contains the information necessary for the installation and putting into service of VD4-LMT medium voltage circuit breakers.

For the correct usage of the VD4-LMT, please read this manual carefully.

For the correct mounting of accessories and spare parts, please refer to the relevant instructions.

Like all the apparatus manufactured by ABB, the VD4-LMT circuit breaker is designed for different installation configurations. The VD4-LMT does however, allow for further technical and constructional variations to suit specific customer installation requirements. For this reason, the information given herein does not always cover specific customer configurations.

Apart from this manual, it is therefore always necessary to refer to the latest technical documentation available (circuit diagram, wiring diagrams, assembly and installation drawings, any studies of protection co-ordination, etc.), especially with regard to any variations from standard configurations requested.



All procedures regarding installation, putting into service, operation and maintenance service, must be carried out by suitably qualified personnel with an in-depth knowledge of the apparatus.

Use only original spare parts for maintenance operations. For further information, please refer to the technical catalogue on the circuit breaker and the spare parts catalogue.

Programme for environmental protection

VD4-LMT circuit breakers comply with ISO 14000 Standards (Guidelines for Environmental Management).

ABB's production system in the manufacture of medium voltage switchgear complies with environmental protection regulations in terms of energy consumption, raw materials and waste.

The environmental impact during the product's life cycle is assessed by the LCA (Life Cycle Assessment) procedure, which has resulted in a well-focused involvement in the selection of materials, processes and packaging.

Production techniques are carried out in a manner that achieves easy dismantling and separation of all components at the end of the circuit breaker's life, while optimising the recycling process.

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1. Packing and transport

The circuit breaker is shipped in special packaging in the open position with the springs discharged.

Each piece of apparatus is protected by a plastic film to prevent any infiltration and ingress of water and dust during the loading, transport, unloading and storage phases.

2. Checking on receipt



Before doing anything to the apparatus, always make sure that the operating mechanism springs are discharged and that the apparatus is in the open position.

On receipt, check the state of the apparatus, that the packing is undamaged and that the nameplate data corresponds (see fig. 1) with that specified in the order acknowledgement and in the delivery note.

Make sure that all the materials described in the shipping note are included in the supply.

If any damage or irregularity is discovered on unpacking, notify ABB directly, or through the agent or supplier, as soon as possible and within five days of receipt.

The apparatus is supplied with accessories specified at the time of order and confirmed in the order acknowledgement sent by ABB.

Check that the following accompanying documents are included in the shipping packing:

- Instruction manual (this document).
- Test certificate.
- Identification tag.
- Fiscal copy of shipping note.
- Electrical diagram.

Other documents that are sent prior to shipment:

- Order acknowledgement.
- Original copy of shipping note.
- Any drawings or documents regarding special configurations/conditions.

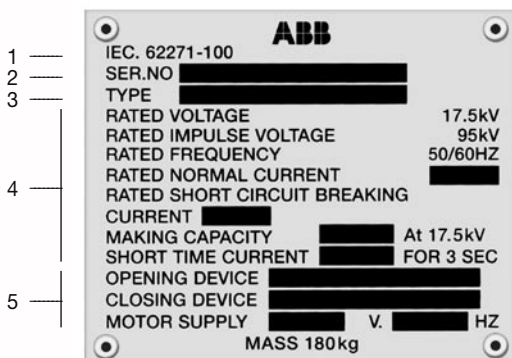


Figure 1. Rating Plate

- 1 Symbols and compliance with Standards
- 2 Serial number
- 3 Type of apparatus
- 4 Circuit breaker characteristics
- 5 Characteristics of the operating auxiliaries

3. Storage

When a period of storage is foreseen, on request our workshops can provide suitable packing for the specified storage conditions.

On receipt of the apparatus, it must be carefully unpacked and checked as described in point 2. "Checking on receipt."

If immediate installation is not possible, the packing must be properly replaced using the original material supplied.

Additionally, insert hygroscopic substances inside the packing with at least one standard bag per piece of apparatus.

Should the original packing not be available and immediate installation is not possible, store the apparatus in a covered, well-ventilated, dry, dust-free and non-corrosive atmosphere, away from any flammable materials at a temperature of between -5°C and +45°C. Avoid any accidental impacts or positioning that will stress the structure of the apparatus.

4. Handling

Before carrying out any handling, always check that the operating mechanism springs are discharged and that the apparatus is in the open position.



The apparatus must not be handled by inserting a lifting device directly underneath the apparatus itself.

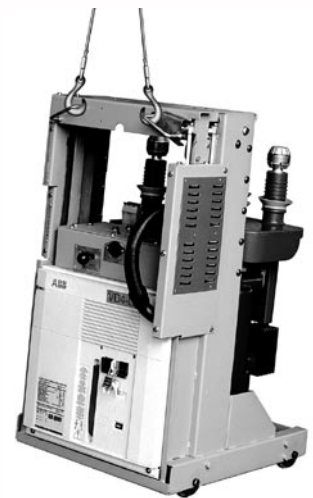


Figure 2. Lifting method

5. Description

5.1. General features

The VD4-LMT series of vacuum circuit breakers are for indoor installation. For electrical performance figures, please refer to the corresponding technical catalogue code 649292. For special installation conditions please refer to ABB.

5.2. Reference standards

VD4-LMT circuit breakers comply with the following Standards:

- EC pubbl. 62271
- EC pubbl. 60694
- CEI 17-1 (file 1375)

5.3. VD4-LMT circuit breaker

VD4-LMT circuit breakers are available for LMT, LMS, LMR, LSR and LMRP switchboards.

The pilot pins for aligning the contacts (connected/isolated), located in the CB enclosure or in the switchboard, are fixed in the top part of the circuit breaker. The slides for activating the segregation shutters of the medium voltage contacts of the enclosure or switchboard are fixed on the side of the circuit breaker. The crosspiece for hooking the circuit breaker

for the connection/isolation operation, is by means of a special operating lever mounted on the front of the circuit breaker truck.

The circuit breaker is complete with tulip isolating contacts. The VD4-LMT circuit breaker is fitted with a special lock on the front crosspiece, which allows hooking into the corresponding joints in the enclosure or fixed part. The lock can only be activated by the handle with the truck resting completely on the fixed portion rail.

The activating lever (connection/isolation) must be fully inserted. The lock prevents the truck from advancing into the enclosure of the fixed part. When the interrupter is in the middle position between isolated and connected, the interlock prevents closure of the circuit breaker either mechanically or electrically.

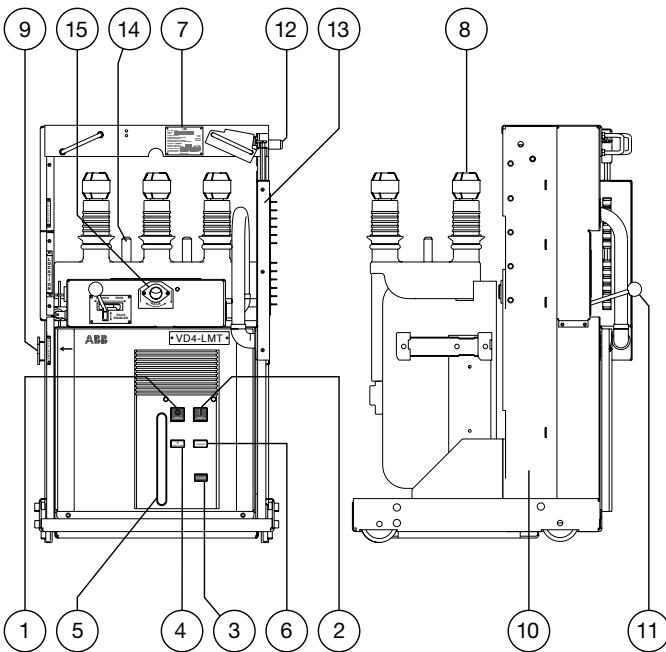


Figure 3. VD4-LMT circuit breaker

- 1 Opening push button
- 2 Closing push button
- 3 Operations counter
- 4 Signalling device for circuit breaker open/closed
- 5 Manual closing spring charging handle
- 6 Signalling device for closing springs charged/discharged
- 7 Rating plate
- 8 Isolating contacts
- 9 Slide for activating the enclosure shutters
- 10 Truck
- 11 Lock activating handle
- 12 Lock for hooking into the fixed part
- 13 Connector (plug or side connector)
- 14 Pilot pins for guiding the contacts located in the enclosure
- 15 Interlock up/down racking mechanism

6. Instructions for circuit breaker operation

6.1. Safety indications



VD4-LMT circuit breakers ensure a minimum degree of protection in accordance to IP3X, if installed under the following conditions:

The VD4-LMT must be installed in a switchboard to achieve IP3X.

Under these conditions, the operator is fully guaranteed against accidental contact with moving parts.

Should any mechanical operations be carried out on the circuit breaker outside the switchboard, or with the protection covers removed, be very careful of any moving parts.

If the operations are prevented, do not force the mechanical interlocks and check that the operation sequence is correct.

The racking-in and racking-out operations of the circuit breaker must be carried out gradually to prevent any impacts which might deform the mechanical interlocks.

6.2. Operating and signalling parts

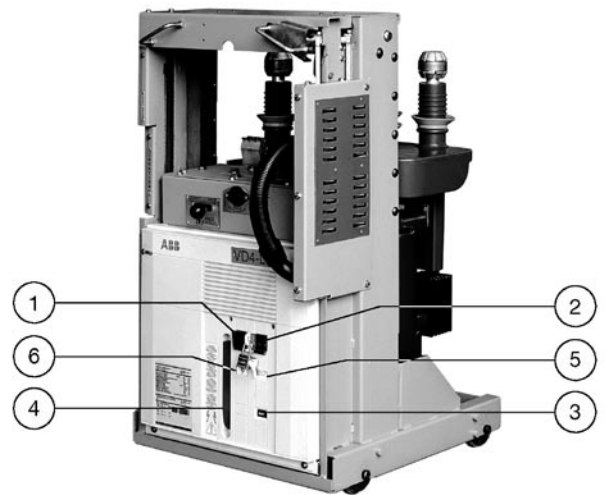


Figure 4. VD4-LMT operating and signalling parts

- 1 Opening push button
- 2 Closing push button
- 3 Operations counter
- 4 Manual closing spring charging handle
- 5 Signalling device for closing springs charged/discharged
- 6 Signalling device for circuit breaker open/closed

6.3. Circuit breaker closing and opening operations (figure 4)

Circuit breaker operation can be manual or electrical.

(a) Manual spring charging operation.

To manually charge the closing springs, it is necessary to repeatedly activate the charging lever (4) to the maximum rotation angle of the lever at about 90°, until the yellow signalling device (5) appears, which indicates the completion of charging.

The maximum force which can normally be applied to the charging lever is 150 N for the EL1 operating mechanism and 200 N for the EL2 operating mechanism.

(b) Electrical spring charging operation

On request, the circuit breaker can be fitted with the

following accessories for electrical operation:

- Geared motor for automatic charging of the closing springs.
- Shunt closing release.
- Shunt opening release.

The geared motor automatically recharges the springs after each closing operation, until the yellow signalling device (5) appears. If the power is cut off during charging, the geared motor stops and automatically starts recharging the springs again when the power returns. It is always possible to complete the recharging operation manually.

(c) Circuit breaker closing

This operation can only be carried out with the closing springs completely charged.

For manual closing, press the push button (2).

When there is a shunt closing release, the operation can also be carried out remotely by means of a special control circuit. Closing having taken place will be indicated by the signalling device (6).

(d) Circuit breaker opening

For manual opening, press the push button (1).

When there is a shunt opening release, the operation can also be carried out remotely by means of a special control circuit. Opening having taken place will be indicated by the signalling device (6).

7. Installation

7.1. General



Correct installation is of prime importance. Instructions given must be carefully studied and followed. It is good practice to wear gloves during installation.

7.2. Normal installation conditions

Maximum atmospheric air temperature	+ 40° C
Minimum atmospheric air temperature	- 5° C
Altitude	d 1540 m
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 water vapour, 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 water vapour, measured for a period longer than 1 month, must not exceed 1.8 kPa.	

The installation room must be well ventilated.

Areas affected by the passage of power conductors or auxiliary circuit conductors must be protected against the possible access of animals, which could cause damage or abnormal service.

7.3. Preliminary operations

- Clean the insulating parts with clean dry rags.
- Check that the upper and lower terminals are clean and free of any deformation caused by possible shocks received during transport or storage.

7.4. Trip curves

The graph shows the number of closing-opening cycles allowed on the vacuum interrupters according to the breaking capacity.

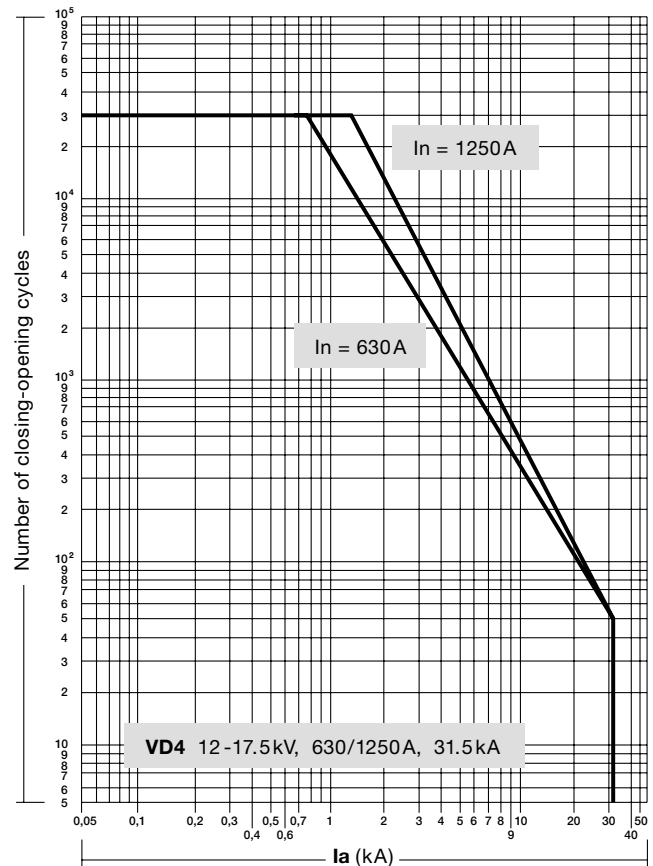


Figure 5. VD4-LMT trip curves

7.5. Installation of VD4-LMT circuit breaker

The VD4-LMT circuit breakers are preset for insertion in the LM range of switchboards.

Insertion and racking of the circuit breakers must be gradual to avoid any shocks, which could deform the mechanical inter-locks.

If the operations are prevented, do not force the interlocks and check that the operating sequence is correct. The force normally applicable for insertion or racking is 260 N. The maximum force applicable must never exceed 400 N.

Please refer to the technical documentation of the enclosures and switchboards for the circuit breaker installation operations.

CAUTION !

The insertion and racking operations must always be carried out with the circuit-breaker in the open position.

7.6. Auxiliary circuit connection

The minimum cross-section of the wires used for the auxiliary circuits must not be less than that used for internal wiring. They must also be insulated for a 3kV test voltage.



Before removing the operating mechanism cover to access the terminals make sure that the circuit breaker is open and the closing springs discharged.

7.7. VD4-LMT circuit breaker

The auxiliary circuits of the VD4-LMT circuit breaker are fully cabled up to the side or plug connector, in our factory. For the external connections, please refer to the electric diagram of the CB enclosure or switchboard.

7.8. Overall dimensions

Type	VD4-LMT
Ur	17.5 kV
Ir	630 A / 1250 A
Isc	31.5 kA

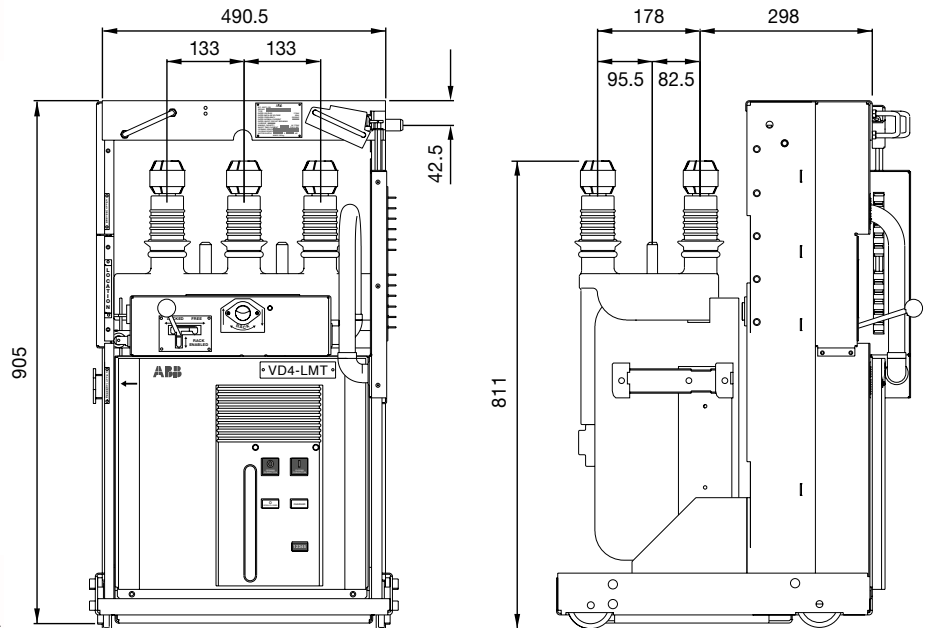


Figure 6. Overall dimensions

8. Putting into service

8.1. General procedures



All procedures regarding putting into service, must be carried out by ABB personnel or the customer personnel, who are suitably qualified and have an in depth knowledge of the apparatus and its installation. If the operations are prevented, do not force the mechanical interlocks, but check that the operation sequence is correct.

For operating forces that can be applied, see paragraph 6.3 (a).

Before putting the circuit breaker into service carry out the following operations:

- Check the tightness of the power connections on the circuit breaker terminals.
- Establish the setting of the direct solid-state over-current release (if provided).
- Check that the value of the supply voltage for the auxiliary circuits is within 85% and 110% of the rated voltage of the electrical devices.
- Check that no foreign body, such as packaging, has got into the moving parts.
- Check that the air circulation in the circuit breaker installation site is adequate, so that there is no danger of overheating.
- Carry out the checks indicated in the following table.

Subject of inspection	Procedure	Positive check
1 Insulation resistance.	Medium Voltage Circuits With a 2500V Megger, measure the insulation resistance between phases and exposed conductive part of the circuit.	The insulation resistance should be at least 50 MW and constant at any time.
	Auxiliary Circuits With a 500V Megger (installed equipment permitting), measure the insulation resistance between the auxiliary circuits and the exposed conductive part.	The insulation resistance should be a few MW and constant at any time.

2 Auxiliary Circuits.	Check that the connections to the control circuits are correct and proceed with relative supply.	Normal switching and signalling.
3 Manual operating mechanism.	Carry out a few closing and opening operations. (refer to paragraph 6.3)	The operations and relative signals occur correctly.
4 Motor operator. (if provided)	Supply the geared motor for spring charging at the relative rated voltage.	The springs are charged correctly. The signals are correct. The geared motor cuts off when the springs are charged.
5 Under voltage release. (if provided)	Supply the under voltage release at the relative rated voltage and carry out the circuit breaker closing operation.	The circuit breaker closes correctly. The signals are correct.
	Disconnect the power supply to release.	The circuit breaker opens. The signal changes over.
6 Shunt opening release and additional shunt opening release. (if provided)	Close the circuit breaker. Supply the shunt opening release at the relative rated voltage.	The circuit breaker opens correctly. The signals are correct.
7 Shunt closing release. (if provided)	Open the circuit breaker. Supply the shunt closing release at the relative rated voltage.	The circuit breaker closes correctly. The signals are correct.
8 Key lock. (if provided)		Both electric and manual closing take place correctly. In this position the key cannot be removed.
9 Auxiliary contacts in the the operating mechanism.	Insert the auxiliary contacts into suitable signalling circuits. Carry out a few closing and opening operations.	Signals occur correctly.

9. Periodical checking



Before carrying out any operation, make sure that the operating mechanism springs are discharged and that the apparatus is in the open position.

9.1. General

During normal service the circuit breakers are maintenance free. The frequency and type of inspections basically depends on the service conditions. Various factors must be taken into account. Frequency of operations, interrupted current values, relative power factor and the installation atmosphere.

The following paragraph gives the checking programme table showing the relevant checking time intervals.

As far as the time interval between these checks are concerned, it is advisable to comply with the specifications given in the table, at least during the first check. On the basis of the results obtained during the periodic inspections, set the optimal time limits for carrying out the following operations.

9.2. Typical life span of VD4-LMT circuit breakers

- Vacuum interrupters: Up to 30,000 operations under normal service conditions and according to the type of interrupter (see fig. 5).
- Activation and transmission system: 10,000 maintenance-free operation and up to 30,000 operations with maintenance.

9.3. Checking programme

Checking operation	Intervals	Criteria
1 Carry out five mechanical opening and closing operations.	1 year.	The circuit-breaker must operate normally without stopping in the intermediate positions.
2 Visual inspection of the poles (resin parts).	1 year, or 5000 operations.	The resin parts must be free of any accumulation of dust, dirt, cracks, discharges or traces of surface discharge.
3 Visual and physical inspection of the opening mechanism and transmission.	1 year, or 5000 operations.	The elements must be free of any deformation. Screws, nuts, bolts etc., must be tight.

4	Visual inspection and lubrication of the isolating contacts.	1 year, or 5000 operations.	The isolating contacts must be free of any deformation or erosion. Lubricate the contact elements with grease type NYE 760G.
5	Measuring of the insulation resistance.	1 year, or 5000 operations.	See paragraph 8.1 inspection point 1.
6	Checking interlock operation.	1 year.	The interlocks must operate correctly.

After 10,000 operations or 10 years, for installation in polluted and aggressive atmosphere, it is advisable to contact your ABB service centre to have the circuit breaker checked.

10. Maintenance operations



Maintenance must only be carried out by ABB personnel, or suitably qualified customer personnel who have in-depth knowledge of the apparatus and IEC 60694, CEI EN 60694 paragraph 10.4.2. Should any maintenance be done by the customer's personnel, responsibility for any intervention lies with the customer.

Replacement of any parts not included in the "List of spare parts and accessories" (paragraph 12), must only be carried out by ABB personnel and in particular:

- Complete pole with bushings/connections.
- Operating mechanism.
- Closing spring unit.
- Opening spring.

11. Application of the X-ray emission standards

One of the physical properties of vacuum insulation is the possibility of X-ray emission when the interrupter contacts open.

The specific tests carried out at the PTB laboratories (Physikalisch-Technische Bundesanstalt, in Brunswick - Germany) shows that local emissions at a distance of 10 cm from the interrupter or pole surface, does not exceed 1 mSv/h.

It therefore follows that:

- At the rated service voltage of the vacuum interrupters, it is absolutely safe.
- Application of the withstand voltage at industrial frequency is safe, as per IEC 62271-100 and VDE 0670 standards.
- Application of a voltage higher than the withstand voltage at industrial frequency or of a direct test voltage in direct current, as specified in IEC and VDE standards, cannot be used.
- Limitation of the above-mentioned local phenomena of interrupters with open contacts, depends on keeping the specific distance between the contacts. This condition is intrinsically guaranteed by the correct operation of the operating mechanism and adjustments of the transmission system.

12. Spare parts and accessories



All assembly operations of spare parts/accessories regarding installation, putting into service, service and maintenance must be carried out by ABB personnel, or suitably qualified customer personnel with an in-depth knowledge of the apparatus and IEC 60694, CEI EN 60694 paragraph 10.4.2. Should any maintenance be carried out by customer personnel, the responsibility for any interventions lies with the customer.

Before carrying out any maintenance, check that the circuit breaker is open, the springs discharged and that there is no voltage on the medium voltage circuit or auxiliary circuits.

To order accessories or spare parts, please refer to the commercial ordering codes given in the Technical Catalogue and always indicate:

- Circuit breaker type.
- Circuit breaker rated voltage.
- Circuit breaker rated thermal current.
- Circuit breaker breaking capacity.
- Circuit breaker serial number.
- Rated voltage of any electrical accessories.

For the availability of spare parts, please contact our Service Department.

List of Spare Parts

- Shunt opening release.
- Additional shunt opening release.
- Under voltage release.
- Contact signalling under voltage release energised / de-energised.
- Shunt closing release.
- Spring charging geared motor with electric signalling of springs charge.
- Contact signalling closing springs charged / discharged.
- Transient contact with momentary closure during circuit breaker opening.
- Auxiliary circuit breaker contacts.
- Opening solenoid.
- Protection for opening push button.
- Protection for closing push button.
- Opening / closing buttons.
- Set of six tulip contacts.

Reserve: Due to ongoing developments, the information contained herein is subject to change.

24hr Technical Support Line : 0861 488 488



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