# VD4G-50

# Vacuum circuit-breaker in withdrawable version for generator applications

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Note

This Manual is valid only in combination with manual for VD4G-50 - 1VCD601413.



# Your safety first – always!

That's why our instruction manual begins with these recommendations:

- Only install switchgear and/or switchboards in enclosed rooms suitable for electrical equipment.
- Ensure that installation, operation and maintenance are carried out by specialist electricians only.
- Comply in full with the legally recognized standards (DIN VDE/IEC), the connection conditions of the local electrical utility and the applicable safety at work regulations.
- Observe the relevant information in the instruction manual for all actions involving switchgear and switchboards.



In der Betriebsanleitung mit dem Warnzeichen markierte Gefahren-Hinweise besonders beachten.

- Pay special attention to the hazard notes in the instruction manual marked with this warning symbol.
- Make sure that under operation condition of the switchgear or switchboard the specified data are not exceeded.
- Keep the instruction manual accessible to all persons concerned with installation, operation and maintenance.
- The user's personnel are to act responsibly in all matters affecting safety at work and the correct handling of the switchgear.
- Always observe the five safety rules set out in EN 50110 on establishing and securing the off-circuit condition at the place of work for the duration of work on the switchgear.
  - Isolate
  - Secure to prevent reconnection
  - Check the off-circuit condition
  - Earth and short-circuit
  - Cover the guard off adjacent live parts



BA 627 is only valid in combination with "BA 623 – Vacuum circuit-breaker for generator application – in fixed version". To ensure correct application and handling, please read the relevant chapters before usage.

If you have any further questions on this instruction manual, the members of our field organization will be pleased to provide the required information.

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# 1 Summary

# 1.1 General

(Figure 2/1)

The vacuum circuit-breaker of type VD4 on withdrawable truck are intended for indoor installation in air-insulated switchgear of withdrawable design. Their switching capacity is sufficient to handle any conditions arising from switching of equipment and systems components under normal operating conditions, particulary short-circuits, within the parameters of their technical data.

Vacuum circuit-breaker have particular advantages for use in networks where there is a high switching frequency in the working current range and/or where a certain number of short-circuit breaking operations are expected. The vacuum circuit-breakers of the type VD4, designed in column form, are suitable for autoreclosing, and have exceptionally high operating reliability and long life.

The vacuum circuit-breakers of the type VD4, designed in column form, can be delivered as version for fixed installation as well as version on withdrawable truck. The general structure is shown in figure 2/1.

# 1.2 Standards and specifications

# 1.2.1 Switchgear manufacture

The switchgear complies with the following specifications in accordance with DIN VDE/the relevant IEC publications:

- VDE 0670, Part 1000 and IEC 60694 / IEC 62271-1
- VDE 0670, Part 104 and IEC 62271-100
- DIN VDE 0847, Part 4 and IEC 61000-4
- IEC/IEEE 62271-37-013 (2014-01-24)
- 1.2.2 Installation and operation

The relevant specifications are to be taken into account during installation and operation, particularly:

- DIN VDE 0101, Power installations exceeding AC 1 kV
- VDE 0105, Operation of electrical installations
- DIN VDE 0141, Earthing systems for special power installations with rated voltages above 1 kV
- Accident prevention regulations issued by the appropriate professional bodies or comparable organisations.
   In Germany, these comprise the following safety regulations:
  - Health and Safety at Work Standards BGV A1 and BGV A3
- Safety guidelines for auxiliary and operating materials
- Order related details provided by ABB Calor Emag.

# 1.3 Operating conditions

# 1.3.1 Normal operating conditions

Design to VDE 0670, part 1000, "Common specifications for high-voltage switchgear and controlgear standards" and IEC publication 62271-1, with the following limit values:

Ambient temperature:	
- Maximum	+40 °C
- Maximum 24 hour average	+35 °C
- Minimum (according to	
"minus 5 indoor class")	−5 °C
Humidity:	
- the average value of the relative	
humidity, measured over a period	
of 24 h, does not exceed	95 %
- the average value of the water	
vapour pressure, over a period	
of 24 h, does not exceed	2.2 kPa
- the average value of the relative	
humidity, over a period of one	
month, does not exceed	90 %
- the average value of the water	
vapour pressure, over a period	
of one month, does not exceed	1.8 kPa
Maximum site altitude:	
< 1000 m abova apa laval	

-  $\leq$  1000 m above sea level.

# 1.3.2 Special operating conditions

Special operating conditions are to be agreed on by the manufacturer and user. The manufacturer must be consulted in advance about each special operating condition:

- Site altitude over 1000 m:
- Allow for the reduction in the dielectric strength of the air.
- Increased ambient temperature:
  - Current carrying capacity is reduced
  - Provide additional ventilation for heat dissipation.
- Climate:
  - Avoid the risk of corrosion or other damage in areas:
    - with high humidity and/or
    - with major rapid temperature fluctuations.
  - Implement preventive measures (e.g. electric heaters) to preclude condensation phenomena.

### 2 **Technical data**

### Technical data of the generator circuit-breaker 2.1

The technical data are dependent on the network circumstances and the generator to be protected. A generator calculation is therefore necessary in advance.

	VD4G-50 XS	VD4G-50 M
kV	1	5
А	3150	4000 1)
Hz	50 /	60
·····		
kV	38	8
kV	4	5
·····		
kV	9	5
kV	11	0
·····		
kA	kA 50	
- asymmetrical short-circuit current <sup>2)</sup> kA 73		3
	1.5	
	CO-30 m	nin-CO <sup>3)</sup>
kA	137 <sup>4)</sup>	
kA	2	5
kA	37	
kA	50	D
ms	≤ 61	
kV/µs	3.	5
kV/µs	1.	6
kV/µs	3.	3
	КV А Hz КV КV КV КV КV КV КV КV КV КV	VD4G-50 XS        KV      1        A      3150        Hz      50 /        KV      33        KV      34        KV      34        KV      39        KV      91        KV      91        KV      11        KA      50        KA      71        KA      71

# Mechanical performance

≤	62
≤	30
≤	55
≤	32
20 (*	120 <sup>5)</sup> )
20 (	80 <sup>5)</sup> )
	≤ ≤ ≤ 20 (1 20 (1

Dimensions			
		VD4G-50 XS	VD4G-50 M
Pole center distance	mm	275	
Height	mm	636	
Depth	mm	459	
Width	mm	750	
Weight	kg	210	

Only with forced ventilation.
 When the operating voltage is lower than the rated voltage, the same values apply as for rated voltage. Higher values on request.
 Other operating sequences on request.
 Higher values on request.
 If the acticating relay contact cannot itself interrupt the release coil current.









# Application conditions for 4000 A rated current:

The suitability of VD4G-50 generator circuit-breaker for 4000 A applications has been proven successfully in an ABB switchear panel. The usage of a fan in the switchgear panel is necessary to ensure the required cooling. In case the circuit-breaker is not installed in a panel qualified by ABB the customer has to verify the proper operation of their specific installation.

# Figure 2/1: Dimension drawing circuit-breaker VD4G-50 in withdrawable version

- Use in UniGear type ZS1
- 15 kV, 3150 ... 4000 A, 50 kA
- 2.1.1 Lifting lugs

# 3 Circuit-breaker on withdrawable truck

# 3.1 Basic structure

(Figures 3/1 to 3/3, 4/1, 4/2 and 5/1)

The withdrawable truck, which can be moved manually or by a motor if fitted, consists of a steel sheet structure on which the circuit-breaker with its ancillary components is mounted.

Insulated contact arms (4.2) with the spring-loaded contact systems are fitted to the circuit-breaker poles. These create the electrical connection to the panel when the withdrawable truck is inserted into the service position.

A multi-pole control wiring plug connector (10) connects the signalling, protection and control wiring between the panel and the withdrawable truck.

The withdrawable assembly and the circuit-breaker are connected via a multi-pole control wiring plug connector (10.3).

As soon as the withdrawable truck (13) has been slid into the panel and its base frame has engaged in the test/disconnected position, it is positively connected to the panel. At the same time, it is earthed by its travel rollers in their rails. The stored-energy spring mechanism of the circuit-breaker, including its controls and indicators, is accessible at the front of the withdrawable truck.

# 3.2 Interlocks / protection against maloperation

A series of interlocks are provided to prevent dangerous situations and any maloperation. The interlocks of the panel system UniGear ZS1 and/or the mounting frame, which are normally effective, are as follows (concerning the circuit-breaker):

- The withdrawable truck can only be moved from the test/ disconnected position into the service position (and back) with the circuit-breaker open and the earthing switch open (that means that the breaker must be opened before).
- The circuit-breaker can only be closed when the withdrawable truck is precisely in the defined test position or service position (mechanical interlock, with additional electrical interlock for circuit-breakers with electrical releases).
- The circuit-breaker can only be opened manually in the service or test position when no control voltage is applied, and cannot be closed (electromechanical interlock).
- Connection and disconnection of the control wiring plug connector (10.2) is possible only in the test/disconnected position.
- The earthing switch can only be closed when the withdrawable truck is in the test/disconnected position or the removed position (mechanical interlock).
- The withdrawable truck cannot be moved from the test/ disconnected position into the service position when the earthing switch is closed (mechanical interlock).

- Details of any additional interlocks, e.g. in connection with a blocking magnet on the withdrawable truck and/or earthing switch operating mechanism, can be found in the order documents for each individual case (see also section 5.5.6).
- Details of typical interlocks for the panels can be found in the panel documentation.

# 3.2.1 Basic equipment

Motor-operated breaker				
1st shunt release OFF	-MBC	-MBO1		
5 pole auxiliary switches	-BGS1	-BGB1	-BGB2	
Charging motor	-MAS			
Anti-pump relais	-KFN			
Blocking magnet	-RLE1			
Auxiliary switches	-BGL1	-BGT3		



Figure 3/1: Pole side of a circuit-breaker in withdrawable version, type VD4G-50

- 13.9 Protective transport cover
- (remove before commissioning)
- 13.13 Lifting lug (remove before commissioning)
- 4.2 Contact arm
- 4.3 Contact system



Figure 3/2: Withdrawable version of a circuit-breaker, type VD4G-50, mechanism side

- 10.2 Control wiring plug
- 13.6 Socket for charging lever
- 13.7 Front plate



Figure 3/3: Withdrawable assembly with built-in auxiliary switch

(type B,	see section 5.6)
BGT2	Test position indicate

-bgiz	rest position indicator
-BGT1	Service position indicator
18	Spindle

- 18.2 Scene head on spindle
- 10.3 Control wiring connector plug for withdrawable assembly

# 4 Commissioning / Operation

# 4.1 Note on safety at work



- The switchgear may only be operated by specially trained personnel who are familiar with the characteristics of the particular device.
- Observe the relevant instructions in section 1.2.
- Due to safety reasons, the circuit-breaker has to be treated as "switched on" if the switching position can not be clearly determinated.
- In this case all high voltage connections to the breaker have to be de-energized and zero potential on the primary side of the breaker has to be confirmed prior to commissioning, operation, maintenance or repair work.

# 4.2 Preparatory work

(Figure 3/1 and 3/3)

In preparation for commissioning, the following work should be carried out prior to connection with the high-voltage power supply:

- Check the general condition of the switchgear for detrimental circumstances of all kinds.
- Perform a visual examination of the switching devices, withdrawable parts, isolating contacts, insulating parts, etc.
- Check primary and secondary connections as well as earthing conductor.
- Check the connection of the main earthing bar with the station earthing conductor (DIN VDE 0141).
- Check the paintwork for damage and touch up as described in section 5.5 where necessary.
- Remove all material residues, foreign bodies and tools from the switchgear.
- Clean the switchgear, rubbing down insulating parts with a clean, soft, non-fraying and dry cloth. Remove greasy or adhesive dirt as described in section 5.3.
- Properly refit all covers, etc., removed during assembly and testing processes.
- Transport caps (13.9) on the poles of vacuum circuitbreakers, where fitted, must be removed (Fig. 3/1).
- Lifting lugs (13.13) for high current circuit-breakers, if still fitted, must be removed (Fig. 3.1).
- Perform AC voltage testing on the main circuits to VDE 0670, Part 6 (IEC 60298) as far as necessary. Pay special attention during this procedure to voltage transformers and cables etc.
- Turn the auxiliary and control voltage on.
- Check the function of the charging motor.
- Carry out test operations of switching devices manually or by electrical control, and simultaneously observe the relevant position indicators.
- Manual charging of the stored-energy spring system (see chapter 4.5.1).
- Carry out test operations of switching devices manually or by electrical control, and simultaneously observe the relevant position indicators.

- The instruction manual has to be stored accessible to the operating personnel at any time.
- Check mechanical and electrical interlocks for effectiveness, without using force.
- Set the protective devices in the panel to the required values, and check their functioning with test equipment.
- On motor-driven withdrawable trucks, check the direction of rotation of the travel motors as described in section 5.6.5.
- For any further questions on the functions of the withdrawable circuit-breaker part and its testing, see section section 5.6.
- Instruct the local operators in the fundamental details of regular handling of the switchgear.
- Check on the operational readiness and switching status of upstream and downstream electrical installations.
- From areas bordering on the switchgear, in accordance with responsibilities, check on the following where applicable:
  - Power cables
  - Auxiliary cables
  - Supply voltage source
  - Remote control
  - Entire earthing installation, according to DIN VDE 0141
  - Switchroom equipment
  - Switchroom condition

# 4.3 Start-up

- Comply with all relevant safety regulations.
- Ensure that the circuit-breakers and switch disconnectors in the switchgear are in the OFF position.
- Remove any existing earthing and short-circuiting connections in the critical switching area.
- Energize the feed cables.
- Connect the switchgear, step-by-step, observing the signals and indicators.
- Check that the relevant conductors are in phase, as far as necessary when several incoming feeder cables and switchgear sections are concerned.
- Carry out all measurements and check all functions dependent on the high voltage power supply being connected.
- Watch out for irregularities of any kind.

# 4.4 Moving the withdrawable circuit-breaker

(Figure 3/1, 4/1 und 4/2)

Perform switching operations with the front doors shut.

- 4.4.1 Manual insertion from the test/disconnected position to the service position:
- Connect control wiring plug (10.2).
- Close the front door.
- Ensure that the circuit-breaker is in the OFF position.
- Fit the crank (121) on square spigot (18.1) of the spindle mechanism (18).

# Note:

In order to avoid damage to the operating mechanism, use the original hand crank only:

- Standard version without slip clutch
- Optional version with slip clutch.
- Move the withdrawable breaker truck (13) into the service position with 20 clockwise turns of the crank (for Unigear type ZS1 panels.

# Note:

Do not force to move the withdrawable version circuit-breaker (max. torque 25 Nm)! Comply with the conditions for movement of the withdrawable truck as set out in section 5.5.6!

- Observe the position indicator.
- Remove hand crank (121) by pressing first against the hand crank and then remove.

When removing the crank, it is essential to ensure that the spring-loaded scene head 18.2 slides into the untensioned front position. Spindle 18 is thus locked in place, preventing inadvertent turning of the spindle. Turning of the spindle opens auxiliary switches -BGT2/-BGT1 and thus prevents the circuit-breaker from being operated.

# Note:

The withdrawable truck must not be stopped at any position in the travel range between the service position and test/ disconnected position!

- 4.4.2 Manual withdrawal from the service position into the test/disconnected position:
- Ensure that the circuit-breaker is in the OFF position.
- Reverse the procedure described above for insertion into the service position.

# Note:

Withdrawable versions with blocking magnet -RLE2 may not be forcibly moved during power failures. In such a case they are blocked in the service and test positions. For deblocking, see section 5.6.5.

4.4.3 Motor-driven movement of the withdrawable truck:

- Briefly operate the electrical control for insertion or withdrawal (the withdrawable truck then automatically moves into the opposite position).
- Observe the position indicator.

# Note:

When the motor fails, the withdrawable truck can be moved in emergency manual operation. If the drive motor fails during movement, the withdrawable truck must be moved into a limit position in emergency manual operation. Emergency manual operation is carried out with the hand crank (121) on the spindle mechanism (18), in a similar manner to operation of a withdrawable circuit-breaker with manual systems:

- Turn off the supply voltage (m.c.b.), since the motor would otherwise be braked electrically.
- Turn hand crank (121) in the required direction.

When the withdrawable truck moves, the motor turns. The motor functions in such a case like a generator, i.e. it can lead to reverse voltages in the terminals.

The motor protection device must not be changed from the specified type and rated value, or the behaviour of the permanent magnet motor could be irreversibly impaired!

# Caution:

On emergency manual operation of a motor-operated withdrawable circuit-breaker:

- When a motor-operated earthing switch is fitted, the mechanical interlock with the earthing switch may not be available unless specially ordered.
- When a manual earthing switch is fitted, the mechanical interlock is always effective.

# 4.5 Circuit-breaker operation

(Figures 3/2 und 4/1)

# 4.5.1 Charging the stored-energy spring system

- Charging is carried out automatically.
- If the charging motor should fail, the charging procedure can be carried out or completed by hand, therefore:
  - insert the charging lever 128 into the socket 13.6 and pump for approx. 25 strokes until the charged condition is indicated.
  - When the charging condition is reached, the charging mechanism is automatically disengaged, and any further strokes of the lever have no effect.

4.5.2 Opening and closing the circuit-breaker:

- With the withdrawable circuit-breaker in the service position, on and off switching operations should only be carried out with the doors closed.
- Operate the local or remote electrical control.
- Observe the switch position indicator. The switching operation counter (13.5) for the circuit-breaker is automatically incremented by one unit with each operating cycle.

# 4.5.3 VD4 circuit-breaker run-on block

In case of any irregularity in the area of the inner control mechanism and of the charging function of the stored-energy spring mechanism, the run-on block disables the immediately subsequent switching operation. This is a protective measure to prevent damage to the circuit-breaker.



Release of run-on block may only be performed by servicing personnel from ABB or adequately trained specialist stuff.



## Figure 4/1: Manual operation and mechanical indicators of a withdrawable circuit-breaker, withdrawable circuit-breaker in test/disconnected position

- 10 Control wiring plug connection
- 13.2 Mechanical ON push-button
- 13.3 Mechanical OFF push-button
- 13.4 Mechanical switch position indicator
- 13.5 Mechanical operating cycle counter
- 13.8 Charging condition indicator
- 13.11 Sliding handle, connected to the catch in the withdrawable truck base frame
- (18) Spindle mechanism
- 18.1 Square spigot
- 128 Charging lever



- Bild 4/2: Movement of the withdrawable circuit-breaker between the test/disconnected position and the service position, clockwise up to the stop for the service position and anti-clockwise for the test/disconnected position
  - 13 Withdrawable circuit-breaker part
  - 18 Spindle mechanism
  - 121 Hand crank

# 5 Maintenance

Maintenance serves to preserve trouble-free operation and achieve the longest possible working life of the switchgear. In accordance with DIN 31051, IEC 61208 and IEC 62271-1, it comprises the following closely related activities:

Inspection:	Determination of the actual condition.
Servicing:	Measures to preserve the specified
	condition.
Repairs:	Measures to restore the specified
	condition.

# 5.1 General

Vacuum circuit-breakers are characterized by their simple and robust construction. They have a long life expectancy. Their operating mechanisms have a low maintenance requirement, and the interrupters are maintenance-free during their working life. There is no adverse effect on the vacuum, even from frequent switching of operating and short-circuit currents.

The servicing intervals and scope are determined by environmental influences, the switching sequences and number of short-circuit breaking operations.

# Note:

The following must be observed for all maintenance work:

- The relevant specifications in section 1.2.2
- Notes on safety at work in section 4.1
- Standards and specifications in the country of installation.

Maintenance work may only be performed by fully trained personnel, observing all the relevant safety regulations. It is recommended that ABB after-sales service personnel should be called in, at least during the performance of servicing and repair work.

While the work is in progress, all supply voltage sources must also be disconnected and secured to prevent reconnection.



# Note:

In order to prevent accidents (particularly injury to hands!) extreme care should be taken during all repair work on the operating mechanism, especially with front plate removed.

The spiral spring in the spring energy storage mechanism, for instance, retains a basic tension which is independent of the charging and discharging processes during switching, so as to ensure correct function. This spring energy can be inadvertently released if work is performed incorrectly on the spring mechanism!

Additional instructions may be included in the technical documents provided with the switchgear (e.g. also special agreed operating conditions).

For maintenance instructions read also the relevant chapters of BA 623.

Together with this instruction manual, it is essential to consult manual BA 623, Vacuum circuit-breaker type VD4G-50.

The service life data fundamentally apply to all components which are not directly influenced by the operator.

Components operated manually (movement of the withdrawable truck, etc.) may deviate, depending on how they are handled.

If necessary, further details can be taken from the technical documentation for the switchgear (including, for example, any agreed special operating conditions).

# 5.2 Service life

Typical life expectancies for von VD4G-50 Generator circuit-breakers:

- The maintenance-free vacuum interrupters up to 10,000 operating cycles (see BA 623)
- The breaker itself, depending on presupposing carefully performed inspection and servicing work and normal operating conditions, up to 10,000 operating cycles

The service life data fundamentally apply to all components which are not directly influenced by the operator. Components operated manually (movement of the withdrawable part, etc.) may deviate.

# 5.3 Inspection and functional testing

# 5.3.1 General

- The proper condition of the switching device is to be verified by regular inspection.
- The checks are to be performed in accordance with BGV A3 standards.
- Inspection at fixed intervals may be waived if the switchgear is permanently monitored by a qualified personnel.
- The checks first and foremost comprise visual examination for contamination, corrosion, moisture and discharge phenomena.
- In unusual operating conditions (including adverse climatic conditions) and/or special environmental pollutions (e.g. heavy contamination and aggressive atmosphere), inspection may also be necessary at shorter intervals.
- Visual checking of the isolating contact system. We recommend to turn alternately the contact system in order to clean the inner contact points of the contact system.
- The contact points should be cleaned if signs of unperminable overheating (discoloured surface) are visible (see section Repairs).
- If irregular conditions are detected, then corresponding repair measures should be initiated.

For details of inspection and functional testing, see the relevant sections of manual BA 623.

The inspection should always include a visual examination of the withdrawable part assembly. Special attention is to be paid to those parts which may possibly be damaged by improper handling. (See section "Inspection/Circuit-breaker in general").

- Visual checking of the isolating contact system. We recommend turning the contact system alternately in order to clean the inner contact points.

The contact points should be cleaned if signs of impermissible overheating (discoloured surface) are visible (see section "Repairs").

- The interlock conditions and the ease of movement of the lock and release device are to be checked as described under "Repairs".

When checking the interlock conditions, it is essential to ensure that no force is used.

# Maximum torque 25 Nm!

# 5.4 Servicing

Cleaning surfaces:

If, on the occasion of an inspection in accordance with (5.2), the necessity of cleaning measures has been established, proceed as follows:

- Before cleaning, where required, the working area must be switched off and secured against reconnection in accordance with the "Safety Regulations" specified by DIN VDE/IEC.
- Cleaning the surfaces in general:
  - Poorly adhering dry dust residues with a soft dry cloth.
  - More strongly adhering grime with mildly alkaline household cleaner or with Isopropanol.
- Cleaning insulating surfaces and conductive components:
  - Minor grime with Isopropanol.
- After cleaning, rinse with clean water and dry carefully.
- Should external discharges occur as a result of condensation, application of a thin silicone film on the surface concerned is often effective as a temporary remedy. It is advisable to request advice from the ABB after-sales service department on permanent solutions to such unusual problems.

For details of servicing, see also the relevant sections of manual BA 623.

# Note:

Use only cleaning agents free of halogen, in no case 111-Trichloratan, trichloroethylene or tetrachloromethane!

# 5.5 Repairs

# 5.5.1 Repair of surface damage

Repair of surface damage:

- Sheet steel parts, painted:
  - Remove rust, e.g. with a wire brush.
  - Grind off paint coat and degrease.
  - Apply anti-rust primer and top coat.
  - Use top coat paint in the standard colour RAL 7035.
- Sheet steel parts, with zinc surface and passivated functional parts:
  - Remove white rust with a wire brush or cleaning pad (e.g. Scotch-Brite white).
  - Remove loosely adhering particles with a dry cloth.
  - Apply zinc spray or zinc dust primer.
- Functional parts, phosphated:
  - Remove rust with a wire brush or cleaning pad (e.g. Scotch-Brite white).
  - Clean with a dry cloth.
  - Grease with Isoflex Topas NB 52.
- Switchgear in general:
  - Observe the maintenance instructions in the manuals for the individual equipment components.
  - Check that the bolt connections at the contact points in the busbar system and the earth connections are tight, and that the isolating contact system functions correctly.
  - Regrease the contact points and mechanism of the withdrawable part insertion system as necessary, or, when lubrication is inadequate or missing, thoroughly clean the areas concerned and regrease with Isoflex Topas NB 52 lubricant.
  - Where required, regrease or thoroughly clean slide plates and bearings in the panel and regrease them with Isoflex Topas NB 52 lubricant.

Remove the contact system for thoroughly cleaning as described below (Figure 5/1):

- Slide the two inner annular tension springs (4.4) facing the breaker pole to a position beside the other two outer annual tension springs, thus releasing contact system (4.3), and remove the contact system from contact arm.
- Fit a new contact system back to front on the thin end of arbor (127), and slide it forwards onto the thicker part of the shank.
- Fit arbor (127) onto the relevant contact arm, slide the contact system (4.3) over onto the contact arm, and withdraw the arbor.
- Check all contact fingers and annular tension springs for perfect fit.

# Note:

The set installation position of contact arms must not be changed by the improper use of force.

- 5.5.2 Replacement of withdrawable assembly (Figures 4/2 and 5/1 to 5/5)
- Disconnect plug connector (10.3) only for withdrawable assembly of type B)
- Remove interlock rod (13.91) with pin (13.27) from the withdrawable assembly.
- For motorized withdrawable assemblies, remove the two socket head bolts which are accessible from below the assembly (2 bolts M4).
- Unbolt the circuit-breaker from the withdrawable assembly (4 x M12 bolts).
- Mount the circuit-breaker on a new withdrawable assembly in the reverse order, using new circlip and special pliers for pin (13.27).

Check the setting of interlocking rod (13.91):

- Turn spindlel (18) anti-clockwise to the stop for the disconnected position:
  - The distance between lever (13.26) and cam (13.25) must be 2<sup>+1</sup> mm betragen,
    The distance between roller (13.24) and blocking
    - bracket (13.92) must be 0.2-0.5 mm.
- Turn spindle (18) clockwise to the stop for the service position:
  - The distance between lever (13.26) and cam (13.25) must be  $2^{\scriptscriptstyle +1}$  mm.
  - The distance between roller (13.24) and blocking bracket (13.92) must be 0.2-0.5 mm.
- Loosen bolts (13.91.2 or 13.92.1) for any necessary adjustment.

For details of repairs, see also the relevant sections of manual BA 623.

# 5.6 Testing withdrawable truck of a VD4 type circuit-breaker

When functional tests are carried out on withdrawable parts, compliance with the conditions listed below should also be checked. In this context, a distinction should be made between two types of the devices for the VD4 withdrawable tuck:

- Type A: Withdrawable assembly without integrated auxiliary switches (manual operation only)
- Type B: Withdrawable truck with integrated auxiliary switches (manual or motorized operation)
- 5.6.1 Motor-driven withdrawable truck (non-standard)

Carry out testing of motor-driven withdrawable truck in the same way as for manually operated withdrawable part:

- Turn off the supply voltage (m.c.b.), since the motor could otherwise be braked electrically.
- Turn hand crank (121) in the required direction.

# Note:

When the withdrawable truck moves, the motor turns. The motor functions in such a case like a generator, i.e. it can lead to reverse voltages in the terminals.

- 5.6.2 Checking the correctness of dimensional settings (Figures 5/1 to 5/5)
- The distance between lever (13.26) operated by link rod (13.91) and plastic cam (13.25) should be 2<sup>+1</sup> mm. If adjustment is required, release the two bolts (13.91.1) and (13.91.2). Deviations from the specified value can have the following effects:
  - Dimensions too large, blocking system for the drive spindle deactivated.
  - Dimensions too small, proper action of the electrical interlock no longer guaranteed.
- 2. The distance between roller (13.24) and angle lever (13.92) should be 0.2-0.5 mm when the circuit-breaker is closed.

If adjustment is required, release the two bolts (13.91.2) and (13.91.1).

5.6.3 Checking auxiliary switch settings on type A withdrawable truck (Figure 5/1)

Compliance with the interlock conditions in the areas of the test/disconnected position and the service position is ensured by auxiliary switch -BGT3, located in the breaker housing and factory-set.

In test operations, the withdrawable truck must be moved by hand with the crank fitted.

- 1. Settings in the area of the test/disconnected position
  - Move the withdrawable truck out of the test/disconnected position towards the service position with a few turns of the crank.
  - Slowly move the withdrawable truck back to the stop.
    Auxiliary switch -BGT3 must then operate when the hand crank has a remaining angle of ≥ 600 of turn to reach the stop.
  - Slowly insert the withdrawable truck from the test/disconnected position towards the service position until auxiliary switch -BGT3 just operates.

In this position, it must still just be possible to move closing push rod (13.2.1). For this test, the function of the blocking magnet -RLE2 must be deactivated manually. This condition ensures that the electrical interlock takes effect before the mechanical interlock in the motion sequence involved.

- 2. Settings in the area of the service position
  - Move the withdrawable truck out of the limit position towards the test/disconnected position with a few turns of the crank.
  - Slowly move the withdrawable truck forwards again to the stop:

Auxiliary switch -BGT3 must then operate when the hand crank has a remaining angle of  $\geq$  600 of turn to reach the stop.

5.6.4 Checking auxiliary switch settings on type B withdrawable truck (Figures 3/3 and 5/1)

Compliance with the interlock conditions in the test/disconnected and service position areas is ensured by position signalling switches -BGT2 and -BGT1 located in the withdrawable assembly and factory-set.

In test operations, the withdrawable truck must be moved by hand with the crank fitted with the motor power switched off.

- 1. Settings in the area of the test/disconnected position
  - Move the withdrawable truck out of the test/disconnected position towards the service position with a few turns of the crank.
  - Slowly move the withdrawable truck back to the stop. Auxiliary switch -BGT2 must then switch over just before the stop is reached.
  - Slowly insert the withdrawable truck from the test/disconnected position towards the service position until auxiliary switch -BGT2 just operates.
    In this position, it must still just be possible to move closing push rod (13.2.1). For this test, the function of the blocking magnet -RLE2 must be deactivated manually. This condition ensures that the electrical interlock takes effect before the mechanical interlock in the motion sequence involved.
- 2. Settings in the area of the service position
  - Move the withdrawable truck out of the limit position towards the test/disconnected position with a few turns of the crank.
  - Slowly move the withdrawable truck forwards again to the stop:

Auxiliary switch -BGT1 must then switch over just before the stop is reached.

- 5.6.5 Checking the direction of rotation of the travel motors on motor-driven withdrawable versions
- Move the withdrawable truck by hand into a central position between the test/disconnected position and the service position.
- Remove the hand crank.
- Switch the supply voltage for the travel motor on.
- Use the local electrical controls to check that the withdrawable truck moves in the correct direction.

# Danger:

Do not allow the withdrawable truck to run up against a block when the travel direction is incorrect! Switch the motor power off immediately (the travel process functions electrically by a seal-in system with limit position switch-off).

There may be a danger of injury when the door is open!

5.6.6 Testing of interlock conditions (Figures 3/2 and 5/1)

The testing procedures for type A and type B withdrawable truck are identical.

 The withdrawable truck must only be movable from the test/disconnected position into the service position when the circuit-breaker is open and the earthing switch is open.

Check the following conditions individually:

- With the circuit-breaker closed, insertion of the withdrawable truck towards the service position must be blocked after only half a turn of the crank in the clockwise direction, and the travel motor on motor-operated withdrawable parts must not be capable of being switched on.
- With the earthing switch closed, insertion of the withdrawable truck towards the service position must be blocked after only two clockwise turns of the crank, and the travel motor on motor-operated parts must not be capable of being switched on.

# Do not use force

(max. torque 25 Nm)!

2. The withdrawable truck must only be movable from the service position into the test/disconnected position with the circuit-breaker open.

# Check this condition as follows:

With the circuit-breaker closed, withdrawal movement of the withdrawable truck must be blocked after only half a turn of the crank in the anti-clockwise direction, and the travel motor on motor-operated withdrawable truck must not be capable of being switched on.

3. Closing of the circuit-breaker must only be possible when the withdrawable truck is in the defined test/disconnected position or service position.

The control wiring plug (10.2) must previously have been inserted.

Check this condition as follows:

- It must not be possible to close the circuit-breaker with the withdrawable truck in any position between the test/ disconnected position and the service position.
- Enabling of switching when the withdrawable truck moves into the service position is effected electrically by operation of auxiliary switch -BGT3 in the breaker housing (for type A), or of auxiliary switch -BGT1 in the withdrawable assembly (for type B), and mechanically slightly earlier; the latter corresponds to a position approximately half a turn of the crank before stop.
- For motion into the test/disconnected position, the same enabling conditions apply analogously, in this case by means of auxiliary switch -BGT3 in the breaker housing (for type A) or the auxiliary switch -BGT2 in the withdrawable assembly (for type B).

 It must only be possible to open the circuit-breaker (manually) when the withdrawable truck is in the service position or test/disconnected position and the control voltage has failed.

Check this condition.

5. Withdrawable truck with order-related blocking magnet -RLE2 may not be moved in case of control power failure, or when there is no control power. Do not forcibly move blocked withdrawable trucks! The blocking magnet -RLE2 is only present on manually operated withdrawable truck.

Releasing the blocking magnet -RLE2:

- Remove front plate (13.7).
- Disengage blocking magnet -RLE2 by pulling the magnet armature.
- While doing so, turn crank (121) about one half turn (either direction of rotation is permissible).
   The blocking magnet is only active in the test position and service position. In intermediate positions it has no effect.
- 6. Disconnection of the control wiring plug (10.2) as well as later insertion must be blocked in the withdrawable truck's service position.

# 5.7 Spare parts, auxiliary materials, lubricants

# 5.7.1 Spare parts

When parts are required, the serial number of the relevant withdrawable breaker part or circuit-breaker should always be quoted. Setting instructions are to be requested separately.

# Circuit-breaker VD4

- Shunt release, auxiliary switch: For notes on settings see drawing GCE 717 96 11
- Charging motor with gearbox: No special notes required (table 1)

# Withdrawable assembly of VD4

- Manually moveable withdrawable assembly:
  - type A: For notes on settings see drawing GCE 7003570, sheet 1 and 2
  - type B
    For notes on settings see drawing GCE 7003570, sheet 1 and 2.
- Motor-driven withdrawable trucks: For notes on settings see drawing GCE 7003571
- Blocking magnet -RLE2: For notes on settings see drawing GCE 7003820, sheet 1. (table 2)

Check this condition.

Designation	Item no.	Rated supply voltage	Part-no. (order code)
Auxiliary switches with clamp type terminals	-BGS1 -BGB1 -BGB2 -BGB3		GCE7002397R01 <sup>1) 3)</sup>
Auxiliary switch on blocking magnet	-BGL1		GCE7003022P0 <sup>1)</sup>
Auxiliary switch for fault annunciation	-BGB4		GCE0905121P0 <sup>1)</sup>
1st schunt release OFF	-MBO1	24 V 240 V DC	GCE7004590P011 <sup>1)</sup>
2nd shunt release OFF	-MBO2	110 V 240 V AC	GCE7004590P012 <sup>1)</sup>
Shunt release ON	-MBC	24 V 240 V DC	GCE7004590P010 <sup>1)</sup>
Blocking magnet	-RLE1	110 V 240 V AC	GCE9478103P011 <sup>1)</sup>
Undervoltage release with spring mechanism	-MBU	24 V 240 V DC	GCE9371466R0 <sup>1)</sup>
Delayed undervoltage release with spring mechanism	-MBU	see RN3U for supply voltage	GCE9371466R0 <sup>1)</sup>
Indirect overcurrent release with intermediate current transformer and spring mechanism	-MBO3	24 V 240 V DC	GCE9371466R0212
Intermediate current transformer for indirect overcurrent release		24 V 220 V DC	GCE9371466R0248
Magnet holder, complete (with integrated rectifiers -TB4, -TB1, - TB3, -TB2)		24 V 220 V DC	GCE7000880R0121
Series rectifier	-TB6/-TB7		GCE7004050R0129
Charging motor (with gearbox)	-MAS	24 V 240 V DC 110 V 240 V AC	GCE0940084P013 <sup>2)</sup>
Push-on sleeve 4.8-2.5 for push-on blade 0,8 thick (for additional connections)			DIN 46247 Page 2

1) Quote contact arrangement

2) State the type of release and voltage

3) Quote contact arrangement

Table 1: VD4 circuit-breaker

# Table 2: VD4 withdrawable assembly

Designation	Item no.	Rated supply voltage	Part-no. (order code)
Auxiliary switch for manually operated mechanism (type A)	-BGT3		GCE7004023R0101
Auxiliary switch for manually operated mechnaism (type B) - contacts silver plated - contacts gold plated	-BGT2 -BGT1		GCE7004024R0101 GCE7004024R0103
Auxiliary switches for motor-operated driving mechanism - contacts silver plated - contacts gold plated	-BGT2 -BGT1		GCE7004024R0102 GCE7004024R0104
Blocking magnet	-RLE2	24 V 30 V 48 V 60 V 110 V 125 V 220 V	GCE7003820R0101 GCE7003820R0102 GCE7003820R0103 GCE7003820R0104 GCE7003820R0105 GCE7003820R0106 GCE7003820R0107
Motor with gearbox	-MAT	24 V 30 V 48 V 60 V 110 V 220 V	GCE0940150P0111 GCE0940150P0112 GCE0940150P0113 GCE0940150P0114 GCE0940150P0115 GCE0940150P0116

# 5.7.2 Auxiliary materials and lubricants

Auxiliary materials	Part-no. (order code)
Lubricant: Isoflex Topas NB 52	GCE0007249P0100
Halogen-free cleansers For general cleaning: Isopropanol	1VB0000463P0100
Touch-up paint: Standard colour RAL 7035 - 1-kg-box - Spray tin	GCE9014060R0103 GCE0007895P0100



13.26 13.24 13.92 (-BGT3) 13.2.1 121 10.3

Figure 5/1: Motor-driven withdrawable circuit-breaker in an intermediate position close to the test/disconnected position, with fitted crank for manual operation and breaker front plate removed

- 10.3 Control wiring plug connector forwithdrawable assembly
- 13.2.1 ON push rod
- 13.24 Roller
- 13.26 Lever
- 13.92 Angle lever
- (-BGT3) Auxiliary switch (only with type A withdrawable truck)

-RLE2

121 Hand crank



Figure 5/2: Detailed view of the opening and closing mechanism

13.2.1	ON push rod
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- 13.25 Plastic cam
- 13.26 Lever
- -RLE1 Blocking magnet



Figure 5/3: Manually moveable withdrawable circuit-breaker, front plate removed -RLE2 Blocking magnet for withdrawable truck



Figure 5/4: Detail in the area of a withdrawable truck with travel motor, viewed from the left-hand side

13.24	Roller
13.25	Cam
13.26	Lever

- 13.26 13.27 Pin
- 13.90 Travel motor Link rod 13.91
- 13.91.1 Bolt
- 13.91.2 Bolt
- 13.92 Angle lever
- 13.92.1 Bolt



Figure 5/5: Mechanical interlock, withdrawable assembly/circuit-breaker with manually operated withdrawable truck

13.24	Roller
13.25	Cam
13.26	Lever
13.27	Pin
13.91	Link rod

- 13.91.1 Bolt
- 13.91.2 Bolt 13.92
- Angel lever 13.92.1 Bolt

### 5.8 Wiring diagrams for circuit-breakers on withdrawable truck

# Note:

The wiring diagrams comprise the basic components and all further equipment options for the various VD4 types. The scope of equipment possible within an individual type series is listed in the relevant switchgear list, and the euquipment fitted in each individual case can be found in the order documentation.



Drawing no.: GCE 2032404



D		
Closing block magnet with rectifier -TB4	-BGL1	Auxiliary switch on block magnet -RLE1
1. Shunt release OFF with rectifier -TB1	-BGB1	Auxiliary switch on switch shaft
Closing release with rectifier -TB3	-BGB2	Auxiliary switch on switch shaft
Undervoltage release U< with rectifier -TB6	-BGB3	Auxiliary switch on switch shaft
Indirect overcurrent release	-BGT3	Auxiliary switch at c.bunit
2. Shunt release OFF with rectifier -TB2	-BGB4	Fleeting contact 35 ms for c.b. tripped indication
Charging motor	-BGT2	Limit switch test position
Antipumping relay	-BGT1	Limit switch service position

-MBO1

-RLE1

-MBO2

-MAS -KFN

-MBO3

-MBC

- Auxiliary switch -BGS1 shown for c.b.-mechanism

C.b.-unit in service position Control wiring plug 58-pole

1

discharged

# Figure 5/8: Wiring diagram for VD4 vacuum circuit-breaker on manually moveable withdrawable assembly

- Type B of withdrawable truck
  - Maximum of equipment
- Auxiliary switch -BGB3 wired
- Control wiring plug 58-pole
- Use in panel system UniGear-Typ ZS1
  - Drawing no.: GCE2132701P0101



in panel system UniGear-Typ ZS1
 Drawing no.: GCE2132702P0101

- Control wiring plug 58-pole



- Use in panel system ZS, UniGear-Typ ZS1

- Drawing no.: GCE2009153

# 6 Application of the X-ray regulations

One of the physical properties of vacuum insulation is the possibility of X-ray emissions when the contact gap is open. The specified test performed by the Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig demonstrates that the local dosage output of 1  $\mu$ Sv/h at a distance of 10 cm from the touchable surface is not exceeded when the rated voltage is applied.

The results are as follows:

- Testing of the switching device or the vacuum interrupter to VDE 0671 part 100 or IEC 62271-100 at the relevant rated power frequency withstand voltage may only be performed by trained personnel observing the stipulations of the EU basic standard (Directive 96/29/Euratom of the Council of 13 May 1996 (ABI.L 159 of 29 June 1996)).
- Application of the rated voltage specified for the switching device by VDE 0671 part 100 or IEC 62271-100 is completely safe.
- Higher voltages than the rated voltage or DC test voltage specified in VDE or IEC standards must not be applied!
- The containment of the above mentioned local dosage output with the vacuum interrupter in the open position is dependent on maintenance of the specified distance between the contacts (which is automatically ensured with correct mechanism function and force transmission).
- Safety clearances must be maintained.

# 7 Comparison of designations to IEC 81346-1/IEC 81346-2, IEC 61346-1/IEC 61346-2 and VDE-DIN 40719 Part 2

Designation	IEC 81346-1/IEC 81346-2	IEC 61346-1/IEC 61346-2	VDE DIN 40719 Part 2
Auxiliary switch on mechanism	-BGS1	-BS1	-S1
Auxiliary switch on block magnet -RLE1	-BGL1	-BL1	-S2
Auxiliary switch on switch shaft	-BGB1	-BB1	-S3
Auxiliary switch on switch shaft	-BGB2	-BB2	-S4
Auxiliary switch on switch shaft	-BGB3	-BB3	-S5
Fleeting contact 35 ms for c.b. tripped indication	-BGB4	-BB4	-S7
Closing block magnet with rectifier -TB4	-RLE1	-RL1	-Y1
1. Shunt release OFF with rectifier -TB1	-MBO1	-MO1	-Y2
Closing release with rectifier -TB3	-MBC	-MC	-Y3
Undervoltage release U< with rectifier -TB6	-MBU	-MU	-Y4
Indirect overcurrent release	-MBO3	-MO3	-Y7
2. Shunt release OFF with rectifier -TB2	-MBO2	-MO2	-Y9
Series rectifier for -RLE1	-TB4	-TR4	-V1
Series rectifier for -MBO1	-TB1	-TR1	-V2
Series rectifier for -MBC and -KFN	-TB3	-TR3	-V3
Series rectifier for -MBU	-TB6	-TR6	-V4
Series rectifier for -MBO2	-TB2	-TR2	-V9
Series rectifier for -MBO3	-TB7	-TR7	
Charging motor	-MAS	-MS	-M0
Antipumping relay	-KFN	-KN	-K0
Series resistor	-RAR	-RR	-R0
Circuit-breaker	-QDB		-Q0
Terminal blocks for circuit-breaker auxiliary circuits	-XDB	-XB	-X2
Block magnet on truck with rectifier -TB5	-RLE2	-RL2	-Y0
Series rectifier for -RLE2	-TB5	-TR5	-V0
Auxiliary switch at c.bunit	-BGT3	-BT3	-S6
Limit switch test position	-BGT2	-BT2	-S8
Limit switch test position	-BGT1	-BT1	-S9
Motor drive for draw-out	-MAT	-MT	-M1

# Contact

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