B747

Instruction for Assembly, Operation and Maintenance of

DRIESCHER Indoor Vacuum Circuit-Breakers

- Rated voltage
  12 kV up to 38,5 kV
- Rated current
  630 A up to 2500 A

Driescher Moosburg
switching • electricity • safely
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V12-

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DRIESCHER - Indoor Vacuum Circuit-Breakers

Contents

General notes

These operating and maintenance instructions must always be kept at the place of installation and must be available to operating personnel at all times.
The operating and maintenance personnel must have read and understood these instructions prior to the commencement of any work.
Correct transport, storage, installation and assembly, as well as careful operating and commissioning are essential to ensure the satisfactory and safe operation of these switchgears.

Guarantee
Driescher shall not accept any liability for damage which is based on incorrect use, incorrect implementation of work or work carried out by non-trained persons, or third party liability.

Warning

During the operation of these electrical switchgears some parts are inevitably under hazardous voltage and mechanical parts, also those remotely controlled, may move fast.
Non-observance of the warning signs can lead to severe injury or damage to property.
Only appropriately qualified personnel, as specified in the VDE 0105 (trained electricians) are to work on this equipment or in the vicinity thereof.
These persons must have a sound knowledge of all general regulations; VDE/IEC specifications, 5 rules on safety in compliance with VDE, safety regulations, accident prevention regulations as well as all warnings and maintenance measures given in these instructions.

Transportation and Storage

After receipt of delivery, please unpack switch carefully and check for possible transportation damages. If damages have occurred, please immediately inform us and the carrier. After unpacking please clean the switches and accessory from any contamination from the packing material and protect them from damages, humidity and pollution until installation. For transportation only use the frame, never the vacuum poles.

Operating Conditions

The switches are designed for normal operating conditions acc. to EN 62271-1, Class "Minus 5 Indoor". A proper functioning is also guaranteed up to temperatures of up to -15°C. The maximum value of the ambient temperature is 40°C; the average value over 24 hours is max. 35°C.
The values of the insulating power are – acc. to EN 62271-1 – are related to sea level.
For altitudes up to 1000 m any reduction in insulation caused by the reduced insulating power of the air is insignificant and can be ignored. For an installation above 1000 m sea level it is necessary to correct the values given for the rated power-frequency withstand voltage and the rated lightning impulse withstand voltage.

Technical Data

Rated voltage	U_r	12 kV	24 kV	36 kV	38,5 kV
Rated frequency	f_r	50 Hz	50 Hz	50 Hz	50 Hz
Rated current	I_r	... 2500 A	...2500 A	...1250 A	...1250 A
Rated short-time current	I_k	...31,5 kA	...31,5 kA	20 kA	20 kA
Rated short-circuit current	t_k	3 s	3 s	3 s	3 s
Rated peak withstand current	I_p	...80 kA	...80 kA	50 kA	50 kA
Rated lightning impulse withstand voltage	U_p	75 kV	125 kV	170 kV	180 kV
Rated short-time power frequency withstand voltage	U_d	28 kV	50 kV	70 kV	80 kV
OFF-period approx.	ms	65	65	65	65
Arcing time	ms	<17	<17	<17	<17
ON-time approx.	ms	60	65	70	70
D.C. component	%	23	23	23	23
Rated short-circuit breaking current	I_{sc}	...31,5 kA	...31,5 kA	20 kA	20 kA
Rated short-circuit making current		...80 kA	...80 kA	50 kA	50 kA
Rated cable breaking current	I_c	25 A	31,5 A	50 A	50 A
Possible switching cycles					
- of the vacuum tube at rated current		30.000	30.000	15.000	15.000
- of the vacuum tube at rated short-circuit breaking current		100	100	100	100
- of the switch actuator		10.000	10.000	10.000	10.000
Rated capacitive switching class		C2	C2	C2	C2
Rated class for mechanical operations		M2	M2	M2	M2
Application class		S1	S1	S1	S1

Designs:

V....F-BK with coil spring stored energy mechanism, front-panel mounting for manual operation

V....KUF with coil spring stored energy mechanism and suitable for automatic reclosing, front-panel mounting with motorized charging mechanism

Rated operating sequence:

O - 0,3s - CO - 15s - CO in case of motor actuated switches

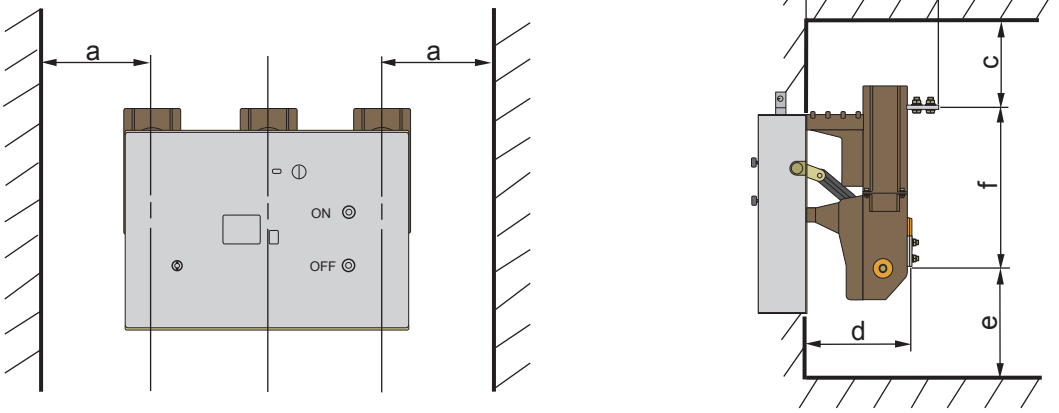
O - 3 min - CO in case of manual operated switches

Type Description

Examples: **V12-630-20 F-BK** **V24-1250-25 KUF**

Vacuum circuit-breaker	V	V
Rated voltage (12 kV / 24 kV)	12	24
Rated current (630 A / 1250 A)	630	1250
Rated short-circuit breaking current (kA)	20	25
Design for front-panel mounting	F	
- with coil spring stored energy mechanism	BK	
Design for front-panel mounting		F
- with coil spring stored energy mechanism and suitable for automatic reclosing		KU

Terminal Zones



Shown: Circuit-breaker 12 kV / 1250 A

For circuit-breakers with a rated voltage of 24 kV, 36 kV or 38.5 kV the terminal zones on the basis of the bus bar connection acc. to the table below.

Rated voltage kV	Rated current A	a mm	b mm	c mm	d mm	e mm	f mm
12	630	145	265	145	260	230	367
	1250		305				
	1600						
	2000						
	2500			205			
24	630	245	365	245	360	330	367
	1250		405				
	1600						
	2000						
36	630	355	475	355	470	440	492
	1250		515				
38,5	630	355	475	365	470	440	492
	1250		515				

Weight

The weight of a vacuum circuit-breaker is about 95 kg.

Assembly

All switches of the V… type series are suitable for vertical installation (related to the vacuum switching tube). For the assembly in switchgear cubicles or on switchgear trucks always pay attention to the following:

The switches must always be mounted on an adequately stable framework construction.

The switches can be attached at 8 bores on the lower and upper side of the switch frame. The recess on the lower side of the switch frame (see page 10, picture, area I) must be kept open. 2 bores each are provided with M12 rivet nuts.
When fixing the switch the base frame may not be distorted. Compensate any unevenness with shims.

Adjust the bus bars in such a way that they rest flat without constraint and with overlapping holes on the contact surfaces of the vacuum circuit-breaker.
Before tightening the screws, carefully treat the mating surfaces of the bus bars and the vacuum circuit-breaker by applying strokes with a steel brush in crosswise action until bright and wipe off any residue with a clean cloth.
Apply a thin coat of acid-free Vaseline to the bright contact surfaces and then screw together immediately.
For the connection use bolts and nuts M12 – property class 8 – and the appropriate spring elements and washers.

Attention! When tightening the connecting bolts (tightening torque 70 Nm) always use an appropriate spanner or socket key as counter-part.

To prevent vibrations of the vacuum circuit-breaker from reaching other sensitive system elements, we recommend inserting flexible intermediate pieces between the switch connections and bus bars.
This applies in particular when the bus bar connections to the next device are very short. (Flexible connecting pieces can be included in delivery on desire).

Earthing
Use the marked bore on the upper side of the switch frame to earth the circuit-breaker.

Interlocking

General

Electrical and mechanical interlocking mechanisms ensure that making operation of the circuit-breaker is only possible when the spring-loaded energy storage mechanism is loaded and has stored energy to carry out a making / breaking operation.
This ensures that the last possible switching operation is always a breaking operation, even if the motor or control voltage should fail.
For circuit-breakers in withdrawable design it must be ensured that the switch truck can only be moved into the operating or disconnecting position when the circuit-breaker is switched off and the plug connector is connected.
Interlocking mechanisms also ensure that the switch truck cannot be removed from the switch panel before the plug connector has been disconnected.

Mechanical Interlocking Mechanisms

Actuators of disconnecting switches can be equipped with a mechanical switchgear interlocking. For this purpose the disconnecting switch is mechanically interlocked with the corresponding circuit-breaker.
The polling parts scan the position of the circuit-breaker and block its mechanical and electrical making operation if the corresponding disconnecting switch is in intermediate position.
On the other side, it prevents any operation of the disconnecting switch when the circuit-breaker is closed.

Electrical Interlocking

Circuit-breakers can be incorporated in electromagnetic branch or interlocking mechanisms. In case of an electrical interlocking there is a magnetic lockout mechanism attached to the disconnecting switch or its operating mechanism, where the lockout mechanism is actuated by means of an auxiliary contact of the circuit-breaker in such a way that the disconnecting switch can only be operated when the circuit-breaker is opened.
On the other hand, the circuit-breaker is actuated by the disconnecting switch or its actuator in such a way that it can only be closed in the end positions of the disconnecting switch.
Therefore, the electrical manual making operation must be provided in the circuit-breaker actuator.

Auxiliary Switches

For control and signalling purposes the circuit-breakers are equipped with auxiliary switches.
These are installed in the covered base-frame and are wired to the female multi-pole connector (page 10, image 9).
Their individual contacts are set at the factory – according to the desired details – as making or breaking or pulse contact elements. To achieve the longest possible pulse duration for the pulse contact elements, one making and one breaking contact are connected in series and are set to overlap.
In case that one or the other contact had to serve an opposite function, it is possible to make the necessary changes in a few simple steps.

Shunt Releases

are available for DC or AC. They are used most as they are suitable for both remote control and automatic protection. However, a requirement for their use is the availability of an auxiliary voltage which must be independent from the network for the tripping on faults.
As the coil is only designed for a short-time current, the circuit is looped through an auxiliary contact actuated by the operating shaft, and this breaks the circuit after the switching operation has been effected.

Undervoltage Releases

They are also known as low-voltage releases. They tend to be used when circuit-breakers are to be opened automatically if the supply voltage should drop too low or fail completely.
If the voltage drops below 35% of the rated voltage, the releases immediately operate and release the breaking operation.

Indirect Releases

are only used for the automatic fault clearing in case of overload or short-circuit. This type of release is used if no auxiliary voltage supply is available independent of the supply voltage.
Indirect releases are included in the secondary circuit of feeder current transformers and are energised when the corresponding protective relay is activated. To protect the release contacts of the protective relays from overload it is usually necessary to interpose an auxiliary transformer which reduces the current of the main transformer and limits it to an acceptable level by means of saturation (auxiliary transformers which have to be installed separately from the switch, are not included in delivery).

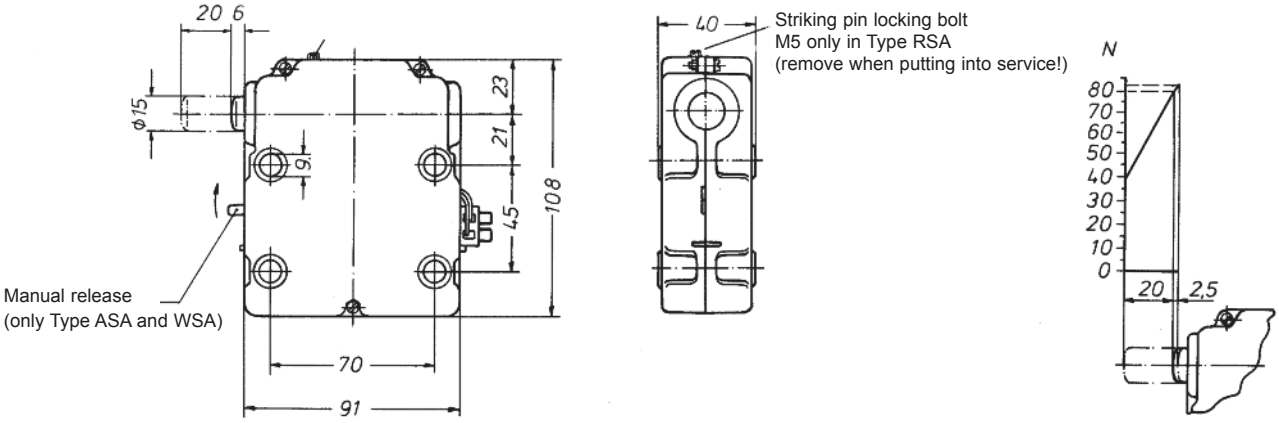
"Breaker tripped" Indication

When switching off the vacuum switch by means of a release, the position switch makes a brief contact. This contact making can be used for a signal. For an intentional mechanical opening, a cut-out switch breaks the contact.

Varistor Module

The disconnection of inductive loads in DC-circuits can cause switching surges which endanger the electronic control equipment. In order to prevent this hazard the inductance of the switch actuator and the control (motor, closing coil, shunt release and auxiliary protection) is connected to the varistors in case of DC-operation.

Illustration of the Release



Type	Rated current (A)	AC operation Rated voltage (V)	AC operation Consumption (VA)	AC operation Part no.	DC operation Rated voltage (V)	DC operation Consumption (VA)	DC operation Part no.
• Shunt release							
ASA		-	-	-	12	56	772 04012
ASA		-	-	-	24	56	772 04024
ASA		-	-	-	48	88	772 04048
ASA		-	-	-	60	56	772 04060
ASA		100/110	105	772 03110	110	57	772 04110
ASA		230	110	772 03220	220	50	772 04220
• Undervoltage release							
RSA		-	-	-	24	10	772 05024
RSA		-	-	-	48	10	772 05048
RSA		100/110	19,5	772 05110	60	10	772 05060
RSA		-	-	-	110	10	772 05115
RSA		230	19,5	772 05220	220	10	772 05225
• Indirect release							
WSA	0,5	-	18	772 06005	-	-	-
WSA	1,0	-	18	772 06010	-	-	-
WSA	5,0	-	18	772 06050	-	-	-

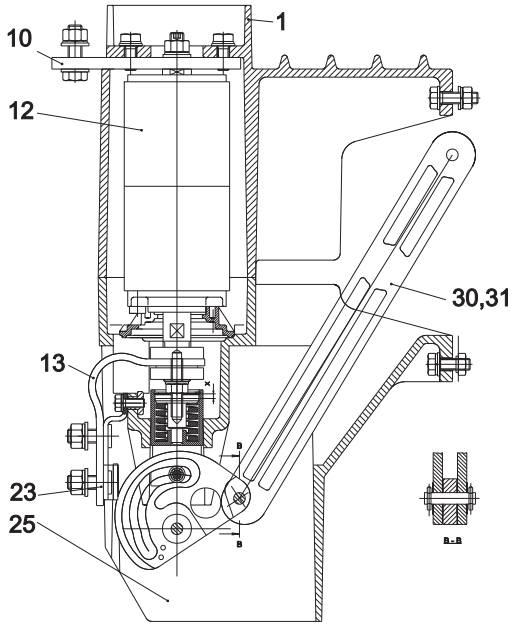
Motorantriebe

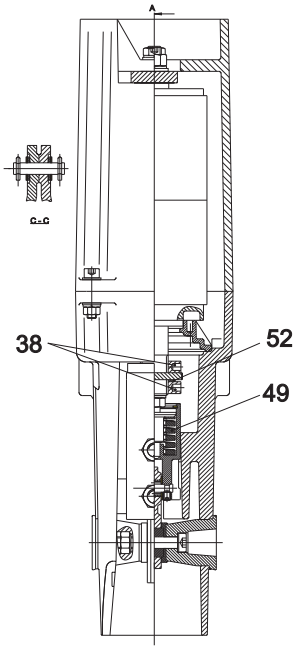
Motors can optionally be delivered for AC or DC systems.
The motors operate in short-time duty (S2).

The supply voltage should not deviate from the rated supply voltage by more than -15% to +10%.

Motor voltage (V)	Current input (A)	Consumption (VA)	Consumption (W)	Charging time (s)	Motor protection switch ..A	Motor protection switch (A)
110 AC	2,2	242		8,2	2,5 - 4	2,5
230 AC	1,2	276		7,8	1 - 1,6	1
24 DC	8,8		211	9,3	10 - 16	11
48 DC	4,5		216	7,3	4 - 6,3	4,4
60 DC	4,5		270	5,7	4 - 6,3	4,6
110 DC	2,2		242	8,2	2,5 - 4	3
220 DC	1,3		286	8,8	1 - 1,6	1,1

Design and Operating Mode of the Vacuum Circuit-Breaker





The Driescher vacuum-circuit breakers are three-pole indoor circuit-breakers for a rated voltage range from 12 up to 38.5 kV.
The switch consists of an actuating mechanism with a spring-loaded energy storage mechanism and control elements as well as three circuit-breaker poles with vacuum tubes.

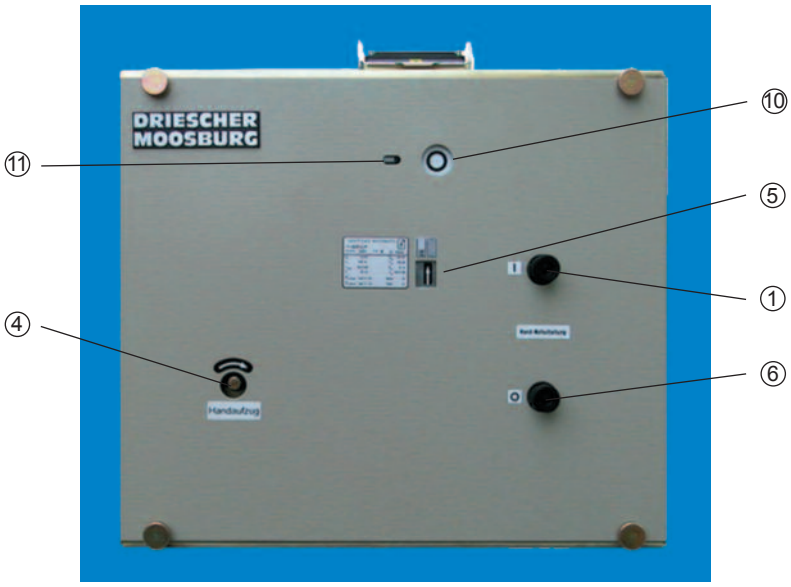
The actuating mechanism (see page 10)

The actuating mechanism is closed by a removable cover. The circuit-breaker is switched on via the operating linkage B by operating the ON push-button (1) or by response of the release (7).
The motion transmission to the vacuum arc quenching chambers is effected by insulating bars (page 8, 30). The actuator (2) immediately charges the spring-loaded energy storage mechanism (3) through the screw gearing (F).
If the supply voltage should fail, the spring-loaded energy storage mechanism can be charged by means of a crank (4). Through an overtighten locking device (4.1) in the actuating mechanism, an overthightening of the spring-loaded energy storage mechanism is not possible.
The energy storage status is indicated (5).
The circuit-breaker is switched off by operating the OFF push-button (6) or of a release (7.1).
The electrical components (8) (e.g. auxiliary switches) are arranged above the spring-loaded energy storage mechanism.
The 50-pole pin-plug connector (9) is mounted on the top of the switch frame. The male connector (9.1) as assembly group (2-74060950) is part of the delivery or part of the corresponding panel.

The Vacuum-Tubes (see above)

These are housed in moulded parts of Duroplast insulating material on epoxide glass-fibre basis (1 and 25). This protects them against damage during transportation, assembly, a.s.o. The design of the moulded parts means that insulators can be omitted what enables a very compact switch design.
A further advantage of this design is that the switch pole can be removed in one piece.
The kinematics described also has the advantage that in both open and closed position the poles are free of forces from the stored energy mechanism, nor they apply any forces (e. g. those of the opening or contact pressure springs) to the operating bars (30, 31). The spring (49) ensures that the necessary contact pressure is maintained and compensates for the contact burn which is permissible over the entire life span of the circuit-breaker.
The current flow in the switch pole flows from the upper connection (10) to the fixed contact of the vacuum-tube (12). The laminated contact ribbon (13) is bolted with perforated nuts (38) to the moving contact of the vacuum-tube with interposed safety element (52). The pressure welded end of the contact ribbon forms the lower pole contact surface which is supported by the contact arm (23).

The installed vacuum-tubes are type tested in compliance with the X-ray ordinance of the Federal Republic of Germany.



Vacuum circuit-breaker

Putting into Service

Every switch is adjusted and tested prior to leaving the factory! Nevertheless, the switch should be checked for proper operation before putting into service. Please observe the following:

1. Carefully clean switch and vacuum poles from assembly contamination and dust. Wipe all insulating parts with a dry cloth
2. Check switch for external damages (control cables, vacuum poles).
3. Charge the energy storage mechanism with actuating crank, then switch ON by operating the ON-push-button, after that switch OFF by operating the OFF-push-button.
4. For circuit-breakers with under-voltage releases, please remove the locking screw (page 7).
5. For trial operation with motor actuator, the control and signalling lines have to be connected as shown on the circuit diagram sticked in the cover and on the circuit diagram of the switchgear.

Immediately after connection to the control voltage the actuator charges the energy storage mechanism.

6. Before putting the switch into service please always check all possible types of actuation like manual or manual emergency operation, electrical remote control, tripping of faults as well as auxiliary switches and shunt releases for proper function.

Operation

Please always observe the following when operating the circuit-breaker:

The position indication ⑩ shows whether the circuit-breaker is in ON or OFF status. The circuit-breaker can be switched on or off by operating the push-buttons ① and ⑥.
The stored energy mechanism position ⑤ shows whether the switch is in a charged status. In this case, the last operation is always a breaking operation in order to switch off the circuit-breaker in case of control voltage failure.
With the manual emergency charging mechanism ④, the stored energy mechanism can be recharged by using an actuating crank.

Only charge the stored energy mechanism by using the original crank!

The total switching operations of the circuit-breaker are shown on the counter ⑪.

General

Our products have been on the market for many years and are used thousand fold. Therefore, we are able to argue that the quality of our products offers a high level of operating safety and robustness. To guarantee the requirements made on the switch and to avoid possible mains failures, appropriate maintenance, inspection and possible repair measures are necessary to provide a reliable power supply, wherein the measures taken depend on the age of the switch, switching frequency and the level of the operated current.

Inspection and Maintenance

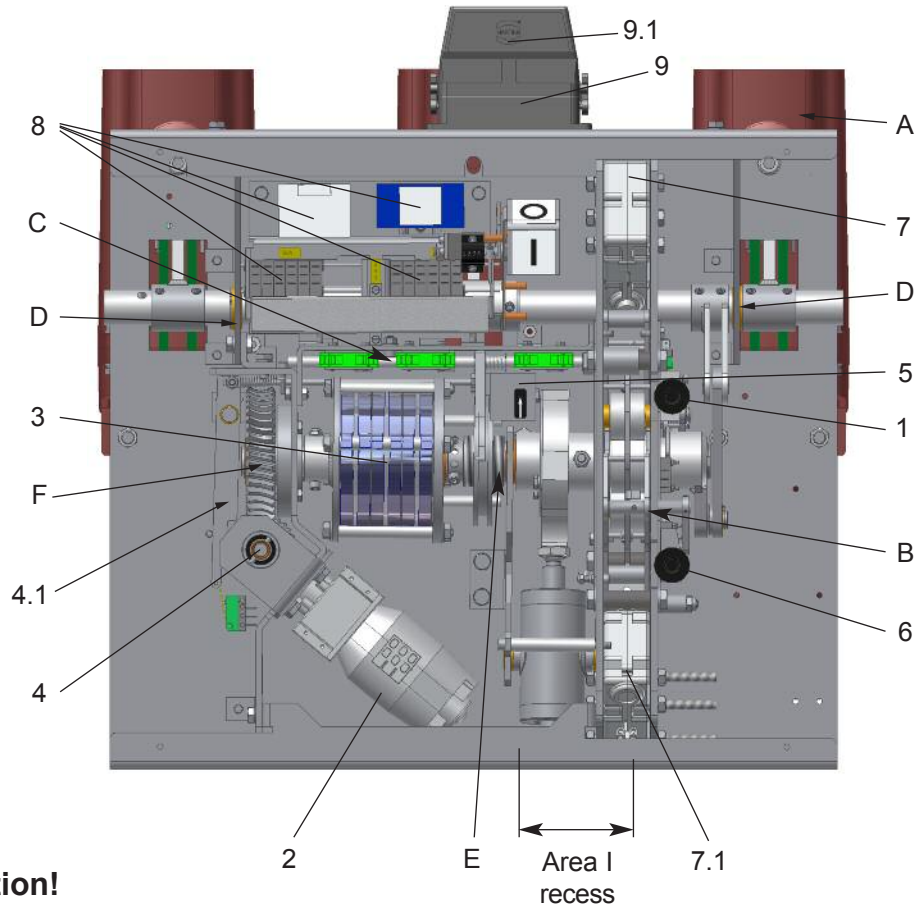
This vacuum circuit-breaker is of very low maintenance. It is merely necessary to grease the stored energy mechanism after 1.000 switching cycles (see b, page 11).
It is also recommended to carry out a visual inspection once a year, even if the switch is seldom operated and only under low load. After 10.000 switching cycles a general overhaul must be carried out by the DRIESCHER service personnel.

Shorter inspection or maintenance intervals can be given through the following facts:

- aggressive atmosphere, strong dusty air, humid switchgear rooms, a. s. o.
- high operating frequency (see table on page 3)
- high switching capacity (see table on page 3)

Before starting to work the working area must be isolated and secured acc. to DGUV Vorschrift 3. The local safety regulations have to be observed (e.g. 5 safety rules).

Any kind of maintenance, repair, servicing and subsequent conversion works may only be carried out by the DRIESCHER service or skilled personnel authorized from DRIESCHER.



Caution!

Touching live parts has fatal consequences or leads to death. The device is only to be operated by qualified personnel that is familiar with the operating instruction and that observes all warning information.

Maintenance

The following points have to be observed during maintenance:

a) Clean the vacuum poles **A** on the back with a clean, dry cloth from dust and dirt.

b) Lubrication of the stored energy unit;

- all bearings and joints of the operating mechanism **B**
- the control shaft **C**
- the operating shaft bearing **D**

have to be lubricated with Rivolta S.K.D 4002, places with difficult access have to be lubricated with Rivolta S.K.D. 16.

- the threaded bush **E**
- the screw gearing **F**

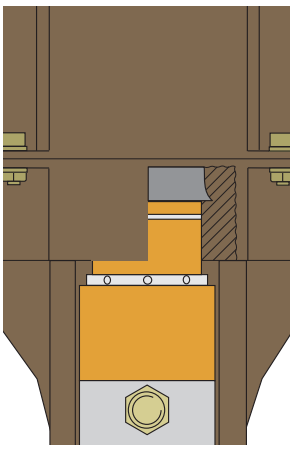
with KLÜBERPLEX BE31-102 (Klüber).

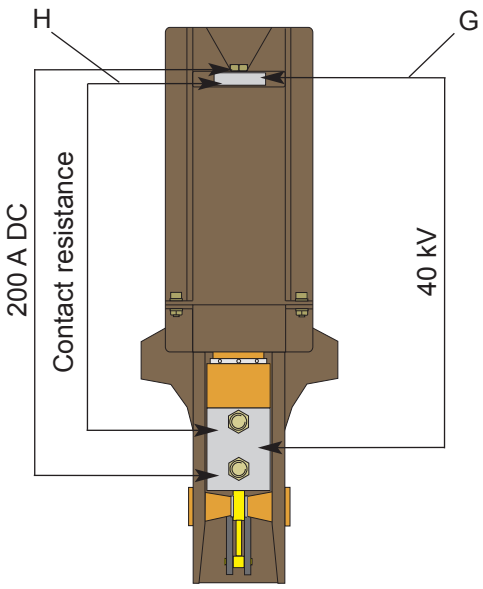
c) The burn-off of the contacts in the vacuum-tubes mainly depends on the number of short-circuit breakings and the respective levels of currents applied (see table on page 3).

d) Check the vacuum by applying a voltage test (40 kV) across the contact gap **G** of each pole in switched OFF condition.
For this purpose we use the vacuum tester "VIDAR" of

Megger/Programma GmbH
Obere Zeil 2
61440 Oberursel
Germany
Phone 00 49 61 71 - 92 98 70

e) Measure the contact resistance **H** of the main current at a test current of 200 A DC. The permissible voltage drops depend on the manufacturer of the vacuum-tubes and are therefore only available on request.
If the permissible voltage drops are exceeded during measurement, the circuit-breaker must be switched on and off several times at zero current and then repeat the measurement. In case of a re-exceeding the switch may not be released.





Corrective maintenance

Wearing or defective parts, i.e. broken, fractured, cracked or bent parts (of plastic, metal, NF metals) are not to be repaired or touched up (welding, soldering, priveting, etc.). Only use original parts and accessory of DRIESCHER or parts approved by DRIESCHER which have been tested for safety, function and suitability.

Service

You can reach our trained personnel at any time, also outside office hours, for assistance in troubleshooting or information on compatibility, assembly or maintenance. Please always indicate the data of the type label.
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- Compact switchgear assemblies
- Customer-specific models
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- Indoor circuit breakers (low oil content and vacuum)
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- Concrete construction
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- Hand-operated and motor-operated mechanisms for indoor and outdoor application

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- For medium and low voltage
- For station equipment
- Insulators (0,5 kV - 38,5 kV)
- Plastic and glass fibre-reinforced plastic screening

Service

- Maintenance and Service of all switches and switchgear
- Training courses and seminars
- Thermography; Live-line working

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