

UniGear ZS3.2

Air-insulated medium voltage switchgear
Instruction manual



Your safety first – **always!**

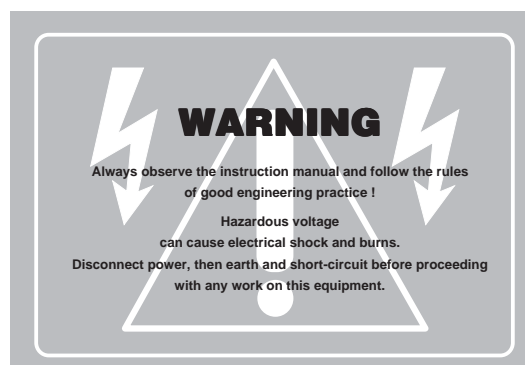
That's why our instruction manual begins with these recommendations:

- 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.

-  **Danger!**

Pay special attention to the hazard notes in the instruction manual marked with this warning symbol.

- Make sure that under service 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.



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

The metal-clad, three-pole air-insulated switchgear panels without disconnectors of UniGear ZS3.2 series are factory-assembled, type-tested indoor panels for a rated voltage of 36/40.5 kV. They are designed as withdrawable module type panels, and fitted with a single busbar system. The withdrawable parts are fitted with vacuum circuit-breakers.

Details of the technical design and configuration of individual switchgears, such as the technical data, detailed equipment lists for the individual panels and comprehensive circuit documentation, etc., can be found in the relevant order documents.

1.2 Standards and specifications

UniGear ZS3.2 switchgear panels comply with the standards and specifications for factory-assembled and type tested high voltage switchgears to VDE 0670 and the relevant IEC publications 62271-200 and 60694. In addition, in accordance with DIN VDE 0470 and the equivalent IEC 60529, the switchgear panels have degrees of protection IP 4X for the enclosure and

IP 2X for the partitions.

All other relevant VDE specifications, especially DIN VDE 0101, VDE 0105 and DIN VDE 0141, the corresponding IEC publications, the national or local safety at work regulations and the safety regulations for production materials are to be followed during erection and operation of these systems. Above and beyond this, the order-related data from ABB Xiamen Switchgear Co., Ltd. are to be taken into account.

1.3 Service conditions

1.3.1 Normal service conditions

The switchgears are fundamentally designed for the normal service conditions for indoor switch-gears to VDE 0670 part 1000/IEC Publication 60694. The following limit values, among others, apply:

- Ambient temperature:
 - Maximum +40° C
 - Maximum 24 h average +35° C
 - Minimum (according to "minus 5 indoor class") -15° C
- Humidity
 - Highest average value measured over 24 hours
 - Relative humidity 95 %
 - Highest average value measured

over 1 month

Relative humidity 90 %

Remark:

VDE 0670 part 6 amends the content of VDE 0670 part 1000 with respect to humidity as follows: With indoor installation, it is assumed that the humidity within the enclosure can reach high values, but that there is normally no condensation on the installed equipment. Condensation can be prevented by appropriate configuration of the station building or switchgear room.

The maximum site altitude is 1000 m above sea level.

1.3.2 Special service conditions

According to VDE 0670 part 1000 and IEC 60694, the manufacturer and user may agree on special service conditions which deviate from the normal service conditions. The manufacturer must be consulted in advance about each special service conditions.

Examples are as follows:

- At site altitudes above 1000 m, the effects of the reduction in dielectric strength of the air on the insulation level are to be taken into account.
- Increased ambient temperatures must be compensated for in the design of the busbars and tee-off conductors, or the current carrying capacity will be limited. Heat dissipation in the switchgear panel can be assisted by fitting additional ventilation facilities.

Note on any special climatic service conditions:

When switchgears are operated in areas with high humidity and/or major rapid temperature fluctuations, there is a risk of dew deposits which must remain an exception in normal service conditions for indoor switchgears. Preventive action (e.g. fitting electric heaters) must be taken in consultation with the manufacturer to avoid such condensation phenomena and the possibly resulting corrosion and other adverse effects.

2 Technical data

2.1 Electrical data

Rated voltage	kV	36	40.5
Rated power frequency withstand voltage	kV	80	95
Rated lightning impulse withstand voltage	kV	170	185
Insulation to:		DIN VDE/IEC	Chinese GB
Rated frequency	Hz	50/60	50
Rated current of busbars	A	...3150	...3150
Rated current of tee-offs, circuit-breaker	A	...3150 ³⁾	...3150 ³⁾
Rated peak withstand current ¹⁾	kA	...80 ⁵⁾	...80
Rated short-circuit breaking current of circuit-breaker	kA	...31.5 ⁴⁾	...31.5
Rated short-time current 3 s ¹⁾	kA	...31.5 ⁴⁾	...31.5
Auxiliary voltage	V	DC ²⁾ 60, 110, 125; AC 110, 220	DC 110, 220

1) Take the short-circuit withstand capability of the instrument transformers into account separately.

2) Special DC voltages on request.

3) Up to 3150 A at 40°C and 2500 A at 55°C with forced ventilation.

4) 40 kA on request.

5) 100 kA on request.

2.2 Resistance to internal arc faults

The fault withstand capability is 31.5 kA, 1 s. Criteria

1 to 6 of PEHLA guideline no. 4 (in conjunction with VDE 0670 part 6 and IEC 62271-200) are fulfilled. In individual cases, depending on the configuration of the switchgear panels and/or the switchroom conditions (e.g. low ceiling height), additional measures may be necessary to ensure compliance with criterion 5.

2.3 Dimensions and weights

(Figure 2/1 and 2/2)

Dimension according to Figures 2/1 and 2/2

Weight: 1300 kg to 1850 kg, according to the equipment installed.

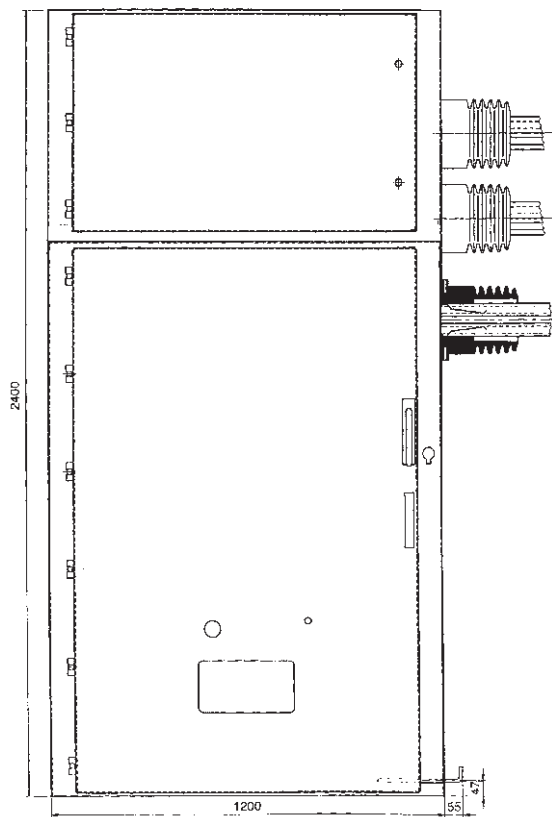


Figure 2/1: Dimensions, without ventilation, front view.

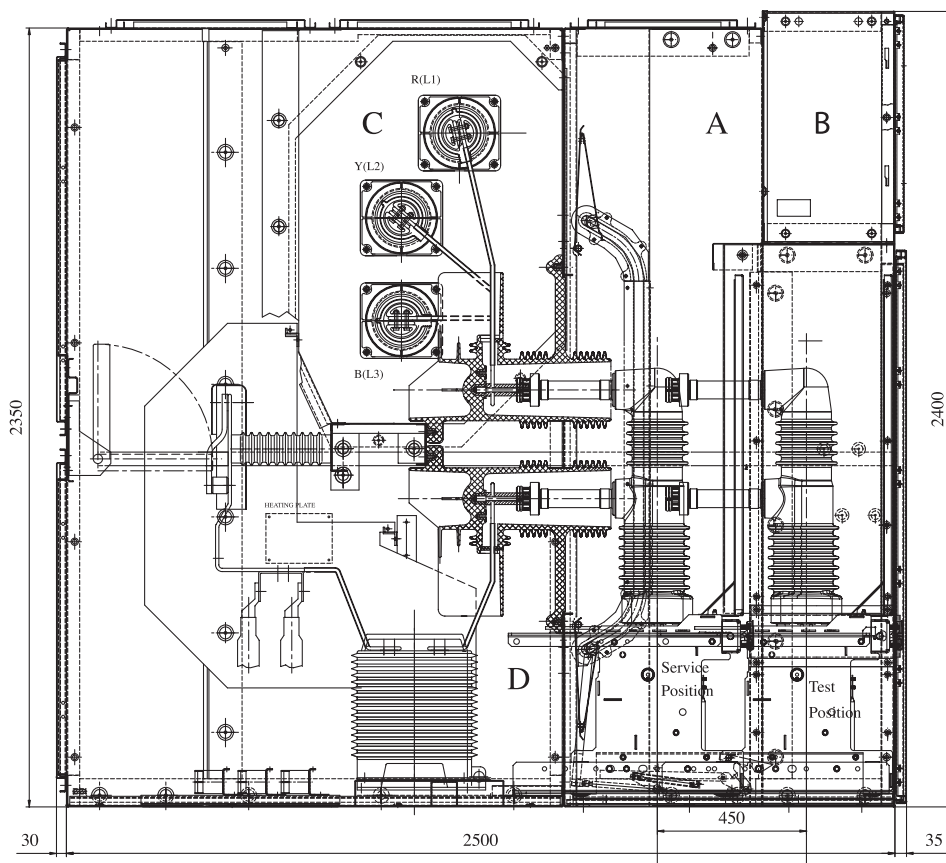


Figure 2/2: Dimension, UniGear ZS3.2, ...2000 A, section view.

- A Circuit-breaker compartment
- B Low-voltage compartment
- C Busbar compartment
- D Cable connection compartment

3 Switchgear panel structure and equipment installed

3.1 Basic structure and variants

(Figures 3/1 to 3/6)

The basic structure of the switchgear panels comprises the panel itself, which is fixed in position, and the movable, withdrawable part with vacuum circuit-breaker. Figures 3/1 to 3/6 show the structure of a panel and the electrical equipment fitted. The whole panel is constructed by bolting up the double folded components manufactured from high quality Al-Zn sheet steel, precisely folded and exactly fitted surface from and extremely rigid construction. Illustration shows the structure of a panel and the electrical equipment fitted. Together with the basic panel version for use as an incoming or outgoing feeder panel, variants, for example for busbar sectionalizing (in conjunction with a bus riser panel) or metering, are available. Further details on the structure and equipment configuration of the switchgears can be taken from the order documents for the particular case.

The panel consists of the following components

- Circuit-breaker compartment
- Busbar compartment
- Cable connection compartment
- Low voltage compartment

The compartments are separated from each other by earthed sheet steel partitions.

3.2 Enclosure and partitions

(Figures 3/1 to 3/6)

The enclosure and internal partitions of the switchgear panels consist of high quality aluminium zinc coated sheet steel. The three high-voltage compartments are fitted with secured pressure relief plates located at the top. These open upward if internal arc faults result in overpressure. The front and rear of the panels is closed off by flameproof doors which open to an angle of almost 180°. Neighbouring switchgear panels are partitioned from one another by the side walls of each panel and the air cushion which remains between these walls as a result of the design when the panels are joined together. This method of construction prevents them from melting through if an arc fault should occur. All heads of the structure bolts do not stick up the fitting surface on the side walls as result of embossing processing used. Thanks to that, it is possible to remove the middle panel of the switchgear without removing the adjacent panels. The separately fitted low-voltage compartment B is designed as a self-supporting shockproof and flameproof sheet steel enclosure, separate from the high-voltage area. Even with the

with-drawable part 50 removed (hinged shutters 35.1/ 35.2 in the closed position), there is protection against contact with live parts in busbar compartment C and cable connection compartment D.

The necessary safety measures to counteract the effects of an internal arc fault must be ensured in connection with the ceiling height. This may in individual cases possibly necessitate additional operator protection measures on the switchgear panels.

The front and rear doors of the switchgear panels and the cover plates of the end panels are thoroughly cleaned, treated to prevent corrosion, and then painted with a high-quality two-coat stoved enamel system in colour RAL 7035 (or special colours as agreed) which are notable after stoving for their particular insensitivity to impacts and corrosion.

3.3 Compartments in the switchgear panels

Circuit-breaker compartment

(Figures 3/2, 3/9 to 3/13)

The circuit-breaker compartment A fitted with the necessary guide rails accommodates the withdrawable part 50, which can be moved between the service position and the test/disconnected position.

If the withdrawable part is moved from the service position into the test/disconnected position, the fixed contacts 25.1/25.2 located in the connection block 20.1/20.2 in busbar compartment C and cable connection compartment D are automatically covered by metal plates which will be interlocked mechanically or can be locked by a padlock when the withdrawable part is moved away. In the test/disconnected position, the withdrawable part is still completely inside the panel with the door closed.

The switching operations (including manual operation) are carried out with the doors closed.

Withdrawable part

(Figures 3/2, 3/10, 3/11, 3/14, 3/15, 6/1 to 6/7)

The manually moved withdrawable part consists of a robust sheet steel structure on which the circuit-breaker poles are mounted and the breaker mechanism with ancillary components are installed.

Contact arms 57.1/57.2 with spring-loaded contact systems are fitted to the circuit-breaker poles. These create the electrical connection to the switchgear panel when the withdrawable part is inserted into the service position. Detail information on the vacuum circuit-breaker can be found in the corresponding instruction manual.

The signalling, protection and control wiring between the switchgear panel and the withdrawable part is coupled by a multiple pin control wiring plug

connector 10.

As soon as withdrawable part 50 has been slid into the switchgear panel and its interlock yoke 51 has engaged in the test/disconnected position, it is positively connected to the switchgear panel. At the same time, it is earthed by earthing contacts 50.1 and earthing rail 19/19.1. The position of the withdrawable part can be checked on the electrical position indicator or through the sight glass in the door at any time. The stored-energy spring mechanism of the circuit-breaker including controls and indicators is accessible at the front of the withdrawable part. Apart from the version with a fitted circuit-breaker, withdrawable parts with other equipment, e.g. for metering, are available.

Busbar compartment

(Figures 3/2 to 3/6, 3/17, 3/18, 5/7 to 5/17)

Busbars 3 are laid in sections from panel to panel, and are held in place by the tee-off conductors 3.1 and by busbar bushings 29. The conductor material used is tubing with a D-shaped cross-section, in either single or double configuration depending on the current rating. The connection to the flat tee-off conductors is made without any special connecting clamps. The busbars and tee-off conductors are covered with shrink-on sleeves. The bolt connections in the busbar system are normally covered by insulating covers 58. In conjunction with bushings 29, panel by panel partitioning is realised.

Cable connection compartment

(Figures 3/2, 5/5, 5/6, 6/10 to 6/12)

Current transformers and an earthing switch (with manual operating mechanisms) are located here. Installation of surge arrestors is possible. Multiple parallel power cables can also be entered without difficulty. The cable sealing ends 16 can be fitted in particularly favourable conditions. A removeable plate for cable glands is located in the cable entry area.

Installation of voltage transformers at cable side of the panel is in preparation and will have influence on the depth of the panel.

The earthing switch is designed with a making capacity of 62.5 kA (design for 80 kA in preparation).

The detailed information on the earthing switch can be found in the corresponding instruction manual.

Low-voltage compartment

(Figures 3/1 to 3/6)

The low-voltage compartment, together with its front door, accommodates the secondary equipment of the switchgear panel required for the particular application.

The control wiring in the switchgear panel area is

led through generously dimensioned and metal covered ducts. The left-hand duct is reserved for the incoming and outgoing control wires, and the internal wiring in the panel is located on the right-hand side.

At the top of the left hand duct, an entry for control cables is reserved with the free-cut rubber sealing which will keep the protection class IP4X for the whole enclosure of the switchgear panel.

3.4 Interlocks/protection against maloperation

(Figures 3/2, 3/10 to 3/12, 6/1 to 6/8)

A series of interlocks are provided to prevent fundamentally hazardous situations and mal-operation, thus protecting both personnel and the switchgear itself. The interlocks which are normally individually effective are as follows:

- The withdrawable part 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 (between positions, the circuit-breaker is mechanically interlocked, and also electrically interlocked in the case of circuit-breakers with electrical releases).
- The circuit-breaker can only be closed when the withdrawable part is precisely in the defined test position or service position. Between these positions, the circuit-breaker is mechanically interlocked, and also electrically interlocked in the case of 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).
- Low-voltage plug 10.2 can only be inserted or removed when the withdrawable part is in the test/disconnected position.
- Earthing switch 6 can only be closed when the withdrawable part is in the test/disconnected position or the removed position (mechanical interlock).
- The withdrawable part 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 part and/or earthing switch operating mechanism, can be found in the order documents for each individual case (see also section 7.4).
- The hinged shutters can be secured with padlocks in the closed position when the withdrawable part has been removed (figure 3/9).

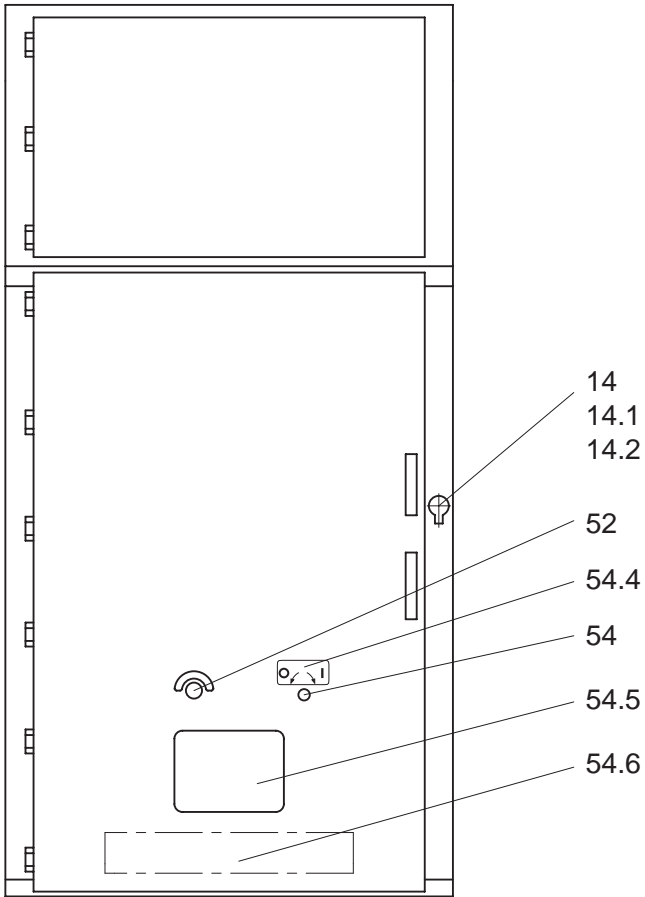


Figure 3/1: UniGear ZS3.2, front view.

- 14 Earthing switch, operation mechanism
- 14.1 Hexagonal shaft
- 14.2 Slide
- 52 Spindle
- 54 ON-OFF operating shaft
- 54.4 Labels for operating advice
- 54.5 Sight glass
- 54.6 Ventilation grid below (optional)

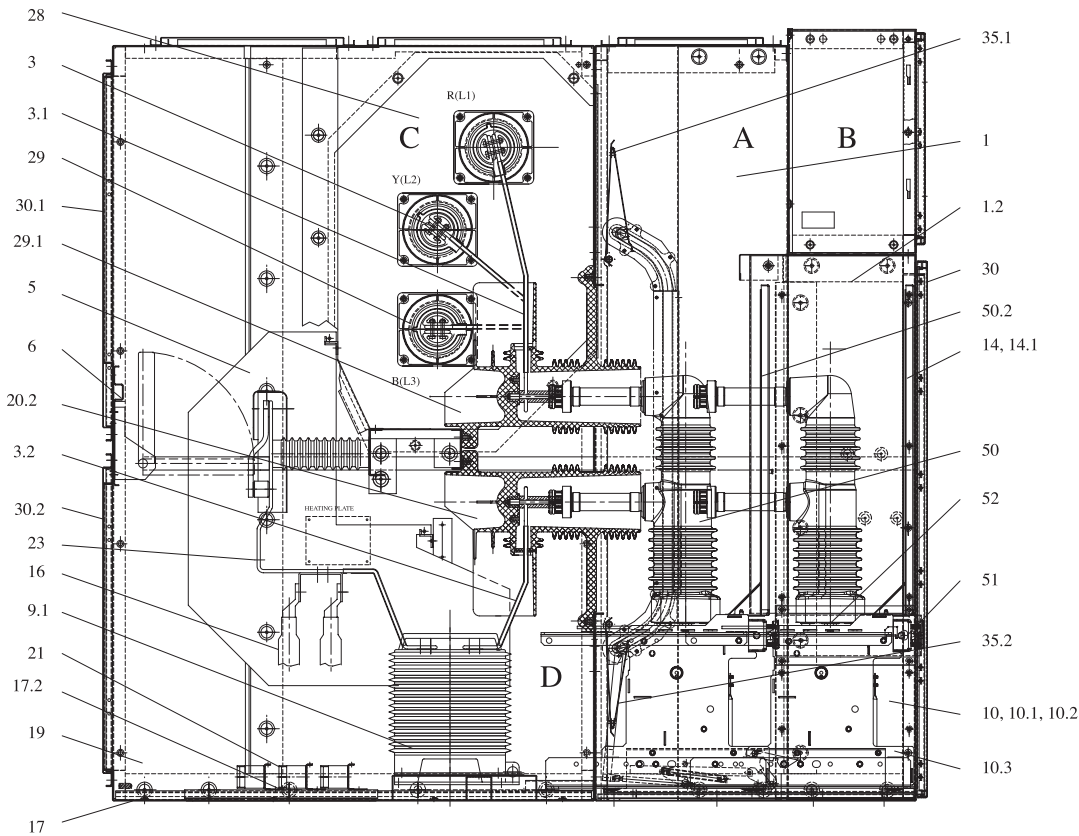


Figure 3/2: UniGear ZS3.2 section view, basic structure of an incoming or outgoing feeder panel, ...2000 A.

A	Circuit-breaker compartment	17	Floor cover plate
B	Low-voltage compartment	17.2	Reducer ring
C	Busbar compartment	19	Main earthing bar
D	Cable compartment	20.1	Spout, above
1	Enclosure	20.2	Spout, below
1.1	Pressure relief plate	21	Cable clamp
1.2	Control wiring duct	23	Cable connection point
3	Busbar	28	Bushing plate
3.1	Tee-off conductor, busbar side	29	Busbar bushing
3.2	Tee-off conductor, cable side	30	Front door for circuit-breaker compartment
5	Insulated separating plate	30.1	Rear panel cover, above
6	Earthing switch	30.2	Rear panel cover, below
9.1	Current transformer	35.1	Hinged shutter system, above
10	Control wiring plug connector	35.2	Hinged shutter system, below
10.1	Control wiring socket	50	Withdrawable part (with circuit-breaker, type VD4)
10.2	Control wiring plug	50.2	Front partition plate
10.3	Interlocking arm for wiring plug	51	Interlock yoke
14	Earthing switch operation mechanism	52	Spindle
14.1	Hexagonal shaft		
16	Cable sealing ends		

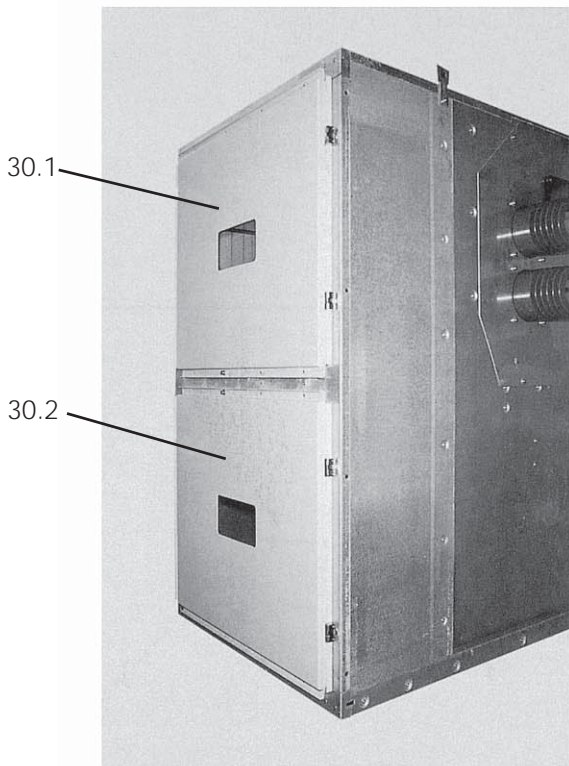


Figure 3/8: Panel of type UniGear ZS3.2, rear side.

- 30.1 Rear cover, above
- 30.2 Rear cover, below

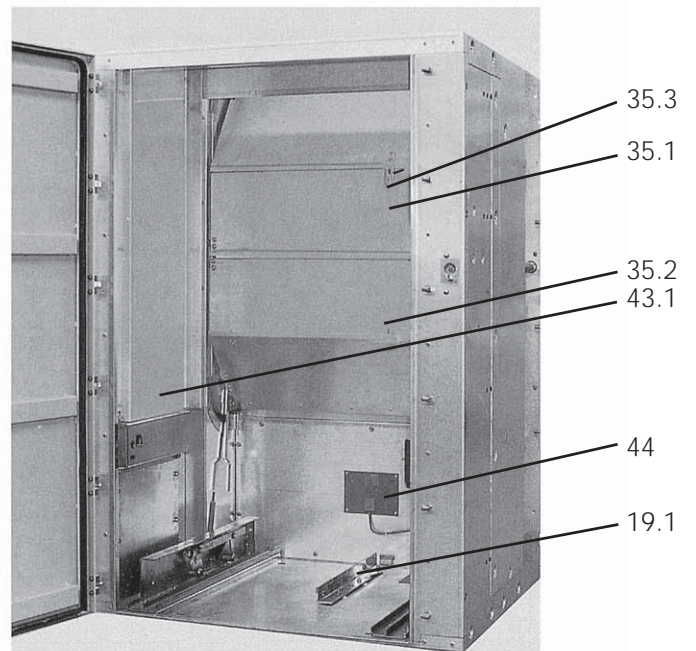


Figure 3/9: Circuit-breaker compartment, door open, withdrawable part removed.

- 19.1 Earthing rail
- 35.1 Hinged shutter system, above
- 35.2 Hinged shutter system, below
- 35.3 Fishplate for inserting a padlock
- 43.1 Duct cover for control cables
- 44 Heater, optional (see section 1.3.2)

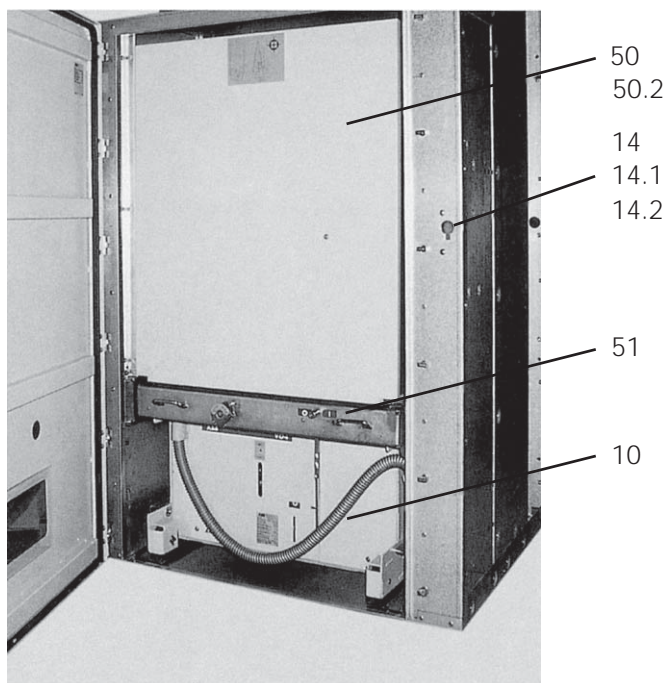


Figure 3/10: Circuit-breaker compartment, door open, withdrawable part in isolated/disconnected position.

- Control wiring plug connection engaged.
- 10 Control wiring plug connector
- 14 Earthing switch, operation mechanism
- 14.1 Hexagonal shaft
- 14.2 Slide
- 50 Withdrawable part (with circuit-breaker, type VD4)
- 50.2 Front partition plate
- 51 Interlock yoke

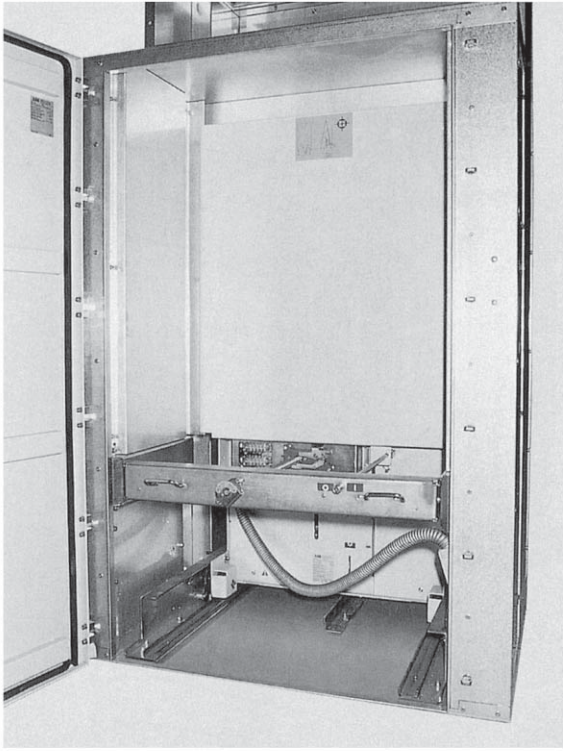


Figure 3/11: Circuit-breaker compartment, door open, withdrawable part in service position.

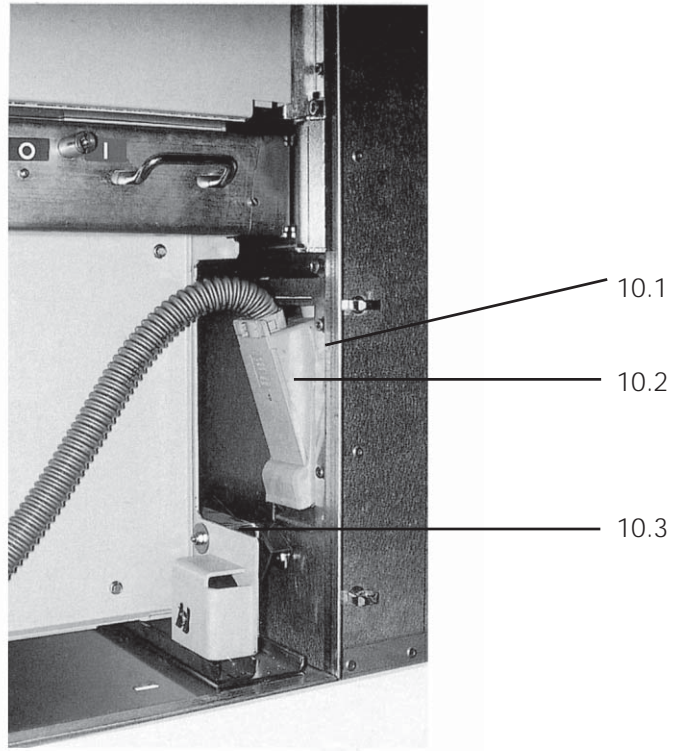


Figure 3/12: Circuit-breaker compartment withdrawable part in service position.

Control wiring plug connection engaged.

Interlocking arm not in blocking position.

10.1 Control wiring socket

10.2 Control wiring plug

10.3 Interlocking, for control wiring plug, disengaged

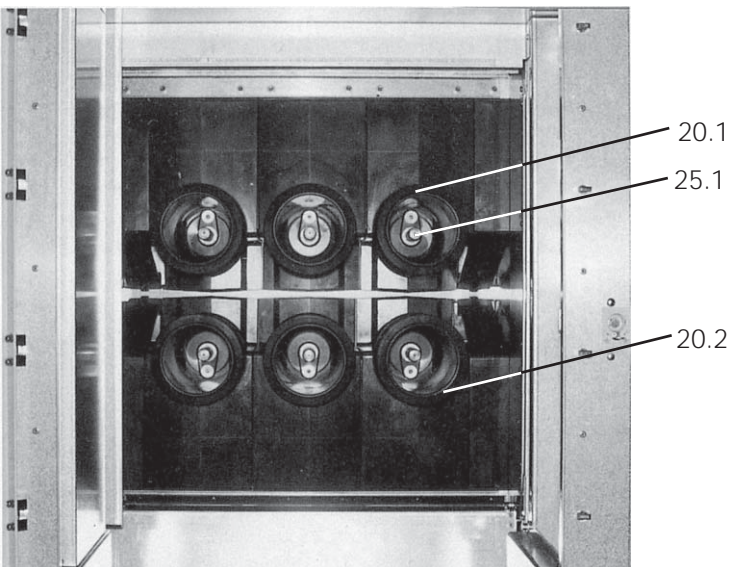


Figure 3/13: View into circuit-breaker compartment withdrawable part removed, hinged shutters opened.

20.1 Spout, above

20.2 Spout, below

25.1 Contact pin, ...1600 A



Figure 3/14: Withdrawable part with circuit-breaker, VD4, operating mechanism side control wiring plug plugged at front partition of the circuit-breaker.

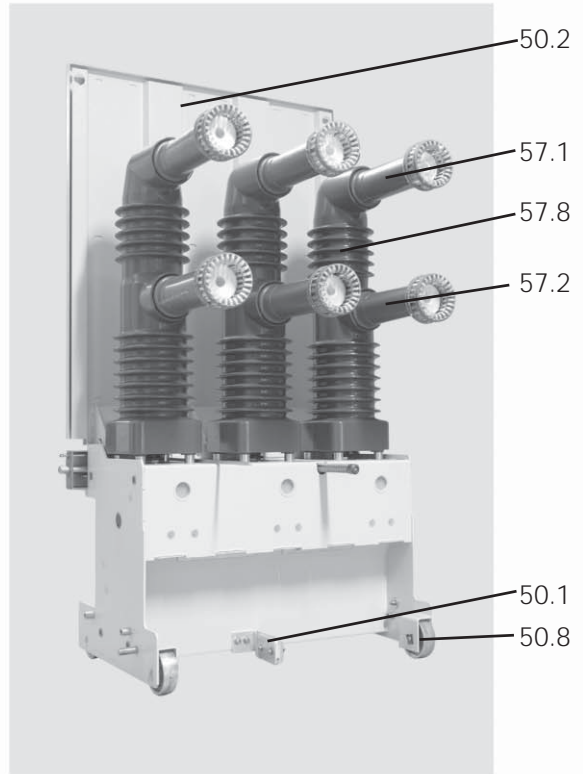


Figure 3/15: Withdrawable part with circuit-breaker, VD4, operating side.

- 50.1 Earthing contact
- 50.2 Front partition plate
- 50.8 Wheel
- 57.1 Upper contact arm, ...1600 A
- 57.2 Lower contact arm, ...1600 A
- 57.3 Contact system, ...1600 A
- 57.8 Embedded pole

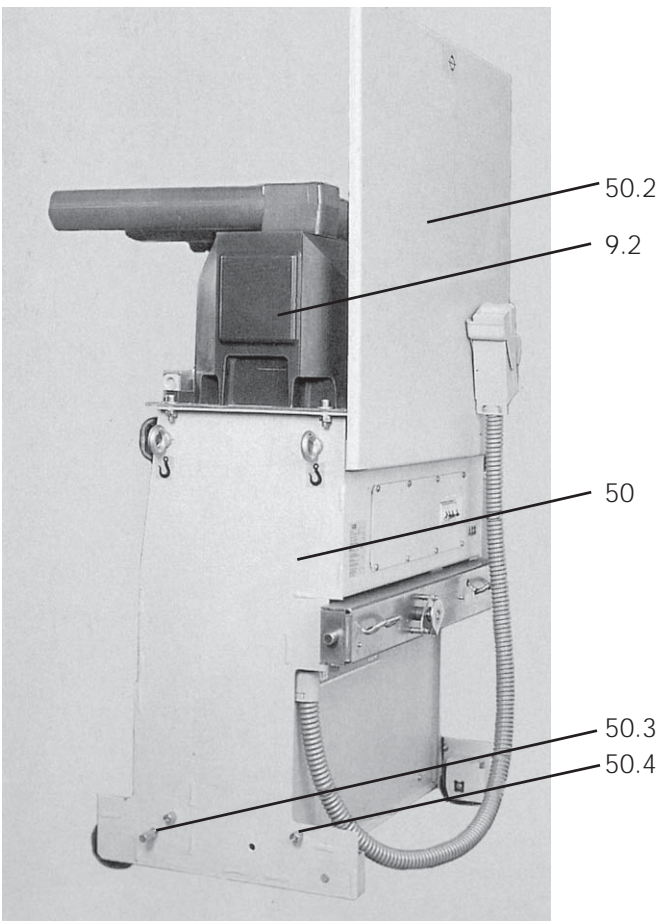


Figure 3/16: Withdrawable part with metering unit, type ME 36/40.5 kV, left and operator's side view.

- 9.2 Voltage transformer
- 50 Frame of the withdrawable part
- 50.2 Front partition plate
- 50.3 Pin (for opening the shutter)
- 50.4 Guide cam

For information refer to instruction manual BA 426/E. Metering unit on withdrawable part.

4 Dispatch and storage

4.1 Condition on delivery

The factory assembled switchgear panels are checked at the works for completeness in terms of the order and simultaneously subjected to routine testing (normally without AC voltage testing of the busbars) to VDE 0670 part 6 or IEC publication 62271-200, and thus tested for correct structure and function.

The busbars are not assembled at factory. The busbar material, fasteners and accessories are packed separately.

4.2 Packaging

The switchgear panels are despatched in appropriate packaging for the prevailing conditions, e.g. „seaworthy packaging“, or also without packaging, as required in individual cases. Particularly for overseas transport, even in containers, they are sealed in airtight plastic sheeting with an appropriate quantity of drying agent to protect them from damage due to moisture, and in many cases fitted with a separate moisture indicator. When aluminium composite sheeting is used, a window has to be fitted for observation of the moisture indicator. The drying agent is active as long as the coloured indicator remains blue. When the colour changes to pink, the relative humidity stated on the bag (e.g. 40%) has been exceeded inside the packaging (possibly as a result of damage). Suitable action including replacement of the drying agent bags is then necessary if the packaging condition is to be maintained. The instructions for use of the drying agent bags to DIN 55 473 are to be followed carefully.

4.3 Transport

(Figure 5/4)

The transport units are individual panels. The switchgear panels are each fitted with four lifting lugs.



Transport switchgear panels upright. Only ever carry out loading operations when it has been ensured that all precautionary measures to protect personnel and materials have been taken and using a

- crane,
- fork-lift truck and/or
- manual trolley jack.

Loading by crane:

- Fit lifting ropes of appropriate load capacity with shackles (opening width ≥ 30 mm, fastening bore diameter 30 mm).
- Maintain an angle of $\geq 60^\circ$ from the horizontal for the ropes leading to the crane hook. The use of a crane cross beam is urgently recommended.

Transport circuit-breaker unit or metering truck with appropriate care: Please refer to instruction Manual BA 442/E, section 4, transport

- Only handle modules by crane with transport crossbeam and a suitable harness with lifting ropes.
- Lifting tackles must never catch on the breaker poles or the part of the operating mechanism! It is to be ensured that the breaker do not suffer impacts or other injurious physical stresses during handling.
- Only handle the modules by crane with bolted on transport brackets (see BA 442/E), suitable lifting ropes and crane harness.
- Take care not to allow the modules to tip, as the centre of gravity is high!
- When transporting modules by forklift, they must be fastened to pallets and secured to the lift truck column.
- When moving the withdrawable part only use the sliding handles 51.2 (e.g. for racking in/out the withdrawable part into/out of the switchgear panel or for the transport of the truck in the switchgear room). Do not bring any force on the front partition plate 50.2 of the truck.
- Take care that the catch pins 51.1 on the interlock yoke 51 are engaged with the guiding rails 51.3 in the switchgear when moving-in withdrawable part into the panel.

4.4

Delivery and intermediate storage

The responsibilities of the consignee when the switchgear arrives at site include, but are not limited to, the following:

- Checking the consignment for completeness and freedom from damage (e.g. also for moisture and its detrimental effects). In cases of doubt, the packaging must be opened and then properly resealed, fitting new drying agent bags, when in intermediate storage is necessary.
- Precisely documenting any short quantities, defects or transport damage on the consignment note and notifying the shipper or carrier immediately and reporting these to the relevant authorities within two weeks.
- Always take photographs to document any major damage.

Optimum intermediate storage – as far as this would be necessary at all – without detrimental consequences depends on compliance with a number of minimum conditions for the switchgear panels and assembly materials.

Switchgear panels with simple packaging or no packaging:

- A dry and well-ventilated store-room, atmosphere in accordance with VDE 0670 part 1000 / IEC 60694.
- Room temperature which does not fall below -5°C.
- No other detrimental environmental influences.
- Store switchgear panels standing upright.
- Do not stack switchgear panels.
- Do not remove or damage the packaging.
- Loosely cover unpackaged switchgear panels with plastic film to prevent dirt ingress. Sufficient air circulation must be maintained to prevent corrosion.
- Carry out regular checks for any condensation until erection starts.

Switchgear panels with seaworthy or similar packaging

and internal protective film:

- Store the transport units in a dry place, protected from the weather and from damage.
- Check the packaging for undamaged condition.
- Check the indicator for correct function of the drying agent on arrival of the consignment and at appropriate intervals, see also the details in section 4.2.
- When the maximum storage life after the date of packaging is exceeded, the protective function of the packaging including its anti-corrosion effects will cease to be effective sooner or later, depending on local conditions. If intermediate storage has to be prolonged, suitable action must be taken.

Note:

Do not walk on the roof of the panels (rupture points in pressure relief devices)!

5 Assembly of the switchgear at site

In the interests of an optimum installation sequence and the assurance of a high quality standard, site installation of the switchgear should only be carried out by specially trained skilled personnel, or at least supervised and monitored by responsible persons.

5.1 General site requirements

On commencement of installation at site, the switch room must be completely finished, provided with lighting and site electricity supply, lockable, dry and with facilities for ventilation. All the necessary preparations such as wall openings, ducts, etc., for laying of the power and control cables up to the switchgear must already be completed.

Compliance with the conditions for indoor switchgear to VDE 0670 part 1000 and IEC 60694, including the conditions for the „minus 5 indoor“ temperature class must be ensured.

5.2 Foundation frame on a concrete floor

(Figures 5/1 to 5/2)

The switchgear is preferably to be erected on a foundation frame set into the switch room floor.

The guideline structural data listed below facilitate a rough calculation of the space required and preliminary planning of the room design for a switchgear project. When the final construction documents are compiled, the binding data supplied by ABB Xiamen Switchgear Co., Ltd. must always be taken into account!

The stipulations of DIN 43 661 are also to be complied with when the foundation is laid. This particularly applies to the evenness and straightness tolerances as a precondition for perfect installation of the switchgear.

The foundation frame, consisting of one or more parts depending on the size of the switchgear, can be supplied with the switchgear by ABB Xiamen Switchgear Co., Ltd.; it is usually laid by site personnel and should if possible be aligned and inspected under the supervision of a ABB specialist.

Installation of the foundation frame:

- If the foundation frame consists of several part 60.1/60.2, bolt these together at the prepared joint locations using links 60.3 in the specified sequence and so as to achieve a level surface.
- Place the foundation frame precisely in the specified position on the concrete floor in accordance with the installation drawing.
- Enter jacking screws 60.8 and place steel strips 60.4 below them.
- Carefully align the foundation frame along the entire surface and to the correct height by screw-

ing the jacking screws down by an appropriate amount and using a levelling instrument.

The top edge of the foundation frame should be 2 mm above the finished floor surface. This facilitates erection and alignment of the switchgear panels. In some cases, this means that the material thickness of an additional floor covering to be fitted later must be taken into account separately. Tolerances for laying of the frame to DIN 43 661, version A,

e.g. evenness tolerance:

± 1 mm within a measuring length of 1 m,

e.g. straightness tolerance:

maximum 1 mm per m, but not more than 2 mm over the entire length of the frame.

- Slide brackets 60.5 against the frame at two points - for each 3 m of frame length -, secure them to the concrete floor with plugs 60.6 and bolts 60.7, and weld them to the frame. The set position of the frame on the concrete floor must not be altered during this operation!
- Weld the foundation frame parts together. Grind projecting parts and weld seams on the top of the frame flat.
- Make the necessary preparations for perfect earthing of the foundation frame with 30 x 4 mm galvanized steel strip. Two connections are necessary for long switchgears.
- When the floor topping is applied, carefully back fill the foundation frame, leaving no gaps.
- The foundation frame must not be subjected to any injurious impacts or pressures, particularly during the installation phase.

If these conditions are not fulfilled, problems during assembly of the switchgear and possibly with movement of the withdrawable parts and opening and closing of the doors cannot be ruled out.

Structural data

Table for figure 5/1 and 5/2:

Rated voltage	kV	36	40.5
System type		UniGear ZS3.2	UniGear ZS3.2
Panel equipment		Withdrawable	Withdrawable
Panel width	mm	1200	1200
Aisle width (front side of panel) ¹⁾	mm	2000	2000
Aisle width (rear side of panel) ¹⁾	mm	1500	1500
Assembly openings:			
in ceilings:			
Width:	mm	1400	1400
Length:	mm	2800	2800
in doors:			
Width:	mm	1400	1400
Height: ²⁾	mm	2600	2600
Panel weight	kg	1100 to 2000	1100 to 2000
Ceiling load	kg/m ²	1000	1000

1) Determined by VDE 0101 and the data for maximum panel width.

2) Applies to low voltage compartments of standard height.

*Add 200 mm for top mounted low voltage compartments
and customized low voltage compartments.*

5.3 Assembly of the switchgear panels

(Figures 3/1 to 3/6, 5/4 to 5/17)

Use DIN screws of tensile class 8.8. The tightening torques for the busbar screw connections with dished washers are as follows:

Recommended tightening torque ¹⁾²⁾ Nm		
Thread	Lubricant ³⁾	
	Without	Oil or grease
M 6	10.5	4.5
M 8	26	10
M 10	50	20
M 12	86	40
M 16	200	80

1) The rated tightening torques for fasteners without lubrication are based on a coefficient of friction for the thread of 0.14 (the actual values are subject to an unavoidable, partly not inconsiderable, spread).

2) Rated tightening torques for fasteners with lubrication in accordance with DIN 43 673.

3) Thread and head contact surface lubricated.

Consult the detailed technical documentation for any tightening torques which deviate from the general table (e.g. for contact systems or switch terminals).

The individual installation stages are as follows:

- Transport the switchgear panels to the prepared installation point in the sequence shown on the switchgear plan.
- Dismantle lifting lugs 1.5.
- Remove withdrawable parts 50 from the switchgear panels and store them with suitable protection.
- Release and remove floor cover 17.
- Remove cover 43.1 from the vertical control wiring ducts at the front right and left of the panel.
- Align the switchgear panels on the foundation one after another for correct position and vertical alignment (deviations of the panel edges from the vertical must not exceed 2 mm, particularly at the front) and bolt the panels together. It is advisable to start from the centre when assembling switchgears with more than ten panels.
- Install and screw bushing plates 28 externally to the right or left hand panel wall.
- When the switchgear has been properly assembled, fasten the panels to the foundation frame by welding or by using adequate bolts.

5.4 Installation of the busbars and bushings

(Figures 3/2, 5/7 to 5/17)

- Install bushings 29.

Note:

- (Upper) busbar system:
Insert bushing 29 (phase B/L3) for the lower busbar into bushing plate 28 from the right in contrast to the procedure for the other two bushings.
- (Lower) tie bus system for bus section:
Insert bushing 29 (phase B/L3) for the rear, lower tie bus into bushing plate 28.1 from the right in contrast to the procedure for the other two bushings.
- Always check that there is proper contact between the metal tube in the bushing and the busbar via the contact spring 29.3. Ensure that the contact spring is in the correct position!
- Clean the insulation on the busbar sections with a dry, soft cloth, and check for insulation damage. Remove greasy or adhesive dirt as described in section 7.2.
- Clean and grease the contact surfaces after any dismantling of busbars.
- Prepare insulating covers 58 and lids 58.5 to suit the relevant busbar connections and thread them onto the busbar.
- Install the busbars panel by panel. Screw on the individual busbar elements one above the other (depending on the system layout) and in line with the flat tee-off conductor. Use the socket head bolt 163 as provided. For tightening torque see the table above. Use two dished washers for each screw.
- Bolt one holder 58.1 to each end of the busbars to support the insulating cover 58.
The screws for holder 58.1 are to be tightened with a lower torque.
- Position insulating covers 58 and lids 58.5 over the relevant bolted joint, and slide the lid onto the cover until it clicks into place.

5.5 **Connection of the power and control cables**

(Figures 3/2, 3/9, 5/5 and 5/6)

- Insert, cut to length and strip the power cable.
- Release floor cover and open the control cable duct on the left hand side.
- Prepare and secure cable sealing ends 16 in accordance with the manufacturer's instructions.
- Connect the cable cores to the prepared connection points 23 with strain relief.
- Fit the insulating separating plates to each phase.
- Connect the cable earth.
- Cut the required holes in floor cover 17 – if not already prepared – insert the cover and fasten it.
- Slide reducer ring 17.2 into the floor plates 17 so as to seal the cable entry.
- Insert the control cables into the left-hand side control wiring ducts 1.2.
- Strip and fasten the control cables on the cable clamps at the side wall in the cable duct and insert the cores via reducer ring into the low-voltage compartment B.
- Connect the control cables to the terminal strip as shown in the circuit diagram.
- Make the control wiring connections to the adjacent panel using bushing 24.

5.6 **Earthing the switchgear**

(Figures 3/2 and 3/9)

- Connect the main earthing bar 19 of the switchgear with the prepared connection links 19.2 panel by panel.
- Make the protection conductor connection to the foundation frame.
- Connect the earthing conductor coming from the ground electrode – preferably via a metering point – to the main earthing bar 19 of the switchgear.

5.7 **Concluding installation work**

- Check the paintwork of the switchgear for any damage, and touch up where necessary (see also section 7.3.1).
- Check bolted connections, especially all those made during on-site assembly in the busbar and earthing system, and tighten where necessary.
- Carefully clean the switchgear.
- Remove all foreign bodies from the switchgear panels.
- Properly refit all covers etc. removed during installation and connection.
- Close off any openings remaining in the enclosure

re as a result of the particular design, but which are no longer required.

- Insert the withdrawable parts into the switchgear panels.
- Check the isolating contacts and interlock mechanisms for smooth function, and relubricate with Isoflex Topas NB52 (section 7.6.2) where necessary.

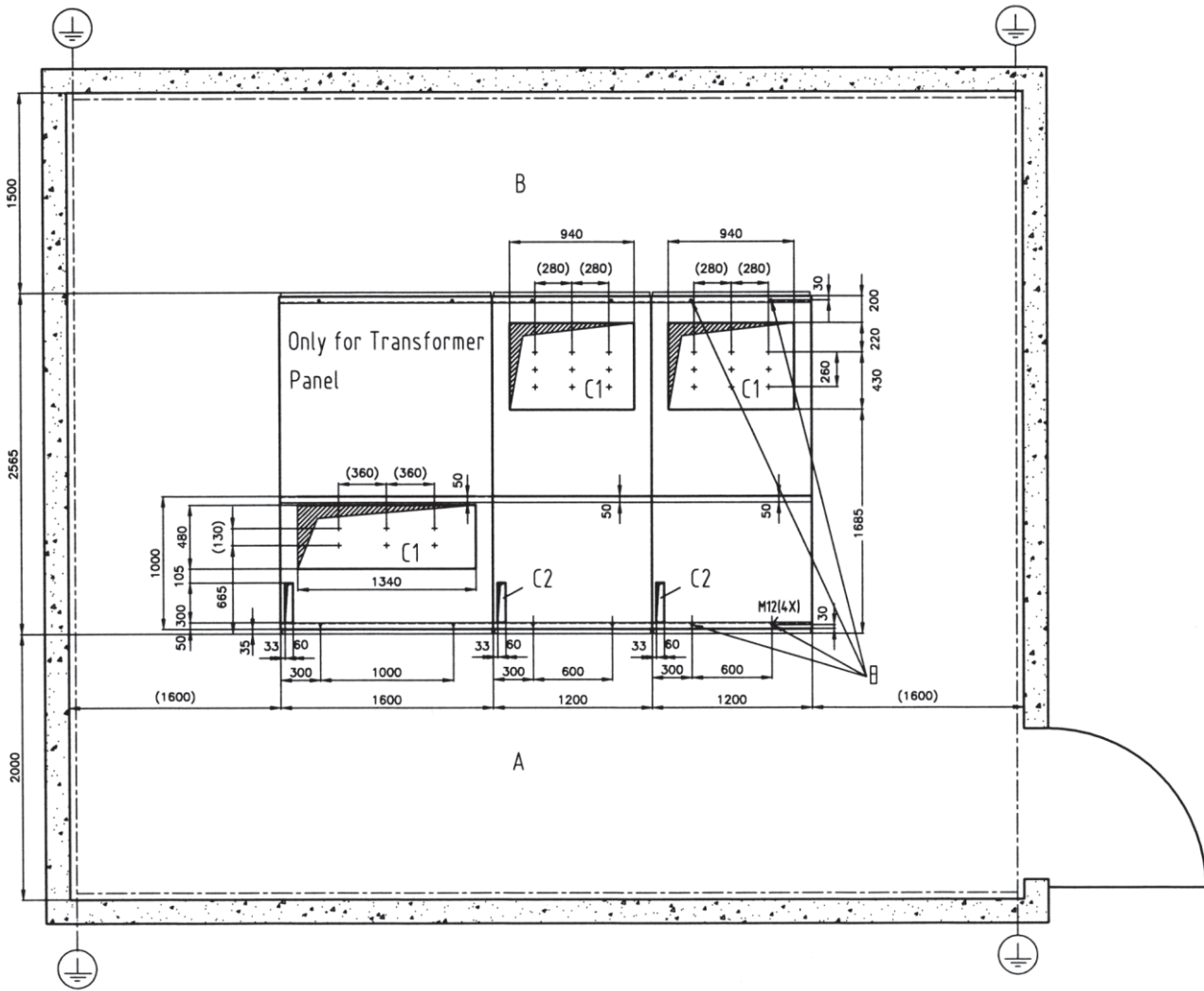


Figure 5/1: Guideline structural data for foundation frame on concrete floor (for information only).

- A Operator aisle
- B Inspection aisle
- C1 Opening for power cables
- C2 Opening for control cables (instead of individual openings, continuous openings or drilled holes are possible)
- E Points for fixing the switchgear panel on the floor frame

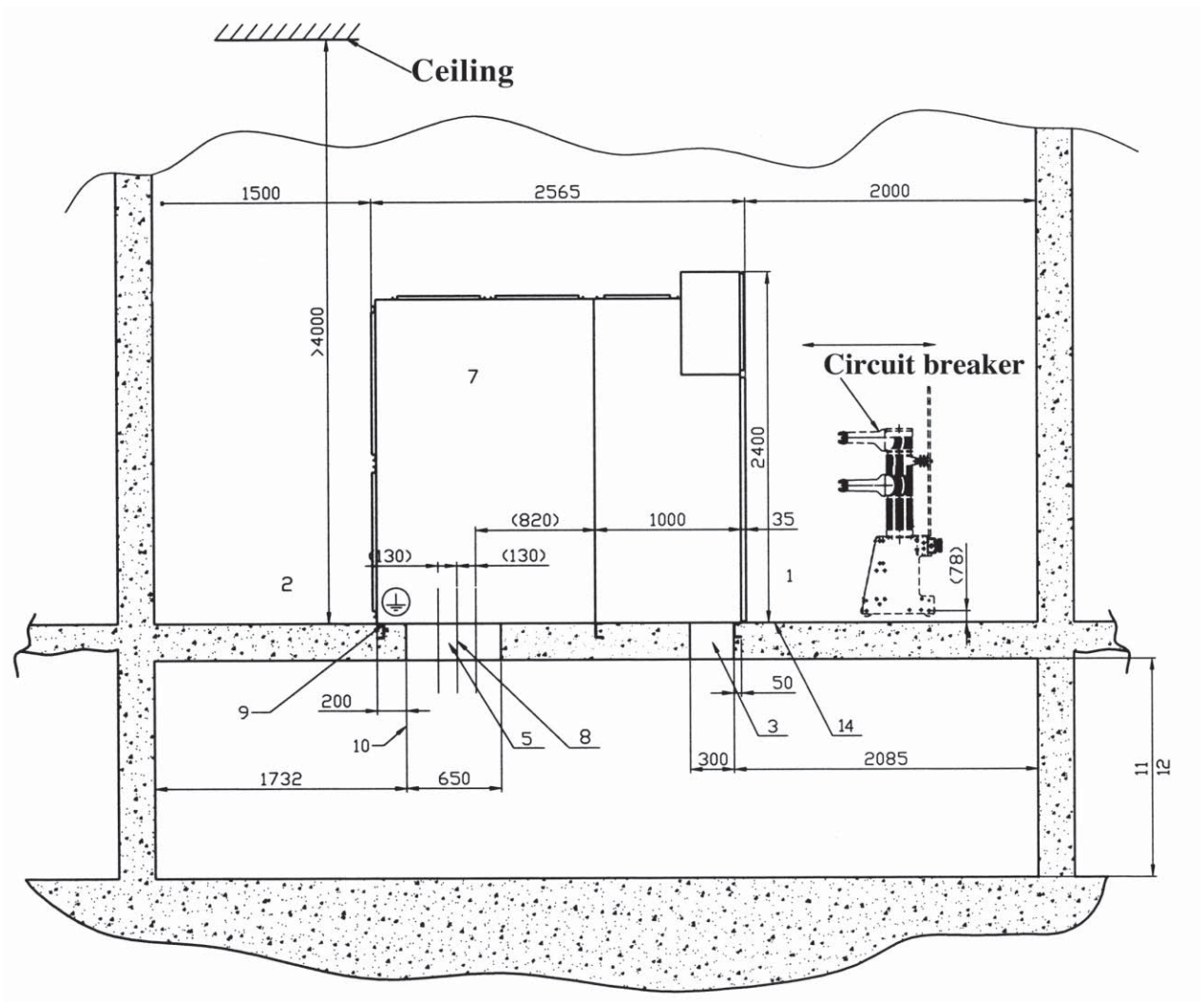


Figure 5/2: Section view for figure 5/1.

1) Minimum dimensions

- 1 Operator aisle
- 2 Inspection aisle
- 3 Opening for control cables (instead of individual openings, continuous openings or drilled holes are possible)
- 5 Openings for power cables
- 7 Panel type UniGear ZS3.2 ...31.5 kA (40 kA)
- 8 Power cables
- 9 Projecting of floor frame:
> 0mm and < 3mm above finished floor level
- 10 Conductor to main earthing bar
- 11 Screen 50mm to 60mm
- 12 Hight of the cable cellar, to be determined by the client
- 14 Guiding ramp, optional
(recommended for circuit-breaker insertion)

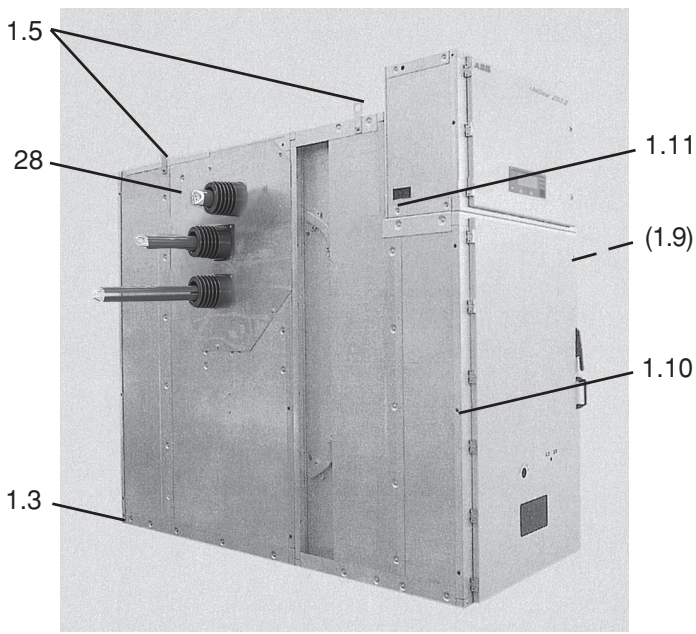


Figure 5/4: For bolting the UniGear ZS3.2 panels together, threaded bushings are provided at the right side near to the front and rear edges of the side walls. Adequate bores are located at the left hand side of the panel.

- 1.3 Aperture for main earthing bar
- 1.5 Lifting lug
- (1.9) Threaded bushing, for switchgear assembly
- 1.10 Bores (bushings), for switchgear assembly
- 1.11 Cut-out for control wiring bushing
- 28 Bushing plate

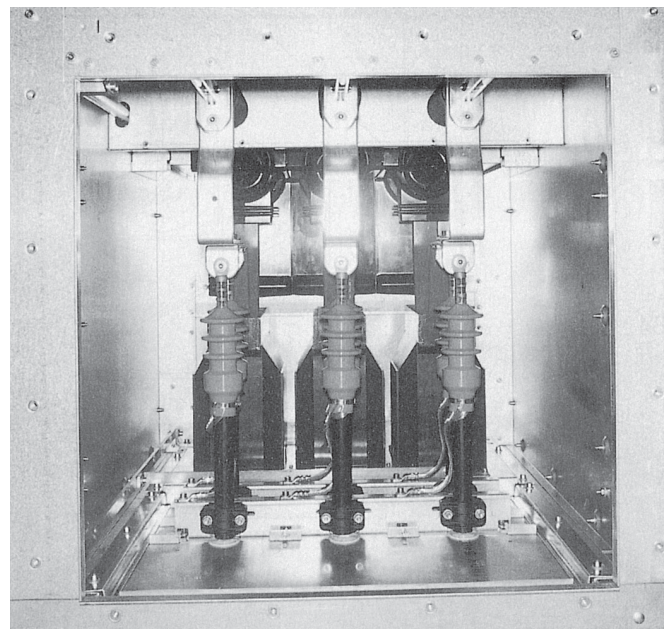


Figure 5/5: View into cable connection compartment max. 3 parallel cables possible.

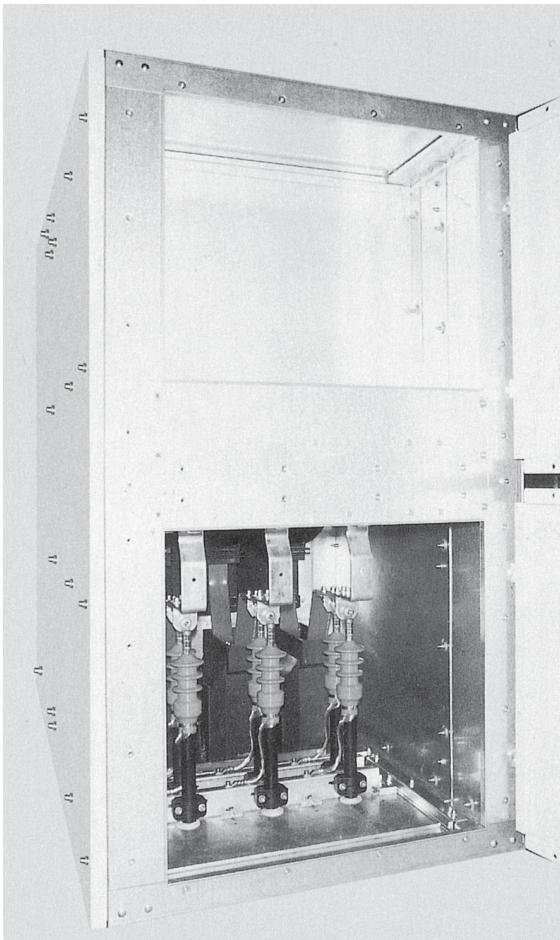


Figure 5/6: Partial view into the cable connection compartment prepared for connection of two parallel cables.

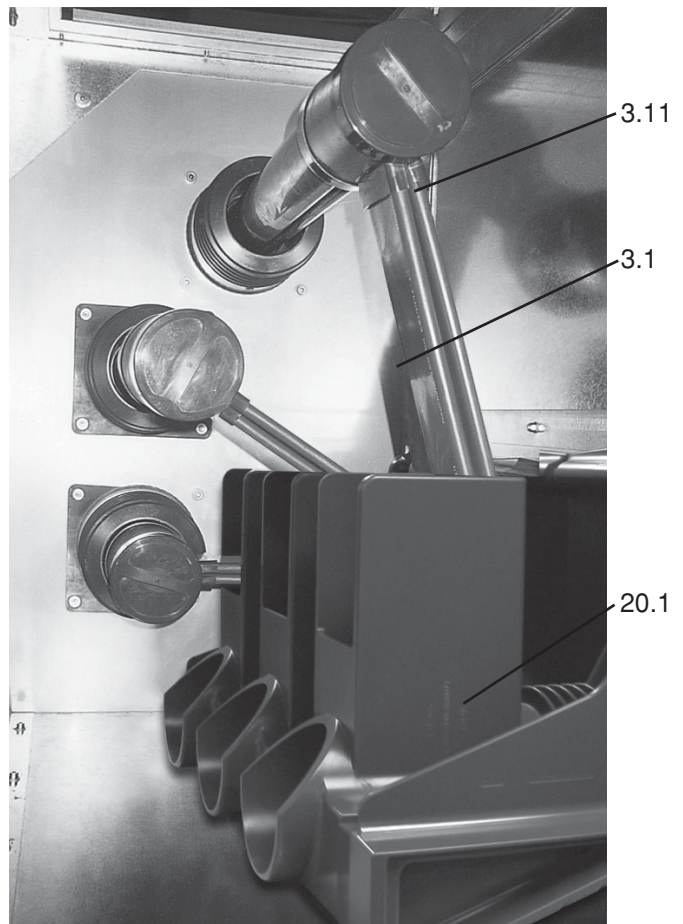


Figure 5/7: View into the busbar compartment.

- 3.1 Tee-off conductor, busbar side
- 3.11 Busbar section
- 20.1 Spout, above

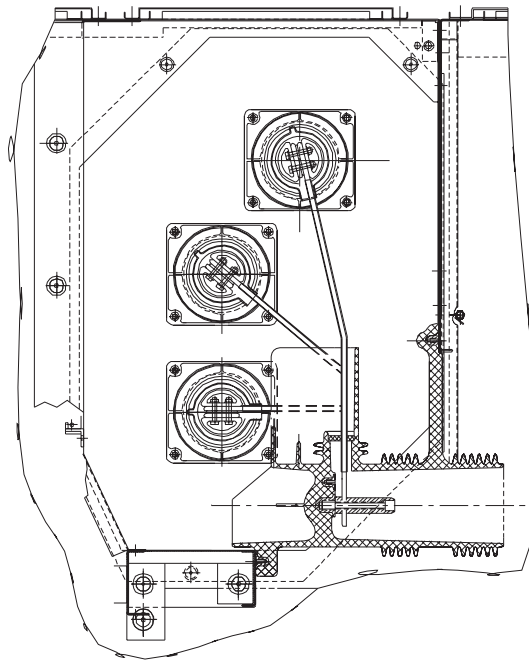


Figure 5/8: Bushings with busbar mountings for busbar system with double D-profile, tee-off ...1600 A.

- 3 Busbar
- 3.1 Tee-off conductor, busbar side
- 25.5 Sealing ring
- 28 Bushing plate
- 29 Busbar bushing
- 29.2 Busbar mounting for double conductor
- 84 Partitioning

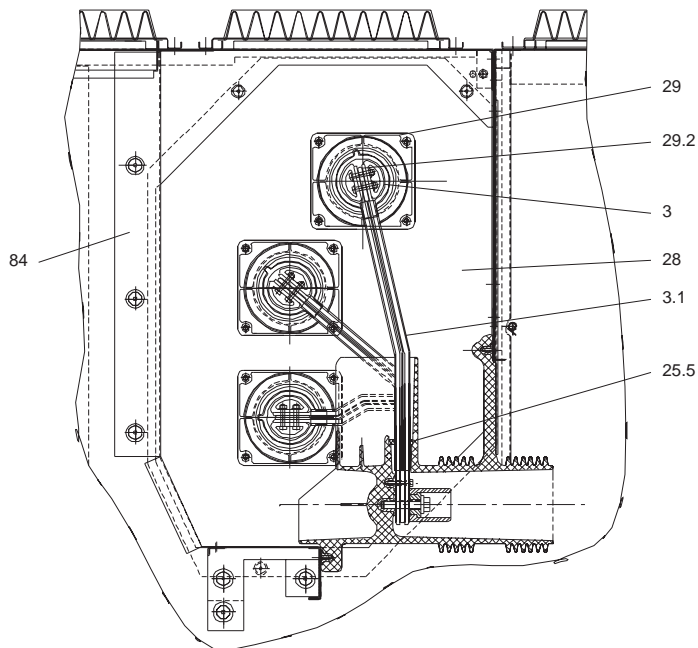
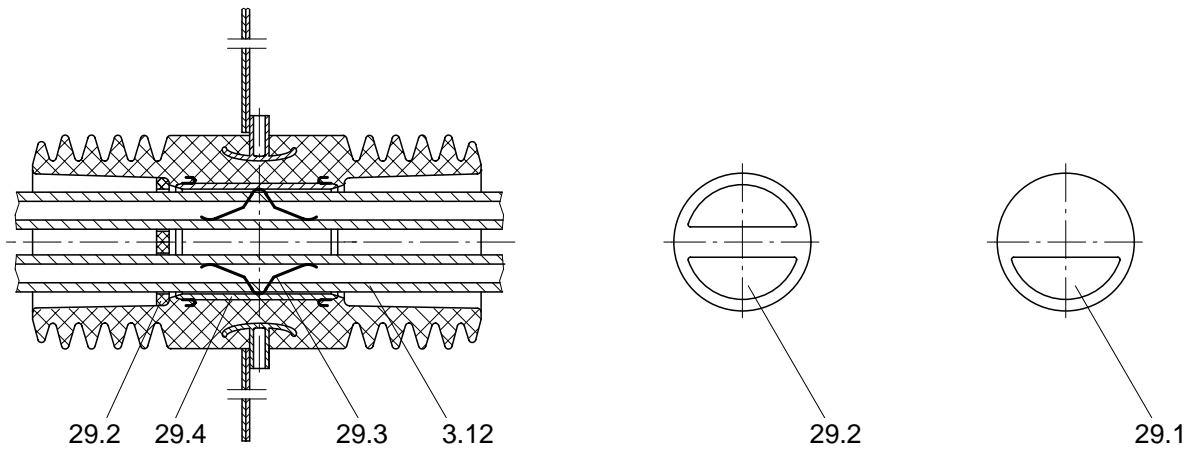


Figure 5/9: Bushings with busbar mountings for busbar system with double D-profile, tee-off ...2000 A to 3150 A.

Figure 5/14: Busbar barriers



a) Detail of a busbar bushing, sectional view. Always check that there is proper contact between the metal tube in the bushing and the busbar via the contact spring.

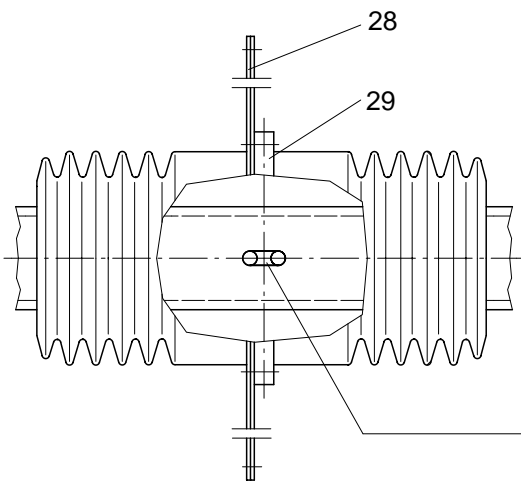
3.12 Busbar section (length)

29.1 Busbar mounting for single conductor

29.2 Busbar mounting for double conductor

29.3 Contact spring

29.4 Metal tube



The shrink-on sleeves must be cut-out above the bores in the busbars. The bores are required for the inset of the contact spring 29.3.

b) Installation position of the phase barriers, viewed from top.

28 Bushing plates

29 Busbar bushing



Caution:

The contact arm springs 29.3 must be inserted during the installation of the busbars. These contact springs prevent damages by glow discharges inside the bushings on life busbars.

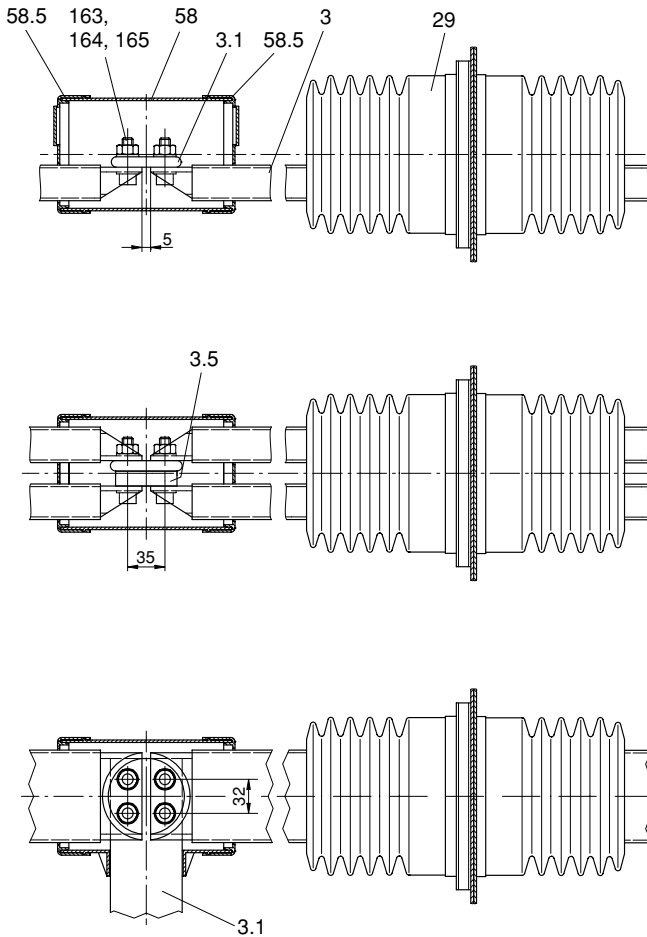


Figure 5/15: Arrangement and bolting of single and double conductor busbars with single and double tee-off bars. Ensure that screws and accessories of the specified quality are used! Use 2 dished washers per screw.

- 3 Busbar
- 3.1 Tee-off conductor
- 3.5 Spacer plate, 15mm
- 3.6 Spacer plate, 10mm
- 29 Busbar bushing
- 58 Insulation cover
- 58.5 Lid of cover
- 163 M10 socket head bolt (10.9 grade)
- 164 M10 nut
- 165 10 mm dished washer

a) Arrangement for tee-off current up to 1600 A and 1600 A or 3150 A busbar current.

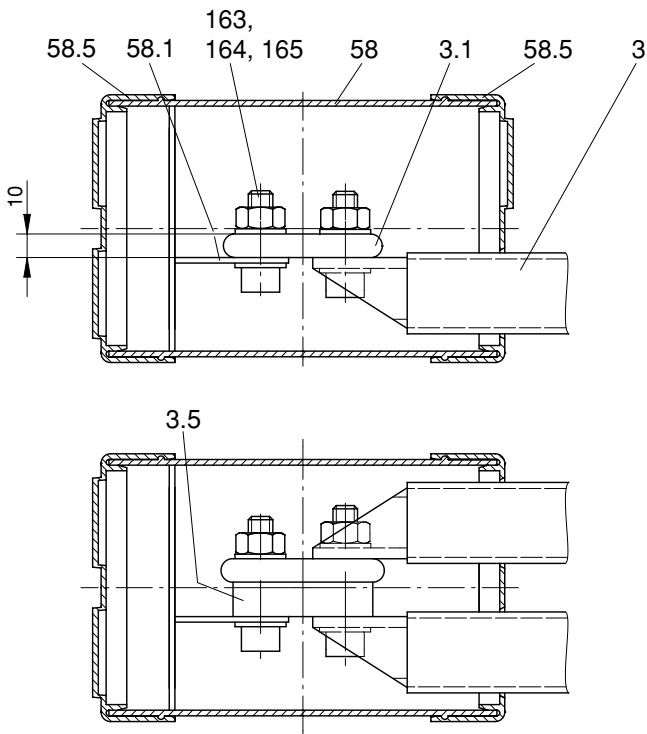


Figure 5/16: Arrangement of the busbar and tee-off conductor at the busbar end.

During assembly, cut out the insulation cover and lid to fit cross-section of the feeder or busbar.

- 3 Busbar
- 3.1 Tee-off conductor
- 3.5 Spacer plate, 15mm
- 3.6 Spacer plate, 10mm
- 58 Insulation cover
- 58.1 Holder for insulation cover
- 58.5 Lid of cover
- 163 M10 socket head bolt (10.9 grade)
- 164 M10 nut
- 165 10 mm dished washer

a) Arrangement for 1600 A tee-off current and 1600 A busbar current.

b) Arrangement for 1600 A tee-off current and 2000 A/3150 A busbar current.

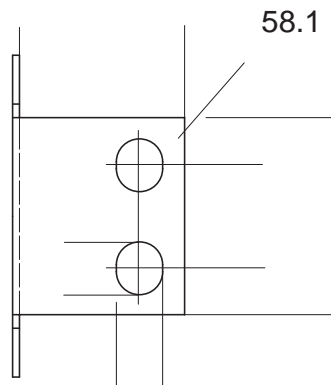
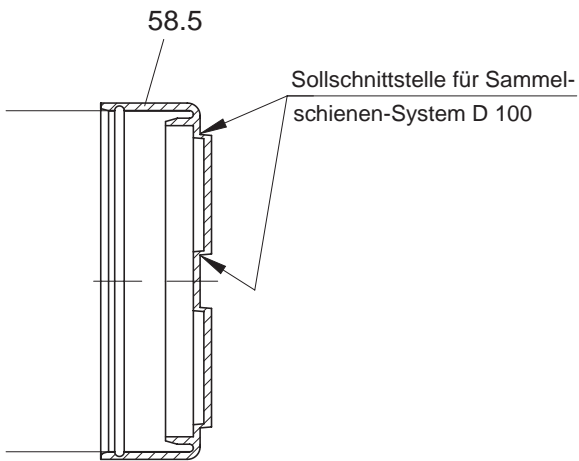
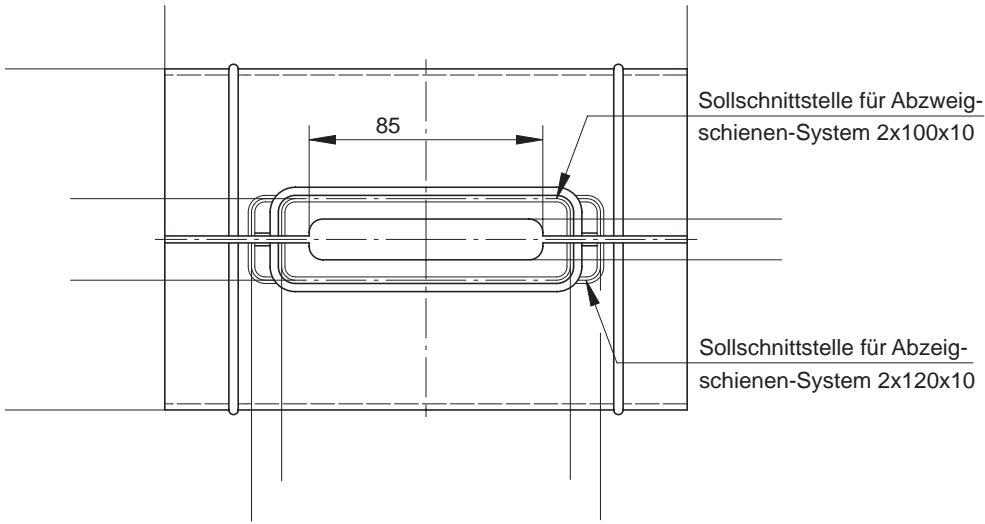


Figure 5/17: Insulating covers for busbars.

58.1 Holder for insulating cover

58.5 Lid for cover

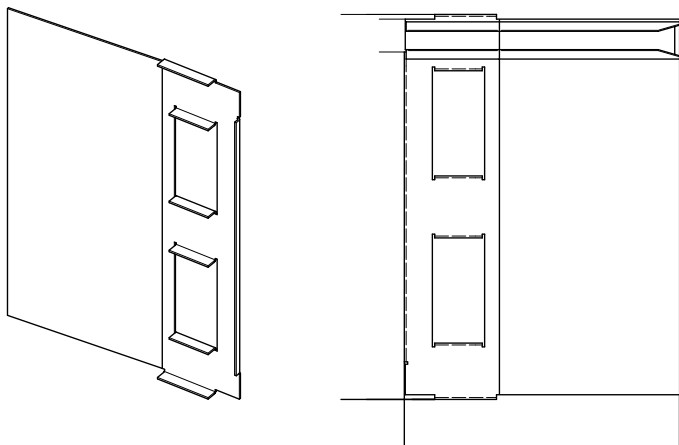


Figure 5/18: Guiding ramp for circuit-breaker insertion, optional. The rail on the guiding ramp must be in line with the guiding rail in the UniGear ZS3.2 panel.

6 Operation of the switchgear

Note on safety at work

The relevant work and operating procedures are to be carried out carefully by trained specialists familiar with the installation, taking into account all the relevant safety regulations to DIN VDE/IEC and the other relevant professional bodies, and other local and works regulations and instructions.

Note:



Do not walk on the top surfaces of the switchgear panels (rupture points for pressure relief).

6.1 Commissioning

6.1.1 Preparatory work

(Figures 3/2, 3/15, 6/1 to 6/7)

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 the connection of the main earthing bar to the station earthing conductor.
- Check the paintwork for damage and touch up as described in section 7.3 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 7.2.
- Properly refit all covers etc. removed during assembly and testing processes.
- Perform on site power frequency voltage testing of the main circuits to VDE 0670 part 6 (IEC 62271-200) as far as necessary. Pay special attention during this procedure to voltage transformers and cables, etc.
- Switch on the auxiliary and control voltage.
- Carry out test operations of switching devices manually or by electrical control, and simultaneously observe the relevant position indicators.
- Check mechanical and electrical interlocks for effectiveness, without using force.
- Set the protective devices in the switchgear to the required values and check their function with test equipment.

- Instruct the local operators in the fundamental details of regular handling of the switchgear.
- Check the readiness for operation and switching status of electrical systems upstream and down stream from the switchgear.
- Display the instruction manual in a position accessible to the operator at any time.

Depending on the allocation of responsibilities, it may also be necessary to check the following equipment in areas adjacent to the switchgear:

- power cables
- auxiliary cables
- auxiliary power source and its polarity
- remote control system
- complete earthing system, to DIN VDE 0141
- switch room equipment
- switch room condition

6.1.2 Start-up

- Comply with all relevant safety regulations.
- Ensure that the circuit-breakers in the system are in the OFF position.
- Remove any existing earthing and short-circuiting connections in the critical switching area.
- Energize the feeder 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 (see also section 6.3.2).
- Carry out all measurements and check all functions dependent on the high-voltage power supply being connected.
- Watch out for irregularities of any kind.

6.2 Switching operations



Carry out switching operations with the panel doors closed.

6.2.1 Withdrawable circuit-breaker part

(Figures 3/2, 6/1 to 6/7)

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 hand crank 146 on square spigot 52.1 of the spindle mechanism 52.

- Turn the crank clockwise through approx. 45 turns until the stop is reached and the withdrawable part is in the service position.
- Observe the position indicator.
- Remove hand crank 146.

Note:

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

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:

Do not use force to move withdrawable parts with blocking magnet Y0 in the event of a voltage drop. If this occurs they are blocked along the whole travel range between the service position and test position. To remove the interlock, consult section 7.4.2.

Withdrawal from the test/disconnection position into the removed position:

- Open the door of the circuit-breaker compartment.
- Release control wiring plug 10.2 and engage it in the storage position on the withdrawable part.
- Unblock the interlock yoke by moving the sliding handle 51.2 inwards against the springs to release the withdrawable part 50.
- Move the withdrawable part out of the panel.
- Close the panel door.

Insertion from the removed position into the test/disconnected position:

- Carry out the procedure as described above for withdrawal, changing the order accordingly.
- When the switchgear is in operation, observe all the operating data and condition indications in the secondary area and watch for any irregularities.

6.2.2 Circuit-breaker

(Figures 6/1 to 6/5)

For operation refer to Manual BA 442/E, VD4, Vacuum circuit-breaker on withdrawable part.

6.2.3 Earthing switch

(Figures 3/2, 6/7 to 6/12)

For operation refer also to instruction manual BA

444/E, EK6 earthing switch.

The earthing switch type EK6 has a snap-action closing mechanism which is independent of the rotation of the drive shaft. The earthing switch type EK6 is only enabled for switching when the withdrawable part 50 is in the test/disconnected position or removed from the switchgear panel. Only switch earthing switches on when the doors are closed. Only open the rear doors of the panel when the earthing switch is closed.

Opening and closing:

- Press slide 14.2 on the operating lever recess socket down. (When the switch is closed, it is already in this position!)
- Fit operating lever 122 to hexagonal shaft 14.1, which is now released for operation.

Note:

Fit operating lever 122 to the hexagon shaft pointing either upwards or downwards for each switching operation in such a way that it is not obstructed at the sides, even in limited space.

- Turn the lever clockwise through approx. 180° until the stop is reached to close the earthing switch, or anti-clockwise until the stop is reached to open the earthing switch.
- Observe the mechanical/electrical switch position indicator.
- Remove operating lever 122. Slide 14.2 remains open if the earthing switch is in the closed position.

Make sure that the operating lever is turned right up to the stop in the opening process, to ensure that the earthing switch is in its defined limit position.

The operating mechanism can also be fitted with a blocking magnet.

6.3 Test procedures

6.3.1 Testing the off-circuit condition

The panels can be fitted with a capacitive voltage indication system including the corresponding (hand-held) plug-in indicator for testing of the off-circuit condition.

A distinction must be made between the low impedance system and the high impedance system. For further details, see draft standard DIN VDE 0682 Part 415 or IEC 61243 Part 5.

The two systems differ in several respects, including different voltage levels which constitute the display thresholds. The capacitive voltage dividers installed in the panels are correspondingly of

different ratings, and the measuring point sockets and indicator units are of different types.

Note:



The only permissible indicators are those which satisfy the requirements of the IEC and VDE standards and correspond to the technical design of the indication system in the relevant switchgear!

Note:

The measuring point sockets must on no account be short-circuited, except for voltage tests on the installation (e.g. at power frequency voltage and/or impulse voltage).

Testing for the off-circuit condition is effected using a plug-in indicator at the corresponding socket pairs located among the controls on the panels.

Use of the indicator:

- Carry out a functional test on the unit immediately before use, e.g. with interface tester KSP. The display must be clearly perceptible.
- The presence of operating voltage is displayed by a signal.

Always follow the details given in the instructions for the particular indicator for your switchgear system.

Interface testing:

- Perform an interface test as a functional test on all coupling components, e.g. with interface tester KSP.
- The interface test is a repeat test as specified in IEC 61243 Part 5 and VDE 0682 Part 415.

Always follow the details given in the instructions for the particular indicator for your switchgear system.

6.3.2 Testing of in-phase condition

Testing of the in-phase condition, e.g. when there is more than one incoming feeder, can be carried

out with a suitable phase comparator coupled to the measuring point sockets of the capacitive voltage indication system (if fitted).

Test procedure:



- Only use phase comparators which comply with the DIN VDE standards and are of suitable design for the switchgear system.
- Check the function of the unit immediately prior to use.
- Ensure that the maximum permissible length of the measuring cables for each phase is not exceeded.
- Connect the measuring cables to precisely the corresponding main conductor sections.
- Follow the directions for the phase comparator in detail!

After commissioning of the system, check all position indicators and displays for irregularities.

Note:

For voltage testing at power frequency and/or impulse voltage:

- Only short-circuit the sockets for the capacitive voltage indicator on the relevant panel for the duration of the test!

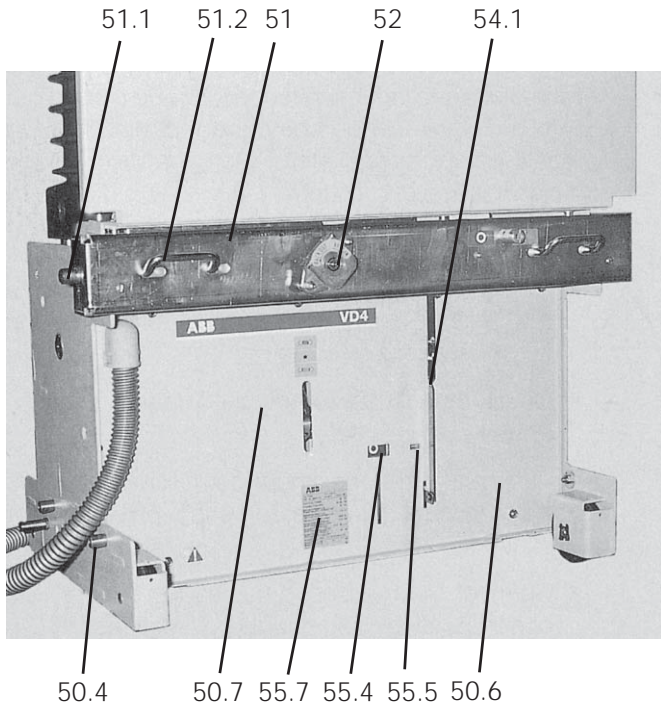


Figure 6/1: Withdrawable part with circuit-breaker, VD4, operating mechanism side.

- 50.4 Guide cam
- 50.6 Front cover plate, right hand side
- 50.7 Front coverplate, left hand side
- 51 Interlock yoke
- 51.1 Catch pin spring loaded
- 51.2 Sliding handle
- 52 Spindle
- 54.1 Link rod
- 55.4 Switch position indicator
- 55.5 Operating cycle counter
- 55.6 Socket for charging lever
- 55.7 Rating plate

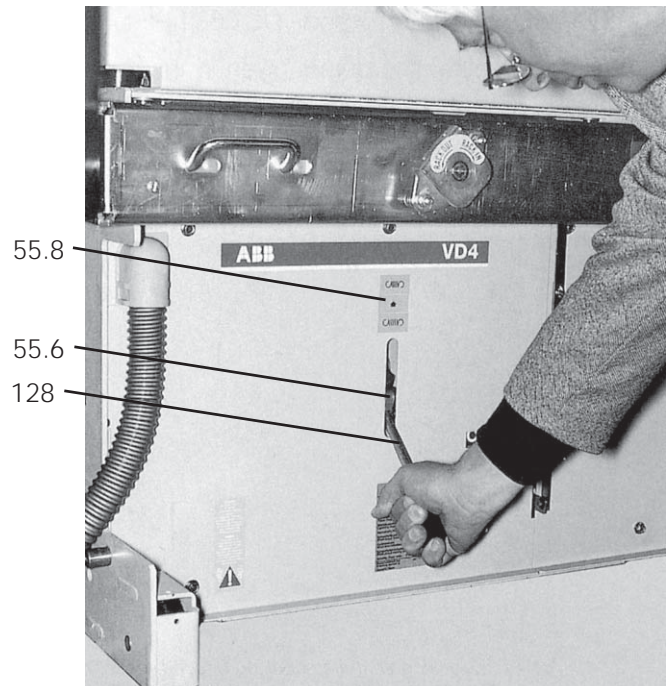


Figure 6/2: Charging the spring energy storage mechanism manually by moving the inserted lever up and down.

- 55.6 Socket for charging lever
- 55.8 Charging condition indicator
- 128 Charging lever

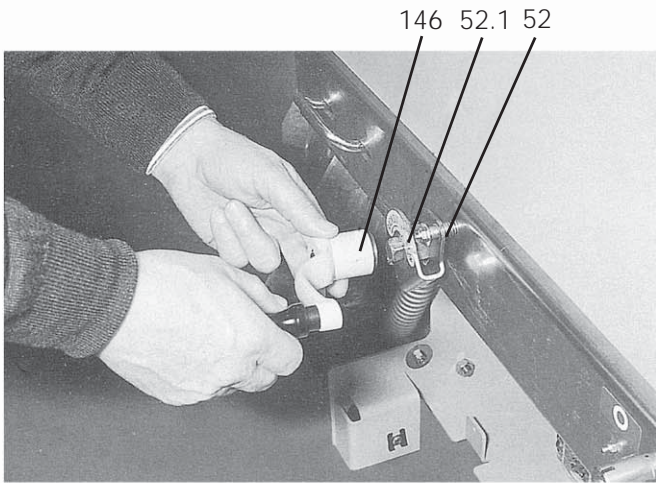


Figure 6/3: Fitting the hand crank (against spring-loaded intermediate plate) to move the truck inside the panel clockwise towards the service position, and anti-clockwise from the service position towards the test/disconnected position.

- 52 Spindle
- 52.1 Square spigot
- 146 Hand crank

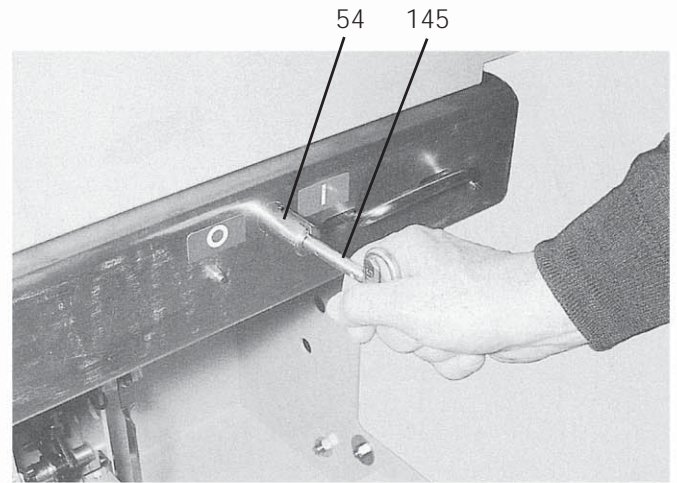


Figure 6/4: Manual operation of the circuit-breaker, by turning the double bit key approx. 15° clockwise (ON), or approx. 15° anti-clockwise (OFF).

- 54 ON-OFF operating shaft
- 145 Three bit key (ON-OFF operation)

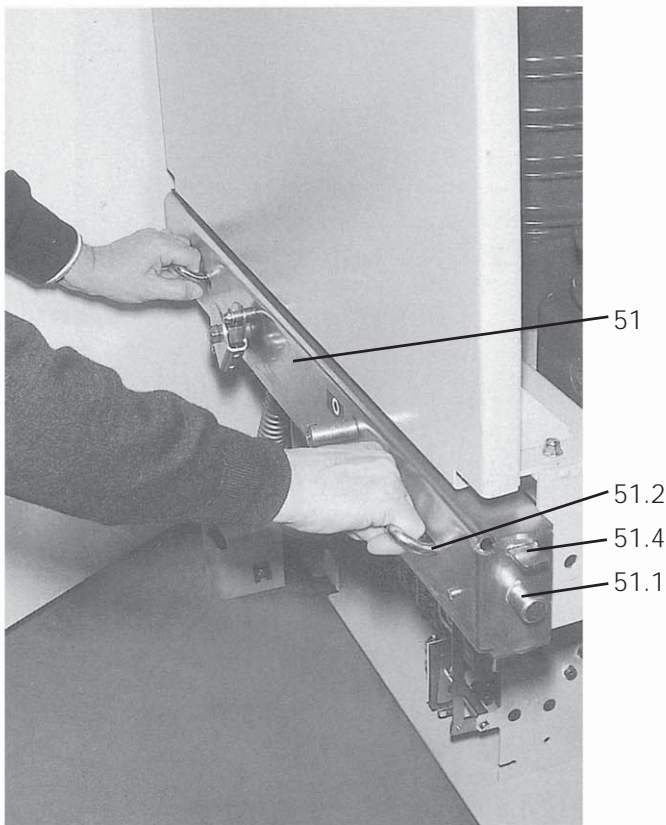


Figure 6/5: Interlock yoke with sliding handles which will be moved inwards to release the circuit-breaker part for withdraw from the panel.

- 51 Interlock yoke
- 51.1 Catch pin, spring loaded
- 51.2 Sliding handle
- 51.4 Blocking shaft (interlocking circuit-breaker and earthing switch)

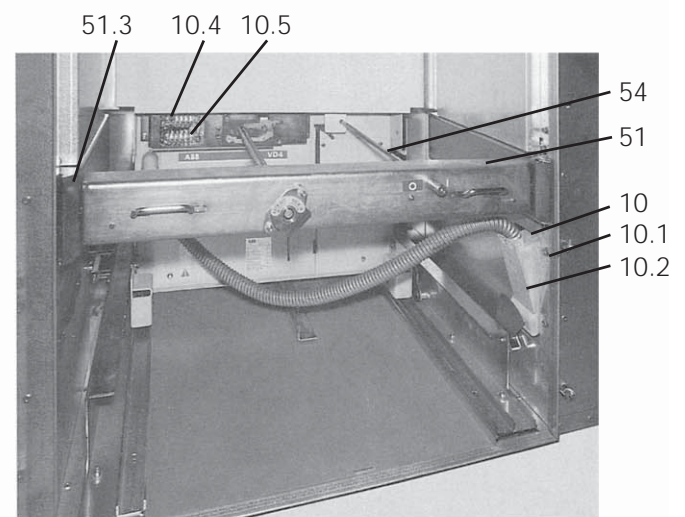


Figure 6/6: Withdrawable part in service position, interlock yoke engaged, control wiring plugged-in and engaged.

- 10 Control wiring plug connector, closed
- 10.1 Control wiring socket
- 10.2 Control wiring plug
- 10.4 S8 /Limit switch for test position indicator
- 10.5 S9 /Limit switch for service position indicator
- 51 Interlock yoke
- 51.3 Guide rail (panel)
- 54 ON-OFF operating shaft

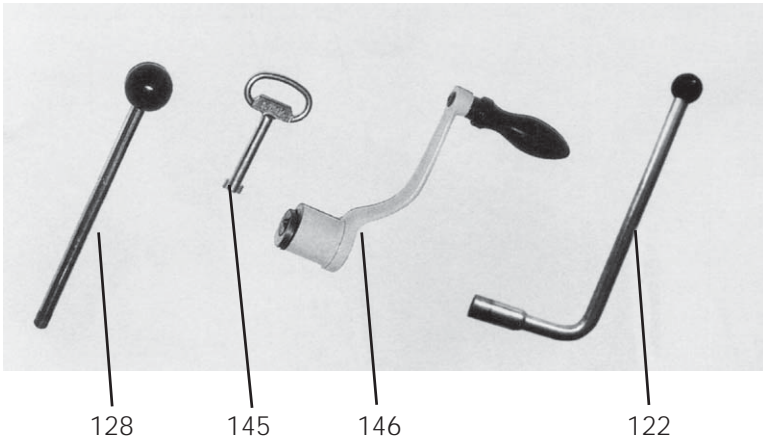


Figure 6/7: Operating accessories.

- 122 Operating lever (for earthing switch)
- 128 Charging lever (for circuit-breaker)
- 145 Three bit key (ON-OFF) operation
- 146 Hand cranked (for moving the withdrawable part)

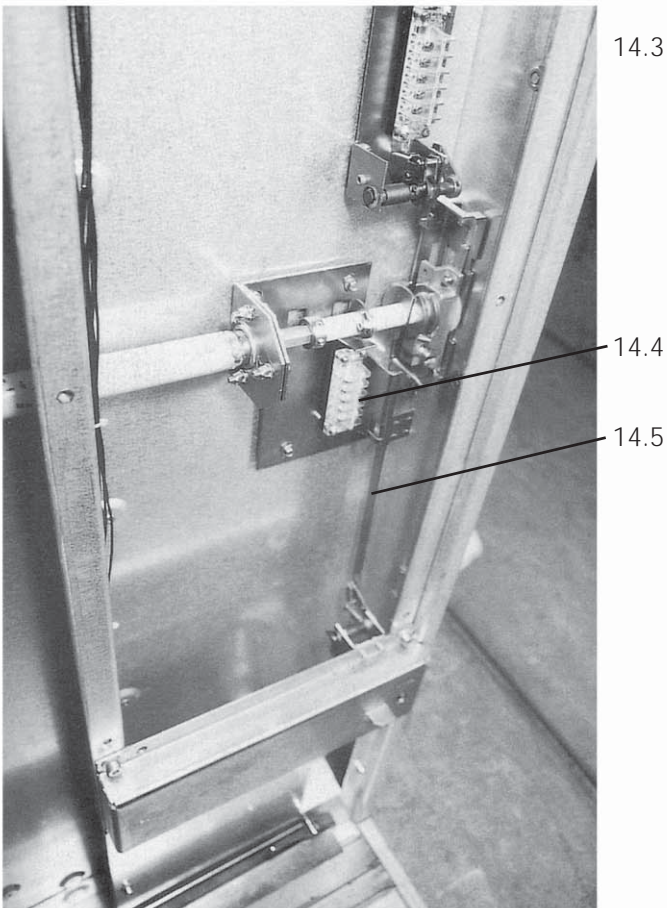


Figure 6/8: Earthing switch operation mechanism.

- Duct cover 43.1 removed (seen from inside panel).
- 14.3 Auxiliary switch Q8S1, earthing switch OFF
- 14.4 Auxiliary switch Q8S2, earthing switch ON
- 14.5 Interlocking rod (Earthing switch - withdrawable circuit-breaker unit)

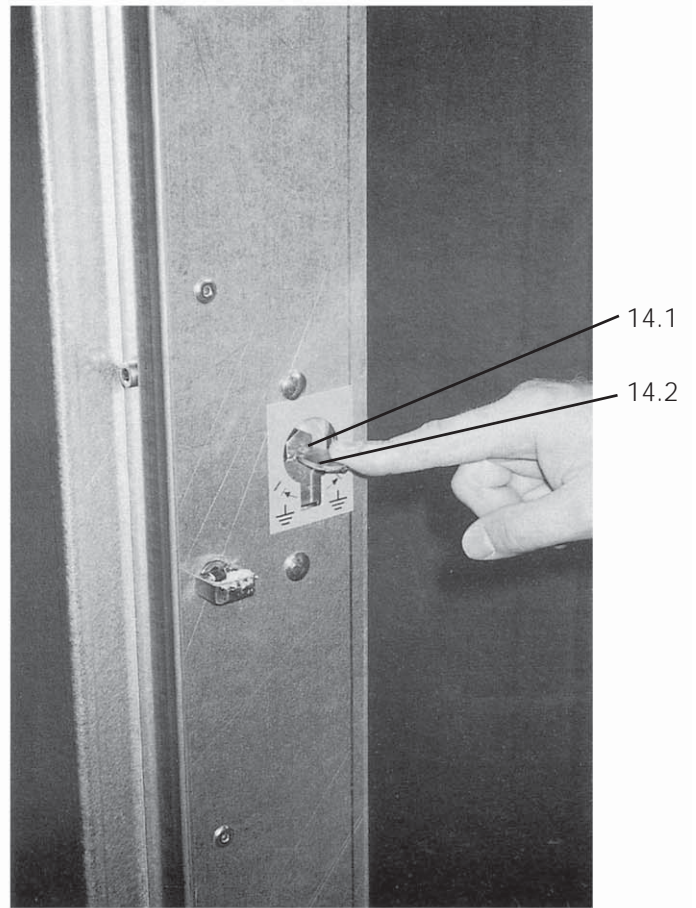


Figure 6/9: Earthing switch operation mechanism (panel front side).

- 14.1 Hexagonal shaft
- 14.2 Slide

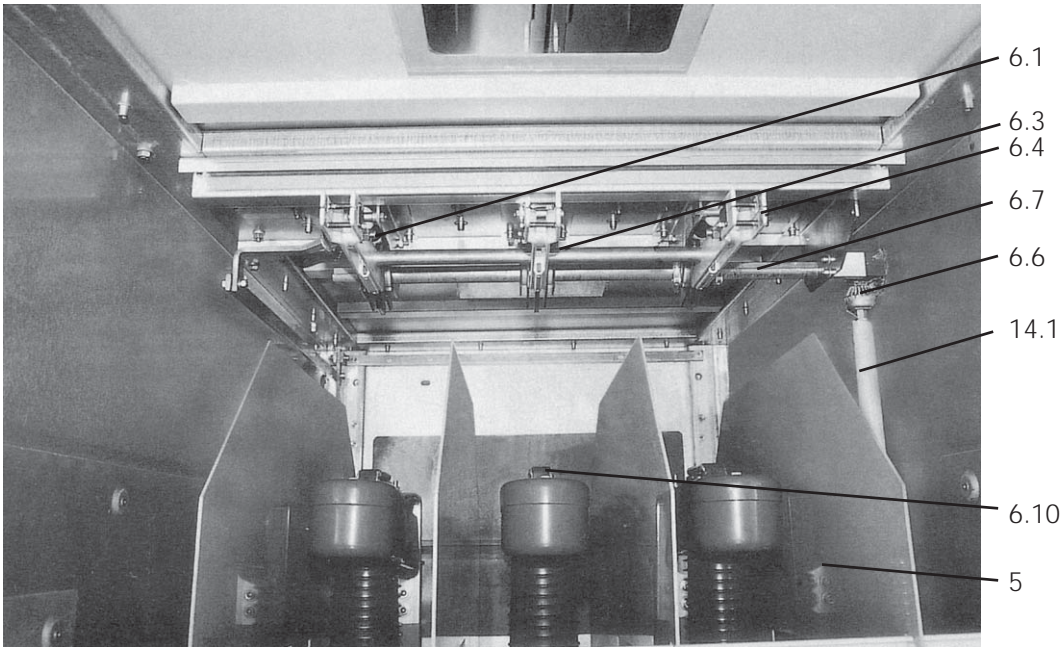


Figure 6/10: Active part of the earthing switch, EK6 mounted in the cable connection compartment shown in open position.

- 5 Insulated separating plate
- 6.1 Bearing bracket
- 6.3 Short circuit bridge
- 6.4 Pair of earthing blades
- 6.6 Bevel gear mechanism (not belonging to the earthing switch)
- 6.7 Operating shaft
- 6.10 Fixed earthing contact
- 14.1 Hexagonal shaft

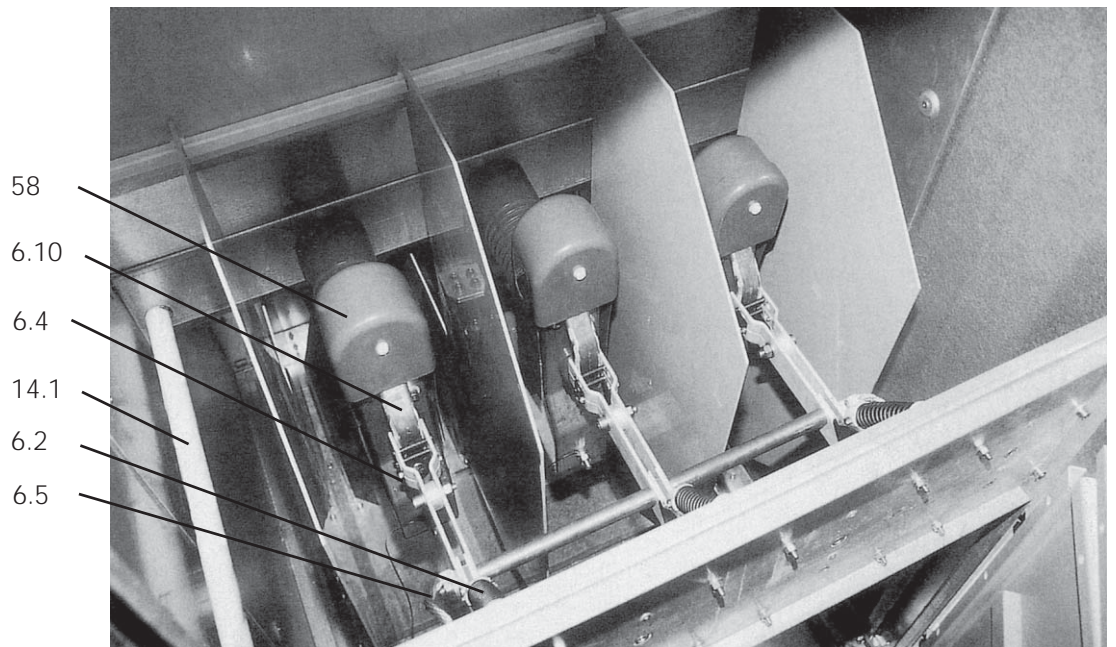


Figure 6/11: Earthing switch, EK6 mounted in the cable connection compartment shown in closed position.

- 6.4 Pair of earthing blades
- 6.5 Earthing conductor
- 6.2 Toggle spring
- 6.10 Fixed earthing contact
- 14.1 Hexagonal shaft
- 58 Insulation cover

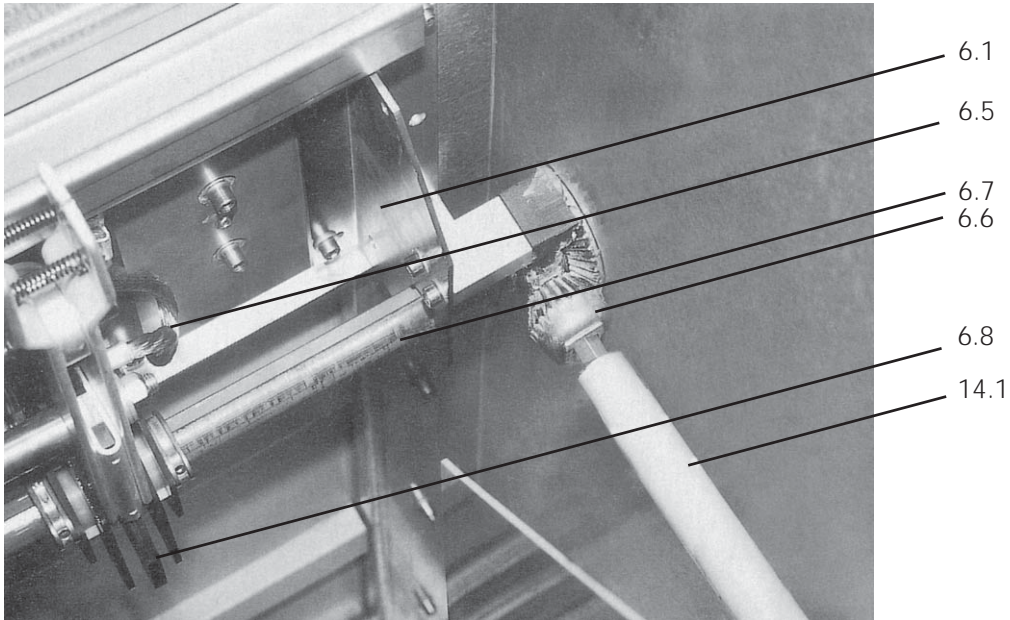


Figure 6/12: Bevel gear mechanism and earthing switch, EK6 in open position.

- 6.1 Bearing bracket
- 6.5 Earthing conductor
- 6.6 Bevel gear mechanism (not belonging to the earthing switch)
- 6.7 Operating shaft
- 6.8 Driver lever
- 14.1 Hexagonal shaft

7 Maintenance

7.1 General

Maintenance serves to preserve trouble-free operation and achieve the longest possible working life of the switchgear. In accordance with DIN 31 051, it comprises the following closely related activities:

Inspection: Determination of the actual on-dition

Servicing: Measures to preserve the specified condition

Repair: Measures to restore the specified condition

Note:

When carrying out all maintenance work, the regulations in the country of installation must be strictly complied with.

Maintenance work may only be performed in a careful manner by trained personnel familiar with the characteristics of the individual switchgear, in accordance with all relevant safety regulations to VDE/IEC and of other technical authorities, and with other overriding instructions. It is recommended that ABB service personnel be called in to perform servicing and repair work, and this is necessary for some of the work detailed below.

The inspection and servicing intervals for some of the equipment/components (e.g. parts subject to wear) are determined by fixed criteria such as switching frequency, length of service and number of short-circuit breaking operations. For other parts, on the other hand, the length of the intervals may depend, for example, on the different modes of operation in individual cases, the degree of loading, and also environmental influences (including pollution and aggressive air).

The following service instructions must also be observed together with this instruction manual in the individual cases concerned:

Metering unit on withdrawable

part, ME BA 426/E

Vacuum circuit-breaker

VD4 BA 442/E

Earthing switch

EK6 BA 444/E

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

7.2 Inspection and servicing

Inspection

Inspection of the switchgear should be carried out approximately every two to four years, depending on the service conditions and local environment, in accordance with VBG4 standard.

Isolate the area where work is to be performed in accordance with the relevant safety regulations to DIN VDE / IEC, and secure it against reconnection.

The inspection may become necessary at shorter intervals under unusual service conditions (including adverse climatic conditions) and/or particularly injurious environmental influences (e.g. heavy pollution and aggressive atmosphere).

The inspection should include but not be limited to the following:

- Check the installation for abnormalities of any kind, dirt and the effects of other environmental influences.
- Check the function of the switching devices and the controls, interlocks, protection, annunciation and other devices.
- Check the surface condition of the isolating contact system (for visual examination of the contact pins with the withdrawable part removed). When the galvanic silver coating on the contact parts is worn to such an extent that the copper conductor material below becomes visible, or when their surfaces are heavily corroded or show signs of other damage or overheating (discoloured surface), replace the contact parts. See also section 7.3.
- Check all switchgear accessories and the auxiliary equipment (e.g. storage batteries etc.).
- No external discharge may occur on the surfaces of equipment at operating voltage. This can, for example, be detected by characteristic noises, a clearly perceptible smell of ozone, or visible glowing in the dark.

Servicing

Basic servicing activities, and those which may be found necessary during inspections, include the following:

- Carefully clean the unit, and in particular the insulating material surfaces, when they are found to be dirty (contamination may also be caused by salt, mould formations, insects or conductive materials in conjunction with frequent condensation when the switchgear is operated in a tropical climate). Remove dry dust deposits which do not adhere strongly using a soft dry cloth. Remove more strongly adhering, e.g. sticky/ greasy dirt, with a cloth soaked in a slightly alkaline household cleaner. Wipe off with clear water and dry carefully.

Use halogen-free cleaners such as Rivolta BWR

210 or cold cleanser 716 (for components in insulating material and for major contamination). Observe the manufacturer's instructions and the special ABB instruction manuals BA 1002E and BA 1006E respectively on safety at work.

Never use 1.1.1-trichloroethane, trichloroethylene or carbon tetrachloride!

- 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.
- 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 NB52 lubricant.
- Top up the grease on sliding and bearing surfaces in the panels - for example on the separating plates, the interlock and guide systems, the spindle mechanism and the travel rollers of the withdrawable part - or thoroughly clean and regrease with Isoflex Topas NB52 lubricant where necessary.
- Observe the maintenance instructions in the manuals for the individual switch types.

7.3 Repair

7.3.1 Switchgear surface

- Carry out repair work immediately after a defect has been discovered.
- Completely remove all rust from damaged paintwork areas on steel sheet and other steel parts by mechanical means, e.g. with a wire brush.

Lightly grind the surrounding paint coat and carefully degrease the entire area. Then immediately apply an anti-rust primer and, after an appropriate hardening time, apply the top coat. The total dry film thickness should be approx. 60 µm. Only use suitable and compatible paint products.

Top coat in standard colour RAL 7035 or the relevant special colour.

- Carefully remove any white rust from Al-Zn sheet steel surfaces with a wire brush or Scotch Sprite, and remove loosely adhering particles with a dry, non-fraying cloth. Then treat the cleaned areas with zinc spray or zinc dust paint, and then with aluminium spray to match up the colour.

- Carefully remove any white rust on chromium plated functional parts and rust on phosphatized parts with a wire brush or Scotch Sprite, and clean with a dry cloth. Then evenly grease the parts (with Isoflex Topas NB52).

7.3.2 Replacement of components

Replacement of the isolating contact systems: (Figures 7/1 to 7/4)

- Slide the two inner annular tension springs 57.6 facing the breaker pole to a position beside the two outer annular tension springs, thus releasing contact system 57.7, and remove the contact system from isolating contact arm 57.1/57.2.
- 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 57.1/57.2, slide the contact system 57.3 over onto the isolating contact arm, and withdraw the arbor.
- Check all contact fingers and annular tension springs for perfect fit.

Note:

The set installation position of isolating contact arms 57.1/57.2 must not be changed by the improper use of force.

Replacement of the contact pins:

(Figure 3/13, 3/17 and 3/18)

After any required replacement of contact pins 25.1/25.2, these are to be retightened using socket head screws:

- Thread M10, non-greased, at 46 Nm
- Thread M12, non-greased, at 65 Nm
- Thread M20, non-greased, at 250 Nm.

7.4 Tests on withdrawable parts with circuit-breakers of VD4

(Figures 3/12, 3/14, 3/15, 6/1 to 6/7)

When functional tests are carried out on withdrawable parts, compliance with the conditions listed below should also be checked.

7.4.1 Checking the auxiliary switch settings on withdrawable parts

(Figures 6/3 to 6/6)

Refer to manual BA 442/E; VD4, Vacuum circuit-breaker on withdrawable part.

Compliance with the interlock conditions in the areas of the test/disconnected position and the service position is ensured by position signalling switches 10.4 (S8) and 10.5 (S9) located on the withdrawable part and set at the works.

In the inspection and test operation, the withdrawable part is to be moved with the crank fitted.

1. Settings in the area of the test/disconnected position
 - Move the withdrawable part out of the test/disconnected position towards the service position with a few turns of the crank.
 - Slowly move the withdrawable part back to the stop.

Auxiliary switch 10.4 (S8) must then operate when the hand crank still has $\geq 60^\circ$ of turn to reach the stop.

- Slowly insert the withdrawable part from the test/disconnected position towards the service position until auxiliary switch 10.4 (S8) just operates.

In this position, it must still just be possible to move the ON-OFF operating shaft 54. For this test, the function of the blocking magnet must be deactivated manually.

This condition ensures that the electrical inter-lock becomes active before the mechanical interlock in the motion sequence involved.

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

Auxiliary switch 10.5 (S9) must then operate when the hand crank has a remaining angle of $\geq 60^\circ$ to turn up to the stop.

7.4.2 Testing of interlock conditions

(Figures 6/1 to 6/9)

1. The withdrawable part 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 part towards the service position must be blocked after only half a turn of the crank in the clockwise direction.
- With the earthing switch closed, insertion of the withdrawable part towards the service position must be blocked after only two clockwise turns of the crank.

2. The withdrawable part 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 part must be blocked after only half a turn of the crank in the anti-clockwise direction.

3. Closing of the circuit-breaker must only be possible when the withdrawable part 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 part in any position between the test/disconnected position and the service position.

Enabling of switching when the withdrawable part moves into the service position is effected electrically by operation of auxiliary switch 10.5 (S9), and mechanically slightly earlier; the latter corresponds to a position approximately half a turn of the crank before the stop.

- The enable conditions for the movement into the test/disconnected position apply accordingly, in this case established by auxiliary switch 10.4 (S8).

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

Check this condition.

5. The withdrawable part with blocking magnet Y0 (if ordered) may not be moved if the control voltage fails or is not available. Do not use force to move the blocked withdrawable part!

Removing the block:

- Remove front plate 50.6 and 50.7
- Release the blocking magnet Y0 by pressing the armature continuously when moving the withdrawable part by using the hand crank 146 for 1/2 right or left.
- The blocking magnet is effective only in the service and test/disconnected position and is not effective in the intermediate position.

6. Removal of control wiring plug 10.2 and reinsertion of the plug must be blocked with the withdrawable part in the service position.

Check this condition.

7. Operation of the earthing switch must only be possible when withdrawable part 50 is in the test/disconnected position or the removed position (subject to any additional electromagnetic interlocks in individual cases!).

Check these conditions as follows:

- With the withdrawable part in the test/ disconnected position, it must be possible to press slide 14.2 in front of the earthing switch drive shaft 14.1 downwards to the opening position. The earthing switch can then be operated.
- When the withdrawable part is moved inwards towards the service position, pressing down of the slide 14.2 must be blocked after only one and a half clockwise turns on the crank.

7.5 Tests on the switchgear panel

7.5.1 Auxiliary switch setting on the earthing switch

(Figures 6/8 and 6/9)

1. There must be a run-on of 0.5 mm in the fully operated position before the plunger reaches the stop (for safety reasons).
2. Limit position auxiliary switch Q8S2 for earthing switch ON must be operated immediately after the dead centre position of the toggle spring mechanism is reached in the closing process and the automatic quick-closing process has started.
3. Limit position auxiliary switch Q8S1 for earthing switch OFF must be operated on earthing switches with manual mechanisms during the opening motion of the slide 14.2 before half of the hexagon shaft has become visible, or 1 mm before the tongue of the slide makes contact with the armature of the unexcited blocking magnet.

7.6 Spare parts, auxiliary materials and lubricants

7.6.1 Spare parts

A spare parts list is available on request for procurement of spare parts. It fundamentally comprises moving parts and parts subject to wear. When parts are required, the serial numbers of the relevant switchgear panel and circuit-breaker should always be quoted.

7.6.2 Auxiliary materials and lubricants

Part no.
(order ref.)

Lubricant:

- Isoflex Topas NB52 GCE0007249P0100

Halogen-free cleansers:

- Rivolta BWR 210 GCE0007707P0100
(for general cleaning)

ABB directions for use
BA 1002/E

GCEA901002P0102

- Cold cleanser 716 GCE0007706P0100

(use for conductive components, components in insulating material and for heavy soiling)
ABB directions for use

BA 1006/E

GCEA901006P0102

Touch-up paint:

- Standard colour

RAL 7035

– 1-kg-box

GCE9014060R0103

– 1 Spray tin

GCE0007895P0100

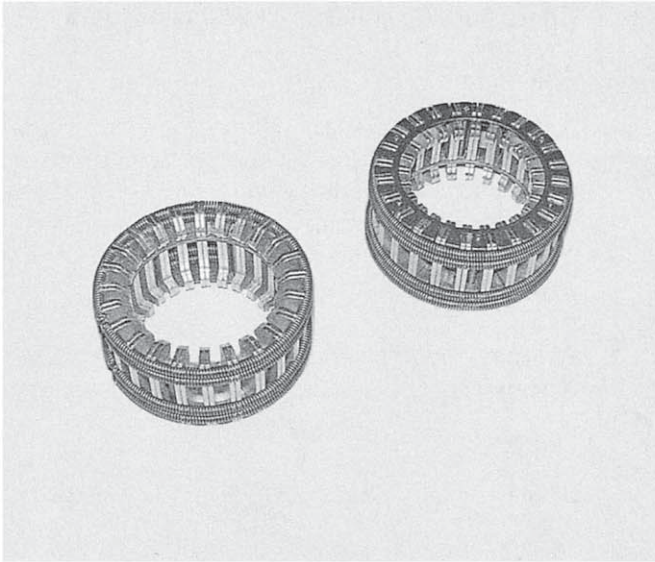
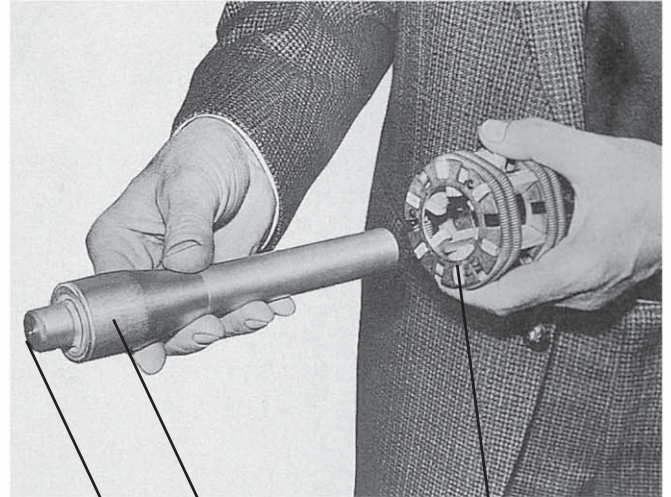


Figure 7/1: Contact system sample for 2000 A to 3150 A.

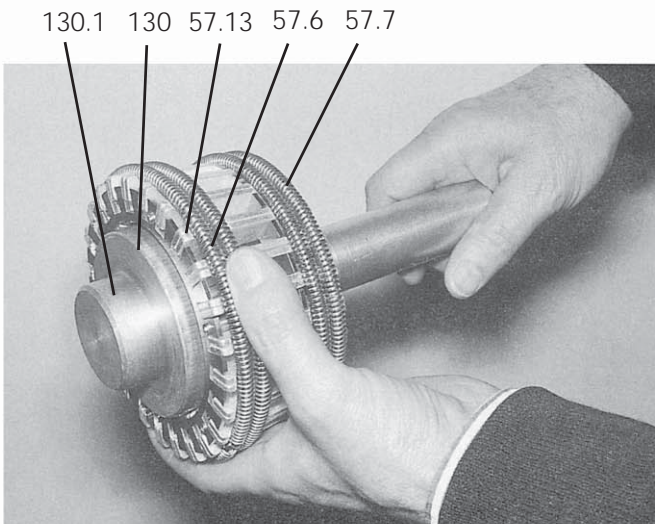
- 1> left: front view
- 2> right: rear view



127.1 127 57.3

Figure 7/2: Sliding the contact system onto the auxiliary arbour with the rear end first, schematic representation here for 1600 A.

- 57.3 Contact system, ...1600 A
- 127 Auxiliary arbour, ...1600 A
- 127.1 Plug, ...1600 A



130.1 130 57.13 57.6 57.7

Figure 7/3: Contact shift on auxiliary arbour for 2000 A to 3150 A.

- 57.13 Contact system, 2000 A to 3150 A
- 57.6 Internal annular tension springs
- 57.7 External annular tension springs
- 130 Auxiliar arbour, 2000 A to 3150 A
- 130.1 Plug, 2000 A to 3150 A

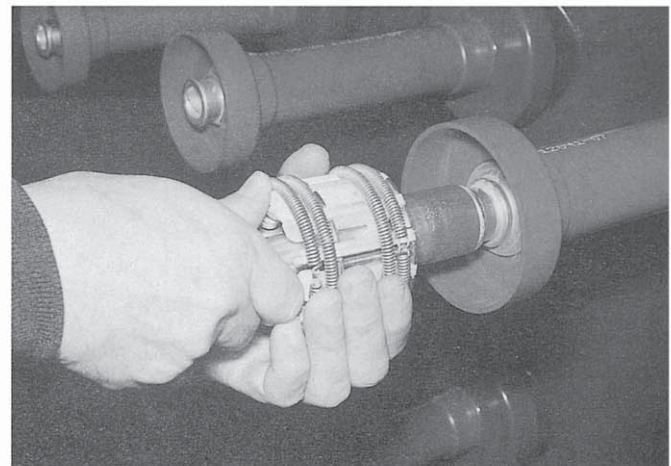


Figure 7/4: Sliding of the contact system from the auxiliary arbour onto the contact arm and engaging it here.



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