SIEMENS

Medium-Voltage Switchgear

Type 8BT2 Extendable Truck- Type Circuit-Breaker Switchgear up to 36kV Metal-Enclosed, Indoor Installation, LSC 2B PM, Single Busbar, Air-Insulated

INSTALLATION AND OPERATING INSTRUCTIONS

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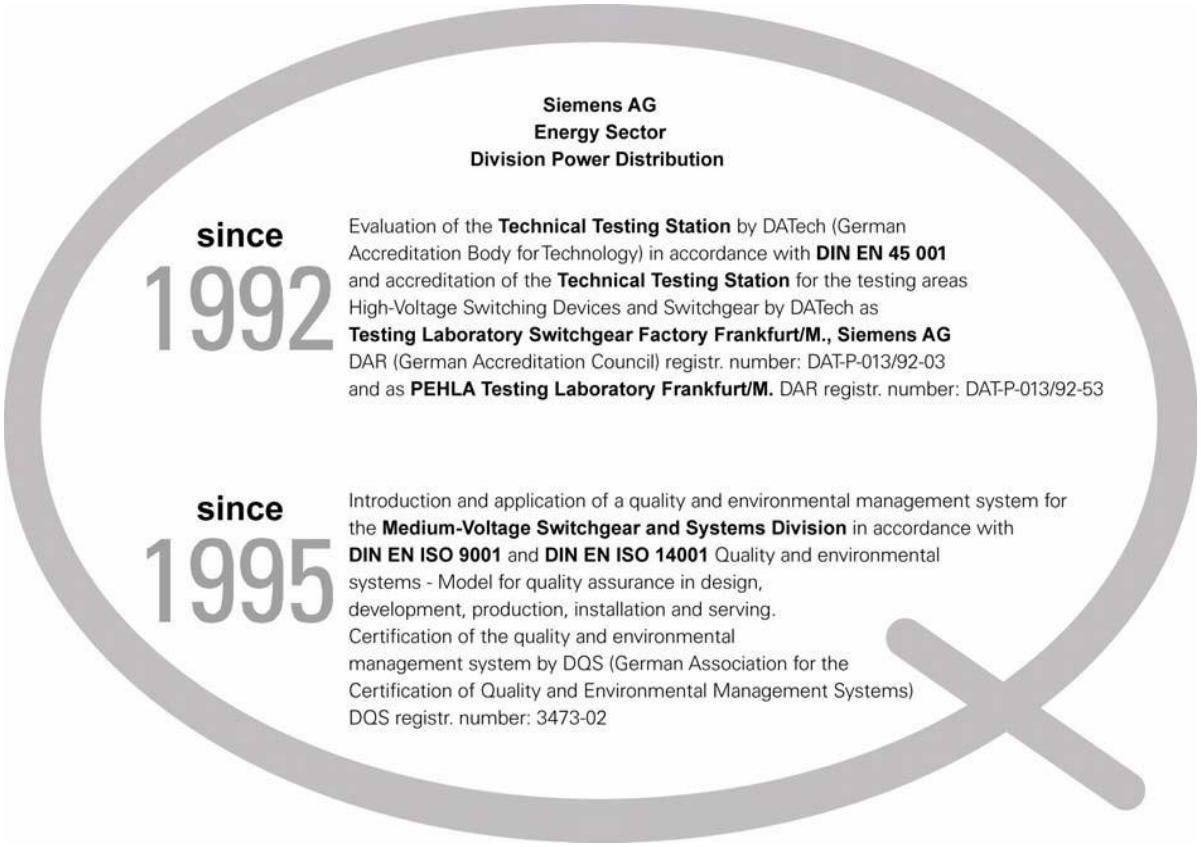

About these Instructions

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation or operation.

For details about technical design and equipment like e.g. technical data, secondary equipment, circuit diagrams, please refer to the order documents.

The switchgear is subject to continuous technical development within the scope of technical progress. If not stated otherwise on the individual pages of these instructions, we reserve the right to modify the specified values and drawings. All dimensions are given in mm.

For further details, e.g. about additional equipment and information about other switchgear types, please refer to catalog HA 26.41.

Should further information be desired or should particular problems arise which are not covered sufficiently by these instructions, the matter should be referred to the competent Siemens department.

The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The Sales Contract contains the entire obligations of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

Contents

1. SAFETY INSTRUCTIONS……4
1.1. Signal terms and definitions……4
1.2. General instructions……4
1.3. Due application……5
1.4. Qualified personnel……5
2. TECHNICAL INFORMATION……7
2.1. General……7
2.1.1. Features……7
2.1.2. Electrical data (max. values)……7
2.1.3. Dimensions of panels and the switchgear room……7
2.1.4. Wall opening details for the outlet of the closed pressure relief duct……9
2.1.4.1. Outlet from the rear……10
2.1.4.2. Outlet from the lateral side……10
2.1.5. Protection against solid foreign objects, electric shock and water……11
2.1.6. Basic prescriptions and standards……11
2.1.7. Electromagnetic compatibility – EMC……11
2.1.8. Rating plates……12
2.1.9. IAC classification……13
2.1.10. X-ray regulations……13
2.1.11. Operating conditions……13
2.2. Panel design……14
2.2.1. Basic panel types……16
2.2.1.1. Circuit breaker panel……16
2.2.1.2. Bus sectionalizing panel……16
2.2.1.3. Metering panel……16
2.2.1.4. Disconnecting panel……16
2.2.1.5. Busbar connection panel……16
2.3. Ventilation of the panels……16
2.4. Components……18
2.4.1. Truck type 3AH vacuum circuit breaker……18
2.4.2. Disconnector truck……19
2.4.3. Metering truck……19
2.4.4. Current & Voltage transformer……20
2.5. Interlocks……20
2.5.1. Panel interlocks with circuit breaker……20
2.5.2. Panel interlocks with earthing switch……20
2.6. Accessories……20
3. DISPATCH AND STORAGE……23
3.1. Delivery condition……23
3.2. Packing and transportation……23
3.3. Intermediate storage……23
4. INSTALLATION OF THE SWITCHGEAR……25
4.1. Preparation before the installation……25
4.1.1. General site requirements……25
4.1.2. Floor drawings and floor fixing details……25
4.1.3. Foundation……26
4.1.4. Tools……26
4.2. Unloading units……27
4.2.1. Unloading by forklift……27
4.2.2. Unloading by crane……27
4.2.3. The completeness and transport damage……28
4.2.4. Transport to the installation place……28
4.3. Assembly of the switchgear……30
4.3.1. Bolting panels together……30
4.3.2. Fastening panels to the foundation……32
4.3.3. Assembly of the busbars (Feeder and Coupling panels)……33
4.3.4. Busbar compartment separation (optional)……38
4.3.5. Earthing……45
4.3.5.1. Interconnecting the earthing busbar……45
4.3.5.2. Earthing the switchgear……46
4.3.6. Assembly of the low voltage compartment (on request)……46
4.3.7. Assembly of the arc routing plates……47
4.3.7.1. Gas pressure relief from the ear……48
4.3.7.2. Gas pressure relief from the top……49
4.3.8. Assembly of the closed relief duct……51
4.3.9. Electrical connections……56
4.3.9.1. Power cable connection……56
4.3.9.1.1. Front access of the panel……58
4.3.9.1.2. Rear access of the panel……61
4.3.9.1.3. Deep bottom pans (optional)……64
4.3.9.2. Control cable connection……65
4.3.9.3. Bus wire connection……66
4.4. Final installation work……66
4.4.1. Checking high voltage connections……67
4.4.2. Checking bolted joints……67
4.4.3. Checking control cable connections……67
4.4.4. Cleaning the switchgear……67
4.4.5. Checking and completing protection against adverse environmental influences (protection against corrosion)……67
4.4.6. Checking installation work……67
5. COMMISSIONING……68
5.1. Safety instructions……68
5.2. Preliminary work……68
5.2.1. Instructing the operating personnel……68
5.2.2. Drying dampness……68
5.2.3. Checking the installation work and the accessories……68
5.2.4. Checking interlocks mechanically……69
5.2.5. Test operation……69
5.2.6. Preparing power-frequency voltage test……69
5.3. Putting into service……70
5.4. Customer support……71
6. OPERATION OF THE SWITCHGEAR……72
6.1. Safety instructions……72
6.2. Control elements and indicators……72
6.3. Access to compartments……73
6.4. Operating tools……73
6.5. Opening and closing the high voltage compartment door……74
6.6. Moving the withdrawable device truck into and out of panel……75
6.7. Low voltage plug connection and coding……76
6.8. Racking the withdrawable device truck……78
6.9. Operating the circuit breaker……80
6.10. Operating the feeder and busbar earthing switches……82
6.11. Operation of the fused voltage transformers in the cable compartment……83
6.12. Verification of safe isolation from supply (LRM system)……86
6.13. Verification safe isolation (w/o LRM system)……87
6.14. Connecting the earthing and short circuiting facility……87
7. MAINTENANCE AND SERVICE……89
7.1. Maintenance……89
7.1.1. Visual inspection……89
7.1.2. Preventive maintenance……89
7.1.3. Maintenance of vacuum circuit breaker……90
7.1.4. Replacement of spare parts……90
7.2. Service information……91
7.2.1. Maintenance……91
7.2.2. Switchgear extension & retrofit……91
7.2.3. Spare part orders……91
7.2.4. Replacement panels and components……91
7.2.5. Disposal……91
8. TROUBLE SHOOTING……92
9. INDEX……93

1. SAFETY INSTRUCTIONS

1.1. Signal terms and definitions

	**DANGER!** As used in these instructions, this means that personal injuries can occur if the relevant precautionary measures are not taken. ⇨ Observe the safety instructions.

	**ATTENTION!** As used in these instructions, this means that damage to property or environment can occur if the relevant precautionary measures are not taken. ⇨ Observe the safety instructions.

	**NOTE!** As used in these instructions, this points at facilitations of work, particularities for operation or possible mal-operation. ⇨ Observe the notes.

Symbols used
⇨ Operation symbol: Identifies an operation. Ask the operator to perform an operation.
✓ Result symbol: Identifies the result of an operation.

1.2. General instructions

Independently of the safety instructions given in these operating instructions, the local laws, ordinances, guidelines and standards for operation of electrical equipment as well as for labor, health and environmental protection apply.

Any kind of modification on the product or alteration of the product must be coordinated with the manufacturer in advance, as uncoordinated modifications or alterations can cause the expiration of warranty claims, cause danger to life, limb and other legally protected interests, and the fulfillment of the type tests (according to IEC 62271-200) may not be guaranteed anymore.

The edition of the standard is only mentioned in the test report applicable at the time of switchgear manufacture.

Five Safety Rules of Electrical Engineering

The Five Safety Rules of Electrical Engineering must generally be observed during operation of the products and components described in these operating instructions:

- Isolate.
- Secure against reclosing.
- Verify safe isolation from supply.
- Earth and short-circuit.
- Cover or barrier adjacent live parts.

1.3. Due application

The switchgear corresponds to the relevant laws, prescriptions and standards applicable at the time of delivery. If correctly used, they provide a high degree of safety by means of logical mechanical interlocks and shockproof metal enclosure of live parts.

DANGER!

The perfect and safe operation of this switchgear is conditional on:

- ⇨ Observance of operating and installation instructions.
- ⇨ Qualified personnel.
- ⇨ Proper transportation and correct storage of the switchgear.
- ⇨ Correct installation and commissioning.
- ⇨ Diligent operation and maintenance.
- ⇨ Observance of the instructions applicable at site for installation, operation and safety.

1.4. Qualified personnel

Qualified personnel in accordance with these instructions are persons who are familiar with transport, installation, commissioning, maintenance and operation of the product and have appropriate qualifications for their work.

To get appropriate qualifications about transport, installation and commissioning, the personnel must have taken part in the training for assembly and installation of Siemens air- insulated medium-voltage switchgear type 8BT2.

This installation training provides detailed information about design, operation, installation and trouble shooting on the primary part of 8BT2 switchgear. After successful participation, the participants in this training get a certificate. This certificate authorizes the participants to install, assemble and connect this medium-voltage switchgear electrically at their own responsibility.

For further information about this installation training, please contact:

SIEMENS Sanayi ve Ticaret A.S.

Gebze Organize Sanayi Bölgesi (GOSB)

1000. Cd. 13. Sk. No:1004 , postal code: 41480 , Gebze – Kocaeli / TURKEY

E-mail: aftersaleskartal.tr@siemens.com

Tel : +90 216 459 3434

Furthermore, qualified personnel must have the following training and instruction or authorization:

- Training and instruction or authorization to switch on, switch off, earth and identify power circuits and equipment / systems as per the relevant safety standards
- Training and instruction regarding the applicable specifications for the prevention of accidents and the care and use of appropriate safety equipment
- Training in first aid and behavior in the event of possible accidents

Certificate

Assembly and Installation Training
8BT2 switchgear

Mr./Mrs. N.N.
Country

This is to certify that Mr./Mrs. N.N. successfully participated in the Training of Assembly and Installation of Siemens air-insulated medium-voltage switchgear type 8BT2 at the Siemens Training Center Gebze, Turkey.

By this certificate Mr./Mrs N.N. is authorized to install 8BT2 medium-voltage switchgear and the electrical connections self-dependently, including mechanical and electrical tests on site.

Mr./Mrs. N.N. is obliged to send written reports about any work performed on the switchgear to the Switchgear Factory Gebze, Turkey, department E D MV Q.

This certificate expires three years after the date of issue. Its validity can be extended by E D MV Training Center Gebze.

Gebze, May 4, 2010

Training Center Gebze

Instructor & Head of Training Center Gebze

Plant Manager

Answers for energy.

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2. TECHNICAL INFORMATION

2.1. General

2.1.1. Features

Air insulated 8BT2 36/70/170kV switchgear with the truck type circuit breaker has the following features:

- Factory-assembled, type-tested, metal-enclosed and metal-clad switchgear for indoor installation according to IEC 62271-200 / VDE 0671-200
- Loss of service continuity category LSC 2B (or LSC 2A as an option)
- Partition class PM by means of earthed, metallic shutters and partitions
- Internal arc classification: IAC A FLR, Isc ≤ 31.5kA, t=1s arc duration
- All switching operations can be performed with high-voltage door closed
- Standard degree of protection IP4X for the metal enclosure according to IEC 60529 / VDE 0470 Part 1
- Metallic, positively driven shutters protect against accidental contact with the live parts inside the panel
- Logical interlocks between actuation, circuit breaker, disconnecting function and earthing switch operating mechanism prevent mal-operation
- Feeder / busbar earthing by means of earthing switches with short-circuit making capacity.
- Mechanical position indicators for the withdrawable part and the earthing switch integrated in the mimic diagram at the panel front
- Position of the switching device truck visible through window in the high-voltage door.
- High flexibility due to various combinations of the basic panel types
- Wall-standing or free-standing arrangement
- Power cable connection from front for wall standing version and from front/rear for free standing version
- Designed as truck-type switchgear (circuit breaker)
- Panel-internal control cables routed in metallic wiring ducts or steel spiral tubes
- Cable testing without de-energizing the main busbars possible by using the lower shutter opening tool
- Extension of existing switchgear at both ends without modification of panels
- Use of block-type current transformers
- Type tested closed duct version
- Option: Verification of safe isolation from supply with high-voltage door closed by means of a voltage detecting system according to IEC 61243-5

2.1.2. Electrical data (max. values)

Rated voltage	U_r	[kV]	36
Rated power frequency withstand voltage (1 min.)	U_d	[kV]	80
Rated lightning impulse withstand voltage	U_p	[Hz]	170
Rated frequency	f_r	[kA]	50/60
Rated short circuit breaking current	I_{sc}	[kA]	31.5
Rated short circuit making current	I_{ma}	[kA]	82
Rated peak withstand current	I_p	[kA]	82
Rated short time withstand current	I_k	[s]	31.5
Rated duration of short circuit	t_k	[A]	3
Rated current of the busbar	I_r	[A]	3150
Rated current of feeders	I_r	[A]	3150
Rated current of bus-sectionalizing panels	I_r	[A]	3150

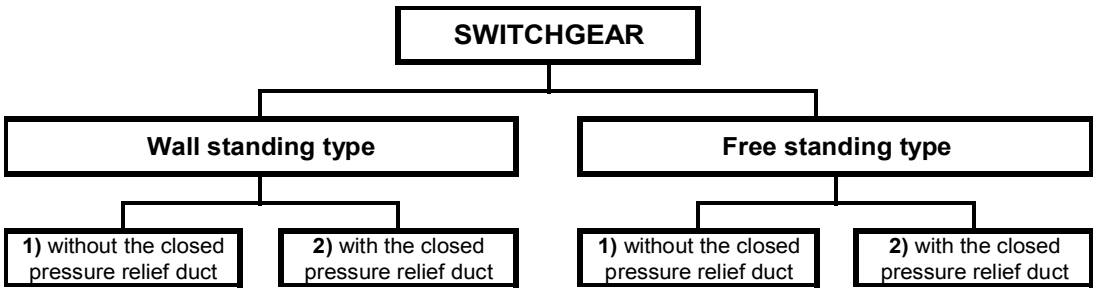
2.1.3. Dimensions of panels and the switchgear room

Panel type 8BT2	Rated current [A]	Panel replacement	width [mm]	depth [mm]	height [mm]	height with arc channel at top [mm]
Circuit breaker panel	≤ 3150	wall-standing	1200	2450	2400	2900
Busriser and Sectionalizing panels			2400			
Disconnector panel			1200	2700*		
Busbar connection panel						
Metering panel						
Circuit breaker panel	≤ 3150	free-standing	2400	2700		
Busriser and Sectionalizing panels						
Disconnector panel			1200			
Busbar connection panel						
Metering panel						

* "Wall-standing"&"with closed relief duct"

Switchgear room Please observe the following points when preparing the switchgear room:

- Transport ways to the switchgear room
- Distribution and intermediate storage spaces
- Size of the room and the doors
- Construction and load-bearing capacity of the floor
- Illumination, heating, power and water supply
- Dimensions of installation scaffoldings and foundation rails
- Installation of high-voltage cables
- Earthing system
- Cleanliness: Switchgear room free of dirt and dust



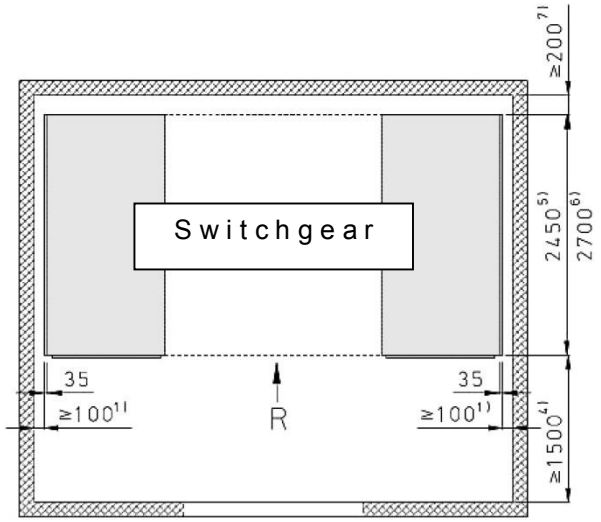
	NOTE!
	To install the switchgear, the room must have the certain minimum dimensions. Please observe the following illustrations.

	Rated short time withstand current [kA]	Without the closed pressure relief duct	With the closed pressure relief duct
Room inner height [mm]	25 – 31.5	≥ 3400	≥ 3000

	ATTENTION!
	Depending on the room height, the pressure relief system of switchgear with the evacuation ducts must be led to the outside of the switchgear building to be able to exhaust the hot gas due to an arc fault.

Wall standing type

1) without the closed pressure relief duct

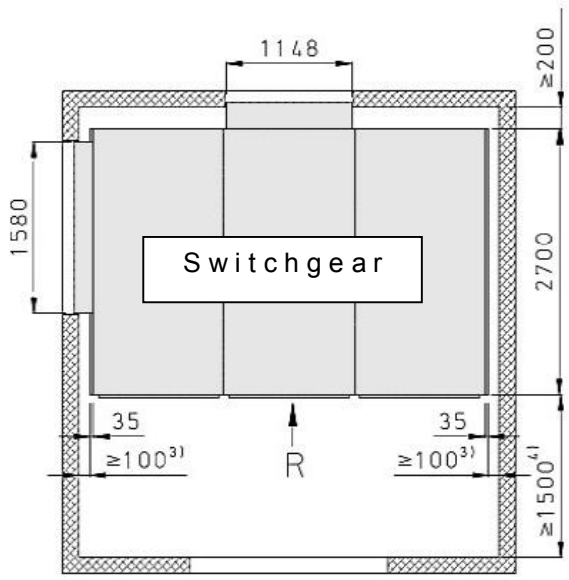


Remarks:

1) in between the panel's side wall and the room's wall:
   ≥ 100 mm or less than this value, PLEASE CONSULT SIEMENS.
   ≥ 500 mm for standard application.
   ≥ 800 mm when the short circuit current is 31.5kA.
4) Control aisle for panel replacement, from ground area of existing panels:
   ≥ 2700 mm for the panel type with the gas pressure relief from the rear
   ≥ 3000 mm for the panel type when the gas pressure relief from the top
5) 2450mm for the panel type with the gas pressure relief from the rear.
6) 2700mm for the panel type with the gas pressure relief from the top.
7) ≥ 200 mm when the short circuit current is 25kA.
   ≥ 800 mm when the short circuit current is 31.5kA

Note: Foundation details are shown on pages 24 and 25.

2) with the closed pressure relief duct



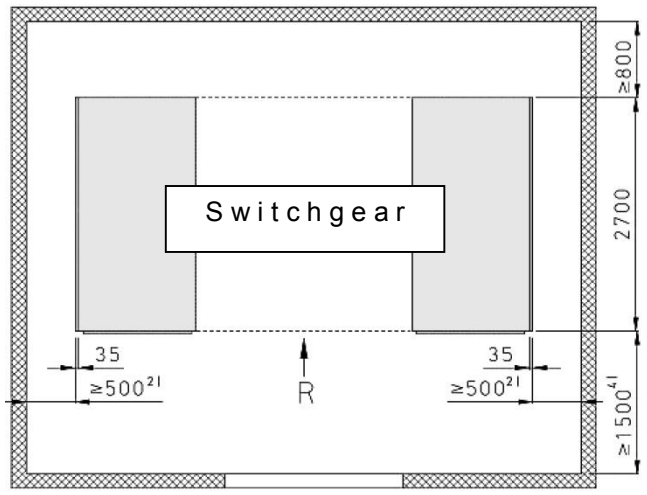
Remarks:

3) in between the panel's side wall and the room's wall:
   ≥ 100 mm or less than this value, PLEASE CONSULT SIEMENS company.
   ≥ 500 mm standard application.
4) Control aisle for panel replacement, from ground area of existing panels:
   ≥ 3000 mm

Note: Foundation details are shown on pages 24 and 25.

Free standing type

1) without the closed pressure relief duct

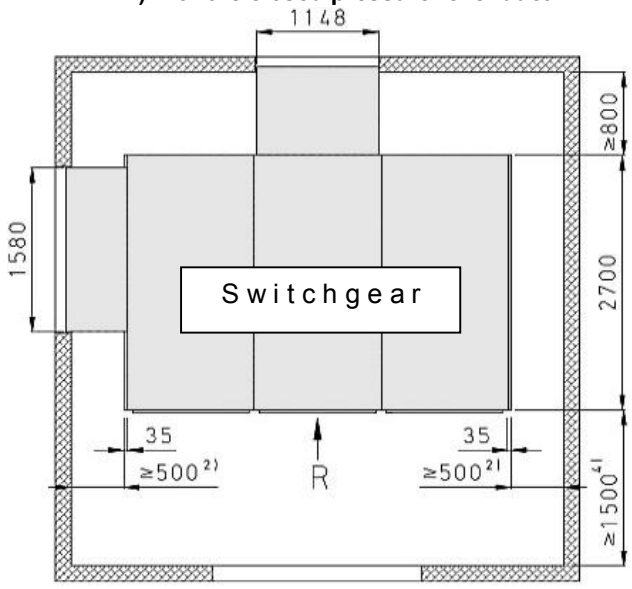


Remarks:

2) in between the panel's side wall and the room's wall:
   ≥ 500 mm to reach the rear of the switchgear.
   ≥ 800 mm when the short circuit current is 31.5kA.
4) Control aisle for panel replacement, from ground area of existing panels:
   ≥ 3000 mm

Note: Foundation details are shown on pages 24 and 25.

2) with the closed pressure relief duct



Remarks:

2) in between the panel's side wall and the room's wall:
   ≥ 500 mm to reach the rear of the switchgear.
4) Control aisle for panel replacement, from ground area of existing panels:
   ≥ 3000 mm

Note: Foundation details are shown on pages 24 and 25.

2.1.4. Wall opening details for the outlet of the closed pressure relief duct

There are two ways to let the gas pressure out of the switchgear room, a) from back of the switchgear and b) from the lateral side of the switchgear. In both ways, the below site works

on the wall need to be done:

2.1.4.1. Outlet from the rear of the switchgear

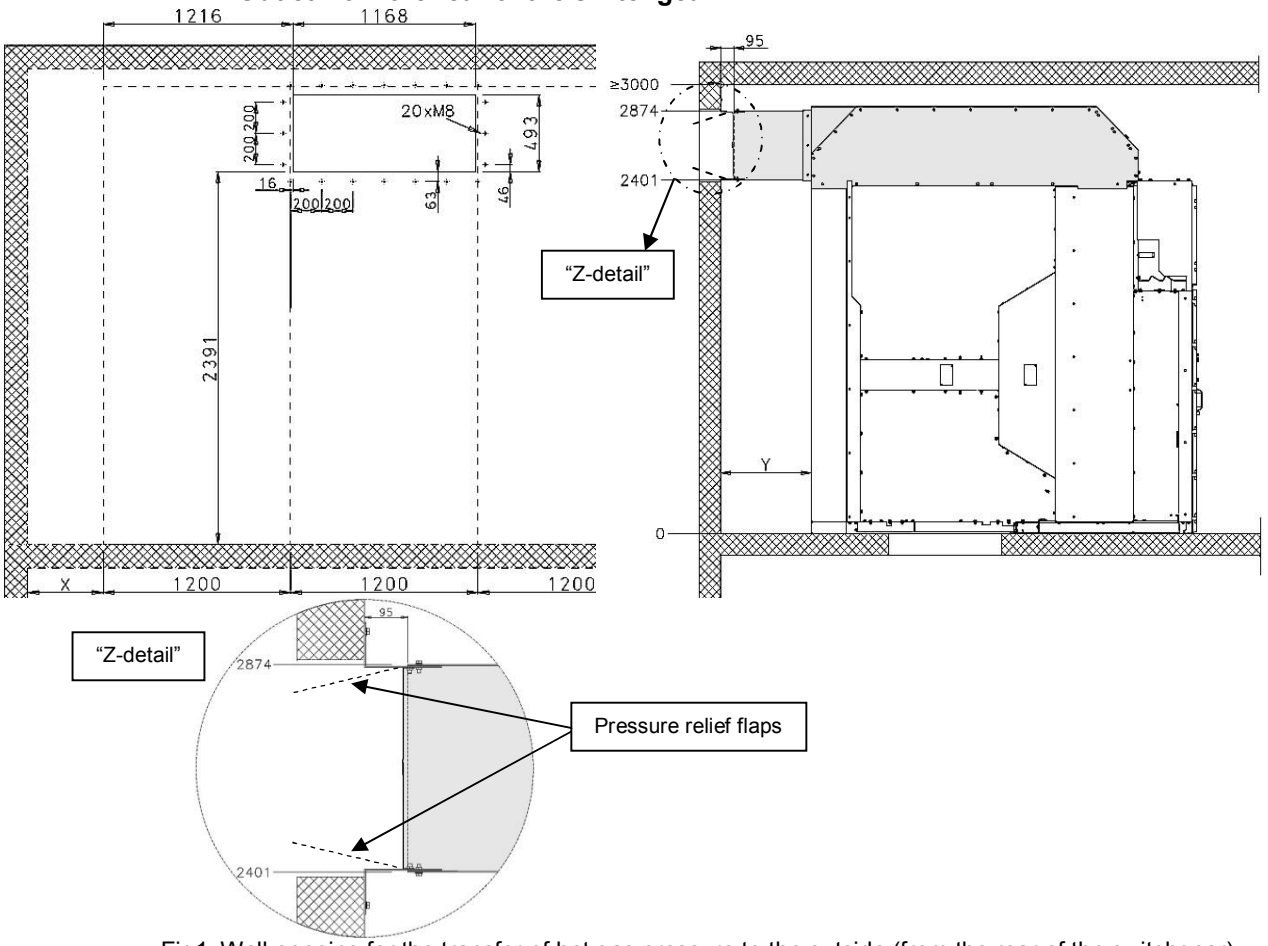
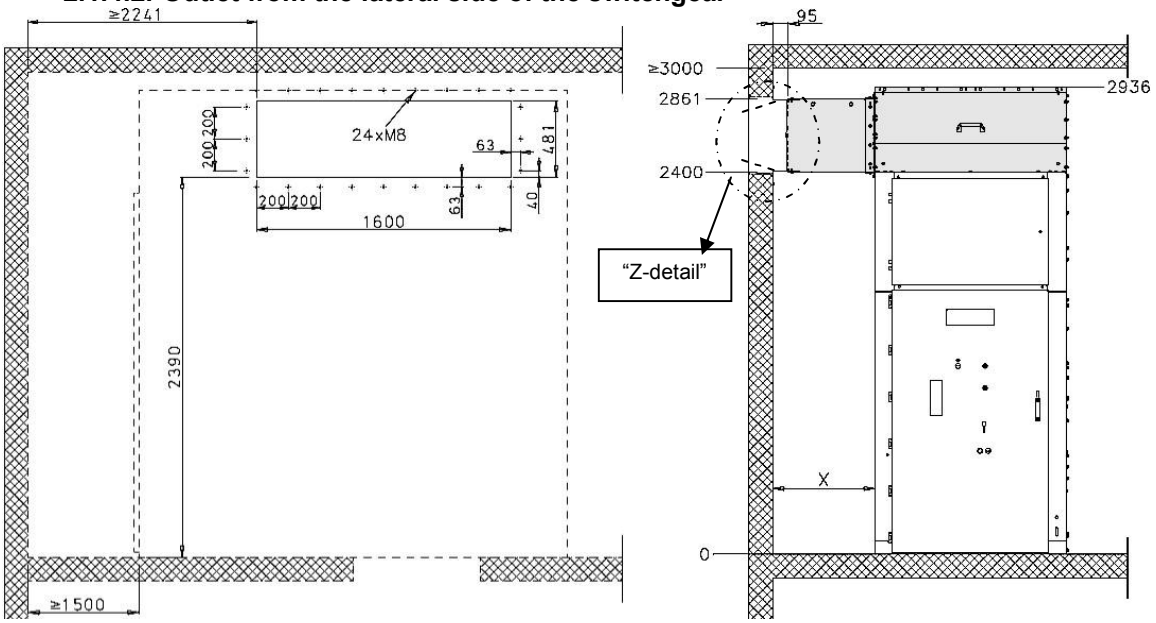


Fig1. Wall opening for the transfer of hot gas pressure to the outside (from the rear of the switchgear)

To make this arrangement on the wall, the reference point is the related panel's arrangement as seen in fig1. The gap (X dimension) between lateral side of the switchgear and the wall is important to identify the location of wall opening. The aisle at the back side of the switchgear (Y dimension) determines the length of the outlet channel. It should be specified during the order stage to be able to produce the suitable exhaust channels.

2.1.4.2. Outlet from the lateral side of the switchgear



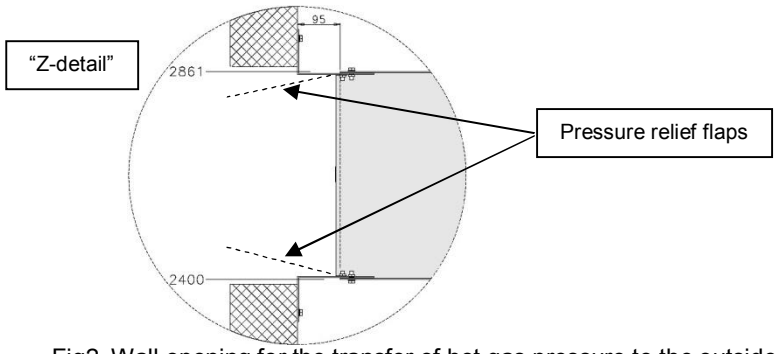


Fig2. Wall opening for the transfer of hot gas pressure to the outside (from the lateral of the switchgear)

To make this arrangement on the wall, the reference point is the aisle at the front of the switchgear (≥ 1500mm or ≥ 2241mm dimension) as shown on fig2. The aisle at the lateral side of the switchgear (X dimension) determines the length of the outlet channel. It should be specified during the order stage to be able to provide adequate channel.

	NOTE!
	Please see on page49 – 54 for the detailed information of the assembly of pressure relief channels.

2.1.5. Protection against solid foreign objects, electric shock and water

8BT2 switchgear complies with the following degrees of protection according to IEC 60529:
- IP4X for switchgear enclosure of the operating front and the side walls
- IP2X for between compartments

Degree of protection	Type of protection
IP4X	Protection against solid foreign objects: Protected against solid foreign objects, diameter > 1 mm. Protection against electric shock: Protected against access to hazardous parts with a wire (the access probe of 1 mm diameter shall not penetrate).
IP2X	Protection against solid foreign objects: Protected against solid foreign objects, diameter > 12.5 mm. Protection against electric shock: Protected against access to hazardous parts with a finger (the jointed test finger of 12 mm diameter, 80 mm length, shall have adequate clearance from hazardous parts).

2.1.6. Basic prescriptions and standards

		IEC/EN Standard	VDE Standard
Switchgear		62271-1	0670-1
		62271-200	0671-200
Switching devices	Circuit-breakers	62271-100	0671-100
	Disconnectors / Earthing switches	62271-102	0671-102
Voltage detecting systems		61243-5	0682-415
Insulation		60071-1	0111
Surge arresters		60099	0675
Degree of protection		60529	0470-1
Instrument transformers	Current transformers	60044-1	0414-1
	Voltage transformers	60044-2	0414-2
Installation, erection		61936-1	0101
Environmental conditions		60721-3-3	DIN EN 60721-3-3

2.1.7. Electromagnetic compatibility - EMC

To achieve appropriate electromagnetic compatibility (EMC), some basic requirements must be observed while erecting the switchgear. This applies especially to the installation and connection of external cables and wires.

Basic measures for ensuring EMC are already taken during design and assembly of the switchgear panels. Among other things, these measures include:
- the low-voltage compartment is an integral part of the panel, which means that the protection and control devices with the internal wiring are metal-enclosed;

- reliable earth connections of the frame parts via toothed contact washers or locking washers;
- inside the panel, wires are laid in metal ducts;
- spatial separation of sensitive signal wires from wires with high interference voltage levels;
- limitation of switching over voltages of inductive loads (e.g. relay or contactor coils, motors) by means of protective circuits with diode, varistor or RC element;
- within the LV compartment, the secondary devices are mounted in defined zones;
- shortest possible connection between corresponding modules in sub-racks;
- consideration of the magnetic leakage fields of conductor bars and cables;
- protection of sub-racks and wiring backplanes against interference by perforated shielding plates;
- large surface bonding between all modules and devices as well as bonding to the earthing conductor of the switchgear assembly.

These measures basically enable proper operation of the switchgear itself. The planner or operator of the switchgear must decide whether additional measures are required depending on the electromagnetic environment where the switchgear is installed. Such measures must be implemented by the installation company in charge.

In an environment with heavy electromagnetic interference it may be necessary to use shielded cables and wires for the external connections in order to avoid interferences in the low-voltage compartment and thus, undesired influences on the electronic protection and control or other automation devices.

Cable shields must be electrically bonded to be able to carry high frequencies, and contacted concentrically at the cable ends.

The shields of cables and wires are connected and earthed in the low-voltage compartment.

Connect the shields to earth potential - with high electrical conductivity and all around as far as possible. Protect the contact surfaces from corrosion in case of humidity (regular condensation).

When laying cables into the switchgear assembly, separate the control, signaling and data cables and other lines with different signal and voltage levels by laying them on separate racks or riser cable routes.
Corresponding to the different shield designs, there is a number of methods to perform connection. The planning department or site management determines which of the methods will be used, taking EMC requirements into account. The preceding points should always be taken into account.

The shield is connected to cables or wires with clamps contacting all around. If low demands are placed on EMC, it is also possible to connect the shield directly to earth potential (combine or twist the shield wires) or via short cable connections. Use cable lugs or wire-end ferrules at the connecting points.

Always keep the connecting leads of the shields as short as possible (< 10 cm).
If shields are used as protective earth conductors at the same time, the connected plastic-insulated lead must be marked green/yellow over its entire length. Non-insulated connections are inadmissible.

2.1.8. Rating plates

The rating plates contain all relevant data for the cubicle and its components.

Rating plates are located:
- On the inside of the door of the low-voltage compartment (rating plates for cubicle, current/voltage transformers)
- On the gear block of the circuit breaker (circuit breaker rating plate)

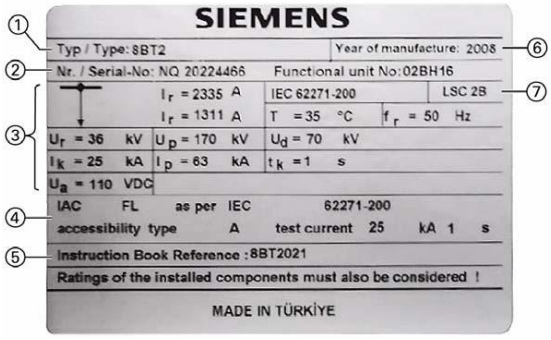


Fig3. Rating plate of the panel

2.1.9. IAC Classification

The data (pos.nr. ④ in fig3) describes the internal arc classification of the panel according to IEC 62271-200. The entries IAC A FL 25 kA 1 s in the example shown mean:

- IAC: Internal Arc Classification
- A: Type of accessibility A; for authorized personnel only; switchgear in closed electrical service location; access for expert personnel only.
- F: Internal arc classification for the front side (Front)
- L: Internal arc classification for the lateral sides (Lateral)
- R: Internal arc classification for the rear side (Rear)
- 25 kA: Tested short-circuit current
- 1 s: Rated duration of short circuit

2.1.10. X-ray regulations

The vacuum interrupters fitted in the 3AH vacuum circuit breakers are type-approved in accordance with theX-ray regulations of the Federal Republic of Germany. They conform to the requirements of the X-ray regulations of January 8, 1987 (Federal Law Gazette (BGBl.) I Page 144) §8 and Annex III Section 5 up to rated short-duration power-frequency voltage (rated power-frequency withstand voltage) stipulated in accordance with IEC/DIN VDE.

2.1.11. Operating conditions

8BT2 switchgear is designed for normal indoor operating conditions according to IEC 62271-1.

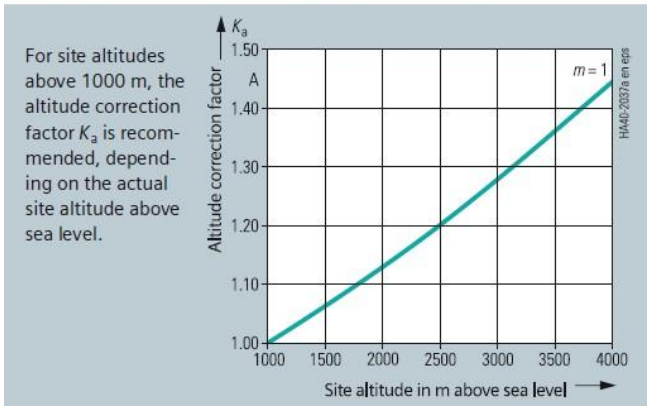
In this respect, the following limit values for the ambient air temperature must be complied with as a minimum:

	The ambient air temperature
Maximum value	+40
Minimum value	-5
Maximum value of 24-hour mean	+35

When 8BT2 switchgear is used in regions with high air humidity or considerable temperature fluctuations, there is risk of condensation. The formation of condensation should be an exception under normal operating conditions. To prevent condensation, rusting or other serious consequences, the associated preventive measures must be taken by installing electrical heating equipment in the switchgear. The ambient air must not be significantly polluted by dust, smoke, corrosive and/or flammable gases, vapors or salt.

In the normal service condition, the site altitude shouldn't exceed 1000m above sea level according to IEC 62271-1:2007, clause 2.1.1. If it exceeds 1000m value, Ka correction factor should be considered as explained below:

Altitude correction factor K_a for site altitudes



Example:
Site altitude: 3000 m above sea level
Switchgear rated voltage: 36kV - Rated lightning impulse withstand voltage: 170kV
Rated lightning impulse withstand voltage to be selected
170 kV · 1.28 = 217.6 kV
Result:
According to the above table, the switchgear with the rated voltage of 52 kV and rated lightning impulse withstand voltage of 250 kV is to be selected. (Please see IEC 62271-1:2007, clause 2.2.1)

2.2. Panel design

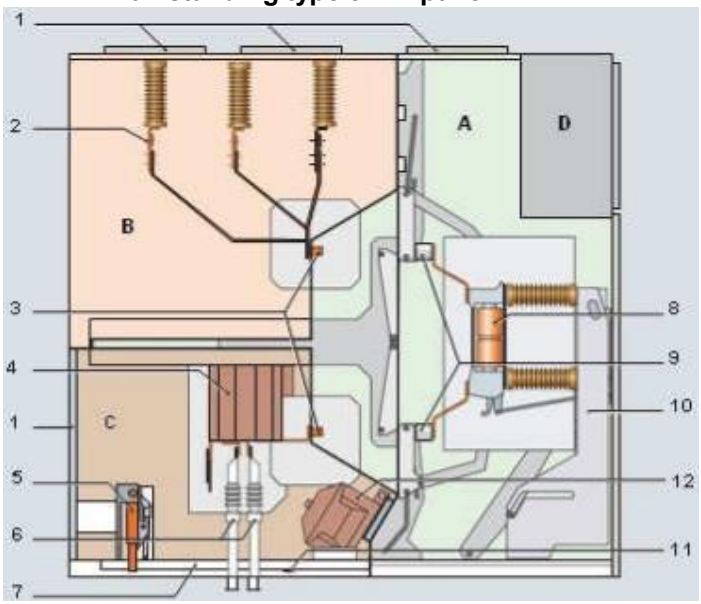
8BT2 truck-type circuit-breaker switchgear consists of various panel types which can be freely combined according to the requirements.

Basic design

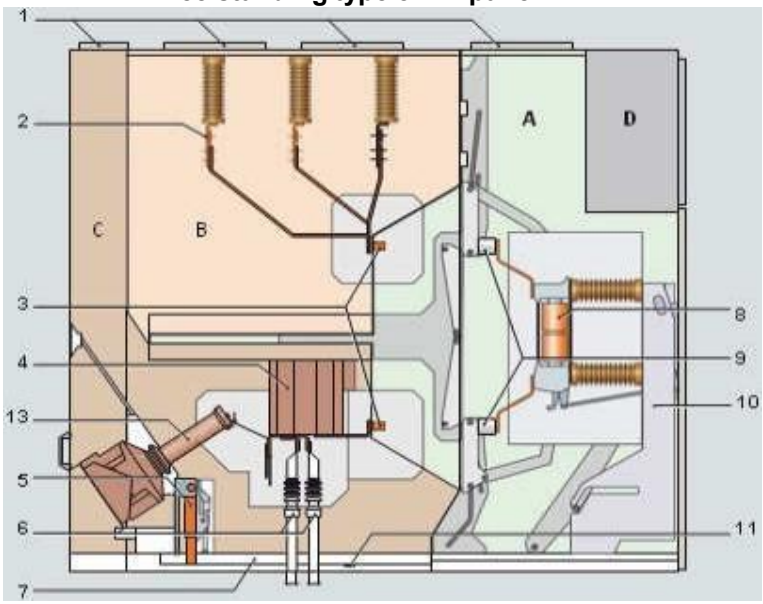
- Enclosure made of galvanized sheet steel
- Front doors and lateral switchgear end walls are powder-coated with resistant epoxy resin Material
- Individual modular compartments in solid-wall design
- Modular compartments bolted together

8BT2 truck-type circuit breaker switchgear is of the modular type and has four compartments.

Wall standing type 8BT2 panel



Free standing type 8BT2 panel



1 Pressure relief flaps
2 Busbars
3 Bushings
4 Block-type current transformer
5 Earthing switch
6 Cable sealing ends
7 Cable bracket
8 Vacuum interrupters
9 Contact system
10 Switching-device truck
11 Earthing busbar
12 Voltage transformer
13 Withdrawable voltage transformer with primary fuses
A Switching-device compartment
B Busbar compartment
C Cable compartment
D Low voltage compartment

Fig4. Panel types according to layout plan

A. Switching device compartment

Basic equipment

It consists of;

- All switching operations with high voltage door closed
- Pressure relief upwards
- Panel powder coated with epoxy resin
- Metallic, earthed shutters ensure partition class PM
- High voltage door pressure resistant in the event of internal arc in the panel
- Metallic ducts on the side for laying control cables
- Interlocking between high voltage door and the circuit breaker truck ensures interlock controlled access
- Components; vacuum circuit breaker truck, disconnector truck, metering truck

B. Busbar compartment

Basic equipment

- Version with rated normal current 800 A, 1250 A, 2000 A, 2500 A or 3150 A
- Busbars made of bare flat copper, bolted from panel to panel
- Pressure reliefs upwards into the switchgear-room or into the pressure relief duct.

Additional equipment

- Capacitive voltage taps in the post insulators for capacitive voltage detection
- Busbar voltage transformers
- Make-proof busbar earthing switch
- Transverse busbar partition from panel to panel and busbar insulation

C. Cable compartment

Rated normal feeder current I_r [A]	Single-core XLPE cables		Three-core XLPE cables 1)	
	Quantity per phase	Conductor cross section [mm²]	Quantity per phase	Conductor cross section [mm²]
≤ 1250	2	500	2	300
1250 < .... ≤ 2000	4	500		
2000 < ... ≤ 3150	6	500		

1) For the application of three-core cables, please see the deep bottom pan at the clause-4.3.9.1.3 on page62.

	NOTE!
	Please find the detailed information about the cable termination length at clause-4.3.9.1. on pages55 and 56.

Additional equipment

- Block-type current transformers
- Block-type voltage transformers
- Surge arresters
- Earthing switch with short-circuit making capacity
- Panel heater
- Sockets for capacitive voltage detecting systems

D. Low voltage compartment

Basic equipment

- Completely partitioned off the panel and removable from the panel as a separate unit
- For accommodation of protection, control, measuring and metering equipment
- Plug-in bus wires and control cables
- Standard version with 750 mm height
- Door hinge on the left

Additional equipment
- Heater
- Lighting

2.2.1. Basic panel types

	Circuit breaker panel	Bus sectionalizing panel	Metering panel	Disconnecting panel	Busbar connection panel
Basic components	Busbars	Busbars	Busbars	Busbars	Busbars
	Truck with 3AH vacuum circuit breaker	Truck with 3AH vacuum circuit breaker	Truck with voltage transformers	Truck with disconnector links	Truck with voltage transformers
	Low voltage plug connector to be coupled manually between truck and panel	Low voltage plug connector to be coupled manually between truck and panel	Low voltage plug connector to be coupled manually between truck and panel	Low voltage plug connector to be coupled manually between truck and panel	---
	Panel connection for cables	---	---	Panel connection for cables	Panel connection for cables
Additional components	Block type current transformers at the cable	Block type current transformers in the circuit breaker panel	Block type current transformers at the busbar	Block type current transformers at the cable	Block type current transformers at the cable
	Voltage transformers at the cable and busbar compartment	Voltage transformers two sets (one set in circuit breaker panel, one set in busriser panel)	---	Voltage transformers at the cable and busbar compartment	Voltage transformers at the cable compartment
	Earthing switch for busbar and feeder with short circuit making capacity	Earthing switch for busbar in the bussectionaliser panel with short circuit making capacity	Earthing switch for busbar with short circuit making capacity	Earthing switch for feeder with short circuit making capacity	Earthing switch for busbar with short circuit making capacity
	Capacitive voltage detecting system	Capacitive voltage detecting system	Capacitive voltage detecting system	Capacitive voltage detecting system	Capacitive voltage detecting system
	Surge arresters	---	---	Surge arresters	---
	---	---	Three HV HRC fuses mounted on the truck	---	---

2.2.1.1. Circuit breaker panel

Circuit breaker panels are used as incoming or outgoing feeder panels. The 3AH vacuum circuit breaker is mounted on a truck for pushing the vacuum circuit breaker into the panel. The vacuum circuit breaker can break the normal and short-circuit currents specified on the rating plate.

2.2.1.2. Bus sectionalizing panel

Bus sectionalizing consists of a circuit breaker panel and a bus riser panel.

2.2.1.3. Metering panel

Metering panels are used for measuring the voltage at the busbar system. The metering panel is equipped with a metering truck.

2.2.1.4. Disconnecting panel

Disconnecting panels can be used for no-load disconnection of two busbar sections in bus sectionalizing.

2.2.1.5. Busbar connection panel

Busbar connection panels are bus riser panels with a panel connection for cables.

2.3. Ventilation of the panels (circuit breaker feeders)

Rated feeder current [A]	Ventilation type without the pressure relief duct at the top	Ventilation type with pressure relief duct at the top
800	Not	Not
1250	Not	Not
2000	Not	Not
2500	Natural	Air forced with one fan
3150	Air forced with one fan	Air forced with one fan

	NOTE!
	In the rated current 3150A for Sectionalizing and Bus riser panel group, the fan for air forced ventilation is located in the sectionalizing panel which the circuit breaker is available. Bus riser panel is naturally ventilated.

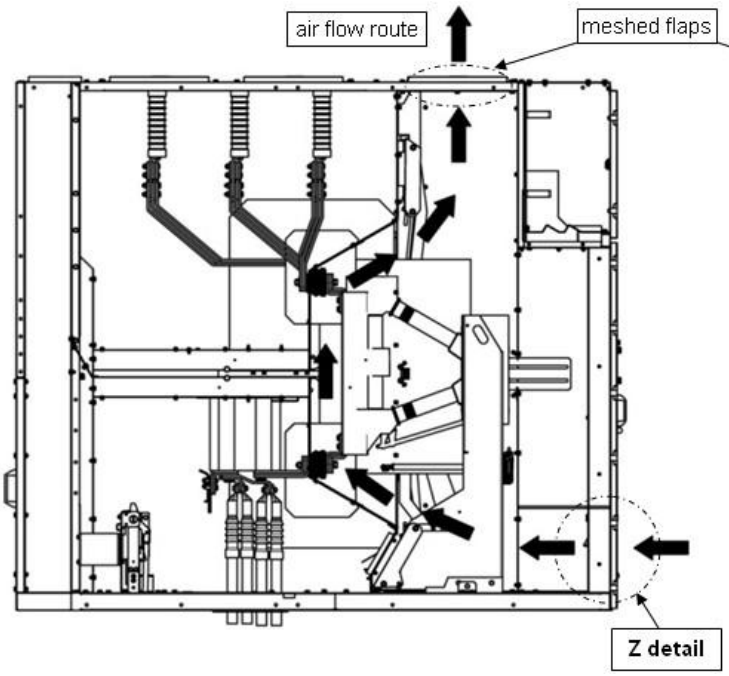


Fig5. Natural ventilation for 2500A rated current

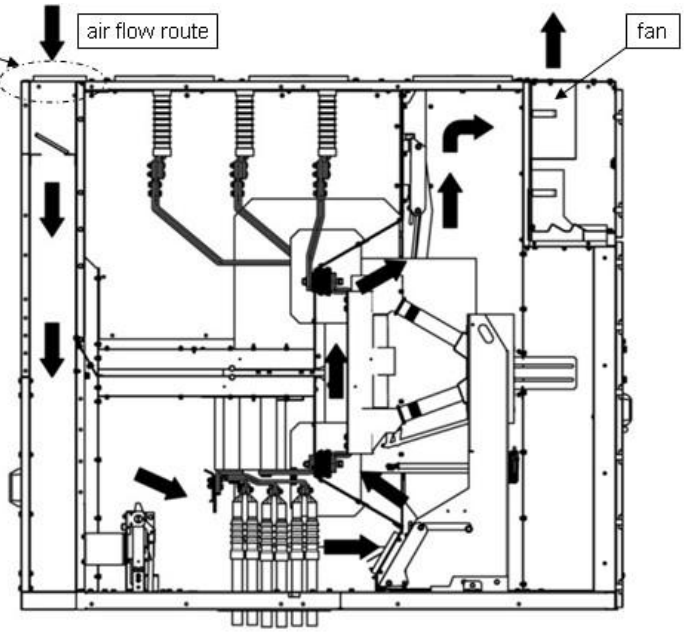


Fig6. Air forced ventilation for 3150A rated current

Z-detail

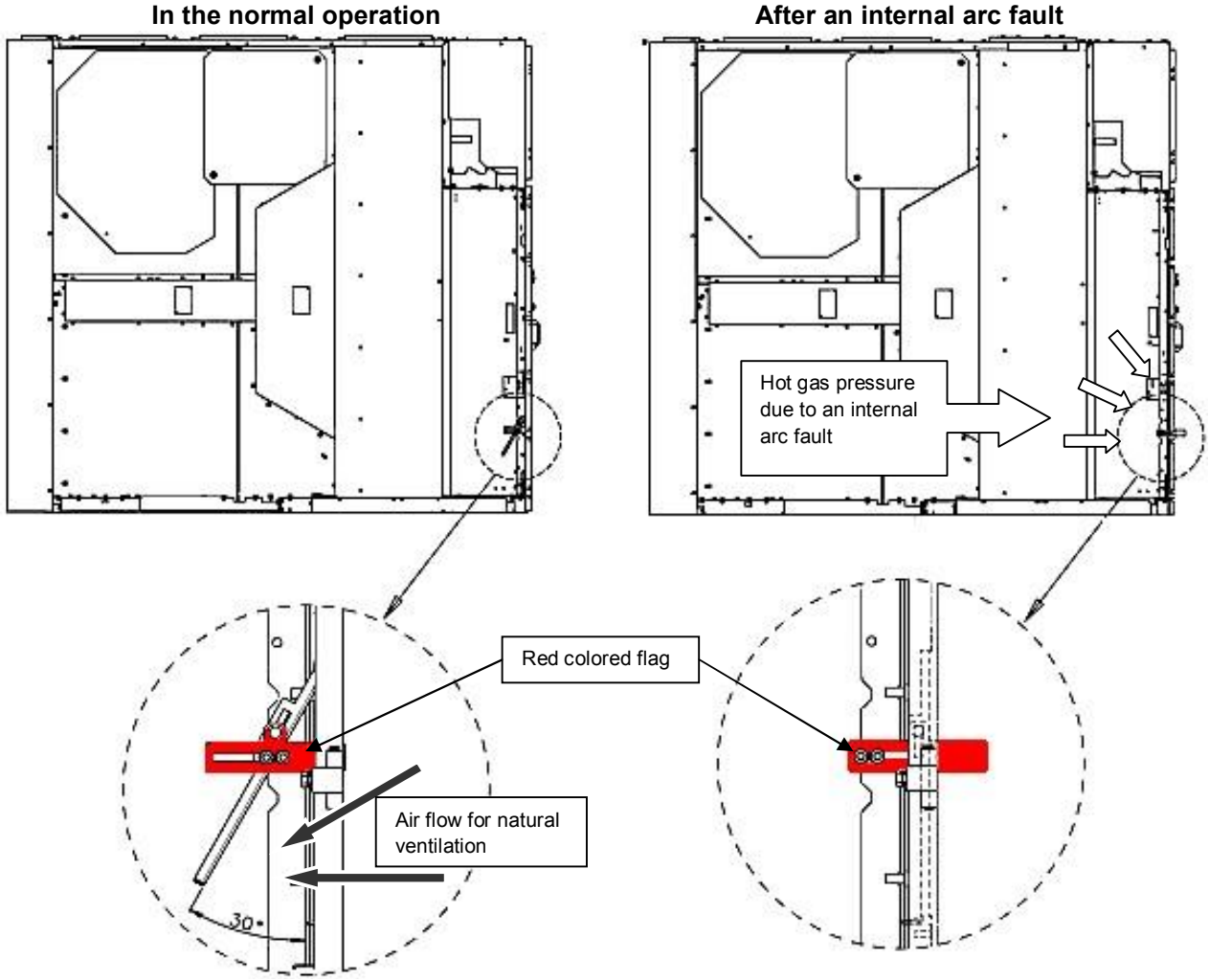


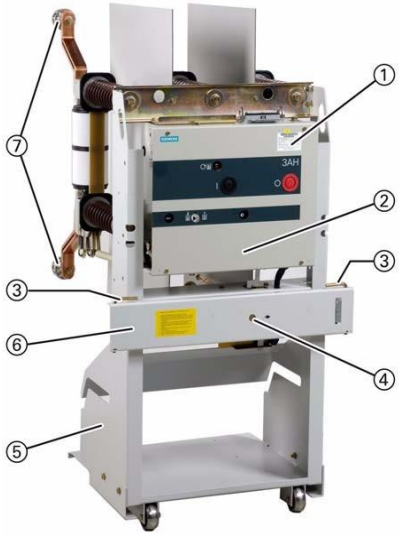
Fig7. Working condition of the ventilation flap on high voltage compartment door

	ATTENTION!
	In the normal operation, be sure that the red flag shown in fig7 is inserted to the hole until disappeared from the front of the panel. The ventilation window should be open to be able to perform the natural air flow. If not, the cooling will not be efficiently done. Accordingly, temperature rise value may exceed the limit.

Openings on the outer enclosure are needed to perform the air circulation in the panel for 2500A and 3150A rated feeder currents. Although slots and meshed flaps are arranged at the outer of enclosure, IP4X protection degree and the safety conditions in the case of hot gas release because of an arc fault are still available.

2.4. Components

2.4.1. Truck type 3AH vacuum circuit breaker



① Rating plate

② Front plate of 3AH circuit breaker with control elements

③ Fixing lever to lock the truck in the panel

④ Control element for racking the switching device truck

⑤ Truck

⑥ Mechanical interlock for operation of switching device truck

⑦ Contact poles

Features of truck with vacuum circuit breaker

- Integrated mechanical interlock for operating mechanism
- Mechanical position indicators for circuit-breaker
- Truck firmly interlocked with panel
- Manual operation of the switching device truck mechanism
- The control cables of the truck are connected with the panel through a low-voltage plug connector to be coupled manually when the circuit breaker truck is inserted in the panel

Additional equipment for vacuum circuit breaker

- Electromagnetic interlocks
- Second shunt release
- Under voltage release
- C.t.-operated release 0.1 s
- Design for higher insulation requirements

Note: For operating instruction, please see Page76, clause 6.9

Technical data

Spring charging motor

Rated voltage	Operating voltage		Power consumption		Rated current of miniature circuit breaker (CB) with C-characteristic [A]	
	max. [V]	min. [V]	W [at DC]	VA [at AC]	3AH3 type CB	3AH5 type CB
24 DC	26	20	500	-	16	8
48 DC	53	41	500	-	8	6
60 DC	66	51	500	-	6	4
110 DC	121	93	500	-	4	3
220 DC	242	187	500	-	2	2
110 AC	121	93	-	650	4	3
230 AC	244	187	-	650	2	2

Shunt release coils

Release	Power consumption		Tripping ranges	
	DC [approx. W]	AC [approx. W]	voltage [at DC]	voltage or current [at AC]
Closing solenoid	140	140	85 to 110% U	85 to 110% U
1st shunt release	140	140	70 to 110% U	85 to 110% U
2nd shunt release	70	50	70 to 110% U	85 to 110% U
Under voltage release	20	20	35 to 0% U	35 to 0% U

Operating times

Operating times at rated voltage at secondary circuit	Equipment of circuit breaker	Duration	
		3AH3 type CB	3AH5 type CB
Closing time	-	<75 ms	<65 ms
Opening time	1st shunt release	<60 ms	<55 ms
	2nd and 3rd release	<55 ms	<45 ms
Arcing time	-	<15 ms	<15 ms
Break time	1st shunt release	<80 ms	<70 ms
	2nd and 3rd release	<60 ms	<60 ms
Dead time	-	300 ms	300 ms
CLOSE/OPEN contact time	1st shunt release	<90 ms	<75 ms
	2nd and 3rd release	<70 ms	<60 ms
Minimum command duration	Closing solenoid	45 ms	45 ms
	1st shunt release	40 ms	40 ms
	2nd and 3rd release	20 ms	20 ms
Pulse time for CB tripping signal	1st shunt release	>15 ms	>15 ms
	2nd and 3rd release	>10 ms	>10 ms
Spring charging time for electrical operation	-	<15 s	<15 s

Closing time: The interval of time between the initiation (command) of the closing operation and the instant when the contacts touch in all poles.
Opening time: The interval of time between the initiation (command) of the opening operation and the instant when the contacts separate in all poles.
Arcing time: The interval of time from the first initiation of an arc and the instant of final arc extinction in all poles.
Break time: The interval of time between the initiation (command) of the opening operation and the instant of final arc extinction in the last-pole-to-pole (= opening time and arcing time).
Close/open contact time: The interval of time (in a make-break operating cycle) between the instant when the contacts touch in the first pole in the closing process, and the instant when the contacts separate in all poles in the subsequent opening process.

NOTE!

For the detailed information about 3AH series circuit breaker (CB), please consult to the below catalogues:

3AH3 vacuum CB……3AH3_Catalogue HG11_03_2010

3AH5 vacuum CB……3AH5_Catalogue HG11_05_2010

2.4.2. Disconnector truck

Features of Disconnector truck

- Truck firmly interlocked with panel
- The control cables of the truck are connected with the panel through a low voltage plug connector to be coupled manually when the truck is inserted in the panel

2.4.3. Metering truck

Basic equipment of metering truck

- Voltage transformers for all three phases

Additional equipment for vacuum circuit breaker

- Electromagnetic interlocks

2.4.4. Current & Voltage transformer

	Current transformer	Voltage transformer	Voltage transformer with fuse
Features	• According to IEC 60044-1 • 4MA7 block-type current transformer, cast-resin insulated	• According to IEC 60044-2 • Cast-resin insulated	• According to IEC 60044-2 • Cast-resin insulated • Replaceable primary fuses
Mounting location	The block-type current transformers can be installed in the cable compartment of switching device panels, bus sectionalizing panels or at the busbar in the metering panel.	VB36M voltage transformers can be mounted on the metering truck, in the cable compartment or at the busbar. The transformers on the metering truck can be equipped with fuses.	VBF36-KDS voltage transformers with fuses can be mounted in cable compartment as withdrawable, only in free standing version.
Pictures			

2.5. Interlocks

2.5.1. Panel interlocks with circuit breaker

Mechanical interlocks

Action	Interlocking condition
Closing the circuit-breaker	Low-voltage plug connector on circuit-breaker is plugged in; switching device truck has reached defined end position
Removing the low-voltage plug connector from the circuit-breaker	Switching device truck is in TEST position
Opening the high-voltage door	If the switching device truck is in the panel: Switching device truck is in TEST position
Closing the high-voltage door	If the switching device truck is in the panel: Low-voltage plug connector on circuit-breaker is plugged in, and locking gates of guide rails are closed
Racking the switching device truck to SERVICE position	High-voltage door is closed and feeder earthing switch is open
Racking the switching device truck to TEST position	High-voltage door is closed and circuit-breaker is open
Replacing the switching device truck	Switching device truck can only be replaced if the coding is identical

Additional interlocks (optional)

Action	Interlocking condition
Racking the switching device truck	Electromechanical interlock
	Mechanical locking device with padlock for switching device truck

2.5.2. Panel interlocks with earthing switch

Mechanical interlocks

Action	Interlocking condition
Operating the feeder earthing switch	Switching device truck is in TEST position
Racking the switching device truck to SERVICE position	Feeder earthing switch is in OPEN position

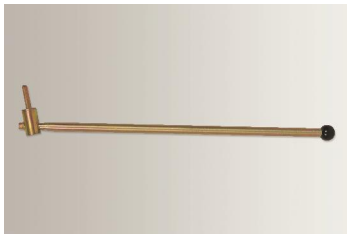
Additional interlocks (optional)

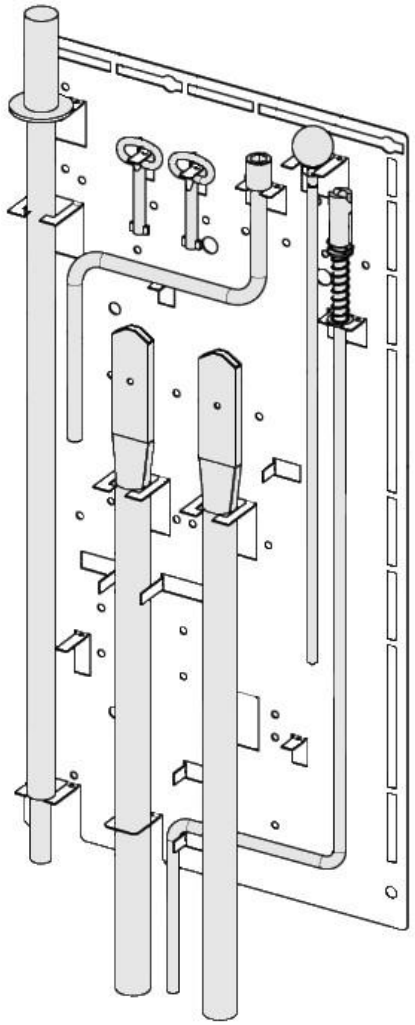
Action	Interlocking condition
Operating the feeder earthing switch	Electromechanical interlock
	Padlock

2.6. Accessories

Standard accessories The below accessories are supplied with the switchgear:

Operating rod for closing / opening the circuit breaker mechanically	
Double bit key with a diameter of 3 mm for opening and closing the door of the low voltage compartment	

Double bit key with a diameter of 5 mm for releasing and interlocking the withdrawable part	
Operating lever for the feeder and the busbar earthing switches	
Hand crank for racking the switching device truck in and out	
Hand crank for manual charging of the circuit breaker's closing spring in SERVICE position	
Lower shutter opening tool	
Operating lever for the withdrawable voltage transformers mechanism	

Wall-mounting holder for the storage of operating tools (optional)	

Other accessories

- Wall mounting holder for accessories
- Touch up set for paint damages
- Lubricants
- Earthing accessories for ratings ≤ 31.5kA
- 64 pole connecting cable, length: 3m
- Test equipment for the pressure switch
- KP incandescent lamp voltage indicator with operating rod 12kV
- HV HRC fuse links
- Cable lugs / adapter systems
- Surge arresters
- HR voltage indicators
- Test units to check the capacitive interface and the voltage indicators (fig8)
- Phase comparison test units for capacitive voltage indicators type EPV-HR (e.g. Pfisterer, including 2HR-LRM adapters and storage bag) (fig9)

Fig8. Test unit for capacitive interface and indicators

Fig9. Test unit for phase comparison

3. DISPATCH AND STORAGE

3.1. Delivery condition

8BT2 cubicles are factory assembled and the withdrawable parts are in the service position and the doors are closed during the dispatch.
They are checked at the works for completeness in terms of the order and simultaneously subjected to routine test to IEC publication 62271-200, and are therefore tested for correct structure and function.
The busbars are not assembled. The busbar material, fasteners and accessories are packed separately.

3.2. Packing and transportation

Packing

Depending on the kind of transport and country of destination, the transport units can be packed as follows:

- On pallets, covered with PE protective foil
- In a seaworthy crate (switchgear is sealed with desiccant bags in PE protective foil, maximum storage period: 6 months)
- Other packing in special cases.

	**NOTE!** The packing materials of 8BT2 switchgear can be disposed of as classified materials. ⇨ Please observe the local regulations for disposal and environmental protection.

Transport unit

The switchgear is delivered in transport units. These consist of individual switchpanels without fitted busbars.
Accessories are packed separately and included with the switchgear.

Transport weights, dimensions with packing

Panel type	Domestic packing dimensions (mm)			Transport weights (kg)
	width	depth	height	maximum
A Wall standing	1250	2600	2620	1250
A Free standing	1250	2850	2620	1450
	Seaworthy packing dimensions (mm)			Transport weights (kg)
	width	depth	height	maximum
A Wall standing	1470	2720	2670	1900
A Free standing	1470	2970	2670	2100

3.3. Intermediate storage

	**DANGER!** Risk of injury and damage to the storage place and the stored goods if the storage space is overloaded. ⇨ Observe the load-bearing capacity of the floor. ⇨ Do not stack the transport units. ⇨ Do not overload lighter components by stacking.

	**ATTENTION!** Fire risk. The transport unit is packed in flammable materials. ⇨ No smoking. ⇨ Keep fire extinguishers in a weatherproof place. ⇨ Mark the location of the fire extinguisher.

ATTENTION!

Supplied desiccant bags lose their effectiveness if they are not stored in the undamaged original packing.

⇨ Do not damage or remove packing of desiccant bags.
⇨ Do not unpack desiccant bags before use.

If the comprehensive accessories, the delivered switchgear or parts thereof have to be stored before installation, a suitable storage room or place has to be selected and prepared.

In a suitable storage room, condensation must not be possible; if necessary, cooling or heating systems should be installed to prevent condensation.
Intermediate storage of the transport units:

- In original packing as far as possible
- Observe the permissible storage temperature from -25 °C to +70 °C in accordance with the installed secondary devices. In the individual case, the electronic components must be checked regarding the permissible limit temperatures and the relevant temperatures for the application (e.g. Siemens Siprotec in the range from -25 °C to +70 °C).
- In a weatherproof place
- Protected against damage
- If packed in seaworthy crates, the switchgear can be stored for a maximum of 6 months (desiccant bags) with a relative humidity of 60 %.
- Store transport units in such a way that the can be taken out later in the correct order for installation.

Switchgear storage in closed room

As a rule, the switchgear should be stored in a closed room. The storage room must have the following characteristics:

- Floor with adequate load bearing capacity (weights as per delivery note)
- Even floor to enable stable storage
- Well-ventilated and free of dust as far as possible
- Dry and protected against humidity and vermin (e.g. insects, mice, rats)
- Heat to about 10 °C above outside temperature to prevent condensation
- Provide adequate ventilation in heated storage rooms
- Check humidity in the packing every 4 weeks (condensation)
- Do not unpack small parts to avoid corrosion and loss.

Outdoor storage of Switchgear packed in seaworthy crates

If the switchgear or parts thereof are delivered in seaworthy crates, these can be stored up to 6 months in other rooms or outdoors. The storage place must have the following characteristics:

- Floor with adequate load-bearing capacity (weights as per delivery note)
- Protected against humidity (rain water, flooding, melting water from snow and ice), pollution, vermin (rats, mice, termites, etc.) and unauthorized access
- Place all crates on planks and square timber for protection against floor humidity
- After 6 months of storage, have the desiccant agent regenerated professionally. To do this, ask for expert personnel via your regional SIEMENS representative.

4. INSTALLATION OF THE SWITCHGEAR

4.1. Preparation before the installation

In order to obtain an optimum installation sequence and ensure high quality standards, site installation of the switchgear should only be carried out by specially trained and skilled personnel or at least by supervised and monitored by responsible persons.

When the installation is in the scope of supply of the manufacturer, the regional SIEMENS representative requires the following information from you several weeks before the delivery of the switchgear.

- Sketch of the installation room including the locations and numbers of the individual cubicles and the storage space for the accessories
- Sketch of the access route from the public road to the switchgear building and information concerning the condition thereof (meadows, arable soil, sand, gravel, etc.)
- Sketch of the transport route inside the switchgear building with the locations and dimensions of doors and other narrow points, as well as the floor number of the installation room
- Information about available lifting equipment, e.g. mobile crane, fork-lift truck, lifting truck, hydraulic jack, roller pads. If no lifting equipment is available, please notify this explicitly.

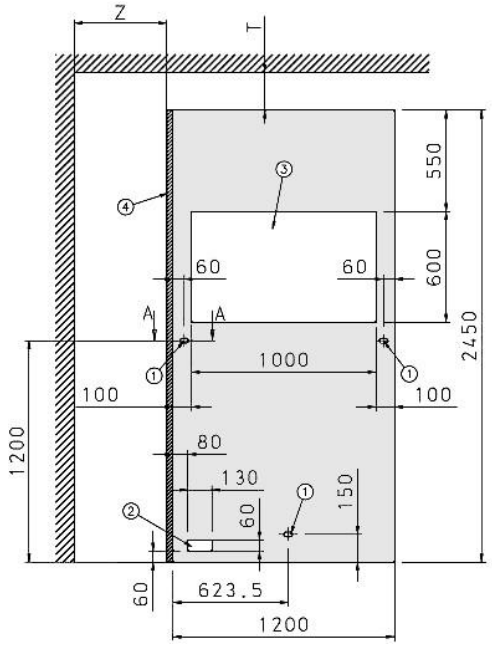
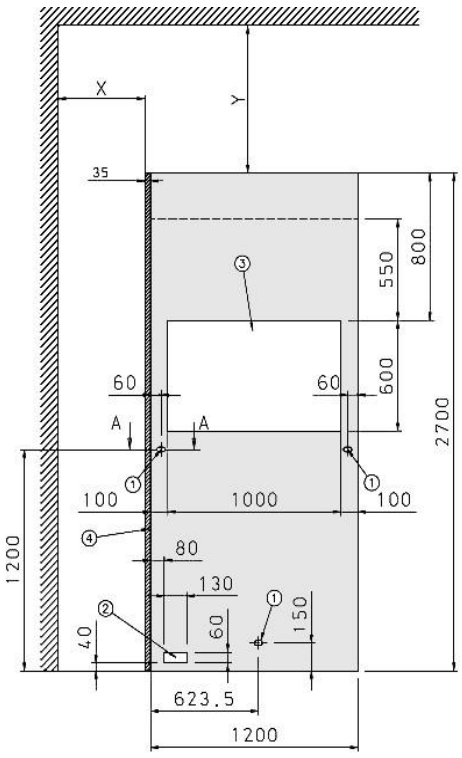
4.1.1. General site requirements

Before starting the installation of the switchgear, the below conditions should be completed properly:

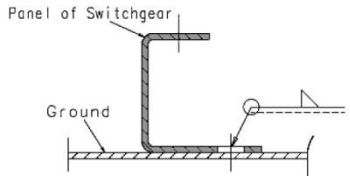
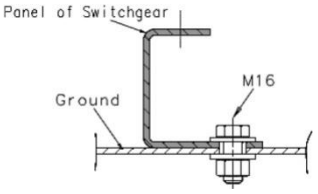
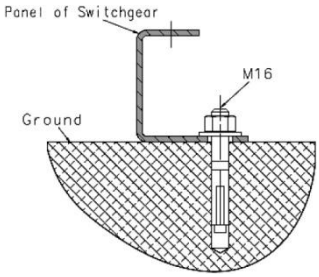
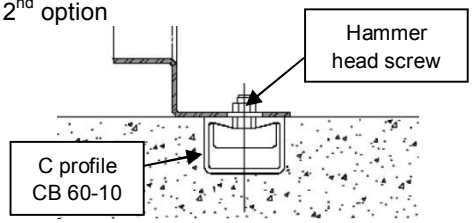
- Lighting and electricity supply
- Switchgear room having ventilation, lockable facilities and dry condition
- Wall opening(s) for outlets of pressure relief ducts
- Cable ducts and channels for laying the power and control cables
- Sufficient ceiling height for the switchgear
- Being ensure about -5 °C indoor temperature class in the switchgear room

4.1.2. Floor drawings and floor fixing details

Floor drawings

	Wall standing type	**Free standing type**
Detailed foundation drawings		
Pos.nrs.	① …Floor fixing points (Opening dimensions: 25 x 45mm.) ② …Floor opening for low voltage control cables ③ …Floor opening for high voltage power cables ④ …Switchgear end wall	
Note	X, Y, Z, T dimensions are mentioned in drawings on page9 and 10.	

Floor fixing details

Welded floor fixing	Bolted floor fixing	Floor fixing with dowels
		1st option  2nd option 
A-A section in floor drawings	A-A section in floor drawings	A-A section in floor drawings

4.1.3. Foundation

- A suitable foundation can be a false floor, a double floor or a reinforced-concrete foundation. The reinforced-concrete floor must be equipped with foundation rails for supporting the panels.
- As for design and construction of the foundation, the relevant standards DIN 43661 “Fundamentschienen in Innenanlagen der Elektrotechnik” (Foundation rails in electrical indoor installations) and DIN 18202 “Maßtoleranzen im Hochbau” (Blatt 3) (Measuring tolerances in structural engineering (Sheet 3)) apply.
- If the foundation has to be resistant to earthquakes, additional points must be considered. Please ask your regional SIEMENS representative for the advice on this special condition.
- Determine level differences between the installation surfaces of the panels using a measuring sheet, and compensate them with shims (0.5 to 1.0 mm).

ATTENTION!

During the preparation of the cable gallery, the deep bottom pan’s dimensions (especially height) should be taken into consideration.

Please see on page62 and 63 for the detail information.

4.1.4. Tools

- These instructions
- Measuring sheet of the base frame
- Lifting truck
- Several roller pads (reinforced rollers)
- Several strong boards
- Rope or chain with transport shackles
- Transport rods (diameter 25 to 30mm)
- Reinforcing bars, roller crowbars
- Torque wrench (6-260 Nm)
- Shim plates 0.5 to 1 mm
- Phase tape (L1, L2, L3, gn/ye)
- Shell VASELINE 8422 DAB 8 (0.250 kg tube, order no.: 8BX 2041)
- Plumb bob, nylon thread (kite string or similar)
- Wire brush, copper sponge
- Soft, lint-free cloth
- Brush, cleaning cloth
- Cleaning agent: ARAL 4005 or HAKU 1025/90, HAKU 5067, MTX 60 and household cleaner

Also useful:

- Building site distribution board for 400/230 V AC (50/60 Hz)
- Extensions for 230 V AC (50/60 Hz)
- Hydraulic jack (2 to 3 t, for vertical and horizontal stroke)
- Sling ropes
- Transport rollers
- Various pieces of squared timber
- Step-ladders
- Workbench with vise
- 1/2"and 3/8" ratchet spanners with various extensions
- Nuts for M10, M13, M16, M17, M18, M19, M24
- Ring spanners, sizes 10, 13, 16, 17 ,18 ,19, 24
- Various slotted-head and Torx screwdrivers
- Side cutter
- Water pump pliers
- Various crimping pliers, stripping pliers, flat nose pliers, universal pliers, pointed pliers etc.
- Water level
- Guide string
- Scriber
- Vacuum cleaner
- Scriber
- Try-square
- Tape measure
- Vernier caliper
- Measuring instrument with test probes, measuring cables, clamp-type test probes
- Continuity tester (beeper)
- Site illumination
- Hand lamp
- Pocket lamp
- Hammer drill

4.2. Unloading units

	**DANGER!** If incorrectly unloaded, the transport units may fall down and cause injury. ⇨ Please ensure that the lifting and transport gear used meets the requirements as regards construction and load-bearing capacity. ⇨ Ensure even weight distribution.

	**ATTENTION!** If incorrectly unloaded, the transport units may be damaged. ⇨ Observe the instructions on the packing. ⇨ Attach ropes far enough on the hoisting tackle so that they cannot exert any forces on the cubicle walls under load. ⇨ Do not climb onto the roof of the cubicles. ⇨ Unload the transport units in packed condition and leave packed for as long as possible. ⇨ Do not damage the PE protective foil during unloading. ⇨ Set down the transport units as close to the switchgear building as possible in order to avoid unnecessary ways. ⇨ Move the transport units into the building. Only remove packing where absolutely necessary in order to keep the switchgear as clean as possible.

4.2.1. Unloading by forklift

Unloading the transport units from the truck should be done by a forklift (fig10).
- Fork length ≥ 1500 mm

⇨ Insert the lifting forks from the side of the panel.
⇨ Ensure that the panel is balanced on the forklift.

Fig10. Unloading by forklift

⇨ Move the transport unit as close as possible to its intended foundation.
⇨ Dismantle and remove the crates if provided.
⇨ Lift the plastic packing sheet and check the transport unit for potential damage.

4.2.2. Unloading by crane

⇨ Attach ropes far enough on the hoisting tackle so that they cannot exert any forces on the cubicle walls under load. The hoisting tackle can optionally be ordered as an accessory (fig11).
⇨ Do not drag the cubicle along the ground.

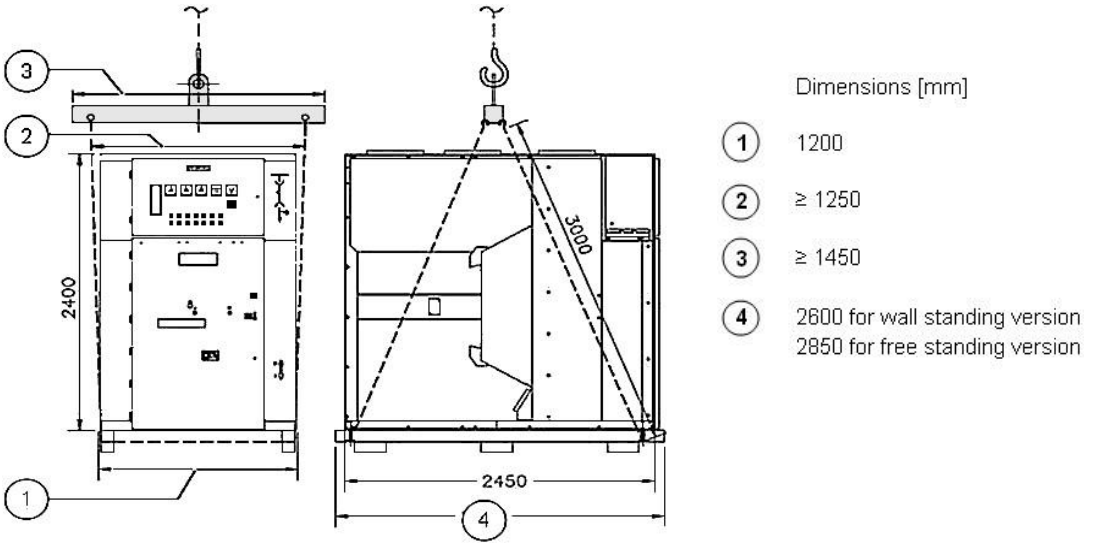


Fig11. Unloading by crane

- ⇨ Unload the transport units and set them down as close to the switchgear building as possible in order to avoid unnecessary ways.
- ⇨ Move the transport units into the building, if possible on their wooden pallets. Only remove packing where absolutely necessary in order to keep the switchgear as clean as possible.
- ⇨ Remove foil only in the building, right before assembling the transport units.

4.2.3. The completeness and transport damage

- ⇨ Check whether the delivery is complete and correct using the delivery note and packing lists
- ⇨ Compare the serial number of the switchgear panels on the delivery note with that on the packing and the rating plates of the panels
- ⇨ Check whether the accessories are complete
- ⇨ Temporarily open the packing in a weatherproof place, preferably in the building
- ⇨ Immediately determine and record any damage (and the cause thereof if possible). In case of transport damage, do this together with the forwarding agent
- ⇨ Repair transport damage or have it repaired, otherwise you may not start installation
- ⇨ Check whether the delivery is complete using the delivery note and packing lists. If the delivery is incomplete, inform the regional SIEMENS representative
- ⇨ Repack the switchgear as far as possible and reasonable. Do not remove the PE foil until reaching the mounting position in order to keep the switchgear as clean as possible

4.2.4. Transport to the installation place (switchgear room)

- ⇨ Thoroughly clean the switchgear room, since extreme cleanliness is required during installation.
- ⇨ Move the transport units on their wooden pallets as far as possible.
- ⇨ Move the transport units to the switchgear room in the order of installation.
- ⇨ Inside the building, move the transport units to the place of installation using a lifting truck, fork-lift truck or rollers.
- ⇨ Set down the transport units in the correct sequence directly in front of the place of installation. Leave enough clearance between the transport units to perform installation work.

Removing the transport units from the wooden palettes

	**DANGER!**
	Non-observence of the weight loads of the panels can endanger people or damage the transport units while unloading. ⇨ Please ensure that the lifting gear used meets the requirements of the weight loads of the panels from the table (see page22, “Transport weights and dimensions with packing”) as a minimum.

⇨ Remove PE foil.

⇨ Remove 4 transport fixing bolts from inside the panel (fig12 – 14).

Fig12. Position of transport fixing bolts on right side (same on left side)

Fig13. Bolt to remove inside at front right (same on left side)

Fig14. Bolt to remove inside at rear left (same on right side)

⇨ Prepare transport material (e.g. ropes, eyelets, roller pads (reinforced rollers), etc.).

Further transport without wooden palettes

If the transport units cannot be directly lifted from the wooden pallets onto their mounting

	ATTENTION!
	For further transport of a cubicle with a floor conveyor or other means of transportation (reinforced rollers, etc.), a minimum live load of 14.5 kN/m^2 must be considered. Non-observence of the live load can endanger people or damage the transport units during further transport. ⇨ Please ensure that the lifting and transport gear used meets the requirements regarding to construction and load-bearing capacity.

⇨ Lower the transport unit onto boards placed on roller pads (reinforced rollers), i.e. one board placed on two roller pads. Distribute the roller pads so as to support the outer edges of the transport unit (fig15).

Fig15. Transport unit on boards placed on roller pads

⇨ Lift one side, then the other side of the transport unit and slowly lower it on the

mounting position.

Putting down and aligning the transport units to the switchgear room

- ⇨ Lift transport unit with suitable lifting gear or roller crowbar.
- ⇨ Place the first (i.e. rearmost) transport unit as exactly as possible on its mounting position and place the second one at a distance of approx. 200 - 300 mm, so that the units can still be aligned before bolting together.
- ⇨ Align the first left-hand or right-hand panel of the row correctly on the base frame and then align the remaining panels with the first panel.
- ⇨ Lay shim plates under the transport units according to the measuring sheet of the base frame.
- ⇨ Remove packing and transport materials from the place of installation. Remove any dirt occurred during transport, as extreme cleanliness is required during installation.

- ✓ Now the transport units are in the correct order for assembly.

	**NOTE!** ⇨ Make sure that there are no transport damages on the panels. ⇨ Level the base frame according to DIN 43 661. ⇨ Prepare the materials and auxiliary devices required for installation.

4.3. Assembly of the switchgear

To assemble the switchgear, the below steps should be followed:

- Align the panels by using fixing tools
- Bolt the panels together
- Fasten the panels to the foundation
- Open the busbar comparment
- Assemble and interconnect the busbars
- Close the busbar comparment
- Assemble and interconnect the earthing busbars
- Install the end wall
- Assemble and interconnect the closed pressure relief duct at the top or only assemble arc routing plates at the top (It depends on the switchgear condition determined by the customer).

4.3.1. Bolting panels together

For perfect operation of 8BT2 switchgear it is necessary to align the individual panels and bolt them firmly together after erection.

- ⇨ Screw's tensile class should be 8.8.

Tightening torques

	**ATTENTION!** ⇨ Apply the tightening torques at the following tables to perform the bolted copper and joints properly.

	**NOTE!** ⇨ The bolted copper joints effects on the performance of the electrical conductivity. ⇨ The bolted steel joints effects on the performance of the earthing and mechanical strength between steel parts. ⇨ Use strain washers for the bolted copper joints. ⇨ Use contact washers for the bolted steel joints

The bolted copper joints with strain washer	Tightening torque	Control tightening torque
M6	8 Nm	6.8 Nm
M8	20 Nm	17 Nm
M10	40 Nm	35 Nm
M12	70 Nm	60 Nm
M16	170 Nm	145 Nm

The bolted steel joints with contact washer	Tightening torque	Control tightening torque
M6	13 Nm	9 Nm
M8	30 Nm	26 Nm
M10	60 Nm	51 Nm
M12	105 Nm	90 Nm
M16	260 Nm	221 Nm

Bolting panels together

The panels are bolted together from inside. Set-nuts for interconnecting the panels are pressed into the left part of the panel frame, i.e. the panels are bolted together from the right side to the left panel.

The following illustration shows the panel joints in circles (fig16):

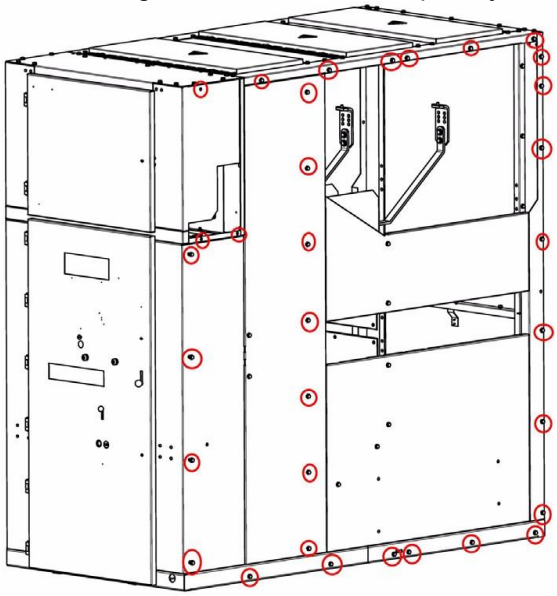


Fig16. Panel joints (marked in the illustration with a circle)

Using the fixing tools

The fixing tools from the supplementary equipment facilitate bolting adjacent panels together.

How to use the fixing tools:

⇨ Place the first panel at the right end.

⇨ Mount four fixing tools (pos.nr. ① in fig17) at the four corners (pos.nr. ② in fig17).

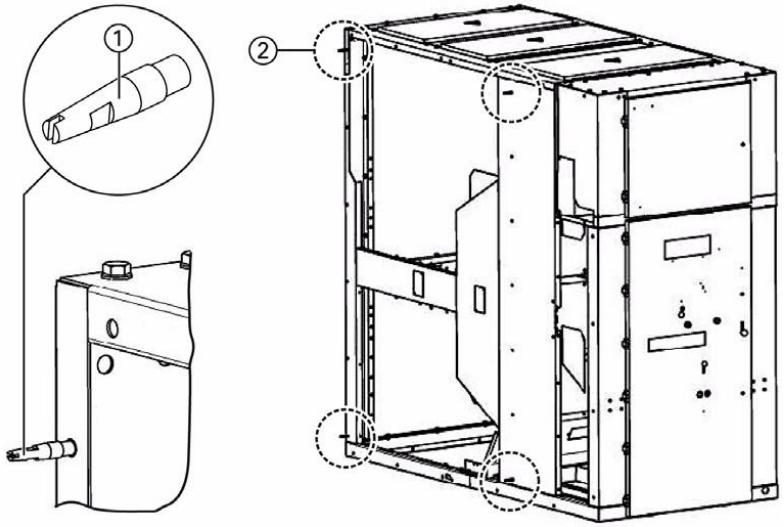


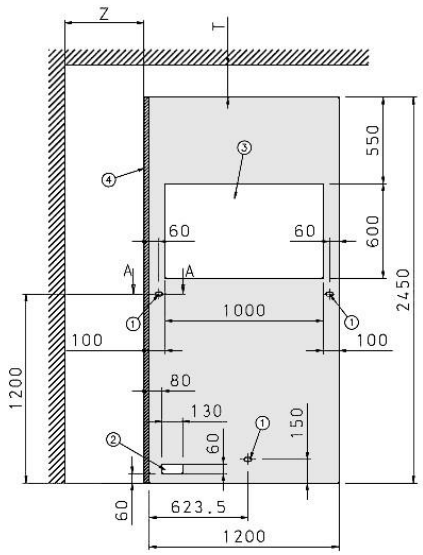
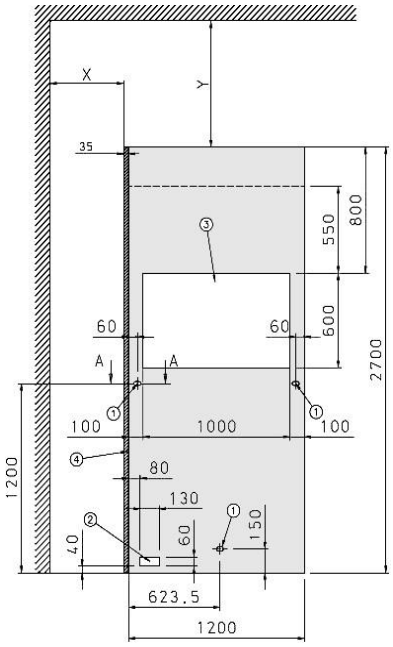
Fig17. Using the fixing tools to bolt panels together

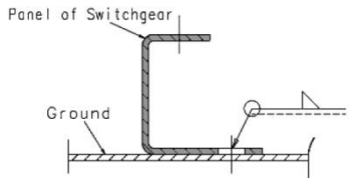
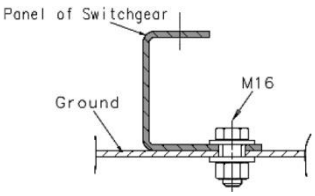
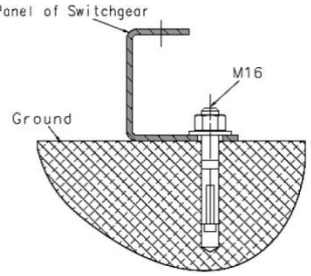
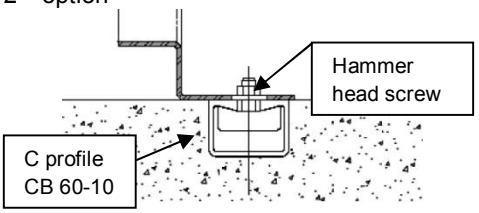
	NOTE!
	For panels equipped with pressure relief duct: ⇨ Assemble the pressure relief duct after bolting the panels and main busbars together.

4.3.2. Fastening the panels to the foundation

The switchgear can be fastened to the foundation in the following ways:
- Welded floor fixing or
- bolted floor fixing or
- floor fixing with dowels.

For fixing the panels on the floor, three holes with a diameter of 14 mm have been provided in the panel floor. In the foundation, an elongated hole 25 x 45 mm has been provided each. Fasten every panel to the foundation at these three points.

	Wall standing type	Free standing type
Detailed foundation drawings		
Pos.nrs.	① : Floor fixing points (Opening dimensions: 25 x 45mm.) ② : Floor opening for low voltage control cables ③ : Floor opening for high voltage power cables ④ : Switchgear end wall	
Note	X, Y, Z, T dimensions are mentioned in drawings on page9 and 10.	

	Welded floor fixing	Bolted floor fixing	Floor fixing with dowels
Floor fixing types	 A-A section in floor drawings	 A-A section in floor drawings	1st option  2nd option  A-A section in floor drawings

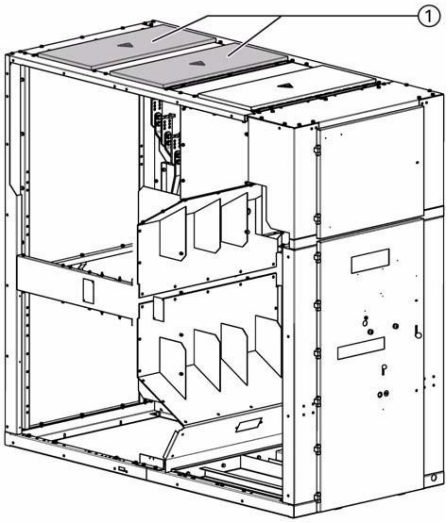
Procedure	Please make sure that tolerances for laying floor frame are as below: Evenness tolerance……±1mm within a measuring length of 1m Straightness tolerance……1mm per 1m, (not more than 2mm in total length of the switchgear) ⇨ If necessary, place shims in the spaces between the switchpanel and the foundation in the area of elongated holes.		
	⇨ Weld the cross members in the area of the holes with a diameter of 17 mm down to the U- profile supports in the foundation.	⇨ Bolt the cross members inside the panel frame to the C-profiles in the foundation using anchor bolts and shim plates. ⇨ Paint welding seams to prevent corrosion.	⇨ Drill elongated holes 25 x 45 mm into the concrete first, fill with plaster and insert dowels with a diameter of 10 mm including the matching screws.
	⇨ Remove any dirt occurred during drilling or welding work. Extreme cleanliness is required during installation.		
	✓ Now the switchgear is fastened to the foundation.		

4.3.3. Assembly of the busbars (Feeder and Coupling panels)

When the switchgear is installed, the busbars can be interconnected between panels. The busbars are temporarily attached to panels for transportation. The busbars on each panel are provided for the interconnection of this panel with the panel on the left. Their bolted joints are supplied separately.

Access to the busbar compartment of circuit breaker panel

Access to the busbar compartment can only be done from top of the panel by removing the pressure relief flaps.



① Pressure relief flaps over the busbar compartment

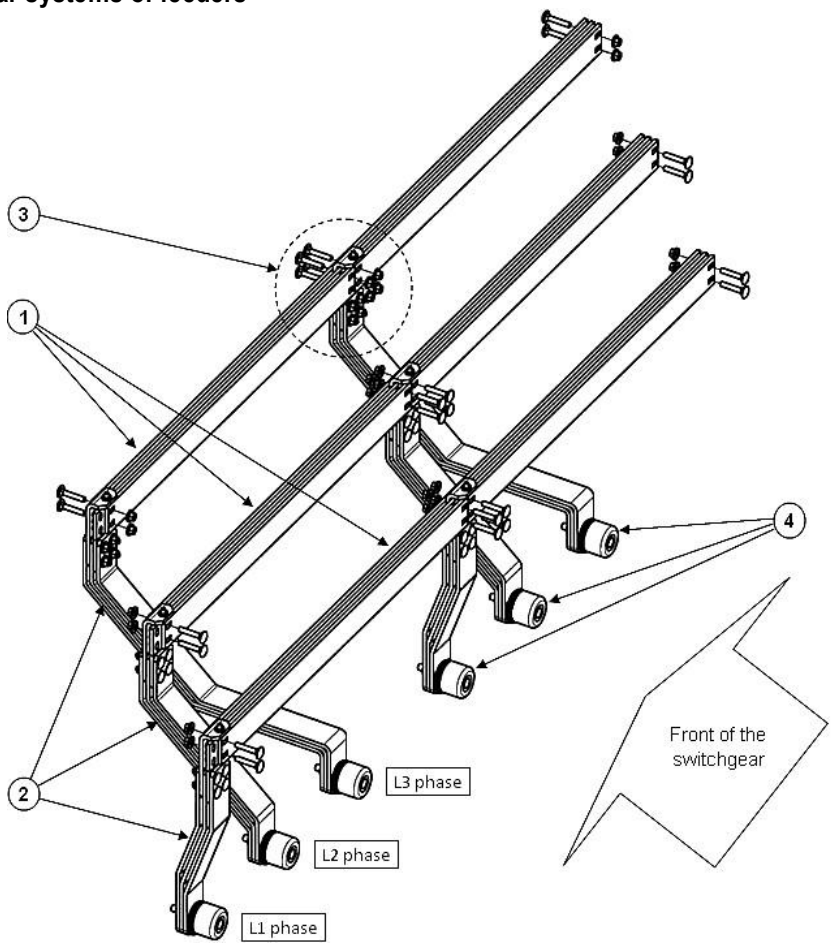
Fig18. Removing the busbar pressure relief flaps at panels

Removing the busbar pressure relief flaps

⇨ Remove the fixing bolts of both pressure relief flaps (pos.nr. ① in fig18) over the busbar compartment

✓ The pressure relief flaps over the busbar compartment can be removed.

Main Busbar systems of feeders



	**ATTENTION!** ⇨ Please ensure that the bolt directions are applied correctly as mentioned at fig19 – fig28. It is important to provide the sufficient clearances between phases and earthed parts. ⇨ Apply the exact bolt sizes listed in below table due to the critical electrical clearances between live parts under the voltage. Longer the bolt is used, more risks it is taken at the insulation. ⇨ The threads of the bolts and nuts must be dry and non-greasy. ⇨ Check contact surfaces of busbars, brush if necessary and apply a thin film of Shell Vaseline 8422 DAB 8.

	**NOTE!** The strain washers at the busbars have one side cambered inwards and one side cambered outwards. Observe correct position of strain washers for assembly. ⇨ Mount the strain washers so that the side cambered outwards points at the bolt head or the nut.

	**NOTE!** All bolts used in main busbar assembly are “mushroom head type”.  Mushroom head bolt with nut

Bolted joints for busbar connections

Rated current of main busbars	Main Busbars (mm)	Dropper bars (mm)	Bolted joints with strain washer	Nut with strain washer	Tightening torque	Control tightening torque
800A	40x10	40x10	M12x40	M12	70 Nm	60 Nm
1250A	80x10	40x10…….or……80x10	M12x40	M12		
	80x10	2x40x10	M12x50	M12		
2000A	2x80x10	40x10…….or……80x10	M12x50	M12		
	2x80x10	2x40x10	M12x60	M12		
2500A / 3150A	3x80x10	40x10…….or……80x10	M12x60	M12		
	3x80x10	2x40x10….or…2x80x10	M12x70	M12		
	3x80x10	3x80x10	M12x75	M12		

Please see the below drawings related to the connection details between main busbars, dropper bars and intermediate copper spacers according to the different combination of current ratings.

1. Intermediate "L" shape copper spacer
2. Intermediate " I " shape copper spacer
3. Main busbars
4. Dropper bars

Bolt's directions are important!

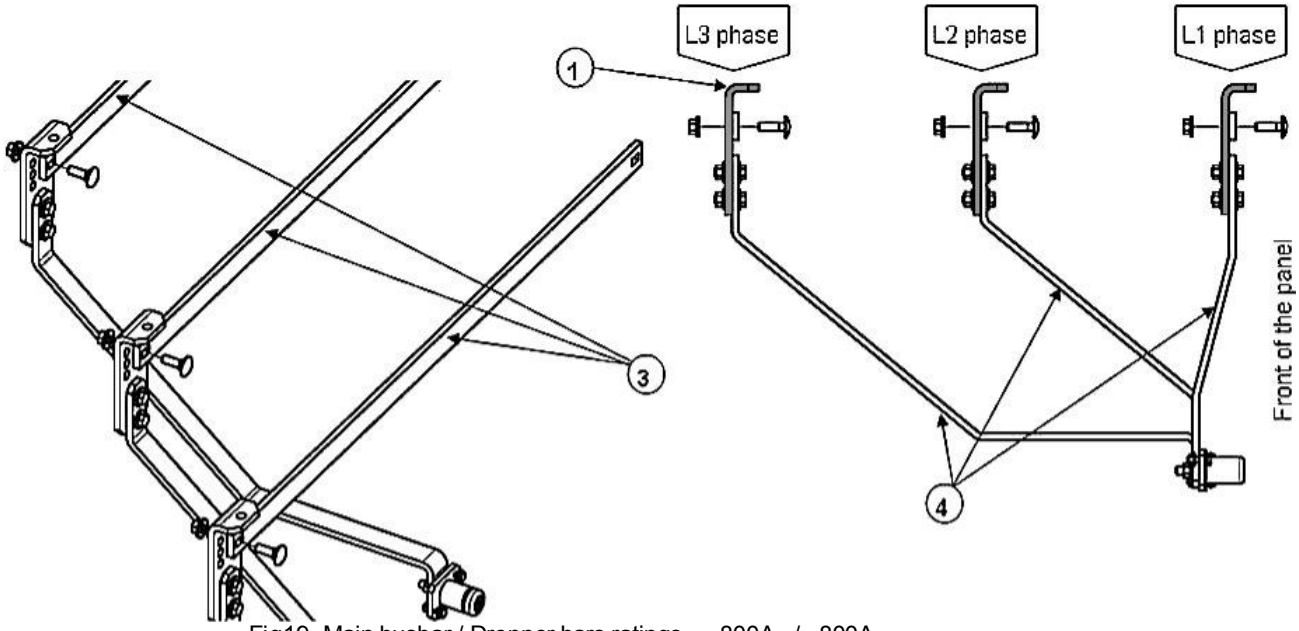


Fig19. Main busbar / Dropper bars ratings _ 800A / 800A

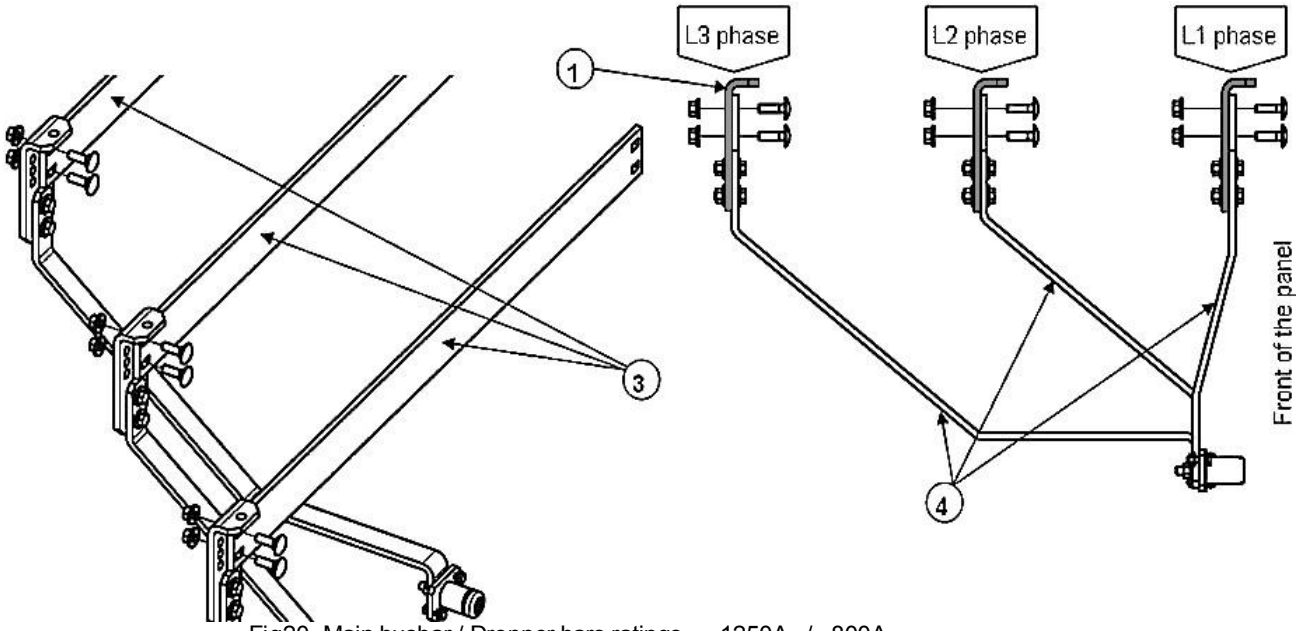


Fig20. Main busbar / Dropper bars ratings _ 1250A / 800A

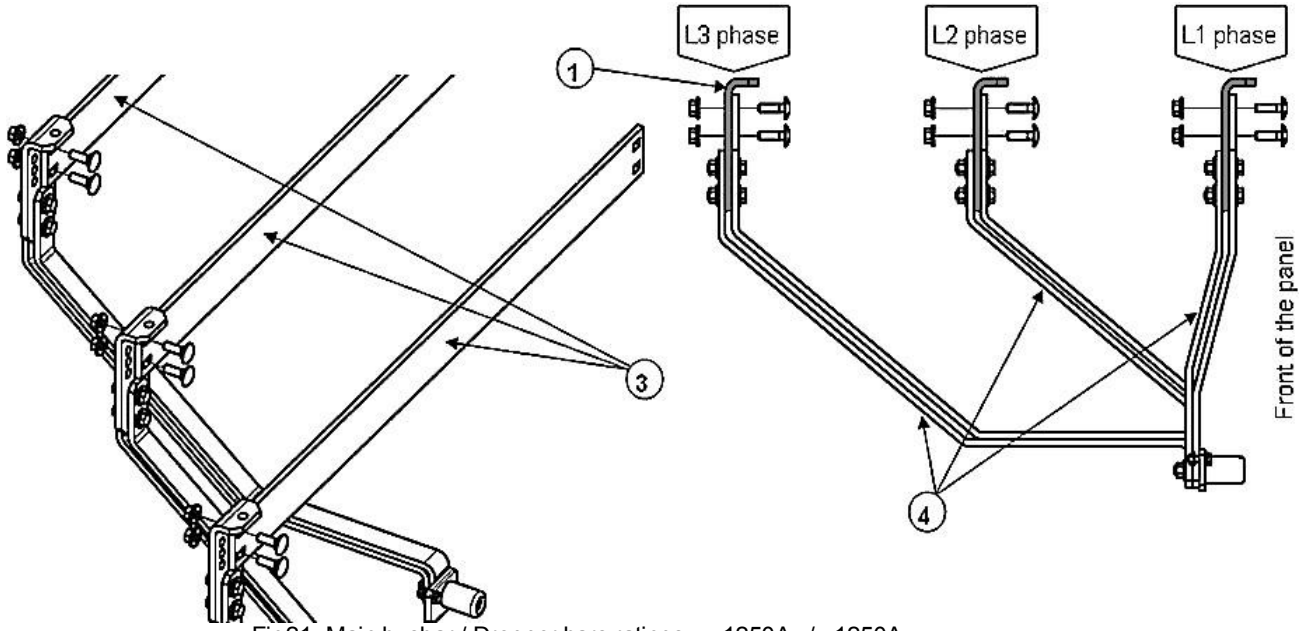


Fig21. Main busbar / Dropper bars ratings _ 1250A / 1250A

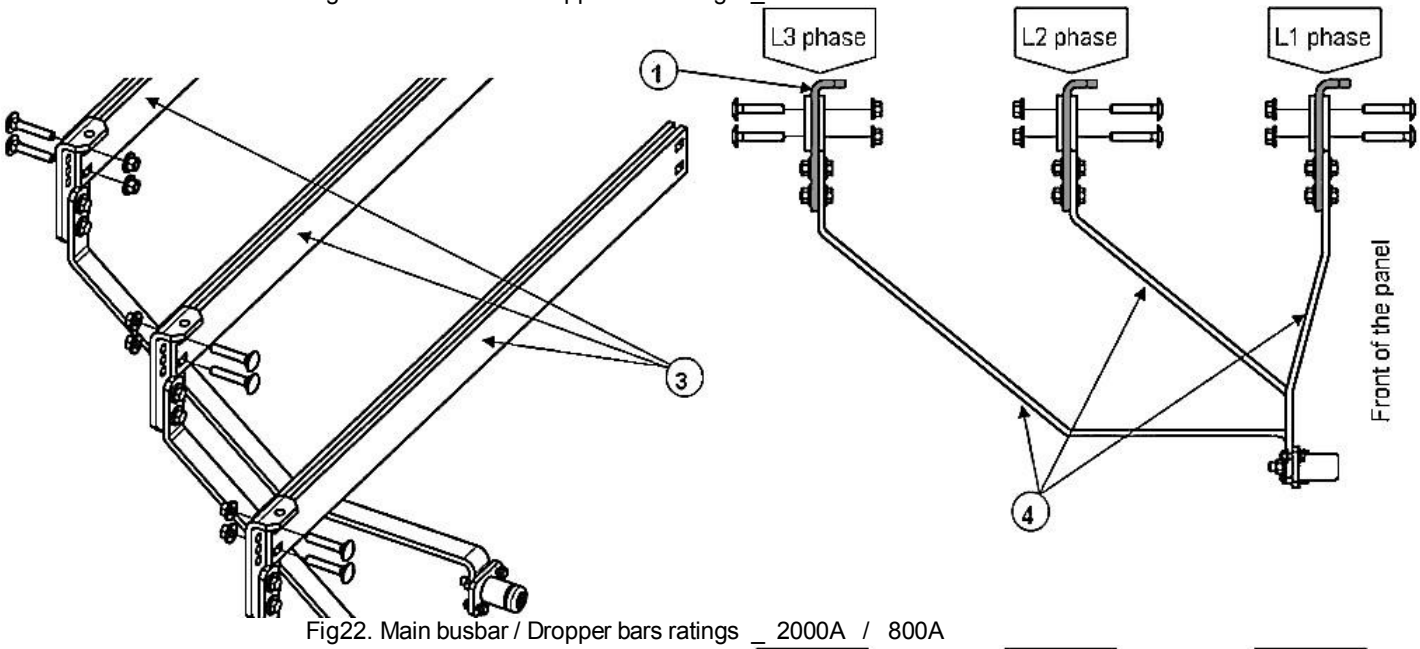


Fig22. Main busbar / Dropper bars ratings _ 2000A / 800A

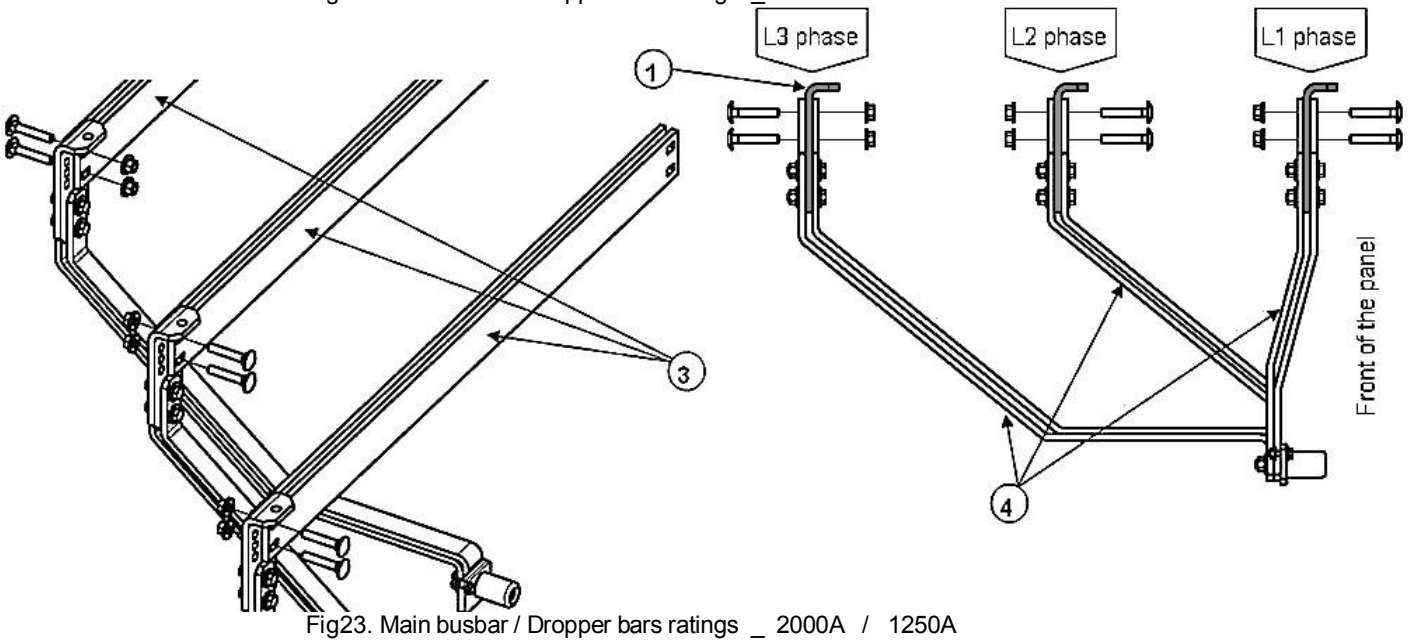


Fig23. Main busbar / Dropper bars ratings _ 2000A / 1250A

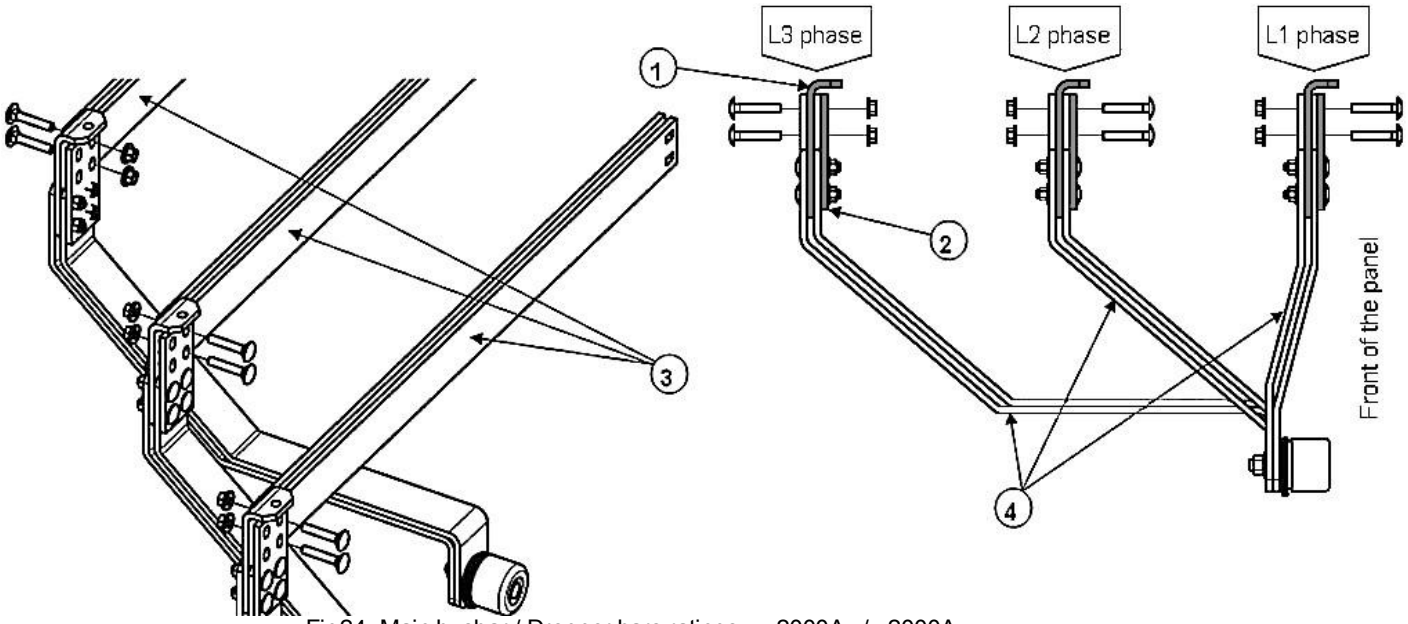


Fig24. Main busbar / Dropper bars ratings _ 2000A / 2000A

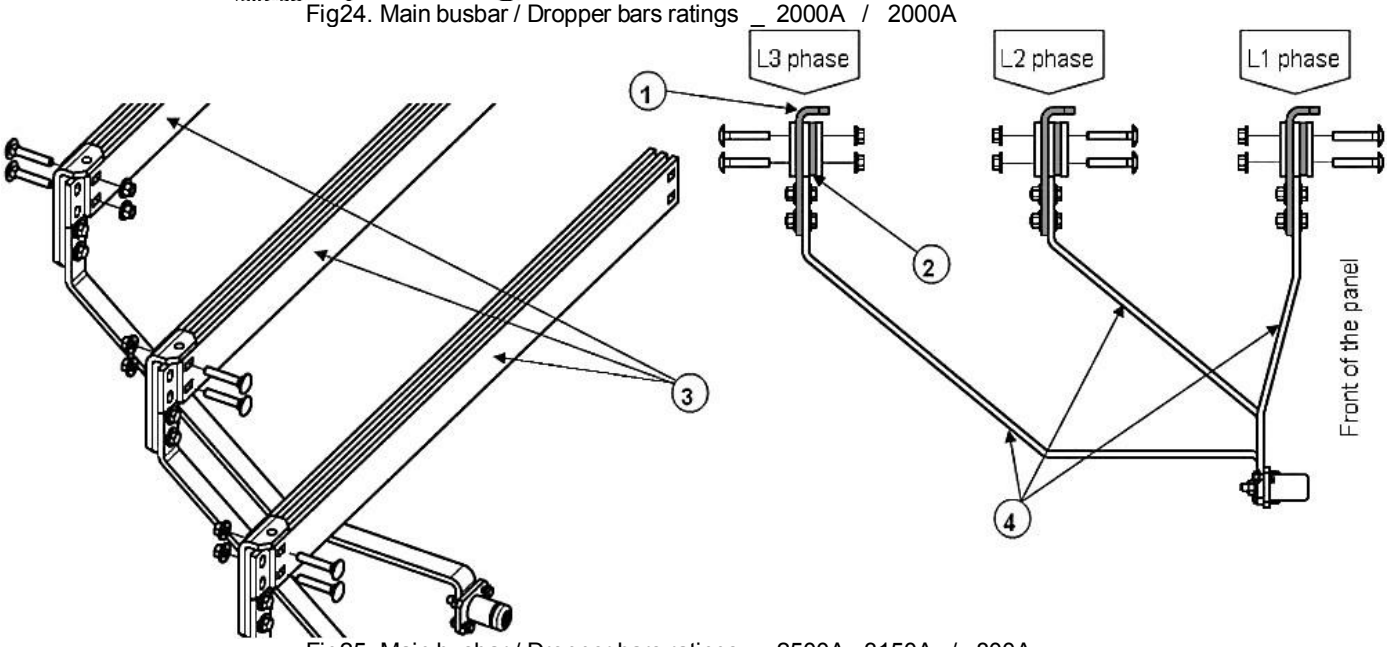


Fig25. Main busbar / Dropper bars ratings _ 2500A - 3150A / 800A

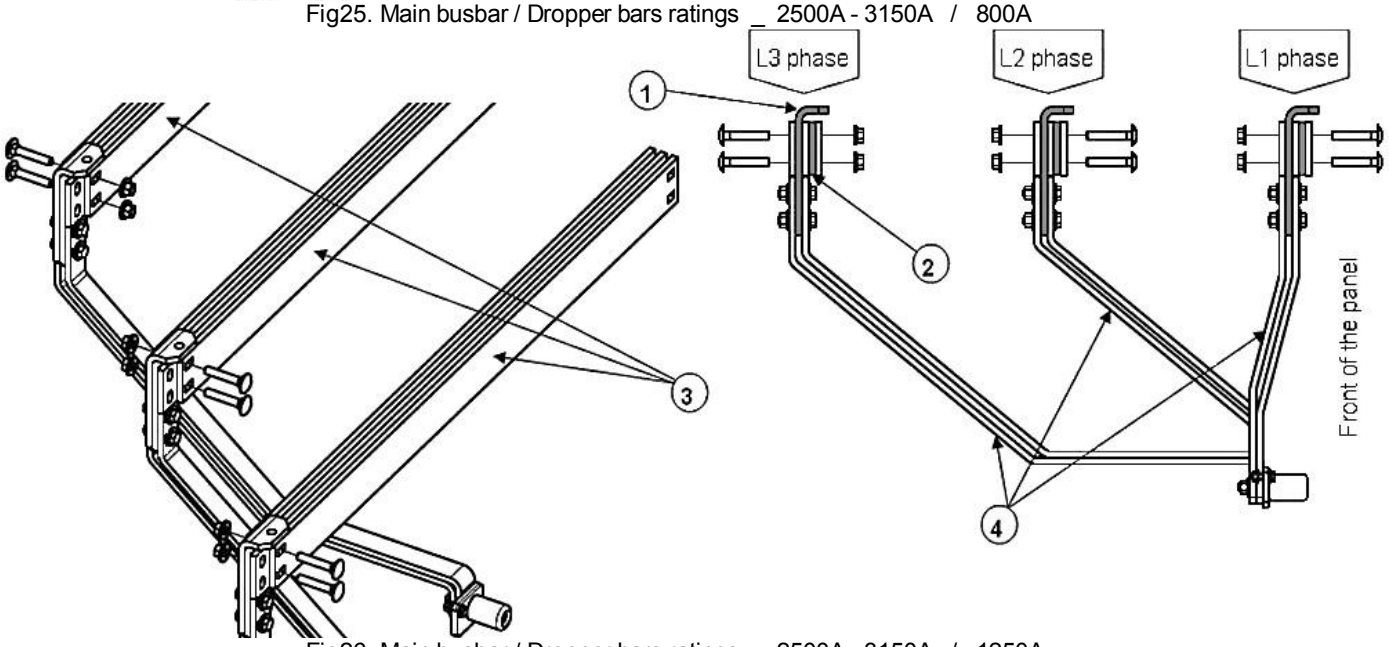


Fig26. Main busbar / Dropper bars ratings _ 2500A - 3150A / 1250A

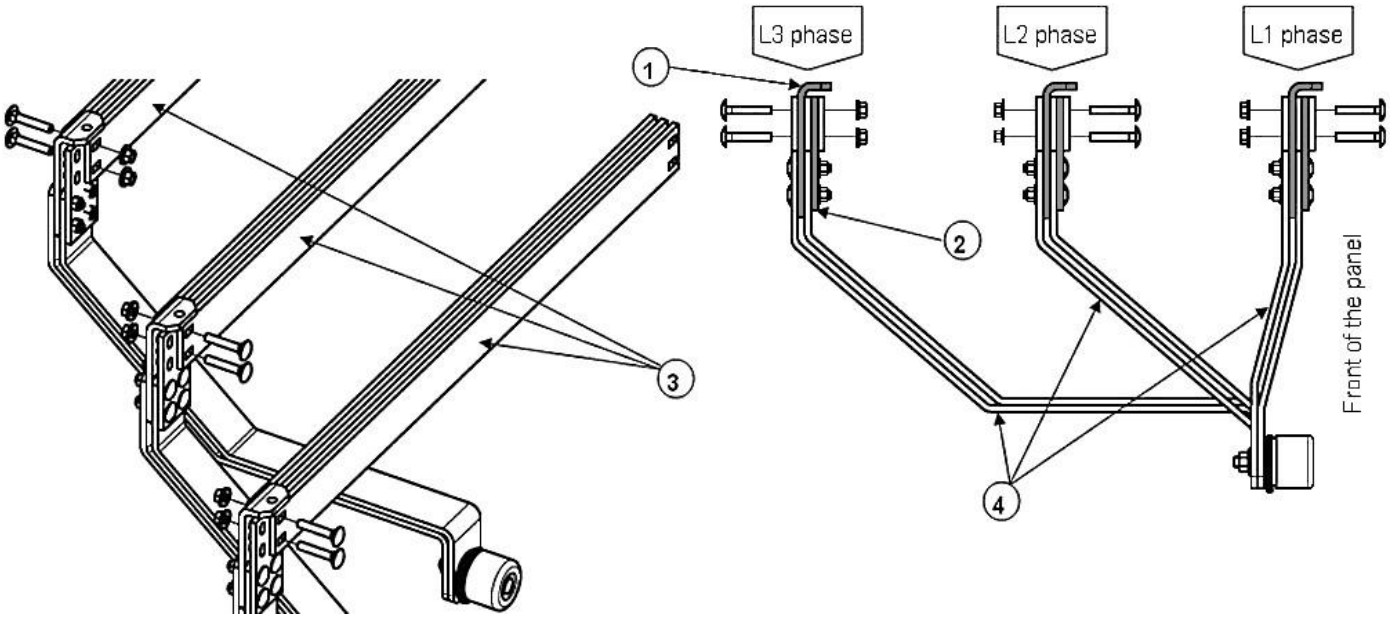


Fig27. Main busbar / Dropper bars ratings _ 2500A - 3150A / 2000A

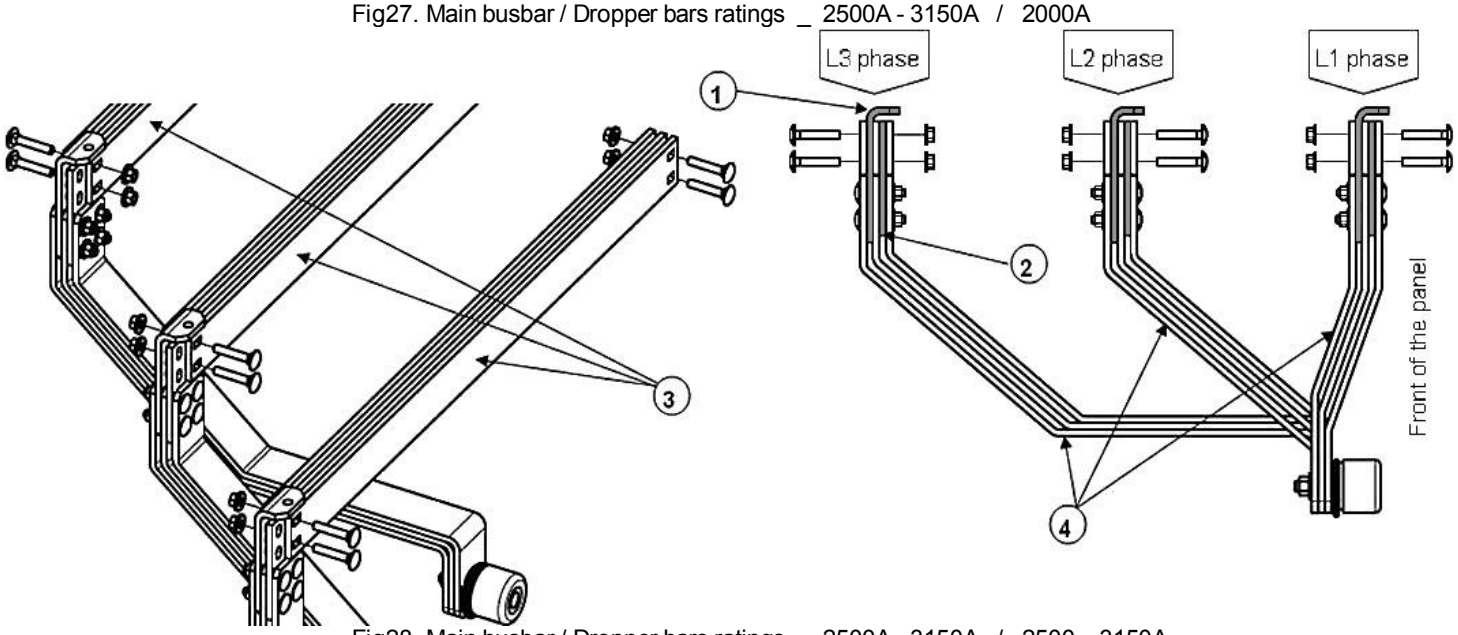
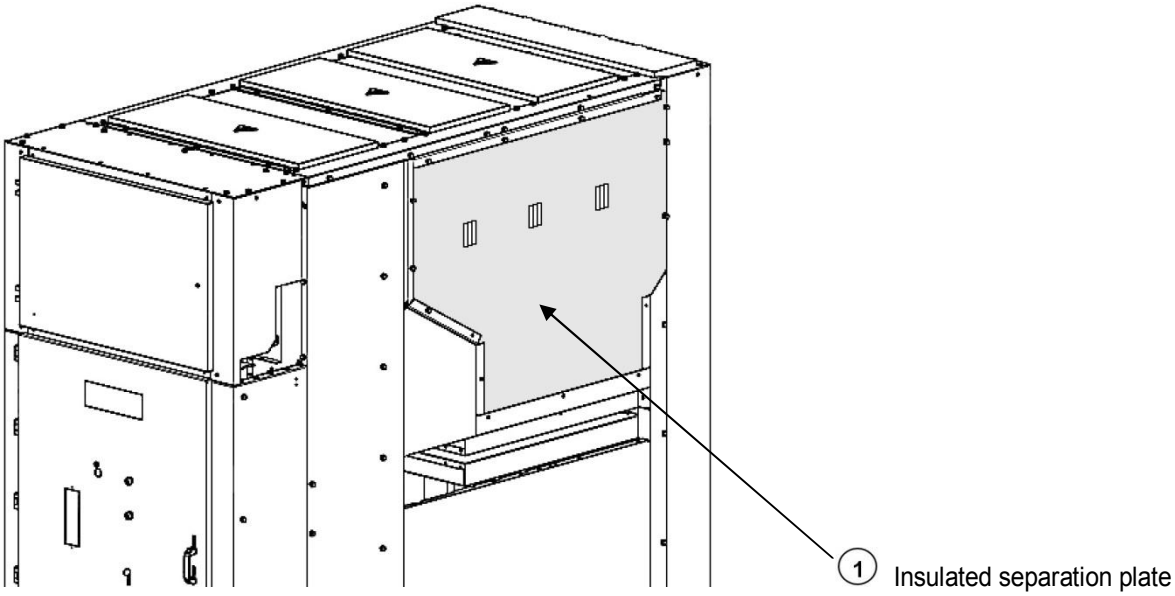
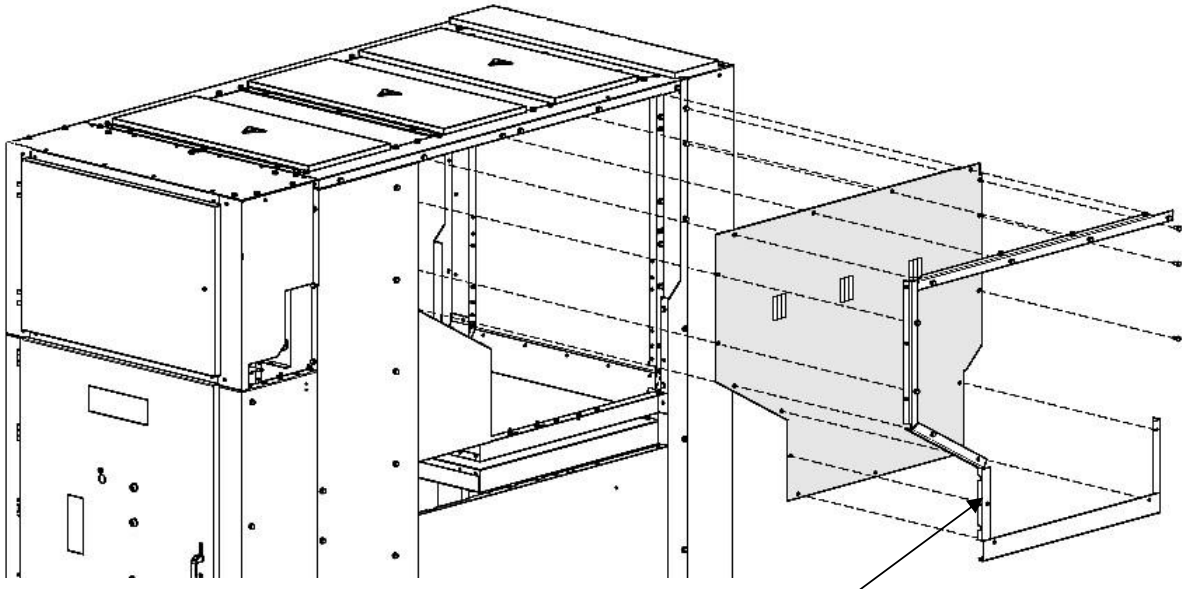


Fig28. Main busbar / Dropper bars ratings _ 2500A - 3150A / 2500 – 3150A

4.3.4. Busbar compartment separation (Optional)





② Steel frame to fix the insulated separation plate

Busbar systems of coupling panels

Coupling panel group consists of two panels, sectionalizing and bus riser. Single line diagrams of two combinations of bus-tie panels are as shown below:

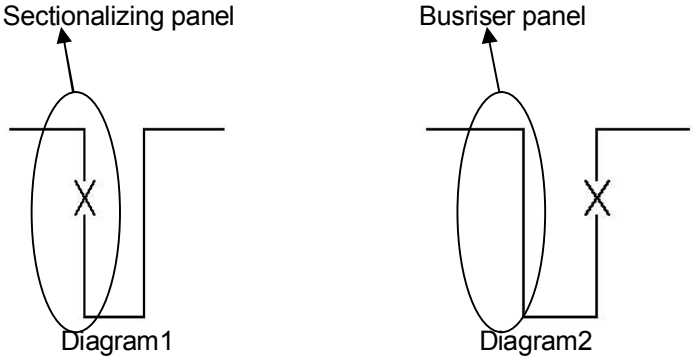


Diagram1 Diagram2

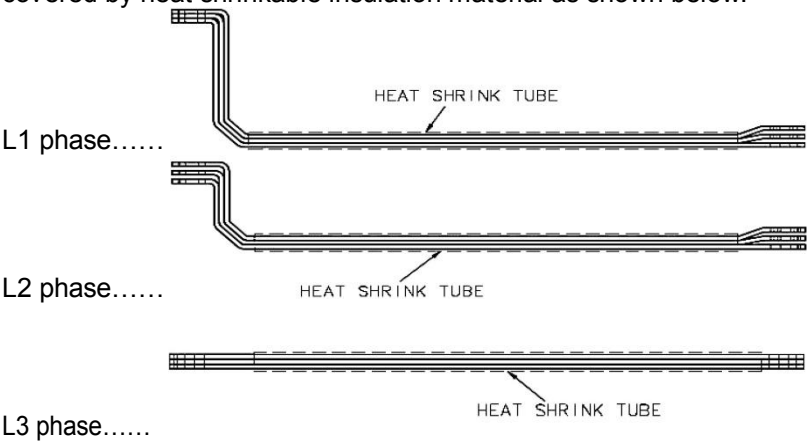
("X" means the circuit breaker.)

You will find the installation instructions;
for Diagram1 in fig29 – 32.on pages40 – 43.
for Diagram2 in fig33.on page44

	ATTENTION!
	⇨ Please ensure that the bolt directions are applied correctly as mentioned at fig29 – fig33. It is important to provide the sufficient clearances between phases and earthed parts. ⇨ Apply the exact bolt sizes listed in below table due to the critical electrical clearances between live parts under the voltage. Longer the bolt is used, more risks you take at the insulation. ⇨ The threads of the bolts and nuts must be dry and non-greasy. ⇨ Check contact surfaces of busbars, brush if necessary and apply a thin film of Shell Vaseline 8422 DAB 8.

ATTENTION!

Lower main busbars are separately provided with panels. Their surfaces are partly covered by heat shrinkable insulation material as shown below:



Depending on the current rating, the copper bar quantity is various in 1 pc (≤1250A), 2pcs (2000A) and 3 pcs (2500A – 3150A) per phase. In each phase, they are covered together with heat shrinkable insulation material.

- ⇨ Do not separate copper bars in a phase covered by a common heat shrinkable insulation material. It will be assembled as a whole.
- ⇨ Do not cause any damage on heat shrinkable insulation material during the assembly. There is a high risk to have a flashover because of the damaged insulation material.

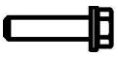
NOTE!

The strain washers at the busbars have one side cambered inwards and one side cambered outwards. Observe correct position of strain washers for assembly.

- ⇨ Mount the strain washers so that the side cambered outwards points at the bolt head or the nut.

NOTE!

Bolt types for connections of lower main busbars:


Hexagon head bolt without nut, used only at Current Transformer or Post Insulator connections in the sectionalizing panel.

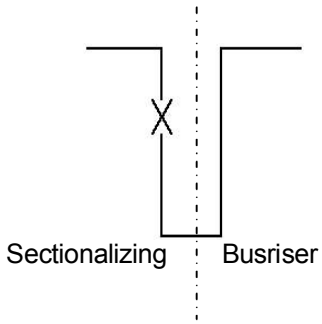

Mushroom head bolt with nut, used at connections of lower main busbars in the sectionalizing and busriser panels.

Bolt sizes used in lower main busbar assembly

Rated current of bus–tie panel	Lower Main Busbars (mm)	Riser bars (mm)	Sectionalizing panel		Busriser panel
			Current transformer with earthing switch	Current transformer without earthing switch	
800A	80x10	40x10	M12x40	M12x30	M12x35
1250A		2x40x10			M12x50
2000A	2x80x10	2x80x10	M12x50	M12x40	M12x60
2500A / 3150A	3x80x10	3x80x10	M12x60	M12x50	M12x75

Please see the following drawings related to the connection details of lower main busbars for all current rating combinations in the sectionalizing and busriser panels:

Sectionalizing panel at the left hand side – Busriser panel at the right hand side



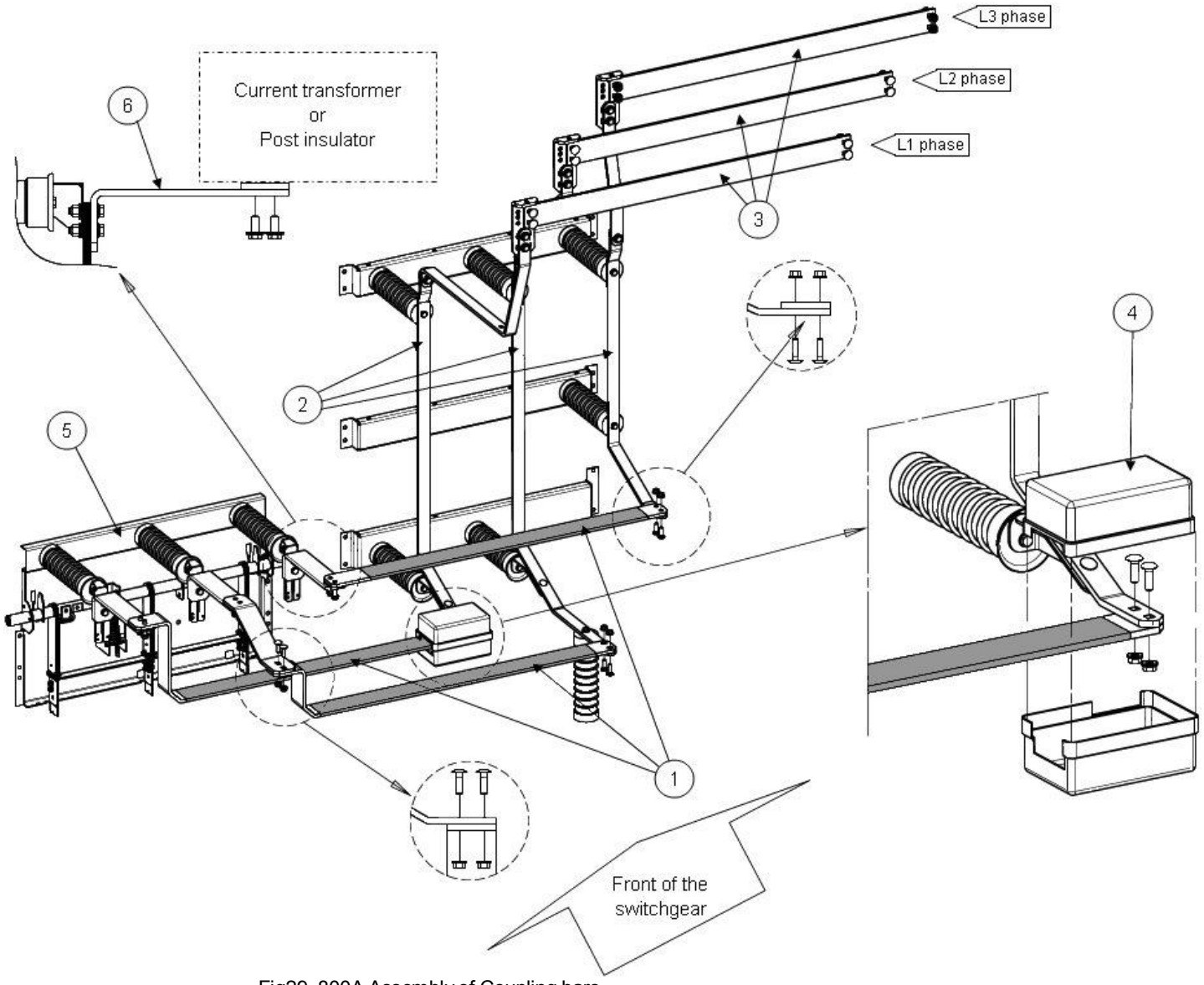


Fig29. 800A Assembly of Coupling bars

1. Lower main busbars insulated by heat-shrinkable material
2. Riser bars
3. Main busbars
4. Insulation box for L1 phase only
5. Earthing switch
6. Connector link between the earthing switch and CT/post insulator (It is used whenever there is the earthing switch.)

Bolt's directions are important!

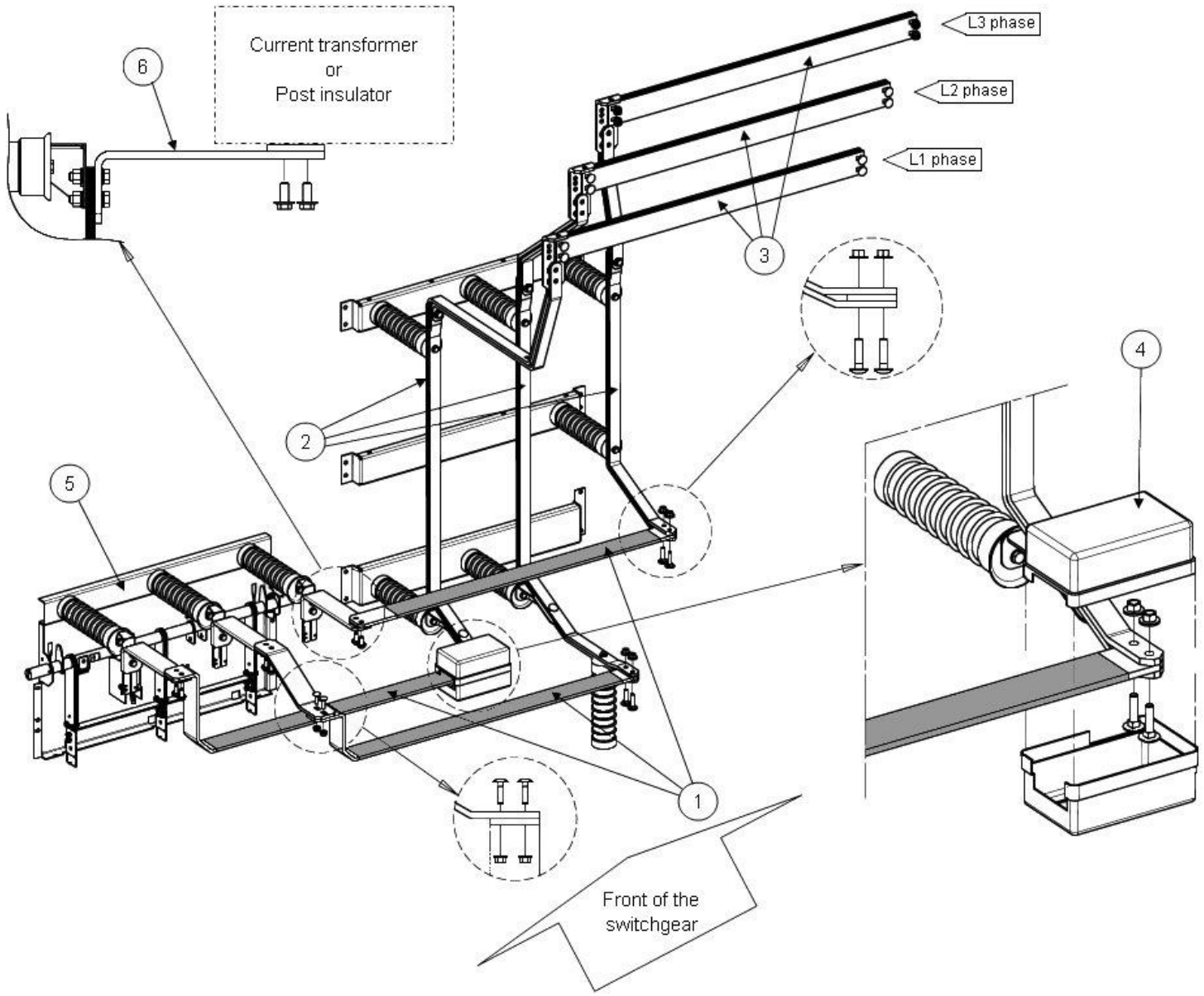


Fig30. 1250A Assembly of Coupling bars

1. Lower main busbars insulated by heat-shrinkable material
2. Riser bars
3. Main busbars
4. Insulation box for L1 phase only
5. Earthing switch
6. Connector link between the earthing switch and CT/post insulator
   (It is used whenever there is the earthing switch.)

Bolt's directions are important!

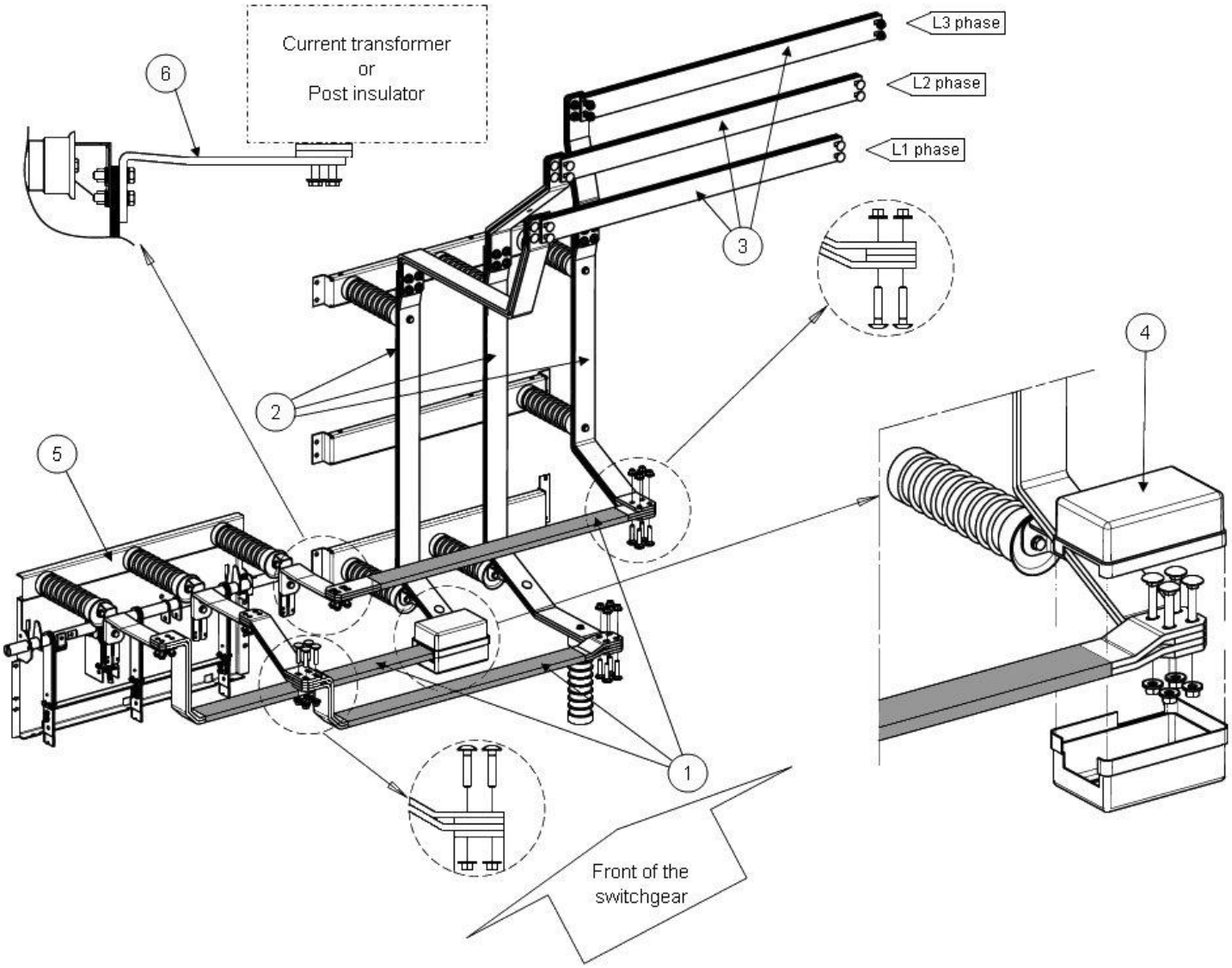


Fig31. 2000A Assembly of Coupling bars

1. Lower main busbars insulated by heat-shrinkable material
2. Riser bars
3. Main busbars
4. Insulation box for L1 phase only
5. Earthing switch
6. Connector link between the earthing switch and CT/post insulator
   (It is used whenever there is the earthing switch.)

Bolt's directions are important!

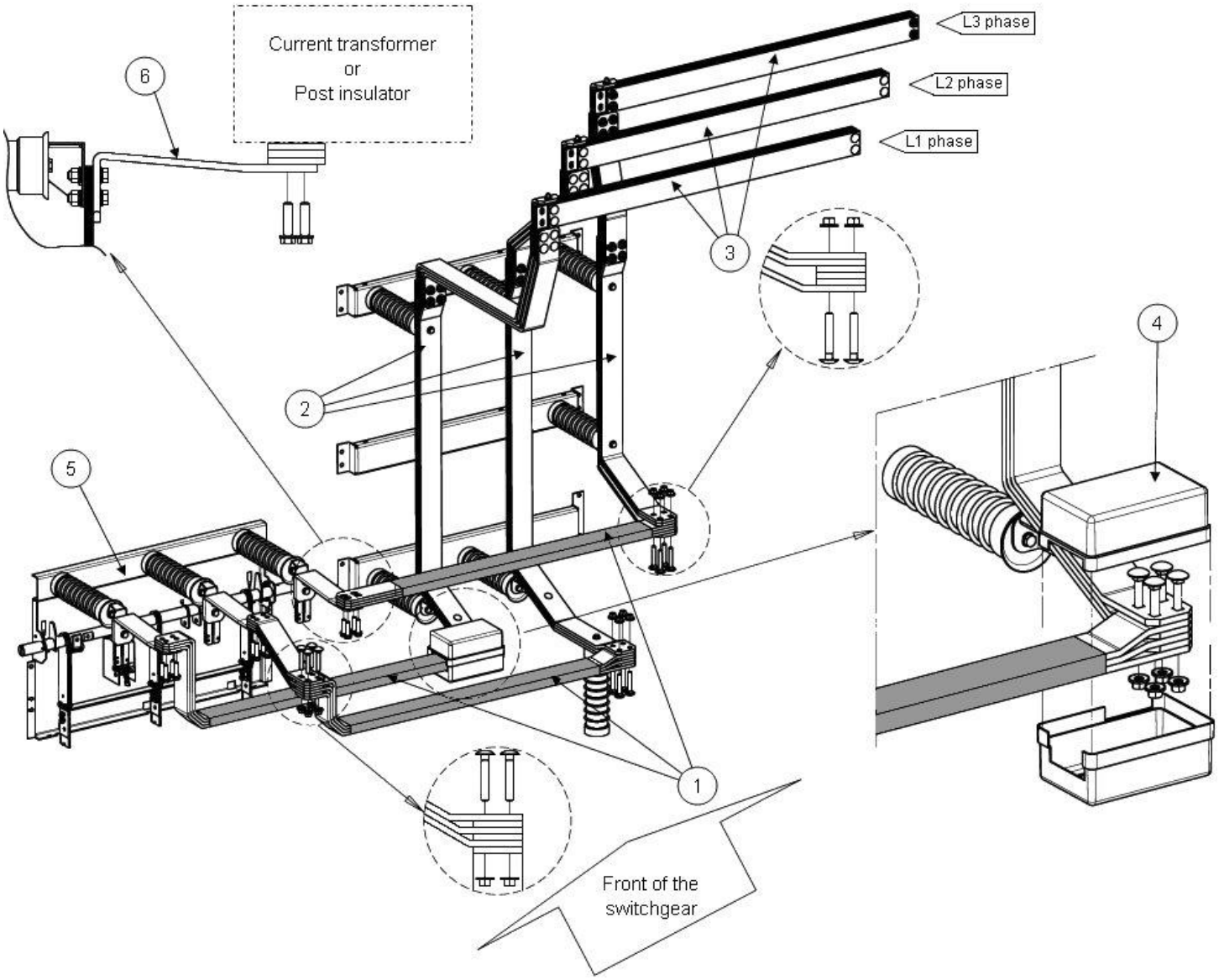
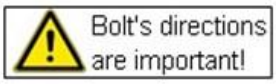


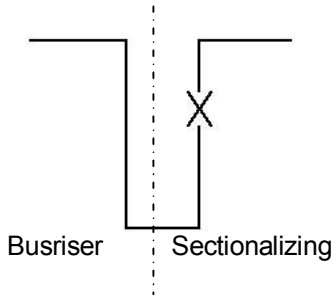
Fig32. 2500A – 3150A Assembly of Coupling bars

1. Lower main busbars insulated by heat-shrinkable material
2. Riser bars
3. Main busbars
4. Insulation box for L1 phase only
5. Earthing switch
6. Connector link between the earthing switch and CT/post insulator
   (It is used whenever there is the earthing switch.)



Sectionalizing panel at the right hand side – Busriser panel at the left hand side

When locations of Sectionalizing and Busriser panels are reversed, the assembly of lower main busbar is also reversed. Please see the below sample for 2500A – 3150A rating assembly (the same method is available for other ratings, 800A, 1250A, 2000A):



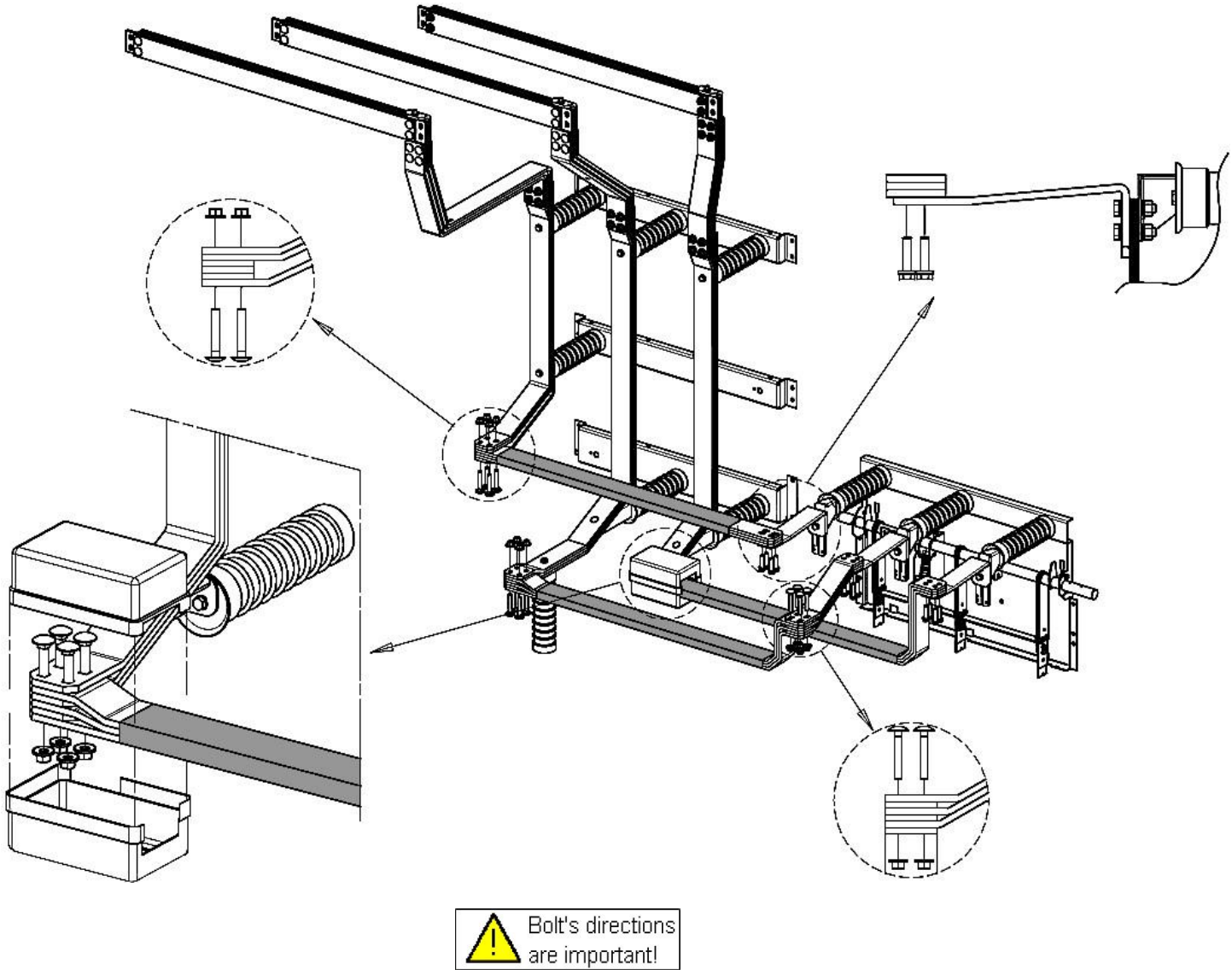


Fig33. 2500A – 3150A Assembly of Coupling bars

	NOTE!
	For rating 2500A – 3150A, please see the other details in fig32 on page43. For other ratings (800A, 1250A, 2000A), the sectionalizing and busriser panels will be reversed on fig29 – 32 drawings as done in fig33.

4.3.5. Earthing

4.3.5.1. Interconnecting the earthing busbars

The earthing busbars in panels are pre-assembled at the factory. When the switchgear is installed, the busbars can be interconnected between panels via the copper bridges which are provided as accessory.

	NOTE!
	Each panel has a fixed earthing bar in the cable compartment. The intermediate copper bridge to interconnect two adjacent panels is a part of the accessories. ⇨ Get the intermediate copper bridge from the accessory box.

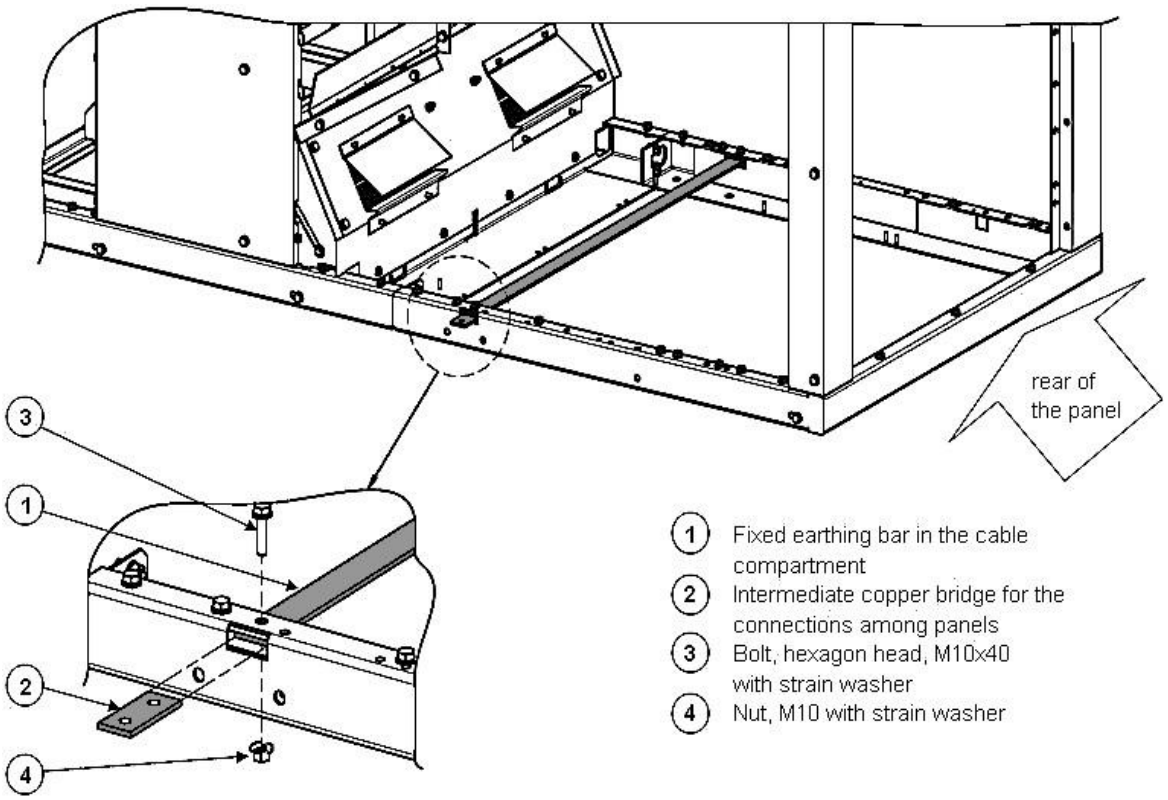


Fig34. Assembly of interconnecting earthing bars

- ⇨ Check the contact surfaces of the earthing busbar. Brush if required and apply a thin film of Shell Vaseline.8422 which is provided in accessories.
- ⇨ Place the interconnecting earthing bar into the corresponding openings of the two adjacent panels and bolt it together with the fixed earthing bars of the panels.
- ⇨ Refit the bolted joints of the earthing busbar.

4.3.5.2. Earthing the switchgear

To earth the switchgear row, make the connection at least the earthing busbar of the left and right end panel to the substation earth of the switchgear building. The connection is available in every panel, either in the cable compartment or in the switching device compartment.

4.3.6. Assembly of the low voltage compartment (on request)

On request, the low-voltage compartments can be delivered separately and must be mounted on site.

	**ATTENTION!** The low-voltage compartment weight is up to ~90 kg with the secondary equipment. ⇨ Observe safe standing position of low-voltage compartment while lifting! ⇨ Do not stay under a lifted compartment**!**

- ⇨ Lift low voltage compartment up to height of upper edge of high voltage door with suitable lifting equipment.

Fig35. Lifting and positioning the low-voltage compartment

⇨ Push low-voltage compartment into its fixture.
⇨ Bolt low-voltage compartment together with the switchgear frame using M10x20 bolts on the upper side and on the lower side.

Please see the below drawing for the assembly of the low voltage compartment:

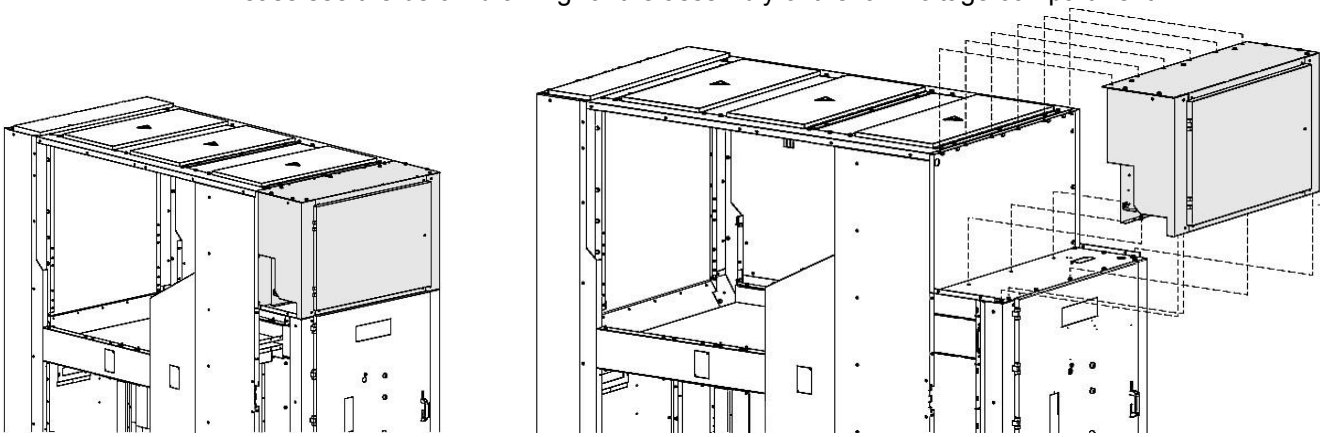


Fig36 Assembly of the low voltage compartment

4.3.7. Assembly of the arc routing plates

	NOTE!
	The application is available when the closed pressure relief duct is not required. (Please see the clause 4.3.8 at page49 for the closed pressure relief duct assembly.)

	ATTENTION!
	Risk of injury. Be aware of the sharp edges of steel parts during the assembly of the pressure relief ducts.

	ATTENTION!
	Arc routing plates have enough weight to endanger people. ⇨ Do not stay under a suspended arc routing plates before completion of assembly.

Preparations

Procedure to be followed if accessibility to the panels is insufficient in the final position:

⇨ Mount the arc routing plates onto corresponding panel before positioning the panel on the final place of installation.
⇨ Position the panel on its final place of installation.
⇨ Proceed in the same way with the adjacent panel.
⇨ Interconnect both arc routing plates before positioning the next panel.

4.3.7.1. Gas pressure relief from the rear (Wall standing)

	NOTE!
	The following application is valid up to 25kA short circuit current value.

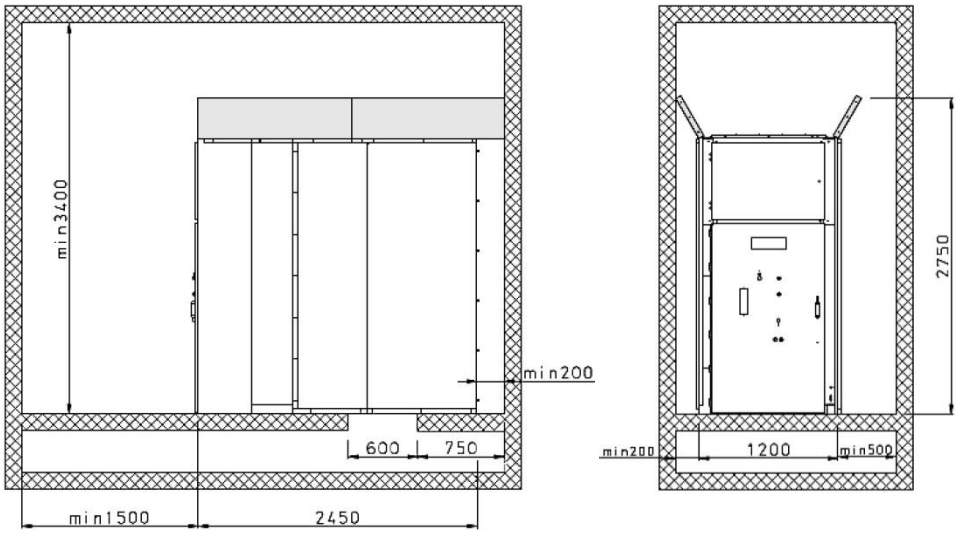


Fig37 Side view and front view

To be able to apply arc routing plates efficiently, min. distances (fig37) should be considered.

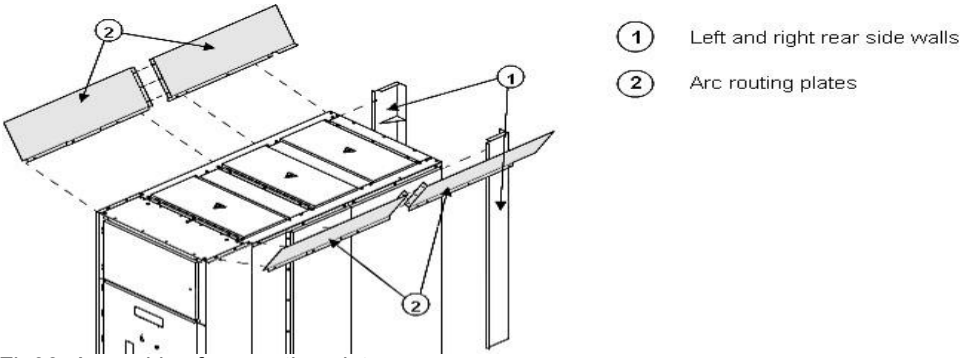


Fig38. Assembly of arc routing plates

Arc routing plates (pos.nr. ② in fig38) are mounted to side holes at the top of the switchgear as shown in fig38 and fig39. Left and right rear side walls (pos.nr. ① in fig38) are used to prevent any hot gas damage on people in the switchgear room.

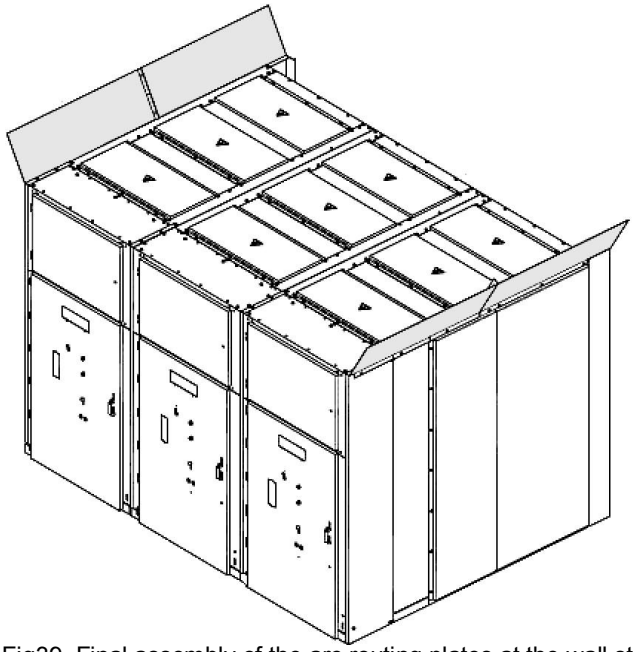


Fig39. Final assembly of the arc routing plates at the wall standing switchgear version

4.3.7.2. Gas pressure relief from the top (Free standing)

	NOTE!
	The following application is valid up to 25kA short circuit current.

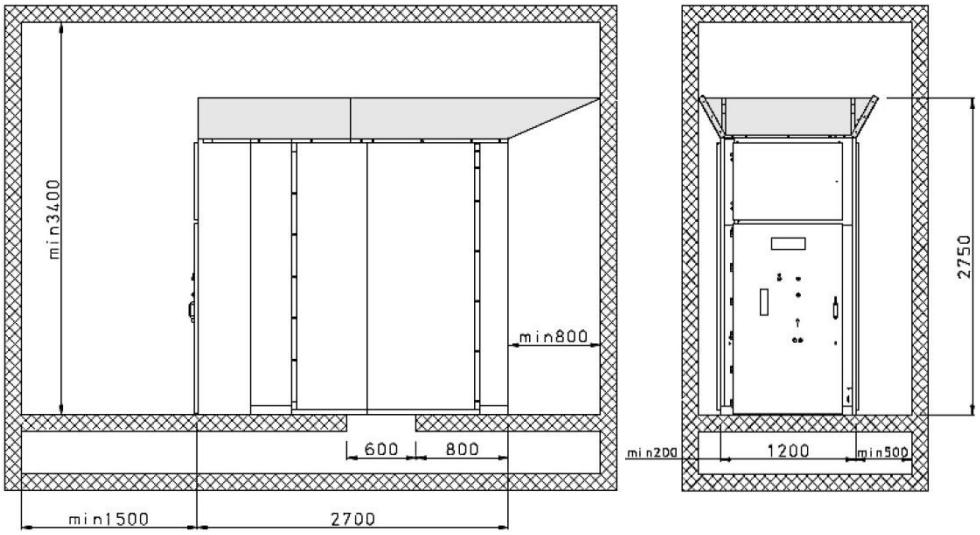


Fig40. Side view and front view

To be able to apply arc routing plates efficiently, the above min. distances should be considered.

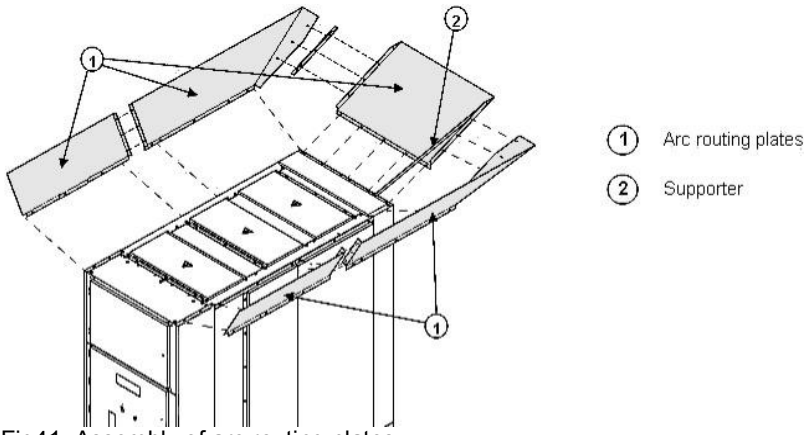


Fig41. Assembly of arc routing plates

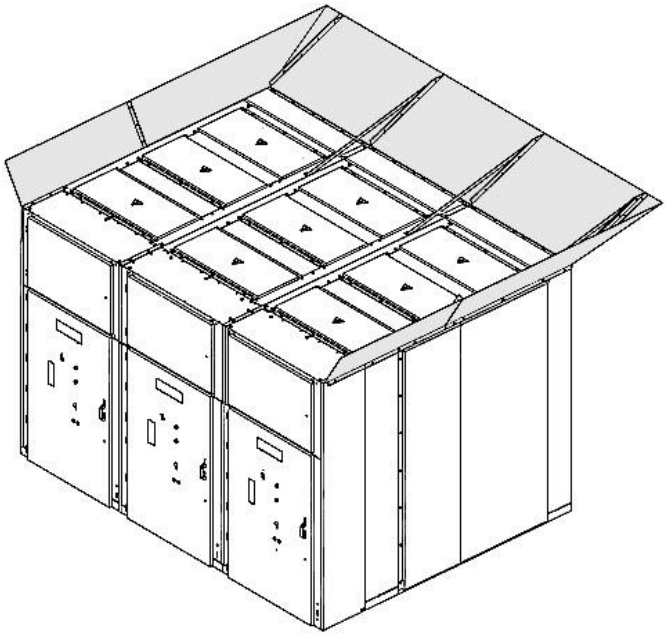


Fig42. Final assembly of the arc routing plates at the free standing switchgear version, 25kA

	NOTE!
	The following application is valid up to 31.5kA short circuit current.

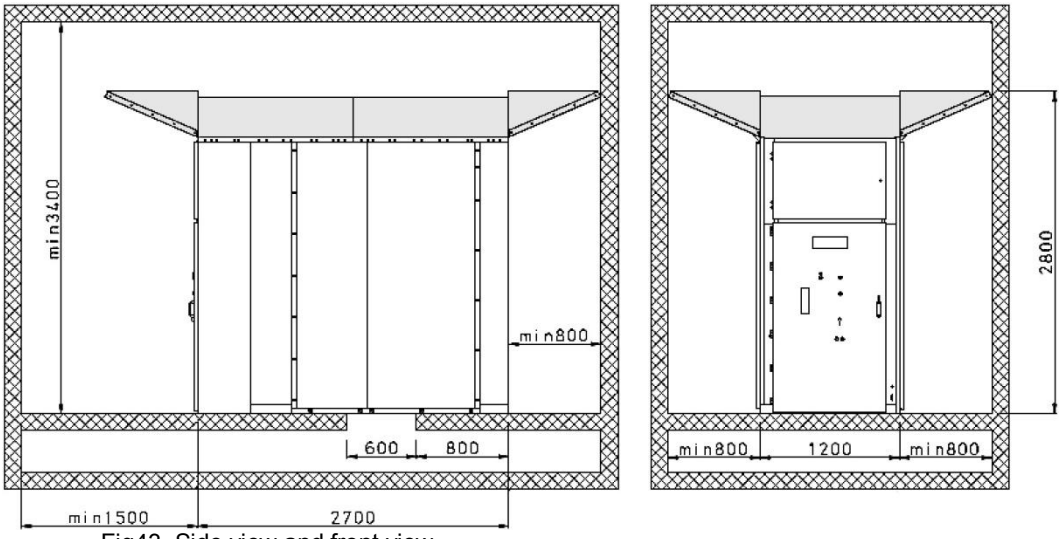


Fig43. Side view and front view

To be able to apply arc routing plates efficiently, the above min. distances should be considered.

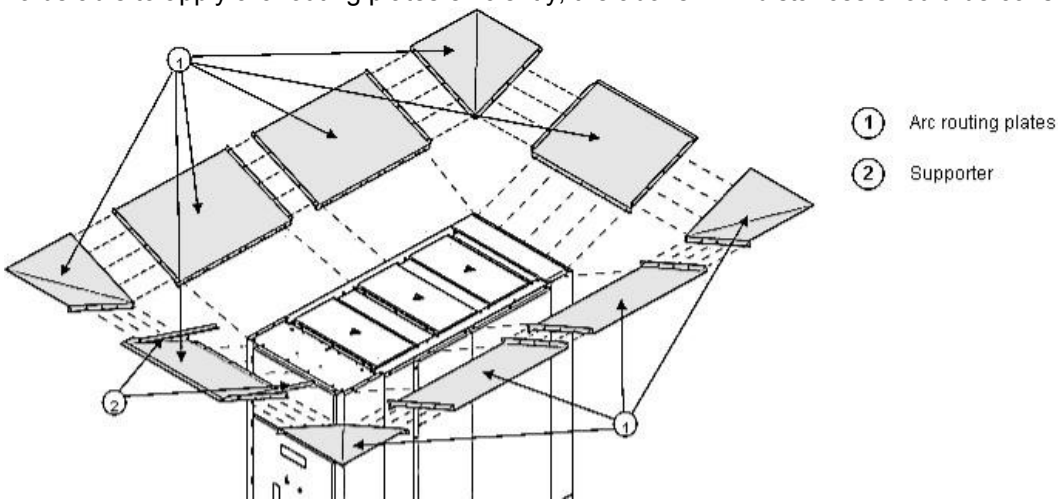


Fig44. Assembly of arc routing plates

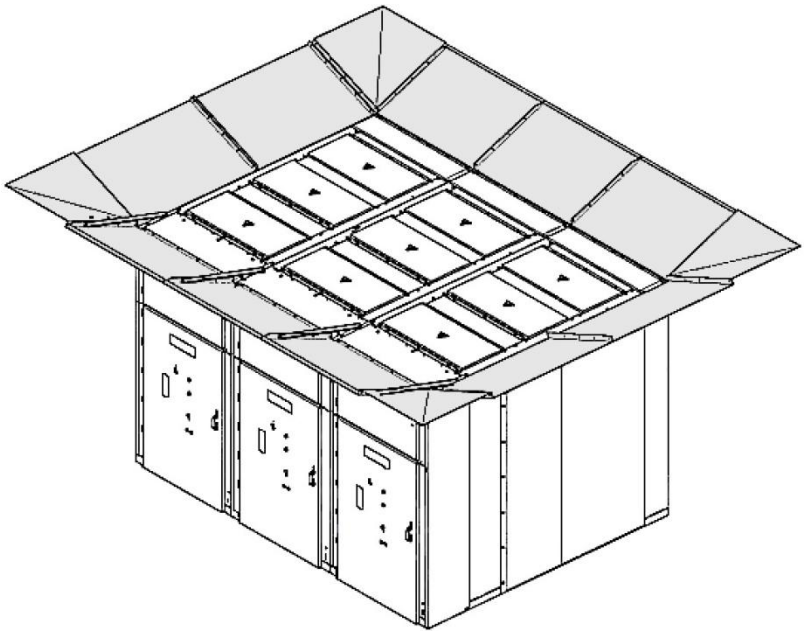
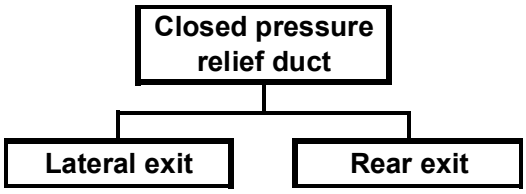


Fig45. Final assembly of the arc routing plates at the free standing switchgear version, 31.5kA

4.3.8. Assembly of the closed relief duct

The duct plates, the connecting bolts, extensions and the ducts leading to the exit (supplied with the loose delivery) must be mounted on site.
According to exhausting the hot gases from the room, there are two directions for the construction of pressure relief channel:



Lateral exit is designed and constructed at the right or left side of the switchgear.
Rear exit is designed and constructed at the back of the switchgear.

ATTENTION!

Risk of injury.

Be aware of the sharp edges of steel parts during the assembly of the pressure relief ducts.

ATTENTION!

Pressure relief ducts have enough weight to endanger people.

⇨ Do not stay under a suspended pressure relief duct before completion of assembly.

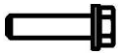
Preparations

Procedure to be followed if accessibility to the panels is insufficient in the final position:

- ⇨ Mount the pressure relief duct onto corresponding panel before positioning the panel on the final place of installation.
- ⇨ Position the panel on its final place of installation.
- ⇨ Proceed in the same way with the adjacent panel.
- ⇨ Interconnect both pressure relief duct before positioning the next panel.

NOTE!

For all connections, the bolt type (M8x25) is used.

 Hexagon head bolts with set-nuts which are already pressed on steel parts at the factory.

Please see the following instruction for the assembly:

Lateral exit

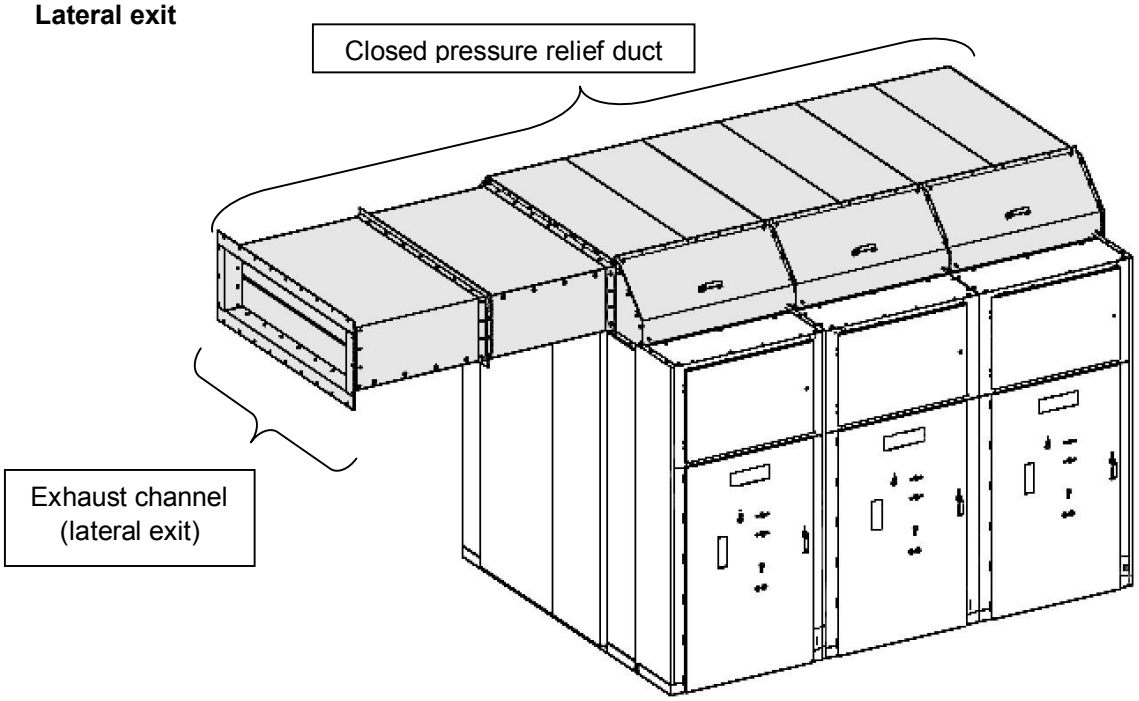


Fig46. Closed pressure relief duct with lateral exit

Assembly of the closed pressure relief duct with lateral exit

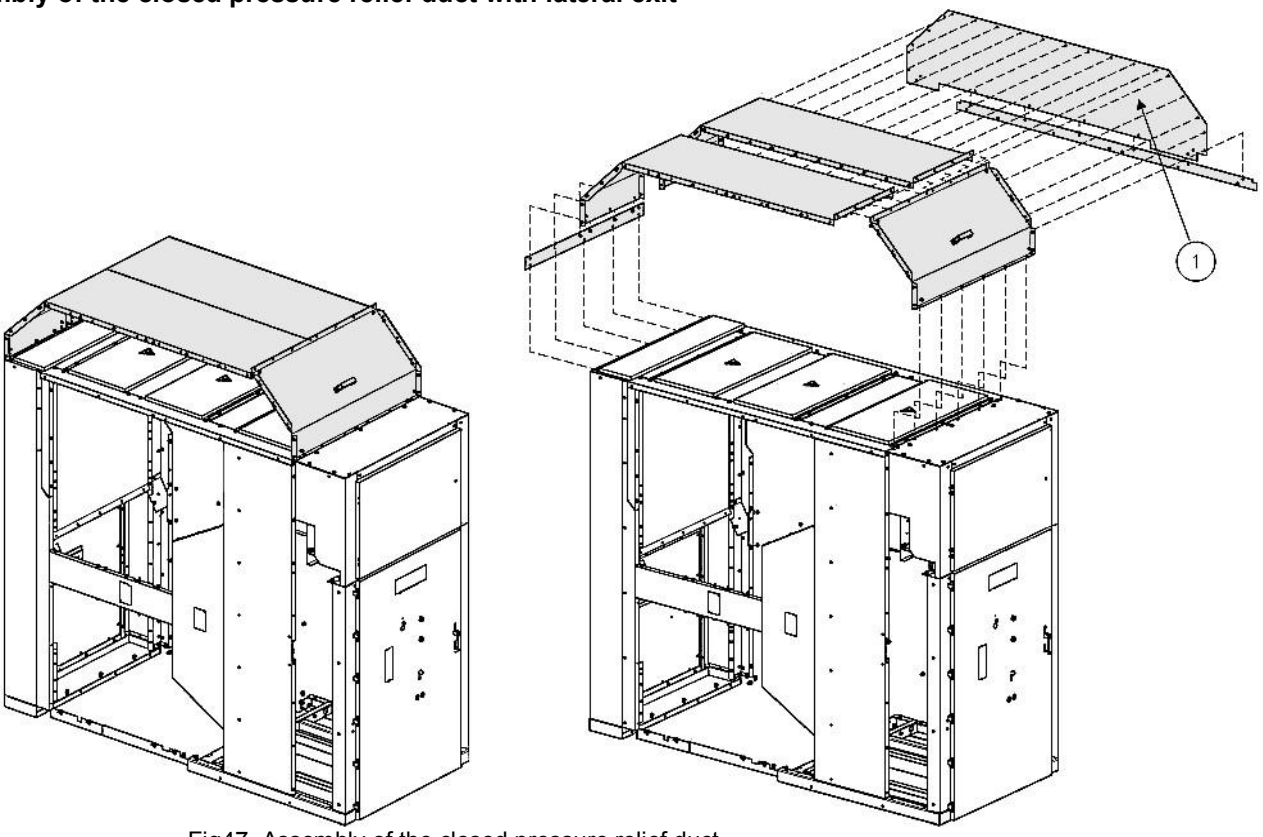
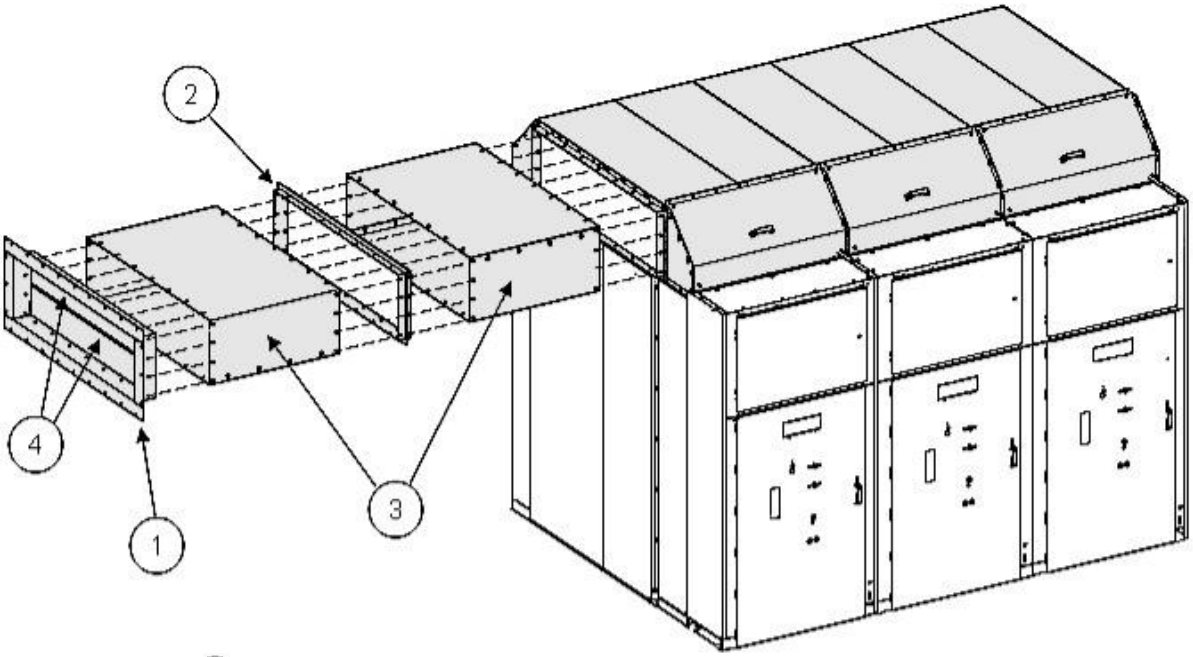


Fig47. Assembly of the closed pressure relief duct

Pos.nr. ① in fig47: Endplate. It is assembled on the right or left end panel.



1. Frame connecting the exhaust channel to the wall outlet
2. Intermediate frame to connect the extension exhaust channel
3. Exhaust channels
4. Pressure relief flaps

Fig48. Assembly of the lateral exit channel

The number of exhaust channels (pos.nr. ③) depends on the distance between the switchgear and the wall.

The intermediate frame (pos.nr. ②) is used whenever the number of exhaust channel group (pos.nr. ③) is more than one (fig48).

The connection details of the frame (pos.nr. ①) to the wall outlet are shown in fig49.

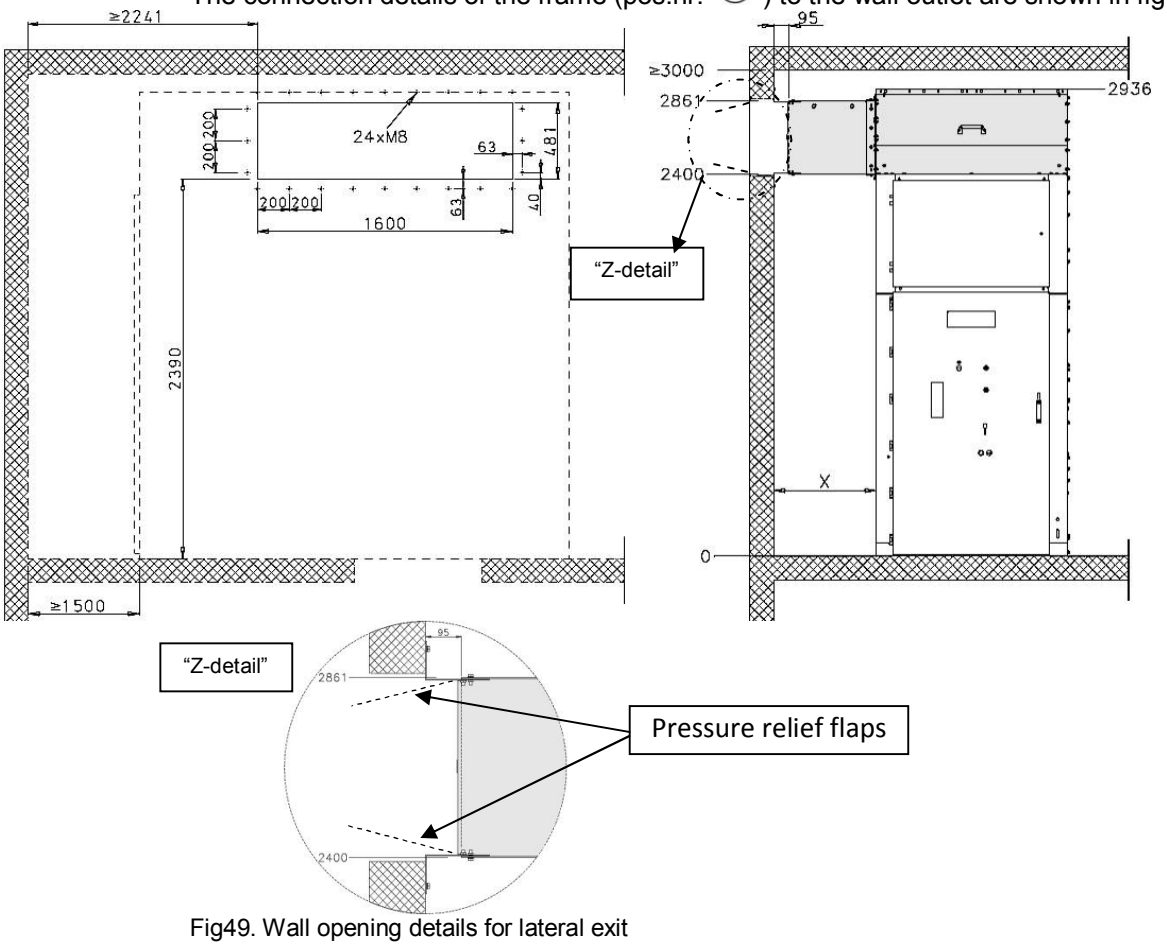


Fig49. Wall opening details for lateral exit

Rear exit

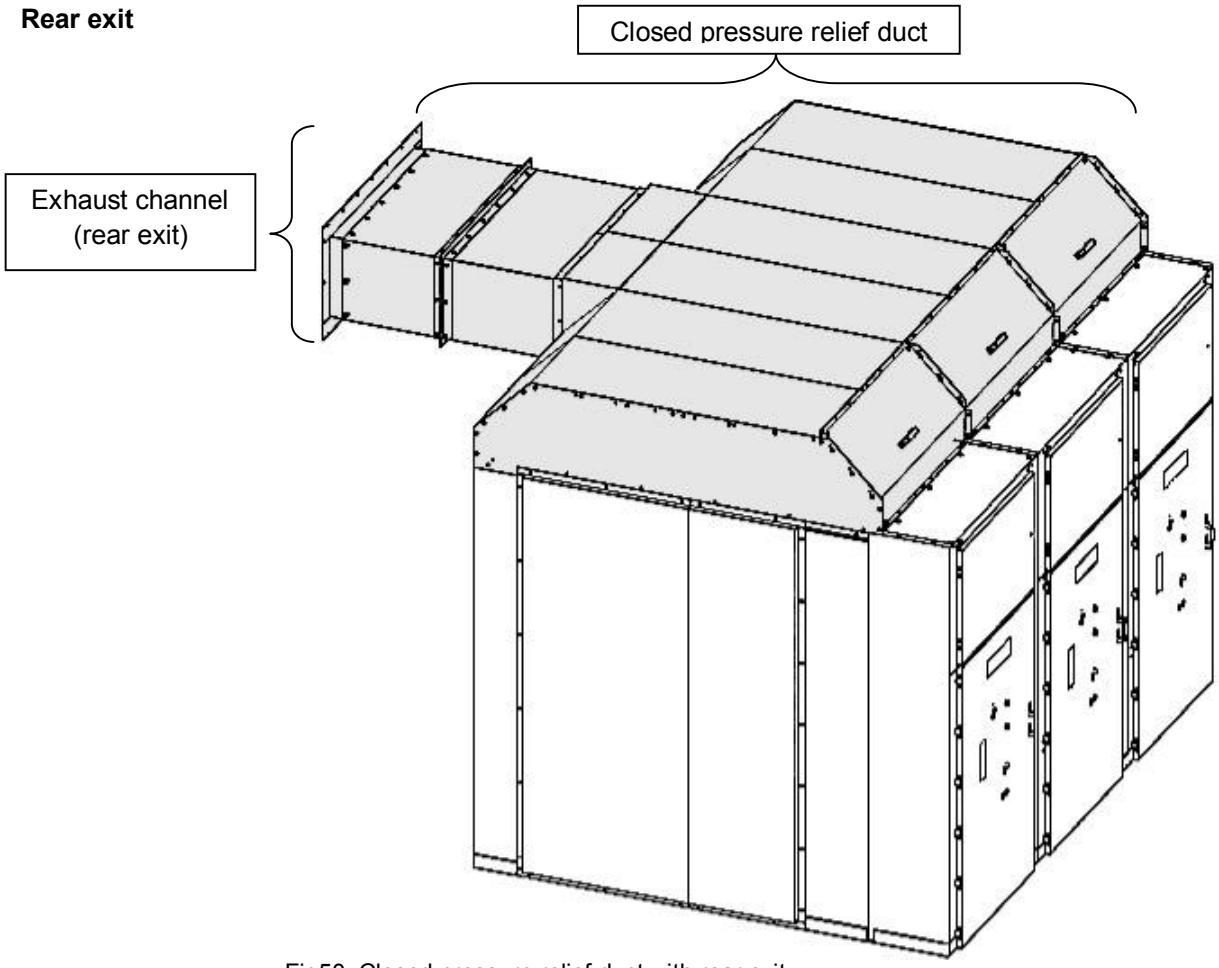


Fig50. Closed pressure relief duct with rear exit

Assembly of the closed pressure relief duct with rear exit

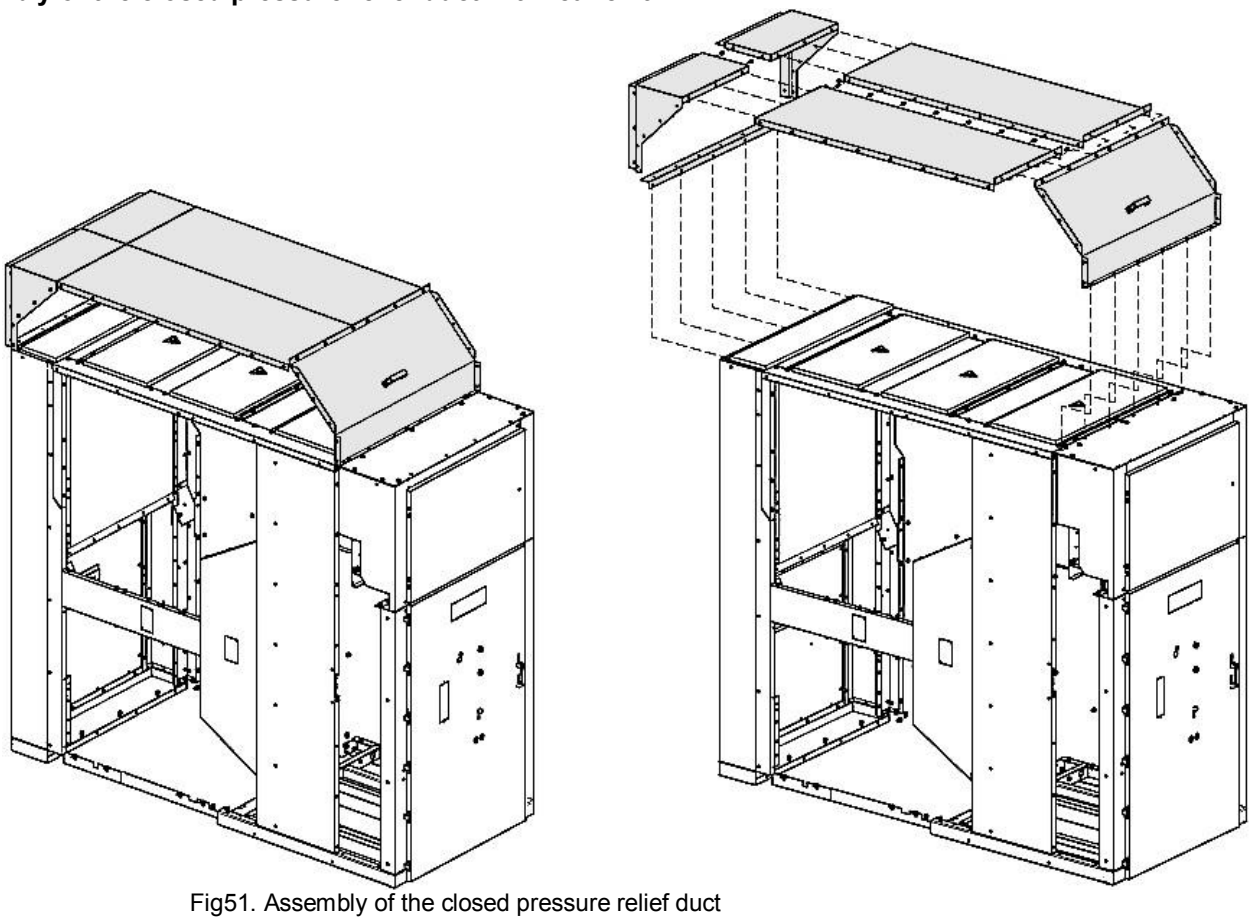


Fig51. Assembly of the closed pressure relief duct

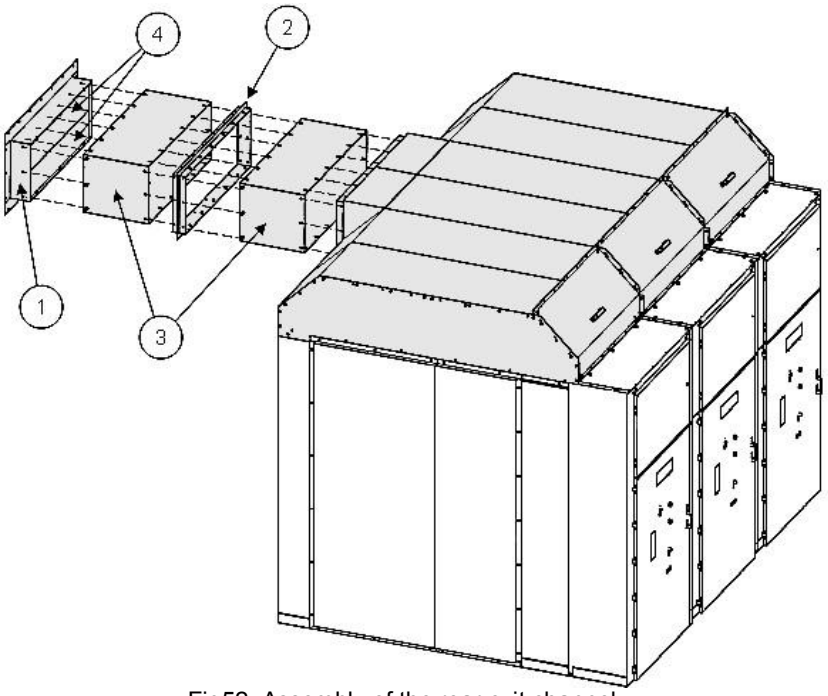


Fig52. Assembly of the rear exit channel

The number of exhaust channels (pos.nr. ③) depends on the distance between the switchgear and the wall.

The intermediate frame (pos.nr. ②) is used whenever the number of exhaust channel (pos.nr. ③) is more than one.

The connection details of the frame (pos.nr. ①) to the wall outlet are as below:

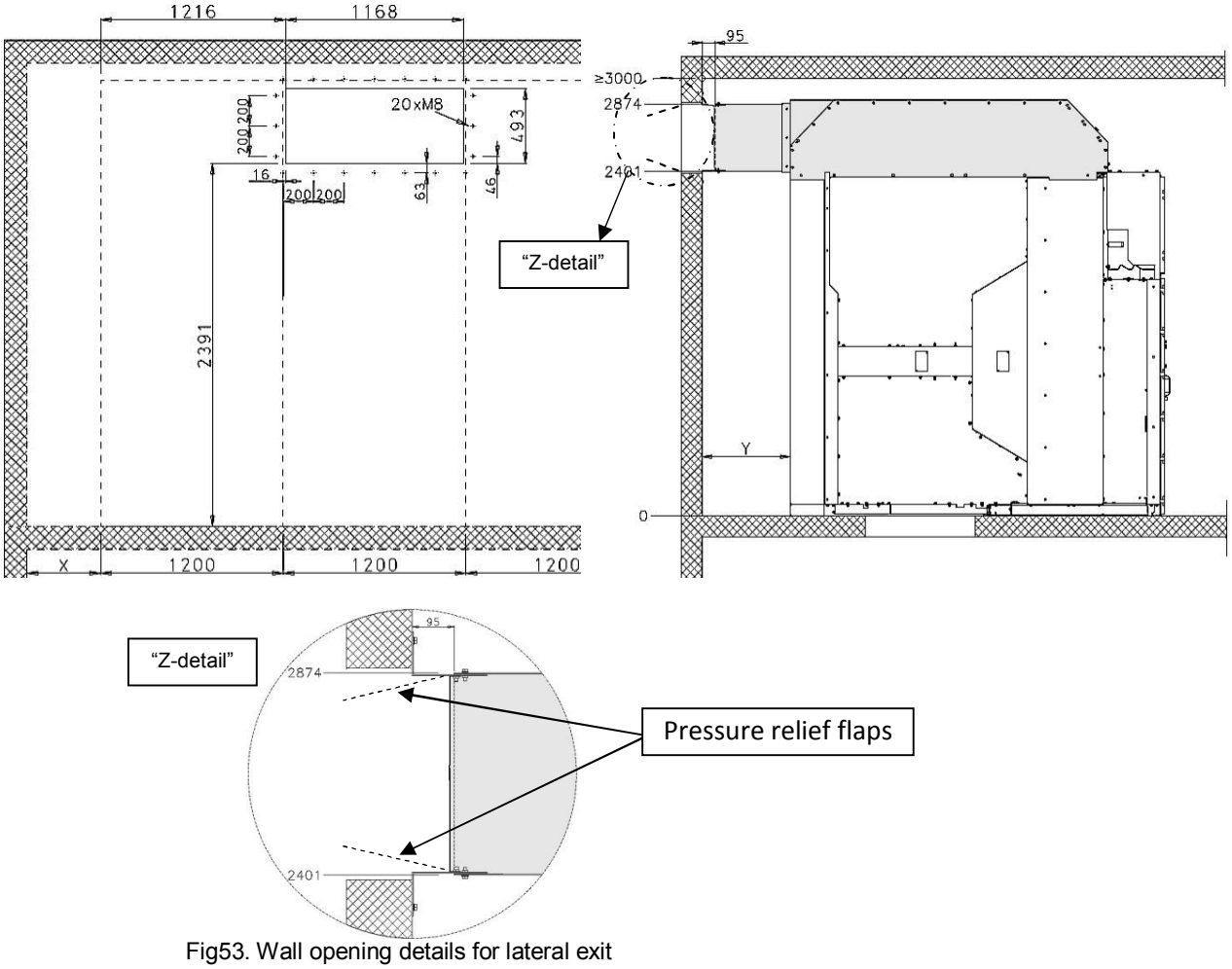


Fig53. Wall opening details for lateral exit

	**ATTENTION!** Make sure that the pressure relief flaps (shown at fig49 and 53) are mounted after the closed pressure exhaust channel assembly to be able to keep the degree of protection IP4X of the complete switchgear according to IEC 60529.

4.3.9. Electrical connections

In the instructions given in the following sections it is assumed that a new switchgear is being installed which has not yet been connected to the mains, and that it is therefore not live.

	**DANGER!** High voltage! Danger! ⇨ If you are going to extend an existing switchgear assembly or replace components, please contact your regional SIEMENS representative.

	**NOTE!** Please observe: ⇨ Before performing any kind of work in the cable compartment, remove the associated withdrawable part from the panel (circuit breaker truck, etc.)

4.3.9.1. Power cable connection

	**DANGER!** High voltage! Danger! ⇨ Do not touch live components. ⇨ Ensure that the switchgear is only operated by qualified personnel who are familiar with the operating instructions and observe the warnings. ⇨ Observe the five safety rules.

	**DANGER!** Risk of injury! During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical parts may move quickly, even remotely controlled. ⇨ Do not remove covers before reading the instruction. ⇨ Do not reach into openings. ⇨ Do not touch circuit breaker poles and operating rods.

	**NOTE!** High voltage cables can be connected from; ⇨ front only for wall standing version ⇨ front and rear for free standing version

Preconditions

- Earthing switch closed, seem Page 78 – clause 6.10, "Operating the feeder earthing switch"
- Truck removed from the panel, see Page 71 – clause 6.6, “Racking the switching device

truck to TEST position"
- High-voltage door open
- Padlocks available
- Lower shutter opening tool available (page21)
- Properly selected cable termination length (fig54 & 55). In the standard application, the cable termination length should be max. 491mm. If longer one needs to be used, please consult SIEMENS for the special design of deep bottom pan. The solution will be to adapt the deep bottom pan as explained in clause 4.3.9.1.3. (page62). Dimensions of deep bottom pan can be changed according to the cable termination length and diameter.

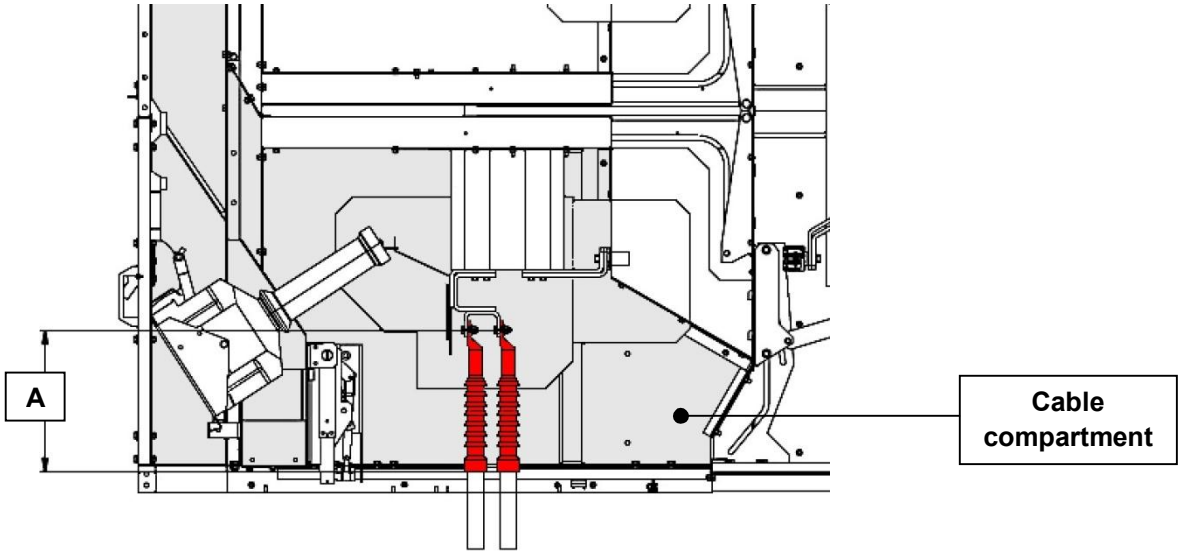


Fig54. Power cable location in the cable compartment

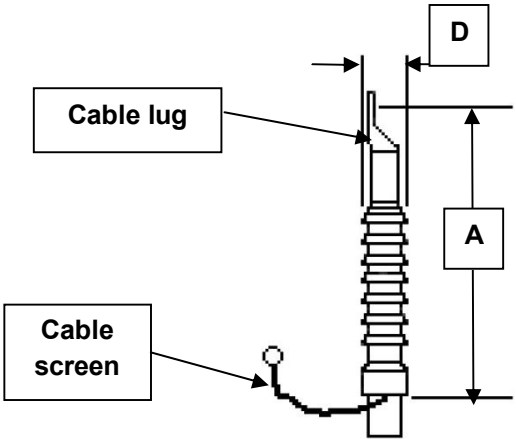


Fig55. Power cable termination details

Dimensions of sealed power cable in [mm]	
Maximum diameter (D)	80
Maximum cable termination length (A)	491

ATTENTION!

The cable compartment can be destroyed if cable termination with inadequate dimensions is used.

⇨ Use only cable termination with the dimensions shown at above table.

⇨ Depending on the manufacturer of the cable terminations, the dimensions may differ from those shown in fig54 & 55 and above table. If they are different, please consult Siemens before installation.

4.3.9.1.1. Front access (wall & free standing versions)

Before installing the cables, the metallic shutter must be opened manually. Then, the lower bushing must be removed.

If the cables need to be installed while the main busbars are energized, use the lower shutter opening tool to open the shutter. The upper shutter remains closed.

Operating lower shutter manually

Step1..... Padlock the upper shutter through the holes on the left and the right sliding racks to prevent accidental opening of the upper shutter during the operation (fig56 and 57).

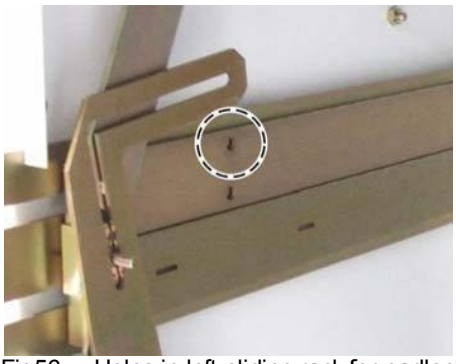


Fig56. Holes in left sliding rack for padlocking

Fig57. Right sliding rack padlocked

Step2..... Remove the M8 nut and 2 washers from the lower shutter drive lever (pos.nr. ① in fig58)

Step3..... Move the lower shutter drive lever aside lever (pos.nr. ② in fig58).

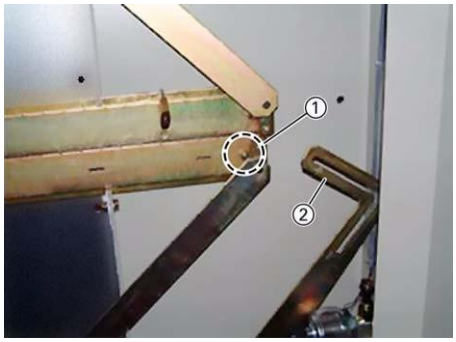


Fig58. Lower shutter drive lever

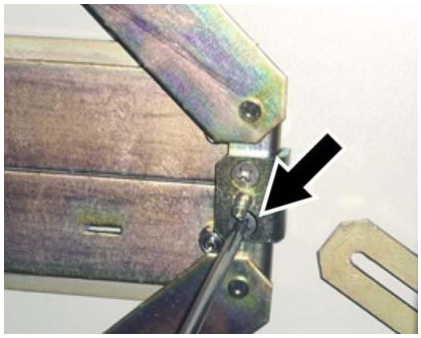


Fig59. Lower shutter drive lever

Step4..... Unscrew the lower shutter arm. (fig59)

✓ Right side is prepared

⇨ Perform steps 1, 2, 3, 4 on lower shutter drive lever and lower shutter analogously for the left side.

Inserting the lower shutter opening tool

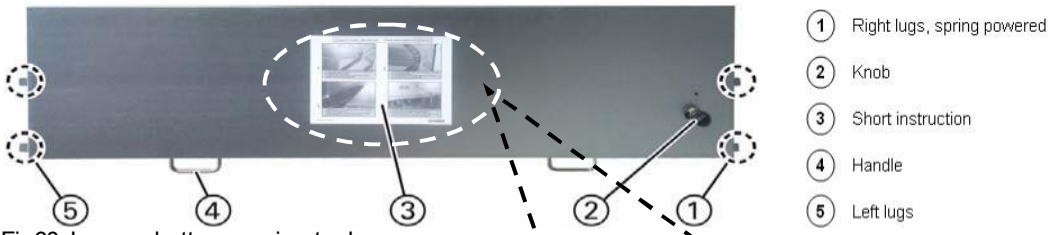


Fig60. Lower shutter opening tool

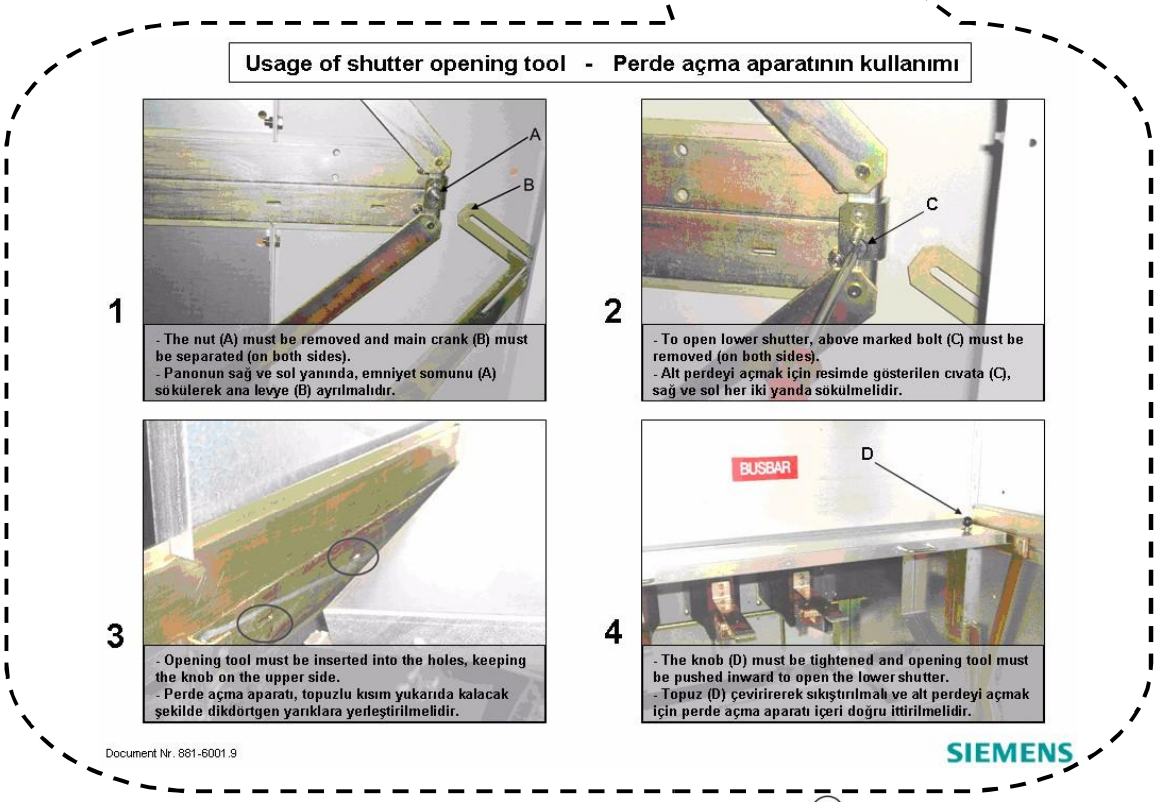


Fig61. Short instruction label on lower shutter opening tool (pos.nr. ③ in fig60).

⇨ Unlock the spring mechanism by screwing the knob approx. 180° counter clockwise (fig62).

⇨ Move the knob laterally between end positions to proof the spring mechanism is free (fig62).

Fig62. Knob detail of lower shutter operating tool

⇨ Push the knob into left position and hold.

⇨ Insert the lower shutter opening tool at the left side by meeting the two slots in the lower shutter arm with the lugs (fig63 and 64).

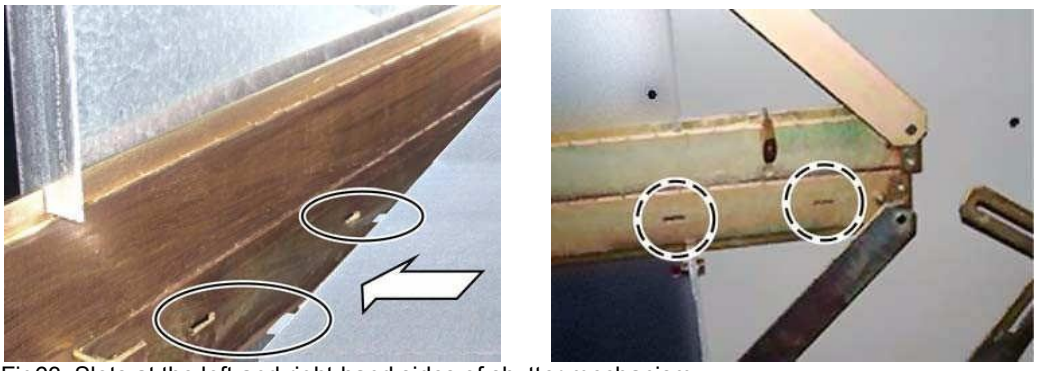


Fig63. Slots at the left and right hand sides of shutter mechanism

⇨ Lower the right end of the lower shutter opening tool to horizontal position.
⇨ Release the knob to meet the two slots in the right lower shutter arm with the spring powered lugs.
⇨ Push the knob to the right that surely the lugs meet the holes.
⇨ Lock the spring mechanism by screwing the knob clockwise (fig64).

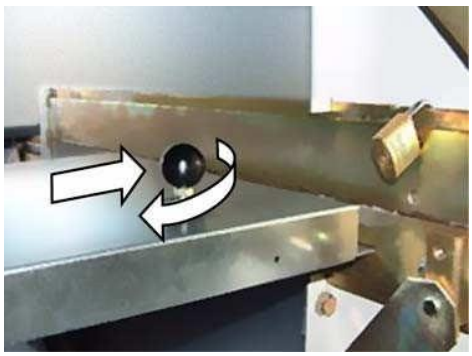


Fig64. Knob mechanism of lower shutter opening tool

✓ The lower shutter opening tool is functionally inserted.

✓ Now, the lower shutter can be operated manually while busbars are energized.

Operating lower shutter manually

Precondition
• Lower shutter opening tool inserted and locked.

Procedure
⇨ Push the lower shutter opening tool at the two handles inside the panel until the lower shutter is fully open (fig65 – 67).

Fig65. Inserting the lower shutter tool

Fig66. Lower shutter half way open

Fig67. Lower shutter fully open

Completing cable installation from the front

	**DANGER!** Hazard due to human error ⇨ Protect your operating area. ⇨ Use warning signs and barrier tape to prevent unauthorized access. ⇨ Observe the Five Safety Rules.

Precondition • Lower shutter opening tool inserted and locked.

Procedure

⇨ Remove 18x M10/M8 bolts from the lower bushing (fig68).

⇨ Remove the lower bushing (fig69).

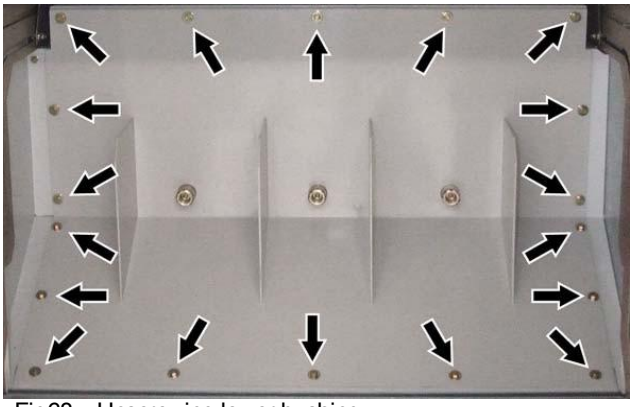


Fig68. Unscrewing lower bushing

Fig69. Access to the cable compartment

✓ Now. The cable compartment is reachable to do the connections

4.3.9.1.2. Rear access (Free standing version)

	**DANGER!** High Voltage! ⇨ Do not touch live components. ⇨ Ensure that the switchgear is only operated by qualified personnel who are familiar with the operating instructions and observe the warnings. ⇨ Observe the five safety rules.

	**DANGER!** Risk of injury**!** During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical parts may move quickly, even remotely controlled. ⇨ Do not remove covers before reading the instruction. ⇨ Do not reach into openings. ⇨ Do not touch circuit breaker poles and operating rods.

Preconditions

- Earthing switch closed, see Page 78 – clause 6.10, "Operating the feeder earthing switch"
- Truck removed from the panel, see Page 71 – clause 6.6, “Racking the switching device truck to Test position"
- Upper shutter closed
- Lower shutter closed
- High-voltage door closed

There are two possible conditions which there are different processes:

i. Cable compartment without withdrawable VT
ii. Cable compartment with withdrawable VT

i. Cable compartment without withdrawable VT

Removing the rear cover

⇨ Remove 18x M10 bolts from the rear cover (fig70).

⇨ Remove rear cover (fig70).

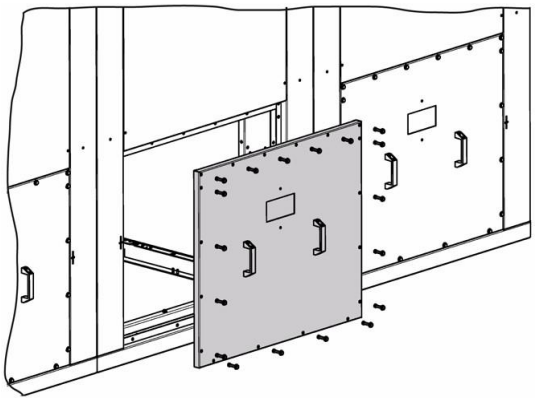


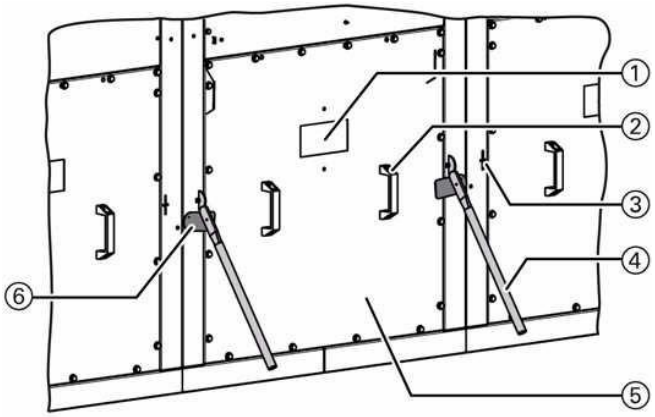
Fig70. Removing the rear cover

✓ Access to the cable compartment possible from the rear.

ii. Cable compartment with withdrawable VT

Removing the rear cover

The rear cover cannot be removed unless the withdrawable voltage transformers are disconnected.



1 Inspection window
2 Handle
3 Slot
4 Operating lever
5 Rear cover
6 Interlock

Fig71. View of the rear cover

⇨ Move two operating levers (pos.nr. ④ in fig71) at the same time as shown in fig72.

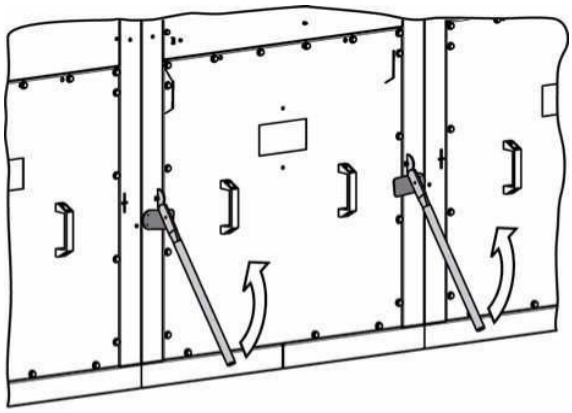


Fig72. Operation directions of two levers to disconnect the withdrawable VT

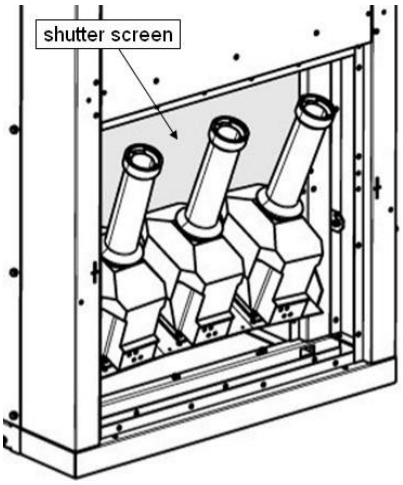


Fig73. Rear view of withdrawable VTs

⇨ Remove 18pcs M10 bolts from the rear cover (fig70).
⇨ Remove the rear cover.

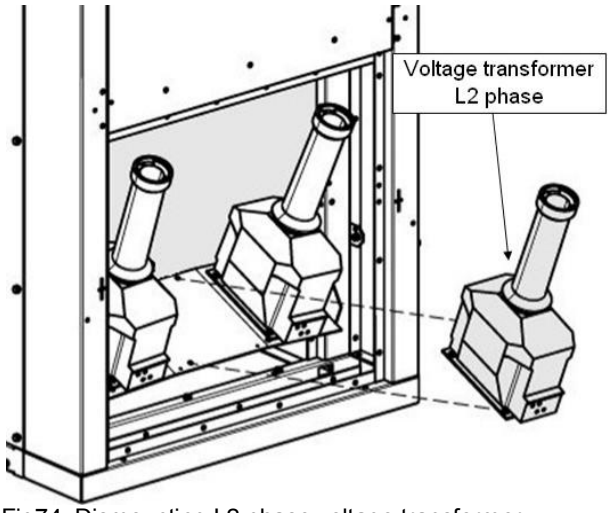


Fig74. Dismounting L2 phase voltage transformer

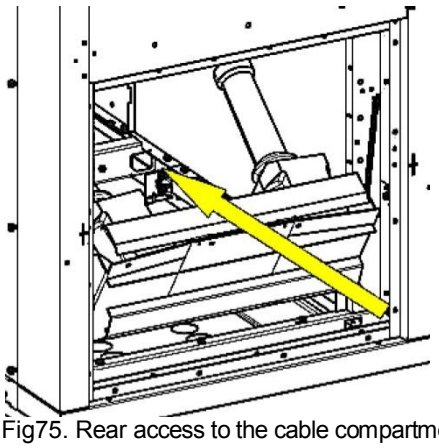


Fig75. Rear access to the cable compartment

⇨ Take out L2 phase voltage transformer (fig74).
⇨ Insert again two operating layers into the hole as done in fig72.
⇨ Move two operating levers (pos.nr. ④ in fig71) downward at the same time to be able to open the shutter just behind the voltage transformers

✓ Now, it is possible to reach the cable compartment (fig75).

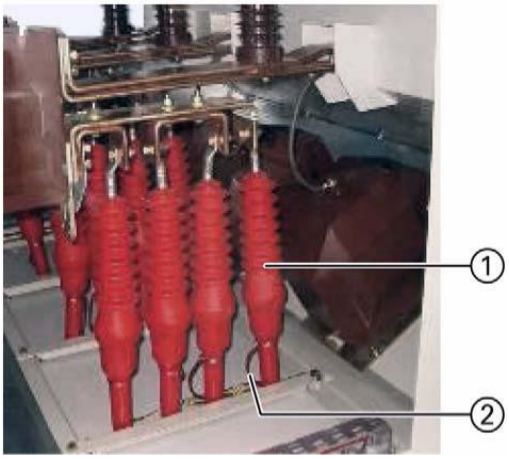
Power cable installation

⇨ Check contact surfaces of cable terminations, brush if necessary and apply a thin film of Vaseline.
⇨ Slip rubber sleeve for the metal floor plates over the cable.
⇨ Mount cable termination according to the manufacturer's instructions.
⇨ Pull cable into connection compartment.
⇨ Connect cable at the panel connection.

	**ATTENTION!** The cable compartment can be destroyed if cable terminations with inadequate dimensions are used. ⇨ Use only cable terminations with the dimensions hereafter. ⇨ Depending on the manufacturer of the cable terminations, the dimensions may differ from those described in here. Please make sure that dimensions do not exceed the limit values.

⇨ Fasten cable lugs at cable bracket (use antimagnetic clamps for single-core cables) with M12 bolts.

⇨ Lead earthing of cable termination to earthing busbar and bolt tight.



① Cable termination

② Cable shield earthing

4.3.9.1.3. Deep bottom pans (optional)

	NOTE!
	Deep bottom pans are used in conditions below: 1. Three core power cable is entered to the panel and phases are separated inside the panel. 2. The cable termination length is longer than the limited value in the application (please see fig54 & 55 on page55 & 56). Note: If the 2nd condition is valid, please consult SIEMENS to arrange the exact dimensions of deep bottom pan according to the cable termination. This is not a standard application. Deep bottom pan is available as supplementary equipment for the switchgear.

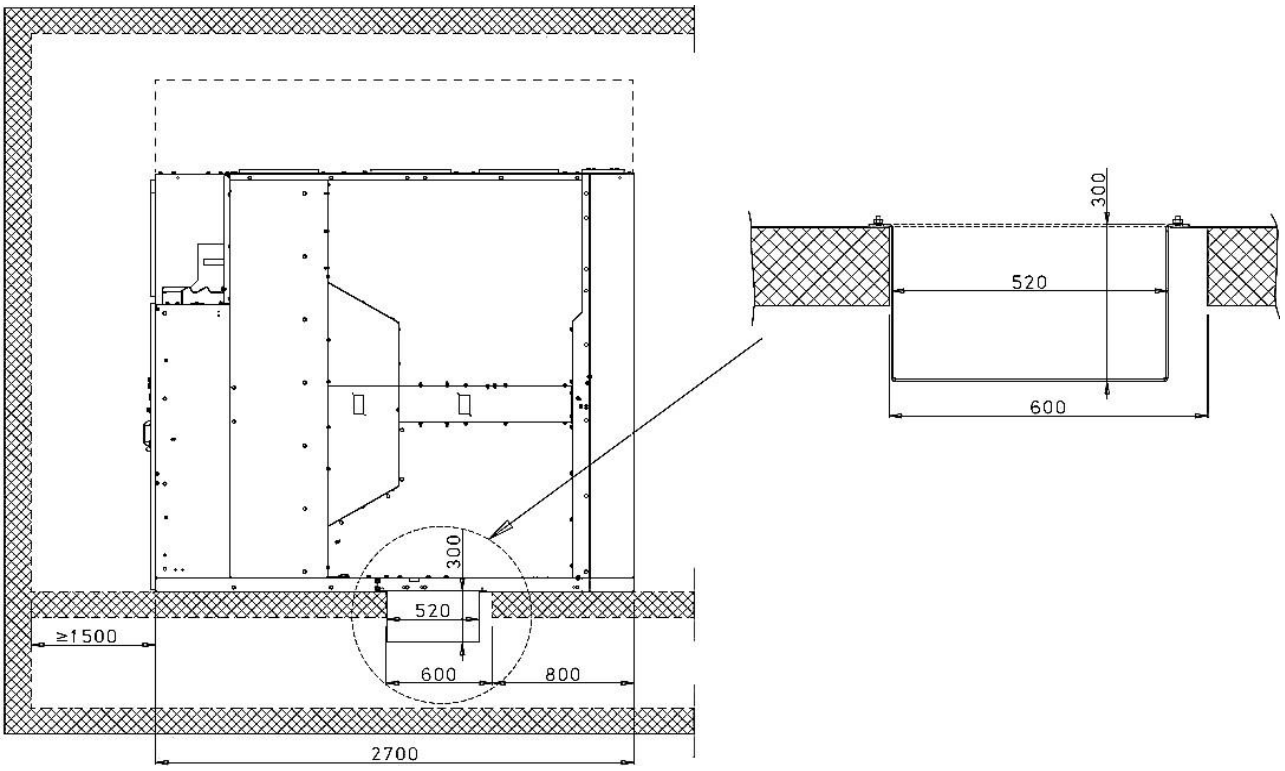
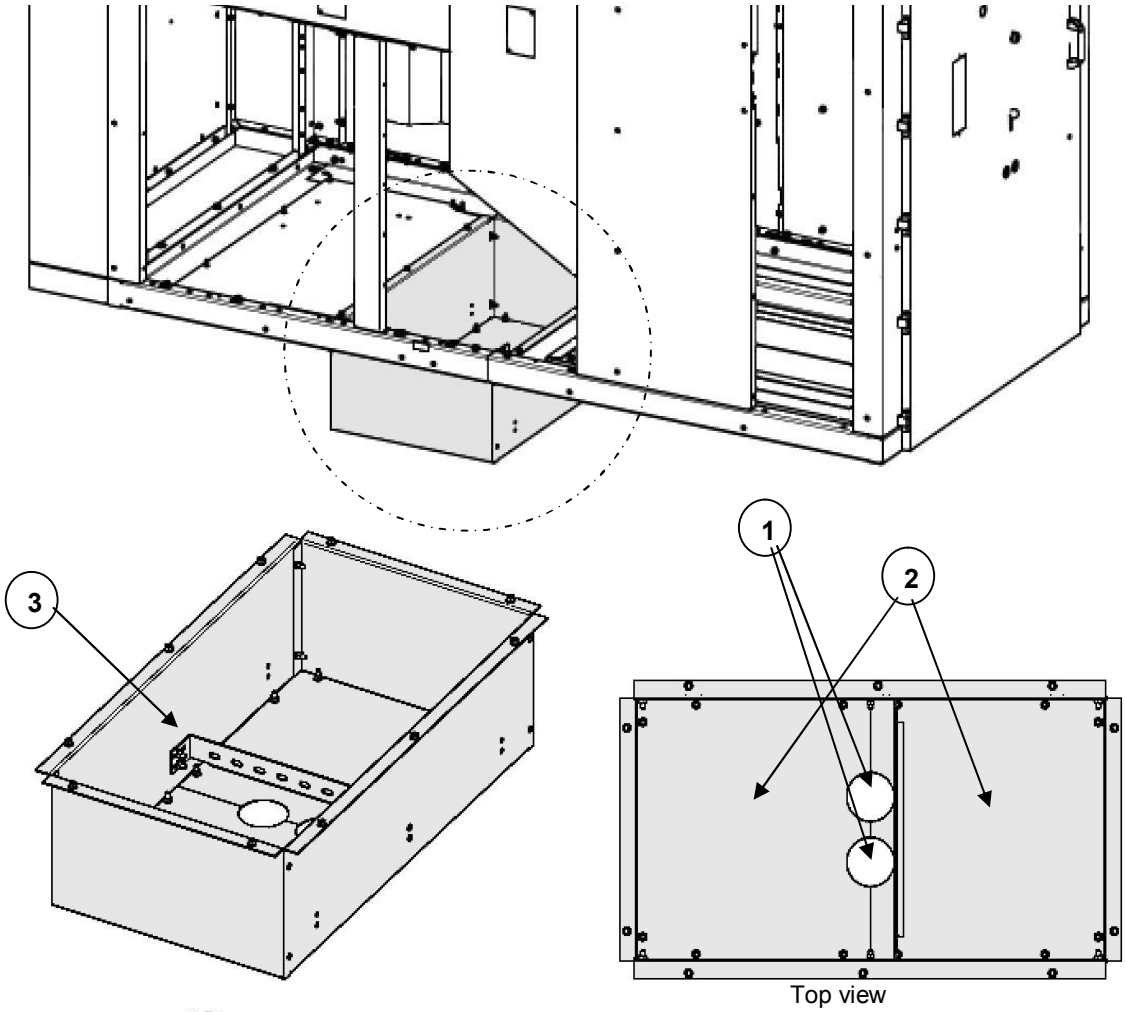


Fig76. Side view of deep bottom pan with standard dimensions



1. Holes and gland plates for power cable entry
2. Closing plate of deep bottom pan
3. Power cable fixing beam

Fig77. Several views of deep bottom pan

4.3.9.2. Control cable connection

Internal wiring
The circuit diagrams for connecting the control cables are included in the low-voltage compartment.

- ⇨ Remove main wiring duct covers on left inner side of switching device compartment.
- ⇨ Install connections from the foundation through the main wiring duct into the low-voltage compartment.
- ⇨ Refit main wiring duct covers.
- ⇨ Connect control cables according to circuit diagrams.

Interconnection wiring between the switchgear and the other location
The control cables coming from outside to the switchgear are put into the channel. The following drawings mention the foundation detail and the channel inside of the panel.

Arrangement in the foundation detail for the control cables:

	NOTE! The drawing in fig78 is taken from “Floor drawings” table at page24.

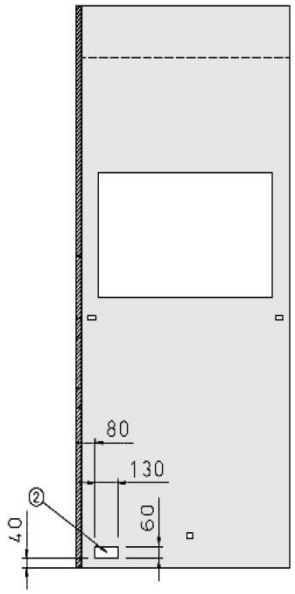


Fig78. Floor opening for control cable at the foundation layout

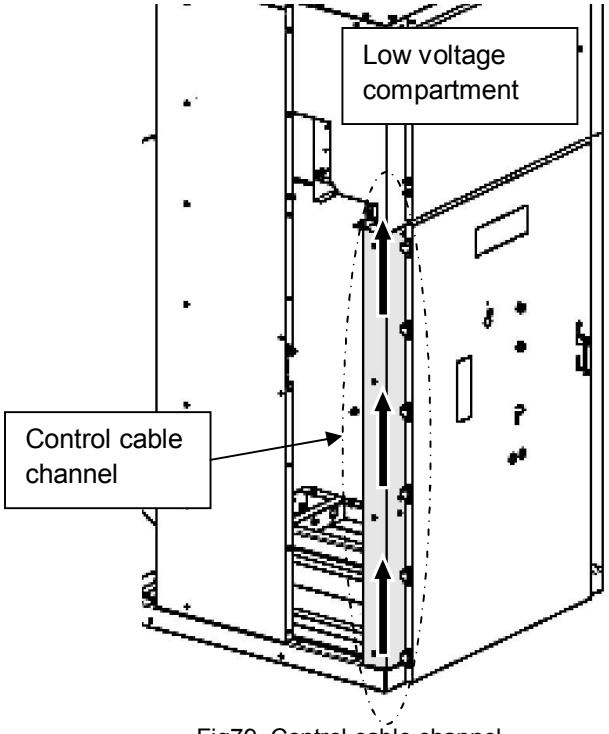


Fig79. Control cable channel

The control cables are entered to the panel from the floor opening (pos.nr.2 in fig78). Then, they are laid down to the low voltage compartment through the cable channel (fig79).

4.3.9.3. Bus wire connection

The bus wire is the electrical connection between panels.

⇨ Plug bus wires into bus wire terminal block in low-voltage compartment.

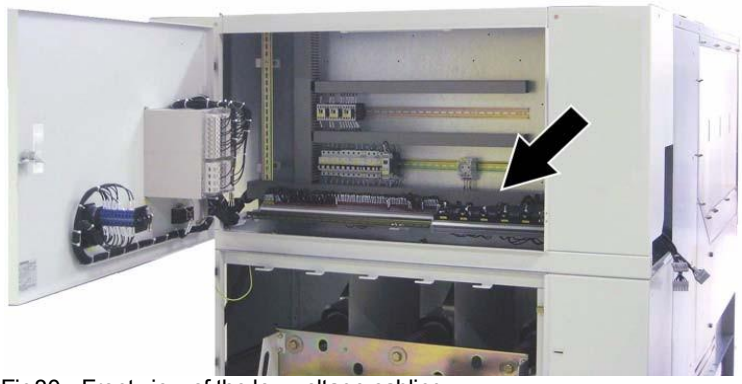


Fig80. Front view of the low voltage cabling

4.4. Final installation work

	NOTE! Please be aware of the below table regarding to the torque values during the control process.

The bolted copper joints with strain washer	Control tightening torque
M6	6.8 Nm
M8	17 Nm
M10	35 Nm
M12	60 Nm
M16	145 Nm

The bolted steel joints	Control tightening

with contact washer	torque
M6	9 Nm
M8	26 Nm
M10	51 Nm
M12	90 Nm
M16	221 Nm

4.4.1. Checking high voltage connections

Perform the following tests on all connected high-voltage cables:

- ⇨ Check tightness of bolts with torque wrench.
- ⇨ Check earthing of cable sealing ends.

4.4.2. Checking bolted joints

- ⇨ Perform random checks of bolted joints on busbars and pressure relief ducts with the torque wrench.

4.4.3. Checking control cable connections

Check the following screw-type connections of control cables:

- ⇨ Perform random checks of the control cable connections on devices and terminal blocks.
- ⇨ Check all control cable connections of current transformer terminals in low-voltage compartment (including slides and jumpers).
- ⇨ If there are any terminal blocks without labels, complete labels using the information given in the circuit diagrams.

4.4.4. Cleaning the switchgear

The bushings and the post insulators of the busbars, especially the openings to the switching device compartment must be free of grease and other pollution.

- ⇨ Wipe all bushings and post insulators of the busbars using a soft, lint-free, dry cloth.

4.4.5. Checking and completing protection against adverse environmental influences (protection against corrosion)

- ⇨ Touch up scratches and impact marks on surface painting

The following products can be supplied for touching up the surface:

- Paint pen for minor paint damages
- Touch-up paint, 1 kg tin

4.4.6. Checking installation work

- ⇨ Check whether all installation work has been performed properly in accordance with the previous sections of installation.

5. COMMISSIONING

5.1. Safety instructions

DANGER!

High voltage! Danger!

- ⇨ Do not touch live components.
- ⇨ Ensure that the switchgear is only operated by qualified personnel who are familiar with the operating instructions and observe the warnings.

ATTENTION!

Risk of injury! During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled.

- ⇨ Do not remove covers.
- ⇨ Do not reach into openings.
- ⇨ Do not touch circuit breaker poles and operating rods.

The perfect and safe operation of this switchgear is conditional on:
- Correct assembly and installation
- Diligent operation Installation and operation of this switchgear are conditional on observance of the following standard of electrical installations in buildings: IEC 60364-5-53

5.2. Preliminary work

5.2.1. Instructing the operating personnel

- ⇨ The operating personnel should be given the operating instructions in good time.
- ⇨ Instruct operating personnel in theory and practice of switchgear operation.
- ⇨ Ensure that the operating personnel are familiar with all operational details when commissioning takes place.

5.2.2. Drying dampness

If the switchgear becomes damp by condensation or high humidity, e.g. prevailing during erection, the switchgear must be dried. Use several electrical heaters of 1000 to 2000 W each. Alternatively switch on the anti-condensation heater if such is part of the switchgear.

The warm air has to flow through all compartments of the switchgear until it is completely dried. Withdraw the truck out of the panel to support the air flow.

5.2.3. Checking the installation work and the accessories

- ⇨ Make sure that the following accessories are ready to hand:

  - Operating instructions
  - Hand crank for truck operation
  - Operating lever for the feeder earthing switch
  - Hand crank for the spring energy store
  - Double-bit key for the racking mechanism
  - Double-bit key for the door of the low-voltage compartment
  - Circuit diagrams
  - Warning signs
  - Earthing and short-circuiting facility (optional)
  - Voltage tester or detecting system (optional)
  - Lower shutter opening tool (optional)

- ⇨ Ensure that the installation work has been performed properly.
- ⇨ Ensure that all covers have been fitted.

5.2.4. Checking interlocks mechanically

- ⇨ Check each panel to establish whether the truck can only be racked to SERVICE position when the circuit breaker and the earthing switch are in OPEN position and the high-voltage door is closed.
- ⇨ Check the circuit breaker panels to establish whether the circuit breakers can only be operated when the respective truck is in interlocked end position (TEST or SERVICE position).
- ⇨ Check all earthing switches to establish whether the earthing switches can only be operated when the respective trucks are in interlocked TEST position.
- ⇨ Check whether the high-voltage door can only be opened when the truck is in interlocked TEST position.

5.2.5. Test operation

With test operation you can check the correct operation of the switchgear before commissioning without being endangered by operational high voltage.

DANGER!

High voltage! Danger!

⇨ If you find out during test operation that a part of the system does not operate in the way described in this document, you must not put the switchgear into operation.

DANGER!

High voltage! Danger!

⇨ Do **not** switch on operational high voltage during test operation!

- ⇨ Switch on control voltage.
- ✓ The motors of the circuit breaker operating mechanisms start up and charge the closing springs.

Checking the switching process and the position indicators

- ⇨ Rack each truck from TEST position to SERVICE position and back several times. At the same time, check whether these positions of the truck are displayed correctly at the panel and, if applicable, in the control room.
- ⇨ Switch each earthing switch from OPEN to EARTHED position and back several times. At the same time, check whether these positions are correctly indicated on the panel and, if applicable, in the control room.
- ⇨ Close and open each circuit breaker several times locally and from remote for test. At the same time, check whether these positions are correctly indicated on the panel and, if applicable, in the control room, and whether the auxiliary switches and position switches operate correctly.
- ⇨ Check the function of the existing shunt closing and shunt opening releases by electrical operation.

ATTENTION!

If you have determined a malfunction during one of these tests:

⇨ Do not put the switchgear into operation.
⇨ Inform your regional SIEMENS representative.

5.2.6. Preparing the power frequency voltage test (optional)

If required, a power-frequency voltage test can be performed at site on the readily assembled switchgear. In this case, make the following preparations:

- ⇨ Remove voltage transformers as well as surge arresters and surge limiters.
- ⇨ Protect bushings of transformers, surge arresters and surge limiters in a surge-proof way using suitable sealing caps.

⇨ Earth the test sockets of the capacitive voltage detecting systems.

✓ Now the test can be carried out.

5.3. Putting into service

Preparations before switching on

The operating personnel must have been trained, the installation work checked and test operation must have been carried out successfully without malfunctions.

⇨ Close all front doors of the panels.
⇨ Open all circuit breakers (see Page76, clause 6.9, "Opening the circuit-breaker").
⇨ Rack all trucks to TEST position (see Page71, clause 6.6, “Racking the switching device truck to TEST position").
⇨ If there is a feeder without connected cables, earth this feeder (see Page78, clause 6.10, “Closing the feeder earthing switch").
⇨ Ensure that all consumers connected to all outgoing feeders are switched off.

✓ Now, you can apply on the operational high voltage to put the switchgear into operation.

Applying voltage to the busbar

DANGER!

High voltage! Danger!

⇨ Switch on the operational high voltage only if you have checked the installation work and performed the test operation without malfunctions.

⇨ Connect the incoming feeder in the associated opposite substation.
⇨ Connect the incoming feeder to the busbar (rack the removable part to SERVICE position and close the circuit breaker) (see Page74, clause 6.8, “Racking the circuit breaker to the service position” and see Page76, clause 6.9, “Closing the circuit breaker”).

✓ Now, the busbar of the switchgear is live.

Switching on more incoming feeders

ATTENTION!

Short-circuit on the busbar if the incoming feeders have different phase sequences.

⇨ Ensure that all incoming feeders have the same phase sequence.

⇨ Verify phase coincidence between the respective incoming feeder and the busbar.
⇨ Switch on tested incoming feeder.

Switching on outgoing consumer feeders

When all the incoming feeders have been connected:

⇨ One after the other, switch on all outgoing feeders with connected consumers.

✓ Now, all feeders are energized; the switchgear is totally in operation.

Revision on circuit diagrams

	NOTE!
	⇨ Note any modifications which may have been made during installation or commissioning in the supplied circuit diagrams. ⇨ Send the corrected documentation to the regional SIEMENS representative so that the modifications can be included.

5.4. Customer support

Switching on

If you have a problem with your switchgear, please refer to your installation and operation instructions for information on usage and trouble shooting. If the fault persists, contact our SIEMENS Customer Support Center.

Repairs

Repairs are carried out by fully trained Siemens engineers, who arrive equipped with original spare parts for your switchgear.

Before you call

To help us deal with your query more quickly, make sure you have the following information at hand:
- Switchgear type
- Switchgear serial number
- Year of manufacture
- Panel number

This information is available on the rating plate on the inside of the high voltage door and the low voltage compartment door.

Contact

E-mail: aftersaleskartal.tr@siemens.com

Tel : +90 216 459 3434

6. OPERATION OF THE SWITCHGEAR

6.1. Safety instructions

	**DANGER!** High voltage! Danger! ⇨ Do not touch live components. ⇨ Ensure that the switchgear is only operated by qualified personnel who are familiar with the operating instructions and observe the warnings. ⇨ Observe the Five Safety Rules (see Page 4, clause 1.2, “General instructions").

	**DANGER!** During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled. ⇨ Do not remove covers. ⇨ Do not reach into openings. ⇨ Do not touch circuit breaker poles and operating rods.

	**DANGER!** Danger by non-observence of local regulations ⇨ In addition to these operating instructions, the instructions of the switchgear operator must be carried out. ⇨ For working in the switchgear, the operator must create the operational work instructions.

	**NOTE!** Perfect and safe operation of the switchgear ⇨ The perfect and safe operation of this switchgear is conditional on correct erection and installation according to the installation instructions.

6.2. Control elements and indicators

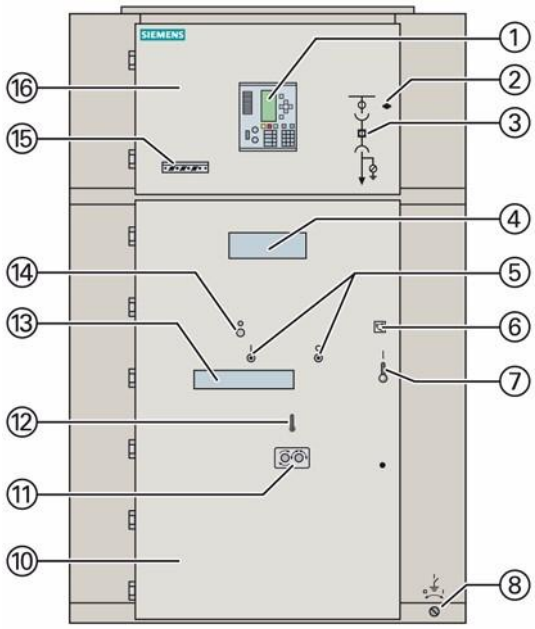


Fig81. Control elements, circuit-breaker panel

1. Protection relay
2. Actuating opening for locking or unlocking low voltage compartment door
3. Mimic diagram
4. Inspection window for checking the switching device truck
5. Actuating openings for manual operation of the circuit breaker
6. Actuating opening for locking or unlocking high voltage compartment door
7. Door locking handle
8. Actuating opening for earthing switch
10. High voltage compartment door
11. Actuating opening and interlock for racking the switching device truck
12. Control gate for opening and closing the actuating hole for racking the switching device truck
13. Inspection window to identify the position indicator of the circuit breaker, the spring energy store indicator and operations counter [1)]
14. Actuating hole manual charging of the circuit breaker closing spring
15. Capacitive voltage detective system for feeder / busbar
16. Low voltage compartment door

[1)] Inspection window is horizontal in panels equipped with 3AH5 type circuit breaker. Inspection window is vertical in panels equipped with 3AH3 type circuit breaker.

Position indication				
Circuit breaker	CLOSED		OPEN	
Earthing switch	CLOSED		OPEN	
Spring energy store of the circuit breaker (Automatically activated whenever the auxiliary supply voltage of spring is ON.)	CHARGED		NOT CHARGED	

6.3. Access to compartments

Regarding accessibility to the individual compartments, 8BT2 switchgear fulfills the loss of service continuity category LSC 2B according to IEC 62271-200.

The degree of protection of the individual compartments between each other is IP2X.

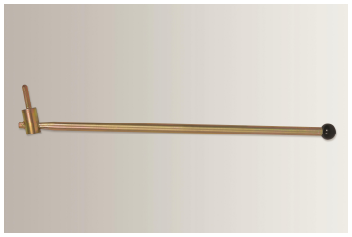
The type of accessibility is provided as follows:

Compartment		Type of accessibility
Switching device compartment		Interlock controlled
Low voltage compartment		Tool based
Busbar compartment		Tool based
Cable compartment	Access from the front side	Interlock controlled and tool based
	Access from the rear side	Tool based

6.4. Operating tools

The below operating tools are supplied as standard accessory with the switchgear:

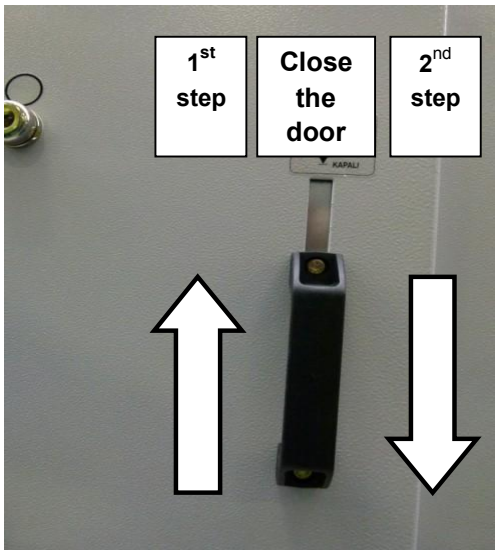
Hand crank for racking the switching device truck in and out	
Double bit key with a diameter of 3 mm for opening and closing the door of the low voltage compartment	
Double bit key with a diameter of 5 mm for releasing and interlocking the withdrawable part	
Operating rod for closing / opening the circuit breaker mechanically	
Operating lever for the feeder and the busbar earthing switches	
Hand crank for manual charging of the circuit breaker's closing spring in SERVICE position	

Operating lever for the withdrawable voltage transformers mechanism	

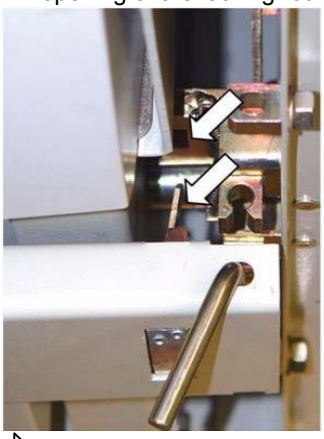
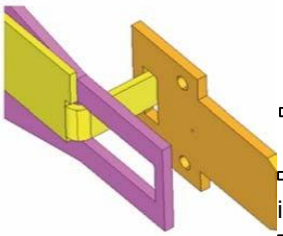
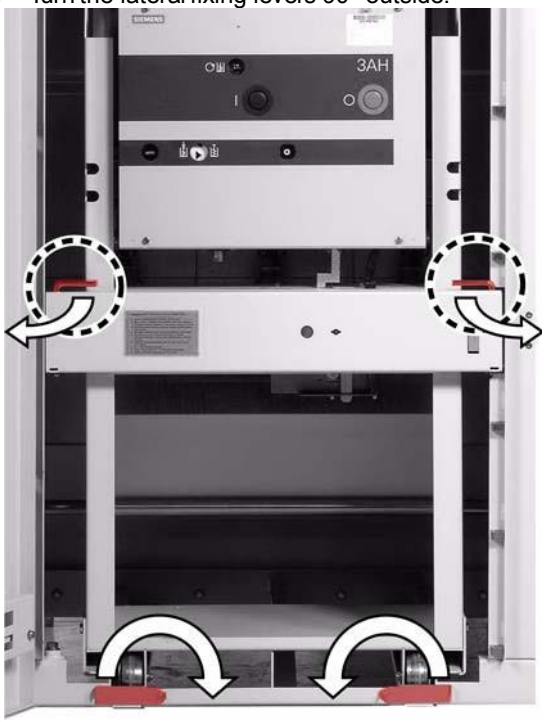
6.5. Opening and closing the high voltage compartment door

	**DANGER!** High voltage! Danger! ⇨ Isolate the busbars in the busbar compartment and the cable or bar connections in the connection compartment **before** opening the high-voltage door. Observe the **Five Safety Rules.** ⇨ Do not operate the panel with the high voltage door open.

	**NOTE!** The following instructions for opening and closing the high-voltage door apply to: ⇨ Circuit breaker panels ⇨ Disconnecting panels ⇨ Metering panels

	Opening the high voltage compartment door	**Closing the high voltage compartment door**
Preconditions	• Truck in test position	Either without truck or: • Truck inserted in TEST position • Low voltage connector plugged in
Procedure	⇨ Pull the door handle upwards and open the door 	⇨ Pull the door handle upwards and close the door ⇨ Push the door handle downwards 
Result	✓ High-voltage door is open.	✓ High-voltage door is closed.

6.6. Moving the withdrawable device truck into and out of the panel

<table>
<tr><th></th><th>Moving the withdrawable device truck into the panel</th><th>Moving the withdrawable device truck out of the panel</th></tr>
<tr><td>Preconditions</td><td>• Open the high voltage compartment door.</td><td>• Open the high voltage compartment door.
The high voltage compartment door can only be opened and the truck can only be racked if the truck is in TEST position and interlocked</td></tr>
<tr><td>Procedure</td><td>⇨ Fold the locking gates of the guide rails to the inside.
 
⇨ Move the withdrawable device truck into the switching device compartment.
⇨ If there is an earthing switch available, verify that the pin in the carriage mechanism reaches into the opening of the locking rod.
 
 
⇨ Push the switching device truck into the panel as far as it will go.
⇨ Fold the locking gates of the guide rails to the outside.
⇨ Turn the lateral fixing levers 90° inside.</td><td>⇨ Remove the low voltage connector. To do this, push the connector lock upwards.
⇨ Fold the locking gates of the guide rails to the inside.
⇨ Turn the lateral fixing levers 90° outside.
 
⇨ Move the switching device truck to the front and out of the panel.
⇨ Fold the locking gates of the guide rails to the inside again.
⇨ Close the high voltage door.</td></tr>
</table>

		
Result	✓ The switching device truck is inserted and locked. ⇨ Plug the voltage connector in and latch the connector lock tight down wards. ⇨ Close the high voltage door.	✓ The switching device truck is moved out of the panel.

6.7. Low voltage plug connection and coding

Plug connection

All control wires related to the circuit breaker's internal circuit are connected to the low voltage connector (fig82).

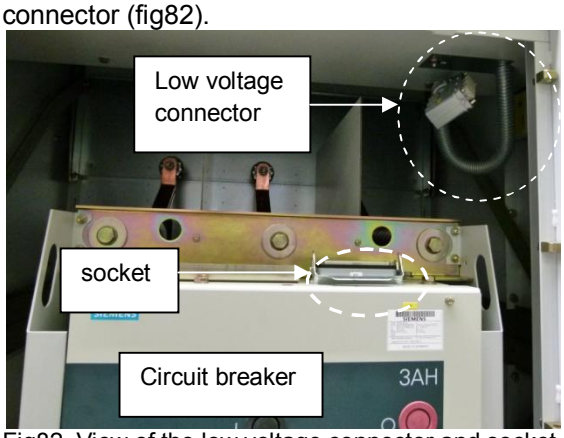


Fig82. View of the low voltage connector and socket.

After inserting the witdrawable truck into the test position in the panel, the connector should be plugged into the socket on the circuit breaker to be able to provide the electrical connection between the circuit breaker's and the low voltage control circuits (Please see fig83 for the connection).

Fig83. Steps to plug the low voltage connector into the circuit breaker's socket.

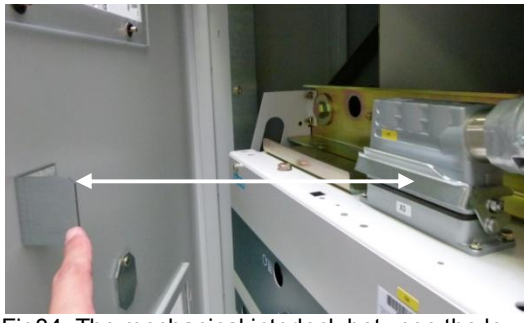


Fig84. The mechanical interlock between the low voltage connector and the high voltage door.

There is also the mechanical interlock between the low voltage connector and the high voltage compartment door. If the connector is not plugged in, the door can not be closed. So, the operation can not be started (Please see the photo in fig84).

Plug coding

Although the circuit breaker's physical dimensions in the switchgear are same, the technical parameters may be different. For example, in spite of the fact that the nominal current ratings are different (1250A, 2000A or 2500A), the circuit breaker (rated 1250A) can be put into the panel rated 2000A.

According to the technical differences, the coding system is applied on plug (Please see photos in fig85 and 86).

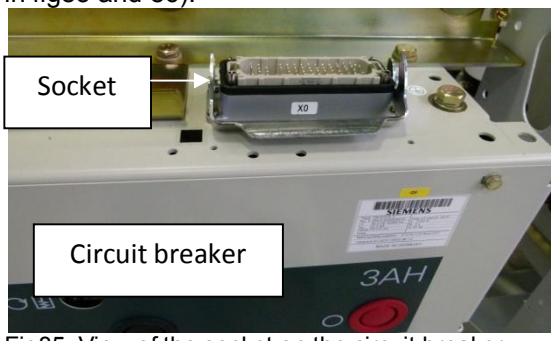


Fig85. View of the socket on the circuit breaker

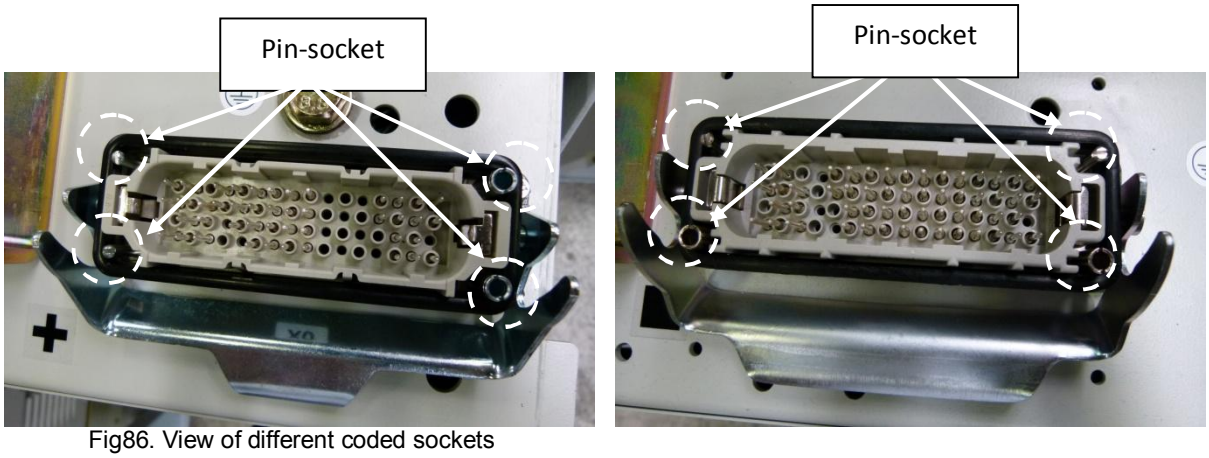


Fig86. View of different coded sockets

The pin-socket combination can let the right circuit breaker put into the related panel. So,

please be aware of this coding before the operation.

6.8. Racking the withdrawable device truck

	**NOTE!** The following instructions for racking the withdrawable device truck apply to: ⇨ Circuit breaker ⇨ Switch disconnector ⇨ Voltage transformer with truck in the metering panel

Control elements of switching device truck

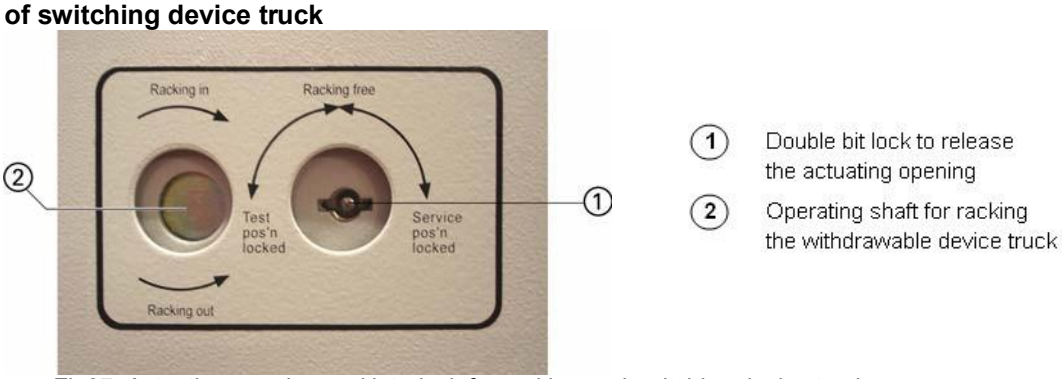


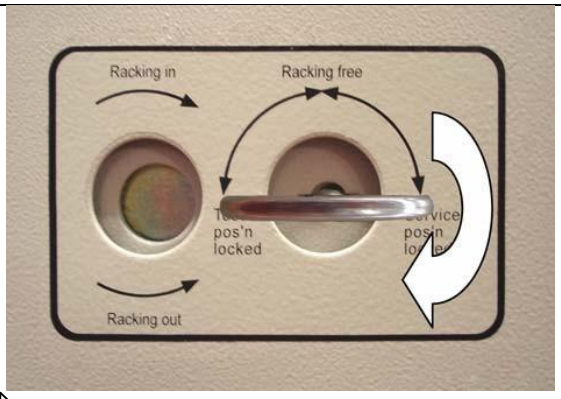
Fig87. Actuating opening and interlock for racking and switching device truck

Racking positions Withdrawable devices (circuit breaker, disconnector, voltage transformers) are mounted on the truck. It can be racked to two different positions:

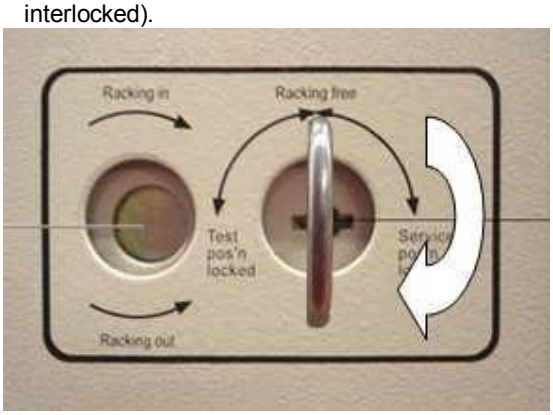
- **SERVICE position**: The contact poles of the switching device are connected with the busbar and the feeder. The low-voltage connector is plugged in.
- **TEST position**: The contact poles of the switching device are disconnected from the busbar and the feeder. In this position e.g. electrical interlocks can be checked. The low-voltage connector can be unplugged.

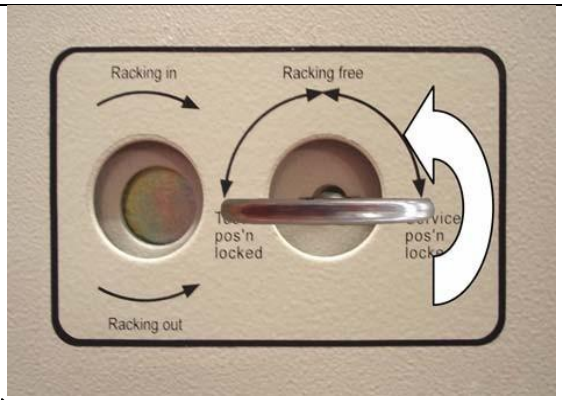
	**ATTENTION!** If there is no auxiliary voltage, both the electrical and the mechanical interlocks are closed. If the interlocks are eliminated, manual switching operations will be possible despite an existing electrical interlock, and they can cause operational breakdowns. ⇨ Ensure that the intended manual switching operation has been released externally.

	Racking the withdrawable truck into SERVICE position	**Racking the withdrawable truck into TEST position**
Preconditions	• Truck completely inserted to the TEST position and interlocked in panel. • High voltage compartment door closed. • Circuit breaker and Switch Disconnector in OPEN position. • Feeder earthing switch in OPEN position. • Low voltage connector plugged in.	• The truck in SERVICE position • Circuit breaker and Switch Disconnector in OPEN position • Feeder earthing switch in OPEN position.
Procedure	⇨ To release the truck: Insert the double bit key into the actuating opening (pos.nr. ① in fig87) and turn 90º clockwise to the “Racking free” position (manual racking).	⇨ To release the device truck: Insert the double-bit key into the actuating opening (pos.nr. ① in fig87) and turn 90° counter-clockwise to the "Racking free" position (manual racking).

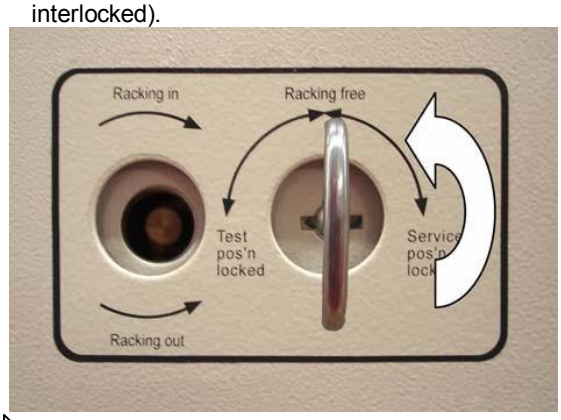
<table>
<tr>
<td></td>
<td>


⇨ Push the hand crank for racking the switching device truck onto operating shaft (pos.nr. ② in fig87) and turn clockwise as far as it will go.

⇨ Remove the hand crank for racking the switching device truck.
⇨ Turn the double-bit key 90° clockwise to the "SERVICE pos'n locked" position (SERVICE position interlocked).


⇨ Remove the double-bit key.</td>
<td>


⇨ Push the hand crank for racking the switching device truck onto operating shaft (pos.nr. ② in fig87) and turn counter-clockwise as far as it will go.

⇨ Remove the hand crank for racking the switching device truck.
⇨ Turn the double-bit key 90° counter-clockwise to the "Test pos'n locked" position (TEST position interlocked).


⇨ Remove the double-bit key.</td>
</tr>
<tr>
<td>Result</td>
<td>✓ The switching device truck was racked from TEST to SERVICE position.</td>
<td>✓ The switching device truck was racked from SERVICE to TEST position.</td>
</tr>
</table>

6.9. Operating the circuit breaker

The 3AH vacuum circuit breaker is equipped with a spring-operated/stored-energy mechanism. The closing spring is charged automatically after every closing operation. If the supply voltage fails, the closing spring can be charged manually. The opening spring is always charged during the closing operation.

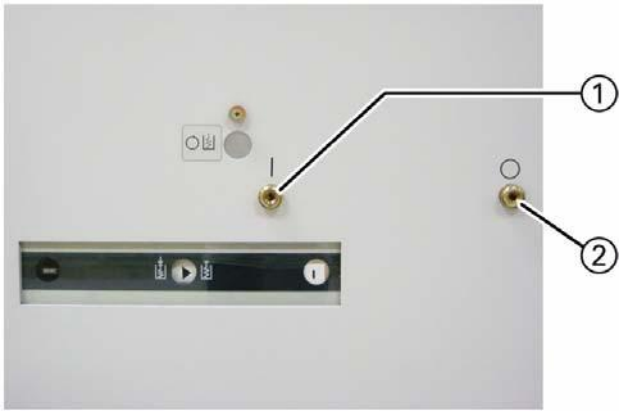
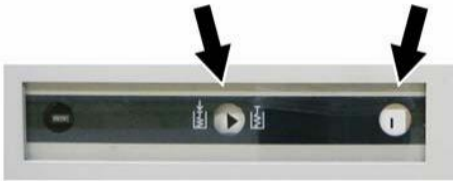
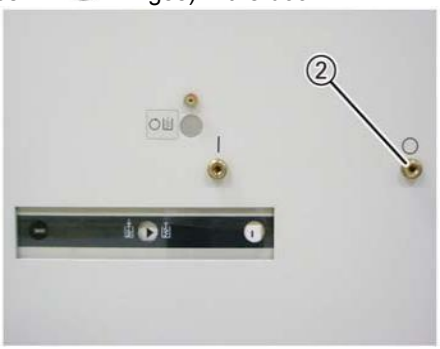
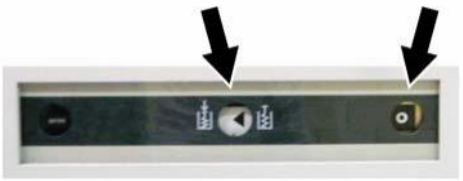


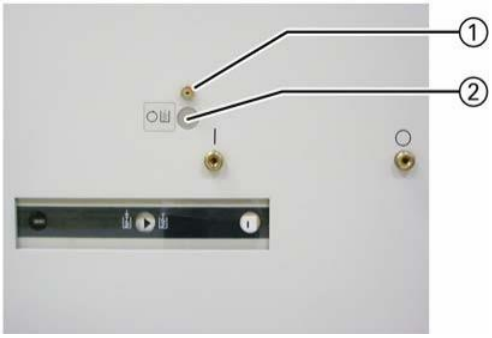
Fig88. Actuating opening for manual operation of the circuit breaker

	**ATTENTION!** If there is no auxiliary voltage, both the electrical and the mechanical interlocks are closed. If the interlocks are eliminated, manual switching operations will be possible despite an existing electrical interlock, and they can cause operational breakdowns. ⇨ Ensure that the intended manual switching operation has been released externally.

	Closing the circuit breaker	**Opening the circuit breaker**
Preconditions for the operation	• Withdrawable truck in SERVICE or TEST position. • Circuit-breaker in OPEN position. • High-voltage compartment door closed. • Feeder earthing switch in OPEN position. • Low voltage connector plugged in.	• Withdrawable truck in SERVICE or TEST position. • Circuit-breaker in CLOSED position. • High-voltage compartment door closed. • Feeder earthing switch in OPEN position. • Low voltage connector plugged in.
Procedure	⇨ Insert the push rod through the actuating opening (pos.nr. ① in fig88) in the door.  ⇨ Operate the ON push button of the circuit breaker.  ⇨ Take push rod out of actuating opening.	⇨ Insert the push rod through the actuating opening (pos.nr. ② in fig88) in the door.  ⇨ Operate the OFF push button of the circuit breaker.  ⇨ Take push rod out of actuating opening.
Result	✓ The position indicator changes from "0" position to "I" position. ✓ The operation counter is increased by 1. ✓ The circuit-breaker is closed.	✓ The position indicator changes from "I" position to "0" position. ✓ The circuit-breaker is open.

	NOTE!
	Depending on the electrical logic, the circuit breaker can be electrically operated from the remote via SCADA connection ⇨ Circuit breaker ⇨ Switch disconnector ⇨ Voltage transformer with truck in the metering panel

Manually spring charging of the circuit breaker



① Rotary button to release the actuating opening for charging the spring

② Actuating opening for charging the spring

Fig89. Actuating hole for manual charging of the circuit breaker spring

If the control voltage fails, the closing spring for operating the circuit breaker is no longer charged automatically. To operate the circuit breaker in spite of this, the closing spring must be charged manually with the hand crank.

Preconditions • Truck completely inserted and interlocked in panel

	DANGER!
	Risk of injury by sudden rotation of hand crank. If you use a hand crank without a freewheel to charge the spring, the hand crank will rotate when the control voltage is switched on again (motor starts up) and can lead to injury. ⇨ Use special hand crank with freewheel from the accessories**!**

⇨ Turn cover of operating shaft (pos.nr. ② in fig89) aside using the rotary button (pos.nr. ① in fig89) located over it.

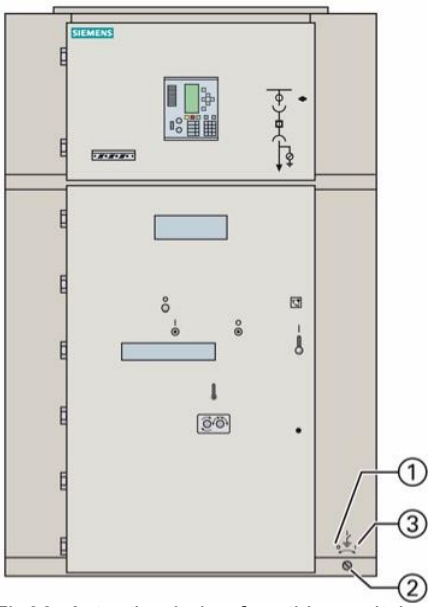
⇨ Push hand crank onto operating shaft.

⇨ Turn hand crank clockwise approx. 25 turns until the "spring charged" indication appears in the inspection window.

⇨ Remove hand crank.

✓ The spring is latched automatically. The energy required for the operating sequence OPEN-CLOSED-OPEN (auto reclosing) is stored in the spring.

6.10. Operating the feeder and busbar earthing switches



1 End position: Earthing switch OPEN
2 Actuating lug
3 End position: Earthing switch CLOSED

Fig90. Actuating hole of earthing switch

The feeder and busbar earthing switches are operated bottom-right beside the high-voltage compartment door.

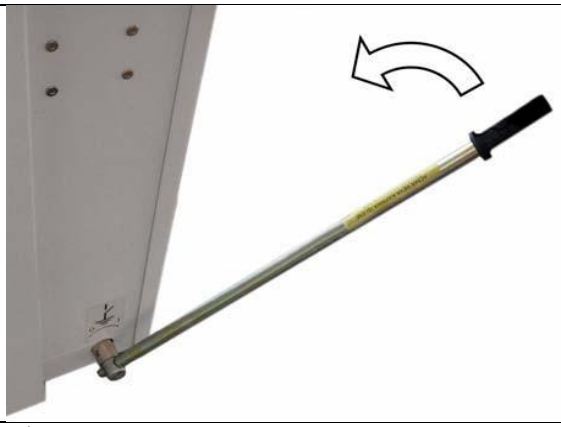
	**DANGER!** Once you have started a switching operation, you must complete it; turning back is blocked. The operating tool cannot be removed at intermediate positions. ⇨ Move the operating tool until reaching the end position.

	**ATTENTION!** Safe operation of the earthing switch is not guaranteed if the penetration of the earthing blade is beyond the tolerance. If the penetration is beyond the tolerance: ⇨ Do not put the earthing switch in operation. ⇨ Contact the local SIEMENS representative to make the fine adjustment.

	**ATTENTION!** If the operating lever is not inserted correctly, the earthing switch may be damaged. ⇨ Insert the operating lever in the actuating opening as far as it will go.

	**ATTENTION!** Make sure that there is no electromechanical interlock on the earthing switch. ⇨ Do perform electromechanical interlock's conditions to unlock before the operation.

	Closing the earthing switch	**Opening the earthing switch**
Preconditions for the operation	• Withdrawable device truck interlocked in TEST position • or: Withdrawable device truck not in the panel.	• Withdrawable device truck interlocked in TEST position • or: Withdrawable device truck not in the panel.
Procedure	⇨ Push the covering sleeve inwards which closes the actuating opening of the earthing switch. ⇨ Insert the operating lever for the feeder earthing switch into the opening. ⇨ Turn the operating lever clockwise approx. 90° into CLOSED position.	⇨ Push the covering sleeve inwards which closes the actuating opening of the earthing switch. ⇨ Insert the operating lever for the feeder earthing switch into the opening. ⇨ Turn the operating lever counter-clockwise approx. 90° into OPEN position.

		
Result	✓ The feeder earthing swith in CLOSED position. ⇨ Remove the operating lever. ⇨ Covering sleeve closes the actuating opening of the earthing switch automatically.	✓ The feeder earthing switch in OPEN position. ⇨ Remove the operating lever. ⇨ Covering sleeve closes the actuating opening of the earthing switch automatically.

6.11. Operation of the fused voltage transformers in the cable compartment

Replacing fuses of the withdrawable voltage transformers in the cable compartment

	**DANGER!** Danger of burning on hot fuse-links. ⇨ Use the personal protective equipment. If not, do not touch fuses before checking temperature. ⇨ Let hot fuse-links cool down before replacing.

	**ATTENTION!** Voltage transformers are exclusively designed for operation with HV HRC fuse-links. ⇨ Operate the voltage transformers with HV HRC fuse-links only. ⇨ Do not mount bridging links instead of HV HRC fuse-links. ⇨ During replacement, take care to use HV HRC fuse-links with the same ratings and from the same manufacturer.

	**NOTE!** Tripped fuses can cause hidden damages on the other fuses. ⇨ It is highly recommended to replace all fuse-links, even if only one fuse has tripped.

The fuses can be replaced while the cable compartment is energized.

Removing the rear cover

The rear cover cannot be removed unless the withdrawable voltage transformers are disconnected.

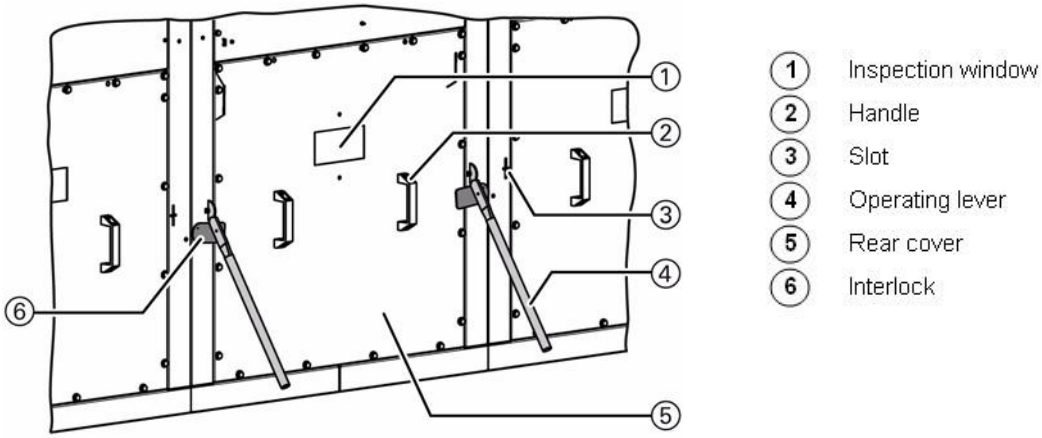


Fig91. View of the rear cover

⇨ Insert two operating levers (pos.nr ④ in fig91) into the slots on both sides of the rear cover (pos.nr. ⑤ in fig91).

⇨ Lift the operating levers to disconnect the withdrawable voltage transformers.

⇨ While lifting the operating levers, the rear cover interlock (in fig92) is released.

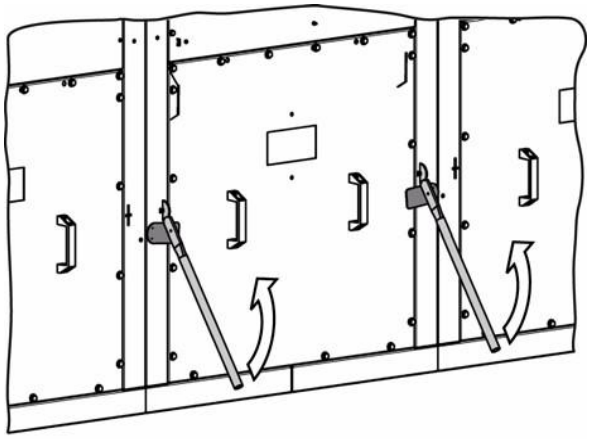


Fig92. Operating handles for withdrawable voltage transformers (movement for disconnecting)

✓ The voltage transformers are disconnected, the interlocks on both sides are released and the shutter is closed.

⇨ Check by looking through inspection window (pos.nr ① in fig91) that inner shutter is closed.

⇨ Remove the rear cover by means of the handles (fig93).

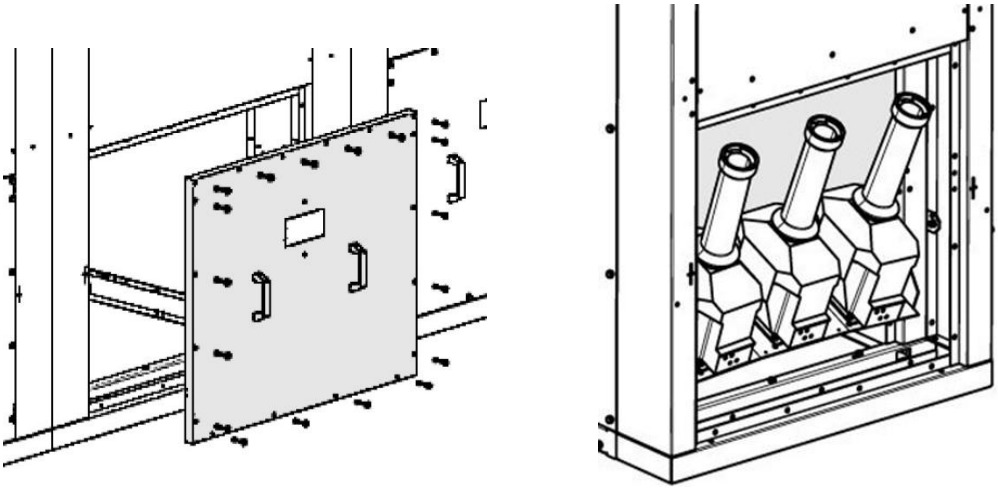


Fig93. Removing the rear cover

✓ The voltage transformers are reachable.

	**DANGER!** High voltage! Danger! ⇨ Observe the **Five Safety Rules** due to the fact that the operation can be done while the line is energized.

Replacing fuse links of the withdrawable voltage transformer

⇨ Remove the cap from the fuse holder of the withdrawable voltage transformer (Please see photos in fig94, unscrew two bolts).

⇨ Remove the fuse-link (pos.nr. ⑦ in fig95) from the fuse holder (pos.nr. ⑧ in fig95).

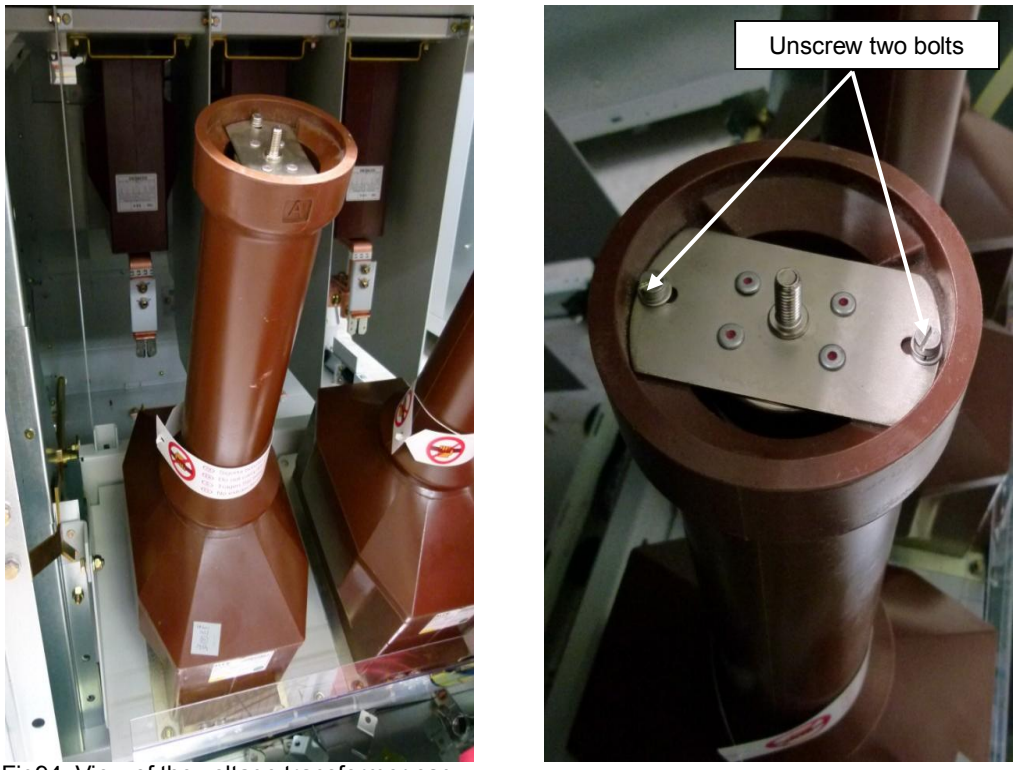
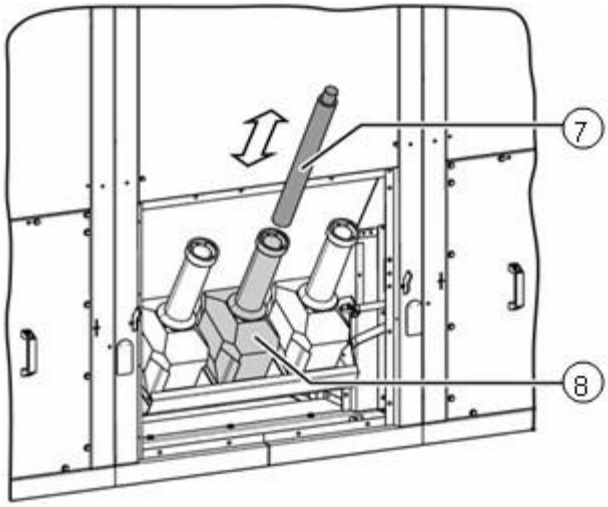


Fig94. View of the voltage transformer cap.



⑦ HV HRC fuse-link
⑧ Voltage transformer

Fig95. Replacement of the voltage transformer fuse

⇨ Insert the new fuse-link into the holder with the striker at the top.

⇨ Mount the cap of the fuse holder.

✓ The fuse replacement is completed.

Replacing fuse links

⇨ Assure that all voltage transformers are equipped with fuse links and fully mounted.

⇨ Insert the rear cover by means of the handles (in fig96).

⇨ Push down the operating levers to connect the withdrawable voltage transformers (fig96).

⇨ While pushing down the operating levers the rear cover interlocking (pos.nr. ⑥ in fig91) is locked.

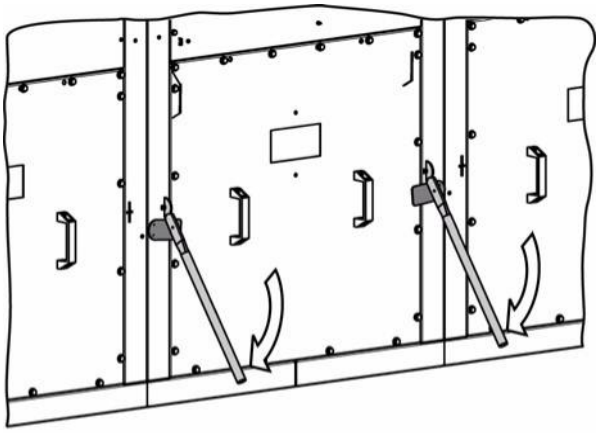


Fig96. Operating handles for withdrawable voltage transformers (movement for connecting)

✓ The voltage transformers are connected, locking on both sides are locked and the inner shutter is open.

⇨ Check by looking through inspection window (pos.nr. ① in fig91) that the inner shutter is open.

⇨ Remove the two operating levers.

✓ The cable compartment is closed.

6.12. Verification of safe isolation from supply (LRM system)

The panels can be equipped with voltage detecting systems.

Use voltage indicators according to IEC 78/183/CDV only.

The perfect function of the voltage indicator must have been verified:
- with a test unit according to IEC 78/183/CDV
- on live equipment

The perfect function of the coupling section must have been verified according to:
- IEC 78/183/CDV

Plug voltage indicator in all three phases L1, L2, L3 of the interface.

Fig97: VOIS+: Cover closed

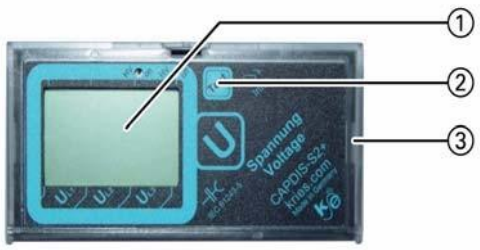


Fig98: CAPDIS-S2+: Cover closed

Fig99: CAPDIS-S2+: Cover open

1	LC display	5	Test socket L2
2	"Display Test" button	6	Test socket L3
3	Cover	7	Earth socket
4	Test socket L1		

Indications VOIS, VOIS R+, CAPDIS – S1+ / S2+

Indication	VOIS+,VOIS R+			CAPDIS-S1+			CAPDIS-S2+			
	L1	L2	L3	L1	L2	L3	L1	L2	L3	
A0							000			Operating voltage not present (CAPDIS-S2+)
A1	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	Operating voltage present
A2										- Operating voltage not present - Auxiliary power not present (CAPDIS-S2+)
A3		ϟ	ϟ		ϟ	ϟ		ϟ	ϟ	Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication)
A4				ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	Voltage (not operating voltage) present
A5				ϟϟϟ			ϟϟϟ			Indication: "Device-Funtion-Test" passed
A6							ϟϟϟ ERROR			Indication: "ERROR" e.g. in case of missing auxiliary voltage (CAPDIS-S2+, error indication M4)

6.13. Verification of safe isolation from supply (without LRM system)

- ⇨ Open the high-voltage door (see Page71, clause 6.5, "Opening the high-voltage door").
- ⇨ Move the switching device truck out of the panel (see Page71, clause 6.6, "Moving the switching device truck into and out of the panel").
- ⇨ Use high-voltage tester according to DIN VDE 0681.

6.14. Connecting the earthing and short circuiting facility

DANGER!

High voltage! Danger! If the busbars in the busbar compartment and the cable or bar connections in the connection compartment have not been isolated, the contacts are live at operating voltage.

- ⇨ Isolate the busbars in the busbar compartment and the cable or bar connections in the connection compartment before opening the shutters or before working at the panel connections.
- ⇨ Observe the Five Safety Rules.
- ⇨ Verify safe isolation from supply.

Preconditions
- Switching device truck out of panel
- Earthing accessories available

The earthing and short-circuiting facility is connected to the earthing point at the front of the panel with an M12 bolt.

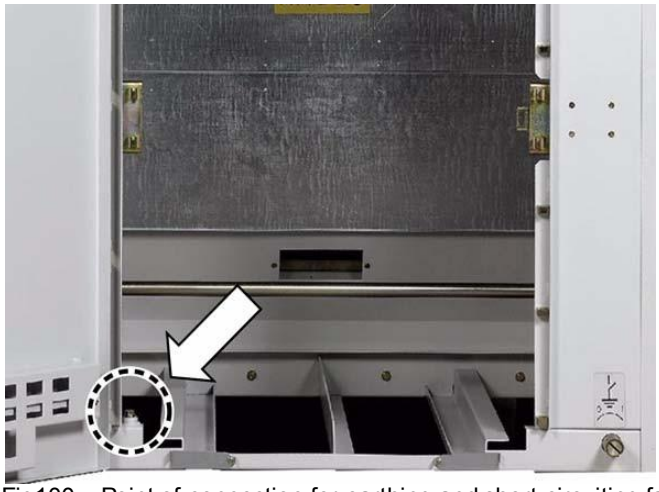
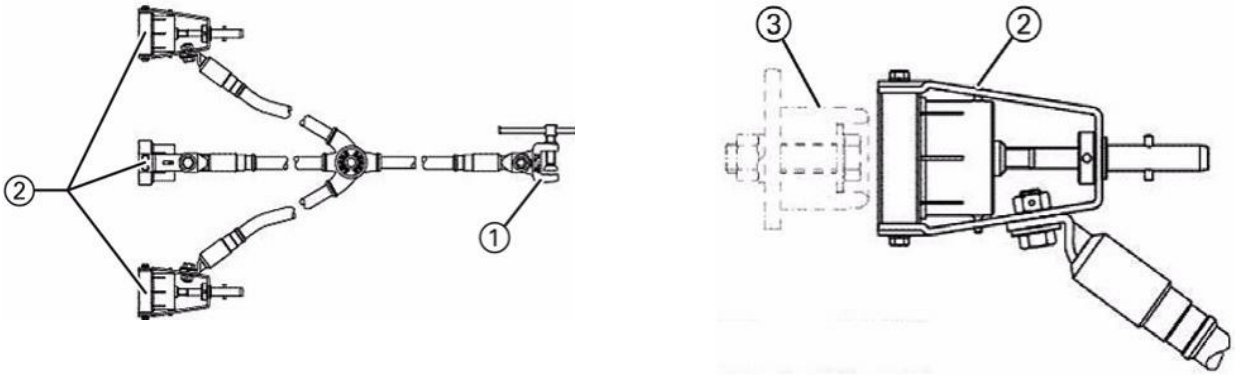


Fig100. Point of connection for earthing and short-circuiting facility

Earthing and short circuiting facility



(1) Connection to earthing point of panel
(2) Connection to fixed contacts
(3) Fully shrouded top hat contact

Fig101. Earthing and short-circuiting facility

Connecting the earthing and short circuiting facility

At the feeder

- ⇨ Connect the earthing and short-circuiting facility to the earthing point.
- ⇨ Open the shutters by pushing the levers. If the busbars are energized, use the lowershutter opening tool (see fig56 – 67, “Use of the lower shutter opening tool”).
- ⇨ Connect the contacts of the earthing and short-circuiting facility to the lower contacts of the panel and screw tight.

At the busbar

- ⇨ Connect the earthing and short-circuiting facility to the earthing point..
- ⇨ Open the busbar shutters by pushing the levers.
- ⇨ Connect the contacts of the earthing and short-circuiting facility to the upper contacts of the panel and screw tight.

7. MAINTENANCE AND SERVICE

7.1. Maintenance

Maintenance ensures undisturbed and uninterrupted operation of the switchgear.

The maintenance measures are divided into the following fields:
- Visual inspection
- Preventive maintenance

	**ATTENTION!**
	Maintenance work may only be performed in a careful manner by trained personnel familiar with the characteristics of the individual switchgear, in accordance all relevant IEC safety regulations and those of other technical authorities, and with other overriding instructions.

Time schedule for maintenance measures

Besides the recommended maintenance intervals, additional maintenance measures may be required for operational reasons.

Recommended time schedule for maintenance measures

Measure	Interval	Operational fact
Visual inspection	Every year or at the operator's discretion	---
Preventive maintenance	Every 5 years, or depending on operational facts, or operator's discretion	i.e. after a short circuit breaking / making operation of a circuit breaker and / or an earthing switch when the permissible number of operating cycles has been reached.

7.1.1. Visual inspection

The visual inspection is performed every year or at the operator's discretion.

- ⇨ General check for paint damages on all panels of a switchgear assembly in the area of the front doors, the lateral and the rear termination. If required, repair damages.
- ⇨ General check of the switchgear for dust layers. If needed, clean them with vacuum cleaners.
- ⇨ General check for humidity. To do this, open the high-voltage door of the switching device compartment of every third panel and check the switching device compartment for humidity or condensation.
- ⇨ If there is humidity or condensation inside a switching device compartment, determine the cause thereof. To do this, do also observe the climatic conditions of the switchgear room, and arrange for suitable measures such as room ventilation or room heating.
- ⇨ General check for partial discharge noises. If there are any partial discharge noises, determine the cause thereof and take adequate countermeasures.
- ⇨ Check whether the operating tools are complete (see Page70 "Operating tools").

7.1.2. Preventive maintenance

- ⇨ When an earthing switch has performed two short-circuit making operations, maintenance work has to be done by means of a visual inspection of the earthing switch blades and the fixed laminated contacts. If there is any visible erosion, the stressed components must be replaced. To do this, please contact the regional SIEMENS representative.
- ⇨ Check the primary connections of current and voltage transformers.
- ⇨ Check the bolted joints (see clause Page64, clause 4.4, “Final installation work”)
- ⇨ Carry out maintenance and servicing at shorter intervals (to be specified by the owner) if there is a lot of dust, or if the air is extremely humid and/or polluted.
- ⇨ Grease the main contacts at:
  - Moving rails
  - Fixed contacts of the earthing switch
  - Fixed contacts at bushings for the withdrawable contacts of circuit breaker

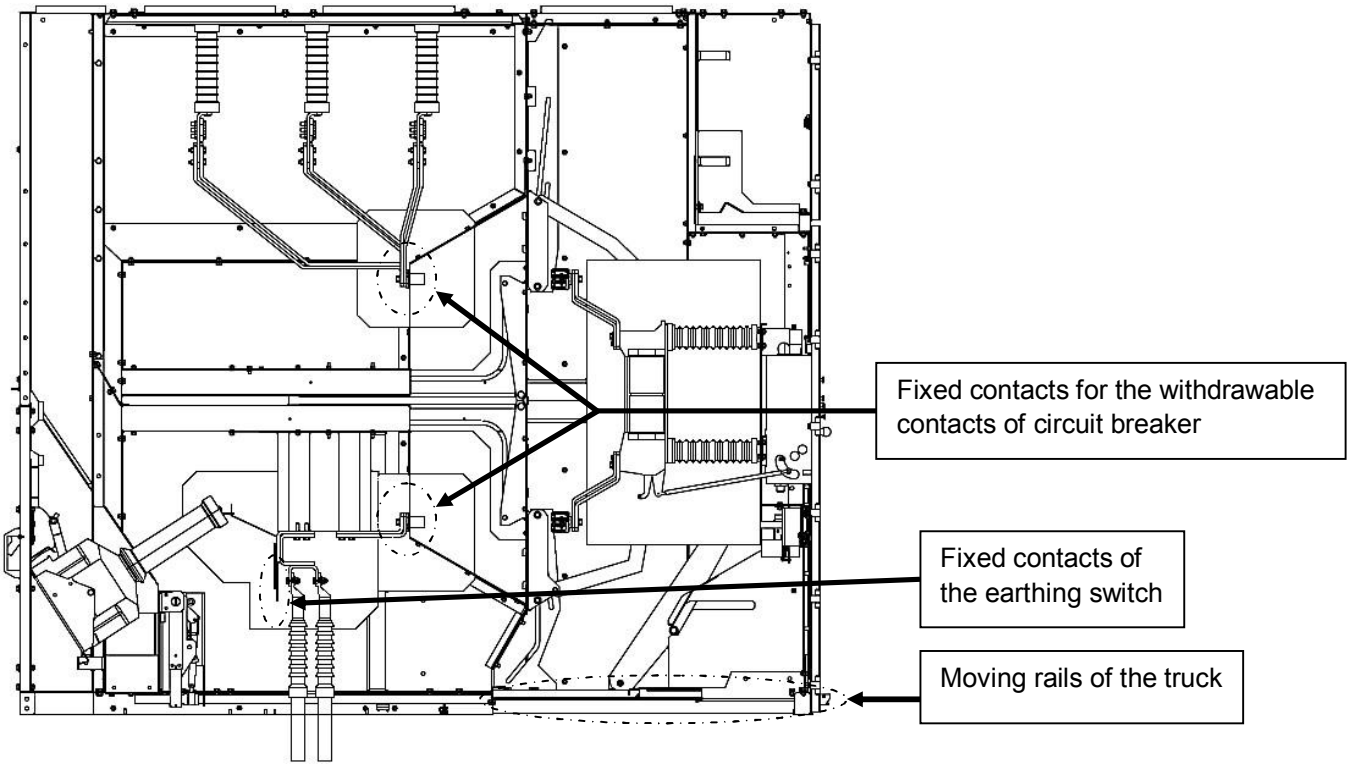


Fig102. Lubrication of the main contacts

7.1.3. Maintenance of vacuum circuit breaker

Preconditions
- Supply voltage switched off
- Circuit breaker in OPEN position
- Spring energy store not charged

	DANGER!
	Working on a closed circuit breaker and on a open circuit breaker with charged spring energy store can cause dangerous injuries. ⇨ Switch off low voltage supply before performing maintenance. ⇨ Close and open the circuit breaker manually. In this way it is ensured that the circuit breaker is open and the spring energy store is not charged.

Under normal conditions, the circuit breaker is maintenance-free. However, we recommend to make visual inspections at regular intervals.

For optimal insulation, the insulating parts must be clean.

⇨ Clean insulating parts with a humid cloth and soft cleaning agent, e.g. dish cleaner.
⇨ Clean all other parts with a lint-free cloth if they are dirty.
⇨ Grease relevant parts with Klüber Isoflex Topas L32 (fig102).

	NOTE!
	For the detailed information about 3AH series circuit breaker (CB), please consult to the below operation manuals: 3AH3 vacuum CB……3AH3_order no: 9229 9860 174 OD 3AH5 vacuum CB……3AH5_order no: 9229 9989 174 OA

7.1.4. Replacement of spare parts

Spare parts may only be replaced by instructed and certified personnel in order to guarantee perfect operation of the switchgear.

The manufacturer's product liability is not effective if at least one of the following criteria applies:

- No original Siemens spare parts are used.
- Assemblers who carry out the replacement have not been trained and certified for this work by Siemens.
- The parts are mounted or adjusted incorrectly.
- Adjustments are not made according to the stipulations of Siemens.

7.2. Service information

7.2.1. Maintenance

The vacuum circuit breaker is maintenance-free within the range of the permissible operating cycles. Under normal environmental and operating conditions, the switchgear has maintenance intervals of 5 years.

7.2.2. Switchgear extension or Retrofit

The switchgear can be extended on both sides without having to modify existing panels.

Please contact SIEMENS with the following data:
- Detailed description of your modification
- Serial number (please see fig3, page13, pos.nr.3)
- Panel number
- If possible, photos with explanations

Contact:

E-mail: aftersaleskartal.tr@siemens.com

Tel: +90 216 459 3434

7.2.3. Spare part orders

Required information when ordering spare parts for single parts and devices:
- Type and serial number of switchgear as per rating plates
- Precise designation of the device or component, if applicable on the basis of the information and illustrations in the associated instructions, a drawing, sketch or circuit diagram

7.2.4. Replacement of panels and components

Replacement of switchpanels

Panels can be replaced after undoing the panel connecting bolts.

If you are planning to replace a panel, please contact your regional SIEMENS representative, as the replacement must only be done by experts with special tools.

Replacement of components

The individual components such as measuring instruments, current transformers, etc can be replaced. Please contact your regional SIEMENS representative for replacing components.

7.2.5. Disposal

8BT2 switchgear is an environmentally compatible product.

All metal plates are powder-coated with resistant epoxy resin material.

The switchgear materials should be recycled if possible. The switchgear can be disposed of in an environmentally compatible manner in compliance with existing legislation.

The components of the switchgear can be recycled as mixed scrap; however, dismantling as far as possible into sorted scrap with a residual mixed scrap portion is the more environmentally compatible way.

Electronic scrap has to be disposed of in accordance with the existing regulations.

The switchgear consists of the following materials:
- Sheet steel, powder-coated
- Copper
- Aluminum
- Cast resin

- Fiber-reinforced plastics
- Rubber materials
- Ceramic materials
- Lubricants
- Bolts, washers, nuts, rivets

As delivered by Siemens, the switchgear does not contain hazardous materials as per the Hazardous Material Regulations applicable in the Federal Republic of Germany. In other countries, the locally applicable laws and regulations must be followed.

Should you require further information, please contact your regional SIEMENS representative.

8. TROUBLE SHOOTING

Truck interlocking

Fault	Cause	Remedy
1) Truck can not be moved out of panel.	Truck interlock closed	Open truck interlock
2) Door to switching device compartment.	Interlocking lever of LV connector not folded inwards	Fold interlocking lever inwards
	Locking gates of guide rails not closed	Close locking gates of guide rails

Truck

Fault	Cause	Remedy
Double bit key can not be turned with open door locking handle.	Circuit breaker in CLOSED position	Switch circuit breaker to OPEN position
Truck ca not be racked to SERVICE position (mechanically).	Operating lever inserted in manual CLOSE/OPEN operating mechanism of feeder earthing switch	Remove operating lever
	Feeder earthing switch not in OPEN position	Switch feeder earthing switch to OPEN position
	General switchgear interlock active	Observe general switchgear interlock
Truck can not be racked to TEST position.	Circuit breaker in CLOSED position	Switch circuit breaker to OPEN position
Double bit key can not be turned.		

Feeder earthing switch

Fault	Cause	Remedy
Operating lever for earthing switch can not be pushed in.	Switching device truck in SERVICE position	Rack switching device truck to TEST position
	Hand crank for switching device truck inserted	Remove hand crank for switching device truck
	Electromagnetic interlocking is active	Observe the electromagnetic interlocking

Circuit breaker

Fault	Cause	Remedy
Circuit breaker can not be closed	Hand crank for truck inserted	Remove hand crank for truck
	Switching device truck is intermediate position	Rack switching device truck to SERVICE or TEST position
	Spring not charged	Wait for 15 s (motor) or charge manually
	Under voltage release not activated	Energize the under voltage release
	Low voltage connector not plugged in	Plug low voltage connector in
Spring energy store is not charged automatically	No control voltage	Apply control voltage or charge spring energy store manually

9. INDEX

A

Accessories..... 20

Aligning, panels 29

B

Bolted joints, checking 29, 63

Bolting together, panels..... 29

Bus sectionalizer, description 16

Bus wires, connecting..... 48

Busbar compartment 15

Busbar connection panel, description 16

Busbar earthing switch, operation..... 92

Busbar system 28

Busbar, applying voltage..... 54

Busbars, assembly 24

C

C.t.-operated release, circuit-breaker..... 73

Cable compartment..... 61

Cable connection..... 38, 61

Cable testing standard panel..... 91

Checking transport damage 15

Circuit diagrams..... 73

Circuit diagrams, correcting..... 54

Circuit-breaker 3AH 60

Circuit-breaker panel, description 58

Circuit-breaker spring, charging 95

Circuit-breaker tripping signal 73

Circuit-breaker, closing 86

Circuit-breaker, opening..... 87

Circuit-breaker, operating cycles..... 71

Circuit-breaker, operation..... 86

Circuit-breaker, technical data..... 70

Cleaning the switchgear 50

Closing solenoid, circuit-breaker..... 72

Closing the high-voltage door..... 80

Closing, circuit-breaker 86

Comissioning, test operation before 53

Commissioning..... 51

Completeness of delivery..... 14

Components..... 60

Consumer feeders, connecting..... 54

Control cable connections..... 49

Control cables, connecting..... 48

Control elements, overview 77

Control elements, switching device truck 82

Control gate, trouble shooting..... 104

Control tightening torque 49

Current transformers..... 63

D

De-earthing, feeder 90

Degrees of protection 69

Description..... 55

Disconnecting panel, description 58

Disposal 74

Due application 6

E

Earthing and short-circuiting facility 100

Earthing busbar, interconnection 29

Earthing facility..... 100

Earthing, feeder 88

Earthing, shield 38

Earthing, switchgear 29

Electrical connections 37

Electrical data..... 68

Electromagnetic compatibility, comments on 37

Emergency operation 95

End wall, installation 31

Environmental influences..... 50

Erecting, panels 17

Extension, panels..... 50

Extension, switchgear..... 50, 74

F

Fastening the switchgear to the foundation..... 23

Features 55

Feeder de-earthing..... 90

Feeder earthing..... 88

Feeder earthing switch, operation 88

Feeders, connecting..... 54

Fixing material..... 11

Fixing on wooden panels for delivery..... 15

Fixing points..... 18

Flexibility..... 55

Floor fixing points 18

Floor openings 18

Foundation, fastening the switchgear to 23
Foundation, preparing 17
G
Guidelines, standards 69
H
High voltage, switching on 54
High-voltage cables, connection 38
High-voltage connections, checking 49
High-voltage door, closing 80
High-voltage door, opening 80
I
Incoming feeders, connection 54
Indicators, overview 77
Information to Siemens before delivery 8
Installation 8
Installation material 11
Installation work, checking 50
Installation work, checks 52
Installation, final work 49
Installation, low-voltage compartments 32
Installation, preparing 8
Installation, required tools 10
Instructing the operating personnel 51
Insulators, cleaning 50
Interlocks 65
Interlocks, additional 65
Interlocks, checking 52
Interlocks, mechanical 65
L
Low-voltage cables, connecting 48
Low-voltage compartment 62
Low-voltage compartments, installation 32
Lower shutter opening tool 39, 41
M
Maintenance 74, 102, 102
Maintenance intervals 102
Maintenance tool 39
Maintenance, circuit-breaker 103
Malfunction during test operation 53
Measuring sheet, foundation 17
Metering panel, description 59
Metering truck 61
Motor operating mechanism, circuit-breaker 71
Moving in, switching device truck 92
Moving out, switching device truck 92
O
Opening the high-voltage door 80
Opening, circuit-breaker 87
Operating cycles, number 71
Operating personnel, instructing 51
Operating times 70
Operating tools 78
Operation 76
Operational high voltage, preparations before switching on 54
P
Packing 12, 12
Panel design 56
Panel replacement 74
Panel types 56
Panels, aligning 20
Panels, bolting together 20, 21
Panels, erecting 19
Panels, extension 50
Panels, fastening to the foundation 23
Panels, joining 21
Panels, maintenance 102
Personal safety 55
Position indicators, checking 53
Power-frequency voltage test at site 53
Power-frequency voltage test, preparation 53
Pressure relief duct, closed, installation 33
Product range 56
Protection against electric shock 69
Protection against solid foreign objects 69
Protection against water 69
Q
Qualified personnel 6
R
Racking positions, switching device truck 82
Rating plates 70
Re-availability 55
Replacement of switchpanels and components 74
S
Safe isolation from supply, verfication without LRM ... 99

Safety instructions 5
Safety instructions, commissioning 51
Safety instructions, operation 76
Security of operation 55
Service information 74
Servicing 74, 102
Shield earthing 38
Short-circuiting facility 100
Shunt releases, circuit-breaker 72
Signal terms and definitions 5
Spare part orders 74
Spring, manual charging 95
Standards, guidelines 69
Storage before installation 8
Storage, in closed rooms 9, 9
Storage, seaworthy crate or container 9
Storage, switchgear 9
Switchgear data 68
Switchgear earthing 29, 30
Switchgear end walls, installation 31
Switchgear extension 50, 74
Switchgear room, dimensions 17
Switchgear room, preparing for installation 8
Switchgear transport with roller pads (reinforced rollers) 16
Switchgear transport without wooden pallets 16
Switchgear, assembly 20
Switchgear, erection 12
Switchgear, unloading 12
Switching device truck, control elements 82
Switching device truck, moving in 92
Switching device truck, moving out 92
Switching device truck, racking 82
Switching device truck, racking positions 82
Switching device truck, racking to SERVICE position 82
Switching device truck, racking to TEST position 84
Switching on high voltage 54
Switching process, checking 53

T

Technical data 68
Technical data, circuit-breaker 70
Technical data, complete switchgear 68
Technical data, rating plates 70
Test operation, malfunction 53
Test operation, preparing 53
Tightening torques 20
Tools for installation 10
Torques 20
Transport damage 15
Transport dimensions 12
Transport to place of installation 15
Transport unit 12, 12
Transport weights 12, 16, 68
Trouble shooting 104
Truck, trouble shooting 104

U

Undervoltage release, circuit-breaker 72
Unloading 13

V

Vacuum circuit-breaker 3AH 60
Vacuum circuit-breaker 3AH, equipment 60
Varistor module 73
Verification of safe isolation from supply 99
Voltage indicator, LRM system 99
Voltage transformers 63
Voltage transformers, cable compartment 96

W

Weights 16, 68
Wooden pallets, removing the switchgear from 15

X

X-ray regulations 69

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