

UniGear ZVC

Installation, operation and maintenance instruction manual

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1. Safety precautions

Recommendations

- Only install switchgear and/or switchboards in closed rooms suitable for electrical equipment.
- Ensure that installation, operation and maintenance are carried out by specialist electricians only.
- Fully comply with the legally recognized standards (IEC or local), the connection conditions of the local electrical utility and the applicable safety at work regulations.
- Observe the relevant information in the instruction manual for all actions involving switchgear and switchboards.
- Pay special attention to the hazard notes in the instruction manual.
- Make sure that the specified data are not exceeded under switchgear or switchboard operating conditions.
- The user's personnel must act responsibly in all matters effecting safety at work and correct handling of the switchgear.

Read and keep these instructions

Carefully read and understand this instruction sheet before installing, operating and maintaining your UniGear ZVC. For safe operation the appropriate Australian or International Standards should be applied.

Keep the instruction manual accessible to all personnel involved in installation, operation and maintenance. This instruction sheet should be available for reference wherever UniGear ZVCs are used. Keep this instruction sheet in a location where you can easily retrieve and refer to it.



Warning!

- Always follow the instruction manual and respect the rules of good engineering practice!
- Hazardous voltage can cause electrical shocks and burns.
- Disconnect power and then earth before proceeding with any work on this equipment.

Notice

The instructions covered in this publication are intended only for qualified personnel and are not a substitute for adequate training and experience in safety procedures.

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

2. Description

2.1 General

UniGear ZVC is three-phase, metal-clad, air-insulated, type tested and factory-assembled indoor switchgear panel designed for the operation, control and protection of motors and transformers at rated voltages up to 7.2kV and rated current up to 400A. Other applications are possible and should be referred to the manufacturer. The panels are designed as withdrawable fused vacuum contactor modules and are fitted with a single busbar system.

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

2.2 Standards and specifications

UniGear ZVC switchgear panels comply with standards and specifications for type tested metal-clad factory-assembled high voltage switchgear to IEC publications 62271-200 and 60694 and, in addition, Australian Standards.

Other relevant IEC publications for components include:

IEC publication	Components covered	
60470	Motor starter & contactor	
60282-1 & 60644	HV fuses	
62271-102	Earthing switch	
60470 & 60529	Degree of protection	IP4X external closure
		IP2X internal shutters & partitions
62271-200 & 60298	Arc fault containment	
60044-1	Current transformers	
60044-2	Voltage transformers	

All other corresponding IEC publications, national or local safety at work regulations and safety regulations for production materials must be followed during erection and operation of UniGear ZVC switchgear. In each case the order-related data from ABB must be taken into account.

2.3 Operating conditions

2.3.1 Normal operating conditions

The switchgear is basically suitable for normal operating conditions for indoor switchgear and switchboards in accordance with IEC 60694. The following limit values, among others, apply:

Ambient temperature	°C
Maximum	+40
Maximum 24 h average	+35
Minimum (according to "minus 5 indoor class")	-5

Ambient humidity	
Maximum 24 h average of relative humidity	95% RH
Maximum 24 h average of water vapour pressure	2.2 kPa
Maximum monthly average of relative humidity	90% RH
Maximum monthly average of water vapour pressure	1.8 kPa

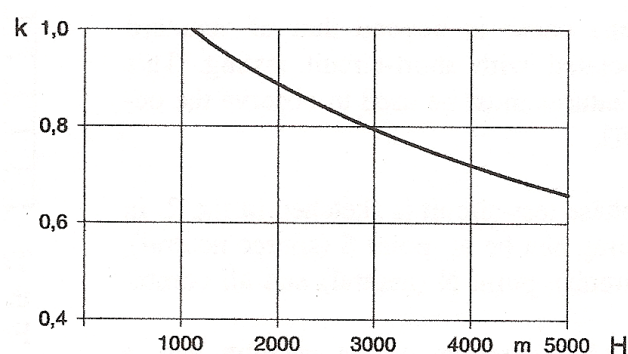
The maximum site altitude is 1000 m above sea level. For higher site altitude, refer to order related data.

2.3.2 Special operating conditions

The switchgear is suitable for operation in climate of Wda type according to IEC 60721-2-1. Special operating conditions must be discussed with the manufacturer in advance. For example:

- At site altitudes above 1000 m, the effects of the reduction in dielectric strength of the air on the insulation level must be taken into account (refer to 2/1).
- Increased ambient temperatures must be compensated for in the design of the busbars and branch conductors as well as for the withdrawable parts, otherwise the current carrying capacity will be limited. Heat dissipation in the switchgear panel can be assisted by fitting additional ventilation facilities.

Note: When switchgear is operated in areas with high humidity and/or major rapid temperature fluctuations, there is a risk of dew deposits which must remain an exception in normal operating conditions for indoor switchgear. Preventive action (e.g. fitting electric heaters) must be taken in consultation with the manufacturer to avoid this condensation phenomenon and any resulting corrosion or other adverse effects. The control of the heaters depends on the relevant project and details must be taken for the order documents.



2/1. Curve for determination of the altitude factor K in relation to the altitude H.

3. Technical Data

3.1 Electrical data

Rated Voltage		kV	3.6	7.2
Rated Power Frequency Withstand Voltage Peak		kV	10	20 (32) ¹
Rated Lightning Impulse Withstand Voltage		kV	40	60
Rated Frequency		Hz	50/60	
Rated Main Busbar Current		A	4000	
Rated Current of Tee-Off Busbar		A	400	
Rated Peak Withstand Current of Main Busbar		kA	125	
Rated Short Time Current of Main Busbar	3 s	kA	50	
Earthing Switch		kA	31.5	
Rated Making Current Peak				
Earthing Switch	1 s	kA	12.5	
Rated Short Time Current				
Withdrawable fused contactor Rated Normal Current		A	200/400	
HV Fuse type			Tag type to BS2692-1986 type II 454mm centres maximum	
CT Rated Secondary Current		A	1	

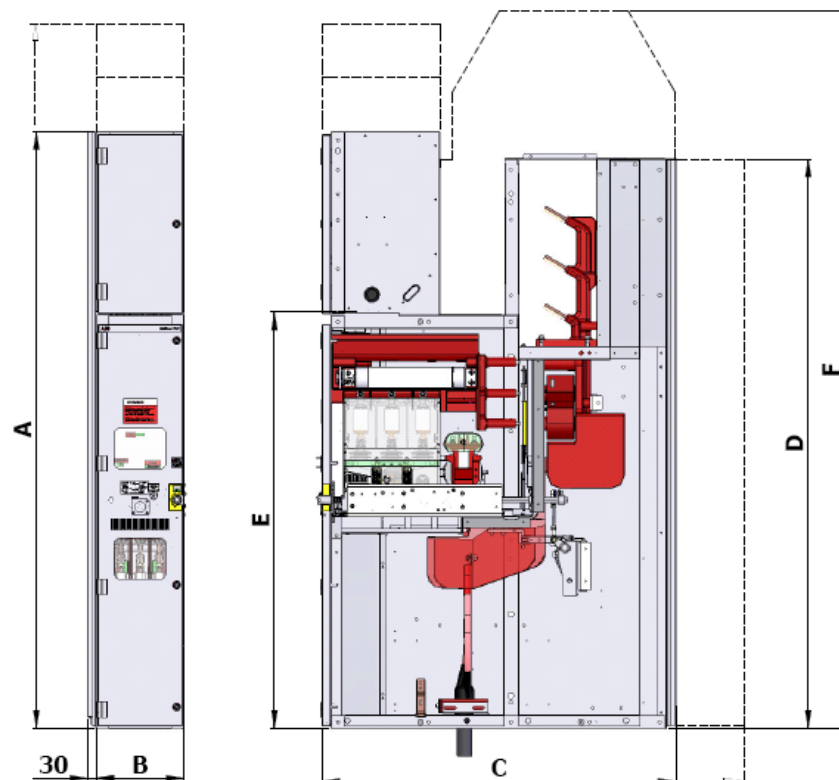
1. On request.

3.2 Resistance to internal arc faults

The internal arc fault withstand capability is up to 50kA for 1s with 125kAp.

Refer to the general arrangement drawings of the order for specific details of the gas duct.

3.3 Dimensions and weights



3/1. Front and side views

Dimension	Symbol	mm
Height	A	2200 / 2400 / 2595
Width of a basic panel	B	325
Depth	C	1304 / 1554 See configuration table below
Height of basic panel	D	2100
	E	1535
Height with standard gas duct fitted	F	2680 ¹

1. Different arc duct options are available. Check the order documentation for overall height.

Depth configuration

Depth 'C' (mm)	1304			1554
Power Cable Entry	Bottom Entry Front Access	Bottom Entry Rear Access	Top Entry Rear Access	Top Entry Rear Access
Control Cable Entry		Bottom Entry Front Access	Top Entry Front Access	Top Entry Front Access
Gas Duct	Yes/No	Yes/No	No	Yes

Weights table

Description	Mass (Kg)
1304mm deep panel with busbars ≤4000A – excluding fused vacuum contactor.	400
1554mm deep panel with busbars ≤4000A – excluding fused vacuum contactor.	550
200A withdrawable vacuum contactor with HV fuses.	90
400A withdrawable vacuum contactor with HV fuses.	90
Standard gas duct – per panel.	40
End covers – per switchboard.	140

4. Panel design and equipment

4.1 Basic structure

The basis for the UniGear ZVC panel is the outgoing feeder panel with fused vacuum contactor of a horizontal withdrawable design. It is divided into busbar compartment A, fused vacuum contactor compartment B, cable compartment C and low voltage compartment D for the secondary equipment. Apart from this, there are variants for other operating needs. 4/1 to 4/3 shows examples of possible configuration of a panel variant for direct-on-line motor starters including electrical equipment. Panels can be coupled in combinations to provide variants for reversing motor starters, two speed motor starters, auto transformer motor starters and reactor motor starters.

Further details about installation and equipping the switchgear can be obtained from the order documents.

4.1.1 Busbar compartment (4/12)

The busbars have a flat cross-section made of copper and are laid in sections from panel to panel. For higher rated currents (up to 4000 A), the busbars have a D-shaped cross-section. According to the current rating, either single or double configuration is used. They are held by a resin encapsulated branch conductor. No special connection clamps are needed. No additional support is necessary to withstand the rated short circuit current of the busbar system.

Busbars are insulated by means of shrink-on Raychem sleeves. The bolt connections are without any covers unless it is a specific requirement of the customer order document.

4.1.2 Fused contactor compartment (Figures 4/10, 4/12, 4/13 and 4/14)

The fused contactor compartment contains all the necessary equipment for removal/insertion and connection/disconnection operation of the withdrawable fused contactor. Like the busbar compartment, it is metallically partitioned on all sides.

The fused contactor compartment B includes guide rails for the withdrawable fused contactor. The withdrawable fused contactor is anchored to the cubicle with a truck lock operated by a double bit key. The truck is moved between ISOLATED and SERVICE position by a racking screw. Self-aligning tulip contacts are located in epoxy resin spout bushings behind a metal partition plate. Automatic metal shutters, covering the busbar and cable spout bushing openings, are also included.

The shutters are opened by means of actuating rods when the withdrawable fused contactor moves to the SERVICE position, and are closed when the withdrawable fused contactor returns to the ISOLATED position. In the ISOLATED position the withdrawable fused contactor is separated by metal partitioning from the main current circuit.

Secondary control wiring contacts are automatically connected via the plug on the rear of the truck, when the truck is installed in the cubicle and the truck lock operated.

The switching operations are carried out with the door closed. The FUSE BLOWN indicator and ON/OFF mechanical indicator on the contactor can be observed through an inspection window. A device for emergency manual opening of a latched contactor in the SERVICE position is located below the inspection window.

4.1.3 Withdrawable fused contactor (Figures 4/10, 4/12, 4/13 and 4/14)

The withdrawable fused contactor consists of a vacuum contactor, type V7/ZVC or VSC7/ZVC, and tag type HRC HV fuses housed in an epoxy resin monoblock mounted on a chassis. Contact spouts are incorporated in the monoblock to establish connection between the withdrawable fused contactor and the tulip contacts in the panel. The secondary contacts plug is automatically connected when the contactor is inserted into the contactor compartment.

The truck is moved manually between the SERVICE and ISOLATED positions with the front door closed by a handle engaged in the racking spindle. SERVICE and ISOLATED positions are monitored electrically by means of auxiliary switches.

The earthing connection between the withdrawable fused contactor and the panel is established by its rollers and travel rails, which are bolted to the panel.

Optional Control VT, with primary fuses, is mounted on the chassis and is connected to terminals on the load side of the HV fuses.

4.1.4 Cable connection compartment (Figures 4/12 and 6/20)

The cable compartment contains current transformers, earthing switch, and cable terminating module. Where specifically ordered, the compartment can also contain surge arresters, capacitive insulators and zero sequence current transformer.

The type ZVCE7 fault-making earthing switch is manually operated by handle, with the front door closed. Its switching position will be indicated both mechanically and electrically by means of the auxiliary switch. The physical position of the moving contacts can be viewed through a window in the front door.

The compartment is suitable for connecting up to 1x240mm² 3-core cable or 2x150mm² 3-core cables on copper tags separated by epoxy resin phase barriers on the cable terminating module. Complex combinations of cable type and size, zero sequence CT, cable clamps/glands, surge arresters and capacitive insulators must be decided at the time of manufacturer.

4.1.5 Low voltage compartment (Figures 4/12, 6/19)

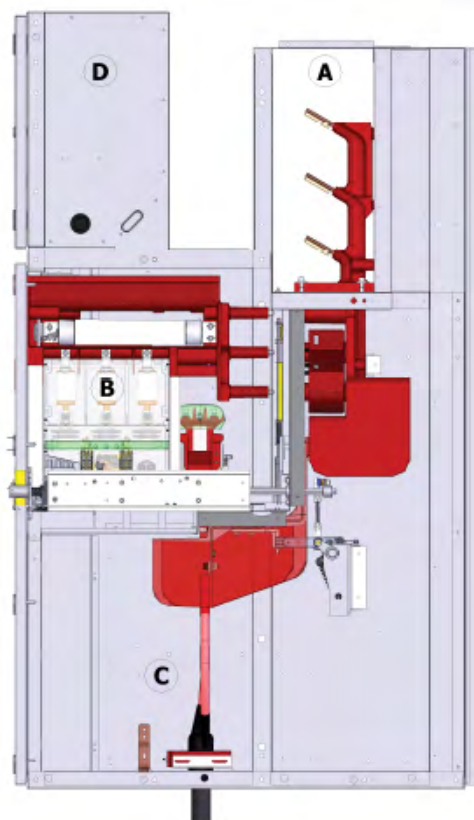
The compartment contains control and protection equipment suitable for both conventional or microprocessor control technology.

The height of the low voltage compartment is 665/865/1060 mm.

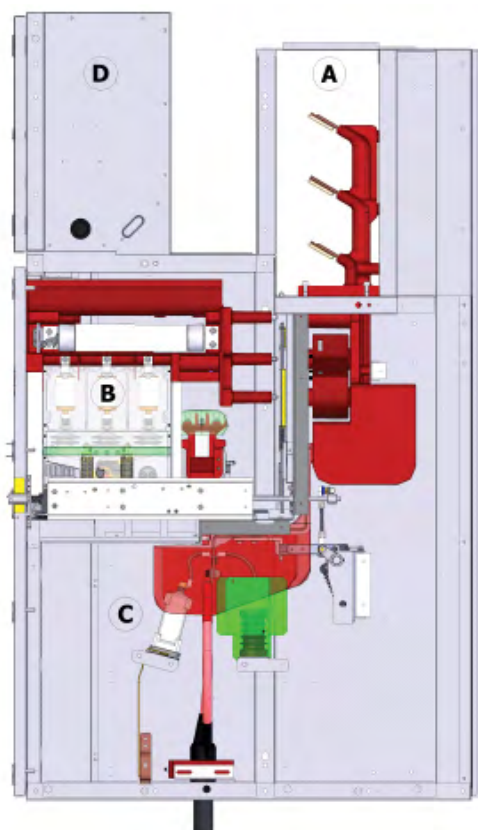
If the secondary devices are not intended for door installation, they are mounted on special metal strips. They enable any subsequent changes to the wiring.

In the lower part of the low voltage compartment, there are rows of terminal strips. There is a bushing for sliding in the interpanel wires at the side of the low voltage compartment.

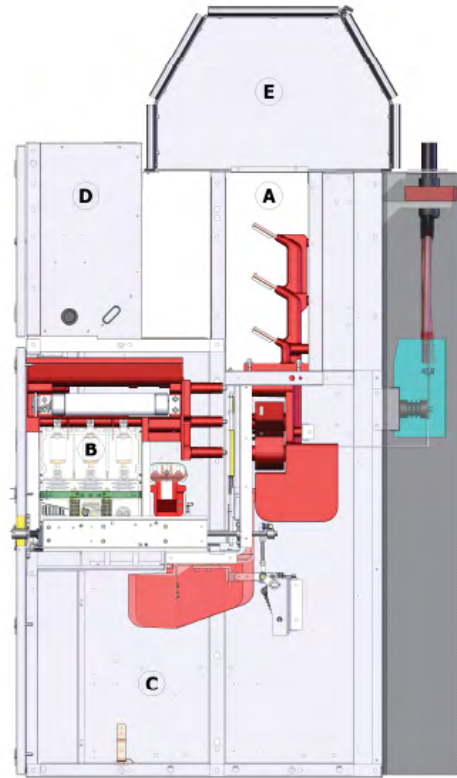
Secondary wiring inside the panel is in a duct on the right side of the panel. The left side of the panel is for the external wiring. The wiring is protected by a steel cover.



4/1. Feeder unit - direct-on-line motor starter. Front access.



4/2. Feeder unit - direct-on-line motor starter with surge arresters and voltage indicator bushings. Front access.

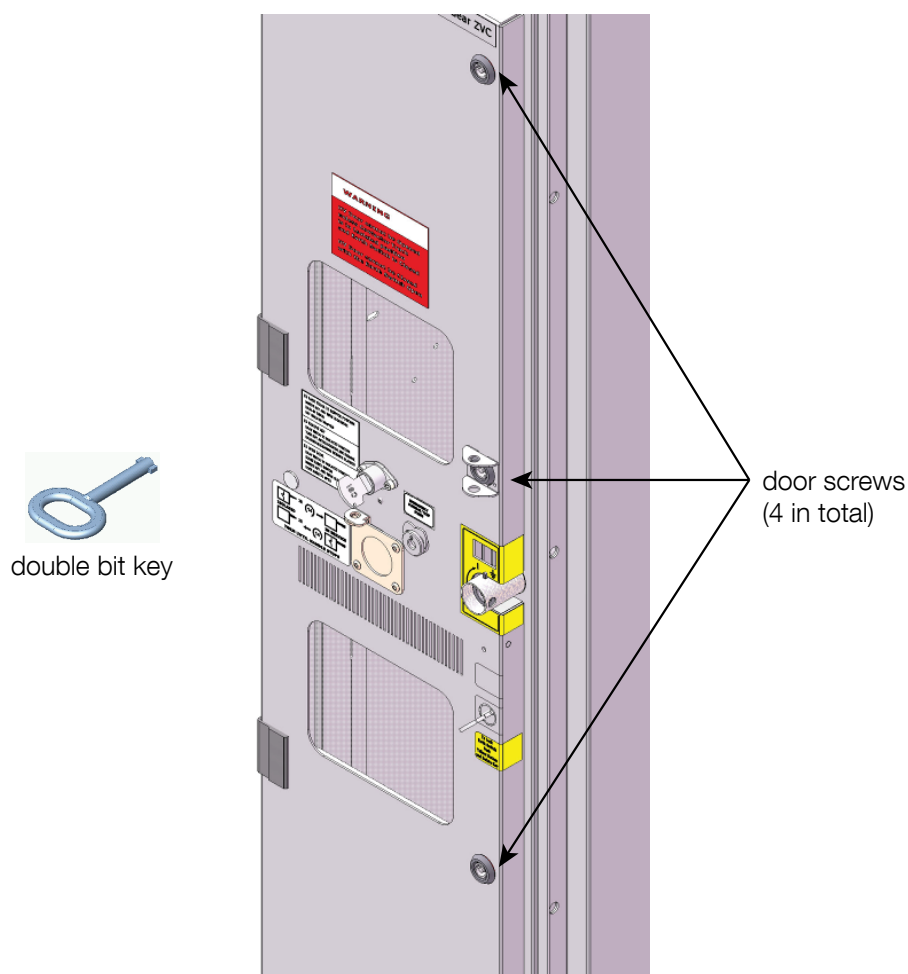


4/3. Feeder unit - direct-on-line motor starter with standard arc duct and top rear entry.

4.2 Enclosure and partitioning (4/12)

The enclosure and internal partitions of the panels are of 2 mm thick high quality aluminium-zinc coated steel sheets. The three high voltage compartments (busbar compartment A, fused contactor compartment B and cable connection compartment C) are equipped with top-mounted and secured pressure relief flaps. These open in the case of overpressure due to an internal arc fault.

The front of the panel is closed off by a pressure resistant door which is opened with the double bit key to an angle of 120°. The door is fitted with a manual closing system secured by screws.



4/4. Operation of the door screw

Cable and fused contactor compartments share a common door. The door is equipped with pressure resistant inspection windows for viewing the fused contactor and cable connection/earthing compartments. Neighbouring panels are partitioned from one another by the side walls of each panel and, as a result of the design, an air cushion remains between these walls when the panels are joined together.

The enclosure is completed:

- a. Above, by top-mounted pressure-relief flaps which, according to the rated branch conductor current, are made of sheet steel or expanded metal, and

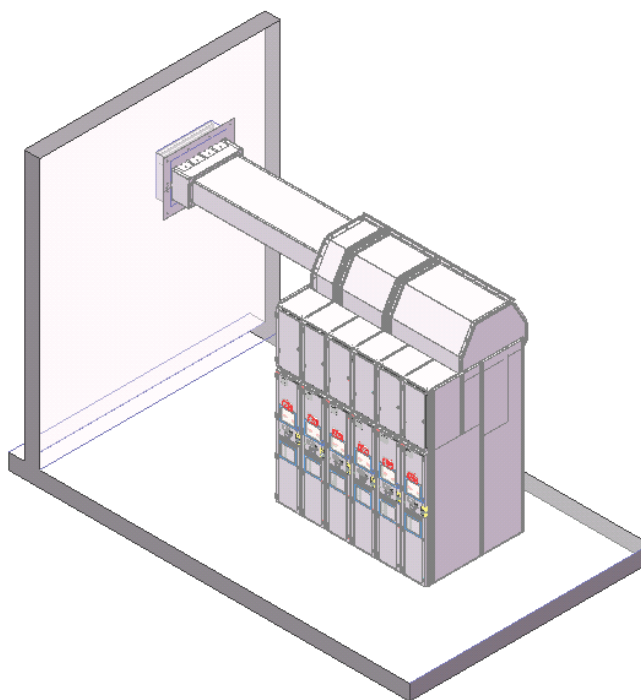
- b. Below, by means of floor mounted sheet steel cable entry gland plate. The pressure-relief flaps are secured with steel screws on the front longitudinal side and on the other longitudinal side with plastic screws. In the case of internal overpressure, the plastic screws are the point of rupture.

Arc fault current limitation in the busbar and fused contactor compartments can be achieved by instantaneous incoming breaker release, initiated by Ith limiter auxiliary switches (4/16) operated by the pressure wave acting on the pressure relief flaps.

Arc fault current limitation in the fused contactor and cable compartments is inherent in rupture of the current limiting HV fuse.

The necessary safety measures to counteract the effects of an internal arc fault must be ensured in relation to the ceiling height. In individual cases, this may require additional operator protection measures on the switchgear panels. These measures include:

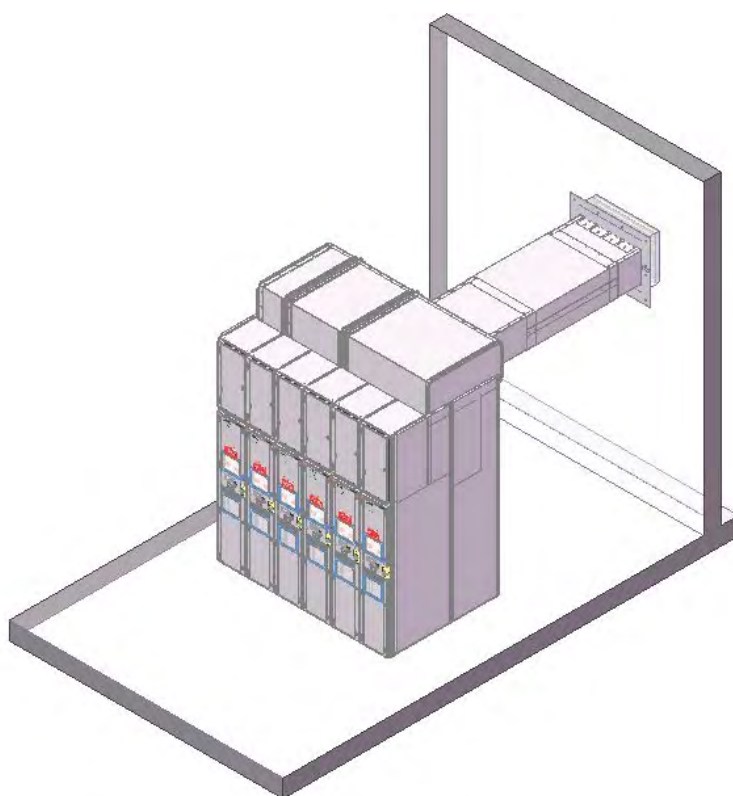
1. Mounting a pressure relief duct (4/5 and 4/6) on the top of the switchgear, with further channels leading out of the switchgear room in a form appropriate for the design of the building. The shock wave and arc discharge are channeled off in the duct.



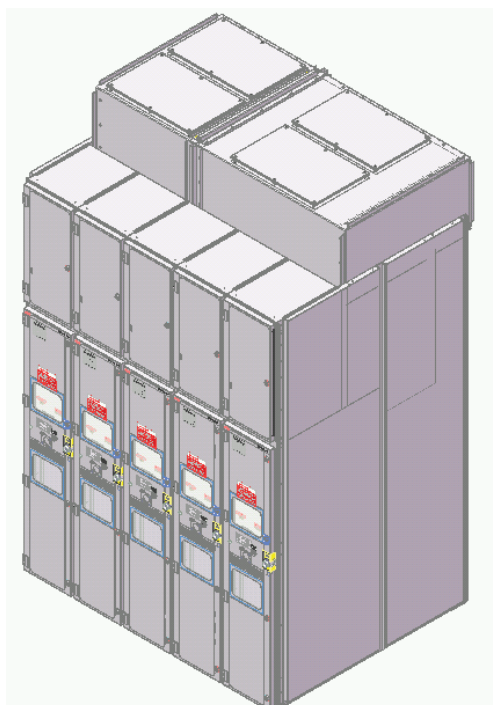
4/5. Typical standard arc duct arrangement

2. Depending on the value of the system fault current and the constraints of the switchroom design the arc products are vented through a top chimney of the arc duct and into the switchroom. A typical arrangement is shown in 4/7.

The rear wall of busbar compartment A, mounting plate with shutters and horizontal partition and form part of the internal partitioning.

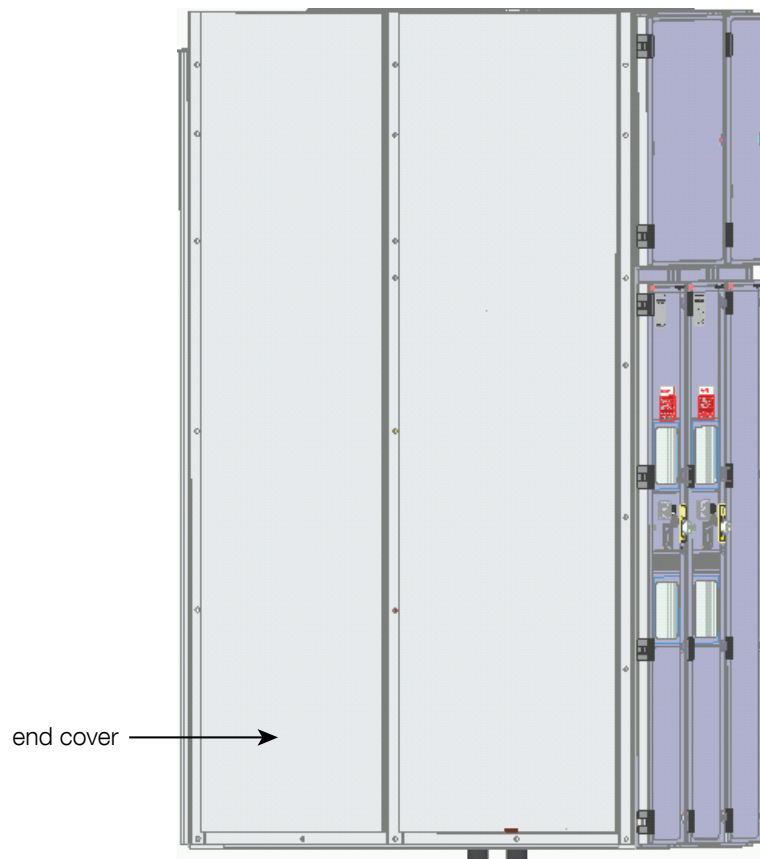


4/6. Typical compact arc duct arrangement



4/7. Typical top chimney arc duct arrangement

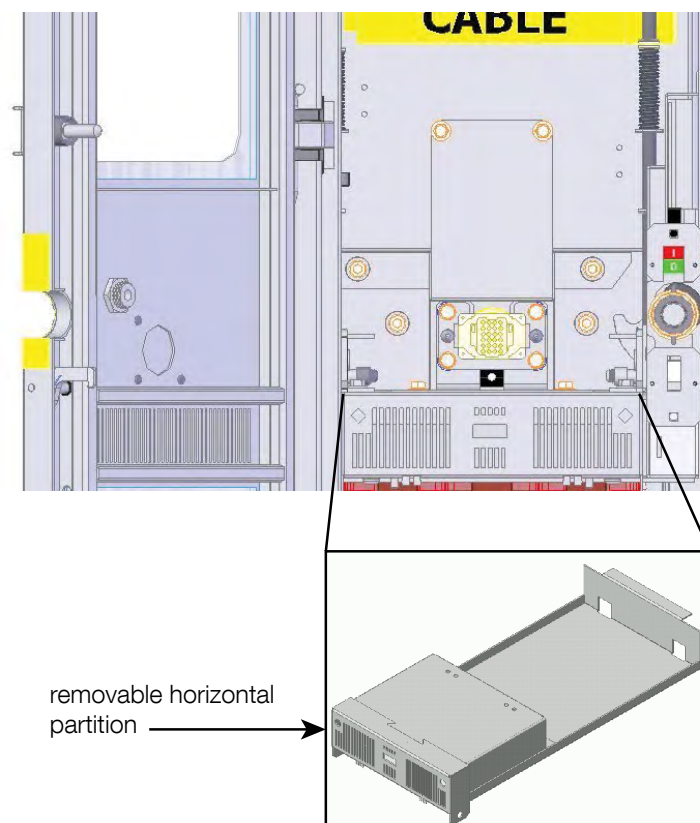
The low voltage compartment for the secondary equipment is completely protected from the high voltage area thanks to its steel-sheet casing.



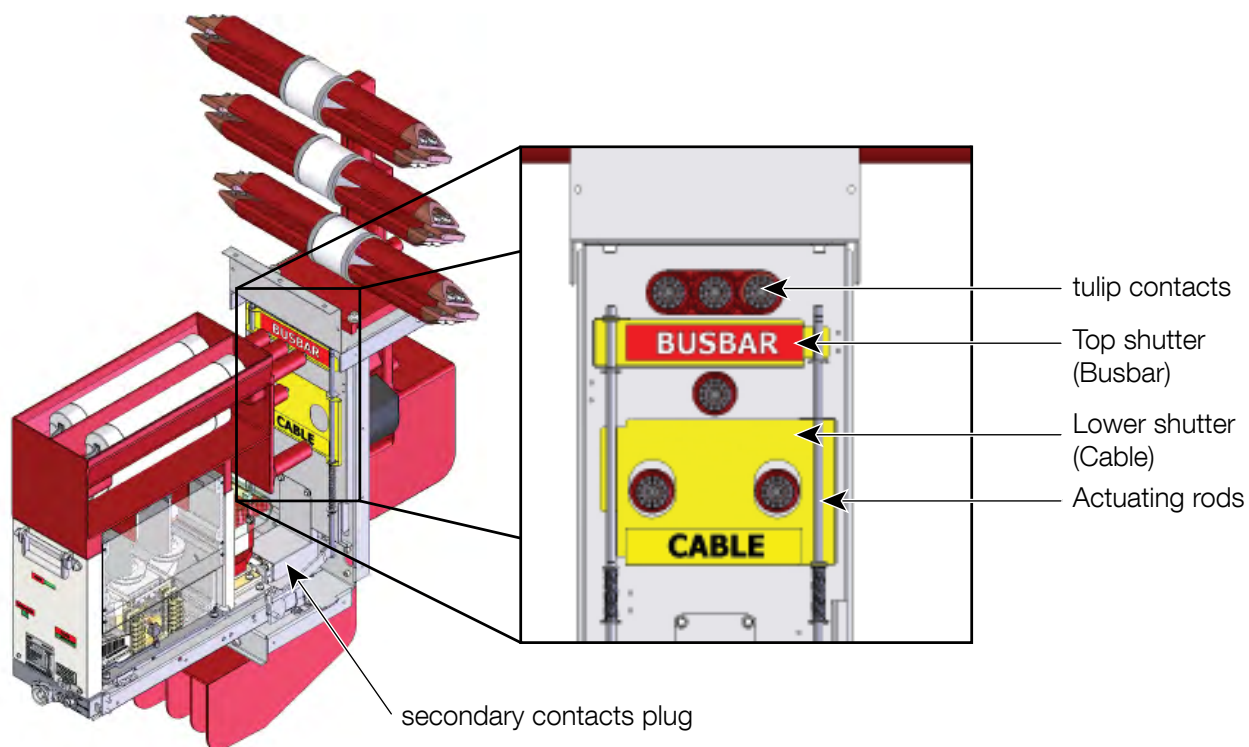
4/8. Switchboard with bolted end cover

On the two ends of the switchboard, end covers ensure good appearance and are mechanically and thermally arc fault proof should such an event occur.

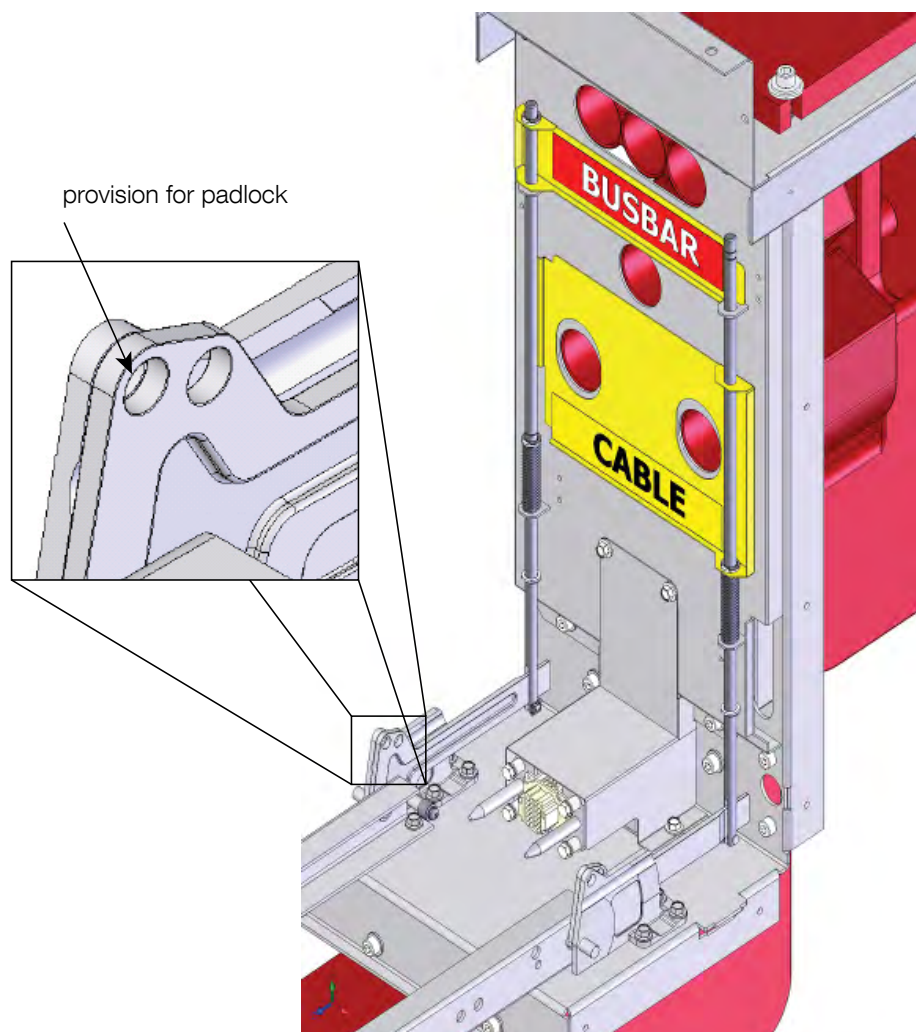
Doors and rear walls as well as the end cover are thoroughly cleaned and treated against corrosion. Then doors and end cover receive high quality powder coating of paint. Rear wall can be painted by agreement. The finishing coat is in the standard RAL 7035 colour (light grey - other colours on request). Stoving completes the painting procedure and provides protection from impact and corrosion.



4/9. View into contactor compartment with door open



4/10. View inside contactor compartment



4/11. Lower shutter may be secured with padlock to prevent unauthorized operation

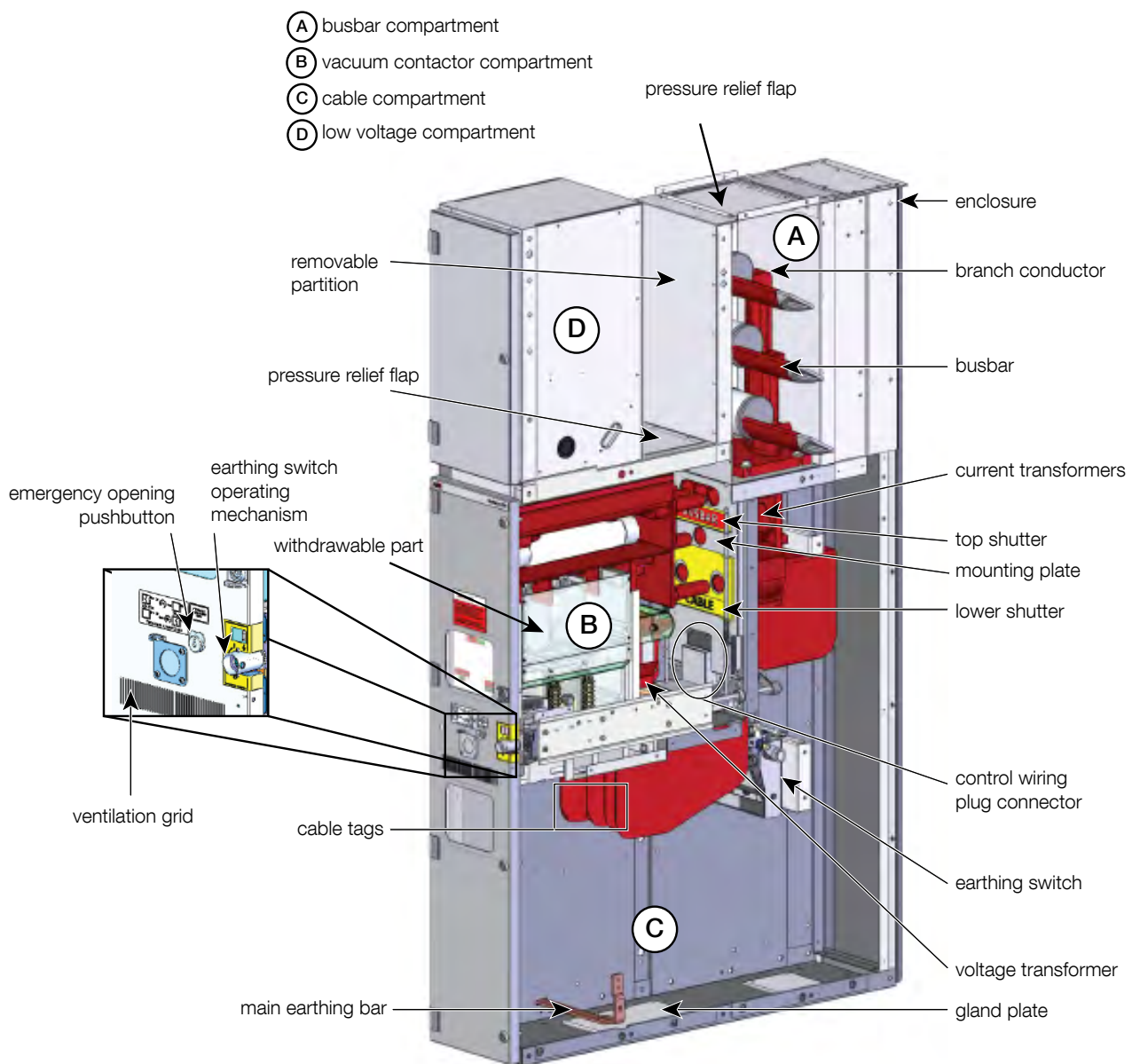
4.3 Interlock/ protection against incorrect operation

4.3.1 Panel internal interlocking (4/12)

To prevent hazardous situations and erroneous operation, there is a series of interlocks to protect both personnel and equipment.

- The withdrawable part can only be moved from the test/disconnected position (and back) when the contactor and earthing switch are off (i.e. the switch must be off beforehand). In the intermediate position, the contactor is mechanically and electrically interlocked and the earthing switch is mechanically interlocked.
- The contactor can only be switched on when the withdrawable part is in the ISOLATED or SERVICE position. In the intermediate position, the contactor is mechanically and electrically interlocked.
- The contactor cannot be switched on if an HV fuse has ruptured.
- In panels with digital control technology, prevention of malfunction of the apparatus can also be achieved by means of the panel software.
- In the SERVICE or ISOLATED positions, the electrically latched contactor can only be switched off manually when no control voltage is applied.

- The earthing switch can only be switched on if the withdrawable part is in the ISOLATED position or outside of the panel (mechanical interlock).
- If the earthing switch is on, the withdrawable part cannot be moved from the ISOLATED position to the SERVICE position (mechanical interlock).
- Details of other possible interlocks, e.g. in connection with a locking magnet on the withdrawable part and/or earthing switch drive, can be obtained from the relevant order documents.
- The voltage transformer secondary winding, when fitted, is isolated when the withdrawable fused contactor is moved from the SERVICE position.



4/12. Example of UniGear ZVC feeder unit

4.3.2 Doors interlocking

The panels are equipped with the following interlocks:

- The fused contactor cannot be racked-in if the contactor compartment door is open.
- The contactor compartment door cannot be opened if the fused contactor is in SERVICE or in an undefined position.
- The contactor/cable compartment door cannot be opened if the earthing switch is open.
- The contactor/cable compartment door cannot be closed if the earthing switch is open.

4.3.3 Locking devices (Figures 4/10, 4/11, 4/12)

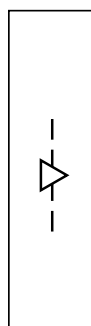
- The shutters can be secured independent of each other with padlocks when the withdrawable fused contactor has been removed.
- Access to the operating-shaft of the earthing switch can be restricted with a padlock.
- Access to the fused contactor racking spindle can be restricted with a padlock.
- Access to the fused contactor compartment and the cable compartment can be restricted with a padlock.

4.3.4 Racking blocking electromagnet

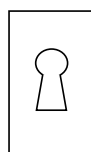
The locking magnet is only active in the ISOLATED position and SERVICE position. In intermediate positions it has no effect.

Withdrawable fused contactors with order-related blocking magnet Y0 may not be moved in case of control power failure, or when there is no control power. Do not forcibly move locked withdrawable fused contactors! Releasing the locking magnet Y0 when the module is in the SERVICE position (refer to 10.4.3).

4.4 Types of interlocks

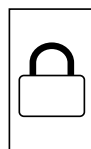


Type	Description	Conditions to be fulfilled
1	A	Racking truck IN
	B	Contactor closing
2	A	Closing earthing switch
	B	Racking truck IN
3	A	Opening panel door
	B	Racking truck IN
4	A	Opening panel door
	B	Earthing switch OFF



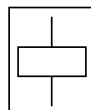
Keys (on request)

5	Truck racking IN lock	Key removed with truck in ISOLATED position
6	Earthing switch closing lock	Key removed with earthing switch open
7	Earthing switch opening lock	Key removed with earthing switch closed



Padlocks

8	Insertion of truck
9	Insertion of earthing switch
10	Shutter open or closed



Locking magnets (on request at time of ordering)

11	Truck racking IN/OUT
12	Earthing switch ON/OFF

4.5 Interchangeability and coding

Fused contactor are interchangeable. In cases where the order documents require the fused contactor and panels to be coded for contactor rating or HV fuse rating code pins are fitted to the transport chassis and the fused contactor compartment floor to prevent a module from inserting fully in to a compartment if the combination is not permitted. If any coding applies, it will be recorded on the routine test report.

4.6 Contactor truck ZVC-V7

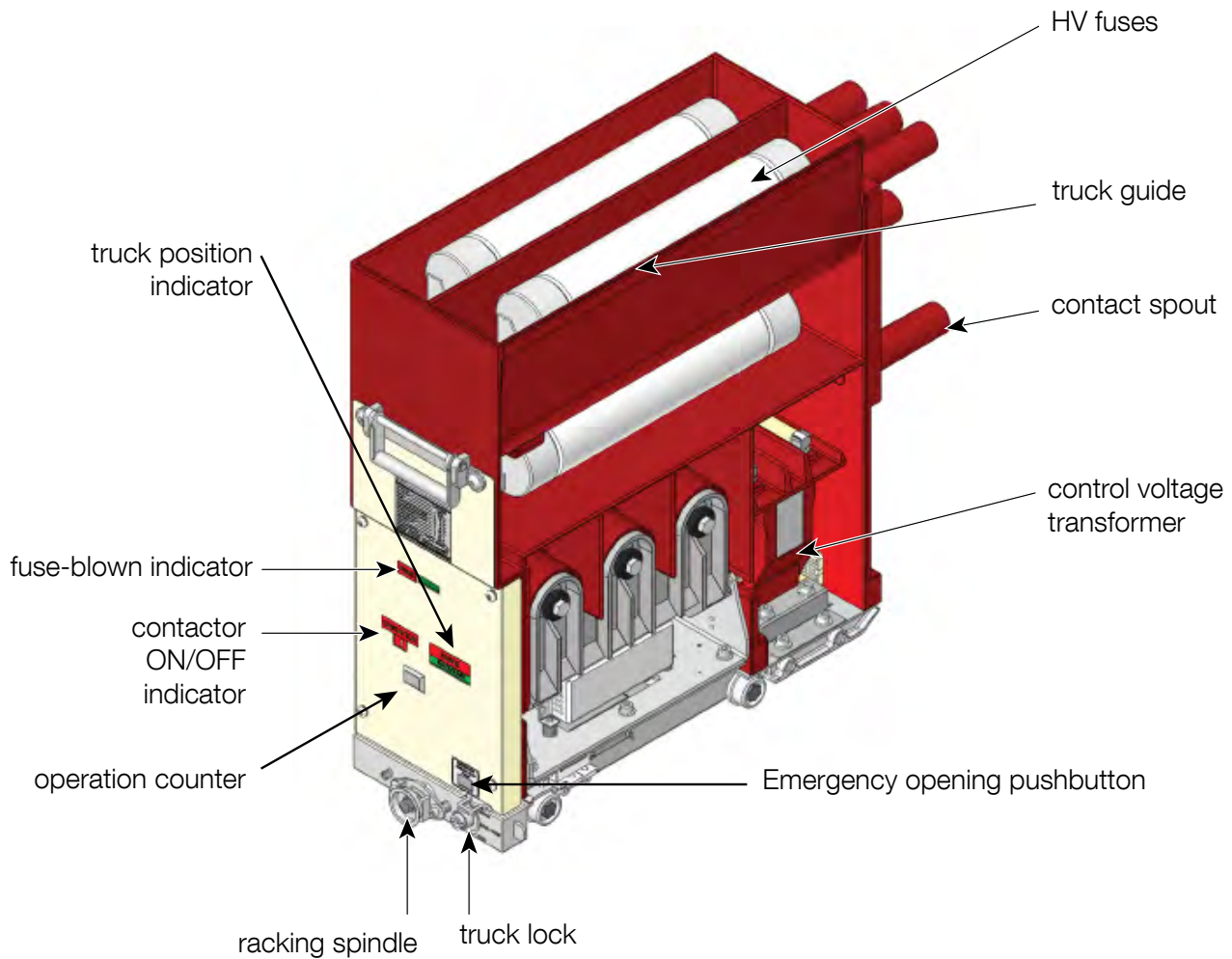
V7/ZVC truck consists of an epoxy resin moulding containing fuse holders that accept parallel HV fuses, vacuum interrupters, the moving apparatus, the electromagnet, the multi-voltage control feeder and auxiliary accessories.

The load & line side connectors for the withdrawable portion are moulded into the epoxy resin.

Closing of main contacts is carried out by means of the control electromagnet.

Opening is carried out by means of a special opposing spring.

Construction is compact and sturdy and ensures very long electrical and mechanical life.



4/13. V7/ZVC operating elements

4.6.1 Versions available

- Electrically held
- Mechanically latched

4.6.2 Standard equipment

- Operating mechanism
- Fuse blown indicator with 1 N/O + 1 N/C auxiliary contacts
- Mechanical operation counter
- 3 N/O + 3 N/C contactor auxiliary contacts
- 24 pin automatic connection plug
- Contactor ISOLATED and SERVICE indicator
- Contactor ON-OFF (I-O) indicator
- Emergency trip provision

4.6.3 Optional equipment

- Control Voltage Transformer
- Mechanical latch coil
- Trip circuit supervision provision
- Racking blocking coil
- Heavy duty racking mechanism (10,000 isolation operations)
- Motorized truck racking

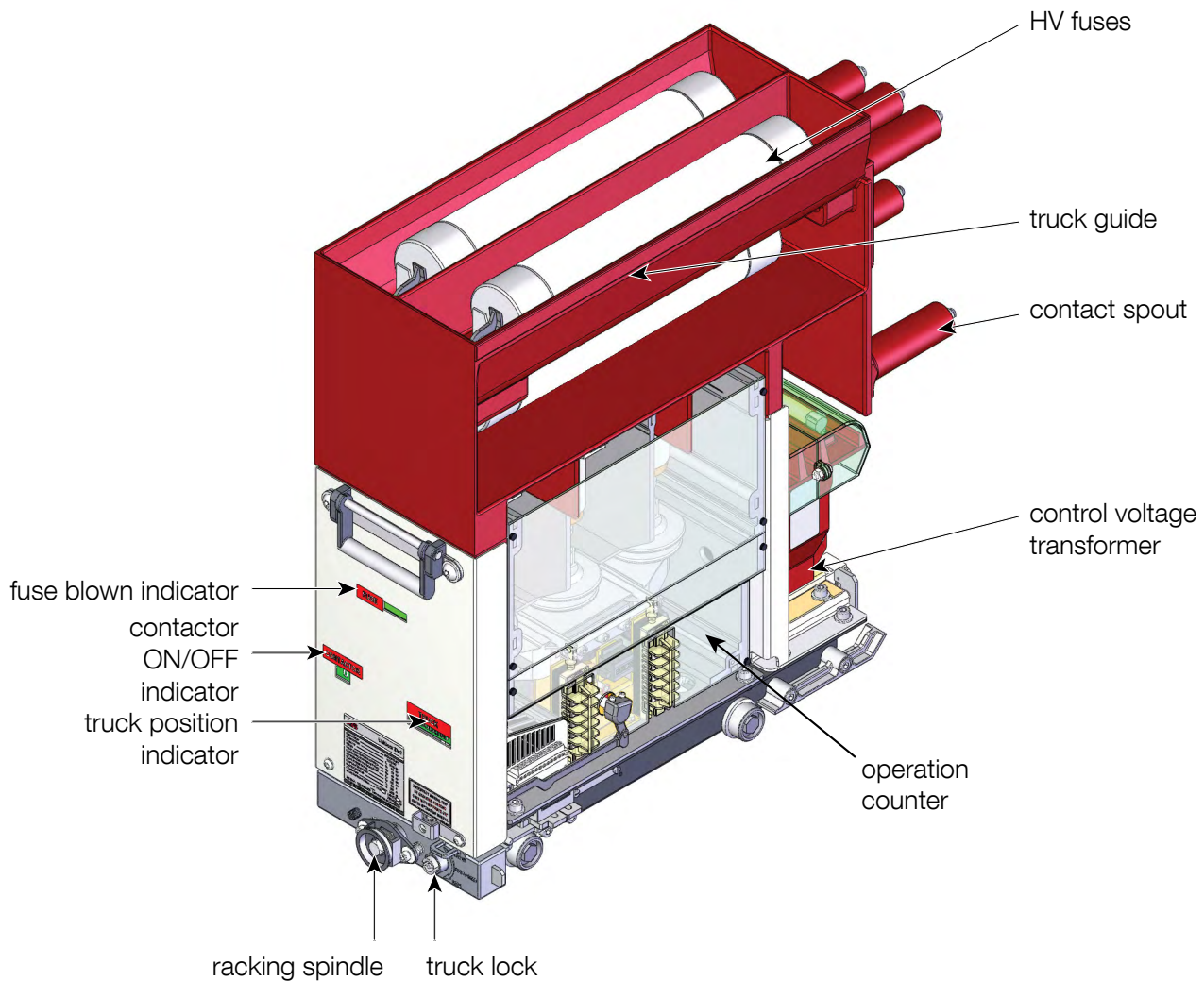
4.7 Contactor truck ZVC-VSC7

VSC7/ZVC contactors are apparatus suitable for operating in MV installations and are normally used to control loads requiring a high frequency of operations.

The VSC7/ZVC contactor introduces the drive with permanent magnets, already widely used and appreciated in medium voltage circuit-breakers and medium voltage contactors.

The experience acquired by ABB in the field of medium voltage circuit-breakers fitted with “MABS” permanent magnet drives, has made it possible to develop an optimised version of the actuator (bistable MAC drive) for medium voltage contactors.

The permanent magnet drive is activated by means of an electronic multi-voltage feeder.



4/14. VSC/ZVC withdrawable fused contactor truck

4.7.1 Versions available

- SCO (Single Command Operate): Closing takes place by supplying auxiliary power to the special input of the multi-voltage feeder. Opening takes place when the auxiliary power is either voluntarily cut off (by means of a command) or involuntarily (due to lack of auxiliary power in the installation). The SCO version is similar to the electrically latched drive of the conventional contactor.
- DCO (Double Command Operate): Closing takes place by supplying the input of the closing command of the apparatus a small pulse of power. Opening takes place when the input of the opening command of the contactor is supplied a small pulse of power.

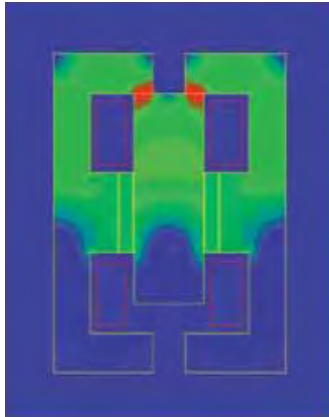
4.7.2 Standard fittings

- SCO Operating Mechanism
- Fuse blown indicator with 1N/O + 1 N/C auxiliary contacts
- Operation counter

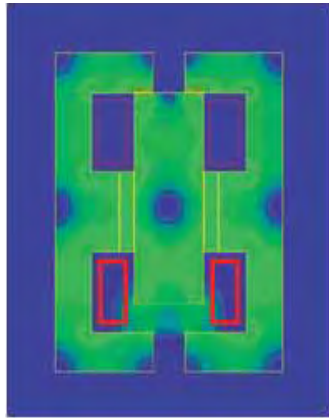
- 2N/O + 2 N/C contactor auxiliary contacts
- 24 pin automatic connection plug
- Contactor ISOLATED and SERVICE indicator
- Contactor ON-OFF (I-O) indicator
- Emergency trip provision

4.7.3 Optional equipment

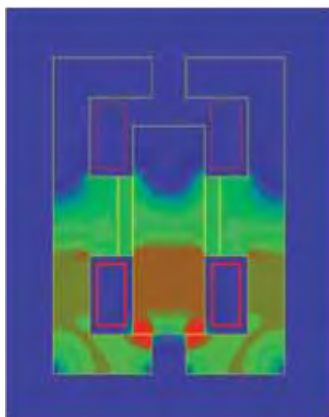
- Control Voltage Transformer
- DCO operating mechanism
- Racking blocking coil



Magnetic circuit in the closed position



Magnetic circuit with the opening coil supplied



Magnetic circuit in the open position

4.7.4 “MAC” magnetic drive

ABB has implemented this technology in the field of contactors on the basis of experience gained in the field of circuit-breakers with magnetic drive.

The magnetic drive adapts perfectly to this type of apparatus thanks to its precise linear travel.

The bistable drive, is fitted with an opening and a closing coil. The two coils, individually energized, allow the drive mobile armature to be moved to one of the two stable positions.

The drive shaft is solid with the mobile armature and held in position in a field generated by two permanent magnets, the magnetic field is generated, which attracts and moves the mobile Armature into the opposite position.

Every opening and closing operation creates a magnetic field concurrent with the one generated by the permanent magnets, with the advantage of keeping the intensity of the field itself constant during service, regardless of the number of operations carried out.

The energy needed for operation is not supplied directly by the auxiliary power supply, but is always “stored” in the capacitor which acts as an energy accumulator, and therefore operation always takes place with constant speeds and times, independent of the variation of the power supply voltage from the auxiliary source.

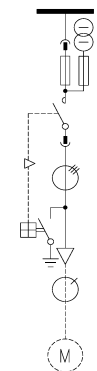
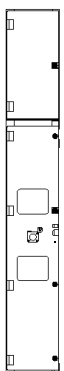
The auxiliary power supply serves to keep the capacitor charged. Consumption is therefore minimal. The power required is less than 5W. In order to recharge capacitor after an operation, there is an inrush of 15W for duration of a few tens of milliseconds.

For the reasons indicated above, both for the DCO and for the SCO versions it is necessary to supply the auxiliary circuits which recharge the capacitor with a continuous auxiliary power supply of 5W. Careful selection of the components and a precise design make the electronic multi-voltage feeder extremely reliable, unaffected by electromagnetic interference generated by the surrounding environment and free of any emissions which may affect other apparatus located in the vicinity.

These characteristics have made it possible for the VSC contactors to pass the electromagnetic compatibility tests (EMC) and obtain the CE mark.

4.8 Single panel variants

4.8.1 Motor starter (direct on line)

Motor starter (DOL)	ZVC	Ratings	
		Circuit Full Load Current	A 400
		Rated Frequency	Hz 50-60
		Rated Voltage	kV 7.2
		Width	mm 325
		Depth ¹	mm 1304
		Height ²	mm 2200

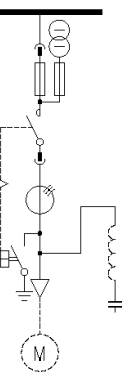
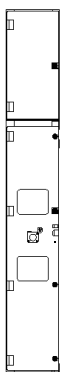
1. Bottom power cable entry version. Top cable power entry version 1554mm with gas duct.
2. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

Refer to shipping sections in the general arrangement drawing.

Note the location of the power cable entry in the contract drawings.

Pay special attention to clauses 6.4 to join panels and 6.5 to install busbars.

4.8.2 Motor starter with power factor correction

Motor starter with PFC	ZVC-PFC3	Ratings	
		Circuit Full Load Current ¹	A 250
		Rated Frequency	Hz 50-60
		Rated Voltage	kV 3.6
		Width	mm 325
		Depth ²	mm 1554
		Height ³	mm 2200

Note: Integrated capacitor and reactor

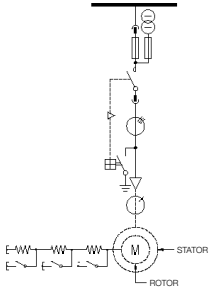
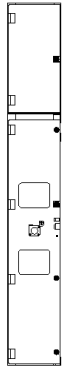
1. Maximum back to back capacitor switching 250A.
2. Bottom power cable entry version. Top cable power entry version 1554mm with gas duct.
3. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

Refer to shipping sections in the general arrangement drawing.

Note the location of the power cable entry in the contract drawings.

Pay special attention to clauses 6.4 to join panels and 6.5 to install busbars.

4.8.3 Slip ring induction starter

Slip ring induction	ZVC-SRI	Ratings		
		Circuit Full Load Current	A	400
		Rated Frequency	Hz	50-60
		Rated Voltage	kV	7.2
		Width	mm	325
		Depth ¹	mm	1304
		Height ²	mm	2200
		Note: external secondary resistor		

- 1. Bottom power cable entry version. Top cable power entry version 1554mm with gas duct.
- 2. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

Slip ring induction starter type ZVC-SRI

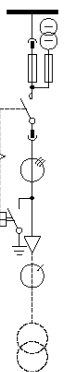
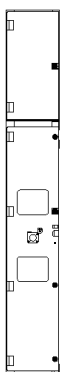
Slip ring or wound rotor motor is an induction machine where the rotor comprises a set of coils that are terminated in slip rings to which external resistors can be connected. The stator is the same as is used with a standard squirrel cage motor.

Refer to shipping sections in the general arrangement drawing.

Note the location of the power cable entry in the contract drawings.

Pay special attention to clauses 6.4 to join panels and 6.5 to install busbars.

4.8.4 Transformer feeder

Transformer feeder	ZVC	Ratings	
		Circuit Full Load Current	A 400
		Rated Frequency	Hz 50-60
		Rated Voltage	kV 7.2
		Width	mm 325
		Depth ¹	mm 1304
		Height ²	mm 2200

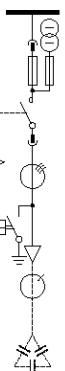
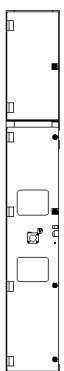
1. Bottom power cable entry version. Top cable power entry version 1554mm with gas duct.
2. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

Refer to shipping sections in the general arrangement drawing.

Note the location of the power cable entry in the contract drawings.

Pay special attention to clauses 6.4 to join panels and 6.5 to install busbars.

4.8.5 Capacitor feeder

Capacitor feeder	ZVC	Ratings	
		Circuit Full Load Current	A 250
		Rated Frequency	Hz 50-60
		Rated Voltage	kV 7.2
		Width	mm 325
		Depth ¹	mm 1304/1554
		Height ²	mm 2200

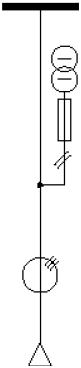
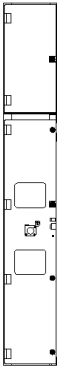
1. Depends on the size of capacitor and the cable entry from top or bottom.
2. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

Refer to shipping sections in the general arrangement drawing.

Note the location of the power cable entry in the contract drawings.

Pay special attention to clauses 6.4 to join panels and 6.5 to install busbars.

4.8.6 Cable to bus

Cable to bus	ZVC-CTB	Ratings	
		Circuit Full Load Current	A 2000
		Rated Frequency	Hz 50-60
		Rated Voltage	kV 7.2
		Width	mm 325
		Depth ¹	mm 1304
		Height ²	mm 2200

1. Bottom power cable entry version. Top cable power entry version 1554mm with gas duct.
2. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

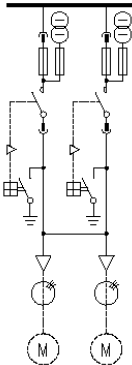
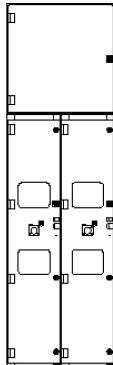
Refer to shipping sections in the general arrangement drawing.

Note the location of the power cable entry in the contract drawings.

Pay special attention to clauses 6.4 to join panels and 6.5 to install busbars.

4.9 Double panel variants

4.9.1 Forward reverse starter

Forward reverse	ZVC-RS	Ratings	
		Circuit Full Load Current	A 400
		Rated Frequency	Hz 50-60
		Rated Voltage	kV 7.2
		Width	mm 650
		Depth ¹	mm 1304
		Height ²	mm 2200

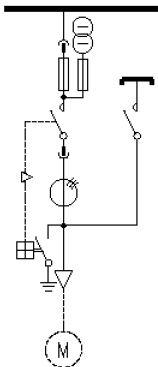
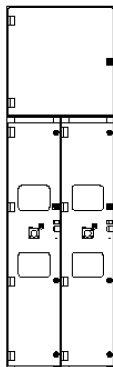
1. Bottom power cable entry version. Top cable power entry version 1554mm with gas duct.
2. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

The Forward and Reverse Panels are joined together in the factory. The two together are part of a shipping section. It is possible to use this for one or two motors.

Note the location of the power cable entry in the contract drawings.

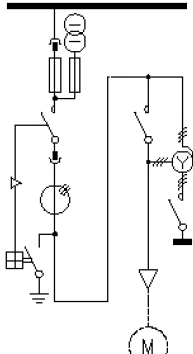
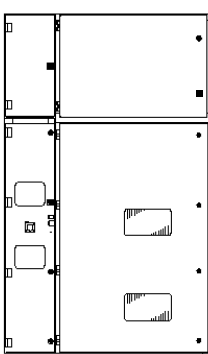
Pay special attention to clauses 6.4 to join panels and 6.5 to install busbars.

4.9.2 DC injection brake¹

DC brake	ZVC-BDC	Ratings	
		Circuit Full Load Current	A 400
		Rated Frequency	Hz 50-60
		Rated Voltage	kV 7.2
		Width	mm 650
		Depth ²	mm 1304
		Height ³	mm 2200

1. Also known as Dynamic Brake.
2. Bottom power cable entry version. Top cable power entry version 1554mm with gas duct.
3. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

4.9.3 Auto-transformer starter

Auto-transformer	ZVC-AT	Ratings		
		Circuit Full Load Current	A	300
		Rated Frequency	Hz	50-60
		Rated Voltage	kV	7.2
		Width	mm	1325
		Depth ¹	mm	1800
		Height ²	mm	2200
		Note: Integrated auto-transformer		

1. Power cable entry at top or bottom.

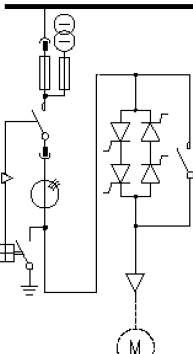
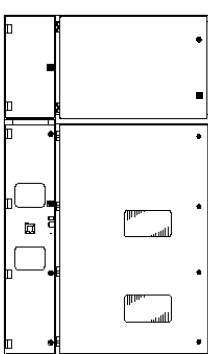
2. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

The two panels are joined together in the factory, and form one shipping section.

Note the location of the power cable entry in the contract drawings.

Pay special attention to clauses 6.4 to join panels and 6.5 to install busbars.

4.9.4 Soft starter

Soft starter	ZVC-SS	Ratings		
		Circuit Full Load Current	A	400
		Rated Frequency	Hz	50-60
		Rated Voltage	kV	7.2
		Width	mm	1325
		Depth ¹	mm	1554
		Height ²	mm	2200
		Note: Integrated soft start power electronics		

1. Bottom power cable entry version. Contact us for top cable power entry version.

2. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

The two panels are joined together in the factory. The two panels together form a shipping section.

Note the location of the power cable entry in the contract drawings.

Pay special attention to clauses 6.4 to join panels and 6.5 to install busbars.

4.10 Other panel variants

4.10.1 Star delta starter

Star delta starter	ZVC-SD	Ratings	
		Circuit Full Load Current	A 400
		Rated Frequency	Hz 50-60
		Rated Voltage	kV 7.2
		Width	mm 975
		Depth ¹	mm 1304
		Height ²	mm 2200

1. Bottom power cable entry version. Top cable power entry version 1554mm with gas duct.
2. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

The three panels are joined together in the factory, and form one shipping section.

Note the location of the power cable entry in the contract drawings.

Pay special attention to clauses 6.4 to join panels and 6.5 to install busbars.

4.10.2 Two speed starter

Two speed starter	ZVC-2S	Ratings	
		Circuit Full Load Current	A 400
		Rated Frequency	Hz 50-60
		Rated Voltage	kV 7.2
		Width	mm 975
		Depth ¹	mm 1304
		Height ²	mm 2200

1. Bottom power cable entry version. Top cable power entry version 1554mm with gas duct.
2. Larger LV compartment with corresponding total panel height 2400 and 2596mm available.

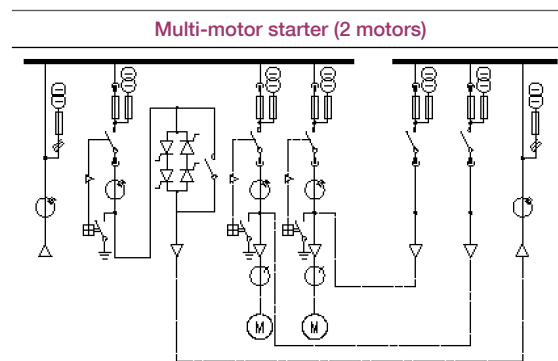
4.10.3 Multi-motor starter for drives and soft starter

It is common in large plants to find one motor starter driving multiple loads. This multi-motor starter method is utilised to reduce investment cost of expensive starters by minimising quantity of drives and/or soft starter. It is also normal to find multi-motor starter with reactor, resistor or auto-transformer. UniGear ZVC-MMS with its unique control and configurability is well equipped to provide this economical solution.

4.10.3.1 Standard panel with separate switchboard

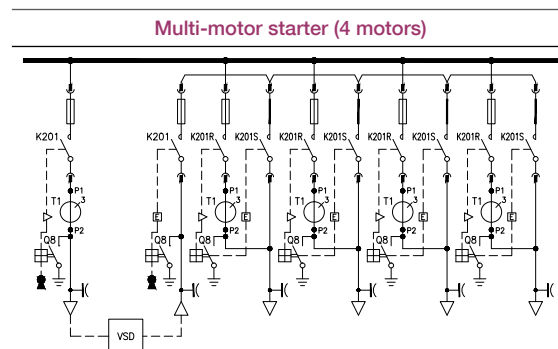
Refer to the circuit diagram shown below which is typical for two motors. The same principle can be extended for more motors.

This solution uses a separate switchboard operating on the output of a variable speed drive or soft starter. Follow the schematic of the contract drawings during installation.

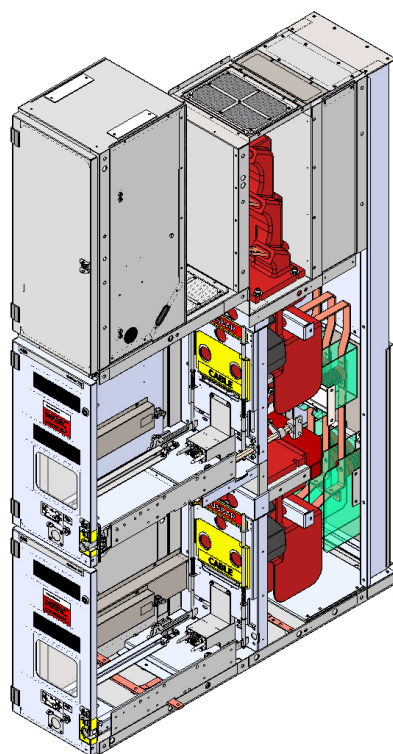


4.10.3.2 Double level panel with integral auxiliary bus

The double level panel receives two contactor trucks. The bottom contactor closes to start the motor through a variable frequency drive or a soft starter. When the motor has reached full speed the bottom contactor switches off and the top contactor runs the motor at the normal frequency.



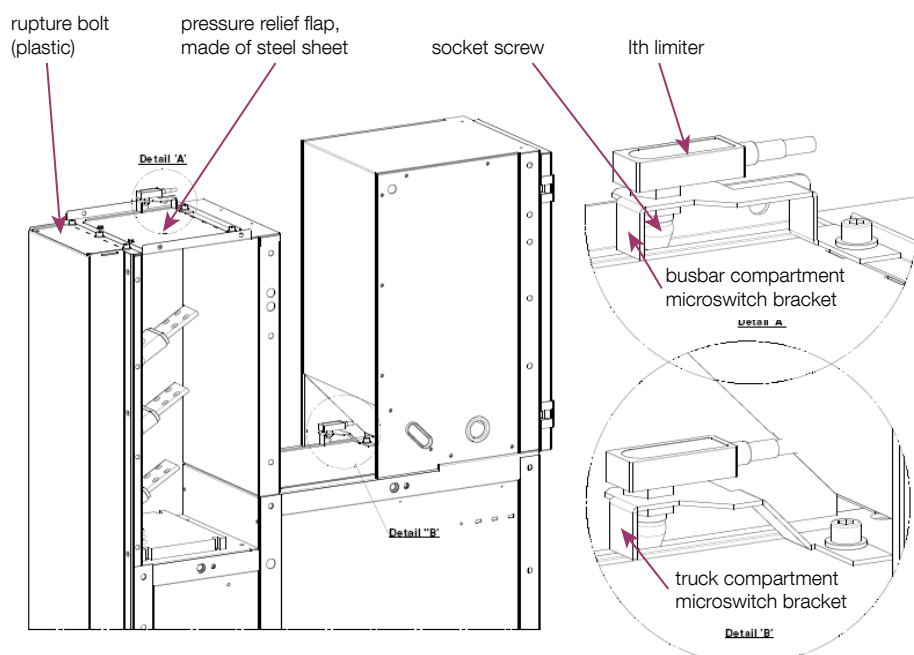
In addition to the main busbars that connect the double level panels to the standard (single level) ZVC and ZS1 panels, a moulded link needs to be fitted from the rear. The link is fitted at site where two adjacent double level panels are in separate shipping sections.



4/15. Double level panel

4.11 lth Limiter designs

It is an additional safety feature on the top of each unit. The microswitch generates an immediate fault signal when the overpressure flap is opened. Reaction time is less than 15 ms. The signal from the microswitch can be sent directly to trigger the circuit-breaker OFF.



4/16. Auxiliary lth limiter switch

4.12 Resistance to internal arc faults

The switchgear has been successfully tested in accordance with IEC 60298 and IEC 62271-200. Several arc control measures to meet the AFLR rating are adopted to suit the design of the switchroom. The specific variation and installation parameters are given in the general arrangement drawings of the contract. Refer to clause 6.6.

5. Dispatch and storage

5.1 Dispatch

At the time of dispatch, the UniGear panels are factory-assembled, the withdrawable parts are in the SERVICE position, the earthing switch is opened and the doors are closed.

The factory-assembled panels are checked at the works for completeness in terms of the order and simultaneously subjected to routine testing (normally without AC voltage testing of the busbars) to IEC publication 60298, and are therefore tested for correct structure and function.

The busbars connecting the panels of a shipping section are factory assembled. The remaining busbar material, fasteners and accessories are packed separately.

5.2 Packing

According to the kind of transport and country of destination, the panels remain unpacked or are wrapped in foil and packed in seaworthy crates:

- Panels with basic packing or without packing.
- Panels with seaworthy or similar packing (including packing for containerised shipments):
 - Sealed in aluminium composite foil wrap
 - Transport drying agent bags included

5.3 Transport

The shipping section normally comprise a suite of two or three panels. Only in exceptional cases will an individual panel form a transport unit. Each suite of panels is fitted with four lifting lugs.

Transport panels upright. Take the high centre of gravity into account. Only ever carry out loading operations when it has been ensured that all precautionary measures to protect personnel and materials have been taken and use the following:

- Crane
- Fork-lift truck and/or
- Manual trolley jack.

Loading by crane:

- Fit lifting ropes of appropriate load capacity with spring catches (eyebolt diameter: 30 mm)
- Keep an angle of at least 60° from the horizontal for the ropes leading to the crane hook

5.4 Delivery

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

- Checking the consignment for completeness and lack of any damage (e.g. for moisture and its detrimental effects also). In case of doubt,

the packing must be opened and then properly resealed, putting in new drying agent bags, when intermediate storage is necessary.

- If any quantities are short, or defects or transport damage are noted, these must be:
 - documented on the respective shipping document.
 - notified to the relevant carrier or forwarding agent immediately in accordance with the relative liability regulations.

Note: Always take photographs to document any major damage.

5.5 Intermediate storage

Optimum intermediate storage, where it is necessary, without any negative consequences depends on compliance with a number of minimum conditions for the panels and assembly materials.

5.5.1 Panels with basic packing or without packing

- A dry well-ventilated store room with a climate in accordance with IEC 60694.
- The room temperature must not fall below -5 °C.
- There must not be any other negative environmental influences.
- Store the panels upright.
- Do not stack panels.
- Panels with basic packing:
 - Open the packing, at least partially.
- Panels without packing:
 - Loosely cover with protective sheeting.
 - Ensure that there is sufficient air circulation.
- Check regularly for any condensation until installation is started.

5.5.2 Panels with seaworthy or similar packing with internal protective sheeting

- Store the transport units:
 - protected from the weather,
 - in a dry place,
 - safe from any damage.
- Check the packing for damage.
- Check the drying agent (also see section 5.2): on arrival of the consignment and subsequently at regular intervals.

- When the maximum storage period, starting from the date of packing, has been exceeded:
 - the protective function of the packing can no longer be guaranteed,
 - take suitable action if intermediate storage is to continue.

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

5.6 Handling

Before carrying out any operations, always make sure that the operating mechanism spring is discharged and that the apparatus is in the open position.

To lift and handle the circuit-breaker, proceed as follows:

1. Use a universal lifting tool (not supplied) fitted with ropes with safety hooks.
2. On completion of the operation (and in any case before putting into service) unhook the lifting accessories from the frame.
3. During handling, take great care not to stress the insulating parts of the contactor truck.



Caution

The contactor truck must be handled as recommended.

Should it be necessary to use this technique, put the contactor onto a pallet or a sturdy supporting surface.

It is always advisable to carry out lifting using the supports.

5.6.1 Switchgear

The switchgear panels are usually fixed to wooden pallets. Handling should be carried out by overhead or mobile cranes. Otherwise, use rollers or fork lift trucks.

Weights and dimensions of each section are listed in the shipping documents and in the general arrangement drawings.

5.6.2 Handling with overhead crane or mobile crane and unpacking

The switchgear must be lifted by crane and circular slings. The slings must engage with the four lifting lugs on the shipping section

Weight and lifting opening angle must be taken into account when choosing the circular slings.

6. Assembly of switchgear at site

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 personnel supervised and monitored by responsible persons.

6.1 General

On commencement of installation on site, the switch-room must be completely finished, provided with lighting and the electricity supply, lockable, dry and with facilities for ventilation. All the necessary preparations, such as wall openings, ducts, etc., for laying the power and control cables up to the switchgear must already be complete. It must be ensured that the ceiling height is sufficient for the opening travel of the pressure relief flaps.

Compliance with the conditions for indoor switchgear according to IEC 60694, including the conditions for the “minus 5 indoor” temperature class must be ensured.

6.2 Foundations

The switchgear must preferably be erected on a floor frame set into the switchroom floor or on a raised false floor.

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

6.2.1 Metal floor frame/plinth fixing system

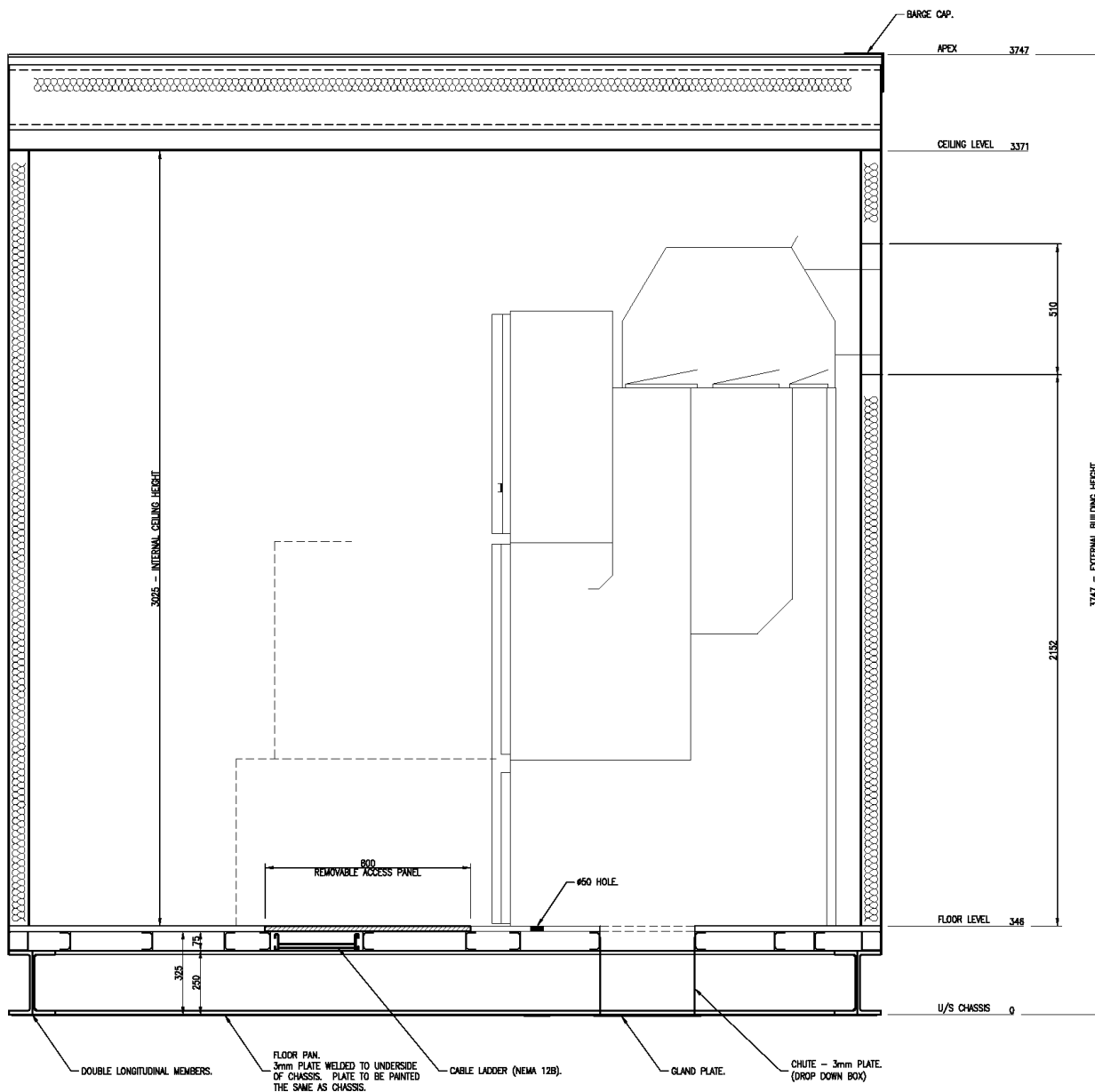
The floor frame/plinth, consisting of one or more parts depending on the size of the switchgear, can be supplied by ABB together with the switchgear. It is usually laid by site personnel and should, if possible, be aligned and inspected under the supervision of an ABB specialist.

Installation of the floor frame/plinth:

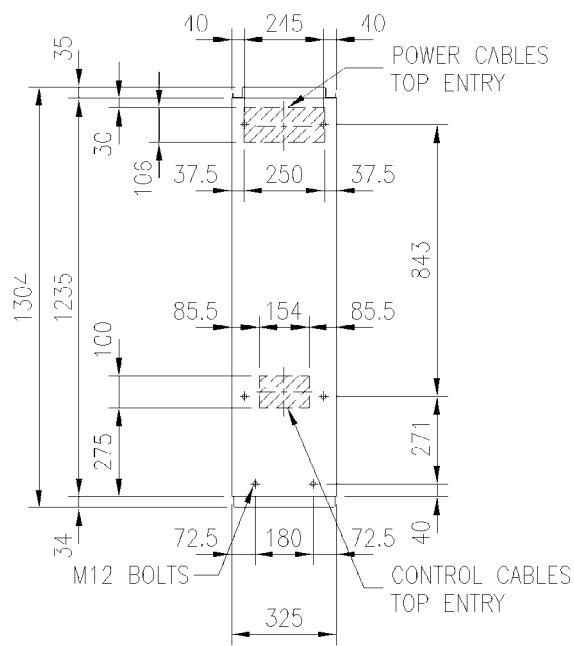
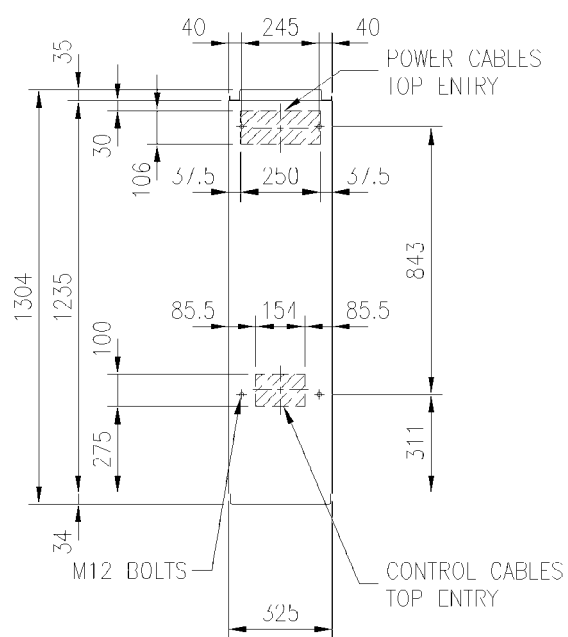
- Place the floor frame/plinth precisely in the specified position on the concrete floor in accordance with the general arrangement drawing.
- Use the floor frames/plinth as a drilling template to install the leveling screws.
- Carefully align the floor frame/plinth horizontally over the entire surface and to the correct height, by screwing up the jacking screws by an appropriate amount and using a leveling instrument. The top edge of the floor frame/plinth should be 2 mm above the finished floor surface. This facilitates erection and alignment of the switchgear panels. In some cases, this means that the material thickness of an additional floor covering to be fitted later must be taken into account separately. Tolerances for laying the frame/plinth:
 1. Flatness of ± 1 mm/metre in all directions under the switchboard and 1m in front of the switchboard.
 2. Flatness of ± 3 mm over the entire switchboard length.
- Slide brackets against the frame at two points – for each 3 m of frame length, secure them to the concrete floor with plugs, and weld them to the frame. The set position of the frame on the concrete floor must not be altered during this operation!

- Weld the floor frame parts together. Grind down projecting parts and weld any seams on the top of the frame flat.
- Make the necessary preparations for perfect earthing of the floor frame with 30 x 4 mm galvanized steel strip. Two connections are necessary for long switchgears.
- When the floor top covering is applied, carefully backfill the floor frame, leaving no gaps.
- The floor frame must not be subjected to any harmful impact or pressures, particularly during the installation phase.

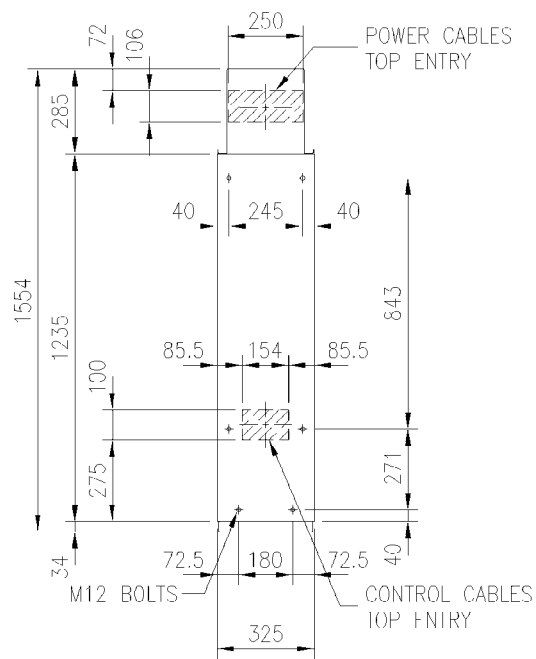
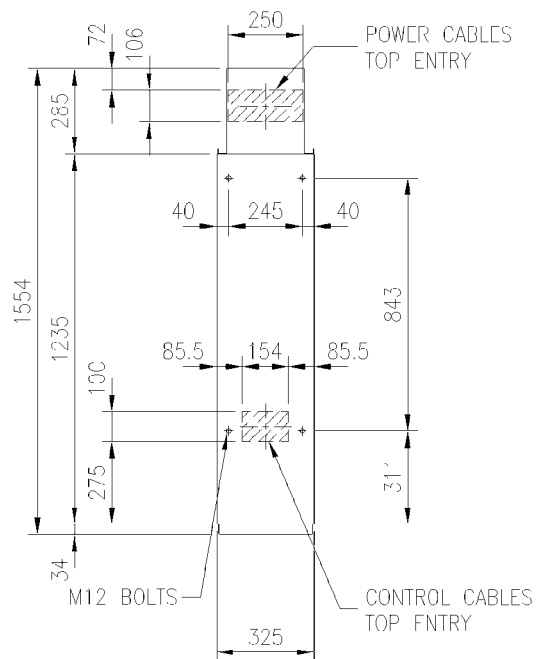
If these conditions are not respected, problems during assembly of the switchgear and possibly with movement of the withdrawable parts, as well as opening and closing of the doors cannot be ruled out.



6/1. Typical floor frame/plinth for UniGear ZVC and ZS1 switchboard. Switchboard holding down bolts to be spotted through and drilled and tapped on site. Mounting is by M12 x 25LG HT bolts.



6/4. Typical floor plan drawing which is applicable for 1304mm depth panel, Front access/top power cable entry (without arc duct)



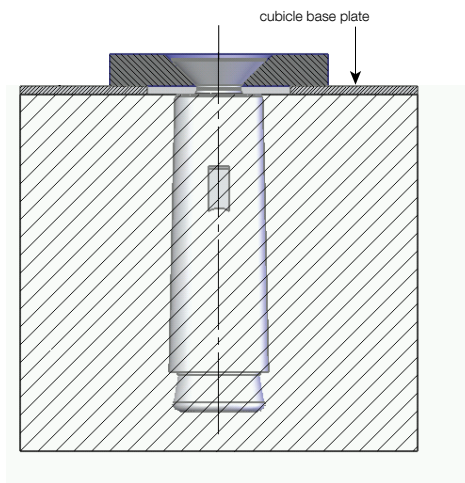
6/5. Typical floor plan drawing which is applicable for 1554mm depth panel, Front access/top power cable entry (with arc duct)

6.2.2 Anchoring systems

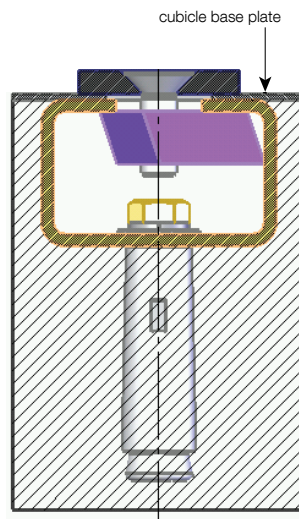
The switchboard can be fixed either to the floor or to special foundation frames (supplied on request):

Usually four fixing holes are drilled in each unit base (confirm with the general arrangement drawing).

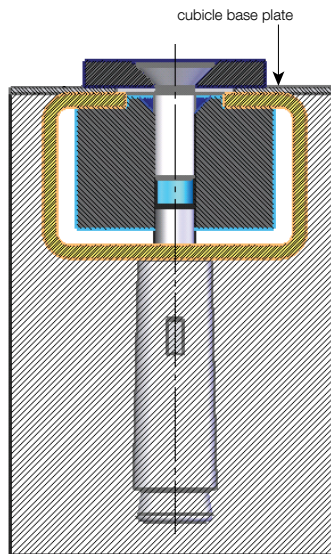
Before positioning the different switchboard units, check both the flatness of the floor, with particular attention to longitudinal leveling (maximum planarity 2/1000).



6/6. Anchoring bolt fixing system on concrete



6/7. Anchoring bolt fixing system on steel profiles



6/8. Anchoring bolt fixing system on steel profiles (Marine version)

6.2.3 Fixing with anchoring bolts to concrete floor:

- Clean the installation area.
- On the slab, visibly trace the perimeter of all the units making up the switchboard, taking the minimum wall and obstacle clearances into account.
- Level the floor both longitudinally and transversally.
- Drill the floor at the foreseen fixing points, referring to the slab drilling drawings. To make the holes, use a hammer drill.
- Insert the expansion anchoring bolts in the holes.

6.2.4 Fixing with anchoring bolts to floor frames:

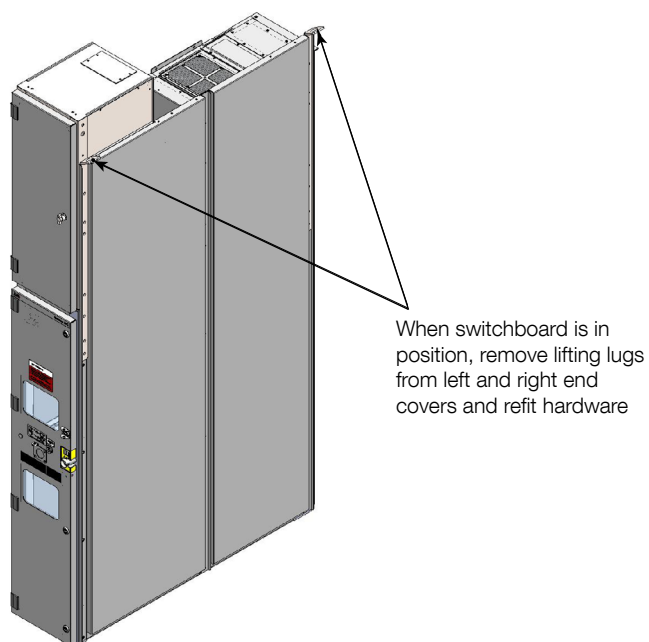
The floor frames, which can be supplied on request, must be installed in the slab before finishing the floor.

Check the panel fixing points correspond to the positions shown in the floor plans on the General Arrangement drawing.

6.3 Prepare switchgear panels

The individual installation stages are as follows:

- Remove the withdrawable fused contactor from the switchgear panels and store them with suitable protection. Observe the interlocks and operation sequences when removing it.
- Transport the switchgear panels to the prepared installation point following the layout shown on the general arrangement drawing.
- Remove the lifting lugs after the panels are in their final position. Refit the hardware after removing the lifting lugs.
It is advisable to start from the centre of the switchboard or the bus-section panel when there are more than 10 panels.

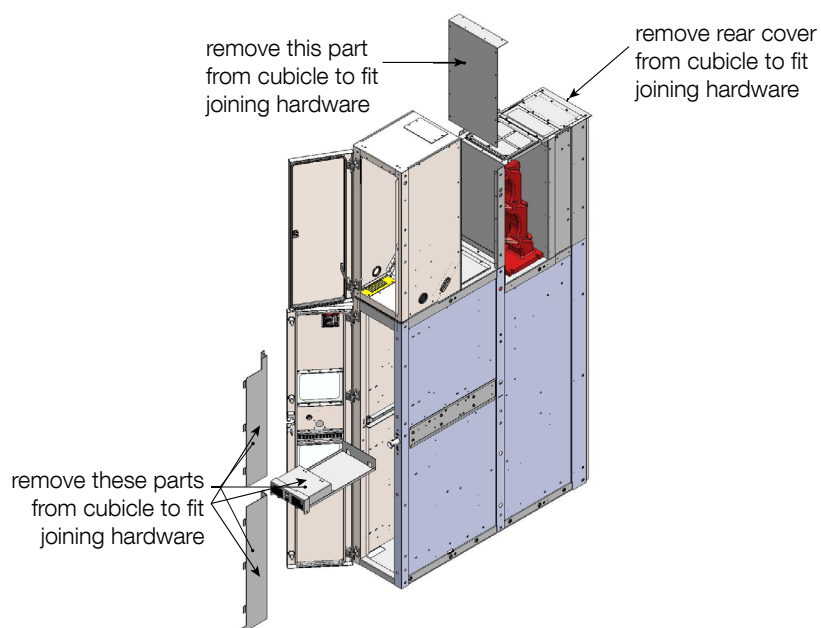


6/9. After switchgear is in position, remove lifting lugs

- When the switchgear has been properly assembled, fix the panels to the concrete floor using expansion anchoring bolts, or weld or adequately bolt them to the foundation frame.

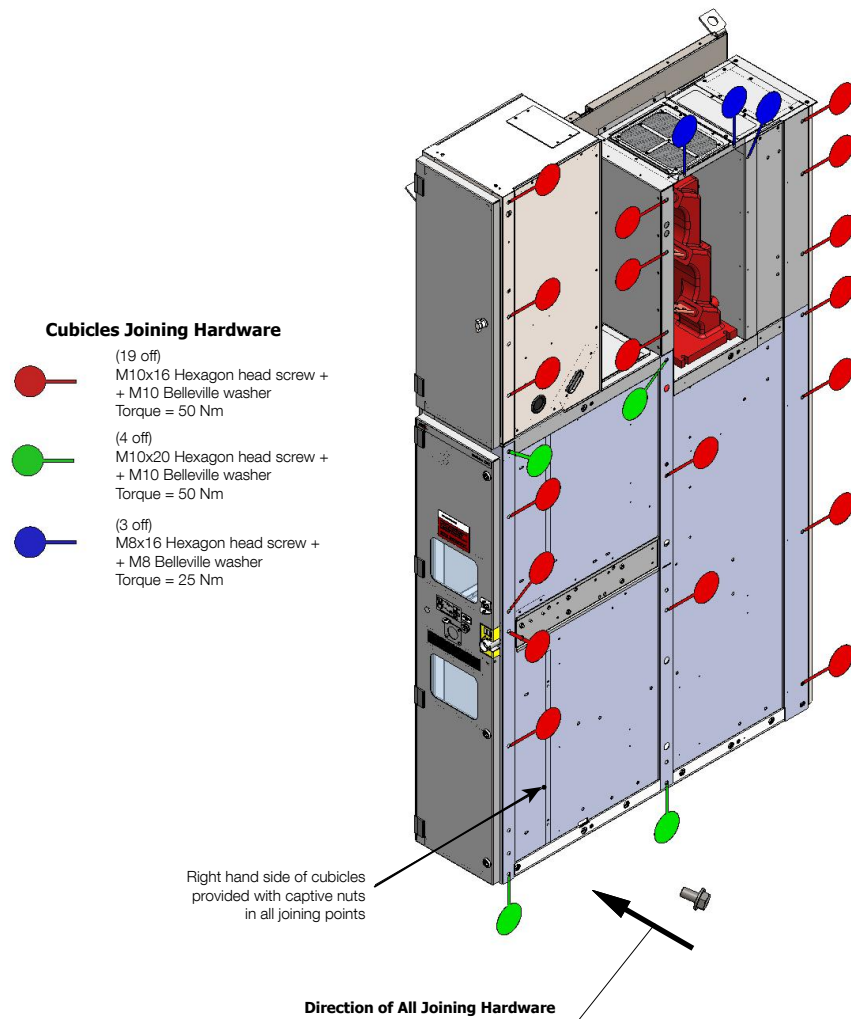
6.4 Join panels

Remove the Rear Cover of the panel and the parts shown from the front to facilitate the joining of the panels.



6/10. Removing the rear cover and parts from cubicle

Refer to 6/11 for the hardware details and tightening torque.

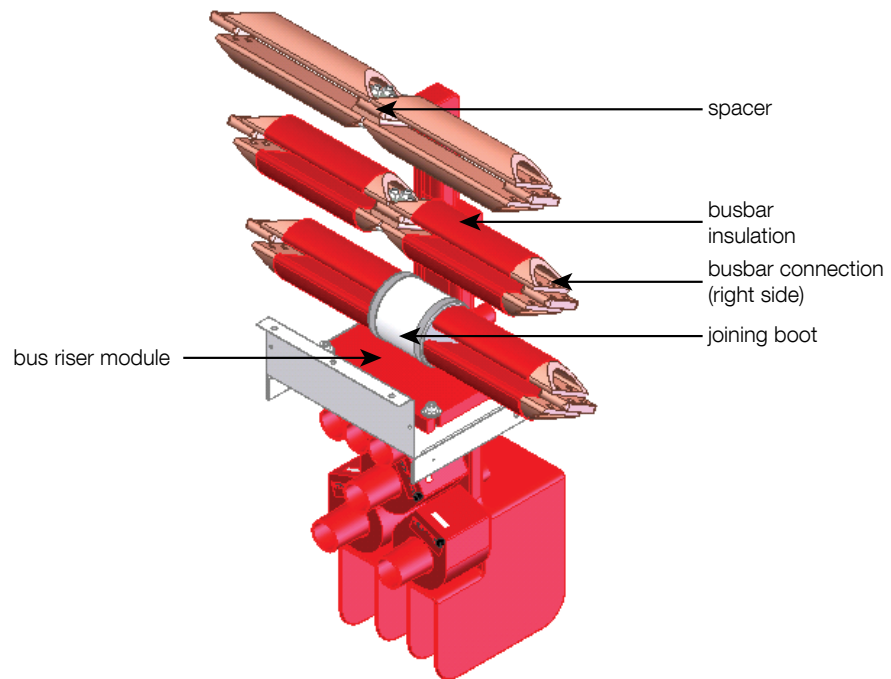


6/11. Cubicle joining hardware

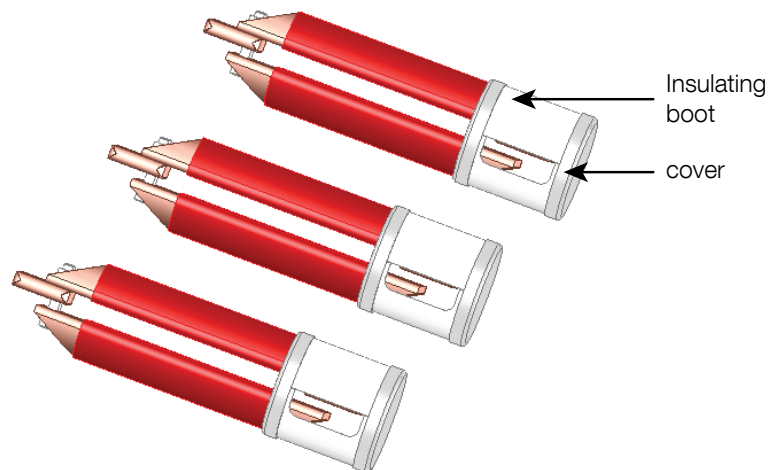
6.5 Install busbars

Clean any greasy or sticky substance off the risers and busbars with a soft dry cloth.

Install busbars supplied loose across each shipping section starting at bottom bar and then continue to work upwards. Remember to fit the joining boots (if provided). Use M10 socket head bolts (tensile 8.8), nuts, spacers (when required) and two Belleville washers per bolt to a tightening torque of 50 Nm.



6/12. Typical installation of the busbars

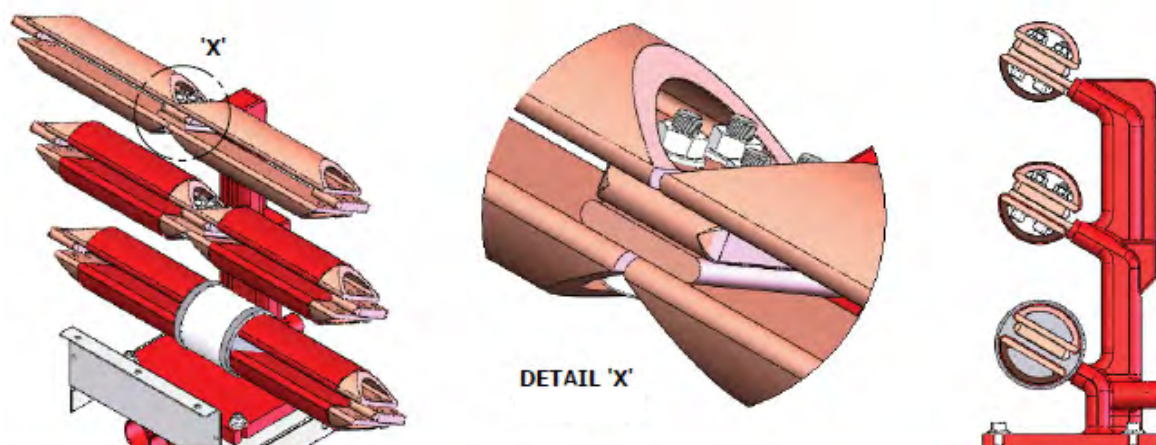


6/13. Typical Installation of the busbar ends

3150A...4000A Busbar
2 x (D100/12 copper bar)

80 x 60 x 15 mm copper spacer
(at intermediate and end joints)

M10 x 60 mm high tensile hexagon socket head screw	Torque = 50Nm
M10 hexagon nut grade 8.0	
M10 Belleville washers (under screw and nut)	

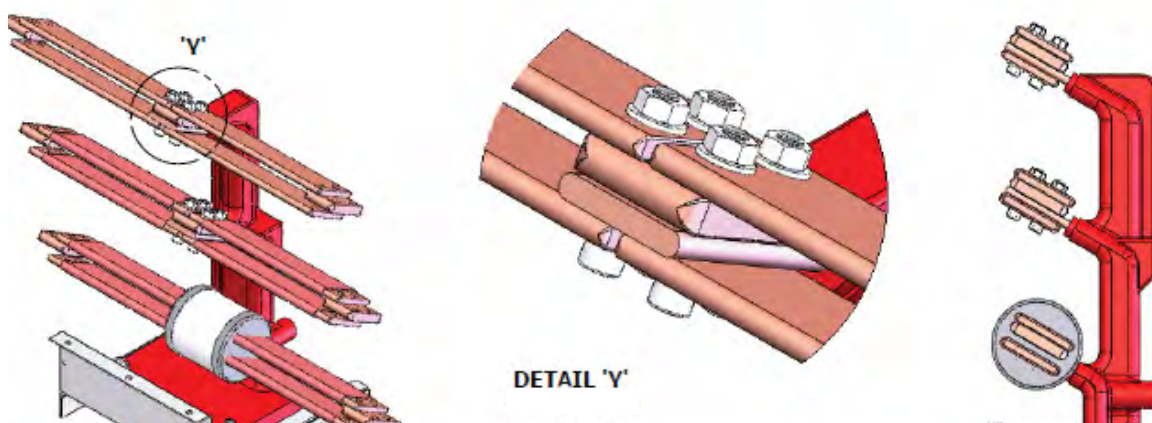


6/14. 3150A.....4000A Busbar arrangement

3150A...4000A Busbar
2 x (D100/12 copper bar)

80 x 60 x 15 mm copper spacer
(at intermediate and end joints)

M10 x 60 mm high tensile hexagon socket head screw	Torque = 50Nm
M10 hexagon nut grade 8.0	
M10 Belleville washers (under screw and nut)	

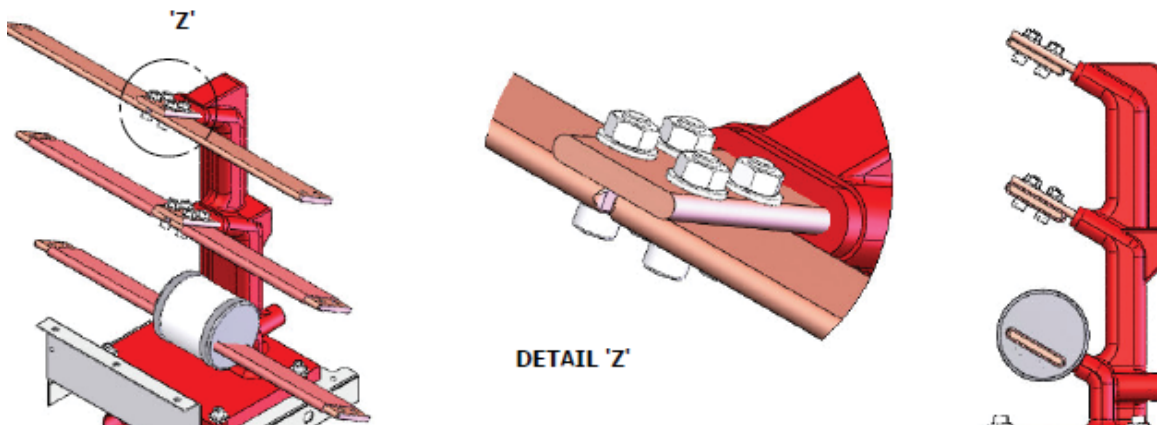


6/15. 1600A....2000A....2500A Busbar arrangement

1600A....2000A....2500A Busbar
2 x (80 x 10 mm round edge copper bar)

80 x 60 x 15 mm copper spacer
(at Intermediate and end joints)

M10 x 60 mm high tensile hexagon socket head screw	Torque = 50Nm
M10 hexagon nut grade 8.0	
M10 Belleville washers (under screw and nut)	



6/16. 1250A Busbar arrangement

1250A Busbar

1 x (80 x 10 mm round edge copper bar)

Copper spacer not required

M10 x 35 mm high tensile hexagon socket head screw	Torque = 50Nm
M10 hexagon nut grade 8.0	
M10 Belleville washers (under screw and nut)	

Any tightening torques which deviate from those in the general recommendation above (e.g. for contact systems or device terminals) must be taken into account as stated in the detailed technical documentation.

Access to busbars is possible from above after dismounting of the pressure relief flap.

Clean the insulation on the busbar sections with a soft, dry cloth, and check for insulation damage. Remove greasy or adhesive dirt as described in 9.3 Servicing.

Busbar connections:

- The silver plated surfaces of the connections must be cleaned with a metal-free non-woven cleaning cloth and thinly and evenly coated with Isoflex Topas NB 52 grease.
- Install the busbars panel by panel starting at the bottom bar and working upwards. Screw on the individual busbar elements one above the other (depending on the system layout) and in line with the flat branch conductor. Use the hexagonal socket head screws provided. See the table for the tightening torque. Use two dished washers for each screw.

Note: The connection of busbars is carried out with so called “stabilized connections”. This means that quality of the copper busbar connections does not change depending on the operating time and therefore it is not

necessary to inspect tightness of busbar connections regularly. But this is on condition that correct assembly is carried out as described above and especially that all connections are tightened with the prescribed torque.

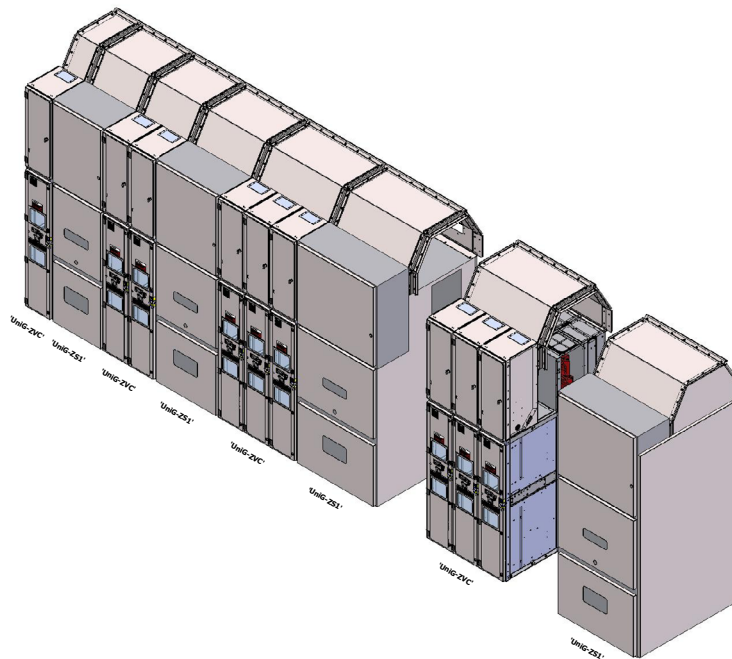
We recommend only inspecting tightness of busbar connections during repairs.

Replace pressure relief flaps ensuring the nylon bolts are used for fixing the rear of the pressure relief flap only.

6.6 Assemble pressure relief ducts

- The pressure relief duct is supplied dismantled in single parts. The rear and front wall correspond, as far as length is concerned, with the appropriate panel width. They are joined together by means of the attachment strips.
- The screw fixing material is contained in the “pressure relief duct” set of bags. Rivet nuts are already provided in the metal sheets.

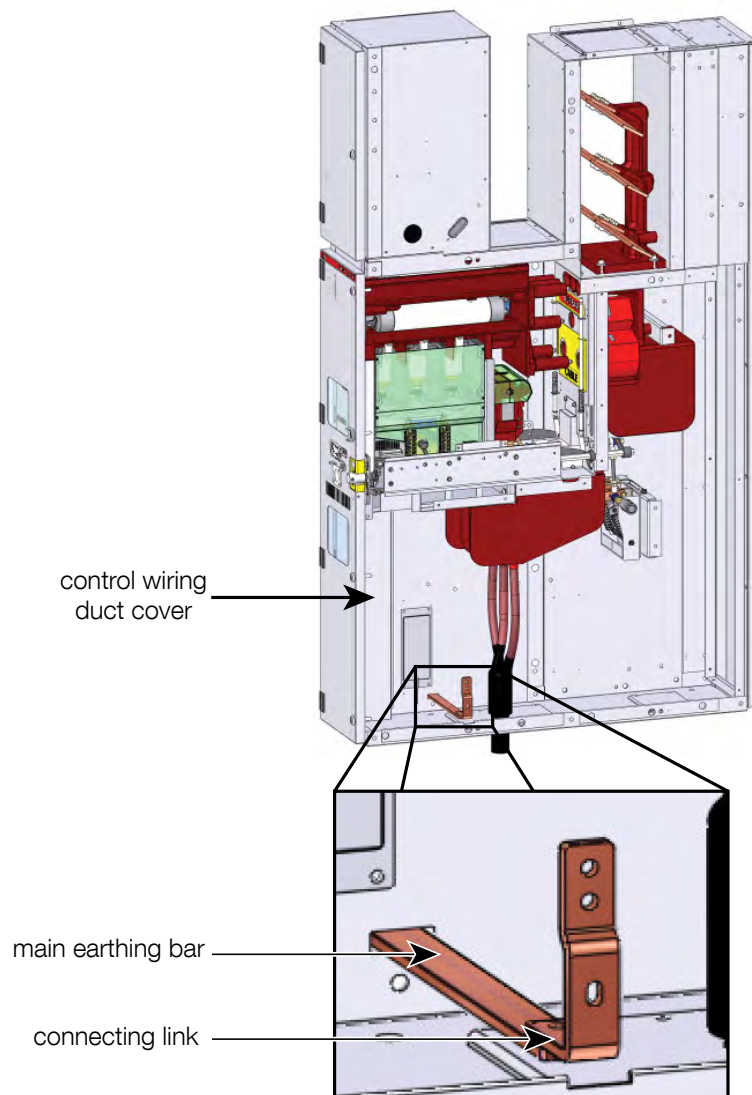
Note: Pressure relief locations in the switchroom are shown on the General Arrangement drawings of the contact. Refer to the figure below showing a typical arrangement with standard arc ducts. For more details of the assembly of UniGear switchgear arc ducts, refer to document 1VLM000034.



6/17. Typical arrangement with standard arc duct

6.7 Control cable connection

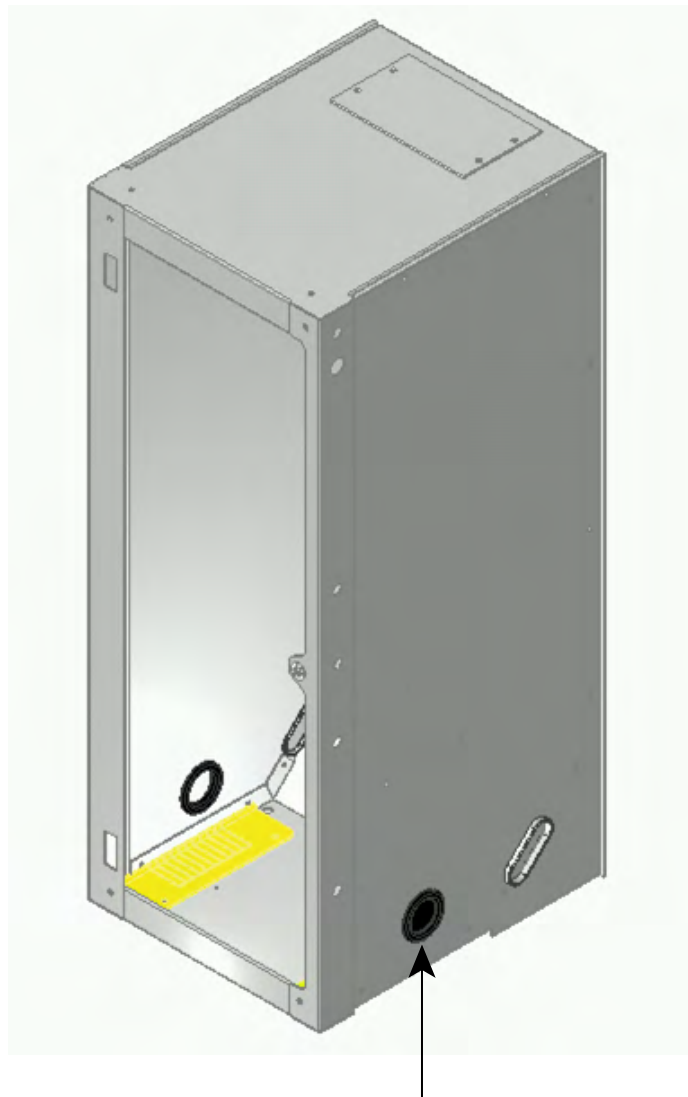
The control cables are conveyed into the panel through the control wiring duct 6/18 on the left-hand panel side.



6/18. Front bottom power cable entry configuration

Mounting procedure:

- Insert the cables into the control wiring duct 6/18 on the left-hand.
- Fasten the control cables at the top end of the duct, strip the insulation and convey cable control cores into the low voltage compartment D (4/12).
- Connect control cables to the terminal strip according to the circuit diagram.
- Make the control wiring connections to adjacent panels using bushing 6/19.

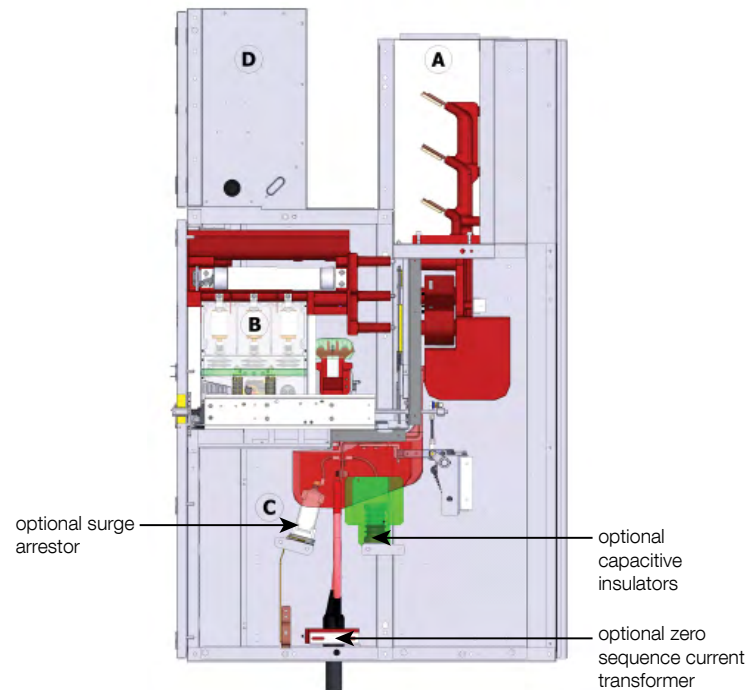


bushing on low voltage compartment
for interpanel wiring

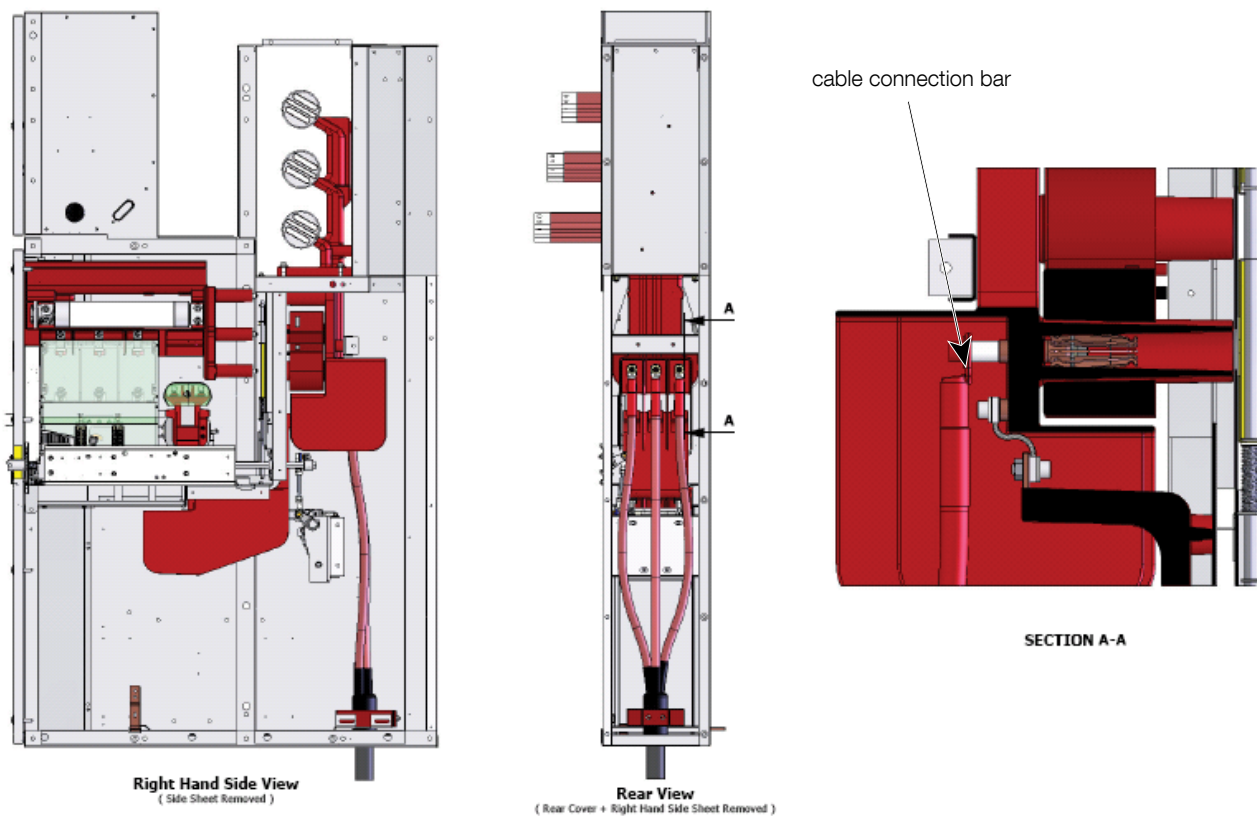
6/19. Low voltage compartment

6.8 Power cable connection

The standard method for entry of power cables in the switchgear is shown in 6/20 and 6/21. The cables are conveyed from below through a gland plate.

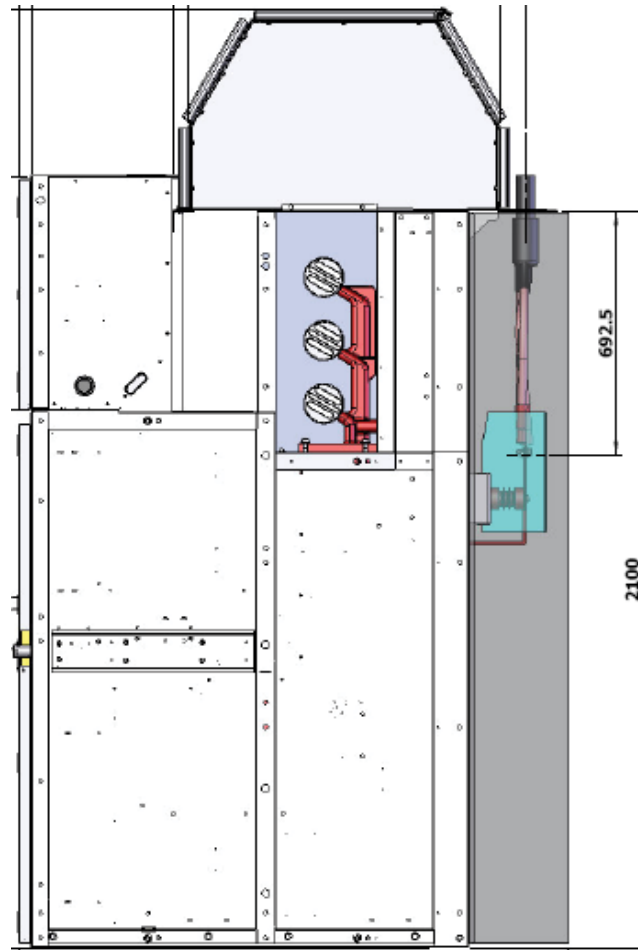


6/20. View with optional surge arrester, capacitive insulators and zero sequence current transformer



6/21. Rear bottom power cable entry configuration

A top rear entry power cable with gas duct is also available as shown in 6/22:



6/22. View with top rear power cable entry configuration

Cable sealing ends are mounted on the cable cores according to the manufacturer's instructions. It is possible to use cable sealing ends of different manufactures (e.g. Pirelli, Raychem etc.), but it is necessary to keep the length of the cable ends, including cable sealing ends, a suitable match to the length given by the distance of cable connecting bars or tags (6/18) from the gland plate (4/12).

The bars are equipped with M10 nuts. The earthing of cable screens is carried out directly to the earth bar adjacent to the cable entry position in the floor.

It is possible to place three fixed mounted surge arresters in the cable compartment. It is also possible to install voltage indication bushings here.

Connection of cables in typical panels:
Maximum;

One x three-core 240mm² plastic insulated cable

Or

Two x three-core 150mm² plastic insulated cables.



Important note!

Connection with three-core plastic insulated cables is presumed in the typical panels. In the case of any typical cable connections or of special cables (e.g. single-core cables, cables with paper or special insulation etc.), an agreement must be reached between the customer and manufacturer.

Mounting procedure for power cables:

- Power cables must be inserted, cut to length and stripped.
- Cable lugs must be connected to the prepared connections bars.
- Earthing of cables must be connected.
- Individual parts of the floor covering must be mounted.

6.9 Switchgear earth

- Connect main earthing bar with connections provided in every panel. Refer to 6/18.
- Connect the earthing conductor coming from the earth electrode, preferably via a removable bolted connection for testing purposes, to the main earthing bar of the switchgear.

6.10 Interpanel wiring

The interpanel wiring is supplied loose. They are marked and fitted with ferrules at both ends. Openings are provided in the side walls of the low voltage compartment for these lines to be looped through from panel to panel.

6.11 Erection check list

- Check painted areas of the switchgear for possible damage, touching up where required.
- Check bolt connections and tighten where required, in particular all those carried out during on-site erection of the busbars and earthing system.
- After the lifting lugs have been removed, the lth limiter auxiliary switch (if ordered) must be adjusted as required:
 - The auxiliary switch holder is fixed by means of screws in the panel.
 - The auxiliary switch holder must be positioned horizontally.
 - The control pin of the auxiliary switch must be moved to the centre of the hole in the pressure relief flap.
 - Adjust the auxiliary switch.
 - If the auxiliary switch is mounted and adjusted according to the above instructions, checking during regular inspections is not necessary.
- Clean the switchgear thoroughly.

- Remove all foreign bodies from the panels.
- Correctly replace all coverings, etc. removed during erection and connection.
- In the enclosure, any remaining openings must be closed if they are no longer needed.
- Check the isolating contacts and interlocking mechanisms for smooth motion, and grease again with Isoflex Topas NB 52 where necessary.
- Withdrawable fused contactors must be inserted and the control supply connected.
- Panels doors must be properly closed.

7. Operation of the switchgear



Note on safety at work

The relative work and operating procedures must be carried out carefully by trained specialists familiar with the installation, taking into account all the relative safety regulations according to the IEC and other relevant professional bodies, as well as any local and work regulations and instructions.

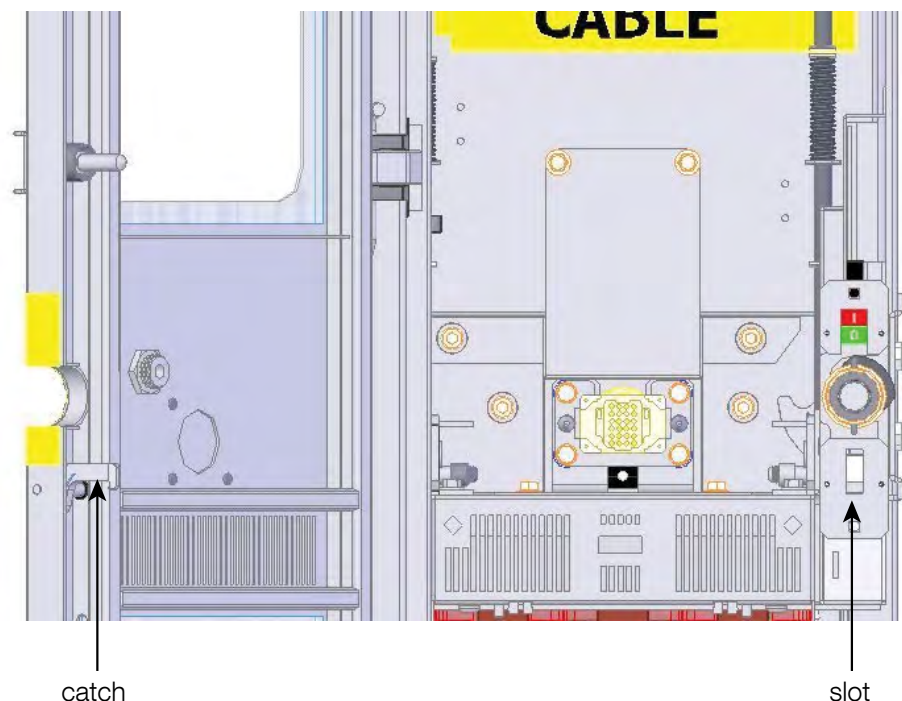
Note: Do not walk on the top surfaces of the switchgear panels (rupture points for pressure relief).

7.1 Switching operations

Carry out switching operations with the front doors closed.

7.1.1 Withdrawable fused contactor

Switching of the contactor is carried out via the control features fitted to the instrument compartment. The contactor status is indicated on the front of the contactor and can be viewed through the top viewing window. Switching operations can only be carried out with the withdrawable contactor in service or in the test position. We highly recommend that all switching be done with the front door closed.



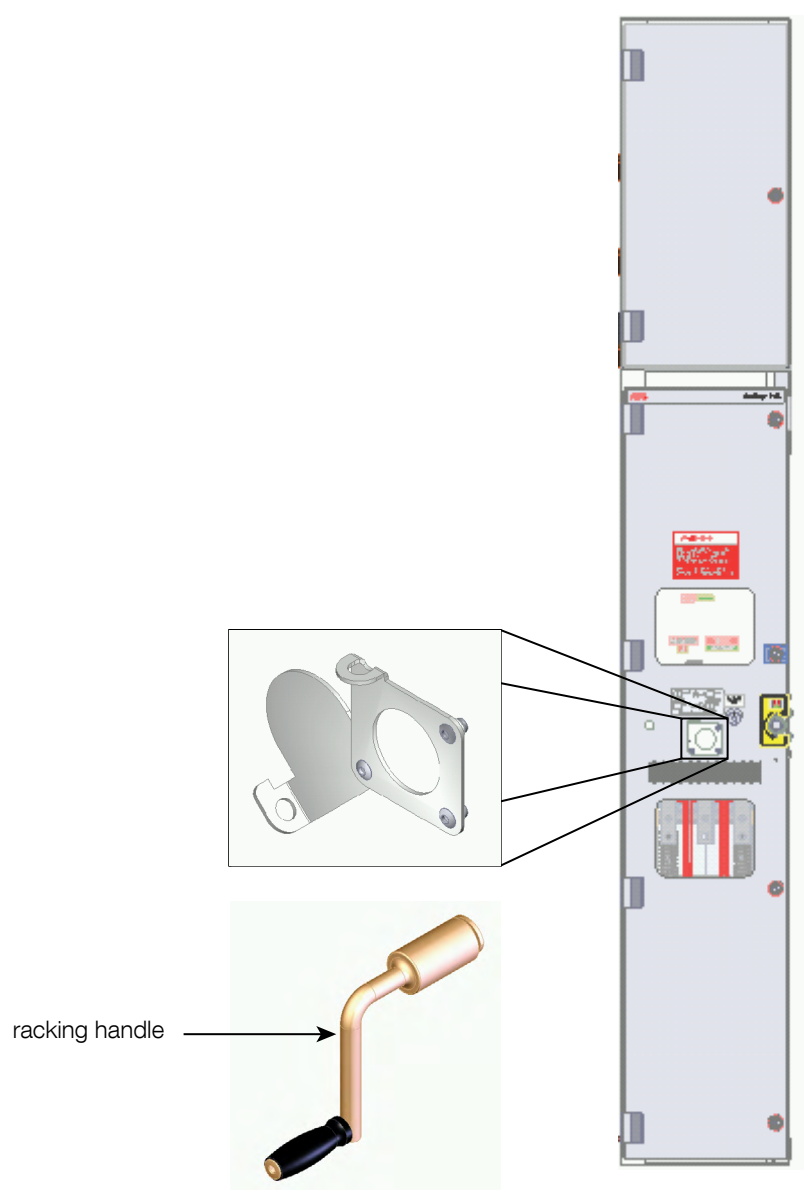
7/1. Operation of the door catch

For a mechanically latched contactor (optional), emergency opening (4/13) is achieved by using the special rod provided to operate the emergency manual trip operator fitted on the withdrawable contactor.

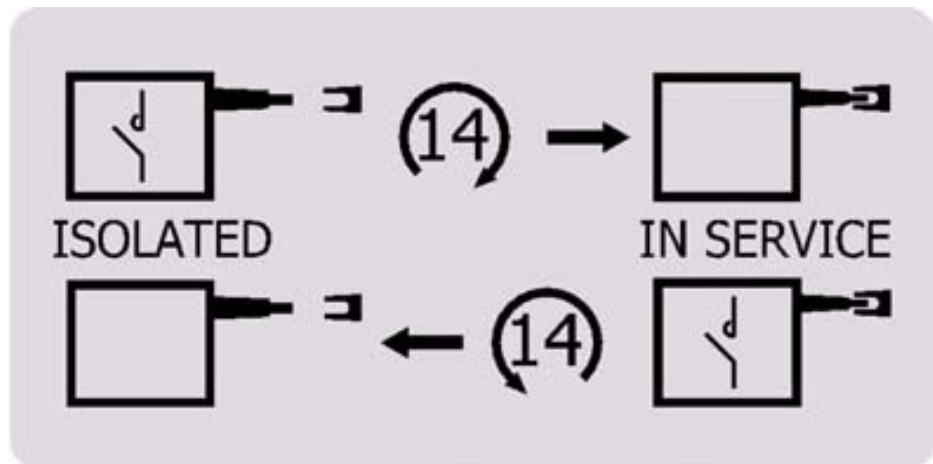
To rack the contactor truck from ISOLATED position into SERVICE position ensure the following:

- The contactor truck is locked using the double-bit key provided.

- The contactor compartment door is closed
- The earth switch is off
- The contactor is off
- The padlock is removed from the blocking plate covering the racking hole. Engage the racking handle (7/2) with the spindle and rotate the handle fourteen revolutions clockwise (7/3). While in service the contactor compartment door cannot be opened and the earth switch cannot be closed. To rack the contactor truck out of service into its test position please ensure the contactor is off. Insert the racking handle in the racking hole and rotate the handle fourteen revolutions anti-clockwise.



7/2. Racking of contactor truck



7/3. Operating contactor truck label

7.1.2 Racking from ISOLATED to IN SERVICE position

It is assumed the truck is in the ISOLATED position. The same label also indicates that you need to rotate the racking handle clockwise to put the truck in the SERVICE position.

Also the label specifies you need to rotate the racking handle clockwise for 14 rotations to reach the SERVICE position.

When the SERVICE position is reached the racking handle comes to a hard stop.

It is, therefore, recommended to rotate the racking handle clockwise till a hard stop is reached to ensure the contactor truck is in the designed SERVICE position.

The mechanical position indicator will show `IN SERVICE` in white letters on a red background.



7/4. Position indicator

Operational interlocks are set to function in the SERVICE position.



Caution!

If the truck has not been racked in 14 turns and the `IN SERVICE` label is not fully visible, the contactor should not be switched ON.

Where a voltage transformer (installed on the contactor truck) powers the control circuit, please note that this supply is active only when the contactor truck is in service. If supply is required to this circuit under other conditions we recommend

connecting a temporary test supply via terminals in the instrument compartment A. Truck position indication label as shown on the picture below is visible through the top viewing glass. Please note that the contactor cannot be closed while the truck is in an intermediate position indicated by the yellow position indication.



Important note

Insertion and withdrawal of contactors must be gradual, in order to avoid any shocks which could deform the mechanical interlock. If the operations are prevented, do not force the interlocks but check that the operating sequence is correct. The torque normally applicable to the insertion/withdrawing lever is 5 Nm.

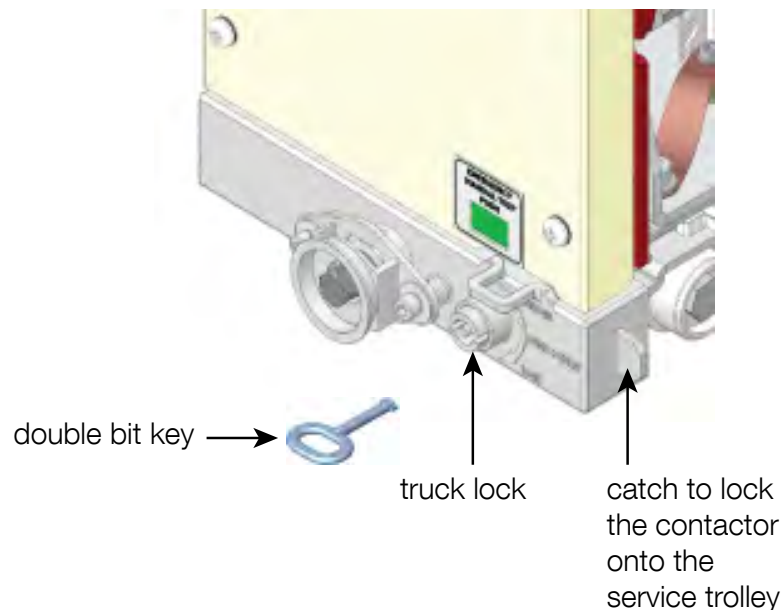


Caution

The insertion and withdrawal must always be carried out with the contactor open! Do not use force to move withdrawable modules fitted with locking magnet Y0 in the event of an auxiliary voltage drop. If this occurs, consult section 4.3.4 to remove the interlock.

Withdrawal from the ISOLATED position onto a service trolley:

- Open the door of the contactor compartment.
- Position service trolley with guide pins (7/6) of the adjustable bench top at the correct height facing the panel front, and push forward to engage.

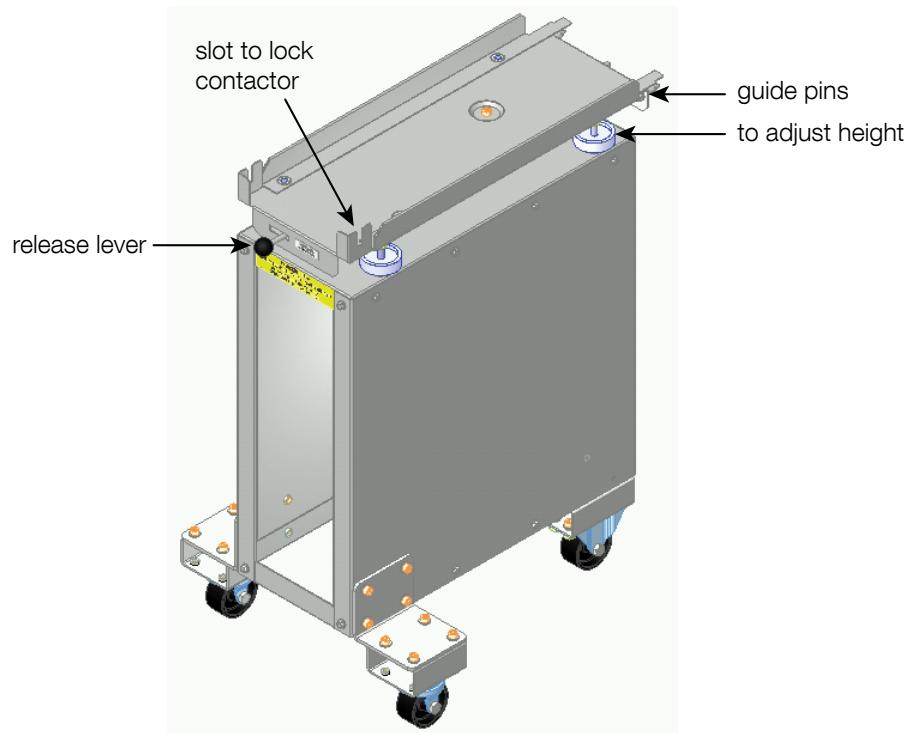


7/5. Service trolley engaged with the switchgear panel

- Insert the double-bit key (7/5), press inwards and turn counter-clockwise against the stop to release truck lock. Draw

the withdrawable truck out onto the service trolley and secure it in the slots by turning the double-bit key clockwise.

- Press release lever to the left to disengage the service trolley from the switchgear panel.
- Secure the position of the shutters with padlock (4/11).



7/6. Service trolley

Insertion from the service trolley into the ISOLATED position:

Open the contactor compartment door and move the contactor truck and trolley in front of the panel ensuring that its hinged part is locked into the slots in the partition plate under the contactor truck. Unlock the contactor truck using a double-bit key and push the contactor off the trolley into the panel. Lock the contactor truck into the panel, unhinge the trolley from the partition plate and remove the trolley.

7.1.3 Racking from IN SERVICE to ISOLATED position

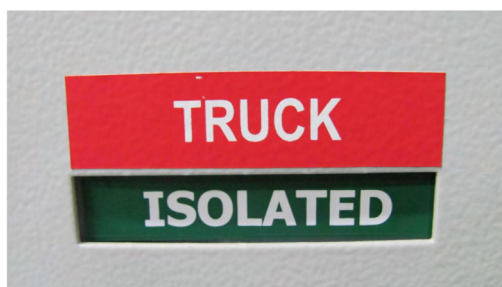
With the contactor IN SERVICE you need to rotate the racking handle anti-clockwise to withdraw the truck to the ISOLATED position.

Further the label indicates you need to rotate the racking handle anti-clockwise for 14 rotations to reach the ISOLATED position.

When the ISOLATED position is reached the racking handle comes to a hard stop.

It is, therefore, a good practice to rotate the racking handle anti-clockwise till a hard stop is reached to ensure the contactor truck is in the designed ISOLATED position.

The mechanical position indicator will show 'ISOLATED' in white letters on a green background.



7/7. Position indicator

In this ISOLATED position the operational interlocks are set to function.

The ISOLATED position is sometimes referred to as the TEST position because in this position switching tests can be carried out on the contactor while it is disconnected from the main busbars.

7.1.4 Motorised racking of V7 contactor truck

7.1.4.1 To put the truck in the panel:

- a. In case the busbar or cable shutters were padlocked, remove the padlock and ensure the shutters are free.
- b. Insert the Truck from the Service Trolley into the Panel.
- c. Lock the Traverse with the double-bit key. Ensure the blades are fully engaged in the left hand side and the right hand side.
- d. Close the door and fully tight the four screws.
- e. Open the earthswitch. Confirm the position by the mechanical indicator.

7.1.4.2 Pre-operation checks:

(These steps are recommended during installation only. After successful installation these steps are not required.)

- a. In case the truck is fitted with a racking blocking coil, make sure it is energized.
- b. Check that the MCB/fuse is as per the contract wiring diagrams and the MDC (Motor Drive Control unit) is energized.
- c. Make sure the contactor is open as shown by the mechanical indicator.
- d. Engage the racking handle and rotate it clockwise about 7 turns.
- e. Electrically give the 'RACK OUT' command. If the truck moves to the 'TEST' position then the motor connections are correct. In case the truck moves to the SERVICE position then the motor connections need to be reversed.

7.1.4.3 Operation

- a. Electrically give the 'RACK IN' command. Confirm the Truck moves forward to the 'SERVICE' position. Check the mechanical position indicator shows 'SERVICE'.

- b. Close the contactor. Confirm the correct operation with the mechanical 'I' indication. Open the contactor. Confirm the correct operation with the mechanical 'O' indication.
- c. Electrically give the 'RACK OUT' command. Confirm the Truck moves out to the 'TEST' position. Check the mechanical position indicator shows 'TEST'.
- d. In case of emergencies (e.g. auxiliary supply failure or motor burn out) the truck may be racked manually.

7.1.4.4 To remove the truck from the panel:

- a. Check that the mechanical position indicator shows 'TEST' and the contactor is open.
- b. Engage the racking handle and rotate it anticlockwise till you reach a hard stop.
- c. Close the earthswitch. Confirm its position with the mechanical indicator.
- d. Undo the four screws and open the door.
- e. Engage the service trolley with the panel. Undo the traverse with the double-bit key and roll the truck on to the trolley. Lock the traverse on the trolley.

7.1.5 Vacuum contactor – type V7

The V-Contact type V7 vacuum contactor is ideal for controlling loads requiring a high number of operations. The contactors basically consist of a moulded resin monoblock, where the vacuum interrupters, moving apparatus, control electromagnet, multi-voltage control feeder and auxiliary accessories are housed. The monoblock is also support for the HV fuses. Closing of the main contacts is carried out by means of the control electromagnet. Opening is carried out by means of a special opposing spring. The contactor can be equipped with electrical or mechanical latching.

The HV fuses are positioned in special chambers. The chambers can house two fuses per phase mounted in parallel configuration.

7.1.6 Vacuum contactor – type VSC7

The V-Contact type VSC7 vacuum contactor is ideal for controlling loads requiring a high number of operations. The contactors basically consist of a moulded resin monoblock, where the vacuum contactor is fitted. The monoblock is also support for the HV fuses. Closing and opening of the main contacts is carried out by means of a bistable electromagnetic drive. The electromagnetic drive can be configured to simulate electrical latching or mechanical latching of the contactor.

The HV fuses are positioned in special chambers. The chambers can house one fuse per phase.

7.1.7 Earthing switch – type ZVCE7

The earthing switch – type ZVCE7 – has a snap closing mechanism which is independent of the rotation of the drive shaft. An earthing switch (4/12) is only enabled for switching when withdrawable fused contactor is in the ISOLATED position or removed from the switchgear panel. Only turn earthing switch ON when the doors are closed.

Manual opening and closing:

- Engage the earth switch handle (refer to 9.6 Tools) with the operating shaft (4/12).

Note: Point the earth switch handle upwards or downwards on the hexagonal shaft so that there is sufficient room for movement of the operating lever even if space is limited at the sides.

- Turn the handle clockwise through 90° until the stop is reached to close the earthing switch, or anticlockwise until the stop is reached to open the earthing switch.
- Observe the mechanical/electrical switch position indicator.
- Remove earth switch handle.



Caution!

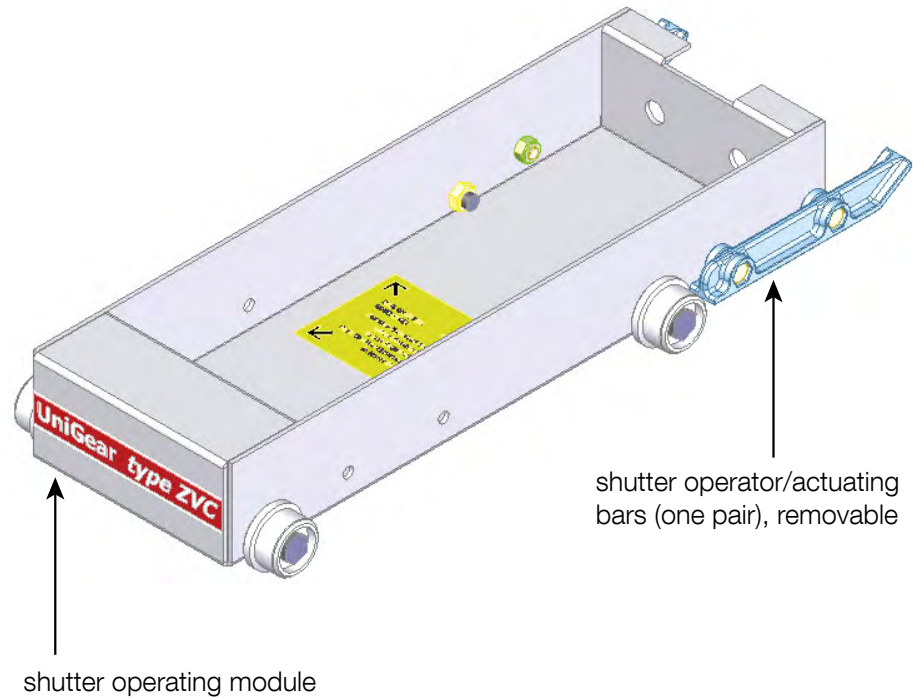
Make sure that the earth switch handle is turned right up to the stop in the opening process, to ensure that the earthing switch is in its defined limit position. The manual operating mechanism can also be fitted with a locking magnet.

If the operation is prevented, do not force the interlock and check that the operation sequence is correct.

7.2 Test procedure

7.2.1 Testing the off-circuit condition

In switchgear panels which are not equipped with capacitive insulators, checking the off-circuit condition is carried out with a HV tester on the tulip contacts (4/10), after the corresponding top shutter or lower shutter has been opened. Shutter opening can be carried out by means of module (7/8).



7/8. Shutter operating module

If the panels are equipped with capacitive insulators, checking the off-circuit condition can be carried out by means of this device. In this case, proceed according to the manufacturer's instructions or the indicators. (Optionally, switchgear can be equipped with various types of indicators coming from various manufacturers.)



Voltage indicator

7/9. Voltage indicator, placed on door of low voltage compartment.

In case of any doubt about correct operation of capacitive insulators, the off-circuit condition must be checked using a HV tester.

Checking the off-circuit condition must always be carried out in compliance with the relevant safety regulations and local operating conditions!

7.2.2 Current and voltage tests

Optional current test rod is available for carrying out current injection tests. It is suitable for supplying primary current to any current transformers which may be fitted during measurements in the protection circuit.

- Isolate and secure the working area in accordance with the IEC safety regulations.
- For primary current supply, fix the connecting cable of the test transformer to the current test rod.

Voltage insulating test can be carried out by applying test voltage directly on power cable connection flag.

- Isolate and secure the working area in accordance with the IEC safety regulations.

Note: With voltage tests at power frequency withstand voltage, carry out the following procedure:

- Disconnect any voltage transformers and capacitive dividers and cover them with an insulating plate.

8. Commissioning

8.1 Preparation

In preparation for commissioning, the following work must be carried out prior to connection with the high voltage power supply.

- Check the general condition of the switchgear for any damage or defects.
- Visually inspect the switching devices, withdrawable parts, isolating contacts, insulating parts, etc.
- Check connection of the main earthing bar to the installation earthing conductor (following the appropriate safety regulations).
- Check the paintwork for damage and, where necessary, touch up as described in 9.4 Repairs.
- Remove all residues of materials, foreign bodies and tools from the switchgear.
- Clean the switchgear, rubbing down insulating parts with a soft, dry, clean, non-fraying cloth. Remove any greasy or sticky dirt as described in 9.3 Servicing.
- Correctly remount all covers etc. removed during assembly and testing procedures.
- Perform AC voltage testing of the main circuits according to IEC 60298 where necessary. Pay special attention to voltage transformers and cables, etc. during this procedure.
- Switch the auxiliary and control voltage on.
- Carry out testing operations on switching devices manually or by electrical control, and simultaneously observe the relative position indicators.
- Check mechanical and electrical interlocks for effectiveness, without using force.
- Set the protective devices in the switchgear to the required values and check their function with test equipment.
- Check readiness for operation and switching status of electrical systems upstream and downstream of the switchgear.
- Instruct local operators regarding the basic details of regular handling of the switchgear.



Warning

If the inspection gives negative results, do not put the apparatus into service but, if necessary, contact ABB's Customer Service Department.

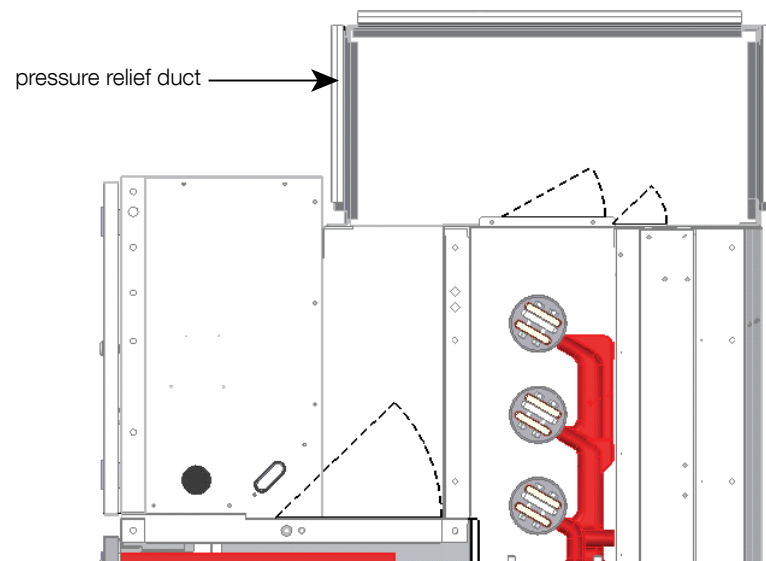
8.2 Measurements and tests

Tests at site are mandatory prior to energization of the switchgear.

The main purpose of site tests in general is to make sure the switchgear is ready for energization, not to repeat the factory testing and confirm the factory results.

For manufacturer's recommendation of test scope and method please contact ABB's Service Department.

After performing the tests, make sure that all normal service conditions are restored.



8/1. Schematic diagram of the pressure relief duct.

9. Maintenance

9.1 Strategies

9.1.1 Preventive maintenance

is maintenance carried out at predetermined intervals or according to prescribed criteria, aimed at reducing the failure risk or performance degradation of the equipment.

This method is based on scheduled activities performed on the out-of-service equipment including: visual checks, apparatus cleaning, mechanical components lubrication, worn parts replacement and routine tests.

9.1.2 Risk-based maintenance

is maintenance carried out by integrating analysis, measurement and periodic test activities with standard preventive maintenance.

The gathered information is viewed in the context of the environmental, operation and process condition of the equipment in the system. The aim is to perform the asset condition and risk assessment and define the appropriate maintenance tasks.

9.2 Inspection



Caution

The switchgear should first be de-energised in accordance with the site procedures and the recommendations in the ZVC Operating Manual.

The checks listed below must be carried out by ABB personnel or suitably qualified client staff.

During normal service the contactors are maintenance-free.

The frequency of inspection will depend on service conditions including frequency of operations, the value of the interrupted current, the power factor and installation ambient.

It is strongly advisable to keep a maintenance card and service book for each unit where the anomaly and the corrective action are listed with dates. These records are invaluable in case of investigations of later events on the switchgear.

General guidelines are given in the table below:

	Description	Interval	Operation
1	Carry out 5 mechanical closing and opening operations	1 year	The contactor must operate normally.
2	Visual inspection of the insulating parts	3 years	The insulating parts must be free of any accumulation of dust, dirt, any cracks, traces of surface discharges or damage.
3	Visual inspection of the structure and mechanisms	3 years	The elements must be free of any deformation, accumulation of dust, dirt or any damage. The screws, nuts and bolts must be tightened correctly.

	Description	Interval	Operation
4	Inspection of the interrupter	3 years	Check that the interrupter is free of any accumulation of dust, dirt, cracks, traces of surface discharge or damage.
		In case of accidental impact	Carry out a voltage test with the contacts open at 15 kV - 50 Hz for 1 minute. If there is a discharge during the test, the interrupter must be replaced since this phenomenon means a deterioration in the degree of vacuum. If necessary, contact ABB service.
5	Erosion of the interrupter contacts	3 years or 500,000 trips at the rated current	Refer to section 9.2.2 below.
6	Auxiliary contacts	3 years	Check correct operations and signals.
7	Auxiliary circuit conductors	5 years	Check whether the cable ties are loose or broken and check the connections are tight.
8	Contact spring	5 years	Check the seal over the spring register is intact
9	Power connections	3 years	Check tightness and absence of any traces of overheating or oxidation:
10	Earthing contact	3 years	Check tightness of the connections.
11	Insulation resistance	3 years	As per routine test report
12	Opening pushbutton of the mechanical latching (if provided)	1 year	Close the contactor and carry out the opening operation (emergency). The contactor opens normally.

9.2.1 Special conditions

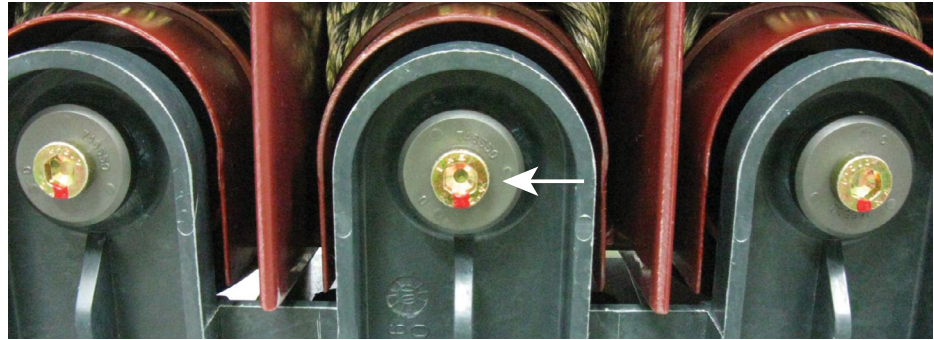
- On panels with ventilation devices, check flap for correct operation.
- With regard to the switching devices, their separate instruction manual should be followed.
- Check all switchgear accessories and auxiliary devices (e.g. storage batteries).
- No partial discharge must occur on the surfaces of equipment at operating voltage. This can, for example, be detected by characteristic noises, a clearly perceptible smell of ozone, or visible glowing in the dark.
- Visually check the contact system. The contact points should be cleaned if signs of overheating (discoloured surface) are visible (see 9.4 Repairs).
- If any irregular conditions are detected, then relative repair measures must be taken.



Caution

At no stage should a tool (eg Allen Key or Ratchet Spanner) be used to check the tightness of the Bolt, as the seal will be broken and the adjustment disturbed.

9.2.2 Vacuum Interrupters of ZVC/V7



9/1. View from right hand side of the truck

Check that the red mark is vertical as shown (either 6 o'clock or 12 o'clock).

With the contactor in the closed position measure the gap between the bolt head and the washer. When the gap is zero, the vacuum interrupters need to be replaced. The replacement can only be done in the ABB factory.

A dielectric test by itself cannot be confirmation that the interrupters have to be put back into service after a fault.

Carry out a voltage test with the contacts open at 15 kV - 50 Hz for one minute. If there is a discharge during the test, the interrupter must be replaced because this type of phenomenon corresponds to deterioration in the degree of vacuum. In case of need, contact ABB Service.

Should this test also be positive, it is reasonable to put the interrupters back into service following a fault.

9.3 Servicing

If, during the course of an inspection in accordance with 9.2 Inspection, the need for cleaning measure has been established, proceed as follows:

- Where necessary, the working area must be switched off and secured against reconnection in accordance with the "Safety Regulations" specified by IEC and appropriate national standards before cleaning.
- Clean the surfaces in general:
 - Weakly adhering dry dust deposits: with a soft dry cloth.
 - More strongly adherent grime: with mildly alkaline household cleanser or with ETHANOL F 25 M.
- Clean insulating surfaces and conductive components with ETHANOL F 25 M.
- Wipe down after cleaning, using clean water, and dry properly.
- Should partial discharges occur as a result of condensation, application of a thin silicone film on the surface concerned is often effective as a temporary remedy. It is advisable to ask the ABB after-sales service department for advice regarding permanent solutions to this type of unusual problem.

9.4 Repairs

Repair of surface damage:

- Carry out repair work immediately after a defect has been discovered.
- Completely remove all rust from damaged paintwork areas on steel sheet and other steel parts by mechanical means, e.g. with a wire brush.
- Lightly grind the surrounding paint coat and carefully degrease the entire area. Then immediately apply an anti-rust primer and, after an appropriate hardening time, apply the top coat. Only use suitable and compatible paint products.
- Apply the top coat in standard RAL 7035 colour, or the relevant special colour.
- Carefully remove any white rust on aluminium/zinc surfaces with a wire brush or cleaning pad, e.g. Scotch-Brite, and clean loosely adhering particles with a dry, non-fraying cloth. Next treat the cleaned parts with zinc spray or zinc powder paint and, finally, treat with aluminium spray for colour matching.
- Carefully remove any white rust from passivated operating parts and rust formation on phosphatised parts with a wire brush or metal-free cleaning pad, e.g. Scotch-Brite, and clean with a dry cloth. Then grease evenly (with Isoflex Topas NB 52).

9.4.1 Switchgear in general

- Follow the maintenance instructions in the manuals for individual equipment components.
- Check that the bolt connections at the contact points in the busbar system and the earth connections are tight, and that the contact system functions correctly.
- Where necessary, grease slide plates and bearings in the panel again or thoroughly clean them. Then grease them again with Isoflex NB 52 lubricant.
- Top up grease on contact areas in the contact system when corroded or otherwise as necessary, or, when lubrication is inadequate or missing, thoroughly clean the areas concerned and grease them again with Isoflex Topas NB 52 lubricant.

9.4.2 Replacement of complex functional groups

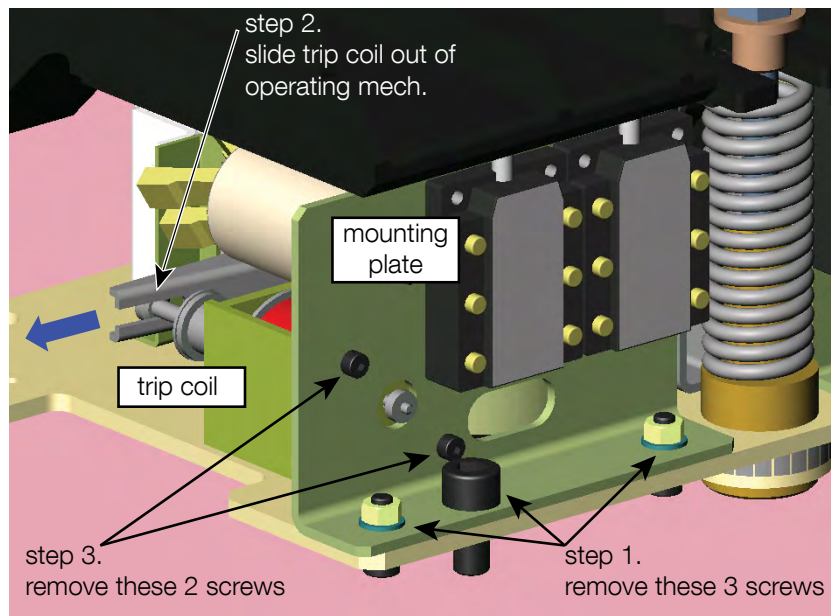
Precise matching of functions for control, interlocking and signalling only permits replacement of individual components to a limited extent.

The contactor truck, earth switch and interlocking assemblies are prefabricated and tested at the works, maintaining high quality standards. In the case of faults, they must therefore be serviced or completely replaced by ABB certified technicians.

9.4.3 Replacement of parts

9.4.3.1 Trip coil replacement for V7/ZVC

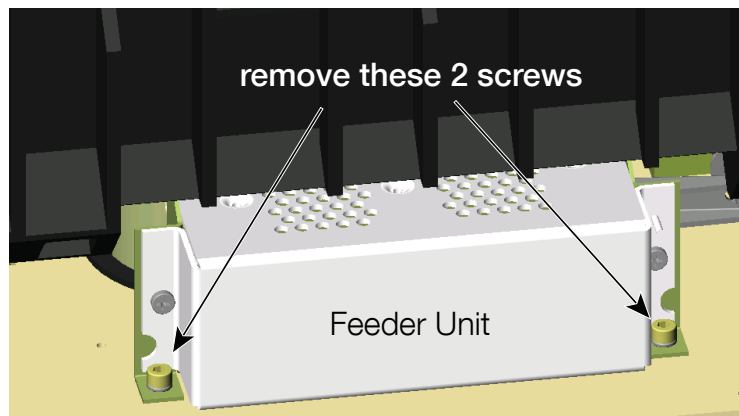
Undo the three screws (step 1) attaching the microswitches' mounting plate to the truck traverse (on the left-hand side of the truck looking from the front). Slide trip coil out of the trip operating mechanism (step 2), disconnect its wires and remove the two screws holding it to the mounting plate (step 3). Fit the new trip coil reversing the steps taken in the removal process.



9/2. Trip Coil

9.4.3.2 Feeder unit replacement V7/ZVC

Undo the two screws holding the feeder unit to the truck (on the right-hand side of the truck looking from the front). Remove feeder unit from the truck and disconnect its wires. Fit the new feeder unit reversing the steps taken in the removal process.



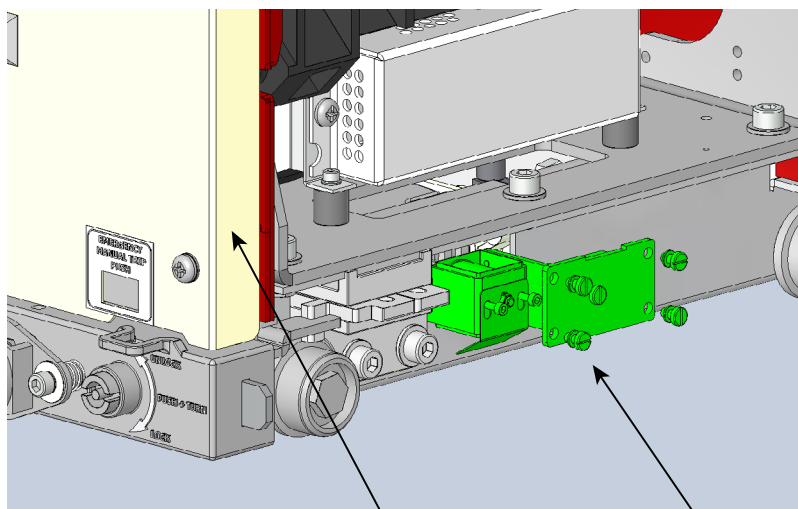
9/3. Feeder Unit

9.4.3.3 Fuse replacement V7/ZVC and VSC7/ZVC

If a fuse is blown we recommend that all fuses on the truck are replaced. Unbolt the four screws connecting each fuse to the moulding and remove each fuse. Replace with new fuses ensuring that the fuse's striker pin is nearest the front of the truck and the majority of the fuse is facing into the moulding. Where two fuses per phase are used, the fuses are fitted, in the same way, back-to-back. Respect the torque limits on the label (25 Nm).

9.4.3.4 Racking blocking coil replacement for V7/ZVC and VSC7/ZVC

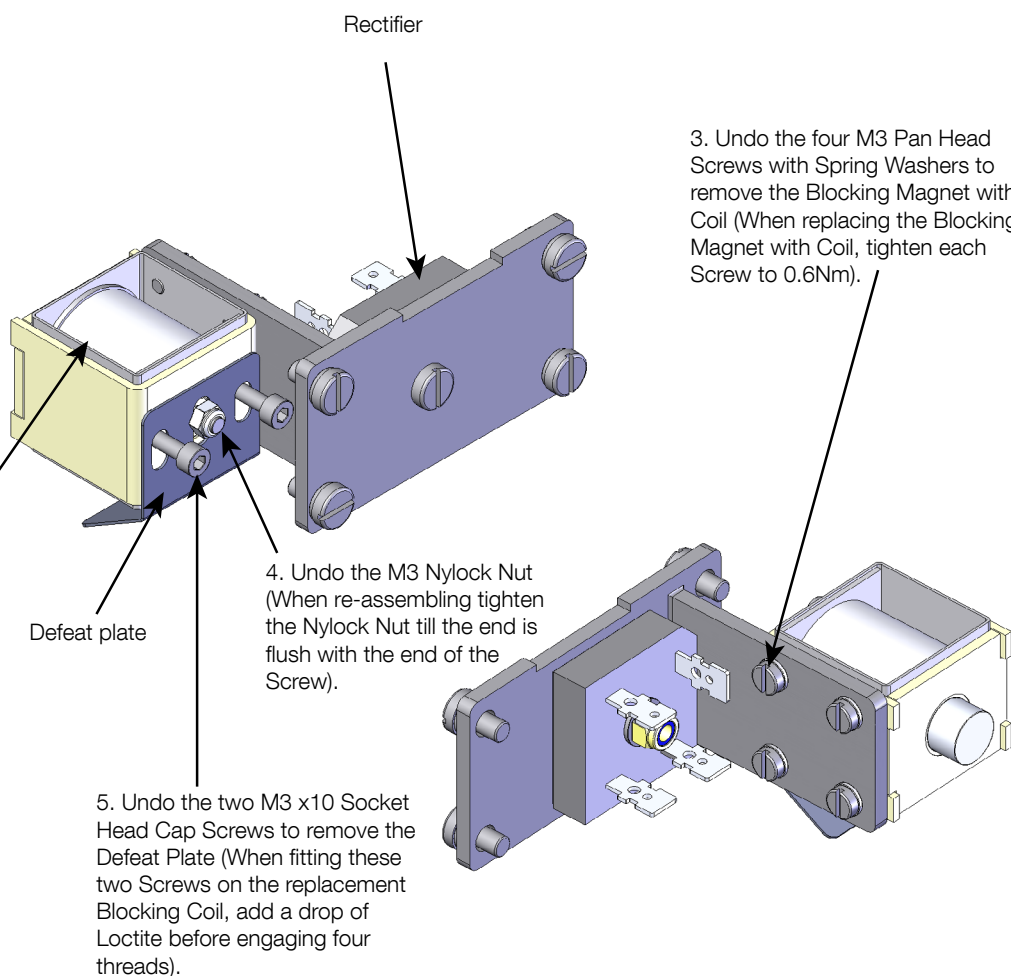
Ensure the voltage rating of the replacement matches that of the original racking blocking coil. Follow the procedure described in the illustrations shown.



1. Remove the Truck from the Panel to the Service Trolley following the safety procedures in the Operating Manual. Securely place the Truck on a Work Bench.

2. Undo four M4 Pan Head Screws with Spring Washers & remove sub-assembly (When replacing sub-assembly tighten each Screw to 1.4Nm).

9/4. ZVC racking blocking coil replacement 1 of 2



3. Undo the four M3 Pan Head Screws with Spring Washers to remove the Blocking Magnet with Coil (When replacing the Blocking Magnet with Coil, tighten each Screw to 0.6Nm).

4. Undo the M3 Nylock Nut (When re-assembling tighten the Nylock Nut till the end is flush with the end of the Screw).

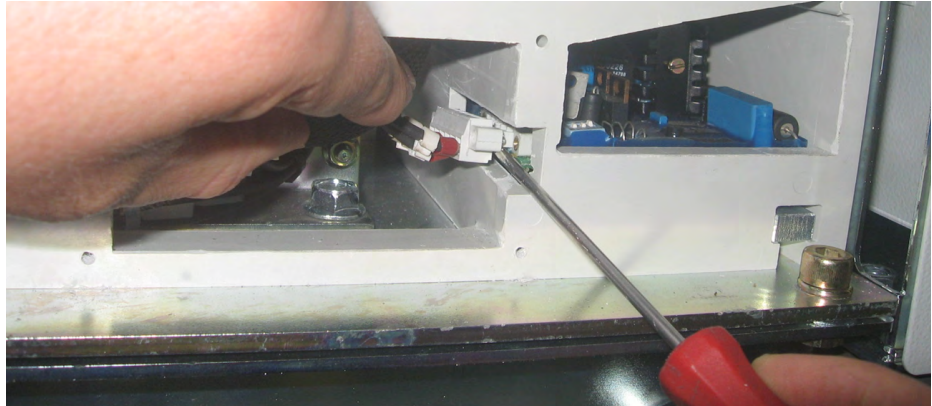
5. Undo the two M3 x10 Socket Head Cap Screws to remove the Defeat Plate (When fitting these two Screws on the replacement Blocking Coil, add a drop of Loctite before engaging four threads).

6. Disengage the two leads of the Coil from the (+) & (-) terminals of the Rectifier (When fitting the replacement Coil engage the two leads with the terminals of the Rectifier).

9/5. ZVC racking blocking coil replacement 2 of 2

9.4.3.5 Feeder unit replacement VSC/ZVC

1. On the left hand side of the Truck remove the polycarbonate sheet, undo the 2 connector screws and disconnect it.



9/6. Drive unit connector

2. Undo the 2 socket head cap screws to disengage the mechanical ON/OFF linkage.

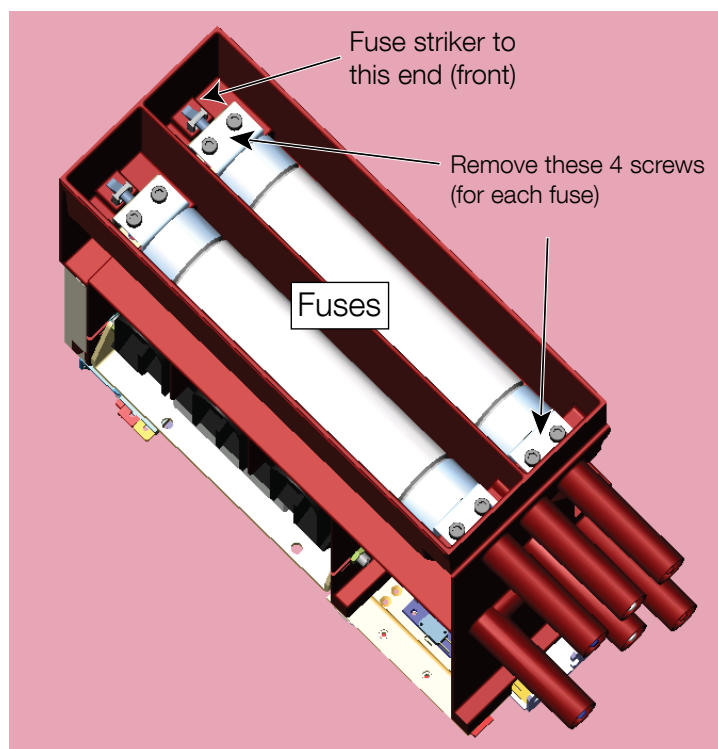


Caution

Ensure the replacement feeder unit is of the same voltage and configuration.

9/7. Mechanical ON/OFF linkage

3. Remove the earthing connection.
4. Draw out the feeder unit.
5. Follow the steps described above (1 to 4) in reverse order.
6. Make sure the mechanical ON/OFF linkage is fitted with the contactor ON.
7. Check the operation of the contactor before returning it to service.



9/8. Fuses module

9.5 Spares, auxiliary material and lubricants

9.5.1 Spare parts

A spare parts list is available on request for procurement of spare parts. It basically includes moving parts and parts subject to wear. When parts are required, the serial number of the relative switchgear or switching device should always be quoted.

9.5.2 Auxiliary materials, lubricants

Lubricant: Isoflex Topas NB 52

Halogen-free cleansers: ETHANOL F 25 M (for general cleaning)

Touch-up paint: Standard colour RAL 7035

9.6 Tools



6E0635: trip release operator

6030792: door key

GCE8004261R0101: door key with handle

6030667: racking handle

6030699/C: earth switch handle

6500831: DT lower truck operating handle

6050192: racking handle for motorised truck

6351108: emergency manual trip handle for ZVC/VSC7

10. Troubleshooting

10.1 Truck cannot enter cubicle.

10.1.1 Current interlock code of the contactor truck.

Solution: Select contactor truck of correct current rating.

10.1.2 Racking mechanism not closed against the front of the truck.

Rotate racking handle to the anti-clockwise stop.

10.1.3 Truck on service trolley

Truck is not parallel with the rails, adjust the height on the service trolley.

10.2 Truck cannot be locked in cubicle.

10.2.1 Earth switch is at the open position.

Close earth switch.

10.2.2 Truck on service trolley.

Push truck inside panel and using inertia, turn truck lock clockwise using double-bit key.

10.3 Truck cannot be racked in.

10.3.1 Handle not fully engaging the racking screw shaft.

Push firmly on the handle. Maintain positive forward pressure on the handle during rotation.

10.3.2 Truck locking bars not fully extended.

Rattle the truck in position and make sure the key spindle pops out at the clockwise stop.

10.3.3 Shutters padlocked.

Remove padlocks.

10.3.4 Front door not completely closed.

Tighten door screws.

10.3.5 Earth switch is closed.

Open earth switch.

10.3.6 Racking hole padlocked.

Remove padlock.

10.3.7 Contactor on.

Open contactor.

10.3.8 Truck with blocking coil.

Energise blocking coil.

10.4 Truck cannot be removed from cubicle.

10.4.1 Truck not fully in isolated/test position

Rotate racking handle to anti-clockwise stop.

10.4.2 Truck locked in cubicle

Unlock truck.



Caution

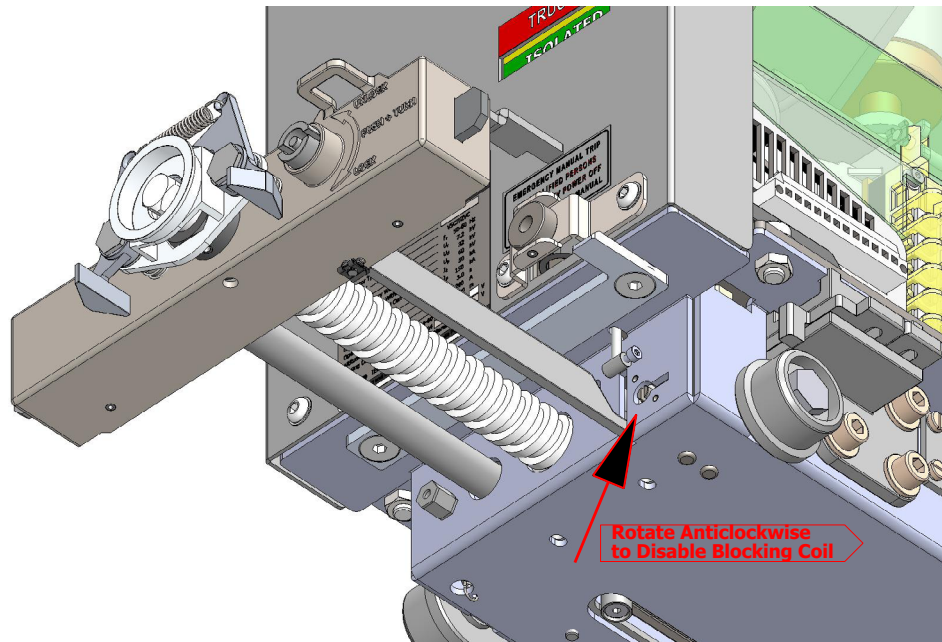
It is strongly recommended the main busbar is shut down before opening the panel front door.

10.4.3 Racking blocking coil defective when truck is in SERVICE position.

Switch the contactor OFF.

Open the panel first door in accordance with the site safety procedures.

Use a screw driver to defeat the racking interlock as shown in the picture



10/1. Truck in SERVICE position

Close the front door

Withdraw the contactor from SERVICE to TEST/ISOLATED position

Replace the racking blocking coil as described at 9.4.3.4

10.4.4 Contactor on.

Open contactor.

10.5 Vacuum contactor cannot be closed.

10.5.1 Racking operation not completed. (mechanical and electrical block).

Rotate handle fully to stop.

10.5.2 Secondary control plug damaged.

Check secondary control plug for damage.

10.5.3 No control supply available.

Check control fuses.

10.5.4 Fuse blown auxiliary switch not reset.

10.5.5 Vacuum contactor auxiliary switches inoperative.

Check operation of auxiliary switches. Replace if necessary.

10.5.6 Open circuit close coil.

Contact ABB to replace close coil.

10.6 Earth switch cannot be closed

10.6.1 Earth switch operating hole cover is padlocked.

Remove padlock.

10.6.2 Truck in service or intermediate position.

Rack truck out to hard stop in ISOLATED position.

11. Environmental protection

The UniGear type panels are produced in compliance with the requirements of international standards for the quality management system and environmental management system. In these fields, the excellence level is proved by quality certificates according to ISO 9001 and by the EMS according to ISO 14001.

End of life of product

ABB is committed to complying with the relevant legal and other requirements for environment protection according to the ISO 14001 standard.

The duty of the company is to facilitate subsequent recycling or disposal at the end of product life.

During disposal of the product, it is always necessary to act in accordance with local legal requirements in force.

We recommend the following methods of disposal: thermally in an incineration plant or by storing on a waste site.

RAW MATERIAL	RECOMMENDED METHOD OF DISPOSAL
Metal material	Separation and recycling
Thermoplastics	Recycling or disposal
Epoxy resin	Separation of metal material & disposal of the rest
Rubber	Disposal
Packing material wood	Recycling or disposal
Packing material foil	Recycling or disposal

For your notes

For your notes

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