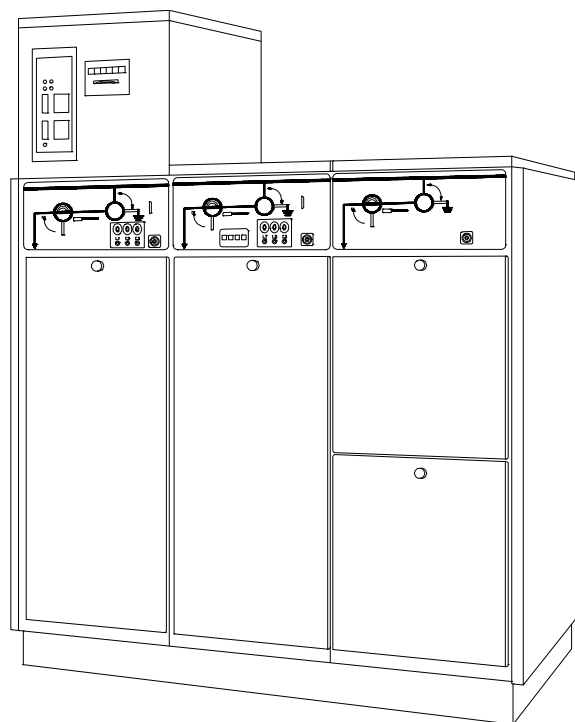




Holec

Medium Voltage switchgear Coupling and extending, type Innovac SVS

Manual 991.129 D



User manual Coupling and extending MV switchgear, type SVS

991.129 D

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Installation, connection, operation, checking, commissioning, decommissioning and maintenance of medium-voltage, type Innovac SVS, switchgear should only be carried out by suitably qualified personnel.

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1. INTRODUCTION

1.1 GENERAL SYSTEM DESCRIPTION

The SVS system is a metal enclosed, epoxy resin insulated switching system with fixed built-in vacuum circuit breakers. The system is not only suitable for electricity companies, but also for industry and utilities. The system is suitable for the medium-voltage range, that is for rated voltages of up to 24 kV, with the panels capable of carrying a rated current of 630 A.

1.1.1 MODULAR CONSTRUCTION

The SVS system is of a modular construction. This enables any combination and sequence of panels. An installation is delivered in sections of up to 7 panels. The sections are completely mounted, assembled, wired and tested. Thanks to this modular construction it is also possible to add one or more panels to existing installations.

1.1.2 DESIGN

The SVS system is in accordance with the applicable regulations as to safety, reliability in operation and environment.

The aspects incorporated in the design are summarised below.

Insulation

The live primary components are insulated by means of epoxy resin, which will prevent failures due to an open arc. All connections between the primary components have rubber sleeves. Thus a constant safe insulation level is maintained throughout the switchgear and the SVS system can be categorised as 'compartmented switchgear and controlgear' (IEC 60298).

The earthed metal enclosure guarantees physical safety during normal operation (IEC 60298).

Mechanical interlocks

Thanks to the built-in mechanical interlocks specific jobs like the earthing of cables and the replacement of fuses can only be done in a safe way. The mechanical interlocks also prevent any unauthorised switching operations.

Connections

The SVS panels can be connected in two different ways:

- by means of cables with plugs.
- For this purpose, the SVS is fitted with connection cones (DIN 47636 and CENELEC pr EN 50181/1994).
- by means of Eaton Holec Magnefix cable boxes.
- In this case the SVS is fitted with interlocked shutters. These will remain closed until the cable is safely earthed.

Materials

All the materials used in the SVS system are - by today's standards - environment-friendly; not just during use, but also at the end of their technical lifetime.

Transport

An SVS installation can be transported in sections of up to 7 panels. Each section can be provided with four lifting eyes or a lifting frame. If there is no lifting equipment available, transport by means of a fork lift truck, braces with transport wheels or steel rollers is possible as well.

Arrangement

The panels can be placed on a flat floor and be fixed with wedge bolts. All installation jobs are carried out from the front of the installation.

1.1.3 OPERATION

Each panel has a control panel. This panel contains the mimic diagram and the necessary controls and indicators. The mimic diagram enables easy recognition of the panel type.

1.1.4 SEPARATE COMPARTMENT FOR SECONDARY EQUIPMENT

Secondary equipment, like protective relays and measuring instruments, can be accommodated in a separate compartment on top of the panel. The auxiliary cables are connected to the terminal strips at the bottom of the panel.

1.2 USING THE MANUAL

1.2.1 TARGET GROUP

The SVS system is developed for use by personnel suitably qualified or trained in electrical operations.

Persons considered to belong to this group: any authorised persons, team leaders, operators and responsible experts. See chapter 8 - Glossary for a description of these concepts.

The user's manual is meant for this target group.

1.2.2 STRUCTURE OF THIS MANUAL

This manual describes the linking and extension of SVS switchgear.

For subjects like operation, connection, commissioning and decommissioning, inspection and maintenance, please refer to the manual

991.137 C - Medium-voltage switchgear, type SVS. The structure of this manual is explained below.

- Chapters 1 and 2 contain general information on the system (design and construction), the manual and general safety aspects. The information is presented in text form, supported by illustrations as necessary. The illustrations are numbered consecutively and subtitled, if necessary, for each chapter.
- Chapter 3 - System assembly
The manual is based on the assumption that linking and extension is done by the user. That is why these operations are described in detail using step-by-step procedures. The procedures describe the individual operations in the exact sequence in which they are to be performed. Illustrations are on the same page as the relevant step and have the same number.

- For chapters 4, 5 and 6, please refer to the manual 991.137 C - Medium-voltage switchgear, type SVS.

- Chapter 7 - Accessories

This chapter contains a summary of available accessories.

The other chapters, viz. chapters 8 and 9, are explanatory chapters of a general nature.

- Chapter 8 - Glossary

This chapter contains clarifications on specific concepts used, but not explained further, in the manual.

- Chapter 9 - Appendix

This chapter shows the structure of an information package that may be supplied with the system.

REMARK

It is important to read through all actions first, using the relevant figures. Please contact Eaton Holec if you do not understand what you are expected to do.

NOTE

Never take any action without knowing what the consequences will be.

1.3 SAFETY INSTRUCTIONS

1.3.1 APPLICABLE REGULATIONS

The SVS switchgear is developed in compliance with EC safety directives. The SVS switchgear meets:

- IEC 60694 Common specifications for high voltage switchgear and controlgear standards (prHD448), for general regulations.
- IEC 60265-1 High voltage switches for rated voltages above 1 kV and less than 52 kV (HD355.1), as a load-break switch combination for general use.
- IEC 60420 High voltage alternating current switch fuse combinations (prEN60420), as a load-break switch with fuses.
- IEC 60056 High voltage alternating current circuit breakers (prHD348), as a power circuit breaker.
- IEC 60298 Alternating current metal enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV (EN 60298-A1), in compartmented execution, according to the insulated connections method.

1.3.2 SAFETY MEASURES

Safety measures are a combination of safety principles which have been incorporated in the system design and measures that are to be taken prior to and during use.

A. Design

A number of aspects are listed below. These aspects are described in paragraphs 1.1 and 2.2.

A.1 Safe

- Safe to touch because of earthed metal enclosure and complete primary insulation
- Unauthorised switching operations are impossible because of mechanical interlocks
- Continuous voltage indication
- Mechanical interlocks safeguard access to the cable connections for replacement of fuses and base contacts
- Environment-friendly materials

A.2 User-friendly

- Uniform and easily understandable control panels
- Good access to the cable connection
- Ample space for cable termination
- Easily transportable
- Easy installation in the switching area

B. Use

This includes aspects with respect to:

- operating area
- personnel
- execution of work
- fire fighting

B.1 Operating area

The civil engineering and related facilities for the operating areas should be in accordance with local regulations.

Clear area

To the front of the switchgear or between two installations situated opposite one another, enough space should be left over the entire length of the installation. This free space must be at least 3 m wide and 2 m high.

There must be no protruding parts in this space.

The width of free spaces is measured from the most protruding part, not from the front of the installation. The height is measured from the floor or from the platform in front of the switchgear.

Escape routes

To the front of the switchgear or between two installations situated opposite one another, an escape route should be available over the entire length at least 0.5 m wide and 2 m high.

Escape routes should be in a straight line as far as possible.

There must be no protruding parts in an escape route. The width of the escape route is measured from the most protruding part of the installation.

The opening direction of doors can be taken into account here; doors opening out into escape routes must not obstruct one another under no circumstances. The height is measured from the floor or from the platform in front of the switchgear.

Access

Access to areas in which switchgear is installed should be available at suitable places and should be at least 0.75 m wide and 2 m high.

It should be accessible from the escape routes, via connecting routes at least 0.5 m wide and 2 m high.

Doors :

- have to open outwardly;
- must allow opening from the outside without the use of aids.

B.2 Personnel

Operations consisting of the installation, connection, operation, inspection, commissioning and decommissioning, and maintenance of type SVS medium-voltage switchgear should only be carried out by persons authorised to do so.

B.3 Execution of work

- Operations that may be carried out by the user either independently or under the supervision of Eaton Holec are described in this manual.

NOTE

The user must only carry out those operations and must strictly follow the procedures described.

- In case of operations which require installations or parts of them to be de-energised, the operating area must clearly be marked.
- All parts that are not de-energised must remain closed and must have warning signs on their front panels.
- Before starting with the operations one will have to make sure that the installation is indeed dead.
- After completion of the operations it is not allowed to energise the installation again until after it has been ascertained that this can be done without danger.
- Before the safety measures taken in connection with the operations are undone, there must be certainty about the fact that the operations in all appropriate places have been completed and terminated, and that all guards have been refitted.

B.4 Fire-fighting

The civil engineering and related facilities should be in accordance with local regulations.

- Recommendations to the user:
 - Before starting with the constructional work and/or adaptation thereof, you should contact the local fire brigade to have your design inspected.
 - The system manager, in conjunction with such bodies as the fire brigade, will have to draw up a safety plan and keep it up to date; this plan should mention any measures that are to be taken in the event of a calamity.
- Access to electrical operating areas must be kept clear. In addition, free areas and escape routes should be kept clear of obstacles.
- Material storage in electrical operating areas is only allowed insofar the material is associated with the installation in that area.
- Lightly flammable substances and propane or butane gas cylinders must not be stored in electrical operating areas.
- It is not allowed to start fire-fighting until after the complete system has been de-energised. Any incoming cables, low-voltage cables, return power supply via the low-voltage side etc. should be taken into account as well.
- Extinguishing materials may conduct the electrical current; when, contrary to regulations, a system which is not dead is being extinguished, personnel and bystanders may be electrocuted.
- Fire in or in the vicinity of the electrical operating areas must not be extinguished with water.

1.3.3 NOTATION GUIDE

LIFE HAZARD

The life of personnel and bystanders is at risk.

WARNING

The user and bystanders may get seriously injured or the product may be seriously damaged. A warning warns against physical injury of the user and/or bystanders or against damage to the product, if the user does not carefully follow the procedures.

CAUTION

The product is at risk. Caution warns against damage to the product, if the user does not carefully follow the procedures.

NOTE

A remark containing additional information for the user. It will make the user aware of possible problems.

REMARK

The user is given suggestions and gives advice to facilitate or simplify the performance of specific operations.

1.3.4 SAFETY INSTRUCTIONS AND WARNINGS

A. SAFETY INSTRUCTIONS

A.1 Organisational instructions

The user is responsible for the organisational instructions, which may, for instance, be:

- allocation of authorities
- procedures for access to the electrical operating areas
- reporting procedures upon start and termination of operations
- regulations with respect to the performance of operations
- drawing up a safety plan
- warning against risks by displaying warning signs on the system

All these aspects depend on the nature and the policy of the company.

Advice to the user: the user may compile a book of all these aspects.

He will have to make sure that all authorised persons are informed about the existence and the contents of this book.

A.2 Operational instructions

Operational instructions are "system related instructions" and they are described in this manual. This is done by means of instructions (like warnings, life hazard etc.), which are given before or with the relevant action in the step-by-step procedures. See chapter 2.2 - Safety) for more details.

B. WARNINGS

B.1 Warning signs

- Inscriptions, warning and information signs should be clearly legible, they should be displayed at easily visible places and be kept in a good condition.
- If such signs are no longer necessary, they are to be removed.
- Warnings have to be brief and clear. The use of standardised expressions is to be considered.
- Warning signs must never be attached to live components.

B.2 Alerting to danger

What to do in case of a relative humidity of 99 % and higher?

Do not use the system at a relative humidity of 99 % and higher.

What to do in case of flooding?

In the event that the system should be completely surrounded by water you should leave the building immediately and turn off the power supply to the system as soon as possible. There is a risk of electrocution due to a high pace voltage.

What to do in the event of a fire?

Any fire will produce noxious gases and harmful substances; exposure should naturally be avoided. Fire is to be fought with the appropriate means (see also chapter 1.3.2, B.4 - Fire-fighting).

The manager responsible for the installation must have a complete safety plan which specifies the appropriate measures.

1.4 PRODUCT INFORMATION

1.4.1 TECHNICAL SPECIFICATIONS

The supply covers a system the specifications of which are stated on the type plate:

1.4.2 REFERENCE TO DIAGRAM PACKAGE

See the electrical section, which is included in the documentation package supplied with the system.

Eaton Electric N.V. Medium Voltage P.O. Box 23, 7550 AA Hengelo The Netherlands		EAT•N		Holec	
M. V. SWITCHGEAR			IEC 60298		
system:	SVS/12 [rel2.1]	serial no.	110000		
year of constr.	2004	w.o. no.	0000000		
U_r	12 kV	U_p	75 kV	f_r	50 Hz
BUSBAR SYSTEM			IEC 60298		
I_r	1250 A	I_k	25 kA	t_k	1,5 s
		I_p	63		kA

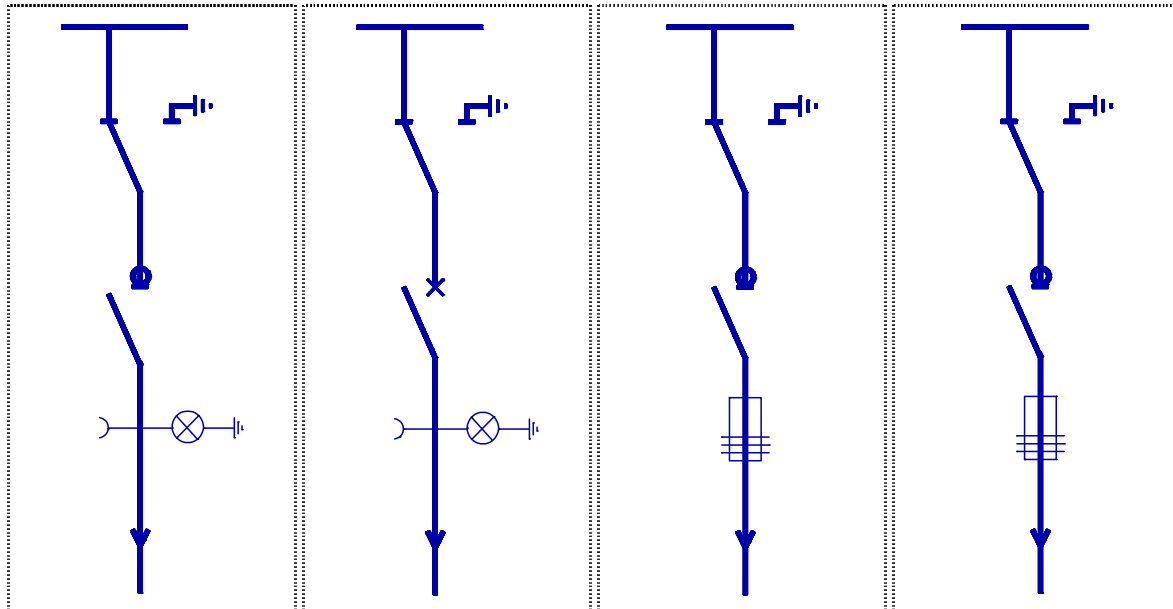
Type plate

Variable	Description	Unit
system	-	-
rel.	release	-
IEC	-	-
serial.no.	Serial number	-
year of constr.	year of construction	-
w.o.no.	work order number	-
U_r	rated voltage	kV
f_r	rated frequency	Hz
I_r	rated normal current	A
$I_{r \text{ T-off}}$	rated normal current switch/circuitbreaker	A
I_k	rated short time withstand voltage	kA
t_k	rated duration of short-circuit	s
I_p	rated peak withstand current	kA
U_p	rated lightning impulse withstand voltage (peak value)	kV_{peak}
I_{ma}	rated short-circuit making current	kA
I_{sc}	rated short-circuit breaking current	kA

2. SYSTEM DESCRIPTION

2.1 THE SYSTEM

2.1.1 PANEL TYPES



Load-break switch panel

24 kV max.

Circuit breaker panel

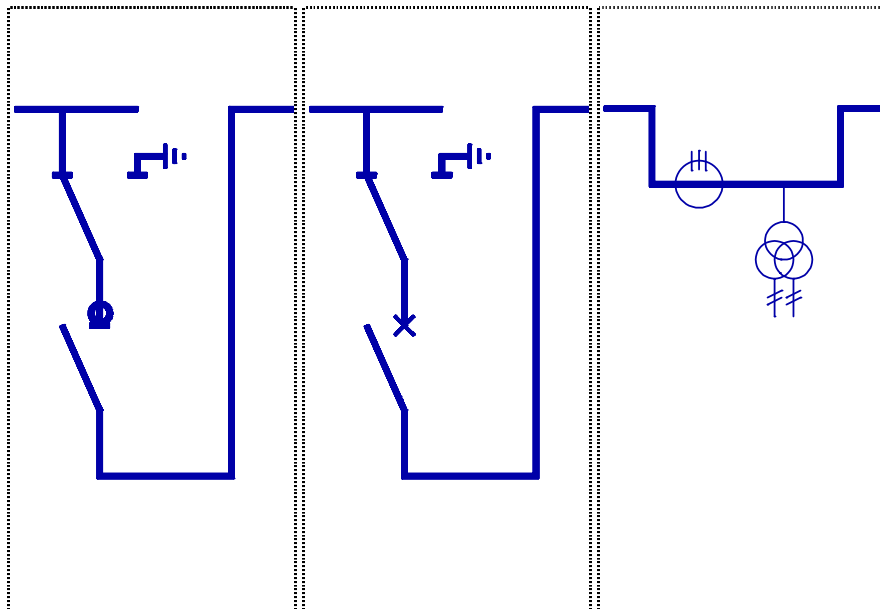
24 kV max.

**Load-break switch/
fuse panel**

24 kV max.

**Load-break switch/
fuse panel**

12 kV max.



**Busbar section panel with
load-break switch**

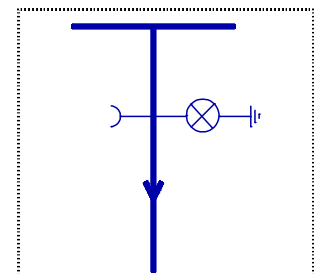
24 kV max.

**Busbar section panel with
circuit breaker**

24 kV max.

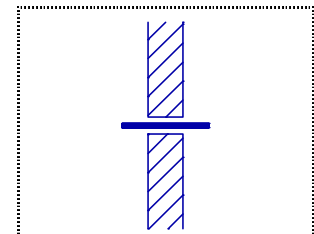
Metering panel

24 kV max.



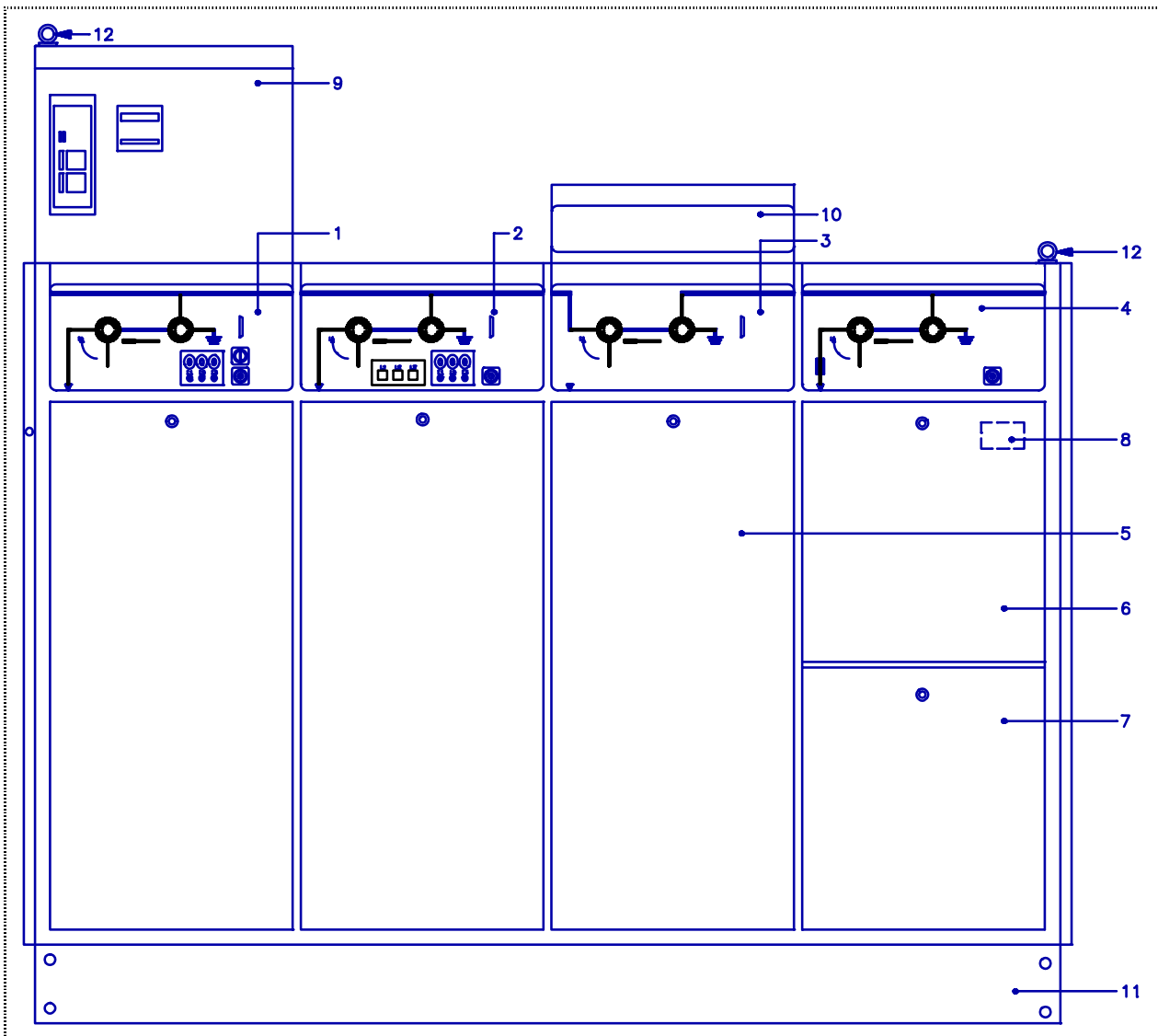
Busbar connection panel

24 kV max.



Wall bushing

24 kV max.



Installation composed of various panel types

- | | |
|---|---|
| <ul style="list-style-type: none"> 1. Control panel of load-break switch or circuit breaker panel (standard version) 2. Control panel of load-break switch or circuit breaker panel (with various options) 3. Control panel of busbar section panel 4. Control panel of load-break switch/fuse panel 5. Cable protection cover | <ul style="list-style-type: none"> 6. Protection cover for fuse links 7. Protection cover for transformer cable 8. Type plate per panel (on inside of door) 9. Instrument compartment (400 mm high) 10. Instrument compartment (150 mm high) 11. Foundation frame 12. Lifting eyes |
|---|---|

Remark:

For a description of the panels see manual
 991.137 - Medium-voltage switchgear, type SVS, chapter
 2.1.2.

2.2 SAFETY

2.2.1 INTERLOCKS

Definitions

- A panel in "operating position" means: the changeover switch is in busbar position, with the load-break switch or circuit breaker being switched on
- A panel in "earthing position" means: the changeover switch is in earthing position, with the load-break switch or circuit breaker being switched on
- A panel in "intermediate position" means: the changeover switch is in busbar or earthing position, with the load-break switch or circuit breaker being switched off.

Changeover switch

- The changeover switch can only be operated when the load-break switch or circuit breaker is switched off.

Load-break switch or circuit breaker panel

- The load-break switch or circuit breaker can only be switched on when the changeover switch is completely in busbar position or completely in earthing position.
- A panel is provided with a padlock so as to prevent:
 - the load-break switch from being switched off when in operating position or in earthing position
 - the circuit breaker from being switched off, this time in earthing position only
- A lock on the access door of the cable compartment is optional.
 - this means that the door can only be opened in earthing position.
 - in this case the load-break switch cannot be locked anymore to prevent switching-off when in operating position
- The cable access port of the 17.5-kV cable terminal block can only be opened when the cable is earthed, so when the panel is in earthing position.
- A scissor-type interlock with padlock is optional. This scissor-type interlock can be used to lock the load-break switch or circuit breaker in an intermediate position.

Load-break switch/fuse panel

- With the load-break switch/fuse panel, access to the fuse holders can only be obtained when the changeover switch is in earthing position and the load-break switch is switched off.
- In this position the load-break switch cannot be switched on when the changeover switch is in earthing position.

Busbar section panel

- With a busbar section panel, the load-break switch or circuit breaker cannot be switched on when the changeover switch is in earthing position.
- The load-break switch can be padlocked so as to prevent switching-off.
- The circuit breaker cannot be locked by means of a padlock.

Metering panel

- The door giving access to a metering panel may be provided with a padlock.

2.2.2 SAFETY

The system-related safety instructions in this manual are the instructions (like warnings, life hazard etc.) that are given before or with the relevant action in the step-by-step procedures.

The procedures describe what the user is allowed to do:

- The user must strictly follow the procedures and should only use the accessories supplied with the switchgear.
- The user must observe the safety instructions that are stated before the relevant procedures or actions.
- Other operations, of any nature whatsoever, are not allowed.
- In the case of open panels, the user is responsible for safety when work is being carried out on the installation.

2.3 TECHNICAL DATA

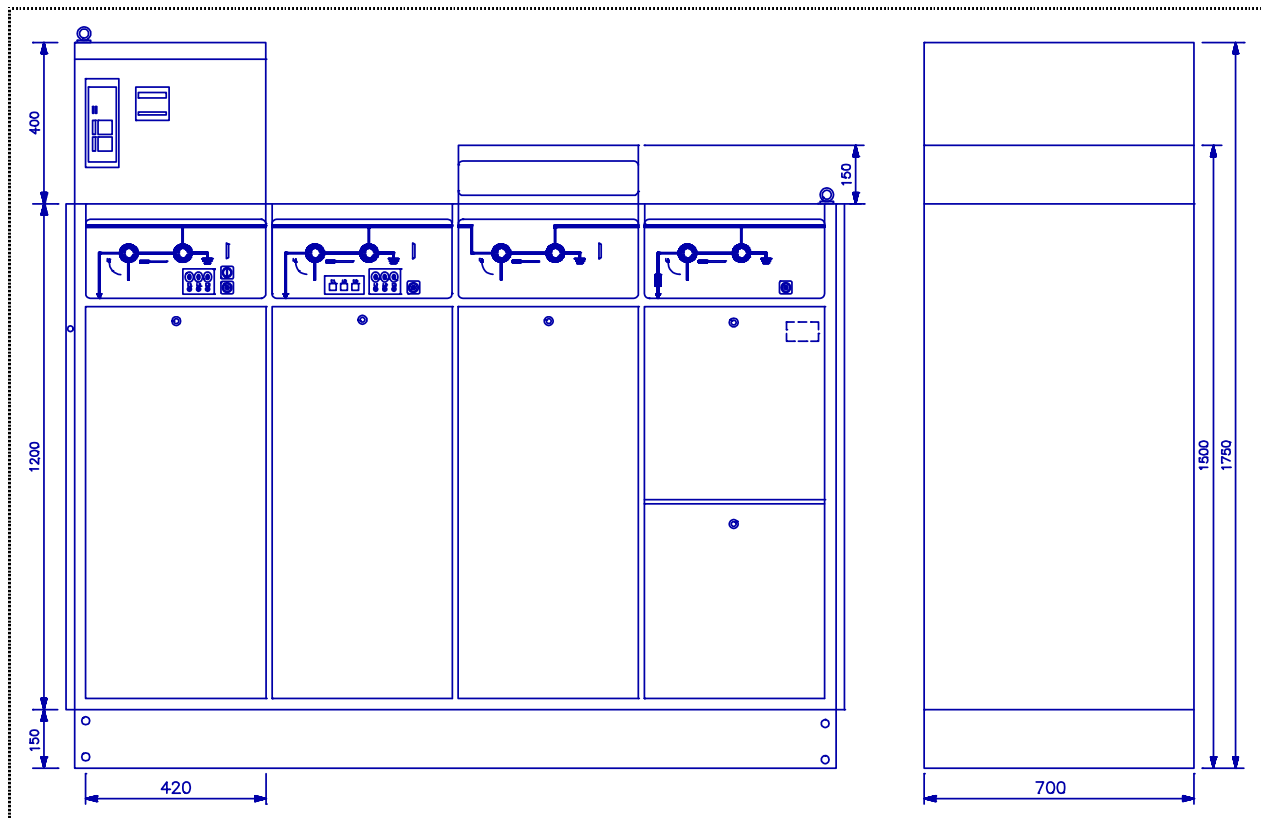
2.3.1 ELECTRICAL DATA

type SVS		12	17.5	24
General				
Rated voltage	kV	12	17.5	24
Impulse withstand voltage	kV	75	95	125
Power frequency withstand voltage	kV	28	38	50
Rated frequency	Hz	50-60	50-60	50-60
Busbar system				
Rated current	A	800	800	800
Rated short-time withstand current 1 s/2.5 s ¹⁾	kA	20	20	16
Rated peak withstand current	kA	50	50	40
Load-break switch				
Rated current	A	630	630	630
Rated breaking current with cos phi = 0.7	A	630	630	630
Rated short-circuit making current	kA	50	50	40
Rated short-time withstand current 1 s/2.5 s ¹⁾	kA	20	20	16
Load-break switch/fuses				
Rated current	A	61/57	61	36
Rated breaking current ¹⁾	A	630	630	630
Rated short-circuit making current ¹⁾	kA	50	50	40
Fuses as per DIN 43625	kV	12	12/24	24
Circuit breaker				
Rated current	A	630	630	630
Rated breaking current ¹⁾	kA	16/20	16/20	16
DC component	%	35	35	35
Rated short-circuit making current ¹⁾	kA	40/50	40/50	40
Rated short-time withstand current 1 s/2,5 s ¹⁾	kA	16/20	16/20	16
Metering panel				
Rated peak withstand current ²⁾	kA	40/50	40/50	40
Rated short-time withstand current 1 s/2.5 s ¹⁾²⁾	kA	16/20	16/20	16
Rated current	A	630	630	630

1) Depending on execution; consult the type plate on the panel for the actual value.

2) Depending on ratio.

2.3.2 DIMENSIONS AND WEIGHTS



	without instrument compartment	with instrument compartment (400 mm high)	with instrument compartment (150 mm high)	centre distance of lifting eyes	
Panel width (mm)	420	420	420	1 panel:	340 mm
Panel depth (mm)	700	700	700	2 panels:	760 mm
Panel height (mm)	1350	1750	1500	3 panels:	1180 mm
				4 panels:	760 mm
Weight per panel (kg)	approx. 150	approx. 175	approx. 165	5 panels:	1180 mm
				6 panels:	1600 mm
				7 panels:	2020 mm

Example:

Number of panels = N;
total width $W = N \times 420 + 80$ mm.

2.3.3 HEAT, RADIATION, NOISE AND GASES

Noise

In general it can be said that the installation does not produce any noise under operating conditions, with the exception of the switching operations.

The noise during switching operations is less than 70 dB(A), so that no noise protection have to be taken.

Radiation

Radiation is well below the safety standard level.

3. SYSTEM ASSEMBLY

3.1 GUIDELINES FOR THE OPERATING AREA

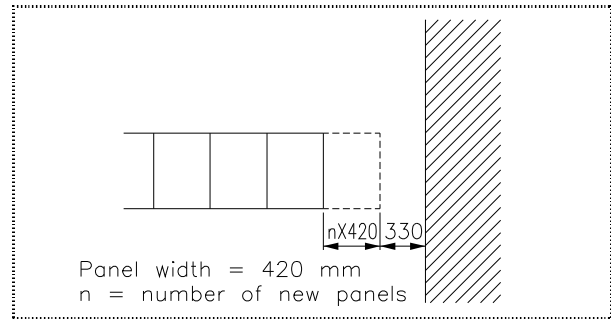
3.1.1 GENERAL

Space aspects

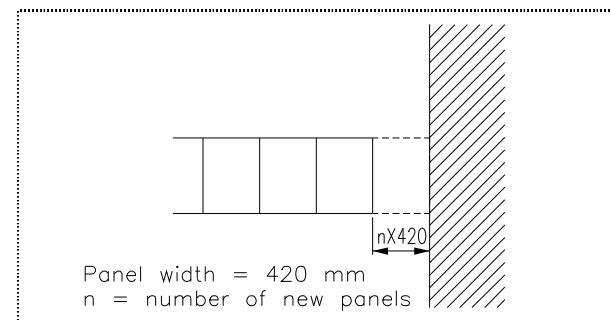
The dimensions of the installation are stated on the floorplan. This is part of the total documentation package (see chapter 10). The dimensions of the electrical operating area can be determined on the basis of this floorplan.

Both with coupling and with extension, the minimum space required for new panels, as indicated in figures 1 and 2, is to be taken into account.

For the demands made on the operating area and for other civil work, see manual 991.137 - Medium-voltage switchgear, type SVS, chapter 3.1.



1. Minimum space required for new panels using a fixed busbar connection



2. Minimum space required for new panels using a flexible busbar connection

3.2 TRANSPORT AND ASSEMBLY

3.2.1 TRANSPORT

An SVS installation is transported in sections of up to 7 panels. The sections can be assembled at site. Packed in Styrofoam and foil, each section is placed on pallets (figure 1). The pallets are attached to the installation by means of retaining straps.

Each installation also has four hoisting points to enable transport by a crane.

In case of installations up to 5 panels without instrument compartment four eye bolts are supplied. Installations with an instrument compartment or installations featuring more than 5 panels are provided with a lifting frame.

The eye bolts and the lifting frame can be removed after installation. The holes in the four hoisting points can be closed by means of the sealing caps supplied as well.

A packed SVS installation can also be moved with the aid of a hand-operated truck or a fork lift truck.

3.2.2 INSTRUCTIONS FOR TRANSPORT

The user is to follow the supplier's instructions.

Lifting

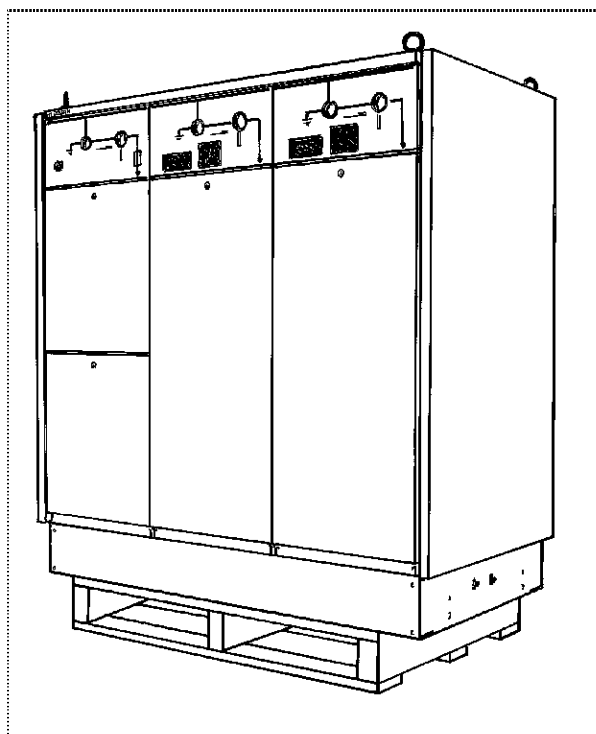
- See that the work area is safe: observe the local statutory provisions.
- Never stand underneath the load.
- The angle of the lifting cable relative to the lifting point must never be smaller than 45°.
- Lifting in extreme temperatures:
- with temperatures between -5 °C and -19°C and when using lifting gear made of a steel grade equal to or lower than B according to Euronorm 25-67 the work load is to be reduced by 25%.
- Lifting in windy conditions:
- The lifting operations will have to be stopped in case of wind force 7 where wind speeds are > 13.9 - 17 m/s. When lifting at a great height, lifting will have to be stopped earlier.

Transport

- The installation is to be transported in vertical position.
- During transport suitable measures are to be taken so as to prevent intrusion of dust and moisture (rain, snow) and to prevent mechanical damage.

Transport and installation in the operating area

For this, see manual 991.137 - Medium-voltage switchgear, type SVS, chapters 3.2.3 and 3.2.4.



1.

3.3 CONNECTIONS

Connection of cables

For cable connection, please refer to chapter 3.3 - Connections, in manual 991.137 - Medium-voltage switchgear, type SVS.

Connection of secondary wiring

The electrical data on the secondary wiring are stated in the diagrams in the documentation package supplied with the switchgear.

For the location of the terminals on the panel, please refer to chapter 2.1.2 .Description of the panels, in manual 991.137 - Medium-voltage switchgear, type SVS.

3.4 COUPLING AND EXTENSION

3.4.1 COUPLING AND EXTENSION METHODS

The table below summarises the coupling and extension options for the various panel types.

Right panel → Left panel ↓	Circuit breaker panel, load-break switch panel and busbar connection	Fused load-break switch panel with short fuse holders (12 kV only)	Fused load-break switch panel with long fuse holders (12/24 kV)	Busbar section panel	Metering panel
Circuit breaker panel/load-break switch panel and busbar connection	A	A	A	C	B
Fused load-break switch panel with short fuse holders (12 kV only)	A	A	A	C	B
Fused load-break switch panel with long fuse holders (12/24 kV)	A	-	A	-	B
Busbar section panel	A	A	A	-	B
Metering panel	B	B	B	-	-

Remarks:

- Two options are described for method A:
 - A1 Coupling and extension with a fixed busbar connection.
 - A2 Coupling with a flexible busbar connection. This method is unfit for extending an existing installation, it is intended only for coupling two parts of an installation.
- Method B is identical to method A1, however, now with main bars of unequal length.

3.4.2 DEFINITIONS

Coupling

Assembling two preassembled parts of an installation at site.

Extension

Adding one or more panels to an existing installation.

3.4.3 SAFETY

1. Creating a safe working situation:
 - when extending an existing installation, make sure that the installation is entirely dead, both on the primary and secondary side, and make the necessary provisions on the other side of the supply cable(s).
 - switch off all the outgoing panels and put all changeover switches in earthing position, (see manual 991.137 - Medium-voltage switchgear, type SVS, chapters 4.2.2 and 4.2.3).
 - remove the high-voltage fuses of all the fused load-break switch panels, (see manual 991.137 - Medium-voltage switchgear, type SVS, chapter 4.2.13). Close the openings of the holders so that no mounting material can fall in.
 - to disconnect and earth the installation, you should also refer to your own operating instructions.
 - take the necessary safety measures, as they are described in chapter 1.3.2, section B.3 of this manual.

3.4.4 METHOD A1: COUPLING AND EXTENSION WITH A FIXED BUSBAR CONNECTION

Required materials

BUSBAR SYSTEM

- three main bars made of epoxy resin
- six (2x 3) socket contacts including washers, conical spring washers and bolts (M8)
- three contact springs
- three busbar guides each with two contact pins
- six rubber sleeves
- one polyamide vent thread for the rubber sleeves
- three screw rods (45 x 8 mm) with six washers and six nuts (M8) (only when extending or coupling a single panel)

PANEL

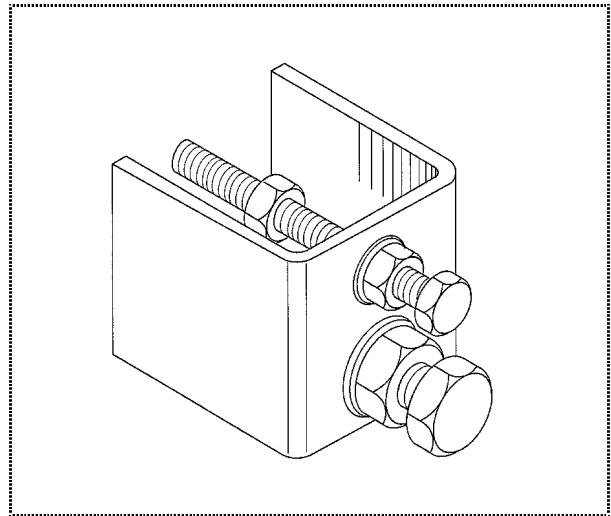
- one strip for the earth plate
- one U-section for the earth bar
- one sealing strip to be interposed between the two operating mechanisms
- one U-section to be interposed between the panels
- one plinth
- two bolts (M12) to pull the base frames together
- two coupling bolts (M8), washers and nuts for the base frame
- miscellaneous bolts
- six extension nuts (M8 x 24)
- silicone grease

Remark:

Some parts have already been preassembled in the panels.

Required accessories

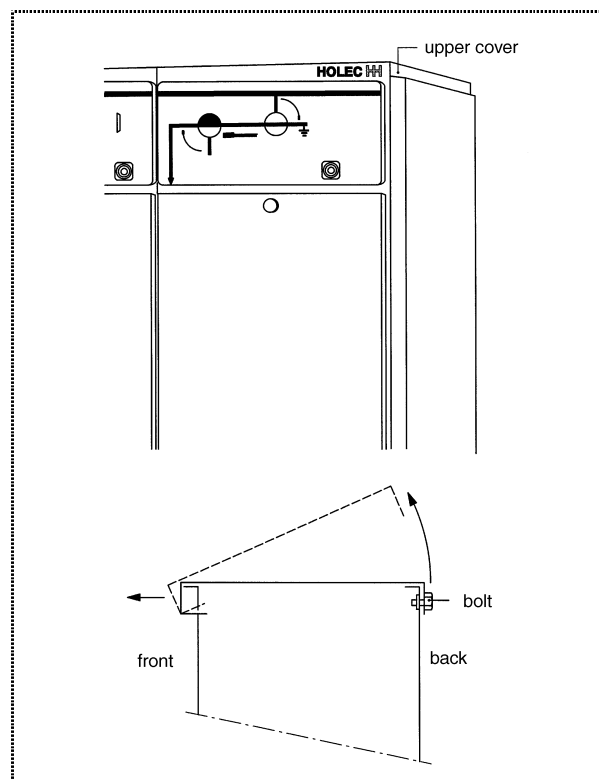
In case of an extension, an auxiliary tool is supplied as an accessory (see figure 1) for removal of the end caps from the existing busbar system.



1.

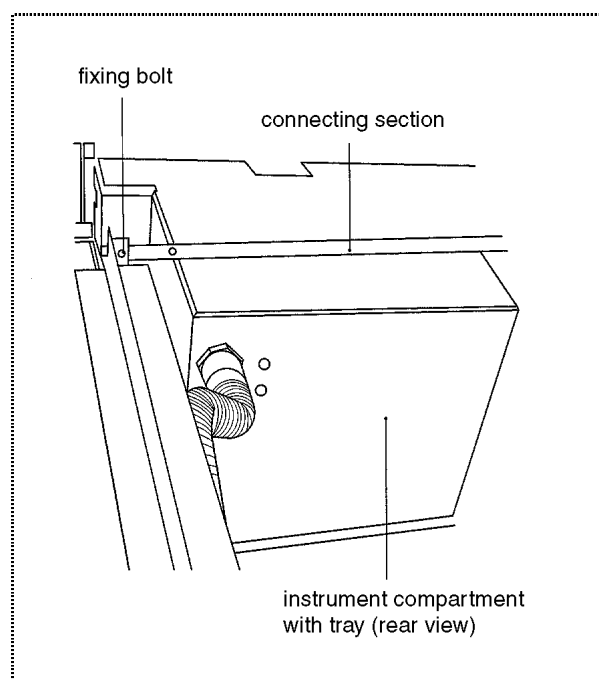
Method

1. Install the first section of the installation in accordance with the procedure described in manual 991.137 - Medium-voltage switchgear, type SVS, chapter 3.2.
2. Remove the upper covers of the panels that are to be coupled:
 - slightly loosen the two bolts at the rear of the installation using a key (size of jaws: 8).
 - lift the cover at the rear and slide it forward.



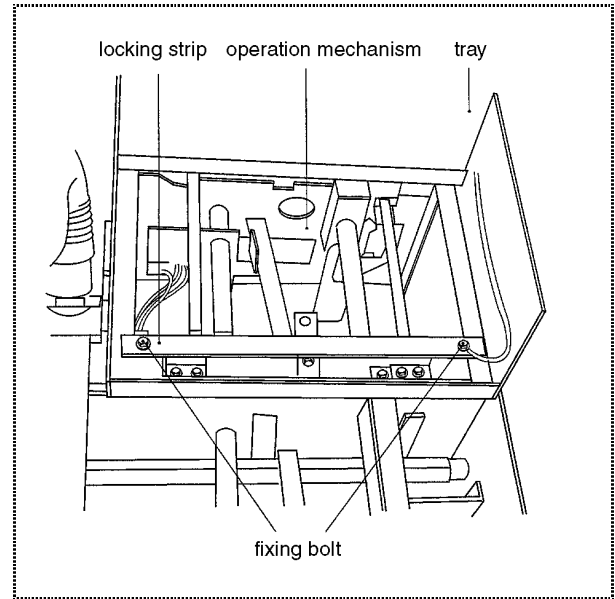
2.

3. Remove the instrument compartment (400 mm high), if it is installed:
 - remove the upper cover:
 - give the lock on the top side a quarter of a turn in anticlockwise direction; lift the cover at the front and slide it backward.
 - on the connection side of the installation, remove the fixation bolt of the connecting section, which is situated high up in the instrument compartment, see figure 3a.

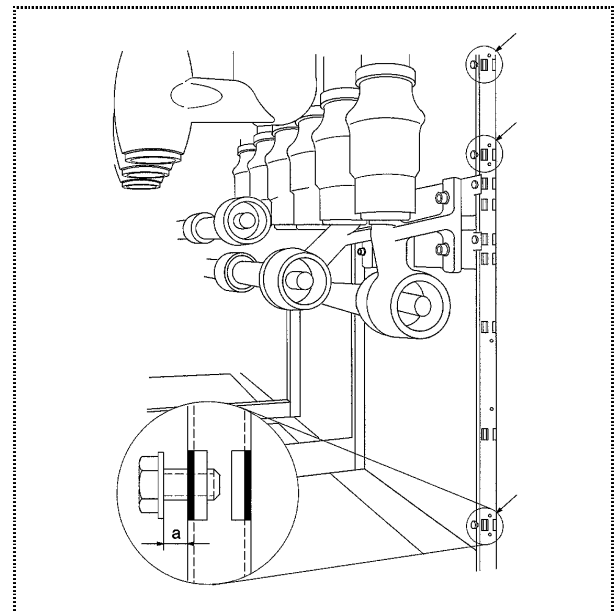


3a

- **In case of an extension only:**
 - also remove the side plate of the instrument compartment by removing the threaded bolts at the rear (2x) and at the front (1x).
 - pull the tray forward as far as possible.
 - remove the two fixation bolts and the locking strip at the bottom of the tray and take the tray out of the instrument compartment.
 - see figure 3b; make sure that no components fall into the mechanism.
 - put the tray on a worktop.
4. Remove the protection cover for the panel, including the earth conductors.
5. **In case of an extension only:**
- remove the side plate from the existing installation by undoing all bolts at the front and the side.
6. Put three threaded bolts in the rear post and leave adequate space (a) behind the bolt head so that the panel to be coupled can be pushed on:
- $a = 4 \text{ mm}$.

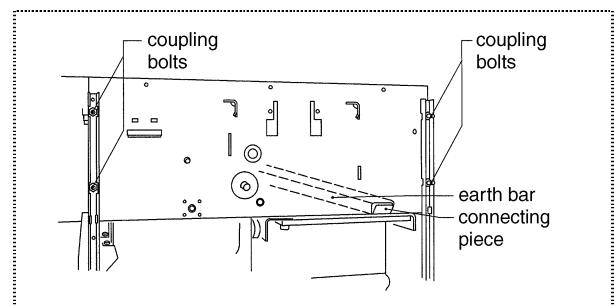


3b.



6.

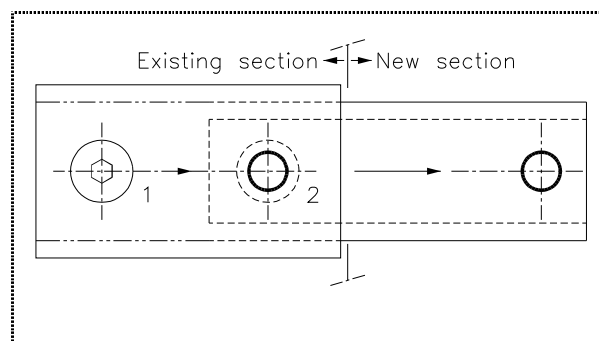
7. **In case of an extension only:**
- Remove the four coupling bolts out of the operating mechanism of the existing section.



7.

8. Move the connecting piece of the earth bar at the bottom of the operating mechanism:

- Remove the fixation bolt (item 1) using an extended coupling key.
- Move the connecting piece to the right, so that the fixation bolt can be fitted in the other hole (item 2).
- Fix the bolt using a torque wrench (20 Nm).
- Make sure the correct mounting sequence is followed for the locking material, viz.: washer, conical spring washer and bolt.



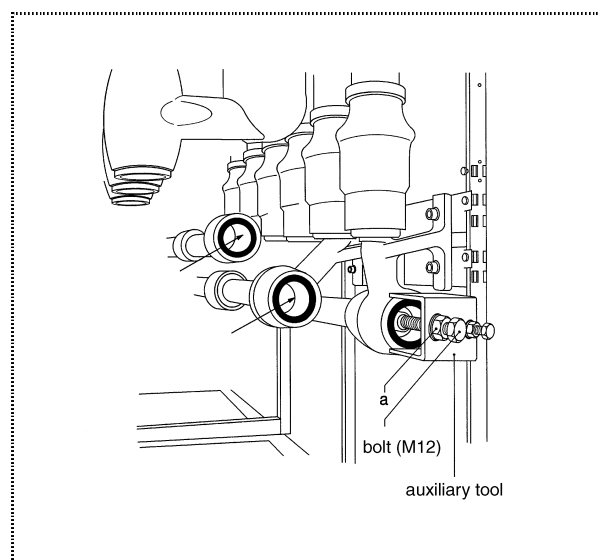
8. Top view of earth bar

9. In case of an extension only:

- if the installation has an inside earth bar on the extension side, this bar must first be removed. The inside earth bar is mounted to the U-section of the main earthing bar.
- if necessary, this earth bar can be shifted to the outermost panel of the installation. Make sure the correct mounting sequence is followed for the locking material, viz.: washer, conical spring washer and bolt.

10. In case of an extension only:

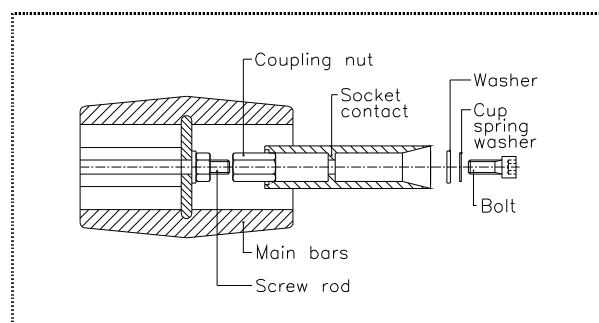
- On the extension side of the existing installation, remove the end caps and the rubber sleeves from the main bar; use the auxiliary tool to do so:
 - turn the bolt (M12) about 1 cm into the end cap and then tighten nut (a), until the end cap is pulled out.
 - clean the holes in the epoxy resin and also clean the contact faces.



10.

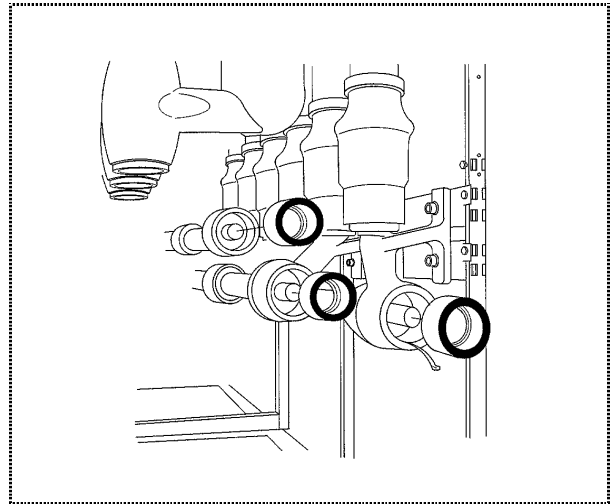
11. In case of an extension only:

- Mount the three socket contacts onto the existing main bars:
 - run the coupling nuts up the existing screw rods in the main bar; for this purpose, the screw rods need to have a threaded length of approximately 10 mm.
 - then mount the three socket contacts on the coupling nuts. To do so, put the washers, the conical spring washers and the bolts (M8) in the socket contacts. Torque the bolts to 14 Nm.



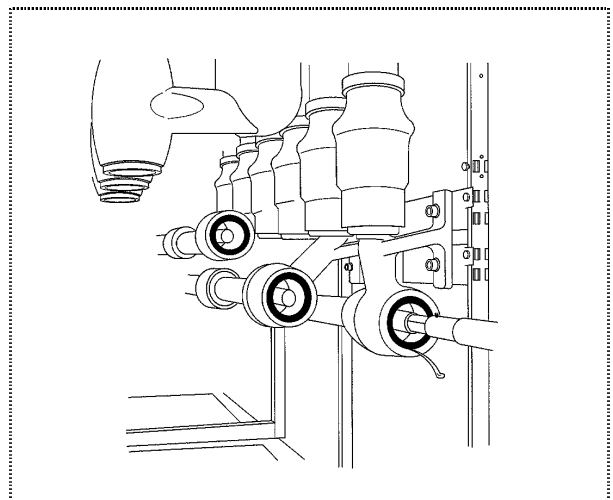
11.

12. Fit new rubber sleeves in the holes in the epoxy resin of the main bars of the two installation sections:
- clean the contact faces and the holes in the epoxy resin.
 - apply silicone grease to the six new rubbers sleeves and fit them in the holes.
 - in so doing, fit a polyamide thread between the sleeve and the epoxy resin insulation of the main bar, for venting purposes.



12.

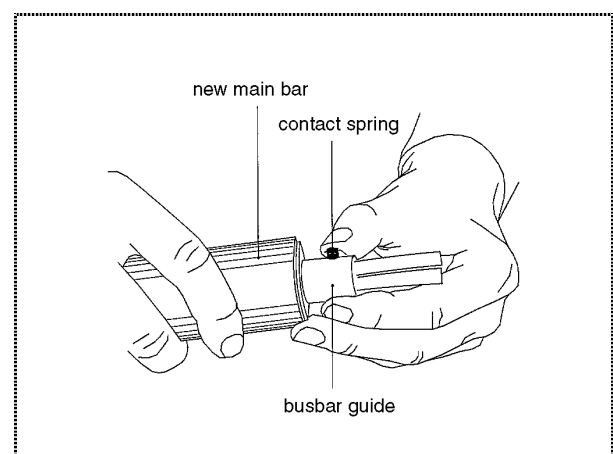
13. Fit the busbar guides.
- If there is adequate space between the installation sections, proceed as follows (figure 13a):
- fit the busbar guides with the contact pins in the socket contacts.
 - position the contact spring in the recess in the busbar guides.
 - keep this spring depressed and slide the new main bar that is to be coupled over the busbar guide.
 - briefly depress the contact pins, so that they are properly positioned in the socket contacts.



13a.

Remarks:

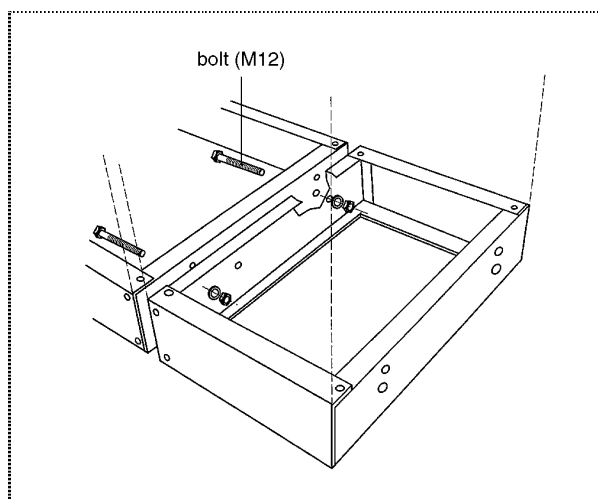
- The contact springs provide a good electrical connection between the busbar guide and the brass inner wall of the main bar, so that discharging phenomena are prevented. That is why you should always check that the inside of the main bar is entirely clean.
- If there is inadequate space in between the two panels, the busbar guide can be slid into the new main bar first, with the spring depressed (see figure 13b).



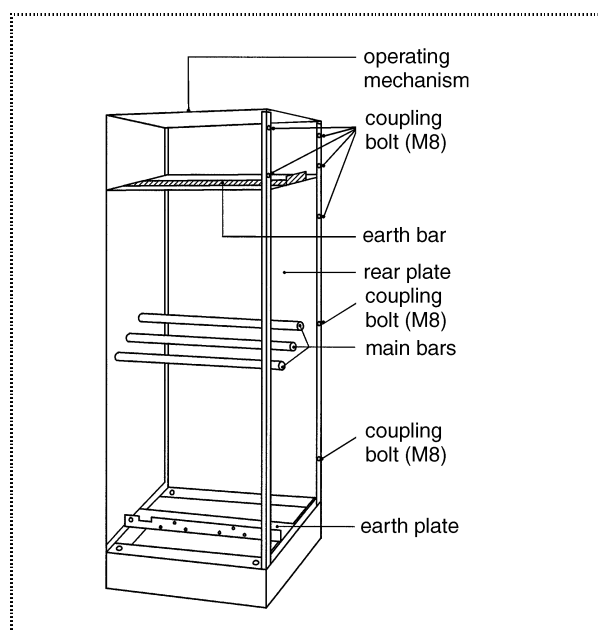
13b.

14. Couple the new section to the section already installed:

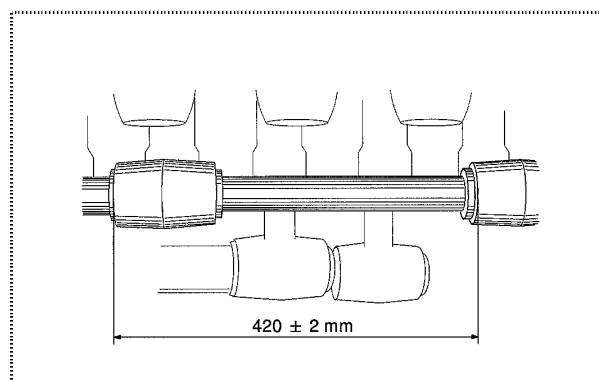
- position the new section as close as possible to the section already installed.
- remove the front and rear posts and the foundation beam on the coupling side of the new section. Remove the means of transport used for the new section, if still there.
- fit the two long bolts (M12) in the relevant holes in the base frame, figure 14a.
- pull the two parts together by tightening the nuts in turn; make sure the following coupling places are correctly positioned, figure 14b:
 - the main bars
 - the earth bar and the four coupling bolts in the operating mechanism, also see steps 7 and 8
 - the earth plate on the base frame (slightly lift the earth plate, if necessary)
 - the rear plate and the bolts that were already fitted for this purpose, also see step 6
- tighten the two long bolts (M12) in the base frame in turn, until both mechanisms can be fixed by means of the coupling bolts (M8).
- tighten the nuts (M8 and M12) in turn, until the two parts are firmly attached.
- check that the distance between the main bar connections is $420 \text{ mm} \pm 2 \text{ mm}$, figure 14c.



14a.

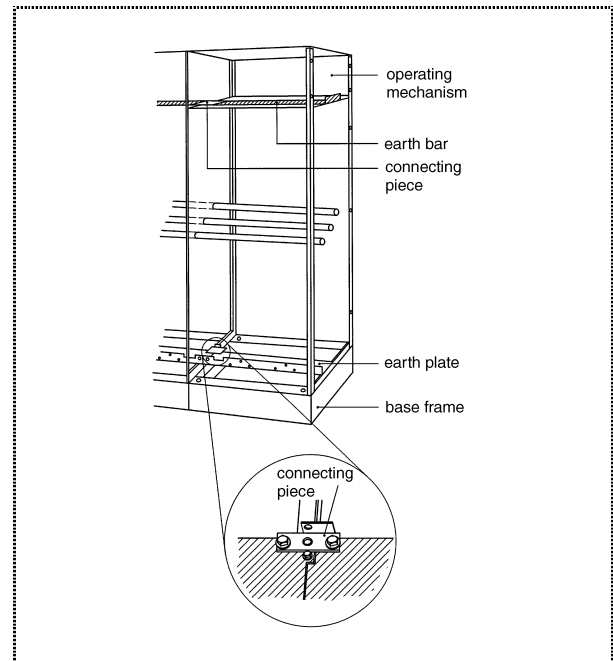


14b.



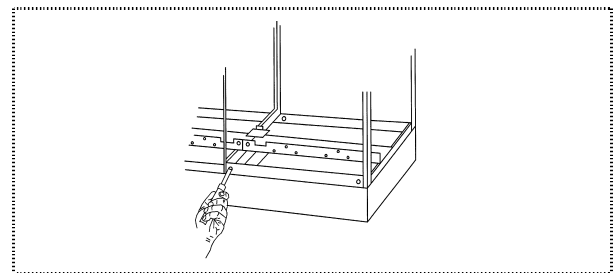
14c.

15. Fit the earth plate in the base frame. Fix it in position, using the connecting piece and the accessory bolts (20 Nm) with conical spring washers.
16. Now tighten the bolts already fitted, at the rear. Also see step 6.
17. Connect the U-shaped earth bar at the bottom of the two mechanisms using the connecting piece. Also see step 8.
18. Take the bolts (M12) out of the base frame.
19. Remove the polyamide threads to enable venting between the rubber sleeves and the epoxy resin insulation.



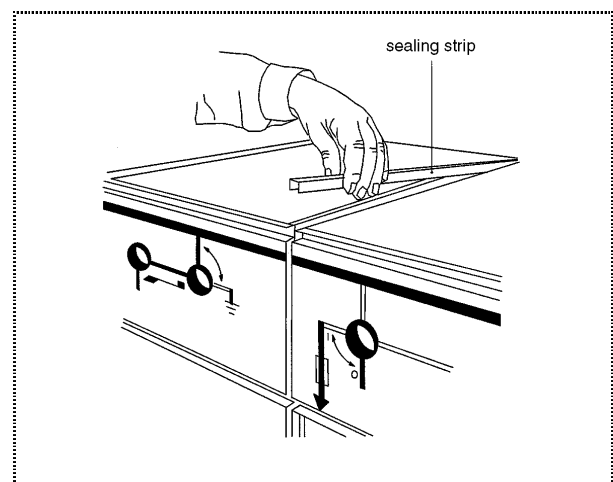
15...17.

20. Fit the U-section in between the panels, if necessary, and fix the plinth.
21. Attach the new section on the flat floor. (Fill up any voids with shims.)



20.

22. Fit the sealing strip on the top side in between the two mechanisms.
23. Test the new connection in the main and earth busbar system following the procedure described in chapter 3.4.8.
24. In the case of an extension, mount the side plate of the new section.
25. Put the tray back into the instrument compartment:
 - position the locking strip in the tray, using the two fixing bolts and the spacer rings, so that the tray can no longer be taken out.
 - slide the tray back in its original position.
 - mount the side plate, with the strip on the rear plate, and fit the fixing bolt of the connecting section.
26. Fit the upper covers and fix them.
27. Fit the protection panels on the front side and mount the earth conductors.



22.

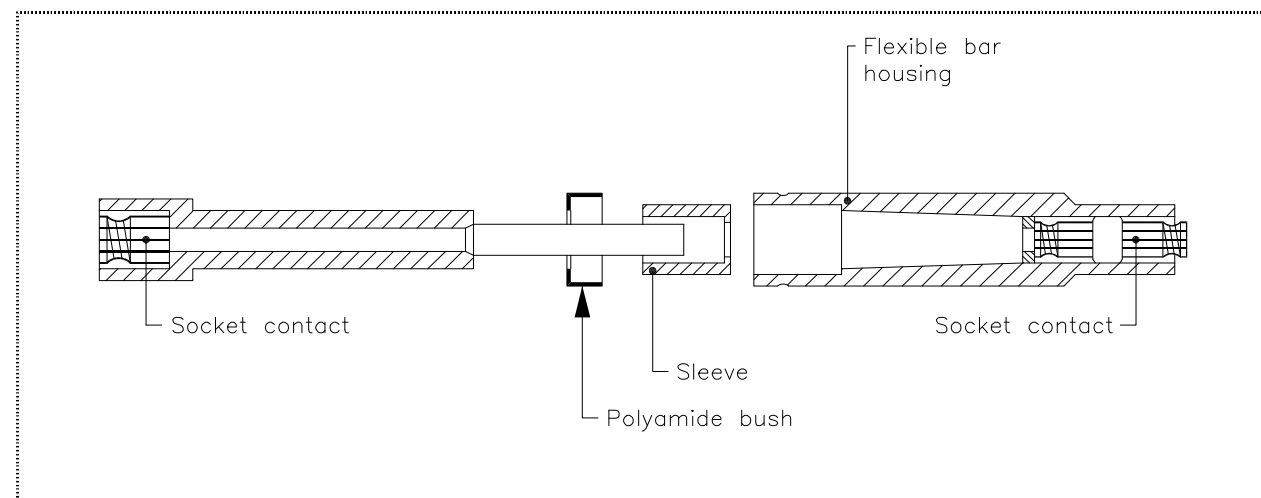
3.4.5 METHOD A2: COUPLING WITH A FLEXIBLE BUSBAR CONNECTION

General

SVS switchgear can also be coupled by means of a flexible busbar connection. This method is simpler, especially when coupling large installation sections or when working in cramped places.

The two installation sections can first be attached mechanically, which will require minimal working space. After that the main bars can be fitted and connected.

Required materials



1.

BUSBAR SYSTEM

- three complete sets of flexible main bars, see figure 1
- six (2x 3) socket contacts intended for being fitted on the main bars of the installations to be coupled
- six rubber sleeves
- one polyamide vent thread, which is to be used when fitting the rubber sleeves

PANEL

- two coupling bolts (M8), washers and nuts for the base frame
- miscellaneous bolts
- one strip for the earth plate
- one U-section for the U-shaped earth bar
- one sealing strip in between the two operating mechanisms
- one U-section between the panels
- one plinth
- two bolts to draw the base frames together
- silicone grease

Remark:

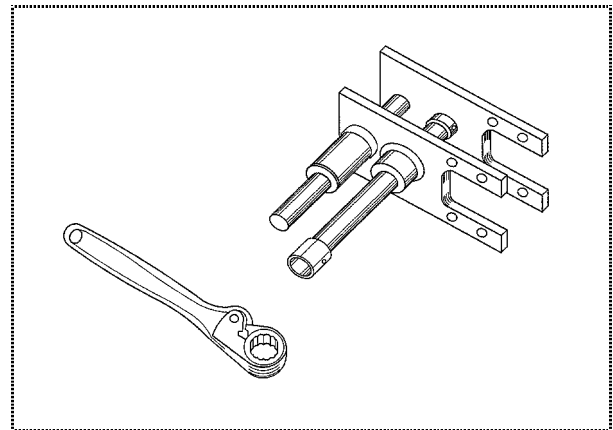
Some parts have already been preassembled in the panels.

Required accessories

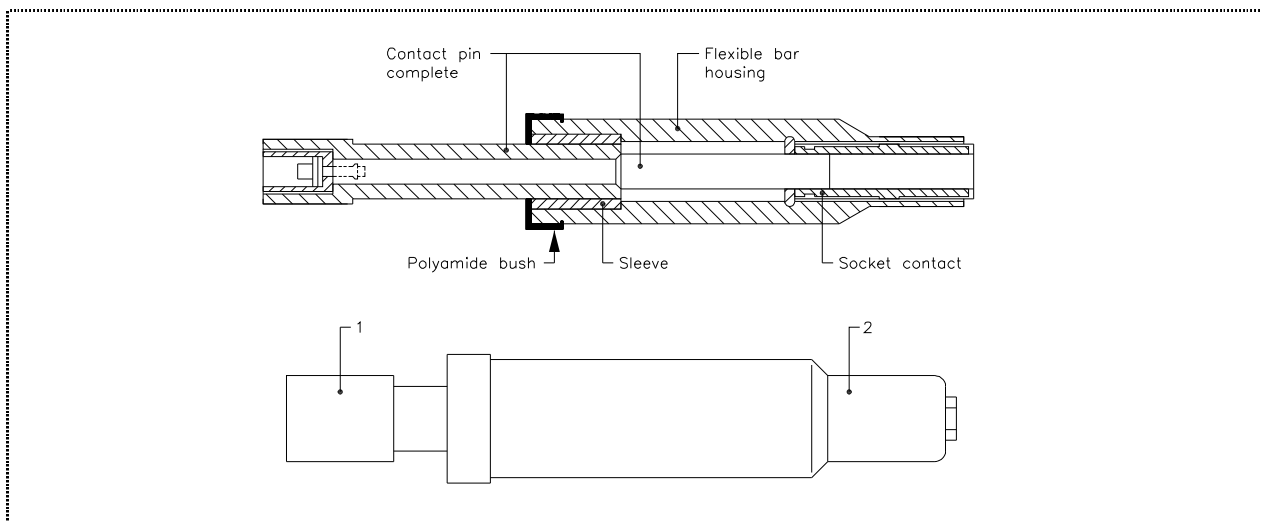
An auxiliary tool can be supplied as an accessory for the installation of a flexible busbar connection, see figure 2.

Procedure

1. Mount the two installation sections to one another, following the procedure described in chapter 3.4.4, steps 1 to 10 inclusive and steps 14 to 22 inclusive.
2. Fit the new rubber sleeves in the holes in the epoxy resin of the main bars of the two installation sections:
 - clean the contact faces and clean the holes in the epoxy resin.
 - apply silicone grease to the six new rubber sleeves and fit them into the holes.
 - in so doing, fit a polyamide thread in between the sleeve and the epoxy resin insulation of the main bar, for venting purposes.
3. Assemble the flexible busbar connection:
 - clean the epoxy resin components and clean the contact faces of the flexible busbar connection.
 - apply silicone grease to the central sleeve.
 - position the sleeve in the housing.
 - position the polyamide bush over the housing.
 - position the socket contact in the housing.
 - then slide the contact pin into the housing. Stop the contact bush from moving when doing so.
 - compress the flexible bar as much as possible.

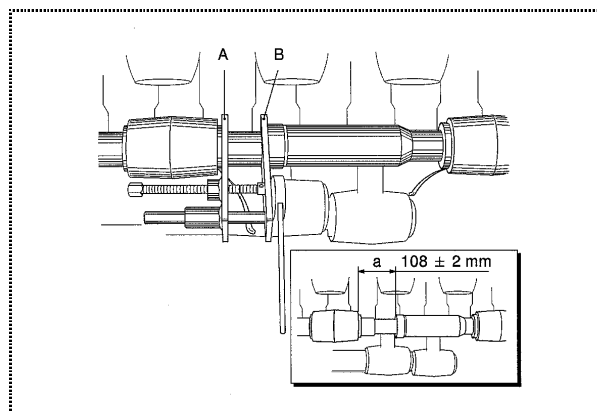


2.



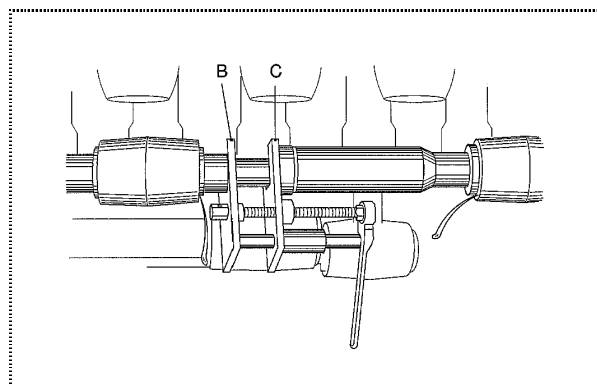
3. Flexible busbar connection (assembled)

4. Check that there are six (2 x 3) contact pins on the main bars of the two sections to be coupled (these pins have already been fitted).
5. Now position the flexible bars in between the main bars of the two installation sections:
 - introduce the flexible bar with end no. 2 approx. 1 cm into the sleeve in the hole in the epoxy resin of the main bar (of either one of the two installation sections). Start with the hindmost bar.
 - now introduce end no. 1 approx. 1 cm into the sleeve in the hole in the epoxy resin of the main bar (of the other installation section). Extend the flexible bar a little, if necessary.
6. Now position the auxiliary tool between A and B (in figure 6) and turn the end plates apart, with the aid of the key, so that end no. 2 is pressed into the main bar.
 - Check that size (a) is now 108 ± 2 mm.



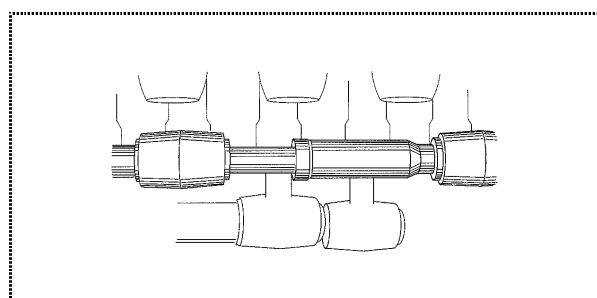
6.

7. Now position the auxiliary tool between B and C (in figure 7) and turn the end plates apart, using the key, so that end no. 1 is also pressed into the main bar. (continued on the following page)

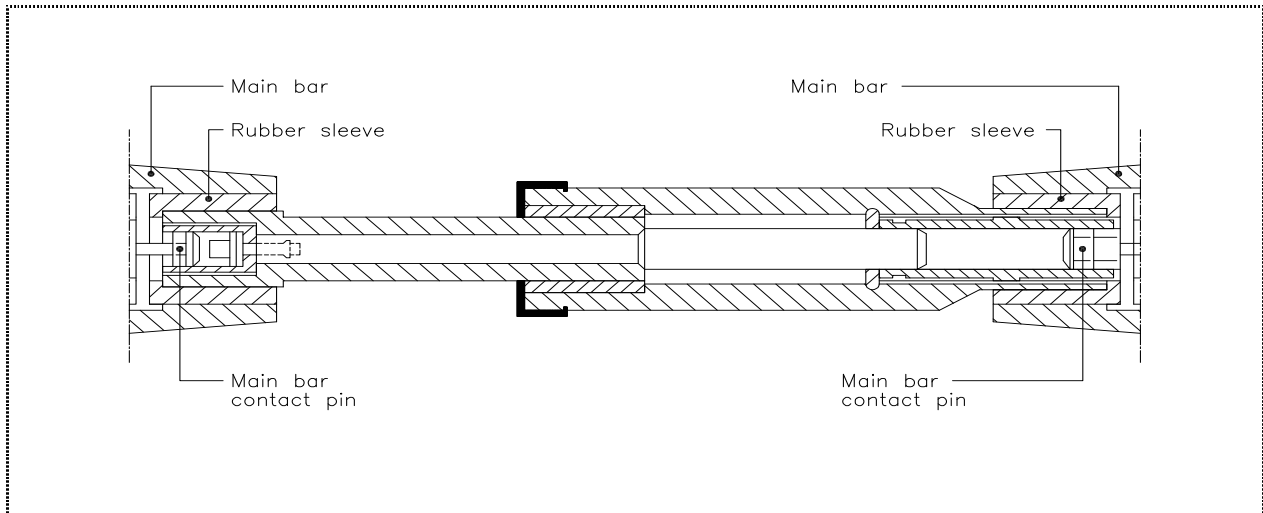


7.

- The thick epoxy resin part of end no. 1 must be pressed completely into the sleeve (figures 7a and 7b).



7a.



7b. Flexible connection, mounted between two main bars

8. Remove the polyamide threads.
9. Test the new connection in the main and earth bar system, following the procedure described in chapter 3.4.8.
10. Put the tray back into the instrument compartment.
 - Position the locking strip in the tray, using the two fixing bolts, so that the tray can no longer be taken out.
 - Slide the tray back into its original position.
 - Position the fixing bolt of the connecting section.
11. Fit the upper covers and fix them.
12. Fit the protection panels on the front side and mount the earth conductors.

3.4.6 METHOD B: COUPLING AND EXTENSION OF METERING PANELS

General

A metering panel can only be coupled to another panel by means of a fixed busbar connection, the main bars being of unequal length. For this purpose, follow the procedure as described in chapter 3.4.4 of this manual.

3.4.7 METHOD C: COUPLING AND EXTENSION OF BUSBAR PANELS

Required materials

BUSBAR SYSTEM

- three U-shaped main bars
- three transition blocks
- ten rubber sleeves (large) for the main bars, transition blocks and interrupter housings
- four rubber sleeves (small) for the transition blocks
- one polyamide vent thread to be used when fitting the rubber sleeves
- four end caps (small) for the transition blocks
- three end caps (large) for the interrupter housings
- three coupling nuts (M8 x 20)
- three screw rods, washers and nuts

PANEL

- threaded bolts
- six bolts (M8 x 20), including washers and conical spring washers
- three L-shaped angle supports, including bolts (M8 x 16)
- one lateral strip for the base frame, including bolts
- one insulated stabilisation plate
- three insulated fixation rods
- three earth wires
- two coupling bolts (M8), washers and nuts for the base frame
- one strip for the earth plate
- one U-section for the earth bar
- one sealing strip to be interposed between the mechanisms
- two bolts (M12) and nuts to pull the base frames together
- one plinth
- one U-section to be interposed between the panels
- silicone grease

Remark:

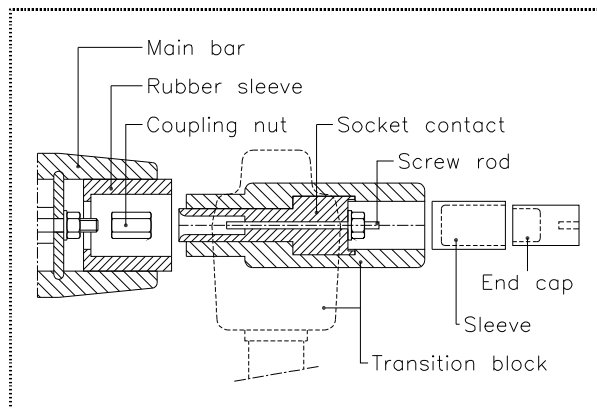
Some parts have already been preassembled in the panels.

Procedure

Remark:

The transition blocks of phases L1 and L2 are factory-assembled.

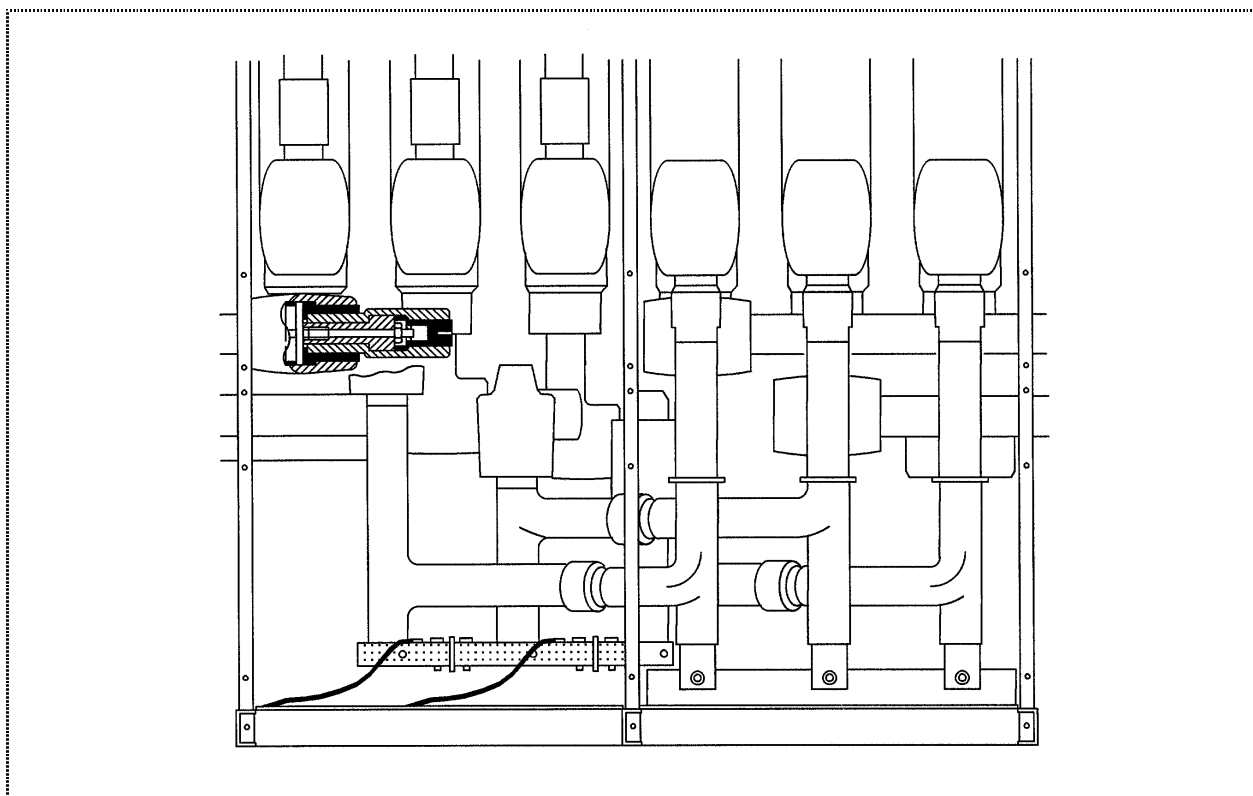
1. Mount the transition block to phase L3 (hindmost phase):
 - clean the contact faces and clean the holes in the epoxy resin of the transition block.
 - position the coupling nut (M8 x 20) on the screw rod of the main bar.
 - fit a greased sleeve in the hole in the epoxy resin of the main bar; use a polyamide thread to enable venting.
 - position the screw rod with washer and nut in the socket contact of the transition block.
 - fit the transition block in the rubber sleeve of the main bar; torque the nut on the screw rod of the transition block to 14 Nm.
 - then fit the sleeve and the end cap in the transition block.



1a.

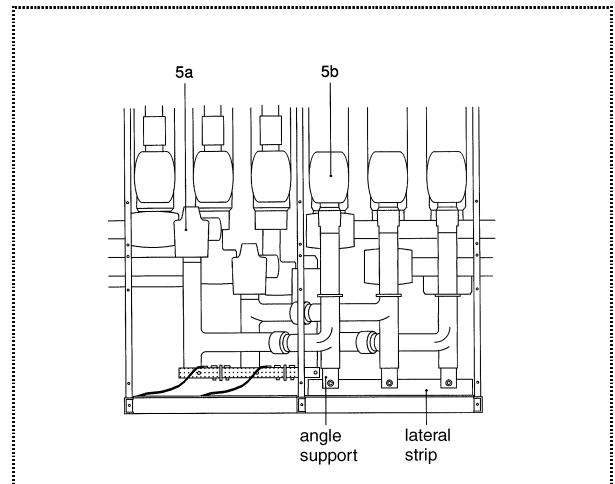
Remark:

Repeat the procedure for phases L1 and L2, if the transition blocks have not yet been mounted.

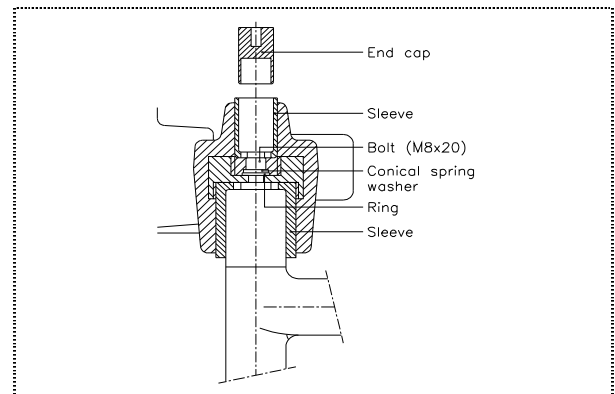


1b.

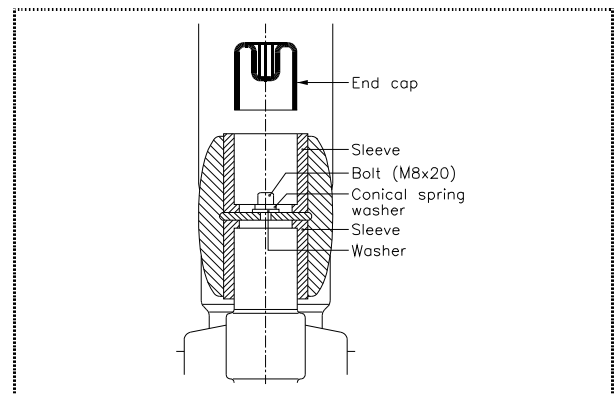
2. Mount the two installation sections to one another, following the procedure described in chapter 3.4.4, steps 1 to 10 inclusive and steps 14 to 22 inclusive.
 - Do not yet mount the U-shaped main bars.
3. Fit new rubber sleeves in the holes in the epoxy resin of the main bars of the two installation sections:
 - clean the contact faces and clean the holes in the epoxy resin.
 - apply silicone grease to the six new rubber sleeves and fit the sleeves in the holes.
4. Assemble the U-shaped main bars:
 - remove the preassembled lateral strip and the three angle supports.
 - mount the U-shaped main bars in the holes in the epoxy resin of the main bars, using M8 x 20 bolts. When fitting the bolts, make sure the washers and conical spring washers are correctly positioned. Torque the bolts to 14 Nm.
 - position the lateral strip back on the frame and attach the three angle supports to the U-shaped main bars.
 - then fix the lateral strip to the base frame.
5. Close the holes in the transition block (3x) (figure 5a) and in the interrupter housings (3x) (figure 5b).
 - To do so, position a suitable sleeve, then fit the end cap. Use the polyamide thread to enable venting.



4.

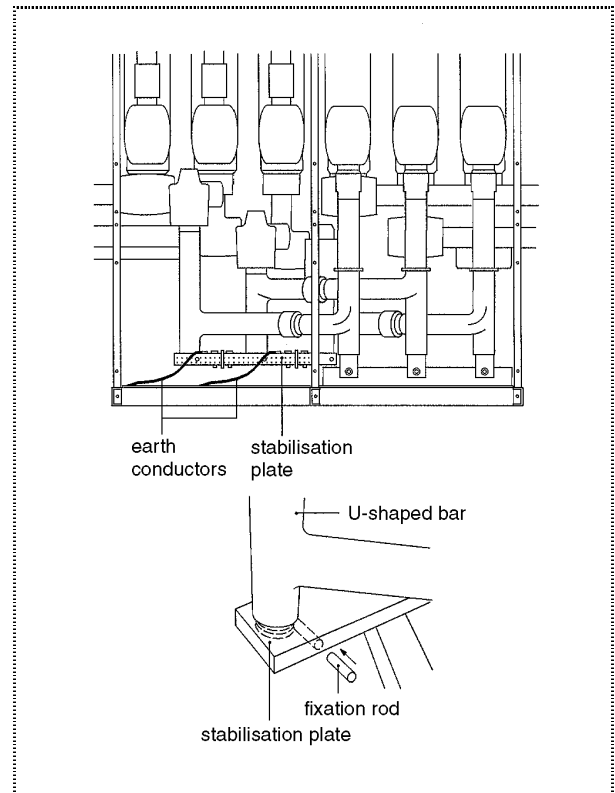


5a.



5b.

6. Mount the insulated stabilisation plate underneath the remaining bar ends of the U-shaped main bars and position the insulated fixation rods in the holes on the side.
 - Fit the earth conductors between the earth plate and the metal parts of the stabilisation plate. Make sure that these parts are properly earthed.
7. Connect the secondary wiring of the current transformers, if these are mounted to the U-shaped bars.



6.

3.4.8 TESTING A COUPLING

General

To check whether two panels have been coupled correctly, the voltage losses across the coupled main bar systems and the earth bars are to be determined. In addition, a high-voltage test is to be carried out for the primary sections of the installation.

Determining voltage losses

1. Switch the two coupled panels to operating position. For this, see manual 991.137 - Medium-voltage switchgear, type SVS, chapter 4.

Remark:

In the case of a fused load-break switch panel, an internal interlock must first be released before this type of panel, with opened door, can be switched to operating position. This interlock can be released by slightly lifting the locking strip near the changeover switch on the inside of the mechanism.

Warning

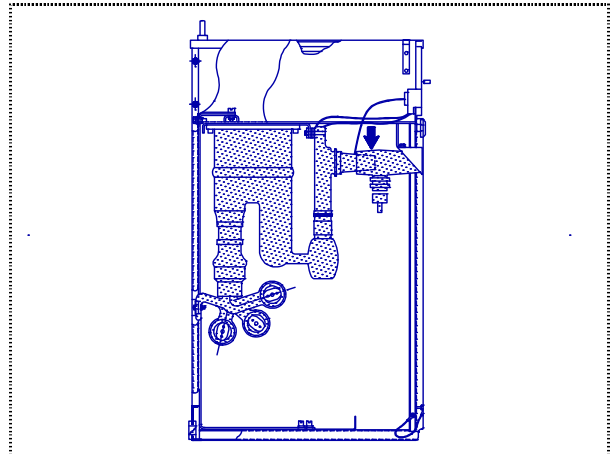
Risk of injury due to uncontrolled movements of the mechanism

- 2 Thoroughly clean the measuring points. The measuring points for the various panel types are indicated by an arrow in figures 2a, 2b and 2c.
- 3 Use direct current to measure the voltage loss across the new connection.
 - Carry out the measurement for all the phases and for the connection in the earth bar.
 - With a direct current of 100 A, the voltage loss per phase has to be less than 35 mV for all panel types.
 - With a direct current of 100 A, the voltage loss across the earth bar connection also has to be less than 35 mV.

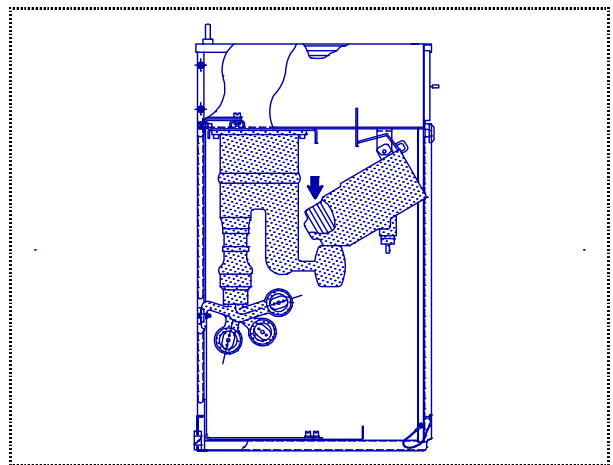
Remark:

When the measurements are carried out with a direct current of a different value, the measured voltage losses may be converted.

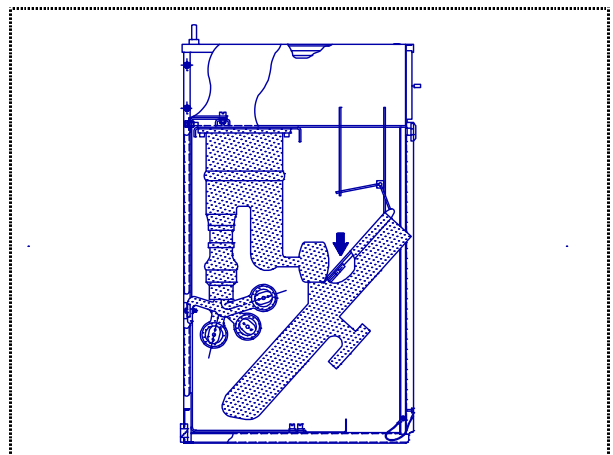
4. If the voltage loss exceeds 35 mV, check first of all that the measuring points are clean, then repeat the measurement.



2a. Load-break switch and circuit breaker panel



2b. Fused load-break switch panel with short fuse holders (12kV only)



2c. Fused load-break switch panel with short fuse holders (12 kV only)

High-voltage test

The high-voltage test is carried out with an AC voltage (50 Hz), its height depending on the rated voltage of the installation.

The rated voltage is stated on the type plate. See the table below for the relevant test voltage.

Rated voltage U (kV)	Test voltage (kV)
3.6	10
7.2	20
12.0	28
17.5	38
24.0	50

The test is carried out per phase, with the other two phases being connected to earth. The installation will have to withstand this test for at least one minute.

4. SYSTEM OPERATION

4.1 WHO IS ALLOWED TO OPERATE THE SYSTEM

See manual 991.137 - Medium voltage switchgear, type SVS.

4.2 OPERATION

See manual 991.137 - Medium-voltage switchgear, type SVS.

5. SYSTEM COMMISSIONING AND DECOMMISSIONING

5.1 COMMISSIONING

See manual 991.137 - Medium-voltage switchgear, type SVS.

5.2 DECOMMISSIONING

See manual 991.137 - Medium-voltage switchgear, type SVS.

6. SYSTEM INSPECTION, MAINTENANCE AND REPAIR

6.1 INSPECTION AND MAINTENANCE

See manual 991.137 - Medium voltage switchgear,
type SVS.

6.2 REPAIR

Contact Eaton-Electrical Services & Systems in case of
faults and repair work.

You can reach Eaton-ES&S 7 days a week,
24 hours a day for advice and repair work.

Address:

Eaton Electric B.V.

Eaton-Electrical Services & Systems

P.O. Box 23, 7550 AA Hengelo, Holland

Europalaan 202, 7559 SC Hengelo, Holland

Telephone: +31 74 246 91 11

Telefax: +31 74 246 44 44

e-mail: Holec-info@Eaton.com

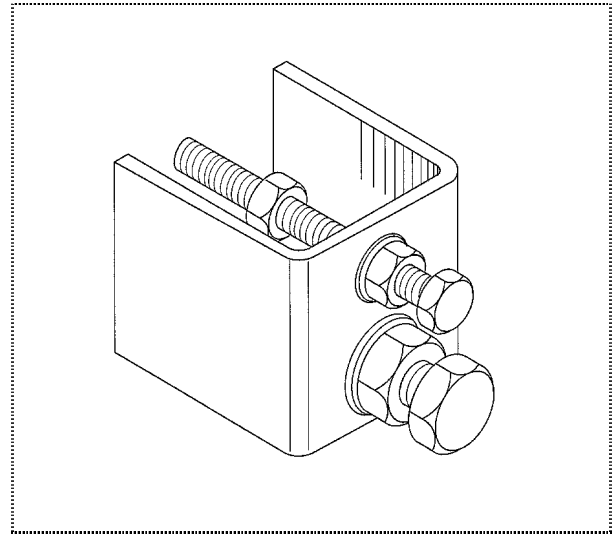
internet: www.Holec.com

In the event of a failure: +31 74 24 66 888

7. ACCESSORIES

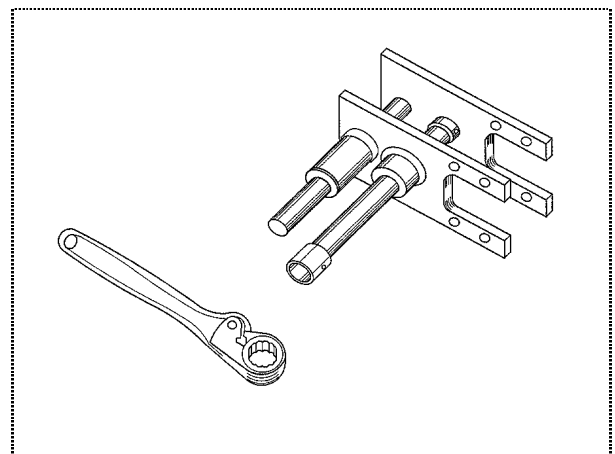
7.1 SUMMARY OF AVAILABLE ACCESSORIES

1. Auxiliary tool to remove the end caps of an existing main busbar system.



1.

2. Auxiliary tool for assembly of a flexible busbar bond.



2.

8. GLOSSARY

8.1 PROTECTION TO PREVENT RISK

- **Live part:**
a conductive part which is or can be live under normal operating conditions
- **Direct touch:**
touching live parts
- **Indirect touch:**
touching:
 - a. metal frames, metal enclosures and cable armouring, as well as metal conduits
 - b. other conductive parts which may become live due to a defect
- **Metal frame:**
an external or a comparable, conductive, dead part of electrical material which may become live due to a defect
- **Full protection:**
protection to prevent risk in case of deliberate and accidental direct touch and too close a proximity
- **Degree of protection (of an enclosure for electrical material):**
the degree of protection which an enclosure of electrical material offers against indirect touch of or too close a proximity to inadequately insulated parts, as well as against the intrusion of foreign objects and harmful amounts of water

8.2 INSTALLATIONS AND MATERIAL

- **Electrical installation:**
a system of electrical material, lines and accessories
- **Electrical material:**
electrical machines, power transformers, static energy transducers, switchgear and controlgear and electrical appliances

8.3 RATED QUANTITIES

- **Rated voltage:**
the voltage underlying the design or manufacture of an electrical installation
- **Rated current:**
the current underlying the manufacture of an electrical installation
- **Rated power:**
the power underlying the manufacture of electrical material

8.4 PERSONNEL

- **Authorised person:**
specialist or qualified persons who are able to perform electrical operations
- **Team leader:**
authorised person in charge of the electrical operations at site
- **Responsible expert:**
specialist not being a team leader who is responsible for the supervision of the electrical operations

8.5 SWITCHGEAR AND CONTROLGEAR

- **Switch and controlgear:**
a unit for protecting or switching on and off two or more parts of an installation at one single location

8.6 OPERATIONS

- **Electrical operations:**
operations consisting of the setting-up, extension, renewal, alteration, repair, maintenance and inspection of electrical installations

8.7 AREAS

- **Electrical operating area:**
a room or area which is mainly used for operation of the installation and which is, in general, only accessible to persons authorised by or on behalf of the company management
- **Locked electrical operating area:**
an electrical operating area that can be locked so that only persons authorised by or on behalf of the company management have access
- **Escape door:**
a door enabling people to leave an area without hindrance if a hazardous situation develops

9. APPENDIX

9.1 GENERAL

This user manual is part of the information package which accompanies every delivery and consists of the following parts

Information on folder(s):

- project title
- name of the installation
- type of installation (key data such as voltage, current etc.)
- client order number
- Eaton Holec name and order number
- Eaton Holec contact address to report faults: name, telephone number, fax number
- date of issue
- contents

Diagram package, including:

- single line diagram
- equipment diagrams
- code explanation list
- panel diagrams
- space allocation
- floorplan drawings with dimensions, measurements and weights

Test reports:

- Routine test reports of:
 - the switchgear
 - the current and voltage transformers supplied
 - other equipment supplied, i.e.:
 - contactors
 - load-break switches
 - earthing switches
 - battery sets

List of spare parts:

- all parts which could be replaced during the lifetime of the installation, such as spring charging motors, trip coils, meters, push buttons, terminal strips etc.
- data such as type, ratings, price, stock number or other order information

User manuals:

- user manual of the Eaton Holec equipment used in the relevant version(s)

9.2 COMMENT FORM

Eaton Holec medium-voltage switchgear installations type Innovac SVS

If you have any comments on this manual or suggestions for improving this manual, please forward them to us on this form.

Is this manual:	YES	NO
• Comprehensive enough?	<input type="checkbox"/>	<input type="checkbox"/>
• Well set out?	<input type="checkbox"/>	<input type="checkbox"/>
• Clear?	<input type="checkbox"/>	<input type="checkbox"/>
• Adequately illustrated?	<input type="checkbox"/>	<input type="checkbox"/>
Is this manual satisfactory?	<input type="checkbox"/>	<input type="checkbox"/>

If not, how could the manual be improved?
Please give specific points or examples.

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Your name:

Your position:

Company name:

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Return this form to:
Eaton Electric B.V. P.O. Box 23, 7550 AA HENGELLO (O), The Netherlands