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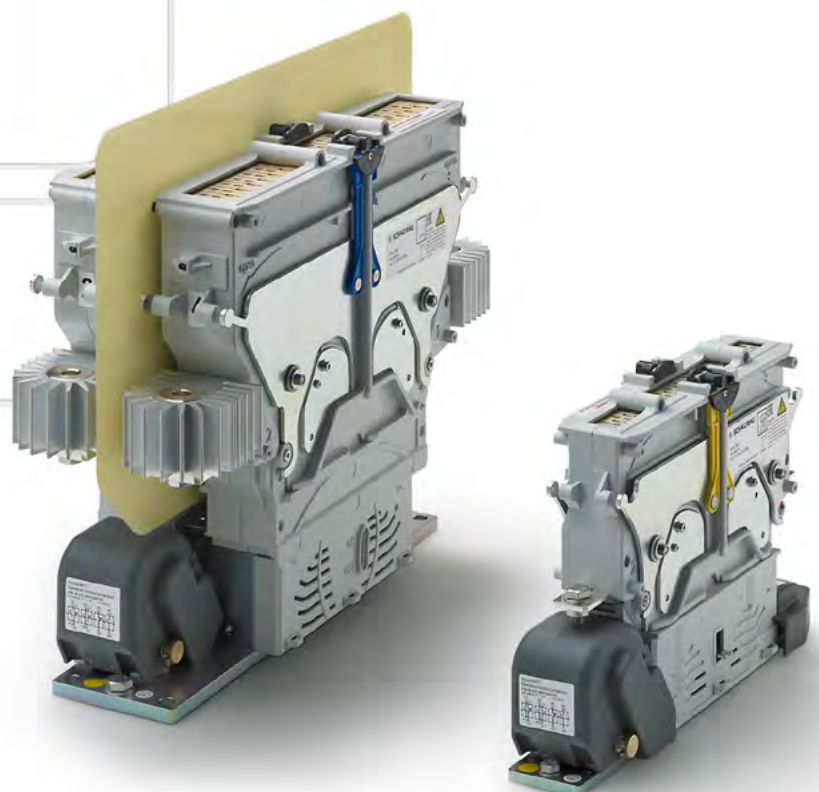
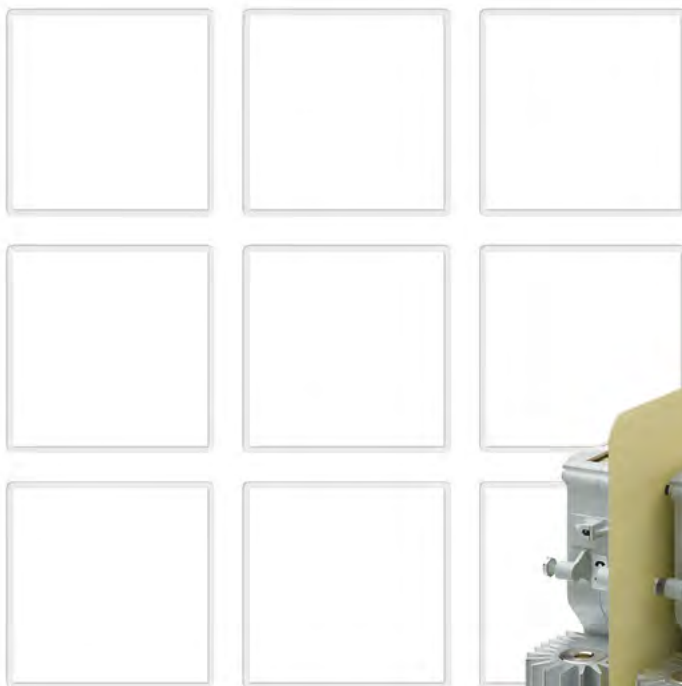
Contactors

CT1115/04 – CT1115/08 – CT1115/10/11
CT1130/04 – CT1130/08 – CT1130/10/11
CT1215/04 – CT1215/08 – CT1215/10/11
CT1230/04 – CT1230/08 – CT1230/10/11

Single pole / double pole NO
power contactors for AC and DC

**Installation and
maintenance instructions**

Manual C20-C21-M.en



Document Revision History

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1. Important basic information

1.1 Legal notes

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Schaltbau GmbH cannot be held liable for damage caused by not observing (or only partly observing) the manual.

1.2 Conventions for this manual

This manual describes the installation, commissioning and maintenance of the contactors.

Cross references are presented in bold italics.

To highlight particularly important safety instructions and other information, the following symbols are used in this instructions:

DANGER

Indicates a hazardous situation with a high level of risk which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation with a medium level of risk which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation with a low level of risk which, if not avoided, may result in minor or moderate injury.

NOTICE

Indicates a hazardous situation which, if not avoided, may result in property damage, such as service interruption or damage to equipment or other materials.



Refers to technical features and methods aimed at facilitating work or to particularly important information.

This manual refers to single pole and double pole contactors of the types:

Single pole contactors	CT/CU 1115/04	CT/CU 1130/04
	CT/CU 1115/08	CT/CU 1130/08
	CT/CU 1115/10/11	CT/CU 1130/10/11
Double pole contactors	CT/CU 1215/04	CT/CU 1230/04
	CT/CU 1215/08	CT/CU 1230/08
	CT/CU 1215/10/11	CT/CU 1230/10/11

- ▶ CT contactors are devices for bidirectional DC or AC operation and have electromagnetic blowout coils.
- ▶ CU contactors are devices that only work in unidirectional DC operation. CU contactors have permanent magnets instead of blowout coils.
- ▶ The contactor types 1115/10, 1215/10 are UL recognized components (Underwriters Laboratories).
- ▶ The contactor types CT XXXX/10 and CT XXXX/11 as well as CU XXXX/10 and CU XXXX/11 have basically the same structure. Apart from electrical data the only difference are the heat sinks:
 - CT/CU XXXX/11 contactors have heat sinks
 - CT/CU XXXX/10 contactors do not have heat sinks

2. General and security information

The contactors dealt with in this document are intended for use with high-voltage systems for special installations. They are designed and tested in compliance with the generally recognised state of the art. However, improper use, operation, handling, maintenance or tampering with electric equipment can cause serious or fatal injury to the user or others, and the appliance or other property can be damaged.

The operation, maintenance and installation instructions for the contactors must therefore be strictly followed.

Any uncertainties must be clarified and all queries must include details of the type of device and the serial number.

Only authorized and trained personnel are allowed to plan and carry out all mechanical and electrical installations, transport, commissioning, as well as maintenance and repair work. This applies to the observation of the general installation and safety regulations for high-voltage systems as well as the proper use of tools approved for this purpose. Electric equipment requires protection from moisture and dust during installation and storage.

2.1 Observing the instructions

- ▶ All staff must read and understand the instructions in this manual and adhere to them when working with the device.

- ▶ **Always carefully observe all safety warnings!**

2.2 User obligations

- ▶ Observe all applicable national provisions, all safety, accident prevention and environmental regulations as well as the recognized technical rules for safe and proper working.
- ▶ Carry out regular inspections of all protection and safety devices to see if they work properly.
- ▶ Work on electric equipment may only be performed by an expert or trained personnel working under the direction and supervision of an expert according to the applicable rules of electrical engineering.
- ▶ An expert is a person who can judge and recognise the possible dangers of the jobs commended to him based on his training, knowledge and experience and by knowledge of the appropriate regulations.
- ▶ Work on the contactors must only be carried out by staff who meets the requirements set out in this manual.
- ▶ Staff must be informed clearly about who is responsible for the maintenance of the contactors.
- ▶ After each installation work and after replacement of main contacts, contact bridge or after any other modifications, alterations or maintenance works, always perform complete checks according to these standards:
 - IEC 60077-2
 - IEC 60947-4-1

2.3 Intended use

- ▶ The contactors have been designed and tested according to national and international standards. Due to their unique features they can also be used in a variety of applications.
- ▶ The contactors must only be used under operating conditions according to the technical specification and the instructions in this manual.
- ▶ None of the operating conditions defined in our catalogues **C20.en** and **C21.en** in section "**Specifications**", such as voltages, currents, ambient conditions, etc. may be changed.
- ▶ The contactors must only be used when all protective devices are present, have been installed properly and are fully operational.
- ▶ The contactors must not be contaminated with aggressive media.
- ▶ Contactors may not be used without further protective measures in potentially explosive atmospheres.

- ▶ The switching device meets the requirements of basic insulation. Make sure the frame or plate onto which the drive of the contactor is mounted is earthed in a shock and vibration resistant way.
- ▶ Do not use the contactor without properly mounted arc chute.
- ▶ The contactor has unprotected live parts and carries labels that warn of the hazard. This caution must be observed and the labels must not be removed in any way.
- ▶ The required clearance of live parts to earth and other parts of the contactor is to be observed as well as the safety regulations of the applicable standards.
- ▶ Switching at maximum breaking capacity might require larger clearance! Do not hesitate to ask our advice for dimensioning.
- ▶ Do not use the contactor without protective covers (for coil terminals and auxiliary switches).
- ▶ Coil suppression for reducing surges when the coil is switched off is optimally attuned to the contactor's switching behaviour. The existing opening characteristic must not be negatively influenced by parallel connection with an external diode.
- ▶ Improper handling of the contactors, e.g. when hitting the floor with some impact, can result in breakage, cracks and deformation. Always handle the contactors with care.
- ▶ Use the contactor only according to its intended use. Replace or repair damaged parts exclusively with original parts. Any other usage of or tampering with the contactors is considered contrary to its intended use. No liability is assumed for damages and accidents caused due to non-compliance with the instructions in this manual or improper use of the contactors.

2.4 Ambient conditions

NOTICE

The contactors are constructed for specific ambient conditions.





- ▶ Operate the contactors only according the ambient conditions, like temperature ranges, IP protection classes, degree of soiling, etc., as defined in our catalogues **C20.en** and **C21.en** in section "**Specifications**".


The catalogues are available under:


<https://www.schaltbau.com/en/media-library/>

3. Dangers and security measures


3.1 Electrical dangers


	<p>⚠ DANGER</p> <p>The contactors are high voltage switches. The touching of electrically conducting parts may result in serious injuries or even death! Energized parts are all metal parts belonging directly to one of the circuits or wires leading there. All other visible metal parts and wires may also be energized in the case of a failure. Before beginning any work on the contactors, always observe the following safety regulations:</p> <ul style="list-style-type: none"> ▶ Disconnect on all sides ▶ Ensure that it is not possible to reconnect unintentionally ▶ Clearly mark your work area ▶ Make sure that there is no voltage present ▶ Earth and short circuit the installation; this also includes the discharging of any capacitors in the main circuit ▶ Besides the main electric circuit, also disconnect additional and auxiliary circuits ▶ Cover or insulate adjacent energized parts ▶ Only an electrically skilled person may determine if there is no voltage present ▶ When the work has been concluded, proceed the other way round.
	<p>⚠ DANGER</p> <p>The contactors are equipped with two protective caps for the coil terminal and auxiliary switches. The protective caps are parts of the insulation system. Operation of the contactors without the protective caps may result in serious injuries or even death!</p> <ul style="list-style-type: none"> ▶ Never operate the contactors without the 2 protective caps. ▶ When removing the protective caps during installation or maintenance works, make sure that the protective caps are re-installed before the contactors are put into service.
	<p>⚠ DANGER</p> <p>The contactors are equipped with a protective earth terminal. Without earth connection, metal parts and wires may be energized in the case of a failure. Risk of serious injuries or even death!</p> <ul style="list-style-type: none"> ▶ Make sure that the contactors are connected to earth. ▶ Make sure that the wire gauge of the earthing cables complies with the specific short circuit conditions.
	<p>⚠ DANGER</p> <p>In the case of a failure of the equipment;</p> <ul style="list-style-type: none"> ▶ don't use it anymore ▶ immediately contact the manufacturer.


	⚠ DANGER
	Interventions in the equipment may cause serious impairments to the safety of men and constructions. They are not permissible and lead to an exclusion of liability and warranty.


	⚠ DANGER
	All checks and the replacement of components or groups of components may only be carried out by qualified personnel according to the instructions of Schaltbau. All spare parts must be parts delivered by or released by Schaltbau..

3.2 Other dangers

	⚠ WARNING
	<p>Exclusively use the contactors for purposes as indicated in the specifications and data sheets. A wrong application can cause accidents and severe damages to persons!</p> <ul style="list-style-type: none"> ▶ The manufacturer doesn't take the responsibility for accidents which were caused by improper use of the product.

	⚠ WARNING
	<p>The contactor is heavy. Risk of injury and damage to the device.</p> <ul style="list-style-type: none"> ▶ Take care when handling the contactor. ▶ Always two persons should be available when unpacking and carrying the contactor. ▶ When carrying the contactor always hold it on the base plate. ▶ Do not carry the contactor by holding it at the upper module.

	⚠ CAUTION
	<p>The contactors may grow warm during operation and they may become hot depending on the ambient temperature and the conditions of use. Risk of burns!</p> <ul style="list-style-type: none"> ▶ Before beginning any work on the contactors make sure that the heated components have cooled down.

	⚠ CAUTION
	<p>The contactors contain sharp-edged parts. Risk of injury!</p> <ul style="list-style-type: none"> ▶ Use appropriate tools for installation and maintenance works on the contactors. ▶ Wear protective gloves when working with sharp-edged components.

3.3 Measures for avoiding damages and malfunctions

NOTICE

Aggressive fluids may damage the contactors.

- ▶ Make sure that the contactors are not exposed to aggressive fluids.

NOTICE

Improper handling of the contactors, e.g. when hitting the floor with some impact, can result in breakage, cracks and deformation.

- ▶ Make sure that the contactors are always used properly.
- ▶ Do not throw the contactors to the floor.
- ▶ Regularly sight-check the contactors for potential damages.
- ▶ Immediately replace damaged components.

NOTICE

The contactors contain strong (permanent) magnets. These magnets can attract ferromagnetic particles and may damage the contactors.

- ▶ Make sure that the contactors are installed at a location, where no ferromagnetic particles can be attracted..

NOTICE

The contactors contain strong (permanent) magnets. These magnets can destroy data on credit cards or similar cards.

- ▶ Keep credit cards or similar cards away from the contactors.

NOTICE

During the switching off, strong electromagnetic fields are generated in the surroundings of the contactors. These may influence other components close to the contactors.

- ▶ Make sure that the contactors are installed at a location, where no other components can be affected.

NOTICE

In the case of damage, wear and tear and/or soiling of the contactor components - in the form of a partial break, sharp edges and discoloured surfaces - the functional safety of the contactors is no longer guaranteed.

- ▶ Carry out regular visual checks to detect wear and tear and dirt.
- ▶ Immediately replace damaged parts.
- ▶ Immediately remove dirt without leaving any residues.
- ▶ Immediately replace parts with stubborn dirt.

NOTICE

Detent-edged rings and detent-edged washers have a limited life time. After 3 times opening of screws secured with detent-edged rings or detent-edged washers, the rings or washers must be replaced by new ones.

- ▶ Record the frequency of screw opening in the work log.
- ▶ After 3 times opening of screws, replace detent-edged rings or detent-edged washers by new ones.

4. Introduction

4.1 CT/CU Power contactors for AC and DC

With the CT/CU contactor series Schaltbau expands its product line of state-of-the-art power contactors. The outstanding technical feature is the innovative combination of electromagnetic and permanent-magnetic blowout technology for electric arc control. The successful combination of these two principles greatly improves both switching functionality and reliability and forms a practical and economically impressive device concept.

CT contactors are devices for bidirectional DC or AC operation and have electromagnetic blowout coils.

CU contactors are devices that only work in unidirectional DC operation. CU contactors have permanent magnets instead of blowout coils.

The CT/CU contactor concept is flexible and can be adapted to suit the needs of the customer. Due to its technical characteristics, its economical advantages, its compactness and versatility, the CT/CU power contactor series is simply predestined for use in industrial and railway applications alike. The contactors are especially suited for use in locomotives, cranes, and converters of wind turbines and PV installations, but also in mining.

4.2 Features

- ▶ Compact, rugged innovative design
- ▶ 2 voltage levels (1,5 kV, 3 kV)
- ▶ Double-break contacts
- ▶ 1, 2, and 3¹ pole versions
- ▶ Easy inspection and replacement of main contact tips
- ▶ Easy to replace arc chute
- ▶ Drive system with coil tolerance according to railway standards
- ▶ Functional insulation for main circuit
- ▶ Basic insulation between main circuit and protective earth
- ▶ Reinforced insulation between main circuit and control circuit/auxiliary circuit

¹ Upon request

4.3 Applications

CT/CU Series contactors comprise a number of various design versions catering to a wide range of uses, such as:

- ▶ **Main contactor for:**
Traction converters and inverters for auxiliary equipment
- ▶ **Contactor for:**
Field circuits of motors, conventional resistor based traction units (retrofit), starter and compressor motors, and heating circuits
- ▶ **Contactor for a host of industrial and railway applications:**
 - locomotives
 - cranes
 - mining

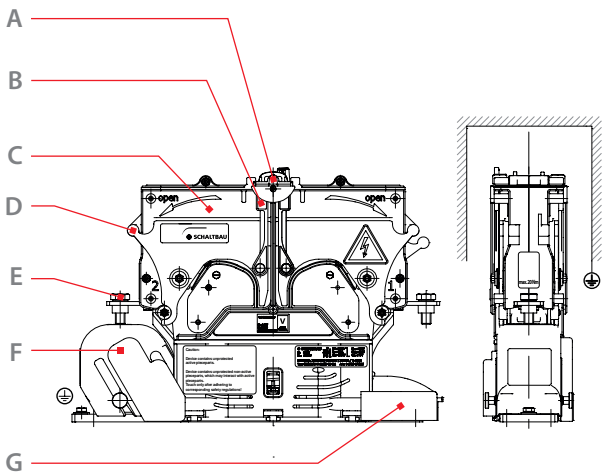
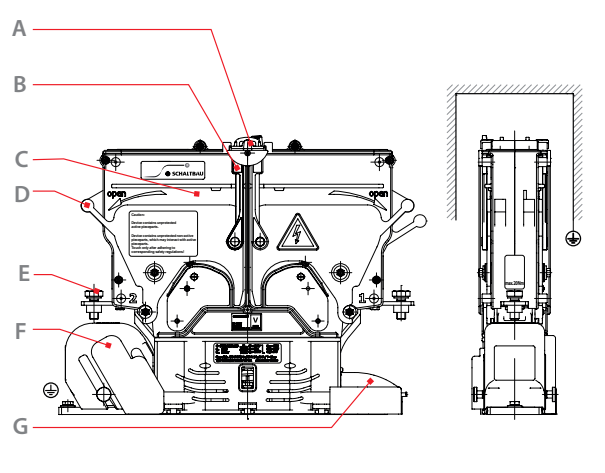
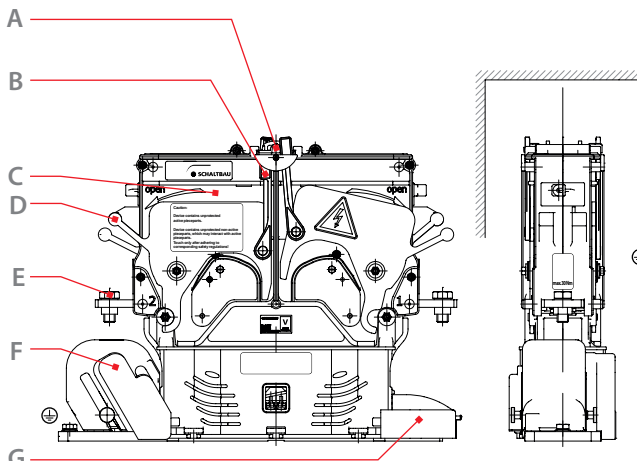
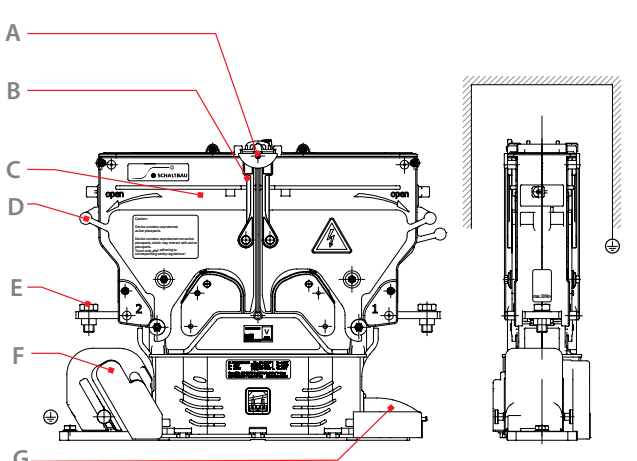
4.4 Technical information and material specification

For technical information, dimensions and material specifications, refer to our catalogues **C20.en** and **C21.en**. The catalogues are available under:

<https://www.schaltbau.com/en/media-library/>

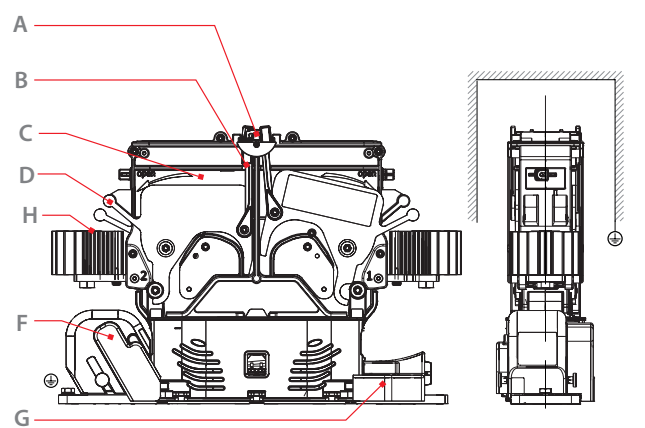
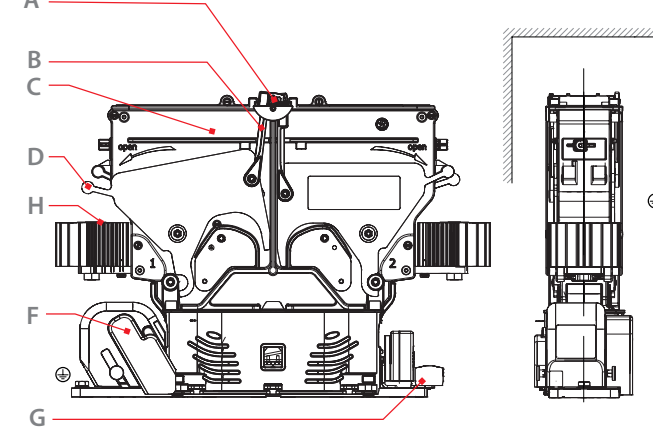
5. Description

5.1 Survey of the CT/CU series (stock items)

Single pole NO contactors for DC/AC	
CT/CU 1115	CT/CU 1130
 <p>CT/CU 1115/04 single pole NO contactor for 1,500 V / 400 A</p>	 <p>CT/CU 1130/04 single pole NO contactor for 3,000 V / 400 A</p>
 <p>CT/CU 1115/08 single pole NO contactor for 1,500 V / 800 A CT/CU 1115/10 single pole NO contactor for 1,500 V / 1000 A</p>	 <p>CT/CU 1130/08 single pole NO contactor for 3,000 V / 800 A CT/CU 1130/10 single pole NO contactor for 3,000 V / 1000 A</p>

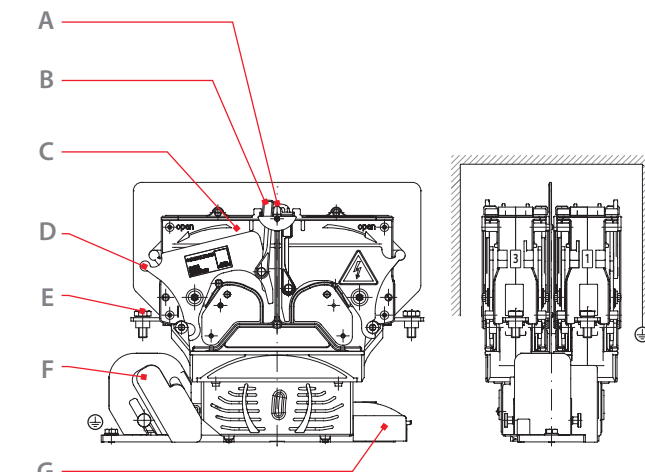
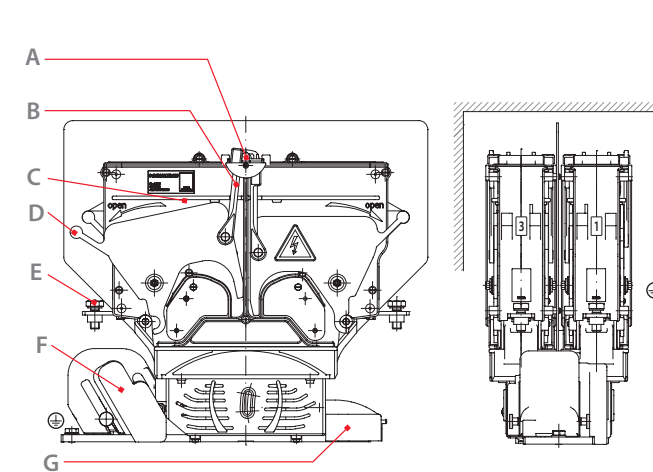
- A Release slider to unlock arc chute
- B Lock bar with indicator (arc chute open/locked)
 - yellow: mounting pos. H (horizontal)
 - red: mounting pos. V (vertical)
 - blue: mounting pos. either H (horizontal) or V (vertical)
- C Arc chute

- D Latching lever
- E Main terminal
- F Auxiliary contact block (incl. cover)
- G Coil terminal WAGO 264 (incl. cover)

Single pole NO contactors for DC/AC	
CT/CU 1115	CT/CU 1130
 <p>CT/CU 1115/11 single pole NO contactor for 1,500 V / 1100 A</p>	 <p>CT/CU 1130/11 single pole NO contactor for 3,000 V / 1100 A</p>

- A Release slider to unlock arc chute
- B Lock bar with indicator (arc chute open/locked)
 - yellow: mounting pos. H (horizontal)
 - red: mounting pos. V (vertical)
 - blue: mounting pos. either H (horizontal) or V (vertical)
- C Arc chute

- D Latching lever
- E Main terminal
- F Auxiliary contact block (incl. cover)
- G Coil terminal WAGO 264 (incl. cover)
- H Main terminal with heat sink

Double pole NO contactors for DC/AC	
CT/CU 1215	CT/CU 1230
 <p>CT/CU 1215/04 double pole NO contactor for 1,500 V / 400 A</p>	 <p>CT/CU 1230/04 double pole NO contactor for 3,000 V / 400 A</p>

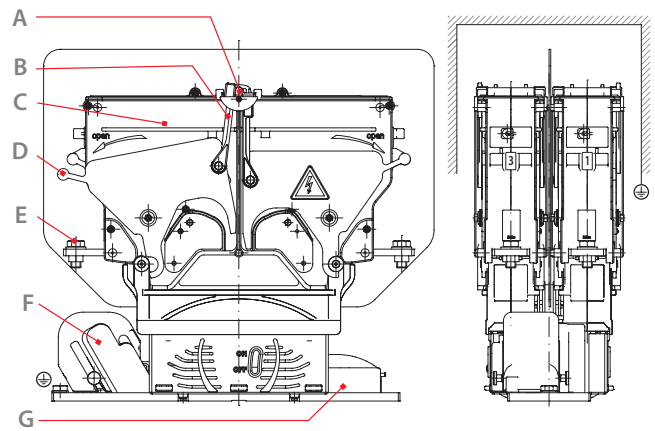
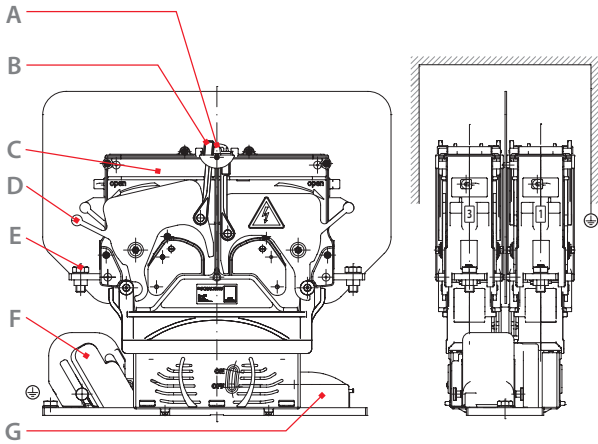
- A Release slider to unlock arc chute
- B Lock bar with indicator (arc chute open/locked)
 - yellow: mounting pos. H (horizontal)
 - red: mounting pos. V (vertical)
 - blue: mounting pos. either H (horizontal) or V (vertical)
- C Arc chute

- D Latching lever
- E Main terminal
- F Auxiliary contact block (incl. cover)
- G Coil terminal WAGO 264 (incl. cover)
- H Main terminal with heat sink

Double pole NO contactors for DC/AC

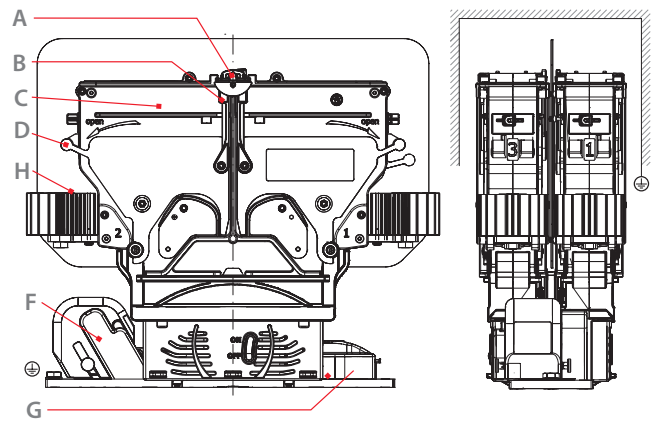
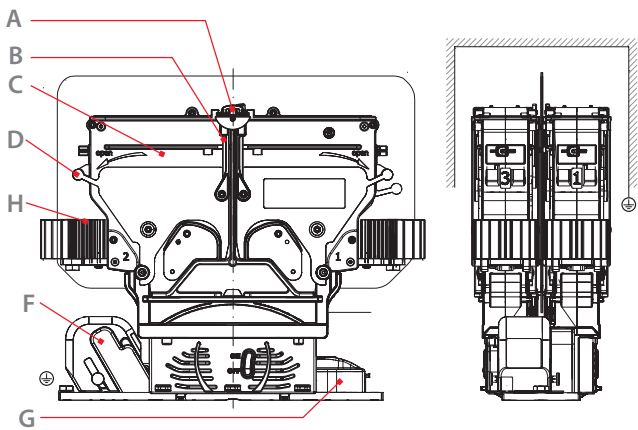
CT/CU 1215

CT/CU 1230



CT/CU 1215/08 double pole NO contactor for 1,500 V / 800 A
CT/CU 1215/10 double pole NO contactor for 1,500 V / 1000 A

CT/CU 1230/08 double pole NO contactor for 3,000 V / 800 A
CT/CU 1230/10 double pole NO contactor for 3,000 V / 1000 A



CT/CU 1215/11 double pole NO contactor for 1,500 V / 1100 A

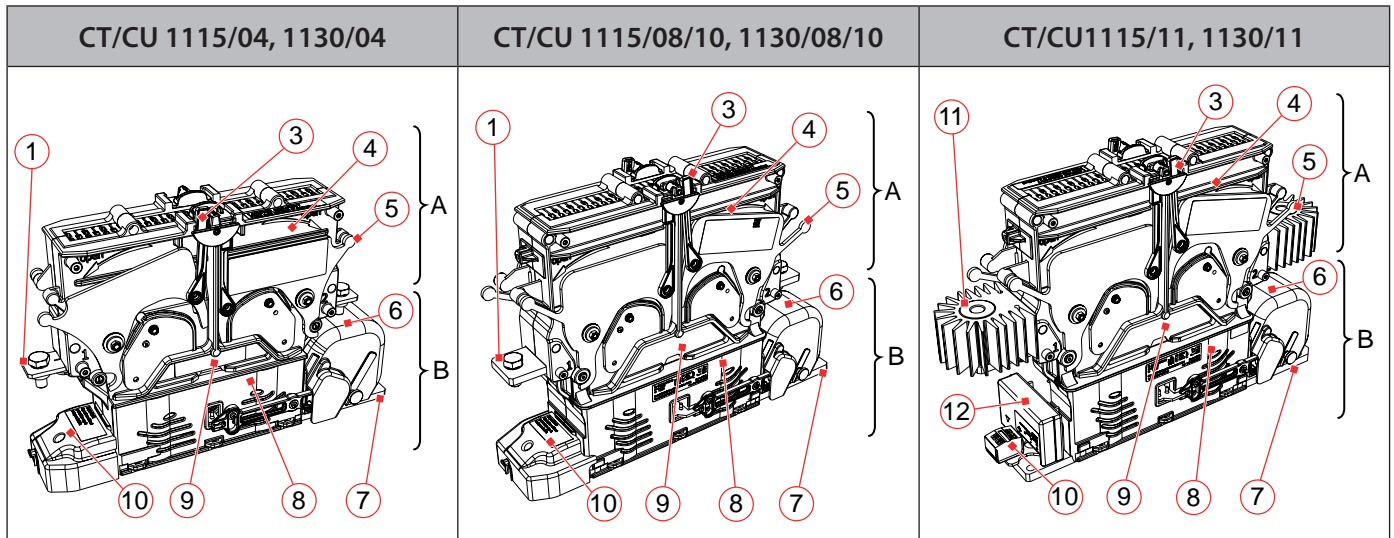
CT/CU 1230/11 double pole NO contactor for 3,000 V / 1100 A

- A Release slider to unlock arc chute
- B Lock bar with indicator (arc chute open/locked)
 - yellow: mounting pos. H (horizontal)
 - red: mounting pos. V (vertical)
 - blue: mounting pos. either H (horizontal) or V (vertical)
- C Arc chute

- D Latching lever
- E Main terminal
- F Auxiliary contact block (incl. cover)
- G Coil terminal WAGO 264 (incl. cover)
- H Main terminal with heat sink

5.2 Parts description

Single pole contactors



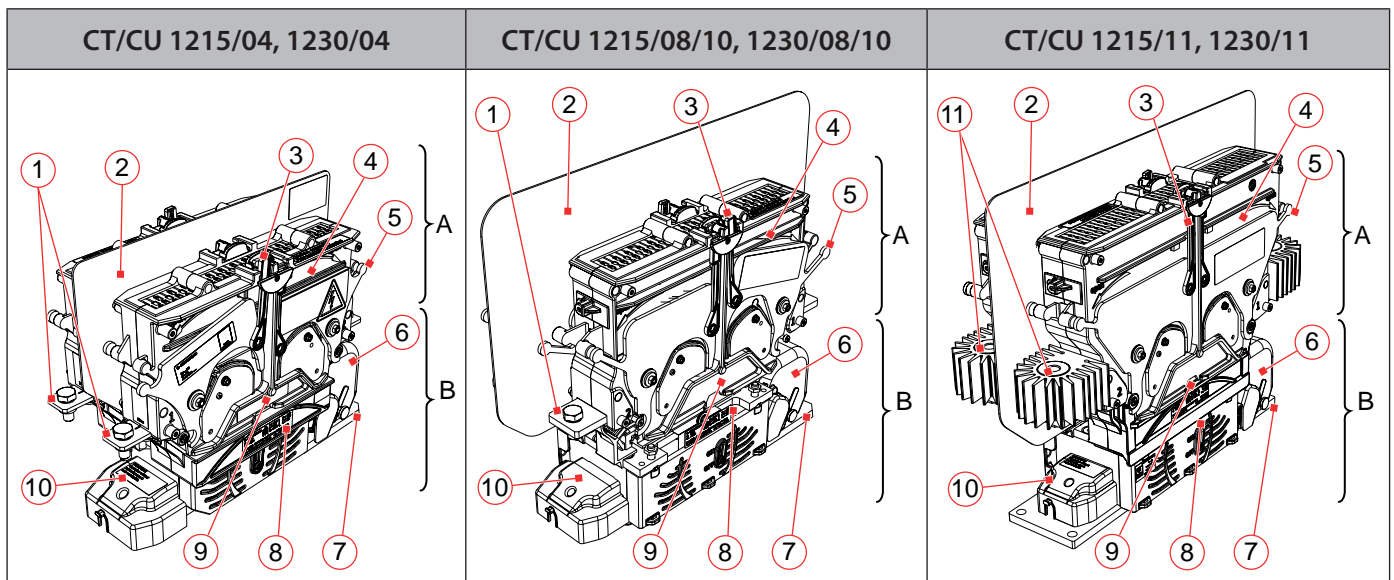
A Upper module

- 1 Fixed contact with main terminals
- 3 Lock bars
- 4 Arc chute
- 5 Latching levers
- 11 Fixed contact with main terminal and heat sink

B Lower module

- 6 Auxiliary contact group with protection cap
- 7 Base plate
- 8 Magnetic drive with coil controller and moving contact bridge (coil controller and moving contact bridge are not visible in the figure)
- 9 Moving contact bridge (not visible in the figure)
- 10 Coil terminal group with protection cap
- 12 Double coil controller

Double pole contactors



A Upper module

- 1 Fixed contact with main terminals
- 2 Insulation plate
- 3 Lock bars
- 4 Arc chute
- 5 Latching levers
- 11 Fixed contact with main terminal and heat sink

B Lower module

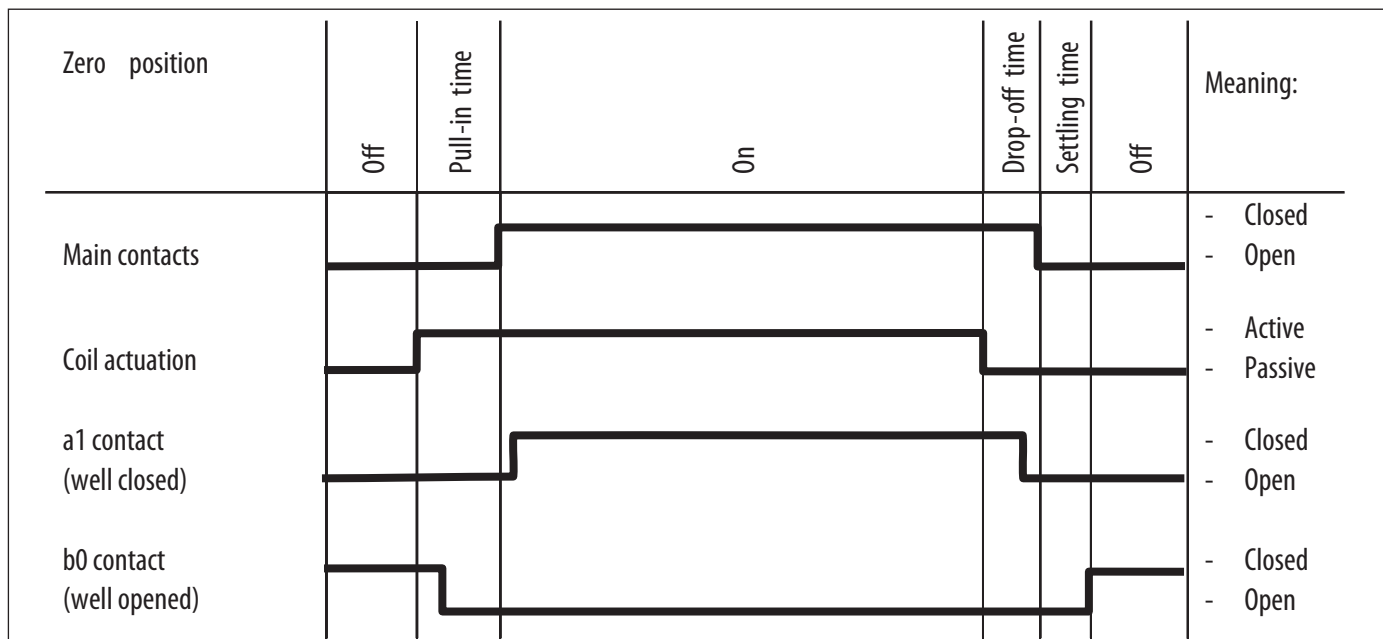
- 6 Auxiliary contact group with protection cap
- 7 Base plate
- 8 Magnetic drive with coil controller and moving contact bridge (coil controller and moving contact bridge are not visible in the figure)
- 9 Moving contact bridge (not visible in the figure)
- 10 Coil terminal group with protection cap

5.3 Switching diagram

The diagram below shows the switching states of the CT contactors.

Typical values:

- Typical pull-in time: 250 ms
- Typical drop-off time: 60 ms
- Time constant of magnetic drive: approx. 90 ms
- Settling time for b0 switch: up to 10 ms



6. Storage

NOTICE

Moisture and dust can damage the contactor. If the device is to be stored for a prolonged period of time,

- ▶ store it in its original packaging,
- ▶ store it in a dry and dust-free location.

Return shipments

Schaltbau recommends to keep the original packing box for any return shipments. If no original packing box is available care must be taken to pack the contactor in a way that prevents damage during shipment.

7. Unpacking and handling

⚠ WARNING



The contactor is heavy. Risk of injury and damage to the device.

- ▶ Take care when handling the contactor.
- ▶ Always two persons should be available when unpacking and carrying the contactor.
- ▶ When carrying the contactor always hold it on the base plate.
- ▶ Do not carry the contactor by holding it at the upper module.

7.2 Check parts for transport damage

NOTICE

If parts are damaged, the functional reliability of the contactor is no longer given.

- ▶ Before installing, check all parts for any possible transport damage.
- ▶ Do not install a damaged contactor.

7.1 Unpack the device

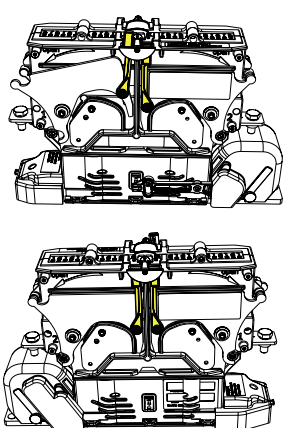
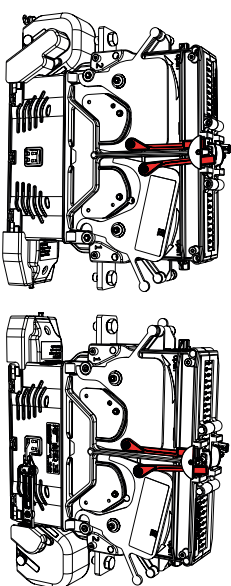
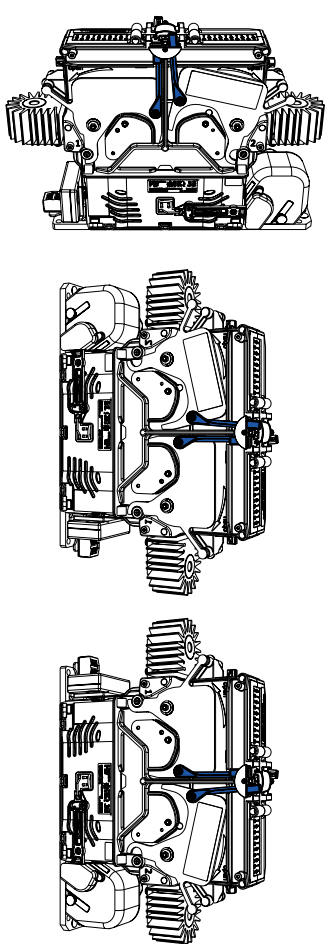
- ▶ Before opening the packaging, perform a visual inspection for any signs that could indicate damage having occurred during transport (impacts, bumps, falling etc.).
- ▶ If any signs indicate that the contactor has been subject to excessive shock influence do not install the contactor.
- ▶ Unpack the contactor. Depending on the contactor type, the upper and lower modules can be packed separately.
- ▶ When carrying the contactor always hold it on the base plate. Do not carry the contactor by holding it at the upper module.
- ▶ Put the contactor or the contactor modules respectively in an upright position on a stable workbench or table.

8. Correct mounting positions

The CT/CU contactors are designed for certain mounting positions, either horizontal or vertical or both. The required mounting position of the different types of contactors is indicated by the colour of the lock bars. Depending on the colour of the lock bars, the contactors must be installed in the position as stated in the table below:

Colour of lock bars	Required mounting position	
	»H« horizontal	»V« vertical
Yellow	X	-
Red	-	X
Blue	X	X

Examples of correct mounting positions

Mounting position	»H« horizontal	»V« vertical	»H« horizontal or »V« vertical
Colour of lockbars	YELLOW	RED	BLUE
Please observe the mounting position as shown on the nameplate			

9. Installation

9.1 Dimensions/interfaces to the vehicle

The dimensions to the interfaces of the vehicle and further technical specifications are given in the respective data sheets or in our catalogues. Refer to our catalogues **C20.en** and **C21.en**.

The catalogues are available under:

<https://www.schaltbau.com/en/media-library/>

9.2 Mechanical installation

Preliminaries

- ▶ Observe the minimum clearance of live parts to the arc chute! Refer to the dimension drawings in our catalogues **C20.en** (for single pole contactors) and **C21.en** (for double pole contactors).
- ▶ An appropriate mounting frame or a mounting plate has to be provided for the fastening of the contactor. The mounting frame or plate must be solid enough to carry the weight of the contactor under the shock and vibration conditions.
- ▶ 4 mounting holes have to be provided at the mounting frame or plate. See also section **“Mounting holes”**.
- ▶ The mounting holes can either be
 - threaded holes (for threaded screws)
 - or through holes (for threaded screws and nuts).
- ▶ The lower module of the contactor is fixed with 4 mounting screws, see also section **“Mounting holes”**.
 The mounting screws (and if applicable the nuts) must be steel grade 8.8 or higher.
 The size of the mounting screws depends on the contactor type and is shown in the following table:

Contactor type CT/CU		Mounting screw size	
Single pole contactors	1115/04	1130/04	M6
	1115/08	1130/08	M8
	1115/10/11	1130/10/11	M8
Double pole contactors	1215/04	1230/04	M10
	1215/08	1230/08	M10
	1215/10/11	1230/10/11	M10

- ▶ In order to secure the mounting screws against self-loosening, appropriate screw locking elements have to be provided. Schaltbau strongly recommends Schnorr-Washers (or similar) to secure the screws.
- ▶ The tightening torque and the length of the fixing screws have to be determined by the manufacturer of the vehicle according to the constructional conditions, e. g. the rated torque permissible for the used screws (and if applicable the nuts).

Safety

- ▶ The installation has to be carried out by qualified trained personnel.
- ▶ The switching device meets the requirements of basic insulation. Make sure that the mounting frame or mounting plate onto which the drive of the contactor is mounted is earthed in a vibration resistant way.

NOTICE

During installation, ensure that dirt caused by surrounding construction activities does not get into the contactor.

NOTICE

Detent-edged rings and detent-edged washers have a limited life time. After 3 times opening of screws secured with detent-edged rings or detent-edged washers, the rings or washers must be replaced by new ones.

- ▶ Record the frequency of screw opening in the work log.
- ▶ After 3 times opening of screws, replace detent-edged rings or detent-edged washers by new ones.

Required tools and auxiliaries

- Set of slotted screwdrivers
- Socket wrench set
- Hexagon socket wrench set
- Torque wrench
- Open-end wrench set

Mounting holes

The mounting holes at the mounting frame or plate can either be

- threaded holes (for threaded screws)
- or through holes (for threaded screws and nuts).

Depending on the contactor type the dimensions and arrangements of the mounting holes are shown in **Fig. 1** to **Fig. 4**.

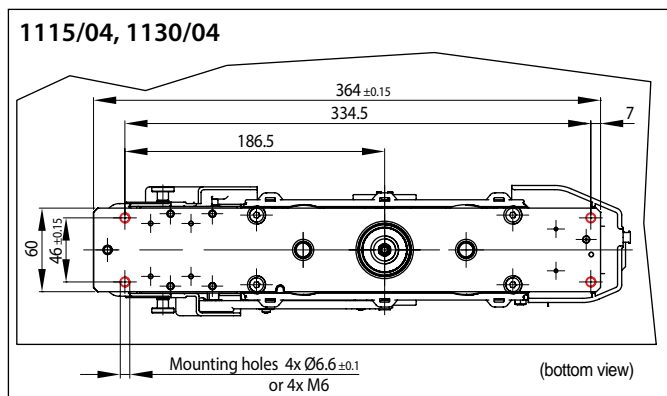


Fig. 1: CT/CU 1115/04, 1130/04: Dimensions (in mm) and arrangement of the mounting holes

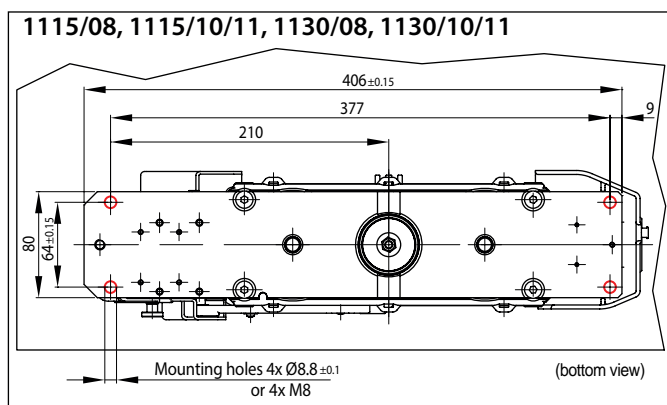


Fig. 2: CT/CU 1115/08, 1115/10/11, 1130/08, 1130/10/11: Dimensions (in mm) and arrangement of the mounting holes

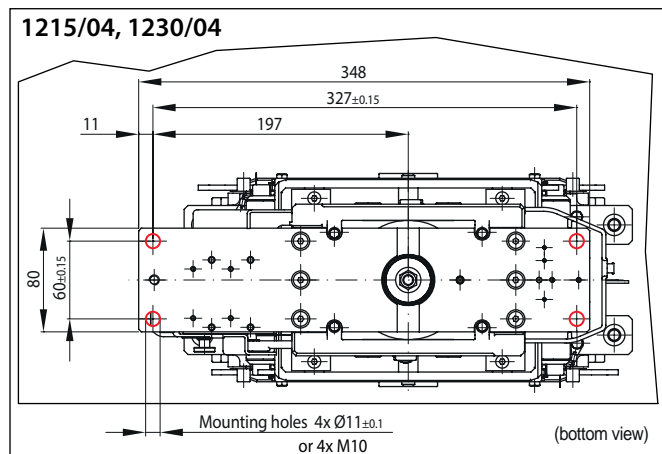


Fig. 3: CT/CU 1215/04, 1230/04: Dimensions (in mm) and arrangement of the mounting holes

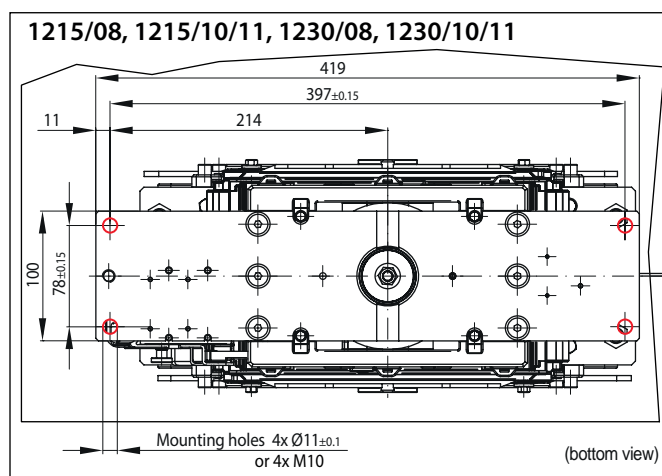


Fig. 4: CT/CU 1215/08, 1215/10/11, 1230/08, 1230/10/11: Dimensions (in mm) and arrangement of the mounting holes

Mechanical installation procedure

Remove the upper module

Depending on the contactor type, see **Fig. 5** to **Fig. 8**.

▶ Remove the upper module (A) from the lower module (B).

In order to do so:

- Press the both release buttons (1) together with one hand.
- With the other hand turn the 4 levers (2) down one by one to unlatch the upper module (A).
- Lift up the upper module (A) and put in on a table in an upright position.

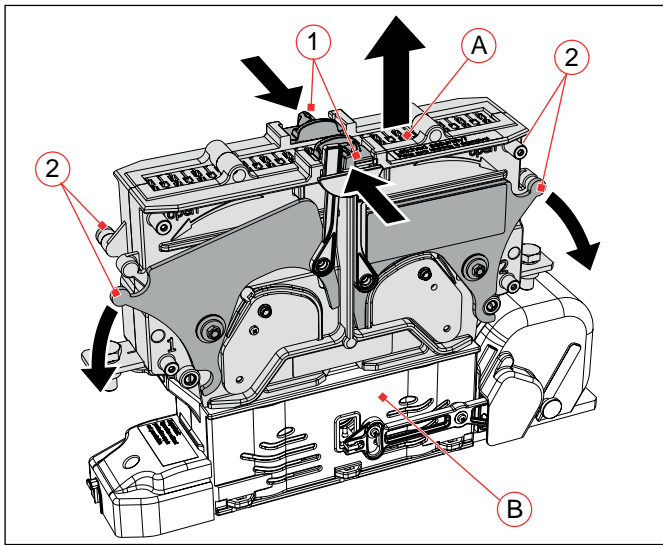


Fig. 5: CT/CU 1115/04, 1130/04, 1115/08/10, 1130/08/10: Remove the upper module (A) from the lower module (B)

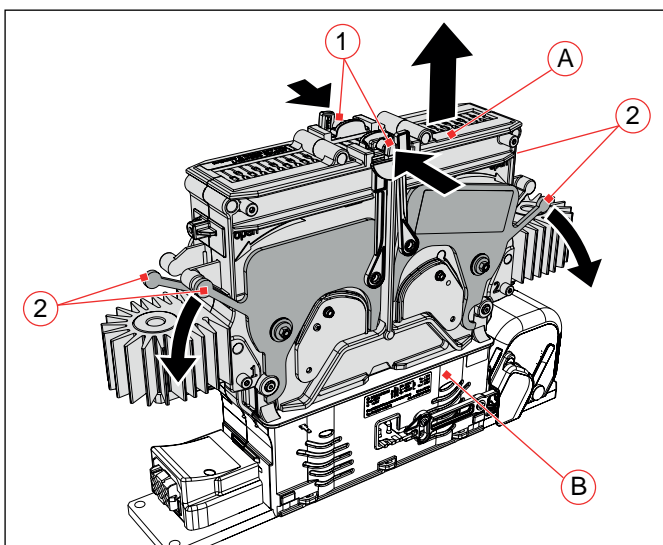


Fig. 6: CT/CU 1115/11, 1130/11: Remove the upper module (A) from the lower module (B)

In case of double pole contactors:

▶ Repeat the steps above with the second upper module.

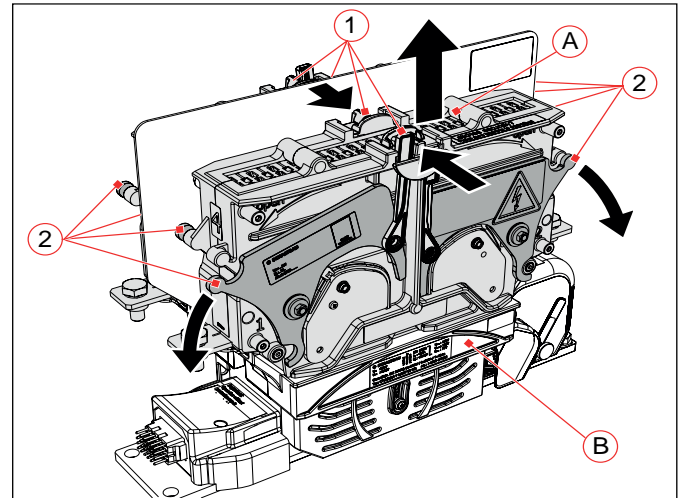


Fig. 7: CT/CU 1215/04, 1230/04, 1215/08/10, 1230/08/10: Remove the upper module (A) from the lower module (B)

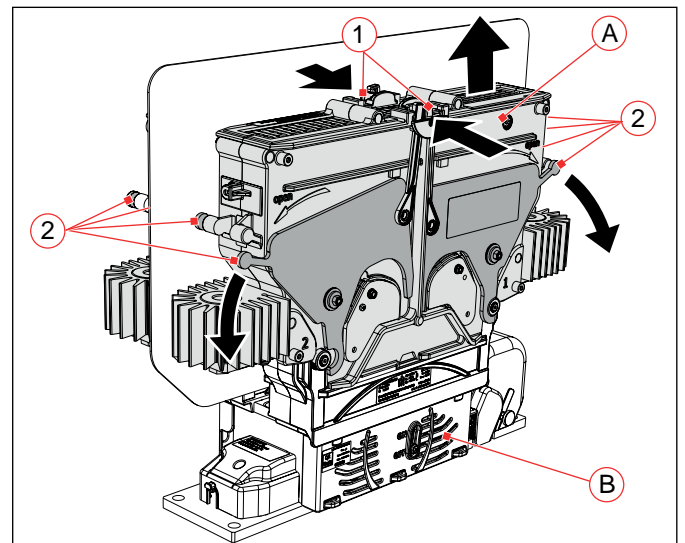


Fig. 8: CT/CU 1215/11, 1230/11: Remove the upper module (A) from the lower module (B)

Remove the protection caps

Depending on the contactor type, see **Fig. 9** to **Fig. 12**.

- ▶ Remove the both protection caps (3 + 4).
 - Remove the both knurled thumb screws (5) including washers and remove the protection cap for the auxiliary switches (3).
 - Unscrew the slotted-head screw (6) including washers and remove the protection cap for the coil terminal (4).

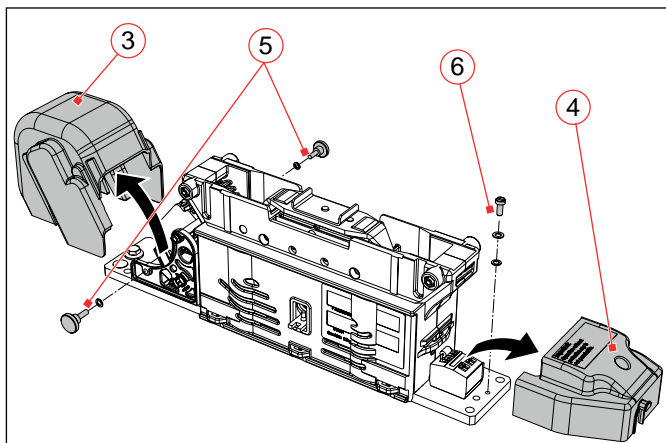


Fig. 9: CT/CU 1115/04, 1130/04, 1115/08, 1130/08:
Remove the protection cap (3) of the auxiliary switches and the protection cap (4) of the coil terminal

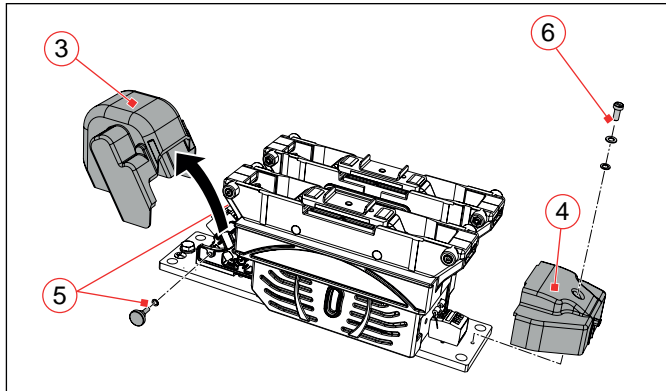


Fig. 10: CT/CU 1215/04, 1230/04, 1215/08, 1230/08:
Remove the protection cap (3) of the auxiliary switches and the protection cap (4) of the coil terminal

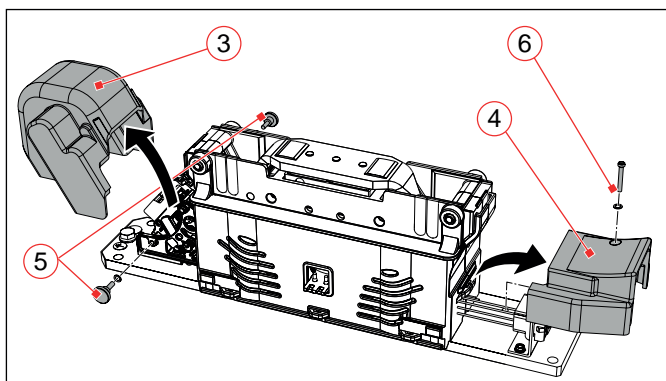


Fig. 11: CT/CU 1115/10/11, 1130/10/11: Remove the protection cap (3) of the auxiliary switches and the protection cap (4) of the coil terminal

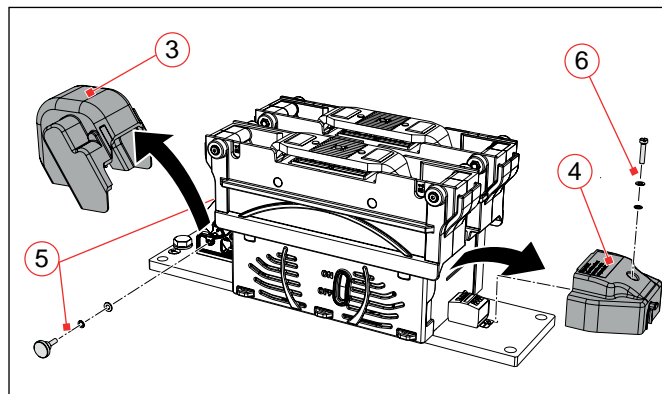


Fig. 12: CT/CU 1215/10/11, 1230/10/11: Remove the protection cap (3) of the auxiliary switches and the protection cap (4) of the coil terminal

Mount the lower module to the mounting frame or plate.

Depending on the colour of the lock bars (yellow, red, blue), the contactors must be installed either in horizontal or vertical position. Refer to chapter "8. Correct mounting positions".

- ▶ Clean the surface of the mounting frame or plate.
- ▶ Clean the base plate at the lower module of the contactor.
- ▶ Place the lower module on the prepared mounting frame or plate.
- ▶ Fix the lower module with the appropriate screws and screw locking elements (and nuts if applicable). Schaltbau strongly recommends Schnorr-Washers (or similar) to secure the screws.
- ▶ Tighten the screws with the correct torque that is required for the used screws.

9.3 Electrical Installation

Preliminaries

- ▶ Observe the minimum clearance of live parts to the arc chute! Refer to the dimension drawings in our catalogues **C20.en** (for single pole contactors) and **C21.en** (for double pole contactors).
- ▶ Switching electrical currents at high voltages will produce arcing and plasma may exit out of the arc chambers. It is essential to observe the minimum clearance to earth and to the connecting bus bars to avoid the risk of a flash-over. The minimum clearance has been tested and specified in relation to the switching capacity of the contactors.
- ▶ For switching heavy loads allow a minimum time of 30 s between switchings. Allow a recovery time of at least 10 min after 3 heavy load switchings in succession.

- ▶ Ensure sufficient ventilation, especially in the case of heavy arc switching. Allow the exchange of surrounding atmosphere to avoid the risk of flashovers and excessive corrosion.
- ▶ The minimum gauges for the main terminals and the earth terminal must be observed. Schaltbau strongly recommends busbars for the connection of the main terminals. The required cross sections of the busbars depend on the contactor type and are shown in the following table:

Contactor type CT/CU			Required cross section of busbars
Single pole contactors	1115/04	1130/04	40 x 4 mm
	1115/08	1130/08	80 x 8 mm
	1115/10/11	1130/10/11	80 x 10 mm
Double pole contactors	1215/04	1230/04	40 x 4 mm
	1215/08	1230/08	80 x 8 mm
	1215/10/11	1230/10/11	80 x 10 mm

- ▶ If wires are used the wire gauges must be selected in coordination with their insulation class and the operating conditions.
- ▶ Undersized gauges for the earth terminal may produce a safety hazard.
- ▶ Refer to catalogues for the power consumption of the magnetic drive system and the electrical data of the auxiliary switches:
 - C20 (Catalogue for Contactors CT/CU 1115/04, 1130/04, 1115/08 and 1130/08)
 - C21 (Catalogue for Contactors CT/CU 1215/04, 1230/04, 1215/08 and 1230/08)
 - D26 (Catalogue for Snap Action Switches S826)
 - D70 (Catalogue for Snap Action Switches S870)

The following information concerns only the contactor types:

- CT 1215/08 and 1230/08
- CT 1115/10/11 and 1130/10/11
- CT 1215/10/11 and 1230/10/11

The magnetic drive system has 2 coils: 1 low resistance pull-in coil and a high-resistance coil. During the pull-in operation the high-resistance coil is short-circuited allowing for a high pull-in power. After approximately


1 s the short circuit is released and both coils are connected in series. The pull-in and holding operation is controlled automatically by an internal controller. The driving circuit however must be capable of supplying the pull-in power for approx. 1 s.

- High pull-in power operation (approx. 230 W for 1 s; $U_s = U_{sni}$; $T_a = 20\text{ °C}$)
- Low power holding operation ($< 30\text{ W}$; $U_s = U_{sni}$; $T_a = 20\text{ °C}$)
- Overvoltage limitation

The high pull-in power allows stronger return springs reducing the danger of contact welding during making and breaking significantly.

The low holding power reduces power consumption without loss of performance

Safety

	⚠ DANGER
	<p>The contactors are high voltage switches. The touching of electrically conducting parts may result in serious injuries or even death!</p> <p>Energized parts are all metal parts belonging directly to one of the circuits or wires leading there. All other visible metal parts and wires may also be energized in the case of a failure.</p> <p>Before beginning any work on the contactors, always observe the following safety regulations:</p> <ul style="list-style-type: none">▶ Disconnect on all sides▶ Ensure that it is not possible to reconnect unintentionally▶ Clearly mark your work area▶ Make sure that there is no voltage present▶ Earth and short circuit the installation; this also includes the discharging of any capacitors in the main circuit▶ Besides the main electric circuit, also disconnect additional and auxiliary circuits▶ Cover or insulate adjacent energized parts▶ Only an electrically skilled person may determine if there is no voltage present▶ When the work has been concluded, proceed the other way round.

NOTICE

Detent-edged rings and detent-edged washers have a limited life time. After 3 times opening of screws secured with detent-edged rings or detent-edged washers, the rings or washers must be replaced by new ones.

- ▶ Record the frequency of screw opening in the work log.
- ▶ After 3 times opening of screws, replace detent-edged rings or detent-edged washers by new ones.


Required tools and auxiliaries

- Socket wrench set
- Set of hex wrenches
- Hexagon socket wrench set
- Open-end wrench set
- Set of POZIDRIV® cruciform screwdrivers
- Set of slotted screwdrivers
- Small cable ties

Electrical installation procedure

Electrical connection of the auxiliary switches

Depending on the contactor type, see *Fig. 13* to *Fig. 16*.

	<p>The auxiliary switches of contactors with plug and socket connectors are completely wired when shipped from the factory (see figure <i>Fig. 15 (7)</i>). Electrical connection of the auxiliary switches is not necessary for these contactor types.</p>
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Preconditions:

- The upper module is removed.
- The protection cap of the auxiliary switches is removed (except for contactor types with plug and socket connectors).
- ▶ Connect the wires (2) to the terminals of the auxiliary contacts (1).
 - For the a1 and b0 contacts (Snap action switches S870) no polarity must be observed.
 - For the general purpose contacts (Snap action switches S826) the polarity must be observed. The position of the switches and the terminal numbers are shown on a label on the protection cap.

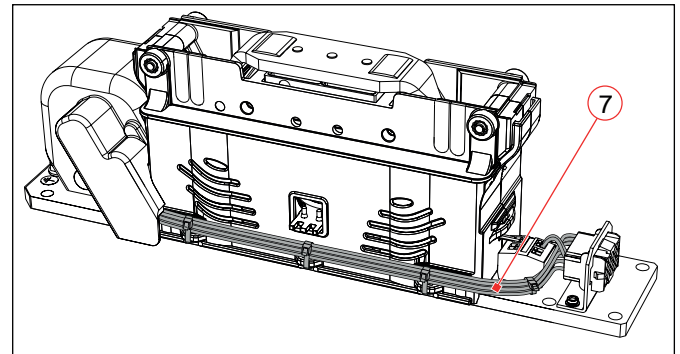


Fig. 15: CT/CU 1115/10/11, 1130/10/11: Auxiliary switches of contactors with plug and socket connectors are completely wired when shipped from the factory (7). Electrical connection of the auxiliary switches is not necessary for these contactor types.

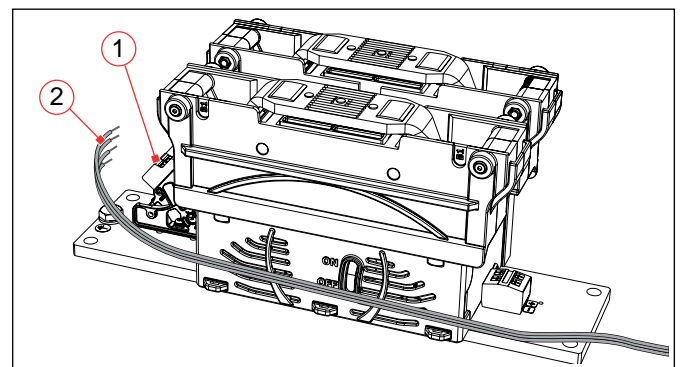


Fig. 16: CT/CU 1215/10/11, 1230/10/11: Connect the wires (2) to the terminals of the auxiliary contacts (1)

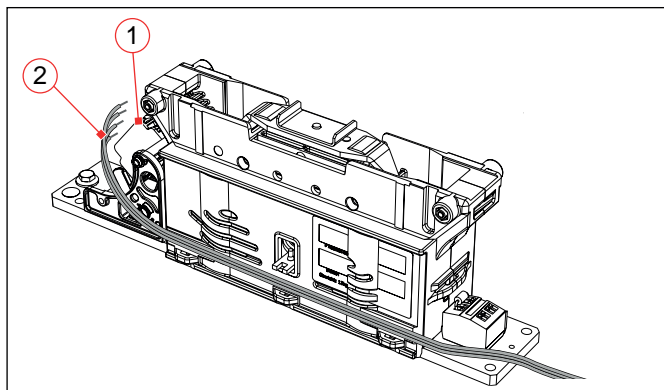


Fig. 13: CT/CU 1115/04, 1130/04, 1115/08, 1130/08: Connect the wires (2) to the terminals of the auxiliary contacts (1)

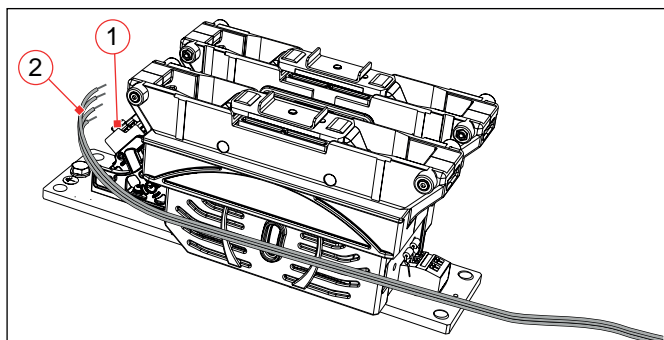


Fig. 14: CT/CU 1215/04, 1230/04, 1215/08, 1230/08: Connect the wires (2) to the terminals of the auxiliary contacts (1)

Electrical connection of the coil control wires

Depending on the contactor type, see *Fig. 17* to *Fig. 20*.

Preconditions:

- The upper module is removed.
- The protection cap for the coil controller terminals is removed.
- ▶ Connect the coil control wires (4) to the cage clamp terminals (3).
- ▶ For contactor types with plug and socket connectors, connect the plug to the socket (7).

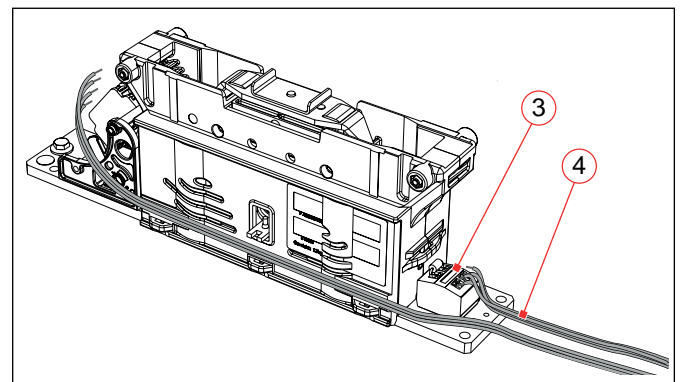


Fig. 17: CT/CU 1115/04, 1130/04, 1115/08, 1130/08: Connect the coil control wires (4) to the cage clamp terminals (3).

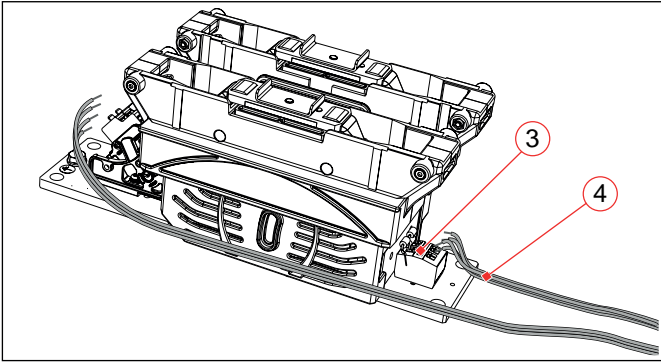


Fig. 18: CT/CU 1215/04, 1230/04, 1215/08, 1230/08:
Connect the coil control wires (4) to the cage clamp terminals (3)

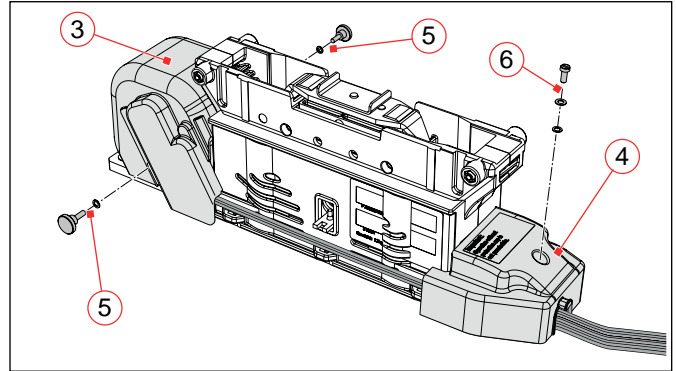


Fig. 21: CT/CU 1115/04, 1130/04, 1115/08, 1130/08:
Reattach the protection cap (3) of the auxiliary switches and the protection cap (4) of the coil terminal

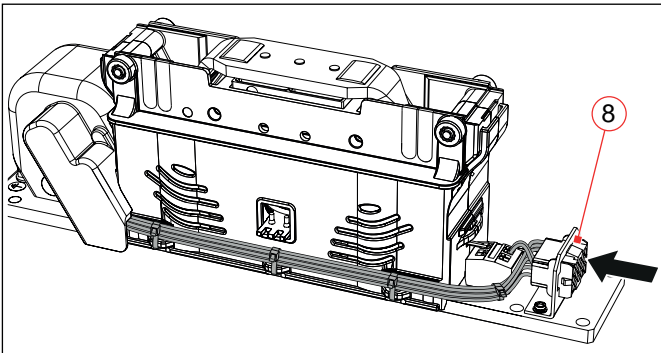


Fig. 19: CT/CU 1115/10/11, 1130/10/11: For contactor types with plug and socket connectors, connect the plug to the socket (8)

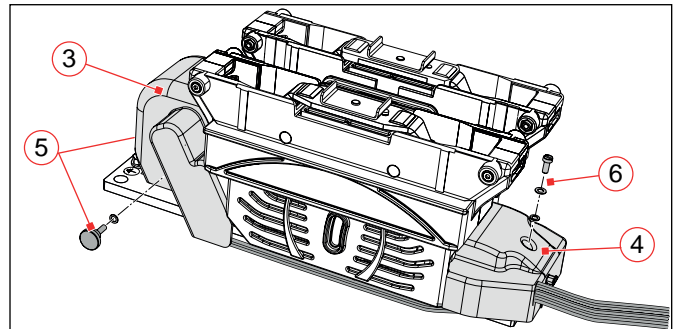


Fig. 22: CT/CU 1215/04, 1230/04, 1215/08, 1230/08:
Reattach the protection cap (3) of the auxiliary switches and the protection cap (4) of the coil terminal

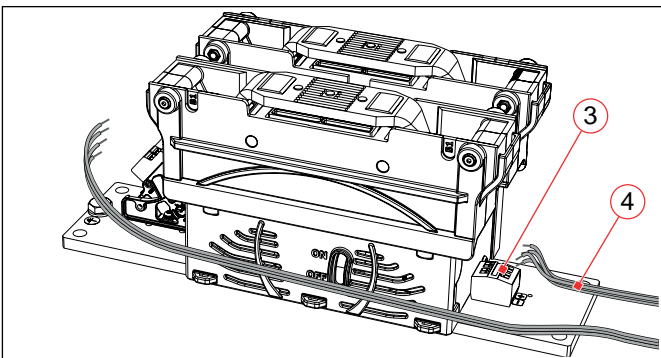


Fig. 20: CT/CU 1215/10/11, 1230/10/11: Connect the coil control wires (4) to the cage clamp terminals (3)

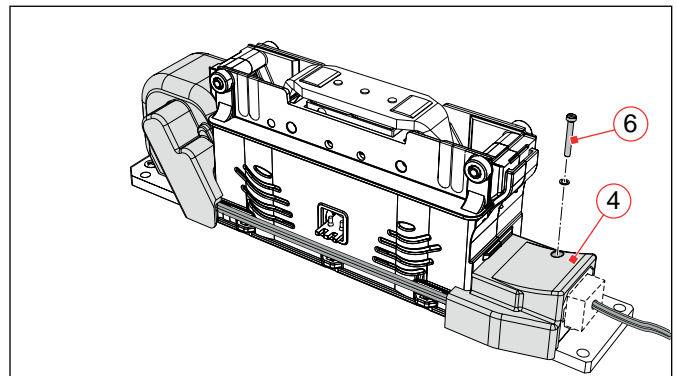


Fig. 23: CT/CU 1115/10/11, 1130/10/11: Reattach the protection cap (4) of the coil terminal

Reattach the protection caps

Depending on the contactor type, see **Fig. 21** to **Fig. 24**.

- ▶ Fix the protection cap (3) of the auxiliary switches.
- ▶ Screw in the 2 knurled thumb screws (5) and tighten them by hand force as tight as possible.
 - Make sure that all the washers are close to the knurled thumb screws (5).
 - The washers must remain outside of the cover.
- ▶ Fix the protection cap (4) of the coil terminal (4).
- ▶ Screw in the the slotted-head screw (6) including washers.

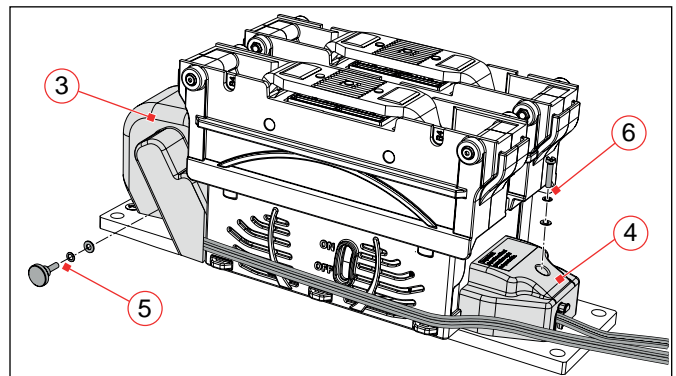


Fig. 24: CT/CU 1215/10/11, 1230/10/11: Reattach the protection cap (3) of the auxiliary switches and the protection cap (4) of the coil terminals

Bundle and fix the wires

Depending on the contactor type, see **Fig. 25** to **Fig. 28**.

The fixing lugs for the cable ties have a size of 7 x 2.5 mm.

▶ Use appropriate cable ties (9) and bundle and fix the wires as shown in the figures below.

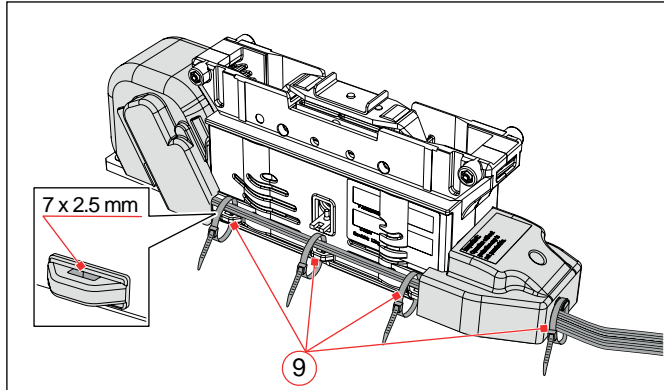


Fig. 25: CT/CU 1115/04, 1130/04, 1115/08, 1130/08:
Bundle and fix the wires

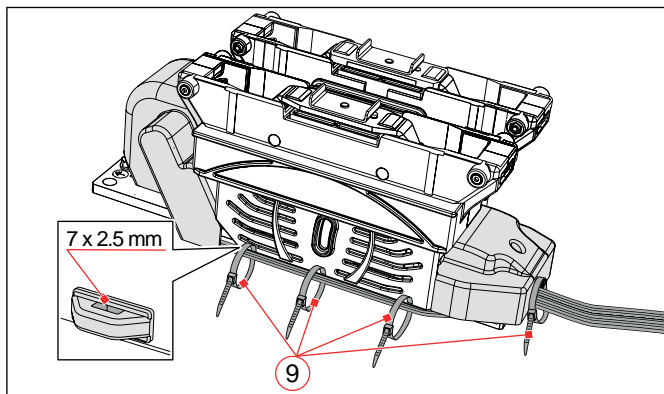


Fig. 26: CT/CU 1215/04, 1230/04, 1215/08, 1230/08:
Bundle and fix the wires

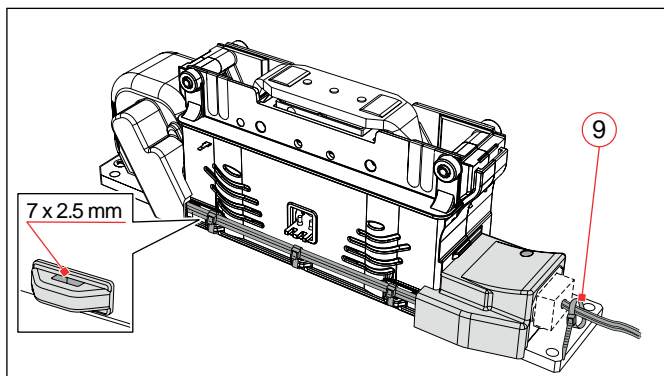


Fig. 27: CT/CU 1115/10/11, 1130/10/11: The auxiliary switches of contactors with plug and socket connectors are completely wired when shipped from the factory. For these contactor types it is not necessary to bundle and fix the wires between connector and switches.

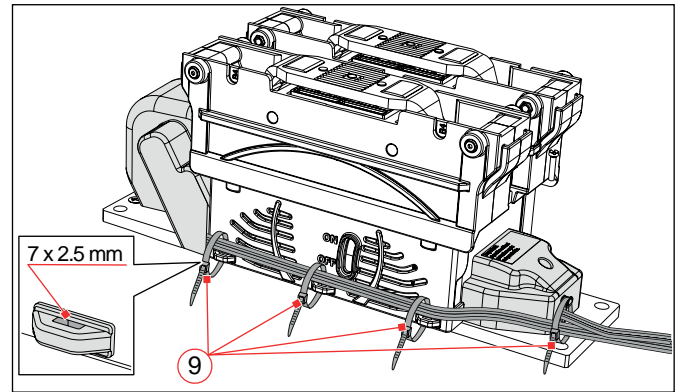


Fig. 28: CT/CU 1215/10/11, 1230/10/11: Bundle and fix the wires

Reattach the upper module

Depending on the contactor type, see **Fig. 29** to **Fig. 32**.

NOTICE

The modules are mechanically coded. Only one mounting position is possible. Optical marks and coding pins are provided to ensure the proper positioning.

- ▶ Do not try to force the upper module into the wrong position.
- ▶ Attach the upper module in the correct position.

- ▶ Make sure that all 4 latching levers (2) are in the open position.
- ▶ Check the correct position and put the upper module (A) onto the lower module (B).
- ▶ Close the 4 latching levers (2) one by one.
 - Each of the 4 lock bars (1) must audible engage.
 - Make sure that the 4 lock bars (1) have snapped into place safely.
 - The upper module must be fixed tightly.

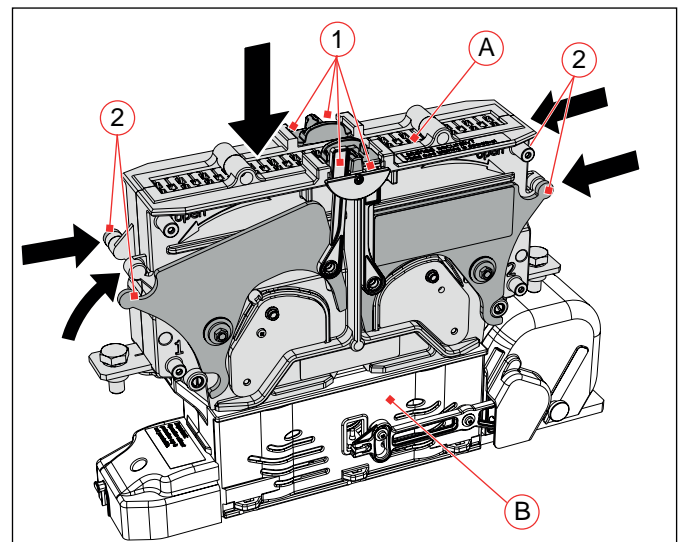


Fig. 29: CT/CU 1115/04, 1130/04, 1115/08/10, 1130/08/10:
Reattach the upper module (A) to the lower module (B)

In case of double pole contactors:

- ▶ Repeat the steps above with the second upper module.

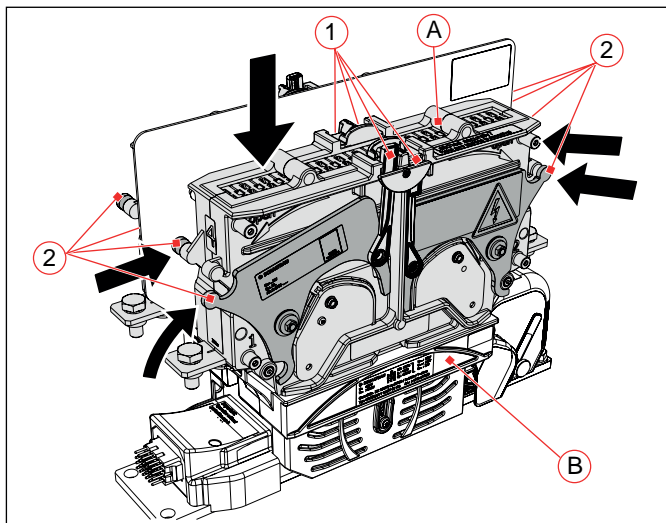


Fig. 30: CT/CU 1215/04, 1230/04, 1215/08/10, 1230/08/10: Remove the upper module (A) from the lower module (B)

In case of double pole contactors:

- ▶ Repeat the steps above with the second upper module.

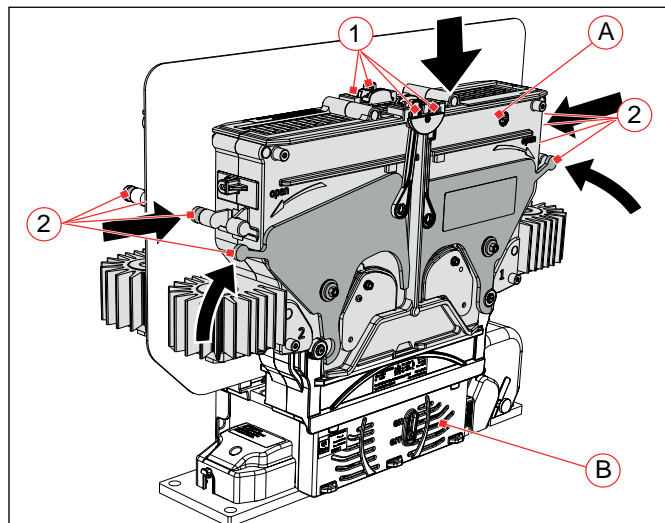


Fig. 32: CT/CU 1215/11, 1230/11: Reattach the upper module (A) to the lower module (B)

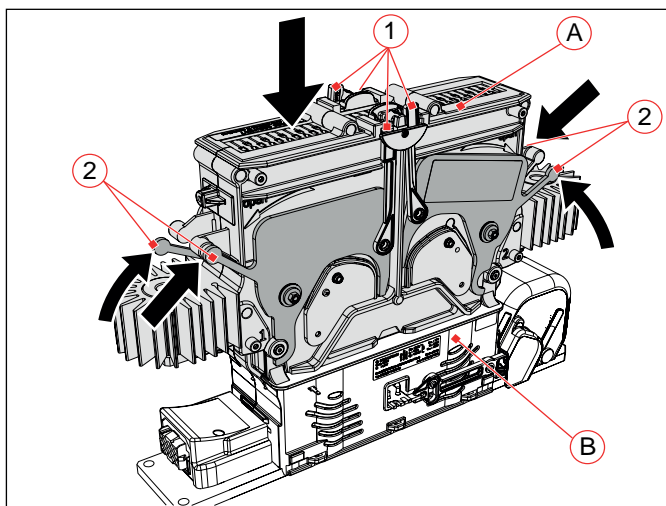


Fig. 31: CT/CU 1115/11, 1130/11: Reattach the upper module (A) to the lower module (B)

Electrical installation of the main circuit

Preconditions:

- The auxiliary switches are connected.
- The coil control wires are connected to the cage clamp terminals.
- The protection cap for the auxiliary switches is reattached and fixed.
- The protection cap for the coil controller terminals is reattached and fixed.
- The upper module is remounted and securely locked.

Depending on the contactor type, see **Fig. 33** to **Fig. 38**.

Schaltbau recommends busbars for the connection of the main terminals. However, also wires can be used.

Installation with wires:


The wires must be fitted with appropriate cable lugs.


- ▶ Place the wires with cable lugs on top of the main terminals (2).
- ▶ Screw the cable lugs on the main terminals (2) using appropriate screws and washers.
 - Schaltbau strongly recommends Schnorr-Washers (or similar) to secure the screws.
- ▶ Tighten the screws with the rated torque.
 - for terminal screws M10: max. 20 Nm
 - for terminal screws M12: max. 30 Nm (refer also to the label on the upper module).

Installation with busbars:


Contactor types CT/CU 1115/04, 1130/04, 1115/08/10, 1130/08/10, 1215/04, 1230/04, 1215/08/10, 1230/08/10

Depending on the contactor type, see *Fig. 33* to *Fig 36*.

 Busbars for the above listed contactor types should preferably be installed on the bottom side of the main terminals. This way maintenance is much easier and the upper module can be removed without removing the busbars. Schaltbau is supplying contactors without press nuts for this purpose.

 The use of press nuts at the busbars will simplify installation and maintenance.

- ▶ Place the busbars (1) on the bottom side of the main terminals (2).
- ▶ Screw the busbars (1) on the main terminals (2) using appropriate screws and washers.
 - Schaltbau strongly recommends Schnorr-Washers (or similar) to secure the screws.
- ▶ Tighten the screws with the rated torque.
 - for terminal screws M10: max. 20 Nm
 - for terminal screws M12: max. 30 Nm (refer also to the label on the upper module).

 If the busbars are rather inflexible it is recommended to use an additional angled bar (3). This compensates mechanical tolerances between the mounting platform for the lower module and the busbars in all 3 axes.

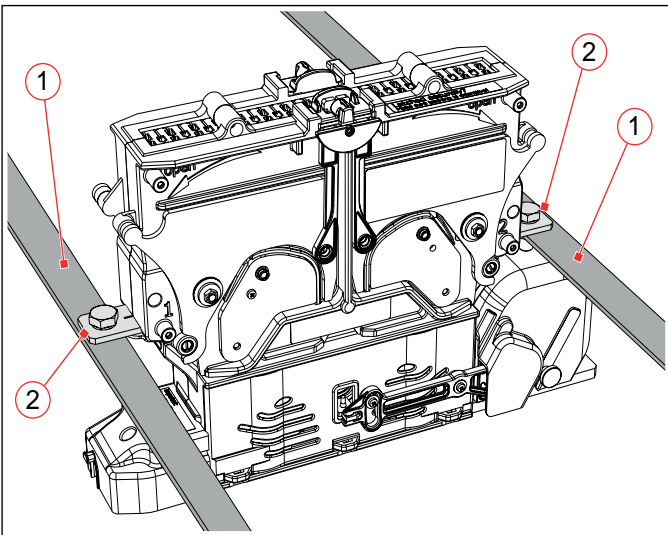


Fig. 33: CT/CU 1115/04, 1130/04, 1115/08/10, 1130/08/10: Install busbars

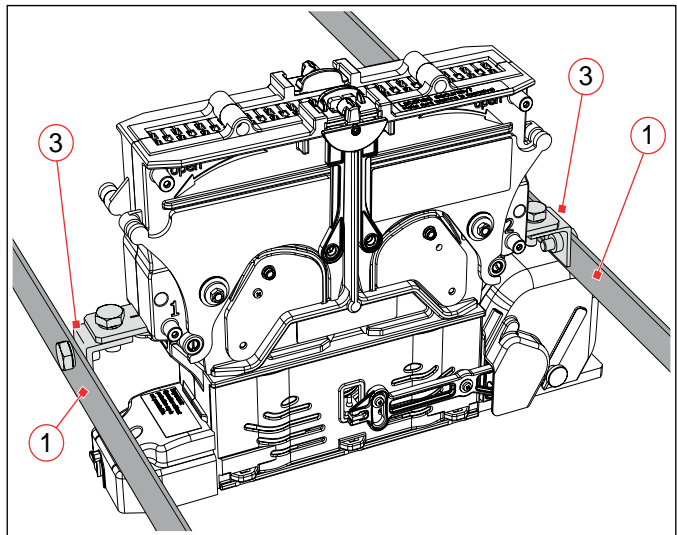


Fig. 34: Only CT/CU 1130/04, 1130/08/10: Install busbars with additional angled bars

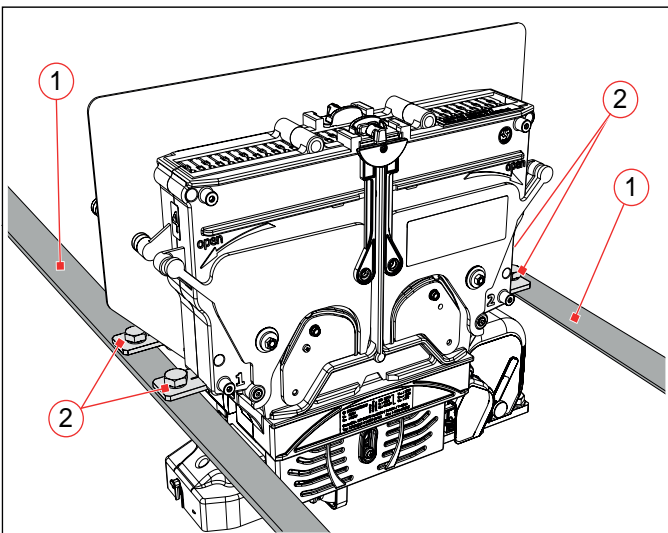


Fig. 35: CT/CU 1215/04, 1230/04, 1215/08/10, 1230/08/10: Install busbars

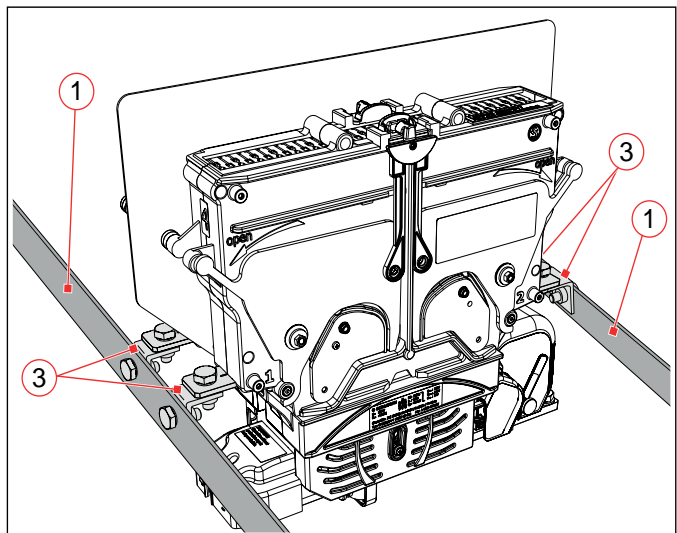


Fig. 36: Only CT/CU 1230/04, 1230/08/10: Install busbars with with additional angled bars

Installation with busbars:

Contactor types CT/CU 1115/11, 1130/11, 1215/11, 1230/11

Depending on the contactor type, see **Fig. 37** to **Fig. 38**.



Busbars for the above listed contactor types must be installed on the top side of the heat sink using screws long enough for that purpose. Schaltbau strongly recommends Schnorr-Washers (or similar) to secure the screws.



The use of press nuts at the busbars will simplify installation and maintenance.

- ▶ Place the busbars (1) on the top side of the heat sink (2).

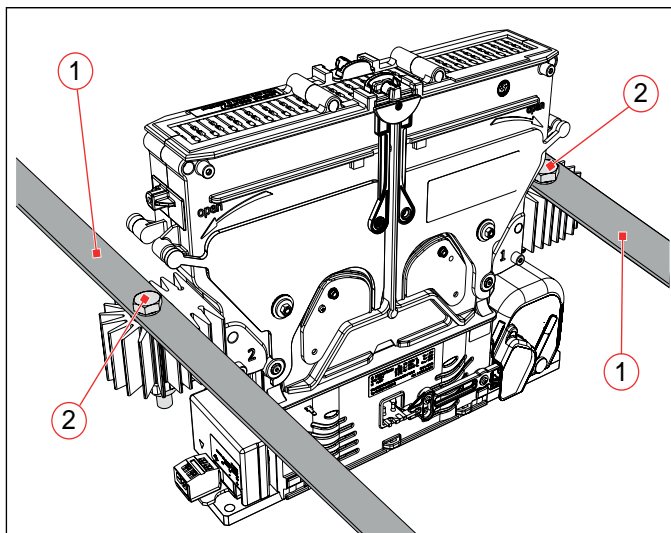


Fig. 37: CT/CU 1115/11, 1130/11: Install busbars

- ▶ Screw the busbars (1) on the main terminals (2) on the top side of the heat sink using appropriate screws and washers.
 - Schaltbau strongly recommends Schnorr-Washers (or similar) to secure the screws.

- ▶ Tighten the screws with the rated torque.

- for terminal screws M10: max. 20 Nm
- for terminal screws M12: max. 30 Nm (refer also to the label on the upper module).



If the busbars are rather inflexible it is recommended to use an additional angled bar (3). This compensates mechanical tolerances between the mounting platform for the lower module and the busbars in all 3 axes.

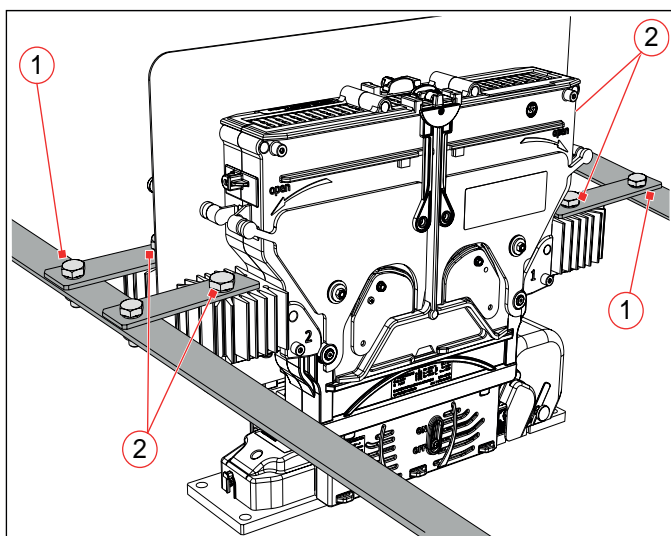
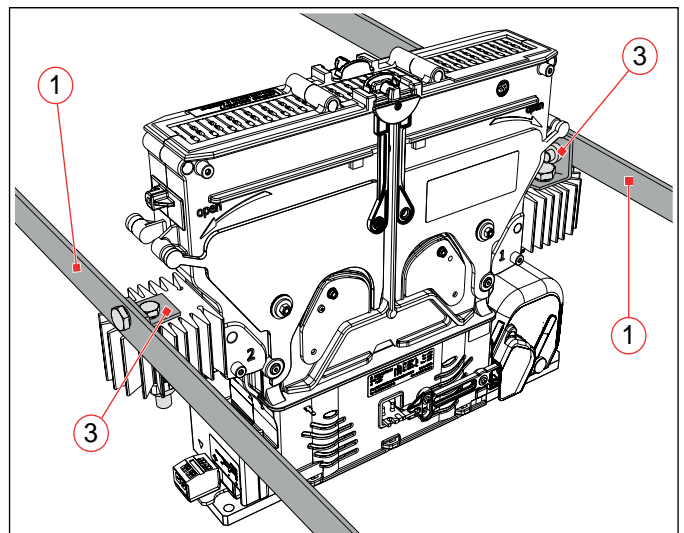
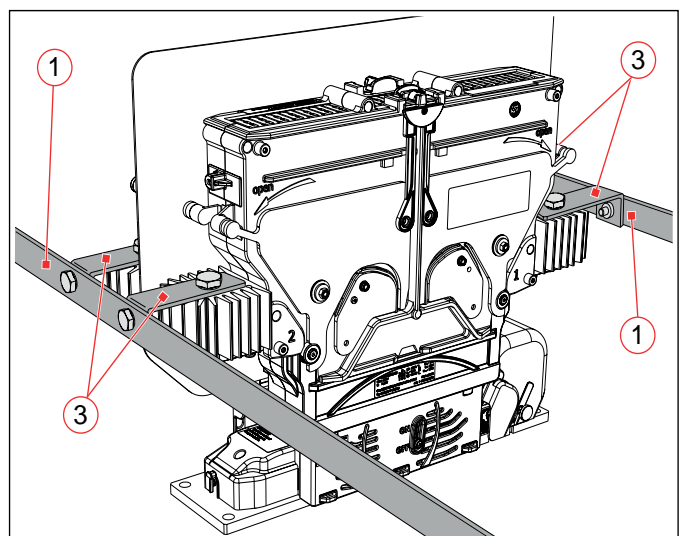


Fig. 38: CT/CU 1215/11, 1230/11: Install busbars



Electrical installation of the earth terminal

Depending on the contactor type, see **Fig. 39** to **Fig. 42**.

Preconditions

- The earthing cable must be fitted with an appropriate cable lug.
- For conductors with short mounting plates only: The protection cap of the auxiliary switches is removed.

▶ For conductors with short mounting plates: First remove the protection cap of the auxiliary switches, see section **“9.2 Mechanical installation”/“Remove the protection caps”**.

▶ Screw the cable lug (1) of the earthing cable on the earthing terminal (2) using the appropriate screw (3) and washer (4).

- Schaltbau strongly recommends Schnorr-Washers (or similar) to secure the screws.

▶ Tighten the screw (3) with a torque of 10 Nm.

▶ If the protection cap of the auxiliary switches has been removed: Reattach the protection cap, see section **„9.3 Electrical Installation”/“Reattach the protection caps”**.

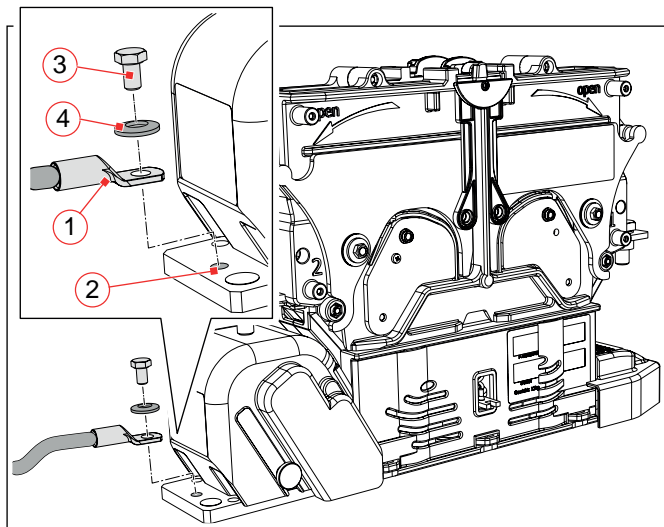


Fig. 39: CT/CU 1115/04, 1130/04, 1115/08/10, 1130/08/10: Install earthing cable

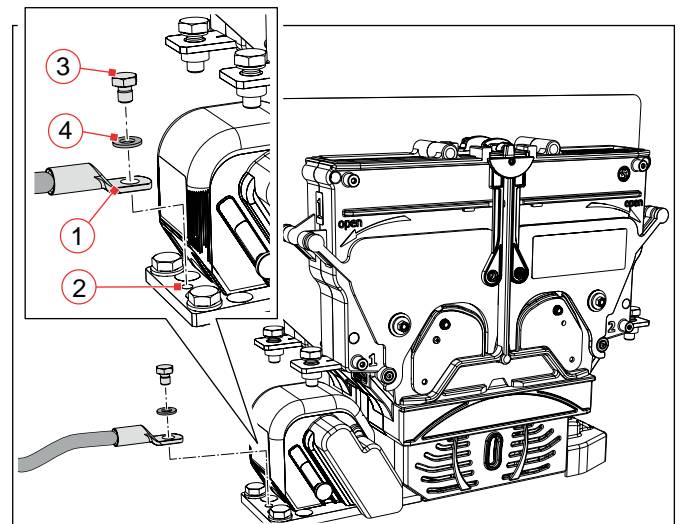


Fig. 40: CT/CU 1215/04, 1230/04, 1215/08/10, 1230/08/10: Install earthing cable

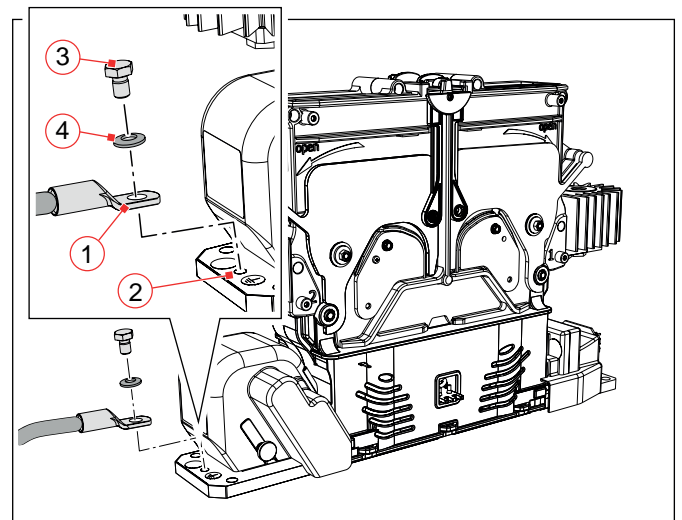


Fig. 41: CT/CU 1115/11, 1130/11: Install earthing cable

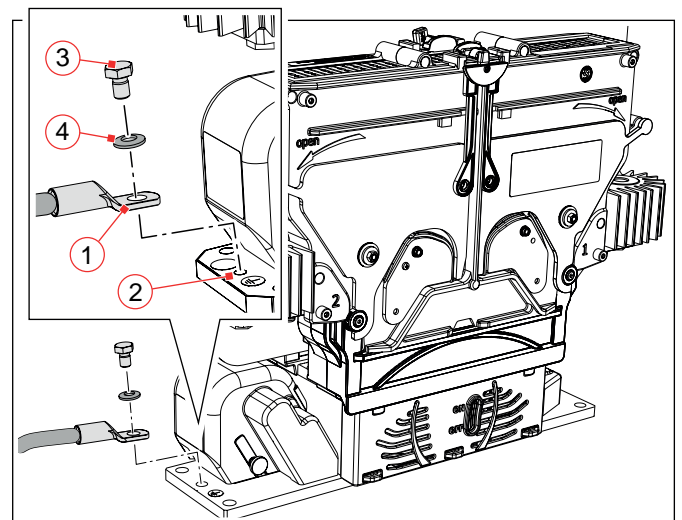


Fig. 42: CT/CU 1215/11, 1230/11: Install earthing cable

9.4 Checks

After the installation is completed, do the following checks:

- ▶ Check the protective earth.
- ▶ Check the main connections.
- ▶ Check the control connections.
- ▶ Check the latching and locking between upper and lower module.
- ▶ Check that both protection covers are fitted.
- ▶ Perform several activation and deactivation operations of the contactor without the main circuit active.
- ▶ Check the function of the auxiliary switches:
Use a continuity tester to check that the wiring is correct and the auxiliary switches are functioning correctly.
- ▶ Check the pull-in voltage and drop-off voltage according to the requirements of Schaltbau.
- ▶ After each installation and after replacement of main contacts, contact bridge or after any other modifications, alterations or maintenance works, always perform complete checks according to these standards:
 - IEC 60077-2
 - IEC 60947-4-1

10. Maintenance

Note the expert knowledge which is essential for carrying out maintenance work, mentioned in chapter "2. General and Security Information".

10.1 Safety

DANGER

The contactors are high voltage switches. The touching of electrically conducting parts may result in serious injuries or even death!

Energized parts are all metal parts belonging directly to one of the circuits or wires leading there. All other visible metal parts and wires may also be energized in the case of a failure.

Before beginning any work on the contactors, always observe the following safety regulations:

- ▶ Disconnect on all sides
- ▶ Ensure that it is not possible to reconnect unintentionally
- ▶ Clearly mark your work area
- ▶ Make sure that there is no voltage present
- ▶ Earth and short circuit the installation; this also includes the discharging of any capacitors in the main circuit
- ▶ Besides the main electric circuit, also disconnect additional and auxiliary circuits
- ▶ Cover or insulate adjacent energized parts
- ▶ Only an electrically skilled person may determine if there is no voltage present
- ▶ When the work has been concluded, proceed the other way round.

10.2 Preventive maintenance

The CT/CU contactors are maintenance-free within the rated mechanical life time. The electrical life time depends on the number of switchings under heavy load conditions and may vary for different applications. In normal use, this corresponds to a decade-long operating period.

Intervals for regular checks

To ensure the correct function and a prolonged operational life span of the contactors, the following checks and maintenance must be performed regularly.

Checks	Interval
Visual inspection of the contactor from outside	▶ 1x per year
Inspection of the main contacts (both fixed and movable contacts)	▶ 1x to 2x per year
Inspection of the auxiliary switches	▶ Every 2 years

If the contactors are operated in particularly dirty environments, the checking intervals for visible inspections should be shortened, because dirt can impair the insulation clearances and there is therefore the possibility of a shorter service life or an operational fault.

Extraordinary services need only be carried out if there has been a significant and extraordinary recorded number of switchings under fault conditions.

DANGER

When damages on the contactor, high voltage cables, busbars or earthing cables are visible, the safety of the contactor is no longer guaranteed.

- ▶ Immediately give damaged contactors to corrective maintenance.
- ▶ Immediately replace all damaged components with new components.

NOTICE

Detent-edged rings and detent-edged washers have a limited life time. After 3 times opening of screws secured with detent-edged rings or detent-edged washers, the rings or washers must be replaced by new ones.

- ▶ Record the frequency of screw opening in the work log.
- ▶ After 3 times opening of screws, replace detent-edged rings or detent-edged washers by new ones.

Regular check activities

All of the maintenance activities that may be carried out on the contactors by skilled personnel are listed below.

Component	Visual inspection	Measures
High voltage power supply cables or bus-bars	Check for: <ul style="list-style-type: none"> ▶ dirt ▶ damage or wear and tear ▶ broken cables ▶ damaged insulation ▶ broken cable lugs ▶ kinks or crushing points ▶ loose or missing fastening elements ▶ tightening torque of the fixing screws 	In case of faults: <ul style="list-style-type: none"> ▶ remove existent dirt ▶ immediately replace damaged parts ▶ tighten the fixing screws with the rated torque
Earthing cables/straps and cable lugs	<ul style="list-style-type: none"> ▶ dirt ▶ damage or wear and tear ▶ broken cables ▶ damaged insulation ▶ broken cable lugs ▶ loose or missing fastening elements ▶ tightening torque of the fixing screws 	In case of faults: <ul style="list-style-type: none"> ▶ remove existent dirt ▶ immediately replace damaged parts ▶ immediately replace a damaged or loose earthing cable/strap ▶ tighten the fixing screws with the rated torque
Contactors housing	Check for: <ul style="list-style-type: none"> ▶ dirt ▶ damage or wear and tear ▶ loose or missing fastening elements 	In case of faults: <ul style="list-style-type: none"> ▶ remove existent dirt ▶ immediately replace damaged parts ▶ immediately replace missing fastening elements ▶ immediately fasten a loose contactor housing
Protection caps for the auxiliary switches and coil terminal	<ul style="list-style-type: none"> ▶ dirt ▶ damage or wear and tear ▶ cracks and ruptured patches ▶ missing protection caps ▶ loose or missing fastening elements 	In case of faults: <ul style="list-style-type: none"> ▶ remove existent dirt ▶ immediately replace damaged protection caps ▶ immediately replace missing protection caps ▶ immediately replace missing fastening elements ▶ immediately fasten a loose protection cap

Component	Visual inspection	Measures
Main contacts (both fixed and movable contacts)	<p>Check for:</p> <ul style="list-style-type: none"> ▶ damage or wear and tear <p>It requires some experience to evaluate the state of the contacts. Even after only a few switchings under load the contacts look used and “polluted” for the inexperienced eye. Contacts need only to be replaced if the wear of the contact tips is more than 70%.</p>	<p>In case of faults:</p> <ul style="list-style-type: none"> ▶ replace contacts if the wear of the contact tips is more than 70%, refer to section „10.3 Corrective maintenance“ / „Replace the main contacts and the ceramic protection insert“
Auxiliary switches	<p>Check for:</p> <ul style="list-style-type: none"> ▶ damage or wear and tear <p>The auxiliary switches are visible for a simple optical inspection from the outside (housings are clean and do not show signs of short-circuits etc.). Under normal working conditions (no short circuit switching) the life time of the auxiliary switches exceeds those of the contactors.</p>	<p>In case of faults:</p> <ul style="list-style-type: none"> ▶ replace auxiliary switches, refer to section „10.3 Corrective maintenance“ / „Replace the auxiliary switches“

10.3 Corrective maintenance

The contactors are maintenance-free. There is therefore no general provision for replacing components during its service life.

However, in case of permanent heavy load switchings, failures, short-circuit switchings or in similar cases corrective maintenance may be necessary.

Replace the main contacts and the ceramic protection insert

If the main contacts need to be replaced, always replace all 4 contacts (the moving bridge and the 2 fixed contacts).

Required tools and auxiliaries

- Socket wrench set
- Hexagon socket wrench set
- Set of torx bits
- Set of slotted screwdrivers
- Torque wrench
- Locking varnish (red)
- Sharp knife, cutter knife

Preconditions

- The main cables/busbars are removed.
- The protection cap of the auxiliary switches is removed (except for contactor types with plug and socket connectors)
- The protection cap of the coil terminal is removed.
- The upper module is removed.
- The earthing cable is disconnected.
- The wires of the auxiliary switches are disconnected (except for contactor types with plug and socket connectors).


- The coil control wires are disconnected.
- The lower module is dismantled from the mounting frame or plate.

For detailed instructions about the above listed preconditions refer to section “9. Installation”.

Replace the moving bridge (single pole contactors)

Depending on the contactor type, see Fig. 43 to Fig. 44.

- ▶ Remove the self-locking nut (M8 x 1.25) including washer (1) at the bottom of the lower module using a 13 mm socket wrench.

	The self-locking nut (1) is secured with red locking varnish which will be destroyed during that operation.
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- ▶ Keep the self-locking nut and washer (1) in a safe place.
- ▶ Pull the moving bridge (2) out of the guidance.

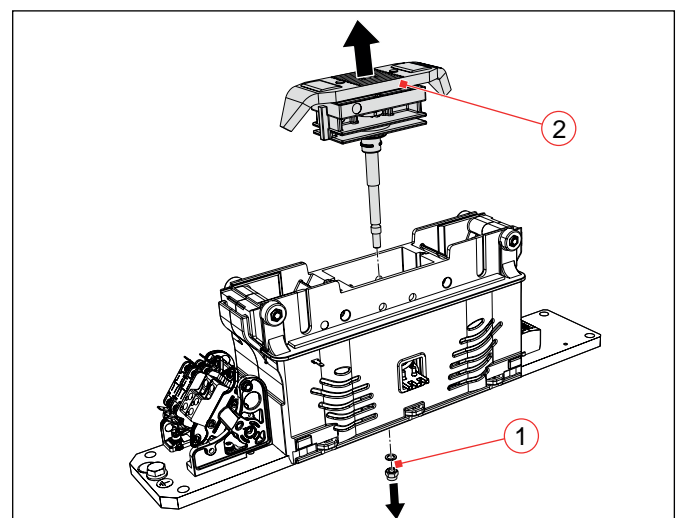


Fig. 43: CT/CU 1115/04, 1130/04, 1115/08, 1130/08: Replace the moving bridge

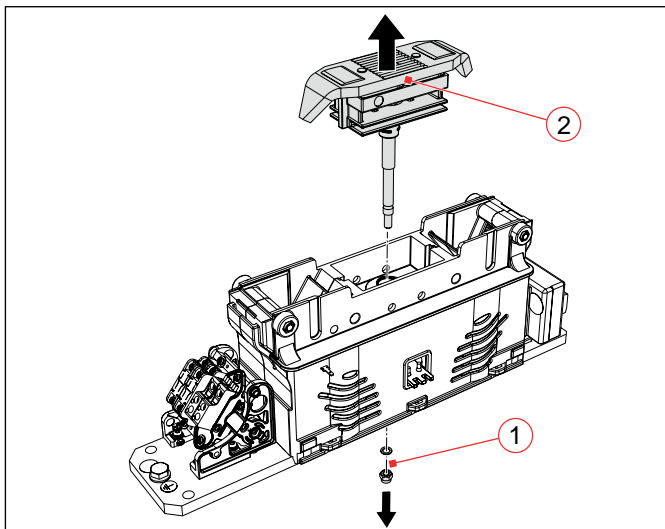


Fig. 44: CT/CU 1115/10/11, 1130/10/11: Replace the moving bridge

- ▶ Insert the new moving bridge (2) from the top into the guidance.
- ▶ Screw on a new self-locking nut (M8 x 1.25) including washer (1) at the bottom of the lower module using a 13 mm socket wrench.
- ▶ Tighten the self-locking nut (1) with a torque of 10 Nm.
- ▶ Test the new moving bridge (2) by lifting it up and down.
 - The moving bridge (2) must easily move up and down.
- ▶ Secure the self-locking nut (1) again with red locking varnish.

Replace the moving bridge (double pole contactors)

Depending on the contactor type, see Fig. 45 to Fig. 50.

- ▶ Remove the self-locking nut (M8 x 1.25) including washer (1) at the bottom of the lower module using a 13 mm socket wrench.



The self-locking nut (1) is secured with red locking varnish which will be destroyed during that operation.

- ▶ Remove the torx screw and the aluminium sleeve (3) in the middle of the side cover (4) using a TX10 torx bit.
- ▶ Remove the 2 hexagon head screws (M4) and washers (2) at the bottom of the side cover (4).
- ▶ Keep all screws, the sleeve and washers in a safe place.
- ▶ Remove the side cover (4).
- ▶ Gently pull the small lever (5) out of the bigger one (6).

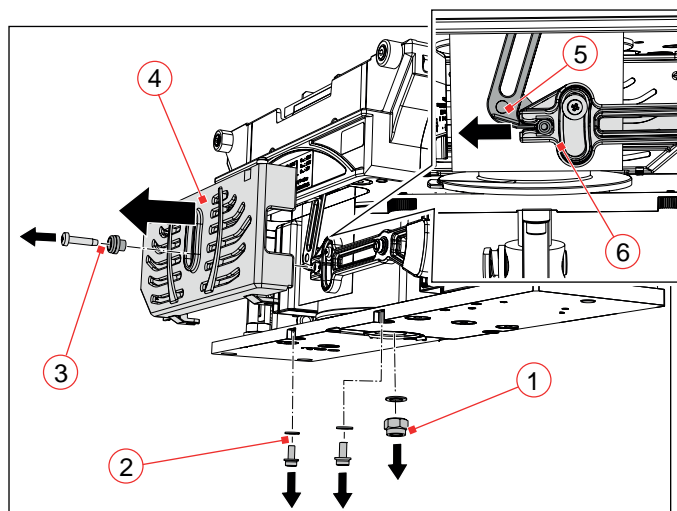


Fig. 45: CT/CU 1215/04, 1230/04, 1215/08, 1230/08: Replace the moving bridge 1

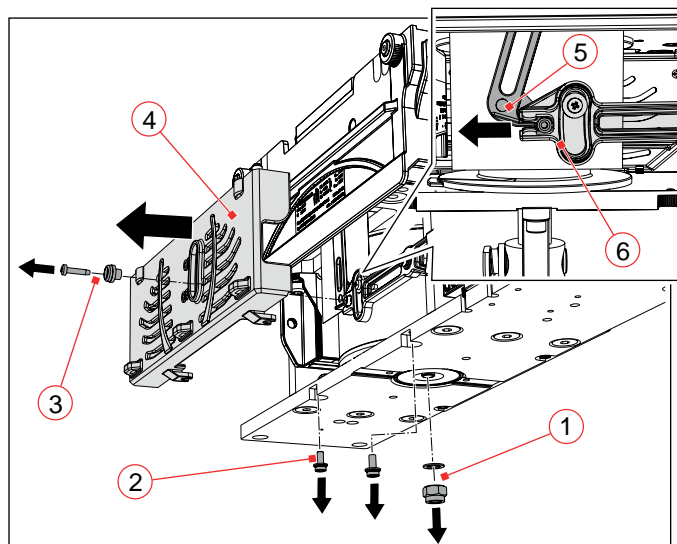


Fig. 46: CT/CU 1215/10/11, 1230/10/11: Replace the moving bridge 1

- ▶ Press and hold the spring holder (8) and remove the 2 screws including washers (7) using a 4 mm hexagon socket wrench.
- ▶ Carefully remove the spring holder (8) and the 2 springs (9).

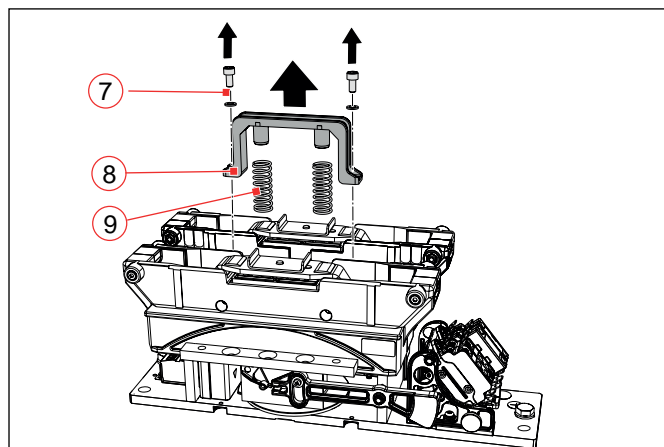


Fig. 47: CT/CU 1215/04, 1230/04, 1215/08, 1230/08: Replace the moving bridge 2

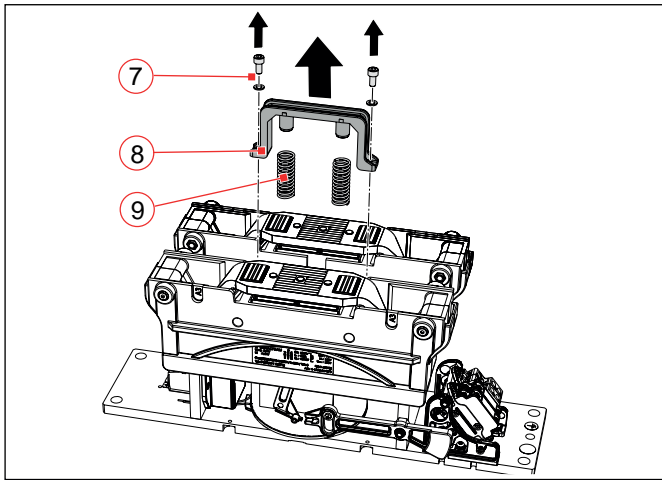


Fig. 48: CT/CU1215/10/11, 1230/10/11: Replace the moving bridge 2

- ▶ Carefully pull the moving double bridge (10) out of the lower modules.
- ▶ Remove the clip (11) and the plastic lever (12).

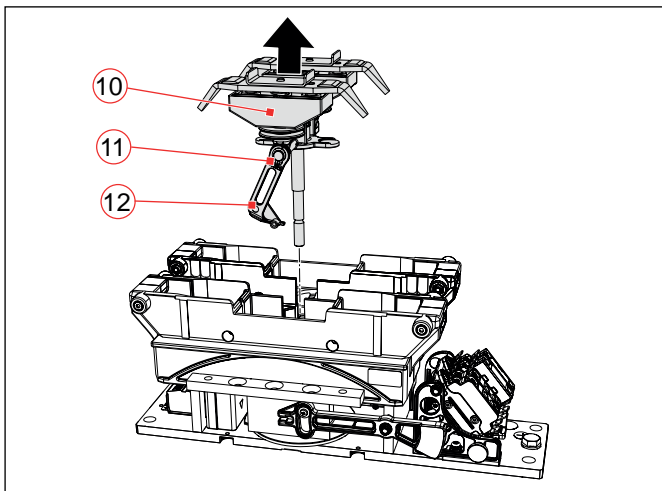


Fig. 49: CT/CU 1215/04, 1230/04, 1215/08, 1230/08: Replace the moving bridge 3

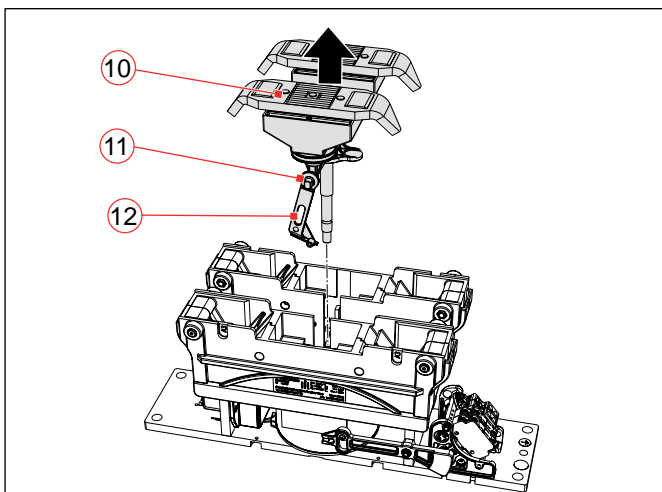


Fig. 50: CT/CU 1215/10/11, 1230/10/11: Replace the moving bridge 3

- ▶ Attach the plastic lever (12) with a new clip (11) to the new moving double bridge (10).
- ▶ Insert the new moving double bridge (10) from the top into the guidance.
- ▶ Attach the 2 springs (9) to the spring holder (8).
- ▶ Press and hold the spring holder (8) in place and fix it with the 2 screws including washers (7) using a 4 mm hexagon socket wrench.
- ▶ Tighten the 2 screws (7) with a torque of 2 Nm.
- ▶ Screw on a new self-locking nut (M8 x 1.25) including washer (1) at the bottom of the lower module using a 13 mm socket wrench.
- ▶ Tighten the self-locking nut (1) with a torque of 10 Nm.
- ▶ Gently push the small lever (5) into the guidance of the bigger one (6).
- ▶ Test the new moving double bridge (10) by lifting it up and down.
 - The moving double bridge (10) must easily move up and down.
- ▶ Put the side cover (4) in place.
- ▶ Fix the side cover with the 2 hexagon head screws (M4) and washers (2) at the bottom.
- ▶ Screw in the torx screw and the aluminium sleeve (3) in the middle of the side cover (4) using a TX10 torx bit.
- ▶ Tighten the torx screw (3) with a torque of 0.5 Nm.
- ▶ Secure the self-locking nut (1) again with red locking varnish.


Remove the fixed contacts

Depending on the contactor type, see *Fig. 51* to *Fig. 58*.

- ▶ Make sure that the latching levers are in the closed position to avoid damage.
- ▶ Put the upper module upside down on a workbench or table on a smooth surface.

Only for contactor types with heat sinks:

- ▶ Remove the 2 fixing screws including washers (5) of each heat sink (6) using a TX20 torx bit.
- ▶ Remove the heat sinks (6) from the fixed contacts.
- ▶ Remove the 4 fixing screws including washers (1) of the fixed contacts (2) using an appropriate socket wrench:
 - 8 mm socket wrench (M5) for CT/CU 11xx/04, CT/CU 12xx/04
 - 10 mm socket wrench (M6) for CT/CU 11xx/08/10/11, CT/CU 12xx/08/10/11

	<ul style="list-style-type: none"> - 2 of the 4 screws are marked with red locking varnish which will be destroyed during that operation. - 2 of the 4 screws are used to fasten the cable lug with the copper wire.
---	--

- ▶ Keep the screws and washers in a safe place.
- ▶ If necessary, push the cable lugs (3) and the copper wires slightly to the side.
- ▶ Push both fixed contacts (2) slightly to the centre to meet the gap.
- ▶ Remove the fixed contacts (2) one by one.

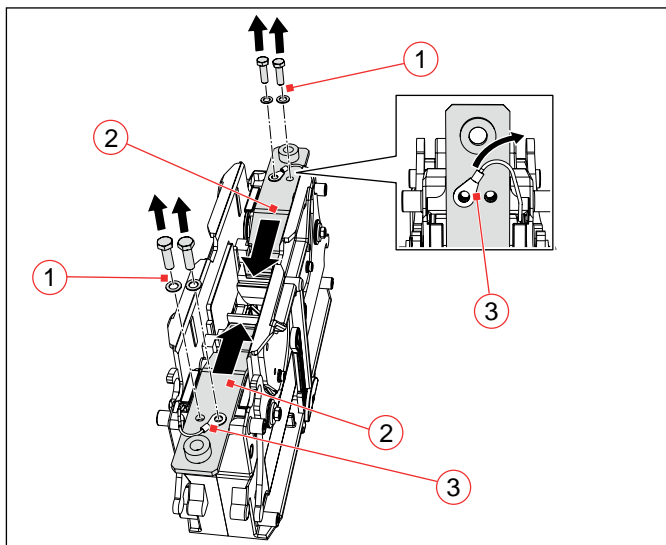


Fig. 51: CT/CU 1115/04: Remove the fixed contacts

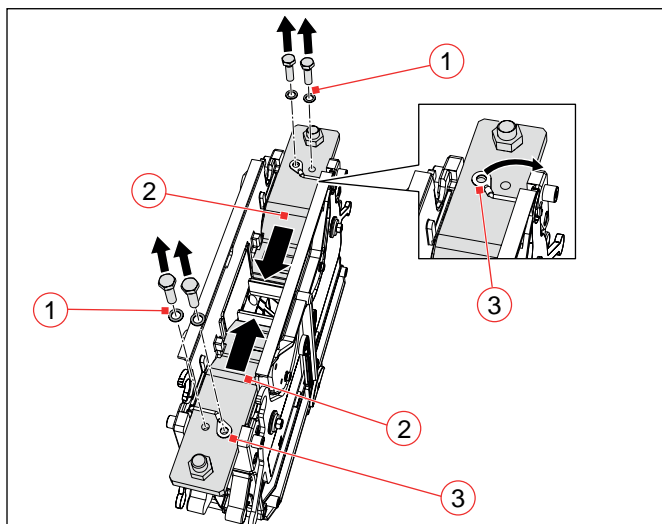


Fig. 52: CT/CU 1130/04, 1115/08/10, 1130/08/10: Remove the fixed contacts

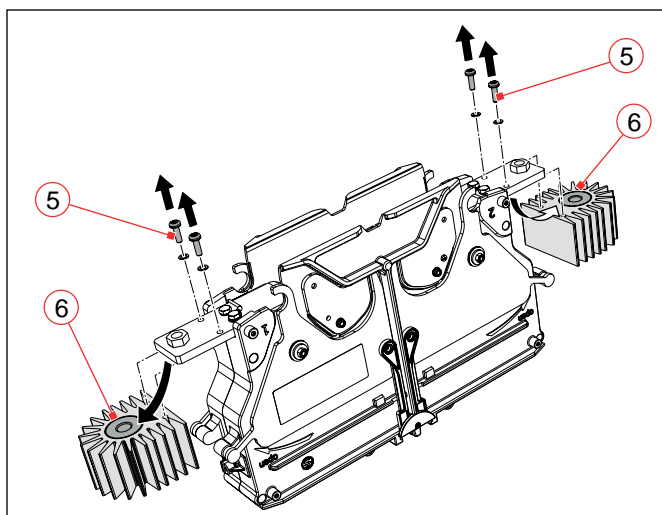


Fig. 53: CT/CU 1115/11, 1130/11: Remove the heat sinks

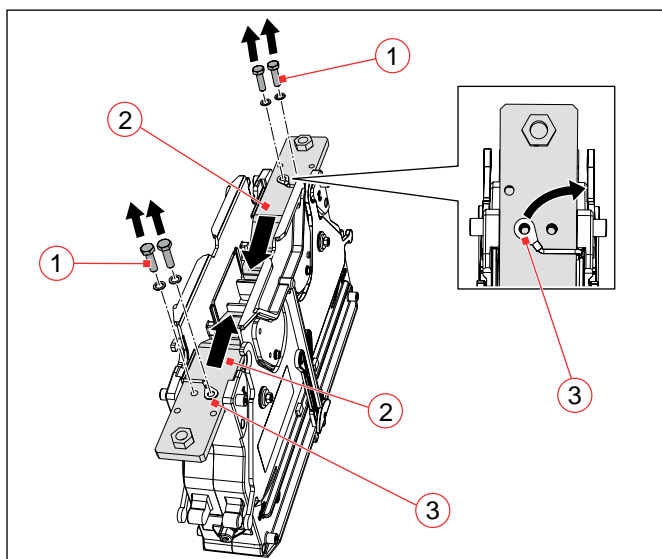


Fig. 54: CT/CU 1115/11, 1130/11: Remove the fixed contacts

In case of double pole contactors:

- ▶ Repeat the steps above with the second upper module.

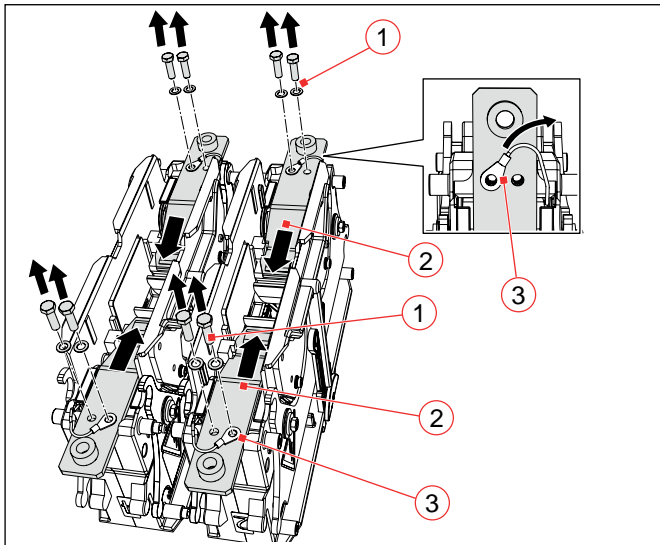


Fig. 55: CT/CU 1215/04: Remove the fixed contacts

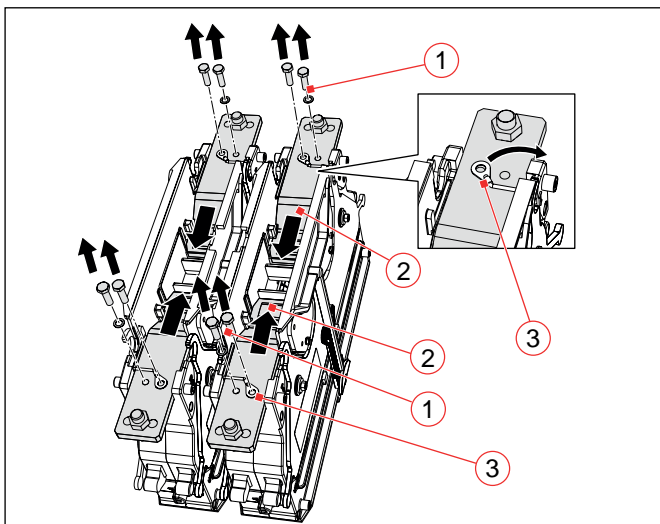


Fig. 56: CT/CU 1230/04, 1215/08/10, 1230/08/10: Remove the fixed contacts

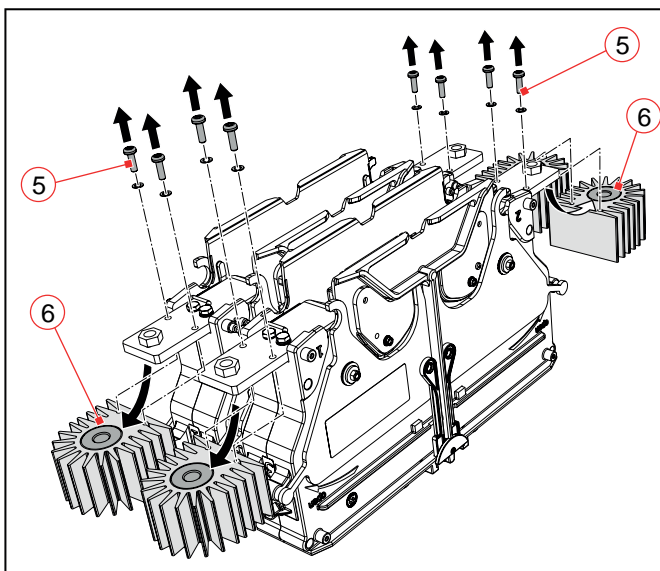


Fig. 57: CT/CU 1215/11, 1230/11: Remove the heat sinks

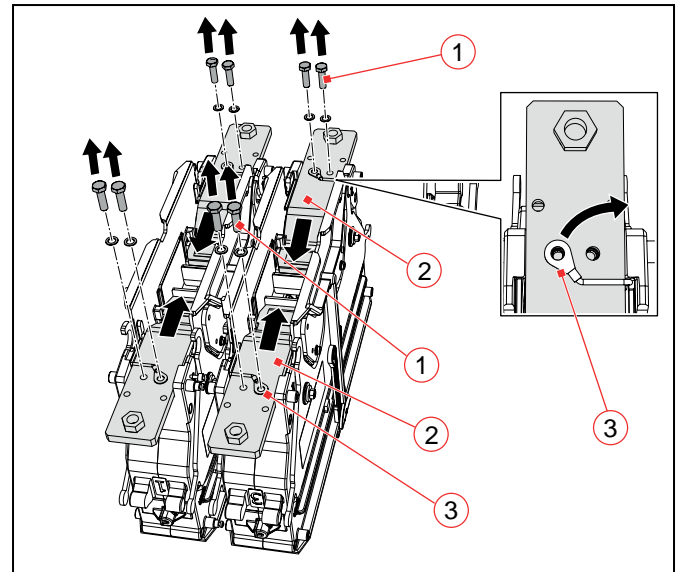


Fig. 58: CT/CU 1215/11, 1230/11: Remove the fixed contacts

Replace the ceramic protection insert

Depending on the contactor type, see Fig. 59 to Fig. 62.

The ceramic protection have to be replaced only in case of apparent wear and tear or damage.



In some older contactor versions the ceramic protection inserts could be fixed with glue. In this case:

- ▶ Cut the glue at the old ceramic protection insert (4) carefully with a sharp knife and pry it open.
- ▶ Remove all residues of old glue.

- ▶ Remove the old ceramic protection inserts (4) one by one.

- ▶ Place the new ceramic protection inserts (4) in the correct position and push them against the plastic guidance.

The ceramic protection inserts must be in-line with the plastic surface without projecting length.

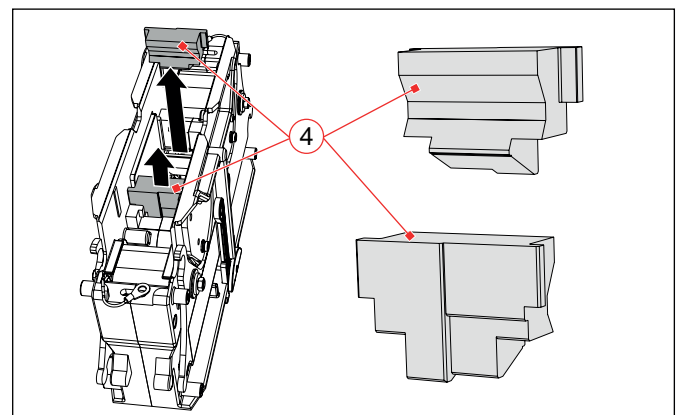


Fig. 59: CT/CU 1115/04, 1130/04: Replace the ceramic protection inserts

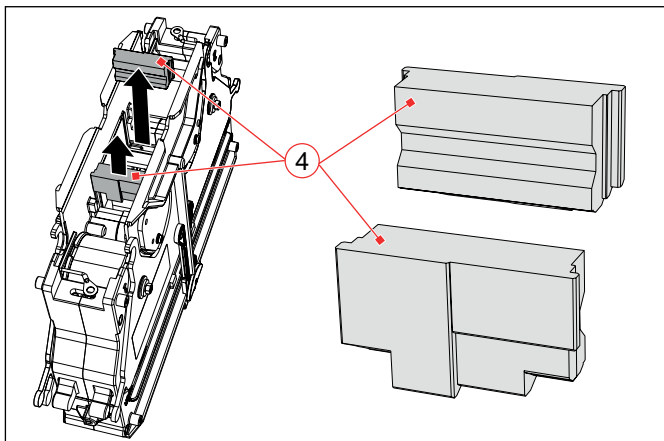


Fig. 60: CT/CU 1115/08, 1130/08, 1115/10/11, 1130/10/11:
Replace the ceramic protection inserts

In case of double pole contactors:

- ▶ Repeat the steps above with the second upper module.

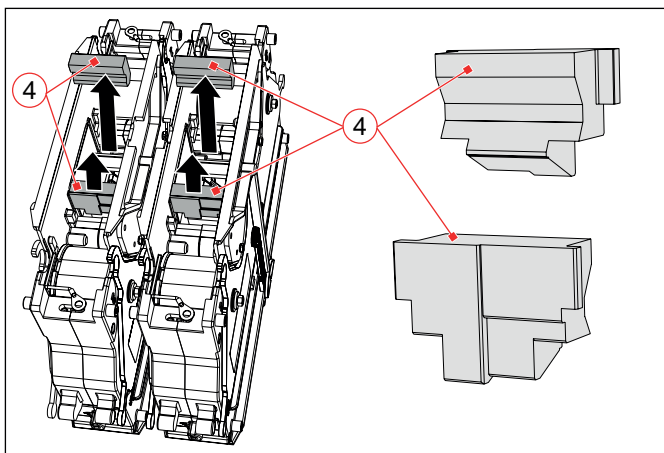


Fig. 61: CT/CU 1215/04, 1230/04: Replace the ceramic protection inserts

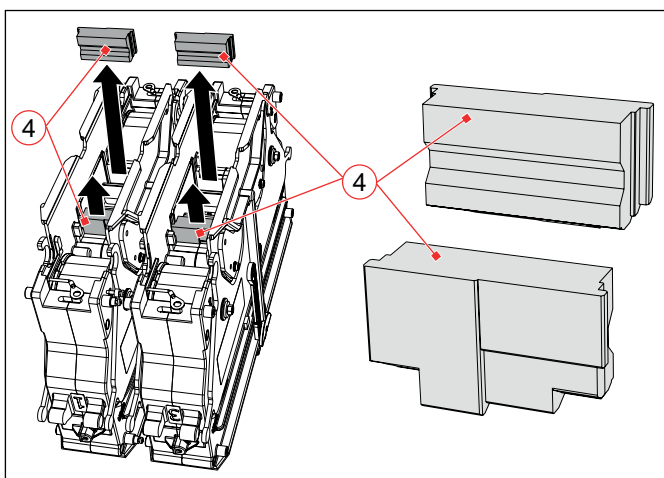


Fig. 62: CT/CU 1215/08, 1230/08, 1215/10/11, 1230/10/11:
Replace the ceramic protection inserts

Install new fixed contacts

Depending on the contactor type, see **Fig. 63** to **Fig. 71**.

- ▶ Prior to install the new fixed contacts, bring all cage nuts (4) in the correct position.

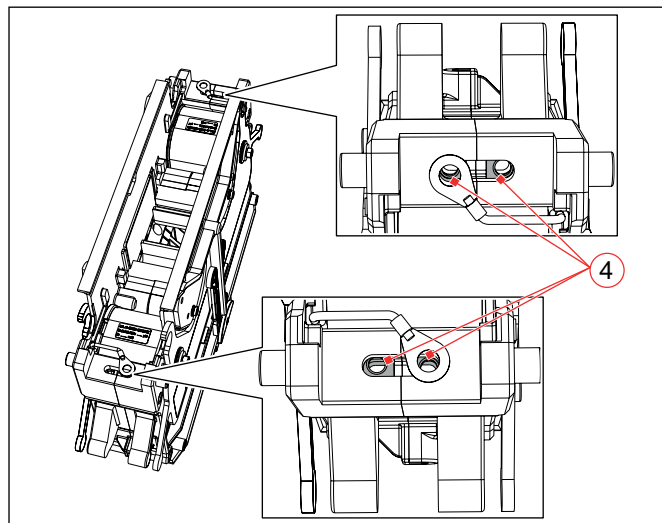


Fig. 63: Correct position of cage nuts

- ▶ Insert the both new fixed contacts (2).
- ▶ Push both new fixed contacts (2) slightly away from the centre into the locked position.
- ▶ Screw in the 4 fixing screws including the washers (1) of the fixed contacts using an appropriate socket wrench:
 - 8 mm socket wrench (screw M5, 16 mm length) for CT/CU 11xx/04, CT/CU 12xx/04
 - 10 mm socket wrench (screw M6, 20 mm length) for CT/CU 11xx/08/10/11, CT/CU 12xx/08/10/11
- ▶ In doing so:
 - Attach the two cable lugs at the copper wires (3) together with the two of the screws (1) according to the figures below.
 - Take especially care that the copper wires (3) are in correct position according to the figures below.
- ▶ Tighten all fixing screws (1) with the torque as required:
 - 3 Nm (M5) for CT/CU 11xx/04, CT/CU 12xx/04
 - 5.5 Nm (M6) for CT/CU 11xx/08/10/11, CT/CU 12xx/08/10/11
- ▶ Check that the cable lugs (3) are tight.
- ▶ Check that all replaced parts are properly in place and fixed tightly.
- ▶ Secure 2 of the 4 fixing screws (1) again with red locking varnish.

Only for contactor types with heat sinks, see *Fig. 67*.

- ▶ Reattach the heat sinks (6) on the fixed contacts.
- ▶ Screw in the 2 fixing screws including washers (5) of each heat sink (6) using a TX20 torx bit.
- ▶ Tighten the fixing screws (5) of the heat sinks (6) with a torque of 3.5 Nm.

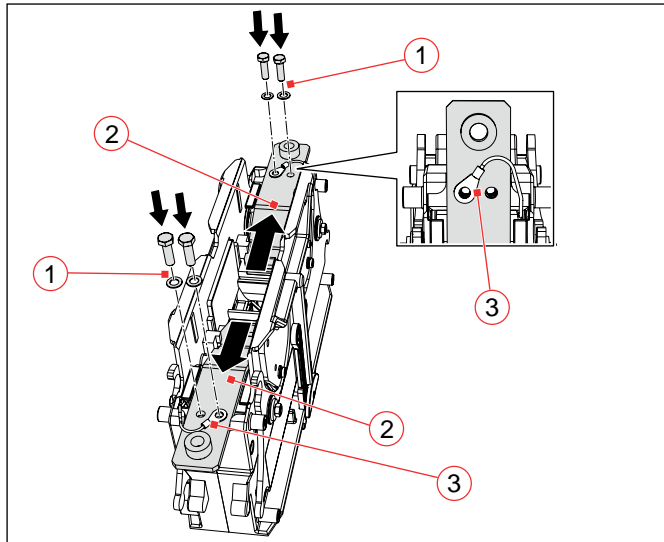


Fig. 64: CT/CU 1115/04: Install new fixed contacts

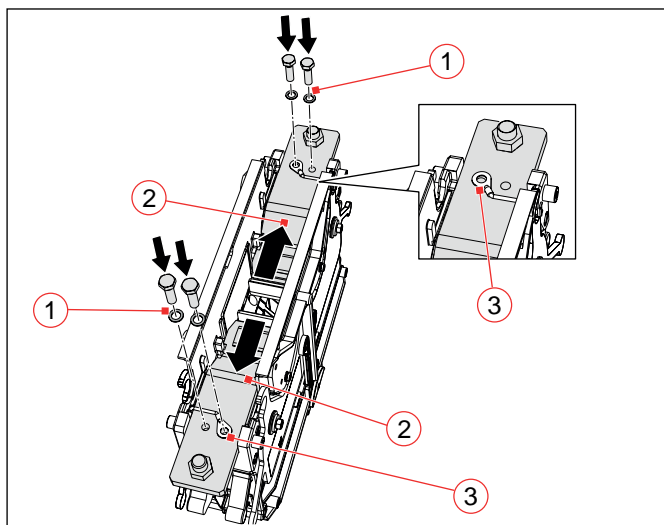


Fig. 65: CT/CU 1130/04, 1115/08, 1130/08: Install new fixed contacts

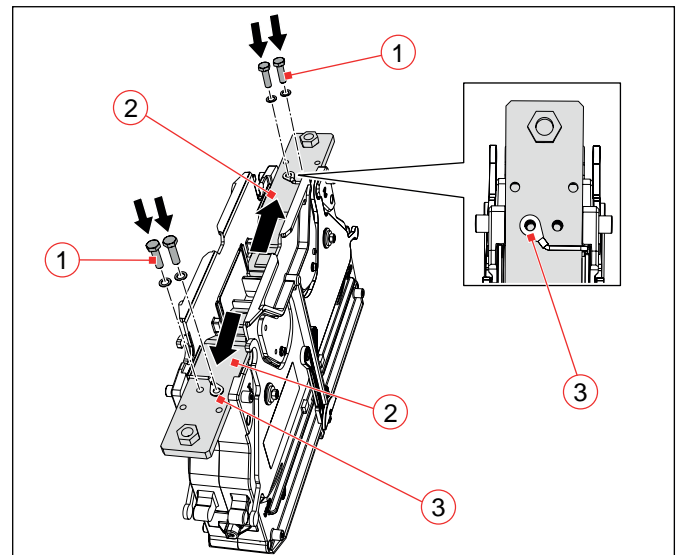


Fig. 66: CT/CU 1115/10/11, 1130/10/11: Install new fixed contacts

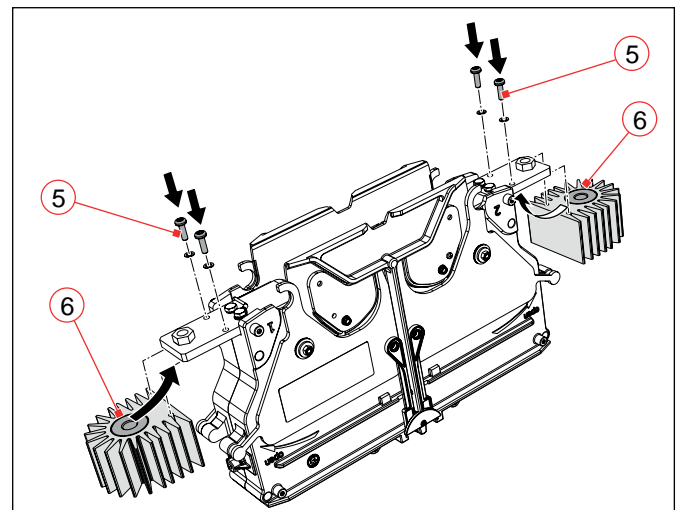


Fig. 67: CT/CU 1115/11, 1130/11: Reattach the heat sinks

In case of double pole contactors:

- ▶ Repeat the steps above with the second upper module.

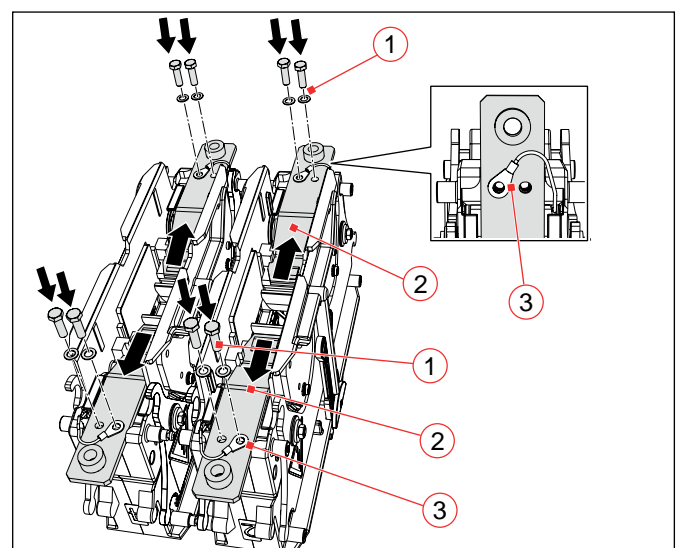


Fig. 68: CT/CU 1215/04: Install new fixed contacts

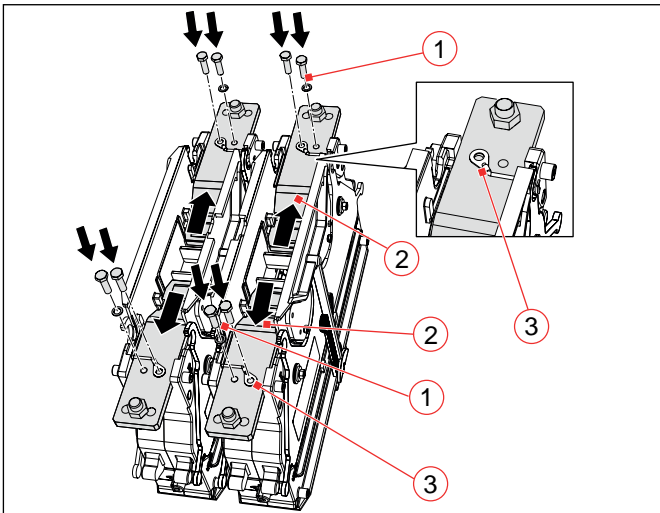


Fig. 69: CT/CU 1230/04, 1215/08, 1230/08: Install new fixed contacts

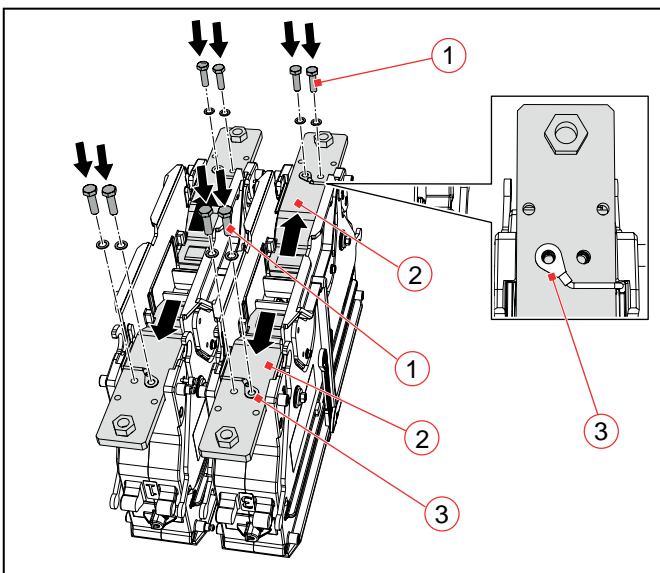


Fig. 70: CT/CU 1215/10/11, 1230/10/11: Install new fixed contacts

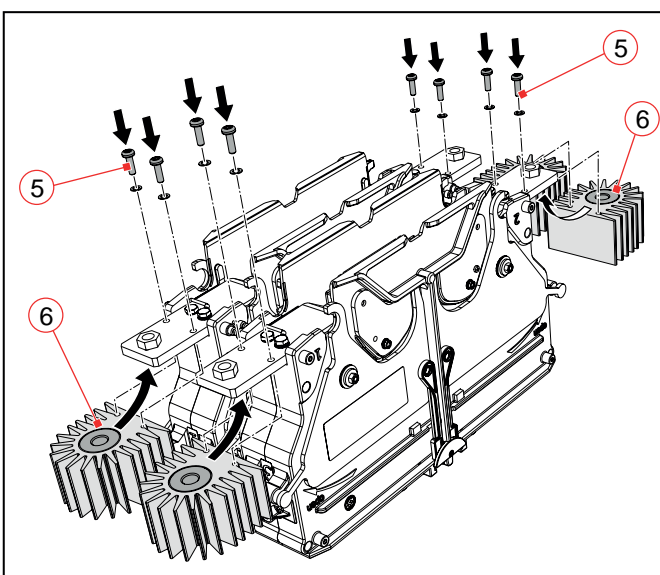


Fig. 71: CT/CU 1215/11, 1230/11: Reattach the heat sinks

Re-install the contactor

- ▶ Re-install the lower module to the mounting frame or plate.
- ▶ Connect the wires of the auxiliary switches.
- ▶ Connect the coil control wires.
- ▶ Install the protection caps for the auxiliary switches and the coil terminal.
- ▶ Install the upper module to the lower module and lock the upper module securely.
- ▶ Reconnect the main cables/busbars.
- ▶ Reconnect the earthing cable.

For detailed instructions about the above listed re-installation procedures refer to section "9. Installation".

Checks

After the maintenance work is completed, do the following checks:

- ▶ Check the protective earth.
- ▶ Check the main connections.
- ▶ Check the control connections.
- ▶ Check the latching and locking between upper and lower module.
- ▶ Check that both protection covers are fitted.
- ▶ Perform several activation and deactivation operations of the contactor without the main circuit active.
- ▶ Check the function of the auxiliary switches: Use a continuity tester to check that the wiring is correct and the auxiliary switches are functioning correctly.
- ▶ Check the pull-in voltage and drop-off voltage according to the requirements of Schaltbau.
- ▶ After each installation and after replacement of main contacts, contact bridge or after any other modifications, alterations or maintenance works, always perform complete checks according to these standards:
 - IEC 60077-2
 - IEC 60947-4-1

Replace the auxiliary switches

If the auxiliary switches have to be replaced all switches of one type (S826 or S870) must be replaced.

Required tools and auxiliaries

- Socket wrench set
- Set of hexagon socket wrenches
- Set of POZIDRIV® cruciform screwdrivers
- Set of slotted screwdrivers
- 90° angle gauge

Preconditions

- The main cables/busbars are removed.
- The upper module is removed.
- The protection cap for the auxiliary switches is removed.
- The wires of the auxiliary switches are disconnected.

For detailed instructions about the above listed preconditions refer to section "9. Installation".

Remove the auxiliary switch subassembly

Depending on the contactor type, see Fig. 72 to Fig. 75. (The actual version may differ from the figures. Standard versions are either 4x S826 or 2x S826 + 2x S870 switches)

- ▶ Note the mounting position of the subassembly and the individual switches.
- ▶ Remove the 2 knurled thumb screws (1) including washers.
- ▶ Remove the 2 hexagon socket head screws (2) including washers.

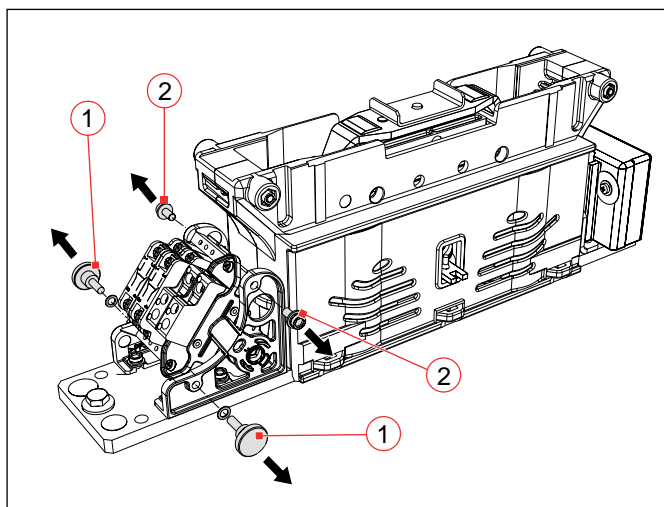


Fig. 72: CT/CU 1115/04, 1130/04, 1115/08, 1130/08, 1115/10/11, 1130/10/11: Remove the auxiliary switch assembly 1

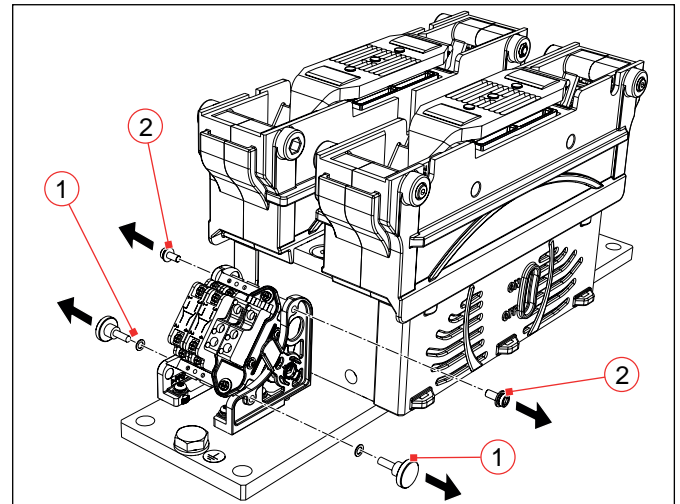


Fig. 73: CT/CU 1215/04, 1230/04, 1215/08, 1230/08, 1215/10/11, 1230/10/11: Remove the auxiliary switch assembly 1

- ▶ Pull the subassembly (3) sideways out in the direction as shown in the figures below.

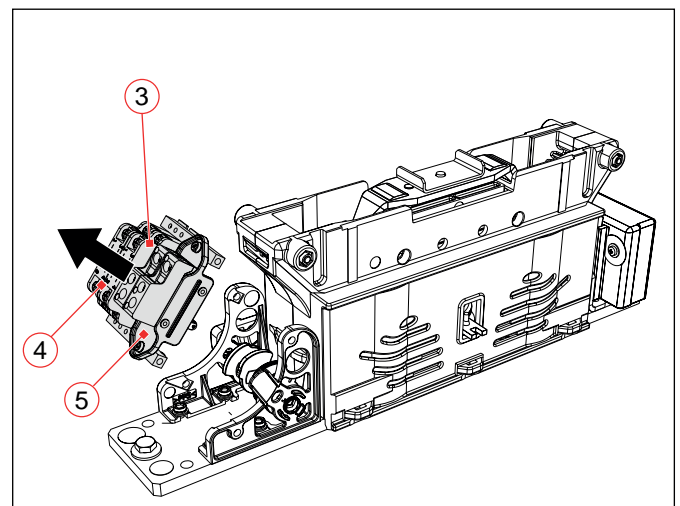


Fig. 74: CT/CU 1115/04, 1130/04, 1115/08, 1130/08, 1115/10/11, 1130/10/11: Remove the auxiliary switch assembly 2

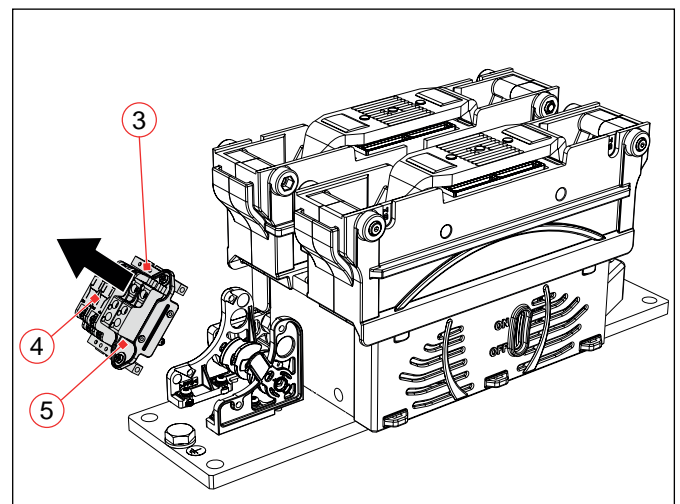



Fig. 75: CT/CU 1215/04, 1230/04, 1215/08, 1230/08, 1215/10/11, 1230/10/11: Remove the auxiliary switch assembly 2

- ▶ Dismount the S826 switches (4) and/or the S870 switch assembly (5) one by one to avoid wrong re-mounting.

	<ul style="list-style-type: none"> ▶ If all switches are removed together and remounted again a readjustment of the frame is necessary. Refer to Fig. 78.
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Remove the S870 switch assembly

- ▶ Remove the 2 screws (6) including washers on the top of the frame using a POZIDRIV® cruciform screw driver size 1.
- ▶ Keep the screws and washers in a safe place.
- ▶ Remove the entire S870 switch assembly (5).

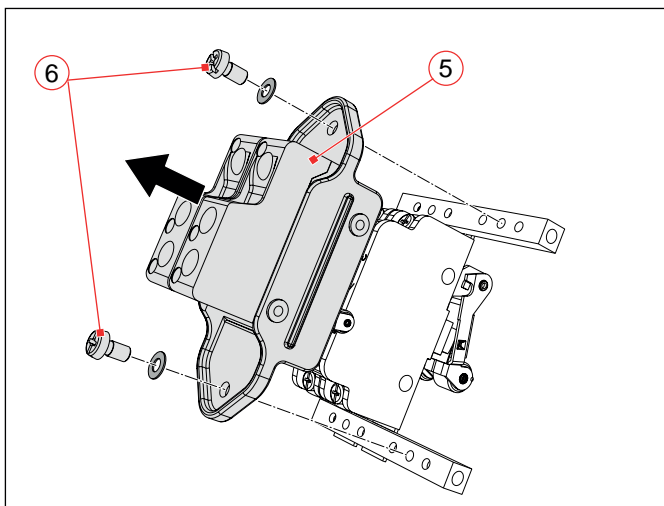


Fig. 76: CT/CU 1115/04, 1130/04, 1115/08, 1130/08, 1215/04, 1230/04, 1215/08, 1230/08, 1115/10/11, 1130/10/11, 1215/10/11, 1230/10/11: Remove the snap action switch assembly S870

Remove the S826 snap action switches

- ▶ Remove the 2 screws (7) including washers for each switch on the bottom of the frame using an appropriate POZIDRIV® cruciform screw driver.
- ▶ Keep the screws and washers in a safe place.

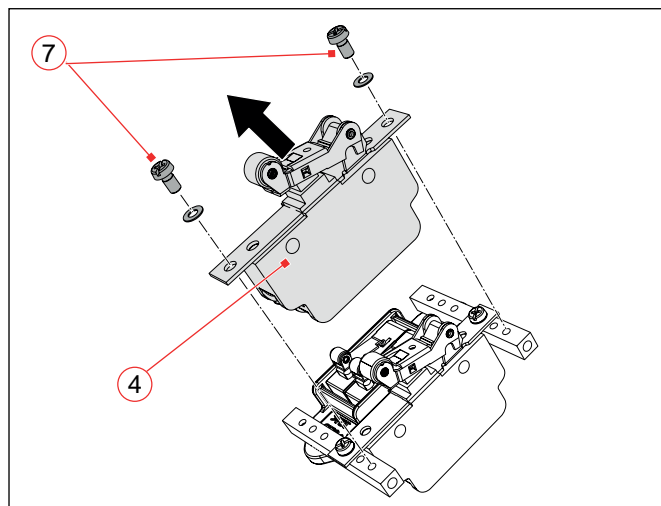


Fig. 77: CT/CU 1115/04, 1130/04, 1115/08, 1130/08, 1215/04, 1230/04, 1215/08, 1230/08, 1115/10/11, 1130/10/11, 1215/10/11, 1230/10/11: Remove snap action switches S826

Install a new S870 switch assembly

- ▶ Install the new S870 switch assembly with the 2 screws (6) including washers on the top of the frame using a POZIDRIV® cruciform screw driver size 1.
- ▶ Tighten the 2 screws (6) with a torque of 1 Nm.
- ▶ Check that all replaced parts are properly in place and fixed tightly.

Install new S826 snap action switches

- ▶ Install the the new switches with the 2 screws (7) including washers for each switch on the bottom of the frame using an appropriate POZIDRIV® cruciform screw driver.
- ▶ Tighten the 2 screws (7) with a torque of 1 Nm.
- ▶ Check that all replaced parts are properly in place and fixed tightly.

Adjust the auxiliary switch subassembly

- ▶ Use a 90° angle gauge (8) and adjust the frame (9) of the auxiliary switch subassembly to a rectangular position.

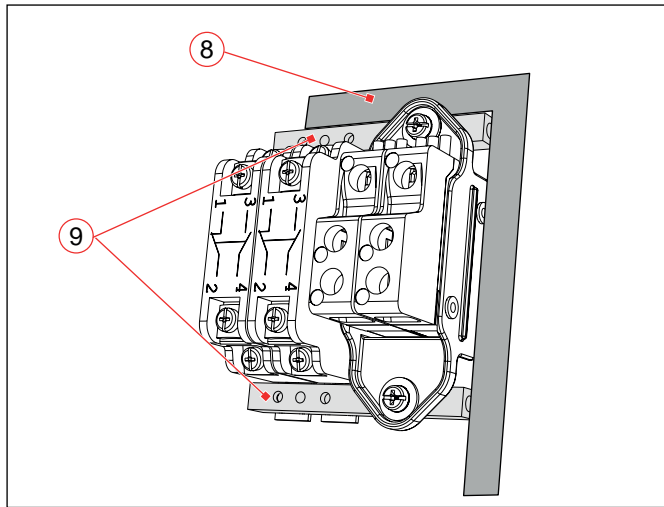


Fig. 78: CT/CU 1115/04, 1130/04, 1115/08, 1130/08, 1215/04, 1230/04, 1215/08, 1230/08, 1115/10/11, 1130/10/11, 1215/10/11, 1230/10/11: Adjust the auxiliary switch subassembly

Re-install the auxiliary switch subassembly

After all switches have been replaced and the frame has been adjusted to a rectangular position, the subassembly can be carefully re-inserted into its original mounting position. Make sure to mount it in the correct same position as it was before.

Depending on the contactor type, see Fig. 79 to Fig. 82.

- ▶ Insert the entire subassembly (3).

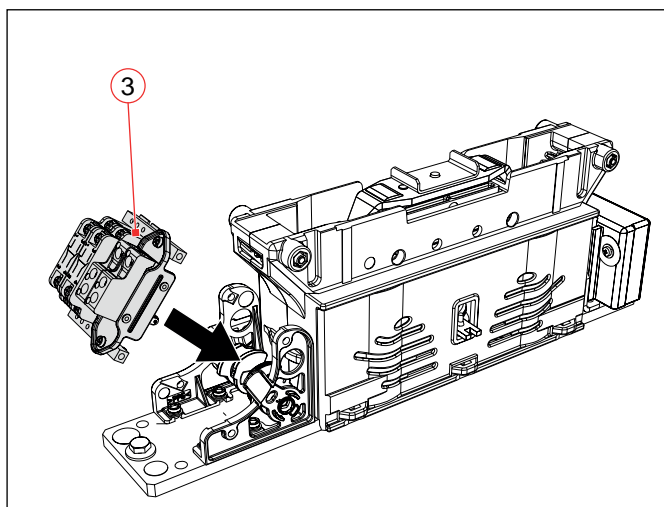


Fig. 79: CT/CU 1115/04, 1130/04, 1115/08, 1130/08, 1115/10/11, 1130/10/11: Re-install the auxiliary switch assembly 1

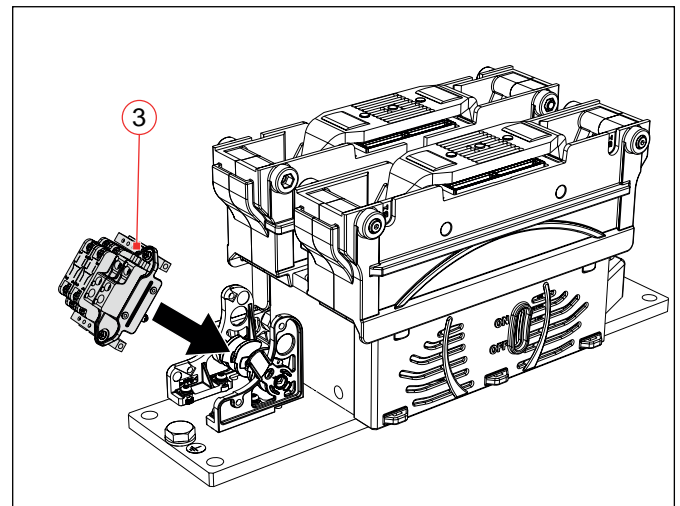


Fig. 80: CT/CU 1215/04, 1230/04, 1215/08, 1230/08, 1215/10/11, 1230/10/11: Re-install the auxiliary switch assembly 1

- ▶ Screw in the 2 hexagon socket head screws (2) and tighten the screws with a torque of 2 Nm.
- ▶ Screw in the 2 knurled thumb screws (1) including washers.
 - Tighten the knurled thumb screws (1) by turning them just once.
- ▶ Check that all replaced parts are properly in place and fixed tightly.

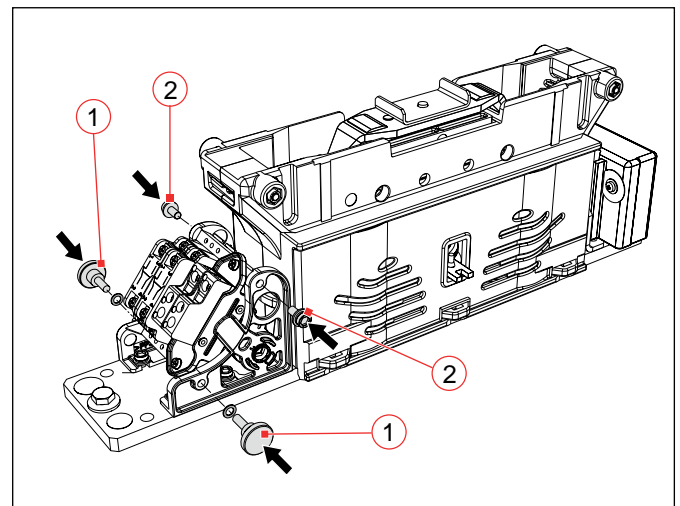


Fig. 81: CT/CU 1115/04, 1130/04, 1115/08, 1130/08, 1115/10/11, 1130/10/11: Re-install the auxiliary switch assembly 2

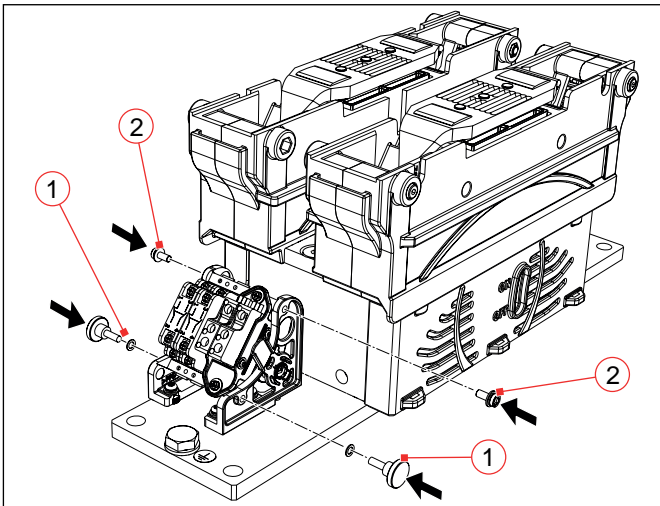


Fig. 82: CT/CU 1215/04, 1230/04, 1215/08, 1230/08, 1215/10/11, 1230/10/11: Re-install the auxiliary switch assembly 2

Re-install the contactor

- ▶ Connect the wires of the auxiliary switches.
- ▶ Install the protection caps for the auxiliary switches.
- ▶ Install the upper module to the lower module and lock the upper module securely.
- ▶ Reconnect the main cables/busbars.

For detailed instructions about the above listed re-installation procedures refer to section **"9. Installation"**.

Checks

After the maintenance work is completed, do the following checks:

- ▶ Check the protective earth.
- ▶ Check the main connections.
- ▶ Check the control connections.
- ▶ Check the latching and locking between upper and lower module.
- ▶ Check that both protection covers are fitted.
- ▶ Perform several activation and deactivation operations of the contactor without the main circuit active.
- ▶ Check the function of the auxiliary switches: Use a continuity tester to check that the wiring is correct and the auxiliary switches are functioning correctly.
- ▶ Check the pull-in voltage and drop-off voltage according to the requirements of Schaltbau.
- ▶ After each installation and after replacement of main contacts, contact bridge or after any other modifications, alterations or maintenance works, always perform complete checks according to these standards:
 - IEC 60077-2
 - IEC 60947-4-1

11. Spare Parts



Important!

When ordering spare parts, always inform Schaltbau about the exact type and the article number of the contactor.

11.1 Single pole contactors

Items	Spare part, description	Ordering code					
		CT/CU 1115/04	CT/CU 1130/04	CT/CU 1115/08	CT/CU 1130/08	CT/CU 1115/10/11	CT/CU 1130/10/11
1	Stationary main contact, complete (order 2 per pole)	MC CT1015/04	MC CT1030/04	MC CT1015/08	MC CT1030/08	MC CT1015/10/11	MC CT1030/10/11
1	Contact bridge with mounted contact holder, mounting position »H« horizontal	CBH CT1015/04	CBH CT1030/04	CBH CT1015/08	CBH CT1030/08	CBH CT1000/08	
1	Contact bridge with mounted contact holder, mounting position »V« vertical	CBV CT1015/04	CBV CT1030/04	CBV CT1015/08	CBV CT1030/08		
1	Ceramic protection inserts (order 2 per pole)	PI CT1030/04		PI CT1000/08			
1	Protective cover coil terminals	CC CT1030/04		CC CT1030/08			
1	Protective cover auxiliary switches	CA CT1030/04		CA CT1030/08			
1	Snap-action switch (SPDT)	S826 a L					
1	Contact block of 2x S870 (momentary switches a1, b0)	AS S870					

11.2 Double pole contactors

Items	Spare part, description	Ordering code					
		CT/CU 1215/04	CT/CU 1230/04	CT/CU 1215/08	CT/CU 1230/08	CT/CU 1215/10/11	CT/CU 1230/10/11
1	Set of two stationary main contacts	MC CT1015/04	MC CT1030/04	MC CT1015/08	MC CT1030/08	MC CT1015/10/11	MC CT1030/10/11
1	Insulation plate	IP CT1015/04	IP CT1030/04	IP CT1015/08	IP CT1030/08	IP CT1015/08	IP CT1030/08
1	Contact bridge with mounted contact holder, mounting position »H« horizontal	CBH CT1215/04	CBH CT1230/04	CBH CT1215/08	CBH CT1230/08	CBH CT1200/08	
1	Contact bridge with mounted contact holder, mounting position »V« vertical	CBV CT1215/04	CBV CT1230/04	CBV CT1215/08	CBV CT1230/08		
1	Ceramic protection insert (order 2 per pole)	PI CT1030/04		PI CT1000/08			
1	Protective cover coil terminals	CC CT1030/04		CC CT1030/08			
1	Protective cover auxiliary switches	CA CT1030/04		CA CT1030/08			
1	Snap-action switch (SPDT)	S826 a L					
1	Contact block of 2x S870 (momentary switches a1, b0)	AS S870					

12. Technical Data

Specifications and information on the material characteristics for the contactors in the CT series are given in our catalogues *C20.en and C21.en*.

Due to our continuous improvement programme, the design of our products can be modified at any time. So some features may differ from the descriptions, specifications and drawings in the catalogues. You can download the latest update of the catalogue at: <https://www.schaltbau.com/en/media-library/>

The updated catalogues render the previous issues invalid.

13. Disposal

This product is designed for exclusive professional use by commercial companies. The owner is responsible for ensuring an environmentally sound disposal of this product at the end of its working life.

This product or parts of it may not be disposed with other household wastes.

To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate this product or parts of it from other types of wastes and recycle it responsibly to promote the sustainable reuse of material resources.

Please observe all local regulations and recommendations for the disposal, recycling or environmentally friendly processing of the parts and materials that have been used or replaced during installation, operation, and maintenance tasks. In the end-of life ensure an environmentally sound disposal of the product according to the legal regulations and requirements for electric and electronic waste equipment in your country.

Notes

Schaltbau GmbH

For detailed information on our products and services visit our website – or give us a call!

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with compliments:



The production facilities of Schaltbau GmbH have been IRIS certified since 2008.



Certified to DIN EN ISO 14001 since 2002. For the most recent certificate visit our website.



Certified to DIN EN ISO 9001 since 1994. For the most recent certificate visit our website.

Electrical Components and Systems for Railway Engineering and Industrial Applications

Connectors

- Connectors manufactured to industry standards
- Connectors to suit the special requirements of communications engineering (MIL connectors)
- Charging connectors for battery-powered machines and systems
- Connectors for railway engineering, including UIC connectors
- Special connectors to suit customer requirements

Snap-action switches

- Snap-action switches with positive opening operation
- Snap-action switches with self-cleaning contacts
- Enabling switches
- Special switches to suit customer requirements

Contactors

- Single and multi-pole DC contactors
- High-voltage AC/DC contactors
- Contactors for battery powered vehicles and power supplies
- Contactors for railway applications
- Terminal bolts and fuse holders
- DC emergency disconnect switches
- Special contactors to suit customer requirements

Electrics for rolling stock

- Equipment for driver's cab
- Equipment for passenger use
- High-voltage switchgear
- High-voltage heaters
- High-voltage roof equipment
- Equipment for electric brakes
- Design and engineering of train electrics to customer requirements