

3

Contactors

CPP Series

1 pole
AC and uni-directional DC
NO and NC contactors

Installation and
Maintenance Instructions

Manual C45-M.en



Document Revision History

Date	Rev. version	Description	Pages
2021-06-09	V1.0	Initial version	All

Content

1. Important basic information	4
1.1 Legal notes	4
1.2 Conventions for this manual.....	4
2. General and safety information.....	4
2.1 Observing the manual.....	4
2.2 Duties of the operating company.....	5
2.3 Intended use.....	5
2.4 Ambient conditions.....	5
3. Hazards and safety precautions.....	6
3.1 Electrical hazards.....	6
3.2 Other hazards	7
3.3 Measures for avoiding damage and malfunctions	7
4. Product information.....	9
4.1 CPP – 1-pole NO or NC contactors for DC or AC	9
4.2 Features	9
4.3 Reliable, robust and economical	9
4.4 Application	10
4.5 Technical information and material properties.....	10
4.6 Overview	11
CPP contactors – stand alone versions.....	11
CPP contactors – built-in versions	12
5. Storage.....	13
6. Unpacking.....	13
6.1 Unpacking the device.....	13
6.2 Check parts for transport damage.....	13
7. Installation	14
7.1 Mounting	14
Dimensions/interfaces and further technical specifications.....	14
Preparatory measures.....	14
Mounting holes.....	14
Permissible mounting orientations.....	14
Required minimum clearances	15
Ventilation requirements	15
Safety	15
Tools required.....	15
Installing the CPP contactor with 1,200 A and 2,000 A CP devices.....	16
Installing the CPP contactor with 600 A CP devices or as stand-alone solution.....	16

7.2	Electrical connection	17
	Electrical data and other technical specifications.....	17
	Preparatory measures.....	17
	Safety	18
	Tools required.....	18
	Connecting the S870 auxiliary switches.....	19
	Connecting the coil.....	20
	Connecting the earth/ground terminal (only for stand-alone versions)	20
	Connecting the main contacts.....	21
7.3	Checks	22
8.	Maintenance	23
8.1	Safety	23
8.2	Preventive maintenance.....	23
	Intervals for regular tests/checks	23
	Regular tests/checks	24
	Removing the arc chamber	26
	Inserting the arc chamber.....	26
	Checking the arc chamber.....	27
	Checking the main contacts	27
8.3	Corrective maintenance	28
	Replacing the arc chamber.....	28
	Replacing the S870 auxiliary switches.....	28
9.	Spare parts	29
10.	Technical data.....	29
11.	Disposal	29

1. Important basic information

1.1 Legal notes

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SCHALTBAU GmbH cannot be held liable for damage caused by non- or only partial observation of the manual.

1.2 Conventions for this manual

This manual describes the installation 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 manual:

⚠ DANGER
Indicates a directly threatening dangerous situation. Death or severe injuries will result if it is not prevented.

⚠ WARNING
Indicates a possibly dangerous situation. Death or severe injuries may result if it is not prevented.

⚠ CAUTION
Indicates a possibly dangerous situation. Medium or minor injuries may result if it is not prevented.

ATTENTION

Indicates a possibly detrimental situation. If it is not prevented, assemblies, the system or property in its surroundings could be damaged.

i	Indicates technical features and methods to simplify working or indicates information of particular importance.
----------	-----------------------------------------------------------------------------------------------------------------

This manual describes single pole AC and uni-directional DC contactors of the following types:

- CPP1115 (NO contactors)
- CPP2115 (NC contactors)

Depending on the configuration, the following abbreviations are used in this manual:

NO = Normally Opened
NC = Normally Closed

Since the CPP series devices offer a wide range of configuration options, not all possible configurations can be presented in this manual.

Even if the configurations shown do not correspond exactly to the present device, the installation and maintenance steps can be carried out identically as described in this manual.

2. General and safety information

The contactors dealt with in this document are intended for use with electrical systems for special applications. They are designed and tested in compliance with generally accepted codes of practice. However, improper use, operation, handling, maintenance of 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. Consequently, the operation, maintenance and installation instructions for the contactors must be strictly followed.

If anything is not clear, clarification must be sought with any queries stating the device type and the serial number.

Only authorised and trained personnel are allowed to plan and carry out all mechanical and electrical instal-

lations, transport, commissioning, as well as maintenance and repair work.

This applies to the observation of the general installation and safety regulations for electrical systems as well as the proper use of tools approved for this purpose. Electrical equipment requires protection from moisture and dust during installation, operation and storage.

2.1 Observing the manual

- ▶ All personnel must read and understand the instructions in this manual and adhere to them when working with the device.
- ▶ **Always adhere strictly to all safety instructions!**

2.2 Duties of the operating company

- ▶ Observe all applicable national regulations, all safety, accident prevention and environmental protection regulations as well as the recognised technical rules for safe and correct working.
- ▶ Regularly check all fitted protection and safety equipment for correct function.
- ▶ Work on electrical equipment must only be carried out by a qualified electrician or by instructed persons under the supervision and control of a qualified electrician in accordance with electrical regulations.
- ▶ A specialist is someone who, on the basis of their technical training, knowledge and experience as well as knowledge of the relevant regulations, is able to assess the work assigned to them and identify possible dangers.
- ▶ Work on the contactors must only be carried out by personnel who meet the requirements set out in this manual.
- ▶ Personnel must be clearly informed about who is responsible for the maintenance of the contactors.
- ▶ Always perform complete checks after any installation work and/or after any other conversions, alterations or maintenance, in accordance with the following standards:
 - EN/IEC 60077-2
 - EN/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 wide range of industrial applications.
- ▶ The contactors must only be used under operating conditions according to the technical specifications and the instructions in this manual.
- ▶ None of the conditions of use, such as voltages, currents or ambient conditions, defined in the corresponding technical data sheets or in our **C45 catalogue** may be overridden. The **C45 catalogue** is available under:
<https://www.schaltbau.com/en/media-library/>
- ▶ The contactors may only be used when all protective devices are present, have been correctly installed and are fully operational.
- ▶ Contactors may not be used without other safety precautions in potentially explosive atmospheres and/or in aggressive media.
- ▶ Operation without a correctly installed arc chamber is not permitted.

- ▶ The device contains unprotected live parts.
- ▶ The prescribed clearances relative to other live parts or earth and other parts must be complied with as well as the safety regulations of the applicable standards.
- ▶ Switching at close to the maximum breaking capacity may require increased minimum clearances! Do not hesitate to ask our advice in respect of any dimensioning.
- ▶ 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. impacts on the floor, may result in breakage, cracks or deformation. Always handle the device with care.
- ▶ Only use the contactors for the specified application and only with original parts. Any other usage of or tampering with the contactors is considered contrary to their 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






ATTENTION

The contactors have been designed for specific ambient conditions.


- ▶ Only operate the contactors in ambient conditions, such as temperature ranges, degree of soiling, etc., as defined in the corresponding data sheets and in our **C45 catalogue**. The **C45 catalogue** is available under:
<https://www.schaltbau.com/en/media-library/>


3. Hazards and safety precautions


3.1 Electrical hazards

	<p>⚠ DANGER</p> <p>The contactors are used for high voltage switching. Contact with live electrical parts can result in serious injuries or even death! Live parts are all metal parts belonging directly to one of the circuits or wires connecting to them. All other visible metal parts and wiring may also be live if a fault exists. Before starting any work on the contactors, always comply with the following safety rules:</p> <ul style="list-style-type: none"> ▶ Disconnect on all sides ▶ Secure to prevent switching back on ▶ Clearly identify the working area ▶ Check that a voltage-free state exists ▶ Earth and short circuit; this includes discharging any capacitors in the main circuit ▶ Besides the main power circuits, also disconnect additional and auxiliary circuits ▶ Cover or insulate adjacent live parts ▶ The presence of a voltage-free state can only be clearly identified by a qualified electrician. ▶ When the work has been concluded, follow the procedure in reverse.
	<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.
	<p>⚠ DANGER</p> <p>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.</p>
	<p>⚠ DANGER</p> <p>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..</p>

3.2 Other hazards

	<p>⚠ WARNING</p>
	<p>Contactors must only be used for the purposes specified in the specifications and data sheets. Incorrect use can cause accidents and severe personal injury.</p> <ul style="list-style-type: none"> ▶ The manufacturer will not be responsible for accidents arising from improper use of the product.

	<p>⚠ CAUTION</p>
	<p>During continuous operation the contactors may become hot. Risk of burns!</p> <ul style="list-style-type: none"> ▶ Before beginning any checks or maintenance on the contactors ensure that the heated components have cooled down.

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

3.3 Measures for avoiding damage and malfunctions

<p>ATTENTION</p>
<p>Aggressive liquids may damage the contactors.</p> <ul style="list-style-type: none"> ▶ Ensure the contactors do not come into contact with aggressive liquids.

<p>ATTENTION</p>
<p>Improper handling of the contactors, e.g. dropping on the floor, can result in breaks, cracks and deformation.</p> <ul style="list-style-type: none"> ▶ Ensure the contactors are always handled correctly. ▶ Do not throw the contactors on the floor. ▶ At regular intervals perform a visual check of the contactors for possible damage. ▶ Immediately replace any damaged parts.

<p>ATTENTION</p>
<p>Depending on the product type, contactors can contain permanent magnets. Such magnets can attract ferromagnetic parts resulting in damage to the contactors.</p> <ul style="list-style-type: none"> ▶ Ensure that the contactors are installed in a location where it is not possible for them to attract any ferromagnetic parts.

<p>ATTENTION</p>
<p>Depending on the product type, contactors can contain permanent magnets. These permanent magnets can destroy the data on the magnetic strips of credit or similar cards.</p> <ul style="list-style-type: none"> ▶ Keep credit or similar cards away from the contactors.

ATTENTION

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

- ▶ Make sure that the contactors are installed in a location where no other components are affected.

ATTENTION

In the case of damage, wear and/or soiling of the contactors - in the form of a partial break, sharp edges and discoloured surfaces - the functional reliability of the contactors is no longer ensured.

- ▶ Visually inspect the contactors regularly to detect wear and soiling.
- ▶ Replace damaged parts immediately.
- ▶ Immediately remove any soiling without leaving any residues.
- ▶ Immediately replace any parts with persistent soiling.

ATTENTION

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

- ▶ Record the frequency of undoing of the screws in the work log.
- ▶ Replace detent-edged rings or detent-edged washers with new ones after the screws have been undone three times.

4. Product information

4.1 CPP – 1-pole NO or NC contactors for DC or AC

Compact single-pole NO and NC contactors up to 3,600 volts rated insulation voltage. Making current up to 2,000 amps; conventional thermal current up to 200 amps; short-time currents up to 2,000 amps.

The super-compact DC contactors of the CPP series are the smallest Schaltbau switching devices in the power class up to 200 amps and suitable for rated operating voltages up to 3,000 volts. The single-pole switching devices are available as NO or NC contactors.

They are used in main and auxiliary converters of railway vehicles, but also in converters and inverters in the field of renewable energies or, more generally, in industrial environments.

4.2 Features

▶ **Compact dimensions – high rated insulation voltage U_{Nm} up to 3,600 volts**

Small dimensions – great performance! All air gaps in the contact area are generously dimensioned. The rated insulation voltage is 3,600 volts for OV2 and 3,000 volts for OV3. A highly efficient ceramic arc chamber with permanent magnetic blowout is used to handle arcs.

▶ **High making capacity I_{cm} of up to 2,000 amps**

The CPP can switch on currents of up to 2,000 amps in the make contactor version. In the version as a break contactor, up to 850 amps. High contact forces and optimised silver contacts favour the excellent breaking capacity.

▶ **High thermal continuous current I_{th} of up to 200 amps**

The CPP series can permanently carry currents of up to 200 amps in the NO contactor version. In the version as a NC contactor, currents of 120 amps can be carried. Connection cross-section: NO contactor 120 mm², NC contactor 35 mm², maximum ambient temperature: 70 °C. The values are achieved through high contact forces.

▶ **High short-time withstand current rating I_{cw} of up to 2,000 amps**

For 100 milliseconds, the normally open contact can carry a maximum current of 2,000 amps. The short-circuit current carrying capacity of the NC contact is 1,800 amps. This time is sufficient to trigger the short-circuit protection and prevent welding of the main contacts. The short-time current carrying capacity is supported by high contact forces and optimised silver contacts.

▶ **Auxiliary contacts with snap-action switches**

Two S870 series auxiliary switches are optionally available for extensive diagnostics and switching condition monitoring.

The switches have robust silver or gold contacts.

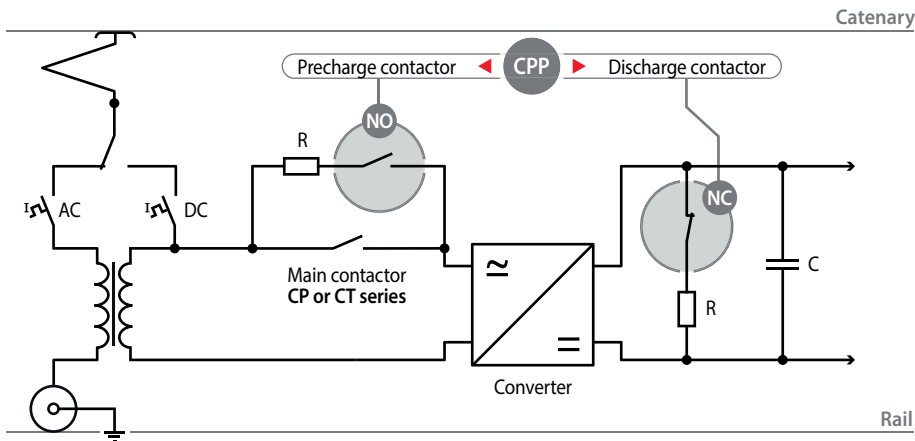
4.3 Reliable, robust and economical

Contactors of the CPP series are designed for continuous currents up to 200 A. Among other features, the robust switchgear has a high breaking and breaking capacity as well as a high short-time rated current. This ensures long operational reliability. Depending on the application, different requirements are placed on electromechanical components.

The new DC contactors are very robust against shock and vibration loads and meet the requirements of IEC 60077.

4.4 Application

Thanks to many years of experience and expertise in the development of electromechanical switchgear and the control of arcs, especially DC arcs, Schaltbau has a compact contactor for high rated insulation voltages in its range with the CPP series. The device, which is available as a NO or NC contactor, is suitable as a precharging contactor for the large Schaltbau CP and CT series. It can also be used as a universal contactor.



NO Precharging NO contactor

Use as a classic precharging contactor in the make contact variant: connecting and disconnecting the resistor for precharging the DC link in converters of railway vehicles.

NC Discharging NC contactor

Use as discharge contactor in the NC contact variant: discharging the capacitor in the DC link in converters of railway vehicles or in industrial test systems.

> Universal contactor

NO or NC contactor for switching single-pole loads for small and medium switching capacities.

4.5 Technical information and material properties

For technical information and material properties, refer to the corresponding data sheets and to our *C45 catalogue*. The *C45 catalogue* is available under:

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

4.6 Overview

CPP contactors – stand alone versions

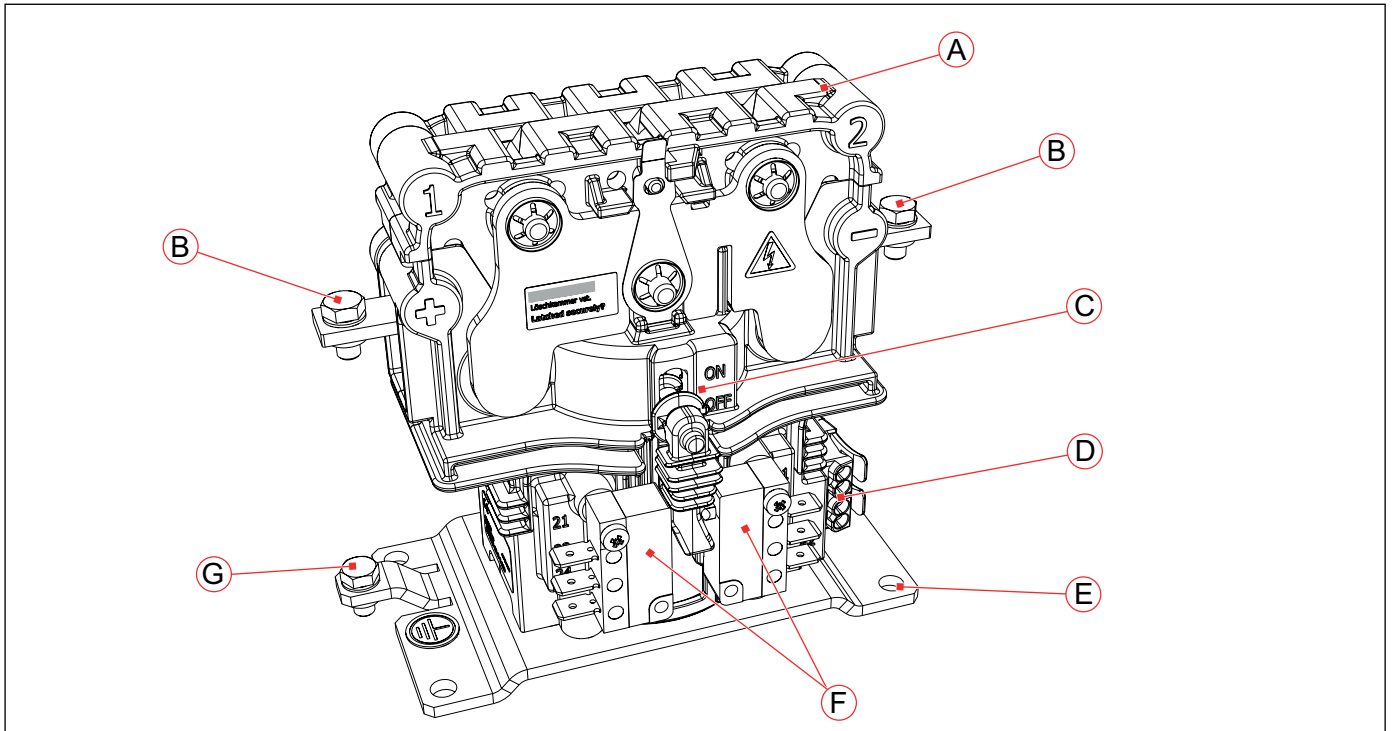


Fig. 1: CPP 1115 NO/2115 NC contactors, stand alone version

- | | | | |
|---|-----------------------------------------------------------------------|---|---------------------------------------------------------------------|
| A | Arc chamber unit (removable) | E | Base plate with 4 fastening holes $\varnothing 6$ mm, for M5 screws |
| B | Main contacts, connection: M5 (torque: 4 - 5 Nm) | F | Auxiliary switches S870, flat plug connections
6.3 x 0.8 mm |
| C | ON/OFF indication | G | Earthing connection M5 (torque: 4 - 5 Nm) |
| D | Coil terminal A1 (-), A2 (+), connection: spring clamp terminal block | | |

CPP contactors – built-in versions

CPP pre-charging contactors as built-in versions have a special angled mounting flange for direct integration into CP main contactors.

For CP contactor types with 1,200 A or 2,000 A the CPP can be mounted directly on the base plate of the CP main contactor.

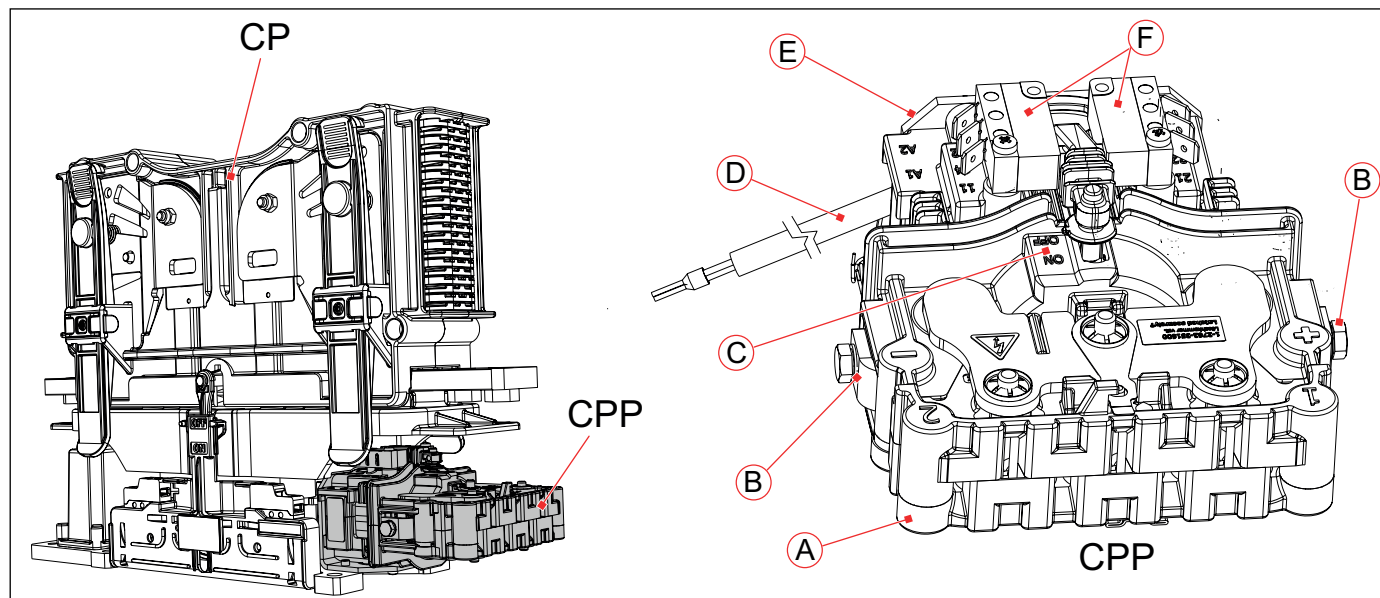


Fig. 2: CPP 1115 NO/2115 NC pre-charging contactor, built-in version, integrated into a 1,200 A or 2,000 A CP main contactor

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>A Arc chamber unit (removable)</p> <p>B Main contacts, connection: M5 (torque: 4 - 5 Nm)</p> <p>C ON/OFF indication</p> <p>D Coil terminal, completely wired, the coil control wires can be connected directly to the designated spring clamp terminals on the CP main contactor</p> | <p>E Angled mounting flange with 2 threaded fastening holes for M5 screws</p> <p>F Auxiliary switches S870, flat plug connections 6.3 x 0.8 mm</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|

For CP main contactor types with 600 A, the CPP precharging contactor cannot be directly integrated. If CPP pre-charging contactors are combined with 600 A CP main contactors, a stand-alone CPP version must be used.

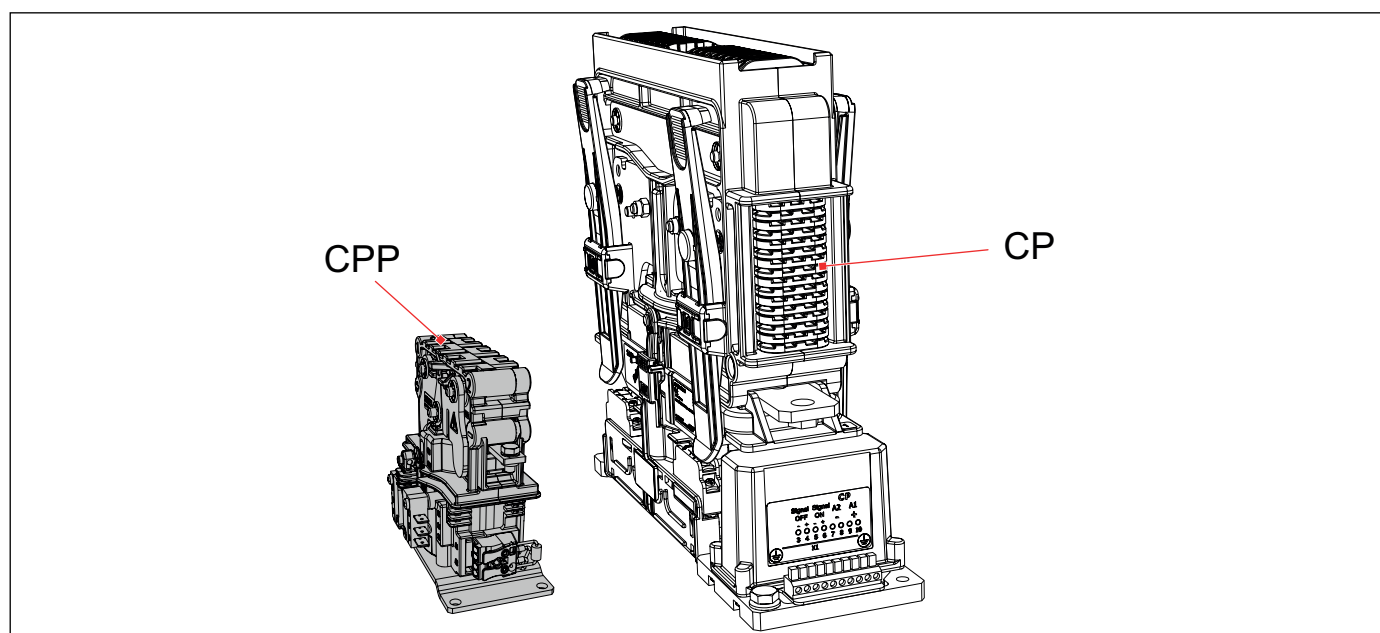


Fig. 3: CPP 1115 NO/2115 NC pre-charging contactor, stand-alone version in combination with a 600 A CP main contactor

5. Storage

ATTENTION

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

- ▶ Store the device in its original packaging,
- ▶ Store the device in a dry and dust-free location.

Return shipments

Schaltbau recommends retaining the original packaging for any return shipments.

If the original packaging is not available, care must be taken to pack the contactor in a way that prevents damage during shipment.

6. Unpacking

6.1 Unpacking the device

- ▶ Before opening the packaging, perform a visual inspection for any signs that could indicate damage having occurred during transport (impacts, bumps, dropping, etc.).
- ▶ If any signs indicate that the contactor has been subject to excessive impacts do not install it.

6.2 Check parts for transport damage

ATTENTION

If parts are damaged, functional reliability of the contactor has been lost.

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

7. Installation

7.1 Mounting

Dimensions/interfaces and further technical specifications

The dimensions and other technical specifications are given in the respective data sheets or can be found in our *C45 catalogue*. The *C45 catalogue* is available under: <https://www.schaltbau.com/en/media-library/>

Preparatory measures

- ▶ For stand alone versions, a suitable mounting plate with 4 mounting holes in accordance with the following dimensional drawing (Fig. 4) must be provided for fastening of the contactors.
- ▶ The mounting holes can be either:
 - threaded holes (for threaded screws)
 - or through holes (for threaded screws and nuts)
- ▶ Fastening of the contactors on the mounting plate is performed using 4 M5 mounting screws.
 - The length of the mounting screws must be determined dependent on the structural circumstances.
 - To secure the mounting screws so that they do not come loose, appropriate screw locking elements must be provided. Schaltbau recommends using Schnorr washers (or similar).
 - The mounting screws must be equipped with washers (resting on the device). Installation without washers is not permitted!
 - The mounting screws (and if applicable the nuts) must be strength class 8.8 or higher.
 - The mounting screws must be tightened to the specified torque, which depends on the strength class (min. 8.8) of the screws/nuts used.

Mounting holes

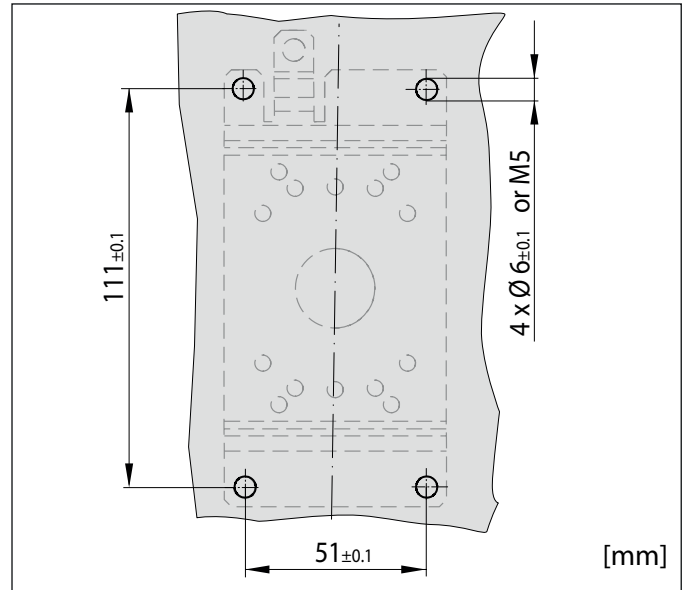


Fig. 4: Dimensions and layout of mounting holes (stand-alone version)

Permissible mounting orientations

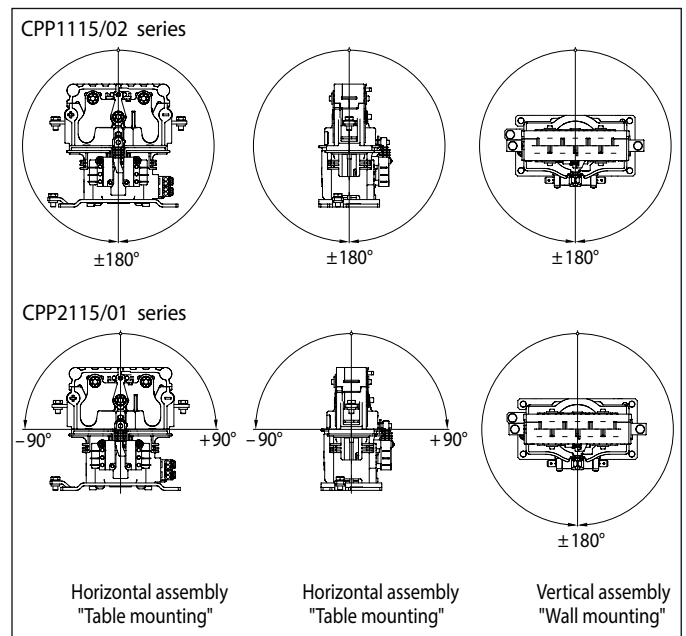


Fig. 5: Permissible mounting orientations (stand-alone version)

Required minimum clearances

Switching of high voltage currents produces electric arcs and it is possible that plasma will escape from the openings of the arc chambers. Therefore, it is extremely important to maintain the minimum clearances to ground/earth and the connecting contacts to avoid flash-overs.

Minimum clearances for CPP contactors

A minimum clearance (A, B) to earth/ground potential and insulating structure parts is required on all sides and above the contactor. See *C45 catalogue*.

In addition, a distance (C) of 30 mm to the top is required to be able to remove the arc chamber in case of maintenance work.

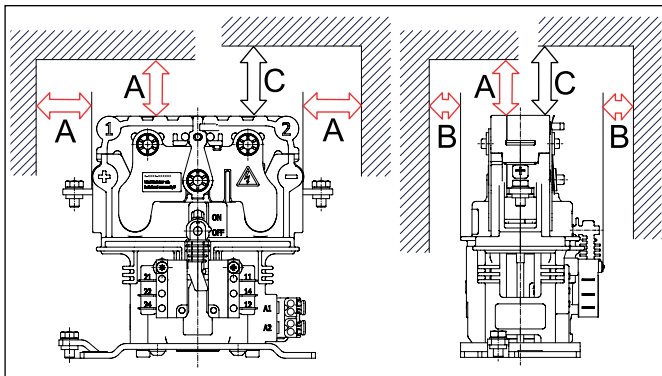


Fig. 6: CPP stand alone versions: For minimum clearance to earth/ground potential and insulating structure parts see *C45 catalogue*.

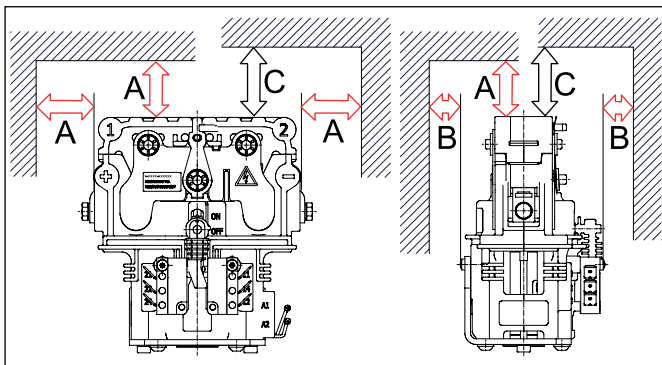


Fig. 7: CPP built-in versions: For minimum clearance to earth/ground potential and insulating structure parts see *C45 catalogue*.

ATTENTION

Make sure that there is sufficient space for routing the wires for auxiliary switches and coil terminals. Otherwise, if the wires are routed too tightly, the auxiliary switch connections and/or coil terminals can break off or bend.

Ventilation requirements

- ▶ Ensure sufficient ventilation in the installation area, especially when switching heavy loads. This allows the plasma to be dissipated more quickly and reduces the risk of flash-over and corrosion.

Safety

- ▶ Installation must be performed by qualified trained personnel.

ATTENTION

When installing, ensure that no dirt can get into the contactor as a result of surrounding building activities.

ATTENTION

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

- ▶ Record the frequency of undoing of the screws in the work log.
- ▶ Replace detent-edged rings or detent-edged washers with new ones after the screws have been undone three times.

Tools required

- Socket spanner set
- Hexagon socket spanner set, hexagon socket bits
- Set of Torx bits or Torx screwdrivers
- Torque spanner

Installing the CPP contactor with 1,200 A and 2,000 A CP devices

CPP pre-charging contactors as built-in versions have a special angeled mounting flange for direct integration into CP main contactors.

For CP contactor types with 1,200 A or 2,000 A, the CPP can be mounted directly on the base plate of the CP main contactor.

- ▶ Position the CPP (2) at the base plate (3) of the CP main contactor (4).
- ▶ Screw in the 2 fixing screws (1).
- ▶ Tighten the 2 fixing screws (1) to a torque of 3.2 - 4 Nm.

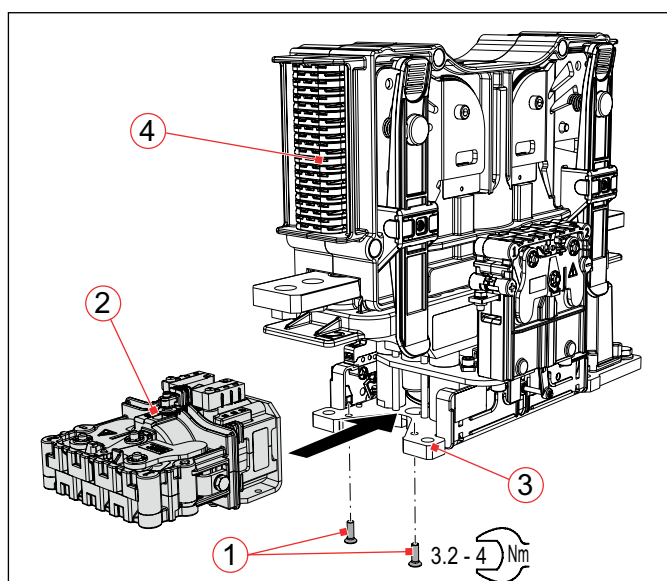


Fig. 8: With 1,200 A and 2,000 A CP devices: Example for the installation of the CPP at the base plate of the CP main contactor

Installing the CPP contactor with 600 A CP devices or as stand-alone solution

CPP pre-charging contactors as stand-alone versions have a special mounting flange for the installation at a separate mounting position (e.g. next to a CP main contactor).

For CP contactor types with 600 A, the CPP can only be mounted at a separate mounting position.

- ▶ Ensure that the contact surfaces on the mounting plate (3) and the bottom of the CPP (1) are free from dirt and other contamination (e.g. metal chips).
- ▶ Position the CPP (1) on the mounting plate (3) which is provided with mounting holes.
- ▶ Screw the CPP (1) on the mounting flange to the mounting plate (3) using 4 mounting screws M5 including washers (2).
 - In designs with the mounting holes implemented as threaded holes, screw the mounting screws into the holes directly, not forgetting the washers.
 - In designs with through holes, fit the mounting screws and washers and tighten the screws using suitable screw locking elements and nuts.
- ▶ Tighten the mounting screws to the specified torque, which depends on the strength class (min. 8.8) of the screws/nuts used.

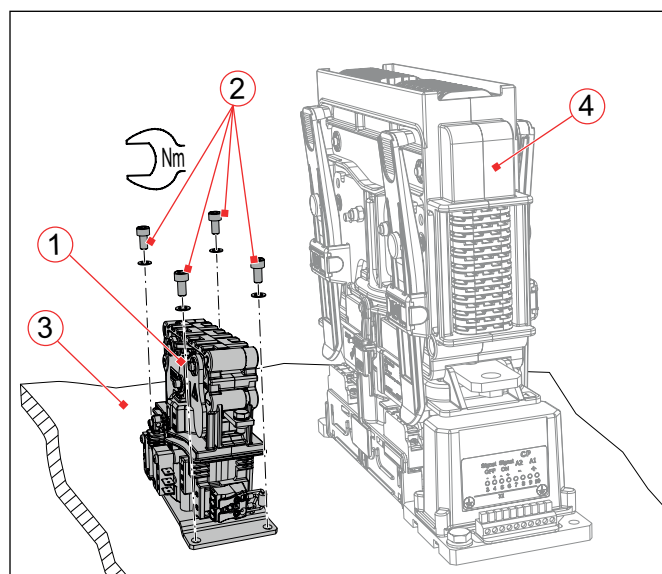


Fig. 9: With 600 A devices or as stand-alone solution: Example for the installation of the CPP (1) at a separate mounting position next to the CP main contactor (4)

7.2 Electrical connection

Electrical data and other technical specifications


For the power consumption of the magnetic drive system and electrical data of the auxiliary switches as well as other technical specifications, refer to the respective data sheets and to our *C45 catalogue*. The *C45 catalogue* is available under:

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

Preparatory measures

- ▶ The minimum clearances to live and earthed parts are given in the corresponding data sheets or in our *C45 catalogue* and must be adhered to. The catalogue is available under:
<https://www.schaltbau.com/en/media-library/>
 - ▶ Switching of high voltage currents produces electric arcs and it is possible that plasma will escape from the openings of the arcing chambers. Therefore, it is extremely important to maintain the minimum clearances to live and earthed parts to avoid flashovers. These minimum clearances have been tested and specified in relation to the switching capacity of the contactors.
 - ▶ Only for stand-alone versions: The earth/ground connecting cable must be fitted with an appropriate ring terminal (for M5 terminal screw).
 - ▶ Undersized conductor cross-sections for the earth connection may produce a safety hazard.
 - ▶ The minimum conductor cross-sections for the main terminal connection and the earth/ground connection must be observed.
 - ▶ The connecting wires must be selected taking into consideration the insulation class and the ambient conditions.
 - ▶ The connecting wires of the main power circuit must be fitted with appropriate ring terminals (for M5 terminal screws).
 - ▶ To secure the main terminal screws so that they do not come loose, appropriate screw locking elements must be provided. Schaltbau recommends using Schnorr washers (or similar).
- ▶ The main terminal screws must be tightened to a torque of 4 - 5 Nm.
 - ▶ The connections for the auxiliary switches are made with flat plugs. Consequently, the control wires must be equipped with corresponding flat receptacles 6.3 x 0.8 mm.
 - ▶ The maximum permissible conductor cross-section of the auxiliary contact control wires is 1 mm² / AWG 18 stranded wire.
 - ▶ For stand-alone versions a receptacle spring clamp terminal block is provided for the coil control wires. The control wires for the coil connection must be stripped accordingly (if necessary, fit with appropriate wire end sleeves).
 - ▶ For the power consumption of the magnetic drive system and the electrical data of the auxiliary switches refer to our catalogues:
 - *C45* (Catalogue CPP series devices)
 - *D70* (Catalogue auxiliary switches S870)

Safety

	⚠ DANGER
	<p>The contactors are used for high voltage switching. Contact with live electrical parts can result in serious injuries or even death!</p> <p>Live parts are all metal parts belonging directly to one of the circuits or wires connecting to them. All other visible metal parts and wiring may also be live if a fault exists.</p> <p>Before starting any work on the contactors, always comply with the following safety rules:</p> <ul style="list-style-type: none">▶ Disconnect on all sides▶ Secure to prevent switching back on▶ Clearly identify the working area▶ Check that a voltage-free state exists▶ Earth and short circuit; this includes discharging any capacitors in the main circuit▶ Beside the main power circuits, also disconnect additional and auxiliary circuits▶ Cover or insulate adjacent live parts▶ The presence of a voltage-free state can only be clearly identified by a qualified electrician.▶ When the work has been concluded, follow the procedure in reverse.

ATTENTION
<p>Detent-edged rings and detent-edged washers have a limited life time. After screws secured with detent-edged rings or detent-edged washers have been undone three times, the rings or washers must be replaced by new ones.</p> <ul style="list-style-type: none">▶ Record the frequency of undoing of the screws in the work log.▶ Replace detent-edged rings or detent-edged washers with new ones after the screws have been undone three times.

Tools required

- ▶ Socket spanner set
- ▶ Open-ended spanner set
- ▶ Torque spanner
- ▶ Continuity tester
- ▶ Cable ties

Connecting the S870 auxiliary switches

The control wires for the auxiliary contacts must be fitted with receptacles (6.3 x 0.8 mm).

ATTENTION

- ▶ The maximum permissible conductor cross-section of the auxiliary contact control wires is 1 mm² / AWG 18 stranded wire.
- ▶ Mechanically secure the control wires to minimise feedback effects of forces caused by the wires (e. g. shock, vibrations) acting on the terminals.
- ▶ Route the control wires (1) to the terminals (2) of the auxiliary switches.
- ▶ Plug the pre-assembled control wires with the receptacles (1) to the terminals (2).
- ▶ Check the routing of the wiring. Wires must not be squeezed or bent.
- ▶ If applicable bundle and secure the wires using cable ties.

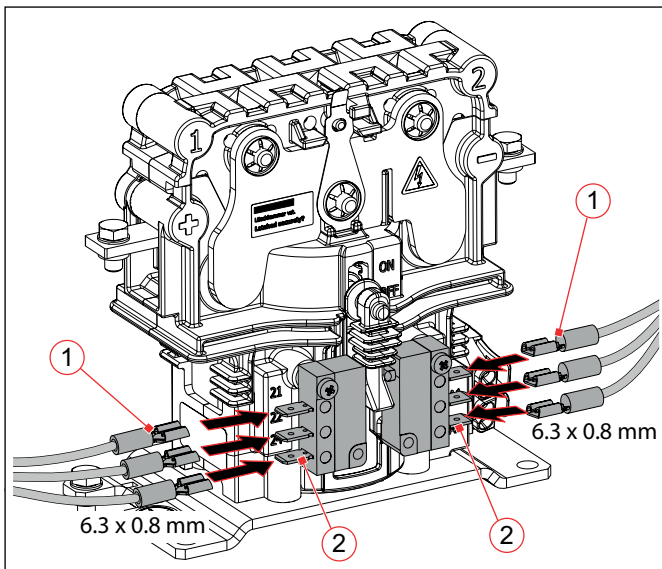


Fig. 10: Stand alone version: Connecting the S870 auxiliary switches

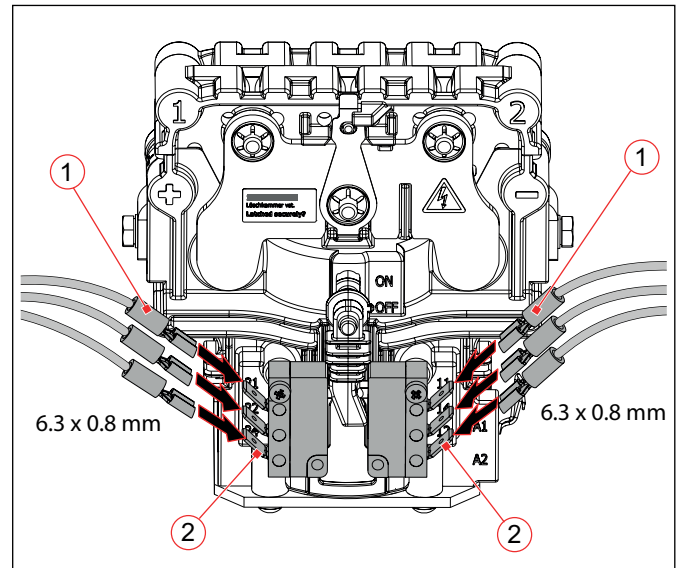


Fig. 11: Built-in version: Connecting the S870 auxiliary switches

Connecting the coil

ATTENTION

The value of the overvoltage limitation is part of the magnetic system and must not be modified and in particular not be short-circuited (e.g. by an external diode).

- ▶ Make sure that no such diode is used in your control circuit.

ATTENTION

- ▶ Mechanically secure the control wires to minimise feedback effects of forces caused by the wires (e. g. shock, vibrations) acting on the terminals.

Stand-alone versions

For stand-alone versions a spring clamp terminal block is provided for the coil control wires. The control wires for the coil connection must be stripped accordingly (if necessary, fit with appropriate wire end sleeves).

- ▶ Route the coil control wires (1) to the spring clamp terminal block (2).
- ▶ Connect the control wires (1). The polarity (+/-) need not be observed.
- ▶ Check that the coil control wires are correctly installed
- ▶ Check the routing of the wiring. Wires must not be squeezed or bent.
- ▶ If applicable bundle and secure the wires using cable ties.

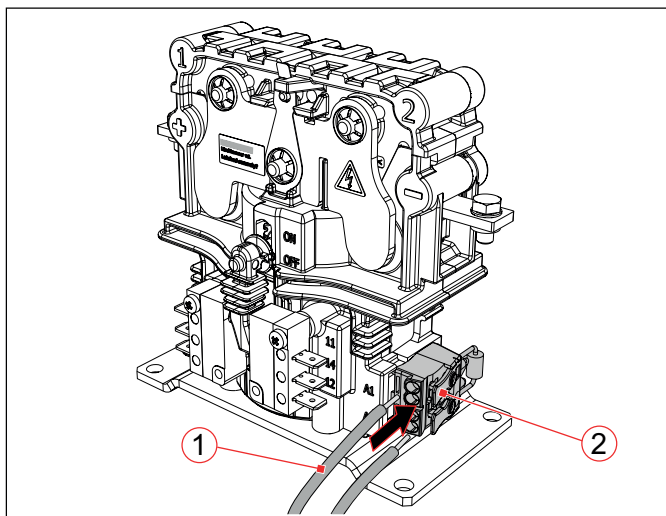


Fig. 12: Connecting the coil (stand-alone versions)

Built-in versions

For built-in versions the coil control wires (1) are completely wired and can be connected directly to the designated spring clamp terminals on the CP main contactor.

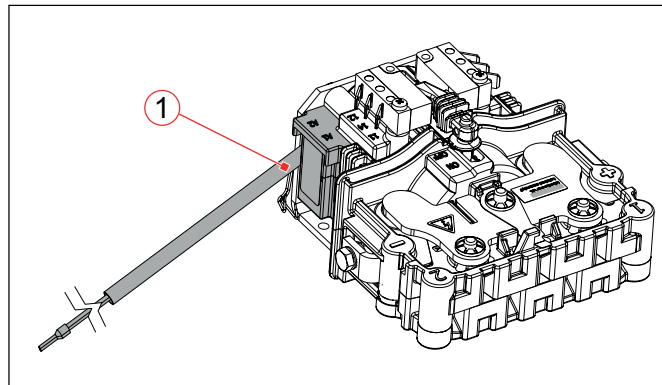


Fig. 13: Connecting the coil (built-in versions)

Connecting the earth/ground terminal (only for stand-alone versions)

- ▶ Connect an earthing cable (2) to the earth terminal (1) which is provided on the mounting flange of the CPP.
- ▶ Screw the ring terminal of the earthing cable (2) in place using the terminal screw (3) and suitable screw locking elements.
 - Schaltbau recommends using Schnorr washers (or similar).
- ▶ Tighten the earth terminal screw (3) to a torque of 4 - 5 Nm

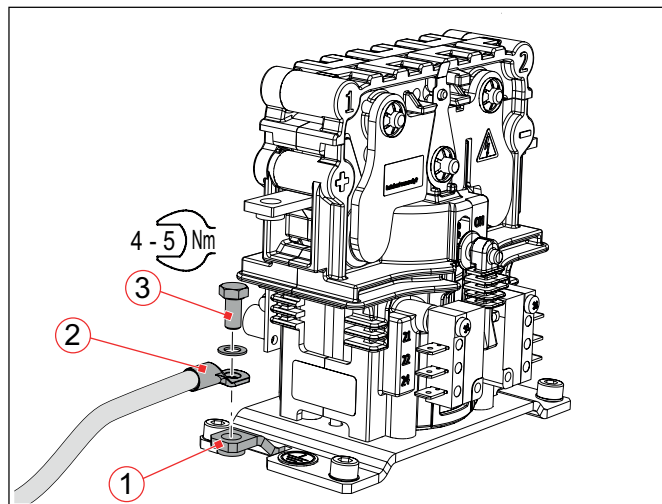


Fig. 14: Connecting the earth terminal (only for stand-alone versions)

Connecting the main contacts

ATTENTION

Ensure that the connection points for the main contacts are free from corrosion.

The main connection cables for the optional CPP must be fitted with appropriate ring terminals (for M5 terminal screws).

- ▶ Route the cables (3) to the contact terminals (2) of the CPP (1).

ATTENTION

For DC versions, make sure to observe the correct polarity.

- ▶ Screw the ring terminals (3) in place using the terminal screws (4) and suitable screw locking elements.
 - Schaltbau recommends using Schnorr washers (or similar).
- ▶ Tighten the terminal screws (4) to a torque of 4 - 5 Nm.

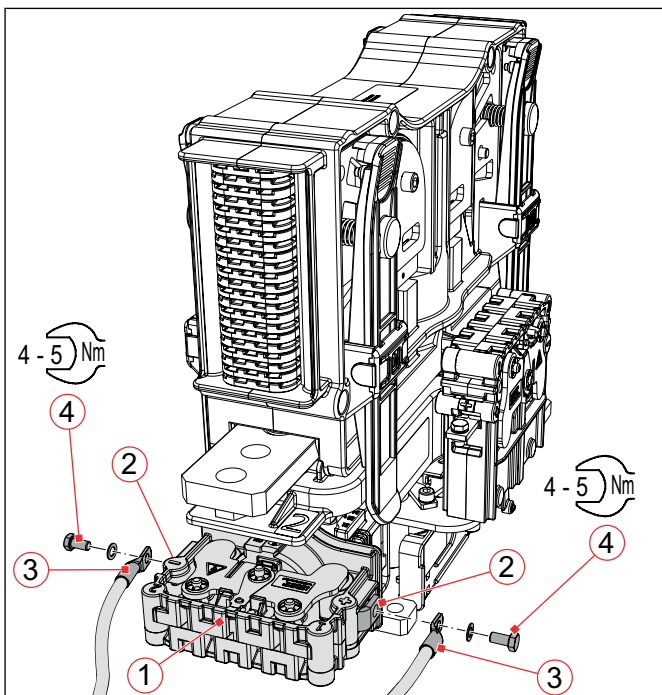


Fig. 15: Connecting the main contacts: Connection example of a built-in version

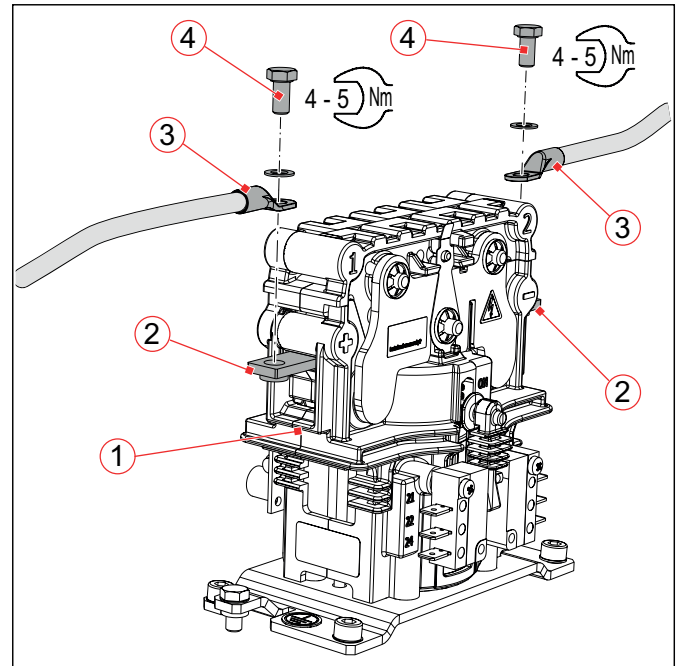


Fig. 16: Connecting the main contacts: Connection example of a stand-alone version



Alternatively, the main contact connection can also be made using busbars. The procedure is the same as for connection with cables.

7.3 Checks

After the installation, perform the following checks:

- ▶ Check that the contactors are correctly installed on the mounting plate or at the base plate of the main contactor and tightly screwed in place.
- ▶ Check that the main circuit cables are correctly installed and fit tightly at the main contacts.
- ▶ For DC versions, check that the correct polarity of the main circuit connection is observed.
- ▶ Check that the control wires of the coil terminals are correctly installed.
- ▶ Check that the control wires are correctly connected to the auxiliary switches.
Check the correct assignment and function of the auxiliary switch using a continuity tester.
- ▶ Switch the contactor several times without activating the main power circuit.
- ▶ Check the pull-in and drop-off voltage based on the Schaltbau specifications. See *C45 catalogue*.
- ▶ Check the routing of the wiring. Wires must not be squeezed or bent. If applicable bundle and secure wires using cable ties.
- ▶ After every installation or after maintenance, check the contactor for correct operation in accordance with the following standards:
 - EN/IEC 60077-2
 - EN/IEC 60947-4-1

8. Maintenance

Note the expert knowledge which is essential for carrying out maintenance work, referred to in chapter "2. General and safety information".

8.1 Safety

DANGER

The contactors are used for voltage switching. Contact with live electrical parts can result in serious injuries or even death!
 Live parts are all metal parts belonging directly to one of the circuits or wires connecting to them. All other visible metal parts and wiring may also be live if a fault exists.
 Before starting any work on the contactors, always comply with the following safety rules:

- ▶ Disconnect on all sides
- ▶ Secure to prevent switching back on
- ▶ Clearly identify the working area
- ▶ Check that a voltage-free state exists
- ▶ Earth and short circuit; this includes discharging any capacitors in the main circuit
- ▶ Besides the main power circuits, also disconnect additional and auxiliary circuits
- ▶ Cover or insulate adjacent live parts
- ▶ The presence of a voltage-free state can only be clearly identified by a qualified electrician.
- ▶ When the work has been concluded, follow the procedure in reverse.

8.2 Preventive maintenance

Contactors of the CPP series are maintenance-free within the rated mechanical life time. The electrical life time depends on the number of switching cycles under heavy load conditions and may vary for different applications. In normal use, this corresponds to a decade-long operating period.

Intervals for regular tests/checks

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

Test/check	Interval
External visual inspection of the contactor	▶ 1x per year
Check of the main contacts (both, stationary and moving contact bridge)	▶ 1x to 2x per year
Check of the auxiliary switches	▶ Every 2 years

If the contactors are operated in a particularly dirty environment, the visual checks should be performed at shorter intervals. Dirt can impair the clearance and creepage distances, which can result in a shorter service life or to a malfunction.

Extraordinary checks need only be carried out if there has been a significant and extraordinarily high recorded number of switching cycles under short-circuit conditions.

DANGER

If damage to the contactor or wires is visible, the safety of the contactor is no longer guaranteed.

- ▶ Immediately submit any damaged contactors or components for maintenance.

ATTENTION

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

- ▶ Record the frequency of undoing of the screws in the work log.
- ▶ Replace detent-edged rings or detent-edged washers with new ones after the screws have been undone three times.

Regular tests/checks

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

Component	Tests/checks	Measures
Wires/busbars	Check for: <ul style="list-style-type: none"> ▶ damaged wires, cable lugs ▶ damaged insulation ▶ corrosion ▶ damaged busbars ▶ kinked or crushed wires ▶ loose or missing fastening elements ▶ correct tightening torque of the terminal screws 	In case of faults: <ul style="list-style-type: none"> ▶ immediately replace damaged wires or cable lugs ▶ immediately replace damaged busbars ▶ remove corrosion and replace corroded parts ▶ tighten loose fastening elements immediately replace missing fastening elements ▶ tighten the terminal screws to the rated torque
Earthing cable (only for stand-alone versions)	Check for: <ul style="list-style-type: none"> ▶ damaged cable, cable lug ▶ damaged insulation ▶ corrosion ▶ kinked or crushed cable ▶ loose or missing fastening elements ▶ correct tightening torque of the earthing terminal screw 	In case of faults: <ul style="list-style-type: none"> ▶ immediately replace a damaged cable or cable lug ▶ remove corrosion and replace corroded parts ▶ tighten loose fastening elements immediately replace missing fastening elements ▶ tighten the earthing terminal screw to the rated torque
Base plate/mounting flange	Check for: <ul style="list-style-type: none"> ▶ loose or missing fastening elements 	In case of faults: <ul style="list-style-type: none"> ▶ tighten loose fastening elements immediately ▶ replace missing fastening elements ▶ tighten a loose contactor immediately

Component	Tests/checks	Measures
Contactor housing	Check for: <ul style="list-style-type: none"> ▶ dirt ▶ damage or wear ▶ loose or missing fastening elements 	In case of faults: <ul style="list-style-type: none"> ▶ remove any dirt that may be present ▶ if the contactor housing is damaged or heavily worn replace the entire contactor ▶ tighten loose fastening elements immediately replace missing fastening elements ▶ tighten a loose contactor immediately
Arc chamber	Check for: <ul style="list-style-type: none"> ▶ dirt ▶ damage or wear ▶ traces of combustion residue (slight soot deposits permitted) ▶ correct and firm seating of the entire arc chamber unit on the magnetic drive assembly ▶ correctly engaged latching lever 	In case of faults: <ul style="list-style-type: none"> ▶ remove any dirt that may be present ▶ if the housing is damaged or heavily worn replace the complete arc chamber ▶ if there are holes in the housing walls, replace the complete arc chamber ▶ adjust the arc chamber in correct position and firm seating ▶ make sure that the arc chamber is latched securely
Main contacts (both stationary contacts and moving contact bridge)	Prior to checking the main contacts, the arcing chamber must first be removed, see section <i>“Removing the arc chamber”</i> . Thereafter, the main contacts are accessible and can be checked for: <ul style="list-style-type: none"> ▶ damage or wear ▶ traces of combustion residue (slight soot deposits permitted) A certain level of experience is required to assess the state of the contacts. Even after a few load switching cycles, to a lay user the contacts appear worn and the surroundings fouled. Replacement of the contactor is only necessary after more than 70% of the contact material is burnt through.	In case of faults: <ul style="list-style-type: none"> ▶ if more than 70% of the contact material is burnt through, replace the contactor as a whole unit.
Auxiliary switches S870	Check for: <ul style="list-style-type: none"> ▶ dirt ▶ damage or wear on the housing ▶ signs of short circuits The auxiliary switches can be accessed from the outside for a simple visual inspection. Under normal working condition (there have been no short circuits in the control circuit) the life time of the auxiliary switches exceeds those of the contactor.	In case of faults: <ul style="list-style-type: none"> ▶ replace the auxiliary switches, see section <i>“Replacing the S870 auxiliary switches”</i>

Removing the arc chamber

Prior to the following tests/checks, the arc chamber must be removed from the housing of the contactor.

- Checking the main contacts for wear (both stationary contacts and moving contact bridge)
- Checking the arc chamber for wear

- ▶ Press the latching lever (1) sideways slightly away from the contactor and keep it in this position.
- ▶ Remove the arc chamber (2) upwards from the housing.

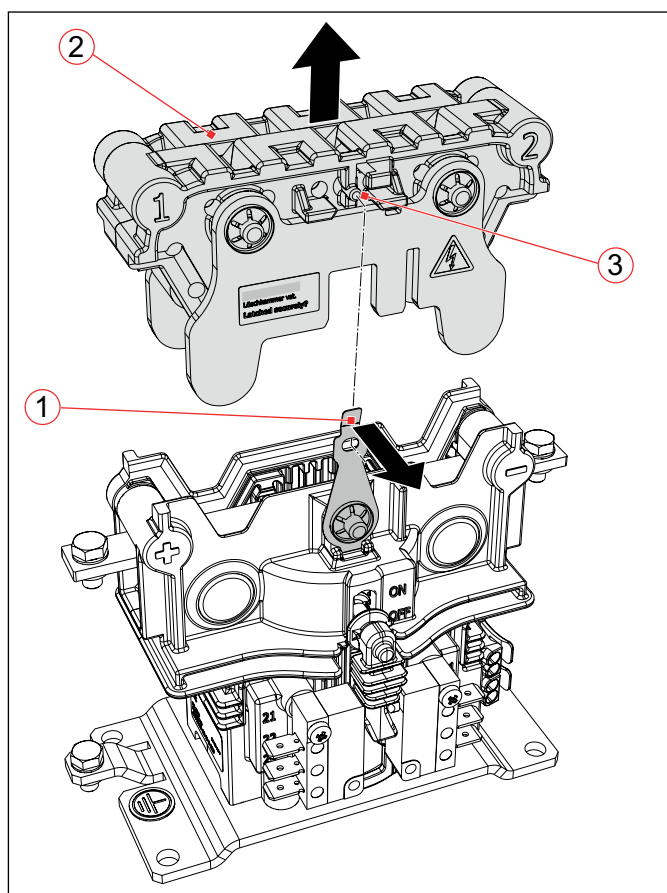


Fig. 17: Removing the arc chamber (stand-alone versions)

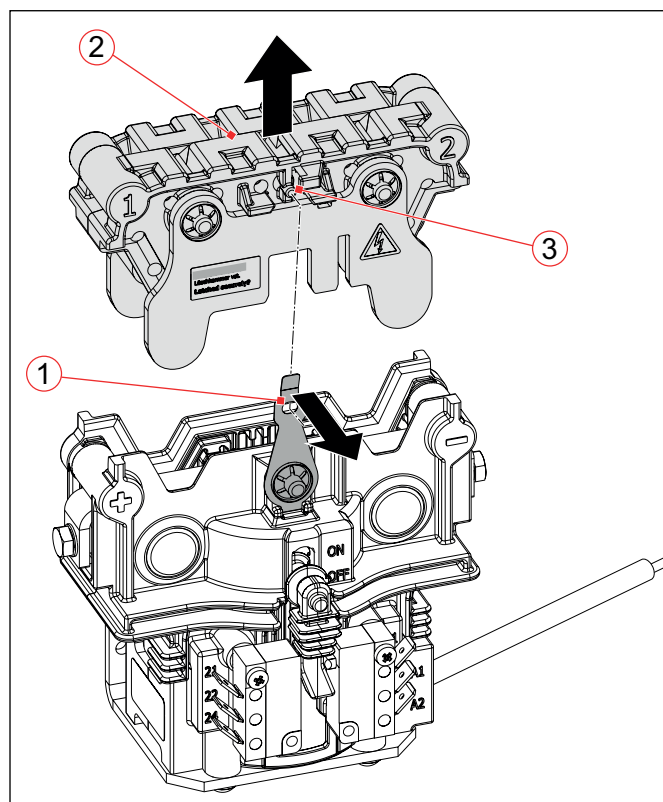


Fig. 18: Removing the arc chamber unit (built-in versions)

Inserting the arc chamber

(Refer to Fig. 17 and Fig. 18)

- ▶ Press the latching lever (1) sideways slightly away from the contactor and keep it in this position.
- ▶ Insert the arc chamber (2) into the housing.
- ▶ Release the latching lever (1) so that the small pin (3) on the housing slides into the hole on the latching lever (1).
- ▶ Make sure that the arc chamber is latched securely.

Checking the arc chamber

Precondition

The arc chamber must be removed from the contactor housing. See section *“Removing the arc chamber”*.

Checking the arc chamber for wear

- ▶ Check the arc chamber for:
 - broken parts of the housing (1)
 - burned through holes in the housing wall
 - broken out areas on the ceramic rolls (2)
- ▶ If the arc chamber is damaged or heavily worn replace the complete arc chamber.

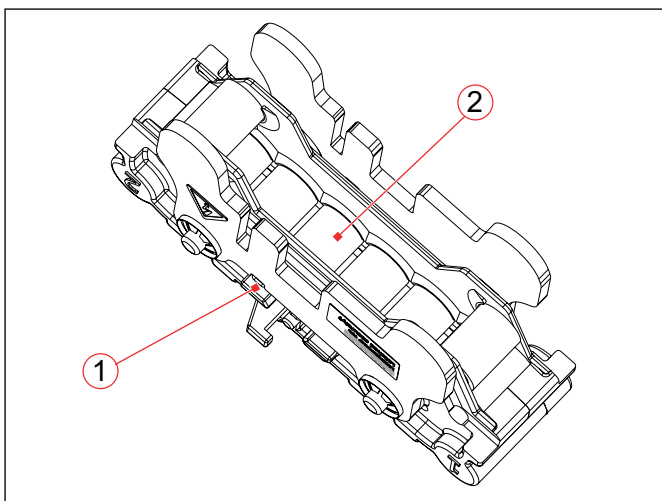


Fig. 19: Checking the arc chamber for wear

Checking the main contacts

Precondition

The arc chamber must be removed from the contactor housing. See section *“Removing the arc chamber”*.

Tools required

Inspection mirror

Checking the main contacts for wear

- ▶ Check the main contacts. In doing so
 - check both the stationary contacts (1),
 - as well as the contacts (2) on the underside of the moving contact bridge.
- ▶ To get a better view of the contacts, use an inspection mirror.
- ▶ If more than 70% of the contact material is burnt through, replace the contactor as a whole unit.

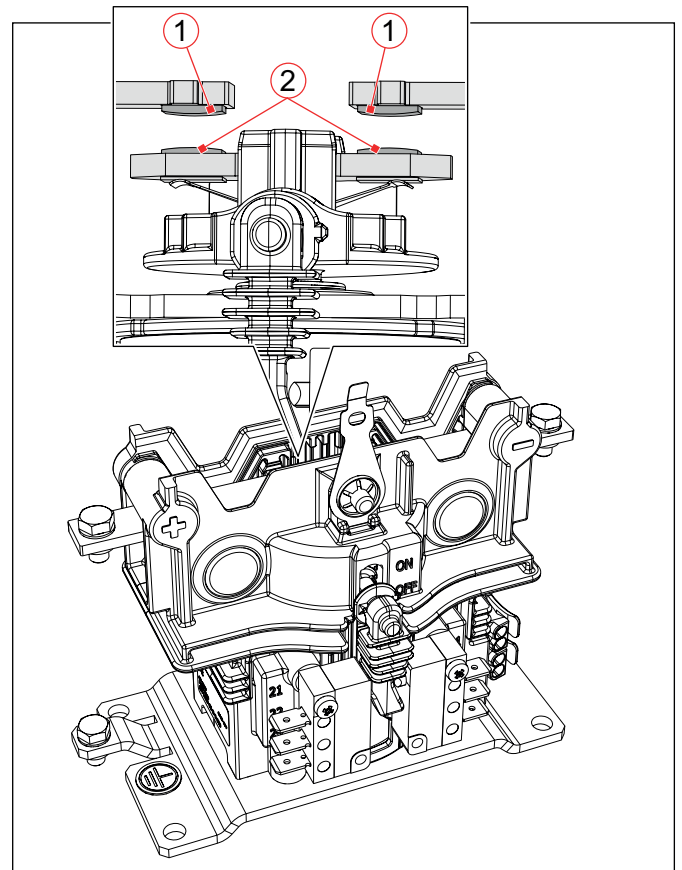


Fig. 20: Checking the main contacts for wear (stand-alone version)

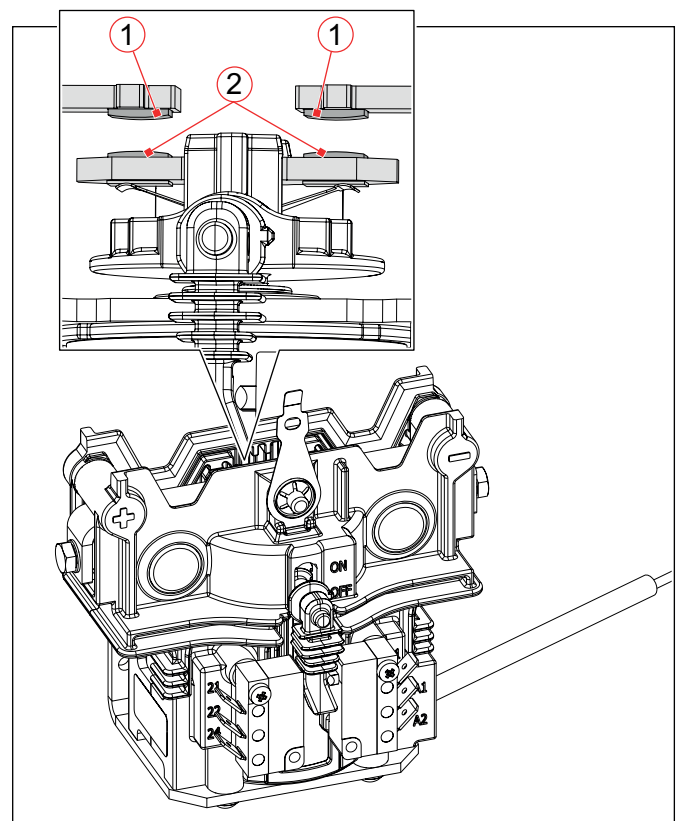


Fig. 21: Checking the main contacts for wear (built-in version)

8.3 Corrective maintenance

The contactors are largely maintenance-free. Therefore there is no general requirement to replace parts during its service life. Excepted from this are auxiliary switches and the arc chamber:

Replacing the arc chamber

- ▶ Remove the arc chamber. See section *“Removing the arc chamber”*.
- ▶ Insert the new arc chamber into the contactor housing. See section *“Inserting the arc chamber”*.
- ▶ Make sure that the arc chamber is latched securely.

Replacing the S870 auxiliary switches

Under normal working condition (there have been no short circuits in the control circuit) the main switch must be replaced after no more than one million actuations in accordance with this manual. However, in the event of a short circuit in the control circuit, it is possible that an auxiliary switch is damaged and must be replaced.

Tools required

- Set of Torx bits or Torx screwdrivers
- Torque spanner

Precondition

Only for built-in versions: The CPP contactor must be removed from the base plate of the CP main contactor. See section *“Installing the CPP contactor with 1,200 A and 2,000 A CP devices”*.

Procedure

To secure the auxiliary switch, use only the original plastic-self-tapping screws 3 x 20, Torx drive (T10) – do not use any screws with a standard/regular screw thread!

- ▶ Pull off the receptacles of the control wires from the auxiliary switches (2).
- ▶ Using the Torx tool (T10) screw out the plastic-self-tapping screws (1) and remove the auxiliary switches.
- ▶ Position the new auxiliary switches (2) on the mounting so that the pin (3) on the contactor housing slides into the second bore hole of the auxiliary switch.
- ▶ Lightly screw in the plastic-self-tapping screws (1).

- ▶ Check that the auxiliary switches (2) are level on the mounting and are not skewed.
- ▶ Tighten the two plastic-self-tapping screws (1) to a torque of 0.8 Nm.
- ▶ Plug the receptacles of the control wires back on to the contacts of the auxiliary switches (2).

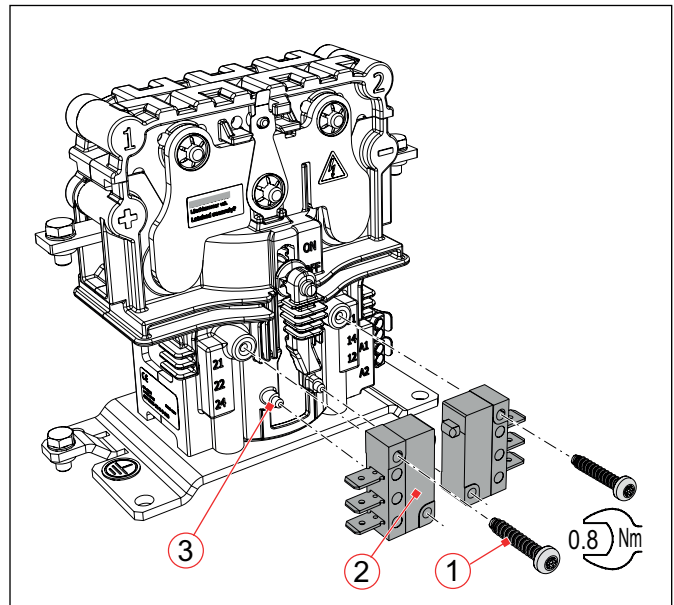


Fig. 22: Replacing the auxiliary switches (stand-alone version)

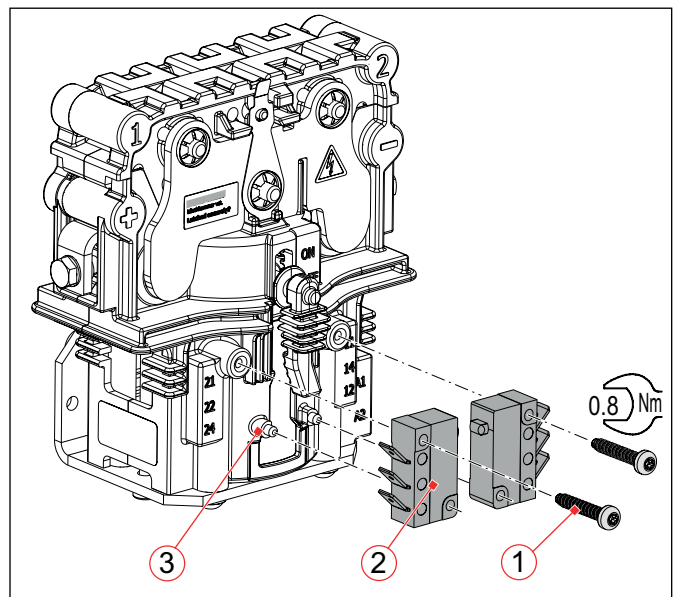



Fig. 23: Replacing the auxiliary switches (built-in version)

9. Spare parts

	<p>Important! When ordering spare parts, always specify the precise type and article number of the contactor. You can find this data on the rating plate.</p>
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Designation
Arc chamber CPP, complete
Auxiliary switches S870

10. Technical data

Technical data and information on the material properties for the contactors of the CPP series are given in our *C45 catalogue*.

Schaltbau products are subject to continual improvement. Therefore, the product information in catalogues, data sheets, etc. may change at any time. Therefore, only the latest version of a catalogue is valid at any time – downloads available under:

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

11. 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 of with other household waste.

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.

At the end of the product's useful life ensure environmentally sound disposal of the product according to the legal regulations and requirements for electrical and electronic waste equipment in your country.

Schaltbau GmbH

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

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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
- Snap-action switch made of robust polyetherimide (PEI)
- Snap-action switch with two galvanically isolated contact bridges
- Special switches to suit customer requirements

Contactors Emergency disconnect switches

- 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