SCHALTBAU

Connect · Contact · Control

Switchgear for Railway and Industrial Applications

Power contactors for AC and DC

Series CT1015/04 and CT1030/04

User Manual

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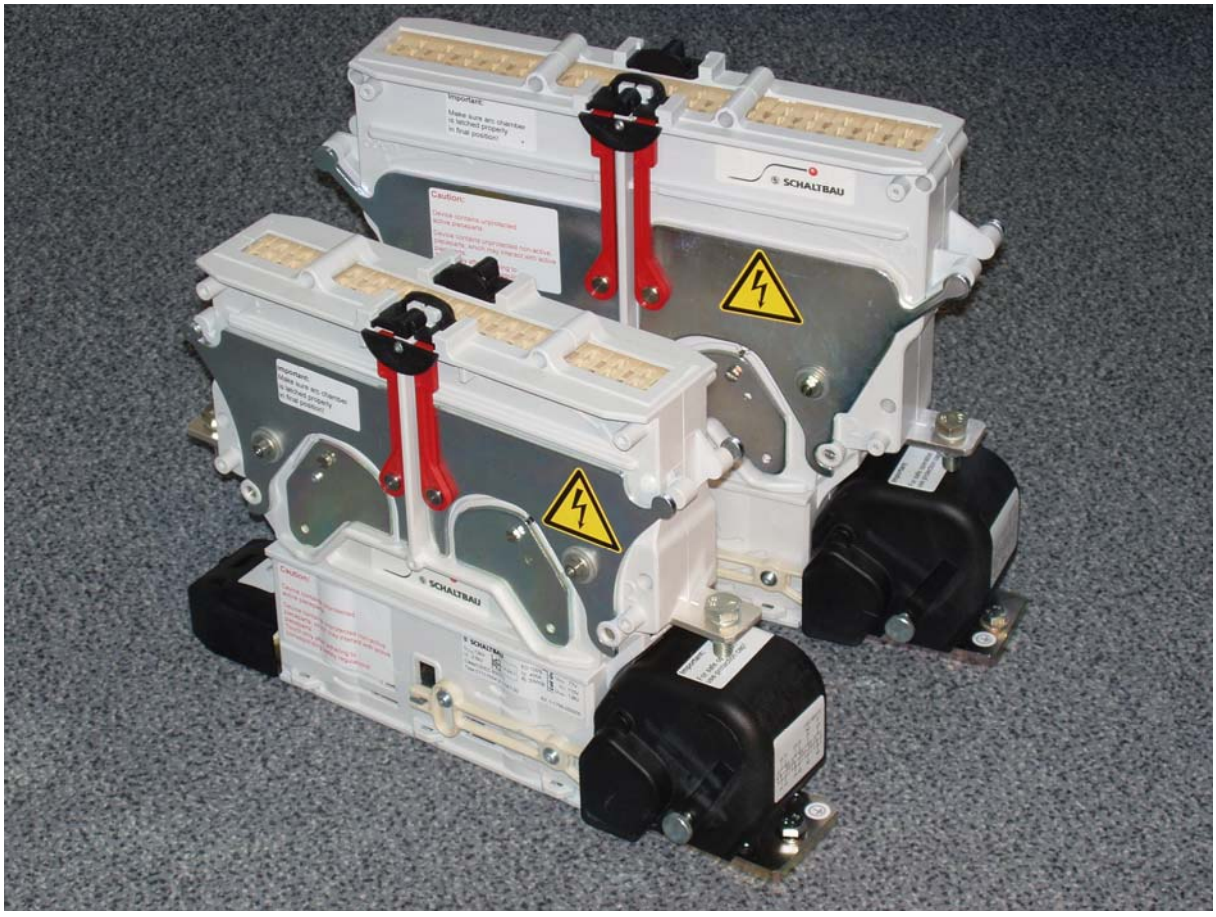
POWER CONTACTORS FOR AC AND DC SERIES CT1015/04 AND CT1030/04

USER MANUAL



1 Introduction

CT1000 contactors are air switching components with arc breaking in ceramic. They use a highly sophisticated principle of arc control, combining the permanent-magnetic and electro-magnetic blow-out technique.

This allows practically unrestricted operation for all AC and DC voltages and currents within the technical specification.

- CT1015 contactors are designed for nominal voltages of 1,500 V.
- CT1030 contactors are designed for nominal voltages of 3,000 V. Due to the very high rated insulation voltage CT1030 contactors can be used in networks up to 5,000 V.
- CT1000 contactors are currently available for conventional thermal currents of 400 A. Versions for 800 A are in development. Versions for 200 A and 1,400 A are in planning.

CT1000 contactors provide excellent switching performance from very small up to heavy loads.

CT1000 contactors are available in 1-, 2-, and 3- pole versions.

CT1000 contactors are available for vertical and horizontal mounting.

CT1000 contactors have been designed and tested according to National and International Railway Standards. Due to their unique features they can also be used in a variety of industrial applications.

CT1000 contactors offer the following design-related advantages:

- Compact, rugged design
- 2 voltage, 4 current levels
- Double-break contacts, cadmium-free contact tips
- 1-, 2-, and 3- pole versions
- Easy maintenance:
  - Easy inspection of main contact tips, easy replacement of main contacts
  - Easy replacement of arc chamber (upper module)
- Drive system suitable for standard railway supply voltages and tolerances. No economy circuit required. Drive systems for industrial applications on demand.
- Insulation coordination:
  - Functional insulation for main circuit
  - Basic insulation between main circuit and protective earth
  - Reinforced insulation between main circuit and control circuit / main circuit and auxiliary circuits
- Long mechanical and electrical life
- No regular maintenance required. Inspection intervals and exchange of wear parts depending on specific application.

2 Safety notice

CT1000 contactors are high-voltage switches. Coming into contact with conductive parts of the contactors can result in serious injury or even death!

Active parts are all piece parts associated with the main circuit. All metal parts visible may potentially become active under fault conditions. A respective label is attached to the contactor. This label must not be removed.

For safety reasons the contactors must be connected to earth. An earth terminal is provided for that purpose. The wire gauge must be observed according to the specific short-circuit conditions.

Before carrying out any inspection and maintenance work on CT1000 contactors, the contactors must be de-energized and in addition life wires made safe by earthing. If the environment has no disconnecting and earthing device, other suitable measures must be used to ensure that no voltage is present. Please make sure that any capacitors in the main circuit are discharged before touching main wires. We recommend securing the supply lines to prevent switching back on.

During continuous operation the contactors will warm up. It is recommended to wait an appropriate time before starting any service and touch the contactors.

2.1 General safety instructions

The 2 black protection caps must not be removed for operation. They are part of the insulation system. Operation without the 2 black protection caps is not permissible.

All inspections and the replacement of components may only be performed by qualified personnel and must be done according to Schaltbau specification.

All components which have to be replaced must be original components defined by Schaltbau.

2.2 General application notes

CT1000 contactors are designed to be mounted in environments defined by pollution degree PD3 (EN60077-1):

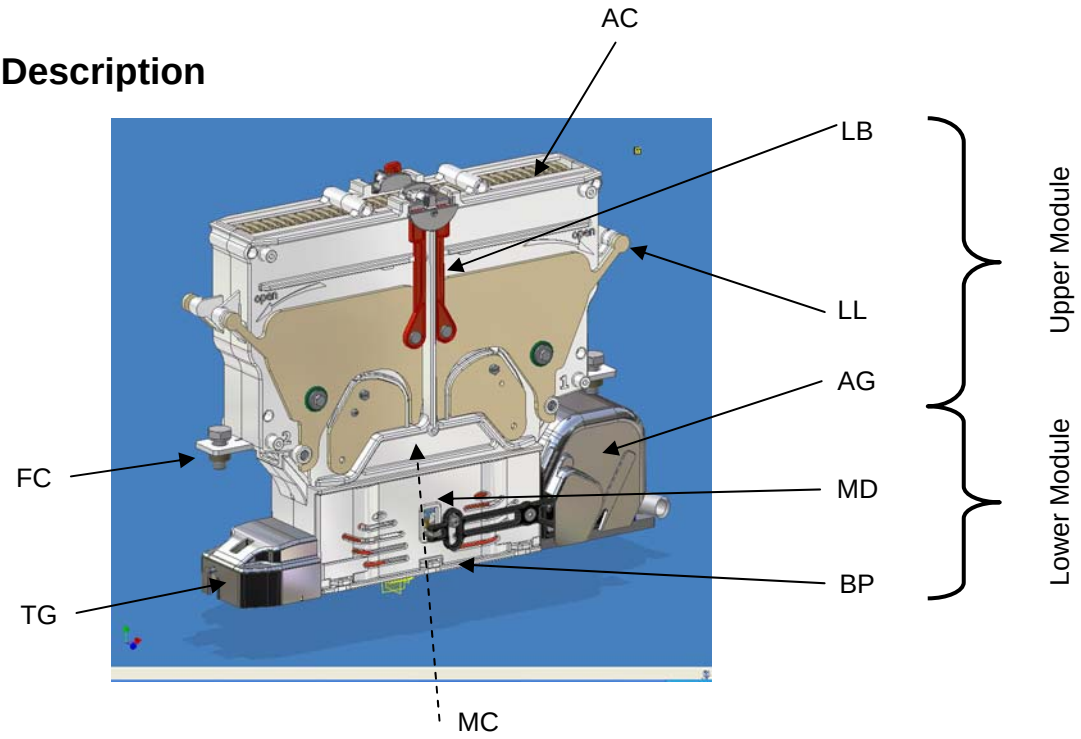
> *Conductive pollution or dry non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation is to be expected when the equipment is out of operation.*
>
> *Example: Location in an enclosure ensuring an efficient protection against pollution, at least equivalent to IP54 according to EN60529.*

CT1000 contactors contain strong magnets for the permanent-magnetic blow-out. Make sure that these magnets do not attract any ferromagnetic particles into the contactors, either opened or closed.

These magnets may destroy data on credit cards or such.

During the short time of the switching-off operation strong magnetic fields are generated in the vicinity of the pole plates. They may affect other components close to the contactor.

3 Description



CT1000 contactors consist of two main modules:

- Lower Module:

  Magnetic drive (MD) with moving contact bridge (MC, not visible); base plate (BP); auxiliary contact group (AG); coil terminal group (TG); AG and TG are under protection caps.

- Upper Module:

  Fixed contacts with main terminals (FC); arc chamber (AC); latching levers (LL) and lock bars (LB)

3.1 Lower Module

- Magnetic drive (MD) with moving contact bridge (MC)
  - Compact magnetic drive system for DC voltages.
  - Designed for standard railway supply voltages and tolerances. Standard nominal supply voltages are U_s = 24 V and U_s = 110 V, tolerances from 70% up to 125% of U_s. Other nominal supply voltages are available on request.
  - Polarity independent overvoltage protection device. The value of the overvoltage limitation is part of the magnetic system and must not be changed or short-circuited by external means. It is explicitly stated that the use of diodes is prohibited for that purpose. Take care there is no such diode in the external control circuit.
  - Double-break moving contact bridge
- Base plate (BP)
  - 4 fixation holes
  - Earthing terminal

  The contactor should be mounted on a metal rack to provide a secure mounting as well as a heat sink for the magnetic drive.
- Auxiliary contact group (AG)

  Standard:
  - 1 contact to indicate the “well closed” position of the main contacts (EN60077: a1)
  - 1 contact to indicate the “well opened” position of the main contacts (EN60077: b0)
  - 2 CO contacts to generally indicate the position of the main contacts

  Option:
  - 4 CO contacts to generally indicate the position of the main contacts

  - M3 screw or 6.3 x 0.8 mm fast-on terminals
  - Protection cap (can be removed and fixed only when the Upper Module has been removed)

- Coil terminal group (TG)
  - Cage clamp terminals
  - Protection cap (can be removed and fixed only when the Upper Module has been removed; fixation with screw M4 x 10)

3.2 Upper Module

- Fixed contacts with main terminals (FC)
  - Press nuts M10 for easy connection
  - Minimum wire gauges for connecting cables or current bars must be observed.
  - Double-break contacts
- Arc chamber (AC)
  - Permanent-magnetic blow-out system with magnets and pole plates
  - Electro-magnetic blow-out system with blow-out coils and pole plates
  - Arc guidance plates
  - Ceramic inserts for arc extinction
- Latching levers (LL)
  - Latching and unlatching simply by turning pole plates. No tool required.
  - Large handles for easy operation.
- Lock bars (LB)
  - Simple locking and unlocking mechanism with optical control. No tool required for unlocking.

  Note: The Upper Module must be latched and completely locked before starting operation.

  Note: Red bars indicate contactors for vertical mounting position

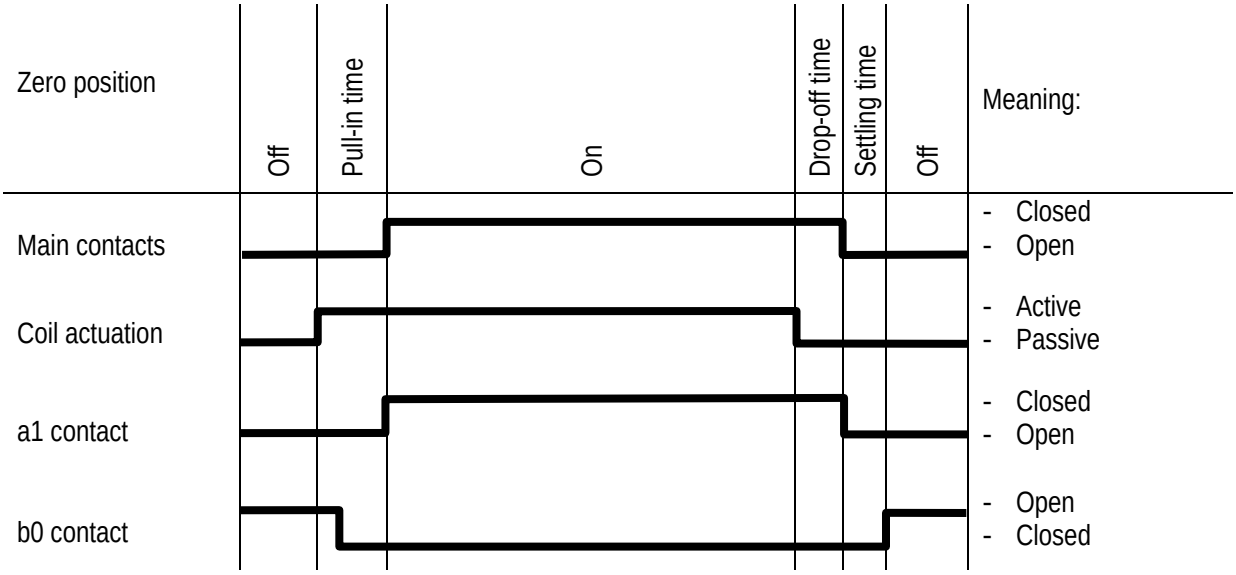
  Yellow bars indicate contactors for horizontal mounting position

3.3 Functional description

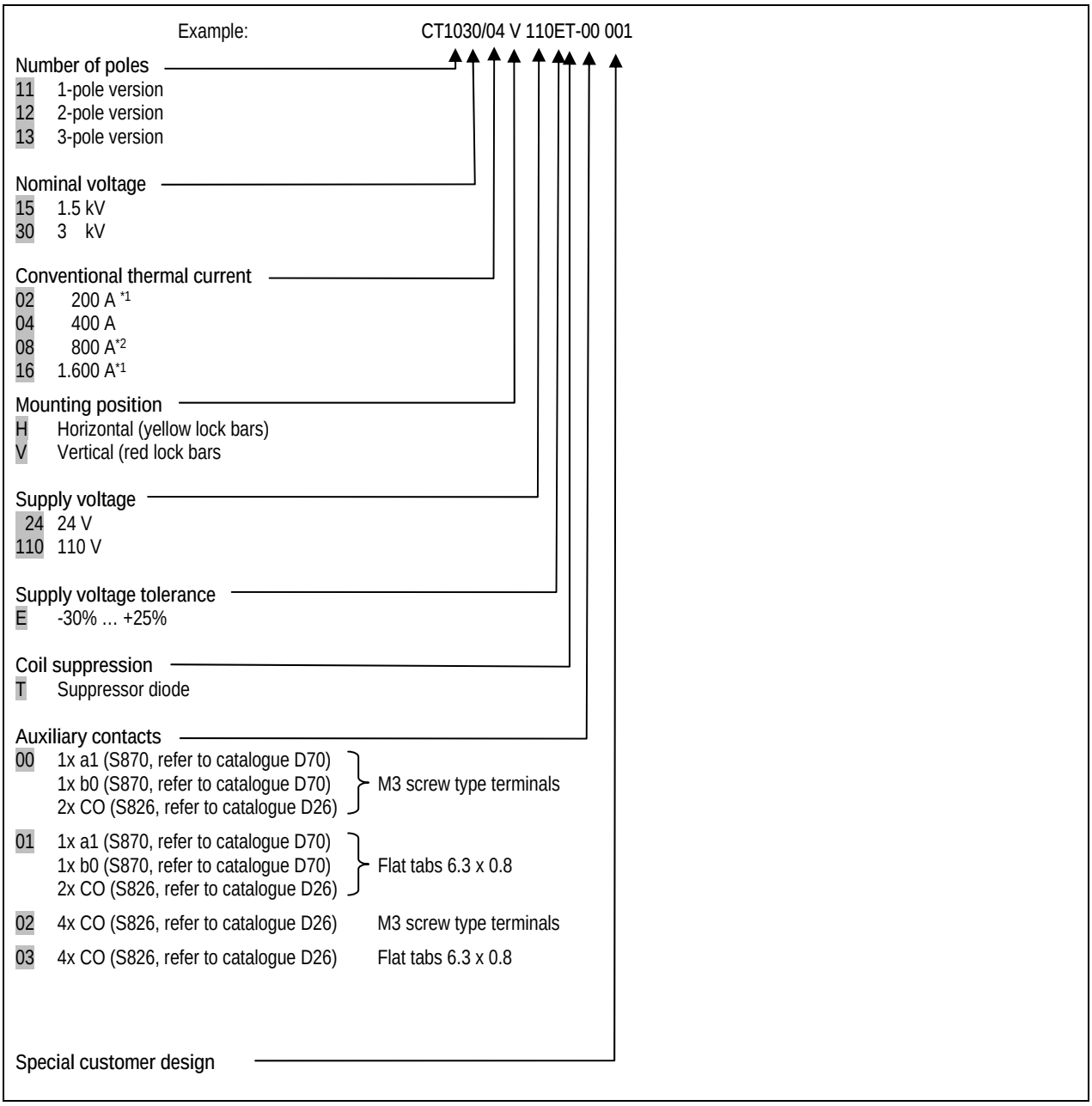
The diagram below shows the switching states of the CT1000 contactors.

Typical values:

- Pull-in time: 120 ms
- Drop-off time: 60 ms
- Settling time for b0 switch: up to 10 ms



3.4 Order code

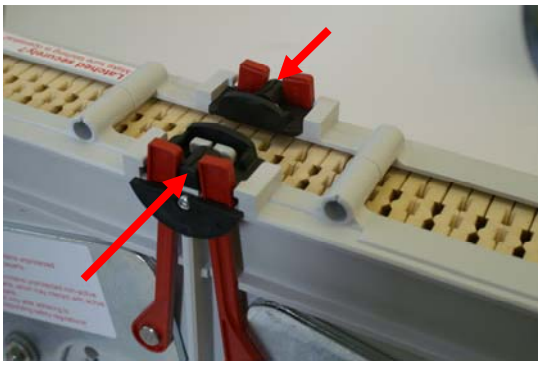


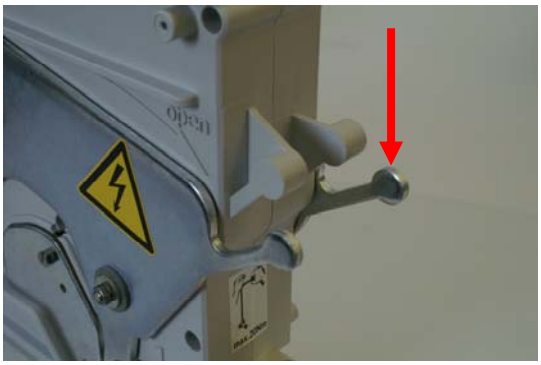
4 Installation

4.1 Unpacking and handling

Before opening the packaging, perform a visual inspection for any signs that could indicate damage having occurred during transport (impacts, bumps, falling etc.).

Unpack the contactor and put it on the table in an upright position. With one hand press the release buttons on top of the arc chamber together and turn the 4 levers down one by one to unlatch the Upper Module. Lift the Upper Module and put it on the table in an upright position. Repeat for all Upper Modules in cases of multi-pole versions. Check the insulation plates for damage.





Remove both protection covers (the small one is fixed with a M4 x 10 screw, the big one with knurled thumb screws).

The Lower Module is ready for mounting.

Note: If the contactor has been subject to excessive shock influence (e.g. during transport) do not install the contactor.

Note: Only single pole contactors may be carried by Upper Module provided the contactors are safely locked and the devices are undamaged.

4.2 Operating position

Make sure that you have received the correct contactors for the application.

- CT1000 contactors for horizontal mounting must only be mounted horizontally (Lock bars are yellow, position is also shown on the labels); they can be mounted in any position in reference to the direction of movement of the vehicle. Make sure that both Upper and Lower Module are for horizontal mounting.
- CT1000 contactors for vertical mounting must only be mounted vertically (Lock bars are red, position is also shown on the labels); they can be mounted with the auxiliary group either on top or at the bottom. Make sure that both Upper and Lower Module are for vertical mounting.

In most cases, the contactors are mounted on mounting plates or mounting frames. They must be solid enough to carry the weight of the contactors under the shock and vibration conditions of the railway environment.

The contactors (Lower Module) are fixed with 4 or more mounting screws, depending on the number of poles. The screws (and if applicable the nuts) must be steel grade 8.8. Schaltbau strongly recommends Schnorr-Washers (or similar) to secure the screws. The screws must be tightened with the rated torque permissible for the screws and the nuts.

4.3 Mechanical requirements

4.3.1 Device dimensions

Refer to the dimensioned drawings of the contactors.

4.3.2 Installation dimensions

Refer to the dimensioned drawings of the contactors.

4.4 Electrical requirements

The minimum clearances to earth or other components must be observed. Refer to the dimensioned drawings for details.

Switching electrical currents at high voltages will produce arcing and plasma will exit out of the top of the arc chamber. It is essential to observe the minimum clearance to earth 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 app. 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 wire/current bars gauges for the main terminals and the earth terminal must be observed. Smaller gauges for the main terminals will reduce the rated thermal current. Smaller 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 CT1015/04 and CT1030/04)
- D26 (Catalogue for Snap Action Switches S826)
- D70 (Catalogue for Snap Action Switches S870)

4.5 Installation

Installation must be carried out by qualified personnel.

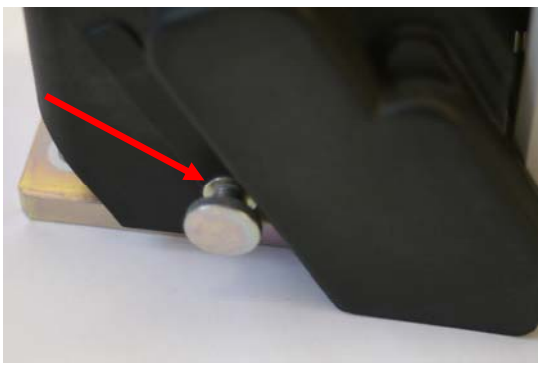
4.5.1 Mechanical installation

- Clean the surface of the mounting plate and the base-plate of the contactor (Lower Module).
- Put the Lower Module on the mounting plate and secure with the appropriate screws using the correct tightening torque. Schaltbau strongly recommend Schnorr-Washers (or similar) to secure the screws.

4.5.2 Electrical installation of the auxiliary switches

- Connect the wires for the auxiliary contacts. For the a1 and b0 contacts (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. Bundle and fix the wires as shown below.

- Fix the protection cap and tighten the knurled thumb screws. Make sure that all the washers are close to the nuts when you mount the cover. The washers must remain outside of the cover. Secure the nuts by hand force as tightly as possible. It is not allowed to operate the contactors without the cover



4.5.3 Electrical installation of the magnetic drive

- Connect the coil control wires to the cage clamp terminals. No polarity must be observed. Bundle and fix the wires as shown below.
- Fix the protection cap with the M4 x 10 screw (plus flat washer and Schnorr washer).

4.5.4 Electrical installation of the main circuit

- Mount the Upper Module(s) onto the Lower Module(s). Make sure all 4 latching levers are in the open position. Attention: The modules are mechanically coded. Only one mounting position is possible. Attach the Upper Module in the correct position. Optical marks and coding pins are provided to ensure the proper positioning. Do not try to force the Upper Module into the wrong position!
- In case of multiple pole contactors make sure that the insulation plates between the poles are correctly positioned between the poles.

- Close the 4 latching levers and make sure that all 4 lock bars have snapped in safely. The Upper Module must be fixed tightly to the Lower Module.
- Connect the main cables or current bars with the appropriate screws. Schaltbau strongly recommends Schnorr-Washers (or similar) to secure the screws. The screws must be tightened with the rated torque permissible (refer to label on the Upper Module).
- Connect the earthing cable to the earth terminal with the appropriate screw. Schaltbau strongly recommends a Schnorr-Washer (or similar) to secure the screw.

4.6 Commissioning

After installation the following checks are recommended:

a) Check the protective earth
b) Check the main connections
c) Check the control connections
d) Check the latching and locking between Upper and Lower Module(s)
e) Check that both protection covers are fitted
f) Check that all insulation plates are fixed and not broken
g) Several activation and deactivation operations of the contactor without the main circuit active
h) Check the function of the auxiliary contacts

5 Service

CT1000 contactors are maintenance-free within the rated mechanical life time data. The electrical life data depend on the number of switchings under heavy load condition and vary for different application. In normal use, this corresponds to a decade-long operating period.

5.1 Recommended Service intervals

Checking activity designation	Checking interval
Optical inspection from outside	1x annually
Inspection of the main contacts	1x to 2x annually, depending on application
Inspection of the auxiliary contacts	Every 2 years

5.2 Inspection activities

5.2.1 General

If the contactors are being used in particularly dirty environments, the checking intervals for the optical inspection 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.

5.2.1.1 High voltage supply cables

Check of the high voltage supply cables and the tightening torques of the fastening screws.

5.2.1.2 Earthing

Check of the supply cables and the tightening torques of the fastening screw.

5.2.1.3 Cleaning

In case of excessive dirt the surface of the contactors should be cleaned.

5.2.1.4 Inspection of the main contacts

Disconnect the main cables/current bars and remove the Upper Module (refer to 4.1). Inspect the main contacts (both fixed and movable contacts).

It requires some experience to evaluate the state of the contacts. Even after only a few switchings under load the contacts look used and “dirty” for the inexperienced eye. Contacts need only to be replaced if the wear of the contact tips is more than 70%.

Replace the Upper Module and secure it (refer to 4.5.4). Reconnect the main cables/current bars.

5.2.1.5 Inspection of the auxiliary contacts

Disconnect the main cables/current bars and remove the Upper Module (refer to 4.1).

Remove the protection cover. 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.

Replace the protection cap and the Upper Module and secure it (refer to 4.5.3 and 4.5.4). Reconnect the main cables/current bars.

5.3 Spare parts, replacement of parts

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, of failures, of short-circuit switchings or in similar cases spare parts are offered by Schaltbau. Only original parts are to be used as a replacement.

5.3.1 Main contacts and ceramic protection insert

If the main contacts have to be replaced all 4 contacts must be replaced (the moving bridge and the 2 fixed terminals).

Disconnect the main cables/current bars

Remove the Upper Module (refer to 4.1).

Remove the protection caps (refer to 4.1).

Dismount the contactor.

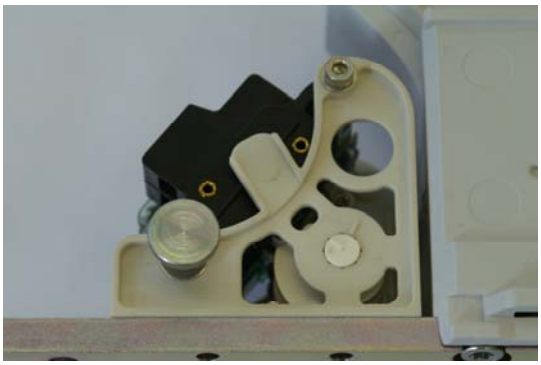
Remove the moving bridge

Remove the nut at the bottom of the contactor with a number 8 socket wrench and put the nut and the washer aside. The nut is secured with red locking varnish which will be destroyed during that operation. The moving bridge can be pulled out of the guidance.

Insert the replacement bridge

Since the moving bridge construction is connected to the lever to operate the auxiliary switches the assembly must be done with great care. The arrow on the axle of the auxiliary switch actuation cam must be in line with the mark on the frame when the new bridge is being inserted. Mount the new bridge from the top and secure it with washer and nut (Torque = 5 Nm). Secure the nut again with red locking varnish.

Correct position (not activated)



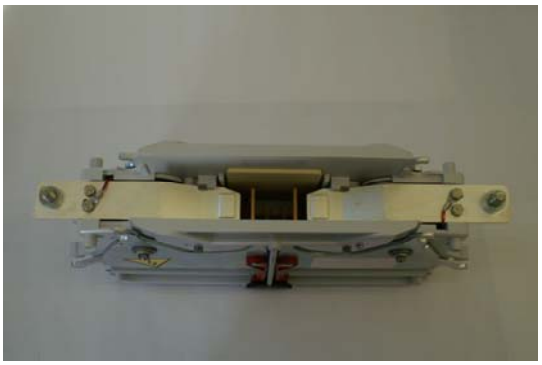
Wrong position (activated)

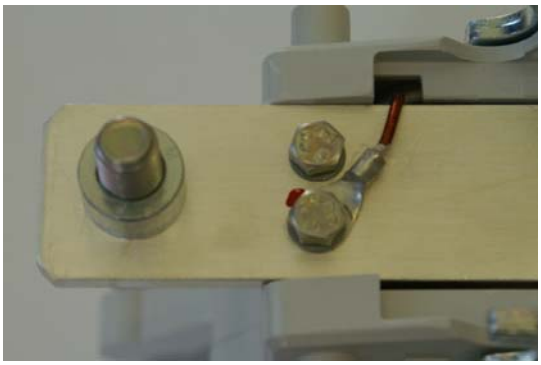
Test the replacement bridge

Lift the bridge. The bridge must be moved up and down easily. The lever to operate the auxiliary switches must follow the movement of the bridge; the arrow must change from the “not activated” position to the “activated” position when the moving bridge is being lifted.

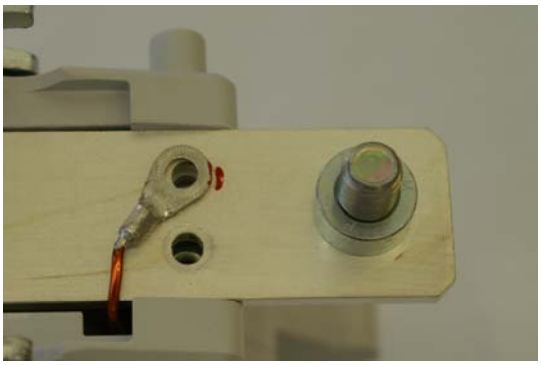
Remove and replace the fixed contacts and/r ceramic protection insert

Put the Upper Module onto the table upside down on a smooth surface. The latching levers must be in the closed position to avoid damage.

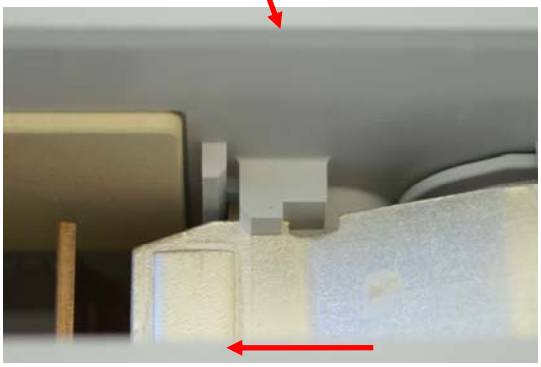


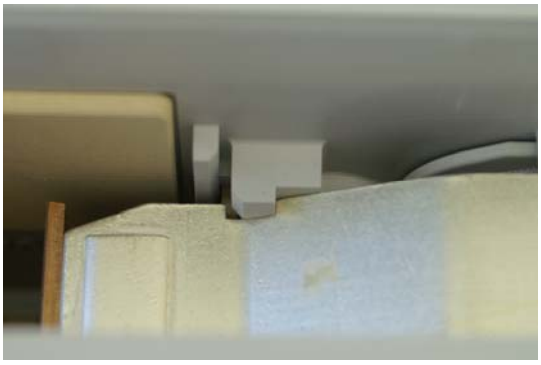


Remove all four M5 screws with a number 8 socket wrench and put the screws and washers aside. Two screws are secured with red locking varnish which will be destroyed during that operation.

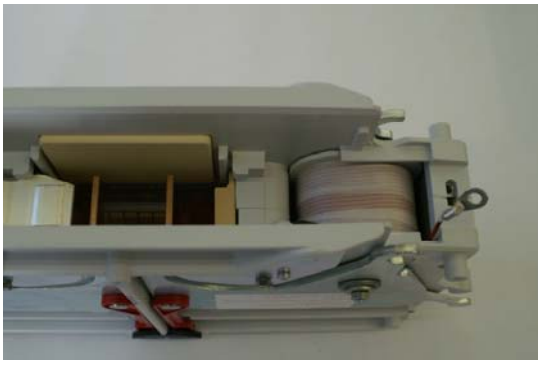


The fixed contacts must be pushed slightly to the middle and can then be removed easily.



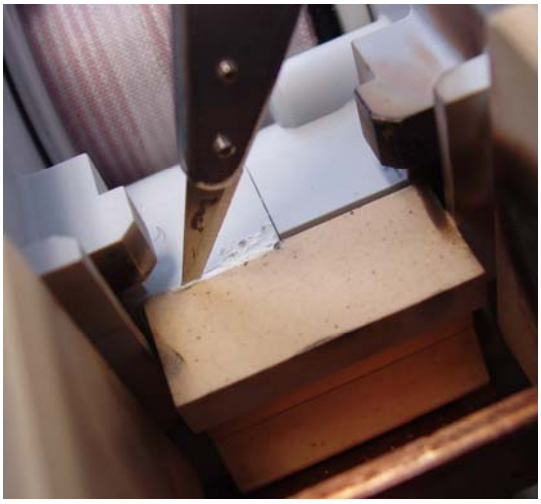


The copper wire may be pushed slightly to the side.

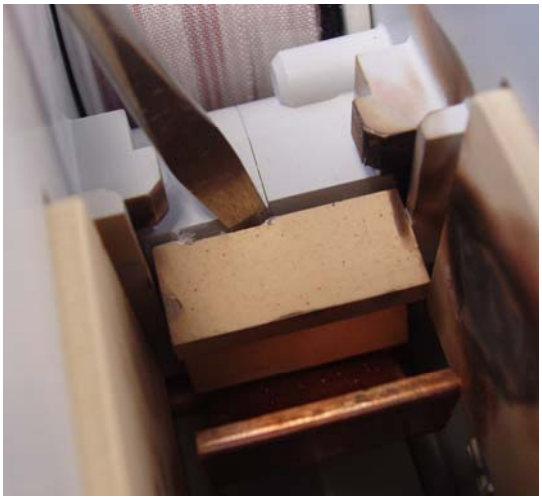


The following steps concerning the ceramic protection insert are for CT1030/04 only.

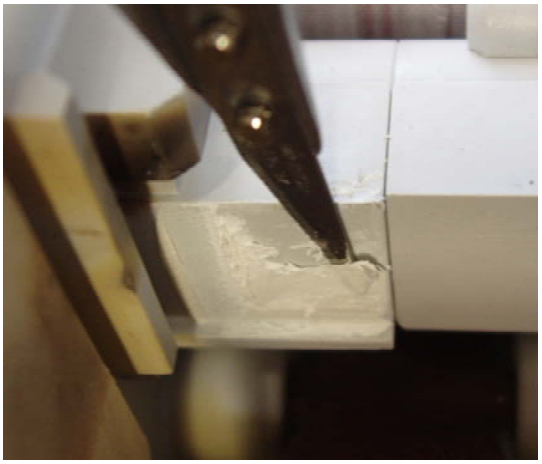
The ceramic protection insert is fixed with glue. It has to be replaced only in case of apparent wear or damage.



Cut the glue carefully with a knife and pry it open.



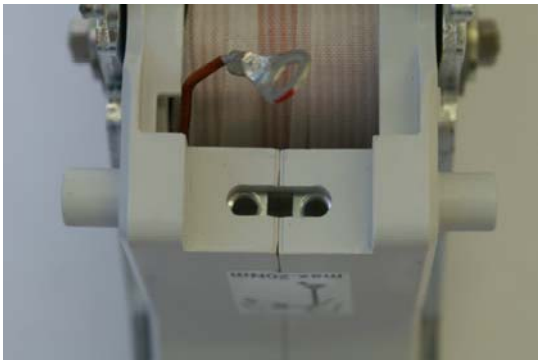
Remove all remains of old glue.



Apply glue to the replacement insert (use Weicon, Speed-Flex white, part number 13600310 only).

Place the new protection insert in the correct position and push it against the plastic guidance. Remove excessive glue. The insert must be in-line with the plastic surface without projecting length.

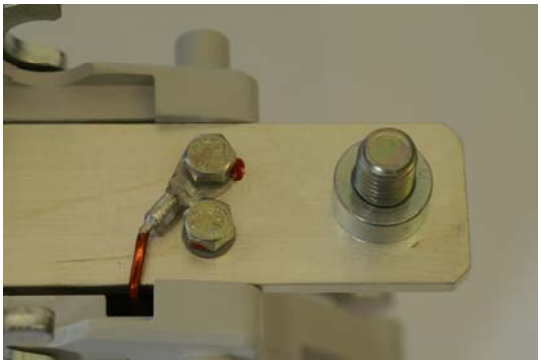
Control the position of the nuts prior to assembly of the new fixed contacts.



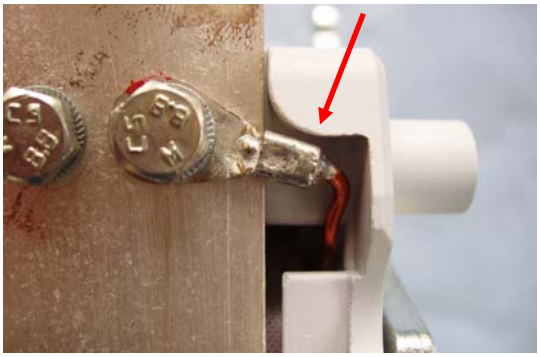
Replace the fixed contacts and push them into the locked position.

Retighten the four M5 screws (Torque = 5 Nm).

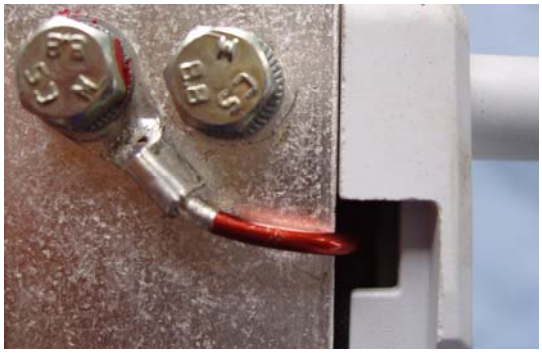
Check that the cable lug is tight.



Take special care concerning the correct position of the wires, close to the plastic **(CT1015/04)**.



Take special care concerning the correct position of the wires **(CT1030/04)**.



Reinstall the Lower Module (refer to 4.5.1)

Replace the protection cap for the auxiliary switches (refer to 4.5.2)

Replace the protection cap for the magnetic drive (refer to 4.5.3)

Replace the Upper Module and secure it (refer to 4.5.4). Reconnect the main cables/current bars.

Spare parts:	
MC CT1015/04	CT1015/04, terminal with fixed contact (order 2 per pole)
MC CT1030/04	CT1030/04, terminal with fixed contact (order 2 per pole)
CB CT1030/04	CT1015/04 / CT1030/04, moving contact bridge (order 1 per pole)
PI CT1030/04	CT1030/04, protection insert (order 2 per pole)
IP CT1015/04	CT1015/04, insulation plate for multi-pole versions (1 for 2pole, 2 for 3 pole versions
IP CT1030/04	CT1030/04, insulation plate for multi-pole versions (1 for 2pole, 2 for 3 pole versions

5.3.2 Auxiliary contacts

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

Disconnect the main cables/current bars

Remove the Upper Module (refer to 4.1).

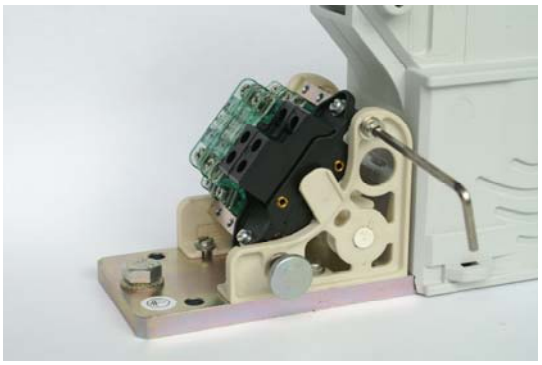
Remove the protection caps (refer to 4.1).

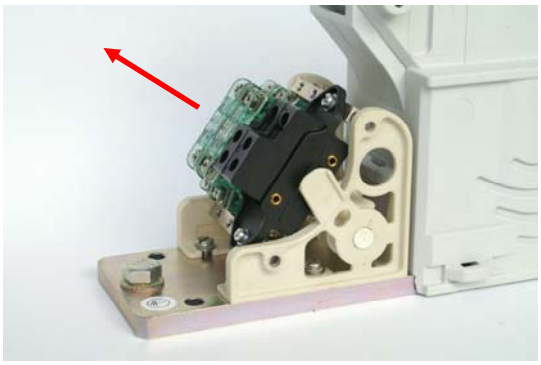
Dismount the contactor.

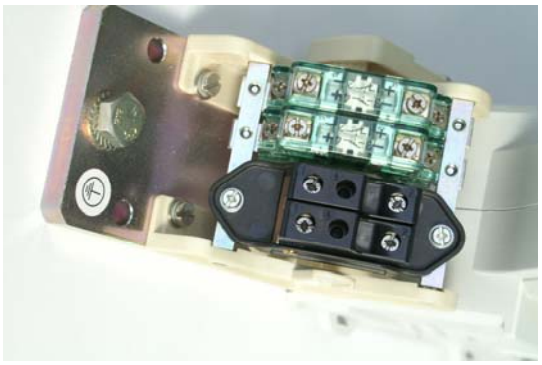
Removal of the auxiliary switch subassembly

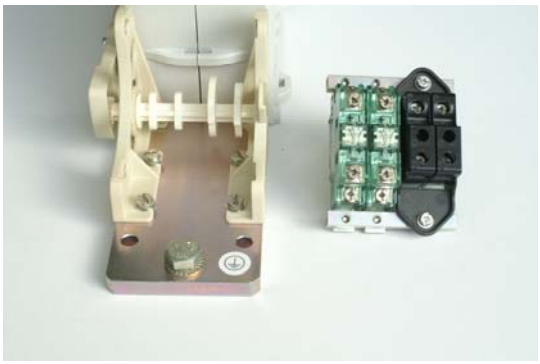
Remove the 2 knurled thumb screws and the 2 Allen head screws M4.

Note the mounting position of the subassembly and the individual switches. Pull the subassembly out in the direction of the arrow.



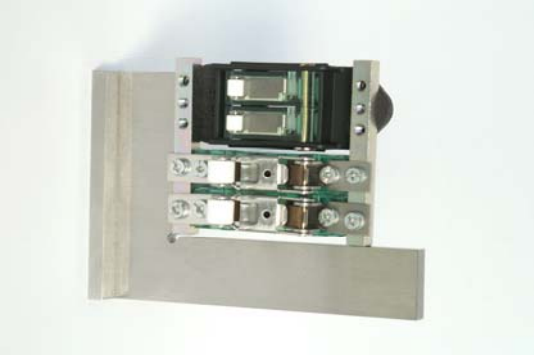






The actual version may differ from the photos. Standard versions are 4x S826 and 2x S826 + 2x S870 (as shown)

Dismount and mount the switches or the S870 switch group one by one to avoid wrong mounting. If all switches are removed together and mounted again a readjustment of the frame is necessary.



Changing the S870 assembly:

Use a **POZIDRIV** ® cruciform screw driver size 1 to remove the 2 screws on the top of the frame. Mount the replace assembly in the same mounting positition. Do not forget the washers.

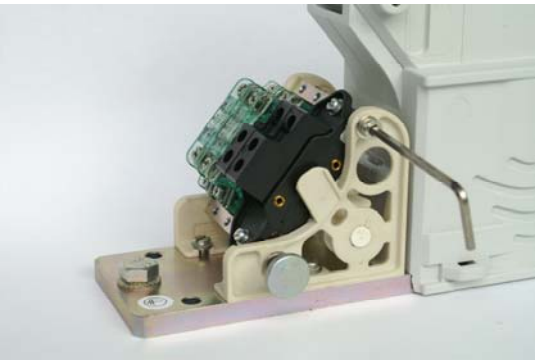
Changing the S826 snap action switches

Use a **POZIDRIV** ® cruciform screw driver size 1 to remove the screws (2 for each switch) on the bottom of the frame. Mount the replace switch in the same mounting positition. Do not forget the washers.

Reassembly of the switch subassembly

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

Tighten the 2 Allen head screws M4. The 2 knurled thumb screws should be just turned once. Do not forget the washers.



Reinstall the Lower Module (refer to 4.5.1)

Replace the protection cap for the auxiliary switches (refer to 4.5.2)

Replace the protection cap for the magnetic drive (refer to 4.5.3)

Replace the Upper Module(s) and secure it (refer to 4.5.4). Reconnect the main cables/current bars.

Spare parts:	
CC CT1030/04	Protection cap, coil terminal
CA CT1030/04	Protection cap, auxiliary switches
S826 a L	Snap action switch S826 (order 2 or 4 per contactor)
AS 870	Switch group with S870 (order 1 per contactor if appropriate)

6 Technical data

Refer to catalogue C20 and measured drawings

7 Applied standards

Refer also to catalogue C20

EN60077-1:2002	Railway applications - Electric equipment for rolling stock Part 1: General service conditions and general rules (IEC 60077-1:1999, modified)
EN 60077-2:2002	Railway applications - Electric equipment for rolling stock Part 2: Electrotechnical components; General rules (IEC 60077-2:1999, modified)
EN 50124-1:2001 +A1: 2003+A2: 2005	Railway applications - Insulation coordination Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment
EN 61373:1999	Railway applications - Rolling stock equipment Shock and vibration tests
EN 50125-1: 1999	Railway applications – Environmental conditions for equipment Part 1:Equipment on board rolling stock