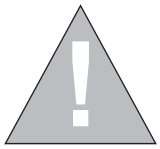
V-Contact VSC

Installation and service instructions

7.2/12 kV - 400 A

For your safety!

- **Make sure that the installation room (spaces, divisions and ambient) is suitable for the electrical apparatus.**
- **Check that all the installation, putting into service and maintenance operations are carried out by qualified personnel with suitable knowledge of the apparatus.**
- **Make sure that the standard and legal prescriptions are complied with during installation, putting into service and maintenance, so that installations according to the rules of good working practice and safety in the work place are constructed.**
- **Strictly follow the information given in this instruction manual.**
- **Check that the rated performance of the apparatus is not exceeded during service.**
- **Check that the personnel operating the apparatus have this instruction manual to hand as well as the necessary information for correct intervention.**
- **Pay special attention to the danger notes indicated in the manual by the following symbol:**



Responsible behaviour safeguards your own and others' safety!

For any requests, please contact the ABB Assistance Service.

Index

I.	Introduction	3
II.	Programme for environmental protection	4
III.	Application of the standards for X-ray emission	4
IV.	Safety information	4
V.	Qualified personnel	5
VI.	Interventions in the field	5
1.	Description	6
	1.1. “MAC” magnetic drive	6
	1.2. Versions available	7
	1.3. Characteristics	7
	1.4. Performances	8
	1.5. Contactor auxiliary contacts	8
	1.6. Compliance with Standards	8
	1.7. Protection against short-circuit	8
2.	Checking on receipt	9
3.	Handling	10
	3.1. Handling using a lifting or fork-lift truck	10
	3.2. Handling and lifting using a crane for withdrawable contactors	11
4.	Storage	11
5.	Installation	12
	5.1. General	12
	5.2. Installation and operating conditions	12
	5.3. Normal conditions	12
	5.4. Special conditions	12
	5.5. Overall dimensions	13
	5.6. Assembly and making the connections	15
	5.7. Description of the closing and opening operations	20
	5.8. Manual emergency opening operation	22
6.	Putting into service	23
	6.1. General procedures	23
	6.2. Racking the contactor in and out	24
	6.3. Accessories and tools for the operations	27
7.	Maintenance	28
	7.1. General	28
	7.2. Inspection	28
	7.3. Servicing	29
	7.4. Servicing following a short-circuit or overload	30
	7.5. Repairs	30
	7.6. Instructions for dismantling or replacing fuses	31
	7.7. Replacement of the contactor fuses	32
	7.8. Mounting and dismantling the short-circuit busbar	35
	7.9. Putting the contactor back into service	35
8.	Spare parts and accessories	36
	8.1. List of spare parts	36

I. Introduction

The instructions in this manual refer to the fixed and withdrawable versions of the VSC series of contactors. For correct use of the product, please read it carefully.
For the electrical and construction characteristics and the overall dimensions of the V-Contact VSC contactors, please also see technical catalogue 1VCP000165.
Like all the apparatus we manufacture, the V-Contact vacuum contactors are designed for different installation configurations. Furthermore, this apparatus allows further technical and construction modifications (at the customer's request) to adapt to special installation requirements. Consequently, this manual may not provide information concerning special configurations of the apparatus.
Apart from this manual, it is therefore always necessary to consult the latest technical documentation (circuit and wiring diagrams, assembly and installation drawings, any protection coordination studies, etc.), especially regarding any variants requested in relation to the standardised configurations.
Only use original spare parts for maintenance operations. The use of non-original spare parts can cause hazardous malfunctions and the apparatus warranty will no longer be valid.
Please refer to the technical sheets of the Kits for correct assembly of the accessories and/or spare parts. For further information, also see the 1VCP000165 technical catalogue of the contactor and the spare parts catalogue.
This manual and all the enclosed drawings must be considered an integral part of the apparatus. They must be easily to hand at all times for revision and reference.
These instructions do not intend to cover all the details, configurations or variants of the apparatus, storage or installation. For this reason, the information given below may sometimes not contain the instructions regarding special configurations. This does not relieve the user from their responsibility for using good technical working practices in application, installation, service and maintenance of the apparatus purchased. Should further information be required, please contact ABB.

	**WARNING**
	**Dangerous voltages. Risk of death, serious injury to people, damage to the apparatus or other objects.** Before carrying out any maintenance operations, turn the power supply off and earth the apparatus. Read and understand this instruction manual before installation, service or maintenance of the apparatus. Maintenance must only be carried out by skilled personnel. The use of unauthorized spare parts for repairs to the apparatus, modification of the apparatus itself, or any tampering by unskilled personnel creates hazardous conditions which may cause death or serious injury to people, or damage to the apparatus or other objects. Carefully follow all the safety instructions given in this manual.

II. Environmental protection programme

The V-Contact vacuum contactors are manufactured in accordance with the ISO 14000 Standards (Guidelines for environmental management). The production processes are carried out in compliance with the Standards for environmental protection in terms of reduction in energy consumption as well as in raw materials and production of waste materials. All this is thanks to the medium voltage apparatus manufacturing facility environmental management system.

III. Application of the X-ray emission Standards

One of the physical properties of vacuum insulation is the possibility of X-ray emission when the interrupter contacts are open. The tests carried out at the PTB laboratories (Physikalisch-Technische Bundesanstalt, in Brunswick - Germany) show that local emission at a distance of 10 cm from the interrupter or pole surface, does not exceed 1 mSv/h. It follows that:

– at the rated service voltage the use of vacuum interrupters is absolutely safe;
– application of the withstand voltage at power frequency, according to the IEC 60694 Standard, is safe;
– application of a voltage higher than the withstand voltage at power frequency or of a direct current test voltage, specified in the IEC Standard, cannot be used;
– limitation of the above-mentioned local phenomena, on interrupters with open contacts, depends on keeping the specified distance between the contacts. This condition is intrinsically guaranteed by correct operation of the drive and by transmission system adjustments.

IV. Safety information

All the installation, putting into service, running and maintenance operations must be carried out by suitably qualified personnel with in-depth knowledge of the apparatus.
Make sure that the personnel working on the apparatus have this manual to hand and all the information required for correct intervention.
Strictly follow the information given in this instruction manual.
Make sure that during the installation, service and maintenance stages the standard and legal requirements for constructing the installations in accordance with the regulations for safety in the workplace are respected.
Check that the rated performance of the apparatus is not exceeded during service.

V. Qualified personnel

For the purposes of this manual and the product rating plates, a qualified person is intended as a person who:

1) carefully reads the instruction manual all the way through.
2) has in-depth knowledge of the installation, construction and service of the apparatus and knows about the risks connected with any interventions.
3) is qualified and authorised to energise, de-energise, earth and identify the circuits according to the safety procedures and the local regulations in force.
4) is qualified and authorised to put this apparatus into service, and to carry out maintenance and repair operations on it.
5) is trained in correct use of protective equipment, such as rubber gloves, hard hats, protective goggles, face shields, flameproof clothing, etc. according to the safety procedures and the local regulations in force.
6) is trained in first-aid procedures.

VI. Interventions in the field

ABB can provide competent and well-trained personnel for assistance in the field to give technical guidance and consultancy regarding installation, complete overhauling, repair and maintenance of apparatus.

1. Description

The medium voltage V-Contact VSC contactors are pieces of apparatus suitable for operating in alternating current and are normally used to control users requiring a high number of hourly operations.

The basic contactors consist of:

- moulded polyester resin monobloc containing the vacuum interrupters
- bistable electromagnet drive
- multi-voltage feeder
- auxiliary contacts
- mechanical status indicator (open/closed).

Apart from what is specified for the fixed contactors, the withdrawable contactors also consist of:

- fuseholders preset for DIN or BS fuses (according to the customer's requirements)
- automatic opening device for intervention of even a single fuse
- truck
- lock which prevents closing during the racking-in/out operation.

The V-Contact VSC contactor introduces the drive with permanent magnets - already widely used, experimented and appreciated in medium voltage circuit-breakers - into the worldwide panorama of medium voltage contactors.

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

The drive is operated by means of an electronic feeder which, with just three versions, can cover all the power supply voltage values required by the major international Standards.

1.1. "MAC" magnetic drive

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

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

This means that a simple and direct axial transmission of the movement to the moving contacts of the vacuum interrupter can be realised, with both electrical and mechanical benefits.

The drive, which is of bistable type, is fitted with an opening and a closing coil.

The two coils - individually energised - allow the drive core to be moved from one of the two stable positions to the other.

The drive shaft is solid with an iron core which is immersed and held in position in a field generated by two permanent magnets (fig. A).

Energising the coil opposite to the magnetic latching position (fig. A) of the core, the magnetic field (fig. B) is generated, which attracts and moves the core into the opposite position (fig. C).

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

Fig. A
Magnetic circuit in the closed position.

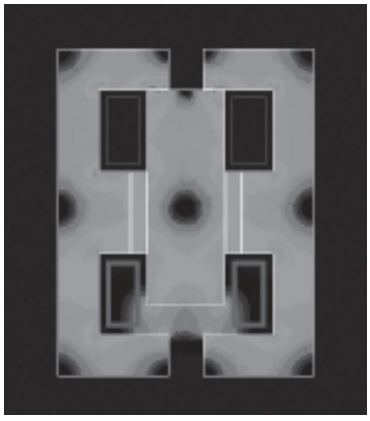


Fig. B
Magnetic circuit with opening coil supplied.

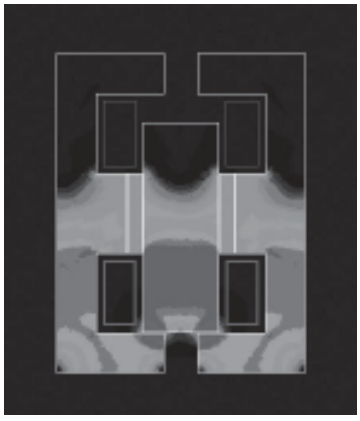


Fig. C
Magnetic circuit in the open position.

The energy needed for operation is not supplied directly by the auxiliary power supply, but is always “stored” in the capacitor which acts as an energy accumulator, and therefore operation always takes place with constant speeds and times, regardless of the divergence of the power supply voltage from the rated value.
The auxiliary power supply only has the aim of keeping the capacitor charged. Consumption is therefore minimal. The power required is less than 5 W. In order to re-instate the rated energy value in the capacitor following an operation, there is an inrush of 15 W for a duration of a few tens of milliseconds.
Careful selection of the components and a precise design make the electronic multi-voltage feeder extremely reliable, unaffected by electromagnetic interference generated by the surrounding environment and free of any emissions which may affect other apparatus placed in the vicinity.
These characteristics have made it possible for the V-Contact VSC contactors to pass the electromagnetic compatibility tests (EMC) and obtain the CE mark.

1.2. Versions available

The V-Contact VSC are available in the fixed and withdrawable version with rated voltages of 7.2 kV and 12 kV.
Their main characteristics are listed below.

1.3. Characteristics

Contactor / **IEC 60470**		**Reference**	**VSC 7**	**VSC 12**	**VSC/P 7**	**VSC/P 12**
Rated voltage	[kV]	4.1	7.2	12	7.2	12
Rated insulation voltage						
Withstand voltage at 50 Hz	[kV]		23	28	23	28
Impulse withstand voltage	[kVbil]		60	75	60	75
Rated frequency	[Hz]		50-60	50-60	50-60	50-60
Rated service current	[A]	4.101	400	400	400	400
Short-time withstand current						
Short-time withstand current for 1 s	[A]	4.5	6.000	4.000	6.000	4.000
Short-time withstand current for 30 s	[A]	4.5	2.500	2.500	2.500	2.500
Rated peak current	[kA]	4.6	15	15	15	15
Rated short-circuit time (tk)	[s]	4.7	1	1	1	1
Rated values						
Operations / hour	[N.]		900	900	900	900
Rated load and overload characteristics in category of use:						
- (Category AC4) 100 closing operations	[kA]	4.103, 4.104	4.000	4.000	4.000	4.000
- (Category AC4) 25 opening operations	[kA]	4.103, 4.104	4.000	4.000	4.000	4.000
Rated voltage of the switching devices and auxiliary circuits		4.8, 4.9				
Feeder type 1 (24 ... 60 DC)			■	■	■	■
Feeder type 2 (110 ... 130 AC-DC)			■	■	■	■
Feeder type 3 (220 ... 250 AC-DC)			■	■	■	■
Normal current	[A]	4.4.101	400	400	400	400
Electrical life (category AC3)	[N.]	29.mar	100.000	100.000	100.000	100.000
Electrical life at rated current (cat. AC1 - electrical latching)	[N.]	29.mar	1.000.000	1.000.000	1.000.000	1.000.000
Mechanical life	[N.]		1.000.000	1.000.000	1.000.000	1.000.000
Short-circuit breaking capacity (O-3min-CO-3min-CO)	[A]	4.107, 6.104	6.000	4.000	6.000	4.000
Short-circuit making capacity (O-3min-CO-3min-CO)	[A]	4.107, 6.104	15.000	8.000	15.000	8.000
Opening time with electrical latching	[ms]		20..30	20..30	20...30	20...30
Closing time	[ms]		30..50	30..50	30...50	30...50
Weight	[Kg]		20	20	49(*)	49(*)
Overall dimensions 	[mm] H		371	391	635	635
	[mm] W		350	350	531	531
	[mm] D		215	215	657	657
Tropicalisation		721-2-1	■	■	■	■

(*) Without fuses.

1.4. Performances

Contactor		VSC7-VSC/P 7				VSC12-VSC/P 12
Rated voltage	[kV]	2.2/2.5	3.6	3.6/7.2	6.2/7.2	12
Ultimate performances for:						
Motors	[kW]	1.000	1.500	1.500	3.000	5.000
Transformers	[kVA]	1.100	1.600	2.000	4.000	5.000
Capacitors	[kVAR]	1.000	1.500	1.500	3.000	4.800 (1)
Ultimate performances for back-to-back capacitor banks						
Rated current	[A]	250	250	250	250	Contact ABB
Max. transient current of the capacitor	[kA]	8	8	8	8	Contact ABB
Max. transient frequency of the capacitor	[kHz]	2.5	2.5	2.5	2.5	Contact ABB

(1) Overvoltage surge arresters are compulsory between phases and between phase and earth.

1.5. Contactor auxiliary circuits

10 auxiliary contacts (5 normally open and 5 normally closed) are available on the contactor for the customer's use, with the following characteristics.

Un	24 ... 250 V AC-DC
Rated current	Ith^2 = 10 A
Insulation voltage	2500 V 50 Hz (per 1 min)
Electric resistance	3 mOhm

Rated current and breaking capacity in category AC11 and DC11

Un	Cos φ	T	In	Icu
220 V ~	0,7	—	2,5 A	25 A
24 V –	—	15 ms	10 A	12 A
60 V –	—	15 ms	6 A	8 A
110 V –	—	15 ms	4 A	5 A
220 V –	—	15 ms	1 A	2 A

1.6. Compliance with Standards

V-Contact contactors comply with the Standards of the major industrialised countries and in particular with the following Standards:

– IEC 60470 (2000) and IEC 632-1 (1978) for the contactor;
– IEC 60694 (2002).

1.7. Protection against short-circuit

The value of the installation short-circuit current could exceed the breaking capacity of the contactor. The contactor must therefore have adequate protection against short-circuit.

Fuse replacement must only be carried out by qualified personnel.

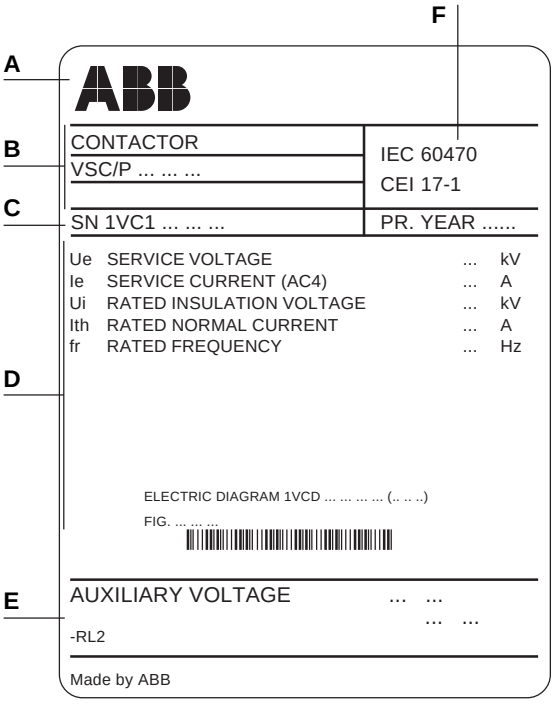
2. Checking on receipt

During handling, take great care not to stress the insulating parts of the apparatus and the terminals of the contactor.
Any operation carried out on the contactor must be done without the presence of voltage and with the main protection device open: danger of electrocution and/or severe burns.
Make sure that operations are carried out with the main and auxiliary power off.

On receipt, immediately check integrity of the packing and the colour of the "SHOCKWATCH" indicator (Fig. 1) placed on it.
If the "SHOCKWATCH" impact indicator is WHITE, it means that the packing has not received any notable shocks during transport. Open the packing, remove the contactor as indicated below, and check the state of the apparatus and its correspondence with the nameplate data (see fig. 2) with what is specified in the accompanying shipping note and in the order confirmation sent by ABB.
If the "SHOCKWATCH" impact indicator is RED, follow the instructions indicated on the plate.
Opening the packing does not damage its components and it can therefore be re-instated using the original material.
The contactor is shipped in special packing, in the open position.
Each piece of apparatus is protected by a plastic cover to prevent any infiltration of water during the loading and unloading stages and to keep the dust off during storage.
To remove the contactor from the packing, proceed as follows:
– open the plastic bag
– remove the contactor, avoiding any stress to the functional insulating parts and the terminals of the apparatus.
– use the special lifting plates for the withdrawable version
– check the rating plate characteristics to make sure that the performances are suitable for the destined application and that they are those indicated in the order confirmation.

Should any damage or irregularity be noted in the supply on unpacking, notify ABB (directly or through the agent or supplier) as soon as possible and in any case within five days of receipt.
The apparatus is only supplied with the accessories specified at the time of ordering and validated in the order confirmation sent by ABB.
The accompanying documents inserted in the shipping packing are:
– instruction manual (this document)
– test certification
– identification label
– fiscal copy of the shipping advice note
– electric wiring diagram.
Other documents which are sent prior to shipment of the apparatus are:
– order confirmation
– original shipping advice note
– any drawings or documents referring to special configurations/conditions.

Shock indicator



A Trademark
B Type of apparatus
C Serial number
D Characteristics of the apparatus
E Characteristics of the control auxiliaries
F Reference standards

Fig. 1

3. Handling

The contactor can be lifted using a lifting truck or a fork-lift truck.

The following precautions must be taken during contactor handling:

1. Keep the contactor in the upright position.
2. Make sure that the load is balanced on the truck or on the transport plate/pallet.
3. Interpose protective material between the contactor and the truck to avoid any damage or scratches.
4. Fix the contactor onto the truck or onto the transport plate/pallet to prevent it moving or tilting over.
5. Avoid excessive speed, sudden starts and stops or sharp changes in direction during contactor handling.
6. Only lift the contactor enough to avoid any obstacles on the floor.
7. Take care to avoid any impacts with structures, other apparatus or with personnel when handling the contactor.
8. Never lift a contactor over an area where there are people.
9. During handling of the apparatus, do not stress the insulating parts and the contactor terminals.

3.1. Handling using a lifting or fork-lift truck.

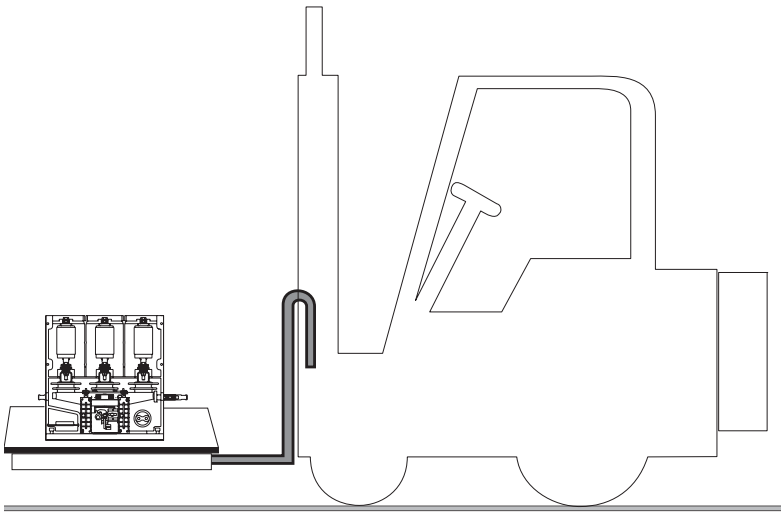
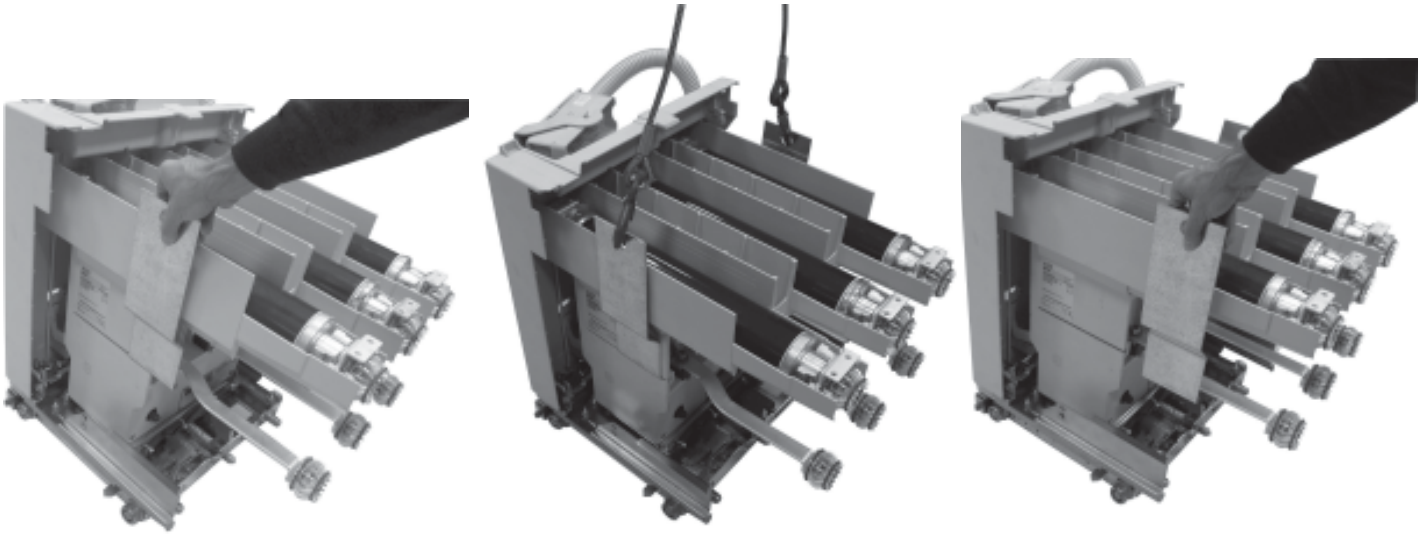


Fig. 2

3.2. Handling and lifting using a crane for withdrawable contactors

– Insert the lifting plates
– Lift
– After the unpacking and lifting operations, remove the lifting accessories.



Removal of the contactor from the packing and dismantling the lifting tools.

Fig. 3

4. Storage

When a period of storage is foreseen, the original packing must be put back. Store the contactor in a dry dust-free area. It must not be left outside or in adverse micro-climatic conditions: if it is left without protection, rust and deterioration of the insulation can occur.
Insert special hygroscopic packets inside the packing, with at least one standard packet per piece of apparatus. Replace the packets approximately every 6 months.

Should the original packing no longer be available and immediate installation is not possible, store in a covered, well-ventilated, dry, dust-free, non-corrosive ambient, with a dry atmosphere, away from any flammable materials and at a temperature between –5 °C and +40 °C.
In any case, avoid any accidental impacts or positioning which stresses the structure of the apparatus.

5. Installation

5.1. General

Correct installation is of primary importance. The manufacturer's instructions must be carefully studied and followed. It is good practice to use gloves for handling the pieces during installation.

The areas involved by the passage of power conductors or conductors of the auxiliary circuits must be protected against access of any animals which might cause damage or disservices.

The contactor enclosure must be installed in a clean, dry and heated place with good ventilation. It must be easily accessible for cleaning and inspection, and must be levelled, placed on the supporting foundations and securely fixed into position.
When the contactor is connected to a capacitive load, make sure that there is a heating element to keep the humidity down and of suitable size for the compartment where the contactor is installed. The contactor must always be installed associated with a suitable protection device (e.g.: fuses).

The fixed version of the V-Contact VSC contactors must be installed by the customer so as to guarantee a minimum degree of protection of IP2X.

5.2. Installation and operating conditions

The following Standards must be taken into particular consideration during installation and service:
– IEC60694/DIN VDE 0101
– VDE 0105: Operation of electrical plants
– DIN VDE 0141: Earthing systems for electrical installations with rated voltage higher than 1 kV
– All the accident prevention regulations in force in the relative countries.

5.3. Normal conditions

Follow the recommendations in the IEC 60694 and 60470 Standards. In more detail:

Ambient temperature

Maximum	+ 40 °C
Average maximum over 24 hours	+ 35 °C
Minimum (according to class – 5), apparatus for indoor installation	– 5 °C

Humidity
The average value of the relative humidity, measured for a period longer than 24 hours, must not exceed 95%.
The average value of the water vapour pressure, measured for a period longer than 24 hours, must not exceed 2.2 kPa.
The average value of the relative humidity, measured for a period longer than 1 month, must not exceed 90%.
The average value of the water vapour pressure, measured for a period longer than 1 month, must not exceed 1.8 kPa

Altitude
< 1000 m above sea level.

5.4. Special conditions

Installations above 1000 m a.s.l.
Possible within the limits allowed by reduction of the dielectric resistance of air.

Climate - Increase in temperature
In order to avoid the risk of corrosion or other damage in areas with high humidity and/or rapid large fluctuations in temperature, take appropriate measures (for example, using suitable electric heaters) to prevent any condensation phenomena.

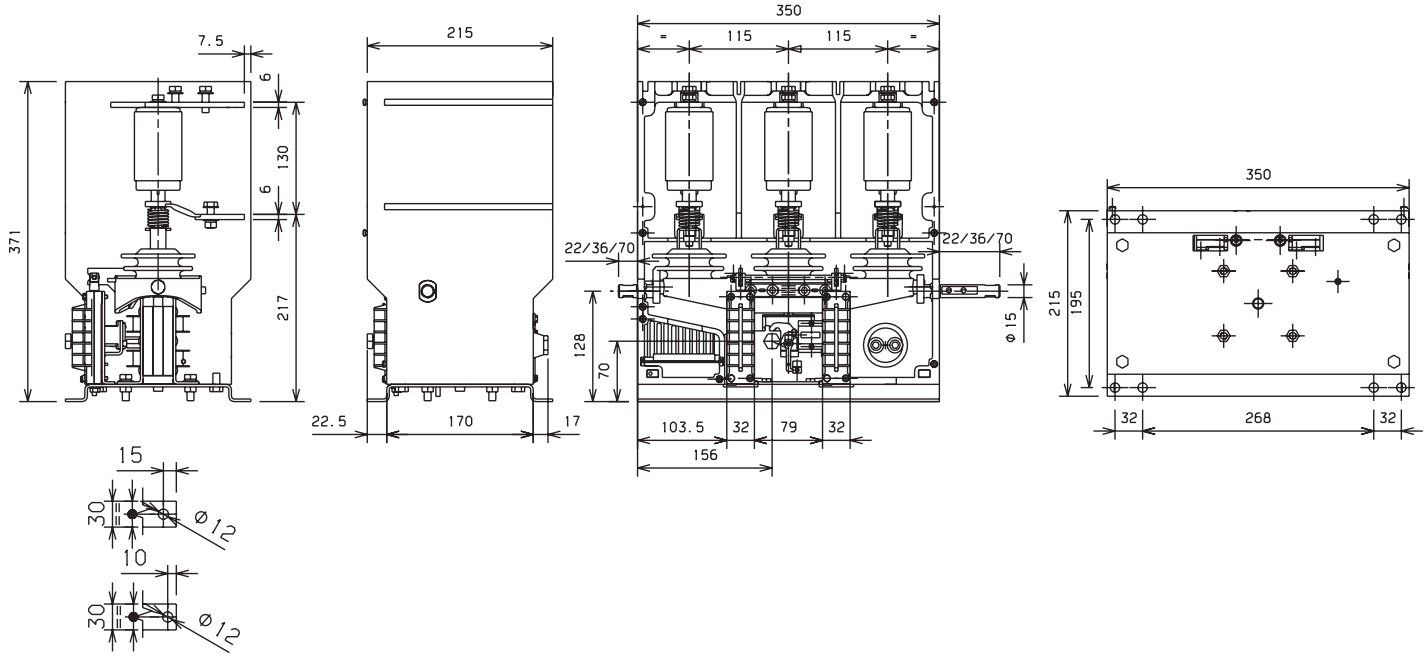
For special installation requirements or other operating conditions, please contact ABB.

5.5. Overall dimensions

5.5.1. VSC fixed contactor

For the overall dimensions and distances between fixing holes, refer to figure 4a.
In any case, avoid stressing the supporting structure of the contactor: if necessary, arrange slots in the fixing area to facilitate correct positioning of the apparatus.
The assembly positions can be selected between the two shown in figure 4b.

VSC7



VSC12

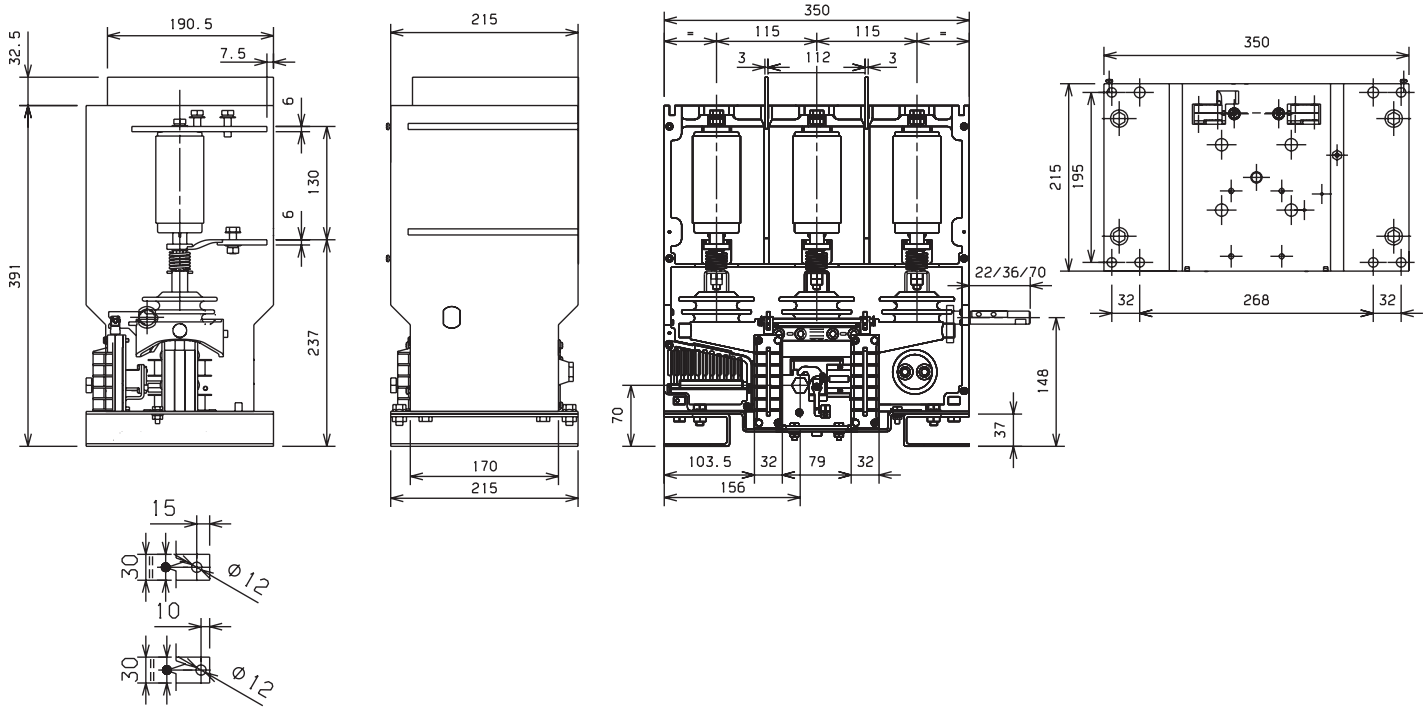


Fig. 4a

Installation of fixed contactors

The contactor keeps its performances in the installation positions indicated:

A) floor-mounted with moving contacts at the bottom

B) wall-mounted with horizontal moving contacts and terminals at the bottom.

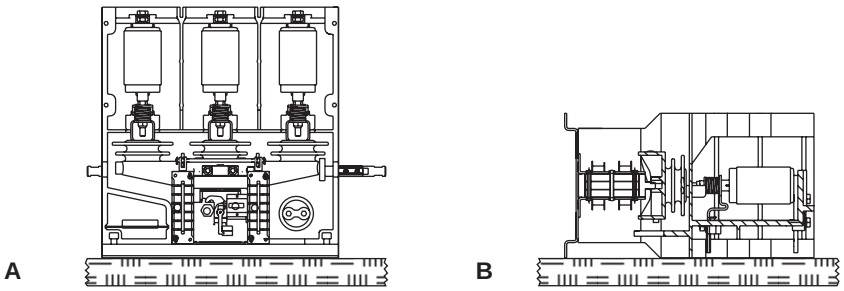


Fig. 4b

5.5.2. VSC/P withdrawable contactors

VSC/P 7 - VSC/P 12

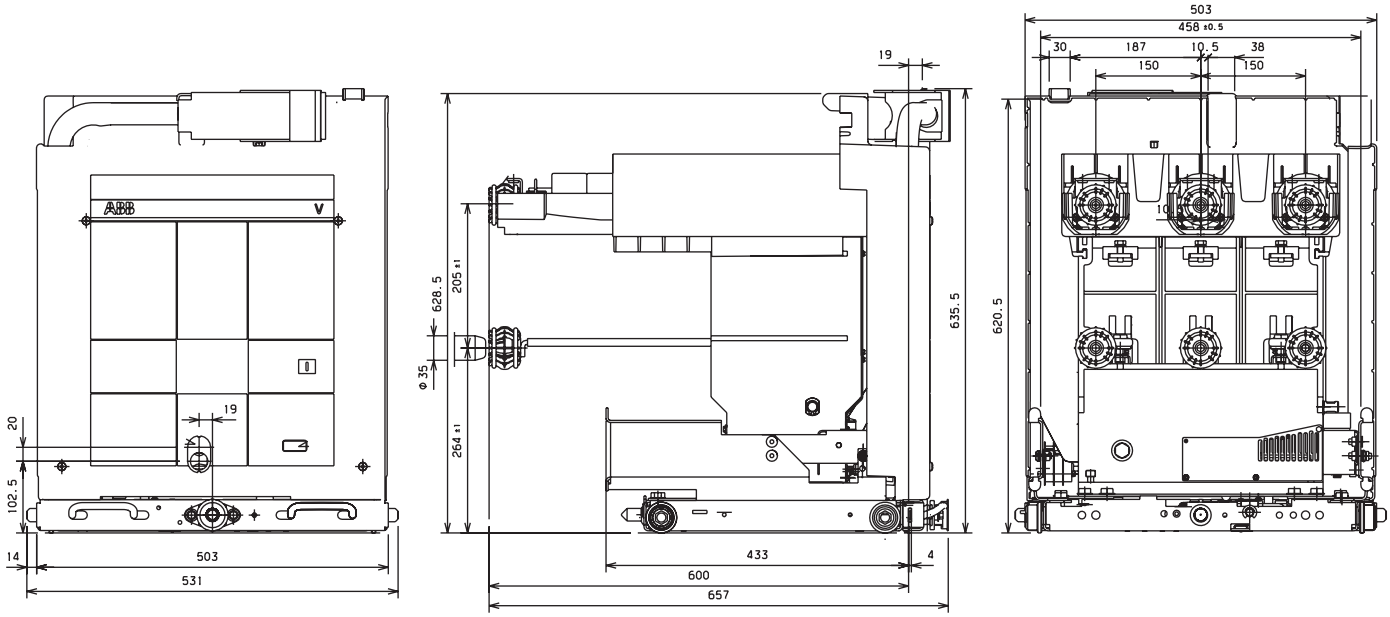


Fig. 5

5.6. Assembly and making the connections

5.6.1. Fixed contactors

⚠	**WARNING**
	**Dangerous voltages. Risk of death, serious injury to people, damage to the apparatus or other objects.** Togliere l'alimentazione, mettere a terra e in sicurezza tutte le fonti di potenza e di tensione di controllo prima di iniziare i lavori su questo o qualsiasi apparecchio elettrico. L'installazione deve essere effettuata solo da personale qualificato.

Introduction

Before carrying out any installation operations:

- Test all the power terminals to check that they are not supplied with voltage. Only use high voltage testing equipment approved for checking the voltage on the power terminals. **Do not attempt to measure the high voltage (above 600 volt) with a volt-ohm/meter.**
- Check all the control and secondary circuit terminals with a voltmeter to ensure that all the control and secondary input voltage sources have been turned off.
- Connect the safety earthing to the power terminals after having turned the power supply to the system off and before working on the apparatus.
- Carry out all the operations for turning off the voltage and earthing according to the established safety procedures.

Power circuit

General precautions

– Check that the connections of the fixed contactor or the isolating contacts of the withdrawable contactor are clean and free of any deformation caused by shocks received during transport or storage in the warehouse.
– Select the cross-section of the conductors according to the service current and the short-circuit current of the installation.
– Prepare special pole insulators, near the terminals of the contactor, sized according to the electrodynamic forces deriving from the short-circuit current of the installation and avoid stressing the connections laterally.

Surface treatment of the connections

The connections can either be made of bare copper or bare aluminium. In any case, it is always advisable to silver-plate the contact surfaces. The surface treatment must have a constant and even thickness.

Assembly procedures for fixed contactors

– Check that the contact surfaces of the connections are flat, and are free of any burrs, traces of oxidation or deformation caused by drilling or impacts received.
– Carry out the operations indicated on the contact surface of the conductor (silver-plated copper):
  - clean with a rough dry cloth
  - only in the case of obstinate traces of oxidation, clean with a very fine grain emery cloth taking care not to remove the surface layer
  - if necessary, restore the surface treatment (consult ABB)
  - put the connections in contact with the contactor terminals, taking care to avoid mechanical stresses produced, for example, by the conductor busbars on the terminals themselves.

– Interpose a spring and a flat washer between the head of the bolt and the connection.
– The use of bolts according to DIN class 8.8 Standards is recommended, also referring to what is indicated in the table.
– In the case of cable connections, strictly follow the manufacturer's instructions for making the terminals.

Bolt	Recommended tightening torque (1) Without lubricant
M6	10.5 Nm
M8	26 Nm
M10	50 Nm
M12	86 Nm

(1) The nominal tightening torque is based on a friction coefficient of the thread of 0.14 (distributed value the thread is subjected to which, in some cases, is not negligible).
Take into account the deviations from the general Standards table (for example, for contact systems or terminals) as foreseen in the specific technical documentation.
The thread and surfaces in contact with the heads of bolts must be slightly oiled or greased, so as to obtain a correct nominal tightening torque.

Earthing

For the fixed version contactor, carry out earthing by means of the special hole marked with the relative symbol. Clean and degrease the area around the screw to a diameter of about 30 mm and, on completion of assembly, cover the joint again with Vaseline grease.
Use a conductor (busbar or cord) with a cross-section conforming to the Standards in force.

Connection of the auxiliary circuits

The cables to be used for connection of the auxiliary circuits must have a rated voltage Uo/U of 450/750 V and be insulated for 3 kV test.
Note: before carrying out the test, disconnect the earthing connection of the electronic feeder.
Also remember that the auxiliary circuits must be checked at the maximum voltage of 2 kV in accordance with what is prescribed in the Standards.

The cross-section of the connection cables must not be less than 1.5 mm^2.
Connection of the contactor auxiliary circuits must be made by means of the socket with terminal box mounted on the front of the electronic card.
Outside, the wires must run through metallic pipes or ducts suitably earthed.

Connection to be made by the customer (*)

Pins KM1-1 and KM1-2 must always be supplied, both in the SCO and DCO version (also see par. 5.8.). The polarity is not important since the internal circuits take both AC or DC signals. For further details, consult the electric circuit diagram enclosed with the apparatus.

N. of pin	Connections	Meaning of each pin
KM1-1	Auxiliary power supply	Auxiliary power supply AC or DC (pole 1)
KM1-2	Auxiliary power supply	Auxiliary power supply AC or DC (pole 2)
KM1-3	Binary output n° 1	Indication of Unit ready (pole 1)
KM1-4	Binary output n° 1	Indication of Unit ready (pole 2)
KM1-5	Binary input n° 1	Protection trip (pole 2)
KM1-6	Binary input n° 1	Protection trip (pole 1)
KM1-7	Binary input n° 2	Closing (pole 1)
KM1-8	Binary input n° 2	Closing (pole 2)
KM1-9	Binary input n° 3	Opening (pole 1)
KM1-10	Binary input n° 3	Opening (pole 2)
KM1-11	Binary input n° 3	Undervoltage (pole 1)
KM1-12	Binary input n° 3	Undervoltage (pole 2)

(*) Only for fixed contactors. The withdrawable contactors are cabled in the factory.

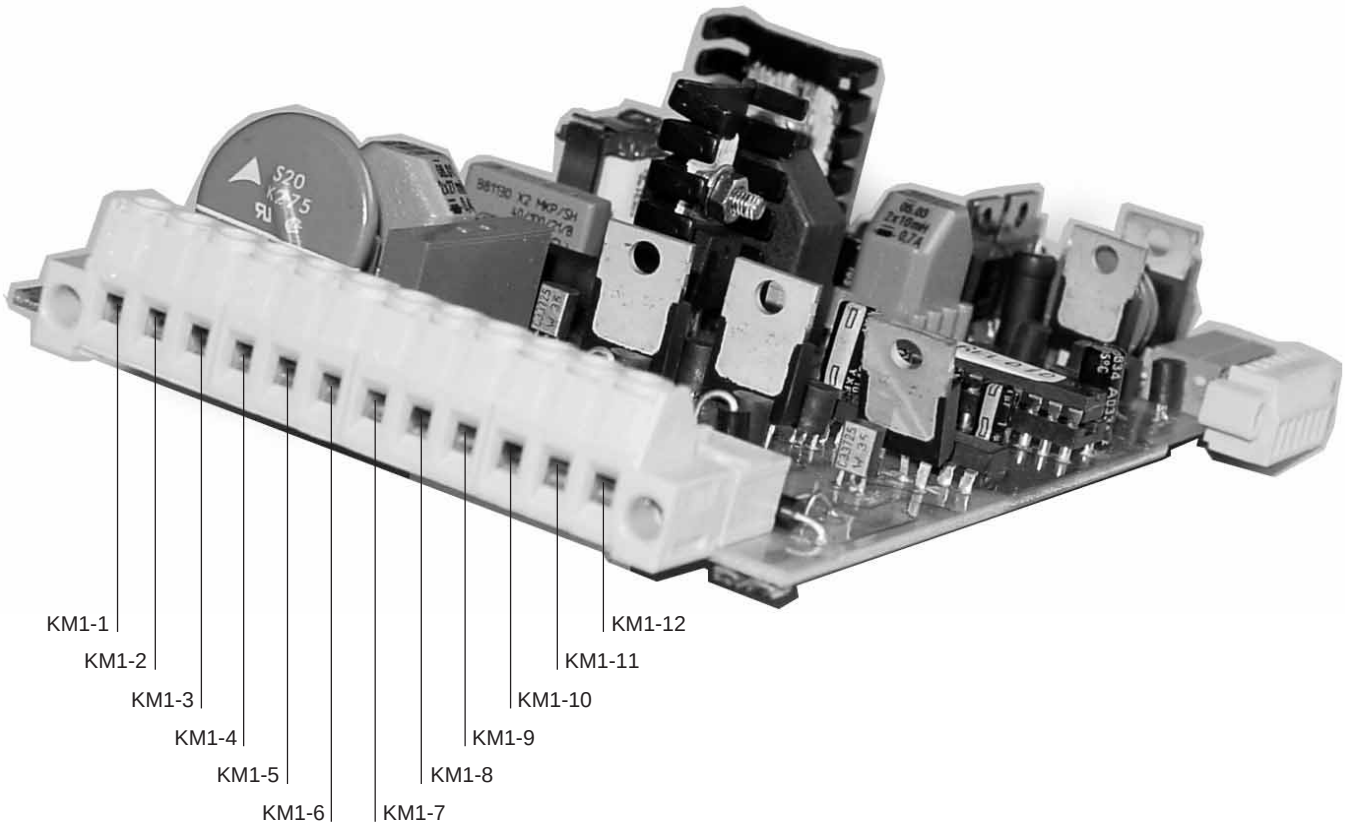


Fig. 6

Checks

After the above-mentioned operations, carry out the following checks:
– check that the connections do not exert any force on the terminals
– check tightness of the connections.

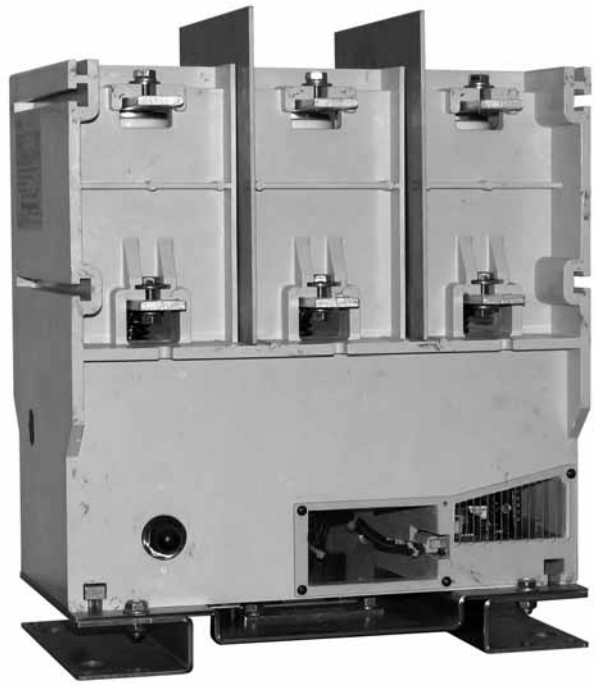


Fig. 7

5.6.2. Withdrawable contactors and enclosures

The withdrawable contactors are used in the UniGear ZS1 type switchgear and in the PowerCube enclosures.
Appropriately fixed together in the configurations defined by the customer, the enclosures build up medium voltage switchgear consisting of various units.

Rules for designing the switchgear

Arc proof

The ABB enclosures are supplied with a reinforced door, suitable for making arc proof switchgear.

- **The reinforced enclosure alone cannot guarantee arc proofing of the switchgear designed by the customer. To guarantee this, some representative configurations, selected by the customer, must be subjected to the tests according to the prescriptions indicated in the IEC 62271-200 Standards.**
- **For UniGear ZS1 type switchgear, all the door knurls must be tightened to guarantee arc proofing.**

Degree of protection

Limited to the front part, the ABB enclosures guarantee the following degree of protection:
- IP30 on the external housing;
- IP20 inside the switchgear with the door open.

Special versions up to IP41.

The reinforced enclosure alone supplied by ABB cannot guarantee the degree of protection of the switchgear designed by the customer. It must undergo the tests according to the prescription indicated in the IEC62271-200 Standards.

Heating

Refer to technical catalogue 1VCP000165 for the rated capacity of the contactors, bearing in mind that apparatus heating is affected by the following variables:
- layout of the enclosures in the switchgear designed by the customer;
- degree of protection (ventilation slats);
- current density of the power supply busbars (busbar duct - branches);
- ambient temperature.

For any needs, please contact ABB Service.

Reference Standards

The enclosures and contactors comply with the following Standards:
– CEI 17/6 (1993) (where applicable)
– ICE 62271-200 (2003) (where applicable)
– CEI EN 60694 (1997) (where applicable)
– IEC 60694 (2002) (where applicable)
– IEC 60470 (2000) (where applicable)

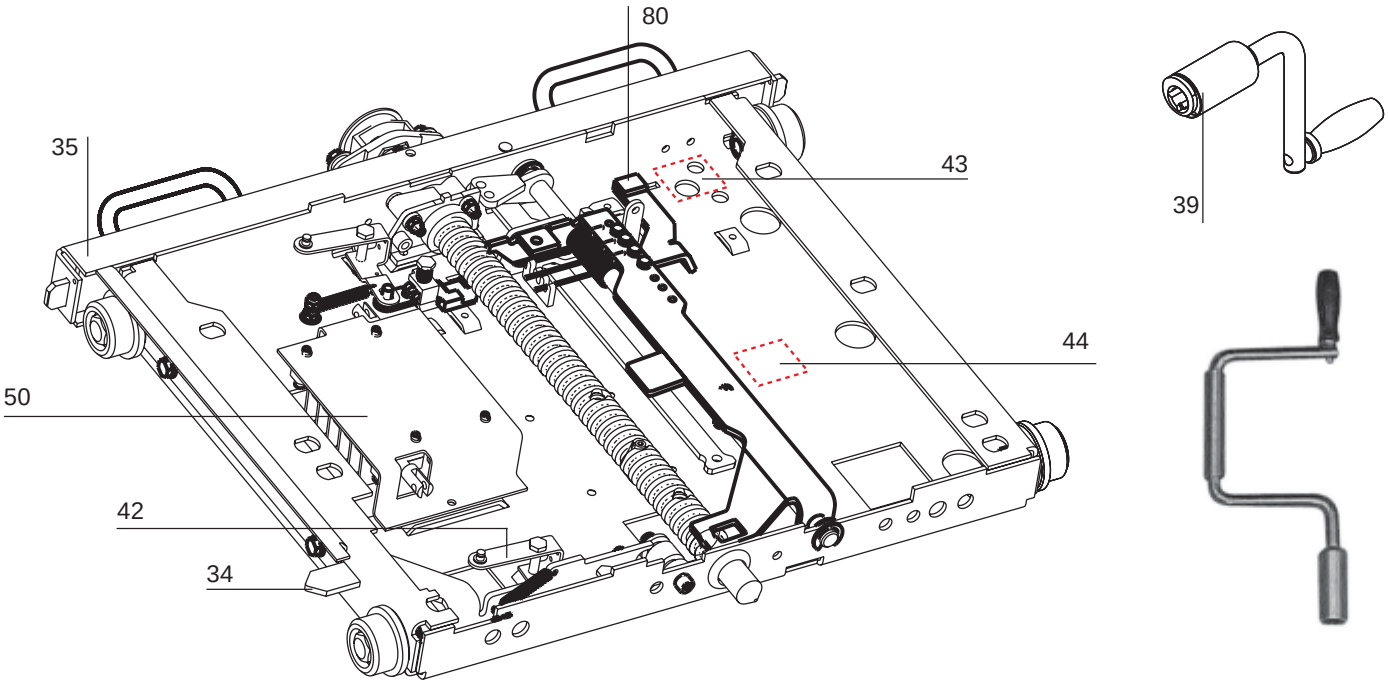
Withdrawable VSC/P contactors

The contactors are used for rated voltages from 7.2 to 12 kV, rated normal currents up to 400 A and fault levels up to 1000 MVA (with suitable protection fuses in series with the contactor).
The VSC/P contactor is made up of:
– a three-pole contactor with SCO or DCO function
– mechanical signalling of open/closed
– two pairs of auxiliary contacts signalling open/closed
– multi-voltage feeder:
  - type 1: from 24 to 60 Vdc
  - type 2: from 100 to 135 Vdc/Vac- 50-60 Hz
  - type 3: from 220 to 250 Vdc/Vac- 50-60 Hz
– a truck on which the supporting structure of the contactor is fixed, consisting of two supports, closed at the front by the protection with characteristics nameplate.
  In the top part of the protection there are strikers (30a) and (30b) for actuating the enclosure contacts to signal protection connected/isolated.
  The pin (34) for locking contactor racking-in with the earthing switch closed on the enclosure, comes out on the right side of the truck (28).

The crosspiece for hooking up the contactor to the enclosure for operation of the truck is mounted on the front of the truck;

– two supports house the slide for actuation of the segregation shutters of the fixed medium voltage contacts of the enclosure and the locking slide of operation of the switch itself with the contactor in the connected position or during the isolation stage;
– when it is not inserted in the socket located on the enclosure, the plug connector for the auxiliary circuits of the contactor must be hooked up to the stake;
– mechanical signalling of open/closed;
– fuseholder complete with connections for fuses;
– input and output tulip isolating contacts;
– locks as per par. 5.6.2.1.;
– three current-limiting fuses (supplied on request) with high breaking capacity connected in series to the contactor, with dimensions according to:
  • DIN 43625 Standard with maximum cartridge length e = 442 mm;
  • BS 2692 Standard with maximum centre fixing distance L = 553 mm;
– an impulse counter (supplied on request) which indicates the number of operations carried out by the contactor;
– manual emergency opening device and device for opening when a fuse blows.

Fig. 8a



Locking devices on the racking-out truck

Fig. 8b

5.6.2.1. Description of the locks for withdrawable contactors

– Electric lock which prevents the contactor being closed when the truck is not in the racked-in and isolated positions.
– Mechanical lock which prevents the contactor being racked-in and out when it is closed and closing of the contactor when the truck is not in the racked-in and isolated positions.
– Electric lock which prevents closing of the contactor when a fuse is missing or blown.
– Lock which prevents putting a contactor into service in an enclosure preset for a circuit-breaker (*).
– Locking electromagnet on the contactor truck which when there is no voltage, prevents racking-in or racking-out.
– Mechanical lock which prevents contactor racking-in if the enclosure door is not closed (requires the same interlock in the fixed part).
– Mechanical interlock with earthing switch placed on the enclosure - with earthing switch closed the contactor cannot be racked-in and with the contactor racked-in or in intermediate positions between racked-in and isolated, it is not possible to close the earthing switch.
– Mechanical lock of the shutters when the contactor is racked-out.
– Key lock on contactor racking-in - it is only possible to activate the lock and free the key preventing contactor racking-in with the contactor in the isolated position.
– Key lock with earthing switch open - this can only be activated with the earthing switch open. The key can only be removed with the electric lock activated.
– Key lock with earthing switch closed - this can only be activated with the contactor in the isolated position and with the earthing switch closed. The key can only be removed with the lock activated.
– Preset for independent padlock locks of the shutters and in the closed and/or open position.

(*) This lock consists of some pins assembled in the plugs of the auxiliary circuits which, with a suitable code, prevent connection of the plug in the enclosure socket. The lock also foresees compulsory application of the locking magnet in the truck.

– Electric lock on racking-in and racking-out with the door open (microswitch on the door) of the enclosure connected in series with the locking electromagnet on the contactor truck.
– Key lock on earthing truck racking-in - with the lock activated all the operations with the contactor are possible, but positioning the earthing truck in the isolated position starting from the racked-out position is not allowed.
– Mechanical lock which prevents racking-out of the connector of the auxiliaries when the contactor is racked-in and during racking-in and racking-out.
– Electro-mechanical lock on de-energisation for the earthing switch, which when there is no voltage prevents the earthing switch operations.
– Electro-mechanical lock on the compartment door.

5.7. Description of the closing and opening operations

The contactor drive operates in two different ways as shown in Table 1.
For the DCO version, further personalisation of the apparatus can be made. In fact – the first of its kind – the V-Contact VSC contactor is fitted (on request) with an undervoltage function (UV) with delays which can be set according to the requirements of the installation.
For a more detailed description of the behaviour of the apparatus according to the version, see table 2.
Supply the contactor with auxiliary voltage and operate it several times electrically. The contactor must carry out the opening and closing operations correctly at between 85% and 110% of the rated auxiliary control voltage.

TABLE 1

Version	Description	Inputs		
		Closing KM1-7, KM1-8	Opening KM1-9, KM1-10	UV (undervoltage) KM1-11, KM1-12
SCO (Single Command Operated)	With this version the closing operation takes place by supplying auxiliary energy to the UV (undervoltage) input of the apparatus. On the other hand, the opening operation takes place when the auxiliary energy is either voluntarily cut off (by means of an auxiliary command) or involuntarily (due to no auxiliary energy in the installation) at the UV (undervoltage) input of the contactor.	Not used	Not used	Used
DCO (Double Command Operated)	With this version, the closing operation takes place by supplying the input of the closing command of the apparatus in an impulsive way. On the other hand, the opening operation takes place when the input of the opening command of the contactor is supplied in an impulsive way.	Used	Used	Usedif the undervoltage function is requested.

TABLE 2a

SCO version (Single Command Operated)	
Closing operation.	• Power supply, continuously, at the UV input
Voluntary opening operation.	• Power supply cut at the UV input (1)
Automatic opening operation (2).	• Drop in the auxiliary voltage supplied at the UV input (1) below the trip thresh-old prescribed by the Standards.

TABLE 2b

DCO version (Double Command Operated)	
Closing operation.	• Power supply, in an impulsive way, of the closing input (30 ms minimum impulse time)
Voluntary opening operation.	• Power supply, in an impulsive way, of the opening input (30 ms minimum impulse time). If the closing command persists at the same time, the contactor opens since the opening command has priority. In this situation the contactor remains in the open position due to the integrated anti-pumping function (until the opening command ceases).
Operazione di apertura automatica (2).	• Function available on request (UV – undervoltage) • Drop in the auxiliary voltage supplied at the UV input (1) (undervoltage) below the trip threshold prescribed by the Standards.

(1) The opening operation can be instantaneous or delayed (adjusting the delay by means of the special selectors) by 0.5 - 1 - 2 - 3 - 4 - 5 s. It is adjusted to 0 s as the default.
(2) The contactor is fitted with watchdog function which makes it open automatically if the capacitor charge drops below the ultimate safety limit.

It is possible to preset the opening delay with the group of selectors S1 ... S3 both in the SCO version and, when the undervoltage accessory is provided, in the DCO version.

(*) DCO = undervoltage disabled.

Fig. 9

5.8. Emergency opening operation

The contactor is provided with manual emergency operation which must be carried out by suitably qualified personnel with in-depth knowledge of the apparatus and with voltage to the apparatus compulsorily turned off on the power supply side.

The following Standards must be taken into particular consideration during installation and service:

- **IEC60694/DIN VDE 0101**
- **VDE 0105: Operation of electrical plants**
- **DIN VDE 0141: Earthing systems for electrical installations with rated voltage higher than 1 kV**
- **All the accident prevention regulations, in force in the relative countries.**

To manually open the contactor, it is necessary to work on operating part A, consisting of a 17 mm hexagonal-head bolt, working clockwise with a torque of about 5 Nm and at an angle of about 30° (see fig. 10a).

If the contactor (in the fixed version) is placed inside the switchgear, it is necessary to provide a transmission made of insulating material of suitable length which allows safe operation. The transmission device is to be provided by the customer.

For the withdrawable VSC/P contactors placed in UniGear ZS1 type switchgear or PowerCube modules, carry out the emergency operation with the compartment door closed. To carry out the operation, work towards the opening on the compartment door using the special tool provided, fitted on the end with an 8 mm hexagonal spanner. Apply a torque of 5 N with an operating angle of about 30° clockwise. The point to operate in is shown by the special plate located on the contactor shield (see fig. 10b).

For fixed contactors, if the operations are carried out with the medium voltage protection "B" removed, pay great attention to the moving parts.

For withdrawable contactors, do not remove the front shield to carry out the emergency opening operation.

In any case, if auxiliary voltage is present, take special care not to remove the protective shield of the stored energy capacitor and not to touch the capacitor itself in any way.

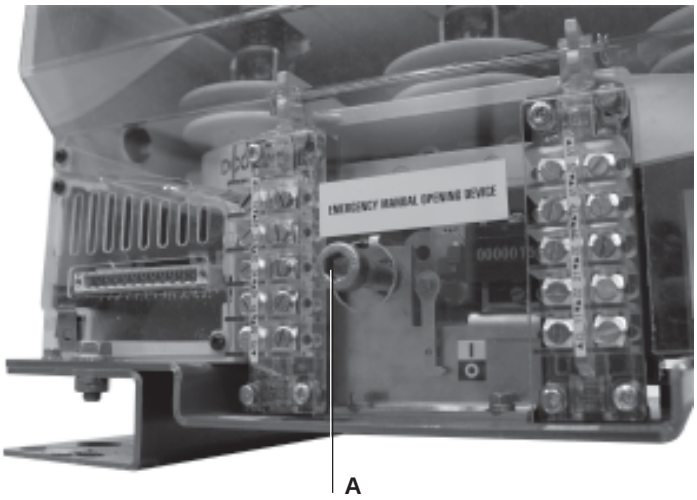


Fig. 10 a

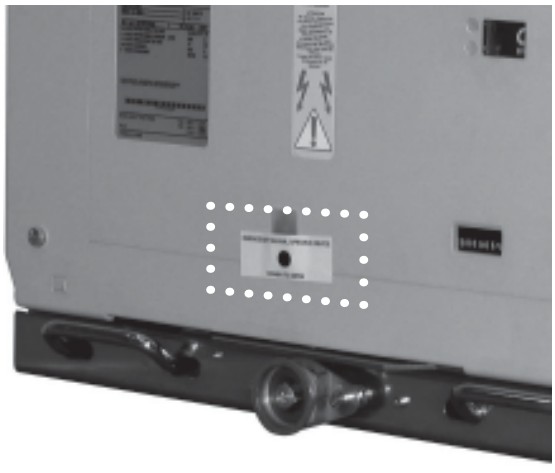


Fig. 10 b

6. Putting into service

6.1. General procedures

All the operations regarding putting into service must be carried out by ABB personnel or by suitably qualified customer personnel with in-depth knowledge of the apparatus and of the installation.

Before putting the apparatus into service, carry out the following operations as well as those indicated in the table:

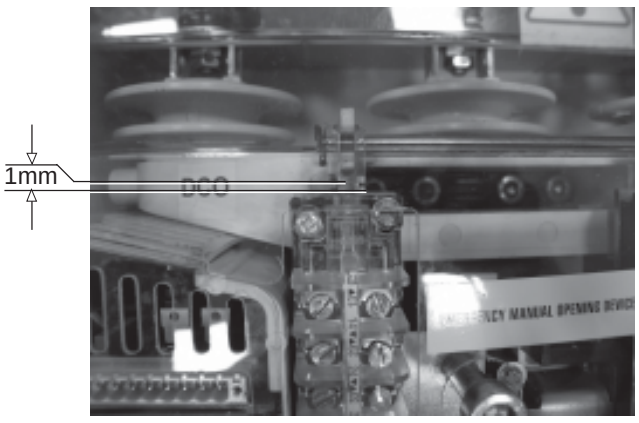
– check that the voltage and current applied are within the specified rated values
– check tightness of the power connections of the fixed contactors and integrity of the isolating contacts of the withdrawable contactors
– carefully clean the sheets and insulating parts with brushes and clean dry cloths. Avoid using jets of compressed air
– check the earthing connection of the fixed contactors
– check that no foreign bodies, such as bits of packing, have got into the moving parts
– check that the value of the power supply voltage of the circuits is between 85% and 110% of the rated auxiliary voltage of the apparatus
– check that the contactor vacuum interrupter has not been damaged due to accidental impacts. In case of doubt, carry out the check indicated in paragraph 7.2 Table 4.
– make sure that all the barriers and protective shields are correctly installed
– carry out the inspections indicated in table 3.

On completion of the operations indicated, check that everything is put back in its original position.

The check can only be considered as passed if all the tests indicated have had a positive outcome.
In the case of a negative check, do not put the apparatus into service and, if necessary, contact ABB Service.

TABLE 3

Item inspected	Procedure	Positive check
1 Insulation resistance.	Medium voltage circuit With a 2500 V megger, measure the insulation resistance between the phases and the exposed conductive part of the circuit.	The insulation resistance should be at least 50 Mohm and in any case constant over time.
2 Drive. Open/closed indicator, operation counter (if provided)	Carry out a few closing and opening operations of the contactor.	Operations and signals normal.
3 Auxiliary circuits.	Check that the connections to the control circuits are correct: proceed with the relative power supply.	Operations and signals normal.
	With the contactor open, check that the thickness between the body of the contact and the stem is 1 mm.	Tighten the fixing screws.



6.2. Racking the contactor in and out

- **Should operations be carried out with the contactor racked-out of the switchgear, pay great attention to the moving parts.**
- **The contactor must only be racked into the unit in the open position. Racking-in and racking-out must be gradual to avoid shocks which might deform the mechanical interlocks.**

Operations in ABB enclosure

In the instructions given below, an ABB circuit-breaker is shown.

The instructions are, in any case, also valid for V-Contact VSC/P contactors.

a) Racking-in operation

(1) Passing from contactor racked-out to the "isolated" position

– lift the apparatus (2) (fig. 11a) and rest it on the handling truck (1) (fig. 11a) following the instructions given in par. 3.2. "Handling the contactor with a crane";
– open the compartment door;
– move the truck close to the switchgear (fig. 11a)
– insert the hooking bracket (4) (fig. 11b - c), and lock the wheels (3) (fig. 11a);
– release the contactor from the truck by moving the two handles (5) (fig. 11d) at the same time towards the median axis of the contactor and simultaneously progressively push towards the back of the module by means of the contactor, until the contactor locks with the handles (5) (fig. 11e) which click sideways inserting themselves into the slots (6) (fig. 11b);
– unlock the wheels (3) (fig. 11a), lift the hooking bracket (4) (fig. 11f) and move the truck away from the switchgear.

Make sure that the handles have clicked sideways (horizontal locks of the truck racked into the enclosure).

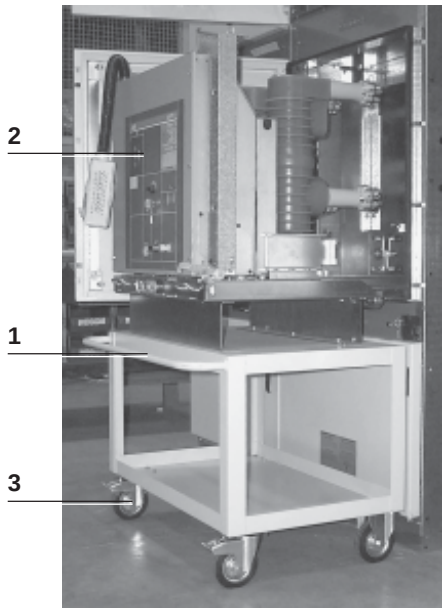


Fig. 11a

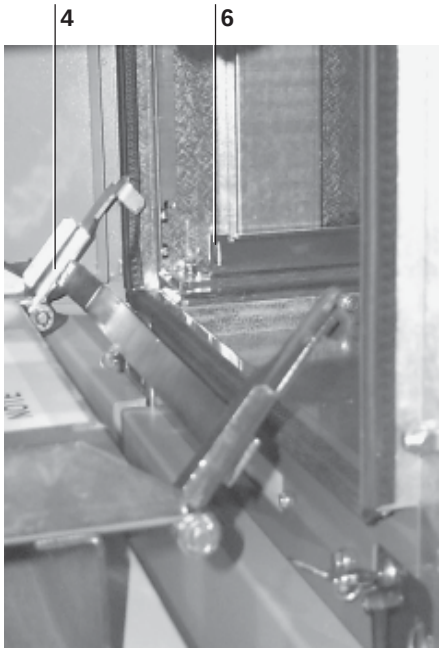


Fig. 11b

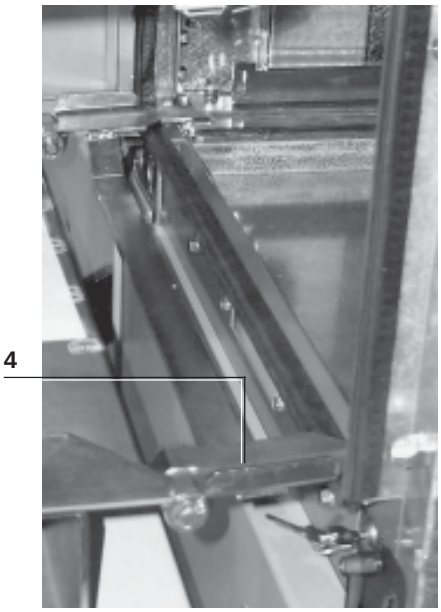


Fig. 11c

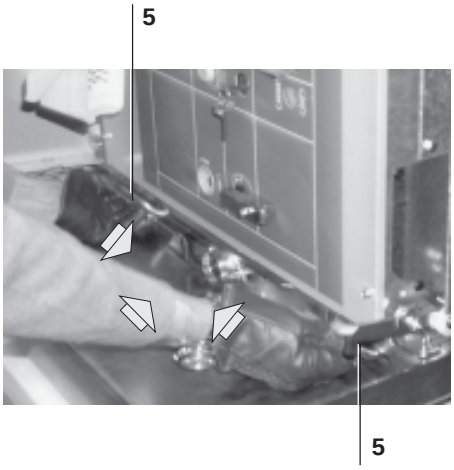


Fig. 11d

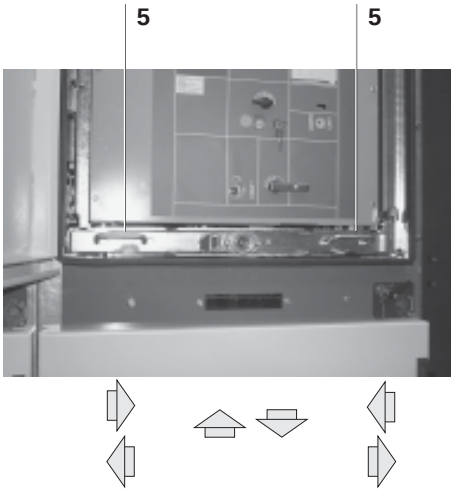


Fig. 11e

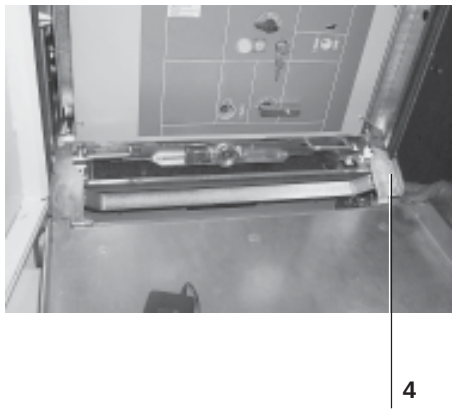


Fig. 11f

(2) Passing from the “isolated” to the “isolated for test” position (connection of the auxiliaries)”.

– Insert and hook up the mobile connector (1) (fig. 13) in the fixed socket of the enclosure (2) (fig. 12).

Make sure that the lever (3) (fig. 11) is fully pressed against the connector (1) (fig. 11).

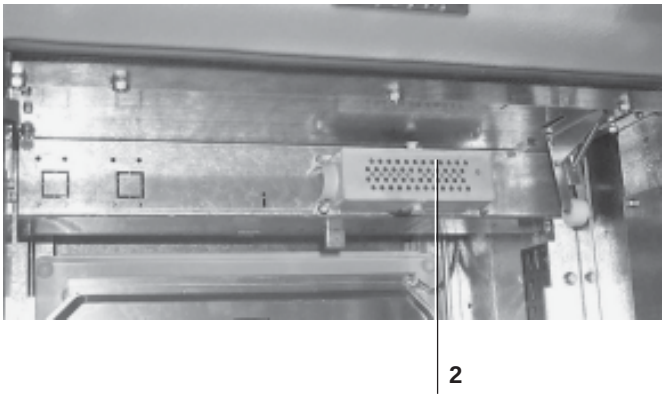


Fig. 12

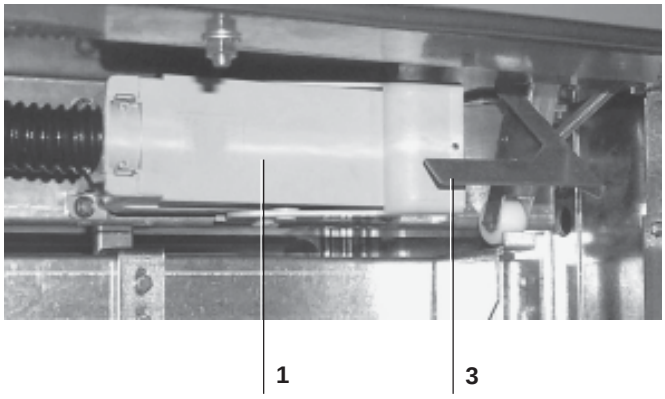


Fig. 13

(3) Passing from the “isolated for test” to the “racked-in” position (with earthing switch closed) (fig. 14).

– close the compartment door (1) by pushing the handle downwards;

– close the feeder compartment door (2) by pushing the handle downwards;

– check that:

• the locking magnet of the earthing switch (if provided) is supplied;

• the key locks (7-8-9), if foreseen, are deactivated;

– insert the operating lever (13) in the seat of the earthing switch, making the protrusion (12) coincide with one of the two slots (11);

– open the earthing switch by turning the operating lever anti-clockwise (13);

– remove the operating lever (13) from the earthing switch seat;

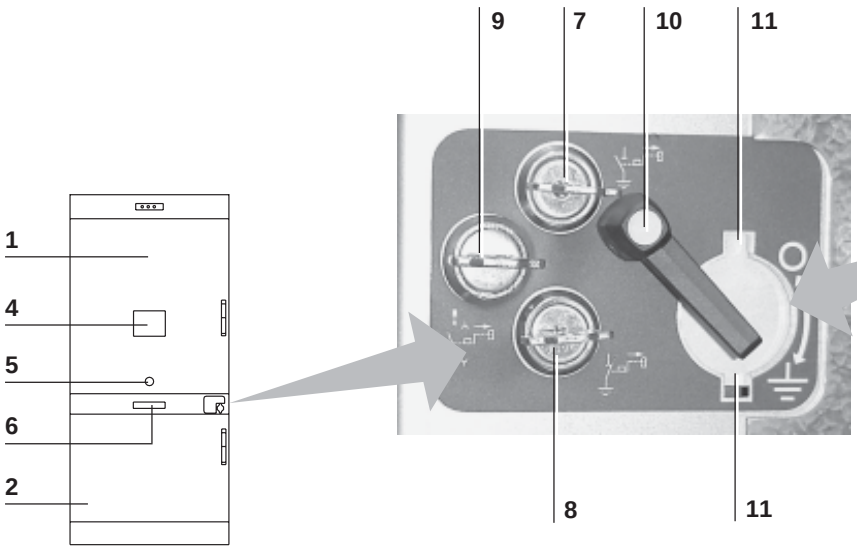
Check that the feeder compartment door (2) is locked.

– close the shutter of the operating seat of the ST turning the actuator (10) clockwise. This operation releases the contactor and a prevention lock against insertion of the operating lever into the earthing switch is activated;
– check that the locking magnet on the contactor truck (if provided) is supplied with power and check that the key lock on racking-in (if provided) is de-activated;
– fully insert the truck racking-in lever (3) (fig. 15) in the corresponding coupling (5) and turn it clockwise until the contactor is completely racked-in;
– through the inspection window (4) check that the contactor is racked-in.

b) Racking-out operation (only with contactor open)

(1) Passing from the “racked-in” position to the “isolated for test” position (with contactor open) (fig. 14)

– through the inspection window (4) check that the contactor is open (indicator in position “O”);
– fully insert the racking-in/out lever of the truck (3) fig. 15 in the corresponding coupling (5) and turn it anti-clockwise until the contactor stops;
– open the shutter of the ST operating seat by turning the actuator (10) anti-clockwise;
– insert the operating lever (13) in the seat of the earthing switch, making the protrusion (12) coincide with one of the two slots (11);
– close the earthing switch by turning the operating lever clockwise;
– remove the operating lever (13) from the earthing switch seat;
– check that the position indicator of the earthing switch indicates that it is closed “I” on the operating seat (14 - fig. 14a) and through the inspection window (6);
– open the contactor compartment door (1) by pulling the handle upwards.



Caption to the key locks of the earthing switch

7 lock with earthing switch open
8 lock with earthing switch closed
9 lock on contactor racking-in.

Fig. 14

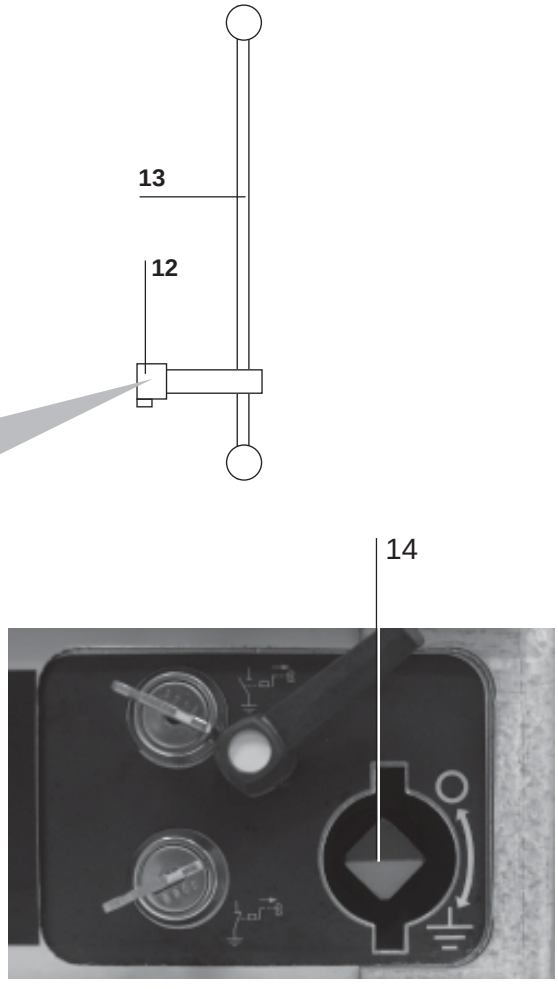


Fig. 14a

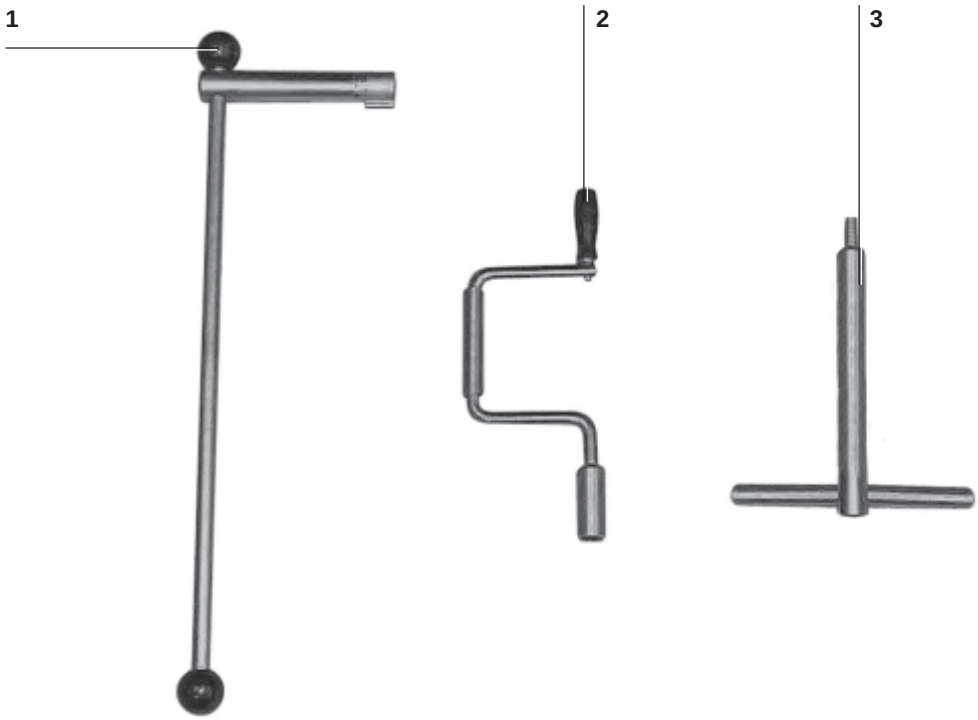
(2) Passing from the “isolated for test” to the “isolated” position (disconnection of the auxiliaries)

– release the mobile connector (1) (fig. 13) and remove it from the fixed socket of the enclosure (2) (fig. 12);

(3) Passing from the “isolated” to the “racked-out” position

– bring the truck close to the switchgear;
– insert the hooking bracket (4) (fig. 11b - c) and lock the wheels (3) (fig. 11a);
– move the two handles (5) (fig. 11d) at the same time towards the median axis of the contactor, and simultaneously pull the contactor progressively towards the outside on the truck by means of the handles;
– let go of the handles and continue extraction until the contactor locks with the handles (fig. 11a) which click sideways locking the contactor on the truck.
– unlock the wheels (3) (fig. 15a) and lift the hooking bracket (4) (fig. 15f);
– lift the hooking bracket (4) (fig. 15f) and move the truck away from the switchgear.

6.3. Accessories and tools for the operations



Caption

1 Operating lever of the earthing switches
2 Contactor racking-in/out lever
3 Tool for manual emergency opening operation

Fig. 15

7. Maintenance

Maintenance operations are aimed at ensuring trouble-free operation of the apparatus for the longest possible time. The following operations must be carried out in accordance with the IEC 61208/DIN 31051 Standards:

Inspection: Assessment of the actual conditions

Servicing: Measures to be taken to maintain the specified conditions

Repairs: Measures to be taken to restore the specified conditions.

7.1. General

- **Maintenance must be carried out by ABB personnel or by suitably qualified customer personnel with in-depth knowledge of the apparatus and of the installation (IEC 60694, CEI EN 60694 par. 10.4.2.).**
  Should maintenance be carried out by the customer's personnel, responsibility for the interventions lies with the customer.
- **Before carrying out any maintenance operation, always check that the apparatus is in the open position.**
- **Check that the medium voltage and auxiliary power supply are turned off. Maintenance of the apparatus must only be carried out with the contactor without power supply and racked out of the enclosure compartment and with the capacitor suitably discharged.**

Notes

The following rules must be respected for all maintenance operations:
– the relative specifications indicated in the "Standards and specifications" chapter;
– the regulations for safety in the workplace indicated in the "Putting into service and running" chapter;
– the regulations and specifications in the country of installation.

It is good practice to keep a maintenance card and a service book where all the operations carried out can be noted down in detail, together with the date, description of the anomaly and the references of data needed to identify the apparatus, etc. (see chapter 2).
Experience gained in use of the apparatus will allow the optimal time intervals for interventions to be established. In any case, inspection of the apparatus not more than one year after it has been put into service is recommended.
In case of need and for further details, please refer to what is prescribed in article 10.4.2 of the Standard (CEI EN 60694).
In any case, for any problems, please do not hesitate to contact us.

7.2. Inspection

– Carry out regular inspections to check that the interruption devices are in good condition.
– The checks must include a visual inspection to find any contamination, traces of corrosion or electrical discharge phenomena (according to what is prescribed in table 4 (see next page).
– When there are unusual service conditions (including adverse climatic conditions) and/or in the case of environmental pollution (e.g. heavy contamination or an atmosphere with aggressive agents), the frequency of inspections must be increased.
– Visual examination of the main contacts. The contact areas must be cleaned if there are signs of overheating (discoloured surface) (also see the paragraph on "Repairs").

If any anomalous conditions are found, appropriate maintenance measures must be taken (see the "Servicing" paragraph).

TABLE 4

Item to be inspected	Interval	Operation to be carried out
1 Insulating parts.	1 year or 50,000 operations.	Visual inspection of the insulating parts. The insulating parts must be free of any accumulation of dust, humidity, dirt (clean), cracks, traces of surface discharges or damage.
2 Structure.	1 year or 50,000 operations.	Visual inspection of the structure and mechanisms. The components must be free of any deformation, accumulation of dust, dirt or damage. The screws, nuts and bolts must be correctly tightened. Avoid touching the ceramic surface.
3 Interrupter.	1 year or 50,000 operations.	Check that the interrupter is free of accumulation of dust, dirt (clean), cracks (replace), traces of surface discharges or damage.
	In case of accidental impacts.	Carry out a voltage test with the contacts open at 15 kV - 50 Hz for one minute. If there is a discharge during the test, the interrupter must be replaced because this type of phenomenon corresponds to deterioration in the degree of vacuum. In case of need, contact ABB Service.
4 Interrupter contacts.	1 year or 50,000 interruptions at the rated current.	Refer to fig. 16. The contact material vaporises from the surfaces during each interruption and condenses elsewhere inside the vacuum interrupter. This is a normal process, and is foreseen by the overrun, or by the wear tolerance. As the contacts wear, the overrun distance “M” decreases. When distance “M”, of any pole, goes below 0.5 mm with the contactor in the closed position, all the sub-assemblies must be replaced. Use a fork-shaped gauge 0.5 mm thick to carry out this measurement. **Caution! Never attempt to adjust the nuts of the vacuum interrupters for any reason whatsoever.** The overrun distance must be checked, but not adjusted.
5 Auxiliary contacts.	1 year or 50,000 operations.	Check correct operation and the signals.Check that there are no burnt or worn contacts (replace).
6 Auxiliary circuit conductors.	1 year or 50,000 operations.	Check whether any cabling straps are loose or broken and check connection tightness.Examine all the wire or cable connections to make sure that none of them are loose and that there is no overheating.
7 Visual inspection of the isolating contacts (withdrawable contactors)	5 years or 5.000 operations.	The isolating contacts must be free of any deformation or erosion. Lubricate the contact elements with 5RX Moly type grease.

7.3. Servicing

Carry out the checks described below.

Item to be serviced	Interval	Operation to be carried out
1 Contactor.	2 years or 100,000 operations.	Carry out five mechanical closing and opening operations. The contactor must operate regularly without stopping in intermediate positions.
2 Contactor springs.	2 years or 100,000 operations.	Check integrity of the springs.
3 Power connections.	2 years or 100,000 operations.	Check tightness: M8 bolt = 19 Nm; M10 bolt = 33 Nm. Check there are no traces of overheating or oxidation.
4 Earthing contact (fixed contactors).	2 years or 100,000 operations.	Check tightness of the connections.
5 Insulation resistance.	2 years or 100,000 operations.	See par. 6.1.
6 Racked-in/isolated auxiliary contacts in the truck.	2 years or 100,000 operations.	Check that the signals are correct.

Furthermore the following is recommended:
– replacement of the interrupters after 250,000 operations;
– replacement of the auxiliary contacts after 300,000 operations.

7.4. Servicing following a short-circuit or overload

General

It is foreseen that the VSC contactor be protected by power fuses and/or by a circuit-breaker. In any case, the value of a short-circuit can exceed the threshold of damage to the vacuum bottles.

After interruption of a short-circuit at the maximum rated MVA of the contactor, put the cause of the fault right, inspect all the apparatus and carry out the repairs or replacements necessary before putting the apparatus back into service.

Make sure that all the spare parts (when required) are suitable for the application.

In case of any doubts, please contact ABB.

Have a complete check of the contactor carried out by ABB personnel after 1,000,000 operations or 10 years of operation.
Contact ABB Service Assistance.

Vacuum interrupters

A dielectric test by itself cannot be confirmation that the interrupters have to be put back into service after a fault. However, if there is no physical sign of stress and if the distance M exceeds a minimum of 0.5 mm, the interrupters can be tested dielectrically as mentioned in point 3 of table 4.

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

Enclosures

External evidence of deformation of the enclosure is usually indicative of damage inside it. Extensive damage will require replacement of the enclosure parts and of the apparatus contained in it.

Terminals and internal conductors

Replace the damaged parts which show discolouration, melting or damage caused by electric arcs. Pay special attention to the moving parts.

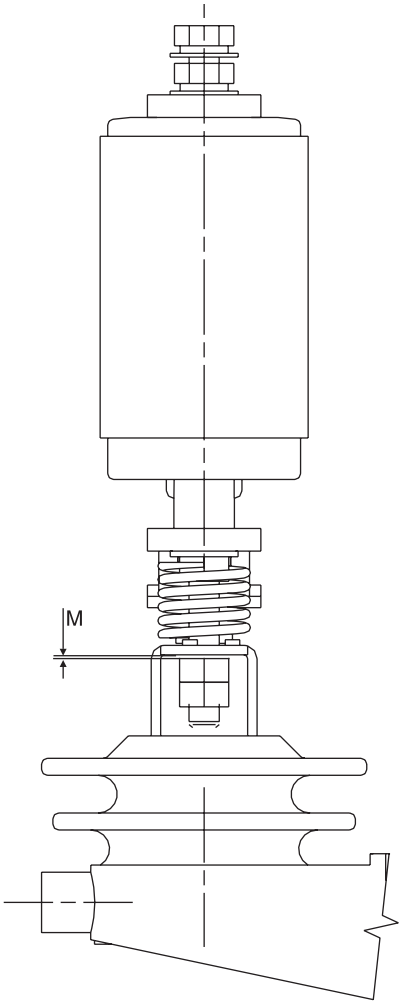


Fig. 16

	VSC 7.2	VSC 12
M [mm]	1.5 - 2	1.3 ... 1.7

Carry out the “Checking” procedures indicated in par. 6. of this manual before putting the apparatus back into service..

7.5. Repairs

Replacement with spare parts and accessories must only be carried out by ABB personnel or by suitably qualified personnel with appropriate training.

All the power supply sources must be turned off and the capacitor must be discharged.

Always work with the contactor open, with the work area insulated and made safe.

Should maintenance be carried out by the customer’s personnel, responsibility for the interventions lies with the customer.

7.6. Instructions for dismantling and replacing fuses

7.6.1. General

- **All the operations described below must be carried out by suitably qualified personnel with in-depth knowledge of the apparatus.**
- **Do not rack the contactor out unless the enclosure is securely fixed in the switchgear or to a stable base.**
- **Check that the contactor is open before proceeding with isolation and its racking-out from the enclosure.**
- **Check that the contactor is open before proceeding with replacement of the fuses.**
- **The withdrawable contactor is not preset for housing fuses of CMF/BS and CEF/BS type.**

The fuseholder is preset for installation of fuses with the dimensions and average type of striker according to DIN 43625 (1983) and BS 2692 (1975) Standards and with electrical characteristics according to IEC 282-1 (1974) Standards. The fuseholder is always fitted with an automatic opening device for a fuse blowing. This device prevents contactor closing when even a single fuse is missing.

7.6.2. Preliminary operations for fuse replacement

The contactor must be racked out of the enclosure for replacement of the fuses. The instructions for the racking-out operations are given in par. 7.7.

With the contactor racked out of the switchgear, unscrew the four fixing screws of the shield and relative DIN washers (fig. 17a) and position it as in fig. 17b. For 12 kV contactors, remove protection (2) and proceed to replace the fuses according to the instructions given in par. 7.7.

Fig. 17a

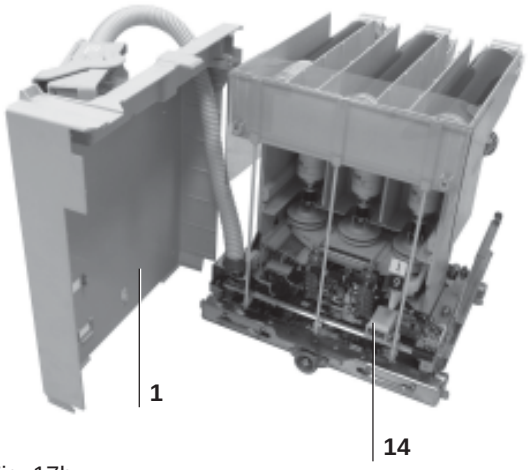


Fig. 17b

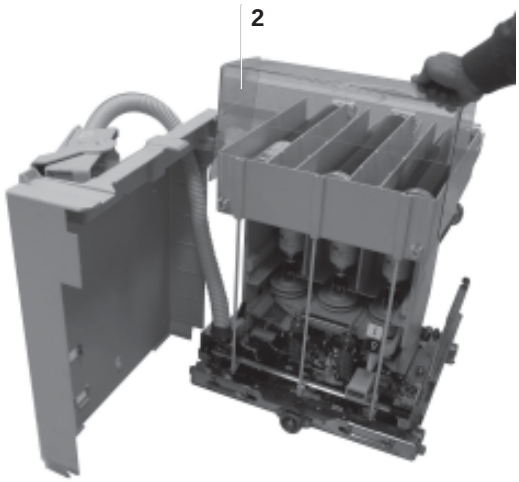


Fig. 17c

Fig. 17d

7.7. Replacement of the contactor fuses

Check that the rated normal current of the fuses to be installed corresponds with the value indicated on the nameplate on the rear of the fuseholder.

Fuses according to DIN Standards

a) Mounting the adapters (fig. 18a)

The fuseholder is designed to take fuses with a length of 442 mm. For smaller sizes, two adapters are required:

– Adapter (45) for fuses with a length of 192 mm (A)

– Adapter (46) for fuses with a length of 292 mm (B).

Select the type of adapter in relation to the type of fuse to be used, and insert it fully over the fuse contact, opposite to the one of the striker. Tighten the steel band (47) and fully tighten the screw (48). To dismantle, proceed in reverse order.

The same instructions are given in the Kit sheet put in the adapter packing.

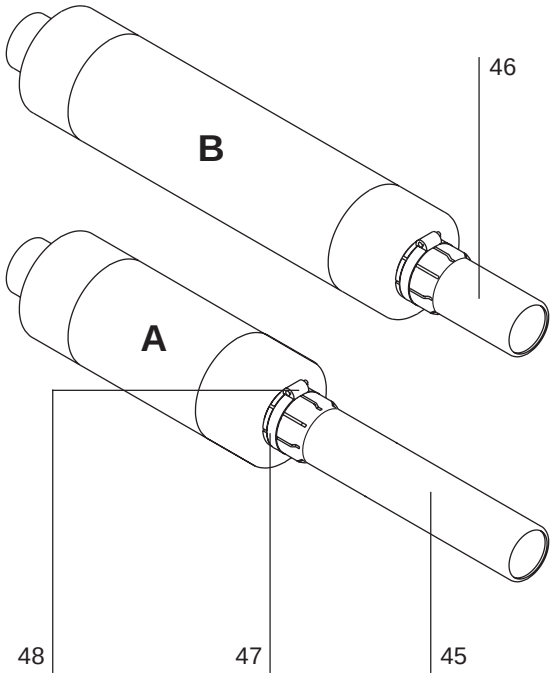


Fig. 18a

b) Dismantling the fuses (fig. 18b)

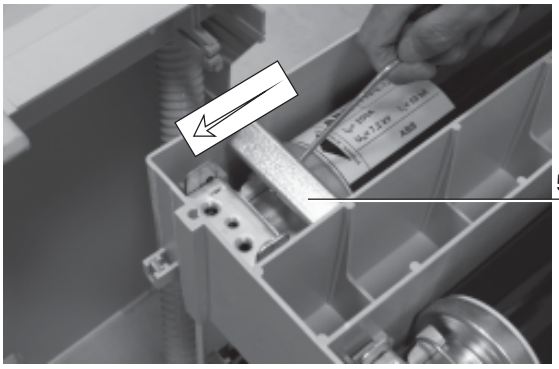
Open the locking rings (49) (fig. 18b) moving them in the direction shown by the arrows using the tool (50), and remove the fuse using the special tool (50).

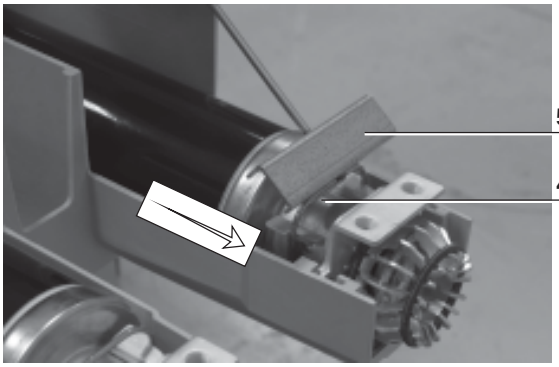
c) Mounting the fuses (fig. 18c)

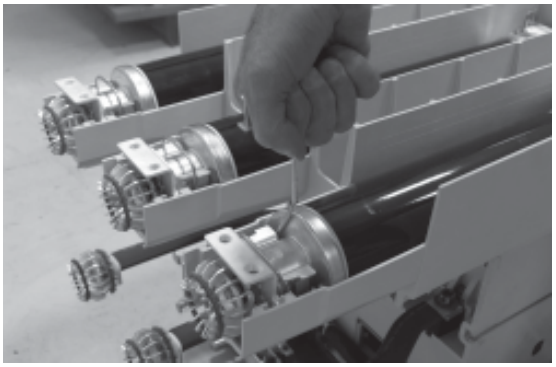
Open the locking rings (49) moving them in the direction shown by the arrows using the tool (50 fig. 18b), fully insert the fuses with the contacts fitted with striker on the opposite side to the isolating contacts of the contactor. Close the locking rings again, moving them in the opposite direction to the opening one.

Fuses according to BS Standards

- **Check that the rated normal current of the fuses to be installed corresponds with the value indicated on the nameplate on the rear of the fuseholder.**
- **When tightening the screws, do not force the connections (25 Nm maximum tightening torque).**
- **Fuse mounting and dismantling must only be done with the adapter (if required) already mounted on it.**
- **Only use the material specified, provided by ABB, for assembly.**







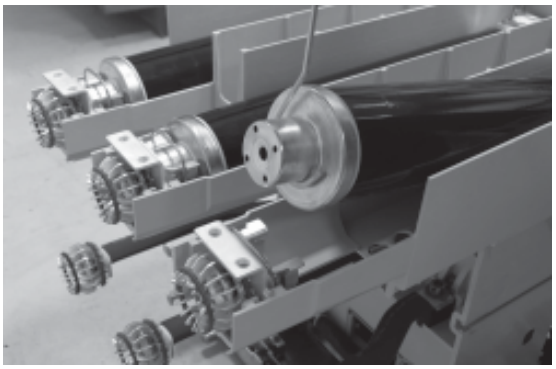
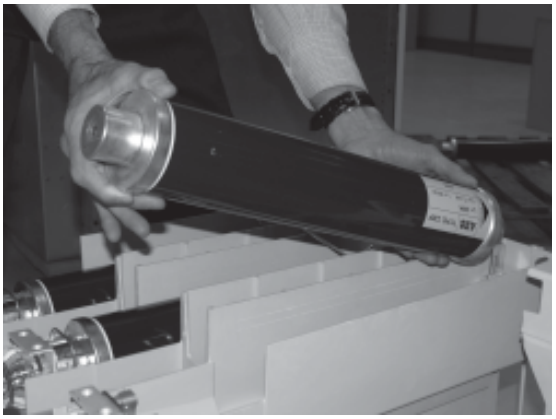
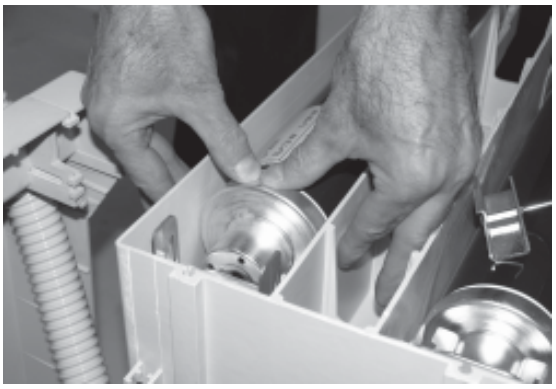


Fig. 18b





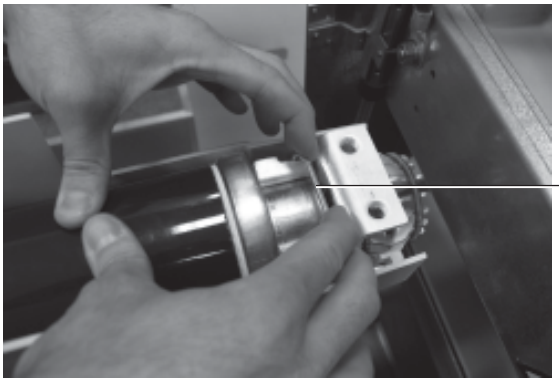


Fig. 18c

a) Mounting the adapters (fig. 19a)

The fuseholder (32) (fig. 19b) is preset to take fuses with fixing centre distance of 553 mm. For smaller sizes, three adapters are needed, as indicated below:

– adapter (51) for fuses with fixing centre distance l = 235 mm
– adapter (52) for fuses with fixing centre distance l = 305 mm
– adapter (53) for fuses with fixing centre distance l = 454 mm.

Select the type of adapter, fix it onto the fuse on the striker side by means of the grub screws (54), the cup springs (55) and the short nuts (58). Mount the adapter with the extension, with the cap facing the striker.

The same instructions are given in the Kit sheet put in the adapter packing.

⚠ **Only position the grub screws (54) as shown in the drawing.**

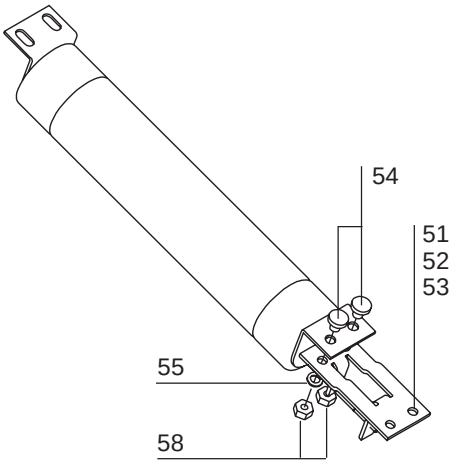


Fig. 19a

b) Mounting the fuses (fig. 19b)

Mount the fuses or the adapter (preassembled as indicated in par. a) with the striker, (indicated by the arrow) facing the opposite side to the one of the contactor tulips and fix them by means of the screws (56) and the spring washers (57).

c) Dismantling the fuses

To dismantle the fuses and relative adapters, proceed in reverse order to par. b) and a).

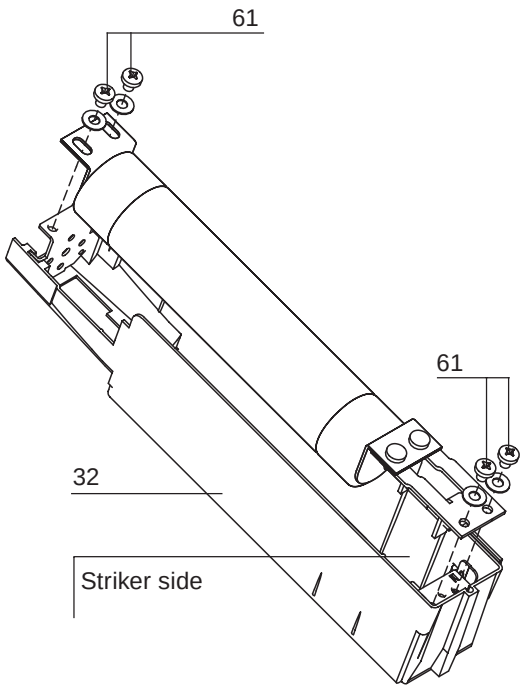


Fig. 19b

7.8. Mounting and dismantling the short-circuit busbar (fig. 20)

a) Mounting

Mount the busbar with the feeler pin (60) on the opposite side to that of the tulips and fix it with the screws (61).

b) Dismantling

To dismantle, proceed in reverse order.

The same instructions are given in the Kit sheet put in the short-circuit busbar packing.

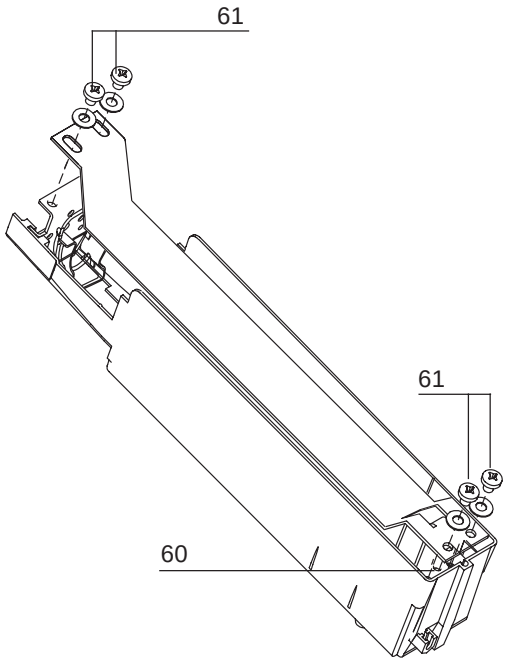


Fig. 20

7.9. Putting the contactor back into service

7.9.1. Mounting the shield and insulating guard (fig. 14)

Reposition the protection (1) (fig. 17b), repeating the operations indicated in par. 7.6.2. in reverse order.

Remount the shield. Check that the impulse counter (14) (fig. 17c) inserts itself into the special seat (69) (fig. 17d) and fix the shield with the screws (70) and DIN washers (71) (fig.17a).

7.9.2. Checking apparatus functions

Rack the contactor into the enclosure, working as indicated in par. 6.

In the “isolated for test” position, check the correctness and functionality of the contactor “open/closed” signalling by carrying out a few operations.

8. Spare parts and accessories

To order contactor spare parts/accessories, refer to technical catalogue 1VCP000165 and always state the following:

– type of contactor
– rated voltage of the contactor
– rated normal current of the contactor
– serial number of the contactor
– rated voltage and frequency of any electrical spare parts.

For availability and to order spare parts, please contact ABB Service.

8.1. List of spare parts

– Vacuum interrupter assembly (replacement to be carried out by ABB)
– Electronic feeder
– Auxiliary contacts (5 normally open and/or 5 normally closed)
– Capacitor
– Interfacing shaft (only fixed contactors)
– 12 kV insulation shields (only fixed contactors)
– Drive assembly (replacement to be carried out by ABB).
– Operation counter
– Fuses
– Adapters for fuses
– Fuseholder (replacement to be carried out by ABB)
– Isolating contacts
– Locking magnet in the truck
– Microswitches.

1VCD600192 - Rev. B, en - Instruction Manual - 2005.12 (V-Contact VSC - VSC/P)

ABB Power Technologies S.p.A.
Unità Operativa Sace
Via Friuli, 4
I-24044 Dalmine
Tel: +39 035 395111
Fax: +39 035 395874
E-mail: sacetms.tipm@it.abb.com
Internet://www.abb.com

ABB Calor Emag Mittelspannung GmbH
Oberhausener Strasse 33 Petzower Strasse 8
D-40472 Ratingen D-14542 Glindow
Phone: +49(0)2102/12-1230, Fax: +49(0)2102/12-1916
E-mail: calor.info@de.abb.com
Internet:http://www.abb.de/calor