Guidelines for inspection and maintenance of main circuit contacts

ABB A-line and EH series Contactors

Contents

Mechanical wear

The number of mechanical operations has a low impact on the life of the main contacts and their overall electrical life. However general information concerning mechanical wear could be of interest.

AC-Hum

Pollution of the magnet pole surfaces will create a slight hum coming from the contactor in the closed position.
When cleaning, use a soft and dry piece of cloth.
Hum can also occur if the pole surfaces are deformed.
A louder hum will occur if the shading coil is broken because the magnet will cause the contactor to chatter.
If so the contactor needs to be exchanged.

Another reason for AC-hum could be corrosion caused by environmental conditions that exceed the contactor specifications.

Contactors need to be protected from condensation in order to keep the pole surfaces of the magnet free from corrosion.
For more specific information regarding this please see the our technical catalogue, section: *Climatic withstand of devices.*

Contact bounce

The operational limit of the contactor is between 85 and 110% of the rated coil voltage.
A voltage variation of ± 5% will minimize the contact wear. The reason for this is that higher voltages will increase the speed of the electromagnet at closing. Lower voltages will decrease the speed at closing. Both these factors can lead to a higher level of contact bounce at closing. High voltage and the increased speed at closing also contribute to some increased sound level.

Maintenance of Contacts

A contact is not necessarily damaged or worn out, just because the surface is rough and discolored. The contacts in the figure below may look rather inferior but experience has shown that they are better than a new set of contacts.
This is because they are ”electrically seated” and make good contact over the entire surface.
Based on this it would be completely wrong to change a contact only by judging from the appearance of the surface.

Filing of contacts

Today, with highly developed contact materials and high performance contactors, filing, grinding, or other attempts to restore contacts or contact surfaces should be avoided.
Our experience shows that this increases the risk of causing other problems. For example the risk of increasing the contacts resistance is high due to remnants from grinding paper, etc.

Also lack of cleanliness when attempting to restore the contacts can influence the contactor performance.

Maintenance should be limited to inspection of the contacts for the level of contact wear. This is to ensure a trouble free operation of the contactor until the next service is required.
At the same time observations can be made to judge if the contactor operates well in the application and that no signs of abnormal wear or damages are present on the contacts.

The appearance of contacts after a very low number of operation in an AC-3 application.

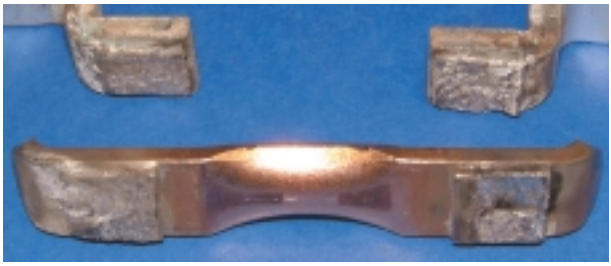
A contact just having reached a ‘good worn in’ level in an AC-3 application.

Interpreting levels of electrical contact wear

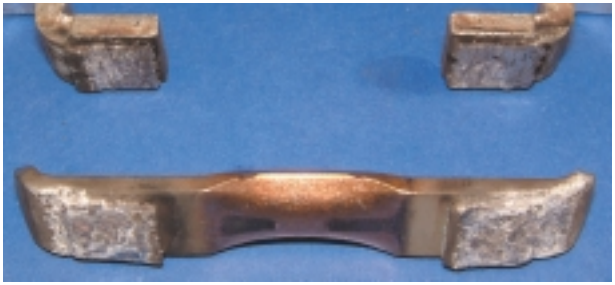
Determining the level of wear on contactors in use is essential from both the functional and economical point of view. Premature service on contactors will increase the overall cost. However, service at the right time to avoid interruptions or breakdowns is more cost effective.

General

The rate of wear is different depending of the utilization category or the application of the contactor. For motor control it also depends on the selected starting method. The following main utilization categories are the most common.



Early stage of fixed and movable contacts in an AC-3 application.



Mid-life stage of fixed and movable contacts in an AC-3 application

End of life of fixed and movable contacts in an AC-3 application

AC-1. (General purpose) Non-inductive or slightly inductive loads, resistance furnaces.

The closing of the main contacts is relatively easy as the starting current is equivalent to the rated current of the load. Breaking is made at full voltage, the arc has a rather low level of energy.

AC-2. Slip-ring motors. Starting, switching off

Typical making and breaking is with approximately 2,5 times the rated current of the motor (Ie x 2.5) the voltage is corresponding to the nominal voltage.

AC-3. Cage motors. Starting, switching off running motors

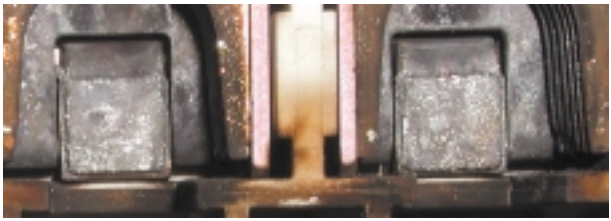
Closing of the main contacts with approximately 6 to 8 times the rated motor current, depending on motor characteristics and type of load.
Breaking is easier, as the current equals the rated motor current, and voltage is reduced to 17 % of the rated voltage.
Typical electrical wear comes from the contact making operation.
Visual inspection of an AC-3 application normally shows none or very little material from the contact tips thrown out into the arc-extinction packages.

AC 4. Cage motors. Starting, plugging, inching.

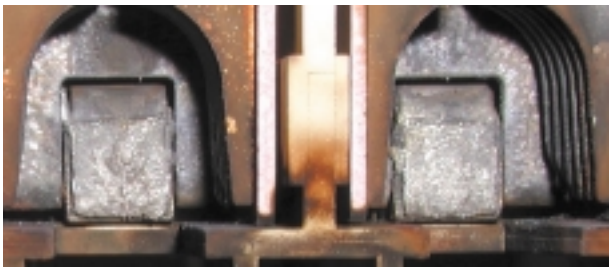
Making and breaking the motor starting current approximately 6 to 8 times the rated motor current. Voltage is not reduced and equals the rated voltage of the motor.

Both making and breaking are contributing to the contact wear. The arc-extinction packages have an important role in extinguishing the arc. Therefore material from the contact tips is in most cases thrown out in the packages. See Figure B on page 5.

Contact wear in AC 4 application, making/breaking locked rotor current



Early stage of fixed (above) and movable contacts (right), 5000 operations.



Mid-life stage of fixed (above) and movable contacts (right) 10000 operations.

End of life.

Changing Contacts

Fig. A

Fig. B

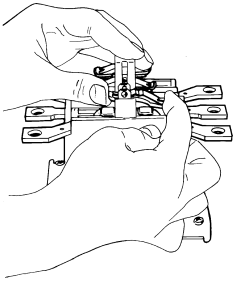
Typical appearance of contacts (Fig. A) and extinction package (Fig B) when breaking locked rotor current (LRC) in an AC-4 application.

Changing contacts on installed units.

EH/ EK Contactors

(1SFC 380002-89)

Replace all of the main contacts at the same time.



EH 100 ... 300

- Remove the arc-chute.
- Press out the moving contacts. Lift the contact somewhat to let the contact easier slide out.
- Exchange the fixed contacts.
- Put in the new moving contacts.

EH 370...800,
EK 370...1000

- Remove the arc-chute.
- Press out the moving arc contacts, see Fig. 1.
- Moving main contacts: Lift the respective clamp and press the contact into neutral position. See Fig. 2. Remove the contacts.
- Exchange the fixed contacts. See Fig. 3.
- Put in the new movable contacts.

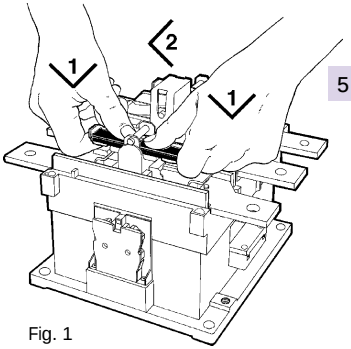


Fig. 1

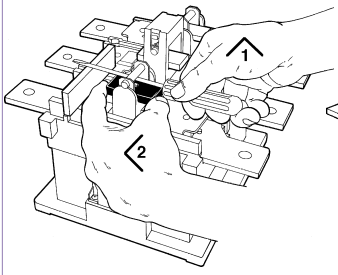


Fig. 2

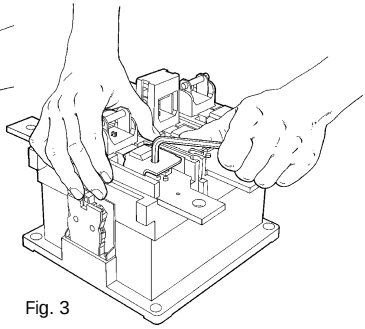


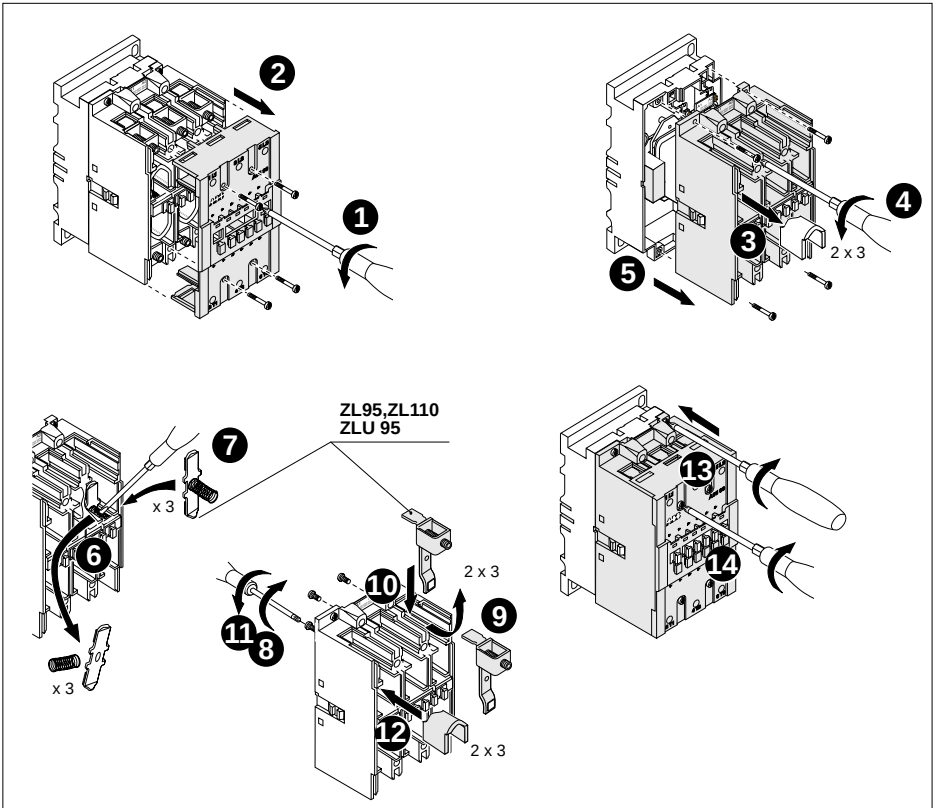
Fig. 3

A-Line Contactors – see page 6 →

Changing Contacts *(cont.)*

Changing contacts
on installed units.

A-Line Contactors, A 95-110



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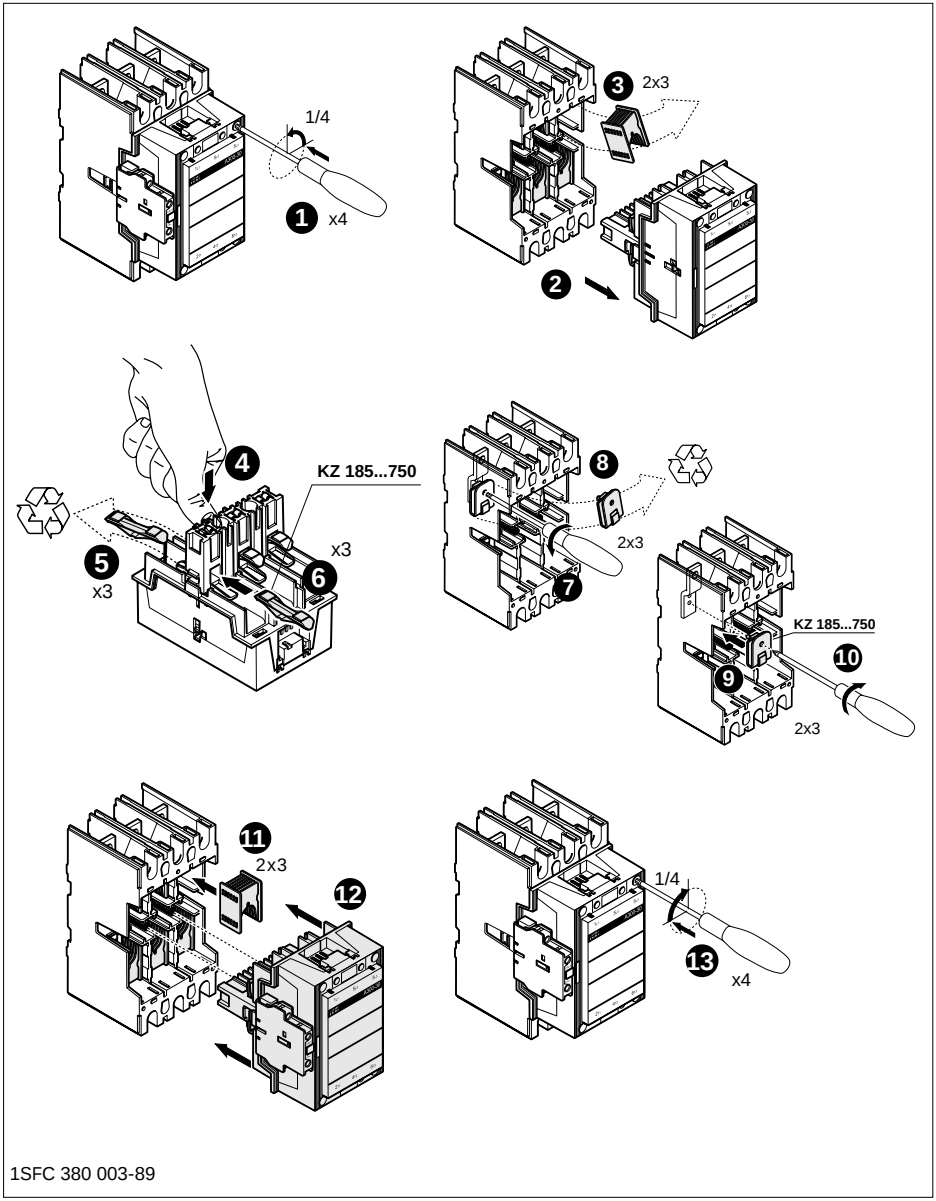
A-Line Contactors, A(F) 145 - AF 750



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Trouble shooting

Some examples of common reasons for excessive contact wear and shortened contact life:

Voltage drop during start up of the motor
Voltage drop to less than 85 % of nominal voltage for 5 to 10 ms can be enough for the contactor to start opening.
Also, other disturbances in the control voltage could be responsible for this problem.
The result of these voltage problems can be increased contact wear and also lead to welding of main contacts.

...related to different starting methods.

DIRECT ON LINE (ACROSS-THE-LINE) MOTOR STARTING
Current peaks due to heavy duty starting

- If the application requires a high level of torque during start-up, for example a fan or a pump, it is important that the contactor's making capacity and short time withstand current are capable of handling the starting current and current peak.

Restarting with motor idling

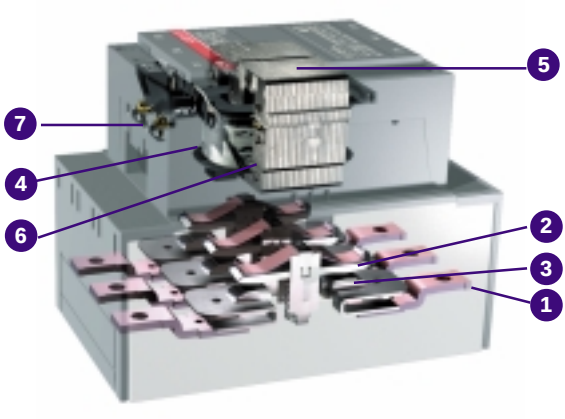
- Attempting to restart the motor before the motor has come to a full stop will cause a current peak that theoretically can reach twice the current compared to starting the motor from a standstill.
  This can result in welded contacts.

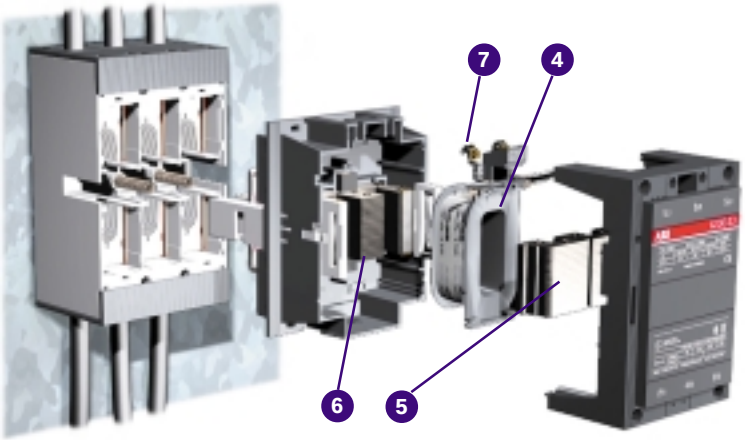
STAR DELTA (WYE-DELTA) STARTERS
Change over time between star and delta.

- Setting the change over time between star and delta too short will not allow the motor to reach 80-90% of its nominal speed. This will cause the star contactor to break a higher current than expected. If the starter stays in the star position for too long of a period; this will increase the stress of the star contactor because the star contactor is mainly sized for the short time current rating.
- The change over time between the star and delta is important. If no timer or other device is used to get an idle time between opening of the star contactor and closing of the delta contactor, there is a risk that the arc inside the star contactor could remain and create a short circuit.

If the elapsed time is too long, the motor starts to decelerate and the delta closing will create a higher current peak than expected. This can result in welded contacts.
Generally the idle time should not exceed 50 ms.

1 Terminal bar
2 Moving contact
3 Fixed contact
4 Operating coil
5 Armature
6 Core
7 Coil terminal





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