Manual

Guidelines for Contactor inspection and maintenance
ABB A/AF-line and EH/EK series Contactors

Power and productivity
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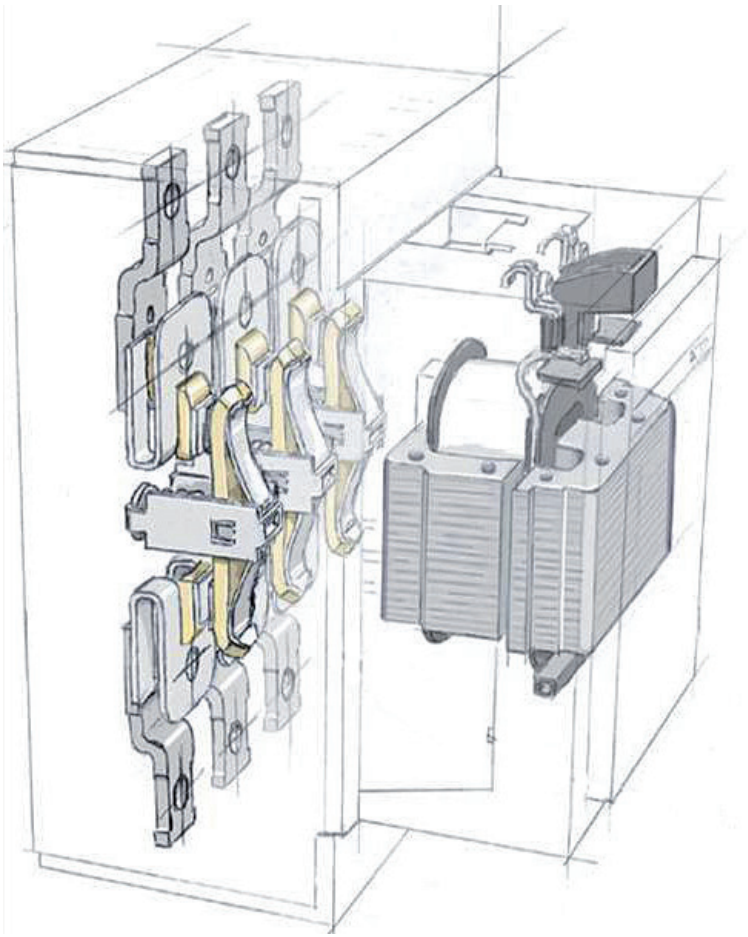
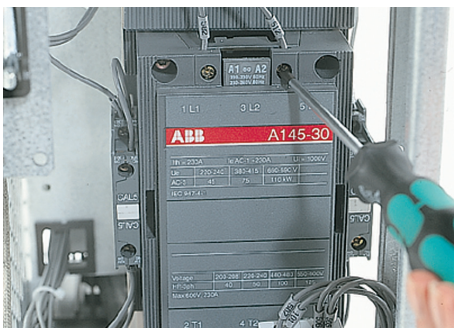
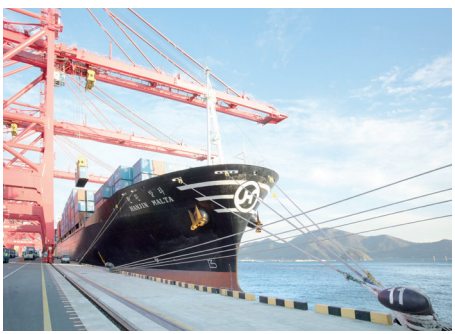
The purpose of this manual is to provide guidance for correct selection and maintenance of contactors in industrial installations to ensure a trouble free operation. This without increasing the overall cost.



Contents

Some general advice





1. Choose correctly

- Nature of the duty
- Positioning of the contactor
- Voltage and frequency
- Frequency of operation
- Safety regulations
- Electrical and mechanical stresses

2. Mounting/installation

- The instructions supplied with every contactor should be followed.
- In case of drilling in the panel make sure to protect the contactor from falling metal shavings that otherwise could lead to excessive hum or flashovers.

3. Storage and climate

Consider the immediate environment (variable temperatures, humidity, storage conditions etc).

4. Connections

Make sure the recommended torque values given in the instructions are followed and that proper torque checks depending on the application are done.

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 (does not apply to AF) is broken because the magnet will cause the contactor to chatter. If so the complete 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 our technical catalog 1SBC1001122C0202, section: General Technical Data.

Contact bounce

The operational limit of the contactor is between 85 and 110% of the rated coil voltage according to IEC60947-4-1. A voltage variation of ±5% of the above limits will increase the contact bounce that leads to increased contact wear (does not apply to AF with its electronic wide range coil). 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.

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 like bad contacts but the fact is that they are better than a new set of contacts. This is because they are ”electrically seated” and make good contact over a larger surface. Based on this it would be completely wrong to change a contact only by judging from the appearance of the surface. Also it is quite normal that the contacts in the three phases are not evenly worn and because of this all contacts both fixed and movable need to be changed. At the same time it is recommended to change the arc chutes.

Inspection of contacts

With today´s high performance contactors, filing, grinding, or other attempts to restore contacts or contact surfaces should be avoided. Our experience shows that filing and grinding increases the risk of causing other problems. For example the risk of increasing the contacts resistance is high due to scrap from this grinding and filing.

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 (see next section –Interpreting levels of electrical contact wear). 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.

1. The appearance of contacts after a very low number of operation in an AC-3 application
2. A contact just having reached a ‘good worn in’ level in an AC-3 application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Interpreting levels of electrical contact wear

General

Basically these contactors are considered maintenance free. Depending on the severity of the application contact inspection may be required. A typical severe application would involve frequent making and breaking of high currents, reversing and inching (AC4). Premature service on contactors will increase the overall cost while delayed service could cause costly interruptions or breakdowns. Service at the right time will avoid these kind of problems. The following main utilization categories are the most common ones.

AC-1.

(General purpose) Non-inductive or slightly inductive loads, resistance furnaces.
The closing of the main contacts is relatively easy as the initial 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.

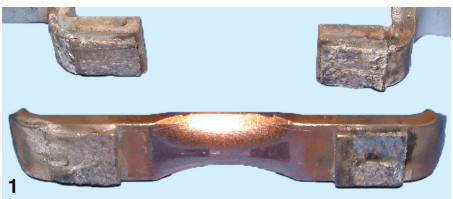
Slip-ring motors. Starting, switching off.
Typical making and breaking is with approximately 2,5 times the rated current of the motor (Ie x 2.5) the voltage is corresponding to the nominal voltage.

AC-3.

Cage motors. Starting, switching off running motors.

Closing of the main contacts with approximately 6 to 8 times (or higher with today´s high efficiency motors) 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 chutes.

1. **Early stage of fixed and movable contacts in an AC-3 application**
2. **Mid-life stage of fixed and movable contacts in an AC-3 application**
3. **End of life of fixed and movable contacts in an AC-3 application**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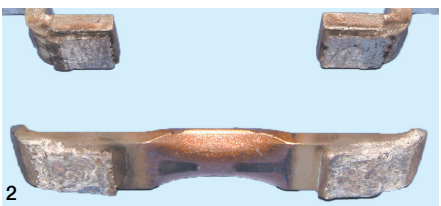
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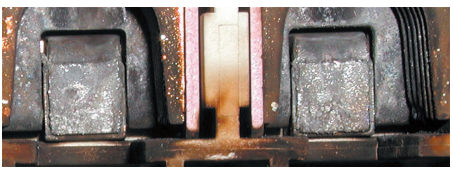
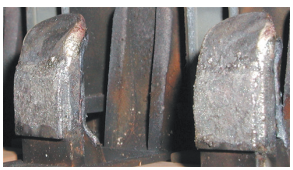
AC 4.

Cage motors. Starting, plugging, inching.

Making and breaking the motor starting current approximately 6 to 8 times (or higher with today´s high efficiency motors) 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 chutes have an important role in extinguishing the arc. Therefore material from the contact tips is in most cases thrown out in the packages. See picture B below.

1. Early stage of fixed and movable contacts, 5000 operations
2. Mid-life stage of fixed (above) and movable contacts (right) 10000 operations
3. End of life in AC-4 application
A. Typical appearance of contacts
B. Typical appearance of an arc chute





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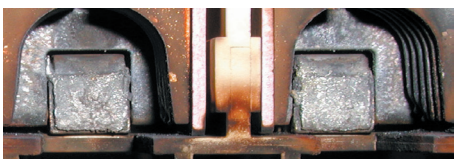

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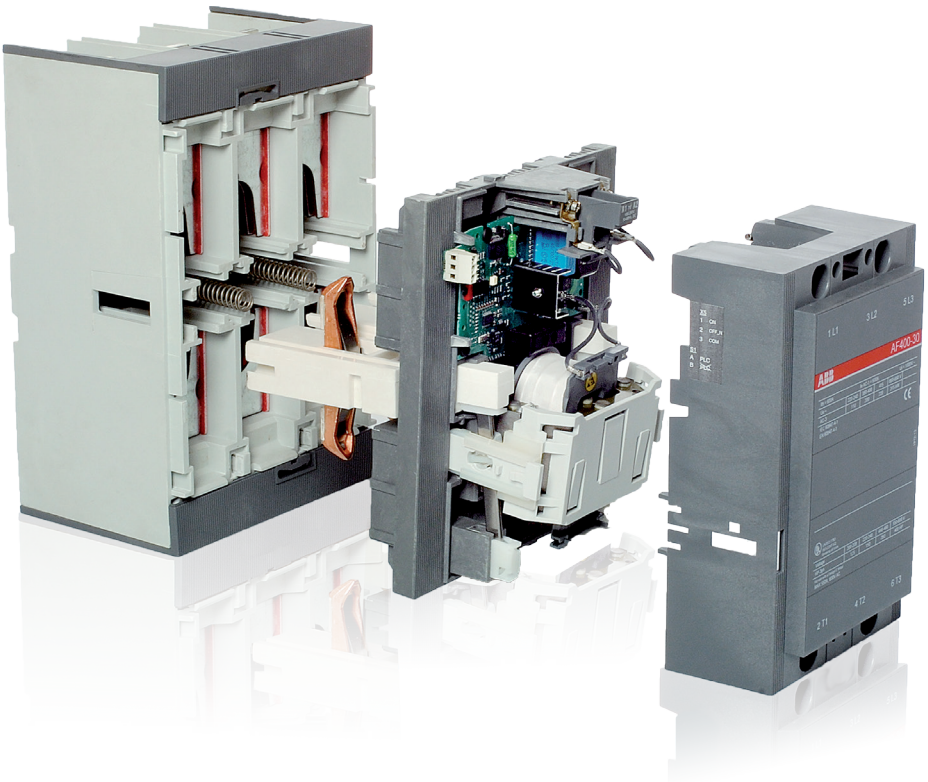
A

B

Changing main contacts, arc chutes and coils



For information on how to take the contactors apart see the instruction that comes with the contactors or go to www.abb.com/lowvoltage if instruction is not available.

Before any dismantling of the contactor: Make dead by, turning off the contactor. Opening the main circuit by turning off the main switch, if any, or by removing the main fuses in all three phases. To protect against making attempt, open also the control circuit.

When changing the AF coil with its PCB (printed circuit board) care must be taken to avoid ESD damage.

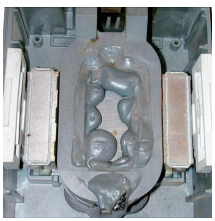
Trouble shooting
examples of common reasons for contactors not working properly

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 such as poor relay contacts or too small control transformer/power supply 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. With the AF technology these problems are avoided.

Poor voltage to coil
Control voltage less than 85% during pick up may not be enough to safely close the contactor and can cause the coil to melt due to over heating. This because the coil is designed to withstand the inrush current for a limited time only. One common reason is when the coil supply is taken from the main supply were high current is causing the voltage to drop. Too high continuous control voltage could also cause the coil to melt. See picture below for typical failure.

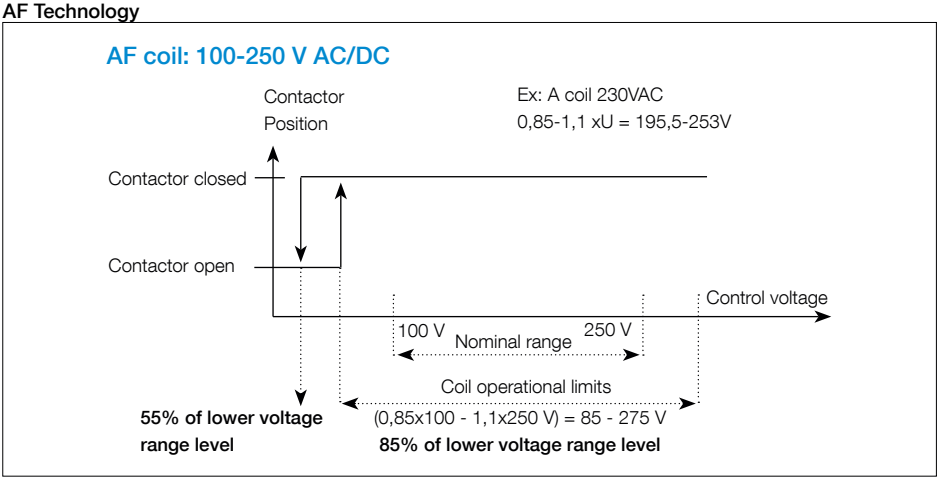
Direct on line (across-the-line) motor starting.
Current peaks used by heavy duty starting

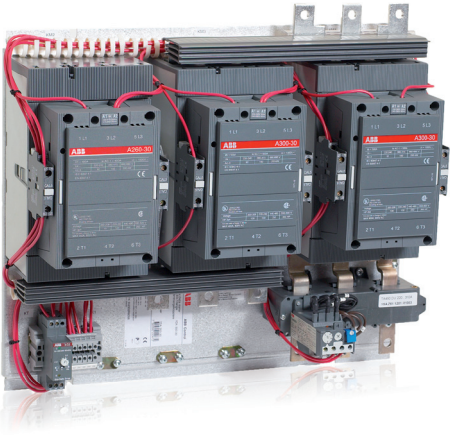
- If the application requires a high level of torque during start-up, for example a big fan or a pump, it is important that the contactor's making capacity and short time withstand current are capable of handling the starting current and current peak.

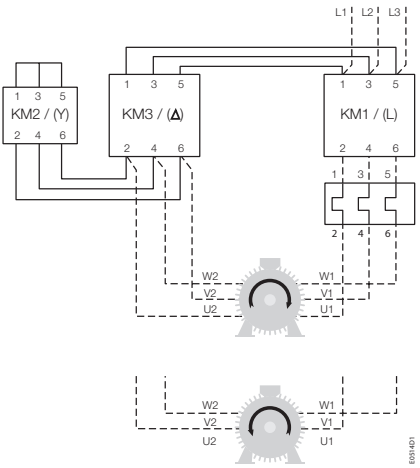


Coil failure. Melted coil due to low voltage condition

AF Technology







Restarting with motor idling

- Attempting to restart the motor before it 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. When AF is used no separate time delay is needed.

Product coordination

Lack of product coordination with fuse or breaker missing or wrongly sized can cause excessive contact wear or lead to welded contacts.

For more specific information regarding short circuit protection coordination please see our technical catalog 1SBC1001122C0202, section: General technical data.

PLC control of AF400 and above

Make sure the dip switch is in the correct position for proper operation See picture below. Position A when using PLC control and position B for conventional operation (default).

High temperature readings

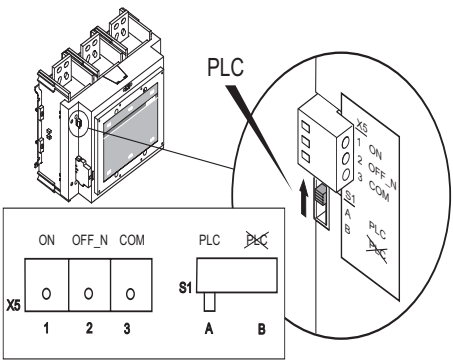
When concern of high temperatures on and around the contactor please check the following (also see picture below for max permitted temperatures).

- Make sure the connections are properly torqued.
- Make sure the cable size is what is recommended in our catalogs.
- Make sure the correct coil is selected for the applications.

Measurement of the resistance of the main contacts is not recommended since only advanced equipment can be used to get a correct reading. Due to the location of the armature the cover can reach very high temperatures (>100C). This is still within acceptable limits.

Transients affecting AF coils

Voltage peaks/transients are not uncommon especially in poor quality or weak net works. Too high voltage peaks/transients may cause damage to the AF coil. The AF coils are designed to handle certain peaks/transients and have been tested to meet relevant IEC standards.



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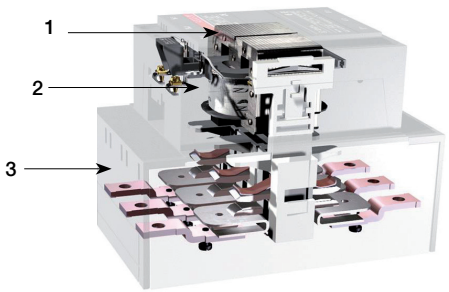


Maximum permitted temperatures

1. **Magnet: 140°C**
2. **Coil: 150°C.**
   Temp.rise 110°C (acc. to IEC 60947) + ambient temp. 40°C
3. **Connection bars: 105°C.**
   Temp.rise 65°C (acc.to IEC 60947) + ambient temp.40°C

Spare parts and warranty claims

Inspection intervals

The intervals between inspections are determined by the design and operating conditions of the contactor.

If advise is needed on a specific application please contact ABB

Spare parts

Basically these contactors are considered maintenance free. Based on reasons above occasionally there could be a need to change certain parts. Following parts are considered contactor spare parts and can be found in ABB product catalogs or on ABB web site:

- Main contact sets
- Arc chutes (recommended to be changed at the same time as the main contacts)
- Contactor coils
- Auxiliary contact blocks

Note: Use only ABB original spare parts to ensure product reliability

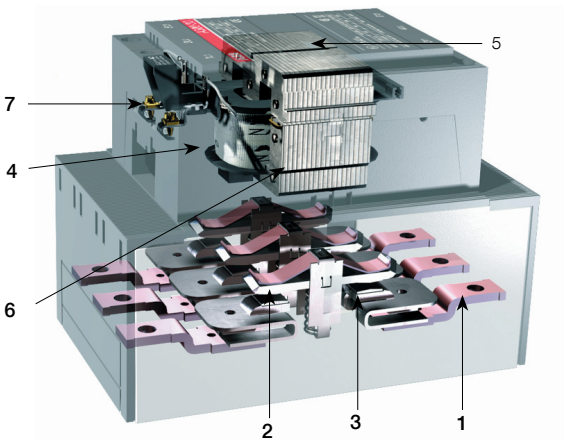
Warranty claims

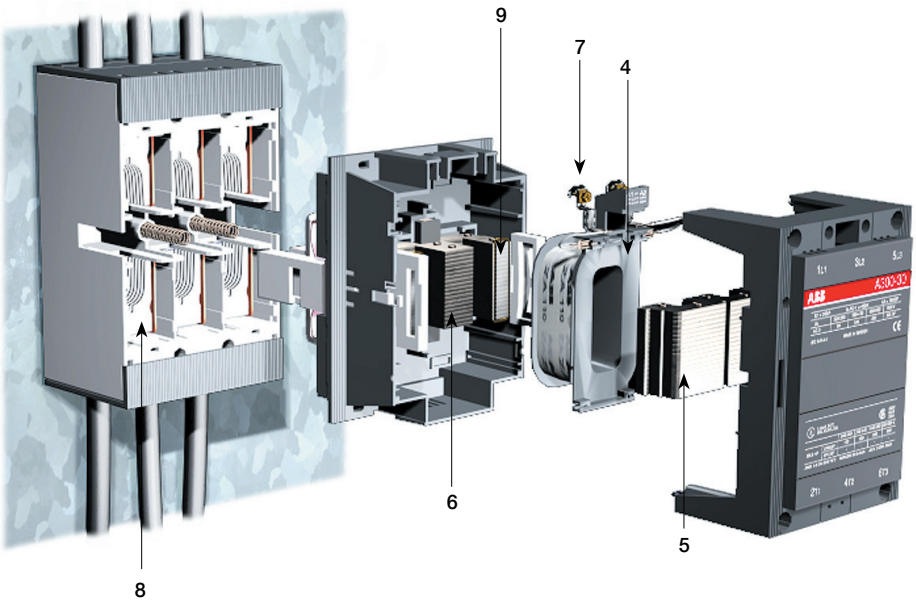
The warranty period is 12 months. In case there is a need for a warranty return please provide as much descriptive information as possible. To assist you please use the trouble shooting form available on the ABB web library. Each contactor has a date code that must be included in the claim. See picture below.

Sample from A95 and AF2050 range
03 = Year
36 = Week
S595 = Identifies the person responsible for the final approval

Contactor parts terminology

1. Terminal bar
2. Moving contact
3. Fixed contact
4. Operating coil
5. Armature
6. Core
7. Coil terminals
8. Arc chutes
9. Shading coil





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