

Welded Contacts

QUESTION: What are the possible reasons for welding of contactor main contacts?



ANSWER:

- **Speed of operation (sometimes called cycling) exceeding the specified values for the contactor.**
- **Issues in the contactor coil circuit**
- **The contactor was exposed to a short-circuit.**
- **End of electrical life of the contactor.**

When a contactor is cycled too fast the silver alloy of the contact tips will heat up and become molten and then tack-weld on the next closing which renders the contactor inoperative. So, the question becomes: what issues in the control circuit can cause excess cycling of the contactor?

Speed of operation (sometimes called cycling or operating frequency) exceeding the specified values for the contactor. Main contact(s) welding in a contactor occurs during rapid closing and opening of the main contacts. Most manufacturers publish limits to how fast a contactor can be operated (cycled). The general rule is more than one operation per minute requires further investigation. The fact is that most small contactors (less than 100 amps) can be operated more than once a minute but the conventional rule seems reasonable for further consideration.

Issues in the control circuit can cause opening and immediate reclosing of contacts; particularly in two-wire (maintain) control circuits where repetitious opening/closing often results in welded contacts.

It should be pointed out that welded contacts most often occur during the initial set-up (start-up) of the control system which may result from:

- Insufficient control power. Under sizing control power transformers for AC circuits or power supplies for DC control circuits can result in welded contacts as well as coil failures. [Please reference our on-line white paper entitled “Preventing coil Burnouts” for a detailed explanation.](#)
- Particularly when generators are the source of main power, the under sizing of the power source can lead to low voltage due to the current demand of the motor during inrush. Low voltage from the source will be transformed by the CPT to low voltage on the secondary and therefore low voltage on the control source. Measuring voltage before or after a start command does not reveal the voltage drop due to current demand during starting.
- Erratic signals from peripheral control components. Thermostats, thermistors, bouncing contacts supplied by others or incorrect PLC programming can send erratic (on and then off and repeat) signals to the coil of a contactor when connected to an automatically controlled two-wire control circuit. Even brief periods of inconsistent on and off signal (cycling) can result in coil failure and/or tack welded contacts. Some control circuits are controlled by timers like in a wye-delta or compelling two speed starters. If timers are not set properly for the application then transition times may be too short and current spikes can result in tack welded main contacts.

End of electrical life: If the installation has been functional for some time period then we have to look for other reasons for welded main contacts as follows:

- Electrical life exceeded – When the silver alloy of the contact tips are worn away (burnt off) due to long use then the copper straps may tack weld closed.
- Erratic signals from worn-out peripheral control components. Apart from the contactor reaching its end of life similarly peripheral control components can wear out over time and cause repeated on/off signals resulting in cycling the contactor. [See our white paper entitled “Contact Inspection & Replacement.”](#)

Short-circuit: Contactors that are subjected to a short-circuit can and often results in welded contacts. Contactors are not protective devices like molded case circuit breakers or fuses. Contactors are tested by UL 508 standards, which instructs that the current carrying parts may not move during a short-circuit. You will note there is no promise by UL that the contactor will emerge from a short-circuit with no damage. An abundance of black soot, some melted plastic around discolored copper terminals and straps, possible holes in the side of the plastic housing and welded main contacts can result from a short-circuit condition. Note that many of these excessive current symptoms are usually not present from welded contacts from cycling issues which makes it easier to identify the root cause. Some customers may assume that contactors with normally open contacts are supposed to fail open and this is in error. Standard contactors are not protective devices and an up-stream disconnect per NEC should be used for any maintenance since following a short-circuit the contactor may well be welded closed. Even so called safety contactors and relays with positive guided or forced guided contacts which undergo third party inspection are expected to tack-weld normally open base contacts but when this happens normally closed auxiliaries are not allowed to return to their closed state.

Many customers assume that ‘crispy or burnt’ contactors damaged from short-circuit are covered under warranty but this simply is not true. Welded contacts resulting from cycling, control source issues, short-circuit or end of electrical life of the contactor are not covered by warranty.

