

MULTI-STEP STARTERS GENERAL ELECTRIC COMPANY REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the KS-5162 and KS-5365 multi-step starters for a-c motors.

1.02 Reference shall be made to Section 020-010-711 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements listed herein.

1.03 These starters limit the initial inrush current to polyphase a-c motors and cause a time delay before the next increment of current. This process continues in steps until the motor is up to full speed on the line. The starter also provides under-voltage and overload protection. The maximum current increments and the minimum time intervals depend on local service regulations. Once the proper delay is set on the delay devices to meet the specified values, it would not ordinarily be necessary to change these adjustments.

1.04 The starters furnished prior to January 1926 were equipped with a CR2823-MC-4A type definite time delay relay and the time interlocks were held closed electrically. Starters furnished thereafter were equipped with a definite time delay relay of the CR2823-MC-9A type and the time interlocks were combined with the associated contactor and were held closed mechanically.

1.05 The a-c service shall be opened ahead of the switch before making tests or adjustments not requiring service voltage.

2. REQUIREMENTS

2.01 Operation

Note: Fig. 1 shows the circuit of a typical starter of four steps. Although other starters may have more steps or fewer steps and different wire service, the operation is similar. For reference in giving the following operating requirements for the Fig. 1 arrangement, the individual pieces of apparatus are designated numerically in their sequence of operation in starting the motor.

(a) The start switch, when closed, shall first close contactor (1) which connects the neutral points of the auto-transformer. The closing of this contactor shall close line contactor (2).

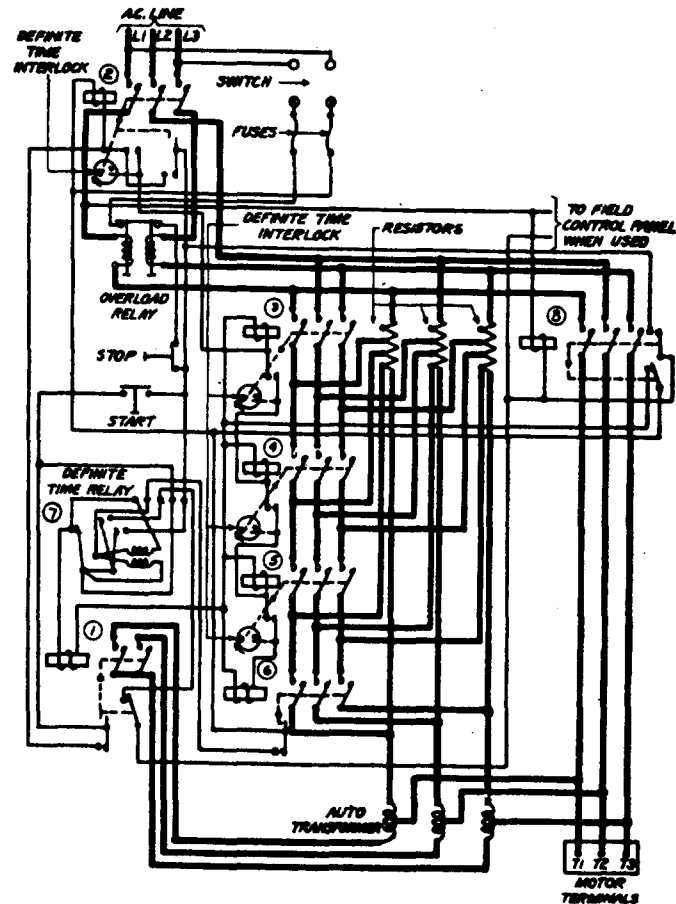


Fig. 1 - Circuit of a Multi-Step Starter

This operation shall energize the line side of the auto-transformer in series with resistances. With the proper tap connected on the transformer, the resistance shall be of such value that the initial current inrush shall not be greater than that allowed for the particular installation.

(b) At the end of not less than the time increment specified, the definite time interlock associated with the line contactor (2) shall operate and close the first accelerating contactor (3) which by-passes a sufficient amount of series resistance to permit an additional current inrush of not more than the allowed increment. After contactor (3) closes, its interlock shall operate

2.01 (Continued)

resistances. The running contactor (8) shall then close immediately and by-pass the auto-transformer coils and connect the motor directly on the line. The change over from the starting to the running side of the auto-transformer shall not cause a greater current inrush than the increment allowed.

(d) When the running contactor (8) closes, its auxiliary normally closed contact shall open the circuit through the contactor coil (3) thus releasing this and in turn all other contactors except the line (2) and running (8) contactors.

(e) Pulling out the stop switch or operation of the overload relay shall open the circuit through the line contactor coil and open all contactors.

2.02 The contact surfaces shall be clean, smooth, and free from pits.

Pull Button Switches

2.03 The handle and arm carrying the contact disc shall move freely.

2.04 The movement of the handle and associated contact disc shall be opposed by the action of the spring which shall return the handle and disc to its normal position when released.

2.05 The contact fingers shall move freely, engage with a wiping action, and shall seat firmly so as to make good contact with the disc.

Contactors

2.06 Contact fingers shall close with sufficient compression to insure a wiping action and to make good electrical contact when the armature is closed against the pole-faces.

2.07 Contactor noise such as humming shall be a minimum.

Overload Relay

2.08 The plungers of the overload relay shall move freely in the solenoids.

2.09 The adjustments shall be such that the relay will operate to open the contact when the current in either solenoid exceeds 125 per cent of the normal full load current of the motor unless the local instructions specify otherwise.

Definite Time Interlock (See Fig. 2)

2.10 The operating finger shall hold the flywheel in its normal position until moved from that position by the closing of the associated contactor. The movement of

the operating finger shall release the flywheel and permit it to rotate. When the associated contactor opens, the operating finger spring shall return the flywheel to its unoperated position.

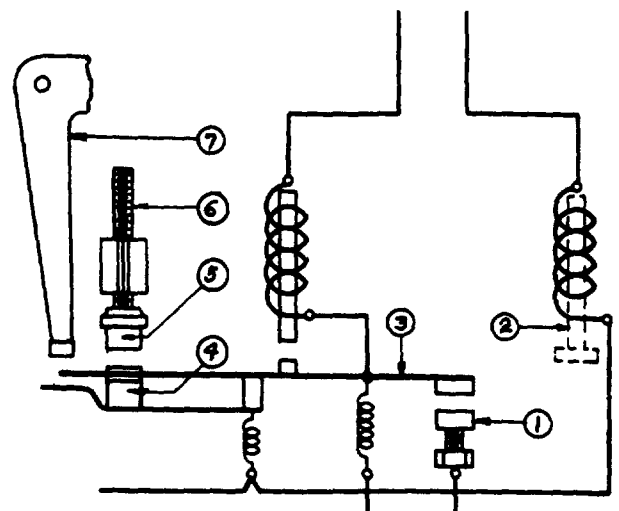
2.11 The auxiliary contacts shall normally be open with a clearance of approximately 1/8" to 3/16". Gauge by sight.

2.12 The flywheel shall rotate freely when released. The degree of movement of the flywheel shall be limited by the stop pin. The stop pin shall be screwed into the hole which permits a specified time delay, usually approximately 1/2 second, before the movement of the flywheel closes the auxiliary contacts.

Definite Time Relay (See Fig. 3)

2.13 The motor disc shall rotate freely and shall not touch or bind on the pole-pieces in any position.

2.14 The relay armature shall pull up at the same time that the disc starts to rotate. After a movement of approximately 1/32" (visual check) the armature shall mesh the gear train moved by the motor disc and close the contact. Gears shall operate freely.



1. Contact
2. Rotating Motor Element
3. Armature
4. Contact
5. Contact
6. Contact Adjusting Screw
7. Latch

Fig. 3 - Schematic of CR-2823-MC-4A Time Relay (Furnished on Starters Prior to January 1926)

3.001 (Continued)Materials

Cloth, Cleaning, Twill Jean, D-98063
Kerosene
Oil, Dashpot, G.E.
Sandpaper, 4/0

3.002 Equipment covered by this section is adjusted and tested before it leaves the factory and should only require adjustment if injured in transit, unpacking or installing. Adjustment should only be made by persons familiar with the equipment who understand what may be expected from each change.

3.01 Operation (Rq. 2.01)

(1) If the starter does not operate satisfactorily, locate the piece of apparatus not functioning properly by noting the position of all contactors. In general, the trouble will be due to either a blown fuse or poor condition of the auxiliary contacts on the various contactors or the contacts of the start switch or overload relay. Adjust the individual pieces of apparatus as covered under their respective headings.

3.02 Contact Surfaces (Rq. 2.02)

(1) Contacts shall be smoothed when necessary with sandpaper and wiped with a dry cloth and any foreign material removed. Metal contacts when slightly pitted may be filed before being given the above treatment. Replace any badly pitted contacts.

Full Button Switches3.03 Handle and Arm (Rq. 2.03)

(1) Remove any foreign matter which may interfere with the movement of the arm in its guide. If the arm is bent the switch and the arm should be straightened or the switch replaced.

3.04 Movement of the Handle (Rq. 2.04)

(1) If the spring is so weak that return to the normal position is not positive, the switch shall be removed and the spring stretched or replaced.

3.05 Contact Fingers (Rq. 2.05)

(1) When the contact fingers bind or fail to make good contact they should be adjusted with a pair of long nose pliers or the switch replaced.

Contactors3.06 Contact Fingers (Rq. 2.06)

(1) If the armature fails to close, look for binding and, if none,

check the coil. Connect a voltmeter across the terminals of the contactor coil. If the voltmeter shows no reading when voltage is applied, the circuit is open ahead of the coil. If the circuit is not open, connect the voltmeter in series with the contactor coil. No reading on the voltmeter indicates that the coil is open. Replace any open coil.

(2) If the pressure of the contacts is weak, the springs should be stretched or replaced. Only sufficient pressure to insure positive contact with wiping action between the contact surfaces should be maintained.

3.07 Noise (Rq. 2.07)

(1) If a contactor is noisy, see that the movable armature fits closely against the face of the pole-pieces; that the short-circuiting band or wire fits tightly; that the laminations of the pole-pieces are clamped rigidly; that the faces of the pole-pieces and the armature are free from rust and dirt and that the shaft carrying the fingers fits snugly in the bearings. Any loose parts should be tightened or replaced and any rust or dirt on the faces of the armature or pole-piece should be removed with sandpaper and the parts should then be wiped with a dry cloth.

Overload Relay3.08 Plungers (Rq. 2.08)

(1) Move plungers up and down by hand and if they bind or stick see that no dust or dirt is in the solenoids and that the oil in the dash-pots has not become gummed or thick. The dash-pot may be removed by unscrewing the oil well. Empty the old oil, clean the by-pass, rinse with kerosene and wipe dry, removing lint. Refill with dash-pot oil to the level marked on the well.

3.09 Adjustment (Rq. 2.09)

(1) The overload relay may be adjusted to open the contacts at a lower current value in the following manner. Loosen the set screw in the upper knurled nut on the plunger. Turn the plunger (while holding the piston) part of a revolution in a counter-clockwise direction, thereby raising the plunger in the solenoid. To open the contacts at a higher current value, the plunger should be turned in a clockwise direction, lowering the plunger in the coil. The time element setting may be increased by loosening the set screw in the lower knurled nut, holding the plunger firmly so that it does not turn, and turning the nut at the bottom