

## CONTACTORS

### KS-5323, KS-5323-01, KS-5694, AND KS-15572

### REQUIREMENTS AND ADJUSTING PROCEDURES

#### 1. GENERAL

1.01 This section covers KS-5323, KS-5323-01, KS-5694, and KS-15572 Cutler-Hammer magnetic contactors used with motor-driven charging generators and rectifiers.

1.02 This section is reissued to:

- add warnings,
- change millivolt drop requirements,
- revise List of Tools, Gauges, and Materials,
- specify a new cleaning procedure,
- clarify arc contact replacement,
- clarify reassembly procedure, and
- add Fig. 5.

This reissue does not affect the Equipment Test List.

1.03 Reference shall be made to Sections 020-010-711, 040-630-701, and 040-631-701 for additional information necessary for the proper application of the requirements listed herein.

1.04 **Number Sign (#):** Requirements and associated procedures marked with a number sign (#) need not be checked by the installer, unless it is thought that the requirement is not being met or performance indicates that such a check is advisable.

1.05 **Asterisk (\*):** Requirements and associated procedures marked with an asterisk (\*) need not be checked during maintenance, unless performance indicates that such a check is advisable.

1.06 On 20- and 50-ampere contactors, the arcing contacts are silver plated and also serve as the main contacts. On other sizes, the main contacts are laminated brushes contacting a silver-plated or silver-faced contact plate. All but 20-ampere contactors have magnetic blowouts and arcing shields. Typical contactors are shown in Fig. 1 and 2.

⚠ **Warning:** ⚠ *When cleaning or making any mechanical adjustment, disconnect the contactor from all power sources and loads.*

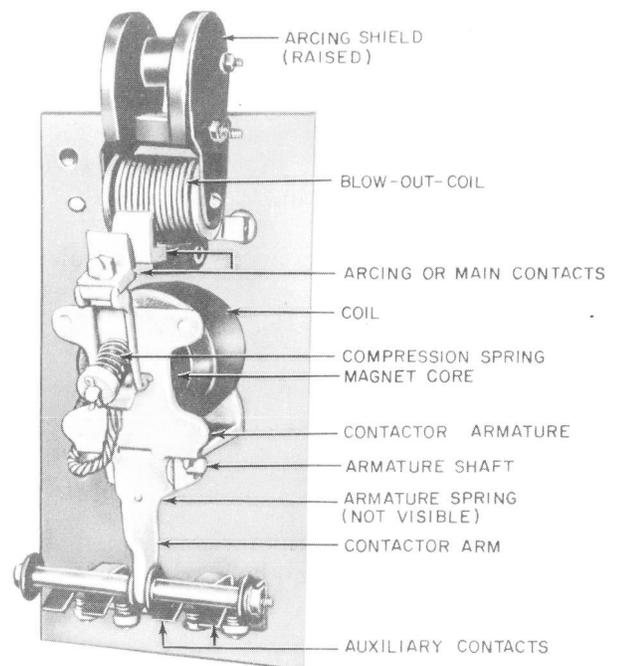


Fig. 1—Typical Contactor

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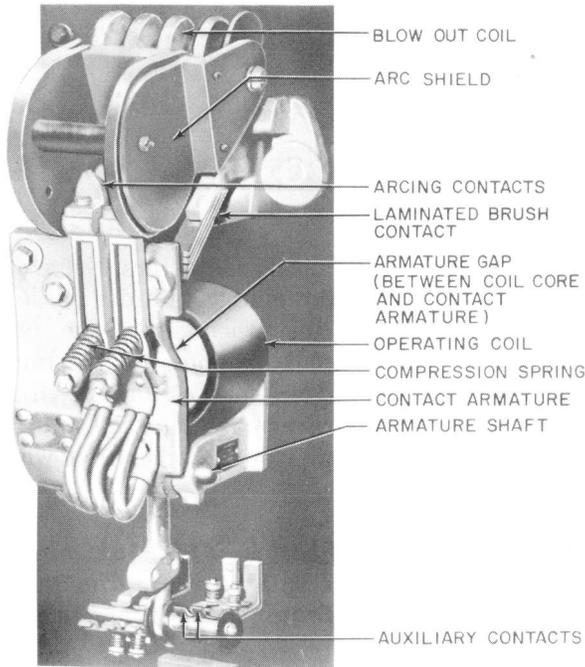


Fig. 2—KS-15572 Contactor

## 2. REQUIREMENTS

**\*2.01 Mounting:** The contactor shall be fastened securely to the panel.

Check with wrench or screwdriver, as required.

### 2.02 Contact Surfaces

(a) Contact surfaces shall be clean and free from burrs.

Check annually.

(b) Auxiliary contacts and laminated brush contacts, if any, shall be lubricated sparingly with petrolatum.

**Note:** If the operation of the contactor is infrequent, the contact surfaces may oxidize and cause high-contact resistance between the

laminated brush and the contact plate, which leads to overheating. If contactor operation is infrequent in any particular application, it is highly desirable to periodically (once a month is suggested) take the associated machine out of service and manually operate the contactor several times. The wiping action of the contacts will tend to remove any oxidation which is being formed. Lubricant is not specified for arcing contacts since it would increase burning and shorten their life.

### 2.03 Contact Pressure

(a) With the contactor in its operated position, the compression spring shall provide positive contact pressure for the arcing contacts.

(b) With the contactor in its operated position, the laminated brush-type contact, if any, shall have flexed noticeably after making contact. The brush shall be flexed so that the individual laminations are separated at the contact end.

(c) With the contactor in its open position, the auxiliary contact springs shall be noticeably compressed. Failure of the contactor to close reliably may be due to faulty operation of the auxiliary contacts. The auxiliary holding contacts should remain in contact (shorting the associated holding resistor) until the contactor is about 90 percent operated. The gap between the shorting bar and the normally closed auxiliary contacts which short the coil series resistor shall be 1/8-inch maximum when the contactor is fully operated. See dimension X in Fig. 4.

### # 2.04 Contact Length

(a) Contacts on 20-ampere switches shall be long enough to make firm positive contact.

(b) On contactors larger than 20 amperes, the distance (A in Fig. 3) between the back edges of the arcing contacts with the contactor closed shall be at least the minimum shown in the table below.

CONTACTOR RATING AMPERES	"A" MINIMUM INCHES
50	1-13/16
100	1-13/16
200	1-11/16
400	1-11/16
800	2-5/32
1000	2-1/8
1500	2-1/8

Use rule or scale.

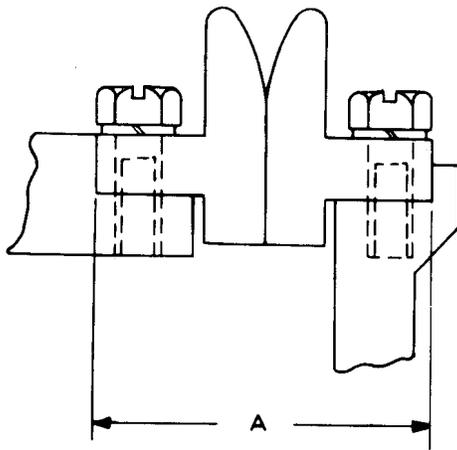


Fig. 3—Arcing Contacts

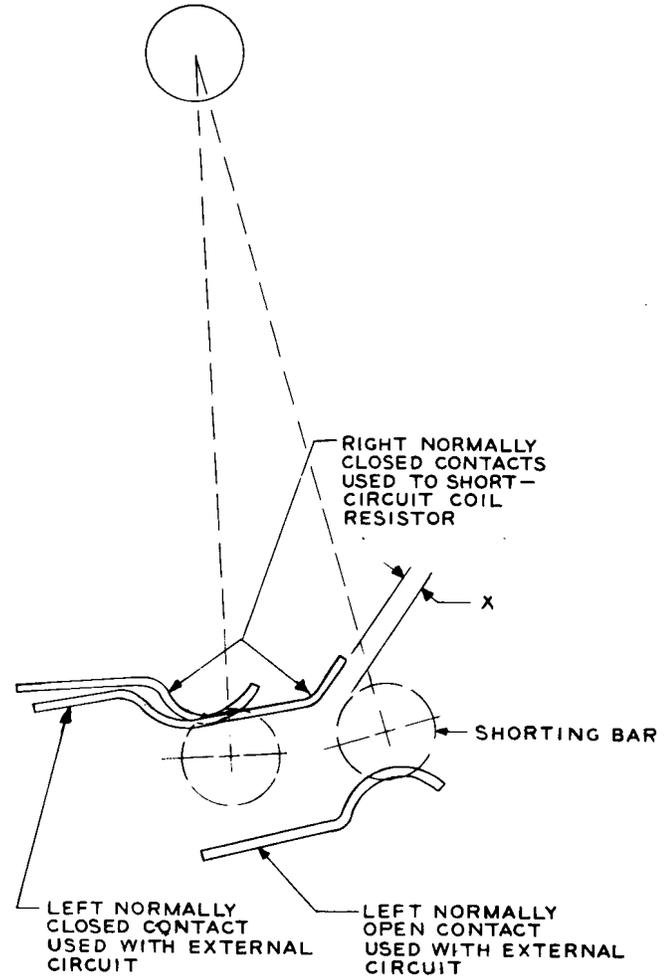


Fig. 4—Auxiliary Contact Arrangement

**2.05 Armature Gap:** Where contactors are equipped with laminated brush contacts, the clearance between the armature and the center of the operating coil as the contact plate just touches the longest brush leaf shall be as follows.

CONTACTOR RATING AMPERES	MINIMUM INCHES	MAXIMUM INCHES
200 and 400	0.090	0.105
800, 1000, and 1500	0.145	0.160

**SECTION 026-350-701**

Use gauge.

**2.06 Temperature**

(a) The temperature of the main laminated brush contact, if any, shall not exceed 105C (221F). The temperature of any current-carrying part shall not be excessive.

Use thermometer.

(b) If the temperature of any current-carrying part becomes excessive, the voltage drop across the associated current-carrying junction shall be measured with the KS-8039 voltmeter. The voltage drop across any current-carrying junction shall not exceed 0.0015 volt.

Use voltmeter.

**Warning:** Various parts in the contactor reach temperatures which can cause severe burns.

**2.07 Electrical Requirements**

(a) The contactor shall meet the electrical requirements specified in the circuit requirements table.

(b) Where electrical requirements are not specified, the contactor shall close positively when the generator voltage applied to the operating coil is equal to the value shown in the table below.

NOMINAL VOLTAGE OF GENERATOR	OPERATE VOLTAGE OF CONTACTOR
24	20
48	44
130	120

(c) The contactor shall open when potential is removed from the shunt winding.

Use dc voltmeter.

**3. ADJUSTING PROCEDURES**

**3.001 List of Tools, Gauges, and Materials**

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
417A	1/4- by 3/8-inch open double-end flat wrench
418A	5/16- by 7/32-inch open double-end flat wrench
KS-2663	File
KS-6367	7/16- by 5/8-inch open double-end flat wrench
KS-14208	Brush (2 required)
—	B long-nose pliers
—	3-inch C screwdriver
—	5-inch E screwdriver
—	2-inch socket wrench
—	1/2-inch drive with socket
<b>GAUGES</b>	
168R	0.090-inch nonmagnetic thickness gauge
KS-8039	Volt-milliammeter, dc, Weston special model 622
R-1032, Detail 1	Thermometer
R-2310	0.105- and 0.125-inch thickness gauges
R-8550	6-inch steel scale
—	0.144-inch twist drill
—	0.161-inch twist drill
<b>MATERIALS</b>	
KS-6232	Light mineral oil
KS-7860	Petroleum spirits
KS-14666	Cleaning cloth

CODE OR SPEC NO.	DESCRIPTION
<b>MATERIALS</b>	
◆KS-19578 L1	Trichloroethane, 1-ounce bottle◆
—	4/0 sandpaper
—	Petrolatum

**\*3.01 Mounting:** (Reqt 2.01)—If necessary, tighten loose nuts of mounting studs with a wrench or on some auxiliary contact studs with a 3-inch cabinet screwdriver.

**3.02 Contact Surfaces:** (Reqt 2.02)

- (1) ◆Clean contacts to remove dirt and gummy substance as follows.
  - (a) Pour a small quantity of trichloroethane into a clean 1-ounce bottle. It is important to avoid the use of contaminated trichloroethane in cleaning the contacts. Therefore, discard the trichloroethane as soon as it appears slightly dirty.
  - (b) Dip the hairs of a clean KS-14208 brush their full length in the trichloroethane. Remove excess fluid by wiping the brush on the edge of the bottle. Then, with the contacts open, brush the entire surface of the contact to be cleaned with the moist brush.
  - (c) Brush the contacts with a dry, clean KS-14208 brush.◆
- (2) Remove burrs from contacts with a fine file or sandpaper. Dressing of contact surfaces, particularly the silver-plated contacts, should be held to the minimum consistent with satisfactory operation. Contactors should be opened and closed several times periodically to take advantage of the contact surface scouring caused by the wiping action.
- (3) If the bar of the contactor arm (except on 20-ampere contactors) no longer presents a satisfactory surface to the auxiliary contact fingers, loosen the nut on the end of the bar, turn the bar as required, and retighten the nut. Use wrench.
- (4) Wipe excess lubricant from the surfaces adjacent to the contact surface.

**3.03 Contact Pressure:** (Reqt 2.03)

(1) If failure of arcing contacts to make positive contact is due to short contacts, replace contacts. (See 2.04.) If failure is due to poor compression in the compression spring, replace the spring.

(2) Replace a main laminated brush contact if it does not flex when contactor is operated. Failure to flex may be due to the brush being worn until too short or to loss of temper caused by overheating. (See 2.06.) It is recommended that when a brush is replaced the associated contact plate should also be replaced.

(3) On contactors larger than 20 amperes, shape the auxiliary contact fingers with pliers if necessary to obtain positive contact when contactor is open. On 20-ampere contactors, replace auxiliary contacts if they do not make positive contact.

(4) The holding contacts must be shaped so that the shorting bar maintains contact until the contactor is almost closed but must break the circuit when the contactor is fully operated. The inertia of the moving parts assures final closure of the contactor, but early opening of the holding contacts will cause erratic operation.

**# 3.04 Contact Length:** (Reqt 2.04)

- (1) Replace contacts not of required length. Use a wrench or 5-inch screwdriver, as required.
- (2) ◆When replacing arcing contacts, clean the mating surfaces of the arcing contacts and armature arm with KS-19578 L1 trichloroethane and a KS-14208 brush. After cleaning, brush surfaces dry with a clean KS-14208 brush. Tighten assembly with screwdriver.◆

**3.05 Armature Gap:** (Reqt 2.05)

**◆Warning:** *When cleaning or making any mechanical adjustment, disconnect the contactor from all power sources and loads.◆*

(1) **200- and 400-Ampere Size:** To check for proper operating coil and armature clearance, disconnect the power supply from the contactor and manually hold operated the armature at a point where the armature just touches the

longest contact brush leaf. Insert the 168R gauge between the center of the operating coil and the armature. Remove the 168R gauge. Repeat with the R-2310 gauge. If the 168R gauge does not fit, the operating coil clearance is insufficient and removal of washers, as described in (3), is required. If the R-2310 gauge when inserted is loose, the clearance is excessive and washers should be added as in (3).

**(2) 800-, 1000-, and 1500-Ampere Size:**

With the contactor disconnected and held operated as in (1), insert the 0.144-inch twist drill shank between the center of the operating coil and the armature. Remove the 0.144-inch twist drill, and insert the 0.161-inch twist drill shank between the center of the operating coil and the armature. Remove the 0.161-inch twist drill. If the 0.144-inch twist drill shank does not fit, the operating coil clearance is insufficient and removal of washers, as described in (3), is required. If the 0.161-inch twist drill shank when inserted is loose, the clearance is excessive and washers should be added as in (3).

(3) When it becomes necessary to add or remove washers to adjust the operating coil clearance, disconnect the contactor from the power supply. With pliers remove the compression spring retaining cotter pin from the main lever spring stud or studs. On contactors less than an 800-ampere rating, it will be necessary to exert a pressure on the cupped washer to compress the compression spring and release tension on the cotter pin. On contactors of 800-ampere rating or larger, remove the nut from the main lever spring studs. Remove the cupped washer and compression spring. Lower the arcing contact arm so as to provide a clear working space. With a wrench remove the nut or nuts and washers (located behind the armature) which hold the contact plate to the main lever. Separate the contact plate from the main lever. Remove or add sufficient washers on the contact plate stud or studs to bring the operating coil clearance within limits. (See 2.05.) Reassemble in reverse order, recheck the operating coil clearance as in 2.05, and reconnect the power supply.

**Note:** Where the contact plate is equipped with two or more studs, an equal number of washers should be added or removed on each contact plate stud.

**3.06 Temperature:** (Reqt 2.06)

(1) To check the temperature, hold the thermometer bulb against the brush, covering that part of the bulb not in contact with the brush with a small felt pad. If the temperature is high enough to cause the felt to smoke or char, asbestos on the face of the pad is suggested. If the temperature is too high, apply the following procedures.

(2) Check the condition of contact surfaces and contact pressures. (See 2.02 and 2.03.)

(3) Check the maximum load the contact is forced to carry. If it exceeds the ampere nameplate rating, the brush may lose temper and fail to give satisfactory operation. If overload cannot be avoided, refer to supervisor.

(4) Check the temperature of stud to bus-bar joint on rear of panel. If it is higher than the brush temperature, refer to the supervisor who may want to consider remaking external connections to the contactor. Also check the temperature of all bolted current-carrying connections on the front of the contactor panel. If temperatures are high, refer to (5) below.

(5) If heating of any of the associated parts of the contactor is experienced, the following procedure is recommended. First, measure the voltage drop across the made contacts of the laminated brush and the contact plate, measuring between the contact support structures. This should not exceed  $\nabla 0.0015 \nabla$  volt. Second, measure the drop across all current-carrying junctions of the contactor. A reading of over  $\nabla 0.0015 \nabla$  volt indicates a poor or loose connection; and the part should be disassembled, sanded lightly if necessary, cleaned with  $\nabla$ trichloroethane, $\nabla$  dried thoroughly, and reassembled.  $\nabla$ When reassembling use two copper nuts and one locknut, as shown in Fig. 5. Tighten nuts with appropriate wrench. Recheck voltage drop across the connection. $\nabla$

**3.07 Electrical Requirements:** (Reqt 2.07)

(1) When checking operate voltage, disconnect the voltage regulator (where furnished) and obtain the desired voltage by manually operating the field rheostat of the generator.

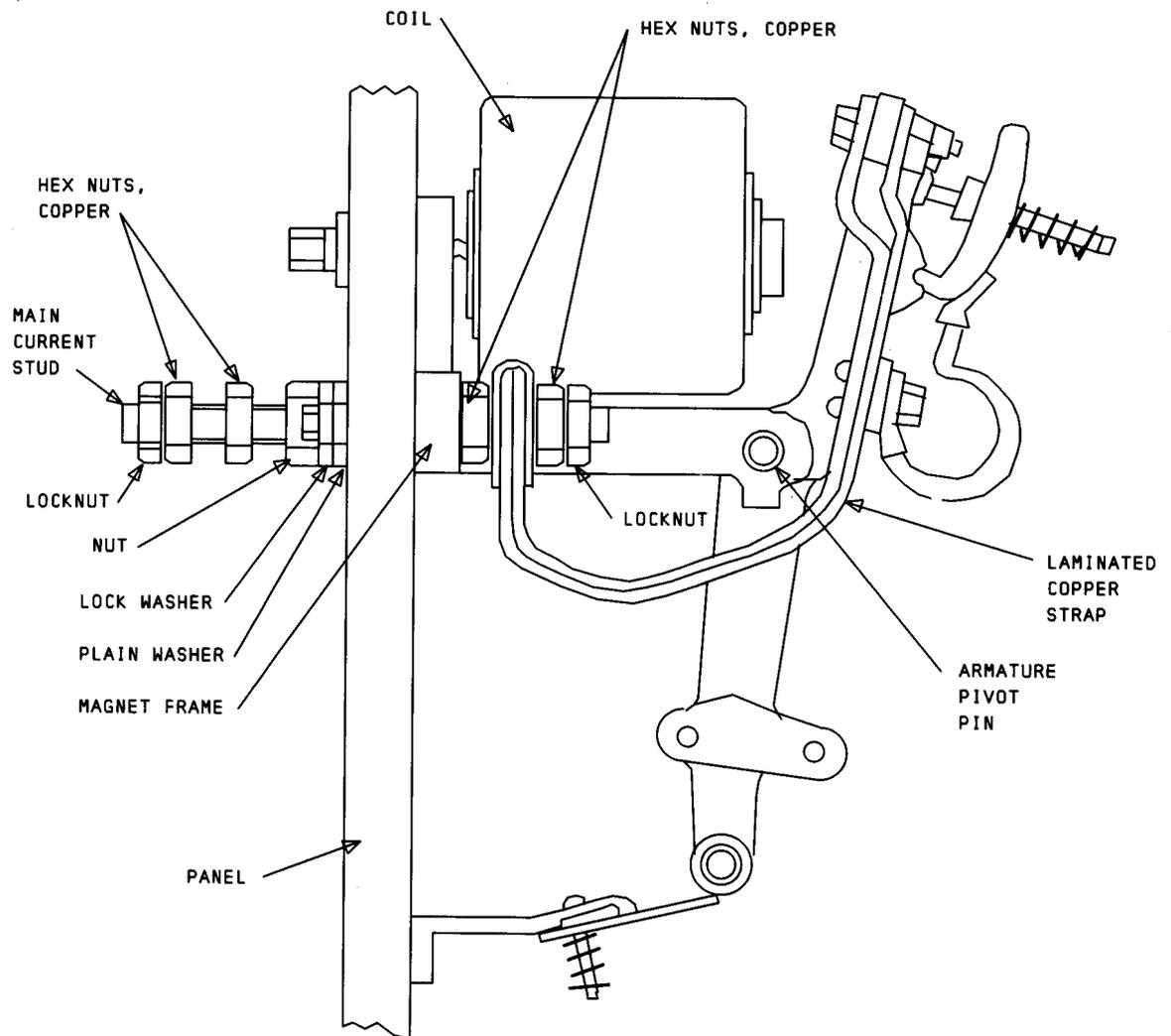


Fig. 5—Typical Nut and Stud Assembly for Main Current-Carrying Connection

- (2) If the contactor does not close, check (3) below and then test for open circuit using a voltmeter. Connect the voltmeter in parallel with the coil, and if the voltmeter shows no reading when voltage is applied, the external circuit is open. Check the operation of the associated reverse current relay. Having determined that the circuit is not open, connect the voltmeter in series with the coil. No reading on the voltmeter indicates the coil is open and should be replaced.
- (3) Periodically apply a drop or two of light mineral oil to each end of the armature

shaft. If binding persists, remove cotter pin with pliers, take out shaft, and clean shaft and associated parts with a cloth moistened with petroleum spirits. In extreme cases of corrosion, 4/0 sandpaper may be used for cleaning. Oil the shaft before reassembly. Check whether or not the armature spring has sufficient tension to return the armature to its open position. Check that there is no dirt or foreign material between the pole face and the armature to interfere with proper closing. Replace parts as necessary.