

STRUTHERS-DUNN RELAYS HAVING NO KS DESIGNATIONS REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers relays of the following types manufactured by Struthers-Dunn Incorporated, and not covered separately by KS designations.

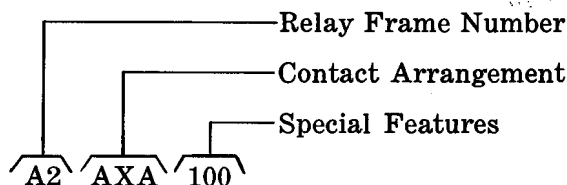
MIDGET RELAYS

B1XXA	1XXB144
	1XXB154
1XXB130-4B	
1XXB132	

POWER RELAYS

A2AXA100, etc	8HXX285
	8BXX325
2PXM100, etc	8BXX338
2NXX101	
2NXP102, etc	84XBX, etc
8BXX, etc	89BXC100, etc
8BXA106	89BXX101, etc
8AXA115	
8AXA116	106QXX100, etc
8AXX124	106PXM103
8BXX192	
8HXX222	166BXB100

Note: The etc following the above designations refers to any combination of letters identifying the contact arrangement; for example: AXA, XBX, BXC, etc. Struthers-Dunn relay designations are understood as follows.



1.02 This section is reissued to add information covering 8BXX338 and 166BXB100 relays, and to include a requirement covering contact spring clearance.

1.03 Reference shall be made to Section 020-010-711 covering general requirements and definitions for additional information necessary for the proper applications of the requirements listed herein.

1.04 **Asterisk (*)**: Requirements are marked with an asterisk when to check for them would necessitate dismantling or dismounting of apparatus, or would affect the adjustment involved, or other adjustments. No check need be made for these requirements unless the apparatus or part is made accessible for other reasons, or its performance indicates that such a check is advisable.

1.05 For the purpose of this section, contacts are normally open (NO) or normally closed (NC) depending on their position when no operating current is flowing through the coil and not on their normal position for a particular application which may involve continuous operating current through the coil under normal circuit conditions. NO and NC contacts are sometimes referred to as front and back contacts, respectively.

1.06 **Operate**: A relay is said to operate if, when current is connected to its winding, the armature moves sufficiently to meet the following conditions.

- (a) All NO contacts close and all NC contacts open.
- (b) The armature rests against the core.

1.07 **Release**: A relay is said to release when the armature has moved sufficiently for NO contacts to open and NC contacts to close with reliable contact.

1.08 **Nonoperate**: A relay is said to nonoperate when, with current flowing through the coil, the armature has not moved sufficiently for NO contacts to close or to reduce the pres-

sure of NC contacts enough to cause unreliable contact.

1.09 Caution: *In circuits where less than 150 volts are applied across terminals on the relay, service may be maintained while working on the relay by bridging and insulating the contacts as covered in 3.002. In some cases, it may be necessary to disconnect leads to maintain service. If this type relay is in a circuit where 150 volts or more are applied across terminals on the relay, the voltage should be removed from the terminals before performing any work on the relay or checking requirements.*

1.10 Caution: *If the relay operates in an automatic control circuit, before work is started on the relay the automatic control should be made inoperative as described in the appropriate section covering the apparatus.*

1.11 Relays should not be handled by the contact springs.

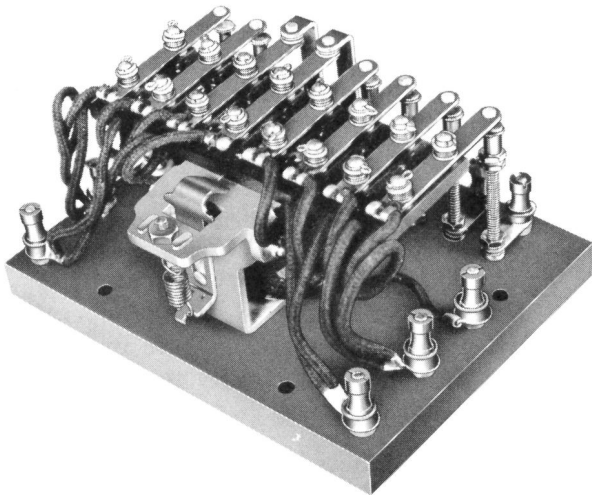


Fig. 1 – Struthers-Dunn Type 2PXM100 Power Relay

2. REQUIREMENTS

2.01 Cleaning Contacts and Removing Build-ups: Contacts shall be clean and free from build-ups which might interfere with reliable contact.

Gauge by eye.

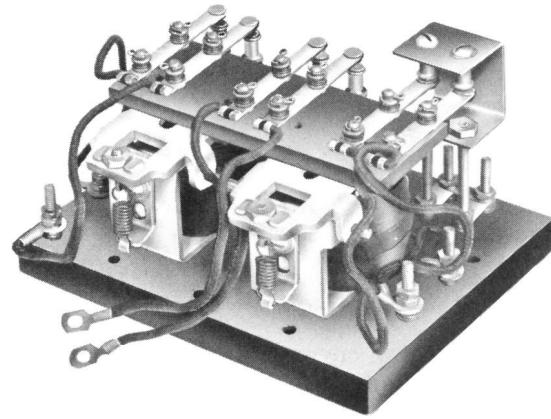


Fig. 2 – Struthers-Dunn Type 106PXX100 Power Relay

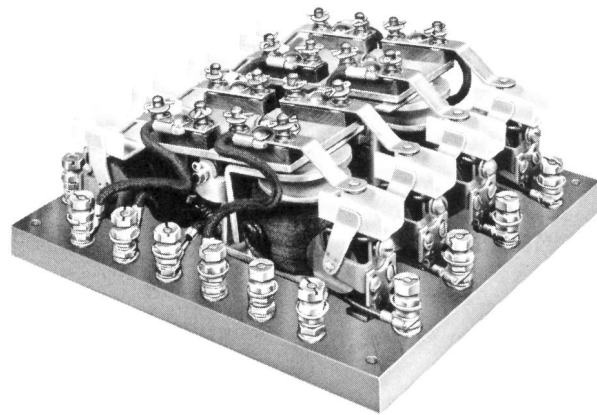


Fig. 3 – Struthers-Dunn Type 166BXX100 Power Relay

2.02 Relay Mounting and Tightness of Component Parts

- (a) The relay shall be securely mounted.
- (b) The component parts shall be held together securely.

Gauge by feel.

Caution: *Do not touch or short-circuit live terminals or parts.*

2.03 Contact Alignment

- (a) Contacts of the same diameter shall be so aligned that when the contacts are closed, the outer edge of one contact does not extend over the outer edge of the other more than

Max 1/32 inch

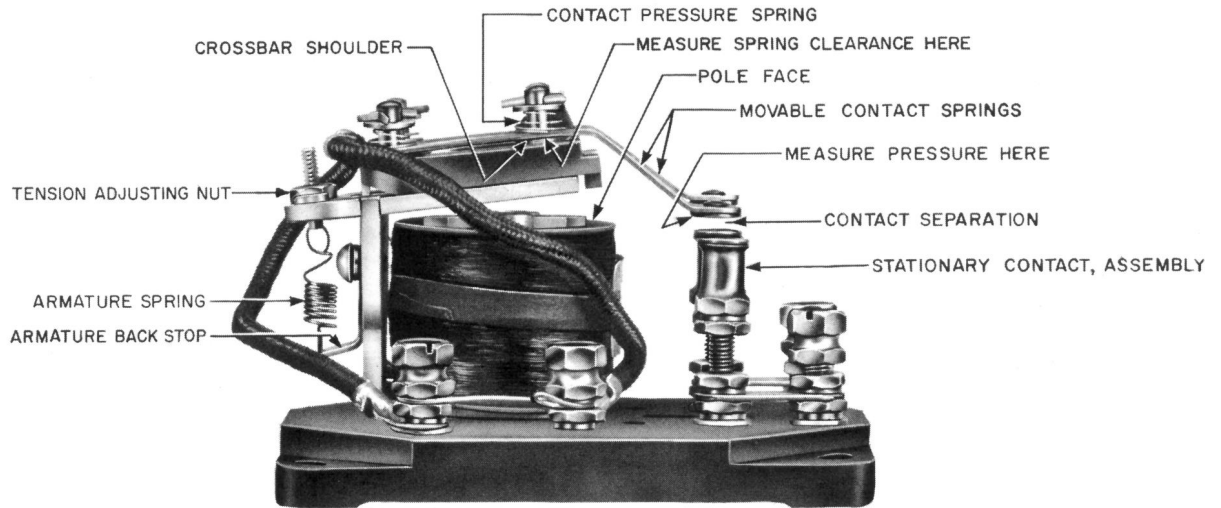


Fig. 4 - Typical Struthers-Dunn Power Relay (8BXX shown)

If contacts are of different diameters, the smaller contact shall not extend beyond the periphery of the larger.

Gauge by eye.

(b) The alignment of bifurcated contacts (see Fig. 5) shall be such that, when they are completely closed, both members of the movable contacts shall make contact with the stationary contact.

Gauge by eye.

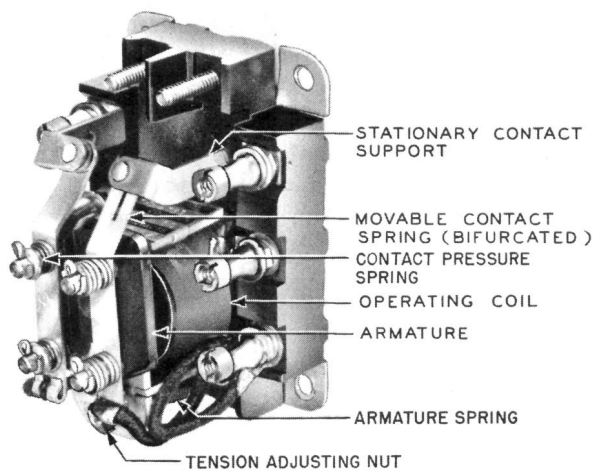


Fig. 5 - Typical Struthers-Dunn Midget Relay (1XXB132 shown)

2.04 Contact Sequence

- (a) All NO contacts shall make at approximately the same time.
- (b) All NC contacts shall break at approximately the same time.

Gauge by eye.

2.05 Contact Separation

(a) The minimum separation between mating contacts when open shall be as specified in the circuit requirements table. Contact separation of the following relays shall be as follows.

	MIN INCH	MAX INCH
8HXX222	5/32	—
8HXX285	5/32	—
8BXX325	5/32	—
8BXX338	5/32	—
166BXB100	5/32	7/32

When checking, use the gauges as follows.

SEPARATION INCH	GAUGE
1/16	89
3/32	161A
1/8	TP91681M
5/32 and 7/32	R-8550 Scale

To check this requirement, the contacts must be disconnected from the power supply.

(b) If the contact separation is not specified, like contacts on the same relay shall have approximately the same separation. In no case shall the separation be so small that the arc formed at the opening of the circuit is not readily extinguished.

Gauge by eye.

(c) To measure the separation of single-throw type contacts, move the armature as required with the KS-6320 orange stick. On relays having movable contacts arranged for transfer (double-throw contacts), measure the separation of each contact while its associated contact is just made, without any follow or flexing of the contact pressure spring.

↗ **2.06 Spring Clearance:** When closed, the NO and NC contacts shall have a separation between the movable contact arm and the cross-bar shoulder of

Min 0.020 inch

↳ Use the 67B gauge (part of 66D gauge nest).

2.07 Contact Pressure

(a) Contact pressure, measured with the contacts closed, shall be as specified in the circuit requirements table. Contact pressure of the following relays used in engine control circuits SD-80994-01, SD-81017-01, and SD-81017-02 shall be as follows.

	CONTACTS	MIN GRAMS
8BXX, 8CXX, 8AXX124, 8BXX192	NO	45
8AXB, 8BXA106, 8AXA115, 8AXA116, 84BXC, 84XBX	NO NC	45 30

Contact pressure of the following relays shall be as follows.

	CONTACTS	MIN GRAMS
↗ 8HXX222, 8HXX285, 8BXX325, 8BXX338	NO	45
↳ 166BXB100	NO NC	40 30

Use the 70D or 79C gauge.

To check this requirement, the contacts must be disconnected from the power supply.

(b) *To measure* the contact pressure of the NO contacts, hold the armature securely against the pole face with a KS-6320 orange stick, taking care not to press on any part of the contact spring which supports the moving contact or to force the armature out of alignment. Place the 79C gauge against the contact spring as near to the moving contact as possible and exert a pressure with the gauge away from the stationary contact. Read the gauge as the moving contact leaves the stationary contact. When access to the contacts is impossible with the 79C gauge, the 70D fan-type gauge may be used.

(c) *To measure* the contact pressure of the NC contacts, proceed in a manner similar to that outlined in (b), but allow the armature to be held in its nonoperated position by the pull of its spring.

2.08 Freedom of Operation of Armature: The armature shall move freely throughout its travel.

Gauge by feel.

To check the requirement, slowly operate the armature manually with the KS-6320 orange stick.

2.09 Electrical Requirements

(a) The relay shall meet the electrical requirements specified in the circuit requirements table or other job information.

(b) Where electrical requirements are not specified in the circuit requirements table, operation of a relay shall be checked at the minimum coil voltage specified on the nameplate, where the operating voltage is expressed as a range. Where a nominal value is given, check at a value which is 10 per cent less than the nominal.

(c) Check of electrical requirements may be at the temperature at which the relay is found, unless H (hot) or C (cold) is specified in the circuit requirements table.

(d) Where H is specified in the circuit requirements table without heating instructions, the relay coil shall be energized at nominal voltage for at least 1 hour prior to the test.

(e) Where C is specified in the circuit requirements table without cooling instructions, the relay shall be de-energized for at least 2 hours prior to the test.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, Materials, and Test Apparatus

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
46	3/8-Inch Hex. Single-End Socket Wrench
365 (as reqd)	Connecting Clip
373D	Contact Burnisher Holder
374A	Burnisher Blade
417A (2 reqd)	1/4- and 3/8-Inch Hex. Open Double-End Flat Wrench
KS-6015	Duck-Bill Pliers
KS-6278 (as reqd)	Connecting Clip (jaws insulated with the 108 cord tip)
KS-6320	Orange Stick
KS-6780 (as reqd)	Connecting Clip (jaws insulated with the 108 cord tip)
KS-14208 (2 reqd)	Brush
—	3-Inch C Screwdriver
—	4-Inch E Screwdriver
GAUGES	
66D	Thickness Gauge Nest
70D	50-0-50 Gram Gauge
79C	0-200 Gram Push-Pull Tension Gauge
89	1/16- and 1/64-Inch Round Thickness Gauge
161A	0.050- and 0.094-Inch Thickness Gauge
R-8550	6-Inch Steel Scale
TP91681	0.160- and 0.180-Inch Thickness Gauge

CODE OR SPEC NO.

DESCRIPTION

GAUGES

—	Voltmeter, AC, Weston Model No. 528, Ranges 300-150
—	Voltmeter, DC, Weston Model No. 931, Ranges 300-150-75-30 (if available, 35-type test set is not equipped with a voltmeter)

MATERIALS

KS-2423	Cotton Twill Cloth
KS-7187	Bond Paper
KS-8372	Stabilized Trichloroethylene
—	Abrasive Cloth, 150 Grade
—	No. 14 Gauge, AM-14, Wire
—	1-Ounce Bottle

TEST APPARATUS

35 Type	Test Set
—	893 Cord, 3 Feet Long, Each End Equipped With a 360A Tool (1W13A cord) and a 365 or KS-6278 Connecting Clip
—	893 Cord, 6 Feet Long, Each End Equipped With a 360A Tool (1W13B cord) and a 365 or KS-6278 Connecting Clip
—	Autotransformer, Continuously Tapped (Variac, 2-ampere, 230-volt input, type W-5, HMT, provided with overload protector, or equivalent; General Radio Company, suggested)

3.002 Maintaining Service While Working on Relay

(1) **General:** If less than 150 volts are applied across terminals and it is not practicable to disconnect the relay from the power supply (see 1.09 and 1.10), bridge the current-carrying contacts and insulate live parts as covered in (2) and (3), respectively.

Caution: Use care when working in close quarters with live parts.

(2) **Bridging Contacts:** To maintain service while work is being done affecting closed contacts carrying current in working circuits,

bridge the contacts at the most convenient points in the circuit other than at the relay, if practicable. No. 839 cords (3 or 6 feet long) each end equipped with a 360A tool and a KS-6278 connecting clip (jaws insulated with the 108 cord tip) are satisfactory for strapping purposes. Lengths of 14-gauge insulated wire or flexible cord such as is commonly used in lighting circuits, with KS-6780 connecting clips (jaws insulated with the 108 cord tip), are equally satisfactory.

(3) **Insulating Contacts and Parts:** KS-7187 bond paper should be used for insulating live parts and should be shaped or bent as necessary to provide protection with minimum interference to the work being done. To prevent closure of open contacts in a live circuit, place bond paper, as required, around the fixed contact or disconnect the lead to the contact spring.

3.003 Closing Open Contacts: To close NO contacts, hold the armature against the pole face with the KS-6320 orange stick. To close NC contacts which are open and operating in a working circuit, open one connection to the coil, after first bridging or insulating the other contacts as necessary.

3.004 Removing Relay From Mounting: If it is necessary to remove the relay, patch the working circuit around the relay. Disconnect all power supply from the winding and contact circuits of the relay by opening switches, if provided, or by removing fuses. Then, disconnect the leads from the relay terminals using the 46 wrench. Remove the mounting screws with the 4-inch E screwdriver.

3.005 Relays whose contacts (either NO or NC) carry current continuously, should be operated or released, and returned to their normal position periodically; for example, once every month, to prevent the development of high resistance at the contacts.

3.006 Caution: *Unless otherwise stated in the procedures, do not make adjustments or perform work on live contacts or parts.*

3.01 *Cleaning Contacts and Removing Build-ups* (Reqt 2.01)

(1) *General*

(a) The purpose of cleaning contacts is to remove any gummy or dirty substance that would interfere with reliable contact. The oxide which forms on silver contacts is not objectionable and does not interfere with the contact. It is not necessary or desirable to keep contacts polished or shining.

(b) Before cleaning contacts or removing build-ups, disconnect the power supply from the contacts, if practicable (refer to 1.09 and 1.10). If contacts are badly worn, replace the complete contact spring (movable contact finger) or stationary contact as covered in Section 040-810-801.

Caution: *Do not clean or burnish live contacts.*

(2) **Cleaning Contacts:** To remove dirt and gummy substance, clean the contacts with KS-8372 trichloroethylene as covered in (a) and (b) and then brush them with a dry, clean KS-14208 brush as covered in (c).

(a) Pour a small quantity of the trichloroethylene into a 1-ounce bottle. It is important to avoid the use of contaminated trichloroethylene in cleaning the contacts. Therefore, discard the trichloroethylene as soon as it appears slightly dirty.

(b) Dip the hairs of a clean KS-14208 brush their full length in the trichloroethylene. Remove excess fluid by wiping the brush on the edge of the bottle. Then, with the pair of 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. If necessary, burnish the contacts with the 374A burnisher blade as covered in (d).

(d) To burnish the contacts, insert the 374A burnisher blade held in the 373D contact burnisher holder between the contacts. If the contacts are normally open, press them together by holding the armature firmly against the pole face with the KS-6320 orange stick. Draw the burnisher blade back

and forth until the contacts are clean as determined by visual inspection. After burnishing, brush the contacts with a dry, clean KS-14208 brush.

(3) **Removing Build-ups:** To remove build-ups in dead circuits, use a strip of 150 grade abrasive cloth, or the 374A burnisher blade held in the 373D contact burnisher holder. For contacts in live circuits of less than 150 volts to ground, use abrasive cloth only. For contacts in live circuits of 150 volts or more to ground, remove the voltage from the terminals as outlined in 1.09 and 1.10 before removing build-ups. Insert the abrasive cloth or blade between the contacts. If the contacts are normally open, hold the armature firmly against the pole face with the KS-6320 orange stick, taking care not to touch the contact springs. Draw the cloth or blade back and forth until the build-ups are removed. Exercise care to avoid reducing the height of the contact. After burnishing, brush the contacts with a dry KS-14208 brush.

3.02 *Relay Mounting and Tightness of Component Parts* (Req't 2.02)

- (1) Tighten loose mounting screws and other screws with the 4-inch E screwdriver.
- (2) Tighten loose terminal nuts with the 417A wrench.

3.03 *Contact Alignment* (Req't 2.03)

(1) Adjust bent or misaligned movable contacts using the KS-6015 pliers (see 3.006). On midget-type relays straighten the stationary springs as required. Movable contact springs that are badly bent should be removed and reshaped if practicable; otherwise, they should be replaced as covered in Section 040-810-801.

- (2) If satisfactory contact alignment cannot be obtained, replace the relay.

3.04 *Contact Sequence* (Req't 2.04)

(1) If associated contacts do not make or break at approximately the same time, check the stationary and movable contacts in the group of NO or NC contacts. Adjust misaligned movable springs and stationary con-

tact supports as covered in 3.03 and adjust the height of stationary contacts as covered in 3.05. Recheck the requirement and also check requirements 2.03, 2.05, 2.06, 2.07, and 2.09.

3.05 *Contact Separation* (Req't 2.05)

(1) To adjust contact separation on midget-type relays, adjust the height of the stationary contact supports using the KS-6015 pliers.

(2) To adjust contact separation on power-type relays, not equipped with blowout coils, adjust the height of the stationary contacts as follows. Loosen the locknut of the stationary contact using one or two 417A wrenches, turn the stationary contact assembly as required, and tighten the locknut. Do not bend the movable contact spring.

(3) To adjust contact separation, on power-type relays equipped with blowout coils, loosen the two screws holding the blowout coil to the mounting bracket using the 3-inch C screwdriver and adjust the height of the stationary contact. Do not bend the movable contact spring.

(4) After adjustments are made, recheck the requirement and also check requirements 2.03, 2.04, 2.06, 2.07, and 2.09.

3.06 *Spring Clearance* (Req't 2.06)

(1) The clearance between the movable contact arm and the crossbar shoulder may be changed by raising or lowering the stationary contacts or blowout coils as covered in 3.05. After adjustments are made, recheck the requirement and also check requirements 2.03, 2.04, 2.06, 2.07, and 2.09.

3.07 *Contact Pressure* (Req't 2.07)

(1) Contact pressures are specified on a minimum basis and have a direct bearing on the electrical requirements. If the pressure is greatly in excess of the specified minimum limit, the relay may fail to meet its electrical requirements. After changing contact pressure, check requirement 2.04.

(2) To change the contact pressure of NO contacts, adjust the height of the stationary contacts, stationary contact supports, or blowout coils, as covered in 3.05

(3) To change the contact pressure of NC contacts, adjust the armature spring tension as follows. Raise the threaded rod where present and adjustable to permit turning the nut. Turn the adjusting nut clockwise to increase and counterclockwise to decrease the tension. Further adjustment may be obtained by moving the armature backstop down to increase and up to decrease the spring tension. Use the 3-inch C screwdriver to loosen and tighten the backstop mounting screw. Where the threaded rod and nut are not available (for example on the 166BXB100 relay) the contact pressure of the NC contacts may be changed by raising or lowering the stationary contacts or blowout coils as covered in 3.05.

3.08 Freedom of Operation of Armature (Reqt 2.08)

(1) Remove any foreign matter which may have lodged between the armature and pole face of the coil with the KS-6320 orange stick. In some cases, the armature or pole face may require cleaning with KS-8372 trichloroethylene on a KS-2423 cloth wrapped around the orange stick.

(2) If the armature is binding on the hinge pin, remove the pin by removing a hinge cotter pin and withdrawing the hinge pin. Clean the hinge pin and bearings with a KS-2423 cloth moistened with a trichloroethylene and wipe the parts with a dry cloth. Re-mount the hinge pin and insert the cotter pin.

3.09 Electrical Requirements (Reqt 2.09)

(1) A check of the operation of a voltage rated relay is made as follows.

(a) **AC Relays:** With power removed from the relays as covered in 1.08, connect the coil of the relay to be tested across the output of a continuous tap autotransformer. Connect the Weston Model No. 528 voltmeter across the output of the autotransformer. Connect the input of the autotransformer to the ac supply through 3-ampere fuses. Ad-

just the output of the autotransformer to the values specified in the circuit requirements table.

(b) **DC Relays:** With power removed from the relay as covered in 1.09 and 1.10 connect the coil of the relay across the output of a 35-type test set equipped with voltmeter. Adjust the output of the 35-type test set to the value specified in the circuit requirements table.

(2) **Operate:** If, when the operate current is applied to the coil, the armature moves part way to the core, it is an indication of excessive contact pressure, armature spring tension, or binding of the armature. Check requirements 2.06, 2.07, and 2.08.

(3) Release

(a) If the relay does not release, it is an indication of insufficient armature spring tension or binding on the armature. Clean armature as covered in 3.08 and adjust the armature spring as covered in 3.07(3). If sufficient armature spring tension cannot be obtained, replace the spring as covered in Section 040-810-801.

(b) If the stop pin, which is in the face of the armature, fails to prevent the armature coming in direct contact with the pole face and permits it to stay there after the voltage is removed from the coil, replace the armature if feasible; otherwise, replace the relay.

(4) **Nonoperate:** If the relay fails to meet its nonoperate requirement, increase the armature spring tension as covered in 3.07(3). On relays equipped with double-throw (transfer) contacts, the armature air gap may be increased by lowering the stationary NC contacts as outlined in 3.05.

(5) After readjusting any parts in connection with meeting the electrical requirements, check these parts for the applicable requirements.