ADJUSTMENT OF
TYPE 57-A AND TYPE 58-A
(CLASS B AND CLASS C)
RELAYS

Technical bulletin 538

AUTOMATIC ELECTRIC
GENERAL SYSTEM
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

Factory, development laboratories, and general office at Northlake, Illinois, U.S.A.

AUTOMATIC ELECTRIC COMPANY is an organization of designing, engineering, and manufacturing specialists in the fields of communication, electrical control, and allied arts. For more than sixty years the company has been known throughout the world as the originator and parent manufacturer of the Strowger Automatic Telephone System. Today Strowger-type equipment serves over 75% of the world's automatic telephones. The same experience and technique that have grown out of the work of Automatic Electric engineers in the field of telephone communication are also being successfully applied on an ever-increasing scale to the solution of electrical control problems in business and industry.

PRINCIPAL PRODUCTS

Strowger Automatic Telephone Systems—Complete automatic central-office equipment for exchange areas of any size, from small towns to the largest metropolitan networks.

Community Automatic Exchanges—Unattended automatic units for small rural or suburban areas, with facilities for switching into attended exchanges.

Automatic Toll Boards—An adaptation of Strowger principles to toll switching, resulting in simplification of operators' equipment and greater economy of operating and toll-circuit time.

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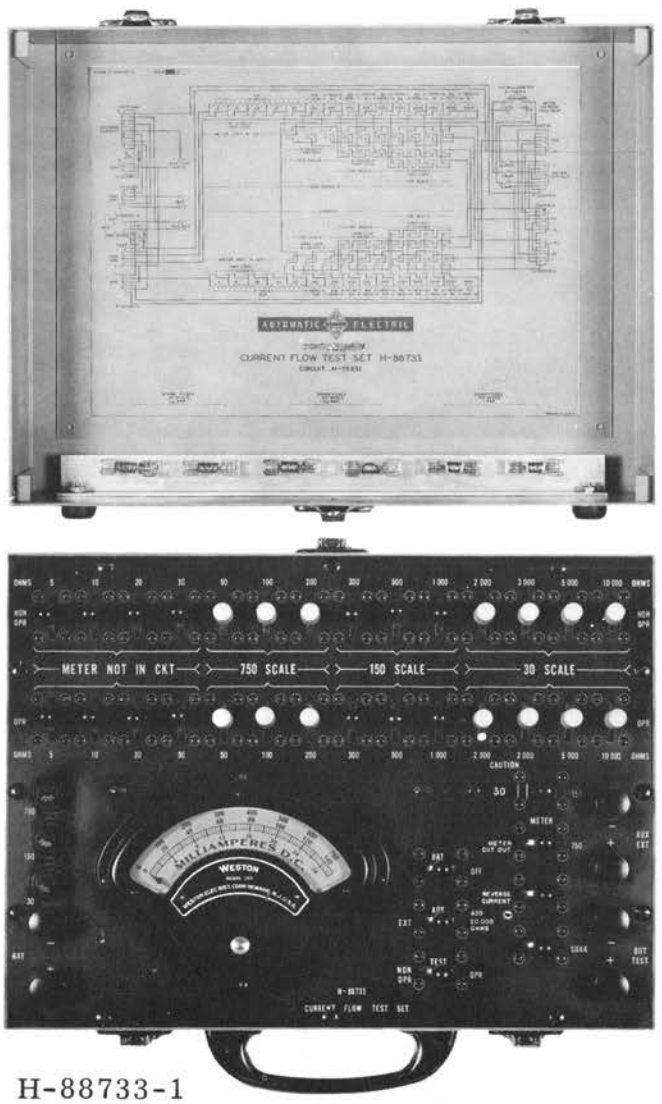
Makers also of electrical control apparatus for industrial, engineering, and public utility companies, telephone apparatus for railroads and pipe-line companies, private telephone systems of all types, electrical and communication devices for aircraft and airways control, and special communication apparatus for military and naval departments.

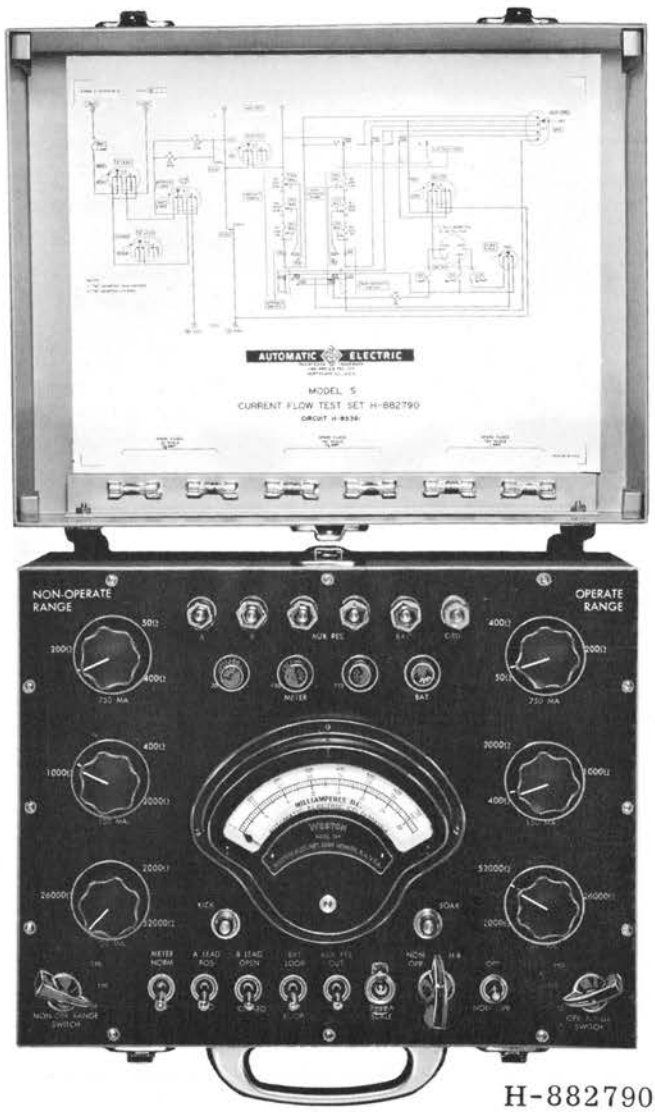
ADJUSTMENT OF

TYPE 57-A AND TYPE 58-A (CLASS B AND CLASS C)

RELAYS



H-88733-1



H-882790

Figure 1. Current-flow test set.

Bulletin 538

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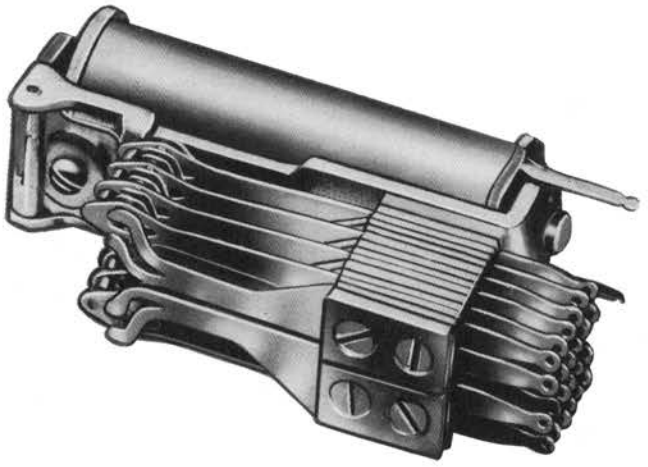
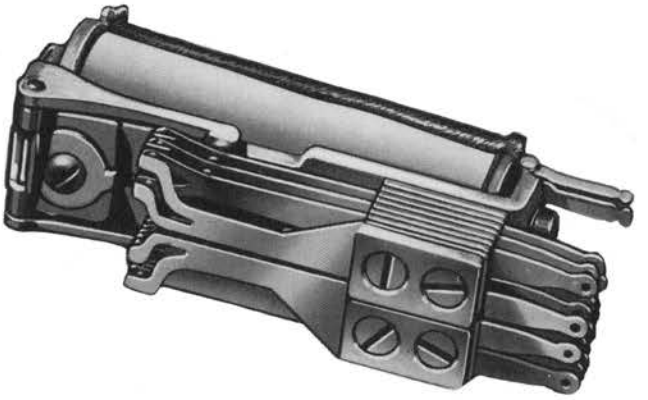
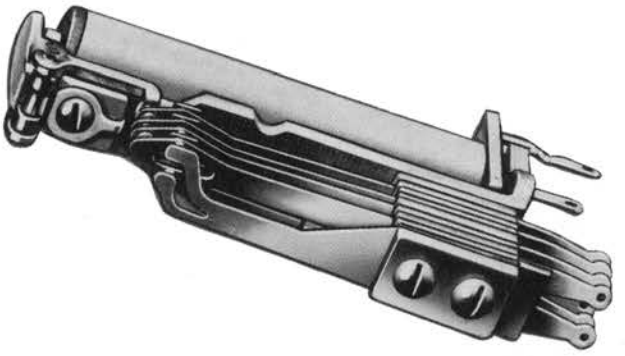
ILLUSTRATIONS



Type 57-A or class B relay with short-lever armature



Type 57-A or class B relay with long-lever armature (most widely used)



Type 58-A or class C relay

Figure 2. Typical relays.
Our Telephone customers know these as type 57-A and type 58-A.
Our Industrial customers know these as class B and class C.
There is no difference between a type 57-A relay and a class B relay, nor between a type 58-A relay and a class C relay.

ADJUSTMENT OF
TYPE 57-A AND TYPE 58-A (CLASS B AND CLASS C)
RELAYS

1. INTRODUCTION

Type 57-A and type 58-A relays are general-purpose twin-contact relays for exacting applications. Basically the type 58-A relay incorporates the same design characteristics as the type 57-A relay, but the type 58-A relay is only half as big and can be used advantageously where space and weight are important.

All type 57-A or type 58-A relays of one single catalog- or piece-number are commercially uniform to one another as to contact pressure, contact spacing, and operating current (or voltage). This uniformity or consistency of manufacture insures adequate contact pressure for reliable contacting, contact-load handling capability, and long contact life. This uniformity assures that the relay will operate under the required circuit conditions (on the specified minimum current or voltage, or in the required time, or with the required contacting sequence). To insure this uniformity and reliability every relay is factory-adjusted and inspected to specifications set forth on an adjustment card for that relay piece-number (see figure 3, ART- card). Telephone-equipment customers receive Relay Adjustment Sheets covering all relays incorporated in the circuits of the equipment furnished. Industrial customers may order adjustment cards for the relays they use. For a more detailed explanation of the design details and features of both type 57-A and type 58-A relays, refer to bulletin 537.

Field readjustment will rarely be required, but the information contained in this bulletin should be helpful in readjustment of the relay when necessary.

Before attempting to readjust any relay, study the construction of the relay (see figure 5). It is important to know not only how to make each adjustment, but also how each adjustment will affect the operation of the relay. If one understands fully the construction of the relay and the effect each adjustment has on the operation of the relay, the readjustment technique will be mastered more quickly. However, it will take time and practice to acquire the knack of relay adjustment, so do not become discouraged easily. It might be helpful if, before attempting to readjust relays which are in use, some practicing is done on discarded or surplus relays. Relay adjustment is delicate work and requires skill acquired through practice and developed, much like a watch-repairman's skill, over a considerable time. Only very slight movement of the adjusting tool is enough to affect relay performance. Withdraw tools carefully to avoid undoing adjustments.

2. DEFINITIONS

CONTACT SPRING: an individual spring of a contact form. Springs are assembled into five basic forms, shown normal (unoperated) in figure 4, and known industry-wide by letters "A" through "E". Figure 6, usual sequence of forms, applies in particular to type 58-A and short-lever-armature type 57-A relays. For long-lever-armature relays the sequence of forms B, C, and A is the same, but form E or form D (one, not both) must be on top of the pile-up.

CONTACT SPRING COMBINATION: two or more contact springs in a circuit-closing, -opening, or transfer arrangement, containing one armature spring.

CONTACT SPRING PILE-UP: one or more contact spring combinations actuated by a single armature arm.

PAIR OF CONTACTS: one contact of an armature spring and the mating contact of a stationary spring. For example, in twin-contact relays type 57-A and type 58-A, a make combination consists of two pairs of contacts.

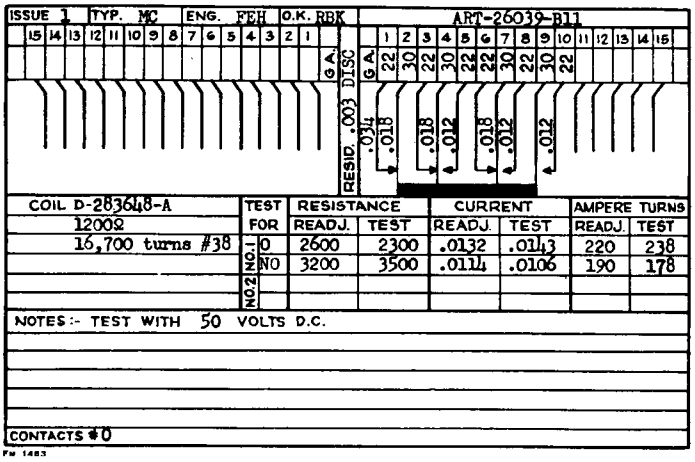


Figure 3. Typical adjustment card (ART-) for an individual relay.

BACK CONTACT: a contact of the stationary spring of a break combination (or similar spring of a combination which includes a break spring).

BREAK COMBINATION: a combination of springs, the contacts of which are normally closed; i.e., the springs make contact when the relay coil is not energized.

FRONT CONTACT: a contact of the stationary spring of a make combination (or similar spring of a combination which includes a make).

MAKE COMBINATION: a combination of springs, the contacts of which are normally open; i.e., the springs are not in contact when the relay coil is not magnetized.

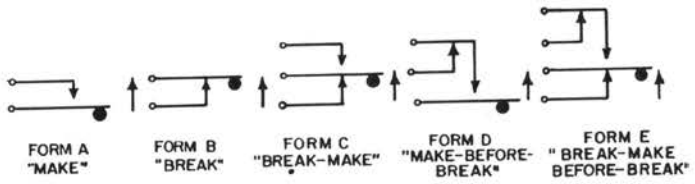


Figure 4. Basic contact forms.

BREAK-MAKE COMBINATION: a combination of springs of which the first pair of contacts, that nearest the armature lever, is normally closed and the second pair normally open when the coil is not energized, and respectively open and closed when it is energized. This is sometimes referred to as a ''transfer'' combination. See figure 4 form C.

MAKE-BREAK or MAKE-BEFORE-BREAK COMBINATION: a combination of springs of which the first pair of contacts, that nearest the armature lever, is normally open and the second pair normally closed when the coil is not energized, and respectively closed and open when it is energized. See figure 4 form D.

BREAK-MAKE-BEFORE-BREAK COMBINATION: a combination of springs of which the first pair of contacts, counting from the end closest to the armature lever, is normally closed, the second pair normally open, and the third normally closed when the coil is not energized, and respectively open when the coil is energized. See figure 4 form E.

STATIONARY SPRINGS: springs not actuated by the armature arm. Examples: back contacts, front contacts.

ARMATURE SPRING: a moving spring actuated by the armature arm, either directly or through a buffer on another armature spring.

FOLLOW: the yield or bending of a stationary spring which results in the contact points being firmly held and rubbed together to improve their conductivity. For a front contact it occurs when the armature is operated, and for a back contact when the armature is restored.

CONTACT SPRING ASSEMBLY: all the spring combinations on one relay. It may have one or two spring pile-ups. (Replacement spring assemblies will be supplied mounted on heelpieces.)

SINGLE-ARM RELAY: relay having only one spring pile-up, actuated by a single arm of the armature.

DOUBLE-ARM RELAY: relay having two spring pile-ups, each pile-up having one or more contact forms.

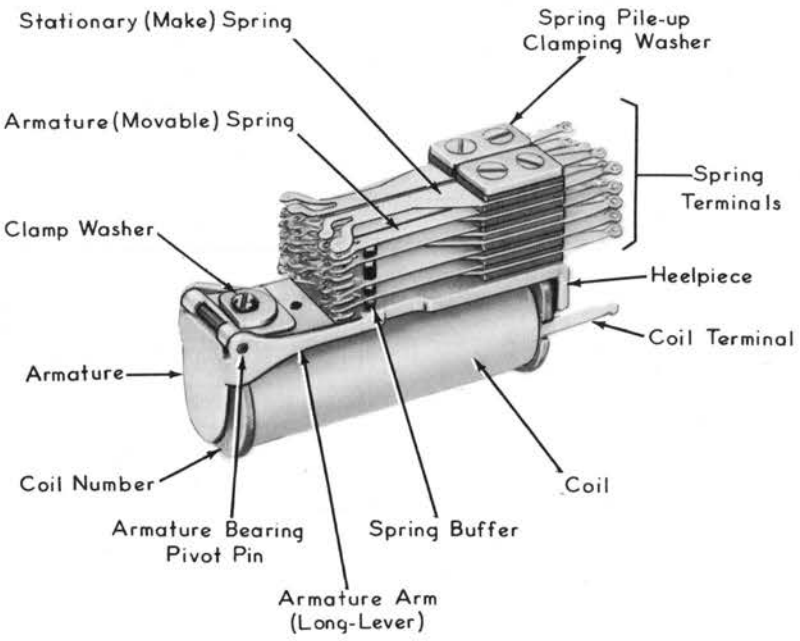


Figure 5. Typical type 57-A or class B relay.

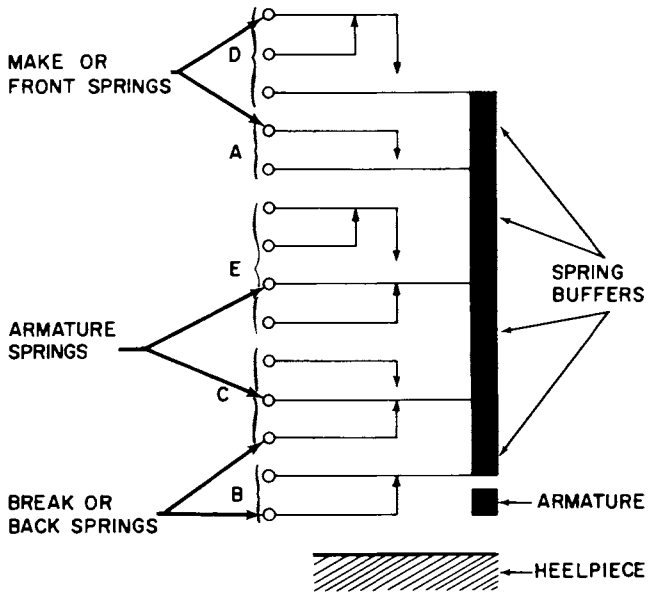


Figure 6. Usual sequence of contact forms.

HEELPIECE: metal base of the relay which completes the magnetic circuit between the coil-core and the armature. On it are mounted the coil assembly, the armature, and the spring assembly. It is tapped for screws to attach the whole relay to the equipment in which it functions.

COIL ASSEMBLY: the coil-core and winding together with the insulating washers and coil terminals. Sometimes includes a copper collar or sleeve, or both, to make the relay slow in operating or releasing.

ARMATURE: the moving portion of the relay that completes the magnetic path between the coil-core and the heelpiece, and actuates the contact springs.

AIRLINE: the gap between the armature and the heelpiece determined by the yoke clamping screw.

LEFT-HAND RELAY: a single-arm relay with the springs on the left-hand side as you visualize the relay held with the armature at the top and the springs toward you. See figure 7. About half the relays on Strowger linefinder, selector, and connector switches are left-hand relays. They are not usual elsewhere.

RIGHT-HAND RELAY: a single-arm relay with the springs on the right-hand side. See figure 7. About half the relays on Strowger linefinder, selector, and connector switches are right-hand relays. The right-hand relay is usual for all other applications, such as manual switchboards, industrial control, etc.

RESIDUAL AIR-GAP: the space between the face of the coil-core and the magnetic inner surface of the armature with the relay electrically operated and the residual disc or screw touching the core. The residual air-gap can be provided by either an adjustable non-magnetic screw (adjustable residual) or a thin non-magnetic disc welded to the inside of the armature (fixed residual).

STROKE: the amount of armature travel, measured between the coil-core face and the armature residual.

GAUGING: the bending of the armature arm and positioning of the stationary springs so that the contacts make, break, and follow properly; also, the dimension value as shown on adjustment card which measures indirectly the distance between contacts.

SHORT-LEVER ARMATURE: an armature whose arm is short relative to the arm of the other of two classes of armatures. Specifically, in the case of type 57-A short-lever-armature relays the ratio of buffer travel to stroke is 1.15:1. See figure 1 upper left. Slow-releasing relays often have short-lever armatures. Cf. long-lever armature.

LONG-LEVER ARMATURE: an armature whose arm is long relative to the arm of the other of two classes of armatures. Specifically, in the case of type 57-A long-lever-armature relays the ratio of buffer travel to stroke is 1.65:1. See figure 1 upper right. The long-lever armature is the usual armature. Cf. short-lever armature.

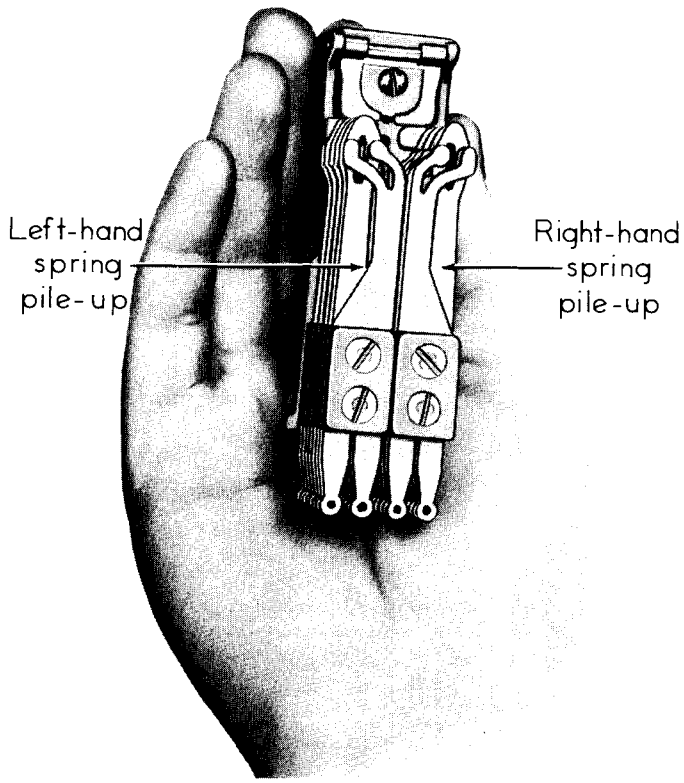


Figure 7. Left- and right-hand spring pile-ups.

Definitions relating to adjustment procedure:

MARGINING: adjustment of armature-spring tension. Also, the determination of armature-spring tension by electrical tests.

"N.O.": abbreviation for non-operate, a test whether the armature springs have enough tension to insure reliable back-contact pressure.

"O": abbreviation for operate, a test to make sure the armature springs were not adjusted too stiff during the non-operate test; i.e., to insure that the relay can respond for its normal circuit function.

"READJ.": close margining-value limits, used when a relay is first adjusted at the factory or readjusted in service.

"TEST": margining-value limits wider than readjust margining values; used for all inspections subsequent to the original manufacture or field readjustment of a relay.

PRELIMINARY CONTACTS: combinations which operate completely before any other combinations on the relay operate. The magnetization required to operate the preliminary contact is less than the non-operate magnetization for the other combinations. The preliminary and other combinations are margined separately, with different operate and non-operate values. (See figure 8.)

TWO-STEP RELAY: a relay with preliminary contacts in a circuit where after its preliminary contacts operate it remains for a time with the armature partially operated, and awaits additional magnetization to complete its stroke and operate the other combinations.

NORMALLY OPERATED RELAY: a relay which is energized most of the hours of the day and performs its useful circuit function when released.

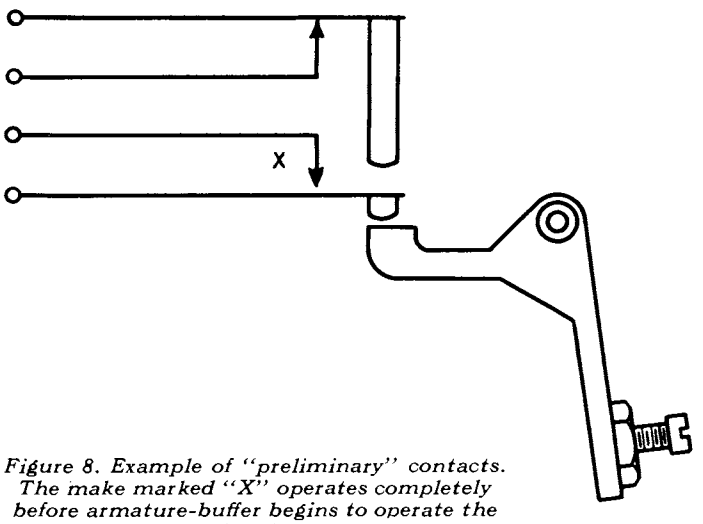
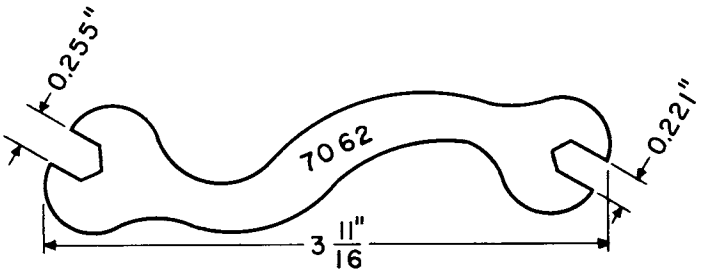


Figure 8. Example of "preliminary" contacts. The make marked "X" operates completely before armature-buffer begins to operate the break.

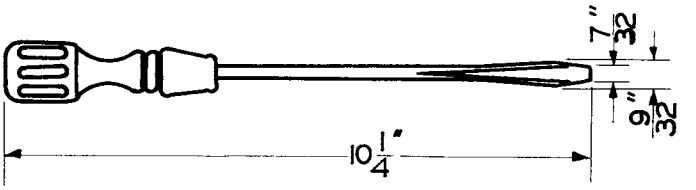
3. TOOLS USED IN ADJUSTMENT

In the adjustment of type 57-A and type 58-A relays several different tools will be needed:

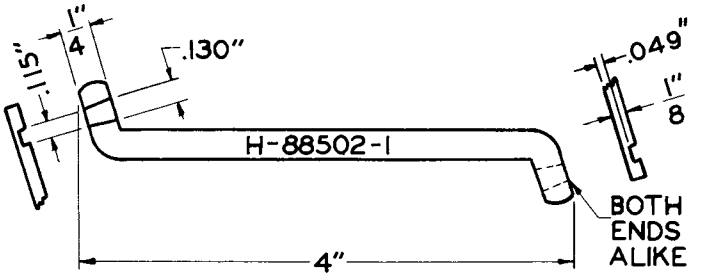
3.01 "S" wrench H-7062. Holds the residual nut during adjustment of the residual screw on type 57-A and type 58-A relays.



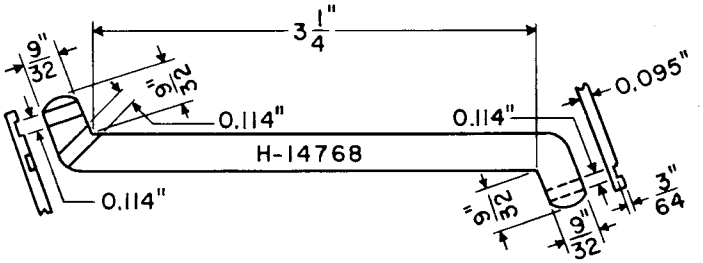
3.02 Screwdriver H-24664. Used to adjust the residual screw.



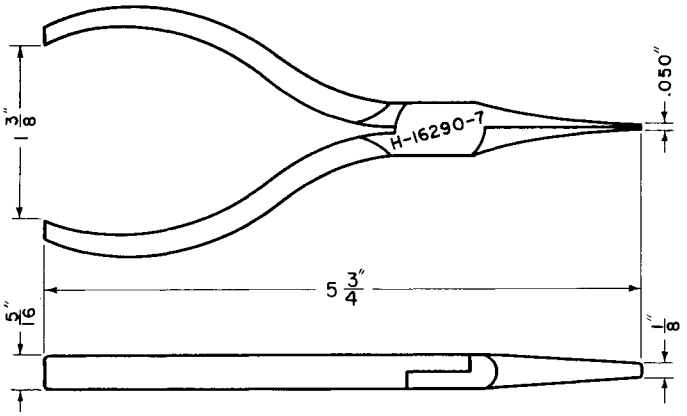
3.03 Armature bender H-88502-1. This tool is used to bend the armature arm to adjust the stroke (or travel) of the armature. It is used on type 57-A relays with long-lever armatures.



3.04 Armature bender H-14768. This tool is used for the same purpose as armature bender H-88502-1 listed above, except that it is used on all type 58-A relays and on type 57-A relays with short-lever armatures.



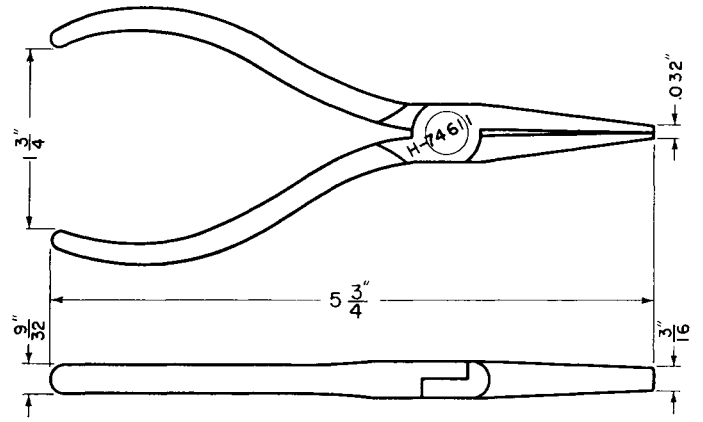
3.05 Spring adjustment pliers H-16290-7. Where space permits, use to tension and straighten armature springs.



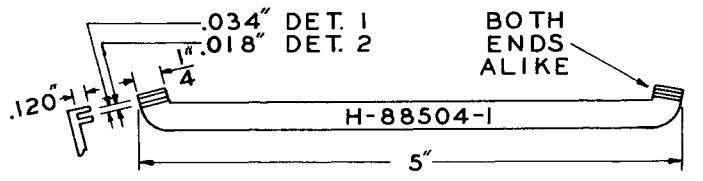
3.06 Duck-bill pliers H-74611. Where space permits, use to tension and straighten the heavier stationary springs.

Both these pliers and H-16290-7 have jaws sufficiently narrow to fit between the springs and permit slight twisting. Or, adapt other duck-bill pliers with wider jaws by grinding the jaws to a width of not more than 3/16".

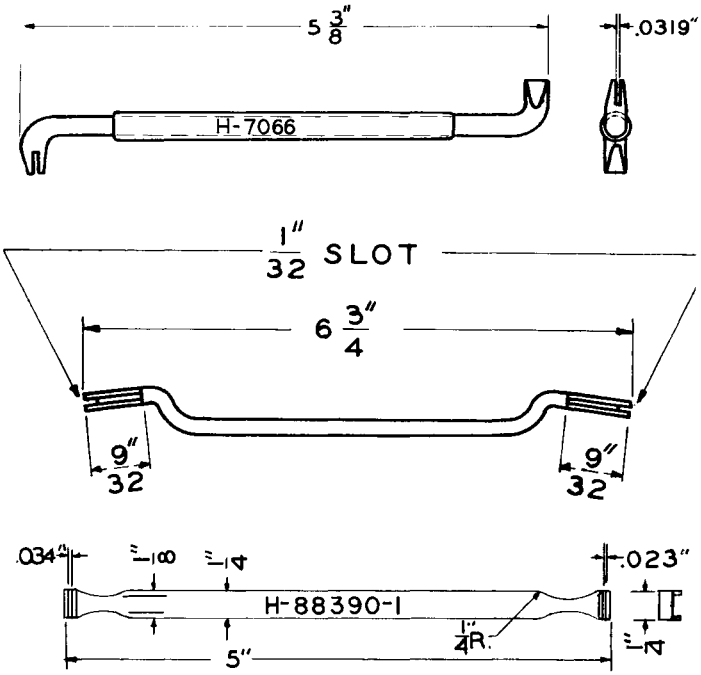
Ordinarily, the inner faces of the jaws are not polished in manufacture because their usual purpose is to grip something. Since these pliers will need to slide freely, it is suggested that the inner faces of the jaws be polished with a piece of crocus cloth.



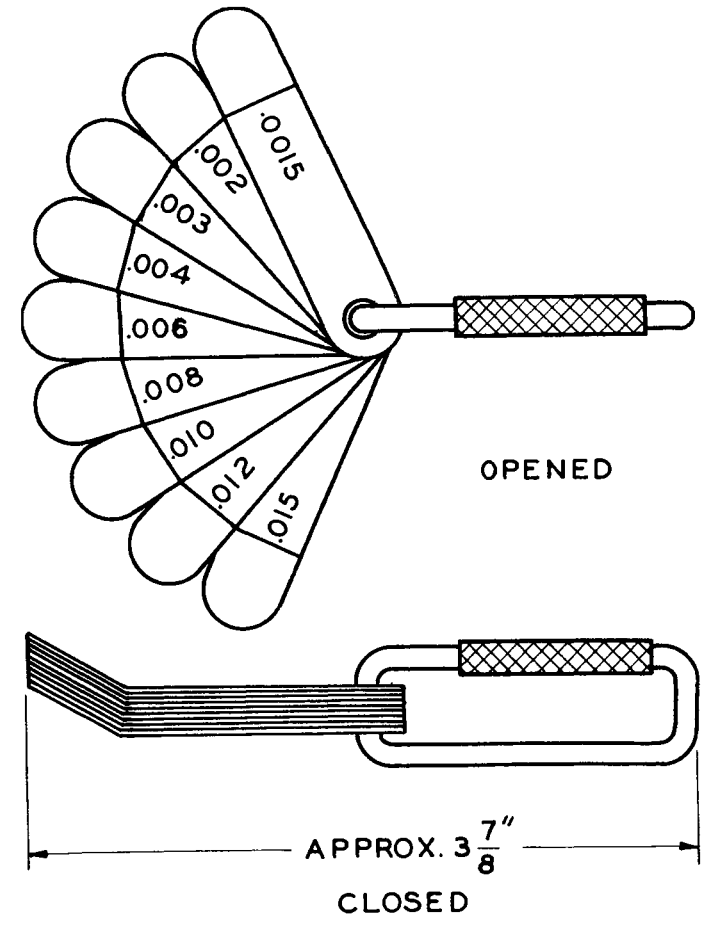
3.07 Spring adjuster H-88504-1 and -2. Use adjuster H-88504-1 when gauging stationary or other heavy springs. Use adjuster H-88504-2 to adjust armature (moving) springs.



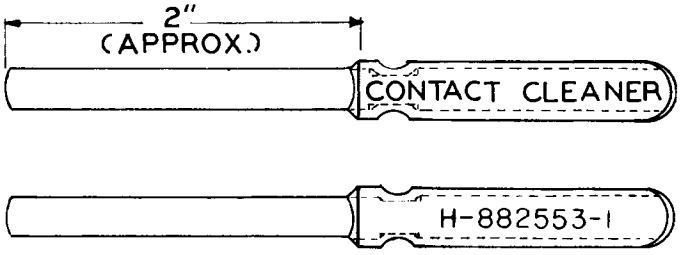
3.08 Spring adjusters H-7066, H-20777, H-88390-1. Use to adjust stationary springs.



3.09 Thickness gauges (bent tips) H-46795-1. Use to check residual gap, spring gauging, and armature stroke. Bent-tip thickness gauges are preferred to straight thickness gauges because bent-tip gauges can be used where relays are mounted close together.



3.10 Contact cleaner H-882553-1. Use to remove dust or foreign matter from relay contacts.



4. INSPECTION AND ADJUSTMENT

4.1 Caution. The most important rule to remember in relay maintenance is: Do not readjust a relay until certain that it is out of its allowable operating range. Slight deviation from nominal values is to be expected and is not in itself cause for readjustment. Where adjustment limits are given, inspect the relay with the extreme limiting ("test") values; readjust only if the relay is outside the test limits.

The avoidance of adjustment until absolutely necessary is emphasized because of the interaction of adjustments which can easily result in a relay being less able to operate properly than before. Such interaction can be seen if one considers that changing the airline or changing the residual affects the gauging, and changing the gauging affects the margining, or that changing the spring tension affects the gauging, etc.

4.2 "Standard Adjustments" (tolerances). For all new telephone central-office installations, Standard Adjustments are shipped with Relay Adjustment Sheets (AH). Standard Adjustments, A-300 in the case of type 57-A* relays and A-301 in the case of type 58-A relays, show further qualifications of the tolerances. Specimen pages of A-300 are shown in figure 16. Non-telephone customers may purchase the Standard Adjustments.

4.3 Mechanical inspection. An orderly sequence of steps in relay inspection will save time. Mechanical inspection and cleaning will precede electrical inspection.

4.31 Inspect the relay for general defects such as loose parts, bent springs, or contacts out of alignment. Check that the relay mounting screws, the coil mounting screw, and the armature mounting screw are tight. Also see that coil terminals do not touch the heelpiece.

4.32 Check that the relay is approximately level and clears adjacent relays by at least 1/32" in the case of type 57-A relays and 0.010" in the case of type 58-A relays.

4.33 The airline or the air gap between the armature and the heelpiece may have been disturbed if the armature mounting screw was loose. For type 57-A relays the airline would be not over 0.003" for adjustment and 0.004" for inspection if the residual is "fixed". For type 58-A relays the airline would be not over 0.003" for adjustment and 0.004" for inspection with a "fixed" residual of 0.003", and not over 0.006" for adjustment and 0.008" for inspection with a "fixed" residual of 0.006".

4.4 Cleaning. Contact cleaning will be the most common operation in relay maintenance. To clean contacts use only contact cleaner H-882553-1. Do not use paper as it leaves dust or lint on the contacts. Do not use any liquid cleaners because they leave an oily residue which will only collect more dirt.

Occasionally, a thorough general cleaning of all the relays on a switch may be necessary. Using a vacuum cleaner and an ordinary 1½" paint brush, stir up the dust with the brush and draw it up with the vacuum cleaner hose, held as close as possible to the relays. Clean the coil and other relay parts before cleaning the springs. When cleaning the springs, push the hairs of the brush in between the springs and draw them through the contacts. Operate the armature by hand to clean both make and break contacts, and use contact cleaner H-882553-1 on them, as previously described. If both these methods fail to remove deposits caused by arcing, they can be removed with a piece of chamois stretched over a thin piece of wood or metal and drawn through the contacts.

4.5 Electric connections. For telephone equipment, the electric connections for testing each relay are given in the adjustment sheet covering the circuit of which the relay is part. Adjustment sheets usually bear the same number as the circuit, prefixed AH. Thus for circuit H-85016 the adjustment sheet is AH-85016. Refer to figure 9 as an example. The testing instructions are listed in the right-hand column. The adjoining column to the left of this may indicate which, if any, of the notes in the lower left-hand corner are to apply. Similar information is provided for Industrial customers by the "Customer Drawing" (see figure 21), furnished only on request. Use either a current-flow test set or a resistance box for testing the relay.

*As shown in figure 16, Standard Adjustment A-300 is headed "...type 57L and 57S...", meaning that it covers both long-lever-armature and short-lever-armature type 57-A relays.

FM-1461-2

RELAYS	SPRING GAUGING	TEST FOR	RESISTANCE READJ.	RESISTANCE TEST	CURRENT READJ.	CURRENT TEST	SEE NOTE	TESTING INSTRUCTIONS
Y2-Y5 RT-26628-B11 D-283648-A #1-1200Ω	.003D RESID. NO. 1: .032 .018 .018 .018 .012 .012 .012 .012 NO. 2:	0	1200		.0208			POS. TO SPG. 13 OF RLY. UNDER TEST.
DS RT-19011-A12 D-283242-A #1-1300Ω SR	.003 RESID. SHORT LEVER NO. 1: .016 .024 .016 .024 .040 NO. 2:	0	2900		.0129			POS. TO UPPER SPG. 2 OF RLY. DR.
DR RT-21270-B11 D-280028-A #1-1300Ω	.003D RESID. NO. 1: .020 .012 .008 .008 .008 NO. 2:	0	600		.0263			POS. TO LOWER JACK 27.
	-- RESID. NO. 1: .020 .012 .012 .008 .008 NO. 2:							DOUBLE-ARM RELAY
PG RT-13016-C14 #1-750Ω (1200-2000ΩNI) #2-1000Ω	.006D RESID. NO. 1: .008 .008 .008 .008 .014 NO. 2:	0	1450		.0227			INS. UPPER SPGS. 6 & 7 OF RELAY PD. POS. TO ROT. SW. S1 O.N. SPG. 3.
PT RT-12044-C16 D-280424-A #1-1600Ω SO	.006D RESID. NO. 1: .022 .012 .008 .008 .008 .008 .008 NO. 2:	0 NO	700 1400	500 1700	.0217 .0167	.0238 .0152		POS. TO UPPER SPG. 5 OF RLY. TG OR TO LOWER JACK #31.

ASSOCIATED DRAWINGS

EXPLANATION OF TERMS

#1—INSIDE OR ARMATURE END WINDING. #2—OUTSIDE OR HEEL END WINDING. S. A.=SLOW TO OPERATE & SLOW TO RELEASE: S. R.=SLOW TO RELEASE: S. O.=SLOW TO OPERATE: E. P.=ELECTRO POLAR: A. C.=ALTERNATING CURRENT. W.=BRASS WASHER BETWEEN COIL & HEEL PIECE. O=OPERATE: N. O.=NON-OPERATE VALUES. RESID.=RESIDUAL ADJUSTMENT VALUE. TEST VALUES ARE FOR INSPECTION ONLY. READJ. VALUES ARE FOR ADJUSTING ONLY. CURRENT IS SHOWN IN AMPERES. RESISTANCE VALUES ARE FOR 50 V. BATTERY. POS.—TEST WITH POSITIVE BATTERY THRU RESISTANCE OF TEST SET. NEG.—TEST WITH NEGATIVE BATTERY THRU RESISTANCE OF TEST SET.

NOTES

1—TEST WITH BOTH WINDINGS IN SERIES.
2—TEST WITH VERTICAL MAGNET IN SERIES.
3—TEST WITH ROTARY MAGNET IN SERIES.
4—NO. 1 WINDING TO OPER. NO. 1 SPRING ONLY.
5—SPRINGS NEED ONLY MAKE CONTACT ON OPERATE TESTS.
6—BOTH TESTS MADE ON NO. 1 WINDING. NO. 1 TEST IS FOR NO. 1 SPRING ONLY.
7—CONNECT RESIST. ACROSS TEST JACKS 1 & 2.
8—SHT. LEVER ARM. RESID. MIN. .0015 MAX. .004

STANDARD ADJUSTMENTS

TYPE.- | ENG.- | APP'D.- | OK.-

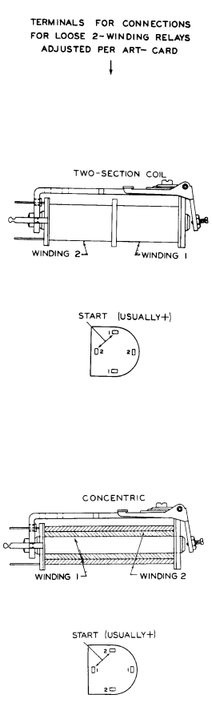
AUTOMATIC ELECTRIC COMPANY
CHICAGO, U. S. A.

RELAY ADJUSTMENT SHEET

CKT.- H-85XXX | SHEETS

AH-85XXX

Figure 9. Typical "Relay Adjustment Sheet" (AH-) for a relay group.



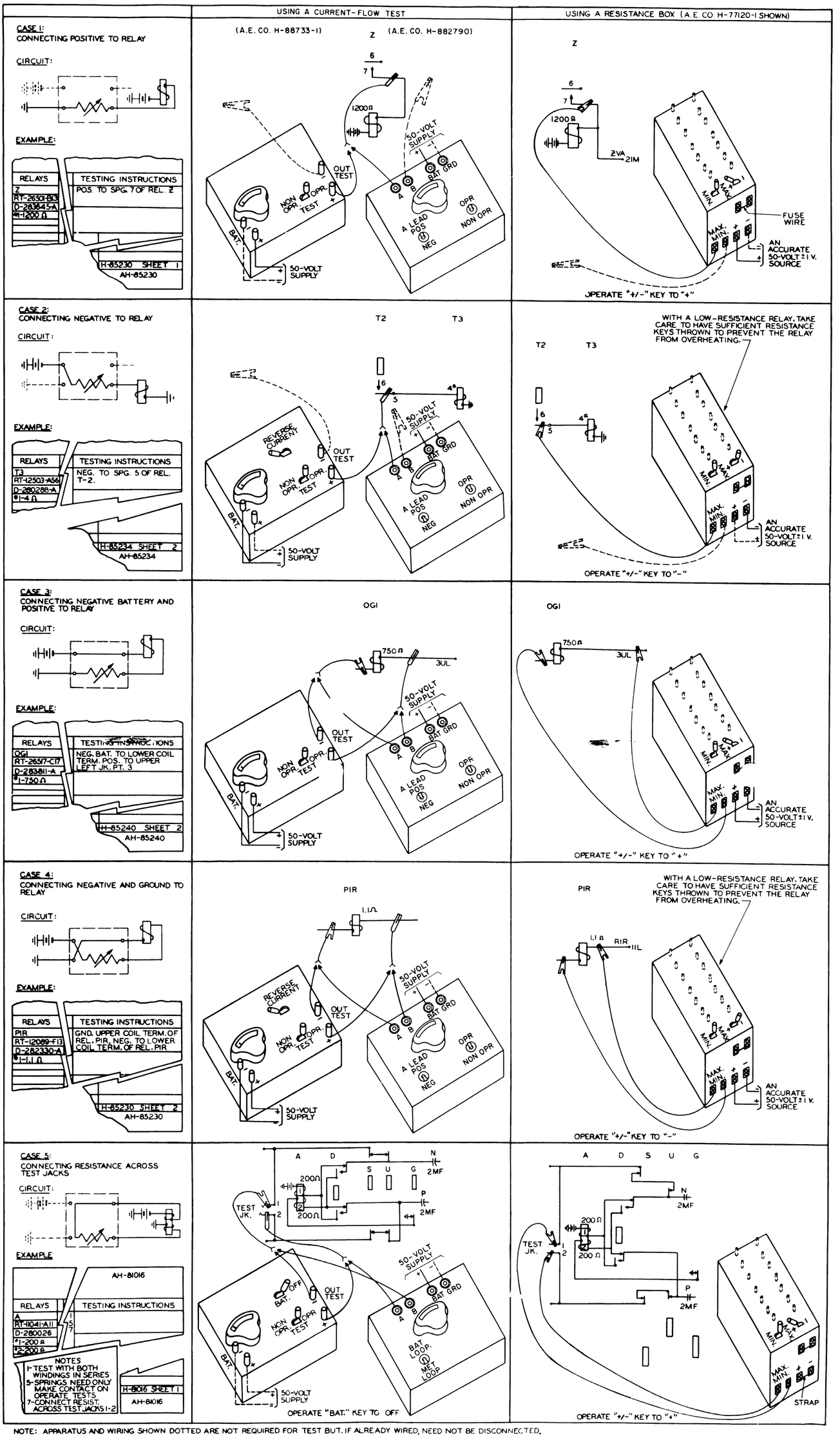


Figure 10. Typical electric connections for margining.

As in ordinary telephone parlance, "ground" on a Relay Adjustment Sheet (figure 9) means direct connection to + battery; likewise "negative battery" means direct connection to "-" battery. But notice that for relay adjustments "positive" and "negative" are used as explained in figure 9 lower left-hand corner:

POS. = test with positive battery thru resistance of test set.
NEG. = test with negative battery thru resistance of test set.

Figure 10 cases 1 - 4 illustrate these meanings, and how to make connections for them.

Special attention is called to the case of low-resistance relays; i.e., relays whose coils have 100Ω or less resistance. To prevent such relays from overheating when inspecting them electrically, insert at least 50Ω resistance in the circuit. The SOAK key in current-flow test set No. H-88733 or H-882790 automatically provides a 50Ω resistor of sufficient wattage rating. However, earlier-model resistance boxes have resistors of lower wattage ratings. The 50Ω resistor might be as low as 1 watt, which together with a low-resistance relay could overheat, or blow fuses. It is suggested that the two 20Ω and the one 10Ω resistors be used together, instead. If the relay is in a circuit, an adjoining component can be used to supply the needed resistance. Whenever there is doubt as to the adequacy of the resistance, take care and operate the relay momentarily only.

Current-flow test set H-88733 has resistance-setting key rows marked "NON OPR" and "OPR" indicating lower and higher currents, respectively. Thus, a large resistance must be set on the keys affecting the "NON OPR" side of the test key, and a low resistance on the keys affecting the "OPR" side of the test key. Current-flow test set H-882790 has two resistance ranges marked OPERATE RANGE and NON OPERATE RANGE. The OPERATE RANGE contains three potentiometers of different resistance values. These potentiometers can be operated individually, or in combinations to provide a greater resistance range. The NON OPERATE RANGE contains the same equipment as the OPERATE RANGE. Operation of the OPR, NON OPR toggle switch, closes either the OPERATE or NON OPERATE RANGE potentiometers to the equipment under test. ON resistance box H-77120-1 the resistance-setting key rows are marked "MAX" and "MIN". In paragraph 4.52 the instructions with respect to the MAX/MIN test key assume "MAX" to mean maximum resistance (non-operate) and "MIN" to mean minimum resistance (operate). If the adjuster finds it easier to think of "MAX" as maximum current (operate) and "MIN" as minimum current (non-operate), he can of course use the box that way, but he will reverse the MAX/MIN test key operating instructions given in paragraph 4.52.

4.51 Current-flow test set H-88733* (figure 1). Be sure all keys of the current-flow test set are in their normal positions. Connect central-office "+" and "-" battery to the current-flow test set. For "O" and "N.O." insert the necessary values of resistance by switching the appropriate keys.

(a) If the testing instructions in the adjustment sheet read "POS. TO . . ." connect terminal +OUT TEST to the point mentioned after "POS. TO . . ." (figure 10 case 1).

(b) If the instructions read "NEG. TO . . ." connect terminal +OUT TEST to the point mentioned after "NEG. TO . . ." and throw the REVERSE CURRENT key to the left (figure 10 case 2).

(c) If the instructions read "POS. TO . . ." and "NEG. BAT. TO . . ." connect terminal +OUT TEST to the point mentioned after "POS. TO . . ." and terminal -OUT TEST to the point mentioned after "NEG. BAT. TO . . ." (figure 10 case 3).

(d) If the instructions read "GND. . . ." and "NEG. TO . . ." connect terminal OUT TEST to the point mentioned after "NEG. TO . . .", connect terminal -OUT TEST to the point mentioned after "GND. . . ." and throw the REVERSE CURRENT key to the left (figure 10 case 4).

(e) If the instructions make reference to note 7, "CONNECT RESIST. ACROSS TEST JACKS 1 & 2", or the instruction itself says as much, connect both terminals to test jacks 1 and 2 and turn the battery key on the current-flow test set to OFF. Then the set provides only resistance. As in other cases, the resistance value is shown on the adjustment sheet (figure 10 case 5).

(f) If the instructions read "INS. SPGS....", insert a strip of phenolic fiber between the mentioned spring contacts to insulate them electrically. Do not use paper to insulate springs, because after the paper is withdrawn, its lint sometimes adheres to the contacts and prevents good electric contact.

(g) Perform any other operations required in the "TESTING INSTRUCTIONS".

*In the U.S. Army and U.S. Navy this is known as Telephone Test Set TS-699A/FTM, covered in Department of the Army Technical Manual TM 11-2112.

4.52 Current-flow test set H-882790 (figure 1). Be sure all switches of the current-flow test set are in their normal positions. Connect central office "+" and "-" battery to the current-flow test set. For "O" and "N.O." insert the necessary values of resistance by regulating the proper OPERATE or NON OPERATE potentiometers.

(a) If the testing instructions in the adjustment sheet read "POS. TO . . .". Connect terminal "A" to the point mentioned after "POS. TO . . .", and operate the "A" LEAD toggle switch to the POS. position (figure 10 case 1).

(b) If the instructions read "NEG. TO . . .". Connect terminal "A" to the point mentioned after "NEG. TO . . .", and operate the "A" LEAD toggle switch to the NEG. position, and the "B" LEAD toggle switch to the CLOSED position (figure 10 case 2).

(c) If the instructions read "POS. TO . . ." and "NEG. BAT. TO . . .". Connect terminal "A" to the point mentioned after "POS. TO . . ." and terminal "B" to the point mentioned after "NEG. BAT. TO . . .", operate the "A" LEAD toggle switch to the NEG. position, and the "B" LEAD toggle switch to the CLOSED position (figure 10 Case 3).

(d) If the instructions read "GND. . . ." and "NEG. TO . . .". Connect terminal "A" to the point mentioned after "NEG. TO . . .", connect terminal "B" to the point mentioned after "GND." and operate the "A" LEAD toggle switch to the NEG. position (figure 10 case 4).

(e) If the instructions make reference to note 7, "CONNECT RESIST. ACROSS TEST JACKS 1 and 2, or the instruction itself says as much, connect both terminals to test jacks 1 and 2 and operate the BAT. LOOP, MET. LOOP key to the MET. LOOP position. Then the set provides only resistance. As in other cases, the resistance value is shown on the adjustment sheet (figure 10 case 5).

(f) If the instructions read "INS. SPGS.", insert a strip of phenolic fiber between the mentioned spring contacts to insulate them electrically. Do not use paper to insulate springs, because after the paper is withdrawn, its lint sometimes adheres to the contacts and prevents good electric contact.

(g) Perform any other operations required in the "TESTING INSTRUCTIONS."

4.53 Resistance box. Be sure all keys of the resistance box are in their normal positions. Connect central-office battery to the resistance box. With the keys, insert "O" and "N.O." resistances per section 4.5 using the MAX row for non-operate and the MIN row for operate.

(a) If the instructions read "POS. TO . . .", connect ground to the + terminal, the left MAX/MIN terminal to the point mentioned after "POS. TO . . .", and throw the +/- key to + (figure 10 case 1).

(b) If the instructions read "NEG. TO . . .", connect negative battery to the "-" terminal, the left MAX/MIN terminal to the point mentioned after "NEG. TO . . .", and throw the +/- key to "-" (figure 10 case 2).

(c) If the instructions read "POS. TO . . ." and "NEG. BAT. TO . . .", connect ground to the + terminal, negative battery to the "-" terminal, the left MAX/MIN terminal to the point mentioned after "POS. TO . . .", the right MAX/MIN terminal to the point mentioned after "NEG. BAT. TO . . .", and throw the +/- key to + (figure 10 case 3).

(d) If the instructions read "GND. . . ." and "NEG. TO . . .", connect ground to the + terminal, negative battery to the "-" terminal, the left MAX/MIN terminal to the point mentioned after "NEG. TO . . .", the right MAX/MIN terminal to the point mentioned after "GND. . . .", and throw the +/- key to "-" (figure 10 case 4).

(e) If the instructions make reference to note 7, "CONNECT RESIST. ACROSS TEST JACKS 1 & 2", or the instruction itself says as much, connect both terminals to test jacks 1 and 2 and turn the +/- key on the resistance box to the center position; i.e., OFF. Then the box provides only resistance. As in other cases the resistance value is shown on the adjustment sheet (figure 10 case 5).

(f) If the instructions read "INS. SPGS. . . .", insert a strip of phenolic fiber between the mentioned spring contacts to insulate them electrically. Do not use paper to insulate springs, because after the paper is withdrawn, its lint sometimes adheres to the contacts and prevents good electric contact.

(g) Perform any other operations required in the "TESTING INSTRUCTIONS".

4.54 In the following text the use of both test sets will be discussed. In some instances a

key from both test sets will be mentioned. In these instances the two keys will be separated by a (double slash) // mark. The key preceding the // mark refers to test set H-88733, the key following the // mark refers to test set H-882790.

4.6 Residual adjustment. If the armature were allowed to touch the coil/core when a relay is operated, residual magnetism in the core might hold the relay operated after the circuit was opened. To prevent the armature from touching the core a piece of non-magnetic material called a "residual" is fixed to the center of the armature, so that when the relay operates only the protruding residual hits the coil-core. The gap made in this way is called the "residual air gap"; it prevents residual magnetism in the core from holding the armature.

Residuals may be fixed (disc), or adjustable (screw). A disc residual can be verified, but not adjusted; if it is outside tolerances, replace the armature. A screw residual, held by a lock nut, may be adjusted as follows. Since the 5-50 X $\frac{1}{4}$" residual screw has 40 threads per inch, one turn changes the residual 0.025", 1/25 of a turn changes it 0.001", $\frac{1}{8}$ of a turn changes it 0.003 etc. The relay adjustment sheet RESIDUAL column shows the correct residual setting.

4.61 0.0015" residual. Where the adjustment sheet specifies a residual of 0.0015", the residual will pass inspection if the armature does not touch the face of the coil-core, but is no more than 0.004" from the face of the coil-core.

First, check whether or not the armature touches the coil-core. Using a current-flow test set or a resistance box connected per the adjustment sheet, throw the TEST // OPR, NON OPR key of the current-flow test set to OPR or the MAX/MIN key of the resistance box to MIN to operate the relay electrically. If the armature touches the core, return the key to normal, loosen the residual nut, and turn the residual screw slightly clockwise until it projects beyond the surface of the armature. Operate the relay electrically again; you should be able to see the residual air gap. Turn off and disconnect the test set or resistance box.

Second, check the distance of the armature from the coil-core. Using a 0.003" gauge (part of H-46795-1) for type 57-A relays and a 0.002" gauge for type 58-A relays, slip the gauge hole over the end of the residual screw (figure 11). Operate the armature manually and check that the gauge is caught tightly between the armature and the core, so that you cannot move it easily.

If you can move the gauge easily, release the armature and turn the residual screw slightly counterclockwise so that it projects less beyond the armature surface. Repeat the test operations explained above. When all the requirements are met, hold the residual screw in its setting with a screwdriver and tighten the residual nut.

4.62 0.003" or greater residual. When the adjustment sheet specifies a residual of 0.003" or more it will pass inspection with a tolerance of 0.002" either way. For adjustment the tolerance is ± 0.001".

Use a gauge 0.001" smaller than the specified residual setting. Slip this gauge over the end of the residual screw. Operate the relay electrically as in paragraph 4.51 above and gently push and pull the gauge to check that it slides freely between the armature and the core. If the gauge is tightly held, return the key to normal and loosen the hexagonal residual nut. Slightly turn the residual screw clockwise so it projects a bit farther beyond the inner surface of the armature. Then repeat the test as explained above.

Next, using a gauge 0.001" larger than the specified residual setting, slip the gauge over the end of the residual screw. Operate the relay electrically and check that the gauge is caught tightly between the armature and the core and cannot be moved. If the gauge can be moved, return the key to normal, loosen the hexagonal nut, and slightly turn the residual

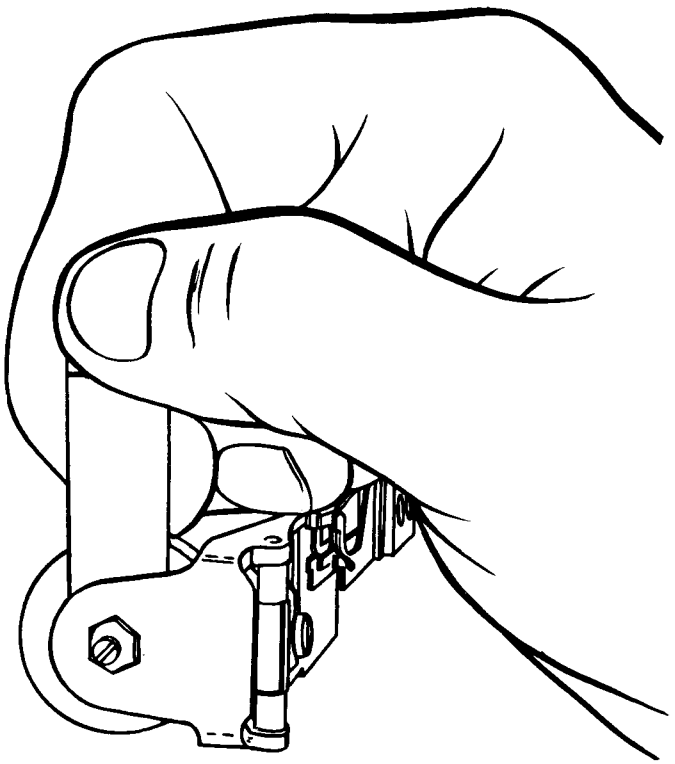


Figure 11. Gauging a residual.

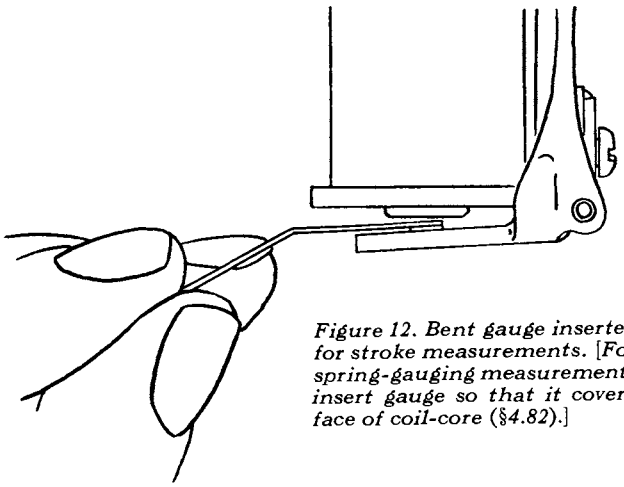


Figure 12. Bent gauge inserted for stroke measurements. [For spring-gauging measurements insert gauge so that it covers face of coil-core (§4.82).]

screw counterclockwise so it projects slightly less beyond the surface of the armature. Repeat the maximum and minimum residual gauging until the requirements are met. Then hold the residual screw in its setting with a screwdriver and tighten the hexagonal nut to lock the screw.

4.7 Stroke adjustment. In the relay adjustment sheet (figure 9) the figure nearest the border of the spring-gauging column is the stroke. Use a gauge (or a combination of gauges) 0.004″ larger than the stroke for type 58-A relays or 0.003″ larger than the stroke for long-lever-armature type 57-A relays, or 0.005″ larger than the stroke for short-lever-armature type 57-A relays. Try to insert the gauge (or gauges) between the armature and the core. The gauge should not enter or, if it does, the armature arm or both arms of a double-arm armature should not leave the fixed heelpiece residual when the relay is electrically operated. (Throw the TEST // OPR, NON OPR key to OPR or the MAX/MIN key to MIN.)

If the relay does not meet this requirement, return the TEST // OPR, NON OPR or MAX/MIN key to normal, and place an armature adjuster (H-88502-1 or H-14768) on the arm which left the heelpiece residual. Hold the armature tightly against the core with the thumb (figure 13) and bend the armature arm slightly away from the springs. Repeat the test described above, and adjust the arm (or arms in the case of a double-arm relay) until its requirements are met.

Insert a gauge (or a combination of gauges) 0.002″ less than the stroke between the armature and the core. Hold the gauge flat against and just covering the core face. Operate the relay electrically by throwing the TEST // OPR, NON OPR key of the current-flow test set to OPR, or the MAX/MIN key of the resistance box to MIN. The armature arm or both arms of a double-arm armature should leave the fixed heelpiece residual. If this requirement is not met, return the key to normal, and place an armature adjuster (H-88502-1 or H-14768) on the arm which did not leave the heelpiece residual. Bend the armature arm slightly toward the springs, while holding the relay as previously described. Repeat the stroke adjustment until the armature arm (or arms) meets the requirements as described.

4.8 Spring gauging. The nominal spring-gauging values will be found in the SPRING GAUGING column on the applicable relay adjustment sheet. The permitted variations from these nominal values are shown in the table of tolerances, figure 14. You will notice one column of ADJUSTMENT values and another of INSPECTION values. When adjusting or readjusting a relay, stay within the ADJUSTMENT limits. When the relay is inspected subsequently, if its adjustment still is within the INSPECTION values the relay is considered still to be in good working order. If, however, on later inspection any adjustment is found to be outside the INSPECTION value, readjust the relay so its adjustments are again within the ADJUSTMENT tolerances. Start by gauging the pair of springs next to the heelpiece, and work outward until all spring-contact pairs have been gauged.

4.81 Straightening springs. Check that the springs have no kinks, sharp bends, or bows exceeding 0.025″. If the springs do not meet

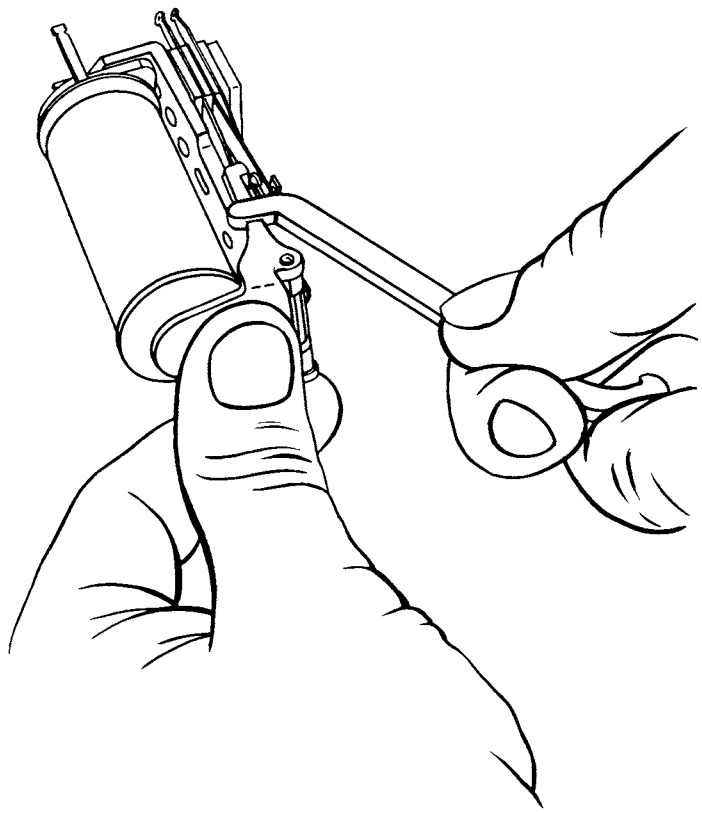


Figure 13. Bending an armature arm.

CHART OF SPRING GAUGING TOLERANCES

Relay	Adjustment	Inspection
Type 57-A (long lever)	±.001″	±.002″
Type 57-A (short lever)	±.002″	±.004″
Type 58-A	+.001″ -.001″	+.003″ -.002″

NOTE: See Standard Adjustments A-300 and A-301 for exceptions to these tolerances.

Figure 14. Principal gauging tolerances.

this requirement, they will need to be straightened. Use spring adjuster H-88502-1 or H-88504-1 (whichever most nearly fits the spring) or, if space permits, a pair of duckbill pliers (H-74611). Stroke the spring with the tool while removing the kink or bow (figure 15).

4.82 Maximum gauging. Refer to the SPRING GAUGING column on the relay adjustment sheet for the spring gauging values and to figure 14 for the maximum gauging tolerance for the particular type of relay being gauged. For example, in the case of a type 57-A relay with a long-lever armature, the spring-gauging value given in the relay adjustment sheet should not be exceeded by 0.001″ for adjustment and by 0.002″ for inspection. Of course, the size of the gauge and the amount of tolerance will not necessarily be the same for the other types of relays. Insert the gauge between the armature and the core face so that it is flat against and just covering the core. Throw the TEST // OPR, NON OPR key to OPR or the MAX/MIN key to MIN. If neither of a pair of make contacts make or if neither of a pair of break contacts break the maximum gauging will be considered met. That is, make contacts should almost, but not quite, make; break contacts should almost, but not quite, break. If the maximum gauging is not met, return the test key to normal and place a spring adjuster (H-88504-1) on the stationary spring of the bad combination. If it is a make combination, bend the stationary spring slightly away from the armature spring; if it is a break combination, bend the stationary spring slightly toward the armature spring.

After the relay has been adjusted, it should be gauged again, using the "adjustment" values. Repeat the gauging and adjustment procedure until the maximum gauging requirement is met.

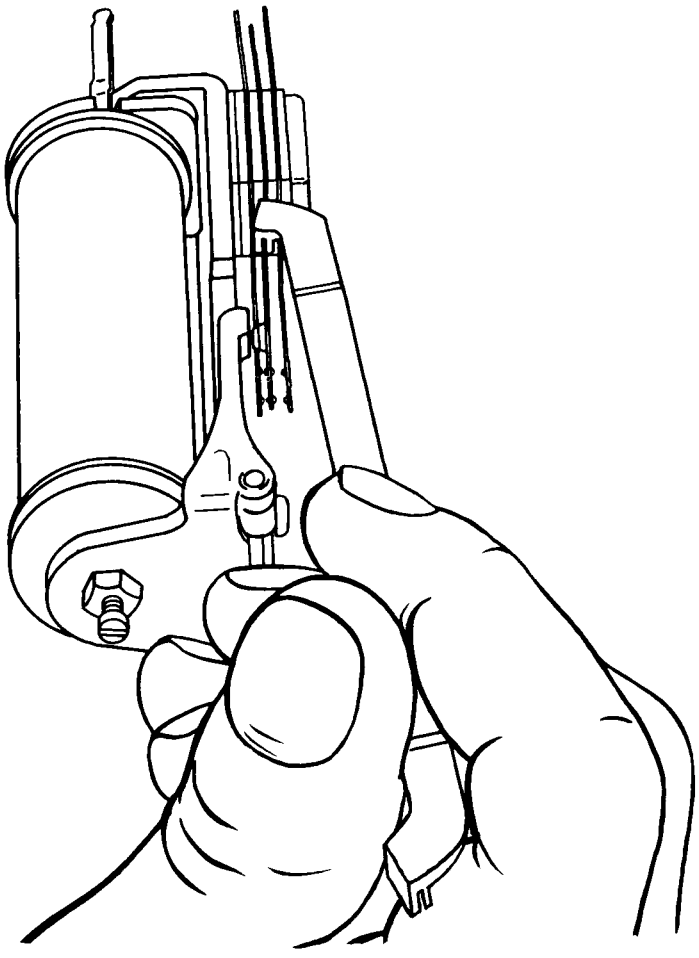


Figure 15. Spring straightening.

4.83 Minimum gauging. Use the spring-gauging value given in the relay adjustment sheet and refer to figure 14 for the minimum gauging tolerance. For example, in the case of a type 58-A relay the spring-gauging value given in the relay adjustment sheet should be reduced by 0.001 for adjustment and by 0.002 for inspection. Insert the gauge between the armature and the core face so that it is flat against and just covering the core. Throw the TEST key to OPR or the MAX/MIN key to MIN. Both pairs of contacts should make if it is a make combination, or break if it is a break combination. If the contacts do not make or break as required, the springs will need to be adjusted.

Return the TEST // OPR, NON OPR or MAX/MIN key to normal and place a spring adjuster on the stationary spring of the combination. If it is a make combination, bend the stationary spring slightly toward the armature spring; if it is a break combination, bend the stationary spring slightly away from the armature spring.

After the relay has been adjusted, it should be gauged again using the "adjustment" values. Repeat the gauging and adjustment procedure until the minimum gauging requirement is met.

4.84 Contact alignment. Operate the relay manually several times slowly and note whether the contacts of both pairs make or break within 0.003″ of each other. If the two

pairs of contacts are out of alignment, place a spring adjuster on one of the armature springs and twist the spring until the contacts make or break within 0.003″ of each other.

4.85 Caution. In some spring pile-ups certain combinations may have been designed to operate before, or after, or at the same time as other combinations. Such an operating sequence may be worked out physically in more than one way, but all the ways depend upon gauging sequence. Usually, the difference between adjacent values in the gauging sequence for the pile-up is more than, or equal to 0.004″. When this is true, the operating sequence cannot be changed by gauging within adjustment tolerance. Occasionally, the difference between adjacent values in the gauging sequence for the pile-up is less than 0.004″. In this case the operating sequence may be changed even when adjacent springs are separately gauged within adjustment tolerance. Then the adjuster should reduce the tolerance before hand to allow for this possibility, and double check his work to see that he has not changed the operating sequence.

4.9 Margining. Margining includes an electrical test of overall spring tension made to determine if the tension of each armature spring is sufficient for its operation under normal circuit conditions. However, this margining test cannot determine the distribution or quality of contact pressure. The relay adjustment sheet gives readjust and test values for resistance and current measurements in margining. Use test values for inspection and readjust values for adjustment.

4.91 Inspecting with test values.

(a) Using the current-flow test set H-88733. Note the figure in the RESISTANCE TEST* column and line O. Throw the keys of the OPR group that total this figure, and throw the TEST key to OPR. If the meter does not read exactly the figure in line O of the CURRENT TEST column, operate and restore keys of the OPR group as needed to bring the meter to that reading, and restore the TEST key to normal.

If the relay has a non-operate value, note the figure in the RESISTANCE TEST column and line N.O. Throw the keys of the NON OPR group that total this figure and throw the TEST key to NON OPR. If the meter does not read exactly the figure in line N.O. of the CURRENT TEST column, operate and restore keys of the NON OPR group as needed to bring the meter to that reading, and restore the TEST key to normal.

Soak** the relay by throwing the SOAK key, holding it at least one second, allowing it to restore, and waiting at least another second before testing.

(b) Using current-flow test set H-882790. Note the figure in the RESISTANCE TEST* column and line O. Regulate the potentiometer(s) of the OPERATING RANGE that total this figure, and close the OPR, NON. OPR toggle switch to the OPR position. If the meter does not read exactly the figure in line O of the CURRENT TEST column, regulate the potentiometer(s) of the OPERATING RANGE as needed to bring the meter to that reading, restore the OPR, NON OPR toggle switch to normal.

If the relay has a non-operate value, note the figure in the RESISTANCE TEST column and line N.O. Regulate the potentiometer(s) of the NON OPERATE RANGE that total this figure and close the OPR, NON OPR toggle switch to the NON OPR position. If the meter does not read exactly the figure in line N.O. of the CURRENT TEST column, regulate the potentiometer(s) of the NON OPERATE RANGE as needed to bring the meter to that reading, restore the OPR, NON OPR toggle switch to normal.

(c) Using the resistance box. Check that the test voltage is 50 volts ± 1 volt, and if it is not, bring it to this voltage. Throw the resistance keys of the upper group to total 50Ω. Soak the relay by throwing the MAX/MIN key to MAX for at least one second; then restore the MAX/MIN key to normal. Restore all the keys of the box (except +/-). Note the figure in the resistance test column and line O. Throw the keys of the lower group that total this figure. Note the figure in the resistance test column and line N.O. (if any). Throw the keys of the upper group that total this figure.

(d) Testing. Throw the TEST key to OPR or the MAX/MIN key to MIN. The relay should operate fully: all make contacts should make, all break contacts should break, and the armature residual should touch the coil-core. (Where the relay adjustment specifies note 5, "springs need only make contact on operate tests", the armature residual need not touch the coil-core.)

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*If no TEST OPERATE value is specified for the relay, use the READJUST OPERATE value for inspection.

**"Soaking" the relay (magnetically saturating its core) insures that the coil-core has recent residual magnetism of definite polarity and of at least a certain minimum magnitude. This insures uniformity in relay adjustments.

ISSUE NO 1
4-21-48

STANDARD ADJUSTMENT
FOR
TYPE 57L AND 57S (CLASS "B")
GENERAL PURPOSE TWIN CONTACT RELAYS

INTRODUCTION

The General Purpose Relays, Type 57L and 57S, consist of the following basic parts coil assembly, heelpiece, armature assembly, and spring assembly.

The coil assembly is made of a magnetic iron core upon which is wound a number of turns of wire. Fastened to each end of the iron core are fibre spool heads which hold the winding in place. The coil terminals are attached to the rear spool head.

The heelpiece is also made of magnetic iron and it provides mounting for the coil, the armature assembly, the spring assembly and also provides a means of mounting the relay to its associated equipment.

The armature is the moving portion of the relay that completes the magnetic path between the coil core and the heelpiece and actuates the contact springs.

The armature is attached to the heelpiece by means of the brass yoke. An adjustable non-magnetic screw or a thin non-magnetic metal plate is spot welded to the under face of the armature to provide either an adjustable or fixed residual gap between the armature and the coil core when the relay is operated.

The spring assembly may consist of one or two spring pile-ups which are composed of contact springs and separating insulators that are mounted on the heelpiece. The spring assembly is assembled in a fixture which aligns the contacts and positions the springs. The assembly screws are tightened after the insulators have been heated and while the spring pile-up is under pressure. Any changes in spring combinations should, therefore, be made only at the factory.

ROUTINE INSPECTION

The inspection of the relay should be in the following order with readjustments made only as necessary. Where limits of adjustment are given, the relay should be inspected with the extreme limiting values and readjusted only if it is found to be outside these limits. Deviation from nominal values is to be expected and is not cause for readjustment.

ARMATURE - The armature is fastened to the heelpiece by the yoke so that when the residual air gap is reduced to zero the armature makes line contact with the heelpiece.

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3. When the relay armature is equipped with a fixed residual, the air gap between the armature and the heelpiece shall not be more than .003" for adjustment and .004" for inspection at either end with the armature operated.

D. RESIDUALS

1. Relays with adjustable residuals shall be adjusted as specified on the Relay Adjustment Sheets. This is an adjustment of the space between the core and the armature with the relay electrically operated.

2. Where the residual specified on the Relay Adjustment Sheet is .003" or more, a tolerance not to exceed plus or minus .001" for adjustment and .002" for Inspection shall be allowed.

3. Where the residual is specified as .0015" the armature shall not outch the core, or be more than .003" for Adjustment and .004" for Inspection, from the core at the closest point, with the armature operated electrically.

E. STROKE

1. The variation allowed for inspection of the stroke shall be as follows:

(a) A gauge .003" larger than the specified stroke gauging for standard armature or .005" for short lever armature should not enter between the armature (or residual when used) and the coil core when the relay is not energized, or, if it does enter, the armature shall not leave the fixed heelpiece residual when the relay is electrically energized.

(b) When the first spring of a spring pileup is a back contact, the armature shall leave the fixed heelpiece residual when a thickness gauge of .002" less than the value specified for the stroke is inserted between the armature (or residual when used) and the coil core.

NOTE: In the case of a relay having two spring pileups, the above requirement applies only when the first spring in each spring pileup is a back contact.

(c) The actual difference between the stroke gauging and the highest break contact gauging, excluding the break contact of the standard make-before-break spring combinations, shall not be less than .006" for the standard armature relay and .012" for the short lever armature relay.

(d) When the difference between the values specified for stroke gauging and the highest make contact gauging is .005" or more, the armature shall leave the fixed heelpiece residual when a thickness gauge of .002" less than the values specified for the stroke is inserted between the armature (or residual, when used) and the coil core.

(e) When the difference between the values specified for the stroke gauging and the highest make contact gauging is .004" or less, the armature shall leave the fixed heelpiece residual when a thickness gauge of .002" more than the value on which the make contact actually makes, (gauged within .001"), is inserted between the armature (or residual, when used) and the coil core.

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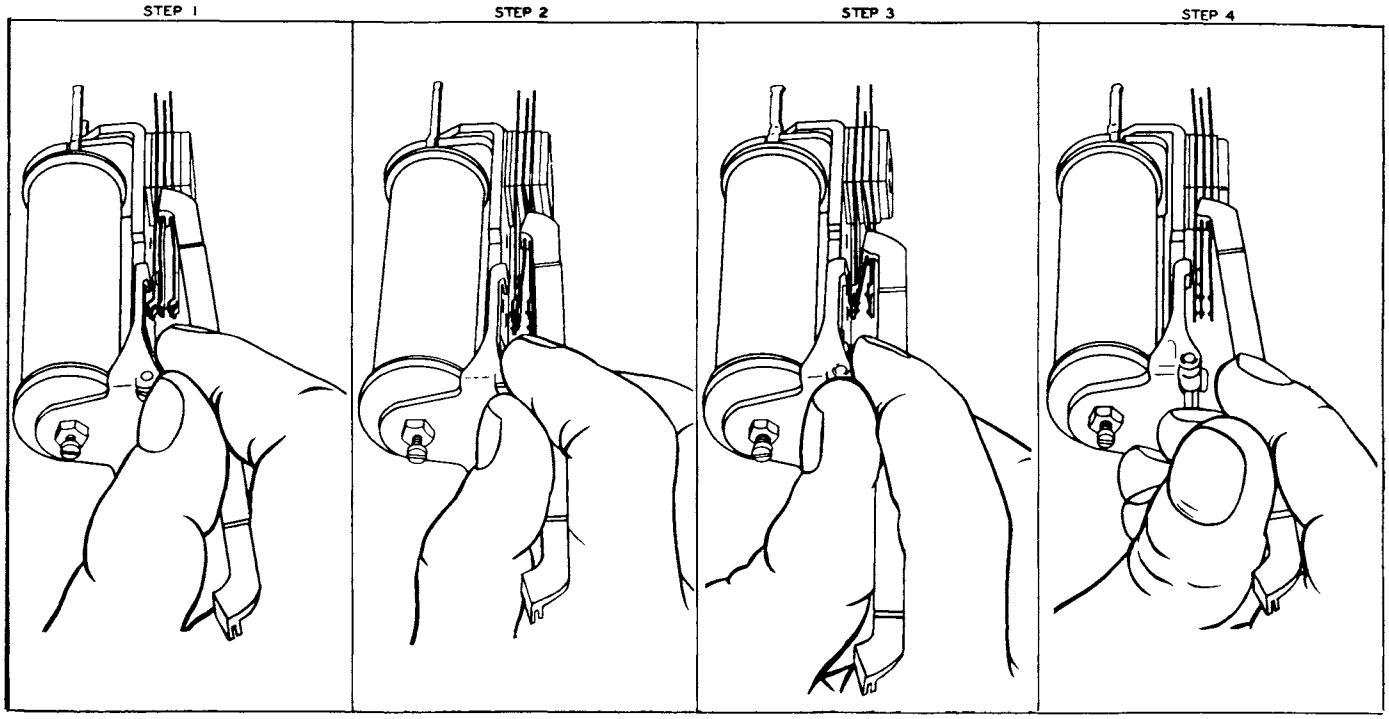
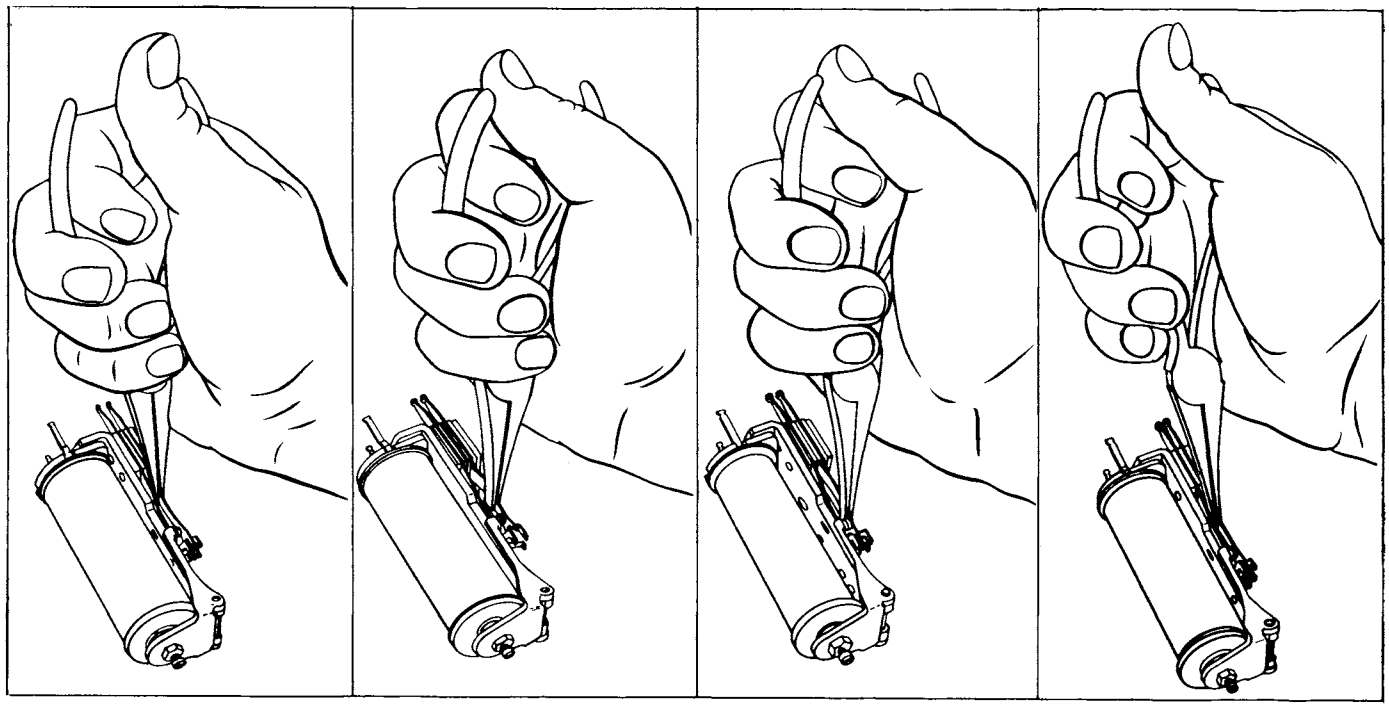
Figure 16. Typical "Standard Adjustment" pages (see page 10 §4.2).



Using spring adjuster



Using duck-bill pliers

Figure 17. Spring tensioning.

If the relay has a non-operate value, throw the TEST // OPR, NON OPR key to NON OPR, or the MAX/MIN key to MAX. The relay should not operate: none of its make contacts should make, and none of its break contacts should break*.

If the relay does not have a non-operate value, test as follows. For a break combination, manually operate the armature and release it slowly. As the break combination makes during release, its armature spring should move its stationary spring 0.01" or more. For a make combination attach a gram gauge to the armature spring and pull it toward the stationary spring until they just make contact. The gram gauge should read 10 grams or slightly more.

If the relay has passed the operate and non-operate tests, the relay is fully adjusted and nothing more need be done.

4.92 Adjusting the Tension. If the relay operated during the non-operate test, or did not show enough follow, tension will have to be increased in the armature springs. If the relay did not operate during the operate test, tension will have to be decreased in the armature springs.

CAUTION: Adjust the tension in armature springs delicately, since very little effort is needed to change the tension, and it is easy to kink or twist a spring badly. Spring tension adjustment is not easily learned, so practice it before attempting to adjust a relay which is in service.

(a) Increasing the tension. Increasing tension in an armature spring results in a slope of the whole spring very slightly toward the heelpiece, and in addition to the pressure between the spring and its back contact, or between the buffer on the spring and the armature arm. Use a spring adjuster or a duck-bill pliers to increase spring tension. The duck-bill pliers are the best tool for the job, but when working space is small, you may not be able to use them. Then, choose a spring adjuster that best fits the spring, but is loose to slide along it freely.

To increase the tension of the armature spring very slightly, place the slotted end of the spring adjuster over the spring next to the insulators, or grip the spring with the pliers in the same place. Bend the spring a little toward the heelpiece. If this method does not increase tension enough, use the following method instead.

Grip the spring with the tool next to the insulators. Then draw the tool along the spring toward the contacts, exerting enough pressure so that you have to pull the tool along, but not so much pressure that you scrape shavings from the spring. As you pull the tool, twist your wrist slightly clockwise so that the spring curves or bows away from the heelpiece. Stop just before you reach the contacts or the buffer. These motions should place a very slight and smooth bow in the spring. Now, place the tool next to the insulators again, and without moving it, bend the

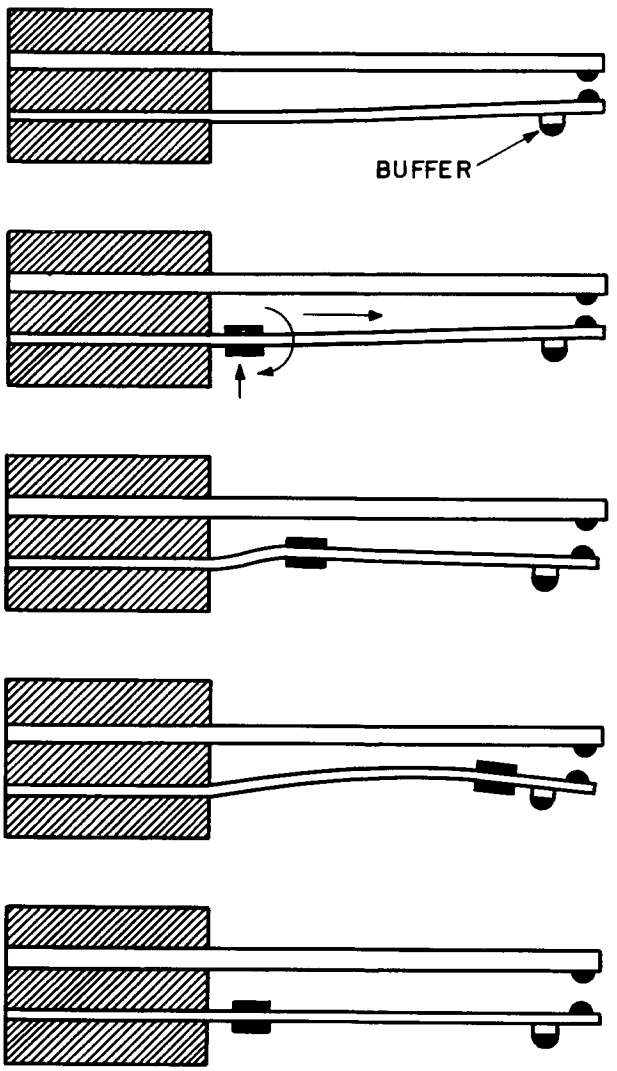


Figure 18. Tension-adjustment technique. In upper view, armature spring lacks tension, and non-operate current would operate relay. Place tool (pliers or adjuster) over spring near insulators. Apply slight forces, one toward desired bow, one rotary, and one to slide tool toward contacts. This bows spring slightly. Apply tool near insulator again and squeeze spring or bend it slightly, near insulators, straightening spring.

*On two-step relays, the preliminary contacts (those to which the weaker electrical requirements apply) may make or break on the "non-operate" requirements specified for the entire spring assembly.

spring toward the heelpiece. This should remove the bow and leave enough tension in the spring.

Repeat this method or the first method until you have worked good tension into the spring. All armature springs should have approximately equal tension.

(b) Decreasing the tension. To decrease the tension of an armature spring, bow it as in (a) but make the bow toward the heelpiece, by twisting your wrist slightly counterclockwise. Or, if the tension needs to be decreased only very little, just bend the spring slightly away from the heelpiece near the insulators.

4.93 CAUTION. If you adjust tension in armature springs, recheck spring gauging. If gauging fails to pass inspection tolerances, regauge and then recheck tension.

You should also clean all the relays after adjustment has been completed, and then check them using inspection values and tolerances.

5. ORDERING REPLACEMENT PARTS

Locate part numbers as follows:

(a) Mechanical part: Find part number on applicable maintenance drawing (example figure 20, MD-186). Customers will be sent maintenance drawing upon request.

(b) Spring assembly: Look for relay number (RT-), stamped on heelpiece under coil. At end of this number, substitute -X. For example, for relay RT-25003-B11 order spring assembly RT-25003-X. Spring assembly is shipped on heelpiece, unadjusted; customer installs coil, then adjusts relay.

(c) Coil: Piece number (D-28 . . . . -A) is on fiber disc at armature-end of coil.

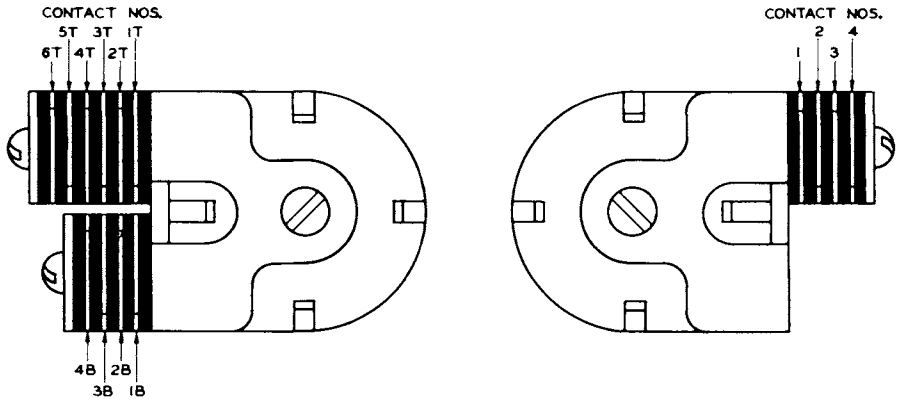


Figure 19. Contact-spring numbering.

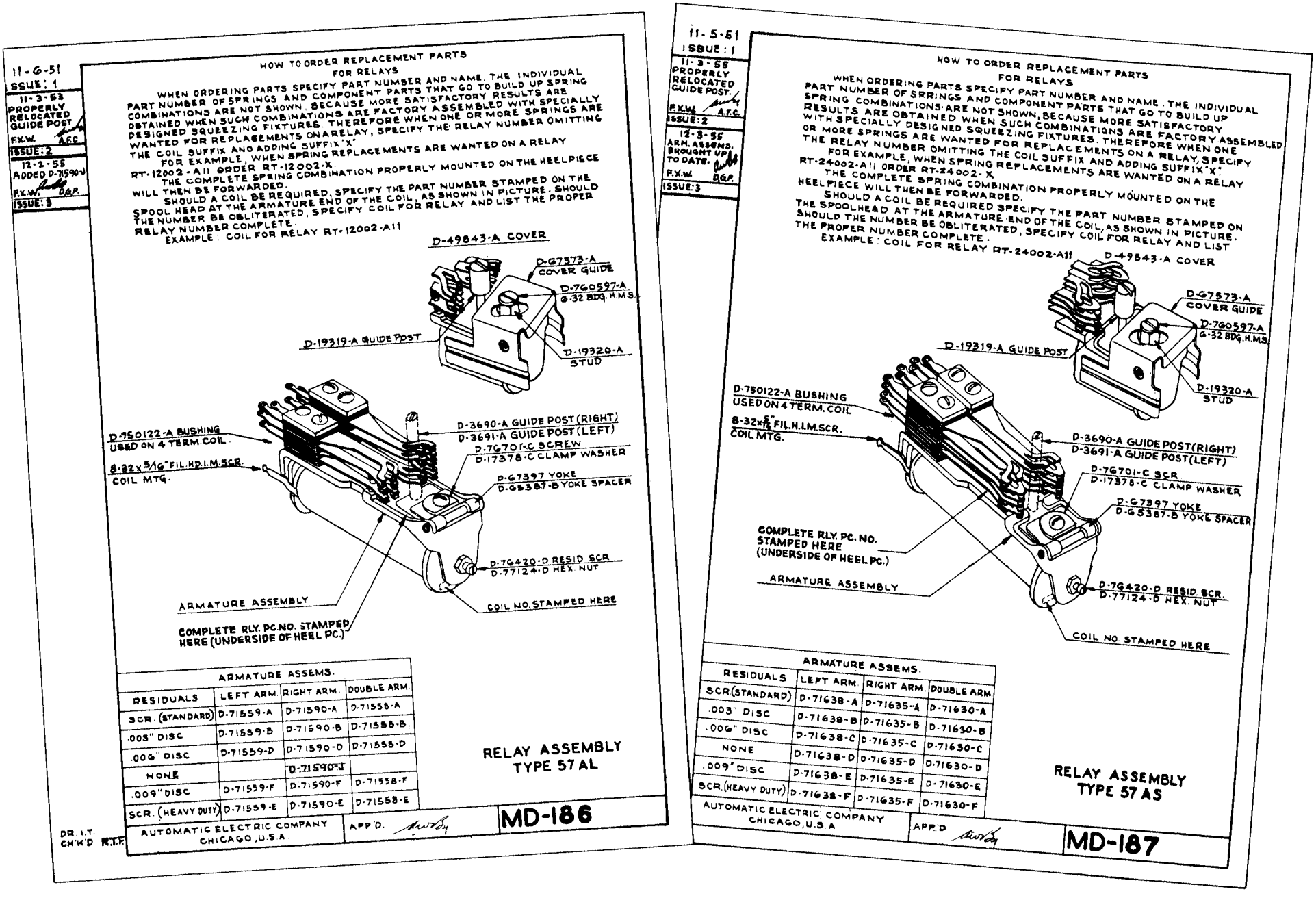
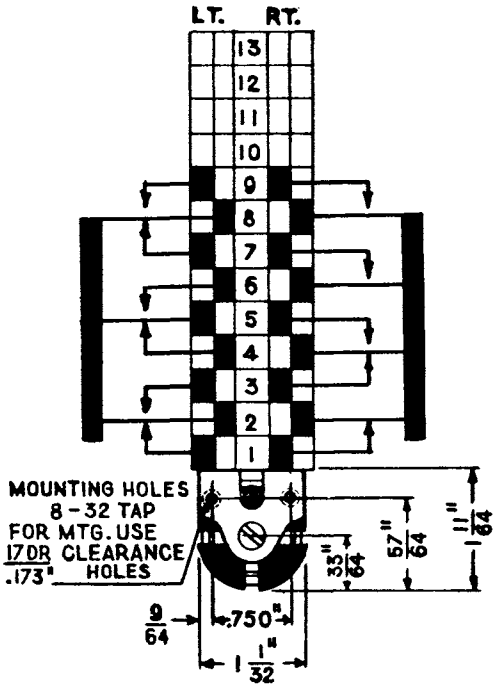
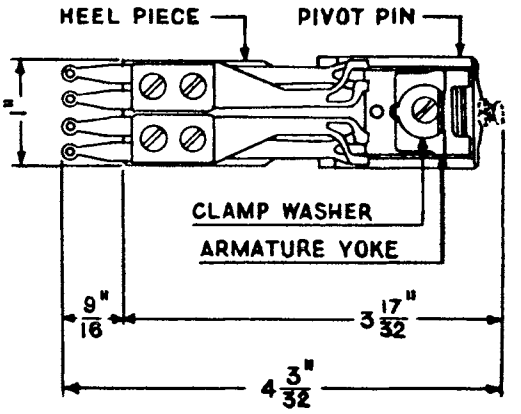
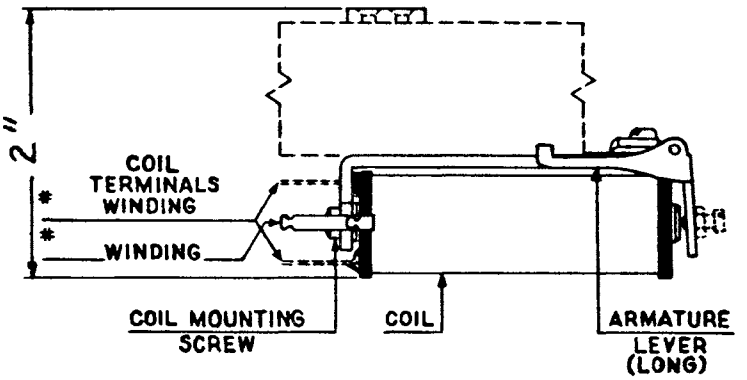


Figure 20. Typical "Maintenance Drawing" (MD-) for parts ordering (see page 22 §5).

SPRING COMBINATION & TERMINAL ARRANGEMENT







NOMINAL VOLTAGE 48 VOLTS 0. C.
CURRENT .048 AMPERES 0. C

CONTACTS: CODE 0-18 GAUGE; RATING 135 WATTS / 3 AMPS } NON. INDUCTIVE

SPECIAL FEATURES:

ADJUSTMENT DATA				
COIL D-280208-A	TEST FOR		CURRENT READJ.	CURRENT TEST
1000 ω				
18000 T	NO.1	O	.013	.014
35 EC ⊣		NO	.011	.010
	NO.2			

NOTES:

RESID. .003" DISK

CUST. NAME KLEINSCHMIDT LABORATORIES, INC.

CUST. PART NO.

CLASS "B" RELAY
TYPE 57AL

RELAYS AUTOMATIC ELECTRIC SWITCHES

DR. 7/8-54 CHK

APP'D. R.J. ARCANO

CUST. DRAWING PG-21074-B11

Figure 21. Typical "Customer Drawing" (see page 10 §4.5).

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