

KEYS
290 AND 293 TYPES
REQUIREMENTS AND ADJUSTMENT PROCEDURES

1. GENERAL

- 1.01 This section covers 290 and 293 type keys (except the 290-G, 290-H and 290-HU).
- 1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.
- 1.03 Reference shall be made to Section 020-010-711 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements listed herein.
- 1.04 Part 1, "General" and Part 2, "Requirements" form part of the Western Electric Co. Inc. Installation Department handbook.
- 1.05 Requirements are marked with an asterisk (*) when to check for them would necessitate the dismantling 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.
- 1.06 The normal (unoperated) position of a lever is that position in which the lever is perpendicular to the key top with the normally open contacts open and the normally closed contacts closed.
- 1.07 The operated position of a lever is that position in which the lever is thrown either to the extreme front or rear.

contact disc. Gauge by eye.

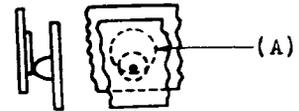


Fig. 1

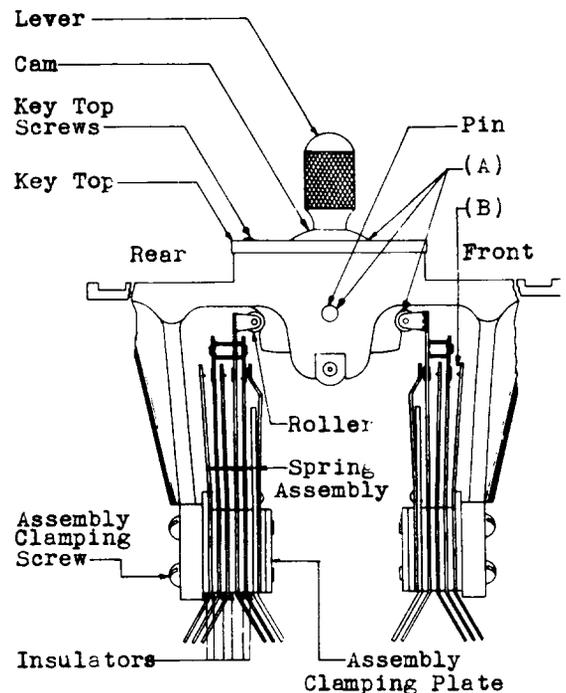


Fig. 2

2. REQUIREMENTS

- 2.01 Cleaning
 - (a) Contacts shall be cleaned in accordance with the section covering cleaning procedures for key contacts.
 - (b) Other parts shall be cleaned in accordance with approved procedures.
- 2.02 Lever Movement - Fig. 2 (A) - The cam and hard rubber rollers shall turn freely on their bearing pins. Gauge by feel.
- *2.03 Contact Alignment - Fig. 1 (A) - Contacts shall line up so that the point of contact falls wholly within the circumference of the opposing

- *2.04 Contact Separation - Fig. 2 (B) -
 - (a) There shall be a separation between the normally open contacts in the normal position and between the normally closed contacts in the operated position on that side to which the lever is operated of
 - Test - Min. .014"
 - Readjust - Min. .016"
 Gauge by eye.
 - On the 290-A key the separation applies with the lever in the normal position only and shall be
 - Test - Min. .020"
 - Readjust - Min. .022"
 Gauge by eye.

2.04 (Continued)

(b) When the lever is operated to one side, there shall be a separation on the opposite side between the normally closed contacts and between the normally open contacts of

Test - Min. .008"
 (.005" for 290-A)
Readjust - Min. .010"
 (.006" for 290-A)

Gauge by eye.

This requirement shall not apply to the 290-FU, 290-GU, 293-A, 293-B and 293-F keys.

*2.05 Spring Clearance - Fig. 3 (A) - There shall be a clearance between springs designed never to make contact and between any spring and the frame whether in the operated or unoperated position of the lever of

Test - Min. .014"
Readjust - Min. .016"

Gauge by eye.

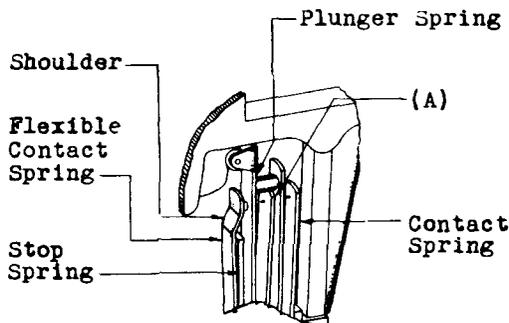


Fig. 3

*2.06 Contact Pressure There shall be a pressure between all closed contacts of

Test - Min. 50 gs.
Readjust - Min. 55 gs.

Use the No. 68-B gauge.

On the 290-FU keys the contact pressure of the normally closed contacts shall be measured when the lever is operated to the opposite side.

*2.07 Contact Follow There shall be a follow on all contacts of

Test - Min. .008"
Readjust - Min. .010"

Gauge by eye.

This requirement shall not apply to the 290-CU and FU keys on which the follow is governed by the contact pressure.

*2.08 Flexible Contact Spring Position The inner flexible contact spring shall rest at least on the end of the stop spring that is nearest the contact on the flexible spring when the lever is operated to such a position as to break its contact. Gauge by eye.

*2.09 Contact Sequence

(a) Normal Contact Sequence - Break-Make Combinations - Fig. 4 (A) - Unless otherwise specified, the normally closed contacts operated directly by a plunger spring of an individual spring combination shall break before the normally open contacts of the same spring combination directly associated with that plunger spring make by

Test - Min. .005"
Readjust - Min. .006"

Gauge by eye.

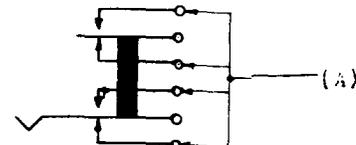


Fig. 4

(b) Cross Sequence - Break-Make Spring Combinations On Ringing and Coin Control Spring Combination - Fig. 5 (A) - Unless otherwise specified, all normally closed contacts operated by the throw of the lever shall break before any of the normally open contacts make by:

Test - Min. .005"
Readjust - Min. .006"

Gauge by eye.

This requirement shall not apply to the 290-GU and FU keys.

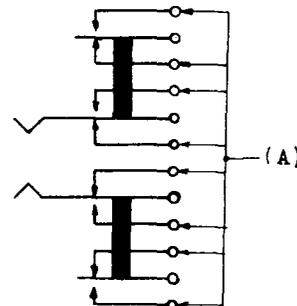


Fig. 5

3.09 (Continued)

(c) Other Contact Sequences when specified on the circuit drawing.

2.10 Lever Overthrow (290-GU Key Only)
When the lever returns unrestrained from an extreme operated position it shall not snap over so as to lock in the opposite position. Gauge by eye.

2.11 Lever Operate Pressure - Fig. 6 (A) -
The pressure required to operate the lever to the extreme position of its throw shall be:
Test - Max. 1500 grams
Readjust - Max. 1400 grams
 In checking for this requirement, the pressure shall be applied at the top portion of the handle and perpendicular to it. Use the No. 79-E Gauge.

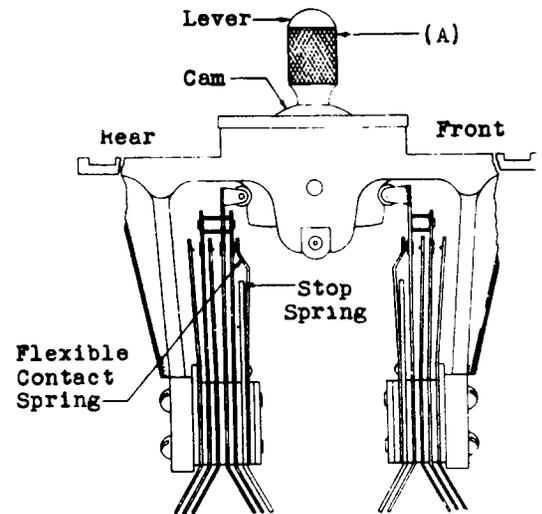


Fig. 6

3. ADJUSTING PROCEDURESTools

<u>Code No.</u>	<u>Description</u>
35	Screw-driver - 3 1/2"
KS-2993	Cleaning Brush
KS-6015	Duck-bill Pliers
R-1572	Hammer - 4 Oz.
-	Bell System Cabinet Screw-driver - 3-1/2" per A.T.& T. Co. Dwg. 46-X-40
-	Bell System P-Long Nose Pliers - 6-1/2" per A.T.& T. Co. Dwg. 46-X-56
-	Pin Punch 4-3/8" x 1/16" Point

Gauges

68-B	70-0-70 Gram Gauge
79-E	0-3000 Push-Pull Tension Gauge

Materials

KS-2423	Cloth
KS-6232	Oil
KS-7860	Petroleum Spirits
-	Hardwood toothpick - Flat on one end and pointed on the other
	No. 22 Bare Tinned Copper Wire

3.01 Cleaning (Rq.2.01)

M-1 Clean the contacts in accordance with section covering cleaning procedures for key contacts. Clean other parts in accordance with procedures 3.02, M-5 and M-6 and 3.03-3.10, M-4.

3.02 Lever Movement (Rq.2.02)

M-1 To determine whether a cam binds, operate and release the lever slowly and note if the movement is smooth throughout the travel. If when operating the lever, a drag is detected or if the lever does not restore with a uniform pressure it is an indication that the cam binds.

M-2 Cracked, warped or broken hard rubber key tops may cause the levers to bind and thus prevent or delay the release of the lever. In this case replace the key top.

M-3 Loose or missing screws in the hard rubber key top may cause it to move and bind the lever. Replace missing screws and tighten all screws with the No. 35 screw-driver.

M-4 Smooth bright spots on the cam caused by rubbing are an indication that the cam binds on the key top. In some cases, it may be possible to correct by loosening the key top screws and shifting the key top as required. However, when this is not possible due either to proximity to other keys or to no side play in the key top, it will be necessary to enlarge the slot in the key top.

M-5 If the bind is not removed by the above procedure it may be corrected as follows. Unscrew the lever handles and remove the key top mounting screws with the screw-driver. If the key top is not readily removable push it up from the bottom with the screw-driver. Examine the cam and the slots in the key frame for dirt. Clean the parts if necessary by means of the KS-2993 brush.

M-6 If the cam binds on its bearing pin, the following procedure will usually rectify the trouble: Remove the key top screws with the screw-driver, the lever handles and the key top and then observe whether the cam is tight in the key frame. This can be done by moving it from side to side. If it is tight remove the key by removing the mounting screws. If the keyshelf is equipped with retaining strips, remove the retaining strip screws with the 3-1/2" cabinet screw-driver and remove both retaining strips. Then remove the mounting screws and raise the key out of the keyshelf. Drive out the pin by means of the R-1572 hammer and pin punch. Wipe off the cam and pin with petroleum spirits. When dry lubricate the pin sparingly with KS-6232 oil and then wipe it off again with a clean dry KS-2423 cloth. Replace the pin in the cam. This is usually sufficient to remove the bind. Replace the key.

M-7 Whenever it is necessary to remove the cam from a key mounted in a universal type mounting proceed in the following manner: Raise the keyshelf, remove the mounting screws with the 3-1/2" cabinet screw-driver and then raise the key above the keyshelf, if possible without unsoldering any form wires. Then proceed to take the key apart as outlined in M-6.

- 3.03 Contact Alignment (Rq.2.03)
- 3.04 Contact Separation (Rq.2.04)
- 3.05 Spring Clearance (Rq.2.05)
- 3.06 Contact Pressure (Rq.2.06)
- 3.07 Contact Follow (Rq.2.07)
- 3.08 Flexible Contact Spring Position (Rq.2.08)
- 3.09 Contact Sequence (Rq.2.09)
- 3.10 Lever Overthrow (Rq.2.10)

M-1 In making these adjustments consult the associated circuit drawing and circuit requirement table and give proper consideration to the maintenance of any requirement for contact sequence which may be specified thereon. Unless otherwise specified adjust the springs close to the point where they leave the spring assembly clamping plates and insulators, with duck-bill pliers, as shown in Fig. 7. In adjusting the springs take care not to kink them. Kinked springs should not be straightened unless the kink interferes with the proper adjustment of the key. Removing kinks tends to weaken the spring and shorten the life of the key.

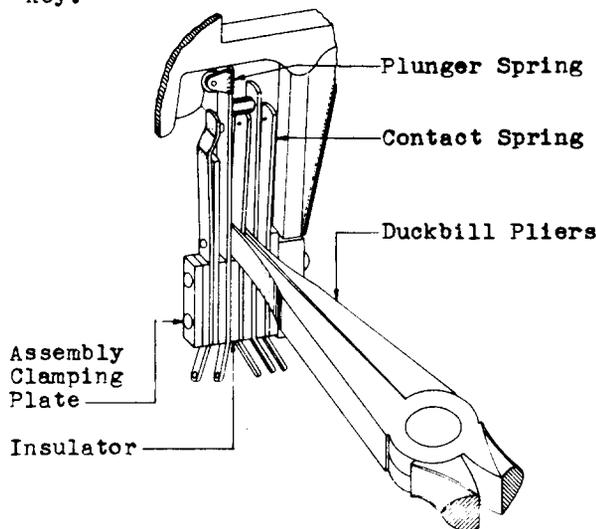


Fig 7 - Method of Adjusting Contact Springs

M-2 Contact Alignment First check the springs for alignment. If necessary to shift the springs, loosen the spring assembly mounting screws with the 3-1/2" cabinet screw-driver on that side of the key where the springs are out of alignment, then shift the springs until they are all in alignment and tighten the screws securely. The contacts should rest wholly within the corresponding contact discs and as near the center as possible.

M-3 Spring Clearance Failure to meet the specified clearance

between springs designed never to make contact may be due to the springs being distorted. Straightening the springs will usually rectify any trouble which may exist because of springs touching each other which are designed to clear at all times.

M-4 Contact Separation and Contact Pressure Foreign matter wedged between the contact springs may prevent springs from making contact when the lever is operated. Remove the foreign matter with a toothpick which has been dipped in petroleum spirits. Do not use the same toothpick for more than one operation.

M-5 On the 290-FU keys, the pressure is measured when the lever is moved over to the opposite side. Failure to meet this requirement generally results from insufficient contact follow. Correct this by increasing the tension of the springs slightly but not enough to interfere with any of the previous adjustments. Adjust the springs with the duck-bill pliers.

M-6 When adjusting contact springs take care to adjust the springs in line with their movement and not to twist the contact off center.

M-7 Contact Follow If a follow requirement cannot be met by adjusting the springs close to the point where they leave the spring assembly clamping plates and insulators, the upper part of the spring just below the contact disc may be given a slight bend toward the moving springs with the duck-bill pliers. This bend should not be enough, however, to make a visible kink in the spring. In the case of inner flexible contact springs, the spring should be bent slightly at the shoulder with the long nose pliers applied as shown in Fig. 8.

M-9 Flexible Contact Spring Position Failure of an inner flexible contact spring to rest flat against the stop spring when the lever is operated to such a position as to break its contact, is due to its being distorted. Correct this condition as follows: Insert a piece of No. 22 bare tinned copper wire between the two springs where they are riveted together. Then place the duck-bill pliers over both the stop spring and flexible contact spring close to the rivets, and press the springs together. Remove the wire and then the duck-bill pliers.

M-10 Contact Sequence When adjusting for contact sequence increase or decrease the contact separation, contact

3.03-3.10 (Continued)

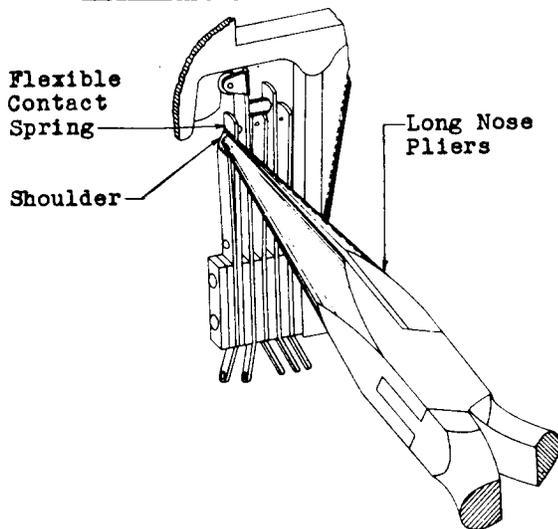


Fig. 8 - Method of Adjusting for Contact Follow

pressure, contact follow and spring clearances as outlined in paragraphs M-1 to M-8.

M-11 Lever Overthrow In readjusting

for lever overthrow, operate the lever to the locked position and then push the handle until it reaches a point in its travel where it will release without further aid. Should the key fail to meet the lever overthrow requirement, increase the tension of the plunger spring on that side to which the lever is falsely overthrowing. When tensioning the springs see that the tension of the opposite plunger springs against the lever is as nearly equal as possible.

3.11 Lever Operate Pressure (Rq.2.11)

M-1 If the key fails to meet this requirement inspect the key for bind. The cam should not bind in its bearings. In case it does bind, proceed as outlined in procedure 3.02.

M-2 If the lever still fails to meet this requirement, it is an indication that the springs have excessive tension. Reduce the tension using the duck-bill pliers taking care not to interfere with any of the previous adjustments.

M-3 Do not use any lubricant on the key to facilitate this adjustment.