

KEYS

102, 103, 104, 105, 107, 110, 111, 115, 116, 117, 118, 120, 121, 122, 123, 124,  
131, 135, 136, 139, 140, 143, 147, 150, 151, 155, 156, 164, 165, 167, 172, 177,  
178, 184, 189, 192, 194, 196, 198, 201, 210, 212, 225, 247, 249, 250, 256, 257,  
262, 264, 266, 267, 270, 277, 280, 285, 291, 369, 415, 421, 423, 425, 429, 431,  
432, AND 454 TYPES AND NO. 6002-E

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

- 1.01 This section covers 102, 103, 104, 105, 107, 110, 111, 115, 116, 117, 118, 120, 121, 122, 123, 124, 131, 135, 136, 139, 140, 143, 147, 150, 151, 155, 156, 164, 165, 167, 172, 177, 178, 184, 189, 192, 194, 196, 198, 201, 210, 212, 225, 247, 249, 250, 256, 257, 262, 264, 266, 267, 270, 277, 280, 285, 291, 369, 415, 421, 423, 425, 429, 431, 432, and 454 type and No. 6002-E keys.
- 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 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.
- 1.06 The normal (unoperated) position 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 is that position in which the lever is thrown either to the extreme front or rear and, on the spring assembly involved all normally open contacts are closed and all normally closed contacts are open.
- 1.08 Local contact springs are those springs which although operated by the plunger springs do not make electrical contact with them.

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 The hard rubber rollers and cams shall turn freely in their bearings. Gauge by feel.

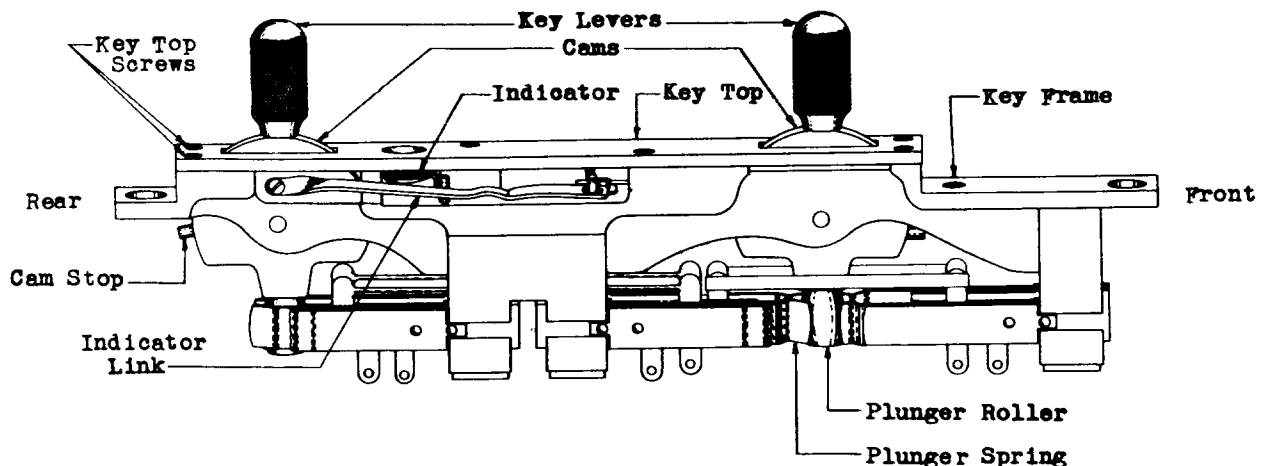


Fig. 1 - 102-A Key

- \*2.03 Pressure of the Plunger Springs Against the Separator - Fig. 2 (A) -** The pressure of the plunger springs against the separator shall be:  
Test - Min. 100 grams,  
 Max. 1020 grams.  
Readjust - Min. 115 grams,  
 Max. 1020 grams.  
 Use the No. 62-B gauge for minimum limits and gauge maximum limits by feel.

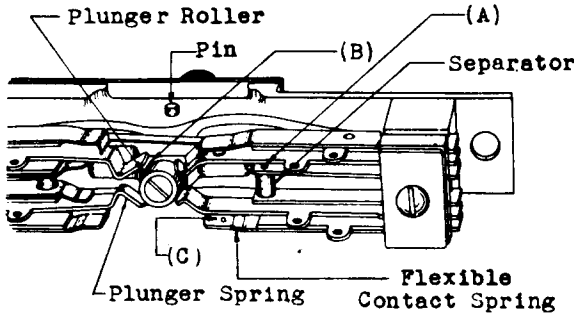


Fig. 2

- \*2.04 Position of the Plunger Springs Against the Plunger Roller - Fig. 2 (B)**  
 (a) When the plunger roller of a key having no separator is moved in either direction from the normal position, there shall be no movement of the opposite pair of plunger springs. Gauge by eye.  
 (b) On spring combinations having a separator there shall be no pressure between the plunger springs and the plunger roller when the lever is in its normal position. Gauge by eye or feel.
- \*2.05 Clearance Between the Plunger Springs and the Plunger Roller - Fig. 2 (B) -** When the plunger roller is resting without pressure against the opposite pair of springs or the cam stop is resting against the key frame, the clearance between the plunger springs and the plunger roller shall be:  
Test - Max. .010"  
Readjust - Max. .012"  
 Gauge by eye.

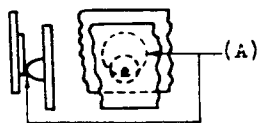


Fig. 3

- \*2.06 Contact Alignment - Fig. 3 (A)** Contacts shall line up so that the point of contact falls wholly within the circumference of the opposing contact disc. Gauge by eye.

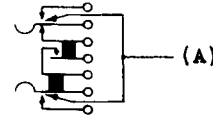


Fig. 4

- \*2.07 Contact Separation - Fig. 2 (C) and Fig. 4 (A) -** The separation between any pair of contacts normally open or between any pair of contacts that are opened when the key is operated shall be:  
Test - Min. .010"  
Readjust - Min. .012"  
 Gauge by eye.
- \*2.08 Spring Clearance** 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 key of:  
Test - Min. .014"  
Readjust - Min. .016"  
 Gauge by eye.
- \*2.09 Contact Pressure** There shall be a pressure between all closed contacts of:  
Test - Min. 50 grams  
Readjust - Min. 55 grams  
 Use the No. 68-B gauge.
- \*2.10 Flexible Contact Spring Position - Fig. 5 (A) -** The flexible contact springs shall rest on their respective stop springs when the lever is in the unoperated position for normally open contacts and in the operated position for normally closed contacts. It is not necessary for the spring to rest on the stop spring for its entire length, but it must rest on the end of the stop spring which is nearest the contact. Gauge by eye.

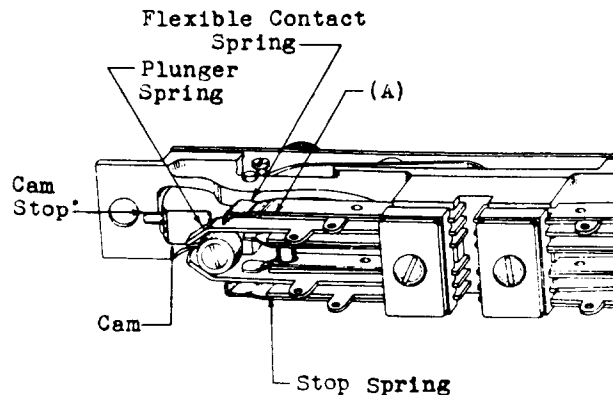


Fig. 5

**\*2.11 Contact Follow**

(a) There shall be a contact follow on flexible contact springs of:

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

Gauge by eye.

(b) The above requirement does not apply to normally open local contacts in which a thin spring makes contact with a heavy spring. In the operated position of such contacts there shall be a clearance of min. .010" between the stud on the thin spring and the inner side of the associated plunger spring. Gauge by eye.

**\*2.12 Cam Side Play** When the cam is moved sidewise sufficiently to take up the play between the cam and the frame of the key, none of the normally open contacts shall make and none of the normally closed contacts shall break. Gauge by eye.

**\*2.13 Contact Sequence**

(a) - Fig. 6 (A) - Normal Contact Sequence - Break-Make Combinations Unless otherwise specified, the normally closed contacts operated directly by a plunger spring of an individual combination shall break before the normally open contacts of the same combination directly associated with that plunger spring make by:

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

Gauge by eye.

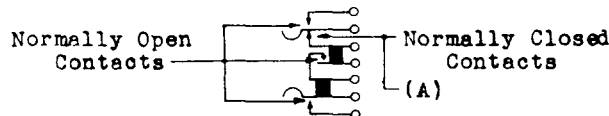


Fig. 6

(b) Cross Sequence - Break-Make Spring Combinations on Ringing Spring Combinations and Where Otherwise Specified 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"

This requirement shall not apply to local contacts. Gauge by eye.

(c) - Fig. 7 (A) - Local Contact Sequence Local contacts on listening spring combinations shall make or break respectively before the plunger contacts make. Gauge by eye.

(d) Other contact sequences when specified on the circuit drawing.

**2.14 Non-Click** When the lever is restored unrestrained from the operated to the

normal position, no normally closed contacts of the opposite side shall break and no normally open contacts of the opposite side shall make. Unless otherwise specified, this requirement shall apply only where the key is equipped with talking and ringing spring combinations on the same lever unit.

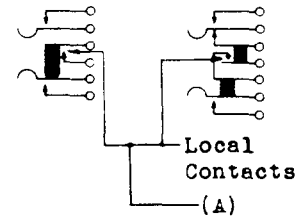


Fig. 7

**2.15 Lever Operate Pressure - Fig. 8 (A) -** The pressure required to operate a lever shall be:

Test - Min. 400 grams,  
Max. 1600 grams  
Readjust - Min. 450 grams,  
Max. 1400 grams

except on keys which are equipped with indicators in which case the pressure shall be:

Test - Min. 400 grams,  
Max. 2050 grams  
Readjust - Min. 450 grams,  
Max. 1850 grams

The pressure shall be applied at the top portion of the handle and perpendicular to it. Use the No. 79-E Gauge.

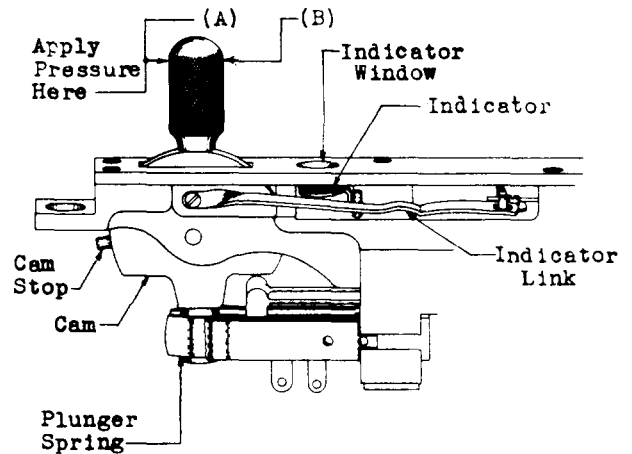


Fig. 8

**2.16 Lever Release - Fig. 8 (B) -** The pressure required to restore the lever

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2.16 (Continued)

from the locked position shall be:

Test - Min. 75 grams

Headjust - Min. 85 grams

The pressure shall be applied at the top portion of the handle and perpendicular to it. Use the No. 62-B gauge.

2.17 Visibility of Indicator Only one color of the indicator shall be exposed to view when the indicator is at either of its resting points. Gauge by eye.

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 P-Long Nose Pliers - 6-1/2" per A. T. & T. Co. Drawing 46-X-56
-	Pin Punch - 4-3/8" x 1/16" Point

Gauges

62-B	0-700 Gram Gauge
68-B	70-0-70 Gram Gauge
79-E	0-3000 Gram Push Pull Tension Gauge

Materials

KS-2423	Cloth
KS-6232	Oil
KS-7860	Petroleum Spirits
-	Toothpicks - Hardwood - Flat on One End and Pointed on the Other

3.00 In adjusting the 6002-E key remove the key from the box using the No. 35 screw-driver to remove the mounting screws and adjust the key the same as the 136 type key.

3.01 Cleaning (Rq.2.01)

M-1 Clean the contacts in accordance with the section covering cleaning procedures for key contacts. Clean other parts in accordance with procedures 3.02, M-6 and M-7 and 3.16, M-1.

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 First examine the plunger springs and note if the pressure is approximately equal. If the tension of

the springs on the plunger roller varies excessively, it will produce a torque effect causing the cam to bind on the key top. Correct as necessary by re-adjusting the plunger springs in accordance with procedure 3.03.

M-3 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-4 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-5 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-6 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-7 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 from the keyshelf as follows. Remove the retaining strip screws with the 3 1/2" cabinet screw-driver and remove the 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 a pin punch. Wipe off the cam and the pin with KS-2423 cloth. Then lubricate the pin sparingly with KS-5232 oil and wipe it off again with the cloth. Replace the pin in the cam. This is usually sufficient to remove the bind. Replace the key.

- 3.03 Pressure of Plunger Springs Against Separator (Rq.2.03)
- 3.04 Position of Plunger Springs Against Plunger Roller (Rq.2.04)
- 3.05 Clearance Between Plunger Springs And Plunger Roller (Rq.2.05)

M-1 To adjust for these requirements increase or decrease the tension of the plunger spring as required. In some cases it may be necessary to change the tension of the back contact springs which rest against the plunger springs. In adjusting place the duck-bill pliers on the spring near where it leaves the spring assembly clamping block as shown in Fig. 9

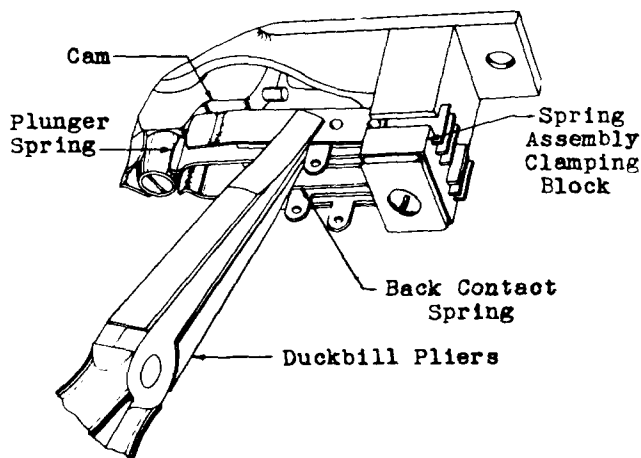


Fig. 9 - Method of Adjusting Contact Springs

Exercise care not to damage the wiring. To facilitate adjusting on two way keys, move the lever against the opposite spring combination. When changing the tension of the springs, keep the tension of similar springs on both sides of the combination as nearly uniform as possible.

- 3.06 Contact Alignment (Rq.2.06)
- 3.07 Contact Separation (Rq.2.07)
- 3.08 Spring Clearance (Rq.2.08)
- 3.09 Contact Pressure (Rq.2.09)
- 3.10 Flexible Contact Spring Position (Rq.2.10)
- 3.11 Contact Follow (Rq.2.11)
- 3.12 Cam Side Play (Rq.2.12)
- 3.13 Contact Sequence (Rq.2.13)
- 3.14 Non-Click (Rq.2.14)

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 the spring leaves the spring assembly clamping block and insulators, with duck-bill pliers, as shown in Fig. 9. 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.

M-2 Contact Alignment When adjusting springs, exercise care to adjust them in line with their movement and not to twist the contacts off center since the springs cannot be shifted in the assembly to align the contacts. If the contacts are not in alignment it is probably due to the springs having been twisted.

M-3 Spring Clearance Trouble due to springs touching each other which are designed never to make contact is caused either by springs being kinked or bowed or by excessive follow. Straighten the springs or reduce the excessive follow as required with the duck-bill pliers.

M-4 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.

M-5 Flexible Contact Spring Position It should also be noted, at this time, that the flexible contact springs rest flat against their stop springs when the lever is in such a position as to break their contacts.

M-6 If the flexible contact spring does not rest against its stop spring as specified, insert a piece of No. 22 bare copper wire between the two springs near the point where they are held together. Then place the duck-bill pliers over both the back stop and the flexible contact spring close to the wire and pinch the two springs together with the pliers. It will be satisfactory to have a slight kink in the flexible contact spring near the point where the springs are held together which may be introduced in making this adjustment.

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 block bend the spring slightly at the shoulder with the long-nose pliers.

M-8 Cam Side Play If the contacts open or close on the side play

## 3.06-3.14 (Continued)

test, increase the follow for the normally closed contacts and the separation for the normally open contacts.

M-9 Normal and Other Contact Sequences When adjusting for contact sequence increase or decrease the contact separation, contact pressure or contact follow as outlined in M-1.

M-10 Non-Click In readjusting for non-click, 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. On non-locking units allow the lever handle to return from the operated to the normal position unaided or unrestrained in any way. Should the key fail to meet the requirement increase the follow on the normally made contacts as outlined in M-7. If the click is caused by the overthrow being so great as to momentarily make an open contact, increase the contact separation slightly and also reduce the tension of the plunger springs on that side from which the roller was released. In either case recheck all previous adjustments.

3.15 Lever Operate Pressure (Rq.2.15)  
3.16 Lever Release (Rq.2.16)

M-1 If the lever fails to operate when the maximum pressure is applied examine the plunger springs to determine whether a gummy substance has formed on them. Clean the surface of the plunger springs with a toothpick which has been dipped in petroleum spirits.

M-2 If, after the plunger springs have been cleaned the key still fails to meet the maximum lever operate pressure requirement the tension of the plunger springs should be reduced. If the key fails to meet the minimum lever operate pressure or lever release requirement increase the tension of the plunger springs. Increase or reduce the tension of the springs as outlined in procedure 3.06-3.14.

M-3 Do not use any lubricant on the plunger roller to facilitate

meeting the lever operate requirement.

3.17 Visibility of Indicator (Rq.2.17)

M-1 To adjust for proper indicator exposure unscrew the lever handles, remove the key top mounting screws with the No. 35 screw-driver and remove the key top.

M-2 Adjust the lugs on the indicator which engage the indicator link at the vertical portion with the long nose pliers applied as shown in Fig. 10. The indicator should not extend out beyond the sides of the key top and should not rub on the key top.

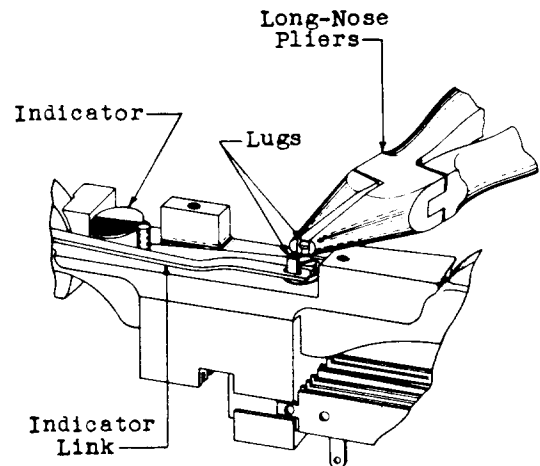


Fig. 10 - Method of Adjusting for Indicator Position

M-3 After adjusting note that the indicator moves freely to the limits of its travel before the cam has been moved to its farthest point.