

KEYS
E1 AND E2 TYPES
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers E1 and E2 type 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 *Normal (Unoperated) Position* is that position where the plunger lock rests against the buffer plates and the normally closed contacts including the common contacts are closed and the normally open contacts including the common contacts are open.

1.07 *Operated Position on Locking Plungers* is that position in which a locking roller is locked in the locking plate. All associated normally open contacts including the common contacts are closed and all associated normally closed contacts including the common contacts are open.

1.08 *Operated Position on Non-Locking Plungers* is that position in which the plunger is depressed to the limit of its stroke. All associated normally open contacts including the common contacts are closed and all associated normally closed contacts including the common contacts are open.

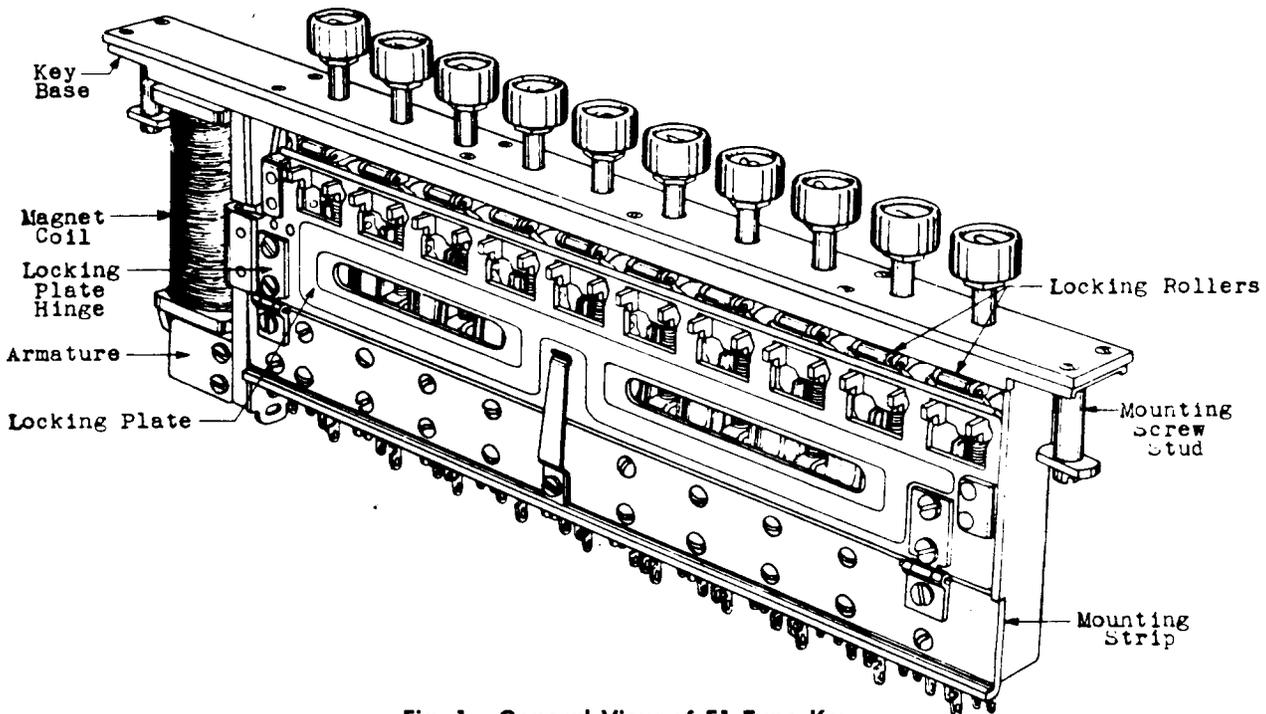


Fig. 1 - General View of E1 Type Key

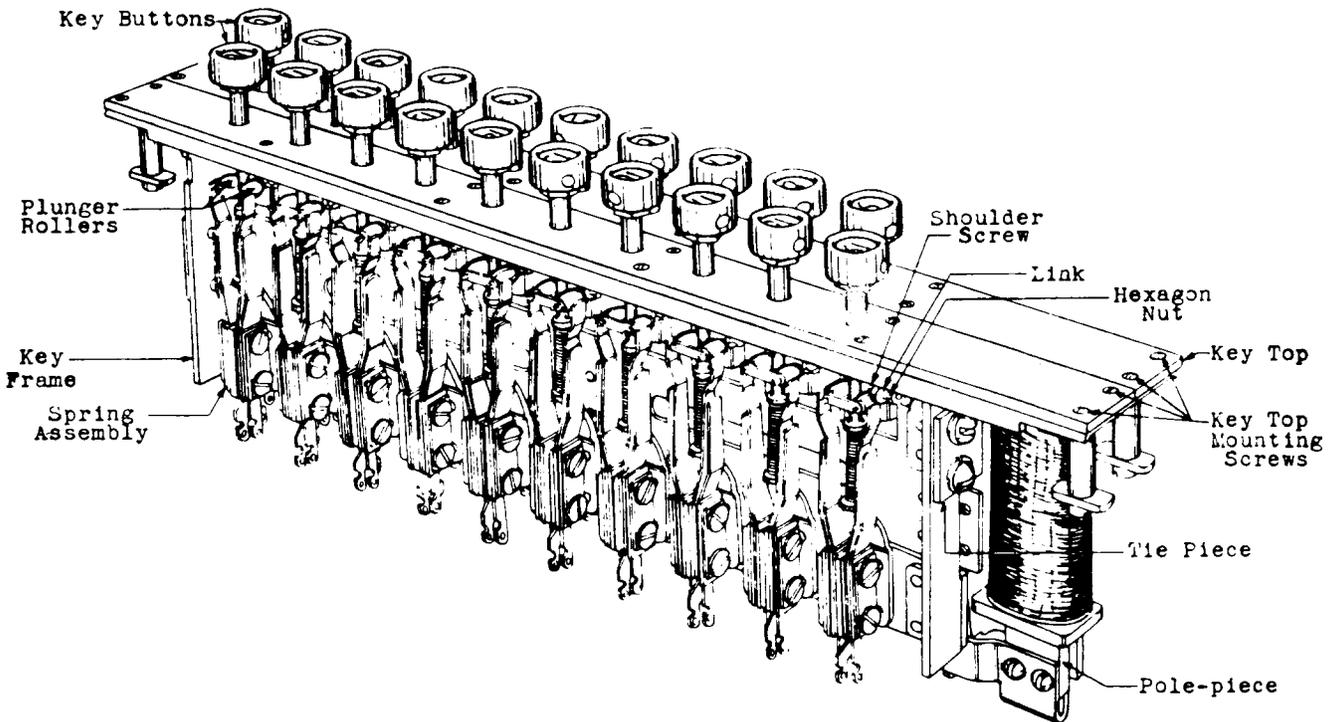


Fig. 2 - General View of E2 Type Key

2. REQUIREMENTS

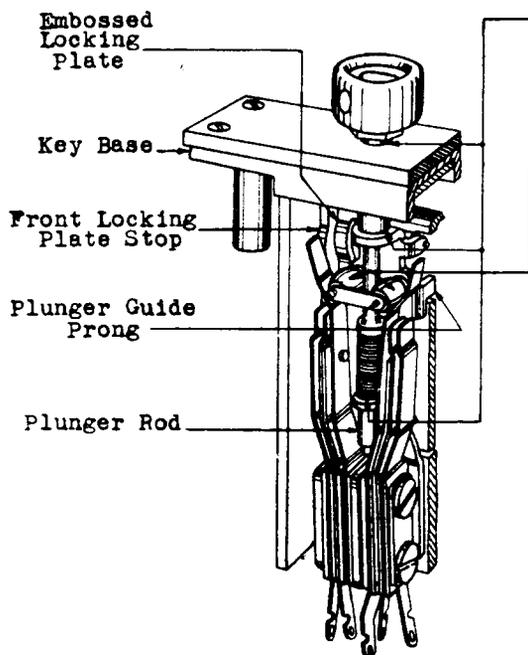


Fig. 3

2.01 Plunger Movement: The plunger rods shall slide without binding in their bearings and shall not be sluggish in restoring to normal from the operated position. Gauge by feel.

***2.02 Roller Movement:** All hard rubber rollers and locking rollers shall turn freely in their bearings. Gauge by feel.

***2.03 Locking Plate Retractable Spring Tension:** With the key in the normal (unoperated) position the tension of the locking plate retractile spring measured at the top edge of the locking plate between the fifth and sixth locking plate openings shall be sufficient to restore the locking plate to its normal position against one or more of the locking rollers or against the locks with a pressure of:

Test — Min. 45 grams

Readjust — Min. 50 grams

Use the No. 79-C gram gauge.

On E2 type keys these values shall apply to the combined tension of both of the locking plate retractile springs.

2.04 Plunger Lock Engagement

(a) When the armature is electrically locked against the pole-piece, it shall not be possible, without using force, to twist the plunger guide prongs out of the locking plate. On keys equipped with embossed locking plates this shall be checked with the plunger in the operated position. On keys equipped with unembossed locking plates this shall be checked with the plunger in its normal position. Gauge by feel.

*** (b)** The locking plate shall set so that the locking rollers will be approximately in the center of the openings provided for them. Gauge by eye.

*** (c)** When all plungers are in the normal (unoperated) position and the key is held so that the plunger rods are in the mounted position, the gap between the plunger guide prongs and the upper edge of the locking plate opening shall be

Min. .015"

Gauge by eye.

(d) It shall be possible to depress any locking plunger an appreciable amount after the locking roller has engaged with the locking plate. Gauge by feel.

2.05 Locking Plate Stop Location: When the locking plate is fully operated, the stop brackets shall touch the inside of the key base.

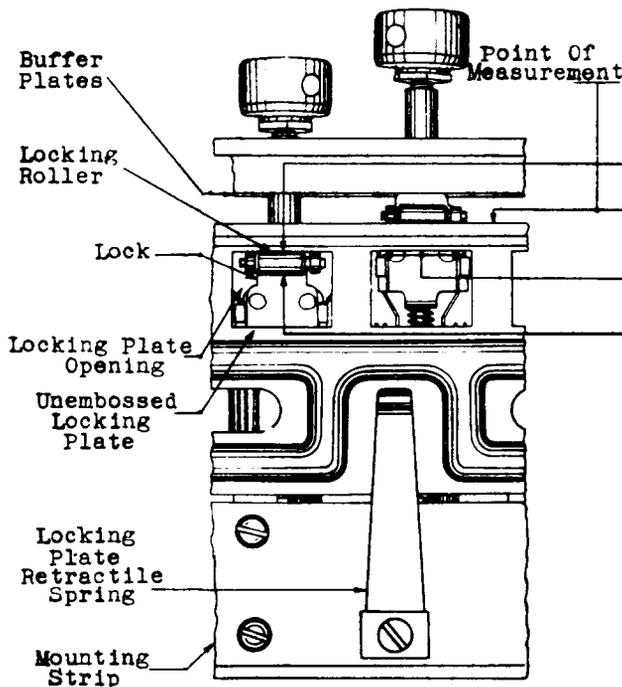
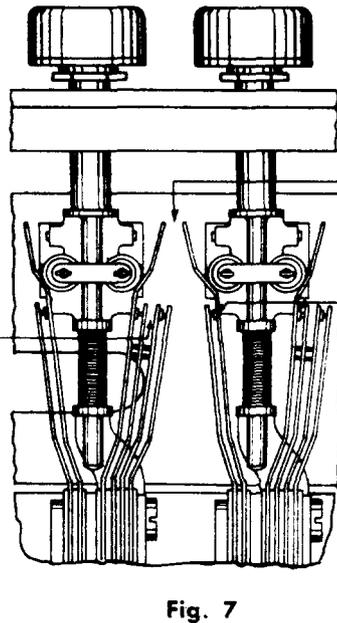
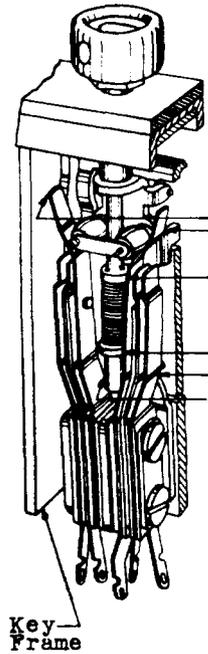
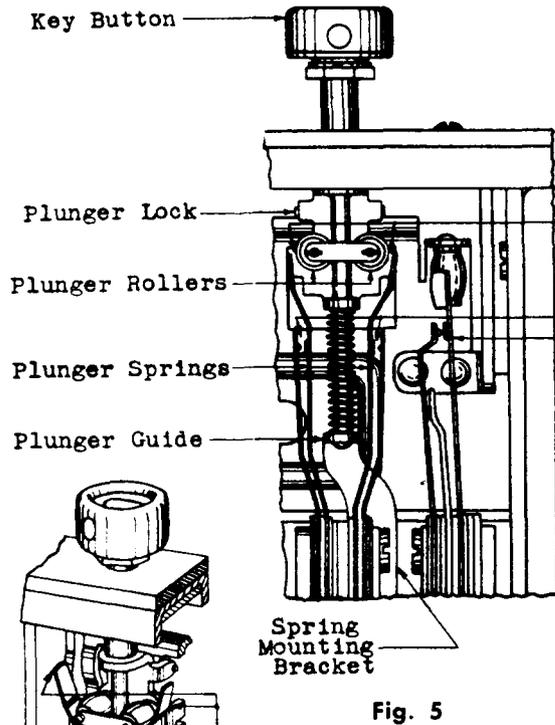


Fig. 4



2.06 Plunger Hold

- (a) A locking plunger in the operated position shall not release when pushed directly upward without turning with a pull of min. 1000 grams exerted on it. Use the No. 79-B gram gauge.
- (b) When any locking plunger in one key is depressed, it shall not release when adjacent plungers in adjacent keys are depressed and then released.

2.07 Plunger Release: Any depressed locked plunger shall release with a snap when any other plunger of the key is depressed or when the magnet is energized.

*2.08 Contact Separation

- (a) **Plunger Contacts:** There shall be a gap of:
Test — Min. .008"
Readjust — Min. .010"
 between all open plunger contacts. Gauge by eye.
- (b) **Common Contacts:** The separation between contacts normally open or between contacts that are opened when the locking plate is operated shall be Min. 0.008"
 Gauge by eye.

*2.09 Spring Clearance

- (a) With the plunger in the normal position there shall be a clearance between the plunger springs and rollers in at least one position as the button is rotated by hand. Gauge by eye.
- (b) There shall be a clearance between springs designed never to make contact and between springs and the frame of:
Test — Min. .014"
Readjust — Min. .016"
 Gauge by eye.
- (c) The clearance between adjacent plunger springs shall be such that they will not touch each other when the plungers are depressed simultaneously. Gauge by eye.

***2.10 Contact Alignment:** The point of contact shall fall wholly within the circumference of the opposing contact disc. Gauge by eye.

*2.11 Contact Pressure

- (a) **Plunger Contacts:** The pressure between closed plunger spring contacts shall be:
Test — Min. 35 grams
Readjust — Min. 40 grams
 Use the No. 70-D gram gauge.
- (b) **Common Contacts:** The pressure between closed common contacts shall be:
Test — Min. 25 grams
Readjust — Min. 30 grams
 Use the No. 70-D gram gauge.

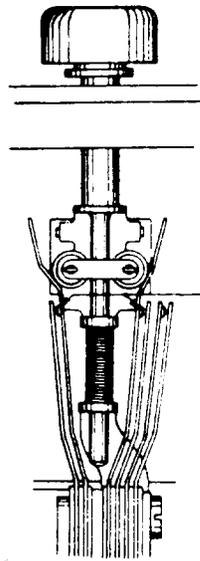


Fig. 9

***2.12 Contact Follow:** The follow on all plunger contact springs and on the springs of normally closed common contact spring combinations shall be:

Test — Min. .008"

Readjust — Min. .010"

Gauge by eye.

***2.13 Contact Sequence**

(a) **Normal Contact Sequence — Break-Make Combinations**

Unless otherwise specified, the normally closed contacts operated directly by a plunger spring of an individual spring assembly shall break before the normally open contacts of the same spring assembly directly associated with that plunger spring make by:

Test — Min. .005"

Readjust — Min. .006"

Gauge by eye.

(b) **Other Contact Sequences:** When specified on the circuit drawing.

2.14 Electrical Requirement: The magnet shall operate the locking plate and release any depressed plunger on a current of

Test — 0.145 amp.

Readjust — 0.135 amp.

Note: This requirement applies to a single magnet. If this apparatus is wired in parallel in the circuit, disconnect it from the circuit when the test is to be made.

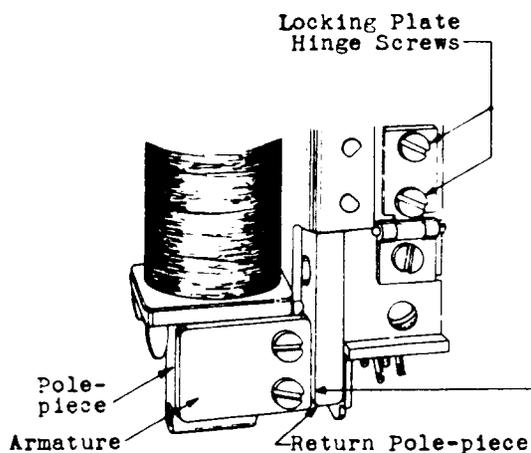


Fig. 10

***2.15 Armature Gap:** The gap between the end of the armature and the return pole-piece shall be:

Min. — .010"

Gauge by eye.

2.16 Plunger Operate Pressure: The pressure required to depress and lock any plunger and release any other plunger or the pressure required to depress any nonlocking plunger an equivalent distance (approximately 1/4") shall be:

Test — Max. 525 grams

Readjust — Max. 500 grams

Use No. 79-B gram gauge.

2.17 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.

3. ADJUSTING PROCEDURES

CODE NO.	DESCRIPTION
TOOLS	
35	Screwdriver — 3-1/2"
209	Wrench — 5/16" Hex. Open-end — Offset
210	Pliers
355	Back Stop Adjuster
356	Retractable Spring and Magnet Lead Guard Adjuster
KS-6015	Duck-bill Pliers
429B (2 required)	Key Support
—	Bell System Cabinet Screwdriver — 3-1/2" per A.T.&T. Co. Drawing 46-X-40.
—	Bell System Cabinet Screwdriver — 6-1/2" per A.T.&T. Co. Drawing 46-X-40.
—	Bell System P-Long Nose Pliers — 6-1/2" per A.T.&T. Co. Drawing 46-X-56
GAUGES	
70-D (or the re- placed 70)	50-0-50 Gram Gauge
74-D	Thickness Gauge Nest
79-B	0-1000 Gram Push-Pull Tension Gauge
79-C	0-200 Gram Push-Pull Tension Gauge
MATERIALS	
KS-2423	Cloth
KS-7860	Petroleum Spirits
—	Toothpick, Hard wood, Flat at one End and Pointed at the Other
TEST APPARATUS	
35-Type	Test Set

3.00 Except where otherwise specified the key should be supported at both ends by 429B key supports while it is being readjusted. The two mounting screws which hold the key in the keyshelf or other mounting should be loosened and the key should be lifted out and one of the wooden blocks slipped over the mounting screw stud at each end of the key.

3.01 Plunger Movement (Reqt 2.01)

M-1 To check for a binding plunger rod operate and release the plunger and at the same time hold the locking plate in the operated position so that it will clear the plunger roller when the plunger is depressed.

M-2 If a plunger binds in a slot loosen the key top mounting screws with a No. 35 screwdriver and shift the key top if possible until no bind occurs. If necessary enlarge the plunger slot. In order to gain access to the plunger slot at fault, it is necessary to remove the screws which hold the key top to the key base with the No. 35 screwdriver and then remove all the key buttons associated with the key top as covered below in paragraph M-8.

M-3 Cracked, warped or broken hard rubber key tops may cause the plunger to bind and thus prevent or delay the release of one plunger when another is depressed. In this case the key top should be replaced.

M-4 Loose or missing screws in the hard rubber key top may cause it to move and bind the plunger rods. Replace missing screws and see that all the key top screws are tight.

M-5 If a plunger binds in the key frame it is probably due to dirt. Place a few drops of petroleum spirits in the slot between the plunger rod and the key frame. Operate the plunger a few times and then wipe the plunger rod with a clean, dry, KS-2423 cloth. Repeat this operation a number of times until all dirt has been removed.

M-6 If the bind is not due to any of the conditions mentioned, see whether the plunger rod is binding in the plunger guide of the spring mounting bracket or whether it is due to the plunger rod being bent.

M-7 If the plunger rod binds in the plunger guide of the spring mounting bracket, loosen the screws holding the spring mounting bracket to the mounting strip with a No. 35 screwdriver and shift the bracket very slightly so as to eliminate the bind, then retighten the bracket firmly. This should eliminate the bind, but in some cases it may be necessary to bend the plunger guide portion of the spring mounting bracket slightly up or down with a pair of long-nose pliers. If this is done be careful not to nick the plunger rod with the pliers.

M-8 If the plunger rod is bent replace it with a new one. To do this, first remove the key button associated with the faulty plunger rod. Hold the hexagonal check nut under the button with a No. 209 wrench and twist the button in a counterclockwise direction by means of the No. 210 key button pliers. As soon as the button is free from the check nut, it may be removed by unscrewing it manually. Remove the lock washer and the check nut.

M-9 The next steps is to remove the screws holding the spring mounting bracket to the mounting strip with the No. 35 screwdriver. On E2 type keys if the plunger rod at fault is part of a unit which bears the keys numbered from 10 to 19 inclusive it will be necessary to remove the unit in order to expose the screws holding the spring mounting bracket to the mounting strip. To remove this unit, first remove the two screws holding the mounting strip to the spacers with the No. 35 screwdriver. With the long-nose pliers, loosen the hexagonal nut which holds the shoulder screw to the lock plate. Then unscrew the shoulder screw with the 6-1/2" cabinet screwdriver. This releases the link. The four screws which hold the key frame to the tie pieces should then be removed with the 3-1/2" cabinet screwdriver. Remove the key unit bearing the numbers 10 to 19, inclusive. The screws holding the spring mounting bracket to the mounting strip may now be removed and the spring mounting bracket taken off. The plunger spring will now fall off.

M-10 Remove the screw holding the locking plate retractile spring to the mounting strip and the screws holding the locking plate hinge to the mounting strip with the 3-1/2" cabinet screwdriver. By removing the locking plate the bent plunger rod may be taken out.

M-11 When resetting the parts see that none of the plungers are turned out of the locking plate and that the locking plate is mounted so that its lower edge is parallel to the edge of the mounting strip to which it is attached. Also see that the contact springs are mounted so that they line up centrally with the rollers which operate them.

M-12 If the plunger still binds, examine the key to determine whether the bind is caused by friction between the plunger rod and the buffer plates. If this is the cause of the trouble it will be necessary to replace the key.

M-13 Lubricants must not be used on any part of the key to facilitate this adjustment.

3.02 Roller Movement (Reqt 2.02)

M-1 To check for the freedom of movement of the locking rollers and all hard rubber rollers, operate the plunger or locking plate associated with the roller to be checked and observe that it turns freely on its bearing pin.

M-2 If any of the rollers bind, apply a small amount of petroleum spirits from the end of a toothpick to the roller bearing pin at the end of the roller at fault. After the petroleum spirits is applied, operate and release the plunger or locking plate associated with the faulty roller a few times to insure that the roller bearing is well flushed out. Wipe off the petroleum spirits remaining with a clean, dry KS-2423 cloth.

M-3 If the roller still binds repeat the operations outlined in M-2 a number of times until all dirt has been removed.

M-4 If the roller still binds, the plunger or locking plate on which it is mounted will have to be replaced.

3.03 Locking Plate Retractable Spring Tension (Reqt 2.03)

3.04 Plunger Lock Engagement (Reqt 2.04)

3.05 Locking Plate Stop Location (Reqt 2.05)

3.06 Plunger Hold (Reqt 2.06)

3.07 Plunger Release (Reqt 2.07)

M-1 To adjust for locking plate retractile spring tension, plunger lock engagement, locking plate stop location, plunger hold and plunger release proceed as follows.

M-2 Locking Plate Retractable Spring Tension: Remove the key from the shelf or other mounting and place it in a position on the No. 429B key supports. Operate the armature by hand and see that it moves freely when slowly released. Reoperate it and hook one end of a No. 79C gram gauge over the top edge of the locking plate between the fifth and sixth locking plate openings as shown in Fig. 11. Take up the tension on the gauge, holding the locking plate forward, and remove the thumb. Slowly release the locking plate until it almost touches one or more of the locking rollers or one of the locks. Read the tension.

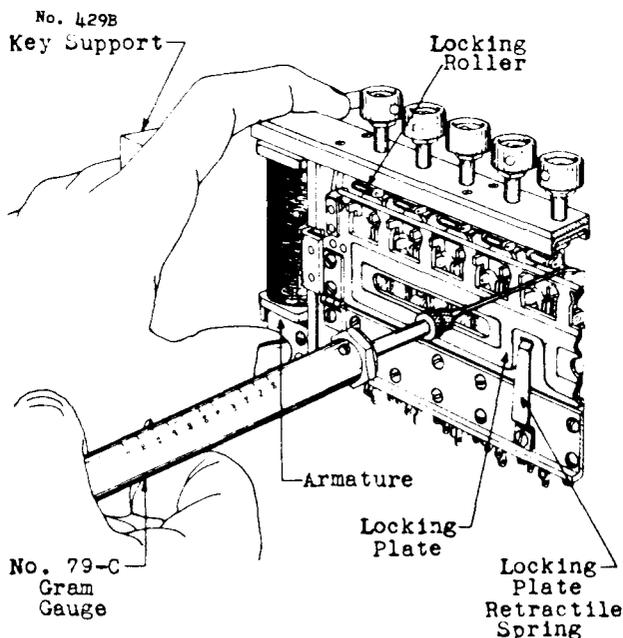


Fig. 11 – Measurement of Locking Plate Retractable Spring Tension

M-3 To readjust for this requirement, grip the locking plate retractile spring with the No. 356 retractile spring and magnet lead guard adjuster as shown in Fig. 12, using the smaller opening of the adjuster for the bending process. When adjusting see that the end

of the locking plate retractile spring lies flat against the locking plate and that the bend is not sufficient to cause a permanent kink in the spring. On E2 type keys adjust only the locking plate retractile spring associated with the key unit bearing the numbers 0 to 9. If the requirement cannot be met in this way, separate the units as covered in procedure 3.01. Then adjust the locking plate retractile spring associated with the key unit bearing the numbers 10 to 19.

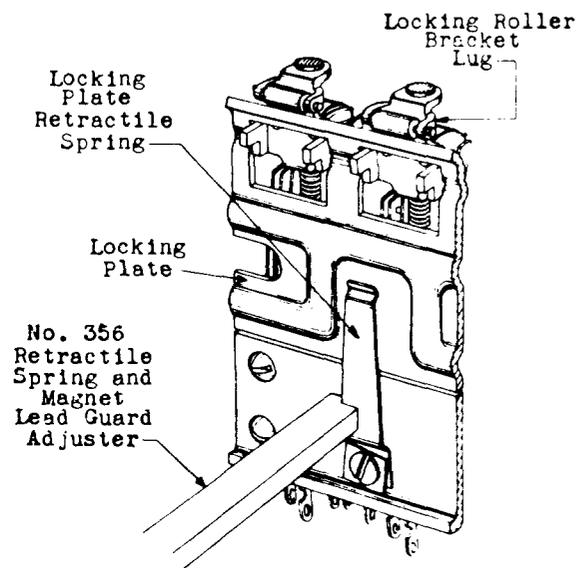


Fig. 12 – Method of Adjusting Locking Plate Retractable Spring Tension

M-4 To readjust keys where the locking plate hinge and spring are combined, it is necessary to remove the hinge screws with a 3-1/2" cabinet screwdriver and tension the spring with a pair of duck-bill pliers. Replace the hinge screws and recheck the tension. If this method does not suffice, it will be necessary to replace the locking plate with a new one.

M-5 Plunger Lock Engagement: Operate and release the armature electrically at the same time applying a light twist to the plunger button. The plunger should be held in the operated position if the key is equipped with an embossed locking plate, and held in the normal position if the key is equipped with

an unembossed locking plate. Under this test the plunger locks should not turn out of the locking plate.

M-6 Should turning out occur the trouble may be due to the locking plate having too much end play or its being set so that the locks are not approximately in the center of the openings provided for them. In the case of E2 type keys, if the fault occurs on the unit bearing the numbers 10 to 19 inclusive, it will be necessary to disconnect the link holding the two units together and separate the units as covered in Procedure 3.01 before corrective measures may be applied. To correct for excessive end play loosen the locking plate hinge screws with the 3-1/2" cabinet screwdriver and shift the hinges slightly toward the center of the locking plate. If it is found that all the plunger locks in a unit appear to be off center with respect to the slots in the locking plate, the locking plate should be shifted to the left or right as required. If this offset condition is peculiar to any individual plunger lock loosen the screws holding the spring mounting bracket to the mounting strip and shift the bracket to relieve the faulty condition. Take care to see that the plunger is free from bind after performing this operation. Before tightening the hinge screws see that the locking plate is mounted so that it is parallel to the mounting strip to which it is attached and that the specified gap exists between the plunger locks and the upper edge of the locking plate opening when all plungers are in the normal position. At the same time, see that it is possible to depress the plunger an appreciable amount after the plunger roller has engaged with the locking plate. This adjustment may be obtained by lowering the locking plate slightly. See that there is a perceptible clearance between the tops of the locking roller brackets and the top side of the rectangular openings in the locking plate when the plunger is in the locked position. If this clearance does not exist, it is an indication of a defective plunger unit and this unit should be replaced.

M-7 Locking Plate Stop Location: Should turning out still occur, it is an indication that the movement of the locking plate is too great. If this is the case, it will be necessary to adjust the front locking plate stop.

Depress the key adjacent to it and insert the narrower end of the No. 355 back stop adjuster as shown in Fig. 13. Grip the rear locking plate stop and then release the key. If the rear locking plate stop fails to touch the key base bend it up until it just touches the key base when the armature touches the pole-piece of the magnet. Take care not to bend the rear locking plate stop enough to cause failure to release when the key is electrically operated. When removing the adjuster it may again be necessary to depress the key adjacent to the bracket. In order to adjust the rear locking plate stop, use the end of the No. 355 back stop adjuster marked "magnet". In each case when bending is done, exercise extreme care that the bend is not excessive. In adjusting the rear locking plate stop on an E2 type key proceed as follows. Remove the screws holding the locking plate hinges to the mounting strip and the screw holding the locking plate retractile spring to the mounting strip. This will allow the locking plate to be lifted up and permit placing the No. 355 back stop adjuster on the rear locking plate stop as shown in Fig. 14, after which the rear locking plate stop may be bent as required.

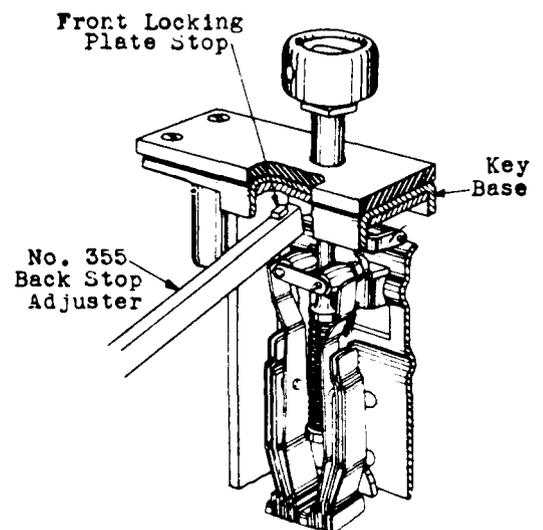


Fig. 13 - Method of Adjusting Front Locking Plate Stop

M-8 If this does not remedy the trouble it will be necessary to reduce the gap between the armature and the magnet pole-piece after which the front and rear locking plate

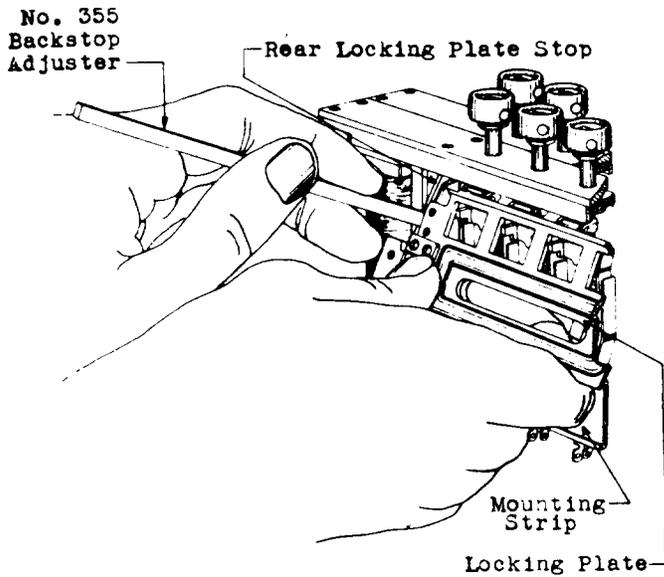


Fig. 14 – Method of Adjusting Rear Locking Plate Stop on E2 Type Keys

stops should be readjusted as covered in paragraph M-7. To reduce the gap between the armature and the magnet pole-piece, grip the magnet lead guard with the wider slot of the No. 356 retractile spring and magnet lead guard adjuster and bend it in a direction toward the armature as shown in Fig. 15.

M-9 In order to check for the proper adjustment operate the armature manually. With the armature operated, depress each plunger separately noting that the phosphor bronze rollers of the locking plungers have either a slight clearance or just touch the locking plate. Then insert between the armature and core the .018" step of the No. 74-D thickness gauge and with the armature operated, at least two of the plungers when depressed should fail to restore due to interference between roller and locking plate. This will secure a maximum engagement of the plunger lock with the locking plate.

M-10 Plunger Hold: If a locked plunger fails to remain operated when the required upward pull is exerted upon it, or if it fails to remain in the operated position when

adjacent plungers in adjacent keys are depressed, it is an indication that the rollers and locking plate are not properly adjusted with respect to each other. Tension the locking plate retractile spring with the No. 356 retractile spring and magnet lead guard adjuster.

M-11 If the key still fails, loosen the hinge screws and slightly raise the locking plate.

M-12 In order to secure a maximum engagement of the plunger lock with the locking plate, the throw of the locking plate may be adjusted so as to cause interference between the locking rollers and the operated locking plate so long as the interference does not prevent the plunger rod restoring from the locked position when the armature is electrically locked.

M-13 Examine the locking plate closely to determine whether it is straight. If the offset portion is bent in any way, it may prevent the rollers from being properly locked in the locking plate. In this case the plate should be replaced.

M-14 Plunger Release: Examine the locking plate to determine whether there are any burrs on that portion of the locking plate over which the roller travels. If this is the case it will be necessary to replace the locking plate.

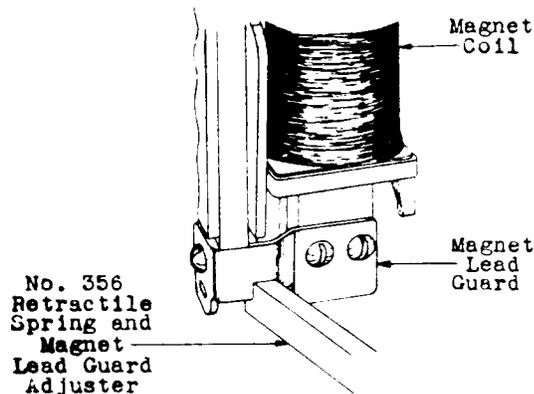


Fig. 15 – Adjustment of Gap Between Armature and Magnet Pole-Piece

M-15 If it is found necessary to allow greater movement in the locking plate in order to provide a satisfactory release, see that this movement is not so great as to allow the plunger locks to be twisted out of the locking plate when the armature is electrically locked against the pole-piece.

M-16 With the armature operated by hand, depress the plungers allowing them to release slowly. Note that the interference is not so great as to prevent the plunger from releasing satisfactorily. If it is necessary to readjust in order to meet this requirement, see that all previous requirements are met.

M-17 General: As a final check for these adjustments and also for bind, depress a plunger, apply the specified current to the magnet and see that the key functions correctly.

- 3.08** *Contact Separation* (Reqt 2.08)
- 3.09** *Spring Clearance* (Reqt 2.09)
- 3.10** *Contact Alignment* (Reqt 2.10)
- 3.11** *Contact Pressure* (Reqt 2.11)
- 3.12** *Contact Follow* (Reqt 2.12)
- 3.13** *Contact Sequence* (Reqt 2.13)

M-1 Contact Alignment: Before adjusting for contact separation spring clearance, contact pressure, contact follow or contact sequence check the contacts and springs for alignment. If necessary remove the entire springs assembly with the 3-1/2" cabinet screwdriver. Loosen the assembly screws very slightly and shift the springs so that they are all in alignment making sure that the contacts rest wholly within the corresponding discs and as near the center as possible. Then tighten the assembly screws and reset the assembly in the mounting strip. If it is found necessary to remove the spring assemblies on the unit bearing the numbers 10 to 19 inclusive, of E2 type keys, or if the spring assemblies of the 0 to 9 unit of this type key are to be checked for contact separation, contact pressure, contact follow or spring clearance, it will first be necessary to separate the two units as covered in procedure 3.01. When mounted the springs should be as nearly parallel to the mounting strip as can be judged by eye.

M-2 Spring adjusting for contact separation, spring clearance, contact follow and contact pressure should, unless otherwise specified, be done close to the point where the springs leave the assembly clamping plates and insulators as shown in Fig. 16. Adjusting should be done with a pair of KS-6015 duck-bill pliers.

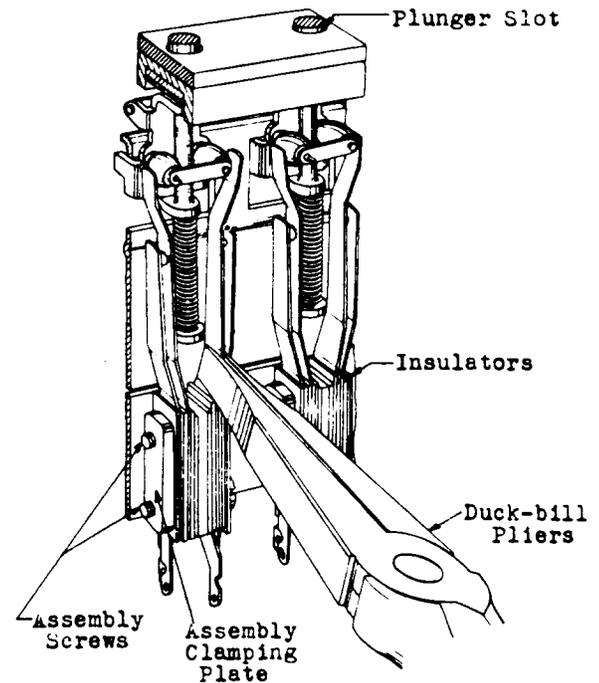


Fig. 16 – Method of Adjusting for Contact Pressure

M-3 Contact Sequence: In readjusting a key to meet the requirements for contact separation, contact pressure, contact follow and spring clearance, the associated circuit drawing should be consulted and proper consideration given to the maintenance of any requirement for contact sequence which may be specified thereon. No readjustment which will interfere with the proper contact sequence should be attempted.

M-4 Spring Clearance: Failure to meet the specified clearance between the adjacent plunger springs may be caused by the plunger springs not being near enough to their respec-

tive plunger rollers. Bend the plunger springs at the offset portion nearest the rollers with a pair of duck-bill pliers so that with the plungers in the normal position there is a very slight clearance between the rollers and the plunger springs. See that the minimum contact separation is maintained at all times. The plunger springs should never be tensioned against the plunger rollers when the plungers are in the normal position. When correcting this condition bend the plunger spring slightly at the offset portion nearest the rollers with a pair of duck-bill pliers as shown in Fig. 17.

M-5 Contact Follow: When readjusting for the proper contact follow adjust the stationary contact spring close to the point where the springs leave the clamping plates, exercising care that the minimum contact separation is maintained. If however, a satisfactory contact follow cannot be obtained it will be permissible to adjust the spring at the offset portion close to the contact disc. This adjustment should not be great enough to make a visible kink in the spring.

3.08-3.13 (Continued)

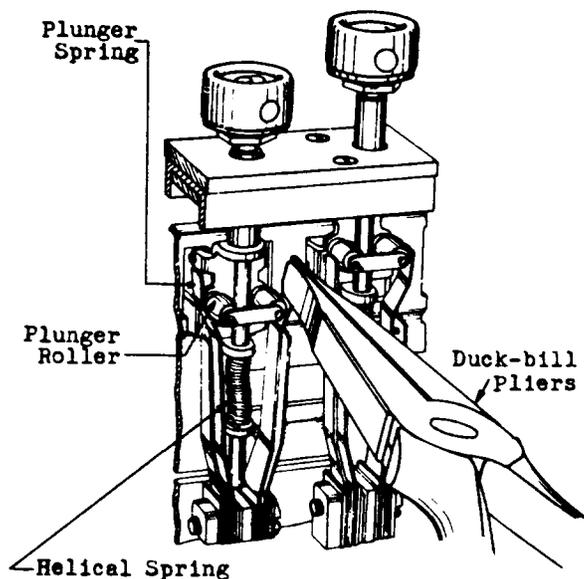


Fig. 17 - Method of Adjusting for Spring Clearance

3.14 Electrical Requirement (Reqt 2.14)

3.15 Armature Gap (Reqt 2.15)

M-1 Electrical Requirement: To adjust for the electrical requirement change the retractile spring tension or armature gap as required. If it is found necessary to change the tension or the gap between the end of the armature and the return pole-piece to meet this requirement, exercise care not to reduce either the tension or gap below the minimum value specified.

M-2 Armature Gap: If necessary change the gap between the armature and the return pole-piece by loosening the two screws on the armature with the 3-1/2" cabinet screwdriver and move the armature to the right or left as desired. There is no maximum specified for this requirement, but it is important that this gap be held near to the minimum specified in order that the magnet will meet its electrical requirement.

3.16 Plunger Operate Pressure (Reqt 2.16)

M-1 Before adjusting for plunger operate pressure first examine the helical spring to determine whether it is broken or distorted in any way and if necessary replace it taking the key apart in the manner described in procedure 3.01.

M-2 Next examine the plunger springs to determine whether a gummy substance has formed on them. Clean the surface of the spring nearest the rollers with a toothpick which has been dipped in petroleum spirits. Do not use the same toothpick for two operations. Then holding the locking plate in the operated position clean the offset portion of the locking plate nearest the phosphor bronze rollers and also the phosphor bronze rollers in the manner described for cleaning the springs. Clean the hard rubber rollers with a clean, dry KS-2423 cloth.

M-3 If after cleaning the springs the key still fails to meet the requirement determine whether the plunger spring tension is excessive and if necessary weaken these springs by adjusting them close to the point where they leave the clamping plate with a pair of KS-6015 duck-bill pliers.

M-4 Operate the magnet armature by hand and then while holding the armature in this position depress the plunger. The plunger should operate freely and without appreciable interference.

M-5 Check the tension of the locking plate retractile spring and see that it is not excessive. If necessary, proceed as in procedure 3.07.

3.17 Cleaning (Reqd 2.17)

M-1 Clean the contacts in accordance with the section covering cleaning procedures for key contacts. Clean other parts in accordance with procedures 3.01, M-5, 3.02, M-2 and M-3 and 3.16, M-2.

3.18 Resetting Loose Buttons

M-1 Employ the following method in resetting buttons which have become loose. Turn the hexagonal check nut down as far as it can go using a No. 209 wrench. Then place the lock washer over the nut and screw the button down to its correct position. Set the button so that with the figure right side up the top of the button will line up with the top of adjacent buttons. Grip the button with a pair of No. 210 pliers and while holding it tighten the lock nut against it.

Caution: *Exercise care not to place undue strain on the plunger when tightening the button to prevent loosening the plunger lock on the plunger rod.*