I. & M. REQUIREMENTS SPECIFICATION
BELL TELEPHONE LABORATORIES, INC.
SYSTEMS DEVELOPMENT DEPARTMENT, NEW YORK

X-70097-01, ISSUE 1
DECEMBER 3, 1927
SUPERSEDING X-70097
ISSUE 1 OF 3/6/27

INSTALLATION AND MAINTENANCE REQUIREMENTS

FOR

186 TYPE RELAYS

REASON FOR ISSUE

This specification is issued to supersede specification X-70097, issue 1 for the following reasons:

1. To add a requirement to the effect that the relay shall meet its electrical requirements (2.8).

2. To add an armature air gap requirement (2.7).

Changes were also made:

3. To bring specification up-to-date as to form with test and readjust requirements on a separate sheet.

4. To change and add maintenance methods.

CHANGES FROM X-70097, ISSUE 1

Paragraph No.	Change
1.1	Was 1.1 and 1.2. Reworded.
1.2	Was 1.4. Reworded.
1.3	Was 1.5. Reworded.
-	1.3 (X-70097) omitted.
1.4	Added.
1.5	Was 1.6. Added 371 and KS-6015 tools, cabinet screw-driver, long nose pliers, 35-C test set. Omitted 265 tool.
-	1.71, 1.711, 1.712, 1.72, 1.73 and 1.81 (X-70097) omitted.
*2.001	Was 1.811 and 1.812. Reworded.
*2.002	Was 1.813. Reworded.
*2.003	Was 1.814. Reworded.
*2.004 to 2.006) incl. and 2.08)	Added.
*2.007	Was 3.1. Reworded.
2.01	Added.
*2.1	Added method of checking.
*2.2 and 2.4) to 2.6 incl.)	Reworded.
*2.3	Omitted reference to convex and cylindrical contacts which are not used on this relay.
*2.7 and *2.8	Added.
*2.9	Was 3.4.
3.01 and 3.02	Added.
3.1	Was 3.2. Reworded.
3.2	Was 3.3. Added methods.
3.3	Was 3.6. Reworded.
3.4	Was 3.5. Added methods.
3.5	Was 3.7. Added methods.
3.6	Was 3.8. Added methods.
3.7 and 3.8	Added.
3.9	Was 3.4. Added methods.
-	Fig. 1, Fig. 2 and Fig CA (X-70097) omitted.

*These paragraphs are given on Sheet 1 which has been added to this specification.

SECTION 1 - GENERAL

1.1 This specification supersedes specification X-70097, issue 1 and covers the installation and maintenance requirements for 186 type relays. Unless otherwise specified herein or in the Circuit Requirement Tables the requirements covered by this specification apply to all relays of the above types.

1.2 Section 2 of this specification covers the requirements for the inspection of mechanical adjustments which shall be used to determine whether the relay is in proper condition for delivery to the customer and for service. These are called "Test Requirements" and are listed on Sheet 1 attached hereto.

1.3 Section 3 of this specification covers the mechanical requirements which must be met in readjusting a relay which fails to meet the test requirements. These are called "Readjust Requirements" and are listed on Sheet 1 attached hereto. In addition to the readjust requirements, Section 3 also gives the approved maintenance methods of meeting these requirements.

1.4 The tensional and dimensional requirements set up in this specification should be met, unless otherwise specified, regardless of the method of test or adjustment employed. Facilities for meeting these requirements are provided in the form of standard tools and gauges. However, if it is found by experience that certain requirements can be met satisfactorily by "feel" or by "eye", these methods may be employed. It is suggested that checking with tools and gauges be made often enough to insure that proper test and adjustment

requirements are being met. Furthermore, where requirements are close, it would be advisable to use tools and gauges to obtain adjustments.

1.5 The following is a list of the tools, test apparatus and materials specified in Section 2 and Section 3 for use in testing and readjusting the relay.

Tools

Code No.	Description
35	Screw-driver - 3-1/2"
102	Wrench - 3/8" Hex. Socket
371	Spring Adjuster
KS-6015	Duck-bill Pliers
-	Bell System Cabinet Screwdriver - 3-1/2"
-	Bell System P-Long Nose Pliers - 6-1/2"

Materials

-	Toothpicks - Hardwood - Flat at one end and pointed at the other
-	C. P. Carbon Tetrachloride

Test Apparatus

35-C	Current Flow Test Set

SECTION 2 - TEST REQUIREMENTS

2.01 Unless otherwise specified, any relay of the type covered by this specification shall meet the test requirements given on Sheet 1 attached hereto.

SECTION 3 - READJUST REQUIREMENTS

3.0 GENERAL

3.01 A relay should be readjusted in accordance with the following methods to meet the readjust requirements specified on Sheet 1 attached hereto.

3.02 Where two or more requirements are covered by one set of methods the requirement headings in this section will be connected together with a bracket. The readjustments for meeting these requirements are more or less interdependent and in making readjustments to meet any one requirement consideration should be given to the others.

3.1 RELAY MOUNTING (Rq.2.1)

M-1 To tighten relays loose on the mounting plate, securely tighten the mounting nuts with the No. 102 wrench.

3.2 ARMATURE MOVEMENT (Rq.2.2)

M-1 If the armature fails to move freely in its bearings, remove the mounting nut with the No. 102 wrench and then remove the relay from the mounting plate. Remove the four screws which hold the faceplate to the frame with the No. 35 screw-driver, then loosen the two screws which hold the pole-piece (frame) to the spoolhead with the 3-1/2" cabinet screwdriver. Spread the front end of the pole-piece (frame) apart and remove the armature assembly from its bearings. Clean the bearings and the armature pivots with C.P. carbon tetrachloride applied with a clean toothpick. The same toothpick should not be used for more than one operation.

M-2 The core face and the entire armature assembly except the hard rubber stud should be thoroughly cleaned with C.P. carbon tetrachloride also.

M-3 Care should be exercised when applying the carbon tetrachloride to prevent its coming in contact with the spoolhead, studs and insulators.

M-4 At this time advantage should be taken to check the relay for all the following adjustments.

3.3 CONTACT ALIGNMENT (Rq.2.3)

M-1 If the contacts do not line up properly remove the relay from its mounting as outlined in 3.2, M-1. To align the contacts loosen the spring assembly mounting screw with the No. 35 screw-driver and shift the spring to the desired position. Then with the spring held firmly in this position retighten the screw securely noting that the springs rest on their respective stop springs.

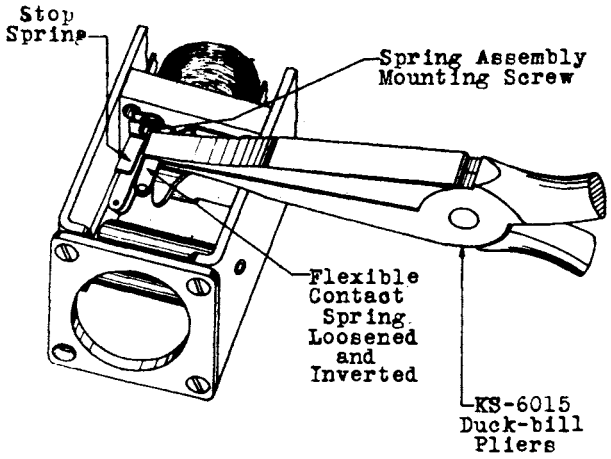
3.4 FLEXIBLE CONTACT SPRING POSITION (Rq.2.4)

M-1 If the flexible front contact spring does not rest on the stop spring at its contact end, remove the relay from its mounting as outlined in 3.2, M-1. Then form the flat end of the toothpick so that its thin end can be inserted between the stop spring and the flexible spring. Insert the thin end of the toothpick between the stop spring and the flexible spring as close to the base of the spring as possible and then with the blade of the No. 35 screw-driver exert a slight downward pressure on the spring. Remove the screw-driver and then the toothpick.

M-2 If the top flexible contact spring does not rest on the stop spring due to the flexible spring being distorted, loosen the spring assembly mounting screw with the No. 35 screw-driver, turn the flexible spring in a clockwise direction through an angle of 180° and adjust it with the KS-6015 duck-bill pliers as shown in Fig. A. It will be satisfactory to have a slight kink in the flexible contact

spring close to the base of the spring. This kink may be introduced in making the adjustment outlined in M-1. After resetting the spring in position tighten the spring assembly mounting screw securely noting that the contacts are in proper alignment. In tightening the screw exercise care that the spring is not twisted in such a way that it will not rest against the stop spring and the contacts misaligned. Clean the contacts at this time in accordance with the methods outlined under paragraph 3.8.

M-3 If the lower flexible contact spring is not positioned correctly, due to kinks, it will be necessary to remove it from the spring pileup in order to straighten the spring.



Method of Straightening Upper Flexible Contact Spring

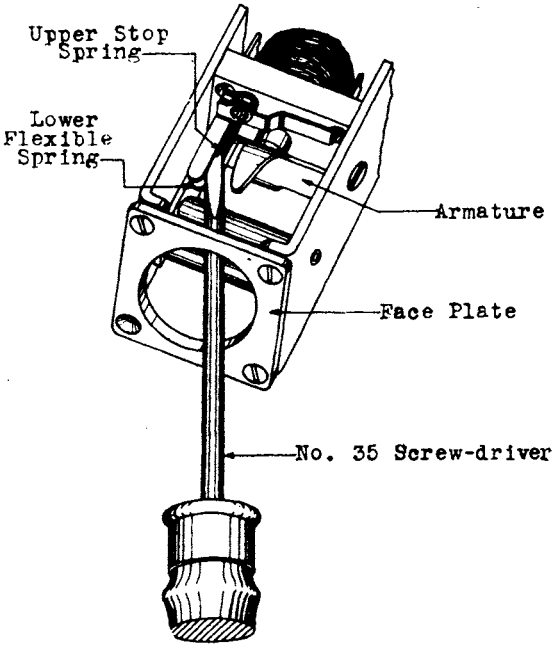
Fig. A

3.5	CONTACT SEPARATION	(Rq.2.5)
3.6	CONTACT FOLLOW	(Rq.2.6)
3.7	ARMATURE AIR GAP	(Rq.2.7)
3.8	ELECTRICAL REQUIREMENTS	(Rq.2.8)

M-1 The adjustments for contact separation and contact follow may be made with the relay mounted. These adjustments can be made with the faceplate in position but if more room is required to make these adjustments, the faceplate should be removed. Use the No. 35 screw-driver to remove the faceplate screws. To increase the contact separation or to decrease the contact follow apply the blade of the No. 35 screw-driver between the upper stop spring and the lower flexible contact spring as shown in Fig. B and exert a slight upward pressure on the screw-driver. To decrease the contact separation or to increase the contact follow apply the blade of the No. 35 screw-driver near the base of the upper flexible contact spring and exert a downward pressure or apply the blade near the base of the lower stop spring and exert an upward pressure.

M-2 Contact Separation If necessary to adjust for contact separation it is advisable to make this separation as near the minimum value as is consistent with meeting all the other requirements.

M-3 Contact Follow If the contact follow is insufficient it may be due to excessive contact separation in which case the follow should be increased or the separation decreased as outlined in M-1. The contact follow will be satisfactory when with the armature in the fully operated position there is a clearance between the upper flexible contact spring and its back stop. If, however, the relay is operating on alternating current, it will be satisfactory if the contacts only make and insure a reliable electrical circuit through them.



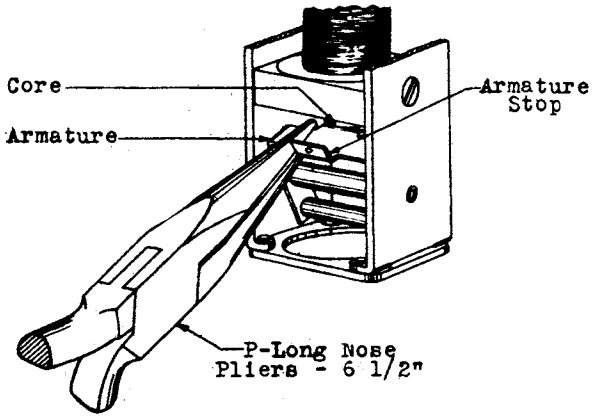
Method of Adjusting for Contact Separation and Contact Follow

Fig. B

M-4 Electrical Requirements If the relay fails to release, increase the contact follow by adjusting the springs as outlined in paragraphs M-1 and M-3. It should be noted that the contact separation requirement is still met and that the flexible spring rests on its stop spring.

M-5 Failure to release may also be due to an accumulation of dirt on the armature stop pin, on the bottom surface of the core, or may be due to dirty bearings. In this case remove the dirt as outlined in the methods under paragraph 3.2.

M-6 If the relay still fails to release, examine the armature to determine whether there is sufficient clearance between it and the core when the relay is energized. An insufficient clearance between the armature and core with the armature in the operated position may result from worn bearings. Move the armature toward and away from the core and if the motion is excessive compensate for it by increasing the gap between the armature and core. To do this, revolve the relay so that its smaller axis turns through an angle of 180°. With the armature held firmly in position as shown in Fig. C, adjust it on each side of the offset portion slightly toward the center with the long nose pliers. An increase in the separation between the armature and core will also affect the correct operation of the relay. Care must therefore be exercised in making this adjustment that the gap between the armature and core will not be so great as to prevent the armature from fully operating when the operate current is applied.

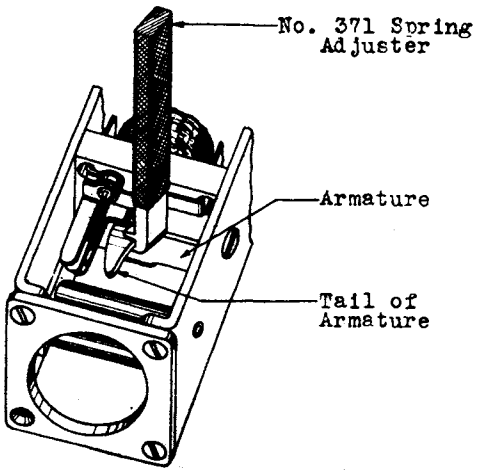


Method of Adjusting Armature

Fig. C

M-7 If the contact separation and contact follow is close to the minimum value in each case and the relay fails to meet its operate requirement, it may be due to any one or all of the following reasons: The tail of the armature being distorted so that the armature gap does not decrease uniformly as the relay operates; that portion of the armature which in the operated position is opposite the core being bent; or worn bearings which allow the armature excessive front and back motion.

M-8 If the tail of the armature is distorted, remove the relay from the mounting as described in 3.2, M-1 and operate the armature manually noting that the separation between the armature and core is least when the armature is in the fully operated position. Should this separation be less between some point on the tail of the armature and the core than that between the armature and core when the armature is in the operated position, correct this condition by adjusting the tail of the armature with the No. 371 spring adjuster applied as shown in Fig. D. Operate the armature manually and while holding it firmly in this position, adjust the required portion of the tail of the armature by exerting a slight pulling force on the spring adjuster (toward the front of the relay). Care must be exercised when adjusting the tail of the armature since the slightest deformation may affect the correct operation of the relay. After each adjustment of the tail of the armature operate the armature manually and recheck the separation between each point on the armature and the core as the armature is being operated.



Method of Adjusting Tail of Armature

Fig. D

M-9 Worn bearings likewise may cause failure of the armature to operate correctly. Move the armature toward and away from

the core. If the motion is excessive when the operate current is applied, the armature may freeze against the core before it has reached the fully operated position. To correct for this condition increase the separation between the armature and core as outlined in M-6.

M-10 Operate the armature manually and see whether the gap between the armature and core in this position is excessive. The cause of an excessive gap may be due to that part of the armature, which in the operated position is opposite the core, being bent. To correct for this condition proceed as outlined in M-6 except that in reducing the gap adjust the armature on both sides of the offset portion in a direction away from the center.

M-11 If the relay operates when the non-operate current is applied, force the lower contact spring and stop spring downward with the No. 35 screw-driver. If this is done, a recheck should be made to determine whether the relay will operate when the operate current is applied.

M-12 When any adjustments are made so as to cause the armature to operate more easily, a recheck must be made to determine whether or not it will release.

3.8 CLEANING (Rq.2.8)

M-1 Clean the contacts in accordance with the X specification covering "Cleaning of Relay Contacts and Parts".

M-2 Clean the armature bearings, the armature stop pin and core in accordance with 3.2.

Attached:

X-70097-01, Sheet 1, Issue 1

BELL TELEPHONE LABORATORIES, INC.

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DEPT. 332-B-4

DEFINITIONS AND GENERAL INFORMATION

2.001 Operate means that when the specified operate current is applied the armature shall move sufficiently to make the front contact reliably.

2.002 Non-Operate means that when the specified non-operate current is applied, the armature shall not move from the unoperated position sufficiently to make the front contact.

2.003 Release means that when the specified operate current is reduced to open circuit the armature shall move from the operated position sufficiently to break reliably, the contact that has been made.

2.004 Reliable Contact If necessary to check for a reliable contact this may be done by bridging a receiver across made contacts through which current is flowing. Absence of fluttering in the receiver is evidence of a reliable contact. If fluttering is present the contact is unreliable.

2.005 Application of Requirements Unless otherwise specified, the requirements given on this sheet are both test and readjust requirements.

2.006 One Limit Requirement Unless otherwise specified, where a readjust requirement specifies only one limit (either a maximum or a minimum limit) it is advisable if possible, to readjust inside of the limit.

2.007 Readjusting Sequence Requirements are given in the order in which adjustments should be made by the Telephone Company.

2.008 Gauges and Methods listed on this sheet are for the use of the Telephone Company.

Fig. 1

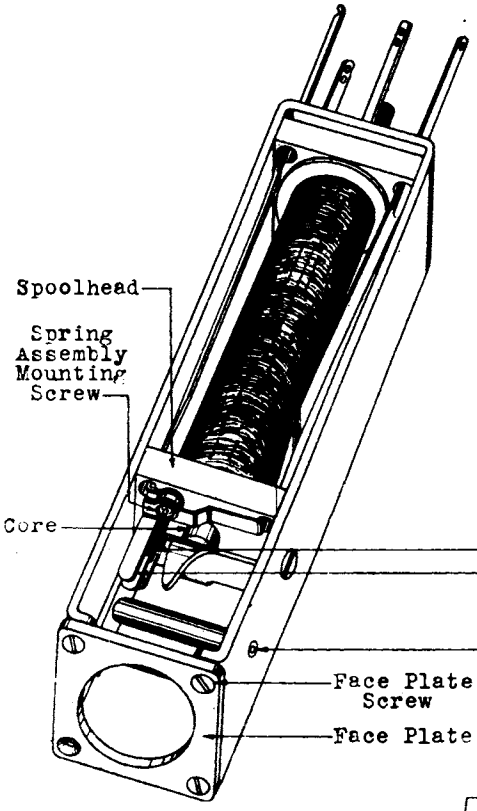

Fig. 2

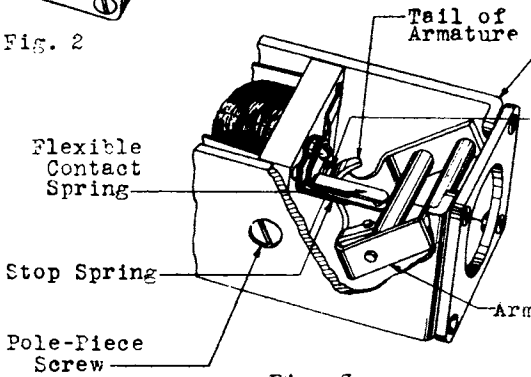

Fig. 3

REQUIREMENTS

2.1 Relay Mounting Relays shall be fastened securely to the mounting plate. This shall be checked by applying a vertical and a horizontal pressure to the relay and not by attempting to turn the relay.

2.2 Armature Movement The armature shall move freely in its bearings. Gauge by eye.

2.3 Contact Alignment Contacts shall line up so that the point of contact falls wholly within the circumference of the opposing contact disc. Gauge by eye.

2.4 Flexible Contact Spring Position The flexible contact spring shall rest on the stop spring, at least on the end of the stop spring that is nearest the contact. Gauge by eye.

2.5 Contact Separation The separation between normally open contacts shall be perceptible (approximately .005"). Gauge by eye.

2.6 Contact Follow The contact follow shall be perceptible (approximately .005") when the armature is manually operated to its fully operated position against the core. Gauge by eye.

2.7 Armature Air Gap The armature shall not touch the face of the core as the relay operates electrically. Gauge by eye.

2.8 Electrical Requirements The relay shall meet the electrical requirements specified on the "Circuit Requirement Table".

2.9 Cleaning

(a) The contacts shall be cleaned when necessary in accordance with the "X" specification covering "Cleaning of Relay Contacts and Parts".

(b) Other parts shall be cleaned when necessary in accordance with approved methods.

TEST AND READJUST REQUIREMENTS
FOR
186 TYPE RELAYS