

American Telephone and Telegraph Company

BELL SYSTEM PRACTICES
Teletypewriter and Manual
Telegraph Station and PBX
Installation and Maintenance

ADDENDUM P35.613
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Long Lines Department
(Telegraph)
Dist. Class. 600AC

MONITORING TELETYPEWRITERS - 14 TYPE

REQUIREMENTS AND PROCEDURES

1. GENERAL

- 1.01 This addendum supplements Section P35.613 to specify the transmission tests, adjustments and limits for 60 and 75 speed monitoring teletypewriters which are also to be used for transmission measuring purposes. Teletypewriters are not recommended for measuring the quality of 100 speed telegraph transmission. This issue replaces Issue B of the addendum.
- 1.02 The information contained in this section is intended for use by both the Equipment Maintenance Forces and Telegraph Test Room Attendants and is issued as Section E35.901 also.
- 1.03 Part 2 covers "Readjust Requirements, Adjustments and Tests." It is to be applied both when performing initial lineups on monitoring teletypewriters and when readjusting them after they have been turned down because of failure to meet the "Test Requirements."
- 1.04 Part 3 covers "Test Requirements", which are to be applied by Telegraph Test Room Attendants in order to determine if the monitoring teletypewriters are in correct adjustment. The making of these tests is primarily the responsibility of the Telegraph Repeater Force.
- 1.05 Any set failing to meet the "Test Requirements" shall be adjusted to meet the "Readjust Requirements" specified in Part 2.

1.06 Monitoring teletypewriters which are used only for purposes of obtaining copy may be maintained in accordance with the instructions covering the transmission maintenance and adjustment of a customer machine at the end of a short loop.

1.07 A sufficient number of monitoring teletypewriters suitable for transmission measuring purposes, suitably designated, should be maintained at any one office to insure against shortage of transmission measuring apparatus due to trouble in other transmission measuring equipment.

1.08 A suggested designation arrangement is to insert in the 87693M name plate a red card marked "MONIT. ONLY" for those machines used only for monitoring, and a red card marked "MEASURING" for those machines used for measuring and monitoring. These cards should be stenciled in black india ink or typed in capitals. In addition to the above card on the monitoring only machine, it is suggested that the range scale crank and the end scales be removed.

Note: If not so equipped the covers should be provided with 87693M name plates. These are secured with four 78484M screws requiring a 2-56 tap or 34-11M nuts.

2. READJUST REQUIREMENTS, ADJUSTMENTS AND TESTS

2.01 The procedures and limits here specified are intended for use by the Equipment Maintenance Force both when performing initial lineups on monitoring teletypewriters and when lining up the machines which have failed to meet the "Test Requirements" specified in Part 3.

2.02 Dual speed machines shall be lined up for the higher speed at which they are intended to operate. If such machines are fitted with zero end scales, the scales shall be adjusted for measuring at the higher speed at which the machines are intended to operate.

2.03 The following items shall be checked before applying the transmission adjustments:

- (a) In the case of initial lineup, all mechanical requirements and tolerances must be checked. The machine must be clean, properly lubricated and in good condition.
- (b) In the case of lineup after turndown, only those mechanical features requiring attention or suspected of requiring it need be checked.
- (c) Check the speed of the motor and adjust if necessary. In the case of a dual speed machine check both motor speeds.

2.04 Test Setup for Testing the Receiving Mechanism - Bias Set Available

- (a) Set up a 60 mil TLT and drive it with polar signals obtained by connecting the polar output of the bias set to Drop 1 if the bias set has a polar output. If the bias set does not have a polar output then drive the TLT with the neutral output of the bias set by connecting it to Looping 1 of the TLT.
- (b) Connect the teletypewriter under test to Looping 2 of the TLT.
- (c) Drive the bias set with automatic signals of the proper speed and check these signals to be sure that they are free of distortion.

2.05 Determination of Bias Index and Skew Index of Monitoring Teletypewriter - Bias Set Available

- (a) Transmit to the typing unit under test, miscellaneous signals (test sentence), at the proper speed, biased 25% marking and determine the range. Record the upper limit as "H" and the lower limit as "L".

(b) Determine the range similarly, using 25% spacing bias except that in this case the upper limit should be recorded as "h" and the lower limit as "l"

(c) Record the readings as follows:

h	H
l	L

The readings are recorded in this manner as an aid to the memory; notice that each of the values appears in the same relative position with respect to the others as would be the case if an actual parallelogram were drawn and the readings then marked on the parallelogram at the points which they determine.

(d) The next step is to determine "X" and "Y" as indicated below, and then under "Y" record "X - Y", and under "X - Y" record X + Y.

h - H	=	X
l - L	=	Y
		X - Y
		X + Y

The purpose of this somewhat mechanical procedure is to simplify the computation. The quantity "X - Y" is the "bias index" and it is merely twice the internal bias of the machine. The "bias index" automatically comes out positive if the internal bias is marking, and negative if the internal bias is spacing. The quantity "X + Y" is the "skew index"; it is 50 plus twice the internal skew of the machine. If the internal skew is positive, the skew index is greater than 50 and if the internal skew is negative, the skew index is less than 50. There is no point in determining the actual internal bias and skew in order to adjust the machine, however, because the limits are given in terms of the "bias index" and the "skew index" which are easier to determine.

- (e) As an example, suppose a machine was measured and the following results were obtained:

$$\begin{array}{ll} h = 85 & H = 62 \\ l = 39 & L = 10 \end{array}$$

The computations would be made as follows:

$$\begin{array}{r} 85 - 62 = 23 \\ 39 - 10 = 29 \\ \hline -6 = \text{bias index} \\ 52 = \text{skew index} \end{array}$$

As a matter of interest it might be stated that the internal bias is 3% spacing and the internal skew is 1% positive.

- (f) The following is a sample computation on a machine with zero internal bias and zero skew:

$$\begin{array}{r} 85 - 60 = 25 \\ 35 - 10 = 25 \\ \hline 0 = \text{bias index} \\ 50 = \text{skew index} \end{array}$$

2.06 Adjustment of Receiving Mechanism Based on Measurements Using a Bias Set

(a) If the skew index is outside the limits of 48 to 52 as measured in Paragraph 2.05, adjust it to within these limits. The skew index may be adjusted by varying the armature spring tension. Increasing the tension increases the skew index and vice versa. Machines differ but at 60 speed one full turn of the armature spring tension adjusting screw will change the skew index about 2 points. The final spring tension, based on these measurements, should be within the limits of 160 to 210 grams or 5-5/8 to 7-3/8 ounces for 60 speed. For 75 speed, experience indicates the final spring tension should be within the limits of 190 to 220 grams or 6-3/4 to 8-1/4 ounces.

- (b) Measure the bias index and skew index again. The skew index should now be within limits; if not, make a suitable readjustment and repeat the measurements.
- (c) Notice that the bias index of the machine will vary while the skew index is being adjusted. It may, in fact, become somewhat worse than it was when initially measured.
- (d) When the skew index is finally within limits, proceed to remove the bias last measured. Do this by adjusting the armature air gap. Remove positive bias by increasing the armature air gap and negative bias by decreasing the armature air gap. Machines differ but at 60 speed, .001 inch change in the air gap will change the bias index about 5%. The final mean armature air gap setting should be within the limits of .002 to .008 inch based on this method of adjustment for 60 speed. For 75 speed, experience indicates the final mean armature air gap setting should be within the limits of .002 to .004 inch.
- (e) Repeat adjustments of the air gap and measurements of the bias index and the skew index until the bias index is within the limits of plus 2 to minus 2 per cent. The skew index should not change much while the air gap is being adjusted; in fact, this is the basis of the whole procedure.
- (f) In order to facilitate armature air gap adjustments all monitoring teletypewriters should be fitted with armature air gap adjusting brackets.
- (g) If the machine has zero end scales, adjust the bias set for zero bias and determine the upper and lower points of failure. Set the zeros of the zero end scales to coincide with these points. The receiving mechanism is now ready for service.

(h) If the machine does not have zero end scales, set the bias box for zero bias and determine the upper and lower points of failure. These should be recorded and turned over to the telegraph test room attendant when the machine is turned up for service. The receiving mechanism is now ready for service.

(i) In the case of a dual speed machine with zero end scales, set the scales for the higher speed and report the local range on the lower speed when the machine is turned up for service.

(j) In the case of a dual speed machine without zero end scales report the local range at both speeds when the machine is turned up for service.

2.07 Monitoring teletypewriters intended to be used for measuring purposes can not be adjusted satisfactorily without some means of introducing predetermined amounts of bias into the test signals; therefore, if such machines are located at a point where a bias set is not normally available, arrangements shall be made to ship in a portable bias set at periodically established test intervals in order to test and adjust the monitoring teletypewriters, provided a source of reversals is available at the point for use in calibrating the bias set. Whenever a bias set is shipped to such a point the procedures specified in Paragraphs 2.02 through 2.06 shall be applied to all the monitoring teletypewriters at the point.

2.08 Keyboard Adjustment - 118 Type Telegraph
Transmission Measuring Set Available

(a) Set up a 60 mil test TLT, patch the measuring set into Looping 1 and the teletypewriter into Looping 2. Transmit the test sentence twice (or an equivalent number of letters) at a speed just sufficient to crowd the keyboard. The total distortion should not exceed 7% at 60 speed or 9% at 75 speed.

(b) If the distortion does exceed the limits shown above, the mechanical adjustments should be checked and readjusted as necessary to reduce the distortion. Anti-distortion detents may be applied if available.

2.09 Keyboard Adjustment - 118 Type Telegraph Measuring Set Not Available

(a) Set up a 60 mil test TLT, patch another monitoring teletypewriter known to be in good adjustment into Looping 1; patch the teletypewriter with the keyboard under test into Looping 2. Set the range arm of the measuring machine the required number of per cent below its upper failure point on local signals and transmit the test sentence twice (or an equivalent number of letters) from the keyboard under test at a speed just sufficient to crowd it. Repeat this procedure with the range arm of the measuring machine set to the required number of per cent above its lower failure point on local signals. No errors should be received on the measuring machine.

*(b) The readjust requirements for keyboards at 60 or 75 speed should be 7% or less.

(c) If the distortion limits are exceeded, the mechanical adjustments should be checked and readjusted as necessary to reduce the distortion. Anti-distortion detents may be applied if available.

2.10 A monitoring teletypewriter may be turned up for service only when both its receiving mechanism and keyboard meet the specified readjust requirements.

2.11 Whenever a monitoring teletypewriter is turned over to the Equipment Department because either its keyboard or receiving mechanism failed to

meet the test requirements, then both the keyboard and the receiving mechanism shall be adjusted to meet the readjust requirements.

3. TEST REQUIREMENTS

3.01 The procedures and limits specified under "Test Requirements" are designed to indicate whether the set is in satisfactory operating condition. They are not as severe as the "Readjust Requirements" specified in Part 2 but provide ample margin for satisfactory operation.

3.02 Any set which fails to meet the "Test Requirements" shall be readjusted to meet the more severe "Readjust Requirements"

3.03 Test of Receiving Mechanism

(a) Use the same setup specified in 2.04. Send miscellaneous signals biased 10% marking and determine the upper point of failure. The indicated reduction in range at the upper end should be between 7% and 11%.

Note: When making this test if the lower point of failure is measured, it may be as much as 3 points below or one point above the zero setting of the lower zero end scale due to the permissible amounts of bias and skew which may be present.

(b) Now send miscellaneous signals biased 10% spacing and determine the lower point of failure. The indicated reduction in range at the lower end should be between 7% and 11%.

Note: When making this test if the upper point of failure is measured, it may be as much as 3 points above or one point below the zero setting of the upper zero end scale due to the permissible amounts of bias and skew which may be present.

(c) If either or both of the requirements specified in (a) and (b) above are not met, the machine shall be turned over to the Equipment Maintenance Force for further tests.

(c) If a bias set is not normally available at the point involved then follow the procedure specified in 2.07.

3.04 Test of Keyboard

(a) If a 118 type telegraph transmission measuring set is available, use the testing procedure specified in Paragraph 2.08(a), otherwise use the procedure specified in 2.09(a).

* (b) The Test Requirements to be met by keyboards at either 60 or 75 speed should be 8% or less.

(c) If the Test Requirements specified in (b) above are not met, the machine shall be turned over to the Equipment Maintenance Force for further tests.