

Installation Engineering Handbook 19
Western Electric Company, Incorporated
Kearny Works

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ROTARY MERCURY AND KS-5746 INTERRUPTERS

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1. GENERAL

1.1 Scope

1.11 This section covers rotary mercury-type interrupters and KS-5746 spring type interrupters associated with ringing machines.

1.12 BSP 163-650-701 covers mercury interrupters and BSP 163-630-701 covers KS-5746 interrupters.

1.2 Associated Information

1.21 Timing Charts on SD drawings indicate interrupter timing required in terms of high speed shaft revolutions. Time in seconds, also indicated, is based on the shaft running 1200 rpm (20 revolutions per second).

1.22 Tables covering assembly position of interrupter rings on the shaft are shown on drawing ED-80296-30 which is usually listed in job papers.

1.3 Precautions

1.31 Where possible all tests and adjustments except those which must be made with machine in operation should be made on the idle machine and with the transfer circuit blocked to avoid unexpected starting of the machine while work is being done.

1.32 Before commencing any work or tests on interrupter arrangements driven by a ringing machine which is in service, consideration should be given to the section in Handbook 0 which covers cooperation with the customer, prevention of service interruptions, and protection of personnel and equipment.

1.4 Description

1.41 A mercury type interrupter unit consists of two or three steel discs, in which are cut annular grooves or channels, with an insulator separating each pair of discs. The channels contain mercury. Openings or ports in the insulators connect adjacent channels. As the ring rotates contact is made from one steel disc to another when the insulator port dips into the pool of mercury. Number and spacing of ports and speed of rotation determine the timing. External circuit connections are made through brushes which ride on each steel disc. Each unit is coded such as 800-A, 901-B, etc., according to its construction.

1.42 Mercury interrupter assemblies consist of a gear case, or speed reduction unit, with various interrupter rings mounted on the low speed shafts of the speed reduction unit. The rings furnished are in accordance with drawing ED-80296-01 or ED-80296-30 for a particular application. See Figure 1.

1.43 A KS-5746 interrupter has several spring packs with a contact spring for each pack. New interrupters operate the contact springs by nylon cam followers which ride on nylon cams driven by the 10 rpm shaft of W.E. No. 3 type interrupters. See Figure 1.

2. INSTALLING EQUIPMENT

2.1 Tool kits normally on the job will contain sufficient tools for installing. The following items are specifically required for these interrupters.

2.2 Tools

Code	Description
265C	Burnisher, Contact
KS-6015	Pliers, Duckbill
Obtain from Telephone Company	Crank, Code C-500

This section includes material from BSP's 163-630-701 and 163-650-701 Copyright, 1954 and 1962, respectively, by American Telephone and Telegraph Company.

2.3 Gauges

R-72046 Gauge, Feeler, .0015" to .040"
79B Gauge, Gram, Tension, Barrel
Type, 0-1000

2.4 Test Apparatus

ITE-4137 Continuity Test Set, AC
(2 required)

2.5 Supplies

KS-2423 Cloth, Twill Jean
KS-6824 Compound, Sealing
RM-642701 Oil, Extreme Pressure
Obtain. Paper, Flint, Extra Fine or
Locally Paper, Garnet, 4/0
R-3429 Trichloroethylene

3. MOUNTING AND COUPLING

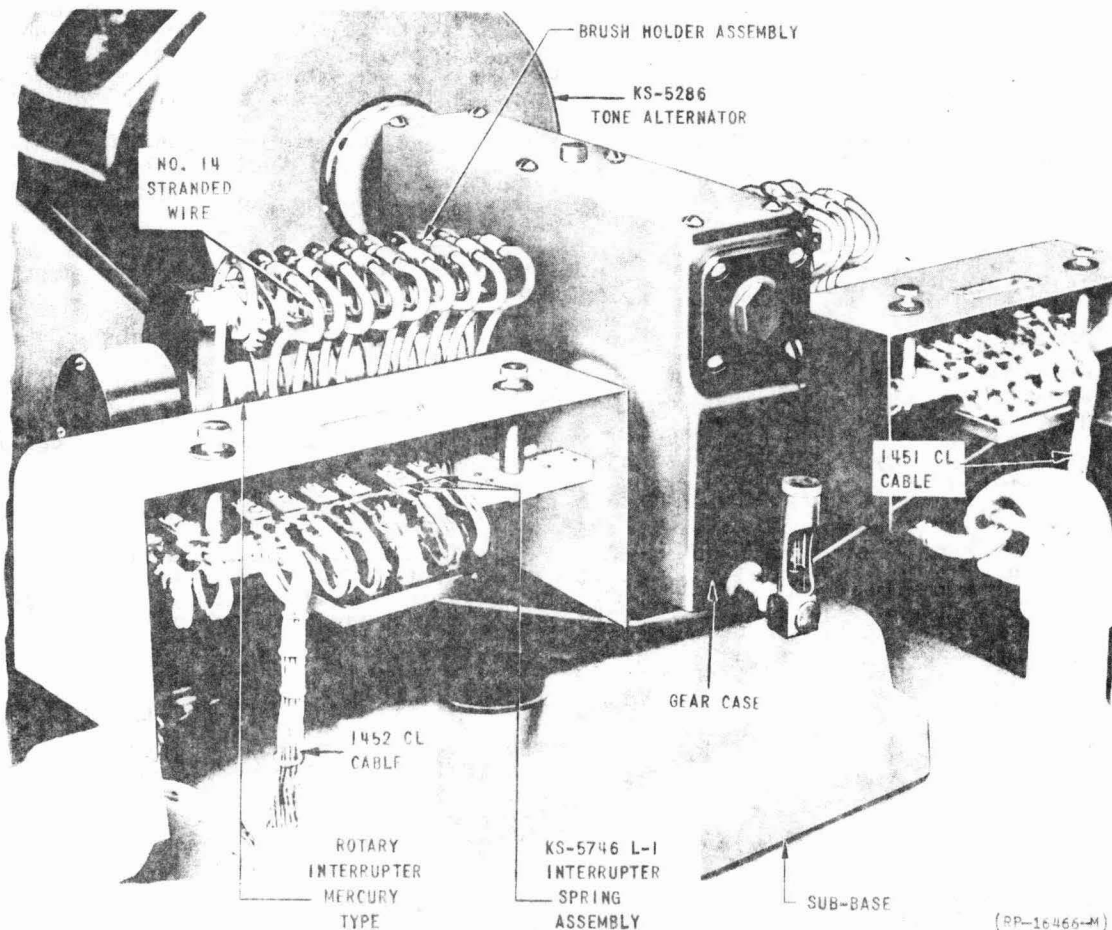
3.1 Mount the interrupter gear case on the base of the ringing machine as indicated on job drawings. Bolts, shims and couplings are furnished as required.

3.2 The center line of the interrupter drive shaft and the center line of the tone alternator shaft shall be in approximate alignment. Shim gear case as required to meet this requirement.

3.3 Mount the mercury interrupters in accordance with job drawings. Be sure to observe location key way position, etc., for each interrupter unit.

3.4 Mount KS-5746 spring interrupters in accordance with job drawings. Connect KS-5746 shaft to shaft of interrupter gear case with flexible couplings provided. After couplings are lined up tighten the mounting bolts for the interrupter. Coupling screws can be tightened temporarily at this time. Final adjustment of the coupling will be for proper relation to mercury interrupter as in Paragraph 11.

3.5 Connect the interrupter gear case to the tone alternator with the leather coupling disc. Place the leather coupling disc over the two pins on the tone alternator. Loosen the set screw in the coupling half on the gear box and slide the coupling half toward the tone alternator until the drive pins fit into the two free holes in the coupling disc. Then tighten the set screw securely.



(RP-16466-M)

FIG. 1 INTERRUPTER ASSEMBLY SHOWING MERCURY ROTARY INTERRUPTERS AND KS-5746 INTERRUPTERS

4. LUBRICATION

4.1 Check oil level in interrupter gear case. Level in oil gauge (Gits No. 4202) after machine has been stopped for a minimum of one hour shall be:

Maximum - $3/8"$
Minimum - $1/4"$

4.11 If oil is required remove the plug in the top of the gear case and add 150-200 S210 extreme pressure oil (RM-642701) through the hole until proper level is indicated in the sight glass.

4.2 Do not lubricate the shaft bearings of KS-5746 interrupters.

4.3 Nylon cams and followers of KS-5746 interrupters shall not be lubricated in any way.

4.4 Grease cups, if any, on interrupter shaft outboard bearings shall be turned down (clockwise) one complete turn every six months.

5. FREEDOM OF OPERATION

5.1 Gear case shafts and KS-5746 interrupter shafts shall turn freely in their bearings.

Gauge by feel.

5.11 If binding occurs check alignment of interrupter gear case and tone alternator shaft. Check mounting bolts and screws and tighten if necessary. Check for sticking mercury interrupter brushes. Check gear case lubrication.

5.12 If KS-5746 interrupter shaft binds due to oil having been applied to the bearings, it will be necessary to replace the bearings.

6. BRUSH HOLDERS

6.1 Clearance from the interrupter disc surface to the nearest point on the brush holder shall be:

Minimum - $1/32"$
Maximum - $3/32"$

Use scale.

6.11 To adjust clearance loosen the set screw (see Figure 2) securing the brush holder to its supporting stud, and move the holder so that it has approximately $1/16"$ clearance from the interrupter disc. Lay a scale across the edges of brush holders on the same supporting stud and check that all holders are in approximately the same plane. Tighten the set screws.

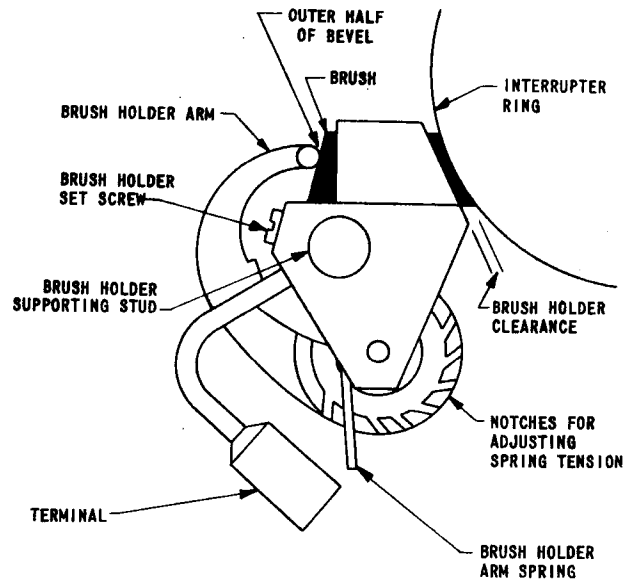


FIG. 2 BRUSH AND BRUSH HOLDER - ASSEMBLY

6.12 If all brush holders on the same stud are in the same plane but the clearances between brush holders and interrupter discs are outside of limits all may be adjusted at the same time by loosening the acorn nuts at the ends of the supporting stud and rotating the stud as necessary. Tighten the acorn nuts after this adjustment.

6.2 Clean dirt, lint, carbon dust, etc., from the outside edge or rim of insulating washers between interrupter brush holders with compressed air or air from a hand bellows if available.

7. BRUSHES AND BRUSH FIT

7.1 To fit a brush to the interrupter disc cut Extra Fine Flint or 4/0 Garnet abrasive paper slightly wider than the brush and at least as long as the circumference of the interrupter disc. Place the abrasive paper under the brush with the abrasive side next to the brush and hold it so that it bears on about half of the disc surface. Draw the abrasive paper back and forth under the brush until the brush has the same curvature as the interrupter disc. Make the final cut in the direction the interrupter disc rotates. After fitting, wipe interrupter ring, brushes, and brush holders with a cloth. Remove carbon dust from the insulating washers between the brush holders.

7.2 Brushes shall be free in their holders. Gauge by feel. If there is any binding remove the brush and wipe with a clean cloth. Smooth any projections with abrasive paper, wipe with a clean cloth and replace the brush in the holder.

7.3 If brushes pick up dirt or dust, take the machine out of service, remove brushes and wipe each brush with a clean dry cloth.

8. BRUSH PRESSURE

8.1 On new brushes the brush holder arm shall contact the brush in the outer half of the beveled top, that is, in the half away from the brush holder slide. See Figure 2.

8.11 Brush holder arm position may be changed by bending slightly.

8.2 Total pressure of each brush on associated interrupter disc shall be:

Minimum - 300 grams

Maximum - 400 grams

Use 79B gram tension gauge.

8.21 Brush pressure is checked as follows. Loop a piece of cord under the brush holder arm as near to the point where it touches the brush as possible. Place a strip of bond paper between the brush and the disc. Hook the gram tension gauge into the loop of string and pull along the center line of the brush while exerting a gentle steady pull on the paper. Read the gauge just as the paper is released and begins to move. Unhook the gauge from the string loop and hold the gauge at the same angle used to pull the string loop and read the gauge. The brush pressure equals the reading obtained when pulling the string minus the static or zero reading obtained when holding the gauge at an angle.

8.22 Adjust brush pressure, as required, by shifting the brush holder arm spring to the proper notch.

9. MERCURY INTERRUPTERS

9.1 Contact Surfaces

9.11 Contact surfaces of interrupter discs shall be clean and free from pits and scores.

9.111 Clean dirty disc surfaces with a KS-2423 cloth moistened with R-3429 Trichloroethylene. Do the cleaning wherever possible with the brushes removed from the holders. Hold the moistened cloth against the ring as it rotates, then wipe dry with a clean dry cloth. If brushes cannot be removed, it will be necessary to hold a dry cloth at a point on the ring surface where the Trichloroethylene will be wiped off before it reaches the brushes.

9.112 If disc surfaces are streaked or rough, or if traces of rust are present, remove the brushes and polish the disc surfaces with abrasive paper (Extra Fine Flint or 4.0 Garnet Paper). Wipe with a dry cloth and return brushes to their original position. After polishing, if disc surfaces show a tendency to rust, wipe surfaces with a cloth moistened with a few drops of light oil, wipe with a dry cloth and then reinstall brushes.

NOTE: This polishing also removes the white deposit which comes from the seal between the discs. Special cleaning is not required because this white deposit is not objectionable in limited quantities.

9.2 Timing

9.21 Timing of mercury interrupters are a function of the type, mounting location, and keyway location. These are indicated on drawing ED-80296-01 or -30. Schematic drawings will indicate timing intervals. (Refer to Figure 3).

9.22 Timing may be checked by the use of 120 volt lamps. Refer to Figure 3. Connect a lamp from BR1 to ground and start the machine. Observe if lamp lights on AC and then on trip battery for the proper intervals on chart shown on interrupter and distributing SD circuit drawing specified for job. Repeat for BR2 and BR3.

9.23 Relation of one disc to another may be checked by using two test lamps as in Figure 3. From the timing chart make a sequence chart for two test lamps, one connected to BR1 and ground and the other to BR2 and ground. Rotate the interrupter shaft using the crank connected to the gear case high speed shaft and check lamp sequences. If these are correct with respect to each other, connect test lamp 2 to BR3 and repeat test for relation between BR1 and BR3. Continue in this way to check relation of other discs to BR1.

10. KS-5746 INTERRUPTERS

10.1 Mechanical

10.11 Contacts shall be clean and smooth. Gauge by eye. Smooth contacts as necessary, with a 265C contact burnisher and then wipe with a dry cloth. If contacts are in bad condition they should be replaced.

10.12 Contacts shall have visible follow.

10.13 Spring assemblies shall be tight.

10.14 The point of contact shall fall entirely within the circumference of the opposing contact disc.

10.15 On transfer spring combinations each closed contact shall break before the associated open contact makes. Minimum separation between the actuated spring and the open contact at the instant of breaking the closed contact shall be .007 inch.

Use R-72046 feeler gauge.

10.16 Shape springs that are slightly bent, or that require shaping to meet requirements in Paragraphs 10.12 through 10.15, with a pair of KS-6015 duck-bill pliers. This should be done before checking Timing, Paragraph 10.2. If springs are badly bent they should be replaced.

10.24 Additional Timing Requirements.

10.21 Timing shall be as indicated in
Timing Charts on job drawings.
In addition, the timing requirements in
Paragraph 10.24 shall also be met.

10.22 Timing Charts indicate timing with respect to revolutions of the high speed shaft. Check timing with the C-500 crank. Disengage coupling between interrupter gear case and tone alternator by loosening set screws on the coupling half and sliding it back on the shaft. Remove the plug in the gear case at the end of the high speed shaft and screw the stud of the crank into the end of the shaft. Remove crank immediately after checking timing, replace plug and connect gear case shaft to tone alternator as in Paragraph 3.5.

10.241 Taking closure of spring i on List 3 and spring f on List 4 as occurring at 0 revolutions, other springs shall open or close within $\pm$ one revolution of the high speed shaft from the number of revolutions for them on the Timing Chart.

10.242 On springs having more than one make combination, contacts of springs not adjacent to the cam shall not make before the contacts of the spring adjacent to the cam have made and shall make not later than 1/2 revolution of the high speed shaft after these contacts have made.

EXAMPLE

NOTE: THIS EXAMPLE COVERS A CODE 800A INTERRUPTER RING FOR MACH. RING 1. THE INTERVALS AND SEQUENCE OF MACH. RING 2, PICK UP, ETC., WILL VARY IN ACCORDANCE WITH CHART ON SD DWG SPECIFIED FOR JOB.

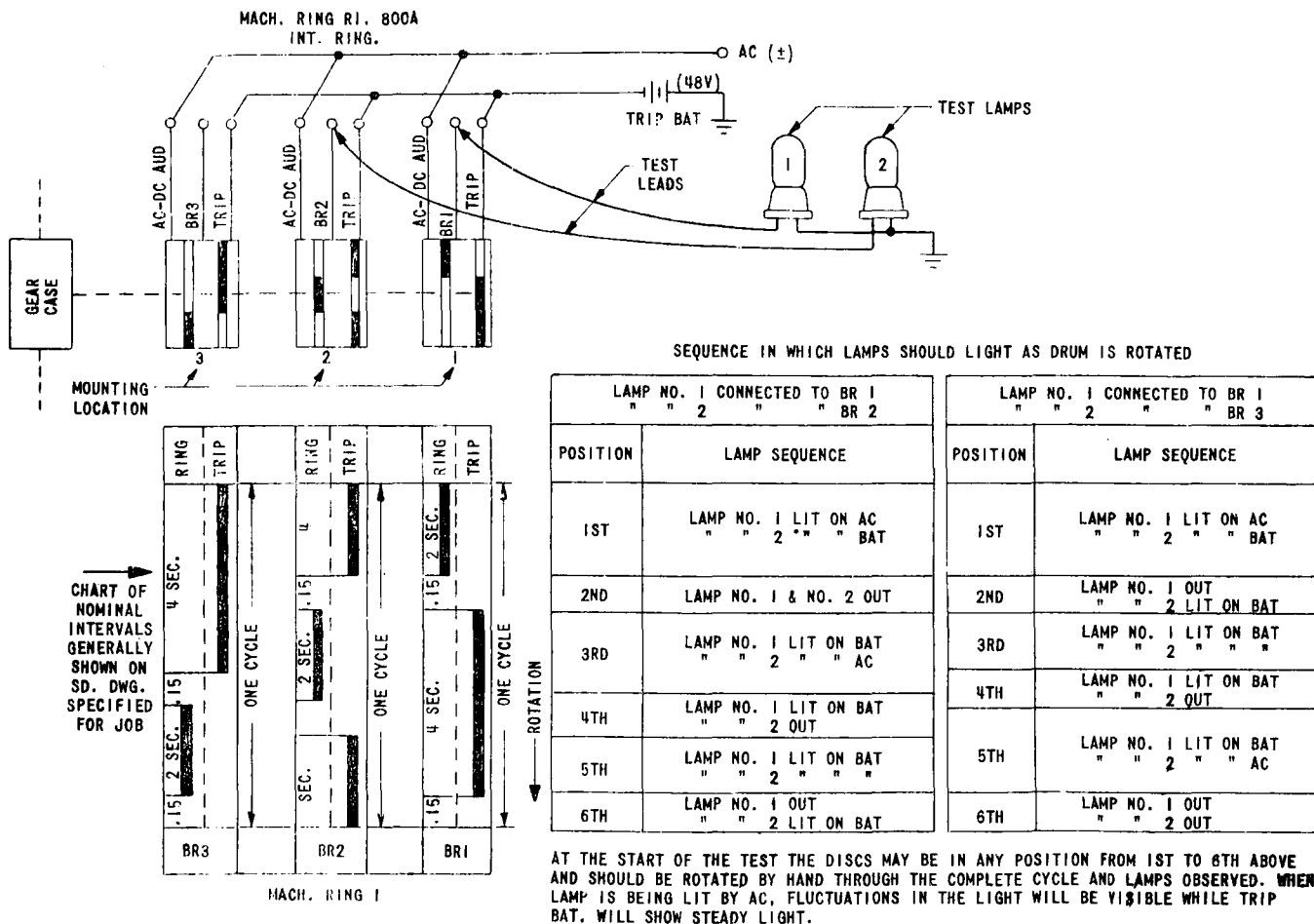


FIG. 3 SAMPLE TEST FOR INTERRUPTER TIMING

10.23 Contact closures may be gauged by eye or detected by operation of two buzzers. Buzzers are useful where one man must work alone. When buzzer sets are used the transfer T relays should be operated (electrically or by blocking) as if the other ringing machine were in service. This will clear the contact springs of wiring in the control board and beyond which might interfere with buzzer set operation thru back up paths.

10.25 Shape springs that need read-
justment with a pair of KS-6015
duckbill pliers.

11. COUPLING KS-5743 INTERRUPTERS AND MERCURY INTERRUPTERS

11.1 Do not adjust KS-5746 spring in-
terrupters with respect to mercury
interrupters until requirements in Paragraph
11 have been checked for the KS-5746
interrupter. This adjustment is done

with the interrupter high speed shaft disengaged from the tone alternator as described in Paragraph 10.22.

11.2 Rotate the high speed shaft clockwise until the ringing interval of CODE 1 GEN BRUSH 2 just starts. Continue rotation of the high speed shaft for 3 turns. Rotate the KS-5746 interrupter shaft by hand until the first closure of spring 3 just opens. Tighten the set screws in the coupling half engaging this shaft.

11.3 Rotate the high speed shaft clockwise until the front contacts of spring 7 just close. Then turn the high speed shaft back (counterclockwise) 1-1/2 revolutions. Rotate the KS-5746 interrupter shaft by hand until the second closure of spring 12 just opens. Tighten the set screws of the coupling half engaging this shaft.

12. GEAR CASE OIL LEAKS

12.1 The gear case including the oil gauge shall be free from oil leaks.

12.11 If there is leakage around the gear case cover, it must be resealed. If the leak occurs around a bolt remove the bolt, dip threads in sealing compound and replace. To rescal the cover remove cover hold-down screws and pry cover loose, applying pressure between cover and gear case. Scrape off old sealing compound and clean dry. Coat the sealing edge of the gear case lightly with KS-6824 compound,

replace cover, apply sealing compound to threads of the screws, replace the screws and tighten. Where there is a ball bearing, see that none of the new compound squeezes in between the cover and the ball bearing outer race. If possible allow the compound to set for four hours before running the set. It is recommended that goggles be worn while scraping off old compound not previously softened.

12.12 If there is leakage around the threads of an oil gauge first drain the oil out of the gear case. Remove the knurled cap on the gauge, turn the gauge so that the open end points down. Catch the oil in a cup or can as it will be returned to the gear case. When the oil has drained, remove the oil gauge, clean threads, coat threads with sealing compound and replace the gauge. If the leak is at the gear case housing remove the short nipple with a pipe wrench, clean threads, coat with sealing compound and replace nipple and gauge. Refill gear case with oil as in Paragraph 4.11.

13. NOISE AND VIBRATION

13.1 The noise and vibration of the interrupter under any normal operating condition shall not be excessive. Gauge by sound and feel.

13.2 Where excessive noise or vibration is present see that all bolts, nuts and screws are set up tightly and alignment is correct. If the noise or vibration continues, report the trouble in a J.I.M. in accordance with established routines.

No arrows are shown due to extensive changes.

Vertical lines at side of paragraphs indicate requirements.

Manager, Product Engineering

Reason for Reissue:

- (1) show R-3429 Trichloroethylene instead of Petroleum Spirits.
- (2) show present coupling to Tone Alternator.