INDUCTIVE NOISE

1. GENERAL

1.03 Inductive noise, as used in this section, is caused by telephone plant being within the electromagnetic field of:

- Power circuits
- Transformers
- Neon lights
- Fluorescent lights
- Office machines

Such fields create foreign voltages on the telephone circuit. Unbalance of the telephone circuit will result in noise and low frequency hum. The purpose of this section is to show methods of balancing or isolating this condition.

Station apparatus and associated wiring should not be located closer to possible sources of inductive noise than the separations specified in the sections covering wiring, clearances, and station set location.

2. CONTROL OF INDUCTIVE NOISE

2.01 Poor insulation or resistance unbalance of the telephone circuit contributes to noise resulting from inductive interference. Locating and eliminating the cause of high leakage or resistance unbalance may adequately solve the problem.

2.02 The balance-to-ground of the customer station sets is often the controlling factor in the susceptibility to inductive noise.

> ***Note:*** The unbalance between the two sides of a line which has only the capacitance afforded by the air dielectric between the tip and ring shall not exceed three volts on the meter at the local test desk.

2.03 The unbalances due to nongrounded ringers are small and noise resulting from the action of induced voltages on these unbalances is usually negligible.

2.04 The steps required for the control of inductive noise (in order of practical application) are:

(1) Balance line

(2) Install 3-element tube

(3) Install 4-element tube

(4) Install solid state ringer isolator

3. STATION RINGING BRIDGES

3.01 B-type ringers, which are manufactured with magnetic iron core ringer coils, have red-striped markings on both coil covers. These red-striped ringers are lower in impedance and increase the susceptibility to inductive noise when used for grounded ringing.

3.02 All low-impedance ringers on grounded ringing lines troubled with inductive noise should be replaced by high-impedance capacitor-type ringing bridges.

3.03 The high-impedance station ringers connected on each side of a line should balance within certain limits. Section 500-114-100 lists figures as units of unbalance which may be applied to the various station ringers to determine the unbalance between the two sides of the line.

3.04 When inductive noise is excessive on lines with high-impedance capacitor-type grounded ringing bridges, tubes or ringer isolators may be utilized to minimize the effects of the induced voltage.

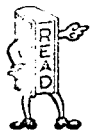
3.05 From the standpoint of susceptibility to inductive noise, a grounded station ringer equipped with a tube or ringer isolator is equivalent to a nongrounded ringer (provided the induced voltage between the line and ground is not high enough to cause conduction of the tube, or exceed the limits of the ringer isolator, and that tip party identification is not used).

4. MULTISLOT COIN STATIONS

Note: A coin collector normally requires a subscriber set to provide talking and ringing components whereas a coin telephone has all components within one housing.

4.01 Dial and manual prepay coin collector and 235, 1235, and 236 coin telephone lines are susceptible to inductive noise in exposed areas. Older types of prepay coin collectors have a large shunt unbalance caused by the connection of the coin relay from one side of the line to ground. Later types correct this unbalance by use of center-tapped 101B induction coils or 425- or 4010-type networks with the coin relay connected from the center tap (balance point) to ground.

4.02 Where noise problems arise with older type coin collectors, it will be necessary to replace the coin collector with one employing a 425- or 4010-type network.



The single slot coin telephone (1A, 2A type) is much less susceptible to inductive noise and should be used in place of multislot coin collector/telephones to effectively reduct inductive interference.

4.03 On coin collectors, earth potential or long loops may interfere with the proper operation of the coin relay. Earth potential may be either positive or negative. If negative, it opposes the negative coin battery and reduces the coin return range; if positive, it reduces the collect range. Station equipment is available which employs a sensitive relay (S36) wired in series with the coin relay which, when it operates, effectively parallels the tip and ring conductors at the station and thus reduces the total resistance in the control path after the user hangs up. In dial offices, coin collector return current is normally applied to the tip and ring conductors at the central office.

4.04 Refer to Section 506-215-404 for the 685B subscriber set employing an S36 relay.

4.05 The electromagnet associated with 10-cent operation is connected in series with the line. In order to minimize the effect of the electromagnet on transmission, a 452A or 452B 4-uf capacitor is connected in parallel with it. In areas of low-frequency inductive interference it may be necessary to increase the size of this capacitor to keep the noise pickup within acceptable limits. A D-180327 Kit of Parts (Fig. 1) is available for this purpose and is intended for use in all 200-type coin collector/telephones using a 425- or 4010-type network. It replaces the 452A or 452B capacitor.

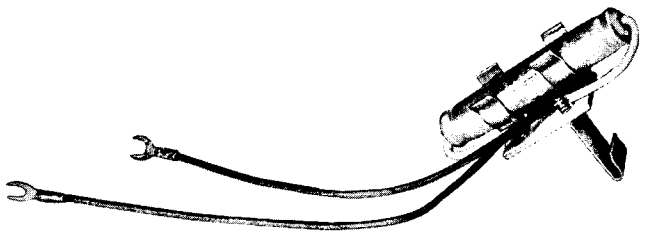


Fig. 1—D-180327 Kit of Parts

4.06 The D-180327 Kit of Parts will not fit in the 3-slot panel, 235- and 1235-type cover telephones.

5. DEVICES TO MINIMIZE INDUCTIVE NOISE

5.01 Three different electrical devices may be used to minimize the effect of inductive noise.

- 426-type, 3-element, gas-filled cold cathode electron tube
- 425-type, 4-element, gas-filled cold cathode electron tube
- P90D011, solid-state ringer isolator

5.02 Table A shows usage of the tubes and ringer isolator for the various party services.

5.03 Tube equipped sets usually require either superimposed ringing (ac ringing voltage plus a dc bias voltage), or a pulsating ringing current, in order to assure satisfactory ringer operation. If a suitable supply is not available, tube equipped sets cannot be used.

5.04 The limitations on the number of tube equipped ringing bridges and the permissible loop resistance are more restricted than for regular capacitor-type ringing bridges. The reduction in limitations is different for various central office ringing arrangements. For the limitations, refer to Section 500-114-100.

5.05 Tube equipped sets may be used on 2-party lines provided tip-party identification is not required.

3-ELEMENT TUBE (426-TYPE)

5.06 The 426-type 3-element tube may be added to high-impedance grounded ringers to minimize the effects of inductive noise.

5.07 When 3-element tubes are used to combat inductive interference, station ringers should be connected as shown in Fig. 2.

5.08 For positive stations on lines experiencing inductive interference, induced noise voltages of 20 to 30 volts RMS may be sufficient to cause the control gap to conduct. This conduction ("flashover") will result in noise (sputtering) on the line during conversation.

5.09 For negative stations, the control gap is bridged across the line, and the main gap is connected between the line and ground in series with the ringing bridge (Fig. 2, negative stations). The main gap will normally withstand 70 to 80 volts RMS of induced noise before "flashover" (conduction) occurs.

5.10 For additional information on the 3-element tube, see Section 501-320-100.

4-ELEMENT TUBE (425-TYPE)

5.11 The 425-type 4-element tube may be required in cases where the induced voltage on the telephone line exceeds the values for satisfactory operation of the 3-element tube.

5.12 The control gap of the 4-element tube is bridged across the line (and the main gap connected between the line and ground) for both positive and negative stations (Fig. 3). The line is protected from induced noise by the high breakdown point of the main gap.

5.13 For additional information on the 4-element tube see Section 501-320-100.

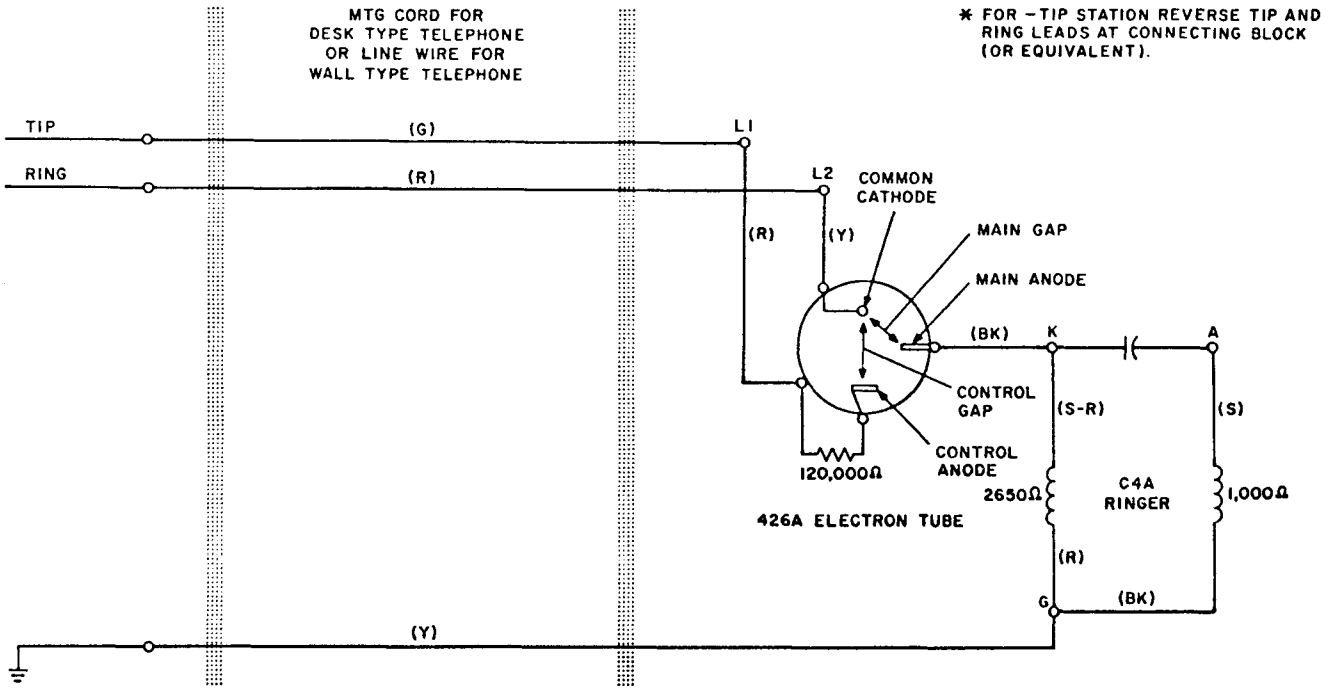
RINGER ISOLATOR (D-180036 KIT OF PARTS)

5.14 The P-90D011 ringer isolator (furnished with kit) may be used in those cases where the central office is not equipped to handle superimposed ringing (see 5.03).

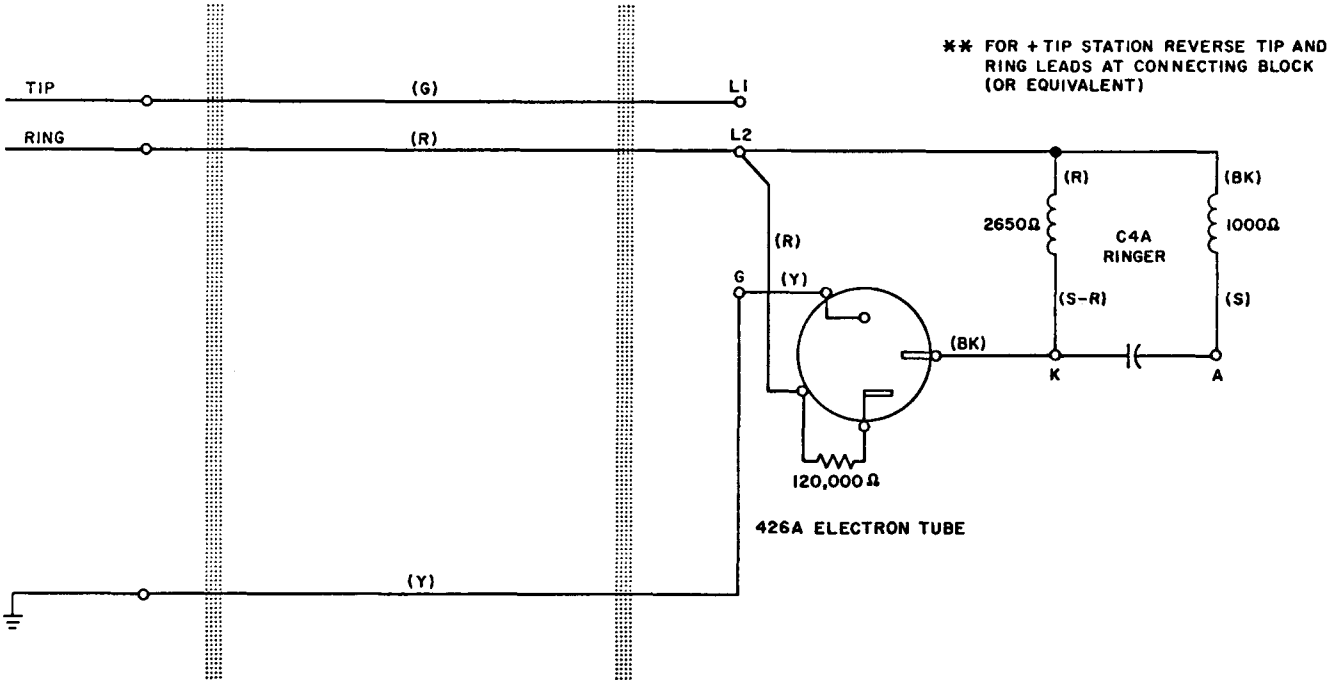
5.15 The ringer isolator is intended for use with all grounded ringers except those used in 4-party full selective and 8-party semiselective ringing service (Fig. 4). Thr ringer isolator may be used at subscriber stations requiring tip party identification. Identification connections are made in the normal manner, but only the 2650-ohm

TABLE A

DEVICE	2-PARTY	4-PARTY FULL SELECTIVE RINGING	4-PARTY SEMISELECTIVE RINGING	8-PARTY SEMISELECTIVE RINGING	2-PARTY WITH TIP PARTY IDENTIFICATION
3-Element Tube	•	•	•	•	
4-Element Tube	•	•	•	•	
Ringer Isolator	•		•		•

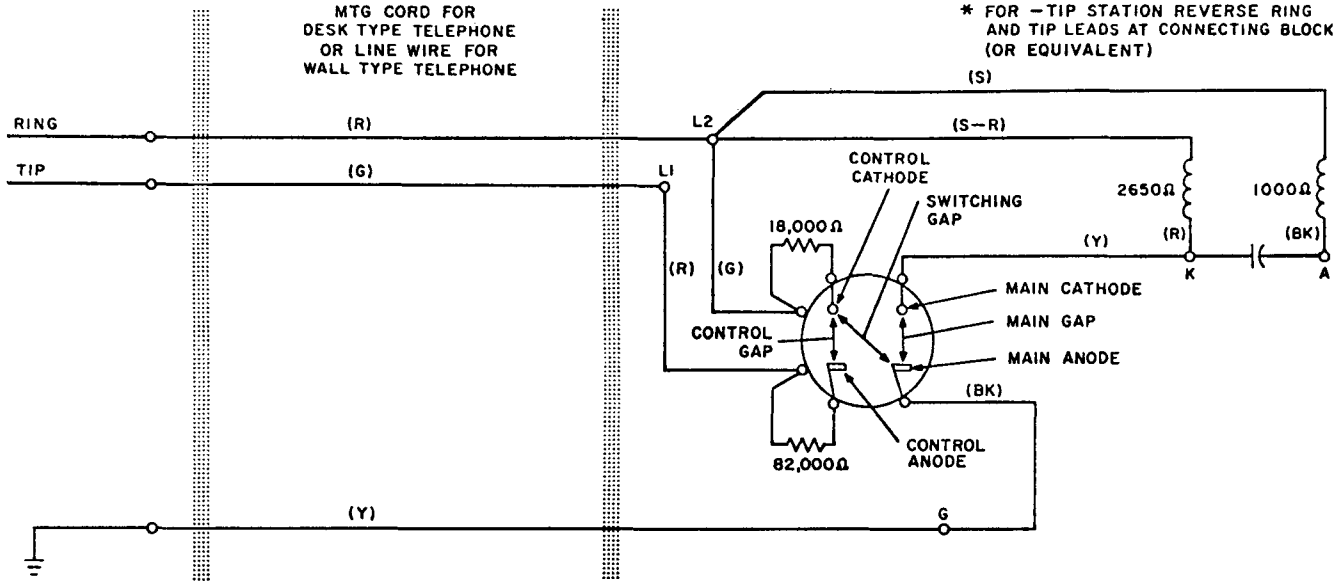


− RING STATION *

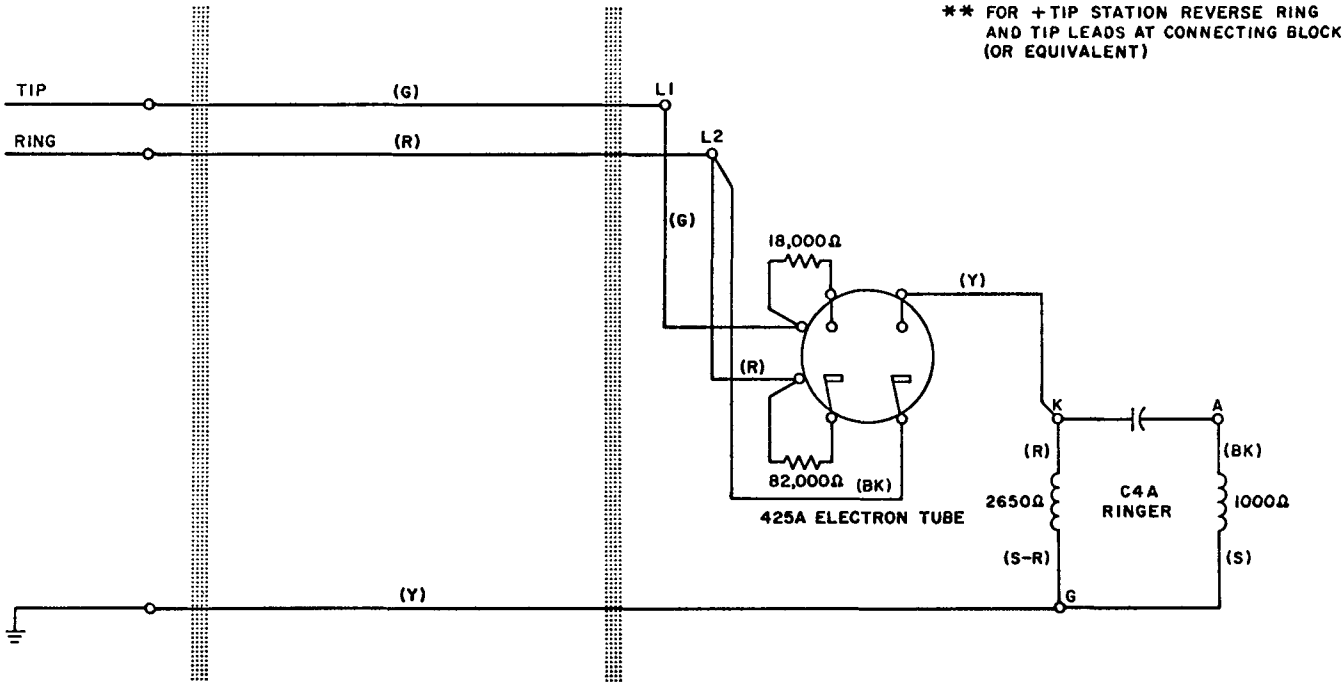


+ RING STATION **

Fig. 2—3-Element Tube, Typical Ringing Bridge Connections



− RING STATION *



+ RING STATION **

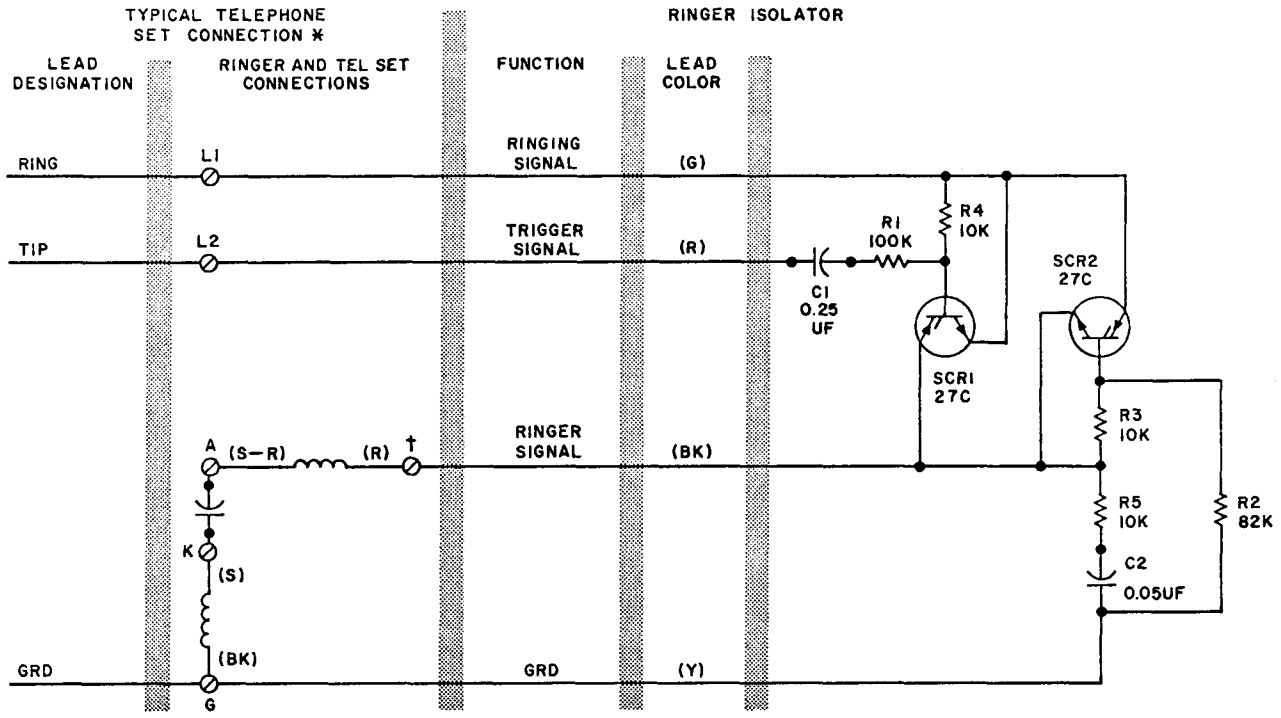
Fig. 3—4-Element Tube, Typical Ringing Bridge Connections

identification circuit should be used. One ringer isolator is required for each grounded ringer (Fig. 5).

Lines equipped with ringer isolators cannot be tested for continuity by conventional test desk procedures. This device should be installed in such a manner as not to interfere with electrical or mechanical operation of the telephone set.

5.16 For additional information on the D-180036 Kit of Parts (ringer isolator) see Section 501-375-100.

5.17 If situations are encountered where induced voltage exceeds the capabilities of the electron tubes and ringer isolator, the problem must be referred to the proper supervision for other corrective arrangements.



* RING STATION. FOR TIP STATION REVERSE TIP AND RING LEADS AT CONNECTING BLOCK (OR EQUIVALENT).

† USE SPARE TELEPHONE SET TERMINAL OR D-161488 CONNECTOR.

Fig. 4—Ringer Isolator, Typical Ringing Bridge Connections

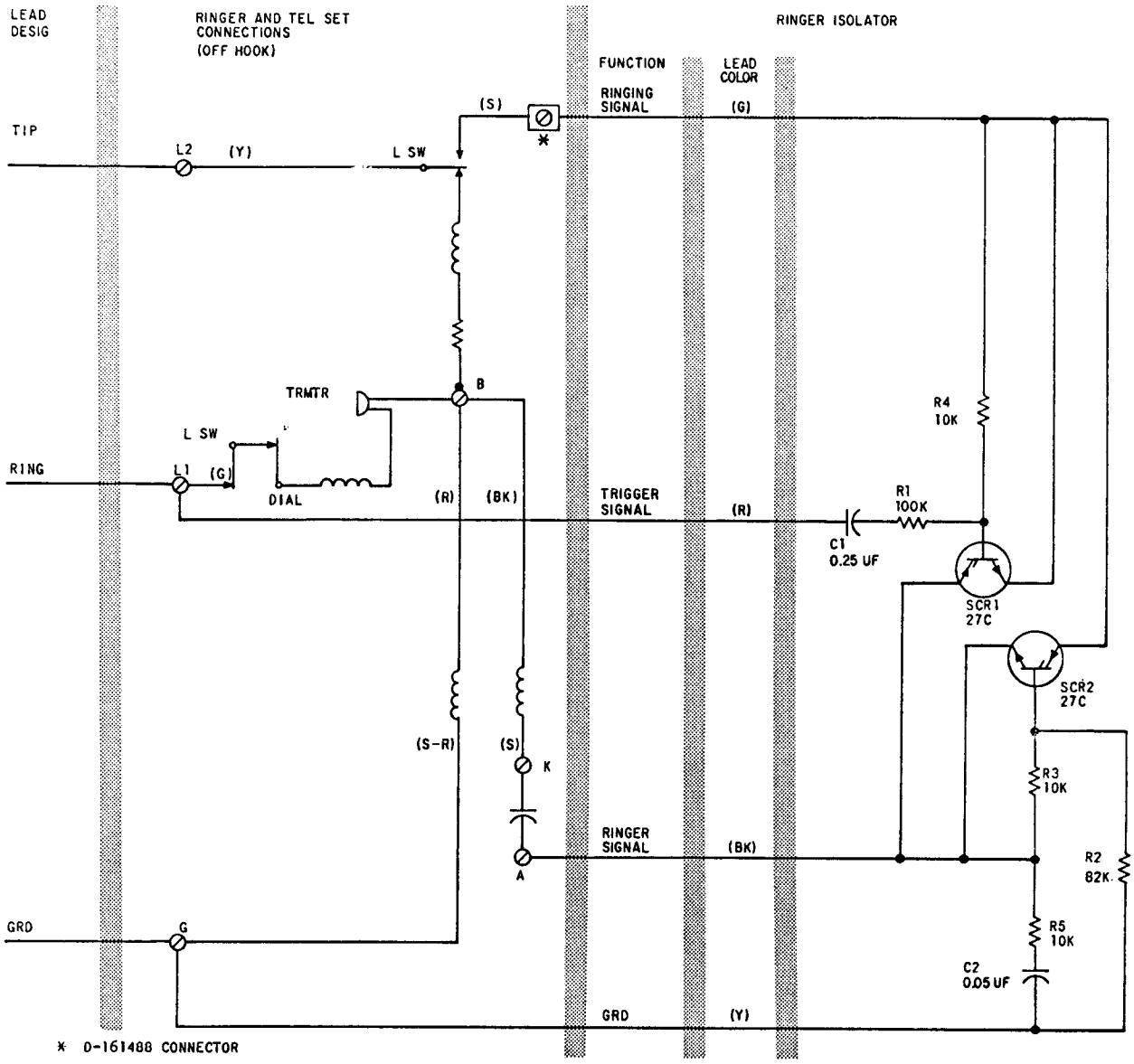


Fig. 5—Ringer Isolator Connections for Tip Porty Identification—2650 Ohms