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## **1.0 Intent**

The requirements given in this recommendation cover detailed testing procedure of communication lines.

## **2.0 Equipment**

Equipment required:

- Digital VOM
- Zener diode breakdown tester
- Gas surge suppresser breakdown tester
- Lineman's handset
- Terminal socket wrench (3/8" & 7/16" narrow wall sockets)
- Assorted screwdrivers, pliers

## **3.0 Internal Equipment Test**

### **3.1 Preparation**

- Remove Bell plug from receptacle in lower cabinet.
- Remove Zener diodes from across Bell blocks.
- Check Zener diodes with zener tester. Breakdown should be 6.7 volts +/-5%. Replace if otherwise.

### **3.2 DDAU Test**

- Ensure AC power is applied to DDAU via power switch in "ON" position. Correct if necessary.
- Measure and record 12 volt output from DDAU. Acceptable range is 11.75 to 12.75 volts. Replace DDAU if otherwise, then return to step 3.2.
- Measure and record 48 volt output from DDAU. Acceptable range is 48 volts to 56 volts. Replace DDAU if otherwise, then return to step 3.2.

## **4.0 External Equipment Check**

### **4.1 Telephone Line Test**

- With Bell lines still connected to Bell block, measure and record tip to ring resistance of each line pair. Resistance should not exceed 2.5 kilo-ohms, and the measurements should be within 590 ohms of each other. If not go to step 4.2.
- Remove Bell lines from block and check condition of lines. If wires are excessively worn or corroded, re-terminate the wires (ie. strip back and tin applicable wires), otherwise return Bell wires to their respective Bell blocks.
- Remove surge arrestors (carbons) from Bell block, and test individually with breakdown tester. Breakdown should be between 250 and 350 volts, and individual breakdown points of pairs of "carbons" should be within +/- 50 volts of each other. Re-install carbons into Bell block.

## **4.2 Insulate Node Site Equipment**

- Contact communications system operator and request that Bell lines for this intersection be shorted (tip shorted to ring on each pair). Measure (at the Bell block) and record tip to ring resistance for each pair again. Resistance should be approximately 50 ohms lower on each pair as compared to measurements made in step 4.1. Acceptable range is 45 to 55 ohms. If otherwise, convey information to the communications system operator.
- Using volt-ohmmeter, measure resistance, AC voltage and DC voltage between the following connections; tip-pair 1 to tip-pair 2, ring-pair 1 to ring-pair 2, tip-pair 1 to ring-pair 2, and ring-pair 1 to tip-pair 2. (Note pair one is considered to be located on the leftmost Bell block within the Bell compartment at the base of the TSC cabinet.) Each measurement should indicate resistance and all scales up to and including 20 megohms. If any voltage is measured above 0.5 volts, it should be reported to the communication system operator.
- Contact communication system operator and request that Bell lines for this intersection be opened (tip and ring disconnected completely from node site equipment). Measure and record tip to ring resistance for each pair again. Resistance should read infinite on all ranges up to and including 20 megohms. If otherwise, convey information to the communication system operator.
- Using a linesman's handset, listen to each pair. Check for and record (on paper) any noise (buzzing, hissing, crackling) found on the lines, and report observations to the communication system operator.
- Using volt-ohmmeter, measure resistance, AC voltage and DC voltage between the following connections: tip-pair 1 to tip-pair 2, ring-pair 1 to ring-pair 2, tip-pair 1 to ring-pair 2, and ring-pair 1 to tip-pair 2. Each measurement should indicate indefinite resistance on all scales up to and including 20 megohms. If any voltage is measured above 0.5 volts, it should be reported to the communication system operator.
- Using a linesman's handset, listen to each pair. Check for and record (on maintenance report) any noise (buzzing, hissing, crackling) found on the lines, and report observations to the communication system operator.

## **4.3 Node Site Equipment Check**

- Re-install zener diodes onto Bell block. Insert Bell plug into its receptacle in the lower traffic signal controller cabinet. Listen to pair two (right Bell block) with linesman's headset. A clear, audible solid tone should be present. If a frequency counter is available, measure frequency of tone. Acceptable range is 1790 to 1910 Hz. If beyond this range, replace DDAU, repeat section 2 of this test procedure, then section 5 onwards.

- If a warbling tone is heard, contact communication system operator, and request that the pairs for this traffic signal controller circuit be opened at the applicable node site, then return to previous step.
- If a solid tone cannot be found on pair 2 (rightmost Bell block), check pair one. If the solid tone is found here, exchange the pairs from the Bell plug to the Bell block, ie. move the pairs currently connecting the bell plug to lefthand Bell block over to the righthand Bell block and vice versa.
- Remove Bell plug from its receptacle in lower traffic signal controller cabinet. Contact communications system operator, and request that node equipment for this intersection is returned to normal mode. Listen to pair one with linesman's headset. A clear audible FSK "warble" should be heard. If it cannot be found, check pair two. If found on pair two, reverse Bell pairs feeding Bell blocks (ie. move Bell pair from lefthand Bell block to righthand Bell block and vice versa).

#### **4.4 Communication Testing**

- Insert Bell plug into its receptacle in the lower cabinet. Listen to each pair and verify that the DDAU and QFSK have synchronized i.e. no constant "beat" sound on either pair. If a "beat" is heard on either pair, check that Bell block connections are tight. If "beat" continues, convey information to the communication system operator.
- Assuming DDAU and QFSK have synchronized (no "beat" heard on either pair), contact communication system operator and request that the data channel be monitored at the operator's console. If operator finds data channel to be functional, request intersection be "picked-up" by communication system operator.

#### **4.5 Definitions of Bell Circuit Conditions (Node to PX)**

##### Open Circuit

Unreadable with digital meter on top scale when LINE SHORTED at the Node. Loop resistance Tip to Ring over 20 Mega $\Omega$ .

##### High Resistance

Readable with digital meter when LINES SHORTED at the Node. Loop resistance Tip to Ring more than 2.5 K $\Omega$  but under 20 Mega $\Omega$ , or one pair higher than the other pair by 50 $\Omega$  or more.

##### Short Circuit

Readable with digital meter on the 20K $\Omega$  scale when LINES OPEN at the Node. Loop resistance Tip to Ring any readable value.

### Pair Grounded

Readable with digital meter on the 20K $\Omega$  when LINES OFF THE BLOCK. Resistance either Tip to Ground or Ring to Ground under 20K $\Omega$ .

### Line Voltage

AC Voltage: Tip or Ground or Ring to Ground more than 1VAC. Tip to Ring more than 0.25VAC.

DC Voltage: Tip to Ground or Ring to Ground more than 4VDC. Tip to Ring more than 0VDC.

NOTE: Any voltage (below 4VDC) on lines should be equal on both pairs.

### Line Noise

Any noise on Bell lines other than the normal warble from the Node site with the lines normal or any noise value above 30 Dbrn with the use of a D/b meter ("C" Message) when LINE SHORTED OR OPEN at the Node.