Westinghouse I. L. 41-946.1

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE JZ-71 LINE COUPLING TUNERS

SINGLE-FREQUENCY PHASE-TO-GROUND

LINE COUPLING TUNERS

TYPE 71.1 - STYLE 1473985 - WITHOUT DRAIN COIL
TYPE 71.2 - STYLE 1473986 - WITH DRAIN COIL

DESCRIPTIVE RATING

FREQUENCY RANGE:	30 to 200 KC
INPUT IMPEDANCE:	50 to 70 OHMS
OUTPUT IMPEDANCE:	300 to 1000 OHMS
POWER RATING:	100 WATTS CARRIER - UNMODULATED
	25 WATTS CARRIER - 100% MODULATED

SUPERSEDES CF-1379B

EFFECTIVE DECEMBER 1961

TYPE JZ-71.1 AND JZ-71.2 LINE COUPLING TUNERS STYLE 1473985 AND 1473986

APPLICATION

These Line Coupling Tuners are designed for phase-to-ground coupling of a single carrier frequency from a coaxial cable through a coupling capacitor to a power line. The impedance matching transformer and line tuning coil, in conjuction with the coupling capacitor, provide a low loss circuit for coupling a carrier transmitter to the power line.

DESCRIPTION

Mechanical Description

The tuner is mounted in a cabinet suitable for outdoor mounting. Knockouts are provided on each side of the cabinet for the capacitor lead-in bushing and in the bottom of the cabinet for 1-1/2 conduit for the coaxial cable. The outline, mounting dimensions and the location of the knockouts are shown on drawing 50-B-7683.

All of the electrical components are mounted on a hinged panel which may open for making the coaxial calble and capacitor lead-in connections. The transformer taps, tuning coil taps, grounding switch and spark gap are accessible front of the panel.

Electrical Description

The electrical circuits are shown on drawing 50-C-8918, Schematic Diagram. The coaxial cable is connected through jack J-1 to the matching transformer, T-1. The high impedance tap of the transformer is connected through jack J-2 to the line tuning coil, L-1. An adjustable spark gap, SG-1, protects the equipment from excessive voltage surges. The knife switch, S-1, is provided for grounding the lead-in from the coupling capacitor while adjustments are being made.

The type JZ-71.2 Tuner, Style 1473986, has a drain coil, L-3, which provides a low impedance path to ground for power line frequency voltages and presents a high impedance to ground at carrier frequencies.

INSTALLATION

It is recommended that the Line Tuner be located as near the coupling capacitor as possible.

Remove the knockout from the side of the cabinet nearest the coupling capacitor for installation of the porcelain bushing for the capacitor lead-in.

CAUTION

Before making any connections to this equipment, turn off the power switch of the carrier transmitter and ground or open circuit the lead-in at the coupling capacitor.

Connect a good ground to the cabinet and to terminal #1 on the terminal board. Connect the coaxial cable to terminal #3. Run the lead-in cable from the coupling capacitor through the porcelain bushing and connect it to the terminal stud of the contact of switch S-1. Leave sufficient slack in this lead inside the cabinet so that the panel can be swung open. For the lead-in cable, use a good rubber covered cable of at least 7500 volts service grade, with a conductor equivalent to No. 14 gauge or larger. Run a copper bonding cable from the tuner cabinet to the ground frame of the coupling capacitor.

ADJUSTMENTS

CAUTION

When making any tap adjustments or changing any connections in this tuner, make certain that the grounding switch is closed. Do not depend on the drain coil for personal safety. Do not touch any terminal when the transmitter is on.

The first consideration in adjusting this tuner is to determine the operating frequency and the capacitance of the coupling capacitor. The value of inductance required for resonance can then be determined as follows:

Refer to curve No. 358437 for the L-C ratio at the carrier frequency. Divide the L-C ratio by the value in micro-microfarads of the coupling capacitor.

$$\frac{\text{L-C Ratio}}{\text{C in Unit}} = \text{MH inductance for resonance.}$$

Refer to curve No. 358433 for the tap number of the tuning coil, L-1, for this value of inductance.

The final tuning may require changing the tuning coil connection to a higher or lower tap than the tap determined above due to stray capacitance of the lead-in cable from the coupling capacitor to the tuner or to a slightly reactive power line.

The impedance of the different taps of the transformer T-1 are given in Table I.

Table I

Coaxial Tap	Tuner Tap	Line Impedance
3	4	100
2	4	139
3	5	193
2	5	268
3	6	372
2	6	517
3	7	720
2	7	1000

The average power line impedance is 500 to 600 ohms, and the usual coaxial cable impedance is 50 to 70 ohms. If the impedance of power line is known, connect the TUNER and COAX leads of the transformer to the corresponding taps. If the power line impedance is not know, connect the COAX lead to tap 2 and the TUNER lead to tap 6.

Open the link of jack J-2 and connect a thermocouple ammeter to the terminals.

Turn on the local transmitter and adjust the core of the tuning coil, L-1, for maximum current in jack J-2. If the current is increasing with the core all the way out, change the connection to the next higher or lower tap, respectively.

Adjust the transformer taps so that maximum current in jack J-2 is obtained. For each transformer tap change, recheck the adjustment of the tuning coil. If two transformer taps give the same reading of current, use the higher impedance connection.

A procedure for more exact impedance match i shown on drawing 50-C-8729, Line Coupling Tuner Adjustment. The dummy load resistors must be of sufficient wattage rating to dissipate the transmitter output. Use the transformer tap connections given in this instruction book.

A line tuner which is used to bypass a circuit breaker should be adjusted with the circuit breaker open. However, since this may be difficult to arrange, an alternate method is to disconnect the coupling capacitor from the line and connect its high potential side to ground through a resistor. If the impedance of the line with circuit breaker open is known, use a resistor of this value. If the line impedance is not known, use a 500 ohm resistor.

Adjust the spark gap, SG-1, to 0.015 inch spacing. Observe the gap while transmitting full carrier power. If the gap arcs over, increase the spacing until the arcing stops. The minimum spacing for the gap depends upon the carrier power, the capcitance of the coupling capacitor and the impedance of power line.

With some combinations of coupling capacitor values and the higher carrier frequencies, the tuning of the line tuning coil will be so broad that the exact adjustment for resonance is very difficult to determine by normal measurements. However, under these conditions, the frequency response curve for the coupling circuit will be so flat that an exact adjustment of the inductance of the line tuning coil is not necessary. For carrier frequencies above 150 kc and for coupling circuits with a Q of less than 2, adjust the inductance of the line tuning coil to the calculated value. Then adjust the ratio of the matching transformer T-1 so that the current in jack J-1 is approximately the same as the current measured when the coaxial cable is terminated in a 60 ohm resistor.

To determine whether or not the above adjusting procedure is applicable, calculate the Q of the coupling circuit as follows:

Calculate the reactance of the coupling capacitor at the operating frequency.

$$X_C = \frac{1}{2\pi FC}$$

Determine the approximate power line impedance.

For a single trapped line use a value of 500 ohms.
For lines which are not trapped, divide 500 ohms by the number of lines leaving the bus.

Divide the reactance of the capacitor by the impedance of the line to determine the Q of the circuit.

$$Q = X_C/R$$

(Since this calculation is only an approximation the possible reactance of the power line is neglected.)

Example:)

Coupling Capacitor = .00275 μF
Operating Frequency = 165 kc
Single Trapped Line = (use 500 ohms)

$$X_C = \frac{1}{2\pi FC} = 350 \text{ ohms}$$

$$Q = 350/500 = 0.7$$

For this installation, calculate the inductance required to resonate the coupling capacitor.

$$L = \frac{X_L}{2\pi F} = 0.34 \text{ mh.}$$

Refer to Curve 358433.

For 0.34 mh use tap 78, with core at center of travel. Short unused turns.

NOTE:

The instructions on curve 358433 state that the unused taps are to be shorted when a tap lower than 100 is used and also when the frequency is above 150 kc.

This procedure will leave a gap in the inductance range between tap 100 with the unused turns shorted. Continuous inductance adjustment can be obtained by using tap 113 with the unused turns shorted as the next lower inductance tap below tap 100 with the unused turns not shorted.

MAINTENANCE

Routine Checks and Records

This line tuner requires very little maintenance. It should be inspected occasionally to see if there has been excessive burning of the spark gap. If the discs show signs of

burning, rotate the discs to a new position and readjust the gap. Usually a semi-annual or yearly inspection is sufficient.

A permanent record should be kept of the tap settings and the position of the tuning coil core so that they can be restored to the correct positions in case of unauthorized changes.

Ordering Replacement Parts

Replacement parts for this Line Tuner may be ordered through the nearest Westinghouse District Office.

When ordering, include:

1. The following data from the nameplate of the Line Tuner: (a) the type number, (b) the style number, and (c) the serial number.

2. The (a) electrical parts list symbol, (b) the function, (c) the description, and (d) the manufacturer's designation.

ELECTRICAL PARTS LIST

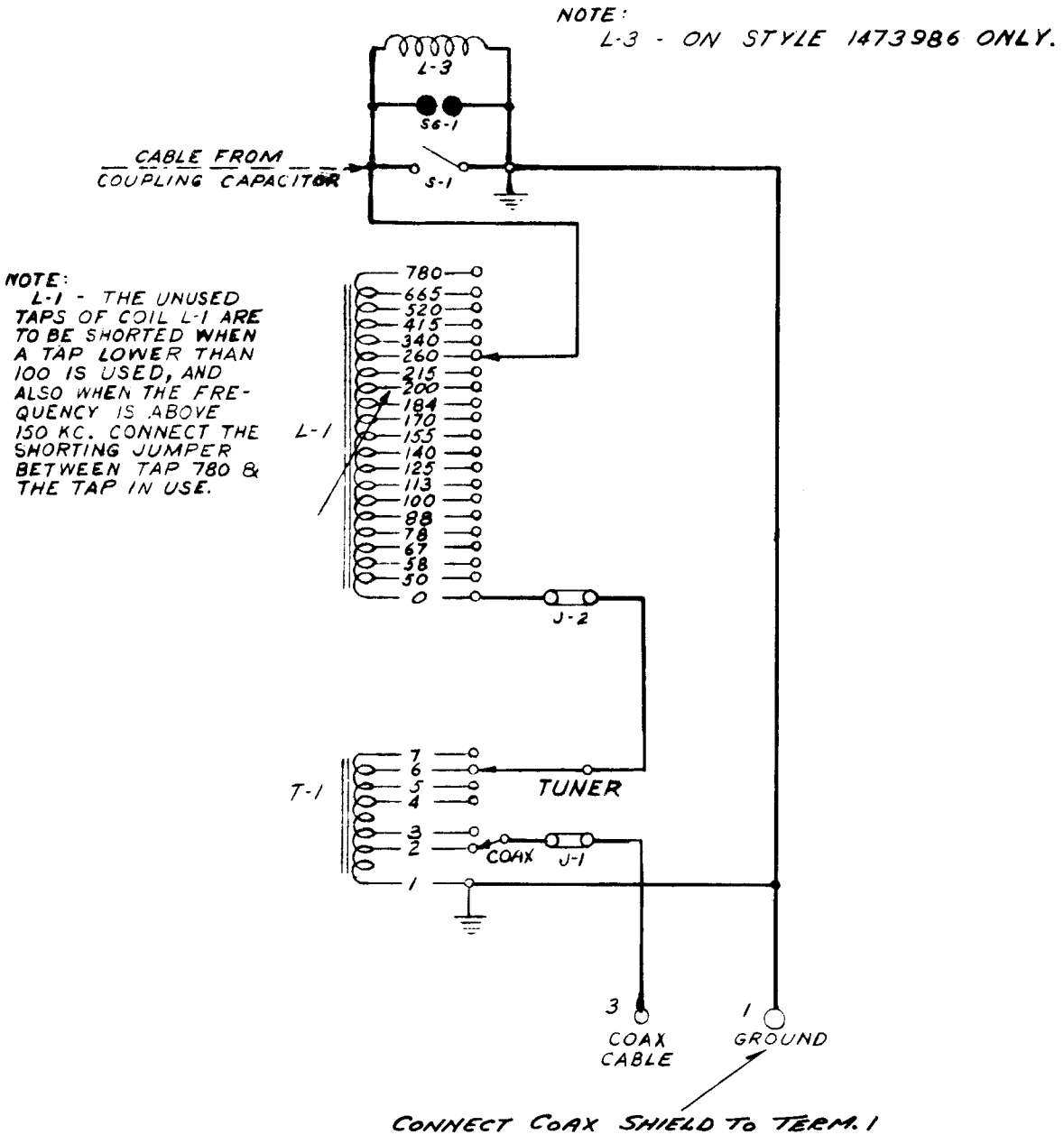
Circuit Symbol	Function	Description	Mfr. Code	Manufacturer's Designation
		SUB-ASSEMBLIES		
L-1	Line Tuning Coil	Line Tuning Coil Assembly	1	S# 1474218
T-1	Autotransformer	Autotransformer Assembly	1	S# 1474010
	Protector Unit	Protector Unit Assembly	1	S# 1474014
		COMPONENTS		
J-1	Jack--Coax Metering	Binding Post Type 2-Binding Posts 1-Shorting Link	 1 1	 S# 1474453 S# 1474455
J-2	Jack--Line Metering	Same as J-1		
L-1	Line Tuning Coil	Order Sub-Assembly		
*L-3	Drain Coil	0.25 henry	1	S# 1473966
S-1	Switch-Grounding	30 Amp., 250 V.	1	S# 554207
SG-1	Spark Gap	Disc Type	1	2-50-D-5679 It.1
T-1	Autotransformer	Order Sub-Assembly		

*Used on Type JZ-71.2 (S# 1473986) only.

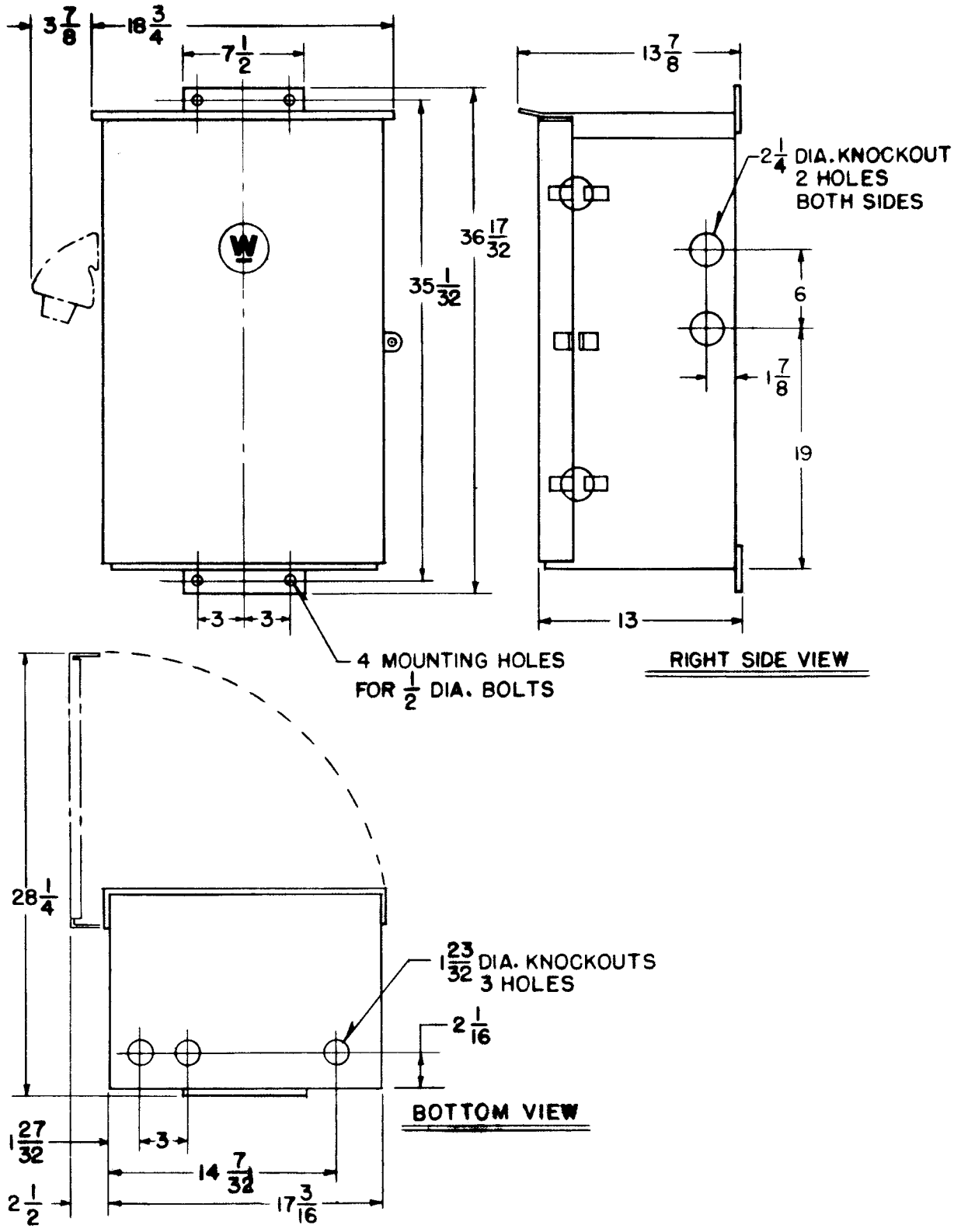
MANUFACTURER

1. Westinghouse Electric Corporation

LINE COUPLING TUNER
STYLE 1473985 & STYLE 1473986

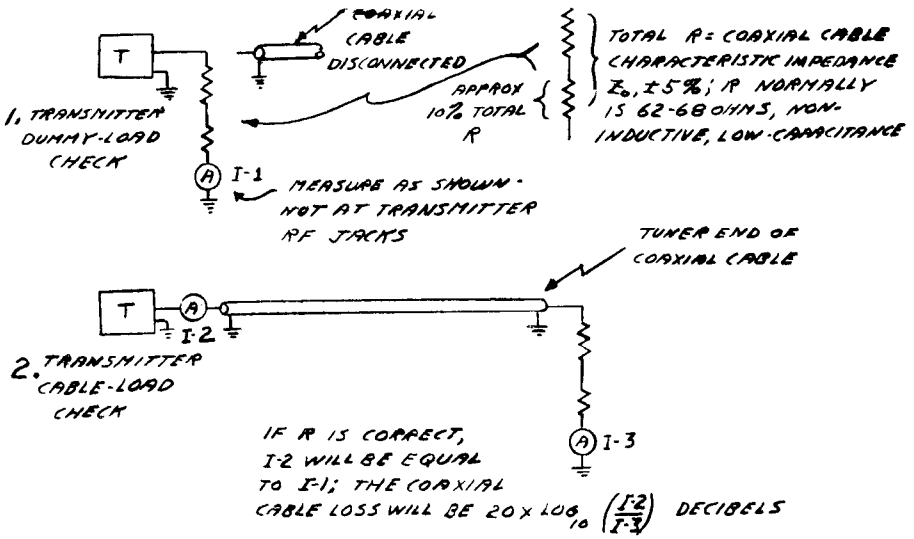


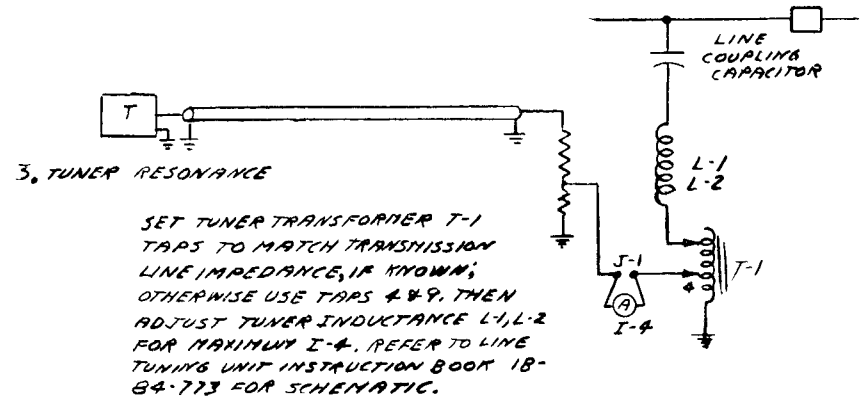
Type JZ Line Coupling Tuners, Schematic Diagram
(Dwg. 50-C-8918)

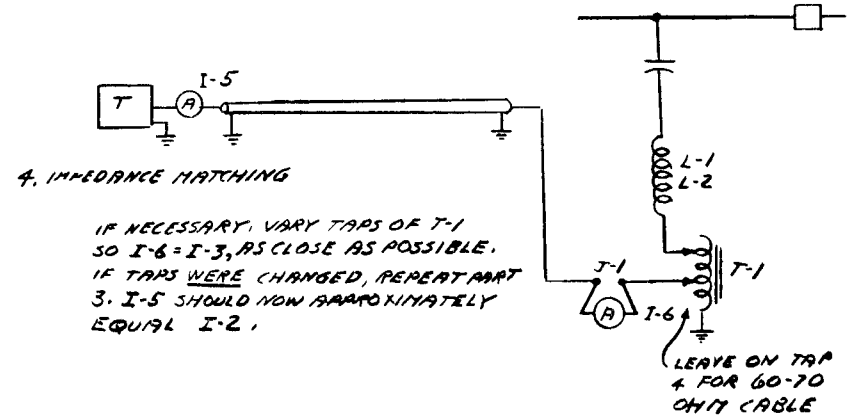


Type JZ Line Coupling Tuners, Outline Drawing
(Dwg. 50-B-7693)

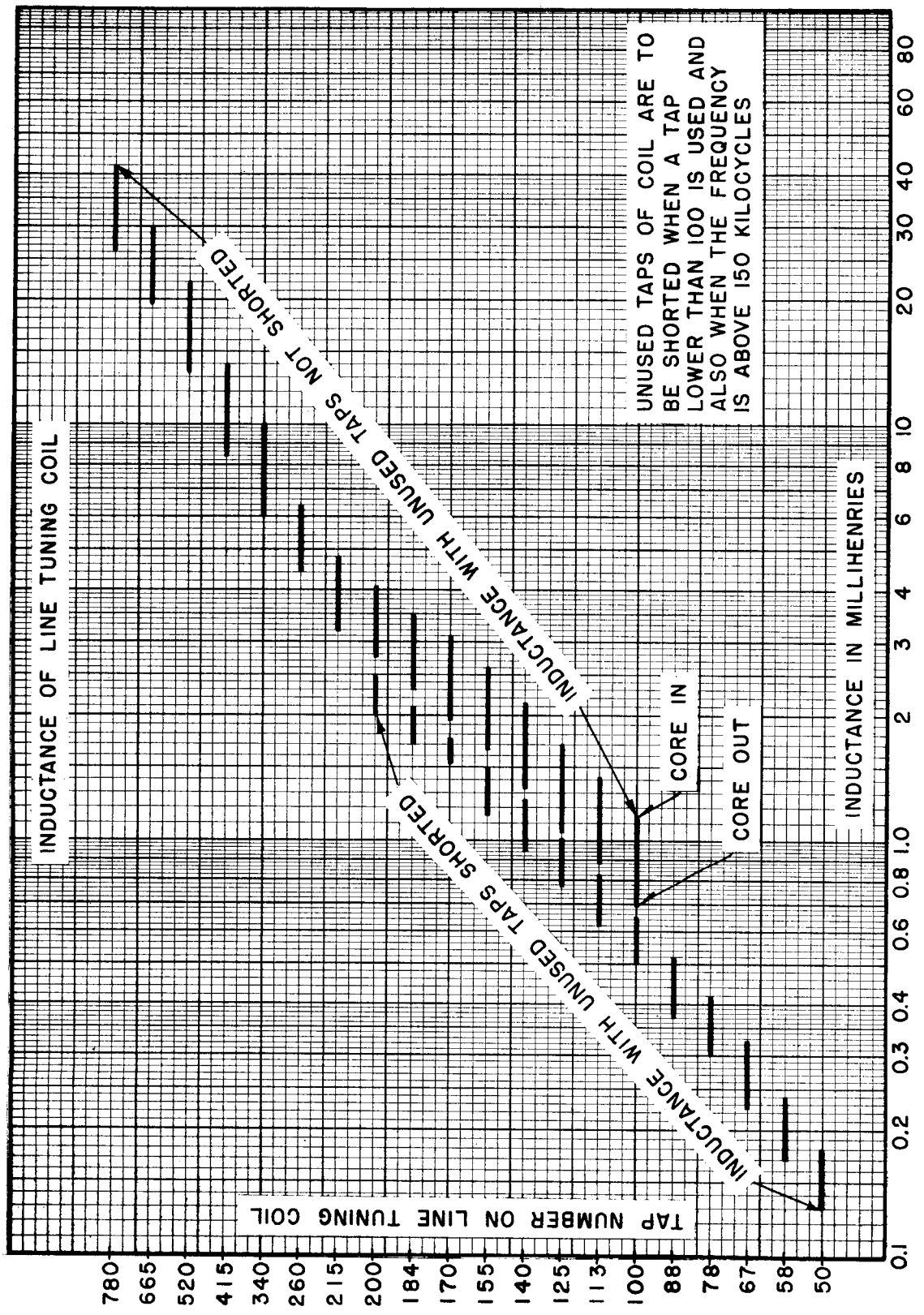
SINGLE FREQUENCY - PHASE TO GROUND



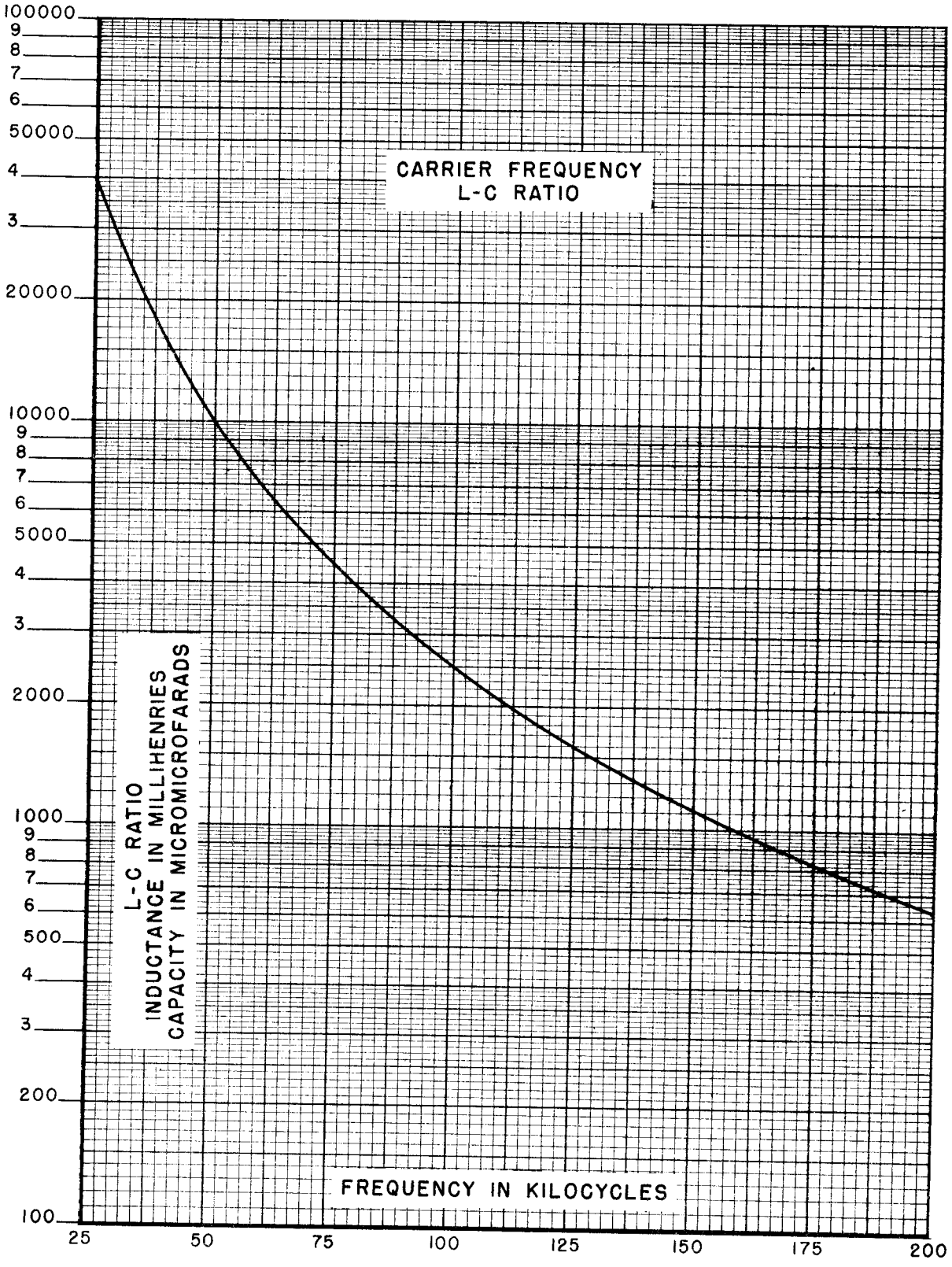




Line Coupling Tuner Adjustment (Dwg. 50-C-8729)



Inductance of Line Tuning Coil (Curve 358433)



Carrier Frequency L-C Ratio (Curve 358437)

WESTINGHOUSE ELECTRIC CORPORATION

RELAY DEPARTMENT

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