INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

R-F HYBRIDS
TYPE H1R, H2R, H3X

APPLICATION

The type H1R, H2R, and H3X r-f hybrids are used to provide isolation between two or more closely-spaced carrier transmitters operating effectively in parallel into a common coaxial cable. They are also used between transmitters and receivers to prevent the local transmitter from overloading the receiver input circuit. Hybrids present high signal losses from one input to the other input (return loss), but low losses from input to output or output to either input (insertion loss). The use of these hybrids will thus allow closer frequency spacing than normal when paralleling equipment directly.

The H1R and H2R hybrids have a resistive balance impedance. These are single unit and double unit hybrids, respectively. The resistive-type hybrids are used when applying several hybrids in cascade and the correct output terminating impedance of 60 ohms is provided by the input of the next hybrid in series. However, the last hybrid in the series (with output to coaxial cable and line tuner) must be the H3X unit which has a reactive balance network (R, L, and C). This enables the hybrid to be tuned to match the combined impedance characteristic of the line tuner, coupling capacitor, and power line. If only a single hybrid is required, it must be the reactive type H3X unit.

CONSTRUCTION

The type H1R (fig. 1) is the resistive type hybrid, which consists of a wide-band matching transformer and a 30-ohm non-inductive balance resistor. The primary winding of the transformer consists of two identical sections to provide an accurate mid-tap. The secondary of the transformer has no taps. A 0.0015-mfd. capacitor is connected across the secondary to compensate for leakage inductance of the transformer over the entire frequency band.

The type H2R consists of two units of H1R with the same type of construction as described above.

The type H3X (fig. 2) is a reactance type hybrid and has provision for tuning and impedance matching. This hybrid consists of a matching transformer and a balance network containing resistance, inductance, and capacitance. The primary winding of the H3X transformer is similar to the winding of H1R transformer, but the secondary has 10 taps to provide an impedance range of 44-75 ohms.

The tuning network consists of several capacitors which can be connected in parallel for any combination, (see Table I for values and connection) and a tuning coil which has five taps and an adjustable core to provide the inductance range of 20 to 1000 microhenries. The combination of the capacitors and the inductor taps provide tuning over the frequency range of 30 to 300kHz., as shown in Table II.

TABLE I

CAPACITANCE VALUES – H3X HYBRID

Capacitance in Mfd.	Connect Terminals From/To
.0068	1 to 2
.0100	2 to 3
.0150	4 to 5
.0168	1 to 2 and 2 to 3
.0200	5 to 6
.0218	1 to 2 and 4 to 5
.0250	2 to 3 and 4 to 5
.0268	1 to 2 and 5 to 6
.0300	2 to 3 and 5 to 6
.0318	1 to 2, 2 to 3, 4 to 5
.0350	4 to 5, 5 to 6
.0368	1 to 2, 2 to 3, 5 to 6
.0418	1 to 2, 4 to 5, 5 to 6
.0450	2 to 3, 4 to 5, 5 to 6
.0518	1 to 2, 2 to 3, 4 to 5, 5 to 6

All possible contingencies which may arise during installation, operation, or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.

SUPERSEDES I.L. 41-948.5, dated July 1972 EFFECTIVE NOVEMBER 1975
* Denotes change from previous issue.

TABLE II
TUNING RANGES OF H3X HYBRID

Frequency Range-kHz	L Tap	C Taps	Mfd.
30 - 40	1.0	1-2-3, 4-5-6	.0518
40.1 - 55	.4	1-2-3, 4-5-6	.0518
55.1 - 85	.25	1-2-3, 4-5-6	.0518
85.1 - 120	.1	1-2-3, 4-5-6	.0518
120.1 - 150	.1	1-2, 4-5-6	.0418
150.1 - 200	.035	1-2, 4-5-6	.0418
200.1 - 300	.035	1-2-3, 5-6	.0368

The balance resistor has three taps (A, B, C) to provide a fine adjustment for the best balance condition (return loss) at the hybrid input at its tuned frequency.

Outline dimensions for the hybrids are shown in Figure 3. A 19-inch mounting panel 2 rack units high (nominally 3½ inches) is available which will accomodate a total of three hybrid units (for example, 2-H2R and 1-H3X units). This is adequate for most applications.

OPERATION

Hybrids provide a means of coupling two or more carrier transmitters or transmitters and receivers to a common coaxial cable output circuit with negligible interaction between the units. With reference to Figure 1, if a 60-ohm load is connected to the output (at P1), a reflected load of 30 ohms will appear across each half of the mid-tapped winding. Thus a carrier transmitter connected to Input 1 will see a load impedance of 60 ohms: 30 ohms reflected impedance across the upper half of the transformer T1 mid-tapped winding plus the 30 ohms of R1 balance resistor. The full transmitter output voltage (to ground) will be present at J3, with one-half of this voltage appearing at the mid-tap of transformer T1. Because of the auto-transformer action of T1 primary winding, the voltage appearing at J4 (the opposite input) will be essentially zero (down 30-db minimum from the transmitter output level). With a resistive load, this balance will exist over the entire carrier band of 30 to 300kHz.

For the hybrid which connects to the coaxial cable, line tuner, and coupling capacitor, a simple balance resistor is inadequate to provide a satisfactory return loss over a reasonable band of frequencies. For this unit, the balance network includes resistance, inductance, and capacitance in order to get a good balance over a band of frequencies.

Characteristics	H1R, H2R	H3X
Frequency Range	30-300kHz.	30-300kHz.
Max. Power, each input	15 watts	15 watts
Output Impedance	60 ohms	44-75 ohms
Range-Taps	None	3-4 ohm intervals
Insertion Loss- with exact impedance matching:		
Input to Output	3.5 db, max.	3.5 db, max.
Output to Input	3.5 db, max.	3.5 db, max.
Return Loss-each input to other input with exact impedance matching:		
For all frequencies	30 db, min.	–
For any one frequency	30 db, min.	40 db, min.
Bandwidth for 30-db return loss *		
30-50kHz.	–	4%
50.1-300kHz.	–	6%

*Receivers are not subject to these limitations.

ADJUSTMENTS

R-type: There are no adjustments on this type of hybrid.

X-type: Before this hybrid can be adjusted, it is necessary that all other related components of the carrier installation be adjusted first in accordance with their respective instructions.

These include the following:

a) Line traps on the carrier channel where the hybrids are used.

b) Carrier transmitters. These should each be separately adjusted for rated output into a 60-ohm non-inductive load resistor, being sure that any output filter or associated series L/C unit is tuned to resonance.

c) Line-tuning equipment. Since an associated transmitter is generally used as the signal source for adjusting a line tuner, the r-f hybrid or hybrids should be by-passed for this step. This can be done by disconnecting the transmitter output from its associated hybrid and connecting it directly to the coaxial cable to the line tuner.

NOTE: If only one transmitter is involved with the hybrid, it may be used to adjust the line tuner and the hybrid. For two closely spaced transmitter, use either one. If three or more transmitters are involved, use the one whose frequency is nearest the center of the group of transmitter frequencies.

After the foregoing adjustments have been completed, the transmitter output connections can be returned to normal. The H3X hybrid can now be adjusted, using the same transmitter that was used for adjusting the line tuner, as follows:

1. Connect an electronic a-c voltmeter across the other input of the H3X hybrid to which the selected transmitter (per foregoing Note) is connected. This connection can be made from the small red pin jack to ground. In order to reject noise and other carrier signals which may be present, it is preferable to use a frequency selective voltmeter for this purpose. Tune it to the frequency of the associated carrier transmitter.
2. Set the H3X hybrid taps as follows:
   a) Set the ohms tap to 60 unless the input impedance of the coaxial cable is known to be some other value. In that case, set it to the known value.
   b) Set the balance tap (Bal.) to tap B.
   c) Initially set the capacitor links and the inductance tap (IND. MH.) in accordance with Table II for the frequency of the transmitter being used. Take care that the spade connectors on the tap leads do not touch the capacitor links.
   d) Turn out (c.c.w.) the threaded shaft of the tuning core until about one-half inch of the threaded portion is visible.
3. Turn on the carrier transmitter and note the reading of the voltmeter. If a frequency selective voltmeter is used, tune it for maximum reading.
4. Now turn out the threaded shaft of the Tuning core until a minimum value is obtained on the voltmeter connected to the second hybrid input. If the output load is resistive, a definite minimum will be obtained within the range of the tuning inductance. If the voltmeter reading is only slowly decreasing and no minimum is reached at the extreme position of the core screw, use the next lower capacitance value as listed in Table I. Conversely, if the voltmeter reading increases as the core screw is turned out, use the next higher value of capacitance.
5. After the best possible balance is obtained in Sec. 4, check other impedance taps above and below 60 ohms to see if a still lower voltmeter reading can be obtained (better return loss). If a different tap is selected, readjust the tuning core for minimum voltage.
6. Change the balance taps (A-B-C) and leave it on the tap giving the lowest voltmeter reading.
7. As a last step, readjust the tuning core to be sure it is set for minimum voltmeter reading. Lock the core screw in this position using the knurled locking ring.
8. By this time, the matching and tuning has been accomplished and the voltmeter reading should be about 40 db less than the transmitter voltage (at the other input jack). However, if the voltage reading is higher than expected value, repeat steps 4, 5, 6, and 7 for a minimum voltage. The actual value will depend on how closely the hybrid terminating impedance matches the Z tap in use, and whether the voltmeter is of the frequency-selective type. Also, the reading may be 5-6 db higher with the high-impedance load of a TCF receiver.
9. In some cases, the voltmeter reading will not decrease to the desired value by readjusting the hybrid taps. This situation may indicate that the line tuning equipment is not adjusted properly for that specified frequency, and therefore a slight readjustment of the inductance

of the line tuning equipment should bring the voltage reading to the minimum desired value.

10. After completing the adjustment of the H3X hybrid, turn on all the transmitters and note the signal level that each produces at the opposite input of the H3X hybrid. (This will require a tuned voltmeter set for a narrow bandwidth.) This procedure will show that the complete system is operating properly.

MAINTENANCE

The r-f hybrids require very little maintenance. At annual inspection intervals, any accumulated dust should be removed.

A permanent record should be kept of the tap settings so that they can be restored to the correct positions in case of inadvertent changes.

Renewal Parts:

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data, and the part's style number.

* The style numbers of the complete r-f hybrids are as follows:

Type Unit	Style Number
H1R	6266D72G01
H2R	6266D72G03
H3X	6266D71G01

ELECTRICAL PARTS LIST

Circuit Symbol	Style Number	Description
H1R & H2R HYBRIDS		
R1	880A353H02	30 Ohms, 25W non-inductive, ±1%
C1	762A680H05	.0015 mfd, ±10% 2 KV
T1 Transformer	204C175G01	Matching transformer
H3X HYBRID		
R1	880A353H01	28 ohms, 25-watt non-inductive, ±1%
R2, R3	848A645H15	1 ohm, 1W, ±5%
R4	877A136H02	70 ohms, 5W, ±5%
C1	187A705H40	6800 MMF, 1200 V
C2, C4, C5	187A705H38	10,000 MMF, 1200 V
C3	187A705H39	15,000 MMF, 1200 V
Coil Assy.	204C171G01	20-1000 Microhenries
T1-Transformer	204C175G02	Matching transformer with ten taps on secondary

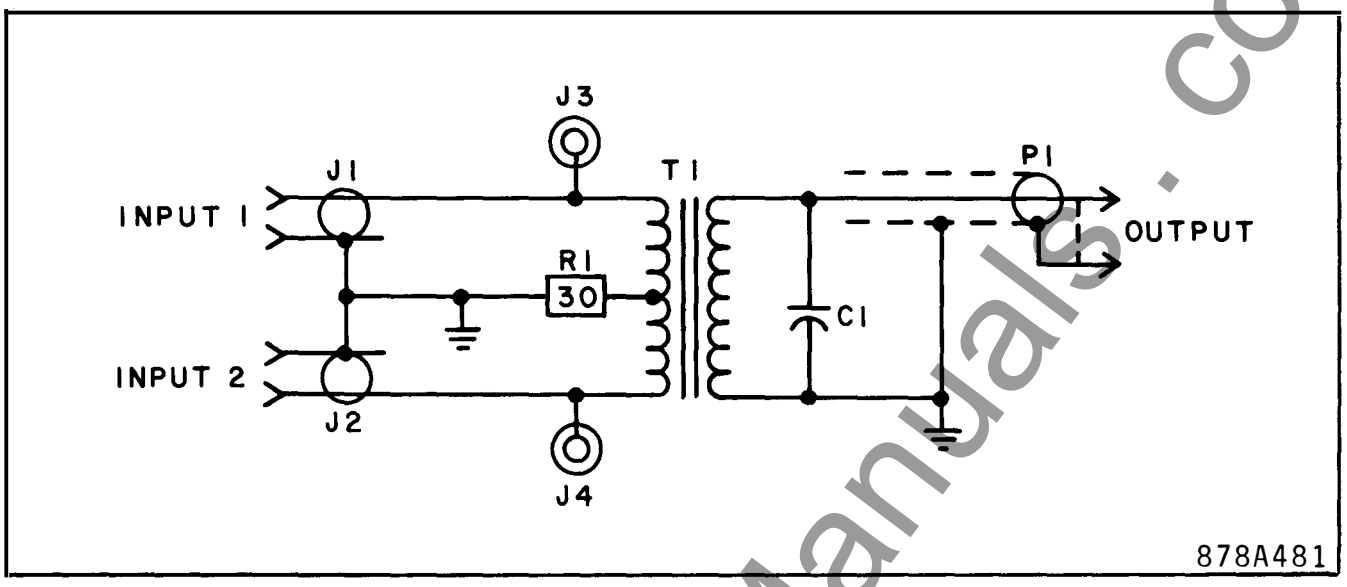

Fig. 1. Type H1R and H2R R-F Hybrids Internal Schematic.

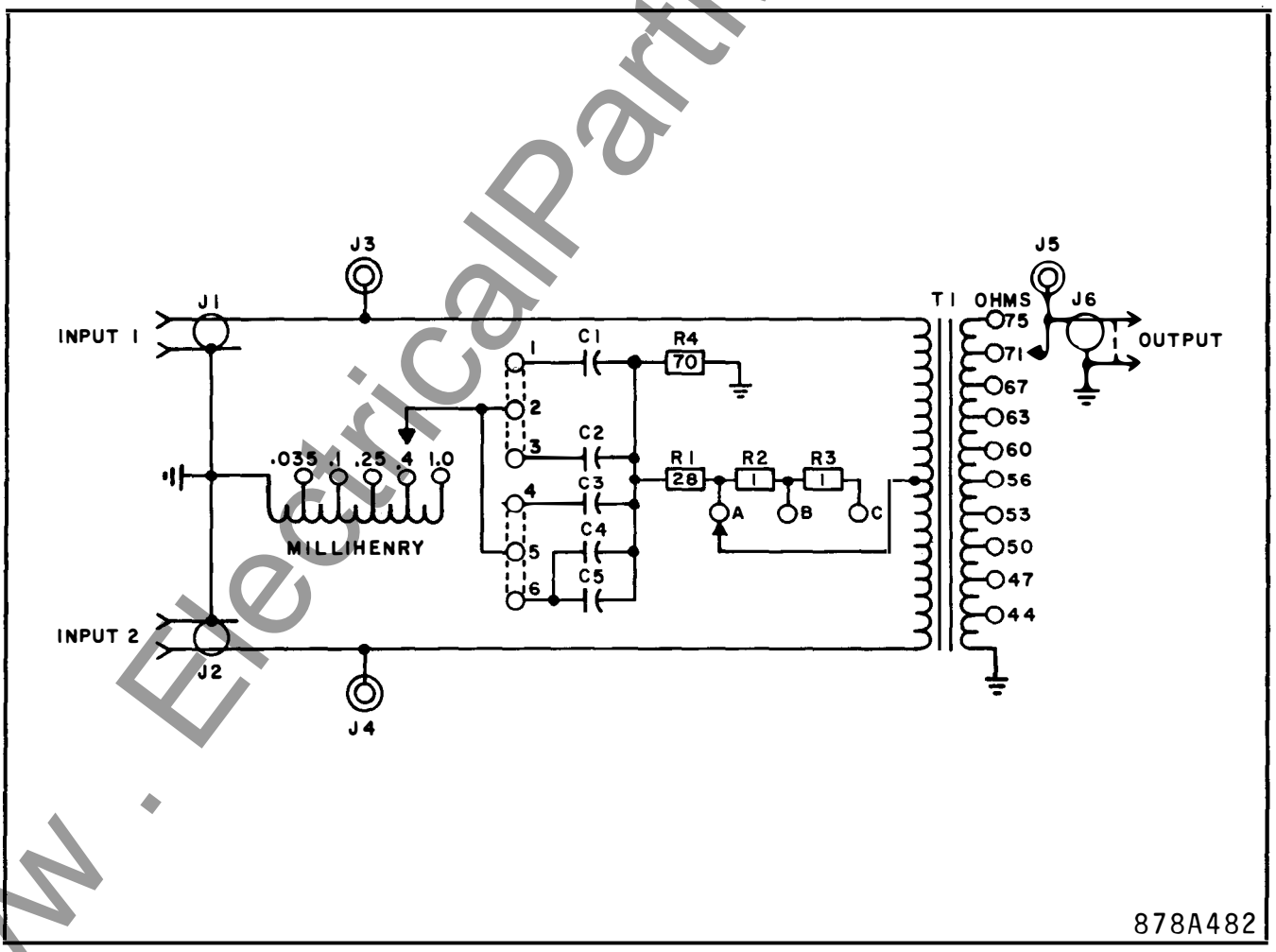

Fig. 2. Type H3X R-F Hybrids Internal Schematic.

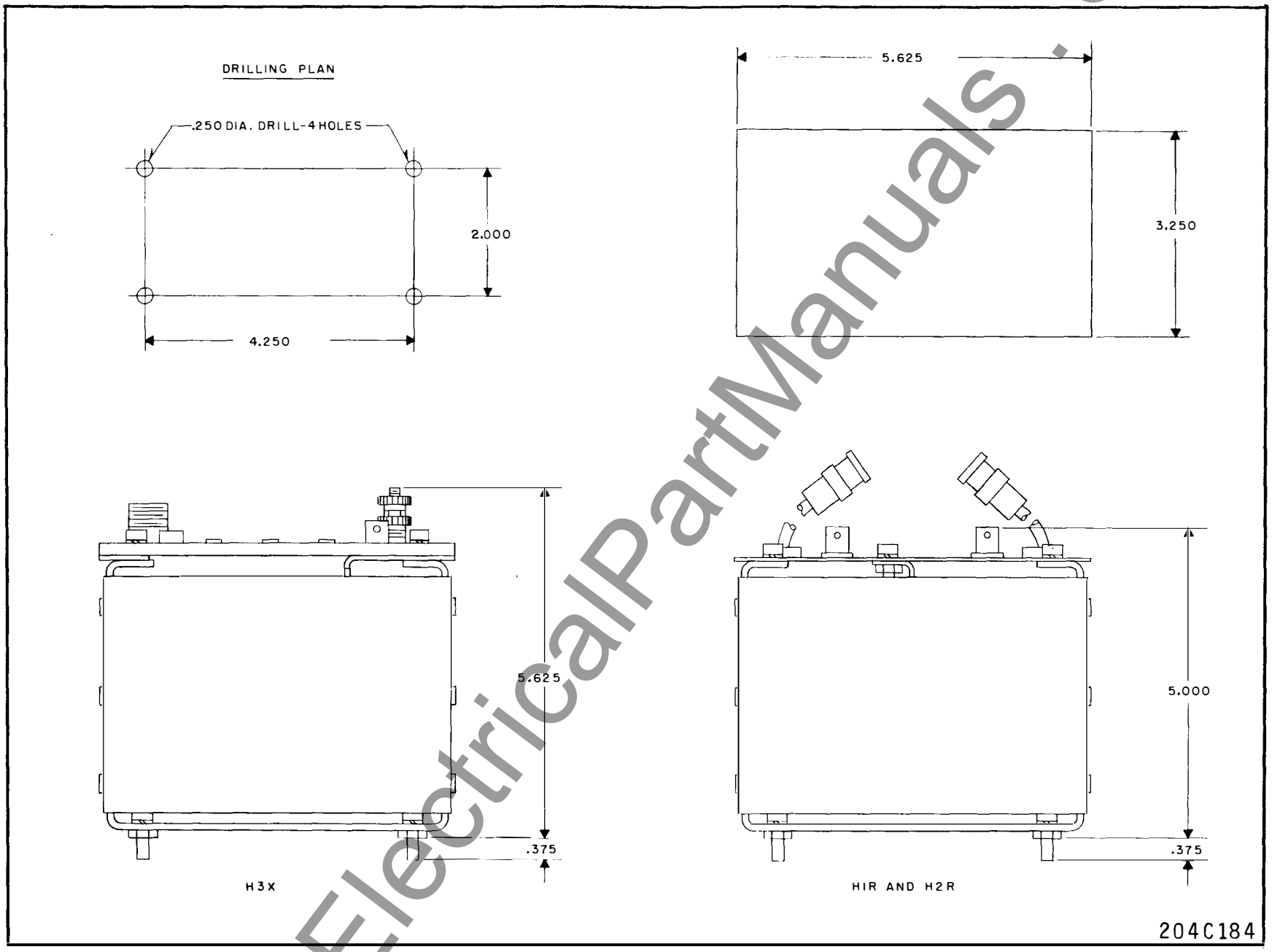

Fig. 3. Outline Drawing

WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **CORAL SPRINGS, FL.**

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INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

HI-COUPLER
AND
JZ 83. WIDE-BAND LINE TUNERS

TYPE	STYLE	SCHEME	DESCRIPTION
HI-COUPLER	148A432G04	629A850	40 to 300 kHz-2 Winding Matching Transformer
JZ 83.6	542D023G01	293B268	—
JZ 83.6D	542D023G02	293B268	—
JZ 83.63	544D677G01	293B268	—
JZ 83.63H	4825D66G01	670B638	115V Heater and Duplex Outlet
JZ 83.63H	5491D67G01	715B364	115V Heater and Disconnect Switch
JZ 83.63H	5491D67G02	715B364	230V Heater and Disconnect Switch
JZ 83.63DH	4825D66G02	670B638	115V Heater and Duplex Outlet
JZ 83.63DH	6695D18G01	774B935	230V Heater
JZ 83.63DH	4825D66G03	774B925	115V Heater and Wiring to Contactor Cabinet and Duplex Outlet
JZ 83.63DH	6695D18G02	774B935	230V Heater, Tropicalized

Nomenclature for JZ 83. Series:

.6 is the 15"x19"x9" Outdoor Cabinet
.63 is the 18"x36"x13" Outdoor Cabinet
D means Drain Coil Included
H means Heater Included

All possible contingencies which may arise during installation, operation, or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.

SUPERSEDES IL 41-948.11D, dated February 1974
Also supersedes L-Specs 385774, 779659, 779802, 836018, 836742, 836743
Complete Revision

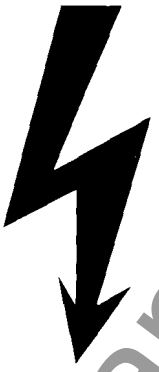
EFFECTIVE JUNE 1977

CAUTION

FOR YOUR SAFETY

DO NOT ATTEMPT TO HANDLE, INSTALL, USE OR SERVICE THIS PRODUCT BEFORE READING INSTRUCTION BOOK

To Do So Will Lead to Bodily Injury or Property Damage or Both



SAFETY WARNING

Protect your life while making adjustments! Before handling any part of the electrical circuits:

1. Be sure the grounding switches in this assembly are in the "grounded" or closed position.
2. Be sure that all power switches in this assembly are turned "off".
3. Follow the instructions in the caution warnings.

Protect the equipment against damage by not applying power until thoroughly familiar with the adjustments described in this book.

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ILLUSTRATIONS

Drawings **References**

APPLICATION

The Hi-Coupler is a wide-band tuner designed for use with a coupling capacitor to couple one or more carrier frequencies to a power line.

HI-COUPLER DESCRIPTION

MECHANICAL

The Hi-Coupler is contained in a small aluminum housing which mounts on the hinged panel in the base of the Westinghouse Coupling Capacitors or JZ83 tuner cabinets. The transformer link, inductor link, the link connectors for the capacitors, the spark gap and the voltage jacks are mounted on the front panel of the Hi-Coupler. The connections for the coupling capacitor, coaxial cable and ground are on the rear of the unit. The outline of the Hi-Coupler is shown on Fig. 3.

ELECTRICAL

The electrical circuits of this unit are shown on Fig. 1. The coaxial cable from the power-line carrier equipment is connected to transformer T-1 primary. A link connector selects impedance ratios to match a 60-ohm coaxial cable to line impedances of 60 to 1500 ohms. The inductor L-1 with one or more of capacitors C-1, C-2 or C-3 and the coupling capacitor form a single-section high-pass filter of the constant-K type. The Hi-Coupler is designed to operate with coupling capacitors of .002 mfd. to .015 mfd. Combinations of capacitors C-1, C-2 and C-3 give a capacitance value close enough to the value of any of the coupling capacitors. The inductor is variable in 10 steps from 0.4 mh to 8.0 mh. This range provides the required adjustment for the coupling capacitor value, line impedance, and lowest operating frequency. The inductor consists of three sections.

Pin jacks are provided for measuring the voltage on the coaxial cable and the voltage across the inductor.

CHARACTERISTICS

Power Rating:	100 watts continuous.
Frequency Range:	40 to 300 kHz with coupling capacitors of .002 to .015 mfd.
Transmission Line Impedance:	Matches a 50 to 70 ohm coaxial cable to line impedances of 50 to 1500 ohms.
Operating Temperature Range:	−40° C to +60° C.
Insertion Loss: (See Fig. 2)	Typical values, using 500-ohm non-inductive load.

Coupling C	Freq.	Coupling Loss
.003mfd.	40 kHz	4.5db
.003mfd.	50-300 kHz	1.5db
.006mfd.	40−300 kHz	0.6db
.01 mfd.	40−300 kHz	0.6db

TYPE JZ83 (HI-COUPLER) WIDE-BAND TUNER DESCRIPTION

MECHANICAL

The type JZ83. Hi-Coupler is a wide-band tuner designed for use with a coupling capacitor to couple one or more carrier frequencies to a power line, using phase-to-ground coupling. (Phase to phase coupling can be provided with two hi-coupler units).

The Hi-Coupler assembly 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 1-½ inch conduit for the coaxial cable. The outline, mounting dimensions, and knockout locations are shown on the outline drawing, 292B299, for the JZ83.6 tuners and on outline drawing 50B7683 for JZ83.63 tuners. (Figures 4 and 5 respectively).

The following units are mounted on the swinging panel of the outdoor cabinet.

1. Hi-Coupler S#148A432G04 with two-winding matching transformer.
2. One protector unit, S#1474014, consisting of protective gap, and grounding switch.

Optionally supplied on H (Heater) units:

1. Two heater resistors (1120 ohms, 25 watts) wired in series for 230V ac operation and in parallel for 115V ac operation.
2. Toggle switch and fuse assembly for the heater control.
3. An optional duplex outlet.

Optionally supplied on D (Drain Coil) units:

1. A 60 Hertz drain coil S#607B800G03 connected across the protector unit.

ELECTRICAL

The electrical circuits are shown on Figure 6. The coaxial cable connects to an isolated primary winding of transformer T1. An adjustable spark gap SG-1 protects the equipment from excessive voltage surges. The knife switch S-1 provides for grounding the lead-in from the coupling capacitor while adjustments are being made. The type D JZ83 tuner has a drain coil connected across the protector unit.

HI-COUPLER INSTALLATION

GENERAL (When Supplied Unmounted)

When the Hi-Coupler is unpacked, it should be checked carefully for damage or shortage. Report any transportation damage to both the transportation company and to the nearest Westinghouse District Office.

Remove the screws from the bottom and left side of the unit and mount it with the same screws on the panel in the base of the coupling capacitor.

CONNECTIONS FOR PHASE-TO-GROUND OPERATION

Make the following connections to the terminals on the rear of the Hi-Coupler (When supplied unmounted):

Connect terminal 1 to a ground terminal on the panel.

Connect terminal 4 to the terminal on the top of the drain coil.

Cables for these connections are supplied with the Hi-Coupler.

The coaxial cable from the power-line carrier equipment is to be connected to Hi-Coupler terminals 3 (center conductor) and 5 (shield lead). NOTE: The primary winding of the T1 transformer is isolated from ground to eliminate the path for the flow of 60 Hz. current over the cable shield in the event of induction or difference of ground potential. However, if this is not a problem, the coaxial-cable shield may be grounded at the Hi-Coupler by making a connection between terminals 1 and 5.

CONNECTIONS FOR PHASE-TO-PHASE OPERATION

For phase-to-phase operation with the two Hi-Couplers operating with their outputs in phase (push-push), both units are connected as described for phase-to-ground operation.

However, if conventional phase-to-phase operation (push-pull) is desired, reverse the connections of the coaxial cable to terminals 3 and 5 of one of the Hi-Couplers by connecting the center conductor to terminal 5 and the shield lead to terminal 3. The coaxial cable to the other Hi-Coupler is connected as described for phase-to-ground operation.

It is not necesary to run a separate coaxial cable from the carrier equipment to each Hi-Coupler. A single coaxial cable is run to one Hi-Coupler, then continued to the second one where the coaxial cable connections may be reversed. For the unit with the reversed connections, note that this also reverses the "polarity" of pin jacks J-1 and J-2 on the front panel. Thus J-2 becomes "Ground" under this condition.

JZ83. TUNER INSTALLATION

It is recommended that the JZ83 assembly be located as near the coupling capacitor as possible. The outdoor cabinet should be mounted vertically. The outline and mounting dimensions of the cabinet are shown in Figures 4 and 5 for the JZ83.6 and JZ83.63 cabinets respectively.

Connect a good ground to the cabinet and to terminal #1 on the hi-coupler terminal board. Remove the knockout from the side of the cabinet nearest the coupling capacitor for installation of the porcelain bushing for the capacitor lead-in. (See Figure 7 for bushing assembly). Run the lead-in cable from the coupling capacitor through the porcelain bushing and connect it to the terminal stud on the rear jaw terminal of the protector unit (S-1 and SG-2). Leave sufficient slack in this lead inside the cabinet so that the panel can be removed from the housing. For the lead-in cable, use a good rubber covered cable with a conductor equivalent to a #14 gauge or larger. Run a copper bonding cable from the tuner cabinet to the ground frame of the coupling capacitor.

The coaxial cable is connected to the cabinet terminals 3 and 5 as shown in Fig. 6. Cabinet terminal #1 is connected to ground. The Hi-Coupler has a two-winding matching transformer to allow for an ungrounded coaxial cable shield at the tuner location. This eliminates any path for the flow of 60 hertz current over the coaxial cable shield between the carrier set and Hi-Coupler locations caused by difference of ground potential.

If the assembly has a heater or duplex receptacle make the proper ac connections.

ADJUSTMENTS

PRELIMINARY

CAUTION: Close the carrier grounding switch when changing the capacitor links or the inductor link. Do not depend on the drain coil for personal safety. Do not touch any terminal when a transmitter is on.

The links for the capacitors C-1, C-2 and C-3 can be placed in the correct position before the coupling capacitor is connected to the power line. The link marked SHORT is always open, except as noted in a later paragraph.

Close the capacitor links as shown in the following table in an attempt to have the Hi-Coupler capacitance equal the value of the coupling capacitor.

System Voltage KV	Coupling Capacitor MFD.	Hi-Coupler Capacitance MFD.	Close Links
46	.015	.011	C-1, C-2, C-3
69	.010	.009	C-1, C-2
115	.006	.006	C-1
138	.005	.005	C-2, C-3
161	.0042	.003	C-2
230	.003	.003	C-2
287	.0025	.002	C-3
345	.002	.002	C-3

The impedance ratios of the matching transformer are as follows:

Coaxial cable terminal – 60 ohms (50 to 70 ohms).

Transformer Tap Position	Matching Impedance
1	60
2	85
3	120
4	175
5	245
6	350
7	500
8	750
9	1060
10	1500

The final adjustment of the ratio of the transformer must be made after the inductor is adjusted. However, if the impedance of the power line is known, set the transformer link to the position for the nearest value. If the impedance of the power line is not known, set the transformer link to tap number 7.

ADJUSTMENT FOR PHASE-TO-GROUND OPERATION

Since the adjustment of the inductor will be affected by reactance of the power line it must be adjusted after installation of the equipment. A vacuum-tube voltmeter suitable for carrier frequencies is required for adjusting the inductor. Adjustment of the Hi-Coupler must be made at 50 kHz. for a pass band of 40 to 300 kHz. When the

adjustment is made using the signal from a transmitter or using a signal generator, all other carrier-frequency signals must be temporarily removed from the channel.

Begin the adjustment with the inductor link on position 10.

CAUTION: Always close the carrier grounding switch in the base of the coupling capacitor before changing the inductor link.

ADJUSTMENT WITH A LOCAL TRANSMITTER

Connect the vacuum-tube voltmeter from the l.h. spark-gap electrode (ground) to jack J-3. Turn on the transmitter and adjust the inductance link for maximum voltage reading. If several transmitters are connected to the Hi-Coupler, use the lowest frequency transmitter for this adjustment.

Change the voltmeter connection from jack J-3 to jacks J-1 (coaxial shield) and J-2. Adjust the transformer link to a position which gives a voltage reading approximately equivalent to the nominal power of the transmitter into a resistance of 60 ohms.

$E = \sqrt{WR}$, where W = watts output, and
R = load resistance.

For a 10-watt transmitter.

$E = \sqrt{(10)\ (60)} = 24.5$ volts

This completes the adjustment of the Hi-Coupler except for checking the voltage at jack J-2 with full power being transmitted.

The Hi-Coupler power rating of 100 watts continuous, is based on an impedance of 60 ohms at the coaxial-cable terminal.

ADJUSTMENT WITH A SIGNAL GENERATOR

The Hi-Coupler can be adjusted by means of a signal generator in the absence of other signals.

Terminate the output of a 60-ohm signal generator in a pad consisting of a 50-ohm series resistor and a 10-ohm shunt resistor. It is preferable to connect the signal generator to the remote end of the coaxial cable; however, if this is not feasible, connect the generator to jacks J-2 and J-1. Adjust the signal generator for at least a 1 watt output at 50 kHz. Connect the vacuum-tube voltmeter to jack J-3 and ground and adjust the inductor link for the maximum voltage reading. Then adjust the transformer link for maximum voltage reading.

ADJUSTMENT FOR PHASE-TO-PHASE OPERATION

When adjusting the two Hi-Couplers used for phase-to-phase operation, it is necesary to open-circuit one unit while the other is being adjusted. This is done by opening all the capacitor links. (Be sure to close the grounding switch first.) Adjust one unit by the same procedure used for phase-to-ground operation, then open circuit the first unit, replace the links in the second unit and repeat the adjustment. The voltage readings for the two units should be approximately the same and the transformer and inductance links should be at the same position on both units. With both units connected recheck the transformer taps as described under Adjustment With a Local Transmitter.

OPERATION AS IMPEDANCE MATCHING TRANSFORMER

In some installations where only the higher carrier frequencies are used with the higher value coupling capacitors, better coupling may be obtained by using only an impedance-matching transformer rather than the high-pass filter circuit of the Hi-Coupler. The conditions controlling this choice of coupling are so variable that no specific recommendation can be given. Only an operational test of the installation will determine which gives the best results.

To operate the Hi-Coupler as an impedance-matching transformer, close the link marked SHORT, open the inductor link. The transformer ratio is then adjusted in accordance with the instructions given for phase-to-ground operation with a local transmitter.

SPARK GAP ADJUSTMENT (Both SG-1 and SG-2)

The spark gap is adjusted to .015 inch when the unit is shipped. This spacing should be checked to see that it has not been changed.

The nominal spacing of the spark gap SG-1 is 0.015-inch. Check the gap to see that this spacing

is maintained. After all tuning adjustments have been made, observe the gap while transmitting full power. If the gap arcs over, increase the spacing until the arcing ceases. The minimum gap spacing is dependent upon several factors (i.e., carrier power, coupling capacitor, capacitance and power line impedance.)

MAINTENANCE

The Hi-Coupler will require very little maintenance. It should be checked occasionally to see if there has been excessive burning of the spark gap. If the electrodes show signs of burning, clean the points and adjust the gap to .015 inch. SG-2's discs can be rotated to a new position to readjust the gap. Usually a semi-annual or yearly inspection is sufficient.

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

HI-COUPLER ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	FUNCTION	DESCRIPTION	STYLE NUMBER
C-1	Capacitor-Series	Mica, .006 mfd. ± 5% 3000 V PWV	584C256H03
C-2	Capacitor-Series	Mica, .003 mfd. ± 5% 3000V PWV	584C256H02
C-3	Capacitor-Series	Mica, .002 mfd. ± 5% 3000V PWV	584C256H04
J-1	Jack-Coaxial Cable Shield	Pin Jack (black)	330C686H03
J-2	Jack-Coaxial Cable Voltage	Pin Jack (red)	330C686H02
J-3	Jack-Inductor Voltage	Same as J-2	
L-1	Inductor-Shunt	0.4 to 8.0 MH	201C364H01
SG-1	Spark Gap	Point Type	2 of 219B550H01
T-1	Transformer-Impedance Matching	60 ohms/85, 120, 175, 245, 350, 500, 750, 1060, 1500 ohms	584C259H01

ADDITIONAL JZ83 ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	FUNCTION	DESCRIPTION	STYLE NUMBER
SG-2, S-1	Protector Unit	30A 250V Knife Switch, Spark Gap (Disc Type)	1474014
SG-2	Spark Gap	Disc Only	2 of 183A358H20
	(D Option)		
L-2	60 Hz Drain	Drain Coil 20 K ohms minimum impedance 30-300 kHz	606B800G03
	(H Option)		
	Heater Resistors	1120 ohm 25W	2 of 1955641
	Toggle Switch	DPST, 5A, 250V	188A856H01
	Fuse Holder		763A942H01
F1, F2	Fuse	5A, 250V	2 of 1723721
	Optional Receptacle	Duplex Outlet	Bryant #5242

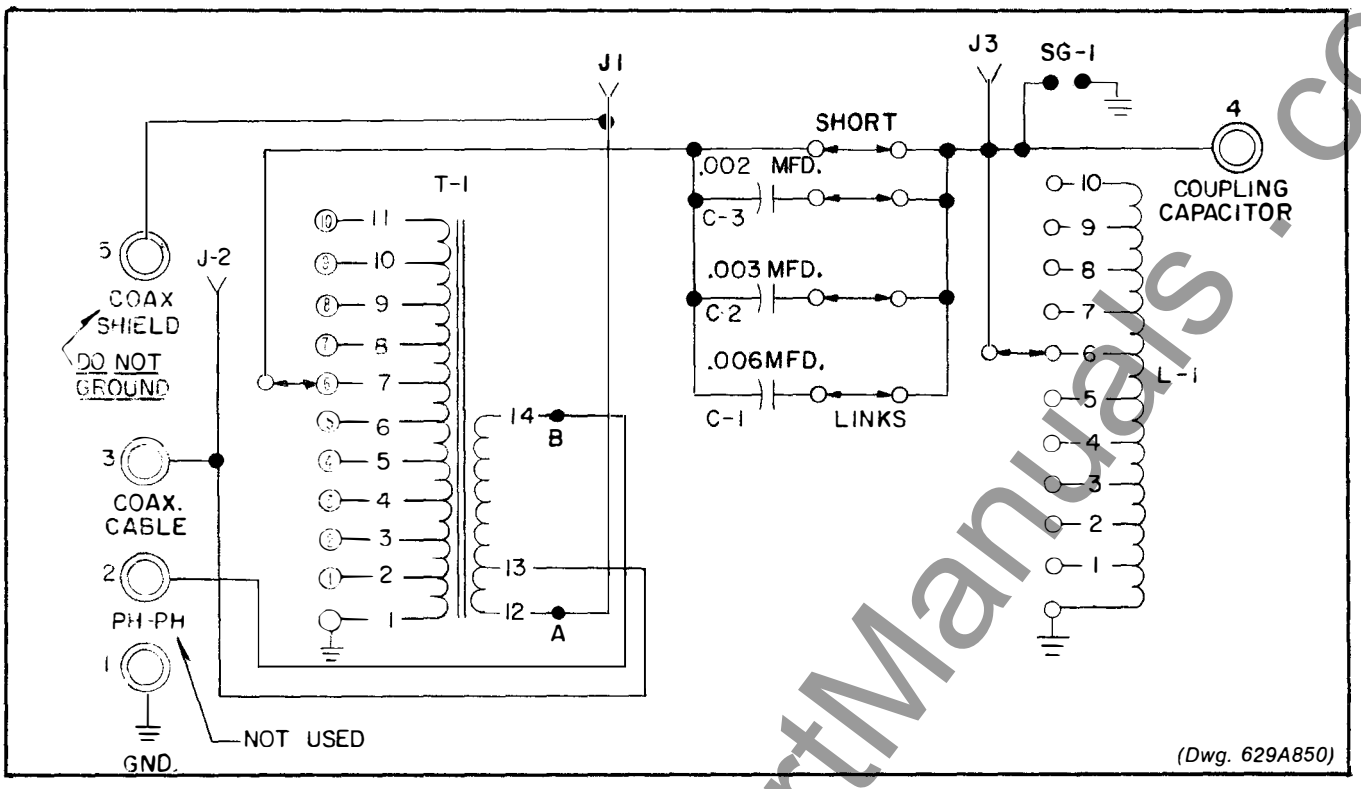

Fig. 1. Hi-Coupler – Internal Schematic

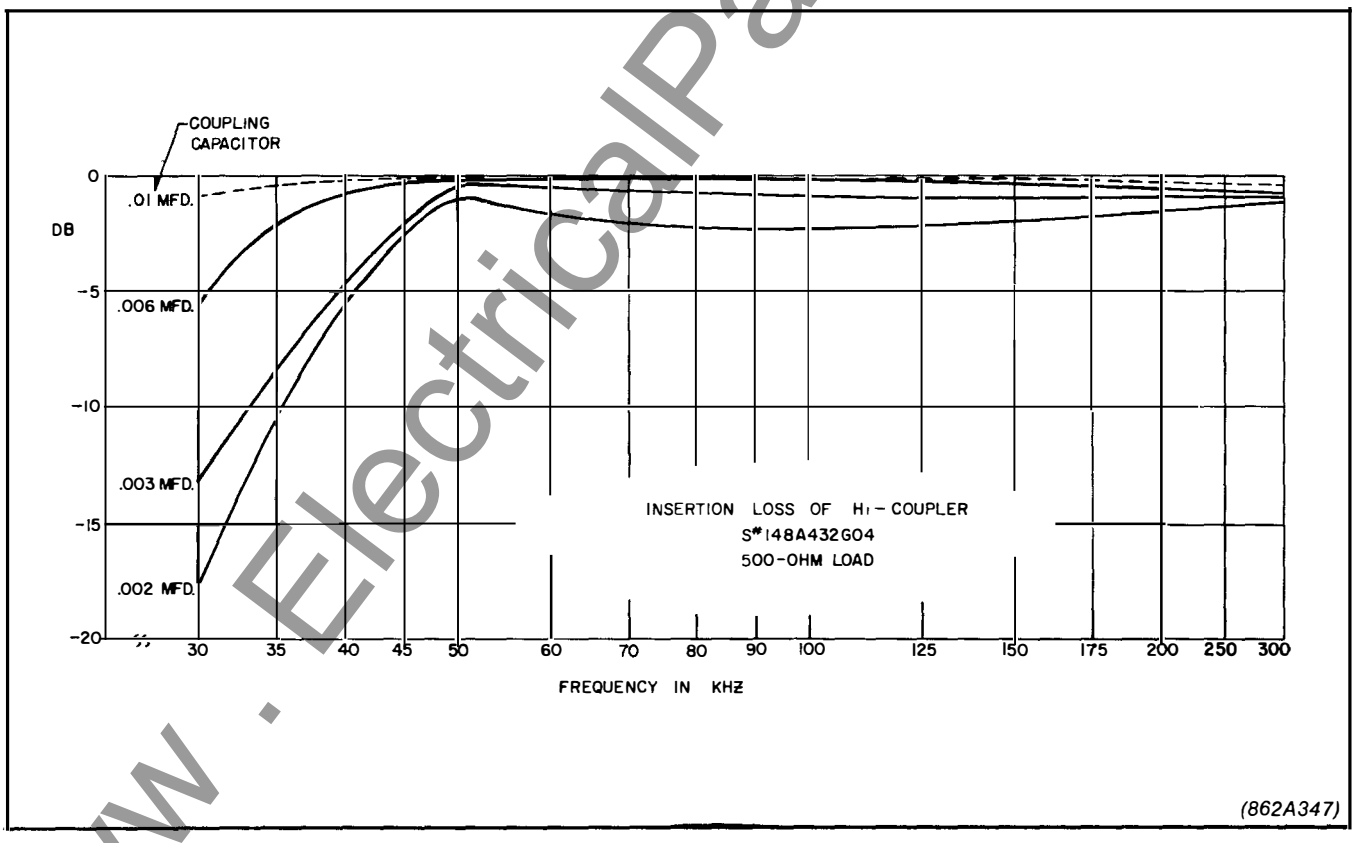

Fig. 2. Typical Insertion Loss of Hi-Coupler

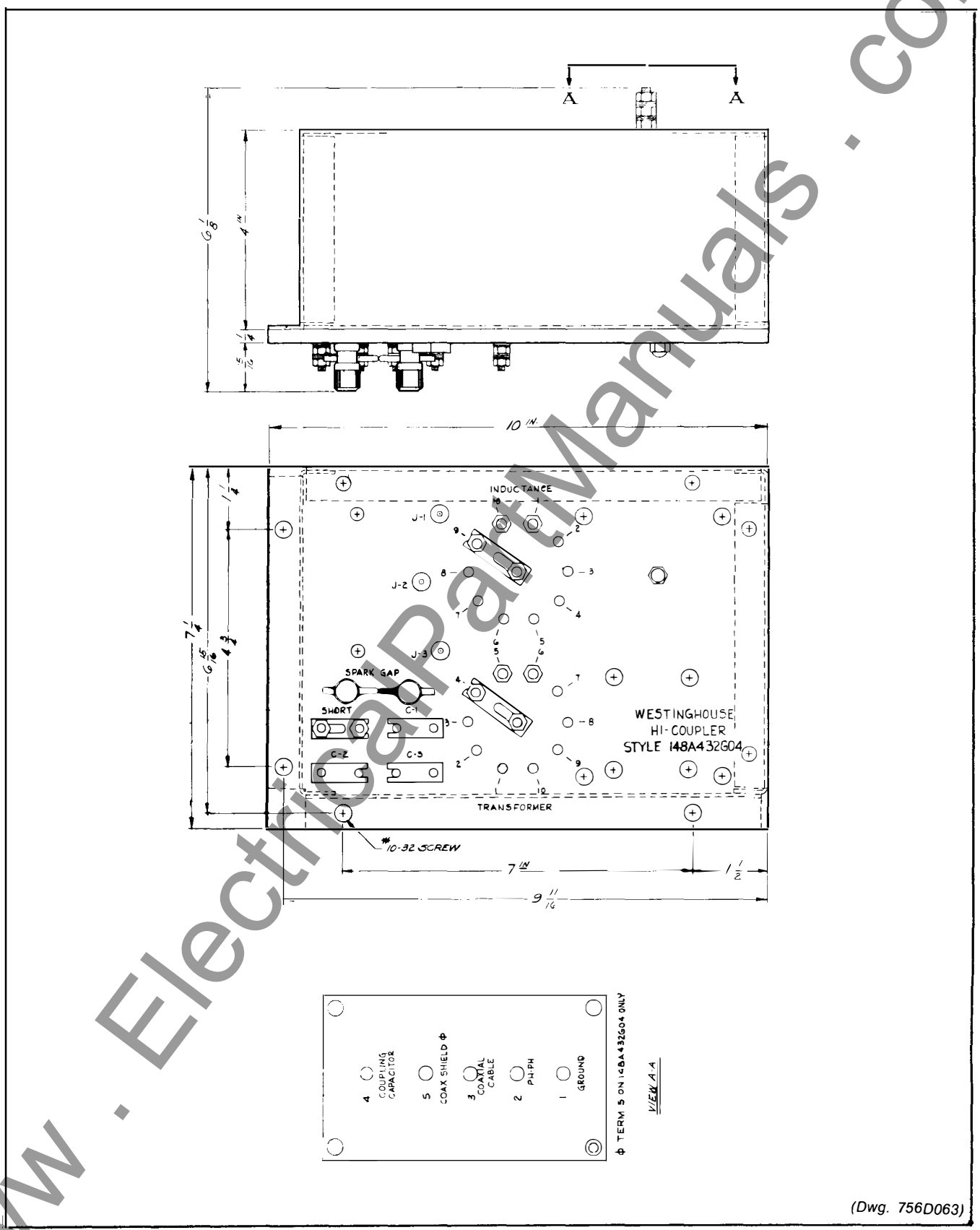

Fig. 3. Hi-Coupler Outline

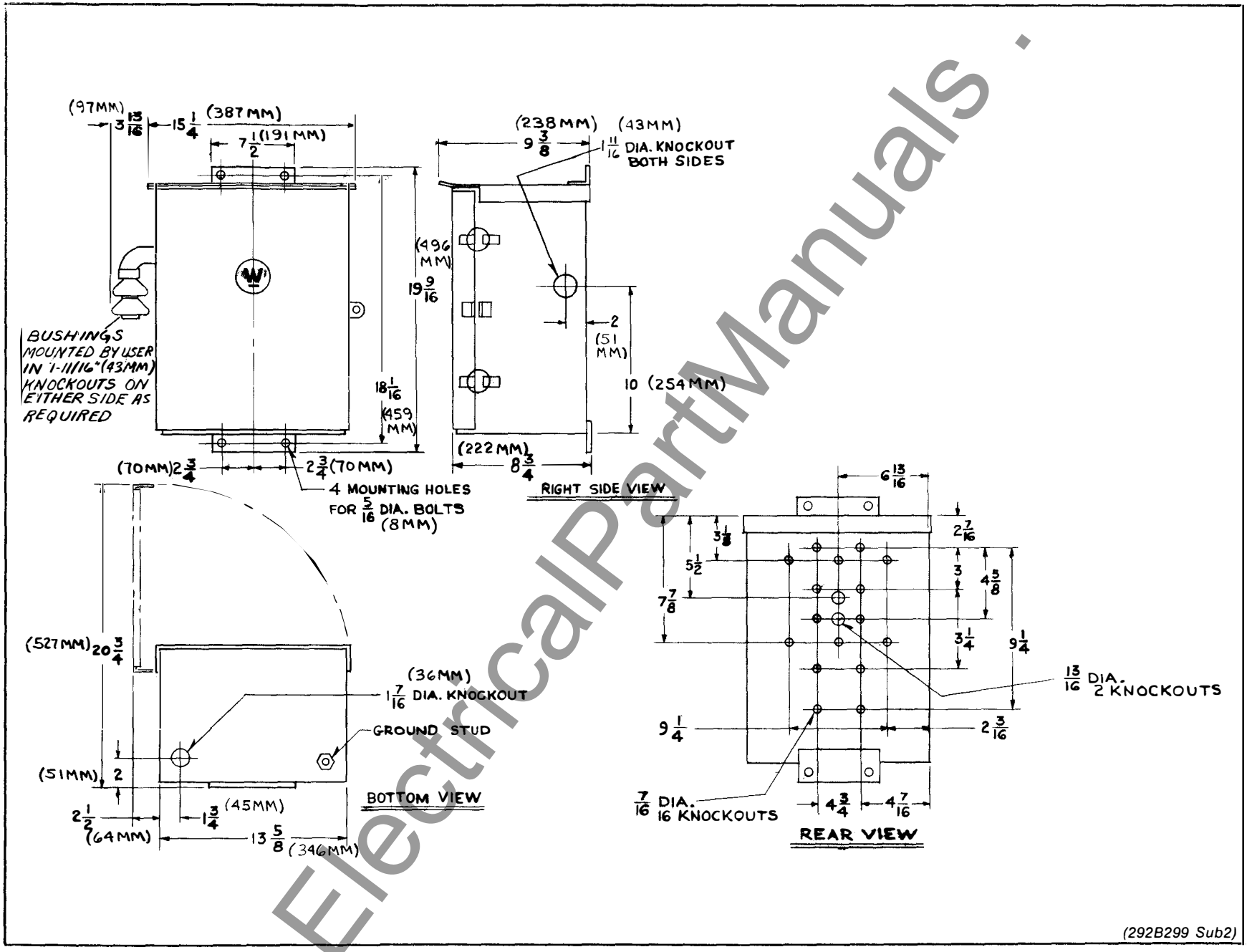

Fig. 4. Outline Dwg., Type JZ-83.6 Line Tuner Cabinet

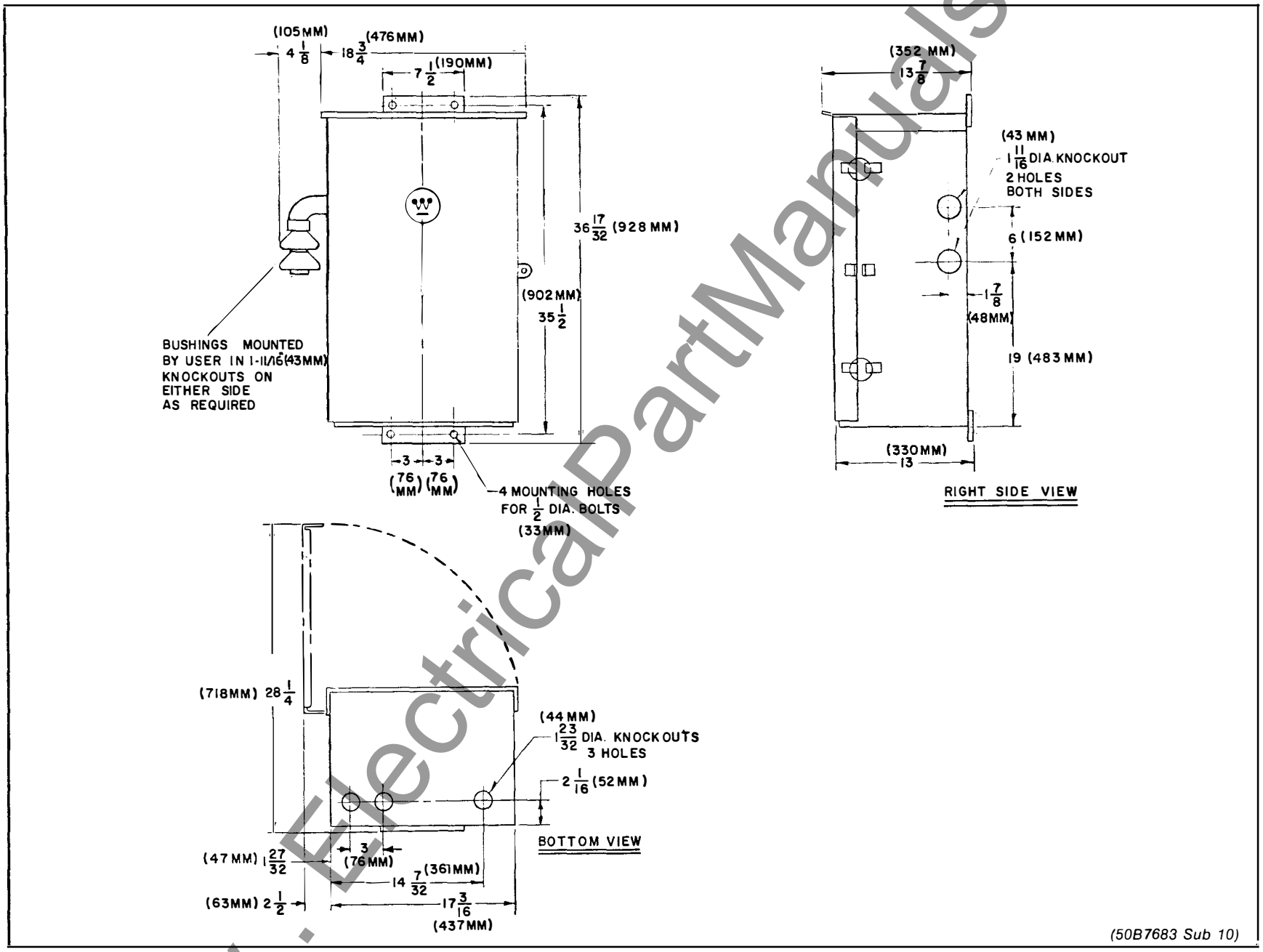

Fig. 5. Outline Dwg., Type JZ83.63 Line Tuner Cabinet

TYPE JZ 80 LINE TUNER

TYPE	STYLE	†SCHEMATIC	††OPTIONS								
			1	2	3	4	5	6	7	8	9
JZ 83.6	542D023G01	293B268									
JZ 83.6D	542D023G02	293B268			Yes						
JZ 83.63	544D677G01	293B268									
JZ 83.63H	4825D66G01	670B638				Yes			Yes	Yes	
JZ 83.63H	5491D67G01	715B364		Yes		Yes				Yes	
JZ 83.63H	5491D67G02	715B364		Yes			Yes			Yes	
JZ 83.63DH	4825D66G02	670B638			Yes	Yes			Yes	Yes	
JZ 83.63DH	6695D18G01	774B935			Yes		Yes				Yes
JZ 83.63DH	4825D66G03	774B925	Yes		Yes	Yes			Yes	Yes	
JZ 83.63DH	6695D18G02	774B935			Yes		Yes				Yes

† Schematic Diagram is available from factory on request. Diagram is equivalent to Fig. 6 (775B739) with options as supplied.

†† Options (option numbers for convenience in chart)

1 - Wiring to contactor cabinet
2 - Disconnect Switch
3 - Drain Coil
4 - 115 V Heater (Resistors in parallel)
5 - 230 V Heater (Resistors in series)
6 - Toggle Switch
7 - Duplex Outlet
8 - 5A Fuses
9 - ¾A Fuses

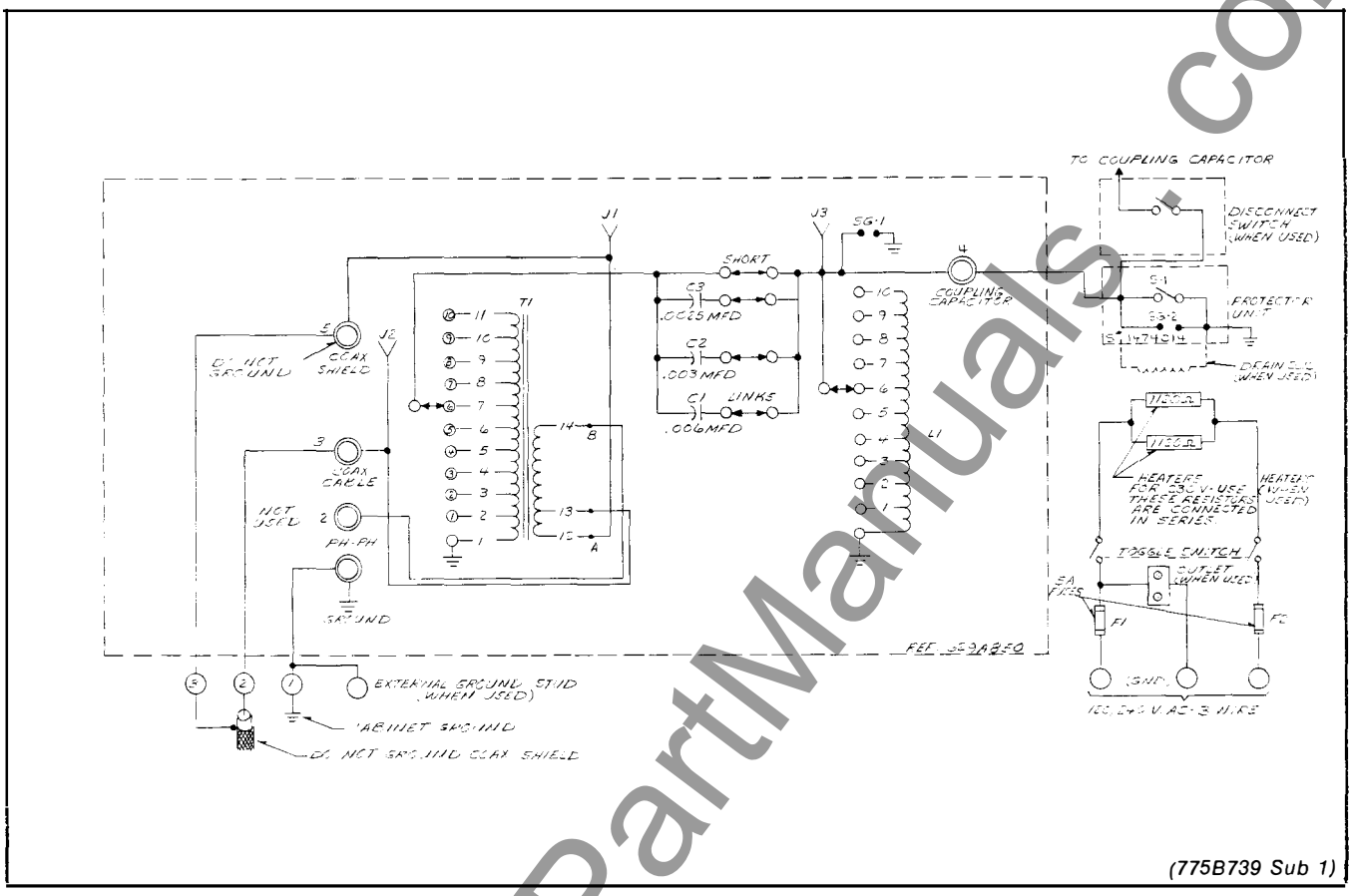

Fig. 6. Type JZ83.6 and JZ83.63 with options

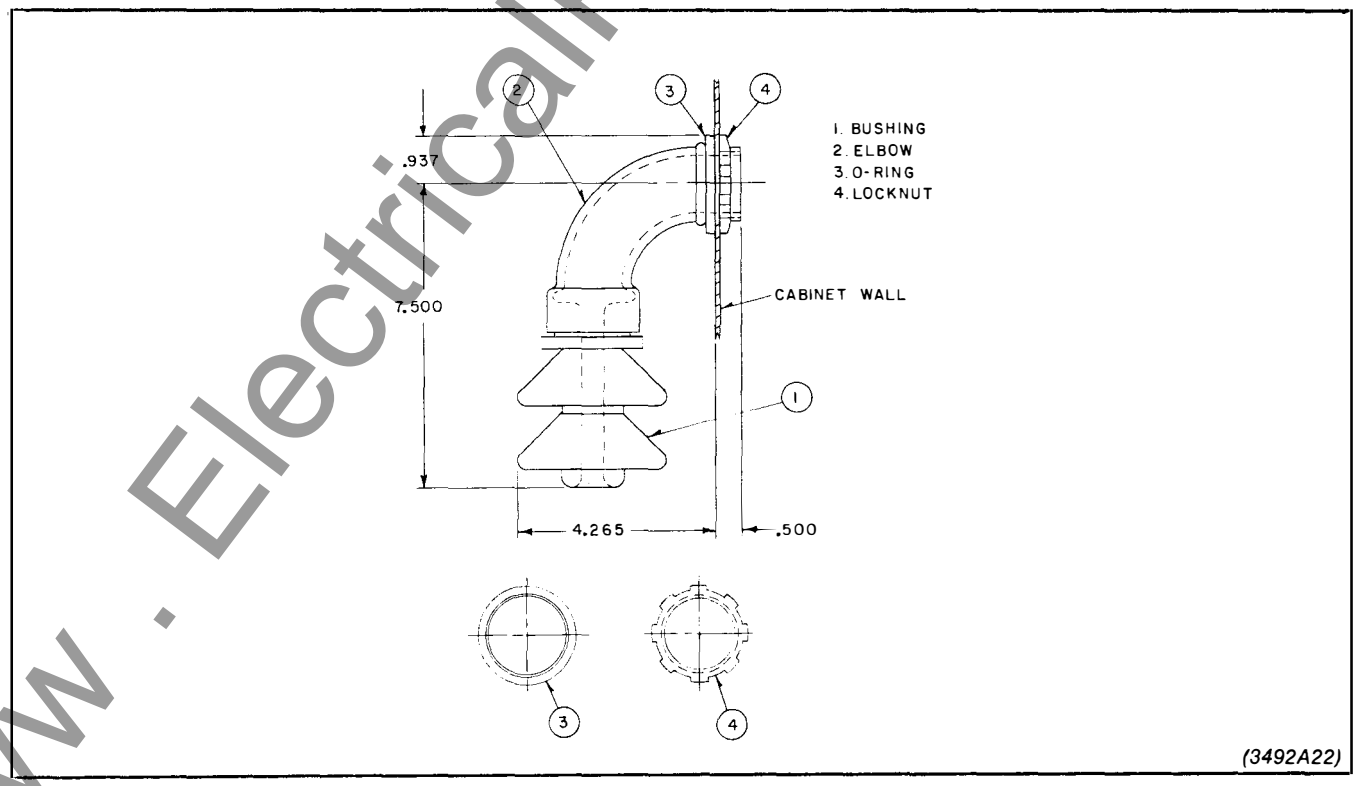

Fig. 7. Lead-in Bushing Assembly

WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

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