SECTION VIII
ANTENNAS WITH 52-OHM COAXIAL FEED LINES

8.1. GENERAL.

This section pertains to some antennas which may be used with the KWS-1 Transmitter.

The advantages of using these antennas are listed below:

(a) Broadband.

(b) Coaxial feed system provides shielding for better signal-to-noise ratio at the receiver input terminals.

(c) The half-wave dipole antennas attenuate spurious radiation and the half-wave dipole feed lines attenuate spruious radiation at TV frequencies.

(d) No added tuning controls are necessary.

(e) Coaxial connectors provide a convenient means of transferring antennas.

8.2. ANTENNA DETAILS.

The table following gives the nominal performance expected from the antennas described in this section.

TABLE 8-1

NOMINAL ANTENNA PERFORMANCE SPECIFICATIONS

	FIGURE 8-2	FIGURE 8-3	FIGURE 8-4	FIGURE 8-5
ITEM / ANTENNA	10-Meter Beam	20-Meter Beam	40-Meter Dipole	80-Meter Dipole
Frequency range	29.96 to 29.7 mc	14.0 to 14.4 mc	7.0 to 7.3 mc	3.5 to 4.0 mc
Front to back ratio	4 to 1	10 to 1	----	----
Gain over half-wave dipole	6.75 db	5.1 db	----	----
SWR	1.1 at band ctr.			
	2.1 at band ends	1.8 at band ends	1.8 at band ends	2.5 at band ends

The KWS-1 Amateur Transmitter is designed with an unbalanced output to secure the advantages of pi and L networks.

The KWS-1 Amateur Transmitter antenna output circuits are designed to work into an unbalanced resistive load of 52 ohms with a maximum standing wave ratio of 2.5 to 1. Hence, the transmission line must incorporate a method of line balancing in order to match between the unbalanced output circuits and a balanced radiator. Figures 8-2 and 8-3 show construction details of beams for use on 10 or 11 and 20 meters. Each beam is constructed with a balanced to unbalanced transformer (balun) to match the beams to a coaxial feed line. Figures 8-4 and 8-5 show construction details of horizontal dipoles for use on 40 and 80 meters. Each dipole is constructed with a balun to match the dipole to a coaxial feed line. If it is desired to use shorter length baluns than those shown for the 40 and 80-meter dipoles, refer to figure 8-6, Short Balun for 40 80 Meters.

The 100 mmf ceramic capacitor used in the 10 and 20-meter beams is described below. The r-f current flowing in this capacitor at 10 meters is 6 amperes; at 20 meters, 3 amperes.

CAPACITOR: Ceramic, 100 mmf ±10%, 5000-vdcw. Collins part number 913 0821 00 or Centralab Type 850A.

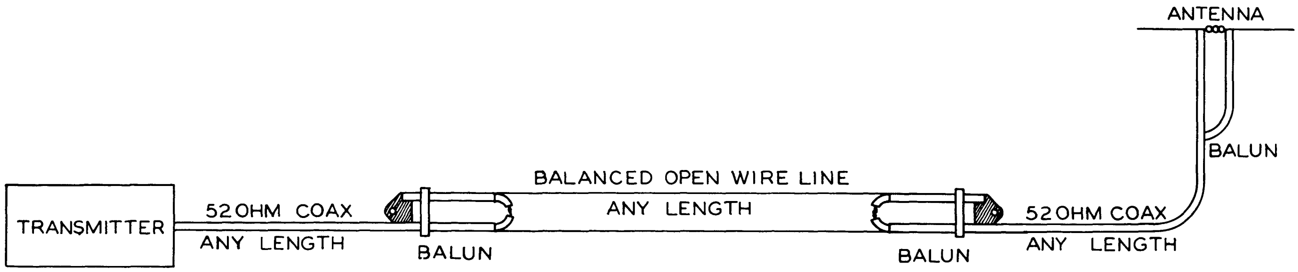
8.3. TRANSMISSION LINE.

At some installations a long transmission line will be necessary. For lowest transmission line losses, a high impedance open wire balanced line is recommended. To secure the advantage of the low losses of an open wire line, it is necessary to use an unbalanced to balanced impedance matching transformer (balun) to transfer from the unbalanced low impedance output termination, provided on the transmitters to a high impedance open wire balanced line. Figure 8-1 indicates the construction details of a balun for this purpose.

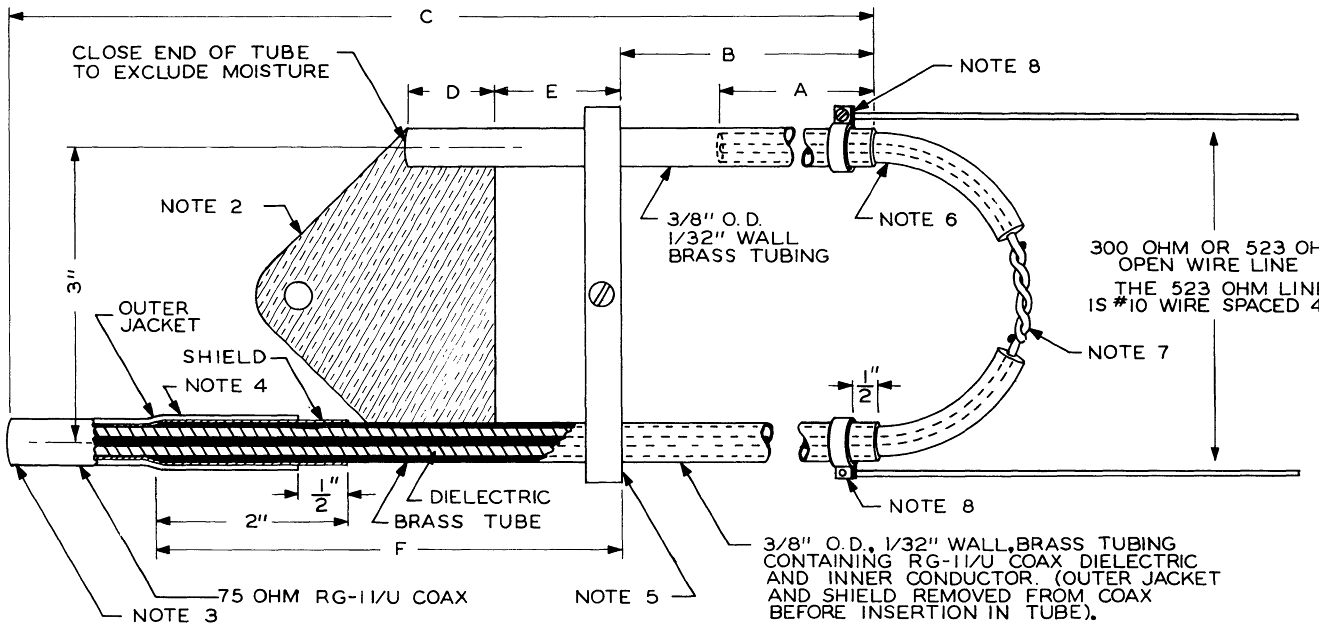
8.4. TEST INFORMATION.

All baluns mentioned in this discussion are resonant circuits. The baluns are cut to operate at the center frequency of the band specified.

If it is desired to check any balun, disconnect the antenna from the balun, and the center conductor of the feed cable from the shield of the opposite cable. Use a grid dip meter, or other means, to check for resonance. If the balun is off frequency, correction may be made by either changing the length of the balun or changing the value of the capacity used. The resonant frequency may also be varied by altering the spacing between cables. The length of the balun must not exceed one quarter wavelength, and baluns shorter than those given in figure 8-6 are not recommended.



THIS SYSTEM PERMITS USE OF A BALANCED OPEN WIRE LINE TO REDUCE LOSSES ON LONG TRANSMISSION LINES. CONSTRUCTION DETAILS OF THE UNBALANCED TO BALANCED IMPEDANCE MATCHING TRANSFORMER (BALUN) USED BETWEEN THE OPEN WIRE LINE AND THE 52 OHM RG-8/U COAXIAL CABLE ARE SHOWN BELOW.



NOTES:

1.

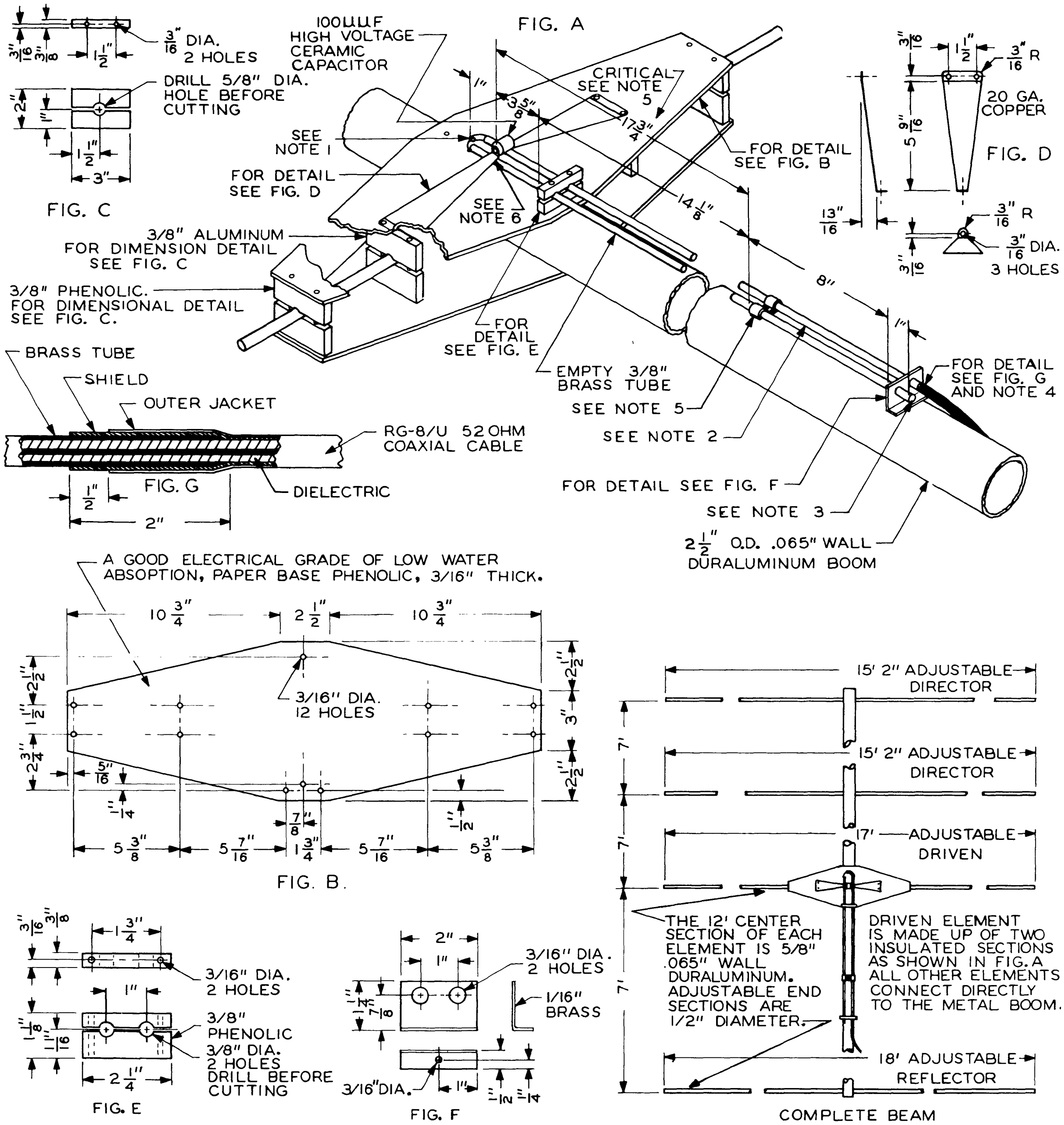
FREQ. MC.	OPEN WIRE LINE IMPEDENCE	LENGTH - INCHES		
		A	B	C
27 TO 29.7	300 OHMS	15 3/8	38 1/4	69 5/8
27 TO 29.7	523 OHMS	10 5/8	44 1/2	69 5/8
14 TO 14.3	523 OHMS	21 1/4	92 1/4	139

DIMENSIONS D, E, AND F ARE NOT CRITICAL AND MAY BE ADAPTED TO THE INDIVIDUAL INSTALLATION. DIMENSION D SHOULD BE LONG ENOUGH TO PERMIT SILVER SOLDERING BRASS PLATE AND TUBES TOGETHER. DIMENSION E SHOULD BE LONG ENOUGH TO PERMIT ADJUSTMENT OF THE SHORTING BAR. DIMENSION F SHOULD BE LONG ENOUGH TO PROVIDE SUFFICIENT OVERHANG FOR CONNECTING THE RG-11/U CABLE.

2. BRASS PLATE OF CONVENIENT SIZE SILVER SOLDERED TO THE TWO BRASS TUBES. PLATE MAY BE GROUNDED OR UNGROUNDED AND IS DESIGNED TO SECURE THE BALUN TO AN END SUPPORT.
3. ATTACH A COAX CONNECTOR HERE TO PERMIT ATTACHING A LENGTH OF 52 OHM RG-8/U COAX.
4. REMOVE OUTER JACKET AND SHIELD FROM A LENGTH OF RG-11/U 75 OHM COAXIAL CABLE. CUT THE OUTER JACKET 1/2 INCH SHORTER THAN THE SHIELD. BEVEL THE OUTER EDGE OF THE 3/8" O.D. BRASS TUBE. SLIDE THE DIELECTRIC INSIDE THE TUBE. FORCE THE BEVELED END OF THE BRASS TUBE BETWEEN THE DIELECTRIC AND THE SHIELD FOR A DISTANCE OF ABOUT 2 INCHES AS SHOWN. SOLDER THE SHIELD TO THE TUBE, USING A MINIMUM AMOUNT OF HEAT TO AVOID DAMAGING THE DIELECTRIC. COVER THE AREA WITH SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE.
5. THIS SHORTING BAR SHOULD BE MOVABLE TO PERMIT ADJUSTING THE BALUN TO REDUCE THE OVERALL STANDING WAVE RATIO OF THE SYSTEM.
6. REMOVE THE OUTER JACKET AND SHIELD FROM A LENGTH OF RG-8/U 52 OHM COAX. INSERT THE PROPER LENGTH OF BARE DIELECTRIC INSIDE THE TUBE.
7. SOLDER INNER CONDUCTORS TOGETHER. COVER THE TUBE ENDS AND ALL OF THE CABLE BETWEEN WITH A CONTINUOUS WRAPPING OF SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE.
8. INSTALL A BRACKET FOR ATTACHING THE OPEN WIRE LINE. IF BRACKET IS SOLDERED, BE VERY CAREFUL TO AVOID OVERHEATING AND DAMAGING THE DIELECTRIC.

BALUN WITH BALANCED OPEN WIRE LINE
FOR REDUCTION OF LOSSES ON LONG TRANSMISSION LINES.

Figure 8-1. Balun With Balanced Open Wire Line for Reduction of Losses on Long Transmission Lines

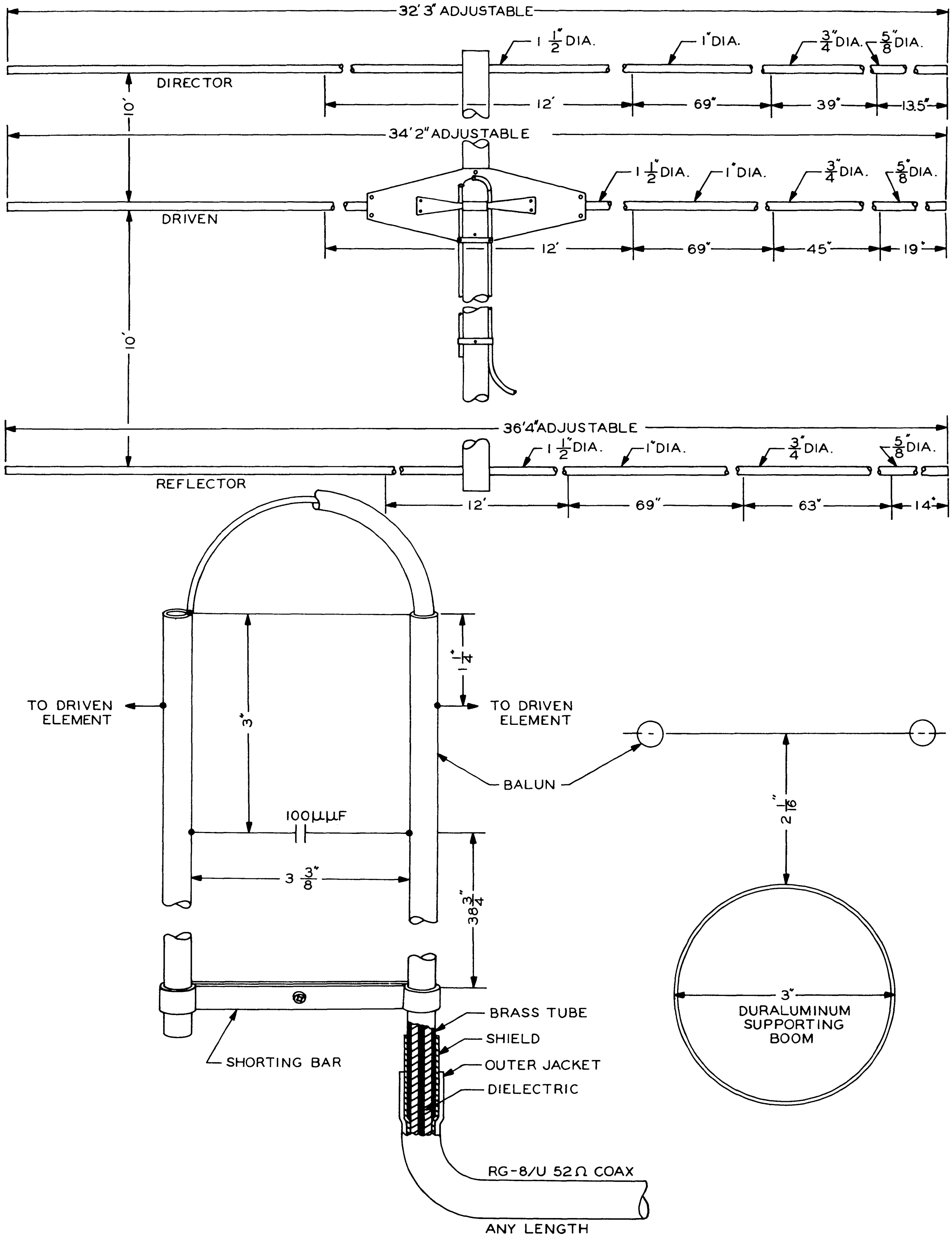


NOTES:

1. ALLOW COAXIAL CABLE DIELECTRIC MATERIAL TO EXTEND FROM TUBE. SOLDER COAX INNER CONDUCTOR TO END OF OTHER TUBE. WRAP COAX DIELECTRIC MATERIAL AND END OF BOTH TUBES WITH SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE. MAKE A CONTINUOUS WRAPPING ALONG THE DIELECTRIC FROM ONE TUBE TO THE OTHER.
2. 3/8" BRASS TUBE CONTAINING COAX CABLE MINUS JACKET AND SHIELD.
3. CLOSE END OF TUBE TO EXCLUDE MOISTURE.
4. REMOVE OUTER JACKET AND SHIELD FROM A LENGTH OF RG-8/U 52 OHM COAXIAL CABLE. CUT THE OUTER JACKET 1/2" SHORTER THAN THE SHIELD. BEVEL THE OUTER EDGE OF THE 3/8" O.D. BRASS TUBE. SLIDE THE DIELECTRIC INSIDE THE THE TUBE. FORCE THE BEVELED END OF THE BRASS TUBE BETWEEN THE DIELECTRIC AND THE SHIELD FOR A DISTANCE OF ABOUT 2 INCHES AS SHOWN. SOLDER THE SHIELD TO THE TUBE, USING A MINIMUM AMOUNT OF HEAT TO AVOID DAMAGING THE DIELECTRIC. HOLD THE CABLE STRAIGHT WHILE SOLDERING. COVER THE AREA WITH A CONTINUOUS WRAPPING OF SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE.
5. THE DISTANCE BETWEEN THE SHORTING BAR AND THE CAPACITOR IS CRITICAL. BEFORE INSERTING THE COAXIAL CABLE, AND BEFORE CONNECTING THE COPPER TRIANGLE TO THE ELEMENT, USE A GRID-DIP OSCILLATOR TO RESONATE THE BALUN TO THE CENTER OF THE BAND. THE 17 3/4" DIMENSION IS APPROXIMATELY CORRECT.
6. SOLDER 100μμF. HIGH VOLTAGE CERAMIC CAPACITOR TO END OF 20 GA. COPPER TRIANGLE. SOLDER COPPER TRIANGLE TO BRASS TUBE.

10 METER BEAM WITH SHORTENED UNBALANCED TO BALANCED TRANSFORMER (BALUN) FEED SYSTEM

Figure 8-2. 10-Meter Beam With Shortened Unbalanced to Balanced Transformer (Balun) Feed System



20 METER BEAM WITH SHORTENED UNBALALANCED TO BALANCED TRANSFORMER (BALUN) FEED SYSTEM. GENERAL CONSTRUCTION IS THE SAME AS THE TEN METER BEAM.

Figure 8-3. 20-Meter Beam With Shortened Unbalanced to Balanced Transformer (Balun) Feed System

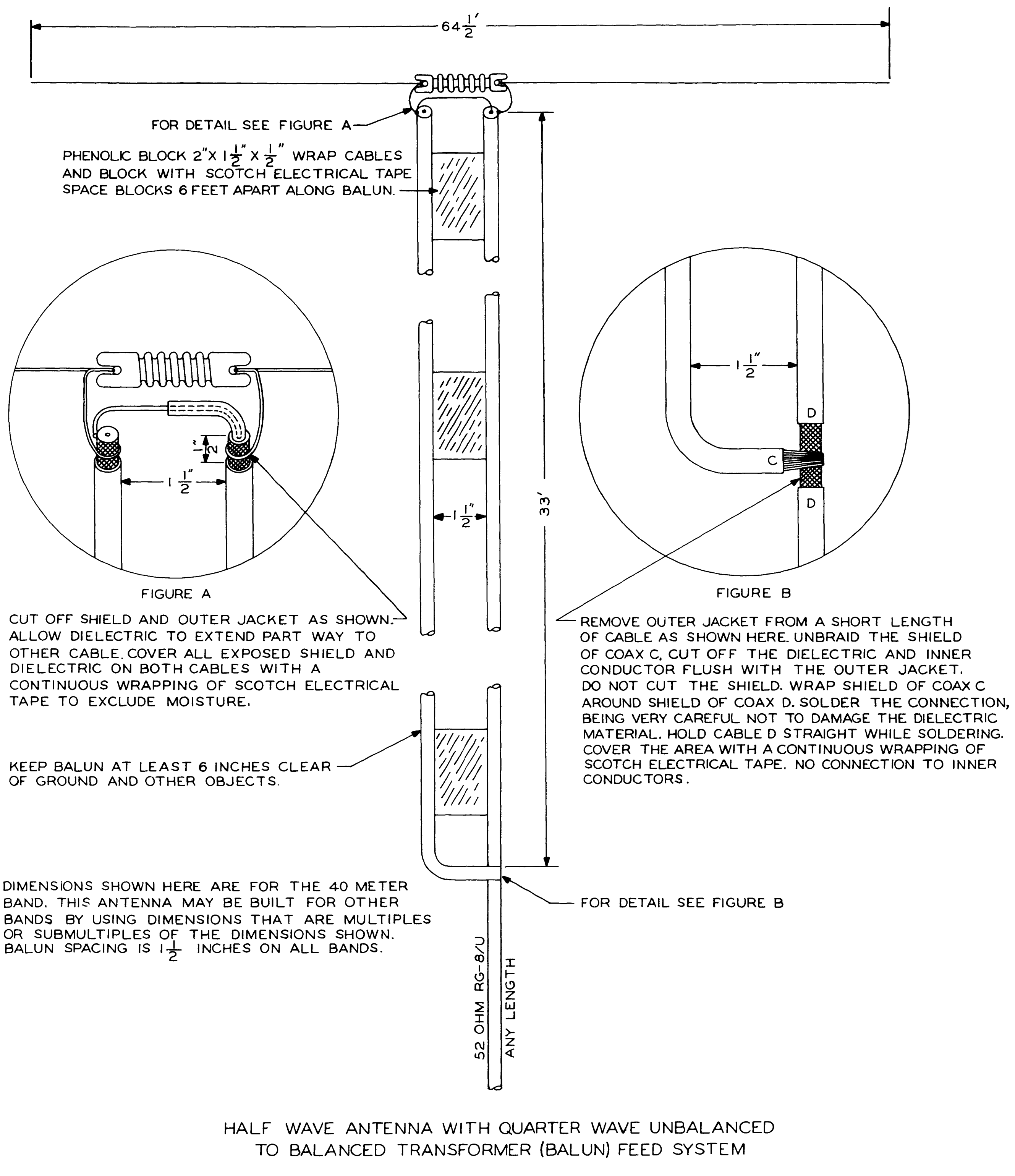


Figure 8-4. Half-Wave Antenna With Quarter-Wave Unbalanced to Balanced Transformer (Balun) Feed System

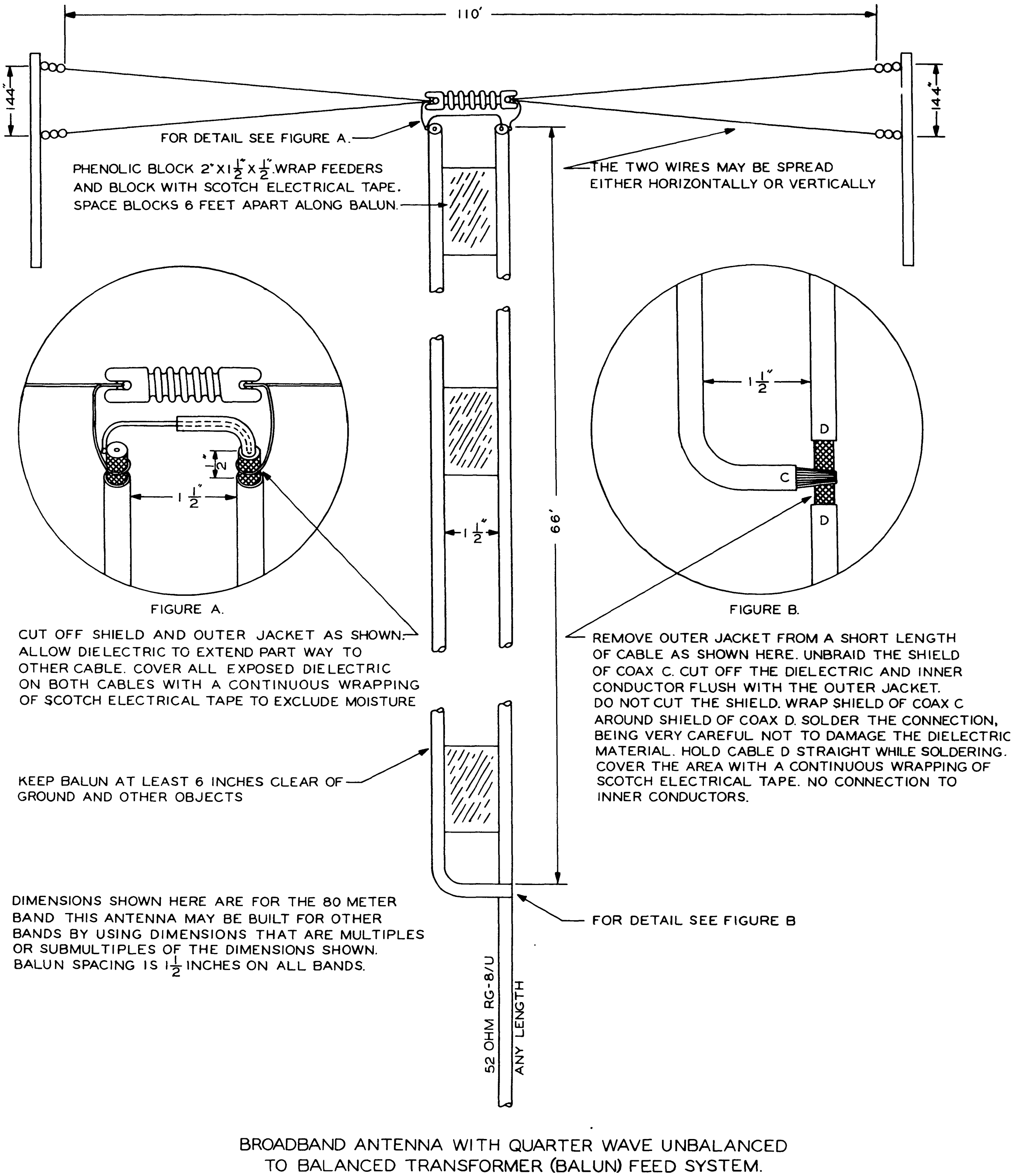


Figure 8-5. Broadband Antenna With Quarter-Wave Unbalanced to Balanced Transformer (Balun) Feed System

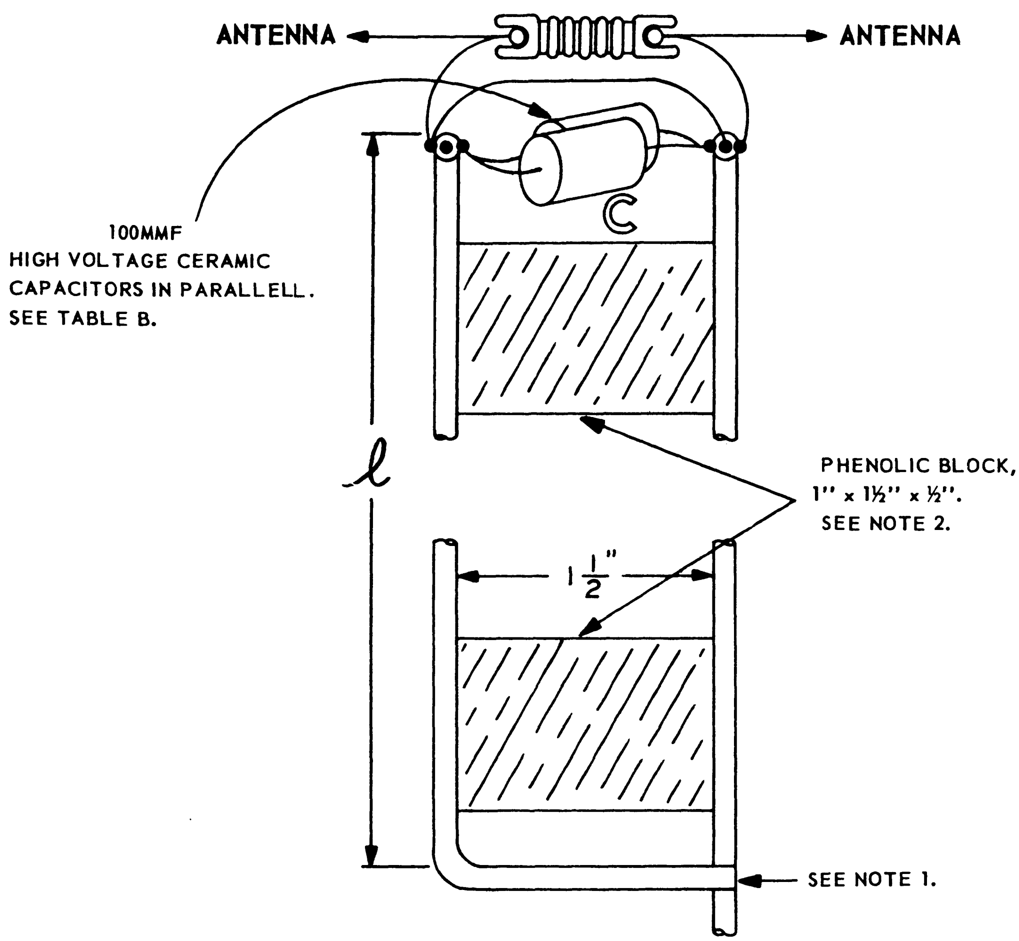


TABLE A

BAND	ℓ	C
40 METERS	7'3"	200MMF
80 METERS	13'6"	400MMF

TABLE B- SUITABLE CAPACITORS

QUANTITY	TYPE	VALUE	COLLINS PART NO.
2	CENTRALAB TYPE 850	100MMF	913 0821 00
4	CENTRALAB TYPE 850	100MMF	913 0821 00

NOTE: 1. FOR PERTINENT CONSTRUCTION DETAILS, REFER TO FIGURES 8-4 AND 8-5.

2. CONSTRUCT BALUN FOR 40-METER BAND WITH THREE SPACERS. CONSTRUCT BALUN FOR 80-METER BAND WITH FOUR OR FIVE SPACERS.

3. THE TWO CABLES SHOULD BE VERY NEARLY PARALLEL.

Figure 8-6. Short Balun for 40 and 80 Meters