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# LJ-204BA

4-Element 20-Meter  
 HF Beam

## INSTRUCTION MANUAL

### General Description

The Hy-Gain Model 204BA-S is a close spaced, 4-element, 20-meter beam. The 204BA-S is ideal for the 20 meter DX'er with limited space or for your local club for field day use. It is equipped with Hy-Gain's exclusive Beta Match, rugged boom-to-mast brackets and stainless steel hardware for all electrical and most mechanical connections. It is designed to fit mast sizes from 1 1/4" to 2 1/2" and can be rotated with Hy-Gain's CD-45 II or HAM IV Rotators.

### WARNING

When installing your antenna system, take extreme care to avoid any accidental contact with powerlines or overhead obstructions. Failure to exercise this care could result in serious or fatal injury.

Dimensions are included to scale this antenna to the new 17 m (18 MHz) band. All electrical specifications are identical to those shown below.

### 204BA-S Specifications

#### *Electrical*

*Power Gain .....	8.2 dBi (6.0 dBd)
*Front-to-Back Ratio .....	15 dB Minimum, 28 dB Maximum
*Half-power Beamwidths .....	64° (E) 96° (H)
Nominal Impedance .....	50 ohms
VSWR at resonance .....	less than 1.2:1
Maximum Power Input.....	maximum legal
Lightning Protection.....	DC ground

#### *Mechanical*

Boom Length.....	(0.38 wavelength) 26 feet (7.92 m)
Boom Diameter.....	2 inches (5.08 cm)
Longest Element.....	36' 6" (11.13 m)
Turning Radius.....	22' 6" (6.86 m)
Net Weight.....	50 lbs (22.68 kg)
Accepts Mast .....	1 1/4" to 2 1/2" O.D. (3.17 to 6.35 cm O.D.)
Maximum Wind Survival .....	100 mph (161 kmph)
Wind Surface Area .....	7.27 sq. ft. (0.675 sq. m)
Wind Load at 80 mph .....	186 lbs. (84.4 kg)
Element Tubing Clamps .....	stainless steel
Hardware.....	18-8 stainless steel except for boom-to-mast bolts
Suitable Rotators .....	Hy-Gain CD-45II, HAM IV

\*Gain, Front-to-Back Ratio, and Beamwidths verified by the MININEC 3' Computer code along with radiation pattern measurements of full size antennas on Hy-Gain's test range.

## Preparation for Assembly

**FOR OUR OVERSEAS CUSTOMERS:** The United States uses American units of measurement. Please see the last page of this manual for assistance in identifying the hardware and components used with this product. Choose a large, clear area to assemble the 204BA-S. The area must be at least 26'x 37' (8 m x 11.5 m). When unpacking your antenna, check inside of all tubing for parts. To conserve space, these smaller articles are sometimes put inside larger pieces. Check all parts against the parts list to ensure no parts are missing.

All tubing supplied with the 204BA-S telescopes together. Make all measurements to the given dimensions, plus or minus, no more than one eighth (1/8) inch.

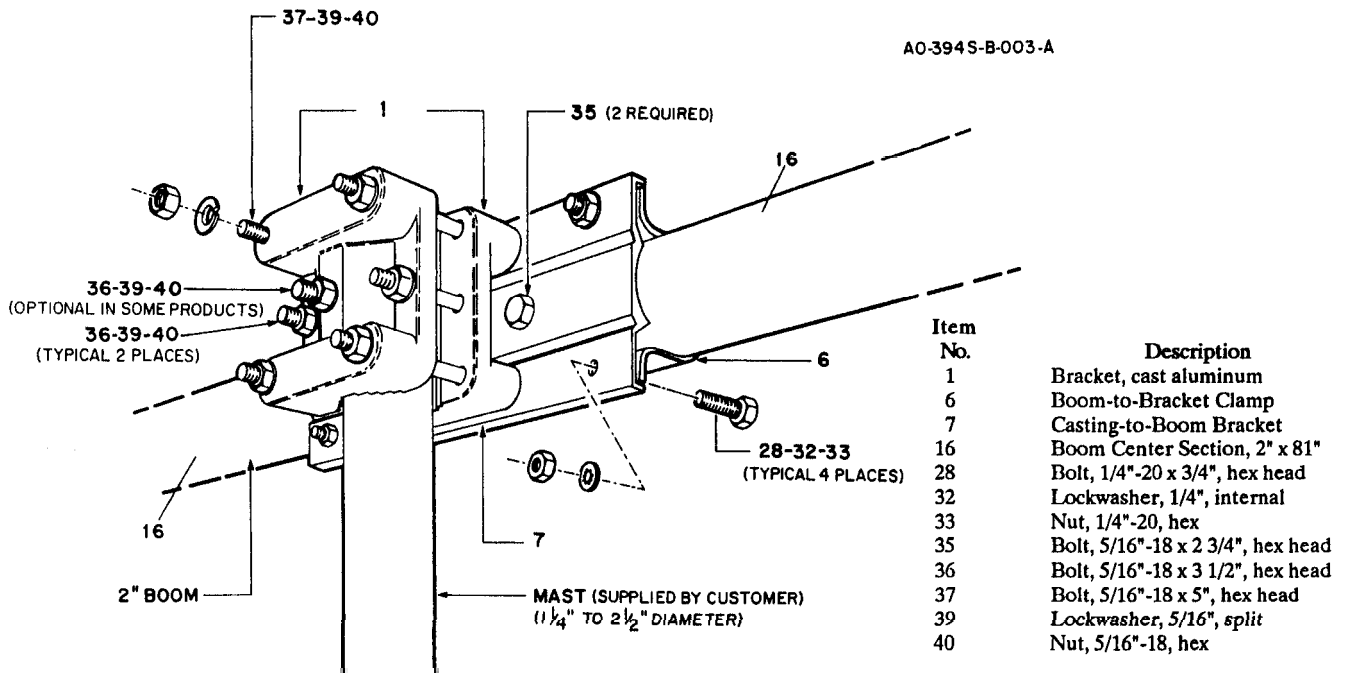
## Assembly of the Boom

Select the two formed boom clamps (Item 6 and 7) and loosely assemble onto the two center boom sections (Item 16), using four of the 1/420 x 3/4" bolts (Item 28), 1/4-20 nuts (Item 33), and 1/4" lockwashers (Item 32), and two of the 5/16-18 x 2 3/4" bolts (Item 35), 5/16-18 nuts (Item 40), and 5/16" lockwashers (Item 39). Refer to Figure 1.

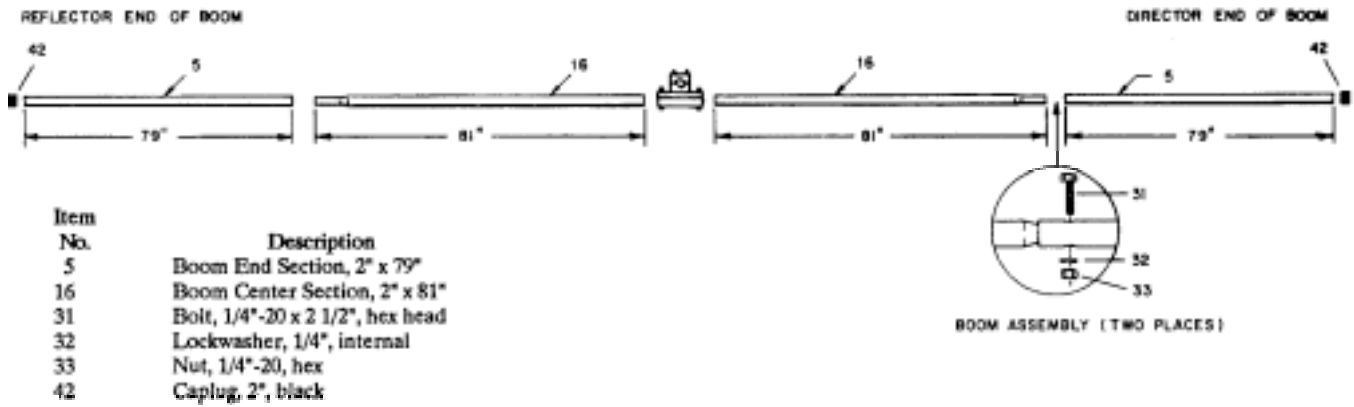
If available, drive a temporary mast into the ground in the center of a large, clear area. Attach the two cast aluminum brackets (Item 1) to the temporary mast at a convenient height, using two of the 5/16-18 x 3 1/2" bolts (Item 36), 5/16-18 nuts (Item 40) and 5/16" lockwashers (Item 39).

Attach the boom assembly to the cast brackets on the temporary mast using four of the 5/16-18 x 5" bolts (Item 37), 5/16-18 nuts (Item 40), and 5/16" lockwashers (Item 39). Tighten all hardware. Refer to Figure 1.

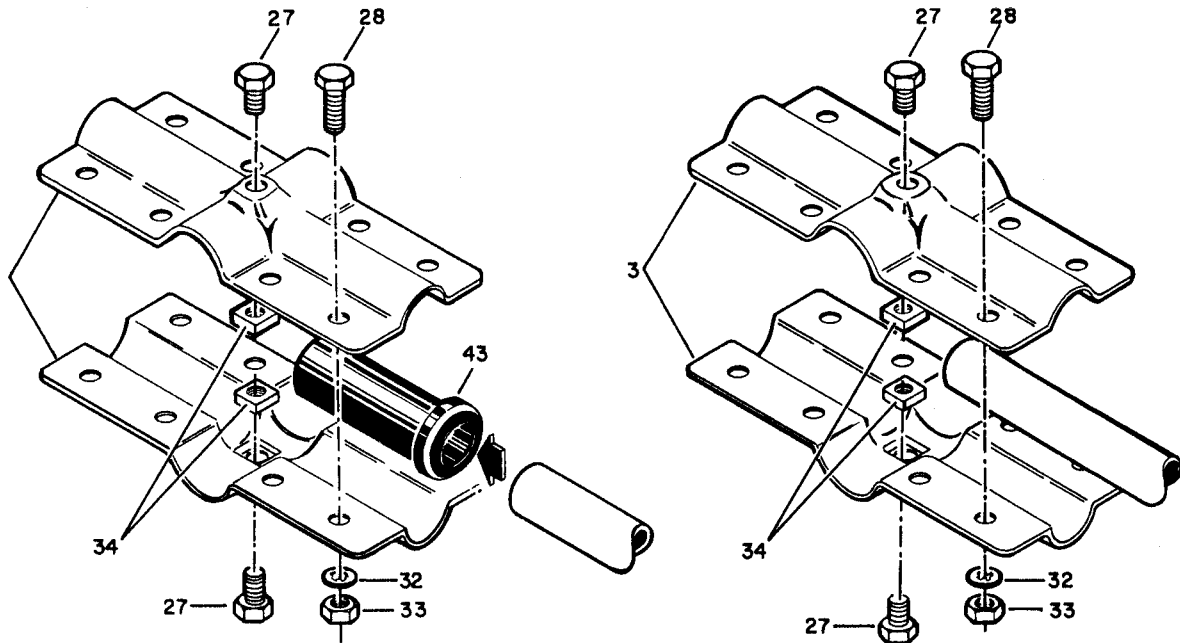
Install the two outer boom sections (Item 5) as shown in Figure 2. Tighten these two bolts at this time. Install the two black caplugs during final assembly.



**Figure 1**  
**Boom-to-Mast Clamp**



**Figure 2**  
**Boom Dimensions and Assembly**



Driven Element Detail

Reflector-Director Detail

Item No.	Description
3	Element-to-Boom Bracket, #13 (small)
4	Element-to-Boom Bracket, #4 (large)
27	Bolt, 1/4"-20 x 3/8", hex head
28	Bolt, 1/4"-20 x 3/4", hex head
32	Lockwasher, 1/4", internal
33	Nut, 1/4"-20, hex
34	Nut, 1/4"-20, square
43	Insulator, driven element

**Figure 3** Element-to-Boom  
Brackets

## Assembly of the Driven Element and Beta Match

Select a set of large sized element-to-boom brackets (Item 4) and loosely assemble on the Reflector end of the boom, approximately 31 5/8" from the center of the boom-to-mast bracket. Refer to Figure 3, 4, and 7.

NOTE: The following steps will have to be done first for one side of the boom, then repeated for the other side.

Select the DE1 section of tubing. Slip the thick walled end (end with extra strength tubing inside) of the DE1 into a Driven Element insulator as shown in Figure 3. Slip the insulated end of the DE1 into the bracket assembled on the boom. Tighten the bolts to hold the element securely, but do not tighten the anchor bolts (in the center of the bracket) at this time.

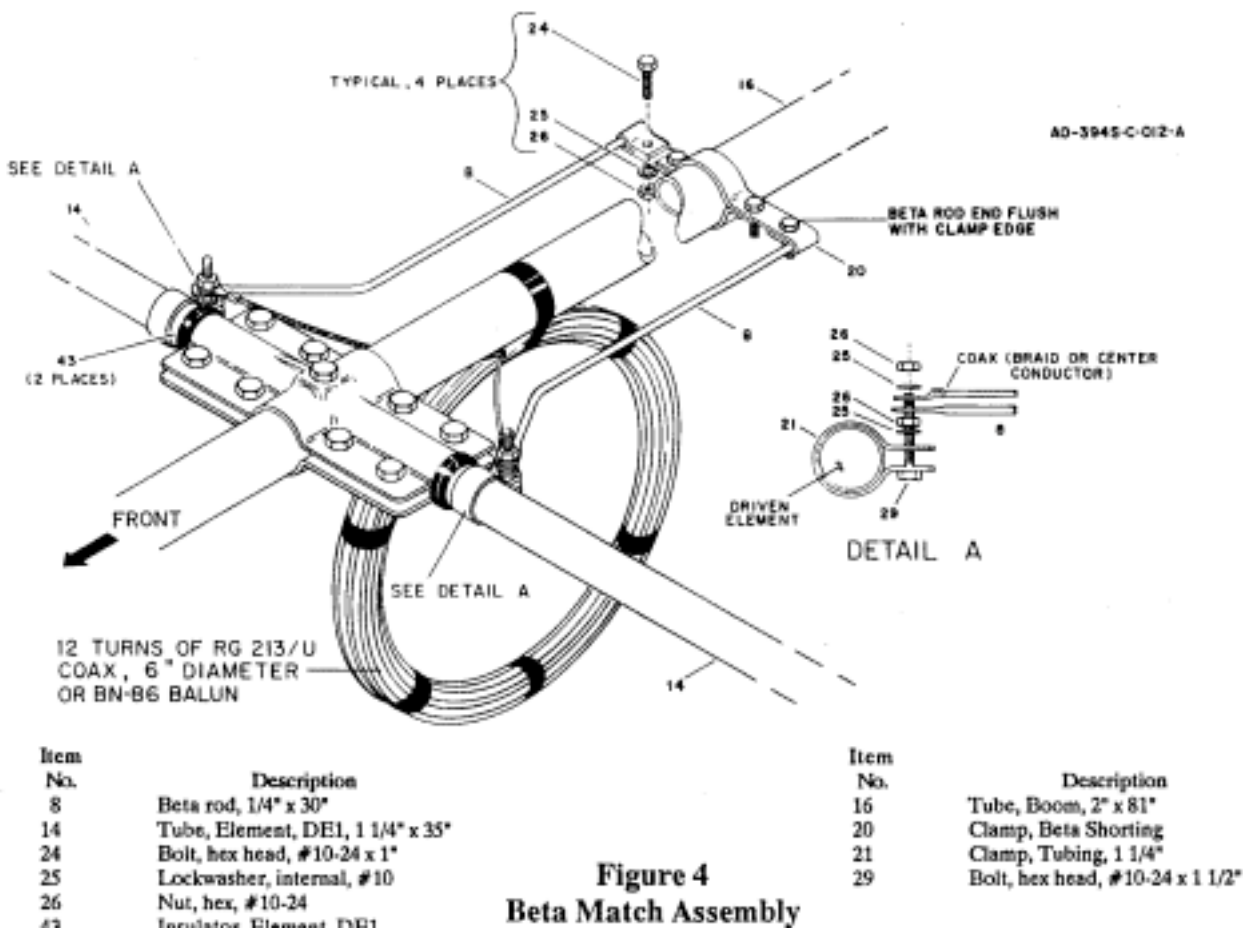
Select the parts listed in Figure 4 and Detail A and assemble them as shown. The beta shorting clamp should be flush with the ends of the beta rods. After attaching your coax cable to the feedpoint, tighten all hardware

NOTE: Do not allow the beta rods or coax cable leads to touch the element-to-boom bracket.

Check to see that the Driven Element will lie in a plane parallel to the earth, then tighten the anchor screws (Item 27) in the bracket

securely.  
Select a # 16 tubing clamp (Item 22) as shown in Figure 5.

NOTE: Figure 5 shows all the clamps and the proper way to align them on the tubing. Slip the #16 tubing clamp (Item 22) over the end of the DE1 section. Select the DE2 section and slip the unswaged end into the DE1 section. Adjust to the dimension shown in Figure 7, then tighten the clamp securely.

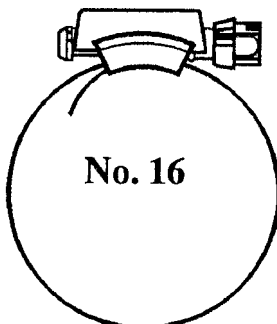
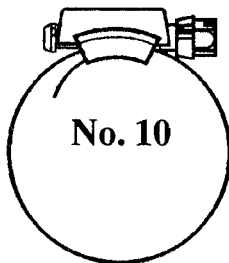
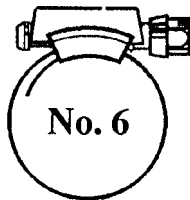
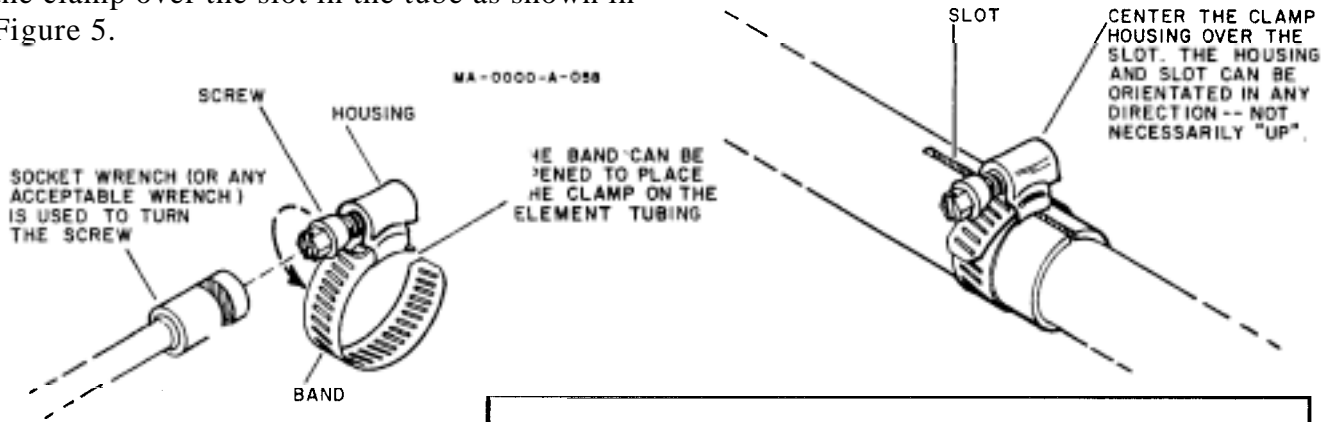


**Figure 4**  
**Beta Match Assembly**

## Installation of Tubing Clamps

Select the proper size tubing clamp as shown in the chart. When installing the clamps, place the clamp near the tube end with the top of the clamp over the slot in the tube as shown in Figure 5.

After adjustment of the tubing lengths, tighten the clamp with a nut driver, socket, or open end wrench until the tubing will not twist or telescope.



Part No.	Description	Fits Tubing Sizes
358759	Clamp, Size #4 all stainless steel 1/4" hex head screw	1/2"

Part No.	Description	Fits Tubing Sizes
358756	Clamp, Size #6 all stainless steel 5/16" hex head screw	1/2 and 3/4"

Part No.	Description	Fits Tubing Sizes
358757	Clamp, Size #10 all stainless steel 5/16 hex head screw	1"

Part No.	Description	Fits Tubing Sizes
358758	Clamp, Size #16 all stainless steel 5/16 hex head screw	1 1/4"

**Figure 5**  
Tubing Clamps

Select a # 10 tubing clamp (Item 21) as shown in Figure 5.

Slip the clamp over the end of the

Select the DE3 section and slip the unswaged end into the DE2 section. Measure the dimensions shown in Figure 7, then tighten the clamp securely.

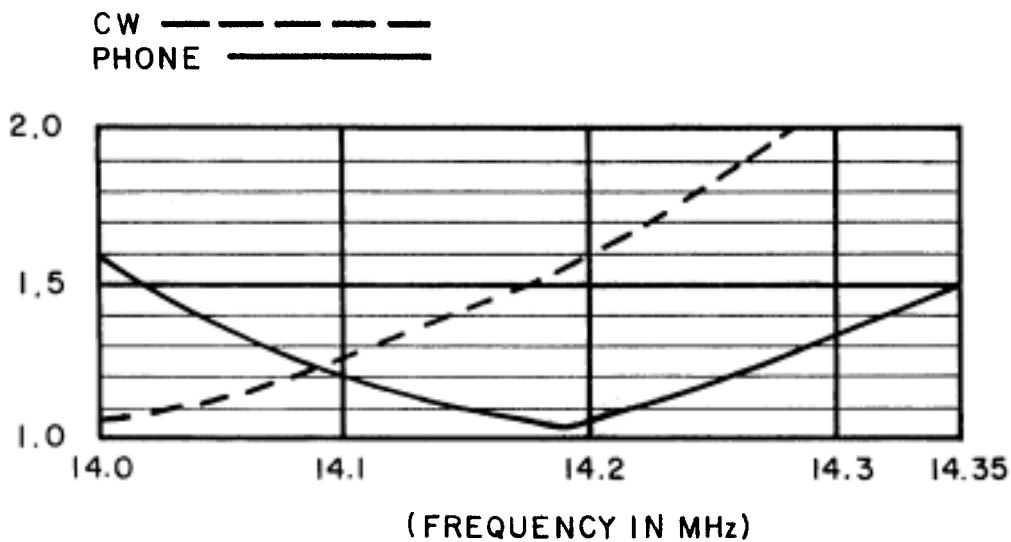
Select a #6 tubing clamp (Item 19) as shown in Figure 5. Slip the clamp over the end of the DE3. Select the DE4 section and slip the unswaged end into the DE3. Measure the dimensions shown in Figure 7, then tighten the clamp securely.

Select a #4 Tubing clamp (Item 18) as shown in Figure 5. Slip the clamp over the end of the DE4.

Select the DE5 section and slip it into the DE4 section. At this time, you must select the mode of transmission you wish to favor, either Phone or Continuous Wave (CW). Adjust the DE5 section to the dimensions shown in Figure 7 for your mode of transmission. Now tighten the clamp securely.

Important

Once you have selected your mode of transmission, either Phone or CW, you must use the same mode for all dimensions. Continuous Wave covers 14.00 to 14.25 MHz with less than 2:1 VSWR. Phone covers 14.00 to 14.35 MHz with less than 2:1 VSWR.

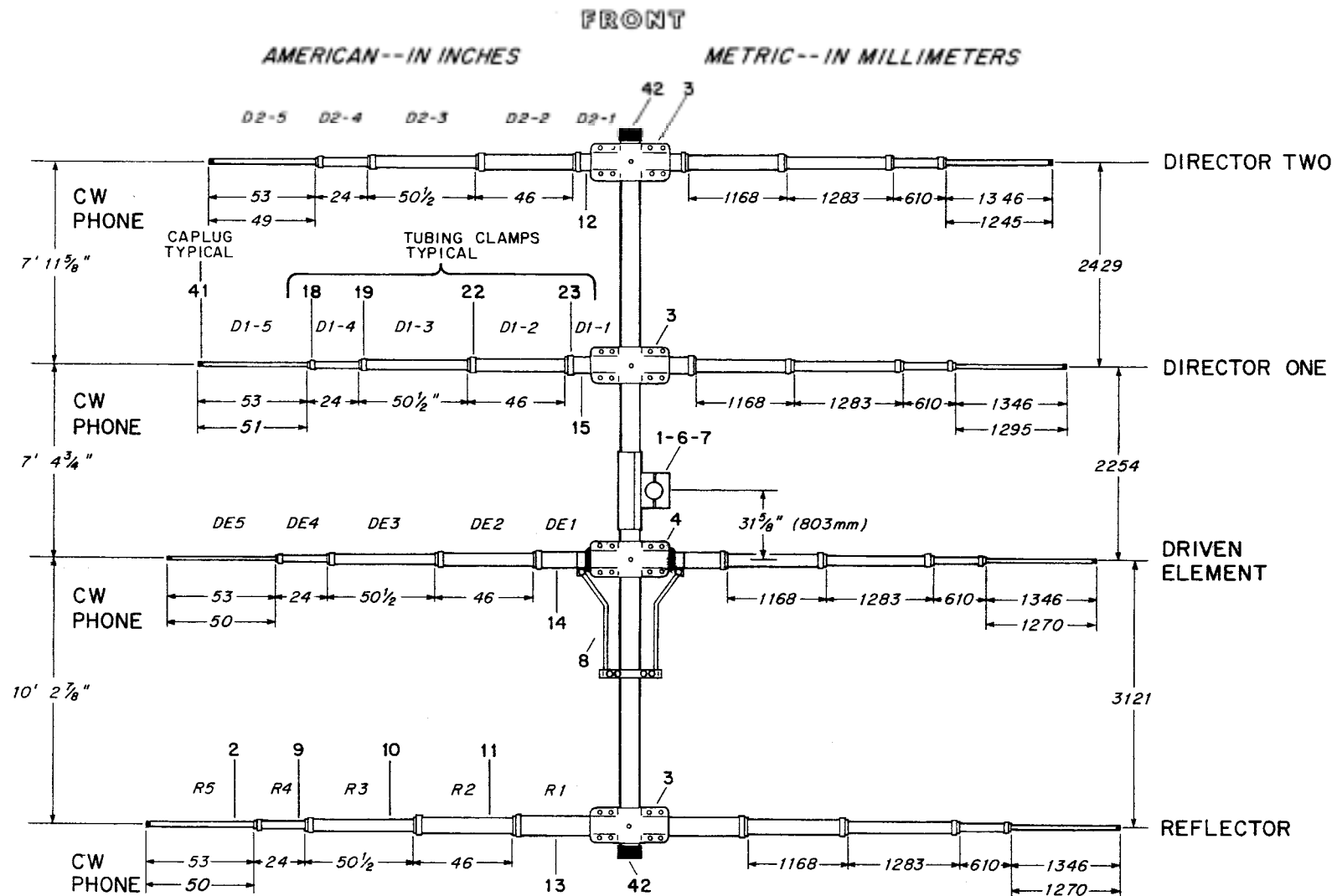


## 20 METERS

Figure 6 VSWR Chart

### VSWR Charts

These VSWR curves are typical for this antenna Mounted 70 feet above ground, horizontally polarized. Similar curves can be expected for this antenna mounted at least 30 feet above ground. Do not try to tune this antenna for low VSWR at ground level.



Item No.	Description
1	Bracket, cast aluminum
2	Element End Section, 7/16" x 55"
3	Element-to-Boom Bracket, #13 (small)
4	Element-to-Boom Bracket, #14 (large)
6	Boom-to-Bracket Clamp
7	Casting-to-Boom Bracket
8	Beta Rod, 1/4" x 30"
9	Element Section 4, 5/8" x 26"
10	Element Section 3, 7/8" x 55"
11	Element Section 2, 1 1/8" x 48"

Item No.	Description
12	D2-1, 1 1/4" x 16 3/4"
13	R-1, 1 1/4" x 44 1/2" w/insert
14	DE-1, 1 1/4" x 35" w/insert
15	D1-1, 1 1/4" x 21" w/insert
18	Clamp, #4 Tubing
19	Clamp, #6 Tubing
22	Clamp, #10 Tubing
23	Clamp, #16 Tubing
41	Caplug, 7/16", black
42	Caplug, 2", black

### **Assembly of the Reflector**

Select a set of small sized element-to-boom brackets and loosely assemble on the Reflector end of the boom as shown in Figures 3 and 7. Assemble the bracket 10' 2 7/8" from the center of the Driven Element bracket to the center of the Reflector bracket.

Select the R1 section and slip the thick walled end (end with extra strength tubing inside) into the bracket assembled on the boom.

Tighten the bolts to hold the element securely but do not tighten the anchor bolts (in center of bracket) at this time.

Check to see that the Reflector element will lie in the same plane as the Driven Element. Carefully recheck the 10' 2 7/8" measurement then tighten the anchor screws securely

Assemble the remainder of the Reflector in the same manner as the Driven Element. Refer to Figure 7 for tubing descriptions and dimensions and Figure 5 for tubing clamp details.

### **Assembly of Director One**

Select a set of small sized element-to-boom brackets and loosely assemble on the boom 7' 4 3/4" from the center of the Driven Element to the center of Director One. Refer to Figure 7.

Select the D 1-1 section and slip the thick walled end (end with extra strength tubing inside) into the bracket assembled on the boom. Tighten the screws to hold the element securely but do not tighten the anchor bolts (in center of bracket) at this time.

Check to see that the Director will lie in the same plane as the other elements and carefully recheck the 7' 4 3/4" measurement then tighten the anchor bolts securely.

Assemble the remainder of Director One in the same manner as the previous elements. Refer to Figure 7 for tubing descriptions and dimensions and Figure 5 for clamp details.

### **Assembly of Director Two**

Select the remaining set of element-to-boom brackets and loosely assemble on the boom 7' 11 5/8" from the center of Director One bracket to the center of Director Two Bracket. Refer to Figure 7.

Slip the D2-1 section into the bracket assembled on the boom. Tighten the bolts to hold the element securely but do not tighten the anchor bolts at this time.

Check to see that Director Two will lie in the same plane as the other elements and carefully recheck the 7' 11 5/8" measurement, then tighten the anchor bolts securely.

Assemble the remainder of Director Two in the same manner as the previous elements. Refer to Figure 7 for tubing descriptions and dimensions and Figure 5 for tubing clamp details.



## Final Element Assembly

After all elements have been installed, align all elements in the horizontal plane and tighten all anchor bolts. Select the dampener rope and cut it into eight equal lengths of 7' 6" each. Slip a rope into the end of each element. With about 1/2" rope extending from the element end, separate the fibers and fold them back over the element end. Refer to Figure 8. Now slip a 7/16" caplug over the element and rope. The rope inside the element will dampen vibrations caused by low wind speeds. Select the 2" caplugs and place one on each boom end. Check all element spacings and dimensions and tighten all bolts before continuing.

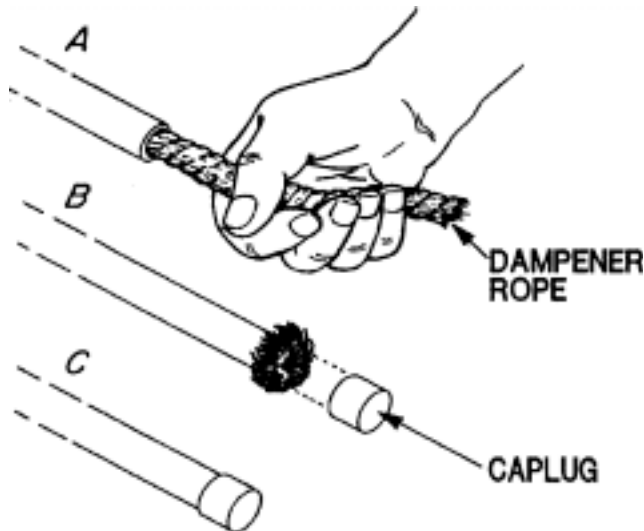


Figure 8 Rope Damper

## Final Assembly

A balun is not required for normal operation of this antenna. However, there are three recommended feedpoint configurations, one of which utilized the Hy-Gain Model BN-86 balun for increased performance.

The first feedpoint configuration involves connection of the coaxial feedline directly to the driven element. The recommended feedline is RG-213/u (such as Belden 8267). Other types of coaxial cable may be used if proper selection and careful assembly are utilized. The feedline should be stripped as shown in Figure 9. Attach solder lugs (not supplied) to the center conductor and shield for easy connection to the driven element.

The second feedpoint configuration involves construction and installation of a homemade RF choke. See Figure 4. The RF choke will prevent RF from flowing on the outside of the coaxial shield. This will block radiation from the coaxial feedline, thereby reducing the risk of TVI and preventing radiation pattern degradation. Wind the RF choke from RG-213/u (or equivalent) coaxial cable. The choke should consist of 12 turns with an inside coil diameter of six inches. Allow enough cable at the end to reach from the mast to the driven element. Strip the coaxial cable as shown in Figure 9. Attach solder lugs (not supplied) to the center conductor and shield for easy connection to the driven element.

The third feedpoint configuration involves using a 50 ohm 1:1 balun to connect the feedline to the driven element. (Hy-Gain Model BN-86 is recommended.) A balun will act as an RF choke and will balance the flow of current on the driven element, resulting in a symmetrical radiation pattern. A balun will also have a coaxial connector, providing more convenience than a coax splice. Follow the instructions supplied with the balun for connection to the antenna

NOTE: Use caution when selecting a balun to use with this antenna. Some baluns are designed for 50-75 ohm impedance and may result in a higher SWR when used with this antenna. For best results, use the Hy-Gain Blot-S6, 50 ohm balun. The Model Bbl-g6 is available at your local Icy-Gain dealer.

#### Weatherproofing

To prolong the life of this product in or around coastal areas, it is recommended that all coaxial connectors be encapsulated with Coax-Seal® or another similar substance.

The stainless steel hardware requires no further protection.

### Installing the Antenna IMPORTANT

Model 204BA-S is a fairly large antenna and requires some consideration as to how you are going to get it to the top of the tower. There are two methods available.

Method One: Completely assemble the antenna on the ground, then hoist it into position using the setup as shown in Figure 10.

Method Two: Assemble the antenna on the ground in halves, then hoist each half up the tower. Assemble the antenna and attach to the boom-to-mast bracket. See Figure 11.

Mount the antenna on your mast using one of the two methods shown in Figures 10 and 11. Tighten all screws in the boom-to-mast bracket securely.

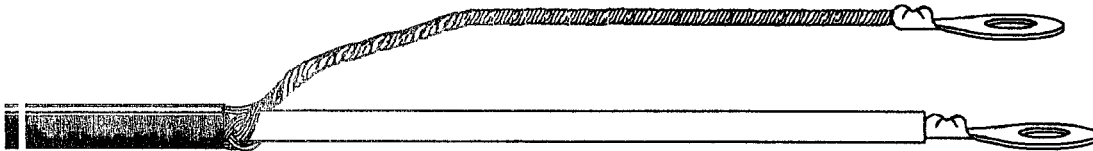


Figure 9 Coax Stripping  
Details

## 174BA Option

This antenna may be adjusted to operate on the new 17 meter (0) MHz band. The new dimensions are

R3, DE3, D1-3, D2-3.....	25" (635 mm)
R5 .....	30 3/4" (781 mm)
DE5.....	29 1/2" (749 mm)
D1-5 .....	36 1/4" (927 mm)
D2-5 .....	35 3/4" (908 mm)
R-DE spacing .....	97 1/2" (2,477 mm)
DE-D1 spacing .....	70 1/2" (1,791 mm)
D1-D2 spacing .....	76" (1,930 mm)
DE to Beta short (center to center) .....	18" (457 mm)
DE to mast bracket (center to center).....	31 5/8"

Using these dimensions, the antenna will have the following new specifications at 18.1

### SPECIFICATIONS

Power Gain .....	8.35 dBi (6.20 dBd)
Front-to-Back .....	24.4 dB
VSWR.....	1.06:
1 Boom Length (used).....	21 feet (6.4 m)
Longest element.....	28'6 1/2" (8.7 m)
Turning radius .....	18' (5.5 m)

## WARNING

When installing your system, take extreme care to avoid any accidental contact with power lines or overhead obstructions. Failure to exercise this care could result in serious or fatal injury.

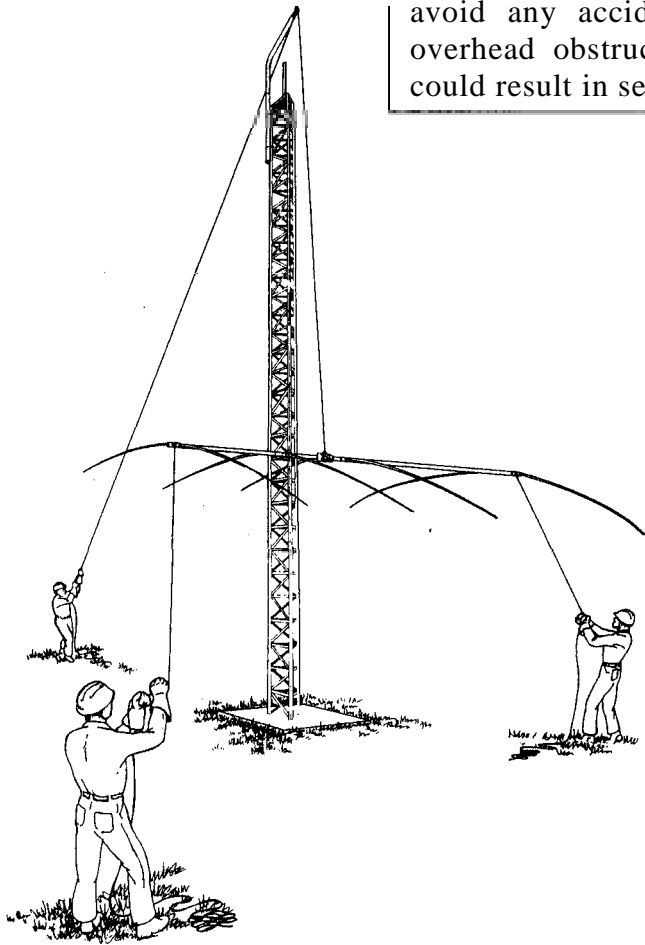


Figure 10 Complete Antenna Installation

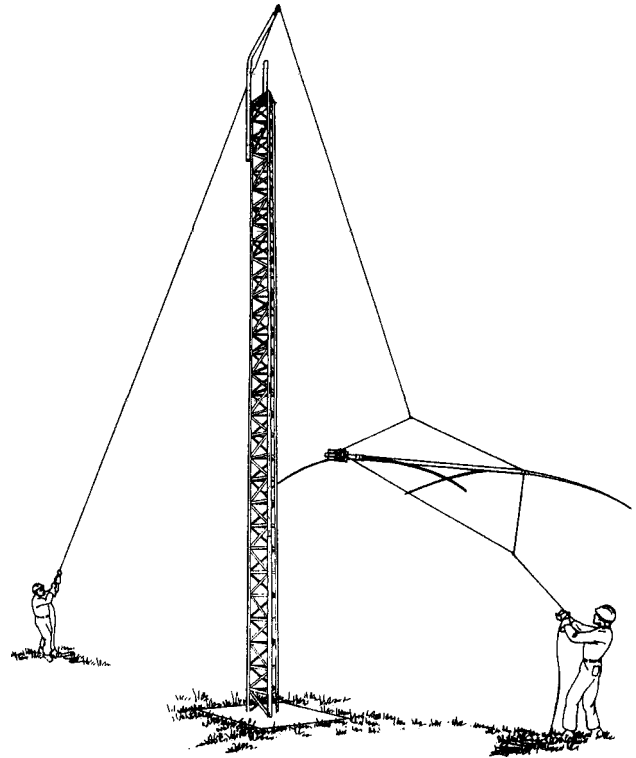


Figure 11 Half Antenna Installation

NOTE: The boom-to-mast brackets have a hole through their center to allow securing to the mast with the 5/16"-18 x 3 1/2" bolt. It is recommended that the mast be removed and 11/32" hole be drilled at the desired mast clamp position, then reinstall the mast. If this is not possible, the clamp will hold its position on the mast in all but the most severe weather conditions.

Securely tape the feedline to the mast and your Model 26413A-S is ready for use.

### Lightning Protection

You must ground your antenna supporting structure. This will also insure noise-free operation. A proper ground consists of a 1/2" x 8' copper clad, steel ground rod driven into the ground 12 inches from the base of your tower or mast. Connect the rod to the tower or mast using #8 copper wires and commercial, noncorrosive ground clamps.

## PARTS LIST

Item No.	Part No.	Description Qty
1	102734	Bracket, cast aluminum ..... 2
2	174939	Element End Section, 7/16" x 55..... 8
3	165919	Element-to-Boom Bracket, #13 (small) ..... 6
4	165920	Element-to-Boom Bracket, #14 (large) ..... 2
5	171029	Boom End Section, 2" x 79..... 2
6	172732	Boom-to-Bracket Clamp ..... 1
7	172735	Casting-to-Boom Bracket ..... : . . . 1
8	179786	Beta Rod, 1/4" x 30" ..... 2
9	190006	Element Section 4, 5/8" x 26 "..... 8
10	190206	Element Section 3, 7/8" x 55" ..... 8
11	190300	Element Section 2, 11/8" x 48..... 8
12	190906	D2-1, 11/4 <sup>11</sup> x 16 3/4" ..... 2
13	871044	R-1, 11/4" x 44 1/2" w/insert ..... 2
14	878579	DE-1, 11/4" x 35" w/insert ..... 2
15	871046	D1-1, 11/4 <sup>11</sup> x 21" w/insert ..... 2
16	871048	Boom Center Section, 2" x 81" ..... 2
17	690190	Rope, 5/32" x 60..... 1
	878581	Parts Pack 3945, Clamps ..... 1
18	358759	Clamp, #4 tubing ..... 8
19	358756	Clamp, #6 tubing ..... 8
20	163371	Beta Clamp, shorting ..... 2
21	171333	11/4" tubing clamp ..... 2
22	358757	Clamp, #10 tubing ..... 8
23	358758	Clamp, #16 tubing ..... 8
	878580	Parts Pack 394S, hardware ..... 1
24	504069	Bolt, # 10-24 x 1", hex head ..... 4
25	565697	Lockwasher, #10, internal ..... 10
26	554071	Nut, #10-24, hex ..... 8
27	500156	Bolt, 1/4"-20 x 3/8", hex head ..... 8
28	505266	Bolt, 1/4"-20 x 3/4", hex head ..... 36
29	500159	Bolt 10-24 x 1 1/2 hex head ..... 2
30		(Not Used)
31	505734	Bolt, 1/4"-20 x 2 1/2", hex head ..... 2
32	562961	Lockwasher, 1/4", internal ..... 38
33	554099	Nut, 1/4"-20, hex ..... 40
34	551367	Nut, 1/4"-20, square ..... 10
35	506968	Bolt, 5/16"-18 x 2 3/4", hex head ..... 2
36	500154	Bolt, 5/16"-18 x 3 1/2", hex head ..... 3
37	500153	Bolt, 5/16"-18 x 5", hex head ..... 4
38		(Not Used)
39	564792	Lockwasher, 5/16", split ..... 9
40	555747	Nut, 5/16"-18,hex ..... 9
	872241	Parts Pack B, 204BA ..... 1
41	455644	Caplug, 7/16", black ..... 10
42	455625	Caplug,2",black ..... 2
43	465833	Insulator, driven element ..... 2

When ordering replacement parts, include the product number (394S), the part number, and the full description.

### **Converting American Measurements to Metric**

Use this scale to identify lengths of bolts, diameters of tubes, etc.. The American inch (") and foot (') can be converted to centimeters in this way.

$$1 \text{ inch (1")} = 2.54 \text{ cm}$$

$$1 \text{ foot (1')} = 30.48 \text{ cm}$$

Example:

$$42" \times 2.54 = 106.7 \text{ cm}$$

