



# ORDER NO. 2085-1 MODEL 28 FM

8 Element, 2-Meter Beam

PN 801318-

## INSTRUCTION MANUAL

### General Description

This antenna is an 8 element, optimum spaced, 2 meter beam. It features extremely high forward gain, a clean radiation pattern and an excellent front-to-back ratio. The dimensions shown in Figure 2 produce a radiation pattern with low sidelobes and backlobes over the entire 2 meter band. This antenna comes with stainless steel hardware for all electrical and most mechanical connections, and now features a new boom-to-mast bracket that will allow mast sizes of 15/8" to 2 1/16" in diameter.

### SWR and Feedline

The 28 FM antenna has an input impedance of 200 ohms. The supplied balun matches the input to 50 ohms. If you are using transmission line with a characteristic impedance other than 50 ohms or 200 ohms, a matching device must be made. Refer to any current Amateur Handbook for information on constructing a matching device.

### Specifications

#### Mechanical

Boom Length .....	148 3/4" (3.78 m)
Longest Element .....	40 1/4" (1.022 m)
Net Weight .....	4.1 lbs. (1.9 kg)
Turning Radius .....	75 1/8" (1.98 m)
Wind Survival.....	80 mph (129 kmph)
Mast Diameter.....	1 5/8" to 2 1/16" (41 mm to 52 mm)
Boom Diameter.....	1 1/4" O.D. (32 mm)
Wind Area.....	1.26 sq. ft. (0.12 m <sup>2</sup> ) (vertical) 1.02 sq. ft. (0.09 m <sup>2</sup> ) (horizontal)

#### Electrical

Gain.....	14.0 dBi (11.8 dBd)
Front-to-Back Ratio .....	20 dB
Maximum SWR .....	2:1
Bandwidth .....	4 MHz
Maximum Power .....	250 watts continuous, 500 watts P.E.P.
Impedance.....	50 ohms (with balun)
Half-Power Beam Width.....	43° (vertical polarization) 36° (horizontal polarization)
Broadside Stacking Distance .....	123" (3.12 m) (82" [2.08 m] minimum)

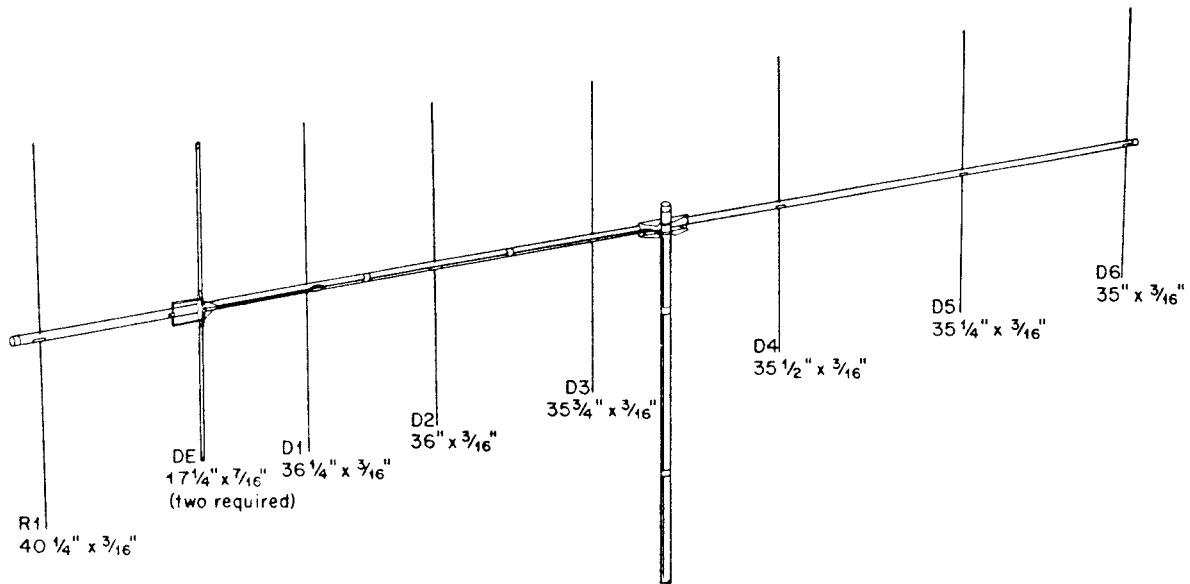


Figure I  
Overall View

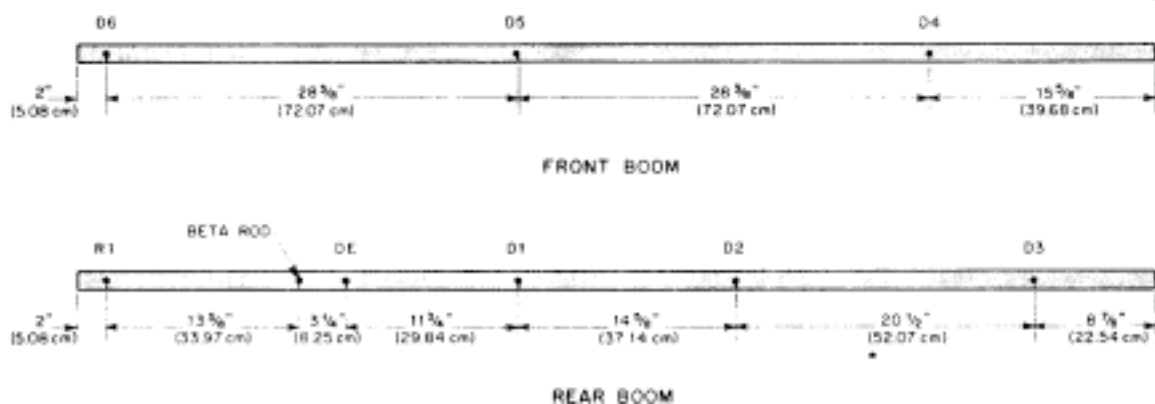


Figure 2  
Front and Rear Boom Detail

## Tuning

NOTE: The Driven and Parasitic Elements are adjusted independently in the following manner.

**Parasitic Elements:** This antenna is pretuned for maximum gain and best radiation pattern at 144 MHz. This setting will give good performance over the entire 144-148 MHz band.

If you wish to optimize the antenna for a frequency higher than 144 MHz, cut 1/4" off of the total element lengths for each MHz higher than 144 MHz.

**Driven Element:** SWR can be lowered to less than 1.2:1 at a desired frequency by carefully trimming the driven element. Keep the element symmetrical by cutting the same amount from each side. Typical SWR curves are shown in Figure 3A, and a cutting chart is shown in Figure 313. Each installation is slightly different, so cut the driven element for the lower SWR at your particular location. Measure the SWR as close to the antenna as you can for accurate results.

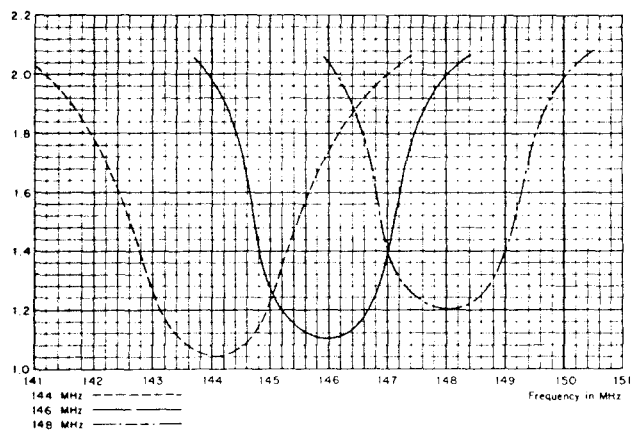


Figure 3A  
VSWR for Horizontal Polarization Only

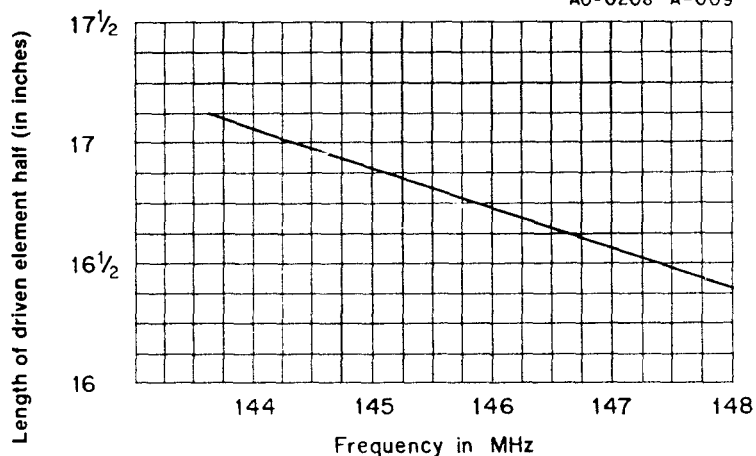


Figure 3B  
Driven Element Cutting Chart

### Stacking

The antenna can be easily stacked for approximately 3 dB more gain each time the number of yagi is doubled. Refer to Figure 4 for stacking and phasing harness cutting information.

The two phasing lines coming from the two antennas to the "T" connector can be any odd multiple of one-quarter wavelength in the 75 ohm transmission line. See Figure 5.

NOTE: When phasing two antennas, the Driven Element halves that are connected directly to the phasing lines should be on the same side of the array.

The feedline impedance is for 50 ohms (RG-8/u). For detailed information on stacking more than two yagis, please consult any current Amateur Handbook.

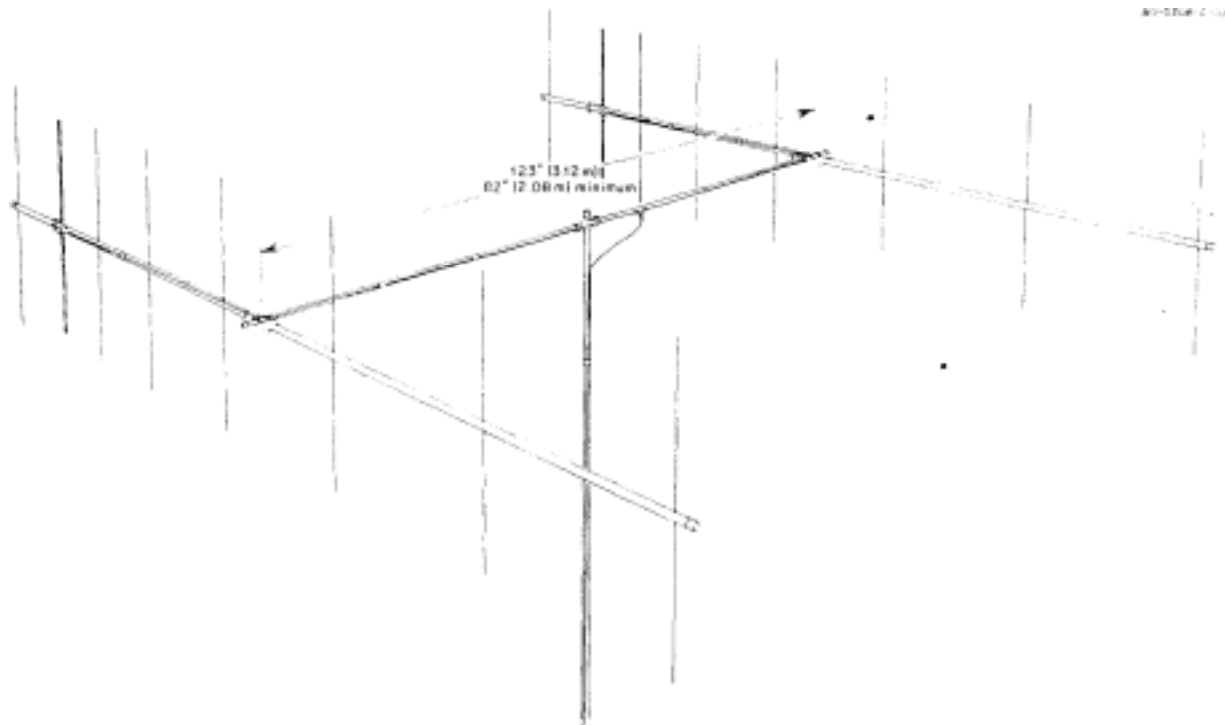


Figure 4 Stacking Two  
(2) Antennas

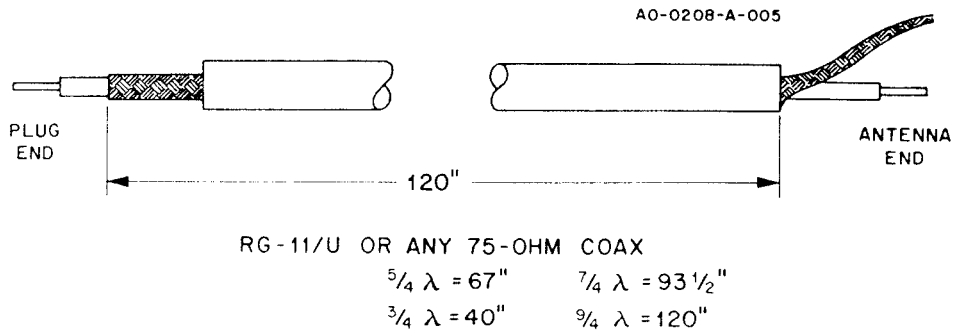


Figure 5 Phase Line Cutting  
Dimensions

## Installation

This antenna fits a 1 5/8" to 2 1/16" outside diameter mast.

Mount the antenna in the clear. Surrounding objects-particularly power lines and other objects of considerable mass or length -are detrimental to the performance of the antenna.

### WARNING

Do not allow any part of the antenna to touch power lines. This could cause severe burns or fatal injuries.

When mounting the 208S-1 with an HF beam antenna on the same mast, the 208S-1 should be on top. If the 208S-1 is to be vertically polarized, separation of the two antennas should be at least 2 feet. If the 208S-1 is to be horizontally polarized, separation should be at least 6 feet.

The mast, if metallic, should never be run completely through the plane of the elements. Slightly reduced performance will be noticed if a vertically polarized 208S-1 is mounted at the top of a metallic mast as shown in Figure 1. Horizontally polarized mounting will not be affected. For optimum performance with a vertically polarized 208S-1, a wooden mast should be used and the coax routed past the reflector then dropped to the mast.

The antenna can be mounted either vertically or horizontally for FM or SSB/CW operation respectively. Circular polarization can be obtained by using two yagis. For information about which polarization to use consult local Amateurs who use the frequencies you desire.

## Step-by-Step Assembly

Remove the parts from the carton and check them against the Parts List and the illustrations.

Select the boom back-up plate, the boom-to-mast bracket and the four (4) 1/4"-20 x 3/4" bolts, 1/4" lockwashers and nuts.

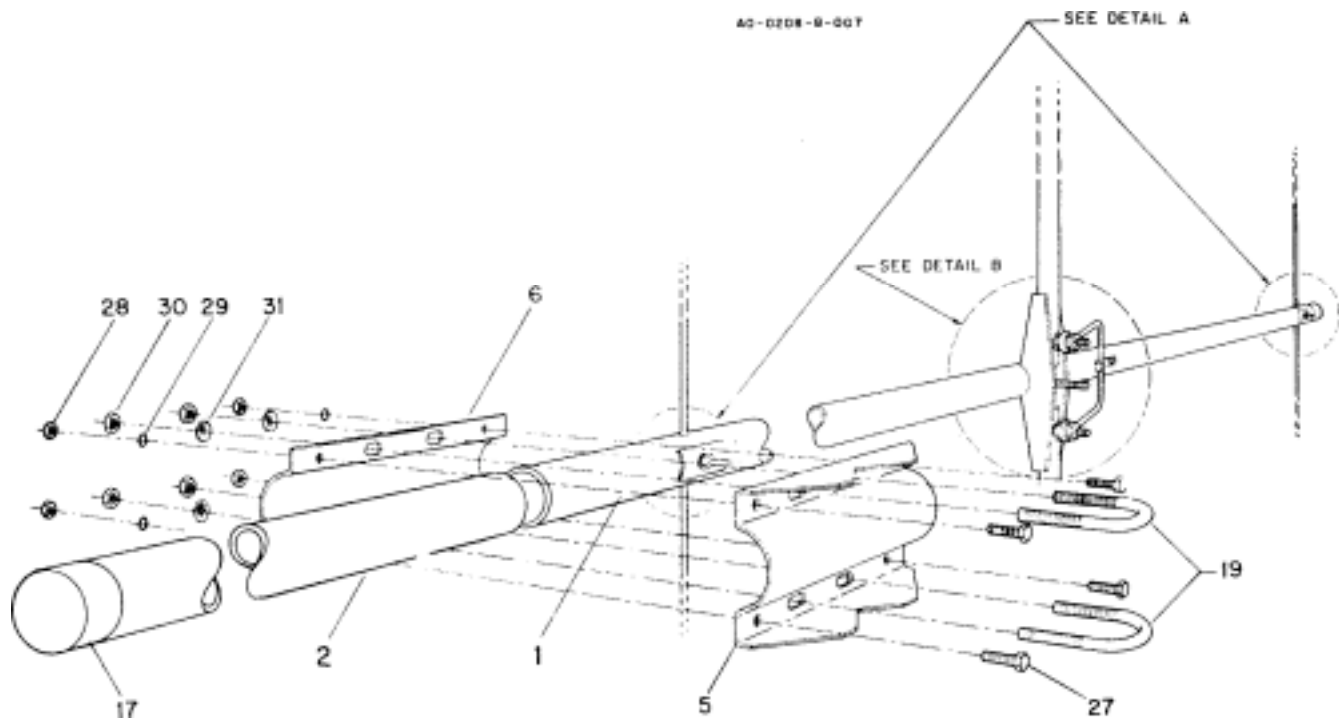
Place the boom-to-mast bracket on the boom as shown in Figure 6. The front and rear boom sections should meet in the middle of the boom-to-mast bracket. Use the 1/4"-20 x 3/4" bolts in the outside holes. Leave the inside holes for the two (2) U-bolts, which will be used later for mounting the mast. Select either the vertical or horizontal mounting position. Adjust the boom accordingly before tightening the bolts securely.

Select the R1 (40 1/4" rod). Use a pencil to place a mark at the center of the rod (20 1/8" from either end). Place two more marks 5/8" from each side of the center mark.

Place a #10-24 x 1 1/2" eyebolt into the R1 slot as shown in Figure 6, Detail A. Slide the R1 through the holes and the eyebolt until the outer two marks on the R1 are visible on each side of the boom. Slip on an aluminum half-washer, a lockwasher and a # 10 nut. Tighten it just enough to hold the rod securely. **DO NOT OVER TIGHTEN.**

Select the element-to-boom insulator, two sections of the Driven Element (DE) 7/16" x 17 1/4" tubing) and a beta rod. See Figure 6, Detail B.

40-0208-B-007



**Item No.**

**Description**

- 1 Boom, Rear, 1 1/4" x 74 3/8"
- 2 Boom, Front, 1 1/4" x 74 3/8"
- 5 Clamp, Boom-to-Mast
- 6 Back-Up Plate
- 17 Caplug, 1 1/4"
- 19 U-Bolt, 5/16" x 3 5/8"
- 20 Eyebolt, #10-24 x 1 1/2" x 5/16"
- 21 Half-Washer, aluminum

**Item No.**

**Description**

- 25 Nut, hex, #10-24
- 26 Lockwasher, internal, #10
- 27 Bolt, hex head, 1/4"-20 x 3/4"
- 28 Nut, hex, 1/4"-20
- 29 Lockwasher, internal, 1/4"
- 30 Nut, hex, 5/16"-18
- 31 Lockwasher, split, 5/16"

Figure 6 Boom-to-Mast Clamp Assembly

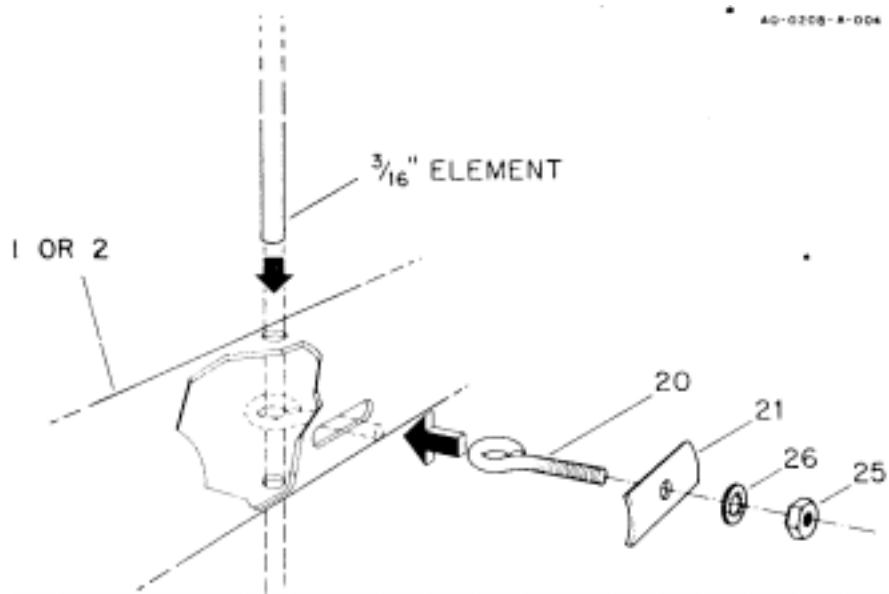
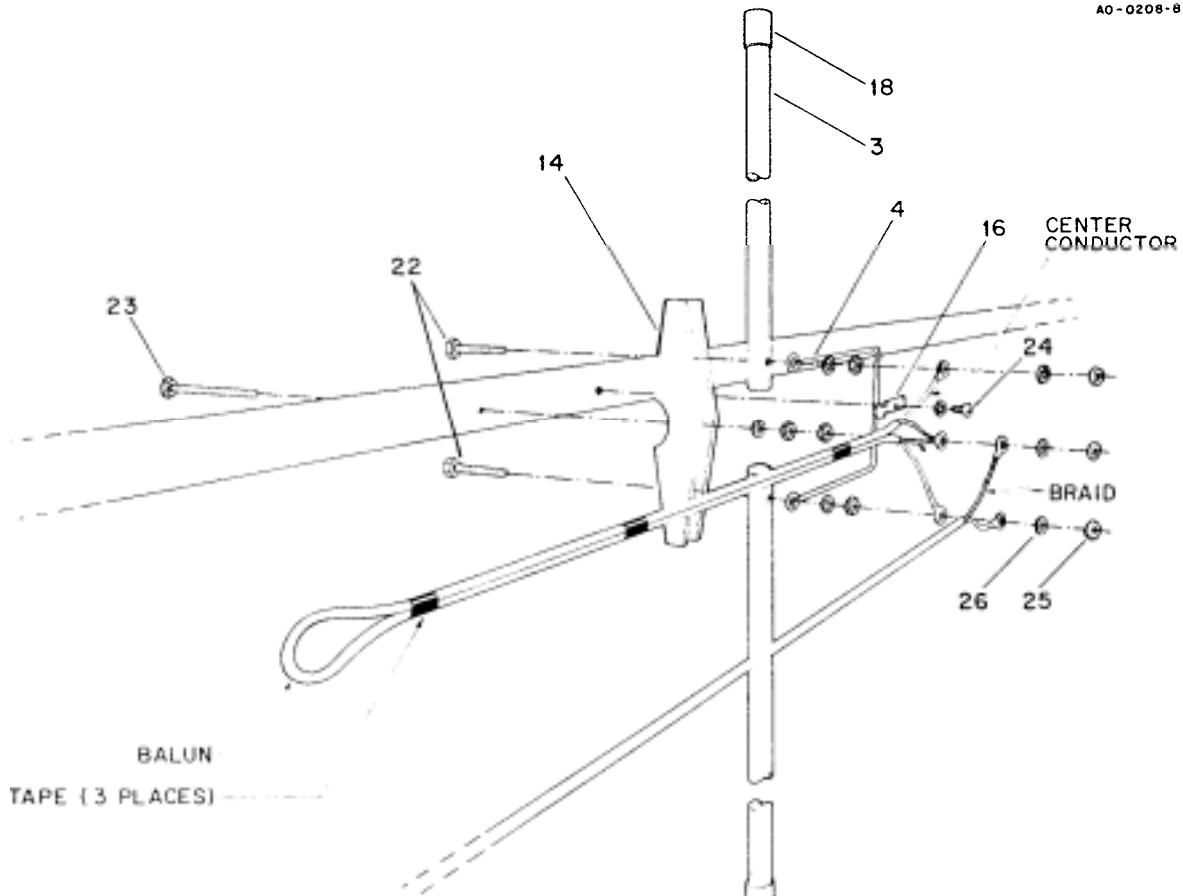


Figure 6-Detail A Parasitic Element Attachment



Item No.	Description	Item No.	Description
3	Driven Element, 7/16" x 17 1/4"	22	Bolt, hex head, #10-24 x 1 1/2"
4	Beta Rod, 3"	23	Bolt, hex head, #10-24 x 2 1/2"
14	Insulator (Driven Element-to-Boom)	24	Screw, pan head, Type A, #10 x 3/8"
16	Beta Clip	25	Nut, hex, #10-24
18	Caplg, 7/16", with hole	26	Lockwasher, internal, #10

**Figure 6-Detail B Driven Element, Beta Match and Balun Assembly**

NOTE: If 50 ohm coaxial cable is used to feed the antenna, select the supplied balun at this

Use the #10-24 x 2 1/2" bolt to fasten the element-to-boom insulator to the boom. Refer to Figure 6, Detail B.

Use the two (2) #10-24 x 1/4" bolts to assemble the Driven Element as shown in Figure 6, Detail B. Pay particular attention to the connections of the beta rod, balun and feedline.

Water proof the connection with neoprene, Krylon®, or some similar substance.

Install caplugs on **the ends of the booms and the Driven Element.**

Use the #10 x 3/8" screw to fasten the beta rod shorting clip over the beta rod, as shown in Figure 6. Detail B.

Select the following rods: D1 (36 1/4" long), D2 (36" long), D3 (35 3/4" long), D4 (35 1/2" long), D5 (35 1/4" long), and D6 (35" long). Mark the center point on each rod, then make two more marks 5/8" on either side of the center mark. Secure the elements to the boom as shown in Figure 1 and Figure 6, Detail A. Be sure they are oriented as shown.

Slip the two (2) U-bolts into the boom-to-mast bracket and fasten it to the mast securely.

Tape the coax feedline and balun to the boom and to the mast. Be sure to insulate any connection from the boom or the mast. This completes your installation.

# PARTS LIST

Item No.	Part No.	Description	Qty
1	170391	<b>Booth</b> , Rear, 11/4" x 74 3/8,".....	1
2	170388	Boom, Front, 11/4" x 74 3/8".....	1
3	175157	Driven Element, 7/16" x 17 1/4".....	2
4	160040	Beta Rod, 3" .....	1
5	385142-1	Clamp, Boom-to-Mast.....	1
6	385144-1	Back-Up Plate.....	1
7	160038	R1, 40 1/4" x 3/16".....	1
8	160017	D1, 36 1/4" x 3/16".....	1
9	160018	D2, 36" x 3/16".....	1
10	160019	D3, 35 3/4" ".....	1
11	160020	D4, 35 1/2" x 3/16".....	1
12	160022	D5, 35 1/4" x 3/16".....	1
13	160023	D6, 35" x 3/16" .....	1
14	465420	Insulator (Driven Element-to-Boom) .....	1
15	871704	Balun Assembly, 2-meter .....	1
	872071-1	Parts Pack 208S-1, Stainless Steel .....	1
16	163266	Beta Clip.....	1
17	455630	Caplug, 11/4 ".....	2
18	475639	Caplug, 7/16", with hole.....	2
19	540067	U-Bolt, 5/16" x 3 5/8".....	2
20	540065	Eyebolt, #10-24 x 1 1/2" x 5/16".....	7
21	170376	Half-Washer, aluminum.....	7
22	500159	Bolt, hex head, #10-24 x 1 1/2".....	2
23	500164	Bolt, hex head, #10-24 x 2 1/2".....	1
24	510670	Screw, pan head, Type A, #10 x 3/8.....	1
25	554071	Nut, hex, # 10-24.....	14
26	565697	Lockwasher, internal, #10 .....	15
27	505266	Bolt, hex head, 1/4"-20 x 3/4".....	4
28	554099	Nut, hex, 1/4"-20 .....	4
29	562961	Lockwasher, internal, 1/4".....	5
30	555747	Nut, hex, 5/16"-18 .....	4
31	564792	Lockwasher, split, 5/16" .....	4



## **hy-gain**® LIMITED WARRANTY

**Hy-Gain** Warrants to the original owner of this product, if manufactured by **Hy-Gain** and purchased from an authorized dealer or directly from **Hy-Gain** to be free from defects in material and workmanship for a period of 12 months for rotator products and 24 months for antenna products from date of purchase provided the following terms of this warranty are satisfied.

1. The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original or machine reproduction of such proof of-purchase to **Hy-Gain** at the time of warranty service. **Hy-Gain** shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, or forgery shall be cause to void any and all warranty terms immediately.
2. **Hy-Gain** agrees to repair or replace at **Hy-Gain's** option without charge to the original owner any defective product under warranty, provided the product is returned postage prepaid to **Hy-Gain** with a personal check, cashiers check, or money order for \$8.00 covering postage and handling.
3. Under no circumstances is **Hy-Gain** liable for consequential damages to person or property by the use of any **Hy-Gain** products.
4. Out-of-warranty Service: **Hy-Gain** will repair any out-of-warranty product provided the unit is shipped prepaid. All repaired units will be shipped COD to the owner. Repair charges will be added to the COD fee unless other arrangements are made.
5. This warranty is given in lieu of any other warranty expressed or implied.
6. **Hy-Gain** reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.
7. All **Hy-Gain** products to be serviced in-warranty or out-of-warranty should be addressed to **hy-gain, 308 Industrial Park Road, Mississippi 39759, USA** and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase.
8. This warranty gives you specific rights, and you may also have other rights which vary from state to state.