



Model UB-7031DX

70 cm / 31 Element Yagi
for SSB/CW DXing

INSTRUCTION MANUAL

GENERAL DESCRIPTION

The Hy-Gain Model 70-31 DX is a high-performance yagi antenna for SSB/CW DX'ing in the Amateur 70 cm band.

It features 31 elements on a 24 foot (10.4 wavelength) boom, with the ultimate in high gain, low sidelobes, and high front-to-back ratio. It also features an encapsulated feedpoint and a weatherproof type N connector for use in all types of climates. The usable frequency range of 420-438 MHz makes the 70-31 DX suitable for 432 MHz EME and terrestrial DX, 435-437 MHz satellite communications, and 420-430 MHz ATV. The 70-31 DX antennas may be easily stacked for increased performance.

ELECTRICAL DESIGN

The 70-31 DX design is based upon the DL6WU log-tapered design information, with enhancements to the gain, sidelobe levels, and front-to-back.

Performance was verified by testing on Hy-Gain's antenna range and by computer modelling with the NEC-3 and YO-4 codes. The antenna's performance characteristics were optimized for the 432-436 MHz frequency range. This improves the antenna's performance in rainy, icing and snowy conditions at 432 MHz.

MECHANICAL DESIGN

The 70-31 DX mechanical design features a 6-section boom which can be easily disassembled and reassembled for portable operations. An adjustable 7/8" and 1" O.D. tubular boom support is included to reduce boom droop when using heavy, low loss coaxial cable or under severe icing conditions. The boom-to-mast bracket and boom support can be adjusted for best balance in an EME array. The boom support may be installed above or below the boom.

Most hardware is stainless-steel including the element retaining rings (pushnuts). All insulators are UV protected. The coaxial balun assembly is made from high-quality RG-303/u and RG-142 B/u PTFE dielectric and FEP jacketed coaxial cable.

SPECIFICATIONS

Electrical

Gain.....	17.6 dBd at 432.1 MHz
Beamwidth.....	19 x 20 degrees
Front-to-Back.....	28 dB
Sidelobe Levels.....	-17 dB
Typical VSWR.....	1.2:1
Maximum Power.....	1 kW Ave./2 kW PEP
Frequency Range (usable).....	420-438 MHz
Electrical Boom Length.....	10.42 Wavelengths
Connector.....	Type N - Female

SPECIFICATIONS

Mechanical

Number of Elements.....	31
Element Diameter	3/16 in. (4.8 mm)
Element Lengths	10 1/2 - 13 7/8 in. (267-352 mm)
Boom Diameter	1 - 1 1/4 in (25-32 mm)
Boom Length.....	288 3/4 in [(24.06 ft.) (7.33 m)]
Turning Radius (max.).....	12' - 7" (3.8 m)
Wind Area	1.9 sq. ft. (0.18 sq. m)
Weight (net).....	9.25 lbs (4.2 kg)
Boom Support	tubular 7/8 in., 1 in. (22 mm, 25 mm)
Mast Size Accepted	1 1/2 - 2 1/16 in. (38-52 mm)
Polarization	Horizontal

PREPARATION FOR ASSEMBLY

FOR OUR OVERSEAS CUSTOMERS: If you use the Metric System, see the American-to-Metric Conversion table in the rear of this manual. Most illustrations in this manual will provide both American and Metric Dimensions.

Choose a moderate-sized clear area to assemble the 70-31 DX Beam. The area must be at least 24" x 63" for each boom section. A bench-vice with jaws no wider than 6 inches is recommended to hold the booms while the elements are being installed. An alternate method is to drive a 5' (1.5 m) length of mast material into the ground and attach the entire boom and boom-to-mast bracket to this mast temporarily during assembly. If you assemble this antenna over a grassy area, precautions should be taken so that hardware is not accidentally lost during assembly. A concrete driveway is an excellent area for assembly.

TOOLS: The following tools are required for easy assembly of the 70-31 DX Beam:

Qty	Tool Type
1	Tape Measure, 12 ft.
1	Nut Driver, 1.2 inch
1	Nut Driver, 7/16 inch
1	Nut Driver, 3/8 inch
1	Nut Driver 11/32 inch
1	Screwdriver, small flat blade

A six inch length of 3/8" tubing is supplied. This can be used for pushing on the pushnuts and insulators. Standard wrenches or adjustable wrenches may also be used in place of the nut drivers.

When unpacking your antenna, check inside of all tubing for small parts and elements. To conserve space, these smaller articles are sometimes put inside larger pieces. Check all parts against the parts list in the rear of this manual to ensure no parts are missing.

Make all measurements to the given dimensions, plus or minus, not more than 1/16 inch! The assembly of this antenna will be easier if you read this manual completely through at least twice and follow the recommended directions. Allow at least four hours for assembly.

ASSEMBLY OF THE BOOM-TO-MAST BRACKET AND BOOM

Select the boom-to-bracket parts, boom sections and mast bracket parts as shown in Figure 1. Line-up the holes in the 6 boom sections as shown. The #3 and #4 boom sections should meet at the center of the boom-to-mast brackets or at the center of the

The boom sections can be identified by their length and diameter. The mating ends of each boom section can be identified by the element mounting hole reference dimensions as shown in Figure 1

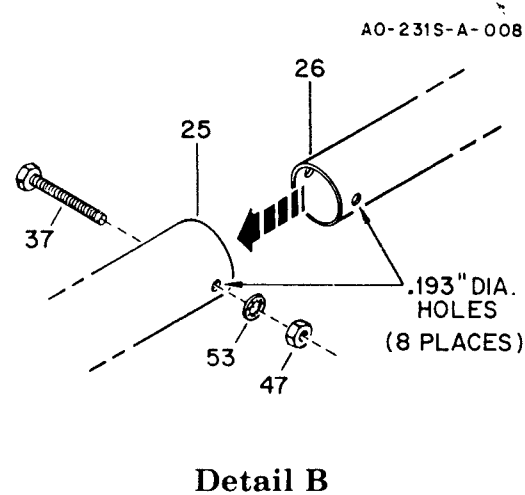
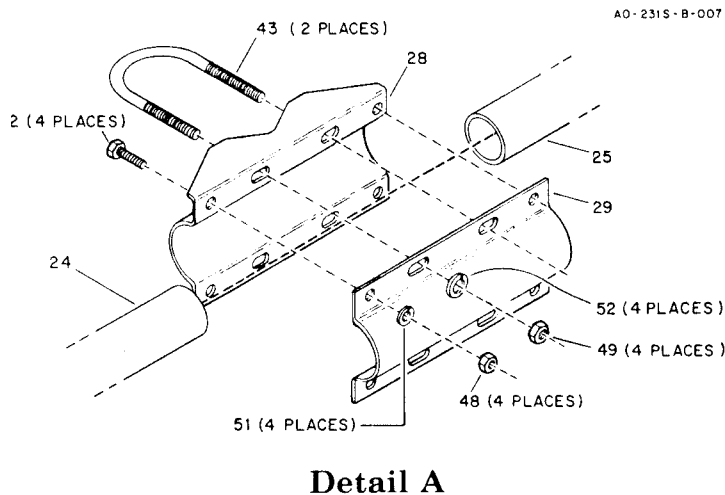
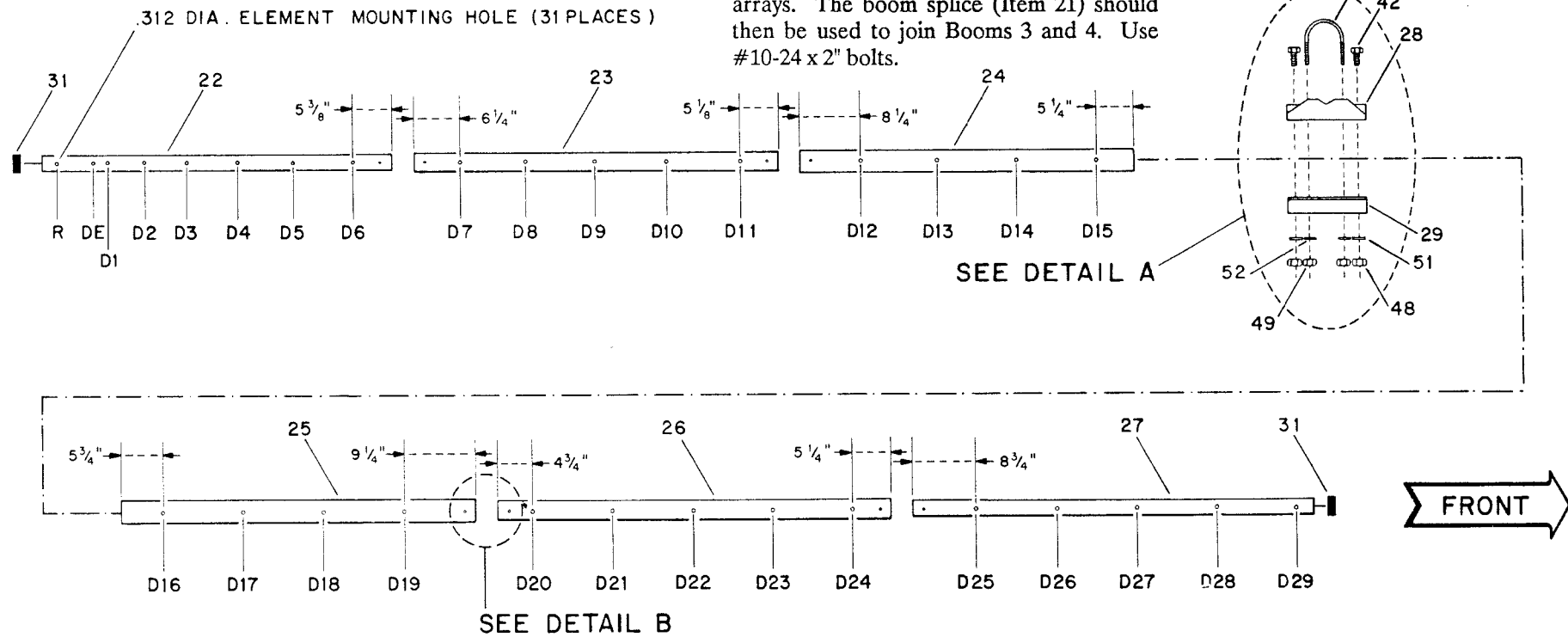
If the elements are to be installed in the boom sections indoors, label each boom end with masking tape at this time, and assemble the boom sections together when the antenna is ready to be attached to the mast.

If the elements are to be installed in the boom outdoors, assemble the boom sections together at that time, and tighten all hardware securely.

ELEMENT SPACINGS		
Element	Spacing from previous element	
	Inches	MM
DE	5	127
DI	2	51
D2	5	127
D3	57/8	149
D4	67/8	175
D5	75/8	194
D6	81/4	210
D7	85/8	219
D8	9	• 229
D9	91/2	241
D10	97/8	251
D11		260
D12	103/8	264
D13	105/8	270
D14	107/8	276
D15-D29	11	279

Table 1

NOTE: The boom-to-mast bracket assembly may be positioned between directors on Boom #3 to obtain better balance in EME arrays. The boom splice (Item 21) should then be used to join Booms 3 and 4. Use #10-24 x 2" bolts.



Item No.	Description
22	Boom, 1" x 48", drilled
23	Boom 2, 1 1/8" x 50", drilled
24	Boom 3, 1 1/4" x 46", drilled
25	Boom 4, 1 1/4" x 48", drilled
26	Boom 5, 1 1/8" x 54", drilled
27	Boom 6, 1" x 55", drilled
28	Bracket, boom body, 1 1/4"
29	Bracket, boom-to-mast, 1 1/4"
31	Caplug, 1", black
37	Bolt, #10-14 x 1 1/2", hex head
42	Bolt, 5/16"-18 x 3 5/8"
43	U-bolt, 5/16"-18 x 3 5/8"
47	Nut, #10-24, hex
48	Nut, 1/4"-20, hex
49	Nut, 5/16", hex, full
51	Lockwasher, 1/4", internal
52	Lockwasher, 5/16", split
53	Lockwasher, #10, internal

Figure 1 Assembly of Boom and Boom-to-Mast Bracket

ASSEMBLY OF DRIVEN ELEMENT

Select the 70-31 DX Driven Element, 3/16" x 13 1/2". marked with a single black color band near one end. Also select the insulators and pushnuts as shown in Figure 2.

Push one of the element insulators (Item 32) onto the Driven Element (DE), so that its shoulder is 6 1/4" from the nearest end (as shown in Figure 3). Insert the long end of the DE into the driven element mounting holes on the # 1 boom section, as shown in Figure 2.

Slide another element insulator (Item 32) over the end of the DE, and push it onto the element until it seats into the mounting hole. Recheck the exposed length of the DE and reposition if necessary.

Carefully slip the 3/16. inch pushnuts (Item 46) over each end of the driven element, and push them along the element until they are snug against each element insulator. Check the exposed length of the DE during this process, to ensure the correct dimensions.

NOTE: You may wish to use the 3/8" x 6" tube supplied to help push the element insulators and pushnuts. If you accidentally slide a pushnut on too far, then you should cut it off the element and try again with one of the spare pushnuts.

Select the DE T-Rod (Item 34) and 3/16 inch tubing' clamps (Item 36), and associated hardware. Assemble these parts to the driven element as shown in Figures 3 and 4.

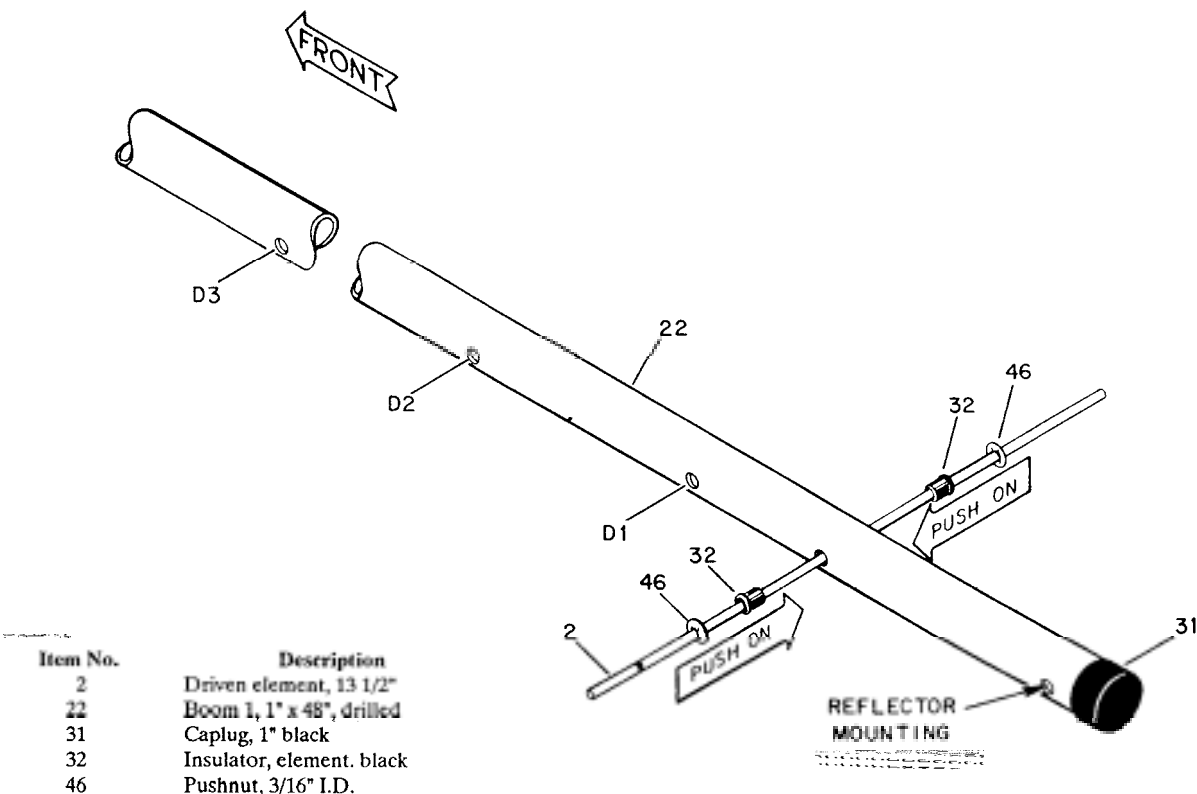
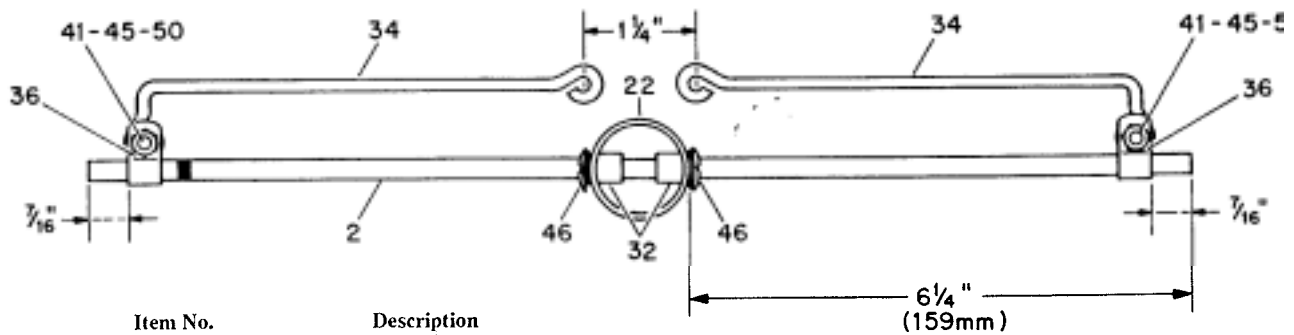


Figure 2 Driven Element Location and Assembly



Item No.	Description
2	Driven element, 13 1/2"
22	Boom 1, 1" x 48", driller
32	Insulator, element, black
34	T-match wire
36	Clamp, 3/16" tubing
41	Bolt, #8-32 x 1/2", round head
45	Nut, #8-32, hex
46	Pushnut, 3/16" I.D.
50	Lockwasher, #8, internal

Figure 3 Driven Element T-Rod Assembly

ASSEMBLY OF OTHER ELEMENTS

Select the reflector element 3/16" x 13 7/8", marked with two black bands near one end. Also select two insulators and two pushnuts.

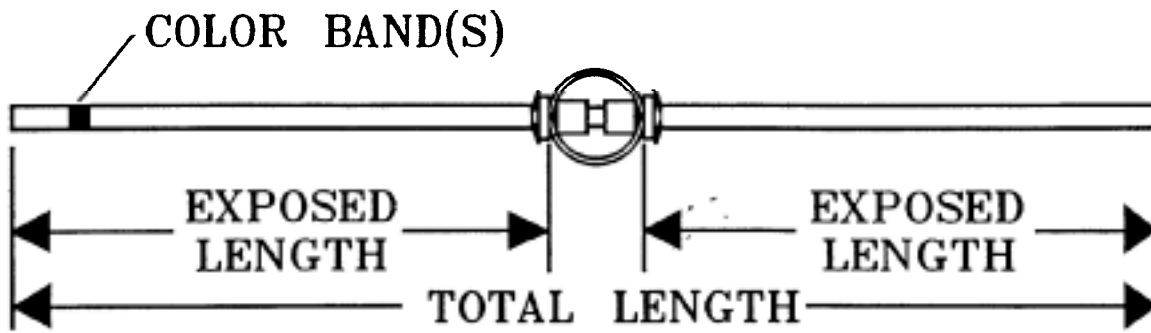
Install the reflector element in the reflector mounting holes as shown in Figure 2. Use the same methods as described for the driven element along with the exposed length given in Table 2.

Select one each of elements - D1, D2, D3, D4, D5, and D6. Identify these elements by the length and color bands listed in Table 2. Install these elements on the boom section in the holes shown in Figure 1 and 2. Start with D1 adjacent to the driven element. Use the insulators and pushnuts and assemble in the same manner as described earlier.

Select one each of elements - D7, D8, D9, D10 and 1311. Install these elements on the #2 boom section in the holes shown in Figure 1. Select the remaining elements - D12 thru D29. Install these elements on the #3, #4, #5, and #6 boom sections in the remaining holes as shown in Figure 1.

After the installation of all elements, check each exposed length from Table 2. Also check to make sure the elements are in the proper order on each boom section. If any element has to be adjusted or moved, there are extra pushnuts supplied for partial reassembly.

NOTE: After installing the elements onto the boom sections, wipe all excess grease and oil from the element surfaces. Acetone may help remove this oil. Clean, dry elements will shed water faster, thus allowing operation during and after rain showers.



Element	Item		Total Length		Exposed Length		Color Bands
	No.	Part No.	Inches	MM	Inches	MM	
R	1	160075	137/8	352	67/16	164	2- Black/Black
DE	2	160076	131/2	343	61/4	159	1- Black
D1	3	160077	125/8	321	513/16	148	1- Brown
D2	4	160078	123/8	314	511/16	144	1- Red
D3	5	160079	121/8	308	59/16	141	1- Orange
D4	6	160080	12	305	51/2	140	1- Yellow
D5	7	160081	117/8	302	57/16	138	1- Green
D6	8	160082	1111/16	297	511/32	136	1- Blue
D7	9	160083	119/16	294	57/32	133	1- Violet
D8	9	160083	119/16	294	57/32	133	1- Violet
D9	10	160084	117/16	291	55/32	131	1- White
D10	11	160085	115/16	287	53/32	129	2 - Brown/Black
D11	12	160086	111/4	286	51/16	129	2 - Brown/Brown
D12	12	160086	111/4	286	5	127	2 - Brown/Brown
D13	13	160087	113/16	284	431/32	126	2 - Brown/Orange
D14	14	160088	111/8	283	415/16	125	2 - Brown/Yellow
D15	14	160088	111/8	283	415/16	125	2 - Brown/Yellow
D16	15	160089	111/16	281	429/32	125	2 - Brown/Blue
D17	15	160089	111/16	281	429/32	125	2 - Brown/Blue
D18	16	160090	11	279	47/8	124	2 - Brown/White
D19	16	160090	11	279	47/8	124	2 - Brown/White
D20	17	160091	103/4	273	413/16	122	2 - Red/Black
D21	18	160092	1011/16	271	425/32	121	2 - Red/Brown
D22	18	160092	1011/16	271	425/32	121	2 - Red/Brown
D23	18	160092	1011/16	271	425/32	121	2 - Red/Brown
D24	19	160093	109/16	268	423/32	120	2 - Red/Yellow
D25	19	160093	109/16	268	425/32	121	2 - Red/Yellow
D26	19	160093	109/16	268	425/32	121	2 - Red/Yellow
D27	20	160094	101/2	267	43/4	121	2 - Red/Violet
D28	20	160094	101/2	267	43/4	121	2 - Red/Violet
D29	20	160094	101/2	267	43/4	121	2 - Red/Violet

Table 2 Element Length & Color Band Identification

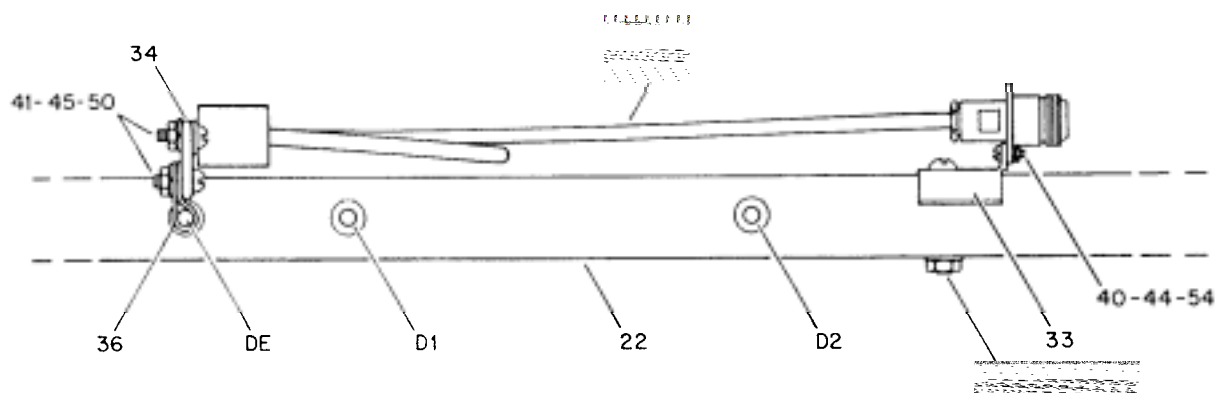
ATTACHMENT OF BALUN

ASSEMBLY

Select the Balun Assembly (Item 30), the connector bracket (Item 33), and the hardware shown in Figure 4. Insert the 10-24 x 1 1/4" bolt through the connector bracket (Item 33) before attaching the bracket to the type "N" connector on the balun assembly (Item 30) using 4-40 hardware as shown in Figure 4.

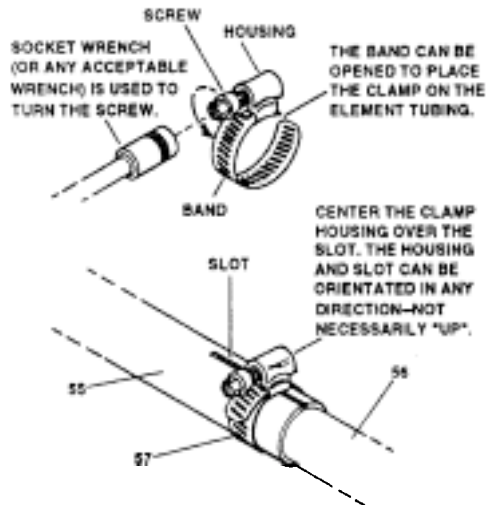
Attach the balun assembly with connector bracket to the boom using 10-24 hardware as shown in Figure 4. Ensure that the RG-303 balun is on the boom side of the RG-142 B/u coax. This will be very important later if you decide to stack 2,4 or more of these antennas.

Attach the balun assembly to the T-Match wires (Item 34) with #8-32 hardware as shown in Figure 4. Tighten all hardware securely. The feed point end of the balun assembly may be taped securely to the boom.



Item No.	Description
22	Boom 1, 1"x48", drilled
30	Balun Assembly, 70-31 DX
33	Connector bracket
34	T-Match wire
36	Clamp, 3/16" tubing
39	Bolt, #10-24 x 1 1/4", round head
40	Bolt, #4-40 x 3/8", pan head
41	Bolt, #8-32 x 1/2", round head
44	Nut, #4-40, hex
45	Nut, #7-32, hex
47	Nut, #10-24, hex
50	Lockwasher, #8, internal
53	Lockwasher, #10, internal
54	Lockwasher, #4, split

Figure 4 Balun
Assembly



DETAIL A

DETAIL B

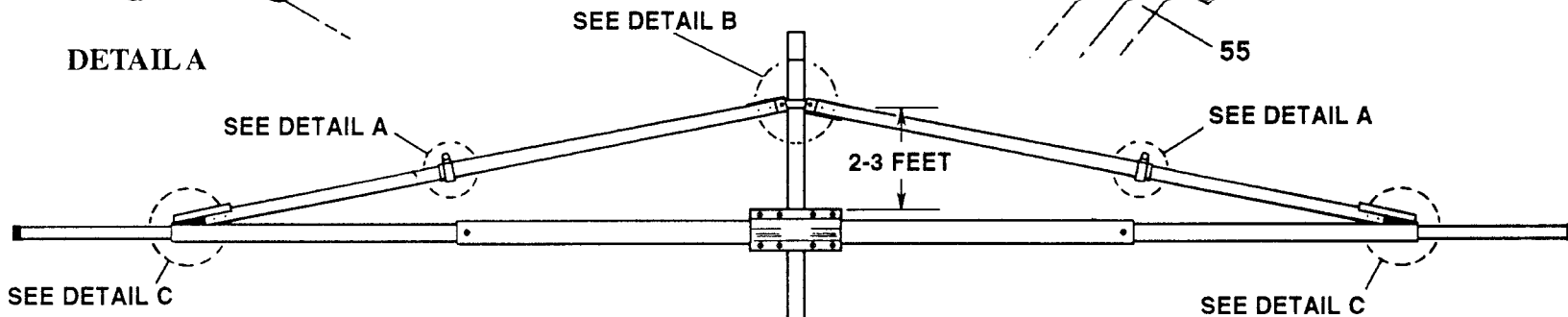
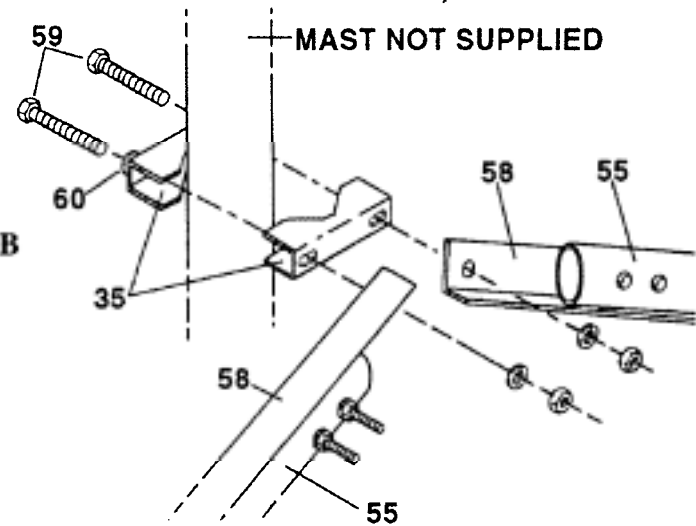
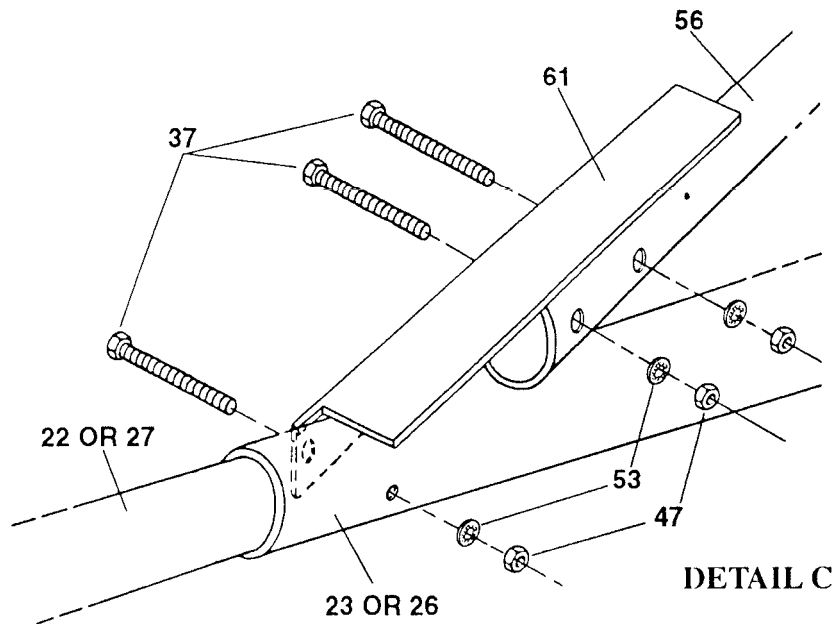


Figure 5
Boom Support



DETAIL C

Item No.	Description
22	Boom 1, 1" x 48", drilled
23	Boom 2, 1 1/8" x 50", drilled
26	Boom 5, 1 1/8" x 54", drilled
27	Boom 6, 1 x 55", drilled
35	Clamp, U-bracket
37	Bolt, #10-24 x 1 1/2", hex head, ss
43	U-bolt, 5/16"-18 x 3 5/8"
47	Nut, #10-24, hex
49	Nut, 5/16", hex, full, ss
51	Lockwasher, 1/4", internal, ss
53	Lockwasher, #10, internal, ss
55	Boom Support, 1 x 60
56	Boom Support, 7/8" x 57
57	Clamp, Tubing
58	Support Angle, mast
59	Bolt, 5/16"x 4" hex head, ss
60	Flatwasher, 5/16, ss
61	Support Angle, boom

ATTACHMENT OF BOOM SUPPORTS

Select the boom support tubes (Items 55 and 56), Support Angles (Items 58 and 61), U-brackets (Item 35), Tubing clamps (Item 57), and associated hardware as shown in Figure 5.

The boom supports may be assembled either above or below the boom. Either position will give adequate support to the antenna. Figure 5 shows the supports above the boom. Assemble the antenna and boom support to a temporary mast first to determine the desired dimensions of the boom support.

Attach a Mast Support Angle (Item 58) to the end of each 1" x 60" support tube (Item 55) using #10-24 x 1 1/2" hardware. Attach a Boom Support Angle (Item 61) to the end of each 7/8" x 57" support tube (Item 56) using the same hardware.

Loosely assemble the support tubes together as shown in Detail A of Figure 5, using a No. 10 tubing clamp (Item 57). Arrange the Support Angles as shown in Figure 5. The 7/8" support tube should be centered over the 1 1/8" boom tube. The boom-to-mast bracket should be assembled on the boom for best balance, using the coaxial cable to be installed with the antenna. See Note in Figure 1.

Assemble the U-brackets to the temporary mast above or below the boom-to-mast brackets. Attach the tubing assemblies to the boom and to the Ubracket assembly. Tighten the 5/16" bolts in the U-bracket assembly to your preferred distance from the boom. Securely tighten the tubing clamps, when you are sure the boom is level. Securely tighten the support assembly to the boom at each end.

Remove the U-brackets and the boom-to-mast brackets from the temporary mast.

INSTALLATION

the balun assembly. Tighten securely and tape coax to the boom every 2 feet for strain relief. Do Not allow the feedline to touch any director element.

Attach the antenna to your mast with the balun assembly/coax on the bottom of the boom. Position the boom support for minimum boom sag, and tighten securely.

Recommended feedline for the 70-31 DX antenna is a low-loss cable such as Belden 8214 or 9913 with type "N" connectors.

WARNING

DO NOT ALLOW ANY PART OF THE ANTENNA TO TOUCH POWERLINES. THIS COULD CAUSE SEVERE BURNS OR FATAL INJURIES.

When mounting the 70-31 DX beam above or below any other antennas, allow at least 5 feet for minimum interaction.

When stacking more than one antenna, keep the balun assemblies all on the same side of the booms. This will ensure proper phasing.

The maximum stacking distance should be about 2.7 wavelengths or 74 inches (1.88 m) in the E-plane and 2.6 wavelengths or 71 inches (1.80 m) in the H-plane.

SERVICE INFORMATION

If you are unable to resolve technical problems, you should contact the Hy-Gain Customer Service Department in Starkville, Mississippi.

You should retain your sales receipt or other proof of purchase for antennas that are still under warranty. (See separate sheet for Hy-Gain Warranty.)

All requests, inquiries or warranty claims, and to order replacement parts contact:

Hy-Gain
308 Industrial
Park Road
Starkville, MS
39759
Phone: (662)
323-9538

PARTS LIST

Item No.	Part No.	Description	Qty
1	160075	Reflector, 3/16" x 13 7/8"	1
2	160076	Driven Element, 13 1/2"	1
3	160077	D1, 3/16" x 12 5/8"	1
4	160078	D2, 3/16" x 12 3/8"	1
5	160079	D3, 3/16" x 12 1/8"	1
6	160080	D4, 3/16" x 12"	1
7	160081	D5, 3/16" x 11 7/8"	1
8	160082	D6, 3/16" x 11 11/16"	1
9	160083	D7 and D8, 3/16" x 11 9/16"	2
10	160084	D9, 3/16" x 11 7/16"	1
11	160085	D9, 3/16" x 11 7/16"	1
12	160086	D 11 and D 12, 3/16" x 11 1/4".....	2
13	160087	D13, 3/16" x 11 3/16"	1
14	160088	D14 and D15, 3/16" x 11 1/8".....	2
15	160089	D16 and D17; 3/16" x 11 1/16".....	2
16	160090	D18 and D19, 3/16" x 11".....	2
17	160091	D20, 3/16" x 10 3/4"	1
18	160092	D21, D22, and D23, 3/16" x 10 11/16".....	3
19	160093	D24, D25, and D26, 3/16" x 10 9/16".....	3
20	160094	D27, D28, and D29, 3/16" x 10 1/2".....	3
21	179729	Boom Splice, 1 3/8" x 6"	1
22	179657	Boom 1, 1" x 48", drilled.....	1
23	179658	Boom 2, 1 1/8" x 50", drilled	1
24	179659	Boom 3_1 1/4" x 46", drilled	1
25	179660	Boom 4, 1 1/4" x 48", drilled	1
26	179661	Boom 5, 1 1/8" x 54", drilled.....	1
27	179662	Boom 6, 1" x 55", drilled.....	1
28	385142-1	Bracket, boom body, 1 1/4".....	1

PARTS LIST (Continued)

Item No.	Part No.	Description	Qty
29	385144-1	Bracket, boom-to-mast, 1 1/4"	1
30	877966	Balun Assembly, 70-31 DX	1
	877964	Parts Pack, 231 S, Insulators	1
31	450401	Caplug, 1,, black.....	2
32	460337	Insulator, Element, black.....	64
	877965-1	Parts Pack, 231S, Hardware.....	1
33	179663	Connector bracket	1
34	179664	T -Match wire.....	2
35	179665	Clamp, U-bracket.....	2
36	358705	Clamp, 3/16" tubing.....	4
37	500159	Bolt, #10-24 x 1 1/2", hex head, stainless steel	12
38	500157	Bolt, #10-24 x 2", hex head, stainless steel	2
39	504739	Bolt, #10-24 x 1 1/4", round head, ss.....	1
40	500374	Bolt, #4-40 x 3/8", pan head, ss	3
41	500185	#8-32 x 1/2", round head, ss.....	4
42	505266	Bolt, 1/4"-20 x 3/4", hex head, ss.....	4
43	540067	U-bolt, 5/16"-18 x 3 5/8"	2
44	559612	Nut, #4-40, hex	3
45	550063	Nut, #8-32, hex	4
46	550081	Pushnut, 3/16", LD.....	66
47	554071	Nut, #10-24, hex	16
48	554099	Nut, 1/4"-20, hex, ss.....	4
49	555747	Nut, 5/16", hex, full, ss	6
50	560035	Lockwasher, #8, internal, ss.....	5
51	562961	Lockwasher, 1/4", internal, ss	4
52	564792	Lockwasher, 5/16", split, ss.....	6
53	565697	Lockwasher, #10, internal, ss.....	16
54	561530	Lockwasher, #4, split	3
57	358757	Clamp, #10 Tubing, ss	2
58	179857	Angle, boom support.....	2
59	5142400	Bolt, 5/16"-18 x 4", hex head, ss.....	2
60	560024	Flatwasher.....	2
55	191014	Boom Support 1" x 60".....	2
56	191015	Boom Support 7/8" x 57".....	2
61	179856	Angle, Boom Support	2
62	179720	Pushtube, 3/8" x 6".....	1