

**ASSEMBLY AND INSTALLATION
INSTRUCTIONS**



13B2

**2 METER BROADBAND BOOMER
SSB/CW/FM YAGI
144-148 MHz**

Cushcraft
Amateur Radio Antennas

951410_GF_AB

WARNING

THIS ANTENNA IS AN ELECTRICAL CONDUCTOR. CONTACT WITH POWER LINES CAN RESULT IN DEATH, OR SERIOUS INJURY. DO NOT INSTALL THIS ANTENNA WHERE THERE IS ANY POSSIBILITY OF CONTACT WITH OR HIGH VOLTAGE ARC-OVER FROM POWER CABLES OR SERVICE DROPS TO BUILDINGS. THE ANTENNA, SUPPORTING MAST AND/OR TOWER MUST NOT BE CLOSE TO ANY POWER LINES DURING INSTALLATION, REMOVAL OR IN THE EVENT PART OF THE SYSTEM SHOULD ACCIDENTALLY FALL. FOLLOW THE GUIDE LINES FOR ANTENNA INSTALLATIONS RECOMMENDED BY THE U.S. CONSUMER PRODUCT SAFETY COMMISSION AND LISTED IN THE ENCLOSED PAMPHLET.

Your Cushcraft 13B2 Boomer antenna is designed and manufactured to give trouble free service. This antenna will perform as specified if the instructions and suggestions in this manual are followed and care is used in the assembly and installation. When checking the components received in your antenna package use the parts listed beside each diagram. There is a master parts list on page 2. If you are unable to locate any tube or component, check the inside of all tubing. **IMPORTANT:** Save the weight label from the outside of the carton. Each antenna is weighed at the factory to verify the parts count. If you claim a missing part, you will be asked for the weight verification label.

PLANNING

Plan your installation carefully. If you use volunteer helpers be sure that they are qualified to assist you. Make certain that everyone involved understands that you are the boss and that they must follow your instructions. If you have any doubts at all, employ a professional antenna installation company to install your antenna.

LOCATION

Location of the antenna is very important. Surrounding objects such as trees, power lines, other antennas, etc. will seriously reduce efficiency. To minimize the effects of surrounding objects, mount the antenna as high and in the clear as possible. If metal guy wires are used, they should be broken with strain insulators. **EXTREME CARE MUST BE USED FOR YOUR SAFETY. YOU MUST INSURE THAT WHILE THE 13B2 IS IN OPERATION NEITHER PEOPLE OR PETS CAN COME IN CONTACT WITH ANY PORTION OF YOUR ANTENNA. DEADLY VOLTAGES AND CURRENTS MAY EXIST. ALSO, SINCE THE EFFECTS OF EXPOSURE TO RF FIELDS ARE NOT FULLY UNDERSTOOD, LONG TERM EXPOSURE TO INTENSE RF FIELDS IS NOT RECOMMENDED. THERE IS A WARNING STICKER WHICH MUST BE ATTACHED TO THE BOOM AS SHOWN IN FIGURE E.**

MOUNTING

The mast mount bracket will accommodate up to a 2" (5.1 cm) mast. A 1-1/2" OD (3.8 cm) or larger heavy wall tubing mast should be used. A good heavy duty antenna rotator will provide the best service and longest life. Often it is desirable to mount several antennas on one mast. To keep possible interaction to a minimum, place your antennas as far apart as you can. The 13B2 provides excellent gain, clean pattern and low VSWR across the entire 2 meter band. It can be mounted either horizontally or vertically.

VERTICAL (FM) : If you plan to mount the 13B2 for vertical polarization, best results can be obtained by mounting the antenna at the top of the mast. Note that element #6 is 3" (7.6 cm) from the edge of the mast mounting plate as shown in Figure D. *Install the 13B2 with the elements on the side of the mast opposite from the mounting plate.* A vertically polarized 13B2 will have a VSWR of under 2:1 from 144.5 to 148.0 MHz. See page 6 for suggested dual and quad array configurations.

HORIZONTAL (CW/SSB) : Mount your 13B2 horizontally and as high as possible, with the boom-to-mast plate between elements 6 and 7 as shown in figure D. See page 6 for a suggested dual array configuration.

SYSTEM GROUNDING

Direct grounding of the antenna, mast and tower is very important. This serves as protection from lightning strikes and static buildup, and from high voltage which is present in the radio equipment connected to the antenna. A good electrical connection should be made to one or more ground rods (or other extensive ground system) directly at the base of the tower or mast, using at least #10AWG ground wire and non-corrosive hardware. For details and safety standards, consult the National Electrical Code. You should also use a coaxial lightning arrester. Cushcraft offers several different models, such as LAC-1, LAC-2 and the LAC-4 series.

ASSEMBLY

Assemble your antenna by following the directions and illustrations in steps 1 through 6. After the antenna is completely assembled, verify dimensions and element spacings for accuracy. Then, return to the section below for final tuning.

TUNING PROCEDURE

The 13B2 does not normally require tuning after assembly. However, if you wish to check the VSWR before installation, please observe the following procedures. To prevent detuning the antenna, it should be tuned in place or at least 7 feet (2.13 meters) above ground and clear of surrounding objects. Keep all metal obstructions such as guy wires and other antennas at least 10 feet (3.05 m) away since they will nullify any adjustment and degraded performance will result.

Run the coax cable from your transmitter to the area in which the antenna is going to be tested. The length of this cable or your feedline is not critical. Connect a good quality VSWR bridge to the end of this cable. Connect a short length of cable [10 ft (305 cm) or less] from the VSWR bridge to the antenna. Set the transmitter to your center operating frequency. When you read VSWR, be sure you move far enough away from the antenna so that your body does not effect the reading.

Measure the VSWR. If it is high, move both T-Match straps (125) by 1/4" (.6 cm) in one direction and check the VSWR. If the VSWR improved, then continue moving the T-Match straps in the same direction. If the VSWR deteriorated then move the T-Match straps in the opposite direction. Repeat this procedure until no further improvement can be made. You have matched your antenna to 50 Ohms. Then tighten all connections on the T-Match driven element assembly. Tape the feedline to the boom and mast as shown in figure G.

MASTER PARTS LIST

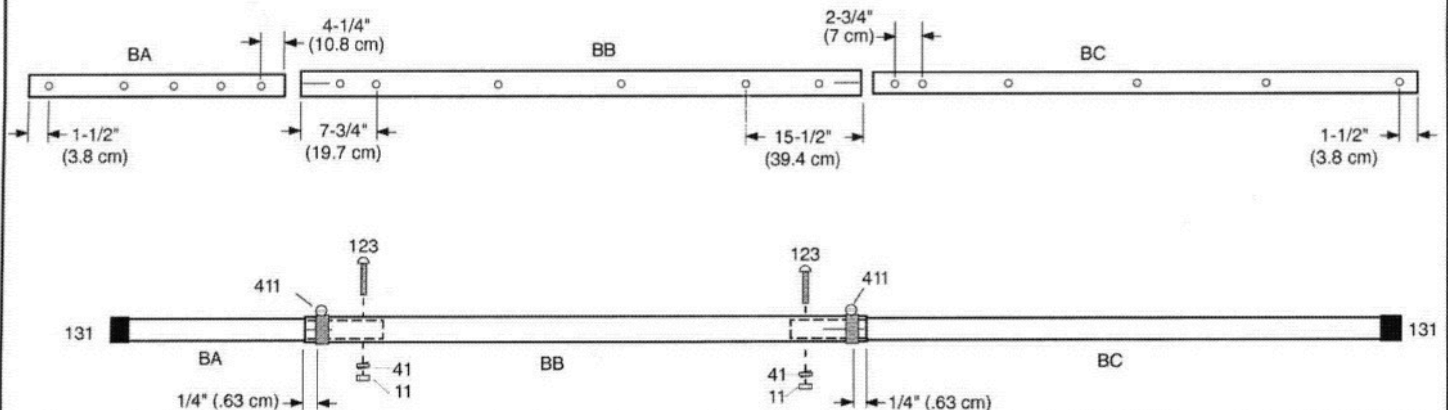
| KEY | P/N | DESCRIPTION | QTY. | KEY | P/N | DESCRIPTION | QTY. |
|-----|--------|--|------|-----|--------|---|------|
| 11 | 010011 | 8-32 stainless steel hex nut | 22 | 232 | 010232 | 8-32 x 2 -1/2" (6.4 cm) stainless steel machine screw | 5 |
| 26 | 190026 | 7/8" (2.2 cm) formed aluminum bracket | 13 | 326 | 290326 | Danger label | 1 |
| 28 | 190028 | Aluminum half washer | 12 | 401 | 010401 | 1-1/2" x 3" (3.8 x 7.6 cm) stainless steel U-bolt | 2 |
| 41 | 011941 | No. 8 split lock washer | 38 | 404 | 010404 | 2-1/2" x 3" (5.5 x 7.6 cm) stainless steel U-bolt | 2 |
| 53 | 050053 | 1/2" (1.27 cm) black plastic cap | 2 | 411 | 030411 | 1-3/8" (3.5 cm) stainless steel worm clamp | 2 |
| 70 | 190070 | 4" x 6" (10.2 x 15.2 cm) formed mounting plate | 1 | 940 | 360940 | No. 8 flat washer | 1 |
| 77 | 050077 | 3/8" (.95 cm) black plastic cap | 2 | BA | | 1-1/8" x 48" (2.9 x 121.9 cm) aluminum tubing | 1 |
| 79 | 010079 | 8-32 x 1/2" (1.3 cm) stainless steel machine screw | 4 | BB | | 1-1/4" x 72" (3.2 x 182.9 cm) aluminum tubing | 1 |
| 84 | 010084 | 1/4" (.64 cm) stainless steel lock washer | 4 | BC | | 1-1/8" x 72" (2.9 x 182.9 cm) aluminum tubing | 1 |
| 85 | 010085 | 1/4" (.64 cm) stainless steel hex nut | 4 | UM | UM2U | UltraMatch Balun | 1 |
| 104 | 010104 | 1/4" (.64 cm) stainless steel flat washer | 4 | EA | | 39-3/4" (101 cm) aluminum rod | 1 |
| 115 | 050115 | Vinyl Boot | 1 | EB | | 1/2" x 38-7/8" (1.3 x 98.7 cm) aluminum tubing | 1 |
| 116 | 240116 | Silicone Package | 1 | EC | | 37 -7/8" (96.2 cm) aluminum rod | 1 |
| 118 | 010118 | 5/16" (.79 cm) stainless steel hex nut | 4 | ED | | 36 -1/4" (92.1 cm) aluminum rod | 2 |
| 119 | 010119 | 5/16" (.79 cm) stainless steel lock washer | 4 | EE | | 35 -3/4" (90.8 cm) aluminum rod | 1 |
| 120 | 010120 | 8-32 x 2" (3.0 cm) stainless steel machine screw | 8 | EF | | 35-1/4" (89.5 cm) aluminum rod | 1 |
| 123 | 010123 | 8-32 x 1-1/2" (3.8 cm) stainless steel machine screw | 3 | EG | | 34-5/8" (88 cm) aluminum rod | 6 |
| 125 | 200125 | T-match strap | 2 | ET | | 3/8" x 6-1/2" (.95 x 16.5 cm) aluminum tubing | 2 |
| 131 | 050131 | 1-1/8" (2.86 cm) black plastic cap | 2 | | | | |

#1 - ASSEMBLE BOOM

BB until the first set of drilled holes are aligned. Join booms with screw. Assemble the boom as shown below. Slide worm clamps (411) onto the slotted ends of tube BB. Insert the end of tube BC into the end of tube (123), washer (41) and nut (11). Refer to the dimensions in figure A to be sure that the proper tube ends are joined. Do the same with tube A. Tighten the screws and worm clamps. Push the end caps (131) onto the ends of the boom.

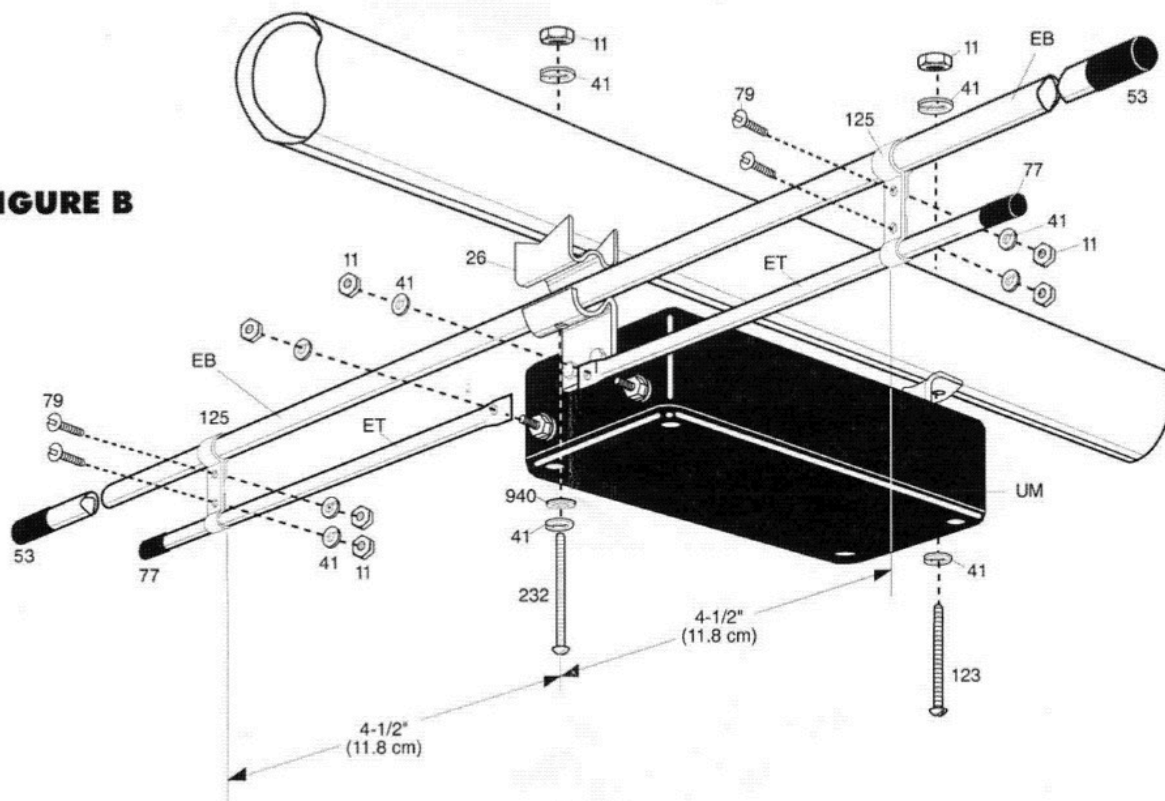
| KEY | P/N | DESC. | SIZE | QTY |
|-----|--------|----------------|----------------------------------|-----|
| BA | | ALUM TUBING | 1-1/8" x 48" (2.9 x 121.9 cm) | 1 |
| BB | | ALUM TUBING | 1-1/4" x 72" (3.2 x 182.9 cm) | 1 |
| BC | | ALUM TUBING | 1-1/8" x 72" (2.9 x 182.9 cm) | 1 |
| 11 | 010011 | SS HEX NUT | 8-32 | 2 |
| 41 | 011941 | SS LOCK WASHER | #8 | 2 |
| 123 | 010123 | SS SCREW | 8-32 x 1-1/2" (3.8 cm) | 2 |
| 131 | 050131 | PLASTIC CAP | 1-1/8" (2.86 cm) | 2 |
| 411 | 030411 | SS WORM CLAMP | 1-3/8" (3.5 cm) | 2 |

FIGURE A



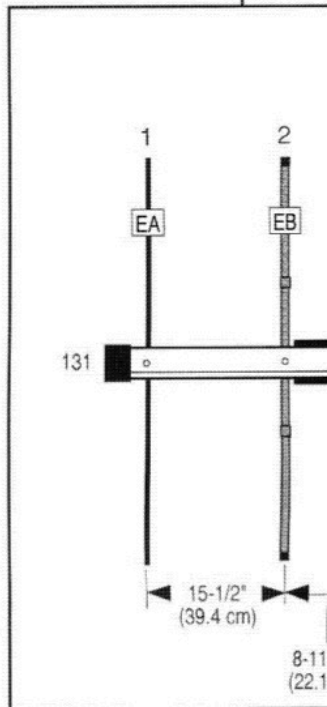
#2 - ASSEMBLE T-MATCH



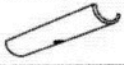


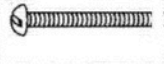
FIGURE B



| KEY | P/N | DISPLAY | DESC | SIZE | QTY |
|-----|--------|---------|------------------|-----------------------------------|-----|
| EB | | | ALUM TUBING | 1/2" x 38-7/8" (1.3 x 98.7 cm) | 1 |
| ET | | | ALUM TUBING | 3/8" x 6-1/2" (.95 x 16.5 cm) | 2 |
| UM | UM2U | | UltraMatch BALUN | | 1 |
| 11 | 010011 | | SS HEX NUT | 8-32 | 8 |
| 26 | 190026 | | ALUM BRACKET | 7/8" (2.2 cm) | 1 |
| 41 | 011941 | | SS LOCK WASHER | #8 | 10 |
| 53 | 050053 | | PLASTIC CAP | 1/2" (1.27 cm) | 2 |
| 77 | 050077 | | PLASTIC CAP | 3/8" (.95 cm) | 2 |
| 79 | 010079 | | SS MACHINE SCREW | 8-32 x 1/2" (1.3 cm) | 4 |
| 123 | 010123 | | SS MACHINE SCREW | 8-32x1-1/2 (3.81) | 1 |
| 125 | 200125 | | T-MATCH STRAP | | 2 |
| 232 | 010232 | | SS MACHINE SCREW | 8-32 x 2 1/2" (6.4 cm) | 1 |
| 940 | 360940 | | ALUM FLAT WASHER | #8 | 1 |

Assemble the T-match to the driven element (EB) as illustrated in figure B. First attach the UltraMatch to the driven element with the hardware shown. Then connect the T-match elements (ET) to the UltraMatch with the split washers (41) and nuts (11). Next, attach the T-match elements to the driven element with the T-match straps (125) and hardware shown while noting the spacing dimensions between the straps. Place plastic caps (53) on the ends of the tube EB and plastic caps (77) on the ends of the tubes ET. Attach this subassembly to position 2 on the boom as shown in figure D noting that the UltraMatch feedpoint must face the center of the antenna. Tighten all screws.



| KEY | P/N | DISPLAY | DESC | SIZE | QTY |
|-----|--------|---|-------------------------|-------------------------|-----|
| 11 | 010011 |  | SS HEX NUT | 8-32 | 12 |
| 26 | 190026 |  | ALUMINUM BRACKET | 7/8" (2.2 cm) | 12 |
| 28 | 190028 |  | ALUMINUM HALF WASHER | | 12 |
| 41 | 011941 |  | SS LOCK WASHER | #8 | 12 |
| 120 | 010120 |  | SS MACHINE SCREW | 8-32 x 2" (5.1 cm) | 8 |
| 232 | 010232 |  | SS MACHINE SCREW | 8-32 x 2.5" (6.4 cm) | 4 |

#3 - MOUNT ELEMENTS

Attach the solid rod reflector and directors to the boom at the locations shown on figure D. First check all element lengths using table A. Group similar element lengths together. The elements are progressively shorter as you proceed toward the front end of the boom. Attach each element to the boom using the hardware shown in figure C. Use 010232 screws when mounting ED, EE, EF & EG.

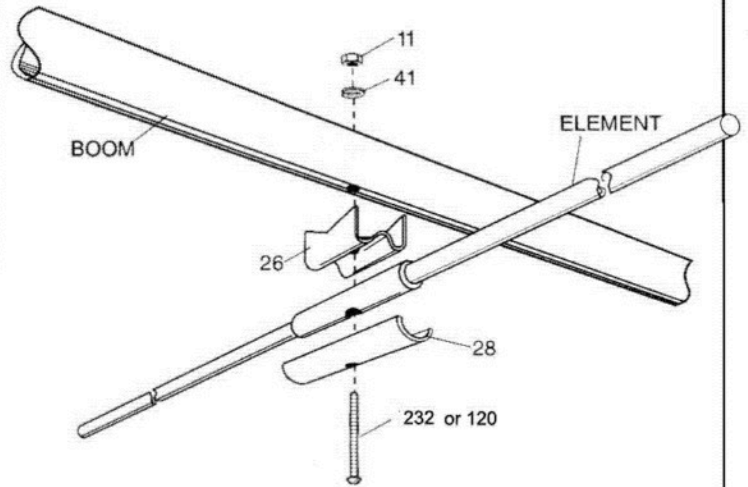
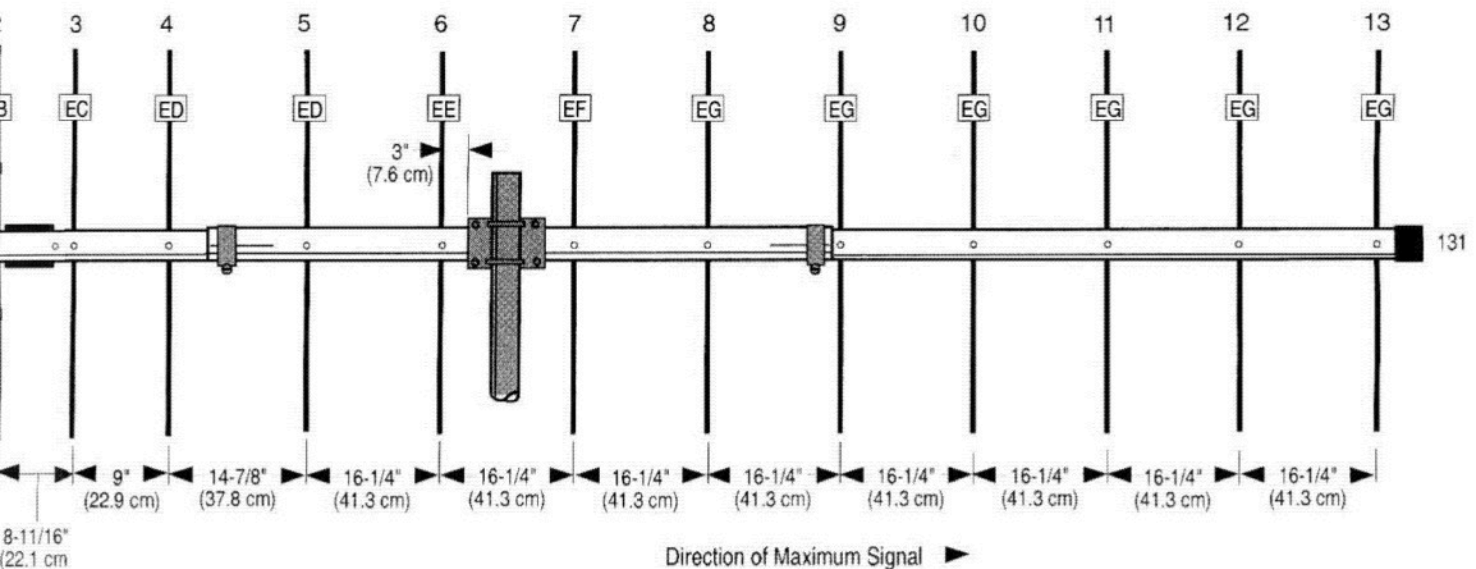


FIGURE C

TABLE A (Element Lengths)

| KEY | Element No. | Length | |
|-----|-------------|--------|-------|
| | | INCHES | CM |
| EA | 1 | 39-3/4 | 101.0 |
| EB | 2 | 38-7/8 | 98.7 |
| EC | 3 | 37-7/8 | 96.2 |
| ED | 4,5 | 36-1/4 | 92.1 |
| EE | 6 | 35-3/4 | 90.8 |
| EF | 7 | 35-1/4 | 89.5 |
| EG | 8-13 | 34-5/8 | 88.0 |

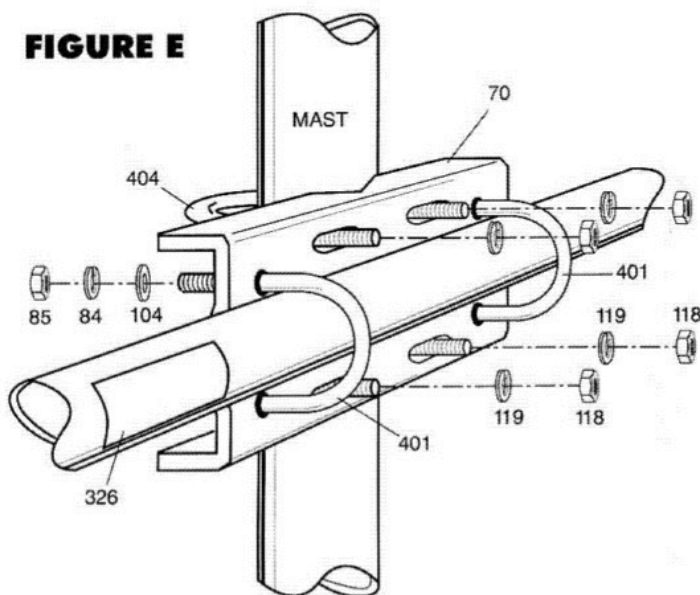
FIGURE D



#4 - ASSEMBLE BOOM TO MAST MOUNT

Assemble and mount the boom to mast clamp bracket (70) between elements 6 and 7 with the U-bolts 401 as shown in figure E. Secure with flat washer (104), lock washer (84) and nut (85) in that order. Note that the rear of the mast clamp must be 3 inches (7.6 cm) from element 6 as shown on figure D. You are now ready to mount the antenna to your mast using the U-bolts 404. Secure with lock washers (119) and nut (118) in that order. Affix the warning label (326) to the boom as shown in figure E.

FIGURE E



| KEY | P/N | DISPLAY | DESC | SIZE | QTY |
|-----|--------|---------|----------------|----------------------------|-----|
| 84 | 010084 | | SS LOCK WASHER | 1/4" (.64 cm) | 4 |
| 85 | 010085 | | SS HEX NUT | 1/4" (.64 cm) | 4 |
| 104 | 010104 | | SS FLAT WASHER | 1/4" (.64 cm) | 4 |
| 118 | 010118 | | SS HEX NUT | 5/16" (.79 cm) | 4 |
| 119 | 010119 | | SS LOCK WASHER | 5/16" (.79 cm) | 4 |
| 401 | 010401 | | SS U-BOLT | 1 1/2" x 3" (3.8 x 7.6 cm) | 2 |
| 404 | 010404 | | SS U-BOLT | 2 1/2" x 3" (5.5 x 7.6 cm) | 2 |
| 70 | 190070 | | MOUNTING PLATE | 4" x 6" (10.2 x 15.2 cm) | 1 |
| 326 | 290326 | | DANGER LABEL | | 1 |

#5 - CONNECTOR ASSEMBLY

| KEY | P/N | DISPLAY | DESC | SIZE | QTY |
|-----|--------|---------|------------------|------|-----|
| 115 | 050115 | | CONNECTOR BOOT | | 1 |
| 116 | 240116 | | SILICONE PACKAGE | | 1 |

The antenna is designed for use with 50 Ohm coaxial cable terminated with an N connector. Any length of feedline can be used with your 13B2N. The shortest length of cable will have the least loss. A connector boot is included for use with your new antenna. A connector boot is included with your new antenna. Slide the boot over the cable before attaching your N connector (figure F). Spread silicone on the outer threads of the UltraMatch and N connector. **DO NOT COAT THE CENTER PINS OF THE N CONNECTOR OR THE ULTRAMATCH SOCKET.** Attach the connector to the UltraMatch. Apply the remaining silicone to the outside of the connector and against the mast bracket for a weather tight connection.

FIGURE F



COAT WITH SILICONE GREASE
(DO NOT coat the center pin or socket!)

#6 - FEEDLINE ATTACHMENT

Tape your feedline down the boom and mast. If you choose horizontal polarization, it's a good idea to form a drip loop in the coax to help protect the connector from water damage (figure G.) If you choose vertical polarization, bring the feedline all the way down the boom until you come to the mast, then bring the feedline straight down the mast (figure H).

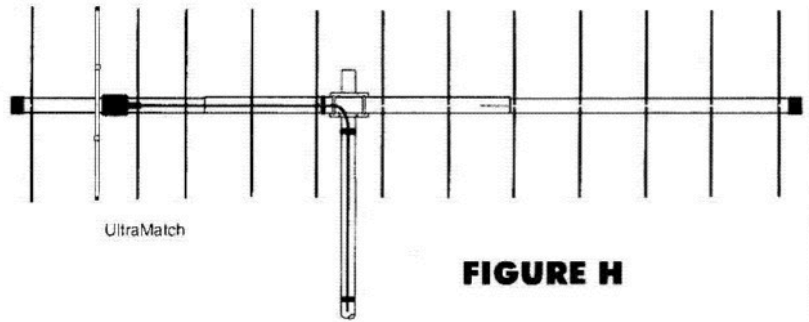
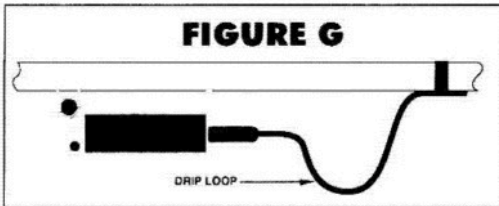


FIGURE H

STACKING THE 13B2

Boomers may be stacked in arrays of two or four 13B2 antennas for improved radiation patterns and increased gain. They may be mounted for either horizontal or vertical polarization. When stacking two vertically polarized 13B2's use the 26B2VPK stacking kit, Figure I. When stacking four vertically polarized 13B2's use two 26B2VPK and one PD2. Figure J. When stacking two horizontally polarized 13B2's use the PD2 Power Divider, adding equal lengths of 50.0 ohm cable, to reach the antenna feed points.

FIGURE I

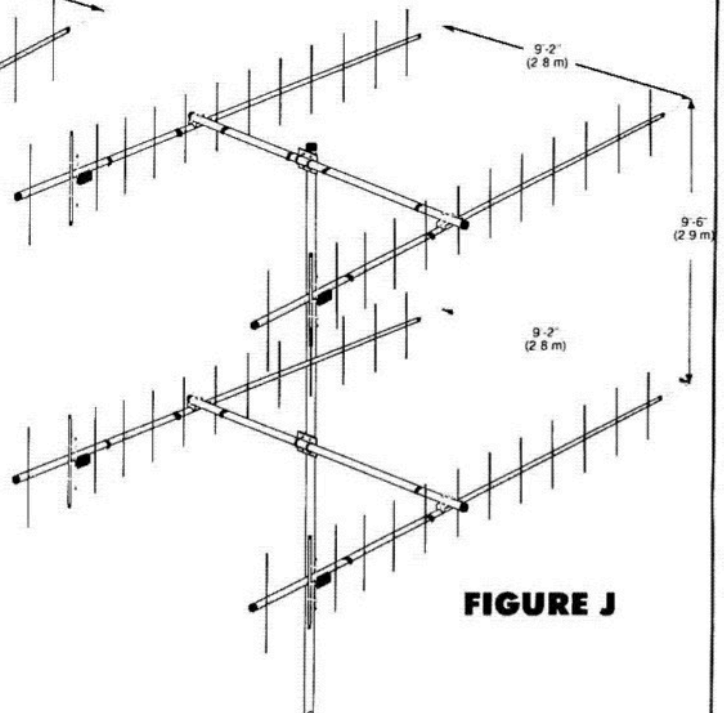
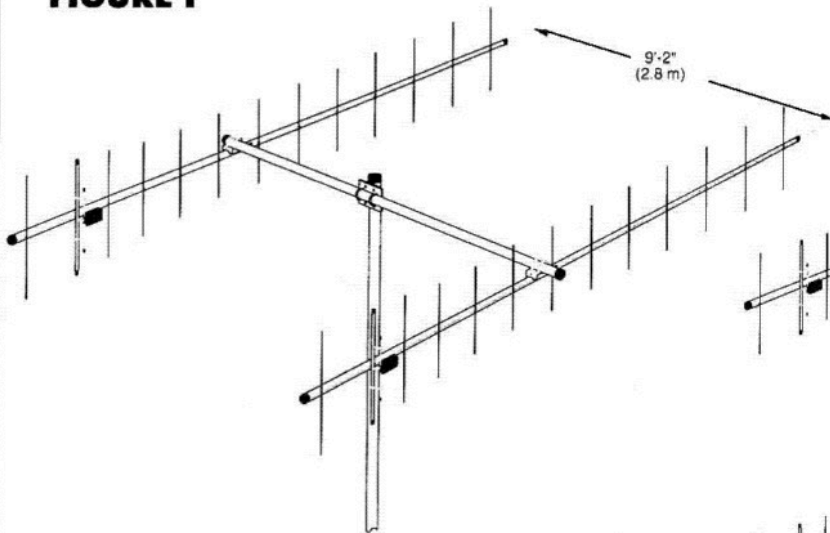
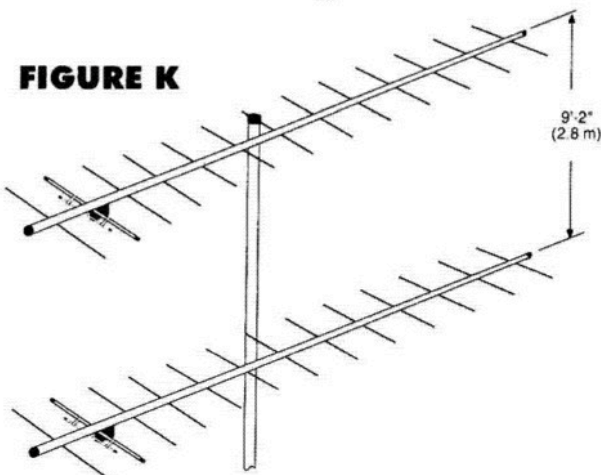


FIGURE J

FIGURE K



When stacking antennas, all UltraMatches must be facing in the same direction for proper phasing. That is to say, vertically polarized must have all UltraMatches on one side or the other. Horizontally polarized antennas must have all UltraMatches on the bottom.

SPECIFICATIONS

| | |
|--|--------------------|
| Frequency, MHz | 144-148 |
| No. Elements | 13 |
| Forward Gain, dBd | 15.8 |
| Front to Back Ratio, dB | 26 |
| SWR 1.2:1 Typical | |
| 2:1 Bandwidth, MHz | >4 |
| Power Rating, Watts PEP | 2000 |
| 3 dB Beamwidth, Degrees | |
| E Plane | 2 x 18 |
| H Plane | 2 x 19 |
| Side Lobe Attenuation, dB, E Plane | >60 |
| Electical Wavelength | 2.2 |
| Longest Element, in (cm) | 39.75 (101) |
| Turning Radius, ft (m) | 8.9 (2.7) |
| Mast Size Range, in (cm) | 1.5-2 (3.8-5.1) |
| Wind Load, ft ² (m ²) | 1.8 (.17) |
| Weight, lb (kg) | 6.7 (3.1) |

LIMITED WARRANTY

Cushcraft Amateur Radio Antennas, 308 Industrial Park Rd., Starkville, MS 39759, warrants to the original consumer purchaser for one year from date of purchase that each Cushcraft antenna is free of defects in materials or workmanship. If, in the judgment of Cushcraft, any such antenna is defective, then Cushcraft Amateur Radio Antennas will, at its option, repair or replace the antenna at its expense within thirty days of the date the antenna is returned (at purchasers expense) to Cushcraft or one of its authorized representatives. This warranty is in lieu of all other expressed warranties, any implied warranty is limited in duration to one year. Cushcraft Amateur Radio Antennas shall not be liable for any incidental or consequential damages that may result from a defect. Some states do not allow limitations on how long an implied warranty lasts or exclusions or limitations of incidental or consequential damages, so the above limitation and exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state. This warranty does not extend to any products that have been subject to misuse, neglect, accident or improper installation. Any repairs or alterations outside of the Cushcraft factory will nullify this warranty.

Cushcraft

Amateur Radio Antennas

300 Industrial Park Rd., Starkville, MS 39759

Phone: 662-323-5803 Fax: 662-323-6551

www.CushcraftAmateur.com