

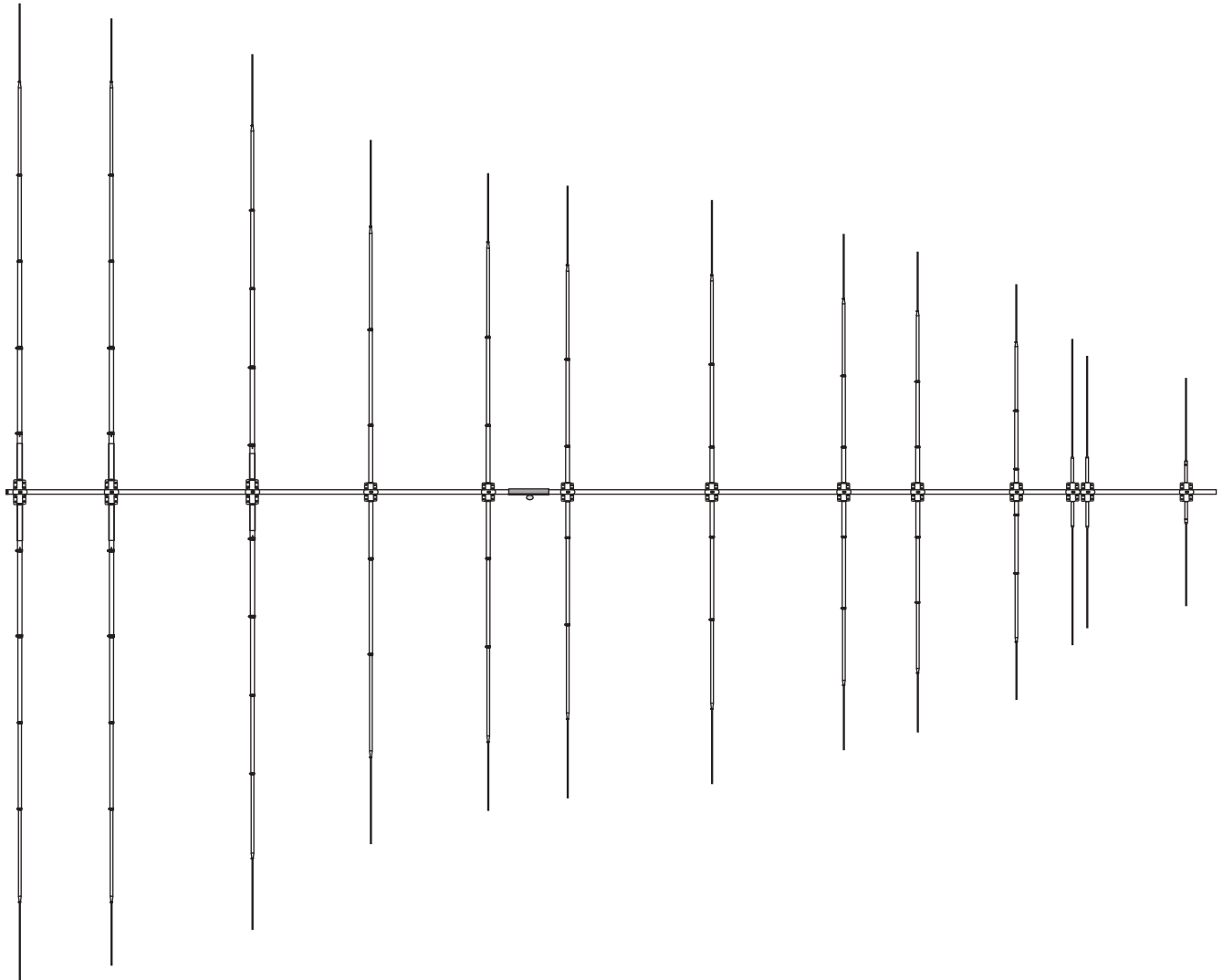
# Cushcraft

Amateur Radio Antennas

## BOLP-1013

13 Element 5 Band Optimized Log Periodic Antenna

### INSTRUCTION MANUAL



CAUTION: Read All Instructions Before Operating Equipment

**Cushcraft**  
Amateur Radio Antennas

308 Industrial Park Road  
Starkville, MS 39759 USA

Tel: 662-323-9538 Fax: 662-323-6551

VERSION 1A

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## Theory of Operation

The design of the BOLP-1013 is based on a 13 element log-periodic dipole array with computer optimization on each of the 20,17,15,12,10 and 6 meter bands. This gives the antenna more gain and better swr at each of these frequencies. Large feed tubes and high power balun make this antenna easily handle legal limit power. Boom supports and high grade tubing make this antenna strong enough to handle high winds and icing.

### Tubing List

174865	7/16 X 48	4
174987	7/16 X 60	4
175512	7/16 X 6042-3/4	6
175669	7/16 X 56-1/2	4
176214	7/16 X 31-1/2	2
179782	7/16 X 19	6
195650	7/16 X 65	2
171539	2X .120 X 54-3/4 SW	1
171540	2X .120 X 81 SW	2
171541	1-7/8 X .083 71-1/8 INSERT	1
173754	2X .049 X 75	1
179876	2 X .120 X 80-3/8	1
195000-1	FEED TUBE 1	2
195000-2	FEED TUBE 2	2
195000-3	FEED TUBE 3	2
195000-4	FEED TUBE 4	2
195000-5	FEED TUBE 5	2
195000-6	FEED TUBE 6 Short	2
193360	5/8 X 36 SWAGE	22
193155	5/8 X 15-1/2 SWAGE	6

## Preparation for Assembly

When unpacking your antenna, check inside of all tubing for smaller diameter tubes and other small parts. To conserve space, these smaller parts are sometimes packed inside larger pieces. Check all parts against the parts list to ensure no parts are missing. The hardware supplied with this antenna is bagged to aid in assembly when possible.

You may want to sort the aluminum tubing for the elements before assembly. This makes element assembly much easier. The table shows tubing size length, and quantity. A good practice is to mark the tube with a sharpie so that it can be identified quickly and verified once the antenna is assembled. Marking the elements once assembled will also help. Some rubber bands will hold the tubes nicely until needed.

At the beginning of the Assembly section, a list of parts and diagrams showing the locations used has been supplied. This separation of parts is to make the assembly less confusing because of all the parts used. The QTY number on the bags is the actual number of parts needed to assemble the antenna. The number of parts actually in the bag may exceed this number so don't worry if you have a few left over when your done. The few extra parts included are on purpose just in case some are lost during assembly.

### Tubing List

194360	7/8 X 36	6
194355	7/8 X 35-1/2	2
194205	7/8 X 20-1/2	2
194155	7/8 X 15-1/2	8
194055	7/8 X 5-1/2	4
195360	3/4 X 36	22
196360	1 X 36	6
199350-SA	1-1/4 X .058 X 30	4
199250-SA	1-1/4 X .058 X 20	2
170067-0	BETA ROD 1/4 rod x 20"	2

Choose a large, clear area to assemble your antenna. The area must be at least 28' x 38' (8.5 m x 11.6 m). You may wish to use a temporary mast or sawhorses to support the boom during assembly. A concrete driveway or parking area is an excellent area for assembly. If you assemble this antenna over a grassy area, precautions should be taken so that hardware is not accidentally lost during assembly. We have included some extra small parts with this product, just in case some are lost.

All tubing supplied with the BOLP-1013 antenna telescopes together. Make all measurements to the given dimensions, plus or minus no more than 1/8 inch (3 mm).

**TOOLS:** The following tools are required for easy assembly.

Tape measure, 30 feet.....	1
Adjustable wrench, 8 inch.....	2
Nut Driver, 5/16" (element compression clamps).....	1
Nut Driver, 3/8" (#10 hardware).....	1
Nut Driver, 7/16" (element-to-boom clamps).....	1
Nut Driver or open-end wrench, 1/2" (boom-to-mast).....	1

We suggest that the assembly of this product be done over at least a 3 day period. We further suggest that you read this manual thoroughly, in its entirety, and then go through the manual a second time and identify and familiarize yourself with all of the antenna components. Start assembling the antenna when you are prepared. A few extra minutes invested in the assembly process will ensure many years of satisfaction with this antenna.

To the right is an example of one of the parts pack labels. You will find the rest on the next few pages. These labels give the part number along with the quantity of items in the bag. There are a total of 19 parts packs that have divided the parts, when possible, into bags that are associated with a step in the process of assembly.

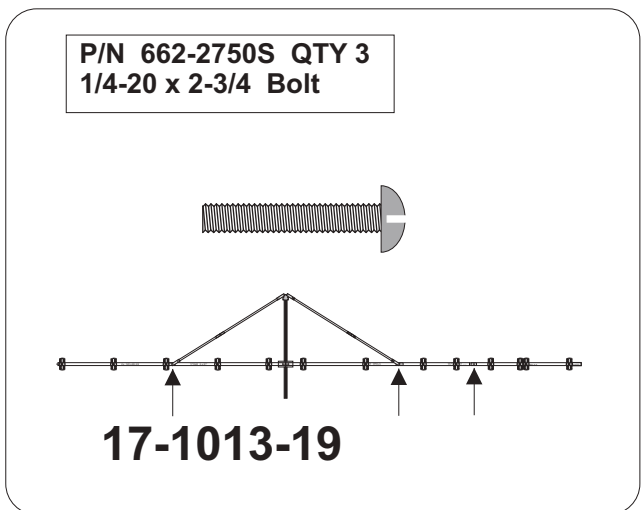
## Installation Planning

The Hy-Gain BOLP-1013 Log-Periodic Antenna requires a supporting tower structure which is at least 20' (6.1 m) in height above ground level and which will support at least 16 sq. ft. (1.5 sq. m) wind surface area. A support mast is not supplied with this antenna. Mast height will vary according to installation. A standard 10 foot mast will suffice in most cases. This antenna may also be installed atop buildings or other structures. In these cases, the antenna should be at least 10' (3 m) above a peaked roof and at least 20' (6.1 in) above a large flat roof. Performance may be degraded at less than these heights, depending upon the amount of metal in the roof and/or attic. Other nearby antenna structures, power lines, and guy wires may also affect the performance of this antenna.

The BOLP-1013 also requires a suitable rotator, if not installed in a fixed azimuth. Suitable rotators include Hy-Gain models T2X and HDR- 300/A.

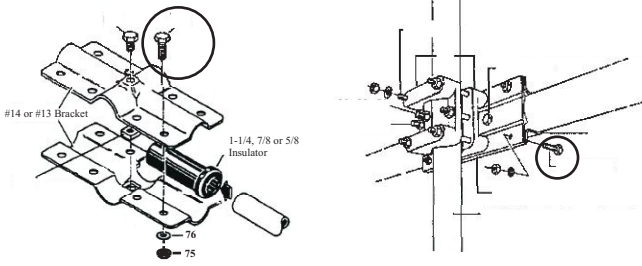
## Corrosion Precautions

The BOLP-1013 antenna is designed to be relatively maintenance free for most environments. All hardware is made of passivated stainless steel, typically grade 304. The internal tooth-type lockwashers used in this antenna are grade 410 stainless steel, and are slightly magnetic. The element tubing clamps are grade 304 stainless steel. Most other metallic parts are aluminum. All insulators exposed to sunlight are made from U.V. resistant black polyethylene or black Cycolac®.



**P/N 505266**  
**1/4-20 X 3/4 HEX BOLT**

**QTY 110**

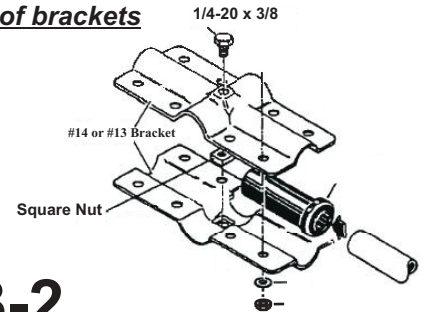


**17-1013-1**

**P/N 500156 ITEM 68 QTY 13**  
**1/4-20 X 3/8 HEX BOLT**

**P/N 551367 ITEM 74 QTY 13**  
**1/4-20 Square Nut**

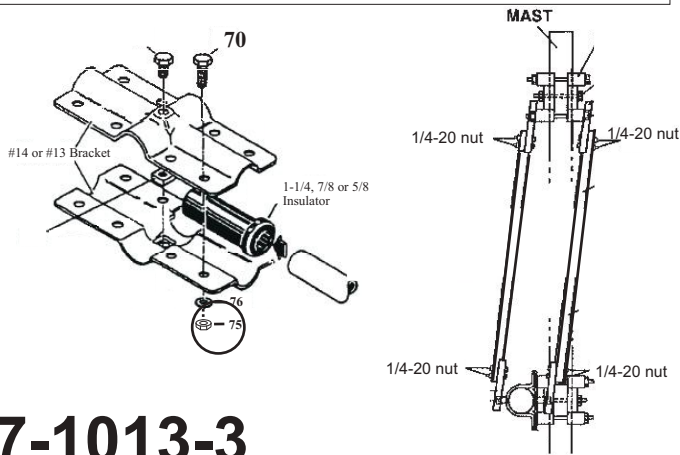
*Only used on top of brackets*



**17-1013-2**

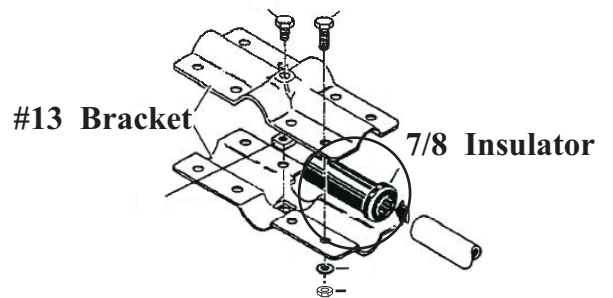
**P/N 554099**  
**1/4-20 HEX nut**

**QTY 130**



**17-1013-3**

**P/N 463767 ITEM QTY 14**  
**7/8 INSULATOR**

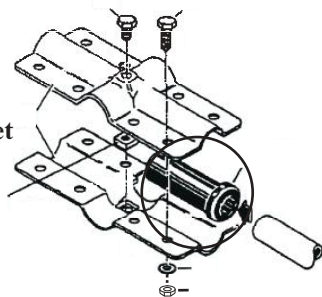


**17-1013-4**

**P/N 465833 ITEM QTY 6**  
**1-1/4 INSULATOR**  
 Used in #14 Bracket

**P/N 461057 ITEM QTY 6**  
**5/8 INSULATOR**  
 Used in #13 Bracket

7/8 uses #13 bracket  
 1-1/4 uses #14 bracket

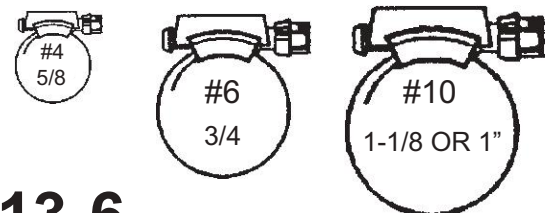


**17-1013-5**

**P/N 745-3104s ITEM QTY 26**  
**#4 hose clamp**

**P/N 745-3106s ITEM QTY 24**  
**#6 hose clamp**

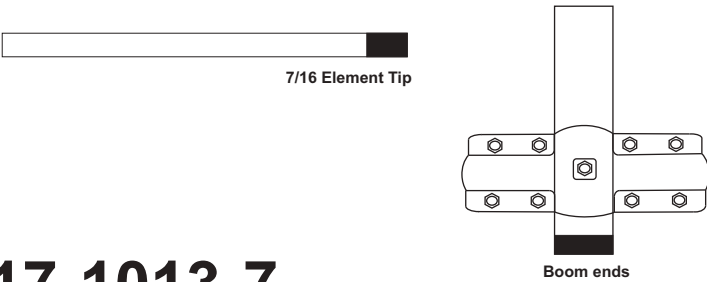
**P/N 745-3110s ITEM QTY 32**  
**#10 hose clamp**



**17-1013-6**

P/N 455625 ITEM QTY 2  
2 inch end cap

P/N 455644 ITEM QTY 26  
7/16 inch end cap

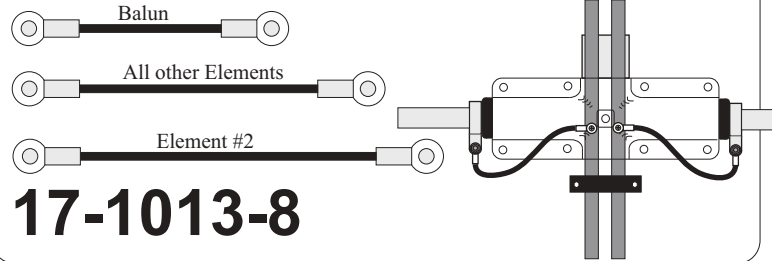


17-1013-7

P/N 878561 QTY 24  
short pigtail 6-1/2 All Other Elements

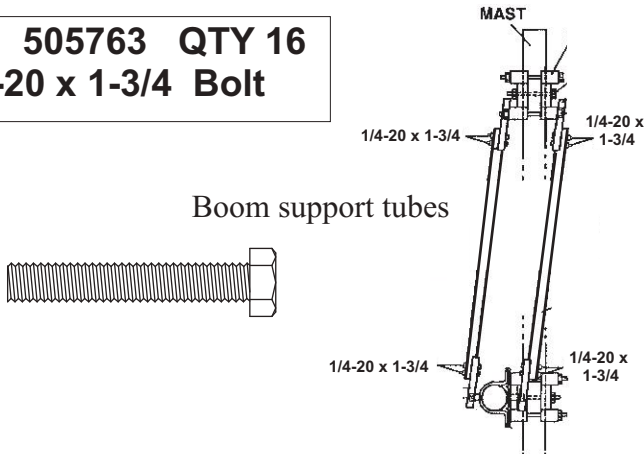
P/N 879973 QTY 2  
long pigtail 9-1/2 Element #2 Only

P/N 870546 QTY 2  
pigtail 4-1/8 Balun Connection



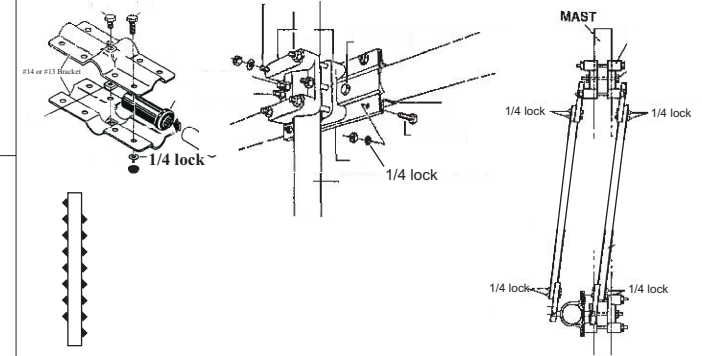
17-1013-8

P/N 505763 QTY 16  
1/4-20 x 1-3/4 Bolt



17-1013-9

P/N 562961 QTY 130  
1/4" Internal lock washer



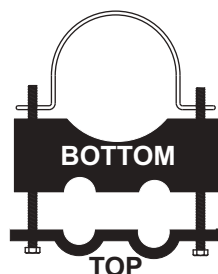
17-1013-10

P/N 465595 ITEM QTY 8  
FEED INSULATOR BOTTOM

P/N 465600 ITEM QTY 8  
FEED INSULATOR TOP

P/N 177888 ITEM QTY 8  
FEED INSULATOR CLAMP

P/N 500157 ITEM 63 QTY 16  
10-24 x 2 hex bolt FEED INSULATORS



17-1013-11

P/N 500349 QTY 6

5/16 X 5 HEX BOLT

P/N 5142400 QTY 1

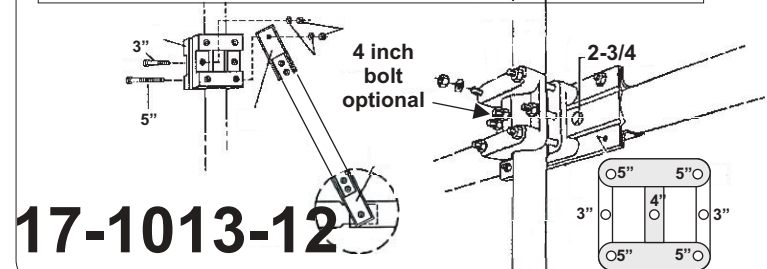
5/16 X 4 HEX BOLT

P/N 500392 QTY 4

5/16 X 3 HEX BOLT

P/N 506968 QTY 2

5/16 X 2-3/4 HEX BOLT

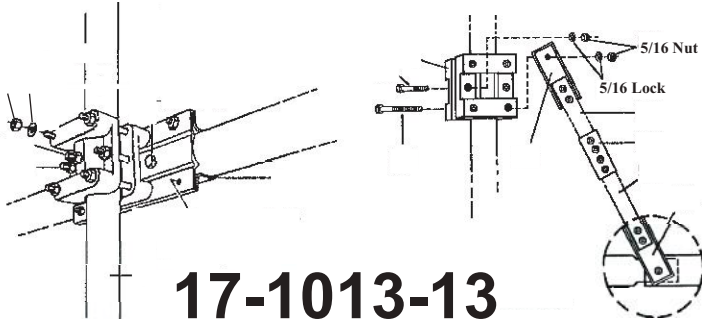


17-1013-12

P/N 555747 QTY 16  
5/16 hex nut



P/N 564792 QTY 16  
5/16 lock washer



**17-1013-13**

P/N 168695 QTY 6  
1-1/4 clamp



P/N 169339 QTY 16  
7/8 clamp

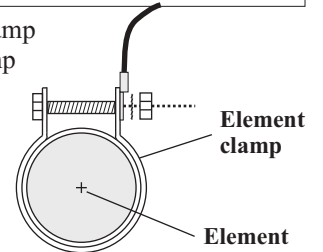


P/N 171329 QTY 6  
5/8 clamp



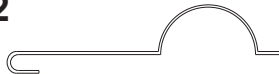
Elements 1,2,3----- 1-1/4 clamp  
Elements 4,5,6,7,8,9,10, ----7/8 clamp  
(Element #11 for 10 meter option)

Elements 11,12,13 -----5/8 clamp  
(For 6 meter option)

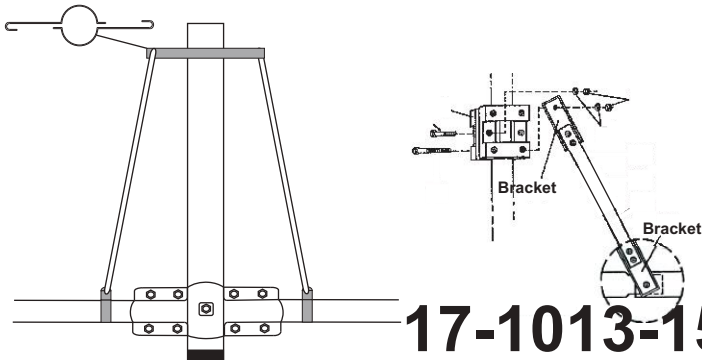


**17-1013-14**

P/N 163371 QTY 2  
shorting clamp

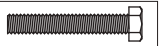


P/N 179888 QTY 8  
channel bracket



**17-1013-15**

P/N 500159 QTY 6  
10-24 x 1-1/2 hex bolt Element clamps 1,2,3



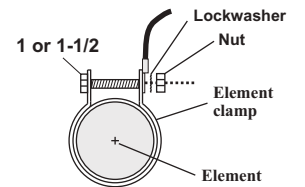
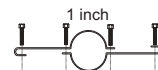
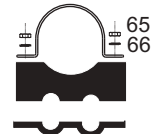
P/N 504069 QTY 24  
10-24 x 1 hex bolt Element clamps 4-13



P/N 554071 QTY 46  
10-24 hex nut used on all 10-24 bolts



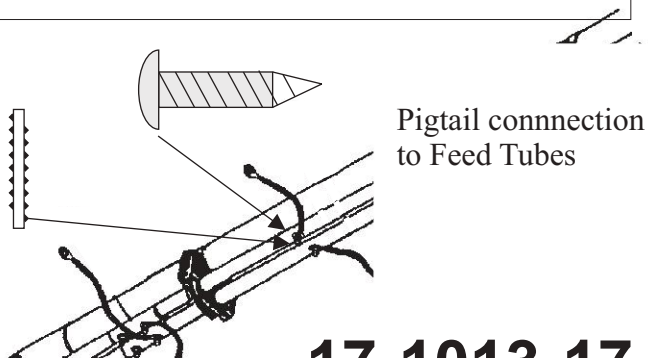
P/N 565697 QTY 46  
#10 internal lock used on all 10-24 bolts



**17-1013-16**

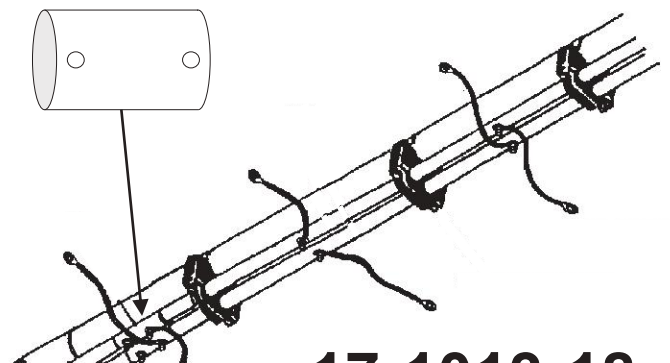
P/N 560035 QTY 48  
#8 Internal lock washer

P/N 562064 QTY 48  
#8 SELF TAPPING SCREW



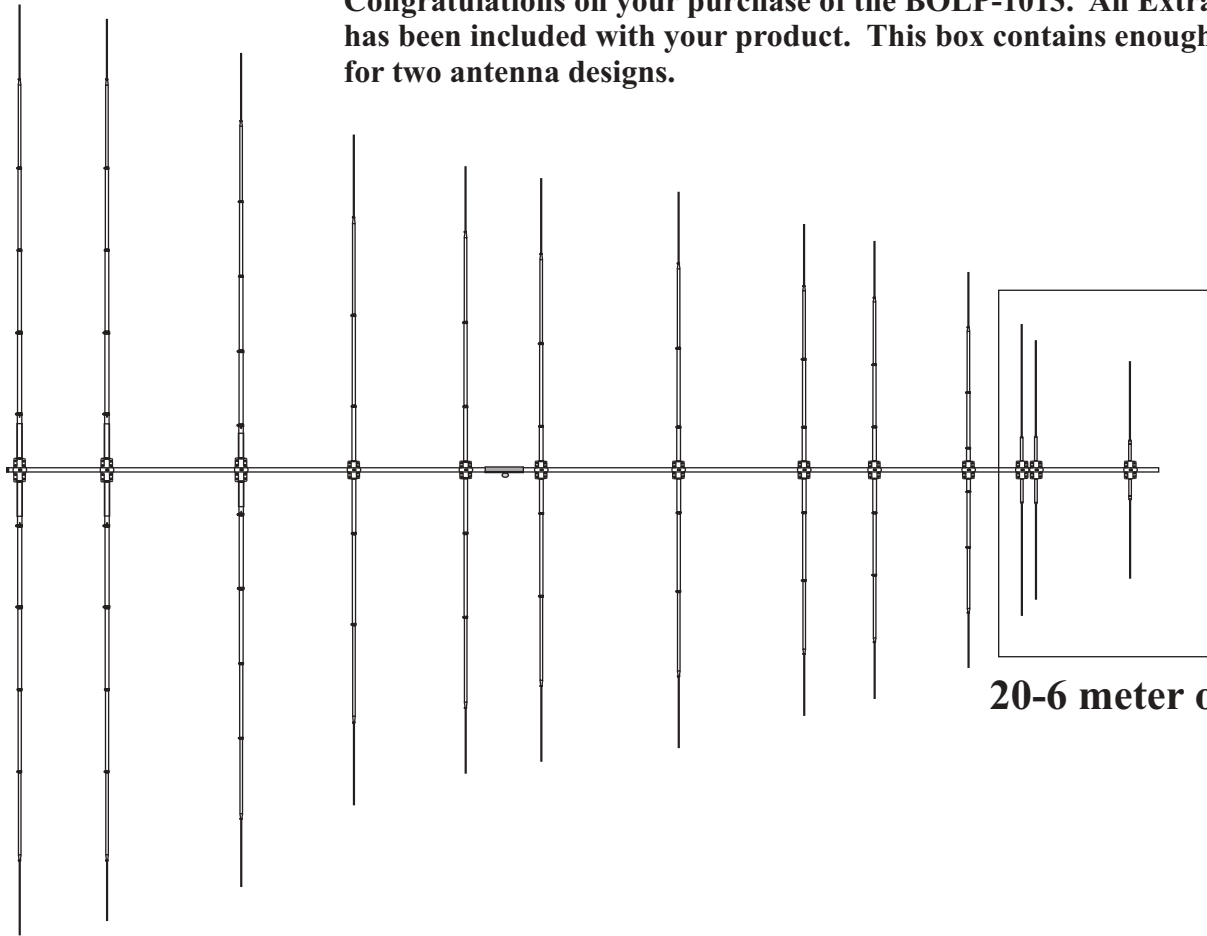
**17-1013-17**

P/N 191012 QTY 8  
FEED TUBE SPLICE

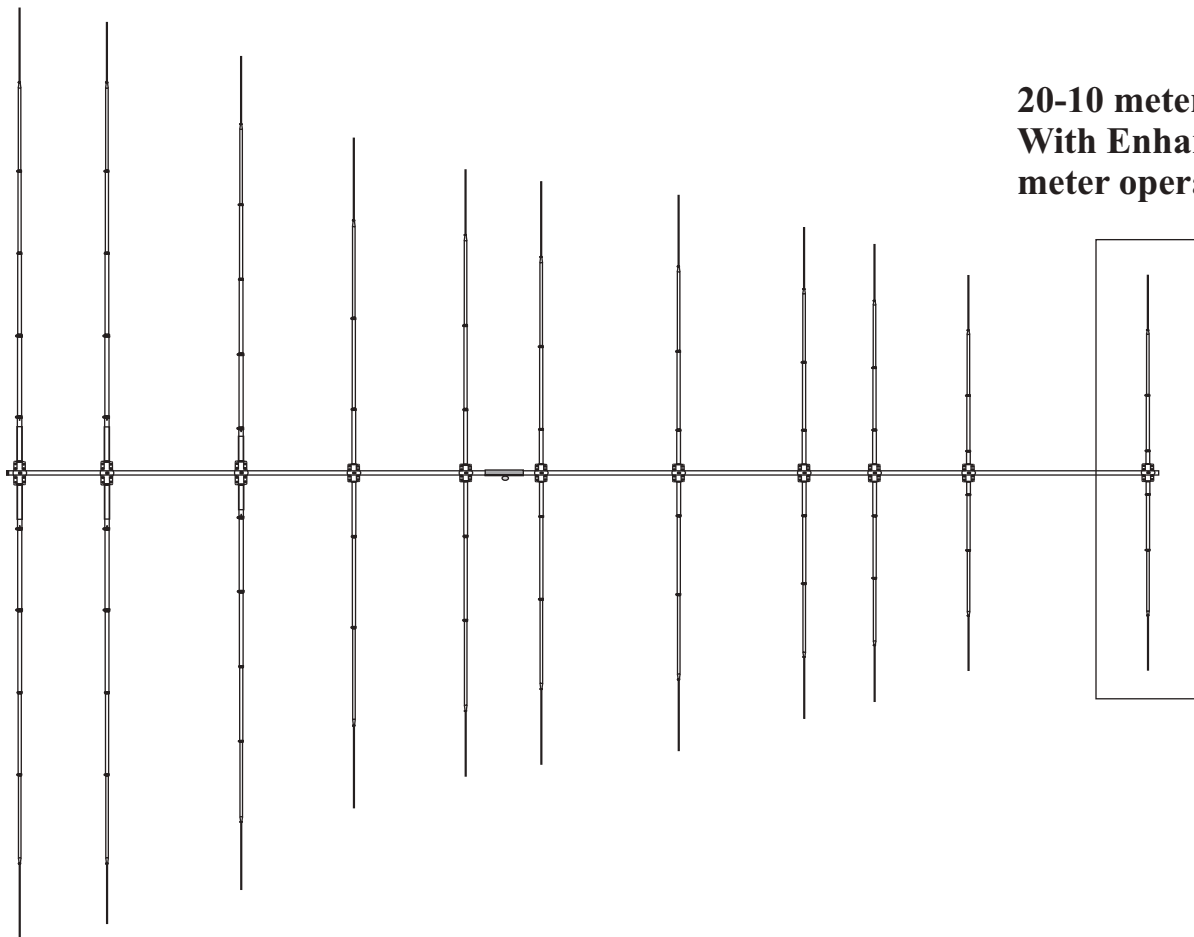


**17-1013-18**

**Congratulations on your purchase of the BOLP-1013. An Extra surprise has been included with your product. This box contains enough tubing for two antenna designs.**



**20-6 meter option**



**20-10 meter option  
With Enhanced 10  
meter operation**

A light amount of clear lacquer or an acrylic spray may be used to coat the exterior surface of the element assemblies if this antenna is to be installed near a sea coast. Tighten all joints securely before coating! Also, if installed near a sea coast, the solder lugs on the pigtail wire assemblies should not touch the aluminum tubing or clamp directly. Each solder lug should be between 2 stainless steel flatwashers (not supplied). Tighten these connections securely and completely coat with Scotchkote© or RTV.

NOTE: Only use alcohol-based RTV (non-corrosive). The acid-based RTV (which releases acetic acid and smells like vinegar) will corrode metal.

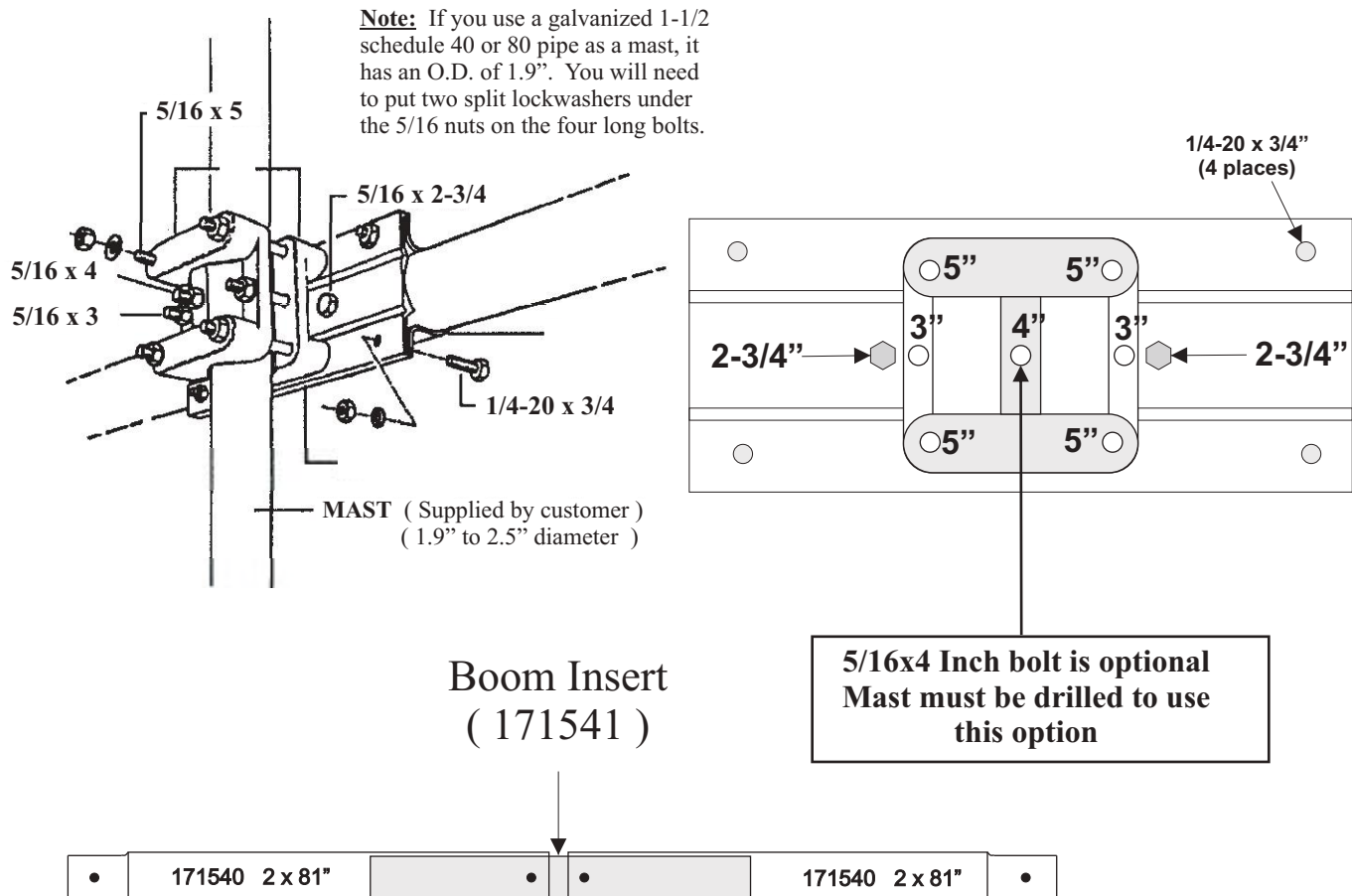
If a UHF connector (PL-259) is used with the BN-4000 balun, seal the connector with Coax-Seal™ or black electrical tape for rain protection. Type N connectors are designed to be weatherresistant if tightened securely.

## Assembly of the Boom

Slide the boom insert into the boom ends, as shown in Figure 1. Select the boom to mast bracket and clamp parts. Loosely assemble them on the boom ends.

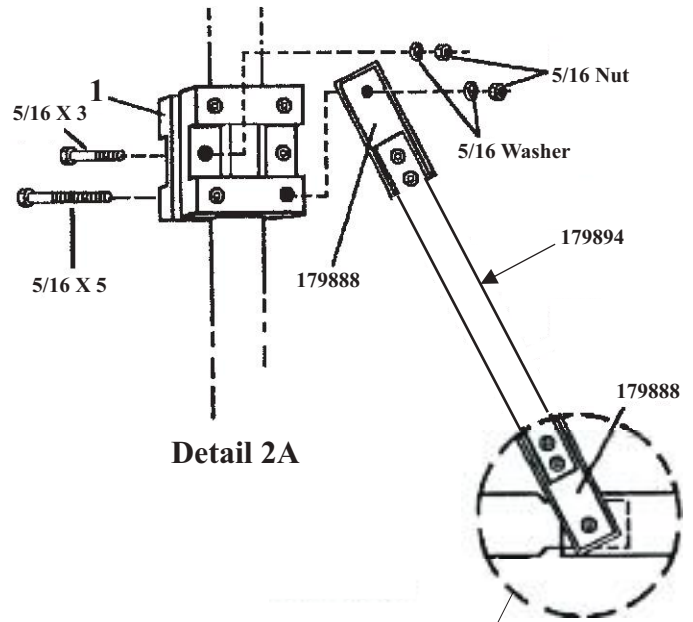
Secure the boom ends and brackets together with four 1/4-20 x 3/4 bolts, lockwashers and nuts, and two 5/16 x 2-3/4 bolts, lockwashers and nuts. Tighten these six bolts securely. the casting to boom bracket may deform slightly when the four 1/4 bolts are tightened. This is normal.

Assemble the two cast aluminum brackets on your temporary mast about 4 feet above the ground. An eight foot length of 2" ABS or PVC plastic drain pipe makes an inexpensive temporary mast. Secure the two brackets together using two 5/16 x 3 bolts, lockwashers and nuts. tighten these two bolts evenly until the brackets are snug.

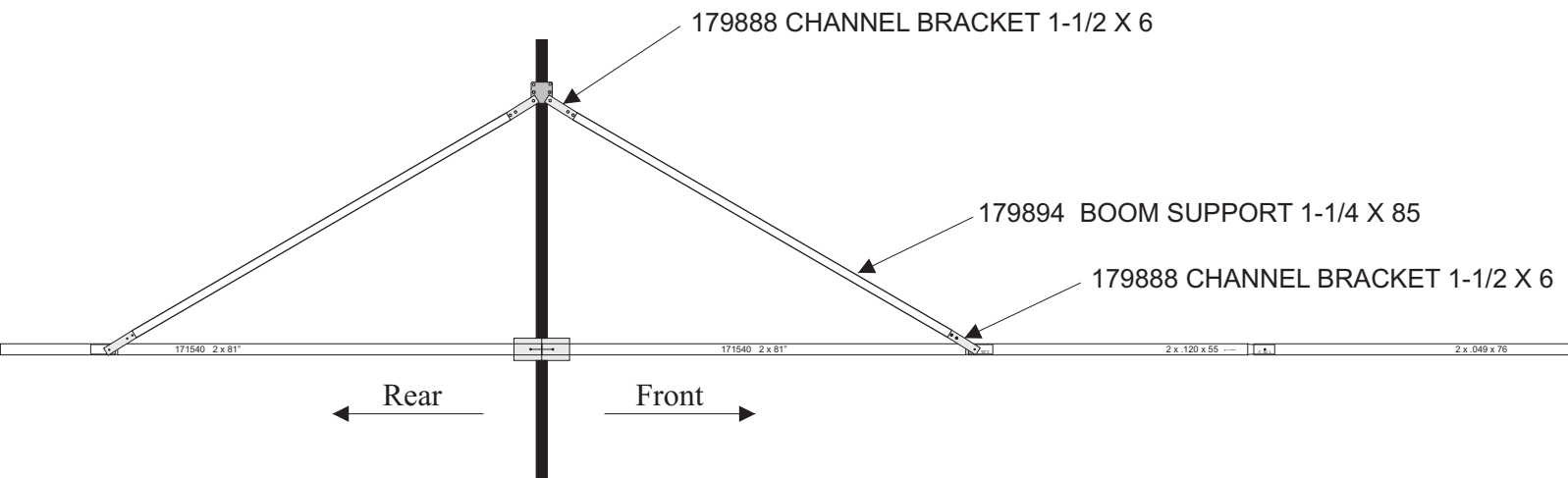
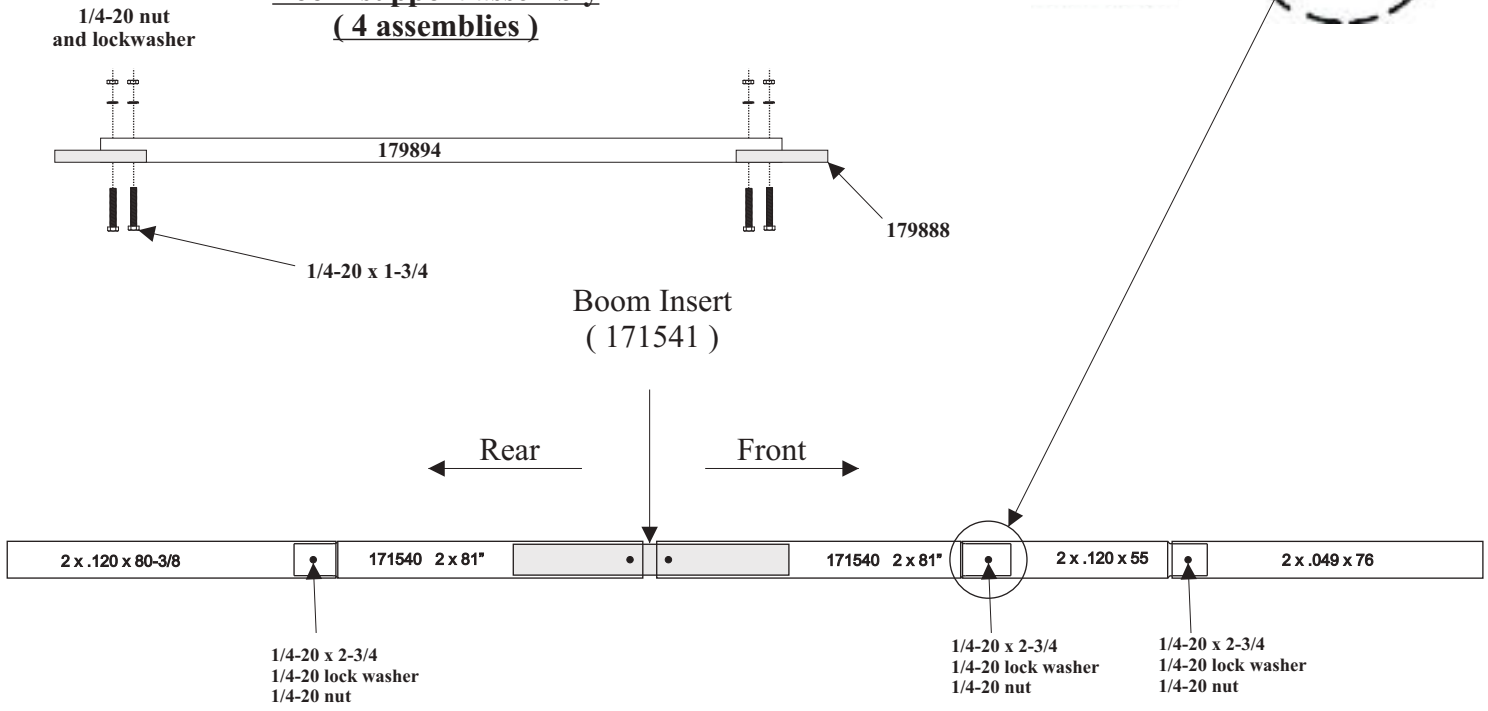


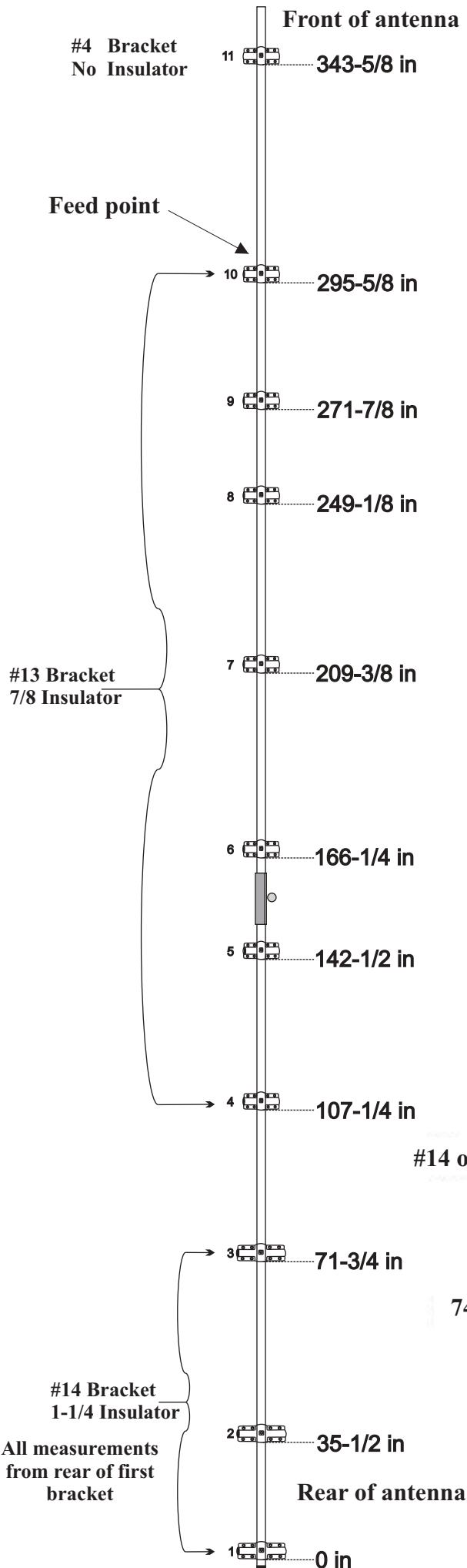


Loosley attach (2) two mast brackets to the mast approximately 4 feet above the boom with (2) two 5/16" x 3" bolts and hardware, and the top (2) two 5/16" x 5" bolts and hardware. Attach the channel bracket ends of the spliced front and rear boom support tubes to the mast bracket on the bottom (2) 5/16" x 5" bolts. Slide the mast brackets up and down to line up the holes, then attach with 1/4" x 1 3/4" bolts and hardware. Tighten all hardware on the channel brackets and boom. Snug all hardware on the mast bracket so they do not vibrate off.

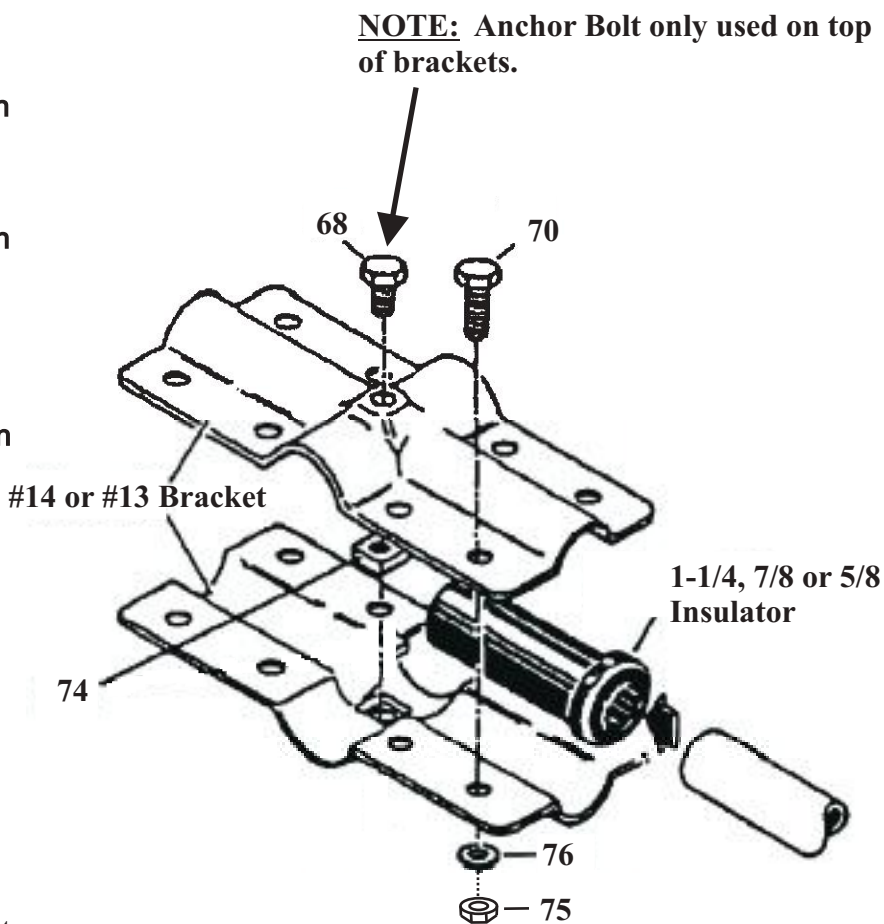


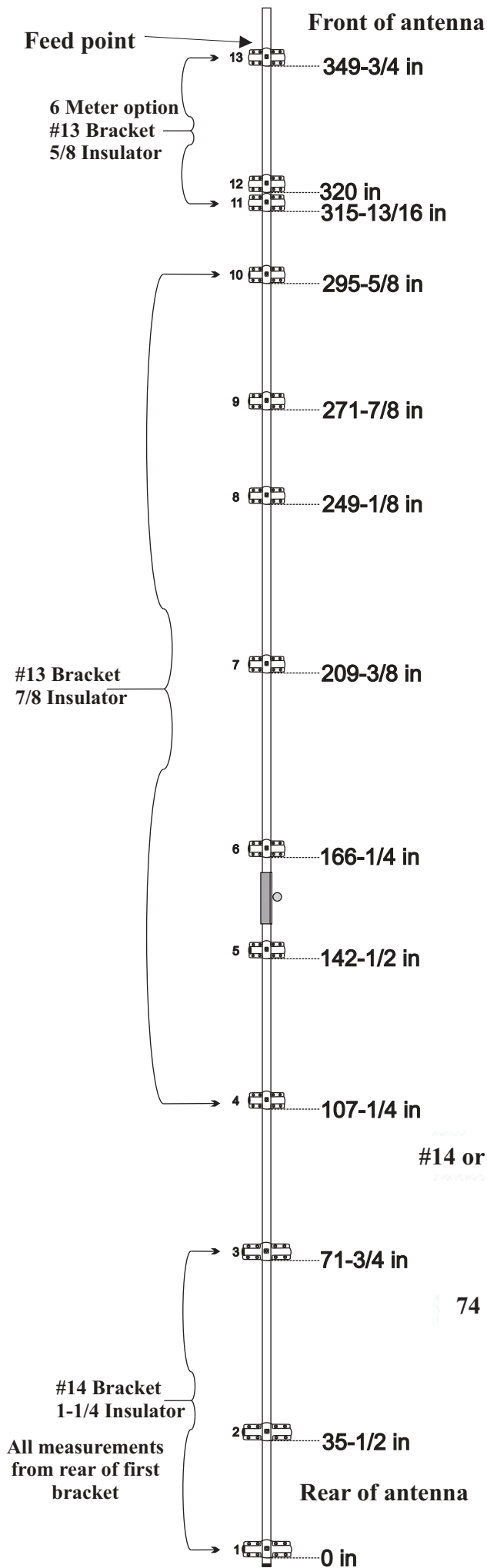
**Boom support assembly  
( 4 assemblies )**





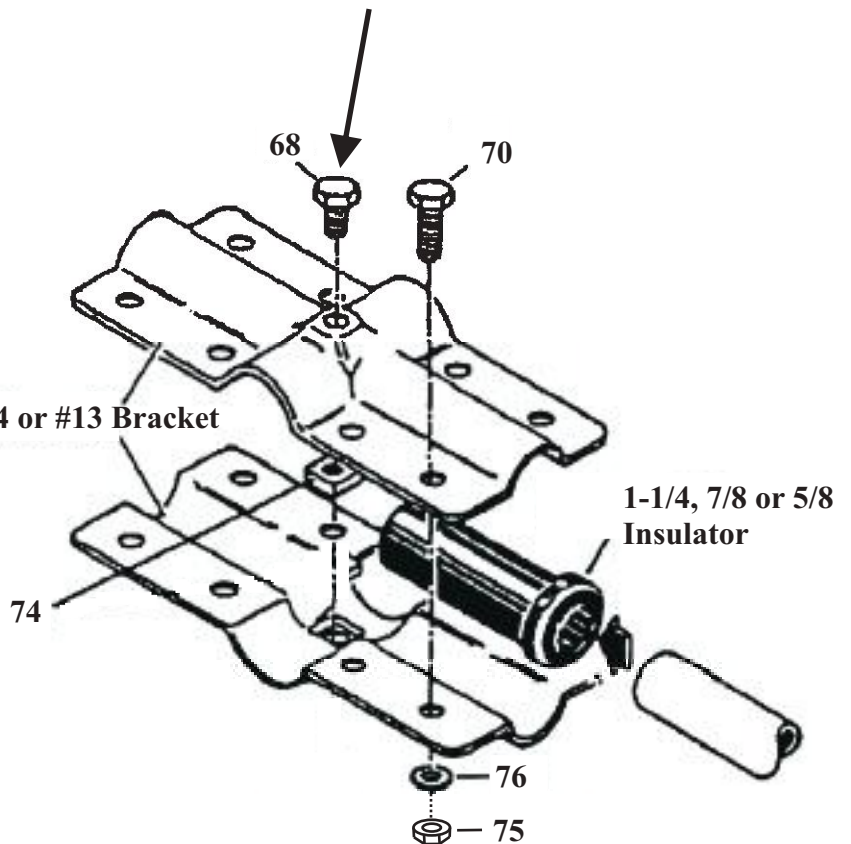
Assembly at this point can go two ways. If your not interested in six meter operation on this antenna, then you have the option of leaving it off and installing a ten meter parasitic element instead. This parasitic will add gain and F/B performance on ten meters without affecting the other bands. The feed point of the antenna will move to bracket # 10 if you choose this option. A shorter feed tube pair has been included in the box for this. The diagram on the left shows the element placement for the ten meter option. Each measurement is from the rear of the bracket to the rear of bracket #1. Install the #1 bracket about 1-1/2 inch from the end of the boom. The rear of bracket #1 is the Zero point for all measurements to the other brackets. Use a marking pen to draw a line on the boom at each of the measurements before installing the brackets. Each bracket should be in front of this line. Brackets can move during assembly and this line will be a reference for final adjustments when aligning the elements. Three different element brackets and two different insulators are used in this configuration. The parasitic element (11) does not have an insulator and is not connected to the feed line. Do not install anchor bolts on the bottom of the brackets.





The diagram to the left shows the bracket locations for the six meter option. Use the same installation method as described for the ten meter option. This configuration uses 2 different brackets and 3 sizes of insulators. All the elements are fed in this layout and the feed point is at element #13 which is at the very front of the antenna. There will be a few inches of boom left on the front. This is where the BN-4000B will mount later. Install the brackets on the boom snug but not tight as the elements will still need to be pushed into the insulators. The marks on the boom will help in case the bracket moves when installing the elements. All measurements on this version are the same as the ten meter version on elements 1-10. Enough parts have been included to make either version of the antenna so you will have extra parts left over when your done. If your tape measure does not have inch increments but rather feet and inches, then you can convert these numbers by dividing by 12 to get the number of feet and the remainder will be the number of inches. For example, 320 divided by 12 is 26. So the feet number is 26. What is left over is the inch number so 26 feet = 312 inches  $26 \times 12 = 312$  To get to 320 you need 8 more inches.  $320 - 312 = 8$  so 320 inches = 26 feet 8 inches

**NOTE:** Anchor Bolt only used on top of brackets.



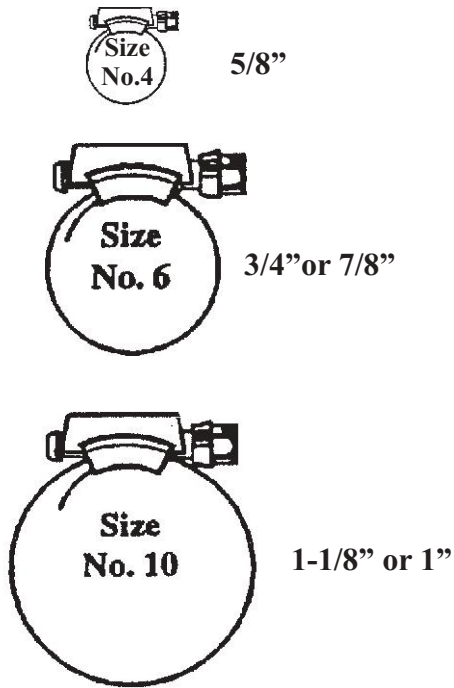
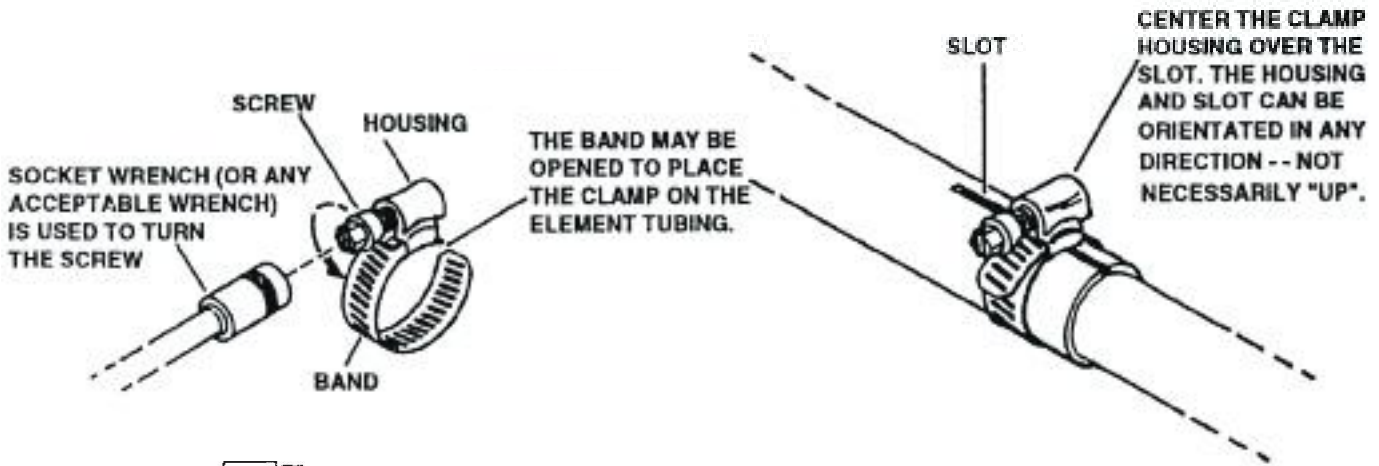


Figure 6

### Installation of Tubing Clamps on Elements

Select the proper size tubing clamps as shown in Figure 6. 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 6.

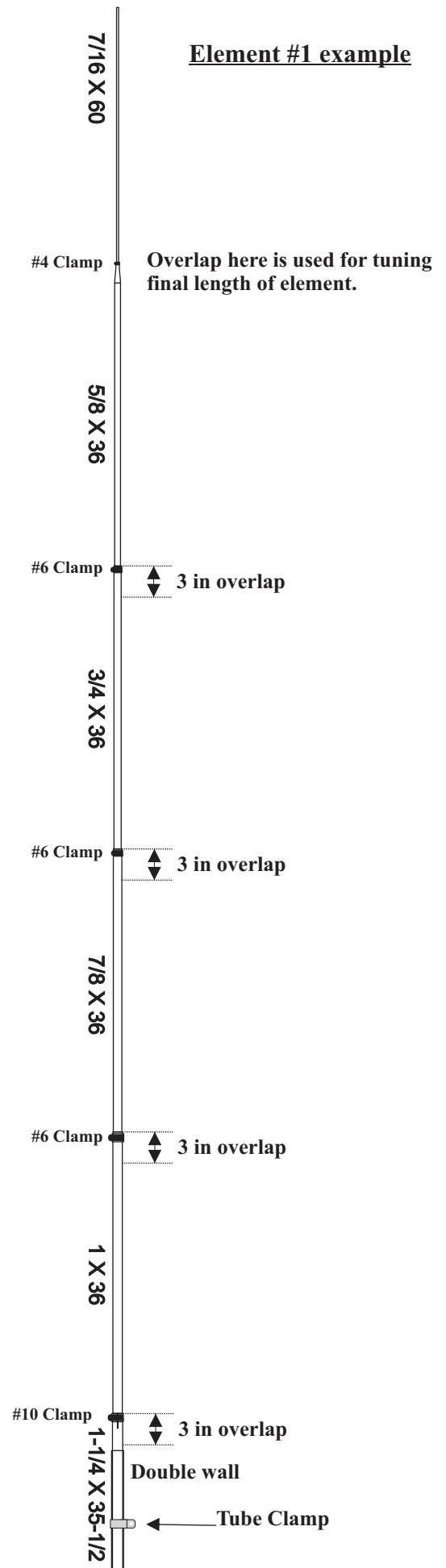
After adjustment of the tubing lengths, tighten the clamp with a 5/16 inch nut driver, socket or open end wrench until the tubing will not twist or telescope. DO NOT overtighten! Also, if you loosen and re-tighten a clamp more than 5 times, we suggest that you replace the clamp. After repeated tightenings, these clamps may become difficult to completely tighten. Should you need to replace these clamps, use only high quality stainless steel clamps to ensure proper torque.

## Element Assembly

Use the diagrams to select the tubing for each element. If you previously sorted the tubing, this step will be much easier. Each element uses two identical element halves. Assemble both halves of each element at the same time.

Remember that because there are two versions of this antenna that some tubing will be left over no matter which version you assemble. Take your time and lay the elements in order on the ground as you finish each pair. Start with the longest element (#1) and largest tube. The first 3 elements have a double wall tube at the boom. Insert the 1 inch tube into the 1-1/8 end of the double wall tube. Allow the tubes to overlap 3 inches. Use a hose clamp to secure the tubes together. Repeat this with each tube. The 7/16 tubing is used to adjust the final length of the entire element so the overlap may be much greater or less than 3 inches. Use the chart to assemble the rest of the elements. Element lengths are from center of the boom to the tip of the 7/16 tubes so you won't be able to adjust the 7/16 tube until the elements are mounted into the brackets. Remember to slide the electrical connection clamps over the inside tube closest to the boom before inserting the element into the bracket. If you forget, the clamps can be stretched open to allow them to slide over the tube.

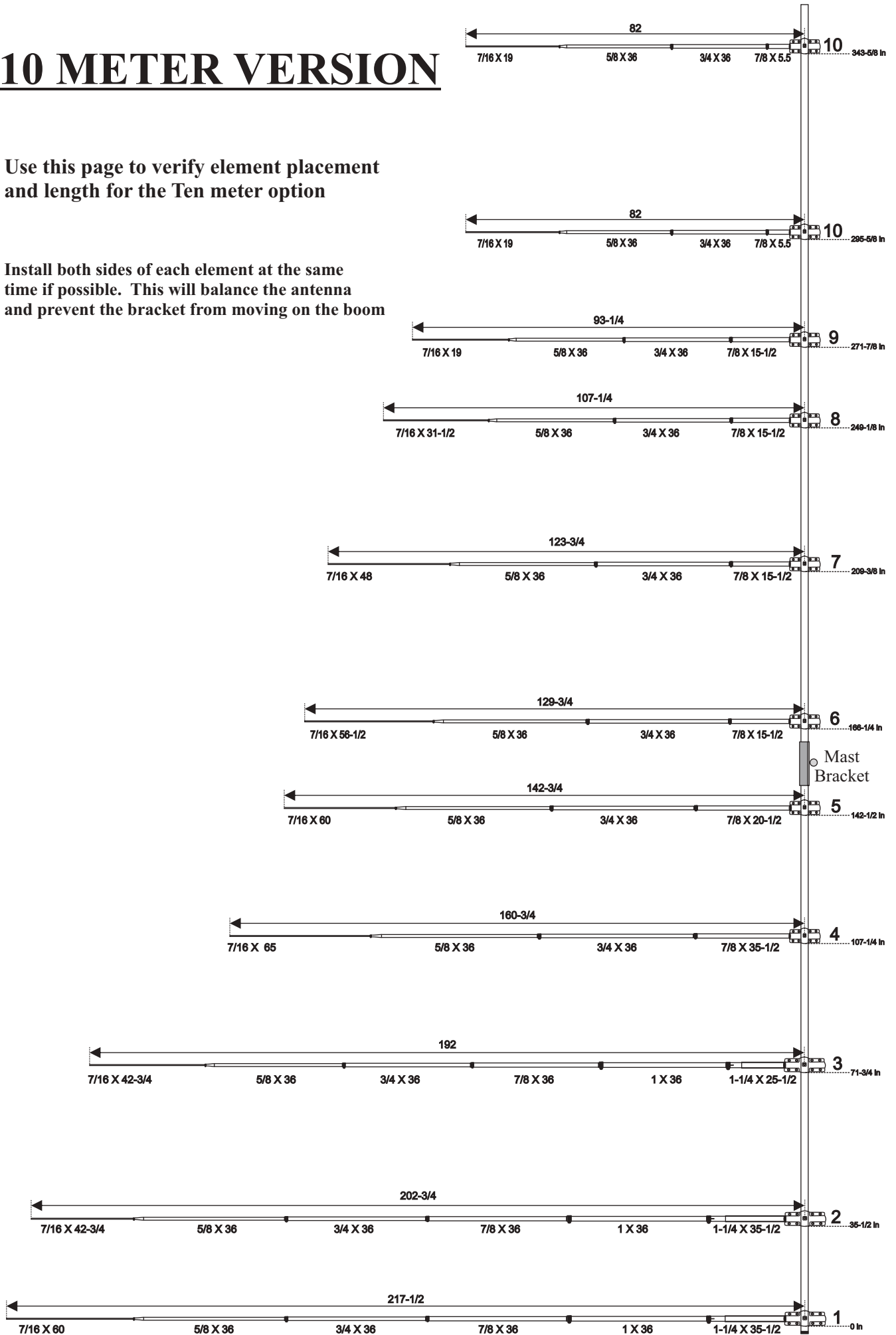
### Element # 1 Example



# 10 METER VERSION

Use this page to verify element placement and length for the Ten meter option

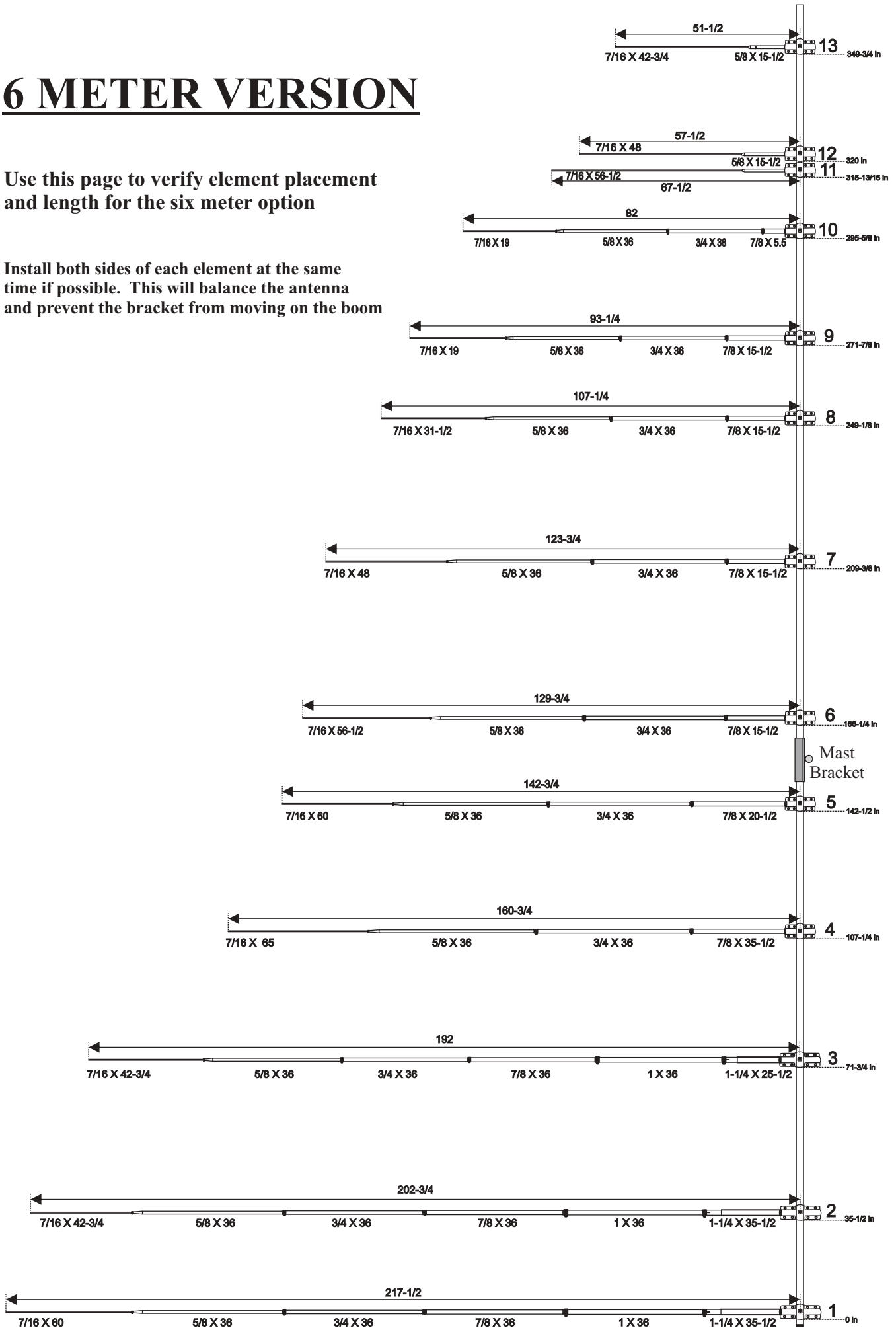
Install both sides of each element at the same time if possible. This will balance the antenna and prevent the bracket from moving on the boom



# 6 METER VERSION

Use this page to verify element placement and length for the six meter option

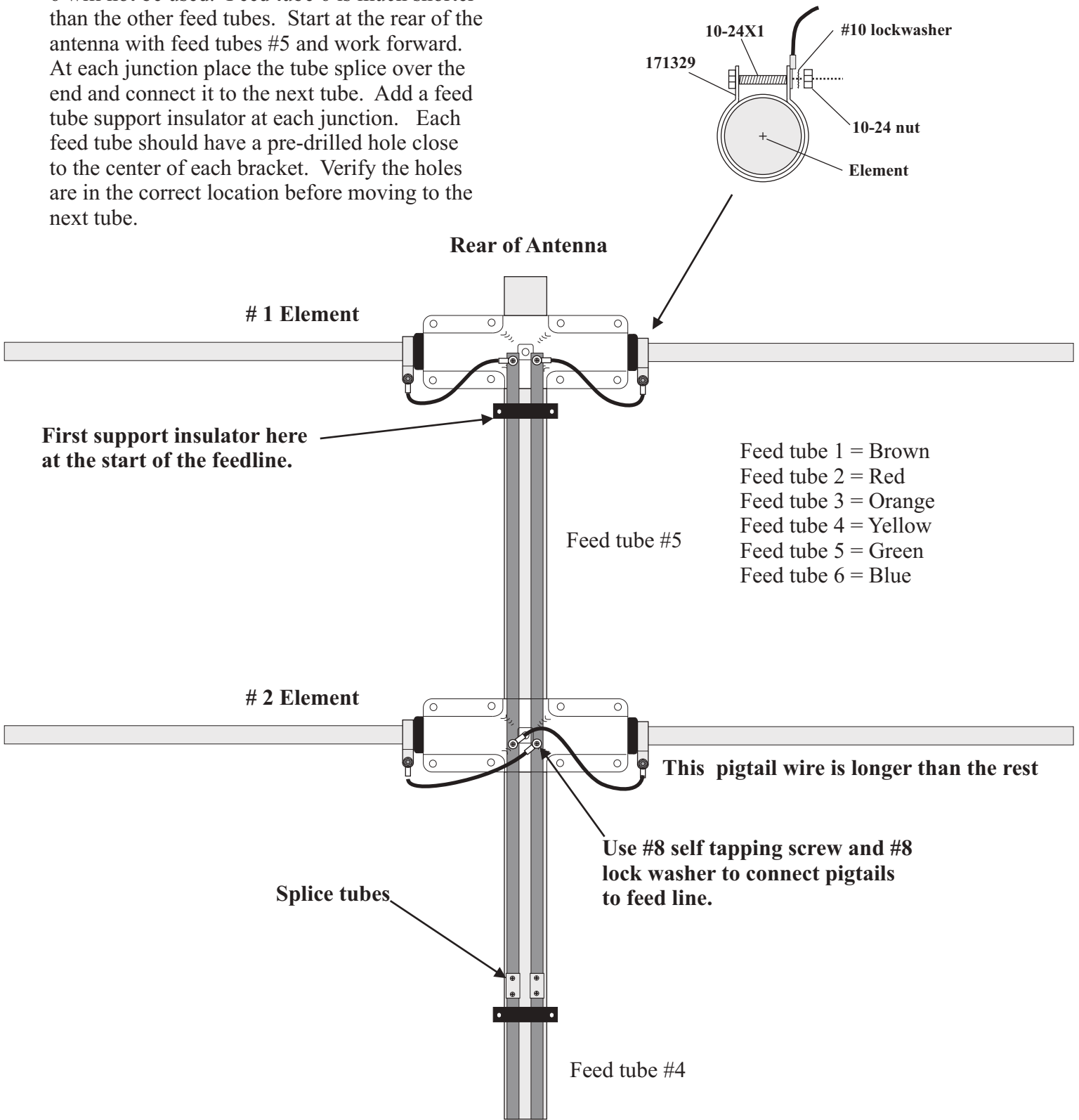
Install both sides of each element at the same time if possible. This will balance the antenna and prevent the bracket from moving on the boom



## Feedline Assembly

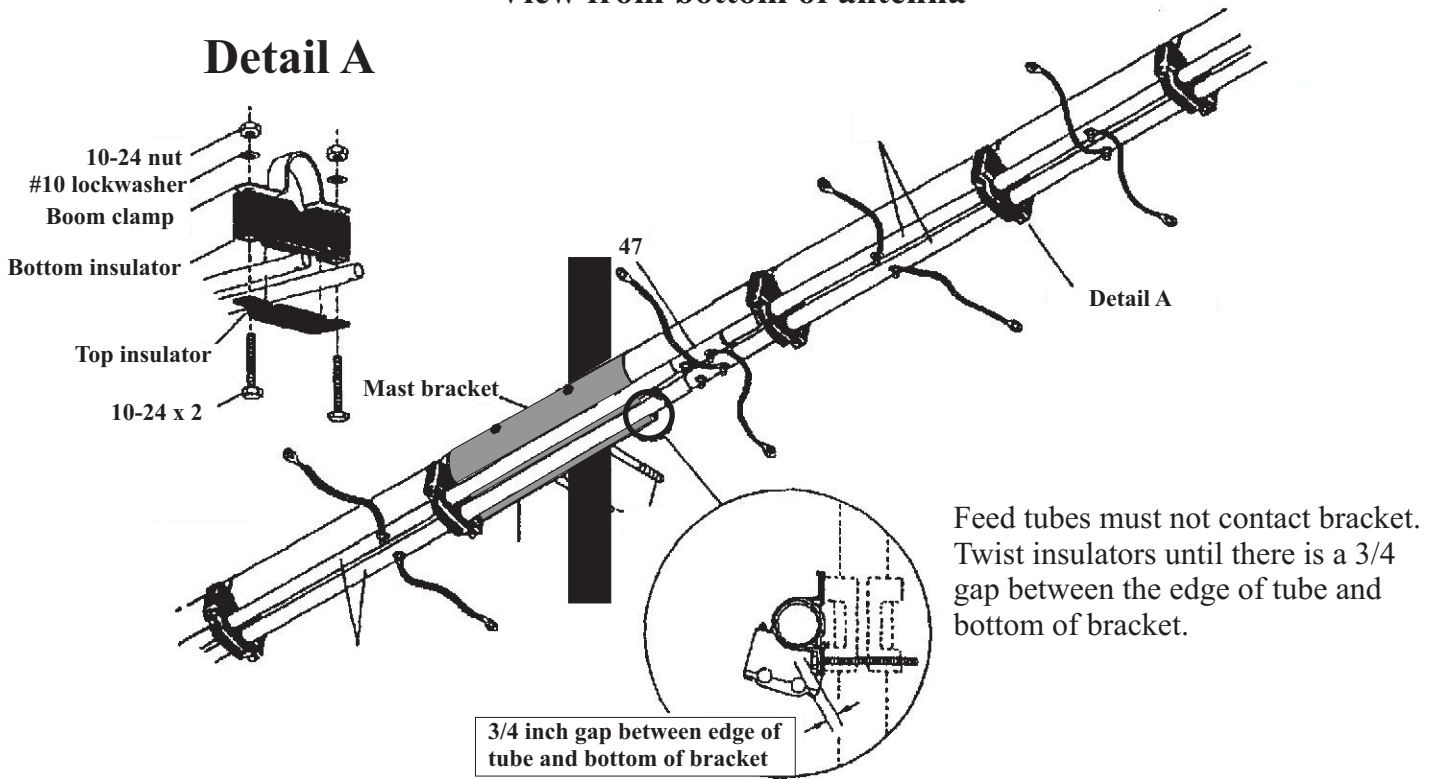
Select the ten 3/4" feed line tubes, eight 7/8 x 2" splice tubes, pigtail wire assemblies, support clamps, insulators and hardware as shown in the diagrams below. Identify each feed tube by the color band on it. If your building the ten meter version, feed tube 1 will not be used. If your building the six meter version, feed tube 6 will not be used. Feed tube 6 is much shorter than the other feed tubes. Start at the rear of the antenna with feed tubes #5 and work forward. At each junction place the tube splice over the end and connect it to the next tube. Add a feed tube support insulator at each junction. Each feed tube should have a pre-drilled hole close to the center of each bracket. Verify the holes are in the correct location before moving to the next tube.

All the holes in the feed tube must point downward. Leave the insulator brackets loose enough to twist them on the boom. The two insulator brackets close to the mast will need to be tilted to one side to avoid feed line connection to the mast bracket.



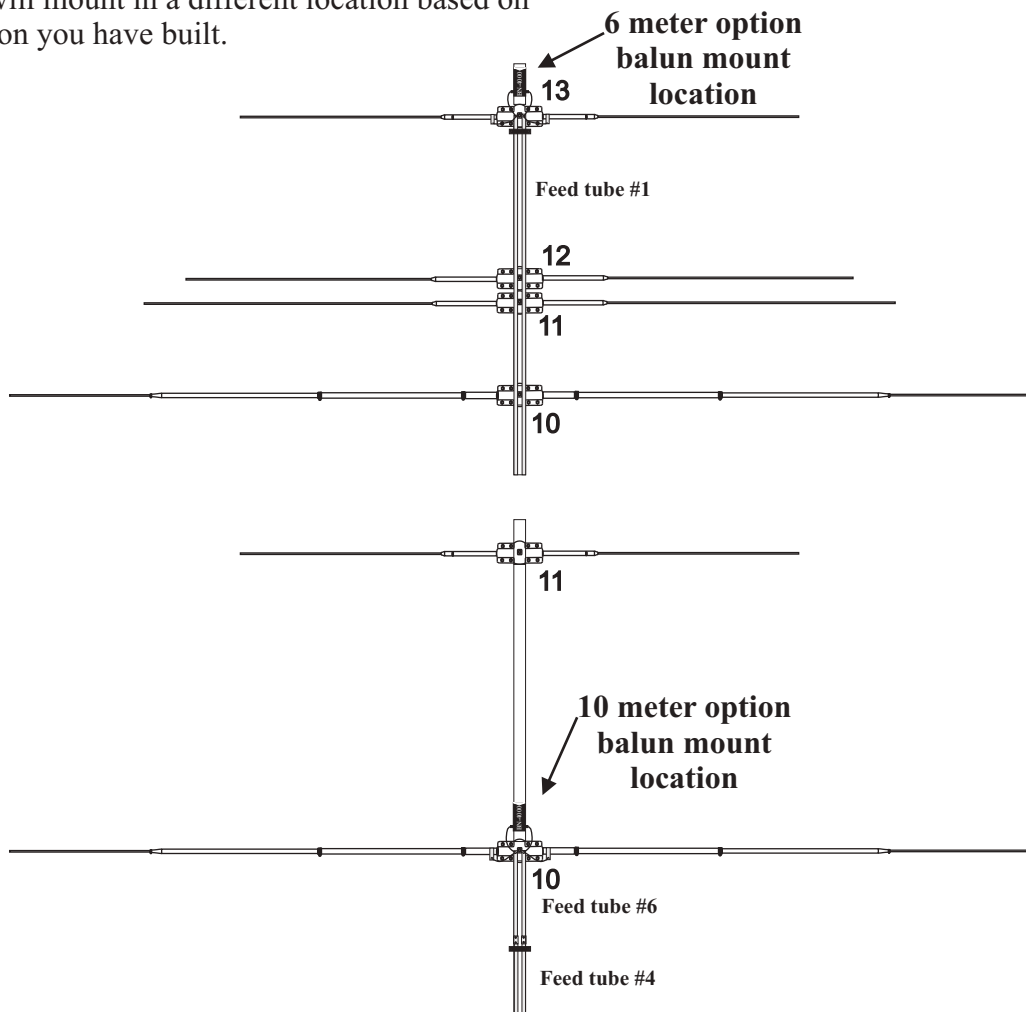


**View from bottom of antenna**



**Figure 11**

The balun will mount in a different location based on which version you have built.



## Balun connection

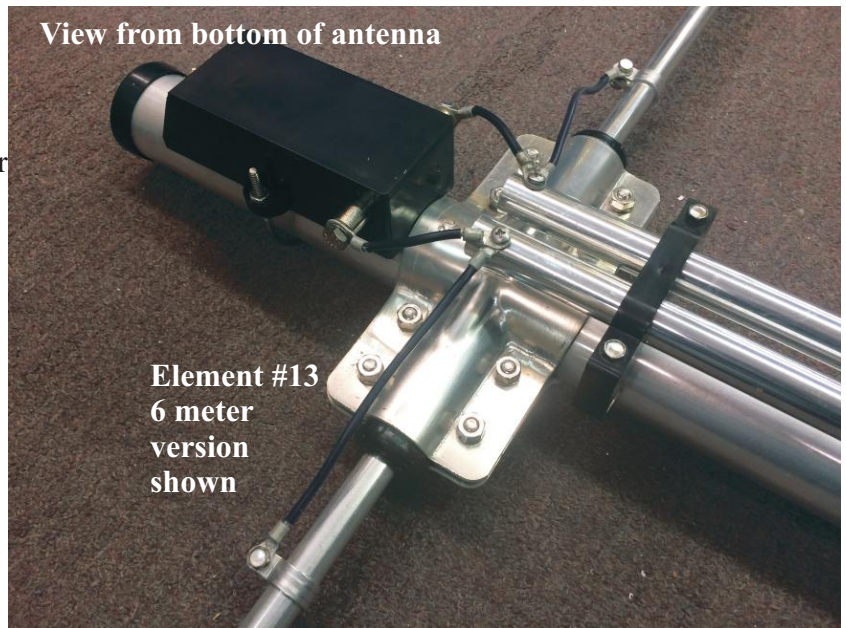
Once the feed tubes are installed, select the pigtailed and connect them to the antenna element clamps and the feed line. Start at the front of the antenna and alternate the connection from straight to crossed on each element. Refer to the picture for an example. The balun is connected at the front of the antenna, as shown, to the same point as the #13 element. Use the u-bolt and nuts supplied to fasten the balun to the boom. It is a good idea to have one of the feed line insulators at this point where the balun connects. The balun connection is straight to element #13. Elements 13,11,9,7,5,3 and 1 are all straight connections. Elements 12,10,8,6,4 and 2 are crossed connections.

The pre-drilled holes in the feed line should line up with the brackets when assembled correctly. When making the cross connection, make sure the wires do not touch each other or the opposite feed tubes. Arch them in opposite directions to ensure proper power handling. Element bracket #2 requires a longer pigtail than the rest because it is wider and the elements are crossed. Elements that are not crossed may have slack in the wire. This is not a problem and does not affect operation. If you wish, you can move the clamps outward on the element to remove the slack. Do not make the wire tight enough to strain it or touch where it should not. The chart below applies to both versions of antenna

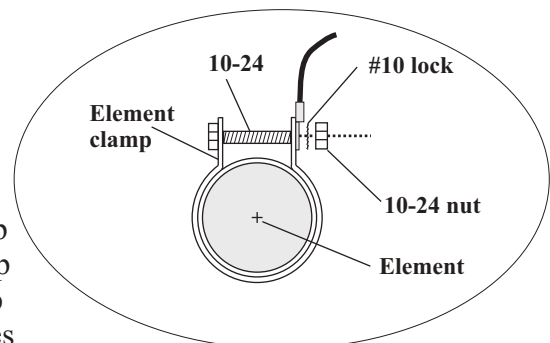
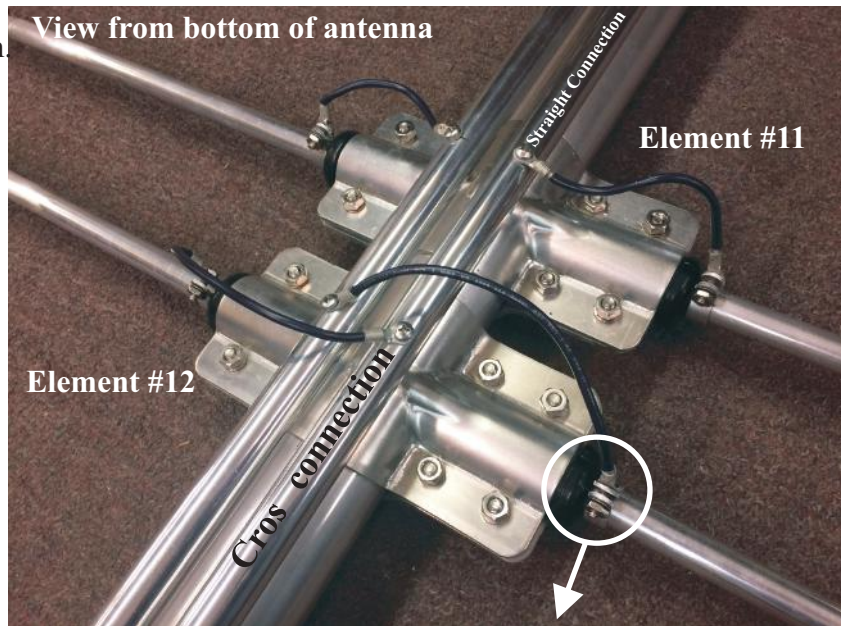
ELEMENT #	CONNECTION
1	STRAIGHT
2	CROSS
3	STRAIGHT
4	CROSS
5	STRAIGHT
6	CROSS
7	STRAIGHT
8	CROSS
9	STRAIGHT
10	CROSS
11	STRAIGHT
12	CROSS      Six mtr only
13	STRAIGHT    Six mtr only

There are 3 clamp sizes.  
1-1/4, 7/8 and 5/8

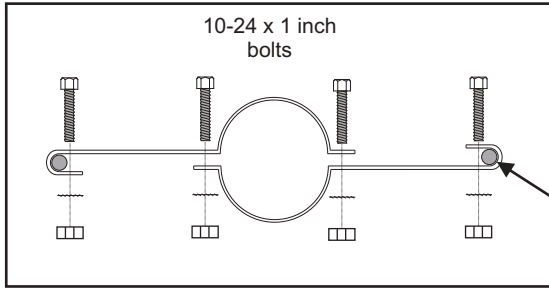
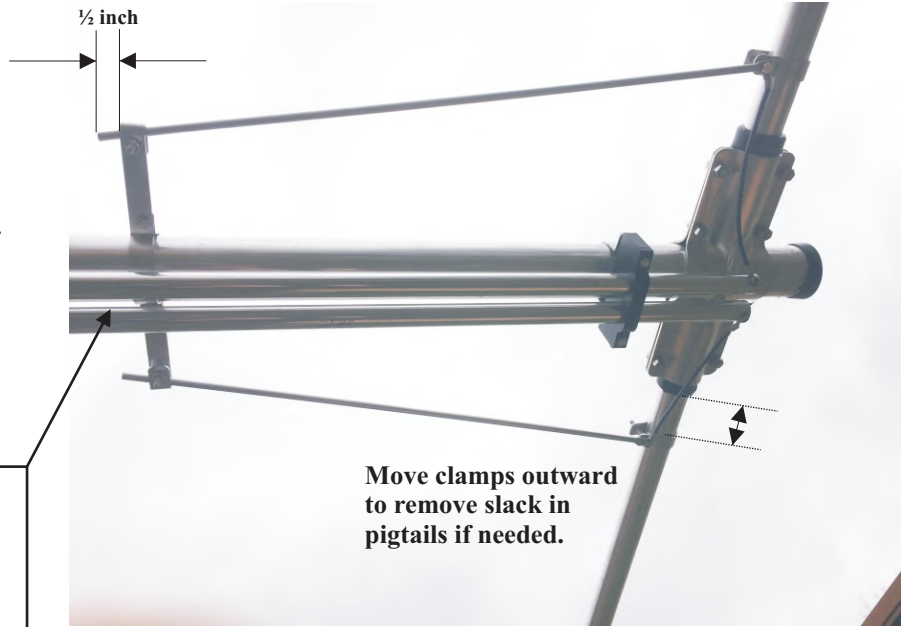
Elements 1,2,3----- 1-1/4 clamp  
Elements 4,5,6,7,8,9,10-----7/8 clamp  
Elements 11,12,13 (6mtr)-----5/8 clamp  
Element 11 on 10 meter version requires a 7/8 clamp



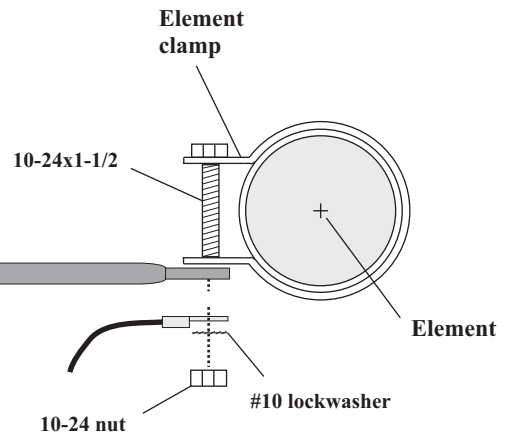
## Straight and Cross Connections



A shunt has been provided to improve SWR on the lower bands. This shunt mounts to the #1 element using the same connection point as the pigtail assemblies.



Insert rod here



### Final Inspection

The antenna should now be completely assembled. Make final alignment adjustments on each element and ensure that it is level. Place the plastic end caps over all the elements and boom ends. Punch a small hole in each of the caps to allow water to drain from the tubes. Orientate this hole at the bottom of the tube. Check that all hardware is tight and secure all clamps.

# CHAPTER 2

## Antenna Installation

**IMPORTANT:** The BOLP-1013 is a very large and heavy antenna and requires consideration as to how you are going to get it to the top of your tower. Thoroughly read this section before beginning to install your antenna!

### Installation on a Crank-Up Tower

Crank the tower completely down or as low as it will go and block all sections from moving by using a 2" x 4" piece of wood or a solid iron bar for heavier towers. The block should be inserted through the lattice structure before the tower is completely down, then the tower can be cranked down until the block takes the weight off of the winch cable. ALL sections must be prevented from moving!

**WARNING:** Installation of this product near power lines is dangerous! For your safety, follow the instructions provided with your tower and the instructions in this manual.

Use a ladder to reach the top of the tower. **NEVER CLIMB THE LATTICE STRUCTURE OF ANY CRANK-UP TOWER!!** Attach the mast to the tower and rotator. The cast aluminum boom-to-mast brackets should be removed from your temporary mast and installed on the permanent mast as shown in Figure 1. The center hole in the cast brackets should be used to pin the brackets to the mast. If you wish to use this feature, you must drill a 5/16" hole through your mast at this location. Attach a gin pole to the tower or support structure to assist in lifting the antenna.

You may wish to install the antenna, mast and boom support as one assembly. In this case, use a large gin pole or crane to lift this assembly onto your tower.

### Installation on Guyed Towers

When installing the BOLP-1013 on a guyed tower, you may wish to use a guide system. If you have insulators on your guy wires, you will need to keep the antenna away from the guy wires as well as the tower during the raising process. You can use two ropes attached together at the top of the tower and attached to the ground about 15 to 20 feet apart. These two ropes can be used to slide the antenna on as it is also being lifted. The two ropes will need to be far enough from the tower base to allow some sag and still support the antenna away from the guy wires. Remember that this antenna weighs 120 pounds! Trim any tree branches that might interfere with the installation process.

Remove the cast boom-to-mast brackets from your temporary mast and install on your permanent mast. Drill 5/16" holes in your mast if you wish to pin the castings to the mast. This will ensure that your antenna does not twist on the mast in high winds.

### Attachment of Coaxial Feedline

Use a good quality 50 ohm coaxial transmission line such as Times RG- 213/U (solid), or Belden 8267 (solid). Belden 9913 or 8214 is not required but may be used with careful connector installation. Belden 9913 should NOT be used above the rotator or on crank-up towers!! Take extra care when soldering connectors to foam dielectric coaxial cable. RG-213[U "TYPE" cable is not recommended because it usually has less shielding than better quality RG-213/U. Weatherproof all UHF connectors which will be exposed to rain or ice, with Coax-Seal C19 or another similar substance.

Coax-Seal® is a registered trademark of Universal Electronics,

Pre-attach a 25' length of transmission line to the BN-4000 balun and tighten the connector securely. Tape the coax to the boom about every 3 feet (1 m) and provide suitable strain relief. Allow enough coax to reach your tower or other support structure.

### **Attaching the Antenna to the Mast**

Attach the lifting rope to the balance point of the antenna. Be careful not to damage the feedline assembly next to the boom-to-mast clamp. The lifting rope should be fed through the gin pole or other pulley arrangement attached to the tower. The other end should be at ground level, available to the ground crew for lifting. Guide ropes may be LOOSELY looped over the boom ends and used by the ground crew to guide the antenna away from the tower, guy wires, tree branches or ladder. The guide rope's two loose ends should be held by the ground crew, so that the guide rope can be retrieved later.

When the antenna reaches the mast bracket, the top two 5" bolts should be inserted through the top two holes in the aluminum castings and secured using 5/16" - 18 lockwashers and nuts.

NOTE: Use a few drops of heavy motor oil or grease on the stainless steel threads to prevent galling! If these threads gall, you may have to cut the bolts with a hacksaw to remove the antenna!

The other two remaining 5/16"-18 x 5" bolts should now be installed and secured with lockwashers and nuts. Tighten all bolts securely. The bolt heads must be on the same side of the boom-to-mast brackets as the feedline tubing.

Attach the boom support brackets and support tubes to the mast and adjust to level the boom.

NOTE: There will be considerable boom sag until the boom support tubes are adjusted.

### **Lightning Protection**

For proper lightning protection, you must ground your antenna supporting structure. Grounding will also help with noise reduction. A proper ground consists of a 1/2" x 8 foot copper clad steel ground rod driven into the ground approximately 12" (0.3 m) away from the concrete tower base. Connect the tower to the ground rod using #8 copper wire and commercial non-corrosive ground clamps.

### **VSWR Curves**

These VSWR curves are typical for the antenna mounted 70 - 80 feet above the ground and fed with 100 feet of RG-213/U cable. Similar curves can be expected for this antenna mounted between 50 and 100 feet above ground. DO NOT TRY TO TUNE THIS ANTENNA FOR LOW VSWR AT GROUND LEVEL. Higher VSWR can be expected if mounted at less than 40 feet or within 20 feet of a large roof or metallic structure. Guy wires within 10 feet of this antenna should be broken into non-resonant lengths (less than 12 foot lengths) and insulated from the tower. Other antennas which are resonant somewhere in the 3 - 40 MHz range should be kept at least 10 feet above or below this antenna. Antennas which are resonant above 40 MHz can be mounted as close as 3 feet from this antenna. The measured VSWR may also be affected by strong local broadcast signals.

Extreme care must be used if you use an air-dielectric coaxial cable such as Belden 9913. Water intrusion can easily raise the VSWR and loss.

## Operation

Connect the end of your transmission line to a good quality VSWR meter and then to your transmitter. While using low power ( less than 100 watts output), check the VSWR across the 10 - 30 MHz range. Use your authorized frequencies when applicable. Record this information for future comparison. Record the antenna azimuth and other environmental factors along with the VSWR. Check the VSWR periodically to ensure proper operation.

The front-to-back ratios may be checked by using a steady carrier transmitted by a local station at least 1 mile distant. You may also use the signal from WWV on 15 and 20 MHz to check gain and frontto-back. Other time/frequency standard stations may be used where applicable.

## Converting American Measurements to Metric

Use this scale to identify lengths of bolts, diameters of tubes, etc. The American inch (1") and foot (1') can be converted to centimeters in

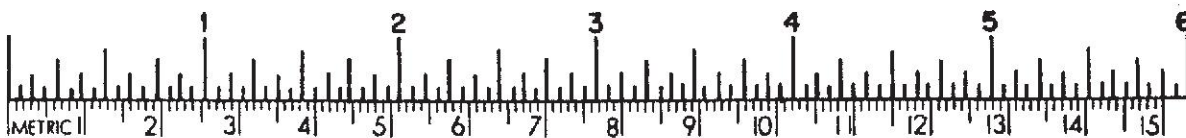
$$1 \text{ inch (1 ") = 2.54 cm}$$

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

Example:

$$42" \times 2.54 = 106.7$$

FRACTION AND METRIC EQUIVALENT FOR ONE INCH			
FRAMONAL		FRACTIONAL	
INCH	MILLMMEERS	INCH	MILLIMETERS
1/16	1.599	9/16	14.288
1/8	3.174	5/8	15.875
3/16	4.700	11/16	17.463
1/4	6.350	3/4	19.050
5/16	7.937	13/16	20.638
3/8	9.525	7/8	22.225
7/16	11.112	15/16	23.813
1/2	12.700	1	25.400



# Tubing List

174865	7/16 X 48	4	194360	7/8 X 36	6
174987	7/16 X 60	4	194355	7/8 X 35-1/2	2
175512	7/16 X 6042-3/4	6	194205	7/8 X 20-1/2	2
175669	7/16 X 56-1/2	4	194155	7/8 X 15-1/2	8
176214	7/16 X 31-1/2	2	194055	7/8 X 5-1/2	4
179782	7/16 X 19	6			
195650	7/16 X 65	2	195360	3/4 X 36	22
			196360	1 X 36	6
171539	2X .120 X 54-3/4 SW	1			
171540	2X .120 X 81 SW	2	199350-SA	1-1/4 X .058 X 30	4
171541	1-7/8 X .083 71-1/8 INSERT	1	199250-SA	1-1/4 X .058 X 20	2
173754	2X .049 X 75	1			
179876	2 X .120 X 80-3/8	1	170067-0 BETA ROD	1/4 rod x 20"	2
195000-1	FEED TUBE 1	2			
195000-2	FEED TUBE 2	2			
195000-3	FEED TUBE 3	2			
195000-4	FEED TUBE 4	2			
195000-5	FEED TUBE 5	2			
195000-6	FEED TUBE 6 Short	2			
193360	5/8 X 36 SWAGE	22			
193155	5/8 X 15-1/2 SWAGE	6			

## Parts Pack List

QTY	PART	DESCRIPTION
20	165919	#13 BRACKET
6	165920	#14 BRACKET
2	163764	#4 BRACKET
108	505266	1/4-20 X 3/4
13	500156	1/4-20 X 3/8
13	551367	1/4-20 SQUARE NUT
130	554099	1/4-20 HEX NUT
6	465833	1-1/4 INSULATOR
14	463767	7/8 INSULATOR
6	461057	5/8 INSULATOR
26	745-3104S	#4 HOSE CLAMP
28	745-3106S	#6 HOSE CLAMP
26	745-3110S	#10 HOSE CLAMP
26	455644	7/16 TUBE CAP
2	455625	2 INCH TUBE CAP
8	179888	CHANNEL BRACKET
2	870546	Balun Pigtail
24	878561	SHORT PIG TAIL
2	879973	LONG PIG TAIL
1	BN-4000B	BEAM BALUN PACK
16	505763	1/4 X 1-3/4 BOLT
130	562961	1/4 LOCK WASHER
4	179894	BOOM SUPPORT 85
8	465595	INSULATOR BOTTOM
8	465600	INSULATOR TOP



## Parts Pack List

QTY	PART	DESCRIPTION
8	500349	5/16X5
4	500392	5/16X3
4	506968	5/16X2-3/4
2	5142400	5/16X4
18	555747	5/16 NUT
18	564792	5/16 LOCK
6	168695	1-1/4 CLAMP
16	169339	7/8 CLAMP
6	171329	5/8 CLAMP
16	500157	10-24 X 2 BOLT
8	177888	INSULATOR CLAMP
2	163371	BETA MATCH CLAMP
6	504739	10-24X 1-1/4
53	565697	#10 LOCK
53	565697	10-24 NUT
6	500159	10-24 x 1-1/2
24	504069	10-24 x 1
5	505734	1/4-20X2-1/2
48	515852	SELF TAPPING SCREW
48	560035	#8 LOCK WASHER
10	191012	FEED TUBE SPLICE
4	102734	CAST BRACKET MAST BRICK
1	172732	U-CLAMP
1	172735	EXTRUSION BRACKET

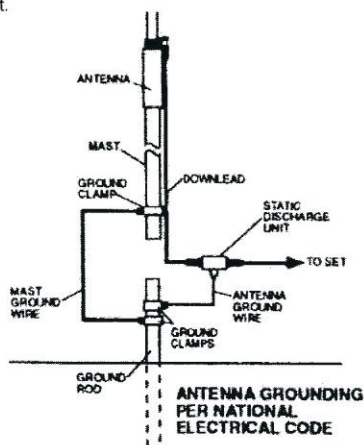
## GENERAL INSTALLATION INSTRUCTIONS FOR MAST MOUNTED ANTENNAS

1. Assemble your new antenna on the ground at the installation site. Keep separate assembly instructions that come with it. Large CB and Amateur beams may have to be finally assembled on the tower or mast.
2. On the ground, clamp the antenna to mast and connect the coaxial cable to the antenna.
3. To insure that the mast does not fall the "wrong way" it should get away during the installation or takedown, durable non-conductive rope should be secured at each two foot level as the mast is raised. The boss stands in a position where he can yank or pull the ropes if the need arise to deflect the falling mast away from hazards (such as power lines) into a "safe fall" (such as a yard or driveway). The ropes are tied taut at the base of the mast after installation and in place at the various levels.
4. Install selected mounting bracket.
5. If you are going to use guy wire installation instead of a mounting bracket:
  - install guy anchor bolts
  - estimate length of guy wire and cut
  - attach a mast using guy ring
6. Carefully take antenna and mast assembly to mounting bracket and insert. Tighten camp bolts. In case of guyed installation, it will be necessary to have at least a second person hold the mast upright while the guy wires are attached and tightened to the anchor bolts.
7. Install self-adhering "DANGER" label packaged in antenna hardware kit at eye level on your mast.
8. Install ground rod to drain off static electricity build-up and connect ground wire to mast and ground rod. Use special ground rods, not a spare piece of pipe.

## EXAMPLE OF ANTENNA GROUNDING AS PER NATIONAL ELECTRICAL CODE INSTRUCTIONS

1. Use No. 10 AWG copper or No. 8 AWG or larger copper-clad steel or bronze wire, as ground wires for both mast and lead-in. Securely clamp the wire to the bottom of the mast.
2. Secure lead-in wire from antenna to antenna discharge unit and mast ground wire to house with stand-off insulators spaced from 4 feet (1.2 meters) to 6 feet (1.8 meters) apart.
3. Mount antenna discharge unit as close as possible to where the lead-in wire enters the house.
4. Drill a hole in wall (CAREFUL! There are wires in that wall.) near your set just large enough to permit entry of cable.
5. Push cable through hole and form a rain drip loop close to where it enters the house.
6. Put small amount of caulking around cable where it enters house to keep out drafts.
7. Install static electricity discharge unit.
8. Connect antenna cable to the set.

You should not attempt to raise a mast in excess of 30 feet in height/length (not including the antenna proper) in a fully-extended condition. Thirty to fifty foot tubular masts must be elevated, a section at a time, with the base or outer section secured in place with guy wires. GET PROFESSIONAL HELP.



# WARNING

INSTALLATION OF THIS PRODUCT NEAR POWER LINES IS DANGEROUS. FOR YOUR SAFETY, FOLLOW THE ENCLOSED INSTALLATION DIRECTIONS.

## HOW TO INSTALL YOUR OUTDOOR ANTENNA SAFELY IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE U.S. CONSUMER PRODUCT SAFETY COMMISSION

### YOU, YOUR ANTENNA, AND SAFETY

Each year hundreds of people are killed, mutilated or receive severe permanent injuries when attempting to install an antenna. In many of these cases, the victim was aware of the danger of electrocution, but did not take adequate steps to avoid the hazard.

For your safety, and to help you achieve a good installation, please **READ** and **FOLLOW** the safety precautions below. **THEY MAY SAVE YOUR LIFE!**

1. If you are installing an antenna for the first time, please, for your own safety as well as others, seek **PROFESSIONAL ASSISTANCE**. Consult your dealer. He can explain which mounting method to use for the size and type antenna you are about to install.
2. Select your installation site with safety, as well as performance, in mind. (Detailed information on Site Selection appears in a separate section of this booklet.) **REMEMBER: ELECTRIC POWER LINES AND PHONE LINES LOOK ALIKE. FOR YOUR SAFETY, ASSUME THAT ANY OVERHEAD LINES CAN KILL YOU.**
3. Call your electric power company. Tell them your plans and ask them to come look at your proposed installation. This is a small inconvenience considering **YOUR LIFE IS AT STAKE**.
4. Plan your installation procedure carefully and completely **before you begin**. Successful raising of a mast or tower is largely a matter of coordination. Each person should be assigned to a specific task, and should know what to do **and** when to do it. One person should be designated as the "boss" of the operation to call out instructions and watch for signs of trouble.
5. When installing your antenna, **REMEMBER: DO NOT** use a metal ladder. **DO NOT** work on a wet or windy day. **DO** dress properly -shoes with rubber soles and heels, rubber gloves, long sleeve shirt or jacket.
6. If the assembly starts to drop, get away from it and let it fall. Remember, the antenna, mast, cable and metal guy wires are all excellent conductors of electrical current. Even the slightest touch of any of these parts to a power line complete an electrical path through the antenna and the **installer-THAT'S YOU!**
7. If any part of the antenna system should come in contact with a power line-**DON'T TOUCH IT OR TRY TO REMOVE IT YOUR SELF. CALL YOUR LOCAL POWER COMPANY.** They will remove it safely.

If an accident should occur with the power lines call for qualified emergency help immediately.

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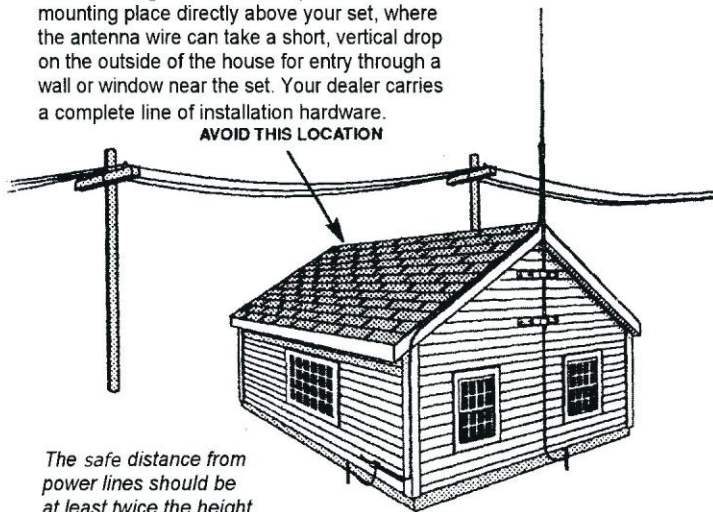
## SITE SELECTION

Before attempting to install your antenna, think where you can best place your antenna for **safety** and performance.

To determine a safe distance from wires, power lines and trees:

1. Measure the height of your antenna.
2. Add this length to the length of your tower or mast, and then
3. Double this total for the minimum recommended safe distance.

If you are unable to maintain this safe distance, **STOP! GET PROFESSIONAL HELP.** Many antennas are supported by pipe masts attached to the chimney, roof or side of the house. Generally, the higher the antenna is above the ground, the better it performs. Good practice is to install your antenna about 5 to 10 feet above the roof line and away from power lines and obstructions. Remember that FCC limits your antenna height to 60 feet. If possible, find a mounting place directly above your set, where the antenna wire can take a short, vertical drop on the outside of the house for entry through a wall or window near the set. Your dealer carries a complete line of installation hardware.



*The safe distance from power lines should be at least twice the height of the antenna and mast combined.*

## TELESCOPING MAST

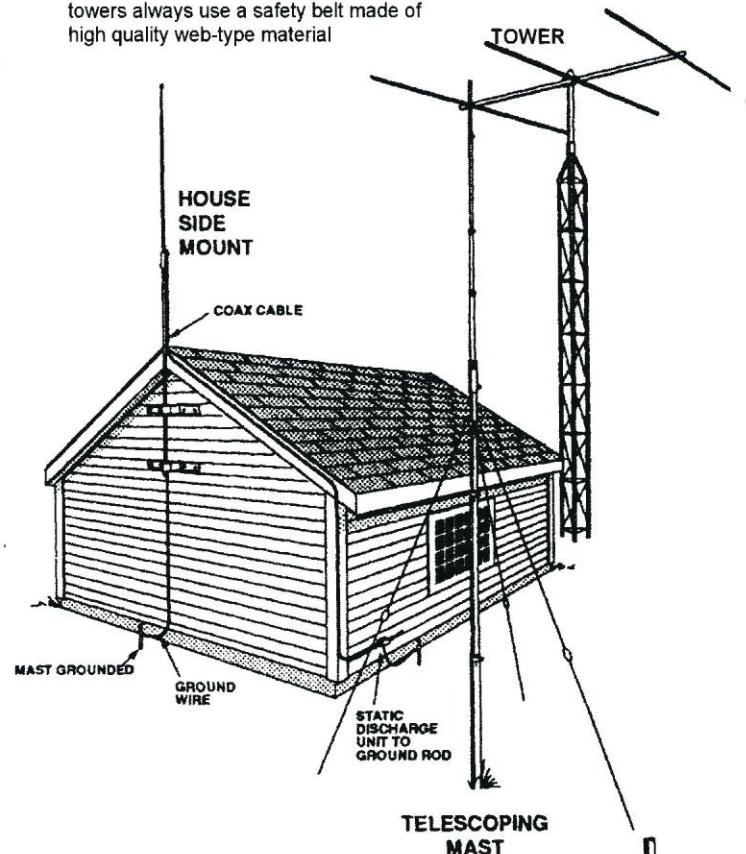
Guy wires should be equally spaced in at least three directions. Use at least three guy wires for each 10 foot section of mast.

## SIDE OF HOUSE MOUNTING

The safe distance from power lines is at least twice the height of antenna and mast combined. Where roof overhang is not excessive, the side of the house provides a convenient mounting. Position the brackets over a stud if possible, one above the other, and space two or three feet apart. For metal siding, first mark mounting holes, then drill pilot holes through the siding to accept mounting screws.

## TOWER

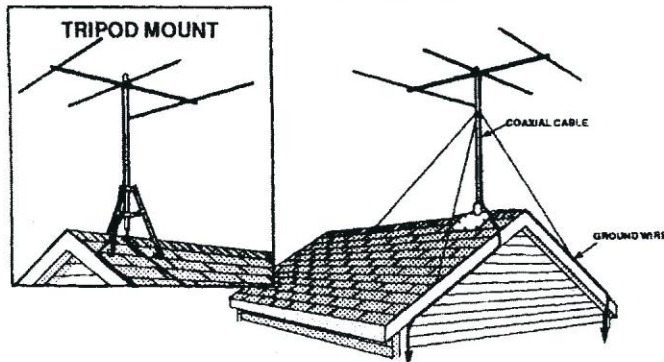
Tower safety is paramount to a good installation and requires that you take location, tree growth, soil depth and proximity to buildings into consideration. Tower foundations must be securely based on a solid concrete/tower mounting plate. An alternative is to sink a 4-6 foot section of tower into a concrete base for an extremely rugged mount. Proper guying is essential to a safe weather-resistant installation that must handle severe wind loading and is best accomplished with preformed guy grips, torque brackets and turnbuckles. When working on towers always use a safety belt made of high quality web-type material



## CHOOSE A PROPER SUPPORT AND MOUNTING METHOD

However you decide to mount and support your antenna always make sure that safety is your first concern. Some of the more common installation methods are illustrated below.

### ROOF MOUNTED

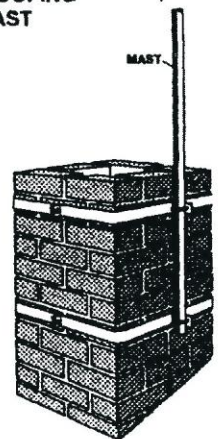


## ROOF MOUNTING

The swivel feature of "universal" type mounting brackets makes a convenient antenna mount for flat or peaked roofs. One clamp type bracket is used with 3 or 4 guy wires equally spaced around the mast and anchored to the roof or eaves by eyebolts. Apply roofing compound around the base of the bracket, screws and eyebolts for moisture sealing.

## CHIMNEY MOUNTING

The chimney is often an easy and convenient mounting place. But the chimney must be strong enough to support the antenna in high winds. Do not use a chimney that has loose bricks or mortar. A good chimney mount makes use of a 5 or 10 foot, 1-1 1/4" diameter steel mast, and a heavy duty two strap clamp-type bracket. Install the upper bracket just below the top course of bricks, and the lower bracket two or three feet below the upper bracket. For maximum strength, space the brackets as far apart as possible.



## **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.