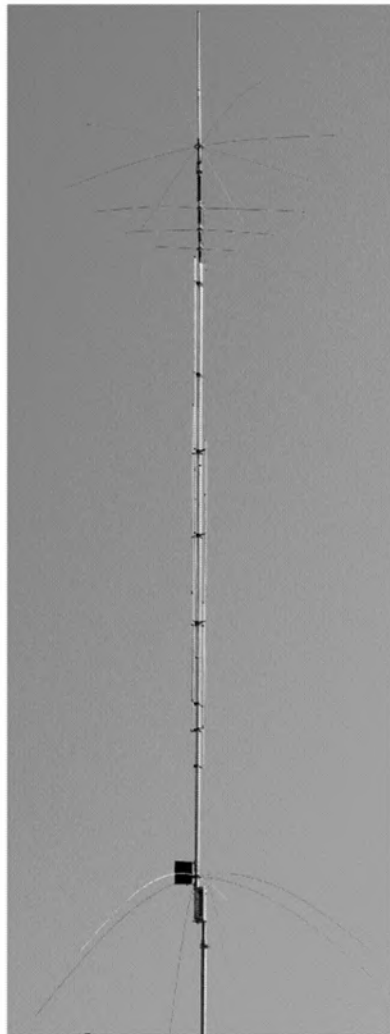


# ***hy-gain***®

## MODEL AV-680

### INSTRUCTION MANUAL



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Made in USA

925-0680-REV A4

## **Introduction**

Hy-Gain is proud to deliver the AV-680 Nine Band Vertical. Drawing on our many years of Amateur Radio HF and VHF antenna design experience, we have produced a well-engineered antenna capable of maximum efficiency, unmatched performance, and superior construction.

Computer optimization of the AV-680 design yields the most efficient  $3/8$  wavelength electrical design with maximum gain and low angle of radiation for long distance communication. No traps are used to achieve nine band performance. The AV-680 is resonant on 6, 10, 12, 15 and 17 meters with individual  $3/8$  wavelength radiators. The center radiator resonates on 20, 30, 40 and 80 meters using parallel end loaded Teflon wire coils. Capacity hats on these bands give wide 2:1 VSWR bandwidth and the antenna is kept to a height of 27 feet by the low inductance coils. There are no "tricks" or "mystery resonances" used for impedance matching on any band.

No long-wire radials or counterpoise kits are necessary for operation of the AV680. The AV-680 is self contained for simple, convenient portable or fixed operation.

Mechanical construction of the AV-680 is designed for extreme light weight and high wind survival. Aircraft grade 6063-T832 aluminum and high strength fiberglass are used for the entire radiator. The trap-free design presents a very low wind surface area. Bulky tubing is not required to support unwieldy traps. The broad 2:1 VSWR bandwidth on all bands lessens large frequency shifts seen in other antennas when the antenna is wet or iced.

The AV-680 is covered by our Hy-Gain Warranty and supported by our customer service team. We would like to thank you for purchasing this product from us and ask that you let us know of any suggestion you may have. With proper assembly, installation, and maintenance, your AV-680 will provide years of faithful service.

## **Theory of Operation**

The AV-680 HF Multiband Vertical antenna consists of an end fed radiator that is resonant in the 6, 10, 12, 15, 17, 20, 30, 40 and 80 meter amateur frequency bands. Resonances on each band are the result of impedance matching a  $3/8$  wavelength element with a broadband RF transformer. The characteristic impedance at the base of the  $3/8$  wavelength radiator is in the order of a few hundred ohms.

To match this impedance two tools are employed. First a counterpoise of 72" spokes is mounted at the AV-680 base. The capacitance from this ground plane

helps lower the base impedance. Second, a 4:1 toroidal transformer (voltage balun) steps the base impedance down to 50 ohms. This transformer uses a ferrite core for high power capability. Also, the windings are made of twisted pair wire to improve coupling and reduce loss. A second high power transformer is configured as a 1:1 current balun to help stop RF from traveling back on the feedline shield. The radiator of the AV-680 is at DC ground potential for static drain. This is accomplished by a radio frequency choke in the matching circuit.

The center radiator of the AV-680 supports 1/4 wavelength stubs for 6, 10, 12 and 17 meters. The stubs are placed approximately one tenth of a wavelength (electrically 1/8 wavelength) above the AV-680 base. At the top of each stub the impedance is very high at the frequency the stub is tuned. This high impedance stops, (chokes) RF at this point creating a resonant 3/8 wavelength radiator. There is minimal loss using this method as compared to standard trap circuits. Also, VSWR bandwidth is not restricted by the "Q" of trap components. For 20, 30, 40 and 80 meters, a coil and capacity hat are used on each band to create a 3/8 wavelength radiator. The coils are mounted at the top of the center radiator. These four coils are connected in parallel. Parallel connection separates each band to allow individual band tuning and has less loss than does series connection. Also, the AV-680 coils have significantly less loss than a standard trap because the AV-680 capacity hats exhibit greater capacitance than a typical trap, therefore, less inductance is required.

#### **Antenna Location**

The best performance for receiving and transmitting will be obtained by mounting the antenna in a clear location above or away from buildings, buildings, towers, feedlines, utility wires, and other antennas. While your own ingenuity and particular circumstances will determine the final mounting method, remember, any object within 75 feet from the base of the antenna can influence the performance of the AV-680.

**WARNING: Always mount this antenna so that it is out of the reach of adults as well as children and pets. The counterpoise rods can cause injury and or severe RF burns.**

- **NEVER mount this antenna in a location that will permit unsuspecting people to come in contact with any part of the antenna.**
- **NEVER mount this antenna where a mechanical failure might allow the antenna, antenna support or feedline to contact power lines or other utility wires.**
- **ALWAYS ground the feedline at the point where it enters a building to a good earth ground for lightning protection.**
- **ALWAYS follow the guidelines for antenna installations as recommended by the US Consumer Product Safety Commission.**

## **Antenna Mast**

The recommended support mast for the AV-680 is steel water pipe between the sizes of 1-3/4" OD to 2 1/2" OD and with a length that will place the antenna base at a safe height. **Do not use** thin walled conduit, aluminum tubing, or "TV" mast. The AV-680 is designed to operate at a height of 8 or more feet for proper performance. Placement on the side of a house or garage at eaves level is acceptable as long as the counterpoise whips will not be in contact any snow on the roof. Placement above metal roofs is acceptable if the antenna base is at least 5 feet or more above the metal surface.

## **Antenna Grounding**

Although the AV-680 is designed to operate efficiently without the requirement of an earth ground, SAFETY GROUNDING must still be provided to protect equipment, property and persons from the hazards of lightning strikes and other weather related electrical discharges. In addition the coaxial cable feeding the antenna should have the shield grounded to eliminate the risk of any indoor equipment failure from allowing hazardous voltages from appearing indoors and creating a shock hazard. The support mast should be grounded with a large diameter ground wire.

The AV-680 is DC grounded for static discharge. This is accomplished with a choke coil in the Matching Unit. This coil could fail under high voltage spikes from a near or direct lightning strike.

Additional protection can be accomplished by grounding the shield of the coax where it enters the building to a good earth ground or directly burying the cable in the earth for several feet before it enters the building. The coaxial cable should be totally disconnected from the station during threatening weather conditions for maximum lightning protection.

## **Antenna Guying**

For normal operation up to 65 mph winds, the AV-680 will not require guying. For extreme locations such as tall building rooftops, a safety guy is recommended. Use Dacron® rope to guy the center radiator. Attach ropes 14 feet above the antenna base. Use care not to disturb the radiator stubs.

## **Customer Supplied Components**

- Quality low-loss 50 ohm coax cable with PL-259 connectors
- VSWR Analyzer (MFJ-259B or equiv.) or HF transceiver with VSWR meter
- Mounting mast with required hardware to provide sturdy support

#### Tools Required For Assembly

- 1/4" Standard Blade Screwdriver
- #1 Phillips Screwdriver
- #2 Phillips Screwdriver
- 3/8" Open End Wrench
- 3/8" Nut Driver
- 5/16" Nut Driver
- 5/16" Open End Wrench
- 7/16" Nut Driver
- 7/16" Open End Wrench
- 10 nun Open End Wrench
- Tape Measure 20'
- Safety Glasses
- Pliers

#### Safety Precautions

**WARNING: You can be killed if the antennas, feedline, or the equipment used to install the antenna accidentally contacts any utility lines. Never install an antenna near power lines!**

- **Be careful while climbing and carrying the antenna. It is heavy enough to cause you to lose your balance if it is handled too casually or if any part of the antenna snags on a gutter, ladder, tree, or other item.**
- **Mount the antenna high enough and in the clear so that it is out of reach by any person or pet. Do not allow trees or other structures near the radiator portion of the antenna. The counterpoise whips can cause serious eye injury.**
- **Ensure that the mast is sturdy enough to support the weight of this antenna including the windload of the antenna.**

## Parts List

Part Number	Part Description	ID Number	Quantity
17-AV680-4	Instruction Manual Bag	IM	1
17-AV640-1	Parts Bag #1	PB1	1
17-AV640-2	Parts Bag #2	PB2	1
17-AV640-3	Parts Bag #3	PB3	1
80-AV680-1	AV680 Matching Unit	MU	1
810-0620-1	Base Insulator 1-1/4" x 12"	IN	1
11-0680-1	AV-680 Coil Assembly	L1	1
810-0640-5	Base Tube 1-1/2" x 12"	BA	1
810-0640-2	Radiator Section 1-1/2" x 72"	BB	1
810-0640-3	Radiator Section 1-3/8" x 75"	BC	1
810-0640-4	Radiator Section 1-1/4" x 75"	BD	1
810-0640-9	Radiator Section 5/8" x 36"	BF	1
17-AV680-9	Small Tube Bundle	ST	1
17-AV680-10	Spoke Bundle	BS	1
735-0680	Antenna Mounting Plate	MB	1
810-AV640-23	Radiator Section 3/4 x 24"	BE	1

### Small Tube Bundle 17-AV680-9

Part Number	Part Description	ID Number	Quantity
810-0680-55P	Stub Section 3/8" x 55"	E1	4
810-0680-60	Stub Section 3/8" x 60"	E2	2
810-0680-44	Stub Section 3/8" x 44"	E3	2
810-0680-6	Stub Section 5/16" x 6" Rod	CP	8
758-2764	72" Stainless Steel Whip	CW	7

### Spoke Bundle 17-AV680-10

810-0680-48	1/8" 48" Aluminum Rod	SP1	8
810-0680-36	1/8" 36" Aluminum Rod	SP2	4
810-0680-25	1/8" 25" Aluminum Rod	SP3	4
810-0680-15	1/8" 15" Aluminum Rod	SP4	4
810-0640-28	1/8" 40" Aluminum Rod	Spares	2

## 17-AV680-4

Part Number	Part Description	ID Number	Quantity
925-AV680	AV-680 Instruction Manual	MN	1
925-0006	Hy-Gain Warrant Card	WC	1
784-1780	Warning Label	WL	7

## 17-AV680-1

Parts Bag #1	Part Description	ID Number	Quantity
656-0375S	6-32 x 3/8" Screw SS	S1	48
656-0500S	6-32 x 1/2" Screw SS	S2	12
656-1250S	6-32 x 1-1/4" Screw SS	S4	12
656-1500S	6-32 x 1-1/2" Screw SS	S3	6
656-1750S	6-32 x 1-3/4" Screw SS	S5	2
705-0632S-K	6-32 Nut W/Lock SS	N1	82
660-0375S	10-32 x 3/8" Screw SS	S6	12
711-1037S	#10 Lock Washer SS	W1	8
745-3104S	#4 Hose Clamp SS		12
705-1032S-NL	10-32 Nut Nylon Insert SS	N3	8
662-2000S	1/4-20 x 2" Bolt SS	S8	4
705-2520S-NL	1/4-20 Nut Nylon Insert SS	N5	8
745-3110S	1" Hose Clam SS	HC2	1
745-3112S	1 1/2" Hose Clam SS	HC1	3
765-1002	1/8" Rod Cap	RC	22
745-3108	Counterpoise Ring SS W/tabs	RI	2
745-3116S	#16 Hose Clamp SS		3
765-1062	Plastic Ca 5/8"	C2	1

## 17-AV680-2

Parts Bag #2	Part Description	ID Number	Quantity
735-1610	Radiator Clamp Bracket	RB	16
195902	Mast Saddle	BR2	2
170035	AL mast block	BR1	2
561016	3/8 split washer	SW1	4
555694	3/8 x 16 nut	NB1	4
013209	3/8 u-bolt	UB1	2
543792	5/16 u-bolt	UB2	2
564792	5/16 split washer	SW2	4
555747	5/16 x 18 nut	NB2	4

## 17-AV680-3

Part Bag #3	Part Description	ID Number	Quantity
735-1618	Single Stub Base Bracket	SB1	2
735-1611	Dual Stub Base Bracket	SB2	1
738-0680-3	Single Stub Insulator	P3	5
738-0680-1	90 Degree Stub Insulator	P1	2
738-0680-2	180 Degree Stub Insulator	P2	2
11-AV620-1	Jumper Wire	J1	1

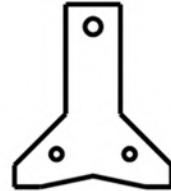
# Plastic parts



90 Degree Stub Insulator  
P/N 738-0680-1 Qty (2)  
ID # P1

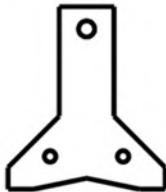


180 Degree Stub Insulator  
P/N 738-0680-2 Qty (2)  
ID # P2

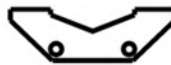


Single Stub Insulator  
P/N 738-0680-3 Qty (5)  
ID # P3

# Aluminum parts



Single Stub Base Bracket  
P/N 735-1618 Qty (2)  
ID # Sb1



Radiator Clamp Bracket  
P/N 735-1610 Qty (16)  
ID # RB



Dual Stub Base Bracket  
P/N 735-1611 Qty (1)  
ID # Sb2



## TASK I

### Center Radiator Assembly

( ) Refer to Figure A to assemble the Center Radiator. Attach BA tubing section to either end of the Base Insulator (IN) with (2) 1/4-20 x 2" bolts (S8) and (2) 1/4-20 nylock nuts (N5). Do not tighten the nuts at this time.

( ) Find the (2) counterpoise rings (RI) The ones with the tabs. . Press the flat sides of the rings together and slide them onto the Base Insulator (IN). Leave rings loose at this time.

( ) Attach the drilled end of tubing section BB to the Base Insulator (IN) with (2) 1/4-20 x 2" bolts (S8) and (2) 1/4-20 nylock nuts (NS). Do not tighten the nuts at this time.

( ) Place (1) hose clamp (HC 1) over the slotted end of tubing section BB. Slide unslotted end of BC tubing section into BB until it stops. Tighten hose clamp. NOTE: For protection against oxidation, a conductive paste such as NoAlox® may be used between *telescoping pieces of aluminum tubing only*. Do not apply the paste to insulators or coax connections.

( ) Place (1) hose clamp (HC 1) over the slotted end of tubing section BC. Slide unslotted end of BD tubing section into BC. Tighten hose clamp.

( ) Place (1) hose clamp (HC 1) over the slotted end of tubing section BD. Insert AV-680 Coil Assembly (LI) 3 inches into tubing section BD. Tighten hose clamp.

( ) Install two sections BE and BF on top of the coil assembly. Use the 6-32 x 1- ¼ screw and nut to secure BE into the top of the coil assembly. Slide BF into BE three inches and place the HC2 hose clamp over the slotted end and tighten. Install the jumper on the top of the loading coil to the tube BE using a 6-32 x 1-1/4" screw and nut.

( ) Place 5/8" plastic cap (C2) on end of tubing section BF

## TASK II

### Stub Base Bracket Assembly

( ) Refer to Figure B for Stub Base Bracket Assembly. Study Figures B and C to learn how the stub base brackets are attached for each band. Note how the brackets are offset 90 degrees from each other for proper antenna assembly.

( ) Find the aluminum Stub Brackets (SB 1 & SB2). Attach a Radiator Bracket (RB) to each Stub Bracket with (2) 6-32 x 3/8" screws (S I) and (2) 6-32 lock nuts (N1) as shown in Figure B.

( ) Find a Single Stub insulator (P3). Attach it to a Radiator Bracket (RB) with (2) 6-32 x 3/8" screws (S I) and (2) 6-32 lock nuts (NI).

( ) Mount each Stub Base Bracket to the AV-680 Radiator using a Radiator Bracket (RB), (2) 6-32 x 1 1/2" screws (S3), and (2) 6-32 lock nuts (N1). Place the Single Stub insulator opposite the Single Stub Base Bracket shown in Figure C.

( ) NOTE the degrees offset for each bracket and the distance from the base insulator (IN) in Figure C. Position the Stub Brackets ABOVE the Radiator Brackets.

### **TASK III**

#### **Stub Insulator Assembly**

( ) Place the AV-680 Radiator on a flat surface such as a driveway or garage floor. This will aid in mounting the Stub Insulators by keeping them aligned with each other.

( ) Refer to Figure D for Stub Insulator Assembly. There are three types of stub insulators: Single, 90 Degree and 180 Degree. The 180 Degree insulators are used with a Single Stub insulator to make a Three Stub insulator. The locations of the Single insulators are labeled «A", 90 Degree insulators are labeled "B" and the Three Stub insulators are labeled "C".

( ) Attach 90 Degree Stub Insulators (P1) to a Radiator Bracket (RB) using (2) 6-32 x 3/8" screws (S1) and (2) 6-32 Keps nuts (N1) as shown in Figure D.

( ) Attach Single Stub Insulators (P3) to a Radiator Bracket (RB) using (2) 6-32 x 3/8" screws (S1) and (2) 6-32 Keps nuts (N1).

( ) For Three Stub Insulators, attach a Single Stub and a 180 Degree Stub Insulator (P3 & P2) to a Radiator Bracket (RB) using (2) 6-32 x 1/2" screws (S2) and (2) 6-32 Keps nuts (N1).

( ) Mount the Stub Insulators on the AV-680 Radiator using a Radiator Bracket (RB), (2) 6-32 x 1 1/4" (S4) screws, and (2) 6-32 Keps nuts (N1). USE the dimensions in Figure E to space and rotate the insulators into their proper locations. Position the Stub Insulators ABOVE the Radiator Brackets.

### **TASK IV**

#### **Stub Assembly**

( ) Refer to Figure F for the stub assembly diagram.  
Assemble the stubs on the antenna.

( ) All four stubs share the same base tube ( E1 ) which has the threaded insert in one end. This end attaches to one of the metal brackets at the bottom of the antenna. You may attach all four of these elements sections to the antenna using the 10-32 screw and lock washer. Use "Figure G" For location of each Stub.

( ) SIX METER STUB: The six meter stub consist of only the first section (E1) and the coupler (CP) and is attached to the lowest metal clamp on the antenna "Figure C". Slide the coupler into the top of the stub and use a hose clamp to secure it. This rod will be used to adjust the length of the stub.

TEN AND TWELVE METER STUB:

( ) TEN AND TWELVE METER STUB. These two stubs are attached to the 180 degree metal bracket above the 6 meter stub "Figure C". It does not matter which side you chose for each band. They will work the same in either place. Assemble them on the antenna by sliding the sections down the insulators and connecting them using the couplers (CP) and the small hose clamps. The 10 meter uses the E1, and E3 sections which makes it slightly shorter than the 12 meter section which uses E1 and E2. Insert a coupler into the top of each section and secure it with a hose clamp.

( ) SEVENTEEN METER STUB: This is the longest stub and consist of all three sections E1,E2 and E3. This element attaches to the uppermost metal bracket and extends all the way up to the loading section of the antenna. Insert each section into the insulators and connect them using the couplers (CP) and hose clamps. Insert one coupler into the top section and secure with the hose clamp.

## **TASK VI**

### **Matching Unit Mounting**

- ( ) Refer to Figure H for the mounting location of the Matching Unit (MU). Use the pair of bolts through the Base Insulator (IN) to mount the MU as shown in Figure H. Remove the (2) 1/4-20 nuts (N5) from the (2) 1/4-20 x 2" bolts (S8) previously installed.
- ( ) Place the Matching Unit on the bolts and secure in place with the (2) nuts. Be sure the coax connector end of the Matching Unit faces the base (bottom) of the antenna.
- ( ) Using a 6-32 Keps nut (N1), connect one end of the jumper wire (JI) to the counterpoise terminal of the Matching Unit. Do not over-tighten this nut. The other end of the jumper wire is attached later.

## **TASK VII**

### **Counterpoise Assembly**

- ( ) Refer to Figure H to assemble the counterpoise.
- ( ) Loosely attach the counterpoise rings (RI) to the base insulator (IN) with (2) 6-32 x 1 3/4" screws (S5) and (2) 6-32 Keps nuts (NI).
- ( ) Loosely attach the counterpoise rings (RI) together with (8) 10-32 x 3/8" screws (S6) and 10-32 nylock nuts (N3).
- ( ) Place the (7) 72 inch (183 cm) counterpoise whips (CW) into the slots provided in the sides of the rings. The slot facing the Matching Unit (MU) does not receive a whip.
- ( ) Tighten the 10-32 nuts (N3) around the rings to secure the whips.
- ( ) Place the loose end of jumper wire (JI) under the closest 6-32 screw (S5) that holds a ring to the base insulator as shown in Figure H. Tighten the (2) 6-32 nuts (N1) that secure the rings to the base insulator.
- ( ) Attach a warning label to the end of each whip as shown in Figure H.

## **TASK VIII**

### **Antenna Mounting Plate Assembly**

- ( ) Refer to Figure I for assembly of the Antenna Mounting Plate (AM).
- ( ) Attach the antenna to the mounting plate first as the u-bolt nuts will not be accessible once the mast is attached. Place a drop of oil on the threads of each u-bolt to prevent stainless components from seizing together.

- ( ) The smaller u-bolt should be on top and center between the two ¼-20 bolts in the mast. If the lower bolt contacts the bracket then rotate it around the mast until it clears.
- ( ) Tighten the (4) bolts that hold the antenna to the bracket.
- ( ) Place the (2) Larger U-bolt assemblies into the holes in the antenna mounting plate as shown in Figure I. Leave nuts loose until installation of the antenna.

## **TASK IX**

### **Capacity Hat Assembly**

- ( ) Refer to Figure J for assembly of the five Capacity Hats.
- ( ) Rotate the AV680 Coil Assembly (LI) so the top end of the 17 meter stub is away from the AV680 Coil Strap as shown in Figure J. To rotate the coil assembly, loosen the lower coil hose clamp (HC 1). Tighten hose clamp when finished.
- ( ) Place (8) 6-32 x 3/8" screws (S1) and (8) 6-32 lock nuts (Ni) in each Counterpoise Ring assembly on the AV-680 Coil Assembly (LI). Leave the nuts loose so that the spokes can be slid between the rings.
- ( ) There are spokes of lengths 15", 25",36" and 48". Place the spokes in the ring assemblies as shown in Figure J. The shorter spokes will be on the bottom end of the coil and the longer spokes will be on the upper end of the coil. The 40" spokes are spares. Tighten all hardware on the ring assemblies. Slide the 1/8 inch rod caps onto each of the rods. Use caution when around the spokes, they will poke you easily.
- ( ) NOTE: For tuning 20, 30, 40, and 80 meters, the lengths of the spokes are adjusted as shown in Figure J. It is suggested that the spokes be installed at their initial lengths. If any of the bands are resonant too low in frequency, one of the corresponding spokes can be pruned. *Only one spoke will require pruning but you may also prune the one on the opposite side to maintain a balanced look to the spokes.* Please refer to the Tuning section in figure J for more information.

## **Installation**

The AV-680 antenna should be mounted at least 8 feet above ground. The main reason for this minimum height is safety. The AV-680 will work well at a minimum height of five feet but precautions from dangerous voltages must be taken.

Always have help for the installation process. Do not attempt to install the antenna alone. Review the requirements for Antenna Location and safety precautions regarding Power Lines earlier in this manual.

The AV-680 may be roof mounted on a tripod or similar support. Keep the AV-680 base a minimum of 5 feet above the roof surface. This minimum dimension is the same for any roof material type. Attach a suitable ground wire to the support mast as mentioned in the Grounding section of this manual.

## **Tuning**

The AV-680 should be checked with an VSWR meter before permanent installation to verify proper assembly and Matching Unit performance. Place the AV-680 at least 8 feet above ground and in as clear an area as possible. Connect the coax to the antenna base and test the VSWR using either an MFJ-259B VSWR Analyzer or equivalent or a transceiver and VSWR meter.

The 2:1 VSWR Bandwidth should be referenced to determine performance. VSWR measurements made at the antenna base are the most accurate and may show a slightly narrower VSWR bandwidth than the specifications chart lists. Be sure to use very low power (less than 5 watts) when measuring VSWR at the antenna base.

The AV-680 has few variables in its design. Therefore, VSWR should be very close to specifications. Each band can be adjusted individually. The element and stub lengths given in the drawings for the assembly of the antenna should tune the antenna close to the bottom of each band. Adjusting the stub lengths and trimming the capacity hats for each band will be needed to set the antenna your preferred section of the band.

### **Tuning 20, 30 and 40 meters**

Individual adjustment of 20, 30, and 40 meters is accomplished by pruning one spoke in the corresponding capacity hat. Only one spoke needs to be adjusted and it does not matter which spoke is selected. Refer to Chart B to calculate the amount of spoke to prune and Figure J for spoke location. It is strongly suggested the AV-680 be assembled and tested with the spokes at the initial lengths to determine if any pruning is actually required. The initial length will tune the antenna to a frequency below each band. Trimming the spokes will cause the resonant frequency to go up. Trim a small amount each time and recheck. If you go too far and the resonant frequency is too high, make a longer spoke from one of the 40" spare spokes and try again.

### **Tuning 80 meters**

80 meters has an additional tapped loading coil that will allow for retuning the antenna after the spokes have been adjusted. For initial tuning, move the tap to the uppermost part of the coil so that all the turns are shorted out. Trim the spokes for the top of the band. Use the tapped loading coil to lower the operating frequency by moving the tap down. Set the antenna to the frequency you will be using the most. Use a Phillips screwdriver to secure the tap to the coil.

### **Tuning 6, 10, 12, 15 and 17 meters**

Stub lengths can be adjusted for tuning the 6, 10, 12 & 17 meter bands. 15 meters usually will not require adjustment but can be adjusted by moving the loading coil on the main mast in and out of the main radiator. The total stub lengths are found in figure F. These values will tune the antenna to the lower part of the band.

Please note the length of coax will vary the VSWR on certain bands. Lengths less than 50 feet have stronger harmonic resonances than longer lengths. If a particular band will not properly resonate, try adding 3-5 feet or more of coax. Record the resonant frequencies with and without the added coax. There will be a change in resonant frequencies on one or more bands. RF loss at HF is not a major problem with RG8X or larger coax. There will be a minimal performance difference between a 50 ft. length and a 75 ft. length of coax.

To lessen the possibility of RFI/TVI, roll up 6-8 turns of coax 8" inches diameter approximately one quarter wave (or multiple) from the base of the antenna. Use the quarter wave length of the frequency that causes the greatest amount of interference.

### **Maintenance**

The AV-680 should be inspected mechanically at least once a year. *Normal* wear and tear varies significantly with climate.

Anti-Oxidation paste such as NoAIOX® or others can be applied to the radiator tubing sections. Use small amounts. Do not place the paste on the coax connector or inside of the Matching Unit.

Inspect the inside of the Matching Unit on a regular basis. Remove dirt, bugs, or questionable material. Look for any degradation of parts. High voltage static discharges (lightning) may cause a failure to the small coil in the Matching Unit. This coil is a protection device. Make sure it is in good shape.

Do not screw and unscrew the nylon insert nuts several times. If portable operation is desired, use stainless steel hardware without the nylon locking feature.

### **Technical Assistance**

Technical assistance is available during normal business hours on weekdays. Hy-Gain is located in the Central Time Zone. Our hours are 8:00 AM till 4:00 PM CST Monday through Friday.

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Web Page "<http://www.hygain.com>"



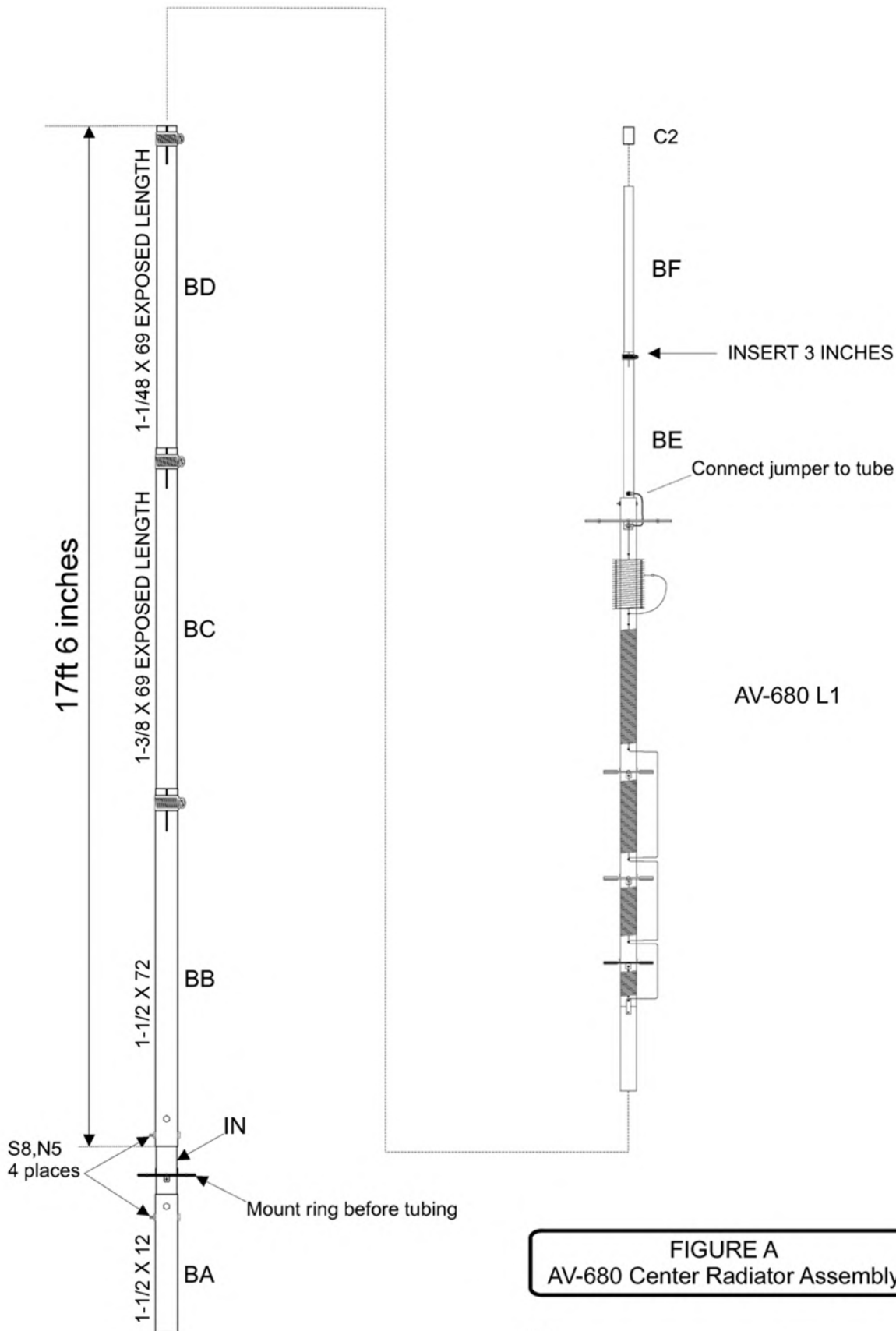
Service history has shown that most problems are operating or installation errors, rather than equipment failures. Most problems can be resolved over the telephone. Please contact our staff before shipping parts or equipment to us.

The packing material used to ship this antenna is designed to prevent shipping damage. Please reuse the original shipping carton if possible. Hy-Gain will not be responsible for shipping damage on returned items with improper packing.

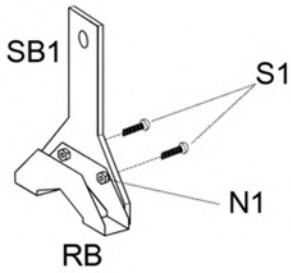
<b>BAND</b>	<b>Trimming Affect</b>
80 Meters	10 KHz per inch
40 Meters	17 KHz per inch
30 Meters	50 KHz per inch
20 Meters	100 KHz per inch
17 Meters	60 KHz per ½ inch
15 Meters	100 KHz per inch
12 Meters	150 KHz per ½ inch
10 Meters	100 KHz per ½ inch
6 Meters	300 KHz per ½ inch

CHART B  
Spoke Tuning



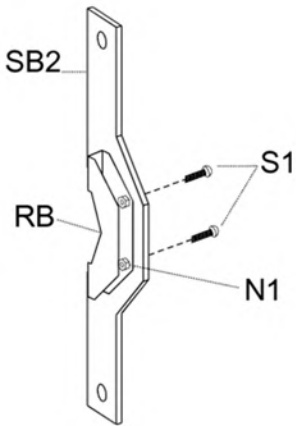
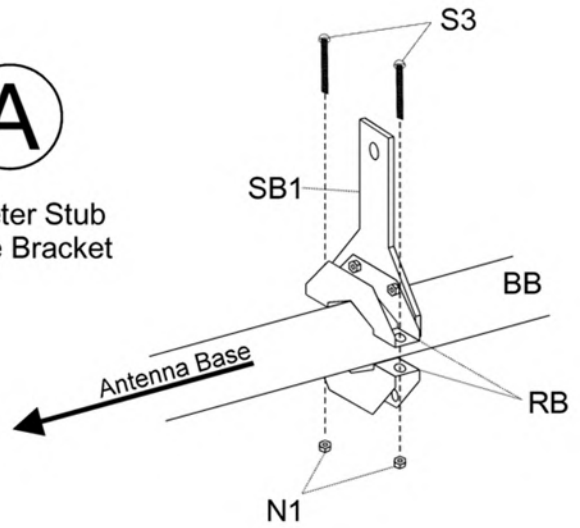


**FIGURE A**  
**AV-680 Center Radiator Assembly**



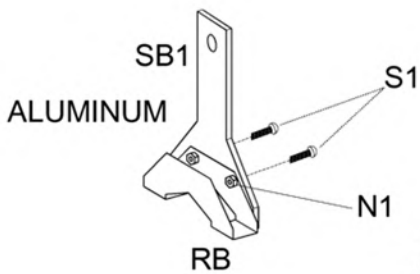
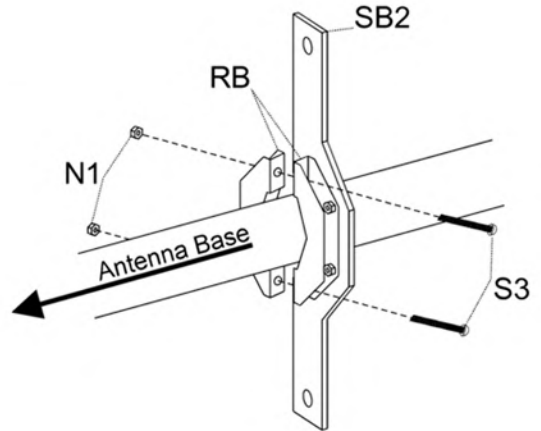
**A**

6 Meter Stub  
Base Bracket



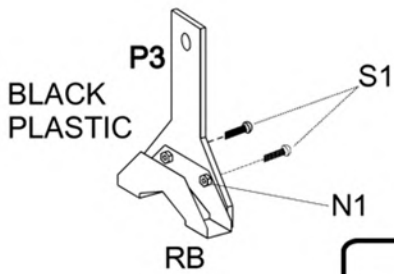
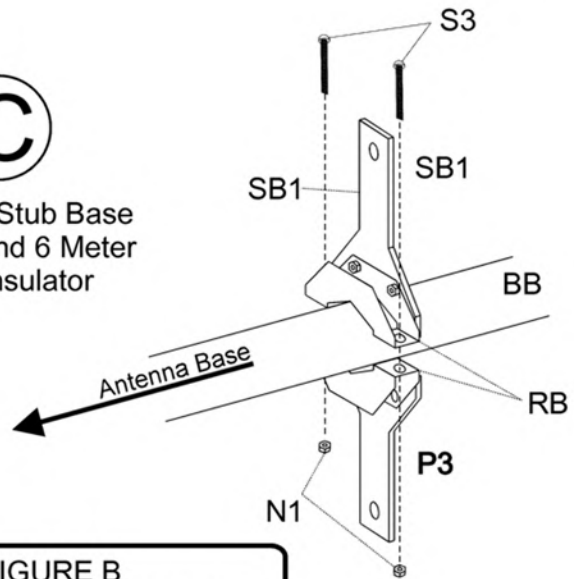
**B**

10&12 Meter  
Stub Base  
Bracket

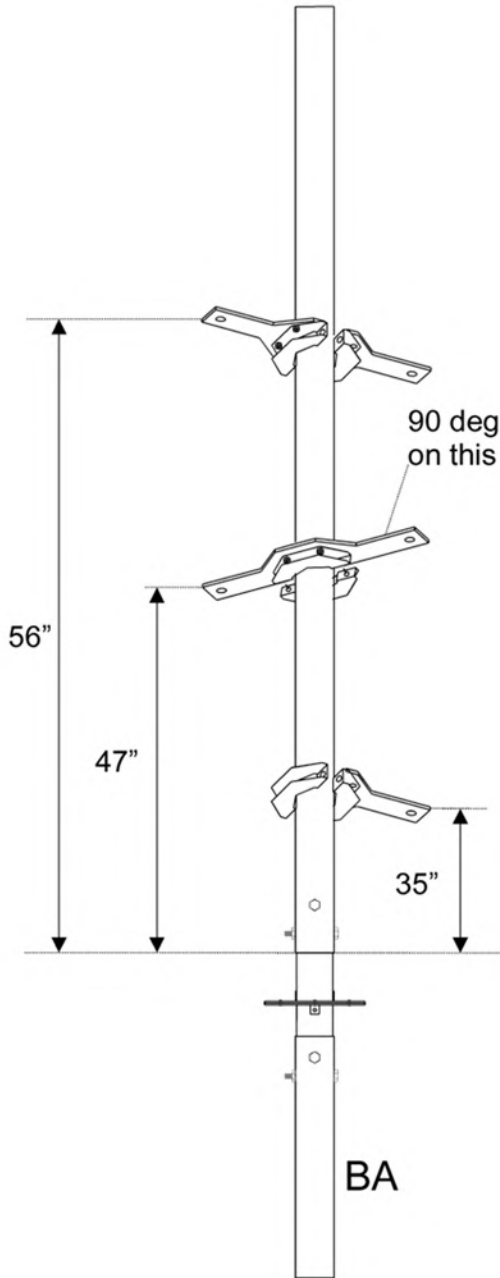


**C**

17 Meter Stub Base  
Bracket and 6 Meter  
Stub Insulator



**FIGURE B**  
Assembly of Stub Base Brackets



Ⓒ

17 Meter Stub Base Bracket and 6 Meter Stub Insulator

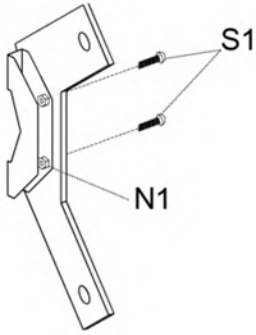
Ⓑ

10&12 Meter Stub Base Bracket

Ⓐ

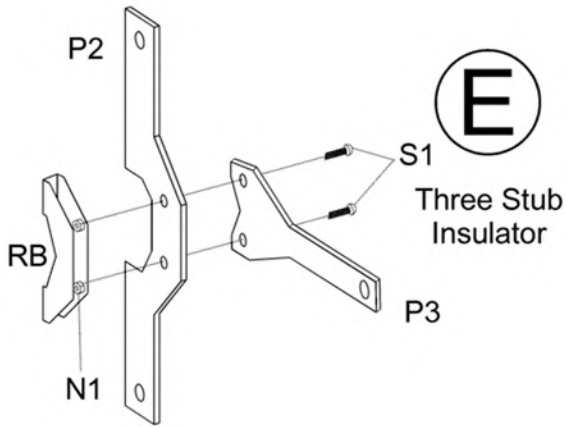
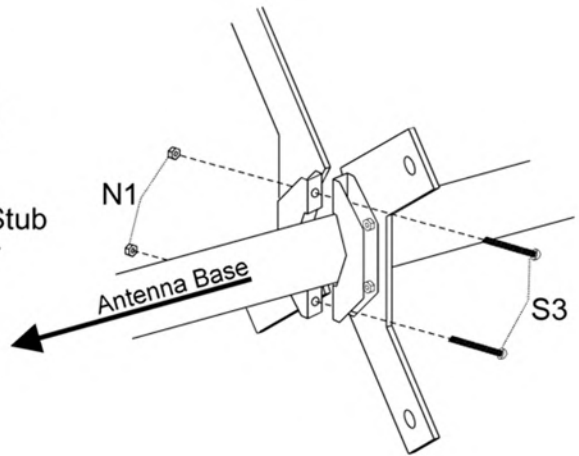
6 Meter Stub Base Bracket

**FIGURE C**  
Installation of Stub Base Brackets



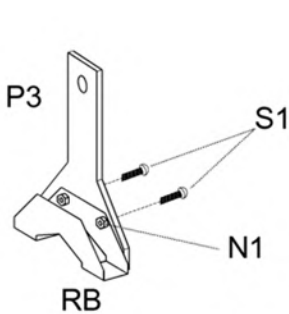
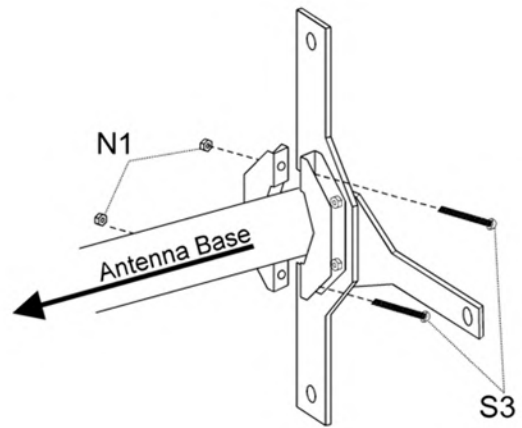
**D**

90 Degree Stub Insulator



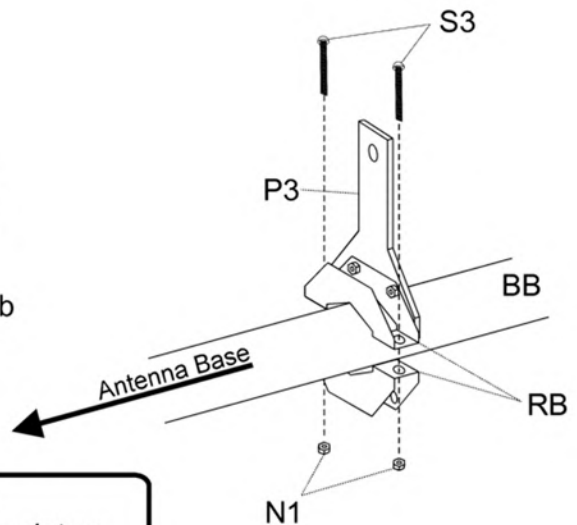
**E**

Three Stub Insulator



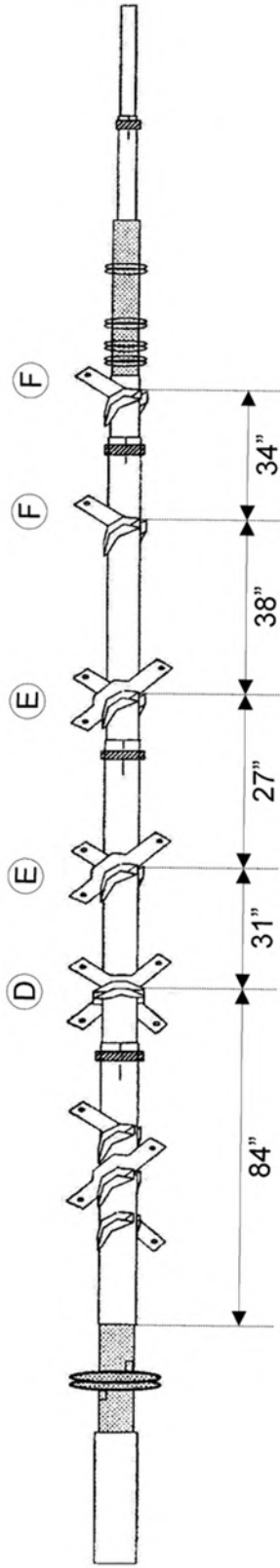
**F**

Single Stub Insulator



**FIGURE D**  
Installation of Stub Insulators

Align as shown. Keep corresponding holes in line.

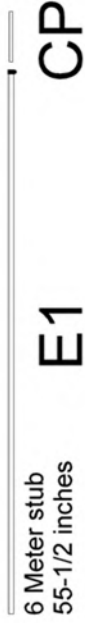


All measurements measured to the TOP of each insulator.

- ⓓ 90 Degree Stub Insulators
- ⓔ Three Stub Insulators
- ⓕ Single Stub Insulators

FIGURE E  
Installation of Stub Insulators

This chart for reference when assembling the element stubs. Do not preassemble the elements. Assemble them on the antenna. The hose clamps will not pass through the insulators. Use the coupler at the top of each stub to make the element the total length given. This will tune the antenna to the bottom of the band.



6 Meter stub  
55-1/2 inches



10 Meter stub  
102-1/2 inches



12 Meter stub  
116 inches



17 Meter stub  
161 inches

FIGURE F  
Stub Components

CP 5/16 x 6" \_\_\_\_\_

E3 3/8 x 44" \_\_\_\_\_

E1 3/8 x 55" \_\_\_\_\_

E2 3/8 x 60" \_\_\_\_\_

The coupler "CP" should be inserted about 3 inches into one tube and clamped. The other tube should be slid all the way till it contacts the other tube and clamped. The coupler at the end of the tube is used for final length adjustment. This will lower or raise the resonance frequency of the antenna.

Install the four base sections of the elements stubs (A) to the Aluminum mounting brackets. These are the 3/8 x 55" aluminum tubes with the threaded inserts in one end. Use the 10-32 screw and the #10 lock washer to secure the tube to the bracket. Install one in each bracket shown. Thread the upper part of the tube through the insulator directly above it.

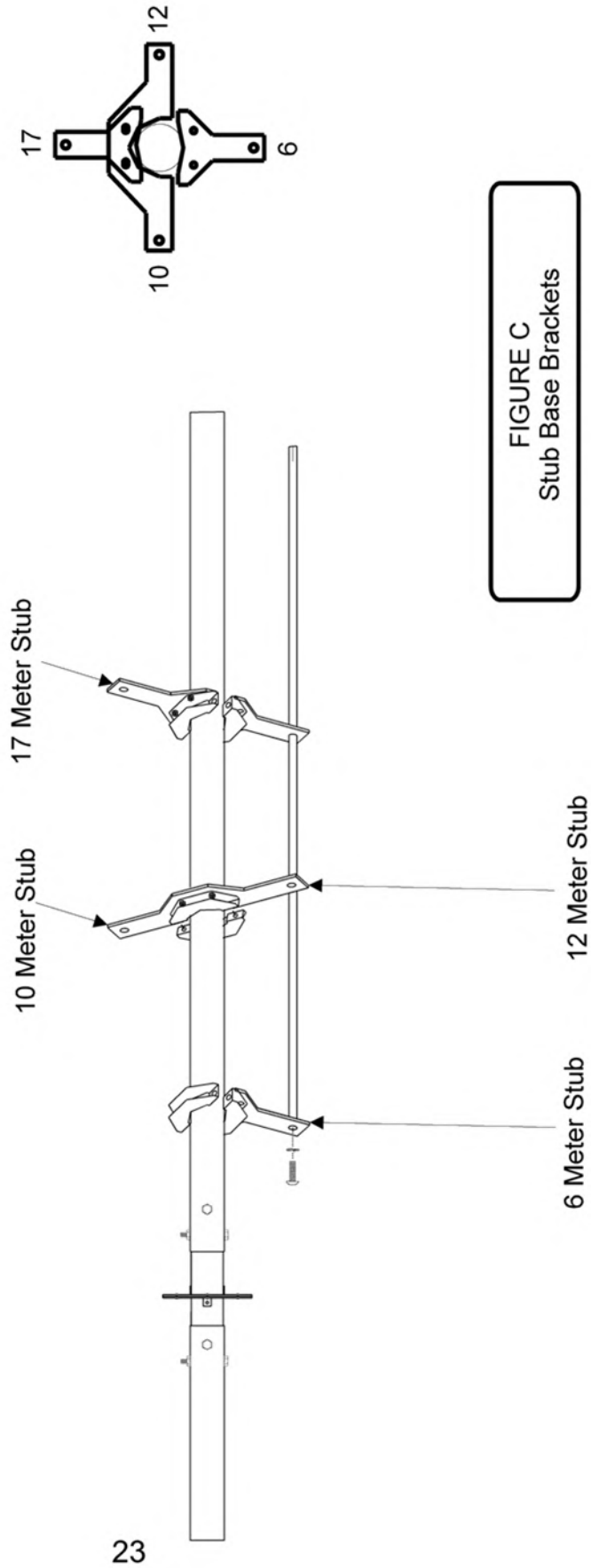
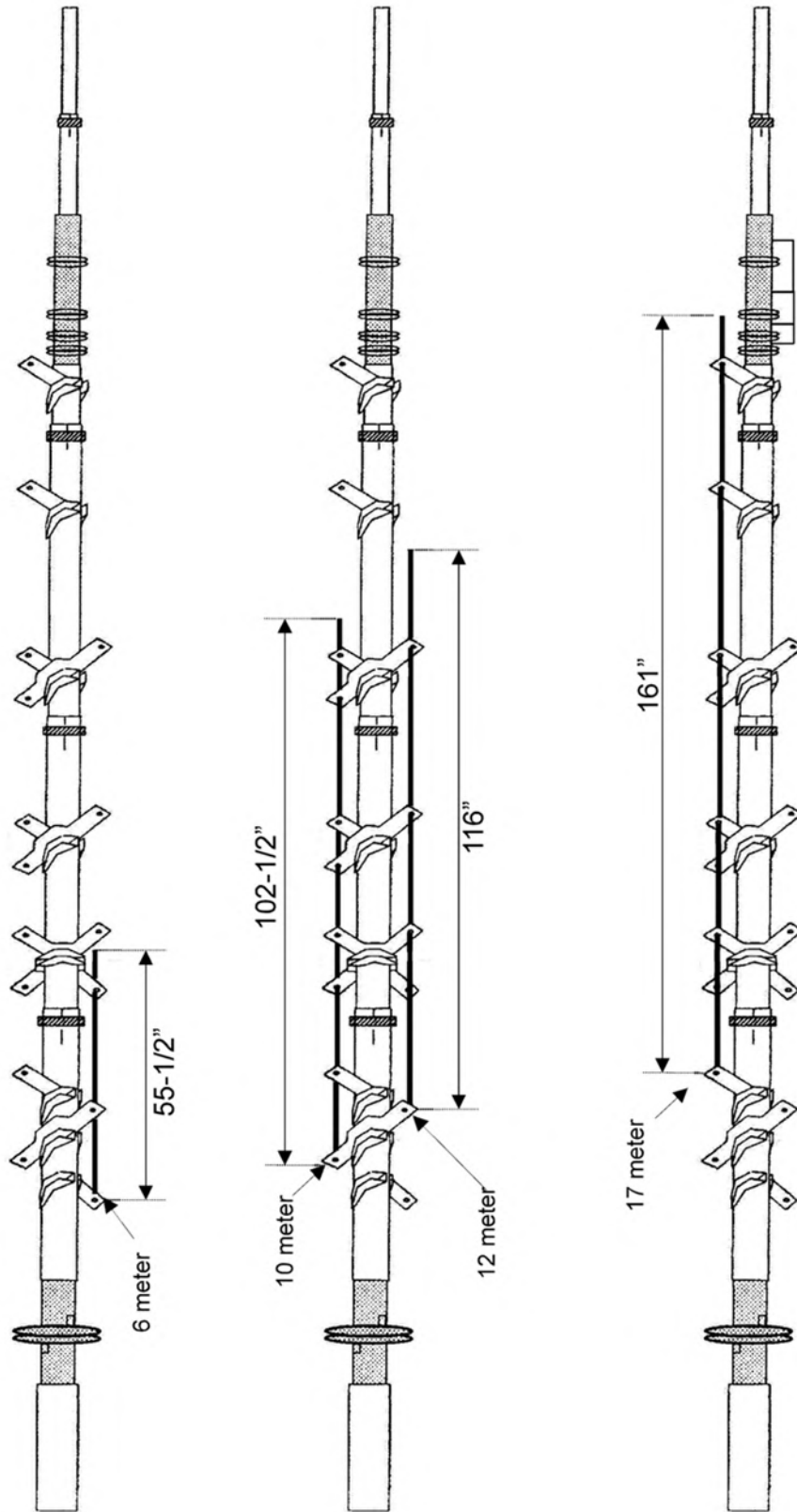


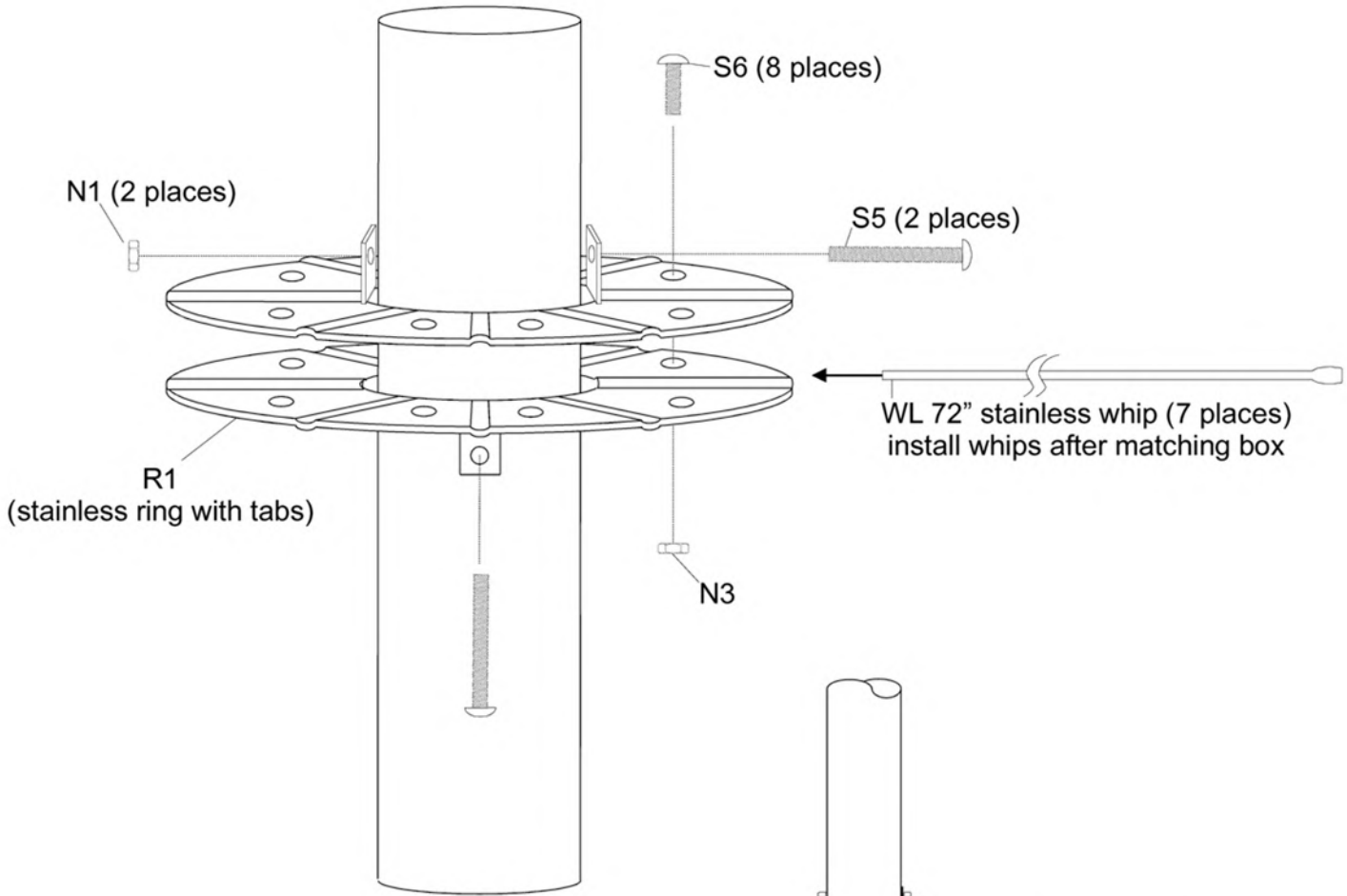
FIGURE C  
Stub Base Brackets



17 meter stub should be opposite of shoring bar on loading coil.

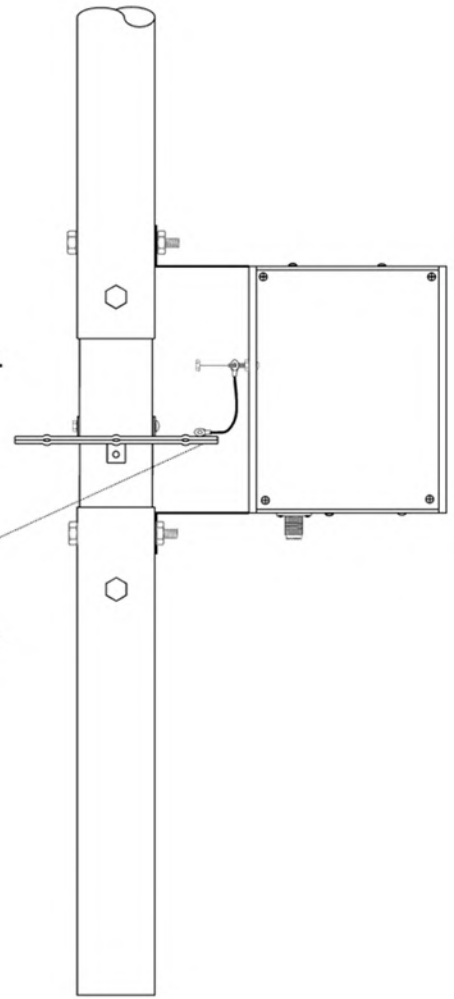
**FIGURE G**  
Stub Installation





One slot on the radial ring will be left empty. This empty slot will make room for the matching box assembly.

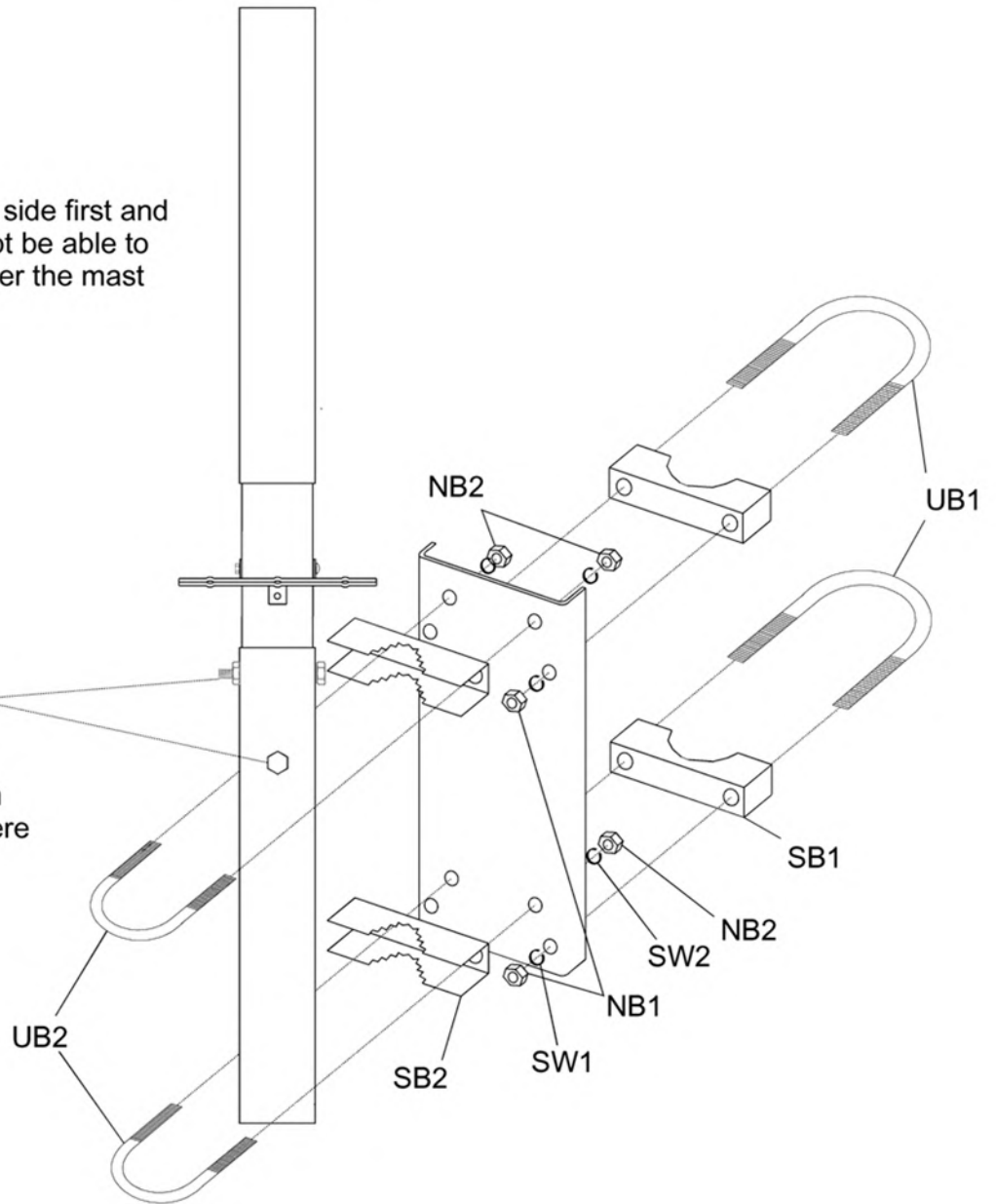
Attach jumper from box to radial ring. Attach to ring with clamping screws.



**FIGURE H**  
Conterpoise Assembly

Install the Antenna side first and tighten. You will not be able to access the nuts after the mast is installed.

Top u-bolt will sit between these two bolts. Rotate bracket until bottom bolt does not interfere with mount.



**FIGURE I**  
Mounting Plate Assembly

Parts		
NB2	4 X 555747	5/16 x 18 nut
SW2	4 X 564792	5/16 split washer
UB2	2 X 543792	5/6 U-bolt
BR2	2 X 195902	Steel saddle bracket
NB1	4 X 010209	3/8 x 16 nut
SW1	4 X 010208	3/8 split washer
UB1	2 X 013209	3/8 u-bolt
BR1	2 X 170035	AL saddle bar
MB	1 X 735-0680	Mast Bracket

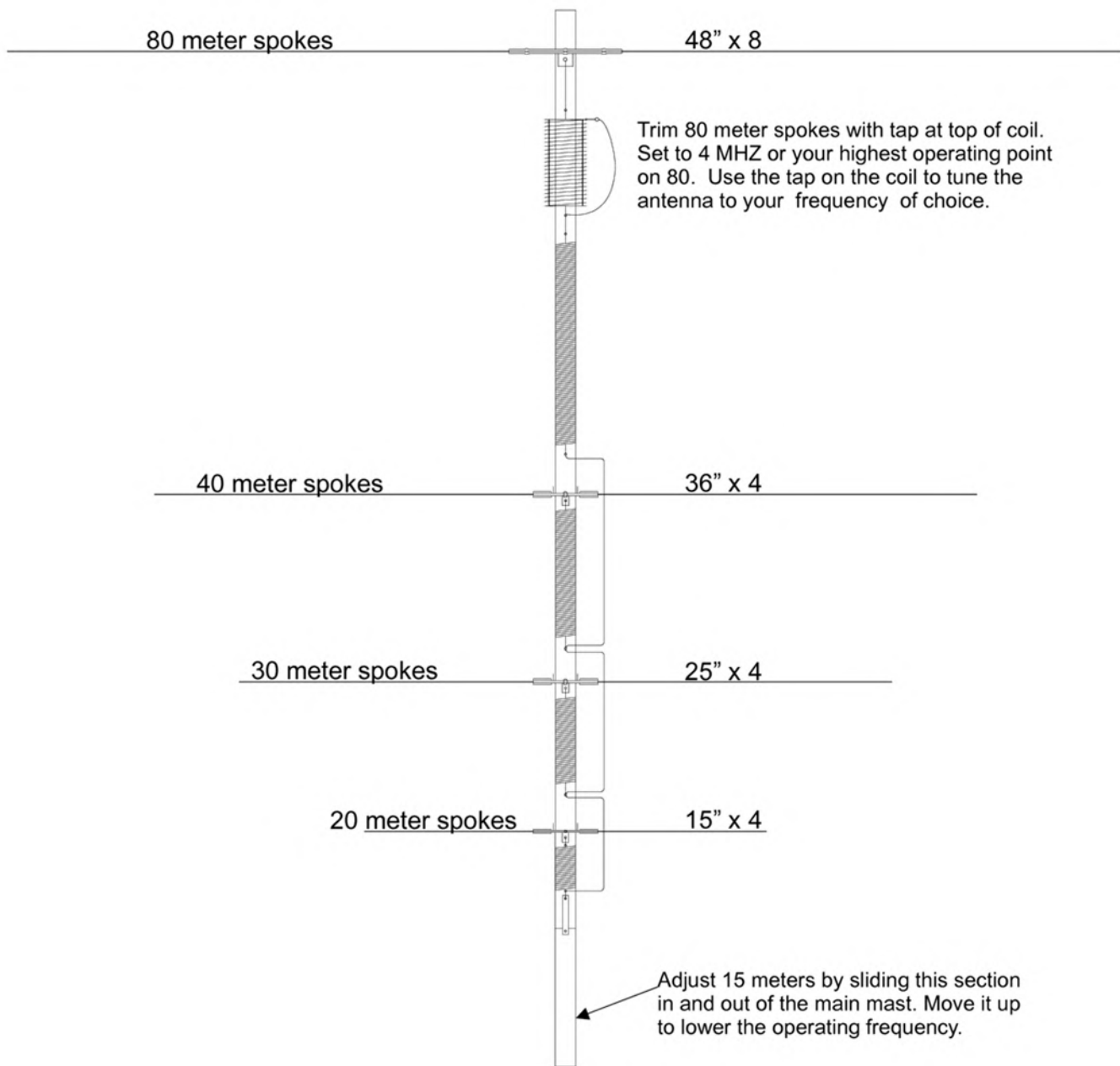
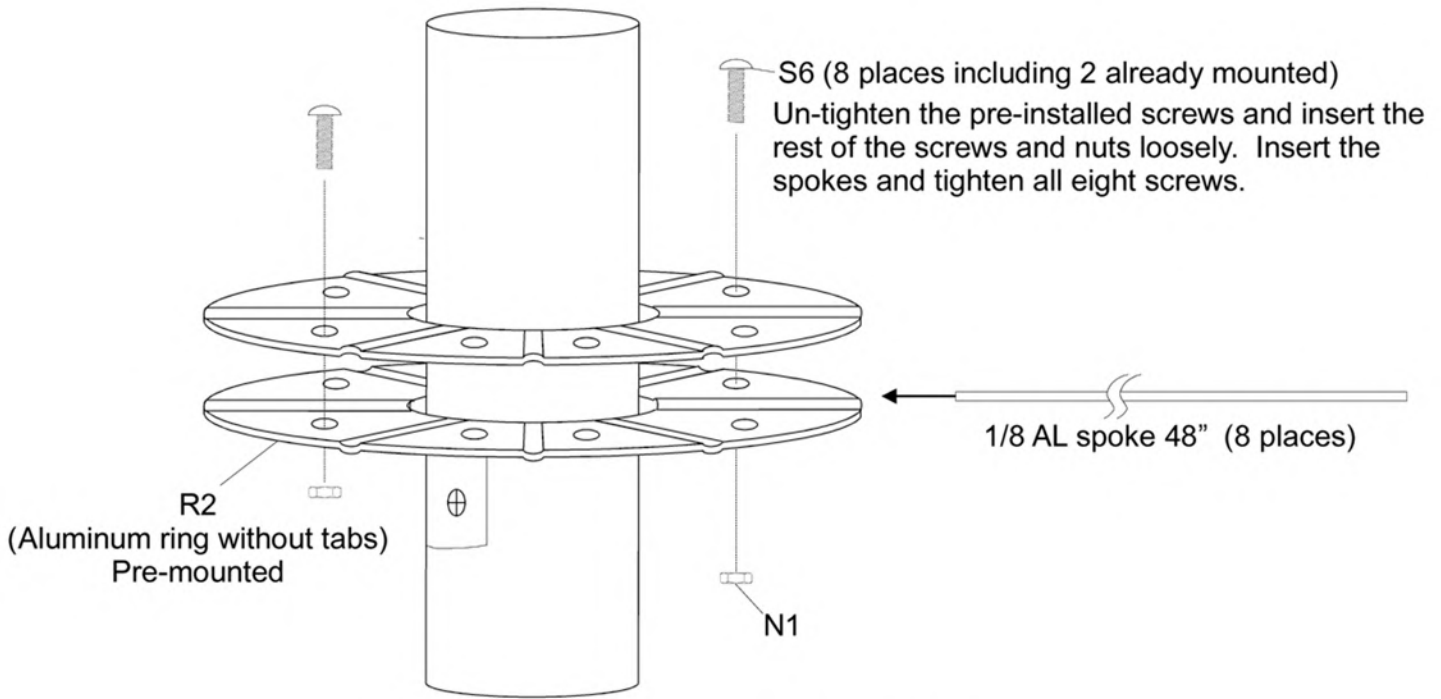
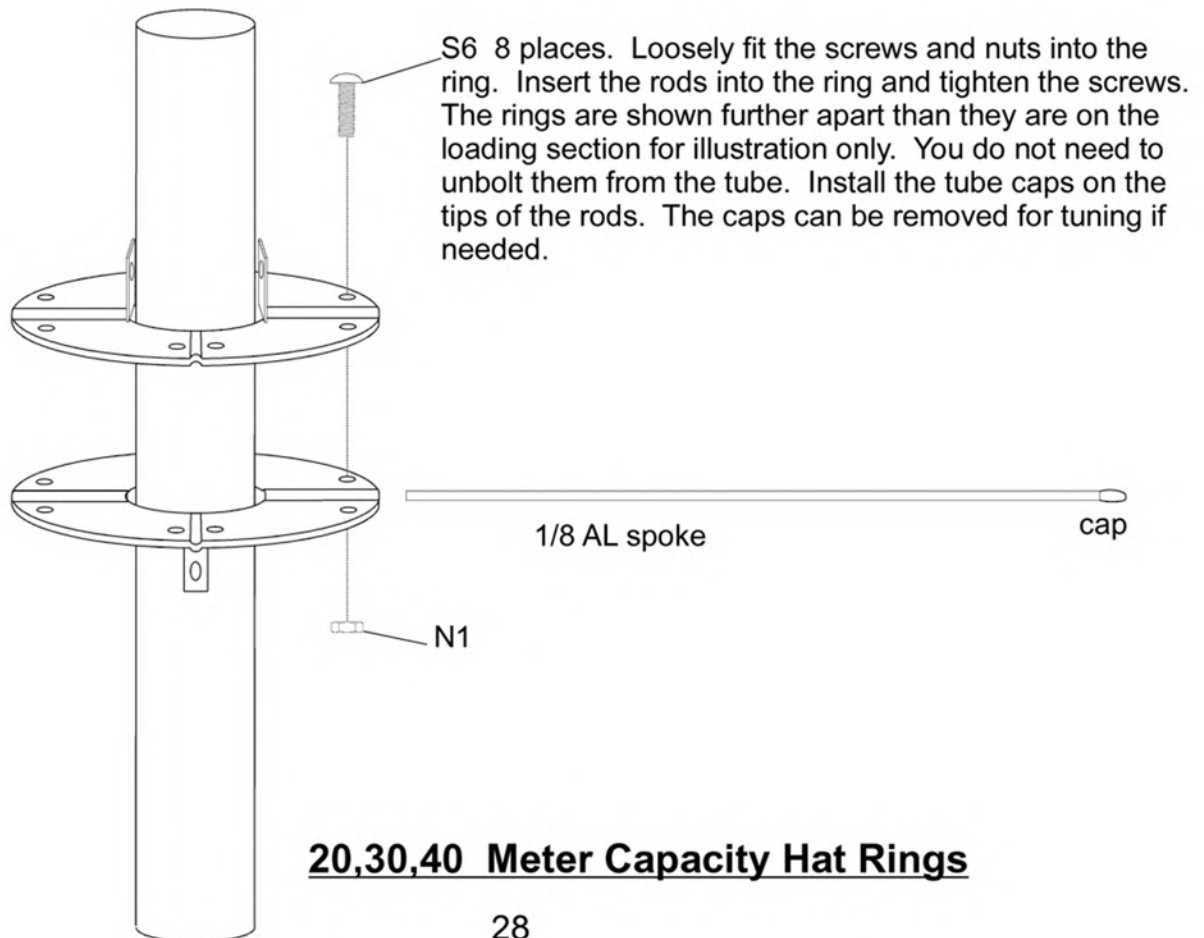


FIGURE J  
Spoke Assembly



### **80 Meter Capacity Hat Ring**



### **20,30,40 Meter Capacity Hat Rings**

# Notes

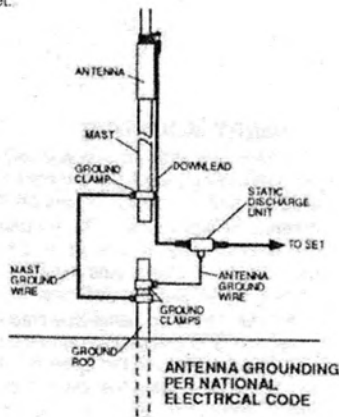
## GENERAL INSTALLATION INSTRUCTIONS FOR MAST MOUNTED ANTENNAS

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 YOURSELF. 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

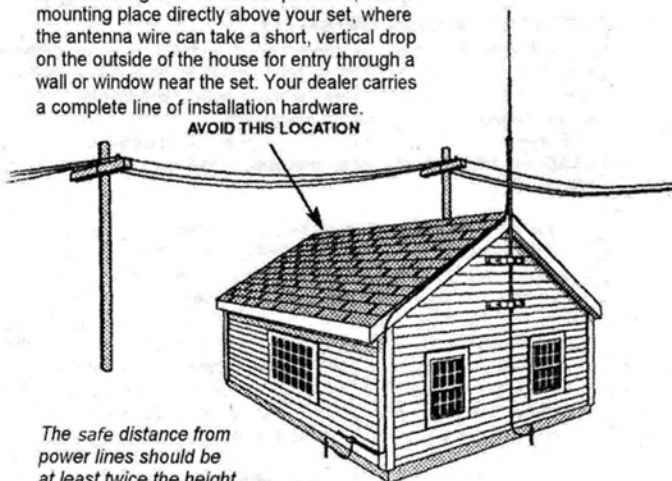
Before attempting to install your antenna, think where you can best place your antenna for **safety** and performance.

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.

**AVOID THIS LOCATION**

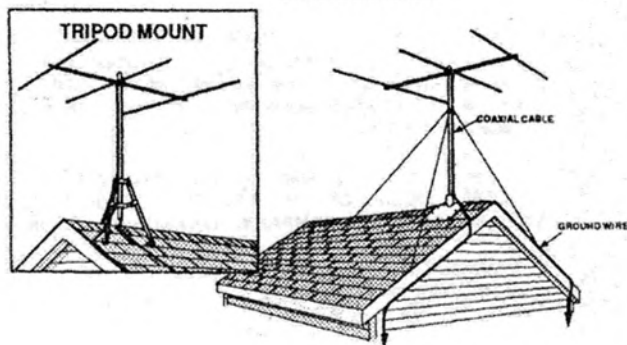


*The safe distance from power lines should be at least twice the height of the antenna and mast combined.*

## 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.

## TELESCOPING MAST

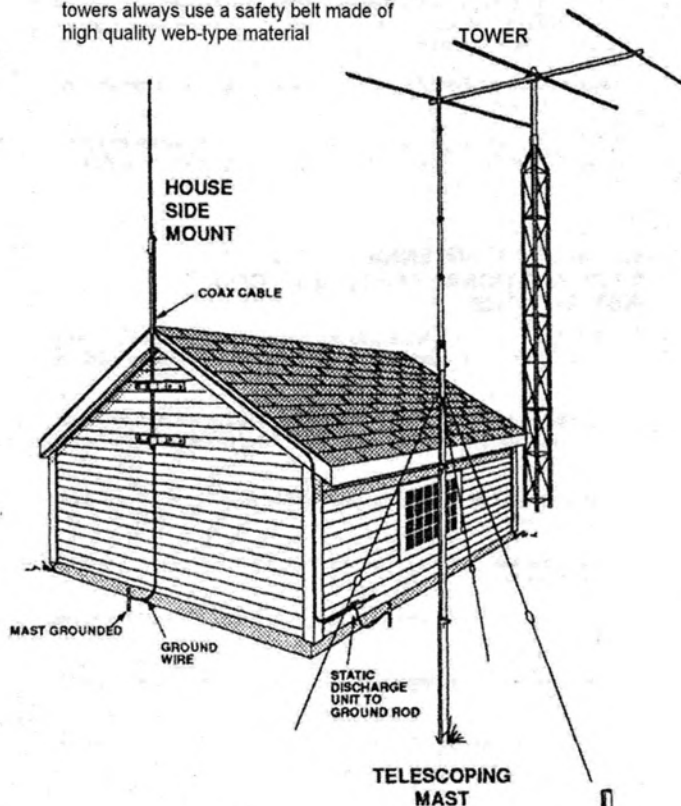
Guy wires should be equally spaced in at least three directions. Use at least three guy wires for each 10 foot section of mast.

## 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



## 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.



# **hy-gain**®

## LIMITED WARRANTY

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

The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original or machine reproduction of such proof-of-purchase to hy-gain at the time of warranty service. hy-gain shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, or forgery shall be cause to void any and all warranty terms immediately.

hy-gain agrees to repair or replace at hy-gain's option without charge to the original owner any defective product under warranty, provided the product is returned postage prepaid to hy-gain.

Under no circumstances is hy-gain liable for consequential damages to person or property by the use of any hy-gain products.

Out-of-warranty Service: hy-gain will repair any out-of-warranty product provided the unit is shipped prepaid. All repaired units will be shipped COD to the owner. Repair charges will be added to the COD fee unless other arrangements are made.

This warranty is given in lieu of any other warranty expressed or implied.

hy-gain reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.

All hy-gain products to be serviced in-warranty or out-of-warranty should be addressed to hy-gain, 308 Industrial Park Road, Starkville, Mississippi 39759, USA and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase.

This warranty gives you specific rights, and you may also have other rights which vary from state to state.