CUBEX

Quad Antennas

SKYMASTER III– 3B
SKYMASTER III– 5B
3 Element ; 3 and 5 band Quad

Plus 6 meters

Safety warning

Please read through these instructions completely before starting your installation.
Antenna work is dangerous. Always wear an OSHA approved safety harness with the appropriate nylon or wire rope safety lanyards to protect yourself and your helpers from falls. Also all helpers on the ground should be wearing hard hats to protect them from falling objects such as tools etc.

Cubex Co., Inc. has no control over the conditions at the antenna site and therefore can not be held responsible for any damage or injury to persons or property.

If for any reason you do not understand any part of these instructions, or your installation is different and these instructions do not pertain to your situation. Do not hesitate to call Cubex Co., Inc. for assistance at (561) 748-2830; or email: cubexco@aol.com

Note: Take precautions when handling and further processing fiberglass material. It is recommended that gloves and dust mask be used when cutting and drilling this material.

Price: $ 4.95 US

INTRODUCTION

The construction instructions and dimensions contained in this Manual are intended primarily for use with the basic SKYMASTER QUAD KIT. The design data and dimensions can, however, also be used with other quad support structures.

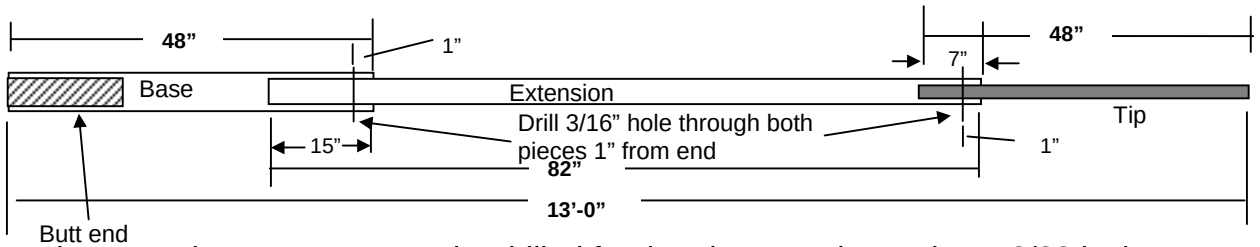
There are two basic design concepts for the Quad with respect to the method of determining reflector and driven element lengths. One method provides for making both the reflector and director element(s) physically equal to the driven element. In this case they are electrically lengthened or shortened through the use of stubs or inductors. The other method calls for a determination of the proper physical length of the elements (usually plus and minus 3% respectively) prior to cutting them. This manual will present data for both methods but a choice should naturally be made prior to measuring and cutting the reflector and (if used) the directors as the case may be. A choice should also be made regarding the orientation of the element assemblies themselves with respect to ground, i.e. a diamond or a square configuration. (The Square configuration is recommended, and the data presented is in reference that orientation).

The book Cubical Quads Antennas by William Orr and Stuart Cowan is also an excellent source of dimensions and information about quad antennas and is a great addition to your library. This book is available at most amateur radio stores.

Some Quad "experts" feel that the square position results in a slightly higher forward gain. While others favor the diamond configuration, because it offers a convenient anchor point for the element termination, as well as a support for the feedlines in routing them up to the boom. The physical dimensions given in this manual can be used for either configuration, note however it is not possible to use a single feed point or the matching transformer in the Diamond configuration.

ASSEMBLING SPREADER ARMS

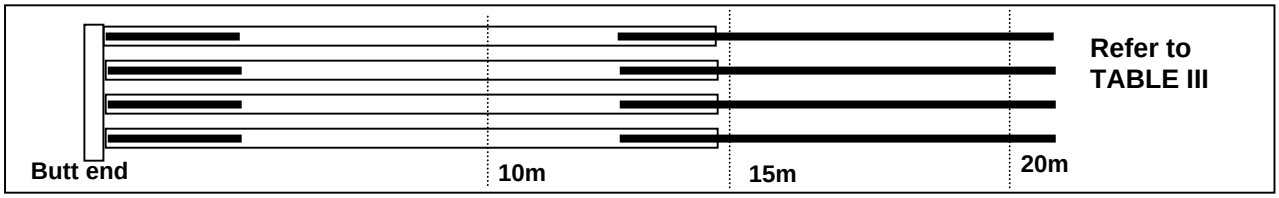
The SKYMASTER spreader arms are a three piece design and require assembly (Refer to Assembly Drawing Attached). The three pieces of telescoping fiberglass tubing that when completed will produce a robust spreader arm about 13 feet long (4m). Each arm is identical in its assembly and construction regardless of the function, Reflector, Driven or Directors. However the holes for the element wires are unique and those dimensions must be carefully measured and positioned per the drilling chart found later in these instructions.



1. The spreader arms may now be drilled for the element wires using a 3/32 inch (2.38mm) drill bit (or other size suitable for wire being used). Naturally the 3 holes in each arm should be drilled in the same plane. The spreader arm drilling data maybe

found in TABLE III.

2. To assure uniform drilling of any one type element set, the following procedure is recommended. Select four (4) of the previously prepared arms and line them up side by side with the butt end against a solid stop to assure common length and alignment.

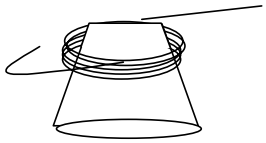


REMEMBER to allow for drilling THROUGH the arm by spacing the arm above the work surface. Pieces of scrap wood positioned along the length of the arms will provide the necessary clearance. Orient the arm assembly screws vertically and clamp the arms to prevent them accidentally turning during the drilling process. Now using the dimensions in Table III and measuring from the "butt" end mark each arm for each band. Recheck your measurements and then proceed to drill through both sides of the arm with a 1/8" (3.1 mm) drill bit. Mark the arms per their function (REFL, DRV, D1, D2) and set them aside.

PREPARATION OF WIRE ELEMENTS

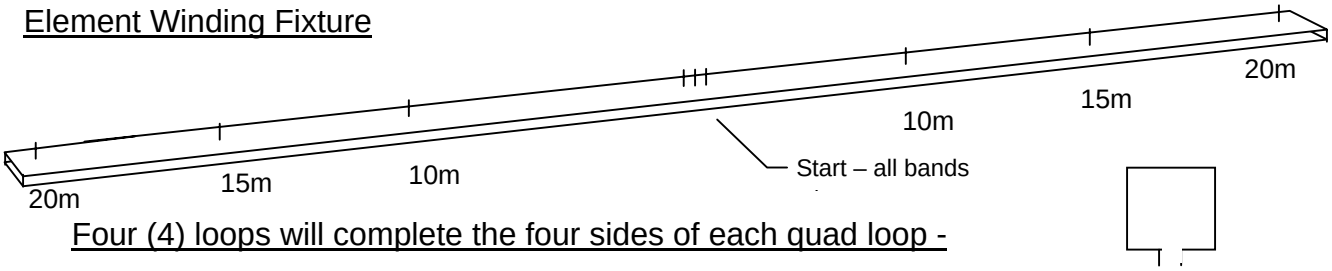
4. The wire has been spooled in a relatively large diameter to minimize "curl" and reduce the chance of kinking. The wire bundles are marked for as follows – Reflectors & Driven Elements (2el, 3bands) WARC band Reflectors and Driven Elements (12m/17m) are separately packaged. There are additional packages of wire for the Directors as applicable. All wire lengths should be carefully un-spooled by rolling the coil of wire in the appropriate direction.

   A convenient device for helping to keep the wire manageable is a plastic water "Pail" inverted. Its conical shape allows the wire spool to slip over while providing support for the bundle.



5. **A suggested method for winding accurate elements** is to fabricate a temporary winding jig consisting of a few lengths of 1" x 4" wood board stock for a total length of about 20 feet (6 m). Mark the center of this board, and 1-1/4" (3 cm) on either side. The center is used for Reflectors and Directors, and the two separated points are for Driven Elements. Regular number 6pd finishing nails can be driven into the board leaving about 1" or so protruding.

Element Winding Fixture



Four (4) loops will complete the four sides of each quad loop -

6. Now using the dimensions in TABLE IIb (per side) Mark the end points of each band element by measuring from the center nail half the length of the side in each direction. Mark and drive more nails at those points. It is less confusing if you only have the end nails in place for the band you are fabricating the element for to facilitate this. Also when completed remove those nails and use then for the next element. This may be facilitated by simply drilling holes in the board at the appropriate places and using the nails as "PEGS" for the proper dimensions.

When using this method of winding the elements, it is better NOT to precut the wire. Use the entire full spool of wire, and carefully wind each element (remember to include the "connection tails") then cut the wire at that point. (Be sure to add at least 2" to each side for Directors and Reflectors, and 12" for DRIVEN elements as a provision for splicing and attaching to the feed point terminals

This board, element-winding jig, can be lain across several saw horses, attached to a convenient backyard fence or on the side of a building. It is worth the effort to make this tool as it forms the corners of each element, which can be easily marked and then lined up on the arms. To minimize tangling and unnecessary wire kinks it is recommended that the wire loops be lightly taped along their length prior to removing them from the winding jig. Set these finished elements aside taking precautions to keep them identified and separated for future use.

Alternatively you could measure the appropriate length of wire per Table II a. and then carefully measure and mark the wire per Table II b. (total length is 4 X each side length).

Before cutting the wire should be re-measured exactly and marked for the total required length from Table IIb. **(be sure to add 2" to each side for Directors and Reflectors, and 12" for DRIVEN elements as a provision for splicing and attaching to the feed point terminals**). Now with tape or marker pen (if tape mark an arrow indicating which edge of the tape is used for the marker). Elements should also be clearly identified, i.e., 10 mtr. driven ele.; 10 mtr. Refl. Ele.; 10 mtr. director, etc., as required. Element wires should be cut according to dimensions shown in Table IIb, plus the added amounts for splicing and connections, and the corners marked by using Table IIb "one side" dimensions.

*NOTE- If you have taken the time to create the "winding fixture", it is recommended that you **do not cut the wire** (per Table Iia), but spool the wire around the "per side nails" from*

the main spool. Allow enough connecting wire at the start, wrap around the nails so as to have four (4) sides and finish with a "tail" of connecting wire – now cut the wire.

Elements should also be clearly identified, i.e., 10 mtr. driven ele.; 10 mtr. Refl. Ele.; 10 mtr. director, etc., as required, and the corners can be marked with paint or marking pen while still on the winding jig. These Corner markings can be useful in aligning the element squarely.

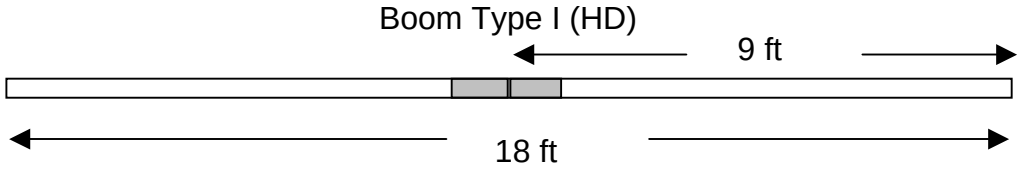
ASSEMBLING THE SUPPORT STRUCTURE

There are several methods of assembling and erecting large antennas such as the SKYMASTER, and they are dependant on the type of supporting structure (Tower), space available, clearance from surrounding objects and other mechanical aides and helpers. The exact method will be left up to the assembler, and the following are general requirements for completing the antenna assembly and do not necessarily address specific erecting procedures.

7. Choose a level area that will accommodate a 17 *X* 17-ft square with extra working room around all sides. Lay one of the end spider castings in the center of this area with "troughs" facing upward. Lay four of the assembled spreader arms, one in each of the depressed troughs. Be sure to orient the drilled holes now horizontally to facilitate element wire assembly. Fasten each spreader arm to the spider using two stainless steel worm gear clamps. One clamp is positioned near the butt of the spreader arm and should seat between two small "buttons" on the underside of the spider spoke. The other clamp is placed near the outer end of the spider spoke and should seat into a depression in the underside of the spoke. DO NOT TIGHTEN COMPLETELY AT THIS TIME.

8. Assembly of the Boom

The boom for the 3 element Quad is two equal length pieces, coupled together with an "split" insert section about 17" long. these are coupled together and secured with four (8) #12 SS Screws.



Next the Bridge Truss Eyebolts must be installed at the pre-drilled points near the ends of the boom. The "eye" should be topside, and apply the lock washer and tighten the nuts again just until the washer is compressed. This completes the boom assembly.

9. Element Spacing and Placement:
   The REFLECTOR Assembly, is placed at the end of the boom, as shown in Figure 4. The DRIVEN ELEMENT is placed at the 10 ft. mark , and The DIRECTOR is at the other end of the boom. After the assemblies are in place on the boom they should be rotated and aligned so that all bottom element wires are parallel to the ground.

BOOM LENGTH	Reflector	Driven El	Director 1

18 ft Boom	End (start)	+ 10 ft	18 ft

10. The next step is to attach the 5/16" truss guying Dacron to the two Boom "Eye-Bolts" and dress the rope through the element array and secure to the two "S" hooks that make up the Mast support assembly (2" U-Bolt, plates and S hooks) that is installed on the top of the mast and put a slight upward tension on the boom using a truckers knot to gain a mechanical advantage. Final tensioning can be made by sliding the u-bolt along the mast then tighten securely!

Assembly of the Boom to the Mast

11. These directions are a general outline only and your installation may be different. For instance you may have a tilt over tower and this would make the installation process different and easier. Feel free to modify these instructions to meet your individual needs.

Place the BOOM/MAST COUPLER plate at the center of the boom (for improved clearance offset from center 6 inches toward the Reflector). Fasten the mast plate to the boom using the supplied bolts. 3" OD boom requiring 4 - 3"x3/8" U-bolts. All U-bolts are secured using, nuts and lock washers. The bolts should be tightened on the boom sufficiently to preventing rotation of either with respect to the other. One should keep in mind that as the mast length is increased the matter of side loading on the rotor increases. Also, if longer lengths are to be used, the wall thickness of the material should be sufficient to withstand the greater side loading effects. When the rotor is placed inside a tower, lengths of 10 feet can be used without trouble as the side loading is absorbed by a tower bearing sleeve. As an aid to lifting the array, an 8 to 10 foot pole or pipe section (GIN POLE) may be temporarily slipped into the mast and secured. The Gin Pole is a pole or pipe that has a small pulley at the top. Using a strong rope the antenna can be pulled up to the final mounting position by an assistant with little danger to the tower climber. This will usually facilitate getting the array up to the top of tower, mast, etc.

The antenna array is then lifted into place on the tower and the boom/mast coupler plate is secured to the mast using the supplied hardware. The antenna & boom assembly is bolted to the mast using the supplied 3", "U "bolts REMINDER: DON'T TAKE CHANCES. USE A CLIMBING BELT OR SAFETY HARNESS WHILE ON A TOWER. THE LIFE YOU SAVE COULD BE YOURS!

CAUTION; While every effort has been made in designing and fabricating both the spreader arms and the spiders for maximum strength, it is possible to suffer breakage if the assembly is dropped or impacted against buildings, trees, etc., Use care in handling.

Position the boom to achieve adequate tower clearance while still maintain a reasonable balance of support by the boom to mast plate. Take time to sight the arms and adjust to obtain alignment.

12. FEEDING THE, 3 ELEMENT QUAD. The feed-point impedance's of this antenna will vary with each band. Twenty meters is about 50 ohms, Fifteen meters about 75 ohms and Ten meters is about 110 ohms. The CUBEX matching transformer is a combination

unbalanced to balanced and impedance transformation device. It will allow for single feed line with acceptable SWR while using 3 or 5 bands of operation.

An alternative method of feeding the multi band quad utilizes a remote antenna switch such as the AMERITRON RCS-8V. When using the remote antenna switch or separate feed lines for each band it will be necessary to fabricate Co-Ax matching sections from 75 ohm RG11U cable. **See TABLE I**

For 10 meters use 68 inches (172.72cm) of RG/11U attached to 10 -meter DRVN. EL. FEED POINT and any length of RG8/U from the other end of the RG/11U to the transmitter.

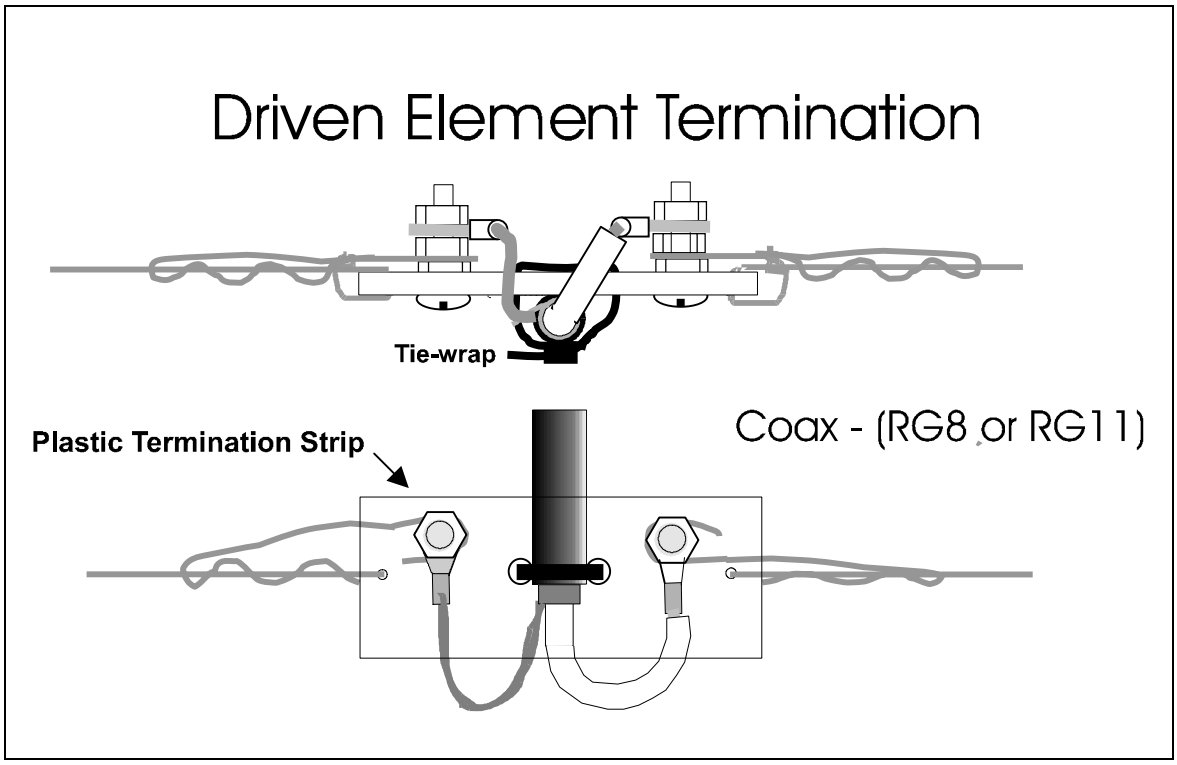
For 15 meters, use 92 inches (233.68 cm) of RG/11U attached to the 15-meter DRVN. EL. FEED POINT and any length of RG8/U from other end of RGII/U to the transmitter. ***(Note: in many cases the match is satisfactory feeding directly with 50 ohm cable. It is suggested that you try 50 ohm connection first)***
Any excess cable can be coiled and taped together.

For 12 meters use 79 3/4 inches (202.74 cm) of RG/11U cable.

Where a REMOTE SWITCHING SYSTEM is used, one would position the remote unit at a point on the boom where both 10 and 15 meter matching sections could terminate in the box. This would eliminate splicing of cables, Baluns are generally not needed and have proven effective in only a small percentage of unusually rough situations. Fortunately, the great majority of quad installations perform very satisfactorily without the need to resort to complicated matching systems, but in an occasional "rare" case of difficulty, the Gamma Match (either individual or Tri-Gamma) has proven to be a good solution. For Gamma Match information see Note No. 3 at end of instructions.

The CUBEX matching transformer is an excellent choice for matching the antenna system to the transceiver. It allows for a single FEED LINE and matches the CUBEX antenna without the hassle of complicated matching networks.

Good luck and DX –



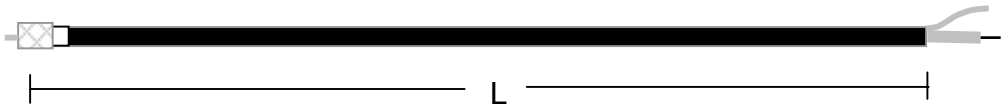
Note: These terminals are not supplied when Cubex Matching Transformer is ordered with Antenna

Matching Stub dimensions: Table I

Electrical Quarter wave 75 ohm coax ; velocity factor = 0.66

BAND	CABLE TYPE	LENGTH (IN.)	LENGTH (CM)
10 Meters	RG11/U 75 ohm	68 in	172.72 cm
12 Meters	RG11/U	79 3/4 in	202.74 cm
15 Meters	RG11/U	92 in.	233.68 cm
17 Meters	Note 3		
20 Meters	RG 8/U 50 ohm	Any length	
40 Meters	RG11/U	23.35 ft (420 in)	711.71 cm

Note 1- that any length 50 ohm coax maybe connected to the end of these matching stubs.
Note 2- Some experimentation may be required in adjusting each matching stub to optimize the impedance transformation.
Note 3- 17 meters should not require any stub and match okay with 50 ohm cable.



Dimensions above

For ¾ wave lengths multiply the lengths above by a factor of 3, excess cable may be coiled into a 6 inch dia. Coil and taped together.

Table IIa

3 ELEMENT QUAD **Total** Length Cutting Chart *

BAND	10 M	12M	15M	17M	20M
Reflector	39 ft	44 ft	50 ft	59 ft	80 ft
Driven El	38 ft	43ft	48 ft	58 ft	74 ft
Director 1	35 ft	40 ft	47 ft	54 ft	70 ft

*** Note, the above dimensions are longer then required to permit adequate wire for forming elements. The following table has precise per side measurements.**

Be sure to cut elements from the appropriately labeled spool of wire

Table IIb 3 ELEMENT QUAD DIMENSIONS (PER SIDE) Element Framing Dimensions

BAND	10 M	12M	15M	17M	20M
Reflector	107.5”	124.0”	145.0”	170.5”	218.0”
Driven El	105.0”	120.75”	142.0”	166.5”	212.0”
Director 1	100.8”	117.25	139.0”	161.5	207.25”

The total length is 4 X the above dimensions. In order to make splices and connections and additional 4 inches must be added to Reflectors and Directors. Driven elements need an additional 24” for 10m/20m, 18” for 12m/17m and 6” for 15m - **This is IMPORTANT. This additional Driven Element length is essential if the MT-3 matching transformer will be used!**

Table III ARM DRILLING DIMENSIONS

REFLECTOR:

|BUTT END
|---------- 10M --------- 74-3/8” (188.91 cm) ---------->
|---------- 12M --------- 85-1/2” (217.17 cm) ---------->
|---------- 15M --------- 101-3/8” (257.50 cm) ---------->
|---------- 17M ---------118-1/2” (301.0 cm) ---------->
|---------- 20M --------- 152-5/8” (387.67 cm) ---------->

DRIVEN ELEMENT:

BUTT END
|---------- 10M --------- 71-3/8” (181.30 cm) ---------->
|---------- 12M --------- 83-1/2” (212.09 cm) ---------->
|---------- 15M --------- 98-3/8” (249.87 cm) ---------->
|---------- 17M ---------115-1/4” (292.74 cm) ---------->
|---------- 20M --------- 147-5/8” (374.97 cm)---------->

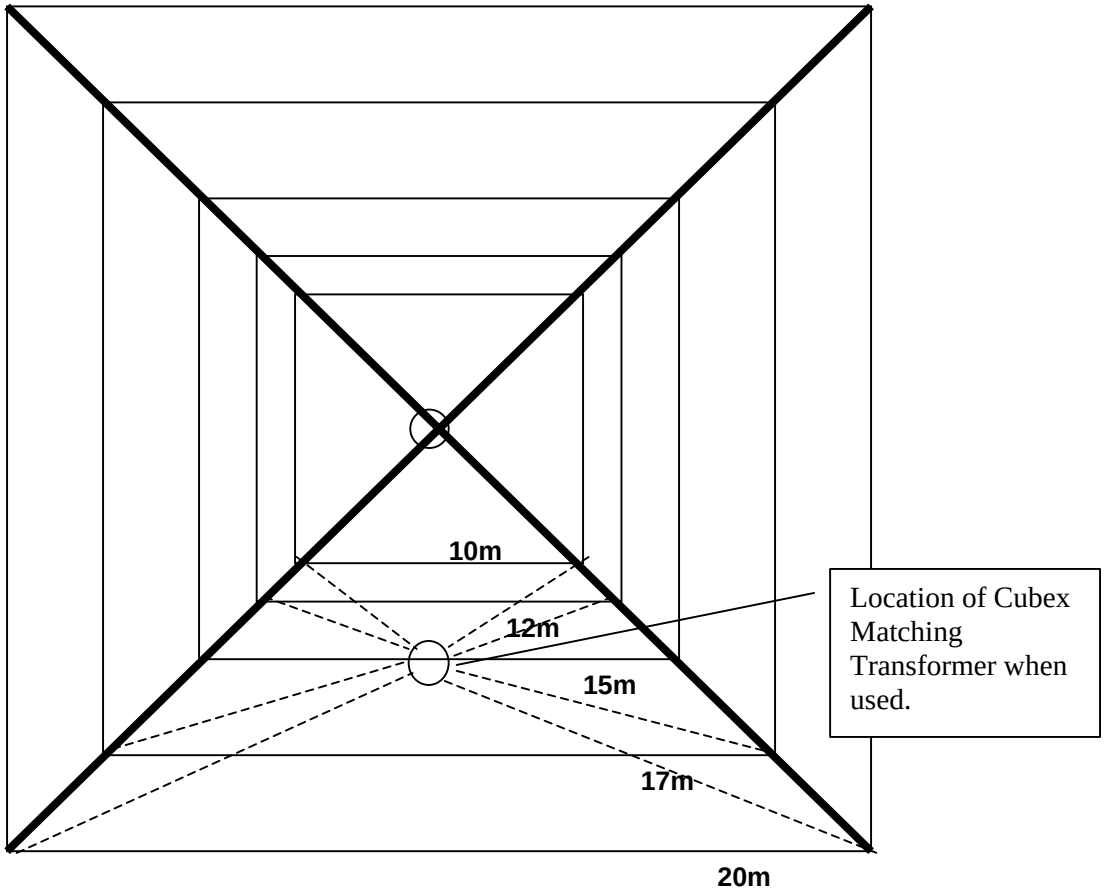
DIRECTOR:

BUTT END
|---------- 10M --------- 69-1/8” (175.58 cm) ---------->
|---------- 12M --------- 80-1/2” (204.47 cm) ---------->
|---------- 15M --------- 96-3/8” (244.79 cm) ---------->
|---------- 17M ---------112-1/4” (285.12cm) ---------->
|---------- 20M ---------144-7/8” (367.98 cm) ---------->

NOTE:

These dimensions are for reference only, actual dimensions may vary slightly from those above in actual practice.

QUAD LOOP DIMENSIONS:



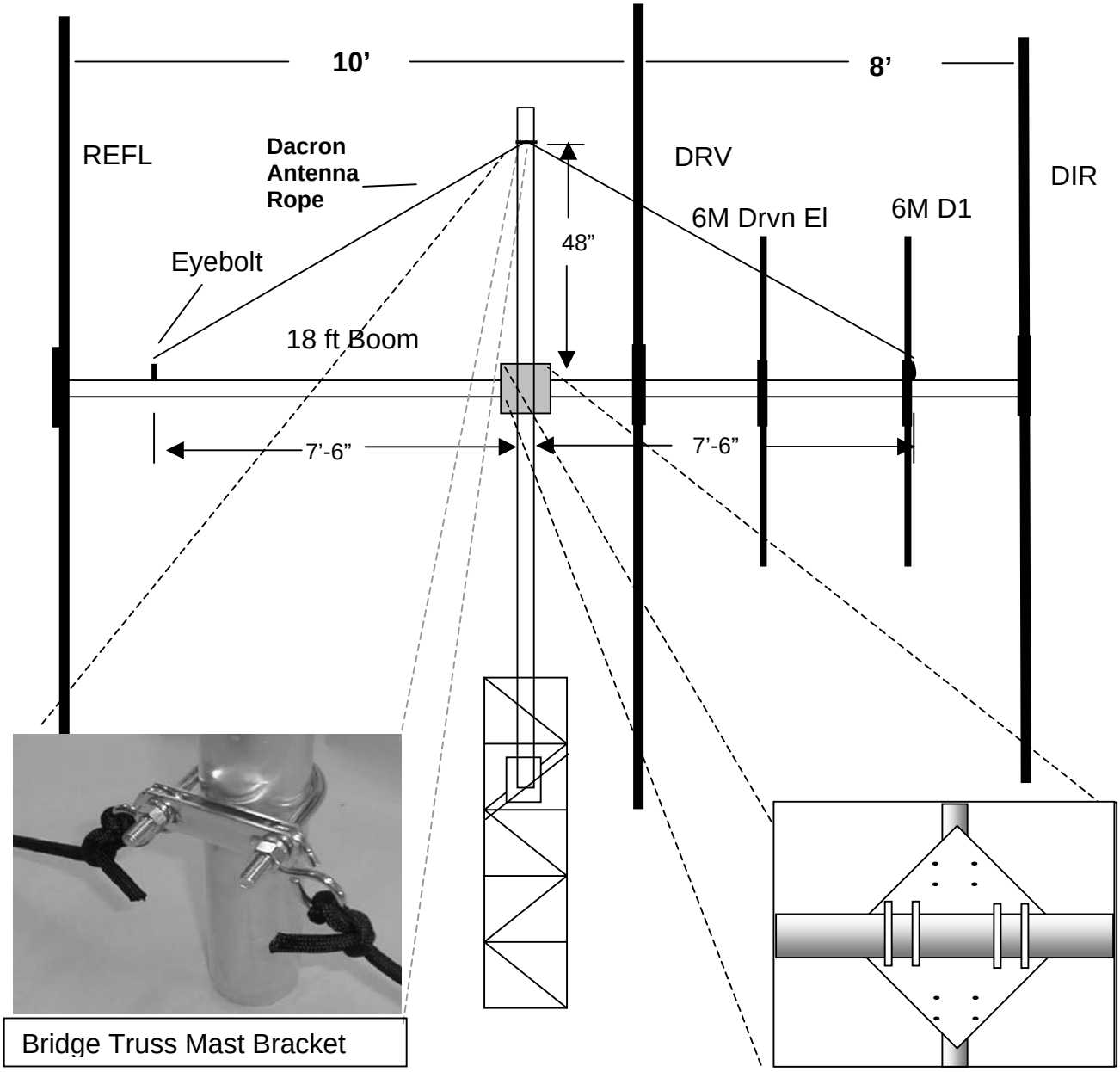
BAND	10M	12M	15M	17M	20M
Reflector					
Driven					
Director 1					
Director 2					

Additional notes about Feeding quads: Separate lines are to be preferred over the simplified "Single FEED LINE" method to a common juction point of elements. This is not to say that the "SF" system is unacceptable, but one must be prepared to accept some SWR compromise when using it If difficulty is encountered in LOADING and/or SWR with either system.

FEED LINE PRUNING should be attempted as the NUMBER ONE approach when using the "SF" approach.

Baluns are generally not needed and have proven effective in only a small percentage of unusually rough situations. Fortunately, the great majority of quad installations perform very satisfactorily without the need to resort to complicated matching systems, but in an occasional "rare" case of difficulty, the Gamma Match (either individual or Tri-Gamma) has proven to be a good solution. For Gamma Match information see historical notes at end of instructions, or refer to Bill Orr's book on Quads.

TRUSS ARRANGEMENT
3 element Quad ELEMENT Spacing

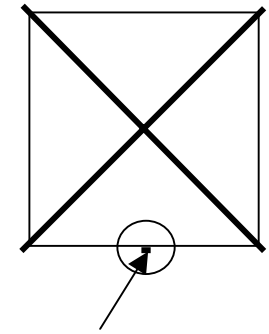


Bridge Truss Mast Bracket

In the SKYM III and SKYM IV antenna models an appropriate length of high quality UV resistant Dacron antenna rope is supplied along with necessary eyebolts to complete the truss guying of the boom. Eyebolts for a 2” mast and 3” boom are supplied and the boom holes are pre-drill for proper location of the truss line.

ADDENDUMS

Joining Element Wires



Reflector / Director Connections - splice or crimp sleeve

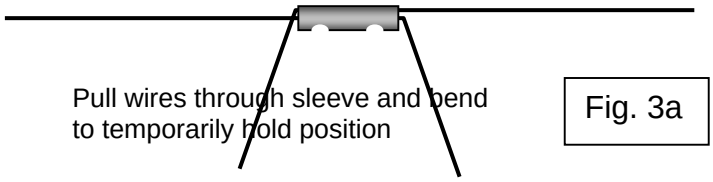


Fig. 3a

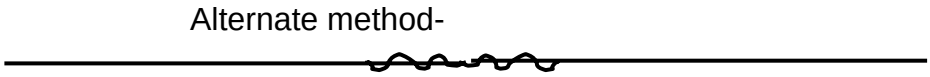
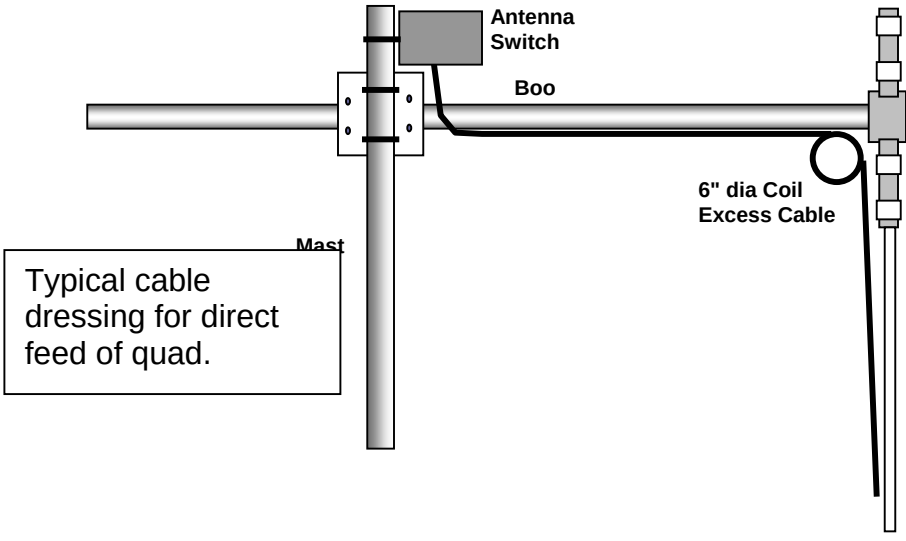


Fig. 3b

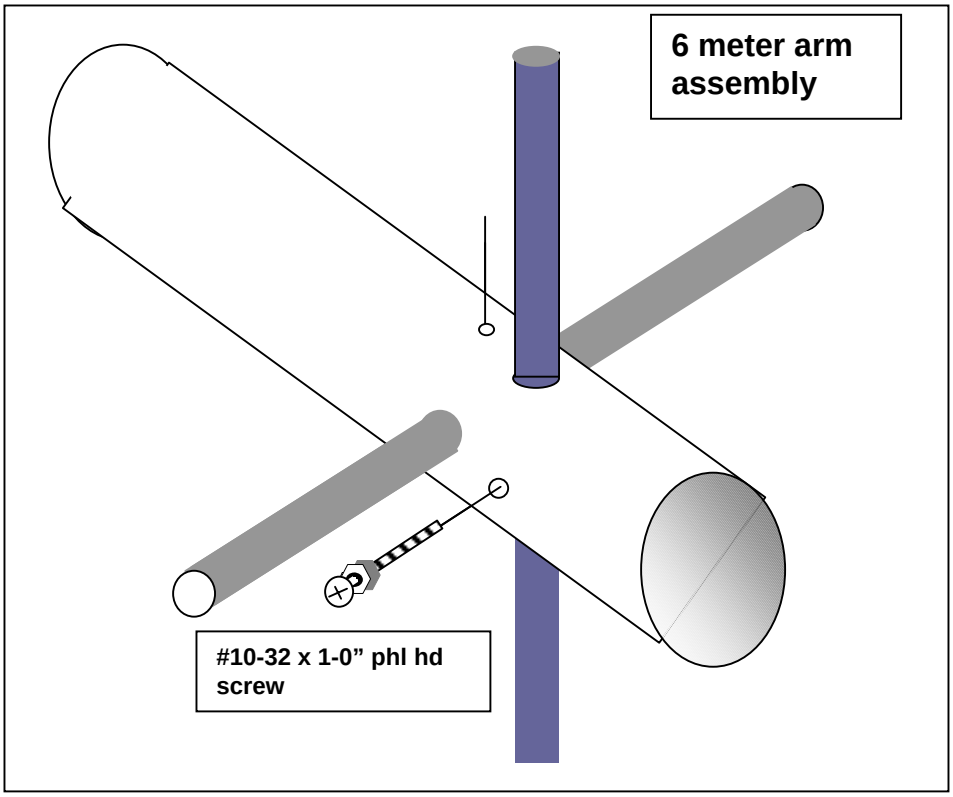
Locate the small bag of <u>crimp sleeves (5 +1spare).</u>
After completing the wiring of the Reflector and Director elements the ends must be connected to complete the Quad loop. Slide both ends through the sleeve as shown in fig 3b. Pull wire through to eliminate the slack in the wire. Temporarily fold each wire end as above to hold the wire position. Check the tension in all of the sides of this element, making sure that the arms are "square" and in line. Make an adjustment at the sleeve and if satisfied Crimp, or solder the element wire into the sleeve. This technique allows you to get the element wire tension correct without committing to a wire wrap or crimped connection.

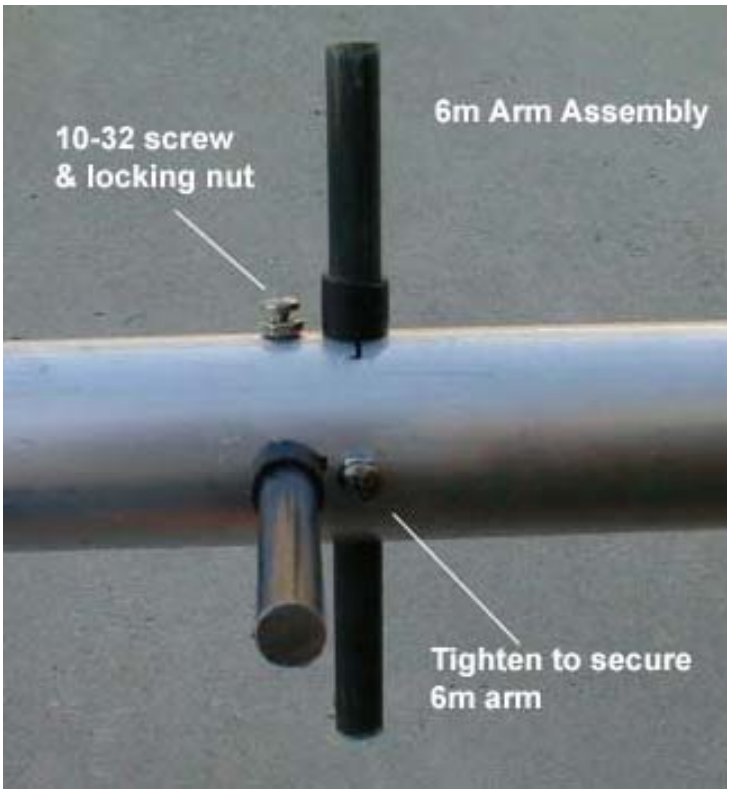


Typical cable dressing for direct feed of quad.

Cubex Engineering

6 METER ARM ASSEMBLY





Note:
This 6m option requires the addition of two sets of spreader arms to be added to holes drilled in the boom. The Driven Element (RED) and the 1st DIR (WHT) .
These 6m arms should be centered in the boom and then tighten the Phillips head screw to secure the arm into the boom. Be careful to not over tighten as damage to the screw or fiberglass arm can occur.

The hex nut should be turned clockwise to LOCK the screw inplace.