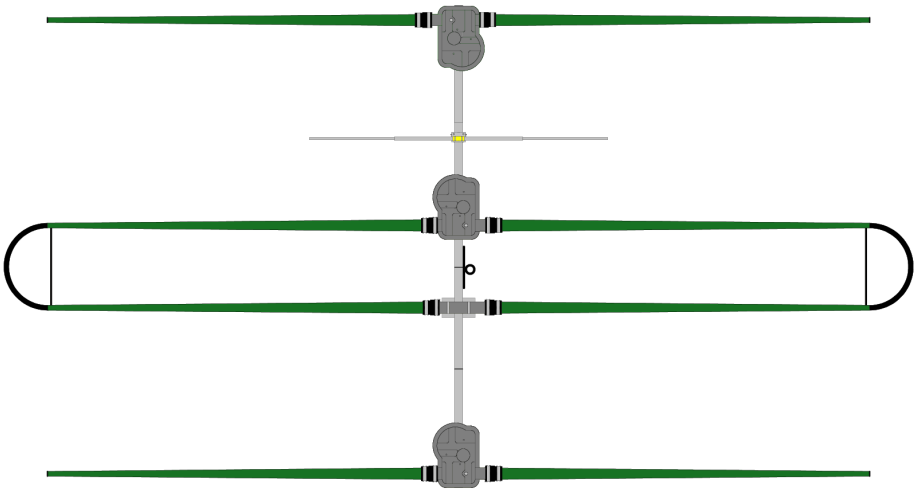
steppIR COMMUNICATION SYSTEMS

# *3 Element Yagi Instruction Manual*



**Revision 3.81 05/22/2023**

**13406 SE 32nd St, BELLEVUE WA, 98005 WWW.STEPPIR.COM TEL: (425)-453-1910**

# SteppIR - Why Compromise?

The SteppIR antenna was originally conceived to solve the problem of covering the six ham bands (20m, 17m, 15m, 12m, 10m and 6m) on one tower without the performance sacrifices caused by interaction between all of the required antennas.

Yagi's are available that cover 40 meters through 10 meters by using interlaced elements or traps or log periodic techniques, but do so at the expense of significant performance reduction in gain and front to back ratios. With the addition of the WARC bands on 30m, 17m and 12m, the use of interlaced elements and traps has clearly been an exercise in diminishing returns.

Obviously, an antenna that is precisely adjustable in length while in the air would solve the frequency problem, and in addition would have vastly improved performance over existing fixed length Yagi's. The ability to tune the antenna to a specific frequency, without regard for bandwidth, results in excellent gain and front to back at every frequency.

The patented folded dipole loop elements on the DB36 allow for outstanding performance on 40m and 30m with element lengths that are 40% shorter than a full sized Yagi—at the expense of only 0.3dB of gain!

The SteppIR design was made possible by the convergence of determination and high tech materials. The availability of new lightweight glass fiber composites, Teflon blended thermoplastics, high conductivity copper-beryllium and extremely reliable stepper motors has allowed the SteppIR to be a commercially feasible product.

The current and future SteppIR products should produce the most potent single tower antenna systems ever seen in Amateur Radio! We thank you for using our SteppIR antenna for your ham radio endeavors.

73 and good DX!

John Mertel

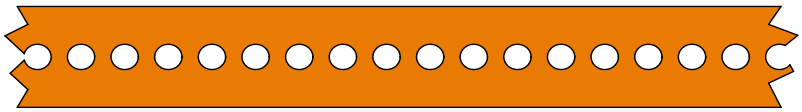
*John Mertel*
*President/CEO*
*WA7IR*

# SteppIR Design

Currently, most multi-band antennas use traps, log cells or interlaced elements as a means to cover several frequency bands. All of these methods have one thing in common–they significantly compromise performance. The SteppIR™ antenna system is our answer to the problem. Yagi antennas must be made a specific length to operate optimally on a given frequency.

So, instead of trying to "trick" the antenna into thinking it is a different length, or simply adding more elements that may destructively interact, why not just change the antenna length? Optimal performance is then possible on all frequencies with a lightweight, compact antenna. Also, since the SteppIR can control the element lengths, a long boom is not needed to achieve near optimum gain and front to back ratios on 20 - 10 meters.

Each antenna element consists of two spools of flat copper-beryllium tape conductor (.54" Wide x .008" Thick) mounted in the element housing unit. The copper-beryllium tape is perforated to allow a stepper motor to drive them simultaneously with sprockets. Stepper motors are well known for their ability to index very accurately, thus giving very precise control of each element length. In addition, the motors are brushless and provide extremely long service life.

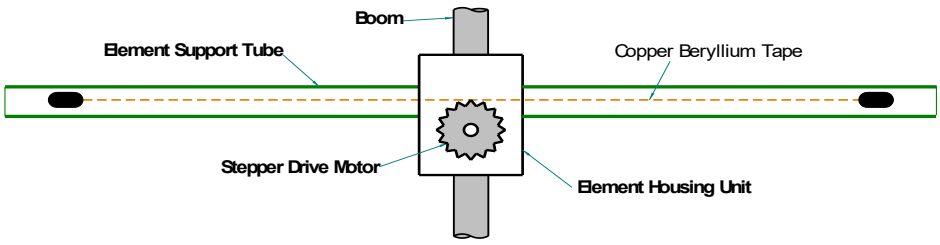


**Copper-Beryllium Tape**

The copper-beryllium tape is driven out into a hollow fiberglass elements support tube (see below), forming an element of any desired length up to the limit of each specific antenna model (a vertical uses only one side). The fiberglass elements support tubes (poles) are telescoping, lightweight and very durable. When fully collapsed, each one measures approximately 57" in length. Depending on the model, there may be additional extensions added to increase the overall element length.

The ability to completely retract the copper-beryllium antenna elements, coupled with the collapsible fiberglass poles makes the entire system easy to disassemble and transport.

The antenna is connected to a microprocessor-based controller (via 22 gauge conductor cable) that offers numerous functions including dedicated buttons for each ham band, continuous frequency selection from 80m to 6m (depending on the model). There are also 17 ham and 6 non-ham band memories and you can select a 180° direction reversal* or bi-directional* mode and it will adjust in just about 3 seconds (* yagi only).



| Specifications | 3 Element Yagi | 3 Element Yagi with 40/30 |
|---|---|---|
| Boom length | 16 ft / 4.87 m | 16 ft / 4.87 m |
| Boom outside diameter | 1.75 in / 4.5 cm | 1.75 in / 4.5 cm |
| Longest element | 36 ft / 10.97 m | 39 ft / 11.9 m |
| Turning radius | 19.7 ft / 6.0 m | 19.7 ft / 6.0 m |
| Weight | 51 lb / 23.1 kg | 58 lb / 26.3 kg |
| *Projected area | 10.73 sq ft / 0.996 sq m | 14.37 sq ft / 1.34 sq m |
| Wind rating | 100 mph | 100 mph |
| Adjustable elements | 3 | 3 |
| Power Rating | 3000 watts continuous | 3000 watts continuous |
| Feed points | 1 | 1 |
| Frequency coverage | 13.8 MHz—54 MHz | 6.8—54 MHz |
| Control cable | 12 conductor shielded, 22AWG | 12 conductor shielded, 22AWG |

| 3E Gain / Front-to-rear (by band) | 3E Gain, dBi | 3E Front-to-rear, dB | 3E with 30/40 Gain, dBi | 3E with 30/40 Front-to-rear, dB |
|---|---|---|---|---|
| 40M | NA | NA | 1.8 | NA |
| 30M | NA | NA | 2.1 | NA |
| 20M | 7.4 | 25 | 7.4 | 25 |
| 17M | 8.3 | 25 | 8.3 | 25 |
| 15M | 8.5 | 20 | 8.5 | 20 |
| 12M | 8.8 | 15 | 8.8 | 15 |
| 10M | 9.0 | 11 | 9.0 | 11 |
| 6M | 6.2 | 4 | 6.2 | 4 |
| 6M w/passive opt. | 10.1 | 30 | 10.1 | 30 |

***Projected area is the total perpendicular surface area measured in square feet/square meters, that is exposed to wind. To calculate wind load you always take the largest projected area whether that is from the perspective perpendicular to the boom or perpendicular to the elements. In the case of SteppIR Yagi's, the maximum projected area will always be the sum of the surface area's perpendicular to the Yagi elements. This calculation is a constant number and will not change regardless of EIA specification changes. Do not mistake this projected area calculation as anything more than a datapoint to present to your structural engineer, tower manufacturer or rotator manufacturer so that they can determine what is necessary for your application.**

**When sizing an antenna to a tower, many factors need to be taken into consideration including, but not limited to: projected area of antenna in square feet or square meters, weight of the antenna and other items on tower, turning radius, element lengths, antenna height, location exposure category, locations three-second gust wind-speed, locations maximum radial ice loading.**

**Improper specification of an antenna or rotator to a tower can result in product failure, injury or death. SteppIR is not an expert on tower or rotator sizing and for this reason will never offer any recommendation – this specification process is meant for industry professionals such as a structural engineer, tower manufacturer or rotator manufacturer. Please do not attempt to self-specify our products – the information provided by SteppIR is to be utilized by industry professionals only and we will not accept any liability for improperly specified antenna/tower/rotator applications.**

# TABLE OF CONTENTS

## BILL OF MATERIALS— as shipped

| 00243-SPS | 3 ELEMENT | |
|---|---|---|
| | | |
| | | Qty Per |
| | **Antenna Box (61” x 13” x 10”)** | |
| 09-0001 | Electrical tape 3/4" PVC MERCO 307 | 1 |
| 09-1025 | conical grinding stone, 3/4", (ENCO) | 1 |
| 10-1013-02 | Telescoping Pole, 18 foot 4 section | 8 |
| 10-1028-21 | TM-1 Thread Magic Anti-seize sticks | 1 |
| 10-1054-02 | Truss Support, 30m/40m, 36" | 1 |
| 10-1059-01 | Polyolefin Heat Shrink 1-1/2" x 6" | 16 |
| 10-1059-21 | Polyolefin Heat Shrink 1.1” x 6” | 8 |
| 10-1501-23 | Cover for Black EHU, With countersunk drain hole | 3 |
| 10-1509-02 | Diverter Cone, Include DC Instructions | 2 |
| 21-6040 | Splitter, 6" 3-1/2mm, Stereo Male to Two RCA Female | 1 |
| 60-1006-22 | QUICK DISCONNECT, 1-1/2" to 1-1/4", Fernco, (1056-150-125) | 8 |
| 70-1007-01 | Foam plug assembly consisting of plastic cap and foam plug | 4 |
| 70-1510-02 | Boom Assembly, 3 Element | 1 |
| 70-2025-13 | CPVC tube, 49" x 3/4", with coupler | 2 |
| 70-2025-23 | CPVC tube, 39-7/8" x 3/4", w/o coupler | 2 |
| 70-2034 | Connector Junction Box, 2E and 3E | 1 |
| 70-3000-11 | 33V, 3.03A 100watt, Power Supply w/Cord | 1 |
| 70-3403-01 | EHU, 40m Driven | 1 |
| 70-3420-01 | EHU, 20m Passive | 2 |
| 70-6010-01 | Adapter, 25pin Dsub Field Splice | 1 |
| 72-0009-03 | Kit, Glue | 1 |
| 72-0010-21 | Kit, 25' 4 Conductor Cable and 24" Coax Seal | 1 |
| 72-0054-01 | Kit, EHU Lid Hardware -1 for Driven and 2 for Passives | 3 |
| | Flash Drive - Instruction Manual | 1 |
| 70-6003-01 | 3E 6m passive element | 1 |

## BILL OF MATERIALS (continued)

| 00243-SPS | 3 ELEMENT | |
|---|---|---|
| | **Sweep Box (32” x 24” x 7”)** | |
| 10-1153-01 | Poly Sweeps (100psi) | 2 |
| 10-1511-01 | Sweep Diverter | 4 |
| 10-1059-21 | Polyolefin Heat Shrink 1.1” x 6” | 4 |
| 10-1503-21 | Fiberglass rod, 3/8" x 31-3/4" long, black | 2 |
| 72-0008-11 | Kit, 30/40m Return Hardware | 1 |
| 72-0014-01 | Kit, 2E/3E 6 m Hardware | 1 |
| 72-0018-31 | Kit, 39' Element Truss, 2E, 3E, DB18/18E/36/42 end Elements | 1 |
| 72-0027-03 | EST Return Tube, 1-3/4" x 12", Fiberglass, (U-bolt type) with reinforcing rings | 1 |
| 72-0030-61 | Kit, Sweep Hardware | 1 |
| 70-6003-01 | 6m Passive Element | 1 |

## BILL OF MATERIALS—KITS

| Item | 72-0009-03 GLUE KIT | Qty Per |
|---|---|---|
| 09-1020-10 | Weldon 10259 1/2 Pint 790 Multi-Purpose Cement, Clear, 6ml | 0.02537 |
| 09-1013 | Glass Vial, 6ml | 1 |
| 09-1011 | Puritan cotton tip applicator, 3", non sterile, Manuf PN 803WC | 4 |

| Item | 72-0010-21 CABLE KIT | Qty Per |
|---|---|---|
| 21-5001-01 | Control cable, 4 conductor, 22awg, shielded | 25ft |
| 09-1022 | Coax Seal, 12' x 1/2". | 24in |

| Item | 72-0054-01 LID HARDWARE KIT | Qty Per |
|---|---|---|
| 60-0019 | Nut, 10-32, Nylock, S/S | 11 |
| 60-0017-10 | Screw, 10-32 x 7/8", Flathead, Phillips | 2 |
| 60-0061 | Screw, 10-32 7/8", Panhead, S/S | 9 |
| 60-0018 | Washer, 10-32, Flat, S/S (5c) | 11 |

# BILL OF MATERIALS— KITS

| Item | 72-0008-01 ELEMENT RETURN HARDWARE KIT | Qty Per |
|---|---|---|
| 09-0001 | Electrical tape 3/4" PVC MERCO 307 | 1 |
| 10-1029-01 | Connector Protector Cat, No CP-1, .14 oz, (silicon goop for terminals) | 2 |
| 20-6020-01 | Terminal Block, 1 position | 1 |
| 60-0061 | Screw, 10-32 7/8", Panhead, S/S | 34 |
| 60-6000-40 | Hose Clamp, 4.0", #56, S/S, (4 el term hosing clamp) | 1 |
| 60-1009-01 | Plug, 1-1/2", ABS Threaded, ADWVCOPJ | 1 |
| 20-6020-08 | Terminal Block, 8 position | 2 |
| 70-1102-21 | Terminal Housing, 1-1/2" | 1 |

| Item | 72-0014-01 6M PASSIVE HARDWARE KIT | Qty Per |
|---|---|---|
| 60-0003 | U-BOLT & SADDLE, 1-3/4" | 1 |
| 60-0011 | Screw, 6-32 x 3/4", Panhead | 2 |
| 60-0014 | Nut, 6-32 Nylock | 2 |
| 60-0046 | Nut, 5/16" -18, Nylock, S/S | 2 |

| Item | 720018-31 ELEMENT TRUSS KIT | Qty Per |
|---|---|---|
| 10-1510-21 | Element Truss Coupler (sets) | 4 |
| 21-7001-01 | Dacron double braided poly rope, 1/8" | 75ft |
| 10-1601-03 | Saddle, 1-3/4" x 3/4" | 2 |
| 60-0083 | Turnbuckle, 1/4" x 4", Eye to Eye, S/S | 2 |
| 60-0110 | Bolt, 1/4"-20 x 1-1/4", S/S | 1 |
| 60-0030 | Nut, 1/4"-20, Nylock, S/S (5c) | 1 |
| 60-0065 | Bolt, 5/16" x 3-1/2", S/S (5c) | 2 |
| 60-0046 | Nut, 5/16" -18, Nylock, S/S | 2 |
| 60-0033 | Washer, 5/16", Flat, S/S | 2 |
| 60-0014 | Nut, 6-32 Nylock | 16 |
| 60-0014-01 | Screw, 6-32 X 7/8", Panhead | 15 |
| 60-0158 | Thimble, 1/8", Heavy galvanized | 2 |
| 60-0157 | Wire Clips, 1/8", galvanized | 4 |
| 10-1028-01 | Anti-seize single packets, TMP-1 | 1 |
| 09-0001 | Electrical tape 3/4" PVC MERCO 307 | 1 |
| 60-0112 | Set Screw, 10-32 x 1/4", Cup Point, S/S | 1 |

| Item | 72-0030-61 SWEEP HARDWARE KIT | Qty Per |
|---|---|---|
| 60-0014 | Nut, 6-32 Nylock | 28 |
| 60-0016 | Washer, 6-32, Flat | 20 |
| 60-0186 | Screw, 6-32 x 2", 18-8 SS, Button Socket CS | 28 |
| 10-1155-01 | Sweep Clamp, SCH-160 Clamp half | 8 |
| 60-9000 | Turn Key, Long Arm Hex Tip 5/64" | 1 |

## BEFORE YOU BEGIN INSTALLATION

1. Go to the SteppIR web site at www.steppir.com and download the latest manual for your antenna, and also the Operators Manual for the controller.

2. Read the manuals from cover-to-cover ---TWICE! Don't just read them –Study them, so you are familiar the terminology used about the antennas and have a good idea of how the antenna is assembled and where the various parts go.

3. As you go through the manuals make notes of any instructions you may not clearly understand, then call or email for clarifications. It is better to have it all sorted out before you start assembly. We don't mind answering your questions beforehand.

4. Now, wait for notification your antenna is being shipped.

5. If the antennas is to arrive on Wednesday----DO NOT plan an antenna party for Saturday!

6. Even if you plan to install the antenna weeks later, the first thing to do is to unpack the antenna and do a complete inspection. Make sure nothing is missing or has been damaged in shipment.

7. Do a complete inventory of every part, nut and bolt. Yes it takes time, but it also allows you to notify SteppIR if anything is missing and allow time to get it to you before you start assembly of the antenna. There is nothing more frustrating than realizing that something is missing, just hours before you want to install the antenna.

8. Go back to the SteppIR website and download the latest manual. SteppIR constantly is improving and adding to the manual, so even though your paper instruction manual is going to have all the data you need, it makes sense to check for the latest updates online. This is especially true If you purchased the antenna and a period of time has passed between arrival and install dates.

9. Take the controller and power supply out of their wrappings and connect them. The controller does not have to be connected to the antenna in order to familiarize yourself with it. In fact, it is best to get familiar with the controller when it is not connected to the antenna. Turn on the controller and read through the Operators Manual again while operating the controller in all it modes. Go through the menus so you know what each does and how to navigate through the various menus and functions.

10. Once the antenna is completely assembled and ready to mount on the antenna tower, use an antenna analyzer, if you have one, to test resonance of the antenna.. If you don't have an analyzer, try to borrow one. It will save you a lot of time and worry. Check the antenna on each band for some sign of resonance within the frequency range. Leave the antenna on the default frequency and tune the analyzer to see where the dip occurs. It will be somewhere below the lower band edge on each band with the antenna 3 or 4 feet above the ground on sawhorses. Also, don't expect to see a 1:1 SWR here, just look for a good indication of resonance.

**11.** DO NOT put the antenna up onto the tower until you are positive it is working correctly—this is what these tests are helping you determine. Err on the side of caution.

**12.** Once it has been determined this part of the antenna is working correctly do the following: Select the lowest band and establish the dip condition by tuning the analyzer. Do not touch the analyzer again. Retract the elements and then reselect the same band. The antenna should come back to very near the same setting. Do this 2 or 3 times on each band. Also, try going from the band being tested to any other band and back again and observe that the antenna comes back to the same resonant point. Now you know the antenna is tuning correctly from band to band and is consistent.

# STAINLESS STEEL FASTENER INFORMATION

From time to time, we get complaints from customers regarding galling of stainless steel fasteners.

Here is an excerpt from the Industrial Fastener Institute's Standards Book: *Thread galling seems to be the most prevalent with fasteners made of stainless steel, aluminum, titanium and other alloys which self-generate an oxide surface film for corrosion protection. During fastener tightening, as pressure builds between the contacting and sliding thread surfaces, protective oxides are broken, possibly wiped off and interface metal high points shear or lock together. This cumulative clogging-shearing-locking action causes increasing adhesion. In the extreme, galling leads to seizing - the actual freezing together of the threads. If tightening is continued, the fastener can be twisted off or its threads ripped out.*

During minor galling, the fastener can still be removed, but in severe cases of galling, a strong bond between the bolt and nut can prevent removal of fasteners. Unfortunately, little is known on how to control it, but here are two ways to minimize this effect: *Decreasing installation RPM speed will cause less friction and decrease heat generation. Lubrication used prior to assembly can dramatically reduce or eliminate galling. Recommended lubricants should contain higher amounts of molybdenum disulfide, such as graphite which is very commonly used as a solid lubricant or special anti-galling lubricants sold by chemical companies.*

We provide an anti-seize compound stick called "Thread Magic" with all of our antennas and **strongly encourage** you to use it to reduce the aggravation of galling. Nylock nuts are no exception—apply the anti-seize on fastemers that use Nylock nuts as well. The Thread Magic stick is fantastic and is good for all metal fastener use—and, you can get plenty of anti-seize on the fastener without getting it on your hands!

Turn-of-nut tightening of nuts to bolts is recommended where torque values are not named, with metal to metal connections. Turn the wrench/socket until it is flush with the material it will seat against and snug-tightened, and then turn approximately 2/3 of a rotation past that point. When in doubt use common sense to ensure the fastener is not too loose, or not too tight—both positions can cause issues. On all connections, check the tightness 30 minutes or more later to ensure no creeping has taken effect.

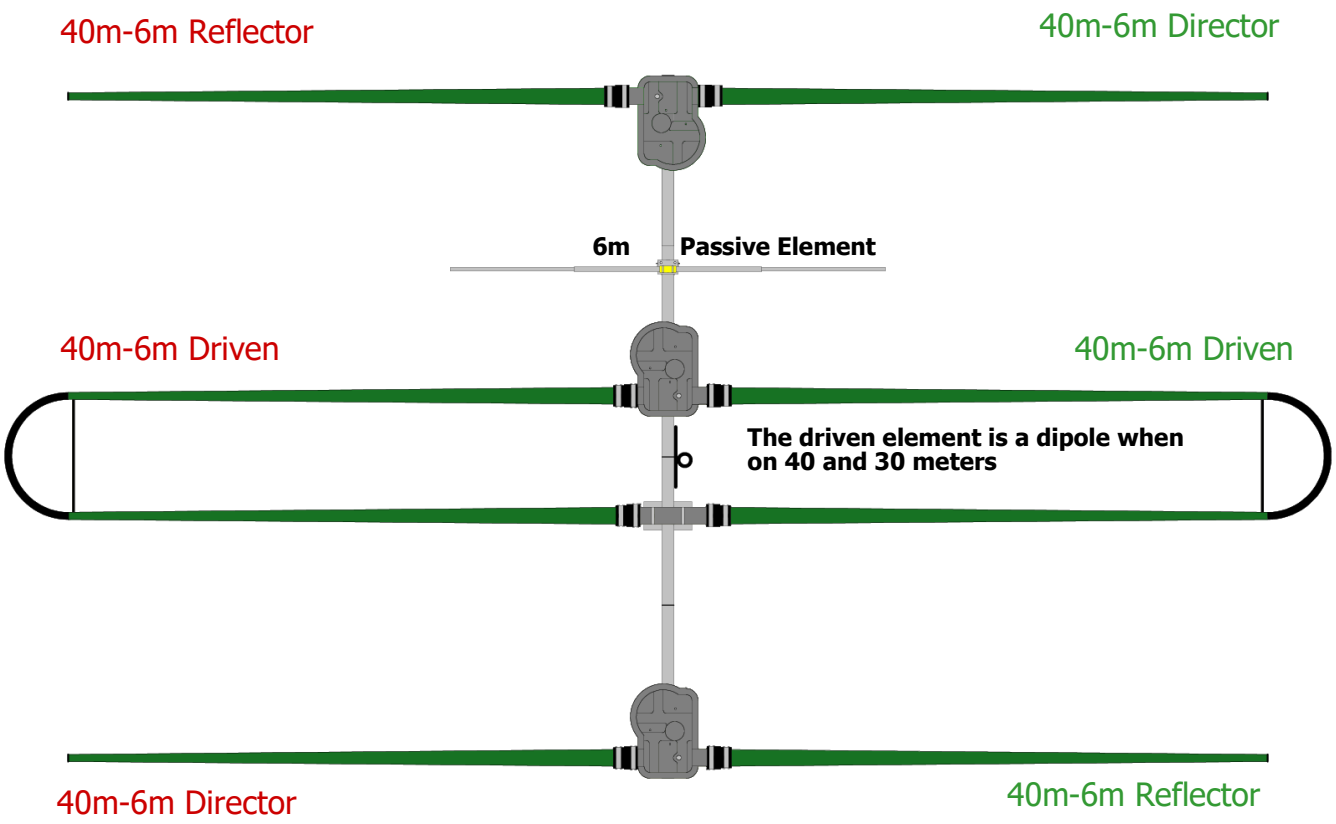
Contrary to popular belief, galling of stainless steel is not a symptom of a "cheap" fastener - it is prevalent in all types of stainless steel, aluminum and titanium fasteners. You can be assured that the stainless steel fasteners we provide with our products are manufactured of very high quality.

**Save yourself a lot of grief and always use a thread lubricant when working with stainless steel fasteners.**

# ANTENNA DIRECTION CONFIGURATION

**REVERSE DIRECTION (180 deg)** ↓

↑ **FORWARD DIRECTION (Normal)**



# BOOM INSTALLATION

The 3 element SteppIR Yagi boom consists of four sections of aluminum tubing that are 4 feet long x 1-3/4" OD x 1/8" wall, along with three aluminum element mounting brackets as shown in **Figure 1**. The element mounting brackets are pre-installed at the factory. To assemble your antenna, you will need a 1/2" (13mm) and 7/16" (11mm) wrench and / or socket drive. We double check the fasteners for proper tightness before shipping but it is always a good idea to check them yourself before installing the antenna. Put anti-seize on all bolts and screws, especially on the u-bolts. An anti-seize stick has been provided.

## Assemble the boom & connect to mast plate

The boom is completely assembled and drilled at the factory to assure precision alignment. The boom, once fitted in place on a jig, is then drilled so there is no chance for a mistake on hole placement. You may notice in some cases that on a given splice (**Figure 2**) the holes on each side of the splice are at 90 degrees with each other. This is as designed and **not** a mistake. Pre-drilled holes are quite snug to align almost perfectly. In some cases you may find it necessary to assist the bolts with a tap of a hammer, or "thread" them in by turning with a wrench. If the holes are visibly out of alignment when you are assembling the boom, you probably have the boom pieces put together in the wrong order - or the section of booms without an element to boom bracket may need to be rotated 180 degrees. Each boom piece has a number permanently **written**, **scribed** or **stamped** on it. Match each number with the exact same number of a corresponding boom piece. **Figure 2** also shows an example of how a joint should be lined up—in this case it is joint #1. The numbers much line up as shown in the picture.

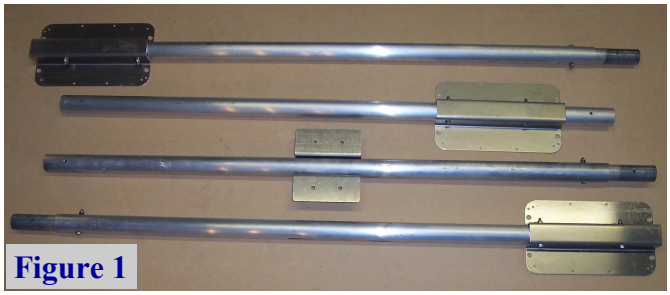


Figure 1


Figure 2


Figure 3

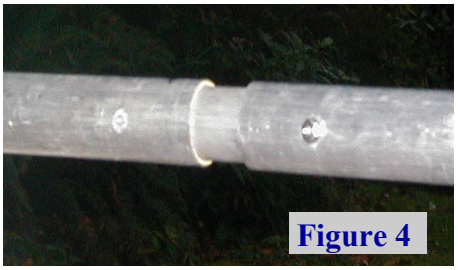


Figure 4

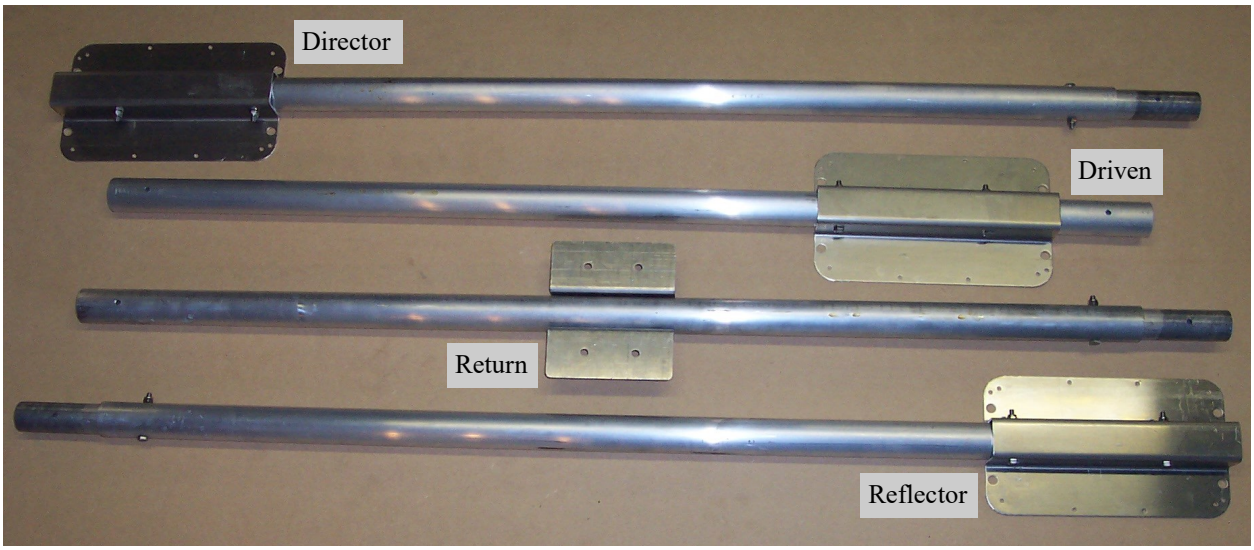

Figure 5

# BOOM INSTALLATION (continued)

Connect the boom by sliding the respective sections together and align the pre-drilled holes (**Figure 3 and 4**). Refer to **Figure 6** and **figure 7** for correct configuration. It is advisable to apply a thin film of anti-zeize (included) or Naolox (not included) to the joints before mating them.

Do not twist the aluminum excessively, as this can cause binding - the lubricant will help keep the two pieces from seizing together. Insert the included bolts into the pre-drilled holes, and tighten the Nylok nut securely (**Figure 5**). Be sure to position the bolts and nuts so that they are in the same direction as the others.

## Figure 7




**Note:** Element spacing is measured from element center line to element center line in all cases - not from the brackets or element housing units.

# ELEMENT HOUSING UNIT (EHU) WIRING

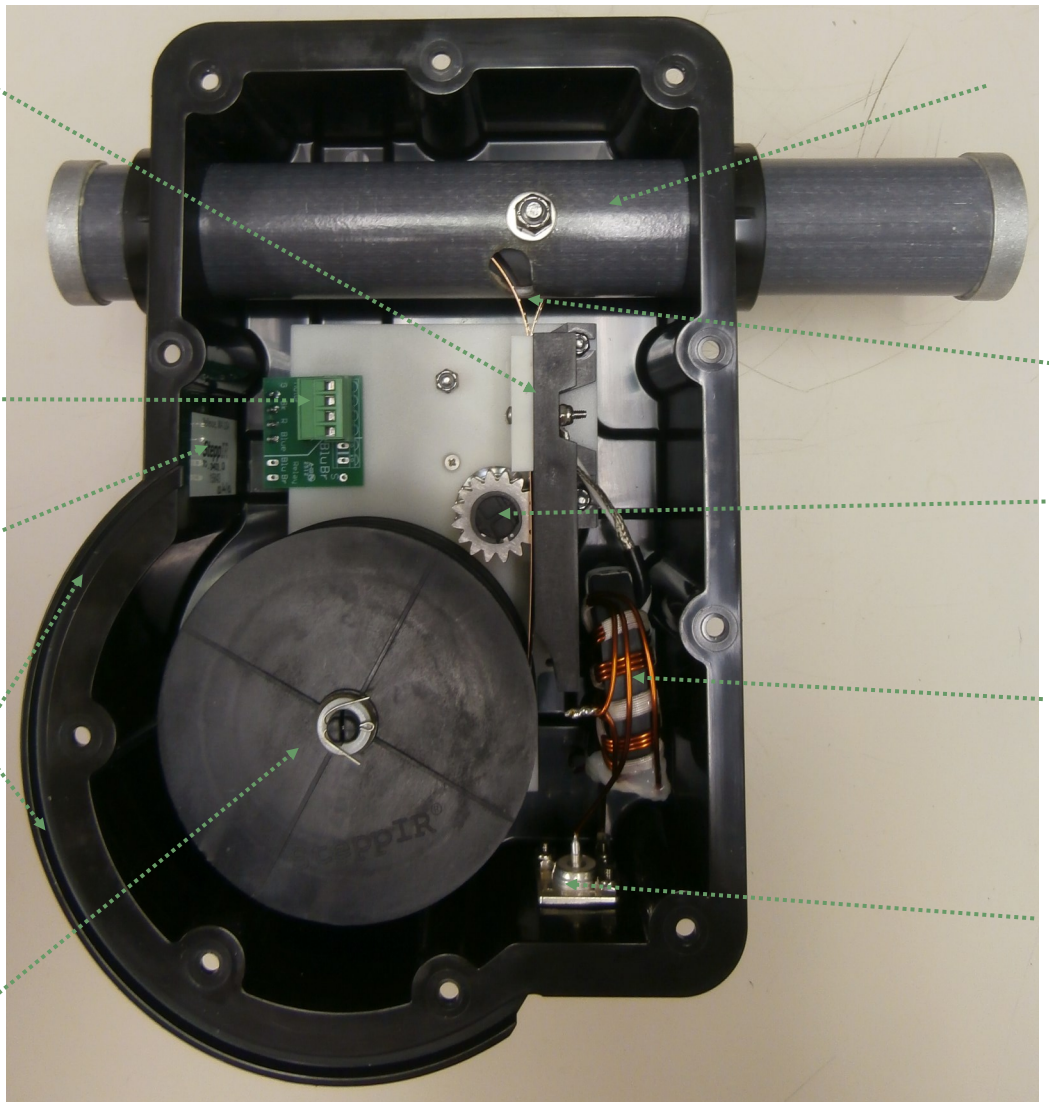
Figure 8 gives an overview of the inside of a SteppIR EHU. Wiring of each EHU will be covered in detail on the following pages.

**NEVER ATTEMPT ANY WIRING WHILE THE ELECTRONIC CONTROLLER IS CONNECTED TO THE CONTROL CABLE**. Even if the power is turned off of the controller, damage can occur. This is the number one cause of antenna installation failures, so please be sure to heed the advice.

If possible, lay out the boom to measure and cut the appropriate amount of control cable for each EHU. If laid out correctly, your measurements should be approximately:

- 124.5" from reflector EHU to Junction Box
- 51" from driven EHU to Junction Box
- 124.5" from DIR-1 EHU to Junction Box

**FIGURE 8**



# EHU WIRING (continued)

Trim approximately 1.5 inches of the outer jacket of the control cable (4 wire). Remove the shield material, the support thread and cut the ground wire off as shown in figure 9. Attach electrical tape at the end of the trimmed control cable jacket so that there is no chance for a short. Remove 0.25 inches of the insulation from each of the individual 22 AWG wires, leaving bare copper. Tinning of the copper wire ends with solder is not required but may be helpful in keeping the ends together while attaching the control cable wires. Figure 10 shows the control cable should look like when you are finished with the trimming. Dip each of the copper wires into connector protector before inserting into the terminal plug. Figure 11 shows what the connector protector will look like.

The terminal header assembly consists of the terminal header and the terminal plug as shown in figure 8. The plug is shipped loosely attached to the header. Remove this plug when wiring and firmly plug back in when completed. Follow the wire sequence in figure 13 for each EHU. *Be careful to ensure that there are no bare wires protruding out from the terminal clamps, to avoid potential shorts.*

The wiring sequence for each EHU is also imprinted on the PCB that the terminal header is mounted on (located inside the EHU). Pay no attention to the second row of imprinted text, these pins are for use in the manufacturing of the board itself and are of no use to you. Figure 12 shows a blue line crossing out the text in question. The yellow circle shows the correct wiring sequence.

**FIG. 9**

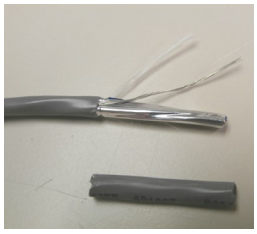


**FIG. 10**

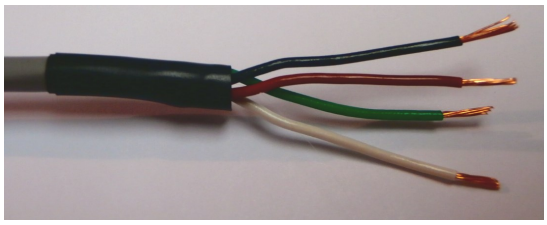


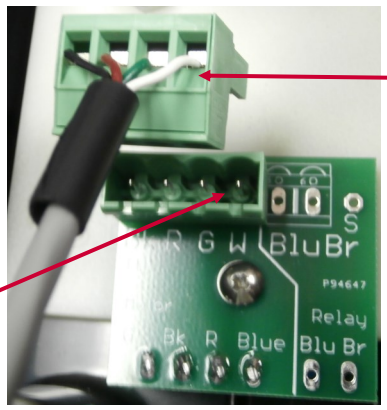
**FIG. 11**


**FIG. 12**


**4 Pin Header Wiring Sequence**

| BLACK | RED | GREEN | WHITE |
|---|---|---|---|

**FIG. 13**



# EHU WIRING (continued)

Check to be sure the terminal plug is firmly inserted into the terminal header.

Lay the control cable wire inside the wire tray of the EHU as shown in figure 14. This trough acts as a strain relief so that the cable will not be pulled out of the EHU. It is a good idea to leave a small amount of slack between the plug and the point which the tray starts as shown in figure 15.

Using the coax seal and cut into 1 inch strips as shown in figure 16. You will need three strips. The remainder can be used to seal the driven element SO239 connectors, should you wish to.

Apply coax seal on top of the control cable and work it around the cable and on top of the cable tray as shown in figure 17. This will help keep water from entering into the EHU. Apply the coax seal to the 2 remaining sections of the wire tray as shown in figure 18.

Repeat wiring and coax seal preparation for each EHU. When finished, the EHU's will be secured to the aluminum element mounting plates. This is covered in detail in the next chapter.

**FIG. 14**

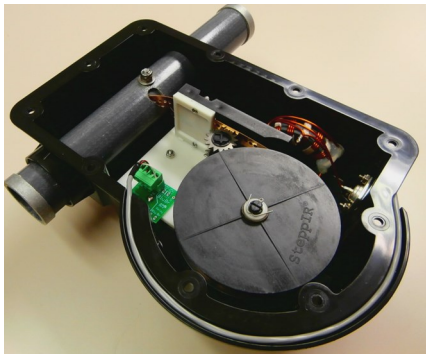


**FIG. 15**

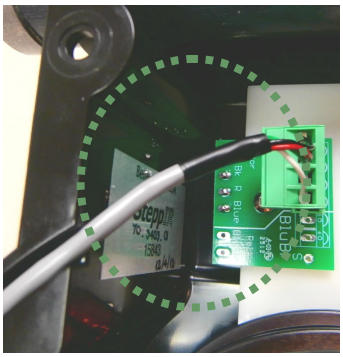


**FIG. 16**

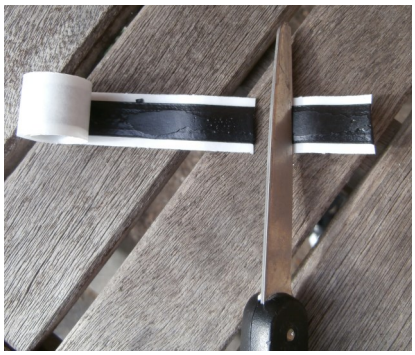


**FIG. 17**

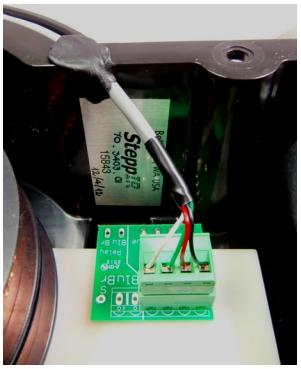
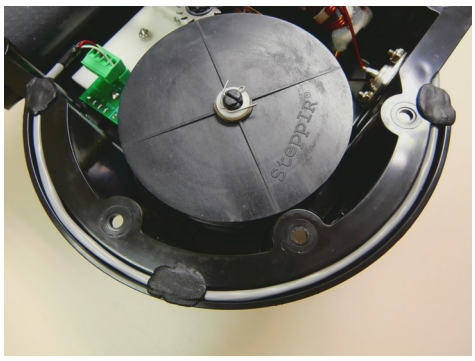


**FIG. 18**



# 25 PIN DSUB WIRING INSTRUCTIONS

## PREPARING THE CONTROL CABLE

1. Strip the jacket and aluminum shielding off of the control cable as shown in figure 1, approximately 2.75" from end of control cable, being careful not to damage the individual wires.
2. Strip the plastic insulation off of each of the control cable wires, approximately 0.25" in length should be bare wire.

## CONNECTING CONTROL CABLE TO THE DB25 FIELD SPLICE

The DB25 Field replaces the standard connector with a convenient solder-less connection of the control cable to the SteppIR controller. Follow the steps below to connect it to your control cable.

1. Apply dielectric grease to the exposed copper portion of each wire.
2. Connect each wire to the appropriate terminal and tighten using a flat head screwdriver. Note that the terminals may be closed by default. If so, turn the terminal screw ccw ~10 turns to open it before inserting the wires. Consult the table on the next page for the correct wiring sequence.
3. Position the control cable between the cable clamp halves.
4. Tighten the two pan head screws until the cable is snug, but do not over-tighten.
5. Thread the two thumb screws into the connector face as shown in figure 2
6. Plug the DB25 splice into the back of the controller and twist the thumb-screws to secure it.

**FIG. 1**

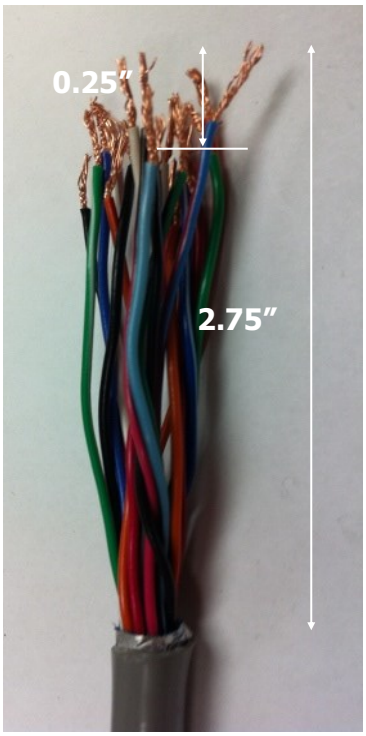
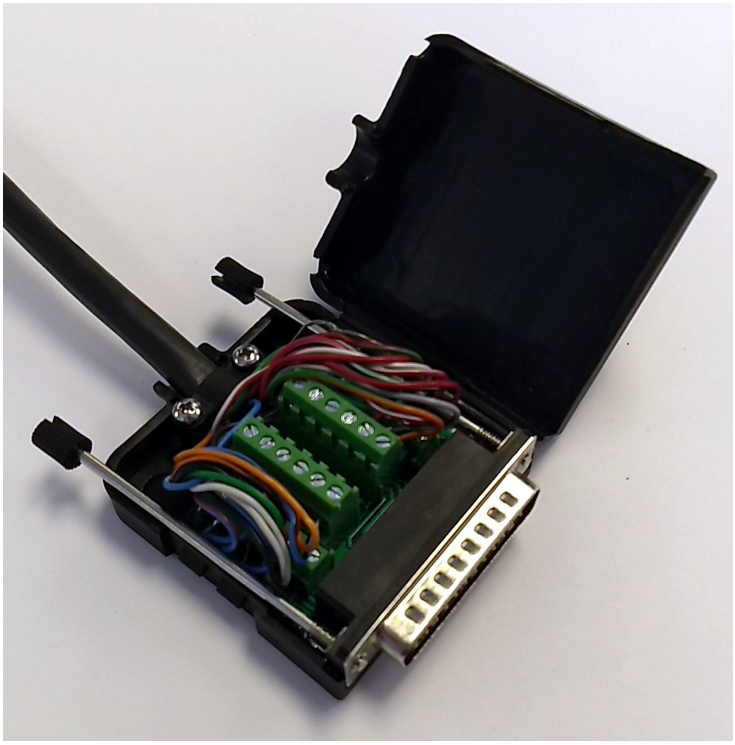
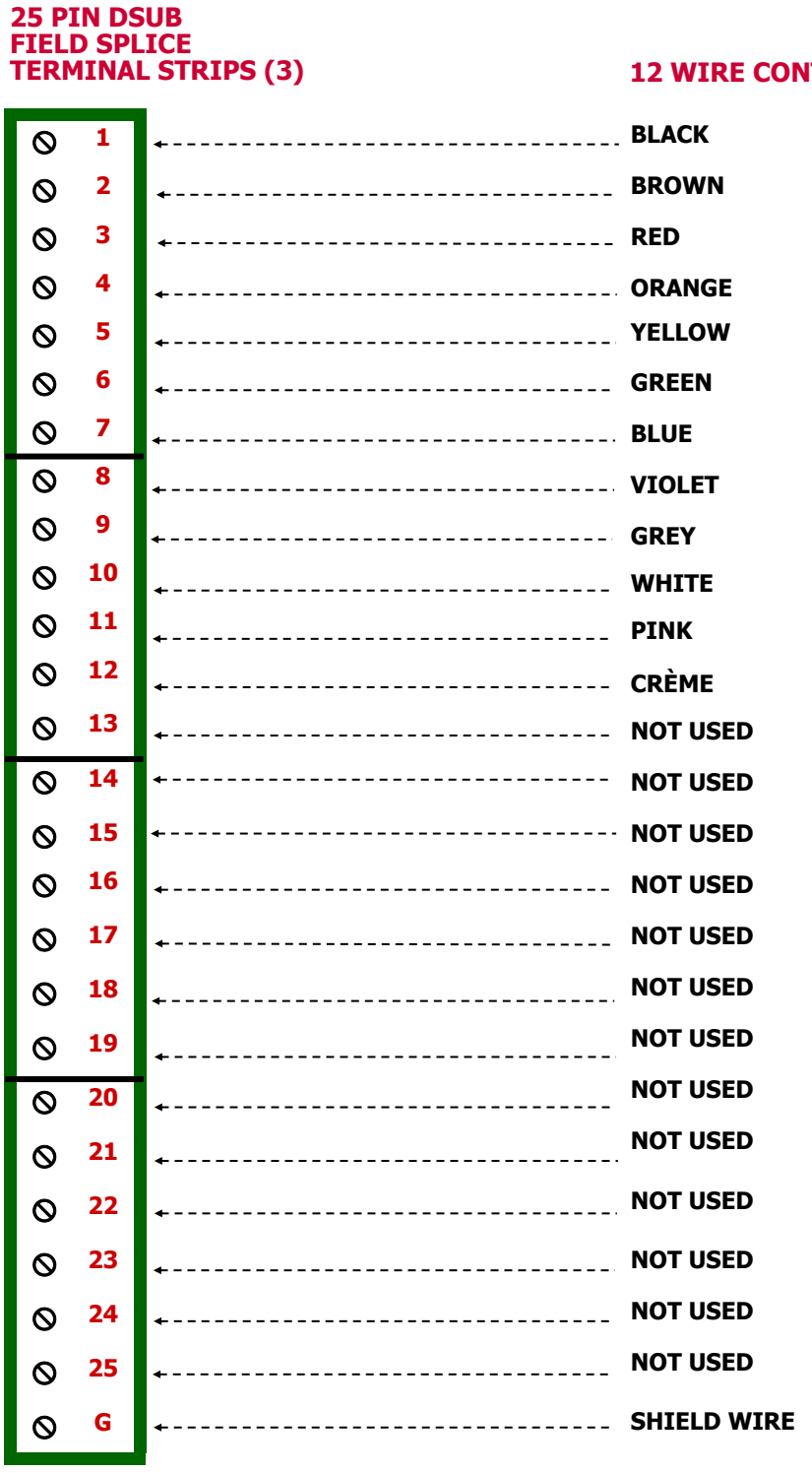



**FIG. 2**



# 25 PIN DSUB SPLICE INSTALLATION

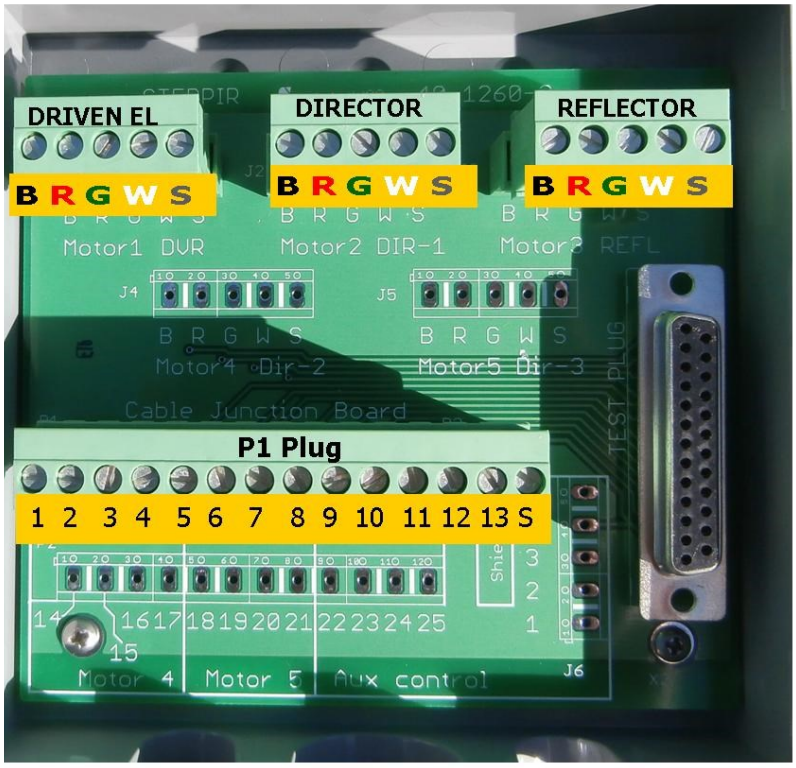
FIG. 23




**Note:** If you are wiring the control cable yourself using a 25 pin connector and backshell instead of using the above dSub field splice, use the same pin numbers shown above. For the 25 pin connector installation, you would solder the ground wire to the case of the 25 pin connector and then put the backshell on.

# CONNECTOR JUNCTION BOX WIRING LAYOUT

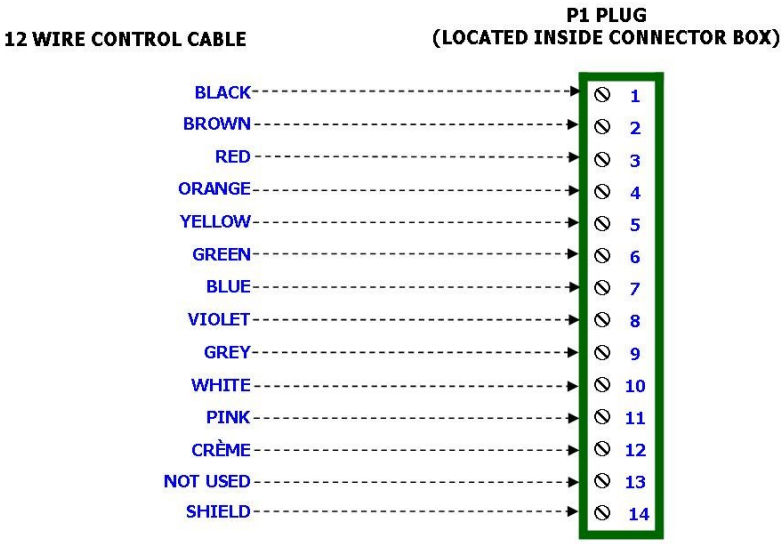
**FIGURE 42**




**4 wire control cable key**

| B | R | G | W | S |
|---|---|---|---|---|
| BLACK | RED | GREEN | WHITE | SHIELD |

**FIGURE 43**



# MOUNTING THE EHU TO THE BOOM

Attaching the EHU to the boom is a two step procedure. The first step involves attaching the lid and gasket with the three screws shown in figure 31. The second step is to attach the EHU to the element mounting plate on the boom with the remaining seven screws as shown in figure 32.

**WARNING:** When assembling the lid to the housing and the housing to the boom, make sure that the control cable is not being pinched or damaged in any way. This can cause a short and will drastically effect the performance of the antenna.

**FIGURE 31** Lid Assembly

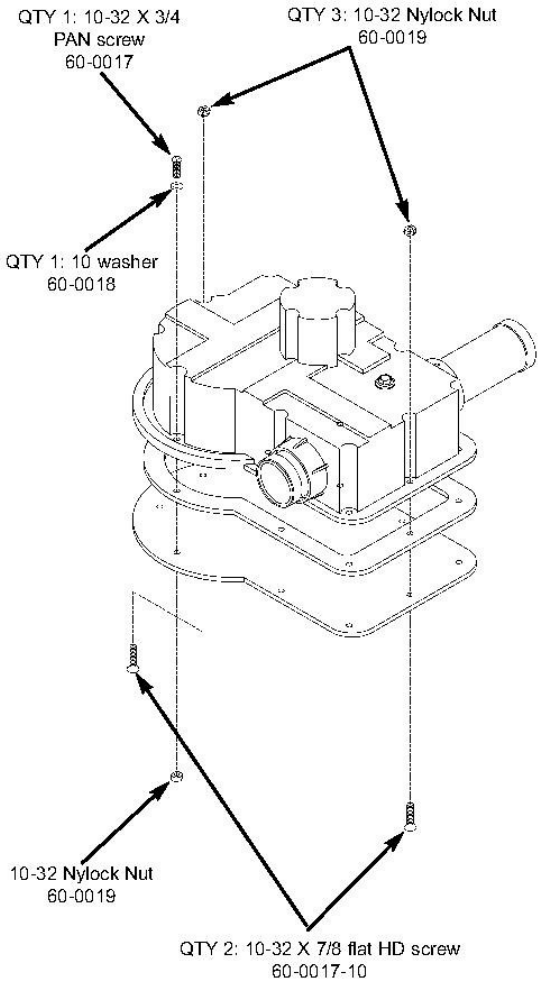
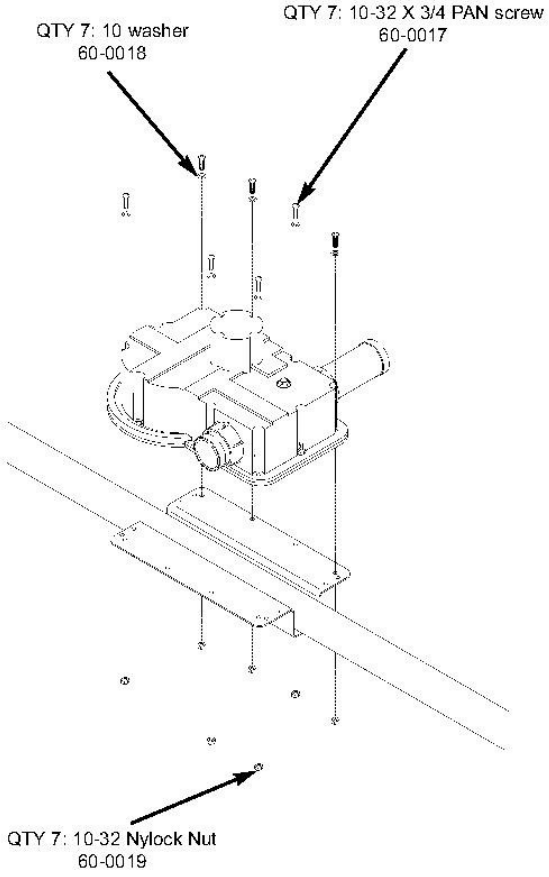



**FIGURE 32** EHU Assembly




**NOTE:**
Orientation of the EHU and the style of the element mounting bracket shown here may not be for your specific antenna model. Follow antenna assembly manual for correct EHU orientation.

# MOUNTING THE EHU TO THE BOOM

## Attach the antenna housing to the element-to-boom bracket

**Figure 33** shows the element boom bracket. Place the flat side of the element housing unit (EHU) on top of the element boom brackets (**Figure 34**). If the mounting holes for the element housing do not line up with the holes in the element bracket it may be necessary to loosen the two horizontal bolts that hold the element bracket to the boom . After mounting the element housing to the element bracket be sure to re tighten the two horizontal bolts. **Figure 35** shows the mounted end element.

The housings without the SO-239 coax connector are the director and reflector (they are identical and interchangeable), the one with the SO-239 connector is the driven element (the balun is on the inside of this housing). The reflector and director should be positioned so the actual fiberglass element is furthest away from the driven element (**Figure 35**).

The driven element should be positioned so that the element is closest to the mast plate (**Figure 36**). Fasten each element housing to the element bracket, using eight 10-32 x 7/8" screws, flat washers, Nylock nuts. **The flat washer needs to be placed between the screw head and the plastic element housing**. Tighten securely, but not too tight (if you over-tighten the nut, you may split the plastic flange on the element housing). The dark grey element support tube (EST) on each antenna housing will appear uneven in length - it is actually centered on the inside of the antenna housing .

The reflector element and the driven element will have the EST (offset tube) lined up so that the short side and long side of the each EST are facing in the same directions. The director element EST configuration will be the opposite. This is normal.

FIGURE 33

FIGURE 34

FIGURE 35

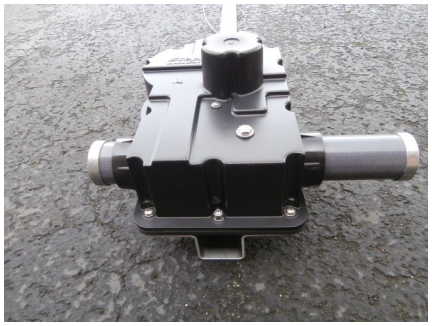
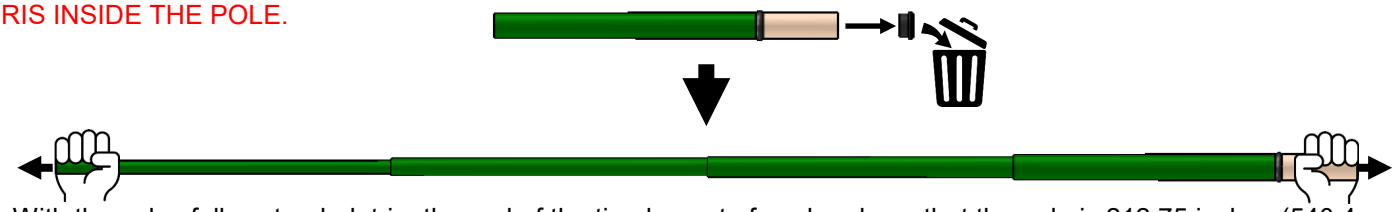


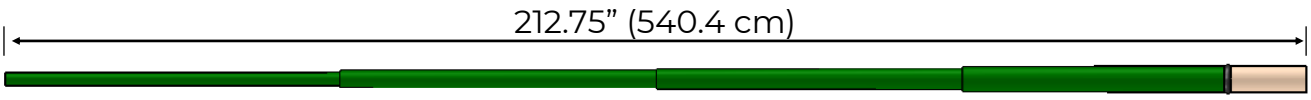
FIGURE 36

# PREPARING THE TELESCOPING POLES

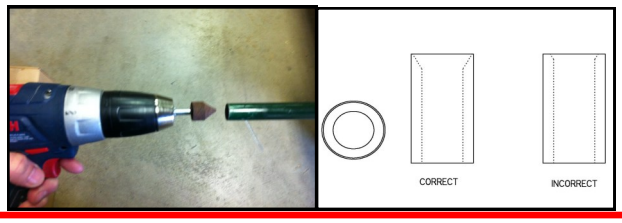
**1.** Extend the telescoping poles (PN 10-1013-02) to full length by firmly locking each section of the pole in place. A good methodology is to position each half of the joint so that they are several inches apart (while still within each other), and then pull quickly and firmly. Do this for each pole. There are rubber plugs inside the base section of each telescoping pole. These make it easier for handling, but they MUST BE REMOVED BEFORE ASSEMBLY. VERIFY THE FOAM INSERT IN THE PLUG HAS NOT MADE ITS WAY DOWN THE POLE AND THAT THERE IS NO OTHER FOREIGN DEBRIS INSIDE THE POLE.



**2.** With the poles fully extended, trim the end of the tip element of each pole so that the pole is 212.75 inches (540.4 cm) from the tip of the pole to the butt end, as shown below. ONLY trim the poles used for the 40/30 loops—if your antenna has 20m-6m straight elements, those should not be trimmed (must have a length of at least 213.1"). Use a hack saw, pipe cutter, or similar cutting blade that is suitable for fiberglass. Be sure that you cut the pole perpendicular to the length of the pole so that it is as "square" as possible.

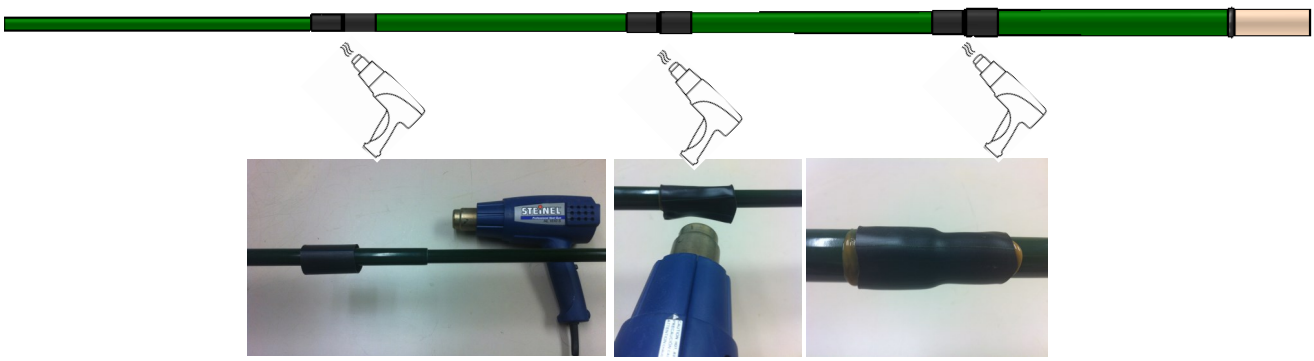



**3.** Using the conical drill bit, chamfer the tips of the 40/30 poles as shown below. The image below shows the proper angle to chamfer to. Clean out the interior of the fiberglass poles after chamfering it.



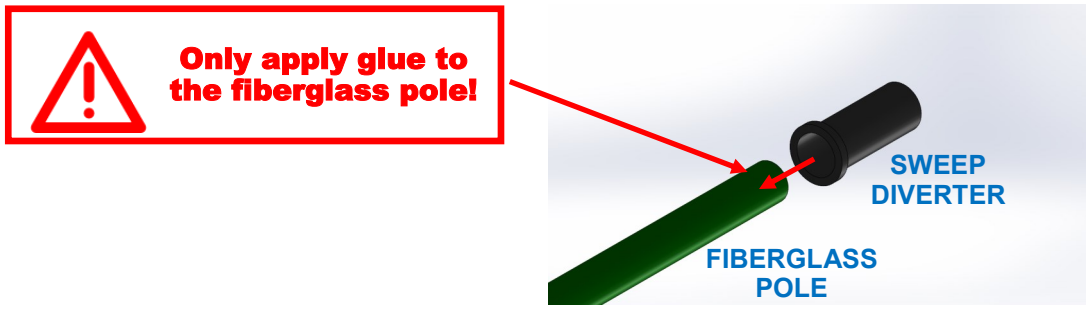

**LOOK INSIDE OF THE TELESCOPING POLE TO VERIFY NOTHING IS BLOCKING IT. YOU SHOULD BE ABLE TO SEE LIGHT AT THE OTHER END IF THE POLE IS KEPT STRAIGHT. DEBRIS INSIDE THE TELESCOPING POLES CAN LEAD TO FAILURE OF THE EHU.**

**4.** Each telescoping pole uses 3 polyolefin heat shrink pieces 1.5" x 3" (PN 10-1059-01), one covering each joint after it has been pulled tight. Once finished, the seal is secure and waterproof. This product requires a heat gun for activation of the adhesive.
**5.** When positioning the heat shrink, place it so that the joint of the telescoping pole is centered in the middle of the heat shrink.
**6.** Using a heat gun (hair dryers will NOT work), apply heat evenly around the entire area of heat shrink. Note: there are 4 blue colored lines imprinted on the tubing. The joint is considered done being heated and waterproof when the lines change color to a yellowish green. Each line needs to change color to ensure even adhesion temperatures.
**7.** The heat shrink will want to slide as it is heated so wear gloves and reposition the heat shrink to keep it centered on the joint as needed. Caution: The heat shrink will be HOT, wear insulated gloves!

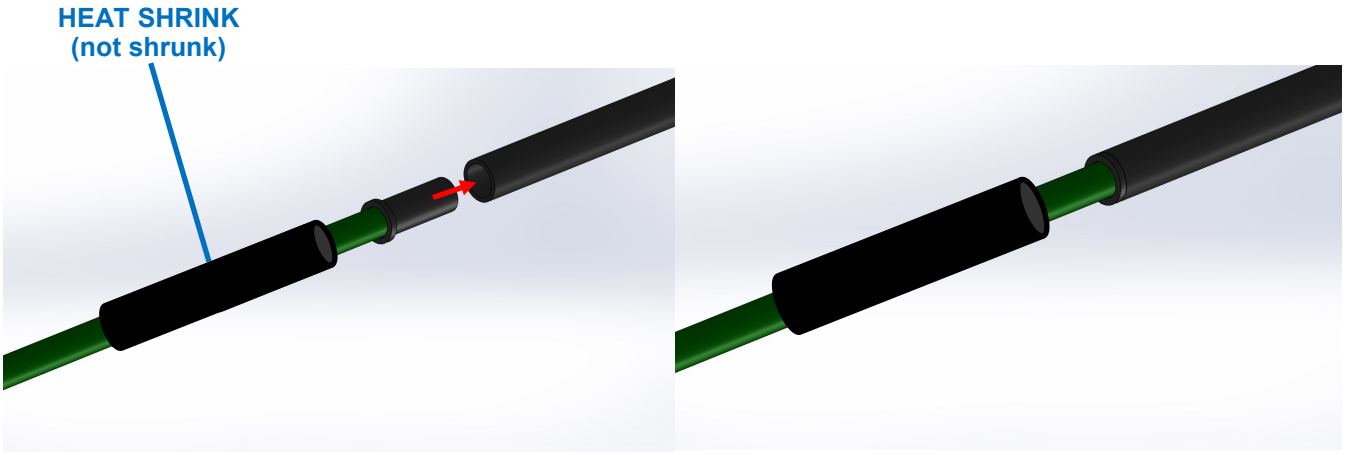


# ATTACHING SWEEPS AND DIVERTERS TO FIBERGLASS

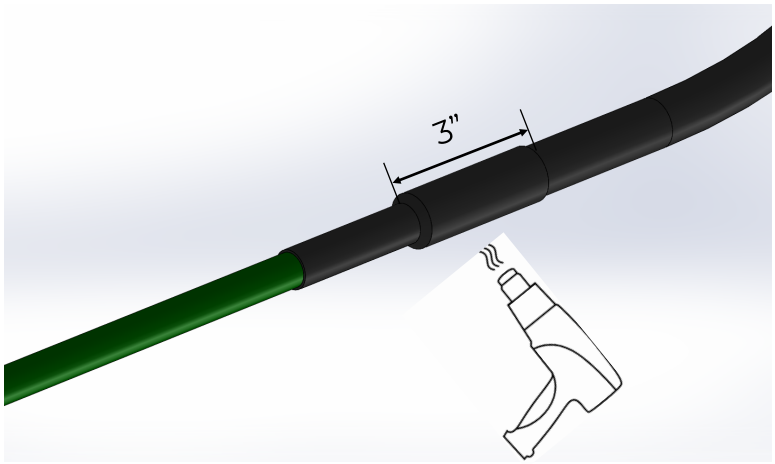
**8.** Use the glue kit (PN 72-0009-03) from the glue/tape kit to attach the sweep diverters (PN 10-1511-01) to the tips of the fiberglass telescoping poles. ONLY APPLY GLUE TO THE FIBERGLASS. Slowly rotate the sweep diverter as you slide it onto the pole to let the glue cover the most surface area possible. MAKE SURE THE SWEEP DIVERTER IS PUSHED AS FAR DOWN ONTO THE FIBERGLASS POLES AS POSSIBLE. The sweep diverter should be oriented in the same way as shown in the figure below, with the flanged edge towards the rest of the pole. Be sure the glue has dried completely before moving onto the next steps.




**9.** Put a piece of polyolefin heat shrink 1.1” x 6” (PN 10-1059-21) onto the telescoping pole, leaving the diverter clear. It should be down on the pole far enough that it doesn’t interfere with fitting the diverter into the sweep.
**10.** Insert the fiberglass pole, with the sweep diverter on it, into the sweep as far as possible. DO **NOT** GLUE THE SWEEP DIVERTER INTO THE SWEEP. Reposition the heat shrink to cover the joint.




**11.** Shrink the polyolefin sleeve over the joint as described on step 6 on the previous page; LEAVE AT LEAST 3” OF HEAT SHRINK ON THE SWEEP SIDE OF THE JOINT. **Be EXTREMELY careful not to overheat the poly sweep, you will deform or kink the material if too much heat is applied** (if this occurs you will need to undo your work and replace the poly sweep).
**12.** Remember, the heat shrink will want to slide as it’s heated. Reposition it as it cools to make sure the joint is fully covered. The heat shrink will be hot; wear insulated gloves.



# ATTACHING SWEEP COUPLERS TO SWEEP TUBES

- Refer to figure 6.06 during the following steps for an overview of the assembly process.
- Each of the sweep coupler halves (PN 10-1155-01) will have a notch in the mold on one side marked with silver sharpie. IT IS CRITICAL THAT THESE NOTCHES ARE POINTING TOWARDS THE SWEEPS OR THEY WILL NOT WORK PROPERLY. See figure 6.07 for the location of the mark. Be certain that each half of the coupler has the mark facing the sweep tube!

**13.** Place the coupler halves over the heat shrink on the sweep side of the joint. The flange on the diverter should still be visible through the heat shrink, as well as the edge of the sweep material. The non-marked side of the coupler should be placed as close to the edge of the sweep material as possible, without overhanging, as shown in the cutaway in figure 6.08 where the sweep diverter is highlighted in blue.

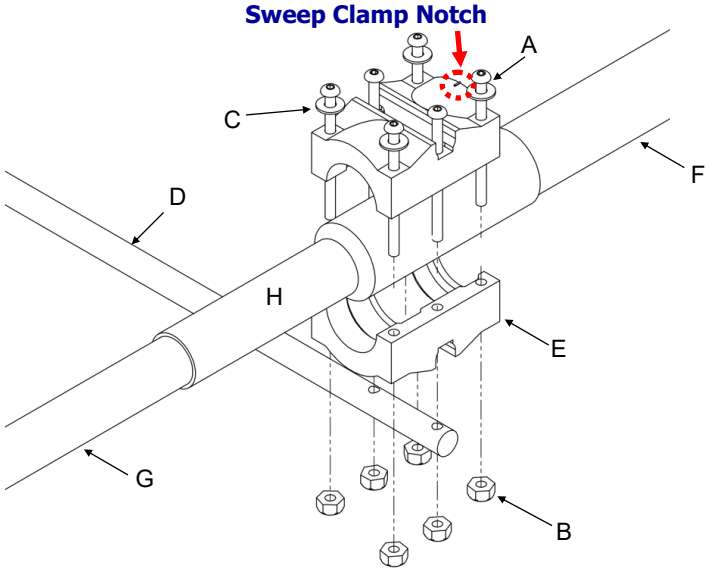
**14.** Insert four of the 6-32 x 2" socket head screw (PN 60-0186) with washer (PN 60-0016). Place the screws so that the threaded portion of the screw is facing downward. BE SURE THAT THE DRAIN HOLES FOR THE PLASTIC SWEEP TUBE ARE POINTING DOWNWARD BEFORE INSTALLING THE COUPLERS.

**15.** Apply anti-seize to the threads and screw the Nylock nuts on. Tighten using a 5/16" wrench/socket to turn the nut and the provided 5/64" Allen Key to hold the screw. Tighten enough so that the clamp is held in place on the sweep/heat shrink. Final tightening will happen once the fiberglass spreader is installed.

**16.** Repeat the previous steps on the other side of sweep tube.

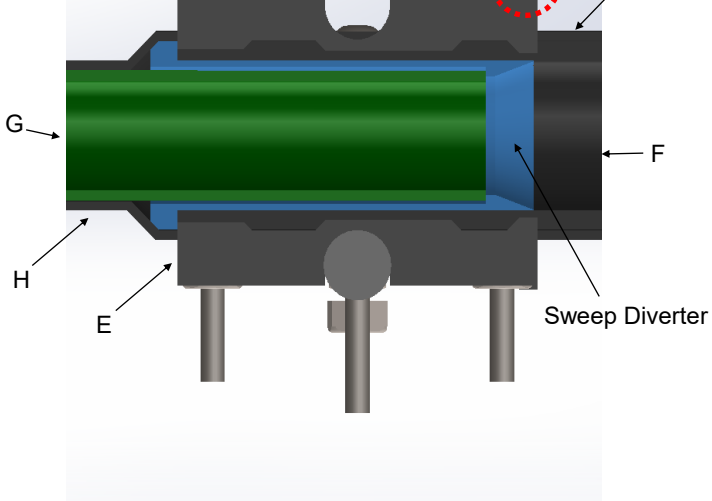
## FIG. 6.06

| Key | QTY | Part Number | Description |
|---|---|---|---|
| A | 6 | 60-0186 | Screw, 6-32 x 2", 18-8 Button Socket CS |
| B | 6 | 60-0014 | Nut, 6-32 Nylock |
| C | 4 | 60-0016 | Washer, 6-32, Flat |
| D | 1 | 10-1503-21 | Fiberglass Rod, 3/8" x 31-3/4" long, black |
| E | 2 | 10-1155-01 | Sweep Clamp, SCH-160 Clamp Half |
| F | 1 | 10-1153-01 | Poly Sweeps (100psi) |
| G | 1 | 10-1013-02 | Telescoping Pole, 18 foot 4 section |
| H | 1 | 10-1059-21 | 1.1" x 6" polyolefin heat shrink |




## FIG. 6.07


## FIG. 6.08



# MOUNTING THE FIBERGLASS SPREADERS

**17.** Mount the black fiberglass sweep spreaders (PN 10-1503-21) to the sweep couplers. There is a concave mounting area on each side of the plastic couplers. Position the fiberglass spreader so that the holes align with the clam shell couplers as shown in figure 6.10. When installing the fiberglass spreader, you will want the spreader to be underneath the plastic coupler as shown in figure 6.11. The spreaders will be longer than the couplers on each side of the loop. This is done on purpose to ensure plenty of fiberglass material is on each side of the screw.
**18.** Insert 2qty 6-32 x 2" socket head screw (PN 60-0186) through each of the coupler halves and the fiberglass rod. This screw must be placed so that the Nylock nut (PN 60-0014) is resting on the fiberglass material and the screw head are resting inside the concave groove on the top of the sweep coupler. Refer to figures 6.10 and 6.11 for detail. The screws are longer than necessary so that you can get the nut on in the initial stages.
**19.** Tighten the Nylock nuts firmly. Be sure to use anti-seize on these screws or they will likely gall and have to be replaced.
**20.** Repeat the previous steps on the other side of sweep tube.

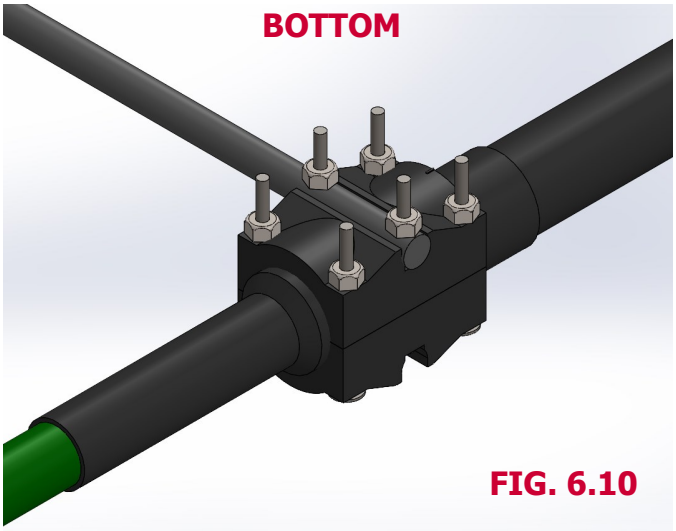



**FIG. 6.10**

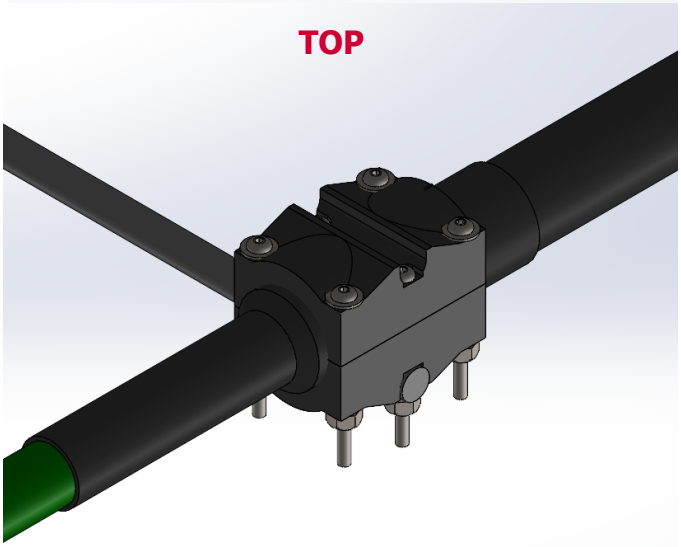



**FIG. 6.11**

## FINAL TIGHTENING

**21.** Finish tightening the four screws on the outside corners of the plastic coupler. Tighten evenly, in an automobile X type pattern as shown in figure 6.14. If you do not tighten evenly, you may break the fastener. Once the outsides are firmly tight, tighten the two screws that hold the fiberglass spreader in place. Figure 6.15 shows the suggested method for tightening the screws.
**22.** When completely tightened, THE SWEEP COUPLER HALVES SHOULD HAVE GAP OF ABOUT 5/16" – 3/8", as shown in figure 6.16. This gap is not critical as the coupler is mostly to keep the spreader in place properly. IT IS BEST TO LET THE SCREWS SIT FOR A WHILE (15-30MIN) AND TIGHTEN IN IN-TERVALS IN ORDER TO ALLOW THE PLASTIC CLAMP MATERIAL TO RE-FORM. This also will reduce the chance of snapping a screw.
**23.** Figure 6.17 shows the completed sweep—repeat the process for each sweep.

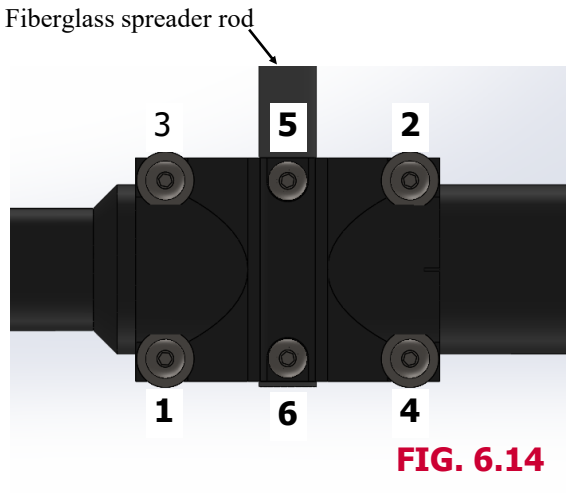


FIG. 6.14

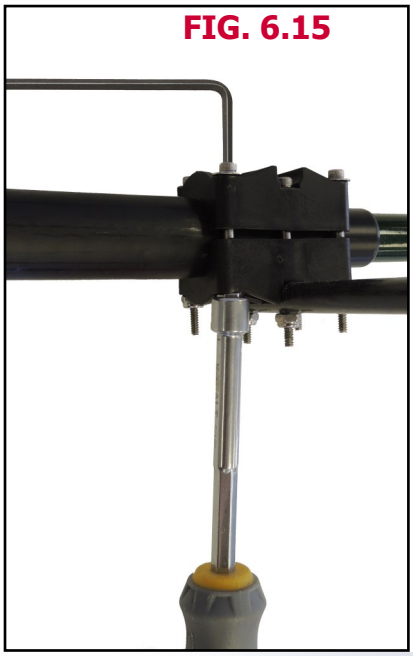


FIG. 6.15

FIG. 6.16

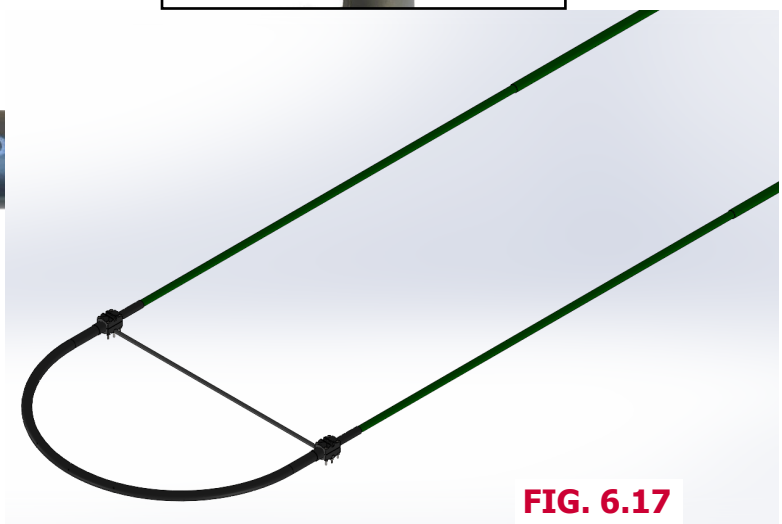


FIG. 6.17

# ATTACH FOAM PLUGS TO NON LOOP ELEMENT TIPS

Each 20m-6m telescoping pole tip requires a breathable foam plug to allow for venting of the EHU. The foam plug assembly (PN 70-1007-01) consists of a special UV resistant foam plug material, and a plastic housing as shown in figure 6.30.

The foam plug is installed inside the plastic housing at the factory. No trimming or chamfering is required for the 20m-6m telescoping poles used for the driven element.

The fit of the plastic housing on the pole tip is purposely very tight, so that the foam plug assembly will stay in place. Before attaching the plastic housing, spread a small amount of dish soap around the inside edge of the plastic housing as shown in figure 6.31. This helps the housing slide on easily, and the soap will eventually evaporate, leaving you with a firm interference fit.

Insert the plastic housing onto the telescoping pole tip as shown in figure 6.32. Be sure that the plastic housing bottoms out on the pole tip, as shown in figure 6.33.

Repeat for the other telescoping pole tip.

**FIG. 6.30**

**FIG. 6.31**

**FIG. 6.32**

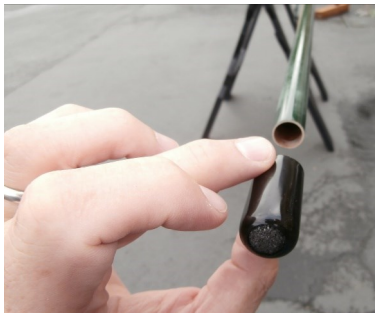
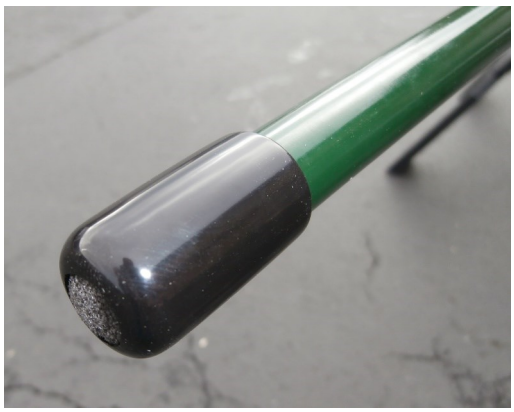


**FIG. 6.33**



# ATTACH THE ELEMENTS TO THE EHU's

## PREPARE THE CPVC INNER-GUIDE TUBE & DIVERTER CONE

The 40/30 loops on the DB18E Yagi use a plastic tube and a diverter cone located inside the telescoping pole, to guide the copper strip out of the EHU. Note that the straight elements do not use this inner tube, only the 40/30 loops. The plastic tube is off-white and is made of CPVC. There are 3 pieces that make up the guide tube assembly: The diverter cone (PN 10-1509-02), the 39-7/8" section of 3/4" CPVC with no coupler (PN 70-2025-23) and the 49" section of 3/4" CPVC with a coupler attached to one end (PN 70-2025-13). The guide tube is not needed on the return side of the loop. Figure 7.01 shows the three pieces in the assembly.

The smaller diameter end of the diverter cone is glued to one end of the 39-7/8" CPVC tube as shown in figure 7.02 . Use the supplied glue and applicator as shown in figure 7.03. Apply the glue evenly around the outside diameter of the tube. Be sure you get even coverage all the way around the tube. Cover about 3/4" of an inch deep as shown in figure 7.03. Firmly push the 39-7/8" CPVC tube into the diverter cone end as shown in figure 7.04. Let the glue dry at least 20 minutes before moving it.

Apply glue evenly around the outside diameter of the 39-7/8" CPVC tube as shown in figure 7.05. Apply approximately 3/4" deep as per prior step. Locate the 49" CPVC tube (PN 70-2025-13) with coupler, as shown in figure 7.06. Push the 39-7/8" tube firmly into the coupler as shown in figure 7.07.

Repeat above instructions for remaining guide tube assembly's (two per EHU, six total).

**WARNING**: Do not apply glue to the inner "female" portion of either the diverter cone or coupler. The glue applied to the outside of the tube is sufficient to bond the two pieces, and will prevent potential for damaging obstructions being formed by dried glue.

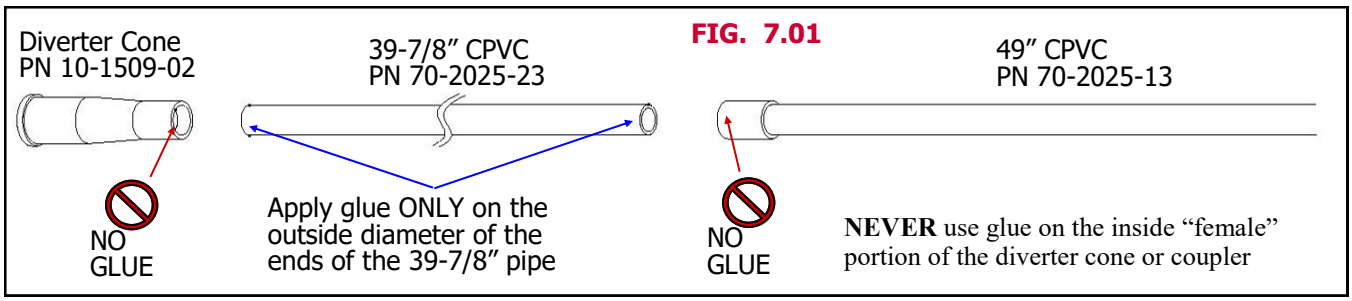



**FIG. 7.01**

**FIG. 7.02**

**FIG. 7.03**


**FIG. 7.04**

**FIG. 7.05**

**FIG. 7.06**

**FIG. 7.07**

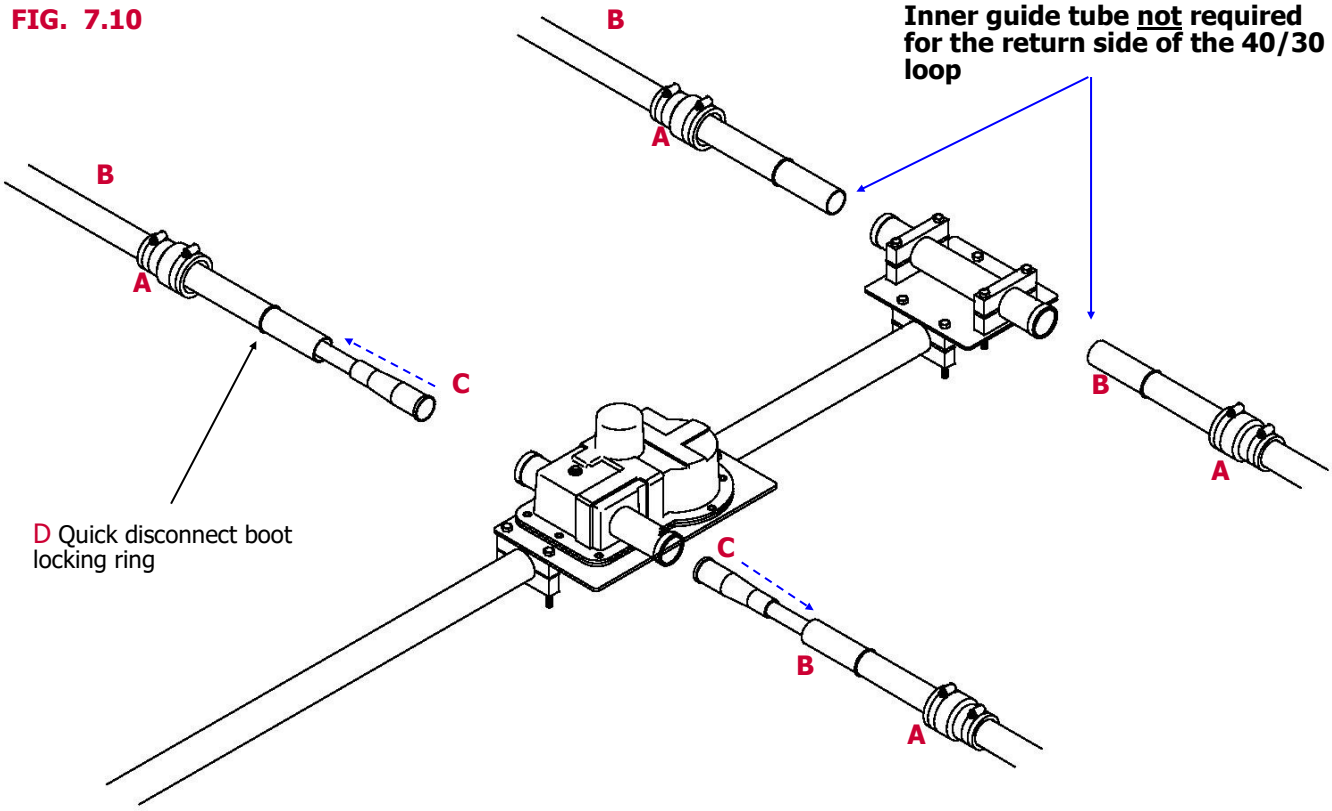
# ATTACH THE ELEMENTS TO THE EHU's (continued)

## SECURING THE ELEMENT SUPPORT TUBE (EST) TO THE EHU

When the CPVC inner guide tubes are completed, they will need to be inserted into the telescoping poles and secured to each EHU. Figure 7.10 below gives an overview of this procedure, with detailed instructions following on the next page.

This drawing shows the EHU placement for the Reflector element, the procedure is the same for the Director and Driven elements. The parts required in the table below are shown for EACH complete loop assembly.

**FIG. 7.10**




| Key | QTY | Part # | Description |
|---|---|---|---|
| A | 4 | 10-1006-22 | Quick disconnect boot |
| B | 4 | 10-1013-02 | Telescoping pole |
| C | 2 | NA | Inner guide tube assembly consisting of diverter cone , 39-7/8" and 49" CPVC Plastic tube, glued together. They are only used on the EHU side of the 40/30 loop |
| D | 4 | NA | Quick disconnect boot locking ring (these are molded into the base section of each telescoping pole and are used to keep the pole from sliding out of the quick disconnect boots in high wind situations) |

# ATTACH FOAM PLUG HOUSINGS TO TELESCOPING POLES

Each 20m-6m telescoping pole tip requires a breathable foam plug to allow for venting of the EHU. The foam plug assembly (PN 70-1007-01) consists of a special UV resistant foam plug material, and a plastic housing as shown in figure 50.

The foam plug is installed inside the plastic housing at the factory.

The fit of the plastic housing on the pole tip is purposely very tight, so that the foam plug assembly will stay in place. Before attaching the plastic housing, spread a small amount of dish soap around the inside edge of the plastic housing as shown in figure 51. This helps the housing slide on easily, and the soap will eventually evaporate, leaving you with a firm interference fit.

Insert the plastic housing onto the telescoping pole tip as shown in figure 52. Be sure that the plastic housing bottoms out on the pole tip, as shown in figure 53.

Repeat for the other telescoping pole tip.

**FIG. 50**

**FIG. 51**

**FIG. 52**

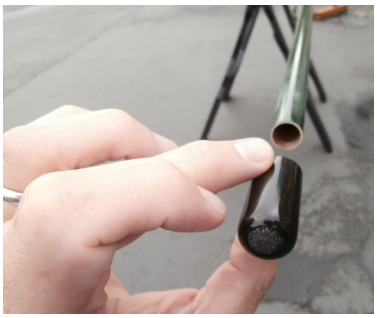


**FIG. 53**

## Attach the non-loop Fiberglass Element Support Tubes to the Element Housing Units

The butt ends of the green fiberglass poles may very slightly in outside diameter. Some of them may have been sanded, while others were not. The colors at the ends will be either natural, or black. The difference in colors has no affect on performance. Do not be concerned if they vary slightly in tightness when being installed on the EHUs. This is normal. All poles are tested at the factory prior to shipping, however in the event the pole just won't fit sanding it is okay. Check to be certain there are no obstructions inside the poles—this can cause catastrophic failures!

The EHTs on the EHUs have aluminum reinforcing rings attached to provide extra strength in high wind conditions (**Figure 54**).

Locate the six rubber boots and repeat the following procedure for each of the six fiberglass poles.

- Place the narrow end of a rubber boot onto the butt end of an EST. Slide it about 6" out onto the EST (**Figure 55**).

**Figure 54**

**Figure 55**

**Figure 56**

**Figure 57**

- Insert the butt end of that EST into one of the EHTs on an EHU, as shown in **Figure 56**. **It is very important to ensure that the butt end of the EST firmly bottoms out inside the EHT. Make sure the EST is seated all the way into the EHT. Then push the rubber boot firmly onto the EHT until the hose clamp is past the aluminum ring and will clamp down onto the fiberglass EST.** The correct mounting position of the rubber boot is shown in **Figure 57**. Note that current production antennas now have a narrower aluminum ring (.4"). **It is imperative that the stainless steel hose clamp be located so that the clamp on the outside of the rubber boot on the EHU side of the connection is completely PAST the the aluminum reinforcing ring. This ensures that the hose clamp can grip onto the fiberglass and the ring will prevent the rubber boot from ever coming off.**

- Firmly tighten both stainless steel hose clamps, one over the EHT and the other over the EST. Then test the connection by pulling and twisting it. There should be no slippage at the joints.

NOTE: You should re-tighten each clamp a second time (at least 30 minutes after the first time you tightened them) before raising the antenna to the tower, to be sure that there has been no cold flowing of the PVC material on the rubber boot.

# 6 Meter Passive Element

The 6 meter passive element comes in 3 pieces. The main body with a 1/2" x 58" element section attached to it, and two 3/8" element sections (**Figure 58**). The overall length of the element is approximately 112" for the 3 element and 114" for the 2 element when assembled.

The required fasteners will already be attached to each end of the 1/2" element section - remove this hardware, and slide in the short ends of the 3/8" tubing (the end that has the least amount of distance from the edge of the tubing to the drilled hole). Use a small amount of the included Teflon® connector protector solution when connecting the two sections of tubing. Fasten securely. The six meter aluminum element mounts between the driven element and the director (the elements that are approximately 89" apart). The center of the 6m element should be 31" from the center of the driven element (see **Figure 7**) Fasten securely to the boom using the 304 SS U-bolt, saddle and hardware. Make certain that you have the 6 meter passive element level with the others.

When you are using the 6 meter band, keep the antenna in the forward direction and rotate accordingly. Optimum performance will be from 50.000 MHz to 50.500 MHz. The 180 degree mode is exactly the same as the forward mode since we have no choice when the aluminum passives are used, however, the Bi-Directional works to the same degree by directly reducing the front to back ratio.

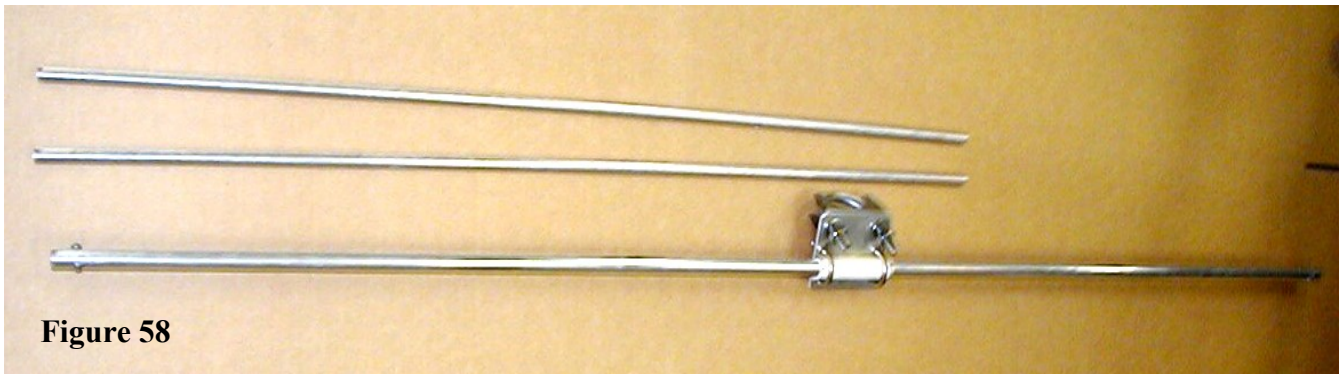
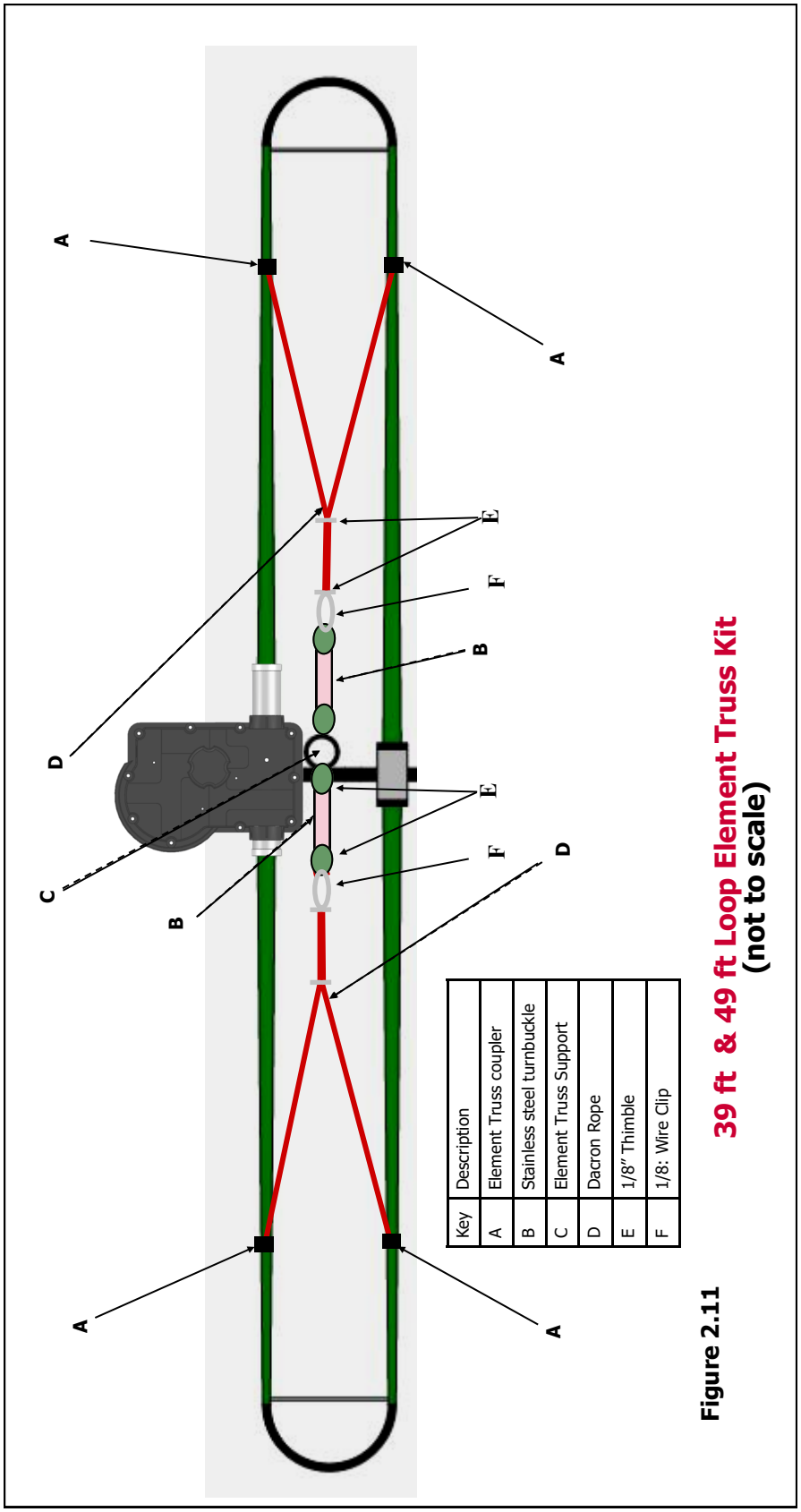


**Figure 58**

# ELEMENT TRUSS OVERVIEW




| Key | Description |
|---|---|
| A | Element Truss coupler |
| B | Stainless steel turnbuckle |
| C | Element Truss Support |
| D | Dacron Rope |
| E | 1/8" Thimble |
| F | 1/8: Wire Clip |

**39 ft & 49 ft Loop Element Truss Kit**
**(not to scale)**

**Figure 2.11**

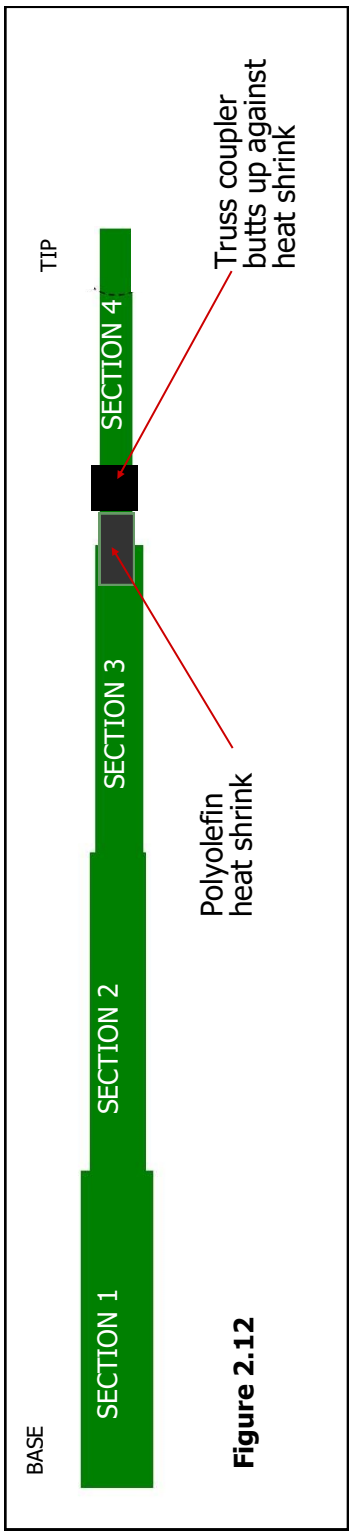


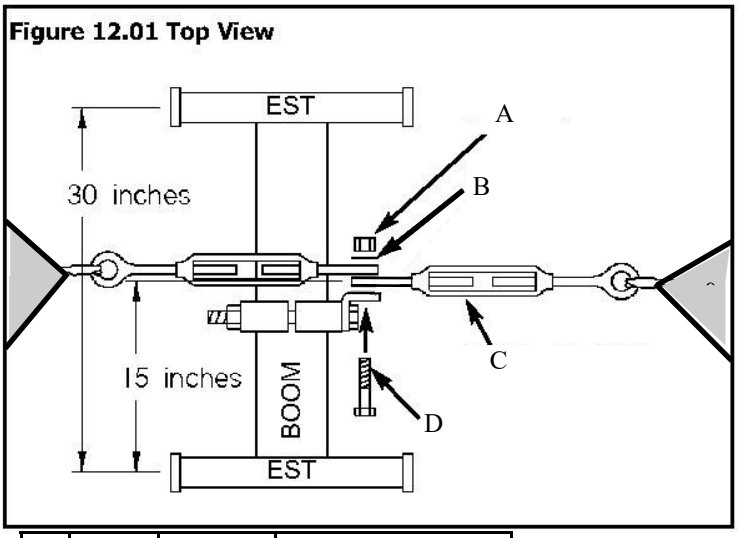

**Figure 2.12**

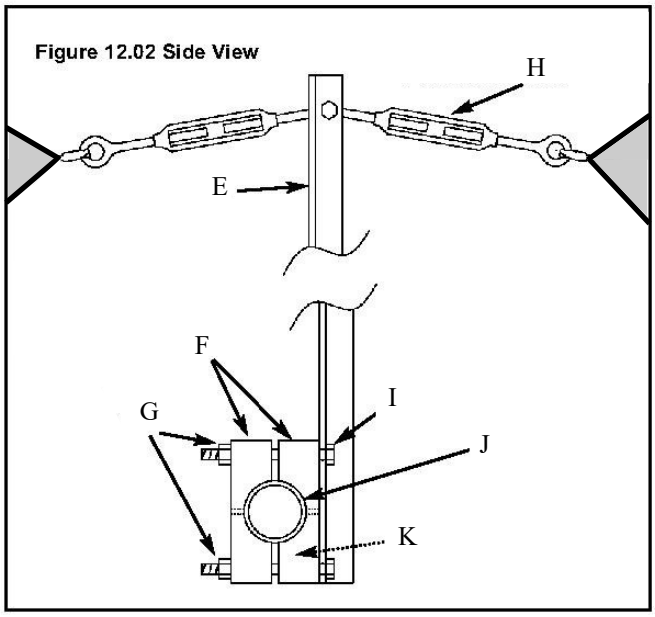
# ELEMENT TRUSS SUPPORT

- Check and inventory that you received all the parts for the 39 ft 40M/30M truss option.
- Be sure to use anti-seize on all of the stainless steel fasteners in this step. Failure to do so will potentially cause them to seize/gall.

1. Secure the element truss support (PN 10-1054-01) to the aluminum saddles so that the head of the 5/16" bolt are on the truss support side as shown in Figure 12.02. Secure the truss support and saddle assembly around the boom so that its halfway between the driven EST and return EST as shown in Figure 12.01. **NOTE: The DB18E truss support for the DRIVEN element is completely different than all of the other antenna models. Refer to page 9 for these instructions. For the two end elements on the DB18E, follow instructions on this page (Pg 10).** It is not critical which side of the boom the truss support is on. Use the boom as a line to sight in the truss support so that it is perpendicular to the boom. Level the support before tightening as shown in figure 14.03. After tightening, insert a set screw into the exposed saddle and tighten.

**Figure 12.01 Top View**




| Key | QTY | Part # | Description |
|---|---|---|---|
| A | 1 | 60-0030 | 1/4" SS nylock nut |
| B | 2 | 60-0033 | 5/16" SS washer |
| C | 2 | 60-0083 | 4" SS turnbuckle |
| D | 1 | 60-0110 | 1/4" X 1-1/4" SS hex bolt |
| E | 1 | 10-1054-01 | 30m / 40m truss support |
| F | 2 | 10-1601-03 | 1-3/4" Aluminum saddle |
| G | 2 | 60-0046 | 5/16" SS nylock nut |
| H | 2 | 60-0083 | 4" SS turnbuckle |
| I | 2 | 60-0065 | 5/16" X 3-1/2" SS hex bolt |
| J | 1 | N/A | Antenna Boom |
| K | 2 | 10-1601-22 | 2" saddle |

**Figure 14.01**

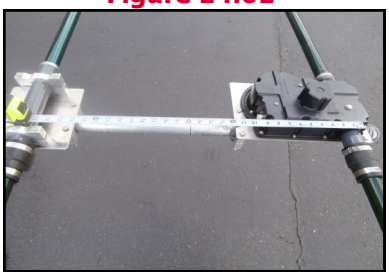


**Figure 14.02**

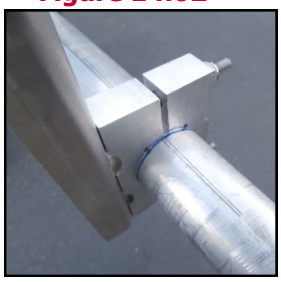
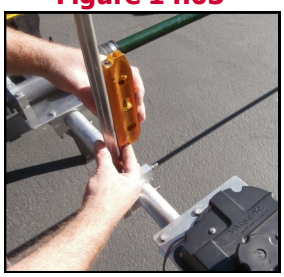


**Figure 14.03**



# ELEMENT TRUSS SUPPORT CONT.

2. Attach each of the 4” stainless steel turnbuckles (PN 60-0083) using the 1/4” x 1-1/4” hex head bolt (PN 60-0110), two of the 5/16” stainless steel flat washers (PN 60-0033) and 1/4” Nylock nuts (PN 60-0030) as shown in figure 14.04 and figure 14.05. Figure 14.06 shows the top of a completed element truss support without the Dacron rope attached.

**Figure 14.04**

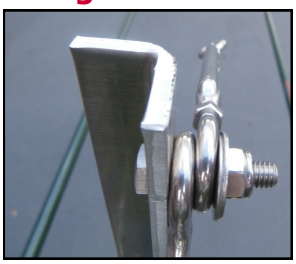


**Figure 14.05**

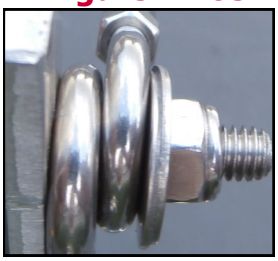
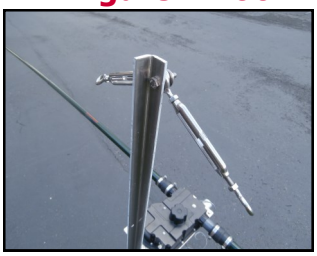


**Figure 14.06**



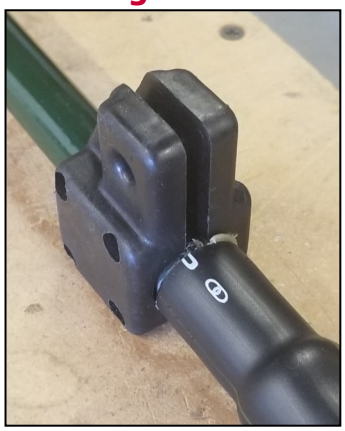
# ELEMENT TRUSS COUPLER

1. Each element truss coupler consists of 2 halves as shown in **figure 2.01**. The element truss couplers (PN 10-1510-01) are used for fastening the Dacron rope to the last section of the telescoping poles. **Figure 2.12** on page 8 provides an expanded view of a truss element assembly.
2. Position each coupler so that it is flush to the polyolefin heat shrink on the smallest joint of the telescoping pole as shown in **figure 2.02** and **2.03**. **DO NOT** place the coupler over the polyolefin heat shrink or it will not seat properly. **Figure 2.12** on page 8 shows the location respective to the telescoping pole to mount the truss coupler.

**Figure 2.01**

**Figure 2.02**

**Figure 2.03**



3. Insert the 6-32 x 7/8" stainless steel screws (60-0014-01) through round the opening and place the 6-32 nylock nuts (60-0014) in the hex opening of the element truss coupler. These are handy for holding the #6 Nylock nut (PN 60-0014) when tightening, but you will need to position your finger over the nut to keep it from spinning when you thread on each of the #6 x 7/8" pan-head machine screw (PN 60-0014-01). Tighten the stainless steel screws and Nylock nuts. Be sure your couplers are perpendicular to the pole and level before final tightening. **Figure 2.04** and **figure 2.05** show the coupler when tightened. They should be flush or have a small gap between the couplers.

**Figure 2.04**

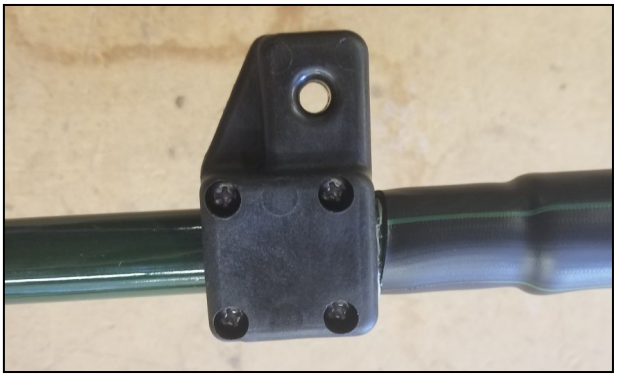
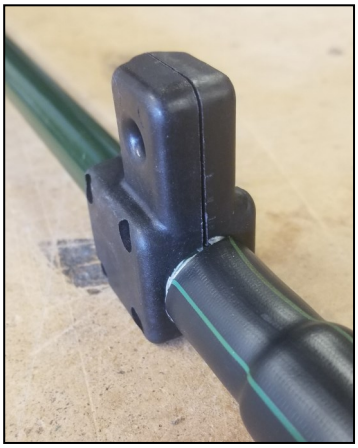


**Figure 2.05**



# ELEMENT TRUSS COUPLER (CONTINUED)

4. The Dacron rope is provided in a single piece. You will need to trim the pieces to length as you proceed in installing each half-portion of the truss. Melt the end of the rope with a lighter as shown in **figure 2.09** to insure it does not fray. Thread the Dacron rope through the single larger hole at the top portion of the coupler as shown in **figure 2.06**, so it is tight and the elements are level, with the turnbuckle approximately half way unscrewed. This should let approximately 10" of rope stick out the other end. Secure the rope to the coupler using four half-hitches, leaving approximately 4" extra rope or "leader". Run the rope up the telescoping pole towards the stainless steel eye-bolt/thimble and then thread the rope through the thimble and back down to the truss coupler opposite of the one that is already secured. **Figure 2.07** shows the Dacron rope tied to the element truss coupler.

**Figure 2.09**

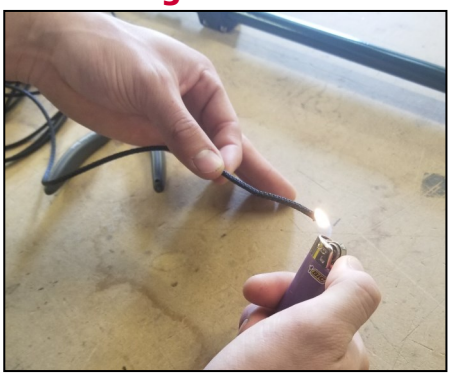


**Figure 2.06**


**Figure 2.07**

5. Tape the leader to the main truss line as shown in **figure 2.08**, trim the rope that portion of the truss and repeat for the next. There will be more than enough rope. Tape the leader to the other portion of the rope as shown in **figure 2.08**. Electrical tape works fine for this.
6. Melt the other end of the rope with a lighter as shown in **figure 2.09** to insure it does not fray. **Figure 2.10** shows the finished coupler with the Dacron rope secured.

**Figure 2.08**

**Figure 2.10**

# ELEMENT TRUSS SUPPORT (CONTINUED)

3. Loop 1/8" Dacron rope (PN 21-7001-01) around each thimble as shown in **Figure 2.18**.
4. Secure each rope length together with two 1/8" Wire Clips (PN 60-0157). There should be about 3" between each clip as shown in **Figure 2.19**.

**Figure 2.18**

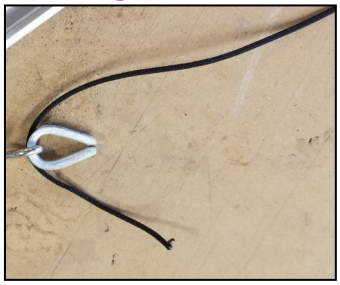
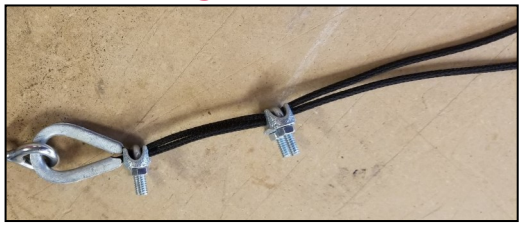


**Figure 2.19**



5. Repeat steps three and four such that both turnbuckles have a rope length attached as shown in **Figure 2.20**.
6. Loosen turnbuckles by unscrewing them such that they are fully extended as shown in **Figure 2.20** and **Figure 2.21**.

**Figure 2.20**

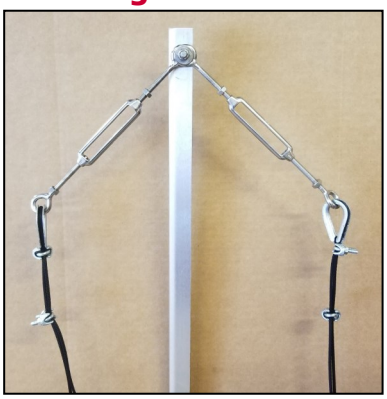
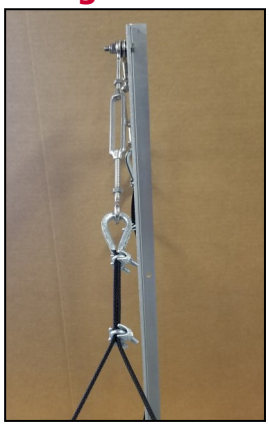
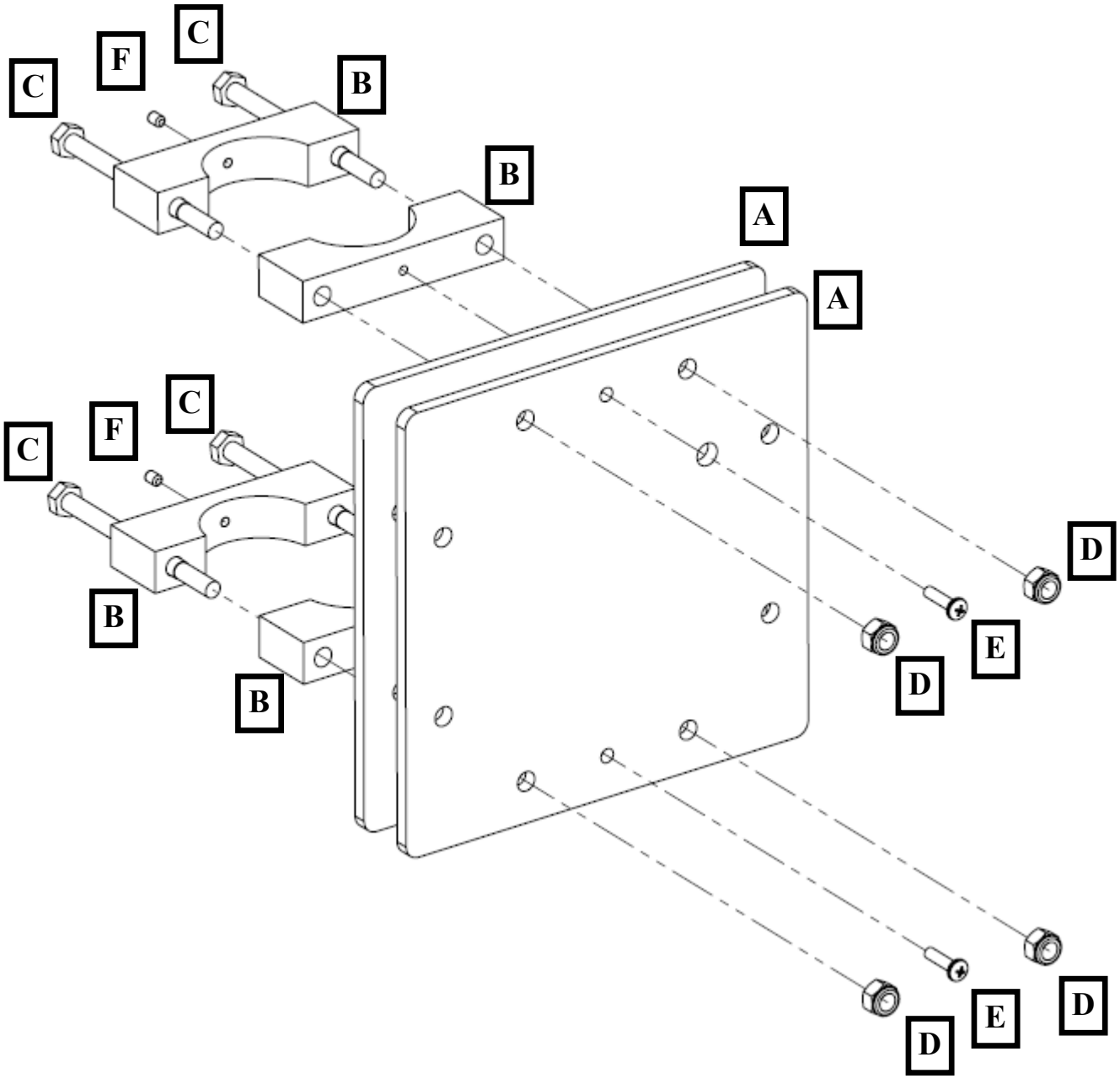


**Figure 2.21**



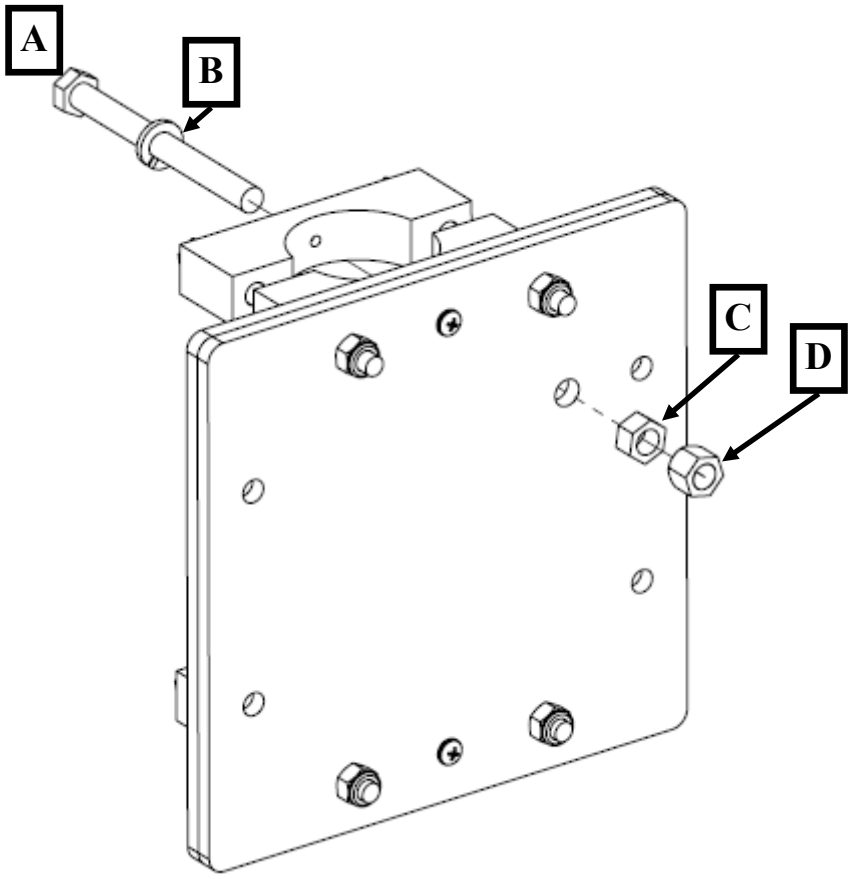
# INSTALL THE MAST SADDLES

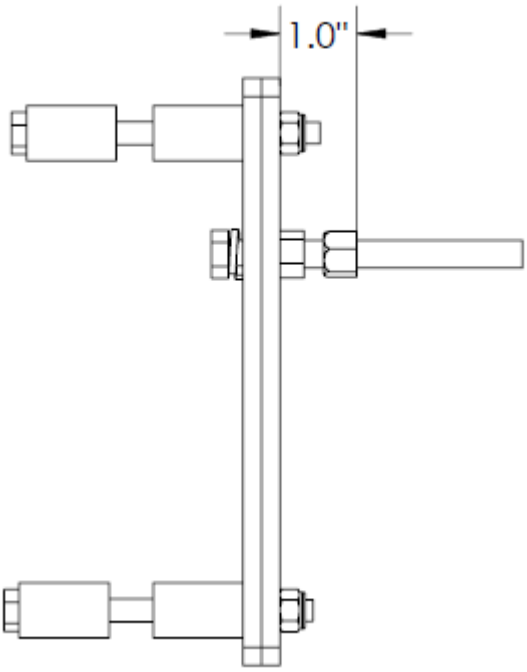
| KEY | QTY | Part Number | Description |
|---|---|---|---|
| A | 2 | 10-1021-43 | Mast Plate |
| B | 4 | 10-1601-22 | Saddle Clamp, 2” |
| C | 4 | 60-0066 | Hex Bolt, 5/16” x 4” |
| D | 4 | 60-0046 | Nylock Nut, 5/16 |
| E | 2 | 60-0017 | Pan Screw, 10-32 x 3/4” |
| F | 2 | 60-0112 | Set Screw, 10-32 x 1/4”, Cup Point |



# INSTALL THE FULLY THREADED BOLT

| KEY | QTY | Part Number | Description |
|---|---|---|---|
| **A** | 1 | 60-0085 | Hex Bolt, 3/8” x 4”, Fully Threaded |
| **B** | 2 | 60-0051 | Lockwasher, 3/8”, Split |
| **C** | 1 | 60-0049 | Nut, 3/8” |
| **D** | 2 | 60-0050 | Nylock Nut, 3/8” |



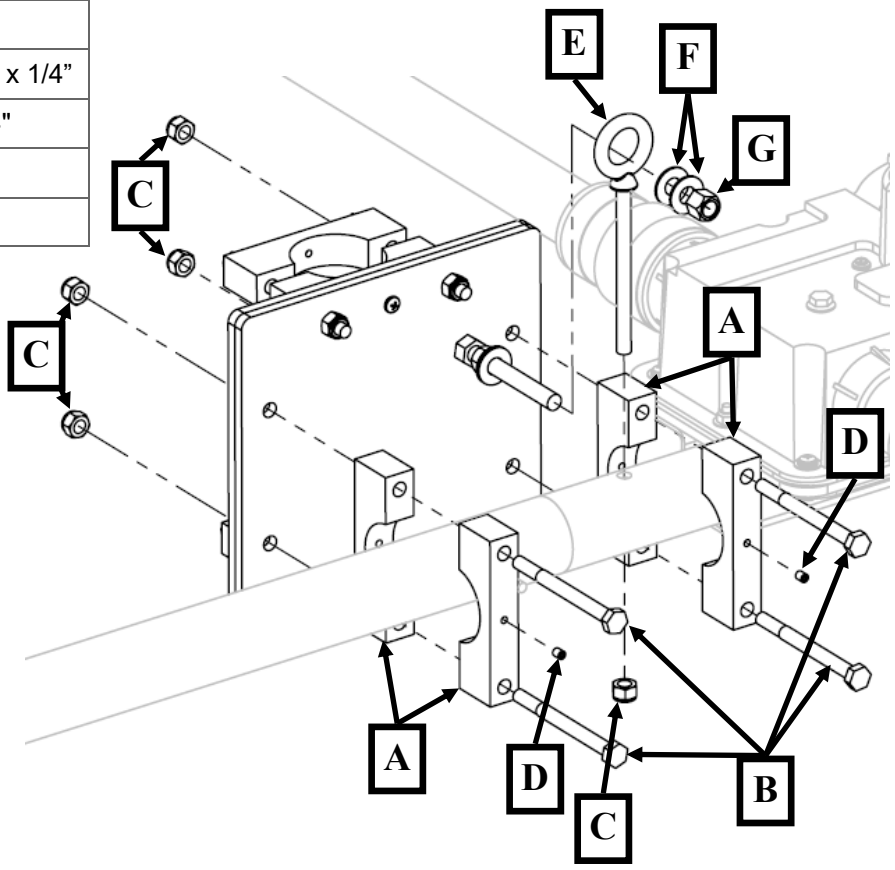



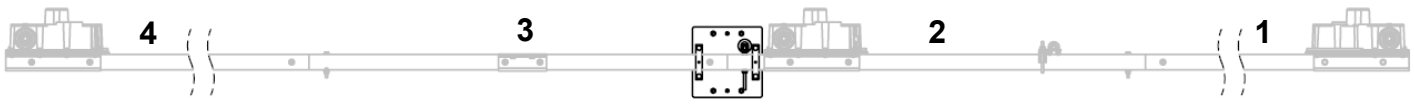
# HIGH WIND KIT

- Remove the vertical 1/4-20 bolt from the #2 splice.
- Drill out the hole with the included “N” (.320”) drill bit.
- Use the exploded view drawing below to install the mast plate.
- Adjust the two Nylock nuts on the EZ-Eye stud to make sure the boom is level.
- Tighten the Nylock nuts on the boom saddle clamps and EZ-Eye.

**NOTE: The boom can be re-leveled if necessary by loosening the bolts on the boom saddle clamps and then adjusting the two Nylock nuts that position the EZ-Eye. Be sure to tighten all nuts when finished.**

| KEY | QTY | Part Number | Description |
|---|---|---|---|
| A | 4 | 10-1601-03 | Saddle, 1-3/4” x 3/4” |
| B | 4 | 60-0065 | Hex Bolt, 5/16” x 3-1/2” |
| C | 5 | 60-0046 | Nylock Nut, 5/16” |
| D | 2 | 60-0112 | Set Screw, 10-32 x 1/4” |
| E | 1 | 60-0037-21 | Eyebolt, 5/16" x 4" |
| F | 2 | 60-0034 | Washer, 3/8” |
| G | 1 | 60-0046 | Nylock Nut, 3/8” |



## SteppIR Performance

SteppIR antennas are developed by first modeling the antenna using YO-PRO and EZ-NEC. We created antennas that had maximum gain and front to rear without regard for bandwidth.

The antennas that reside in our controllers memory are all optimized for gain and front to rear with a radiation resistance of approximately 22 ohms (16 ohms to 30 ohms is considered ideal for real world Yagi's. The modeling also takes into account the changing electrical boom length as frequency changes. When the 180 degree function is enabled, a new Yagi is created that takes into account the change in element spacing and spacing and in the case of 4 element antennas creating a two reflector antenna to get maximum use of all elements . The result is slightly different gain and front to rear specifications.

We then go to the antenna range and correlate the modeled antenna to the real world. In other words, we determine as closely as possible the electrical length of the elements. We are very close to the modeled antennas, but it is virtually impossible to get closer than a few tenths of a dB on gain and several dB on front to rear.

**There are three factors that make our antennas outstanding performers:**

1. They are tuned to a specific frequency for maximum gain and front to rear – without the compromise in performance that tuning for bandwidth causes.
2. They are very efficient antennas with high conductivity conductors, a highly efficient matching system (99% plus) and low dielectric losses.
3. There are no inactive elements, traps or linear loading to reduce antenna performance.

## Fixed Element Spacing and the SteppIR Yagi

First of all, there really is no "ideal" boom length for a Yagi. To get maximum gain the boom of a three element beam should be right around .4 wavelengths long. This would allow a free space gain of 9.7 dBi, however the front to back ratio is compromised to around 11 dB. If the boom is made shorter, say .25 wavelengths, the front to back can be as high as 25 dB, but now the maximum gain is about 8.0 dBi. Shorter booms also limit the bandwidth, which is why right around .3 wavelengths is considered the best compromise for gain, front to back and bandwidth for a fixed element length yagi. It turns out that being able to tune the elements far outweighs being able to choose boom length. We chose 16 feet for our three element boom length which equates to .23 wavelength on 20 meters and .46 wavelength on 10 meters, because very good Yagi's can be made in that range of boom length if you can adjust the element lengths. This compromise works out very well because 10m is a large band and F/B isn't as important so you get excellent gain with still very acceptable F/B. When bandwidth is of no concern to you (as it is with our antenna), you can construct a Yagi that is the very best compromise on that band and then track that performance over the entire band. It is this ability to move the performance peak that makes the SteppIR actually outperform a mono-bander over an entire band – even when the boom length isn't what is classically considered "ideal". Bear in mind that a Yagi rarely has maximum gain and maximum front to back at the same time, so it is always a compromise between gain and front to back. This is the same philosophy we use on all of our yagi antennas to give you the most performance available for a given boom length. With an adjustable antenna you can choose which parameter is important to you in a given situation. For example, you might want to have a pile-up buster saved in memory, that gets you that extra .5 – 1.0 dB of gain at the expense of front to back and SWR – when you are going after that rare DX!

## RF Power Transmission with the SteppIR Yagi

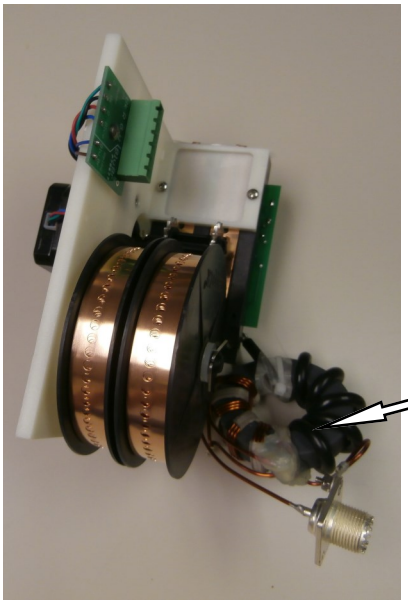
The RF power is transferred by brushes that have 4 contact points on each element that results in a very low impedance connection that is kept clean by the inherent wiping action. The brush contact is .08 in thick and has proven to last over 2 million band changes. The copper beryllium tape is .545 inches wide and presents a very low RF impedance. The type of balun we are using can handle tremendous amounts of power for their size because there is almost no flux in the core and they are 99% efficient. That coupled with the fact that our antenna is always at a very low VSWR means the balun will handle much more than the 3000 watt rating, how much more we don't know. Jerry Sevicks book "Transmission Transformers" (available from ARRL) has a chapter (Chap. 11) that discusses the power handling ability of ferrite core transformers.

**WARNING: WHEN OPERATING WITH MORE THAN 200 WATTS, DO NOT TRANSMIT WHILE THE ANTENNA IS CHANGING BANDS. A MISMATCH AT ELEVATED WATTAGES MAY CAUSE DAMAGE TO THE DRIVEN ELEMENT.**

## Balun / Matching System

The SteppIR has a matching system that is included in the 2 element, 3 element, 4 element and MonstIR Yagi (a balun is available as an option on the dipole). Our antenna designs are all close to 22 ohms at all frequencies, so we needed a broadband matching system that would transform 22 ohm to 50 ohm. We found an excellent one designed by Jerry Sevick, that is described in his book “Building and Using Baluns and Ununs”.

Our matching network is a transmission line transformer that is wound on a 2.25 inch OD ferrite core that operates with very little internal flux, thus allowing it to function at very high power levels. The transformer includes a 22 ohm to 50 ohm unun and a balun wound with custom made, high power, 25 ohm coax for superior balun operation. Jerry has espoused these transformers for years as an overlooked but excellent way to match a Yagi, he would probably be proud to know they are being used in a commercial Yagi. This matching network does not require compressing or stretching a coil, or separating wires to get a good match – something that can easily be bumped out of adjustment by birds or installation crews.



## Yagi Gain / Front to Back Modeling

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When we claim our Yagi outperforms much larger arrays we are referring to multi-band Yagi's that interlace elements on a long boom and don't use the entire band boom for each band, and additionally have degraded performance due to element interaction. There are many antennas out in the world that are not getting the maximum theoretical gain from their boom! Because we have tunable elements and a very efficient antenna, we are getting close to the maximum gain from our boom. Traps, linear loading and interlaced elements all contribute to this degradation.

## Stacking Two Antennas

Since SteppIR™ antennas are super-tuned mono-banders they stack very well because there are no destructive interactions going on. A good distance is anywhere from 32' to 64', the best being closer to the 32' value. You can also stack them with other non-SteppIR™ antennas and get some reasonably good results. You must ensure that the "hot" side (center conductor) of the driven elements of all the antennas in the stack are on the same side or you will get attenuation instead of gain **(**see **Figure 23 ).** If you want a good demonstration of this phenomenon turn one SteppIR™ 180 degrees to the other in physical direction and run one antenna in the 180 degree reverse mode. You will be amazed at how much it kills the performance. Stacking them as described will result in excellent performance over the entire frequency range (except 6M) because stacking distances aren't that critical, just don't put them too close.

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**Warning:** When operating with more than 200 watts, do not transmit while the antenna is changing bands. A mismatch at elevated wattages may cause damage to the driven element.

## STEPPIR COMMUNICATION SYSTEMS

# 5 YEAR LIMITED PRODUCT WARRANTY

**(as of May 22, 2023; Prior to that date warranty is 2 years)**

Our products have a limited warranty against manufacturers defects in materials or construction for five (5) years from date of shipment. Do not modify this product or change physical construction without the written consent of Fluidmotion Inc, dba SteppIR Communication Systems.

This limited warranty is automatically void if the following occurs: improper installation, unauthorized modification and physical abuse, customer misuse or damage from weather events or natural disasters that are outside of the stated survivability of the product. For wind damage, proof of winds beyond 100 mph must be presented. Lightning or near-lightning events are not covered under this warranty. Driver chip module replacement is not covered under this warranty. This warranty is not transferrable.

**SteppIR Communication System's responsibility is strictly limited to repair or replacement of defective components, at SteppIR's discretion. SteppIR will not be held responsible for any installation or removal costs, costs of any ancillary equipment damage or any other costs incurred as a result of the failure of our products**.

In the event of a product failure, a return authorization is required for warranty repairs. This can be obtained at www.steppir.com. Shipping instructions will be issued to the buyer for defective components, and shipping charges to the factory will be paid for by the buyer. SteppIR will pay for standard shipping back to the buyer. The manufacturer assumes no further liability beyond repair or replacement of the product.

Modification of this product is not authorized and may cause product failure, injury or death.


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