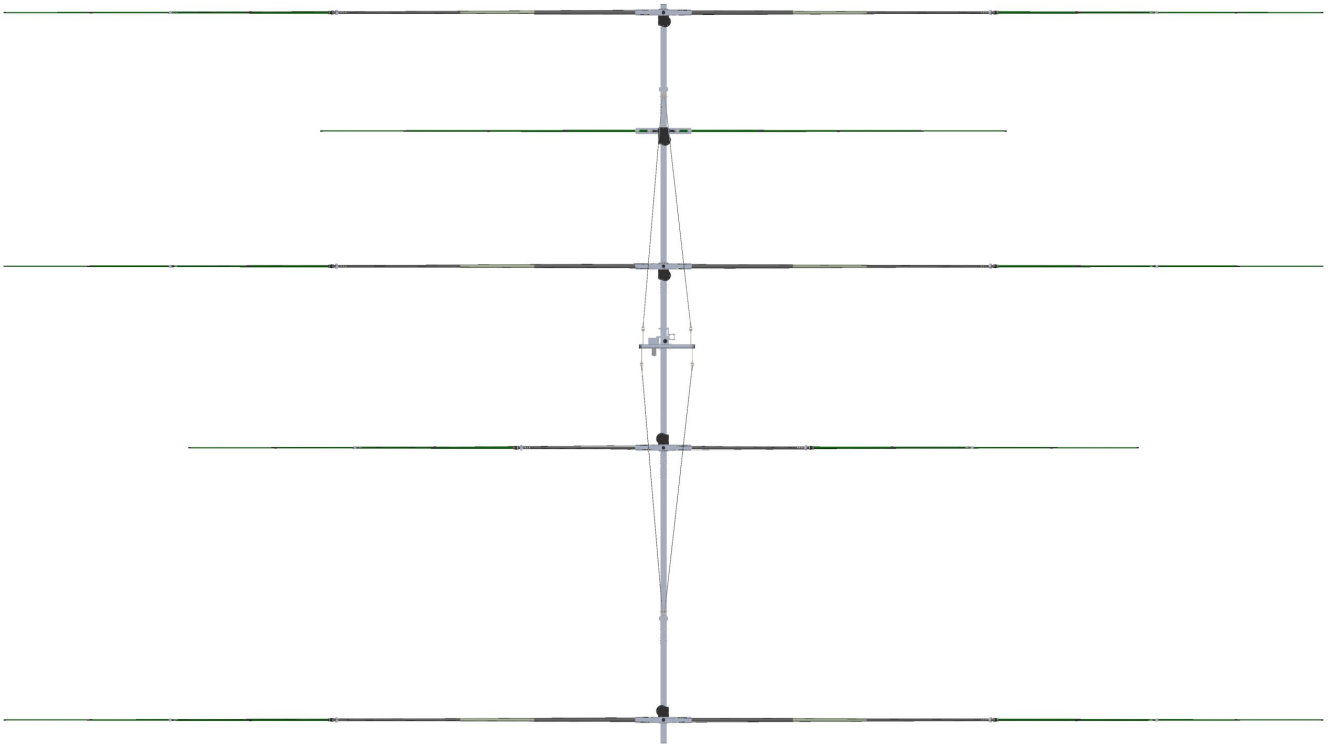




HFT540C Assembly Manual



REV 2.1.8 8/23/2022

PRE-INSTALL NOTES

- Taking inventory of the parts received and comparing with the Bill of Materials (BOM) is recommended. That way if any parts are missing they can be delivered quickly to minimize delays.
- We recommend reading the entire manual at least once before beginning assembly, this will give you an overview of the assembly.
- The antenna assembly is divided into sub-assemblies which can be performed simultaneously. Working on multiple sub-assemblies in parallel can speed up the assembly time.
- Critical bolt torques are listed on the appropriate assembly step. Make sure to tighten from the nut with a torque wrench and use anti-seize or threadlock where applicable.

Recommended Tools/Materials:

- Sawhorses (at least 2)
- Heat Gun
- Speed Square
- Level
- Torque Wrench
- Safety Wire Twist Pliers (provided)
- Paint Pen
- Acetone
- Loctite 243 (provided)
- Lighter or hot knife (for cutting Dacron)
- Multimeter
- SWR Analyzer
- Wrenches (open-end/box-end)
- Socket Set and Ratchet
- Tape Measure
- Hammer/Mallet

Estimated assembly time: 5 days (with 2 installers)

INVENTORY CHECKLIST

Saddle Box (72-7000-01)		
Item	Part Number	Quantity
Boom Truss Attachment Plate V2.1	10-1601-82	2
Aluminum Saddle, 2.5"	10-1601-41	12
Aluminum Saddle, 3"	10-1601-61	8
Plastic Saddle, 2.5", tall	10-1611-44	12
Plastic Saddle, 2.5", short	10-1611-04	12
Plastic Saddle, 2.25"	10-1611-03	16
Plastic Saddle, 1.75", tall	10-1611-22	4
Plastic Saddle, 1.75", short	10-1611-02	4
Plastic Saddle, 1.5" tall	10-1611-11	2
Plastic Saddle, 1.5" short	10-1611-01	6
Backing Plate—Angle	10-1601-91	10
Square Saddle	10-1601-71	6
Saddle, 3"	10-1601-61	8
Saddle, 2.5"	10-1601-41	12
Element Plate Spacer (HFT540C)	10-1613-31	4

Boom Box (72-7000-03)		
Item	Part Number	Quantity
4" Square Boom Section - 10ft	10-1200-01	1
4" Square Boom Section - 9ft	10-1200-11	2
4" Square Boom Section - 6ft	10-1200-21	2
Element Truss Mast, 2.25" x 48"	10-1618-51	4
Boom Truss Boom, 2.5" OD x 36"	10-1618-61	1
Boom Truss Mast, 2.5" OD x 48"	10-1618-71	1
New Boom Splice, 12"	10-1203-51	8
Element Mounting Plate - Lower	10-1605-31	5
Element Mounting Plate - Upper	10-1605-41	4
Guy Line Grip (PLP-2739)	60-7016	10

Hardware Box (72-7000-02)		
Item	Part Number	Quantity
Button Head, Hex Drive, 1/4-20 x 3", S/S	60-7009	18
Heavy Duty Thimble, 1/2 - SS	60-7010	8
Turnbuckle, 1/2" x 8", SS	60-7011	5
Washer, 0.5" ID x 1.5" OD	60-7012	14
Wire Clip, 3/16 -S/S	60-7013	52
Eyebolt, 1/2" x 4"	60-7014	2
Double cable clamp, 3/16"	60-7015	18
Hex Bolt, 5/16-18 x 8", SS	60-7032	9

INVENTORY CHECKLIST

Hardware Box (72-7000-02) - Continued		
Item	Part Number	Quantity
Thimble, 3/16, Heavy-Duty, SS	60-7048	35
Spacer, #10 x 0.5 OD x 0.25 tall Aluminum	10-1613-12	21
Spacer, 5/8 x 1.0 OD x 0.25 tall Aluminum	10-1613-13	4
Washer, #10, Flat, S/S	60-0018	25
Nut, 10-32, Nylock, S/S	60-0019	3
Nut, 1/4-20, Nylock, S/S	60-0030	37
Washer, 5/16", Flat, S/S	60-0033	147
Washer, 3/8", Flat, S/S	60-0034	96
Washer, 1/4", Flat, S/S	60-0041	37
Nut, 5/16", Nylock, S/S	60-0046	117
Nut, 3/8", S/S, Nylock	60-0050	7
Bolt, 5/16" x 4", S/S	60-0066	14
Turnbuckle, 1/4" x 4", Eye to Eye, S/S	60-0083	9
Hex Bolt, 5/16-18 x 2.75", S/S	60-0093	3
Pan Screw, 10-32 x .75" w/ locking strip, S/S	60-0101	3
Pan Screw, 10-32 x 1" w/ locking strip, S/S	60-0101-01	9
Pan Screw, 10-32 x 1.25" w/ locking strip, S/S	60-0101-02	25
Set Screw, 10-32 x 0.25", Cup Point, S/S	60-0112	18
Pan Screw, 10-32 x 5/8", S/S	60-0113	3
Hex Bolt, 5/16-18 x 4.5", S/S	60-0115	23
Hex Bolt, 5/16-18 x 5", S/S	60-0141	9
Turnbuckle, 5/16" x 8", Eye to Eye, S/S	60-0159	9
Lock Washer, 10-32, Split, S/S	60-0175	37
Hex Bolt, 5/16-18 x 7", S/S	60-0215	61
Hose clamp, #16, S/S	60-6000-15	10
Hose Clamp, #24, S/S	60-6000-20	4
Hose Clamp, #48, S/S	60-6000-35	13
Hex Bolt, 1/2" x 2.5", S/S	60-7000	3
Hex Bolt, 3/8-16 x 0.75", S/S	60-7001	96
Hex Bolt, 3/8 x 7", S/S	60-7002	8
Hex Bolt, 3/8-16 x 1", S/S	60-7003	9
Hex Bolt, 5/16-18 x 6", S/S	60-7004	5
Button Head, Hex Drive, 1/4-20 x 1.75", S/S	60-7005	18
Nut, 1/2", Nylock, S/S	60-7006	5
Bow Shackle, S/S	60-7007	2
Shackle, 7/16", S/S	60-7008	4

INVENTORY CHECKLIST

Pole Box (72-7000-04)		
Item	Part Number	Quantity
Fiberglass Extension, 1.75in OD x 7.5ft (not sanded)	70-2050-01	2
Fiberglass Extension, 1.75in OD x 7.5ft (6" sanded base)	70-2050-11	6
Fiberglass EST Extension, 2.5" to 2" , 10.5ft	70-2051-01	6
CPVC 3/4 x 89" w/coupler	70-2021-01	6
CPVC 3/4 x 89" w/out coupler	70-2022-01	8
CPVC Assembly with 1.35" foam ring + washer hose w/out coupler	70-2025-43	2
CPVC Assembly with 1.5" foam ring + washer hose + coupler	70-2025-33	2
CPVC Assembly with 2" foam ring + washer hose	70-2025-53	6
Telescoping Fiberglass Pole	10-1013-02	10

Cable Box (72-7000-05)		
Item	Part Number	Quantity
Control Cable - 4c	21-5001-01	50
Control Cable - 6c	21-5013	30
Dacron, 3/16"	21-7002-01	250
Phillystran, 4000i	21-8004	80
Phillystran, 2100i	21-8002	165
Coax jumper, 15', PL259/RG213	21-6301-98	1
Coax jumper, 8', PL259/RG213	21-6301-80	2
Counter Weight	10-1050-21	4
Control Cable—24c	-	-

EHUs (72-7000-07)		
Item	Part Number	Quantity
HFT540C 20m Driven w/Normal Passive Relay	70-3413-01	1
HFT540C 40/30 Passive	70-3414-01	2
HFT540C 40m Driven w/Normal Driven Relay	70-3415-01	1
HFT540C 40m Driven w/Normal Passive Relay	70-3412-01	1
EHU Lid (packaged with EHUs)	10-1501-23	5
EHU Lid Hardware Kit (packaged with EHUs)	72-0054-01	5

Controller Box (72-7000-08)		
Item	Part Number	Quantity
OptimizIR Controller	70-4005-01	1
Stereo Splitter	21-6040	1
DB25 Field Splice	70-6010-01	1
DB42 100W Power Supply	70-3000-11	1

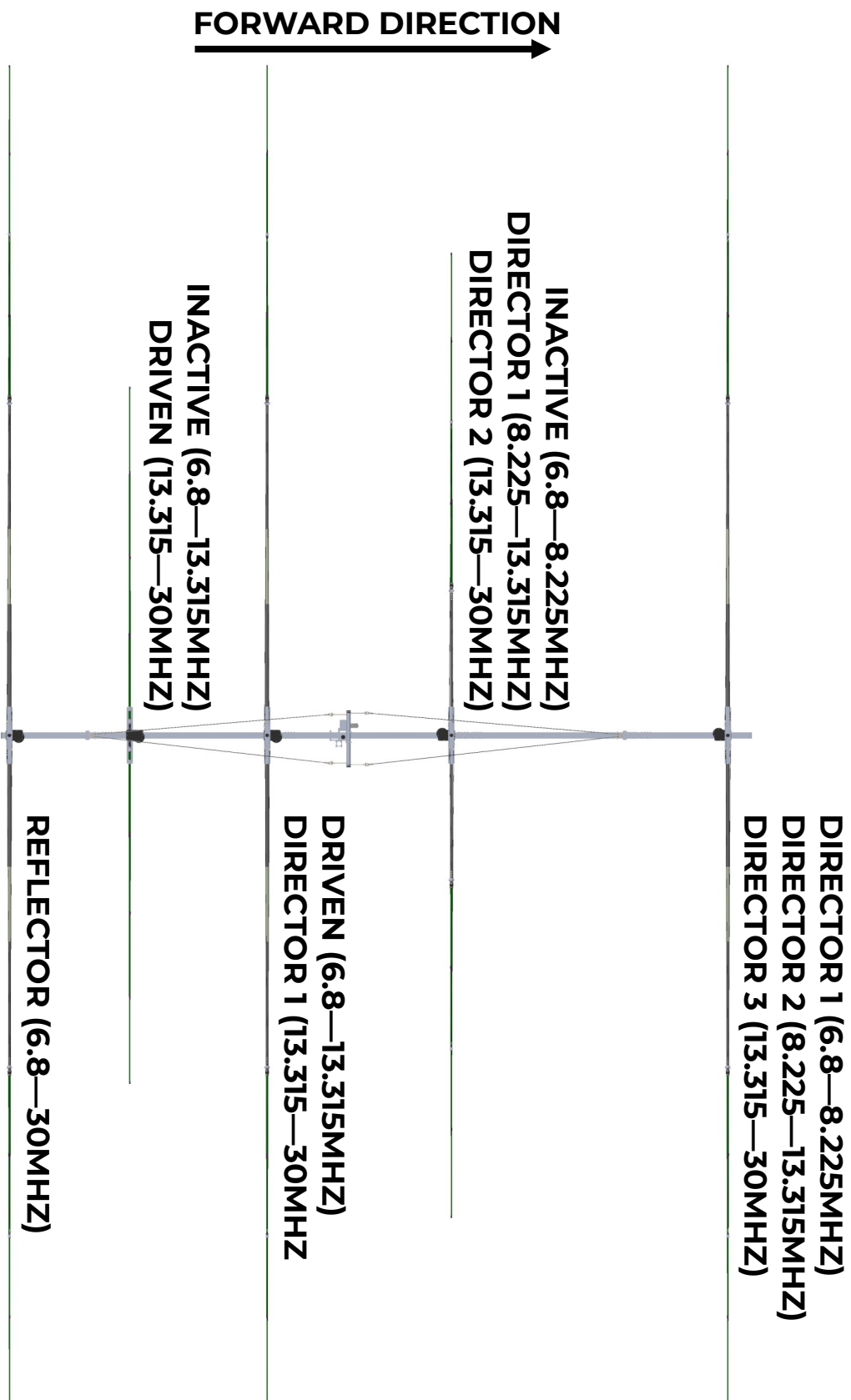
INVENTORY CHECKLIST—CONTINUED

Miscellaneous Parts Box (72-7000-06)		
Item	Part Number	Quantity
Vinyl Cap, 1.5" x 1.5", Black, with hole	60-7024	2
Vinyl Cap, 1.75" x 1.5", Black, with hole	60-7025	2
Vinyl Cap, 2.5" x 1.5", Black, with hole	60-7026	6
Zip Tie, Black, UV, Small 8"	09-2019	10
Zip Tie, Black, UV, Large 24"	09-2019-01	15
Vinyl Cap, 2.25" x 1.5", Black, w/o hole	60-7021	4
Vinyl Cap, 2.5" x 1.5", Black, w/o hole	60-7022	3
Plug for Square Tube, 4", Black	60-7023	2
Polyolefin Heat Shrink, 1.5" x 3"	10-1059-01	33
Resin Clamp, 1.75" (set)	60-7020	8
Resin Clamp, 1" (set)	60-7019	8
Phillystran Rubber Cap (2100i)	60-0044	17
Phillystran Rubber Cap (for 4000i)	60-7018	9
Foam Plug	70-1007-01	10
Mixing Nozzle, 1:1, 2:1	60-7029	1
Urethane Adhesive, 3M Scotch-Weld DP620NS	60-7028	1
Glue Gun, 50ml , 1:1 / 1:2	60-7027	1
Glue kit	72-0009-03	3
Red Loctite glue - 243	60-7030	1
Safety Wire Twisting Pliers	60-7031	1
Electrical Tape, 3M Super 88	09-0005	2
Electrical Tape, MERCO	09-0001	1
Coax Seal (sold per inch)	09-1022	40
0.032" S/S lock wire (full roll)	60-7017	1
Anti-seize, TM-1	10-1028-21	3
Element Truss Attachment Plate - 2in	10-1607-21	8
Element Truss Attachment Plate - 4in	10-1607-31	8
Coax Switch and Connector Junction Box Dual Mounting Bracket	10-1619-11	1
Coax Switch	70-3001-01	1
Connector Junction Box, DB42	70-2038	1
Quick Disconnect Boot, 1.75" to 1.5", Fernco	60-1006-22	10
Quick Disconnect Boot, 2" to 1.75", Fernco	60-1006-51	6
Boom Plate, 8"	10-1021-43	1
HFT540C Mast Plate	10-1021-51	1

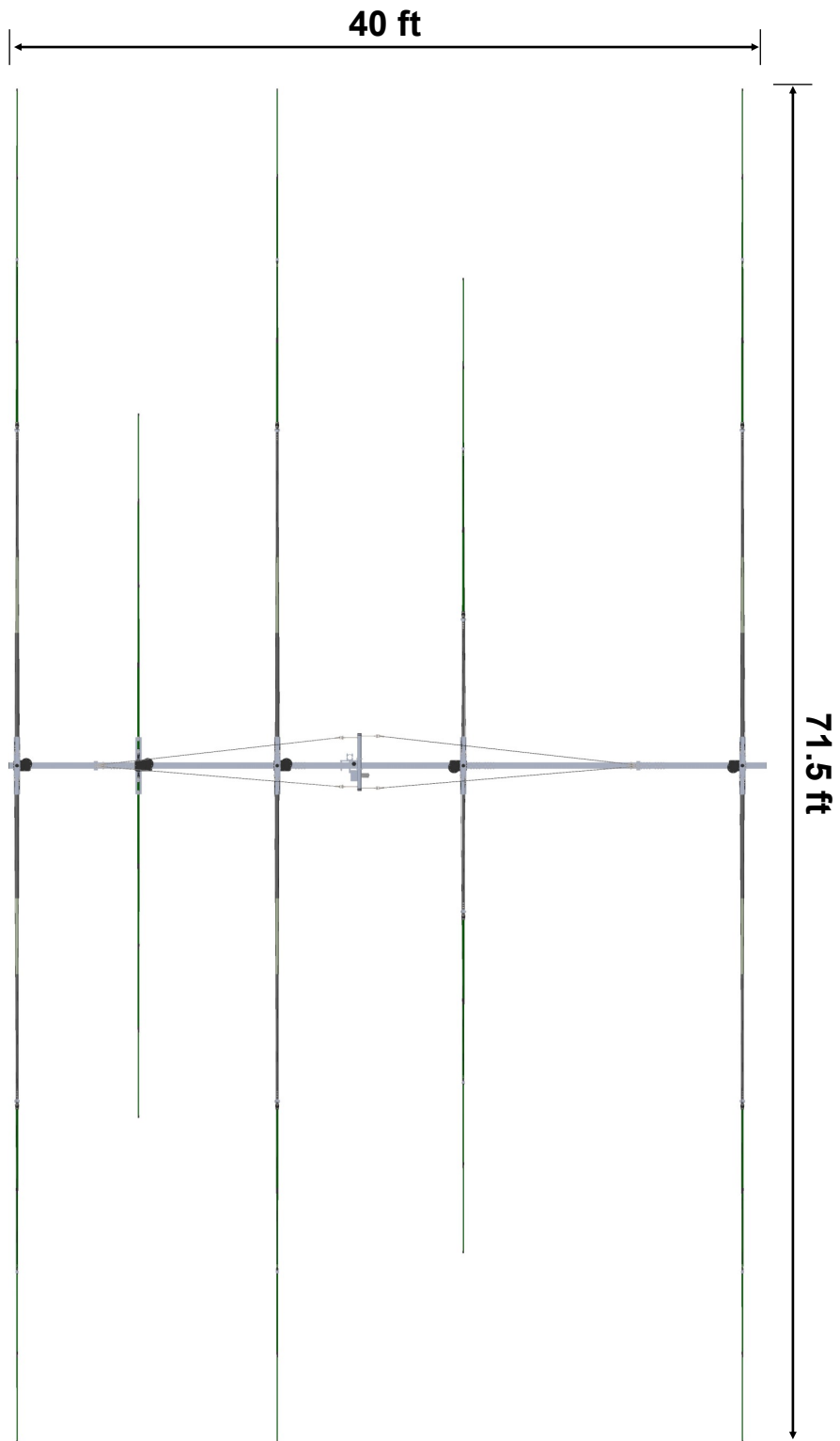
INVENTORY CHECKLIST—CONTINUED

High Wind Tie-back Kit (72-7000-09) **Ships inside Misc Parts Box		
Item	Part Number	Quantity
Tie back boom attachment plate	10-1607-51	1
Saddle, 3"	10-1601-61	12
Square Saddle	10-1601-71	2
Hex Bolt, 3/8 x 7", S/S	60-7002	3
Nut, 3/8, Nylock	60-0050	3
Hex Bolt, 5/16 x 4.5"	60-0115	14
Nut, 5/16, Nylock	60-0046	14
Boom Plate, 8"	10-1021-43	1
Screw, 10-32 x 5/8", Panhead, Phillips, S/S	60-0113	3
Set Screw, 10-32 x 1/4", Cup Point, S/S	60-0112	7
Washer, 3/8"	60-0034	3

ANTENNA OVERVIEW—ELEMENT FUNCTIONS



ANTENNA OVERVIEW—DIMENSIONS



- Cleaning rag
- (6x) Fiberglass Extension

GLUING THE FIBERGLASS POLES

- The 17.5ft fiberglass extension pole is shipped in 2 parts which must be glued together. This is to allow the antenna to be shipped without requiring crating.



**The glue will take 48 hours to fully cure so be sure to do this step first!
The glue must cure in room temperature (73°F/23°C).**

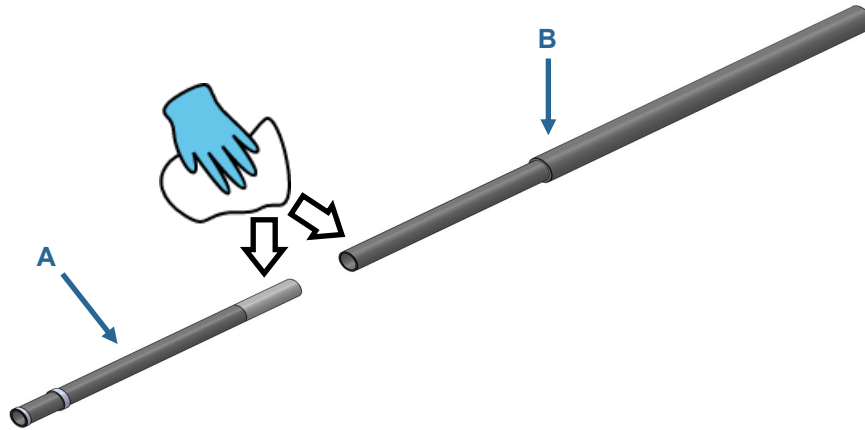


Gluing Procedure:

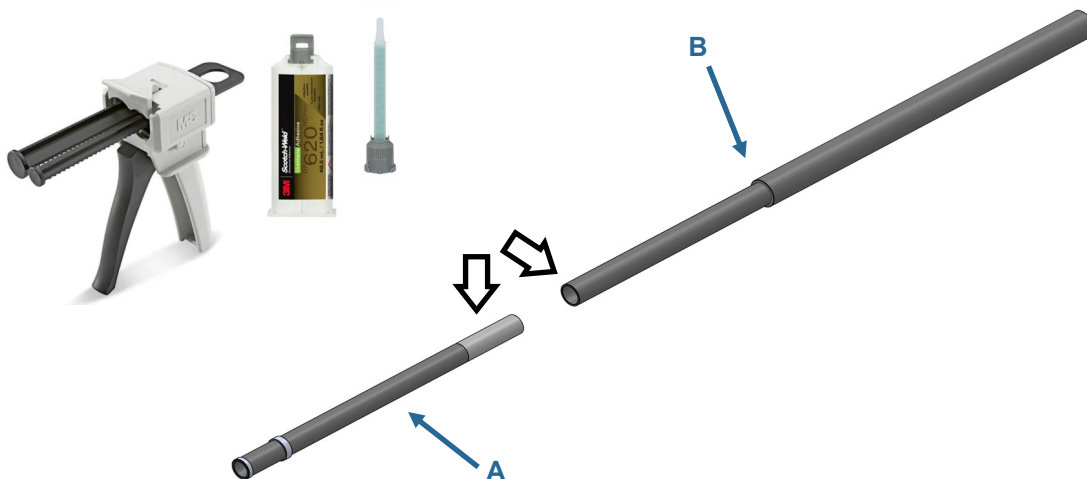
You will need:

Key	QTY	Part Number	Description
A	6	70-2050-11	1.75" OD Fiberglass Poles, gray <u>with sanded base</u>
B	6	70-2050-01	Fiberglass Extension
-	1	-	3M Glue Gun, Glue, and Mixing nozzle
-	1	-	Acetone or Isopropyl Alcohol
-	1	-	Cleaning Rag

Step 1: Degrease 6 inches (entirety of sanded area) of the interior and exterior mating surfaces with acetone/alcohol to remove dust/dirt.

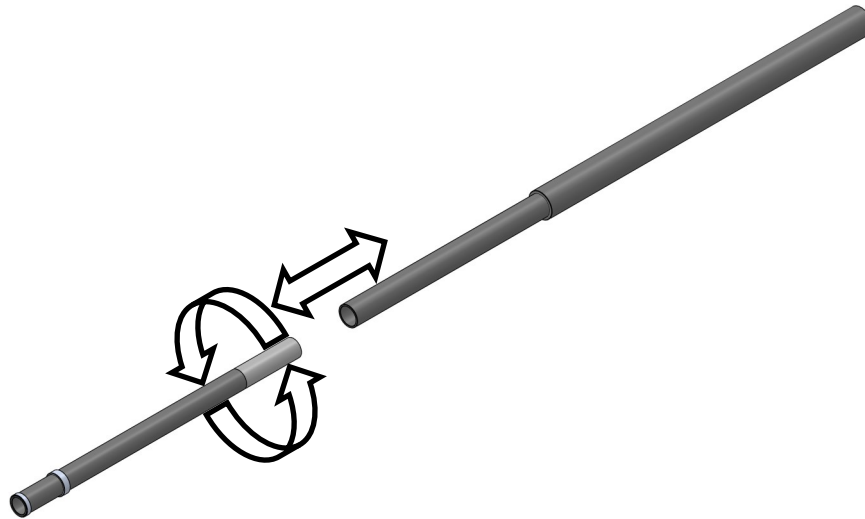


Step 2: Use applicator gun to apply glue to the sanded outer diameter of the 1.75" pole. Apply any excess glue from the 1.75" pole to the inner diameter of the 2.0" OD pole.



GLUING THE FIBERGLASS POLES—CONTINUED

Step 3: Insert the smaller pole into the larger pole. Twist a few times to spread the glue around and then back the pole out. Remove excess glue from the inside of the smaller pole.



Step 4: Add more glue if necessary and repeat until the mating surfaces are completely covered in glue evenly and there are no blockages caused by excess glue. Work quickly as the work time of the glue is 20 minutes.

Step 5: Once the glue is evenly distributed, insert the pole 6" into its final position. Measure the overall length of the pole to be 17.5ft.

Step 6: Set the poles aside so that the glue can dry, undisturbed for 48 hours. Support the end so that the element is straight as the glue dries.

Work time: 20 min

Handle (Set) Time: 4 hours

Full cure: 48 hours

BOOM ASSEMBLY

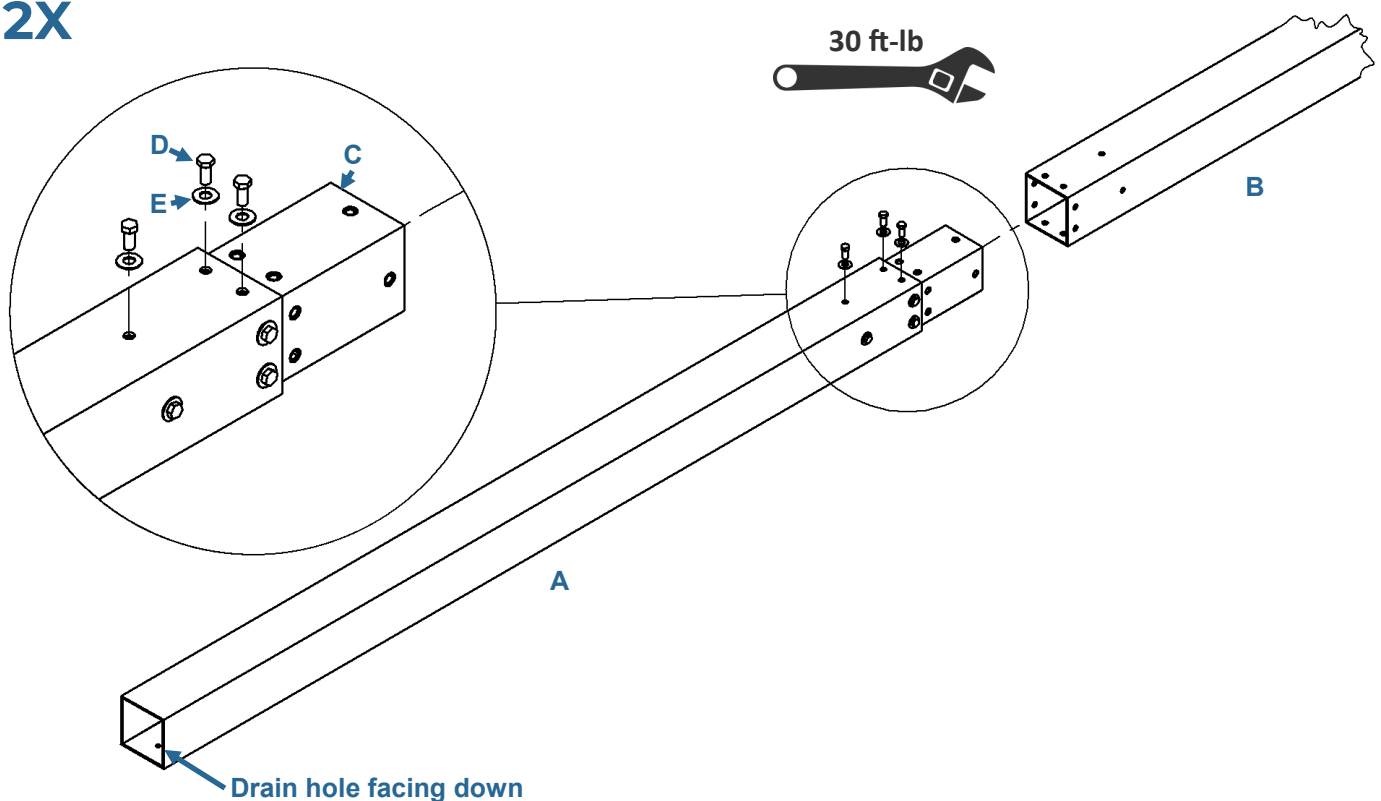
- Join the 5 boom sections together using the boom splices and secure them with the provided hex bolts and washers. Be sure to use the proper length boom section, 10ft in the middle followed by 9ft and then 6ft on the ends.
- Once installed, tighten the bolts to a final torque of **30 ft-lb**
- Make sure that the drain holes on the ends of the 6ft boom sections are on the **bottom face** of the boom.

Apply the provided Loctite 243 to the Hex bolts before installing them, just a few drops will do. This is critically important to prevent the bolts from loosening due to vibrations! Tighten and torque the bolts immediately after applying Loctite.

Key	QTY	Part Number	Description
A	1	10-1200-21	4" Square Boom Section - 6ft
B	1	10-1200-11	4" Square Boom Section - 9ft
C	2	10-1203-51	Square Boom Splice 12"
D	12	60-7001	Hex Bolt, 3/8 x 3/4in
E	12	60-0034	Washer, 3/8



2X



BOOM ASSEMBLY

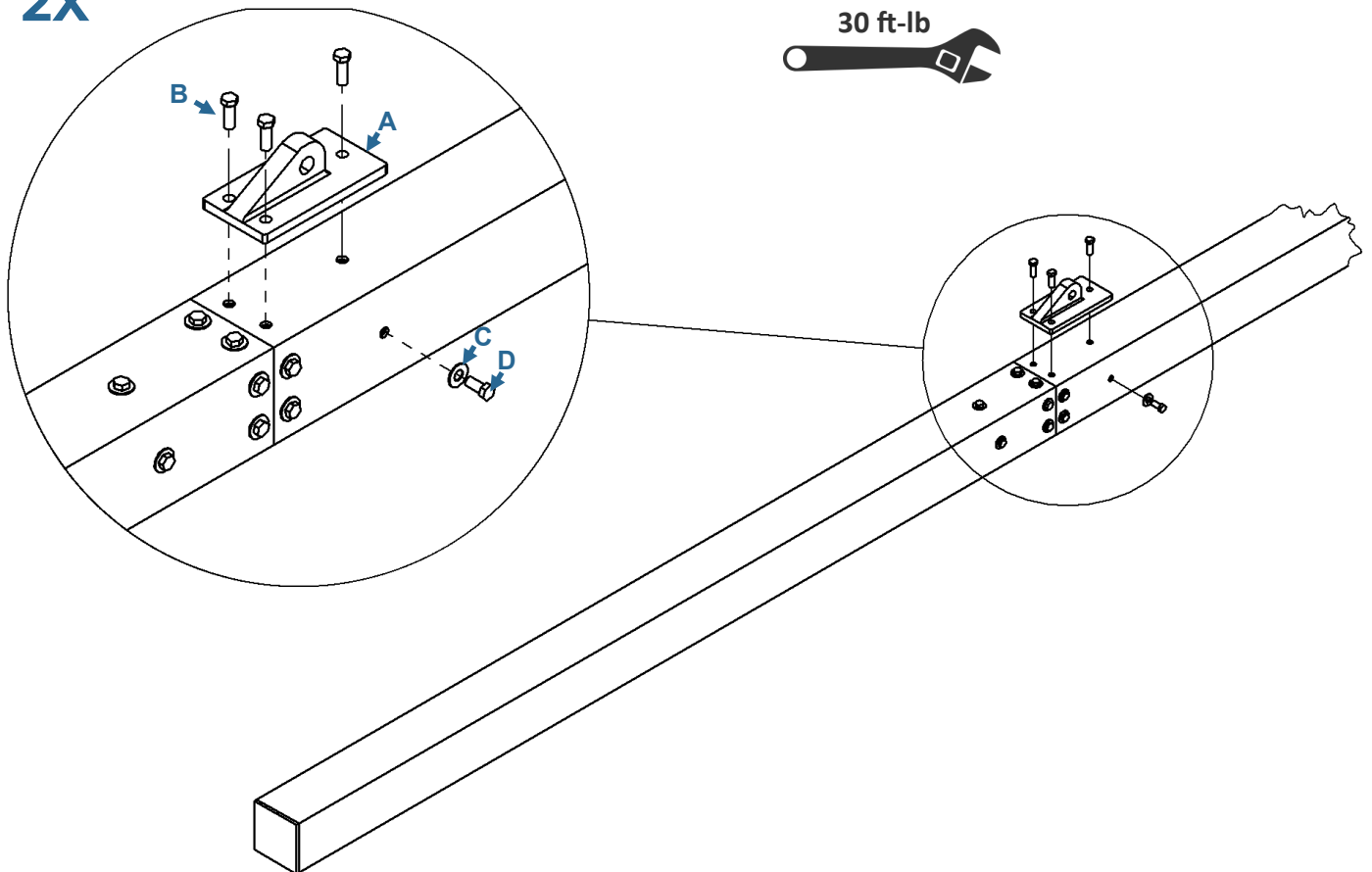
Apply the provided Loctite 243 to the Hex bolts before installing them, just a few drops will do. This is critically important to prevent the bolts from loosening due to vibrations! Tighten and torque the bolts immediately after applying Loctite.

- Install the boom truss attachment bracket on the top face of the boom (opposite of the drain hole).

Key	QTY	Part Number	Description
A	1	10-1601-82	Boom Truss Attachment Bracket
B	3	60-7003	Hex Bolt, 3/8 x 1in
C	9	60-0034	Washer, 3/8
D	9	60-7001	Hex Bolt, 3/8 x 3/4in



2X

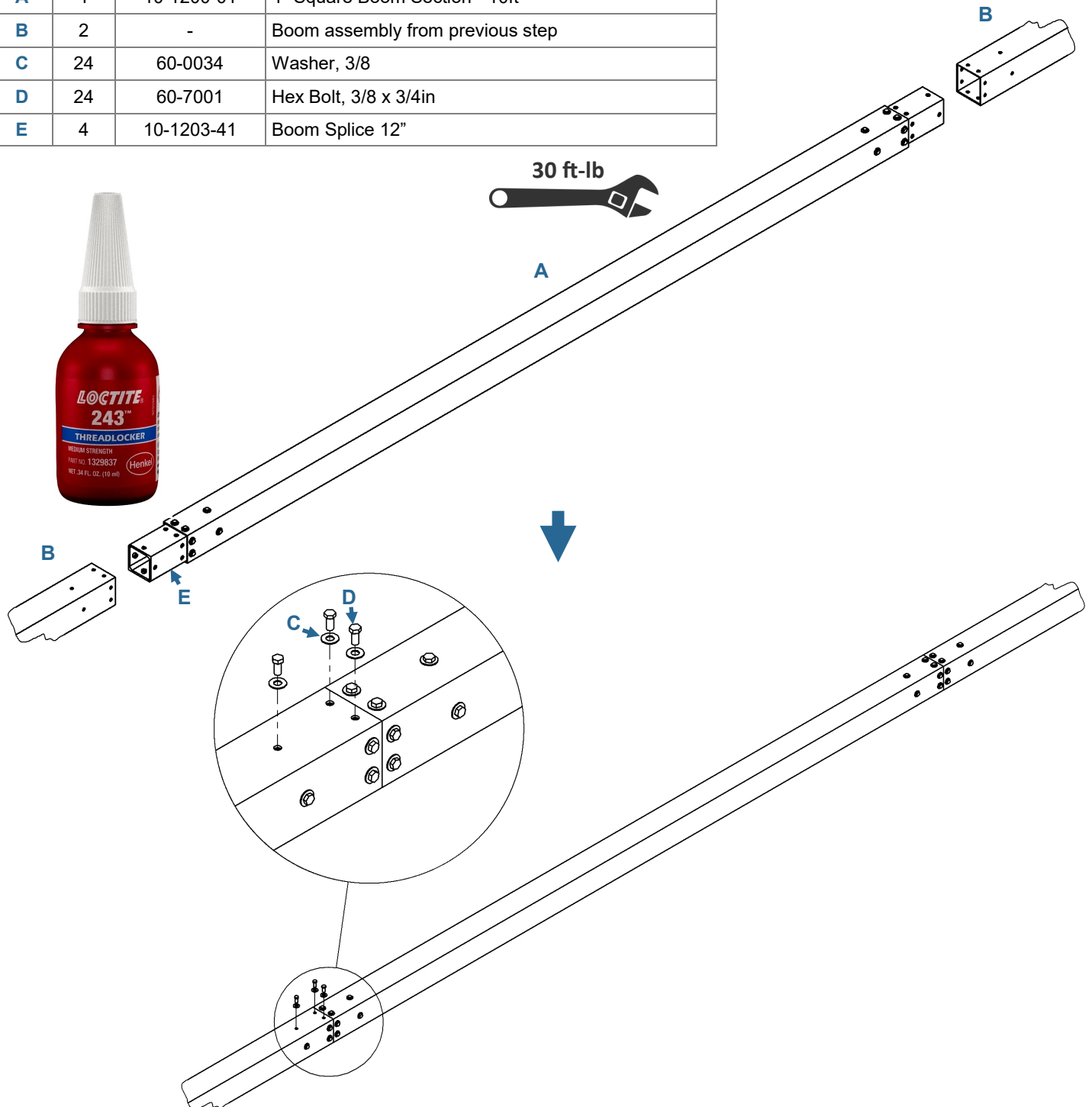


BOOM ASSEMBLY

Apply the provided Loctite 243 to the Hex bolts before installing them, just a few drops will do. This is critically important to prevent the bolts from loosening due to vibrations! Tighten and torque the bolts immediately after applying Loctite.

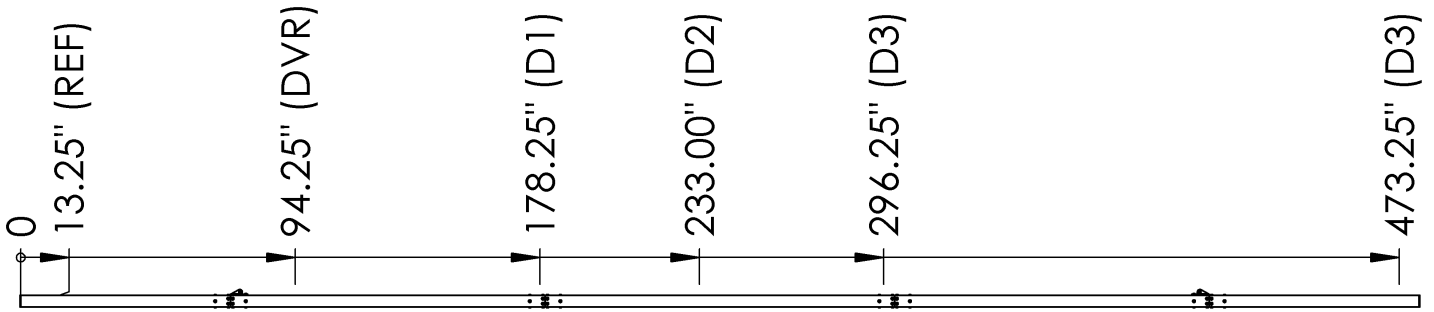
- Install the boom truss attachment bracket on the **top face** of the boom (opposite of the drain hole).

Key	QTY	Part Number	Description
A	1	10-1200-01	4" Square Boom Section - 10ft
B	2	-	Boom assembly from previous step
C	24	60-0034	Washer, 3/8
D	24	60-7001	Hex Bolt, 3/8 x 3/4in
E	4	10-1203-41	Boom Splice 12"



BOOM ASSEMBLY—MARKING THE BOOM

- The location of the element plates and mast plate is critically important. Take care when measuring and double check your measurements.
- Pick one end of the boom (it doesn't matter which) to be the back of the antenna. Measuring from the back of the antenna, mark the boom with a permanent marker/paint pen at the locations listed in the table below. Label the marks with the indicated labels for future reference.



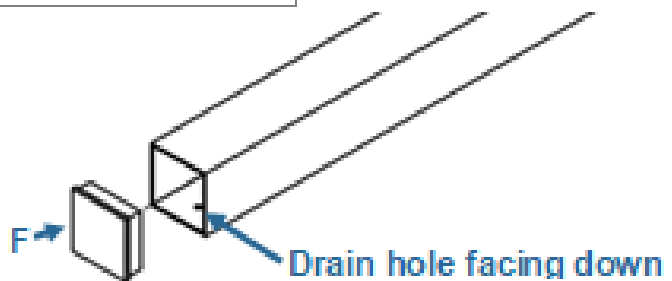
BACK

FRONT

Description	Label	Distance (in)	Distance (cm)
Reflector Element Mounting Plate	REF	13.25	34
Driven Element Mounting Plate	DVR	94.25	239
Director 1 Element Mounting Plate	D1	178.25	453
Mast Plate	MAST	233	592
Director 2 Element Mounting Plate	D2	296.25	753
Director 3 Element Mounting Plate	D3	473.25	1202

After measuring and marking the antenna, cap the end of the antenna as shown in the diagram below.

Key	QTY	Part Number	Description
F	1	60-7023	Plug for Square Tube, 4", Black



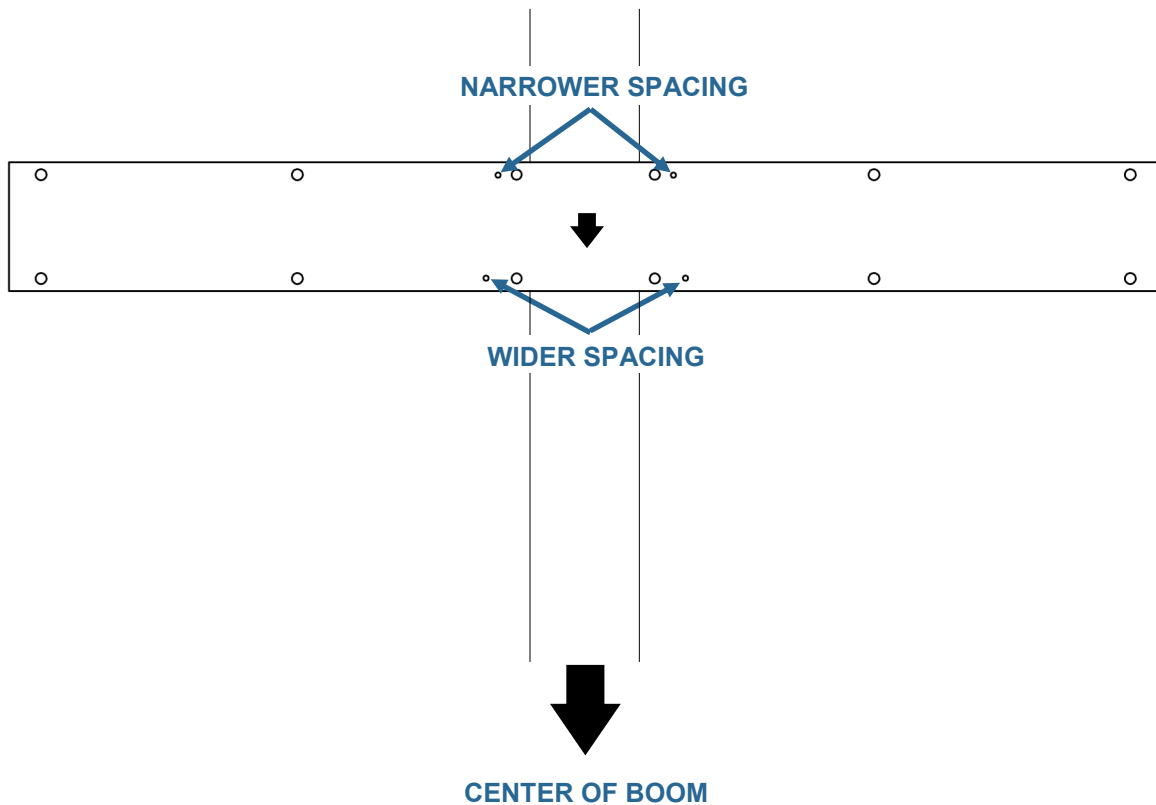
ELEMENT PLATE INSTALL—OVERVIEW



Note the orientation of the element plates before installing them on the boom!

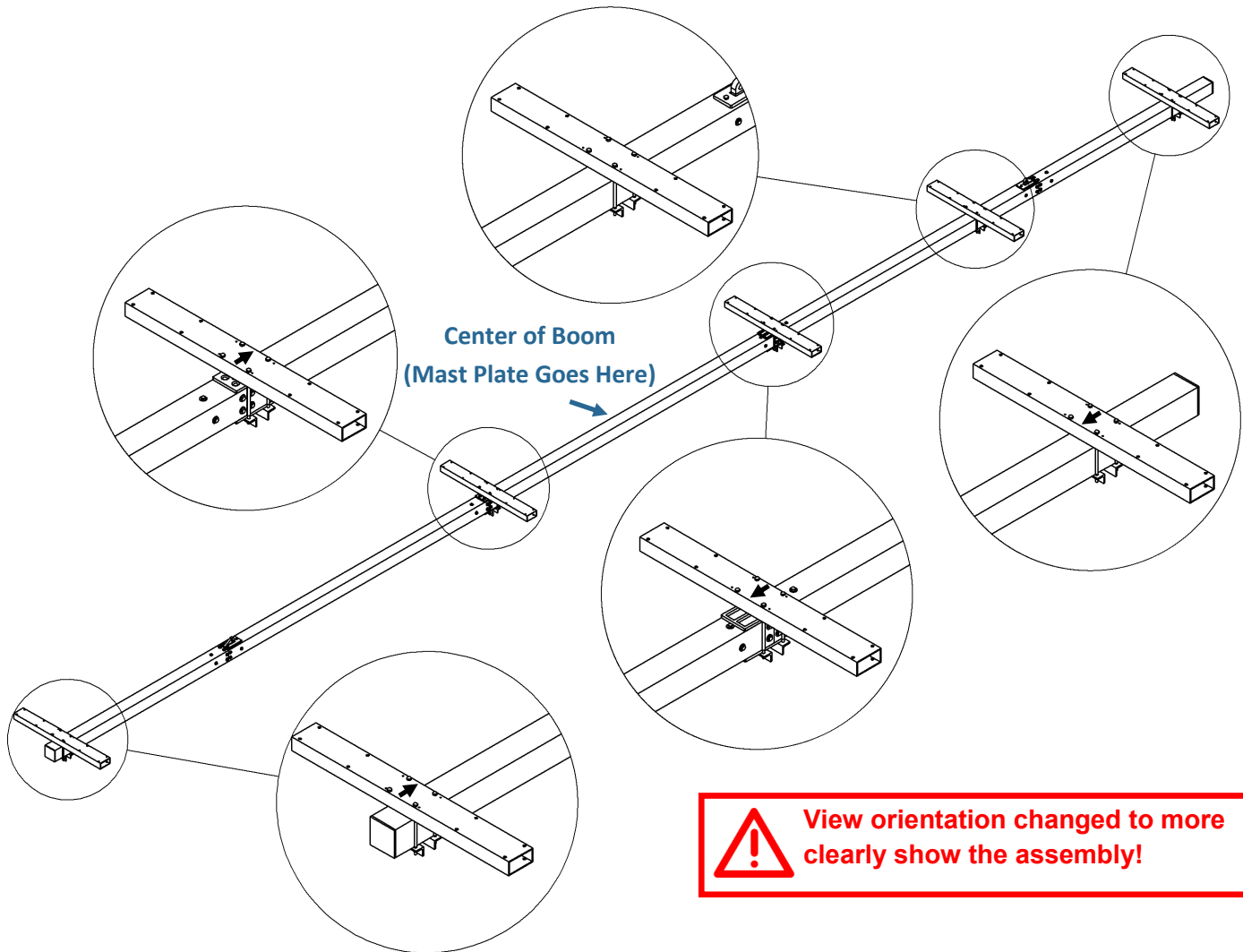


- In the following steps, the element mounting plates will be installed on the boom. The orientation of these plates is important because they are **NOT** symmetrical. There are two important things to note:
 1. The mounting plate must be installed with the four threaded #10-32 holes facing **UP**.
 2. The plate should be oriented with the wider spaced tapped holes closer to the boom center. The imaginary black arrow shown on the plate should point towards the center of the boom regardless of where the plate is located.



ELEMENT PLATE INSTALL—OVERVIEW

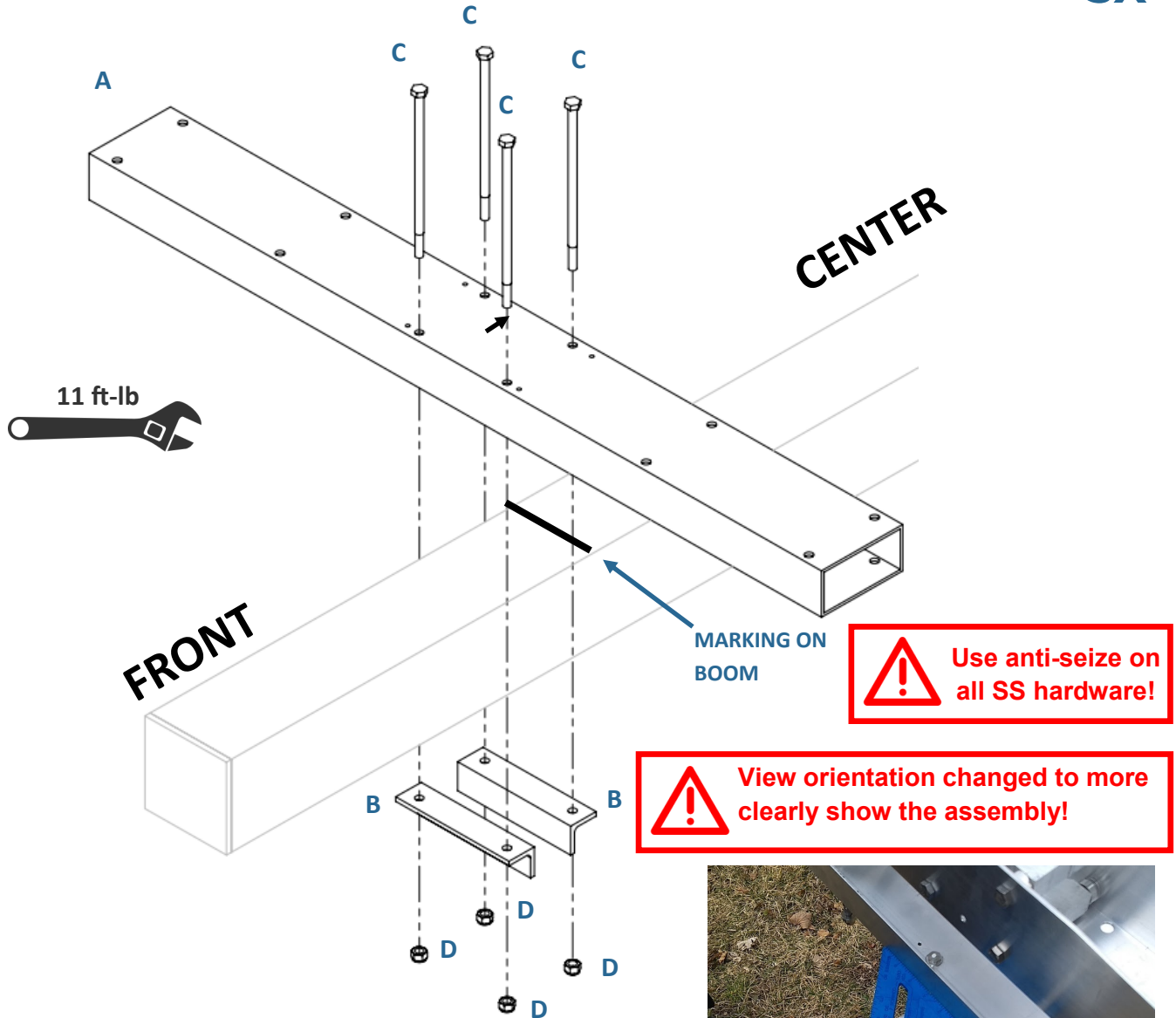
- 5 element plates will be installed on the boom. Use the markings on the booms to position the element plates correctly. **The position of the element plates is very important as the performance of the antenna depends on accurate element placement!**
- Note the orientation of each element plate, they are NOT all the same.



ELEMENT PLATE INSTALL

- Install the element plates following the drawing below. Use the markings on the boom to position the plates. Place the plates on the side of the mark closer to the FRONT of the antenna. **DO NOT INSTALL ELEMENT PLATES D1 AND D2 YET.** There are special steps for those two that are detailed on the following page.
- Note the orientation of the mounting plate! The plate is **NOT** symmetrical and must be installed with the wider spaced threaded holes closer to the **center** of the antenna.
- Use a speed square to position the element plate perpendicular to the boom as shown in the photo below.
- Tighten the hex bolts to **11 ft-lb** with the torque wrench on the nut side.

5X

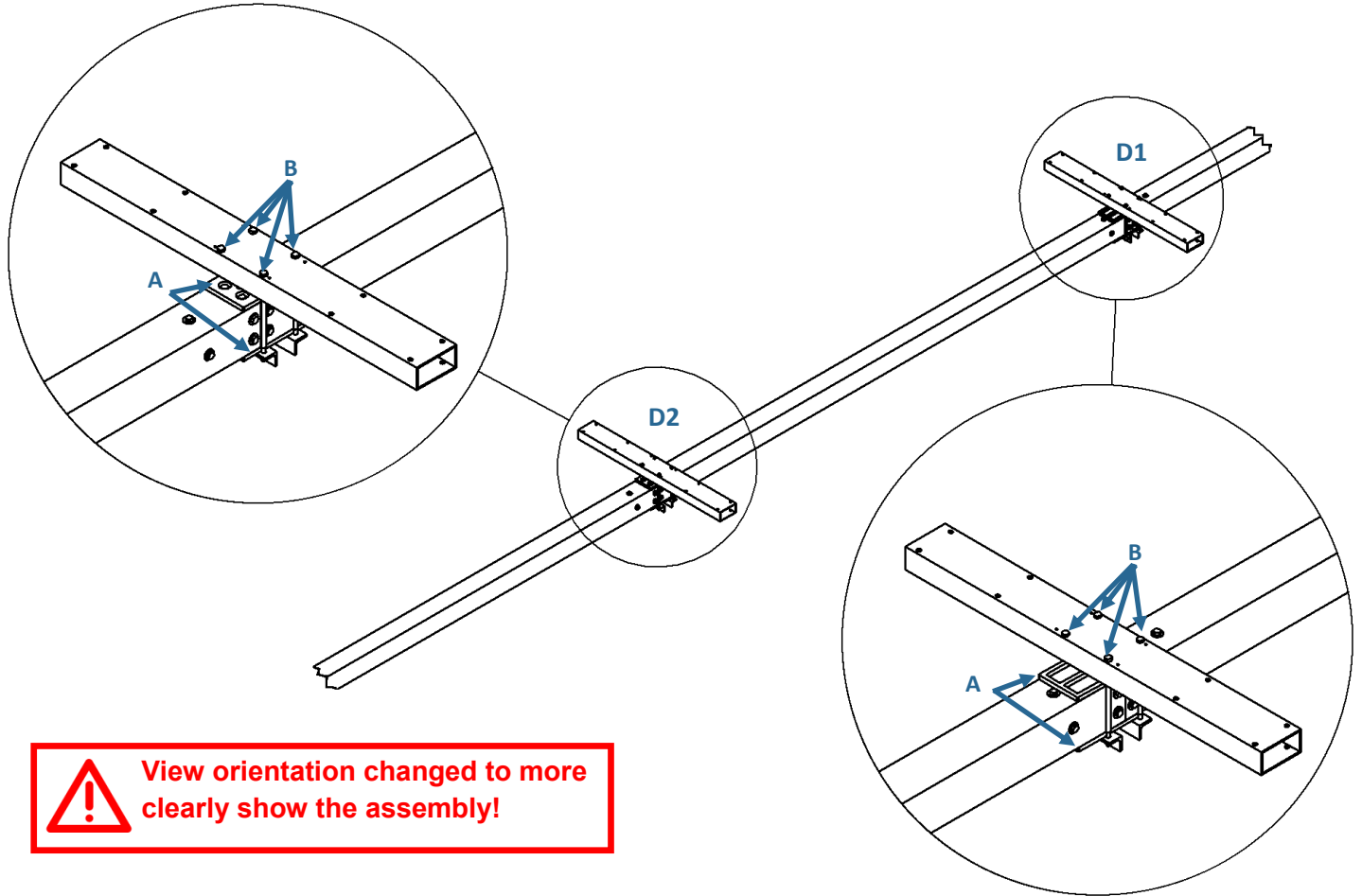


Key	QTY	Part Number	Description
A	1	10-1605-31	Element Mounting Plate—Lower
B	2	10-1601-91	Backing Plate
C	4	60-0215	Hex Bolt, 5/16 x 7"
D	4	60-0046	Nut, 5/16, Nylock



ELEMENT PLATE INSTALL

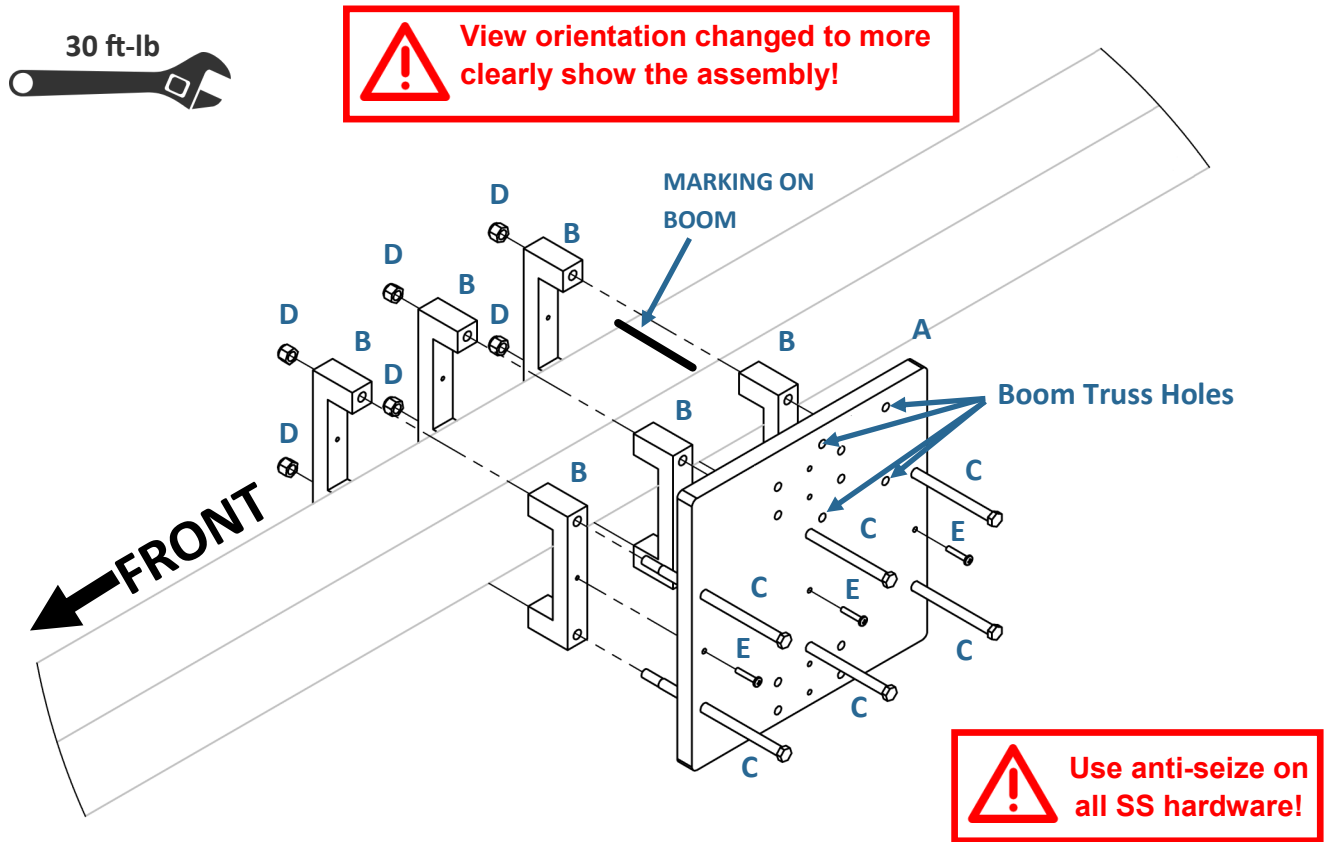
- Install the Director 1 and Director 2 element plates following the drawing below.
- Note the element plate spacer on the top and bottom face of the boom. Align the holes in the plate with the hex bolts and washers and orient it such that the mounting plate and lower backing plates rest entirely on the spacer.



Key	QTY	Part Number	Description
A	4	10-1613-31	Element Mounting Plate Spacer
B	8	60-7032	Hex Bolt, 5/16 x 8"
-	2	10-1601-91	Backing Plate
-	4	60-0046	Nut, 5/16, Nylock

MAST PLATE INSTALL

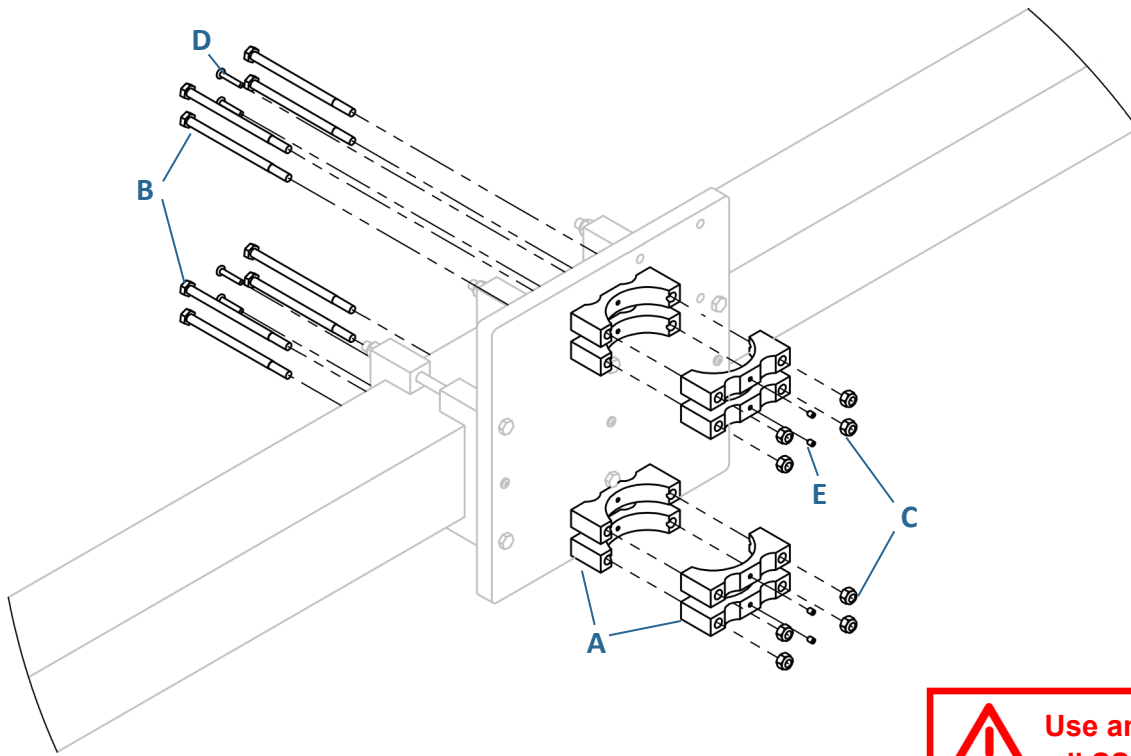
- Install the mast plate as shown below. Use the marking on the boom to position the mast plate.
- Note the four holes for the boom truss mast are closer to the front of the antenna.
- **Note:** If you are side-mounting the antenna on a tower, you may need to mount the mast plate on the opposite side of the boom. This is okay as long as you make sure that the boom truss mast attachment holes are still closer to the front of the antenna.
- Tighten the hex bolts down to **30 ft-lb** with the torque wrench on the nut side.



Key	QTY	Part Number	Description
A	1	10-1021-51	HFT540 Mast Plate
B	6	10-1601-71	Square Saddle, 4"
C	6	60-7002	Hex Bolt, 3/8 x 7"
D	6	60-0050	Nut, 3/8, Nylock
E	3	60-0101-01	Pan Screw, #10-32 x 1" w/locking strip

MAST PLATE INSTALL—CONTINUED

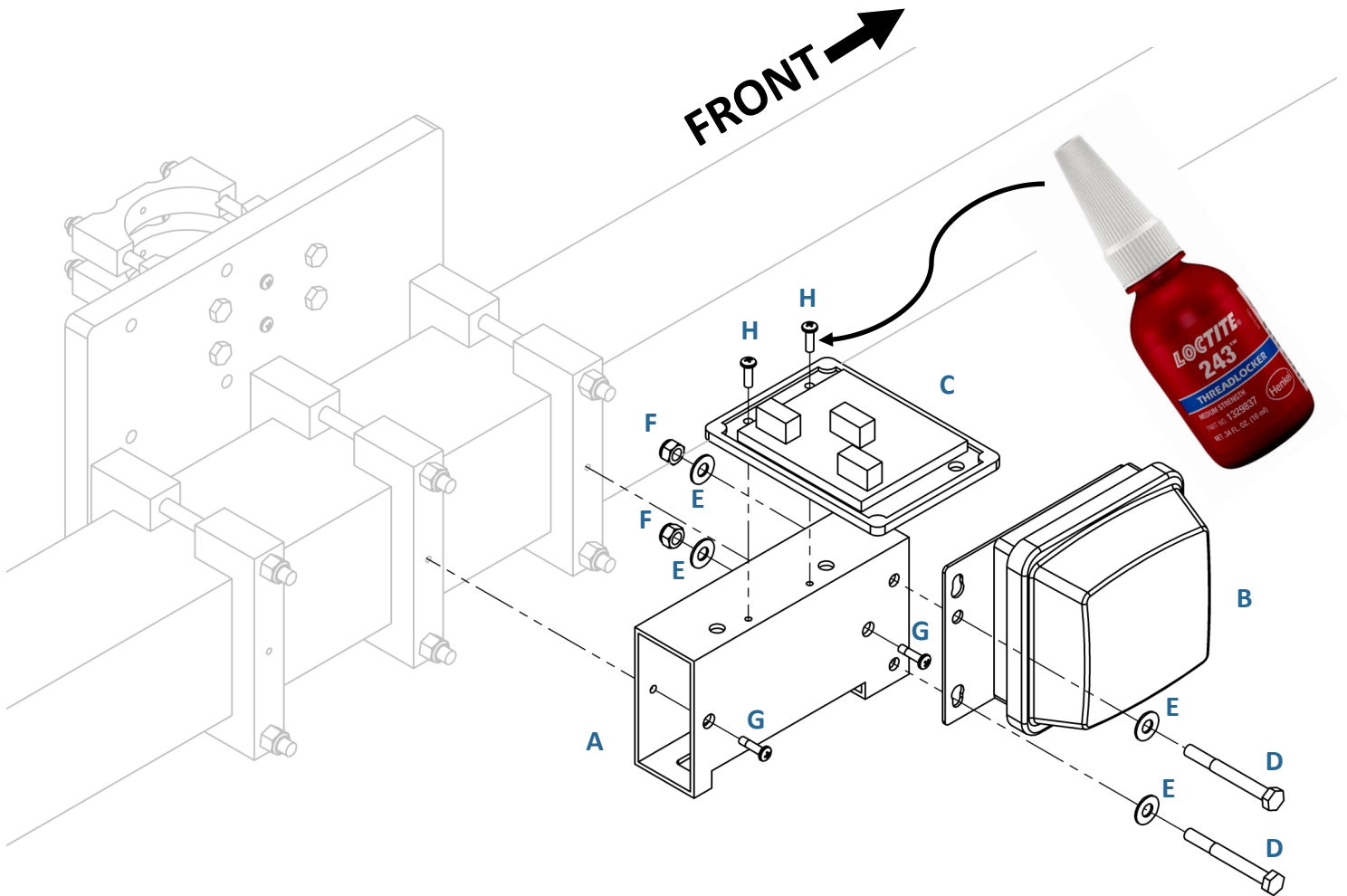
- The antenna uses saddles that are designed to mount onto a 3" OD pipe.
- Use the 10-32 pan screws to hold the inner saddles in place while the antenna is mounted onto the mast. Then install the hex bolts and nuts. Do not tighten the hardware until the antenna is installed onto the mast.
- Remember to install and tighten the set screws after the antenna is mounted to the mast. This will help prevent the antenna from twisting around the mast.



Key	QTY	Part Number	Description
A	8	10-1601-61	Saddle, 3"
B	8	60-0141	Hex Bolt, 5/16 x 5"
C	8	60-0046	Nut, 5/16, Nylock
D	3	60-0101-01	Pan Screw, #10-32 x 1" w/locking strip
E	4	60-0112	Set Screw, 10-32 x 1/4"

COAX SWITCH AND JUNCTION BOX ASSEMBLY

- Apply blue Loctite to the 10-32 x .625" Pan Screws (H) before installing them in the threaded holes in the mounting bracket.
- Be careful when tightening the hex bolts (D) as the mounting bracket will deform. Tighten just until the mounting bracket square tube begins to bow inward.
- **Note:** you may need to shift the location of the coax switch and junction box assembly over one saddle if you chose to mount the mast plate on the opposite side of the boom (relative to what is shown in this manual).



Key	QTY	Part Number	Description
A	1	10-1619-11	Coax Switch / Connector Junction Dual Mounting Bracket
B	1	70-2038	Connector Junction Box
C	1	70-3001-01	Coax Switch Box
D	2	60-0093	Hex Bolt, 5/16 x 2.75"
E	4	60-0033	Washer, 5/16
F	2	60-0046	Nut, 5/16, Nylock
G	2	60-0101-01	Pan Screw, #10-32 x .75", w/locking strip
H	2	60-0113	Pan Screw, #10-32 x 0.625

COAX SWITCH WIRING

- Locate the 4 conductor control cable and cut off a 2ft length. This cable will connect the coax switch box to the connector junction box.
- Trim the cable jacket off (about 1.5" will suffice) and remove the foil. Be careful when removing the cable jacket—too much pressure can cause damage to the other wires.
- Trim the reinforcing thread so that you end up with a cable end that looks like [figure 10.05](#). Only three of the four wires are used, along with the shield wire. The green wire needs to be trimmed as shown in [figure 10.06](#).
- Use electrical tape to cover the end of the trimmed green wire, to ensure that there is no opportunity for an electrical short to occur. [Figure 10.07](#) shows the completed control wire prep.

FIG. 10.05

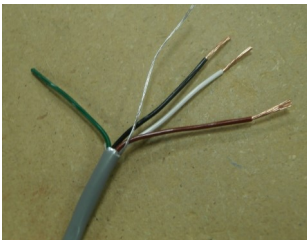


FIG. 10.06

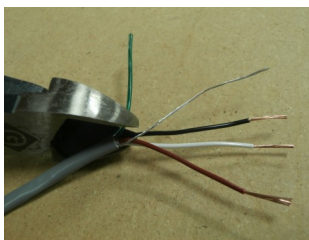
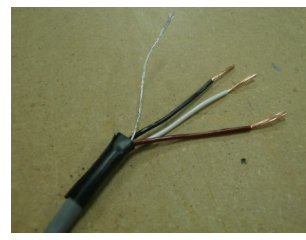


FIG. 10.07



COAX SWITCH WIRING—CONTINUED

- Figure 10.10 shows the wiring sequence for the coax switch. Be certain not to use terminal pin R4. This is the green wire that was cut off in the earlier step.
- Always dip your bare copper wire ends into the provided connector protector before securing to the terminal connections. Insert wires as shown in figure 10.12.
- Form a knot in the control cable as shown in figure 10.13. This will serve nicely as a strain relief. Be careful not to over-stress the control cable while forming your knot. Alternatively, a tie wrap works well.

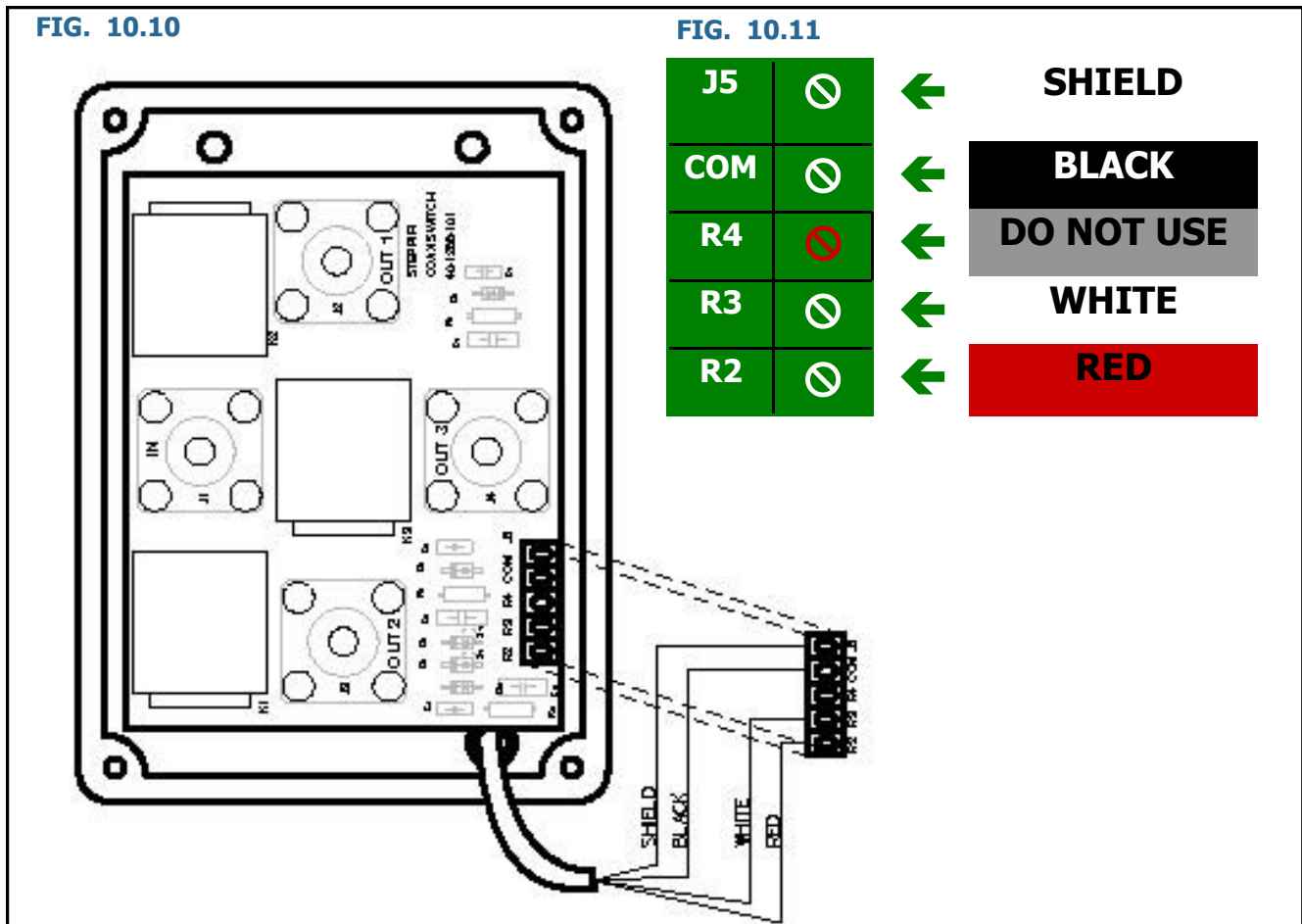


FIG. 10.12

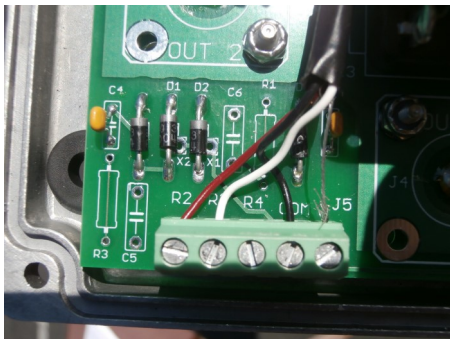
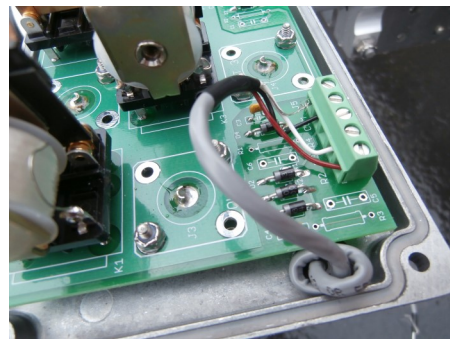


FIG. 10.13



COAX SWITCH WIRING—CONTINUED

- Locate the small plastic bag that contains the enclosure gasket and the screws used for securing it as shown in [figure 10.20](#). Inside this baggie there will also be two tiny 1/4" screws—these will not be used.
- Push the gasket into the gasket tray as shown in [figure 10.21](#). There is plenty of material, and you will need to trim it as shown in [figure 10.22](#).
- Lower the top half of the enclosure and position so that the mounting holes are lined up as shown in [figure 10.23](#). Locate the flathead threaded screws included in the plastic baggie. The screws will be inserted from the bottom of the housing as shown in [figure 10.24](#). Tighten so that the lid is firmly in place and the gasket is compressed..
- You will likely need to take the lid off for the final wiring test, but leaving it in place is necessary in order to protect the components of the coax switch housing while completing assembly of the antenna.
- [Figure 10.25](#) shows the completed coax switch housing. (note that these instructions were borrowed from a different antenna so the mounting scenario will be different).

FIG. 10.20



FIG. 10.21

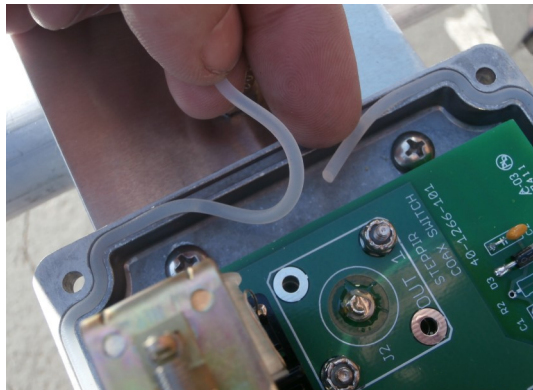


FIG. 10.22

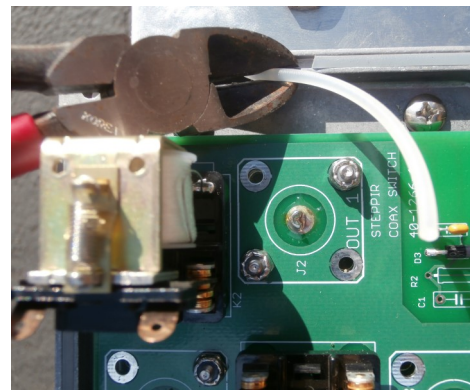


FIG. 10.23

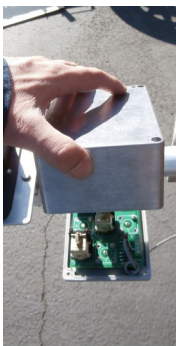


FIG. 10.24

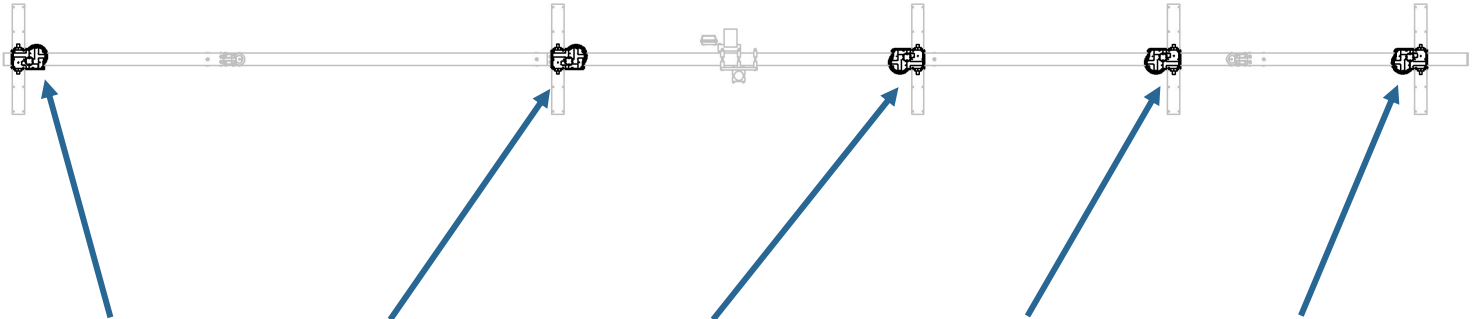


FIG. 10.25



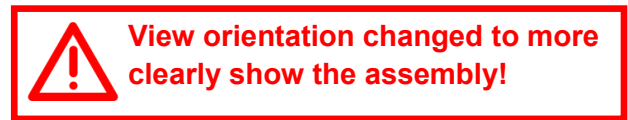
EHU WIRING INSTRUCTIONS

- The control cable is shipped as a single piece which must be cut to the appropriate length for each element. Note that two of the passive elements use 4 conductor (black) cable and three driven elements use 6 conductor (grey) cable (refer to the table below).
- Cut the control cable to the correct lengths as indicated in the table below. There will be two or three feet of slack on each element.



Director 3 (D3)	Director 2 (D2)	Director 1 (D1)	Driven (DVR)	Reflector (REF)
40/30 Passive	40m Driven Normal Driven relay	40m Driven Normal Passive relay	20m Driven Normal Passive relay	40/30 Passive
70-3414-01	70-3415-01	70-3412-01	70-3413-01	70-3414-01
4 Conductor	6 Conductor	6 Conductor	6 Conductor	4 Conductor
24'	7'	8'	15'	24'

- Make sure to pair each control cable with the appropriate EHU after you cut it.



EHU WIRING INSTRUCTIONS

- Once you have cut the control cable for each element repeat the following steps for each cable:
 - Trim approximately 1.5 inches of the outer jacket of one end of the control cable.
 - Remove the shield material, the support thread and cut the ground wire off as shown in [figure 3.11](#).
 - 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. [Figure 3.1](#) shows the control cable should look like when you are finished with the trimming (6 conductor is shown).
 - Dip each of the copper wires into connector protector. [Figure 3.12](#) shows what the connector protector will look like.
 - Remove the green phoenix terminal plug from the EHU header and use a flathead screwdriver to open the terminals.
 - Insert the wires into the appropriate terminal following the wiring sequence shown in [figure 3.14](#). Be careful to ensure that there are no bare wires protruding out from the terminal clamps. **Also be sure that when you tighten the terminals you are clamping on the bare wire and not the insulation!** This can happen if you don't strip enough insulation off the wires or if you insert them too far into the terminal.

FIG. 3.11

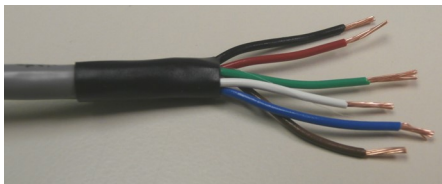


FIG. 3.12



FIG. 3.13

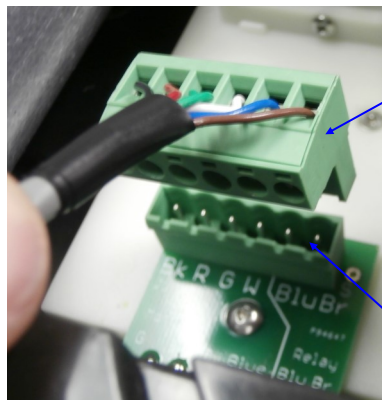


6 Pin Header Wiring Sequence (EHU's with Relays)

BLACK RED GREEN WHITE BLUE BROWN

4 Pin Header Wiring Sequence (EHU's without Relays)

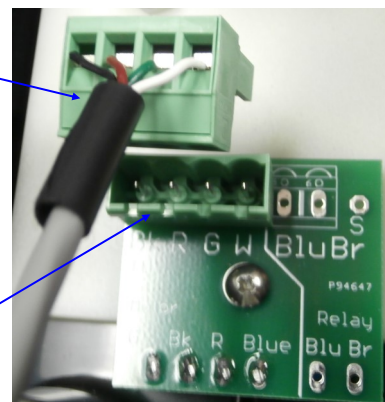
BLACK RED GREEN WHITE



TERMINAL PLUG

FIG. 3.14

TERMINAL HEADER



EHU WIRING INSTRUCTIONS—CONTINUED

8. Plug the phoenix plug **firmly** into the EHU header and double check that the wires match the colors written on the PCB
9. Lay the control cable wire inside the wire tray of the EHU as shown in [figure 3.16](#). 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 3.17](#).
10. Cut the provided coax seal into 1 inch strips as shown in [figure 3.15](#). You will need three strips per EHU. The remainder can be used to seal the driven element SO239 connectors.
11. 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 3.18](#). This will help keep water from entering into the EHU.
12. Repeat wiring and coax seal preparation for each EHU.



**Make sure that you are using the correct length of control cable for each EHU!
It is much easier to correct a mistake before you install the lid.**



Figure 3.15

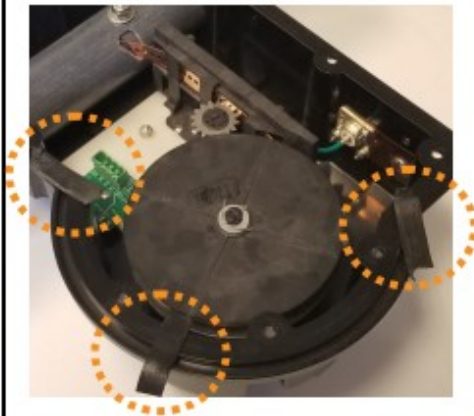


Figure 3.16

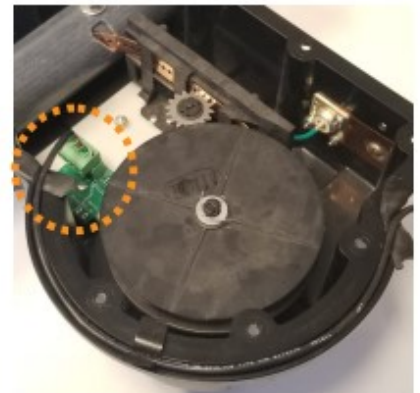


Figure 3.17

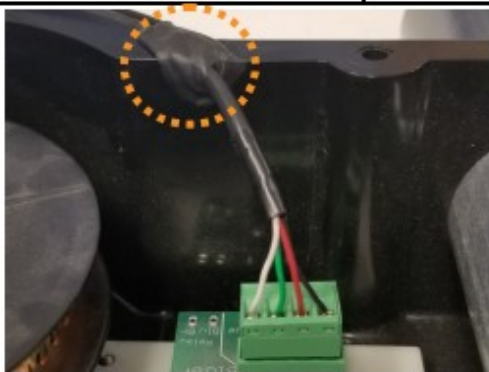


Figure 3.18

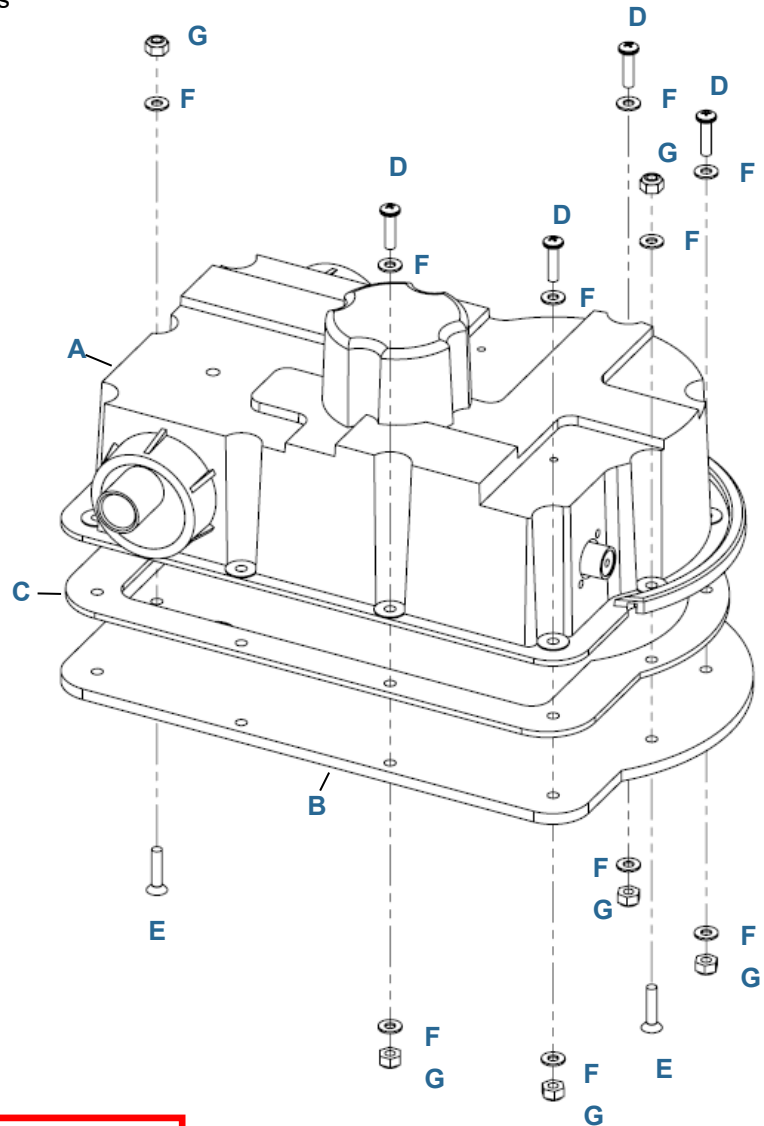
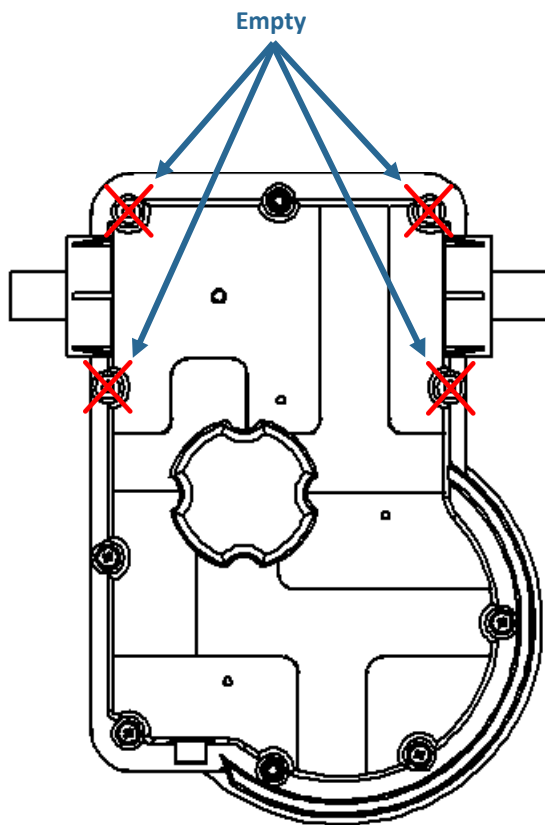


Figure 3.19

EHU LID ASSEMBLY

5X

- Install the lid on each EHU as shown. The lid hardware and gasket are stored in the box with the EHU.
- Use the provided anti-seize stick on the bolt threads to prevent galling!
- **Do not over tighten the bolts!** Tighten the bolts just until the gasket is fully compressed.
- Note that 4 of the bolt holes are not occupied, these will be used to attach the EHU to the element plate in the next step. These empty locations are shown below with **red X markings**.

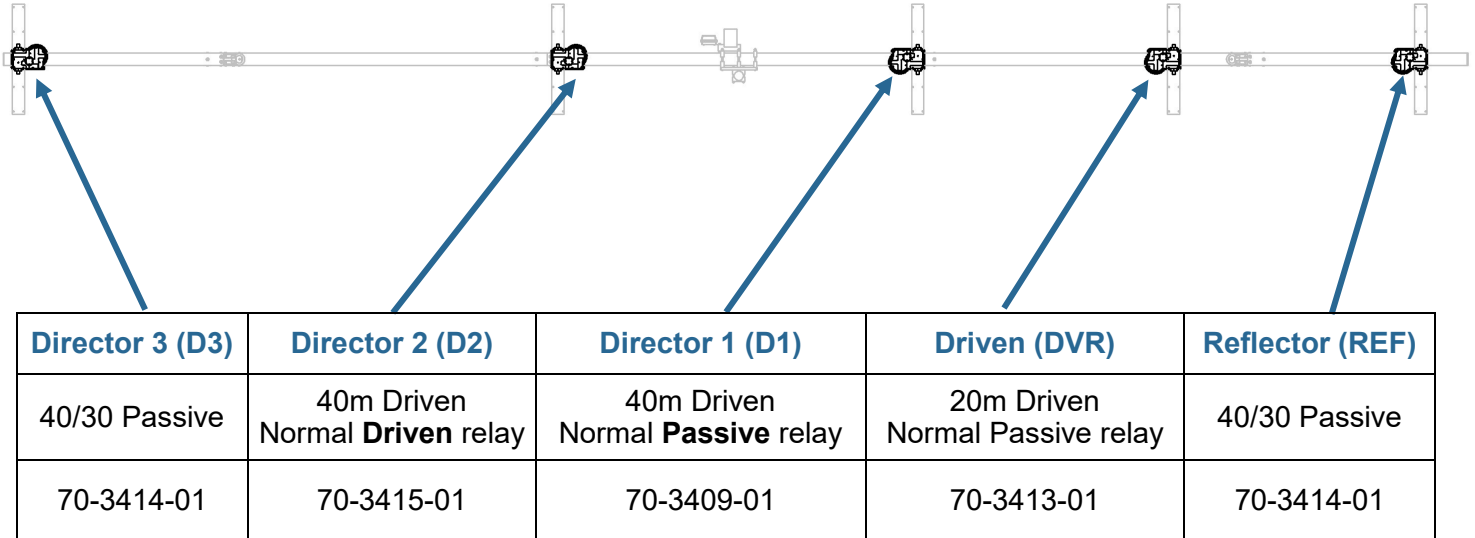



Use anti-seize on all SS hardware!

Key	QTY	Part Number	Description
A	1	-	EHU
B	1	10-1501-23	Cover for EHU, w/drain hole
C	1	10-1502-01	EHU Gasket
D	4	60-0017	Pan Screw, 10-32 x 3/4"
E	2	60-0017-10	Flat Head Screw, 10-32
F	10	60-0018	Washer, 10-32, Flat
G	6	60-0019	Nut, 10-32, Nylock

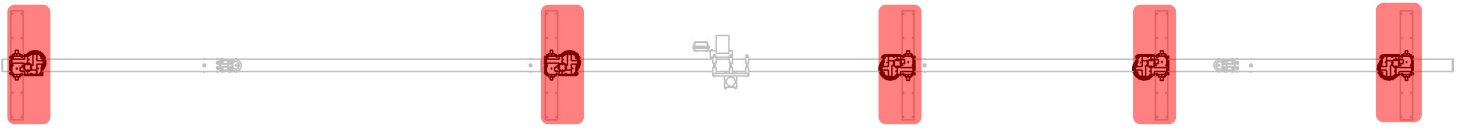
EHU INSTALL—OVERVIEW

- The graphic below provides an overview of the placement of the EHUs on the antenna.



 **View orientation changed to more clearly show the assembly!**

EHU INSTALL

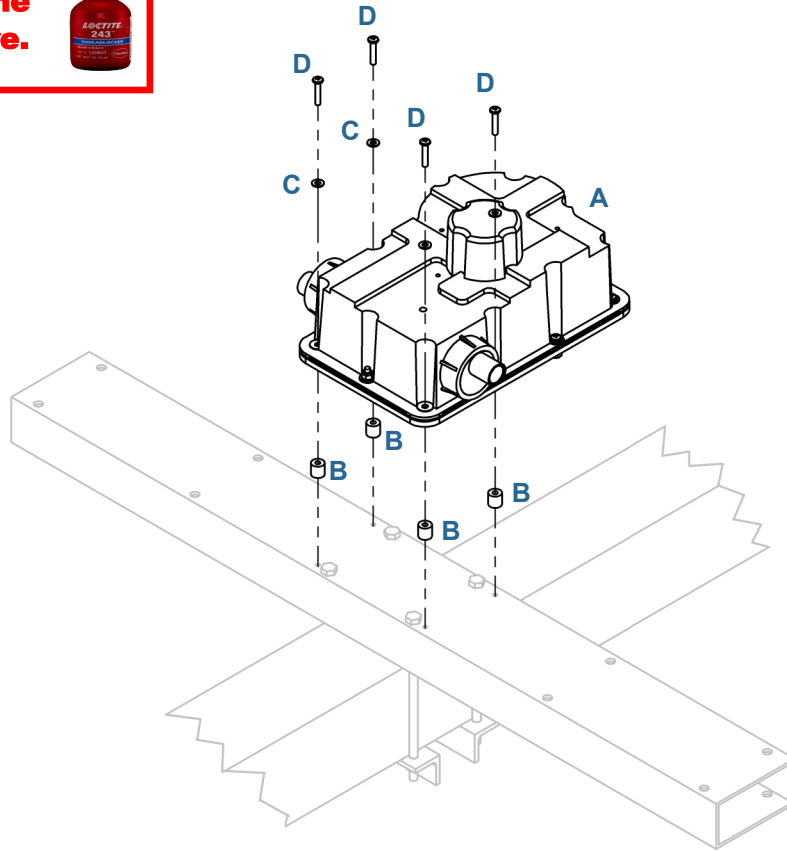




Apply Loctite 243 to the hardware.



5X



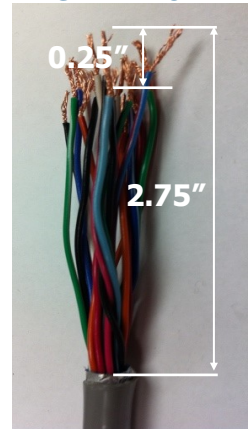
Key	QTY	Part Number	Description
A	1	-	EHU (see previous page for correct type)
B	4	10-1613-13	Aluminum Spacer, #10 ID x 0.25" height
C	4	60-0018	Washer, #10
D	4	60-0072	Pan Screw, #10-32 x 1.25" w/locking strip

CONTROL CABLE WIRING

PREPARING THE CONTROL CABLE

1. Strip the jacket and aluminum shielding off of the both ends of the control cable as shown in figure 11.20, approximately 2.75" from the 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.

FIG. 11.20



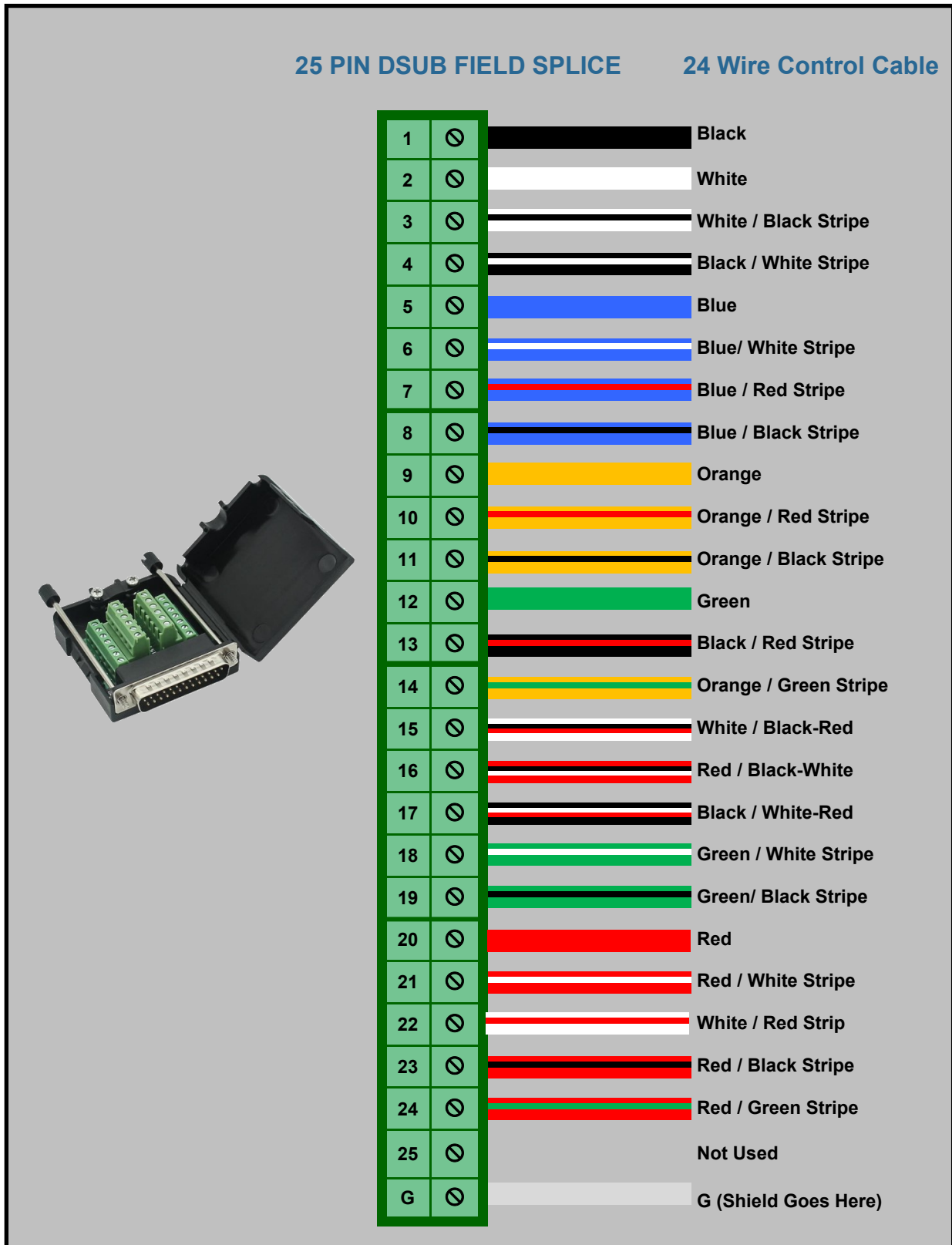
CONNECTING CONTROL CABLE TO THE OPTIONAL DB25 FIELD SPLICE

The DB25 Field Splice provides 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 the provided 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 following 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.
6. Plug the DB25 splice into the back of the controller and twist the thumb-screws to secure it.

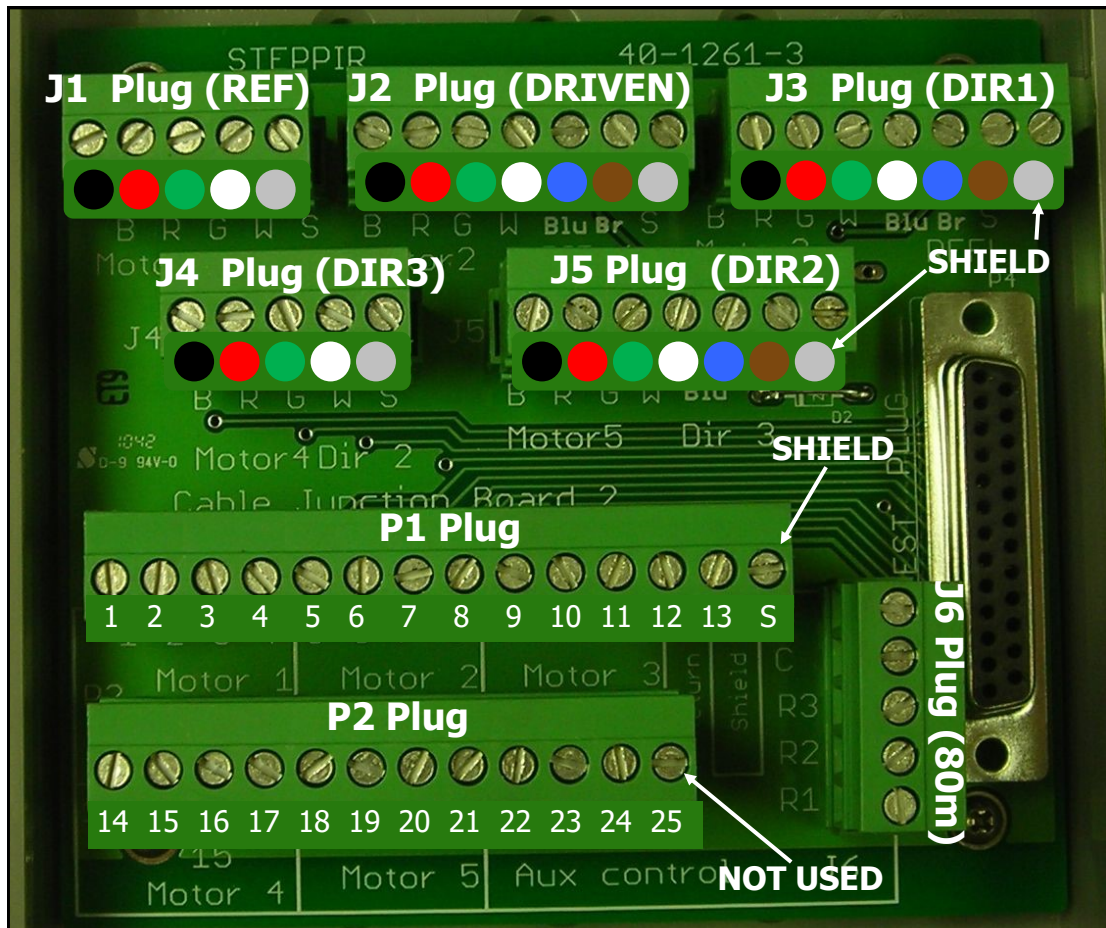


CONTROL CABLE WIRING



JUNCTION BOX WIRING—OVERVIEW

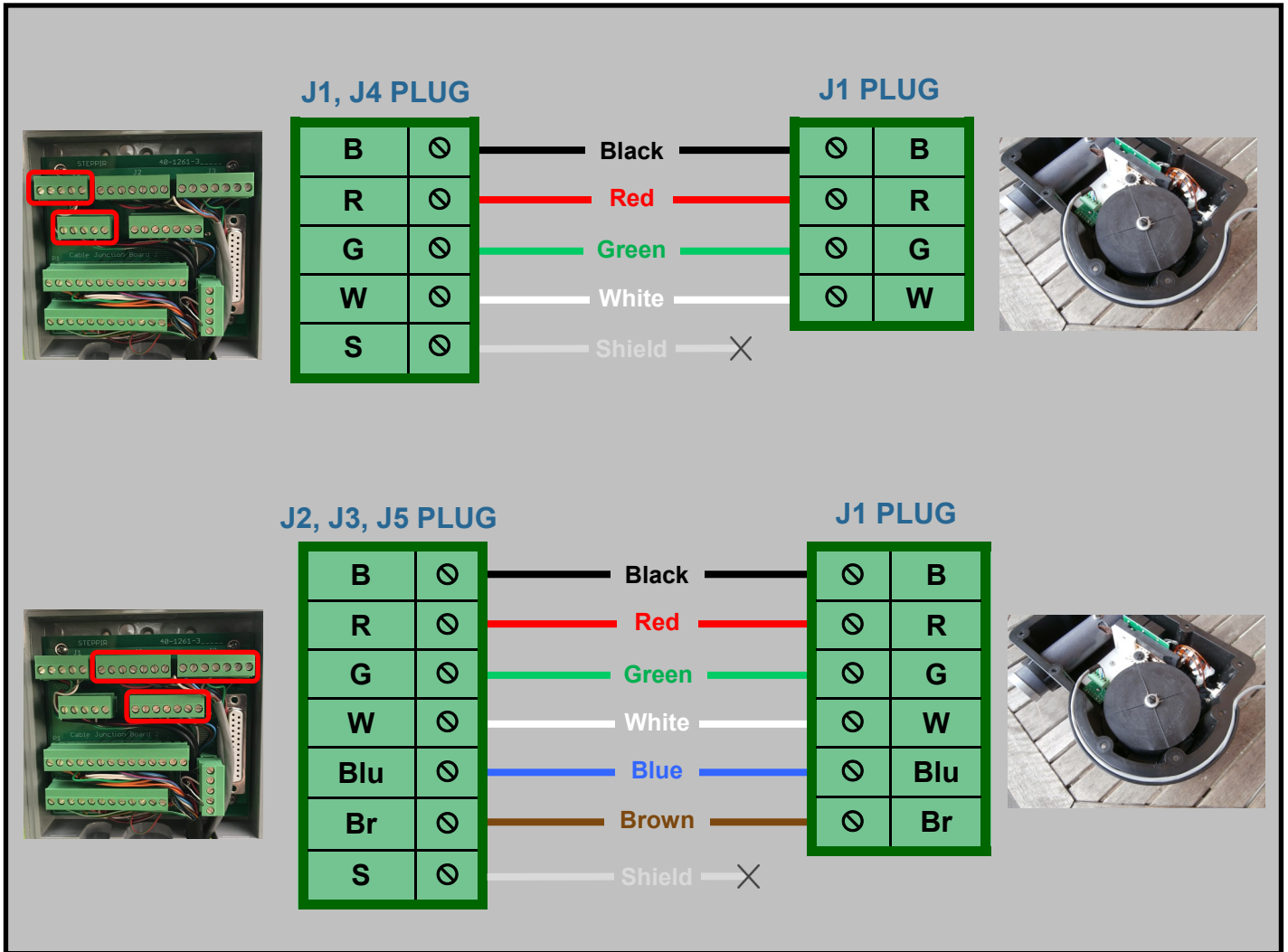
- All electrical functions of the antenna are routed through the connector junction box.
- The junction box is shipped with plugs J1—J6, P1, and P2 inserted into headers on the PCB.
- Remove the plugs from the junction box before inserting the appropriate control cable into them, then re-insert into the headers pressing firmly.



ID	Cable Routed From:	Installation Notes
J1	REFLECTOR	4 wire control cable, plus shield wire (all wires used).
J2	DRIVEN	6 wire control cable, plus shield wire (all wires used).
J3	DIRECTOR 1	6 wire control cable, plus shield wire (all wires used).
J4	DIRECTOR 3	4 wire control cable, plus shield (all wires used)
J5	DIRECTOR 2	6 wire control cable, plus shield (all wires used)
P1	CONTROL CABLE FROM GROUND	The first 13 wires of the 24 the conductor cable used (Pins 1-13), plus the shield wire.
P2	CONTROL CABLE FROM GROUND	The remaining 11 wires of the 24 conductor cable used (Pins 14-24). Pin 25 is NOT USED .
J6	COAX SWITCH	4 wire control cable; the green wire needs to be trimmed and taped; R1 is NOT USED . 3 total wires used, plus shield wire.

JUNCTION BOX WIRING—EHUS










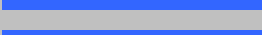


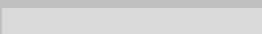
- Wire the loose ends of the control cables coming from the EHUs to the J1—J5 plugs as shown below.
- Review the drawing on the previous page for information about which plug correlates to which element.



CONTROL CABLE WIRING












24 Wire Control Cable

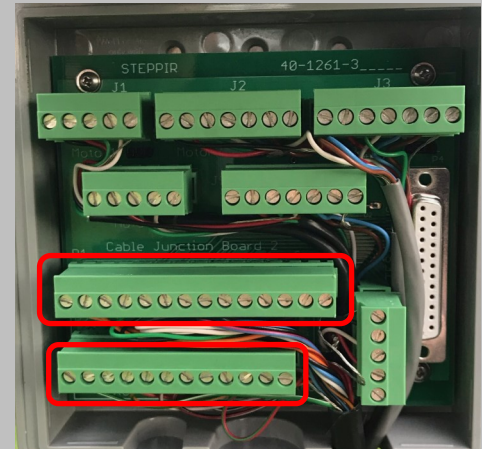
P1 PLUG

ORANGE		⊗	1
ORANGE / RED STRIPE		⊗	2
ORANGE / BLACK STRIPE		⊗	3
GREEN		⊗	4
BLACK		⊗	5
WHITE		⊗	6
WHITE / BLACK STRIPE		⊗	7
BLACK / WHITE STRIPE		⊗	8
BLUE		⊗	9
BLUE / WHITE STRIPE		⊗	10
BLUE / RED STRIPE		⊗	11
BLUE / BLACK STRIPE		⊗	12
BLACK / RED STRIPE		⊗	13
SHIELD WIRE		⊗	S

24 Wire Control Cable

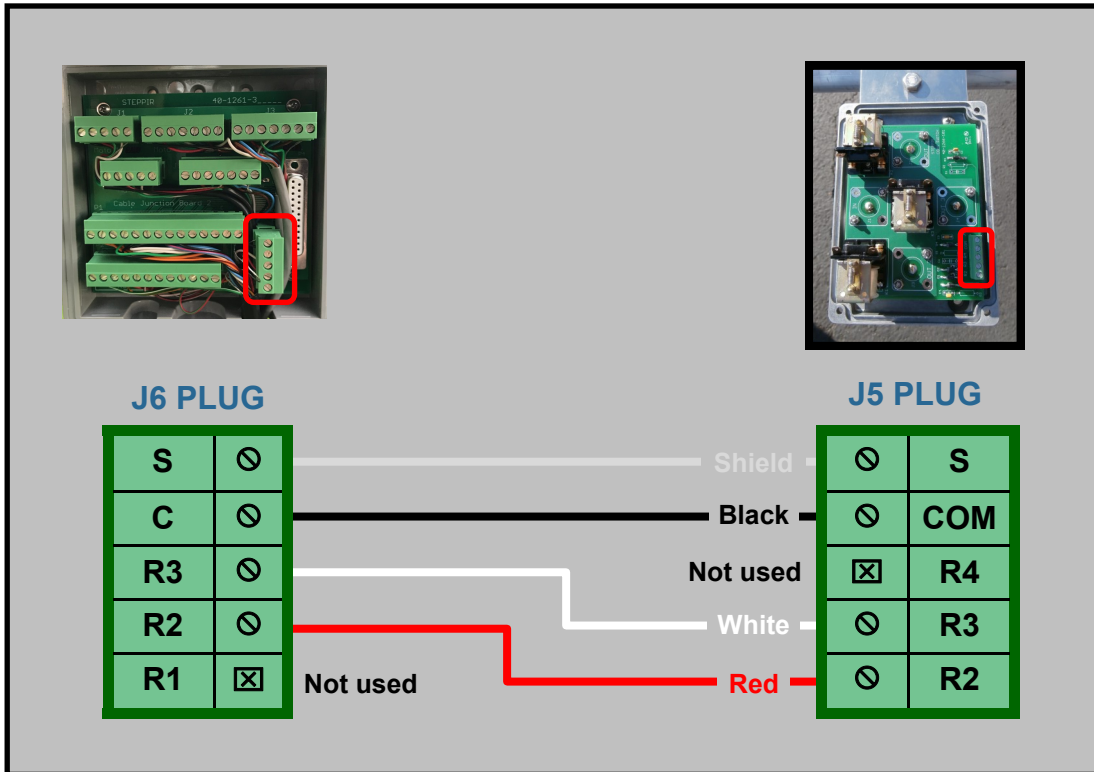
P2 PLUG

GREEN / WHITE STRIPE		⊗	14
GREEN / BLACK STRIPE		⊗	15
RED		⊗	16
RED / WHITE STRIPE		⊗	17
ORANGE / GREEN STRIPE		⊗	18
WHITE / BLACK-RED		⊗	19
RED / BLACK-WHITE		⊗	20
BLACK / WHITE-RED		⊗	21
WHITE / RED STRIPE		⊗	22
RED / BLACK STRIPE		⊗	23
RED / GREEN STRIPE		⊗	24
NOT USED		⊗	25



JUNCTION BOX WIRING—COAX SWITCH

- Connect the other end of the wire that you connected to the coax switch box earlier to the J6 plug in the connector junction box following the drawing below.
- Note that the green wire is not used. Be sure to trim the green wire on each end of the control cable and tape over it to avoid potential electrical shorts.
- Note that the R4 position on the J5 plug and R1 position on the J6 plug are not used!



CONTROL CABLE WIRING TEST

- Once you have installed the control cables we recommend that you perform the following test to confirm that everything is wired correctly. If something is wired incorrectly it could cause damage to the electronics in the antenna controller.
- Take the following measurements on the 25 pin Dsub field splice. Measure on the indicated pin pairs using a multi-meter set to measure Ohms.

Pin Pair	Antenna Element	Expected Resistance
1-2	Driven	~ 20 Ohms
3-4		~ 20 Ohms
5-6	Director 1	~ 20 Ohms
7-8		~ 20 Ohms
9-10	Reflector	~ 20 Ohms
11-12		~ 20 Ohms
14-15	Director 2	~ 20 Ohms
16-17		~ 20 Ohms
18-19	Director 3	~ 20 Ohms
20-21		~ 20 Ohms
13-23	Relay 2	~ 140 or ~ 360 Ohms
13-24	Relay 3	~ 280 or ~ 720 Ohms

- Your results may be slightly higher or lower but the readings for the elements should be consistent. If your results do not match the results of the table below, check your wiring and/or contact SteppIR for assistance.

MOTOR/RELAY TEST

- In the previous step you should have checked that the wiring is correct by measuring the control cable resistances. The following test provides further confidence that everything is working as intended.
- Before beginning these steps read through the OptimizIR Operators Manual so you are familiar with the operation of the controller. Then read through the following section before performing any of the steps below.
- You will also need a multimeter to test for continuity. The jumper cables and fiberglass poles should not be installed on the antenna at this time.

Test Procedure

Step 1: Connect the control cable to the SDA 2000 OptimizIR controller and then connect the power supply to the controller.

Step 2: The display should read “Elements Home”. If not, push the retract button. After the tuning LED stops flashing it should now read “Elements Home”. If “**check fault**” appears in the top right corner of the display, stop and address the fault before proceeding.

Step 3: Press the setup button and scroll to “Motors Test”

Step 4: Test each motor by extending and retracting it (using out-in or cycle). Make sure that the correct motor responds, for example, REF signals the Reflector, DVR signals the Driven element and so on. If the wrong motor responds, a plug may be switched in the junction box or the antenna may be miswired. **Note that the copper tape will only extend 4 inches and that it won't stick out of the CPVC stub on both sides of the EHU.**

Step 5: Exit the motors test menu and select the “Relays Test”

Step 6: Open all relays. Using a multimeter check for continuity between the Coax IN and OUT 3 on the coax switch (probe the center pin of both conductors). Make sure that there is no connection between IN and OUT 1 or OUT 2.

Step 7: Close relay 2. Check for continuity between the Coax IN and OUT 1. Make sure that there is no connection between IN and OUT 2 or OUT 3.

Step 8: Close relay 3. Check for continuity between the Coax IN and OUT 2. Make sure that there is no connection between IN and OUT 1 or OUT 3.

Step 9: Exit the relay test menu. Power off the controller and disconnect the power and control cable.

ADVANCED MOTOR/RELAY TEST (OPTIONAL)

- For added peace of mind, the following “advanced” motor and relay tests may be performed to thoroughly check that the antenna is functioning properly.
- Before beginning these steps read through the OptimizIR Operators Manual so you are familiar with the operation of the controller. Then read through the following section before performing any of the steps below.
- You will need a multimeter to test for continuity. The jumper cables and fiberglass poles should not be installed on the antenna at this time.

Test Procedure

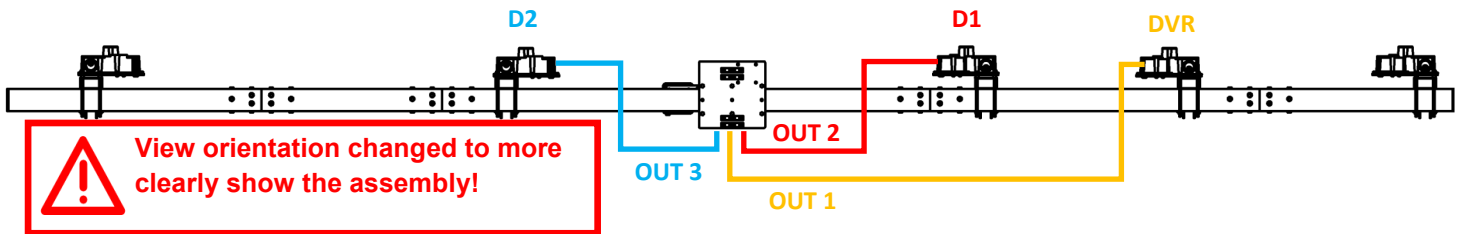
1. With control cable DISCONNECTED from the controller, turn the controller on. It should read “Elements Home”. If not, push the retract button. After the tuning LED stops flashing it should now read “Elements Home”. **“check fault”** will appear in the top right corner of the display when the control cable is disconnected but should go away once the control cable is connected.
2. Go into Setup mode and select “Create/Modify”.
3. Now CONNECT the control cable to the controller.
4. THE ELEMENTS WILL BE EXTENDED OUT OF EACH EHU LESS THAN 1’. MAKE SURE THE ENDS OF EACH EHU ARE CLEAR OF OBSTRUCTIONS
5. Select each element in turn and extend them to about 16” , as indicated by the controller LCD display. This will allow you to put the ohm meter probe on the copper elements during the tests. Each EHU should also correspond to the correct description on the controller. Driven is DVR, Director 1 is DIR1, etc. If not, stop, disconnect the control cable, and recheck your wiring.
6. DISCONNECT the control cable BEFORE exiting “Create/Modify”. This is to prevent the elements from moving when changing the controller to the first test frequency.
7. Set the controller to normal direction by selecting the button labeled “Normal”, the green LED next to the button should light.
8. Set the controller frequency to any frequency in the 20m band.
9. When the Tuning LED stops flashing, RECONNECT the control cable.
10. Set the ohm meter to a low ohms scale (around 200 ohms or so) and check the resistance on each of the three “driven” elements (Driven, D1, D2) between the center conductor of the SO-239 and each of the two copper tapes. The Driven element should measure near a dead short, while D1 and D2 should measure open circuit. (or a very high value) Note that when an element is in the “driven” mode there will still be a dead short between the copper tapes, rest assured it is only a dead short at DC not RF frequencies. This is by design of the balun. This verifies that the Driven EHU element is selected to be the driven element for 20m Normal direction.
11. Next check the resistance between the two copper tapes on both D1 and D2, it should be very near a dead short. This verifies they are switched to be passive elements by the internal relays in the EHUs.
12. The next test is to verify the antenna switch has selected the proper coax line.
13. Using the ohm meter verify there is close to a dead short between the center conductor of the SO-239 labeled “IN” and the center conductor of the SO-239 labeled “OUT1”. Verify that an open circuit exists between the “IN” connector and both “OUT2” and “OUT3” center pins. Also, there should be a dead short between “OUT2” and “OUT3” center pins and ground. (chassis)
14. If any of these tests fail check your wiring and correct any mistakes.
15. DISCONNECT the control cable.

ADVANCED MOTOR/RELAY TEST (OPTIONAL)

16. Set controller to "180" direction (leave the frequency as it was on 20m) and wait for tuning to stop.
17. RECONNECT the control cable and repeat the above procedure except now D2 is the driven element and Driven and D1 are passives. D2 should now show continuity between the coax connector center pin and each of the two copper elements. Director 1 and Director 2 elements should not. As before check the elements that are passives for continuity between their two copper tapes.
18. The antenna switch box should now show a dead short between the "IN" connector center pin and the "OUT3" connector center pin. There should be an open circuit between "IN" and "OUT1" and "OUT2". Also there should be a dead short from each "OUT1" and "OUT2" to ground.
19. DISCONNECT the control cable from the back of the controller.
20. Set the controller to "NORMAL" direction and the frequency to anywhere in the 30m band, wait for the Tuning LED to stop.
21. RECONNECT control cable and repeat the previous procedures except now D1 is the driven element. There should be a short circuit between the center pin of the Director 1 coax connector and each of the copper tapes. The Driven EHU should show an open circuit between the coax connector center pin and each of the copper tapes. Director 2 will show CONTINUITY between the coax center pin and each of the copper tapes. This is correct and ok since the EHU is disconnected by the coax switch box. The Driven EHU and Director 2 EHU will also show a dead short between each of their copper tapes.
22. The antenna switch box should now show a dead short between the "IN" connector center pin and the "OUT2" connector center pin. There should be an open circuit between "IN" and "OUT1" and "OUT3". Also "OUT1" and "OUT3" should each measure a dead short to ground.
23. If all these tests are good, DISCONNECT the control cable from the back of the controller. Push the retract button and wait for the tuning light to stop flashing and for the controller to read "Elements Home".
24. RECONNECT the control cable. Press the setup button and select "Calibrate Antenna". The copper tapes will now go back into the EHUs and you will hear a ratcheting sound for approximately 70 seconds. When finished the controller and antenna are now synchronized.
25. This concludes the test and verifies the antenna is wired correctly and all the relays operate properly.

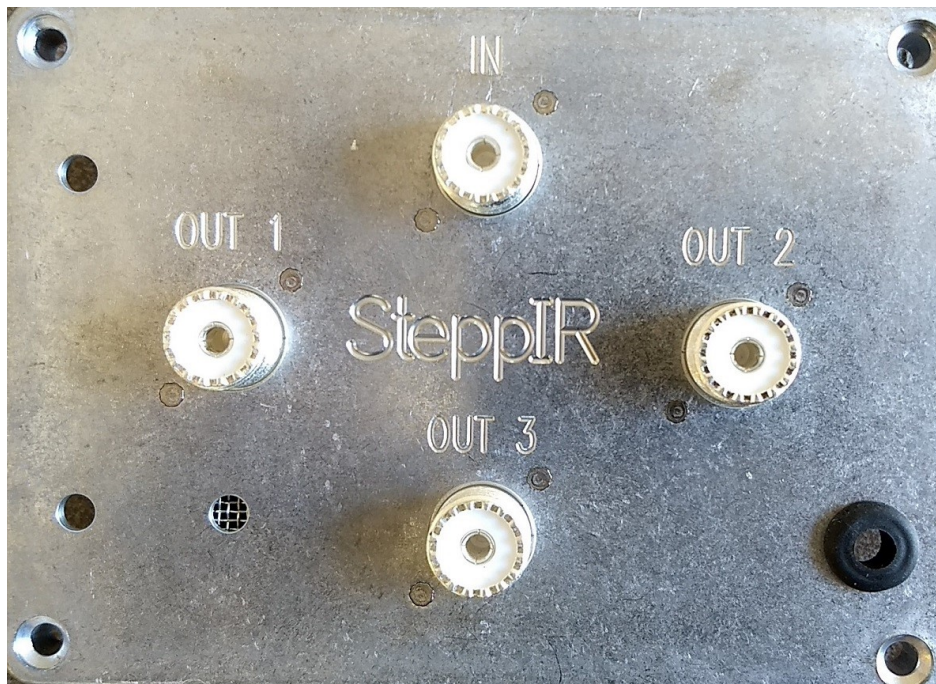
COAX JUMPER CONNECTIONS

- Use the provided coax jumpers and connect the EHU coax ports to the coax antenna switch as shown.
- Apply dielectric grease to the center conductors of all coax connections.
- Tighten the coax connectors with pliers.
- Use provided coax seal or silicone tape (not provided) to seal the coax connections (both at the EHUs and at the coax switch box).



COAX SWITCH SO239 CONNECTOR	COAX PURPOSE	JUMPER LENGTH
IN	FEEDLINE FROM SHACK	N/A
OUT 1	COAX JUMPER TO DRIVEN EHU	15 FT
OUT 2	COAX JUMPER TO DIRECTOR 1 EHU	8 FT
OUT 3	COAX JUMPER TO DIRECTOR 2 EHU	8 FT

COAX ANTENNA SWITCH



PREPARING THE TELESCOPING POLES

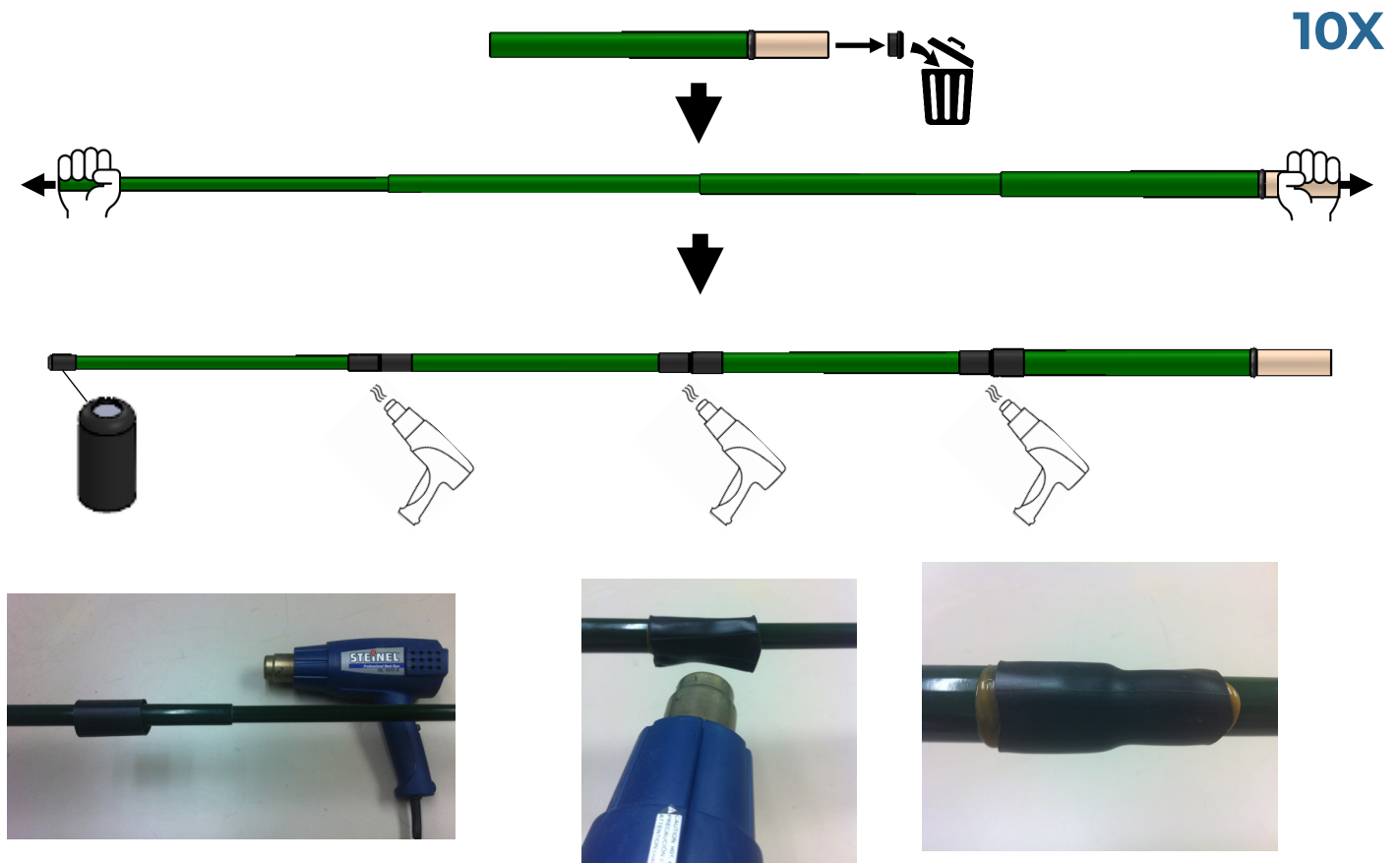
- Extend the telescoping poles PN 10-1013-02 to full length by firmly “locking” each section of the pole in place. A good methodology is to position each half of the joint so that they are several inches apart (while still within each other), and then pull quickly and firmly. Do this for each pole. There are rubber plugs inside the base section of each telescoping pole. These make it easier for handling, but they **must be removed before assembly**.



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.



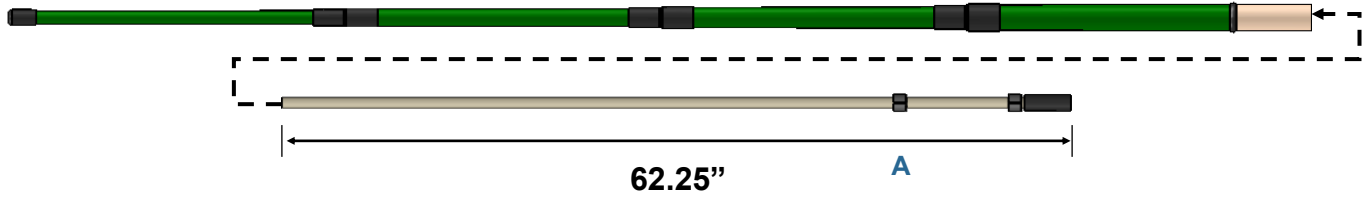
- Each telescoping pole uses 3 polyolefin heat shrink pieces PN 10-1059-01. Once finished, the seal is secure and waterproof. This product requires a heat gun for activation of the adhesive.
- When positioning the heat shrink, place it so that the joint of the telescoping pole is centered in the middle of the heat shrink.
- 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.
- 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!**



ASSEMBLE THE 36FT ELEMENT AND CPVC

Key	QTY	Part Number	Description
A	1	70-2025-43	CPVC Assembly with 1.35" foam ring + washer hose w/out coupler

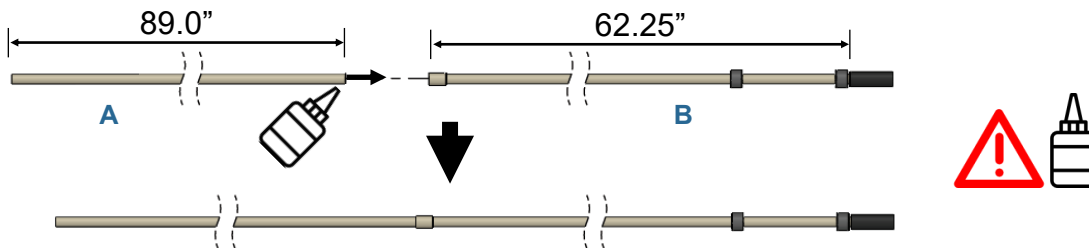
2X



PREPARE THE 50 FT ELEMENT CPVC

Key	QTY	Part Number	Description
A	1	70-2022-01	CPVC 3/4 x 89" w/out coupler
B	1	70-2025-53	CPVC Assembly with 1.5" foam ring + washer hose + coupler

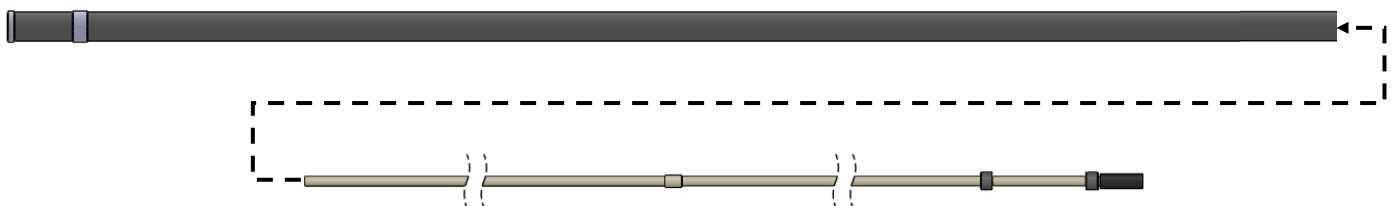
2X



- Use the provided glue kit (PN 72-0039) to bond the CPVC sections. **Apply the glue to the outer diameter ONLY** before inserting into the coupler and twisting. Work quickly as the glue will dry quickly and become less effective

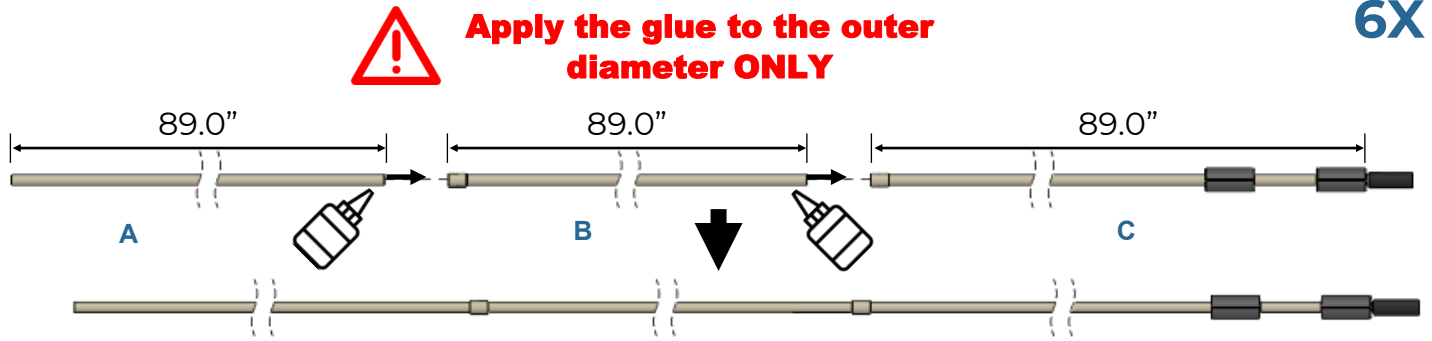
ASSEMBLE THE 50 FT ELEMENT AND CPVC

2X



PREPARE THE 70 FT ELEMENT CPVC

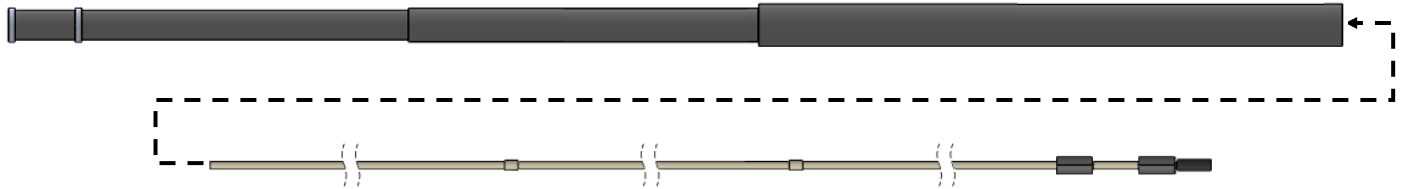
6X



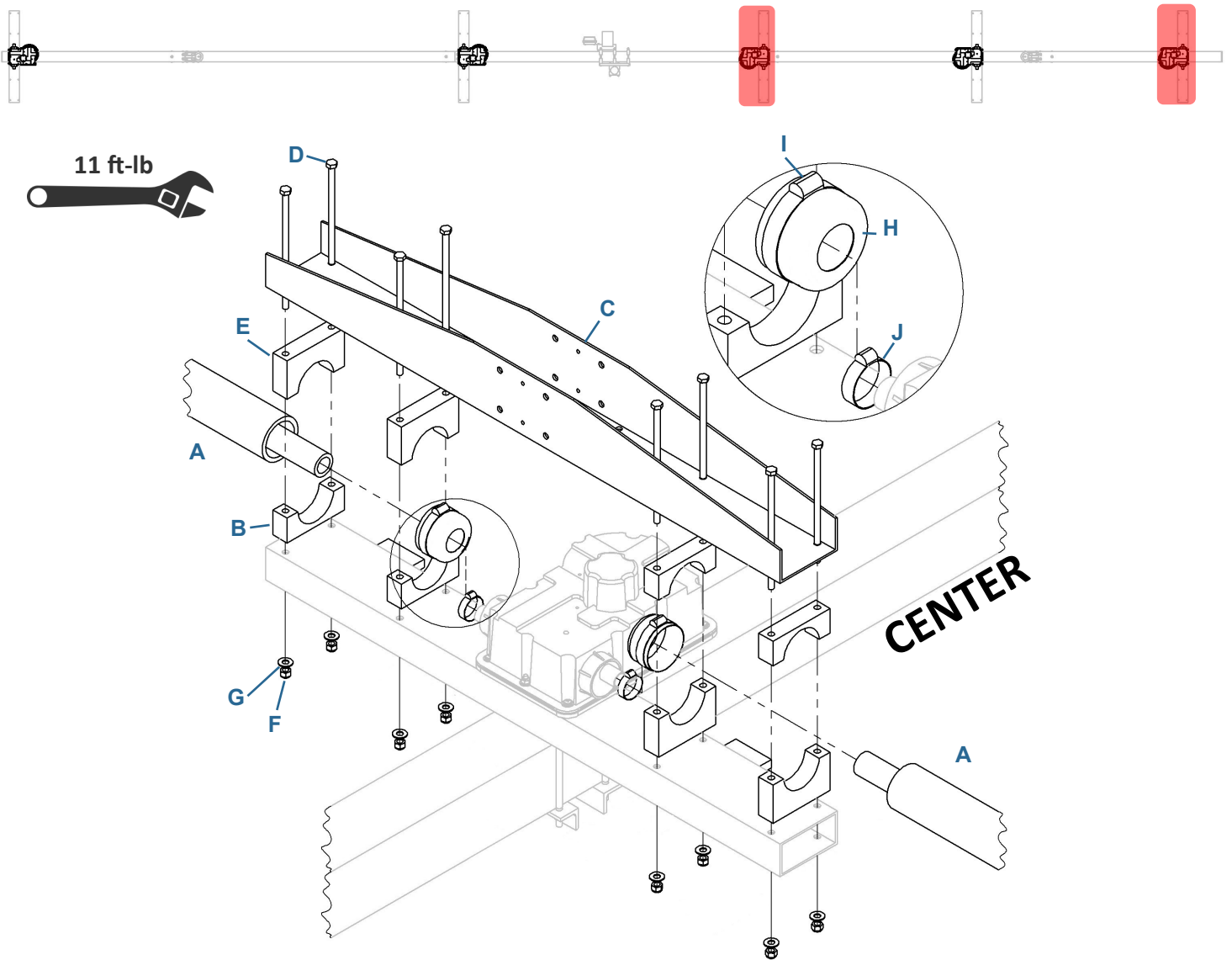
Key	QTY	Part Number	Description
A	1	70-2022-01	CPVC 3/4 x 89" w/out coupler
B	1	70-2021-01	CPVC 3/4 x 89" w/coupler
C	1	70-2025-53	CPVC Assembly with 2" foam ring + washer hose

ASSEMBLE THE 70 FT ELEMENTS AND CPVC

6X



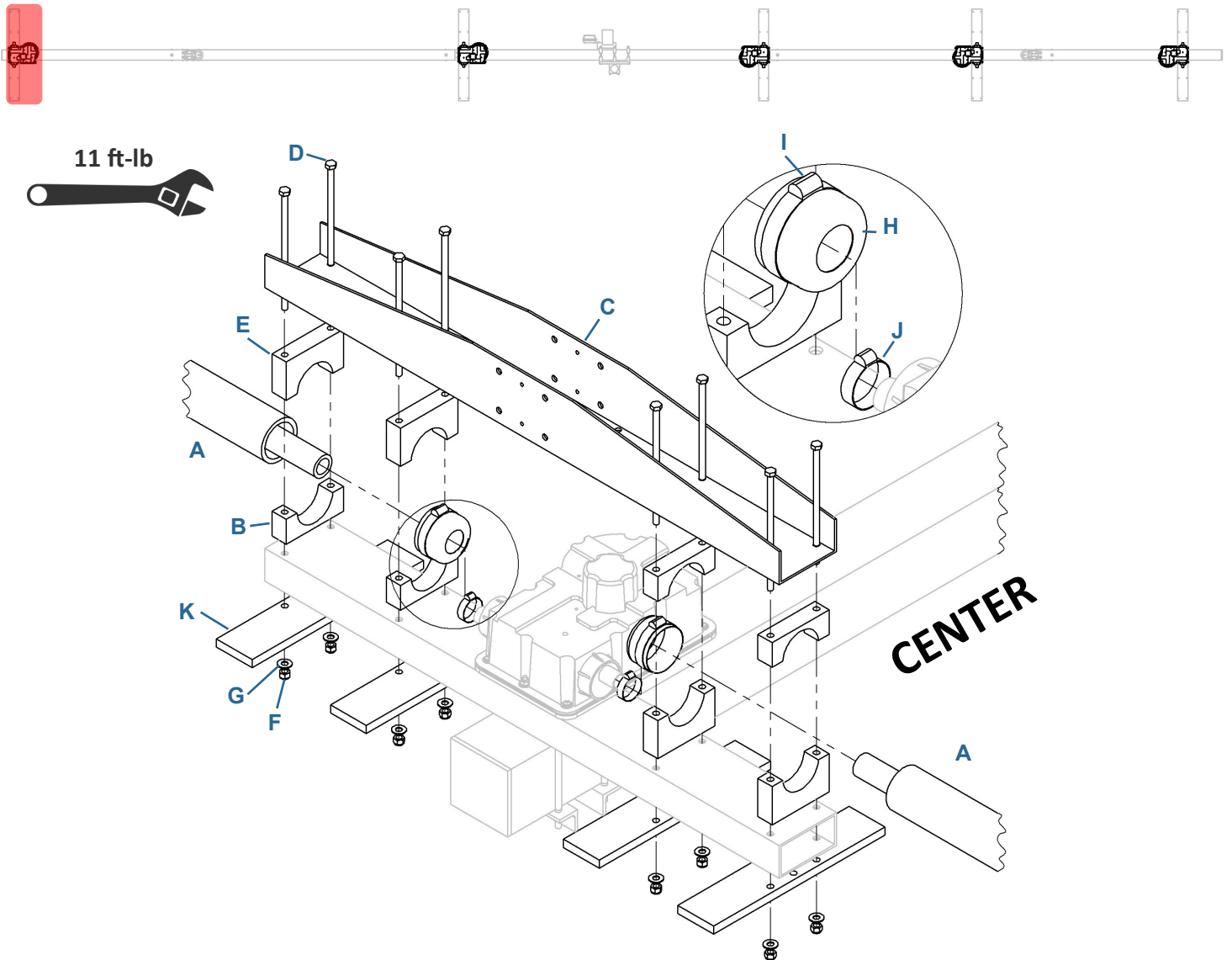
INSTALL THE 70FT ELEMENT FIBERGLASS—D1 AND REF



Key	QTY	Part No	Description
A	2	-	17.5' Fiberglass Extension Assembly w/ CPVC Liner
B	4	10-1611-04	Plastic Saddle, 2.5" Short
C	1	10-1605-41	Element Mounting Plate—Top
D	8	60-0215	Hex Bolt, 5/16-18 x 7", SS
E	4	10-1611-44	Plastic Saddle, 2.5" Tall
F	8	60-0046	Nut, 5/16, Nylock
G	8	60-0033	Washer, 5/16
H	2	60-7026	Vinyl Cap, 2.5" with hole
I	2	60-6000-35	Hose Clamp, #48
J	2	60-6000-15	Hose Clamp, #16

Use anti-seize on all SS hardware!

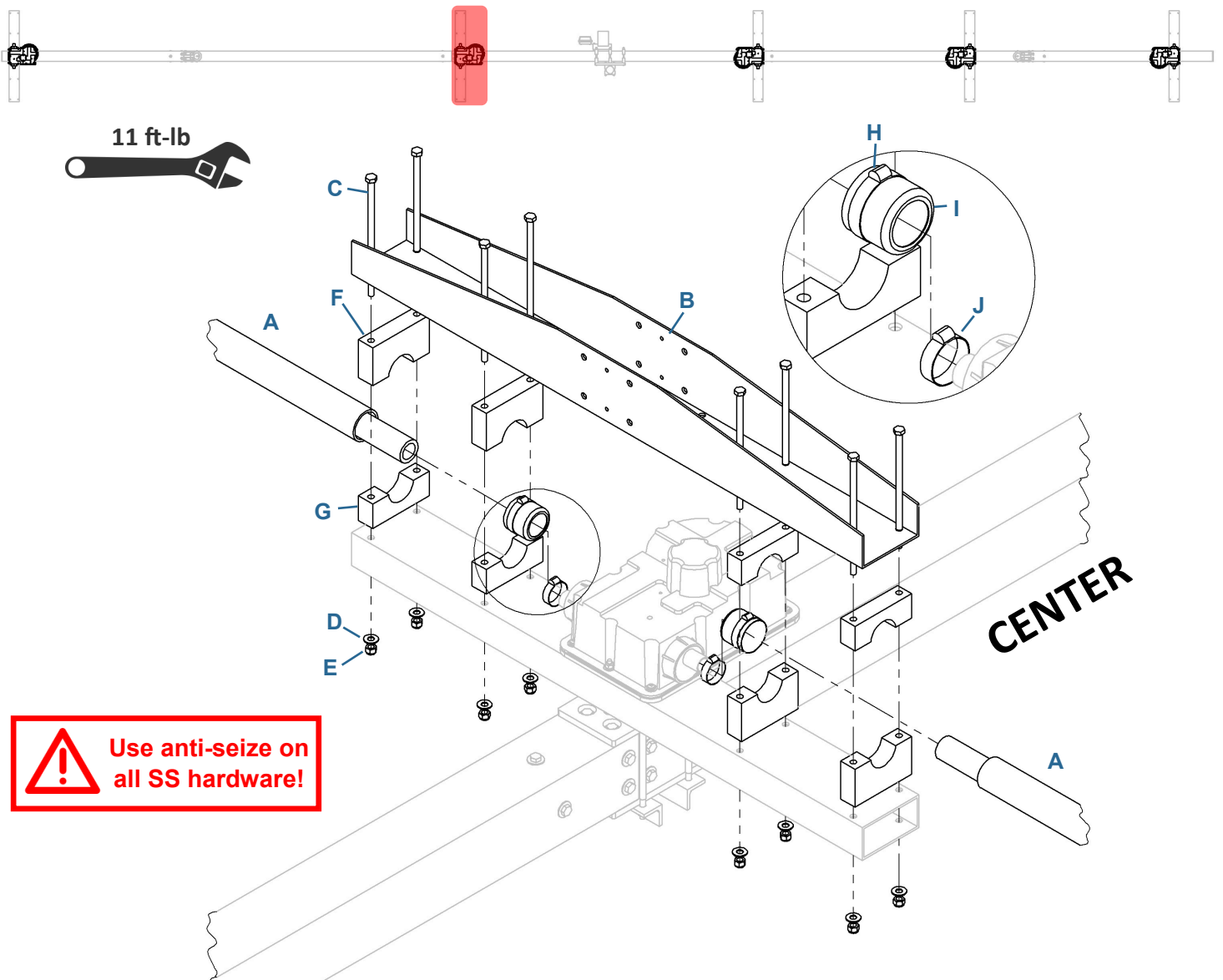
INSTALL THE 70FT ELEMENT FIBERGLASS—DIRECTOR 3



Key	QTY	Part No	Description
A	2	-	17.5' Fiberglass Telescoping Pole Assembly w/ CPVC Liner
B	4	10-1611-04	Plastic Saddle, 2.5" Short
C	1	10-1605-41	Element Mounting Plate—Top
D	8	60-0215	Hex Bolt, 5/16-18 x 7", SS
E	4	10-1611-44	Plastic Saddle, 2.5" Tall
F	8	60-0046	Nut, 5/16, Nylock
G	8	60-0033	Washer, 5/16
H	2	60-7026	Vinyl Cap, 2.5" with hole
I	2	60-6000-35	Hose Clamp, #48
J	2	60-6000-15	Hose Clamp, #16
K	4	10-1050-21	4lb Counterweight

Use anti-seize on all SS hardware!

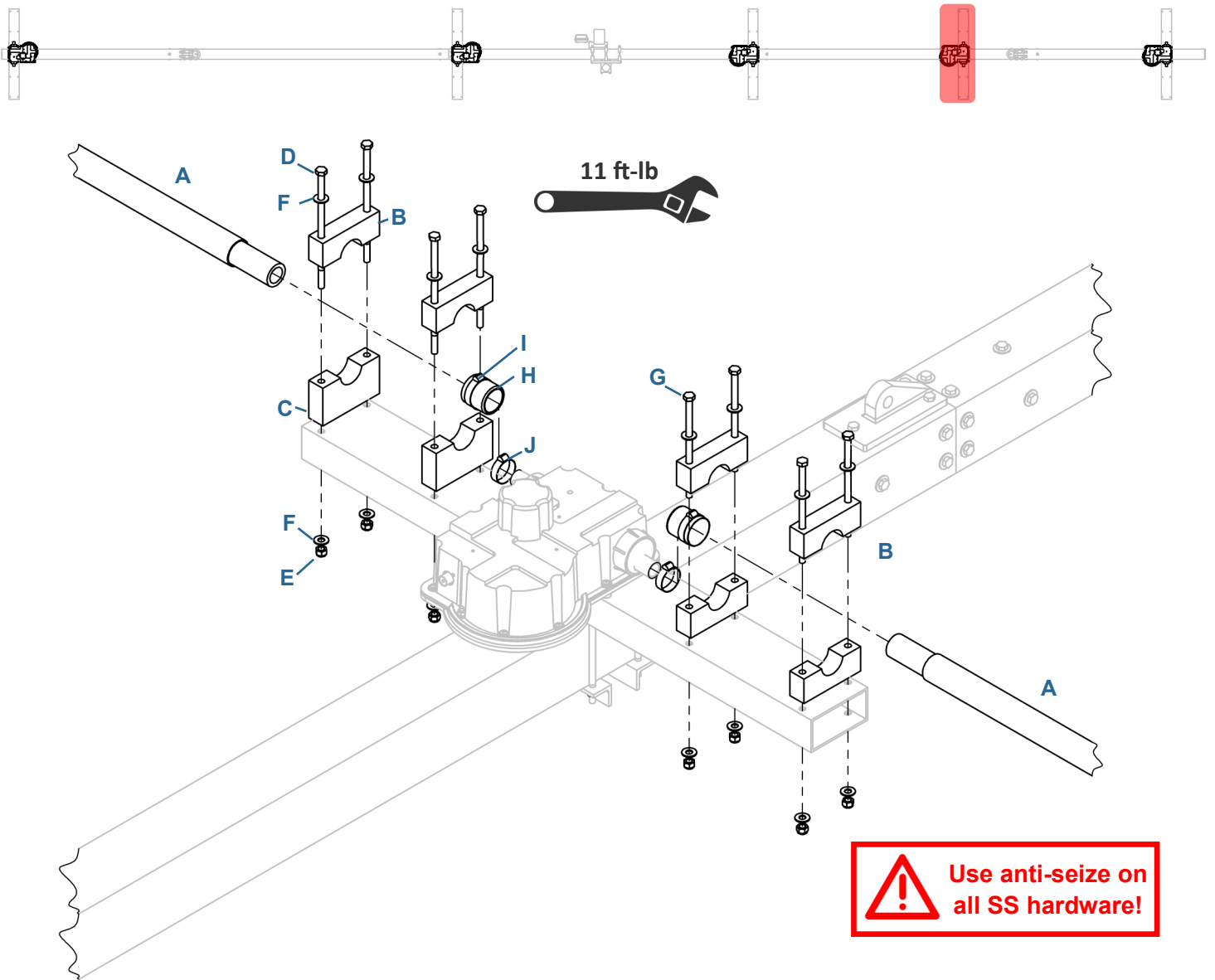
INSTALL THE 50FT ELEMENT FIBERGLASS



Use anti-seize on all SS hardware!

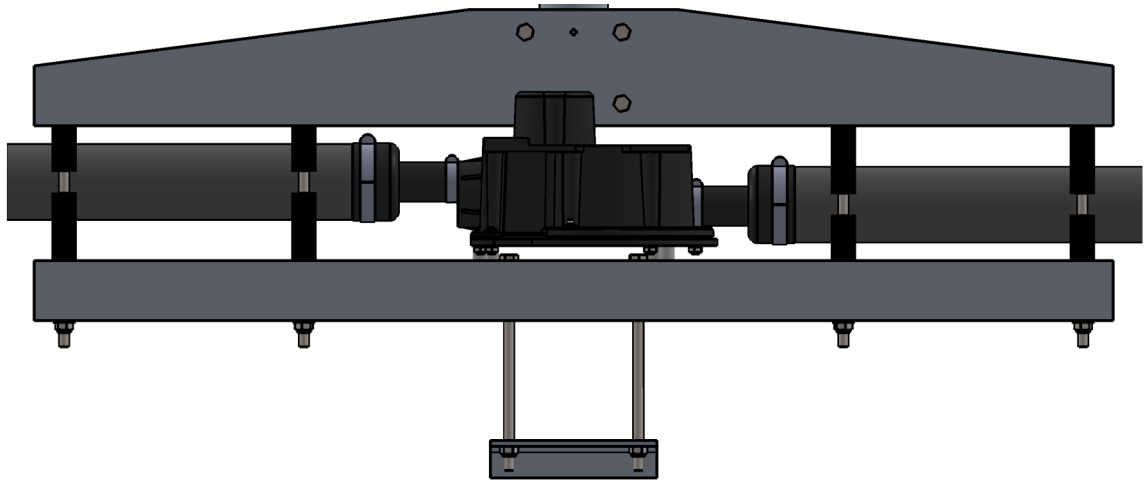
Key	QTY	Part No	Description
A	2	-	7.5' Fiberglass Telescoping Pole Assembly w/ CPVC Liner
B	1	10-1605-41	Element Mounting Plate—Top
C	8	60-0215	Hex Bolt, 5/16-18 x 7", SS
D	8	60-0033	Washer, 5/16
E	8	60-0046	Nut, 5/16, Nylock
F	4	10-1611-22	Plastic Saddle, 1.75" tall
G	4	10-1611-02	Plastic Saddle, 1.75" short
H	2	60-6000-20	Hose Clamp, 2", SS
I	2	60-7025	Vinyl Cap, 1.75" x 1.5", with hole
J	2	60-6000-15	Hose Clamp, #16, SS

INSTALL THE 36FT ELEMENT FIBERGLASS

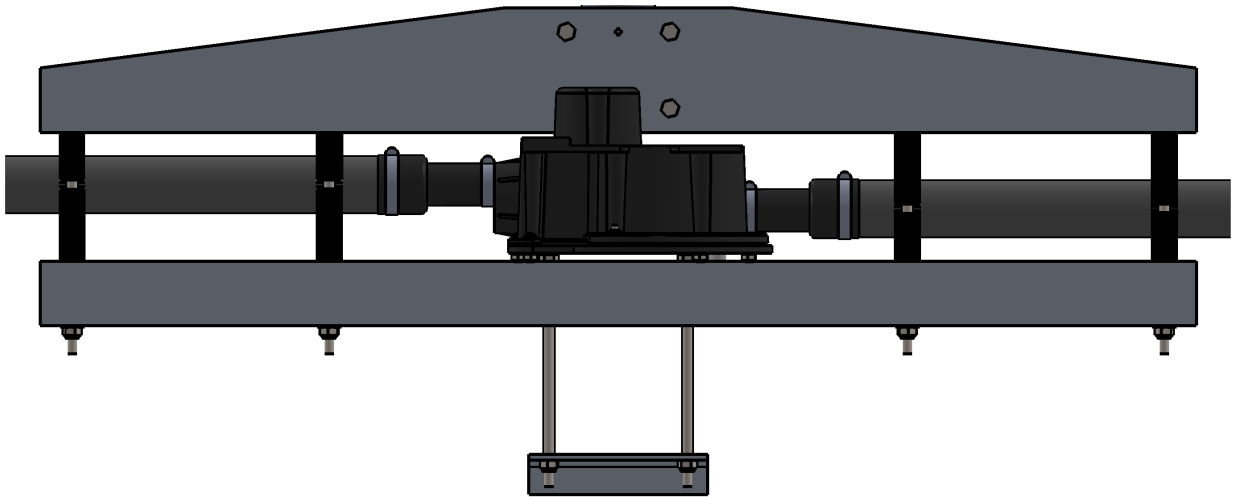


Key	QTY	Part No	Description
A	2	-	Standard 18' Fiberglass Telescoping Pole Assembly
B	6	10-1611-01	Plastic Saddle, 1.5", short
C	2	10-1611-11	Plastic Saddle, 1.5", tall
D	4	60-0215	Hex Bolt, 5/16 x 7"
E	8	60-0046	Nut, 5/16, Nylock
F	8	60-0033	Washer, 5/16
G	4	60-7004	Hex Bolt, 5/16 x 6"
H	2	60-7024	Vinyl Cap, 1.5", with hole
I	2	60-6000-20	Hose Clamp, #24
J	2	60-6000-15	Hose Clamp, #16

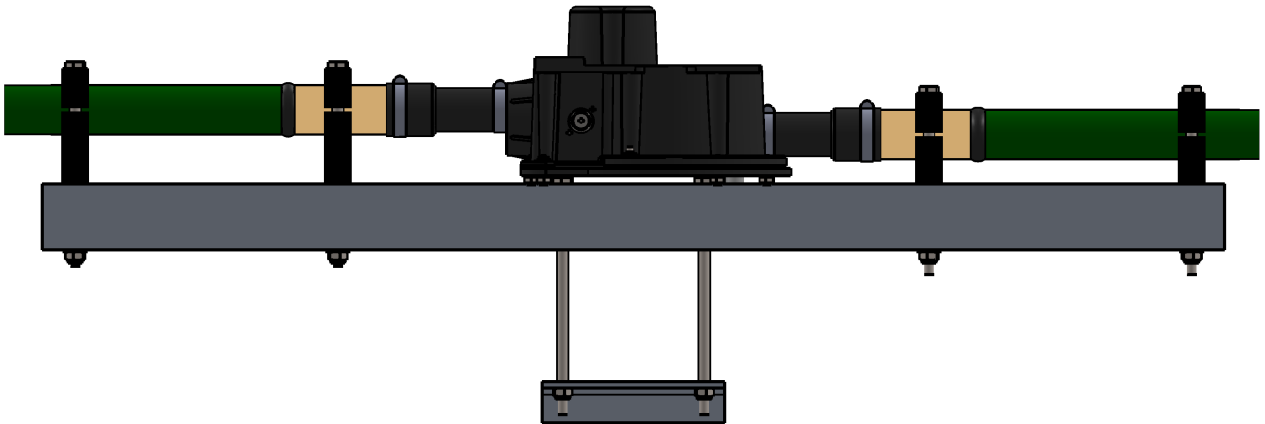
VINYL CAP INSTALL—70FT ELEMENT



VINYL CAP INSTALL—50FT ELEMENT



VINYL CAP INSTALL—36FT ELEMENT

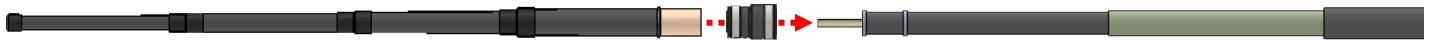


INSTALL THE TELESCOPING FIBERGLASS POLES

- Collect the 8 telescoping green fiberglass poles as well as 8 FERNCO rubber quick-disconnect boots.
- Slide the small end of the rubber quick disconnect boot over the telescoping pole base and then insert the telescoping poles into the fiberglass extensions. Press the poles in until they “bottom out”.
- Secure the rubber boot by tightening the hose clamps. Tighten twice, waiting at least 15 minutes between to allow the rubber to “cold-flow”.

70' Element

6X

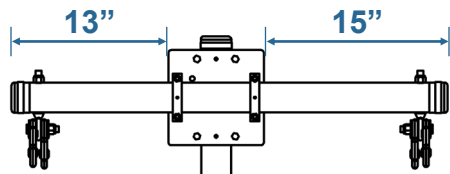


50' Element

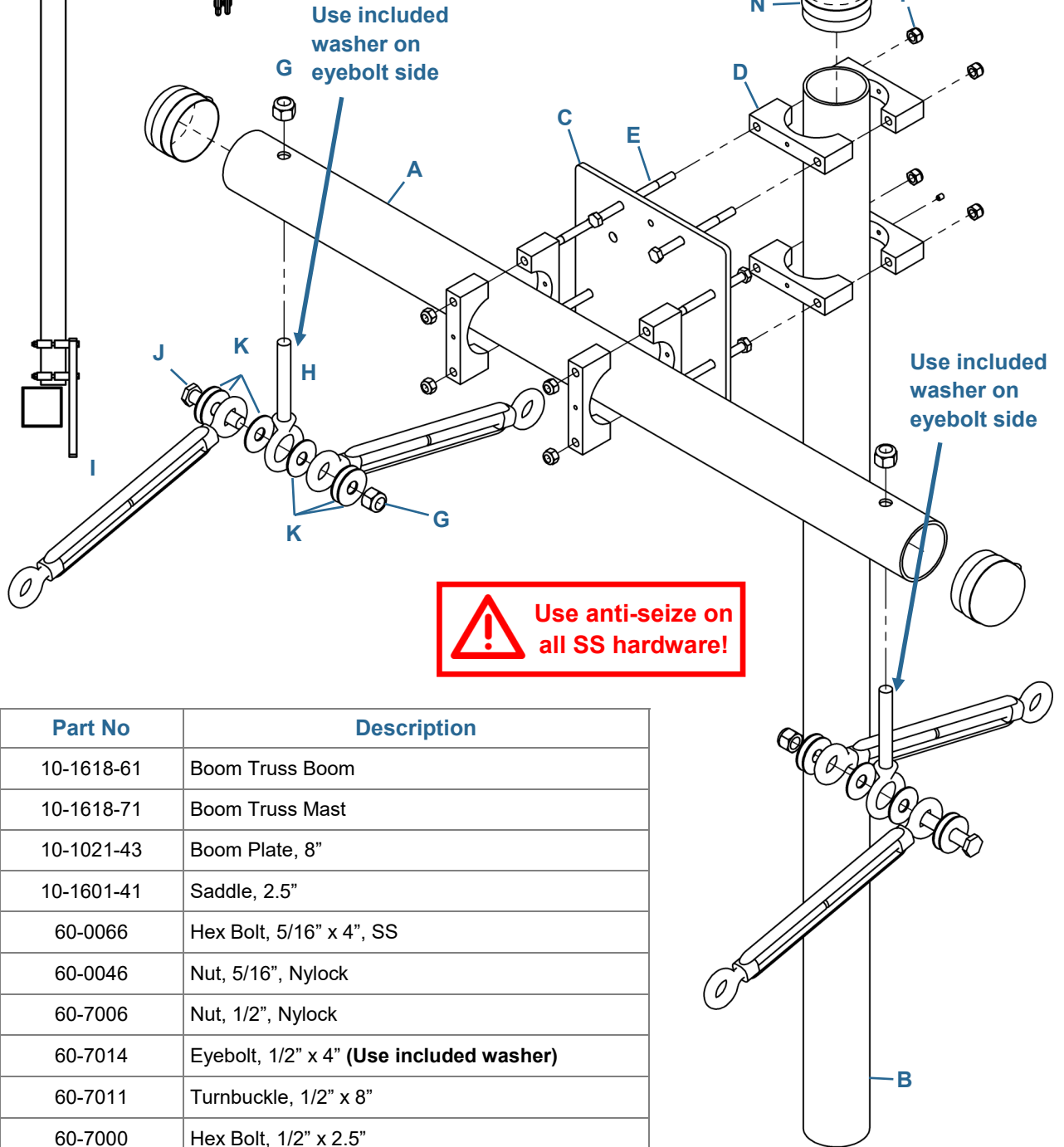
2X



ASSEMBLE THE BOOM TRUSS



! These measurements are critical!

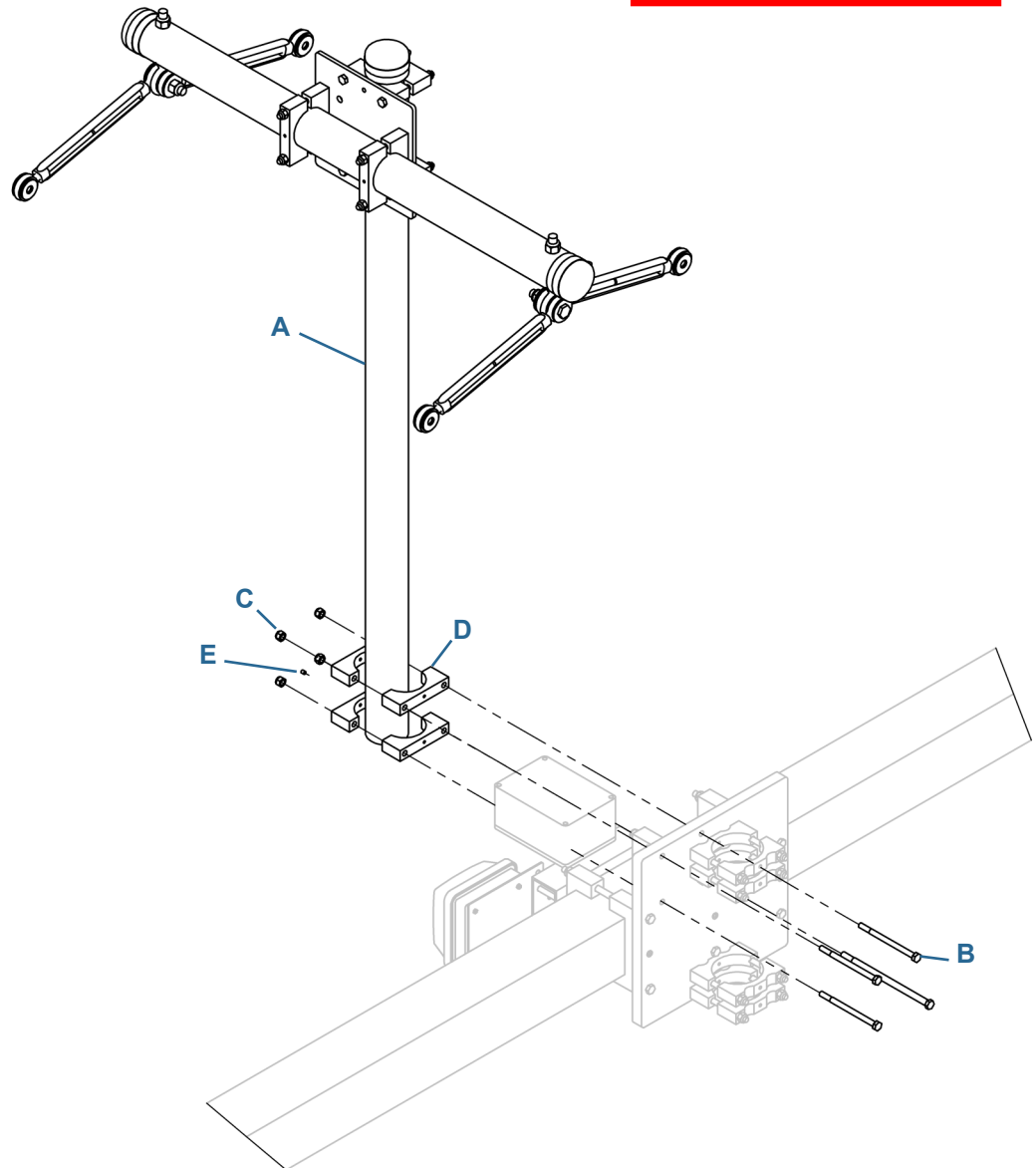


! Use anti-seize on all SS hardware!

Key	QTY	Part No	Description
A	1	10-1618-61	Boom Truss Boom
B	1	10-1618-71	Boom Truss Mast
C	1	10-1021-43	Boom Plate, 8"
D	8	10-1601-41	Saddle, 2.5"
E	8	60-0066	Hex Bolt, 5/16" x 4", SS
F	8	60-0046	Nut, 5/16", Nylock
G	4	60-7006	Nut, 1/2", Nylock
H	2	60-7014	Eyebolt, 1/2" x 4" (Use included washer)
I	4	60-7011	Turnbuckle, 1/2" x 8"
J	2	60-7000	Hex Bolt, 1/2" x 2.5"
K	12	60-7012	Washer, .5" ID x 1.5" OD
L	1	60-0112	Set Screw, #10-32 x 1/4"
M	3	60-7022	Vinyl Cap, 2.5" x 1.5", Black, w/o hole
N	3	60-6000-35	Hose Clamp, #48, SS

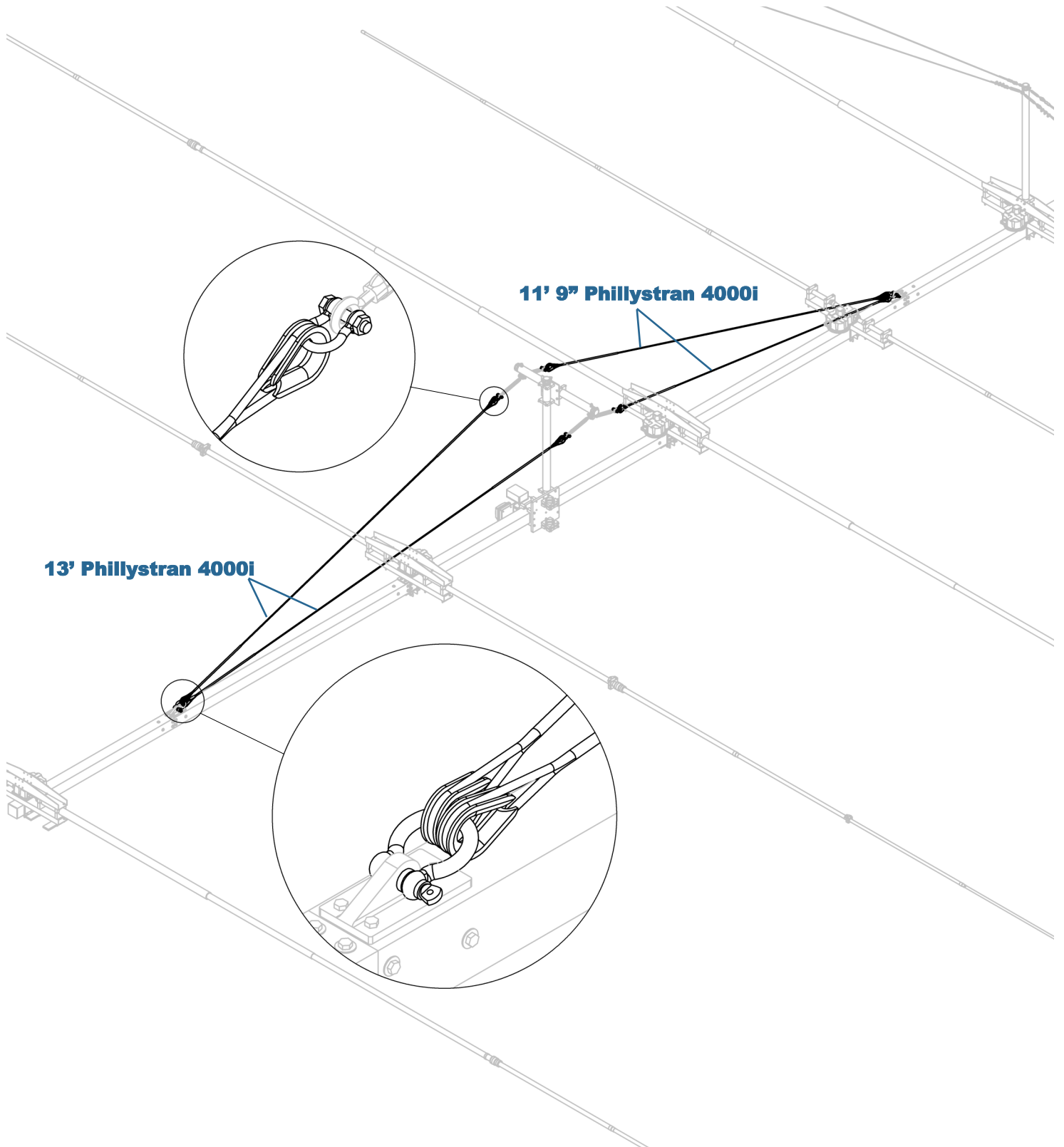
INSTALL THE BOOM TRUSS

 Use anti-seize on all SS hardware!



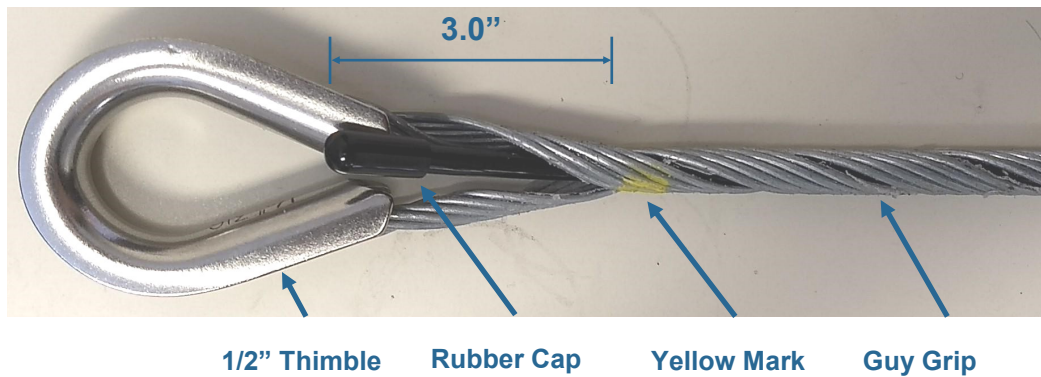
Key	QTY	Part No	Description
A	1	-	Boom Truss Assembly
B	4	60-0115	Hex Bolt, 5/16 x 4.5", SS
C	4	60-0046	Nut, 5/16, Nylock
D	4	10-1601-41	Saddle, 2.5"
E	1	60-0112	Set Screw, #10-32 x 1/4"

TRUSS THE BOOM—OVERVIEW



TRUSS THE BOOM—PHILLYSTRAN

- Cut the provided 4000i Phillystran into the following lengths: 2 pieces at 13ft long, and 2 pieces at 11ft 9in long.
- Install a guy grip on each end of the Phillystran. Make sure to place a thimble inside the eye of each guy grip before twisting it together. Leave 3" of slack (measured from the yellow mark). Refer to this video for clarification on how to assemble the guy grips: www.youtube.com/watch?v=q366DoJoMkM (note this video is not ours but the technique shown is the same).
- Zip tie the ends of the grips to prevent them from loosening and place a rubber cap on both ends of the Phillystran.



8X

TRUSS THE BOOM

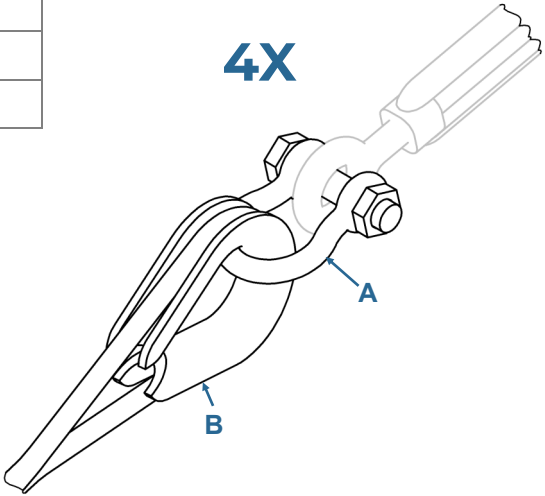


- Loosen the 1/2" x 8" turnbuckles at the top of the boom truss.



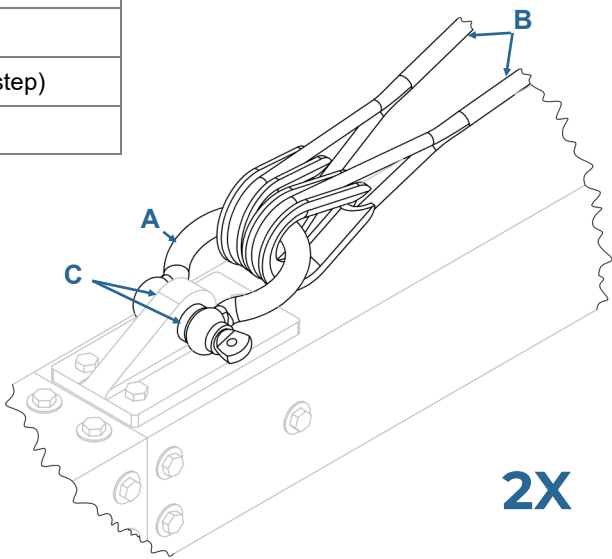
- Feed a 7/16" shackle (60-7008) through one thimble of each thimble/grip/Phillystran assembly and the free end of the boom truss turnbuckle.
- Remember to re-install the cotterpin to secure the bolt.

Key	QTY	Part No	Description
A	1	60-7008	Shackle, 7/16", SS
B	2	-	Phillystran Assembly (from previous step)



- Install the bow shackle on the boom truss attachment couplers.
- Apply blue Loctite to the shackle pin threads and tighten with pliers or a crescent wrench.
- Remember to re-install the cotterpin on the 1/2" shackle to secure the bolt.

Key	QTY	Part No	Description
A	1	60-7007	Bow Shackle, SS
B	2	-	Phillystran Assembly (from previous step)
C	2	10-1613-13	Spacer, 5/8" x 1" x 0.25"



TENSION THE BOOM TRUSS

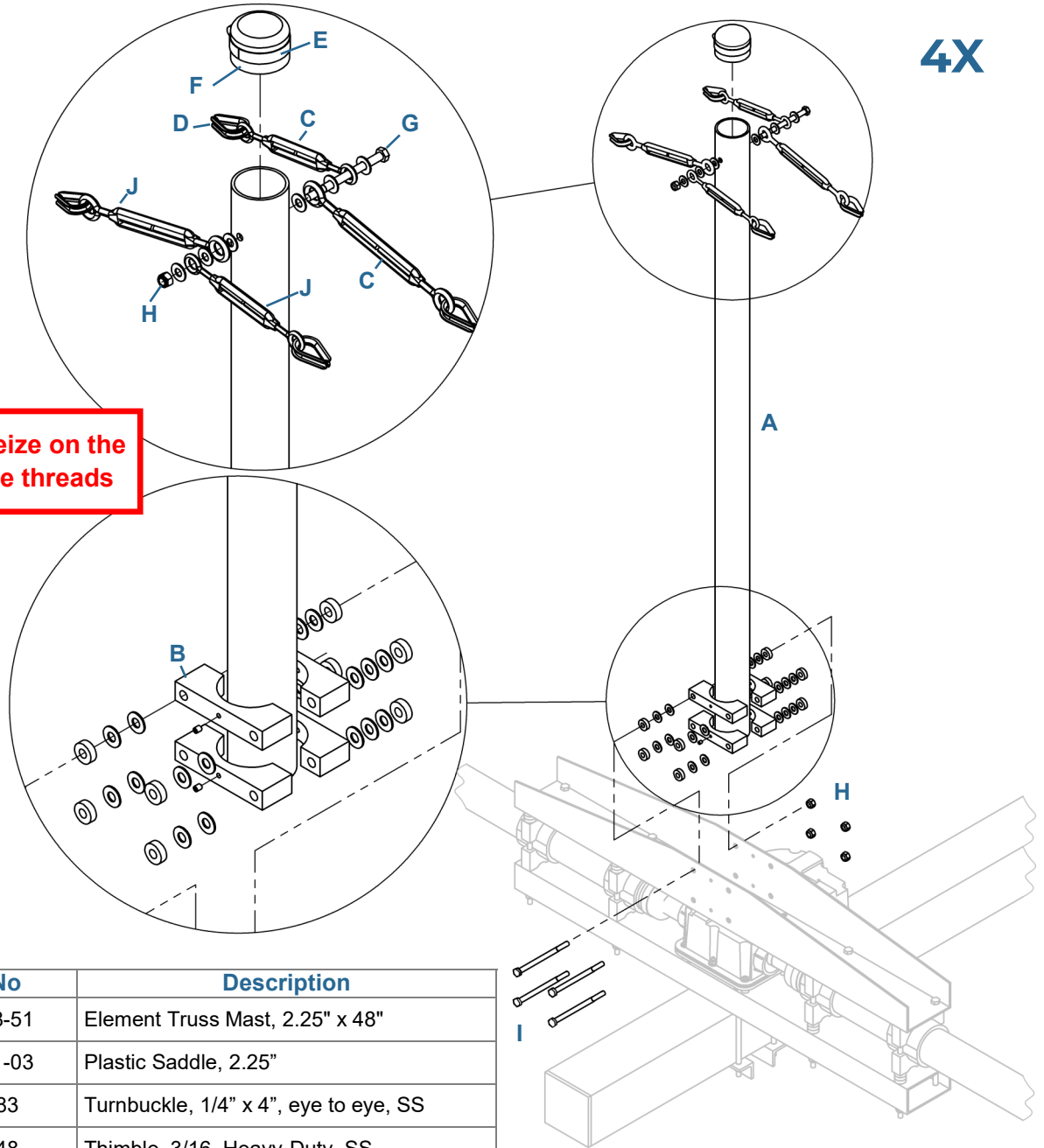
- **Apply anti-seize generously to the turnbuckle threads.**
- Twist all 4 boom truss turnbuckles to apply tension to the Phillystran trusses.
- Tighten the turnbuckles incrementally so that the tension on each rope stays approximately the same. Be careful to avoid overtightening one line which could cause the boom to twist or flex incorrectly.
- Place a level near each end of the boom so that you can tell when the boom is level.
- Once the boom has been leveled, use the provided locking wire to lock the twisted shackle bolts and the turnbuckles.



INSTALL THE ELEMENT TRUSS MAST

4X

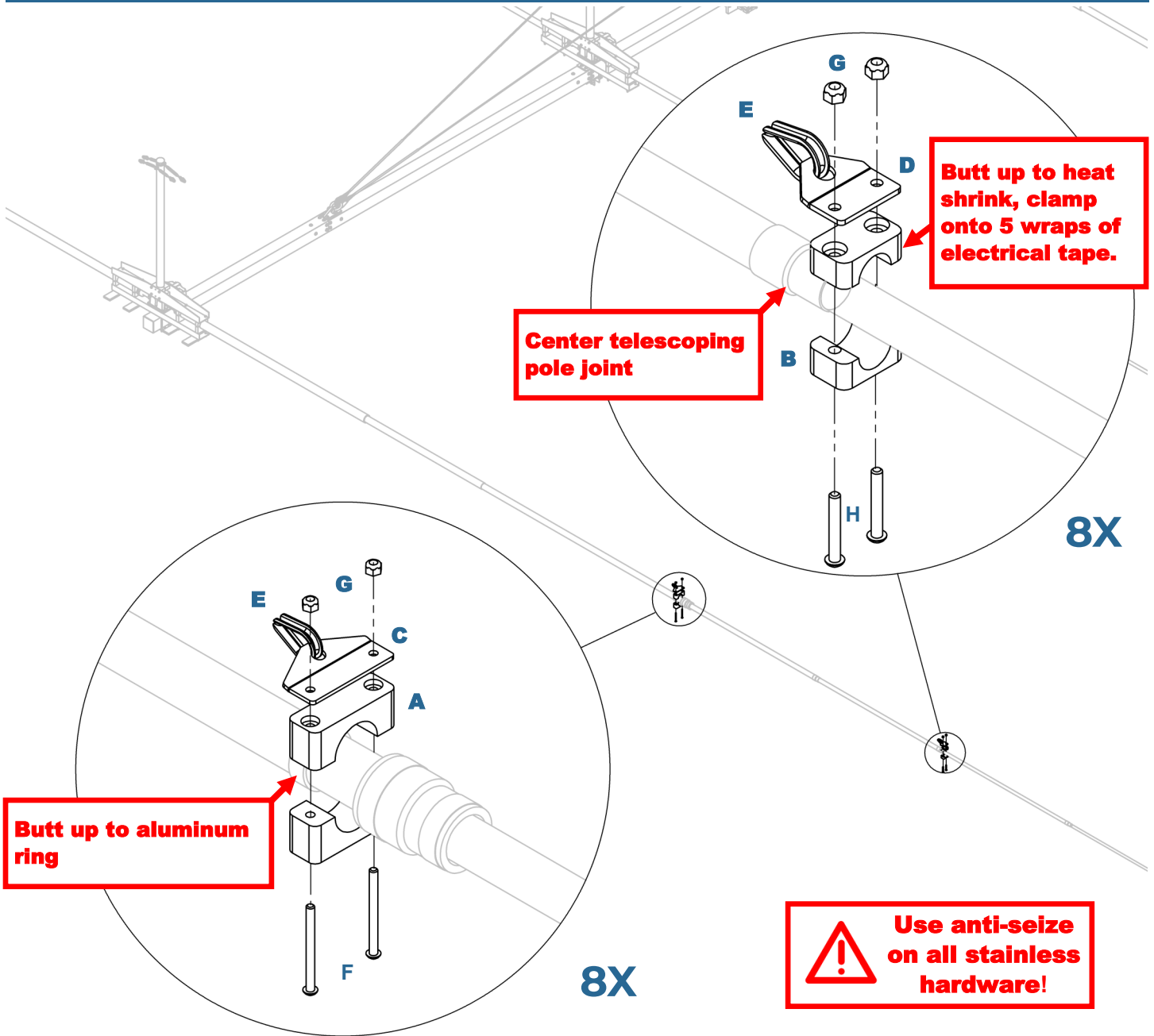
Use anti-seize on the turnbuckle threads



Use anti-seize on all stainless hardware!

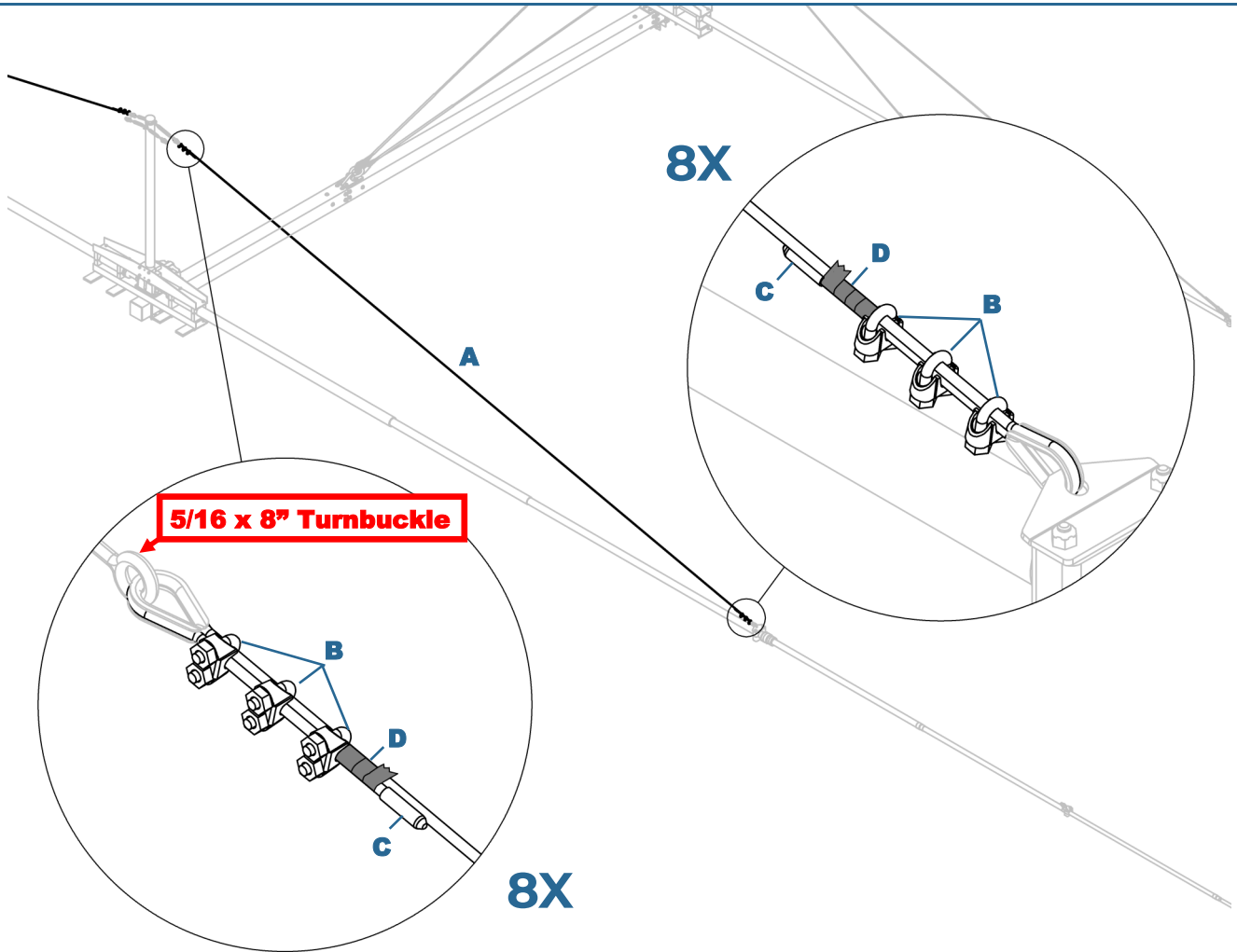
Key	QTY	Part No	Description
A	1	10-1618-51	Element Truss Mast, 2.25" x 48"
B	4	10-1611-03	Plastic Saddle, 2.25"
C	2	60-0083	Turnbuckle, 1/4" x 4", eye to eye, SS
D	4	60-7048	Thimble, 3/16, Heavy-Duty, SS
E	1	60-6000-35	Hose Clamp, #48, SS
F	1	60-7021	Vinyl Cap, 2.25" x 1.5", Black, w/o hole
G	1	60-0066	Hex Bolt, 5/16-18 x 4"
H	5	60-0046	Nut, 5/16", Nylock
I	4	60-0115	Hex Bolt, 5/16-18 x 4.5"
J	2	60-0159	Turnbuckle, 5/16" x 8", eye to eye, SS

ATTACH THE ELEMENT TRUSS COUPLERS



Key	QTY	Part No	Description
A	2	60-7020	Resin Clamp, 1.75"
B	2	60-7019	Resin Clamp, 1"
C	1	10-1607-31	Element Truss Attachment Plate - 4in
D	1	10-1607-21	Element Truss Attachment Plate - 2in
E	2	60-7048	Thimble, 3/16, SS
F	2	60-7009	Button Head, Hex Drive, 1/4-20 x 3"
G	4	60-0030	Nut, 1/4-20, Nylock
H	2	60-7005	Button Head, Hex Drive, 1/4-20 x 1.75"

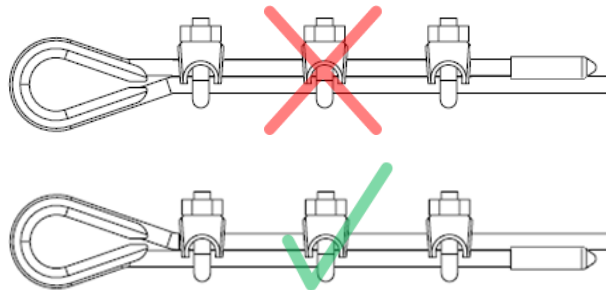
TRUSS THE ELEMENTS—PHILLYSTRAN—OVERVIEW



Key	QTY	Part Number	Description
A	-	21-8002	Phillystran 2100i (230" - 70ft element, 115" - 50ft element)
B	6	60-0045	Wire Clip, 3/16
C	2	60-0044	Rubber cap
D	-	09-0001	Electrical tape

TENSION THE PHILLYSTRAN (INNER) ELEMENT TRUSSES

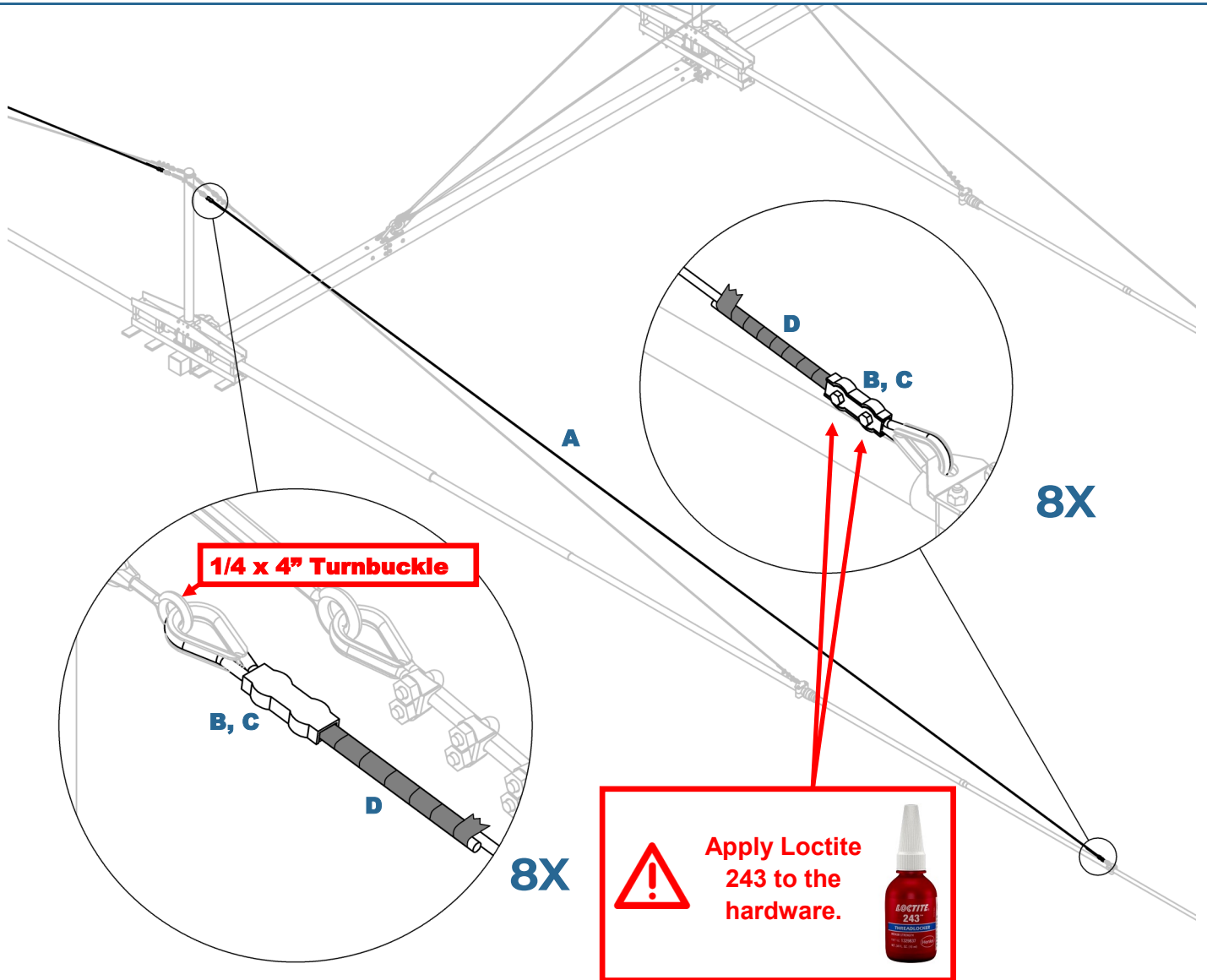
1. First loosen all of the turnbuckles on the element trusses and apply anti-seize to the threads, this is important so that you will be able to apply tension to the truss later by tightening the turnbuckles to take up slack.
2. The Phillystran may be precut to 230" for the 70ft element or 115" for the 50ft element.
3. Start at the lower end of the truss where it attaches to the fiberglass extension (near the joint with the telescoping tube).
4. Slide three wire clips onto the Phillystran and then feed it through the thimble until there is ~8 inches of rope on the "dead" side. Guide it around the thimble and then back through the wire clips. Pull the rope taught so that it conforms to the shape of the thimble. **Make sure the U-bolts wrap around the capped, "dead" side as shown.**
5. Arrange the thimbles ~ 1.5 inches apart as shown and tighten. Tighten the thimbles at least twice waiting at least 15 minutes between tightening's. Generally, if you tighten them in a consistent order, by the time you tighten the last element you can go back and retighten them all in the same order.



6. Pull the rope to the other attachment point: the 5/16 x 8" turnbuckle at the top of the mast. Make sure to attach to the larger 5/16" turnbuckle and not the smaller 1/4" turnbuckle.
7. Pull the rope tight and then cut it 12 inches past where it meets the "eye" of the turnbuckle. This is to give you extra material.
8. Repeat steps 3-4. **Make sure that you apply tension to the rope in step 3**, any slack left in the line will need to be taken up by the turnbuckle before it can apply tension to the line. The turnbuckle has 8" of travel so if you leave too much slack in the line you might not be able to tension the line appropriately.
9. Apply tension to the Phillystran (inner) guy wires by twisting the 5/16 x 8" turnbuckles.
10. Use a level to confirm when the element is leveled.
11. When the elements are level, secure the turnbuckles with the provided locking wire to prevent them from loosening.
12. Install the rubber cap on the loose ends of the phillystran and then wrap the ends with electrical tape to secure them.



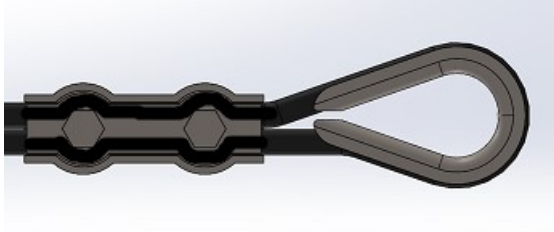
TRUSS THE ELEMENTS—DACRON—OVERVIEW



Key	QTY	Part Number	Description
A	-	21-7002-01	Dacron, 3/16" (336" - 70ft element, 220" - 50ft element)
B	2	60-7015	Double cable clamp, 3/16"
C	4	60-0175	Lock Washer, 10-32, Split, S/S (installed on cable clamp)
D	-	09-0001	Electrical Tape

TENSION THE DACRON (OUTER) ELEMENT TRUSSES

1. First loosen all of the turnbuckles on the element trusses and apply anti-seize to the threads, this is important so that you will be able apply tension to the truss later by tightening the turnbuckles to take up slack.
2. The Dacron may be precut to 336" for the 70ft element or 220" for the 50ft element.
3. Feed the Dacron through the thimble until there is ~8 inches of rope on the "dead" side.
4. Open a double cable clamp and press the Dacron inside as shown.



5. Close the cable clamp, apply Loctite under each nut and tighten the nuts just enough that there is friction but the rope is still able to slide through the clamp.
6. Pull the rope taught so that the cable clamp is close to the thimble as shown, then tighten the nuts on the clamp fully.
7. Pull the rope to the other attachment point: the 1/4 x 4" turnbuckle at the top of the mast.
8. Pull the rope tight and then cut it 12 inches past where it meets the "eye" of the turnbuckle.
9. Repeat steps 3-6. **Make sure that you apply tension to the rope before fully tightening the nuts**, any slack left in the line will need to be taken up by the turnbuckle (and Dacron likes to stretch!) before it can apply tension to the line. The turnbuckle has only 4" of travel so if you leave too much slack in the line you might not be able to tension the line appropriately. If this occurs, undo the turnbuckle, loosen the nuts on one of the cable clamps, pull the "dead" end of the Dacron to apply tension to the line, re-tighten the nuts, and tighten the turnbuckle.
10. Apply tension to the Dacron rope by twisting the 1/4" x 4" turnbuckles.
11. Use a level to confirm when the element is leveled. Some droop in the element past the truss attachment point is inevitable. Tighten until the fiberglass is level but be careful not to overtighten such that the element bows upward.
12. When the elements are level, secure the turnbuckles with the provided locking wire to prevent them from loosening.
13. Use a lighter to melt the loose ends of the Dacron so that the rope doesn't unravel and then wrap electrical tape around them to secure them.



WIRE LOCKING

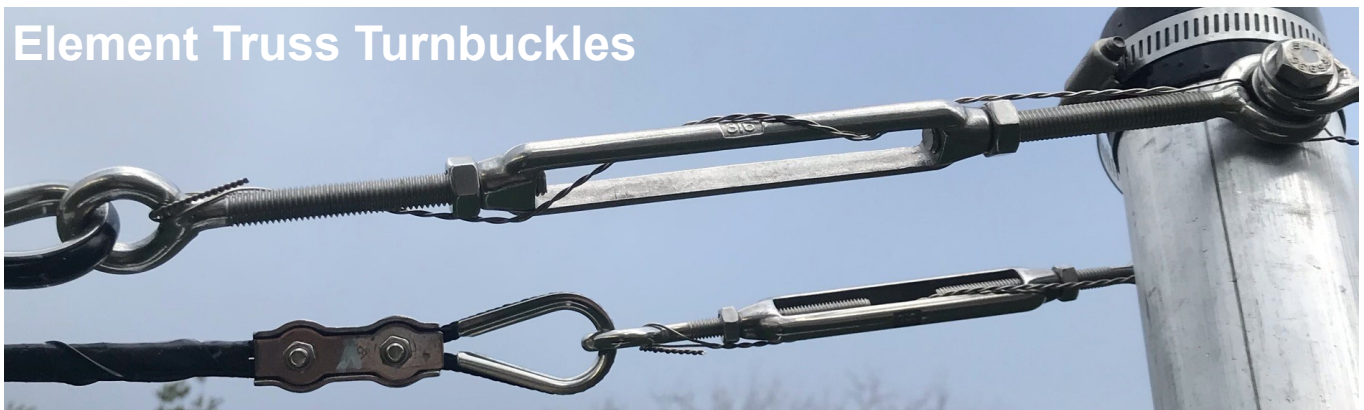
- All turnbuckles should be secured with safety wire to prevent them from loosening due to vibrations.
- For best results, use a pair of safety wire pliers as shown below.
- For instruction on using the safety wire pliers refer to this youtube video: https://www.youtube.com/watch?v=FJ-bkk_IIXQ



Boom Truss Turnbuckles



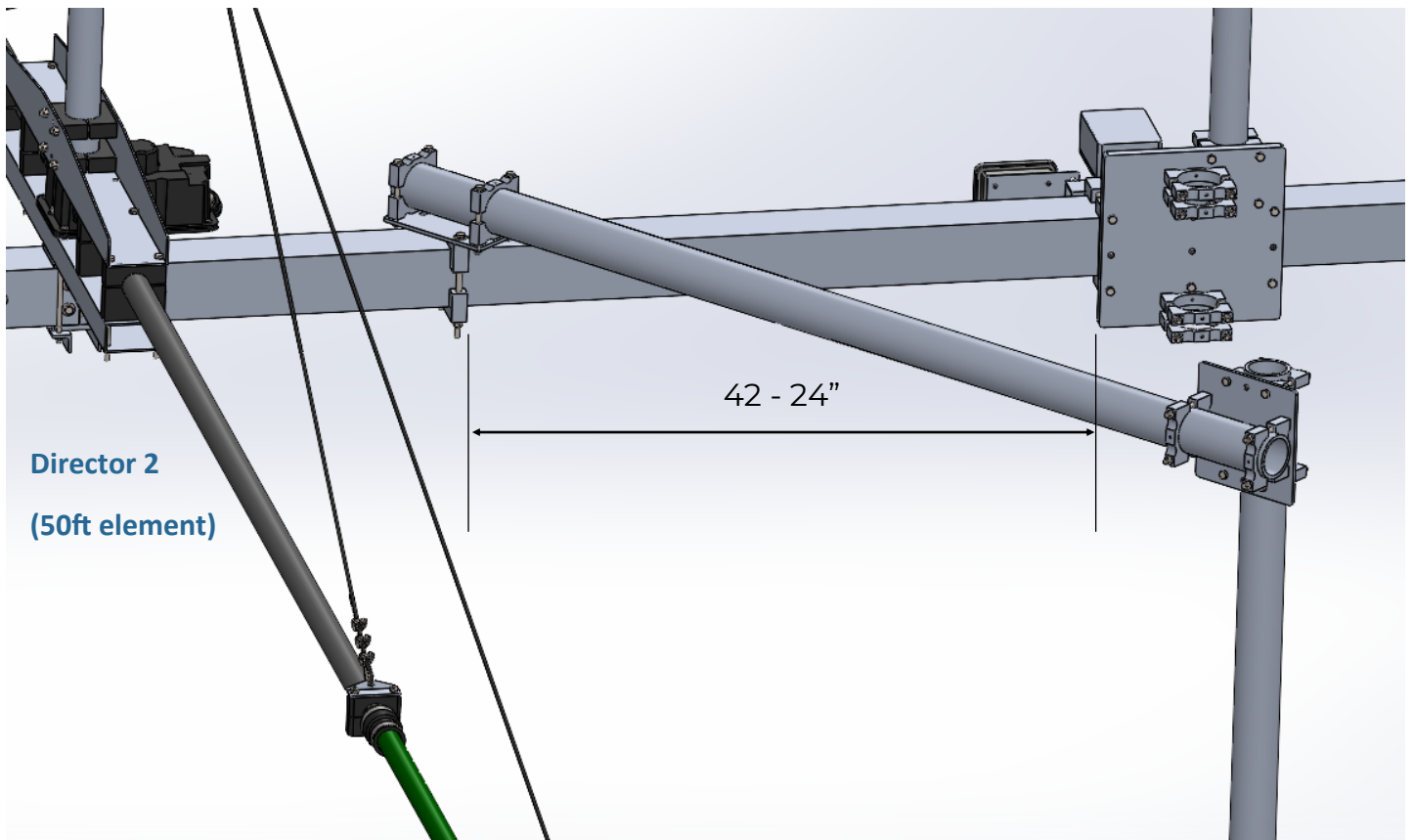
Element Truss Turnbuckles



BOOM TIE-BACK OVERVIEW

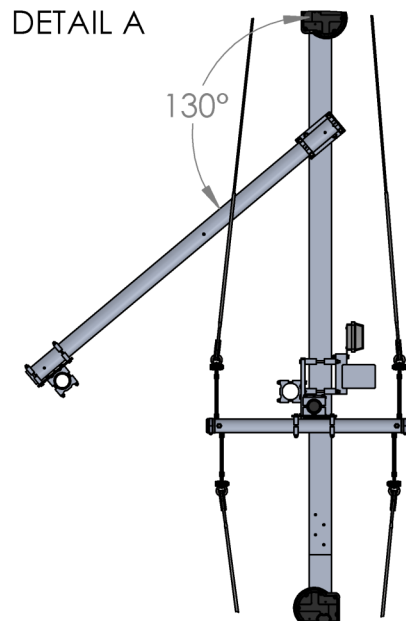
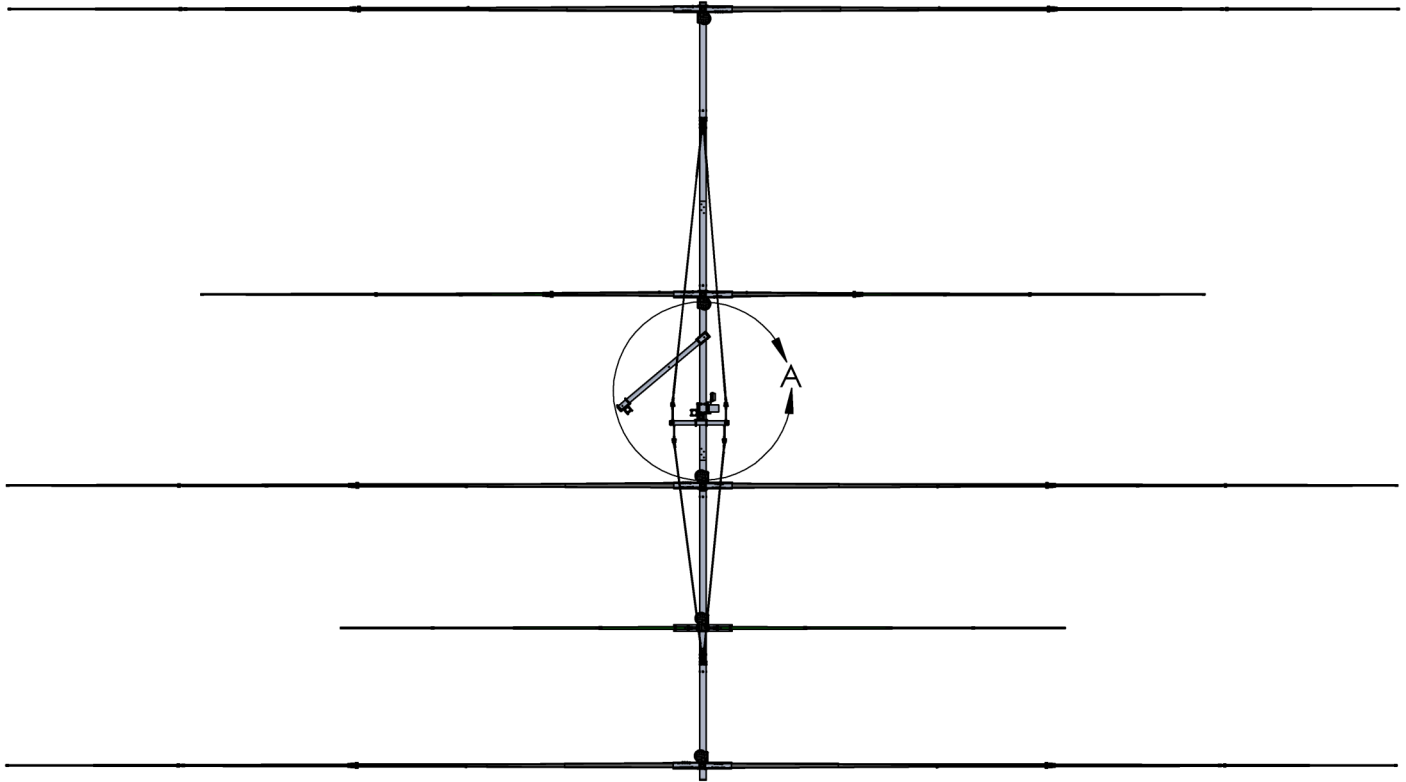
High Wind Tie-back Kit (72-7000-09) **Ships inside Misc Parts Box		
Item	Part Number	Quantity
Tie back boom attachment plate	10-1607-51	1
Saddle, 3"	10-1601-61	12
Square Saddle	10-1601-71	2
Hex Bolt, 3/8 x 7", S/S	60-7002	3
Nut, 3/8, Nylock	60-0050	3
Hex Bolt, 5/16 x 4.5"	60-0115	14
Nut, 5/16, Nylock	60-0046	14
Boom Plate, 8"	10-1021-43	1
Screw, 10-32 x 5/8", Panhead, Phillips, S/S	60-0113	3
Set Screw, 10-32 x 1/4", Cup Point, S/S	60-0112	7
Washer, 3/8"	60-0034	3

- The Boom Tie-Back should be mounted as **far away from the mast** as possible in order to prevent the most amount of rotational force. This distance can be upwards of 42" and should be no less than 24".
- 3" structural tubing is **NOT** supplied as the lengths will vary on every install depending on a variety of factors.



BOOM TIE-BACK OVERVIEW

- The Boom Tie-Back has a maximum angle of 130 degrees and should be **mounted as close to 90 degrees** as possible .

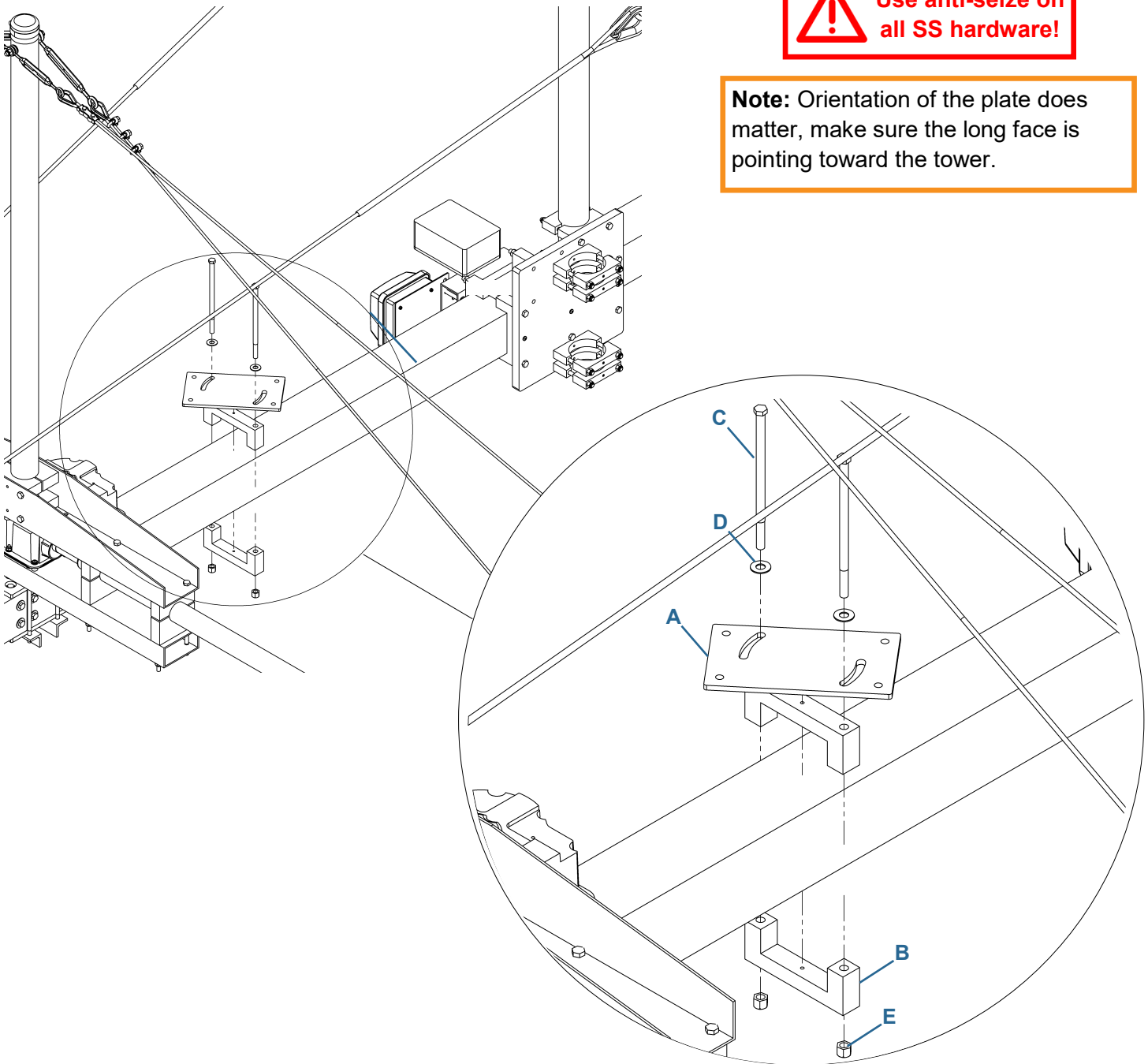


BOOM TIE-BACK PLATE ATTACHMENT

Key	QTY	Part Number	Description
A	1	10-1607-51	Boom Tie-back Attachment Plate (HFT540C)
B	2	10-1601-71	Square Saddle (HFT504C)
C	2	60-7002	Hex Bolt, 3/8 x 7" SS
D	2	60-0050	Washer, 3/8"
E	2	60-0034	Nut, 3/8", S/S, Nylock

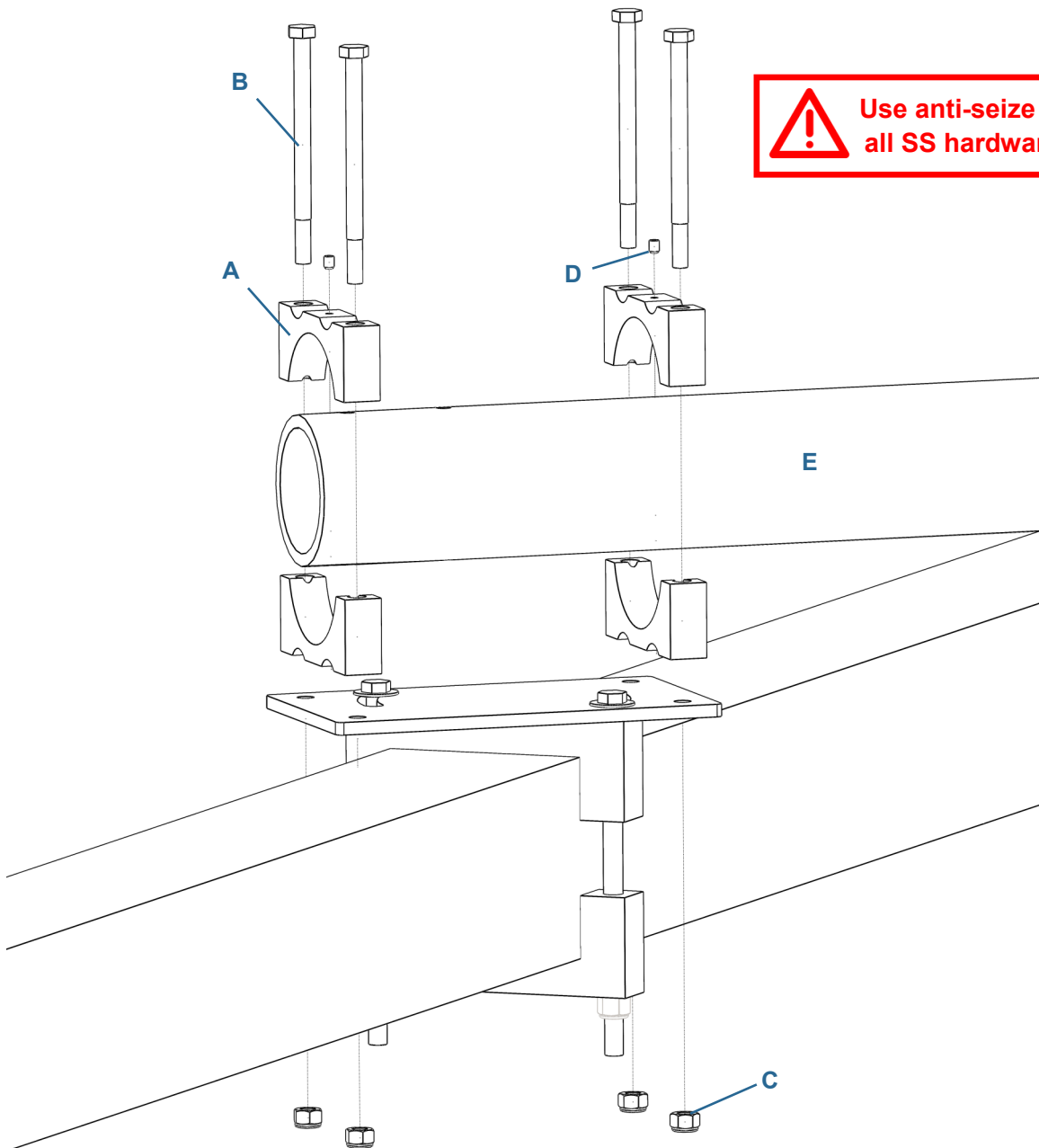
 **Use anti-seize on all SS hardware!**

Note: Orientation of the plate does matter, make sure the long face is pointing toward the tower.



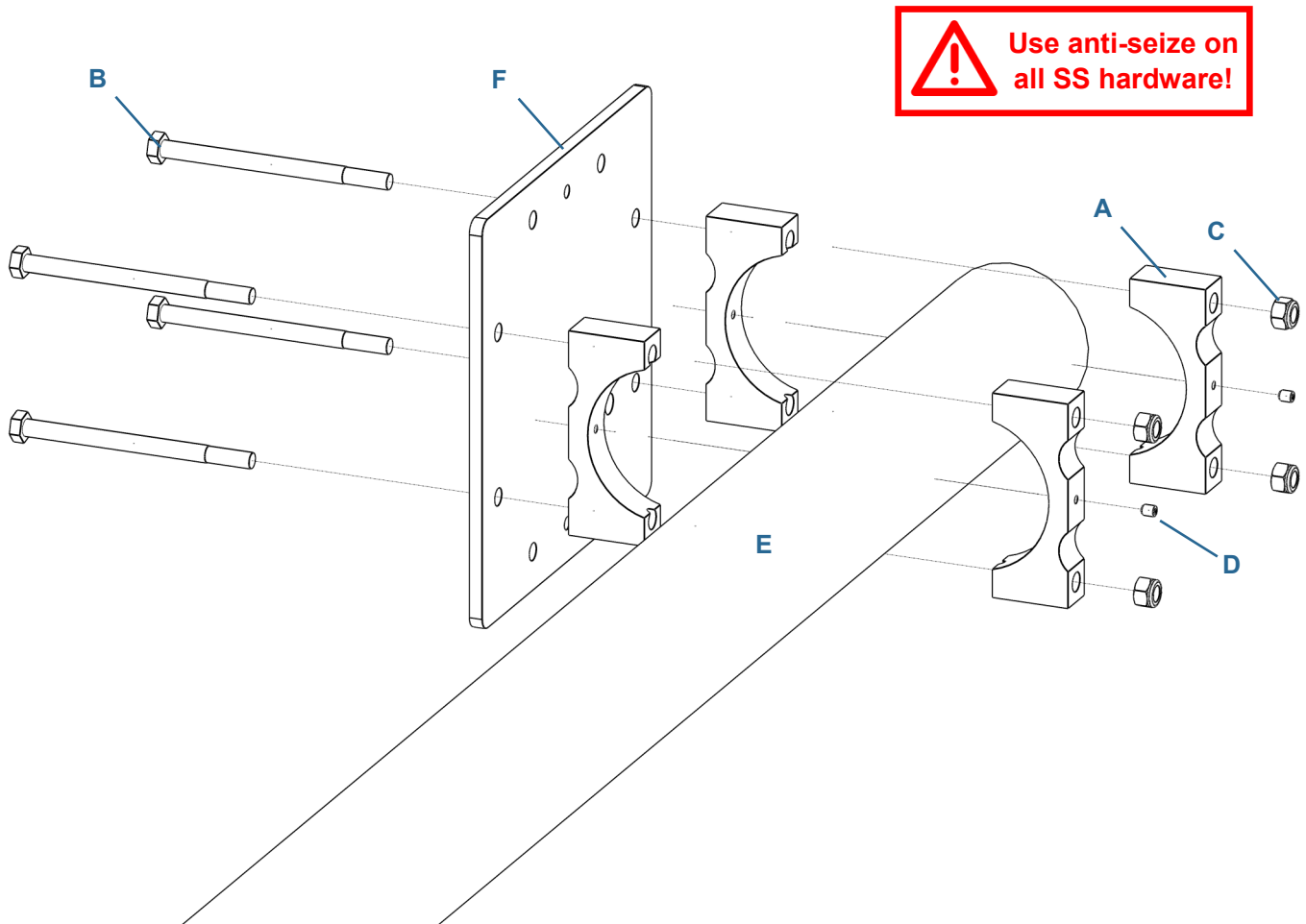
BOOM TIE-BACK ARM ATTACHMENT

Key	QTY	Part Number	Description
A	4	10-1601-61	Saddle, 3"
B	4	60-0115	Hex Bolt, 5/16" x 4-1/2", S/S
C	4	60-0046	Nut, 5/16" -18, Nylock, S/S
D	2	60-0112	Set Screw, 10-32 x 1/4", Cup Point, S/S
E	1	N/A	3.0" Structural Tubing (Galvanized Chromoly Recommended, Customer Supplied)



BOOM TIE-BACK VERTICAL/TOWER MOUNTING PLATE ATTACHMENT

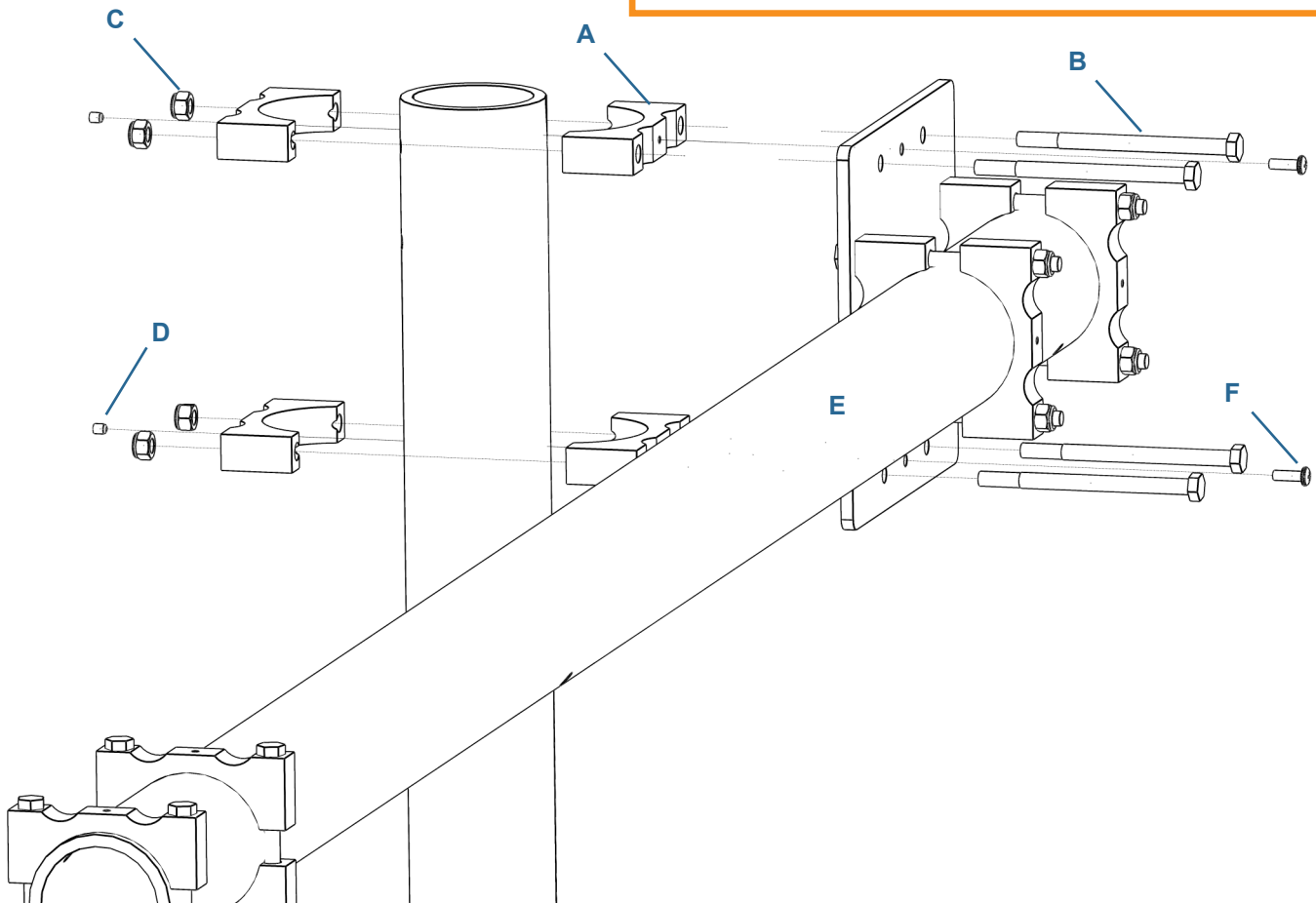
Key	QTY	Part Number	Description
A	4	10-1601-61	Saddle, 3"
B	4	60-0115	Hex Bolt, 5/16" x 4-1/2", S/S
C	4	60-0046	Nut, 5/16" -18, Nylock, S/S
D	2	60-0112	Set Screw, 10-32 x 1/4", Cup Point, S/S
E	1	N/A	3.0" Structural Tubing (Galvanized Chromoly Recommended, Customer Supplied)
F	1	10-1021-43	Boom to Mast plate, 8" x 8"



BOOM TIE-BACK ARM TO VERTICAL MAST ATTACHMENT

Key	QTY	Part Number	Description
A	4	10-1601-61	Saddle, 3"
B	4	60-0115	Hex Bolt, 5/16" x 4-1/2", S/S
C	4	60-0046	Nut, 5/16" -18, Nylock, S/S
D	2	60-0112	Set Screw, 10-32 x 1/4", Cup Point, S/S
E	1	N/A	3.0" Structural Tubing (Galvanized Chromoly Recommended, Customer Supplied)
F	2	60-0112	Screw, 10-32 x 5/8", Panhead, Phillips, S/S

Optionally: Aluminum saddles and vertical mast can be omitted, then the plate can be mounted directly to tower using customer supplied hardware. Otherwise different size aluminum saddles/hardware (1.75", 2.00", 2.25", or 2.50") can be purchase to mount to tower leg.



FINAL CHECKS / INSPECTION

- Use locking wire on all turnbuckles to prevent them from loosening due to vibrations once the antenna is in the air.
- Do a final check that all bolts are torqued down to the proper spec.
- Check that all control cables and coax jumpers have proper strain relief at both ends and that there are no pinch points where cables would be compressed when the antenna is lifted.
- If you are lifting the control cable with the antenna, make sure that there is proper strain relief for the 24 conductor control cable at the connector junction box.
- Ensure all coax jumper connections are properly waterproofed with silicone tape or coax seal.

STANDARD OPERATING PROCEDURE—SWR TESTS

Ground SWR Test

At this point it is helpful to do an SWR test to confirm that the elements and switching are still working properly. Even though the SWR will be high because the antenna is close to the ground and has not been tuned yet, the test will still reveal any major mechanical or electrical issues.

Step 1: Connect the controller to the antenna and connect an SWR analyzer to the feedline. **No fault codes should appear on the controller! If “check fault” appears in the top right corner of the display go to the fault code menu to diagnose the issue. Correct the issue before continuing with the installation. Contact support@steppir.com for help**

Step 2: Print the *Ground SWR Results* table on the following page. Tune the antenna to the frequencies listed and record the SWR, the resonant frequency and minimum SWR using an antenna analyzer. When finished, snap a picture of the results and send it to commercial-forms@steppir.com.

Step 3: Analyze the results, SWR < 3:1 is OK and can be tuned to 1.5:1 or less once the antenna is in the air. SWR > 3:1 indicates an issue with the wiring, controller, or motors. Address the cause of the high SWR (Contact support@steppir.com for help) and then repeat the SWR test.

Initial Tune SWR Test

Once the antenna has been raised onto the tower, an initial tune must be performed to optimize the antenna for minimum SWR. Familiarize yourself with the antenna controller by reading the controller manual, particularly the section describing the Create/Modify function.

Step 1: Connect the controller to the antenna and connect an SWR analyzer to the feedline. **No fault codes should appear on the controller! If “check fault” appears in the top right corner of the display go to the fault code menu to diagnose the issue. Correct the issue before continuing with the installation. Contact support@steppir.com for help**

Step 2: Print the *Initial Tune SWR Results* page and tune the antenna to the frequencies listed. Enter create/modify mode on the controller to begin the tuning process.

Step 3: For each frequency: record the initial SWR, resonant frequency, and minimum SWR. If the initial SWR is above the acceptable limit, apply a band correction factor to adjust the antenna until the SWR is reduced to the desired level. Note the band correction factor and SWR after tuning. Tune to the next frequency and repeat until the table has been filled out.

Step 4: When finished, snap a picture of the results and send it to commercial-forms@steppir.com.

GROUND SWR RESULTS

Print a copy of this page, fill it out, and email a photo of it to commercial-forms@steppir.com

Controller Frequency (MHz)	SWR (at controller freq.)	Resonant Frequency (MHz)	Minimum SWR
30.000			
20.000			
15.000			
13.000			
10.000			
7.000			

Please watch the tuning support videos on our website at steppir.com/videos, then use the frequency sheet on the next page of this manual.

As a reminder, make sure there is **NO POWER** to the antenna before it is fully tuned, and only tune **ONCE** per segment.

You can scan the QR code below to go directly to the site with support videos.



INITIAL TUNE SWR RESULTS

Print a copy of this page, fill it out, and email a photo of it to commercial-forms@steppir.com

Controller Frequency (MHz)	Resonant Frequency (MHz)	SWR (at res. freq.)	Band Correction Factor (%)	SWR (after Band Cor.)
29630				
28540				
27090				
25640				
24190				
23100				
22380				
21650				
20930				
20200				
19480				
18750				
18030				
17300				
16580				
15850				
15130				
14400				
13680				
12950				
12230				
11500				
10780				
10050				
9440				
8950				
8460				
7990				
7510				
7040				