



**ASSEMBLY &
INSTALLATION**



XM520
20 METER 5 ELEMENT YAGI



CUSHCRAFT
COMMUNICATIONS ANTENNAS

XM520

Thank you for your purchase of the Cushcraft XM520. This antenna is designed and manufactured to give the best performance and trouble free service. The antenna will perform as specified if the instructions are followed during assembly and installation. If you have technical questions and have access to the World Wide Web you can visit Cushcraft's **TECHEXPRESS** support service (<http://www.cushcraft.com>). The site enables the user to place parts orders, ask technical questions, locate part numbers, initiate warranty inquiries and review *Frequently Asked Questions*. Our technical support staff can be reached by phone at (603) 627-7877 (8 AM to 5 PM Eastern time or voice mail after hours), faxed at (603) 627-1764 or can be e-mailed at techsup@cushcraft.com.

THIS ANTENNA IS AN ELECTRICAL CONDUCTOR. CONTACT WITH POWER LINES CAN RESULT IN DEATH OR SERIOUS INJURY. DO NOT INSTALL THIS ANTENNA WHERE THERE IS ANY POSSIBILITY OF CONTACT WITH OR HIGH VOLTAGE ARC-OVER FROM POWER CABLES OR SERVICE DROPS TO BUILDINGS. THE ANTENNA, SUPPORTING MAST AND/OR TOWER MUST NOT BE CLOSE TO ANY POWER LINES DURING INSTALLATION, REMOVAL OR IN THE EVENT PART OF THE SYSTEM SHOULD ACCIDENTALLY FALL. FOLLOW THE GUIDELINES FOR ANTENNA INSTALLATION RECOMMENDED BY THE U.S. CONSUMER PRODUCT SAFETY COMMISSION AND LISTED IN THE ENCLOSED PAMPHLETS.

Antenna System Planning

Before assembly, take time to review your installation plans for the antenna. Location of the antenna is very important. Surrounding objects such as trees, power lines, buildings, and other antennas will interact with an HF Yagi. To minimize the effects of surrounding objects, mount the antenna as high and in the clear as possible. Metallic guy wire within 30 feet of this antenna, if broken with strain insulators, will improve performance. **YOU MUST INSURE THAT NEITHER PEOPLE OR PETS CAN COME IN CONTACT WITH YOUR ANTENNA WHILE IT IS IN OPERATION. DEADLY VOLTAGES AND CURRENTS MAY EXIST. ALSO, SINCE THE EFFECTS OF EXPOSURE TO RF ARE NOT FULLY UNDERSTOOD, LONG TERM EXPOSURE TO INTENSE RF FIELDS IS NOT RECOMMENDED. THERE IS A WARNING STICKER WHICH MUST BE ATTACHED TO THE BOOM AS SHOWN IN FIGURE A.** Plan your installation carefully. If you use volunteer helpers be sure that they are qualified to assist you. Make certain that everyone involved understands that you are in charge and that they must follow your instructions. If you have any doubts at all, employ a professional antenna installation company to install your antenna.

System Grounding

Direct grounding of the antenna, mast and tower is very important. This serves as protection from lightning strikes and static buildup. A good electrical connection should be made to one or more ground rods directly at the base of the tower or mast using at least #10 AWG ground wire and non-corrosive hardware. For details and safety standards, consult the National Electrical Code. A coaxial lightning arrester should be used. Cushcraft offers several different models such as the LAC series.

Assembly

The assembly procedure for the XM520 consists of assembling the following subassemblies. **1) Boom Assembly. 2) Element Assembly. 3) Element to Boom Assembly. 4) Feed System Assembly. 5) Boom to Mast Assembly. 6) Boom Truss Assembly.** Assembly of the XM520 will be easiest if the preceding steps are performed in the given order. **Please read through the entire assembly procedure before beginning.**

Verification of Parts

Verify all parts are present by using the XM520 Master Parts List. Check off each part when it is counted. There are extra parts intentionally shipped with this antenna. Place common hardware in temporary containers for ease of assembly. Note all hardware is Stainless Steel.

Part No.	Description	Metric Equivalent	Quantity	Qty Check
MNXM	Matching Network		1	___
X79FS	6" feed strap	15.2 cm	2	___
XM520FL	5/8" x 85-1/2"	1.6 x 217.2 cm	2	___
XM520EA	1-3/8" x 48" aluminum tube	3.5 x 121.9 cm	3	___
XM520EB	1-1/4" x 24" aluminum tube, slotted one end	2.5 x 60.1 cm	10	___
X79EC	7/8"-1" x 36" aluminum tube, swedged, slotted one end	2.2-2.5 x 91.4 cm	10	___
X79ED	5/8-3/4" x 36" aluminum tube, swedged, slotted one end	1.6-1.9 x 91.4 cm	10	___
X79EE	1/2" x 36" aluminum tube, slotted one end	1.3 x 91.4 cm	10	___
X79EF	3/8" x 48" aluminum tube	.9 x 121.9 cm	6	___
XM520EG	3/8" x 50" aluminum tube	.9 x 127 cm	2	___
XM520EH	1-3/8" x 24" aluminum tube	3.5 x 61.0 cm	4	___
X79EJ	3/8" x 32" aluminum tube	.9 x 81.3 cm	2	___
XM520EK	1-1/8" x 36" aluminum tube	2.9 x 91.4 cm	10	___
XM520BA	2-1/2" x 84" aluminum tube, 4 holes	6.3 x 213.4 cm	2	___
XM520BB	2-1/2" x 84" aluminum tube, 4 holes	6.3 x 213.4 cm	2	___
XM520BC	2-1/2" x 84" aluminum tube, 8 holes	6.3 x 213.4 cm	1	___
X79BD	2-3/8" x 12" aluminum tube, 4 holes	6.0 x 30.5 cm	2	___
XM520BE	2-3/8" x 60" aluminum tube, 8 holes	6.0 x 152.4 cm	1	___
XM520BF	2-3/8" x 84" aluminum tube, 4 holes	6.0 x 213.4 cm	1	___

XM520

Part No.	Description	Metric Equivalent	Quantity	Qty Check
010011	#8-32 Stainless Steel Nut		4	___
010082	1/4-20 x 1" Stainless Steel Machine Screw	0.6 cm - 20 x 2.5 cm	60	___
010084	1/4" Stainless Steel Flat Washer	0.6 cm	112	___
010085	1/4-20 Stainless Steel Nut	0.6 cm	11	___
010120	8-32 x 2" Stainless Steel Machine Screw	5.1 cm	4	___
010207	3/8" Stainless Steel Flat Washer	0.9 cm	10	___
010208	3/8" Stainless Steel Lock Washer	0.9 cm	10	___
010209	3/8" Stainless Steel Nut	0.9 cm	10	___
010719	1/4"-20 x 3" Stainless Steel Hex Bolt	7.6 cm	2	___
011941	#8 Stainless Steel Lock Washer		4	___
013209	2-7/8" Center-to-center U-Bolt 4" Long	7.3 cm -10.2 cm Long	5	___
014387	#8-32 Stainless Steel Lock Nut		6	___
014399	1/4" -20 Stainless Steel Lock Nut	0.6 cm	110	___
014498	1-3/8" Cush-A-Clamp	3.5 cm	20	___
014588	1/4" x 3-1/2" Stainless Steel Hex Bolt	0.6 x 8.9 cm	10	___
014592	1/4" Stainless Steel Flat Washer 1/8" Thick	0.6 x 0.3 cm	8	___
024259	1/8" Cable Thimble	.3 cm	4	___
024623	Turnbuckle		2	___
024624	1/8" Cable Clamp	.3 cm	12	___
030407	5/8" Worm Clamp	1.6 cm	10	___
030409	11/16" Worm Clamp	1.7 cm	10	___
030410	1" Worm Clamp	2.5 cm	10	___
030411	1-1/8" Worm Clamp	2.9 cm	10	___
030412	1-1/2" Worm Clamp	3.8 cm	20	___
032881	2-1/16"-3" Worm Clamp	5.2-7.6 cm	2	___
050077	3/8" Black Plastic Cap	0.9 cm	10	___
054526	2-1/2" Black Plastic Cap	6.4 cm	2	___
PS40	40' Phillystran Cable	12.2 m	1	___
124567	1" x 8" Drilled Fiberglass Insulator	2.5 x 20.3 cm	2	___
154815	Feed Line Insulator Block		1	___
170035	3-1/2" Formed Aluminum Vee Blocks	8.9 cm	5	___
194542	8" x 8" x 1/4" Aluminum Mounting Plate	20.3 x 20.3 x 0.6 cm	1	___
194618	Boom to Mast Backing Plate		1	___
194707	4" x 24" x 3/16" Aluminum Bracket	10.2 x 61 x .5	5	___
194791	1/8" x 2" x 4" Truss Bracket	.3 x 5.1 x 10.2 cm	1	___
290326	Danger Label		1	___
324506	8" x 5-1/4" x 3/16" Drilled Extruded Aluminum Bracket	20.3 x 13.3 x 0.5 cm	2	___
324509	4" x 5-1/4" x 3/16" Drilled Extruded Aluminum Bracket	10.2 x 13.3 x 0.5 cm	10	___
324564	1" x 5-1/4" x 1/8" Drilled Aluminum Bracket	2.5 x 13.3 x .3 cm	2	___

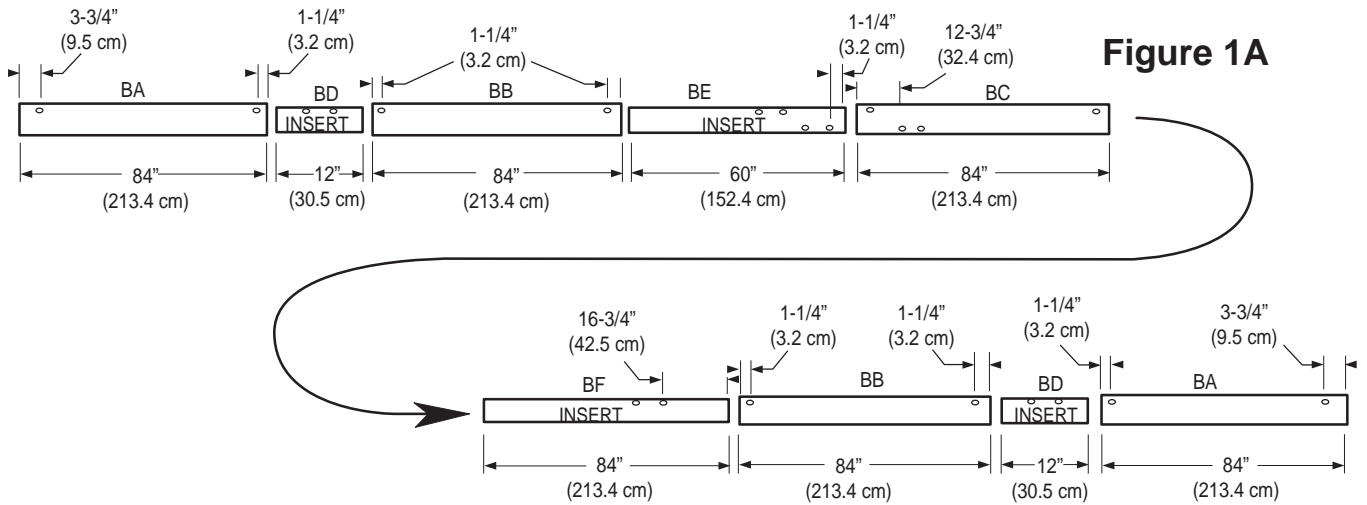


Figure 1A

Figure 1B

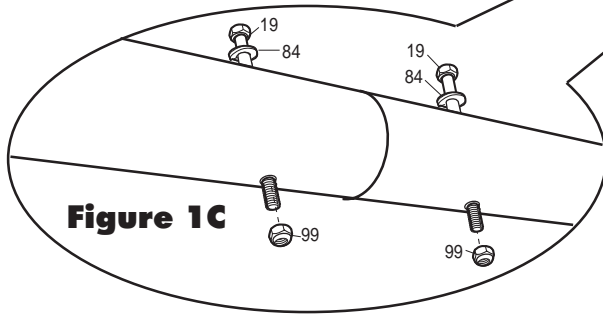
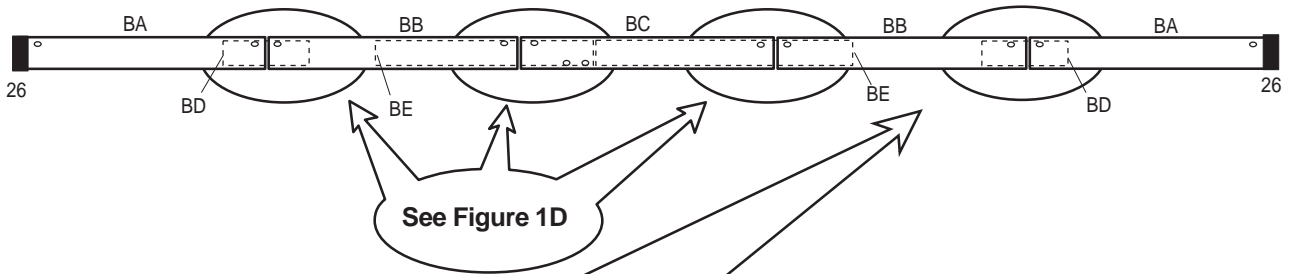


Figure 1C

1-Boom Assembly

Lay out boom sections as shown in Figure 1A. Make sure tube ends are free of debris to allow the inserts BD, BE and BF to slide more easily. Applying penetrating oil to the inserts will also be helpful. Secure the BB/BA connection as shown in Figure 1C. The other connections are made using the element mounting hardware as shown in Figure 1D. After the boom is assembled attach the remaining two element mount brackets (Figure 1E).

ID	Part #	Description	Dimensions	Qty
BA	XM520BA	Aluminum Tube	2-1/2" x 84" (6.3 x 213.4 cm)	2
BB	XM520BB	Aluminum Tube	2-1/2" x 84" (6.3 x 213.4 cm)	2
BC	XM520BC	Aluminum Tube	2-1/2" x 84" (6.3 x 213.4 cm)	1
BD	X79BD	Aluminum Tube	2-3/8" x 12" (6.0 x 30.5 cm)	2
BE	XM520BE	Aluminum Tube	2-3/8" x 60" (6.0 x 152.4 cm)	1
BF	XM520BF	Aluminum Tube	2-3/8" x 84" (6.0 x 213.4 cm)	1
19	010719	SS Hex Bolt	1/4-20 x 3" (7.6)	2
26	054526	Black Plastic Cap	2-1/2" (6.3 cm)	2
84	010084	SS Lock Washer	1/4"	2
99	014399	SS Lock Nut	1/4-20	2

Figure 1D

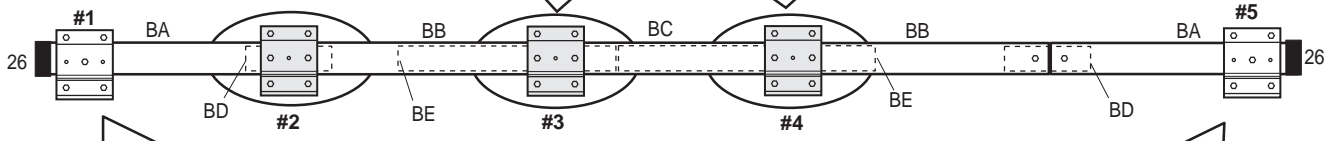
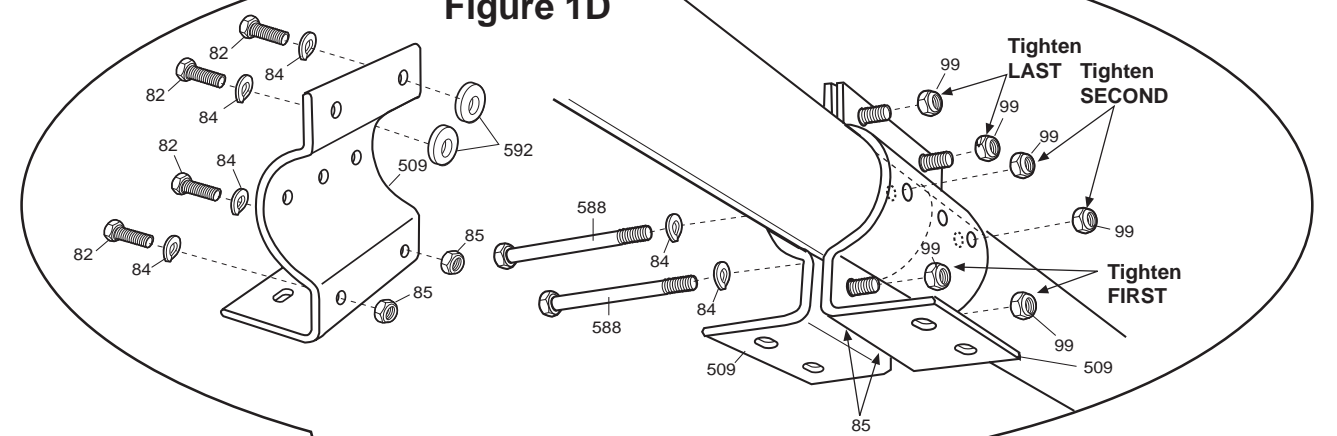
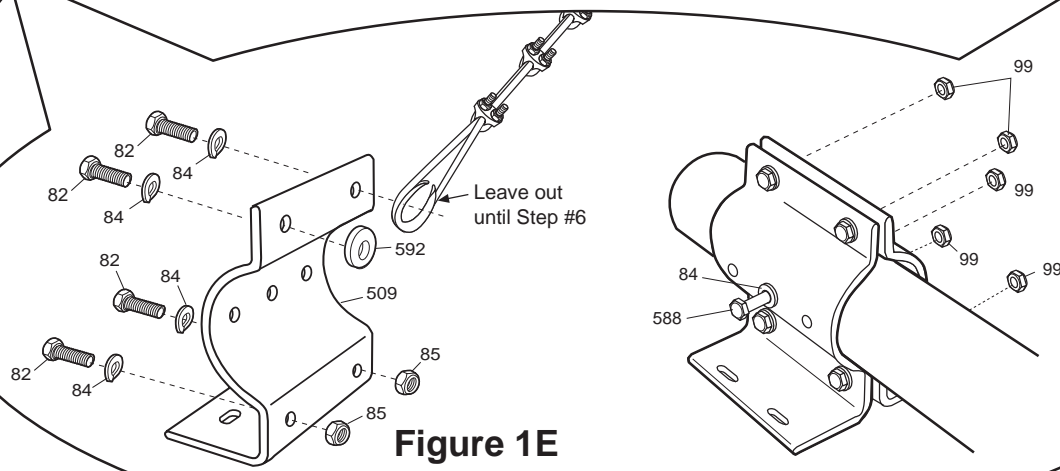


Figure 1E



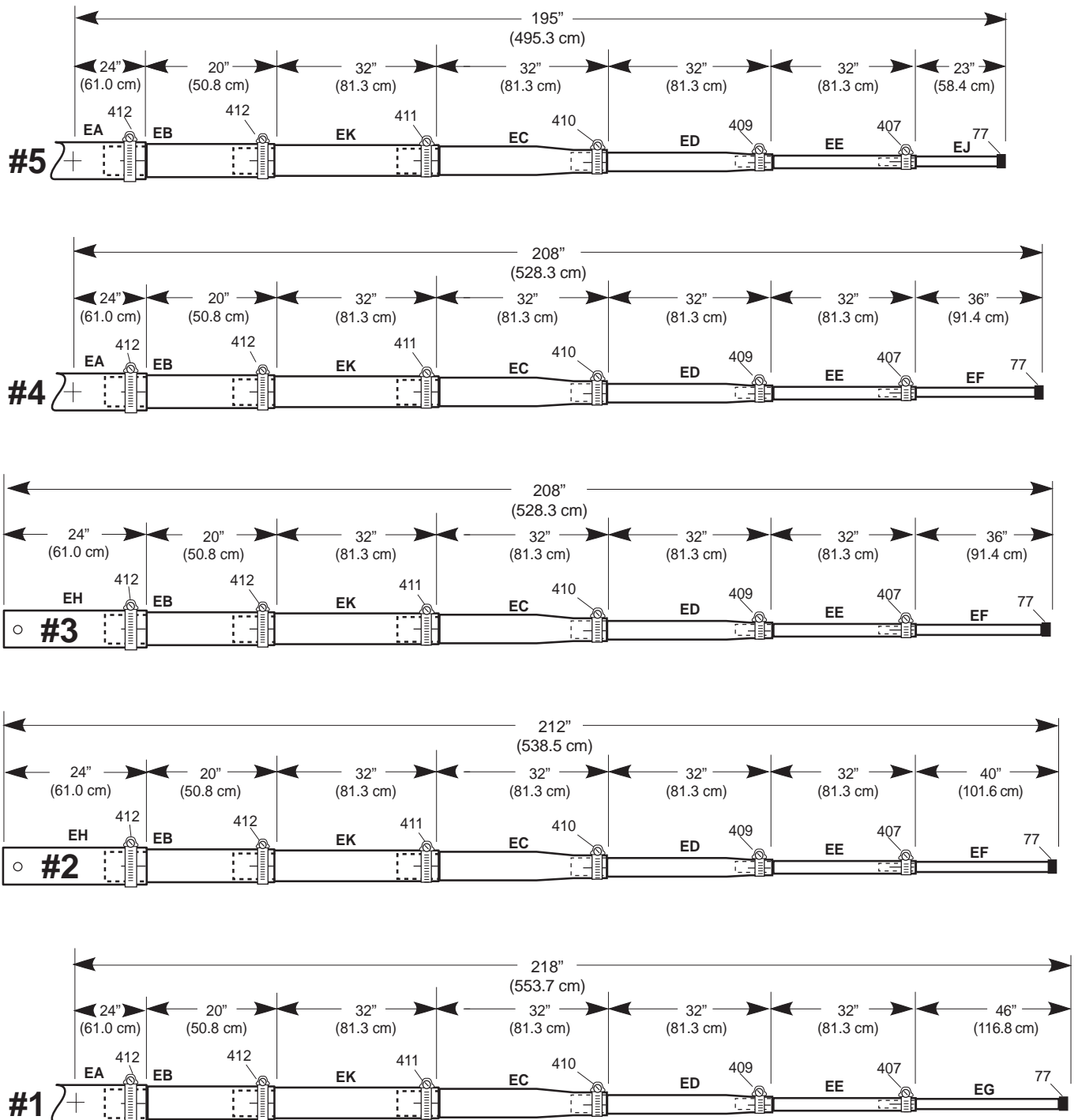
ID	Part #	Description	Dimensions	Qty
82	010082	Hex Bolt	1/4-20 x 1" (.6 x 2.5 cm)	20
84	010084	SS Lock Washer	1/4" (.6 cm)	28
85	010085	SS Nut	1/4-20 (.6 cm)	10
99	014399	SS Lock Nut	1/4" (.6 cm)	28

ID	Part #	Description	Dimensions	Qty
509	324509	Aluminum Bracket	4" x 5-1/4 x 3/16" (10.2 x 13.3 x .5 cm)	10
588	014588	SS Hex Bolt	1/4" x 3-1/2" (.6 x 10.2 cm)	8
592	014592	SS Flat Washer	1/4" (1/8" thick) (.6 x .3 cm)	8

2 - Element Assembly

Figures 2A and 2B show the steps required for element assembly. For elements 2 and 3 slide EB sections over fiberglass insulator (566) until #8 screw holes line up (Figure 2B) . Insert screws (120) through holes and secure with lock washer (41) and nut (11). Pay close attention to all dimensions shown. Dimensions shown for elements #1, #4 and #5 are to the midpoint of tube EA. Dimensions for elements #2 and #3 are to the end points of tube EH.

Figure 2A



Element Assembly Continued

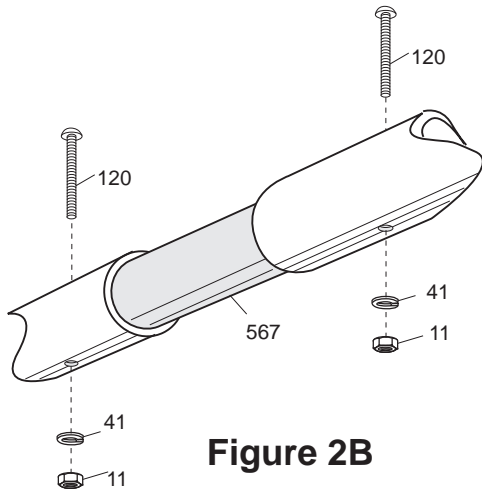


Figure 2B

ID	Part #		Description	Dimensions	Qty
11	010011		SS Nut	#8-32	4
41	011941		SS Lock Washer	#8	4
77	050077		Black Plastic Cap	3/8" (0.9 cm)	10
120	010120		SS Machine Screw	#8-32 x 2" (5.1 cm)	4
407	030407		Worm Clamp	5/8" (1.6 cm)	10
409	030409		Worm Clamp	11/16" (1.7 cm)	10
410	030410		Worm Clamp	1" (2.5 cm)	10
411	030411		Worm Clamp	1-1/8" (2.9 cm)	10
412	030412		Worm Clamp	1-1/2" (3.8 cm)	20
567	124567		Fiberglass Insulator	1" x 8" (2.5 x 20.3 cm)	2
EA	XM520EA		Aluminum Tube	1-3/8" x 48" (3.5 x 121.9 cm)	3
EB	XM520EB		Aluminum Tube	1-1/4" x 24" (2.5 x 60.1 cm)	10
EC	X79EC		Aluminum Tube	7/8"-1" x 36" (2.2.-2.5 x 91.4 cm)	10
ED	X79ED		Aluminum Tube	5/8"-3/4" x 36" (1.6-1.9 x 91.4 cm)	10
EE	X79EE		Aluminum Tube	1/2" x 36" (1.3 x 91.4 cm)	10
EF	X79EF		Aluminum Tube	3/8" x 48" (.9 x 121.9 cm)	6
EG	XM520EG		Aluminum Tube	3/8" x 50" (.9 x 127 cm)	2
EH	XM520EH		Aluminum Tube	1-3/8" x 24" (3.5 x 61.0 cm)	4
EJ	X79EJ		Aluminum Tube	3/8" x 32" (.9 x 81.3 cm)	2
EK	XM520EK		Aluminum Tube	1-1/8" x 36" (2.9 x 91.4 cm)	10

3 - Element to Boom Assembly

Figures 3A and 3B show the steps for element mounting on the XM520 boom. For element location see Figure 4A. Attach the U-channel plate (707). Attach elements using 4 Cush-a-Clamps (98) (Figure 3B). Be sure Cush-a-Clamps are placed in the correct locations according to Figure 3B. The element pictured in Figure 3B is the Driven Element. All elements mount with the same hardware.

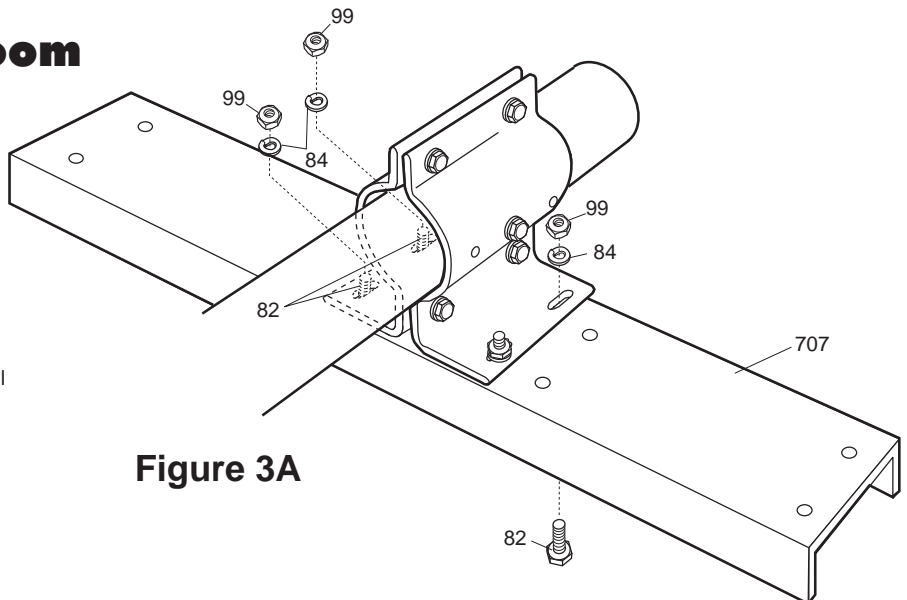


Figure 3A

XM520

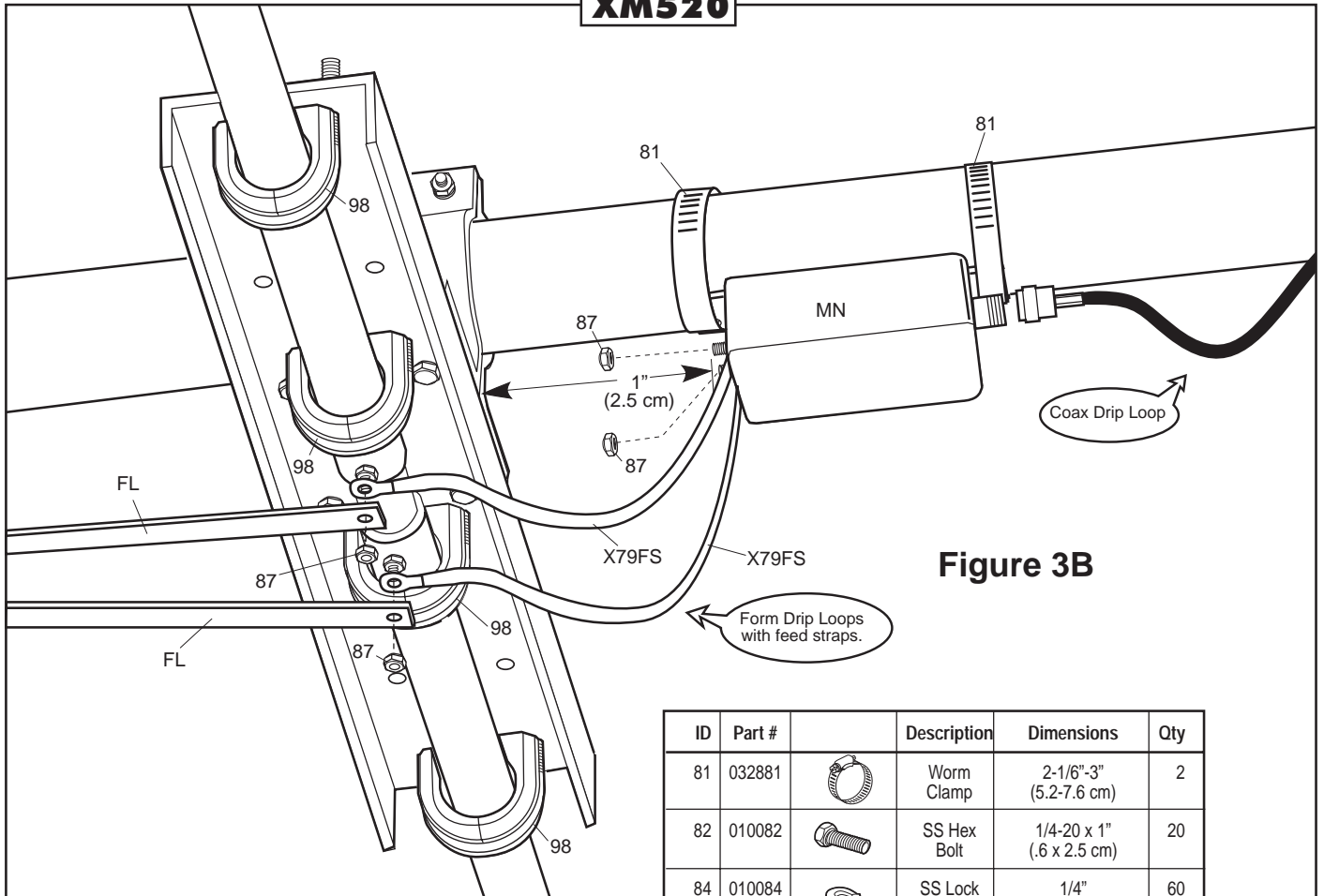
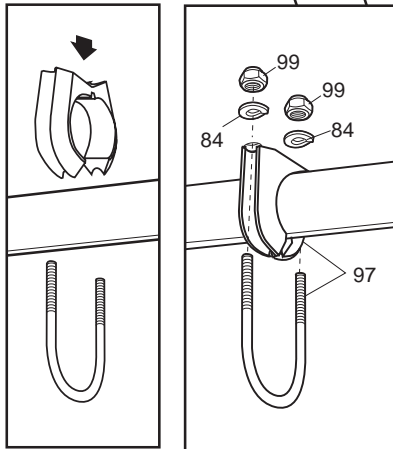


Figure 3B

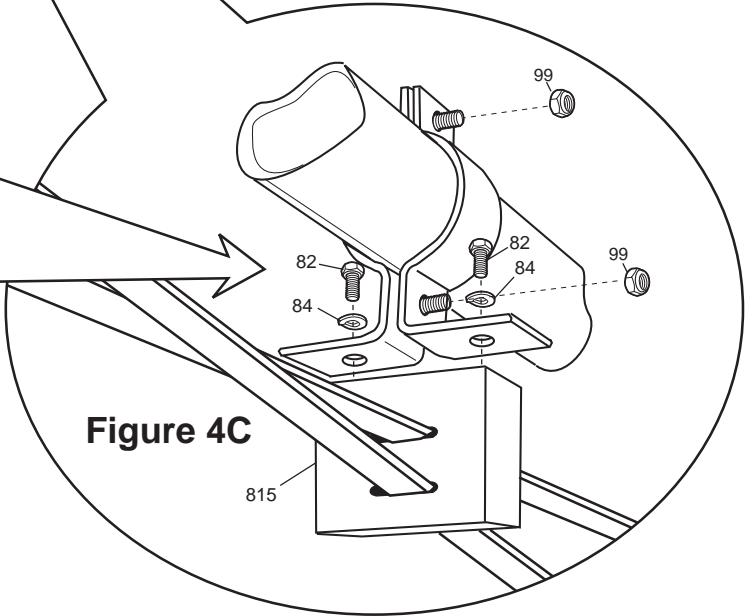
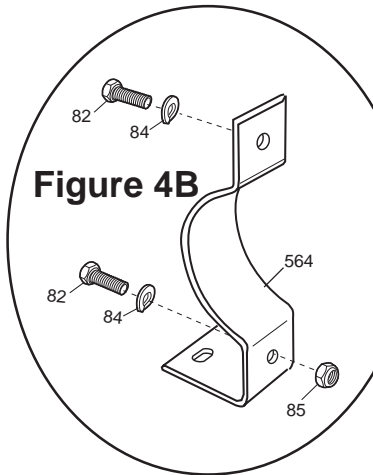
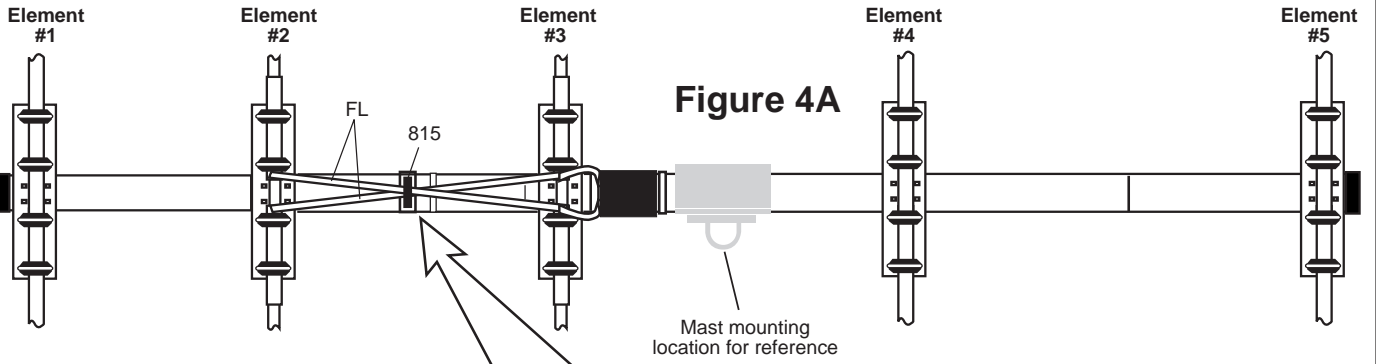








ID	Part #		Description	Dimensions	Qty
81	032881		Worm Clamp	2-1/6"-3" (5.2-7.6 cm)	2
82	010082		SS Hex Bolt	1/4-20 x 1" (.6 x 2.5 cm)	20
84	010084		SS Lock Washer	1/4" (.6 cm)	60
87	014387		SS Lock Nut	#8-32	4
98	014498		Cush-a Clamp	1-3/8" (3.5 cm)	20
99	014399		SS Lock Nut	1/4" (.6 cm)	60
707	194707		U-Channel Bracket	4" x 24" (10.2 x 61 cm)	5
MN	MNXM		Matching Network		1
FL	XM520FL		Aluminum Strap	5/8" x 85-1/2" (1.6 x 217.2 c m)	2
FS	X79FS		Copper Braid	1/2" x 6" (1.2 x 15 cm)	2

4 - Feed System Assembly

Figures 3B, 4A, 4B and 4C show the steps for feed system assembly. Attach the Matching Network (MN) to the boom as shown above with 2 worm clamps (81). Attach the Feed Straps (FS) to the two screws on the MN and the two driven element screws with the hardware shown. Be sure to form a drip loop with the feed straps.

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ID	Part #		Description	Dimensions	Qty
82	010082		Hex Bolt	1/4-20 x 1" (2.5 cm)	4
84	010084		SS Lock Washer	1/4" (.6 cm)	4
85	010085		SS Nut	1/4"-20 (.6 cm)	1
99	014399		SS Lock Nut	1/4"-20 (.6 cm)	2
815	154815		Strap Insulator	2" x 1-1/2" x 1/8" (5.1 x 3.8 x .3 cm)	1
564	324564		Aluminum Bracket	1" x 5-1/4" x 1/8" (2.5 x 13.3 x .3 cm)	2

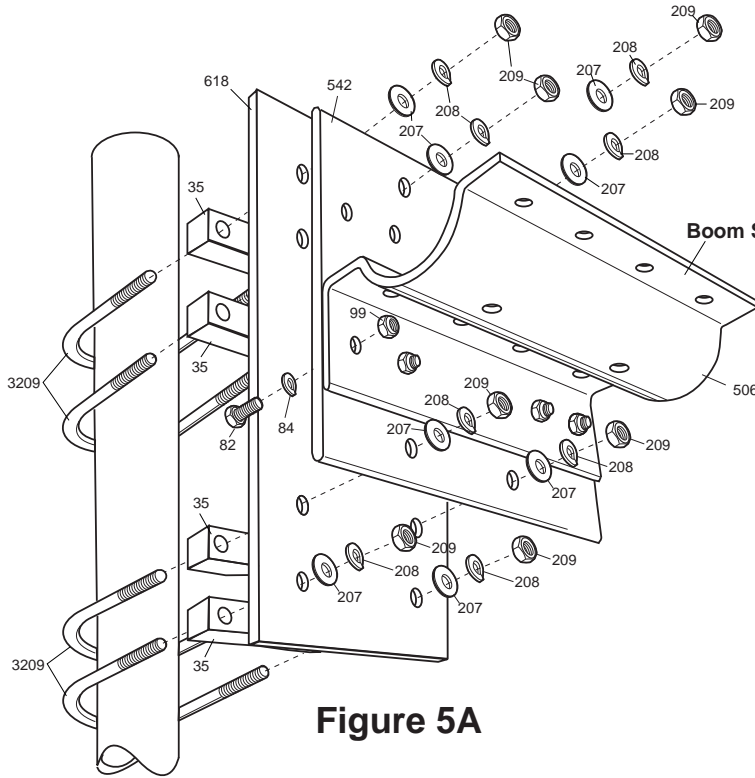


Figure 5A

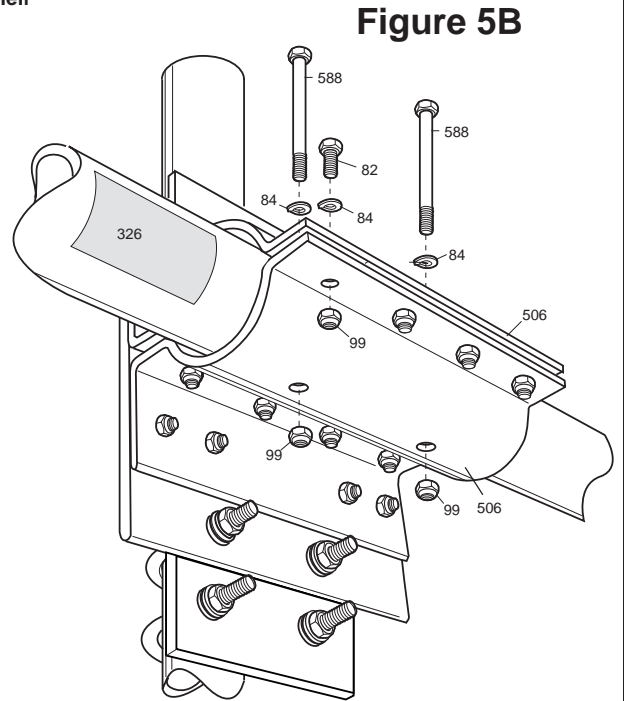















Figure 5B

ID	Part #		Description	Dimensions	Qty
35	170035		Aluminum V-Block	3-1/2" (8.9 cm)	4
82	010082		Hex Bolt	1/4-20 x 1" (2.5 cm)	16
84	010084		SS Lock Washer	1/4" (0.6 cm)	18
99	014399		SS Lock Nut	1/4" (.6 cm)	18
207	010207		SS Flat Washer	3/8" (.95 cm)	8
208	010208		SS Lock Washer	3/8" (.95 cm)	8
209	010209		SS Nut	3/8" (.95 cm)	8
326	290326		Danger Label		1
506	324506		Aluminum Bracket	8" x 5-1/4" x 3/16" (20.3 x 13.3 x .5 cm)	2
542	194542		Alu Mounting Plate	8" x 8" x 1/4" 20.3 x 20.3 x .6 cm)	1
588	014588		SS Hex Bolt	1/4" x 3-1/2" (.6 x 8.9 cm)	2
618	194618		Alu Mounting Plate	6" x 12" x 1/4" (15.2 x 30.5 x .6 cm)	1
3209	013209		U-Bolt	2-7/8" (7.3 cm)	4

5-Boom to Mast Clamp Assembly

The XM520 boom-to-mast clamp is designed to be mounted on the tower/mast so the built in boom shelf feature can be utilized. Following this suggestion, if possible, will simplify antenna installation.

Reference Figures 5A and 5B for assembly of boom to mast clamp. Required hardware is listed in the Boom to Mast Clamp Assembly Parts List. Form the boom shelf by attaching the lower boom bracket (506) to the mast plate (542). Attach mast plates (542 & 618) to mast using U-bolts (3209) and V-blocks (35).

Place the boom on the boom shelf during installation. Loosely attach the top boom bracket (506) to the mast-plate (542) and to the lower boom bracket (506) as shown in Figure 5B. This allows the boom to be moved back and forth for tower top element mounting.

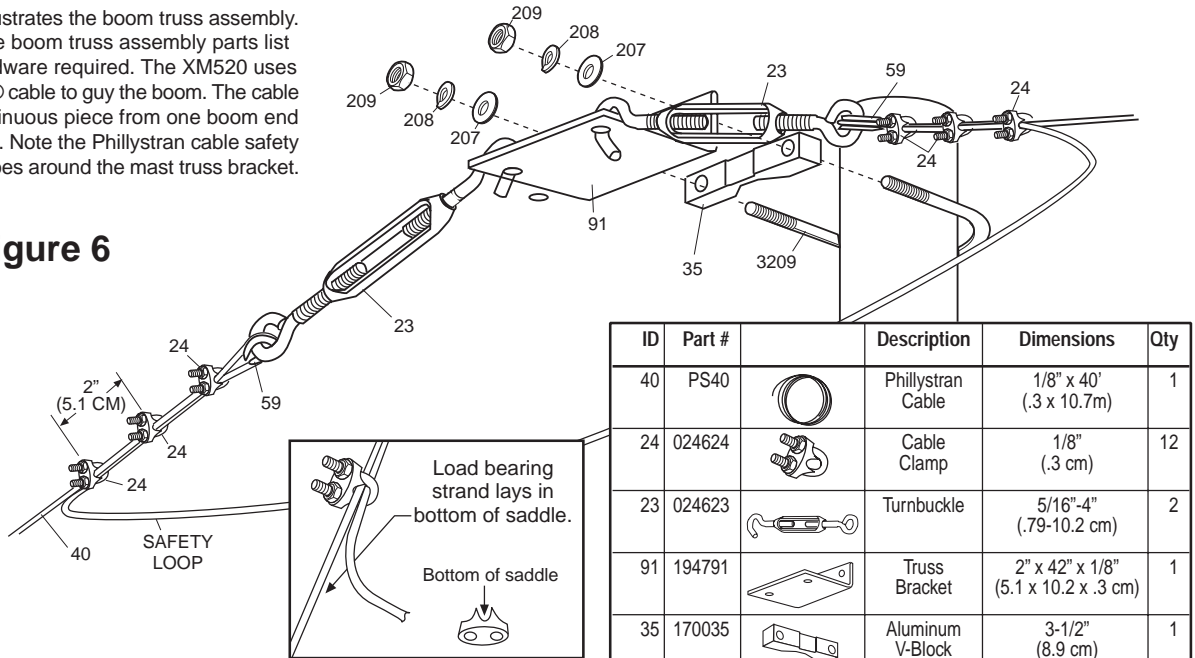
When all elements are securely mounted to the boom and the feed system is in place, line up the 2 holes in the top of the upper boom bracket (506) holes with the corresponding 2 holes in boom section BC. Insert bolts (588) and tighten in place. Next, tighten the 8 bolts, securing the upper and lower boom brackets. Tighten the 4 bolts connecting the upper boom bracket to the mast plate.

Attach good quality coax with a PL-259 connector to the XM520 matching network. Route the coax as shown in Figure 3B. Form a drip-loop with the coax and secure the coax to the boom. Insure PL-259 connector is waterproofed with a good quality sealant after it is attached to the matching network.

6 - Boom Truss Assembly

Figure 6 illustrates the boom truss assembly. Refer to the boom truss assembly parts list for the hardware required. The XM520 uses Phillystran® cable to guy the boom. The cable is one continuous piece from one boom end to the other. Note the Phillystran cable safety loop that goes around the mast truss bracket.

Figure 6



ID	Part #		Description	Dimensions	Qty
40	PS40		Phillystran Cable	1/8" x 40' (.3 x 10.7m)	1
24	024624		Cable Clamp	1/8" (.3 cm)	12
23	024623		Turnbuckle	5/16"-4" (.79-10.2 cm)	2
91	194791		Truss Bracket	2" x 42" x 1/8" (5.1 x 10.2 x .3 cm)	1
35	170035		Aluminum V-Block	3-1/2" (8.9 cm)	1
59	024259		Thimble	1/8" (.3 cm)	4
207	010207		SS Flat Washer	3/8" (.95 cm)	2
208	010208		SS Lock Washer	3/8" (.95 cm)	2
209	010209		SS Nut	3/8" (.95 cm)	2
3209	013209		U-Bolt	2-7/8" (7.3 cm)	1

Attach the truss bracket (91) to the mast 3 feet (1m) above the boom to mast clamp using the 3/8" hardware provided. Position the truss bracket on the same side of the mast as the boom to mast clamp. Unscrew the turnbuckle ends until there is 1/2" (1.2 cm) of thread remaining. Place the jaw of each turnbuckle (23) into the holes of the truss bracket. Place a thimble (59) on the eye of each turnbuckle. Place three loose cable clamps (24) onto the cable end. Reference Figure 6 and place the cable clamp saddle over the load bearing cable. The load bearing cable is the cable that attaches to the boom end. Feed the cable through a turnbuckle eye. Run the cable back through the cable clamps. Place three additional cable clamps on the end of the cable. Feed the cable through the other turnbuckle eye. Run the cable back through the cable clamps. Feed enough cable through these parts until the center of the Phillystran cable coil is located at the truss bracket. Insure there is enough slack in the cable to form a loose safety loop between the turnbuckles. Tighten the cable clamps beginning with the clamp closest to the thimble.

Refer to Figure 1E for attachment of the cable to the boom ends. Place a thimble (59) on the 1/4-20 x 1" bolt. Place three loose cable clamps (24) onto the cable end. Feed the cable end through the element bracket and around the thimble. Run the cable back through the cable clamps. Tighten the cable to remove the majority of the sag from the boom. Space the cable clamps 2 inches (5.1 cm) apart. Insure the load bearing cable is seated in the cable clamp saddle as shown above. Tighten the cable clamps beginning with the clamp closest to the thimble. Cut off excess cable 2" (5.1 cm) after the third cable clamp.

Adjust each turnbuckle to bring each boom end level with the center. Phillystran cable has a minimal amount of stretch over time. A safety wire can be placed through the turnbuckle openings to keep the turnbuckles from unscrewing.

SPECIFICATIONS

Frequency Coverage (Meters)	20	Boom Length, ft (m)	35.4 (10.8)
Total number of Elements	5	Boom Diameter, in (cm)	2.5 (6.3)
Free Space Gain (dBi)	9.3	Maximum Mast Diameter OD, in (cm)	2.5 (6.3)
Maximum Front to Back Ratio (dB)	20-30	Maximum Wind Survival, mph (kph)	>90 (>145)
VSWR Minimum	1.1:1	Maximum Wind Surface Area, ft ² (m ²)	9.2 (0.85)
VSWR 1.5:1 Bandwidth (KHz)	350	Wind Load @ 80 mph (129 kph), lb (kg)	115 (52.3)
Longest Element, ft (m)	36.3 (11.1)	Maximum Power Handling (Watts)	1500
Turning Radius, ft (m)	25.9 (7.9)	Weight, lb. (kg)	92 (41.8)
		Design Safety Factor	1.25

The Electrical Specifications for all Cushcraft Amateur Antennas are derived from numerical analysis and measured data taken on our test range. Performance may vary due to the random variables associated with a specific application or installation.

Limited Warranty

Cushcraft Corporation, 48 Perimeter Road, Manchester, New Hampshire 03103, warrants to the original consumer purchaser for one year from date of purchase that each Cushcraft antenna is free of defects in material or workmanship. If, in the judgement of Cushcraft, any such antenna is defective, then Cushcraft will, at its option, repair or replace the antenna at its expense within thirty days of the date the antenna is returned (at purchaser's expense) to Cushcraft or one of its authorized representatives. This warranty is in lieu of all other expressed warranties. Any implied warranty is limited in duration to one year.

Cushcraft Corporation shall not be liable for any incidental or consequential damages which may result from a defect. Some states do not allow a limitation on how long an implied warranty lasts or exclusions or limitations of incidental or consequential damages, so the above limitation and exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. This warranty does not extend to any products which have been subject to misuse, neglect, accident or improper installation. Any repairs or alterations outside of the Cushcraft factory will nullify this warranty.



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