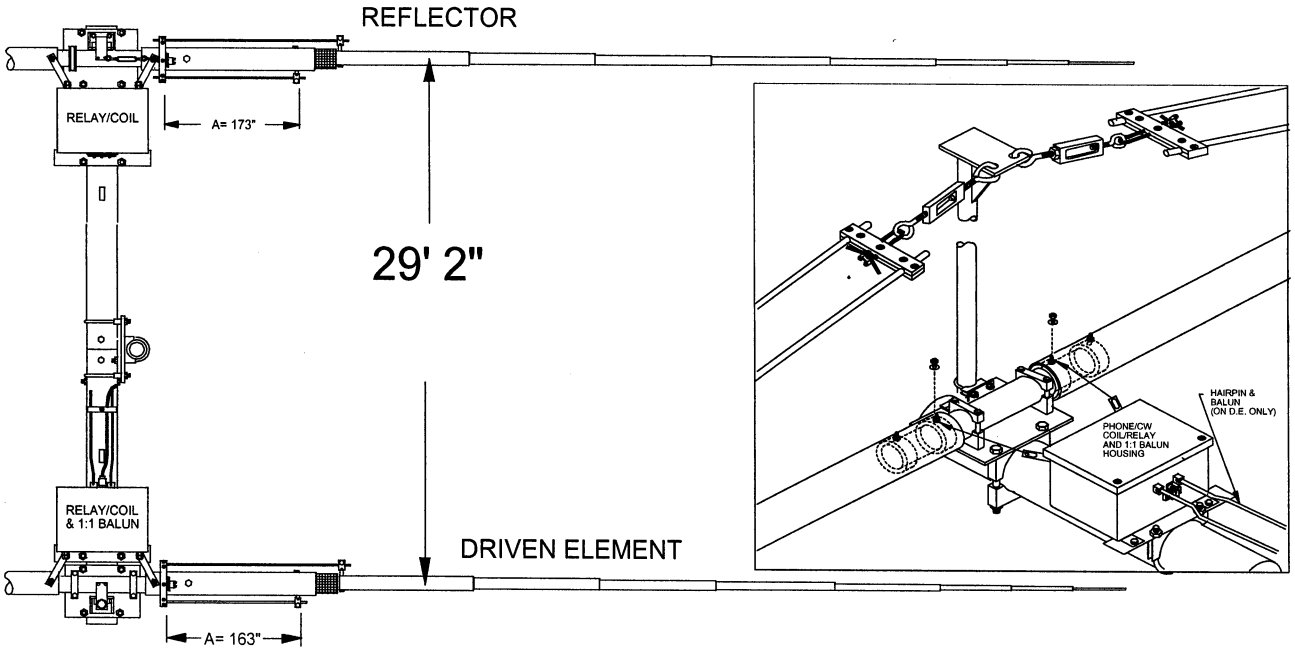
# 80M2LLB Yagi, Linear Loaded

3-16-00
REV. 5-11-05




## SPECIFICATIONS

| | |
|---|---|
| Model Number | 80M2LLB |
| Frequency Range | 3.50-3.550 and 3.770-3.820 MHz<br>Remote Switching @ 12 VDC |
| Gain over dipole | 6.2 dBi |
| Front to Back | 15 dB Typ. |
| Power Handling | 3.5 kW, cont. , 5 KW peak, standard |
| Feed Imp. / Conn type | 50 Ohms/ SO-239 ('N' opt.) |
| VSWR / Bandwidth | 1.2:1 typ. / 2:1 @ edges (approx 50kHz) |
| Balun | 1:1 Coaxial, Teflon* |
| Boom Length / Dia. | 30 ft / 4" O. D. |
| Element length | 105' , Refl. 98' D.E. / Linear Loaded |
| Element diameter | 3", 2, 1-3/4, 1-1/2, 1-1/4, 1, 3/4, & 1/2" tips |
| Recommended height | 70 to 180 ft . |
| Turning radius | 54' 8" |
| Mast Size | 2 in. nom. or specify |
| Wind Area / Survival | 19.5 sq. ft. / 100 mph |
| Weight / Ship wt. | 200 lb. / 250 lb. -Truck |

## FEATURES

The recently computer upgraded and improved 80M2LLB is now even better, both mechanically and electrically. Gain is up by .6 dB over older versions and efficiency is now over 95%! This is accomplished by using low loss 3/8" aluminum tube for the linear loading elements. Element halves start with 3" diameter tubing and taper through 2", 1-3/4", 1-1/2", 1-1/4", 1" and 3/4", 1/2" sections to the 3/8" tips. Machined saddle clamps have replaced the U-bolts previously used. A solid 2" O.D. Fiberglass rod, sleeved to the 3" elements, serves as the center insulator.

The new, highly efficient 3/8" tube linear loading system is supported above the boom and out of the element plane to reduce inductive cancellation, provide element support, and minimize excessive element droop. New, rugged linear loading shorting bars now allow easier assembly and adjustment. A weather proof fiberglass housing now protects the 5 kW 1:1 balun, the relays for phone-CW switching and the high Q (600+) CW band coils. These top quality components are now accessible for frequency adjustments in the 3.5 to 3.6 MHz section of the band. Relays requires 12 VDC at 0.3A supply. Look forward to outgunning even the best of the 4 squares! Parts are available for upgrading older 80M2's.

**4402 N. Selland Ave, Fresno CA 93722 (559) 432-8873 FAX 432-3059**
**www.m2inc.com Email: sales@m2inc.com**

# 80M2LLB Yagi, Linear Loaded

10-24-94
REV. 5-10-05

OVERVIEW: Feel free to change order of assembly to fit your space needs.
Once fully assembled or even in pieces, this antenna is LONG. Assemble the center section to the 2" diameter point. Then assemble the element tip sections from the 1-3/4 inch diameter section out. Use the length and hardware sizes called out on the DIMENSION AND ASSEMBLY DRAWING. Penetrox (zinc paste) has been supplied to be used on the threads of bolts and screws, as well as every aluminum joint.

1. Locate the large, 36" long 2 inch diameter fiberglass rod used as center insulator. The rod has 4 bushings or coupling rings and the rod may be labeled to match two 3 " x 180"' inner element sections. Using four machined 2 inch saddles, attach the center insulator to a 8" x 8" x 1/4" element to boom plate. Use the 3/8-16 x 3-1/2" stainless bolts and locknuts. Rotate the 2" rod so the holes through the coupling rings are up or Perpendicular to the plate. Center the insulator on the plate and tighten the 3/8" hardware.

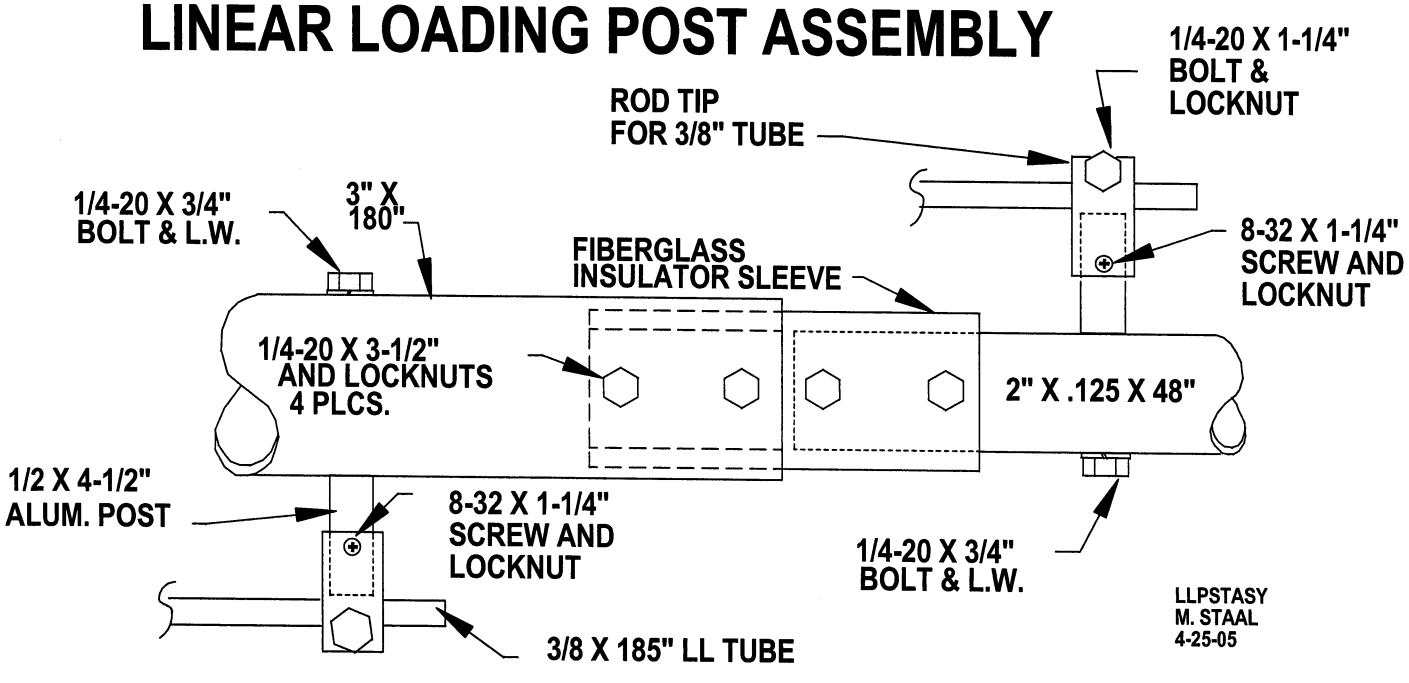
2. Assemble the center section of each element. Slip on the butt sections and NOTE THE LARGE 1/2" HOLES AT THE OPPOSITE END OF THE SECTIONS ARE FACING THE SAME DIRECTION. Insert a 1/4-20 x 3-3/4" inch bolt UP through the inner hole and add a plain nut. Use 1/4-20 x 3-1/2 inch bolts and LOCKNUTS through the outer set of holes. NOTE: The longer inner bolts now form studs where the CW LOADING/SWITCHING assembly is attached later in the assembly. Tighten all hardware. Repeat for each element. All the center sections are the same.

3. Locate the 1/2" x 4-1/2 " aluminum rods and attach the 3/4" square rod tips and secure each with an 8-32 x 1-1/4" screw and locknut and tighten. Assemble all at this time.

4. Insert the completed rod assembly near the outer end of the 3" sections . Attach with 1/4-20 x 3/4" bolts and lock washers. BUT DO NOT TIGHTEN YET. Now orient the rod assembly so the 3/8" holes at the ends are parallel with the element and tighten the bolts. Add the 1/4-20 x 1-1/4" bolts and locknuts, finger tight at this time.

5. Next, install the completed rod assemblies into the 1/2" hole at the butt of the 2" x 48" element section. Again attach with 1/4-20 x 3/4" bolts and lock washers. Now orient the rod assembly so the 3/8" holes at the ends are parallel with the element and tighten the bolts. Add the 1/4-20 x 1-1/4" bolts and locknuts finger tight at this time.

## LINEAR LOADING POST ASSEMBLY



6. Insert each 2-3/4 x 8" fiberglass sleeve insulator into the outer end of the 3" element butts and add the 1-4-20 x 3-1/2" bolts and locknuts finger tight. Now insert the 2" x 1.25 x 48" section into the insulator and align the holes. Make sure the 1/2" post assembly installed in step #4, points opposite from the post assembly in the 3" element section. Install the 1/4-20 x 3-1/2 bolts and locknuts and NOW TIGHTEN all 4 bolts. Repeat for the other element halves.

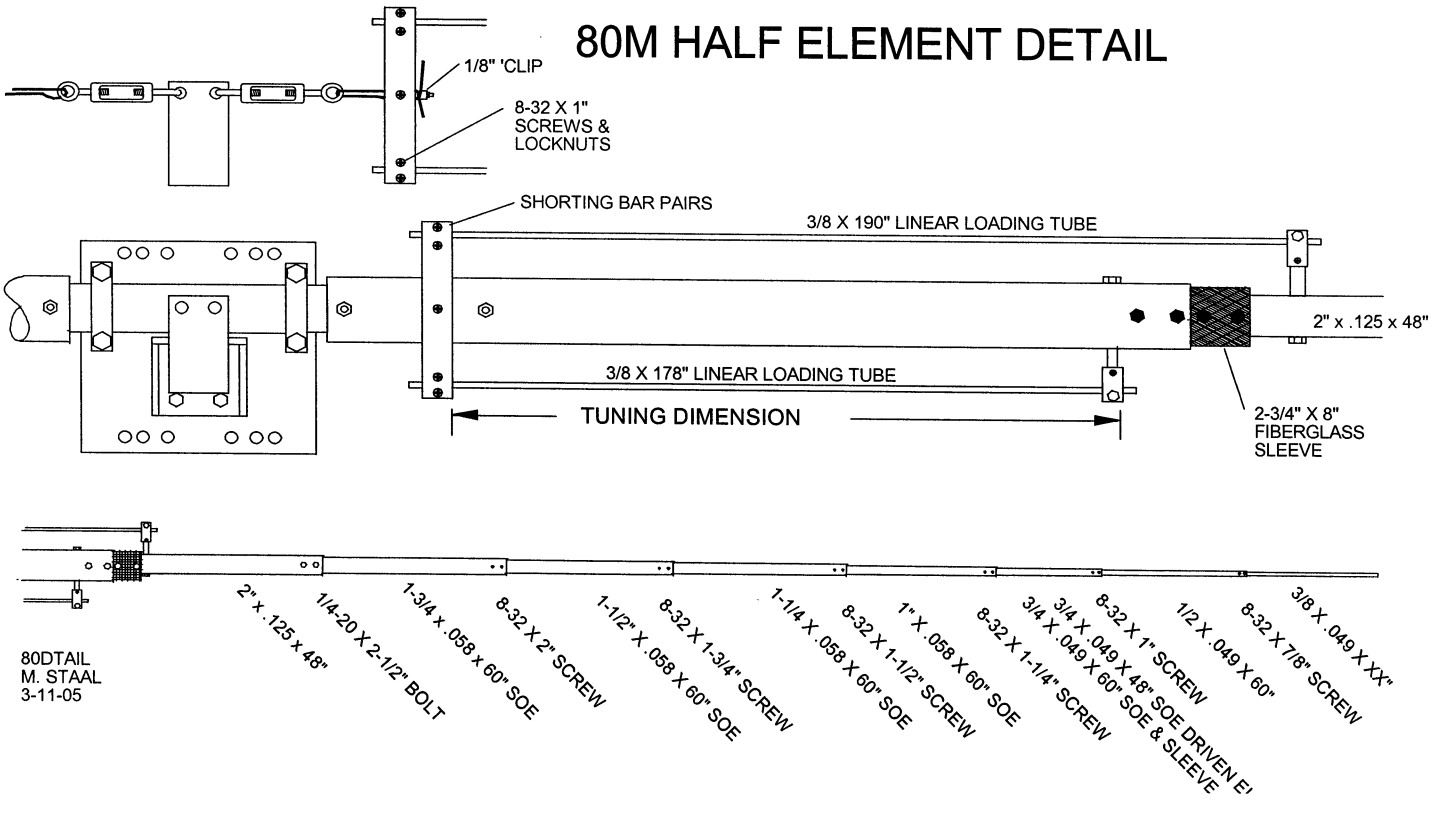
7. Add a 3/8" x 178" tube to each inner post and a 3/8" x190" tube to the outer post. Insert it through the hole about 1 inch, and tighten the 1/4-20 x 1-1/4" bolt and locknut. Do both elements this way.

8. Loosely install five (5) 8-32 x 1" screws and locknuts in pairs of "linear loading shorting bars". Refer to the DIMENSION SHEET for the shorting bar positions for the linear loading tubes. Use a permanent marking pen or a ring of masking tape to mark the shorting bar position on the 3/8" tubes. Prepare the 5/16" turnbuckles by removing the "hook" end of each turnbuckle and add a 5/16-18 nut on the threads all the way to the hook. Now replace the hook end into the turnbuckle body and adjust the threaded ends so that just one thread "shows" inside the body of the turnbuckle. Add a 3/16" cable eye to each "eye" of the turnbuckles. Now hook the turnbuckles into the turnbuckle plate.

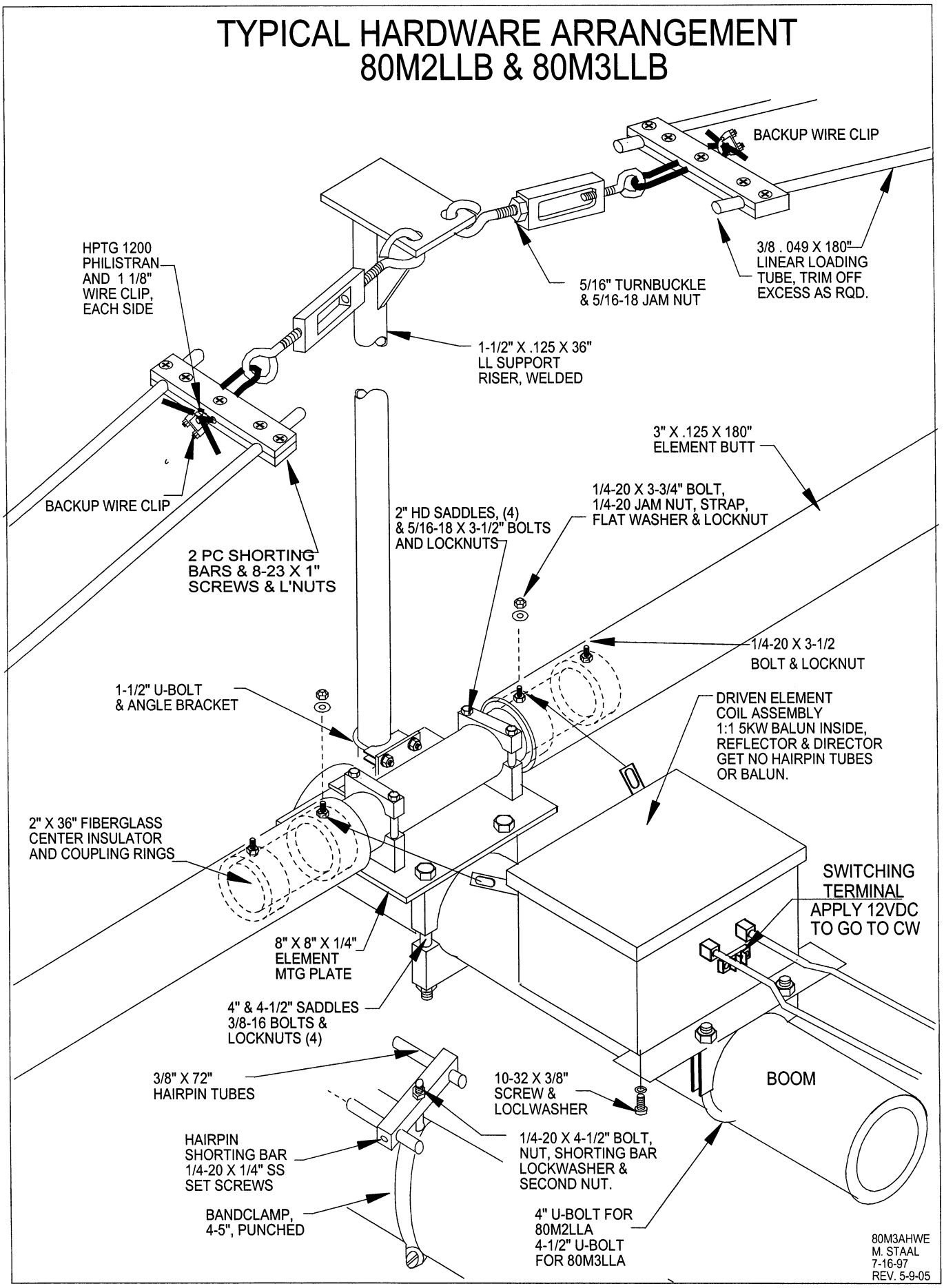
9. Refer to the TYPICAL HARDWARE ARRANGEMENT drawing. Slide one loosely assembled shorting bar pair onto the two tubes to the marks. Tighten one outside screw just enough to hold the shorting bar in position. Insert the 12" section of HPTG-1200 Phillistran cord into the two center grooves in the shorting bar pair. Note one groove is dead center and the other is offset. The long end of the cord should come out the "centered" groove. The short end should loop around and come back out about 2". Now tighten the rest of the screws in the shorting bars.

10. Route the black cord around the thimble in the turnbuckle eye and back on itself. Keep this length between the eye and the shorting bar pair no more than 3" in length. Now lift the linear loading tubes and pull the cord until the tubes are under tension. Install the cable clips around all three cords and tighten the clips. .

11. Now, begin tensioning the linear loading tubes using the turnbuckles. If you run out of adjustment, relax the turnbuckle again and pull more slack with the cord. Then re-tighten the clips and tension again with the turnbuckles. Adjust tension until each element is flat and not bowed up.
Final adjustment of the wire tensioning is done after the element is complete and even on the mast. NOTE: THESE TUBES FORM THE ELEMENT LINEAR LOADING AND ALSO HELP TO SUPPORT THE ELEMENT HALVES AND MINIMIZE DROOP.

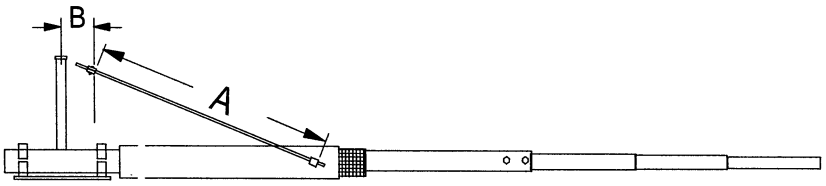


# TYPICAL HARDWARE ARRANGEMENT
# 80M2LLB & 80M3LLB

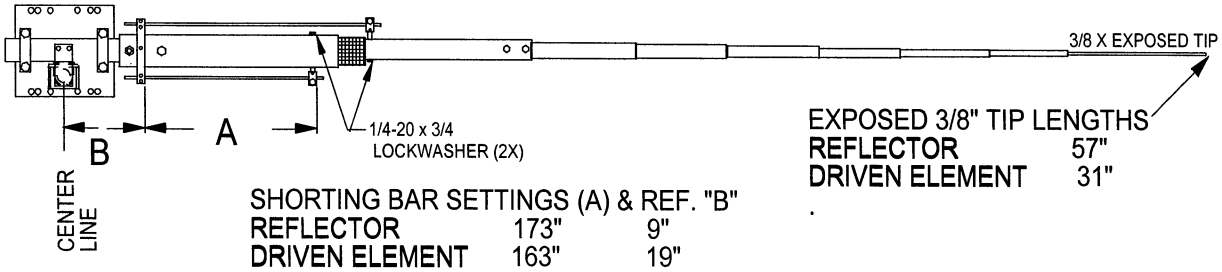



80M3AHWE
M. STAAL
7-16-97
REV. 5-9-05

# 80M2LLB PHONE/CW
# SWITCHING DIAGRAM AND DIMENSIONS




'A' IS YOUR PRIMARY DIMENSION.
'B' IS A CROSS CHECK DIMENSION.
'B' SHOULD NOT BE OFF BY MORE THAN 1/2".

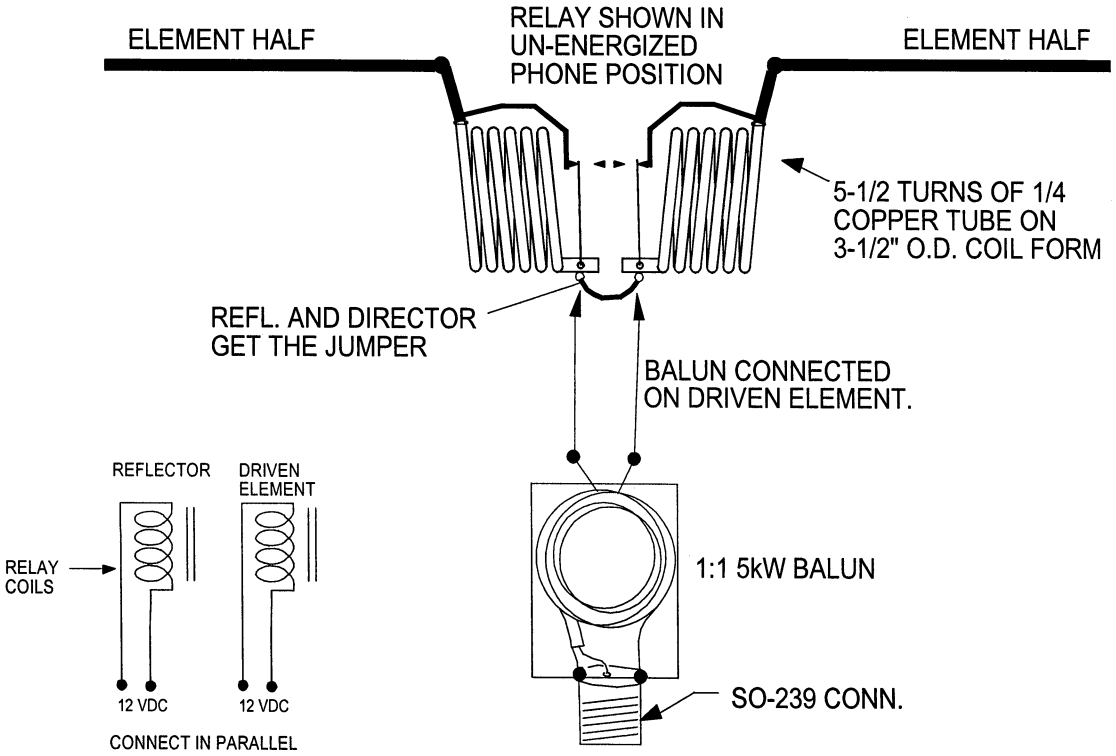



EXPOSED 3/8" TIP LENGTHS

| | |
|---|---|
| REFLECTOR | 57" |
| DRIVEN ELEMENT | 31" |

SHORTING BAR SETTINGS (A) & REF. "B"

| | | |
|---|---|---|
| REFLECTOR | 173" | 9" |
| DRIVEN ELEMENT | 163" | 19" |




LOADSKEM
M. STAAL
7-21-01
REV. 5-10-05

12. Now assemble the outer element sections together (1-3/4" through 3/8") using the supplied 8-32 hardware. See the 80M Dimensions and Assembly Sheet as a guide. Next, install the assemblies (1-3/4" through 3/8") to the ends of the 2" elements using 1/4-20 x 2-1/2" bolts and locknuts. This can be done later as well.
PLEASE NOTE: THE REFLECTOR ELEMENT USES A 3/4" X 60" ELEMENT SECTION WITH A 5/8" X 18" INNER SLEEVE.

13. Assemble the boom beginning with the 60" BOOM SPLICE. Check the machined surfaces of the splice bushings. File off any rough spots, LUBRICATE lightly with oil and gently slide into the drilled end of either boom section (they are identical). Install two 3/8-16 x 4-1/2" bolts, lockwashers, and nuts but do not tighten yet. Now slide on the remaining boom section, add the hardware, and tighten all four bolts.

14. Install the forged eyebolts (with cables and turnbuckles) to the holes 3 feet from boom ends. Attach the 12" x 12" x 3/8" BOOM TO MAST PLATE to the boom using the 4" U-bolts and 3/8" stainless steel nuts and lock washers. Tighten just enough to keep from slipping as final alignment of the elements will be adjusted later. Install a temporary 2" x 6 to 8 foot mast to the boom side of the plate with a two 2" Heavy Duty (3/8") U-bolts. Mount the large turnbuckle plate about 4 feet up to the boom side of the mast using two standard 2" U-bolts (5/16" hdwe.). Uncoil the guy cables. Open the turnbuckles until just one thread shows inside the body. Raise the turnbuckle plate until cables are tensioned and boom is straight. Then adjust the BOOM TO MAST plate position so cables are tensioned the same and the mast is perpendicular to the boom. TIGHTEN THE BOOM TO MAST PLATE IN POSITION.

**NOTE:** The temporary mast MAY be left in position as a support and stabilizing member while lifting the completed antenna into position on the tower.

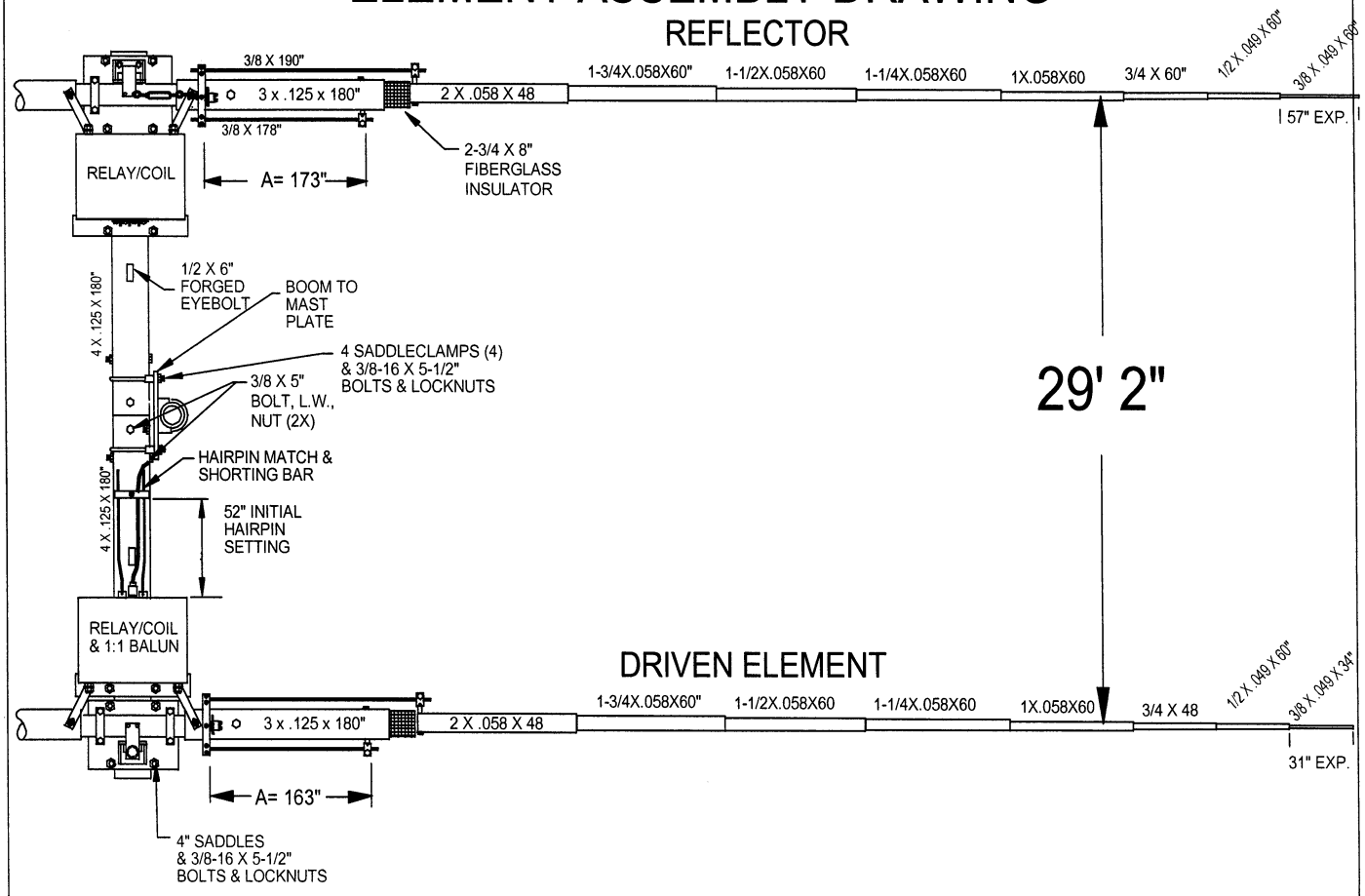
**ELEMENT MOUNTING**:
15. Place the reflector assembly on one end of the boom with the riser nearest the end of the boom. Secure with 4" saddle pairs and 3/8-16 x 5-1/2" bolts and locknuts. Install the REFLECTOR RELAY-COIL assembly, facing the two 1/4" stud posts toward the element. Add the two aluminum angle jumpers from the housing studs using flat washers and locknuts. Use a 4" U-bolt to hold the assembly on the boom. Push it against the boom to element plate and drop the jumpers over the studs on the elements. Add a flat washer and locknut to the element bolt and tighten. Tighten the nuts on the Relay–Coil assembly. Tighten the U-bolt. REPEAT this step for the driven element assembly at the other end of the boom.

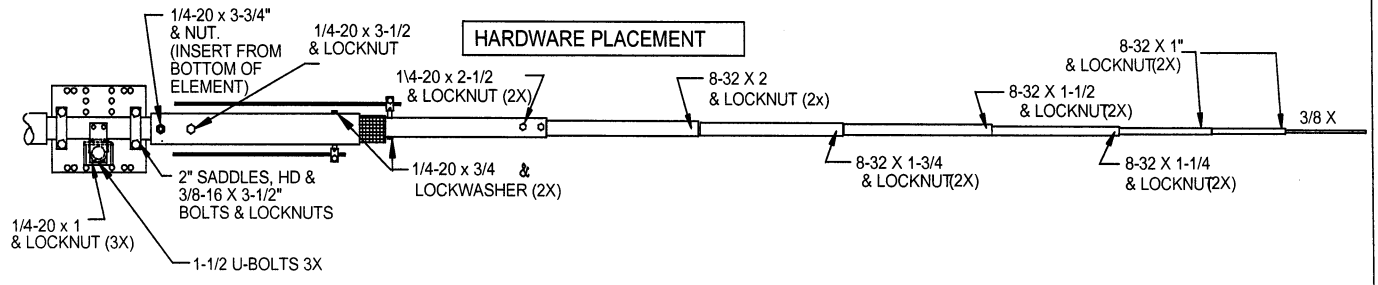
16. Align elements with each other and at right angles to the forged eyebolts and the boom to mast plate. Tighten the U-bolts securely with the 3/8-16 lock washers and nuts.

17. Insert the 3/8 x 72" HAIRPIN tubes into the block connectors on the driven element relay switch box , align the tubes and lightly tighten one set screw in each block with an 1/8" Allen wrench. Add 2 set screws to the HAIRPIN SHORTING BAR and slide the bar onto the ends of the tubes. Set the bar to the recommended dimension on the DIMENSION SHEET and lightly tighten the set screws. Place a 1/4-20 x 4-1/2" bolt through the stainless BAND CLAMP and attach the clamp assembly around the boom under the Shorting Bar. Run a 1/4-20 nut onto the bolt and slide the shorting bar over the stud. Align the assembly and tighten the band clamp. Add a locknut nut to the stud and tighten the shorting bar in position. Now tighten all the set screws in this assembly. THIS DC GROUNDS THE DRIVEN ELEMENT ASSEMBLY. Final adjustment of the hairpin match and driven element linear loading jumper positions may be done (if necessary) after final installation is complete.

18. Wire up the Relay-Coil housings by running a #20 AWG or larger twisted pair, shielded wire, OR RG-58AU between the reflector and driven element switching terminals Or to a common point near the center of the boom. Also connect a 12 VDC supply lead to this junction or to the driven element terminals and route back to center of boom. Tie all shields together. Each relay is simply in parallel with the other and CW is activated when 12 VDC is applied to the leads. There is no polarity requirement. The shield of the main lead should be grounded at the SHACK end. The shield should eliminate any RF from getting into the shack. DO NOT SWITCH FROM PHONE TO CW WHILE TRANSMITTING AS

# 80M2LLB DIMENSIONS & ELEMENT ASSEMBLY DRAWING




80M2BDM
M. STAAL
9-27-94
REV. 5-9-05

RELAY DAMAGE MAY OCCUR. Connect a length of 50 ohm feedline to the connector and route back to center of boom. Secure coax and 12 VDC wires with nylon ties or equivalent.

19. Lastly if not already done, Install all the outer element sections to the inner element assemblies already installed on the boom. See Dimension Sheet for section size, length, and hardware.

20. Equalize linear loading / element support by adjusting 5/16" turnbuckles holding the fiberglass spacers at the center of the element. All elements should droop equally. Do not attempt to "gullwing" elements - they are more stable in the wind if 3" inner sections are level or droop slightly below horizontal and outer sections are permitted to droop roughly 4-5'. When adjustments are complete, tighten 5/16 jam nuts on the upper end of the turnbuckles.

**NOTE**: The standard balun in the DRIVEN element relay housing is made of Teflon coax and uses NO ferrite. It will handle 3500 watts of continuous RF and peaks of 5KW energy as with SSB or CW. However there may be situations where higher power handling is advantageous. **CONTACT $M^2$ FOR RECOMMENDATIONS FOR A 10 KW VERSION.**

CAREFULLY MANUFACTURED BY:

**$M^2$ ANTENNA SYSTEMS, INC.**
4402 N. Selland Ave.
Fresno, CA. 93722
559-432-8873 FAX 432-3059
www.m2inc.com Email: sales@m2inc.com

# 80M2LLB PART LIST

10-24-94
REV. 5-10-05

| DESCRIPTION | QTY |
|---|---|
| Boom section 4 X .125 X 180" ALUM. TUBE | 2 |
| Boom Splice, bushed, 3.5 x 60" alum | 1 |
| Inner Element , 3 X .125 X 180" STR | 4 |
| Element, 2 X .125 X 48" DOE to fit 1-3/4" | 4 |
| Element, 1-3/4 X .058 X 60" SOE | 4 |
| Element, 1-1/2 x .058 x 60" SOE | 4 |
| Element, 1-1/4 x .058 x 60" SOE | 4 |
| Element, 1 x .058 x 60" SOE | 4 |
| Element, 3/4 x .049 x 60" SOE | 2 |
| Element, 3/4 x .049 x 48" SOE | 2 |
| Element, 1/2 x .049 x 60" | 4 |
| Element, 3/8 x .049 x 60" | 2 |
| Element, 3/8 x .049 x 36" | 2 |
| Linear loading tube, 3/8 x .049 x 178" | 4 |
| Linear loading tube, 3/8 x .049 x 190" | 4 |
| Hairpin tube, 3/8" x 72" | 2 |
| Insulator, center assembly, 2 x 36" fiberglass rod & bushings | 2 |
| Riser, element support ass'y, 1-1/2 x .125 x 36", welded. | 2 |
| Boom support cable ass'y, 154" x 3/16" w. eyebolts, turnbuckles. | 2 |
| 80M2LLA assembly manual | 1 |

**SMALL PARTS BOX**

| | |
|---|---|
| Riser bracket, 3 x 4 x 1/4 angle, welded, aluminum | 2 |
| Rod end, linear loading, 3/4 sq. x 1-13/16" | 8 |
| Linear loading support rod, 1/2 x 4-1/2" alum. | 8 |
| Shorting bar halves, 1/4 x 3/4 x 7" mach. Alum. | 8 |
| Phillistran cable, HPTG-1200 x 18" | 4 |
| Element insulator sleeves, 2-3/4 x 8" fiberglass | 4 |
| Band clamp, 4-12" stainless, modified with 1/4" hole | 1 |
| Shorting bar, hairpin, 1/2 x 1/2 x 5" alum. | 1 |
| Boom to mast plate, 12 x 12 x .375 alum | 1 |
| Main turnbuckle plate, 4 x 6 x .25 alum | 1 |
| Plate, element mounting, 8 x 8 x .25 alum | 2 |
| Saddle clamp, 4" | 12 |
| Saddle clamp, 2" | 8 |
| U-bolt, 2" heavy duty, 3/8" | 4 |
| U-bolt, 2" standard, 5/16" | 2 |
| U-bolt, 1-1/2" | 4 |
| Turnbuckles, 5/16" hook and eye | 4 |

| HARDWARE BAGS | QTY |
|---|---|
| Bolt, 3/8-16 x 5-1/2 hex head stainless | 12 |
| Bolt, 3/8-16 x 4-1/2 hex head stainless | 4 |
| Bolt, 3/8-16 x 3-1/2 hex head stainless | 8 |
| Locknut, 3/8-16 stainless | 24 |
| Nut, 3/8-16, stainless | 8 |
| Lockwasher, 3/8 split ring stainless | 8 |
| Nut, 5/16-18 stainless | 16 |
| Lockwasher, 5/16 split ring stainless | 12 |
| Bolt, 1/4-20 x 4-1/2" hex head stainless | 1 |
| Bolt, 1/4-20 x 3-3/4" hex head stainless | 4 |
| Bolt, 1/4-20 x 3-1/2" hex head stainless | 20 |
| Bolt, 1/4-20 x 2-1/2" " " " | 8 |
| Bolt, 1/4-20 x 1" " " " | 6 |
| Bolt, 1/4-20 x 3/4" " " " " | 8 |
| Set screw, 1/4-20 x 1/4", stainless | 6 |
| Nut, 1/4-20 locknut stainless | 40 |
| Nut, 1/4-20 stainless | 6 |

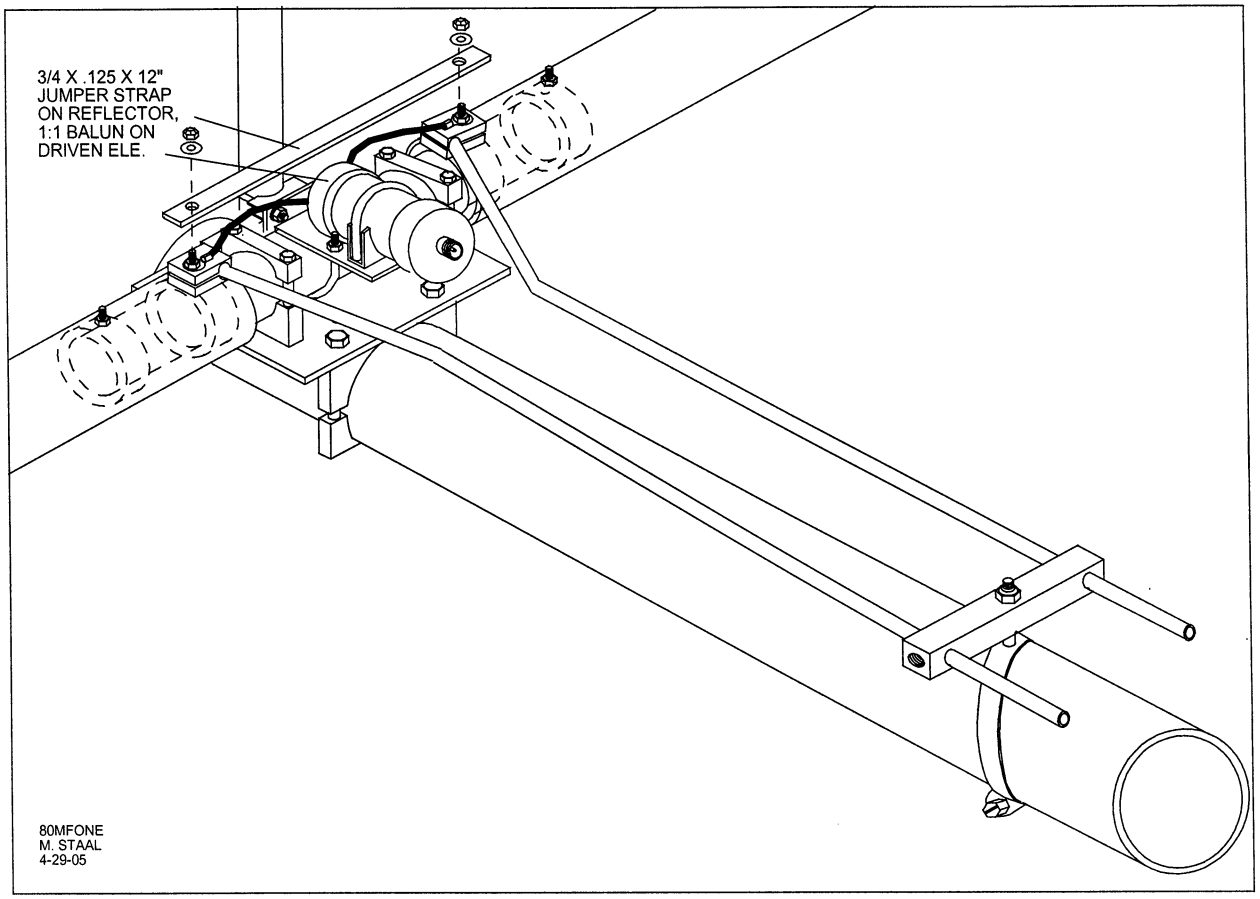
Lockwasher, 1/4" split ring stainless ..... 8
Flat washer, 1/4" stainless ..... 4
Screw, 8-32 x 2 pan head stainless ..... 8
Screw, 8-32 x 1-3/4" " " " ..... 8
Screw, 8-32 x 1-1/2" " " " ..... 8
Screw, 8-32 x 1-1/4" " " " ..... 8
Screw, 8-32 x 1" " " " ..... 28
Screw, 8-32 x 7/8" stainless ..... 8
Locknut, 8-32 stainless ..... 68
Wire clips, 1/8" ..... 8
Cable eyes, (thimbles) 3/16" ..... 4
Allen wrench, 1/8" ..... 1
Penetrox cup ..... 2

**RELAY PHONE-CW HOUSING PARTS.**
KIT SEPARATELY AS CUSTOMER MAY ELECT NOT TO GET THESE PARTS.

Phone/ CW relay/ coil assembly housing ..... 1
Phone CW relay / coil + 1:1 balun assembly housing ..... 1
Jumper. 3/4 x 4" bent ..... 4
Mounting plate 2 x .125 x 9.5" (relay and coil ass'y on boom) ..... 2
U-bolt, 4" and saddle ..... 2
Nut, 3/8-16, ss ..... 4
Lockwasher, 3/8" split ring ss ..... 4
Locknut, 1/4-20, ss ..... 4
Flat washer, 1/4" ss ..... 4
Screw, 10-32 x 3/8", stainless ..... 4
Lock washer, #10, split ring , ss ..... 4

# OPTIONAL PHONE BAND ONLY 80M PARTS LIST AND DIAGRAM

4-29-05




| | | |
|---|---|---|
| 1:1 BALUN, 1:1 HF, 5KW | 1 | |
| PLATE, BALUN MOUNTING | 1 | |
| HAIRPIN TUBE, 3/8 X 72, MODIFIED | 2 | |
| CLAMP BLOCK, 3/8" | 4 | |
| U-BOLT AND SADDLE, 2-1/2" | 1 | |
| U-BOLT, 2", SS | 2 | |
| JUMPER STRAP 3/4 X.125 X 12" ALUM. | 1 | *2 FOR 80M3LLA |
| BOLT, 1/4-20 X 4" | 2 | |
| NUT, 5-16", SS | 2 | |
| LOCK WASHER 5/16" SPLIT RING , AA | 2 | |
| LOCKNUT, 1/4-20, SS | 6 | |
| FLAT WASHER, 1/4", SS | 2 | |