

## MFJ-1792/1793 Vertical Antenna

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## **MFJ-1792/1793 INSTRUCTION MANUAL**

### **INTRODUCTION**

On frequencies below 7 MHz, where vertical polarization and low wave angles are desired, the antenna must be very high above ground or vertically polarized. On low frequencies, the height of a vertical half wave dipole antenna is usually impractical to construct. A half wave vertical (Hertz) on 80 meters, for example, is approximately 133 feet high. This is a very difficult height to achieve. If a vertical antenna is grounded, the height only needs to be a quarter wave length. The ground system acts as an "electrical mirror". The missing half of the antenna is supplied by the "mirror image". The directional characteristics of a grounded quarter wave antenna over perfect ground are the same as a half wave antenna in free space. A grounded quarter wave vertical has a circular or omni-directional pattern in the horizontal plane, and radiates maximum signal at low angles above the horizon.

A grounded vertical antenna can be shorter than a quarter wavelength and be made resonant by loading it with inductance, capacitance (at or near the top), or both. Loading the antenna can be done several different ways, but not every way has the same efficiency. In general, the best efficiency is obtained by top loading the antenna.

The efficiency of a quarter wave or a shorter vertical antenna can easily exceed 50% if special care is taken in constructing of the ground system and the loading method. To attain an efficiency comparable with a 1/2 wave antenna in grounded antennas having heights of 1/4 wavelength or less, great care must be taken to reduce ground resistance and the resistance of any required loading inductors. MFJ 1792 / 1793 uses the best technique available to provide maximum efficiency on the 80, 40 and 20 meter bands. On 40 meters the antenna is a 33 foot (full quarter wave) large diameter antenna. On the 20 meter band, MFJ uses decoupling stub technology for maximum efficiency. The decoupling stub is a full quarter wave. Top loading technology, the most efficient form of loading, is used on 80 meters.

### **DESCRIPTION**

The MFJ-1792 / 1793 operates as a full quarter wave on 40 and 20 meters, and a top loaded 1/8 wavelength antenna on 80 meters. When used with a good ground system, the MFJ-1792 / 1793 has excellent efficiency and bandwidth on 40 and 20 meters. No loading coils are used on these bands. On 80 meters, the antenna is a very efficient top loaded antenna. Top loading is the most efficient loading method known. It is top loaded with a loading coil, wound on fiberglass with Teflon™ coated wire. It also uses a large diameter capacitor hat (4.5 foot). Top loading provides a uniform distribution of current on the antenna element. Top loading guarantees maximum efficiency and performance. The 80 meter radiation comes from the entire length of the 33 foot tall, large diameter

aluminum tubing. The antenna has a swivel base to allow easy mounting and access to the top for tuning the 80 meter band. The swivel base is constructed with heavy duty aluminum plate, and a large diameter, super strong, solid fiberglass insulator. The antenna can be mounted on a short mast with 2" maximum diameter. MFJ supplies U-Bolts for use with 1.5" maximum diameter masts. You can buy your own 2" diameter U-Bolts and install them in the holes provided on the base swivel mount. Since the antenna is 35 feet tall it requires guying. Guying anchors and guy lines are not supplied with the antenna. For best results, non-conductive marine type nylon cords can be used.

**BANDWIDTH, SWR, AND POWER HANDLING**

- The 40 meter band has a very wide bandwidth (*approximately 800 KHz*). The entire band is covered at less than 1.5:1 SWR.
- The 80 meter band is top loaded with a high-Q loading coil. The SWR on this band is very low (less than 1.4:1). The bandwidth is approximately 80 KHz at 2:1 SWR points. An L-network at the feed point on the base of the antenna ensures the lowest SWR.
- The 20 meter band has a very low SWR (*less than 1.4:1*). The bandwidth is approximately 300 KHz. The 20 meter operating frequency is easily adjusted by increasing or decreasing the length of the decoupling stub at the bottom of the antenna.

MFJ- 1792/1793 is capable to of handling full legal PEP power as follows:

BAND	SSB	CW
80 meter	1500	1500
40 meter	1500	1500
20 meter	1500	1500

**SAFETY PRECAUTIONS:**

**1.) THIS ANTENNA IS AN ELECTRICAL CONDUCTOR**

**2.) ANY CONTACT BETWEEN THE ANTENNA, FEEDLINE OR SUPPORTING STRUCTURE AND POWER LINES WILL RESULT IN DEATH OR SERIOUS INJURY.**

***FOR SAFETY PLEASE:***

- 1.) DO NOT INSTALL THIS ANTENNA WHERE THERE IS ANY POSSIBILITY OF CONTACT WITH UTILITY LINES.**
- 2.) DO NOT LOCATE THE ANTENNA SUPPORT WHERE IT CAN CONTACT POWER LINES IN THE EVENT OF MECHANICAL FAILURE OR ACCIDENT.**

**3.) FOLLOW THE GUIDELINES FOR ANTENNA  
INSTALLATION AS RECOMMENDED BY THE US  
CONSUMER PRODUCT SAFETY COMMISSION.**

### **CHOOSING A LOCATION FOR THE ANTENNA**

The ideal antenna mounting location is an open area more than 70 feet away from other large conducting objects or antennas. If such a location is **not** available, the *least obstructed* location should be selected.

This antenna should be mounted on a rigid support. The mounting U-Bolts are supplied with this antenna. The antenna accepts masts between one and 1.5 inches outside diameter. Additional holes in the base mount of this antenna will accept mast clamps up to 2" OD. Soft or thin wall masts should not be used to mount this antenna to any supporting structure.

The MFJ-1792 / 1793 will perform quite well in ground mounted installations with a good ground system of either welded mesh wire fence or 8 or more 33 foot long (or longer) radials. The antenna can be mounted a few feet above level with ground plane drooping down until it reaches the ground. If the antenna is ground mounted, it **MUST** be surrounded with a protective non-metallic fencing. This will increase the safety and lessen the likelihood of damage to the antenna.

### **GROUNDING**

Unlike some other verticals, this antenna requires an RF ground system. However, it is a good idea to have some sort of earth connection to avoid lightning damage to station equipment and to improve operator safety. The feedline's shield should be grounded at the entrance point of the building *before* it reaches the operating position. Failure to do so can result in lightning damage to the equipment.

Grounds should consist of a solid copper rod driven into the soil (at least 6 feet deep). Never use woven flexible braiding for ground connections unless *absolutely necessary*. Braiding has a very high resistance to both RF and lightning. Copper flashing, wide copper foil, or large gauge solid copper wires are the proper materials for use in RF and lightning grounding applications.

The use of an in-line coaxial lightning arrestor will only offer a minimal improvement in lightning protection. The best method of protecting the station equipment is to disconnect the feedline outside the building or, at the minimum, use a switch to disconnect and ground the feedline.

### **MAINTENANCE**

Your antenna is constructed of heavy duty non-corrosive materials and should withstand normal climates for many years. The use of some type of coaxial connector moisture

protection is recommended at the bottom coax connection and also around the matching network feed point, especially in coastal areas where salty mist is commonplace.

GE makes a pure silicone grease called "SILICONE DIELECTRIC COMPOUND" that can be applied SPARINGLY to the threaded area of the female connector. This compound, or even a clear silicone heat sink compound, will prevent moisture from entering the connector through the threads and protect the connector from corrosion. THIS IS THE SAME TYPE OF SEALER THAT COMMERCIAL ANTENNA INSTALLERS AND CATV COMPANIES USE WITH GREAT SUCCESS.

A less desirable but adequate sealer is the automobile seam sealer commonly sold as "coax seal". It is a pliable black sealing compound.

When installing any coax sealer, NEVER completely cover the barrel of the coax connector. The sealer should ONLY be placed near the junction of the threaded part of the chassis connector and the knurled area of the male connector. This will leave the bottom of the male connector's outer sleeve open and permit the connector to "breathe" so it does NOT collect moisture!

#### **WARNING:**

- **Keep this antenna out of reach of adults, children, and animals.**
- **Any contact with this antenna while transmitting will cause severe RF burns and voltages that kill.**
- **Never place this antenna close to electric power lines or utility wires.**

#### **Tools and Time Required for Assembly**

The estimated assembly time for this antenna is two to three hours. An additional one hour is required to adjust the antenna on all the bands.

#### **The required tools are:**

1/4" standard screwdriver  
 3/8" open end wrench ( if you purchased the 1793 )  
 5/16" nut driver  
 7/16" nut driver  
 7/16" open end wrench  
 Large wire cutters  
 #1 or #2 Philips screwdriver  
 Eye protection  
 Flat ground or at least 3 saw horses.

#### **SAFETY PRECAUTIONS!!**

- 1.) THIS ANTENNA IS AN ELECTRICAL CONDUCTOR.**
- 2.) ANY CONTACT BETWEEN THE ANTENNA, FEEDLINE OR SUPPORTING STRUCTURE AND POWER LINES WILL RESULT**

**IN DEATH OR SERIOUS INJURY.*****FOR SAFETY PLEASE:***

- 1.) **DO NOT INSTALL THIS ANTENNA WHERE THERE IS ANY POSSIBILITY OF CONTACT WITH UTILITY LINES.**
- 2.) **DO NOT LOCATE THE ANTENNA SUPPORT WHERE IT CAN CONTACT POWER LINES IN THE EVENT OF MECHANICAL FAILURE OR ACCIDENT.**
- 3.) **FOLLOW THE GUIDELINES FOR ANTENNA INSTALLATION AS RECOMMENDED BY THE US CONSUMER PRODUCT SAFETY COMMISSION.**

**MFJ-1792 PARTS LIST**

- One 1 1/2" x 6' 6061-T6 Aluminum tubing
- One 1 3/8" x 6' 6061-T6 Aluminum tubing
- Two 1 1/4" x 6' 6061-T6 Aluminum tubing
- One 1 1/8" x 6' 6061-T6 Aluminum tubing
- One 1 1/8" x 55" 6061-T6 Aluminum Tubing
- Two 1 3/8" x 1' 6061-T6 Aluminum Couplers
- One 1 1/4" x 1' 6061-T6 Aluminum Coupler
- Three 3/8" threaded rods (one 55", and two 6') for 20 meter element
- One fiberglass 80 meter loading coil assembly with 7 x 27" spokes
- One Angle Bracket to support 20 meter element
- One fiberglass 1 1/4" x 16" solid rod for base mounting
- One Aluminum base mount with matching coil on fiberglass form (attached)
- Two Aluminum guy wire mounts
- Three bags of hardware; including:

**HARDWARE BAG #1**

- Nine Hose Clamps
- Two Guy Wire Mounts and Clamps
- Three U-Bolt Kit For 1 1/2" Mast

**HARDWARE BAG #2**

- Eight 1/4-20 x 1 3/4" Bolts
- One 1/4-20 x 2" Bolt
- Seven 6-32 x 1/4" Pointed Screws
- One 10-32 x 1 3/4" Screw
- One 10-32 Nut
- One 1/4" Id Spacer
- Nine 1/4-20 Nuts
- Nine 1/4" Split Washers
- Two 6-32 Nuts

**HARDWARE BAG #3 (20 METER KIT - for 1793 only)**

- Two 3/16" Id x 1" Aluminum Couplers
- Three L-Brackets
- Three 4.5" x 3/4" Fiberglass Insulators
- One Triangular Support Bracket
- Nine 6-32 x 1/2" Screws
- Four 6-32 x 1/4" Pointed Screws
- Nine 6-32 Nuts
- Two 10-32 Nuts
- Three Hose Clamps

**ASSEMBLY AND INSTALLATION PROCEDURE**

*IF YOU DID NOT PURCHASE OR DO NOT WISH TO INSTALL THE 20 METER ELEMENT, SKIP SECTIONS 13 THROUGH 16, 22 AND 23.*

***WARNING!*** *You can be killed if the antenna, feedline, or the equipment used to install the antenna accidentally contacts any utility lines. Never install an antenna near power lines!*

1. Be especially careful while moving or installing this antenna. This antenna is bulky enough to cause a loss of balance if handled by an inexperienced person, or if a capacitance spoke accidentally becomes snagged on a gutter, a tree limb, or any other object.
2. Mount the antenna in a location completely out of reach, or protect it with a non-conductive fence. The ends of the capacitance spokes and other parts of the antenna can cause eye injury, serious RF burns, or both.
3. Be sure the mast is sturdy enough to support more than 20 pounds of weight and a wind load of approximately 3 square feet.

**NOTE: WEAR SAFETY GLASSES WHENEVER WORKING ON OR NEAR THIS ANTENNA.**

*During assembly please refer to the figures listed in the following steps as well as the figures on the inside front cover.*

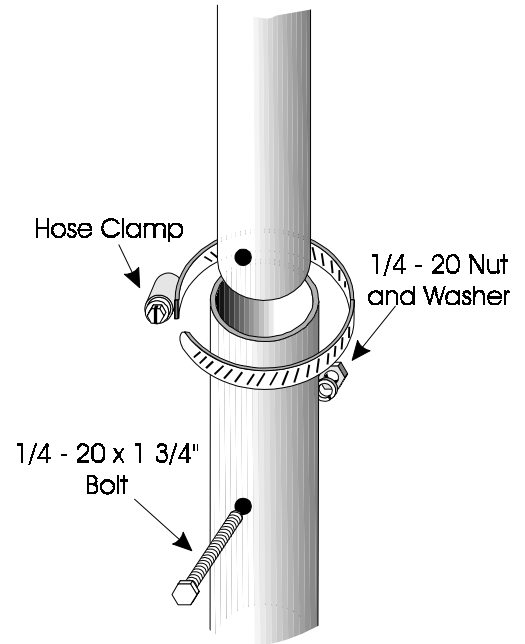
**NOTE:** This antenna can be mounted on ground or roof level mounts only!

1- Prepare a ground-level mounting mast that will permit easy initial testing and adjustment. Set up stable supports (table, saw horses etc.). Also a flat ground can be used.

2- Sort out parts you have unpacked into groups of similar parts. Be sure all parts are available.

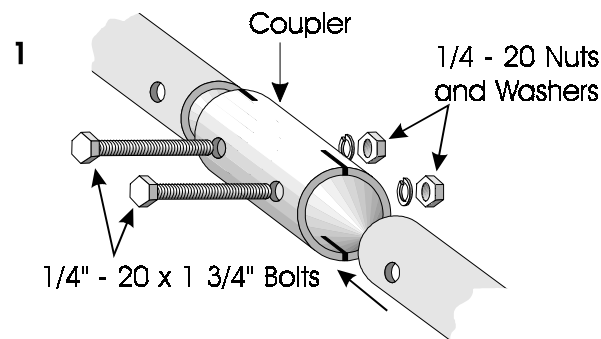
3- After examining the antenna parts, gather the tools needed for basic assembly. At the minimum these consist of:

- #1 Philips screwdriver for capacitance spokes screws.
- #2 Philips screwdriver for other 6-32 and 10-32 screws.
- 1/4" standard screwdriver or 5/16" nut driver for hose clamps.
- 3/8" wrench for the stub nuts.
- Two 7/16" open end wrenches or wrench and one nut driver for U-bolts and coupling bolts.
- Large wire cutter for trimming capacitance spokes.
- Safety glasses.



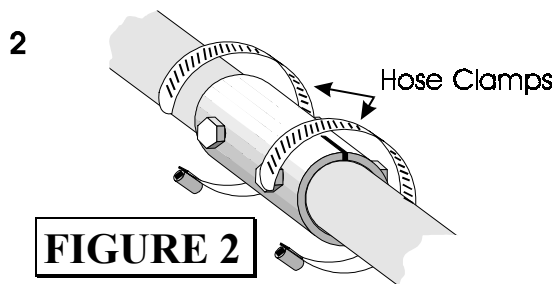
**FIGURE 1**

4- Insert End B of Tube 2 into End B of Tube 1. Line up the holes. Bolt tubes together with a 1/4 - 20 x 1 3/4" bolt, 1/4 - 20 nut and split washer. Place and secure a hose clamp over the slit. *See Figure 1.*



5- Insert End B of Tube 3 into End A of Tube 2. Line up holes. Bolt tubes together with a 1/4 - 20 x 1 3/4" bolt, 1/4 - 20 nut and split washer. Place and secure a hose clamp over the slit. *See Figure 1.*

6- Slide a guy wire clamp and guy wire mount over the end of Tube 3, and set them on End B of Tube 3.



**FIGURE 2**

7- Slip End B of Coupler 2 over End A of Tube 3. Line up holes. Bolt tube and coupler together with a 1/4 - 20 x 1 3/4" bolt, 1/4 - 20 nut and split washer. Place and secure a hose clamp over the slit. *See Figure 2.*



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8- Insert End B of Tube 4 into End A of Coupler 2. Line up holes. Bolt tube and coupler together with a 1/4 - 20 x 1 3/4" bolt, 1/4 - 20 nut and split washer. Place and secure a hose clamp over the slit. See *Figure 2*.

9- Insert End B of Tube 5 into End A of Tube 4. Line up holes. Bolt tubes together with a 1/4 - 20 x 1 3/4" bolt, 1/4 - 20 nut and split washer.

10- Slide a guy wire clamp and guy wire mount over Tube 5 and place them above the 1/4 - 20 x 1 3/4" bolt at end B of Tube 5. Place and secure a hose clamp over the slit. Refer to *Figure 1*.

11- Slip End B of Coupler 3 over End A of Tube 5. Line up holes. Bolt tubes together with a 1/4 - 20 x 1 3/4" bolt, 1/4 - 20 nut and split washer. Place and secure a hose clamp over the slit. See *Figure 2*.

12- Insert End B of Tube 6 into End A of Coupler 3. Line up holes. Bolt tube and coupler together with a 1/4 - 20 x 1 3/4" bolt, 1/4 - 20 nut and split washer. Slide and secure a hose clamp over the slit. See *Figure 2*.

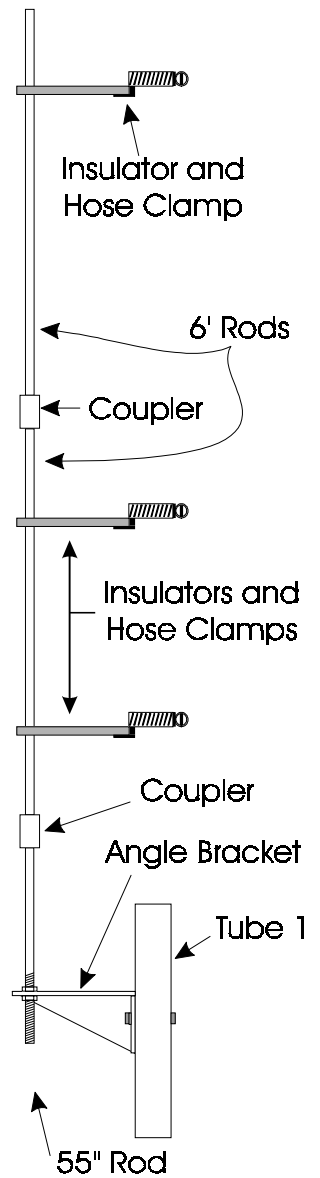
**NOTE: Steps 13 - 16, 22 and 23 are for 1793 assembly only !!**

13- Assemble insulators to L brackets using 6-32 x 1/2" screws and 5/16" hex nuts. See *Figure 4*.

14- Assemble Aluminum couplers using 6-32 x 1/4" screws. See *Figure 4*.

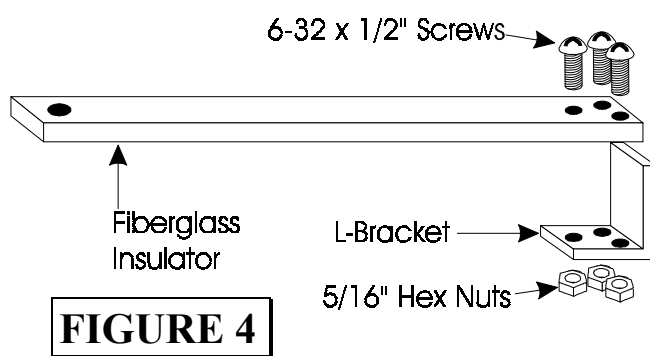
15- Next Assemble the 20 meter element *parallel* to the main antenna as follows:

## Instructions

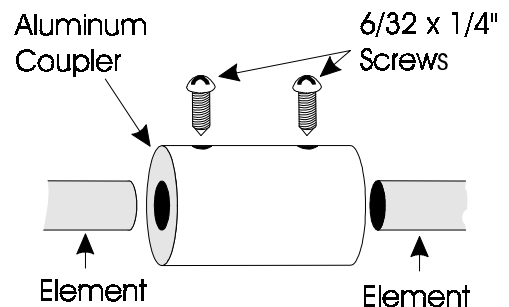


**FIGURE 3**

Couple the two 6' rods together using one of the Aluminum couplers. Slide one insulator assembly over the top section and 2 others over the bottom one. Couple the bottom section (the one with two insulators) to the 55" threaded rod. See *Figure 3*.



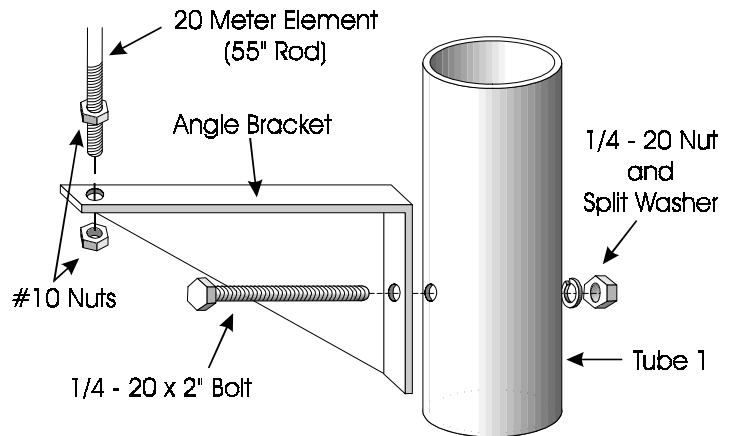
**FIGURE 4**



## MFJ-1792/1793 Vertical Antenna

## Instructions

16- Screw a #10 nut over the threaded rod. Slide the threaded end of the 55" rod through the triangular support bracket with the angle pointing down. Thread another #10 nut over the rod to sandwich the bracket between the two nuts. Refer to Figures 4 and 5. (**NOTE: Do not** attach angle bracket to Tube 1 yet, it will be installed later.)



**FIGURE 5**

17- Mount the matching network to the base mount by inserting the 6-32 x 2 1/4" screws into the provided holes then threading a 6-32 nut over both of them. See Figure 6.

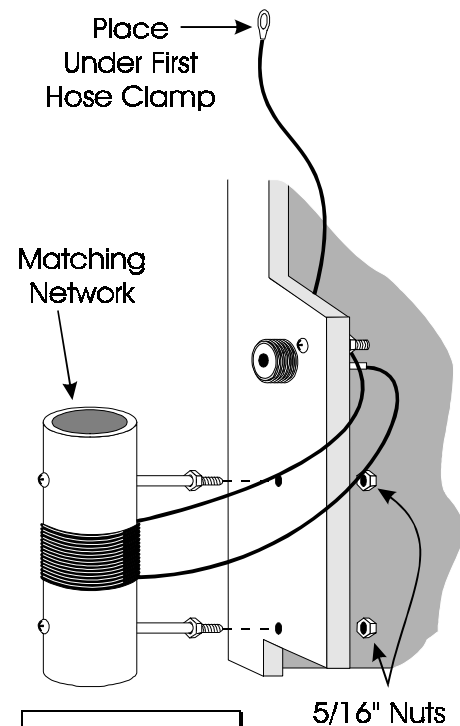
18- Line up End A of the fiberglass rod with the 1/4" holes in the U-channel of the Aluminum base mount. Bolt End A of the fiberglass rod to the U-Channel with a 1/4 - 20 x 1 3/4" bolt, 1/4 - 20 nut, 1/4" spacer, and a split washer.

**NOTE: Use the 1/4" spacer between the fiberglass rod and mount wall as shown in Figure 7.**

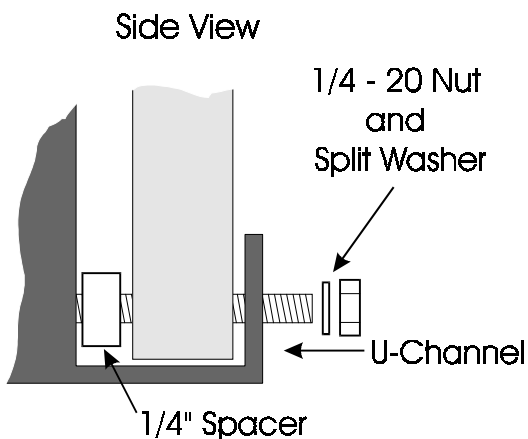
19- Insert 2 U-bolts in the base mount designated holes. Thread 1/4 - 20 nuts and split washers over them. See figure inside front cover.

20- Insert End B of Coupler 1 into End A of Tube 1. Insert the solid fiberglass rod into Coupler 1. Line up holes. Bolt tube, coupler, and rod together with a 1/4 - 20 x 2" bolt, 1/4 - 20 nut and split washer (Refer to Figure 1 for an example of tube insertion).

**Do not secure this bolt yet if you are planning to install the 20 meter element !**



**FIGURE 6**



**FIGURE 7**

21- Place a hose clamp over end A of Coupler 1. **Do not attach the solder lug of the feedline, as shown in Figure 6, at this time!**

22- With the help of another person, lay the 20 meter element parallel to the antenna. Insert the 1/4 - 20 x 1 3/4" bolt through the 1/4" hole in the triangular support bracket of the 20 meter element and secure bolt. See Figure 5.

23- Attach the 20 meter element to the antenna

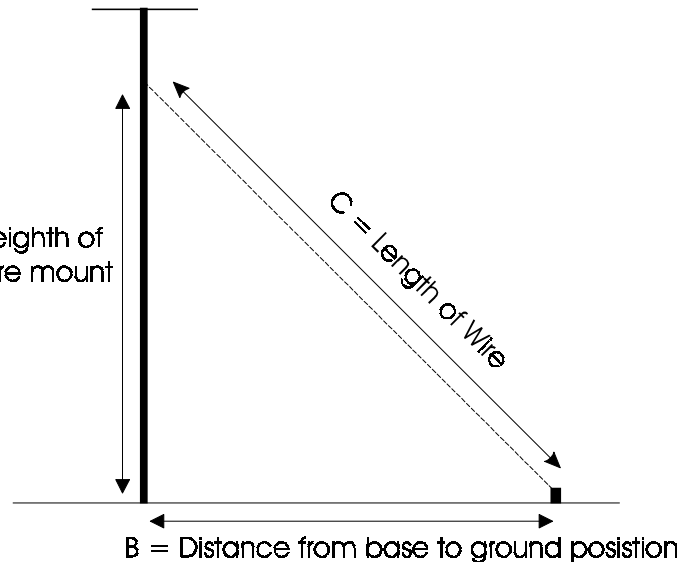
## MFJ-1792/1793 Vertical Antenna

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using hose clamps over the L-brackets. Secure hose clamps. *See figure inside front cover and figure 3.*

24- Place guy wires on guy wire mounts. Make sure the guys are non-conductive and long enough to reach their attaching ground position when antenna is up. Use the formula:  $C = \text{SQRT}(A^2 + B^2)$  to estimate the length of the wire. **Add** a few extra feet to your calculation to be on the safe side. *See Figure 8.*

A = Height of wire mount

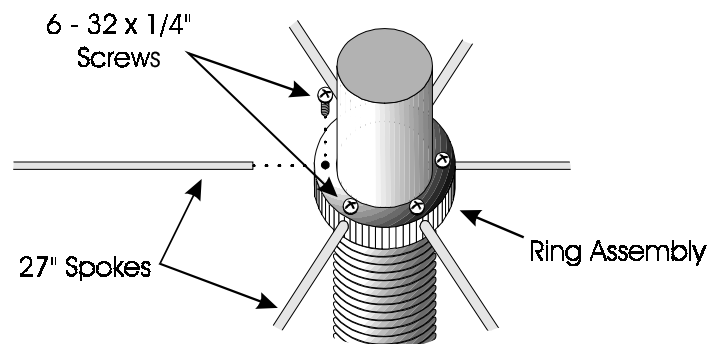


**NOTE:** It is possible to use a single set of guy lines to secure this antenna. This set of guy lines can be placed on top of either the hose clamp or the 1/4 - 20 x 1 3/4" bolt of Tube 4 end B.

**FIGURE 8**  $C = \sqrt{A^2 + B^2}$

25- Thread six 6-32 x 1/4" screws in the capacitor hat ring on the loading coil assembly. **Do not tighten them yet.** *See Figure 9.*

**IMPORTANT:** Do not use a high torque electric screwdriver to mount the capacitance spokes. The screw heads will be shredded off if too much torque is applied.



**FIGURE 9**

*NOTE: Actual spoke length not shown in drawing*

26- Assemble the Loading coil assembly by placing six of the 27" long spokes into the ring assembly. Tighten the 6-32 x 1/4" screws until the spokes are snug. *See Figure 9.*

27- With the help of another person, move the antenna to the location of the ground pole. Place the swivel base mount over the ground pole, while the antenna is still laying on the ground, and tighten the U-bolts.

**WARNING:** *Do not allow the ground pole to pass beyond the edge of the base mount.*

## RAISING THE ANTENNA

**WARNING:** *Be especially careful when moving or mounting this antenna. The weight and length of this antenna can cause a loss of balance if handled by an inexperienced person, or if a capacitance spoke accidentally becomes snagged on a gutter, a tree limb, or any other object.*

28- Attach two of the guy wire sets to their ground position. Use the third set as a pulling wire to help raise the antenna into position.

29- Insert the 10-32 x 1 3/4" screw into the hole provided on end A of Tube 6. Thread a 10-32 nut over the screw and tighten. This will help to secure the loading coil.

30- Slide a hose clamp over the top of the antenna. Insert the base of the 80 meter loading coil into end A of Tube 6 (1 1/8" tube). Place the solder lug under the hose clamp and secure it well. ***Make sure that the Loading Coil is secured in place!***

**WARNING:** **DO NOT TRY TO LIFT THE ANTENNA BY YOURSELF !!**  
**GET HELP FROM AT LEAST ONE OTHER PERSON. SERIOUS INJURIES OR DEATH CAN RESULT IF THIS ANTENNA FALLS ON YOU !!**

31- ***With the help of at least one other person.*** Start walking the antenna in a straight line toward the base, while the other person pulls in the same direction with the third guy wire set. When the antenna is completely up, the two sets of guy wires will be almost snug. Hold the antenna base while the other person fastens the third guy wire in place.

**NOTE: DO NOT SECURE GUY LINES COMPLETELY AT THIS TIME !!**

32- Secure Antenna to the base mount, by placing a U-bolt Saddle Clamp between the fiberglass solid rod and the Aluminum wall. (see inside front cover) Line up the Saddle Clamp with the 1/4" holes. Insert the U-Bolt through. Thread two 1/4" - 20 nuts and split washers onto the U-bolt. Secure the U-bolt and the bottom 1/4"- 20 bolt.

33- Straighten up the antenna, and secure guy wires (*not permanently*). Make the grounding connection necessary.

34- Place the solder lug of the feedline under the Coupler 1 hose clamp at the base of the antenna and tighten the hose clamp. *See Figure 6.*

35- Antenna assembly is completed now, it can be tested using a transceiver on low power or with an analyzer such as the MFJ-249, or the MFJ-259, then fine tuned before mounting it permanently.

## TUNING THE ANTENNA

Measure and record the frequency on which the lowest SWR occurs for the 80, 40 and 20 meter bands. The MFJ-1792 is tuned for lowest SWR either at the lower frequency of each band or slightly below.

**NOTE:** Make sure to disconnect the connection to the matching network before lowering the antenna to tune the 80 or 40 meter bands. Failure to do so will damage the matching network feed wire !!!

### 40 Meter Band:

**The MFJ-1792 generally does not require tuning on the 40 meter band.** This antenna covers the entire 40 meter band with very low SWR. However, the location and the ground system may cause the antenna to slightly detune. Retuning the antenna can be accomplished by sliding Tube 5 into Tube 4 to decrease or increase the length of the radiator, which in turn increases and decreases the frequency respectively. Use the information below for your adjustment.

40 m: 1' of length equals *approximatly* 200 KHz

### 80 Meter Band:

80 meter bands has narrower bandwidths. It should be tuned to the most desired section of the band by shortening one or more spokes in the capacitance hat (from the inner side) according to the information given below.

80 m: 1" trimmed off a spoke equals *approximately* 10 KHz

***WARNING:*** shortening the spokes from the looped end will affect the performance of the antenna and degrade its power handling capabilities

**If the resonant frequency on 80 meter is lower than your equipment can detect, take one spoke off the capacitance hat to raise the resonant frequency. Measure the resonant frequency again. Estimate the approximate resonant frequency as if the spoke was in place using the information above.**

*Example: The antenna measured 3.47 MHz, the desired frequency is 3.95 MHz (less .05 MHz) for a difference of .43 MHz or 430 KHz. This would require the trimming of 43" from one spoke. Instead, cut 4.3 inches from **all six spokes** and measure the new resonant frequency. Assume the new resonant frequency is 3.82 MHz. A single spoke can now be trimmed 8" to adjust the antenna to resonance.*

## 20 Meter Band

The 20 meter band is tuned by lengthening or shortening the threaded portion of the stubs. This adjustment is very coarse. If frequency is too low with the stub element extension at minimum, the unthreaded end of the stub can be trimmed.

## TECHNICAL ASSISTANCE

If you have any questions that the manual does not answer, please contact MFJ Enterprises. You may call MFJ toll-free at 1-800-647-TECH (8324), FAX 1-601-323-6551, or TELEX 53 4590 MFJ STKV. Outside the continental USA please call 601-323-5869. Please have the model number, date of purchase, this manual and all additional information you can supply close by the telephone. This will help with any questions the technicians may have.

You can also send written correspondence to MFJ Enterprises INC., PO Box 494, Mississippi State, MS 39762. Send a complete description of your problem, an explanation of exactly how you are using your unit and a complete description of your station.

If you have any helpful suggestions, or find any errors in this manual, please drop us a note. Direct your comments to Attn.: Product Engineering at the above address. We appreciate your assistance and thank you for purchasing our products.

*Autoryzowany Przedstawiciel MFJ w Polsce:*


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