



# Butternut HF2V 80/40 Dual-Band Vertical Antenna

**BUT-HF2V**

BUT-HF2V-INS-Revision 4a

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Artist's rendition of an installation

## Introduction

The classic Butternut HF2V vertical antenna operates on 80 and 40 meters. Designed with corrosion-resistant aluminum tubing, this 32-foot tall antenna is very durable and attractive. Optimize your performance on 80 & 40 meters.

## Features

- Band coverage for 80 and 40 meters
- Height is 32 feet
- Weight is only 13 pounds
- Feedpoint Impedance is a nominal 50 ohms and uses a coaxial cable connection at the antenna base
- Power handling up to 1,500 watts - full legal limit on both bands
- Will handle 60 mph winds (no ice) - higher winds with guying
- Bandwidth for VSWR 2:1 or less: 40 m - entire band. 80 m is 90 kHz
- Active element length on 80 & 40 meters is 32 feet
- Requires radial system

**Please** - Read the entire manual to become familiar with the construction of the Butternut HF2V vertical antenna. This manual does follow the 'classic' design and construction methods. However, throughout the manual information has been added that varies from the 'classic' design by adding newer options that you may want to consider when installing your Butternut HF2V.

## WARNING!

### INSTALLATION OF ANY ANTENNA NEAR POWER LINES IS DANGEROUS



**Warning:** Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, because they may cause serious injury or death.

Before you begin working, check carefully for overhead power lines in the area you will be working. Don't assume that wires are telephone or cable lines; check with your electric utility for advice. Although overhead power lines may appear to be insulated, often these coverings are intended only to protect metal wires from weather conditions and may not protect you from electric shock. Keep your distance! As a suggestion, remember the 10-foot rule; when carrying and using ladders and other long tools, keep them at least 10 feet away from all overhead lines - including any lines from the power pole to your home.

There are parts made from fiberglass in this kit. Take normal precautions when handling any fiberglass material. There may be fiberglass dust, slivers or particles present when the fiberglass parts were manufactured. The use of typical fiberglass handling safety gear (gloves, dust mask, eye shield, clothing, etc.) when handling and working with fiberglass is recommended. Use a damp rag

to wipe the parts. **Do not** use compressed air to clean fiberglass parts. Measures can be taken to reduce exposure after a person has come in contact with fiberglass. Eyes should be flushed with water and any area of exposed skin should be washed with soap and warm water to remove fibers. Clothing worn while working with fiberglass should be removed and washed separately from other clothing. The washing machine should be rinsed thoroughly after the exposed clothing has been washed. Check with your local or state safety and/or environmental agencies for more detailed precautions.

## Tools Required

Straight Slot Screwdriver, Phillips Head Screwdriver, 1/4" Nut Driver or socket set, 11/32" Nut Driver or socket set, 3/8" Nut Driver or socket set, Tape measure, Pencil.

## Additional Material Needed But Not Supplied

**JTL-12555** Jet Lube SS-30 Anti-Oxidant Corrosion Inhibiting Lubricant

**ERO-611360** Ground Rod installed near base of the antenna

**DXE-RADW-32RT** or **65RT** Radial Wires

**DXE-RADP-3P** Radial Plate

**DXE-UHF-FDFB-KIT** SecureMount Double SO-39 Connector for the Radial Plate

Guying Kit for Vertical Antennas - Some vertical antenna manufacturers indicate their antennas do not need guying. During times of high winds or ice loading, some of these vertical antennas may sustain damage or fail altogether. With the small amount of effort needed to install a four point guying system, the risk hardly seems worth taking. A four-point guying scheme provides the best mechanical advantage to reduce wind stress, regardless of direction. Information on guying the Butternut HF2V is included in this manual.

## Site Selection

Ideally, select a mounting location clear from power lines, structures and other antennas by a minimum of 35 feet. **Consider overhead power lines, utility cables and wires.** The vertical should be mounted away from local noise sources or other metallic objects which can re-radiate noise and affect the tuning, radiation pattern and SWR. Determine the direction you want the antenna to tilt down and make sure there is adequate clearance (at least 35 feet). There should also be a clear diameter of 65 to 130 feet from the antenna for the guying and radial systems that will extend away from the antenna. As with all Amateur Radio antennas there may be compromises and the ideal site may not be available.

## Radial System

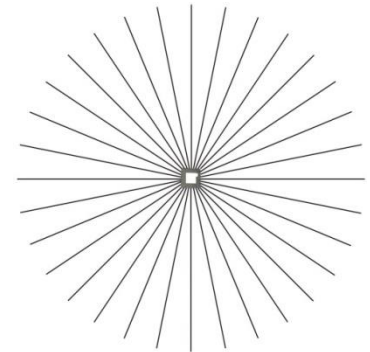
The use of a radial system is a key requirement for any high performance quarter wave vertical antenna system. **With any vertical antenna system, the radials are the second half of the antenna. The radials contribute to the radiation efficiency of the entire vertical antenna system.**

The exact number of radials required for low SWR and reasonably efficient operation on 80 and 40

meters will depend in large measure on local earth conductivity, and this may vary considerably from one place to the next and from one frequency band to the next.

The best procedure is to assume that most earth is a poor conductor over the HF range and that some radial wires will be needed. Radials may be placed on the surface of the earth or buried slightly below the surface to get them out of the way, and their length is largely a matter of convenience. In general, a large number of short radials are preferable to a small number of longer radials for a given amount of wire, especially if fewer than a dozen radials are to be used. Unlike resonant radials that must be cut to the proper lengths for use with elevated verticals, ground-level radials need not to be cut to any particular length; their sole purpose is to provide less lossy return paths for currents flowing along the earth than the earth itself can provide. And, since "return" currents will be flowing back to the antenna from all points of the compass, the radial wires should be spaced uniformly over 360 degrees, although physical circumstances will often make this "ideal" distribution impossible. For a discussion of ground system for elevated verticals, see the section entitled "Above Ground Installations" following Checkout and Adjustment instructions.

At a minimum, 20 radials, each 32 feet long, may be used with this antenna. Using 32 radials at 65 feet long is preferred and highly recommended for the best performance on 80 meters with this antenna. The extra radials help overcome unknown poor-soil conditions, improve bandwidth, and ensure the best performance efficiency possible from the Butternut HF2V antenna. Radial Wire that is 14 gauge stranded copper with black relaxed PVC insulation wire is suggested for the best results. **DXE-RADW-32RT** or **65RT** Radial Wire Kits.



The wire radials should be placed as symmetrically as possible straight from the feedpoint around the vertical antenna and spaced evenly, regardless of how many radials are used. Do not cross or bunch any radial wires as this nullifies their effectiveness. If you have limited space, put in as many straight radials as you can. The radials must be connected to the shield of your feedline. A Radial Plate is the ideal optional item which provides an excellent system for attaching radial wires to your vertical antenna system.

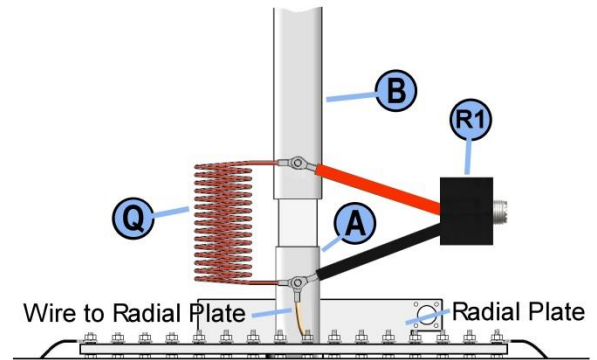
Radial wires can be laid on the roots of the grass or on bare ground using Radial Wire Anchor Pins to hold them down. Using enough staples will ensure the wires will not be snagged by mowers, people, or animals. Depending on where you live and the type of grass you have, grass will quickly overgrow the radials and it will be virtually impossible to see them. Radials can also be buried just under the surface (approximately 1" - anything deeper and you will start losing effectiveness) by using a power edger to make a slit in the soil.

**NOTE:** The function of a ground rod is to place the antenna at D.C. ground potential. It cannot take the place of an effective RF ground system, such as a number of radial wires, regardless of its depth in the earth. It does, however, serve as a convenient tie-point for such radials, as does the bolt through mounting post w/insulator (A) to which radials can be connected by means of the remaining #8 hardware.

## The Optional Radial Plate

A **DXE-RADP-3** Radial Plate is an ideal option for the radial system that is needed for the Butternut HF2V vertical antenna. The radial plate can be set on the ground, or connected by means of a clamp to the lower tube of the HF2V.

In either case, a ground wire attachment from the lower tube to the Radial Plate should be made to ensure a good RF connection. One benefit of the Radial Plate is an optional double female connector that can be installed ensuring that the radial field is tied to the antenna system.



**Radial Plate shown installed.**

## Aluminum Tubing Information

When assembling any telescoping aluminum tubing sections you should take the following steps.

1. Make sure the edges are smooth and not sharp. Deburring may be necessary, since burrs and shavings can occur on seams as well as edges. All surfaces need to be completely smooth to allow easy assembly of tubing sections.

### Caution

*Aluminum tubing edges can be very sharp.  
Take precautions to ensure you do not get accidentally cut.*

The raised particles and shavings that appear when the aluminum tubing is machined are referred to as burrs, and the process by which they are removed is known as deburring.

The aluminum tubing is machine cut on both ends. You should further assure that there are no ragged edges or protrusions.

2. Clean the inside of the aluminum tubing to clear out any dirt or foreign material that would cause the aluminum tubing sections to bind during assembly. Do not use any type of oil or general lubricant between the aluminum tubing sections. Oils or general lubricants can cause poor electrical connections for radio frequencies.
3. Clean the outside of the aluminum tubing to clear any dirt or foreign material that would cause the clamps to malfunction during assembly.
4. The use of **JTL-12555 Jet Lube SS-30 Pure Copper Anti-Seize** is highly recommended. Jet Lube is an electrical joint compound which effects a substantial electrical connection between metal parts such as telescoping aluminum tubing or other antenna pieces. Using Jet Lube assures high conductivity at all voltage levels by displacing moisture and preventing corrosion or oxidation.
5. When assembling the aluminum tubing sections, ensure the area is clear of grass, dirt or other foreign material that could cause problems during assembly of the closely fitted telescoping sections.



## Assembly

**Note:** For reference purposes, a completed basic **HF2V Antenna** is shown at the end of this manual following the complete detailed parts list.

1. Check to be sure that no parts are missing (see assembled antenna pictorial page)
2. If the antenna is to be installed at ground level, plant mounting post (A) in a hole approximately 21 inches deep so the upper end of the fiber rod insulator is approximately 3 to 5 inches above ground level. Pack earth tightly around mounting post (A) so that it will remain vertical. Concrete may be used in areas of high wind for greater rigidity, in which case the mounting post should be rotated while the concrete is setting so that it may be easily removed later. If the antenna is to be mounted in concrete or in damp, acidic or alkaline soil, the mounting post should be given a protective coating of asphalt roofing compound, polyurethane varnish, or another suitable covering to protect the metal against corrosion. You may also want to use the optional **BUT-MPS** Mounting Post Sleeve which fits over Tube A (when the outside sleeve on Tube A is removed) to help protect it from contamination.



**NOTE: DO NOT HAMMER THE MOUNTING POST INTO THE GROUND AS THIS CAN SPLINTER THE FIBER ROD INSULATOR AND COMPLICATE INSTALLATION.**

3. Slide the insulator on 40 meter tube (B1) into the top of base section (B) and secure with a #8 x 1-1/2" bolt, #8 lock washer and #8 hex nut. [The antenna will be mated to tube (A) and the other insulator - along with the red coil (Q) - in a later step in the assembly].



**NOTE:** The top of base section (B) has the mounting hole located 1/4" from the end. Tube B1 - the end where the hole is drilled 5/8" from the end goes toward the top of the antenna.



In all subsequent steps involving base section (B), assembly should be done indoors or in an area where dropped hardware may easily be recovered.

4. Locate the 80/40 meter coil assembly (C) and slide the clamp at the outer end of the larger coil over the 40 meter tube (B1) and onto base section (B), until the middle clamp can be positioned around the fiber glass insulating rod. The middle clamp will have to be pulled open slightly to pass over the 40 meter tube (B1) and bolt that goes through the insulator



rod. Position the center coil clamp around the insulator rod so that the distance from the clamp to the end of either piece of tubing is approximately equal, and pass a #10 x 1" bolt through the holes of the center coil clamp as shown in the drawing immediately below. The

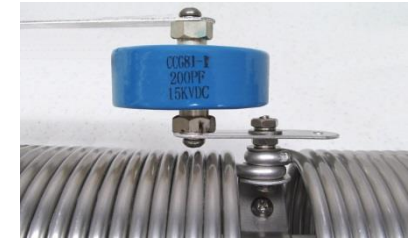


outer tab of this clamp may be bent back slightly to provide clearance for the bolt, and bent back into place after final assembly. Fasten the center



coil clamp firmly in place using a #10 lock washer and #10 wing nut. Using #10 lock washers and #10 wing nuts secure the two remaining coil clamps, tightening the wing nuts only enough to hold the hardware in place. **Coil adjustments will be made later.**

5. Install the capacitor bracket (E) on the capacitor assembly (D) using the hardware already on the capacitor.
6. Position capacitor assembly (D) over the threaded end of the bolt protruding from the center coil clamp on the 80/40 meter coil assembly (C). Make sure that the capacitor bracket (E) runs along side the lower (80 meter) coil of the 80/40 meter coil assembly (C). Fasten the capacitor assembly (D) to the 80/40 meter coil assembly (C) using a #10 flat washer, #10 lock washer and a #10 hex nut.



Using the large non-adjustable clamp, fasten the end of capacitor bracket (E) firmly against base section (B) and secure it with a #8 x 1" bolt, #8 lock washer and a #8 hex nut.



**NOTE: IN THE FOLLOWING STEPS TUBING SECTIONS G THROUGH M WILL BE ASSEMBLED AS A UNIT FOR LATER PLACEMENT ON THE BASE SECTION.**

*Note: **Jet-Lube™ SS-30 Anti-Oxidant** should be used between all antenna element sections. **Jet-Lube™ SS-30** is an electrical joint compound to affect a substantial electrical connection between metal parts such as **telescoping aluminum tubing** or other antenna pieces. It ensures high conductivity at all voltage levels by displacing moisture and preventing corrosion or oxidation.*

***Jet-Lube™ SS-30** should also be used on all **coil clamps, element clamps, bolts and stainless steel threaded hardware** to provide good electrical contact, prevent galling, allow easier disassembly and to ensure proper tightening.*

7. Insert tube (H) into tube (G), align the four holes, and pass a #8 x 1 1/2" bolt through both tubes. Secure it with a #8 lock washer and #8 hex nut and tighten snugly.



**Steps 7 through 10 Typical screw/lock washer, hex nut installation between tubes H through L. Do not over tighten which may deform or damage the tubing.**

8. Insert the end of tube (I) into tube (H) and proceed as in step 9, using a #8 x 1 1/4" bolt, #8 lock

washer and #8 hex nut.

9. Insert the end of tube (J) into the end of tube (I) and proceed as before, using a #8 x 1 1/4" bolt, #8 lock washer and #8 hex nut.
10. Insert tube (K) into tube (J) as in the previous steps, using a #8 x 1" bolt, #8 lock washer and #8 hex nut.
11. Insert tube (L) into tube (K) as in the previous steps, using a #8 x 1" bolt, #8 lock washer and #8 hex nut. Note that the upper end of tube (L) has only slots. Place the small gear-driven element clamp around the slotted end of (L) and tighten only enough to hold the clamp in place.



12. Place a black (or grey) cap over the end of tube (M) and slide the uncapped end into the slotted end of tube (L) to a depth of 3 inches. Tighten the hose clamp around the upper end of tube (L) snugly in order to hold tube (M) in place.



**NOTE:** If a rooftop or other above-ground installation is intended, please read the section entitled "Above Ground Installations" immediately following the check-out and adjustment instructions before proceeding.

13. Take the assembled base section (B), slide its lower end over mounting post w/insulator (A) and align the holes in the tube with the hole through the insulator. Pass a #8 x 2" bolt through the tube and insulator securing it with a #8 lock washer and #8 hex nut.
14. Raise tube assembly G through M vertically and slide the lower end of tube (G) into the upper end of 40 meter tube (B1). Align the holes of tube (G) with those of 40 meter tube (B1), pass a #8 x 1-1/2" bolt through the holes and tighten securely with a #8 lock washer and #8 hex nut.



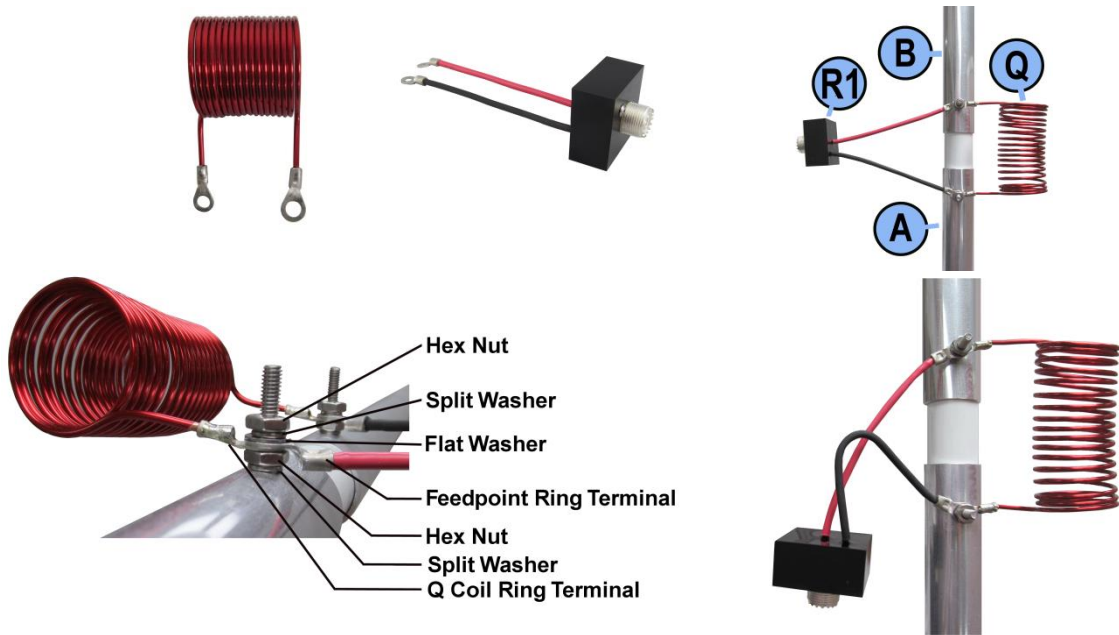
**NOTE: DURING THE FOLLOWING STEPS PLEASE REMEMBER THAT A DIFFERENCE IN POTENTIAL MAY EXIST BETWEEN COAXIAL LINES CONNECTED TO STATION TRANSMITTING OR OTHER EQUIPMENT AND THE ANTENNA OR THE EARTH AROUND IT.**

**IN ORDER TO AVOID A POSSIBLY FATAL SHOCK HAZARD BE SURE THAT THE FEEDLINE TO THE ANTENNA IS DISCONNECTED FROM STATION EQUIPMENT BEFORE ATTACHING IT TO THE ANTENNA OR OTHERWISE COMING INTO CONTACT WITH IT**

15. Any length of cable having a characteristic impedance of 50 to 53 ohms may be used to feed the HF2V.
16. Install the Red Coil (Q) and the Feedpoint Connector (R1) in place as shown below. The Red Coil and the Feedpoint Connector span over the insulator between Tube (A) and Tube (B). The Red lead on the Feedpoint Connector connects to Tube (B), the Black lead on the Feedpoint Connector connects to Tube (A). The coaxial cable from your transceiver connects to the Feedpoint Connector (R1). The leads connecting the Feedpoint Connector can be bent to

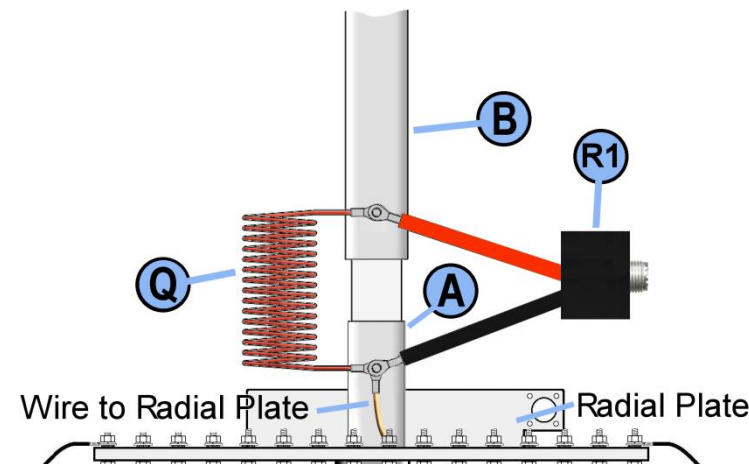


accommodate your installation requirements. To aid in eliminating water damage of the coax, weatherproof the coax connector when connected to the Feedpoint Connector.

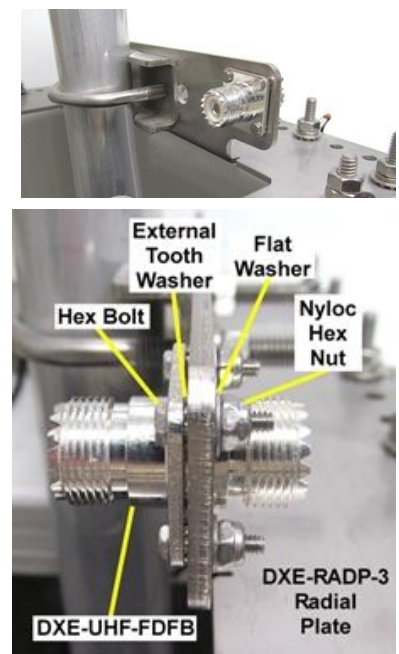


NOTE: Attach radials and ground to tube with insulator (A) using the remaining # 8 hardware on the ground side (lower side - black lead) of the (R1) coaxial cable connection.

A stainless steel Radial Plate **DXE-RADP-3** is an ideal option for the radial system that is needed for the Butternut® HF2V vertical antenna. The radial plate can be set on the ground. When the antenna is installed, run a short piece of copper strap from the radial plate to the lower connection of coil Q mounted on tube (A) of the HF2V or the optional **BUT-MPS** Mounting Post Sleeve. In either case, a ground wire attachment from the lower tube (A) to the Radial Plate should be made to ensure a good RF connection. The **DXE-RADP-3** has a mounting area for an optional dual SO-239. This can be used with a short connecting coax cable from the (R1) Feedpoint Connector to the Radial Plate for the Butternut 2-HF Verticals and makes for an easy, effective connection to your radial system.



Radial Plate shown installed.



## Checkout and Adjustment

Adjustments will vary since every antenna installation is not the same. Antenna performance is influenced by nearby structures such as fences, building, other antennas, etc. A good antenna analyzer is a must to determine resonance. You cannot rely on you radio SWR meter to give you an accurate reading, especially when tuning the antenna for the first time.

NOTE: The two coil shorting straps (F) are provided as a means of decreasing the inductance of the 80 and 40 meter coils more than is possible simply by stretching the coils. Lower than normal inductance may be necessary if the HF2V is top loaded as described later for the sake of greater SWR bandwidth on 80/75 meters.

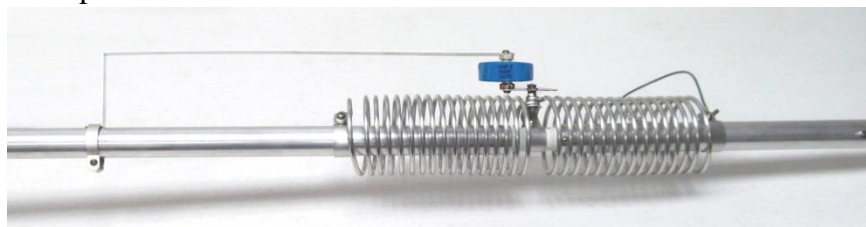
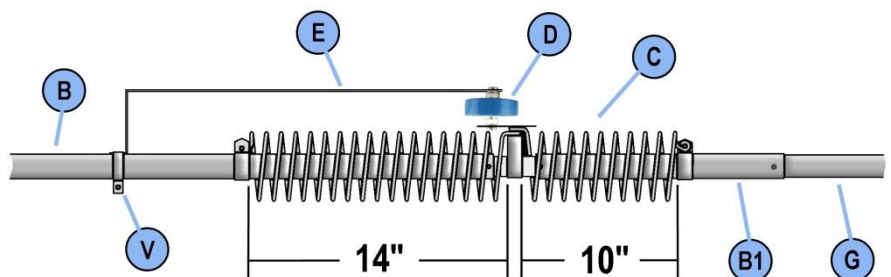
For operation of the HF2V without top loading or any optional accessories for other bands attach the lug end of one shorting strap to the upper clamp of the 40 meter coil. This is done by removing the wing nut and other hardware from the upper clamp and placing the lug end of the coil shorting strap (F) over the #10 bolt ahead of the locking washer and the wing nut. The other end (clamp end) of the coil shorting strap (F) should be tapped down along the 40 meter coil so that four full turns are shorted out. Secure it with #8 x 3/4 bolt, #8 lock washer, two #8 flat washers and #8 hex nut.

The other shorting strap, if needed, may be attached to the lower clamp of the 80 meter coil and tapped upward along the coil for decreased inductance. Secure it with #8 x 3/4 bolt, #8 lock washer, two #8 flat washers and #8 hex nut.

With no top loading, however, it is unlikely that any turns will need to be shorted to achieve satisfactory operation over any 60 kHz segment of the 3500-4000 kHz range. For MARS or other operation above 4000 kHz the shorting strap will probably be required.

With the 40 meter coil shorted as noted above and with the following coil settings resonance and lowest SWR should occur at approximately 7150 and 3750 kHz. This is an approximate starting point since antenna performance varies greatly depending on installation variations.

1. Set the 80 meter coil so that the distance between the upper edge of the lower coil clamp to the lower edge of the center clamp around the insulator is **14 inches**. The 40 meter coil should be adjusted so that the distance between the lower edge of the upper clamp and the upper edge of the center clamp is **10 inches**.



2. Accurate SWR measurements can be obtained at the antenna using a modern antenna analyzer.

- Determine the frequency at which the SWR reading is lowest on 80/75 meters. In order to minimize interference to other stations adjust the SWR indicator for maximum sensitivity and use only enough power for full scale deflection in the "forward" position. Resonance on this band is fairly sharp, so it may be necessary to take readings at every 25 kHz or so across the band to find the frequency at which the SWR drops to a minimum value. If lowest SWR (not necessarily less than 2:1 at this point) occurs at a higher frequency than desired, simply loosen the wing nut on the lower 80 meter coil clamp and readjust its position upward for greater compression of the coil and increased inductance. If, on the other hand, the initial reading of lowest SWR occurs at a lower frequency than desired, position the 80 meter coil for less compression and decreased inductance. Adjustments in either direction should be made in steps of one inch or less to avoid "overshooting the desired setting." A one-inch change in the position of the lower coil clamp will produce a 75-100 kHz change in resonance.

Once the 80/75 meter coil adjustment has been made for lowest SWR at a particular frequency it will be found that the SWR cannot be lowered further without the adjustment of the base matching coil (Q), especially if an effective ground system is used with the antenna. One should remember that the radiation resistance of a vertical antenna that is physically shorter than a quarter-wavelength will be less than 35 ohms and that the total feedpoint impedance at resonance will be the sum of this radiation resistance, plus conductor and loading losses, plus earth loss resistance. With a loss-free ground system the resistive part of the feedpoint impedance of the HF2V on 80/75 meters will be less than 20 ohms and the resulting mismatch with 50-ohm cable would produce SWR of greater than 2:1. Base matching coil (Q) may be viewed as a step-up transformer that will match the lower impedance at the feedpoint, to the characteristic impedance of the feedline, and proper adjustment will produce SWR of close to unity in those cases where the earth loss resistance is sufficiently low to keep the feedpoint impedance below the characteristic impedance of the cable used. If earth losses are unusually great, as in desert areas, and if no efforts are made to reduce these losses, base matching coil (Q)'s transformational properties will be the opposite of what is needed. In such a case base matching coil (Q) should be left fully compressed or disconnected entirely, depending on which condition produces lower SWR.

- Stretch base matching coil (Q) a slight amount from its fully compressed condition and observe the effect on SWR. In general, the more efficient the ground system is in reducing earth losses, the greater the amount of stretch required for low SWR, and if one is fortunate enough to have a zero-load ground system base matching coil (Q) may have to be stretched to several times its compressed length for a proper match, in this case it may be more convenient to reduce its inductance by sniping off several turns rather than continued stretching. If you have a good radial system, you will have to remove up to half of the turns. If base matching coil (Q) has to be stretched a good deal for the sake of a good match the frequency of minimum SWR may drop slightly, in which case the adjustment of the 80/75 meter coil setting may be touched up as in the preceding step.



- Determine the frequency at which SWR is lowest on 40 meters and adjust the upper or 40 meter coil in exactly the same manner as the 80/75 meter coil was adjusted. Since the antenna is a full quarter wavelength tall on this band, tuning will be fairly broad and the radiation resistance will be close to 35 ohms with negligible conductor loss. Depending on the adjustment that has been made to base matching coil (Q) in connection with the 80/75 meter tuning, 40 meter SWR should be no worse than 1.5:1 at resonance, and even lower SWR is likely.

## Above Ground Installation

If the HF2V is to be mounted some distance above the earth a **resonant** radial ground system will most likely be necessary for low SWR and efficient operation. The length in feet of radial wires for any band can be found from the formula:

$$\text{Length} = \frac{240}{\text{Frequency(MHz)}}$$

At least two radials per band should be used if at all possible for the sake of efficiency, although operation with a reasonably low SWR may be possible with only a single radial per band. If only two radials are used per band these should run at 180 degrees to each other. Resonant radials should be connected to the braid side of the coax at the feedline terminals and insulated at the far end. Resonant radials need not remain parallel to the earth, and a fair amount of slope will not significantly affect SWR or performance. If, however, resonant radials are not sufficiently elevated, the earth below them can cause them to resonate at a much lower frequency than expected, and their length may have to be trimmed considerably to restore the overall system (vertical radiator and radials) to resonance for low SWR operation without having to resort to a trans match at the input end of the feedline.

If the antenna is to be mounted **above ground** it is recommended that one set of **short** guys be attached to the antenna at a point that is approximately 1/3 of the way up from the feedpoint. These guys will help to steady the lower sections and to prevent the wind loading on the upper sections of the tubing. Four guys will offer more support than three, and unusually long guys should be avoided. Under no circumstances should guys be placed on the upper section of an antenna. The light tubing used in the upper half of the antenna is capable of supporting itself in very high winds, but it cannot support itself and guy lines that will themselves will be subject to wind and perhaps ice loading.

Guys should be made of non-stretch non-conductive material such as monofilament fishing line in the larger sizes. Light nylon twine should be avoided regardless of its strength rating because it can stretch as much as 15%. Polypropylene rope or even nylon rope may also be used, although the former should be checked periodically for signs of weather deterioration.

The wire suggested for elevated radials is a 14 gage stranded copper with a black relaxed PVC insulation. The relaxed insulation makes handling the wire easy since it will not kink or act like a spring. The PVC-insulated stranded copper radial wires are UV-resistant and roll out easily, unlike the wire that is commonly available at "big-box" stores.

## Optional Accessories for the HF2V and Notes on Top Loading

In its basic configuration the HF2V stands 32 feet tall and thus operates as a quarter-wave vertical on 40 meters with reasonably good efficiency over fair to good ground system.

On 80 meters, however, this height represents something of a compromise compared to a full quarter-wave vertical antenna for this band. One simple way to approach the performance of a full size vertical on 80 meters is to attach top-loading wires near or at the top of the antenna in order to simulate a much taller physical structure. Maximum loading will occur when the wires are extended parallel to the earth, but that arrangement would call for additional supports that are nearly as tall as the antenna itself. The "umbrella" system shown will conserve space and resources in that the support lines to the top loading wires may be placed at ground level.

The angle of slope for each wire is not especially critical, but 45 degrees represents a good compromise between loading and space conservation. Fewer than four wires may be used, although in such a case it may be expected that three wires of given length will provide less loading than four wires of the same length.

It is obvious that the addition of top-loading wires to the HF2V will call for less inductance in the 80 and 40 meter tuning circuits, in which case the shorting strap for the 80 meter circuit will be needed. Unfortunately, there is a limit to the amount of top loading that may be used with the HF2V before 40 meter operation is adversely affected. Four "umbrella" wires each attached to the antenna at the junction of tubes (K) and (L)



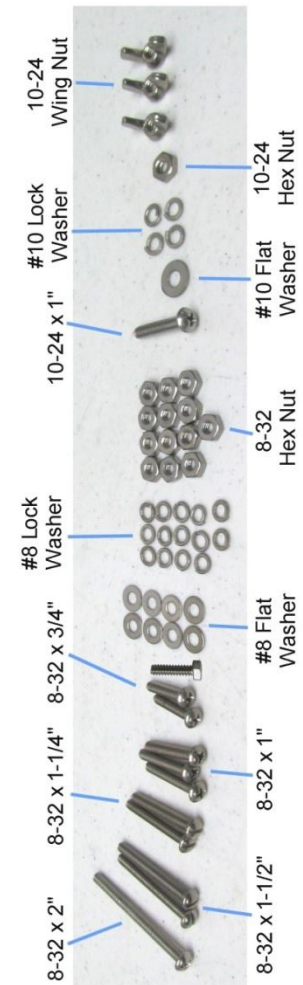
and each approximately 12 feet long and sloping downwards at 45 degrees, is probably the greatest amount of loading that can be used for coverage of the entire 40 meter band with acceptable SWR, even if all the turns of the 40 meter coil are shorted out. With this particular top-loading arrangement the 80/75 meter bandwidth between the 2:1 SWR points should be nearly 100 kHz.

If one is willing to sacrifice 40 meter operation for the sake of even greater operating bandwidth and greater efficiency on the lower bands the "umbrella" wires can be lengthened considerably. Four 25-foot "umbrella" wires, for example, would provide some 125 kHz of operating bandwidth on 80/75 meters.

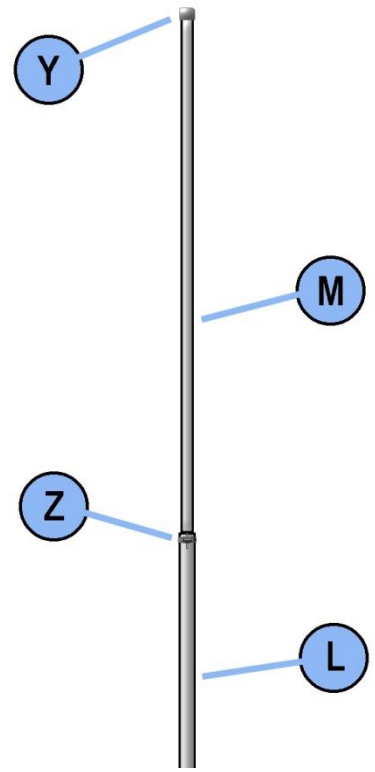
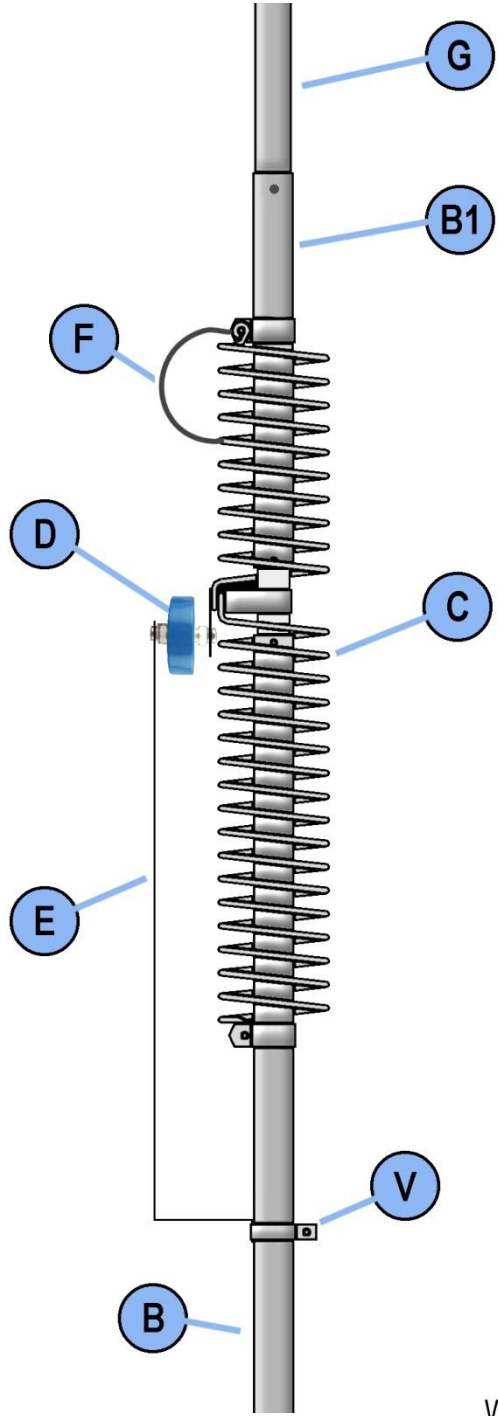
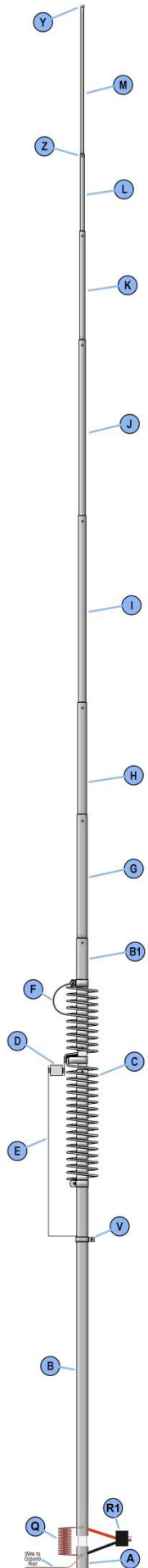
Top-loading wires should not be attached to the very tip of the antenna because the tubing in the two uppermost sections is no stronger than it needs to be to support itself. Operation of the HF2V may be extended to the other bands through the addition of accessories without sacrificing 80 and 40 meter performance.

## Butternut HF2V Parts List

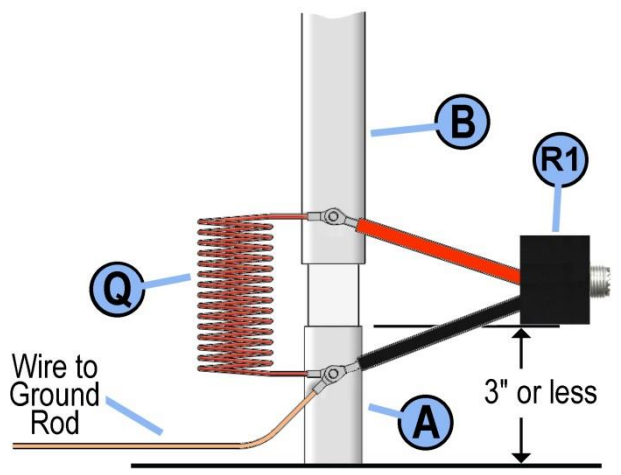
Ref	Description	Qty
A	Tube A with Insulator, 1-1/4" dia x 24" long	1
B	Tube B element, 1-1/4" dia x 48" long	1
B1	Tube B1 with Insulator, 1-1/4" dia x 14" long	1
C	Coil Assembly - 80/40 Meters	1
D	Capacitor Assembly 80 Meters	1
E	Capacitor Bracket 80 Meters	1
F	Coil Shorting Strap	2
G	Tube, 1-1/8" dia x 48" long	1
H	Tube, 1" dia x 48" long	1
I	Tube, 7/8" dia x 48" long	1
J	Tube, 3/4" dia x 48" long	1
K	Tube, 5/8" dia x 48" long	1
L	Tube, 1/2" dia x 48" long	1
M	Tube, 3/8" dia x 48" long	1
Q	Coil Q Base Matching	1
R1	Feedpoint Connector with Ring Terminals	1
	# 8-32 x 2" Screw	1
	# 8-32 x 1-1/2" Screw	2
	# 8-32 x 1-1/4" Screw	2
	# 8-32 x 1" Screw	3
	# 8-32 x 3/4" Screw	2
	# 8 Flat Washer	6
	# 8 Lock Washer	13
	# 8-32 Hex Nut	13
	#10-24 x 1" Screw	1
	#10 Flat Washer	1
	#10 Lock Washer	4
	#10-24 Hex Nut	1
	#10-24 Wing Nut	3
Y	Vinyl End Cap (Black or Grey)	1
Z	Adjustable Element Clamp	1
V	Capacitor Bracket Clamp	1







**Butternut HF2V  
Detail Drawings**  
(Not Scale)



## Guying the HF2V Antenna

Guying of vertical antennas is always recommended for stability. However, if your area encounters severe wind velocities or icing conditions, simple guying will reduce the possibility of failure. Guying rope should be tightened just enough to get any slack out of the rope. They do not need to be real tight. The ends of the ropes are slanted at about 45 degrees and tied to the earth anchors that screwed into the ground at about the same 45 degree angle as the ropes will be. The ropes are tied at the B1 and G tube joint.

Synthetic Textile Industries Antenna Support Rope which is a premium double-braided Dacron/Polyester rope has been used for guying vertical antennas. A single set of guys placed just above the 40 meter circuit will contribute greatly to the stability and the longevity of the antenna, provided that the guys retain a slight amount of slack and do not come off at too steep an angle.

At angles of less than 45 degrees, the guys begin to exert a downward compressive force on the structure that can be more of a threat to survival than lateral wind loading on an un-guyed structure.

Under no circumstances should guys be placed higher than one-third of the way up the antenna. The upper two-thirds of the HF2V has little more than its own weight to support, so these sections may be allowed to bend with the wind with no serious risk of damage. It is the lower third of the antenna that must support both the weight of the upper sections and the wind loading on them and are thus more likely to receive damage in severe winds.

## A Few Words About the Capacitors.

The door-knob capacitor used on the Butternut Verticals can be difficult to find. Over the years the shape and size has changed depending on the source of the capacitors.

Prior to October of 2016 - the following capacitor assemblies were used:



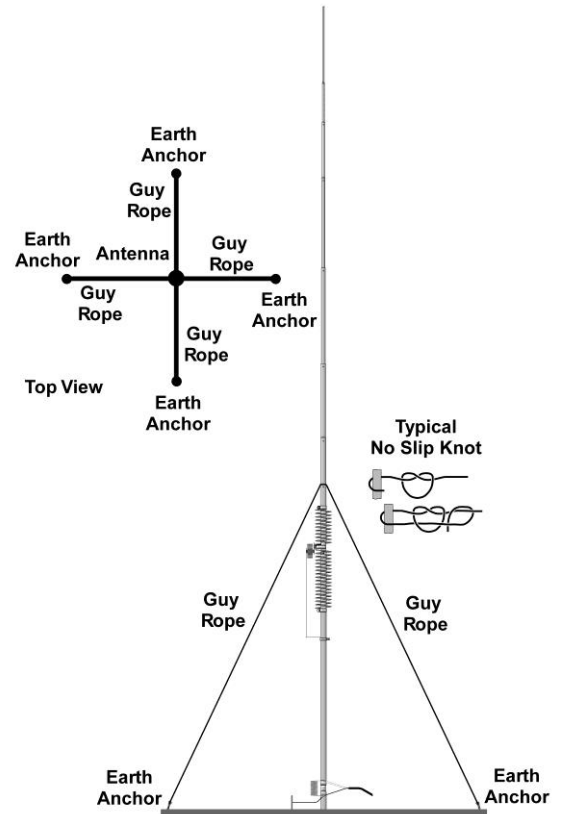
**BUT-290-05**  
200 pf



**BUT-290-06**  
67 pf



**BUT-290-07**  
67 and 200 pf with Bracket



As of October 2016 - the following capacitor assemblies are:



**BUT-290-05A**  
200 pf



**BUT-290-06A**  
67 pf with Bracket



**BUT-290-07A**  
67 and 200 pf with Bracket

The bracket with the newer capacitors is longer than the older bracket. When upgrading to the newer capacitors, the user will also have to slightly drill out the holes in parts D1 and D2 to fit the larger screws used on the newer capacitors.

There is no difference in tuning the antenna with the newer capacitors.

## Technical Support

If you have questions about this product, or if you experience difficulties during the installation, contact Butternut at (330) 572-3200.

For best service, please take a few minutes to review this manual before you call.

Another great place for information about the classic Butternut<sup>®</sup> Antennas is the Butternut<sup>®</sup> IO Group - <https://groups.io/g/butternut>

This special interest group is moderated by Scott Myers, AC8DE and contains a treasure trove of Butternut<sup>®</sup> antenna information from users around the world.

## Warranty

All products manufactured by Butternut<sup>®</sup> are warranted to be free from defects in material and workmanship for a period of one (1) year from date of shipment. Butternut's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by Butternut<sup>®</sup>. If Butternut<sup>®</sup> products are claimed to be defective in material or workmanship, Butternut shall, upon prompt notice thereof, issue shipping instructions for return to Butternut<sup>®</sup> (transportation-charges prepaid by Buyer). Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing. The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation, damaged from severe weather including floods, or abnormal environmental conditions such as prolonged exposure to corrosives or power surges, or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's specifications. In addition, Butternut's warranties do not extend to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to Butternut<sup>®</sup>. The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR BUTTERNUT ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.

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Specifications subject to change without notice.



BUT-HF2V-INS