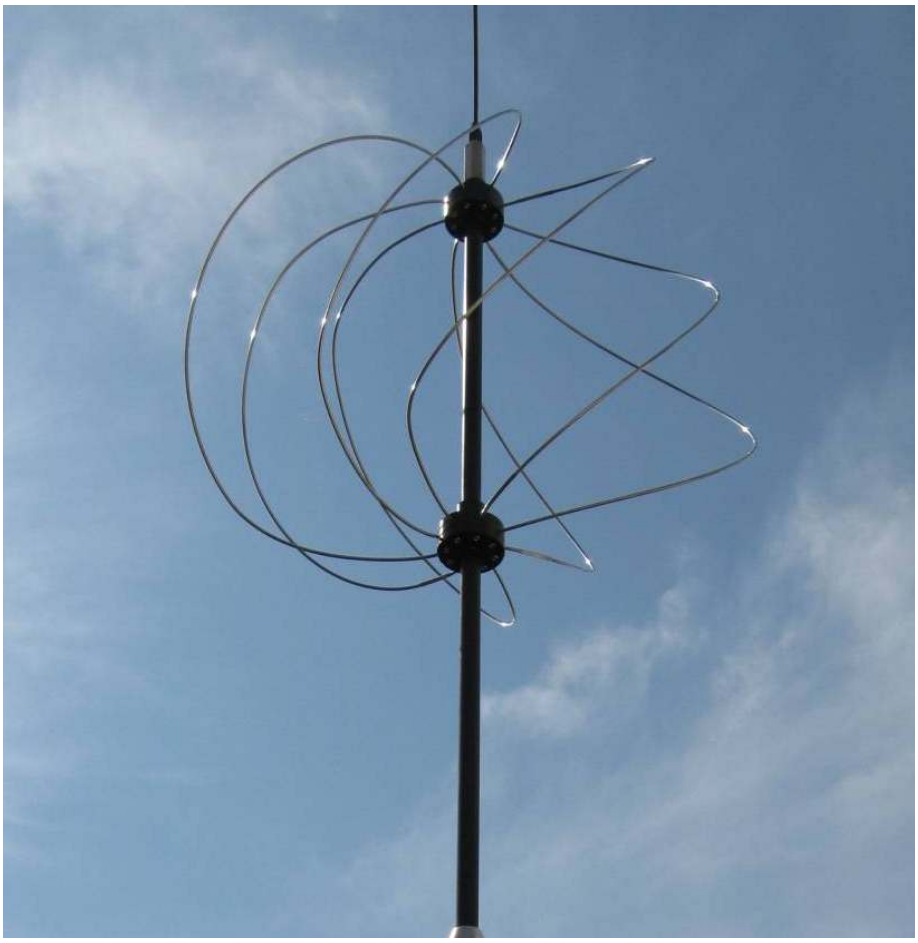
EB-4 / EB-8 CAPHAT ASSEMBLY INSTRUCTIONS



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1 Introduction

The EB-4 and EB-8 Caphat assemblies are “capacitance hats” which are used to add capacitance to an antenna system. They were designed by Charlie Gyenes, W6HIQ / VE7BOC / HA5CMG , and are manufactured by Hi-Q Antennas in Wildomar, CA., *www.hiqantennas.com*. They are supplied in a kit form, which requires the consumer to assemble them prior to their incorporation into their antenna system. Supplying the assembly in a kit form significantly reduces the shipping cost and almost eliminates the possibility of damage during the shipping process; hence the purpose of these assembly instructions. These instructions assume that the consumer has minimal mechanical experience and owns several common hand tools.

The EB-4 and EB-8 Caphat assemblies are constructed of aluminum hubs and extension rod, with stainless steel rods as radials. All hardware is stainless steel. To prevent galling and oxidation, all set screws and any interface between dissimilar metals should be coated with some form of anti-oxidation compound or anti-seize compound. Most anti-oxidation compounds will suffice as an anti-seize compound and most quality anti-seize compounds will more than adequately function as an anti-oxidation compound. However, one or the other MUST be used to insure proper and extended low maintenance operation of these assemblies.

Please read these instructions completely prior to beginning the assembly process!

2 Parts List and Part Illustrations

2.1 Parts Included In Kit

Photo #1

2 – Hubs
2 – 12” Extension Rod
3 - 3/8”x 1 ½” Stainless Steel Set Screws
4 - 3/32” Stainless Steel Rods, 24” in length (8 - Rods for the EB-8)

2.2 Items Needed – User Supplied

Allen Wrenches
Channel Loc Pliers
Anti-Oxidant Compound (Ox-Guard or equivalent)

3 Theory of Operation

When a quarter-wave antenna is mounted near the rear of a vehicle, the back of the vehicle and capacitance to the roadway act as the other required quarter-wave of a half-wave dipole. An antenna which uses the ground (earth/vehicle) as part of its resonant circuit is a *Marconi* antenna. An example of a *Marconi* antenna is a quarter-wave antenna, where the ground operates as the missing quarter wavelength. Most mobile antennas are a variation of the *Marconi* antenna.

At High Frequencies (HF) it becomes impractical to use full length quarter wave or half wave antennas for mobile operation. Therefore, it is often desirable to top or center load a mobile antenna. This top or center loading lengthens the antenna, but more importantly, it materially increases the capacitance between the top or center of the antenna and ground. As a result of this lengthening and the increased capacitance, a shorter antenna can be made to resonate at a relatively lower frequency than that of the unloaded antenna.

One method of achieving the loading of an antenna is to add a hat-type structure to the top or center of the antenna. Since this structure increases the capacitance and originally was shaped to resemble the rim of a hat, they were referred to as “Capacitance Hats”. This term has since been used to describe many shapes of load devices that have the effect of increasing the relative capacitance of the antenna with respect to the ground. A Capacitance Hat may appear as an “X”, a butterfly, a circular hat or a sphere. Basically the idea of a capacitance hat is to make up the length needed for resonance while limiting the vertical height.

Normally a vertical antenna has the lowest RF voltage/highest RF current flowing near the base, where most of the radiation occurs, and the highest RF voltage/lowest RF current at the top of the antenna, where the least radiation occurs. A capacitance hat placed at the top of an antenna will be exposed to the highest RF voltage/lowest RF current. Therefore due to the low RF current, the capacitance hat does not radiate a significant amount of signal. However, due to the increased effective height of the vertical radiator, the radiated energy is more evenly distributed along the length of the vertical radiator, resulting in an increase of RF radiation from the top of the vertical radiator with respect to a vertical radiator without the capacitance hat. Increasing the effective height of the antenna has the beneficial side-effect of reducing the losses caused by nearby shrubs and buildings, assuming your antenna is taller than these objects.

The symmetry of the hat causes any radiation from the hat to cancel and multiple elements are used to reduce the RF current flowing in each individual element. (If you use 1 radial element, it's called an inverted L, the radiation does not cancel and the radiation pattern is distorted.) The effective length of the vertical is then approximately the vertical length plus the length of the capacitance hat radials. It is also advantageous to use a “skirt”; joining the ends of the hat to maintain symmetry and ensure that a more balanced RF current flows in the hat section. In that case, the effective length is

approximately the vertical length, plus the radial length of the hat, plus 1/2 of the length of the skirt joining the radials.

Adding a large capacitance hat at either end of a coil also reduces coil Q, since a large portion of the hat's capacitance directly shunts the inductor. It will act like a big capacitor in lowering the resonant frequency of the antenna. The Q will decrease and your bandwidth will widen. Also, if we add a large capacitance hat at the top of the coil, (bottom of the whip), we change nothing below the coil.

A capacity hat will also raise the radiation resistance (the resistance that represents energy radiated from the antenna) for shortened antennas. If the radiation resistance is increased, it will increase the efficiency of the antenna system assuming other losses are kept the same.

Specifications and Test Data can be found on the Hi-Q Website: *www.hiqantennas.com*

4 Assembly Instructions

4.1 Hub Assembly

1. Apply a small amount of the Anti-Oxidant Compound to the lower half of one of the 3/8"x 1 ½" Stainless Steel Set Screws.
2. Insert the Set Screw into one end of the 12" Extension Rod and tighten using the appropriate Allen Wrench.
3. Apply a small amount of the Anti-Oxidant Compound to the lower half of the other 3/8"x 1 ½" Stainless Steel Set Screw.
4. Insert the Set Screw into the other end of the 12" Extension Rod and tighten using the appropriate Allen Wrench. (If the 3/8" set screws are installed properly, an Allen Wrench can be inserted into each of the 3/8" set screws in the ends of the 12" Extension Rod and the Allen Wrenches tightened against each other.)
5. Apply a small amount of the Anti-Oxidant Compound to the exposed half of one of the 3/8"x 1 ½" Stainless Steel Set Screw.
6. Thread one of the Hubs onto the Anti-Oxidant Compound treated 3/8"x 1 ½" Stainless Steel Set Screw.
7. Apply a small amount of the Anti-Oxidant Compound to the exposed half of the other 3/8"x 1 ½" Stainless Steel Set Screw.
8. Thread the other Hub onto the Anti-Oxidant Compound treated 3/8"x 1 ½" Stainless Steel Set Screw.
9. Be sure that the small set screws on the face of the Hubs are both on the same side as shown in Photo #2.
10. Photo #3 shows the small set screws on the bottom of the Hub Assembly of an EB-8 Caphat.
11. To fully tighten each hub to the 12" Extension Rod, it may be useful to wrap a thin cloth around one of the hubs prior to placing it into a vice or holding it with the Channel-loc pliers. Then using an Allen Wrench in the opposite end of the 12" Extension Rod, tighten the 12" Extension Rod into the hub being held. Reverse this procedure to tighten the other hub. The thin cloth may need to be double-layered to protect the finish of the hub being held.

12. This should complete the assembly of the Hub Assembly. Continue to Section 4.2.

Photo #2

Photo #3

4.2 Radial Installation

1. Each kit is supplied with either 4 or 8 - 3/32" Stainless Steel Rods which are 24" long, as shown in Photo #4.
   ***Note: If any of the radials should ever become damaged, replacement rod material can be obtained by purchasing 3/32" Stainless Steel - Type 316 welding rods, which come in 3' lengths, from most any welding supply store.**

2. Take the Hub Assembly created in Section 4.1 and insert a small amount of the Anti-Oxidant Compound into each of the small holes in the hubs.
3. Take one of the 24" rods and insert it into one of the holes in the side of the lower Hub and tighten the associated set screw, to lock the rod into the hub.
4. Grab the top Hub in one hand and the free end of the Rod in the other hand.
5. Slowly and carefully bow the rod such that it is aligned with the hole in the top hub that is approximately 90° counter clockwise when viewed from the top.
6. While holding the rod in to the hole, tighten the associated set screw, to lock the rod into the hub.
   ***Note: By bowing the rod counterclockwise, you are placing torsion on the hubs that will help to keep them tightened.**
7. Repeat steps 6, 7, 8 and 9 for each of the remaining rods. When done you should have an assembly which resembles that in Photo #5.

Photo #4

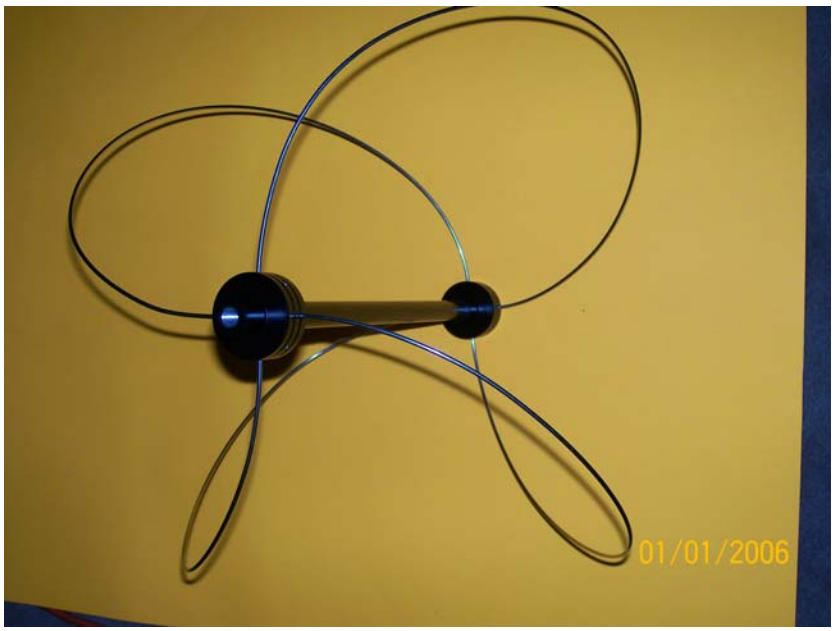

Photo #5

4.3 Final Assembly

Hi-Q Antennas recommends that the EB-4/EB-8 be installed 12" above the coil assembly of their antennas. Therefore, a second 12" extension rod and 3/8"x 1 ½" Stainless Steel Set Screw are included in the kit. The extension rod is assembled in the same manner as the extension rod in Section 4.1, Steps: 1 and 2. This 12" extension rod should then be inserted into the bottom of the EB-4/EB-8 assembly as shown in Photo #6.
(***NOTE**: **Radials removed in Photo #6 for ease of photography)**

Photo #6

When the assembly is complete, it should look like photo #7. The assembly is now ready to be installed into your antenna system.
(NOTE: Care must be used when installing in a mobile antenna system. Use caution not to exceed a 13' 6" overall height as measured from the pavement surface to the top of the antenna system.)

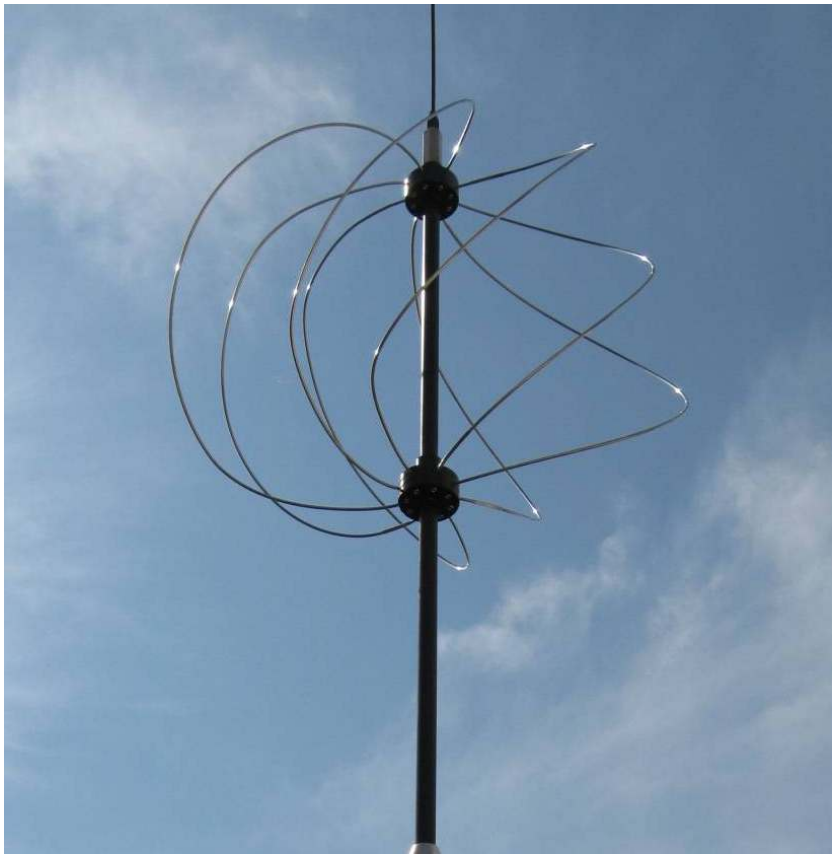

Photo #7