butternut

Instructions

Model HF5V-III

Butternut Electronics Co's Instruction Manual for:
Model HF5V-III — 1979

NOTE:

The HF5V Vertical antenna previously manufactured by Butternut Electronics Co. was discontinued in 1981. Parts are no longer available for these antennas. This instruction is made available as a reference.

BUTTERNUT ELECTRONICS CO.
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MODEL HF5V-III*

ASSEMBLY AND INSTALLATION INSTRUCTIONS

READ INSTRUCTIONS CAREFULLY BEFORE PROCEEDING. DURING ASSEMBLY AND INSTALLATION TAKE EXTREME CARE TO AVOID CONTACTING POWER LINES WITH THE ANTENNA OR WITH OTHER CONDUCTORS. DO NOT INSTALL THE ANTENNA IN ANY PLACE WHERE IT MAY COME INTO CONTACT WITH POWER LINES IN THE EVENT OF STRUCTURAL FAILURE OF ANY PART OF THE INSTALLATION OR IN THE COURSE OF NORMAL FLEXING AFTER INSTALLATION. SUCH CONTACT MAY RESULT IN DAMAGE TO PROPERTY, BODILY INJURY, OR EVEN DEATH!

Tools recommended for assembly: standard blade screwdriver, pliers, knife. A 5/16 inch nutdriver will be useful, but it is not a necessity.

Refer to the pictorial diagrams and proceed as follows:

1. Check to be sure that all parts are present (see parts pictorial page).

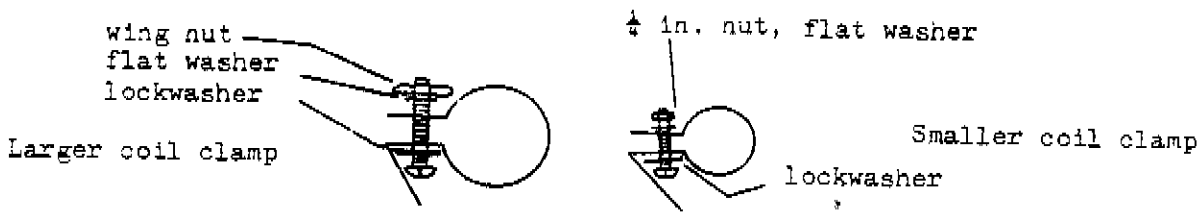
2. Plant mounting post (A) in a hole approximately 21 in. deep so that the upper end of the fiberglass insulator is 5 or 6 inches above ground level. Pack earth tightly around the tubing post so that it will remain vertical. Concrete may be used in areas of very high winds for greater strength, in which case the tube may be twisted slightly during setting for easier removal later. NOTE: Hammering the post into the ground may cause splintering of the fiberglass insulator. If the post must be hammered, protect the top with a block of wood.

3. Prepare impedance matching/grounding coil (M) as shown on the pictorial page.

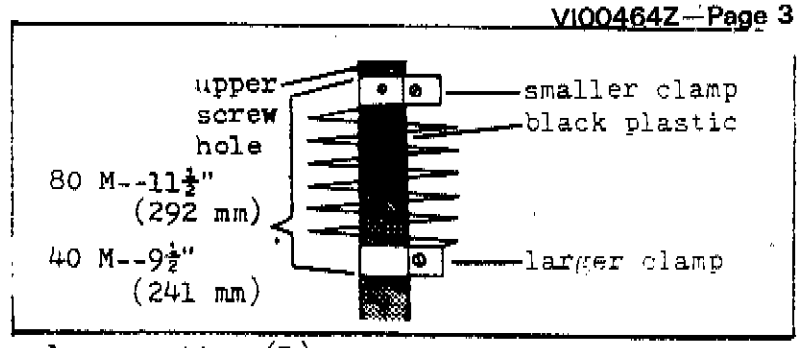
4. Note that the 80 M resonator coil (C) has two clamps. Pass the top of section (B) first through the larger clamp, and then through the smaller clamp. The larger clamp should go below the black plastic on (B).

5. Pass a 1/4 in. x 1 in. bolt through a lockwasher and then through the holes in the smaller clamp of (C). Line up the small hole in the curved part of the clamp with the lower screw hole in the top of section (B). Tighten the 1/4 in. hardware using a flat washer and a hex nut, then put a #10-24 self-tapping screw into the small hole in the curved part of the clamp and tighten, further securing the clamp to (B).

NOTE: If you use a screwdriver to put in the self-tapping screws, do not hold onto the work immediately opposite the blade. Be prepared for the blade to slip.



* Patent Applied For



6. Pass a 1/4 in. x 1 in. both through a lockwasher, then through the holes in the larger clamp of (C). Secure with a flat washer and a wing nut, but do not tighten, as the clamp will be moved in the next step.

7. Slide the larger clamp of (C) downwards along section (B) until the bottom of the clamp is 11-1/2 inches from the top of the smaller clamp. Tighten the wing nut. This setting of the lower clamp is merely a preliminary adjustment, and resonance should occur at approximately 3700 kHz. Set (B) and (C) aside.

8. Locate the 40M resonator coil (E) and the 40 M resonator capacitor section (D). Mount the coil on the capacitor section as in the preceding steps, extending the lower clamp to a point 9-1/2 inches below the top of the upper clamp (see pictorial drawing above). This preliminary setting will produce resonance at approximately 7150 kHz.

9. Slide one end of section (F) over the top of (D). Line up the screw holes in both sections and secure with a self-tapping screw.

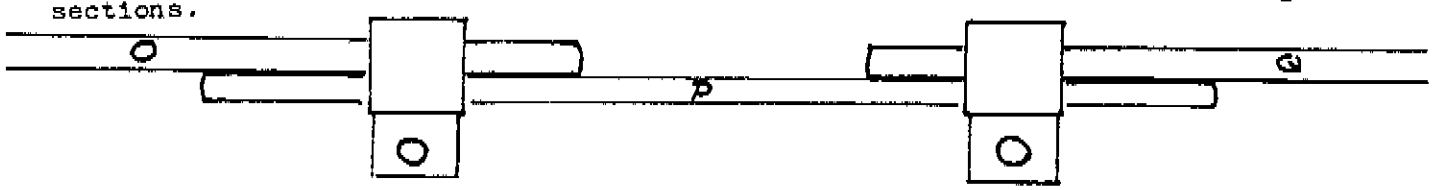
10. Locate sections (G), (H) and (I) as well as plastic spacers (R), (S) and (T). Force-fit (G) into the large hole of spacer (R) and position spacer (R) 10-12 inches from one end of (G). Similarly, force-fit sections (H) and (I) into the large holes of spacers (S) and (T), respectively and position both spacers near the middle of each section.

11. Slide the end of section (G) farthest from spacer (R) into the top of section (F). Align the screw holes and secure with a self-tapping screw. Proceed in the same manner with sections (H), (I) and (J), sliding one end of each section into the next-larger tubing size, aligning the screw holes, and securing with self-tapping screws.

12. Slide the large loop of clamp (U) over the upper (slotted) end of section (J) and position immediately below the slot. Pass a 1/4 in. x 3/4 in. bolt through a flat washer and then through the clamp holes for the larger loop. Secure, using a lockwasher and a hex nut.

13. Slide the hose clamp over the slotted end of (J) and telescope section (K) into (J), adjust the length of section (K) according to the pictorial diagram and tighten the hose clamp.

14. Locate rod sections (O), (P) and (Q). Note that (O) has a sharp bend at one end; slide the <u>other</u> end of (O) downwards through the small loop of clamp (U) and through the small hole of spacer (T). In like fashion, slide rod section (Q) upwards through spacers (R) and (S). Use rod section (P) to splice sections (O) and (Q) together by means of the two rod clamps from the hardware package (see pictorial diagram below). The total length of sections (O), (P) and (Q) may now be set to 11 feet 3 inches (3.43 meters). The rod end of clamp (U) should be secured as in step #12. Plastic spacers (R), (S) and (T) should be aligned with clamp (U) so that the rods run parallel to the adjacent tubing sections.



NOTE: The first section of the antenna (A) will be placed on the mounting post in the following step. If the antenna is to be roof mounted, it may be desirable to assemble the entire antenna before installing it on the mounting post.

15. Place the bottom of section (B) over the fiber glass insulator of (A). Line up the holes and pass a 1-3/4 in. x #8 bolt through a flat washer and then through the holes. Secure with a #8 lockwasher and nut.

16. AVOID POWER LINES! Raise assembly (D) through (K) and place it atop (B). Line up the screw holes and secure with a self-tapping screw.

17. Install the 75-ohm matching line on sections (A) and (B) as shown on the pictorial page. The center conductor must be attached to (B). Simply place the lugs over the ends of the #8 bolts at this time.

18. Place #8 flat washers over the lugs and install impedance matching/grounding coil (M) as shown in the pictorial. Point 1 should go to (B), point 2 to (A), and point 3 to any ground rod or other earth connection. Secure the connections to (A) and (B) with flat washers, lockwashers, and nuts.

19. Radials or additional grounding may be attached to the connection at (A). Secure with #8 flat washer, lockwasher and nut.

20. CAUTION! Remember that the antenna system is grounded! To avoid a shock hazard, all station equipment should be connected to a GOOD earth ground. Better still, disconnect all transmitting and receiving equipment from the AC line before connecting the feedline. Connect the matching line (L) to any length of 50-53 ohm coaxial feedline. A double-female connector (N) is provided.

CHECKOUT AND ADJUSTMENT PROCEDURE

1. The dimensions given in the pictorial diagrams should produce low VSWR readings over the entire 20, 15, and 10 meter bands, and low VSWR at some point in both the 40 and 80 meter bands, although some variation may be expected in a given installation. The following procedure may be used to adjust the antenna for minimum VSWR at any point in the 80/75, 40, 15 and 10 meter bands. Tuning on 20 meters is so broad that no special adjustments for that band are required. VSWR readings may be taken either at the transmitter end of the line for the sake of convenience or at the junction of the 75-ohm matching line and the main transmission line if greater accuracy is desired. Similarly, resistance/reactance devices (e.g., the Palomar R-X Noise Bridge) may be inserted at the same points. It is a good idea to monitor VSWR during operation, as erratic or unusually high readings could indicate a problem that must be corrected.

2. Determine the frequency of minimum VSWR on 15 meters. To lower frequency, simply increase the length of the 15 meter stub (sections O,P and Q) a slight amount; to raise frequency, shorten a slight amount. A one-inch change in stub length will move the resonant (minimum VSWR) frequency approximately 100 kHz.

3. Determine the frequency of minimum VSWR on 10 meters. To lower frequency, loosen the hose clamp at the top of section (J) and extend section (K) 2 or 3 inches at a time; to raise frequency, telescope (K) into (J) a like amount. Tuning is quite broad on 10 meters, and a 2-3 in. change in length should produce a change of no more than 200 kHz.

4. Determine the frequency of minimum VSWR on 40 meters. Adjustment may be made by loosening the lower clamp of the 40 meter resonator coil (E) and compressing or expanding the spacing between coil turns to lower or raise frequency, respectively. One half-inch of travel will shift the frequency of minimum VSWR approximately 70 kHz. When the proper setting has been found tighten the lower clamp securely.

5. Determine the frequency of minimum VSWR on 80/75 meters. Tuning is fairly sharp in this frequency range, so high values of VSWR may be encountered at frequencies not far removed from that of minimum VSWR. Adjustment may be made as in the preceding step by repositioning the lower clamp on the 80/75 meter resonator coil (C). When the proper setting has been found and the lower clamp tightened, coil (M) at the base of the antenna may be adjusted by spreading the turns farther apart or squeezing them closer together until the VSWR drops to a new minimum value. Ordinarily, however, no adjustment of coil (M) is required. In any case, a single adjustment of coil (M) should suffice for operation over the entire 3500-4000 kHz range provided that coil (C) is readjusted for each 90-120 kHz segment of the band. In general, adjustments made for 40 and 80/75 meters will have little or no effect on previous adjustments for the higher bands. However, if 80/75 meter tuning is readjusted for operation at a much higher or lower frequency, it may be necessary to readjust 40 meter tuning as in step 4 in order to maintain VSWR of 2:1 or less at both band edges.

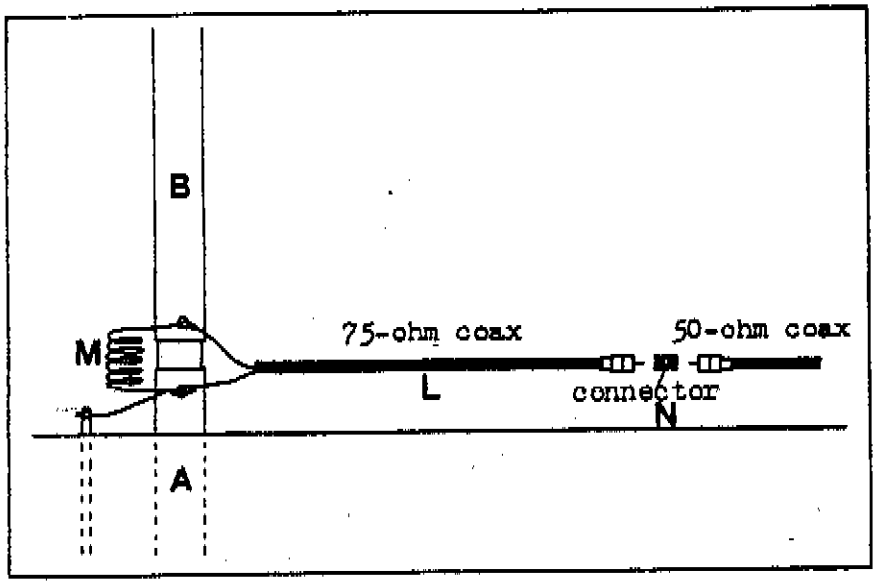
6. One should remember that VSWR will depend to some extent on local ground conductivity, the number of radials used, and a number of other conditions that may be peculiar to a given installation. In any case, there is no point in spending a great deal of time and effort to achieve VSWR's much below 2:1 over the operating range of the antenna on any band provided that the output circuit of the transmitter is capable of delivering full power into the load.

7. In every case a vertical antenna will provide better performance if a good ground system is installed beneath it. Even the best earth is a relatively poor conductor at most frequencies in the HF range, and a good radial system can greatly increase antenna efficiency. For elevated verticals a system of resonant quarter-wave radials for each band of operation will be required for proper operation in all but a few specialized cases.

THEORY OF OPERATION

The HF5V-III operates as a slightly extended quarter wave radiator on 15 meters, using a quarter-wave decoupling stub to isolate the upper sections of the antenna from the first quarter-wavelength on that band. On 20 meters the entire radiator is active and functions as a 3/8-wave resonant vertical having much higher radiation resistance than conventional or "trapped" antennas with heights of one-quarter wavelength or less. On 10 meters the HF5V-III operates as a 3/4-quarter wave radiator with considerably greater efficiency than quarter wave types. On 40 and 80/75 meters the appropriate resonator circuits provide the inductive reactance required for resonance in conjunction with a slight "top loading' effect from the 15 meter decoupling stub. The L/C ratios of the 40 and 80/75 meter resonator circuits also determine resonance on 20 and 10 meters. Because of the higher than normal 20 M radiation resistance, the feed-point impedance on that band is in the neighbor hood of 100 ohms in a typical installation. Therefore, a quarter-wave matching section of 75-ohm line is is used as a transformer for the 50-ohm impedance of the main transmission line. This matching section has no appreciable effect on operation on other bands.

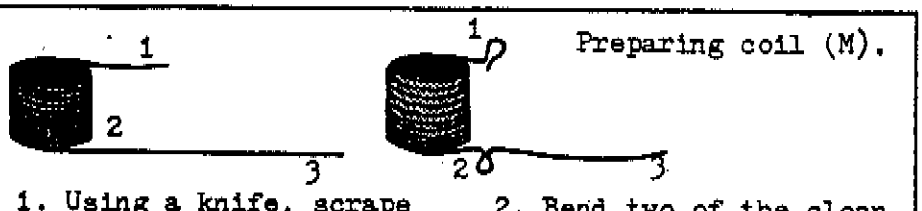
Pictorial Diagram



SAFETY FIRST! Do not install the antenna where it can contact power lines during or after installation!

High r.f. voltages can appear on the exposed resonator coils. A protective fence around the antenna should be considered if there is a chance of persons contacting them during operation.

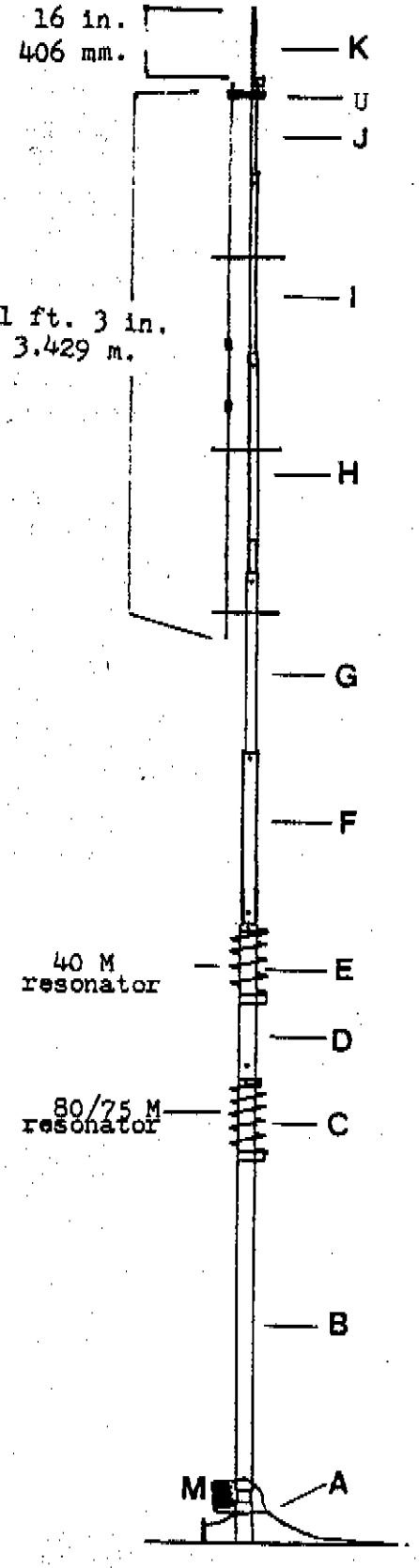
Remember that the transmitter chassis and perhaps other equipment will be connected to the braid of the coaxial feedline. A good earth ground to the transmitter chassis will reduce the danger of a.c. shock when making adjustments at the antenna.



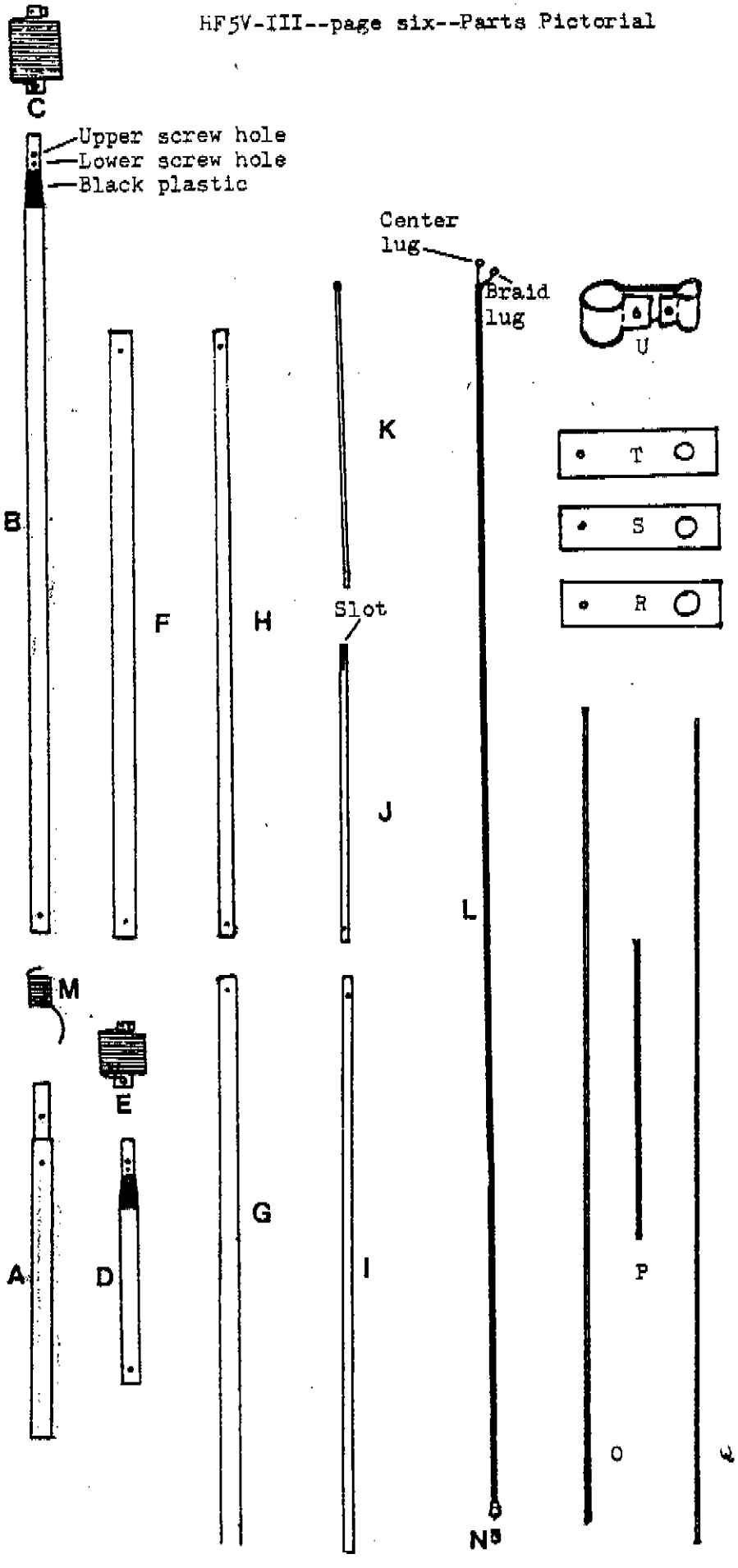
Preparing coil (M).

1. Using a knife, scrape 1½ in. of enamel insulation from points 1, 2, and 3. Be sure the copper is bright and clean.

2. Bend two of the clean areas (1 and 2) into loops for connection later. The clean areas may be tinned with solder.



HF5V-III--page six--Parts Pictorial



Parts List

(A) mounting post with insulator
(B) 80 M capacitor section
(C) 80 M resonator coil
(D) 40 M capacitor section
(E) 40 M resonator coil
(F) 1 in. x 4 ft. tube
(G) 7/8 in. x 4 ft. tube
(H) 3/4 in. x 4 ft. tube
(I) 5/8 in. x 4 ft. tube
(J) 1/2 in. x 2 ft. tube (upper end slotted)
(K) 3/8 in. x 3 ft. tube (upper end capped)
(L) 75-ohm matching line
(M) 80 M matching/grounding coil
(N) double-female coaxial connector
(O) 3/16 in. x 5 ft. rod
(P) 3/16 in. x 2 ft. rod
(Q) 3/16 in. x 5 ft. rod
(R) plastic spacer--7/8 in. hole
(S) plastic spacer--3/4 in. hole
(T) plastic spacer--5/8 in. hole
(U) tubing-to-rod clamp

Hardware packets

1. #8 hardware: one 1-3/4 in. bolt;
five flat washers;
three lockwashers;
three nuts

self-tapping screws: eight

hose clamp: one

2. 1/4 in. hardware: four 1 in. bolts
four 3/4 in. bolts;
eight flat washers;
eight lockwashers;
six hex nuts;
two wing nuts.

rod-splicing clamps: two

NOTE: Coil (M) is not strictly required for operation of the antenna. If a better 80 M match is possible it may be left out of the circuit, in which case a static discharge lightning arrestor or high-impedance r.f. choke may be used in its place.

IN THE EVENT OF DIFFICULTY. . .

Please feel free to write or telephone for assistance. The most common source of difficulty in vertical antenna installations may be traced to inadequate ground systems, so the following points should be kept in mind:

1. The lead from the braid of the coaxial feedline to the ground connection should be no more than a few inches long, as this lead will increase the effective electrical length (height) of the radiator on all bands. Long leads can therefore cause detuning and should be avoided. Or, to state the matter another way, any ground plane (whether the earth itself, a capacitive counterpoise, or a system of resonant radial wires) should be located immediately below the base of the antenna.

2. The feedpoint impedance of a vertical antenna will depend to some extent on the quality and extent of the ground system used. In some cases a short metal stake or rod driven into the earth at the base of the antenna will permit low-VSWR operation on all bands, although efficiency will no doubt be fairly poor. In most cases, however, a minimum number of radial wires will be required for VSWR readings of 2:1 or less on most bands, the exact number depending on local ground conditions. ALL ground-mounted verticals will perform more efficiently with an extensive radial system (five or more wires) than without one, so a relatively modest investment in wire can produce excellent dividends if the space is available.

3. If a vertical is to be mounted on a roof or any other above-ground structure a system of resonant radials for each band will be required. In some cases the radials for 40 through 10 meters will provide enough capacitive coupling to the earth ground plane for low-VSWR 80 meter operation, but the likelihood is that at least one resonant radial for 80/75 meters will be required for proper tuning. It is recommended that the antenna be adjusted for minimum VSWR at ground level over a temporary radial system before installation above ground where further adjustments may be difficult to perform.

When requesting advice or assistance with respect to problems of installation or operation, please include a complete description of physical circumstances, VSWR and other measurements made, etc. No two installations are ever quite the same, so a complete statement of all the possible factors involved will enable us to reply more promptly and completely to all queries.

ELECTRICAL AND MECHANICAL SPECIFICATIONS: MODEL HF5V-III

Shipping weight: 12 lbs./ 5.4 kg:
Height (max.): 26 ft./ 7. 8 m.
Feedpoint impedance: nominal 50 ohms with included matching section
VSWR at resonance: 1.5:1 or less on all bands
Bandwidth (for VSWR of 2:1 or less): entire 40, 20, 15 and 10 meter bands;
90-120 kHz on 80/75 meters

Power rating (input): 2 KW PEP/ 1 KW c.w. 40 through 10 meters
1.2 KW PEP/500 W c.w. 80/75 meters

Windloading area: 1.5 sq. ft./ .14 sq. meters

NOTICE

The mounting post should be sealed against corrosion if it is to be placed in concrete or in very damp, acidic or alkiline soil. Asphalt roofing compound, polyurethane varnish, or any other sealant which protects against moisture should be suitable for the purpose. No sealing is required for above-ground and most ground-level (in earth) installations.

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