



TELEX COMMUNICATIONS, INC.

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INSTRUCTION MANUAL

ORDER NO. 182S

Model 18-HT-S "Hy-Tower".

10-80 meter vertical antenna PN 801121-1

General Description

The "Hy-Tower" is an omnidirectional, self-supporting vertical radiator, which operates on 10 thru 80 meters. A 160-meter operation is possible with the addition of a loading coil, as shown in Figure 13. The "Hy-Tower" is now supplied with stainless steel hardware.

The use of stub decoupling systems allows band switching on 10, 15, 20, 40, and 80 meters. The stubs isolate various sections of the vertical antenna so that an electrical 1/4-wavelength (or odd multiple of 1/4-wavelength) exists on all bands. On 20 meters, the 80-meter section acts as a 3/4-wave radiator.

The lifting base of the "Hy-Tower" allows the antenna to be completely assembled on the ground before it is raised into position. It is light enough for one man to assemble and for two men to erect.

Specifications

Mechanical

Total Height	53 feet (16.15 m) (approximately)
Tower Construction	galvanized steel
Wind Survival	75 mph (120.7 kmph)
Hardware	stainless steel

Electrical

Pattern Characteristics	omnidirectional
Gain	unity on 20, 40 and 80 meters 2 dB on 10 and 15 meters
Input Impedance	52 ohms
Input Power	1 kW AM; 2 kW PEP

NOTE: For information on how to phase two or more 18-HT-S's together, see Hy-Gain's Engineering Report entitled "Amateur Phasing". This report is available from the Hy-Gain Warranty Service Department, 8601 N.E. Highway 6, P.O. Box 5579, Lincoln, Nebraska 68505.

Pre-Assembly

NOTE: When unpacking your antenna, check the inside of all tubing for parts. To conserve space, the smaller items are sometimes put inside larger pieces.

The Model 18-HT-S has three (3) 8 foot tower sections and an aluminum tubing mast. For maximum security, the tower section should be set in a concrete base. The concrete must cure for at least three (3) days before the tower is set in place.

Read the instructions and study the illustrations before beginning your installation.

Tools Required

Qty	Type Tool	Qty	Type Tool
1	Screwdriver—flat blade	1	Open-End Wrench, 7/16"
1	Tin Snips or Lineman's Pliers	1	Ratchet handle for socket wrenches
1	Tape Measure, 50 foot	1	Socket Wrench, 1/2"
2	Adjustable Wrenches, 8"	1	Socket Wrench, 9/16"
1	Nut Driver, 7/16"	1	Open or Box End Wrench, 9/16"

SWR and Feedline

The Model 18-HT-S can be used with 50 ohm coaxial cable such as RG-213/U or RG-58A/U. Coaxial cable RG-213/U (such as BELDEN 8267) is recommended for its lower line losses and higher power handling capabilities. The SWR at resonance is less than 1.2:1 and will not exceed 3.5:1 over the entire range of each band.

Base Installation

Find a convenient location for the 18-HT-S "Hy-Tower" antenna. It should be installed away from any power lines and should be at least 10 feet from any metallic structure. Be sure to allow approximately 50 feet in one direction from the base for assembly of the antenna and tower.

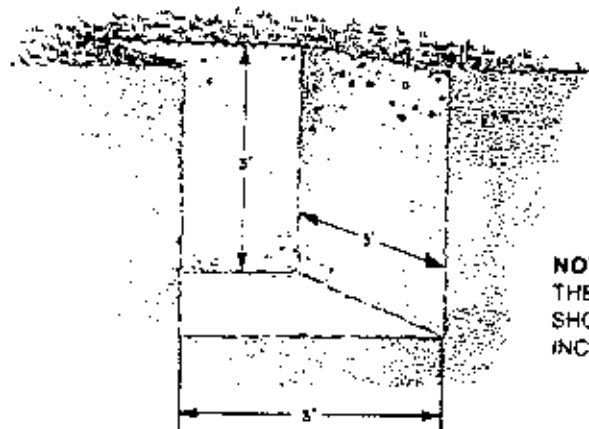
WARNING

When installing your system, take extreme care to avoid any accidental contact with power lines or overhead obstructions. Failure to exercise this care could result in serious or fatal injury.

Dig a hole 3 feet square by 3 feet deep for the concrete base as shown in Figure 1.

NOTE: The depth of the base foundation will vary depending upon climate conditions. It should extend at least 6" below the frost line. It should never be less than 3 feet.

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NOTE: IN COLD CLIMATES THE DEPTH OF THE HOLE SHOULD BE A MINIMUM OF 6 INCHES BELOW FROST LINE.

Figure 1
Base Foundation Hole

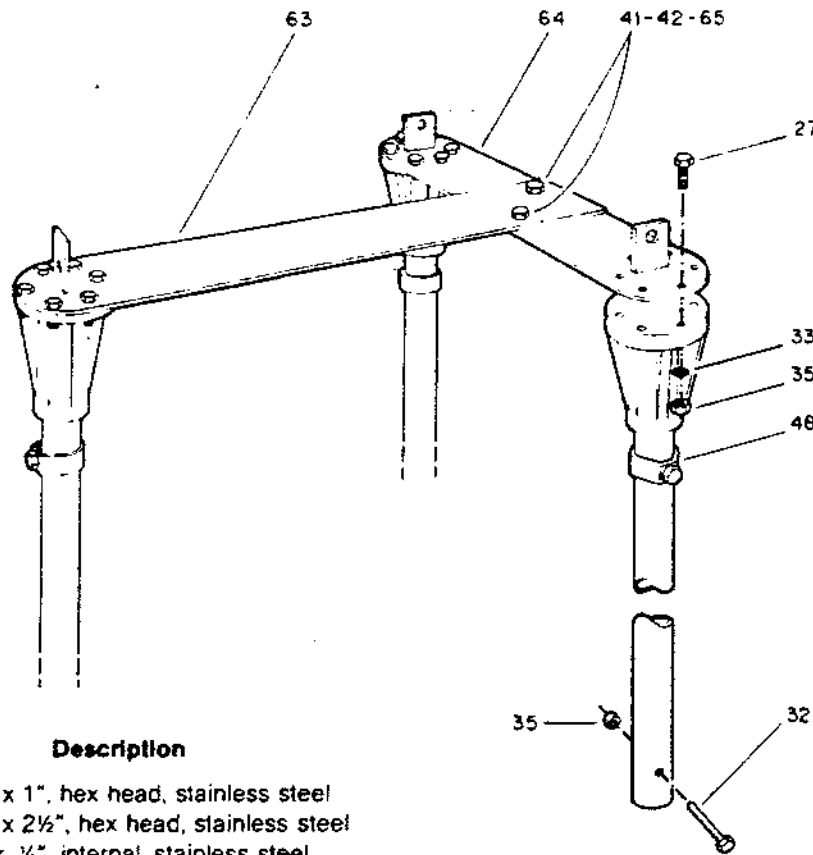
Assemble base assemblies "A" and "B" using $\frac{3}{8}$ "-16 hardware. See Figure 2.

Install the three base insulator assemblies (with pipe legs attached) on the base assemblies, using $\frac{1}{4}$ "-20 hardware. See Figure 2.

Install the three (3) $1\frac{1}{4}$ " compression clamps onto the pipe legs and position them near the insulators as shown in Figure 2. Tighten the clamps just enough to hold them in position. Refer to Figure 5 for compression clamp instructions.

Install the $\frac{1}{4}$ "-20 x $2\frac{1}{2}$ " hex head bolts and nuts on the bottom of each base insulator assembly. This bolt will help to anchor each leg in the concrete. See Figure 2.

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Item No.	Description
27	Bolt, $\frac{1}{4}$ "-20 x 1", hex head, stainless steel
32	Bolt, $\frac{1}{4}$ "-20 x $2\frac{1}{2}$ ", hex head, stainless steel
33	Lockwasher, $\frac{1}{4}$ ", internal, stainless steel
35	Nut, $\frac{1}{4}$ "-20, hex, stainless steel
41	Bolt, $\frac{3}{8}$ "-16 x 1", hex head, stainless steel
42	Lockwasher, $\frac{3}{8}$ ", internal, stainless steel
48	Clamp, compression, $1\frac{1}{4}$ "
63	Base Assembly "B"
64	Base Assembly "A"
65	Nut, $\frac{3}{8}$ "-16, hex, stainless steel

Figure 2. Tower Base

Pour a standard mix of concrete (five parts sand, one part cement) into the hole until it reaches ground level. Vibrate the concrete during the pouring to eliminate voids.

NOTE: For extra security, steel reinforcing rods can be added to the base before the concrete is poured.

Insert the base assembly, with legs attached, into the concrete base until approximately six inches remain above the concrete, as shown in Figure 3. Position the assembly so that the tower can hinge on base assembly "A".

CAUTION

The base assembly must be assembled level so that the tower will be vertical when it is installed. Support the base assembly above the concrete in the manner shown in Figure 3 while concrete is curing.

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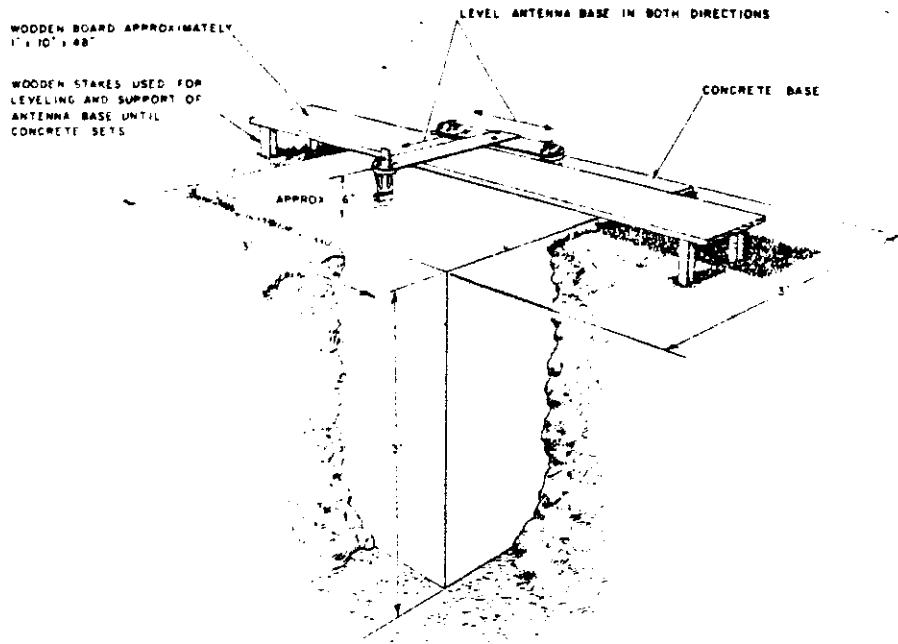


Figure 3
Tower Base Installation

Assembly of the Tower

Remove the shipping straps from the tower assembly. (Save the nuts and bolts.)

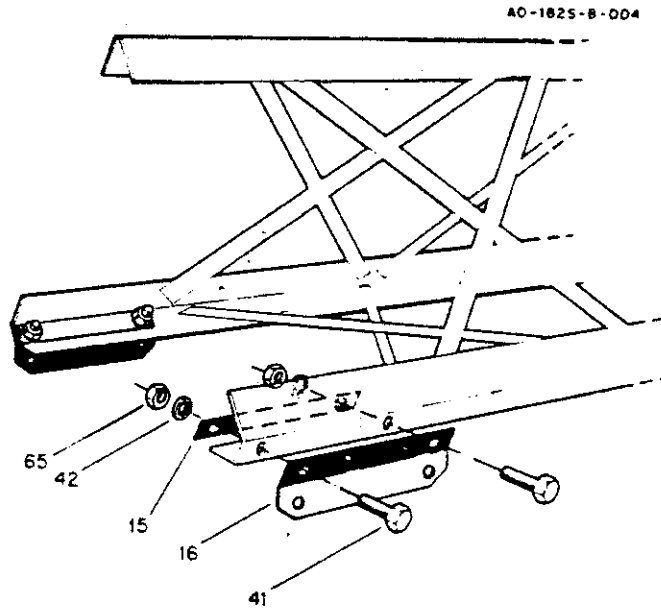
Assemble the three tower sections by placing each succeeding smaller tower section into the next larger section. Secure the tower legs using two (2) $\frac{1}{2}$ " hex head bolts per splice. Use the six (6) bolts taken from the shipping straps.

Install the tower leg hinges and braces onto two tower legs as shown in Figure 4.

The compression clamps used on this antenna are a universal device and are used in many varied applications. Depending upon the application, the bolt head may or may not contact the clamp body. *Do not over tighten* the clamps in an attempt to contact the clamp body with the bolt head. To do so may result in clamp failure or tube failure caused by puncture. Be sure to locate the clamp bolt 90 degrees from the tube slot. Do not tighten the compression clamps until instructed to do so.

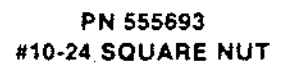
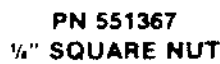
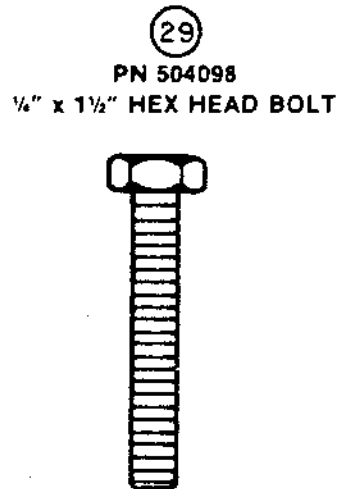
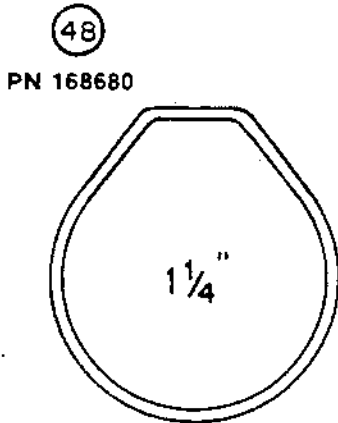
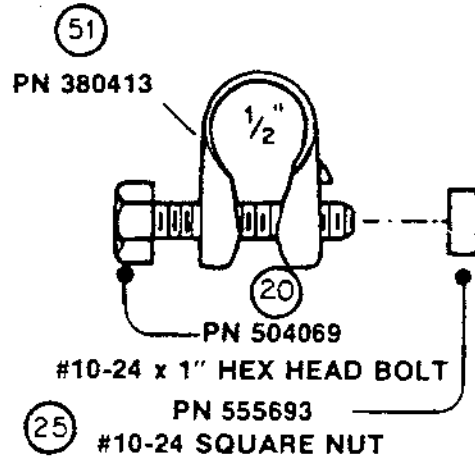
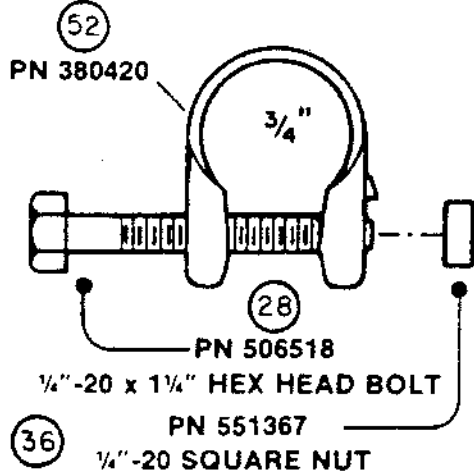
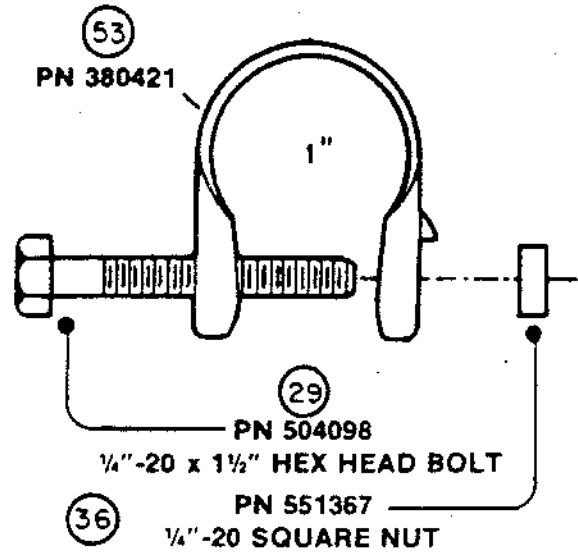
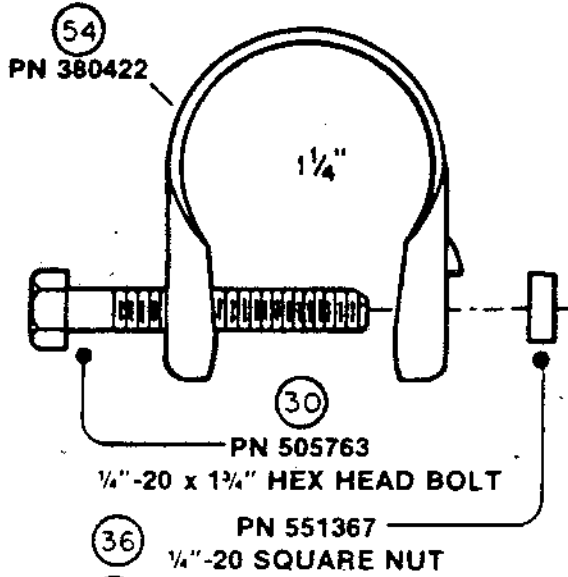
Figure 5 shows all of the compression clamps and their associated hardware in full size. To identify the parts, lay the part over the proper drawing.

To save time, loosely assemble all of the compression clamps and their appropriate hardware before beginning further installation of the antenna.



Item No.	Description
15	Plate, leg backing, $\frac{3}{4}$ " x $5\frac{3}{4}$ "
16	Hinge, tower, formed
41	Bolt, $\frac{3}{8}$ "-16 x 1", hex head, stainless steel
42	Lockwasher, $\frac{3}{8}$ ", internal
65	Nut, $\frac{3}{8}$ "-16, hex, stainless steel

Figure 4
Tower Leg Hinge Installation



36



25

Figure 5
Compression Clamps

Assembly of Vertical Radiator

Attach one 4" metal angle to the lower tower plate and one to the upper tower plate using two (2) $\frac{1}{4}$ "-20 x $\frac{3}{4}$ " screws for each angle. Do not tighten the screws at this time.

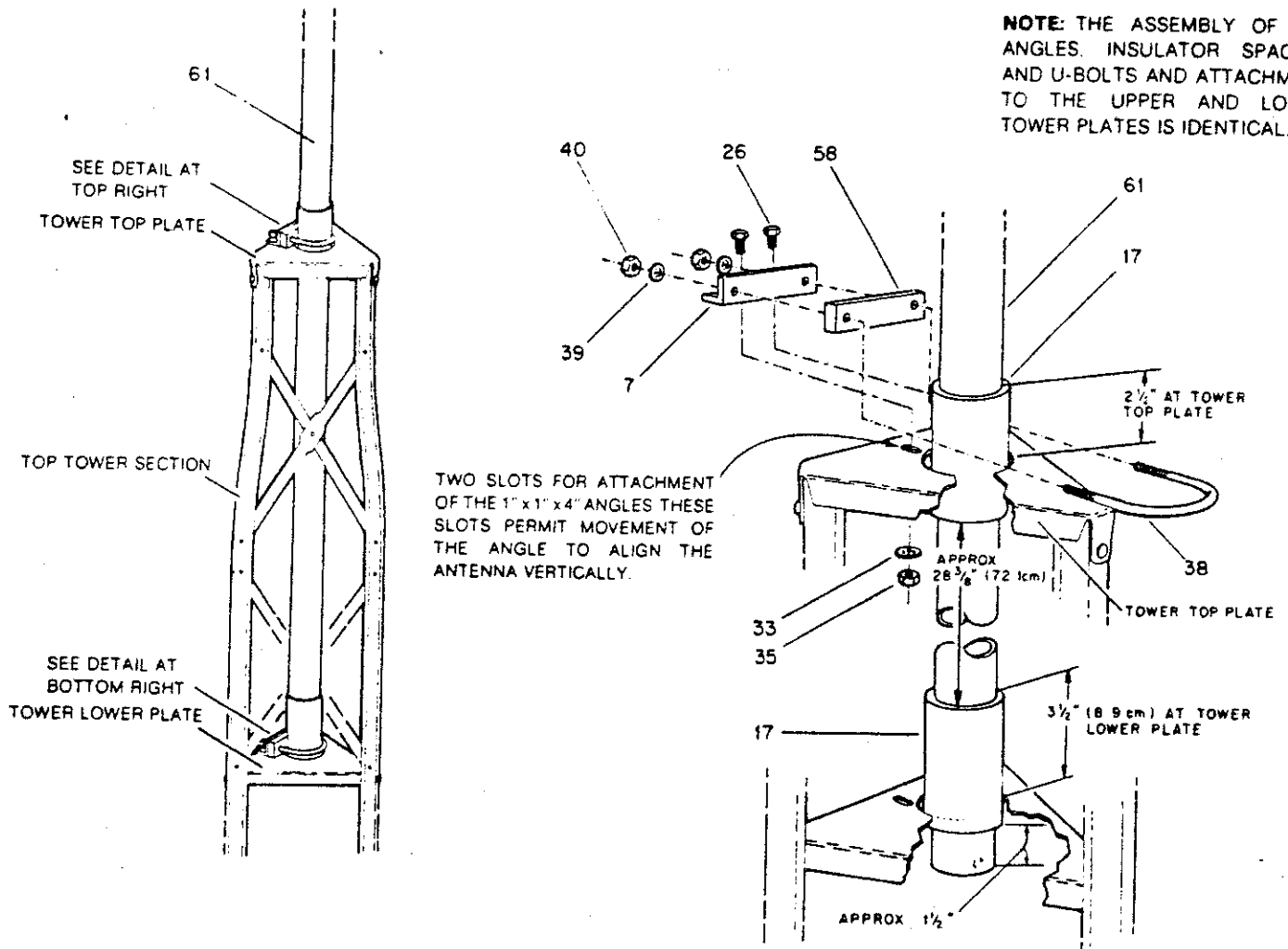
Select the two (2) U-bolts and spacer insulators and place them in the holes provided on the 4" metal angles attached to the top tower section. See Figure 6

Select the 2" x 75" length of aluminum tubing and place the two (2) 2" ID x $3\frac{1}{8}$ " insulators over the end of the tubing which has the metal sleeves inserted in it.

Adjust the insulators so that they are approximately $28\frac{3}{8}$ " apart, with the bottom one approximately $1\frac{1}{2}$ " from the end of the tubing (the end with the metal sleeve).

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NOTE: THE ASSEMBLY OF THE ANGLES, INSULATOR SPACERS AND U-BOLTS AND ATTACHMENT TO THE UPPER AND LOWER TOWER PLATES IS IDENTICAL.



Item No.	Description
7	Angle, vertical element, 1" x 1" x 4"
17	Insulator, 2" I.D. x $3\frac{1}{8}$ "
26	Bolt, $\frac{1}{4}$ "-20 x $\frac{3}{4}$ ", hex head, stainless steel
33	Lockwasher, $\frac{1}{4}$ ", internal, stainless steel
35	Nut, $\frac{1}{4}$ "-20, hex, stainless steel

Item No.	Description
38	U-Bolt, $\frac{5}{16}$ " x 3" x $3\frac{1}{16}$ "
39	Lockwasher, split, $\frac{5}{16}$ ", stainless steel
40	Nut, $\frac{5}{16}$ "-18, hex
58	Insulator, vertical element spacer, 1" x 4"
61	Assembly, tube with dowel, 2" x 75"

Figure 6
Top Element Installation

Slide the 2" x 75" length of tubing (the end with the insulators attached) through the upper and lower plate of the top tower section as shown in Figure 6. *Do not tighten the U-bolts at this time.*

Select the 2" x 51" section of tubing and slip the drilled end over the swaged end of the 2" x 75" piece of tubing. Align the holes and secure with the ¼"-20 x 2½" screw, nut and lockwasher as shown in Figure 7.

Select the reducer clamps and install on the end of the 2" tubing, using #10 x ½" screws, lockwashers and nuts. *Do not tighten at this time.*

Carefully adjust the partially assembled vertical radiator until you measure 90½" from the top edge of the top tower plate to the top edge of the reducer clamp. Refer to Figure 7.

Position the two insulators on the 2" tubing as shown in Figure 6, then tighten the U-bolts evenly. The insulators must be positioned as shown to properly insulate the tubing section from the tower.

Slide the metal angles in the elongated holes to position the tubing section until the tube is perfectly aligned with the axis of the tower. Tighten the screws *securely!*

NOTE: You may wish to assemble the remainder of the vertical radiator separately and install on the antenna immediately before raising the antenna to its vertical position. This will avoid allowing the tubing to droop and permanently "set" in this condition.

Select the 1¼" x 48" piece of tubing, mark at 9" from the end and slip it 9" into the 2" tube assembled in the tower, so that 36¾" (93.02 cm) remain exposed above the reducer clamp. See Figure 7.

Select a 1¼" compression clamp and slip it over the end of the 1¼" tube. Select the 1½" x 38" tube and insert it into the 1¼" tube so the swaged end is 33¾" (85.72 cm) from the end of the 1¼" tube. See Figure 7.

Select a 1" compression clamp and assemble it as shown in Figure 5.

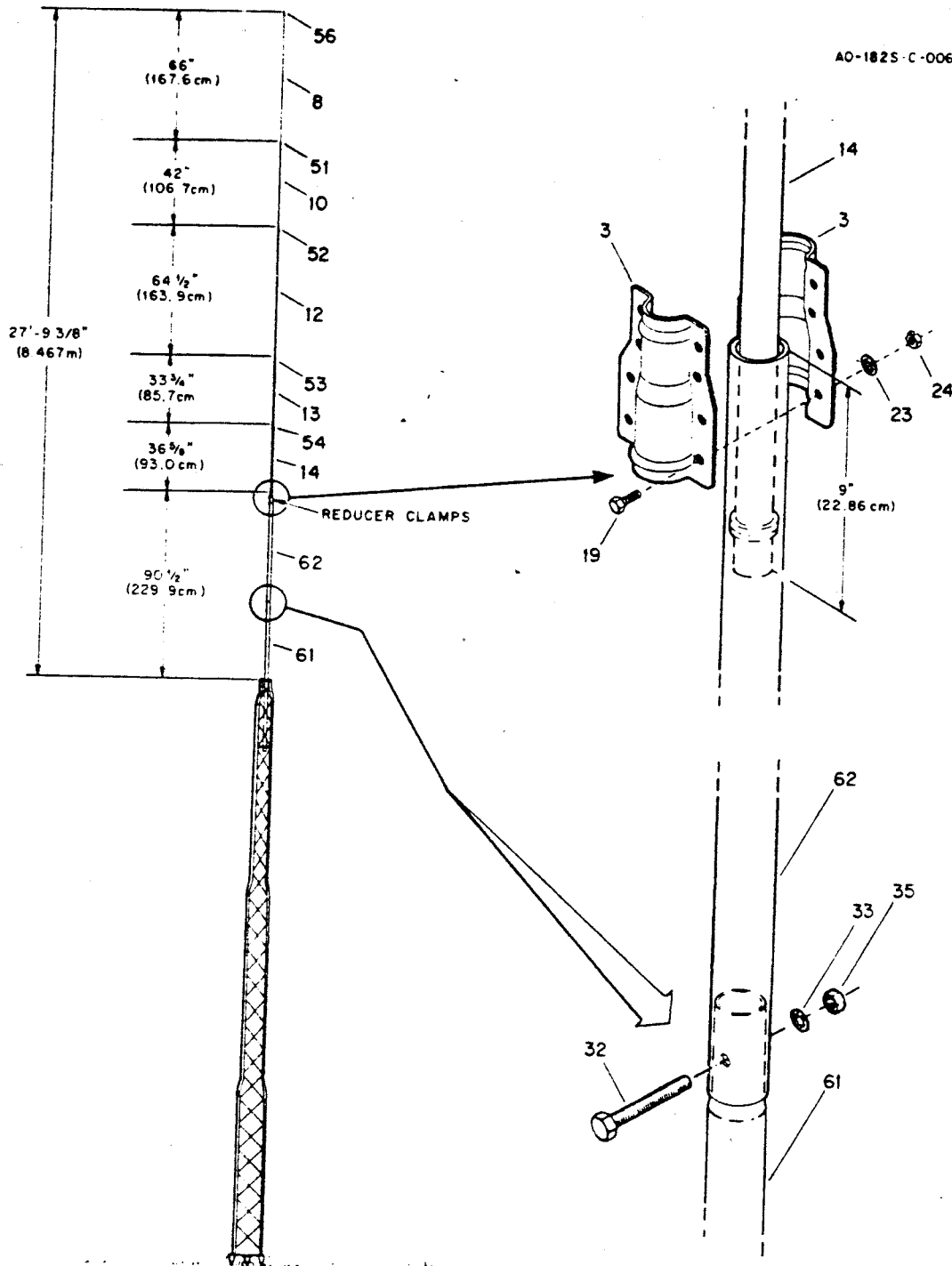
Select the ¾" x 72" piece of tubing and slip the unswaged end into the swaged end of the 1½" tube. Measure 64½" (163.8 cm) from the end of the 1½" tubing to the end of the ¾" tubing. Secure with a 1" compression clamp. See Figure 7.

Slip an assembled ¾" compression clamp over the end of the ¾" tubing. Tighten slightly.

Select the ⅝" x 48" piece of tubing and slip the unswaged end into the ¾" tubing. Measure 42" (106.7 cm) from the end of the ¾" tube to the end of the ⅝" tube. See Figure 7.

Slip an assembled ½" compression clamp over the end of the ⅝" tubing. Tighten slightly.

Select the 7/16" x 68" piece of tubing and slip it into the ⅝" tube. Measure 66" (167.6 cm) from the end of the ⅝" tube to the end of the 7/16" tube. See Figure 7.



Item No.	Description
3	Clamp, reducer, 2" to 1 1/4", formed
8	Tube, 7/16" x 68"
10	Tube, 5/8" x 48", swaged
12	Tube, 7/8" x 72", swaged
13	Tube, 1 1/8" x 38", swaged
14	Tube, 1 1/2" x 48", slotted
19	Bolt, #10-24 x 1/2", hex head, stainless steel
23	Lockwasher, internal, #10, stainless steel
24	Nut, #10-24, hex, stainless steel
32	Bolt, 1/4"-20 x 2 1/2", hex head, stainless steel

Item No.	Description
33	Lockwasher, internal, 1/4", stainless steel
35	Nut, 1/4"-20, hex, stainless steel
51	Clamp, compression, 1/2", stainless steel
52	Clamp, compression, 3/4", stainless steel
53	Clamp, compression, 1", stainless steel
54	Clamp, compression, 1 1/4", stainless steel
56	Caplug, 7/16", black
61	Tube Assembly with dowel, 2" x 75"
62	Tube/Shim Assembly, 2" x 51"

Figure 7
Vertical Radiator Assembly

Check the overall dimension of the vertical radiator. It should be 27' 9 $\frac{3}{8}$ " (8.47 m) from the top of the upper tower plate to the end of the radiator. If it is not, adjust the $\frac{7}{16}$ " tubing accordingly. Now tighten the compression clamps *securely*.

Place a $\frac{7}{16}$ " caplug on the end of the vertical radiator.

Installation of 15-Meter Stub

Select a $\frac{7}{16}$ " x 60" piece of tubing and fasten one end to one leg of the base tower section using the clamps and shorting strap, as shown in Figure 8. Position the stub 67" (see Figure 16) from the bottom edge of the tower leg to the bottom edge of the $\frac{7}{16}$ " tube. Refer to Figure 8 for dimensions and Figure 10 for installation of clamps and shorting strap.

Assemble another leg clamp, insulator and splice and install the second $\frac{7}{16}$ " x 60" section of tubing onto the 15-meter stub as shown in Figure 8.

Install a leg clamp, insulator and tubing clamp 42 $\frac{3}{4}$ " above the center of the splice.

Select the $\frac{3}{8}$ " x 23" section of tubing and slip it into the $\frac{7}{16}$ " tube. Adjust to either Phone (19") or CW (21 $\frac{1}{4}$ ") dimension as shown in Figure 8. Install a $\frac{1}{2}$ " compression clamp and tighten *securely*.

NOTE: Typical VSWR curves are shown in Figure 16. The 10- and 15-meter stubs require two settings to cover the bands with less than 2:1 VSWR. Use the VSWR curves to help you decide which setting is best for your particular application.

Place a $\frac{3}{8}$ " caplug on the end of the 15-meter stub.

Installation of 10-Meter Stub

Select the remaining $\frac{7}{16}$ " x 60" piece of tubing and fasten one end to one of the remaining tower legs, as shown in Figure 9, using a set of leg clamps and a shorting strap.

Position the bottom edge of the stub 160" (see Figure 16) from the bottom edge of the lower tower leg. Refer to Figure 9 for dimensions and Figure 10 for installation of the clamps and shorting strap.

Select the $\frac{7}{16}$ " x 38" section of tubing and install as shown in Figures 9 and 10.

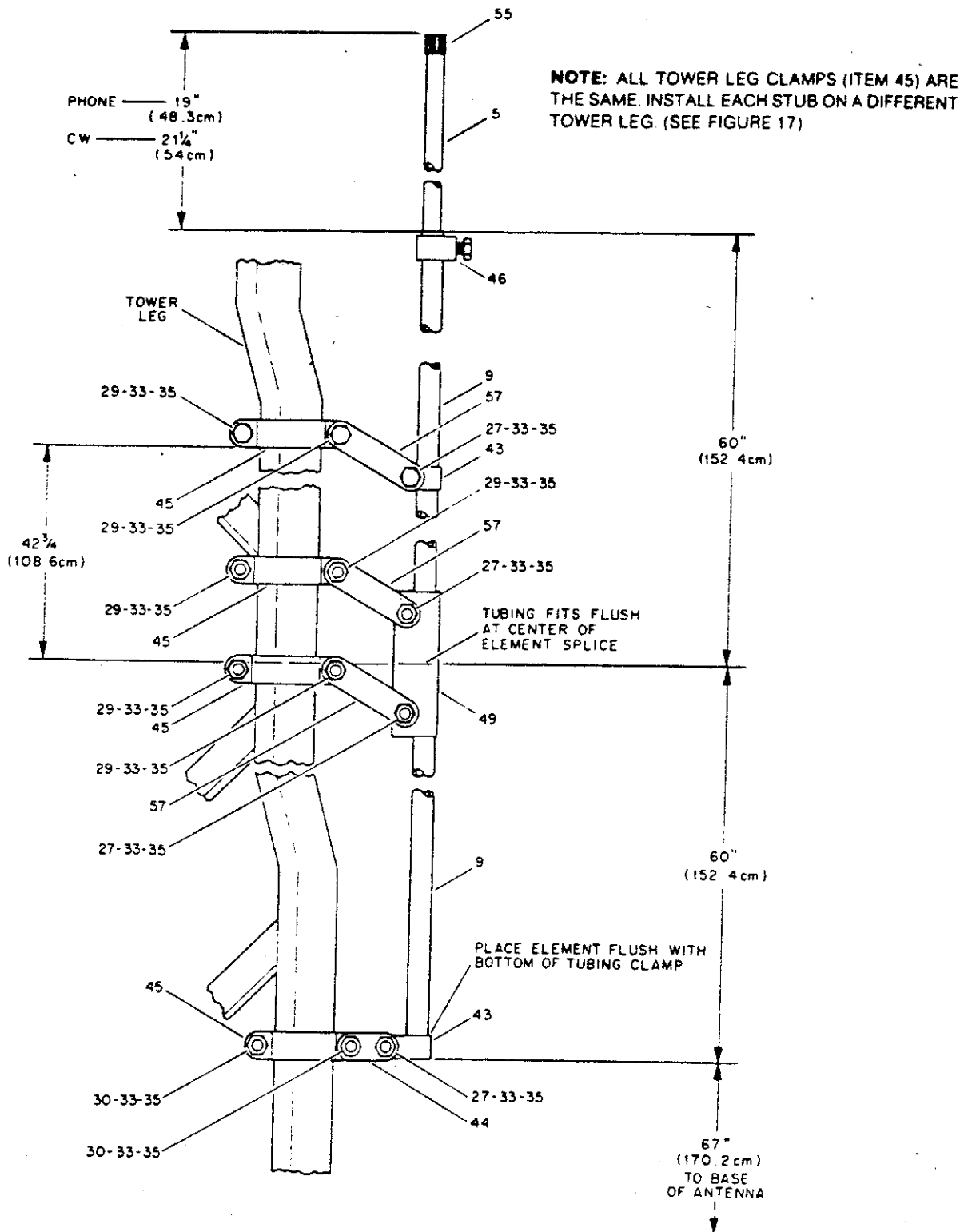
Install a leg clamp, insulator and tubing clamp 26 $\frac{1}{4}$ " above the center of the splice.

Select the $\frac{3}{8}$ " x 9 $\frac{1}{2}$ " section of tubing and slip it into the $\frac{7}{16}$ " tubing. Adjust for Phone (3") or CW (5") dimension as shown in Figure 9. Refer to Figure 16, VSWR Charts.

Install a $\frac{1}{2}$ " compression clamp and tighten *securely*.

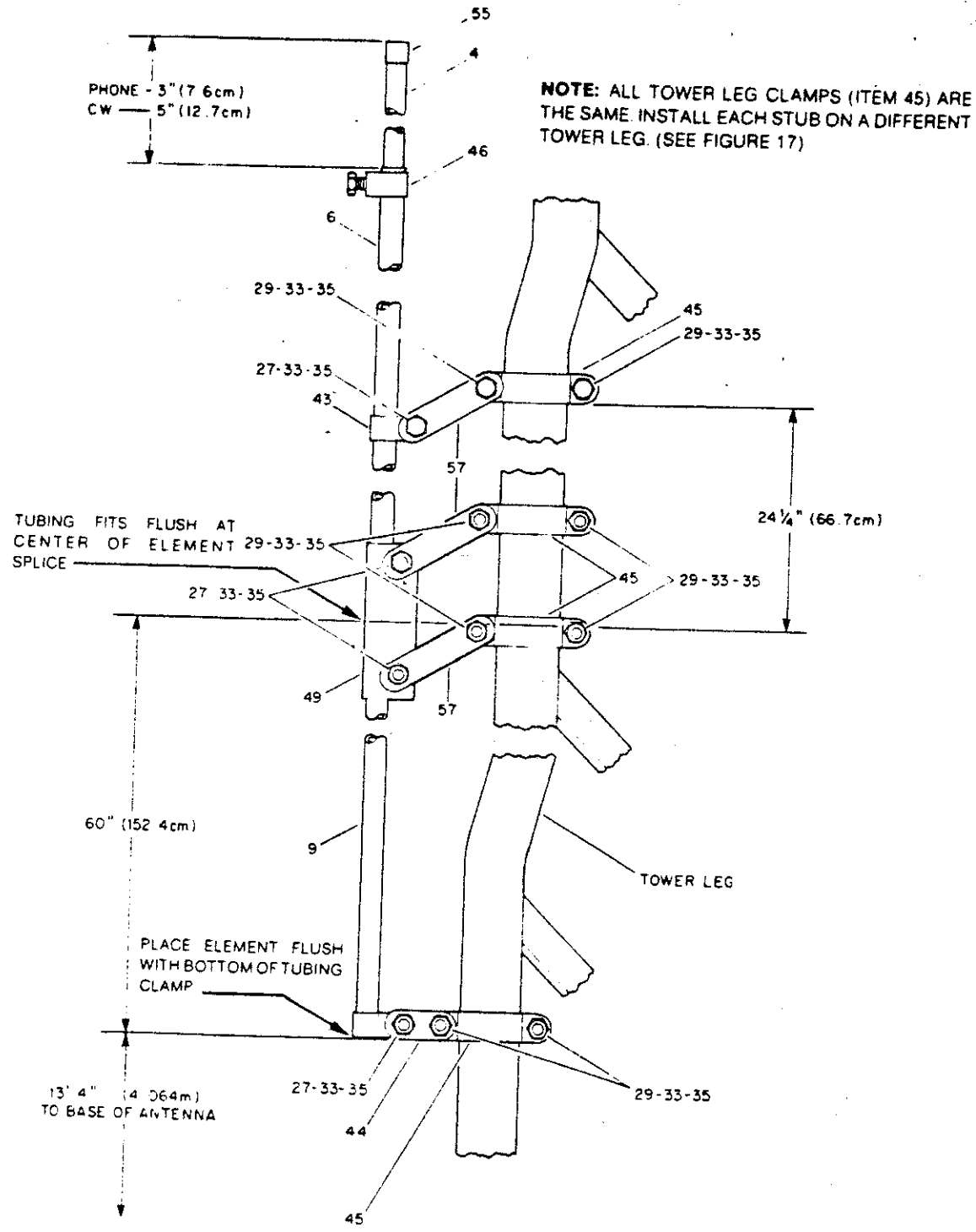
NOTE: The 10- and 15-meter stubs can be set independently. One can be set for CW and one for Phone, or they can both be adjusted for the same mode. If you wish to adjust a stub for any particular frequency within a band, this can be done experimentally.

Place a $\frac{3}{8}$ " caplug on the end of the 10-meter stub.



Item No.	Description	Item No.	Description
5	Tube, 3/8" x 23"	43	Clamp, tubing, 7/16" I.D.
9	Tube, 7/16" x 60"	44	Strap, shorting, 3/8" x 1 1/2"
27	Bolt, 1/4"-20 x 1", hex head, stainless steel	45	Clamp, leg, 3/8" x 3 1/2", formed
29	Bolt, 1/4"-20 x 1 1/2", hex head, stainless steel	46	Clamp, compression, 1/2"
30	Bolt, 1/4"-20 x 1 3/4", hex head, stainless steel	49	Element Splice
33	Lockwasher, internal, 1/4", stainless steel	55	Caplug, 3/8", black
35	Nut, 1/4"-20, hex, stainless steel	57	Insulator, decoupling stub, 3/8" x 2 15/16"

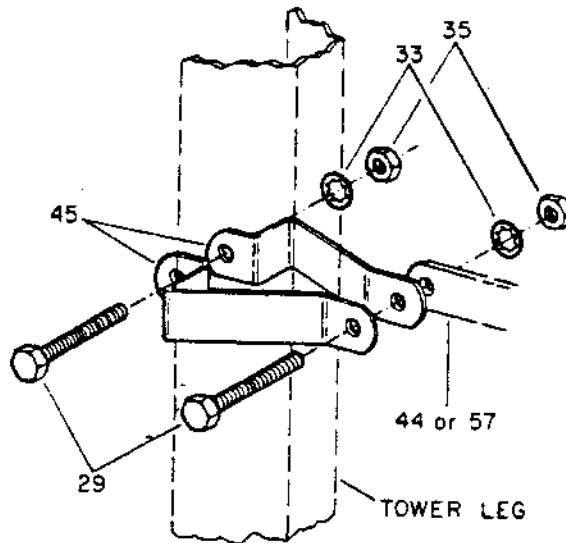
Figure 8. 15-Meter Stub



Item No.	Description
4	Tube, 3/8" x 9 1/2"
6	Tube, 7/16" x 38"
9	Tube, 7/16" x 60"
27	Bolt, 1/4"-20 x 1", hex head, stainless steel
29	Bolt, 1/4"-20 x 1 1/2", hex head, stainless steel
33	Lockwasher, internal, 1/4", stainless steel
35	Nut, 1/4"-20, hex, stainless steel

Item No.	Description
43	Clamp, tubing, 7/16" I.D.
44	Strap, shorting, 3/8" x 1 1/2"
45	Clamp, leg, 3/8" x 3 1/2", formed
46	Clamp, compression, 1/2"
49	Element Splice
55	Caplug, 3/8", black
57	Insulator, decoupling stub, 3/8" x 2 15/16"

Figure 9
10-Meter Stub



Item No.	Description
29	Bolt, ¼"-20 x 1½", hex head, stainless steel
33	Lockwasher, internal, ¼", stainless steel
35	Nut, ¼"-20, hex, stainless steel
44	Strap, shoring, ⅝" x 1½"
45	Clamp, leg, ⅝" x 3½", formed
57	Insulator, decoupling stub, ⅝" x 2 ⅜"

Figure 10
Tower Leg Clamp

Installation of 40-Meter Stub

NOTE: Each stub must be attached to a separate tower leg. The 40-meter stub (now being assembled) must be attached to the very top of the tower section. See Figure 11.

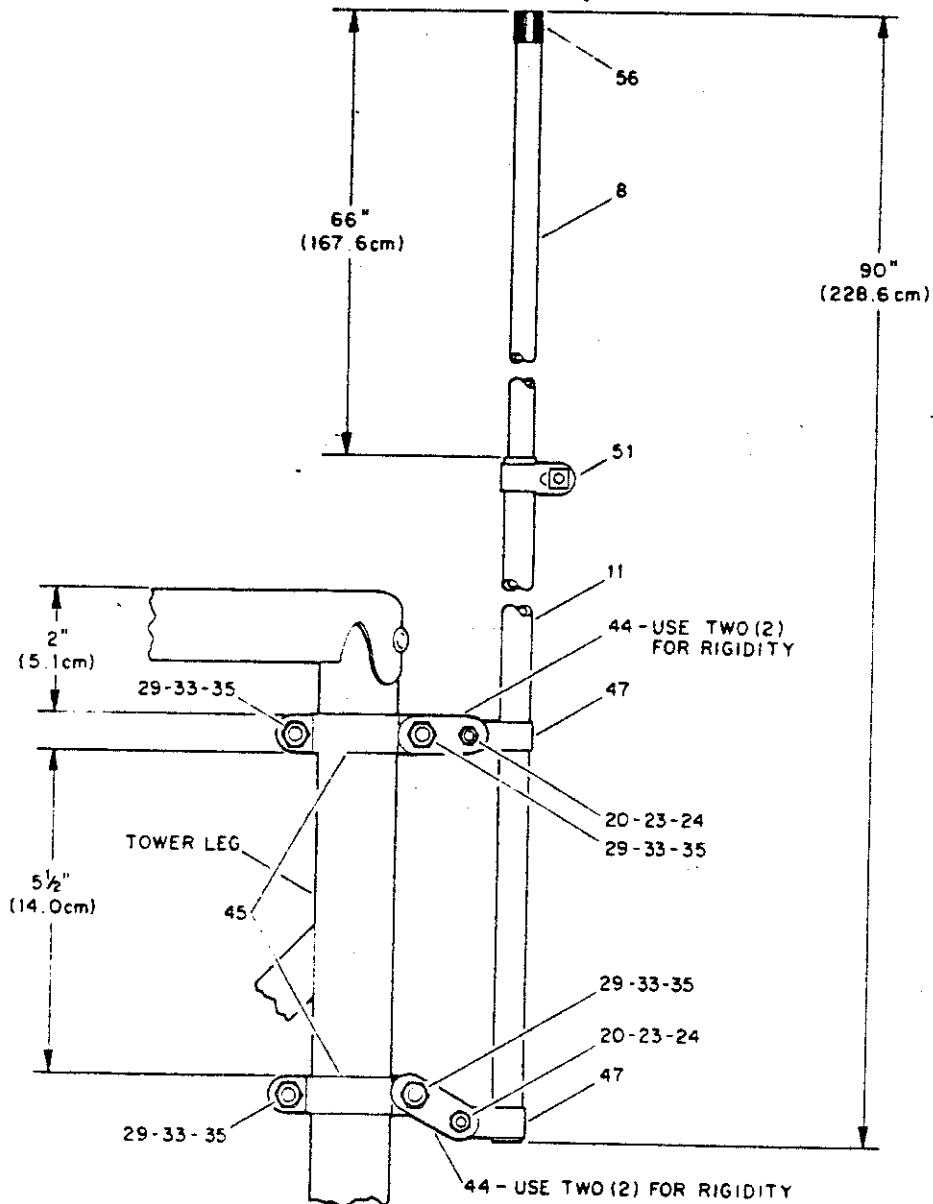
Select the ⅝" x 24" tube and install it on tower using two leg clamps and two shoring straps spaced 5½" apart, as shown in Figure 11.

Slip an assembled ½" compression clamp onto the ⅝" tube. Tighten slightly.

Select the ⅞" x 68" tube and slip it into the ⅝" tube. Measure 90" for both Phone and CW, as shown in Figure 11, then tighten the compression clamp securely.

Place a ⅞" caplug on the top of the 40-meter stub.

NOTE: The higher tubing clamp can be loosened and the lower shoring strap hinged to bring the 40-meter stub into a vertical position.



Item No.	Description
8	Tube, $\frac{7}{16}$ " x 68"
11	Tube, $\frac{3}{8}$ " x 24", swaged
20	Bolt, #10-24 x 1", hex head, stainless steel
23	Lockwasher, internal, #10, stainless steel
24	Nut, #10-24, hex, stainless steel
29	Bolt, $\frac{1}{4}$ "-20 x 1 $\frac{1}{2}$ ", hex head, stainless steel
33	Lockwasher, internal, $\frac{1}{4}$ ", stainless steel
35	Nut, $\frac{1}{4}$ "-20, hex, stainless steel
44	Strap, shorting, $\frac{3}{8}$ " x 1 $\frac{1}{2}$ "
45	Clamp, leg, $\frac{3}{8}$ " x 3 $\frac{1}{2}$ ", formed
47	Clamp, tubing, $\frac{3}{8}$ " I.D.
51	Clamp, compression, $\frac{1}{2}$ ", stainless steel
56	Caplug, $\frac{7}{16}$ ", black

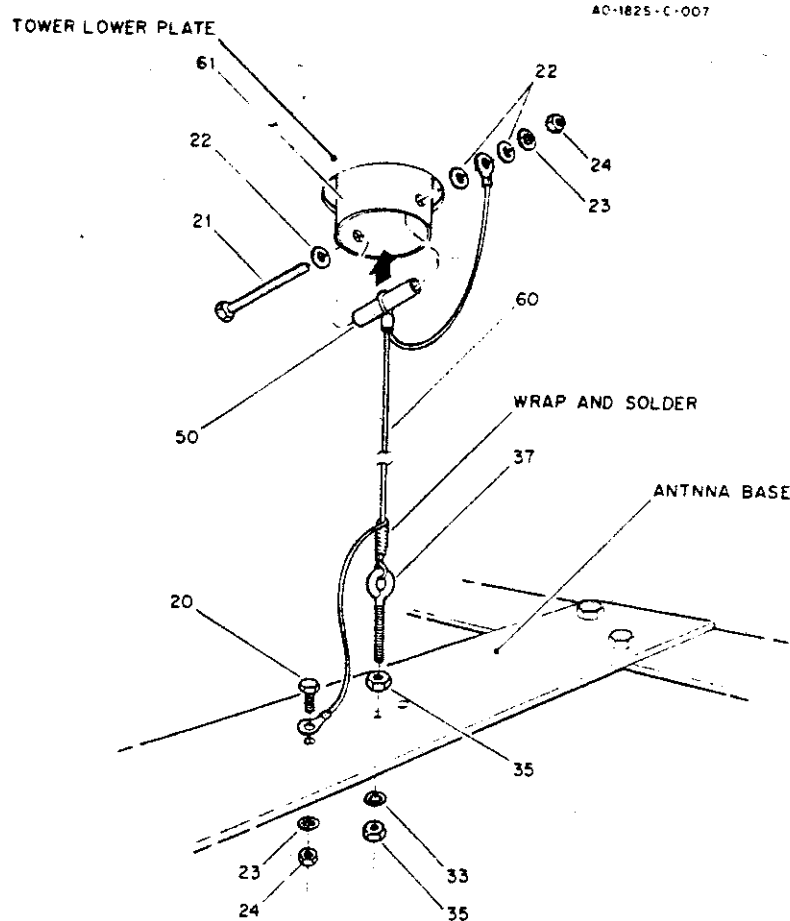
Figure 11
40-Meter Stub

Installation of 80-Meter Wire

Select the 80-meter wire and install it in the center of the tower with the looped end at the top of the tower.

Select the $\frac{3}{8}$ " spacer tube and attach the 80-meter wire to the 2" tube as shown in Figure 12.

Install the eyebolt at the tower base assembly as shown in Figure 12. Adjust for maximum height. The 80-meter wire will attach to this eyebolt after the tower is tilted into place.



Item No.	Description
20	Bolt, #10-24 x 1", hex head, stainless steel
21	Bolt, #10-24 x 2½", hex head, stainless steel
22	Flatwasher, #10, stainless steel
23	Lockwasher, internal, #10, stainless steel
24	Nut, #10-24, hex, stainless steel
33	Lockwasher, internal, ¼", stainless steel
35	Nut, ¼"-20, hex, stainless steel
37	Eyebolt, ¼" x 1½" x ½"
50	Tube, spacer, ⅜" x 1½"
60	80-Meter Wire Assembly
61	Tube Assembly with dowel, 2" x 75"

Figure 12
80-Meter Wire Installation

NOTE: To cover the low end of 80 meters (see Figure 12) it will be necessary to add a loading coil as previously explained and shown in Figure 13. This coil can be used to extend the 80-meter band and will also add 160-meter operation.

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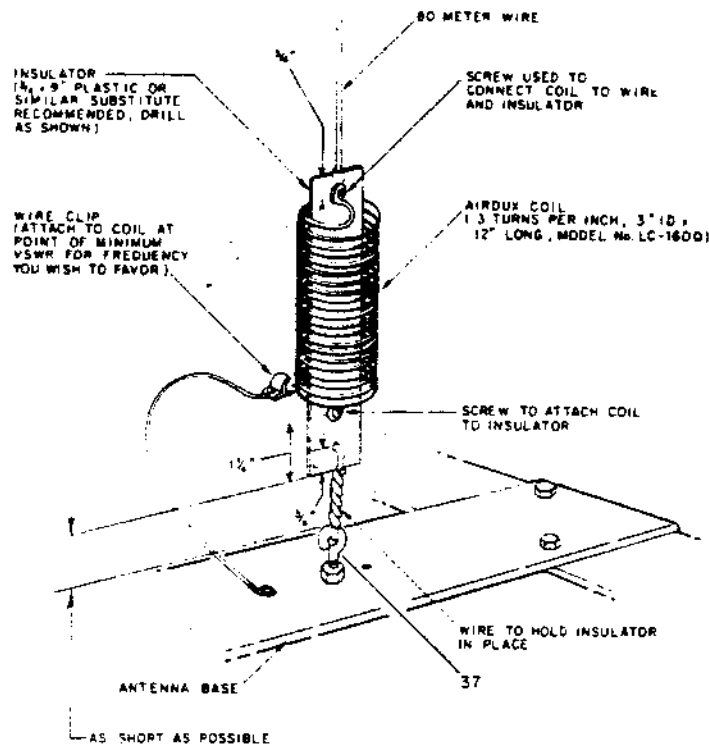


Figure 13
80-Meter and 160-Meter Coil Installation

160-Meter Operation

By adding one of two available kits, 160-meter operation can be added to the 18-HT-S "Hy-Tower". These kits are available from Hy-Gain's Warranty Service Department, Lincoln, Nebraska.

Kit Number LC-160Q is a loading coil that can be added at the tower base as shown in Figure 13. This coil is three turns per inch, 3" I.D. by 10" long. After the coil is installed, the wire clip should be attached at the point that gives minimum VSWR at the frequency you wish to operate on. This coil should be bypassed when operating on 20 or 75 meters.

Kit Number MK-160 is a 40-meter trap and wire assembly that can be added at the top of the tower as shown in Figure 17. This kit will provide a greater bandwidth and a higher power rating than the LC-160Q. It also provides fully automatic band switching from 160 through 10 meters.

Erection of Tower

Install the tower legs with hinges attached onto the base assembly. Do not tighten screws at this time.

WARNING

When installing your system, take extreme care to avoid any accidental contact with power lines or overhead obstructions. Failure to exercise this care could result in serious or fatal injury.

Lift the antenna and walk it into a vertical position. Install the remaining leg brace and bolt the leg to the base assembly as shown in Figure 14. Tighten all screws securely.

Insert the 80-meter wire through the eyebolt installed at the tower base. Wrap the wire around itself several times to insure a good tight connection. Solder the connection for the best electrical connection.

Adjust the eyebolt until the wire is taut.

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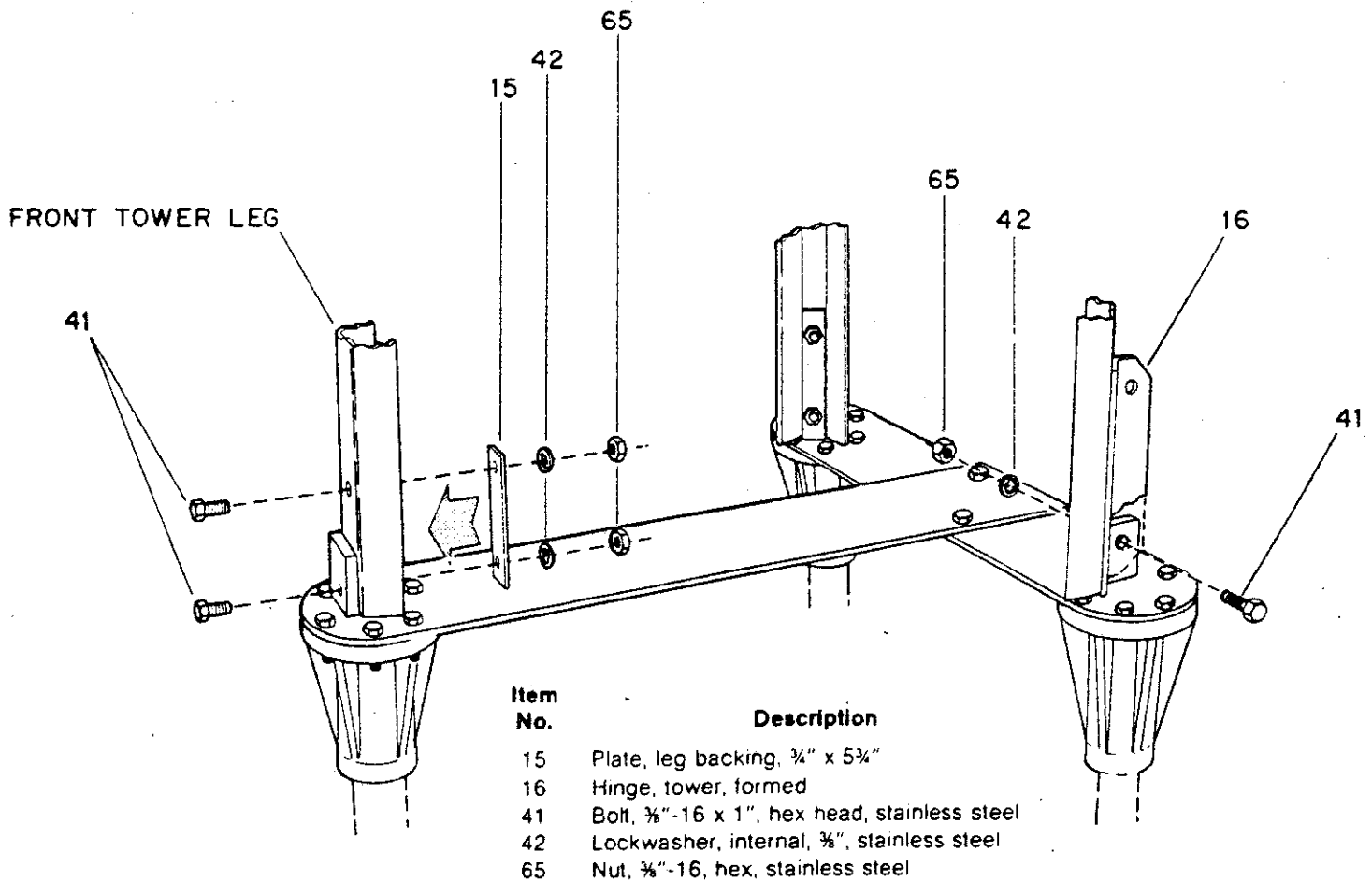


Figure 14
Tower Leg Attachment to Base

Attach the solder lug on the 80-meter wire to the tower base assembly as shown in Figure 14.

Feedline Attachment and Grounding

Install two ground rods at each tower leg. Space them 24" from the leg with 18" between the two rods as shown in Figure 15. Use 1/2" x 8' copper-clad steel rods (not supplied) for a good ground.

Attach each rod to a pipe leg using #10 or larger copper wire (not supplied). Now connect the three pipe legs together as shown in Figure 15. This will insure the best possible ground.

Strip your coaxial cable and attach the center conductor to the tower base using the hole provided as shown in Figure 15. Attach the braid to a pipe leg.

AO-1825-C-006

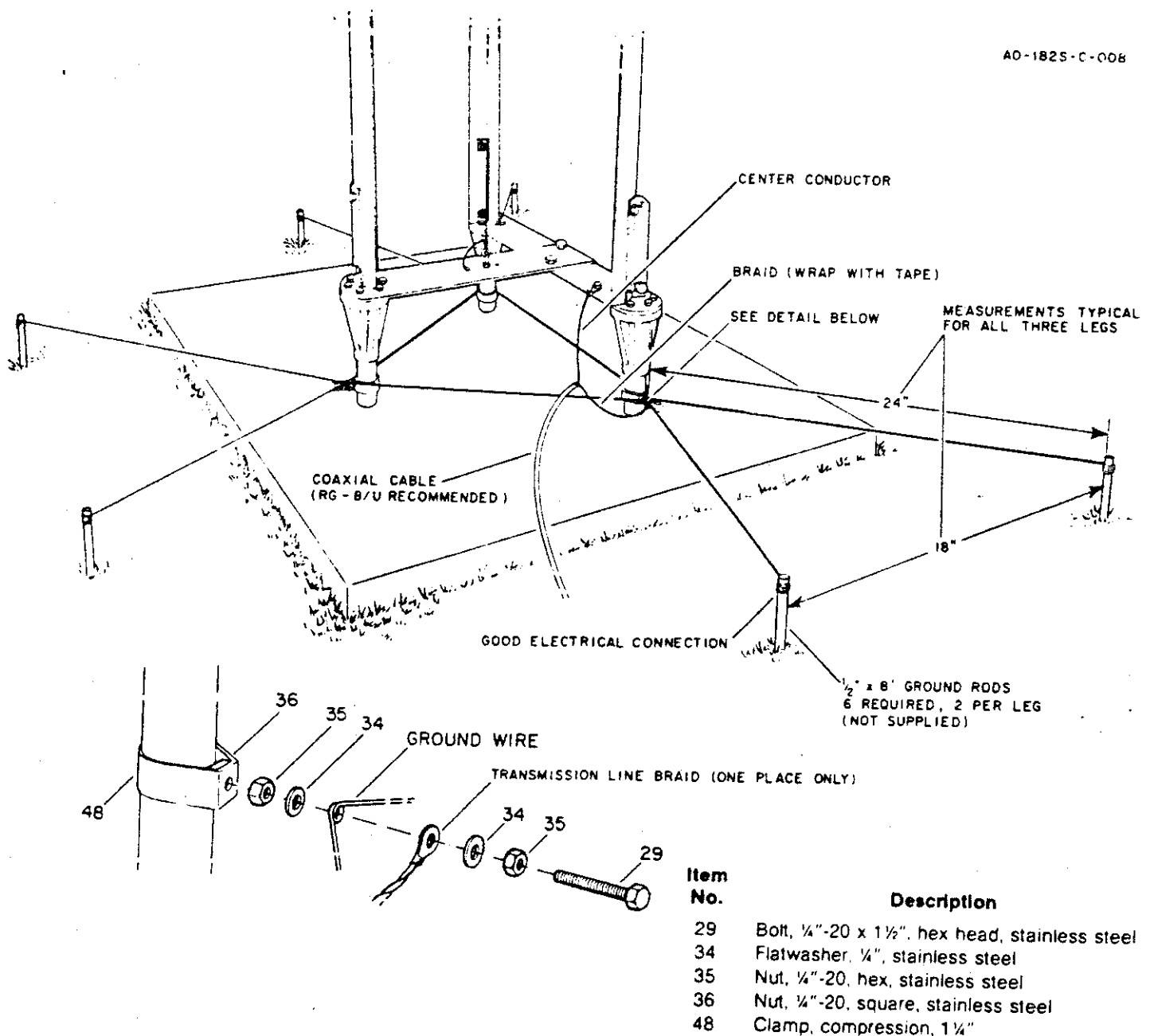


Figure 15
Ground Rod Installation

Weatherproof the coaxial cable using Coax-Seal® or some similar substance to prevent water from entering and ruining the coax.

NOTE: For total lightning protection, it is recommended that you obtain a Hy-Gain Model LA-1 Lightning Arrestor, available from your local Hy-Gain dealer.

The overall efficiency of the 18-HT-S can be improved by adding a radial system. The next section describes how to install a radial system.

Installation of Radials

There is no need to make radials exactly $\frac{1}{4}$ wavelength long for the 18-HT-S Hy-Tower. In fact, the only case where you should have $\frac{1}{4}$ wavelength radials would be for approximately 90 radials. This differs rather dramatically from the case of a *Ground-Plane* antenna where *resonant* radials are installed *above* ground. Since the radials of a *Ground-Mounted* vertical are actually on, if not in, the ground, they are coupled by capacitance or conduction to the ground, and thus resonance effects are not important. Basically, the function of radials is to provide a low-loss return path for ground currents. The reason that short radials are sufficient, when few are used, is that at the perimeter of the circle to which the ground system extends, the radials are sufficiently spread apart. Most of the return currents are already in the ground between the radials rather than in the radials themselves. As more radials are added, the spaces between them are reduced and longer lengths help to provide a path for currents still farther out.

Since the 18-HT-S Hy-Tower is a multi-band, vertical antenna, the radial system should be optimized on the lowest frequency you plan to use. Higher frequencies will benefit equally from the ground system, while lower frequencies will not show as much improvement.

To determine the optimum radial installation for your 18-HT-S Hy-Tower, you must first decide what is the limiting factor for your installation.

1. Cost of radial wires
2. Land available for radials
3. Efficiency of your antenna.

Table 1 shows some various ground system configurations. System A is the least costly and the least efficient. System F is the most expensive, takes the most land and is the most efficient.

SYSTEM

	A	B	C	D	E	F
Number of Radials	16	24	36	60	90	120
Length of each radial in wavelengths	.1	.125	.15	.2	.25	.4
Spacing of radials in degrees	22.5	15	10	6	4	3
TOTAL length of radial wire installed, in wavelengths	1.6	3	5.4	12	22.5	48
Power gain due to increased efficiency in dB	3	4	4.5	5	5.5	6
Feed-point impedance in ohms with a 1/4-wave radiating element	52	46	43	40	37	35
Radial end buried	YES	YES	YES	NO	NO	NO

TABLE 1
Optimum Ground System Configurations

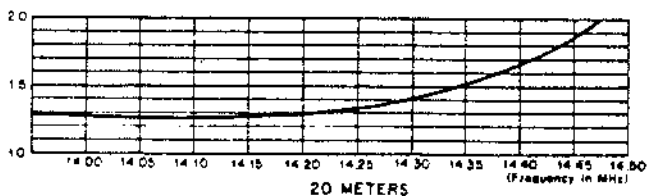
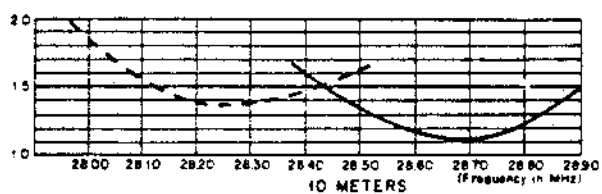
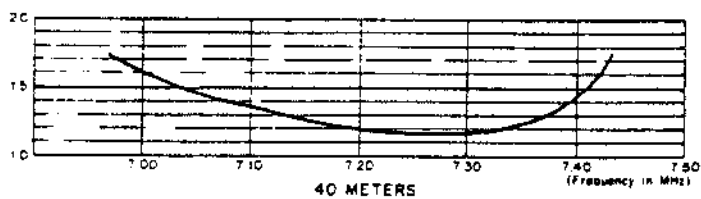
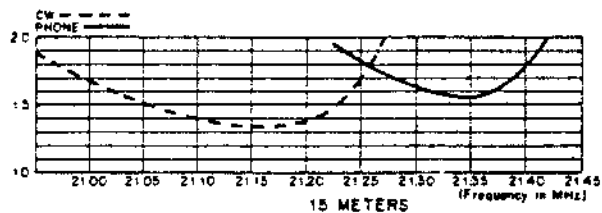
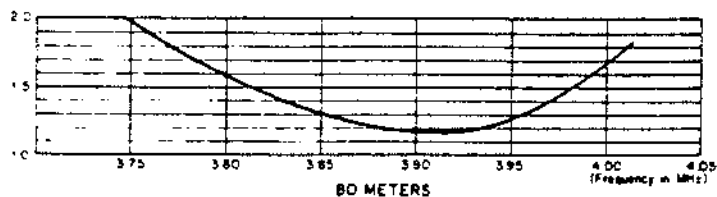


Figure 16
VSWR Charts

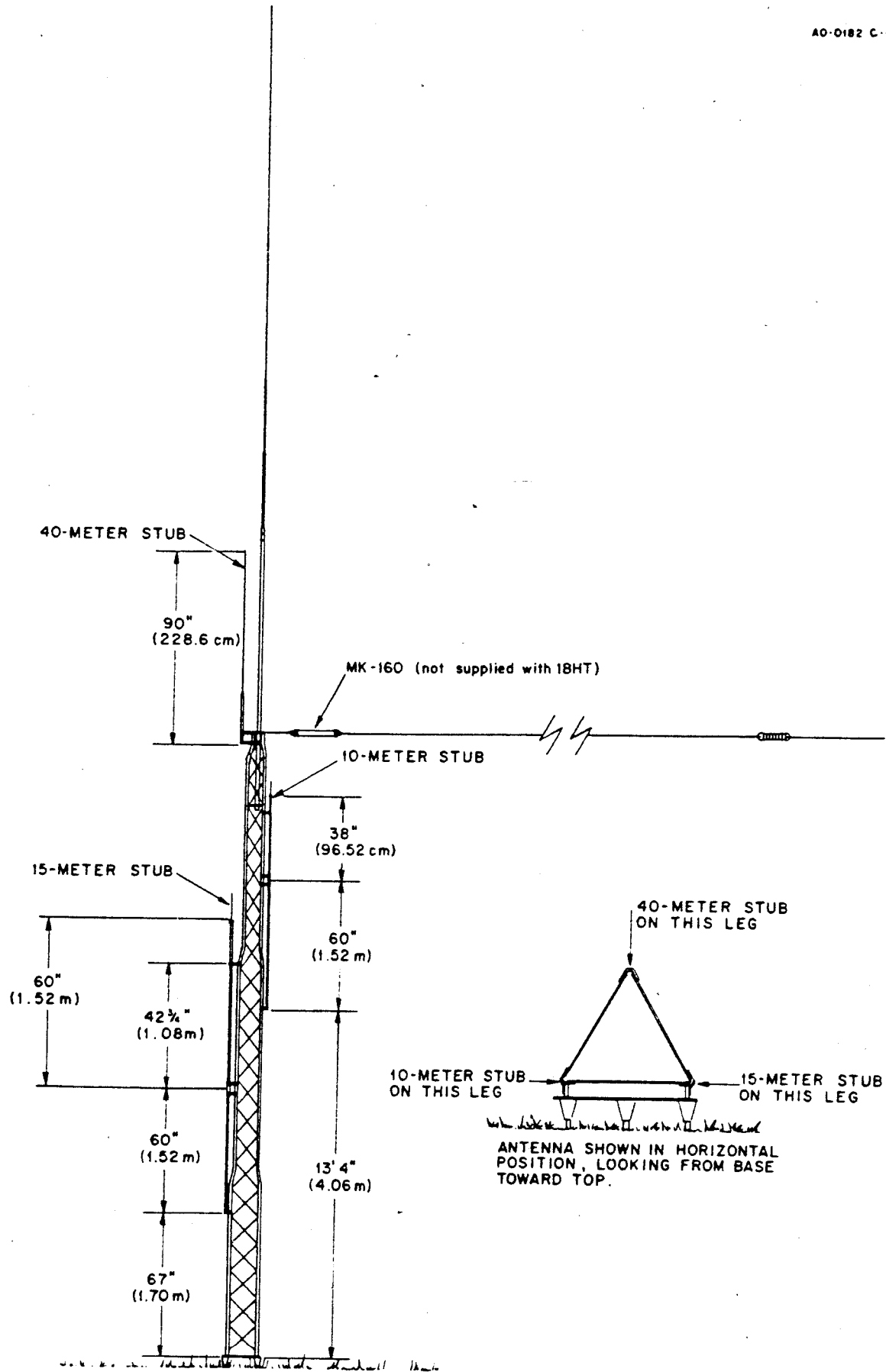


Figure 17
Overall View of 18-HT-S

PARTS LIST

NOTE: Item numbers may not necessarily be in numerical sequence and may appear more than one time, depending on how often a part is used, or identical parts being placed in different parts packs.

Item No.	Part No.	Description	Qty
1	879810	Tower, modified, BX-24	1
2	872077	Carton, tubing and parts	1
3	161411	Clamp, reducer, 2" to 1 1/4", formed	2
4	170403	Tube, 3/8" x 9 1/2"	1
5	170416	Tube, 3/8" x 23"	1
6	171500	Tube, 7/16" x 38"	1
7	173305	Angle, vertical element, 1" x 1" x 4"	2
8	174868	Tube, 7/16" x 68"	2
9	174987	Tube, 7/16" x 60"	3
10	190000	Tube, 5/8" x 48", swaged	1
11	190004	Tube, 5/8" x 24", swaged	1
12	190202	Tube, 5/8" x 72", swaged	1
13	190307	Tube, 1 1/8" x 38", swaged	1
14	190900	Tube, 1 1/4" x 48", slotted	1
15	381664	Plate, leg backing, 3/4" x 5 3/4"	4
16	381666	Hinge, tower, formed	2
17	475500	Insulator, 2" I.D. x 3 3/8"	2
18	872075	Parts Pack, 182S, Hardware	1
19	500158	Bolt, #10-24 x 1/2", hex head, stainless steel	11
20	504069	Bolt, #10-24 x 1", hex head, stainless steel	6
21	500164	Bolt, #10-24 x 2 1/2", hex head, stainless steel	1
22	561165	Flatwasher, #10, stainless steel	3
23	565697	Lockwasher, internal, #10, stainless steel	15
24	554071	Nut, #10-24, hex, stainless steel	12
25	555693	Nut, #10-24, square, stainless steel	5
26	505266	Bolt, 1/4"-20 x 3/4", hex head, stainless steel	5
27	502958	Bolt, 1/4"-20 x 1", hex head, stainless steel	28
28	506518	Bolt, 1/4"-20 x 1 1/4", hex head, stainless steel	1
29	504098	Bolt, 1/4"-20 x 1 1/2", hex head, stainless steel	22
30	505763	Bolt, 1/4"-20 x 1 3/4", hex head, stainless steel	3
31	505737	Bolt, 1/4"-20 x 2", hex head, stainless steel	1
32	505734	Bolt, 1/4"-20 x 2 1/2", hex head, stainless steel	4
33	562961	Lockwasher, internal, 1/4", stainless steel	68
34	566344	Flatwasher, 1/4", stainless steel	6
35	554099	Nut, 1/4"-20, hex, stainless steel	72
36	551367	Nut, 1/4"-20, square, stainless steel	6
37	547260	Eyebolt, 1/4" x 1 1/2" x 1/2"	1
39	564792	Lockwasher, split, 5/16", stainless steel	4
40	555747	Nut, 5/16"-18, hex	4
41	505691	Bolt, 3/8"-16 x 1", hex head, stainless steel	10
42	565696	Lockwasher, internal, 3/8", stainless steel	12
65	555694	Nut, 3/8"-16, hex, stainless steel	12
	872076	Parts Pack, 182S, Clamps	1
38	547225	U-Bolt, 5/16" x 3" x 3 1/16"	2
43	161851	Clamp, tubing, 7/16" I.D.	4
44	163378	Strap, shorting, 5/8" x 1 1/2"	6
45	163300	Clamp, leg, 5/8" x 3 1/2", formed	20
46	165123	Clamp, compression, 1/2"	2
47	171329	Clamp, tubing, 3/8" I.D.	2
48	168680	Clamp, compression, 1 1/4"	3

Item No.	Part No.	Description	Qty
	872076	Parts Pack, 182S, Clamps. (Cont.)	
49	171548	Element Splice	2
50	173221	Tube, Spacer, 3/8" x 1 1/8"	1
51	380413	Clamp, compression, 1/2", stainless steel	2
52	380420	Clamp, compression, 3/4", stainless steel	1
53	380421	Clamp, compression, 1", stainless steel	1
54	380422	Clamp, compression, 1 1/4", stainless steel	1
55	455655	Caplug, 3/8", black	2
56	455644	Caplug, 7/16", black	2
57	465416	Insulator, decoupling stub, 5/8" x 2 15/16"	6
58	471056	Insulator, vertical element spacer, 1" x 4"	2
59	872451	Base Tube Assembly	3
60	872464	80-Meter Wire Assembly	1
61	872465	Tube Assembly with dowel, 2" x 75"	1
62	874687	Tube/Shim Assembly, 2" x 51"	1
63	882782	Base Assembly "B"	1
64	882783	Base Assembly "A"	1

Converting English Measurements to Metric

Using this scale to identify lengths of bolts, diameters of tubes, etc.. The English inch (") and foot (') can be converted in this way.

$$1 \text{ inch (1")} = 2.54 \text{ cm}$$

$$1 \text{ foot (1')} = 30.48 \text{ cm}$$

Example:

$$42" \times 2.54 = 106.7 \text{ cm}$$



FRACTION AND METRIC EQUIVALENTS FOR ONE INCH			
Fractional Inch	Millimeters	Fractional Inch	Millimeters
1/16	1.588	9/16	14.288
1/8	3.175	5/8	15.875
3/16	4.760	11/16	17.463
1/4	6.350	3/4	19.050
5/16	7.937	13/16	20.638
3/8	9.525	7/8	22.225
7/16	11.112	15/16	23.813
1/2	12.700	1	25.400