THUNDERBOLT®
80 Meter Vertical Antenna

DXE-80VA-3

DXE-80VA-3-INS Revision 9d

DXE-80VA-3 at 3Y0X Peter I Island (shown equipped with optional Top Hat Ice Kit)

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Introduction

The DX Engineering THUNDERBOLT® DXE-80VA-3 is a high performance 80 meter vertical antenna that is tunable to operate over segments of the entire band with an SWR of 1.5:1 or less, yet is only an optimum 43 feet high! Designed with 6063 corrosion-resistant aluminum tubing and stainless steel hardware, this antenna is very durable and attractive.

DX Engineering THUNDERBOLT® technology has been proven in the hostile, remote environment of Antarctica’s Peter I Island by the outstanding performance by the 3Y0X DXpedition with an amazing 5,869 QSOs on 80 meters!

This antenna features a properly designed top hat, which forces radiation current to be maximized over the entire height of the vertical. This allows the antenna to be shorter without giving up efficiency or radiating performance. With this antenna, you get full-size 80 meter performance in an antenna only 43 feet high. Instructions provide for two-level mid and top guying.

Of course, another key to performance is a good ground radial system. 32 radials, 65 feet long are recommended. Fewer radials will work, but with diminished results.

The DXE-80VA-3 80 meter vertical antenna includes the antenna element, capacity top hat, mounting plate, Tilt Base, stainless steel V-Clamps, stainless steel hardware and element clamps.

Features
- Full band tunable coverage on 80 meters with an SWR under 1.5:1 No Tuner needed
- Bandwidth greater than 300 kHz with SWR under 2:1
- Power Handling up to 5 kW
- Only 43 ft overall height

Supplied Installation Items:
- 80M Capacity Hat – Allows maximum current flow in vertical 43 ft radiator for uncompromised performance and power rating.
- Tilt Base (patented) - Precision cut from 3/16 in. 304 Stainless Steel, this mounting plate is virtually indestructible. Mounts to the same mast that you use for the radial plate. Allows for easy installation, tuning or severe weather lay-down.
- DXE-VMN-1 Vertical Antenna Matching Unit enhances the tuning in the 80 meter band

Manual Updates
Every effort is made to supply the latest manual revision with each product. Occasionally a manual will be updated between the time your DX Engineering product is shipped and when you receive it. Please check the DX Engineering web site (www.dxengineering.com) for the latest revision manual.
Additional Material Needed but not Supplied:
- **Antenna Mounting** - Steel mounting pipe, up to 2.0" OD *maximum*, 0.25" wall thickness, 4 feet long. The standard 1-1/2" galvanized water pipe (with its 1.9" OD) is just fine for this application and can usually be found at your local home building supply store.
- **Quik-Set Concrete** - Mounting pipe installation
- **DXE-P8A - Penetrox™ A** - To ensure good connection on aluminum
- **PTX-81343 - Anti-Seize** compound - used on the threads of the Stainless Steel Hardware to prevent galling and aid in proper tightening torque.
- **DXE-RADP-3** - Patented **Radial Plate**: The most effective way to connect those essential radial wires and the feedline coax to your vertical antenna for the maximum efficiency and strongest signals. All stainless construction and includes 20 sets of radial connection hardware. Additional radial components available.
- **DXE-363-SST** Bulkhead connector for a clean and quality feedline connection.
- **DXE-RADW** - Radial Wire Kits and Components. To achieve optimal performance with a ground-mounted vertical, install as many radials as possible.
- **DXE-SSVC-2P V-Clamp.** One for the **DXE-RADP-3 Radial Plate**.
- **Guy Rope and Anchors** – **DXE-GUY400-KIT** contains 4 screw-in earth anchors and 4 100 foot rolls of Dacron/polyester rope to guy the **DXE-80VA-3** at two levels in four directions. Additional guy rope is available from DX Engineering in several diameters and lengths.

**Parts List for the DXE-80VA-3**

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tilt Base, patented, 3/16&quot; Laser Cut Stainless Steel</td>
<td>1</td>
</tr>
<tr>
<td>DXE-SSVC-2P V-Clamp</td>
<td>2</td>
</tr>
<tr>
<td>DXE-VMN-1 Vertical Antenna Matching Network</td>
<td>1</td>
</tr>
<tr>
<td>Tilt Base, Mast Mount Channel</td>
<td>1</td>
</tr>
<tr>
<td>1/4-20 x 2&quot; HH Bolt, full thread</td>
<td>4</td>
</tr>
<tr>
<td>1/4&quot; Flat Washer</td>
<td>4</td>
</tr>
<tr>
<td>1/4&quot; Split Washer</td>
<td>4</td>
</tr>
<tr>
<td>1/4&quot; Aluminum Spacer</td>
<td>4</td>
</tr>
<tr>
<td>1/4-20 Hex nut</td>
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</tr>
<tr>
<td>1/4&quot; Fender Washer, 1&quot; OD</td>
<td>4</td>
</tr>
<tr>
<td>1/4-20 Flanged Nut</td>
<td>2</td>
</tr>
<tr>
<td>1/4-20 Nylon nut</td>
<td>4</td>
</tr>
<tr>
<td>3/8&quot; U-Bolt x 2&quot; ID x 3.25&quot; leg</td>
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</tr>
<tr>
<td>2&quot; Saddle for 3/8&quot; U-Bolt</td>
<td>2</td>
</tr>
<tr>
<td>3/8-16 Hex Nut</td>
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<tr>
<td>3/8&quot; Split Washer</td>
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<td>3/8&quot; Flat Washer</td>
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**Antenna Elements**

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<tr>
<td>2.00&quot; x 0.125&quot; x 36&quot; Tube, 6061-T6 mat'</td>
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<td>2.125&quot; x 0.058&quot; x 72&quot; Tube. (Slit both ends)</td>
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<tr>
<td>2.00&quot; x 0.058&quot; x 72&quot; Tube. (Slit one end)</td>
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<td>1.875&quot; x 0.058&quot; x 72&quot; Tube. (Slit one end)</td>
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<td>1.750&quot; x 0.058&quot; x 72&quot; Tube. (Slit one end)</td>
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</tr>
<tr>
<td>1.625&quot; x 0.058&quot; x 72&quot; Tube. (Slit one end)</td>
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<tr>
<td>1.500&quot; x 0.058&quot; x 72&quot; Tube. (Slit one end)</td>
<td>1</td>
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<tr>
<td>1.500&quot; x 0.058&quot; x 72&quot; Tube. (Slit both ends)</td>
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<tr>
<td>1.375&quot; x 0.058&quot; x 8&quot; Tube. (Plain)</td>
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<tr>
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<tr>
<td>DXE-ECL-16SS Element Clamp</td>
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<tr>
<td>DXE-ECL-20SS Element Clamp</td>
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</tr>
<tr>
<td>DXE-ECL-24SS Element Clamp</td>
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<tr>
<td>DXE-ECL-28SS Element Clamp</td>
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<td>Black Vinyl Cap</td>
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**80 Meter Top Hat Assembly**

<table>
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<th>Qty</th>
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</thead>
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<tr>
<td>Multi-purpose Hub, patented</td>
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<tr>
<td>80 Meter Top Hat Plate</td>
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</tr>
<tr>
<td>1/4-20 x 1-1/4&quot; Socket H. full thread</td>
<td>3</td>
</tr>
<tr>
<td>1/4-20 x 1-1/2&quot; Hex Bolt</td>
<td>3</td>
</tr>
<tr>
<td>1/4-20 Square Nut</td>
<td>3</td>
</tr>
<tr>
<td>1/4-20 Hex Nut</td>
<td>6</td>
</tr>
<tr>
<td>1/4&quot; Split Washer</td>
<td>6</td>
</tr>
<tr>
<td>1/4&quot; Flat Washer</td>
<td>9</td>
</tr>
<tr>
<td>Tube, 80 Meter Top Hat, 1/2&quot; x 5.00&quot;</td>
<td>6</td>
</tr>
<tr>
<td>Tube, 80 Meter Top Hat, 3/8&quot; x 72.00&quot;</td>
<td>6</td>
</tr>
<tr>
<td>6-32 x 5/8&quot; Socket Head Cap Screw</td>
<td>18</td>
</tr>
<tr>
<td>#6 Flat Washer</td>
<td>12</td>
</tr>
<tr>
<td>6-32 Nylon Nut</td>
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<tr>
<td>6-32 Hex Nut</td>
<td>6</td>
</tr>
<tr>
<td>#6 Star Washer</td>
<td>6</td>
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<tr>
<td>Wire Assembly, 80 Meter Top Hat.</td>
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**Feedpoint Connection**

<table>
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<th>Description</th>
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<tbody>
<tr>
<td>1/4-20 x 1&quot; HH Bolt, full thread</td>
<td>1</td>
</tr>
<tr>
<td>1/4&quot; Star Washer</td>
<td>2</td>
</tr>
<tr>
<td>1/4&quot; Flat Washer</td>
<td>2</td>
</tr>
<tr>
<td>1/4-20 Hex nut</td>
<td>2</td>
</tr>
</tbody>
</table>
Tools Required

Two 7/16" wrenches, (one of them should be open-end)
1/2" and 7/16" socket and drive
3/16” and 7/64” Allen wrenches
Medium size screwdriver or 5/16” nut driver for the element clamps
Tape measure
Felt-tip marker.

The use of an antenna analyzer such as the MFJ-259B will facilitate the fine tuning of the vertical. Ground conductivity as well as the number of radials and their length can affect tuning parameters. The radial system used in the DX Engineering test vertical contained 32 radials, 65 ft long, symmetrically placed around the vertical using a Radial Plate. A minimum of 16 radials 65 ft long should be used for reasonable performance.

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.

Overhead Power Line Safety

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! 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.
**Installation**

**Site Selection**

Select a mounting location clear from power lines and structures by a minimum of 53 feet (43 plus 10 for the 10 foot safety rule). **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. There should also be a clear diameter of at least 70 feet from the antenna for the guying and radial systems that will extend away from the antenna.

**Radial System**

The use of a radial system is a key requirement for a high performance quarter wave vertical antenna system. With a 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.

At a minimum, 20 radials, each 65 feet long, should be used with this antenna. Using 32 radials at 65 feet long is preferred and highly recommended. The extra radials may help overcome unknown poor-soil conditions, improve efficiency, and ensure the best performance possible from the vertical antenna. Longer radials should be used for improved performance especially if your plans call for 60 or more radials. **DXE-RADW** Radial Wire, a stranded 14 gauge PVC insulated copper wire is suggested for the best results.

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. The **DXE-RADP-3** Stainless Steel Radial Plate is an ideal optional item which provides an excellent system for attaching radial wires to your vertical antenna system feedpoint.

Radial wires can be laid on the roots of the grass using biodegradable **DXE-STPL** Radial Wire Anchor Pins to hold them down. Using enough staples will ensure the wires will not be snagged by mowers, people, or animals. Grass will quickly overgrow the radials and they will be virtually impossible to see or cause trouble. An article describing this process is available the DX Engineering website www.dxengineering.com in the **Tech FAQ** section. Radials can also be buried just under the surface by using a power edger to make a slit in the soil.
Guy Rope and Anchor Installation

Four screw-in earth anchors and sufficient antenna rope are available as model **DXE-GUY400-KIT** to allow guying of the antenna at two levels in four directions. Rule-of-thumb engineering suggests the distance of the anchors from the antenna base should be equal to the height of the highest guy level. This provides a 45-degree guy angle. The guy ropes should be fastened just above an element clamp using a non-slip knot such as shown below.

The set of four earth anchors may be augured into the ground approximately 25 to 35 feet from the antenna base to fasten the guy lines. When you install the earth anchors, make sure one of them is placed exactly opposite the direction toward which the antenna will tilt over. The others should then be evenly spaced as shown above.

You may find it easier to first install and raise only the sections of tubing up to the lower set of guy ropes. This will allow you to establish the correct length and tie off the ropes. Then, you can disconnect the guy rope toward the rear and, leaving the others fastened, lower the partial sections for final assembly. The remaining ropes will provide stability as the antenna assembly is raised.
Mounting Pipe
Use a customer supplied thick-walled galvanized steel mounting pipe at least 4 feet long. This will allow approximately 2 feet or more to be below ground and approximately 2 feet above ground. A thick-walled steel pipe 1-3/4" OD to 2" OD maximum is recommended with a minimum thickness of 1/8" (1/4" preferred) should be used. The standard 1-1/2" galvanized water pipe (with its 1.9" OD) is just fine for this application and can usually be found at your local home building supply store. For permanent mounting, use a post-hole digger to make the hole deep enough to accommodate 2 feet of pipe and a couple inches of gravel at the bottom for drainage. Set the pipe on the gravel, use the pre-mix concrete to fill around the pipe, adding water and mixing as you fill or mix the concrete first, then pour in the hole. Fill the hole until the concrete is level with the ground around it. Use a level as you fill the hole to be sure the pipe is straight. Allow to set overnight. Your location, landscape and ground conditions may require different mounting solutions in order to have the steel mounting pipe and the vertical antenna in a secure position.

Note: Galvanized steel, rather than aluminum, is much more suitable for mounting in concrete. Aluminum will quickly corrode due to incompatibility with the materials used to make concrete.

Assembly
Your antenna is shipped in two separate boxes. The long box contains 7 vertical element sections, and an insulated U-channel. Some of the smaller tubes are inside larger ones. The smaller box contains the tilt base and all installation hardware.

Carefully unbox the antenna and separate the various element tubes. (All the element tubes are 6 feet long except the base tube which is 3 feet long) Using scissors rather than a knife, cut away the bubble wrap being careful not scratch the tubes. Unwrap the U-channel bracket. Unpack the hardware box, separate the individually marked hardware bags and lay them out for easy identification.

Note: DXE-P8A Penetrox™ A Anti-Oxidant should be used between all antenna element sections. Penetrox™ A 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.

PTX-81343 Never-Seez® or DXE-NSBT8 Anti-Seize should be used on all clamps, bolts and stainless steel threaded hardware to prevent galling and to ensure proper tightening.

Note: The following assembly instructions are based on using a 2" OD Mounting Pipe, with the optional patented DXE-RADP-3 Radial Plate and DXE-363-SST Bulkhead Fitting.
Radial Plate to Mounting Pipe

Install the optional DXE-RADP-3 Radial Plate on the 2” OD maximum mounting pipe using an optional DXE-SSVC-2P V-Bolt Saddle Clamp as shown in Figure 1. Mount the radial plate so you have approximately 1” of space between the bottom of the plate and the ground level. This will allow easy access to install the radial wire hardware. The DXE-RADP-3 Radial Plate comes with 20 sets of stainless steel hardware for mounting the radial wires. Mount the plate as shown in relation to how the Tilt Base is mounted. (For reference, Figure 13 shows the completed installation.)

![Diagram of DXE-RADP-3 Radial Plate Installation](image)

**Figure - 1 - Optional DXE-RADP-3 Radial Plate Installation**

**Attaching Ground Radial Wires to the Radial Plate**

Using the 20 sets of supplied 1/4” stainless steel hardware (Bolt, Flat Washer, Star Washer, Split Washer, Nut) connect the optional ground radial wires to the DXE-RADP-3 Radial Plate as shown in Figure 2. Additional hardware kits are available (DXE-RADP-1HWK) that contain 20 sets of Radial Plate Hardware.

There are optional DX Engineering Radial Wire Kits available. DXE-RADW-500K/BD contains a 500 foot spool of 14 gauge copper stranded wire with black PVC insulation, 20 Terminal Lugs and 100 Steel or Biodegradable Lawn Staples. The DXE-RADW-1000K/BD Radial Wire Kit contains a 1,000 foot spool of 14 gauge copper stranded wire with black PVC insulation, 40 Terminal Lugs and 200 Steel or Biodegradable Lawn Staples. RADW-20RT, -32RT or -65RT contain 20 each radial wires with 1/4” terminal attached. These kits come in 20 Ft, 32 Ft, or 65Ft lengths.

Depending on the number of radial wires used, space them out evenly around the Radial Plate. The Radial Plate will accommodate up to 60 radial wires (60 laser drilled holes), or up to 120 radials if doubled up.

![Diagram of Radial Wire Hardware Installation](image)

**Figure - 2 - Radial Wire Hardware Installation**
Tilt Base to Mounting Pipe
Install the Tilt Base to the 2" OD *maximum* mounting pipe using two DXE-SSVC-2P V-Clamps allowing approximately 7" clearance between the bottom of the tilt base plate, to the top of the DXE-RADP-3 Radial Plate as shown in Figure 3. The standard 1-1/2" galvanized water pipe (with its 1.9" OD) is just fine for this application and can usually be found at your local home building supply store. Make sure the Tilt Base and optional DXE-RADP-3 Radial Plate are oriented correctly for the direction you wish to tilt the antenna. Tighten the clamps evenly so the length of the exposed threads is approximately equal. Any clamp should be tightened evenly from side-to-side with an equal amount of thread above each nut.

Vertical Base Section
The base section is made up of an insulated mounting channel with hardware, a mounting plate, two U-Bolt assemblies and the base antenna section which is 2" OD and 36" long.

Using Figure 4, attach the aluminum backing plate to the back of the insulated channel. The base hardware kit contains four 2" hex bolts, four flat washers, four aluminum spacers, four split washers and four hex nuts. From the inside of the channel, insert a 2" bolt with a flat washer through each of the middle four holes, through the backing plate. Put on the aluminum spacer, a split washer and a plain hex nut. Tighten firmly, but not enough to crush the insulated channel.

Using the 36" base section tube, install the 1" bolt through the hole in the tube from the inside, so the threads stick out. Put on a star washer, normal flat washer, then a standard hex nut. Tighten securely. Add another star washer, flat washer and standard nut, but do not tighten. The feed wire attaches to this hardware. Figure 5 shows the completed feed assembly.
Install the lower section to the insulated channel using the two 3/8" x 2" U-Bolts, two saddle clamps, four flat washers, four split washers, and four nuts as shown in Figure 6. The base section tube should extend 1-1/4" beyond the bottom of the U-bolt clamp. When tightening, observe the split washers. When they fully seat (flatten out), the clamp is tight enough. Any clamp should be tightened evenly from side-to-side with an equal amount of thread above each nut.

**Figure - 6**

**Base Section to Tilt Base**

Place the Lower Base Section into the holes of the Tilt Base and loosely install the Tilt Base mounting hardware shown in Figure 7.
Using a wrench or nut driver, securely tighten the two Nyloc Nuts at the bottom of the Tilt Base. Then loosen them one-half turn each. This will allow proper movement of the Tilt Base while raising or lowering the antenna. It is not necessary to tighten these nuts more securely unless further tilt operation is no longer required. They should not be loosened more than one-half turn at any time.

Test the tilt function to ensure proper clearances. Standing in front of the Tilt Base, lift the antenna base section, slide it to the right, and let it down slightly until the lower outside bolt is resting in the pivot point. Then slowly tilt as shown in Figure 8. Make sure when you are tilting the antenna to **lift, slide to the right, and then** tilt. Be careful to keep the pivot bolt resting in the pivot point. Reverse the process when raising the antenna.

It is important to note that the lower, outside bolt becomes the pivot point while raising or lowering the antenna. This pivot bolt **MUST** be retained in the pivot point. It seems natural to **push** the antenna toward the Tilt Base while raising. **Push up** while raising, but not toward the base since this could cause the pivot bolt to lift out of the slot and allow the mechanism to bind up and bend the lower bolts.

The Tilt Base is not made to support the whole antenna by itself when tilted. When the antenna is tilted over, ensure you have some sort of table, stand, or saw horse to set the antenna on to aid in supporting the weight. When the antenna is in the upright position, ensure the mounting hardware (reference Figure 7) is tightened.

![Figure - 8 - Tilt Action](image)

**Note:** A pair of sawhorses or ladders should be used to support the vertical sections during assembly with the tilt-base and whenever the vertical is tilted down. Do not allow the Tilt Base to support the entire weight of the vertical when horizontal.

You need to support the vertical section to allow placement of the capacity top hat at the very top of the vertical with out the capacity hat tubing hitting the ground. Each tubing section is 72" long, so the end of the vertical will need to be at least 72" off the ground.
Assembling the Vertical Element Sections

**Note:** All the measurements given in this manual should result in the fully assembled and extended vertical resonating at approximately 3.5 MHz. By omitting the uppermost 1-1/2” diameter tubing, the antenna will resonate at approximately 3.8 MHz. If omitted, this tubing section and the extra 1-3/8” diameter short splice section should be stored for future use.

**Note:** DXE-P8A - Penetrox™ A Anti-Oxidant should be used between all antenna element sections. Penetrox™ A 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.

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.

   Deburring is a finishing method used in manufacturing. Our aluminum tubing is machine cut on both ends and machine slit on one end. Although DX Engineering manufactured aluminum tubing is deburred, you should further assure that there are no ragged edges or protrusions.

   Use the DXE-22166 Slim Grip Deburring Tool, or the DXE-22600 Deburring Tool with Extending Handle and Extra Blades for this operation.

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 DXE-P8A Penetrox™ A is highly recommended. Penetrox™ A is an electrical joint compound which effects a substantial electrical connection between metal parts such as telescoping aluminum tubing or other antenna pieces. Using Penetrox™ A 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.

Assemble the vertical element sections in an area that is flat and has sufficient room for the length of the antenna (43 feet) during assembly. Lay the tubing out in descending OD sizes. Orient the slits in the tubes toward the top of the antenna. The bottom 2-1/8" section has slits at both ends. All the sections are 6 ft long. You also have an 8 inch section of 1-3/8" tubing which will be used to join the top two 1-1/2" sections together.

Locate the hardware pack containing eight element clamps. Refer to Figure 10 for clamp sizes and placement. Slide all the clamps over each section before putting them together. You can lightly tighten the clamps in each section to hold them until needed. Align the element clamp screws on each element to face the same direction. At final assembly, body of the element clamp should be positioned between the slits in the tubes and 1/8" from the edge of each tube as shown in Figure 9.

Using Figure 10 on the next page for dimensions, assemble the 1-1/2" element sections with slits at both ends to the 1-1/2" element section with slits in one end using the smaller 1-3/8" OD 8" tube. Insert the 8" tube 4" (as marked) into the slit ends of both top section 1-1/2" tubes and tighten the clamps.

Making sure dirt or grass does not adhere to the elements to be joined, insert the marked end of the 2" element into the 2-1/8" bottom element until the 4 inch mark on the 2" element is even with the top of the larger element section. Position the element clamp at the very end, but not hanging over the edge. Make sure the body of the element clamp is positioned between the slits and tighten securely. Repeat the procedure with the marked end of the 1-7/8" element and the 2" element using another element clamp. Refer to Figure 10 for clamp sizes and placement. Continue mating the smaller elements inside the larger ones. Double-check the vertical element sections you have just assembled. They should measure 43 ft in overall length.
Figure 10 - 80VA-3
Element Dimensions
Mating the Vertical Element Sections to the Tilt Base

**CAUTION:** Attempting final assembly without proper precaution can be dangerous.

You should have someone help you steady the vertical antenna sections during mating with the base section.

**Note:** A pair of sawhorses or ladders should be used to support the vertical sections during assembly with the tilt-base and whenever the vertical is tilted down. Do not allow the tilt-base to support the entire weight of the vertical when horizontal.

You need to support the vertical section to allow placement of the capacity top hat at the very top of the vertical with out the capacity hat tubing hitting the ground. Each tubing section is 72" long, so the end of the vertical will need to be at least 72" off the ground.

Mate the vertical element sections to the base element tube section by sliding the bottom 2-1/8" element of the vertical over the 2" base section element tube until it is just above the top U bolt of the insulated channel. See Figure 10. The two element sections will have a snug fit, so use a small amount of Penetrox A on the bottom element section to make the fit easier. Slide the element clamp down to the edge of the bottom section, between the slits, and tighten. For fine tuning, there is 16" of adjustment that can be done between the base element and the vertical element sections. The resonant frequency will decrease about 60 to 80 kHz by moving the vertical element section up the base element tube. See Tuning the Vertical.

**Top Hat Assembly**

The top hat is a critical part of the antenna. Careful attention to detail will result in the vertical antenna having the best performance possible. All hardware should be tightened securely with the correct size tools.

The patented hub and plate are assembled on an eight inch section of 1–3/8” OD aluminum tubing. The final assembly of the top hat aluminum tubing and wires around the circumference should be done on a flat surface or using a roof antenna tripod (as used for FM or TV antenna mounting) as a temporary fixture. We found the tripod to be the most convenient. The finished top hat assembly will be 12 feet in diameter, so you must have a clear area in which to work.

**Plate to Hub Assembly**

The plate should be assembled to the hub using the three 1/4-20 hex head bolts, flat washers, split washers and nuts as shown in Figures 11 and 12. Place a flat washer under the bolt head on top and another on the bottom with a split washer and nut. Tighten securely.

Pre-assemble the three 1/4-20 socket head cap screws by first threading on a hex nut fully. Then place a split washer then a flat washer over the threaded portion and insert it into one of the holes in the side of the hub as shown in Figure 14. As it comes through the hole, place a 1/4” square nut
in the slot and thread the bolt assembly into the square nut until the threads begin to show inside. Moving a third of the way around the hub, install another cap screw in the same manner. Repeat a third time until they are all installed and are equally spaced around the hub.

Locate the 8 inch length of 1-3/8” O.D. tubing. Insert one end into the plate and hub assembly until approximately 1-1/2” is showing above the top of the plate. Evenly tighten the cap screws while keeping the tubing centered in the hub. Tighten them very snugly, but do not crush the tubing. Using a 7/16” end wrench, then tighten the hex nuts to compress the split washers as shown in Figure 12. This will “jam” the bolt and keep the hub securely fastened to the tubing.

![Figure 11 – Top of plate](image1)
![Figure 12 – Bottom of hub before tightening](image2)

**Top Hat Tube to Plate Assembly**

Locate the six short pieces of 1/2” tubing. You will note that the holes are different sizes from one side to the other. The larger hole will provide clearance for the head of the #6-32 cap screws which will be totally inside the tubing. Locate the hole nearest one end and insert a cap screw through the clearance hole in the tubing. Following the assembled view in Figures 13 and 14, insert the screw from the top through one of the slotted holes nearest the center of the plate in one of the six locations. On the bottom side, install a #6 flat washer and Nyloc locking nut. Tighten it to the point that it is almost snug, and proceed to install the remaining five tubes in the same manner.

![Figure 13 – Top of hub/plate assembly](image3)
![Figure 14 – Bottom of hug/plate assembly](image4)
Top Hat Tubing and Wire Final Assembly

At this point, it is advisable to use a 3 foot roof antenna tripod (Figure 15) to hold the top hat hub, plate and tube assembly for final installation of the six rods and surround wires. When you are through, you will have a 12 foot diameter top hat which can be unwieldy at best if constructed on the floor or ground. If you use a tripod, temporarily insert the topmost section of 1-1/2" tubing from the antenna into the tripod clamps and lightly tighten them.

Insert the hub, plate and tube assembly into the top of the 1-1/2" tube as shown in Figure 16. No clamp is necessary for this assembly procedure. If assembling on the ground, follow all the same steps below.

Figure 15 – 3 ft. Tripod and mast

The top hat 3/8" OD tubing sections have holes drilled near each end. The ends with the holes approximately 1-1/2" from the end will be inserted into the tubes on the hub and plate assembly. Note that these holes are different sizes from top to bottom of the tubing. Like the hub tubes, the larger hole faces upward to allow clearance for the head of the cap screw. Insert one of the pieces of tubing into one of the hub tubes so the larger hole is lined up with the unused hole in the hub tube and the plate. Insert a #6-32 cap screw through the holes, and fasten with a flat washer and Nyloc locking nut. Tighten loosely until final assembly of the surround wires. Install the remaining five top hat tubes in the same manner. The heads of the cap screws should be totally inside the tubing.

Slightly loosen all 12 cap screws holding the tubes to the plate so they will slide back and forth in the plate slots for adjustment in the following section. The assembly will appear as in Figure 17.
Install a #6-32 cap screw with star washer and nut at the end of each top hat tubing as shown in Figure 18. Tighten very securely. Locate the six top hat wire assemblies and install them on these screws from tube to tube using the #6 Nyloc locking nuts as shown in Figure 19. Tighten securely.

The surround wires will normally have some slackness to them, depending on the overall dimensional tolerance of all the parts in the assembly. You may adjust this slackness by sliding the top hat tubes in and out from the center of the hub and plate assembly as far as the slotted holes will allow. When the desired tightness is obtained, you may then securely tighten all 12 Nyloc locking nuts which secure the top hat tubing to the hub and plate assembly.

Place the black vinyl cap on the top of the center tubing. You may require a liquid soap lubricant to help since it will be very tight. This completes assembly of the top hat.
**Top Hat and Vertical Radiator Assembly**

The top hat, with its 1-3/8" OD tubing, should now be assembled to the vertical tubing assembly - which should be resting on a ladder or other support. Remember, it must be at least 72" off the ground to allow clearance for the top hat. Insert the top hat tubing into the top section of the vertical at least 4". Using the last remaining clamp, tighten the clamp around the top of the 1-1/2" tubing to secure the top hat in place.

**Raising the Vertical**

It is strongly recommended that you have help when you raise this antenna. The Tilt Base certainly makes it easier however, this antenna is 43 feet long and can be challenging to put up the first time or with gusty winds. If you have properly laid out your guy system in advance, they will help keep the vertical stable as you raise it – and stop you from going beyond vertical at the apex of the lift.

Make sure the guy ropes are in the clear before you begin. It maybe helpful to tape over the element clamps to keep the ropes from getting hung on them as you raise the antenna. Starting from the top of the antenna, walk it up slowly using an overhead hand-over-hand motion, maintaining a slow and steady pace. It is recommended to have someone pulling on the back guy ropes for additional help in raising the antenna. A push-up pole constructed of an 8 or 10 foot 2" x 4" board with small boards nailed to each side of one end in the form of a fork may be used to push up the antenna during the first stages of raising it.

The antenna mounting channel must be kept in alignment with the Tilt Base plate to prevent binding until it is positioned in the Tilt Base. Once the antenna is vertical, slide the antenna to the left, toward the Tilt Base mounting pipe to allow the two parts of the Tilt Base to line up and drop down into the slots. Lightly tighten the top flange nuts on the Tilt Base to hold the antenna.

**Note:** As you raise the antenna to the vertical position, it’s important to maintain the alignment between the antenna mounting channel and the Tilt Base backing plate to minimize binding. Make sure the lower Tilt Base bolts are not excessively loose before raising. They should be first tightened securely and then backed off no more than 1/2 turn.
Feedline Connections

The most efficient way to connect the feedline to the antenna is through the optional DXE-112-KIT Chassis Mount Socket and the optional DXE-RADP-3 Radial Plate included hardware as shown in Figure 20. Solder a customer supplied 12-14 gage wire on the rear of the chassis mount socket. Make the wire long enough to allow tilting of the antenna without binding the wire. At the other end of the wire solder a ring terminal to connect to the antenna feedpoint hardware.

Figure 20 - Feedline connection using the DXE-112-KIT

Included with the vertical is the DXE-VMN-1 Vertical Antenna Matching Network. The DXE-VMN-1 is custom designed for use with base-fed quarter wave monoband resonant vertical antenna systems. In some vertical antenna installations with excellent radial systems, achieving the best SWR on a resonant vertical for 80 meters may be difficult without some means of adjusting feedpoint impedance. The DXE-VMN-1 allows easy adjustment for lowest SWR. As an added benefit, the DXE-VMN-1 will also bleed off any static build up from the vertical antenna (snow static, precipitation static, etc.).

The DXE-VMN-1 aids in tuning a low impedance antenna to the minimum SWR in the customer selected portion of the 80 meter band. The #12 AWG coil wire is tin-nickel plated for high power handling, corrosion resistance, ease of soldering and long term reliability.

The DXE-VMN-1 is installed across the feedpoint (from the feedpoint to the Radial Plate) as seen in Figure 21. Use the wire with the ring lug to connect the DXE-VMN-1 to the antenna feedpoint connection. The other connection is made through the “L” bracket to the Radial Plate.
The “L” bracket is mounted to existing radial wire hardware as shown above.

Figure 21 - DXE-VMN-1 Vertical Antenna Matching Network shown on the optional DXE-RADP-3 Radial Plate with the optional DXE-112-KIT Chassis Mount Socket
Tuning the Vertical

It’s best to use an antenna analyzer for determining antenna resonance. Use the X=0 and +/- j0 readings to determine the resonant frequency. The SWR will be adjusted by the impedance matching assembly mounted at the feed point once the vertical is resonant at the desired frequency. Do not use the DXE-VMN-1 for changing the resonant frequency, initially tune the antenna without the DXE-VMN-1 (remove the connection at the radial plate and isolate it. Do not let the “L” bracket touch the radial plate).

When the antenna is tuned, re-connect the DXE-VMN-1 assembly to the Radial Plate and you can now fine tune by adjusting the tap setting.

Connect the Tap Clip in the Base Matching Network at the 6th or 7th turn from the top as shown and proceed as follows:

Adjust the tap clip by moving the tap clip to a different coil turn on the DXE-VMN-1 Coil for minimum SWR on 80 meters. Disregard any frequency shift of the points of lowest SWR on this band at this time.

Recheck the lowest SWR. If the SWR is higher move the tap clip on the Base Matching Network Coil to a position that gives the best SWR on the 80 meter. Securely tighten the tap clip when done.

The 80VA-3 should resonate at approximately 3.50 MHz with the capacity top hat in place, the impedance matching assembly at the feed point, the recommended ground radial system installed and the vertical dimensions as shown in Figure 10. Resonance is adjusted by the length of the vertical element sections.

If you are having trouble achieving resonance, make sure the element section lengths are correct and the top hat has been properly assembled. Make sure you have at least 16 radials (32 are better), 65 feet long, symmetrically placed around the vertical. A very low SWR might indicate a poor ground radial system. Our test vertical employed 32 radials, 65 feet long. The difference in resonance from 16 to 32 radials is about 30 kHz.

For the vertical to resonate around 3.80 MHz, simply remove the top 6 ft element section of 1-1/2" OD tubing (and the 8" long coupling tube) and replace the top hat. Quick changes between the SSB phone and CW DX frequencies can be made by lowering the antenna and removing/replacing this section.

The antenna resonant frequency may be centered at any point between these frequencies by merely adjusting the overall length. To raise the base resonant frequency, shorten the element tubing stack. Adjusting the vertical base measurement in Figure 10 will move the resonant frequency 20 to 30 kHz. Measurements are taken from the bottom of the base element tube to the first vertical element.
section. To ensure sufficient nesting of the base tube, do not go beyond 29” of separation. The more of the base element tube that is nested, the stronger the bottom section will be. For maximum strength, the base section can be nested until it is slightly above the top clamp on the tilt-base. If a larger excursion is desired, the antenna should be lowered and the length adjustment made to the highest element section. As a rule of thumb, one foot of length should be approximately 50 kHz in frequency. A shorter antenna length = higher frequency and a longer antenna length = lower frequency. Connect the Base Matching Network Assembly and adjust the inductance by changing the tap connection and watch for a change in SWR to obtain the best impedance match.

Once final tuning is complete and you have verified correct operation on-the-air, the **DXE-VMN-1** coil tap should be soldered in place to eliminate any future intermittent connection due to environmental corrosion to the coil taps.

**Appendix A: Optional Ice Kit for Capacity Hat**

The **DXE-80VA-2AK** ice kit is recommended for geographical areas prone to freezing rain and ice conditions. It will provide additional mechanical support for the capacity top hat, and will lower the antenna’s resonant frequency by only 20 kHz. It is also suggested for additional support in high wind areas.

The ice kit is comprised of Dacron polyester antenna rope and associated hardware for complete installation on an existing **DXE-80-VA-3** antenna with top hat. It provides guy rope support for the six top hat tubing sections. The additional weight of ice is then transferred to the main antenna.

The kit includes a short piece of tubing – which mates with the top of the vertical antenna tubing – to extend the length and provide an anchor for the top hat support ropes. A rugged patented hub assembly and patented UV protected links attach to cushioned clamps around the top hat tubing with the Dacron polyester rope.

**Appendix B – Optional DX Engineering Radial Plate**

Using a patented Radial Plate greatly simplifies mounting radial wires in a vertical installation. The **DXE-RADP-3** stainless steel Radial Plate contains enough stainless hardware sets to attach 20 radials. **DXE-RADW** - Radial Wire Kits and Components contain everything you need to make your own radials, including steel or biodegradable lawn staples to hold the wire down, are also available.

The best way to connect the feedline to the radial plate and vertical feed point is to use a **DXE-112-KIT** Chassis Mount Socket.

A **DXE-SSVC-2P** V-Clamp is needed to secure the radial plate to the vertical mounting pipe.

The radial plate should be mounted to the vertical mounting pipe before the tilt base and vertical base section. It should be as close to the ground as possible, while still allowing access to the radial wire hardware for tightening.
Optional Items

**DXE-RADP-3 - Radial Plate, Stainless Steel with 20 Sets of SS Radial Attachment Hardware**
The DX Engineering patented Radial Plate is meant for those of you that have or are building a quarter wave vertical antenna and who want an easy, neat and effective way to connect those essential radial wires and the coax to your vertical antenna for the lowest takeoff angle and strongest signals. DX Engineering Radial Plate is laser cut from tough stainless steel so that it has smooth edges, won’t corrode and will always look good. You will be proud of how good your installation looks. This plate will work perfectly with most commercially available vertical antennas such as the Hustler® BTV series (4-BTV thru the 6-BTV), the SteppIR™ (BiggIR or SmallIR) or one of your own construction.

**DXE-SSVC-2P - Stainless Steel V-Clamp for steel pipe, 2 inch V-bolt**
This V-Clamp is made in one size that fits Steel tubing or pipe from 1” to 2” OD as used in antenna construction. The supplied V-bolt is long enough to attach tubing to thick plates and is made with anti-corrosive properties. The special Stainless Steel saddle has serrated teeth will clamp to the pipe securely by biting into the surface. For this reason, it is not recommended for softer aluminum tubing or pipe. Ideal for fastening a radial plate and antenna mounting to a steel pipe.
- Used to clamp 1 to 2” (OD) steel tubing or pipe
- Designed for attachments that don’t require resistance to torque
- V-bolt and saddle made from high-strength 18-8® stainless steel
*The use of an anti-seize compound is HIGHLY recommended to achieve proper torque and prevent galling.*

**DXE-112-KIT - SO-239, Chassis Mount Socket, Teflon® Insulation** -
Chassis mount with Teflon® insulation for high power situations. Packaged with the correct stainless bolts, flat washers, star washers and Nyloc locking nuts.
- Teflon® insulation
- Stainless steel hardware
- Nyloc nuts

**PTX-81343, DXE -NSBT8 - Anti-Seize & Never-Seez®**
An Anti-seize compound MUST be used on any Stainless Steel nuts, bolts, clamps or other hardware to prevent galling and thread seizure. Any of these products can be used for this purpose.

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>PTX-81343</td>
<td>Anti-Seize, 1 oz. Squeeze Tube</td>
</tr>
<tr>
<td>PTX-81464</td>
<td>Anti-Seize, 8.5 oz. Aerosol Can</td>
</tr>
<tr>
<td>DXE-NSBT8</td>
<td>Never-Seez®, 8 oz. Brush Top</td>
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</tbody>
</table>

*These products are limited to domestic UPS Ground shipping only*

**DXE-P8A - Penetrox™ A Anti-Oxidant - 8 oz Squeeze Bottle**
Use Penetrox™ A electrical joint compound to affect a substantial electrical connection between metal parts such as telescoping aluminum tubing or other antenna pieces. Ensures high conductivity at all voltage levels by displacing moisture and preventing corrosion or oxidation. For Aluminum to Aluminum, Aluminum to Copper, or bare conductors. Not recommended for use with rubber or polyethylene insulated wire.
- 8 oz. squeeze bottle

*This product is limited to domestic UPS Ground shipping only*

**DXE-RADW - 500K or 1000K Radial Wire Kits and Components**
To achieve optimal performance with a ground-mounted vertical, install as many radials as possible. These bulk radial wire kits use insulated wire that is UV resistant, hard to see and lays down easily, unlike the wire that is commonly available at the big box stores. It will last much longer in contact with soil than bare wire.
The DXE-RADW- 500K or 1000K kit provide everything you will need to build the perfect radial system!
- 500/1000 ft. spool of 14 AWG, stranded copper wire with vinyl insulation
- 20/40 lugs
- 100/200 radial wire anchor pins - Eliminating the need to bury your radials!
- Build up to 20/40 radials, 25 feet long

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>DXE-RADW-500K</td>
<td>Bulk Radial Wire Kit, 500 ft Spool of Wire, 20 Lugs, 100 Staples</td>
</tr>
<tr>
<td>DXE-RADW-1000K</td>
<td>Bulk Radial Wire Kit, 1000 ft Spool of Wire, 40 Lugs, 200 Staples</td>
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</tbody>
</table>

**DXE-RADW-500KBD or 1000KBD - Bulk Radial Wire Kits and Components**
To achieve optimal performance with a ground-mounted vertical, install as many radials as possible. These bulk radial wire kits use insulated wire that is UV resistant, hard to see and lays down easily, unlike the wire that is commonly available at the big box stores. It will last much longer in contact with soil than bare wire. The biodegradable anchors allow easy installation of radial wires, and will degrade and disappear in a year or so when they are no longer needed. The DXE-RADW-500 or 1000KBD kits provide everything you will need to build the perfect radial system!

- 500/1000 ft. spool of 14 AWG, stranded copper wire with vinyl insulation
- 20/40 lugs
- 100/200 biodegradable radial wire anchor pins - Eliminating the need to bury your radials!
- Build up to 20/40 radials, 25 feet long

| DXE-RADW-500KBD | Bulk Radial Wire Kit, 500 ft Spool of Wire, 20 Lugs, 100 Biodegradable Staples |
| DXE-RADW-1000KBD | Bulk Radial Wire Kit, 1000 ft Spool of Wire, 40 Lugs, 200 Biodegradable Staples |

**DXE-RADW-20RT/-32RT/-65RT Pre-Assembled, Radial Wire, w/ 1/4" ring Terminals, 20 Pack**

The DXE-RADW Radial Wire Kits include the highest quality 14 gauge stranded copper wire with a relaxed black PVC insulation for easy installation of your radial system. They allow fast and easy installation of your radial ground system, and permit you to mix and match different length to fit the available space. The stranded wire and relaxed insulation mean that the wire will lay flat as you place it on the ground - easy to install! The twenty pre-cut radial wires include 1/4" ring terminals professionally crimped on one end for quick and easy attachment to the radial plate. These Radial Wire Kits are designed for users of vertical antenna systems which have the need for a high quality radial system for optimum antenna performance. The 1/4" ring terminals are machine crimped for maximum grip. Soldering is not required for strength, but is recommended if installed in corrosive environments such as salt spray.

- Packed 20 Radial Wires per package
- 14 gage, stranded copper wire
- Black relaxed PVC insulation
- 1/4" Ring Terminal professionally crimped on each Radial Wire
- 3 lengths to choose from: 20 Ft (-20RT), 32 Ft (-32RT), 65 Ft (-65RT)

| DXE-RADW-20RT | Package of 20 each 20 Ft Radials with 1/4" Ring Terminals |
| DXE-RADW-32RT | Package of 20 each 32 Ft Radials with 1/4" Ring Terminals |
| DXE-RADW-65RT | Package of 20 each 65 Ft Radials with 1/4" Ring Terminals |

**DXE-STPL - Radial Wire Anchor Pins, 100/pack - No need to bury your radials!**

DX Engineering Radial Wire Anchor Pins are perfect for fastening radials below the grass line to eliminate the risk of damaging your radials during lawn maintenance.

- 100 count - 6" Pins
- 11-Gauge

| DXE-STPL-100P | Radial Wire Anchor Pins, 100/pack |
| DXE-STPL-300P | Radial Wire Anchor Pins, 300/pack |

**DXE-STPL-100BD - Radial Wire Staple, Biodegradable, 3”, 100 pack**

DX Engineering DXE-STPL-100BD is a 100-pack of 3” biodegradable anchors that are produced from recycled PLA (Polylactide Resin). Depending on the weather conditions, they will degrade in about a year. They are easily installed and will hold radial wires in place until lawn roots overtake them - and then disappear. Ecologically friendly!

| DXE-STPL-100BD | Radial Wire Staple, Biodegradable, 3”, 100 pack |

**DXE-225RT-20 - Ring terminal 16-14 Wire Gauge, 1/4" hole/20 pack**

This is a set of 20 ring terminals for AWG #14 to 16 wire with a clearance hole for a 1/4" bolt. These are the same crimp terminals supplied with the DXE Radial Wire Kits for #14 Radial and Antenna Wire.
SUM-900031 - Automatic Wire Stripper/Crimper/Cutter, 24-10 Ga.
Our DX Engineering wire stripper uses a spring-loaded design to make quick work of wires ranging from 24 to 10 gauge. Just insert the wire, squeeze the handle, and listen for the click. That’s the sound of another perfect wire stripping job performed in about 2 seconds - a fraction of the time it takes your pocket knife to do the same job. An adjustable wire length guide helps you make uniform strips, and a built-in wire cutter and crimper helps you complete your wiring job.
- Spring-loaded design
- Strips wires ranging from 24 to 10 gauge
- built-in wire cutter and crimper

TES-2155 - 3M Temflex™ 2155 Rubber Splicing Tape.
Conformable self-fusing rubber electrical insulating tape. It is designed for low voltage electrical insulating and moisture sealing applications. For outdoor use, it should be protected from UV deterioration with an overwrap of TRM-06132

TES-06132 - Scotch® Super 33+.
Highly conformable super stretchy tape for all weather applications. This tape provides flexibility and easy handling for all around performance. It also combines PVC backing with excellent electrical insulating properties to provide primary electrical insulation for splices up to 600V and protective jacketing.

DXE-GUY-Kits - Guying Kit for Vertical Antennas
Some vertical manufacturers indicate their antennas do not need guying. During times of high winds or ice loading, some of these verticals may sustain damage or fail altogether. With the small amount of effort needed to install a four point guy system, the risk hardly seems worth taking. A four point guy system provides the best mechanical advantage to reduce wind stress, regardless of direction. A four point guy system is recommended for use with a DX Engineering Tilt Base, because just one of the guy ropes has to be loosened when you tilt the vertical down. The remaining guys help stabilize the vertical in three directions when being raised. These Vertical Guying kits have been designed to be used with ground mounted vertical antenna systems. The guying kits are ideal for fixed or portable installations.

<table>
<thead>
<tr>
<th>DXE-GUY100-KIT</th>
<th>4 - Heavy Duty screw-in earth anchors with eyelets 1 - 100 ft Roll - UV resistant, 3/32 Double-Braided Dacron Polyester Rope SYN-DBR-94-100</th>
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<tr>
<td>DXE-GUY200-KIT</td>
<td>4 - Heavy Duty screw-in earth anchors with eyelets 2 - 100 ft Rolls - UV resistant, 3/32 Double-Braided Dacron Polyester Rope SYN-DBR-94-100</td>
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<tr>
<td>DXE-GUY400-KIT</td>
<td>4 - Heavy Duty screw-in earth anchors with eyelets 4 - 100 ft Rolls - UV resistant, 3/32 Double-Braided Dacron Polyester Rope SYN-DBR-94-100</td>
</tr>
<tr>
<td>DXE-GUY1000-KIT</td>
<td>4 - Heavy Duty screw-in earth anchors with eyelets 1 - 1000 ft Roll - UV resistant, 3/32 Double-Braided Dacron Polyester Rope SYN-DBR-94-1000</td>
</tr>
</tbody>
</table>

DXE-22166 - Slim Grip Deburring Tool
This Slim-Grip deburring tool allows quick and easy removal of burrs left after cutting or slitting aluminum tubing. Useful for most other deburring applications involving aluminum or steel.
- Slim-Grip design allows deburring in hard-to-reach locations.
- Consists of one replaceable blade, handle and pocket clip.
- Blades can be easily inserted and removed.
- DXE-22110 Replacement Blades for aluminum and steel available in packs of 10

DXE-22600 - Deburring Tool with Extending Handle and 2 Blades
Handy for cleaning burrs after cutting or drilling aluminum or steel. This rugged hand tool features an adjustable length blade holder to allow access to burrs deep inside tubing or other hard to reach places. Extremely versatile and handy.
- Includes one blade for aluminum and steel and one blade for cast iron and brass.
- Holder telescopes from 1/2” to 5” for long reach inside objects.
- Handle has storage compartment for spare blades.
- Blade can be inserted at 90° for deburring cross holes.
Technical Support

If you have questions about this product, or if you experience difficulties during the installation, contact DX Engineering at (330) 572-3200. You can also e-mail us at:

DXEngineering@DXEngineering.com

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

Warranty

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