40 Meter Vertical Antenna

DXE-40VA-1

DXE-40VA-1-INS Revision 16c
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Introduction

The DX Engineering DXE-40VA-1 is a self-supporting vertical antenna system that operates over the entire 40 meter band with an SWR of under 1.5:1, yet is less than 24 feet high. It can easily be configured to operate on the 30 meter band with an equally low SWR by simply removing the capacity hat. This vertical uses no traps, coils or linear loading elements to rob power. Designed with 6063 corrosion-resistant aluminum tubing and stainless steel hardware, this antenna is very durable and attractive.

The DXE-40VA-1 vertical antenna system includes the antenna elements, capacity hat, mounting plate and stainless steel hardware and clamps.

Features

- Full band coverage on 40 or 30 meters with SWR under 1.5:1 No Tuner needed
- Bandwidth greater than 750 kHz with SWR under 2:1
- Slow taper for wider bandwidth
- Tunable above and below 7 MHz range for MARS and CAP frequencies
- No Coils or Traps - Maximum Radiation Efficiency
- Power Handling up to 5 kW
- Less than 24 ft overall height

Additional Material Needed, Not Supplied:

- **Antenna Mounting** - Steel tube, 1-3/4" OD, 0.25" wall thickness, 4 feet long. The standard 1-1/4" galvanized water pipe (with its approximate 1.7" 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 electrical connection for aluminum
- **UMI-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 - 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-RAD-1HWK - Stainless Steel Radial Plate Hardware**: Additional 20 Sets of all Stainless Steel Radial Hardware for use with the DX Engineering Radial Plate
- **DXE-RADW** - Radial Wire Kits and Components. To achieve optimal performance with a ground-mounted vertical, install as many radials as possible. These radial wire kits use 14 gage stranded copper wire with a relaxed black PVC insulation 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.
- **DXE-SSVC-2P Stainless Steel V-Clamp. One for the DXE-RADP-3 Radial Plate and one for the DXE-VFCC-H05-A Vertical Feedline Current Choke, if used.**
- **DXE-VFCC-H05-A** - 2/5 kW Vertical Feedline Current Choke for Coaxially Fed 50 Ω HF Vertical Antennas - Prevents unwanted RFI by eliminating feedline current and radiation allowing all power to go to the antenna improving efficiency. Reduces noise or unwanted signals picked-up by the feedline and overcome a less than optimal ground system.
The V-Clamp, used to mount the VFCC, part number **DXE-VFCC-2P**, is not included and must be purchased separately.

- **DXE-8X19-RT** Feed Point Cable and **DXE-363-SST** Bulkhead connector for a clean and quality feedline connection. Not required when using the **DXE-VFCC-H05-A**.
- **Guy Rope and Anchors** – **DXE-GUY200-KIT** contains 4 screw-in earth anchors and two 100 foot rolls of Dacron/polyester rope to guy the **DXE-40VA-1** in four directions. Additional guy rope is available from DX Engineering in several diameters and lengths.

### Optional Equipment

- **DXE-TB-4P Tilt Base** – This patented (US Patent 7,432,875) Tilt Base makes it easy for one person to raise and lower the vertical. All stainless steel construction

### Parts List for the DXE-40VA-1

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty.</th>
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<tr>
<td><strong>Mast Mount Channel</strong></td>
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<tr>
<td><strong>Base Plate</strong></td>
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</tr>
<tr>
<td>1-3/4” / 1-5/8” / 1-1/2” x 24” long</td>
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</tr>
<tr>
<td>Nested Triple Tube Base Section Tube</td>
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<tr>
<td>1/4-20 x 2” Hex Head Bolt</td>
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</tr>
<tr>
<td>Aluminum Spacer</td>
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</tr>
<tr>
<td>1/4-20 Hex nut</td>
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</tr>
<tr>
<td>1/4” Split Washer</td>
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<tr>
<td>1/4” Flat Washer</td>
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<tr>
<td>DXE-SAD-17SS - Saddle Clamp Kit, 1.75”</td>
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<tr>
<td>DXE-CAVS-1P - V-Bolt Saddle Clamp</td>
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<tr>
<td><strong>2” / 1-7/8” Nested Double Tube Assembly</strong></td>
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<td>72” long - Slit both ends</td>
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<tr>
<td><strong>1-3/4” / 1-5/8” Nested Double Tube Assembly</strong></td>
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<td>72” long - Slit one end</td>
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<tr>
<td>1-1/2” x 72” - Slit one end</td>
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<td>1-3/8” x 72”</td>
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<td><strong>DXE-ECL-16SS Element Clamp</strong></td>
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<td><strong>DXE-ECL-24SS Element Clamp</strong></td>
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<td>1.687” Black Vinyl Cap.</td>
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<td>1/4-20 x 1” Hex Bolt</td>
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<td>1/4-20 x 1-1/4” Socket Head Cap Screw</td>
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<td>1/4-20 Square nut</td>
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<td>1/4-20 Nut</td>
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<td>1/4” Fender Washer, 1” OD</td>
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<td>1/4” Flat Washer</td>
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<td>1/4” Split Washer</td>
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<td>Whip Element</td>
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<td><strong>1/4-20 x 1” Hex Head Bolt</strong></td>
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<td>Mast Mount Bar for Pigtail Attachment</td>
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<td>1/4-20 Hex nut</td>
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<td>1/4” Star Washer</td>
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<tr>
<td>1/4” Flat Washer</td>
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<td>#10 Flat Washer</td>
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<tr>
<td>10-24 Hex nut</td>
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</tr>
<tr>
<td>#10 Star Washer</td>
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</tr>
<tr>
<td>10-24 x 1/2” Hex Bolt</td>
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### 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.
Tools Required
Two 7/16” wrenches, (one of them should be open-end)
1/2 inch and 7/16 inch socket and drive
3/16” Allen wrench
Medium size screwdriver or 5/16” nut driver for the element clamps
3/16” and 1/4” nut drivers or wrenches
Tape measure and 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. A minimum of 16 radials 35 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

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 is recommended with a minimum thickness of 1/8” (1/4” preferred) should be used. The standard 1-1/4” galvanized water pipe (with its approximate 1.7” OD) is just fine for this application and can usually be found at your local home building supply store. When using the optional DXE-TB-4P Tilt base a mounting pipe of up to 2” OD may be used. 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.

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 32 feet long, should be used with this antenna. Using 32 radials at 32 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 on the lowest frequency to be used if your plans call for 60 or more radials. DXE-RADW Radial Wire, a stranded 14 gauge relaxed PVC insulated copper wire is suggested for the best results.

The wire radials should placed as symmetrically as possible 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 radial wires can be attached to the vertical using the lower left V-Bolt Saddle nut. The radials must be connected to the shield of your feedline which then connect to the other U-bolt. 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.

Radial wires can be laid on the roots of the grass using DXE-STPL Radial Wire Anchor Pins, or Lawn Staples to hold them down. Using enough of the 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. An article describing this process is available the DX Engineering website www.dxengineering.com in the Tech Info section. Radials can also be buried just under the surface by using a power edger to make a slit in the soil.
Site Selection
Select a mounting location clear from power lines, structures and other antennas by a minimum of 35 feet (added space for the 10 foot safety rule). Consider overhead power lines, utility cables and wires. The further away the vertical is mounted from local noise sources or other metallic objects, which can re-radiate noise and affect the tuning, radiation pattern and SWR, the better. When using the Tilt Base determine the direction you want the antenna to tilt down and make sure there is adequate clearance. There should be sufficient room for a radial system that will extend away from the antenna equally in all directions, if possible.

Assembly

The DXE-40VA-1 shipping box contains vertical element tubing sections, an insulated U-channel, the mounting plate, stainless steel hardware and 6 top-hat rods packaged inside some of the larger element tubing sections. Some of the smaller element tubes may be inside larger ones.

Carefully unbox the antenna and separate the various element tubes. All the element tube sections are 72” long except the base assembly which is 24” long. Remove the 6 top-hat rods from inside the element tubes. Unwrap the U-channel bracket and mounting plate. Separate the individually marked hardware bags and lay them out for easy identification. The vinyl caps for the mounting pipe and top element section should be installed after assembly of the vertical is complete.

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.

UMI-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 DXE-RADP-3 Radial Plate. The standard 1-1/4” galvanized water pipe (with its approximate 1.7” OD) is just fine for this application and can usually be found at your local home building supply store.
Radial Plate to Mounting Pipe

Install the optional **DXE-RADP-3** Radial Plate on the mounting pipe using an optional **DXE-SSVC-2P** stainless steel V-Clamp as shown in **Figure 1**. The standard 1-1/4" galvanized water pipe (with its approximate 17" OD) is just fine for this application and can usually be found at your local home building supply store. 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.

![Diagram of Radial Plate Installation](image)

**Figure - 1 - 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, Star Washer, Flat 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 Radial Wire Kits available. **DXE-RADW-500K/BD** contains a 500 foot spool of 14 gauge PVC insulated black copper stranded wire with 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 PVC insulated black copper stranded wire with 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.

**Base Section**

The base section is made up of an insulated mounting channel, an aluminum mounting plate and the base antenna element section which is a triple-wall tube 24” long, with holes drilled at one end.

Using Figure 3, attach the aluminum mounting plate to the back of the insulated channel. The base hardware kit contains two sets of mounting bolts. Use the four 2” bolts, four flat washers, four lock washers and four nuts to mount the included backing plate. If you have chosen to use the optional TB-4P Tilt Base, refer to the DXE-TB-4P manual. You will be using a smaller mount plate.

**Figure 3**

From the inside of the channel, insert a 1-1/4” bolt with a flat washer through each of the middle four holes, through the backing plate. Put on lock washers, spacers, flat washers and hex nuts. Tighten firmly, but not enough to crush the insulated channel. The spacers are required when using the optional DXE-TB-4P Tilt Base. The spacers are being installed here so they will not get lost.
Locate the short 24" triple wall base section element tube. Make sure the drilled feedpoint hardware mounting holes are aligned. Install a star washer on the 1" bolt, and then insert the bolt through the hole in the triple tubes from the inside, so the threads stick out. Put on a star washer, a flat washer, and nut and tighten securely. Add another star washer, flat washer and nut, but do not tighten. The feed wire attaches to this hardware. Figure 4 shows the completed feed assembly.

*Note: Due to shifting during shipment, some alignment of the triple walls in the base section might be necessary so the holes in all three walls line-up*

![Figure 4](image4.png)

Assemble the short base triple wall element section tube to the inside of the insulated mounting channel using two of the included rounded saddle clamps as shown in Figures 3 and 5. Use the outer upper and lower holes of the channel. The base section tube should extend about 1" beyond the bottom of the insulated channel. Use Anti-Seize on all stainless threads to prevent galling which can give a false feeling of being tight. However, with these clamps, it is not necessary to use excessive torque to get an excellent mechanical connection. Once the lock washer has been flattened out, the clamp is tight enough. Any clamp should be tightened evenly from side-to-side with an equal amount of thread above the nut.

![Figure 5](image5.png)
The feed wire bolt assembly can face either forward or to the rear, depending on how you will connect the feedline. If you are using the optional DXE-8X16-RT pigtail to feed the vertical, orient the feed wire bolt to the rear, facing the backing plate as shown in Figure 6.

**Base Section to Mounting Pipe**

Locate the two V-Saddle Clamps. Assemble them on the mounting plate as shown in Figure 4. We have included an aluminum grounding kit to facilitate making the ground connection to the vertical. (Use is optional unless the DXE-8X16-RT feedline pigtail is used). The kit contains a short aluminum strap, large and small star washers along with a 1/2" x 10-24 bolt, and nut. To install, place the larger star washer from the kit on the right side U-bolt of the lower V-Saddle clamp so it is against the mounting plate. Put the aluminum strap on the U-bolt, then the flat and lock washer and nut. Figure 5 shows the pigtail and aluminum ground strap mounting. To connect the feedline to the pigtail, you will need a DXE-363-SST bulkhead adapter.

If you are not going to use the grounding bracket, the flat washers with the clamps should go against the aluminum mounting plate, then the lock washers and nuts.

The mounting pipe installed in the ground should not extend above the insulated channel. Use Never-Seez® on all stainless threads to prevent galling which can give a false feeling of being tight. However, with these clamps it is not necessary to use excessive torque to get an excellent mechanical connection. Once the lock washer has been flattened out, the clamp is tight enough. Any clamp should be tightened evenly from side-to-side with an equal amount of thread visible above the nut.

![Figure 6 - Completed Vertical Base Mounting Grounding Bracket](image)

*Picture on left shown with optional feedline pigtail*
Assembling the Vertical Sections

**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 in an area that is flat and has sufficient room for the length of the antenna during assembly. Lay the elements out in descending OD sizes of 2", 1-3/4", 1-1/2" and 1-3/8", with the slits in the tubes toward the top of the antenna. All the element sections are 72" long.

The bottom 2" OD element section needs no marking. On the next 1-3/4" OD element section, measure and mark 4" from the end with no slit using a felt tip pen or "magic" marker so it will be clearly visible. Do the same thing with the 1-1/2" OD element section. On the top 1-3/8" OD element section, place a mark 20-1/2" from one end, and 11" from the other end.
Locate the hardware pack containing four element clamps. The **DXE-ECL-24SS** clamps are for the bottom 2” OD element section. Slide the clamps over each element section before putting them together. You can lightly tighten the clamps on the middle of each element section to hold them until needed. Align the clamps on each element section facing the same direction. For final assembly, all the clamps should be positioned close to the top of each element section and the body of the clamp should be positioned between the slits as shown in **Figure 7**.

![Figure 7](image)

Using **Figure 8** on the next page, start the assembly with the bottom 2” OD element section. Insert the marked end of the 1-3/4” OD element section into the 2” OD element section until the 4 inch mark on the 1-3/4” OD element section is even with the top of the 2” OD element section.

Position one of the larger clamps at the very end, but not hanging over. Make sure the body of the clamp is positioned between the slots and tighten securely.

Repeat the procedure using the 1-3/4” OD element section and the marked end of the 1-1/2” OD element section using the supplied element clamp.

Assemble the top 1-3/8” OD element section into the 1-1/2” OD element section using the same procedure and the smaller clamp. As a double check, the length of the top element section from the top of the previous element section should be 51-1/2 ".
Figure 8

Vinyl Cap

Capacitance Hat

1-3/8" OD

51-1/2"

DXE-ECL-16SS
Element Clamp

1-1/2" OD
Slit One End

68"

DXE-ECL-20SS
Element Clamp

1-3/4" OD with
1-5/8" Tube Inside
Slit One End

68"

DXE-ECL-24SS
Element Clamps

2" OD with
1-7/8" Tube Inside
Slit One End

72"

1" Gap from bottom 2" section
to the top U-Clamp on the
Base Section

Base Section: 1-3/4" OD
with 1-5/8" and 1-1/2" inside
This completes the assembly of the vertical section of the antenna. If 30 meters is your intended band of operation, you can do final assembly because *no top hat is needed for 30 meter operation*.

**WARNING:** Attempting final assembly without proper precaution is dangerous. You should have someone help you steady the vertical section during mating with the base section, especially with the top-hat installed for 40 meter operation. Better yet, use a **DXE-TB-4P** Tilt Base to make raising and lowering the vertical a safer, one-person task.

**Mating the Vertical Sections to the Base Section**

Mate the vertical section to the base tube section by sliding the bottom 2" OD element section of the vertical over the base section tube. Slide the 2" OD element section onto the base section until there is approximately 1" from the top of the U-clamp on the base section. Slide the clamp down to the edge of the bottom section, between the slots, and tighten. For fine tuning, if needed, refer to the Tuning Section of this manual.

**Feedline Connections**

The customer supplied coaxial cable feedline is connected to the feedline connection point on the vertical antenna using the **DXE-8X19-RT** Feed Point Cable as shown in Figure 6.

If you are using the optional **DXE-RADP-3** Radial Plate, **DXE-8X19-RT** Feed Point Cable will connect to the Radial Plate using the optional **DXE-363-SST Bulkhead Connector** for a clean and quality feedline connection. Refer to Figure 6 and Appendix A.

If you are using the optional **DXE-VFCC-H05-A** - 2/5 kW Vertical Feedline Current Choke (VFCC) for Coaxially Fed 50 Ω HF Vertical Antennas, the customer supplied coaxial cable will connect to one side of the VFCC. The supplied feedline braid will connect from the VFCC to the antenna as shown in Appendix C.

**NOTE:** For operation on 40 meters, a top hat is used with the vertical section. After building and positioning the top hat, follow the **Mating the Vertical Sections to the Base Section** instructions.
Top Hat Assembly - 40 Meter Operation

The top hat (sometimes called a capacity hat) is used to resonate the vertical for use on 40 meters. It will improve efficiency and provide full band coverage with a SWR below 1.2:1.

The top hat is comprised of a (patented hub, six 60 inch rods, 3 Allen head bolts, 3 regular hex bolts and associated hardware. (US Patent No. 7,321,340).

Assemble 3 sets of Allen head hardware to the hub as shown in Figure 9. Use the holes in the hub without the grooves. The square nuts go to the inside of the hub, with their flat side against the hub. Screw the Allen bolts through the nuts until the threads are even with the surface of the nuts. To prevent interference during assembly with the top section of the vertical, make sure the threads of the Allen bolts do not extend beyond the edge of the nuts. Tighten the lock nuts slightly to hold them in place.

Next, use three hex bolts, nuts, and split washers. Insert the bolts in the hub from the inside, through the holes with grooves. Place two large flat washers on each bolt, against the hub, then a split washer and nut.

You should have 6 tapered rods that make up the top-hat, each 60" long. The larger end of the rods will fit in each pair of grooves on the hub, facing opposite directions and will be held in place by the large flat washers and locking nuts.

Place the hub on a flat surface. Using one pair of rods, put the larger end in each groove, facing opposite directions as shown and tighten the nut that is used as a locking nut. Note the position of the rod ends under the large flat washers. Make sure the rods extend beyond the edge of the large washers, but not beyond the flat surface of the groove. The rest of the rods are assembled in the same way, except the rods should be staggered from top to bottom so that they do not touch each other as they cross. As a final check, make sure the Allen bolts are not extending beyond the edge of the square nuts inside the hub.
Installing the Top Hat – 40 Meter Operation

Note: You need to support the vertical section to allow placement of the top hat at the top end of the vertical without hitting the ground. Each top hat rod is 60" long, so the top of the vertical will need to be at least 60" off the ground to complete assembly.

The top-hat assembly attaches to the top section of the vertical using the 3 Allen head bolts. You will need a 3/16" Allen wrench to tighten these and a 7/16" open end wrench for the lock nuts.

Install the top hat approximately 11" from the top of the antenna as shown in Figure 8. Tighten firmly but avoid crushing or distorting the top element section.

Tuning the Vertical

The use of an antenna analyzer such as the MFJ-259 can make adjustments easier. Use the X=0 and +/- j0 readings to determine the resonant frequency. Use a short piece of coax between the vertical and the analyzer when making measurements. If you don’t have an analyzer, you can use the SWR indicator of your radio or tuner.

With no top-hat, the vertical operates over the entire 30 meter band with an SWR of under 1.2:1 using the indicated section lengths. Local conditions, including proximity to structures, other antennas, the number of radials, or personal preference may require a slight re-adjustment of the top element section length to achieve resonance in the center of the band. Adjust the top element section slightly longer (lower frequency) or shorter (higher frequency) as needed. With a 2:1 SWR bandwidth in excess of 750 kHz, this vertical easily covers either band entirely and can be easily adjusted to cover nearby MARS and CAP frequencies. No tuner is needed.

For 40 meters, adjust the top-hat hub up or down to fine-tune the center resonant frequency. Move the hub in 1" increments at a time. You will change the resonant frequency about 10 kHz per inch of adjustment. NO adjustment of the vertical top element section is needed.

If you are having trouble achieving resonance on either band, make sure the element section lengths are correct and they have been properly assembled. The radial system affects the tuning as well. Make sure you have at a minimum, 16 radials, 32 feet long, symmetrically placed around the vertical. In-fact, a very low SWR might indicate a poor ground radial system.
Appendix A – Optional Radial Plate

Using an optional Radial Plate greatly simplifies mounting radial wires in a vertical installation. The DXE-RADP-3 stainless steel patented 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 lawn staples to hold the wire down, are also available.

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 65 Ft lengths.

In order to connect a coax feedline to the vertical, you will also need an SO-239 connector to use with the Radial Plate. This will also provide a means to ground the feedline shield to the radial system and make a connection to the vertical. The DXE-112-KIT has the SO-239 and stainless mounting hardware needed. You must supply a short piece of 14 gauge copper stranded wire and lug terminal to run from the connector to the vertical as shown in Figure A-1. Stranded wire is flexible, which works best, especially if you are using or will use a Tilt Base. You will also need a V-Clamp, such as the DXE-SSVC-2P to secure the Radial Plate to the vertical mounting pipe. Alternate feedpoint connections are available as shown in Appendix C.

The Radial Plate should be mounted to the vertical mounting pipe before the 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 DXE-RADP-3 Radial Plate shown mounted to customer supplied mounting pipe using an optional DXE-SSVC-2P V-Clamp.](image)

If connecting your coaxial cable direct to the Radial Plate, you can use the Optional DXE-112-KIT SO-239, Chassis Mount Socket, Silver Plating, Teflon® Insulation. A short piece of customer supplied feed wire would be required from the SO-239 to the antenna feedpoint hardware.

When using the optional DXE-VFCC Vertical Feedline Choke, this bulkhead connector is not used. Your coaxial line will connect direct to the VFCC.
Appendix B – Optional Tilt Base

You may wish to add a DXE-TB-4P Tilt Base so your antenna may be quickly and easily lowered for maintenance or severe weather. The stainless steel Tilt Base makes raising and lowering the vertical a one-man operation.

If you are upgrading your existing DXE-40VA-1 installation, the Tilt Base will use some of the hardware that originally came with your vertical.

*Note: The optional DXE-RADP-3 Radial Plate must be placed over the mounting pipe before installing the Tilt Base.*

If you are installing the Tilt Base option on a new antenna installation, you will replace the larger mounting plate with the smaller mounting plate included with the DXE-TB-4P.

If your vertical is already installed, you will have to disassemble it. Remove the vertical section from the base section by loosening the bottom element clamp and lifting it off. *(Be careful. Please have someone help you).* Loosen the two V-Bolt saddle clamps and remove the base section from the mounting pipe. Remove the base tube section from the insulated channel. Remove the aluminum backing plate from the insulated channel. You will use the 2" bolts, flat washers, spacers, split washers and nuts. The 2" bolts must be used to attach the insulated channel to the backing plate and subsequently, the Tilt Base plate.

Refer to the DXE-TB-4P Tilt Base manual for installation details and Tilt Base operation.

Feedline Connections When Using the Tilt Base

Connecting a feedline to the vertical when using a Radial Plate and Tilt Base can be easily done by using the DXE-112-KIT. This kit has the SO-239 connector and stainless mounting hardware. You must supply a 10" piece of 14 gauge copper stranded wire and a lug terminal to run from the connector to the vertical as shown in Figure B-6. Stranded wire is flexible and works best. We recommend crimping and soldering the wire to the wire lug. The SO-239 connection requires soldering.

Connect the feedline pigtail from the Radial Plate to the vertical base section. Loosen and remove the outer nut, put the star washer on first, then the pigtail wire lug, then a flat washer, then the nut. Orient the lug so the flat side is toward the flat washer. Leave this nut loose until the antenna has been tilted-up to the operational position. *(Loosening this connection when tilting the antenna down reduces the stress on the solder joint. Don’t forget to re-tighten before using!)* Figure B-6 shows the correct orientation.

If you do not have a Radial Plate and you are using the Tilt Base, connecting the feedline is a bit more challenging. The connection to the vertical has to be flexible to accommodate the movement encountered during the tilt-over of the antenna. One suggested method is to use the existing ground bracket,
mounted on the left lower U-bolt. The feedline shield is connected there directly or by using the existing pigtail assembly. The feedline center conductor can be spliced with a flexible stranded wire which has sufficient length to accommodate the tilt requirements. By using a pigtail, you could put wire lugs at either end of the flexible wire and use stainless bolts, star washers and nuts to splice them. Be sure to waterproof those connections.

**DXE-TB-4P - Tilt Base Kit for Ground Mounted 1/4 Wave Vertical Antennas**

The DX Engineering patented Tilt Base mounting plate enables operators to raise or lower an antenna in seconds while leaving the base securely attached to the mounting post. With the Tilt Base, one person can service an antenna—no more climbing ladders, or removing a bracket from the support post. Precision cut from 3/16 in. 304 Stainless Steel, this mounting plate is virtually indestructible. Conveniently mounts to the same mast that you use for the antenna and Radial Plate. Easily make repairs, tune your vertical, or lay your antenna down before bad weather hits with a DX Engineering Tilt Base. **Note:** If you are mounting your Tilt Base to a ground mounted pipe, an additional purchase of two saddle clamps is required to mount the Tilt Base to that pipe. The CAVS-2P clamp can be used with pipes from 1” to 2” OD or the SAD-200A can be used with a 2 inch OD pipe.

**Appendix C – Optional Vertical Feedline Choke**

**Using a Vertical Feedline Current Choke**

The **DXE-VFCC-H05-A Vertical Feedline Current Choke (VFCC)** is used to optimize the performance of many kinds of antenna systems, including verticals. It prevents unwanted RFI by eliminating feedline current and radiation. By eliminating stray currents from the feedline all power goes to the antenna, and any noise or unwanted signals picked-up by the feedline are eliminated, improving efficiency. Using a feedline choke can also help overcome a less than optimal ground system.

**Note:** The **DXE-VFCC-H05-A Vertical Feedline Current Choke cannot be used in multi-element vertical array systems.**

**Figure C-1** shows a **DXE-VFCC-H05-A Vertical Feedline Current Choke** kit, which includes a 2/5 kW Current Choke, an insulated mounting bracket and two pre-drilled feed braid wires. The **DXE-SSVC-2P V-Bolt Saddle Clamp** is not included and must be purchased separately.

After mounting the VFCC, connect the 8-1/2” braid from the feedline bolt on the vertical to the VFCC, making sure you are using the terminal closest to the **red "D"** on **DX Engineering** on the VFCC label. Twist the braid as shown. Connect the 7-1/2” braid from the other VFCC terminal to the closest radial wire bolt on the Radial Plate.

The impedance matching assembly provided with the vertical should be connected across the choke terminals. The SO-239 kit or the bulkhead connector and wire feed pigtail are not used when using the VFCC.

The orientation of the VFCC, Tilt Base and Radial Plate must be as shown to ensure correct operation of the Tilt Base with the VFCC. **Figure C-1: VFCC Mounting (shown with optional equipment)**

The braid must not be able to touch the VFCC case or the impedance matching assembly. Connect your coaxial cable direct to the SO-239 on the VFCC. Do not use the Radial Plate Bulkhead Connector.
Optional Accessory 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 Hutsler® BTV series (4-BTV thru the 6-BTV), the SteppIR™ (BiggIR or SmallIR) or one of your own construction.

**DXE-VFCC-H05-A - 2/5 kW Vertical Feedline Current Choke for Coaxially Fed 50 Ø HF Vertical Antennas**
The Advantages of Using a VFCC:
- Prevents unwanted RFI by eliminating feedline current and radiation
- All power goes to the antenna, improving efficiency
- Reduces noise or unwanted signals picked-up by the feedline
- Overcome a less than optimal ground system
- Bracket isolates the VFCC case from ground for best de-coupling

**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

**DXE-112-KIT SO-239, Chassis Mount Socket, Silver Plating, Teflon® Insulation**
Chassis mount SO-239 with Silver plating and Teflon® insulation for high power situations. Packaged with the correct stainless bolts, flat washers, star washers and Nyloc locking nuts. When using the optional DXE-VFCC Vertical Feedline Choke, this bulkhead connector is not used. Your coaxial line will connect direct to the VFCC.

**UMI-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>
</tr>
</thead>
<tbody>
<tr>
<td><em>UMI-81343</em></td>
<td>Anti-Seize, 1 oz. Squeeze Tube</td>
</tr>
<tr>
<td><em>UMI-81464</em></td>
<td>Anti-Seize, 8.5 oz. Aerosol Can</td>
</tr>
<tr>
<td><em>DXE-NSBT8</em></td>
<td>Never-Seez®, 8 oz. Brush Top</td>
</tr>
<tr>
<td><em>DXE-NMBT8</em></td>
<td>Never-Seez®, 8 oz. Brush Top, Marine Grade</td>
</tr>
</tbody>
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* 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

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

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

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-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.

DXE-3M2155 - 3M Temflex™ 2155 Rubber Splicing Tape.
Conformable self-fusing rubber electrical insulating and moisture sealing applications. For outdoor use, it should be protected from UV deterioration with an overwrap of TRM-06132

TRM-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 guying system, the risk hardly seems worth taking. A four-point guying scheme provides the best mechanical advantage to reduce wind stress, regardless of direction. A four point guying 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.

| DXE-GUY100-KIT | 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 |
| DXE-GUY200-KIT | 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 |
| DXE-GUY400-KIT | 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 |
| DXE-GUY1000-KIT | 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 |

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

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

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