EZ™-Tower

Installation Manual

29 ft. (8.8 m)

For the AIR™ and AIR-X™ Wind Generators

Southwest Windpower, Inc.

Renewable Energy Made Simple

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Chapter 1 Introduction

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Welcome

Dear Valued Customer:

On behalf of all of us at Southwest Windpower, Inc., thank you for choosing our company as the source for your renewable energy system. Southwest Windpower, Inc. is confident that you will be pleased with the performance and quality of our products.

Nearly 3 billion people in the world do not have electricity. By necessity, most will ultimately get their electricity from renewable resources to the benefit of all. You are a pioneer and part of the solution!

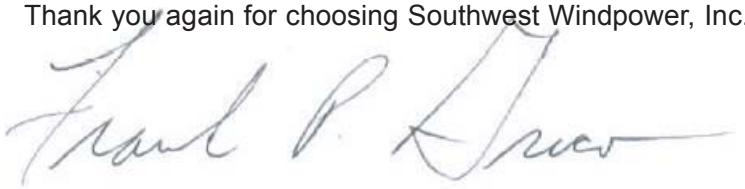
Renewable energy power systems provide independent electric power for boats, homeowners, farms, villages and commercial applications. If utility power is available, your renewable energy system can reduce your electric bill and provide electrical backup during storms or line failure.

Renewable means energy sources that:

- Do not deplete the world's finite fossil fuel resources
- Do not pollute or warm the atmosphere, and
- Do not generate hazardous waste

We hope you will enjoy the benefits of your wind powered electrical system for many years to come.

Thank you again for choosing Southwest Windpower, Inc.



Frank P. Greco,
Chief Executive Officer
Southwest Windpower, Inc.

Southwest Windpower, Inc.

Introduction to the EZ™-Tower

Congratulations! You have just received the simplest, and most economical EZ™-Tower™ available for your AIR™ Wind Generator. This kit is designed to be easy to assemble and erect.

The EZ™-Tower is designed specifically for Southwest Windpower, Inc. AIR-™ Wind Generator, AIR-403™ and AIR-X™ Wind Generators. This guy wire-supported tower uses lightweight tubing while providing plenty of strength. Two people can easily erect this tower in about an hour. Since the wind generator and EZ™-Tower are lightweight, no winches or vehicles are needed to erect the tower.

The EZ™-Tower includes a simple yet effective tower base and anchoring system, which eliminates the need for a concrete pad. Depending on your soil conditions, cement *may be* necessary for proper anchoring. It is important to read this manual first and understand your soil conditions before you begin construction.

Read this manual thoroughly before beginning assembly.
Southwest Windpower, Inc. assumes no responsibility for inaccuracies or omissions. The user of this information and product assumes full responsibility and risk. All specifications are subject to change without notice.

If you have any questions on siting, proper installation or operation, please contact Southwest Windpower, Inc. or your dealer before installation.

Chapter 2 Safety

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- Notice to the Reader 2-1
- Safety Precautions 2-2
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Notice to the Reader

The reader is expressly warned to consider and adopt all safety precautions that might be indicated by the activities described herein, and to avoid all potential hazards. By following the instructions contained herein, the reader willingly assumes all risks in connection with such instructions.

The reader is further warned to pay strong attention to all information boxes emphasized with these special alert symbols:

NOTE

This symbol indicates helpful information.

ALERT

This symbol alerts the reader to follow proper procedures and/or possible damage to equipment.

DANGER

This symbol indicates the presence of electrical shock hazards, situations and/or procedures that may present a danger to personal safety.

Safety Precautions

Southwest Windpower, Inc. systems present mechanical, electrical and chemical (battery) hazards addressed in the following safety messages:

- Obtain all required permits and engineering certifications for your tower and tower location.
- Soil and wind conditions vary. Towers and tower foundations must be designed for your specific location.
- Locate tower so as not to fall on occupied buildings, neighbors' property or power lines.

- STOP! DO NOT climb the tower. Tower climbing is very dangerous.
- Locate the tower mounting mast well away from occupied buildings and power lines. A minimum of 300 ft. (100 m) is recommended.
- If the wind generator sounds or appears loose, or if the tower is making an unusual sound, correct the condition immediately. A loose wind generator or component will incur further damage and/or may fall from the tower.
- Never stand in line with an operating propeller.
- High voltage systems represent a dangerous shock hazard. All high voltage systems should be wired and maintained by a qualified and licensed electrician.
- Use protective gloves when handling guy wires.
- Use protective gloves and safety glasses when working around batteries.

Safe Installation

It is very important to remember that any wind generator has high speed spinning parts and can be very dangerous!

Be sure that all bolted connections are tight and guy wire anchors are suitable for your soil conditions. These elements will be explained in further detail later in this manual.

When installing your EZ™-Tower:

- ***Two people must be present when the tower is raised.*** Have at least two people available during assembly and erection of tower.
- Always wear closed-toe shoes.
- Always wear safety glasses.
- Always wear protective gloves when handling cable.

DANGER

Important! **Choose a very calm day to do your installation. A gust of wind at the wrong moment could cause a very serious accident.**

Chapter 3 EZ™-Tower Parts and Required Tools

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EZ™-Tower Parts

The EZ™-Tower includes:

EZ™-Tower Parts

Description	Quantity
Tower Base	1
21 ft. Guy Wire Set (wire Guy Wire Attachment Plate)	1
30 ft. Guy Wire Set (with Guy Wire Attachment Plate)	1
M10 x 65 mm Bolt	1
M10 Locknut	1
Cable Thimbles	8
Cable Clamps	16
Tower Base Earth Spikes	4
Arrowhead Earth Anchors	4
Earth Anchor Driving Rod	1
1-7/8 inch x 72 inch Tower Tubes	4
1-7/8 inch x 48 inch Tower Tube	1
1-7/8 inch x 42 inch Tower Tube	1

If any parts are missing from the list shown above, call Southwest Windpower, Inc.

Tower Base

Lower Guy Cable Wires - 21 ft. length

Guy Wire Attachment Plates

Upper Guy Cable Wire - 30 ft. length

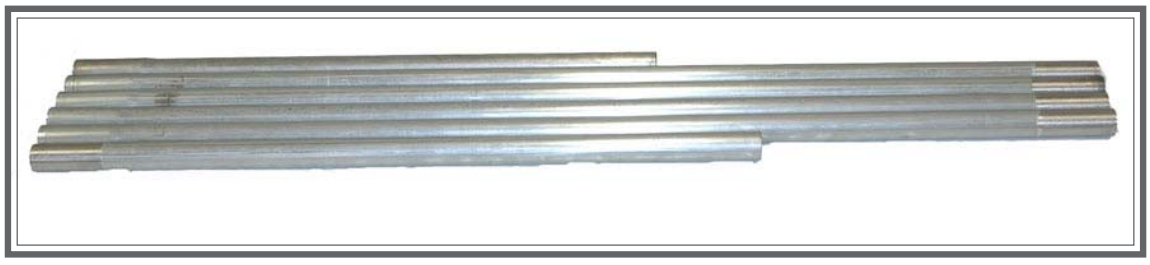
Cable Clamps (16)

Cable Thimbles (8)

Tower Base Earth Spikes

Arrowhead Earth Anchor

Earth Anchor Driving Rod



(1) 42 inch Tower Tube
(4) 72 inch Tower Tubes
(1) 48 inch Tower Tube

Required Tools

Before you begin installation of your EZ™-Tower, be sure you have all parts and required tools.

Required Tools

Description	Quantity
100 ft. Measuring Tape	1
5/16 inch Wrench, Socket or Nut Driver (preferred)	1 or 2
9/16 inch Wrench or Socket	2
10 kg Hammer	1
Mallet	1
Pliers	1
Carpenter's Level	1
Safety Glasses	1 pair for each person
Protective Gloves	1 pair for each person

Chapter 4 Site Selection

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- Topography 4-3
- Barriers 4-3

The information in this chapter gives specifics about the ideal siting of the EZ™-Tower. If your area does not have an ideal location, find the best location possible.

The most important factor in maximizing the performance of your wind generator is proper siting. Remember! The better the siting, the greater the performance of the AIR™ Wind Generator - EZ™-Tower.

Small increases in average wind speeds result in dramatic increases in energy output of the wind generator. For example, an increase in wind speed of 10% (9 mph to 10 mph) results in approximately a 30% increase in the power available from the wind. Therefore, the better the location the better the performance. As a rule, the wind generator should be mounted as high and as far away from obstructions as possible.

Two basic requirements for a good wind generator site:

1. Good average wind speed
2. Low wind turbulence

The lower the turbulence, the less stress your wind generator will sustain, the longer it will last and the more energy it will produce.

Wind Speed

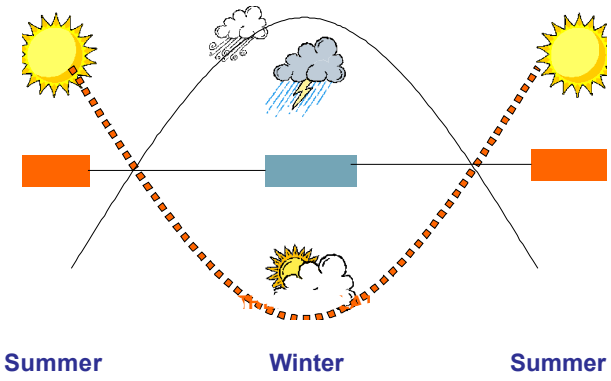
NOTE

Another important element to maximize performance of your wind generator is average wind speed.

Your wind generator will produce energy when there is wind.

Your solar panel will produce energy when the solar is plentiful.

This is typical of seasonal changes. When it is sunny it is calm; when it is cloudy it is windy.



For your wind generator to produce energy, average wind speed at your site should be at least 8 mph:

8 miles/hour = 3.6 meters/second

If winds in your area are less than 8 mph, it is recommended that you install a Photovoltaic (PV) system next to your wind generator creating a hybrid renewable energy system.

Surface Roughness

Rough ground is land covered with small bushes, trees or other obstructions. Smooth land is an area covered only by grass or earth.

- The smoother the ground, the less the friction.
- The rougher the ground the greater the friction, thereby requiring the tower to be higher.

ALERT

It is important to locate your wind generator in an area with as smooth a surface as possible.

Topography

NOTE

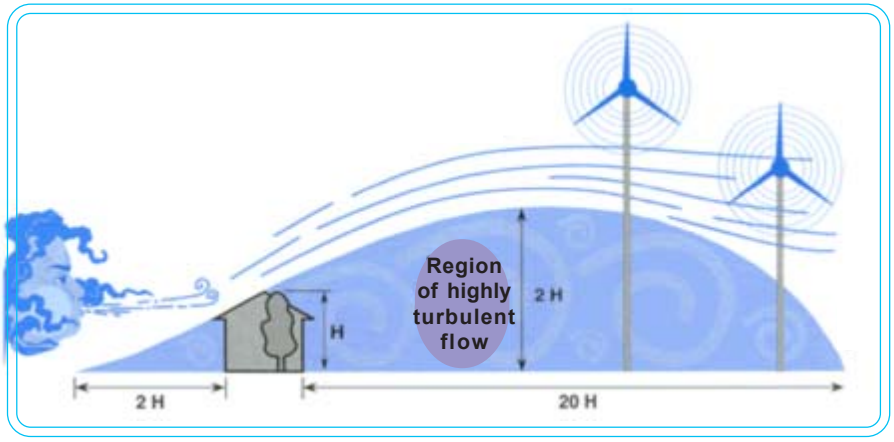
Place your tower on the highest land practical.

If your location is basically flat, topography is not in issue when deciding where to place your wind generator.

There are circumstances where the highest land available may not be the best place for your wind generator. Highest land nearby may be awkward to get to, may be too far away from where you need the power, or may expose your wind generator to potentially damaging turbulent conditions.

Barriers

Barriers (buildings, trees, etc. that impede flow of wind) produce wakes that may extend far downwind of the barrier and to a height considerably above the barrier. These wakes are areas of decreased wind speed and can cause potentially damaging turbulence. Barriers near the wind generator will affect its performance.



ALERT

Keep the following in mind when siting:

1. A tower immediately downwind of a building should be at least 20 ft. (6.0 m) above the height of the building.

2. The tower should be 20 ft. (6.0 m) higher than any barrier within a 500 ft. radius.

Chapter 5 Tower Base and Earth Anchor Layout

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- Tower Base 5-2
- Arrowhead Earth Anchors 5-3
- Soil Type and Recommended Anchors 5-6

When laying out the tower, be sure you have a very calm day, with no wind.

Tower Layout

Overview

The tower is assembled on the ground, then tilted into position. The tower base supports the tower on the ground, and serves as the pivot point to raise and lower the tower.

Two sets of guy wires (an upper and lower set with four wires per set) secure the tower vertically:

- The upper set of guy wires secure the tower at a height of approximately 26 ft. (8.0 m).
- The lower set of guy wires secure the tower at a height of approximately 15 ft. (4.6 m).

Four arrowhead earth anchors (located approximately 15 ft. (4.6 m) from the tower base at 90° intervals) secure the guy wires to the ground. One upper guy wire and one lower guy wire attach to each earth anchor.

Tower Assembly - Hillside

If possible, position the tower to tilt along the incline of the hill, with the top of the tower uphill from the tower base.

Tower Base

Two people must assemble and erect the tower.

1. Locate the area where you will install the tower. Place the tower base on the ground and orient in the direction the tower will be tilted.

2. Have one person stand at the tower base holding a measuring tape.

3. The second person takes the measuring tape *end* and walks out 15 ft. (4.6 m) and in a circle around the tower base.
   - Make sure there are no obstructions along the circumference.
   - Make sure there is sufficient room to tilt the tower into position and install the wind generator.

4. Drive the four tower base earth spikes into the ground toward the center of the base, as shown here.

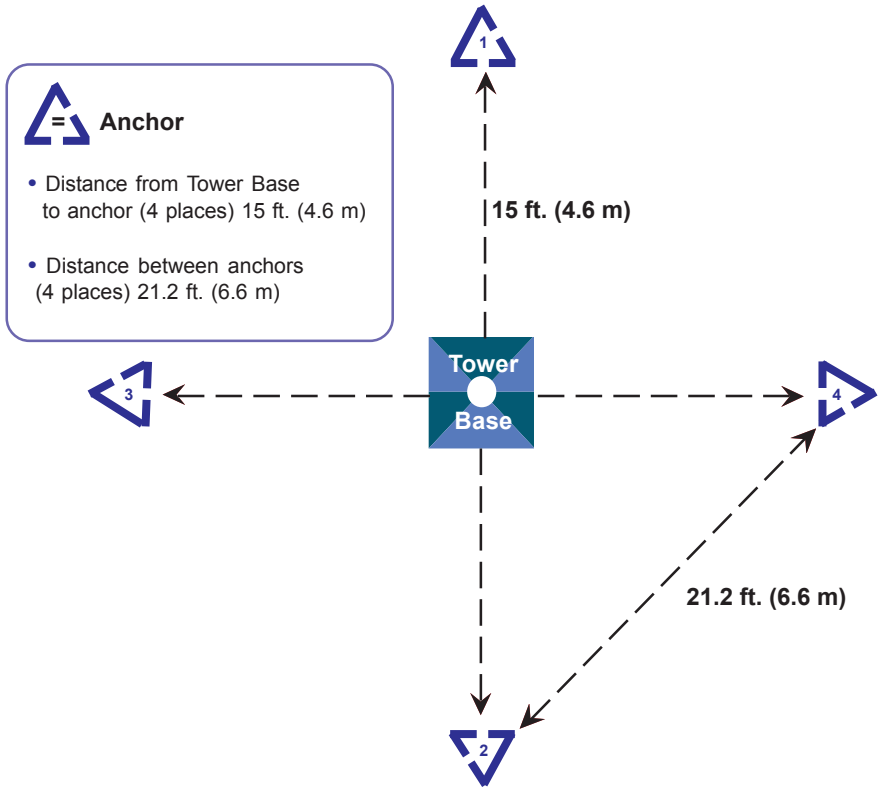
Arrowhead Earth Anchors

1. Position the first earth anchor on the ground along the tower tilt axis, 15 ft. (4.6 m) from the tower base.

2. Place the second earth anchor along the tower tilt axis, 15 ft. (4.6 m) from the tower base in the opposite direction.
   - With the tower base in the center, the first and second earth anchors should form a straight line 30 ft. (9.2 m) along the tower tilt axis.

3. Place the third earth anchor 15 ft. (4.6) from the tower base.

4. Place the fourth earth anchor 15 ft. (4.6 m) from the tower base.
   - With the tower base in the center, the third and fourth earth anchors should form a line perpendicular to the line formed by the first two earth anchors.



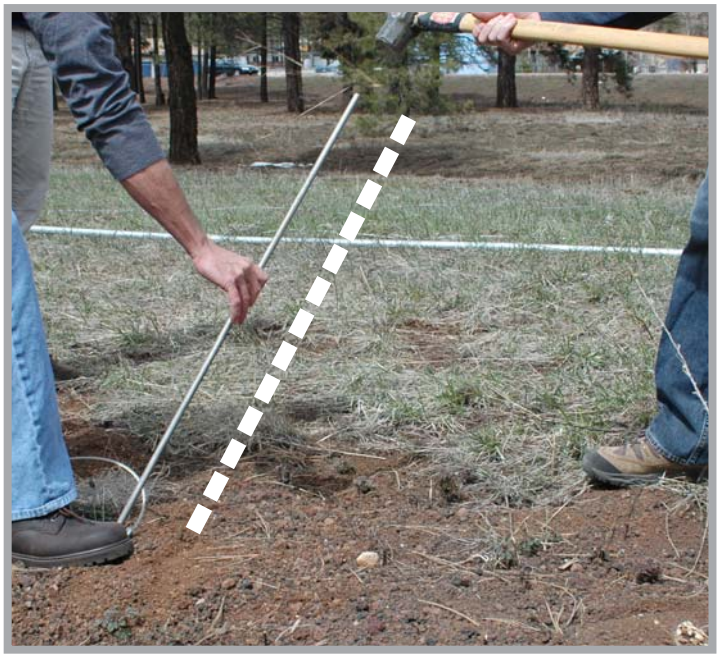
5. Check the position of the earth anchors to ensure that they are within approximately 6 inches (15 cm) of their ideal position.
   - Each earth anchor should be 15 ft. (4.6 m) from the tower base.

6. Insert the beveled end of the earth anchor driving rod into the arrowhead earth anchor, as shown here.

7. Drive the earth anchor into the ground using the earth anchor driving rod and a 10 kg hammer.
   - Notice the angle at which the earth anchor is being driven. This angle is important for maximum pull strength. The angle should be in line with the angle of the guy wire (i.e. the angle should be pointing towards the tower base).

ALERT

Earth anchors must be installed in soil that has been undisturbed.



8. Drive the earth anchor into the ground until 6 inches (15 cm) of cable remains above ground.

9. Then, insert the earth anchor driving rod through the cable eye and pull up with force. You will notice the earth anchor pulling out of the ground slightly. This will lock the earth anchor in the ground.

No more than 12 inches (30 cm) of earth anchor cable should be out of the ground once it has been locked into place.

10. Finish installing the remaining three earth anchors as described above.

ALERT

Although the earth anchor is designed to break through rocks, if there is a rock or obstruction that is too large, remove and relocate the anchor. The depth of the anchor is critical to its effectiveness.

Soil Type and Recommended Anchors

What anchor to be used depends on the soil type. Refer to the Soil Type and Anchor Recommendations table below for suggestions.

Soil Type and Anchor Recommendations

Soil Type	Recommended Anchor	Alternative Anchor
Loose Sand	Cast Concrete (Buried)	None
Loose Gravel	Arrowhead	Cast Concrete (Buried)
Loam	Arrowhead	Cast Concrete (Buried)
Clay	Arrowhead	Cast Concrete (Buried)
Rocky Soil	Arrowhead	Cast Concrete (Buried)
Gravely Soil	Arrowhead	Cast Concrete (Buried)
Solid Rock (Soft)	Large/Long Expansion Bolt	Large Eye Bolt and Cement
Solid Rock (Hard)	Smaller Expansion Bolt	None

If the arrowhead earth anchors included with the EZ™-Tower do not work with your soil conditions, contact Southwest Windpower, Inc. for assistance with an alternative anchor.

Chapter 6 Tower Assembly

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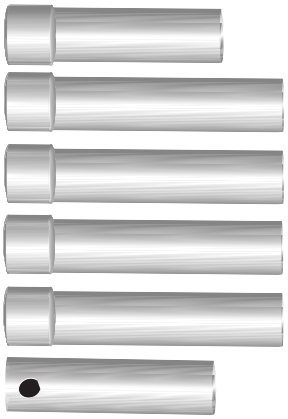
- Tower Tube Layout 6-1
- Attaching the Guy Wires 6-4
- Raising the Tower 6-6

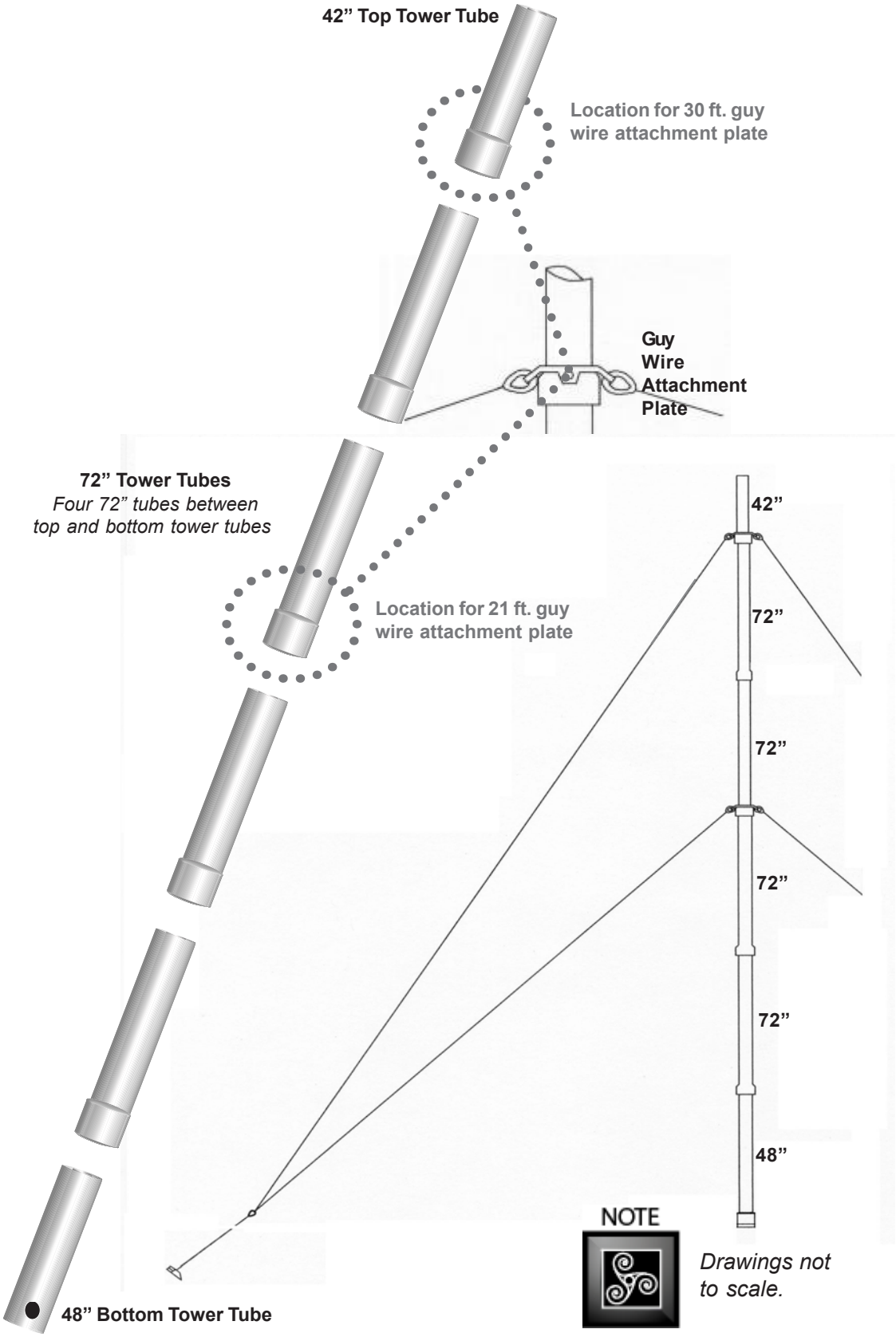
The tower is assembled in several easy steps. If this is a permanent installation, first dig a trench from the base of the tower, to where the battery is housed.

Tower Tube Layout



1. Lay out the six tower tubes on the ground as shown on the following page.

   Leave approximately 6 inches (15 cm) between each tube.



2. With the tubes laid out as shown on the preceding page, slide the guy wire attachment plates over the corresponding tower tubes.

- The expanded end of the tube prevents the guy wire attachment plate from sliding down the tube, and positions the guy wire attachment plate at the correct height.

- Slide the 30 ft. guy wire attachment plate over the top tower tube.
- Slide the 21 ft. guy wire attachment plate over the fourth tower tube from the bottom.

3. Align the guy wire attachment plate so that each guy wire is in line with the anchors.

4. With all guide wire attachment plates in position, electrical wire can be run through the tower tubes. Leave sufficient wire protruding at the top of the tower to connect the wind generator.

- Electrical wire can also be pulled through with a wire snake, after the tower tubes are assembled.
- Refer to AIR™ Wind Generator Operator's Manual (AAS32 - Document #0056) for proper wire gauge selection.

5. Join the tower tubes together using a soft-faced mallet or hammer. Use a piece of wood between the tube and the mallet to protect the end of the tube.

6. Secure the lower tube to the tower base with the M10 bolt and nyloc nut. Tighten the nut until it just contacts the tower base.

Attaching the Guy Wires

1. Orient guy wire attachment plates with their corners pointing *towards* the anchor. If they are not pointing towards the anchor, adjust them before continuing.

2. Uncoil each guy wire bundle and extend them to their respective anchoring point.

   The fourth anchor point is directly under the tower.

ALERT

Be careful not to let the guy wires become twisted when the tower is erected.

3. Begin attaching the guy wires to the earth anchors at the sides of the tower.
   - Insert two cable thimbles in each earth anchor eyelet.
   - Thread an upper guy wire and lower guy wire around its own cable thimble.
   - Loosely attach two cable clamps to each guy wire.

You may need to use pliers to spread open the cable thimbles to install them on the anchors. Use the pliers to press the open end of the cable thimbles back together before attaching the guy wires.

4. Leave about 6 inches (15 cm) of slack in the guy wires, and tighten the cable clamps.

NOTE

The guy wire to the tower should contact the 'saddle' side of the cable clamp. On level ground, there will be approximately 5 ft. (1.5 m) of extra cable.

5. Attach two cable thimbles to the third earth anchor located directly below the tower.

6. Measure the length of the upper and lower guy wires on the side earth anchors. Use the same length for the guy wires on the third earth anchor.

7. Secure the cable clamps to the third guy wire.

8. Place two cable thimbles on the fourth earth anchor. DO NOT connect the guy wires at this time.

9. The fourth set of guy wires are used to help tilt the tower into position. Secure these guy wires *after* the tower is upright.

Raising the Tower

Southwest Windpower, Inc. highly recommends first tilting the tower into position without the wind generator attached, to verify proper installation and operation of the tower.

Ensure that all side and rear guy wires are attached and that all cable clamps are tight before raising the tower!

1. Before raising the tower, have another person ready to assist with installation.

   Be sure to wear gloves when handling the guy wires!

2. One person should push the tower up into position. The other person should pull by the *unattached* upper guy wire.

With the tower off the ground a few feet, make sure that all the wires are coming up cleanly.

Adjusting the Guy Wires

If the guy wires are too tight they may cause the tower to bow as it is raised. If this happens, lower the tower to the ground and reduce the tension on the guy wires.

- Check to see which wire(s) are too tight (the wires act in pairs).
- Release the tension on one of the wires by loosening the 2 cable clamps until the cable can be slid through them
- Let out some cable until there is no tension in the wire.
  It is easy to overtighten the guy wires. Wires should only have the slack taken out with no real tension.

3. Retighten the cable clamps before raising the tower.

4. Once the tower is raised to vertical, attach the last guy wires to their anchor.

5. Now walk a short distance from the tower and look to see that it is straight.

6. Focus on the angle of the tower. Adjust the cables until the tower is straight up and down.

   Use a carpenter's level held against the tower for this.

7. To adjust the angle of the tower, relax one guy wire and tighten the guy wire opposite to it. Repeat this process until the tower is straight.

8. When the tower is straight, make sure that all cable clamps are tight.

9. After all the adjustments have been made, lower the tower.

When the tower is lowered to install the wind generator, undo only the pull-side cables. When adjusting the cables, NEVER loosen both sets of guy wires at the same time. When the tower is re-erected, only those pull-side cables will need to be readjusted.

Chapter 7 Installing the AIR™ Wind Generator

Refer to your AIR™ Wind Generator Operator's Manual for assembly instructions.

Helpful Tips:

- Use the box that your AIR™ Wind Generator was packed in to support the tower when attaching the wind generator.
- A strain relief installed at the top of the tower will help support the wires hanging inside the tower.

DANGER

Proper grounding is very important to protect your AIR™ Wind Generator from lightning and/or other transient voltages.

Southwest Windpower, Inc.

Chapter 8 EZ™-Tower Maintenance

There are no moving parts in the tower, so maintenance is minimal.

However, as part of your annual maintenance, Southwest Windpower, Inc. recommends that several areas are inspected to ensure long term integrity of your EZ™-Tower.

- Check guy wire condition. Inspect for wear and fraying at the guy wire to earth anchor connection points.
- Check guy wire tension. Guy wires should have uniform tension. Wires should be free of slack, but not overly taut.
- Check all bolts for tightness.
- Check cable clamps and pivot bolt.
- Check any unusual noises or vibrations. Investigate and correct as necessary.


Southwest Windpower, Inc.