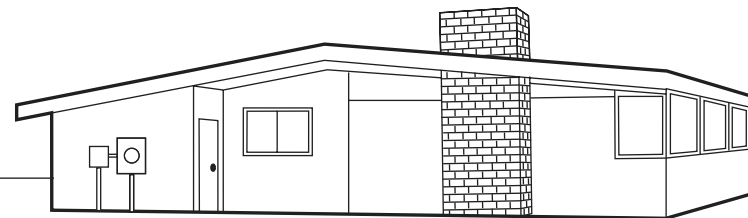
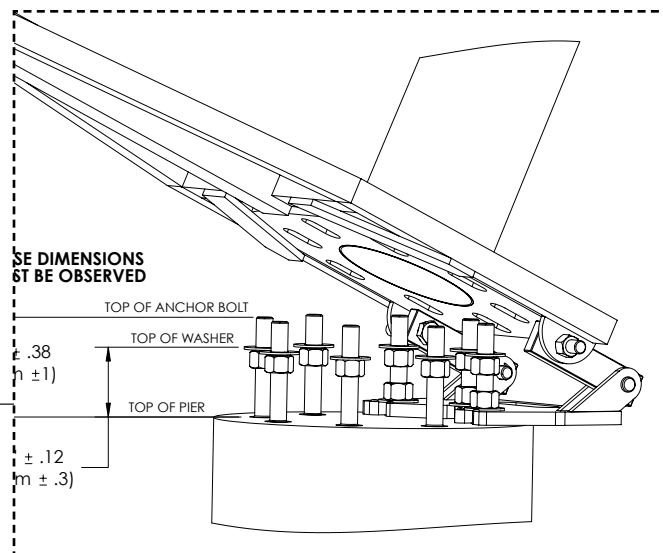
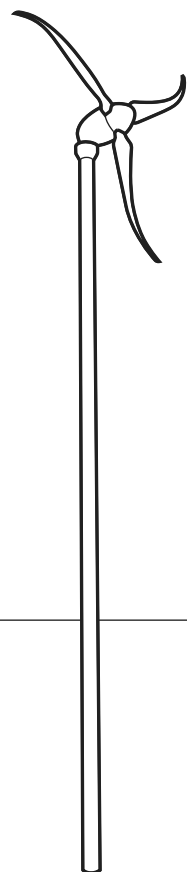


SKYSTREAM^{3.7}

SECTIONAL MONOPOLE TOWER FOUNDATION & INSTALLATION MANUAL

For 33.5 ft (10.2 m) & 45 ft (13.7 m)
Sectional Monopole Towers



Southwest Windpower, Inc.
1801 West Route 66
Flagstaff, Arizona 86001 USA
Phone: 928.779.9463
Fax: 928.779.1485

www.skystreamenergy.com

MADE IN THE **USA** © March 2009 Southwest Windpower, Inc.
All Rights Reserved.

Table of Contents

Important Safety Instructions _____	3	Raising the Tower _____	17-18
PRIOR TO INSTALLATION _____	4	Adjusting Cable Length _____	17-18
Introduction _____	4	Lowering the Tower _____	19
Building Permits & Zoning Requirements _____	4	Leveling the Tower _____	20
Installation Personnel _____	5	Tightening Foundation Bolts _____	20
Siting - Finding the Best Location for Skystream _____	6-7		
CONSTRUCTING THE FOUNDATION _____	8	APPENDICES	
Foundation Drawings _____	8	Appendix A: 33.5 ft (10.2 m) Monopole Tower Foundations	
Wind Zones _____	8	Appendix B: 45 ft (13.7 m) Monopole Tower Foundations	
Soil Conditions _____	9	Appendix C: SMarT Foundation Assembly and Drawings	
Selecting A Foundation Configuration _____	10		
Foundation Bolts & Templates (Pier & Mat Foundations) ____	10		
Foundation Bolts & Templates (SMarT Foundation) _____	10		
Positioning the Foundations Bolts (Pier & Mat Foundations)___	11-12		
Positioning the Foundations Bolts (SMarT Foundation) ____	13		
Electrical Conduit _____	13		
Completing the Foundation _____	13		
TOWER INSTALLATION _____	14		
Introduction _____	14		
Hinge Plate Installation _____	14-15		
Gin Pole Installation _____	16		

Sectional Monopole Tower Foundation
and Installation Manual
Document : 3-CMLT-1367-01
Revision: A

IMPORTANT SAFETY INSTRUCTIONS

READ THESE INSTRUCTIONS IN THEIR ENTIRETY BEFORE INSTALLING.

- 1) SAVE THESE INSTRUCTIONS. This manual contains important instructions for constructing foundations, and raising, lowering and leveling towers that **MUST** be followed.
- 2) Read, Understand and Follow all warnings.
- 3) Read these instructions in their entirety before starting foundation construction and tower installation.
- 4) Install foundation and tower in accordance with National Electric Code, and all local building and zoning codes and requirements.
- 5) Obtain building and construction permits prior to starting construction.
- 6) Foundation concrete must be completely cured prior to installing tower [Minimum 2500 PSI, (17235 kPa) 28 day strength].
- 7) Skystream uses high voltage and is potentially dangerous. Follow all safety precautions at all times.
- 8) Follow proper grounding procedures for tower, foundation and windturbine.
- 9) Remain at a safe distance when raising and lowering tower. **NEVER** stand or walk under tower while it is being raised or lowered.
- 10) Be aware of overhead power lines.
- 11) Do not attempt to raise tower on a windy day.
- 12) Always wear personal protection equipment – closed toe shoes, work gloves, safety glasses, and hardhat.

In this manual



IMPORTANT:
Please take note



TIP: Helpful information
to ease the installation



Professional installation
highly recommended



Warning: Risk of injury or
death - proceed with extreme
caution

PRIOR TO INSTALLATION

Introduction

This manual provides information for the construction of a foundation suitable for installing Southwest Windpower's Skystream 3.7 on one of the following Southwest Windpower towers:

- 33.5 ft (10.2 m) Monopole Sectional Tower, part number 3-CMBP-3218
- 45 ft (13.7 m) Monopole Sectional Tower, part number 3-CMBP-3219

Information for four different "styles" of foundation is provided. The choice of foundation will depend on local building conditions, available construction equipment, and local regulations. The four styles of foundation include:

- Pier Foundation – A "column" shaped foundation; diameter and depth vary depending on soil conditions and maximum wind speed.
- Mat Foundation [33.5 ft (10.2 m) tower only] – A "square" shaped foundation; length, width and depth vary depending on soil conditions and maximum wind speed.
- Pad and Pier Foundation [45 ft (13.7 m) tower only] – An alternative to the Pier foundation – may be easier to construct than Pier foundation if an auger is not available.
- SMarT Foundation™ - manufactured by AnemEronics Inc. , this foundation utilizes a "kit" that is specially designed to construct a foundation for Southwest Windpower's Monopole Towers.

For the Pier and Mat foundations, the information in the manual is sufficient for individuals knowledgeable in working with concrete to construct the foundations. The manual provides useful tips about critical areas of construction, however it does not provide "step by step" instructions for these foundations. It assumes constructor is has the knowledge and experience to complete the foundation.

Detailed instructions are provided for the SMarT Foundation in Appendix C. The SMarT Foundation kit was designed specifically for Southwest Windpower's Monopole towers and may be utilized by both experienced and amateur installers. The unique design of the SMarT foundation provides material and construction time savings compared to a conventional foundation.

Directions for raising, leveling, and lowering the tower are provided in this manual, refer to the Skystream Owner's Manual for instructions for installing Skystream on the tower.

IMPORTANT NOTE:

The foundation drawings contained in the Appendices of this manual present foundations designed in accordance with the 2006 INTERNATIONAL BUILDING CODE (IBC 2006) and ASCE 7-05 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES. These drawings may therefore not be appropriate in localities with construction requirements that differ from these standards.

Building Permits and Zoning Requirements

Building codes and installation requirements may vary greatly depending on state, city, and local townships. Be sure to obtain all required building permits BEFORE beginning the installation.

Be sure you understand all installation and inspection requirements. Many localities require inspections at key phases of the installation before additional work can proceed.



IMPORTANT: Do not pour concrete before all required permits are obtained, inspections completed, and you are authorized to proceed.

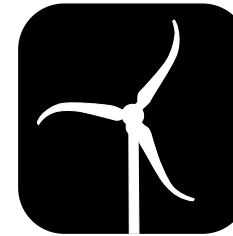
Installation Personnel

Southwest Windpower strongly recommends professional construction of the foundation. Constructing the foundation requires specialized equipment, experience constructing concrete forms and knowledge of local zoning and building codes and inspection requirements.

Skystream Owners who are considering constructing “any or all” of their foundation, or raising their own tower should completely review this manual and the Skystream Owners manual before proceeding. Working with high voltage electricity, constructing foundations and raising and lowering towers can be dangerous. And mistakes can be expensive. **Understand what you are getting into before starting.**

Owners should also be aware that many localities require installation by “certified installers” or by licensed contractors to qualify for clean energy monetary rebates.

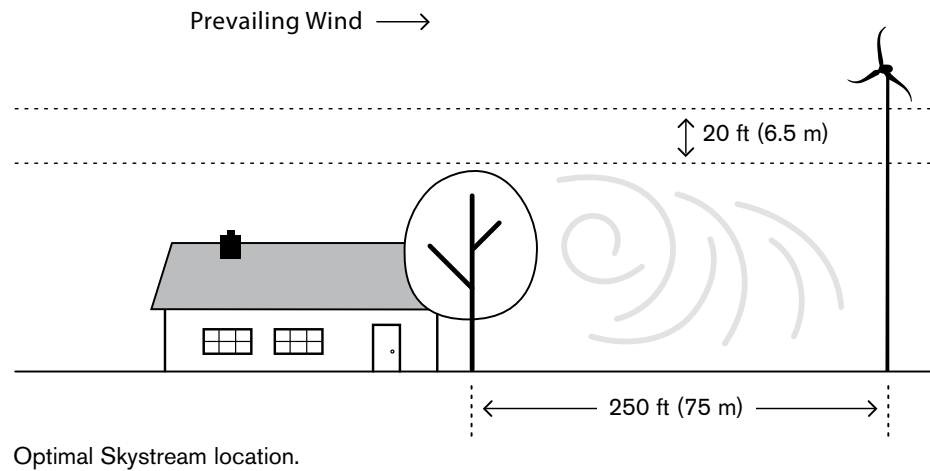
If you decide not to install the tower yourself, dealers displaying the “Skystream Dealer” insignia shown here, have completed factory training on the correct and safe installation of the tower (and Skystream).



Skystream Dealer

Siting – Finding the best location for Skystream

The optimum location to install any wind turbine, including Skystream, is often a compromise. Local building restrictions, the height of surrounding structures, wire length, and available open space may require Skystream be installed in a less than optimum location. At a minimum try to observe the following general rule for siting the turbine.

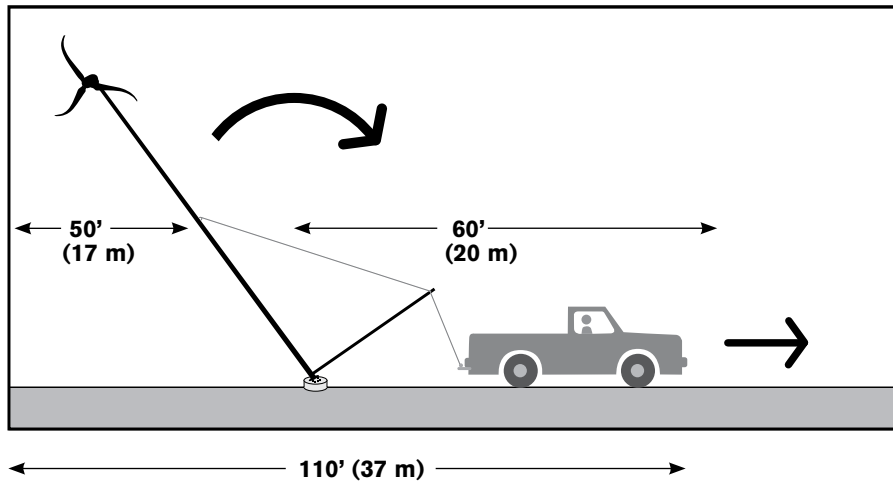


The General Rule: for optimum performance, install Skystream 20 ft (6.5 m) above any surrounding object within a 250 ft (75 m) radius. See figure to left.



TIP: Your dealer can help you determine the best location for Skystream on your property.

When raising the 45 ft (13.7 m) tower using the Gin Pole Kit a minimum of approximately 110 ft (37 m) are required. Slightly over 50 ft (17) are required on one side of the foundation for the tower and Skystream blades. Depending on the length of vehicle used to raise the tower, over 60 ft (20 m) may be required on the other side of the foundation for the vehicle, pulling cable and gin pole. Slightly less space is required to raise the 33.5 ft (10.2 m) tower. Refer to the accompanying figure.



TIP: Approximately 110 ft (37 m) are required to raise the tower vertically into position. 50 ft (17 m) are required on one side of the foundation for the tower and wind generator. An additional 60 ft (20 m) are required on the other side of the foundation for the gin pole and pulling vehicle.

CONSTRUCTING THE FOUNDATION

Foundation Drawings

Detailed technical drawings for the Pier, Mat and SMarT foundations are provided in Appendices A, B and C respectively. The drawings are also available on Southwest Windpower's website (www.skystreamenergy.com). The drawings were prepared by Tower Engineering Professionals (TEP), Raleigh, North Carolina and reviewed and certified by a State of Arizona Registered Professional Engineer.

The drawings are provided as a reference to assist with obtaining building permits and with the construction approval process.

Note the foundation dimensions for the Pier and Pad, and Pier foundations will vary based on the Soil Class and Wind Zone. The dimensions for the SMarT and Mat foundations do not vary based on soil conditions. These foundations assume Soil Class 5 (worst case) conditions exist and are sized accordingly.

Wind Zones

The foundation dimensions are in part dictated by the maximum anticipated wind speed the turbine will experience. A larger (or deeper) foundation is required to withstand higher speed winds.

The dimensions and construction details for each of the foundations will change based on the anticipated wind speed. Refer to the accompanying tables to determine your Wind Speed Zone and the location of the foundation dimensions for your tower height and foundation type.

Wind Zones

Zone	Wind Speed
1	120 – 150 mph / 54 – 67 m / sec
2	90 – 120 mph / 40 – 54 m / sec
3	< 90 mph / 40 m / sec

Tower Height	Foundation	Wind Zone	For Dimensions See
33.5 ft (10.2 m)	Mat	1	Appendix A, Sheet S-4A
33.5 ft (10.2 m)	Mat	2	Appendix A, Sheet S-4B
33.5 ft (10.2 m)	Mat	3	Appendix A, Sheet S-4C
33.5 ft (10.2 m)	Pier	1, 2 & 3	Appendix A, Sheets S-5 & S-6
33.5 ft (10.2 m)	SMarT	1, 2 & 3	Appendix C, Sheet S-1
45 ft (13.7 m)	Pier & Pad	1, 2 & 3	Appendix B, Sheet S-5 & S-7
45 ft (13.7 m)	Pier	1, 2 & 3	Appendix B, Sheets S-8 & S-10
45 ft (13.7 m)	SMarT	1, 2 & 3	Appendix C, Sheet S-1

Local building codes may specify the wind speed the foundation must withstand. If the building code does not specify a wind speed the local weather service can provide maximum wind speed information.



TIP: Excellent wind speed information is available on the internet at <http://www.awea.org/faq/usresource.html> as well as other websites.



TIP: If your installation requires "Wet Stamped" Foundation Drawings for your state they may be purchased from Tower Engineering Professionals, Raleigh, North Carolina. Phone: 919.661.6351.

Soil Conditions

As with the Wind Zones described above the size of a foundation required to support a wind turbine and tower is in part determined by the soil conditions in which the foundation is constructed. Loose sandy soil will require a larger foundation than bedrock.

Refer to the following tables to determine your Soil Class and the location of the foundation dimensions for your tower height and foundation type.

Soil Class	Description
1	Crystalline Bedrock
2	Sedimentary and Floated Rock
3	Sandy Gravel and / or Gravel
4	Sand, Silty Sand, Clayey Sand, Silty Gravel, and Clayey Gravel (SW, SP, SM, SC, GM, and GC)
5	Clay, Sandy Clay, Silty Clay, Clayey Silt, Silt and Sandy Silt (CL, ML, MH, and CH)

Tower Height	Foundation	Wind Zone	For Dimensions See
33.5 ft (10.2 m)	Mat	5 **	Appendix A, Sheet S-4A
33.5 ft (10.2 m)	Pier	1,2,3,4,5	Appendix A, Sheet S-4B
33.5 ft (10.2 m)	SMarT	5 **	Appendix A, Sheet S-4C
45 ft (13.7 m)	Pier & Pad	1,2,3,4,5	Appendix B, Sheet S-5 & S-7
45 ft (13.7 m)	Pier	1,2,3,4,5	Appendix B, Sheet S-5 & S-7
45 ft (13.7 m)	SMarT	5 **	Appendix B, Sheet S-5 & S-7

** Note the foundation dimensions and construction details for the SMarT and Mat foundations do not vary as a result of the soil conditions. These foundations assume Soil Class 5 (worst case) conditions exist and are designed accordingly.

Selecting a Foundation Configuration – Pier, Mat or SMarT

The choice of foundation – Pier, Mat or SMarT foundation – will depend on a number of factors including soil conditions, the depth of the local water table, frost line and available excavation equipment.

If, for example, a contractor has the correct size auger, installing a Pier foundation may be a more economical choice than a Mat foundation since it may use substantially less concrete. Alternately, the SMarT foundation does not require reinforcing bars which can be expensive to purchase and form into the required shapes.

Regardless of the type of foundation, the foundation must extend below the frost line and must also be above the water table. Engineering professionals must be consulted prior to construction if the frost line is known to be greater than the foundation depth or the water table is less than the foundation depth.

In summary consult with a number of contractors and with local building inspectors to achieve the best foundation value.

Foundation Bolts and Templates

Two foundation bolt kits are available. The difference between the two kits is the length of the bolts. The Mat foundation bolts are 32 in (81 cm) long and the Pier foundation bolts are 42 in (107 cm) long. Each kit includes hot dipped galvanized bolts, nuts and washers constructed of the appropriate steel alloys.

A paper bolt circle template is provided with the bolt kit to assist in constructing a rigid frame to secure the foundation bolts while pouring the foundation concrete. The foundation bolts **MUST** be positioned correctly in the foundation or it may be extremely difficult if not impossible to mount the tower to the foundation.

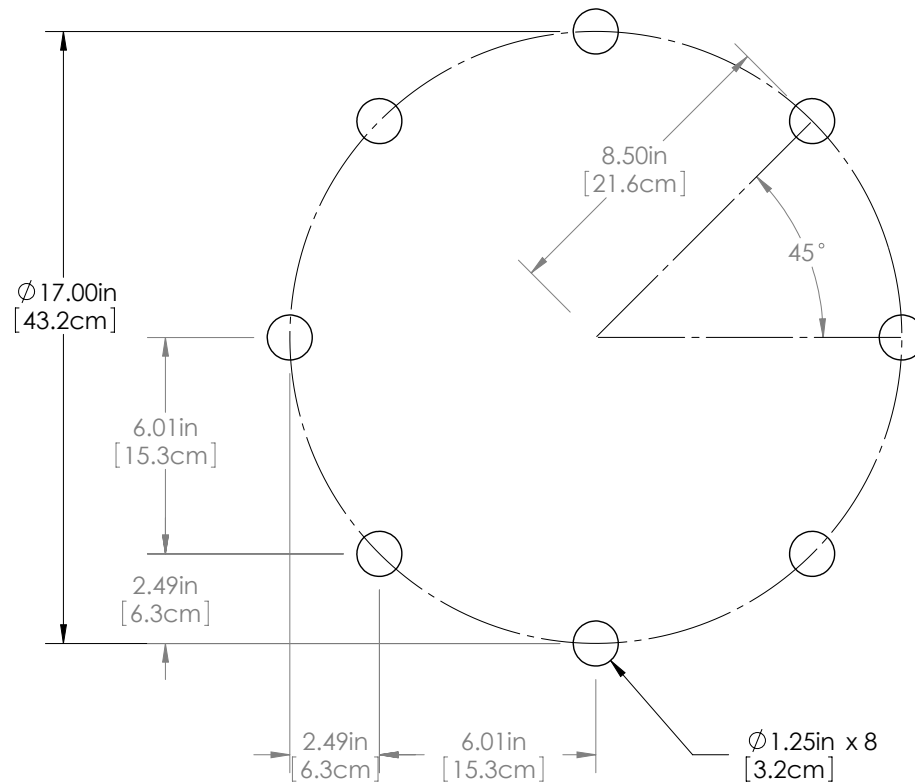
Foundation Bolts and Templates (SMarT Foundation)

The SMarT foundation kits includes all the fastener hardware (nuts, bolts, washers) required to assemble the SMarT foundation. The kit also includes a bolt template to position the foundation bolts in the form. Refer to the SMarT Foundation instructions located in Appendix C of this manual.

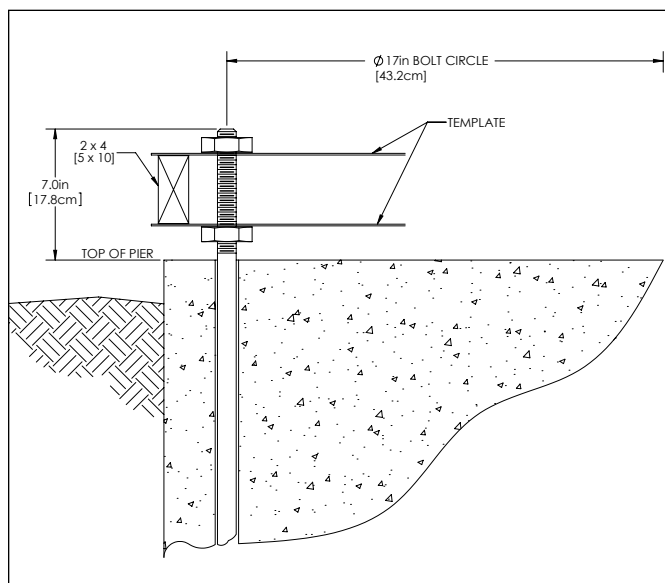
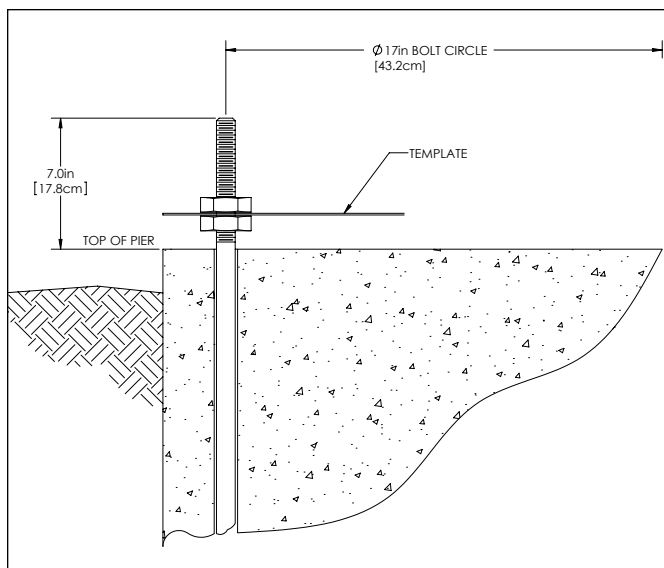
Positioning the Foundation Bolts (Pier and Mat foundations)

Regardless of the foundation – Pier or Mat - it is vital the foundation bolts are correctly positioned in the foundation or it may be extremely difficult if not impossible to mount the tower to the foundation.

Using the paper template supplied with the foundation bolt kit as a guide, construct a wooden template to position the foundation “J” bolts – 1/2 in (13 mm) or 3/4 in (19 mm) plywood works well to construct the wood template. Refer to figure below for a dimensional representation of the foundation bolt pattern template.



Bolt template for 33.5 ft (10.2 m) and 45 ft (13.7 m) towers [17"].

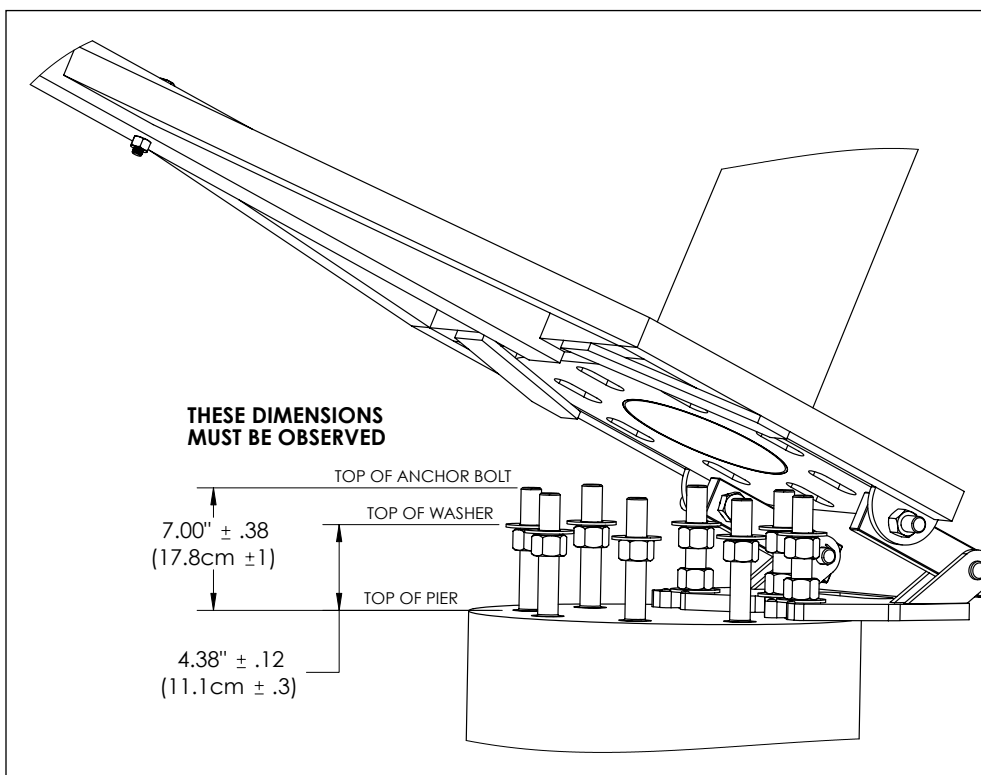


Secure the “J” bolts to the wooden template using the foundation nuts. RTemplates may be fabricated using a single piece of plywood or using two pieces of plywood separated by 2 x 4 in (0.6m x 1.2 m) lumber. Refer to the accompanying figures.

Note the foundation bolts MUST project above the foundation 7.0 +/- 0.38 in (18.0 cm +/- 10 mm) and be vertical and parallel to each other. These dimensions are critical to mount the tower and for proper operation of the hinge plate.



IMPORTANT: Do not exceed 7.0 +/- 0.38 inches (18.0 cm +/- 10 mm) dimension or bolts may interfere with hinge plate.



Positioning the Foundation Bolts (SMarT Foundation)

The SMarT Foundation includes a template as part of the foundation kit therefore the construction of a template is not required. Refer to the SMarT Foundation instructions located in Appendix C of this manual.

Electrical Conduit

Electrical conduit may be cast into the foundation such that the conduit continues below grade to electrical panel. Alternately wire may be routed between tower base plate and foundation. Refer to local building codes **BEFORE** pouring concrete.

Building codes typically require direct burial cables be buried to a minimum depth of 24 in (61 cm) while cables in conduit may be buried at a depth of 18 in (46 cm). Additionally, most codes prohibit embedding cables directly in concrete. Refer to local codes for conduit size and minimum depth requirements.

Tower Grounding

Refer to the Skystream Owner's Manual for complete directions on grounding the tower. It is vital the tower be properly grounded to minimize risk of electrical shock.

Completing the Foundation

Refer to the foundation technical drawings contained in the appendices of this manual for complete notes including; foundation dimensions, construction notes and grading and concrete requirements. Regardless of the foundation 28 days are required for the concrete to cure to a minimum compressive strength of 2500 PSI (17230 kPa).

TOWER INSTALLATION

Tower Installation Introduction

This Manual provides directions for raising the following towers – do not attempt to use the information in this manual to raise any other towers or to construct a foundation for different towers:

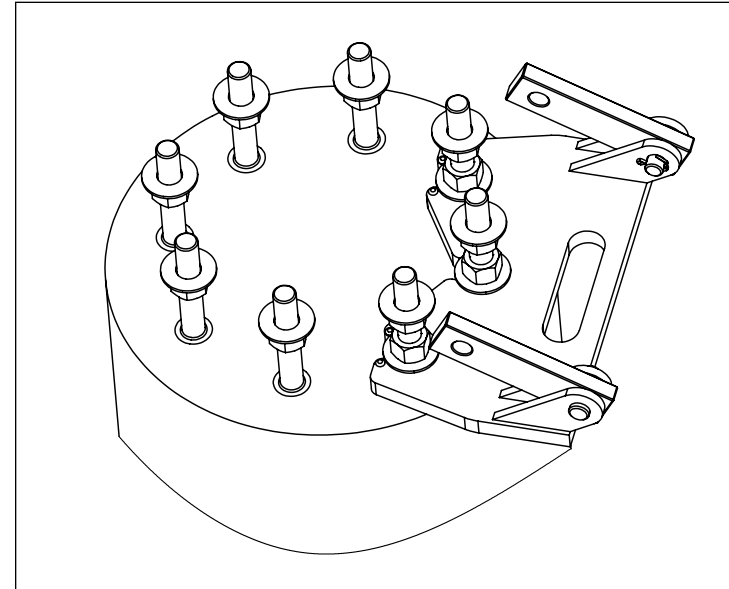
- 33.5 ft (10.2 m) Monopole Sectional Tower, part number 3-CMBP-3218
- 45 ft (13.7 m) Monopole Sectional Tower, part number 3-CMBP-3219

Using:

- Gin Pole (2 piece), part number 3-CMBP-3221
- Gin Pole Kit Part Number 2-TWS-102
- Hinge Plate Kit, part number 3-CMBP-3220
- Hinge Plate Kit Part Number 2-TWS-103

Notes:

- Foundation concrete must be cured 28 day minimum with compressive strength of 2500 PSI (17235 kPa).
- These instructions assume use of a Southwest Windpower foundation bolt kit with correct number and type of fasteners.



Hinge Plate and Gin Pole Installation

- Place the hinge plate on the foundation and fully against the bolts that will be used to secure the hinge plate and thread three nuts and washers (washer below nut) to secure the hinge plate in place.
- Fully tighten the hinge plate to the foundation using the “Turn of the Nut” method described on the following page.

Turn of the Nut Method of Tightening

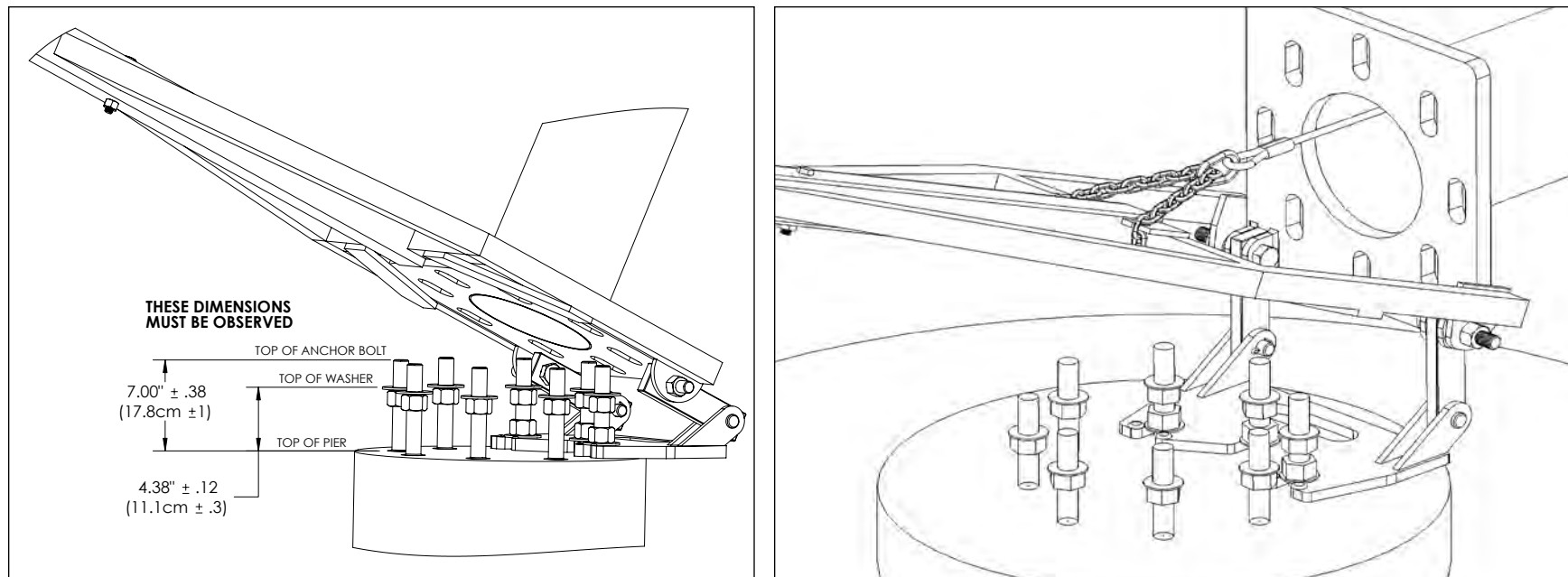
- First tighten each nut to a “snug tight” condition to bring the hinge plate in full contact with the foundation. “Snug Tight” is defined as the tightness attained by a “few” impacts of an impact wrench or the full effort of a man using an ordinary spud wrench (see accompanying figure).
- Following the initial snug tightening, tighten each nut an additional 1/3 to 2/3 turn.

Hinge Plate and Gin Pole Installation -(continued)

- Install eight nuts and washers (washers on top of nuts) onto each of the remaining foundation bolts. Make sure the tops of the washers are 4.5 in (11 cm) above the foundation. Refer to accompanying figures.
- Install the Hinge Plate Links between the tabs of the tower base using two 1/8 x 6 in (0.3 x 15 cm) hex head bolts supplied with the hinge plate kit. Make sure the threaded ends of the bolts face outward to ease disassembly.
- Assemble the lower half of the gin pole to the Hinge Plate / Tower Base assembly and install nuts – hand tight is sufficient.
- Assemble the upper section of the gin pole to the lower section using the 5/8-11 x 4 in (1.6-28 x 10 cm) hex head bolt – tighten securely.

Assembling Tower Sections

At this point the lowest tower segment – the base - should be bolted to the hinge plate and foundation and gin pole. Perform the following steps to join the tower segments using the gin pole to assist with the process. Refer to accompanying figure.



To join the tower sections together :

- Inspect the mating sections of the tower sections for burrs and roughness and smooth and repair as necessary.
- Mark the base section 26 in (66 cm) from the upper end of the section. This mark will be used to determine full insertion of the base section.
- Lubricate the base section using a liquid dish soap (do not use grease or oil as this will stain the tower) and LOOSELY assemble the base and mid sections. Lifting tab on tower center section MUST face upward.
- Run a 5/16 in (8.0 mm) grade 70 transport chain with slip hooks at each end through the tower sections and secure a 4 x 6 x 14 in (10 x 15 x 36 cm) wood block at the end of the pole.



IMPORTANT: Make sure lifting tab on tower mid-section is facing upward and in line with the pull direction before seating the tower sections together.

- Support the tower midsection at its center of gravity – approximately 110 in (279 cm) from the bottom of the section – this will aid keeping the sections aligned axially.
- Raise the gin pole approximately 10 to 20 degrees above horizontal and insert chain links into the slotted plates positioned on either side of the gin pole's central support tube.
- The gin pole should maintain its position under its own weight. Apply a downward force [maximum 200 lb (91 kg)] at the far end of the gin pole to draw the tower sections together.
- Repeat the above process by readjusting the chain links as necessary until the tower mid section is fully seated against the base section.
- After the tower mid section is fully seated onto the tower base; mark the upper end of the tower mid section 21 in (53 cm) from upper end of the section. Use this mark to determine full insertion mid section into the top section.
- Join the top and mid sections using the same procedure that was used to join the base and mid sections.

If difficulties are encountered getting the tower sections to seat fully a few blows from a sledge hammer on wood block while a second person applies pressure using the gin pole will usually result in fully seating the tower sections.

Raising the Tower

Refer to the Skystream Owners Manual for instructions on completing the electrical connections and mounting Skystream on the tower. If you have not raised a tower before Southwest Windpower recommends first raising the tower without the windturbine installed. This provides the opportunity to practice the procedure without risking damage to the windturbine.

Follow these steps to raise the tower:

- Tilt the gin pole to the vertical position and using the wire rope cable (with the adjustable end) connect the end of the gin pole to the lifting tab located at the tower mid section.
- Note that it may be necessary to adjust the length of this cable when switching between the 33.5 ft (10.2 m) and 45 ft (13.7 m) towers or because of variations in the location of the lifting tab. Refer to the accompanying Adjusting Cable Length section for instructions.



TIP: The tower is now set to be raised. Southwest Windpower recommends raising the tower once without the wind turbine installed. This permits checking the proper operation and installation of the hinge and gin pole and also allows inexperienced installers an opportunity to practice raising the tower without risking damage to the wind turbine.

Adjusting Cable Length

READ ALL INSTRUCTIONS BEFORE BEGINNING



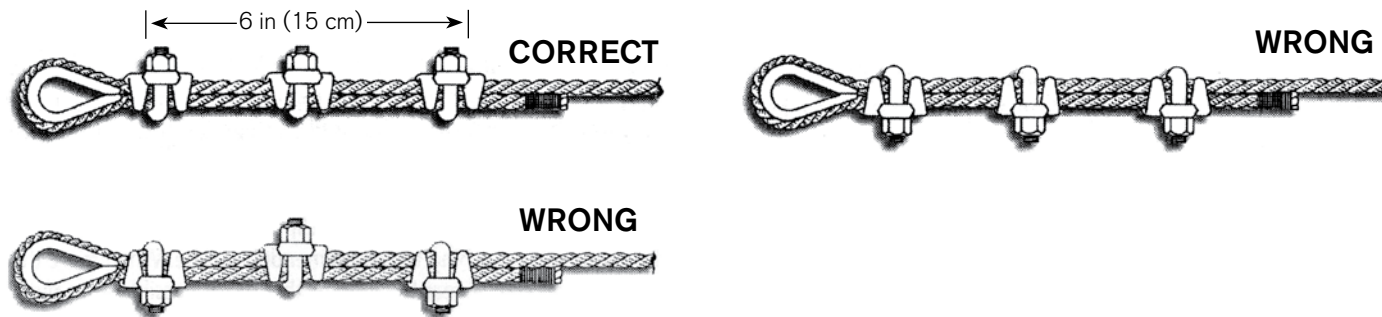
WARNING: When using U-Bolt clips, extreme care must be exercised to make certain they are installed correctly. The U-Bolt clip must be installed so that the “U” section is in contact with the “dead” end of the cable. Refer to the accompanying figure.



WARNING: The TIGHTENING and RETIGHTENING of the U-Bolt clip nuts must be accomplished as described in the instructions. Only use forged U-Bolt clips – never use malleable clips in critical heavy duty applications such as raising the tower.

- Determine the required cable length taking into account the two shackles needed to connect the cable to the gin pole and the tower.
- Turn back the cable over the thimble and install the first U-Bolt clip such that the “U” section of the bolt is in contact with the “dead” end of the cable and is approximately 6 in (15 cm) from the base of the thimble. Refer to the accompanying figure.
- Tighten the nuts evenly, alternating from one nut to the other until reaching 30 lb-ft (41 N-m) of torque.

- Install the second U-Bolt clip as near the thimble as possible. As with the previous U-Bolt clip, tighten the nuts evenly, alternating from one nut to the other until reaching 30 lb-ft (41 N-m) of torque.
- Install the third U-Bolt clip midway between the other clips and tighten the nuts to 30 lb-ft (41 N-m) of torque.
- Apply a load to the cable equal or greater than the maximum anticipated load (DO NOT USE THE TOWER AND TURBINE AS THE LOAD) and retighten the nuts to 30 lb-ft (41 N-m) of torque. This step is very important as the cable may stretch and shrink in diameter when a load is applied effectively loosening the U-Bolt clip nuts. Note the maximum load the cable will experience is approximately 2400 lb (1100 kg).



Raising the Tower - (continued)

- Connect the second wire rope cable to the base of the gin pole and to the “lifting” vehicle using the shackles provided.
- Start to “raise” the tower by slowly driving the “lifting” vehicle away from the tower to take the slack out of the cable – keep the vehicle “in line” with the tower – avoid loading the tower in a lateral direction.
- The vehicle should stop pulling as the end of the gin pole approaches 3-4 ft (1-1.3 m) above ground level. At this point two full size adults can complete raising the tower by pushing down on the end of the gin pole or by pushing down on the cable.
- Observe that the anchor bolt closest to the hinge pivot axis clears the slot in the tower base. This is normally not an issue unless the anchor bolt projection from the foundation exceeds 7.5 in (19 cm).
- As the tower nears the fully vertical position it will be necessary to “lift” the gin pole to slow the tower as it assumes the fully vertical position. Two people are required for this operation.
- When the tower is completely vertical install the remaining nuts and washers to secure the tower to the foundation.

If the tower was raised without the turbine, refer to the section on lowering the tower. If the tower was raised with the turbine proceed to the section on Leveling the Tower.

Lowering the Tower

Lowering the tower is essentially the reverse of raising the tower. Observe the same precautions including not passing under the tower as it is lowered and standing well clear of cables. As with raising the tower, a minimum of three people are recommended.



WARNING: Use extreme caution when lowering the tower. Keep well away and to sides of tower and cable.

- Turn OFF power to the turbine.
- If not already in place install the hinge plate following the directions in Gin Pole and Hinge Plate Installation section of this manual. Observe the recommended bolt tightening procedure.
- Connect the gin pole to the lifting tab at the mid section of the tower using the wire rope cable and shackles provide with the gin pole kit.
- Position suitable bracing to support the tower top and keep the turbine from contacting the ground after the tower is lowered. The bracing should be located approximately 8 ft (2.4 m) from the tower top to clear the turbine blades.
- Connect the second wire rope cable to the gin pole and lowering vehicle.
- Position the vehicle so there is approximately 1-2 ft (30-60 cm) of slack in the cable and the vehicle is in line with lowering path of the tower.
- Remove the foundation nuts and washers.
- Start the lowering process by having two people lift the gin pole to take up the cable slack. Continue lifting the gin pole as the vehicle keeps the cable taught.
- Once the tower passes the “balance point” the vehicle will be in control of the tower lowering and the individuals at the holding the gin pole should clear the area.
- Note pulling force the tower exerts on the vehicle greatly increases as the tower approaches horizontal.



WARNING: Someone **MUST** be in the vehicle at all times to control lowering the tower. The “pulling” force the tower exerts greatly increases as the tower approaches the horizontal. In other words the tower is lowered using the vehicle brakes to slow the descent of the tower. During lowering keep the vehicle engine running to provide power brake assistance.

Leveling the Tower

Leveling the tower is most easily accomplished using only four of the eight foundation bolts. Once the tower is leveled the remaining bolts can be fully tightened to secure the tower.

Be aware that leveling the tower may require some trial and error adjustments – even though the base is level, the upper tower flange may be off level due to manufacturing tolerances.

To level the tower:

- Level the tower on a calm day to minimize movement of Skystream. Start by loosening all the upper foundation nuts about a full turn.
- Loosen and lower the four nuts on the “sides” of the foundation base plate. In other words the tower should be supported by the four “corner” nuts of the tower base plate. (refer to **Fig. 8**, Bolts A and B are “corner” bolts)
- Using two bubble levels set perpendicular to each other on the base plate adjust the foundation nuts until the tower is level. Magnetic bubble levels may make this process easier.
- Once the tower is level tighten all nuts and recheck level.

Observe the position of Skystream on calm days. If the wind turbine seems to favor a single position with no wind, the tower may require fine tuning even if it appears level using the bubble leveling technique.

To fine tune the tower realize that the nose cone of the wind turbine will “point” in the direction of the tower low side. Therefore, to level the tower, slightly raise the side of the tower under the nose cone or lower the side of the tower opposite the nose cone. Make fine adjustments. Approximately one turn of a foundation nut equates to slightly more than 1/8 in (3.2 mm) so even a half turn adjustment will make a difference.

Tightening Foundation Bolts

Tighten the foundation bolts by using the Turn of the Nut Method as described below.

Turn of the Nut Method of Tightening

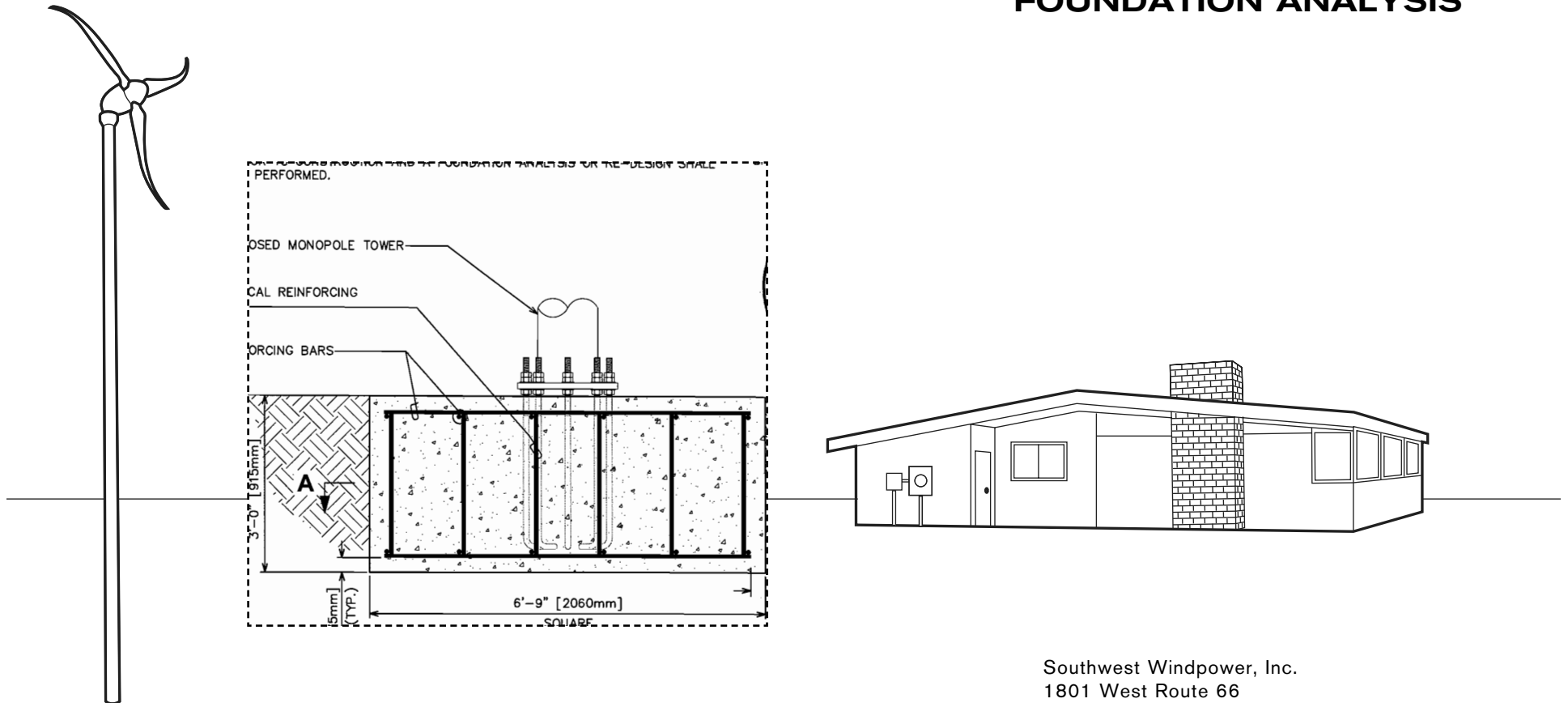
- First tighten each nut to a “snug tight” condition to bring the hinge plate in full contact with the foundation. “Snug Tight” is defined as the tightness attained by a “few” impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.
- Following the initial snug tightening, tighten each nut an additional 1/3 to 2/3 turn.



WARNING: Never leave foundation bolts loose. Foundation bolts may be temporarily loosened during tower leveling – however, never leave tower unless **ALL** foundation bolts are **FULLY** tightened.

SKYSTREAM 3.7®

APPENDIX A FOUNDATION ANALYSIS



Southwest Windpower, Inc.
1801 West Route 66
Flagstaff, Arizona 86001 USA
Phone: 928-779-9463
Fax: 928-779-1485
www.skystreamenergy.com

MADE IN THE **USA** © March 2009 Southwest Windpower, Inc.
All Rights Reserved

Southwest Windpower

Renewable Energy Made Simple

ATTENTION

THE FOUNDATION DESIGNS ARE IN ACCORDANCE WITH THE THE 2006 INTERNATIONAL BUILDING CODE (IBC 2006) AND ASCE 7-05, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES. THE FOUNDATION DESIGNS ARE FOR A 33.5-FT [10.2M] MONOPOLE WITH THE SKYSTREAM 3.7 WIND TURBINE BASED ON THE SOIL INFORMATION LISTED IN TABLE 1804.2 (IBC 2006) REFERENCED ON SHEET S-2 AND THE WIND ZONES DESCRIBED ON SHEET S-3. IT IS THE RESPONSIBILITY OF THE OWNER TO VERIFY BY GEOTECHNICAL INVESTIGATION THAT ACTUAL SOIL INVESTIGATION PARAMETERS MEET OR EXCEED THOSE SHOWN IN THE REFERENCED TABLE. IF CONDITIONS OTHER THAN THOSE DESCRIBED IN THE REFERENCED TABLE ARE ENCOUNTERED A FOUNDATION ANALYSIS SHOULD BE PERFORMED TO DETERMINE THE STRUCTURAL ADEQUACY OF THE SUBSTRUCTURE.

INDEX OF SHEETS

NO.	SHEET TITLE	REV	DATE
T-1	TITLE SHEET	0	02-22-08
S-1	PROJECT NOTES	0	02-22-08
S-2	TABLE 1804.2 ALLOWABLE FOUNDATION AND LATERAL PRESSURE (IBC 2006)	0	02-22-08
S-3	WIND ZONES AND TOWER REACTIONS	0	02-22-08
S-4A	33.5-FT [10.2M] MONOPOLE FOUNDATION - WIND ZONE 1	0	02-22-08
S-4B	33.5-FT [10.2M] MONOPOLE FOUNDATION - WIND ZONE 2	0	02-22-08
S-4C	33.5-FT [10.2M] MONOPOLE FOUNDATION - WIND ZONE 3	0	02-22-08
S-5	33.5-FT [10.2M] MONOPOLE FOUNDATION (ALTERNATIVE) - PIER	0	02-22-08
S-6	33.5-FT [10.2M] MONOPOLE FOUNDATION DIMENSIONS - PIER	0	02-22-08



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**33.5-FT [10.2M]
MONOPOLE
FOUNDATIONS**

Southwest Windpower

Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

0	02-22-08
REV	DATE

DRAWN BY: JAB CHECKED BY: KMM

SHEET NUMBER:

T-1

REVISION:

0

TEP #: 080007.03

GENERAL NOTES:

1. ALL WORK PRESENTED ON THESE DRAWINGS MUST BE COMPLETED BY THE CONTRACTOR UNLESS NOTED OTHERWISE.
2. THE CONTRACTOR MUST HAVE CONSIDERABLE EXPERIENCE IN PERFORMANCE OF WORK SIMILAR TO THAT DESCRIBED HEREIN. BY ACCEPTANCE OF THIS ASSIGNMENT, THE CONTRACTOR IS ATTESTING THAT HE DOES HAVE SUFFICIENT EXPERIENCE AND ABILITY, THAT HE IS KNOWLEDGEABLE OF THE WORK TO BE PERFORMED AND THAT HE IS PROPERLY LICENSED AND PROPERLY REGISTERED TO DO THIS WORK IN THE APPLICABLE STATE/TERRITORY.
3. ALL HARDWARE ASSEMBLY MANUFACTURER'S INSTRUCTIONS SHALL BE FOLLOWED EXACTLY AND SHALL SUPERSEDE ANY CONFLICTING NOTES ENCLOSED HEREIN.
4. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE TO INSURE THE SAFETY OF THE STRUCTURE AND ITS COMPONENT PARTS DURING ERECTION. THIS INCLUDES, BUT IS NOT LIMITED TO, THE ADDITION OF TEMPORARY BRACING, GUYS OR TIE DOWNS THAT MAY BE NECESSARY. SUCH MATERIAL SHALL BE REMOVED AND SHALL REMAIN THE PROPERTY OF THE CONTRACTOR AFTER THE COMPLETION OF THE PROJECT.
5. ALL MATERIALS AND EQUIPMENT FURNISHED SHALL BE NEW AND OF GOOD QUALITY, FREE FROM FAULTS AND DEFECTS AND IN CONFORMANCE WITH THE CONTRACT DOCUMENTS. ANY AND ALL SUBSTITUTIONS MUST BE PROPERLY APPROVED AND AUTHORIZED IN WRITING BY THE OWNER AND ENGINEER PRIOR TO INSTALLATION. THE CONTRACTOR SHALL FURNISH SATISFACTORY EVIDENCE AS TO THE KIND AND QUALITY OF THE MATERIALS AND EQUIPMENT BEING SUBSTITUTED.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INITIATING, MAINTAINING, AND SUPERVISING ALL SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK.
7. THE CONTRACTOR IS RESPONSIBLE FOR INSURING THAT THIS PROJECT AND RELATED WORK COMPLIES WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY CODES AND REGULATIONS GOVERNING THIS WORK. CONTRACTOR SHALL SECURE ALL NECESSARY PERMITS FOR THIS PROJECT FROM ALL APPLICABLE GOVERNMENTAL AGENCIES. ALL PERMITS THAT MUST BE OBTAINED ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR WILL BE RESPONSIBLE FOR ABIDING BY ALL CONDITIONS AND REQUIREMENTS OF THE PERMITS.
8. THE CONTRACTOR IS REQUIRED TO MAINTAIN ALL PIPES, DITCHES, AND OTHER DRAINAGE STRUCTURES FREE FROM OBSTRUCTION UNTIL WORK IS ACCEPTED BY THE OWNER. THE CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGES CAUSED BY FAILURE TO MAINTAIN DRAINAGE STRUCTURE IN OPERABLE CONDITION.
9. ALL MATERIALS AND WORKMANSHIP SHALL BE WARRANTED FOR ONE YEAR FROM ACCEPTANCE DATE.
10. THE TOWER REACTIONS WERE OBTAINED AND THE FOUNDATIONS WERE DESIGNED IN ACCORDANCE WITH THE 2006 INTERNATIONAL BUILDING CODE (IBC 2006) AND ASCE 7-05 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES.

REINFORCING STEEL NOTES:

1. THE REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A-615, GRADE 60 [EU GRADE 420]. IT SHALL BE DEFORMED AND SPLICES SHALL NOT BE ALLOWED UNLESS OTHERWISE NOTED.
2. WELDING IS PROHIBITED ON REINFORCING STEEL AND EMBEDMENTS.
3. REINFORCING CAGES SHALL BE BRACED TO RETAIN PROPER DIMENSIONS DURING HANDLING AND THROUGHOUT PLACEMENT OF CONCRETE. WHEN TEMPORARY CASING IS UTILIZED, BRACING SHALL BE ADEQUATE TO RESIST FORCES OCCURRING FROM FLOWING CONCRETE DURING CASING EXTRACTION.
4. SPACERS SHALL BE ATTACHED INTERMITTENTLY THROUGHOUT THE ENTIRE LENGTH OF TIEBACK REINFORCING TO INSURE CONCENTRIC PLACEMENT OF CAGES IN EXCAVATIONS.
5. MINIMUM CONCRETE COVER FOR REINFORCEMENT SHALL BE 3" [75mm] IF CAST IN PLACE AND 2" [50mm] COVER IF FORMWORK IS USED AS DEFINED IN ACI 318 SECTION 7.7.1. APPROVED SPACERS SHALL BE USED TO INSURE APPROPRIATE COVER ON REINFORCEMENT.

CONCRETE NOTES:

1. WORK SHALL BE IN ACCORDANCE WITH THE LATEST REVISION OF THE ACI-318, "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE."
2. THE CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 2,500 PSI [17230 kPa] IN 28-DAYS.
3. PROPORTIONS OF CONCRETE MATERIALS SHALL BE SUITABLE FOR THE INSTALLATION METHOD UTILIZED AND SHALL RESULT IN DURABLE CONCRETE FOR RESISTANCE TO LOCAL ANTICIPATED AGGRESSIVE ACTIONS. THE DURABILITY REQUIREMENTS OF ACI-318 SHALL BE SATISFIED BASED ON THE CONDITIONS EXPECTED AT THE SITE.
4. CONCRETE SHALL BE PLACED IN A MANNER THAT WILL PREVENT SEGREGATION OF CONCRETE MATERIALS, INFILTRATION OF WATER OR SOIL, AND OTHER OCCURRENCES THAT MAY DECREASE THE STRENGTH OR DURABILITY OF THE FOUNDATION.
5. FREE FALL CONCRETE MAY BE USED PROVIDED FALL IS VERTICAL DOWN WITHOUT HITTING THE SIDES OF THE EXCAVATION, FORMWORK, REINFORCING BARS, FORM TIES, CAGE BRACING, OR OTHER OBSTRUCTIONS. UNDER NO CIRCUMSTANCES SHALL CONCRETE FALL THROUGH WATER.
6. THE MAXIMUM SIZE OF THE AGGREGATE SHALL NOT EXCEED A SIZE SUITABLE FOR THE INSTALLATION METHOD UTILIZED OR 1/3-CLEAR DISTANCE BEHIND OR BETWEEN REINFORCING. THE MAXIMUM SIZE MAY BE INCREASED TO 2/3-CLEAR DISTANCE PROVIDED WORKABILITY AND METHODS OF CONSOLIDATION SUCH AS VIBRATING WILL PREVENT HONEYCOMBS AND



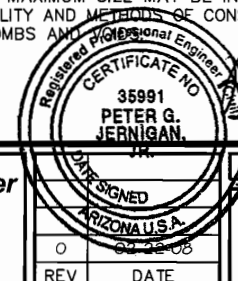
TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**33.5-FT [10.2M]
MONOPOLE
FOUNDATIONS**

Southwest Windpower
Renewable Energy Made Simple

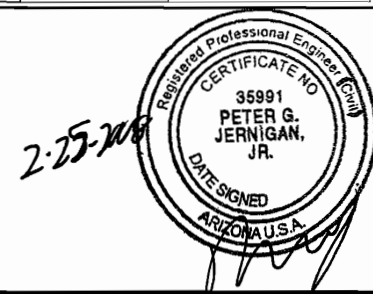
1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463



DRAWN BY: JAB		CHECKED BY: KMM	
SHEET NUMBER: S-1		REVISION: 0	
REV		DATE	
TEP #: 080007.03			

TABLE 1804.2 ALLOWABLE FOUNDATION AND LATERAL PRESSURE (IBC 2006)

SOIL CLASS	DESCRIPTION	ALLOWABLE FOUNDATION PRESSURE	LATERAL BEARING (BELOW NATURAL GRADE)	LATERAL SLIDING		ASSUMED UNIT WEIGHT W/O WATER	ASSUMED INTERNAL ANGLE OF FRICTION
				COEFF. OF FRICTION	RESISTANCE		
1	CRYSTALLINE BEDROCK	12,000 psf	1,200 psf/ft	0.70	—	140 pcf	0°
		574.56 kPa	188.50 kPa/m			22 kN/m ³	
2	SEDIMENTARY AND FOLIATED ROCK	4,000 psf	400 psf/ft	0.35	—	130 pcf	0°
		191.52 kPa	62.83 kPa/m			20 kN/m ³	
3	SANDY GRAVEL AND/OR GRAVEL (GW AND GP)	3,000 psf	200 psf/ft	0.35	—	120 pcf	32°
		143.64 kPa	31.42 kPa/m			19 kN/m ³	
4	SAND, SILTY SAND, CLAYEY SAND, SILTY GRAVEL, AND CLAYEY GRAVEL (SW,SP,SM,SC,GM AND GC)	2,000 psf	150 psf/ft	0.25	—	100 pcf	26°
		95.76 kPa	23.56 kPa/m			16 kN/m ³	
5	CLAY, SANDY CLAY, SILTY CLAY, CLAYEY SILT, SILT AND SANDY SILT (CL, ML, MH AND CH)	1,500 psf	100 psf/ft	—	130 psf	90 pcf	0°
		71.82 kPa	15.71 kPa/m		6.22 kPa	14 kN/m ³	




 TOWER ENGINEERING PROFESSIONALS 3703 JUNCTION BOULEVARD RALEIGH, NC 27603-5263 (919) 661-6351	PROJECT INFORMATION: 33.5-FT [10.2M] MONOPOLE FOUNDATIONS	Southwest Windpower Renewable Energy Made Simple 1801 West Route 66 Flagstaff, AZ 86001 Office: (928) 779-9463		DRAWN BY: JAB	CHECKED BY: KMM
				SHEET NUMBER:	REVISION:
			0 02-22-08 REV DATE	S-2	0 TEP #: 080007.03

WIND ZONES	
ZONE	WIND SPEED
1	120 – 150 MPH [54 – 67 m/sec]
2	90 – 120 MPH [40 – 54 m/sec]
3	≤ 90 MPH [≤ 40 m/sec]

TOWER REACTIONS - 33.5' [10.2M] MONOPOLE				
ZONE	MAXIMUM LOADING CRITERIA	FACTORED** MOMENT	FACTORED** SHEAR	FACTORED VERTICAL
1	SKYSTREAM 3.7 WIND TURBINE 150 MPH & 40 MPH W/ 1/2"-ICE [67 m/sec & 18 m/sec w/ 12.7mm-ICE]	70.8 kip-ft	3.04 kips	0.95 kips
		96.0 kN-m	13.52 kN	3.56 kN
2	SKYSTREAM 3.7 WIND TURBINE 120 MPH & 40 MPH W/ 1/2"-ICE [54 m/sec & 18 m/sec w/ 12.7mm-ICE]	60.7 kip-ft	2.40 kips	0.95 kips
		82.3 kN-m	10.68 kN	3.56 kN
3	SKYSTREAM 3.7 WIND TURBINE 90 MPH & 30 MPH W/ 3/4"-ICE [40 m/sec & 13 m/sec w/ 19mm-ICE]	52.8 kip-ft	1.90 kips	1.05 kips
		71.6 kN-m	8.45 kN	4.67 kN

** THE REACTIONS LISTED ARE FOR REFERENCE ONLY AND SHOULD NOT BE SUBSTITUTED FOR A STRUTURAL ANALYSIS BASED ON SITE-SPECIFIC DATA.



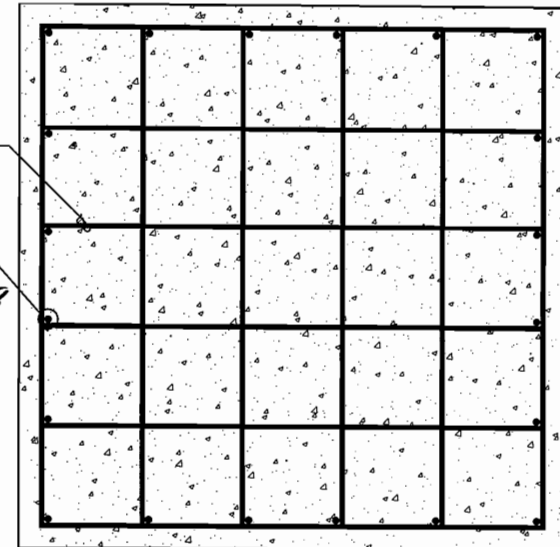
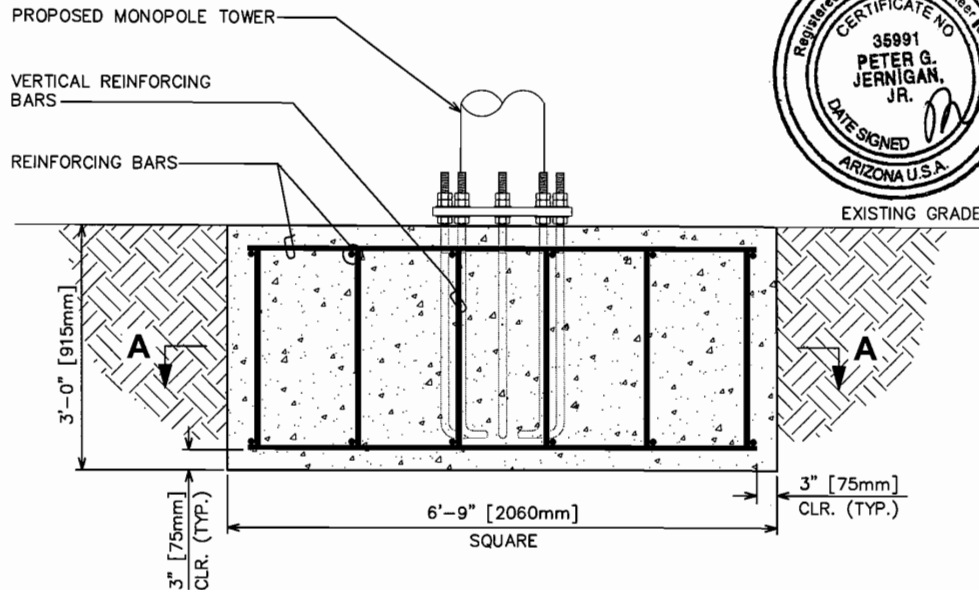
 TOWER ENGINEERING PROFESSIONALS 3703 JUNCTION BOULEVARD RALEIGH, NC 27603-5263 (919) 661-6351	PROJECT INFORMATION:	Southwest Windpower Renewable Energy Made Simple 1801 West Route 66 Flagstaff, AZ 86001 Office: (928) 779-9463		DRAWN BY: JAB	CHECKED BY: KMM
	33.5-FT [10.2M] MONOPOLE FOUNDATIONS		0 02-22-06 REV DATE	SHEET NUMBER: S-3	REVISION: 0 TEP #: 080007.03

NOTES:

1. THE FOUNDATION DESIGNS ARE BASED ON THE SOIL INFORMATION LISTED IN TABLE 1804.2 (IBC 2006) REFERENCED ON SHEET S-2. IT IS THE RESPONSIBILITY OF THE OWNER TO VERIFY BY GEOTECHNICAL INVESTIGATION THAT ACTUAL SITE SOIL PARAMETERS EQUAL OR EXCEED THOSE SHOWN IN THE REFERENCED TABLE. IF CONDITIONS OTHER THAN THOSE DESCRIBED IN THE REFERENCED TABLE ARE ENCOUNTERED A FOUNDATION ANALYSIS SHOULD BE PERFORMED TO DETERMINE THE STRUCTURAL ADEQUACY OF THE SUBSTRUCTURE.
2. IF THE FROST LINE IS KNOWN TO BE GREATER THAN THE FOUNDATION DEPTH OR THE WATER TABLE IS LESS THAN THE FOUNDATION DEPTH, THE DESIGN ENGINEER (TOWER ENGINEERING PROFESSIONALS, INC.) SHALL BE NOTIFIED PRIOR TO CONSTRUCTION AND A FOUNDATION ANALYSIS OR RE-DESIGN SHALL BE PERFORMED.

(6)-#6 [K19] REINFORCING BARS
SPACED EQUALLY EACH WAY, TOP
AND BOTTOM (24 TOTAL)

#7 [K22] VERTICAL REINFORCING
BARS SPACED EQUALLY AS
SHOWN (20 TOTAL)



SECTION A-A

SCALE: $\frac{1}{2}" = 1'-0"$
[12.7mm = 304.8mm]

DESIGN IS BASED ON SOIL CLASS 5:
 $q'_{all} = 1500 \text{ psf}$ [71.82 kPa]

FOUNDATION - WIND ZONE 1

SCALE: $\frac{1}{2}" = 1'-0"$ [12.7mm = 304.8mm]



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-6263
(919) 661-6351

PROJECT INFORMATION:

**33.5-FT [10.2M]
MONOPOLE
FOUNDATIONS**

Southwest Windpower

Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

0	02-22-08
REV	DATE

DRAWN BY: JAB CHECKED BY: KMM

SHEET NUMBER:

S-4A

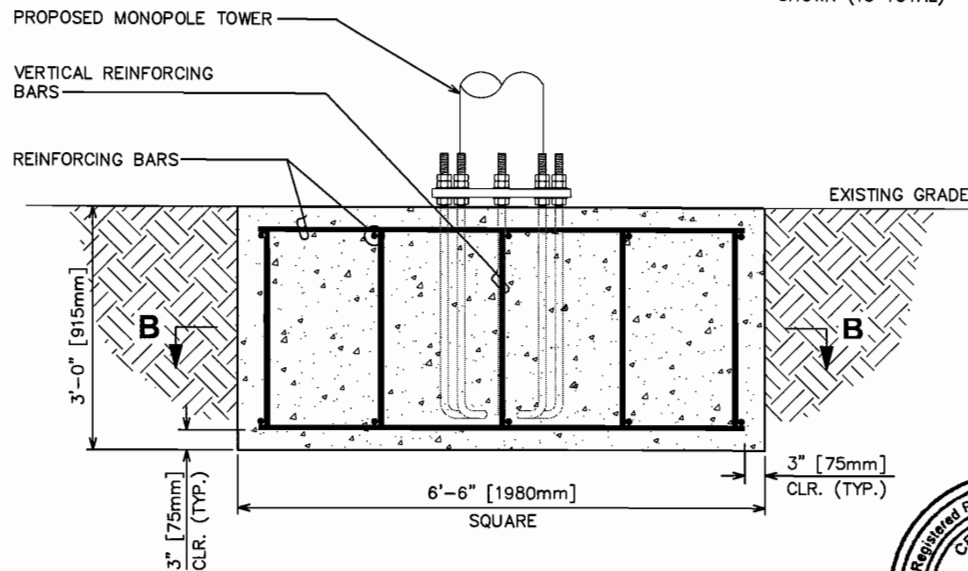
REVISION:

0

TEP #: 080007.03

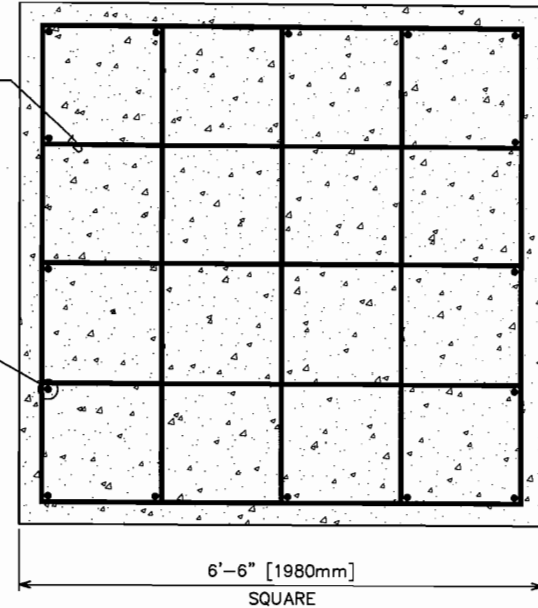
NOTES:

1. THE FOUNDATION DESIGNS ARE BASED ON THE SOIL INFORMATION LISTED IN TABLE 1804.2 (IBC 2006) REFERENCED ON SHEET S-2. IT IS THE RESPONSIBILITY OF THE OWNER TO VERIFY BY GEOTECHNICAL INVESTIGATION THAT ACTUAL SITE SOIL PARAMETERS EQUAL OR EXCEED THOSE SHOWN IN THE REFERENCED TABLE. IF CONDITIONS OTHER THAN THOSE DESCRIBED IN THE REFERENCED TABLE ARE ENCOUNTERED A FOUNDATION ANALYSIS SHOULD BE PERFORMED TO DETERMINE THE STRUCTURAL ADEQUACY OF THE SUBSTRUCTURE.
2. IF THE FROST LINE IS KNOWN TO BE GREATER THAN THE FOUNDATION DEPTH OR THE WATER TABLE IS LESS THAN THE FOUNDATION DEPTH, THE DESIGN ENGINEER (TOWER ENGINEERING PROFESSIONALS, INC.) SHALL BE NOTIFIED PRIOR TO CONSTRUCTION AND A FOUNDATION ANALYSIS OR RE-DESIGN SHALL BE PERFORMED.



(5)-#7 [K22] REINFORCING BARS SPACED EQUALLY EACH WAY, TOP AND BOTTOM (20 TOTAL)

#8 [K25] VERTICAL REINFORCING BARS SPACED EQUALLY AS SHOWN (16 TOTAL)



SECTION B-B

SCALE: $\frac{1}{2}" = 1'-0"$
[12.7mm = 304.8mm]

DESIGN IS BASED ON SOIL CLASS 5:
 $q'_{all} = 1500 \text{ psf [71.82 kPa]}$



2-25-2008

FOUNDATION - WIND ZONE 2

SCALE: $\frac{1}{2}" = 1'-0"$ [12.7mm = 304.8mm]



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**33.5-FT [10.2M]
MONOPOLE
FOUNDATIONS**

Southwest Windpower

Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

REV	DATE
0	02-22-08

DRAWN BY: JAB CHECKED BY: KMM

SHEET NUMBER:

S-4B

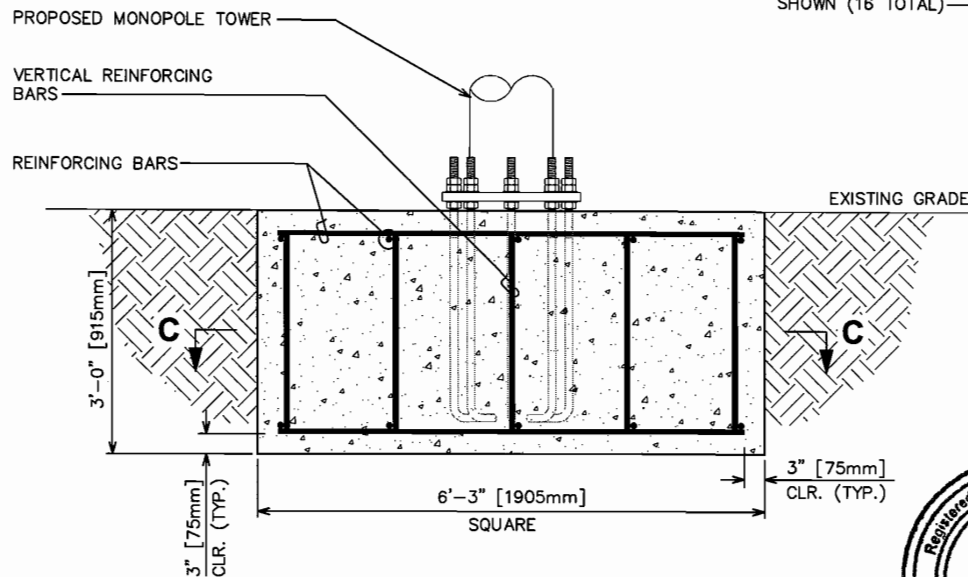
REVISION:

0

TEP #: 080007.03

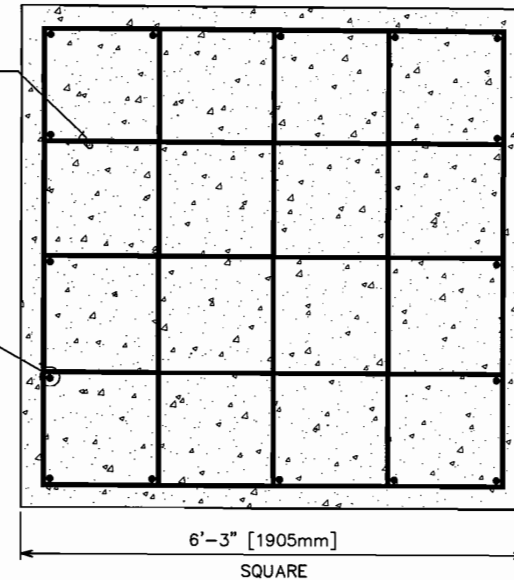
NOTES:

1. THE FOUNDATION DESIGNS ARE BASED ON THE SOIL INFORMATION LISTED IN TABLE 1804.2 (IBC 2006) REFERENCED ON SHEET S-2. IT IS THE RESPONSIBILITY OF THE OWNER TO VERIFY BY GEOTECHNICAL INVESTIGATION THAT ACTUAL SITE SOIL PARAMETERS EQUAL OR EXCEED THOSE SHOWN IN THE REFERENCED TABLE. IF CONDITIONS OTHER THAN THOSE DESCRIBED IN THE REFERENCED TABLE ARE ENCOUNTERED A FOUNDATION ANALYSIS SHOULD BE PERFORMED TO DETERMINE THE STRUCTURAL ADEQUACY OF THE SUBSTRUCTURE.
2. IF THE FROST LINE IS KNOWN TO BE GREATER THAN THE FOUNDATION DEPTH OR THE WATER TABLE IS LESS THAN THE FOUNDATION DEPTH, THE DESIGN ENGINEER (TOWER ENGINEERING PROFESSIONALS, INC.) SHALL BE NOTIFIED PRIOR TO CONSTRUCTION AND A FOUNDATION ANALYSIS OR RE-DESIGN SHALL BE PERFORMED.



(5)-#7 [K22] REINFORCING BARS SPACED EQUALLY EACH WAY, TOP AND BOTTOM (20 TOTAL)

#8 [K25] VERTICAL REINFORCING BARS SPACED EQUALLY AS SHOWN (16 TOTAL)



SECTION C-C

SCALE: $\frac{1}{2}" = 1'-0"$
[12.7mm = 304.8mm]

DESIGN IS BASED ON SOIL CLASS 5:
 $q'_{all} = 1500 \text{ psf}$ [71.82 kPa]



FOUNDATION - WIND ZONE 3

SCALE: $\frac{1}{2}" = 1'-0"$ [12.7mm = 304.8mm]



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

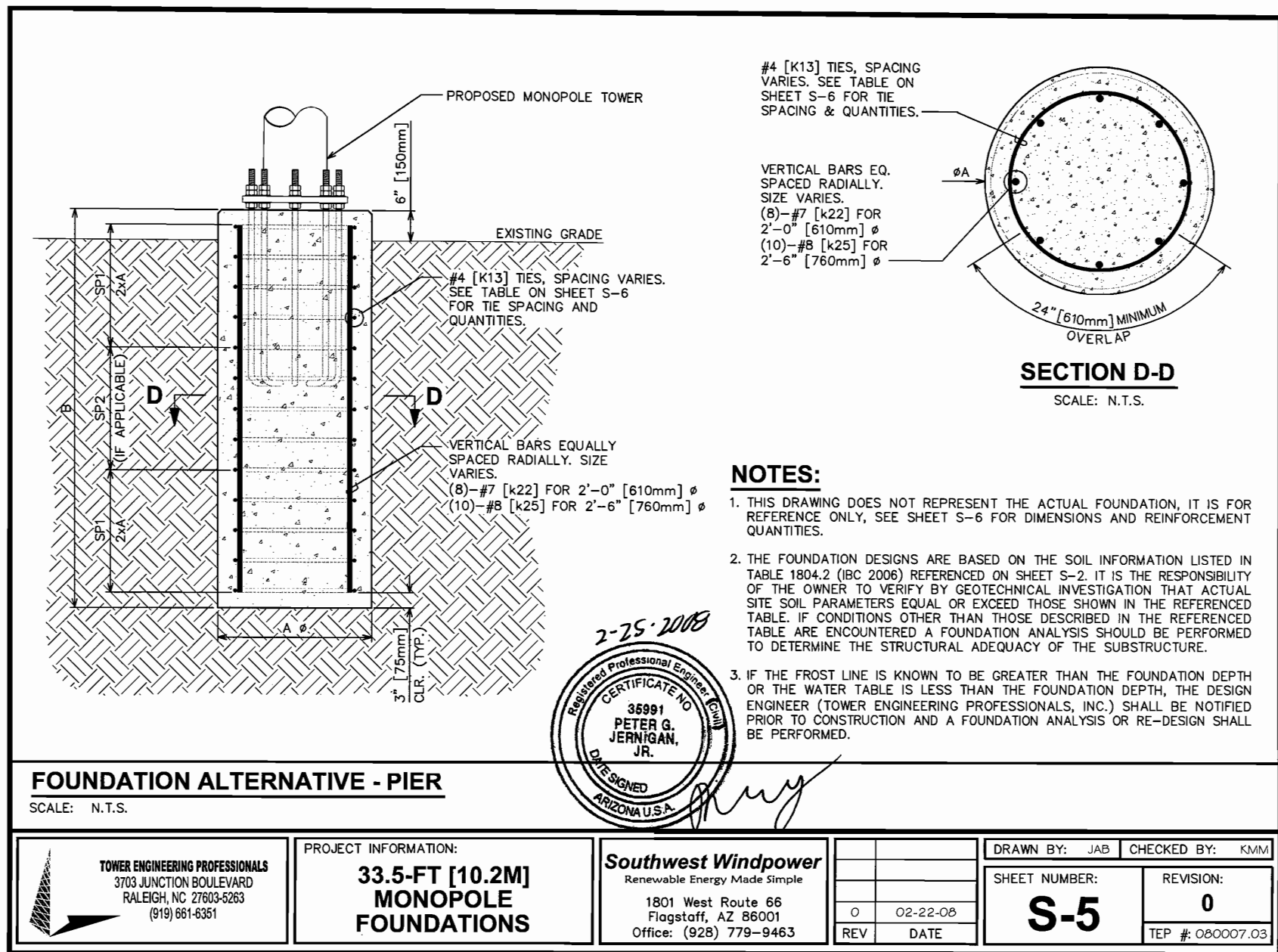
**33.5-FT [10.2M]
MONOPOLE
FOUNDATIONS**


Southwest Windpower
Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463


REV	DATE
0	02-22-08

DRAWN BY: JAB	CHECKED BY: KMM
SHEET NUMBER: S-4C	REVISION: 0 TEP #: 080007.03





33.5-FT [10.2M] MONOPOLE FOUNDATION DIMENSIONS - PIER								
ZONE	SOIL CLASS	DIMENSION		VERTICAL REINFORCEMENT		TIE SPACING		
		A	B	SIZE	QUANTITY	SP1	SP2	#4 [K13] TIE QUANTITY
1	1	2'-0" [610mm]	6'-0" [1830mm]	#7 [K22]	8	6"± [150mm] O.C.	—	12
	2	2'-0" [610mm]	8'-0" [2440mm]	#7 [K22]	8	6"± [150mm] O.C.	—	16
	3	2'-0" [610mm]	11'-0" [3350mm]	#7 [K22]	8	6"± [150mm] O.C.	10"± [255mm] O.C.	20
	4	2'-0" [610mm]	14'-6" [4420mm]	#7 [K22]	8	6"± [150mm] O.C.	12"± [305mm] O.C.	23
	5	2'-6" [760mm]	33'-0" [10060mm]	#8 [K25]	10	6"± [150mm] O.C.	11.7"± [300mm] O.C.	44
2	1	2'-0" [610mm]	6'-0" [1830mm]	#7 [K22]	8	6"± [150mm] O.C.	—	12
	2	2'-0" [610mm]	8'-0" [2440mm]	#7 [K22]	8	6"± [150mm] O.C.	—	16
	3	2'-0" [610mm]	10'-0" [3050mm]	#7 [K22]	8	6"± [150mm] O.C.	9"± [230mm] O.C.	19
	4	2'-0" [610mm]	13'-0" [3960mm]	#7 [K22]	8	6"± [150mm] O.C.	10.8"± [275mm] O.C.	22
	5	2'-0" [610mm]	22'-0" [6705mm]	#7 [K22]	8	6"± [150mm] O.C.	11.6"± [295mm] O.C.	31
3	1	2'-0" [610mm]	6'-0" [1830mm]	#7 [K22]	8	6"± [150mm] O.C.	—	12
	2	2'-0" [610mm]	8'-0" [2440mm]	#7 [K22]	8	6"± [150mm] O.C.	—	16
	3	2'-0" [610mm]	8'-0" [2440mm]	#7 [K22]	8	6"± [150mm] O.C.	—	16
	4	2'-0" [610mm]	10'-0" [3050mm]	#7 [K22]	8	6"± [150mm] O.C.	9"± [230mm] O.C.	19
	5	2'-0" [610mm]	15'-0" [4570mm]	#7 [K22]	8	6"± [150mm] O.C.	11.1"± [280mm] O.C.	24



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**33.5-FT [10.2M]
MONOPOLE
FOUNDATIONS**

Southwest Windpower
Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

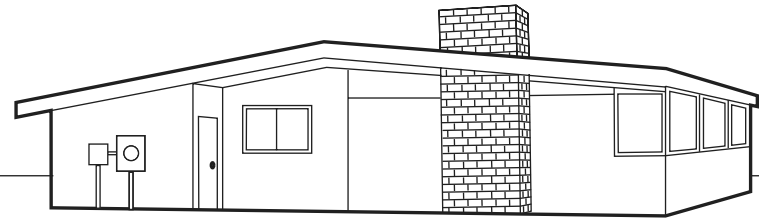
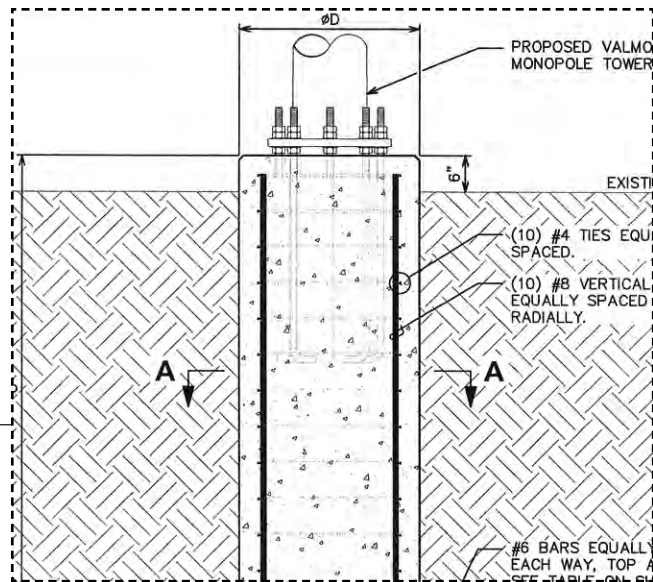
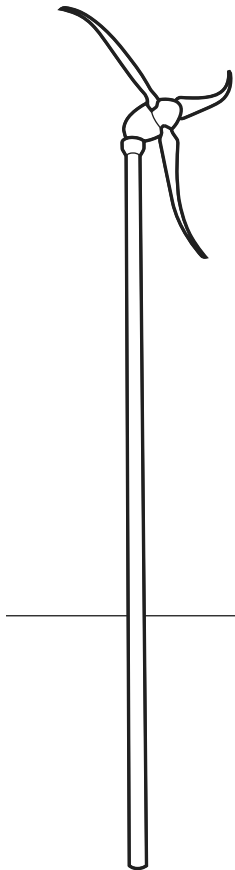
DRAWN BY: JAB	CHECKED BY: KMM
SHEET NUMBER: S-6	REVISION: 0
REV	DATE

TIE SPACING

SP1	SP2
6"± [150mm] O.C.	—
6"± [150mm] O.C.	—
6"± [150mm] O.C.	10"± [255mm] O.C.
6"± [150mm] O.C.	12"± [305mm] O.C.
6"± [150mm] O.C.	11.7"± [300mm] O.C.

SKYSTREAM^{3.7}

APPENDIX B FOUNDATION DRAWINGS



Southwest Windpower, Inc.
1801 West Route 66
Flagstaff, Arizona 86001 USA
Phone: 928-779-9463
Fax: 928-779-1485
www.skystreamenergy.com

MADE IN THE **USA**

© March 2009 Southwest Windpower, Inc.
All Rights Reserved

Southwest Windpower

Renewable Energy Made Simple

ATTENTION

THE FOUNDATION DESIGNS ARE IN ACCORDANCE WITH THE ANSI/TIA-222-G-2005, STRUCTURAL STANDARD FOR ANTENNA SUPPORTING STRUCTURES AND ANTENNAS DATED JANUARY 2006, THE 2003 INTERNATIONAL BUILDING CODE (IBC 2003), AND ASCE 7-02, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES. THE FOUNDATION DESIGNS ARE FOR THE 45-FT AND 60-FT SWWP MONOPOLES BY VALMONT INDUSTRIES, INC. WITH THE SKYSTREAM 3.7 WIND TURBINE BASED ON THE WIND ZONES DESCRIBED ON SHEET S-1 AND THE SOIL INFORMATION LISTED IN TABLE 1804.2 (IBC 2003) REFERENCED ON SHEET S-3. IT IS THE RESPONSIBILITY OF THE OWNER TO VERIFY BY GEOTECHNICAL INVESTIGATION THAT ACTUAL SITE SOIL PARAMETERS MEET OR EXCEED THOSE SHOWN IN THE REFERENCED TABLE. IF CONDITIONS OTHER THAN THOSE DESCRIBED IN THE REFERENCED TABLE ARE ENCOUNTERED A FOUNDATION ANALYSIS SHOULD BE PERFORMED TO DETERMINE THE STRUCTURAL ADEQUACY OF THE SUBSTRUCTURE.

INDEX OF SHEETS

NO.	SHEET TITLE	REV	DATE
T-1	TITLE SHEET	2	06-22-07
S-1	CONTINENTAL UNITED STATES WIND SPEED MAP - ASCE 7-02	2	06-22-07
S-2	PROJECT NOTES	2	06-22-07
S-3	TABLE 1804.2 ALLOWABLE FOUNDATION AND LATERAL PRESSURE (IBC 2003)	2	06-22-07
S-4	TOWER REACTIONS	2	06-22-07
S-5	45-FT MONOPOLE FOUNDATION DIMENSIONS - PAD AND PIER	2	06-22-07
S-6	60-FT MONOPOLE FOUNDATION DIMENSIONS - PAD AND PIER	2	06-22-07
S-7	FOUNDATION ALTERNATIVE I - PAD AND PIER	2	06-22-07
S-8	45-FT MONOPOLE FOUNDATION DIMENSIONS - PIER	2	06-22-07
S-9	60-FT MONOPOLE FOUNDATION DIMENSIONS - PIER	2	06-22-07
S-10	FOUNDATION ALTERNATIVE II - PIER	2	06-22-07



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**45-FT AND 60-FT
MONOPOLE
FOUNDATIONS**

Southwest Windpower
Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

2	06-22-07
1	06-01-07
0	05-24-07
REV	DATE

DRAWN BY: WHM CHECKED BY: MLG

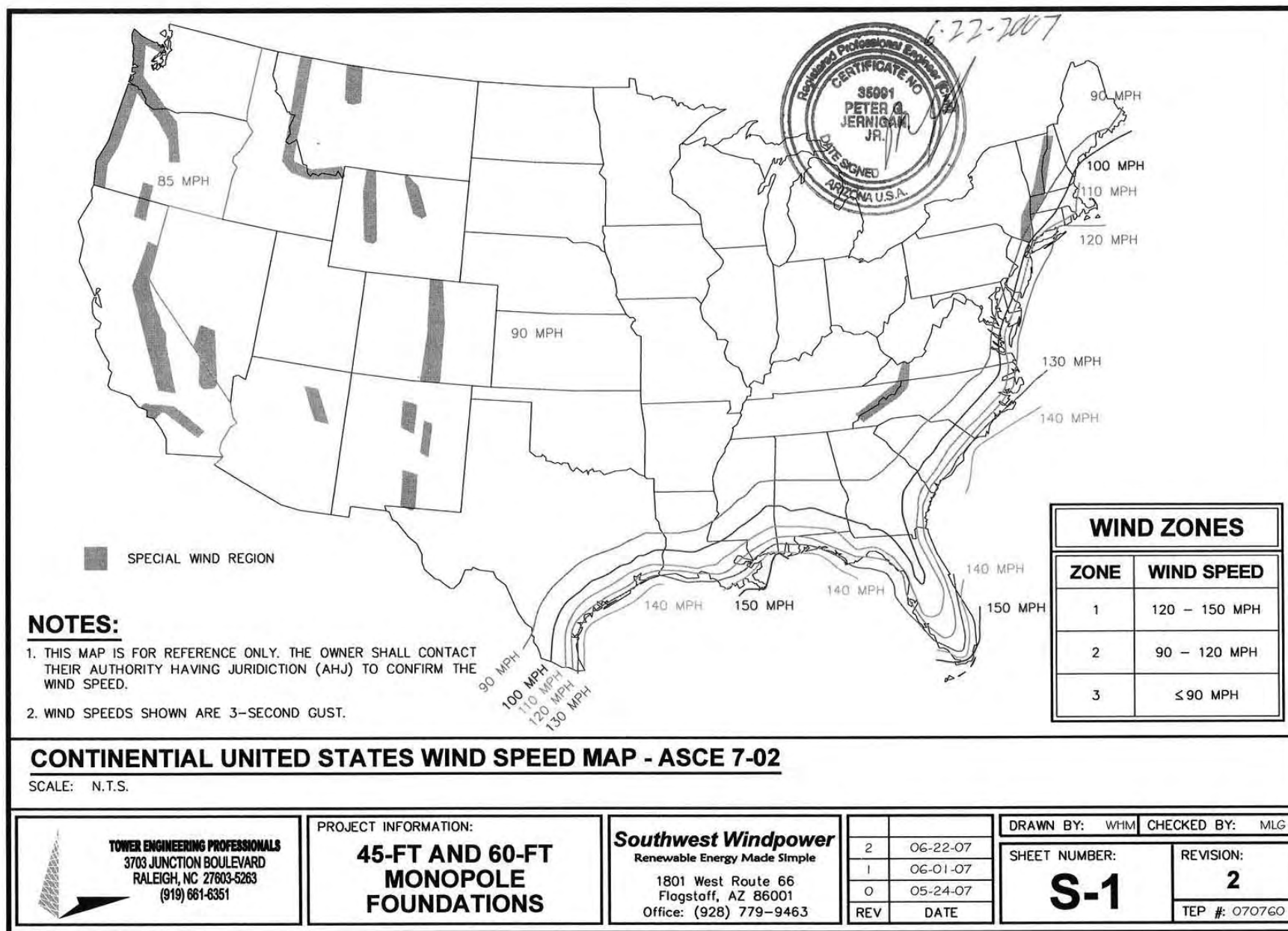
SHEET NUMBER:

T-1

REVISION:

2

TEP #: 070760



GENERAL NOTES:

1. ALL WORK PRESENTED ON THESE DRAWINGS MUST BE COMPLETED BY THE CONTRACTOR UNLESS NOTED OTHERWISE.
2. THE CONTRACTOR MUST HAVE CONSIDERABLE EXPERIENCE IN PERFORMANCE OF WORK SIMILAR TO THAT DESCRIBED HEREIN. BY ACCEPTANCE OF THIS ASSIGNMENT, THE CONTRACTOR IS ATTESTING THAT HE DOES HAVE SUFFICIENT EXPERIENCE AND ABILITY, THAT HE IS KNOWLEDGABLE OF THE WORK TO BE PERFORMED AND THAT HE IS PROPERLY LICENSED AND PROPERLY REGISTERED TO DO THIS WORK IN THE APPLICABLE STATE.
3. ALL HARDWARE ASSEMBLY MANUFACTURER'S INSTRUCTIONS SHALL BE FOLLOWED EXACTLY AND SHALL SUPERCEDE ANY CONFLICTING NOTES ENCLOSED HEREIN.
4. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE TO INSURE THE SAFETY OF THE STRUCTURE AND IT'S COMPONENT PARTS DURING ERECTION. THIS INCLUDES, BUT IS NOT LIMITED TO, THE ADDITION OF TEMPORARY BRACING, GUYS OR TIE DOWNS THAT MAY BE NECESSARY. SUCH MATERIAL SHALL BE REMOVED AND SHALL REMAIN THE PROPERTY OF THE CONTRACTOR AFTER THE COMPLETION OF THE PROJECT.
5. ALL MATERIALS AND EQUIPMENT FURNISHED SHALL BE NEW AND OF GOOD QUALITY, FREE FROM FAULTS AND DEFECTS AND IN CONFORMANCE WITH THE CONTRACT DOCUMENTS. ANY AND ALL SUBSTITUTIONS MUST BE PROPERLY APPROVED AND AUTHORIZED IN WRITING BY THE OWNER AND ENGINEER PRIOR TO INSTALLATION. THE CONTRACTOR SHALL FURNISH SATISFACTORY EVIDENCE AS TO THE KIND AND QUALITY OF THE MATERIALS AND EQUIPMENT BEING SUBSTITUTED.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INITIATING, MAINTAINING, AND SUPERVISING ALL SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK.
7. THE CONTRACTOR IS RESPONSIBLE FOR INSURING THAT THIS PROJECT AND RELATED WORK COMPLIES WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY CODES AND REGULATIONS GOVERNING THIS WORK. CONTRACTOR SHALL SECURE ALL NECESSARY PERMITS FOR THIS PROJECT FROM ALL APPLICABLE GOVERNMENTAL AGENCIES. ALL PERMITS THAT MUST BE OBTAINED ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR WILL BE RESPONSIBLE FOR ABIDING BY ALL CONDITIONS AND REQUIREMENTS OF THE PERMITS.
8. THE CONTRACTOR IS REQUIRED TO MAINTAIN ALL PIPES, DITCHES, AND OTHER DRAINAGE STRUCTURES FREE FROM OBSTRUCTION UNTIL WORK IS ACCEPTED BY THE OWNER. THE CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGES CAUSED BY FAILURE TO MAINTAIN DRAINAGE STRUCTURE IN OPERABLE CONDITION.
9. ALL MATERIALS AND WORKMANSHIP SHALL BE WARRANTED FOR ONE YEAR FROM ACCEPTANCE DATE.
10. THE TOWER REACTIONS WERE OBTAINED AND THE FOUNDATIONS WERE DESIGNED IN ACCORDANCE WITH THE ANSI/TIA-222-G-2005, STRUCTURAL STANDARD FOR ANTENNA SUPPORTING STRUCTURES AND ANTENNAS DATED JANUARY 2006, THE 2003 INTERNATIONAL BUILDING CODE (IBC), AND ASCE 7-02 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES.

REINFORCING STEEL NOTES:

1. THE REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A-615, GRADE 60. IT SHALL BE DEFORMED AND SPLICES SHALL NOT BE ALLOWED UNLESS OTHERWISE NOTED.
2. WELDING IS PROHIBITED ON REINFORCING STEEL AND EMBEDMENTS.
3. REINFORCING CAGES SHALL BE BRACED TO RETAIN PROPER DIMENSIONS DURING HANDLING AND THROUGHOUT PLACEMENT OF CONCRETE. WHEN TEMPORARY CASING IS UTILIZED, BRACING SHALL BE ADEQUATE TO RESIST FORCES OCCURRING FROM FLOWING CONCRETE DURING CASING EXTRACTION.
4. SPACERS SHALL BE ATTACHED INTERMITTENTLY THROUGHOUT THE ENTIRE LENGTH OF TIEBACK REINFORCING TO INSURE CONCENTRIC PLACEMENT OF CAGES IN EXCAVATIONS.
5. MINIMUM CONCRETE COVER FOR REINFORCEMENT SHALL BE 3" UNLESS OTHERWISE NOTED. APPROVED SPACERS SHALL BE USED TO INSURE A 3" MINIMUM COVER ON REINFORCEMENT.

CONCRETE NOTES:

1. WORK SHALL BE IN ACCORDANCE WITH THE LATEST REVISION OF THE ACI-318, "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE."
2. THE CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 2,500 PSI IN 28-DAYS.
3. PROPORTIONS OF CONCRETE MATERIALS SHALL BE SUITABLE FOR THE INSTALLATION METHOD UTILIZED AND SHALL RESULT IN DURABLE CONCRETE FOR RESISTANCE TO LOCAL ANTICIPATED AGGRESSIVE ACTIONS. THE DURABILITY REQUIREMENTS OF ACI-318 SHALL BE SATISFIED BASED ON THE CONDITIONS EXPECTED AT THE SITE.
4. CONCRETE SHALL BE PLACED IN A MANNER THAT WILL PREVENT SEGREGATION OF CONCRETE MATERIALS, INFILTRATION OF WATER OR SOIL, AND OTHER OCCURRENCES THAT MAY DECREASE THE STRENGTH OR DURABILITY OF THE FOUNDATION.
5. FREE FALL CONCRETE MAY BE USED PROVIDED FALL IS VERTICAL DOWN WITHOUT HITTING THE SIDES OF THE EXCAVATION, FORMWORK, REINFORCING BARS, FORM TIES, CAGE BRACING, OR OTHER OBSTRUCTIONS. UNDER NO CIRCUMSTANCES SHALL CONCRETE FALL THROUGH WATER.
6. THE MAXIMUM SIZE OF THE AGGREGATE SHALL NOT EXCEED A SIZE SUITABLE FOR THE INSTALLATION METHOD UTILIZED OR 1/3-CLEAR DISTANCE BEHIND OR BETWEEN REINFORCING. THE MAXIMUM SIZE MAY BE INCREASED TO 2/3-CLEAR DISTANCE PROVIDED WORKABILITY AND METHODS OF CONSOLIDATION SUCH AS VIBRATING WILL PREVENT HONEYCOMBS AND VOIDS.



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**45-FT AND 60-FT
MONOPOLE
FOUNDATIONS**

Southwest Windpower

Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

2	06-22-07
1	06-01-07
0	05-24-07
REV	DATE

DRAWN BY: WHM CHECKED BY: MLG

SHEET NUMBER:

S-2

REVISION:

2

TEP #: 070760

TABLE 1804.2 ALLOWABLE FOUNDATION AND LATERAL PRESSURE (IBC 2003)

SOIL CLASS	DESCRIPTION	ALLOWABLE FOUNDATION PRESSURE (PSF)	LATERAL BEARING (PSF/FT BELOW NATURAL GRADE)	LATERAL SLIDING		ASSUMED UNIT WEIGHT W/O WATER	ASSUMED INTERNAL ANGLE OF FRICTION
				COEFF. OF FRICTION	RESISTANCE (PSF)		
1	CRYSTALLINE BEDROCK	12,000	1,200	0.70	—	140	0°
2	SEDIMENTARY AND FOLIATED ROCK	4,000	400	0.35	—	130	0°
3	SANDY GRAVEL AND/OR GRAVEL (GW AND GP)	3,000	200	0.35	—	120	32°
4	SAND, SILTY SAND, CLAYEY SAND, SILTY GRAVEL, AND CLAYEY GRAVEL (SW,SP,SM,SC,GM AND GC)	2,000	150	0.25	—	100	26°
5	CLAY, SANDY CLAY, SILTY CLAY, CLAYEY SILT, SILT AND SANDY SILT (CL, ML, MH AND CH)	1,500	100	—	130	90	0°



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**45-FT AND 60-FT
MONOPOLE
FOUNDATIONS**

Southwest Windpower

Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

2	06-22-07
1	06-01-07
0	05-24-07
REV	DATE

DRAWN BY: WHM CHECKED BY: MLG

SHEET NUMBER: S-3	REVISION: 2
	TEP #: 070760



TOWER REACTIONS - 45' MONOPOLE

ZONE	LOADING CRITERIA	FACTORED** MOMENT (KIP-FT)	FACTORED** SHEAR (KIPS)	FACTORED** VERTICAL (KIPS)
1	SKYSTREAM 3.7 WIND TURBINE 150 MPH & 40 MPH W/ ½"-ICE	169.80	5.24	1.55
2	SKYSTREAM 3.7 WIND TURBINE 120 MPH & 40 MPH W/ ½"-ICE	108.84	3.36	1.55
3	SKYSTREAM 3.7 WIND TURBINE 90 MPH & 40 MPH W/ ½"-ICE	61.28	1.88	1.74

TOWER REACTIONS - 60' MONOPOLE

ZONE	MAXIMUM LOADING CRITERIA	FACTORED** MOMENT (KIP-FT)	FACTORED** SHEAR (KIPS)	FACTORED** VERTICAL (KIPS)
1	SKYSTREAM 3.7 WIND TURBINE 150 MPH & 40 MPH W/ ½"-ICE	282.80	7.32	2.36
2	SKYSTREAM 3.7 WIND TURBINE 120 MPH & 40 MPH W/ ½"-ICE	181.44	4.68	2.36
3	SKYSTREAM 3.7 WIND TURBINE 90 MPH & 40 MPH W/ ½"-ICE	102.18	2.64	2.62

** THE REACTIONS LISTED ARE FOR REFERENCE ONLY AND SHOULD NOT BE SUBSTITUTED FOR A STRUTURAL ANALYSIS BASED ON SITE-SPECIFIC DATA.



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**45-FT AND 60-FT
MONOPOLE
FOUNDATIONS**

Southwest Windpower

Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

REV	DATE
2	06-22-07
1	06-01-07
0	05-24-07

DRAWN BY: WHM CHECKED BY: MLG

SHEET NUMBER:

S-4

REVISION:

2

TEP #: 070760

45-FT MONOPOLE FOUNDATION DIMENSIONS - PAD AND PIER

ZONE	SOIL CLASS	DIMENSION				PAD REINFORCEMENT	
		A	B	C	D	BAR SIZE	TOTAL QTY.
1	1	—	—	—	—	—	—
	2	—	—	—	—	—	—
	3	11'-3"	1'-6"	4'-6"	2'-6"	#6	36
	4	11'-9"	1'-6"	4'-6"	2'-6"	#6	36
	5	12'-0"	1'-6"	4'-6"	2'-6"	#6	36
ZONE	SOIL CLASS	DIMENSION				PAD REINFORCEMENT	
		A	B	C	D	BAR SIZE	TOTAL QTY.
2	1	—	—	—	—	—	—
	2	—	—	—	—	—	—
	3	9'-9"	1'-6"	4'-6"	2'-6"	#6	32
	4	10'-3"	1'-6"	4'-6"	2'-6"	#6	32
	5	10'-6"	1'-6"	4'-6"	2'-6"	#6	32
ZONE	SOIL CLASS	DIMENSION				PAD REINFORCEMENT	
		A	B	C	D	BAR SIZE	TOTAL QTY.
3	1	—	—	—	—	—	—
	2	—	—	—	—	—	—
	3	8'-0"	1'-6"	4'-6"	2'-6"	#6	28
	4	8'-3"	1'-6"	4'-6"	2'-6"	#6	28
	5	8'-6"	1'-6"	4'-6"	2'-6"	#6	28

6-27-2007



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**45-FT AND 60-FT
MONOPOLE
FOUNDATIONS**

Southwest Windpower
Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

2	06-22-07
1	06-01-07
0	05-24-07
REV	DATE

DRAWN BY: WHM CHECKED BY: MLG

SHEET NUMBER:

S-5


REVISION:

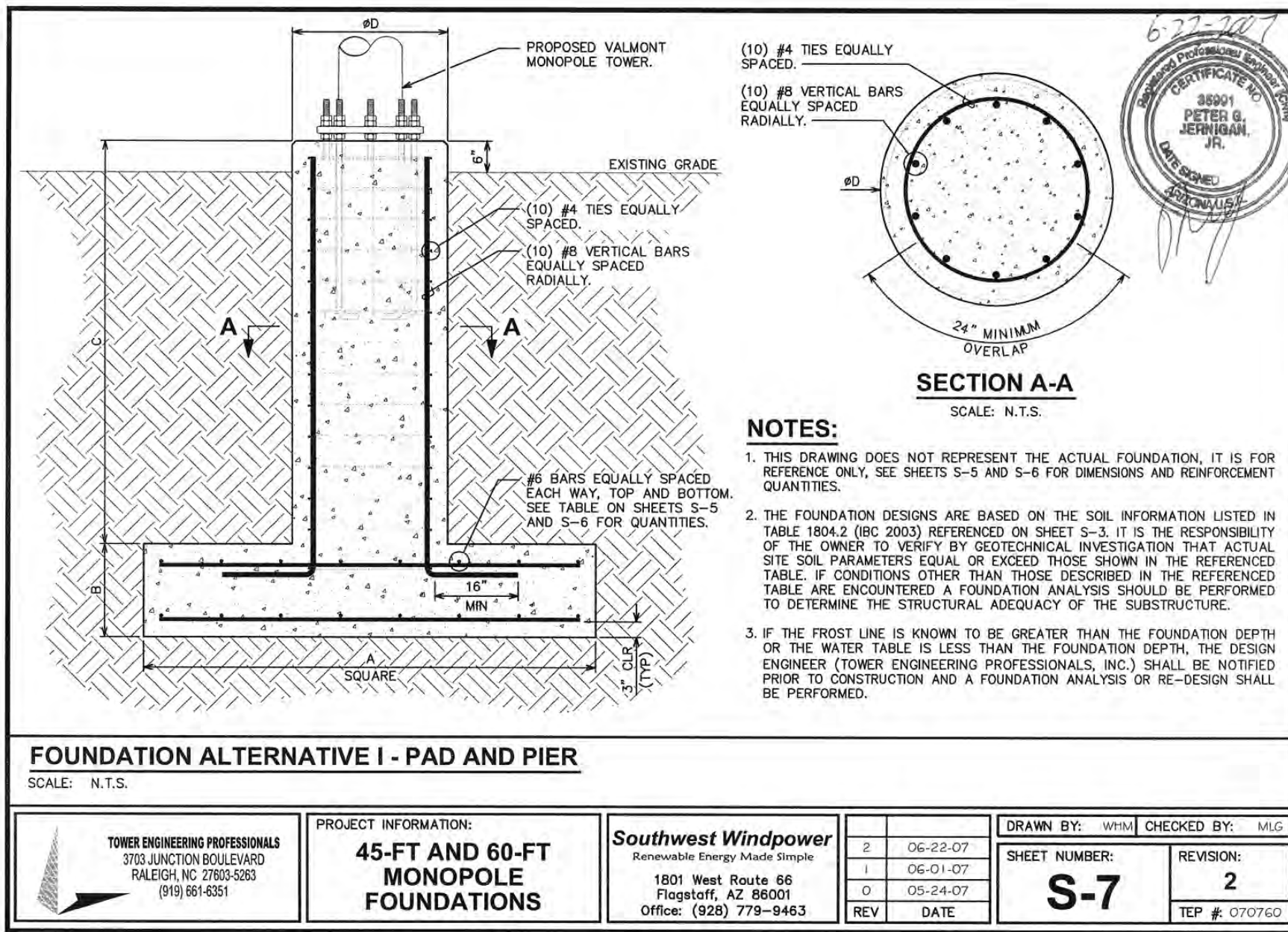
2

TEP #: 070760

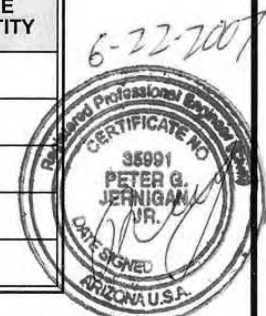
60-FT MONOPOLE FOUNDATION DIMENSIONS - PAD AND PIER							
ZONE	SOIL CLASS	DIMENSION				PAD REINFORCEMENT	
		A	B	C	D	BAR SIZE	TOTAL QTY.
1	1	—	—	—	—	—	—
	2	—	—	—	—	—	—
	3	13'-3"	1'-6"	4'-6"	2'-6"	#6	40
	4	14'-0"	1'-6"	4'-6"	2'-6"	#6	40
	5	14'-3"	1'-6"	4'-6"	2'-6"	#6	40
ZONE	SOIL CLASS	DIMENSION				PAD REINFORCEMENT	
		A	B	C	D	BAR SIZE	TOTAL QTY.
2	1	—	—	—	—	—	—
	2	—	—	—	—	—	—
	3	11'-6"	1'-6"	4'-6"	2'-6"	#6	36
	4	12'-0"	1'-6"	4'-6"	2'-6"	#6	36
	5	12'-3"	1'-6"	4'-6"	2'-6"	#6	36
ZONE	SOIL CLASS	DIMENSION				PAD REINFORCEMENT	
		A	B	C	D	BAR SIZE	TOTAL QTY.
3	1	—	—	—	—	—	—
	2	—	—	—	—	—	—
	3	9'-6"	1'-6"	4'-6"	2'-6"	#6	32
	4	9'-9"	1'-6"	4'-6"	2'-6"	#6	32
	5	10'-0"	1'-6"	4'-6"	2'-6"	#6	32



 <p>TOWER ENGINEERING PROFESSIONALS 3703 JUNCTION BOULEVARD RALEIGH, NC 27603-5263 (919) 661-6351</p>	PROJECT INFORMATION:	45-FT AND 60-FT MONOPOLE FOUNDATIONS	Southwest Windpower Renewable Energy Made Simple 1801 West Route 66 Flagstaff, AZ 86001 Office: (928) 779-9463	<table><tr><td>2</td><td>06-22-07</td></tr><tr><td>1</td><td>06-01-07</td></tr><tr><td>0</td><td>05-24-07</td></tr><tr><td>REV</td><td>DATE</td></tr></table>	2	06-22-07	1	06-01-07	0	05-24-07	REV	DATE	<table><tr><td>DRAWN BY: WHM</td><td>CHECKED BY: MLG</td></tr><tr><td colspan="2">SHEET NUMBER: S-6</td></tr><tr><td colspan="2">REVISION: 2</td></tr><tr><td colspan="2">TEP #: 070760</td></tr></table>	DRAWN BY: WHM	CHECKED BY: MLG	SHEET NUMBER: S-6		REVISION: 2		TEP #: 070760	
	2	06-22-07																			
	1	06-01-07																			
	0	05-24-07																			
	REV	DATE																			
DRAWN BY: WHM	CHECKED BY: MLG																				
SHEET NUMBER: S-6																					
REVISION: 2																					
TEP #: 070760																					



45-FT MONOPOLE FOUNDATION DIMENSIONS - PIER								
ZONE	SOIL CLASS	DIMENSION		VERTICAL REINFORCEMENT		TIE SPACING		#4 TIE QUANTITY
		A	B	SIZE	QUANTITY	SP1	SP2	
1	1	2'-6"	6'-0"	#8	10	6"± O.C.	—	12
	2	2'-6"	8'-6"	#8	10	6"± O.C.	—	17
	3	2'-6"	12'-0"	#8	10	6"± O.C.	—	24
	4	2'-6"	16'-0"	#8	10	6"± O.C.	11"± O.C.	27
	5	2'-6"	26'-0"	#8	10	6"± O.C.	11.6"± O.C.	37
ZONE	SOIL CLASS	DIMENSION		VERTICAL REINFORCEMENT		TIE SPACING		#4 TIE QUANTITY
		A	B	SIZE	QUANTITY	SP1	SP2	
2	1	2'-6"	6'-0"	#8	10	6"± O.C.	—	12
	2	2'-6"	8'-6"	#8	10	6"± O.C.	—	17
	3	2'-6"	11'-0"	#8	10	6"± O.C.	—	22
	4	2'-6"	15'-0"	#8	10	6"± O.C.	9"± O.C.	27
	5	2'-6"	23'-0"	#8	10	6"± O.C.	11.5"± O.C.	34
ZONE	SOIL CLASS	DIMENSION		VERTICAL REINFORCEMENT		TIE SPACING		#4 TIE QUANTITY
		A	B	SIZE	QUANTITY	SP1	SP2	
3	1	2'-6"	6'-0"	#8	10	6"± O.C.	—	12
	2	2'-6"	8'-6"	#8	10	6"± O.C.	—	17
	3	2'-6"	9'-0"	#8	10	6"± O.C.	—	18
	4	2'-6"	12'-0"	#8	10	6"± O.C.	—	24
	5	2'-6"	17'-0"	#8	10	6"± O.C.	11.1"± O.C.	28



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**45-FT AND 60-FT
MONOPOLE
FOUNDATIONS**

Southwest Windpower

Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

2	06-22-07
1	06-01-07
0	05-24-07
REV	DATE

DRAWN BY: WHM CHECKED BY: MLG

SHEET NUMBER: S-8	REVISION: 2 TEP #: 070760
-----------------------------	--

60-FT MONOPOLE FOUNDATION DIMENSIONS - PIER								
ZONE	SOIL CLASS	DIMENSION		VERTICAL REINFORCEMENT		TIE SPACING		#4 TIE QUANTITY
		A	B	SIZE	QUANTITY	SP1	SP2	
1	1	3'-0"	8'-0"	#8	14	6"± O.C.	—	16
	2	3'-0"	9'-0"	#8	14	6"± O.C.	—	18
	3	3'-0"	12'-0"	#8	14	6"± O.C.	—	24
	4	3'-0"	17'-0"	#8	14	6"± O.C.	—	34
	5	3'-0"	30'-0"	#8	14	6"± O.C.	11.7"± O.C.	43
ZONE	SOIL CLASS	DIMENSION		VERTICAL REINFORCEMENT		TIE SPACING		#4 TIE QUANTITY
		A	B	SIZE	QUANTITY	SP1	SP2	
2	1	2'-6"	6'-0"	#8	10	6"± O.C.	—	12
	2	2'-6"	8'-6"	#8	10	6"± O.C.	—	17
	3	2'-6"	12'-0"	#8	10	6"± O.C.	—	24
	4	2'-6"	16'-0"	#8	10	6"± O.C.	11"± O.C.	27
	5	2'-6"	26'-0"	#8	10	6"± O.C.	11.6"± O.C.	37
ZONE	SOIL CLASS	DIMENSION		VERTICAL REINFORCEMENT		TIE SPACING		#4 TIE QUANTITY
		A	B	SIZE	QUANTITY	SP1	SP2	
3	1	2'-6"	6'-0"	#8	10	6"± O.C.	—	12
	2	2'-6"	8'-6"	#8	10	6"± O.C.	—	17
	3	2'-6"	11'-0"	#8	10	6"± O.C.	—	22
	4	2'-6"	15'-0"	#8	10	6"± O.C.	9"± O.C.	27
	5	2'-6"	23'-0"	#8	10	6"± O.C.	11.5"± O.C.	34

6-22-2007



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**45-FT AND 60-FT
MONOPOLE
FOUNDATIONS**

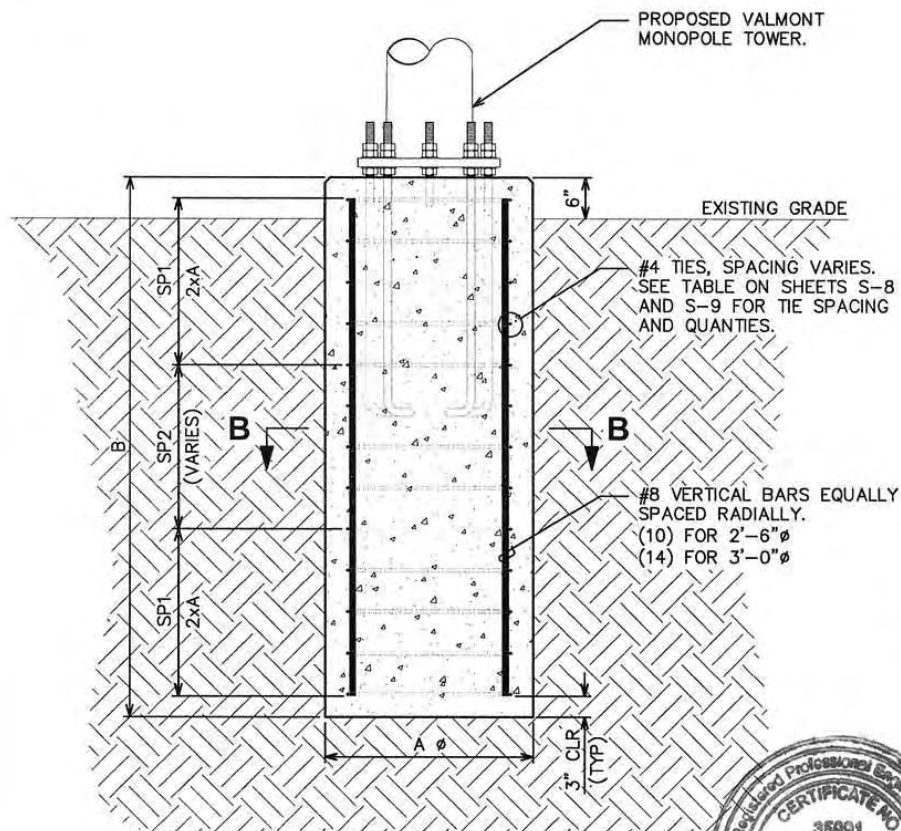
Southwest Windpower
Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

2	06-22-07
1	06-01-07
0	05-24-07
REV	DATE

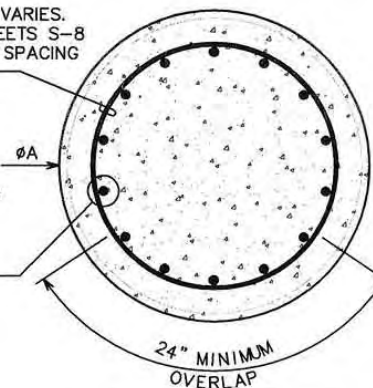
DRAWN BY: WHM CHECKED BY: MLG

SHEET NUMBER: S-9	REVISION: 2 TEP #: 070760
-----------------------------	--



#4 TIES, SPACING VARIES.
SEE TABLE ON SHEETS S-8
AND S-9 FOR TIE SPACING
AND QUANTITIES.

#8 VERTICAL BARS
EQUALLY SPACED
RADIALLY.
(10) FOR 2'-6" ϕ
(14) FOR 3'-0" ϕ



SECTION B-B

SCALE: N.T.S.

NOTES:

1. THIS DRAWING DOES NOT REPRESENT THE ACTUAL FOUNDATION, IT IS FOR REFERENCE ONLY, SEE SHEET S-8 AND S-9 FOR DIMENSIONS AND REINFORCEMENT QUANTITIES.
2. THE FOUNDATION DESIGNS ARE BASED ON THE SOIL INFORMATION LISTED IN TABLE 1804.2 (IBC 2003) REFERENCED ON SHEET S-3. IT IS THE RESPONSIBILITY OF THE OWNER TO VERIFY BY GEOTECHNICAL INVESTIGATION THAT ACTUAL SITE SOIL PARAMETERS EQUAL OR EXCEED THOSE SHOWN IN THE REFERENCED TABLE. IF CONDITIONS OTHER THAN THOSE DESCRIBED IN THE REFERENCED TABLE ARE ENCOUNTERED A FOUNDATION ANALYSIS SHOULD BE PERFORMED TO DETERMINE THE STRUCTURAL ADEQUACY OF THE SUBSTRUCTURE.
3. IF THE FROST LINE IS KNOWN TO BE GREATER THAN THE FOUNDATION DEPTH OR THE WATER TABLE IS LESS THAN THE FOUNDATION DEPTH, THE DESIGN ENGINEER (TOWER ENGINEERING PROFESSIONALS, INC.) SHALL BE NOTIFIED PRIOR TO CONSTRUCTION AND A FOUNDATION ANALYSIS OR RE-DESIGN SHALL BE PERFORMED.



FOUNDATION ALTERNATIVE II - PIER

SCALE: N.T.S.



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351

PROJECT INFORMATION:

**45-FT AND 60-FT
MONOPOLE
FOUNDATIONS**

Southwest Windpower

Renewable Energy Made Simple

1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

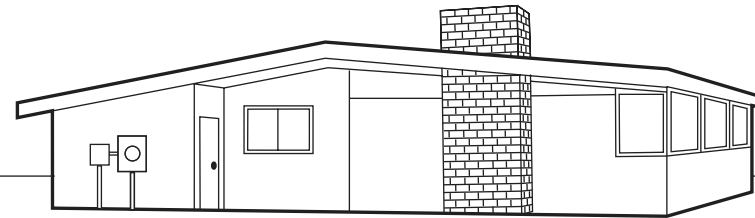
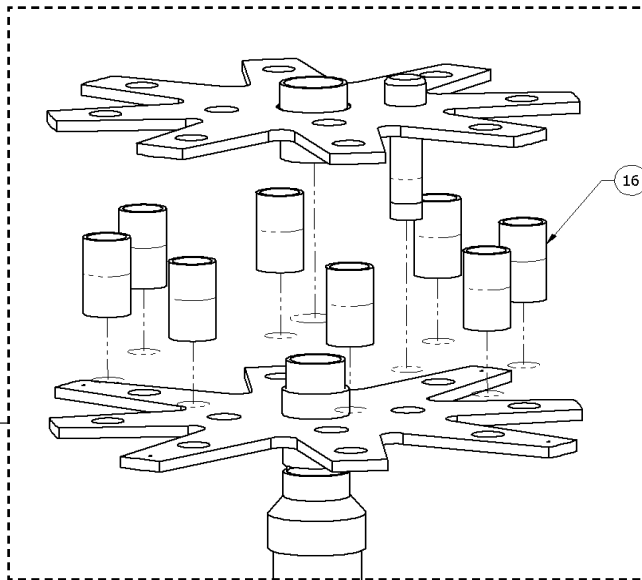
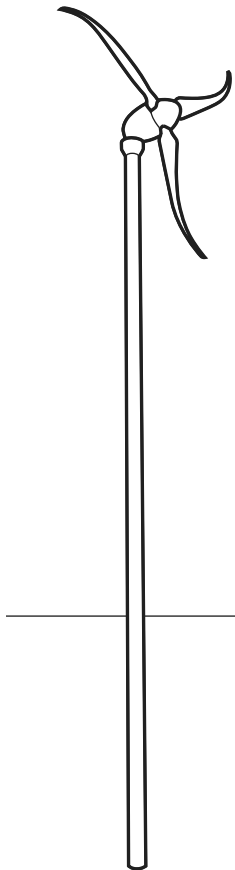
REV	DATE
2	06-22-07
1	06-01-07
0	05-24-07

DRAWN BY: WHM CHECKED BY: MLG

SHEET NUMBER:	REVISION:
S-10	2
	TEP #: 070760

SKYSTREAM 3.7®

APPENDIX C SMART FOUNDATION™



Southwest Windpower, Inc.
1801 West Route 66
Flagstaff, Arizona 86001 USA
Phone: 928-779-9463
Fax: 928-779-1485
www.skystreamenergy.com

MADE IN THE **USA** © March 2009 Southwest Windpower, Inc.
All Rights Reserved

**SMarT_Foundation™ [Simple Modular Technology]
Assembly and Installation Instructions
(U.S. Patent Pending)**

Southwest Windpower Skystream 3.7 Wind Turbine with Towers up to 60 ft. (18.3 m) in Height

AnemErgonics™

**A Colorado Limited Liability Company
www.anemergonics.com**

DESIGNED IN CONFORMANCE WITH THE INTERNATIONAL ELECTROTECHNICAL COMMISSION
(IEC) 61400-2 ED.2 DESIGN REQUIREMENTS FOR SMALL WIND TURBINES
THE NATIONAL ELECTRICAL SAFETY CODE (NEC) AND
THE INTERNATIONAL BUILDING CODE (IBC) 2003 PRESCRIPTIVE SOIL VALUES

ATTENTION

USE OF THESE INSTRUCTIONS, WHICH ARE PROVIDED BY ANEMERGONICS, LLC ("SUPPLIER") IS CONTROLLED BY, GOVERNED BY AND SUBJECT TO THE APPLICABLE ANEMERGONICS, LLC PURCHASE AGREEMENT, WHICH INCLUDES THE ANEMERGONICS, LLC TERMS AND CONDITIONS ("AGREEMENT"). ANY USE OF THESE INSTRUCTIONS THAT IS IN ANY WAY INCONSISTENT WITH THE AGREEMENT IS UNAUTHORIZED. AMONG OTHER THINGS, THE AGREEMENT INCLUDES: BROAD INDEMNITY PROVISIONS IN FAVOR OF SUPPLIER AND THE SUPPLIER INDEMNIFIED PARTIES (AS DEFINED IN THE AGREEMENT), LIABILITY LIMITATION AND LIMITATIONS ON USE. CONTACT SUPPLIER WITH QUESTIONS REGARDING THE AGREEMENT OR IF YOU HAVE NOT BEEN PROVIDED THE AGREEMENT OR ANY OF THE MATERIALS REFERENCED IN THE AGREEMENT.

© 2007–2008 by AnemErgonics, LLC. All rights reserved.



Some Important Notes about Constructing a SMarT Foundation!

- ☐ Check with local building officials to determine the design wind speed at the location where you are installing the wind turbine.
- ☐ Check with local building officials to determine the design frost depth at the location where you are installing the wind turbine. If the frost depth is more than 3.5 ft. (1.07 m), you will need to fabricate an extension for the stanchion in the foundation kits (the “Kit”).
- ☐ Check that the excavation diameter from the construction drawings (the “Drawings”) coincides with your tower height and design wind speed.
- ☐ Check that the bolt circle of your tower base flange matches the bolt circle of the anchor bolt templates and rebar hoops in the Kit.
- ☐ Check that you have ordered fiber-reinforced concrete as specified in the Drawings.
- ☐ Modifications, including design modifications and use of additional or alternative materials supplied by third parties, must be pre-approved in writing by Supplier. Any approvals referenced in these Instructions means Supplier’s prior, written approval.

- ☐ Make sure you read the Drawings, Instructions and Terms and Conditions carefully.
- ☐ Make sure all Parts, materials and tools are in hand before gathering at the construction site.
- ☐ Make sure the construction team is familiar with the Kit before gathering at the construction site.

- ☐ Follow the assembly sequence to avoid mistakes that might cause delays or other problems.
- ☐ Have one person in charge of coordinating the participants and directing construction activity.
- ☐ Conduct a site safety meeting to discuss procedures, roles and responsibilities before commencing construction activities.
- ☐ Do not place excavation spoils (the pile of dirt!) close to the excavation. Avoid tripping hazards and keep dirt out of the foundation.

- ☐ Make sure the width of the excavation is at least that specified in the Drawings.
- ☐ Level the center of the excavation floor where the stanchion base will be placed.
- ☐ Mark the center of the excavation floor for placement of the stanchion.
- ☐ Do not allow dirt or other loose materials to fall into the foundation.
- ☐ Make sure that the anchor rods extend the correct height above the “stub pier” and the final grade.
- ☐ Check the bill of lading when the concrete arrives to make sure the supplier has delivered fiber-reinforced concrete.
- ☐ Do not torque the anchor rod nuts until the concrete has achieved its design strength of 2,500 psi. The required curing time depends on the initial strength of the concrete and the cure conditions.

- ☐ Contact us with questions or if you encounter problems with the installation.

- ☐ Please reuse or recycle all materials remaining after construction.

We provide a unique foundation solution along with Drawings, Parts and Instructions to facilitate placement of reinforcement and anchor rods.

We suggest a sequence of tasks for assembly and installation of the Kit and placement of concrete. However, it is the installer that is responsible for applying appropriate techniques and exercising reasonable standards of care in constructing the foundation. The installer is also responsible for adhering to all applicable safety and health regulations and exercising reasonable prudence during construction. Consult the turbine manufacturer and/or qualified professionals regarding lightning protection and electrical grounding requirements. Those issues are not addressed by us and are not our responsibility. Specification of installation procedures for anchor bolts or anchor rods is the responsibility of the turbine manufacturer. Proper installation, inspection and testing of anchor rods are the responsibility of the installer. Please check with the turbine manufacturer for its recommended procedures.

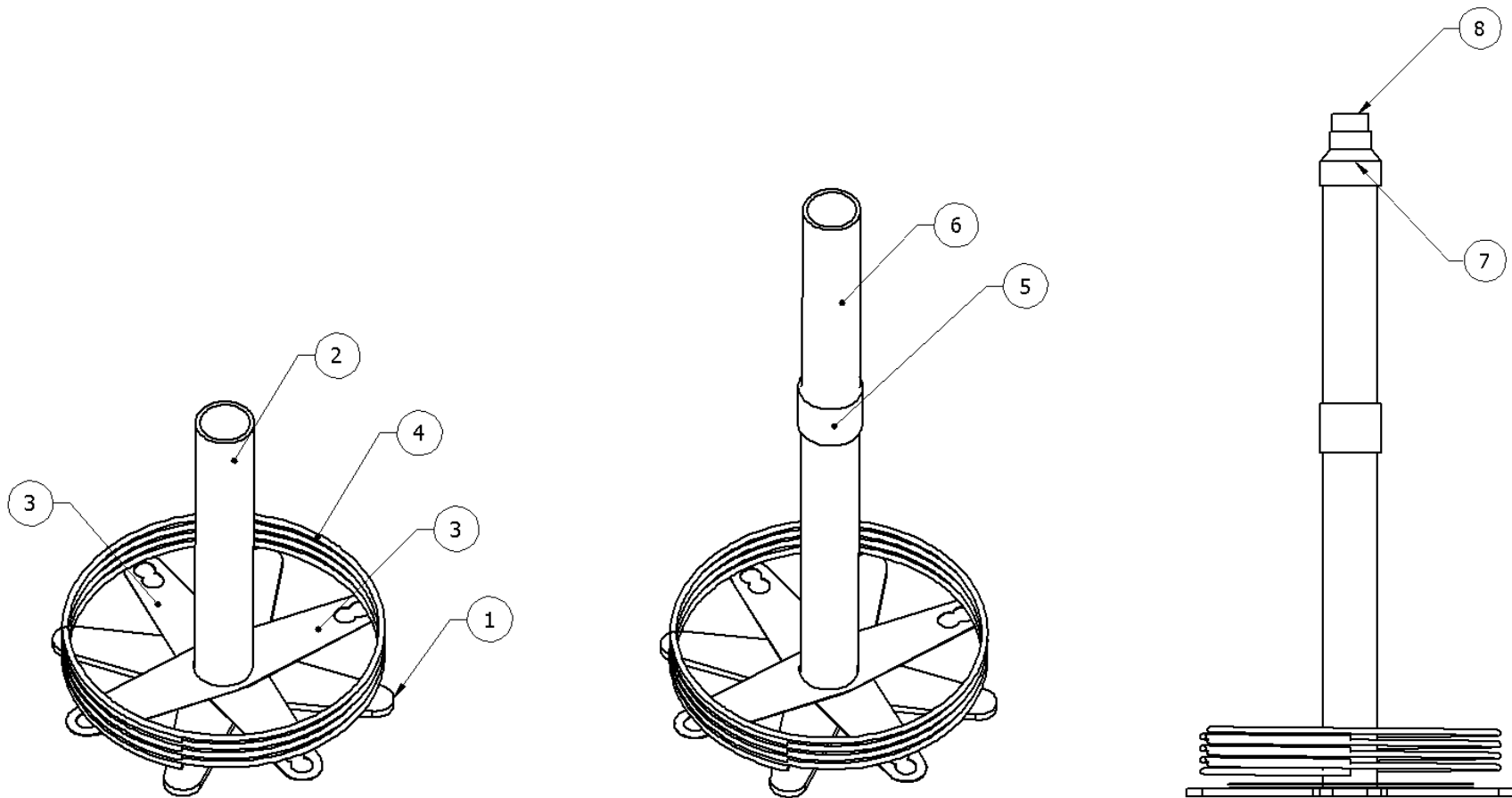
Use of this innovative foundation is intended to reduce material costs, labor hours and wind turbine installed cost. Installers are advised to read the Drawings, Instructions and Terms and Conditions and to plan carefully.

The Kit requires an excavation of 3.5 feet (1.07 m) below the planned final earth grade. Thus, the foundation is suitable for use in frost depths up to and including 3.5 feet (1.07 m). The appropriate frost depth must be determined by consulting local building authorities. For frost depths greater than 3.5 feet (1.07 m), the installer must fabricate a 3" ABS pipe extension, the length of which is given by the equation $l = \text{frost depth} - 42 \text{ inches (1067 mm)}$. Using a standard 3" ABS coupling, this extension would be added to the bottom of the stanchion (Step 4.1).

The required foundation diameter, which depends on the tower height and the site design wind speed, is specified in the Drawings also contained in the Kit.

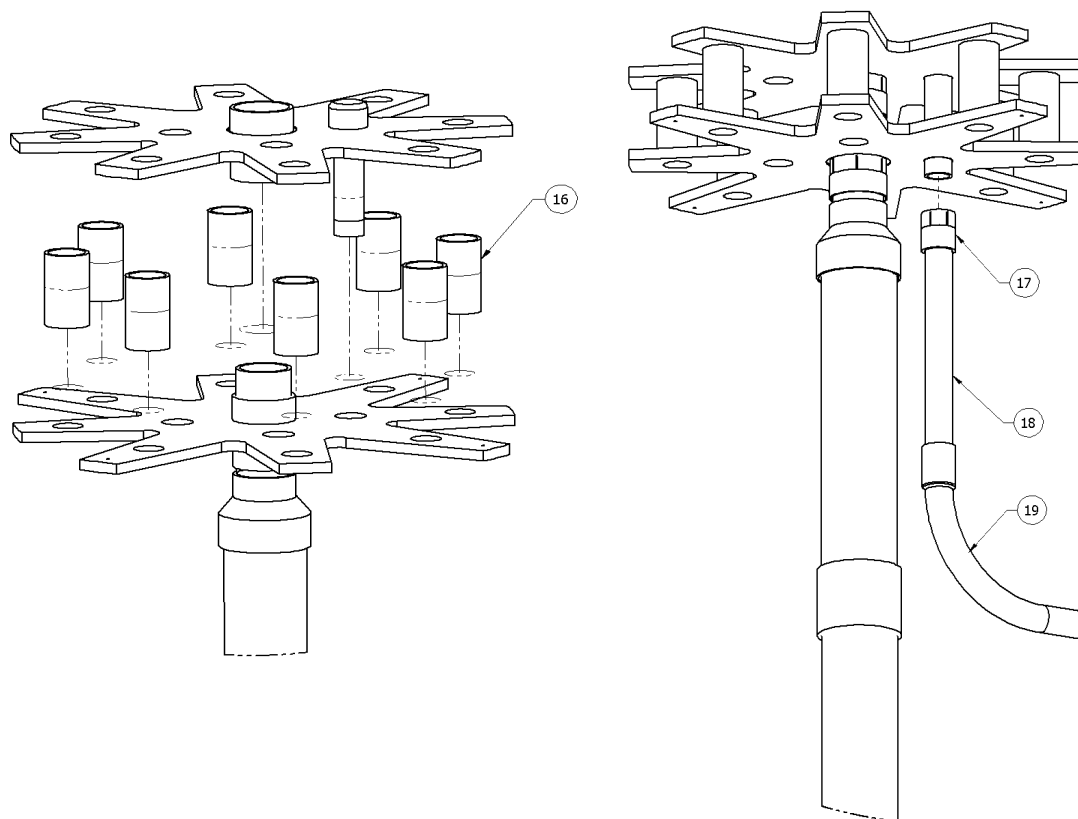
ITEM	PART NUMBER	PART NAME	DESCRIPTION	QTY
1	015-001-0001	STANCHION BASE	1/2" MDF x 19" OUTSIDE DIMENSION	1
2	013-003-0003	LOWER STANCHION	3" ABS PIPE X 23-15/16"	1
3	002-001-001	STANCHION BRACE	16 GA COLD ROLLED STEEL	2
4	014-001-0001/2	REBAR HOOP	#3 STEEL 18 1/2" ID (17" BC) or 20-1/2" ID (19" BC)	4
5	009-002-001	STANCHION COUPLING	3" ABS	1
6	013-003-0004	UPPER STANCHION	3" ABS PIPE X 17-1/16"	1
7	009-006-0001	3" TO 2" ABS REDUCER	3" TO 2" ABS REDUCER	1
8	013-001-0003	2" ABS EXTENSION	2" ABS PIPE x 2"	1
8	013-001-0003	2" ABS TEMPLATE SPACER	2" ABS PIPE x 2"	1
9	016-001-0004/6	LOWER ANCHOR BOLT TEMPLATE	1/2" MDF, 17" or 19" BOLT CIRCLE	1
10	008-003-002	CABLE TIE	Plastic Tie, 7"	20
11	009-004-0001	2" ABS FEMALE ADAPTER	2" ABS	2
12	009-005-0001	2" ABS MALE ADAPTER	2" ABS	2
13	016-001-0003/5	UPPER ANCHOR BOLT TEMPLATE	1/2" MDF, 17" or 19" BOLT CIRCLE	1
14	009-007-0001	1" PVC RISER	1" SCH 80 PVC PIPE X 6", THREADED	1
15	009-001-0002	1" PVC THREADED CAP	1" PVC	1
16	013-002-0001	1-1/2" ABS TEMPLATE SPACER	1-1/2" ABS PIPE X 3-15/32"	8
17	009-004-0002	1" PVC FEMALE ADAPTER	1" PVC	1
18	013-001-0002	1" PVC EXTENSION	1" PVC PIPE X 11-15/16"	1
19	009-003-0001	1" PVC ELBOW	1" PVC 90 DEGREE ELBOW WITH BELL END	1
20	008-001-0001	ANCHOR ROD*	1-1/4" x 32" ASTM 1554	8
21	008-002-0001	ANCHOR ROD NUT*	1-1/4" ASTM A563 HEAVY, HDG	24
22	006-001-0001	CYLINDRICAL CONCRETE FORM	24" ID X 7-3/4" LONG	1
23	003-001-0002	LOCATER BRACKET	16 GA COLD ROLLED STEEL, 3/4" X 9-5/8"	4
24	008-005-0001	LOCATER BRACKET SCREWS	#8 x 1/2" SELF TAPPING SCREW, PHILLIPS	8
25	011-001-0001	GUY ROPES	GUY ROPE WITH SLIDES, 10' LONG, 2/PKG	2
26	012-001-0001	NAIL PEGS	NAIL PEGS, 10" LONG, 4/PKG	1
27	017-001-0001	MULTI-PURPOSE CEMENT	2 OZ DABBER CAN	1
28	018-001-0003	DRAWINGS	SMarT 2_v1 DRAWINGS	1
29	018-002-0002	INSTRUCTIONS	SMarT 2_v1 ASSEMBLY/INSTALLATION INSTRUCTIONS	1

* Anchor Rods and Anchor Rod Nuts are sold separately.



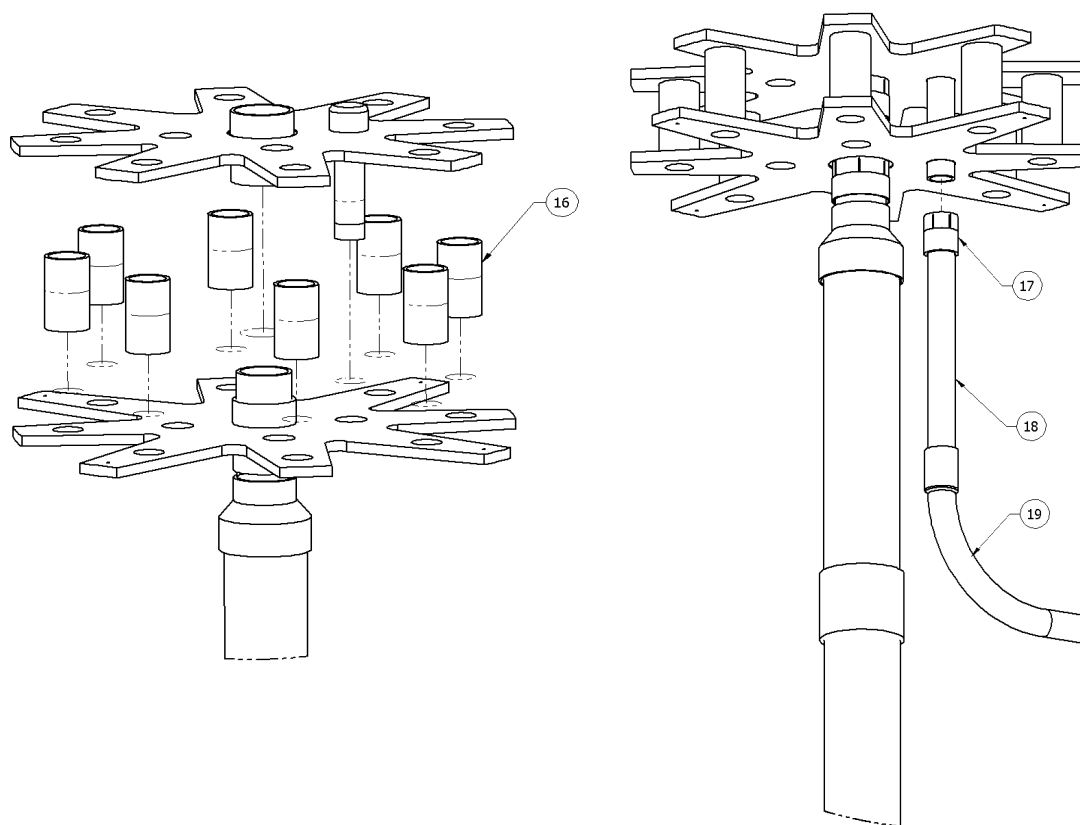
Step 4. Assemble the vertical stanchion. Follow the illustrations from left to right.

Step	Instructions	Notes
1	Check the contents of the Kit against the parts list shown on page 3. Contact the Supplier if any parts are missing.	The Kit is used to assemble and properly locate the anchor bolt templates, spacers, reinforcement and cylindrical concrete form on a vertical stanchion to be placed in the foundation excavation.
2	Read these Instructions carefully, paying close attention to safety issues.	Review the Drawings provided and Terms and Conditions provided with the Kits.
3	Gather all required tools and equipment.	Tools required for Kit assembly and placement are a tape measure, carpenter's level, hammer, Phillips head screwdriver, marking pen and cleanup rag . Typical concrete placement and finishing tools are required to pour the foundation. Personal protection equipment, including work gloves, eye protection and hard hat is required.
4	<p>Assemble the vertical stanchion.</p> <ol style="list-style-type: none"> 1. If necessary, add an extension (not supplied) to the Lower Stanchion (2) to deal with greater frost depths. 2. Insert the Lower Stanchion in the Stanchion Base (1) and place it on a solid, level surface convenient for assembly of the Kit. 3. Slide the two Stanchion Braces (3) over the top of the Lower Stanchion and rest them on the Stanchion Base. 4. Place the Rebar Hoops (4) over the Lower Stanchion and rest them on the Stanchion Braces. 5. Use the Stanchion Coupling (5) to connect the Upper Stanchion (6) to the Lower Stanchion. These parts should be glued together. 6. Install the 3" to 2" ABS Pipe Reducer (7) and the 2" ABS Extension (8), in that order, on top of the Upper Stanchion. These parts should be glued together. 	<p>Note: The Kit may be constructed in the excavation or at an adjacent location. Consider that when assembled it weighs approximately 145 lbs (66 kg).</p> <p>The Lower Stanchion is the longer of the two 3" ABS pipes supplied with the Kit. Important: For frost depths greater than 3.5 feet (1.07 m), the installer must provide an ABS coupling and pipe extension of length $l = \text{frost depth} - 42 \text{ inches (1067 mm)}$.</p> <p>Important: The use of ABS cement, or the Multi-Purpose Cement (27) supplied with the Kit, is required to attach these ABS fittings</p> <p>Important: The use of ABS cement, or the Multi-Purpose Cement (27) supplied with the Kit, is required to attach these ABS fittings.</p> <p>Note: You may find that the parts of Steps 4.5 and 4.6 were pre-assembled at the factory.</p>



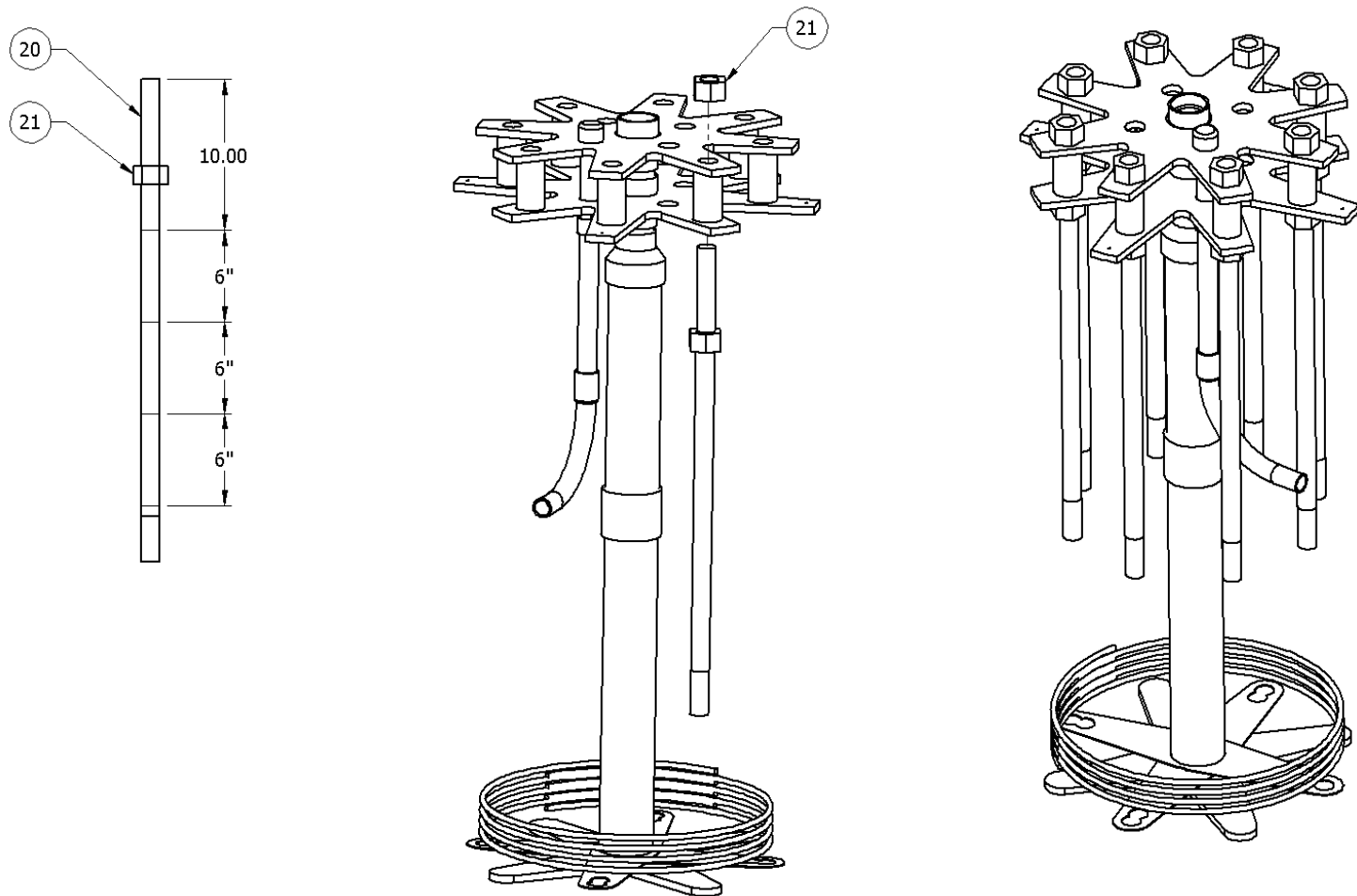
Step 6. Join the upper and lower anchor bolt templates. Follow the illustrations from left to right.

Step	Instructions	Notes
5	<p>Assemble the anchor bolt templates.</p> <ol style="list-style-type: none"> 1. Insert a 2" ABS Male Adapter (12) through the center of the Lower Anchor Bolt Template (9) into a 2" ABS Female Adapter (11). Hand-tighten the threaded fittings. 2. Insert a 2"ABS Template Spacer (8) into the 2"ABS Male Adapter. These parts <u>should not</u> be glued together. 3. Install the assembly (from Steps 5.1 and 5.2) onto the stanchion by inserting the 2"ABS Female Adapter into the 2" ABS Pipe Extension on the top of the stanchion. These parts should be glued together. 4. Insert a 2" ABS Male Adapter (12) through the center of the Upper Anchor Bolt Template (13) into a 2" ABS Female Adapter (11). Hand-tighten the threaded fittings. 5. Screw the 1" PVC Threaded Cap (15) onto one end of the 1" PVC Riser (14). Insert this assembly through any one of the inner holes of the Upper Anchor Bolt Template. 	<p>Note: <i>The Lower Anchor Bolt Template has four long "spokes" and four short "spokes".</i></p> <p>Caution: <i>For this assembly, the 2" ABS <u>Female</u> Adapter fits on the grooved side of the Lower Anchor Bolt Template.</i></p> <p>Important: <i><u>Do not</u> cement these parts.</i></p> <p>Important: <i>The use of ABS cement, or the Multi-Purpose Cement (27) supplied with the Kit, is recommended to attach these ABS fittings.</i></p> <p>The Upper Anchor Bolt Template has eight "spokes" that are the same size.</p> <p>Caution: <i>For this template, the 2" ABS <u>Male</u> Adapter fits on the grooved side of the Upper Anchor Bolt Template.</i></p>



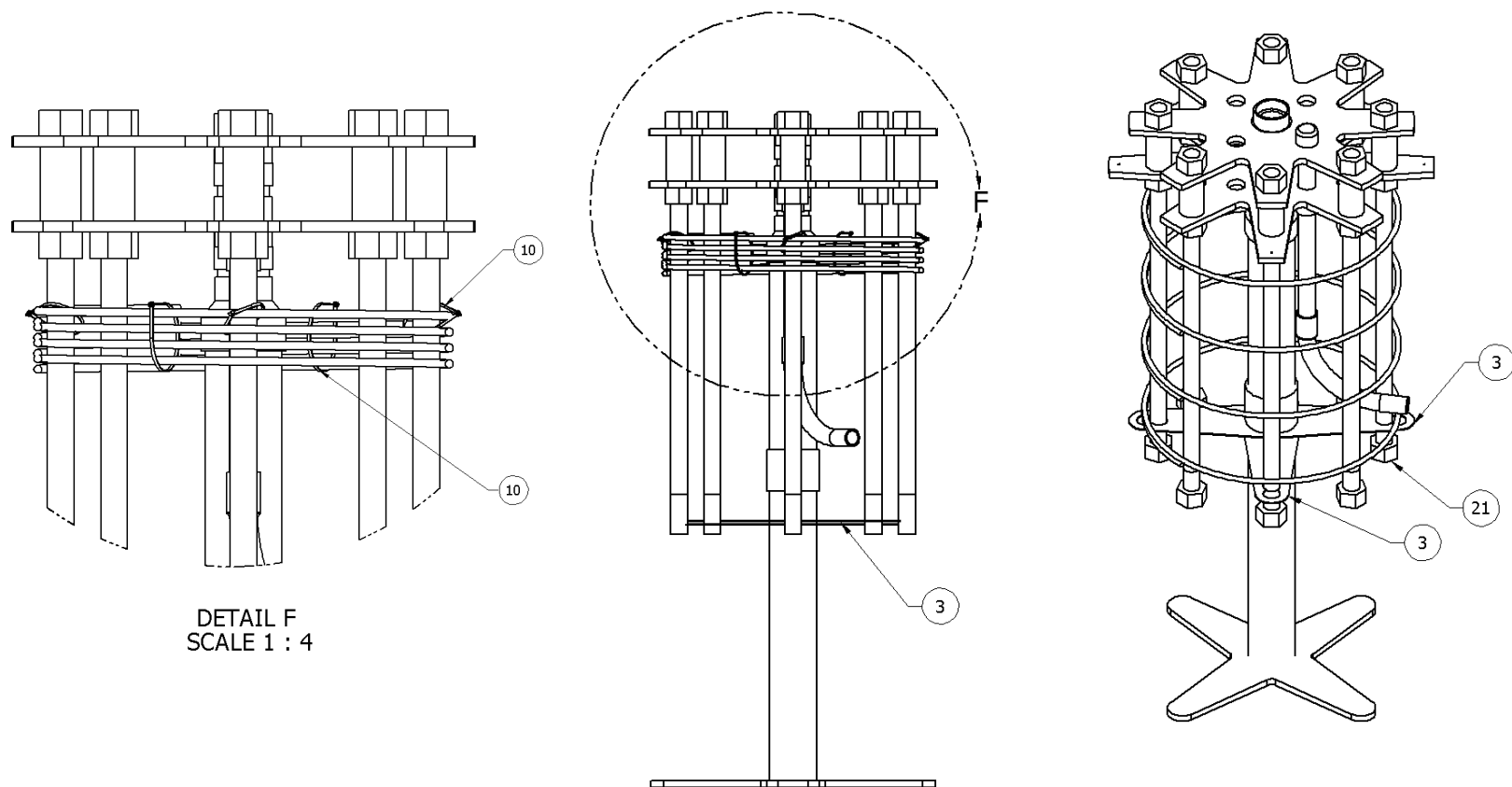
Step 6. Join the upper and lower anchor bolt templates. Follow the illustrations from left to right.

Step	Instructions	Notes
6	<p>Join the Upper and Lower Anchor Bolt Templates.</p> <ol style="list-style-type: none"> 1. Join the Upper and Lower Anchor Bolt Templates by inserting the 2" ABS Female Adapter on the bottom of the Upper Anchor Bolt Template into the 2" ABS Template Spacer protruding from the top of the Lower Anchor Bolt Template assembly. These parts <u>should not</u> be glued together. 2. Slip the eight 1-1/2" ABS Template Spacers (16) between the Upper and Lower Anchor Bolt Templates and align them with the outer bolt holes in the templates. 3. Assemble the 1" PVC Female Adapter (17), the 1" PVC Extension (18) and the 1" PVC Elbow (19) as shown in the illustration. These parts should be glued together 4. Screw the 1" PVC Female Adapter of the above assembly into the 1" PVC Threaded Nipple protruding from the bottom of the Lower Anchor Bolt Template. 	<p><i>Important: Make sure the 1" PVC Threaded Nipple passes through one of the inner holes in both the Upper and Lower Anchor Bolt Templates.</i></p> <p><i>Important: <u>Do not</u> cement these parts.</i></p> <p><i>Important: The use of PVC cement, or the Multi-Purpose Cement (27) supplied with the Kit, is recommended to attach these PVC fittings.</i></p> <p>If necessary, this PVC assembly may be relocated to some other holes in order to mate with a planned electrical interconnection.</p>



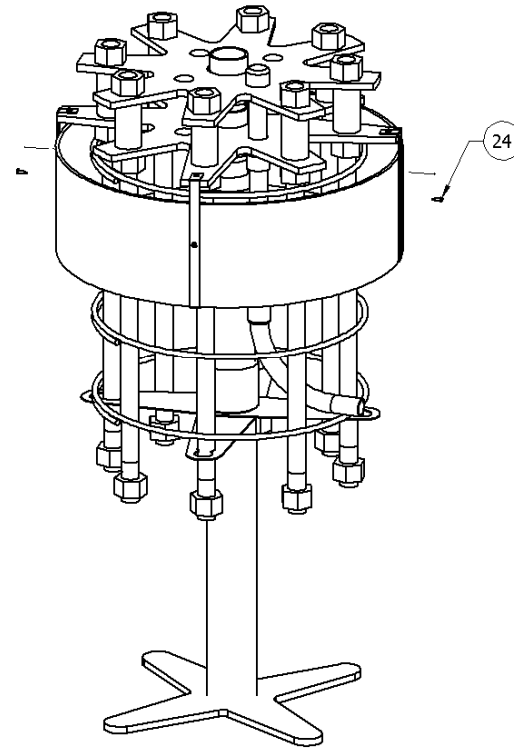
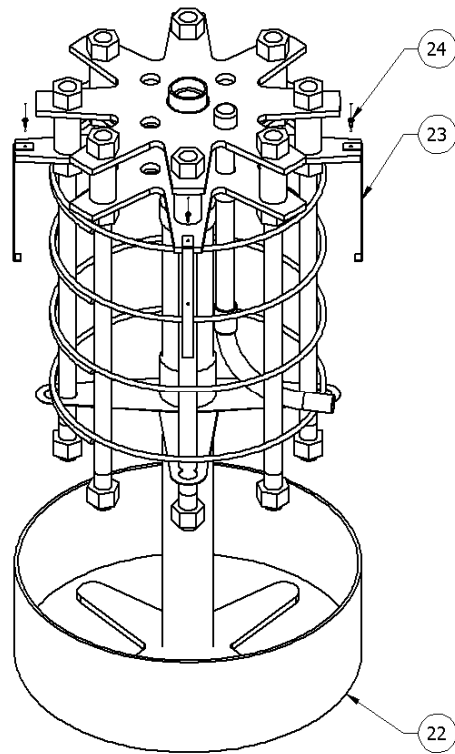
Step 7. Install the anchor rods. Follow the illustrations from left to right.

Step	Instructions	Notes
7	<p>Install the anchor rods.</p> <ol style="list-style-type: none"> 1. Prepare the eight 1-1/4" diameter Anchor Rods (20) as shown in the illustration above. <ol style="list-style-type: none"> 1.1. Remove the Anchor Rod Nuts (21) from the bottom (short thread length) of the Anchor Rods. 1.2. Run one Anchor Rod Nut to the bottom of the thread length on the top of the Anchor Rods. 1.3. Mark the Anchor Rods in the locations shown. These marks will be used to place the rebar hoops. 2. Insert the Anchor Rods through the outer (bolt circle) holes of the Lower Anchor Bolt Template, the 1-1/2" ABS Template Spacers and the Upper Anchor Bolt Template. 3. Thread the Anchor Rod Nuts onto the protruding Anchor Rods until they are just flush with the ends. 4. Adjust the lower Anchor Rod Nuts until they are snug with the Lower Anchor Bolt Template. 5. Before advancing to the next step, check that the top surfaces of the top Anchor Rod Nuts are flush with the top surfaces of the Anchor Rods and that the entire assembly is rigid. This may require additional hand tightening of some nuts. 	<p>Note: <i>Anchor Rods are supplied separately from the Kit. The illustrations above and these Instructions have been prepared for the Anchor Rods provided by the Supplier. If different types or sizes of concrete anchors are supplied by others, appropriate adaptations must be made.</i></p> <p>It is not unusual for minor thread damage to exist. In such cases, external threads may be "dressed" with a metal file and/or both internal and external threads may be "chased" by using a wrench to force the nut past the damaged thread(s).</p> <p>A wrench is not needed. Hand tightening is adequate.</p> <p>A wrench is not needed. Hand tightening is adequate.</p> <p>A wrench is not needed. Hand tightening is adequate.</p>



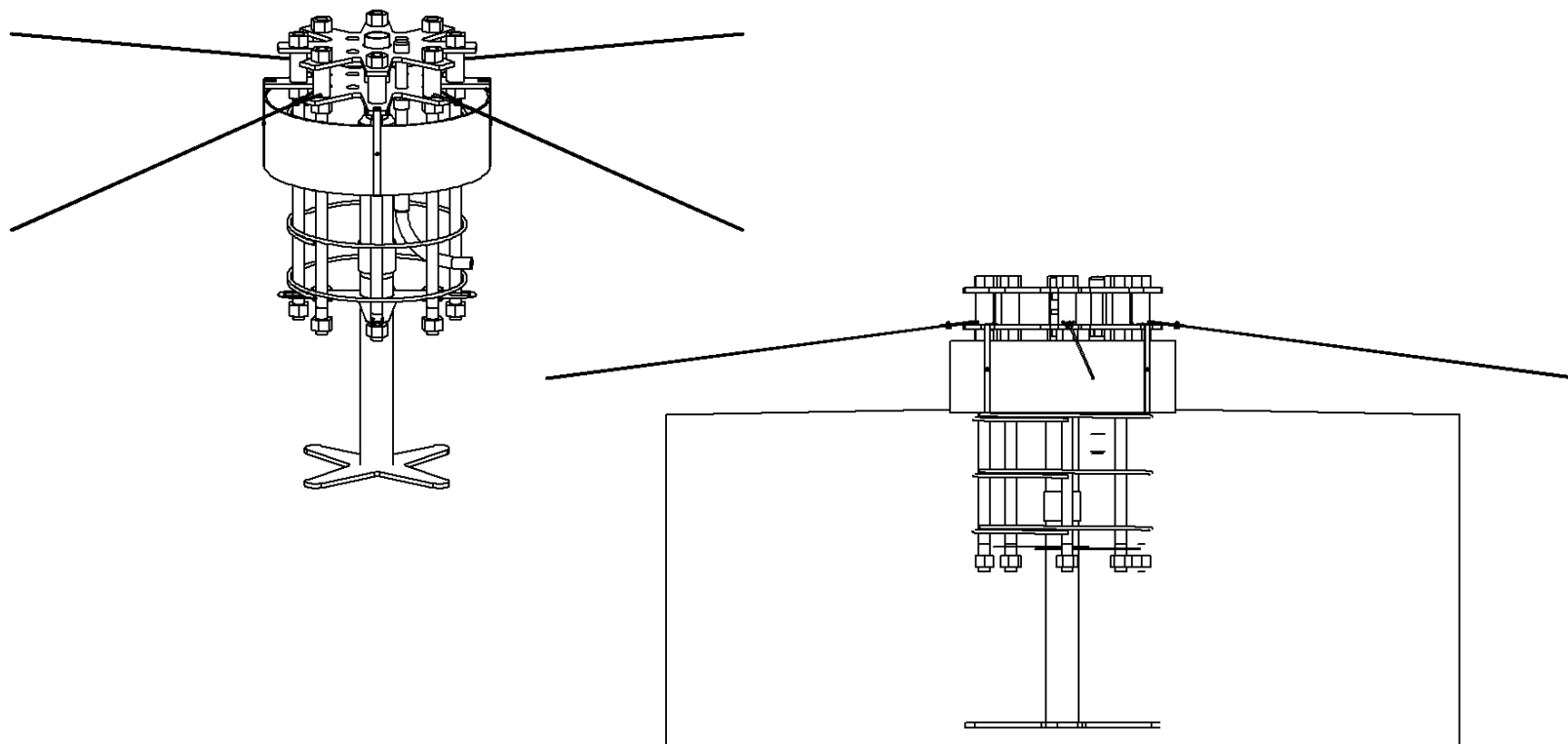
Step 8. Install reinforcement on anchor rod assembly. Follow the illustrations from left to right.

Step	Instructions	Notes
8	<p>Install reinforcement on anchor rod assembly.</p> <ol style="list-style-type: none"> Slide one Rebar Hoop (4) up over the Anchor Rods to the top marks that were placed on the Anchor Rods in Step 7.1.3. This hoop should be at least 4" below the lower surface of the Lower Anchor Bolt Template. Fasten this Rebar Hoop to every other Anchor Rod using the Plastic Cable Ties (10). Slide all remaining Rebar Hoops up over the Anchor Bolts and temporarily secure them to the top Rebar Hoop using several Plastic Cable Ties. Slide one Stanchion Brace (3) up the Lower Stanchion and over two opposing Anchor Rods. Secure the Stanchion Brace with Anchor Rod Nuts threaded hand tight up to the end of the threads on the Anchor Rods. Slide the remaining Stanchion Brace (3) up the Lower Stanchion and over two Anchor Rods 90 degrees opposed to the first Stanchion Brace. Secure the Stanchion Brace with Anchor Rod Nuts threaded hand tight up to the end of the threads on the Anchor Rods. Install the remaining four Anchor Rod Nuts hand tight up to the end of the threads on the Anchor Rods. Check that all Anchor Rod Nuts are hand tight up against the end of the threads on the Anchor Rods. Cut the Plastic Cable Ties and lower all but the top Rebar Hoop to the positions that were marked on the Anchor Rods in Step 7.1.3. Fasten the Rebar Hoops to every other Anchor Rod using the Plastic Cable Ties. 	<p>The vertical position of the Stanchion Braces is not critical, as long as they are below the Stanchion Coupling and secured to the Anchor Rods.</p> <p><i>Note: The Anchor Rod Nuts should be threaded tight up against the end of the threaded portion of the Anchor Rods to discourage movement during assembly in the excavation and subsequent placement of concrete.</i></p>



Step 9. Install the cylindrical concrete form. Follow the illustrations from left to right.

Step	Instructions	Notes
9	<p>Install the cylindrical concrete form.</p> <ol style="list-style-type: none"> 1. Carefully slip the Cylindrical Concrete Form (22) over the anchor bolt assembly and let it rest on the ground. 2. Install the four Locator Brackets (23) on the long “spokes” of the Lower Anchor Bolt Template. Use the Locator Bracket Screws (24) provided and the pre-drilled holes in the Lower Anchor Bolt Template. 3. Raise the Cylindrical Concrete Form and capture it in the bottom tabs of the four Locator Brackets. Fasten the Cylindrical Concrete Form in this position using the self threading Locator Bracket Screws provided and the pre-drilled holes in the Locator Brackets. 	<p><i>Important: Make sure the bottom of the Cylindrical Concrete Form rests on the tabs of the Locator Brackets. This position determines the top surface of the concrete.</i></p>



Step 10. Prepare nail pegs and guy ropes and set the anchor bolt assembly in the excavation. Follow the illustrations from left to right.

Step	Instructions	Notes
10	<p>Prepare nail pegs and guy ropes and set the anchor bolt assembly and stanchion in the excavation.</p> <ol style="list-style-type: none"> 1. Locate four points on the ground where the Guy Ropes (25) will be attached to the Nail Pegs (26). These will be used to secure the anchor bolt assembly. To keep the work area clear, locate the Nail Pegs 7 to 8 feet (2.1 to 2.4 m) from the centerline of the excavation. The two pairs should be aligned 90 degrees from each other. 2. Drive the Nail Pegs securely into the ground with hooks facing away from the excavation. 3. Tie the ends of the four Guy Ropes to four of the 1-1/2" ABS Template Spacers located 90 degrees apart (every other bolt). 4. Temporarily stow the guy ropes in the hollow top of the stanchion. 5. Check for proper assembly of the Anchor Rods, Rebar Hoops and 1" PVC electrical conduit. The assembly should be quite rigid and the top nuts should be flush with the tops of the Anchor Rods. 6. Check the distance from the bottom of the excavation to the top of grade. It must be as specified in the Drawings or the Anchor Rods will not be at the proper height for installation of the tower. 7. Carefully lift the assembly and lower it to the bottom of the excavation. 8. Locate the 1" PVC Elbow to facilitate the planned electrical conduit installation. Some manipulation may be required to avoid interference with the Anchor Rods. 	<p>As noted in Step 4, the installer may already have decided to assemble the Kit in the excavation.</p> <p>Caution: <i>Look ahead to Step 11 and plan the alignment of nail pegs, anchor bolt assembly and PVC electrical conduit. These steps should be completed before placing the anchor bolt assembly in the excavation.</i></p> <p>This step may require some loosening and retightening of the anchor bolt nuts.</p> <p>Caution:</p> <ul style="list-style-type: none"> • <i>Use work gloves.</i> • <i>Plan and discuss Step 10.7 before proceeding.</i> • <i>Clear the excavation of any debris or loose soil.</i> • <i>Check the surrounding area and remove tripping hazards.</i> • <i>Lift the assembly by the anchor rods and not by the anchor bolt templates or rebar hoops. This step requires at least two people.</i> • <i>If the bottom of the excavation is muddy or soft in the center – where the stanchion will rest – the assembly may sink below the desired level. If this is likely, set the stanchion on a solid surface (such as a paving block) to reduce the soil pressure.</i>



Photo by Libby Oliver, Flagstaff, AZ

Step 11. Level and secure the anchor bolt assembly. Nail Pegs and Guy Ropes are used to stabilize and level the assembly. Here, the installer chose to add wood frames to locate the Cylindrical Concrete Form relative to the overall assembly. The Locator Brackets provided in the Kit serve this purpose, so that the wood frames shown above are unnecessary. Note also the use of a “barrel form” to deal with particularly loose soils. Instead of such a “barrel form” the installer could have chosen simply to pour more concrete. This is an individual choice.

Step	Instructions	Notes
11	<p>Level and secure the anchor bolt assembly.</p> <ol style="list-style-type: none"> 1. Check that the stanchion is resting in the center of the excavation. 2. Hold the assembly so that the top anchor bolt template is level. 3. Check that the lower surfaces of the lower Anchor Rod Nuts are 2 to 3 inches (51 to 76 mm) above the desired final earth grade. 4. Check that the Guy Ropes align with the Nail Pegs. 5. Attach the free ends of the Guy Ropes (with slides) to the hooks on the Nail Pegs. 6. Place a level atop two opposing Anchor Rods having Guy Ropes attached. Adjust the Guy Ropes until the assembly is level and held firmly. 7. Repeat Step 11.6 for the other two Anchor Rods with Guy Ropes attached. 8. Insert a 1" PVC electrical conduit of appropriate length (not supplied) into the bell end of the 1" PVC Elbow. Cement this joint to prevent moisture intrusion. 	<p>The lower surfaces of the Anchor Rod Nuts should be slightly above the top of the Cylindrical Concrete Form, which will also be the top surface of the concrete.</p> <p>The top surface of the Anchor Rod Nuts should be flush with the tops of the Anchor Rods. That way, the Anchor Rods are leveled along with the nuts.</p> <p>Caution: Check that the PVC electrical conduit is in an acceptable location. Make sure it is protected against infiltration of debris and that it extends beyond the foundation perimeter for easy access when completing the electrical installation.</p>



Photo by Libby Oliver, Flagstaff, AZ



Photo by Libby Oliver, Flagstaff, AZ



Photo by Libby Oliver, Flagstaff, AZ

Placing the Concrete

Pour the concrete slowly at several places around the foundation. Consolidate it with appropriate tools. Take care to prevent excessive weight on any of the parts and to minimize movement of the anchor bolt assembly. Make a final check of alignment and level.



Photo by Libby Oliver, Flagstaff, AZ

Step 12. Place and finish the concrete.

Step	Instructions	Notes
12	<p>Place and finish the concrete.</p> <ol style="list-style-type: none"> 1. Check that the tops of the Anchor Rods and the top surface of the Cylindrical Concrete Form are level. Adjust if necessary. 2. Check the height of the Cylindrical Concrete Form. Its top edge should be slightly below the bottom surface of the Anchor Rod Nuts. 3. Pour concrete to approximately 6 inches (152 mm) below the final earth grade. The slab should be at least 3 feet (0.91 m) thick. 4. Use a trowel to slope concrete away from the base of the Cylindrical Concrete Form to promote drainage toward the foundation perimeter. 5. Trowel-finish all concrete surfaces. 6. Use an edging tool to smooth the concrete at the perimeter of the Cylindrical Concrete Form. 7. After the concrete sets, remove the templates and forms. 8. Backfill the excavation with native soil and compact it. Gravel or other landscaping materials may be used to fill the annulus around the stub pier. Slope the soil toward the foundation perimeter for drainage. If this area is to be re-vegetated, appropriate soil amendments should be added. 	<p>Caution: Concrete placement should be performed by qualified, responsible individuals. Consult the turbine manufacturer and/or qualified professionals regarding lightning protection and electrical grounding requirements.</p> <p>Suggestions:</p> <ul style="list-style-type: none"> • Safety is first! Identify the work area as a safety hazard and control access to it. • Prevent the excavation from freezing – use heaters or thermal blankets if necessary. • Prevent water from accumulating at the bottom of the excavation. • Keep the excavation clean and free from debris. • Check the condition of the excavation in preparation for concrete placement. • Check that the work area is clear, being especially careful about tripping hazards. • Have all tools and equipment readily available. • Recheck the anchor bolt height relative to the planned earth grade (Step 11.3). • Recheck that the anchor bolt assembly is level (Steps 11.6 and 11.7). • Make sure the concrete mix is fluid enough to fill potential voids. • Consolidate the concrete around the rebar and anchor bolt assembly. Note the Drawings regarding vibration of concrete during construction. • Pour the concrete slowly from several locations around the excavation. Check that the anchor bolt assembly remains in its intended position and is plumb. • Check that the PVC electrical conduit remains in its intended position. • Use hand tools to place and consolidate concrete within the cylindrical concrete form. • Protect the concrete from sun, wind, hail, heavy rain and freezing for at least one week after pouring. Use appropriate curing compounds or keep the concrete covered and moist. • Allow the concrete to cure for 24 hours before removing templates and forms. • Clean the anchor rods with a wire brush and appropriate solvent. • The tower and turbine must not be installed and erected – and design loads must not be applied – until the 28-day concrete strength has been achieved as noted in the Drawings.

SMarT_Foundation™ [Simple Modular Technology] Drawings
(U.S. Patent Pending)

Southwest Windpower Skystream 3.7 Wind Turbine with Towers up to 18.3 m (60-ft) in Height

AnemErgonics™

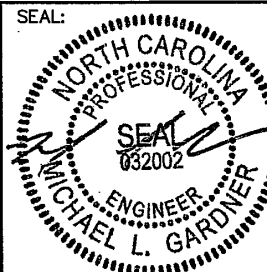
A Colorado Limited Liability Company
www.anemergonics.com

ATTENTION

USE OF THESE DRAWINGS, WHICH ARE PROVIDED BY ANEMERGONICS, LLC ("SUPPLIER") IS CONTROLLED BY, GOVERNED BY AND SUBJECT TO THE APPLICABLE ANEMERGONICS, LLC PURCHASE AGREEMENT, WHICH INCLUDES THE ANEMERGONICS, LLC TERMS AND CONDITIONS ("AGREEMENT"). ANY USE OF THESE DRAWINGS THAT IS IN ANY WAY INCONSISTENT WITH THE AGREEMENT IS UNAUTHORIZED. AMONG OTHER THINGS, THE AGREEMENT INCLUDES: BROAD INDEMNITY PROVISIONS IN FAVOR OF SUPPLIER AND THE SUPPLIER INDEMNIFIED PARTIES (AS DEFINED IN THE AGREEMENT); LIABILITY LIMITATION AND LIMITATIONS ON USE. CONTACT SUPPLIER WITH QUESTIONS REGARDING THE AGREEMENT OR IF YOU HAVE NOT BEEN PROVIDED THE AGREEMENT OR ANY OF THE MATERIALS REFERENCED IN THE AGREEMENT.

DESIGNED IN CONFORMANCE WITH THE INTERNATIONAL ELECTROTECHNICAL COMMISSION
(IEC) 61400-2 ED.2 "DESIGN REQUIREMENTS FOR SMALL WIND TURBINES"
THE NATIONAL ELECTRICAL SAFETY CODE (NEC) AND
THE 2006 INTERNATIONAL BUILDING CODE (IBC) PRESCRIPTIVE SOIL VALUES

© 2007 - 2009 by Anemergonics, LLC. All rights reserved.



April 2, 2009



TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351



AnemErgonics, LLC
(303) 940-7530
www.anemergonics.com

PROJECT INFORMATION:

SMarT Foundation
[Simple Modular Technology]

10	04-02-09
9	03-26-09
8	03-10-09
7	02-16-09
REV	DATE

DRAWN BY: KMM CHECKED BY: MLG

SHEET NUMBER:

T-1

REVISION:

10

TEP#: 090345.03

TOWER HEIGHT
TOP TOWER

PROPOSED TOWER
BY OTHERS

PROPOSED FOUNDATION.
SEE DETAILS ON SHEETS
S-2 THRU S-4.

0'-0" (REFERENCE)
TOP OF BASE PLATE

FOUNDATION Ø
SEE CHART

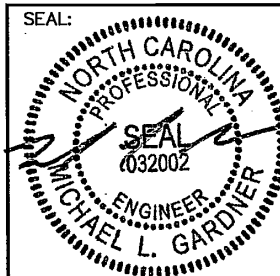
TOWER DESIGN CRITERIA

	TOWER HEIGHT M (FT)	DESIGN WIND SPEED M/S (MPH)	VERTICAL LOAD kN (LBS)	BASE MOMENT kN-M (FT-LBS)	BASE SHEAR kN (LBS)	FOUNDATION DIAMETER M (FT)
CASE 1	≤ 10.4 (34)	≤ 49 (110)	3.4 (761)	25.1 (18,486)	3.0 (677)	1.73 (5'-8")
CASE 2	≤ 10.4 (34)	≤ 67 (150)	3.4 (761)	42.2 (31,156)	5.2 (1,179)	2.03 (6'-8")
CASE 3	≤ 13.7 (45)	≤ 49 (110)	4.4 (998)	37.4 (27,612)	3.7 (828)	1.93 (6'-4")
CASE 4	≤ 13.7 (45)	≤ 67 (150)	4.4 (998)	64.4 (47,513)	6.5 (1,459)	2.36 (7'-9")
CASE 5	≤ 15.2 (50)	≤ 49 (110)	4.4 (1,000)	48.1 (35,500)	4.9 (1,100)	2.13 (7'-0")
CASE 6	≤ 15.2 (50)	≤ 67 (150)	4.4 (1,000)	89.5 (66,000)	8.9 (2,000)	2.49 (8'-2")
CASE 7	≤ 16.8 (55)	≤ 49 (110)	6.9 (1,543)	59.6 (43,995)	5.0 (1,129)	2.18 (7'-2")
CASE 8	≤ 16.8 (55)	≤ 67 (150)	6.9 (1,543)	104.0 (76,681)	9.0 (2,020)	2.67 (8'-9")
CASE 9	≤ 18.3 (60)	≤ 49 (110)	6.9 (1,543)	59.6 (43,995)	5.0 (1,129)	2.18 (7'-2")
CASE 10	≤ 18.3 (60)	≤ 67 (150)	6.9 (1,543)	104.0 (76,681)	9.0 (2,020)	2.67 (8'-9")

NOTES:

1. THE FOUNDATION DESIGNS ARE BASED ON AN IBC CLASS 5 (OR BETTER) SOIL CLASSIFICATION AND AN ALLOWABLE BEARING PRESSURE OF 71.8 kPa (1500 PSF) AND A LATERAL BEARING OF 15.7 kN/m³ (100 PSF/FT) BELOW GRADE. IT IS THE RESPONSIBILITY OF THE OWNER TO VERIFY BY GEOTECHNICAL INVESTIGATION THAT ACTUAL SOIL PARAMETERS AT THE SITE EQUAL OR EXCEED THOSE GIVEN. IF CONDITIONS OTHER THAN THOSE DESCRIBED ARE ENCOUNTERED, A FOUNDATION ANALYSIS SHOULD BE PERFORMED TO DETERMINE THE STRUCTURAL ADEQUACY OF THE SUBSTRUCTURE. INSTALLATION SHALL NOT PROCEED UNTIL STRUCTURAL ADEQUACY HAS BEEN CONFIRMED.
2. IF THE FROST DEPTH IS KNOWN TO BE GREATER THAN 1.07M (42 INCHES), THE 76mm (3") ABS PIPE STANCHION SHALL BE LENGTHENED SO THAT ITS BASE IS AT OR BELOW THE FROST DEPTH. THE LENGTH OF THE EXTENDER SHALL BE EQUAL TO THE FROST DEPTH MINUS 1.07M (42 INCHES), AND MAY BE ATTACHED WITH A 76mm (3") ABS COUPLING.
3. INSTALLATION SHALL NOT PROCEED IF THE WATER TABLE IS LESS THAN THE FOUNDATION DEPTH. CONSULT WITH DESIGN ENGINEER FOR FOUNDATION ANALYSIS OR REDESIGN. CONSTRUCTION SHALL NOT PROCEED UNTIL APPROVAL IS OBTAINED FROM THE DESIGN ENGINEER.

SEAL:



April 2, 2009

TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
(919) 661-6351



AnemErgonics, LLC
(303) 940-7530
www.anemergonics.com

PROJECT INFORMATION:

SMarT Foundation
[Simple Modular Technology]

10	04-02-09
9	03-26-09
8	03-10-09
7	02-16-09
REV	DATE

DRAWN BY: KMM CHECKED BY: MLG

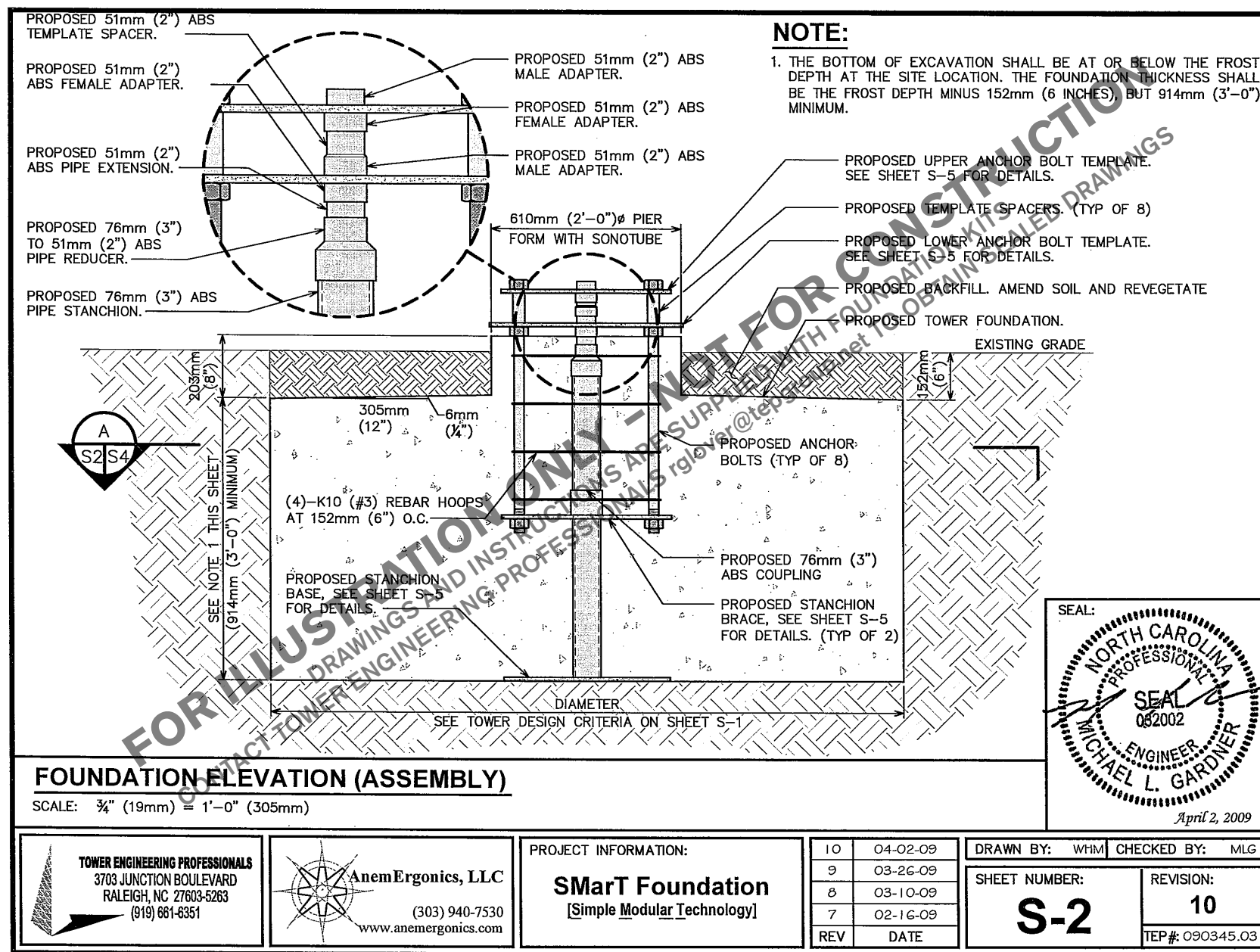
SHEET NUMBER:

S-1

REVISION:

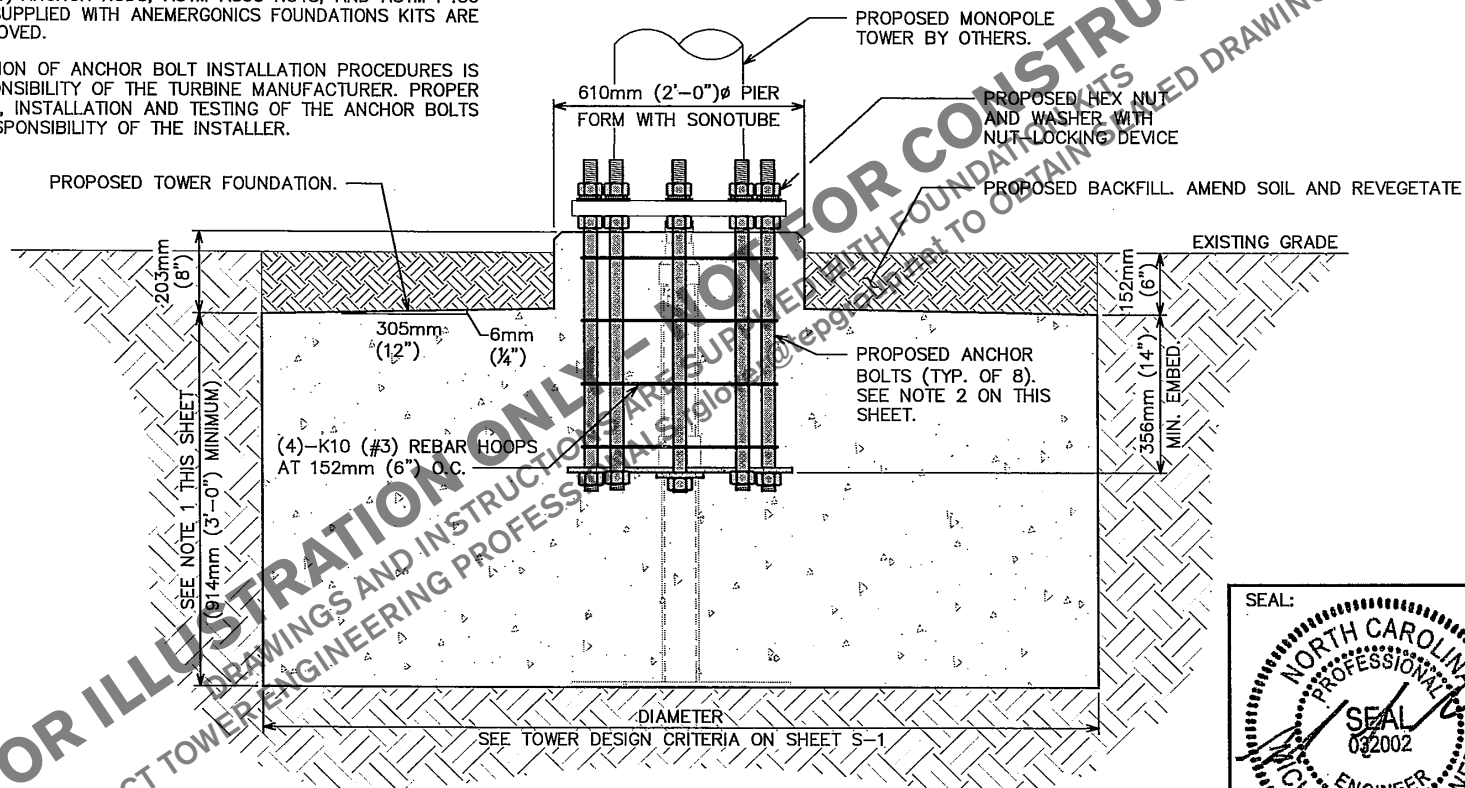
10

TEP#: 090345.03



NOTES:

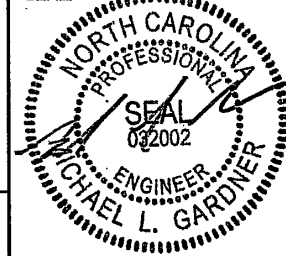
1. THE BOTTOM OF THE EXCAVATION SHALL BE AT OR BELOW THE FROST DEPTH AT THE SITE LOCATION. THE FOUNDATION THICKNESS MUST BE THE FROST DEPTH MINUS 152mm (6 INCHES), BUT 914mm (3'-0") MINIMUM.
2. 32mm ($\frac{1}{4}$ ") ϕ x 813mm (32") LONG ASTM F1554--GRADE 36 (OR EQUIVALENT) ANCHOR RODS, ASTM A563 NUTS, AND ASTM F436 WASHERS SUPPLIED WITH ANEMERGONICS FOUNDATIONS KITS ARE PRE-APPROVED.
3. SPECIFICATION OF ANCHOR BOLT INSTALLATION PROCEDURES IS THE RESPONSIBILITY OF THE TURBINE MANUFACTURER. PROPER INSPECTION, INSTALLATION AND TESTING OF THE ANCHOR BOLTS IS THE RESPONSIBILITY OF THE INSTALLER.



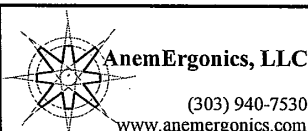
FOUNDATION ELEVATION (FINISHED)

SCALE: $\frac{3}{4}$ " (19mm) = 1'-0" (305mm)

SEAL:



April 2, 2009



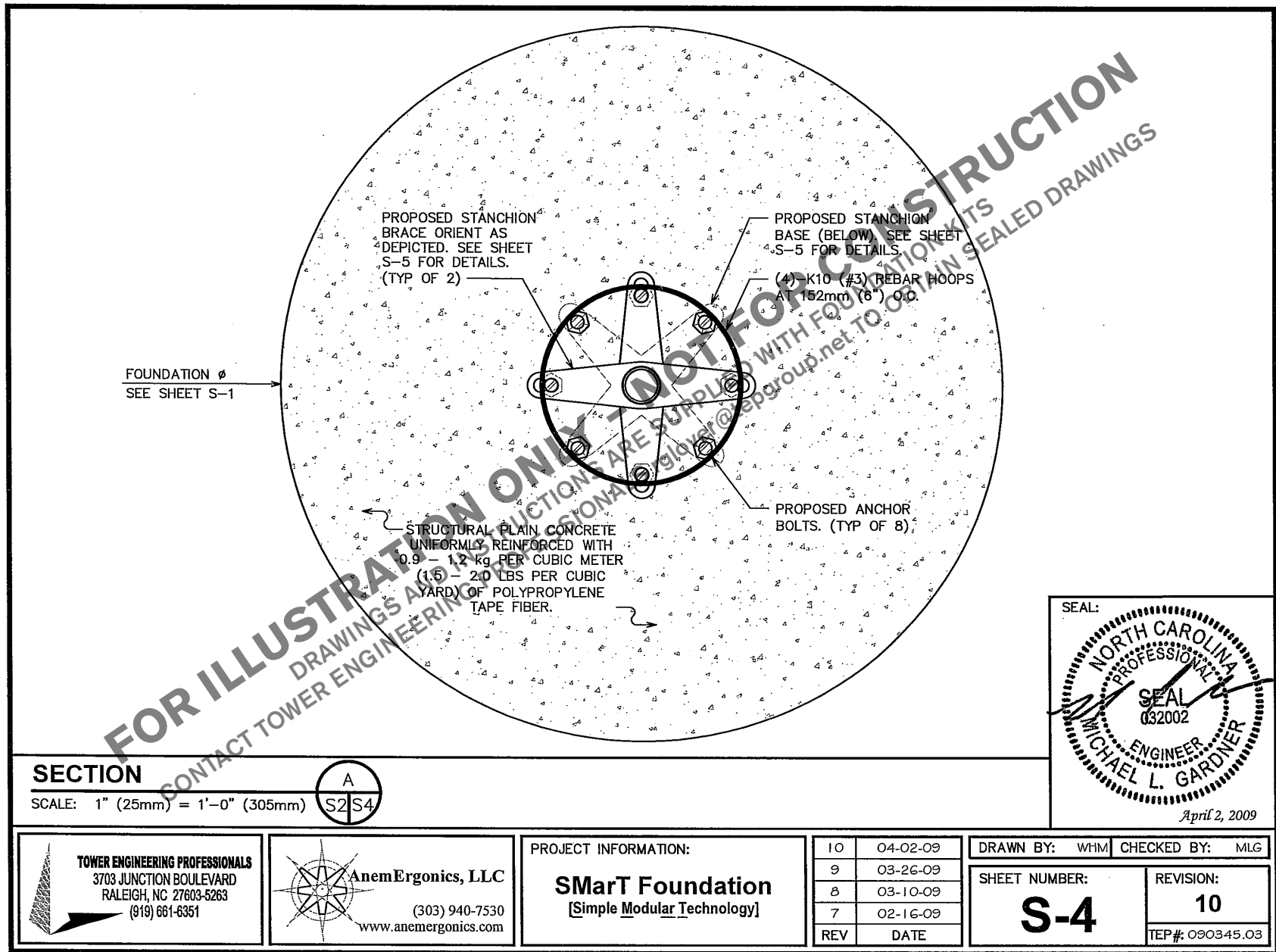
PROJECT INFORMATION:

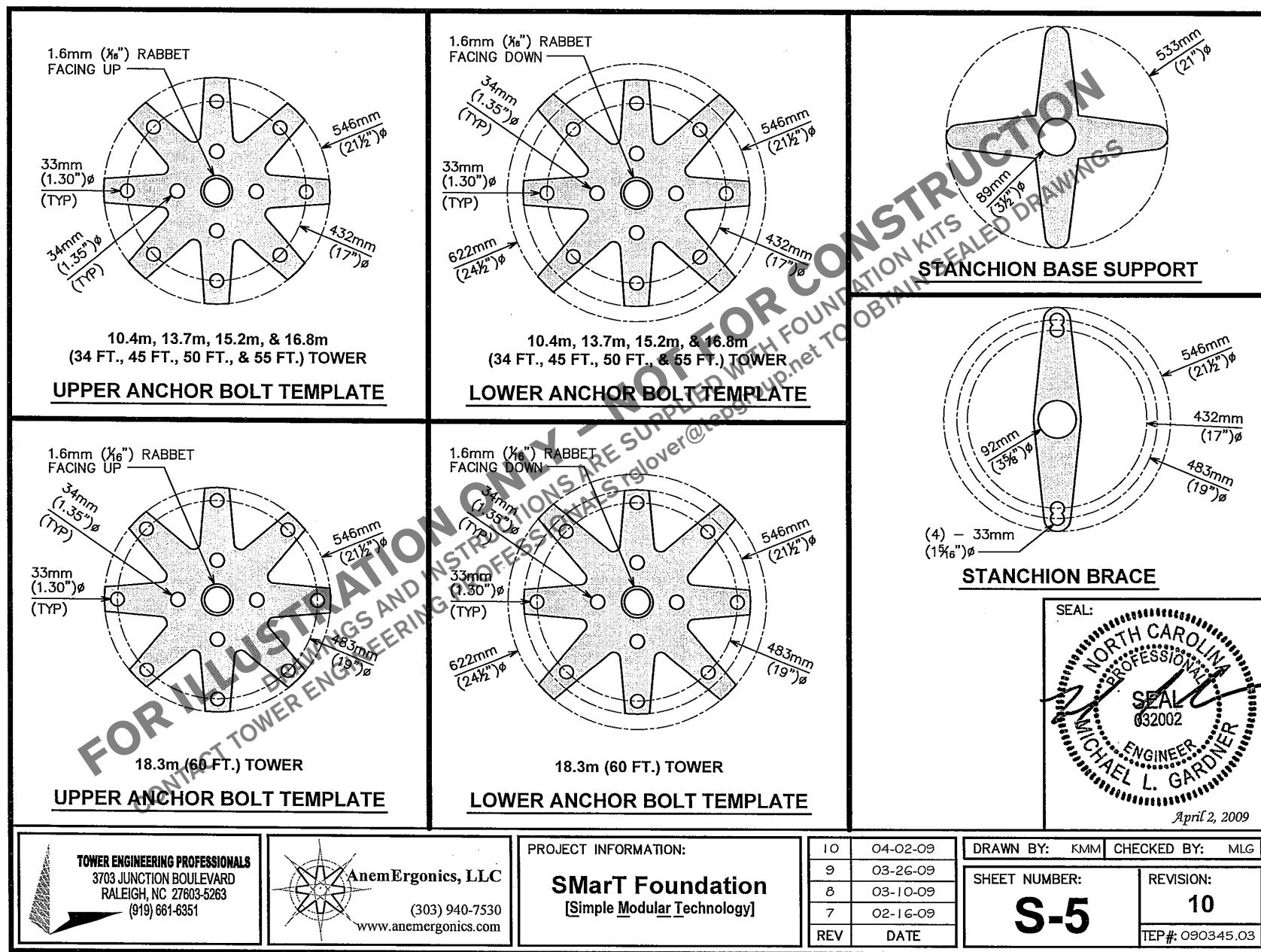
SMarT Foundation
[Simple Modular Technology]

10	04-02-09
9	03-26-09
8	03-10-09
7	02-16-09
REV	DATE

DRAWN BY: WHM CHECKED BY: MLG

SHEET NUMBER:	REVISION:
S-3	10
TEP#: 090345.03	





FOUNDATION NOTES:

GENERAL NOTES:

1. FOUNDATION INSTALLATION SHALL BE SUPERVISED BY PERSONNEL KNOWLEDGEABLE AND EXPERIENCED WITH THE PROPOSED FOUNDATION TYPE. CONSTRUCTION SHALL BE IN ACCORDANCE WITH GENERALLY ACCEPTED PRACTICES AND IN A GOOD AND WORKMANLIKE MANNER.
2. FOUNDATION DESIGN ASSUMES LEVEL GRADE AT THE SITE.
3. THE FOUNDATION DESIGN IS IN ACCORDANCE WITH GENERALLY ACCEPTED PROFESSIONAL ENGINEERING PRINCIPLES AND PRACTICES WITHIN THE LIMITS OF THE ASSUMED SUBSURFACE DATA.
4. FOUNDATION DESIGN MODIFICATIONS MAY BE REQUIRED IN THE EVENT THE DESIGN PARAMETERS ARE NOT APPLICABLE FOR THE SUBSURFACE CONDITIONS ENCOUNTERED DURING CONSTRUCTION.
5. THE FOUNDATION DESIGN ASSUMES INSPECTIONS WILL BE PERFORMED TO VERIFY THAT CONSTRUCTION MATERIALS, INSTALLATION METHODS, AND ASSUMED DESIGN PARAMETERS ARE ACCEPTABLE BASED ON THE CONDITIONS AT THE SITE.
6. THE FOUNDATION DESIGN ASSUMES NO CONSTRUCTION JOINTS. HOWEVER, CONSTRUCTION JOINTS SHALL BE PERMITTED UPON APPROVAL BY THE ENGINEER.

EXCAVATION & GRADING:

1. WORK SHALL BE IN ACCORDANCE WITH LOCAL CODES AND SAFETY REGULATIONS. PROCEDURES FOR THE PROTECTION OF EXCAVATIONS, EXISTING CONSTRUCTION, AND UTILITIES SHALL BE ESTABLISHED AND PERFORMED PRIOR TO BEGINNING WORK.
2. ALL CUT AND FILL SLOPES SHALL BE 3:1 MAXIMUM, UNLESS OTHERWISE NOTED.
3. ALL EXCAVATIONS ON WHICH CONCRETE IS TO BE PLACED SHALL BE SUBSTANTIALLY HORIZONTAL ON UNDISTURBED AND UNFROZEN SOIL AND BE FREE FROM LOOSE MATERIAL AND EXCESS GROUND WATER. DEWATERING FOR EXCESS GROUND WATER SHALL BE PROVIDED IF REQUIRED.
4. ANY EXCAVATION OVER THE REQUIRED DEPTH SHALL BE FILLED WITH EITHER MECHANICALLY COMPACTED GRANULAR MATERIAL OR CONCRETE OF THE SAME QUALITY SPECIFIED FOR THE FOUNDATION. CRUSHED STONE MAY BE USED TO STABILIZE THE BOTTOM OF THE EXCAVATION. STONE, IF USED, SHALL NOT BE USED AS COMPRISING CONCRETE THICKNESS.
5. THE BOTTOM OF THE EXCAVATION SHOULD BE APPROXIMATELY LEVEL. LOOSE MATERIAL SHALL BE REMOVED BEFORE PLACING CONCRETE AND THE STANCHION SHOULD BE CENTERED IN THE BOTTOM OF THE EXCAVATION.
6. AFTER COMPLETION OF THE FOUNDATION AND BEFORE BACKFILLING, ALL EXCAVATIONS SHALL BE CLEAN OF UNSUITABLE MATERIAL SUCH AS VEGETATION, TRASH, DEBRIS, ETC.
7. BACKFILLING SHALL:
 - A. USE APPROVED MATERIALS CONSISTING OF EARTH, LOAM, SANDY CLAY, SAND, AND GRAVEL OR SOFT SHALE.
 - B. BE FREE FROM CLODS OR STONES OVER 64mm (2-1/2") MAXIMUM DIMENSIONS.
 - C. BE PLACED IN LAYERS OF 152mm (6") MAXIMUM AND COMPACTED.
8. FILL MATERIAL AND BACKFILL SHALL BE PLACED IN LAYERS, MAXIMUM 152mm (6") DEEP BEFORE COMPACTION. EACH LAYER SHALL BE SPRINKLED IF REQUIRED AND COMPACTED BY HAND OR MACHINE TAMPERS TO 90% OF MAXIMUM DRY DENSITY, AT THE OPTIMUM MOISTURE CONTENT $\pm 5\%$ AS DETERMINED BY ASTM DESIGNATION D-698, UNLESS OTHERWISE APPROVED. SUCH BACKFILL SHALL NOT BE PLACED WITHIN 3 DAYS OF CONCRETE PLACEMENT.

REINFORCING STEEL:

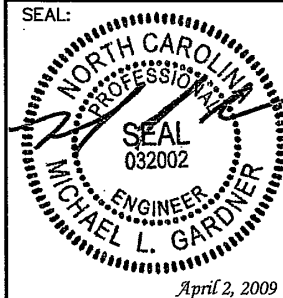
1. THE REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A-615, GRADE 60. IT SHALL BE DEFORMED AND SPLICES SHALL NOT BE ALLOWED UNLESS OTHERWISE NOTED.
2. FIELD WELDING IS PROHIBITED ON REINFORCING STEEL AND EMBEDMENTS.
3. MINIMUM CONCRETE COVER FOR REINFORCEMENT SHALL CONFORM TO THE REQUIREMENTS OF ACI 318-05, SECTION 7.7.1, "CAST-IN-PLACE CONCRETE (NONPRESTRESSED)." CONCRETE COVER SHALL BE AS FOLLOWS:
 - A. CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH 76mm (3 IN.) MINIMUM COVER
 - B. CONCRETE EXPOSED TO EARTH OR WEATHER:
 - NO. 6 BARS THROUGH NO. 18 BARS 51mm (2 IN.) MINIMUM COVER
 - NO. 6 BARS AND SMALLER 38mm (1-1/2 IN.) MINIMUM COVER

CONCRETE:

1. WORK SHALL BE IN ACCORDANCE WITH ACI 318-05, "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE."
2. THE CONCRETE SHALL BE APPROPRIATELY VIBRATED DURING CONSTRUCTION.
3. THE CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 17.2 MPa (2500 PSI) IN 28-DAYS.
4. THE CONCRETE SHALL BE UNIFORMLY REINFORCED WITH 0.9 kg - 1.2 kg PER CUBIC METER (1.5 LBS. TO 2.0 LBS. POLYPROPYLENE TAPE FIBER PER CUBIC YARD) OF CONCRETE. FIBERS SHALL BE IN ACCORDANCE WITH ASTM C1116, "STANDARD SPECIFICATION FOR FIBER-REINFORCED CONCRETE." FIBERS SHALL BE PROCONF AS MANUFACTURED BY NYCON, INC., FIBERMESH 300 AS MANUFACTURED BY PROPEX CORP., OR APPROVED EQUIVALENT.
5. PROPORTIONS OF CONCRETE MATERIALS SHALL BE SUITABLE FOR THE INSTALLATION METHOD UTILIZED AND SHALL RESULT IN DURABLE CONCRETE FOR RESISTANCE TO LOCAL ANTICIPATED AGGRESSIVE ACTIONS. THE DURABILITY REQUIREMENTS OF ACI 318-05 SHALL BE SATISFIED BASED ON THE CONDITIONS EXPECTED AT THE SITE.
6. CONCRETE SHALL BE PLACED IN A MANNER THAT WILL PREVENT SEGREGATION OF CONCRETE MATERIALS, INFILTRATION OF WATER OR SOIL, AND OTHER OCCURRENCES THAT MAY DECREASE THE STRENGTH OR DURABILITY OF THE FOUNDATION.
7. FREE FALL CONCRETE MAY BE USED PROVIDED FALL IS VERTICAL DOWN MINIMIZING CONTACT WITH THE SIDES OF THE EXCAVATION. UNDER NO CIRCUMSTANCES SHALL CONCRETE FALL THROUGH WATER.

FINISHING:

1. THE TOP OF THE FOUNDATION SHALL BE SLOPED TO DRAIN WITH A FLOATED FINISH.
2. THE EXPOSED EDGES OF THE CONCRETE SHALL BE CHAMFERED 19mm x 19mm (3/4" x 3/4").



TOWER ENGINEERING PROFESSIONALS 3703 JUNCTION BOULEVARD RALEIGH, NC 27603-5263 (919) 661-6351	AnemErgonics, LLC (303) 940-7530 www.anemergonics.com	PROJECT INFORMATION: SMarT Foundation [Simple Modular Technology]	10 04-02-09	DRAWN BY: KMM CHECKED BY: MLG
			9 03-26-09	
			8 03-10-09	REVISION: 10
			7 02-16-09	TEP#: 090345.03
			REV DATE	

SKYSTREAM^{3.7}

Southwest Windpower, Inc.
1801 West Route 66
Flagstaff, Arizona 86001
Phone: 928.779.9463
Fax: 928.779.1485
www.skystreamenergy.com