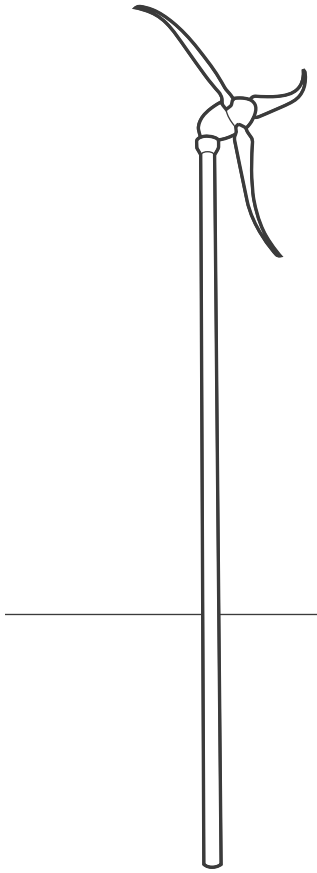
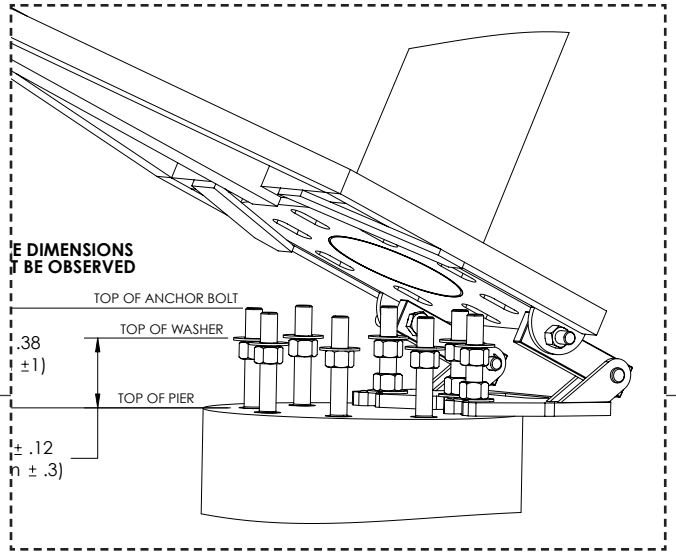
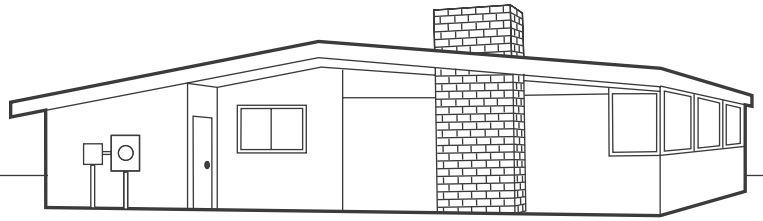
SKYSTREAM®

SECTIONAL MONOPOLE TOWER FOUNDATION & INSTALLATION MANUAL

For 45 ft (13.7 m), 55 ft (16.7 m) & 70 ft (21.3 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

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Sectional Monopole Tower Foundation
and Installation Manual
Document : 3-CMLT-1409-01
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) The foundations, instructions and towers described in this manual are appropriate for Southwest Windpower Inc. Skystream 3.7 wind turbines. DO NOT INSTALL ANY OTHER TURBINE.

5) Install foundation and tower in accordance with National Electric Code, and all local building and zoning codes and requirements.

6) Obtain building and construction permits prior to starting construction.

7) Foundation concrete must be completely cured prior to installing tower [Minimum 2500 PSI, (17235 kPa) 28 day strength].

8) Skystream uses high voltage and is potentially dangerous. Follow all safety precautions at all times.

9) Follow proper grounding procedures for tower, foundation and windturbine.

10) Remain at a safe distance when raising and lowering tower. NEVER stand or walk under tower while it is being raised or lowered.

11) Be aware of overhead power lines.

12) Do not attempt to raise tower on a windy day.

13) 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 foundation construction, tower assembly, and tower installation for the following Southwest Windpower segmented monopole towers with a Skystream 3.7 wind turbine:

- 45 ft (13.7 m) Monopole Sectional Tilt-Up Tower, part number 3-CMBP-3239-100
- 55 ft (16.7 m) Monopole Sectional Tower, part number 3-CMBP-3239-200
- 70 ft (21.3 m) Monopole Sectional Tower, part number 3-CMBP-3239-300

Information for construction of two types of foundation is provided. The choice of foundation will depend on local building conditions, available construction equipment, and local regulations. The foundation types include:

• Mat Foundation – A square foundation; side dimensions vary based on wind speed, depth is approximately four feet deep depending on tower.
• Pier Foundation – A "column" shaped foundation; the diameter and depth of the column vary depending on soil conditions and maximum wind speed.

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

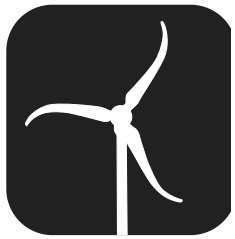
Be sure you understand all installation and inspection requirements. Many localities require inspections at key phases of the installation before additional work can proceed.

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

Professional Installation

Constructing the foundation and raising the Skystream requires in-depth knowledge of Skystream systems, specialized equipment, experience constructing concrete forms and knowledge of local zoning and building codes and inspection requirements. Southwest Windpower requires all dealer selling and installing Skystream systems to have completed up-to-date factory training.

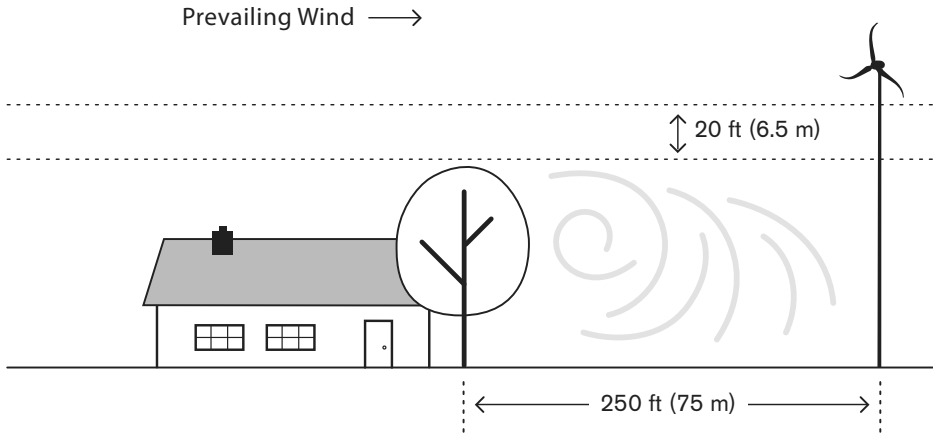
Towers are not be to be installed by any unauthorized person. Dealers displaying the "Skystream Dealer" insignia (shown here) on the Southwest Windpower Web site have completed factory training on the correct and safe installation of the tower (and Skystream).



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.

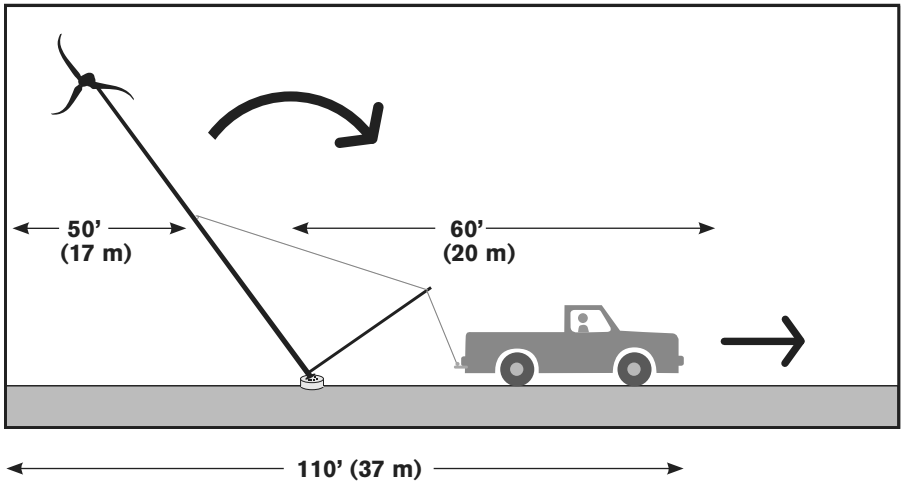


Optimal Skystream location.

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 foundation drawings 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) of 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 dimensions for the Pier foundations will vary based on the Soil Class and Wind Zone. The dimensions for the 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
45 ft (13.7 m)	Mat	1	Appendix A, Sheet S-3A
45 ft (13.7 m)	Mat	2	Appendix A, Sheet S-3B
45 ft (13.7 m)	Mat	3	Appendix A, Sheet S-3C
45 ft (13.7 m)	Pier	1, 2 & 3	Appendix A, Sheets S-4 & S-5
55 ft (16.8 m)	Mat	1	Appendix B, Sheet S-3A
55 ft (16.8 m)	Mat	2	Appendix B, Sheet S-3B
55 ft (16.8 m)	Mat	3	Appendix B, Sheet S-3C
55 ft (16.8 m)	Pier	1, 2 & 3	Appendix B, Sheets S-4 & S-5
70 ft (21.3 m)	Mat	1	Appendix C, Sheet S-3A
70 ft (21.3 m)	Mat	2	Appendix C, Sheet S-3B
70 ft (21.3 m)	Mat	3	Appendix C, Sheet S-3C
70 ft (21.3 m)	Pier	1, 2 & 3	Appendix C, Sheets S-4 & S-5

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: Wind speed information is available with the Skylook wind assessment tool, available to authorized Skystream dealers only. Contact your dealer support representative to learn more.

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	Soil Class	For Dimensions See
45 ft (10.2 m)	Mat	5 **	Appendix A, see Wind Zone Data
45 ft (10.2 m)	Pier	1,2,3,4,5	Appendix A, Sheet S-4 & S-5
55 ft (16.8 m)	Mat	5 **	Appendix B, see Wind Zone Data
55 ft (16.8 m)	Pier	1,2,3,4,5	Appendix B, Sheet S-4 & S-5
70 ft (21.3 m)	Mat	1,2,3,4,5	Appendix C, see Wind Zone Data
70 ft (21.3 m)	Pier	5 **	Appendix B, Sheet S-4 & S-5

Selecting a Foundation Configuration – Pier or Mat

The choice of foundation – Pier or Mat – 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.

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.

Foundation Bolts and Templates

The 45 ft (13.7 m), 55 ft (16.8 m) and 70 ft (21.3) towers each require different foundation bolt kits as follows:

- 45 ft (13.7 m) Monopole Sectional Tower, use Foundation Bolt Kit 3-CMBP-3258-01
- 55 ft (16.7 m) Monopole Sectional Tower, use Foundation Bolt Kit 3-CMBP-3259-02
- 70 ft (21.3 m) Monopole Sectional Tower, use Foundation Bolt Kit 3-CMBP-3259-02

Each Foundation Bolt Kit includes hot dipped galvanized bolts, nuts and washers constructed of the appropriate steel alloys – DO NOT SUBSTITUTE ALTERNATIVE NUT BOLTS OR WASHERS.

The bolt kits differ from each other in a number of ways. The bolts for the 45 ft (13.7 m) and 55 ft (16.7 m) towers are 42 inches (16.5 cm) long while the bolts for the 70 ft (21.3 m) tower are 52 inches (19.7 cm) long.

Additionally, the bolt kit for the 45 ft (13.7 m) tower includes extra nuts to enable use of the hinge plate kit such that the tower may be tilted into position. All bolt kits include a paper template which may be used to construct a rigid template for securing the foundation bolts as the concrete is poured.

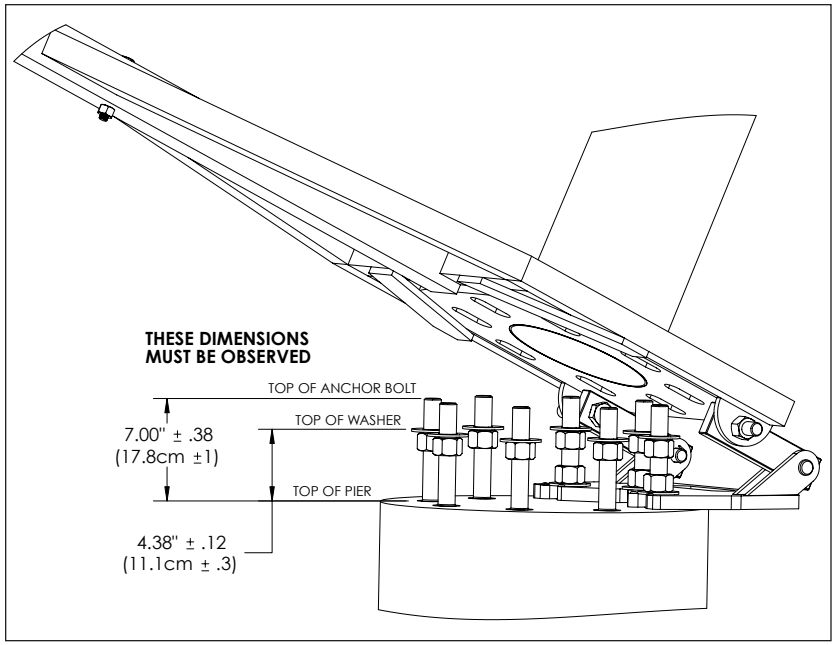
Positioning the Foundation Bolts (Pier and Mat foundations)

Regardless of the foundation it is vital the foundation bolts are correctly positioned in the foundation or it may be extremely difficult if not impossible to bolt the tower to the foundation.

Warning : Be certain to use the correct bolt circle diameter template – the 45 ft (13.7 m) tower requires the foundation bolts in a 19 inch bolt circle diameter. The 55 ft (16.7 m) and 70 ft (21.3 m) towers require the foundation bolts in a 23 inch bolt circle diameter.

Using the paper template supplied with the foundation bolt kit as a guide, construct a rigid template to position the foundation bolts. Secure the foundation bolts to the rigid template using the foundation nuts. Rigid templates may be fabricated using a single piece of plywood or using two pieces of plywood separated by 2 x 4 in lumber. Refer to the accompanying figures.

Warning : 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 especially critical if the tower is to be tilted into position using hinge plate kit and gin pole.


THESE DIMENSIONS
MUST BE OBSERVED
TOP OF ANCHOR BOLT
TOP OF WASHER
TOP OF PIER
7.00" ± .38
(17.8cm ±1)
4.38" ± .12
(11.1cm ± .3)

Hinge Plate and Gin Pole Installation (45 ft Tower Only)

Important Notes:

- The foundation concrete must be fully cured (typically 28 days unless accelerants are employed) with a minimum with compressive strength of 2500 PSI (17235 kPa).
- These instructions assume use of a Southwest Windpower foundation bolt kit with the correct number and type of fasteners along with hinge plate kit part number 2-TWS-200.

Refer to Appendix A while following these directions. Appendix A contains detailed depictions for proper assembly of the 45 ft tower.

- Position the hinge plate on the foundation fully against the bolts that will be used to secure the hinge plate. Thread three nuts onto the bolts as shown in the accompanying figure. “snug” the nuts and then tighten an additional ¼ turn.
- Install eight nuts and washers (washers on top of nuts) onto each of the foundation bolts. The tops of the washers should be 4.5 inch (11 cm) above the foundation as shown in Appendix A and the 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. See Step 1, Appendix A.

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. See Step 3, Appendix A.
- 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. See Step 4, Appendix A.

With the hinge plate bolted to the foundation, and the tower base section bolted to the gin pole and the hinge plate; assembly of the tower sections can begin. Refer to the “Assembling Tower Sections Using the Gin Pole (45 ft Tower Only)” section 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).

Assembling Tower Sections Using the Gin Pole (45 ft Tower Only)

The following equipment should be on hand prior to starting the assembly process:

- 50 ft, 5/16 Grade 70 transport chain with 4700 lb working load with grab hooks on each end.
- Liquid dish soap
- Short lengths of lumber (4 inch x 6 inch) to support the tower sections as the sections they are assembled.

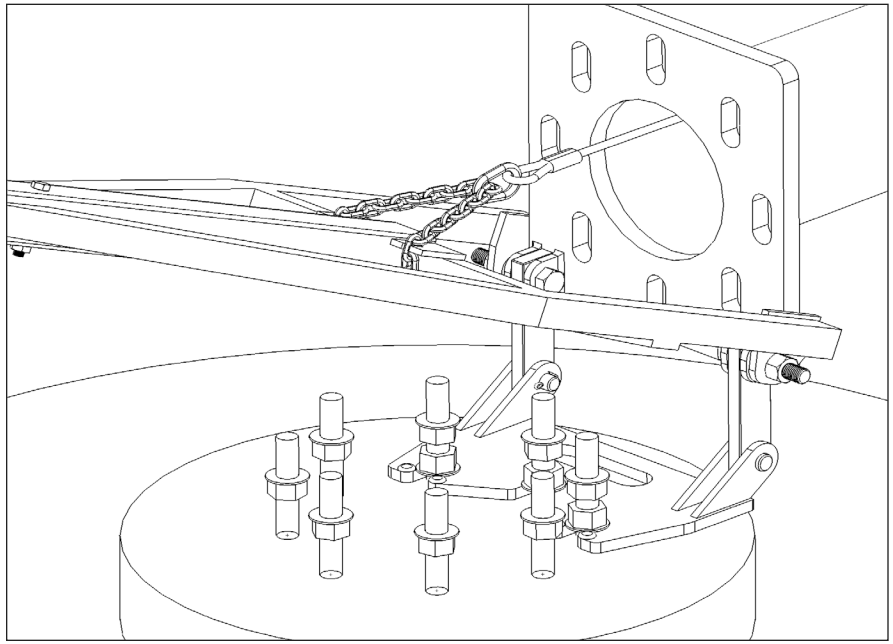
At this point the lowest tower segment – the base - should be bolted to the hinge plate and foundation and gin pole. Perform the following steps to join the tower segments using the gin pole to assist with the process. Refer to Appendix D, sheet 3, and using a permanent marker place “Minimum” and “Maximum” slip length engagement marks at the upper end of the tower base section.

To join the tower sections together :

- Inspect the mating sections of the tower for burrs and roughness and smooth and repair as necessary.
- Align the upper and lower tower section weld seams with each other (see figure).
- 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.
- 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 36cm) wood block at the end of the pole. See Appendix D, Steps 5, 6 and 7.
- Support the tower midsection at its center of gravity – this will aid keeping the sections aligned axially and raise the gin pole approximately 10 to 20 degrees above horizontal and insert chain links into the slotted plates of the gin pole’s central support tube. See Appendix D, Steps 6.
- The tower sections are fully engaged when a fully grown adult (approximately 200 lb) can fully pull down pull on the end of gin pole with the gin pole at a angle of 20 degrees above horizontal.
- Repeat the above process by readjusting the chain links as necessary until the tower mid section is fully seated against the base section.

NOTE : After pulling tower sections together the tower section being pulled onto the lower section may or may not reach the “Maximum” insertion mark. However, each “Minimum” insertion mark MUST be covered by the corresponding upper tower section.

- Repeat the above procedure with each tower section until all sections are assembled. Support the tower as needed as each tower section is added.



Assembling Tower Sections - 55 ft (16.7 m) Tower

The procedure for assembling the 55 (16.7 m) tower is much the same as for assembling the 45 ft (13.7 m) tower; with the major differences being that the 55 ft tower cannot be tilted into position using a hinge plate and gin pole, and the 55 ft tower requires "come-along" chain hoists to pull the tower sections together instead of the using the gin pole for that purpose.

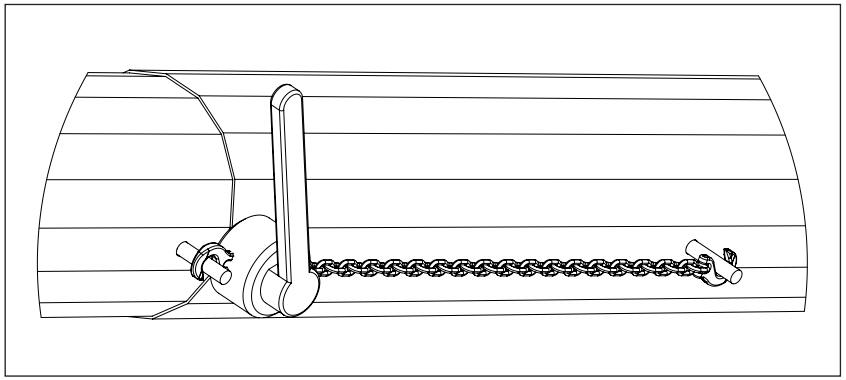
The following equipment should be on hand prior to starting the assembly process:

- Two chain hoist "come-alongs" with a minimum 2 ton pull capacity
- Two steel rods, 24 inches long x 1 inch diameter (not provided with tower)
- Liquid dish soap
- Short lengths of lumber to support the tower sections off the ground as the sections are assembled.

Refer to Appendix E, 53-23 ASSEMBLY and start the assembly by:

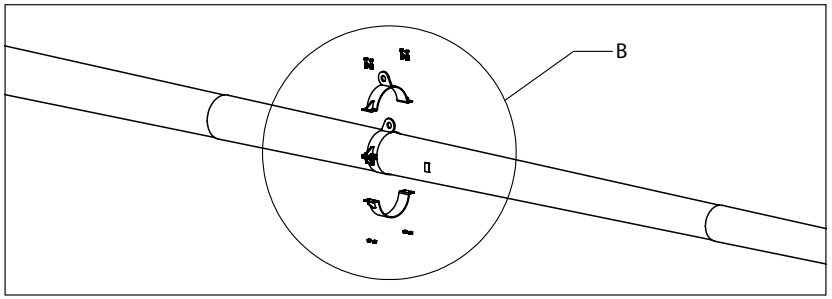
- Inspect the mating sections of the tower sections for burrs and roughness and smooth and repair as necessary. Be sure to inspect and smooth at least the "Design Slip Length" surfaces as indicated in Appendix E.
- Refer to Appendix E, and using a permanent marker place "Minimum" and "Design" slip length engagement marks at the upper end of the tower base section.
- Lubricate the lower section using liquid dish soap, lubricate from the top of the section to the "Design" insertion mark. Do not use grease or oil as this will stain the tower.
- Align the upper and lower tower section weld seams with each other – the weld seam of the "upper" section should lie directly over the lower section weld seam. Loosely start inserting the lower section into the upper.
- Insert 24 inch long by 1 inch diameter steel rods into the holes provided in the individual tower sections – refer to Appendix E, Sheet 4, Detail C.
- With one person on each come-along, draw the sections together until the Design slip length is achieved or the come-along reaches maximum strain. The Minimum slip length must be achieved or exceeded – the Design slip length is ideal but may not be achievable.
- Repeat the above procedure with each tower section until all sections are assembled. Support the tower as needed as each tower section is added.

NOTE : After pulling tower sections together the tower section being pulled onto the lower section may or may not reach the "Design" insertion mark. However, each "Minimum" insertion mark MUST be covered by the corresponding upper tower section.



Raising the Tower Using the Hinge Plate and Gin Pole (45 ft Tower Only)

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



Follow these steps to raise the tower:

- If not already installed, bolt the Lifting Eye clamp approximately 19.5 ft (5.9 m) from the base of the tower. Refer to Appendix D, Sheet 7.
- Tilt the gin pole to the vertical position and using two shackles and the wire rope cable (with the adjustable end) connect the cable to the gin pole and the Lifting Eye clamp as shown in Appendix D, sheet 7.
- Note, if necessary, adjust the cable length by following the Adjusting Cable Length section of this manual.
- Connect the second wire rope cable to the end of the gin pole and to the "lifting" vehicle using the shackles provided.
- Start to "raise' the tower by slowly driving the "lifting" vehicle directly 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.
- 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 may be necessary to "lift" the gin pole to slow the tower as it assumes a 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 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.

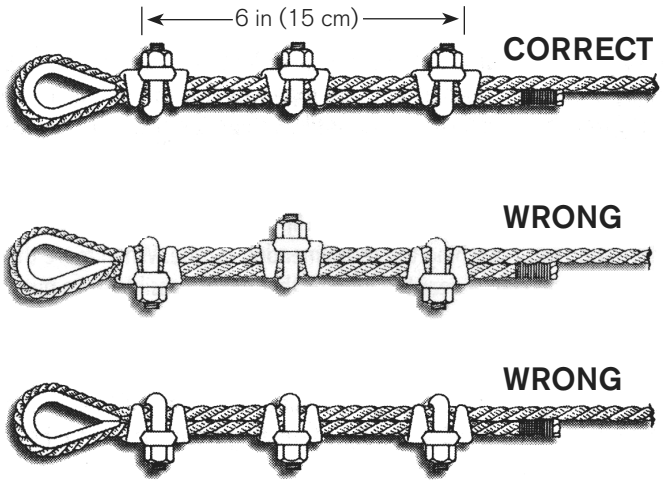
Adjusting Cable Length

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 loosing the U-Bolt clip nuts. Note the maximum load the cable will experience is approximately 2400 lb (1100 kg).



Insert the “Leveling the Tower” section of the manual here

At the beginning of the section add:

The preferred method of leveling the tower is by means of Skylevel. The Skylevel device has an accuracy of +/- 0.5° which is very difficult to equal visually. The majority of difficulties with the Skylevel have been traced to improper mounting of the Skylevel “spider” on the tower flange. Be sure to check the installation of the spider immediately before raising the tower.

Leveling the Tower

Leveling the tower can be 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.
- 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 at the tower top.

Tightening Foundation Bolts

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

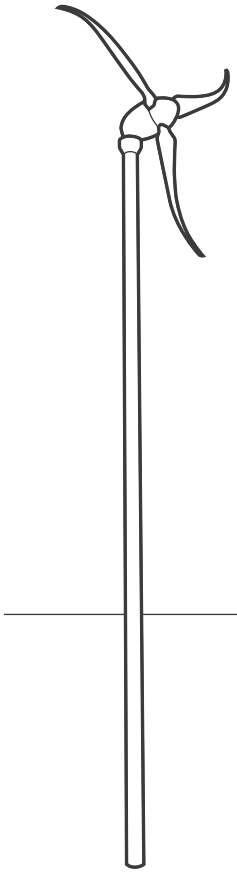
WARNING: Never leave foundation bolts loose. Foundation bolts may be temporarily loosened during tower leveling – however, never leave tower unless ALL foundation bolts are FULLY tightened.

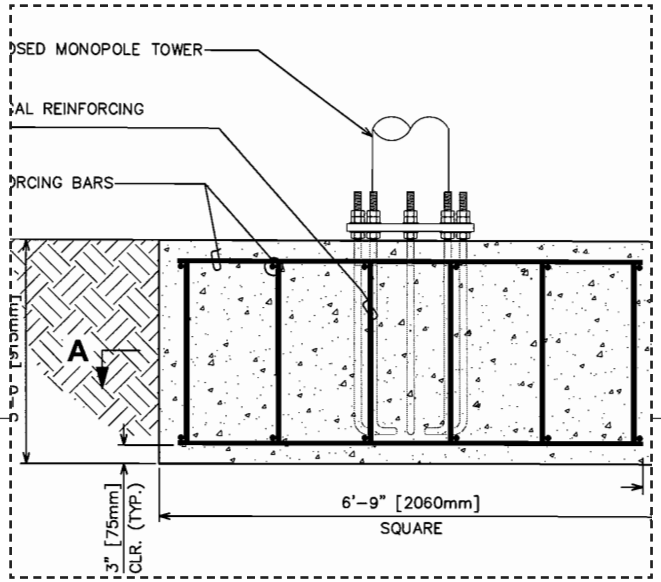
Turn of the Nut Method of Tightening

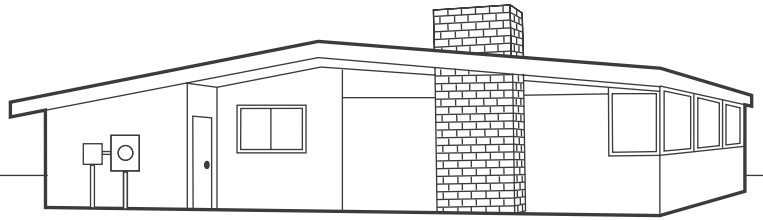
- First tighten each nut to a “snug tight” condition to secure the tower to the foundation. “Snug Tight” is defined as the tightness attained by a “few” impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.
- Following the initial snug tightening, tighten each nut an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

SKYSTREAM®

APPENDIX A
45 ft (13.7 m) SECTIONAL MONOPOLE TOWER FOUNDATIONS







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

Southwest Windpower

Renewable Energy Made Simple

SKYSTREAM 3.7

ATTENTION

THE FOUNDATION DESIGNS ARE IN ACCORDANCE WITH THE 2006 INTERNATIONAL BUILDING CODE, TIA-222-G-2-2009 STRUCTURAL STANDARD FOR ANTENNA SUPPORTING STRUCTURES AND ANTENNAS, AND ASCE 7-05, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES. THE FOUNDATION DESIGNS ARE FOR A 45-FT [13.7M] 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

SEAL:

July 8, 2010

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

PROJECT INFORMATION:

45-FT [13.7M] MONOPOLE FOUNDATIONS

Southwest Windpower
Renewable Energy Made Simple
1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

REV	DATE
i	07-08-2010
0	04-13-2010

DRAWN BY: JRM | CHECKED BY: REG

SHEET NUMBER: **T-1**

REVISION: 1

TEP#: 100002.09

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 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.

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.

REINFORCING STEEL NOTES (CONTINUED):

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.

6. IN REGIONS OF HIGH SEISMIC RISK, ASSIGNED TO SEISMIC DESIGN CATEGORIES C, D, E, AND F, ADDITIONAL TERMINATION DETAILS ARE REQUIRED FOR STEEL REINFORCING BARS. FURTHER, ADDITIONAL DETAILING REQUIREMENTS MAY BE REQUIRED IN OTHER, LESS PRONE AREAS AS REQUIRED BY THE AUTHORITY HAVING JURISDICTION (AHJ).

   A. SEISMIC HOOKS SHALL BE USED TO TERMINATE STIRRUPS, HOOPS, OR CROSSTIES AS DEFINED PER ACI 318.
   B. LONGITUDINAL REINFORCING BARS ARE REQUIRED TO HAVE BOTH A STANDARD BEND AND HOOK EXTENSION (MIN. OF 12 BAR DIAMETERS) AT EACH END AS DEFINED PER ACI 318.

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. HOWEVER, A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI TO 4,500 PSI IN 28-DAYS SHALL BE USED IN LOCATIONS WITH MODERATE TO SEVERE SULFATE EXPOSURE UNLESS OTHERWISE REQUIRED BY THE LOCAL JURISDICTION.

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.

7. 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.

SEAL:

July 8, 2010

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(919) 661-6351

PROJECT INFORMATION:

45-FT [13.7M] MONOPOLE FOUNDATIONS

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Renewable Energy Made Simple
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Flagstaff, AZ 86001
Office: (928) 779-9463

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REVISION: 1

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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	

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TOWER REACTIONS - 45' [13.7M] MONOPOLE

ZONE	MAXIMUM LOADING CRITERIA	FACTORED ** MOMENT	FACTORED ** SHEAR	FACTORED VERTICAL
1	SKYSTREAM WIND TURBINE 150 MPH & 60 MPH W/ 1"-ICE [67 m/sec & 26.8 m/sec w/ 25.4mm-ICE]	112.8 kip-ft	3.51 kips	1.48 kips
		152.9 kN-m	15.61 kN	6.58 kN
2	SKYSTREAM WIND TURBINE 120 MPH & 60 MPH W/ 1"-ICE [54 m/sec & 26.8 m/sec w/ 25.4mm-ICE]	97.3 kip-ft	2.78 kips	1.48 kips
		131.9 kN-m	12.37 kN	6.58 kN
3	SKYSTREAM WIND TURBINE 90 MPH & 60 MPH W/ 1"-ICE [40 m/sec & 26.8 m/sec w/ 25.4mm-ICE]	85.4 kip-ft	2.21 kips	1.48 kips
		115.8 kN-m	9.83 kN	6.58 kN

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

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]

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DRAWN BY: JAB | CHECKED BY: REG

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NOTES:

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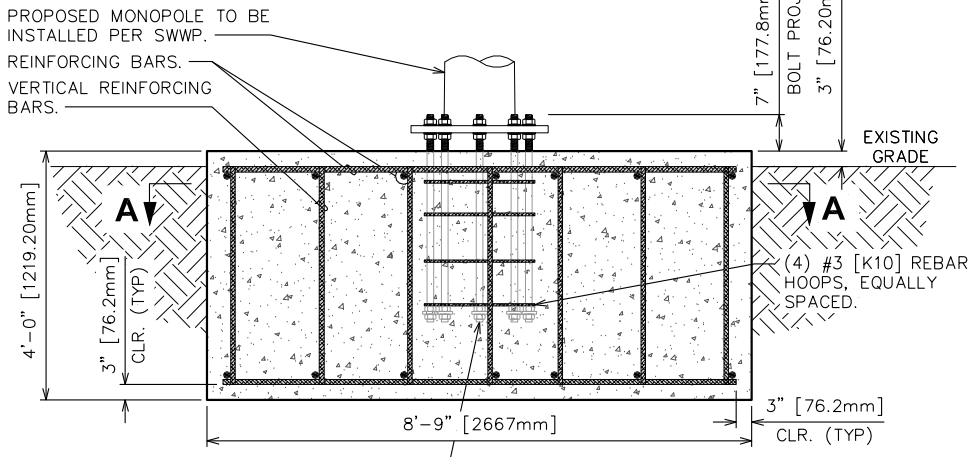
4. ALL BACKFILL SHOULD BE PLACED IN MAXIMUM LOOSE LIFTS OF 8" AND COMPACTED TO A MINIMUM 95% OF ASTM D-1557.
5. TOWER GROUNDING SHALL BE PERFORMED IN ACCORDANCE WITH NEC REQUIREMENTS.
6. CONDUIT PLACEMENT SHALL BE IN ACCORDANCE WITH BOTH THE NEC AND SOUTHWEST WINDPOWER REQUIREMENTS.

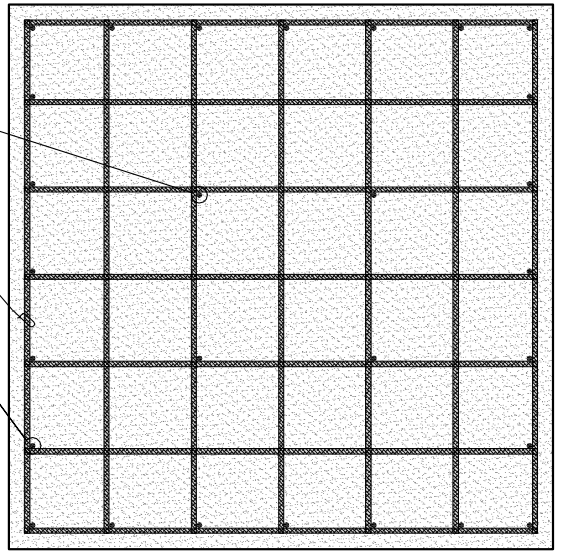
DESIGN IS BASED ON SOIL CLASS 5:
q'_{all} = 1500 psf [71.82 kPa]



(8) 1¼"ø x 42" LONG ANCHOR BOLTS (F1554 GR. 55 OR APPROVED EQUAL) ON 19"ø BOLT CIRCLE. EACH ANCHOR BOLT SHALL BE EMBEDDED WITH A HARDENED WASHER BETWEEN TWO (2) NUTS SECURED BY DEFORMING THREADS. AS A MINIMUM, WASHERS SHALL BE ASTM F436 CIRCULAR WASHERS: MINIMUM O.D.=2¾"ø, MAX I.D.=1½"ø, MINIMUM THICKNESS OF 0.136".

FOUNDATION - WIND ZONE 1

SCALE: ⅜" = 1'-0" [9.5mm = 304.8mm]



SECTION A-A

SCALE: ⅜" = 1'-0" [9.5mm =304.8mm]

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DRAWN BY: JRM | CHECKED BY: REG

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REVISION: 1

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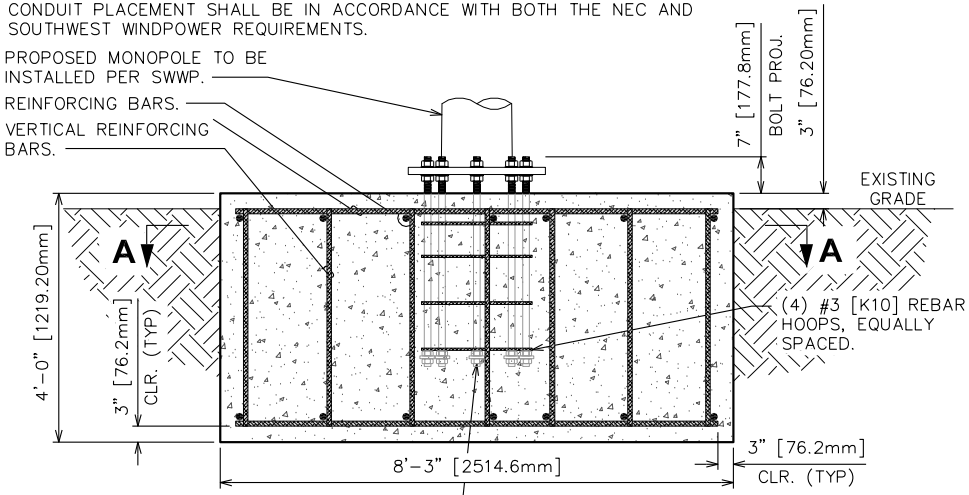

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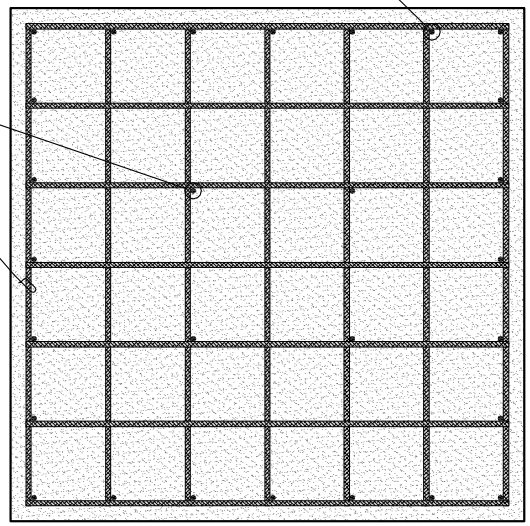
FOUNDATION - WIND ZONE 2

SCALE: ⅜" = 1'-0" [9.5mm = 304.8mm]

#8 [K25] VERTICAL REINFORCING BARS SPACED EQUALLY AS SHOWN (24 TOTAL) PLACE AS SHOWN.

#8 [K25] VERTICAL REINFORCING BARS IN CENTER PLACED AS SHOWN. (4 TOTAL)

(7) #8 [K25] REINFORCING BARS SPACED AS SHOWN EACH WAY, TOP AND BOTTOM (28 TOTAL). ADJUST BARS AS REQUIRED FOR CLEARANCE WITH ANCHOR BOLTS. BAR SPACING SHALL NOT EXCEED 18".



SECTION A-A

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REVISION: 1

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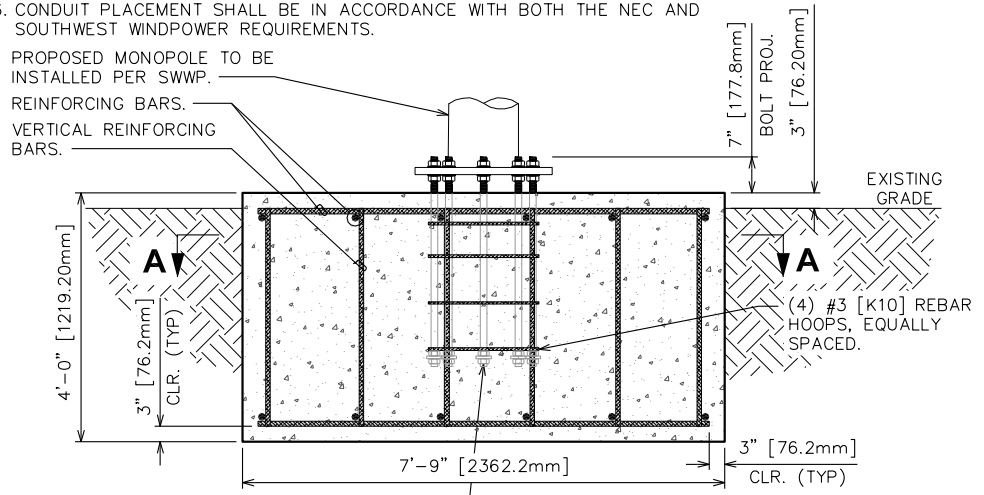
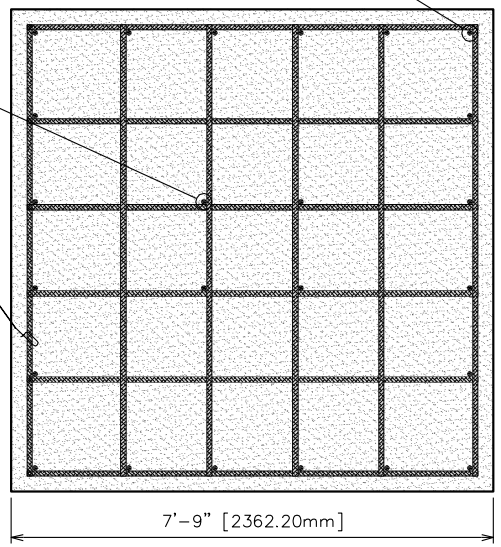


(8) 1¼"ø x 42" LONG ANCHOR BOLTS (F1554 GR. 55 OR APPROVED EQUAL) ON 19"ø BOLT CIRCLE. EACH ANCHOR BOLT SHALL BE EMBEDDED WITH A HARDENED WASHER BETWEEN TWO (2) NUTS SECURED BY DEFORMING THREADS. AS A MINIMUM, WASHERS SHALL BE ASTM F436 CIRCULAR WASHERS: MINIMUM O.D.=2¾"ø, MAX I.D.=1½"ø, MINIMUM THICKNESS OF 0.136".

FOUNDATION - WIND ZONE 3

SCALE: ⅜" = 1'-0" [9.5mm = 304.8mm]



SECTION A-A

SCALE: ⅜" = 1'-0" [9.5mm =304.8mm]

SEAL:

July 8, 2010

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

PROJECT INFORMATION:

45-FT [13.7M] MONOPOLE FOUNDATIONS

Southwest Windpower
Renewable Energy Made Simple
1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

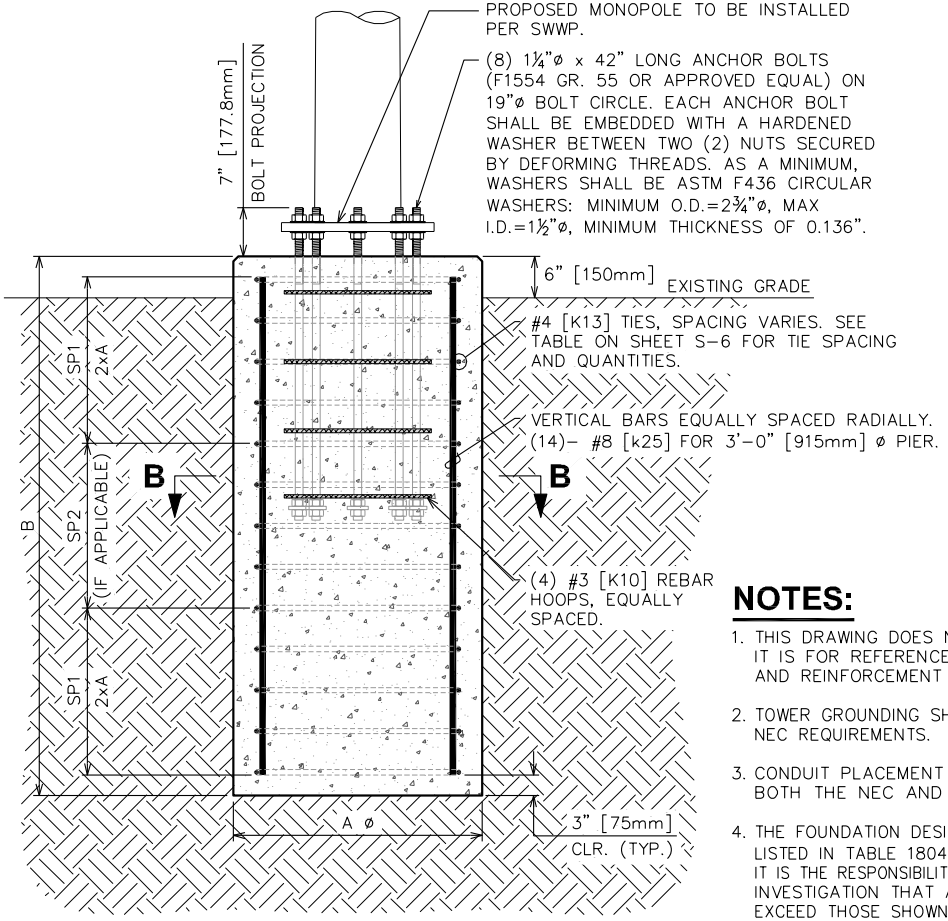
REV	DATE
i	07-08-2010
0	04-13-2010

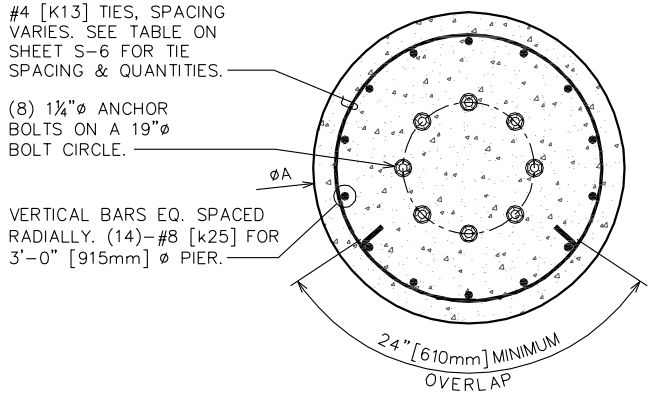
DRAWN BY: JRM | CHECKED BY: REG

SHEET NUMBER: **S-4C**

REVISION: 1

TEP#: 100002.09





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-6 FOR DIMENSIONS AND REINFORCEMENT QUANTITIES.
2. TOWER GROUNDING SHALL BE PERFORMED IN ACCORDANCE WITH NEC REQUIREMENTS.
3. CONDUIT PLACEMENT SHALL BE PLACED IN ACCORDANCE WITH BOTH THE NEC AND SOUTHWEST WINDPOWER REQUIREMENTS.
4. 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.

SEAL:

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FOUNDATION ALTERNATIVE - PIER

SCALE: N.T.S.

TOWER ENGINEERING PROFESSIONALS	3703 JUNCTION BOULEVARD RALEIGH, NC 27603-5263 (919) 661-6351
PROJECT INFORMATION:	**45-FT [13.7M] MONOPOLE FOUNDATIONS**
Southwest Windpower	Renewable Energy Made Simple 1801 West Route 66 Flagstaff, AZ 86001 Office: (928) 779-9463

REV	DATE
i	07-08-2010
0	04-13-2010

DRAWN BY: JRM	CHECKED BY: REG
SHEET NUMBER: **S-5**	REVISION: 1
	TEP#: 100002.09

45-FT [13.7M] MONOPOLE FOUNDATION DIMENSIONS - PIER

ZONE	SOIL CLASS	DIMENSION		VERTICAL REINF.		TIE SPACING		#4 [K13] TIE QUANTITY
		A	B	SIZE	QTY.	SP1	SP2	
1	1	3'-0" [915mm]	13'-6" [4115mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	26
	2	3'-0" [915mm]	13'-6" [4115mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	26
	3	3'-0" [915mm]	13'-6" [4115mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	26
	4	3'-0" [915mm]	15'-6" [4725mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	28
	5	3'-0" [915mm]	17'-6" [5335mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	30

ZONE	SOIL CLASS	DIMENSION		VERTICAL REINF.		TIE SPACING		#4 [K13] TIE QUANTITY
		A	B	SIZE	QTY.	SP1	SP2	
2	1	3'-0" [915mm]	12'-6" [3810mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	25
	2	3'-0" [915mm]	12'-6" [3810mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	25
	3	3'-0" [915mm]	12'-6" [3810mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	25
	4	3'-0" [915mm]	14'-6" [4420mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	27
	5	3'-0" [915mm]	16'-6" [5030mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	29

ZONE	SOIL CLASS	DIMENSION		VERTICAL REINF.		TIE SPACING		#4 [K13] TIE QUANTITY
		A	B	SIZE	QTY.	SP1	SP2	
3	1	3'-0" [915mm]	12'-6" [3810mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	25
	2	3'-0" [915mm]	12'-6" [3810mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	25
	3	3'-0" [915mm]	12'-6" [3810mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	25
	4	3'-0" [915mm]	13'-6" [4115mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	26
	5	3'-0" [915mm]	15'-6" [4725mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	28

SEAL:

July 8, 2010

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PROJECT INFORMATION:

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DRAWN BY: JRM | CHECKED BY: REG

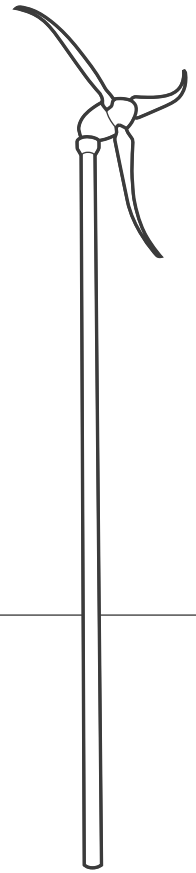
SHEET NUMBER: **S-6**

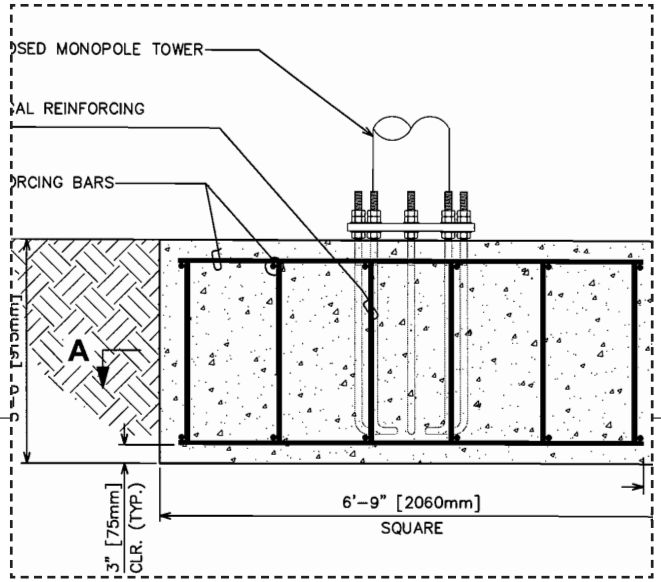
REVISION: 1

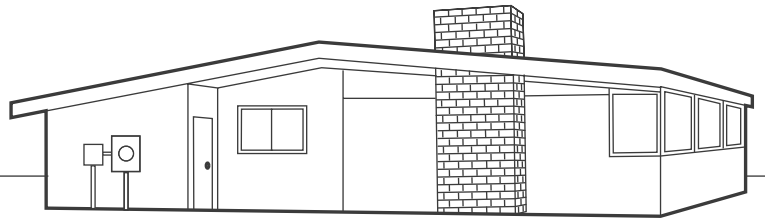
TEP#: 100002.09

SKYSTREAM®

APPENDIX B
55 ft (16.8 m) SECTIONAL MONOPOLE TOWER FOUNDATIONS







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

Southwest Windpower

Renewable Energy Made Simple

SKYSTREAM 3.7

ATTENTION

THE FOUNDATION DESIGNS ARE IN ACCORDANCE WITH THE 2006 INTERNATIONAL BUILDING CODE, TIA-222-G-2-2009 STRUCTURAL STANDARD FOR ANTENNA SUPPORTING STRUCTURES AND ANTENNAS, AND ASCE 7-05, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES. THE FOUNDATION DESIGNS ARE FOR A 55-FT [16.8M] 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

SEAL:

July 8, 2010

TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
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PROJECT INFORMATION:

55-FT [16.8M] MONOPOLE FOUNDATIONS

Southwest Windpower
Renewable Energy Made Simple
1801 West Route 66
Flagstaff, AZ 86001
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REV	DATE
1	07-08-2010
0	04-13-2010

DRAWN BY: JRM | CHECKED BY: REG

SHEET NUMBER: **T-1**

REVISION: 1

TEP#: 100002.09

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 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.

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.

REINFORCING STEEL NOTES (CONTINUED):

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.

6. IN REGIONS OF HIGH SEISMIC RISK, ASSIGNED TO SEISMIC DESIGN CATEGORIES C, D, E, AND F, ADDITIONAL TERMINATION DETAILS ARE REQUIRED FOR STEEL REINFORCING BARS. FURTHER, ADDITIONAL DETAILING REQUIREMENTS MAY BE REQUIRED IN OTHER, LESS PRONE AREAS AS REQUIRED BY THE AUTHORITY HAVING JURISDICTION (AHJ).

   A. SEISMIC HOOKS SHALL BE USED TO TERMINATE STIRRUPS, HOOPS, OR CROSSTIES AS DEFINED PER ACI 318.
   B. LONGITUDINAL REINFORCING BARS ARE REQUIRED TO HAVE BOTH A STANDARD BEND AND HOOK EXTENSION (MIN. OF 12 BAR DIAMETERS) AT EACH END AS DEFINED PER ACI 318.

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. HOWEVER, A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI TO 4,500 PSI IN 28-DAYS SHALL BE USED IN LOCATIONS WITH MODERATE TO SEVERE SULFATE EXPOSURE UNLESS OTHERWISE REQUIRED BY THE LOCAL JURISDICTION.

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.

7. 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.

SEAL:

July 8, 2010

TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
RALEIGH, NC 27603-5263
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PROJECT INFORMATION:

55-FT [16.8M] MONOPOLE FOUNDATIONS

Southwest Windpower
Renewable Energy Made Simple
1801 West Route 66
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Office: (928) 779-9463

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1	07-08-2010
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DRAWN BY: JRM | CHECKED BY: REG

SHEET NUMBER: **S-1**

REVISION: 1

TEP#: 100002.09

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	

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DRAWN BY: JRM | CHECKED BY: REG

SHEET NUMBER: **S-2**

REVISION: 1

TEP#: 100002.09

TOWER REACTIONS - 55' [16.8M] MONOPOLE

ZONE	MAXIMUM LOADING CRITERIA	FACTORED ** MOMENT	FACTORED ** SHEAR	FACTORED VERTICAL
1	SKYSTREAM WIND TURBINE 150 MPH & 60 MPH W/ 1"-ICE [67 m/sec & 26.8 m/sec w/ 25.4mm-ICE]	189.4 kip-ft	5.71 kips	2.37 kips
		256.8 kN-m	25.40 kN	10.54 kN
2	SKYSTREAM WIND TURBINE 120 MPH & 60 MPH W/ 1"-ICE [54 m/sec & 26.8 m/sec w/ 25.4mm-ICE]	148.8 kip-ft	4.14 kips	2.37 kips
		201.7 kN-m	18.42 kN	10.54 kN
3	SKYSTREAM WIND TURBINE 90 MPH & 60 MPH W/ 1"-ICE [40 m/sec & 26.8 m/sec w/ 25.4mm-ICE]	117.2 kip-ft	2.91 kips	2.37 kips
		158.9 kN-m	12.94 kN	10.54 kN

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

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]

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REV	DATE
i	07-08-2010
0	04-13-2010

DRAWN BY: JAB | CHECKED BY: KMM

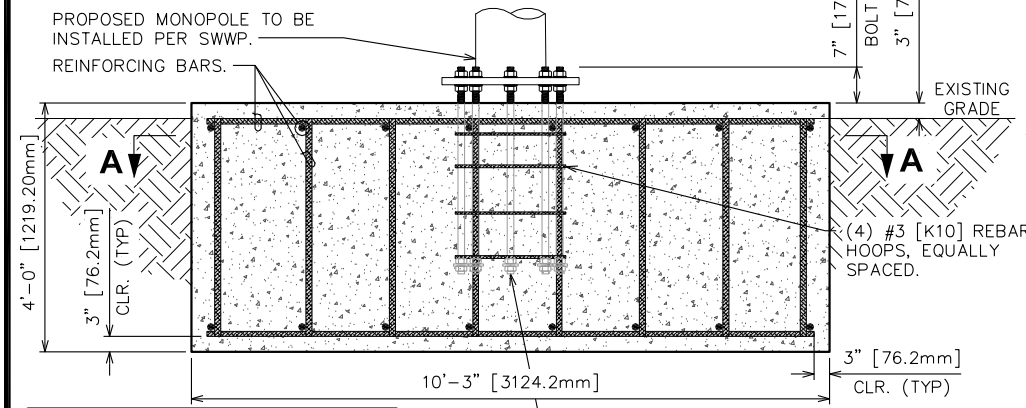
SHEET NUMBER: **S-3**

REVISION: 1

TEP#: 100002.09

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. FOUNDATION WIDTH IS BASED ON WIND ZONES 1-3, SEE SHEETS S-4A – S-4C FOR APPROPRIATE SIZES.
3. IF THE PROPOSED AREA IS FOUND TO CONTAIN FILL MATERIALS, THE EXCAVATION SHALL EXTEND TO THE VIRGIN SAND LAYER AND BE BACKFILLED WITH COMPACTED SAND OR STONE. AFTER EXCAVATION AND PRIOR TO FILL OR CONCRETE PLACEMENT, THE SURFACE OF THE VIRGIN SAND LAYER SHOULD BE MECHANICALLY COMPACTED TO DENSIFY THE SURFACE DISTURBED DURING THE EXCAVATION.
4. ALL BACKFILL SHOULD BE PLACED IN MAXIMUM LOOSE LIFTS OF 8" AND COMPACTED TO A MINIMUM 95% OF ASTM D-1557.
5. TOWER GROUNDING SHALL BE PERFORMED IN ACCORDANCE WITH NEC REQUIREMENTS.
6. CONDUIT PLACEMENT SHALL BE IN ACCORDANCE WITH BOTH THE NEC AND SOUTHWEST WINDPOWER REQUIREMENTS.



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

(8) 1¼"ø x 42" LONG ANCHOR BOLTS (F1554 GR. 55 OR APPROVED EQUAL) ON 23"ø BOLT CIRCLE. EACH ANCHOR BOLT SHALL BE EMBEDDED WITH A HARDENED WASHER BETWEEN TWO (2) NUTS SECURED BY DEFORMING THREADS. AS A MINIMUM, WASHERS SHALL BE ASTM F436 CIRCULAR WASHERS: MINIMUM O.D.=2¾"ø, MAX I.D.=1½"ø, MINIMUM THICKNESS OF 0.136".

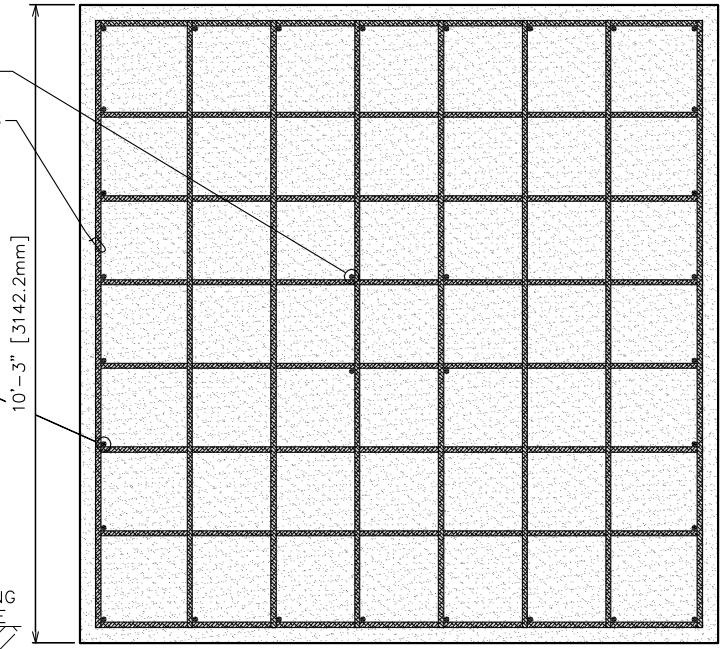
FOUNDATION - WIND ZONE 1

SCALE: ⅜" = 1'-0" 9.5mm = 304.8mm]

#8 [K25] VERTICAL REINFORCING BARS IN CENTER PLACED AS SHOWN. (4 TOTAL)

(8) #8 [K25] REINFORCING BARS SPACED EQUALLY EACH WAY, TOP AND BOTTOM (32 TOTAL). ADJUST BARS AS REQUIRED TO CLEAR ANCHOR BOLTS. BAR SPACING SHALL NOT EXCEED 18".

#8 [K25] VERTICAL REINFORCING BARS SPACED EQUALLY AS SHOWN. (28 TOTAL)



SECTION A-A

SCALE: ⅜" = 1'-0" [9.5mm =304.8mm]

SEAL:

July 8, 2010

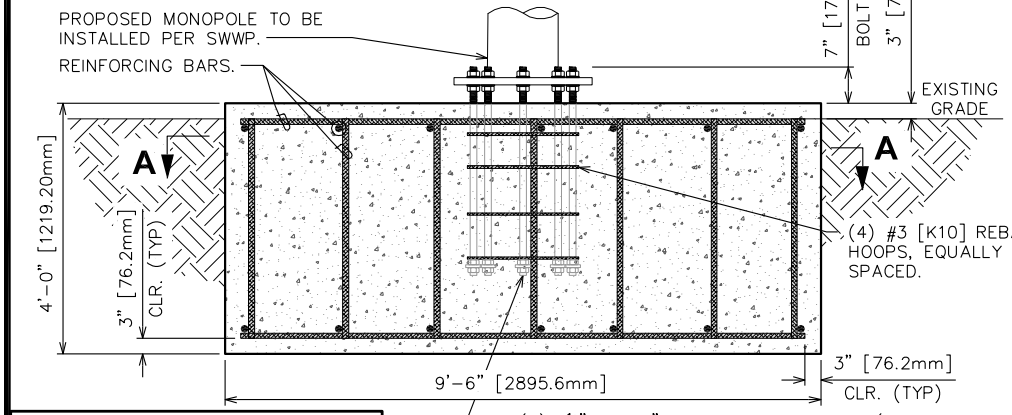
TOWER ENGINEERING PROFESSIONALS 3703 JUNCTION BOULEVARD RALEIGH, NC 27603-5263 (919) 661-6351	PROJECT INFORMATION: **55-FT [16.8M] MONOPOLE FOUNDATIONS**
Southwest Windpower Renewable Energy Made Simple 1801 West Route 66 Flagstaff, AZ 86001 Office: (928) 779-9463	

REV	DATE
1	07-08-2010
0	04-13-2010

DRAWN BY: JRM	CHECKED BY: REG
SHEET NUMBER: **S-4A**	REVISION: 1
	TEP#: 100002.09

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. FOUNDATION WIDTH IS BASED ON WIND ZONES 1-3, SEE SHEETS S-4A – S-4C FOR APPROPRIATE SIZES.
3. IF THE PROPOSED AREA IS FOUND TO CONTAIN FILL MATERIALS, THE EXCAVATION SHALL EXTEND TO THE VIRGIN SAND LAYER AND BE BACKFILLED WITH COMPACTED SAND OR STONE. AFTER EXCAVATION AND PRIOR TO FILL OR CONCRETE PLACEMENT, THE SURFACE OF THE VIRGIN SAND LAYER SHOULD BE MECHANICALLY COMPACTED TO DENSIFY THE SURFACE DISTURBED DURING THE EXCAVATION.
4. ALL BACKFILL SHOULD BE PLACED IN MAXIMUM LOOSE LIFTS OF 8" AND COMPACTED TO A MINIMUM 95% OF ASTM D-1557.
5. TOWER GROUNDING SHALL BE PERFORMED IN ACCORDANCE WITH NEC REQUIREMENTS.
6. CONDUIT PLACEMENT SHALL BE IN ACCORDANCE WITH BOTH THE NEC AND SOUTHWEST WINDPOWER REQUIREMENTS.



DESIGN IS BASED ON SOIL CLASS 5:
q_s' = 1500 psf [71.82 kPa]

(8) 1¼"ø x 42" LONG ANCHOR BOLTS (F1554 GR. 55 OR APPROVED EQUAL) ON 23"ø BOLT CIRCLE. EACH ANCHOR BOLT SHALL BE EMBEDDED WITH A HARDENED WASHER BETWEEN TWO (2) NUTS SECURED BY DEFORMING THREADS. AS A MINIMUM, WASHERS SHALL BE ASTM F436 CIRCULAR WASHERS: MINIMUM O.D.=2¾"ø, MAX I.D.=1½"ø, MINIMUM THICKNESS OF 0.136".

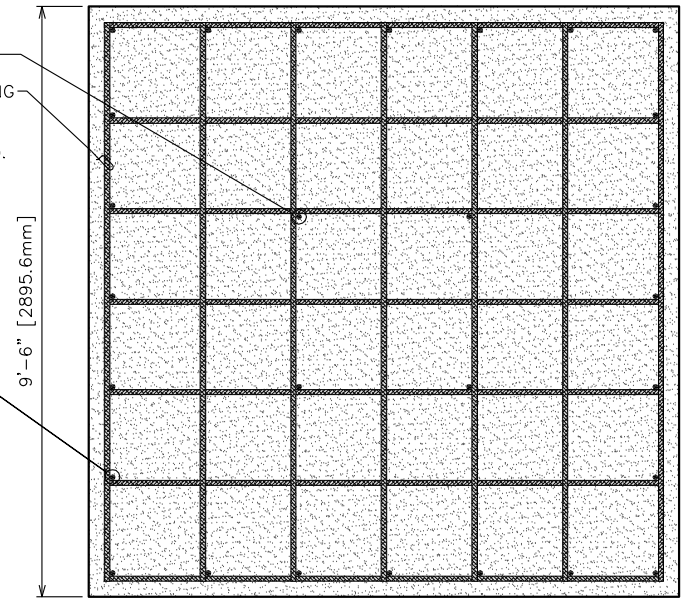
FOUNDATION - WIND ZONE 2

SCALE: ⅜" = 1'-0" [9.5mm = 304.8mm]

#8 [K25] VERTICAL REINFORCING BARS IN CENTER PLACED AS SHOWN. (4 TOTAL)

(7) #8 [K25] REINFORCING BARS SPACED EQUALLY EACH WAY, TOP AND BOTTOM (28 TOTAL). ADJUST BARS AS REQUIRED TO CLEAR ANCHOR BOLTS. BAR SPACING SHALL NOT EXCEED 18".

#8 [K25] VERTICAL REINFORCING BARS SPACED EQUALLY AS SHOWN. (24 TOTAL)



SECTION A-A

SCALE: ⅜" = 1'-0" [9.5mm =304.8mm]

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

PROJECT INFORMATION:

55-FT [16.8M] MONOPOLE FOUNDATIONS

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Renewable Energy Made Simple
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DRAWN BY: JRM | CHECKED BY: REG

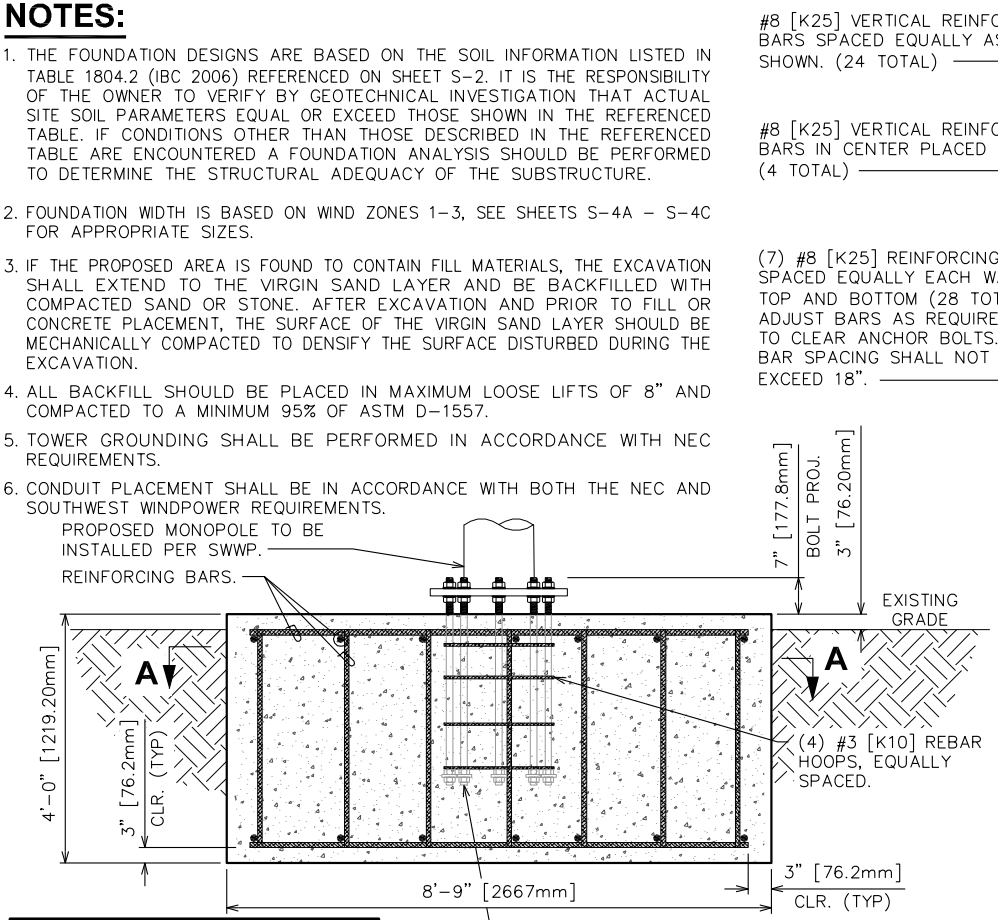
SHEET NUMBER: **S-4B**

REVISION: 1

TEP#: 100002.09

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. FOUNDATION WIDTH IS BASED ON WIND ZONES 1-3, SEE SHEETS S-4A – S-4C FOR APPROPRIATE SIZES.
3. IF THE PROPOSED AREA IS FOUND TO CONTAIN FILL MATERIALS, THE EXCAVATION SHALL EXTEND TO THE VIRGIN SAND LAYER AND BE BACKFILLED WITH COMPACTED SAND OR STONE. AFTER EXCAVATION AND PRIOR TO FILL OR CONCRETE PLACEMENT, THE SURFACE OF THE VIRGIN SAND LAYER SHOULD BE MECHANICALLY COMPACTED TO DENSIFY THE SURFACE DISTURBED DURING THE EXCAVATION.
4. ALL BACKFILL SHOULD BE PLACED IN MAXIMUM LOOSE LIFTS OF 8" AND COMPACTED TO A MINIMUM 95% OF ASTM D-1557.
5. TOWER GROUNDING SHALL BE PERFORMED IN ACCORDANCE WITH NEC REQUIREMENTS.
6. CONDUIT PLACEMENT SHALL BE IN ACCORDANCE WITH BOTH THE NEC AND SOUTHWEST WINDPOWER REQUIREMENTS.



DESIGN IS BASED ON SOIL CLASS 5:
q_s' = 1500 psf [71.82 kPa]

(8) 1¼"ø x 42" LONG ANCHOR BOLTS (F1554 GR. 55 OR APPROVED EQUAL) ON 23"ø BOLT CIRCLE. EACH ANCHOR BOLT SHALL BE EMBEDDED WITH A HARDENED WASHER BETWEEN TWO (2) NUTS SECURED BY DEFORMING THREADS. AS A MINIMUM, WASHERS SHALL BE ASTM F436 CIRCULAR WASHERS: MINIMUM O.D.=2¾"ø, MAX I.D.=1½"ø, MINIMUM THICKNESS OF 0.136".

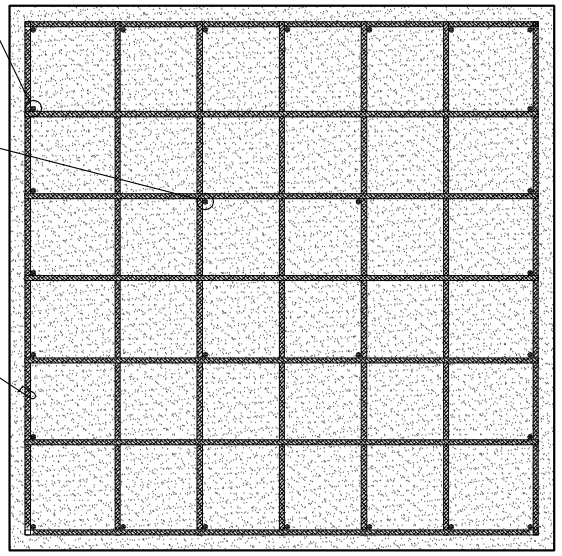
FOUNDATION - WIND ZONE 3

SCALE: ⅜" = 1'-0" [9.5mm = 304.8mm]

#8 [K25] VERTICAL REINFORCING BARS SPACED EQUALLY AS SHOWN. (24 TOTAL)

#8 [K25] VERTICAL REINFORCING BARS IN CENTER PLACED AS SHOWN. (4 TOTAL)

(7) #8 [K25] REINFORCING BARS SPACED EQUALLY EACH WAY, TOP AND BOTTOM (28 TOTAL). ADJUST BARS AS REQUIRED TO CLEAR ANCHOR BOLTS. BAR SPACING SHALL NOT EXCEED 18".



SECTION A-A

SCALE: ⅜" = 1'-0" [9.5mm =304.8mm]

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TOWER ENGINEERING PROFESSIONALS
3703 JUNCTION BOULEVARD
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PROJECT INFORMATION:

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Southwest Windpower
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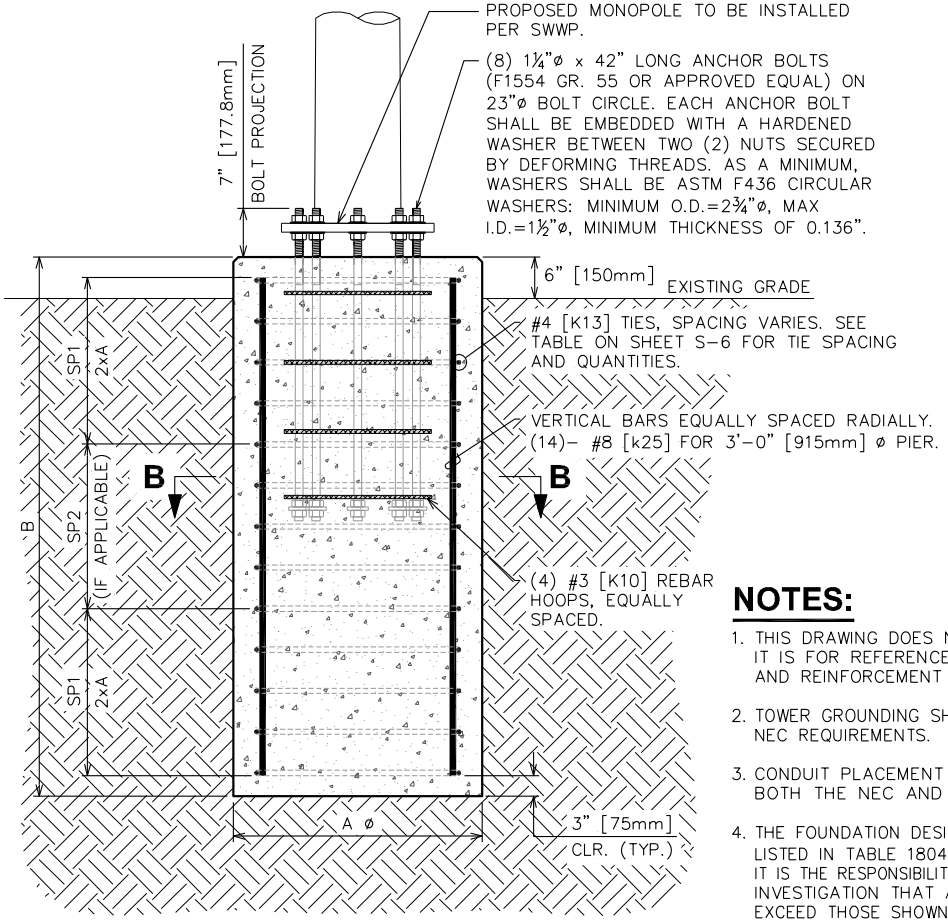

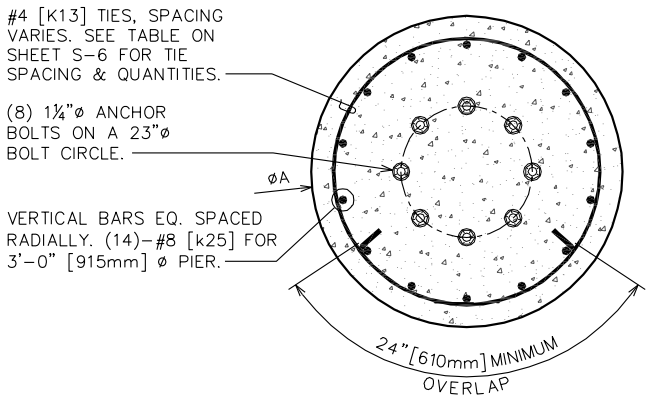

SECTION B-B

SCALE: N.T.S.

NOTES:

1. THIS DRAWING DOES NOT REPRESENT THE ACTUAL FOUNDATION, IT IS FOR REFERENCE ONLY. SEE SHEET S-6 FOR DIMENSIONS AND REINFORCEMENT QUANTITIES.
2. TOWER GROUNDING SHALL BE PERFORMED IN ACCORDANCE WITH NEC REQUIREMENTS.
3. CONDUIT PLACEMENT SHALL BE PLACED IN ACCORDANCE WITH BOTH THE NEC AND SOUTHWEST WINDPOWER REQUIREMENTS.
4. 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.

SEAL:

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FOUNDATION ALTERNATIVE - PIER

SCALE: N.T.S.

TOWER ENGINEERING PROFESSIONALS 3703 JUNCTION BOULEVARD RALEIGH, NC 27603-5263 (919) 661-6351	PROJECT INFORMATION: **55-FT [16.8M] MONOPOLE FOUNDATIONS**
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SHEET NUMBER: **S-5**	REVISION: 1
	TEP#: 100002.09

55-FT [16.8M] MONOPOLE FOUNDATION DIMENSIONS - PIER

ZONE	SOIL CLASS	DIMENSION		VERTICAL REINF.		TIE SPACING		#4 [K13] TIE QUANTITY
		A	B	SIZE	QTY.	SP1	SP2	
1	1	3'-0" [915mm]	16'-6" [5030mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	29
	2	3'-0" [915mm]	16'-6" [5030mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	29
	3	3'-0" [915mm]	16'-6" [5030mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	29
	4	3'-0" [915mm]	17'-6" [5335mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	30
	5	3'-0" [915mm]	20'-6" [6250mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	33

ZONE	SOIL CLASS	DIMENSION		VERTICAL REINF.		TIE SPACING		#4 [K13] TIE QUANTITY
		A	B	SIZE	QTY.	SP1	SP2	
2	1	3'-0" [915mm]	14'-6" [4420mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	27
	2	3'-0" [915mm]	14'-6" [4420mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	27
	3	3'-0" [915mm]	14'-6" [4420mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	27
	4	3'-0" [915mm]	16'-6" [5030mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	29
	5	3'-0" [915mm]	18'-6" [5640mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	31

ZONE	SOIL CLASS	DIMENSION		VERTICAL REINF.		TIE SPACING		#4 [K13] TIE QUANTITY
		A	B	SIZE	QTY.	SP1	SP2	
3	1	3'-0" [915mm]	13'-6" [4120mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	26
	2	3'-0" [915mm]	13'-6" [4120mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	26
	3	3'-0" [915mm]	13'-6" [4120mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	26
	4	3'-0" [915mm]	14'-6" [4120mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	27
	5	3'-0" [915mm]	17'-6" [5340mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	30

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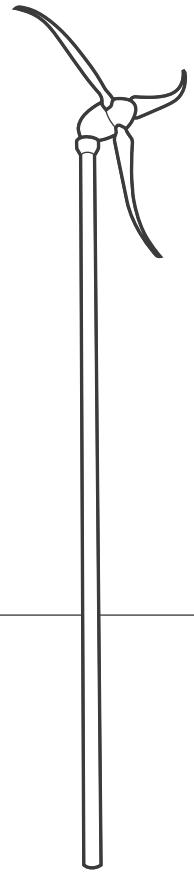
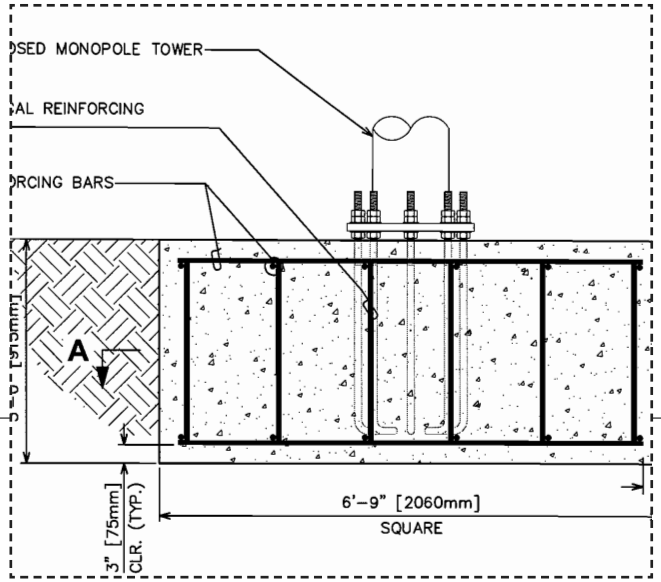
REVISION: 1

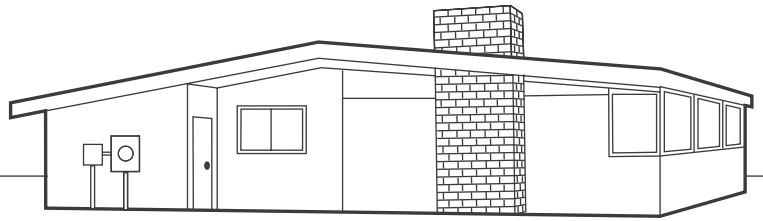
TEP#: 100002.09

SKYSTREAM®

APPENDIX C
70 ft (21.3 m) SECTIONAL MONOPOLE TOWER FOUNDATIONS







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

Southwest Windpower

Renewable Energy Made Simple

SKYSTREAM 3.7

ATTENTION

THE FOUNDATION DESIGNS ARE IN ACCORDANCE WITH THE 2006 INTERNATIONAL BUILDING CODE, TIA-222-G-2-2009 STRUCTURAL STANDARD FOR ANTENNA SUPPORTING STRUCTURES AND ANTENNAS, AND ASCE 7-05, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES. THE FOUNDATION DESIGNS ARE FOR A 70-FT [21.3M] MONOPOLE WITH THE SKYSTREAM 3.7 WIND TURBINE BASED ON THE SOIL INFORMATION LISTED IN TABLE 1804.2 (IBC 2006) REFERENCED ON SHEET S-1 AND THE WIND ZONES DESCRIBED ON SHEET S-2. 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

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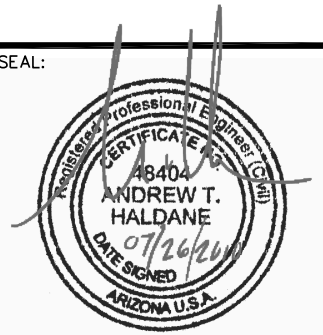

Expires 09/30/2011

July 26, 2010

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

PROJECT INFORMATION:

70-FT [21.3M] MONOPOLE FOUNDATIONS

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Office: (928) 779-9463

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1	07-26-2010
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SHEET NUMBER: **T-1**

REVISION: 1

TEP#: 100002.09

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 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. THE 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.

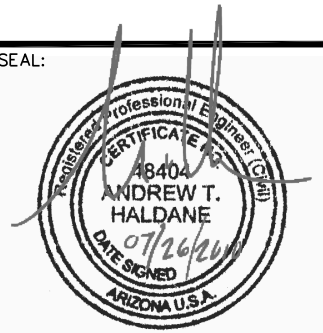
CONNECTION NOTES:

1. OVERSIZED (ROUND) BASE PLATE HOLES SHALL HAVE APPROVED F436 (F436M FOR METRIC) WASHERS INSTALLED, BOTH ABOVE AND BELOW THE BASE PLATE, ON EACH ANCHOR.

2. SLOTTED BASE PLATE HOLES SHALL HAVE EITHER APPROVED F436 (F436M FOR METRIC) WASHERS, OR PLATE WASHERS INSTALLED, BOTH ABOVE AND BELOW THE BASE PLATE, ON EACH ANCHOR. WASHERS SHALL BE SIZED TO COVER THE ENTIRE SLOTTED HOLES. PLATE WASHERS SHALL BE OF ASTM A36 MATERIAL (MINIMUM) AND HAVE A MINIMUM THICKNESS OF 5/16".

3. AN APPROVED NUT LOCKING DEVICE SHALL BE INSTALLED ON ALL BOLTED CONNECTIONS TO PREVENT NUT LOOSENING.

SEAL:



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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.
6. IN REGIONS OF HIGH SEISMIC RISK, ASSIGNED TO SEISMIC DESIGN CATEGORIES C, D, E, AND F, ADDITIONAL TERMINATION DETAILS ARE REQUIRED FOR STEEL REINFORCING BARS. FURTHER, ADDITIONAL DETAILING REQUIREMENTS MAY BE REQUIRED IN OTHER, LESS PRONE AREAS AS REQUIRED BY THE AUTHORITY HAVING JURISDICTION (AHJ).
   A. SEISMIC HOOKS SHALL BE USED TO TERMINATE STIRRUPS, HOOPS, OR CROSSTIES AS DEFINED PER ACI 318.
   B. LONGITUDINAL REINFORCING BARS ARE REQUIRED TO HAVE BOTH A STANDARD BEND AND HOOK EXTENSION (MIN. OF 12 BAR DIAMETERS) AT EACH END AS DEFINED PER ACI 318.

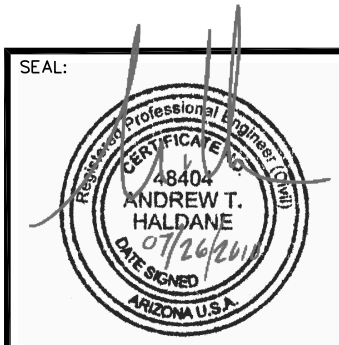
CONCRETE NOTES:

1. WORK SHALL BE IN ACCORDANCE WITH THE LATEST REVISION OF THE ACI-318, "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE."
2. THE CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 2,500 PSI [17230 kPa] IN 28-DAYS. HOWEVER, A MINIMUM COMPRESSIVE STRENGTH OF 3.000 PSI TO 4,500 PSI IN 28-DAYS SHALL BE USED IN LOCATIONS WITH MODERATE TO SEVERE SULFATE EXPOSURE UNLESS OTHERWISE REQUIRED BY THE LOCAL JURISDICTION.
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.

CONCRETE NOTES (CONTINUED):

7. 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.

SEAL:



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July 26, 2010

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

PROJECT INFORMATION:

70-FT [21.3M] MONOPOLE FOUNDATIONS

Southwest Windpower
Renewable Energy Made Simple
1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

REV	DATE
i	07-26-2010
0	04-13-2010

DRAWN BY: JRM | CHECKED BY: REG

SHEET NUMBER: **N-2**

REVISION: 1

TEP#: 100002.09

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	

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TOWER REACTIONS - 70' [21.3M] MONOPOLE

ZONE	MAXIMUM LOADING CRITERIA	FACTORED ** MOMENT	FACTORED ** SHEAR	FACTORED VERTICAL
1	SKYSTREAM WIND TURBINE 140 MPH & 60 MPH W/ 1"-ICE [63 m/sec & 26.8 m/sec w/ 25.4mm-ICE]	212.9 kip-ft	4.79 kips	2.71 kips
		288.7 kN-m	21.31 kN	12.05 kN
2	SKYSTREAM WIND TURBINE 120 MPH & 60 MPH W/ 1"-ICE [54 m/sec & 26.8 m/sec w/ 25.4mm-ICE]	183.3 kip-ft	3.88 kips	2.71 kips
		248.5 kN-m	17.26 kN	12.05 kN
3	SKYSTREAM WIND TURBINE 90 MPH & 60 MPH W/ 1"-ICE [40 m/sec & 26.8 m/sec w/ 25.4mm-ICE]	147.5 kip-ft	2.79 kips	2.71 kips
		200.0 kN-m	12.41 kN	12.05 kN

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

WIND ZONES

ZONE	WIND SPEED
1	120 - 140 MPH [54 - 63 m/sec]
2	90 - 120 MPH [40 - 54 m/sec]
3	≤ 90 MPH [≤ 40 m/sec]

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DRAWN BY: JAB | CHECKED BY: REG

SHEET NUMBER: **S-2**

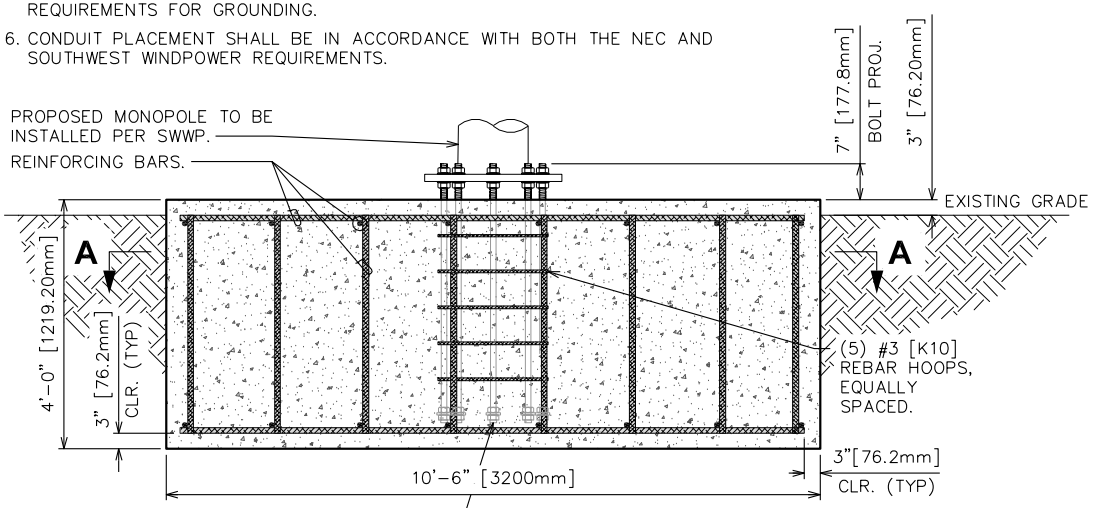
REVISION: 1

TEP#: 100002.09

NOTES:

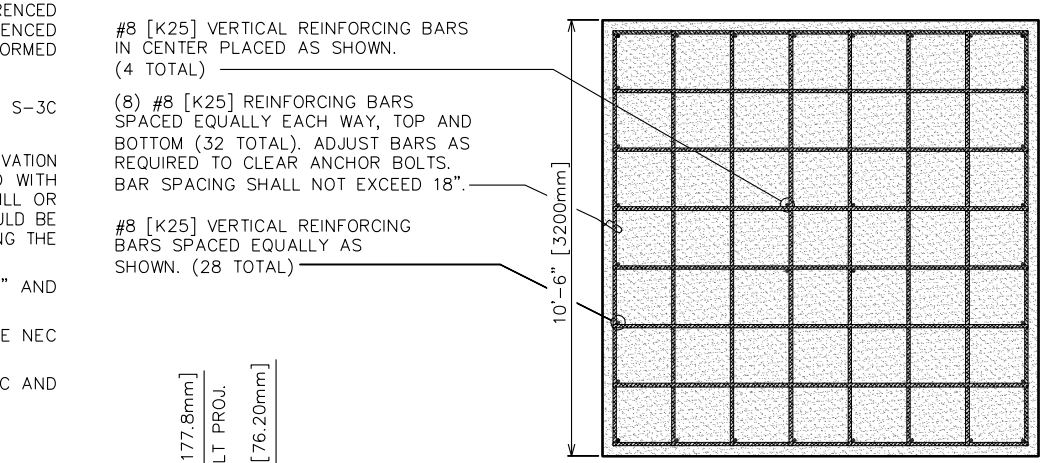
1. THE FOUNDATION DESIGNS ARE BASED ON THE SOIL INFORMATION LISTED IN TABLE 1804.2 (IBC 2006) REFERENCED ON SHEET S-1. IT IS THE RESPONSIBILITY OF THE OWNER TO VERIFY BY GEOTECHNICAL INVESTIGATION THAT ACTUAL SITE SOIL PARAMETERS EQUAL OR EXCEED THOSE SHOWN IN THE REFERENCED TABLE. IF CONDITIONS OTHER THAN THOSE DESCRIBED IN THE REFERENCED TABLE ARE ENCOUNTERED A FOUNDATION ANALYSIS SHOULD BE PERFORMED TO DETERMINE THE STRUCTURAL ADEQUACY OF THE SUBSTRUCTURE.
2. FOUNDATION WIDTH IS BASED ON WIND ZONES 1-3, SEE SHEETS S-3A – S-3C FOR APPROPRIATE SIZES.
3. IF THE PROPOSED AREA IS FOUND TO CONTAIN FILL MATERIALS, THE EXCAVATION SHALL EXTEND TO THE VIRGIN SAND LAYER AND BE BACKFILLED WITH COMPACTED SAND OR STONE. AFTER EXCAVATION AND PRIOR TO FILL OR CONCRETE PLACEMENT, THE SURFACE OF THE VIRGIN SAND LAYER SHOULD BE MECHANICALLY COMPACTED TO DENSIFY THE SURFACE DISTURBED DURING THE EXCAVATION.
4. ALL BACKFILL SHOULD BE PLACED IN MAXIMUM LOOSE LIFTS OF 8" AND COMPACTED TO A MINIMUM 95% OF ASTM D-1557.
5. TOWER GROUNDING SHALL BE PERFORMED IN ACCORDANCE WITH THE NEC REQUIREMENTS FOR GROUNDING.
6. CONDUIT PLACEMENT SHALL BE IN ACCORDANCE WITH BOTH THE NEC AND SOUTHWEST WINDPOWER REQUIREMENTS.

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



FOUNDATION - WIND ZONE 1

SCALE: ⅜" = 1'-0" [9.5mm = 304.8mm]

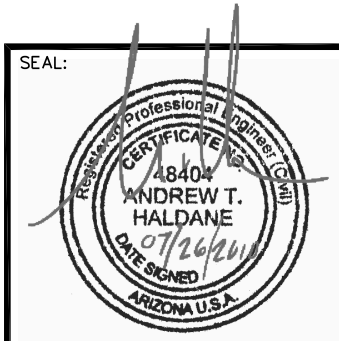


SECTION A-A

SCALE: ¼" = 1'-0" [6.4mm =304.8mm]

(8) 1¼" x 50" LONG ANCHOR BOLTS (F1554 GR. 55 OR APPROVED EQUAL) ON 23"ø BOLT CIRCLE. EACH ANCHOR BOLT SHALL BE EMBEDDED WITH A HARDENED WASHER BETWEEN TWO (2) NUTS SECURED BY DEFORMING THREADS. AS A MINIMUM, WASHERS SHALL BE ASTM F436 CIRCULAR WASHERS: MINIMUM O.D.=2¾"ø, MAX I.D.=1½"ø, MINIMUM THICKNESS OF 0.136".

SEAL:



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DRAWN BY: JRM	CHECKED BY: REG
SHEET NUMBER: **S-3A**	REVISION: 1
	TEP#: 100002.09

NOTES:

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2. FOUNDATION WIDTH IS BASED ON WIND ZONES 1-3, SEE SHEETS S-3A – S-3C FOR APPROPRIATE SIZES.
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DESIGN IS BASED ON SOIL CLASS 5:
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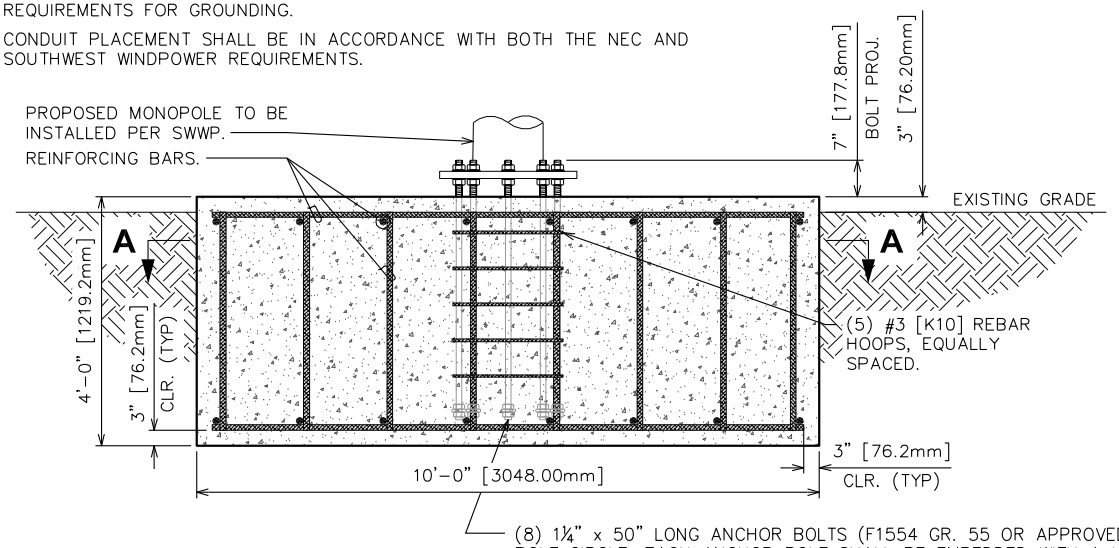

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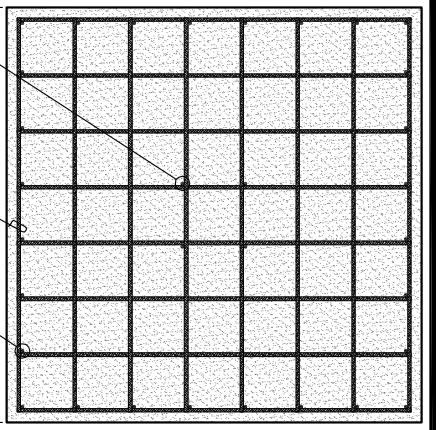
FOUNDATION - WIND ZONE 2

SCALE: ⅜" = 1'-0" [9.5mm = 304.8mm]



SECTION A-A

SCALE: ¼" = 1'-0" [6.4mm =304.8mm]

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Registered Professional Engineer (Civil)
CERTIFICATE NO.
48404
ANDREW T.
HALDANE
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DATE SIGNED
ARIZONA U.S.A.

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SHEET NUMBER: **S-3B**	REVISION: 1
	TEP#: 100002.09

NOTES:

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2. FOUNDATION WIDTH IS BASED ON WIND ZONES 1-3, SEE SHEETS S-3A – S-3C FOR APPROPRIATE SIZES.
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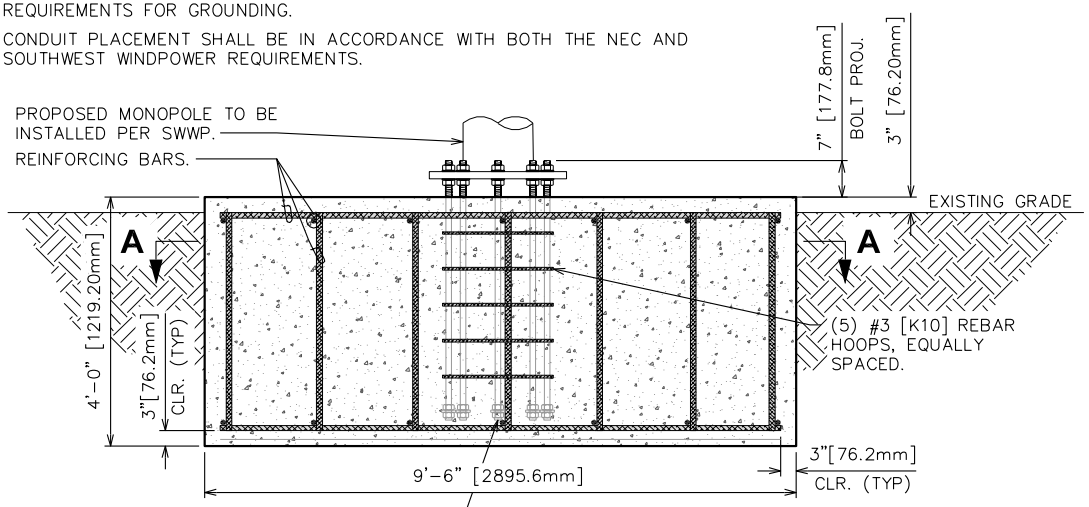

FOUNDATION - WIND ZONE 3

SCALE: ⅜" = 1'-0" [9.5mm = 304.8mm]

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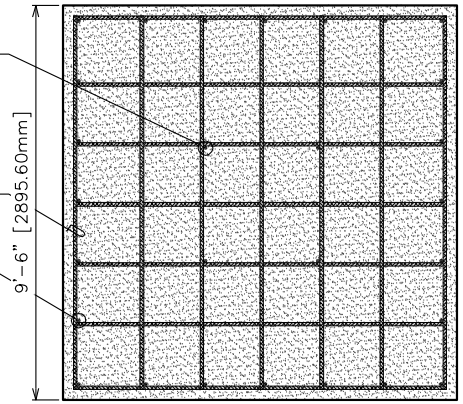

SECTION A-A

SCALE: ¼" = 1'-0" [6.4mm =304.8mm]

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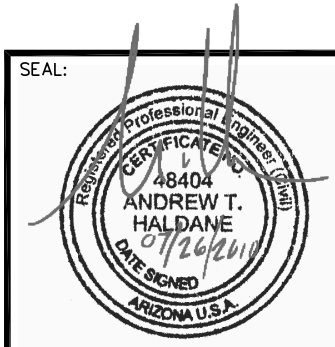

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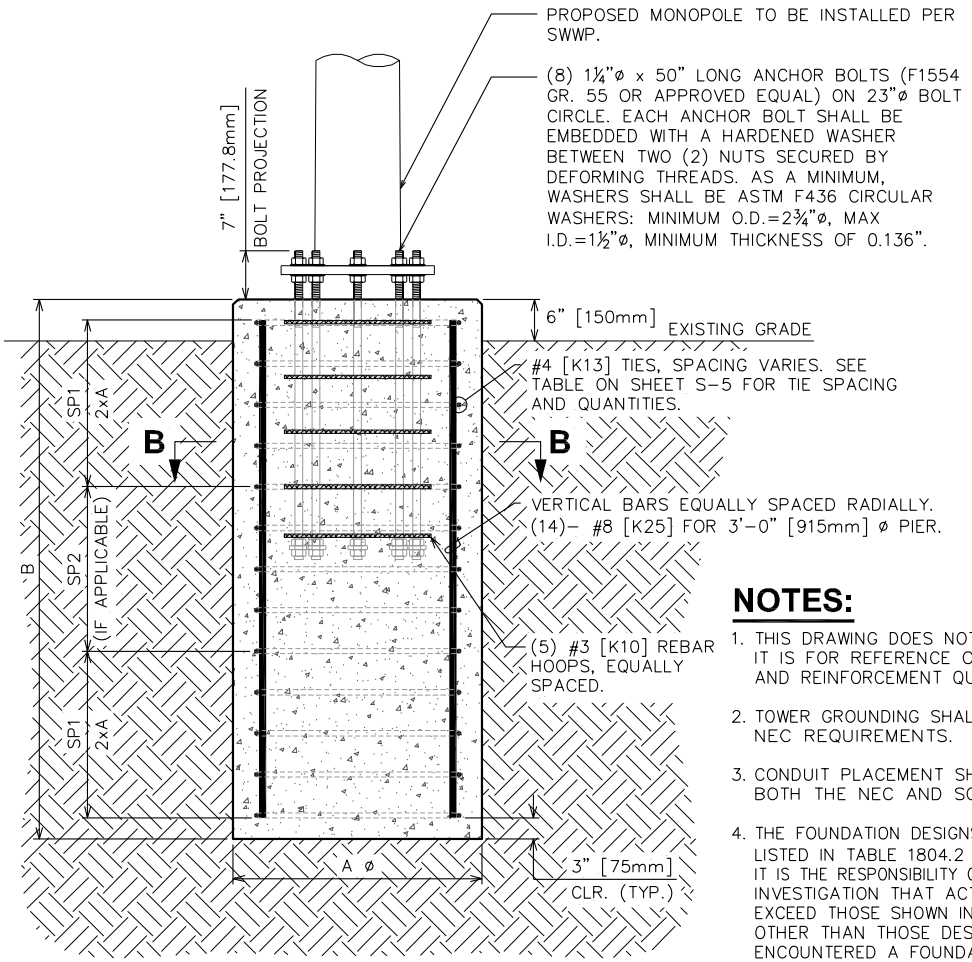

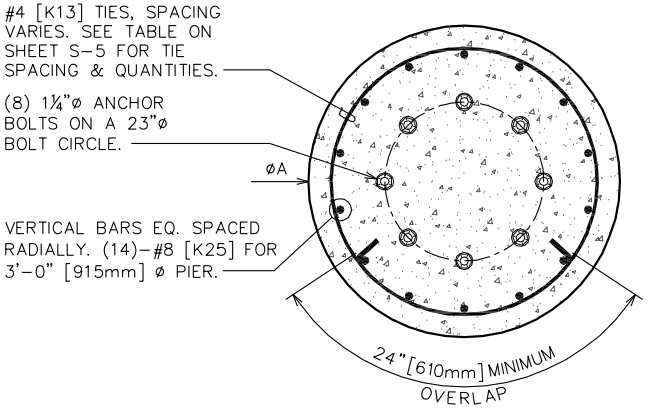

SECTION B-B

SCALE: N.T.S.

NOTES:

1. THIS DRAWING DOES NOT REPRESENT THE ACTUAL FOUNDATION, IT IS FOR REFERENCE ONLY. SEE SHEET S-5 FOR DIMENSIONS AND REINFORCEMENT QUANTITIES.
2. TOWER GROUNDING SHALL BE PERFORMED IN ACCORDANCE WITH NEC REQUIREMENTS.
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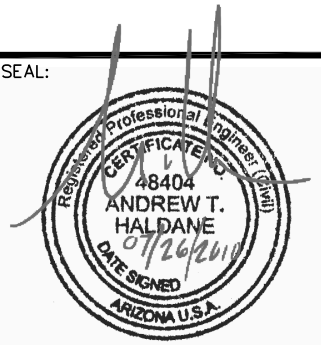

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FOUNDATION ALTERNATIVE - PIER

SCALE: N.T.S.

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REVISION: 1

TEP#: 100002.09

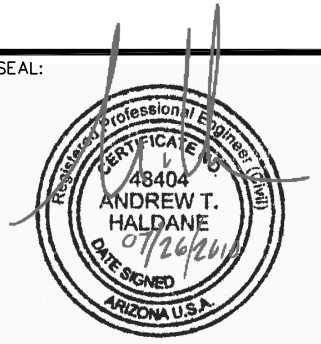
70-FT [21.3M] MONOPOLE FOUNDATION DIMENSIONS - PIER

ZONE	SOIL CLASS	DIMENSION		VERTICAL REINF.		TIE SPACING		#4 [K13] TIE QUANTITY
		A	B	SIZE	QTY.	SP1	SP2	
1	1	3'-0" [915mm]	16'-6" [5030mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	29
	2	3'-0" [915mm]	16'-6" [5030mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	29
	3	3'-0" [915mm]	16'-6" [5030mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	29
	4	3'-0" [915mm]	18'-6" [5640mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	31
	5	3'-0" [915mm]	20'-6" [6248mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	33

ZONE	SOIL CLASS	DIMENSION		VERTICAL REINF.		TIE SPACING		#4 [K13] TIE QUANTITY
		A	B	SIZE	QTY.	SP1	SP2	
2	1	3'-0" [915mm]	15'-6" [4724mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	28
	2	3'-0" [915mm]	15'-6" [4724mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	28
	3	3'-0" [915mm]	15'-6" [4724mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	28
	4	3'-0" [915mm]	17'-6" [5334mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	30
	5	3'-0" [915mm]	19'-6" [5944mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	32

ZONE	SOIL CLASS	DIMENSION		VERTICAL REINF.		TIE SPACING		#4 [K13] TIE QUANTITY
		A	B	SIZE	QTY.	SP1	SP2	
3	1	3'-0" [915mm]	14'-6" [4420mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	27
	2	3'-0" [915mm]	14'-6" [4420mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	27
	3	3'-0" [915mm]	14'-6" [4420mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	27
	4	3'-0" [915mm]	15'-6" [4724mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	28
	5	3'-0" [915mm]	18'-6" [5639mm]	#8 [K25]	14	6"± [150mm] O.C.	12"± [300mm] O.C.	31

SEAL:



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(919) 661-6351

PROJECT INFORMATION:

70-FT [21.3M] MONOPOLE FOUNDATIONS

Southwest Windpower
Renewable Energy Made Simple
1801 West Route 66
Flagstaff, AZ 86001
Office: (928) 779-9463

REV	DATE
1	07-26-2010
0	04-13-2010

DRAWN BY: JRM | CHECKED BY: REG

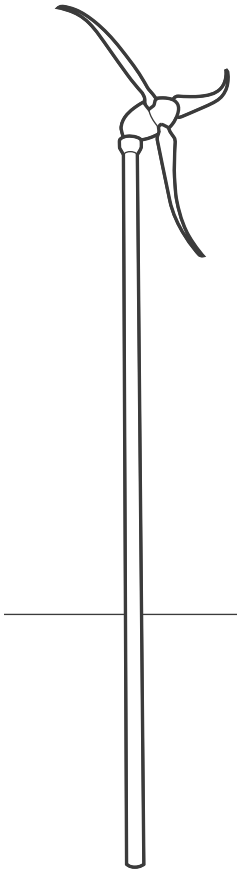
SHEET NUMBER: **S-5**

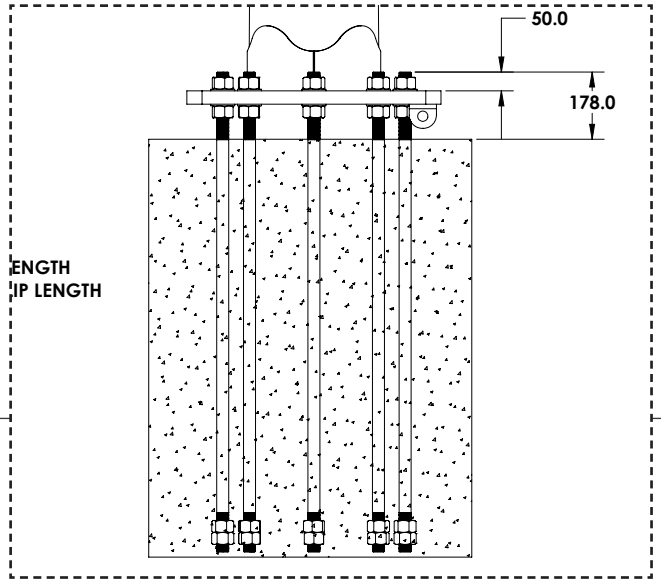
REVISION: 1

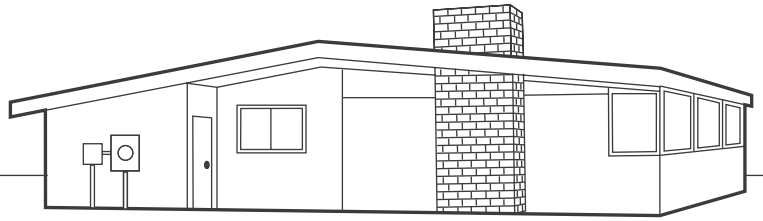
TEP#: 100002.09

SKYSTREAM®

APPENDIX D
45 ft (13.7 m)
TOWER ASSEMBLY
BOOKLET



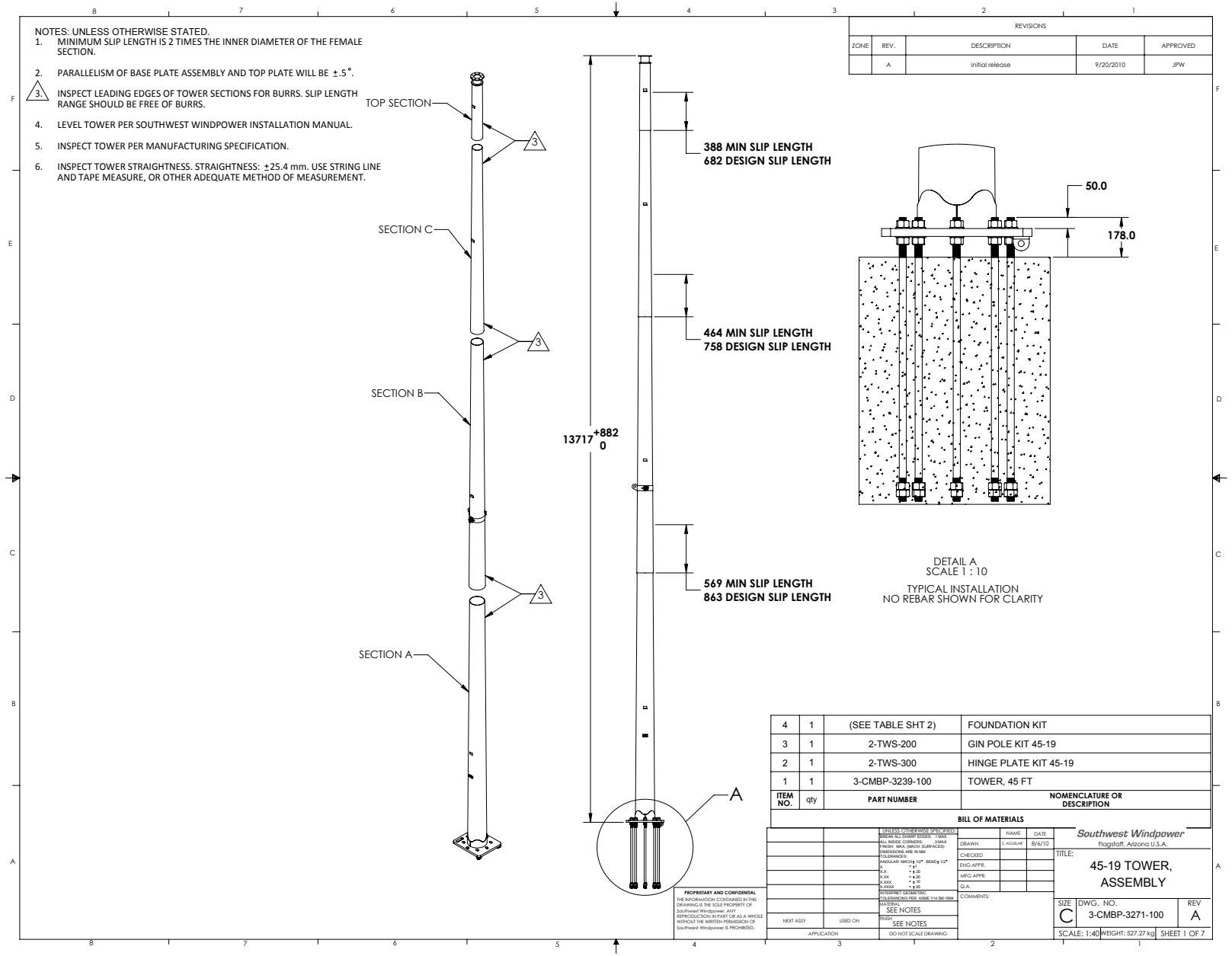


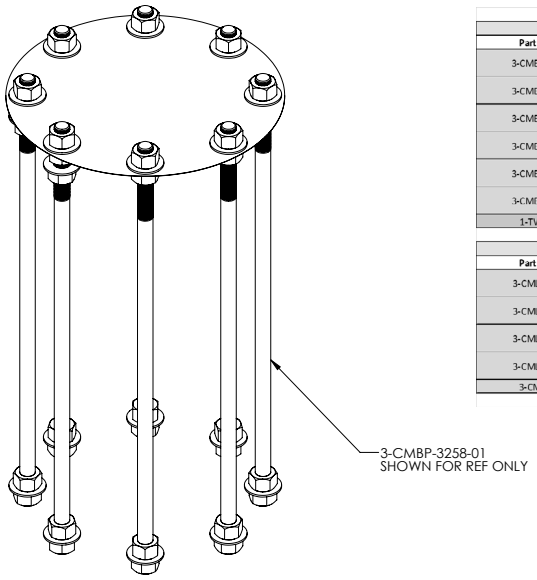


Southwest Windpower, Inc.
1801 West Route 66
Flagstaff, Arizona 86001 USA
Phone: 928-779-9463
Fax: 928-779-1485

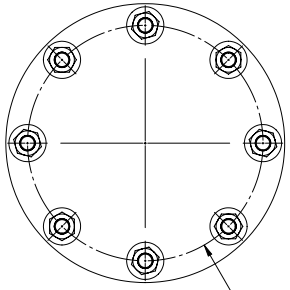
www.skystreamenergy.com

MADE IN THE USA


NOTES: UNLESS OTHERWISE STATED.
1. MINIMUM SLIP LENGTH IS 2 TIMES THE INNER DIAMETER OF THE FEMALE SECTION.
2. PARALLELISM OF BASE PLATE ASSEMBLY AND TOP PLATE WILL BE ±.5°.
3. INSPECT LEADING EDGES OF TOWER SECTIONS FOR BURRS. SLIP LENGTH RANGE SHOULD BE FREE OF BURRS.
4. LEVEL TOWER PER SOUTHWEST WINDPOWER INSTALLATION MANUAL.
5. INSPECT TOWER PER MANUFACTURING SPECIFICATION.
6. INSPECT TOWER STRAIGHTNESS. STRAIGHTNESS: ±25.4 mm. USE STRING LINE AND TAPE MEASURE, OR OTHER ADEQUATE METHOD OF MEASUREMENT.
REVISIONS
ZONE REV. DESCRIPTION DATE APPROVED
A initial release 9/20/2010 JPW
TOP SECTION
SECTION C
SECTION B
SECTION A
388 MIN SLIP LENGTH
682 DESIGN SLIP LENGTH
464 MIN SLIP LENGTH
758 DESIGN SLIP LENGTH
569 MIN SLIP LENGTH
863 DESIGN SLIP LENGTH
13717 +882 0
50.0
178.0
DETAIL A
SCALE 1 : 10
TYPICAL INSTALLATION
NO REBAR SHOWN FOR CLARITY
4 1 (SEE TABLE SHT 2) FOUNDATION KIT
3 1 2-TWS-200 GIN POLE KIT 45-19
2 1 2-TWS-300 HINGE PLATE KIT 45-19
1 1 3-CMBP-3239-100 TOWER, 45 FT
ITEM NO. qty PART NUMBER NOMENCLATURE OR DESCRIPTION
BILL OF MATERIALS
PROPRIETARY AND CONFIDENTIAL
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF Southwest Windpower. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF Southwest Windpower IS PROHIBITED.
UNLESS OTHERWISE SPECIFIED:
BREAK ALL SHARP EDGES .1 MAX
ALL INSIDE CORNERS .5 MAX
FINISH: MAX. (MACH. SURFACES)
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: MACH ± 1/2° BEND ± 1/2°
X ± .1
X.X ± .30
X.XX ± .20
X.XXX ± .10
X.XXXX ± .05
INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5M-1994
MATERIAL
SEE NOTES
FINISH
SEE NOTES
DO NOT SCALE DRAWING
NEXT ASSY USED ON
APPLICATION
NAME DATE
DRAWN S. AGUILAR 8/6/10
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
Southwest Windpower
Flagstaff, Arizona U.S.A.
TITLE: 45-19 TOWER, ASSEMBLY
SIZE C DWG. NO. 3-CMBP-3271-100 REV A
SCALE: 1:40 WEIGHT: 527.27 kg SHEET 1 OF 7



SCALE: 1:6



FOUNDATION KIT TABLE

FOUNDATION KITS					
Part Number	**Description**	**Anchor Rod Length**	**Anchor Rod Diameter**	**Anchor Rod Material**	**TEMPLATE TYPE**
3-CMBP-3258-01	FOUNDATION KIT, 45-19 TOWER, US CUSTOMARY, PAPER TEMPLATE	42"	1.25"	GR55	PAPER
3-CMBP-3258-02	FOUNDATION KIT, 45-19 TOWER, METRIC, PAPER TEMPLATE	1067	M33	GR55	PAPER
3-CMBP-3258-03	FOUNDATION KIT, 45-19 TOWER, US CUSTOMARY, STEEL TEMPLATE	42"	1.25"	GR55	STEEL
3-CMBP-3258-04	FOUNDATION KIT, 45-19 TOWER, METRIC, STEEL TEMPLATE	1067	M33	GR55	STEEL
3-CMBP-3258-05	FOUNDATION KIT, 45-19 TOWER, US CUSTOMARY, PLASTIC TEMPLATE	42"	1.25"	GR55	PLASTIC
3-CMBP-3258-06	FOUNDATION KIT, 45-19 TOWER, METRIC, PLASTIC TEMPLATE	1068	M34	GR55	PLASTIC
1-TWS-11-03	SMART FOUNDATION, SS47, 45-19 TOWER				

STRUCTURAL REPORTS		
Part Number	**DESCRIPTION**	**SWWP ECO**
3-CMLT-1400-01	45-19, FOUNDATION, SKYSTREAM 3.7, 1.25" ANCHOR RODS	ECO 101-2310
3-CMLT-1400-02	45-19, FOUNDATION, SKYSTREAM 3.7, M33 ANCHOR RODS	
3-CMLT-1400-03	45-19, FOUNDATION, SKYSTREAM 4.7, 1.25" ANCHOR RODS	
3-CMLT-1400-04	45-19, FOUNDTION, SKYSTREAM 4.7, M33 ANCHOR RODS	
3-CMLT-1403	45-19, TOWER, STRUCTURAL REPORT	

	NAME	DATE
DRAWN	S. AGUILAR	8/6/10
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

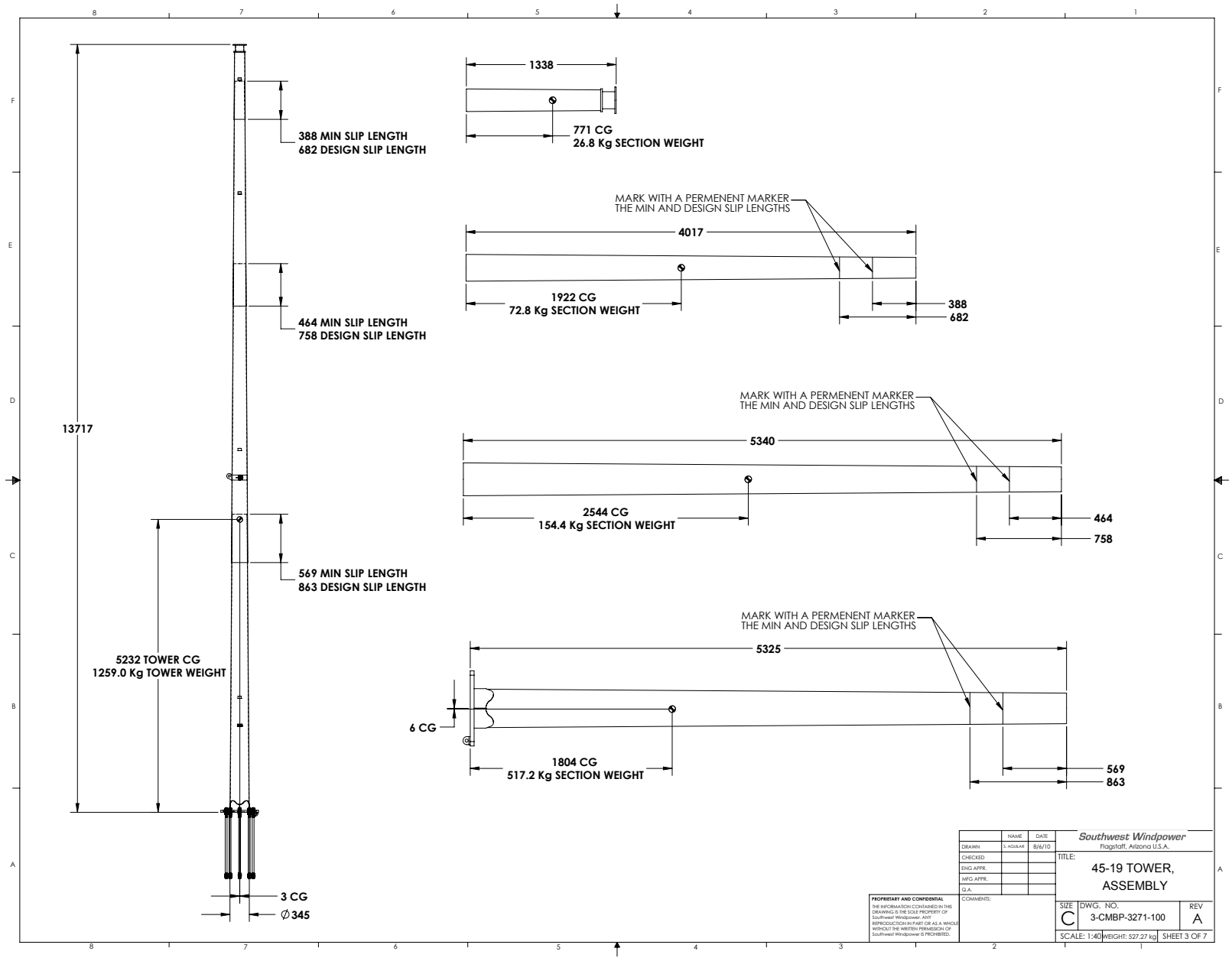
COMMENTS:

Southwest Windpower
Flagstaff, Arizona U.S.A.

TITLE: 45-19 TOWER, ASSEMBLY

SIZE C | DWG. NO. 3-CMBP-3271-100 | REV A

SCALE: 1:40 | WEIGHT: 527.27 kg | SHEET 2 OF 7


13717
388 MIN SLIP LENGTH
682 DESIGN SLIP LENGTH
464 MIN SLIP LENGTH
758 DESIGN SLIP LENGTH
569 MIN SLIP LENGTH
863 DESIGN SLIP LENGTH
5232 TOWER CG
1259.0 Kg TOWER WEIGHT
3 CG
Ø345
1338
771 CG
26.8 Kg SECTION WEIGHT
MARK WITH A PERMENENT MARKER
THE MIN AND DESIGN SLIP LENGTHS
4017
1922 CG
72.8 Kg SECTION WEIGHT
388
682
MARK WITH A PERMENENT MARKER
THE MIN AND DESIGN SLIP LENGTHS
5340
2544 CG
154.4 Kg SECTION WEIGHT
464
758
MARK WITH A PERMENENT MARKER
THE MIN AND DESIGN SLIP LENGTHS
5325
6 CG
1804 CG
517.2 Kg SECTION WEIGHT
569
863
NAME
DATE
DRAWN
S. AGUILAR
8/6/10
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
PROPRIETARY AND CONFIDENTIAL
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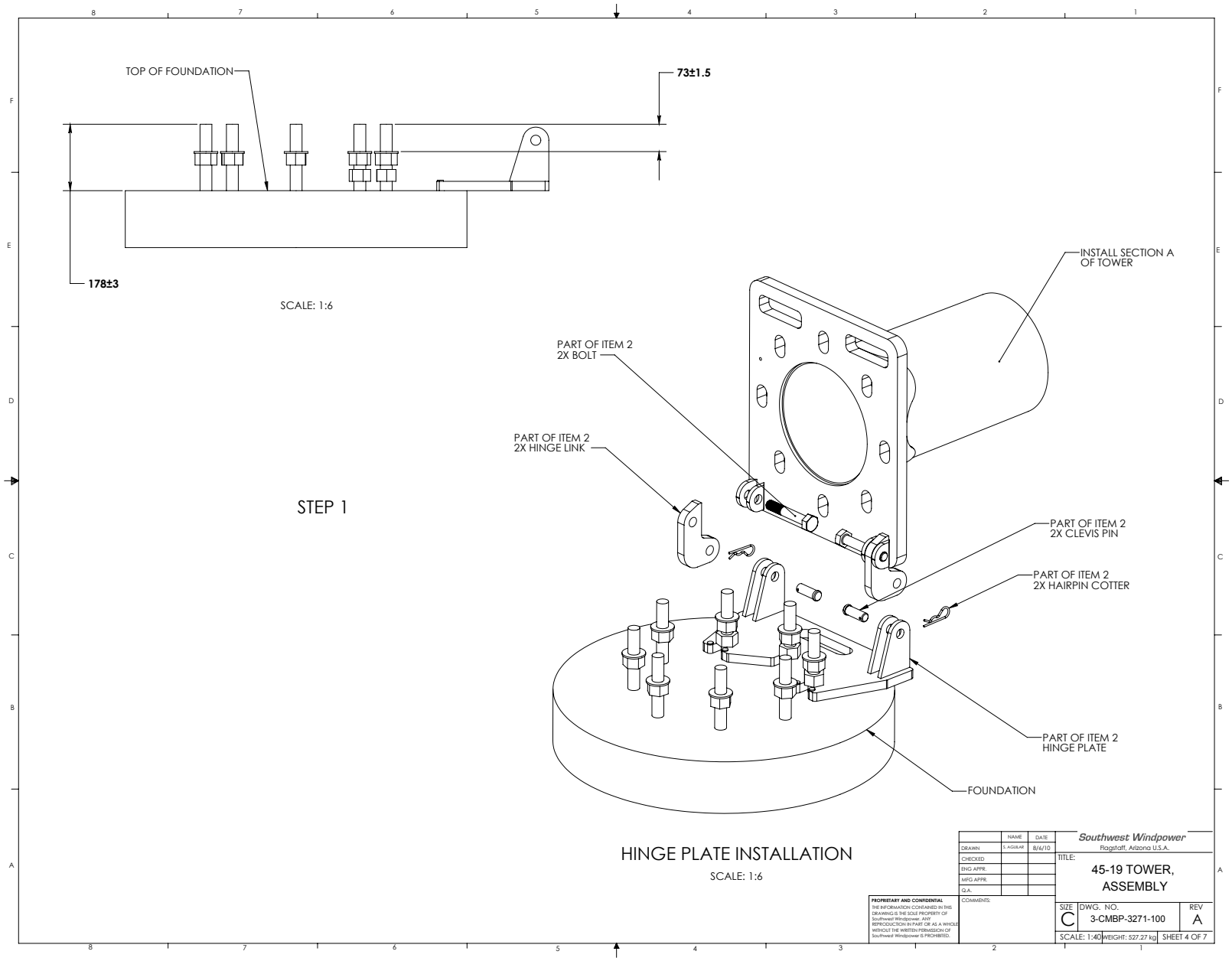
Southwest Windpower
Flagstaff, Arizona U.S.A.
TITLE:
45-19 TOWER, ASSEMBLY
SIZE
C
DWG. NO.
3-CMBP-3271-100
REV
A
SCALE: 1:40
WEIGHT: 527.27 kg
SHEET 3 OF 7


TOP OF FOUNDATION
73±1.5
178±3
SCALE: 1:6
INSTALL SECTION A OF TOWER
PART OF ITEM 2 2X BOLT
PART OF ITEM 2 2X HINGE LINK
STEP 1
PART OF ITEM 2 2X CLEVIS PIN
PART OF ITEM 2 2X HAIRPIN COTTER
PART OF ITEM 2 HINGE PLATE
FOUNDATION
HINGE PLATE INSTALLATION
SCALE: 1:6
NAME
DATE
DRAWN
A. AGUILAR
8/6/10
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
PROPRIETARY AND CONFIDENTIAL
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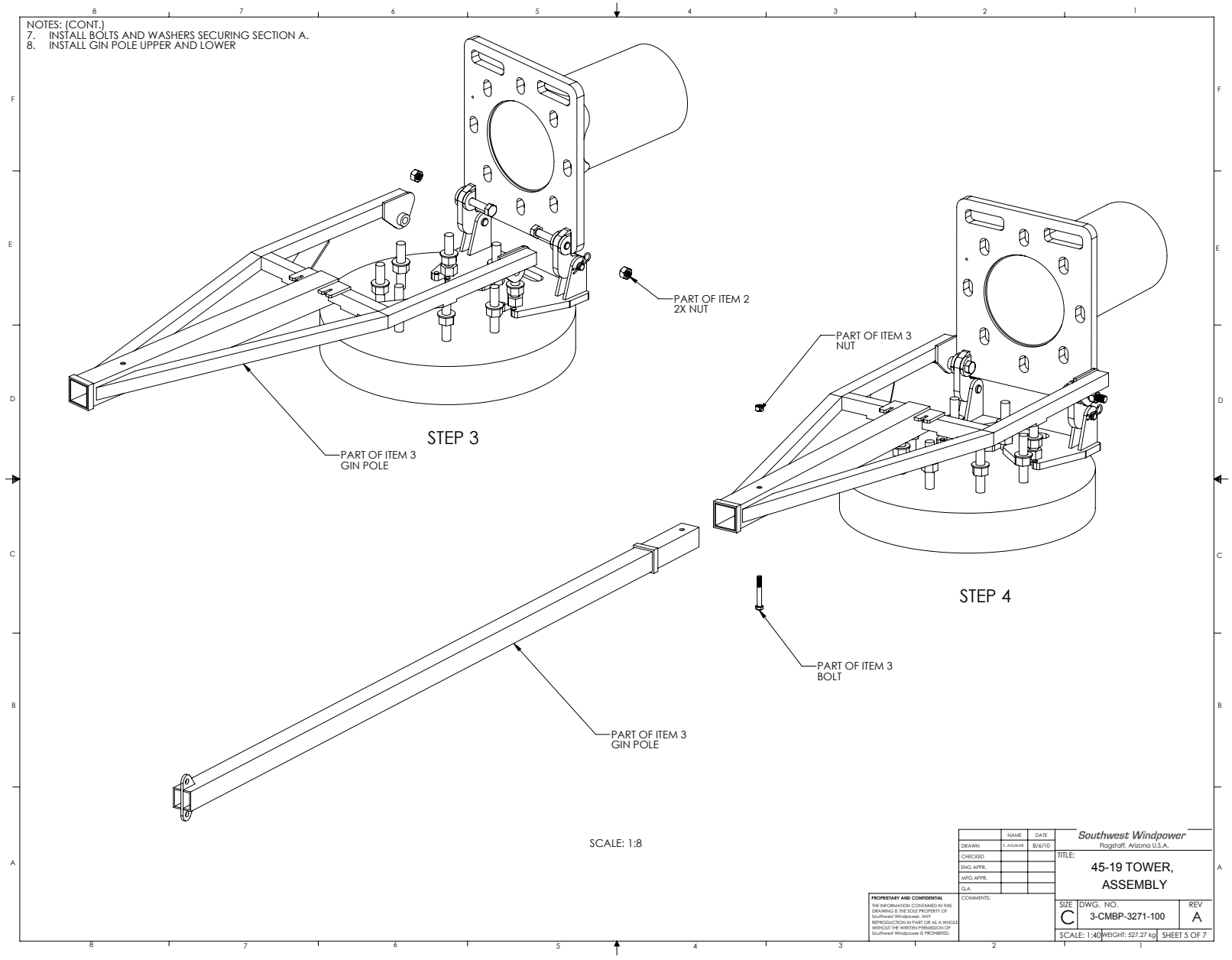
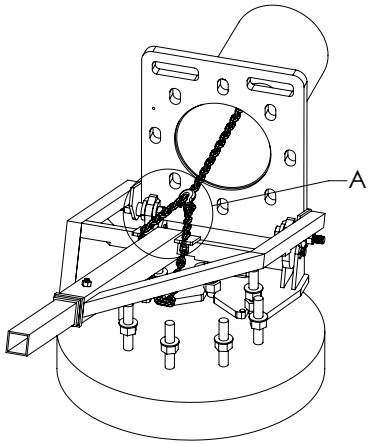
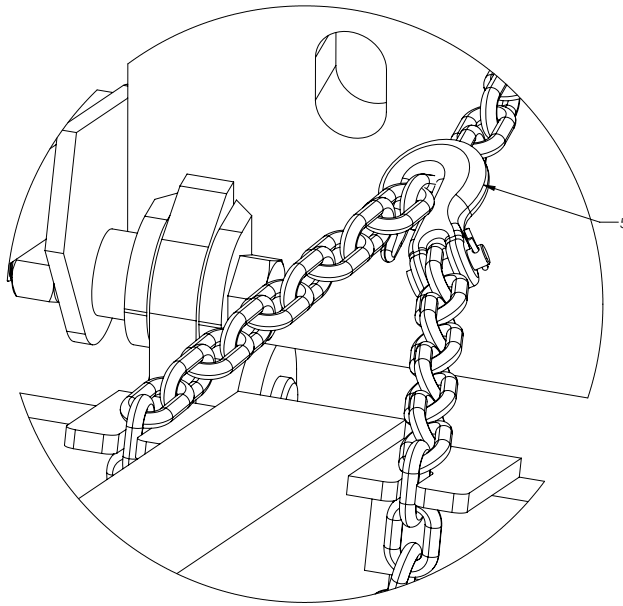
Southwest Windpower
Flagstaff, Arizona U.S.A.
TITLE:
45-19 TOWER, ASSEMBLY
SIZE
C
DWG. NO.
3-CMBP-3271-100
REV
A
SCALE: 1:40
WEIGHT: 527.27 kg
SHEET 4 OF 7


NOTES: (CONT.)
7. INSTALL BOLTS AND WASHERS SECURING SECTION A.
8. INSTALL GIN POLE UPPER AND LOWER
PART OF ITEM 2
2X NUT
PART OF ITEM 3
GIN POLE
STEP 3
PART OF ITEM 3
NUT
STEP 4
PART OF ITEM 3
BOLT
PART OF ITEM 3
GIN POLE
SCALE: 1:8
Southwest Windpower
Flagstaff, Arizona U.S.A.
TITLE:
45-19 TOWER,
ASSEMBLY
SIZE C
DWG. NO. 3-CMBP-3271-100
REV A
SCALE: 1:40 WEIGHT: 527.27 kg
SHEET 5 OF 7

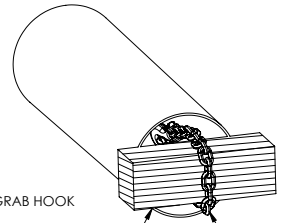
NOTES: (CONT.)
9. INSTALL CHAIN AS SHOWN. USE PINE BLOCK ON SECTION THAT IS DRAWN TOGETHER. USE GIN POLE TO SECURE CHAIN ON BASE SECTION SIDE.
10. CHECK SECURITY OF CHAIN.
11. USE AN AVERAGE PERSONS WEIGHT TO DRAW THE SECTIONS TOGETHER.
12. APPLY DISH DETERGENT TO BOTH MATING SURFACES OF EACH SECTION PRIOR TO DRAWING SECTIONS TOGETHER.



STEP 5
SCALE: 1:10

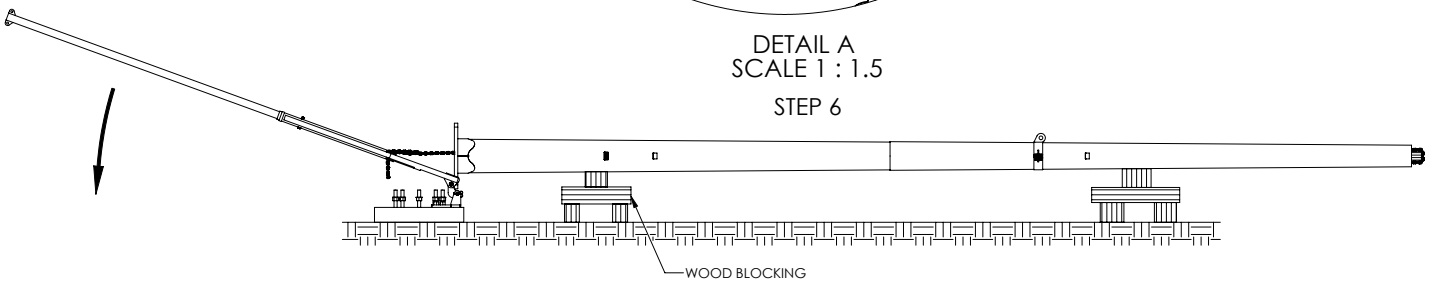


DETAIL A
SCALE 1 : 1.5



STEP 7
SCALE: 1:6

STEP 6



SCALE: 1:30

	NAME	DATE
DRAWN	S. AGUILAR	8/6/10
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

PROPRIETARY AND CONFIDENTIAL
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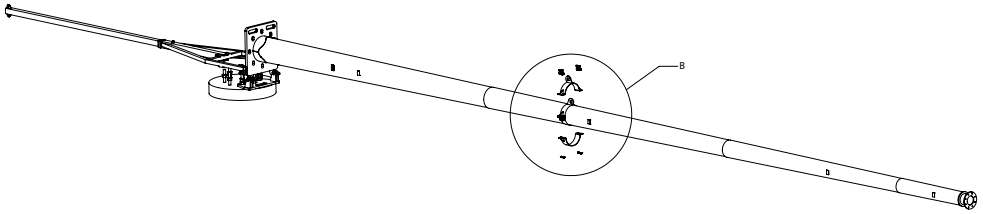
Southwest Windpower
Flagstaff, Arizona U.S.A.

TITLE: 45-19 TOWER, ASSEMBLY

SIZE	DWG. NO.	REV
C	3-CMBP-3271-100	A

SCALE: 1:40 | WEIGHT: 527.27 kg | SHEET 6 OF 7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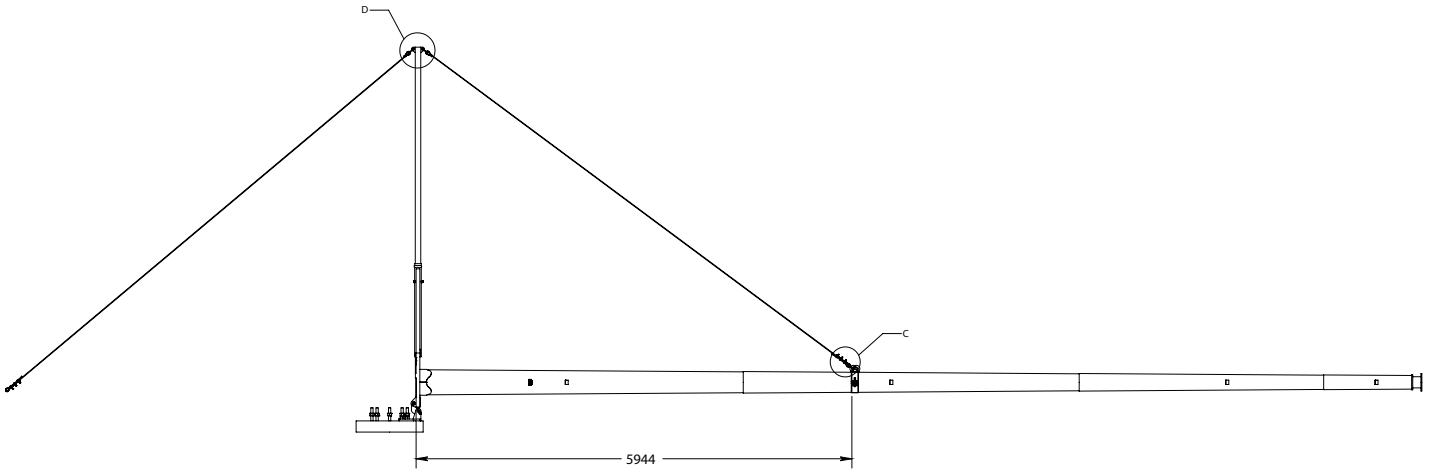
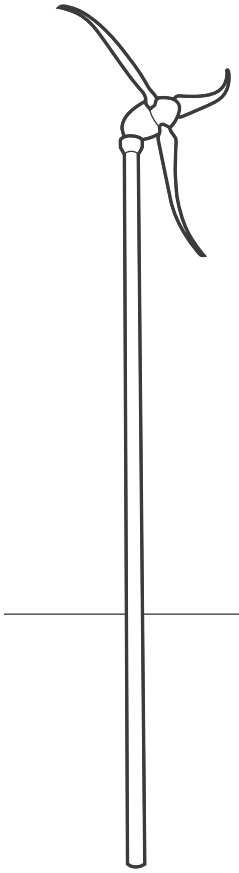
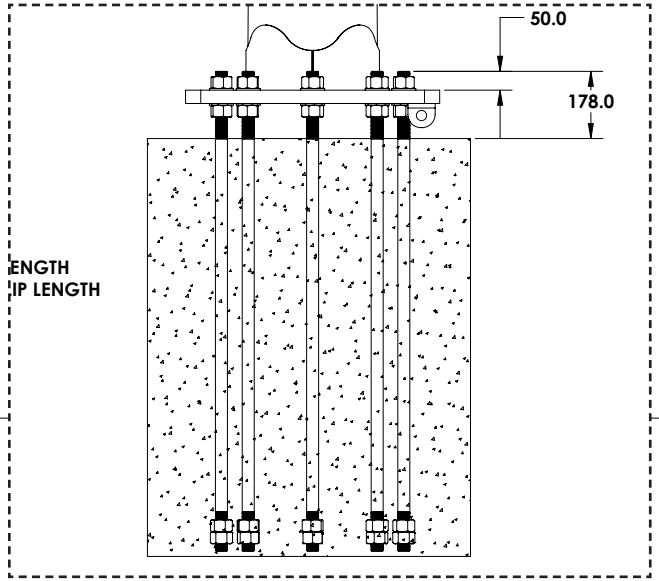
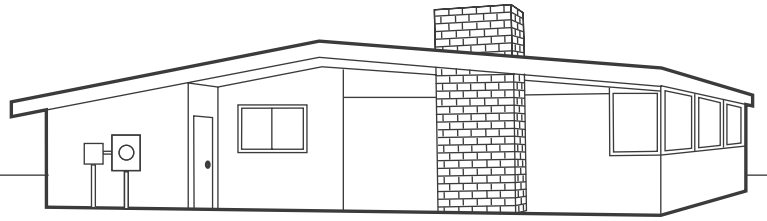

D
C
5944

SKYSTREAM®

APPENDIX E
55 ft (16.8 m)
TOWER ASSEMBLY
BOOKLET







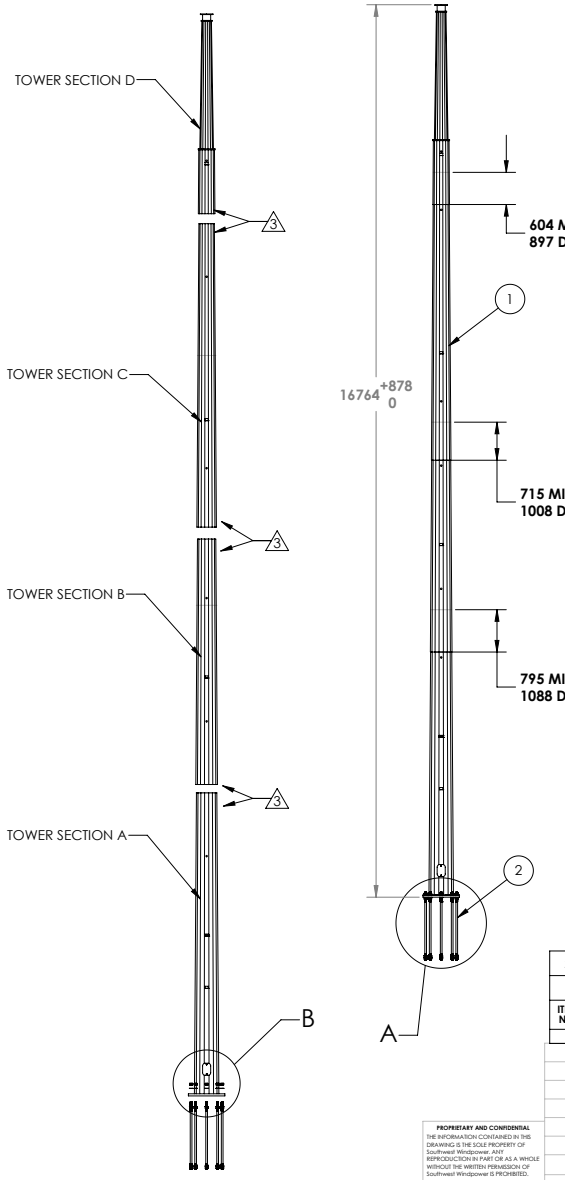
Southwest Windpower, Inc.
1801 West Route 66
Flagstaff, Arizona 86001 USA
Phone: 928-779-9463
Fax: 928-779-1485

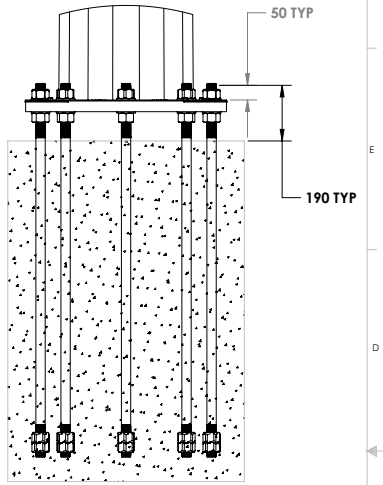
www.skystreamenergy.com

MADE IN THE USA

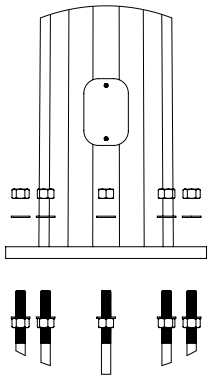
NOTES: UNLESS OTHERWISE STATED.
1. MINIMUM SLIP LENGTH IS 2 TIMES THE INNER DIAMETER OF THE FEMALE SECTION.
2. PARALLELISM OF BASE PLATE ASSEMBLY AND TOP PLATE WILL BE ±.5°.
3. INSPECT LEADING EDGES OF TOWER SECTIONS FOR BURRS. SLIP LENGTH RANGE SHOULD BE FREE OF BURRS.
4. USE CRANE WITH A CAPACITY OF 5 TONS OR MORE TO ERECT THIS TOWER.
5. LEVEL TOWER PER SOUTHWEST WINDPOWER INSTALLATION MANUAL.
6. INPSECT TOWER TOP PLATE PARALLELISM TO TOWER BASE PLATE. PARALLELISM: ±0.5°
7. INSPECT TOWER STAIGHTNESS. STRAIGTHNESS: ±25.4 mm
8. USE STRING LINE AND TAPE MEASURE OR OTHER ADEQUATE METHOD OF MEASUREMENT.

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A		9/24/2010	JPW





DETAIL A
SCALE 1 : 10
TYPICAL INSTALL.
REBAR NOT SHOWN FOR CLARITY.



DETAIL B
SCALE 1 : 10

ITEM NO.	qty	PART NUMBER	NOMENCLATURE OR DESCRIPTION
2	1	FOUNDATION	SEE SHEET 2 FOR OPTIONS
1	1	3-CMBP-3239-200	55' TOWER

BILL OF MATERIALS

UNLESS OTHERWISE SPECIFIED:
BREAK ALL SHARP EDGES .1 MAX
ALL INSIDE CORNERS .3 MAX
FINISH: MAX. (MACH. SURFACES)
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: MACH ± 1/2° BEND ± 1/2°
X ± 1
X.X ± .30
X.XX ± .20
X.XXX ± .10
X.XXXX ± .05
INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5M-1994
MATERIAL
SEE NOTES
FINISH
SEE NOTES
NEXT ASSY | USED ON
APPLICATION | DO NOT SCALE DRAWING

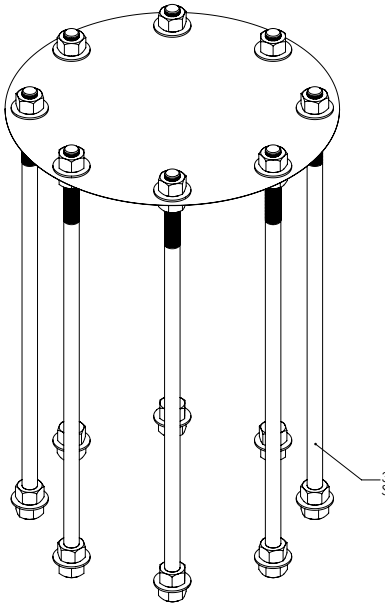
	NAME	DATE
DRAWN	JPW	09/24/2010
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

Southwest Windpower
Flagstaff, Arizona U.S.A.

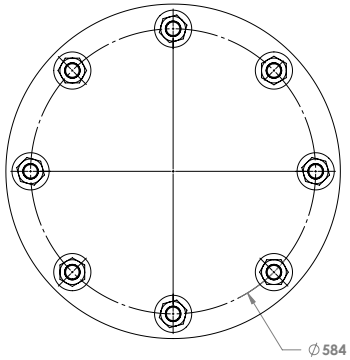
TITLE: 55-23 TOWER ASSEMBLY

SIZE C | DWG. NO. 3-CMBP-3271-200 | REV A

SCALE: 1:55 | WEIGHT: 880.37 kg | SHEET 1 OF 4



3-CMBP-3259-01
SHOWN FOR REF ONLY



∅584 (23") DIAMETER OF BOLT PATTERN

SCALE 1:6

FOUNDATION KIT OPTIONS

Part Number	Configuration	Description	Anchor Rod Length	Anchor Rod Diameter	Anchor Rod Material	TEMPLATE TYPE
3-CMBP-3259	1	FOUNDATION KIT, 55-23 TOWER, US CUSTOMARY, PAPER TEMPLATE	42"	1.25"	GR55	PAPER
3-CMBP-3259	2	FOUNDATION KIT, 55-23 TOWER, METRIC, PAPER TEMPLATE	1067	M33	GR55	PAPER
3-CMBP-3259	3	FOUNDATION KIT, 55-23 TOWER, US CUSTOMARY, STEEL TEMPLATE	42"	1.25"	GR55	STEEL
3-CMBP-3259	4	FOUNDATION KIT, 55-23 TOWER, METRIC, STEEL TEMPLATE	1068	M34	GR55	STEEL
3-CMBP-3259	5	FOUNDATION KIT, 55-23 TOWER, US CUSTOMARY, PLASTIC TEMPLATE	42"	1.25"	GR55	PLASTIC
3-CMBP-3259	6	FOUNDATION KIT, 55-23 TOWER, METRIC, PLASTIC TEMPLATE	1069	M35	GR55	PLASTIC
1-TWS-11	4	SMART FOUNDATION, SS47, 55-23 TOWER				

TOWER ENGINEERING PROFESSIONALS, STRUCTURAL & DESIGN REPORTS

Part Number	CONFIGURATION	DESCRIPTION	SWWP ECO
3-CMLT-1401	1	55-23, FOUNDATION, SKYSTREAM 3.7, 1.25" ANCHOR RODS	ECO 101-2310
3-CMLT-1401	2	55-23, FOUNDATION, SKYSTREAM 3.7, M33 ANCHOR RODS	
3-CMLT-1401	3	55-23, FOUNDATION, SKYSTREAM 4.7, 1.25" ANCHOR RODS	
3-CMLT-1401	4	55-23, FOUNDATION, SKYSTREAM 4.7, M33 ANCHOR RODS	
3-CMLT-1404		55-23, TOWER, STRUCTURAL REPORT	

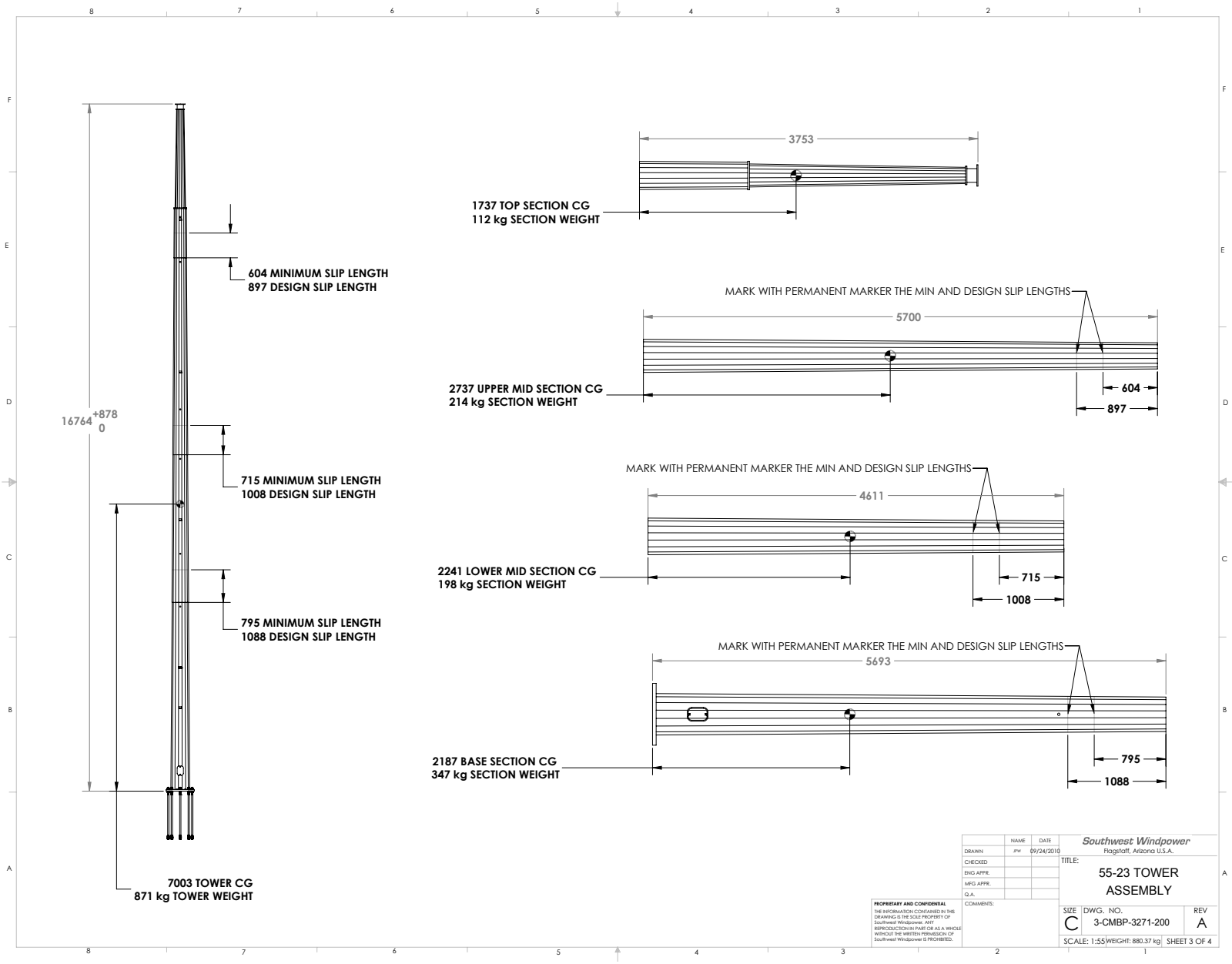
	NAME	DATE
DRAWN	JPW	09/24/2010
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

Southwest Windpower
Flagstaff, Arizona U.S.A.

TITLE:
55-23 TOWER ASSEMBLY

SIZE	DWG. NO.	REV
C	3-CMBP-3271-200	A

SCALE: 1:55 | WEIGHT: 880.37 kg | SHEET 2 OF 4


604 MINIMUM SLIP LENGTH
897 DESIGN SLIP LENGTH
16764 +878 0
715 MINIMUM SLIP LENGTH
1008 DESIGN SLIP LENGTH
795 MINIMUM SLIP LENGTH
1088 DESIGN SLIP LENGTH
7003 TOWER CG
871 kg TOWER WEIGHT
3753
1737 TOP SECTION CG
112 kg SECTION WEIGHT
MARK WITH PERMANENT MARKER THE MIN AND DESIGN SLIP LENGTHS
5700
2737 UPPER MID SECTION CG
214 kg SECTION WEIGHT
604
897
MARK WITH PERMANENT MARKER THE MIN AND DESIGN SLIP LENGTHS
4611
2241 LOWER MID SECTION CG
198 kg SECTION WEIGHT
715
1008
MARK WITH PERMANENT MARKER THE MIN AND DESIGN SLIP LENGTHS
5693
2187 BASE SECTION CG
347 kg SECTION WEIGHT
795
1088
NAME DATE
DRAWN JPW 09/24/2010
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
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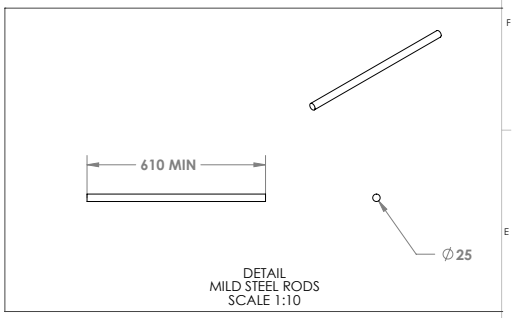
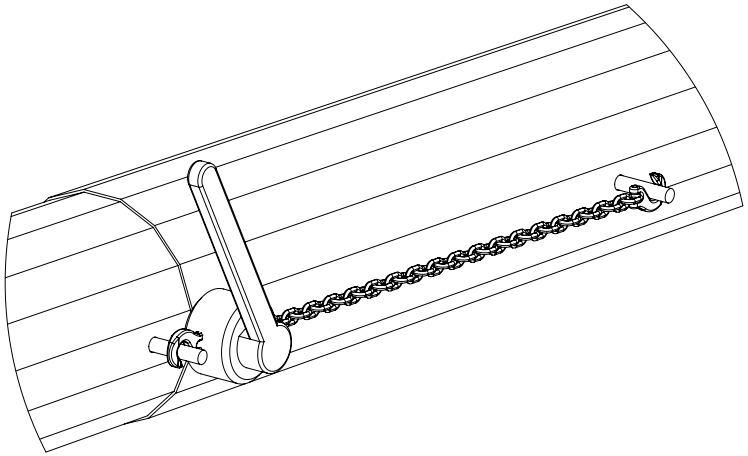
Southwest Windpower
Flagstaff, Arizona U.S.A.
TITLE:
55-23 TOWER ASSEMBLY
SIZE C
DWG. NO. 3-CMBP-3271-200
REV A
SCALE: 1:55
WEIGHT: 880.37 kg
SHEET 3 OF 4

NOTES: (CONT.)

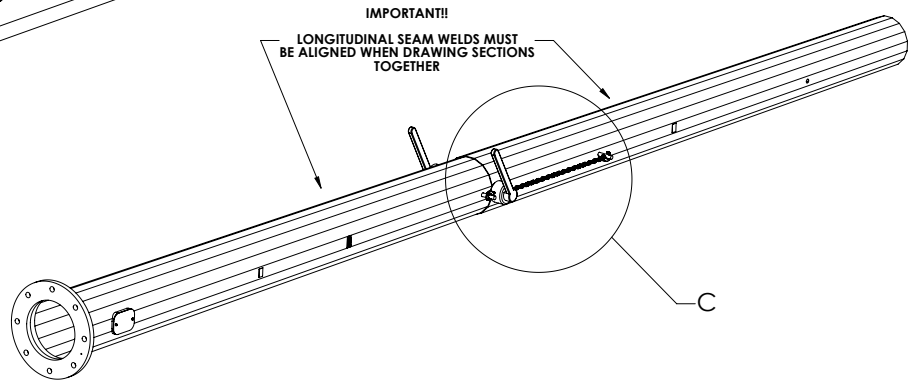
9. MAKE SURE SECTIONS ARE MARKED AS REQUIRED BY INSTRUCTIONS ON SHEET 3
10. LOOK FOR HIGH SPOTS OR BURRS ON THE FEMALE AND MALE SECTIONS, REMOVE IF NECESSARY
11. TOWER MAY BE BUILT IN VERTICAL OR HORIZONTAL POSITIONS. SWWP RECOMMENDS BUILDING IN HORIZONTAL POSITION, AND THEN CRANE INTO PLACE.
12. USE COMMON DISH DETERGENT TO LUBRICATE THE ENDS OF THE SECTIONS AND ALIGN LONGITUDINAL WELD SEAMS ON ALL TOWER SECTIONS PRIOR TO ASSEMBLY.
13. INSERT 1" BY 2 FOOT LONG MILD STEEL RODS IN HOLES PROVIDED ON INDIVIDUAL SECTIONS OF TOWER.
14. USE COME-ALONG MINIMUM 2 TON CAPACITY CHAIN COME-ALONG IS REQUIRED ON EACH SIDE.
15. DRAW SECTIONS TOGETHER UNTIL DESIGN SLIP LENGTH IS ACQUIRED OR CHAIN COME-ALONG REACHES MAXIMUM STRAIN. MINIMUM SLIP LENGTH MUST BE OBTAINED OR EXCEEDED. DESIGN SLIP LENGTH IS IDEAL
16. REPEAT STEPS 9 -14 FOR REMAINING SECTIONS

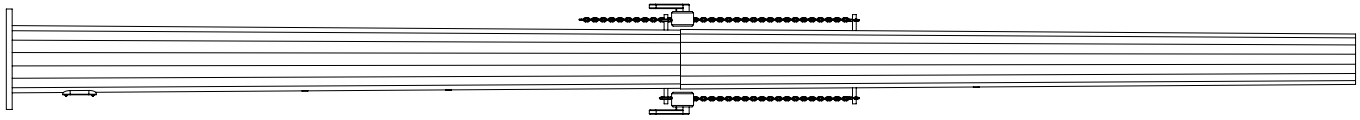


DETAIL
MILD STEEL RODS
SCALE 1:10



DETAIL C
SCALE 1 : 5





SCALE 1:20

EVENLY DRAW SECTIONS TOGETHER BY USING COME-ALONG

	NAME	DATE
DRAWN	JPW	09/24/2010
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

COMMENTS:

Southwest Windpower
Flagstaff, Arizona U.S.A.

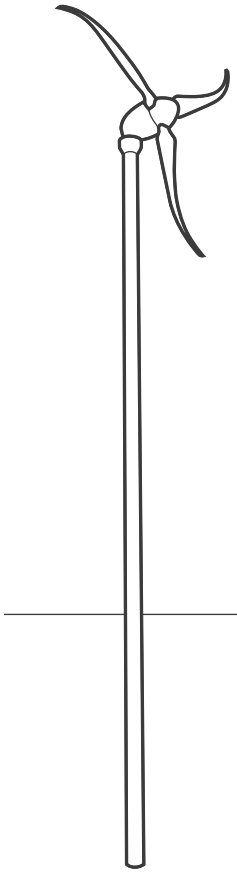
TITLE: 55-23 TOWER ASSEMBLY

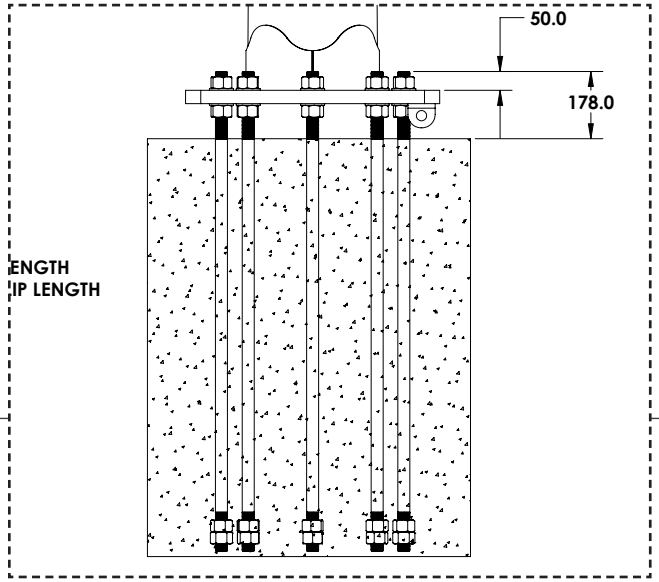
SIZE	DWG. NO.	REV
C	3-CMBP-3271-200	A

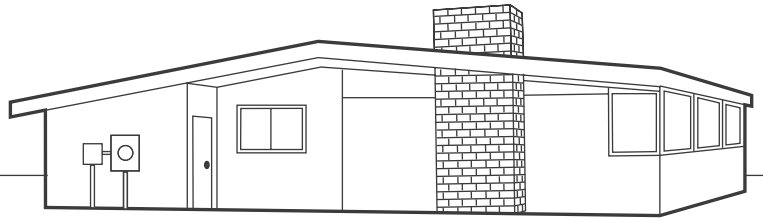
SCALE: 1:55 WEIGHT: 877.33 kg SHEET 4 OF 4

SKYSTREAM®

APPENDIX F
70 ft (21.3 m)
TOWER ASSEMBLY
BOOKLET







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

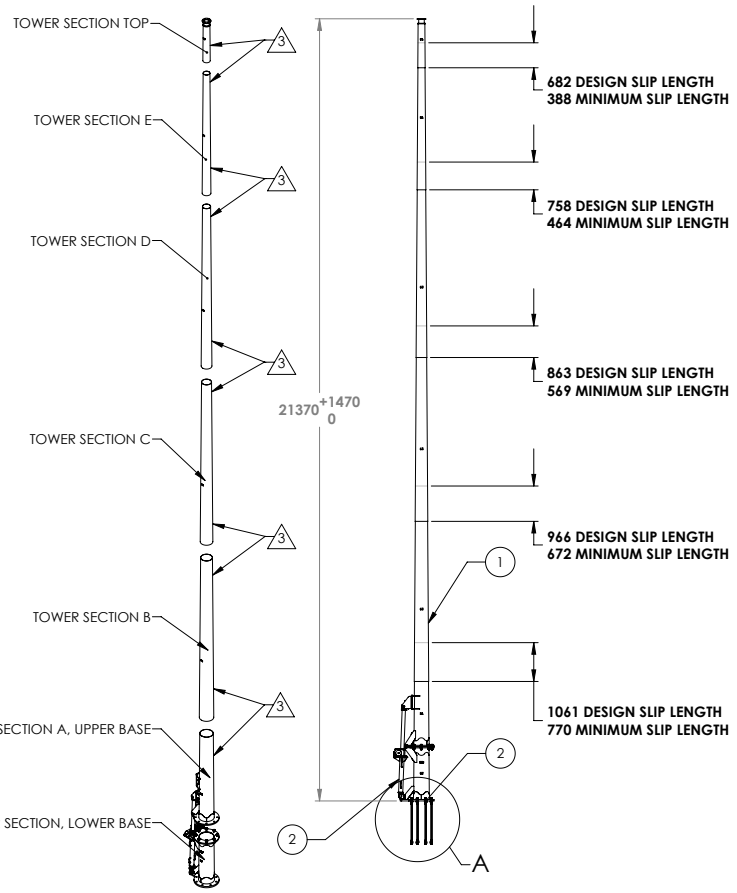
www.skystreamenergy.com

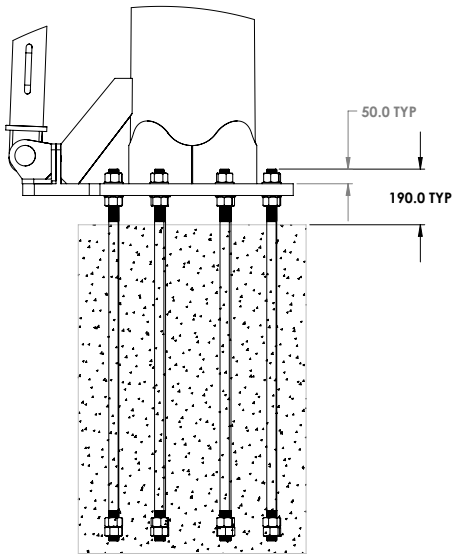
MADE IN THE USA

NOTES: UNLESS OTHERWISE STATED.

1. MINIMUM SLIP LENGTH IS 2 TIMES THE INNER DIAMETER OF THE FEMALE SECTION.
2. PARALLELISM OF BASE PLATE ASSEMBLY AND TOP PLATE WILL BE ±.5°.
3. INSPECT LEADING EDGES OF TOWER SECTIONS FOR BURRS. SLIP LENGTH RANGE SHOULD BE FREE OF BURRS.
4. USE A CRANE WITH A CAPACITY OF 5 TONS OR MORE TO ERECT THIS TOWER.
5. LEVEL TOWER PER SOUTHWEST WINDPOWER INSTALLATION MANUAL.
6. INSPECT TOWER PER MANUFACTURING SPECIFICATION.
7. INSPECT TOWER STRAIGHTNESS. STRAIGHTNESS: ±25.4 mm. USE STRING LINE AND TAPE MEASURE, OR OTHER ADEQUATE METHOD OF MEASUREMENT.

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A		9/26/2010	JPW





DETAIL A
SCALE 1 : 10

NOTE:

8. A MINIMUM OF TWO FULL THREADS IS REQUIRED ABOVE TOP UNIT
9. TYPICAL INSTALLATION, REBAR NOT SHOWN FOR CLARITY.

REFERENCE DOCUMENTS		
ITEM NO.	PART NUMBER	DESCRIPTION
1	T-TWS-400	JACK SCREW ASSEMBLY

ITEM NO.	QTY	PART NUMBER	NOMENCLATURE OR DESCRIPTION
2	1		SEE SHEET 2 FOR OPTIONS
1	1	3-CMBP-3239-300	70-23 TOWER FAB

BILL OF MATERIALS

UNLESS OTHERWISE SPECIFIED:
BREAK ALL SHARP EDGES: .1 MAX
ALL INSIDE CORNERS: .3 MAX
FINISH: MAX. (MACH. SURFACES)
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: MACH ± 1/2° BEND ± 1/2°
X ± 1
X.X ± .50
X.XX ± .10
X.XXX ± .05
X.XXXX ± .05
INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5M-1994
MATERIAL: SEE NOTES
FINISH: SEE NOTES
DO NOT SCALE DRAWING

NEXT ASSY | USED ON | APPLICATION

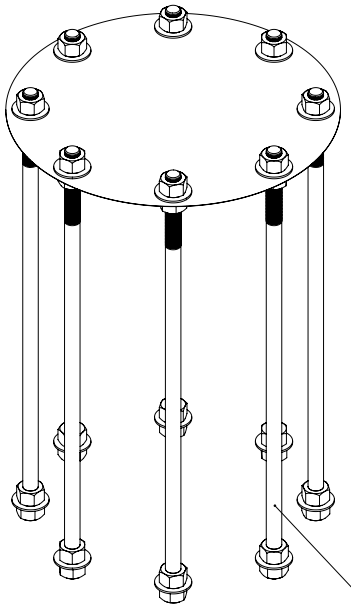
	NAME	DATE
DRAWN	JPW	09/26/2010
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

Southwest Windpower
Flagstaff, Arizona U.S.A.

TITLE: 70-23 TOWER ASSEMBLY

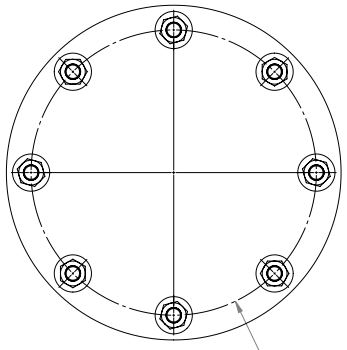
SIZE C | DWG. NO. 3-CMBP-3271-300 | REV A

SCALE: 1:80 WEIGHT: 1259.00 kg SHEET 1 OF 5



SCALE: 1:6

3-CMBP-3260-01
SHOWN FOR REF ONLY



∅584 (23") DIAMETER OF BOLT PATTERN

FOUNDATION KIT OPTIONS

Part Number	Configuration	Description	Anchor Rod Length	Anchor Rod Diameter	Anchor Rod Material	TEMPLATE TYPE
3-CMBP-3260	1	FOUNDATION KIT, 70-23 TOWER, US CUSTOMARY, PAPER TEMPLATE	50"	1.25"	GR55	PAPER
3-CMBP-3260	2	FOUNDATION KIT, 70-23 TOWER, METRIC, PAPER TEMPLATE	50"	M33	GR55	PAPER
3-CMBP-3260	3	FOUNDATION KIT, 70-23 TOWER, US CUSTOMARY, STEEL TEMPLATE	50"	M33	GR55	STEEL
3-CMBP-3260	4	FOUNDATION KIT, 70-23 TOWER, METRIC, STEEL TEMPLATE	50"	M33	GR55	STEEL
3-CMBP-3260	5	FOUNDATION KIT, 70-23 TOWER, US CUSTOMARY, PLASTIC TEMPLATE	50"	1.25"	GR55	PLASTIC
3-CMBP-3260	6	FOUNDATION KIT, 70 23 TOWER, METRIC, PLASTIC TEMPLATE	50"	M33	GR55	PLASTIC
1-IWS-11	5	SMART FOUNDATION, SS4/, /0-23 TOWER				

STRUCTURAL REPORT

Part Number	CONFIGURATION	DESCRIPTION	SWWP ECO
3-CMLT-1402	1	70-23, FOUNDATION, SKYSTREAM 3.7, 1.25" ANCHOR RODS	
3-CMLT-1402	2	70-23, FOUNDATION, SKYSTREAM 3.7, M33 ANCHOR RODS	
3-CMLT-1402	3	70-23, FOUNDATION, SKYSTREAM 4.7, 1.25" ANCHOR RODS	
3-CMLT-1402	4	70-23, FOUNDATION, SKYSTREAM 4.7, M33 ANCHOR RODS	
3-CMLT-1405		70-23, TOWER, STRUCTURAL REPORT	

UNLESS OTHERWISE SPECIFIED:
BREAK ALL SHARP EDGES: .1 MAX
ALL INSIDE CORNERS: .3 MAX
FINISH: MAX. (MACH. SURFACES)
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: MACH ± 1/2° BEND ± 1/2°
X ± .1
X.X ± .50
X.XX ± .05
INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5M-1994
MATERIAL
SEE NOTES
FINISH
SEE NOTES
DO NOT SCALE DRAWING

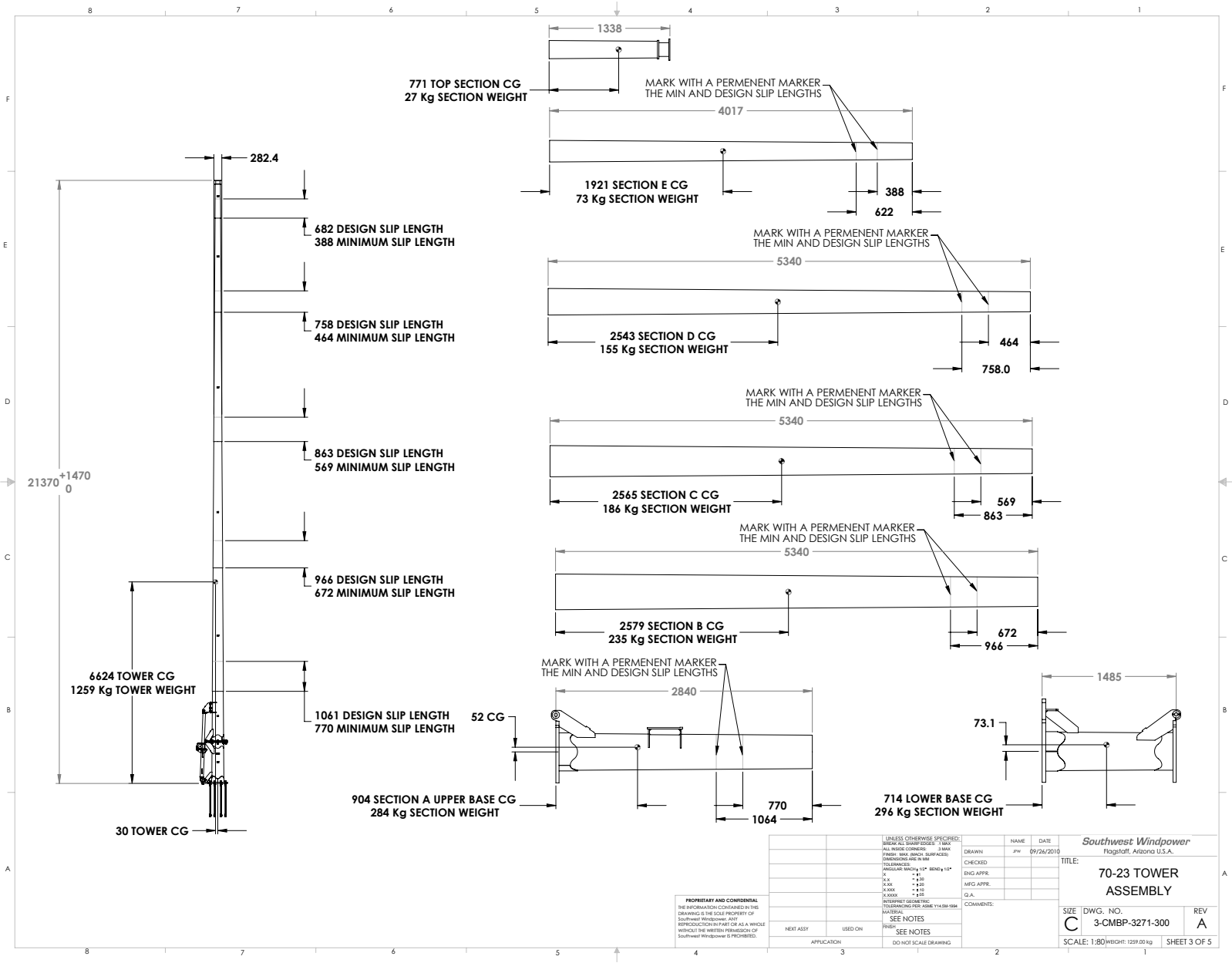
NEXT ASSY | USED ON | APPLICATION

	NAME	DATE
DRAWN	JPW	09/26/2010
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

Southwest Windpower
Flagstaff, Arizona U.S.A.

TITLE:
70-23 TOWER ASSEMBLY

SIZE C | DWG. NO. 3-CMBP-3271-300 | REV A
SCALE: 1:80 | WEIGHT: 1259.00 kg | SHEET 2 OF 5


1338
771 TOP SECTION CG
27 Kg SECTION WEIGHT
MARK WITH A PERMENENT MARKER
THE MIN AND DESIGN SLIP LENGTHS
4017
1921 SECTION E CG
73 Kg SECTION WEIGHT
388
622
282.4
682 DESIGN SLIP LENGTH
388 MINIMUM SLIP LENGTH
MARK WITH A PERMENENT MARKER
THE MIN AND DESIGN SLIP LENGTHS
5340
2543 SECTION D CG
155 Kg SECTION WEIGHT
464
758.0
758 DESIGN SLIP LENGTH
464 MINIMUM SLIP LENGTH
MARK WITH A PERMENENT MARKER
THE MIN AND DESIGN SLIP LENGTHS
5340
2565 SECTION C CG
186 Kg SECTION WEIGHT
569
863
863 DESIGN SLIP LENGTH
569 MINIMUM SLIP LENGTH
21370 +1470 0
MARK WITH A PERMENENT MARKER
THE MIN AND DESIGN SLIP LENGTHS
5340
2579 SECTION B CG
235 Kg SECTION WEIGHT
672
966
966 DESIGN SLIP LENGTH
672 MINIMUM SLIP LENGTH
6624 TOWER CG
1259 Kg TOWER WEIGHT
MARK WITH A PERMENENT MARKER
THE MIN AND DESIGN SLIP LENGTHS
2840
52 CG
1061 DESIGN SLIP LENGTH
770 MINIMUM SLIP LENGTH
904 SECTION A UPPER BASE CG
284 Kg SECTION WEIGHT
770
1064
1485
73.1
714 LOWER BASE CG
296 Kg SECTION WEIGHT
30 TOWER CG
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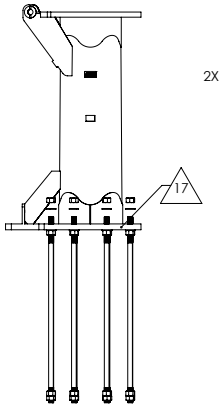
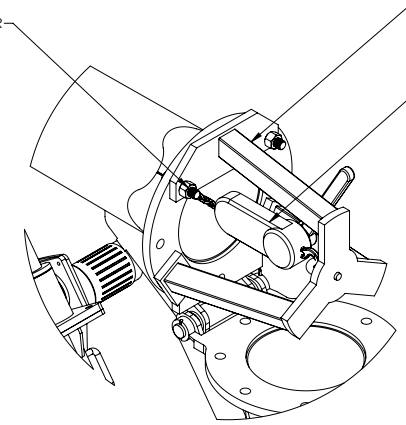
UNLESS OTHERWISE SPECIFIED:
BREAK ALL SHARP EDGES: .1 MAX
ALL INSIDE CORNERS: .3 MAX
FINISH: MAX. (MACH. SURFACES)
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: MACH ± 1/2° BEND ± 1/2°
X ± 1
X.X ± .50
X.XX ± .25
X.XXX ± .10
X.XXXX ± .05
INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5M-1994
MATERIAL
SEE NOTES
FINISH
SEE NOTES
NEXT ASSY
USED ON
APPLICATION
DO NOT SCALE DRAWING
NAME
DATE
DRAWN
JPW
09/26/2010
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
Southwest Windpower
Flagstaff, Arizona U.S.A.
TITLE:
70-23 TOWER
ASSEMBLY
SIZE
C
DWG. NO.
3-CMBP-3271-300
REV
A
SCALE: 1:80
WEIGHT: 1259.00 kg
SHEET 3 OF 5

NOTES:
10. MAKE SURE SECTIONS ARE MARKED AS REQUIRED BY INSTRUCTIONS ON SHEET 3
11. LOOK FOR HIGH SPOTS OR BURRS ON THE FEMALE AND MALE SECTIONS
12. USE COMMON DISH DETERGENT TO LUBRICATE THE ENDS OF THE SECTIONS BEFORE ASSEMBLING THEM. ALL LONGDITUDINAL SEAMS WELDS MUST BE ALIGNED ON ALL TOWER SECTIONS.
13. INSTALL THE HOIST WELDMENT TRIPOD ONTO BASE SECTION AS SHOWN. USE THE SAME BOLTS USED IN ASSEMBLY OF THE TOWER.
14. USE COME-ALONG TO DRAW SECTIONS TOGETHER. A MINIMUM 2 TON CAPACITY CHAIN COME-ALONG IS REQUIRED.
15. DRAW SECTIONS TOGETHER UNTIL DESIGN SLIP LENGTH IS ACQUIRED OR CHAIN COME-ALONG REACHES MAXIMUM STRAIN. MINIMUM SLIP LENGTH MUST BE OBTAINED OR EXCEEDED. DESIGN SLIP LENGTH IS IDEAL.

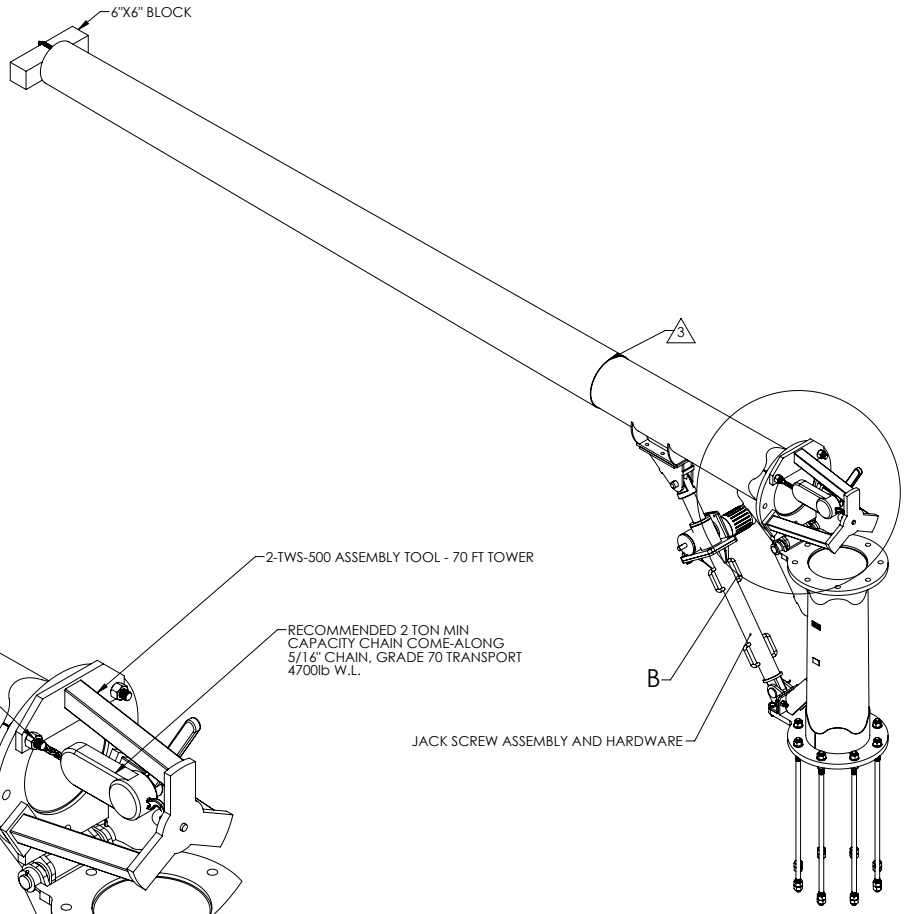
16. STEP 1: UNNEST TOWERS AND LAY THEM OUT.
17. STEP 2: ASSEMBLE HINGED STUB SECTION TO FOUNDATION.
18. STEP 3: SEE DETAIL B.
19. STEP 4: REPEAT STEPS 3 FOR REMAINING TOWER SECTIONS



SCALE: 1:20



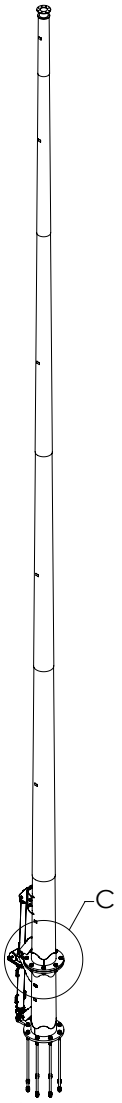
DETAIL B
SCALE 1 : 10



SCALE: 1:20

		UNLESS OTHERWISE SPECIFIED: BREAK ALL SHARP EDGES 1 MAX ALL INSIDE CORNERS 3 MAX FINISH MAX. (EACH SURFACES) DIMENSIONS ARE IN MM TOLERANCES: ANGULAR: MACH ± 1/2° BEND ± 1/2° X ± 1 X.X ± 0.50 X.XX ± 0.25 INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5M-1994 MATERIAL: SEE NOTES FINISH SEE NOTES		NAME	DATE	Southwest Windpower Flagstaff, Arizona U.S.A.
			DRAWN	JPW	09/26/2010	
			CHECKED			TITLE: 70-23 TOWER FAB
			ENG APPR.			
			MFG APPR.			
			Q.A.			
			COMMENTS:			
NEXT ASSY	USED ON					SIZE C DWG. NO. 3-CMBP-3271-300 REV A
APPLICATION		DO NOT SCALE DRAWING				SCALE: 1:80 WEIGHT: 1131.92 kg SHEET 4 OF 5

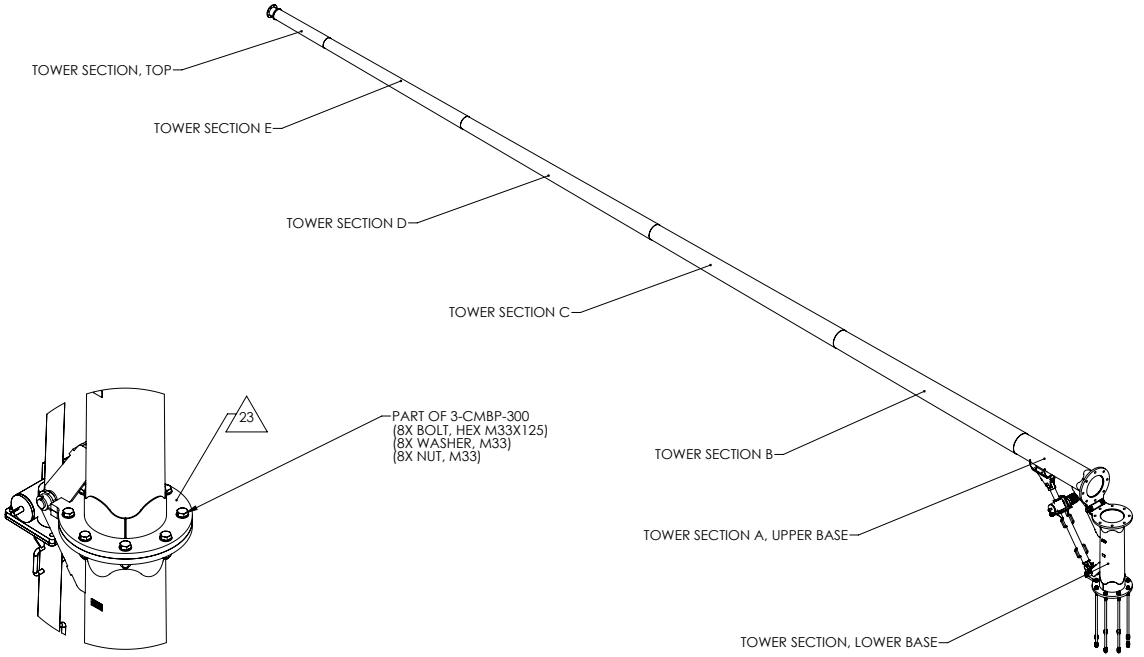
NOTES:
20. STEP 5: REMOVE COME-ALONG AND HOIST WELDMENT TRIPOD.
21. STEP 6: CONFIRM PROPER ASSEMBLY OF EACH SECTION.
22. STEP 7: ACTIVATE JACK TO LIFT TOWER.
23. STEP 8: WHEN TOWER IS COMPLETELY VERTICAL INSTALL BOLTS TO BASE SECTION.



SCALE 1:50

PART OF 3-CMBP-300
(8X BOLT, HEX M33X125)
(8X WASHER, M33)
(8X NUT, M33)

DETAIL C
SCALE 1 : 15



SCALE 1:50

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ALL INSIDE CORNERS: .3 MAX
FINISH: MAX. (MACH. SURFACES)
DIMENSIONS ARE IN MM
TOLERANCES:
ANGULAR: MACH ± 1/2° BEND ± 1/2°
X ± .5
X.X ± .50
X.XX ± .25
INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5M-1994
MATERIAL: SEE NOTES
FINISH: SEE NOTES
DO NOT SCALE DRAWING

	NAME	DATE
DRAWN	JPW	09/26/2010
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

NEXT ASSY | USED ON | APPLICATION

Southwest Windpower
Flagstaff, Arizona U.S.A.

TITLE: 70-23 TOWER ASSEMBLY

SIZE	DWG. NO.	REV
C	3-CMBP-3271-300	A

SCALE: 1:80 WEIGHT: 1552.30 kg SHEET 5 OF 5

SKYSTREAM®

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