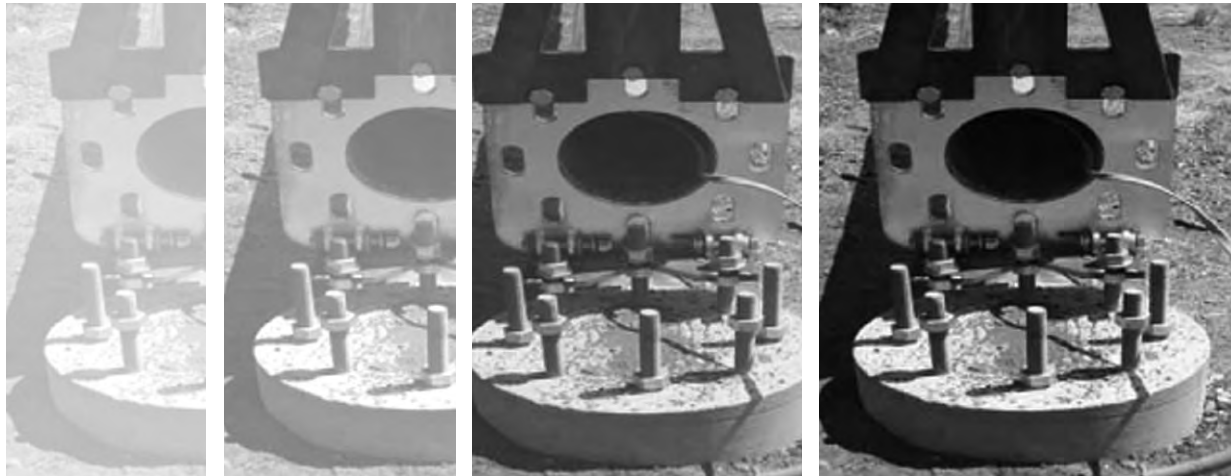


## Appendix B



# Foundation Installation Guidelines

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## Skystream 3.7 Owner's Manual

### Appendix B: Foundation Installation Guidelines

Important Safety Instructions _____	1
<b>1) INTRODUCTION _____</b>	<b>2</b>
<b>1-1 Foundation Bolt Kits _____</b>	<b>2</b>
<b>2) PIER FOUNDATION _____</b>	<b>2-4</b>
<b>2-1 Forming &amp; Reinforcing Bar _____</b>	<b>5</b>
<b>2-2 "J" Bolts &amp; Template _____</b>	<b>5</b>
<b>2-3 Pier Foundation Specifications _____</b>	<b>6</b>
<b>3) MAT FOUNDATION _____</b>	<b>7</b>
<b>3-1 Forming &amp; Reinforcing Bar _____</b>	<b>7</b>
<b>3-2 "J" Bolts &amp; Template _____</b>	<b>8</b>
<b>3-3 Pier Foundation Specifications _____</b>	<b>8</b>
<b>4) ELECTRICAL CONDUIT _____</b>	<b>9</b>

## IMPORTANT SAFETY INSTRUCTIONS

READ THESE INSTRUCTIONS IN THEIR ENTIRETY BEFORE INSTALLING.



**Professional installation**  
highly recommended

- 1) **SAVE THESE INSTRUCTIONS.** This manual contains important instructions for Skystream foundations that must be followed during installation.
- 2) Read, understand and respect all warnings.
- 3) Install Skystream foundation in accordance with National Electric Code (NEC) and local building codes.
- 4) Always obtain a building permit before construction.
- 5) When moving heavy objects to the site, use a cart to prevent back injury.
- 6) Use only proper grounding techniques as established by the NEC.
- 7) The Skystream foundation must be installed in accordance with this manual and local and national building codes. Failure to comply with the manual and local codes will affect and possibly void your warranty.
- 8) Skystream uses high voltage and is potentially dangerous. Be sure to use all safety precautions at all times.

### In this guide



**TIP:** Helpful information to ease the installation



**Professional installation**  
highly recommended



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

## One - Introduction

This guideline provides directions for the construction of two tower foundations – the Pier and Mat foundations. Either foundation is suitable to mount the Southwest Windpower 33-foot monopole tower and Skystream 3.7 wind turbine. Please read and understand the entire installation guideline before proceeding. Local building codes and regulations shall have precedence over this installation guideline.

### I-I Foundation Bolt Kits

A bolt kit is available for each foundation configuration. Use of the bolt kits is strongly recommended. Each kit is designed for its particular application with the bolts, nuts and washers hot-dip galvanized and constructed of the appropriate steel alloys.

Each bolt kit also includes a template that must be used to correctly position the foundation bolts in the foundation. A copy of the template is depicted in Fig. B1.

## Two - Pier Foundation

Technical drawings for the pier foundation are presented in **Figs. B2 and B3**. The pier diameter is 24 inches (61 cm) and the depth of the pier will vary from 5 to 11 feet (1.5 m to 3.35 m) depending on soil classification. Refer to **Fig. B4** (found on pg 4 ) to determine the soil classification.

**A typical pier foundation ►**



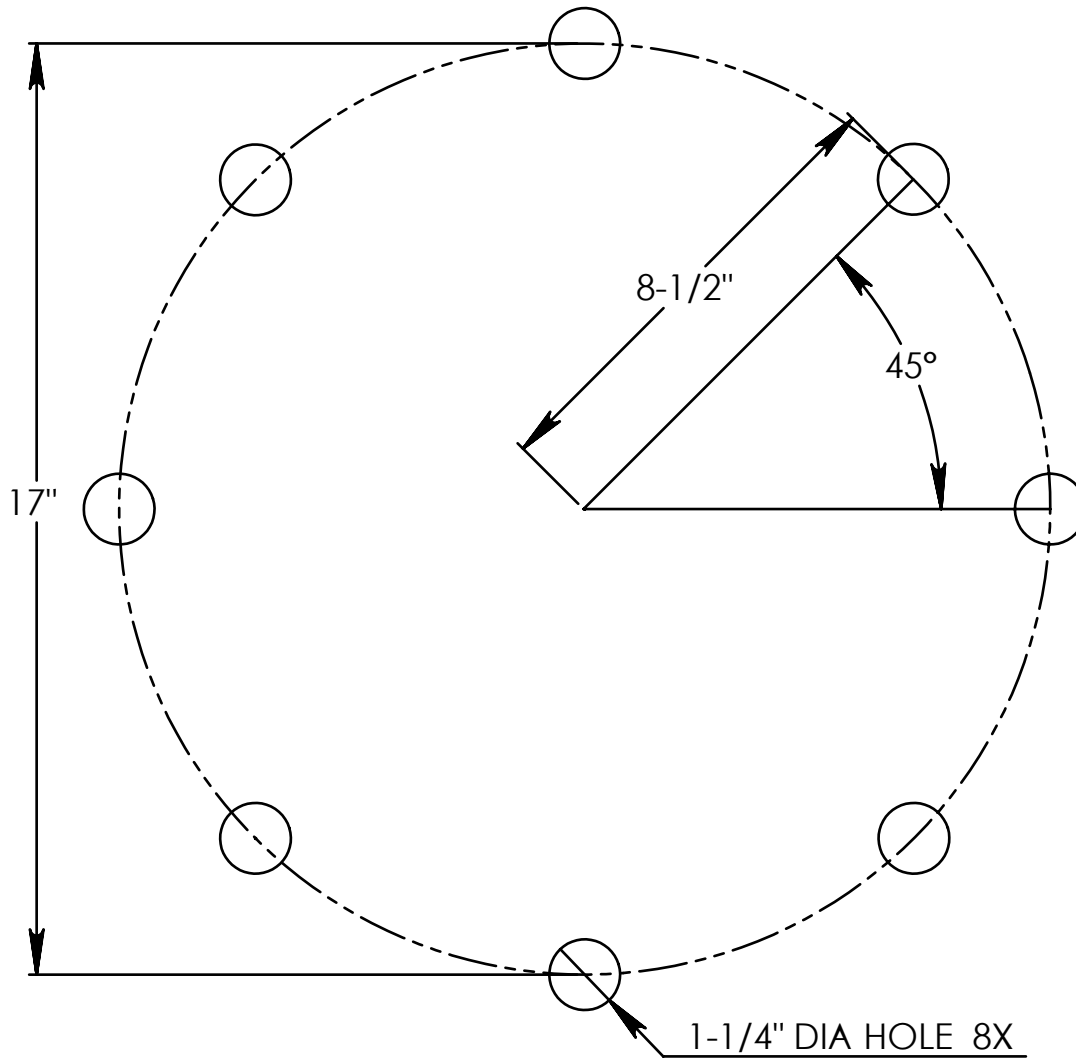


Fig. B1 Bolt template

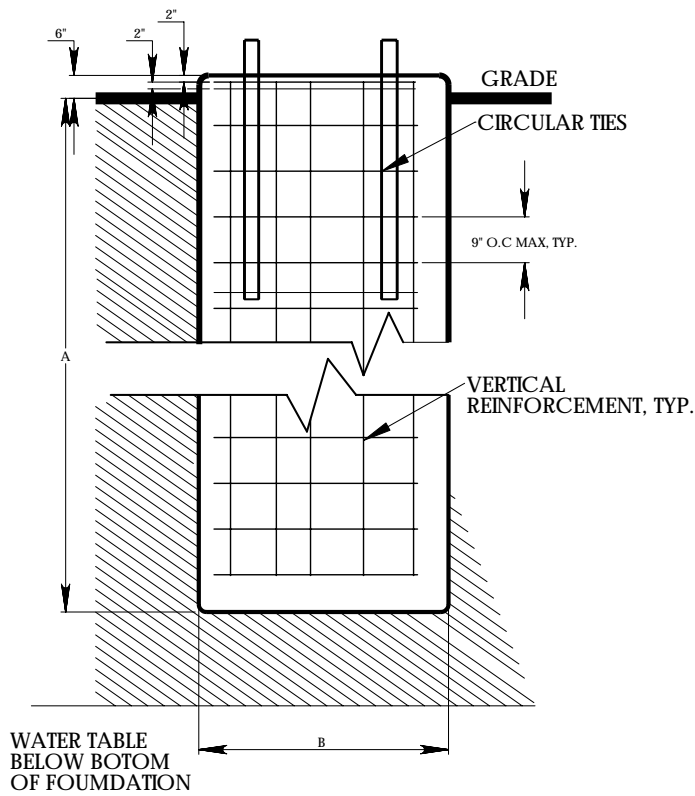


Fig. B2 Technical drawing for Pier Foundation

**TIP:** Because special equipment is required to cut and bend the reinforcing bar it may be most economical to contract with a local concrete company to manufacture the reinforcement structure for the pier foundation.

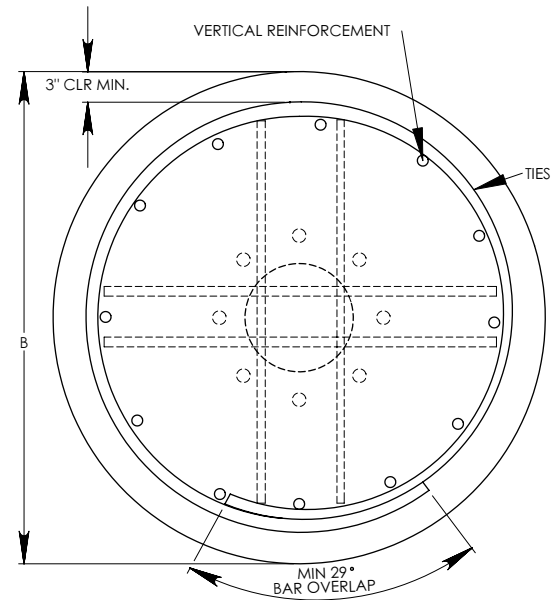


Fig. B3 Technical drawing for Pier Foundation

Soil Classification		Allowable Soil Pressure		Design Loads at Tower Base*			Minimum Pier Dimensions**			Reinforcement	
		Lateral psf	Vertical psf	Shear (V) lbs.	Moment (M) ft-lbs	Vertical (P) lbs	Depth (A) feet	Diameter (B) inches	Projection (C) inches	Vertical	Ties
Class 1	Crystalline bedrock	1200	12,000	867	26,290	760	6	24	6	(8)-#6	#4 @ 9"
							5			O.C. max	
Class 2	Sedimentary and foliated rock	400	4000	867	26,290	760	8	24	6	(8)-#6	#4 @ 9"
							7			O.C. max	
Class 3	Sandy gravel and/or gravel (GW and GP)	200	3000	867	26,290	760	10	24	6	(8)-#6	#4 @ 9"
							9			O.C. max	
Class 4	Sand, silt sand, clayey sand, silt gravel and clay gravel (SW, SP, SM, SC, GM and GC)	150	2000	867	26,290	760	10	24	6	(12)-#6	#4 @ 9" O.C. max
Class 5	Clay, sand clay, silt clay, clayey silt, silt, and sandy silt (CL, ML, MH and CH)	100	1500	867	26,290	760	11	24	6	(12)-#6	#4 @ 9" O.C. max
							10				

\* These Are the unfactored wind turbine extreme loads using a hub-height wind speed of 62.9m/s (140 mph), a wind shear of 0.20 and a tower drag coefficient of 0.28 [ from polhamus, E.C., NASA CR 3809, 1984].

\*\*\*installation of circular ties and anchor bolts shall be in accordance with the drawings.

Fig. B4 Soil chart

## 2-1 Forming and Reinforcing Bar

Position reinforcing bar per Fig. B2. Circular ties require a minimum 29 inch (73.6 cm) overlap and a minimum 3 inch (7.62 cm) clearance from outside diameter edge of pier. Circular ties are #4 reinforcing bar with maximum 9 inch (23 cm) spacing. Vertical reinforcement bars are 12, #6 reinforcing bars equally spaced about circular ties. Forming is most easily accomplished using 24 inch (61 cm) sonotube. Forms must be removed before backfilling. The sonotube need not extend full depth of foundation if excavation is in solid undisturbed soil. See Figure B2. Position 4, #6 cap bars as shown in Figure B2.

## 2-2 “J” Bolts & Template



**Note:** Take the time to prepare an accurate and strong template to position and secure the J bolts. This will save much time and difficult rework.

- Before pouring the foundation the “J” bolts **MUST** be **SECURELY** locked in position.
- A paper template is provided with the bolt kit. Use this template to drill a wood template to hold the “J” bolts in position while concrete is poured.
- Two methods of framing the “J” bolts are presented in Figure B4. The first method uses a single template while the second method utilizes two templates sandwiched between lengths of 2’x4”lumber. Regardless of the method be sure bolts are correctly positioned prior to pouring concrete.
- Fabricate a wood template by securing the paper template to the wood template material (3/4” plywood works well).
- Center punch the center position of each “J” bolt. Remove the paper template and drill a 1.25 inch (3.1 cm) mounting hole for each bolt. If possible compare the template to the tower base to assure bolts will be positioned correctly.
- Mount each of the “J” bolts to the wood template by using a pair of foundation nuts to clamp the template between the nuts.
- Adjust the “J” bolts to extend 7 – 8 inches (17.8 cm-20.3 cm) above foundation as shown in Figure B4.
- Assure all bolts are vertical and parallel to each other.

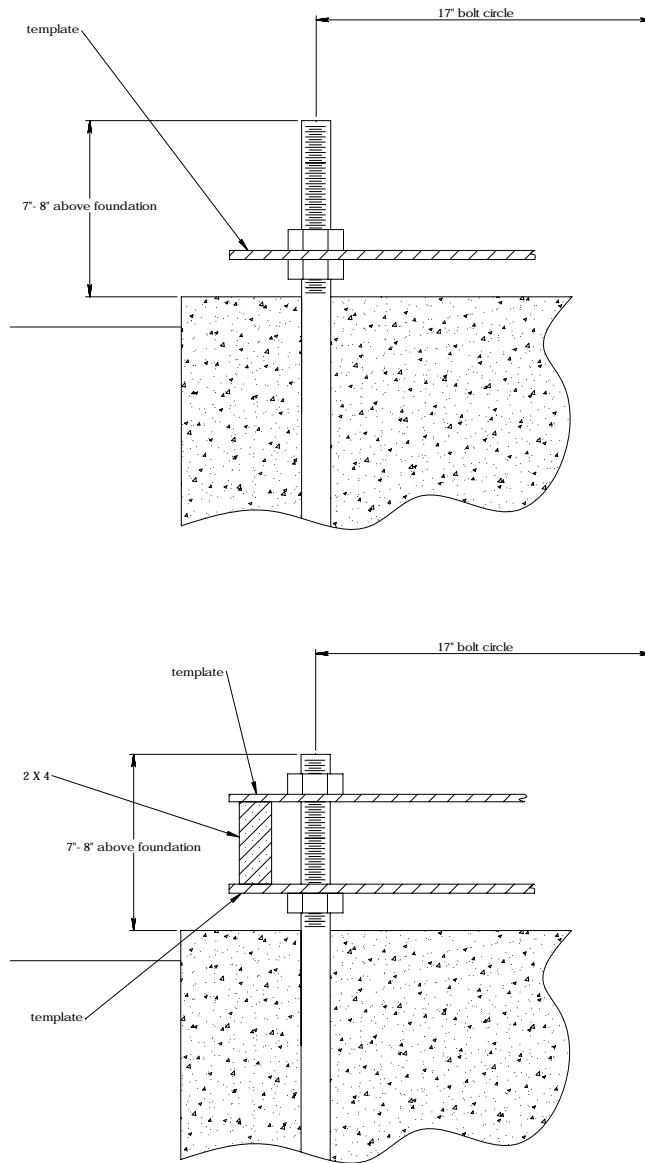


Fig. B5 J bolts and template

**2-3 Pier Foundation Specifications:**

Diameter	24 inches (61 cm)
Depth	Depends on soil conditions
Concrete	Minimum 2500 PSI, 28 day strength, 5% air entrapment
Pier Projection Above Grade	6 inches (16.24 cm)
Reinforcing Bar	ASTM A615 Grade 60
Circular Ties	#4 reinforcing bar, 17-18 inch (43 cm) diameter, 29 inch (73.6 cm) overlap
Vertical Reinforcement	12 equally spaced #6 reinforcing bar
Anchor "J" Bolts	42 inch (1 m) length, 1.25 inch (3.1 cm) diameter, 6 inch (16.24 cm) "J"
"J" Bolt Projection Above Foundation	7-8 inches (17.8 - 20.3 cm)



## Three - MAT Foundation

The MAT foundation is presented in Fig. B6. The foundation is a 6 foot by 6 foot (1.8 m x 1.8 m) square with a depth of 3 feet (.9 m). The MAT foundation is designed for an allowable vertical bearing pressure of 1,500 PSF (IBC Class 5 Soil per Table 1804.2).

### General notes

- 1) The mat foundation was designed in accordance with the IBC 2003
- 2) A professional engineer registered in the state where the project is located shall assume responsibility for the site – specific design. The P.E. shall assure design suitability for varying site and soil condition such as soil classifications, water table, existence of expansive/collapsible soils, susceptibility to liquefaction, frost depth, etc.
- 3) The mat foundation is for a allowable vertical bearing pressure of 1,500 PSF (IBC class 5 soil per table 1804.2)
- 4) All foundation elements shall bear on properly prepared soil
- 5) Soil types and properties shall be verified by the project P.E.
- 6) Concrete work shall be in conformance with the requirements set forth in ACI 301/318
- 7) Anchor bolt design shall be provided by others. Anchor bolts numbers, size, type, and configuration shall be capable of resisting all applied moment, shear, and axial forces
- 8) Concrete shall have min 2,500 PSI 28-day strength and 5% air entrainment +/-1% Concrete unit weight shall not exceed 150lbs/ft<sup>3</sup>
- 9) Reinforcing steel shall be ASTM A615 grade 60 deformed bars
- 10) Wind loads per IEC 200x were calculated by others:
 

Base moment:	26,290 ft-lbs
Base shear:	867 lbs
Axial load:	760 lbs

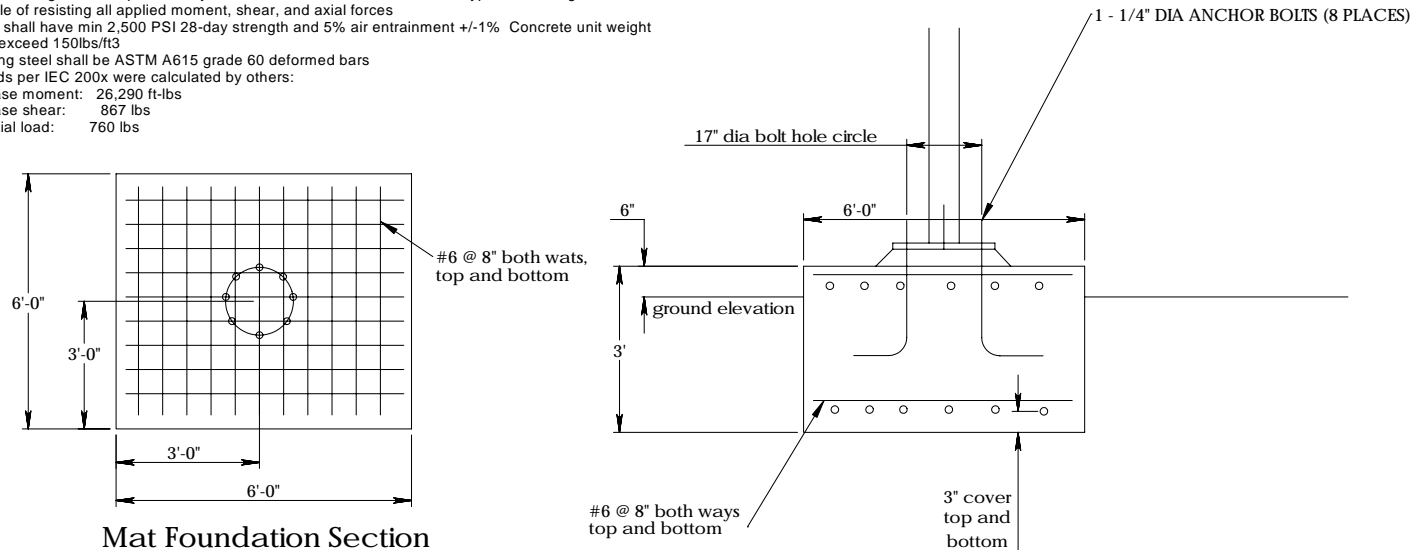


Fig. B6 Technical drawings for Mat Foundation

### 3-1 Reinforcing Bars

Position reinforcing bar "mats" as indicated in Fig. B6. Reinforcing bar is #6 bar spaced at 8 inch (20.3 cm) intervals. Reinforcing bar mats positioned with minimum 3 inch (7.6 cm) concrete cover top and bottom.

### 3-2 “J” Bolts and Template



Note: Take the time to prepare an accurate and strong template to position and secure the J bolts. This will save much time and difficult rework.

- Before pouring the foundation the “J” bolts **MUST** be **SECURELY** locked in position.
- A paper template is provided with the bolt kit. Use this template to drill a wood template to hold the “J” bolts in position while concrete is poured.
- Two methods of framing the “J” bolts are presented in Figure B4. The first method uses a single template while the second method utilizes two templates sandwiched between 2”x4” lengths of lumber. Regardless of the method be sure bolts are correctly positioned prior to pouring concrete.
- Fabricate a wood template by securing the paper template to the wood template material.
- Center punch the center position of each “J” bolt. Remove the paper template and drill a 1.25 inch (3.1 cm) mounting hole for each bolt. If possible compare the template to the tower base to assure bolts will be positioned correctly.
- Mount each of the “J” bolts to the wood template by using a pair of foundation nuts to clamp the template between the nuts.
- Adjust the “J” bolts to extend 7 – 8 inches (17.8 cm-20.3 cm) above foundation as shown in Figure B5.
- Assure all bolts are vertical and parallel to each other.

### 3-3 MAT Foundation Specifications

Dimensions	6 feet x 6 feet x 3 feet (1.8 x 1.8 x .9 m) deep
Reinforcing Bar	ASTM A615 Grade 60
Anchor “J” Bolts	32 inch (81.3 cm) length, 1.25 (3.1 cm) diameter; 6 inch (16.24 cm) “J”
Concrete	Minimum 2500 PSI, 28 day strength, 5% Air Entrapment

## Four - 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 inches (61 cm) while cables in conduit may be buried at a depth of 18 inches (46 cm). Additionally, most codes prohibit embedding cables directly in concrete. Refer to local codes for conduit size and minimum depth requirements.



**Note:** Space between foundation and bottom of tower base plate should be filled with high strength non-shrink grout after final positioning of tower on foundation.

