Step 6. Join the upper and lower anchor bolt templates. Follow the illustrations from left to right.
SMarT_Foundation™ [Simple Modular Technology]
Assembly and Installation Instructions
(U.S. Patent Pending)

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

ATTENTION
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Some Important Notes about Constructing a SMarT Foundation!

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

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

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

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

- Contact us with questions or if you encounter problems with the installation.
- Please reuse or recycle all materials remaining after construction.
We provide a unique foundation solution along with Drawings, Parts and Instructions to facilitate placement of reinforcement and anchor rods.

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

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

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

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

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART NUMBER</th>
<th>PART NAME</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>015-001-0001</td>
<td>STANCHION BASE</td>
<td>1/2” MDF x 19” OUTSIDE DIMENSION</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>013-003-0003</td>
<td>LOWER STANCHION</td>
<td>3” ABS PIPE X 23-15/16”</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>002-001-0001</td>
<td>STANCHION BRACE</td>
<td>16 GA COLD ROLLED STEEL</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>014-001-0001/2</td>
<td>REBAR HOOP</td>
<td>#3 STEEL 18 1/2” ID (17” BC) or 20-1/2” ID (19” BC)</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>009-002-0001</td>
<td>STANCHION COUPLING</td>
<td>3” ABS</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>013-003-0004</td>
<td>UPPER STANCHION</td>
<td>3” ABS PIPE X 17-1/16”</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>009-006-0001</td>
<td>3” TO 2” ABS REDUCER</td>
<td>3” to 2” ABS REDUCER</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>013-001-0003</td>
<td>2” ABS EXTENSION</td>
<td>2” ABS PIPE x 2”</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>013-001-0003</td>
<td>2” ABS TEMPLATE SPACER</td>
<td>2” ABS PIPE x 2”</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>016-001-0004/6</td>
<td>LOWER ANCHOR BOLT TEMPLATE</td>
<td>1/2” MDF, 17” or 19” BOLT CIRCLE</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>008-003-0002</td>
<td>CABLE TIE</td>
<td>Plastic Tie, 7”</td>
<td>20</td>
</tr>
<tr>
<td>12</td>
<td>009-004-0001</td>
<td>2” ABS FEMALE ADAPTER</td>
<td>2” ABS</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>009-005-0001</td>
<td>2” ABS MALE ADAPTER</td>
<td>2” ABS</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>016-001-0003/5</td>
<td>UPPER ANCHOR BOLT TEMPLATE</td>
<td>1/2” MDF, 17” or 19” BOLT CIRCLE</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>009-007-0001</td>
<td>1” PVC RISER</td>
<td>1” SCH 80 PVC PIPE X 6”, THREADED</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>009-001-0002</td>
<td>1” PVC THREADED CAP</td>
<td>1” PVC</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>013-002-0001</td>
<td>1-1/2” ABS TEMPLATE SPACER</td>
<td>1-1/2” ABS PIPE X 3-15/32”</td>
<td>8</td>
</tr>
<tr>
<td>18</td>
<td>009-004-0002</td>
<td>1” PVC FEMALE ADAPTER</td>
<td>1” PVC</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>013-001-0002</td>
<td>1” PVC EXTENSION</td>
<td>1” PVC PIPE X 11-15/16”</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>009-003-0001</td>
<td>1” PVC ELBOW</td>
<td>1” PVC 90 DEGREE ELBOW WITH BELL END</td>
<td>1</td>
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<tr>
<td>21</td>
<td>008-001-0001</td>
<td>ANCHOR ROD*</td>
<td>1-1/4” x 32” ASTM 1554</td>
<td>8</td>
</tr>
<tr>
<td>22</td>
<td>008-002-0001</td>
<td>ANCHOR ROD NUT*</td>
<td>1-1/4” ASTM A563 HEAVY, HDG</td>
<td>24</td>
</tr>
<tr>
<td>23</td>
<td>006-001-0001</td>
<td>CYLINDRICAL CONCRETE FORM</td>
<td>24” ID X 7-3/4” LONG</td>
<td>1</td>
</tr>
<tr>
<td>24</td>
<td>003-001-0001</td>
<td>LOCATER BRACKET</td>
<td>16 GA COLD ROLLED STEEL, 3/4” X 9-5/8”</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>004-001-0001</td>
<td>LOCATER BRACKET SCREWS</td>
<td>#8 x 1/2” SELF TAPPING SCREW, PHILLIPS</td>
<td>8</td>
</tr>
<tr>
<td>26</td>
<td>011-001-0001</td>
<td>GUY ROPES</td>
<td>GUY ROPE WITH SLIDES, 10’ LONG, 2/PKG</td>
<td>2</td>
</tr>
<tr>
<td>27</td>
<td>012-001-0001</td>
<td>NAIL PEGS</td>
<td>NAIL PEGS, 10” LONG, 4/PKG</td>
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</tr>
<tr>
<td>28</td>
<td>017-001-0001</td>
<td>MULTI-PURPOSE CEMENT</td>
<td>2 OZ DABBER CAN</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>018-001-0003</td>
<td>DRAWINGS</td>
<td>SMarT 2_v1 DRAWINGS</td>
<td>1</td>
</tr>
<tr>
<td>30</td>
<td>018-002-0002</td>
<td>INSTRUCTIONS</td>
<td>SMarT 2_v1 ASSEMBLY/INSTALLATION INSTRUCTIONS</td>
<td>1</td>
</tr>
</tbody>
</table>

* Anchor Rods and Anchor Rod Nuts are sold separately.
Step 4. Assemble the vertical stanchion. Follow the illustrations from left to right.
<table>
<thead>
<tr>
<th>Step</th>
<th>Instructions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check the contents of the Kit against the parts list shown on page 3. Contact the Supplier if any parts are missing.</td>
<td>The Kit is used to assemble and properly locate the anchor bolt templates, spacers, reinforcement and cylindrical concrete form on a vertical stanchion to be placed in the foundation excavation.</td>
</tr>
<tr>
<td>2</td>
<td>Read these Instructions carefully, paying close attention to safety issues.</td>
<td>Review the Drawings provided and Terms and Conditions provided with the Kits.</td>
</tr>
<tr>
<td>3</td>
<td>Gather all required tools and equipment.</td>
<td>Tools required for Kit assembly and placement are a tape measure, carpenter’s level, hammer, Phillips head screwdriver, marking pen and cleanup rag. Typical concrete placement and finishing tools are required to pour the foundation. Personal protection equipment, including work gloves, eye protection and hard hat is required.</td>
</tr>
<tr>
<td>4</td>
<td>Assemble the vertical stanchion.</td>
<td>Note: The Kit may be constructed in the excavation or at an adjacent location. Consider that when assembled it weighs approximately 145 lbs (66 kg). The Lower Stanchion is the longer of the two 3” ABS pipes supplied with the Kit. Important: For frost depths greater than 3.5 feet (1.07 m), the installer must provide an ABS coupling and pipe extension of length ( l = ) frost depth – 42 inches (1067 mm). Important: The use of ABS cement, or the Multi-Purpose Cement (27) supplied with the Kit, is required to attach these ABS fittings. Important: The use of ABS cement, or the Multi-Purpose Cement (27) supplied with the Kit, is required to attach these ABS fittings. Note: You may find that the parts of Steps 4.5 and 4.6 were pre-assembled at the factory.</td>
</tr>
</tbody>
</table>

1. If necessary, add an extension (not supplied) to the Lower Stanchion (2) to deal with greater frost depths.
2. Insert the Lower Stanchion in the Stanchion Base (1) and place it on a solid, level surface convenient for assembly of the Kit.
3. Slide the two Stanchion Braces (3) over the top of the Lower Stanchion and rest them on the Stanchion Base.
4. Place the Rebar Hoops (4) over the Lower Stanchion and rest them on the Stanchion Braces.
5. Use the Stanchion Coupling (5) to connect the Upper Stanchion (6) to the Lower Stanchion. These parts should be glued together.
6. Install the 3” to 2” ABS Pipe Reducer (7) and the 2” ABS Extension (8), in that order, on top of the Upper Stanchion. These parts should be glued together.
Step 6. Join the upper and lower anchor bolt templates. Follow the illustrations from left to right.
<table>
<thead>
<tr>
<th>Step</th>
<th>Instructions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Assemble the anchor bolt templates.</td>
<td><strong>Note:</strong> The Lower Anchor Bolt Template has four long “spokes” and four short “spokes”.</td>
</tr>
<tr>
<td></td>
<td>1. Insert a 2” ABS Male Adapter (12) through the center of the Lower Anchor Bolt Template (9) into a 2” ABS Female Adapter (11). Hand-tighten the threaded fittings.</td>
<td><strong>Caution:</strong> For this assembly, the 2” ABS Female Adapter fits on the grooved side of the Lower Anchor Bolt Template.</td>
</tr>
<tr>
<td></td>
<td>2. Insert a 2” ABS Template Spacer (8) into the 2” ABS Male Adapter. These parts should not be glued together.</td>
<td><strong>Important:</strong> Do not cement these parts.</td>
</tr>
<tr>
<td></td>
<td>3. Install the assembly (from Steps 5.1 and 5.2) onto the stanchion by inserting the 2” ABS Female Adapter into the 2” ABS Pipe Extension on the top of the stanchion. These parts should be glued together.</td>
<td><strong>Important:</strong> The use of ABS cement, or the Multi-Purpose Cement (27) supplied with the Kit, is recommended to attach these ABS fittings.</td>
</tr>
<tr>
<td></td>
<td>4. Insert a 2” ABS Male Adapter (12) through the center of the Upper Anchor Bolt Template (13) into a 2” ABS Female Adapter (11). Hand-tighten the threaded fittings.</td>
<td>The Upper Anchor Bolt Template has eight “spokes” that are the same size.</td>
</tr>
<tr>
<td></td>
<td>5. Screw the 1” PVC Threaded Cap (15) onto one end of the 1” PVC Riser (14). Insert this assembly through any one of the inner holes of the Upper Anchor Bolt Template.</td>
<td><strong>Caution:</strong> For this template, the 2” ABS Male Adapter fits on the grooved side of the Upper Anchor Bolt Template.</td>
</tr>
</tbody>
</table>
Step 6. Join the upper and lower anchor bolt templates. Follow the illustrations from left to right.
<table>
<thead>
<tr>
<th>Step</th>
<th>Instructions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Join the Upper and Lower Anchor Bolt Templates.</td>
<td><strong>Important:</strong> Make sure the 1” PVC Threaded Nipple passes through one of the inner holes in both the Upper and Lower Anchor Bolt Templates.</td>
</tr>
<tr>
<td></td>
<td>1. Join the Upper and Lower Anchor Bolt Templates by inserting the 2” ABS Female Adapter on the bottom of the Upper Anchor Bolt Template into the 2” ABS Template Spacers protruding from the top of the Lower Anchor Bolt Template assembly. These parts should not be glued together.</td>
<td><strong>Important:</strong> Do not cement these parts.</td>
</tr>
<tr>
<td></td>
<td>2. Slip the eight 1-1/2” ABS Template Spacers (16) between the Upper and Lower Anchor Bolt Templates and align them with the outer bolt holes in the templates.</td>
<td><strong>Important:</strong> The use of PVC cement, or the Multi-Purpose Cement (27) supplied with the Kit, is recommended to attach these PVC fittings.</td>
</tr>
<tr>
<td></td>
<td>3. Assemble the 1” PVC Female Adapter (17), the 1” PVC Extension (18) and the 1” PVC Elbow (19) as shown in the illustration. These parts should be glued together</td>
<td>If necessary, this PVC assembly may be relocated to some other holes in order to mate with a planned electrical interconnection.</td>
</tr>
<tr>
<td></td>
<td>4. Screw the 1” PVC Female Adapter of the above assembly into the 1” PVC Threaded Nipple protruding from the bottom of the Lower Anchor Bolt Template.</td>
<td></td>
</tr>
</tbody>
</table>
Step 7. Install the anchor rods. Follow the illustrations from left to right.
<table>
<thead>
<tr>
<th>Step</th>
<th>Instructions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Install the anchor rods.</td>
<td><strong>Note:</strong> Anchor Rods are supplied separately from the Kit. The illustrations above and these Instructions have been prepared for the Anchor Rods provided by the Supplier. If different types or sizes of concrete anchors are supplied by others, appropriate adaptations must be made.</td>
</tr>
<tr>
<td></td>
<td>1. Prepare the eight 1-1/4” diameter Anchor Rods (20) as shown in the illustration above.</td>
<td>It is not unusual for minor thread damage to exist. In such cases, external threads may be “dressed” with a metal file and/or both internal and external threads may be “chased” by using a wrench to force the nut past the damaged thread(s).</td>
</tr>
<tr>
<td></td>
<td>1.1. Remove the Anchor Rod Nuts (21) from the bottom (short thread length) of the Anchor Rods.</td>
<td>A wrench is not needed. Hand tightening is adequate.</td>
</tr>
<tr>
<td></td>
<td>1.2. Run one Anchor Rod Nut to the bottom of the thread length on the top of the Anchor Rods.</td>
<td>A wrench is not needed. Hand tightening is adequate.</td>
</tr>
<tr>
<td></td>
<td>1.3. Mark the Anchor Rods in the locations shown. These marks will be used to place the rebar hoops.</td>
<td>A wrench is not needed. Hand tightening is adequate.</td>
</tr>
<tr>
<td></td>
<td>2. Insert the Anchor Rods through the outer (bolt circle) holes of the Lower Anchor Bolt Template, the 1-1/2” ABS Template Spacers and the Upper Anchor Bolt Template.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Thread the Anchor Rod Nuts onto the protruding Anchor Rods until they are just flush with the ends.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Adjust the lower Anchor Rod Nuts until they are snug with the Lower Anchor Bolt Template.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Before advancing to the next step, check that the top surfaces of the top Anchor Rod Nuts are flush with the top surfaces of the Anchor Rods and that the entire assembly is rigid. This may require additional hand tightening of some nuts.</td>
<td></td>
</tr>
</tbody>
</table>
Step 8. Install reinforcement on anchor rod assembly. Follow the illustrations from left to right.
<table>
<thead>
<tr>
<th>Step</th>
<th>Instructions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Install reinforcement on anchor rod assembly.</td>
<td>The vertical position of the Stanchion Braces is not critical, as long as they are below the Stanchion Coupling and secured to the Anchor Rods.</td>
</tr>
<tr>
<td></td>
<td>1. Slide one Rebar Hoop (4) up over the Anchor Rods to the top marks that were placed on the Anchor Rods in Step 7.1.3. This hoop should be at least 4&quot; below the lower surface of the Lower Anchor Bolt Template.</td>
<td>Note: The Anchor Rod Nuts should be threaded tight up against the end of the threaded portion of the Anchor Rods to discourage movement during assembly in the excavation and subsequent placement of concrete.</td>
</tr>
<tr>
<td></td>
<td>2. Fasten this Rebar Hoop to every other Anchor Rod using the Plastic Cable Ties (10).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Slide all remaining Rebar Hoops up over the Anchor Bolts and temporarily secure them to the top Rebar Hoop using several Plastic Cable Ties.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Slide one Stanchion Brace (3) up the Lower Stanchion and over two opposing Anchor Rods. Secure the Stanchion Brace with Anchor Rod Nuts threaded hand tight up to the end of the threads on the Anchor Rods.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Slide the remaining Stanchion Brace (3) up the Lower Stanchion and over two Anchor Rods 90 degrees opposed to the first Stanchion Brace. Secure the Stanchion Brace with Anchor Rod Nuts threaded hand tight up to the end of the threads on the Anchor Rods.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Install the remaining four Anchor Rod Nuts hand tight up to the end of the threads on the Anchor Rods.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Check that all Anchor Rod Nuts are hand tight up against the end of the threads on the Anchor Rods.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. Cut the Plastic Cable Ties and lower all but the top Rebar Hoop to the positions that were marked on the Anchor Rods in Step 7.1.3. Fasten the Rebar Hoops to every other Anchor Rod using the Plastic Cable Ties.</td>
<td></td>
</tr>
</tbody>
</table>
Step 9. Install the cylindrical concrete form. Follow the illustrations from left to right.
<table>
<thead>
<tr>
<th>Step</th>
<th>Instructions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Install the cylindrical concrete form.</td>
<td><strong>Important:</strong> Make sure the bottom of the Cylindrical Concrete Form rests on the tabs of the Locater Brackets. This position determines the top surface of the concrete.</td>
</tr>
<tr>
<td></td>
<td>1. Carefully slip the Cylindrical Concrete Form (22) over the anchor bolt assembly and let it rest on the ground.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Install the four Locater Brackets (23) on the long “spokes” of the Lower Anchor Bolt Template. Use the Locater Bracket Screws (24) provided and the pre-drilled holes in the Lower Anchor Bolt Template.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Raise the Cylindrical Concrete Form and capture it in the bottom tabs of the four Locater Brackets. Fasten the Cylindrical Concrete Form in this position using the self threading Locater Bracket Screws provided and the pre-drilled holes in the Locater Brackets.</td>
<td></td>
</tr>
</tbody>
</table>
Step 10. Prepare nail pegs and guy ropes and set the anchor bolt assembly in the excavation. Follow the illustrations from left to right.
<table>
<thead>
<tr>
<th>Step</th>
<th>Instructions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Prepare nail pegs and guy ropes and set the anchor bolt assembly and stanchion in the excavation.</td>
<td>As noted in Step 4, the installer may already have decided to assemble the Kit in the excavation.</td>
</tr>
<tr>
<td></td>
<td>1. Locate four points on the ground where the Guy Ropes (25) will be attached to the Nail Pegs (26). These will be used to secure the anchor bolt assembly. To keep the work area clear, locate the Nail Pegs 7 to 8 feet (2.1 to 2.4 m) from the centerline of the excavation. The two pairs should be aligned 90 degrees from each other.</td>
<td>Caution: Look ahead to Step 11 and plan the alignment of nail pegs, anchor bolt assembly and PVC electrical conduit. These steps should be completed before placing the anchor bolt assembly in the excavation.</td>
</tr>
<tr>
<td></td>
<td>2. Drive the Nail Pegs securely into the ground with hooks facing away from the excavation.</td>
<td>This step may require some loosening and retightening of the anchor bolt nuts.</td>
</tr>
<tr>
<td></td>
<td>3. Tie the ends of the four Guy Ropes to four of the 1-1/2” ABS Template Spacers located 90 degrees apart (every other bolt).</td>
<td><strong>Caution:</strong></td>
</tr>
<tr>
<td></td>
<td>4. Temporarily stow the guy ropes in the hollow top of the stanchion.</td>
<td>• Use work gloves.</td>
</tr>
<tr>
<td></td>
<td>5. Check for proper assembly of the Anchor Rods, Rebar Hoops and 1” PVC electrical conduit. The assembly should be quite rigid and the top nuts should be flush with the tops of the Anchor Rods.</td>
<td>• Plan and discuss Step 10.7 before proceeding.</td>
</tr>
<tr>
<td></td>
<td>6. Check the distance from the bottom of the excavation to the top of grade. It must be as specified in the Drawings or the Anchor Rods will not be at the proper height for installation of the tower.</td>
<td>• Clear the excavation of any debris or loose soil.</td>
</tr>
<tr>
<td></td>
<td>7. Carefully lift the assembly and lower it to the bottom of the excavation.</td>
<td>• Check the surrounding area and remove tripping hazards.</td>
</tr>
<tr>
<td></td>
<td>8. Locate the 1” PVC Elbow to facilitate the planned electrical conduit installation. Some manipulation may be required to avoid interference with the Anchor Rods.</td>
<td>• Lift the assembly by the anchor rods and not by the anchor bolt templates or rebar hoops. This step requires at least two people.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the bottom of the excavation is muddy or soft in the center – where the stanchion will rest – the assembly may sink below the desired level. If this is likely, set the stanchion on a solid surface (such as a paving block) to reduce the soil pressure.</td>
</tr>
</tbody>
</table>
Step 11. **Level and secure the anchor bolt assembly.** Nail Pegs and Guy Ropes are used to stabilize and level the assembly. Here, the installer chose to add wood frames to locate the Cylindrical Concrete Form relative to the overall assembly. The Locater Brackets provided in the Kit serve this purpose, so that the wood frames shown above are unnecessary. Note also the use of a “barrel form” to deal with particularly loose soils. Instead of such a “barrel form” the installer could have chosen simply to pour more concrete. This is an individual choice.
<table>
<thead>
<tr>
<th>Step</th>
<th>Instructions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Level and secure the anchor bolt assembly.</td>
<td>The lower surfaces of the Anchor Rod Nuts should be slightly above the top of the Cylindrical Concrete Form, which will also be the top surface of the concrete.</td>
</tr>
<tr>
<td></td>
<td>1. Check that the stanchion is resting in the center of the excavation.</td>
<td>The top surface of the Anchor Rod Nuts should be flush with the tops of the Anchor Rods. That way, the Anchor Rods are leveled along with the nuts.</td>
</tr>
<tr>
<td></td>
<td>2. Hold the assembly so that the top anchor bolt template is level.</td>
<td><strong>Caution:</strong> Check that the PVC electrical conduit is in an acceptable location. Make sure it is protected against infiltration of debris and that it extends beyond the foundation perimeter for easy access when completing the electrical installation.</td>
</tr>
<tr>
<td></td>
<td>3. Check that the lower surfaces of the lower Anchor Rod Nuts are 2 to 3 inches (51 to 76 mm) above the desired final earth grade.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Check that the Guy Ropes align with the Nail Pegs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Attach the free ends of the Guy Ropes (with slides) to the hooks on the Nail Pegs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Place a level atop two opposing Anchor Rods having Guy Ropes attached. Adjust the Guy Ropes until the assembly is level and held firmly.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Repeat Step 11.6 for the other two Anchor Rods with Guy Ropes attached.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. Insert a 1” PVC electrical conduit of appropriate length (not supplied) into the bell end of the 1” PVC Elbow. Cement this joint to prevent moisture intrusion.</td>
<td></td>
</tr>
</tbody>
</table>
Placing the Concrete

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

Step 12. Place and finish the concrete.
<table>
<thead>
<tr>
<th>Step</th>
<th>Instructions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Place and finish the concrete.</td>
<td><strong>Caution:</strong> Concrete placement should be performed by qualified, responsible individuals. Consult the turbine manufacturer and/or qualified professionals regarding lightning protection and electrical grounding requirements.</td>
</tr>
</tbody>
</table>

1. Check that the tops of the Anchor Rods and the top surface of the Cylindrical Concrete Form are level. Adjust if necessary.
2. Check the height of the Cylindrical Concrete Form. Its top edge should be slightly below the bottom surface of the Anchor Rod Nuts.
3. Pour concrete to approximately 6 inches (152 mm) below the final earth grade. The slab should be at least 3 feet (0.91 m) thick.
4. Use a trowel to slope concrete away from the base of the Cylindrical Concrete Form to promote drainage toward the foundation perimeter.
5. Trowel-finish all concrete surfaces.
6. Use an edging tool to smooth the concrete at the perimeter of the Cylindrical Concrete Form.
7. After the concrete sets, remove the templates and forms.
8. Backfill the excavation with native soil and compact it. Gravel or other landscaping materials may be used to fill the annulus around the stub pier. Slope the soil toward the foundation perimeter for drainage. If this area is to be re-vegetated, appropriate soil amendments should be added.

*Suggestions:*
- *Safety is first! Identify the work area as a safety hazard and control access to it.*
- *Prevent the excavation from freezing – use heaters or thermal blankets if necessary.*
- *Prevent water from accumulating at the bottom of the excavation.*
- *Keep the excavation clean and free from debris.*
- *Check the condition of the excavation in preparation for concrete placement.*
- *Check that the work area is clear, being especially careful about tripping hazards.*
- *Have all tools and equipment readily available.*
- *Recheck the anchor bolt height relative to the planned earth grade (Step 11.3).*
- *Recheck that the anchor bolt assembly is level (Steps 11.6 and 11.7).*
- *Make sure the concrete mix is fluid enough to fill potential voids.*
- *Consolidate the concrete around the rebar and anchor bolt assembly. Note the Drawings regarding vibration of concrete during construction.*
- *Pour the concrete slowly from several locations around the excavation. Check that the anchor bolt assembly remains in its intended position and is plumb.*
- *Check that the PVC electrical conduit remains in its intended position.*
- *Use hand tools to place and consolidate concrete within the cylindrical concrete form.*
- *Protect the concrete from sun, wind, hail, heavy rain and freezing for at least one week after pouring. Use appropriate curing compounds or keep the concrete covered and moist.*
- *Allow the concrete to cure for 24 hours before removing templates and forms.*
- *Clean the anchor rods with a wire brush and appropriate solvent.*
- *The tower and turbine must not be installed and erected – and design loads must not be applied – until the 28-day concrete strength has been achieved as noted in the Drawings.*
SMarT/Foundation™ [Simple Modular Technology] Drawings
(U.S. Patent Pending)

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

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

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# TOWER DESIGN CRITERIA

<table>
<thead>
<tr>
<th>TOWER HEIGHT (M (FT))</th>
<th>DESIGN WIND SPEED M/S (MPH)</th>
<th>VERTICAL LOAD kN (LBS)</th>
<th>BASE MOMENT kN-M (FT-LBS)</th>
<th>BASE SHEAR kN (LBS)</th>
<th>FOUNDATION DIAMETER M (FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASE 1</td>
<td>≤ 10.4 (34)</td>
<td>≤ 49 (110)</td>
<td>3.4 (761)</td>
<td>25.5 (57,455)</td>
<td>3.0 (68)</td>
</tr>
<tr>
<td>CASE 2</td>
<td>≤ 10.4 (34)</td>
<td>≤ 67 (150)</td>
<td>3.4 (761)</td>
<td>42.8 (91,953)</td>
<td>2.0 (43)</td>
</tr>
<tr>
<td>CASE 3</td>
<td>≤ 13.7 (45)</td>
<td>≤ 49 (110)</td>
<td>4.4 (988)</td>
<td>37.4 (82,632)</td>
<td>3.7 (828)</td>
</tr>
<tr>
<td>CASE 4</td>
<td>≤ 13.7 (45)</td>
<td>≤ 67 (150)</td>
<td>4.4 (988)</td>
<td>64.4 (147,513)</td>
<td>2.36 (53.7)</td>
</tr>
<tr>
<td>CASE 5</td>
<td>≤ 15.2 (50)</td>
<td>≤ 49 (110)</td>
<td>4.4 (988)</td>
<td>48.1 (106,500)</td>
<td>4.9 (1,100)</td>
</tr>
<tr>
<td>CASE 6</td>
<td>≤ 15.2 (50)</td>
<td>≤ 67 (150)</td>
<td>4.4 (988)</td>
<td>89.5 (196,000)</td>
<td>8.9 (2,000)</td>
</tr>
<tr>
<td>CASE 7</td>
<td>≤ 16.8 (55)</td>
<td>≤ 49 (110)</td>
<td>6.9 (1,543)</td>
<td>59.6 (1,339)</td>
<td>5.0 (1,129)</td>
</tr>
<tr>
<td>CASE 8</td>
<td>≤ 16.8 (55)</td>
<td>≤ 67 (150)</td>
<td>6.9 (1,543)</td>
<td>104.0 (233,811)</td>
<td>9.0 (2,020)</td>
</tr>
<tr>
<td>CASE 9</td>
<td>≤ 18.3 (60)</td>
<td>≤ 49 (110)</td>
<td>6.9 (1,543)</td>
<td>59.6 (1,339)</td>
<td>5.0 (1,129)</td>
</tr>
<tr>
<td>CASE 10</td>
<td>≤ 18.3 (60)</td>
<td>≤ 67 (150)</td>
<td>6.9 (1,543)</td>
<td>104.0 (233,811)</td>
<td>9.0 (2,020)</td>
</tr>
</tbody>
</table>

## NOTES:

1. The foundation designs are based on an IBC Class 5 (or better) soil classification and an allowable bearing pressure of 71.8 kPa (1,000 PSF) and a lateral bearing of 18.7 kN/m² (4,000 PSF/ft) below grade. It is the responsibility of the owner to verify by geotechnical investigation that actual soil parameters at the site equal or exceed those given. If conditions other than those described are encountered, a foundation analysis should be performed to determine the structural adequacy of the substructure. Installation shall not proceed until structural adequacy has been confirmed.

2. If the frost depth is known to be greater than 1.07m (42 inches), the 76mm (3") ABS pipe stanchion shall be lengthened so that its base is at or below the frost depth. The length of the stanchion shall be equal to the frost depth minus 1.07m (42 inches), and may be attached with a 76mm (3") ABS coupling.

3. Installation shall not proceed if the water table is less than the foundation depth. Consult with design engineer for foundation analysis or redesign. Construction shall not proceed until approval is obtained from the design engineer.

---

**PROJECT INFORMATION:**

**SMarT Foundation**

*Simple Modular Technology*

**DRAWN BY:** KJM  **CHECKED BY:** MLG

**REV DATE:** 04-02-09  **REV:** S-1  **REVISION:** 10**

---

**SEAL:**

Michael L. Gardner

April 2, 2009

---

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CONTACT TOWER ENGINEERING PROFESSIONALS rglover@tepgroup.net TO OBTAIN SEALED DRAWINGS

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**TOWER ENGINEERING PROFESSIONALS**

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---

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NOTICE:
1. THE BOTTOM OF EXCAVATION SHALL BE AT OR BELOW THE FROST
   DEPTH AT THE SITE LOCATION. THE FOUNDATION THICKNESS SHALL
   BE THE FROST DEPTH MINUS 152mm (6 INCHES) BUT 914mm (3'–0")
   MINIMUM.

PROPOSED UPPER ANCHOR BOLT TEMPLATE
SEE SHEET S-5 FOR DETAILS.

PROPOSED TEMPLATE SPACERS (TYP OF 8)

PROPOSED LOWER ANCHOR BOLT TEMPLATE
SEE SHEET S-5 FOR DETAILS.

PROPOSED BACKFILL, AMEND SOIL AND REVEGETATE
PROPOSED TOWER FOUNDATION.

PROPOSED 76mm (3") ABS PIPE STANCHION.

PROPOSED 51mm (2") ABS MALE ADAPTER.

PROPOSED 51mm (2") ABS FEMALE ADAPTER.

PROPOSED 51mm (2") ABS PIPE EXTENSION.

PROPOSED 76mm (3") TO 51mm (2") ABS PIPE REDUCER.

PROPOSED 76mm (3") ABS PIPE STANCHION.

610mm (2'–0") # PIER
FORM WITH SONOTUBE

305mm (12")
6mm (1/4")

4–K10 (#3) REBAR HOOP
AT 152mm (6") O.C.

PROPOSED STANCHION
BASE, SEE SHEET S-5
FOR DETAILS.

PROPOSED STANCHION
BRACE, SEE SHEET S-5
FOR DETAILS (TYP OF 2)

PROPOSED 76mm (3")
ABS COUPLING

PROPOSED ANCHOR
BOLTS (TYP OF 8)

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FOUNDATION ELEVATION (ASSEMBLY)
SCALE: 1/8" (19mm) = 1'-0" (305mm)

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[Simple Modular Technology]

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NOTES:
1. THE BOTTOM OF THE EXCAVATION SHALL BE AT OR BELOW THE FROST DEPTH AT THE SITE LOCATION. THE FOUNDATION THICKNESS MUST BE THE FROST DEPTH MINUS 152mm (6 INCHES), BUT 914mm (3’-0”) MINIMUM.

2. 32mm (⅜”) x 813mm (32”) LONG ASTM F1554—GRADE 36 (OR EQUIVALENT) ANCHOR RODS, ASTM A563 NUTS, AND ASTM F436 WASHERS SUPPLIED WITH ANEMERGONICS FOUNDATIONS KITS ARE PRE-APPROVED.


PROPOSED TOWER FOUNDATION.

PROPOSED MONOPOLE TOWER BY OTHERS.

PROPOSED BACKFILL, AMEND SOIL AND REVEGETATE

PROPOSED HEX NUT AND WASHER WITH NUT-LOCKING DEVICE

EXISTING GRADE

DIAETER

SEE TOWER DESIGN CRITERIA ON SHEET S-1

FOUNDATION ELEVATION (FINISHED)

SCALE: 3⁄4” (19mm) = 1’-0” (305mm)

PROJECT INFORMATION:

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[Simple Modular Technology]

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DRAWN BY: WIM CHECKED BY: MLC

SHEET NUMBER: S-3 REVISION: 10

TEP#: C09345.03

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04-02-09

03-10-09

03-26-09

04-02-09

02-16-09

10-04-09

8-03-09

9-03-09

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SEAL:
NORTH CAROLINA
ENGINEER
02-2002
M. GARDNER

April 2, 2009

26 Skystream SMarT Foundation™ Manual Rev A
SECTIONS

Scale: 1" (25mm) = 1'-0" (305mm)

PROJECT INFORMATION:

SMarT Foundation
[Simple Modular Technology]

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

REV DATE

NORTH CAROLINA ENGINEER

MICHAEL L. GARDNER
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STANCHION BASE SUPPORT

STANCHION BRACE

10.4m, 13.7m, 15.2m, & 18.8m
(34 FT., 45 FT., 50 FT., & 55 FT.) TOWER

18.3m (60 FT.) TOWER

18.3m (60 FT.) TOWER

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Skystream SMarT Foundation™ Manual Rev A
FOUNDATION NOTES:

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

EXCAVATION & GRADING:
1. WORK SHALL BE IN ACCORDANCE WITH LOCAL CODES AND SAFETY REGULATIONS. PROCEDURES FOR THE PROTECTION OF EXCAVATIONS, EXISTING CONSTRUCTION, AND UTILITIES SHALL BE ESTABLISHED AND PERFORMED PRIOR TO BEGINNING WORK.
2. ALL CUT AND FILL SLOPES SHALL BE 3:1 MAXIMUM, UNLESS OTHERWISE NOTED.
3. ALL EXCAVATIONS ON WHICH CONCRETE IS TO BE PLACED SHALL BE SUBSTANTIALLY HORIZONTAL ON UNDISTURBED AND UNFROZEN SOIL AND BE FREE FROM LOOSE MATERIAL AND EXCESS GROUND WATER. DEMATERIALIZING FOR EXCESS GROUND WATER SHALL BE PROVIDED IF REQUIRED.
4. ANY EXCAVATION OVER THE REQUIRED DEPTH SHALL BE FILLED WITH EITHER MECHANICALLY COMPACTED GRANULAR MATERIAL OR CONCRETE OF THE SAME QUALITY SPECIFIED FOR THE FOUNDATION. CRUSHED STONE MAY BE USED TO STABILIZE THE BOTTOM OF THE EXCAVATION. STONE USED SHALL NOT BE USED AS COMPRISING CONCRETE THICKNESS.
6. AFTER COMPLETION OF THE FOUNDATION AND BEFORE BACKFILLING, ALL EXCAVATIONS SHALL BE CLEAN OF UNSUITABLE MATERIAL SUCH AS VEGETATION, TRASH, DEBRIS, ETC.
7. BACKFILLING SHALL:
   A. USE APPROVED MATERIALS CONSISTING OF EARTH, SAND, GRAVEL, SANDY GRAVEL OR SOIL SHALE.
   B. BE FREE FROM CLOTTING OR STONES OVER 6mm (1/4") MAXIMUM DIMENSIONS.
   C. BE PLACED IN LAYERS OF 152mm (6") MAXIMUM.
   D. FILM MATERIAL AND BACKFILL SHALL BE PLACED IN LAYERS, MAXIMUM 152mm (6") DEEP BEFORE COMPACTING. EACH LAYER SHALL BE COMPACTED TO REQUIRED AND COMPACTED BY HAND OR MACHINE TAMMERS TO 90% OF MAXIMUM DRY DENSITY. THE optimum moisture content ± 2% as determined by ASTM DESIGNATION D 4940, UNLESS OTHERWISE APPROVED. SUCH BACKFILL SHALL NOT BE PLACED WITHIN 3 DAYS OF CONCRETE PLACEMENT.

REINFORCING STEEL:
1. THE REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A-615, GRADE 60. IT SHALL BE DEFORMED AND SPACERS SHALL NOT BE ALLOWED UNLESS OTHERWISE NOTED.
2. FIELD WELDING IS PROHIBITED ON REINFORCING STEEL AND EMBEDMENTS.
3. MINIMUM CONCRETE COVER FOR REINFORCEMENT SHALL CONFORM TO THE REQUIREMENTS OF ACI 318-05, SECTION 7.7.1, CAST-IN-PLACE CONCRETE (NONPRESTRESSED). CONCRETE COVER SHALL BE AS FOLLOWS:
   A. CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH ...... 76mm (3") MINIMUM COVER
   B. CONCRETE EXPOSED TO EARTH OR WEATHER:
      NO. 6 BARS THROUGH NO. 18 BARS ...... 40mm (1-1/2") MINIMUM COVER
      NO. 6 BARS AND SMALLER ...... 36mm (1-1/4") MINIMUM COVER

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

FINISHING:
1. THE TOP OF THE FOUNDATION SHALL BE SLOPED TO DRAIN WITH A FLOAT FINISH.
2. THE EXPOSED EDGES OF THE CONCRETE SHALL BE GRAMMERED 18mm x 18mm (3/4" x 3/4").

PROJECT INFORMATION:

S-6

REV
DATE

29

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S-6

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