ARE

Hydraulic RAM Tilt Monopole

Installation Instructions

American Resource & Energy

www.arewindtowers.com

Call (USA): 651-330-1263

Email: support@arewindtowers.com

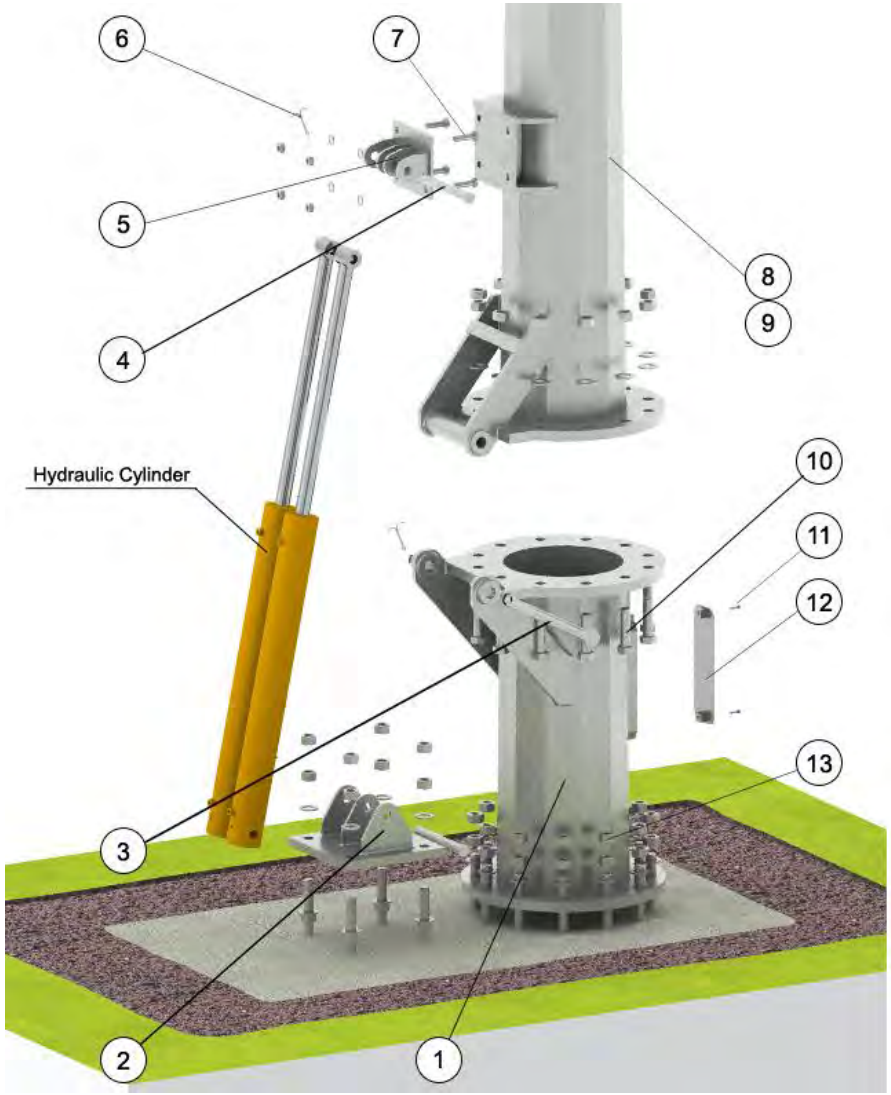
Table of Contents

Section I: Introduction & Safety Guidelines

Read these instructions in their entirety before assembling or attempting to use the Hydraulic RAM Pole System:

- This manual only covers the key points (primary procedures) for installation and use. Please contact American Resource & Energy for assistance with the pole system. Information regarding foundation, hydraulic system, and wind turbine have been included in this manual for reference, however ARE does not supply these components. Please contact applicable vendor for any questions or technical support.
- **WARNING:** Property damage, serious injury or death may result from improper use. Therefore, it is highly recommended that the tower and raising/lowering system be installed and operated by trained professionals.
- Operators must wear head protection and take all adequate safety protection measures during installation and use.
- Keep work area clean and organized to prevent trip hazards.
- **NEVER** stand or walk underneath the pole as it is being raised or lowered.
- Check for damage prior to each use. Replace or repair damaged or worn parts immediately, per manufacturers recommendations.
- The operator must be observant of any unusual sounds, vibrations or erratic system behavior during normal operating conditions. If any of the aforementioned is observed, STOP **IMMEDIATELY** and assess the situation. Contact ARE for further assistance with any pole related issues. Contact your seller or manufacturer for assistance with the pole foundation, wind turbine, hydraulic RAM cylinders, or powerpack.
- Design specifications and local ordinances must be complied with when construction or erection of free-standing objects is planned.
- Planning and determination of clearance distances to ensure proper space for raising and lowering the pole system must be performed prior to installation.
- Pole system **MUST NOT** be installed near power transmission lines.
- Earth grounding **MUST** be installed on all ARE pole systems. Refer to the ARE Pole Grounding Document in the Reference Materials Section of this manual.
- ARE pole systems **MUST NOT** be installed, assembled or handled during severe weather conditions, especially during electrical storm activity. Remember, lightning can travel several miles from the storm cloud.
- Maximum allowable wind speed during installation or maintenance is
- 17m/s (38 mph)
- Use caution and common sense when using this product, as it is nearly impossible to cover all possible conditions and scenarios that may occur. **SAFETY FIRST!**

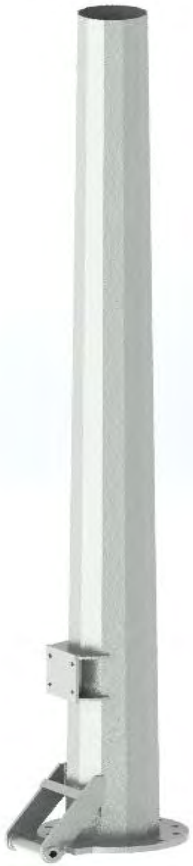
Section I: Bill of Materials
Hydraulic RAM Pole Assembly



#	DESCRIPTION	QTY
1	Base Pedestal	1
2	Foundation Mounting Bracket	1
3	Hinge Clevis Pin	1
4	Mounting Bracket Clevis Pin	2
5	Pole Mounting Bracket	1
6	Cotter Pin	3
7	Pole Mounting Bracket Bolt Set M20x70	4
8	Pole Section A	1
9	Upper Pole Sections – Not Pictured (Refer to tower design for pole section quantities)	*
10	Flange Connecting Bolt Set M33x125	*
11	Socket Head Cap Screw M8x30	2
12	Handhole Cover	1
13	Anchor Bolt Set M33	*
	Hydraulic RAM System (Not Supplied by ARE)	2
	Base Mount Jacking Bracket Kit	1
* Please refer to tower drawing for specific part quantities		

Section I:
Pole Components

1X
Pole Section B (C, D, E…)*



1X
Pole Section A

1X
Base Pedestal

1X
M36x660
Hinge Clevis Pin

1X
Hinge Cotter Pin

2X
Socket Head Cap Screw

1X
Handhole Cover

2X
Template
(Number of holes may vary depending on tower design)

M33 Anchor Rod*

M33x125x70
Flange Connecting Bolt*

M33 Washer*

M33 Nut
(Un-galvanized)*

*** REFER TO TOWER DRAWING FOR INDIVIDUAL PART QUANTITIES**

Section I:
Installation Components

Erection Kit Components

4X
M20x70x45
Pole Mounting Bracket Bolt

4X
M20 Washer

4X
M20 Nut

2X
Mounting Bracket Cotter Pin

1X
Pole Mounting Bracket

2X
Mounting Bracket Clevis Pin

1X
Foundation Mounting Bracket

Base Mount Jacking Bracket Components

1X
M24x160x80 Bolt

2X
Spacer

6X
M24 Washer

3X
M24 Nut

2X
M24x300x100 Bolt

1X
3.2t Grip Hoist
(With 30m Cable)

2X
Cleat Heel

4X
Leg

2X
Shim Washer

1X
Link

RAM & Powerpack

NOTE:

- THE RAM CYLINDERS SHOULD BE USED WITH SUITABLE OVERCENTER AND ANTI-BURST VALVE.
- A SUITABLE HYDRAULIC POWERPACK AND ASSOCIATED HOSES AND FITTINGS WILL BE REQUIRED
- POWERPACK: INTERFLUID G420
- (MINIMUM SPEC. OF POWERPACK - 13L / MIN @ 210 BAR)

2X
Interfluid Hydraulic Cylinder
HFR6500900 RAMS

Section II:
Equipment Recommendations

1. Some heavy equipment will be required to unload, handle and position pole systems. Compliance with federal, state, provincial or local laws and regulations is required when utilizing heavy equipment. Only experienced professionals should operate heavy equipment.

2. The following list is not all-inclusive as other equipment or tools may be necessary during installation and use of the pole system.

List of Recommended Equipment & Tools

1	Forklift or other suitable lifting equipment (capable of lifting pole system to be erected)
A/R	Sawhorses (or other suitable support device) to support pole sections during horizontal assembly
A/R	Lift straps
1	Socket wrench set
Min. 1	Crescent wrench, min. jaw opening of 55mm, (1-3/4”)
Min. 1	Open or box end wrench (to fit anchor & leveling nuts) 55mm
1	Open end torque wrench, (sized to fit anchor & leveling nuts) 55mm
A/R	Screwdrivers - Flat-head & Phillips
Min. 1	Large pliers or channel locks
1	Sledge hammer

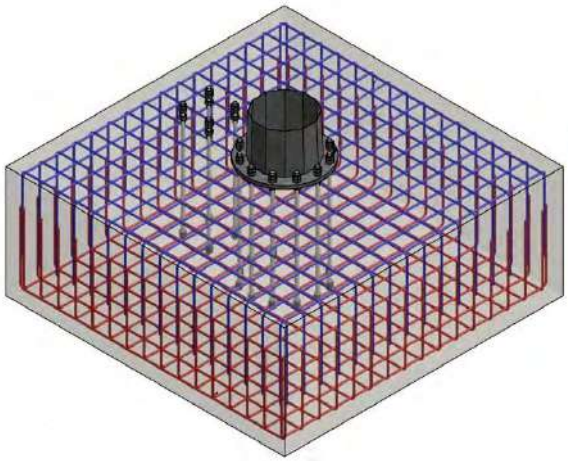
Section II:
Site Preparations

A. Determining the appropriate site is of the utmost importance. Clearances from utility lines, vegetation and structures must be taken into consideration prior to site preparation. Determine the right installation direction and ensure there is enough space for the lifting and lowering of the pole.

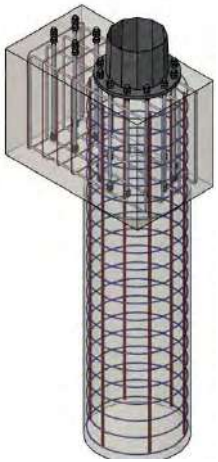
B. Foundations should be designed, formed and poured by experienced professionals. All loads based on local conditions must be taken into consideration.

C. If the pole sections are set directly on the ground prior to install, rocks and other material can puncture the protective wrapping and scratch the surface. Use wooden sawhorses, pallets or other non-abrasive props.

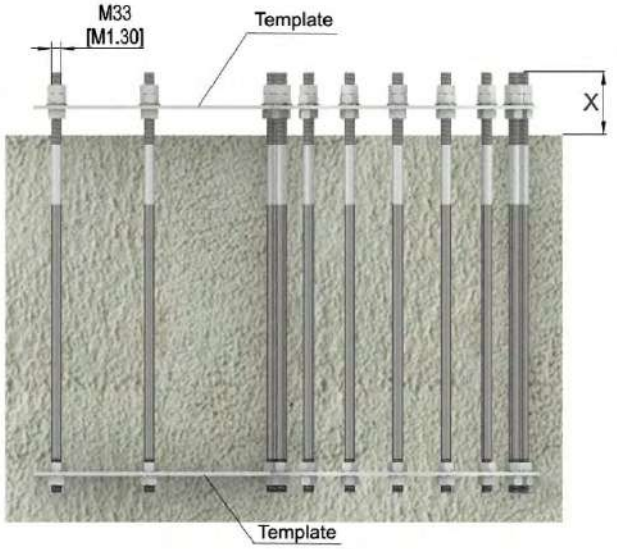
Section II:
Foundation Information



Pad Foundation



Pier Foundation



Anchor Bolts Cage - (Figure A)

1. Contact ARE for standardized third-party engineered foundation designs. For site-specific foundation requirements (if applicable) seek assistance from ARE prior to start-up phases.

2. Provide all utility access through foundation, to include but not limited to, power transmission, coaxial cables, control wiring and/or whatever else will be required by equipment to be mounted.

3. Projection of anchor bolts should allow for the thickness of base plate and nuts (including leveling nuts). Minimum/Maximum anchor bolt projection above concrete (dimension X in Figure A) can be found in tower and foundation drawing.

4. Required cure time shall be applied to the concrete foundation prior to the installation of the pole system.

5. After concrete pad has cured and prior to pole and hydraulic RAM installation, remove upper anchor bolt template. Galvanized nuts and washers will be reused for pole installation.

Section III:
Installing Base Pedestal

Figure No. 1

Figure No. 2

Figure No. 3

A. Adjust leveling nuts to create a level surface for the base pedestal to rest on. (Figure No. 1)

B. Measure to make sure that the distance from the top of the leveling nut's washer to the top of the concrete is no greater than 65mm. (Figure No. 2)

C. Position lifting straps appropriately on the base pedestal. Using a forklift or other appropriate lifting equipment, lift and place the base pedestal on the foundation anchor bolts, ensuring the hinge is facing the foundation mounting bracket anchor bolts. (Figure No. 3)

D. Level the base pedestal as needed and secure in place with galvanized M33 nuts and washers. (Figure No. 4)

Figure No. 4

Section III:
Installing RAM Cylinders

A. Adjust the leveling nuts to create a level surface for the foundation mounting bracket to rest on. Measure to make sure that the distance from the top of the leveling nut washer to the top of the concrete pad is no greater than 65mm.

B. Place the foundation mounting bracket on the anchor bolts and secure with M33 nuts and washers. (Figure No. 5) Use a level to make sure that the bottom of the foundation mounting bracket and the bottom of the base pedestal lie on the same horizontal plane.

C. Attach the bottom of the hydraulic RAM cylinders to the foundation mounting bracket using a mounting bracket clevis pin. Insert a cotter pin through the hole in the end of the clevis pin to secure. (Figure No. 6)

D. Attach the pole mounting bracket to the upper end of the hydraulic cylinders with a mounting bracket clevis pin. Insert a cotter pin through the hole in the end of the clevis pin to secure. (Figure No. 7)

Figure No. 5

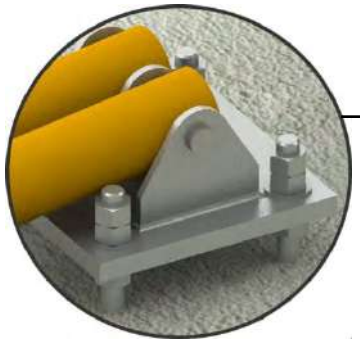
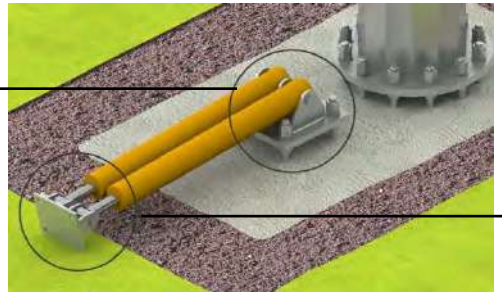


Figure No. 6



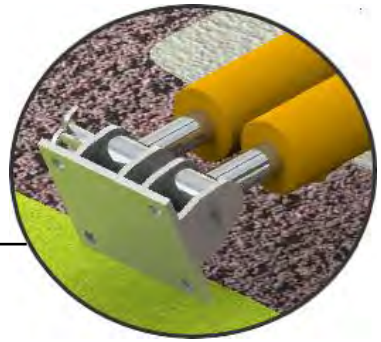


Figure No. 7

Section III:
Assembling Pole Hinge

A. Lift pole section A with a forklift or other appropriate lifting equipment and line up the hinge to the base pedestal. Insert the hinge clevis pin and secure it with a cotter pin. (Figure No. 8)

B. Position suitable support device under the pole section. Using the forklift or other appropriate lifting equipment, lower the pole section to rest on the support. (Figure No. 9) Do not remove straps until the next step (Connecting RAM to Pole) has been completed.

Figure No. 8

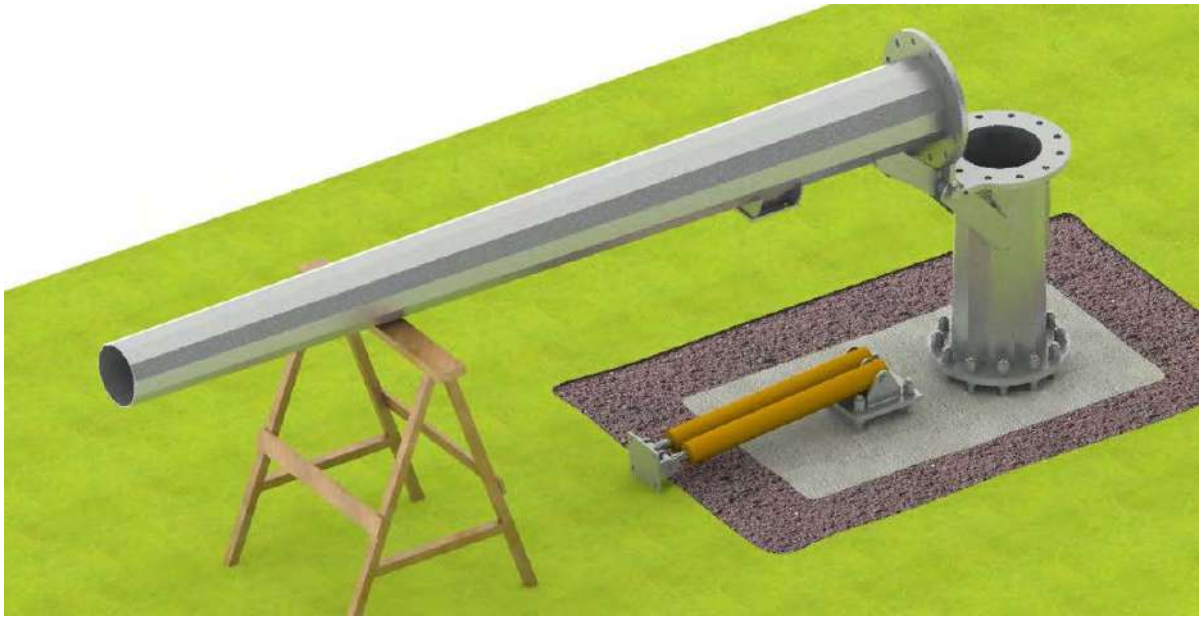


Figure No. 9

Section III:
Connecting RAM to Pole

A. Connect RAM to hydraulic powerpack. Refer to *Interfluid Hydraulic Operating Manual* for specific instructions.

B. Drive the RAM up to meet the pole. Secure the pole mounting bracket to the pole using the M20 bolts, nuts and washers. (Figure No. 10)

C. ARE recommends testing the RAM at this stage of the installation by slowly raising and lowering the pole with the RAM. (Figure No. 11) If any unusual sounds or conditions are noted, immediately raise the forklift or lifting equipment to bear pole weight on the straps. Investigate and correct any problems.
Once testing has been successfully completed, lower the RAM until the sawhorse (or other suitable support device) begins to bear the load of the pole.

Figure No. 10

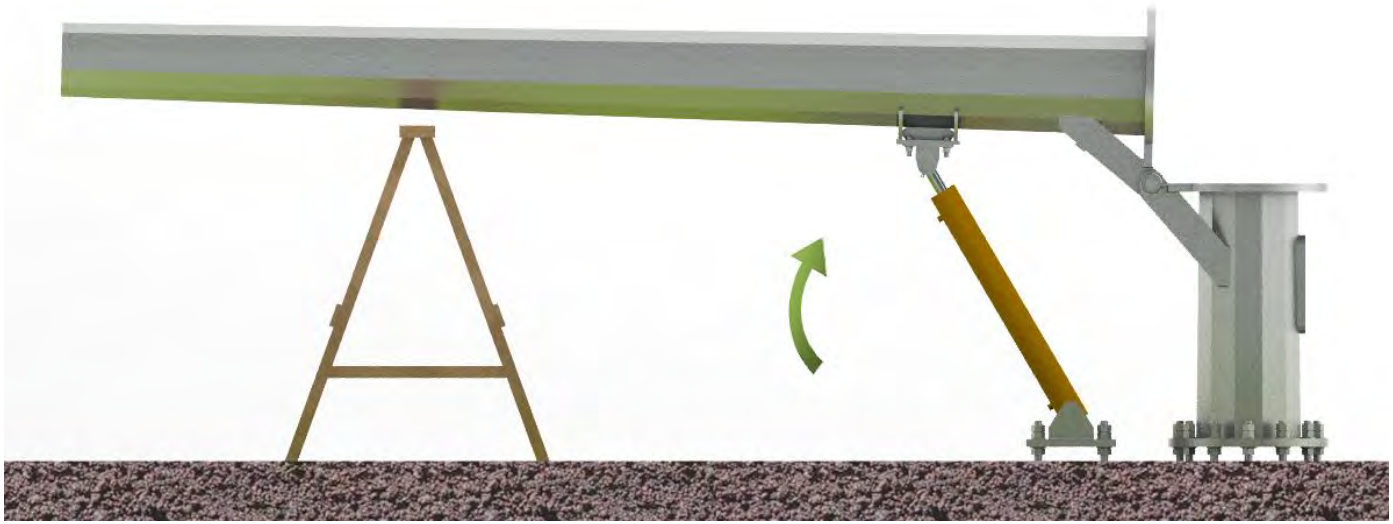


Figure No. 11

Section IV:
Base Mount Jacking Bracket

A. Assemble the base mount jacking bracket installation tool. (Figure No. 12)

B. Using the supplied hardware attach the jacking bracket with grip hoist to the base of pole section A. (Figure No. 13)

C. Grip hoist cable will be fed through the pole to join upper pole sections. (Figure No. 14)

Figure No. 12

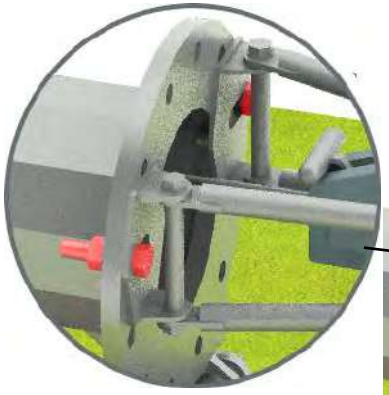


Figure No. 13

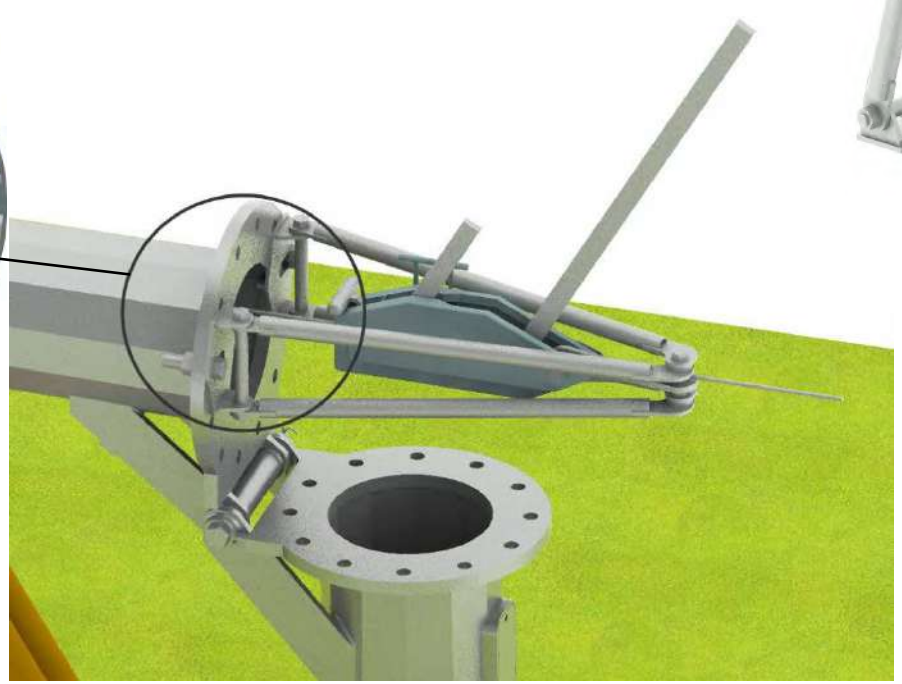


Figure No. 14

Section IV:
Pole Assembly

A. Prepare the remaining pole sections for assembly:
   - Remove any burrs and galvanized coating buildup on the inside of the female end and the outside of the male end.
   - Care should be taken to prevent dirt, stones, etc. from getting trapped between the mating surfaces.
   - Mating surfaces can be lubricated to facilitate slip-joint assembly. Care should be taken not to use a lubricant that will later leak from the joint and stain the pole. Soapy water has been used successfully for this purpose.
   - The minimum slip distance should be marked on the male end of each pole section. Minimum slip distance is 1.5x the diameter of the female end.

B. Using a forklift (or other appropriate lifting equipment), lift pole section B and align female end with pole section A's male end. (Figure No. 15) Each pole section should be lifted or supported at its center of gravity during assembly.

C. While keeping the pole section weight supported by the lifting equipment, align longitudinal seam welds and loosely mate the pole sections together.

D. Feed the grip hoist cable through pole using a cable fishing tool if needed. Secure the top of the cable around a sturdy block wider than the diameter of the pole. (Figure No. 16a) Operate the grip hoist to join the pole sections together, meeting the min. slip distance requirement (Figure No. 16b). A sledge hammer can be used to impact the protected end of the pole in order to tightly seat the pole sections if the minimum slip distance requirement has not been met.

E. Repeat steps B-D with the remaining pole sections until pole is completely assembled.

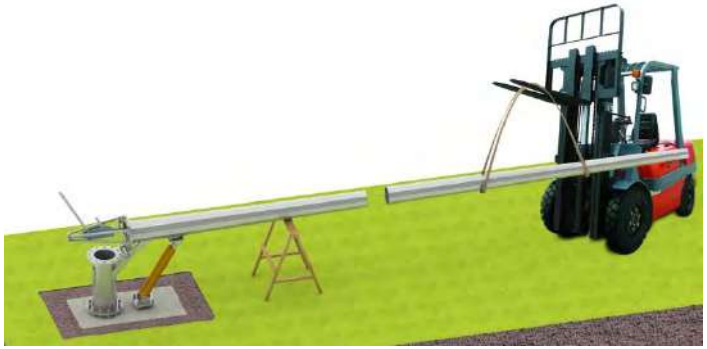


Figure No. 15

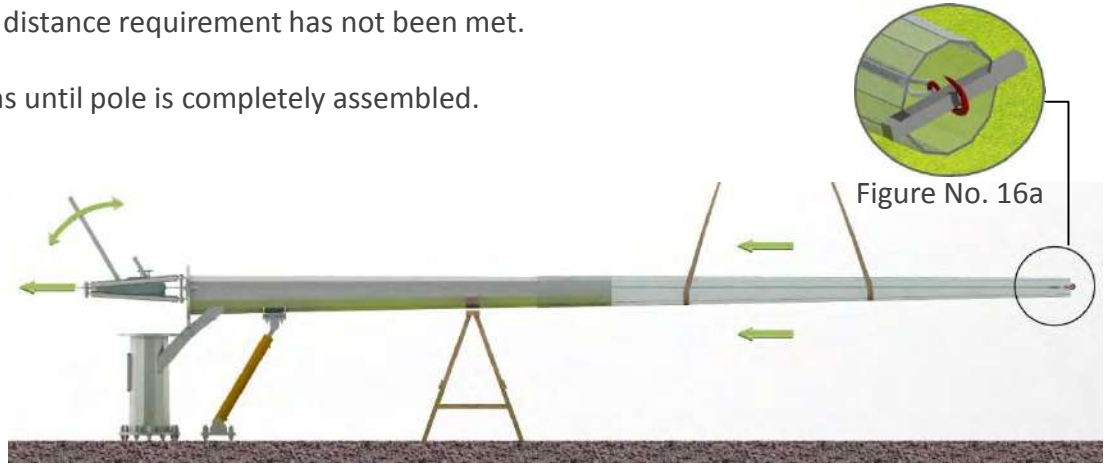


Figure No. 16a

Figure No. 16b

Section V:
Installing the Turbine

A. Install the turbine per turbine manufacturer's instructions.

B. The pole is now ready to be erected. Using the hydraulic controls begin to lift the pole. Ensure the structure lifts as smoothly as possible.

C. Bring the pole to a slow controlled stop and bolt pole section A the base pedestal with M33 bolts, nuts and washers. (Figure No. 17)

D. Remove the RAMS pins and upper and lower RAM brackets. Store the RAM according to manufacturer's specifications.

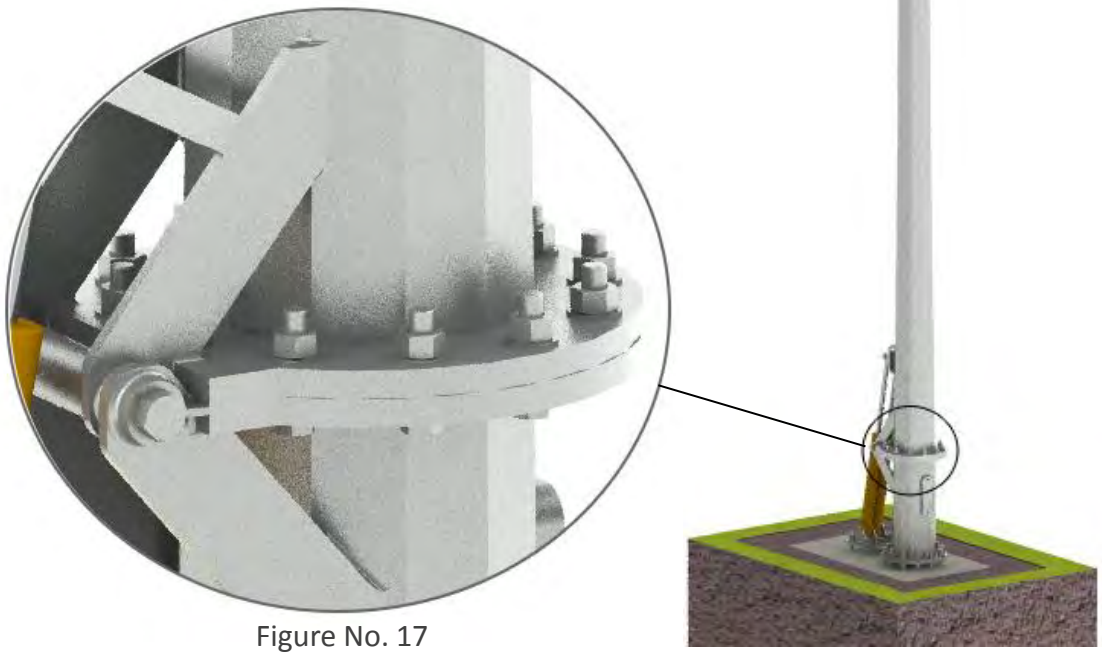
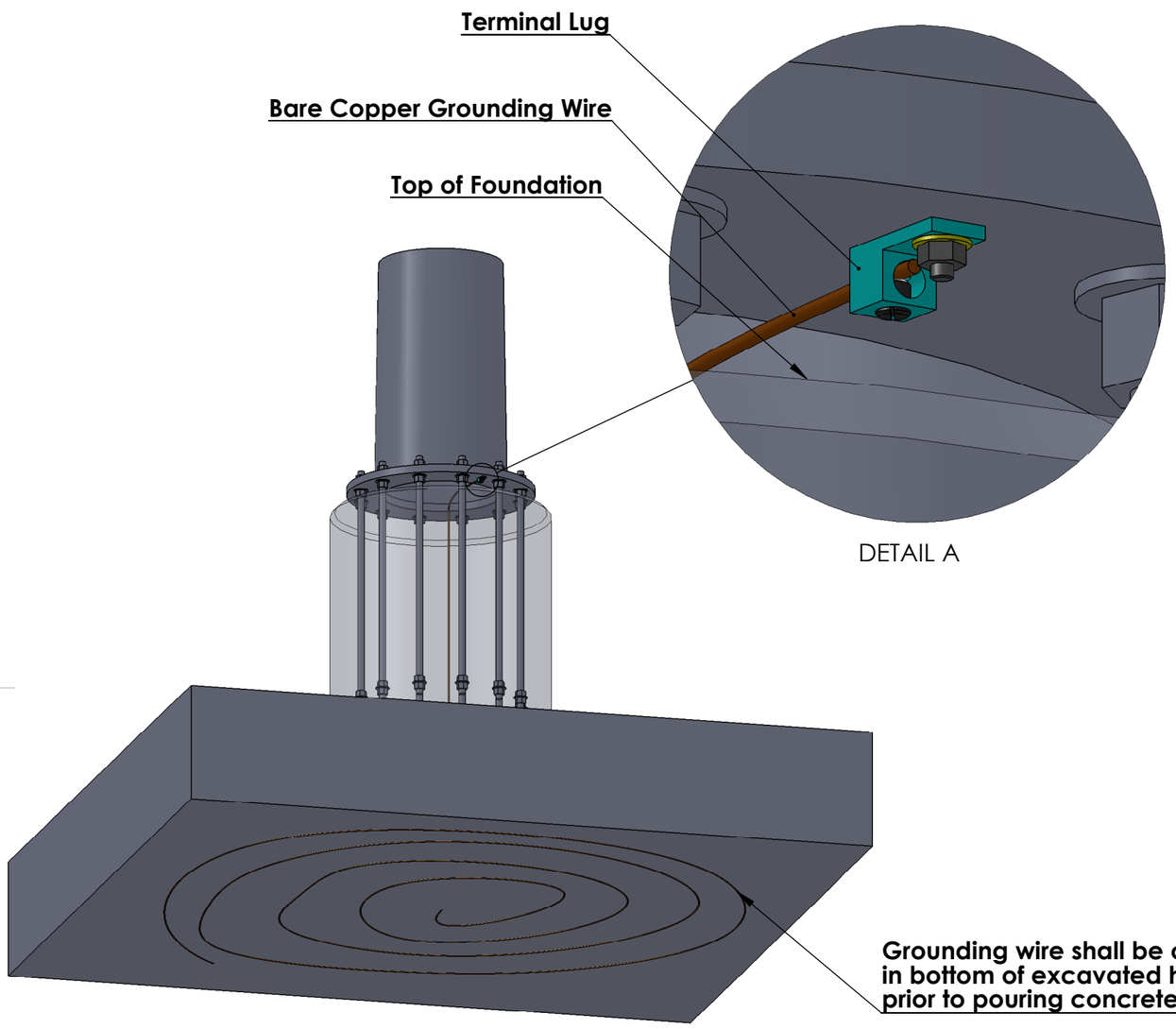
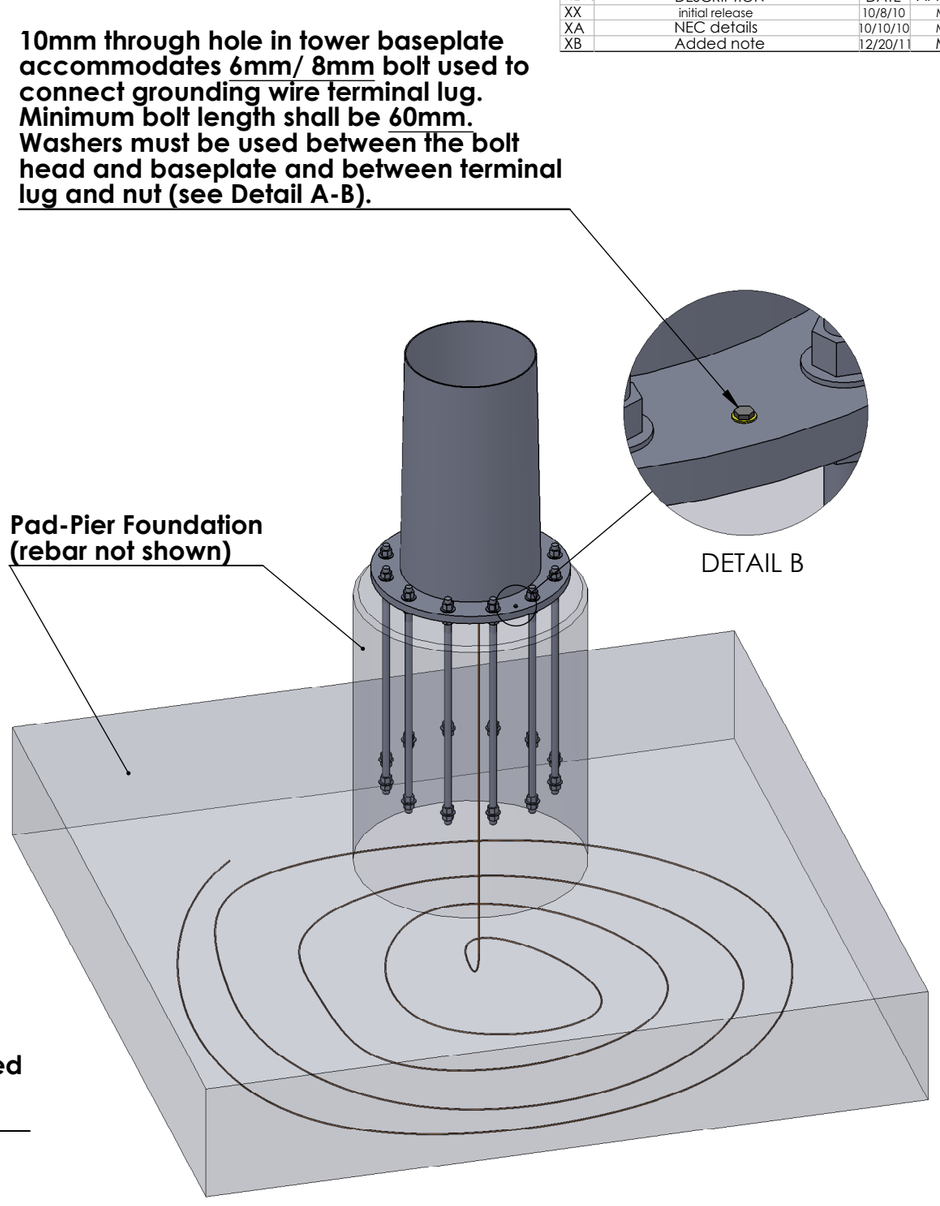


Figure No. 17

Section VI:
Reference Materials

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
XX	initial release	10/8/10	MGC
XA	NEC details	10/10/10	MGC
XB	Added note	12/20/11	MGC





NOTE: **Below are recommendations for grounding ARE monopole towers. Consult your local building authority to verify that grounding is in accordance with all local codes and ordinances.**

- **Minimum diameter of bare solid copper grounding wire shall be 5.5mm (4 AWG).**
- **Minimum length of bare solid copper grounding wire shall be 15m. Insure wire length from top of foundation is sufficient to reach connection on tower baseplate, prior to pouring concrete.**
- **Copper wire shall be tied to steel reinforcing bars (rebar) using steel tie wire or other effective means.**
- **Terminal lug must accommodate 4 AWG or larger grounding wire and must be compatible with galvanized steel to prevent galvanic corrosion.**
- **Tower grounding method shown on this drawing is compliant per NEC 250.52 (3) "Concrete-Encased Electrode."**
- **Grounding method will also work with mat or pier foundations (not shown).**

CAD-generated drawing do not manually update			
Unless otherwise specified dimensions are in mm. Standard M-30 Tolerance apply	APPROVALS	DATE	
	DRAWN MGC	10/8/10	
	CHECKED		
MATERIAL	RESP ENG		
FINISH	MFG ENG		
DO NOT SCALE DRAWING	QUAL ENG		

ARE
American Resource & Energy
413 Wacouta St. Suite #440
St Paul, MN 55101 (651) 330 1263

Tower Grounding

CAD file :

Part #

scale NA | rev. XB | size NA | sheet 1 of 1

Recommended Pretension Torque for Anchor Bolts

Bolt Size	Recommended Torque
M 12 (0.47 in)	60N-m (43lb. ft.)
M 16 (0.63 in)	120N-m (89lb. ft.)
M 20 (0.79 in.)	275N-m (203lb. ft.)
M 24 (0.94 in.)	500N-m (369lb. ft.)
M 27 (1.06 in.)	700N-m (516lb. ft.)
M 30 (1.18 in.)	910N-m (671lb. ft.)
M 33 (1.3 in.) ASTM F1554 GR 55	820N-m (605lb. ft.)
M 36 (1.42 in.)	1320N-m (974lb. ft.)
M 39 (1.54 in)	1600N-m (1180lb. ft.)
M 42 (1.65 in.)	1810N-m (1335lb. ft.)
M 45 (1.77 in)	2100N-m (1549lb. ft.)
M 48 (1.89 in.)	2400N-m (1770lb. ft.)

All bolts are grade 8.8 except for the M33 anchor bolts, which are ASTM F1554 GR 55

If a suitably sized torque wrench is not available the turn-of-nut tightening method may be used. Refer to ARE's "Turn-of-Nut Tightening Guide" for further instructions.