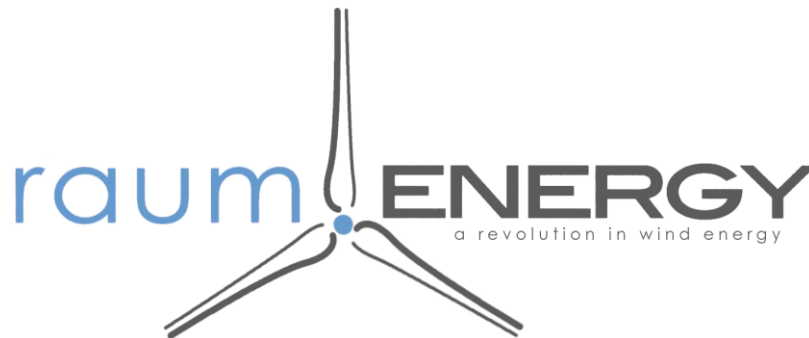
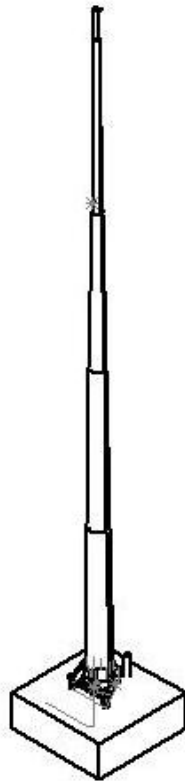


**RAUM ENERGY 15m MONOPOLE TOWER KIT
FOR USE WITH THE
RAUM ENERGY 1.5 kW AND 3.5 kW TURBINES**



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Raum Energy Inc. Proprietary 2011
15m Tower Installation Manual Rev2

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1.0 Important

Read this manual entirely before you start construction of the 49' monopole tower. Failure to accurately follow the steps presented in this manual can result in damage to the foundation, tower and/or turbine.

This manual is written to assist installation of the Raum Energy 49' Monopole Tower. This tower was designed to meet the loading requirements for the Raum Energy 3500 Watt and 1500 Watt wind turbine systems.

The following assumptions were made in design of this tower

- There is no seismic activity
- Max wind speed not to exceed 50 m/s (180 Kph or 111 mph)
- No organic soil or saturated ground under footings. The location must be well drained.
- A licensed and insured professional structural engineer was consulted for your soil type and bearing weight

1.1 Installation Requirements

To assemble this tower the following tools will be required

- Torque Wrench with 10 to 500 ft-lb capacity
- 1 7/8" Wrench
- Loctite

1.2 WARNING

Assembling and lifting a tower can cause injury or death. Carefully read this manual and use safe construction practices. Do not lift tower in winds stronger than 20 kph (12 mph).

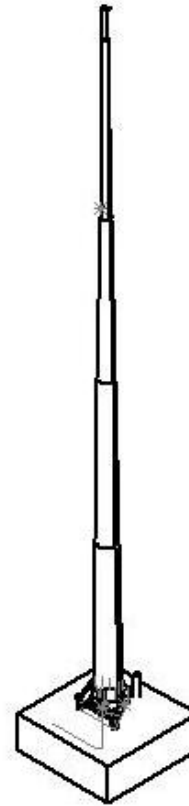
Please read this manual in it's entirety before attempting to erect the tower.

1.3 Introduction

The Raum Energy 15m (49') Monopole Tower consists of 4 sections. Each section is made of a 12 sided 12' polygon which slide into each other in order to construct the tower.

The bottom section, also the largest section, contains a base plate used to pin the tower to the concrete pad designed specifically for this tower. The tower is then constructed on the ground and pulled up using a Raum Energy designed gin pole and a truck.

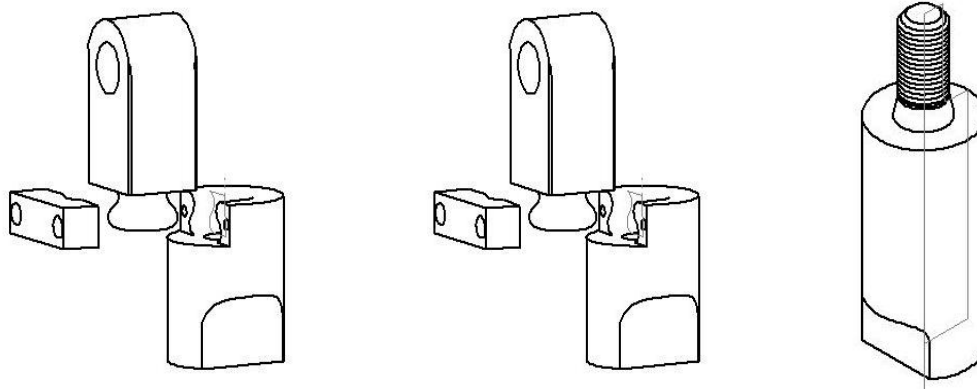
Section 1.4 in this manual gives a detailed parts list of everything included in the Raum Energy monopole kit. Please review this section and assure that all parts are included in the kit before starting the tower installation.



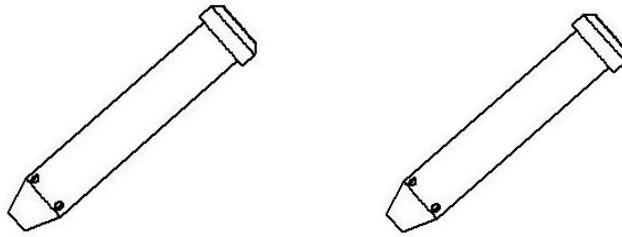
1.4 Monopole Kit Parts List

Please review this section to assure all parts are included in the Raum Energy Monopole kit. Items include,

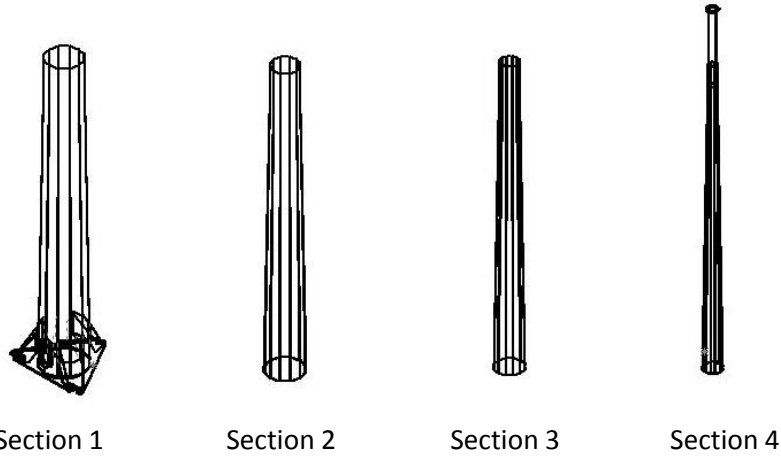
1. A qty of two Adjustable hinge assemblies, and one adjustable anchor



2. Two 1.25 " Hinge pins



3. One of each of the 4 Tower Sections



4. One Tower Access Cap and a plastic electrical box



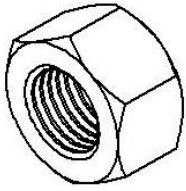
5. And Hardware shown below



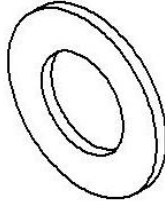
5/16 – 18 X 1.5" Gr 8 Socket
Head Cap Screw,
QTY = 4



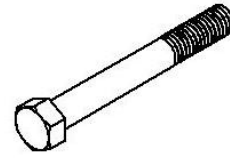
Cotterpin, QTY = 2



1.25" UNC Hex
Nut,
QTY = 1



1.25" Flat Washer,
QTY = 1

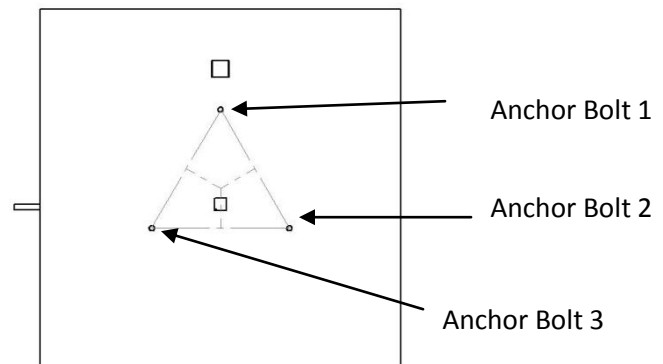
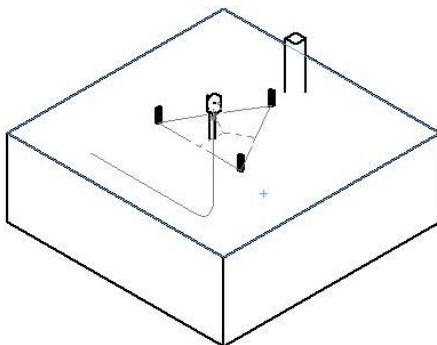


3/8" - 16 X 3" Bolt
QTY = 1

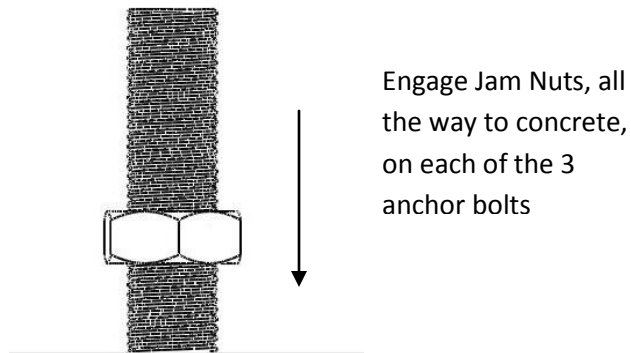
2.0 Attaching the Hinge and Anchor Feet

Before you begin assembling the tower, the foundation should already be completed. There are no instructions for the foundation construction in this manual, that information can be found in the Raum Energy Monopole Tower foundation construction manual.

Thus, assuming the reader has completed foundation construction, this manual shall start with the foundation below. **The anchor bolts must be 32" from each other center-to-center.** The anchor bolts are numbered 1, 2 and 3 for future reference.

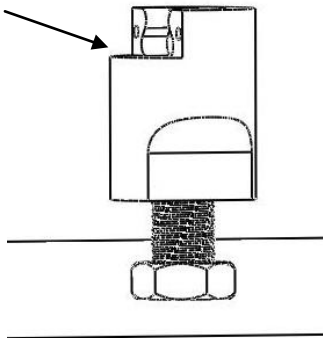


Step 1: Attach the adjustable hinge feet to anchor bolt 2 and 3. To do this first engage the 2 - 1.25" Jam Nuts onto all three anchor bolts, engaging all the way to the concrete.

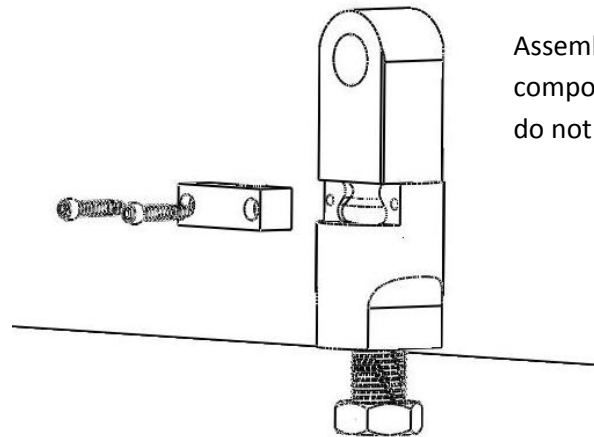


To attach the adjustable hinge feet, engage the bottom half of each foot fully onto anchor bolts 2 and 3, then assemble the other pieces of the hinge assembly using 2 5/16 – 18 X 1.5" socket head cap screws. Tighten the cap screws so that the top assembly part can still be adjusted, these cap screws will be torqued later.

Fully engage foot onto anchor bolt so it is flush

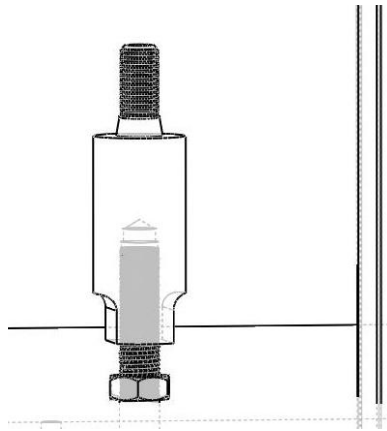


Assemble other components, but do not tighten yet



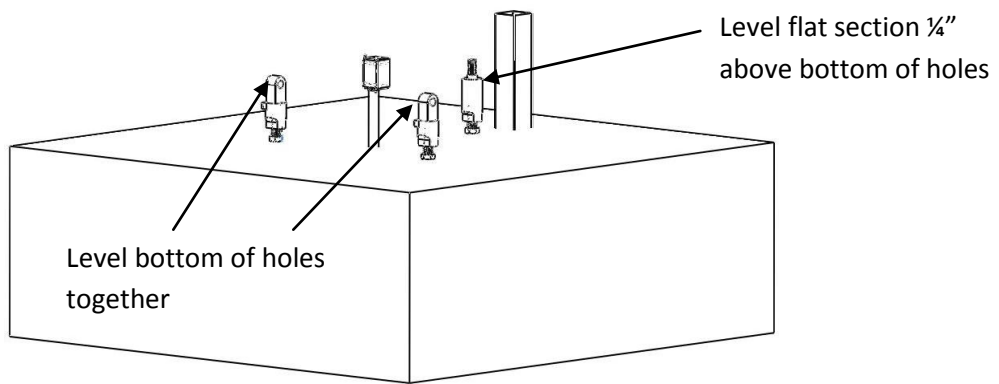
The two adjustable hinge feet should be relatively level, with the holes for the hinge pins facing each other. The cap screws and jam nuts are not to be torqued until after the tower is stood upright.

Step 2: Attach the adjustable anchor. The 1.25" jam nut should be engaged down to the concrete on anchor bolt 1. The adjustable anchor is then fully engaged on the anchor bolt also.



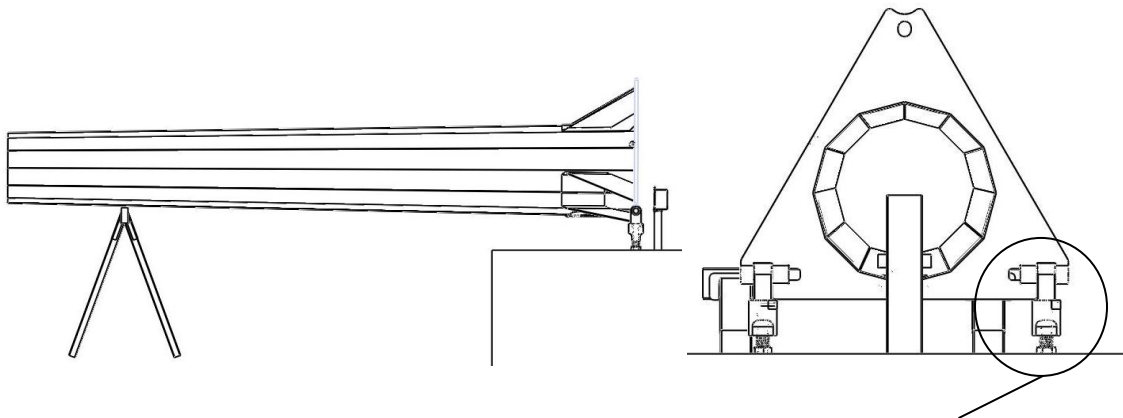
Jam nut engaged to concrete, adjustable anchor fully engaged

The foundation should now have all three hinge/ and anchor supports attached and ready for the tower.



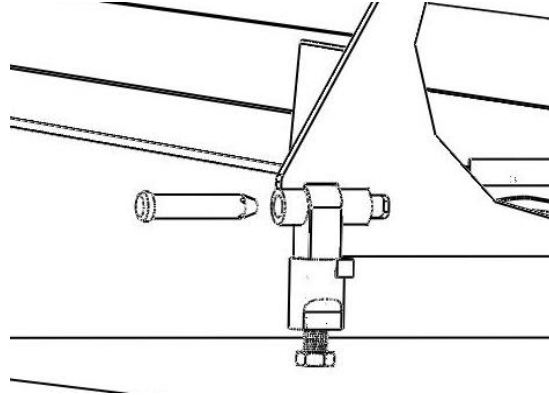
2.1 Tower Section 1

Step 3: Next, tower section 1 is placed over the two adjustable hinges, this is done by lining up the adjustable hinges with the two sets of bushings on the tower sections base plate.

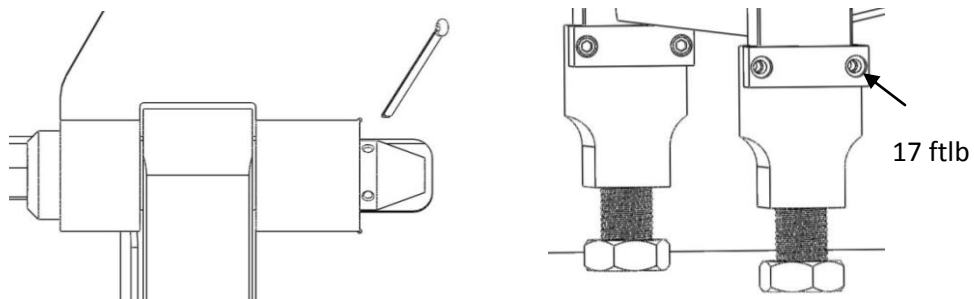


Bushings on base rest on adjustable hinge

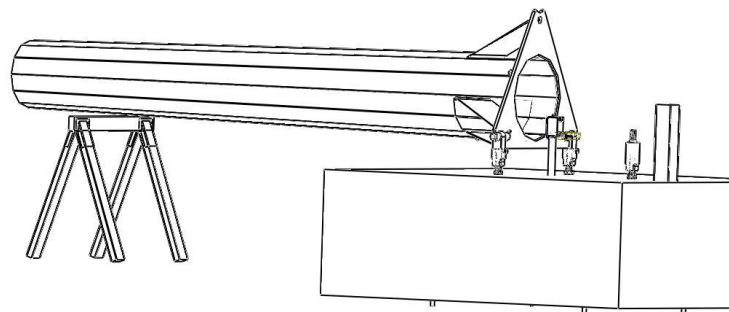
The bushings are aligned with the adjustable hinge feet so that 1.25" hinge pins can be knocked through. Some adjustment of the hinge feet might be necessary to accomplish this. The pins can be knocked in with a mallet or sledge hammer. Use lubricant to aid in hammering the pins through.



Once the two pins are in, cotterpins should be placed through the holes at the end of the pins. The cotterpins need to be bent once through the pins, failure to do this could cause the pin to vibrate out of its seat. The 5/16" socket cap screws in the adjustable anchors should now also be tightened.

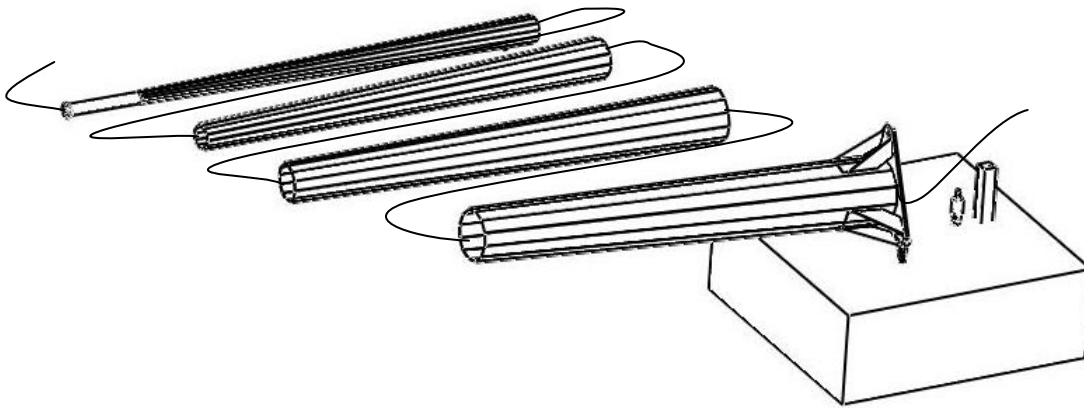


Tower section 1 is now attached, the next three tower sections are ready to be assembled.

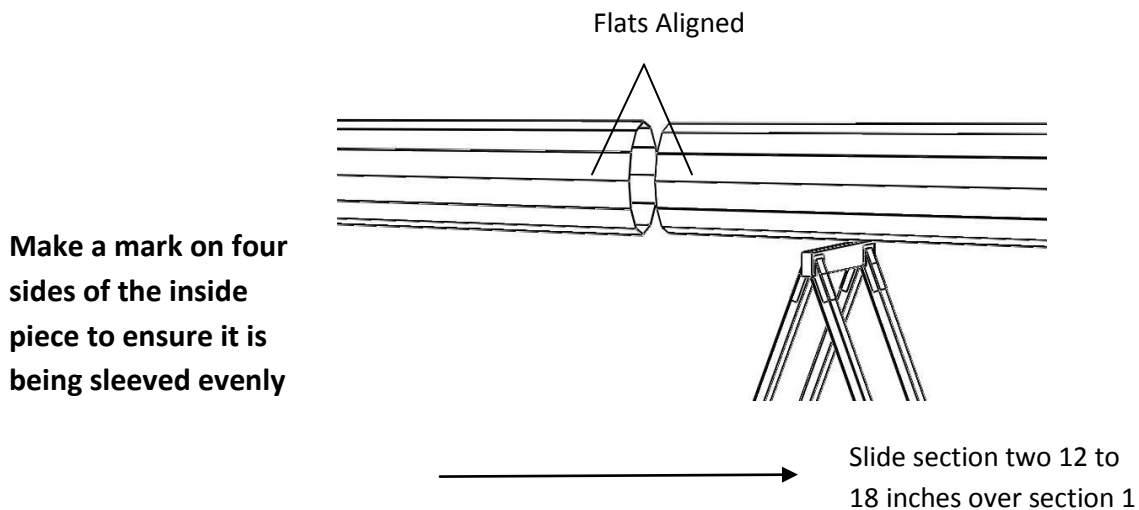


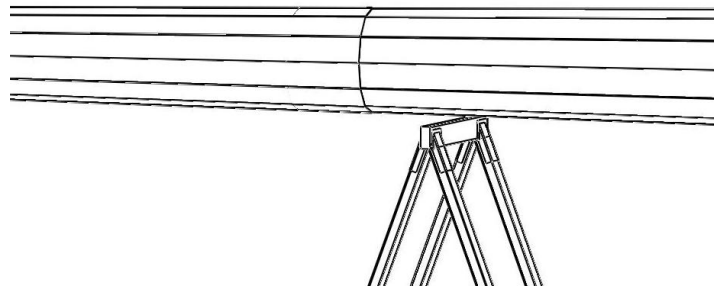
2.2 Top three Tower Sections

Step 4: Before each section of tower is attached, it is beneficial to fish a rope through each section separately. It is difficult to fish the turbine cable through the tower once fully assembled however by tying the cable to a rope that was previously through the tower it can be done more easily.

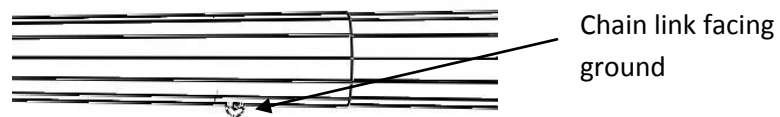


Step 5: Tower sections 2, 3 and 4 are next assembled by sliding each tower onto one another. To begin, first notice that the bottom end of section 2 is larger than the top of section 1. By aligning the welds of each section, the top of section 1 should slip approximately 15" inches into section 2.





To assure that the towers are fully connected place a 4 X 4 across the end of section 2 and hit it with a hammer until section 2 is sufficiently tight. Repeat this process for sections 3 and 4 until each all sections are connected. When connecting tower 4, assure that the half chain link welded to the tower is facing the ground.



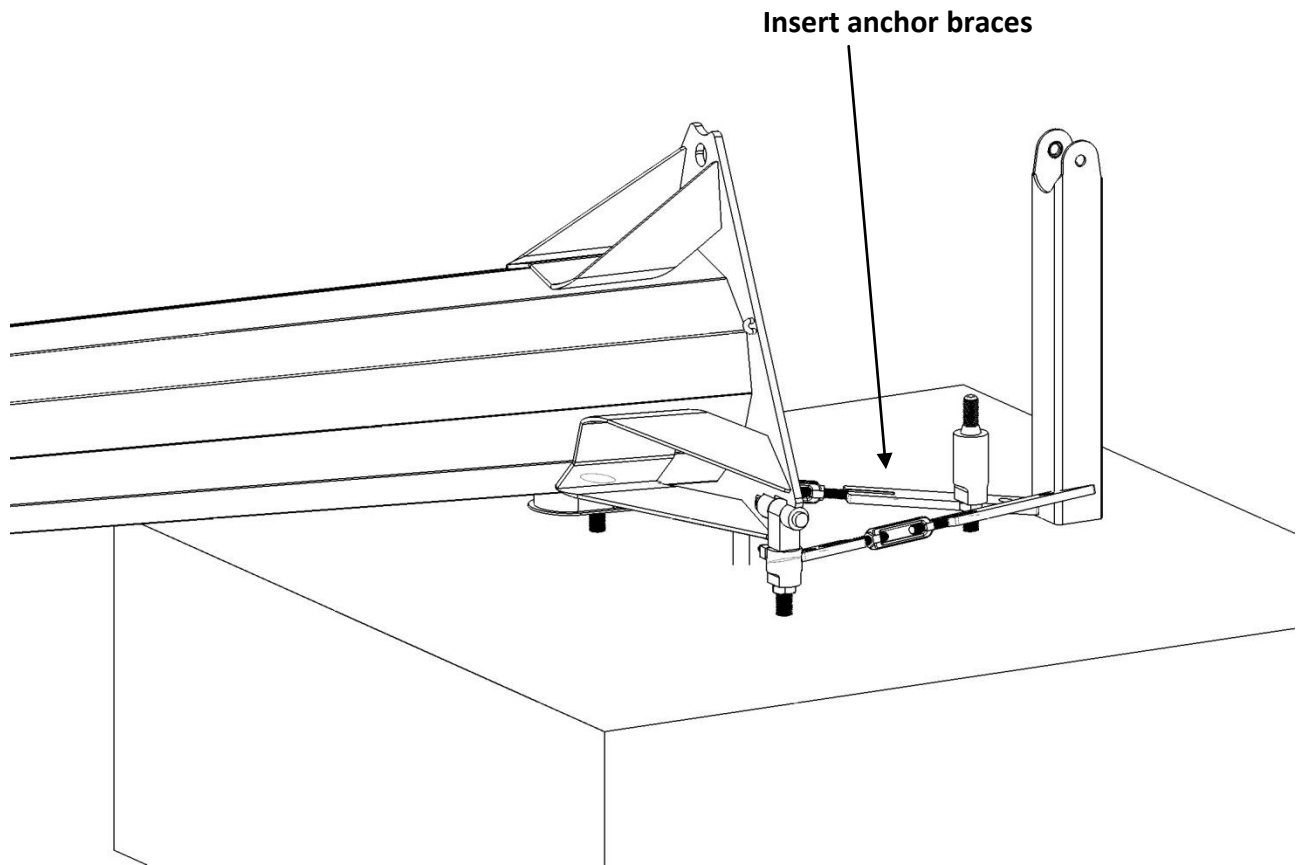
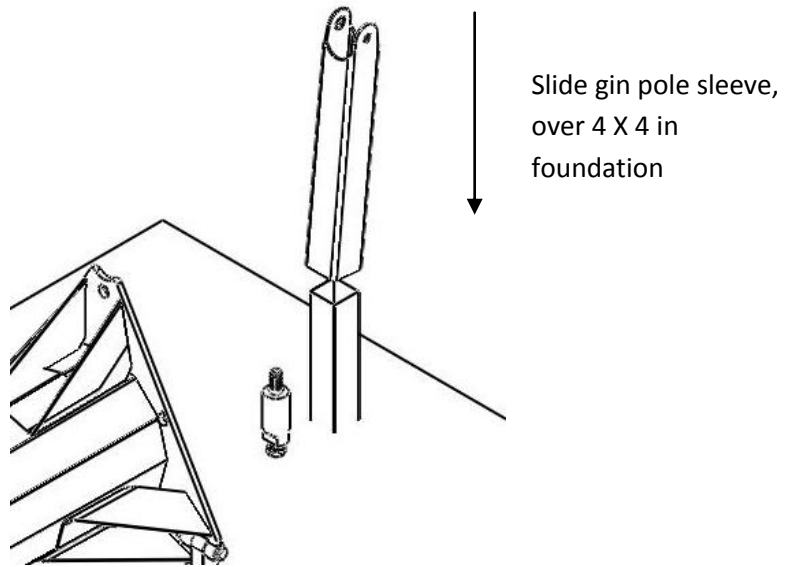
When complete, the four sections of tower should look similar to the below figure.



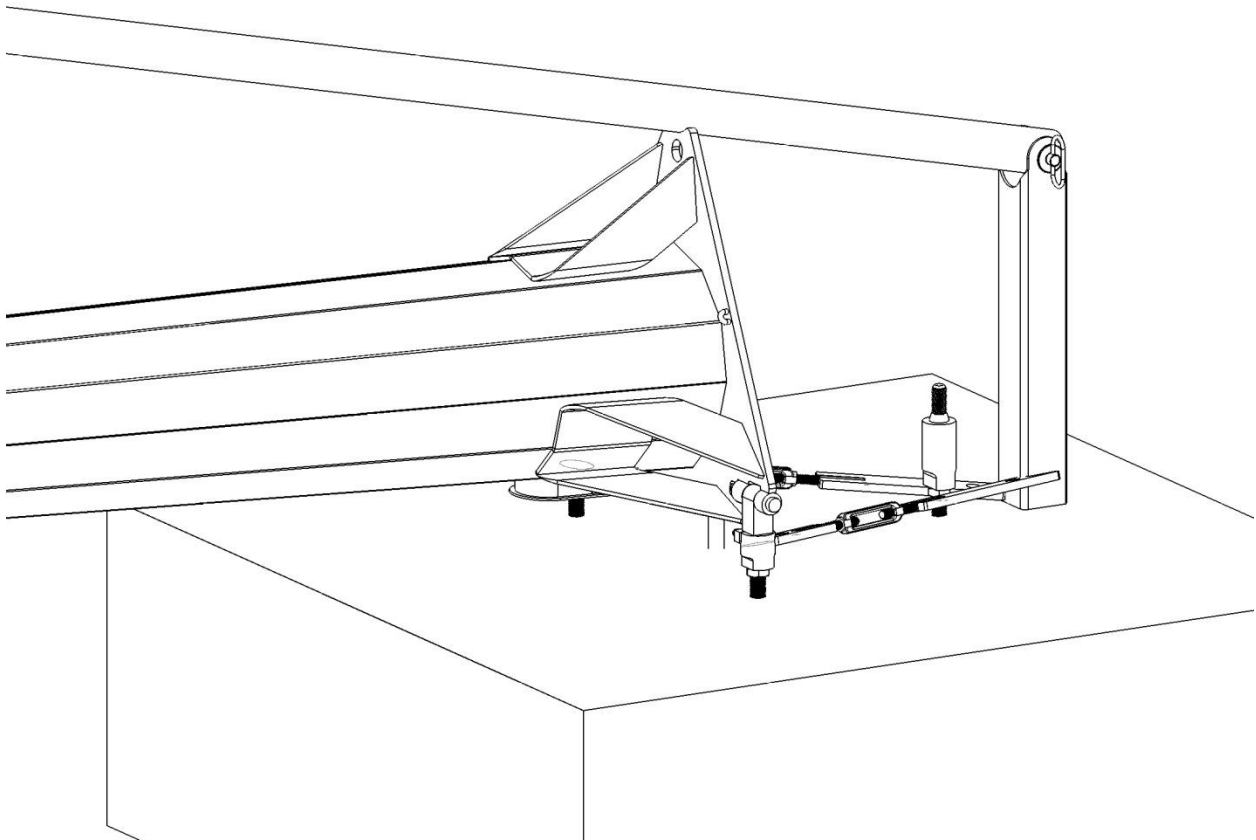
2.3 Attaching the Gin Pole

Step 6: The complete Raum Energy gin pole assembly can be found in the gin pole assembly manual, and thus detailed assembly guide is not included in this manual.

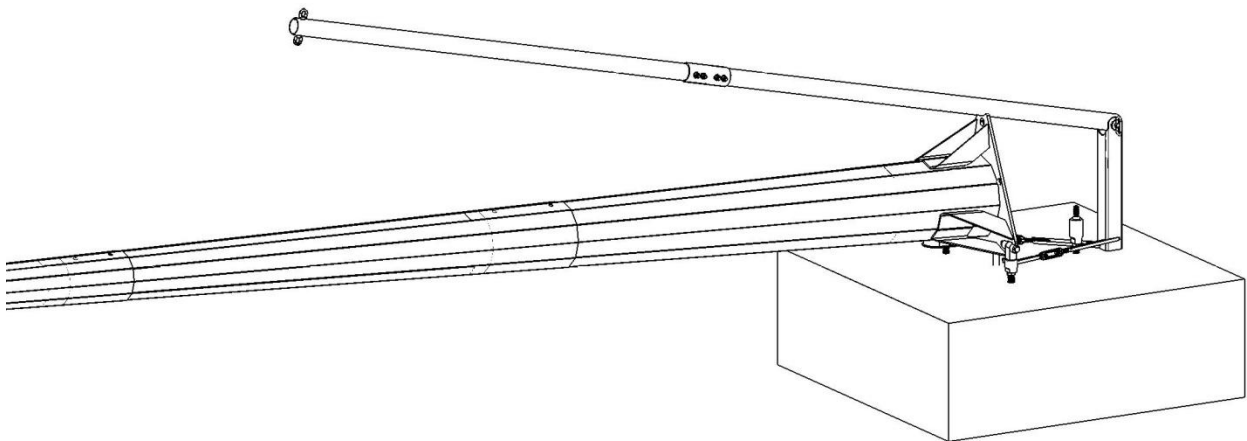
The gin pole can now be attached to the 4 X 4 built into the foundation,



The gin pole is then pinned to the sleeve assembly using the hitch pin and sleeve included in the Raum Energy gin pole package.

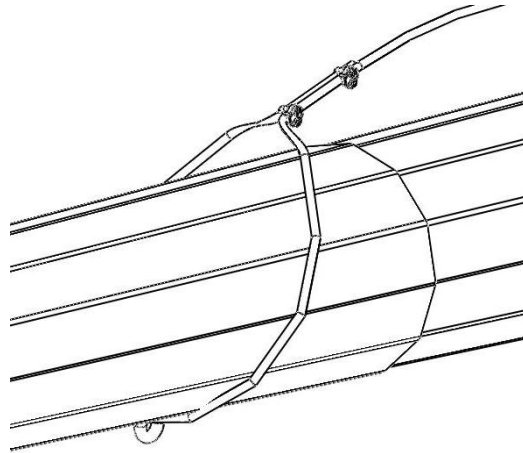


The gin pole should then be set over top of the monopole tower. There is a slot in the base plate which fits the Raum Energy gin pole.

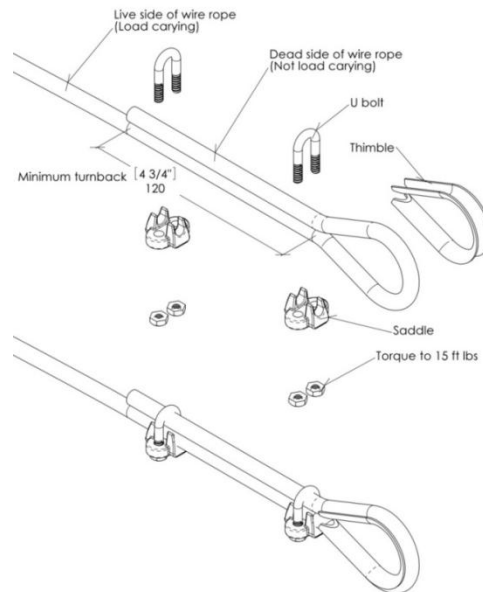


2.4 Tying the Wire Rope

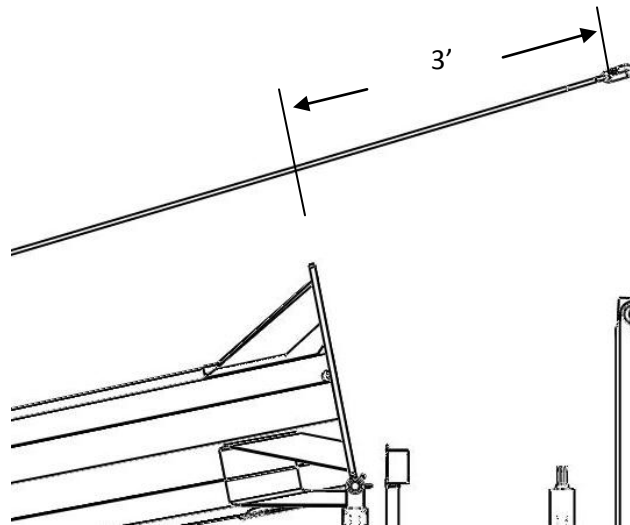
Step 7: The first wire rope is attached to the monopole by first looping the wire rope through the chain link in tower section 4 and around the tower. Notice that the rope is straddled around the tower so that when the tower is lifted all the load goes through the tower instead of on the chain link.



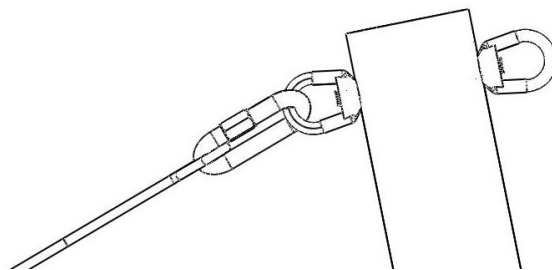
Note, to tie the guy wires around the tower, the thimble is first placed on either the eye nut or tower mast plate. The wire rope is then folded over the thimble with a minimum of 4 3/4" (120mm) of turnback. There will of course be a lot more turnback when tying around a tower, however should be careful when tying around an eyebolt or other lift device. Crosby clips are then placed over the folded area of wire rope and torqued to 15ftlbs. The Crosby "saddles" are tightened on the live cable side as shown.



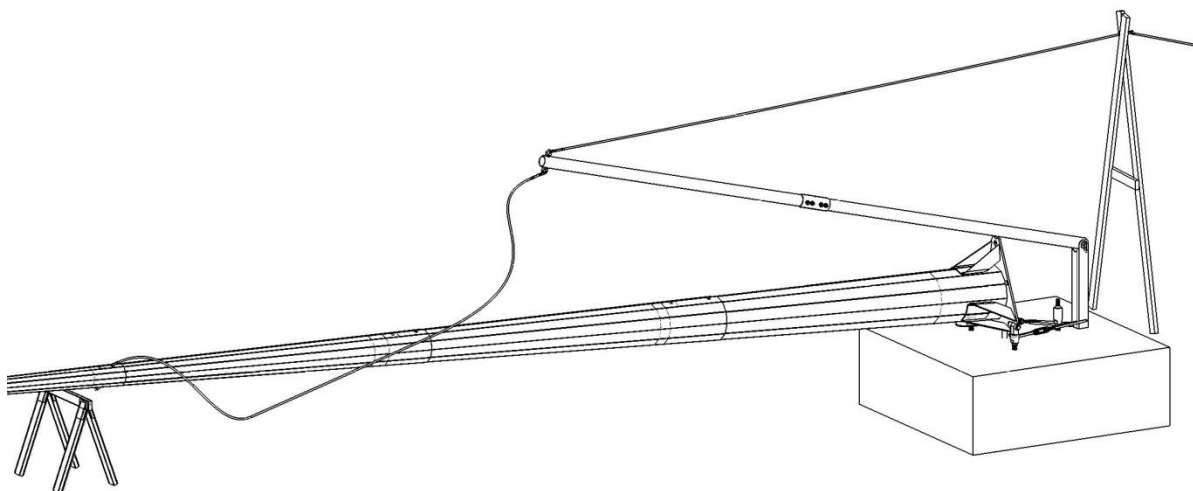
Once the wire rope is tied properly around the tower, the installer should check the length of his/her wire rope by stretching it down the length of the tower. The rope should hang about 3' past the base plate of the tower.



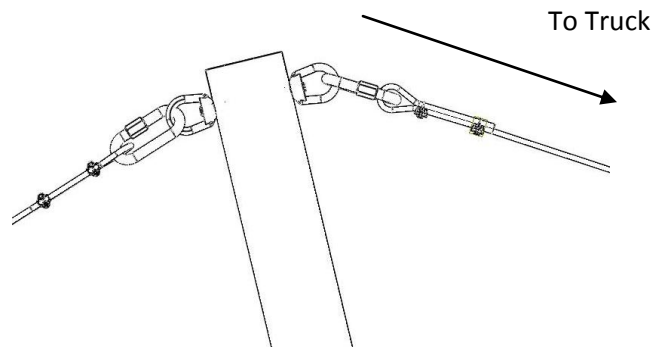
Next, a quick connect chain link is attached to the eye hook on the top of the gin pole facing the tower. Tie the other end of the wire rope connected to the tower to this quick connect.



There should be some lag in the rope after it has been tied on.



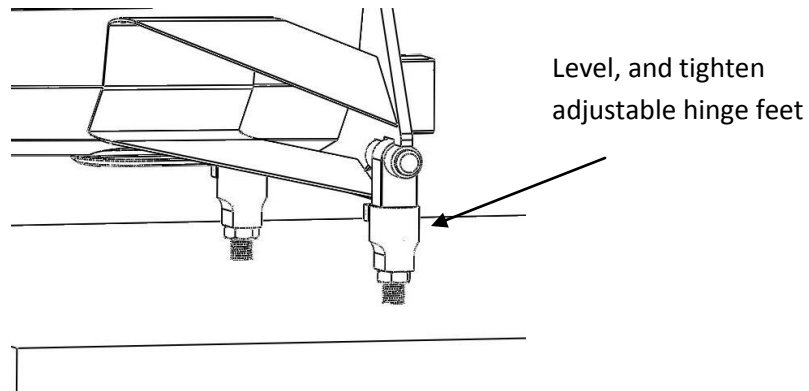
Next a quick connect link is attached to the eye bolt on the other side of the gin pole, and second wire rope attached. The second half of the wire rope extends to the truck.



Once both wire ropes are connected and secure, the installer is ready to raise the tower

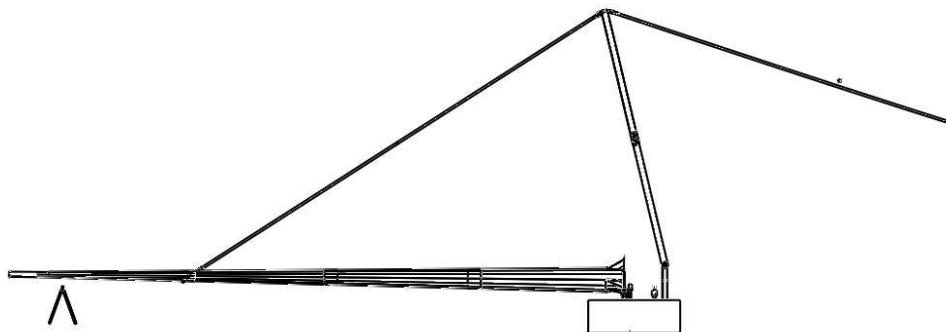
2.5 Lifting the Tower

Step 7: Before lifting the tower, the adjustable hinge feet should be levelled as best as possible, and jam nuts tightened sufficiently. Note that these do not need to be torqued to specification yet (17 ft-lb) as some adjustment may be necessary when lifting the tower.

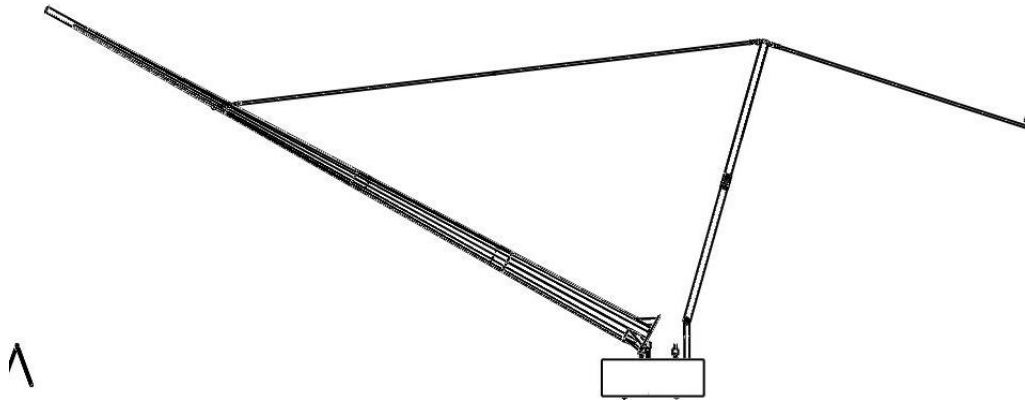


The tower should be blocked so that it is on an angle of at least 5 degrees to begin the lift. Not blocking the tower up could cause excessive stress in the gin pole during lift.

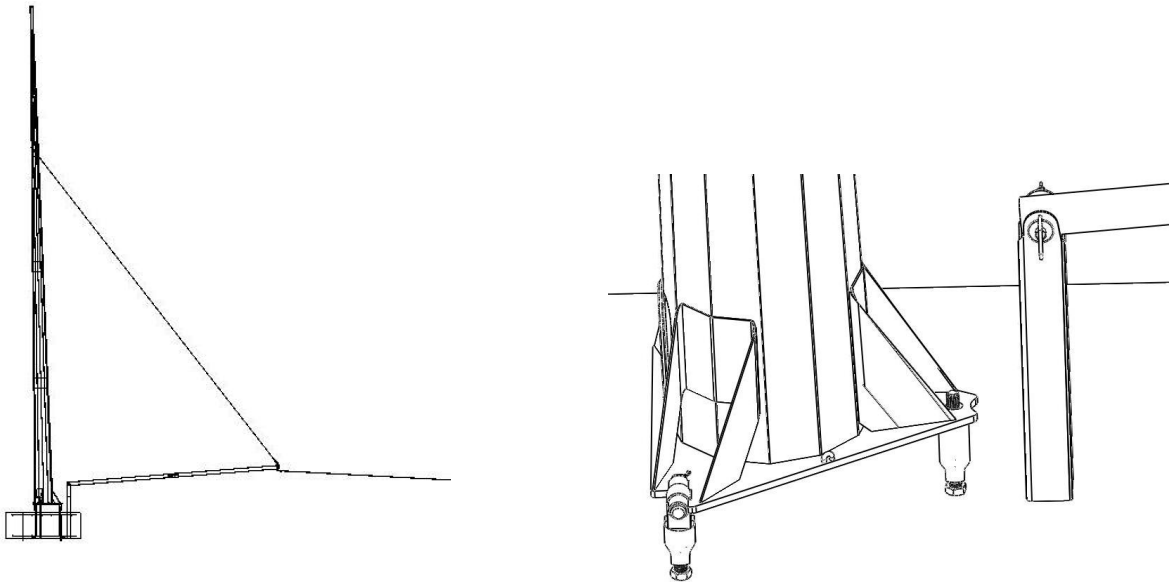
The truck can now be slowly backed up, raising the tower. Note that the tower should be lifted at least once without the turbine attached to assure everything is connected properly without danger of damaging the turbine. The following figures show the steps in raising the tower.



A: The gin pole is lifted from the rest position on the tower and wire ropes become taut, slightly raising the tower from its blocking



B: Gin pole leans over center still raising the tower. The weight of the tower keeps the gin pole from falling



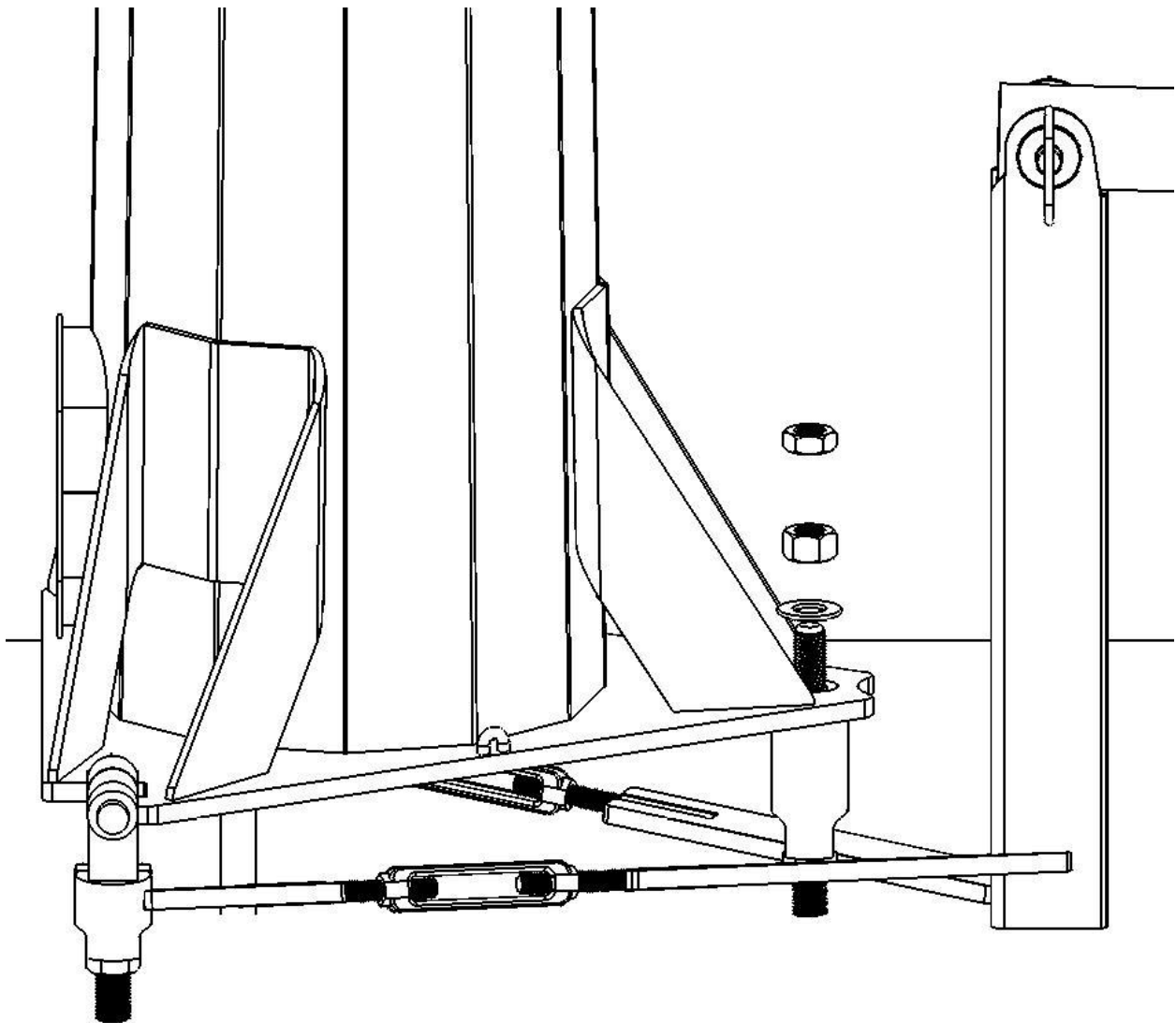
C: Monopole is standing upright and rests on the adjustable anchor

This concludes the tower lift. As long as the initial lift went smoothly, the installer should lower the tower, attach the Raum Energy wind turbine, level and secure the turbine.

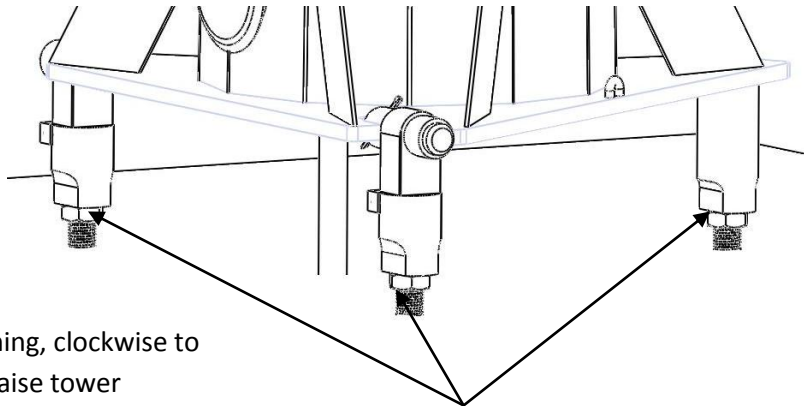
2.6 Leveling and Securing the Tower

Step 8: Once the tower is standing, one can observe whether or not the tower is actually straight. If the tower is not straight, then one can turn the adjustable hinge feet or anchors in order to level the tower. You will note if the tower is not plumb since the turbine will prefer to align in one direction, and even turn backward with oncoming wind if the lean is severe.

To secure the tower in place a 1.25" washer and hex nut are fastened to the adjustable anchor at 500 ft-lbs of torque.



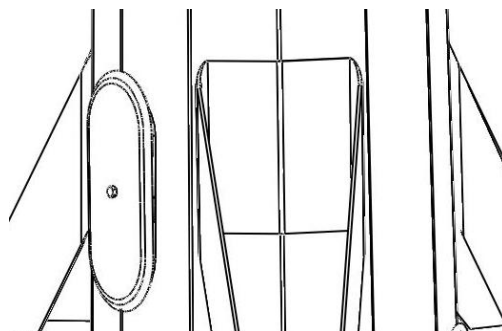
The bottom flats on the anchors are designed to fit a 1 7/8" standard wrench. Once levelled the jam nuts will need to be torque to 500 ft-lbs. **BE SURE NOT TO TURN THE ANCHOR FEET OFF THE ANCHOR BOLTS!! There are only 5" of thread on the anchor bolts.** Only one or two threads either direction on one anchor bolt is usually all that is required.



Adjust tower by turning, clockwise to lower tower, CC to raise tower

Once tower level, tighten all 3 jam nuts to the anchors at 500 ft-lbs of torque

Place the tower access cap on the bottom section of the tower. Fasten the 3/8" bolt so that the access cap is secured.



This concludes the installation process of the Raum Energy Monopole tower. If the tower ever requires lowering, reverse the process by engaging the anchor bolt supports and removing the landing foot nuts

AFTER the gin pole is attached and connected to the lifting vehicle. Use a bottle jack under the base plate to insure the tower has enough lean to get started.

