

# **Installation of Heights Tower Bases and Tower Erection**

## **Threaded Leg Version**

Thank you for choosing a Heights Tower. These are the installation guidelines for installing your free-standing aluminum tower. This installation manual covers stacked towers on Hinged Bases and towers with Fold-Over-Kits. Please read carefully.

### *Tools Needed:*

- Excavation equipment like a small backhoe truck or manually with a shovel.
- Two or three carpenter's levels.
- Combination or ratchet wrenches; bolt-heads require 9/16" or 3/4" sockets.
- hammer and rubber hammer
- Helpful items: a tapered drift-pin for 3/8" and 1/2" holes; rat-tail file(s) also.

### **WARNING:**

Installation of this product near power lines is dangerous. For your safety, follow the installation instructions. Read through these instructions once through completely before planning or beginning any work.

Make sure there are no underground power lines or any phone/cable lines near the sites where you will be digging the foundation hole. If in doubt, call your local utilities companies, and they will check the site for you or recommend someone who can.

DO NOT install, remove or repair this tower at a distance within one and one-half times its height from any electric power lines.

YOU CAN BE KILLED IF THIS PRODUCT COMES NEAR POWER LINES.

## **FOUNDATION INSTALLATION PROCEDURES**

### ***Rebar Caging***

To conform to building codes, we specify rebar caging to be installed inside the perimeters of the footings walls. The specifications for rebar caging are listed in the Footing Design section of your tower's Calculations and it's Concrete Footing Diagram for the tower. We can manufacture a prefabricated cage for your tower, if you do not wish to build your own.

The cage should be centered in the hole and raised up a few inches by propping up the bottom bars with small bricks. There should be at least 3" of clearance between the walls of the excavation and the cage frame.

**Hole Excavation--** Dig the hole size according to the dimensions listed in the calculations. In most cases, the base hole needs to be between 3 and 4 ft. in diameter and from 5' to 12' in depth. These sized

## **Installation of Heights Tower Bases and Tower Erection**

### **Threaded Leg Version**

holes would require from 1.5 to 8 cubic yards of concrete. Concrete is to be 3000# proof or '6 bag' mix.

Our original specs and the illustrations in our brochure show a cylindrical "Sono-tube" tube being installed as forming for the hole. It is not necessary to use a "Sonotube"; you can make a box shaped forming from regular plywood (4' x 8' or similar size). Plywood is usually easier to find and buy, and you can build the excavation into a box form with it. The only disadvantage that a box shape has over a cylindrical shape base is it will require about 20 to 70% more concrete.

Another option is to use no form. This is actually the most desirable option from a building code standpoint, if it can be done. To do this, you should not wait very long after the hole is dug to pour the concrete, so that walls will not loose their shape firmness if it rains or the hole floods.

### **Threaded Anchor Bolts and Hinge Clevises**

It is easiest to assemble the threaded legs and rebar cage together, outside the hole. You would lay the threaded HB legs horizontally inside the rebar cage (also laying on the ground) and bolt everything in place, with the idea of lowering it all down after the legs and templates are together within the rebar cage.

Position the three legs so that the tower will be able to hinge over in the desired direction for that installation. Tower will 'hinge' over on one of the three 'sides' of the triangle when base is completed.

To set the threaded anchor bolts in place, first lay the rebar cage somewhere near the hole, so you are ready to hoist it up and deploy it into the hole vertically when ready. Set the bottom (smaller) leg Template about 4.5 feet down and inside the top of rebar cage. (The top of the rebar cage is the end with the curved, bent hooks that face inwards). Position the Top Template (the one with the extension arms) outside and at the top of the rebar cage. It may help to roughly position the templates in place by wiring them with heavy bailing wire (20 gauge or stronger). At this point it is helpful to have at least one helper also. An unfinished (black) nut (either 1" or 1.25" dia. depending on model size) should first be threaded on to the six threaded rods about 3" down. Next, the six threaded rods should then be lined up and inserted in the bottom template. You should have a helper or an extra set of hands then insert the upper end of the rod into the Top Template. At this point, thread a large 1" or 1.25" finished, plated nut over the top end of the rod sticking out of the Top Template. Then go back to the bottom and fasten another large black nut onto the outside of the bottom Template. Repeat this process until all six threaded legs are inserted in place between the Top and Bottom Templates. It would usually be easier to wait until all the rods are inserted with nuts in place before finally tightening the nuts to moderately wrench tight (about 40 lbs. of torque on the bottom

## **Installation of Heights Tower Bases and Tower Erection**

### **Threaded Leg Version**

Template). Since there will be only one nut on the top of the Top Template for installation, it will obviously not be tightened.

When the cage is put in the hole, the six rods and bottom Template will effectively hang from the Top Template. You can use the unfastened nuts on top to adjust the exact plumb of the rods and the amount that they extend from the top of your ground plane. We recommend allowing them to extend from the planned surface of the concrete between 5.5" and 10".

When the threaded rods and templates are bolted in place inside and on top of the rebar cage, you will be ready to place the cage and anchoring material into the hole. We recommend setting these anchor rods, templates and cage up before actually digging your hole, so you are ready to deploy them as soon as the hole is excavated.

Once the hole is dug, it is helpful to use a truck crane arm or backhoe to lift cage and anchoring rods. This may be most easily accomplished with a chain or canvas sling. The rods can now be 'hung' down into the hole, allowing the top template to support it by spanning over the hole (see diagram labeled "Hinge Base w/ Flatbar Templates in Installation Phase").

Again, there should be 5.5" to 10" of rod length extending above the top of the proposed concrete grade. This will allow for a wide arrange of adjustment to the plum of the tower. If the rods extend a little above or below this range, for example at only 4" or up to 8" above the concrete, you should still have enough room to adjust the base legs without negatively effecting your installation.

Each of the three threaded rods will have 3 nuts: 2 will tighten around the bottom template bars (underground) and 1 will hold the top Template weldment above the cement form. Use the plated ones above the ground and the dark, unfinished nuts on the bottom, submerged in the cement. Also, there are a set of three lock-washers with the base rods; these would be used between the nuts and the Hinge Base Clevis weldments above ground once the concrete is set. The bottom template will not need lock-washers; just tighten the 2 nuts around the bottom template on each leg.

These templates will ensure that the rods will set in the right position when the concrete is cured, eliminating the possibility of incorrect spacing. (With this design, awkward, heavy tower sections with carpenter levels strapped on them no longer need to be used as 'templates'.)

## **TOWER ASSEMBLY/ERECTION**

### *Basic tower section assembly:*

Assemble the sections in their self-evident order. If in doubt, refer to you tower 'bolt list' shipped with the tower (look in hardware boxes),

## **Installation of Heights Tower Bases and Tower Erection**

### **Threaded Leg Version**

drawings, if you ordered them, your Packing List or Invoice.

If you decided to use a lubricant or grease on the tower legs, please apply before mating the tower sections together. A light lubricant like 'Alum-a-Lub' (which may be purchased with your tower order for a wholesale price) or other general utility sprays like WD-40, will only help reduce friction and prevent scarring of telescoping tube surfaces. Some sections, especially the tapering 'AJ' style sections will be much tighter fitting than the straight ones (ACs or AT). Lay the sections on fairly flat ground and attempt to slide all three legs on evenly and incrementally on each side, gradually 'wiggling' the sections together, and not cocking one side in before another.

Once the bolt-holes start approaching alignment, get out your tapered pin tool (if you do not have one, we can lend or sell you one) to align one completely and insert a bolt through them. The tip on an acceptable taper pin should come down to below 3/8" dia. and near 1/4". When you get the first hole bolted, the remaining holes should more easily be aligned.

If it is difficult to align the first hole, a tapered drift pin can help begin the process of better aligning the holes. If you use the taper to drift them into full alignment, you should be able to get at least one other bolt hole in the pattern aligned for bolt insertion. Repeat this process on each of the three legs connection, until you have one bolt in each (of the 3) leg tubes and their couplers or junctions (depending on the tower size).

Please be aware that you will not get more than 2/3rds of the holes perfectly aligned. Because we want your tower connections to remain snug and tight for the life of the tower, we do not manufacture any hole diameter tolerance into the fitting between the section. Each hole has zero tolerance, which means there will be some misalignment on some holes. Almost always, this misalignment between the holes will be less than 1/16" difference between the eclipsed holes. If the overlap is large enough so that it prevent the 'threading' type insertion of the bolts, or gently turning the bolt screws through the holes with a ratchet with moderate turning pressure (less than 80 lbs. if using a torque-wrench), then you may need to ream or drill out the slightly misaligned holes. Before reaming or drilling any holes, you must first align one of the two to four holes in your leg pattern and insert a bolt into them, so that a stable base reference is provided. We recommend first using a small 5/16" or 3/8 dia. 'rat-tail' cylindrical file to carefully shave off the overlapping material within the hole that interferes with a 3/8" or 1/2" bolt passage (depending on the size section you are working on).

## **Installation of Heights Tower Bases and Tower Erection**

### **Threaded Leg Version**

If that does not work, and you are skilled at using an electric hand-drill, you could put in a 3/8" dia. drill in the chuck, and quickly ream through the holes. Be careful not to take out too much of the tube legs meat, and also how you hold your hand-drill, as it is easy to catch them in the holes and break the bit. Again, you must use the above pinning techniques to align at least one hole in each leg **before** drilling any off-alignment holes.

Tighten the locking nuts snugly, but do not over-tighten, as this may egg-shape and gouge the tubing. Our fastener connections do **not** depend on torqued down nuts, or what is sometimes called a 'friction fit.' All the bearing pressure is calculated for on the bolt shanks and holes, so do not worry about overtightening the nuts. Just a snug fit is fine.

When the concrete is cured, you are ready to install the tower. First, insert the Hinge Base clevises on to each of the three double rod legs. Place a nut below and a nut above the body of the clevises. By putting the lockwashers above the clevis plate, you may first accurately adjust the height of the bottom nuts and then tighten the clevises on top by tightening the top nuts. However, save the final tightening process until after the tower is connected to the clevises and erect.

*If you have a **Hinge Base** and **not** a Fold Over Kit:*

Line the tower section up with the two parallel hinge clevises. While the tower is still on the ground, you should attach the interconnecting Hinge Base sleeves to the bottom of the tower, if they have not already been shipped attached. There are three different drill hole patterns in each set of Hinge Base sleeves, Make sure the two sleeves that will hinge the tower up and also be on the lower two legs when installing, are positioned with the lower holes (in series) parallel to the hinge clevises and also parallel to themselves as a left and right leg. When bolting these sleeves on to the tower legs, we recommend starting the fastening process by placing a bolt in one of the middle or in-between holes in the series. This will tend to make it easier to bolt the other holes in the Hinge sleeve as you proceed.

To raise the tower, we recommend fastening a canvas sling about 2/3rds up the height of the tower, and lifting the tower with a crane or utility truck. IF this is a problem, you can go lower, to about half way up or even lower, if your lift crane or truck are positioned right. Consult with the truck operator. Also, be careful not to attach the sling to the small lattice rods; only attach the sling canvass to the large diameter tubes, as they will be able to resist the tension of the pull, while the lattice rods may bend.

## **Installation of Heights Tower Bases and Tower Erection**

### **Threaded Leg Version**

#### **ASSEMBLY of FOLD OVER KIT towers and ERECTION:**

It is recommended to first assemble some of the tower sections together on the ground. Please see Section Assembly instructions, page 3-4 above, for detailed advice on coupling the sections.

Attach the upper half of the Fold Over Kit to the large end of the tower, if it has not already been assembled and shipped together. And if the lower male stubs of the Fold Over Kit are also not already pre-assembled, you will need to attach that half of the Fold Over Kit to the Stand.

After you have attached the Fold Over Kit clevises to the bottom of the tower and the top of the Stand, you are then ready to mate the back two female legs of the Fold-Over-Kit to the back male legs in order to couple the system. Lightly grease the male clevises on the Stand side before connecting the Fold Over Kit together.

The large end of the tower needs to be lifted up a little over four feet, so that the Fold Over Kit may be connected. This will require two to four people, or one or two persons with a mechanical lift or some kind.

As an ***alternative to lifting***, the Stand may be laid over and attached to the Fold-Over-Kit on the ground level. Attach the Stand to two of the closest anchor clevises with one of the large (3/4" or 5/8") clevis bolt on each leg. Then the tower and Stand may be slowly hinged or 'jack-knifed' up until the Stand is vertical. The remaining large clevis bolts would then be inserted into the Stand legs.

The assembly of the Fold Over Kit, at this point, involves the insertion of two 1" dia. shoulder-bolts through the two hinging aluminum clevises of the Fold Over Kit stubs. We recommend lightly greasing those bolts with a heavy multi-purpose grease, such as used on the Screw Actuator, before installation. Once the two back FOK clevises are bolted together, the Screw Actuator System may then be bolted into the front plates of the Fold-Over Kit. The Screw System comes pre-assembled, but final adjustments may be necessary, as shown in the Screw System Diagram and its separate instructions, and explained in the Screw System Operation and Gearmotor Mounting Instructions.

After the Screw Actuator is fastened in place, you can begin to Fold the tower up or back down. You may then install or repair antenna or instruments at your convenience. (Again, please read Screw System Operating Instructions to become familiar with the proper operation of this

## **Installation of Heights Tower Bases and Tower Erection**

### **Threaded Leg Version**

product).

#### **OTHER BASE CONSIDERATIONS:**

Grounding system: All tower structures should be grounded to prevent lightning damage. The simplest grounding system would consist of two or three copper-clad, 8 to 10 ft. long ground rods spiked into the ground near the edge of the concrete pad, connected to the tower legs with 2- $\phi$  stranded cable. Then, a ring around the base should be made with solid #2 size electrical wire. See 'Grounding' diagram. Heights Tower Systems can provide such a kit to meet your installation's requirements.

We do not recommend directly grounding to the steel base legs and rebar cage structure of the base. Our opinion is that a grounding arrangement like this may lead to structural damage of the base, if the base channels a strong enough lightning hit. That is why our typical installation would have the ground rods and cable/plate grounding material outside of and around the actual concrete.

Should you have any questions on these instructions, call Heights Tower Systems at 1-850-455-1210 or email at [info@heightstowers.com](mailto:info@heightstowers.com) or [hts2001@bellsouth.net](mailto:hts2001@bellsouth.net).