

A Beginner's Guide to Tower Climbing Safety

by Ian Woofenden



Ian Woofenden (5)

Left: The height of the towers compounds the dangers of installing and maintaining wind turbines. **Above:** Zander Woofenden demonstrates leaning out in a working position. Note that he is still clipped into the safety cable.

“Tower climbing remains the most dangerous job in America,” according to the U.S. Occupational Safety and Health Administration (OSHA). Fatalities for all types of tower work per 100,000 workers in 2006 were 184, compared to 88 for pilots, 37 for farmers, 35 for utility-line workers, and 34 for roofers.

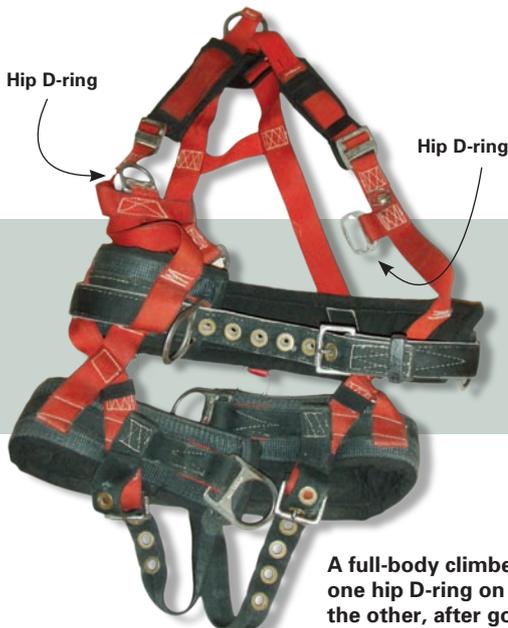
Comprehensive renewable energy industry statistics are not available. But journalist Paul Gipe—the author of several books on wind power—has informally maintained records of wind energy deaths. By his count, 32 deaths occurred between 1975 and 2006, only three of which involved home-scale wind-electric systems. These numbers may seem inconsequential until you consider the small size of the wind power industry, the few hundred people who work on towers, and above all, the tremendous loss for the families of those men and women.

Climbing towers is serious business, and accidents can and will happen. The sad but true reality is that most tower accidents are not caused by nature or the result of faulty equipment, but are the result of human error—lack of proper training and preparation, improper use of or lack of safety equipment, poor communication, or plain old carelessness.

You’ll want to gain knowledge and experience through study, consultation with seasoned climbers, and cautious practice. Workshops hosted by safety gear manufacturers are another great resource. This article provides the fundamentals to get you started, but you’ll gain most of your expertise by carefully practicing on the job. Climbing towers can be highly rewarding work. If you understand the hazards and practice safe climbing techniques, you can enjoy a lengthy, secure career “up tower.”

Hazards

Home-scale wind generator towers pose a variety of hazards. First and foremost is the fall hazard (all other hazards are compounded by the fact that you’re working well above the ground). Properly sited and installed wind generators are on towers from 60 to 200 feet high (or more). Not only is there



A full-body climber's harness. A carabiner attaches to one hip D-ring on the harness and the locking clip to the other, after going through or around the tower.

the danger of falling but also the risk of injuring others or damaging equipment by dropping tools or parts.

Gravity-caused accidents are only one of the many hazards faced by tower climbers. Since wind turbines can produce high-voltage electricity, and the systems can be connected to the utility grid, there is also the risk of shock and electrocution. Turbines are rotating machines, and the grisly fact is that utility-scale wind service people have been killed by being dragged into the equipment.

Weather is another frequent hazard. Climbing in rainy or icy conditions or during extremely cold or hot temperatures increases the danger, often to the point of being unsafe. The greatest danger lies in the unexpected—a lighting storm or wind-driven rain that sneaks up on you. When it comes to weather, common sense is your best defense. Beginning climbers routinely underestimate how much more severe the wind will be when they climb above nearby obstructions, and often find themselves unprepared and underdressed for the higher winds and colder temperatures aloft. When in doubt, err on the side of caution.

Other hazards stem from live distractions, such as bees and hornets, animals on the ground, and other climbers. Noise from nearby equipment can be hazardous as well, primarily because it impairs communication. A smart climber assesses the potential hazards before climbing and prepares for them. Discussing the hazards with your climbing partners and ground crew can help minimize the risk.

Equipment

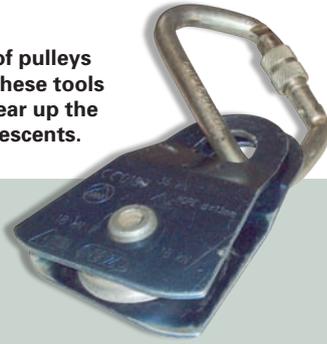
To do tower work safely, you need the right gear. A quality harness is crucial. For maximum safety, a full-body harness with hip, seat, chest, and back D-rings is the preferred choice among professionals. It's impossible to fall out of a properly fitted full-body harness. The same cannot be said of lineman's belts or waist and seat harnesses.

Lanyards allow you to attach yourself to the tower in a number of ways. I like to carry at least two adjustable lanyards for positioning. These allow me to clip in and get comfortable



Left: An adjustable lanyard for fall safety and positioning on towers. Above: A double-locking lanyard clip.

Left & middle: Examples of pulleys mounted on carabiners. These tools can be used for hauling gear up the tower or for emergency descents.



A Lad-Saf fall-arresting device attached to a cable that's permanently mounted on the tower.



right where I need to work. I also carry a short-strap lanyard attached to my seat D-rings. This comes in handy when I need a quick rest on the tower, allowing me to sit down and relax. Other climbers also use split lanyards, with one attachment to the harness and two lanyard legs with clips. These are commonly used as fall-safety devices on scaffolding and roofs, and some tower climbers use them as well. All lanyard clips should be double-locking or better.

When ascending and descending the main portion of a tower, you should be attached to a safety cable or line with a fall-arresting device such as a rope or cable grab. Lad-Saf is a common model. For some tower projects, you will be able to do the entire job while connected to this cable. These fall-arrest devices are meant for fall safety, not positioning—so

Always inspect the tower and system from the ground before attempting a climb.



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you should carry and use lanyards to secure yourself into work positioning. You may need to detach yourself from the safety cable at the tower top, but you should *not* do it before you are securely tied in with at least one lanyard.

Carabiners (or “beeners”) are loops of steel or aluminum with locking gates. For tower climbing, all beeners should be at least double-locking. They are widely used for attaching fall-arrest devices, lanyards, tools, and additional gear to your harness and other places, like the tower. They are handy for any number of uses, so you won’t regret hauling some extras on the side D-rings of your harness.

Descending devices and pulleys can be used for rapid descent in emergencies, or just for reducing the workout of climbing up and down the tower. You must be familiar with rigging these devices, and understand how to attach pulleys and lines to the tower and to yourself.

The proper attire—steel-shank work boots, heavy pants and shirt, gripping gloves, and a protective hat—is key for safe climbing. Also recommended are mesh goggles, which act as sunglasses while protecting your eyes from airborne debris. Plan ahead for the weather, dressing in layers that can be unzipped if it gets too hot. Carrying a closeable bag with extra gloves, a warm hat, an additional wind breaker, water, snacks, and other such items will make you that much more comfortable while you work—and therefore, that much more focused on your safety.

Having a first-aid kit on site—and knowing how to use it—is a must. While you don’t need to be prepared for surgery, don’t underestimate the value of basics like bandages for abrasions and blisters, and water for flushing eyes.

Groundwork

Before you climb, inspect your equipment. Look for wear or damage in your gear, and check that all beeners, clips, and other movable devices are functioning properly. Because another set of eyes never hurts when it comes to safety, have a climbing partner examine your harness and other gear before you climb—just in case anything is amiss.

In addition to a gear inspection and hazard assessment, perform a full inspection of the tower and system from the ground. If it’s a guyed tower, inspect where the anchors come out of the ground and all attachments. Your life depends on the tower, so you want to discover any problems before you go

Open the Lines: Communicating in the Field

Good communication is important in any job, but when you're working high above ground, it can be a matter of life or death. Before you head "up tower," here are the keys to effective tower-climbing communication.

BABY TALK. I like to tell students to speak "baby talk"—tell your working partner everything you're going to do before you do it. Accidentally knocking someone in the nose with your elbow on the ground might hurt. On a tower, it could lead to a serious accident. Slow down and take time to talk through what you're going to do.

HAND SIGNALS. Communicating with the ground crew is vital to safe tower work. On a calm day at a quiet site or on shorter towers, shouting and hand signals get the job done. Before you head up the tower, review your signals with your ground crew, so there's no confusion. Good hand signals are simple and easily recognizable. For instance, a common signal for "stop" is to hold your arm straight out with a clenched fist. At noisy sites or on high towers, radios may become necessary, since it can be difficult to communicate by voice or hand signals.

WALKIE-TALKIES. As a backup to hand signals, most climbers also carry a walkie-talkie or voice-activated radio. These can ease strained voices and strained relations with the ground crew. Shouting from the top of a 150-foot tower can be difficult, especially if the ground crew is engaged with other tasks, or if there is other noise. Often I'll leave my radio in my pocket unless I need to give detailed instructions. That way I can hear



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my ground crew talking to me and answer with a shout or hand signal—without having to interrupt my work to dig out the radio. Sometimes wind noise makes radio communication difficult, so it's important to know hand signals as a backup.

CELL PHONES. Having a cell phone on a tower can really save time and trouble. Many times I've talked with a turbine manufacturer or a colleague from the tower top when I had a problem and needed advice. An earpiece allows me to start the call, put my phone away, and keep both hands free to do work. A hand strap on your radios or cell-phone case may keep them from taking a dive. Voice-activated radios with headsets are a possible option in the right situation.

aloft. Broken or deteriorating gear should be replaced before you climb. Inspect the tower at the foundation, and re-tension guy wires and all bolts and cable attachments to manufacturers' specifications before you ascend and as you climb.

Use binoculars to look over the machine and tower top, and ask the system owners or operators about any recent issues. *Then* make a plan with your crew, specifically outlining the work you will do on the tower and in what order. As you make this list, think about what tools and parts you need. Planning ahead will make the job run more smoothly and limit the number of trips up and down the tower. Finally, practice and review all techniques at ground level first before climbing, especially if it's your first time—or if it's been a long time since you've been "up tower."

Ground Crew

Your ground crew is your connection with terra firma—don't work without them! Make the most of your ground crew so you can dedicate your time and energy to the work on the tower. With a pulley and service line, the ground crew can do all the raising and lowering of tools, parts, or even the whole turbine, if necessary. Trying to do this work from the tower top is exhausting, and can become a safety hazard.

I prefer a dedicated service line in a loop between two pulleys—one at the tower top and one at the tower base.

In addition, the ground crew may be managing the tails of your safety lines, as well as taglines—lines dangling from equipment—for guiding gear up the tower. It's best if these workers are familiar with tower work—experienced climbers make great crew members.

Working with a crane adds another layer of safety concerns. You're dealing with a loud, powerful piece of equipment, often in tight quarters. A good crane operator can not only make your job easier but also keep you alive. Talk with your crane operator about the working plan, the limits of the equipment, and safety issues. Carefully assess the crane rigging and methods when lifting towers and turbines. Typically, heavy webbing slings are attached with large, locked shackles.

Agree on hand signals to use with the crane operator and designate *one* person from the crew to direct the crane. Above all, don't be in a rush. Cranes are expensive by the hour—but cheap compared to lives. Everyone's number-one priority should be getting the job done safely.

Technique

Getting up and down a tower safely and efficiently takes some finesse. The key is to climb primarily with your legs and not overuse your arms. You'll need both, of course, but your legs should take the bigger part of the workout as you make

your way up the tower. Many times novice climbers will find they have aching arms once they return to the ground. Your legs are better equipped to do this job, so *push* your way up the tower—don't pull.

Find an easy stance on the tower at a comfortable distance from the ladder or rungs. Don't hug yourself tight to the tower, or again, you'll end up with sore arms by the time you get back down. Step slowly and carefully up and down, watching as you make each contact with feet and hands, and maintaining two, if not three, points of contact at any time.

Rest when needed. Leave the macho sentiments behind and take a breather at regular intervals. I like to stop at least twice when climbing the 165-foot towers near my home. I strap in, enjoy the view, and take a swig from my water bottle.

Climbing is physical work. If you're not in shape for it, you'll feel it—no matter how you climb. Take it easy and build up to it gradually. It's a developed skill, and your muscles also need time to develop. Get plenty of rest the night before you climb, and eat a good breakfast. I once fainted on a tower from a potentially lethal combination—not enough sleep, not enough food and water, and not enough warmth. After 25 years climbing towers, I should have known better. I was lucky, but I learned a hard lesson. Don't make the same mistake—be prepared and know your limits.

100% Fall Protection

Make sure you are attached to the tower by at least one means at *all* times. I prefer to be attached twice or more, though I settle for one secure method when I'm moving on a tower. As soon as I stop to rest or work, I add another attachment. If the tower you're working on is equipped with a cable, use an appropriate fall-arrest device. Rope can also be used for the fall-arrest line, with a rope grab or an appropriate sliding knot (such as a Prusik knot or a Blake's hitch that arborists rappel on).

After you've moved up the tower to the level where you'll be working, you may need to disconnect from the safety cable or rope. *First* connect one or more lanyards securely to the tower. On large, freestanding towers, you may need to traverse across angled braces. Keep *at least* one attachment to the tower at all times—and watch carefully when detaching and reattaching your lanyards. Use your eyes, not just your ears, to assure yourself that they are properly clipped into your harness and the tower.

Once you're in position to work, adjust your lanyards so that you can stand and sit without holding on with your hands. Get comfortable. Rig a lanyard that will hold you by your seat D-rings, so you can sit at least some of the time. If you have to work over a wide area on the tower (horizontal or vertical), rig a line well above you that gives you the latitude to move, and use positioning lanyards to hold you in the specific places you're working.

Use tool bags with closures—rope bags from arborist supply houses are excellent. Attach small cords on major tools so they can be easily clipped to your harness, the tower, or your tool bag with beeners. One dropped wrench could be lethal for one of your ground crew.

When Problems Occur

Accidents can happen on any job. When you're high up a tower, even a minor accident or illness can be serious. Good planning and preparation are key to handling any unexpected accidents and emergencies that may arise. In addition to basic "up tower" and "on the ground" first aid, you will need to establish and practice a plan for removing an unconscious or injured tower climber.

The best tower rescue is self-rescue. If a climber is ill or injured but can get down the tower, assist him or her in getting down. If that isn't possible, quickly get the rigging together to lower the injured person to the ground. Call 911, but don't wait for them or expect them to remove your co-worker from the tower—you'll have to do it.

There are many descending devices and methods available. Setting a pulley and line and letting your ground crew lower you and the injured person is one straightforward method, but it requires a line twice the height involved. Using a single fixed line and a descending device (such as a Fisk descender), you can rappel down the tower with the injured person suspended by the D-ring on the back of his or her harness.

Depending on the severity of the injury, you may not have a lot of time to get the injured person down. Don't let your haste lead to two injured people. Apply standard safety precautions, staying tied in 100% of the time, and use a backup system if possible.

When it's time to descend, take a breath and make a plan. Gather and secure all your tools. I frequently use a service line on a pulley to raise and lower tools and gear to the tower crew, saving the work and inconvenience of hauling tools up and down on their belts or on a line.

If you had to get off the safety cable or rope, move back to it and reattach yourself. Double-check your fall-arrest device before detaching your lanyards. Climb down the tower slowly and deliberately—watch each foot find its place on each rung or step. You're often coming down the tower in the late afternoon or early evening, which is "accident time" on construction sites. Don't get sloppy. Pay attention until both feet are back on solid ground.

Common Sense

The most important safety device you have is on your shoulders—use your head! Above all, you must have two critical qualities—common sense and good communication. No amount of fancy equipment or paperwork will help you as much as those two traits. By thinking through your game plan and communicating it to your crew and climbing partners, you can avoid most tower accidents and enjoy a long, fulfilling career "up tower."

Access

Ian Woofenden (ian.woofenden@homepower.com) has logged several miles up and down towers over the last 25 years, and lives to tell the tales.

