

# Thanks to our sponsors!



Power and productivity  
for a better world™

bp



## CENTENNIAL SPONSORS



CHUBB



Complete Equity Markets, Inc.



## GOLD SPONSORS



## SILVER SPONSORS

Honeywell

Safety Products



## BRONZE SPONSORS

CNA



## SOCIETY SPONSORS



ARAMARK  
Uniform Services



## ASSOCIATE SPONSORS



# Tethering Tools When Working at Heights

## Selecting the Proper Tether or Lanyard to Reduce Injuries

By John Salentine

A significant workplace safety issue is attracting much attention: tools and other objects dropped when working at heights. Apart from the inconvenience of having to interrupt work to retrieve or replace a dropped tool, there is a serious risk of injury or damage. Consider this: a 1-lb tool falling just 30 ft will hit the ground in less than 2 seconds.

Although a falling tool from any height is a problem, when it falls several hundred feet, equipment and personnel below are in considerable danger. The worker who dropped the tool endangers everything and everyone below. Even a screwdriver that hits someone after being dropped just 10 ft may cause serious injury. A larger, free-falling tool, such as a cordless drill, could kill someone. The injury will cost the company in lost productivity, workers' compensation claims and medical bills, and, depending on the circumstances, may lead to a lawsuit. Morale also becomes an issue when someone is injured on the job.

The threat of injury is not the only serious problem. Equipment and machinery also can be damaged, sometimes beyond repair, from a falling tool. Certain industries such as nuclear power generation, wind power, aerospace manufacturing, and oil and gas production are more prone to damage and injury. A relatively small wrench can cause severe damage to the fuselage or wings of an airplane as it bounces off the plane the whole way down. Whether it's hitting something as expensive and sensitive as the skin of an airplane, or landing on a pump or bearing, a falling tool will create costly damage every time.

According to Liberty Mutual's 2010 Safety Index, incidents caused by falling objects cost U.S. industry \$5.6 billion. A staggering figure, yet this type of incident is largely preventable by using an inexpensive tethering device. OSHA 29 CFR 1926.759(a), Falling Object Protection, states, "All materials, equipment and tools, which are not in use while aloft, shall be secured against accidental displacement." But if we follow Europe's example, as OSHA

often does, it will soon be mandatory for all industries.

Working at height in itself is dangerous. Aside from the possibility of falling, the chance of being struck by dropped tools has proven to be a considerable risk. The European Directives set out minimum requirements and fundamental principles of prevention and risk assessment of objects falling from aloft, as well as the responsibilities of employers and employees. The regulations became effective with the 2005 introduction of the Working at Height regulations, specifically covered in regulations 10 and 11 (falling objects), which says:



©STOCKPHOTO.COM/HENRYK SADUPA

- When it is necessary to prevent injury, you must do all that is reasonably practicable to prevent anything falling.
- If it's not reasonably practicable, you must ensure that no one is injured by anything falling.
- You must ensure that nothing is thrown or tipped from height if it is likely to injure anyone; stored in such a way that its movement is likely to injure.
- If the workplace contains an area in which there is a risk of someone being struck by a falling object or person, you must ensure that the area is clearly indicated and that as far as reasonably

practicable unauthorized people are unable to reach it.

In the U.K. alone, falling objects is a primary cause of workplace deaths and injuries. According to RIDDOR's Health and Safety Executive 2008/2009 report, during the period from April 2008 to April 2009, the following fatalities and accidental injuries were caused by falling objects:

- 15 deaths;
- 3,223 nonfatal major accidents;
- 11,981 workers lost more than 3 days of work time.

Most of these incidents could have been prevented. Personal tool tethers and lanyards are the most effective ways to protect employees from objects falling. When the correct tether is properly matched with the tool, worker and application, the work is safer, easier and more efficient. Employees will appreciate always having their tools and instruments conveniently at hand when needed and out of the way when not needed. Conversely a poorly matched tether can become a safety hazard. The safety engineer's challenge is to provide a tether that is both user friendly and work appropriate.

### Not a One-Size-Fits-All Solution

With such a high risk to worker safety, it is unfortunate that little has been published on the subject of tethering equipment and tethering safety techniques. Many safety professionals may not be aware of the range of options available. Most companies that sell safety equipment or personal fall arrest systems fill out their product line by importing a basic tether in two or three sizes. But the common lanyard-type tool tether is not a one-size-fits-all solution. When tool tethers are ordered without specifications beyond the weight of the tool, chances are the tether is not appropriate.

In reality, thousands of tethering choices are available from U.S. manufacturers specializing in tool, gear and instrument tethers, systems that have been specified by safety engineers for various tethering applications in a range of industries such as wind energy, fire and rescue, manufacturing, law enforcement, military, trucking, oil and gas exploration, scuba, fishing

Figure 1

# Tool Tether Selection Guide

This guide to tethering systems presents a simple overview of how to select the appropriate tether.

## TOOL TETHER SHORT FORM GUIDE

Gear Keeper

**STEP 1 - DETERMINE TOOL TETHER TYPE BASED ON TOOL WEIGHT & HOW TOOL WILL BE USED.**



**A - Attached to Person**



**B - Attached to Structure**



**C - Retractable**



**D - Wrist**

**Tools Under 2 lbs**  
**A - Personal:** For single tool use; moves with you  
**B - Personal with Anchor Strap:** For single tool use; attached to a structure  
**C - Retractable:** Low profile, ideal for multiple tether use  
**D - Wrist:** For short drop lengths; low profile

**Tools 2 lbs - 15 lbs**  
**A - Personal:** Single tool use; moves with you  
**B - Personal with Anchor Strap:** For single tool use; attached to a structure  
**B - Anchor Tether:** Attached to a structure; provides 10 foot working radius

**Tools up to 25 lbs**  
**B - Personal with Anchor Strap:** For single tool use; attached to a structure  
**B - Anchored Tether:** Attached to a structure; provides 10 foot working radius

**IMPORTANT**

When tethering any tool to a person or structure, always check with a qualified safety professional regarding shock loads to, the body, fall-protection devices, or structure anchor points.

**STEP 2 - DETERMINE TOOL ATTACHMENT.**

**Single Tool**  
When you don't need to easily remove a lanyard from a tool, affixed lanyard system is acceptable.



**Multiple Tools**  
When it's necessary to easily change-out tools from a tool tether, a Side Release Lanyard system or Carabiner clip are the best options.



**STEP 3 - CHOOSE TOOL ATTACHMENT POINT FOR LANYARD OR CARABINER.**



**A - Tool has Lanyard Loop**

Lanyard to tool's Lanyard Loop.



**B - Tool has Large Ends**

Tool must have ends large enough that will allow a lanyard to be looped and cinched securely without slipping off.



**C - Tool has Small End(s)**

Tool doesn't have large enough ends (looped lanyard would slide off) Attach a ring using a Band-It for lanyard or carabiner.



**D - Tool Modification**

Tool doesn't have large enough end; lanyard or Band-It might slide off... Tool must be modified.

© 2011 Hammerhead Industries, Inc.

### Anchor to a Structure, Not a Person

Tethering heavy tools (more than 5 lb) to a person is a significant safety concern and safety engineers should instead consider using anchor tethers. Anchored tethering transfers the shock load produced by a dropped tool from the worker to the structure. For heavy tools (more than 10 lb), structure anchoring should be mandatory.

In addition to the obvious protection of transferring the shock load, the anchored tether minimizes entanglement. However, because of the longer reach, other concerns must be considered. The tether must have a higher stretch capability, or it will coil up or cause stress to the worker. It also must have a higher break strength because the drop distance of the tool (as a result of the longer reach), will produce higher shock loads at the stop point. A unique manufacturing process resulting from experience in the scuba industry has solved that problem. A polyurethane coil is employed inside of the tubular webbing to give the worker a long stretching ability, using virtually no force. The result is the creation of a large working radius (up to 10 ft).

### Tethering Small Hand Tools

Picture a worker using multiple small tools: an electrician using screwdrivers, pliers and amp meters, or a scaffold builder climbing up with several tools in a pouch. These tools and working conditions are poor choices for coil type tethers or lanyards. But they are ideal for a retractable tether that safely permits multiple tools to be attached to the worker with virtually no risk of entanglement or snagging. Tool and gear retractable tethering devices offer hundreds of combinations of mounting systems, line technology and shock-absorbing capabilities. This type of highly engineered safety tether provides cost-effective security along with high tool ratings.

### Multiple Tools on One Tether

Change the tool not the tether. A single-tool lanyard is sufficient when one specific tool is the only thing tethered, but what happens when multiple tools must be tethered? It is a common scenario in most industries. Many options are available. Quick-connect tethers offer easy tool change-out and are available on a large selection of tethers.

and communications. Each application has its own set of criteria: withstanding exposure to saltwater, chlorine and high temperatures, or special mounting or attachment needs. Some manufacturers have tools-at-height programs to address the problem.

### Use the Right Tether for Each Application

The objective of tethering is to secure tools to prevent injury and damage to people and equipment below. But other factors affect the safety of the worker using the tether or lanyard. An improperly mated tool and lanyard can inherently lead to reduced productivity and exposure to injury. When the tethering device limits mobility, recoils too fast or exerts too much resistance upon extension, backlash from workers is often the result. Generally, the result is fatigue, annoyance and often noncompliance with the use of the lanyard.

Tethers of that type use an elastic core placed inside tubular webbing and provide minimal stretch/recoil. The

heavy elastic may add a shock-absorbing factor to a heavy tool, yet, because of the tether's high stretch strength, the worker's muscles will tire quickly when s/he extends to full reach. If the tethered tool is fairly light, the shock-absorbing elastic will actually cause the tool to slingshot back to the user too swiftly. It may actually injure or unbalance the worker. In either situation, improperly mated tools and lanyards may force safety engineers to deal with noncompliance, potential injury and reduced productivity.

The correct manufacturing philosophy is to provide a lanyard that has low stretch force so as not to fatigue the user at full extension, while providing the proper degree of recoil. This is achieved by having the elastic material sewn inside the webbing during the manufacturing process and not assembled after the fact. In this manner, the elastic provides optimum retraction tension and low force stretch.

## Top 10 Tethering Do's & Don'ts

**Don't** ever use a tether with lower weight limits than the tool being tethered.

**Don't** tether a tool that exceeds 10 lb to a person.

**Don't** tether a tool to a person without verifying the impact on the person's personal fall protection (PFP) devices.

**Don't** attach a tool tether to a structure without verifying the anchor point's strength and shock-load capability.

**Don't** use tethers or lanyards that require excessive force for full extension. (The result will be reduced worker output and possible muscle injury.)

**Don't** modify the tool lanyard in any way (replacement of tool lanyard components such as carabiner clips, side-release disconnect clips or removal of shock-absorbing components may affect the lanyard's load rating).

**Don't** customize the tool lanyard with hardware that does not have the appropriate load ratings for the tool. For example, key rings are often considered for use as an attachment point to a tool, but typically these will not work for tools that weigh more than 1 lb).

**Don't** assume that a tool tether is a foolproof device.

**Don't** use a tool lanyard as a PFP lanyard.

**Don't** use tool tethers in situations where machinery entanglement is a concern, most tool tethers will not break away against the weight of a person.

**Do** verify a tether's integrity before use, looking for indications of excessive wear or fatigue. (If integrity is questionable, replace the tether.)

**Do** always use a lanyard that is rated properly for the tool weight, provided that the lanyard is designed with a 25% additional margin for a full extension drop.

**Do** verify the tool's attachment point to ensure that it is strong enough to hold the tool for the full drop distance of the tether.

**Do** weigh tools so that a properly rated lanyard is used for the application. (Never assume the weight of a tool just by feel.)

**Do** use a quick-release tether when a group of small tools is being used.

**Do** use a retractable tether to avoid entanglement issues when multiple tethers are needed.

**Do** anchor all tools weighing more than 10 lb to a structure, not a person.

**Do** use lanyards that have low stretch force at full extension as long as they have the proper degree of recoil for the tool and application.

**Do** transfer shock loads from a person to a structure whenever possible.

**Do** always check with a qualified safety professional if in doubt.

reputable manufacturers. A lanyard rated for the weight of the tool is safe to use. When a tool that weighs 5 to 10 lb is attached to a person, an appropriate safety professional should always approve it. If a tool weighs more than 10 lb, it should always be secured to a proper structure.

Lastly, if anchored tethers are used, the anchor point also should be approved by a qualified safety professional. Many times, a lifeline rated for personal fall protection also can be used, but again the appropriate safety person should approve this as well.

### Make the Employee Your Partner

For a tool and instrument tethering safety program to be successful, a partnership must exist between the employee and the safety engineer. A properly tethered tool or instrument makes work more efficient. It simplifies every repair, maintenance or manufacturing project by keeping the worker's tools handy and accessible. When tethers correctly complement the tool, worker and application, you will have an advocate rather than an antagonist.

### Conclusion

The safety engineer's goal in correct tethering procedures is to make sure the tool, application and recoil/retraction force are in balance. When the tool is extended for use, only minimal force should be necessary so as not to cause worker fatigue or in the reverse, cause a kick when retracted. The result of correct tethering is when the tool is stored, held or used, the dangers of entanglement, fatigue and annoyance are minimized and worker satisfaction and output are maximized. Tethering manufacturers focus on providing solutions, and working with customers who are trying to put together a tool tethering safety program that adequately protects their employees without inhibiting their work demands.

### References

**Liberty Mutual Research Institute for Safety.** (2010). 2010 Liberty Mutual Workplace Safety Index. Hopkinton, MA: Author.

### Tool Tether Ratings

Tool tether ratings have not been established or standardized by either the tethering or the safety industry. No universal specifications govern tool tethers as with fall protection devices. As such, when specifying a tool lanyard, the safety engineer has no real basis for choosing proper tethers and arbitrarily determines tether selection based on the weight of the tool (e.g., "I need a tether for a 3-lb tool"). Without additional specifications, the safety engineer may be creating a potentially dangerous situation.

Although the industry is lagging behind in establishing guidelines, the author's experience has shown that for maximum safety, tool tethers and lanyards should meet a 25% margin for a full extension drop. However, a more significant concern is how some suppliers arbitrarily rate lanyards to meet a customer's request. For example, when a safety engineer requests a tether for a 3-lb tool, the distributor may say, "I'll

send you one that's rated for up to 15 lb, so you have a higher safety margin."

Although both supplier and buyer may have good intentions, this is a potentially hazardous situation. Using a tether that is rated for a much heavier tool will not operate effectively because the stretch and recoil are considerably out of scale for a lighter tool. An additional and more serious problem is when a worker, assuming a lanyard is rated for 15 lb, thinks a 15-lb tool can be connected to a toolbelt. It cannot. That 15-lb tool, at a full drop length, will exceed 250 lb of shock load, more than enough to knock a worker off a perch. What if a personal fall protection device does not further protect that person?

Safety engineers should explore practical tool tethering solutions with

**John Salentine** is cofounder and vice president of Hammerhead Industries Inc., manufacturer of the Gear Keeper Tethering Systems. The firm offers a free Tool Tethering Guide. Salentine holds a B.S.E.E. from Marquette University. Prior to founding the company, he spent more than 10 years as an automotive engineer. Additional information about tethering can be found at [www.GearKeeper-Blog.com](http://www.GearKeeper-Blog.com) and [www.GearKeeper.com](http://www.GearKeeper.com).