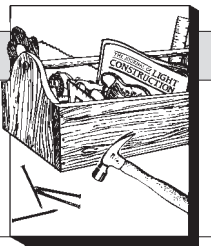

Tying Off for Safety

by Clayton DeKorne

As small contractors are increasingly scrutinized by OSHA, we have received a number of questions about how to comply with their regulations. Many of these questions are about fall protection — the protection of workers in high places with safety belts and lifelines.

The trick to tying off safely is to limit the distance you can fall, but at the same time be able to change position without spending more time on fall protection than you do on your work. There isn't much that teaches contractors efficient ways to do this, but some hints can be gleaned from an understanding of the various types of safety belts and lines available.

Two Kinds of Fall Protection

OSHA puts fall protection in two categories — fall restraint and fall arrest. *Fall restraint* keeps a worker within safe bounds. Typically this is done with guard rails at the edge of a roof or on scaffolding. But it can also be done with a safety belt and a lanyard short enough to prevent a worker from reaching the roof edge or the end of a scaffolding plank.

Fall arrest, on the other hand, catches the worker after he falls. This can only be done with safety equipment that meets ANSI specifications. Under these specifications, equipment is tested to meet the shock loads generated during a free fall.

A new fall-protection standard passed by Washington State OSHA makes the distinction between fall arrest and fall restraint "equipment specific." The new regulation specifies that safety belts can only be used for fall restraint, and only a full-body harness can be used for fall arrest. California OSHA is expected to adopt this standard next year, and a proposal for the same standard is currently before the federal OSHA.

The reason is plain. During a fall, a worker's body must absorb an enormous shock when he comes to the end of a safety line. The longer the fall, the greater the shock. So OSHA requires that lanyards and lifelines be set up to limit a fall to six feet. Yet, if a worker is wearing a safety belt, a free fall from six feet can wrench the body and cause a debilitating injury because the entire force of the fall is concentrated at his waist. However, if the worker is wearing a full-body harness, the force is distributed over his butt, back, and shoulders, which are strong enough to sustain the shock without injury.

Belt Basics

Safety belts come in a number of configurations but perform one of two basic functions (see Figure 1). A *one-ring belt* is made to be worn with the ring centered in the back, so a worker will bend naturally at the waist when he comes to the end of a free fall. If the ring is positioned in front or to either side, the force of the fall can break his back. One-ring belts were originally designed for fall arrest, but under the new standards they may become obsolete, except to keep a worker on a short tether.

A *two-ring belt* with D-rings on each side is used only for positioning a worker. Using a lanyard tied around a post, a worker can lean backwards so he is supported by the belt and has two hands free to work.

A *full-body harness* buckles around the waist and each leg and has two shoulder straps. For fall arrest, a safety line is attached to a D-ring in the center of the back. Look for a harness with a D-ring in the back that slides up the shoulder straps, so the worker is left hanging in an upright position until he can be rescued from the fall.

A full-body harness shouldn't be confused with a *chest harness*, which is used only to lower people into confined spaces or out of dangerous positions in emergencies. Similarly, a *suspension belt*, such as a bosun's chair, is meant for positioning only. This equipment is not impact tested and cannot be relied on to withstand the shock forces of a fall.

Figure 1. *Safety belts come in two basic configurations. A one-ring belt (top left) is made to be worn with the ring centered on the back, so a worker will bend in a natural position when he comes to the end of a free fall. A two-ring belt with D-rings on each side (bottom left) is used only for positioning. If this belt is used to stop a free fall, the force can break a worker's back. A safety harness (right) offers the greatest protection because the shock is distributed across a worker's butt, back, and shoulders.*

Lifelines and Lanyards

A *lanyard* is a short line — usually six feet — that connects a worker's safety belt or harness directly to an anchor point or to an anchored *lifeline*. Lifelines are strung horizontally or vertically across a section of a building, and workers tie into the line with a *rope grab* (see Figure 2). A rope grab makes working on pump jacks particularly easy because the position of the rope grab can be changed quickly as you change the height of the platform. On smaller jobs, you may be able to use an *adjustable lanyard* connected directly to an anchor point and save the effort of rigging a lifeline. Adjustable lanyards are available in 3- to 6-foot, 5- to 10-foot, and 10- to 20-foot lengths.

You can also get a *retractable line reel* that functions like a retractable dog leash. This feeds the line out slowly, without inhibiting a worker's movement, but will lock when the line is jerked, as it would in a fall. Self-retracting models will even keep constant tension on the line, so a roof deck or scaffold won't be cluttered with loose lines. However retractable lines are expensive — about $600 to $800 each.

Anchor Points

According to OSHA regulations, the other end of the lanyard or lifeline should be tied off to something "other than that supporting the worker." This means you can't tie off to a ladder or staging. OSHA also specifies that an anchor point must be able to withstand a 5,400 pound load for each worker. On most wood-frame houses, however, there are few, if any, places that can support such a load. But by using a shock-absorber, often called a "breakaway system," the load can be reduced to 3000 pounds.

A *shock-absorbing lanyard* has a section of webbing sewn into it that will tear apart under stress. This controlled destruction absorbs a considerable amount of the energy in the fall, so less is transferred to the worker. With a shock-absorbing lanyard, a 220-pound worker only generates about 800 pounds of force in a six-foot free fall. By contrast, a conventional nylon web lanyard will transfer about 2500 pounds of force and a steel cable lanyard will transfer about 4000 pounds.

When tying off, the anchor point should be at the level of or above the D-ring on the safety belt or harness. Don't depend on knots to make a connection. A knot can significantly reduce the strength of a rope (up to 50% by some estimates), and knots are difficult to teach everyone on the crew to tie correctly. Instead, use lanyards and lifelines equipped with snap hooks. The best snap hooks have double closures that will reduce the chance for an unexpected "roll out."

Attach the snap hook to another lanyard or a *D-ring strap* — a nylon belt with D-rings on either end — that is looped around a beam or through several studs on a wall.

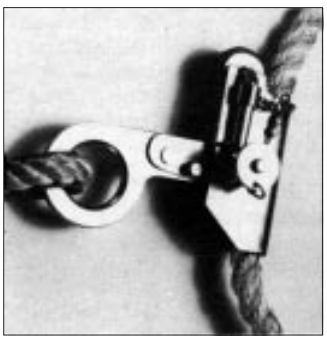

Figure 2. *A safety line must limit a free fall to less than six feet at all times. A rope grab, such as the one shown, clamps to a fixed lifeline, which runs vertically or horizontally across the building. This saves time when a worker needs to change position.*

Figure 3. *A Whirlie-Bird is the closest thing to a sky hook available for fall protection. The stand, which holds two retractable line reels, must be anchored to the roof with J-bolts that slip through holes in the deck and hook under the roof framing.*

Avoid wrapping the lanyard, lifeline, or strap around sharp corners.

When you have open framing, tying off to a secure anchor point is relatively easy. The challenge comes when you're working at the edge of a roof on a completed house. What do you do short of drilling through roofing, sheathing, and plaster to run a line through the structure? In this case, rigging a lifeline may be the only option. To secure the line, try to go through two open windows so the rope is supported by a wall section. You might have to bring the rope up over the peak of the roof to support workers on the opposite wall or roof edge.

But on a small job — for example, when you have two guys unloading shingles from a lift and distributing them over a roof deck — rigging a lifeline would take more time than it would to complete the job. And the lines crossing the roof deck would get in the way. In this case, you need a sky hook.

Sky Hooks

The closest thing to a sky hook is the Sinco *Ridge Runner* and *Whirlie Bird*. These provide a ready-made anchor point on a roof deck without rigging a lifeline across the structure that might trip workers (see Figure 3). The steel stand has three adjustable supports that anchor to the roof with a J-hook. You have to drill through the deck to slip the hooks under a joist or beam.

Though convenient, these setups are expensive. The Ridge Runner — a complete package for one worker including stand, self-retracting line, and harness — sells for about $1800. The Whirlie Bird — a complete package for two workers — sells for about $3500. A more affordable option is the *J-Anchor*, which uses one of the J-hooks to anchor a lifeline for one worker. Including a line and safety belt, this package sells for about $290, and with a body harness, for about $330. ■

Sources of Supply

Elk River Safety Belt Co.
306 2nd St., SW
Cullman, AL 35055
800/633-3954

Klein Tools
7200 No. McCormick Blvd.
Chicago, IL 60659
800-323-3664

Miller Equipment
1355 15th St.
Franklin, PA 16323
800-873-5242

Sinco Products
P.O. Box 361
East Hampton, CT 06424
800/634-4079