A Tagline is Critical to Controlling a Suspended Load

Taglines are used to oppose uncontrolled rotation of a load; alter the rotation of a suspended load; assist in controlling swinging; and avoid the need for workers to control the load with their hands. They are not intended to pull a load out of its natural suspended line; hold a load against wind forces trying to push it out of line; or help support a load.

There are a couple of reasons why a load may rotate on the hook as it is lifted and maneuvered. The first is wind forces. Unless a load has the same area to the wind regardless of rotation, it will want to rotate to present its least area to the wind. Understanding this is a key factor in deciding whether or not taglines are required to control rotation. Second is, the load lines may tend to spin up some as the load is lifted. Using taglines, the load can be held static, allowing the spin up to shake out at the bearing in the hook block.

A load typically swings when the wind is gusting or when it is being moved with the crane. Once started, it can be difficult to stop the swinging. Preventing the start, or at least limiting the amplitude of the swing, is ideal. If an unrestrained suspended load is subjected to a sustained lateral wind force, it moves sideways, inducing an out-of-plumb angle in the suspension. Forces balance when the lateral, or horizontal, component of the tension in the suspension equals the wind force, and the load will reach equilibrium at a slight out-of-plumb as long as the wind continues to act in a constant manner.

Don't lift light loads with large sail areas in high winds. If loads start to swing, attempt to damp down the movement. If that is a problem, try to turn the load to present its least area to the wind, wait until it stops swinging, then turn it back and try again with improved control.

Information for this article came from a spring webinar hosted by Woodland, Wash.-based Industrial Training International and presented by J. Keith Anderson, chief rigging engineer, and Monty Chisolm, equipment superintendent, for Bechtel. Anderson can be reached at jkanders@bechtel.com; Chisolm, at mchiso@bechtel.com.
All hands on deck

Putting hands on a suspended load is always a risky solution for controlling a load and should not be done unless there is no better alternative, and it is absolutely necessary.

If this is the only solution, it can be done with proper precautions and awareness of the hazards and risks.

- Never reach above shoulder height to access a load.
- Place hands on the surface and never in or on the end of a load.
- Maintain an arm's length away from the load.
- Walk the load down. Reaching down moves you closer to the load.
- Dynamic effects on the load (wind, pendulum actions, and swinging) will put you at risk.
- Never place any part of your body in between a load and another object (pinch point).
- Make sure that good communication is always maintained, especially when hands are on the load.

The tagline rope should be laid across the palm of one hand and firmly gripped. If the line is to be pulled in or let out, it should be done hand over hand so that one hand always has the line securely. The line should never be wrapped around the arm or body to get a better grip, or wrapped around a beam, column, hand rail, or the like to hold the load or redirect the angle of pull. There should be a clearly defined escape route, so that in the event of an emergency, the rope can be dropped in front of the handler, who can then make his or her way to safety without stepping into the excess rope.

Given that a person has a limited ability to pull, prevent, or create rotation, the pull should be as effective as possible. The moment arm is the horizontal distance perpendicular from the point of rotation (i.e., the crane hook) to the line of pull. The aim is to make the moment arm as great as possible to give the pull the maximum turning effect about the crane hook. If you imagine a line from the crane hook to the point of attachment of the tagline, the pull is most effective if it makes a 90° angle to that line. While that cannot realistically be achieved 100% of the time, it is a good goal to aim for.

Secondly, the pull is most effective horizontally when the tagline is near horizontal. When working at or near ground level, that is easy to achieve. However, many lifts involve the load being raised to height. The greater the angle the tagline makes to the horizontal, the less effective the pull is in its ability to rotate the load in a horizontal plane. By the time the tagline is at 45°, the pull is only 71% effective.

Note that as the angle to the horizontal increases, you are actually pulling down on the load; at 45°, some 71% of the pulling force (tagline tension) is acting down on the load. By going as far as nearing vertical with the tagline, the pull is all vertical and contributes nothing to rotating, or preventing rotation of, the load. At the start the load may be controlled, but control will become progressively less as the lift progresses. Plan, where possible, to be inclined no greater than 45°. That means being at least as far away from the load as the height the top end of the tagline will be above you. At 45°, the length of your tagline needs to be a minimum of about 1.5 times the height plus 6 ft.

Taglines should be attached to the load toward its lateral extremes to get best “purchase” against rotation, and attached to a lug, nozzle, structural member, or other substantial and solid member capable of taking a significant force without being deformed, damaged, or moved.

Taglines should not be attached to the rigging supporting the load (unless that is the only option and is assessed to be safe to do so); door handles, valves, or items of equipment; or where they can slip off as the operation proceeds.

To determine how long the lines should be, you first need to decide what control is required.

- Is it required only during uplift and receipt?
- Is control required throughout the entire operation?
- Will control have to be handed off to, say, height during a lifting operation?
- Will I have to let go of the tagline(s) at some point? If so, will they be a hazard?

The lines need to be:

- Long enough to keep body parts out of harm’s way;
- Long enough to reach from the load to where the handler has to stand (with some reserve) considering the load height;
- Long enough that the handler can be positioned so the angle of the tagline to the horizontal does not get so steep that control becomes impossible as the lift proceeds (try to maintain 45° or less to the horizontal); and
- Not so long as to create a snagging hazard.

Assuming 45°, the tagline should be at least 1.5 times the height plus 6 ft. There should always be a clear line from the handler to the point of attachment so the tagline does not have to pass over, under, or around parts of the load as the operation proceeds.

Taglines are most effective if their line of action forms a 90° angle, in plain view, to an imaginary line from the center of gravity to the attachment point. Tagline handlers should aim to position themselves as close to that as possible, consistent with being in sight of each other. As a load is rotated, this angle will depart from 90° and the pull will become less effective. It may be necessary for handlers to relocate to regain better purchase on the load.

Lifting may involve relocating a load either by hoisting, swinging, booming out, crawling, or some combination thereof, and tagline use needs to reflect this. Persons handling taglines will either need to move with the load and/or be able to pay out the tagline. It is necessary to consider the attitudes of the load to the boom at the commencement of the operation and at the end of the operation, and the extent of correctional rotation required between the two. If a load has to be rotated to guide it along a path between obstructions, that needs to be considered.

Handlers who are required to move with the load should have clear paths by which they can relocate free of obstructions, trip hazards, changes in level, etc. If this is not practical, it may be required to duplicate taglines and hand over control mid-lift to the duplicate handlers. The load must not be allowed to take over and drag the tagline handlers along a path of its choosing.

The risks of not controlling the forces to which freely suspended loads are subject include the load striking something or someone, and/or lifting equipment, or surrounding structures. Taglines are invaluable in mitigating these risks.