

## WORKING SAFELY NEAR OVERHEAD POWER LINES

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### CONSTRUCTION SITES OFTEN INTERSECT WITH POWER LINES. JEROME SPEAR GIVES TIPS ON:

- Avoiding contact with power lines
- Safeguards for crane operators
- What to do if contact is made with a live power line

**Case 1:** In 2000, a contractor contacted a 440-volt temporary power line located approximately 12 feet above grade at a job site in North Carolina. The power line severed in two. Fortunately, this incident resulted in no injuries but did incur some property damage.

**Case 2:** In 1944, a piping superintendent was not so lucky while off-loading material from a flatbed trailer at a job site in Houston. The operator of a 28-ton rough terrain mobile crane was "walking the load" to a place underneath overhead power lines (with a voltage rating less than 50,000 volts) when contact was made. The superintendent was guiding the load with his hands. The operator survived the incident; however, the superintendent was pronounced dead at the site.

As described by these case studies, there are many outcomes that can result from contacting energized power lines, but all such incidents have the potential to be fatal. In fact, the single largest cause of fatalities in crane use is contact with overhead power lines. According to OSHA, an average of 71 fatalities occurs each

year in the United States due to crane accidents, and nearly 45 percent of such accidents involve contact with overhead power lines.

### KEEP YOUR DISTANCE

OSHA's requirements regarding working near overhead power lines with cranes and other high-reaching equipment are straightforward and strict. For power lines 50 kilovolts (kV) or less, the operator must keep all parts of the crane or other high-reaching equipment at least 10 feet away from the lines. For lifting equipment, this also includes any load being carried. This minimum clearance distance is a buffer zone that must be kept between the equipment and overhead lines.

If the lines are greater than 50 kV, then the line's minimum clearance distance must be increased by 0.4 inches for each kV over 50 kV or twice the length of the line insulator; however, the minimum clearance distance must never be less than 10 feet. ANSI recommends the minimum clearance distances listed in Table 1.

Distribution lines are typically 50 kV or less, whereas transmission lines are typically greater than 50 kV. Distribution lines are the most common lines used by utilities. To determine the voltage rating of the power line, contact the utility company. If you still cannot determine the voltage range, stay at least 45 feet away.

**TABLE 1: MINIMUM CLEARANCE DISTANCES**

VOLTAGE (kV)	MINIMUM CLEARANCE DISTANCE
< 50	10 FEET
> 50 TO 200	15 FEET
> 200 TO 350	20 FEET
> 350 TO 500	25 FEET
> 500 TO 750	35 FEET
> 750 TO 1000	45 FEET

Reference: ANSI B30.5

### ELIMINATE THE HAZARD

If the minimum clearance distance cannot be maintained, the power line should be de-energized and visibly grounded. By eliminating the source, the hazard of electrocution is eliminated. This must be coordinated with the utility company or owner of the line. The line owner may need several weeks to comply with the request, so the work should be planned appropriately. Only authorized personnel may de-energize a power line.

If the power line cannot be de-energized for the duration of the work, the next option is to move the line so the line's minimum clearance distance can be maintained. Like de-energizing the line, only the company that owns the line may move it. Again, the line owner may take several weeks to comply with the request.

### ADDITIONAL SAFETY MEASURES

Additional safety controls may be instituted to further prevent and/or protect against power line contacts. Such safety measures include assigning an additional crane signal person ("wire watcher"), installing insulated sleeves, posting barricades and signs and installing other optional devices (e.g., proximity warning devices, insulated links, boom-cage guards, etc.).

A wire watcher is required when it is difficult for the crane operator to maintain the minimum safe clearance distance by visual means. Insulated sleeves can be attached directly to the power lines. The sleeve (made of non-conductive material) prevents physical contact between the crane and the power line. Only the utility company or the line owner's representative may install insulated sleeves.

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Warning lines and signs should always be used when working around power lines. Using warning lines and signs is a way to visibly alert workers of the existing hazard. Preferred methods of barricading are to erect temporary fencing and/or place equipment or storage containers at the minimum distance barrier line to prevent equipment movement inside the buffer zone.

A signaler is always required when lifting a load. However, in addition to a signaler, a wire watcher is required when it is difficult for the crane operator to maintain the minimum clearance distance by visual means. The key reason crane operators have difficulty around power lines relates to how the human brain functions. The brain uses shadows to help gauge distance and depth perception. Both the wire rope on the crane and the power line are essentially one-dimensional objects that cast no visible shadow. Therefore the operator's normal depth perception is not working in this situation.

The wire watcher's job is to alert the crane operator if the boom or equipment approaches the minimum clearance distance. The wire watcher must be posted at the minimum clearance distance line and shall not be given other responsibilities that may create distractions. The wire watcher should be placed so he or she is at a right angle to the crane operator's line of sight, looking at the left-to-right separation between crane and wire. The wire watcher should not be looking from the same perspective as the operator—otherwise you just have two people trying to see the same thing. Some safety professionals have interpreted the ANSI B30.5 standard to require a wire watcher whenever the crane is within the boom's length of an energized wire. Therefore, a 200-foot mobile crane would require a wire watcher if it operated within 200 feet of the power line.

Protective devices such as insulated links, proximity devices and boom-cage guards should have limited use and application. That is, the minimum clearance distance should still be maintained when using these devices.

Insulated links can be used between the crane hook and the load. If a power line contact occurs, the linkage

will prevent electricity from passing to the load. The entire structure of the crane, however, is not protected and will remain energized. Therefore, it is possible for the rigger to be protected, but any worker near the crane body (particularly in wet soil conditions) may be electrocuted from the current passing through the ground. When insulated links are used, it is important to understand that the operator still shall not allow any part of the crane or load inside the power line's minimum clearance distance.

Also, when working around energized power lines it is recommended the tag line (ropes used by workers to help position the suspended load) be made of polypropylene to reduce the potential shock risk to the worker.

Proximity warning devices are designed to warn the crane operator when he or she moves any part of the boom too close to an overhead line. It is possible to get false readings with these devices. As with the insulated links, the operator still shall not allow any part of the crane or load within the minimum clearance distance.

If a power line contact occurs with a boom-cage guard, it will prevent the boom from becoming energized, thus protecting all workers involved. The drawback of this technology is that it only protects the portion of the boom covered by the cage guard. It is still possible for contacts to occur on other parts of the boom, the load line and the load. Again, the operator must maintain the minimum clearance distance of the power line.

### IF YOU HIT A LINE

Power line contacts involving mobile cranes generally do not result in injuries to the crane operator. The riggers or other workers standing near the equipment experience 70 percent of the injuries and deaths that occur. The reason there are fewer injuries to operators is the physics of electricity and equipment design. If a contact occurs, the operator, as long as he or she stays on the crane, is at the same voltage potential as the equipment and therefore no current will flow through him or her.

If a line is contacted, the operator should carefully try to disconnect from the line. This needs to be done cau-

tiously as the power line may have been tack welded to the equipment during contact. If the line is stuck, STOP. The operator should wait in the crane and all other workers should stay away from the equipment. The line should be de-energized by the power company before the operator attempts to leave the crane cab or until contact between the boom and the power line is broken. Only under extreme circumstances (e.g., fire) should the operator leave the equipment.

If the operator must leave the equipment, he or she should jump from the equipment and land feet together. Care must be taken not to touch any part of the crane and the ground at the same time. The operator must then shuffle his or her feet in very small steps (or bunny hop) away from the crane. After a power line contact, the current flows outward from the crane through the soil in a ripple pattern. Areas of high and low potential circle the energized equipment like ripples in a pond after a stone hits the surface. If a person steps from an area of high potential to an area of low potential or vice versa, electricity can flow through the person's legs, causing injury or death. The current flowing through the ground is also why other workers in the area of the energized equipment must stay away.

### CONCLUSION

Overhead power lines should be identified before any equipment arrives on site. For power lines less than 50 kV, the boom and all parts of high-reaching equipment must be kept at least 10 feet away. For power lines with greater voltages, the minimum clearance distance is increased. There are additional safety measures that can be taken to prevent and/or protect against contacts with overhead power lines; however, the safest advice is to keep your distance. ◀▶

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