



**NATIONAL COMMISSION FOR THE  
CERTIFICATION OF CRANE OPERATORS (NCCCO)**

## **Chapter 6 Self-Erecting Tower Cranes**





# Self-Erecting Tower Cranes

The use of self-erecting tower cranes is increasing substantially. These cranes have replaced rough terrain forklifts in many situations. Many users of self-erecting tower cranes are not familiar with the use of cranes. These machines represent significant risk and their use must be well planned and performed with attention to safety at all times. This paper will discuss several items critical to the safe use of self-erecting tower cranes, the items are as follows: Planning, Set-up, Erection, Operation, and Dismantling.

## PLANNING

Extensive planning must occur prior to the crane's arrival at the jobsite. The plan must be developed by persons with sufficient training, knowledge, and experience on self-erecting tower cranes. The plan should be divided into two (2) major sections as follows:

1. Delivery, set-up, erection, and dismantle.
2. Lifting operations.

Delivery, set-up, erection, and dismantle

These machines can be towed to the site using fixed or removable axels, hauled on a trailer, or driven under their own power. Check horizontal and vertical clearances, weight restrictions, and compaction and traction of surfaces at the jobsite.

A site-specific safety survey must be performed as part of the planning process. This will require a site visit. Items that could have a negative effect on crane operations must be identified. These items would include, but not be limited to, the following: overhead power lines, underground structures and utilities, paved areas, backfill, high water table, basements, proximity to bodies of water, excavations, adjacent structures, and changes to site conditions during construction.

These machines are usually set up on outriggers. The reaction forces at the outriggers are substantial. There are two (2) reactions, in service and out of service. A soil report must be provided prior to crane set-up so adequate foundations can be prepared for the crane. The outrigger float pads do not have sufficient area to spread the reaction loads over a large enough area to prevent settlement on soil. Therefore, concrete footings or crane mats must be placed under the outrigger float pads. The size and strength of these foundations must be determined by a qualified person, who will use information from the soils report and the maximum crane reactions supplied by the manufacturer.

The requirements of the Federal Aviation Administration (FAA) standard 7460-1 must be met for any obstruction of more than 200 feet in height above the ground level at its site.

Most self-erecting tower cranes require 3 phase electric service. This service is not available everywhere. Contact the power company well in advance if you plan on using their service. If using a generator to supply crane power, contact the crane manufacturer for the required kW rating and procure it well in advance. Some self-erecting tower crane control systems require that the power supply to the control panel be left on at all times to ensure a stable temperature for the electronics. In this case, the power from a generator may not be desirable.

Self-erecting tower cranes are required to weather vane (point downwind) when out of service. This will likely cause the crane's jib to over sail adjacent property. In addition, during lifting operations the jib could also over sail adjacent property while the load does not. If this will be the case, permission may be required from adjacent property owners to allow the over sail in order to avoid costly lawsuits and/or crane shutdowns.

Proper clearances (crane and load) must be allowed for during erection (including unfolding), operation, and dismantling (including folding). In order to obtain proper clearances; planners will have to use accurate dimensions of the crane, load, rigging, existing structures, and the structure under construction. It is important to remember that the structure under construction was not there when the crane was erected in most cases. Planners will likely use plan view drawings as well as elevation view drawings.

The knowledge and experience required to erect and dismantle a self-erecting tower crane is much different than the knowledge and experience necessary to operate the crane. Planning must include someone who is qualified to set-up, erect, reconfigure, unfold, dismantle, and fold the crane. During unfolding and folding, self-erecting tower cranes are very vulnerable to wind. The maximum allowable wind speeds, per manufacturer or qualified person, must be part of the plan and adhered to during erecting and dismantling.

The plan must be communicated to the appropriate people. When communicating the plan to those people, ask for input, quite often the plan will be improved. Also, something occurs at this stage called “buy in.” People think this is their plan and are much more likely to work that plan. In addition the plan should be reviewed with personnel just prior to doing specific parts of the work.

## LIFTING OPERATIONS

This section of the plan would identify staging and lay down areas. It is important to have accurate load weights and radii to ensure the crane has sufficient load ratings to do the work. Each work item should have its own place in the plan; examples of work items include, but are not limited to: form work, rebar, concrete placement, steel erection, masonry, framing, and roofing. Rigging methods and materials would be addressed here as well as signaling methods. In addition rigger and signalperson qualifications should be set forth. The crane manufacturer’s, or qualified person’s, requirements for in-service wind should be noted in the plan.

### Set-Up

Self-erecting tower crane set-up includes preparing the foundation, placing the crane on the foundation and connecting the electric service. The foundation must be placed on subgrade as specified by the engineer or qualified person and in the location specified during pre-planning. The foundation size and construction must meet the specifications of the engineer or qualified person.

If using timber, the timber must be capable of distributing loads as intended. Timbers that are thru-bolted to act as a unit are preferred over loose timber. The use of individual loose timbers has been shown to cause a significant number of accidents for self-erecting tower cranes. Figure 1 shows some good and bad foundation conditions.

Once the crane is placed on the foundation the crane must be leveled to within the specification required by the crane manufacturer or qualified person. The foundation itself must be level and completely support the bottom of the outrigger pad.

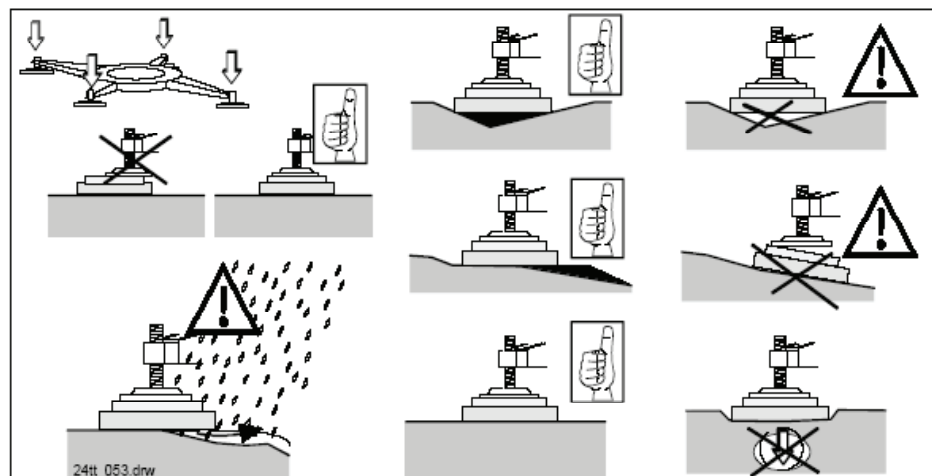


Figure 1

If the self-erecting tower crane needs electric power to level, the electric service would be connected prior to leveling and if not before raising or unfolding. The crane must have a main disconnect switch mounted at or near the base of the crane. The switch must have surge protection and be capable of being locked in the off position. The crane must be properly grounded in accordance with the National Electric Code (NEC).

## **Erection**

Self-erecting tower crane erection includes raising the crane from transport position, installing counterweight/ballast, unfolding, telescoping the mast, and reconfiguration. These operations require much different knowledge and experience than actually operating the crane during lifting operations. It is critical that this work be performed by a qualified person.

Self-erecting tower cranes normally use counterweight/ballast made of reinforced concrete. Prior to installation the counterweight/ballast must be checked for proper size, weight, damage, and integrity of lifting points. Defective or improper counterweight/ballast must not be installed. Install counterweight/ballast according to the crane manufacturer or qualified person's instructions.

Prior to erection, the person performing the erection operation must check for site hazards, see that there are no personnel in crane pinch points or fall zones, and the wind speed is below the maximum permitted by the crane manufacturer. After erection is completed and prior to use, the crane and foundation must be tested in accordance with the crane manufacturer's instructions. This will include setting all motion, zone, and load limits. If the crane is to be reconfigured after initial use, a qualified person is to perform the reconfiguration and ensure that all switches and limits are properly set before operation is continued.

When erection work requires personnel to work at locations where they are exposed to a fall of six (6) feet or more, appropriate fall protection measures must be implemented.

## **Operation**

Self-erecting tower cranes must be operated by qualified persons. The operator must be able to read, understand, and follow signs, decals, labels, and the crane's operating manual. The manual must be available to the operator at all times when the crane is in operation.

If the operator is to leave the radio remote control unattended, the operator must de-energize the crane and secure the remote by removing the key or placing the remote in a lock box. During donning or removal of the remote using a belt or harness, the remote must be turned off or the crane de-energized.

The load ratings of a self-erecting tower crane must not be exceeded, except during testing. During testing, follow the crane manufacturer's instructions and have the operation supervised by a qualified person. Load ratings are for freely suspended loads only. Hoisting, slewing, trolleying, luffing, or traveling must not be used to pull, plumb, or move a load in a horizontal direction. Never attempt to lift stuck, frozen, or embedded loads.

Self-erecting tower cranes are bottom-slewing cranes. The area inside the crane's tail swing must be barricaded. This barricade must be in place at all times while the crane is in operation.

Never allow personnel under a suspended load.

Never leave loads suspended from the crane when the operator is not at the controls.

Never add weight to a suspended load.

Never hoist personnel without manufacturer's approval.

Self-erecting tower crane operators must be familiar with emergency procedures. One such emergency procedure is what to do if the load is lowering in an uncontrolled manner. The proper response is to engage the emergency stop button on the remote or control desk. This will de-energize the crane and set all brakes.

Another emergency would be contact with overhead power lines. If the operator is on the crane he should stay there unless it is unsafe to do so. If the operator is not on the crane he should do his best to advise personnel the crane is energized and they should avoid touching the crane or load. In addition, the operator should try to break contact with the lines if possible, but not exert so much force that the lines could be pulled down.

### **Dismantling**

Dismantling a self-erecting tower crane includes folding the jib, lowering the mast, removal of counterweight/ballast, placing the crane in transport position, and removal from the site. This work requires different knowledge and experience than operating the crane and must be performed by a qualified person.

Prior to dismantling, it must be determined that there is sufficient space available to perform all required operations and to remove the crane from the site.

Prior to dismantling, ensure that all switches, pins, etc. are in their proper position. Follow the crane manufacturer's instructions and specifications. Remove counterweight/ballast in the proper sequence and at the proper time. Follow all applicable fall protection requirements. Keep all personnel out of crane fall zones and pinch points.