

# Electrical fatigue checks

*Felix Weinstein and Vladimir Brockman explain how to maintain tower crane electrics*

**W**hen discussing fatigue in tower cranes, it is usually fatigue within the steel structures of the crane that comes to mind. However, integral to the tower crane are its electrical and drive systems. If these are allowed to wear out, accidents are likely to follow.

The lifespan of mechanical and electrical components in the crane depends on the number of work cycles of that part (as well as, of course, as the load ratio). Failure in control systems caused by fatigue is likely to result in loss of control over the crane, as well as other phenomena. In accidents, resulting from fatigue of electrical parts cement buckets and other loads have fallen from great heights because the operator suddenly had no control over the crane or any ability to stop the fall.

Preventing fatigue of the electrical systems, therefore, is imperative for work safety and the prevention of accidents. Unfortunately, the manufacturers do not give a lot of information about maintenance and fatigue of the electrical parts. All too often it is an aspect of crane maintenance that is neglected until problems begin to occur. As ever, a good preventative maintenance regime – before the crane begins operations on site – is the solution for it is easier to prevent faults than to perform repairs at the building site.

Fatigue of the crane's steel structures and fatigue of electrical components in the tower crane's command systems are the two most complex issues for which precise formulas and clear instructions have not yet been found. The advice on this page, therefore, is based on our professional experience rather than academic theory.

Modern tower cranes have complex electrical systems, as seen here being demonstrated at the site of a leading manufacturer



1. Check power contacts in the main contactors of the hoist systems and/or the actual contactors. Use the following components:
  - A95 contactors able to perform up to 1.5 million operations
  - A150 contactors able to perform up to 1.4 million operations.
 In any event, statistics say that the power contacts in the main contactors require replacement every two or three years.
2. Rinse the electrical range extinguisher cells in the main contactors. The ionization of air inside the extinguisher cells causes the suction of dust particles into the cell, which settle on the cell walls as charcoal. This causes deterioration in the cell performance conditions which erodes the power contacts.
3. Tighten screws and joins in the command systems, the electricity cabinets, the power circuits and the resistor cells. It is most important to maintain the power contacts and control in good repair. When electrical connections are loose there is the danger of a short circuit in the control and electrical system. Electrical connections should be tightened every two or three months. Special attention should be given to the rotor connections of the hoist engines.
4. Check and clean the rotor resistor cells before assembling tower crane on site.
5. Check engine bearings and renew the rotor and stator insulation. Before assembling the crane on site the

## Fault checklist

1. Check power contacts
2. Rinse the electrical range extinguisher cells in the main contactors
3. Tighten screws and joins
4. Check and clean rotor resistors
5. Check engine bearings and renew rotor and stator insulation
6. Check and clean collector rings
7. Replace collector carbons
8. Check brake discs and space between reel and plate of the electromagnet

bearings should be checked and if necessary replaced. Experience shows that bearings need replacing every 12 to 18 months. When the engine is disassembled, the insulation of the rotor and stator should be checked and renewed. The joins between the rings, collector and rotor reels should also be checked. After re-assembling the motor, the margins between the rotor and stator should be checked.

6. Check and clean the collector rings. To extend the life of the collector rings, clean them by etching after the gap between the rings increases.
7. Replace collector carbons after every 18 months of continuous work. Make sure that the carbon length does not decrease by more than one third of the original length.
8. Check brake discs and the space between the reel and plate of the electromagnet. To ensure precise braking of the crane components, the space between the moving parts and fixed parts of the electromagnetic brake should be monitored. Check the level of erosion of the brake disc and the state of the brake springs. Replace if necessary. 

### About the authors

*Felix Weinstein is managing director of Israeli consulting firm Felix-Engineering and an authorised inspector of tower cranes. Vladimir Brockman is an electrical engineer with 28 years of experience in electromechanical systems.*