In-Depth Inspection & Non-Destructive Testing
CRITICAL COMPONENTS ASSESSMENT
Undetected defects and/or deficiencies in load-bearing or safety-related components can lead to catastrophic failure. Most compliance and preventive maintenance inspections rely on visual observations and measurements. Unfortunately, what you can’t see can hurt you. Certain defects and deficiencies cannot be seen with the naked eye; others may occur within components that are not normally disassembled for inspection.

Konecranes Critical Components Assessment has been specifically designed to address this very issue. By utilizing Non-Destructive Testing (NDT), proprietary technologies and proven technologies, our certified inspectors and technicians apply their experience and expertise to uncover defects and deficiencies in critical components that are readily evident. To provide maximum flexibility, the various modules of the Critical Components Assessment can be applied individually or grouped in the most appropriate combination to suit your particular application.

At a minimum, Konecranes highly recommends the Critical Components Assessment in the following situations:

- Older equipment with 10+ years of service
- Process duty applications
- Equipment being used beyond the original design duty
- Equipment that may have been overloaded
- Whenever it is recommended by the Original Equipment Manufacturer

Whatever the findings or recommendations, the Konecranes team can provide you with the required repairs, replacement parts and training to ensure the safest possible operation of your equipment. When needed, we can also provide you with complete engineered solutions that maximize your productivity while minimizing downtime and total life cycle costs.

Konecranes also offers a Crane Life Extension Study (Crane Reliability Survey) and a Geometric Assessment (RailQ Runway and Crane Survey) that complements the Critical Components Assessment.

Ask your Konecranes Representative for more information by calling 800.933.3001 or visit www.konecranesamericas.com.
**YOU CAN PREDICT THE FUTURE**

**Gear Case and Mechanical Load Brake Assessment**

A wide variety of cranes are utilized in just about every industrial environment. Many have been in service for 20, 30 and 40 years or more. This is especially true for very large cranes such as those used in heavy industrial environments. The basic technology of crane design has advanced in many areas including motors, controls, human interface and wire rope design, among others. One area of particular concern is hoisting gears. In general, the gear cases used in cranes have proven themselves to be reliable workhorses capable of delivering years of service with minimal maintenance. In many applications, “thin rim gears” that do not meet today’s gear design standard are prevalent. These gears have an insufficient tooth depth to rim thickness ratio that is inherently more conducive to fatigue failure. In addition, “production” (i.e. loaded crane usage) may have significantly increased over the years. This increase in usage makes the cumulative effects of fatigue much more important in these typically intermittent use devices. It has become apparent that while the cranes themselves may have significantly increased over the years, the gear cases used in cranes have proven themselves to be reliable workhorses capable of delivering years of service with minimal maintenance. However, in many applications, “thin rim gears” that do not meet today’s gear design standard are prevalent. These gears have an insufficient tooth depth to rim thickness ratio that is inherently more conducive to fatigue failure. In addition, “production” (i.e. loaded crane usage) may have significantly increased over the years.

**Level 1 – Detects surface wear and verifies smooth operation**

The access port or cover is removed and a visual inspection of the gear surfaces is performed (using an endoscope if necessary). An oil sample is taken and sent to a lab for analysis to look for clues of potential problems such as metal particles, heat induced changes in the oil chemistry and contaminants. A vibration test/analysis is taken and sent to a lab for analysis to look for signs of potential problems such as metal fatigue, heat induced changes in the oil chemistry, and contaminants. A vibration test/analysis is taken and sent to a lab for analysis to look for clues of potential problems such as metal particles, heat induced changes in the oil chemistry and contaminants.

**Level 2 – Detect fatigue-induced cracks that may lead to catastrophic failure**

In this assessment the gear case is disassembled and the gears, keys and shafts undergo a full examination which may include non-destructive testing techniques such as dye-penetrant and magnetic rubber. Given that the gear case is already disassembled, as a preventive and cost effective measure; bearings, seals and lubricants are typically replaced. It is also highly recommended that critical spare parts are ordered prior to the inspection and are on hand in the event that they need to be replaced thus eliminating equipment downtime.

**Mechanical Load Brake**

Certain hoists are equipped with a mechanical load brake which is normally located at the first gear reduction in the hoisting gear case. Mechanical load brakes are designed to provide a secondary means of braking in the event of a failure in the hoisting brake or in the coupling between the hoist motor and the hoisting gear or in a connecting shaft. Hoists that are not equipped with mechanical load brakes utilize other secondary means of braking whether mechanical or electrical such as regenerative braking. Secondary means of braking are designed to control the speed of descent of the load (not necessarily prevent it). Mechanical load brakes operate through friction thus generating heat and contaminants in the hoisting gear case (and in the lubricants contained therein). Due to friction material wear, they also require periodic inspection and adjustment in accordance with the original equipment manufacturer’s instructions. A load brake that is out of adjustment will not operate properly and may provide a false sense of security. The only way to inspect and adjust the load brake is to empty the lubricant and open or tear down the gear case.

**Konecranes Offers Two Levels of Gear Case Inspection**

1. **Level 1 – Detects surface wear and verifies smooth operation**
   - The access port or cover is removed and a visual inspection of the gear surfaces is performed (using an endoscope if necessary).
   - An oil sample is taken and sent to a lab for analysis.

2. **Level 2 – Detects fatigue-induced cracks that may lead to catastrophic failure**
   - The gear case is disassembled and the gears, keys and shafts undergo a full examination.
   - Non-destructive testing techniques such as dye-penetrant and magnetic rubber are used.
   - Critical spare parts are ordered prior to the inspection.

**Konecranes highly recommends performing a service life analysis to estimate the remaining life of critical components to avoid unsafe conditions and sudden failures.**

---

**Hoist Coupling Assessment**

The mechanical coupling between the hoist motor and the hoisting gear case is another critical component in the safe operation of lifting equipment. Failure of a hoist coupling may lead to a load drop scenario and subsequent reliance on secondary braking such as regenerative braking or mechanical load brakes. Regenerative braking will not be available since the motor that would be providing the retarding torque would no longer be mechanically connected. If the hoist gear case is equipped with a mechanical load brake, it may be properly adjusted to control the speed of descent of the load.

The type and size of the coupling and its accessibility is highly dependent on the torque power needs of the equipment and on its design. Most hoist couplings are not visible or accessible during an inspection (they are typically hidden within the hoist machinery) requiring the motor/ gear case to be disassembled in order to inspect them. Other hoist motor couplings, generally found in higher capacity and/or process duty equipment are more readily accessible.

In either case, the coupling is taken apart and cleaned of old grease. The surfaces are visually inspected. After inspection, non-destructive testing may need to be performed. For couplings that are not easily accessible, it is recommended that they be replaced. Proper alignment/assembly and lubrication are crucial in ensuring proper coupling life.

**Konecranes highly recommends performing a service life analysis to estimate the remaining life of critical components to avoid unsafe conditions and sudden failures.**

---

**Flexible couplings need to be disassembled to see internal wear and lubrication. Most coupling failures are due to lack of lubrication.**
Thermal Imaging Assessment of Electrical/Mechanical Components

Thermal image technology is widely used in the preventive maintenance and troubleshooting of electrical (and mechanical) components. Abnormal temperatures and heat patterns are a warning sign of potential problems; they can point to loose/poor electrical connections, worn contacts, worn insulation, overloaded motors due to electrical imbalance and/or failing bearings, to malfunctioning heat dissipating/cooling equipment or to equipment being used beyond its intended duty or in a more demanding temperature environment.

Konecranes uses a thermal imaging camera on the electrical/mechanical components of your crane to uncover maintenance issues before a sudden failure or safety hazard occurs. Components which may be inspected with thermal imaging technology includes:

- Motors
- Variable Frequency Drives
- Brake Controls
- Contactors
- Protective Circuit Breakers

Motor Assessment

Motor failure can lead to unexpected and costly downtime. One of the key failure modes is the breakdown of the motor winding insulation leading to an electrical short in the motor windings. Motor insulation is heat rated/sensitive. Equipment use beyond the intended design duty and environment will eventually lead to pre-mature failure. A motor insulation assessment tests the motor insulation value by attaching test leads to the motor and requires no motor disassembly. In addition, a vibration analysis is performed to ensure mechanical components (such as bearings) are in working order and are not on the verge of failure and a costly shut-down.

Konecranes also offers a Crane Life Extension Study (Crane Reliability Survey) and a Geometric Assessment (Rail/Q Runway and Crane Survey) that complements the Critical Components Assessment. Ask your Konecranes Representative for more information by calling 800.933.3001 or visit www.konecranesamericas.com.
Konecranes is a world-leading group of Lifting Businesses™, serving a broad range of customers, including manufacturing and process industries, shipyards, ports and terminals. Konecranes provides productivity-enhancing lifting solutions as well as services for lifting equipment and machine tools of all makes.

This publication is for general informational purposes only. Konecranes reserves the right at any time, without notice, to alter or discontinue the products and/or specifications referenced herein. This publication creates no warranty on the part of Konecranes, express or implied, including but not limited to any implied warranty or merchantability or fitness for a particular purpose. © 2011 Konecranes. All rights reserved. ‘Konecranes’, ‘Lifting Businesses’ and are registered trademarks of Konecranes.