



This Guide provides information on inspecting, testing, maintaining and repairing cranes in the workplace and supports the [General guide for cranes](#).

This Guide forms part of a series of guides and information sheets for cranes that includes information on:

- mobile cranes
- tower cranes
- bridge and gantry cranes
- vehicle loading cranes
- vessel-mounted cranes
- crane-lifted workboxes
- using other powered mobile plant as a crane, and
- quick-hitches for earth moving machinery.



## Maintaining a safe work environment

As a person conducting a business or undertaking you have obligations under the Work Health and Safety (WHS) Regulations to ensure, so far as is reasonably practicable, workers and other people are not exposed to health and safety risks arising from the business or undertaking. This includes making sure cranes at your workplaces are inspected and maintained.

A preventative inspection, maintenance and testing program will help ensure a crane is safe to use. Inspections and maintenance should be done in accordance with the manufacturer's instructions or, if these are not available, a competent person's specifications or according to relevant technical standards and engineering principles.



Checklists for the inspection and testing of tower and mobile cranes including for major inspections and tower crane pre-erection and commissioning inspections are at Appendix A.



## Pre-operational checks

Before operating a crane a pre-operational check should be completed by a competent person. An appropriate log book should be used to record the condition of the crane.



## Routine inspection and maintenance

Regular inspection, maintenance and repair are to be carried out in accordance with the manufacturer's instructions or those of a competent person. For inspections, if this is not practicable, they must be completed at least annually.

Cranes should be routinely inspected and tested even if they are not operated regularly. This is because the crane may have deteriorated through corrosion or be damaged.

Routine inspections can take place weekly, monthly or quarterly and should include an inspection of:

- crane functions and the controls for speed, smoothness of operation and limits of motion
- emergency and safety switches and interlocks including limiting and indicating devices
- lubrication of moving parts
- verify accuracy of any load moment indicator (LMI) and rated capacity indicator (RCI) devices with a test lift using a certified test weight
- filters and fluid levels and leaks
- visual inspection and measurements as necessary of structural components and critical parts including brakes, gears, fasteners, pins, shafts, wire ropes, sheaves, locking devices and electrical contactors
- signage including warning signs and control markings
- wear on wheels and tyres, and
- extra items nominated in the crane manufacturer's instructions.

A written report should be prepared when the inspection is finished. If replacement parts are needed as a result of the inspection, these parts should meet the original part's specification.

If a crane has been damaged and there are risks to health and safety, it should be immediately taken out of service and people prevented from operating the crane. If the crane needs to be operating during maintenance or cleaning, risk control measures must enable this to occur without risk to health and safety.



## Annual inspection

Regular inspections must be carried out in accordance with the manufacturer's instructions or those of a competent person or, if this is not reasonably practicable, annually.

An annual inspection may be less comprehensive than a major inspection. It should include every item specified by the crane manufacturer for annual inspection and every item included in the routine inspection and maintenance programs.

Annual inspections should include a detailed check of:

- functioning and calibration of limiting and indicating devices
- structural and wear components
- tolerances for wear limit
- evidence of corrosion
- critical areas for evidence of cracking, and
- for tower cranes, relevant items in the pre-erection inspection and tests that can be safely completed while the crane is erected.

Where a tower crane owner is aware a crane will be erected when the scheduled annual inspection falls due, the owner can choose to carry out an annual inspection before erecting the crane or during the pre-erection inspection.



## Major inspections

A major inspection must be completed for registered mobile and tower cranes. Non-registrable mobile cranes and bridge and gantry cranes should have a regular 'major' inspection completed so that they continue to be safe to operate.

Major inspections must be carried out at the end of the crane's design life, as determined by the manufacturer's instructions, or if these are not available, as determined by a competent person to meet the same minimum requirements established by relevant technical standards.

If it is not reasonably practicable to inspect a crane according to either of these, you should inspect the crane at least every 10 years from the date the crane was first commissioned or registered, whichever was first. This must include inspection of the structure as well as mechanical components.

Major inspections must be carried out by, or under the supervision of, a competent person who:

- has acquired through training, qualifications or experience the knowledge and skills to carry out a major inspection of the plant and is registered under a law that provides for the registration of professional engineers, or
- is determined by the regulator to be a competent person.



[Appendix A](#) lists some items to be inspected during a major inspection for tower and mobile cranes. Some of the items may not apply, for example where the item does not exist on the crane. The full list of items to be inspected must be determined by a competent person.

Completion of a major inspection does not indicate that the components inspected will have a further 10 year life. It should not be assumed that the items included in the list only require inspection at 10 yearly intervals. Items will require some type of inspection and maintenance at more frequent intervals, for example at annual and other inspection intervals, according to the crane manufacturer's instructions.

Where there is documented evidence that inspection and testing has been carried out on certain items, for example slew ring bolts, drive systems and braking systems, within a reasonable preceding period (as determined by a competent person) the item may not have to be stripped down in the major inspection. The competent person should still inspect the safe operation of the item to certify it is operating safely and document the reasons for the decision.



## Record keeping

Crane records including maintenance logbooks of the significant events concerning the safety and operation of the crane must be kept and readily available. Records should be kept in a suitable format and must be transferred with ownership of the crane. Entries in the maintenance logbook should:

- clearly describe the work carried out and parts replaced
- be dated
- note the name of the person carrying out the work, and
- be signed by the person carrying out the work.

The checks, adjustments, replacement of parts, repairs, inspections performed and irregularities or damage concerning the unit's safe use must be recorded.

Inspection records should include a statement from a competent person confirming the item of plant has been inspected and is safe to operate.

Inspection records should include:

- What was looked at – component specification or areas of the plant inspected.
- What was looked for – signs of wear, damage, cracking or corrosion.
- What criteria were used – rejection criteria.
- How was it looked for – techniques used.
- What was found – test results, photographs or measurements.

- What was recommended – repairs required before continued use.
- What recommendations were actioned – recommendations acted upon and date tasks were completed.



## Tower cranes

### Pre-erection inspection and tests—on ground inspection

Tower crane components should be inspected and tested by a competent person according to the manufacturer’s instructions before being delivered to the workplace and before being erected.

Where a tower crane owner is aware a crane will be erected when the scheduled annual inspection is due, the owner may consider carrying out an annual inspection during the pre-erection inspection.

Crane owners should develop their own pre-erection inspection and test report that satisfies the requirements of the WHS Regulations and the manufacturer’s instructions. The report should also reflect the specific type and model of crane and reference relevant design drawings and test certificates.

### Commissioning inspection and tests

Commissioning inspections and test should be carried out by a competent person according to the manufacturer’s instructions before a tower crane is put into service.

### Non-destructive testing of tower crane components

Non-destructive testing (NDT) is the testing of materials to detect internal, surface and concealed defects, cracks, breaks or gaps using methods which do not damage or destroy the material being tested.

NDT must be carried out by a competent person having suitable knowledge and experience in NDT methods and being able to determine the appropriate NDT method for the component being tested.

When using magnetic particle NDT to detect cracks in metals remove the paint from the metal surface. This is not required for Eddy current NDT.

NDT of specific tower crane components should take place according to the manufacturer’s instructions and at set intervals, for example pre-erection tests and major inspection. Table 1 indicates some common minimum frequencies of NDT for particular crane components.

**Table 1** Minimum frequency of NDT for particular crane components

Component tested	NDT description	NDT frequency
Boom clevises	Crack test	Pre-erection
Counterweight sheave bracket welds – moving counterweights only	Crack test	Pre-erection
Cruciform welds – luffing cranes only	Crack test	Pre-erection
Butt heal bosses – luffing cranes only	Crack test	Pre-erection
Band brake welds	Crack test	Pre-erection
Slew ring bolts – where slew ring has to be split at disassembly	Crack test minimum 10% bolts	Pre-erection
Tower bolts (where applicable)	Crack test minimum 10% bolts	Pre-erection
Boom lacing welds	Crack test minimum 10%	Pre-erection
Tower sections	Crack test minimum 10%	Pre-erection
Aluminium sheaves	Crack test	Pre-erection

Component tested	NDT description	NDT frequency
Slew ring bolts - slew rings	Crack test bolts	5 years
Boom chord thickness	Material thickness testing	10 years
Slew ring	Crack test	10 years
Hydraulic luffing cylinder gland nut	Crack test	10 years
Hydraulic luffing cylinder and ram-rod ends and caps	Crack test	10 years
A-frame - connector welds on primary chords	Crack test	10 years
A-frame lacing welds	Crack test minimum 10%	10 years
Hook	Crack test	10 years
Welds on hook trolley	Crack test	10 years

### Crack testing of booms and counterweight sheave bracket welds

Booms on non-self-erecting tower cranes are connected by pins passing through male and female clevises on the ends of each boom section. Every weld on male and female clevises on the ends of every boom section should undergo NDT before each crane erection for non-self-erecting cranes. Magnetic particle testing is the usual method used for performing these tests.

Counterweight sheave bracket welds, butt heal bosses and welds in cruciform area on luffing crane booms are known to crack and should also be crack tested by NDT before each crane erection.

### Crack testing of band brakes

Older designs of luffing tower cranes use band brakes. On some of these cranes the steel band is welded to an end fitting that has a pin passing through it. These welds have been known to crack.

You should crack test the weld between the band and the end fitting by NDT before each time a luffing tower crane fitted with band brakes is erected, keeping in mind there may not be a weld on some brake bands.

### Crack testing of slew ring bolts

The integrity of slew ring bolts is critical for making sure both the machine deck and boom remain attached to the tower. Once removed, slew ring bolts should be replaced unless the manufacturer's instructions state they can be reused. If bolts can be reused they should be tested.

For tower cranes where the slew ring needs to be split each time the crane is moved, NDT 10 per cent

of slew ring bolts is suggested. Bolts to be tested should be selected from the slew ring by a competent person. Complete removal of the bolts from the slew ring and use of magnetic particle testing is recommended. If cracks are detected, bolts should be discarded and replaced with new bolts.

### Crack testing of tower bolts or pins

Tower bolts or pins are a critical part of the crane and permit the effective transfer of load from the crane boom to the crane base. Tower bolts or pins can become damaged and their effective life can be reduced if the bolts are either under or over-torqued. Some tower bolts are made from extremely high grade steel and can be more susceptible to cracking.

Unless the manufacturer's instructions state tower bolts can be reused, they should be replaced. If bolts can be reused, crack test a minimum of 10 per cent of tower bolts by NDT before each crane erection. If cracks are found, tower bolts should be discarded and replaced with new bolts.

A system that makes sure tower bolts or pins are tested over time is preferred. However a random system of testing can also be used. The tested bolts should be identified by a method that does not damage the bolt.

### Chord thickness testing

Steel lattice-type tower crane booms can be prone to internal and external corrosion affecting the thickness of the boom. The thickness of the chord wall can be reduced through abrasive blasting of the boom.

Main chord sections on tower crane booms should undergo thickness testing at intervals not exceeding 10 years. Ultrasonic thickness testing is one method of verifying the strength in the chords of the boom.

Review chord sections for structural adequacy when the thickness is shown by testing to be 90 per cent or less than 90 per cent of the original thickness.



### Further information

The following technical standards provide further information on inspecting and maintaining cranes:

- *AS 2550.1-2011: Cranes, hoists and winches—Safe use Part 1: General requirements*
- *AS 2550.3-2002: Cranes, hoists and winches—Safe use Part 3: Bridge, gantry, portal (including container cranes) jib and monorail cranes*
- *AS 2550.4-2004: Cranes, hoists and winches—Safe use Part 4: Tower cranes*
- *AS 2550.5-2002: Cranes, hoists and winches—Safe use Part 5: Mobile cranes*
- *AS 2550.11-2004: Cranes, hoists and winches—Safe use Part 11: Vehicle-loading cranes, and*
- *AS 2550.20-2005: Cranes, hoists and winches—Safe use Part 20: Self-erecting tower cranes.*

# APPENDIX A – INSPECTION / TESTING FOR TOWER AND MOBILE CRANES

## Inspection / testing for tower cranes

Pre-erection inspections / tests	Commissioning inspections / tests	Major inspection
<ul style="list-style-type: none"> <li><input type="checkbox"/> NDT of welds on vital components including boom clevises, butt heel bosses and counterweight rope sheave brackets</li> <li><input type="checkbox"/> NDT of tower crane bolts</li> <li><input type="checkbox"/> NDT of slew ring bolts</li> <li><input type="checkbox"/> NDT of aluminium sheaves</li> <li><input type="checkbox"/> The condition of the power supply cable—where used</li> <li><input type="checkbox"/> The condition of motor brakes</li> <li><input type="checkbox"/> The condition of the slew ring gear and pinions</li> <li><input type="checkbox"/> Air controls and associated valves</li> <li><input type="checkbox"/> The condition of ropes and sheaves e.g. erecting, hoisting, counterweight and trolley, correct rope tracking and no signs of damage or excess wear</li> <li><input type="checkbox"/> The condition of limit switches and limiting devices</li> <li><input type="checkbox"/> The condition of counterweights</li> <li><input type="checkbox"/> The condition and fitment of machinery guarding</li> <li><input type="checkbox"/> Brake systems can be dismantled and inspected for wear and damage:               <ul style="list-style-type: none"> <li>■ dry brakes—before each erection or more frequently if directed by the manufacturer</li> <li>■ wet brakes—before each erection or after 5 000 hours of crane operation or as directed by the manufacturer</li> </ul> </li> <li><input type="checkbox"/> Normal service items including items supplied by the crane manufacturer e.g. temperature control units and seating being maintained in a serviceable condition according to the crane manufacturer’s instructions, and</li> <li><input type="checkbox"/> Other tests as specified by the manufacturer.</li> </ul> <p>Once the tower crane components have been delivered to the workplace they should be inspected by a competent person for possible damage and wear that may have occurred during transport. Inspections should include:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> The crane base design and engineer’s report</li> <li><input type="checkbox"/> Crane ties and structure to support them where used</li> <li><input type="checkbox"/> The power supply and earthing.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Crane electricity supply—where used</li> <li><input type="checkbox"/> Crane base weights or ballast—where used</li> <li><input type="checkbox"/> Tower section identification and entry</li> <li><input type="checkbox"/> Tower bolts to correct tension</li> <li><input type="checkbox"/> Pins and fastenings</li> <li><input type="checkbox"/> Climbing frame and connection</li> <li><input type="checkbox"/> Jib connection pins and retainers</li> <li><input type="checkbox"/> A-frame connections and retainers—where applicable</li> <li><input type="checkbox"/> Jib and deck pendant pins and retainers—where used</li> <li><input type="checkbox"/> Machinery guarding</li> <li><input type="checkbox"/> Leakage in lines, tanks, valves, pumps and other parts of air or hydraulic systems</li> <li><input type="checkbox"/> The condition of the ropes and sheaves e.g. erecting, hoisting, trolley and counterweight, and correct rope tracking</li> <li><input type="checkbox"/> Isolating switches</li> <li><input type="checkbox"/> The condition and phase of the power supply cable</li> <li><input type="checkbox"/> Verification the crane wiring complies with AS/NZS 3000:2007: Electrical installations</li> <li><input type="checkbox"/> Effective operation of controls including interlocks</li> <li><input type="checkbox"/> Effective operation of indicating devices</li> <li><input type="checkbox"/> Effective operation of travel deceleration switches</li> <li><input type="checkbox"/> Effective operation of hoist upper and lower—where needed—working limit switches</li> <li><input type="checkbox"/> Effective operation of warning devices</li> <li><input type="checkbox"/> Effective operation of weather-vaning</li> <li><input type="checkbox"/> Effective operation of the hoist and travel brakes when the crane is laden to the maximum rated capacity</li> <li><input type="checkbox"/> Effective operation of the rescue controlled descent device</li> <li><input type="checkbox"/> Other tests specified by the crane manufacturer.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Slew Ring</li> <li><input type="checkbox"/> Hydraulic motors</li> <li><input type="checkbox"/> Hydraulic pumps</li> <li><input type="checkbox"/> Valve blocks (bodies)</li> <li><input type="checkbox"/> Hoist and luff drums</li> <li><input type="checkbox"/> Braking systems</li> <li><input type="checkbox"/> Rope sheaves</li> <li><input type="checkbox"/> Hydraulic luffing cylinder</li> <li><input type="checkbox"/> Gear boxes and drive shafts</li> <li><input type="checkbox"/> Boom</li> <li><input type="checkbox"/> A-frame</li> <li><input type="checkbox"/> Pins with moving parts for example, boom heel pins and ram pins</li> <li><input type="checkbox"/> Static pins</li> <li><input type="checkbox"/> Steel wire ropes</li> </ul>

## Inspection / testing for mobile cranes

Major inspection
<input type="checkbox"/> Chassis including outriggers and boxes
<input type="checkbox"/> Drive train and suspension components
<input type="checkbox"/> Slew ring
<input type="checkbox"/> Slew ring bolts
<input type="checkbox"/> Hook rollers
<input type="checkbox"/> Drive systems including winches, hydraulic motors, gearboxes and drive-shafts
<input type="checkbox"/> Control systems
<input type="checkbox"/> Braking systems
<input type="checkbox"/> Electrical systems
<input type="checkbox"/> Hydraulic systems—cylinders including outrigger cylinders
<input type="checkbox"/> Booms
<input type="checkbox"/> Safety devices including rated capacity limiters and load indicators
<input type="checkbox"/> Outriggers
<input type="checkbox"/> Steel wire ropes, and
<input type="checkbox"/> Rope sheaves.
<input type="checkbox"/> Electrical systems—hazardous voltage
<input type="checkbox"/> Control systems—non-hazardous voltage
<input type="checkbox"/> Electric motors
<input type="checkbox"/> Hook assembly