

Amusement device major inspections

Interim guidance

Introduction

In Queensland, it is a requirement under the Work Health and Safety Regulation 2011 (the WHS Regulation) for most amusement devices to have a major inspection carried out by, or under the supervision of, a competent person at specific intervals.

On 1 May 2019, the requirement for major inspections of amusement devices commenced under the WHS Regulation. Transitional arrangements exist for some amusement devices which expire on 1 May 2021.

Workplace Health and Safety Queensland is developing a new Amusement Device Code of Practice to complement the amusement device requirements in the WHS Regulation. While the proposed code of practice will include information about major inspections, this interim guidance is intended to assist amusement device owners and engineers until such time as the code of practice is complete.

Please note the interim guidance may be subject to change. Drafting of the code of practice will continue and consultation with the amusement device industry will be undertaken during this time.

More information about amusement devices and the transitional arrangements for major inspections is available at [worksafe.qld.gov.au](https://www.worksafe.qld.gov.au).



Workplace Health and Safety Queensland
worksafe.qld.gov.au



Who is responsible for ensuring the major inspection is carried out?

The person with management or control of the amusement device at a workplace is responsible for ensuring the device has a major inspection. The 'person with management or control' means the person conducting a business or undertaking that has management or control of the amusement device. Generally, this is the owner of the amusement device.

Which amusement devices are required to have a major inspection?

Major inspections are required for:

- amusement devices which are required to have plant design registration or be item registered for operation in Queensland. This includes amusement devices from interstate which come to Queensland to operate for specific periods (e.g. the show circuit). It also includes amusement devices requiring design or item registration at major amusement parks which have not yet been licensed under the WHS Regulation
- all amusement devices located at a licensed major amusement park. Currently, there are six major amusement parks in Queensland which are required to apply for a major amusement park licence under the WHS Regulation before 1 May 2021.

Who is a 'competent person' for supervising or carrying out the major inspection?

A competent person to supervise or carry out a major inspection of an amusement device is a registered professional engineer (RPEQ) who has acquired through training, qualification or experience the knowledge and skills to inspect this type of plant. For inflatable devices with platform heights under nine metres, the person is not required to be an RPEQ but is competent if they have acquired through training, qualification or experience the knowledge and skills to inspect this type of plant.

RPEQs are engineers registered under the *Professional Engineers Act 2003* (Qld) with the Board of Professional Engineers Queensland.

Depending on the type of device being inspected, one individual may not have all the competencies required for all aspects of the inspection. A competent person undertaking inspections should use the services of specialists for aspects outside their areas of expertise. For example, a competent person may be a qualified mechanical engineer but may need to refer the inspection of electronic control systems to specialist engineers who are qualified and experienced in the field. In forming their opinion, a competent person may use the advice of other competent persons involved in inspecting the device who are not engineers (e.g. a non-destructive testing specialist). Any electrical installation in the device must be inspected by a person who is authorised as a licensed electrical worker to perform this work.

When is a major inspection required?

The WHS Regulation requires a major inspection of an amusement device:

- before the end of any period for a major inspection recommended by the manufacturer of the device, or
- if a competent person who has previously completed an annual inspection or major inspection of the device recommends a shorter period than recommended by the manufacturer, the next major inspection is due by the period recommended by that competent person, or
- if there is no recommendation from the manufacturer or a competent person, the device is due for the next major inspection no later than 10 years after it was first commissioned or registered, whichever is earlier; and then no later than 10 years after its last major inspection.

While not specified in the WHS Regulation, Australian Standard *AS 3533.2-2009 Amusement rides and devices Part 2: Operation and maintenance* also requires a major inspection in the following circumstances:

- after a device has suffered a major departure from normal operation or a failure of any major structural or mechanical component [AS 3533.2-2009 Clause 5.4.4(d)]
- when a device is to be recommissioned and adequate records are unavailable or the device was designed and built to unknown standards. [AS 3533.2-2009 Clause 5.4.4(e)]

AS 3533 Amusement rides and devices is listed in Appendix C of the Managing risks of plant in the workplace Code of Practice as a technical standard which provides additional guidance for conducting major inspections.

What is a major inspection?

Under the WHS Regulation, a major inspection of an amusement device involves:

- a thorough examination of all critical components of the device, including if necessary, stripping down the device and removing paint, grease and corrosion
- a check of the effective and safe operation of the device.

A major inspection ensures all the high stress areas and critical parts of the device are inspected in detail, including those that are normally hidden or inaccessible during other inspections.

Even if an amusement device has not been in frequent or regular operation, it may have deteriorated due to the way it has been stored or the environment in which it has operated.

The extent to which the amusement device will need to be stripped down for the major inspection is a matter for the competent person supervising or carrying out the major inspection to determine based on their professional judgement and experience and taking all the relevant information about the device into account. The competent person should record relevant information (e.g. non-destructive testing reports, photos of partially stripped components) to support any decision not to strip down a critical component of the device.

As the extent to which the device needs to be stripped down will affect the length of time the device is out of service, the person with management or control of the device should consult with the competent person about the scope of the major inspection before it commences to allow for adequate scheduling of time for the inspection. Please refer to the section in this guidance on circumstances to consider when determining the extent to which a device should be stripped down.

Critical components

Under the WHS Regulation, a critical component of an amusement device means a component of the device that would, if the component failed to function properly, be likely to cause a risk to health or safety of a person.

Critical components of an amusement device need to be documented so that details of specification, applicable standards to which they comply and a source of evidence that demonstrates compliance (i.e. test report, third party certificate/listing document) are readily available.

For maintenance and repairs, including those undertaken during a major inspection, critical components should only be replaced by components that provide an equivalent or a higher level of safety (also certified for the safety application) and a record must be kept of the replacement components. Components should preferably be replaced with those approved by the manufacturer. Critical components can be electrical, electronic, hydraulic, pneumatic and mechanical in type.

For systems that are mainly mechanical in construction, Appendix D in Australian Standard *AS 3533.3 Amusement rides and devices Part 3: In-service inspection* provides some guidance on non-destructive testing of critical components.

For safety control systems (which may include electrical, electronic, hydraulic, pneumatic and mechanical components), critical components are those components and sub-assemblies, the

failure of which may leave the device in a condition that exposes operators or other people to a risk to health or safety.

Inspection criteria

Potential damage and wear to an amusement device can be caused over time by many factors, including:

- normal operation of the amusement device, even when operated in accordance with the manufacturer's instructions
- corrosion from water ingress or storage outdoors, particularly in coastal environments or storage over extended periods
- transportable amusement devices, that may be transported over long distances, can be affected by movement and vibration during road travel. This effect will be more severe over uneven roads and when the unit is not restrained correctly for road travel.

The inspection criteria for an amusement device should consider factors specific to the device being inspected including the device's operational history, maintenance records, environmental factors, modes of operation and any other factor that has potentially serious consequences for safety.

The inspection criteria for a major inspection is aimed at reducing the risk of incidents caused by an unexpected failure of critical components in the amusement device. The criteria relates to the amusement device itself and not to roadworthiness issues for vehicle-related components of transportable amusement devices. Additional inspections may be required to ensure the transport-related components comply with requirements set out in transport or road safety legislation. This may include items such as brake/tail and indicator lights, wheels and brakes, suspension, tow connections and load restraint for securing the amusement device during transport.

Before dismantling the amusement device, it is advisable to carry out full function tests on the device to determine if any function requires specific detailed checks and repairs (e.g. tests to identify if the safety control system or rider restraint locking mechanisms are functioning correctly).

Amusement devices are subjected to cyclic loading during normal operation and transport (vibration effects in the case of transportable devices). The cumulative effect of cyclic loading can lead to the development of cracks on various supporting structures. If undetected, the cracks may continue to worsen and increase the risk of a catastrophic failure of the device. For transportable devices, the competent person should not estimate the device's fatigue life based on loading cycles due to hours of operation alone, but also consider the effect of transport on the device.

The person with management or control of the amusement device should ensure the competent person supervising or carrying out the major inspection:

- is provided with any recommendations or instructions for the major inspection supplied by the manufacturer of the device
- follows the manufacturer's recommendations or instructions in supervising or carrying out the major inspection. Where a competent person determines there are reasonable grounds to depart from the manufacturer's recommendations or instructions (e.g. to provide for a higher level of safety or replace a part sooner or later than scheduled) the reason should be recorded in the major inspection report.

Where a manufacturer's recommendations or instructions for a major inspection do not exist or do not include enough details (e.g. do not take local environmental issues into account), the person with management or control of the amusement device should ensure a competent person develops inspection criteria based on sound and proven analytical practice, and develops inspection methods with pass/fail criteria. In every case, whether manufacturer's instructions or a competent person's instructions have been followed, the competent person needs to be satisfied that, in their professional judgement, the purpose of the major inspection has been achieved.

AS 3533 *Amusement rides and devices* is listed in Appendix C of the Managing risks of plant in the workplace Code of Practice as a technical standard which provides additional guidance for conducting major inspections.

Under AS 3533.3-2003 – *Amusement rides and devices Part 3: In-service inspection*, a major inspection includes attention to the following:

- structural, mechanical, electrical, instrumentation, control and operational anomalies
- non-destructive testing (NDT) to an appropriate standard
- controls and emergency stops
- braking systems
- manufacturer's safety upgrades and advice
- adequacy of safety instructions and manuals
- the viability of upgrading to the requirements of the latest standard [AS 3533.3-2003 Clause 11.5].

Under AS 3533.3-2003, a major inspection involves:

- the disassembly of critical components of the amusement device and removal of paint, grease and corrosion to allow a complete and thorough inspection
- detailed visual inspection and tolerance checking of all wear components
- thickness testing as required to check for wear and corrosion
- non-destructive testing of all critical areas for signs of cracking or spalling due to fatigue or excessive stress
- a review of power, control, electrical, hydraulic and pneumatic systems, as applicable to the device [AS 3533.3-2003 Clause 11.5].

An amusement device has a design life. As the end of the design life approaches, defects are likely to appear even though the device has been operated in accordance with the manufacturer's instructions. For this reason, completion of the major inspection does not mean the device will be safe to operate for another 10 years, especially with older devices. The competent person supervising or carrying out the major inspection may specify a shorter period when the next major inspection is due or when the device has reached the end of its life.

Where there are signs of cracks, corrosion or excessive wear, the competent person supervising or carrying out the major inspection should identify the affected component and recommend if it is to be replaced with a new part or repaired. Where the component is repaired, the competent person should prepare a repair procedure that specifies welding details, material types, and dimensions of the repair. Where the competent person has indicated they want to verify the repairs have been completed satisfactorily, the person with management or control of the device should ensure the competent person signs off that the repairs have been completed satisfactorily.

Where no visual faults are observed, hydraulic or pneumatic cylinders may not require stripping down unless they fail any testing.

For amusement devices that include a safety control system designed to a relevant safety control system standard (e.g. AS 4024 *Safety of Machinery* series), critical components of the system should be:

- identified and compiled to form a critical component list
- checked (e.g. through manufacturer's certification) to confirm compliance with the safety level to which the control system has been designed (e.g. Safety Integrity Level (SIL), Category or Performance Level (PL))
- assessed for replacement where they may be nearing the end of their 'design life'
- proof-tested (where specified by the manufacturer or competent person) to ensure that the components continue to function effectively. The functions on the control system, when re-assembled, should be proof-tested to ensure all safety functions operate as designed (e.g. introduce single faults to ensure the safety function responds as designed).

Non-destructive testing

All non-destructive testing (NDT) on the amusement device and associated parts should be:

- based on the manufacturer's specified NDT schedule or as specified by the competent person supervising or carrying out the major inspection
- carried out by a person who has been accredited by an acceptable testing authority e.g. National Association of Testing Authorities, Australia (NATA)
- carried out in accordance with a testing procedure specified in relevant technical standard/s, unless otherwise specified by the competent person
- verifiable through a signed report that complies with NATA reporting requirements. This will include conditions of the test and a record of discontinuities found.

Removal of paint before carrying out NDT

It is generally advisable to remove paint from parts before carrying out NDT, particularly in high stress areas. Some amusement devices have multiple layers of paint which interferes with the effectiveness of NDT.

If the NDT specialist recommends carrying out NDT through paint, the test method is to comply with the relevant conditions for testing through paint (one of the conditions of such testing will be that the paint does not contain metal elements or exceed a maximum thickness) and the recommendation approved by the competent person.

Circumstances under which stripping down of the device or its components may not be required

While periodic inspection, including the annual inspection, can highlight faults on the amusement device, certain critical components can only be thoroughly inspected when the device is dismantled.

The major inspection is a comprehensive inspection process that should include dismantling (stripping down) all structural areas that are subject to high stress, critical components and components that are subject to wear, unless considered unnecessary by the competent person.

Where there is documented evidence that the appropriate inspecting and testing has been carried out on a component within the previous two years, the competent person may determine that this component does not have to be dismantled during the major inspection. However, the component must still be inspected to determine that it is operating effectively and safely.

The competent person may also make a recommendation about future inspection requirements on a component that has not been dismantled as part of the major inspection.

Example scenario

The pins and bosses on one linkage may have been replaced with new parts 18 months ago. The competent person, or a specialist under the supervision of the competent person, carries out a function test, ascertains that the linkage is operating correctly and that tolerances are within the manufacturer's specifications. The competent person may note that this component is to be periodically inspected and that it may require removal and checking within the next 4 ½ years.

Under limited circumstances, the competent person supervising or carrying out the major inspection may decide not to dismantle parts of the device. When making this decision, the competent person should consider the following:

- If the device has had minimal use and has not been adversely affected from its storage (e.g. has been stored indoors and not exposed to the weather and there are no signs of corrosion due to collection of moisture).
- The design life of the device, where this is available from the manufacturer.

- A function test and load test to verify the device is operating in accordance with the manufacturer's specifications.
- If the competent person has a comprehensive knowledge of amusement devices made by the manufacturer or the type of amusement device being inspected.
- Documentation on the working history of the device that details the operating frequency and duration. This information should be available in detailed log books and maintenance records kept for the life of the device and should not be based on statements from the owner that the device has had minimal use. Some sophisticated devices may be fitted with data loggers that can supply some information about usage. However, it can be difficult to verify the data from some data loggers and competent persons should not rely solely on data loggers for the working history of the device.
- There may be documented evidence that carriages of the amusement device (such as carriages of a roller coaster) have been overhauled or refurbished in recent years on a rotational basis. The competent person may determine a visual inspection is satisfactory and there is no need to dismantle or strip down the overhauled carriages during the major inspection.
- Tolerance checking of critical components to ensure they are within the manufacturer's specifications. Where the manufacturer specifies quantitative tolerances, the tolerances should be measured quantitatively and recorded within the inspection report.
- Visual verification and/or testing, by the competent person, that the device is in good condition, after the device has been cleaned and where applicable, outriggers deployed. This visual inspection should identify the absence of cracks, corrosion and damage to the device. Where cracks and corrosion (other than surface corrosion) exist, the affected components of the device must be dismantled for a thorough examination.
- In the case of transportable devices, the absence of damage or metal fatigue on the device from road travel. Even though limited set-ups and operation of the device may have occurred, the device may be showing signs of wear and damage from road travel. This may apply more to devices operated in rural locations.
- Any information from the device manufacturer that may adversely affect the decision not to dismantle the device (e.g. has there been a safety recall or bulletin on the device that highlights failure and/or increased wear of critical components).
- Verifiable documented evidence that a part of the device has been dismantled and re-assembled to an acceptable standard recently.
- Full documented history of major repairs or modifications that have been carried out recently on the device or support structure (photographic evidence and repair method statements should remain with the device for future reference).

Where the competent person has determined that completely dismantling the device is unnecessary, the inspection criteria should be developed by the competent person and include any conditions associated with the ongoing safe use of the device. For example, the competent person may specify more frequent inspection intervals or may state that the device or particular components require dismantling within a period of less than 10 years.

Major inspection report

The person with management or control of the amusement device should require the competent person to provide a comprehensive report on the major inspection. Under the WHS Regulation, the person with management or control of the device must keep records of all tests, inspections and maintenance on the device, and make the records available to the next owner when relinquishing control of the device. This includes major inspection reports for the amusement device in addition to annual inspection reports.

A major inspection report should include:

- A summary of the history of the amusement device prior to the major inspection being carried out, unless this is unavailable (if unavailable, it is likely the major inspection will need to be more comprehensive).
- Where provided, a copy of the major inspection criteria specified by the manufacturer and by the competent person.
- Extracts of the manufacturer's maintenance manual detailing wear tolerances, bolt torques and other relevant instructions to be adhered to during the inspection process.
- A complete list of work carried out on the amusement device during the major inspection process.
- Photographs of the device during the inspection process, including photos of damage, wear, corrosion or cracks.
- If the decision has been made not to dismantle components of the device, specify reasons (based on sound engineering justifications) why this decision has been made, supported by documented evidence.
- A list of specialists called upon by the competent person to assist with specific work on the device as part of the major inspection.
- Signed statements from people involved in the assembly process (where applicable) in relation to:
 - structural bolts being installed correctly (taking into consideration bolt type, lubricant if used, bolt tightening torque and bolting sequence)
 - pin and pin retainers installed correctly
 - hydraulics and/or pneumatic components installed correctly including a statement that replaced components meet the manufacturer's specifications and that fittings have all been tightened to the correct torque
- Where applicable, hydraulic cylinders have been creep tested and are satisfactory.
- Where applicable, functional proof-test or validation on safety control systems.
- A summary of components replaced with copies of receipts for components provided in the report.
- Where aspects of the work have been contracted to third parties, a report of the work done, including full description of the work (scope and nature of work done), copies of test results, any recommendations of follow-up repairs required and copies of invoices.

Log books

The person with management or control of an amusement device must ensure:

- the log book is available for inspection by the competent person carrying out the major inspection of the device
- the log book includes for each major inspection:
 - the name of the competent person who carried out the inspection
 - the date of the inspection
 - the results of the inspection and recommendations of the competent person
 - any components repaired or replaced during, or as a result of the inspection.

More information about amusement device requirements in the Work Health and Safety Regulation 2011 is available at [worksafe.qld.gov.au](https://www.worksafe.qld.gov.au).



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