

**AMUSEMENT RIDES AND DEVICES IN-SERVICE INSPECTION
GUIDELINE FOR APPLICANTS ON
ELIGIBILITY CRITERIA & PROCEDURES FOR
RECOGNITION IN THE SPECIFIC AREA OF PRACTICE**

1. Introduction

This document states the eligibility criteria for applicants seeking recognition on the National Professional Engineers Register (NPER) in the specific area of practice of Amusement Rides and Devices In-service Inspection.

The Guideline has been prepared by a competency panel comprising representatives of the Institution of Engineers, Australia, the Maintenance Engineering Society of Australia, Australasian Institute of Engineer Surveyors, the Association of Consulting Engineers Australia, Workcover NSW, SA Workplace Services, AALARA, various Showmen's Guilds, the Royal Agricultural Society of NSW and Sydney Portable Rides Operators. The document has been reviewed by the Colleges of Civil, Electrical, Mechanical and Structural Engineers. The setting of standards and administration of the registration scheme is the responsibility of the competency panel, but assessment of applications is the responsibility of an assessment panel, established by the Institution and comprising experienced practitioners in the Amusement and Leisure Industry.

The guideline will help owners and operators to choose who to engage for in-service inspections.

2. Background to In-service Inspection

Amusement rides and devices are used by members of the public who have a high expectation that they will be able to do so safely. In Australia, State and Territory Governments are responsible for the regulation of occupational health and safety, which includes fairground and amusement equipment. Though regulations vary considerably between jurisdictions, the law generally holds ride owners responsible for the safety of people on amusement rides and devices.

Ride owners and operators relocate, assemble, check and operate their equipment in accordance with manufacturers' instructions and procedures recommended by AS3533. However, the technical expertise of the engineering profession is essential to in-service inspection and safety certification. Registration on the National Professional Engineers Register (NPER) or the National Engineering Technologists Register (NETR) in the area of Amusement Rides and Devices In-service Inspection

requires competencies to carry out inspections as defined in Addendum I to this guideline.

3. In-service Inspection Competencies

The following competencies are considered essential to practice as an in-service inspector of amusement rides and devices. An Engineering professional practising in this specific area must demonstrate that he or she is able to:

A. Legal and Regulatory requirements

- i) Work within Acts and Regulations and Standards in force in the jurisdiction where the ride or device is set up or is to be registered. (eg. a ride may be inspected in Queensland for registration in NSW or SA.)
- ii) Understand the nature of due diligence and the legal consequences of practice in this area
- iii) Implement appropriate risk management strategies
- iv) Develop relationships with Regulatory bodies to acquire knowledge of current Regulations, requirements and incidents
- v) Investigate and take into account the existence of statutory notices, prohibition notices, safety alerts, manufacturers' bulletins or publicly available information
- vi) Work only within area of competency, in accordance with Code of Ethics, and to consult others on matters outside competency

B. Scope of Inspection

- i) Agree with the owner or lessee the scope of inspection to be undertaken
- ii) Investigate and take into account the existence of previous inspection results, whether complete or partially complete where available
- iii) Select appropriate testing techniques (including test loading and dynamic load measurement) and to establish reporting criteria for inspection
- iv) Select and facilitate external testing

C. In-service Inspection

- i) Take account of transportation and assembly conditions when inspecting equipment in operation
- ii) Inspect equipment at different phases of assembly
- iii) Make reasonable appraisal of equipment's dynamic behaviour, load paths and stability
- iv) Observe and record the effect of start-up, balance, steady operation, stopping and emergency responses
- v) Direct operation of equipment in test modes
- vi) Assess safety and reliability of electrical power and control equipment
- vii) Make reasonable appraisals of electrical and electronic control devices and their operability
- viii) Identify critical components, especially components critical to patron, operator and bystander safety, and closely examine them
- ix) Examine repair work or modifications (the existence of which has been advised by the operator or noted during inspection)
- x) Direct disassembly or surface preparation to aid inspection
- xi) Determine the effect of stiffness, backlash and clearances on the principal load paths during all phases of operation
- xii) Identify and understand the significance of alterations and repairs to equipment
- xiii) Understand the implications of site installation and to take account of ground conditions and the possible effects of wind and water

D. Reporting

- i) Report anomalies (see Addendum R)
- ii) Interpret the results of external testing
- iii) Report faults using a clear component identification system
- iv) Make recommendations for rectification and/or provide reasons for refusing certification
- v) Certify repair work on the basis of appropriate inspection
- vi) Certify modifications on the basis of an assessment of design implications
- vii) Use appropriate minimum reporting techniques

E. Continuing Professional Development

- i) Compile information including manuals, drawings, inspection reports, photographs, alerts and notifications relating to amusement devices
- ii) Review owner's and operator's written and verbal reports of incidents, repairs and inspections and draw conclusions based on engineering principles
- iii) Consult colleagues to broaden knowledge of equipment
- iv) Make links with industry associations to provide ongoing input for operators

4. Eligibility requirements for Registration

Applicants for registration on NPER must possess an academic qualification (eg. a four year engineering degree) accredited or recognised by the Institution, or equivalent qualification. Applicants for registration on NETR must possess an academic qualification (eg. a three year bachelor of technology degree) accredited or recognised by the Institution, or equivalent qualification.

They must also be able to satisfy the National Competency Standards for Stage 2 Professional Engineers or Engineering Technologists, respectively.

In addition to their qualifications and experience, applicants will need to demonstrate:

- That in-service inspection of amusement rides and devices is a regular part of their professional employment or practice.
- Their competencies (section 3 above) on rides and devices of the class to be inspected
- That they practise independently or under general direction as an in-service inspector.
- In the case of Technologists, that they have access to engineer direction
- In the case of Engineers, that they would exercise due diligence in supervising technologists or reviewing inspections carried out by proprietor's staff.

Note 1 Registration for a class of ride or device does not guarantee that the registered practitioner is familiar with a particular ride or device. The code of ethics constrains practitioners from working outside their area of competence (see 3A vi) above).

Note 2 State/Territory Legislation or Regulations may override the effect of the above table.

Inspection from Addendum I	Engineering Technologist (NETR)	Professional Engineer (NPER)
(b) Formal set-up inspection	Independently	Independently
(d) Annual	N/A	Independently
(e) Major	Under engineer direction	Independently
(f) Designer/Manufacturer Stipulated	Under engineer direction	Independently
(g) Ancillary Equipment	Independently	Independently
(h) Non-destructive Testing	Independently to proper instructions	Independently

5. The Application and Assessment Process

5.1 Making an application

The following sections indicate the action you must take to gain certification and to register as an in-service inspector of amusement rides and devices. You do not need to join the IEAust to register on NPER or NETR.

Your application for registration as an amusement ride and devices in-service inspector must be forwarded to the National Office of the Institution of Engineers, Australia, 11 National Circuit, BARTON, ACT 2600.

5.2 Registration in a general area of practice

5.2.1. If you have a professional engineering qualification but are not a CPEng, you must follow guidelines in the Handbook for Applicants for Chartered Professional Engineer (CPEng) at:

<http://www.ieaust.org.au/membership/professional.html#Chartered> (even if you do not intend to join IEAust). You must use the Application Form in the handbook to apply for NPER in an appropriate general area of practice such as Mechanical or Structural. The same process will also allow you to obtain Chartered Membership (CPEng) and College Membership, if you wish.

5.2.2. If you are an engineering technologist, you must register on NETR. There are two parallel application processes for engineering technologists wishing to register on NETR. If you possess an accredited engineering technologist qualification, you must use the Handbook for Applicants for Chartered Engineering Technologist (CEngT) at <http://www.ieaust.org.au/membership/professional.html#Chartered>

5.2.3. If your highest qualification is an Associate Diploma or equivalent, you should contact your local Accredited Assessor before you apply for registration on NETR. A list of Assessors is available at the same web address.

5.2.4. If you are a CPEng, you must apply for NPER in an appropriate general area of practice using the Application for Registration on NPER form at

http://www.ieaust.org.au/careers/engineers/nper/applic_form.html. You must submit a curriculum vitae that demonstrates your competence to practise independently and evidence of how you have kept up to date in your practice, as explained on the form.

5.2.5. If you are already registered on NPER or NETR in an appropriate general area of practice, go to section 5.3.

5.3 Registration in the specific area of practice

5.3.1. You must provide a statement summarising recent responsibilities for the in-service inspection of amusement rides and devices.

5.3.2. Your statement of experience must clearly show that you have the competencies listed in section 3 above and a working knowledge of the equipment for which you will provide in-service inspection. You must demonstrate an awareness of any requirements for transport, assembly, maintenance, post assembly inspection, site establishment inspection and daily inspection and test run procedures for equipment you will inspect. You must show that you have participated in non-destructive testing, annual in-service inspection, and major inspections for amusement rides and devices, all as described in Addendum I.

5.3.3. You must submit at least two examples of in-service inspection reports that you have prepared. Your examples must show a systematic approach to in-service inspection and your capacity to question records provided by the owner or operator and to understand what is important to safety.

5.3.4. Where you have inspected a ride or device for the first time or a repair or modification has been encountered, you must show how additional specialised competencies have been gained to suit the specific case. A CPD

Information and Record Sheet should be used to submit records of relevant continuing professional development. Use Form F3113 at <http://www.ieaust.org.au/careers/engineers/nper/cpd.html>.

- 5.3.5. You must have your documents reviewed by an experienced professional engineer and endorsed as being a true representation of your work as an in-service inspector.
- 5.3.6. Include with your application the names and contact information for three persons who can substantiate your involvement in in-service inspection of amusement rides or devices.
- 5.3.7. Finally, you must complete and sign an application for registration in the specific area of practice for in-service inspection of amusement rides and devices

6. Assessment

Your application, CV (statement of recent responsibilities) and examples of completed in-service inspections will be analysed for evidence that you have exercised the competencies of an in-service inspector of amusement rides and devices. An Assessment Panel will examine the submitted examples and review your statement of experience. Where competency is not evident, your application will be returned to you for further work and substantiation.

If your application is made in accordance with sections 5.2.1, 5.2.2 or 5.2.3, the assessment will be based on the National Generic Engineering Competency Standards and will normally include a professional interview conducted by an assessment panel having expertise in in-service inspection of amusement rides and devices. At the discretion of the Assessment Panel, interviews may also be conducted if the applicant is already a Chartered Member or registered in a general area of practice.

The interview enables a quality assurance check of the educational and professional experience detailed in your application and may include some technical questions on the examples you submitted.

In service Inspections

A. Post-assembly inspection and test run

This activity provides for the recognition of conditions, due to site specific issues and assembly specific issues, for mobile or transportable rides and devices, that may compromise the safety of the ride or device within the period of one set-up.

B. Formal Set-up inspection

This inspection provides verification of a post-assembly inspection and may be called for by a site manager who, for the time being, has legal liability for the safety of persons (public) in the vicinity.

The ride or device shall be set up and operational on the site (or frontage) at which it will operate for the duration of the particular show, carnival, contract or other purpose for which it is set up. Prior to the formal set-up inspection, the ride or device shall have completely satisfied the requirements of a post-assembly inspection and a daily inspection and test run.

The inspection should take into account good practice, manual requirements and AS 3353.2, including the following aspects:

- (i) The suitability of the site topography and ground conditions
- (ii) The suitability of load distributing and installed levelling means
- (iii) The suitability of clearances to the full range operational movement of the ride or device from any potential interference or obstructions at the site
- (iv) The positioning and suitability of fencing, barriers or other zonal guards enclosing the site
- (v) The arrangement of access and egress for patrons of the ride or device, including the provisions for any emergency egress where different from the normal egress
- (vi) The thoroughness of the assembly of connections that are made during set up from the transport state
- (vii) The correct and proper action of controls for starting, stopping and emergency (stop) reaction.

C. Daily inspection and test run

This activity provides for the early recognition of conditions that can compromise the safety in operation of the ride or device within operations spanning a period of one day.

D. Annual in-service inspection

1. General

This activity encompasses such regular inspections as may be required by statute or, where statutory inspections are not required, annual inspection requirements in accordance with AS 3533.2. Annual inspection should take place at any convenient time in the year and, thereafter, no more than one month after the anniversary of a previous annual inspection. If it is necessary to alter the timing of the annual inspection an additional annual inspection should be arranged.

The requirements for annual inspection shall be as follows:

- (a) The ride or device should be observed in various configurations such as that of packed for transport, partly erected, fully assembled or partly dismantled. These requirements may dictate that the inspection takes place over a period of time and, if the ride is mobile or transportable, at more than one site.

The inspector shall determine the desirability of viewing the ride or device in any particular configuration and the proprietor must provide the necessary degree of cooperation in respect of location and labour, so as to facilitate the inspection.

- (b) The annual inspection shall include a view of the ride or device fully established on a site and in operational state, although not necessarily loaded.
- (c) The proprietor must ensure that all records for the ride or device including any current non-destructive testing certificates, the logbooks, manuals, checklists, any relevant statutory notices and current registration papers are available at the site of the ride or device.
- (d) If, during the course of an annual in-service inspection, the inspector becomes aware of a potential fault that cannot be qualified without dismantling a permanently assembled structure or system of components or reasonably positively by any technique of NDT, the inspector shall suspend the inspection. The Inspector shall inform the proprietor of the nature of the fault and recommend to the proprietor an appropriate course of action.

2. Structural and mechanical aspects

The inspection should include the following aspects, where relevant:

- (i) The condition of all patron-seating positions and the environs thereof

- (ii) The condition and efficacy of patron-restraint devices
- (iii) The condition and integrity of every car, capsule, pod, suspension or frame providing the primary structural support to patron positions.
- (iv) The condition and integrity of every mechanical component or assembly on which a car, capsule, pod or frame is free to move or driven.
- (v) The condition and integrity of every drive or brake system concerned with the control of the motion of a car, capsule, pod, suspension or frame either alone or in relation to some other moving or static part or structure.
- (vi) The condition and integrity of every load bearing structural element in the load path(s) related to every car, capsule, pod, suspension or frame, supporting such elements to or from the principal moving or static structure of the ride or device.

In respect to aspects (d), (e) and (f), the inspector shall assess the principal load paths involved during operation and check that such load paths are not compromised by spurious stiffness, inadequate or excessive clearances, backlashes or other conditions unlikely to have been considered in design.

- (vii) The condition and integrity of all structural and mechanical elements that form the main load bearing moving or static system transferring the dead and live loads upon, or the loads developed within the ride or device, to the foundation.
- (viii) The condition and integrity of main frames, chassis or other structures, including jacking points, device stabilisers and anchorage systems integral to the stability of the ride or device opposing any action generated within it or applied to it.
- (ix) The condition and integrity of systems incorporated to produce motion such as motors, gearboxes, hydraulic power packs and pneumatic systems. Such assessment shall include consideration of acceleration, speed and braking actions produced by such systems.
- (x) The proper operation of the controls of the ride or device in respect to starting, interlocks, stopping and emergency reaction.
- (xi) The condition, integrity and efficacy of ride-related fences and barriers and access and egress arrangements for patrons.

3. Electrical and electronic aspects

The inspection should include the following aspects, where relevant:

- (i) The condition of all cabling, including temporary flexible cabling, plugs, sockets and socket

outlets, lighting fittings and fixtures and their mounting and connections.

- (ii) The structural condition of cubicles and enclosures for control and switchgear with respect to sealing, ventilation, accessibility, cable entry, drainage and security.
- (iii) The condition of control and switchgear with respect to fixity, heat or arc damage, corrosion, integrity of connections and terminals, marking, wiring support, insulation and safety barriers.
- (iv) The condition and rating of current limiting devices, residual current protective devices, overload relays, shunts and current transformers.
- (v) The condition of sensing devices that provide for safety-related functions such as speed limitation, supervision, pressure, temperature, voltage, current or count functions. An understanding of the integrity and the mode of failure of the system(s) in the case of malfunction of such devices should be established.
- (vi) The condition of limit switches, proximity switches, their actuating elements and their proper location and adjustment.
- (vii) The condition of electrical supervisory devices and control elements associated with mechanical systems such as hydraulic power packs and manifolds, pneumatic systems.
- (viii) The condition of operator interface panels and devices including signal devices, legend plates and the general utility of the gear.
- (ix) The condition of electronic control devices, their support, enclosure, protection from environmental conditions such as heat, moisture and dust and protection from attack by pests such as insects, spiders and snails. Printed circuit cards and electronic componentry that is enclosed or in ventilated housing should be assessed for the integrity of edge connectors and other terminations.
- (x) Where any programmable device is supervised by a watchdog system or has redundant back up, the action of such systems should be tested. The efficacy of RAM back-up batteries, where used, should be checked. Where appropriate, in relation to safety-related systems, the I/O of programmable logic controllers should be checked and proved, in particular under an emergency command. The settings of adjustable electronic control devices that establish speeds, pressures or other parameters important to the safety of the ride or device should be checked to be within tolerance of the design values.
- (xi) The condition of motors, their terminal boxes, cable glanding, protective covers, cooling fans and

cowls, brushgear and associated capacitors, resistors, feedback and tachometer devices.

Inspection of electrical systems and components may be carried out by a suitably qualified competent person either independently of, or as a delegate of, the principal inspector.

E. Major inspection

This inspection is to provide a thorough basis for an assessment of the prospective life of an amusement ride or device in certain circumstances as follows:

- (a) At the expiry of the design life (if known).
- (b) When the design life is unknown, at a frequency of 10 years of age unless a competent person determines a different period.
- (c) After a ride or device has suffered a major departure from normal operation or a failure of any major structural or mechanical component.
- (d) When a device is to be recommissioned and previous operating records are unavailable or the device was designed and built to unknown standards.
- (e) A ride or device is to be upgraded to a higher load rating.
- (f) The design of a ride or device has been altered.

This inspection shall include electrical systems and components.

A major inspection shall incorporate the following:

- (i) The disassembly of critical components of the amusement device and removal of paint, grease and corrosion to allow a complete and thorough inspection.
- (ii) Detailed visual inspection and tolerance checking of all wear components.
- (iii) Thickness testing as required to check for wear and corrosion.
- (iv) Non-destructive testing of all critical areas for evidence of cracking, fatigue and excessive stress.
- (v) A review of power, control, electrical, hydraulic and pneumatic systems, as applicable, no less thorough than required for an annual inspection.

F. Designer and manufacturer stipulated inspections

Inspection and test procedures of a special or unusual nature specified by a designer or manufacturer at the time of supply of an amusement ride or device, or at

any other time by an authentic bulletin or alert, shall be undertaken by the proprietor. Where any inspection and test procedures are mandatory at regular intervals, such instructions shall be entered fully into the logbook or a positive reference to the source documents and frequency shall be recorded. Where a specified inspection period coincides with the annual inspection, by arrangement, the proprietor may arrange with the competent person undertaking that inspection to include the required inspection.

Where a designer or manufacturer stipulates a once-only inspection or test, a reference shall be entered in that section of the logbook pertaining to 'Alteration or repair affecting the safety of the device' on receipt of the notification. Following completion of the inspection or test, confirmation shall be made in the logbook entry.

In all cases of a stipulated inspection, the documentation relating to the inspection or copies thereof shall remain with the logbook.

G. Ancillary equipment inspection

Where ancillary equipment is critical to the safety of a ride or device during normal or abnormal operation, such equipment shall be subject to the in-service inspection appropriate to its type and purpose.

The inspector carrying out an inspection shall check if the following requirements are met:

- (a) The ancillary equipment must be available, operational, in the correct or appropriate location and has all necessary connections.
- (b) There shall be adequate evidence that the ancillary equipment has satisfied the appropriate in-service inspection requirements pertaining to its type. For example, relevant other requirements include—
 - (i) fire extinguishers have current tags (AS 1851.1);
 - (ii) personal protective equipment for above ground rescue is identifiable with respect to current certifications (AS/NZS 1891);
 - (iii) elevating work platforms or cranes have acceptable current logbooks (AS 2550);
 - (iv) compressed air receivers have current certification (AS 3788); and
 - (v) electrical flexible cords.

Where no Australian Standard exists for the type of equipment, eg. for emergency generating plant, ventilation or air conditioning plant or blowers for inflatable devices, the appropriate evidence shall be determined based on risk management and good practice principles.

H. Non-destructive testing (NDT)

1. Techniques and Standards

Non-destructive testing shall include all the processes available at the time that can detect whether a fault exists in a structural element or mechanical component without causing damage, including the following:

- (a) Visual inspection.
- (b) Dye penetrant inspection (DPI).
- (c) Magnetic particle inspection (including fluorescent ink versions) (MPI).
- (d) Eddy current inspection (ECI).
- (e) Ultrasonic inspection (UT).
- (f) Radiography (RT).
- (g) Specialist types such as for the NDT of wire ropes.

Any technique shall be applied in accordance with the procedures set out in the appropriate Australian Standard or best practice as specified by the appropriate testing authority accreditation body.

2. Technicians

Only persons trained in the application of the various techniques shall apply NDT.

3. Acceptance criteria

A technician must record and report on any defect that could develop to a discontinuity that could impair the integrity of the component. A surface-connected indication of a crack must be investigated to determine whether such an indication is, in fact, a fault. In particular, such faults may be expected to be due to cyclic or unusual loading and signal the onset of fatigue.

In-service NDT is not usually expected to assess if a structural part or mechanical component is in compliance with a fabrication or manufacturing Standard unless the part or component is new.

Where no other acceptance criteria are specified, the following should be applied:

- (a) No evidence of the formation of cracks.
- (b) No reduction of thickness (due to corrosion or wear) such as may compromise safety.

A person competent to evaluate NDT results and recommend remedial action must interpret the NDT report.

4. Reporting

Reports of NDT may be rendered 'by exception', i.e. where no fault is discovered in a group of identical inspections of different parts, it is sufficient to note that fact and identify only the one or more parts where faults were detected. Reports should clearly identify the location of faults by means of carefully worded description, by illustrations or both.

5. Faults

NDT may be expected to be of assistance in determining the following:

- (a) The integrity of welds and base metal within welded components.
- (b) The thickness of ferrous and non-ferrous sheet and plate subject to corrosion, particularly where it is not possible to assess visually or by common measuring instruments.
- (c) The wall thickness of hollow mechanical components subject to wear or corrosion.
- (d) The integrity of solid or hollow shafts and pins subject, in particular, to fatigue loading and having stress raising features incorporated in their design.

Reporting Inspections

Every inspection activity specified in this Standard shall be reported in an appropriate form.

Inspections within the province of the designer or manufacturer or the proprietor shall be recorded in a form determined by those persons, taking into account the requirements and recommendations for the particular inspection given in this Standard, eg. forms in manuals or checklists.

Inspections carried out by competent persons not associated with the designer or manufacturer or the proprietor shall be recorded as follows:

- (a) The inspection shall commence only after production of the logbook(s) pertaining to the ride or device by the proprietor or operator. The logbook(s) produced shall be current and shall show the in-service record of the ride or device for a period of not less than two years prior to the date of the required inspection, or the longest period possible if the ride or device is less than two years old.
- (b) The inspector shall record the start of an inspection in the logbook.
- (c) The inspector shall only complete the logbook entry if the inspection is completed and a certificate can be issued.

NOTE: The inspector's record of the start of the inspection remains in the logbook if there are significant safety matters that prevent a certificate being issued.

- (d) If there are qualifications to the certificate, such as matters that require attention or action during the period of validity of the certificate, the inspector shall enter each matter into the logbook and advise the proprietor or supervisor of the conditions for each matter, eg. when the action is required and what needs to be done.

NOTE: The inspector should set the conditions taking into account the risk involved when assigning the priority, timing or trigger event for each action required.

- (e) The inspector shall record the advice given to the proprietor or supervisor on the certificate and in the inspector's own records. Where a legal certificate cannot be so qualified, the inspector shall provide written advice to the proprietor or supervisor and retain a copy of this advice in his own records.

NOTE: Regulatory authorities may require notification of completion of the actions or proof of this if an audit of the equipment is conducted.

- (f) The proprietor or supervisor shall advise the inspector when the action has been taken.