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Safety of amusement rides and amusement devices —

Part 3:
Requirements for inspection during design, manufacture, operation and use

Sécurité des manèges et des dispositifs de divertissement —
Partie 3: Exigences relatives à l'inspection pendant la conception, fabrication et fonctionnement

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 254, *Safety of amusement rides and amusement devices.*

This second edition cancels and replaces the first edition (ISO 17842-3:2015), which has been technically revised.

The main changes are as follows:

— references to ISO/TS 17929 have been removed;

— a reference to ISO 17842-1 has been added to 4.1.2, Review of design documents

— point g has been added to 4.1.3.1 Description;

— 4.1.3.3, Initial inspection and testing, has been updated;

— 4.2, Pre-use inspection and review – Procedures, has been added;

— 4.4, Installation examination, has been added;

A list of all parts in the ISO 17842 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Safety of amusement rides and amusement devices —

Part 3:
Requirements for inspection during design, manufacture, operation and use

1 Scope

This document specifies the minimum requirements necessary for the independent inspections of amusement devices designed, manufactured, operated and used according to ISO 17842-1 and ISO 17842-2.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

ISO 17842-1, *Safety of amusement rides and amusement devices — Part 1: Design and manufacture*

ISO 17842-2, *Safety of amusement rides and amusement devices — Part 2: Operation and use*

ISO/IEC 17020, *Conformity assessment — Requirements for the operation of various types of bodies performing inspection*

IEC 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17842-1, ISO 17842-2 and ISO/IEC 17020 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Requirements

4.1 Initial approval — Procedures

4.1.1 General

The initial approval of any amusement device consists of review, inspections and tests to be carried out as follows.

The inspection body performing the initial approval shall operate in accordance with ISO/IEC 17020.

All safety-relevant design documents as well as the completed amusement device shall be subject to review and inspection. After a successful inspection, a document confirming conformance with ISO 17842-1 and ISO 17842-2 can be issued.

The results of the various reviews, inspections and tests shall become an integral part of the amusement device log.

The initial approval of the amusement device shall comprise:

a) design review,

b) inspection of manufacturing process, and

c) initial inspection and testing.

4.1.2 Review of design documents

The review of design documents is an inspection of relevant design documents.

The design documents shall, where relevant, be reviewed, checked and accepted by an independent body for:

— completeness,

— correctness of all the assumptions with respect to the input values for any analyses,

— correctness of all calculations, and

— compliance with applicable standards and specifications.

The design documents shall where relevant include the following:

— design risk assessment;

— design calculations;

— stress and fatigue analysis and stability verification;

— structural and mechanical parts;

— hydraulic and pneumatic parts;

— drive units, bearings;

— brakes and safety devices;

— design drawings;

— acceleration/containment details, according to ISO 17842-1;

— hydraulic/pneumatic specification;

— electrical/electronic specification including software details;

— mechanical/structural specification;

— installation, operation, maintenance and inspection information;

See ISO 17842-1:2015, 4.4, for the principles of structural analysis.

4.1.3 Inspection of manufacturing process

4.1.3.1 Description

The inspection for the hereafter stated manufacturing requirements shall be made, when appropriate, during the manufacturing process and completed before the permit to operate with passengers. As a general requirement, the conformance of the parts, assemblies, components as well as their assembly and combined effects within the entire installation shall be confirmed with respect to the approved design documents.

This shall be covered by a report which confirms correctness and suitability of the employed materials and correctness of assembly.

The report can make reference to the manufacturer's inspection documents, quality system and/or declarations as part of the proof of conformity.

4.1.3.2 Inspection requirements

Inspection shall, as a minimum, verify the following:

a) conformity of the main dimensions, clearance distances and dimensions, free (easy) running of moving parts;

b) existence of all constructional components indicated in the construction documents;

c) conformity with the major dimensions of the load-carrying constructional components and their connections. Inaccessible constructional components or component groups are only to be dismantled when there are doubts concerning the compliance of the dimensions or the correct assembly/mounting;

d) conformity with the weight on which the calculations are based for such parts whose excess weight would cause the permissible stress on connections or constructional components to be exceeded, or whose shortage in weight might affect the safety of the equipment as far as lifting-off, sliding or tilting-over are concerned;

e) conformity of the required certificates concerning material specification and quality, e.g. strength, durability, fire resistance;

f) conformity of the electrical, electronic, hydraulic/pneumatic equipment with wiring, circuit diagrams, including when possible software, observance of the relevant national or regional standards and/or IEC standards and the applicable regulations or standards;

g) conformity with welding procedures specifications, shaping, machining, thermal treatment, coating of the structural and safety related parts by NDT.

The inspection of bearings, motors, enclosed drive units, switch and control units and similar components is required for, and limited to, only such cases where their failure could affect the safety of persons.

4.1.3.3 Initial inspection and testing

The initial inspection and testing shall consist of a number of separate inspections and tests which, taken together, demonstrate that at the time and place of the testing and inspection, the amusement device is capable of performing in accordance with the approved design documents. Functional tests concerning the movements unloaded and under full load are required. Unbalanced load tests are to be made in accordance with ISO 17842-1:2015, 4.4.2.1. See also ISO 17842-1:2015, 4.3.3.1.2.1 for test loads.

During the trial run, the following functions and conditions shall be checked, as applicable:

— clearance envelope for passengers relative to any moving parts or other objects (see ISO 17842-1);

— correct working of sequential, forced and interlocked control systems;

— the specified speeds, accelerations and safety critical weights e.g. ballast, counterweights;

— the working pressures of hydraulic/ pneumatic systems;

— the correct connection of electric supply;

— the setting of inclination control switches, terminal switches and other control switches as well as overload protections (e.g. pressure relief valves);

— the safety devices (e.g. anti-roll back devices for vehicles and on the track);

— the brakes as to their efficiency and the acceptable deceleration as far as passengers are concerned;

— the operational performances as far as lifting-off or tilting is concerned;

— the operation of the ride and the accelerations and decelerations under normal working conditions and in cases of emergency (see ISO 17842-1);

— an inspection for the build-up of detritus in fire sensitive electrical areas.

4.2 Pre-use inspection and review — Procedures

Initial approvals, inspections and tests shall be carried out, by applying the following procedures:

The inspection body shall be in accordance with ISO/IEC 17020.

All safety relevant design documents as well as the completed amusement device shall be subjected to review and inspection. After a successful inspection, a document confirming conformance with ISO 17842-1 and ISO 17842-2 can be issued.

The results of the various inspections and reviews shall become an integral part of the amusement device log.

The initial approval of amusement devices shall comprise:

— design review;

— inspection of manufacturing process;

— initial inspection and testing.

4.3 In-service inspection (periodical test)

4.3.1 General

The purpose of in-service inspection is for an inspection body to check on the fitness of an amusement device for continued further use during its operational life. It is a check on the safety-related components of an amusement device to ensure that they have not deteriorated to such an extent that the ride cannot continue to operate safely. The findings of the inspection and the requirements shall be recorded in a report along with the interval to the next inspection.

In-service inspection does not remove the duty on the controller of an amusement device to ensure that the amusement device is adequately maintained, nor does it duplicate the initial approval procedure.

Where there are no national regulations stating otherwise, an annual independent inspection shall be carried out.

More frequent inspections can be agreed between the controller and the manufacturer and/or the inspection body or other relevant authorities to ensure the integrity of the device.

4.3.2 Inspection process

All amusement devices require a visual inspection as part of the in-service inspection.

Any visual inspection can need to be supplemented by non-destructive testing as required by the manual or at the discretion of the inspection body.

The inspection body shall:

a) obtain the schedule from the manual specifying the required non-destructive testing (NDT) and from the manual and/or amusement device log identify the safety related components, recommended inspection methods and frequencies. The controller and the inspection body shall then agree the items to be inspected.

   NOTE It is advised that this be done in advance to allow parts to be prepared for inspection before the inspection body arrives. Preparation can include degreasing, removal of rust, removal of paint, or other protective finishes. This will normally include the disassembling of complex assemblies to allow access to safety-related areas. Difficulty of access is not a valid reason for failing to inspect safety-related components.

b) check with the controller to see whether any safety-related components have required unscheduled maintenance and/or demonstrated unusual performance since the previous inspection. If so, there can be a need for further investigation.

c) obtain from the controller any relevant accident or incident history of the device. This will inform the inspection body of necessary further inspection or action that can be required.

The following steps shall also be carried out (the list being non-exhaustive and dependent on the type of ride).

— Enquire of the controller as to whether any components showed unusual wear, damage or other irregularities, critical to the safe operation of the ride.

— The amusement device structure shall be inspected for deformities, i.e. buckled, bent or dented members, loose or missing parts.

— Structural members shall be inspected for deterioration, such as, rusting of steel, rotting of wood/plywood, delamination or tearing of fibre reinforced composites, or degradation of textile membranes.

— Expose the chosen safety-related components and carry out the relevant inspection(s), with disassembly where required by the amusement device log or manual; and assess their fitness for continued use.

— Safety-related welds, bolts, pins and joints shall be inspected for evidence of cracks, movement or excessive wear.

— Check nails or bolts for corrosion.

— Check for cracked, damaged or missing members which can impair the load carrying capacity of the structure.

— NDT shall be carried out according to the NDT schedule and personnel in accordance with ISO 9712; the report of NDT shall be reviewed by the inspection body and included into the amusement device log.

— Check for defects in any hydraulic or pneumatic systems and where relevant, check that the pressures are within the design specification.

— Check the correct functioning and condition of all passenger restraints and their locking systems.

— Inspect and test the electrical installation according to IEC 60204-1 and other applicable standards.

— A functional test shall be carried by which the amusement device is observed operating (with representative loads if necessary) and the effective operation of safety related controls checked. The observations made shall be compared with the operating specifications set out in the manual (e.g. speed control, stopping devices and interlocks).

— Check that the motion safety envelope and safety distances have not been compromised or are not likely to be compromised.

— On completion of satisfactory functional tests, the report of in-service inspection shall be signed and issued.

— The controller shall enter the record of the inspection reports in the amusement device log and retain a copy as part of the manual.

4.3.3 Electrical equipment

Inspection and test of all electrical equipment shall be performed by a competent person, taking into account, where applicable, requirements of the manual(s), national regulations, and any recommendations.

This inspection for deterioration, particularly of cables and connectors, earthing and bonding (where applicable), enclosures and components, switchgear and ancillary equipment shall be made with regard to the following:

a) corrosion;

b) damage;

c) excessive loading (overloading);

d) external influences;

e) security.

A report of the findings and readings taken shall be issued.

4.4 Installation examination

4.4.1 General

Amusement devices shall be subjected to a special examination after each new installation. This examination shall be carried out by competent persons. Where required by local regulations, an independent inspection can take place.

4.4.2 Extent of installation examinations

The following examinations should be performed:

— observance of the conditions imposed by the device log, the repair of faults detected during prior tests, and compliance with objections made during prior tests;

— correct packing and anchoring according to the plans with respect to the local ground conditions;

— conformity with the design documents, installation of all essential load-bearing components including braces and conformity of shapes and cross-sections of load-carrying components. Attention shall be paid to the correct incorporation of hydraulic and pneumatic components, staircases, platforms, railings, linings, decorations and other equipment.

— the correct siting of the amusement device;

— state of the essential load-bearing construction parts (visual sample tests);