INTERNATIONAL STANDARD

ISO 9927-1

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Cranes — Inspections —

Part 1: General

Appareils de levage à charge suspendue — Vérifications —

Partie 1: Généralités

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Foreword

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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. www.iso.org/directives

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The committee responsible for this document is ISO/TC 96, *Cranes*, Subcommittee SC 9, *Bridge and gantry cranes*.

This third edition cancels and replaces the second edition (ISO 9927-1:2009), which has been technically revised.

ISO 9927 consists of the following parts, under the general title *Cranes — Inspections*:

— *Part 1: General*

— *Part 3: Tower cranes*

Bridge and gantry cranes are to form the subject of a future Part 5. Other parts are planned.

Cranes — Inspections —

Part 1: General

1 Scope

This International Standard specifies the general requirements for inspections to be carried out on cranes as defined in ISO 4306-1. Additional requirements for particular types of cranes are intended to be covered by relevant specific parts of ISO 9927.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4306 (all parts), *Cranes — Vocabulary*

ISO 4310, *Cranes — Test code and procedures*

ISO 8686, *Cranes – Design principles for loads and load combinations*

ISO 10245-1, *Cranes — Limiting and indicating devices — Part 1: General*

ISO 12480-1, *Cranes — Safe use — Part 1: General*

ISO 12482-1, *Cranes — Condition monitoring — Part 1: General*

ISO 23814, *Cranes — Competency requirements for crane inspectors*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4306 and the following apply:

3.1
critical component
component, the failure of which would result in a risk to the health and safety of persons using the crane or located in its vicinity

3.2
design life
estimation of the allowable service life of a crane based on its original design specifications and taking into consideration the stress cycles and stress collectives (design constraints) before a special assessment and general overhaul are required

Note 1 to entry: The design life of a crane as a whole is usually governed by the life of a limited number of critical components (see ISO 12482-1).

Note 2 to entry: The design life may vary from the estimation if the stress cycles and stress collectives experienced during its service life deviate from those expected.

3.3
inspection
all relevant activities for the inspection of a crane including testing, as applicable

3.4
user organization instructions
instructions issued by the user organization for the use of the crane

4 General

4.1 General

In order to ensure safe operation of cranes, the proper working and operational condition shall be maintained.

4.2 Instructions

The user organization instructions shall incorporate the manufacturer's instructions and shall be written in plain language, in the language of the country where the crane is in use. The instructions shall be made available to all persons carrying out inspections. All persons performing inspections shall have read and understood the instructions.

The user organization instructions shall be assessed by a competent person against the requirements of this clause. Where they are determined to be adequate and appropriate they shall be applied to the crane's inspections.

NOTE A suitable checklist for this assessment is shown in Annex A.

Where the manufacturer's instructions are not available, a competent person shall develop suitable guidance.

5 Inspections

5.1 General

All inspections shall be carried out by a competent person (see Annex D) according to the instructions.

Inspections shall be carried out at a frequency to enable the crane to be kept in a safe and satisfactory condition. Inspections shall be carried out in conformance with the ISO 9927 series of standards, and instructions written in accordance with this International Standard. Any such work shall be noted in the records.

The results of all inspections shall be recorded and the records maintained in accordance with Clause 10. Where deleterious conditions are observed, they shall be rectified.

All safety-related issues shall be resolved prior to the use of the crane.

The following inspections are applicable.

NOTE These are general requirements. For additional requirements for a particular type of crane, refer to the relevant specific part of ISO 9927 and the applicable product standard.

a) Daily inspection — required for all cranes.

b) Frequent inspection — required for all cranes.

c) Periodic inspections — required for all cranes.

d) Enhanced periodic inspection (optional).

e) Exceptional inspection.

f) Major inspection — required for those cranes not subject to an enhanced periodic inspection regime (see 5.6.1).

A competent person shall either implement an enhanced periodic inspection after the first five years of service or continue with periodic inspections, followed by a major inspection by the end of the design life. Regardless of the option chosen, all critical components shall have been inspected by the end of the design life.

The intent of the inspections is to ensure the continued safe use of the crane. As cranes remain in service it is essential to ensure that the critical components are inspected and the necessary maintenance is carried out. This becomes important after five years of service and should be completed by the end of the design life.

NOTE 1 Annex B provides flow charts to guide the sequence of inspections outlined above.

NOTE 2 Testing is considered a subset of inspection (see 3.3).

5.2 Daily inspection

Before the commencement of each work shift, the crane shall be given a visual inspection and functional test to find any evidence of deficiencies.

Such inspections may be carried out by the operator. The functional tests should be made without load, where appropriate from the control station.

5.3 Frequent inspection

Frequent inspections are service inspections and shall be carried out with the manufacturer's routine servicing, at no more than three-monthly intervals, unless the crane is not in service. The frequency shall be based upon the frequency and severity of use of the crane while in service and the working environment.

It shall not be inferred that dismantling of any part is necessary during this inspection, but opening of covers (for example, limit switch covers), required for service and inspection purposes, shall be included.

The inspection procedure shall include verification that the current logbook and operator's manual(s) are available on the crane and that this documentation is up-to-date.

The inspection shall include all items specified in instructions written in accordance with this International Standard for frequent inspections.

A written report shall be furnished on completion of the inspection

A competent person may recommend that frequent inspections be carried out more often.

5.4 Periodic inspection

A program of periodic inspection shall be carried out. The frequency of periodic inspection shall be based on the working environment and the frequency and severity of use of the crane. For all cranes that remain in service, the inspection interval shall not exceed 12 months.

The inspection shall include all items specified in instructions for the periodic inspection, written in accordance with this International Standard.

A competent person shall identify components that require particular attention in subsequent periodic inspections.

A written report shall be furnished on completion of the inspection and retained with the crane logbook or record book. The report shall include an assessment of the reasonable practicability of applying the requirements of the latest edition of the applicable International Standards.

5.5 Exceptional inspection

Exceptional inspections shall be performed in the following circumstances:

a) following any exceptional circumstances which may have resulted in damage to the crane, such as
   1) extreme weather conditions outside of the design parameters of the crane,
   2) earthquake or seismic condition,
   3) collision with other structures,
   4) overload above those values normally controlled by limiting devices fitted to the crane,
   5) fire, or
   6) safety device failure;

b) following repair of damaged components or a change of
   1) load rating,
   2) load-bearing mechanical or structural components,
   3) hoisting mechanism,
   4) control station and system,
   5) prime mover,
   6) fixed and non-fixed load-lifting components, and/or
   7) carrier, foundation and support structure.

Exceptional inspections shall be performed by the appropriate inspector (see Annex D), to ensure that deviations from safe operation of the crane do not occur. The initial inspection following an incident or accident may be completed by an experienced technician.

NOTE 1 A repair requires a procedure by a competent person.

NOTE 2 Replacement of parts to the manufacturer's or original specification does not constitute a change.

5.6 Major inspection

5.6.1 Special assessment

A major inspection shall be performed for cranes where

a) the enhanced periodic inspection regime has not been carried out, or

b) they are to be re-commissioned or imported and do not have previous continuous working and maintenance records as specified in Clause 10.

The major inspection shall include a special assessment according to the requirements of ISO 12482-1.

5.6.2 Critical components

The major inspection shall involve examination of those critical components identified by the manufacturer or a competent person. Where necessary, the crane shall be stripped down and paint, grease and corrosion removed from critical components to allow a complete and thorough inspection.

Particular attention shall be given to the following:

a) past state of loading and utilization as compared with the crane's classifications (refer to ISO 12482-1);

b) future intended state of loading and utilization, as required by the user of the crane;

c) structural, mechanical, electrical, instrumentation, control and operational anomalies;

d) non-destructive testing of all nominated critical areas which show evidence of cracking due to fatigue and excessive stress;

e) components whose maintenance records indicate repeated failures;

f) controls and emergency stop;

g) braking systems;

h) platform levelling systems;

i) platform, handrails and gate;

j) adequacy of safety instructions and manuals for operation and maintenance;

k) manufacturer's safety upgrades;

l) emergency retrieval system.

5.6.3 Written report and follow-up

A written report shall be furnished on completion of the inspection. An expert engineer shall assess the results and shall

a) specify the defects, wear and where attention is necessary to ensure its continued safe operation,

b) identify components that require particular attention in subsequent periodic inspections, and

c) determine the reasonable practicability of applying the requirements of the latest edition of the relevant International Standard.

For those cranes and components listed in 5.6.1 b) and 5.6.2 e), the assessment should be supervised by an expert engineer.

Following the major inspection, a deemed design life, where required, shall be determined by the expert engineer (see Annex D) supervising the last major inspection. Subsequently, the crane shall either be subjected to the programme of inspection as part of the periodic inspection specified in 5.4, or reassessed by a competent person within a five-year period. The critical components identified by the assessment shall be inspected.

5.7 Enhanced periodic inspection

Enhanced periodic inspection may be carried out as an alternative to major inspection (see 5.6). After the first five years of service, and within five years thereafter, periodic inspections shall be structured to ensure all critical components are inspected, and tested where appropriate. The manufacturer's or user organization instructions may also detail requirements for enhanced periodic inspections. The scheduling of components for inspection shall be based on the crane's operational history and anticipated future usage, and the criticality and condition of the component or as assessed by ISO 12482-1 procedures. The schedule shall be recorded and updated when altered.

NOTE The periods indicated in this clause are based upon a 10 year design life.

The sequence of inspections may be altered based on the crane's usage, providing all critical components are inspected in the five year period.

The inspections shall include all items specified in the instructions for periodic inspection (see 5.4) together with all frequent inspection items (see 5.3), which should include

a) a detailed visual inspection of all structural components,

b) tolerance checking of wearing components,

c) checks for corrosion and environmental degradation,

d) visual examination of all critical areas (including appropriate NDT) for evidence of cracking,

e) possible replacement of selected critical components,

f) any exceptional inspection,

g) adequacy of safety instructions and manuals for operation and maintenance, and

h) manufacturer's safety upgrades.

For cranes older than five years, the report specified in 5.4 shall indicate those critical components that have been inspected. After 10 years, the report shall confirm that all critical components have been inspected.

6 Methods of inspection

6.1 Visual examination

Visual examinations shall be carried out on every part of the crane in order to detect any abnormalities or deviations from the normal conditions, by means of visual checks, e.g. a hammering test, and measurements.

Generally, the visual examination is to be carried out without dismantling. However, dismantling shall be performed where it is necessitated by the crane condition.

6.2 Non-destructive test

Depending on the result of visual examination, non-destructive tests (e.g. penetrant testing, ultrasonic testing, magnetic particle testing, radiographic testing, acoustic emission testing) may be carried out.

6.3 Functional test

The functions of controls, switches and indicators shall be checked. The measurement of the electrical and/or hydraulic system shall be carried out if necessary.

Functional tests shall be carried out for the following limiting and indicating devices in order to ensure that they are functioning and calibrated correctly for safe operation:

a) rated capacity limiters and indicators;

b) motion limiters and indicators;

c) performance limiters and indicators.

6.4 No-load test

No-load tests shall be carried out for all crane motions, (e.g. hoisting, travelling, traversing, slewing and luffing) at the rated speeds and without lifting loads, in order to check for any abnormalities and/or defects.

6.5 Load test

Load tests shall be carried out on basic crane motions, such as hoisting, travelling, traversing and slewing, while suspending a test load (where permitted), in order to check for any abnormalities and/or defects. The test load should not exceed the rated capacity.

Where systematic load testing is applied, the frequency of load testing shall be in accordance with the legislation of the location where the crane is being used.

NOTE Depending upon national legislative requirements, it may also be necessary to increase the test load beyond the rated capacity.

6.6 Static, dynamic and stability tests

Static, dynamic and stability tests shall be performed in accordance with ISO 4310.

7 Inspection personnel

The inspection personnel shall be competent to inspect the crane. Annex D provides a table of competent personnel.

8 Precautions for inspection

ISO 12480-1 shall apply for the safety of the personnel involved in the crane inspection.

Annex C should also be considered.

9 Repairs

Repairs shall be carried out in accordance with the relevant International Standard and manufacturer's instructions (where available).

10 Records

10.1 General

A continuous working record, including logbook and service/maintenance history of the significant events concerning the safety and operation of the crane, shall be kept and be readily available and assessable. This includes the checks, adjustments, replacement of parts, repairs, modification or relocation, as well as inspections performed and all irregularities or damage concerning the unit's safe use.

The records shall be readily understood and in plain language, in the language of the country where the crane is in use. Any suitable format and system that records these events and is readily available to the operator and inspector should be accepted as meeting the intent of this clause.

The records shall be transferred with ownership of the crane.

10.2 Logbook

The minimum records that shall be retained in the logbook are copies of

a) a summary statement of the last major inspection,

b) a summary statement of the last periodic inspection,

c) a summary statement of the last frequent inspection,