INTERNATIONAL STANDARD

ISO 9927-3

First edition
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Cranes — Inspections —

Part 3: Tower cranes

Appareils de levage à charge suspendue — Vérifications —

Partie 3: Grues à tour

Reference number
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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 9927-3 was prepared by Technical Committee ISO/TC 96, *Cranes*, Subcommittee SC 7, *Tower cranes*.

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

— *Part 1: General*

— *Part 3: Tower cranes*

Cranes — Inspections —

Part 3:
Tower cranes

1 Scope

This part of ISO 9927 specifies the regular inspections to be carried out on tower cranes. It is intended to be used in conjunction with ISO 9927-1. It does not cover inspection prior to the first use of a tower crane.

2 Normative references

The following referenced documents are indispensable for the application 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 4309, *Cranes — Wire ropes — Care, maintenance, installation, examination and discard*

ISO 9927-1:1994, *Cranes — Inspections — Part 1: General*

3 General

In order to ensure safe operation of tower cranes, their proper working and operational condition shall be maintained. Therefore, all cranes need to undergo regular inspections. This ensures that deviations from safe conditions are detected and can be rectified. The inspections shall be arranged by the user.

The regular inspections are

— daily inspections

— frequent inspections

— periodic inspections, and

— thorough inspections.

NOTE The manufacturer can give inspection instructions that differ from those of this part of ISO 9927. In this case, it is the manufacturer's instructions that are applicable.

Annex A gives an overview of the inspections (periodicity, content, persons in charge, results and reports).

4 Daily inspections

4.1 General

Daily inspection shall be performed before starting. This inspection shall consist of a visual inspection (in general, no dismantling is required) and functional tests as defined hereafter.

They shall be carried out by a competent person (e.g. the crane driver).

4.2 Content

The inspections before each start shall take in

a) the functioning of mechanisms, in particular the brakes (generally without load),

b) the functioning of limiting and indicating devices, and

c) observation of conspicuous defects, including ropes.

4.3 Results

Any defect shall be pointed out to a person who can take a suitable decision (to leave the tower crane in use, repair, thorough inspection of a part of the tower crane or the whole tower crane, limitation of use).

The causes of these defects shall be sought, depending on the type of component and defect concerned.

The record book shall be updated (date of the repair, method).

5 Frequent inspections

5.1 General

Frequent inspections shall comprise visual inspections (in general, no dismantling is required), as specified in 5.2, and the functional tests according to 4.2.

They shall be carried out by a competent person (e.g. an experienced technician, see ISO 9927-1).

5.2 Items to be inspected

The following items shall be inspected.

a) Level of lubricants: leakage of lubricants, greasing.

b) Hydraulic equipment: leakage.

c) Hooks and latches: visible deformation, cracks, wear.

d) Wire ropes: in accordance with ISO 4309.

e) Connections, joints: corrosion, visual inspection.

f) Break wear: thickness of brake linings, adjustment, noise, etc.

g) Hydraulic and pneumatic hoses: in particular those which are bent during operations.

h) Electrical installation: state, signs of deterioration, moisture accumulation.

i) Anchorage: braces or guys supporting cranes (condition).

5.3 Periodicity

The periodicity of the frequent inspections shall take into account the actual use of the tower crane and the environment in which the tower crane is working.

The minimum periodicity is as follows:

a) for 5.2 a) to 5.2 e), monthly;

b) for 5.2 f) to 5.2 i), twice yearly.

5.4 Results

Any defect shall be pointed out to a person who can take a suitable decision (to leave the tower crane in use, repair, thorough inspection of a part of the tower crane or the whole tower crane, limitation of use).

The causes of these defects shall be sought, depending on the type of component and defect concerned.

The record book shall be updated (date of the repair, method).

6 Periodic inspections

6.1 General

Periodic inspections are inspections made periodically, as indicated in 6.3, and after each re-erection.

Periodic inspections shall comprise visual inspections (in general, no dismantling is required), and functional tests, both with and without load, as defined below.

They shall be carried out by a competent person (e.g. an experienced technician, see ISO 9927-1).

The competent person shall be in possession of

— the report of the previous inspections, and

— the automatic registered data, where available, (cycles, hours, days, loads, etc.) permitting knowledge of the service time of the components for which data exist.

6.2 Content

The periodic inspections shall include the content of the frequent inspections.

The functional tests for all components shall be performed in the most unfavourable position for these components.

a) Verification of the tower crane's identification and plates.

b) Verification of the presence of the instruction handbook.

c) Verification of the records of maintenance.

d) Verification of the components, equipment and steel structure. Compare the component installed on the tower crane with the component listed in the documentation.

e) Consideration of the condition of equipment indicating its deterioration:

   — the gear or its components are loose and its oil (lubricant) leaks;

   — visible couplings between particular components (e.g. motor, gear, brakes, drums) show wear or damage;

- unusual noise and vibration is noticeable;
- unusual high temperature is noticeable;
- fastening bolts are loose, fissured or defective;
- brake linings are worn or damaged;
- the general condition (corrosion, dirt) is doubtful;
- the electrical installation (cable entries, cable attachments) shows damage;
- wire ropes (see ISO 4309);
- hooks (see Annex B).

f) Functional tests. Functioning and efficiency, with the rated load of

- mechanisms, in particular the brakes, and
- limiting and indicating devices.

g) Steel structure and rails:

- welding;
- corrosion;
- remaining deformation;
- cracks.

h) Support of the tower crane/crane-track.

For an example, see ISO 9927-1:1997, Annex A.

6.3 Periodicity

Tower cranes shall be inspected at least each year and after each re-erection.

NOTE 1 Some verifications can be performed when the tower crane is dismantled.

NOTE 2 Changing of the pulley block or addition of a jib extension or tower section are not considered as dismantling and re-erection.

NOTE 3 After folding and unfolding of a self-erecting tower crane, there is need only for an inspection limited to b), c), f), g) and h) of 6.2.

6.4 Results

Periodic inspections shall be recorded. This report shall indicate the components verified and remaining defects. An example of such a report is presented in Annex C.

The report shall be given to a person who can take a suitable decision (to leave the tower crane in use, repair, thorough inspection of a part of the tower crane or the whole tower crane, limitation of use).

The causes of these defects shall be sought, depending on the type of component and defect concerned.

The record book shall be updated (date of the repair, type, etc.).

7 Thorough inspections

7.1 General

Thorough inspections are detailed inspections made with a periodicity according to 7.3 (and as identified in Annex A).

They shall be performed by a competent person, capable of defining the actions needed to be taken depending on the results of these inspections (e.g. an expert engineer, see ISO 9927-1).

The competent person shall be in possession of

— the report of the previous inspections, and

— the automatic registered data, where available, (cycles, hours, days, loads, etc.) permitting knowledge of the service time of the different components for which data exist.

7.2 Content

The thorough inspections shall comprise at least all the elements of the periodic inspections.

A thorough inspection can require non-destructive tests and/or dismantling if considered justified, taking into account

— the content of the previous verifications (daily, frequent, periodic or thorough),

— the results of the current tests, and

— the result of the current visual checks.

When dismantling, special care shall be taken in order to avoid mistakes or wrong operation while following the maintenance instructions. If these are not available, the manufacturer of the tower crane or of the component concerned should be contacted for assistance.

During the thorough inspection, particular attention shall be given to the following:

— vibration;

— unusual noise or temperature;

— poor general condition, corrosion;

— alignment of machinery, motors and gears, rails, wheels, shafts;

— brakes;

— connections, bolts, pins.

7.3 Periodicity

7.3.1 Periodicity for tower cranes or components for tower cranes with no automatic registration on use

Thorough inspection of a component or the tower crane is recommended at periodic intervals, as follows:

— 4 years;

— 8 years;

— 10 years;

— 12 years;

— 14 years;

— every year after 14 years.

7.3.2 Periodicity for tower cranes or components for tower cranes with automatic registration of data on use

The instruction handbook should contain the periodicity of the thorough inspection of the crane and of the corresponding components based on the registered data, at least at the intervals given in 7.3.1.

In addition to the periodicity, the manufacturer should give guidance to reinitialise the value of the parameter (return to zero, keep the value as new origin, etc.).

7.4 Results

The report of the thorough inspection shall contain the result of the inspection made by the competent person as well as his conclusions and recommendations, including the time until the next thorough inspection.

An example of such a report is given in Annex C.

When the tower crane or a component is not used as classified or is in a condition which seems to be hazardous, the competent person (see 7.1) will recommend appropriate action.

The causes of defects shall be sought, depending on the type of component and defect concerned.

The record book shall be updated (date of the repair, type, etc.).

8 Exceptional inspection

8.1 General

The inspection shall be carried out after

a) exceptional circumstances, such as

   — extreme weather conditions (storm),

   — an earthquake of medium seismic intensity,

   — overload, collision or foundation disturbance,

b) after substantial modification, for example, increase of rated capacity, change of mechanisms, transfer of control station, change of power, change in design of the load-bearing structure, welding on the load-bearing structure, modification of control system or change in operating condition relative to the class of utilisation and load spectrum.

The verifications shall be performed by a competent person (experienced technician or engineer, depending on the nature of the verification).

8.2 Content

The extent of the inspection shall be proportional to any damage or modification that may have occurred.

Annex A
(normative)

Overview of inspections

	Daily inspection	Frequent inspection	Periodic inspection	Thorough inspection
When (periodicity)	— Before each start up of the tower crane	— Monthly or every six months and/or according to the manufacturer's	— At a determined period (legal, given by the manufacturer or recommendation) — After dismantling/re-erection	— After finding a fundamental failure — At a determined period, either — legal, — given by the manufacturer, or — given by recommendation following report (frequent or periodic inspection) — As recommended in 7.3
What (content)	See 4.2	See 5.2	See 6.2	See 7.2
How	— Visual inspections — Functional tests Without dismantling	— Visual inspections — Functional tests Without dismantling	— Visual inspections, including reading of recording instruments — Functional tests (loaded and unloaded) Without dismantling, if not otherwise required by the manufacturer.	— Same as for the periodic inspection If necessary, with dismantling or measurement (play) or specific tests on all or part of the tower crane
By whom	Competent person (e.g. crane driver)	Competent person (experienced technician)	Competent person (experienced technician)	Competent person (engineer)
Inspection results	— OK, or — request for repair if fault found, or — can give rise to a request for a thorough inspection (repetitive cases, major fault, etc.), or — can give rise to a request for adequate information (e.g. driving, instructions, limit of use, etc.)	— OK or, — request for repair if fault found or, — can give rise to a request for a thorough inspection (repetitive cases, major fault, etc.), or — can give rise to a request for a adequate information (driving, instructions, limit of use, etc.)	— OK, or — request for repair if fault found, or — can give rise to a request for a thorough inspection (repetitive cases, major fault, etc.), or — can give rise to a request for a adequate information (driving, instructions, limit of use, etc.)	— Date of the next inspection — Partial or total changes [a], or — scrapping, or — request for repair, or — can give rise to a request for a adequate information (driving, instructions, limit of use, etc.)

	Daily inspection	Frequent inspection	Periodic inspection	Thorough inspection
Report	Not systematic	Not systematic	The report shall include a check list of the points checked and a summary of the detected defects.	The report shall contain the findings of the competent person as well as his conclusions — list of repairs, period before next thorough inspection, tests to be performed, proposal for general overhaul, etc.
Maintenance book	Updating of maintenance book if repair is involved	Updating of maintenance book with reports on maintenance work, defects, damages, repairs, etc.	Updating of maintenance book with reports on maintenance work, defects, damages, repairs, etc.	Updating of maintenance book with reports on maintenance work, defects, damages, repairs, etc.

[a] Systematic changes of certain parts can be recommended by the manufacturer or by way of recommendations.

Annex B
(informative)

Verification of hooks

This annex gives an example for the verification of hooks.

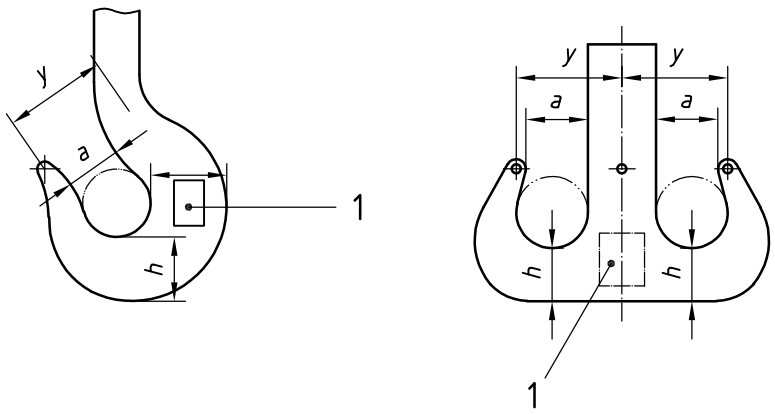
To apply the following method, the initial dimensions of the hooks need to be known. They are available from the manufacturer of the tower crane or of the hook.

— Deformation: if the openings a and y (see Figure B.1) have widened by more than 10 %, which is the maximum permissible limit, replace the load hook.

— Surface fissures: damage and surface fissures may be removed notchless, provided that the permissible tolerance levels are not exceeded.

— Wear: on single or twin hooks, it shall not be greater than 5 % of height h (see Figure B.1). It is not permitted to carry out welding work on load hooks, e.g. to compensate for wear.

— Hook neck shaft: cracks.



Key

1 marking

Figure B.1 — Shape and dimensions of hooks

Reference values for a, h and y are to be taken from the instruction manual. If they are not available, the manufacturer of the tower crane or of the hook shall be contacted.

Annex C
(informative)

Example of report for periodic, thorough or exceptional inspections

Company: _____ Date: _____

Crane type: _____ Serial No.: _____

Manufacturer: _____ Year of construction: _____

Address of customer/hirer: _____

Construction site: _____ Stock number: _____

Person undertaking the inspection: _____ Signature: _____

Inspection observations: _____

No.	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
1	**Crane document**	Crane book											
		Instruction handbook											
		Spare parts lists											
2	**Rail track/area for the erection**	Substructure horizontal											
		Substructure able to take the loads											
		Length of sleepers											
		Condition of sleepers											
		Distance of sleepers											
		Gauge											
		Inner radius of curved rail											
		Rail dimensions											
		Rail fixings											
		Rail joints/joint plates											
		Running-up key for travelling limiter											
		Travel limits											

Notation: + met – not met O not necessary

No.	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
3	**Signs / safety distances**	Type plate											
		Signs											
		Warning signs											
		Safety distances											
		to											
		to											
		to											
		to											
		Barriers											
Notation: + met – not met O not necessary													

No.	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
4	**Undercarriage or portal**	Free of cracks											
		Outrigger arm support											
		Outrigger arm lock											
		Rail wheels											
		Wheel flanges											
		Travelling gears											
		Travelling brakes (travelling test)											
		Guarding of danger spots											
		Devices to limit fall due to wheel failure											
		Rail clamps											
		Track clearer											
		Supporting devices											
		Transport safety retainer removed											
Notation: + met – not met O not necessary													

No.	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
5	**Slewing gear**	Clearance of the slewing ring											
		Fastening of the slewing ring											
		Test run of the slewing ring											
		Slewing gear pinion											
		Fastening of the gear											
		Slewing gear brake											
		Free jib slewing											
		Guarding of danger spots											
6	**Hoisting winch**	Coupling											
		Changing gear											
		Interlock of changing gear											
		Rope drum mounting											
		Fastening of the hoisting winch											
		Clearance of brake linings											
		Brake disk											
		Brake release unit											
		Springs											
		Brake test											
		Lowering without power											
		Rope fastening											
		2 safety turns											
Notation: + met – not met O not necessary													

No.	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
7	**Luffing gear**	Coupling											
		Changing gear											
		Interlock of changing gear											
		Rope drum mounting											
		Fastening of the luffing winch											
		Clearance of brake linings											
		Brake disk											
		Brake release unit											
		Springs											
		Brake test											
		Lowering without power											
		Rope fastening											
		2 safety turns											
Notation: + met – not met O not necessary													

No.	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
8	**Auxiliary hoisting winch**	Coupling											
		Changing gear											
		Interlock of changing gear											
		Rope drum mounting											
		Fastening of the auxiliary winch											
		Clearance of brake linings											
		Brake disk											
		Brake release unit											
		Springs											
		Brake test											
		Lowering without power											
		Rope fastening											
		2 safety turns											
Notation: + met – not met O not necessary													

No.	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
9	**Trolley travelling mechanism**	Rail wheels											
		Rope pulleys											
		Wheel flanges / guides rollers											
		Trolleys travelling limiter											
		Coupling											
		Fastening of the trolley travelling drum											
		Rope fastenings											
		Limit stops											
		2 safety turns											
		Fetch back of the maintenance cage											
10	**Ballast**	Ballast											
		Loose ballast (weight)											
		Fixed ballast (weight)											
		Secured against moving											
		Secured against falling down											
		Slinging points											
Notation: + met – not met O not necessary													

No.	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
11	**Tower construction**	Welds free of cracks											
		Corner posts											
		Diagonals											
		Bolt connections											
		Pin connections											
		Tower joints											
12	**Jib construction**	Welds free of cracks											
		Upper and lower chords											
		Diagonals											
		Bolt connections											
		Pin connections											
		Jib joints											
Notation: + met – not met O not necessary													

No.	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
13	**Counter-jib**	Welds free of cracks											
		Counter-jib chords / girder											
		Diagonals											
		Bolt connections											
		Pin connections											
		Counter-jib joints											
14	**Access, walkways, platforms**	Ladders											
		Hoop guards											
		Personal protective equipment against falls from a height											
		Walkways											
		Platforms											
		Safety device against falling down											
Notation: + met – not met O not necessary													

No.	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
15	**Cabin / control station**	Walls											
		Windows											
		Floor											
		Entrance											
		Doors											
		Seat											
		Ventilation											
		Heating											
		Electric installation											
		Windscreen wiper											
		Side protection											
16	**Controls**	Actuating devices											
		Signs and warnings											
		Radius indicator											
		Indicators											
Notation: + met – not met O not necessary													

No.	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
17	**Electric installation**	Ground fault protection system											
		Feed line											
		Cable drum											
		Crane switch											
		No-volt release											
		Deadman's switch (movable control)											
		Electric installation											
		Strain reliefs											
		Lighting											
18	**Rope drives, pendants**	Hoisting rope											
		Luffing rope											
		Jib tie(s)											
		Trolley travel rope(s)											
		Erection rope(s)											
		Rope pulleys											
		Rope hoop guard											
		Rope guides											
		Rope and terminations											
		Other rope connections											
		Pendant ropes											

Notation: + met – not met O not necessary

Number	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
19	**Block assembly**	Fastening at hoisting rope											
		Wear of the hook											
		Deformation of the hook											
		Surface cracks											
		Load hook's nut safety catch											
		Hook catch											
		Hook block											
20	**Motion limiters / safety devices**	Travelling limiter											
		Hoisting limiter											
		Lowering limiter											
		Derricking limiter up											
		Derricking limiter down											
		Trolley travelling limiter forward											
		Trolley travelling limiter reverse											
		Max. load limiter											
		Load moment limiter											
		Slewing limiters											

Notation: + met – not met O not necessary

Number	Subassembly	Part to be checked	Existing or complete		Condition or maintenance		Function		Repair or replacement		Re-examination		
											Necessary		Carried out
			+	–	+	–	+	–	+	–	Yes	No	Date/ Signature
21	**Other subassemblies** e.g. in accordance with the instruction handbook												
Notation: + met – not met O not necessary													

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