BS 7121-2-5:2012

BSI Standards Publication

Code of practice for the safe use of cranes

Part 2-5: Inspection, maintenance and thorough examination – Tower cranes

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Published by BSI Standards Limited 2012

ISBN 978 0 580 78196 4

ICS 53.020.20

The following BSI references relate to the work on this standard:
Committee reference MHE/3/11
Draft for comment 12/30259756 DC

Publication history

First published November 2012

Amendments issued since publication

Date	Text affected

Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 32, an inside back cover and a back cover.

Foreword

Publishing information

This sub-part of BS 7121-2 is published by BSI Standards Limited, under license from the British Standards Institution and came into effect on 30 November 2012. It was prepared by Subcommittee MHE/3/11, *Crane safety and testing*, under the authority of Technical Committee MHE/3, *Cranes and derricks*. A list of organizations represented on these committees can be obtained on request to their secretary.

Supersession

Together with BS 7121-2-1, BS 7121-2-3, BS 7121-2-4 and BS 7121-2-7, this sub-part of BS 7121-2 supersedes BS 7121-2:2003, which will be withdrawn when all these sub-parts have been published.

Relationship with other publications

The BS 7121 series is being revised. The following new sub-parts of BS 7121-2 have been published or are in preparation.

- Part 2-1: *Inspection, maintenance and thorough examination – General;*
- Part 2-3: *Inspection, maintenance and thorough examination – Mobile cranes;*
- Part 2-4: *Inspection, maintenance and thorough examination – Loader cranes;*
- Part 2-5: *Inspection, maintenance and thorough examination – Tower cranes;*
- Part 2-7: *Inspection, maintenance and thorough examination – Overhead travelling cranes, including portal and semi-portal cranes, hoists, and their supporting structures;*
- Part 2-9; *Inspection, maintenance and thorough examination – Cargo handling and container cranes.*

When all sub-parts of BS 7121-2 have been published, it is intended that CP 3010 will be withdrawn and BS 5744 will be revised to cover manually operated and light cranes only.

This sub-part of BS 7121-2 is intended to be used in conjunction with BS 7121-2-1.

Information about this document

The Health and Safety Executive (HSE) commends the use of this British Standard to those who have duties under the Health and Safety at Work etc. Act 1974 [1]. This standard was drawn up with the participation of HSE representatives and it will be referred to in the relevant HSE publications.

The BS 7121-2 series has been accepted by the HSE as representing the consensus of opinion based on practical experience for safety of cranes.

Hazard warnings

WARNING. This British Standard calls for the use of procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

As a code of practice, this sub-part of BS 7121-2 takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this sub-part of BS 7121-2 is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Particular attention is drawn to the following specific regulations:

- Health and Safety at Work etc. Act 1974 [1];
- Lifting Operations and Lifting Equipment Regulations (LOLER) 1998 [2];
- Provision and Use of Work Equipment Regulations (PUWER) 1998 [3];
- Supply of Machinery (Safety) Regulations 2008 (as amended) [4];
- Work at Height Regulations 2005 (as amended) [5].

NOTE Details of the Lifting Operations and Lifting Equipment Regulations 1998 [2] and the Provision and Use of Work Equipment Regulations 1998 [3], together with an HSE Approved Code of Practice and HSE Guidance, are given in HSE publications Safe use of lifting equipment *[6] and* Safe use of work equipment *[7].*

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1 Scope

This sub-part of BS 7121-2 gives recommendations for the pre-use checks, in-service inspection, maintenance, thorough examination (in service and following exceptional circumstances) and supplementary testing of tower cranes. It covers self-erecting tower cranes, with the exception of vehicle mounted self-erecting tower cranes, which are covered by BS 7121-2-3.

This sub-part of BS 7121-2 is not applicable to permanently installed cranes on marine and other water-borne vessels.

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.

BS 7121-2-1:2012, *Code of practice for the safe use of cranes – Part 2-1: Inspection, maintenance and thorough examination – General*

BS ISO 4309:2010, *Cranes – Wire ropes – Care and maintenance, inspection and discard*

3 Terms and definitions

For the purposes of this sub-part of BS 7121-2, the terms and definitions given in BS 7121-2-1:2012 apply.

4 General

Regular pre-use checking, in-service inspection, maintenance and thorough examination of cranes are essential if cranes are to function safely and reliably. The nature of these activities can be summarized as follows.

- Pre-use checks are visual checks which are carried out to ensure that the crane has not suffered any damage or failure, and is safe to use.
- In-service inspections and maintenance are carried out to ensure that components are repaired or replaced before they deteriorate to a point at which they would become unsafe.
- Thorough examinations are carried out at specified intervals, after installation on a new site, after major alteration or repair or after the occurrence of exceptional circumstances which could jeopardize the safety of the crane.
- Supplementary testing is carried out in support of thorough examination and the extent and nature of any testing are specified by the competent person carrying out the thorough examination.

5 Personnel carrying out pre-use checks, in-service inspections, maintenance and thorough examinations

Attributes, competencies, competency assessment, training plans and training records of personnel should be in accordance with BS 7121-2-1:2012, Clause **5**.

6 Pre-use checks and in-service inspections

6.1 General

Pre-use checks and in-service inspection of cranes, together with a system to rectify any defects disclosed, are required by the Health and Safety at Work etc. Act 1974 [1] Section 2(2)(a), and LOLER 1998 [2] Regulation 9(3)(b) to ensure that the crane is safe to use and that any deterioration is detected and rectified before the crane becomes unsafe.

Examples of checklists for pre-use checking are given in Annex A.

Pre-use checks and in-service inspections should only be carried out by personnel who have been adequately trained and assessed as competent to carry out the required tasks (see Clause **5**). LOLER 1998 [2] requires that results of all in-service inspections are recorded in writing. It is recommended that the results of all pre-use checks are also recorded in writing.

The crane user should ensure that sufficient time is allowed for pre-use checks to be carried before the crane starts work. The user should also ensure that a safe system of work is in place to prevent the person who is carrying out the checks/inspections from being exposed to danger.

6.2 Pre-use checks

Pre-use checks should be carried out at the start of each shift during which the crane is to be used. These are to test the functionality of the crane and visually check for any obvious defects. It is essential that these are carried out from a position of safety.

6.3 In-service inspection

A regular in-service inspection should be made to identify any defects which might not be detected by the pre-use checks. In-service inspections should be carried out at intervals which ensure that any deterioration is identified before there is a risk of failure of the crane or injury to persons. Further guidance is given in HSE document L113 [6]. It might be convenient to schedule the inspections concurrently with planned preventive maintenance (see BS 7121-2-1:2012, **7.2.2** and **7.2.3**).

Steel structures suffer from fatigue, a process which can create cracks that propagate over time. If left unattended, cracks can cause serious failure of the crane structure, so the in-service inspection regime should include measures to detect cracks before the safety of the crane is affected.

The period between inspections should be decided on the basis the duty of the crane and the environmental conditions and might need to vary between 1 week and 6 months. The period should be kept under review and adjusted according to the results of the inspections.

6.4 Reporting of defects

Any defects found during pre-use checks and in-service inspections should be recorded and notified to the user. LOLER 1998 [2] requires that defects identified by in-service inspections which are, or could become, a danger to persons are notified to the employer (user) forthwith.

6.5 Records of pre-use checks and in-service inspections

6.5.1 General

Written records of all pre-use checks and in-service inspections should be kept.

6.5.2 Pre-use checks

The record of a pre-use check should include at least the following information:

- identity of the crane;
- date of the check;
- result of the check, i.e. whether or not the crane passed;
- name and signature of person carrying out the check.

This may be kept to a minimum by, for example, completing a single line of a pro-forma record card.

6.5.3 In-service inspections

The record of an in-service inspection should include at least the following information:

- date and location of the inspection;
- name of person carrying out the inspection;
- description and unique identification number of the equipment inspected;
- nature and extent of the inspection;
- results of the inspection, including details of the condition of critical components which need to be monitored, for example a wire rope showing signs of wear.

The record should be related to the crane's historical records and made available to the competent person responsible for the thorough examination (see Clause **8**).

6.6 Inspection prior to reconfiguration or dismantling

Before an erected tower crane is reconfigured or dismantled it should be inspected to determine whether there are any defects which could affect the safety of the reconfiguration or dismantling operation. Any defects found during such an inspection should be recorded for inclusion in the machine history file and corrective action taken before the reconfiguration or dismantling operation is carried out. The details of these defects, together with any corrective actions, should be made available to the competent person at the time of the next thorough examination.

6.7 Inspection of second-hand tower cranes

When purchasing second-hand tower cranes their condition should be inspected and thoroughly assessed; nothing should be taken for granted. Where possible this assessment should include a review of maintenance records and previous reports of thorough examination.

Once the crane's condition has been fully assessed any necessary repairs should be carried out and appropriate inspection and maintenance intervals established.

7 Maintenance of tower cranes

7.1 General

Under the Provision and Use of Work Equipment Regulations (PUWER) 1998 [3] employers are required to ensure that cranes are maintained in an efficient state, in efficient working order and in good repair. To ensure adequate maintenance an effective maintenance management system should be set up in accordance with BS 7121-2-1:2012, **7.1**.

The Health and Safety at Work etc. Act 1974 [1] sets out a general duty requiring that work equipment is maintained so that it is safe.

For tower cranes, planned preventive maintenance (see BS 7121-2-1:2012, **7.2.2** and **7.2.3**) should be carried out at intervals which ensure that worn and damaged components are renewed before the tower crane becomes unsafe, breaks down or fails.

NOTE Breakdown causes downtime and a consequent loss of production for the user, whilst a component failure could result in a partial or total collapse of the crane with potentially fatal consequences for persons in the vicinity.

7.2 Pre-delivery inspection and maintenance of the crane and its components

Before a tower crane or its components are delivered to site, the crane and/or components should be inspected to identify any worn or faulty components and these should be replaced. The results of the inspection, and any maintenance carried out, should be recorded. This record might be required by the competent person carrying out thorough examination of the crane.

It is considerably easier and less costly to replace components and carry out lubrication and adjustments in a depot, than when the crane has been erected on site. It also enables parts that are not easily accessible on an erected crane to be examined. Work on an erected tower crane always involves work at height and presents difficulty in handling heavy components.

Pre-delivery inspection and maintenance provides a good opportunity for the completion of supplementary tests before the crane is erected. It is also strongly recommended that the tower crane's drive and control systems should be powered up and checked for correct functioning during pre-delivery inspection and maintenance.

The direct transfer of cranes between sites should be approached with extreme caution as it often leads to both delays in erection and time lost through the correction of faults. Best practice guidance is that direct transfers should not be undertaken and that cranes should be taken back to a depot for full pre-delivery inspection and maintenance before the next erection takes place. Where cranes are to be sent from site to site without returning to depot, special arrangements should be made and time allocated for inspection on the ground and for any necessary repairs to be carried out.

7.3 Post-delivery checks

Following delivery of the crane or crane components to site, the erection supervisor should check that the pre-delivery inspection and maintenance was completed at the depot prior to despatch and that the items have not been damaged in transit (see Construction Plant-hire Association publication, Tower Crane Technical Information Note 014, *Pre-erection component checks* [8]). The supervisor should also check that the correct components have been delivered in accordance with the build sheet and the manufacturer's manual.

7.4 Pre-erection checking and inspection of the base

Before a tower crane is erected on site it is essential that the design of the base on which it is to be erected is checked to ensure that the base, of whatever type, has been designed taking into account the loads expected to be imposed on it during installation of the crane, and both in service and out of service, once the crane has been commissioned. Following construction and/or installation of the base, an inspection should be carried out to check that the base has been constructed to the design specification. The results of the inspection should be recorded in writing. An example of a suitable form is shown in Annex B.

Once the base has passed the design check and post-construction inspection, the person responsible for the base construction should complete a permit to erect confirming that the tower crane base has been constructed to the designer's specification and that a post-construction inspection has been carried out. An example of a suitable form, which also provides space for design certification and design check certification, is shown in Annex C.

NOTE 1 Information on base design is given in CIRIA publication C654 Tower crane stability *[9],*

NOTE 2 Information on base design checking is given in Construction Plant-hire Association publication Tower Crane Technical Information Note 031, Tower crane bases and ties *[10] .*

7.5 Checking and inspection of ties

Before a tower crane is erected on site it is essential that the design of any ties and tie attachment points connecting them to the supporting structure is checked to ensure that they have been designed taking into account the loads expected to be imposed on them during installation of the crane, and both in service and out of service, once the crane has been commissioned. Following fabrication and installation of the ties and tie attachment points, an inspection should be carried out to check that the ties and attachment points have been constructed and installed to the design specification. The results of the inspection should be recorded in writing. An example of a suitable form is shown in Annex D.

Once the ties have passed the design check and the post fabrication and installation inspection, the person responsible for the tie fabrication should complete a permit to erect confirming that the ties and tie attachment points to the supporting structure have been fabricated and installed to the designer's specification and that a post-installation inspection has been carried out. An example of a suitable form, which also provides space for design certification and design check certification, is shown in Annex E.

NOTE 1 Information on tie design is given in CIRIA publication C654, Tower crane stability *[9].*

NOTE 2 Information on tie design checking is given in Construction Plant-hire Association publication Tower Crane Technical Information Note 031, Tower crane bases and ties *[10].*

7.6 Verticality of the mast

The importance of the verticality of the tower crane mast cannot be over-emphasized. The mast should be vertical within the limits specified by the manufacturer [see also **8.3**h)]. This should be checked by an engineer or surveyor with a theodolite at the following stages:

a) after erection of the mast and prior to the slew section being installed;

b) upon completion of the installation or reconfiguration of any mast ties;

c) before and after mast climbing operations and after any other reconfiguration.

7.7 In-service maintenance interval

Once a tower crane has been erected on site it should be maintained at regular intervals to avoid breakdown, failure or collapse. The frequency at which inspection and maintenance is carried out should be based on the recommendations contained in the manufacturer's manual for the crane. This should however generally be taken as the maximum interval as various factors, including the following, might require the interval to be reduced.

- *Usage* – Double shifting, frequent lifting at or near the rated capacity, long hoist ropes and excessive slewing, which might accelerate wear of all components.
- *Environment* – Corrosive environments, such as marine or industrial sites, which might accelerate corrosion of structural components, fasteners and wire ropes.
- *Feedback* – Feedback from maintenance records and thorough examination reports, which might indicate accelerated rates of wear and deterioration.

Once established, the maintenance interval should be recorded in the machine history file. It is essential that any variation from the manufacturer's recommended intervals is recorded and justified each time a change is made.

7.8 Information for maintenance

The wide variation of designs and the increasing complexity of tower crane technology make it essential that all maintenance personnel are supplied with adequate information to enable them to carry out their duties effectively and safely. The recommendations given in BS 7121-2-1:2012, **7.8** should be followed.

7.9 Inspection during maintenance

7.9.1 General

This inspection is normally undertaken by maintenance personnel and is in addition to the in-service inspections undertaken in accordance with Clause **6**.

An example of a checklist for inspections during maintenance is given in Annex F.

When inspections are being carried out as part of maintenance it is important that maintenance personnel record all faults and do not omit to record faults that are then rectified as part of the maintenance process. Such masking of faults would invalidate the machine history and hinder the review process.

*NOTE There is a need for site managers to allocate time for routine inspection and maintenance. It is unreasonable for a site manager to expect this work to be undertaken overnight, in darkness, or always at weekends. Time needs to be built into normal working hours for this work (see **7.11.2**).*

7.9.2 Machine history files

7.9.2.1 Crane owner's file

Each tower crane should have its own machine history file, in either paper or electronic format, in which all records of maintenance activities are kept by the tower crane owner. These should include the following (as applicable):

- EC Declaration of Conformity;
- pre-delivery inspections;
- special maintenance procedures;
- service reports and worksheets;
- breakdown reports and worksheets;
- daily and weekly inspection reports;
- records of component replacement;
- records of major overhaul;
- erection, reconfiguration and dismantling records;
- test reports;
- wire rope and hook test certificates;
- thorough examination reports;
- records of defect rectification;
- data logger records;
- records of supplementary tests;
- records of modifications and upgrades;
- safety alerts from manufacturers;
- records of extraordinary events (e.g. replacement or repair of significant load bearing components, severe overloading or wind loading);
- records of unusual applications.

7.9.2.2 Crane user's file to be kept on site

Under PUWER 1998 [3] Regulation 5, where a crane is on site for an extended period the user is required to be able to demonstrate that the crane has been adequately maintained. A machine history file should also be kept on site by the user to record all maintenance activities carried out on the crane while it is erected on that site. This file should include the following (as applicable):

- service reports and worksheets;
- breakdown reports and worksheets, including records of defect rectification, component replacement and work completed following extraordinary events;
- daily and weekly inspection reports;
- erection and reconfiguration records, including records of modifications and upgrades;
- thorough examination reports and records of supplementary tests.

The records in the site machine history file will be less comprehensive than those in the owner's file as they will only refer to the period during which the crane was on that particular site. Copies of records from the site file should be added to the tower crane owner's machine history file to ensure that the owner's file contains a complete "cradle to grave" record for the particular crane.

7.9.2.3 Supplementary information

As tower cranes are essentially modular structures made up of interchangeable components such as tower sections, jib sections, slew sections and various static and travelling bases, it is often difficult to identify what actually makes up an individual crane with an individual serial number. Common practice in the industry is to take a "crane" with a given serial number as being made up of the slew section, operator's cab, counter jib/machinery deck and jib. All other components are added to the "crane" as required, to make up a tower crane of a particular configuration for erection on a specific site. As the machine history file will only refer to those components that make up the "crane", supplementary records should be kept for all other components. For each installation of the crane a record should be made indicating the identification and age of all the main components, including jib sections, slew section, counter jib, tower sections and base components.

7.10 Management review of maintenance records and procedures

For the safe and efficient operation of a tower crane fleet, a regular management review of tower crane maintenance records and procedures should be carried out by the managers responsible for the maintenance operation to enable them to be confident that a robust maintenance system is in place that can be relied upon rapidly to highlight any shortcomings and the need for corrective action. The review should include:

- checks that faults are being corrected and closed out appropriately and that the maintenance schedule is being completed to plan;
- checks to determine if the regime and frequencies are appropriate and to analyse trends.

The review should be carried out initially at least monthly. Once a suitable level of confidence in the systems has been established the review frequency may be reduced in the light of experience.

7.11 Site issues for maintenance

7.11.1 General

Maintaining a tower crane on site presents a particular set of issues when compared with carrying out maintenance operations in a workshop or yard. These issues are best addressed at the planning stage before the crane is erected on site and taken into use. This should be done in close collaboration with the crane user as their cooperation is essential for the effective maintenance of tower cranes on site.

7.11.2 Maintenance downtime

PUWER 1998 [3] Regulation 5 requires employers to ensure that cranes are maintained in an efficient state, in efficient working order and in good repair.

As the main purpose for a tower crane being on site is to carry out lifting operations as part of the construction process, site managers can be, understandably, reluctant to stop the crane while maintenance is carried out.

WARNING. It is essential that maintenance downtime is scheduled into the work programme, so that maintenance is not pushed to the back of the queue and does not end up being carried out hurriedly in unsafe conditions such as poor light.

Tower crane owners should make clear to those hiring their cranes that maintenance is of paramount importance and that adequate maintenance downtime has to be built into the site work programme. Hirers should be informed at the planning stage of the frequency and length of time required for maintenance operations.

Construction projects in built-up areas often have environmental restrictions imposed on them which severely limit working time at weekends and in the evenings. Such restrictions should be taken into account in maintenance planning.

Tower crane hirers should be informed that when maintenance of a tower crane is taking place the maintenance team have full control of the tower crane.

7.11.3 Communication

Those planning and carrying out maintenance on tower cranes on site should ensure that they have effective lines of communication with the site staff for both routine maintenance and attending to breakdowns. Maintenance personnel should always report their arrival on site, agree the programme of work to be carried out and report back once the tasks have been completed. This can avoid much frustration and misunderstanding on both sides.

7.12 Spare parts

Maintenance operations on tower cranes can only be fully effective if the correct spare parts are available at the correct location in a timely manner. A robust spare parts management system should be put in place to avoid any unnecessary additional direct and indirect costs and any adverse effects on the safety of the tower crane.

Where spare parts are not obtained from the crane manufacturer, parts should be obtained that meet the original manufacturer's specification. Where necessary, a full engineering assessment of the part(s) should be carried out to ensure that this is the case.

7.13 Use of special materials in crane construction

Modern tower cranes make extensive use of high tensile steels. When repairs are carried out to any parts of the crane structure, the correct procedure laid down by the manufacturer should be strictly followed to avoid changing the properties of the material.

8 Thorough examination of tower cranes

8.1 General

8.1.1 Tower cranes

8.1.1.1 Thorough examination of a crane is required by LOLER 1998 [2] Regulation 9 in the following circumstances (see BS 7121-2-1:2012, **8.3.1**):

- before being put into use for the first time, unless the crane is new and the owner has an EC Declaration of Conformity dated not more than 12 months prior to the crane being used for the first time, LOLER Regulation 9(1);
- where safety depends on the installation conditions:
  - after installation and before being put into service for the first time, LOLER Regulation 9(2)(a);
  - after assembly and before being put into service at a new site or in a new location, LOLER Regulation 9(2)(b);

    NOTE 1 In the case of tower cranes, assembly includes reconfiguration, e.g. the tower crane being increased in height or the jib being reconfigured.

    *NOTE 2 For self-erecting tower cranes see **8.1.1.3, 8.1.1.4** and **8.1.1.5**.*
- periodically whilst in service, at maximum intervals of 6 months for cranes that lift people and 12 months for cranes that lift goods only, LOLER Regulation 9(3)(a)(i) and (ii);
- after exceptional circumstances have occurred, LOLER Regulation 9(3)(a)(iv).

8.1.1.2 The competent person should normally work to a defined scope of thorough examination (see **8.7**). The examination scheme approach (see BS 7121-2-1:2012, **8.9**) should only be used for tower cranes that are permanently installed.

8.1.1.3 The requirement for thorough examination of self-erecting tower cranes will depend on the extent of assembly from components carried out during the deployment of the crane on site. In the case where a self-erecting tower crane arrives at site, is positioned on a prepared base, connected to a power supply, deployed by unfolding using its own winches and where no additional components are put into the structure, then no thorough examination following erection will be required as the crane will not have materially altered since its last periodic thorough examination. A parallel can be drawn here with mobile cranes (see BS 7121-2-3).

8.1.1.4 On the other hand, a self-erecting tower crane where, after delivery to site and positioning on a prepared base, the deployment of the crane structure requires the assembly of additional components, will require a thorough examination after erection, as is the case with a conventional tower crane.

8.1.1.5 In either case, it is essential that pre-use checks are carried out on site after installation to ensure that all crane motions and limits are functioning correctly (see **6.2**).

8.1.2 Climbing frames

Climbing frames, while not always part of the crane's permanent equipment, are devices for lifting persons. LOLER 1998 [2] Regulation 9 requires that all climbing frames are thoroughly examined after each installation on a crane before being taken into use, and also that they are thoroughly examined periodically at intervals not exceeding 6 months whilst they remain installed on a crane. An example of the procedure for thorough examination of climbing frames is given in Annex G.

8.2 Selection of competent person

It is essential that the competent person undertaking the thorough examination of a tower crane has not been involved in the erection or the maintenance of the crane.

8.3 Check of as-built configuration

As part of every thorough examination, the competent person should check that the crane has been erected to the build specification provided by the crane supplier. To do this, the competent person should check the as-built configuration of the crane, including the following:

a) height under the hook;

b) tower height;

c) jib lengths and configurations (front jib and counter jib);

d) counterweight: type, size and position on counter jib;

e) base ballast (if applicable);

f) tower sections: type, size and position in tower;

g) tie positions (if applicable);

h) that a report of the tower verticality is available and indicates that the verticality is within the specified tolerance;

i) number of falls of hoist rope;

j) rated capacity:

   1) maximum rated capacity;

   2) maximum radius at maximum rated capacity;

   3) rated capacity at maximum radius.

8.4 Review of base/tie information

8.4.1 General

As part of every thorough examination, the competent person should review all the information on base and tie construction listed in **8.4.2** to **8.4.6**.

During the thorough examination, the competent person should inspect the base and ties and check them for consistency with the information listed in **8.4.2** to **8.4.6**.

This information should be retained on site for the time that the crane is erected on that site.

8.4.2 Cast base

The following information should be reviewed and the base checked against it:

a) information on in and out of service wind conditions;

b) force and moment data supplied to the base designer;

c) copy of the base design drawing;

d) copy of the base pre-erection inspection report (see Annex B);

e) copy of pile drawing including vertical reactions (where applicable);

f) photographs of the base prior to pouring, showing the anchors and reinforcement (where available);

g) test cube results;

h) copy of the base approval/completion certificate (see Annex C).

8.4.3 Cruciform base with central ballast

The following information should be reviewed and the base checked against it:

a) information on in and out of service wind conditions;

b) force data supplied to the base designer;

c) copy of the base design drawing;

d) copy of the base pre-erection inspection report (see Annex B);

e) copy of pile drawing including vertical reactions (where applicable);

f) test cube results;

g) copy of the base approval/completion certificate (see Annex C).

8.4.4 Grillage base

The following information should be reviewed and the base checked against it:

a) information on in and out of service wind conditions;

b) force and moment data supplied to the base designer;

c) copy of the grillage design drawing;

d) copy of the grillage pre-erection inspection report (see Annex B);

e) copy of the base approval/completion certificate (see Annex C).

8.4.5 Rail track

The following information should be reviewed and the base checked against it:

a) information on in and out of service wind conditions;

b) force data supplied to the base designer;

c) copy of the rail track design drawing;

d) copy of the rail track pre-erection inspection report (see Annex B);

e) copy of pile drawing including vertical reactions (where applicable);

f) test cube results (where applicable);

g) copy of the base approval/completion certificate (see Annex C).

8.4.6 Ties

The following information should be reviewed and the ties checked against it:

a) information on in and out of service wind conditions;

b) force and moment data supplied to the tie designer;

c) copy of the tie design drawing;

d) copy of the tie fabrication and pre-installation inspection report (see Annex D);

e) copy of the tie approval/completion certificate (see Annex E).

8.5 Scope of thorough examination before the crane is put into use for the first time

The competent person who undertakes the thorough examination should decide the scope of the examination. The extent of the thorough examination should reflect the likelihood of failure and the actual risk which could arise from any such failure. It should also take into account when the components of the crane were made and the likely deterioration since manufacture, which could increase risks in use. Records of tests and inspections carried out by the manufacturer should also be taken into account.

The examination should ensure the crane has been erected, configured, checked and tested in accordance with the manufacturer's instructions.

8.6 Scope of thorough examination following installation

LOLER 1998 [2] Regulation 9(2)(a) and (b) requires that this establishes that the crane has been installed correctly and is safe to use.

The scope of the thorough examination should be proportional to the complexity of the installation. The examination should ensure the crane has been installed, checked and tested in accordance with the manufacturer's instructions. It should also take into account any deterioration and should as a minimum include all the components and assessment criteria listed in **8.7.2** and **8.7.3**.

8.7 Scope of periodic thorough examination

8.7.1 General

The competent person carrying out a periodic thorough examination should work to a defined scope of thorough examination that has been drawn up specifically for the crane they are required to examine (see BS 7121-2-1:2012, **8.6**).

The defined scope of thorough examination should be drawn up in advance of the examination by a competent person and should identify those parts of the crane that should be thoroughly examined, together with required supplementary reports and tests and the extent to which they should be witnessed, and details of any required non-destructive testing of the crane structure and mechanisms.

The competent person carrying out the thorough examination may add to the defined scope but is not permitted to reduce it.

The competent person who prepared the defined scope of thorough examination should periodically review it to take account of changes in usage of equipment, findings of previous thorough examinations, supporting supplementary reports and tests, together with any information from maintenance activities, manufacturers or other sources.

A copy of the defined scope of thorough examination should be kept in the machine history file.

The defined scope of thorough examination should, as a minimum, include the components listed in **8.7.2**. These components should be assessed against the criteria listed in **8.7.3**, taking into account the path of the load through the crane's structure and mechanisms. It is essential that the scope is risk based and takes into account the consequences of failure of the crane.

8.7.2 Components to be included

The following components should be included in the defined scope of thorough examination for a tower crane (as applicable):

NOTE 1 This list is not exhaustive.

- base structure, including fasteners, cast-in anchors, cruciform base, chassis, internal climbing collar, grillage;
- base information board;
- tower sections and ties, including fasteners, ladders and rest platforms and guard rails;
- crane travelling base, drive system and rail track including fasteners and end stops;
- central (base) ballast, including fasteners and tie bars;
- all bolts, pins and other fastenings;
- slew section structure, including fasteners and slew ring;
- slewing mechanism throughout its full range of movement;

  NOTE 2 Luffing jib cranes should be at maximum radius.
- power supply cables and slip rings;
- cab, including controls, indicators, seating, windows, heating, security bars, wipers and load charts;
- counterjib and counterweights, including pendants, fasteners, guard rails and signage;
- hoist and luffing winches and brakes, including hydraulic systems;
- hydraulic luffing systems;
- control cabinets and wiring;
- "A" frame, including sheaves, fasteners, access ladders;
- limiting and indicating devices including:
  - rated capacity system (measurement of load, moment and radius);
  - anemometer;
  - devices indicating:
    - over hoist limits;
    - luffing limits;
    - trolley limits;
    - slack rope limits;
    - rail travel limits;
- jib structure, including pendants, fasteners, pivots, walkway, sheaves, safety line, and wind sail boards;
- trolley, including wheels and basket, and trolley winch;
- hook block, including sheaves, hook and fall change system;
- running wire ropes, including terminations.

8.7.3 Assessment criteria

The following assessment criteria should be included in the defined scope of thorough examination for a tower crane:

NOTE This list is not exhaustive.

- adjustment – as specified by manufacturer;
- alignment – within manufacturer's tolerance;
- backlash – within manufacturer's tolerance;
- bearing play – within manufacturer's tolerance;
- brake performance – within manufacturer's tolerance;
- corrosion – affecting strength or functionality;
- cracks – affecting strength or functionality;
- cylinder creep – within manufacturer's tolerance;
- damage – affecting strength or functionality;
- distortion – affecting strength or functionality;
- fluid levels – within manufacturer's limits;
- functionality – as intended by manufacturer;
- guards – presence and condition;
- limit accuracy – as specified by manufacturer;
- leaks – affecting strength, functionality and slips;
- lubrication – adequacy;
- markings – presence, accuracy and condition;
- mode of operation – as intended by manufacturer;
- obstructions – impeding safe access;
- rope fit – as specified by manufacturer;
- rope reeving – as specified by manufacturer;
- rope specification – as specified by manufacturer;
- security – attachment of components and sub-structures, fasteners, welds, etc.;
- seizure – full or partial seizure of rotating components;
- tidiness – general housekeeping;
- wear – affecting strength or functionality.

8.8 Periodic thorough examination interval

The statutory maximum intervals of 6 months and 12 months may be reduced, taking to take into account environmental factors or the general age and condition of the crane etc. The decision to reduce the interval between thorough examinations may be made by the competent person, the crane owner or the crane user.

Reasons for reduction of the interval between thorough examinations include the following:

- if the crane frequently works above or near people, both personnel on site and members of the public outside the site;
- if the crane might be used for lifting of persons in exceptional circumstances, including rescue, even if it is not initially planned;
- to take into account the intensity of use of the crane and the environment in which it is used;
- following a review by the competent person of the in-service lift plan (risk assessment, method statement and schedule of lifts) to ascertain the likely load spectrum and frequency of use of the crane.

8.9 Thorough examination after exceptional circumstances

LOLER 1998 [2] requires that if the crane is subjected to exceptional circumstances it has to be removed from service and subjected to a thorough examination to determine whether it is safe to be returned to service.

Exceptional circumstances include an overload, jib clash, collision, sudden loss of load, use for particularly arduous duties, failure of a structural component or being subjected to weather in excess of design parameters.

The scope of the thorough examination should be proportional to the nature of the exceptional circumstances and the extent of any repairs, and should take into account the reports of previous thorough examinations, where applicable.

8.10 Preparation for thorough examination

Prior to thorough examination, the base of the crane should be cleaned by appropriate means to remove all spoil/dirt that would otherwise conceal the structure and prevent an effective examination.

Where it is not possible to ascertain the condition of hidden mechanism parts, for example ropes, chains, sheaves, terminations or hydraulic cylinders, dismantling prior to thorough examination should carried out as required by the competent person.

Additional means of safe access should also be provided as required by the competent person.

NOTE Attention is drawn to the Work at Height Regulations 2005 (as amended) [5].

8.11 Rated capacity indicator/rated capacity limiter (RCI/RCL) calibration check and functional test

The thorough examination of a tower crane before being put into use for the first time (see **8.5**) and following installation (see **8.6**) should include a calibration check of the rated capacity indicator/rated capacity limiter (RCI/RCL) in accordance with BS 7121-2-1:2012, **10.15** and a functional test with a known load in accordance with Clause **11**. The periodic thorough examination (see **8.7**) should include a functional test with a known load in accordance with Clause **11**.

9 Overload testing of tower cranes to supplement thorough examination

9.1 General

Overload testing of tower cranes should be carried out to supplement the thorough examination after each erection, and after every reconfiguration (alteration of jib length, alteration of tower height, addition or removal of ties, etc.) (see **8.1.1.1**).

9.2 Before testing

The competent person should seek advice from the crane manufacturer (or other suitable design authority) before deciding on the nature of the test and the method of carrying it out, including the magnitude of the overload to be applied.

A visual examination of the crane and the test area should be carried out prior to commencing the test.

Before the application of a load a thorough examination of the crane should be carried out, including checking that the crane has been erected in accordance with the manufacturer's instructions.

The competent person should check the rated capacity specified on the build specification sheet, that used by the rated capacity indicator/rated capacity limiter, and that specified on the table of rated capacities displayed in the operator's cab and on the base board. The rated capacities should all be identical.

A functional test with no load applied should be carried out to determine whether the controls, switches, contactors and other devices operate correctly. The adjustments of the brakes and limit switches should be checked and tests carried out to determine whether they are operating correctly.

9.3 Verticality of the mast

The importance of the verticality of the tower crane mast cannot be over-emphasized. The mast should be vertical within the limits specified by the manufacturer and this should be checked by an engineer or surveyor with a theodolite, before overload testing is undertaken. [See also **8.3**h).]

9.4 Lifting capacities

The load ratings marked on tower cranes and shown on the manufacturer's rated capacity charts indicate the net loads, i.e. the loads quoted include the loads imposed by the hook block, but not slings and lifting gear. Therefore, when the crane is being tested allowance should be made for the loads imposed by suspended slings and lifting gear. The exact loads imposed by these items should be ascertained before overload testing is undertaken.

9.5 Overload testing

9.5.1 Preparation

When testing a rail mounted crane, at the start of testing the crane should be positioned on a straight and level track with firm foundations and free from obstructions.

9.5.2 Test procedure

NOTE 1 During the raising of any load it might be necessary to luff-in the jib, or trolley-in the load so that the radius is not exceeded owing to deflection of the tower.

The crane should be functionally tested without a load applied to determine whether it is working properly.

With the trolley or jib at the maximum radius for the rated capacity, a load equivalent to the rated capacity should be raised until every tooth in the train of gears has been subjected to the load, then lowered to between 100 mm and 200 mm above the ground and the crane operated through all its permitted motions, to determine whether the crane is safe to proceed with the test.

The load should then be increased by the amount specified by the manufacturer and this load hoisted until each tooth in the train of gears has been subjected to the overload, then lowered to between 100 mm and 200 mm above the ground and the crane operated through its permitted motions.

For horizontal jib cranes with trolleys, the trolley should be set at the maximum radius for the maximum rated capacity. Suitable devices should be fitted to the jib, for example clamps, at a position 50 mm beyond the maximum radius for the maximum rated capacity to prevent the trolley from moving beyond this point. Any movement of the trolley beyond the set position and towards the clamps indicates a problem with the trolley brake, which should be investigated and rectified before further testing is carried out. For other cranes, the load lifting attachments should be positioned at the maximum radius for the maximum rated capacity.

A load equivalent to the appropriate rated capacity should then be raised until each tooth in the train of gears has been subjected to the load, then lowered to between 100 mm and 200 mm above the ground and the crane operated throughout all its permitted motions, subject to site limitations, to determine whether the crane is safe to proceed with the test.

NOTE 2 For most tower cranes it is possible to operate the maximum rated capacity at a number of radii, so for these cranes the motions include moving the load back to the maximum radius position for that rated capacity, taking care to stop before the clamp is reached.

The load should then be increased to the test load specified by the manufacturer and hoisted until each tooth in the train of hoist gears has been subjected to the overload, then lowered to between 100 mm and 200 mm above the ground and the crane operated throughout its permitted motions to ensure the overload is applied to all parts.

If the tests are limited owing to site conditions it might be necessary to dismantle and reassemble the test load at different positions throughout the arc of slew to enable the crane to be thoroughly tested over its working area. Otherwise duties should be restricted.

Where the loaded crane can travel on rail tracks, the overload should be travelled the appropriate length of the track with the jib at right angles, at both sides and in line with it, where such duties are permitted.

During the overload test, the crane should be operated at speeds appropriate to the safe control of the load, for example the lowest possible speed of the crane.

During the overload test the crane should remain stable and the brakes on each motion should function effectively.

9.6 Major repairs or modifications

Tower cranes should be overload tested after major repairs or modifications.

9.7 Post test thorough examination

On completion of the test, a further thorough examination of the tower crane should be carried out (see BS 7121-2-1:2012, **8.12**).

10 Non-destructive testing (NDT) of tower cranes

NDT of tower cranes may be requested by the competent person carrying out the thorough examination, particularly when there is a suspicion that cracks or other damage might be present in structural parts of the crane (see BS 7121-2-1:2012, **10.13**).

11 Rated capacity indicator/rated capacity limiter (RCI/RCL) test

11.1 General

During the testing of the RCI/RCL it is essential that the crane is not loaded beyond 110% of its rated capacity. The radius at which the test load corresponds to 110% of the rated capacity should be marked and the test load should not be taken beyond that point.

11.2 Horizontal jibs with trolleys

Having established the effectiveness of the trolley brake by carrying out the tests given in **9.5.2**, the clamps should be removed and a known load, equivalent to not less than 80% of the maximum rated capacity, should be lifted just clear of the ground at minimum radius and travelled very slowly out until the rated capacity indicator gives the rated capacity warning. At this point the radius should be measured and the load on the crane should be between 90% and 97.5% of the rated capacity for that radius. The load required to cause an overload warning as it is carefully hoisted from the ground should then be determined. This should be between 102.5% and 110% of the rated capacity for that radius.

11.3 Derricking jibs

A known load equivalent to between 80% and 90% of the maximum rated capacity for the configuration should be suspended at the minimum radius of the crane. Keeping the load as close to the ground as possible, the radius should be increased until the rated capacity indicator gives the rated capacity warning. At this point the radius should be measured and the load on the crane should be between 90% and 97.5% of the rated capacity for that radius. The radius should then be reduced slightly and the load increased by small amounts until the load required to cause an overload warning as it is carefully hoisted from the ground is found. The radius should be measured again and the load on the crane should be between 102.5 % and 110 % of the rated capacity for that radius.

11.4 Repeat tests

The test should repeated using a known load approximately midway between the maximum and minimum rated capacities for that configuration of the crane.

12 Assessment of wire rope condition and discard criteria

When carrying out examination of wire ropes as part of the thorough examination of a tower crane, the competent person should examine the rope in accordance with BS ISO 4309:2010, Clause **5** and Clause **6** (see BS 7121-2-1:2012, Clause **14**).

Annex A (informative) Examples of a checklists for pre-use checking of tower cranes

A.1 Trolley jib cranes

The following is an example of a checklist for pre-use checking of trolley jib cranes:

NOTE These checks are in addition to any checks needed in accordance with the crane manufacturer's instructions. This list is not exhaustive.

a) check base for obstructions and debris;

b) check rail track, stops, trailing cable and fencing;

c) check generator oil, fuel and water (if a generator is fitted);

d) check duty board;

e) check isolator security;

f) check tower bolts/pins;

g) check security fan (anti-climbing device) and access gate, (if fitted);

h) check access ladders and rest platforms;

i) carry out a visual check of component security;

j) check housekeeping (tidiness, absence of clutter, which could present slip or trip hazards, and flammable materials);

k) check cab windows and wipers;

l) check operation of rated capacity indicator/rated capacity limiter;

m) check correct operation of controls;

n) check radius indicator or flags;

o) check function of hold to run controls;

p) check gauges and warning lights;

q) check operation of anemometer;

r) check operation of hoist brake by means of a load test;

s) check operation of hook block height limiter;

t) check hook block safety catch and swivel;

u) check trolley rope condition;

v) check operation of trolley brake;

w) check operation of trolley limiters;

x) check operation of slewing brake;

y) check operation of zoning or anti-collision system (if fitted);

z) check crash radio operation.

A.2 Luffing jib cranes

The following is an example of a checklist for pre-use checking of luffing jib cranes:

NOTE These checks are in addition to any checks needed in accordance with the crane manufacturer's instructions. This list is not exhaustive.

a) check base for obstructions and debris;

b) check rail track, stops, trailing cable and fencing;

c) check generator oil, fuel and water (if a generator is fitted);

d) check duty board;

e) check isolator security;

f) check tower bolts/pins;

g) check security fan (anti-climbing device) and access gate, (if fitted);

h) check access ladders and rest platforms;

i) carry out a visual check of component security;

j) check housekeeping (tidiness, absence of clutter, which could present slip or trip hazards, and flammable materials);

k) check cab windows and wipers;

l) check rated capacity indicator;

m) check correct operation of controls;

n) check radius indicator;

o) check function of hold to run controls;

p) check gauges and warning lights;

q) check operation of anemometer;

r) check operation of hoist brake by means of a load test ;

s) check operation of hook block height limiter;

t) check hook block safety catch and swivel;

u) check luffing rope condition;

v) check operation of luffing brake by means of a load test;

w) check operation of luffing limiters;

x) check operation of slewing brake;

y) check operation of zoning or anti-collision system (if fitted);

z) check crash radio operation.

A.3 Climbing frames

The following is an example of a checklist for pre-use checking of climbing frames for top climbing of tower cranes:

a) check that the frame has a current thorough examination report;

b) check that there is a current test certificate for the hydraulic system;

c) check that a radio or telephone communication system is installed and working;

d) check that the jointing bolts are in place and secure;

e) check that the main guide roller pin keep plates are in place and secure;

f) check that the walkways are secure and that no bolts or guardrails are missing;

g) check that the hydraulic system is free from leaks;

h) check that the apron for the support of the section of the crane to be inserted is secure and free to move.

After the checks are complete the slew lock should be engaged or the slew physically locked.

Before the frame is used, authorization of the completed checklist and a permit to climb should be obtained from an appointed person on the site.

Annex B (informative) Example of a tower crane base pre-erection inspection report form

An example of a tower crane base pre-erection inspection report form is given in Figure B.1

Figure B.1 **Example of a tower crane base pre-erection inspection report form**

Tower Crane Base – Pre-erection Inspection Report								
Site Details:								
Tower Crane No/Location:		***Make:***		***Model:***				
Height under Hook:		***Jib Length:***						
Base Type:								
Items Checked (delete where not applicable)			***As Specified?***		***Inspected By***	***Date***		
			Yes	**No**				
All Foundations	Compliance with design drawings/specification							
Cast-in Items	Supplied by tower crane manufacturer or approved source							
	Level check							
	Verticality check							
	Within tolerance							
Concrete	Correct grade							
	Sufficient maturity							
	Rebar – grade, diameter, quantity and position prior to pour							
Piles	Satisfactory pile tests							
	Reinforcement bond length							
Steelwork	Steel grade							
	Weld quality							
	Bolts – grade, torque, tightness, quantity							
Rail Tracks	Bedding properly compacted							
	Rail and sleeper quality							
	Levels and gauge to tolerance							
	Limit ramps and end stops correctly positioned and firmly fixed							
	Rails correctly fixed and earthed							
Documents against which foundation has been checked (drawing nos./document references):								
Notes and Observations:								
I confirm the tower crane foundation has been constructed to the specifications and that a satisfactory post-construction inspection has been carried out.								
Name:		***Signed:***			***Date:***			
Position:		***Company:***						

Annex C (informative) Example of a tower crane base approval/completion certificate

An example of a tower crane base approval/completion certificate, including a permit to erect, is given in Figure C.1.

Figure C.1 **Example of a tower crane base approval/completion certificate**

Tower Crane Base Approval/Completion Certificate					
Site Details:					
Tower Crane No/Location:		***Make:***		***Model*:**	
Height under Hook:		***Jib Length:***			
Base Type:					
Foundation/Grillage Design					
Design Criteria and References:					
Drawings and Documents Issued:					
Limitations or Restrictions: *NOTE If the foundation design relies on the use of permanent works, the designer should state whether the permanent works have been analysed.*					
I certify that reasonable professional skill and care has been used in the preparation of this design, that the details have been checked for compliance with the relevant standards listed above and that the design has been accurately translated into drawings and other documents issued to site.					
Name:		***Signed:***		***Date:***	
Position:		***Company:***			
Foundation/Grillage Design Check*					
I certify that reasonable professional skill and care has been used in the preparation of this design, that the details have been checked for compliance with the relevant standards listed above and that the design has been accurately translated into drawings and other documents issued to site.					
Name:		***Signed:***		***Date:***	
Position:		***Company:***			
NOTE A separate approval/completion certificate is required for each tower crane. **Category 2 check, BS 5975:2008+A1, Table 1.*					
Permit To Erect					
I confirm the tower crane foundation has been constructed to the specifications detailed above and a post-construction inspection has been carried out (recorded on the attached report), and that the tower crane may be erected.					
Name:		***Signed:***		***Date:***	
Position:		***Company:***			
NOTE The tower crane cannot be erected until the completed form is returned to the Operations Department.					

Annex D (informative) Example of a tower crane tie fabrication and pre-installation inspection report

An example of a tower crane tie fabrication and pre-installation inspection report form is given in Figure D.1.

Figure D.1 **Example of a tower crane tie fabrication and pre-installation inspection report form**

Tower Crane – Tie Fabrication and Pre-installation Inspection Report							
Site Details:							
Tower Crane No/Location:		***Make:***		***Model:***			
Height under Hook:		***Jib Length:***					
Tie Type:		***Tie Position (from base):***					
Items Checked (delete where not applicable)			***As Specified?***		***Inspected By***	***Date***	
			Yes	**No**			
All Ties	Compliance with design drawings/specification						
Steelwork	Steel grade						
	Dimensional check						
	Weld quality						
	Bolts – grade, torque, tightness, quantity						
Structure Attachment Points	Confirmation that the tie attachment points on the supporting structure will take the design tie loads						
Tower Crane Mast	Vertical and to tolerance						
Documents against which tie has been checked (drawing nos./document references):							
Notes and Observations:							
I confirm the tower crane tie has been manufactured to the design specifications and that a satisfactory pre-installation construction inspection has been carried out.							
Name:		***Signed:***			***Date:***		
Position:		***Company:***					

Annex E (informative) Example of a tower crane tie approval/completion certificate

An example of a tower crane tie approval/completion certificate is given in Figure E.1.

Figure E.1 **Example of a tower crane tie approval/completion certificate**

Tower Crane Tie Approval/Completion Certificate					
Site Details:					
Tower Crane No/Location:		***Make:***		***Model:***	
Height under Hook:		***Jib Length:***			
Tie Type:		***Tie Position (from base):***			
Tie Design					
Design Criteria and References:					
Drawings and Documents Issued:					
Limitations or Restrictions: *NOTE Where the tie design relies on the use of permanent works for support, the designer should state whether the permanent works have been analysed.*					
I certify that reasonable professional skill and care has been used in the preparation of this design, that the details have been checked for compliance with the relevant standards listed above and that the design has been accurately translated into drawings and other documents issued to site.					
Name:		***Signed:***		***Date:***	
Position:		***Company:***			
Tie Design Check*					
I certify that reasonable professional skill and care has been used in the preparation of this design, that the details have been checked for compliance with the relevant standards listed above and that the design has been accurately translated into drawings and other documents issued to site.					
Name:		***Signed:***		***Date:***	
Position:		***Company:***			
NOTE A separate approval/completion certificate is required for each tower crane. **Category 2 check, BS 5975:2008+A1, Table 1.*					
Permit To Erect					
I confirm the tower crane tie and tie attachment point to the supporting structure has been constructed to the specifications detailed above and a pre-installation inspection has been carried out (recorded on the attached report), and that the tie may be installed.					
Name:		***Signed:***		***Date:***	
Position:		***Company:***			
NOTE The tower crane cannot be erected until the completed form is returned to the Operations Department.					

Annex F (informative) Example of a checklist for inspection during maintenance

The following is an example of a checklist for inspection of a tower crane during maintenance.

a) Check the general condition of structures, fastenings and machinery as follows:
   1) check the condition and secure fixing of ballast blocks and counterweights;
   2) check the condition of structural elements;
   3) check the presence and condition of fastenings;
   4) check the lubrication of jointed connections in operation;
   5) check the condition and assembly of access equipment: platforms, trap doors, ladders, hoop guards, guard rails etc.;
   6) check the fixing of accessories: advertising signs, wind sails, jib radius indicating flags, etc.;
   7) check the condition and fixings of machinery.

b) Test the crane in operation in collaboration with the crane driver as follows:
   1) check the operation of all machinery;
   2) check the condition and operation of alarms: warning lights, horn, beacons, etc.;
   3) check the condition and operation of indicators: load, moment, anemometer, etc.;
   4) check the adjustment and operation of motion limiters: limit switches, slow speed, etc.;
   5) check the condition and operation of cab accessories: windscreen wipers, heater, seat, lighting, etc.

c) Check the brakes as follows:
   1) check lining wear and gap of motion brakes;
   2) check the presence and condition of manual release mechanisms.

d) Check the operation of the weathervaning mechanism.

e) Check the slewing mechanism as follows:
   1) check the condition and operation of the slew bearing path;
   2) check the greasing of the ring and its external teeth;
   3) check the oil level of the reduction gears;
   4) check the oil level of the hydraulic units and check the circuits for leaks;
   5) check the condition and operation of belt transmissions (if applicable);
   6) check the belt tension of the orientation encoder.

f) Check the control system as follows:
   1) check the condition of the cables and electrical components;
   2) check the adjustment and operation of the heating of electrical cabinets;
   3) check the condition and operation of the main isolator and/or main circuit breaker;

4) check the condition and operation of contactors and control switches;

5) check the internal cleanliness of electrical cabinets and the condition of any vents and filters.

g) Check the condition of safety systems: moment, motion and load limiting devices, etc.

h) Check wire ropes, rope alignment and sheaves as follows:

1) check the condition of the jib trolley: structure, straining screw, shafts, wheels, fall protection, etc.

2) check the condition of wire ropes: pulleys, bearings, rope guides, etc.;

3) check the condition and operation of the sliding pulley mechanism;

4) check the greasing of the sliding pulley mechanism;

5) check the winding of ropes on winch drums;

6) check the condition of wire ropes and their attachments: swivel, rope anchor box, wire rope grips, etc.;

7) check the condition and operation of the pulley block: hook, safety catch, fall change locking, thrust ball bearing, etc.

i) Check the documentation and markings as follows:

1) check that the documentation (instruction manual, certificates of conformity, maintenance log, etc.) is present on site;

2) check that warning signs are present on the base and in the cab, and on the jib;

j) If there is a travelling base, carry out the following checks:

1) check the condition of the wheel rims and treads of the bogies;

2) check the condition of the collector and the friction mechanism of the trailing cable drum;

3) check the condition of the safety mechanisms relating to the travelling base: forks, stops, ramps, etc.

Annex G (informative) Example of procedures for thorough examinations and supplementary testing of climbing frames

G.1 Procedure for post-installation thorough examination and 6-monthly thorough examination

The following is an example of a procedure for post-installation thorough examination and 6-monthly thorough examination.

NOTE The post-installation thorough examination and the 6-monthly thorough examination may be supplemented by non-destructive testing (NDT) at the discretion of the competent person.

- Check the identification number of the frame and all corresponding sections to confirm all parts are of the same frame.
- Carry out a visual check of the frame structure, checking for any damage to structural members or evidence of cracking in welds. Pay particular attention to the suspension brackets and the jointing plates.
- Check the free movement of all guide rollers and check them for damage.

- Check the guide rollers for undue wear and check that all keep plates are in place and secure.
- Check the hydraulic ram mounting brackets for security and check the welds for signs of cracking.
- Check the lifting yoke at the base of the hydraulic ram for signs of wear and any cracking or deformity.
- Check the hydraulic ram joint pin for lift and that it is correctly locked in position.
- Check that the rollers to allow horizontal motion of the ram are free to rotate.
- Carry out a visual inspection to check that the hydraulic system is free from leaks and has no damage to the pipework or the connections.
- Check the travelling platform and its supports for damage.
- Check the walkways for damage and security of fixing.

After the thorough examination the walkways should be closed off.

The record of the thorough examination should be retained on site for the time that the frame is installed at that location.

G.2 Supplementary tests to support thorough examination at 2-yearly intervals

The following tests should be carried out to support the thorough examination at 2-yearly intervals. The tests should be carried out at the same time as the 6-monthly thorough examination. The tests should be carried out with the frame at rest on the ground.

The main load bearing parts, including the following, should be carefully examined and subjected to NDT as necessary:

- the jointing plates and associated supporting structures;
- the reaction roller supports and associated structures;
- the main suspension lugs;
- the corner nodes;
- the main lifting yoke.

The reaction roller pins should be removed, measured to assess wear, and subjected to NDT.

G.3 Supplementary tests to support thorough examination at 4-yearly intervals

In addition to the supplementary tests listed in **G.2**, the following tests should be carried out to support the thorough examination at 4-yearly intervals. The tests should be carried out with the frame at rest on the ground.

The hydraulic ram and pressure relief valves should be subjected to a pressure test in accordance with the manufacturer's recommendations for the particular system.

The ram-jointing pin should be removed, measured to assess wear, and subjected to NDT.

Bibliography

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For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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